Computer Network

Connecting the devices

- **Computer Network**: The physical connection between computers and other devices such as printers and remote storage, as well as the software that enables these connections.

Local Area Network

Connecting computer resources at the local level

- **LAN**: Local Area Network, a network that connects machines together that are usually within a single building
- A LAN is the type of network used in a department, small business or home
- For example, the SBA has about 8 LANS, including one for faculty and one each for the three different third floor labs

Benefits of a LAN

Sharing resources

- Share files
- Share printer
- Share applications
- Share Internet connection
Networking Protocols

The language of communication

- **Networking Protocol**: Set of standardized rules and procedures for computers, and other devices such as printers, to communicate with each other.
- To communicate, about 8 or so protocols run simultaneously, at different levels of abstraction, from basic electrical signals to the most abstract level represented by characters such as from the English language.
- That is, a functioning computer network is simultaneously running several different protocols.

Network Router

Connect to the world

- **Router**: A network device that connects networks together.
- Routers that connect Ethernet networks are readily available at many retail outlets, costing less than $100 in wired and mixed wired/wireless varieties.
- Every LAN today needs a router to either connect to other LANs within an organization, or, even for a small office or home network, to connect to the Internet via a broadband connection, either cable model or DSL.

The Internet
Packet-switching vs Circuit-switching Networks

An Internet innovation

▶ Before the Internet, there existed an extensive networking system called the phone system

▶ **Circuit-switching Network**: A network, such as the traditional phone system, in which there is a single physical connection between at least two communication nodes that exists throughout the duration of the communication session

▶ **Packet-switching Network**: A network, such as the Internet, in which each message is broken-down into many small packets and each packet independently travels across the Internet, with the message reassembled by the receiving computer

Motivation for a Packet-switching Networks

**U.S. Military provided the incentive for the Internet**

▶ The concept of packet-switching and the Internet was developed for a military communication system at the height of the cold war in the late 1950’s and early 1960’s

▶ The specification was that surviving military command posts could continue to communicate if a nuclear strike obliterated an important communication center

▶ At that time, AT&T literally owned the phone system, including all the wires and individual telephones in each person’s house and business

▶ AT&T only understood and was interested in circuit switching networks, and so turned down the initial request by the U.S. military to develop the Internet

▶ Instead, the U.S. Government developed the early Internet

The Internet Protocols

**TCP/IP**

▶ Two mid-level protocols, TCP and IP, together are a defining characteristic of all Internet communications

▶ **TCP**: Transmission Control Protocol, which on the sending device breaks-up each message into many, much smaller packets, and on the receiving device reassembles the packets into the original message

▶ **IP**: Internet Protocol, which provides the address of the destination of each packet

▶ Every device connected to the Internet has a unique IP address of the form xxx.xxx.xxx.xxx, such as 132.092.244.167
Domain Name System I

Converting numbers to recognizable names

- No one wants to specify addresses across the Internet in terms of numeric IP addresses
- **Domain Name**: A recognizable name, such as `ibm.com`, that serves to identify a specific IP address on the Internet
- **Top-Level Domain**: The most general part of the domain name, of which the six original domains are
  - `.com` for commercial organization
  - `.org` for non-profit organization
  - `.edu` for educational institution
  - `.net` for network oriented organization
  - `.gov` for U.S. government
  - `.mil` for U.S. military

Domain Name System II

Converting numbers to recognizable names

- For the domain name, `ibm.com`, the `ibm` part is the company or organization name
- The full domain name that is registered and must be unique is the organization name and the top-level domain, such as `ibm.com`
- The `www` part of a web address, such as in `www.ibm.com` is the name of the local server as named by the organization
- Any name is valid, though `www` for World Wide Web is the most common, and can usually be deleted from the address as it is typically the default

DNS Servers

Accessing DNS information

- **Domain Name Server**: Translates a human friendly domain name into the corresponding numeric Internet Protocol (IP) address
- The authoritative DNS servers, which are the ultimate reference for DNS lookups, are located at the top of a hierarchy
- **Root name servers**: The DNS authoritative servers
- There are 13 logical root name server domains, 10 of which originate in the USA, though hundreds of actual physical servers are dispersed throughout the world
- DNS lookup information is cached in subsidiary DNS data bases including your local ISP (Internet Service Provider) and even your own computer
- Free to choose your own local DNS server, such as `http://www.opendns.com/`
Registering Domain Names

Easy and inexpensive

▶ Every domain name must uniquely identify a single IP address
▶ Registering a domain name is simple, and is available to everyone
▶ Originally domain names could only be registered with a very small number of organizations, such as verisign.com, but now hundreds of organizations provide that service
▶ Go to the web site of a web registrar, such as verisign.com or namesecure.com, establish an account, choose a domain name that is available, and pay around $10 a year for the privilege

Protecting Domain Names

Companies must always be on-guard

▶ Cyber-squatting: The purchase of a domain name with the expectation of selling the name for a large price to the organization that wants it
▶ Sometimes a cyber-squatter access public records, such as the recording of a new corporation, and then registers the domain name before the actual corporation does so
▶ Another mischievous practice is for a company to register similar names, but slightly misspelled
▶ Another mischievous practice is to modify a name to project a bad image of the company, such as mycompanysucks.com
▶ Large companies have employees who register many domain names of real names and potential mischievous variants

Who Runs the Internet?

More or less a free-for-all with one exception

▶ ICANN: Internet Corporation for Assigned Names and Numbers, the quasi-governmental U.S. agency that oversees the official Domain Name System, the core of the Internet
▶ ICANN has ultimate authority and responsibility for the official domain name servers as well as the establishment of top-level domains and the registrars that register those domains
▶ In other words, ICANN supervises, through other organizations the registration of the unique domain names that allow the Internet to exist as a coherent whole
▶ Many other countries, particularly China, are not pleased that the U.S. government continues to play a role, however oblique, in the administration of the Internet
Intranets

The Internet on a much smaller scale

- Internet technology is universally adopted, with every computer having built-in TCP/IP and Ethernet networking capability, and all computer users familiar with Internet style communication such as a web browser
- The modern trend is for organizations to leverage this technology for their own, private networks
- **Intranet**: A network that uses Internet technologies, but instead runs within a single company or organization, usually with restricted access from others to the Internet

▶ The End