Chapter 3

The Basics of Networking
The Internet is a global network of computer networks that transmit data by packet switching using the Internet Protocol (IP)
Diagram of the Internet
Internet Facts

- Internet started as 4 node ARPAnet in 1969
- 1.733 billion users as of Sept. 2009
  http://www.internetworldstats.com/stats.htm
- Internet Protocol version 4 addresses are 32 bits long, so there are 4,294,967,296 possible addresses
Internet Protocol

A protocol is a set of standard rules for data representation, signaling, authentication, and error detection and correction required to send and receive information over a communication channel.
The OSI Network Model

Layer 7  Application
Layer 6  Presentation
Layer 5  Session
Layer 4  Transport
Layer 3  Network
Layer 2  Data Link
Layer 1  Physical
IP Addresses & Domain Names

• Every computer (host) on the Internet has a unique identifying number called an IP address. (ie. 128.223.142.89)

• Most servers have domain names as well. (ie. www.uoregon.edu)

• Domain Name Servers (DNS) translate from domain name to IP address and back.
DNS Servers

- DNS Servers resolve domain names to IP Addresses
- DNS is the world's largest distributed database with more than 7.5 million servers in 2006
- There are 5 DNS servers providing lookup services for UO. (arizona.edu, philom.uoregon.edu, bigdog.lsu.edu, dns.cs.uoregon.edu, ruminant.uoregon.edu)
DNS Heirarchy

(Root)

COM  EDU  ORG  NET  GOV  MIL

UOREGON  LANECC

WWW  CS

WWW  IX
DNS Lookup Diagram

- Root DNS Server
- EDU DNS Server
- Local DNS Server
- UOregen DNS Server
Addresses

- IP Addresses are logical addresses that must be assigned to a physical address.
- Physical addresses are built into the Network Interface Card (NIC)
- Physical addresses are also called Media Access Control (MAC) addresses or hardware addresses.
MAC Addresses

- MAC Addresses are made of 6 hexadecimal values (ie. 00-0b-db-6c-aa-f2)
- Every ethernet card in the world has a unique physical address.
- You can figure out your MAC addresses:
  - Windows: ipconfig /all
  - Linux/Mac OS X: ifconfig
ARP and RARP

- The Address Resolution Protocol (ARP) is used to convert IP Addresses to MAC Addresses.
- The Reverse Address Resolution Protocol (RARP) is used to convert MAC Addresses to IP Addresses.
- You can see your computer's ARP tables:
  - Windows/UNIX: `arp -a`
  - Linux: `arp`
The Internet Protocol is both a protocol and a suite of protocols. Included with IP are the following:

- TCP - For reliable data transport
- UDP - For unreliable data transport
- ICMP - For Internet control messages
Built on TCP are some more protocols:

- HTTP - Regular web data
- HTTPS - Encrypted web data
- POP3 - Email protocol for email clients
- IMAP - Email protocol for email clients
- SMTP - Email protocol for sending and receiving email messages
- SSH - Secure shell protocol
- FTP - File transfer protocol
UDP Application Layer Protocols

- Built on UDP are some more protocols:
  - TFTP - Trivial FTP for servers and switches
  - DNS - Standard lookups for speed
  - SNMP - For network management
  - RIP - Router Information Protocol
Summary

- The Internet
- The OSI Network Model
- IP Addresses and Domain Names
- Domain Name Servers
- Hardware Addresses
- TCP, UDP, and ICMP
- Application Layer Protocols