SY110
Networking – Network Layer

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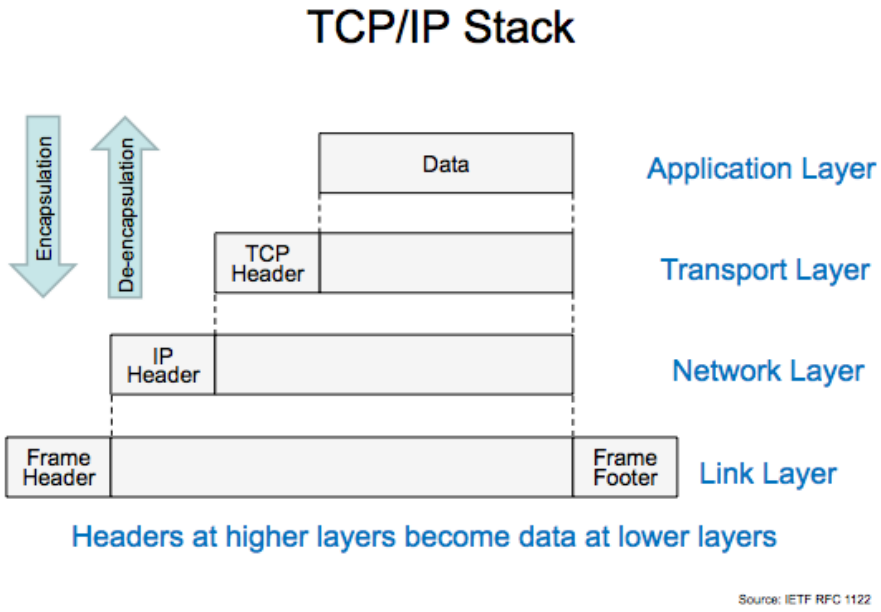
Outline



Data Link Layer

- Operates between Network and Physical Layers
- ARP - IP Address mapping to MAC Addresses
- Provides local network
- Has physical interfaces to transmission medium
- Converts Digital Data (frame) to Digital Signal

Network Layer - Basics

So, the Data Link Layer lets us talk to our local network, but what if I need to talk to a host in another network?

That's what the Network Layer is for!

- Network Layer interconnects local networks, forming interconnected networks; i.e. an internet.

Some Important Terms

- Internet Protocol (IP) Address - identifies hosts on the internet
- Packets - the name for the data being sent at the Network Layer
- Routers - intermediate packet passing hosts
- Subnet Mask - used to determine if two computers are on the same network

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- How does that work?
- What makes that happen?

Answer: Routers!

- Use IP addresses to send packets between networks
- Use a special routing protocol so that they know how to select routes and where to send packets.
- A router will have multiple IP Addresses, one for each network to which it is attached.
- The process of forwarding a packet to the next network performed by a router is known as routing.

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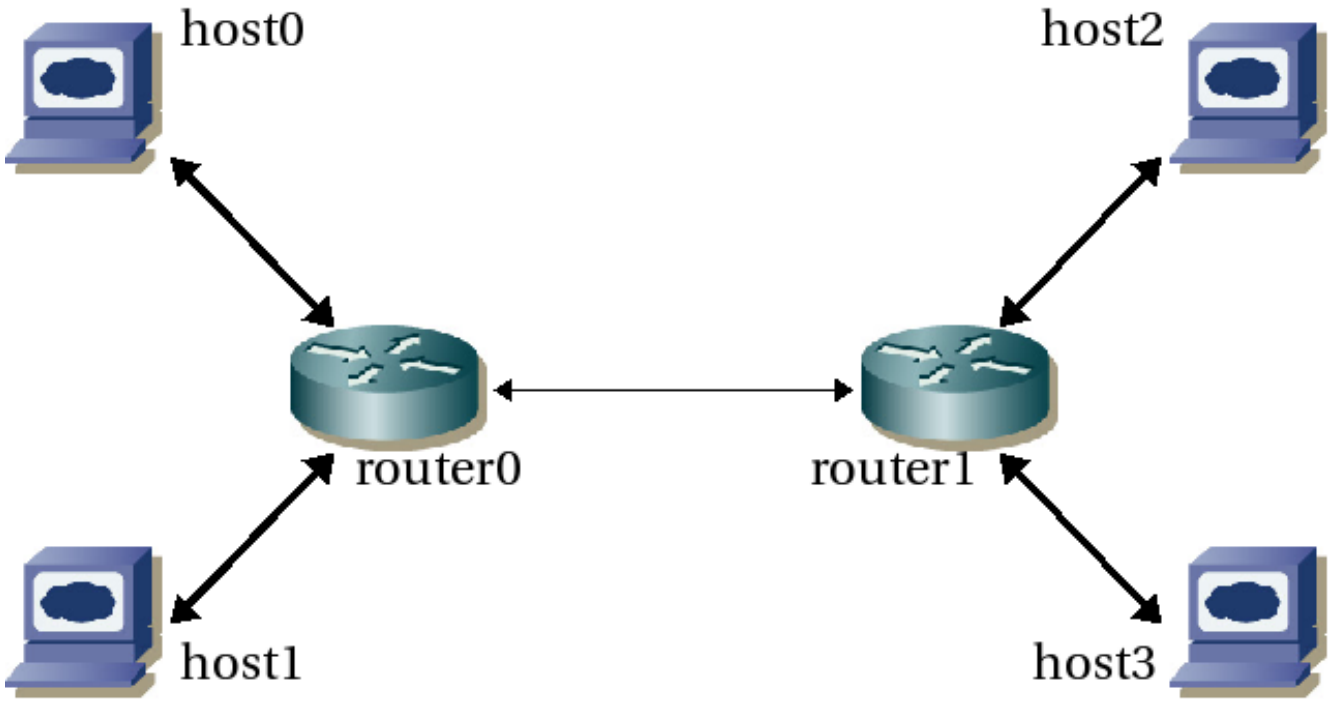
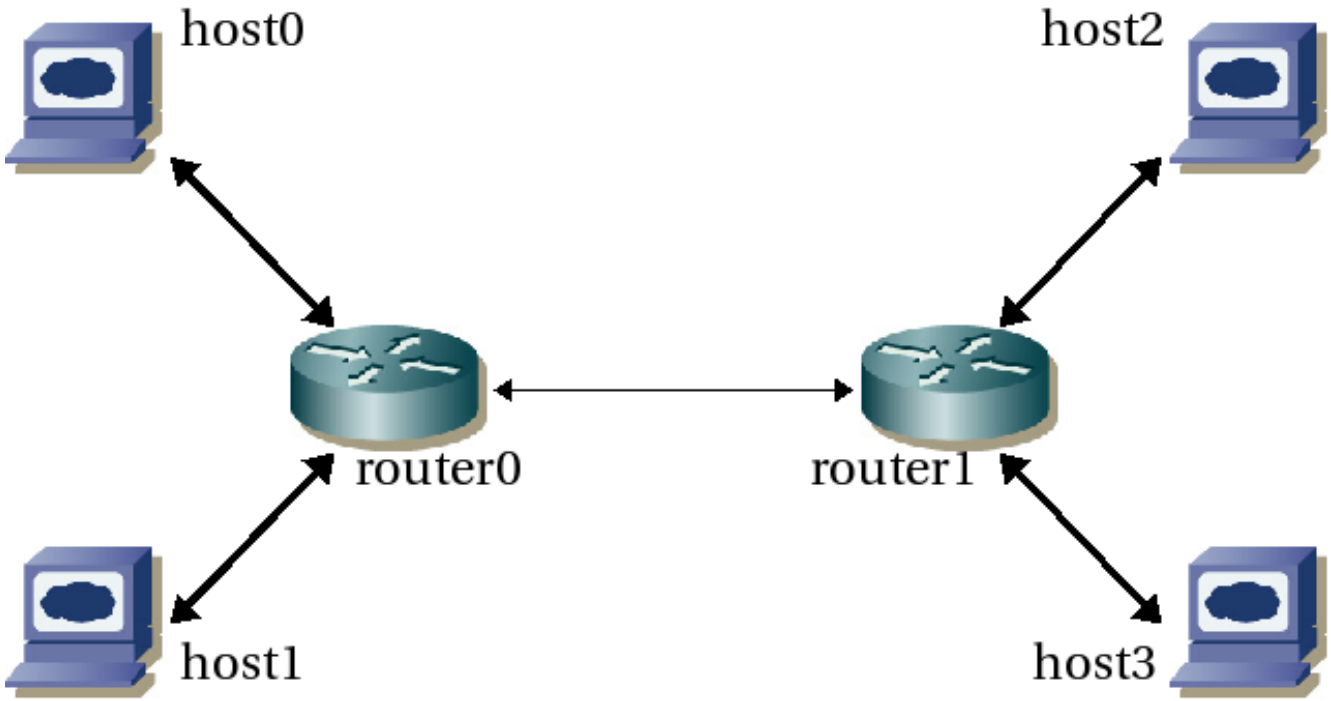
Router



How many networks do you see?
What is the route from host__ and host__ ?
How many hops between host__ and host__ ?

Router



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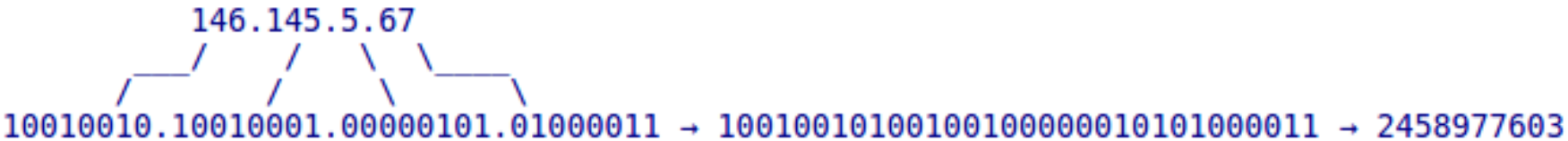
Internet Protocol - IPv4

Dotted-quad notation

- An IP address is a 32 bit number, which can be viewed as four 8-bit chunks (1 byte chunks)
- Usually expressed as 4 decimal numbers, separated by dots
- Preferred for readability and easier to remember



Internet Protocol - IPv4

Best Effort Protocol - Like Ethernet Protocol for Data Link Layer

- Achieves success in identifying hosts across all interconnected networks.
- Does not guarantee delivery - some packets get dropped
- Does not guarantee correct ordering of packets - some packets take different (longer or shorter) routes
- higher layers must address these problems (or not)

Internet Control Message Protocol - ICMP

A companion/supporting protocol to IPv4

- Used by network devices to send error messages and/or operational information.
- For example: that a requested service is not available, or that a host or router could not be reached.

Internet Protocol - IPv6

How many unique IP addresses can we express in 32 bits?

Enter IPv6...

- In reality, there are even fewer IPv4 addresses available.
- The shortage of IPv4 addresses recognized early, and a successor, IPv6, was designed in the 1990s, and deployed in 2006.
- IPv6 addresses have 128 bits, instead of 32.
  - How many addresses available? How many more than IPv4?
- Contains security improvements over IPv4, which was not designed with security in mind
- Adoption has occurred slowly, but increasing at an increasing rate: `https://www.google.com/intl/en/ipv6/statistics.html`

Some useful tools

- Info about my own computer (host):
  - `ipconfig`
  - `ipconfig /all`
- Is there a host at a given IP address?
  - `ping <destIP>`
- What's the route to ... or How far away is ...
  ... the host at a given IP address?
  - `traceroute <destIP>`

Questions

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