

IP Addressing

ITL

Disclaimers

- There's a lot more to IP addresses than we'll discuss today
- We'll only talk about IP version 4, IP version 6 is later in the quarter
- Keep in mind that IP addresses are virtual and work above network addresses

IP Addresses

- IP (v4) addresses are 32 bits long
 - We normally divide them into 4 bytes, each 8 bits long
- Normally represented in “dotted decimal notation”, for example:
 - A 32-bit number in binary
 - 10000100 11101011 11001001 00000010
 - The same 32-bit number expressed in dotted decimal notation
 - 132.235.201.2

What is “Routing”

- We start with the idea of a single physical network
 - May include repeaters (hubs)
 - May include bridges (switches)
- To tie together multiple networks, we use an internet gateway
 - Machine with an interface on multiple physical networks
 - Forms “an internet” (or “The Internet”)
 - Dedicated gateway box is normally called a “Router”

Router Details

- Each interface has a unique IP address
- Need not be a dedicated box
- We'll be using Cisco routers
- Most Unix variants make good routers
 - At one time, most routers were Sun workstations!
- Today's routers can perform a lot of different function, more about that in future classes.

IP Routing

- IP packets are called "datagrams"
- To send a datagram to a machine on the local network, you send directly to its hardware address
- To send a datagram to a machine that is not on the local network, you need to send it to the router
- This leads to the question:
 - "How do you know if the destination machine is on the local network?"

Address Mask

- The address mask (or "subnet mask") is used to determine whether a destination IP address is on the local network and can be reached directly or is non-local and must be reached through a router.
- The address mask shows which bits of a destination IP address must be identical to the local IP address for the destination machine to be on the local network.
- We will see additional uses of address masks when we talk about routing.

Address Mask Examples

- Local IP address 132.235.201.2
- Address mask 255.255.0.0
 - Which of the following is "local"
 - 132.235.3.1
 - 132.235.201.10
 - 132.235.201.100
 - 132.235.201.200
 - 128.10.2.1
 - Now try with address mask 255.255.255.0
 - Now try with address mask 255.255.255.192

Address Mask Shorthand

- Representing the mask in the same format as an address is more general
 - Handles non-contiguous masks (But the standards in use today do not allow them).
 - Some commands insist on this format
- As shorthand, you can just give the “size” of the mask
 - 132.235.0.0/16
 - All of OU
 - 132.235.201.0/24
 - All TTL addresses
 - 132.235.201.64/28
 - A block of 16 addresses in the TTL.
 - 132.235.201.131/32
 - A specific address

TCP/IP Configuration

- When configuring a TCP/IP stack, you normally need to specify
 - IP address
 - Address mask
 - Router address
 - To be able to reach non-local hosts
 - **Must** be an IP address on the local network
 - Other entries that we’ll discuss later

Other Topics

- Mapping between IP addresses and hardware (e.g. Ethernet) addresses.
 - ARP (Address Resolution Protocol)
 - Subject of Lab 3
- Mapping names to IP addresses
 - DNS (Domain Name System)
 - Also subject of Lab 3
- Address masks and the concept of “subnets”
 - Next Lecture
