IP Addresses

- Identify computer (interfaces) in an internet
- Format (IPv4):
  - 32 bits
  - First *n* bits identify (sub-)network in internet
  - Last *h* bits identify host in that (sub-)network
  - (Sub-)net mask determines length of *n* and *h*
  - Dotted Decimal Notation commonly used
    - 10.10.6.210/24: Network 10.10.6.0; Host 24
    - 72.16.32.8/16: Network 72.16..0.0; Host 32.8

Who gives your computer an IP address?

- When a computer boots, the operating system needs to configure an IP address. How?
  - Hardcoded. In hardware (e.g. BIOS).
  - Manual. Everytime computer boots, user sets the value.
  - Static. User or admin sets a value, remains same across boots.
  - Dynamic. Computer is automatically assigned an IP address from another device in the network.

Dynamic Host Configuration Protocol (DHCP)

- DHCP Server is software running on at least one computer in network
  - Configured by admin
  - In lab, computer 10.10.6.1 is running DHCP server
- Every computer runs DHCP client software (usually bundled with operating system)
- Upon boot, DHCP client:
  - Broadcasts a message to LAN to discover a DHCP server
  - Receives an offer from one or more a DHCP servers
  - Broadcasts as a request to use one of the offers
  - Receives an acknowledgement from a DHCP server
- Offer and Ack contain information for computer to configure itself

DHCP Leases

- IP addresses allocated by DHCP server are leased to client
- Leases may include:
  - IP address information for client
  - Address of routers and special servers
  - Lease duration
- In Ubuntu Linux, leases are stored in text files in:
  - `/var/lib/dhcp/`
  - Latest available lease is normally used (old leases are kept in case current one expires)

DHCP Client

- Normally DHCP client is run automatically when boot or network interface is setup
- But we can run it manually with `dhclient`
  - Request lease: `sudo dhclient eth0`
  - Release lease: `sudo dhclient -r eth0`

DHCP Tasks

- Understand how DHCP works by capturing DHCP messages
  - Capture with tcpdump
  - Release existing lease: `sudo dhclient -r eth0`
  - Request new lease: `sudo dhclient eth0`
  - View lease file: `/var/lib/dhcp/dhclient.?.leases`
  - View DHCP messages in Wireshark (filter: bootp)
  - Draw packet formats and message sequence diagram

DHCP Questions

- What are the types of messages used by DHCP?
- How does a computer send IP datagrams in a network before it even has an IP address?
- What information is included in offers?
- How long is the lease valid for?
- What do renew, rebind and expire mean?

- Some man pages: `dhclient`, `dhclient.conf`