



CIS 5530: Networked Systems

Discovery

February 20, 2023



Agenda

- Discovery 
 - DNS 
 - ARP 
 - DHCP



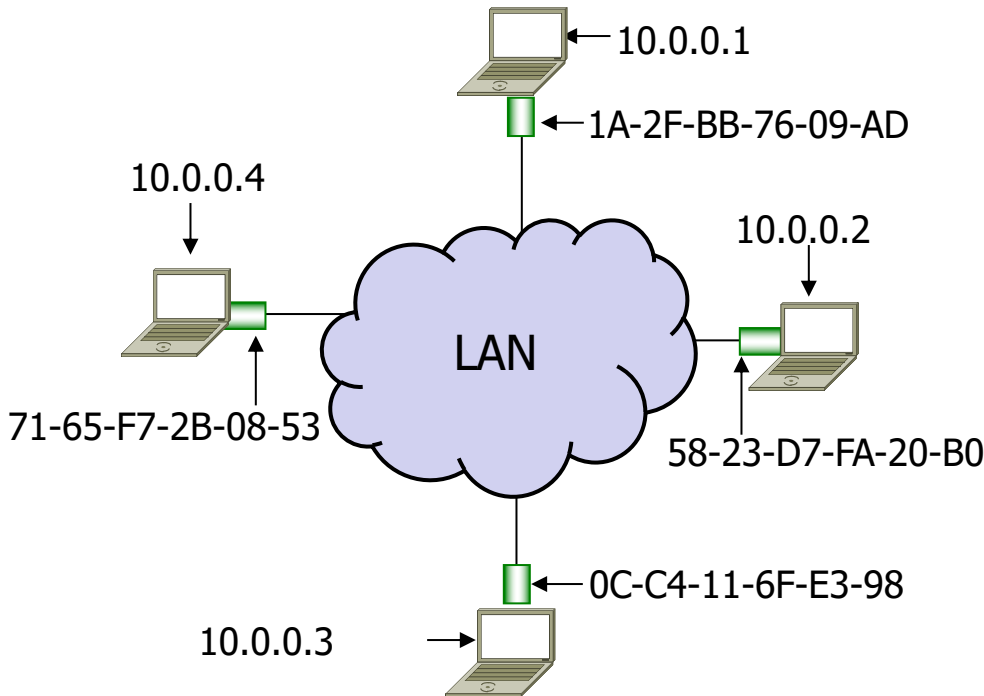
ARP: Address Resolution Protocol

ARP table: each IP node (host, router) on LAN has table

- IP/MAC address mappings for some LAN nodes:

< IP address; MAC address; TTL >

- TTL (Time To Live): time after which address mapping will be forgotten (typically 20 min)









Key ideas in ARP (and learning switches and DHCP)

- **Broadcasting:** Can use broadcast to make contact
 - Scalable because of limited size
- **Caching:** remember the past for a while
 - Store the information you learn to reduce overhead
- **Soft state:** eventually forget the past
 - Associate a time-to-live field with the information
 - ... and either refresh or discard the information
 - Key for robustness in the face of unpredictable change



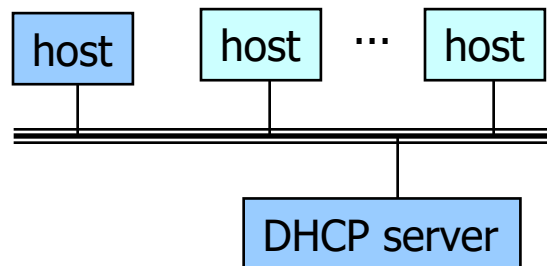
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- Discovery 
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Bootstrapping Problem

- Host doesn't have an IP address yet
 - So, host doesn't know what source address to use
- Host doesn't know who to ask for an IP address
 - So, host doesn't know what destination address to use
- Solution: broadcast to discover a server who can help
 - Broadcast a DHCP server-discovery message





DHCP

- Dynamic Host Configuration Protocol
 - Defined in RFC 2131
- A host uses DHCP to discover
 - Its own IP address
 - IP address(es) for its local DNS server(s)
 - Basic routing information
 - IP address of gateway router
 - Prefix length of LAN



DHCP Modes

- **Dynamic mode:** pool of available addresses, handed out on demand. Renew periodically.
- **Automatic:** DHCP reservation. Address permanently assigned to client.
- **Manual:** Address selected by client, informs DHCP server.



DHCP: Operation

- One or more local DHCP servers maintain required information
 - IP address pool, netmask, DNS servers, etc.
 - Application that listens on UDP port 67



DHCP: Operation

- One or more local DHCP servers maintain required information

Phase 1:

- Client broadcasts a DHCP discovery message
 - L2 broadcast, to MAC address FF:FF:FF:FF:FF:FF



DHCP: Operation

- One or more local DHCP servers maintain required information

Phase 1:

- Client broadcasts a DHCP discovery message
- One or more DHCP servers responds with a DHCP “offer” message
 - Proposed IP address for client, lease time
 - Other parameters



DHCP: Operation

- One or more local DHCP servers maintain required information

Phase 1:

- Client broadcasts a DHCP discovery message
- One or more DHCP servers responds with a DHCP “offer” message

Phase 2:

- Client broadcasts a DHCP request message
 - Specifies which offer it wants
 - Echoes accepted parameters
 - Other DHCP servers learn they were not chosen



DHCP: Operation

- One or more local DHCP servers maintain required information

Phase 1:

- Client broadcasts a DHCP discovery message
- One or more DHCP servers responds with a DHCP “offer” message

Phase 2:

- Client broadcasts a DHCP request message
- Selected DHCP server responds with an ACK



Stateless DHCP

- “Stateless” autoconfiguration (in IPv6)
 - Get rid of server – reuse Ethernet addresses for lower portion of address (uniqueness) and learn higher portion from routers