

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
- Internet Network Architecture
- Internet Service Providers
- Internets, Extranet, Wi-Fi, Wireless, Internet 2, etc.
- Cloud Computing
- Mobile Cellular Networks, IoT

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

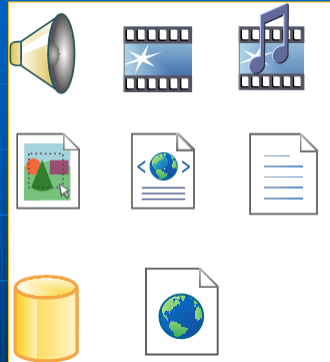
Internet

- **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



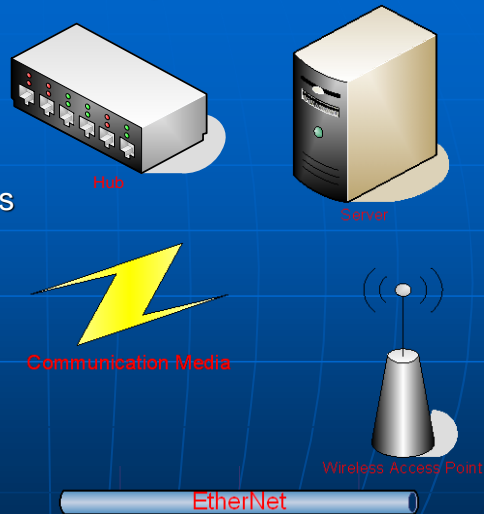
Internet

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



Networking

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



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Computer Networks & Distributed Computer Systems

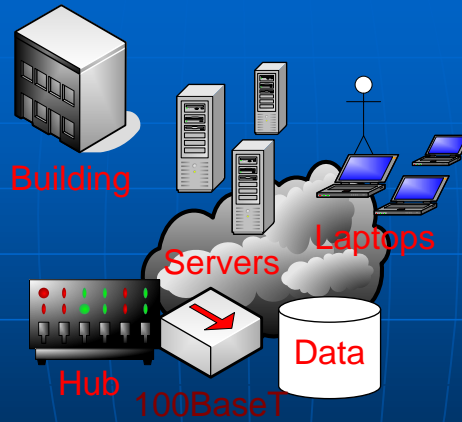
- Distributed Processing
 - Loosely connected computer networks
 - Many computers collaborating with each other
 - Client-Server



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Local Area Networks

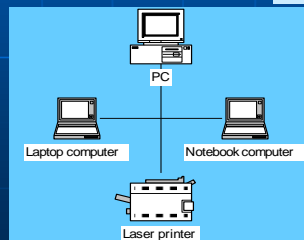
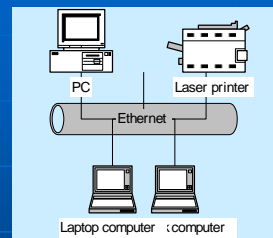


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Multipoint Line Configuration

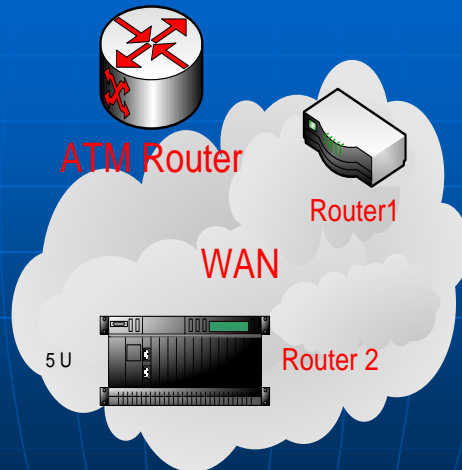
- Multi-drops
- Sharing a single link:
 - Spatially
 - Time sharing



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Wide Area Networks (WANs)



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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

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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

Internet Content/File Types

- **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 Adobe

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

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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

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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.

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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, smart cities, etc)

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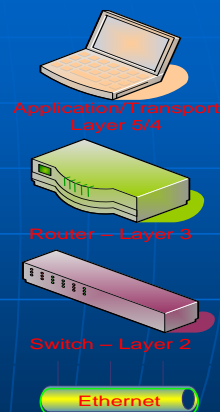
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Internet Web-Enabled Applications

- 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



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>

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Layered Tasks

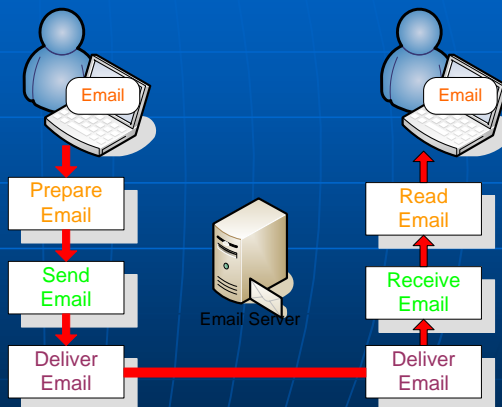
■ Sender, Receiver, and Carrier

■ Hierarchy

- Preparation
- Sending
- Delivering

■ Services

- Higher layer uses lower layer service



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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