CPET 499/ITC 250 Web Systems

Week 1

Web System Infrastructure, Protocols, and Applications

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Topics

- **The Internet**: Technology Background
  - **Internet, Web, Packet Switching, TCP/IP Architecture, IP Addresses; Domain Names, DNS, and URLs; Client/Server Computing**
- TCP/IP Protocols and Application Programs
- The New Client: Mobile Platforms
- Cloud Computing
- Internet Network Architecture
- Internet Service Providers
- Internets, Extranet, Wi-Fi, Wireless, Internet 2, etc.

1

Topics

- **The Development of Web**
  - Web pages - Markup Languages: HTML, XML
  - E-mail, Instant Messaging
  - Search Engine
  - Online Forums and Chat
  - Streaming Media
  - Cookies
- Web 2.0 and Services
  - Podcasting, Wikis, Music and Video Services, VoIP, IPTV, Online software, Web Services
- Mobile Apps

Internet

- **Internet**
  - A TCP/IP networked, distributed information system
  - A collection of computer networks spread around the world
  - The name for a group of worldwide client/server-based information system for sharing resources and for communications
  - A global, interactive, dynamic, cross-platform, distributed, hypertext and hypermedia information system
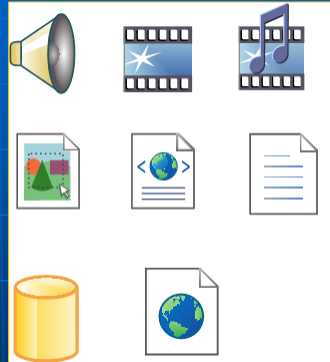- **Examples of Internet-enabled Services**
  - Email, File downloading and uploading, WWW Client/Server applications

Computer Networking & Communications

- Examples of Data and Information:
  - Voice
  - Multimedia
  - Video
  - Medical record
  - Images
 - Web pages
  - Document
  - etc

Internet

- A collection of LANs, WiFi, and WANs systems and network enabled devices and/or computers
- Standard Protocols and Applications

FTP

HTML Pages

XML Pages

3

Networking

- Involves
  - Applications
  - Connections of Computers
  - Networking Protocols
  - Transmission Media
  - Networking Devices

Hub

Server

Communication Media

Wireless Access Point
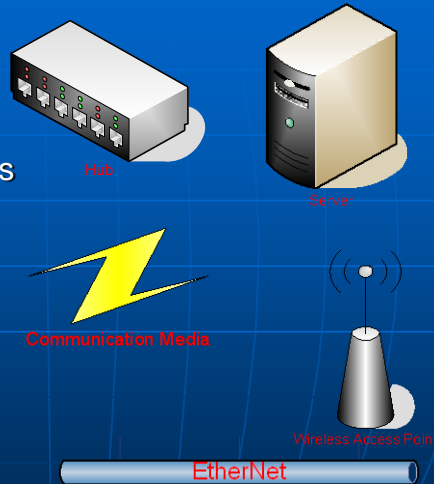
EtherNet

Computer Networks & Distributed Computer Systems

- **Distributed Processing**
  - **Loosely connected computer networks**
  - **Many computers collaborating with each other**
  - **Client-Server**

Mainframes

Workstation Creation Policy

Workstation Group

4

Local Area Networks

Building
Servers
Laptops
Hub
100BaseT
Data
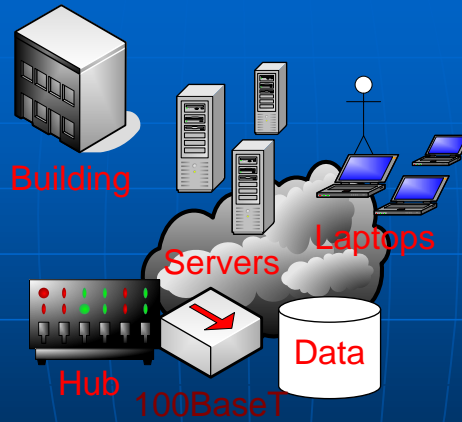
Multipoint Line Configuration

- **Multi-drops**
- **Sharing a single link:**
  - Spatially
  - Time sharing

PC   Laser printer
Ethernet
Laptop computer   computer

PC
Laptop computer   Notebook computer
Laser printer
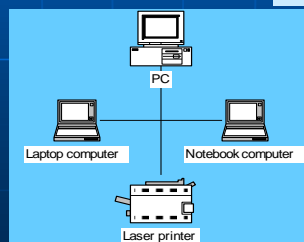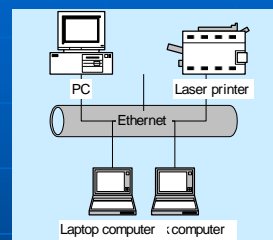
Wide Area Networks (WANs)

ATM Router

Router1

WAN

5 U

Router 2
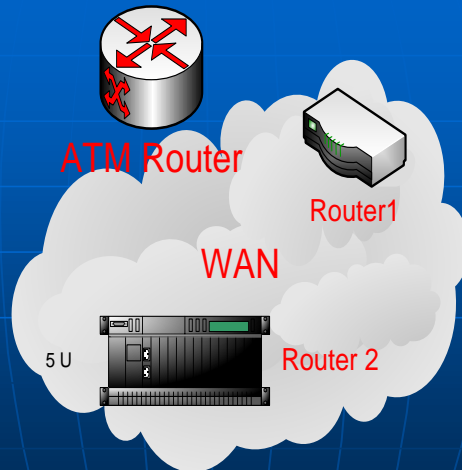
TCP/IP Protocol Suite

- **TCP/IP (Transmission Control Protocol/Internetworking Protocol) Layering Model**
- **TCP/IP Applications**
- **Domain Names**
- **TELNET**
- **FTP (File Transfer Protocol)**
- **HTTP (HyperText Transfer Protocol)**
- **HTTPS (secure)**
- **And more**

Internet Applications and Addressing

- **Email addressing**
- **Web server addressing (domain name, IP address)**
- **TELNET addressing (Web)**
- **FTP address**

Internet Content/File Types

- **Email text**
- **HTML** (Hypertext Markup Language) document
- **Hypertext** -- a technique used to link one word or phrase to another word or phrase in a virtual digital publishing system
- **Hypermedia** -- a technique used in the Web documents to link one media to another media in the forms of words, color graphics, video clip, etc
- **RTF** (Rich Text) - a super ASCII format established by Microsoft in 1980, can be imported to many other systems such as all Windows word processors, and Macs.
- **Postscript** - a highly sophisticated and precise page description language that is used for formatting and typesetting the print media. It is a proprietary format owned by Adobes

Internet Content/File Types

- **MIME** (Multipurpose Internet Mail Extension) for sending binary data
- **Color Graphics File**
  - **GIF** – Graphics Interchange Format
  - **JPEG** – Joint Photographic Experts Group
- **Video** – Digital motion video
  - **.mov** – QuickTime Movie (plug-in player)
  - **.avi** – Audio/Video Interleaved (1992, Microsoft)
  - **.mpg** – a multimedia standard supporting video, audio, and streaming by Moving Picture Expert Group
- **Embedded Programs: JavaScript, Java Applet**

Internet Content/File Types

Audio File formats:

- **wav – Waveform Audio File for PC (uncompressed, CD-quality sound file)**
- **mp3 – the MPEG Layer 3 format (Moving Picture Experts Group)**
- **aiff – Audio Interchange File Format for the MAC**
- **avi – Audio, Video Interleaved**
- **au – standard audio file format used by Sun, Unix and Java**
- **midi: Music Instrument Digital Interface, non-streaming audio file**
- **Real Audio/Video (not-in-real-time audio/ video) - steaming audio/video**

Enterprise Applications

- **E-commerce**
  - high availability and security
- **Messaging/Groupware**
- **Content monitoring**
- **Security**
- **Network Management**
- **Servers:**
  - Web server
  - File and Print server
  - Database server
  - Mail server

Enterprise Applications

- **Intranet:**
  - A network within an enterprise uses TCP/IP, HTTP, and other Internet protocols
- **Extranet:**
  - A private secure extension of an enterprise via a corporate intranet that allows you and your customer, vendors, and other business partners to communicate and do business using standard Internet technology.
- **Virtual Private Network (VPN)**
  - A private network uses public telecommunication infrastructure. Privacy is maintained by the use of tunneling protocol, encryption, and other security procedures.

Internet Web-Enabled Applications

- E-Commerce: B2C (Business to Customer), B2B (Business to Business)
- E-Health
- Smart Power Grid
- Electronics publishing with multimedia technology
- Database applications
- Application Service Provider
- Customer Relationship Management (CRM)
- Supply Chain Management (SCM)
- Enterprise Management (ERP)
- Connected smart infrastructure (smartphone, IoTs, etc)

Internet Web-Enabled Applications

- Distance Education
- Email/Messaging
- Teleconferencing
- Entertainment
- Content Delivery/Advertisement
- Machine Control and Monitoring
- Cloud-based Services

TCP/IP Layer Model

- **Five Layers** (Encapsulation of data units)
  - Layer 5: Application Layer
    - Message
  - Layer 4: Transport Layer
    - Segment or User Datagram
  - Layer 3: Network Layer
    - Datagram
  - Layer 2: Frame
    - Data Link Layer
  - Layer 1: Physical Layer
    - Bits

Application Transport
Layer 5/4

Router — Layer 3

Switch — Layer 2

Ethernet
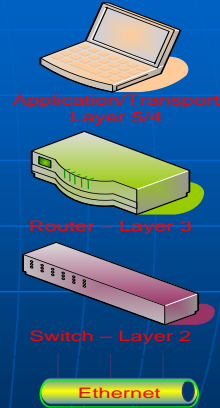
TCP/IP and Internet

- **Internet**
  - **A virtual network system that is formed by using routers to connect physical networks around the world**
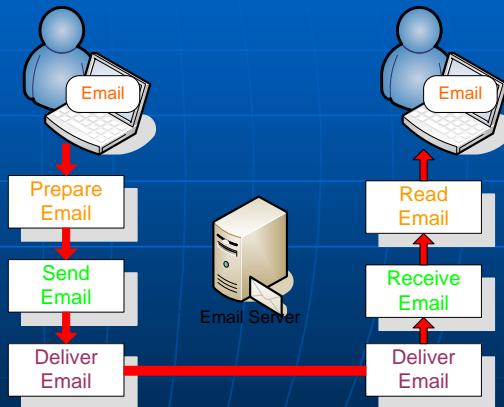- **Routers**
  - **Special purpose computers dedicated to interconnecting heterogeneous networks**
- **Internet Activities Board (IAB)**
  - The Internet Engineering Task Force (IETF)
  - The Internet Research Task Force (IRTF)
  - Request For Comments (RFC) process
  - Proposed Standard - Draft Standard - Full-fledged Standard
  - http://www.w3.org

Layered Tasks

- **Sender, Receiver, and Carrier**

- **Hierarchy**
  - **Preparation**
  - **Sending**
  - **Delivering**

- **Services**
  - **Higher layer uses lower layer service**

Email

Email

Prepare Email

Read Email

Send Email

Receive Email

Email Server

Deliver Email

Deliver Email

TCP/IP Applications

- Ping (echo service)
- Telnet (RFC 854)
  - Remote Login terminal emulation protocol that enable clients to log on to remote hosts on the network
  - Provide access to a computer connected to the network
- FTP – File Transfer Protocol, (RFC 959)
  - RFC 959
  - File transfer applications that enables users to transfer files between hosts across network
  - Provides two virtual connections:
    - Data transfer or exchange (port 20, TCP)
    - Control (commands, replies, process updates; port 21, TCP)
- SMTP (Simple Mail Transfer Protocol, RFC 821)
  - Mail service

TCP/IP Applications

- **SNMP** (Simple Network Management Protocol)
  - RFC 821
  - Simple Network Management Protocol) - used to remotely manage and monitor network devices
- **DNS** (Domain Name Services) - domain names to IP address translation

TCP/IP Applications

- **HTTP** (HyperText Transfer Protocol)
  - Establish a connection between the client and server
  - For transferring hypertext (mixed media) documents through WWW
  - Use TCP/IP to support communications between Web servers and Web clients
  - HTTP Communications:
    - A Request from a Web client (client → Server)
    - A Response from the Web server (server → client)
    - Close or terminate the connection

TCP/IP Applications

- NFS (Network File System) - File Access Protocol
- POP (Post Office Protocol)
- Network News Transfer Protocol
- RPC (Remote Procedure Call) - Transfer Procedure (function) Call to another machine
- TFTP (Trivial File Transfer Protocol))

Transport Layer

- Transport Layer
  - Specify how to ensure reliable transfer
  - Defines two protocols
    - Transmission Control Protocol (connection oriented, reliable)
    - User Datagram Protocol (connectionless, not reliable)

Domain Names

- Human-friendly reference names associated with IP address
- For TCP/IP based network system
- Standardized in hierarchical fashion
- An example:

  www.purdue.edu

  edu   - Top level domain name

  purdue   - main or network specific domain name

  www   - Web server

Domain Name System (DNS)

- DNS identifies each host on the Internet
- Similar to the Telephone Number System (country code, area code, number)
- A Name Server using Client-Server model
- Tree Structure (Root, Leaves):
  - Organization (Generic) domain
  - Country domain
  - Reverse
- Unique Domain Name → Unique IP address

Domain Organization

- ICANN (Internet Corporation for Assigned Names and Numbers), http://www.icann.org/
  - The authority governs global Internet domain name system
  - com   Commercial Organization
  - edu   Educational Institution
  - gov   Government Institution
  - int   International Organization
  - mil   Military Groups
  - net   Network Support Center
  - org   Non-profit Organizations
  - gTLD (Generic Top-Level Domain) Program, http://www.icann.org/en/registries/

Domain Organization

- November 16, 2000: ICANN, the authority that governs global Internet domain name system, has approved seven new domains extensions, in addition to .com, .net and .org:

  biz, info, name, pro, aero, coop, museum

- New gTLD (Generic Top-Level Domains), http://newgtlds.icann.org/en/
  - Overview (Video), http://newgtlds.icann.org/en/announcements-and-media/video/overview-en

Summary

17