



E-commerce

business. technology. society.

Sixth Edition

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Chapter 3

The Internet and World Wide Web: E-commerce Infrastructure

The Internet: Technology Background

- Internet
 - Interconnected network of thousands of networks and millions of computers
 - Links businesses, educational institutions, government agencies, and individuals
- World Wide Web (Web)
 - A system of interlinked hypertext documents accessed via the Internet
 - One of the Internet's most popular services
 - Provides access to around billions, possibly trillions, of Web pages

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Slide 3-2



The Evolution of the Internet

- Innovation Phase, 1964 – 1974
 - Creation of fundamental building blocks
 - Packet Switching hardware
 - TCP/IP communications protocol
 - Client/server computing
- Institutionalization Phase, 1975 – 1995
 - Large institutions provide funding and legitimization
 - DoD and NSF
- Commercialization Phase, 1995 – present
 - Private corporations take over, expand Internet backbone and local service

Slide 3-3



The Internet: Key Technology Concepts

- Federal Networking Council defines **Internet as network that** :
 - Uses IP addressing or its subsequent extensions
 - Supports TCP/IP or its subsequent extensions
 - Provides services to users, in manner similar to telephone system
- Three important concepts that are the basis for understanding the Internet:
 - Packet switching
 - TCP/IP communications protocol
 - Client/server computing

Slide 3-4

Packet Switching

- Method of slicing digital messages into packets
- Sends packets along different communication paths as they become available
 - No dedicated circuit is required
- Reassembles packets once they arrive at destination
- **Uses routers** (special purpose computers that interconnect the computer networks that make up the Internet and route packets) and routing algorithms to ensure packets take the best available path toward their destination

Packets: Discrete units into which digital messages are sliced for transmission over the Internet

Slide 3-5

Packet Switching

Figure 3.3, Page 130

I want to communicate with you.

Original text message

0010110110001001101110001101

Text message digitized into bits

01100010 10101100 11000011

Digital bits broken into packets

0011001 10101100 11000011

Header information added to each packet indicating destination, and other control information, such as how many bits are in the total message and how many packets

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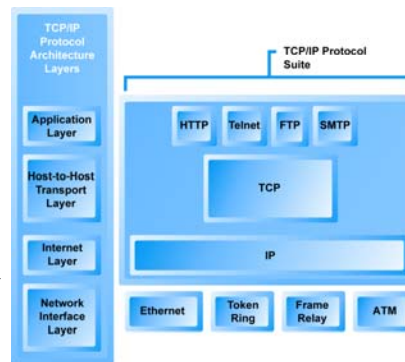
TCP/IP

- Protocol
 - A set of rules and standards for data transfer
- Transmission Control Protocol (TCP):
 - Core communication protocol of the Internet
 - Establishes the connections among sending and receiving Web computers
 - Handles the assembly of packets at the point of transmission, and their reassembly at the receiving end
- Internet Protocol (IP):
 - Protocol to provide the Internet's addressing scheme
 - Responsible for the actual delivery of the packets.

Slide 3-7

Four TCP/IP layers

- **Network Interface Layer**
 - Responsible for placing packets on and receiving them from the network medium (LAN, Token Ring Network, etc.)
- **Internet Layer**
 - Responsible for addressing, packaging and routing messages on the Internet
- **Transport Layer**
 - Responsible for providing communication with the application by acknowledging and sequencing the packets to and from the application
- **Application Layer**
 - Provides applications with the ability to access the services of the lower layers



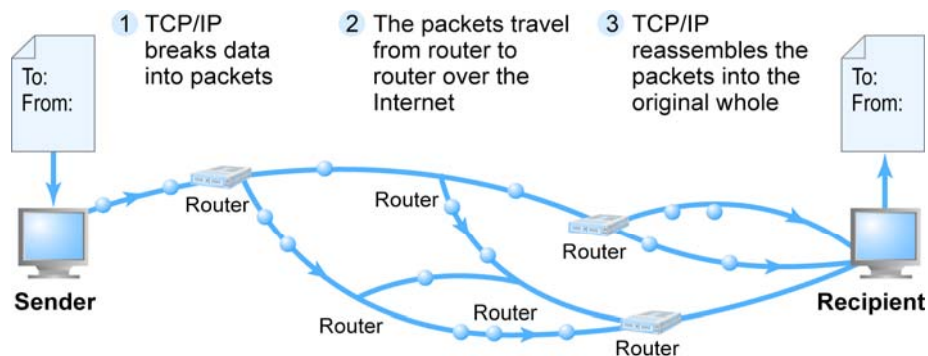
Internet (IP) Addresses

- How can million of computers communicate with one another?
 - Need: A unique address- to send & receive packets
- IPv4:
 - 32-bit number
 - Expressed as series of four separate numbers marked off by periods
 - e.g., 201.61.186.227
- IPv6:
 - 128-bit addresses
 - Able to handle up to 1 quadrillion addresses (IPv4 can only handle 4 billion)

Slide 3-9

Routing Internet Messages: TCP/IP and Packet Switching

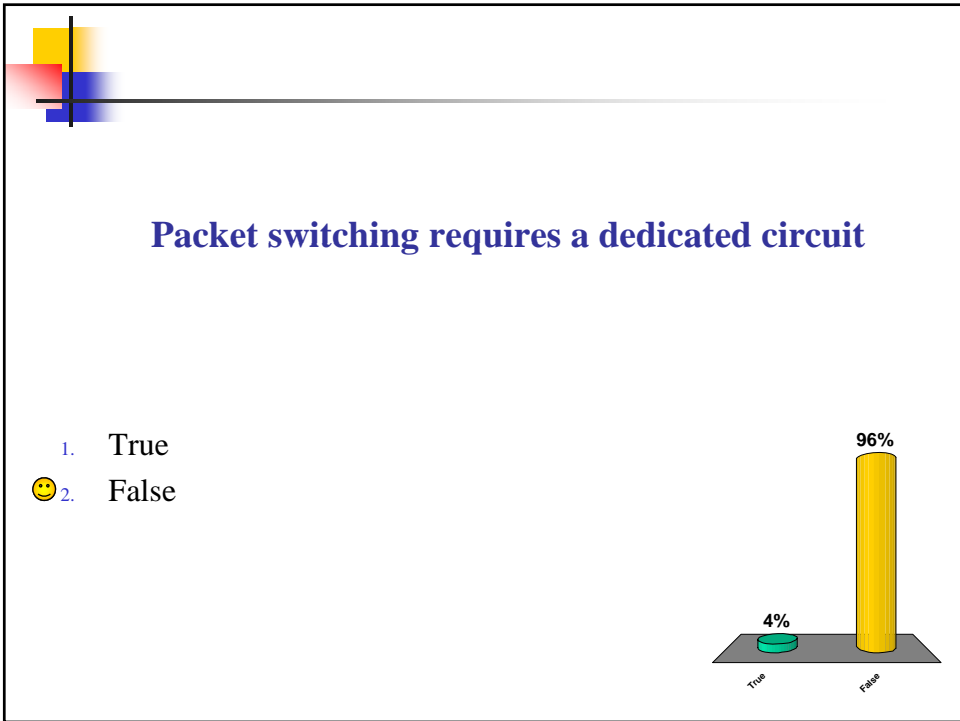
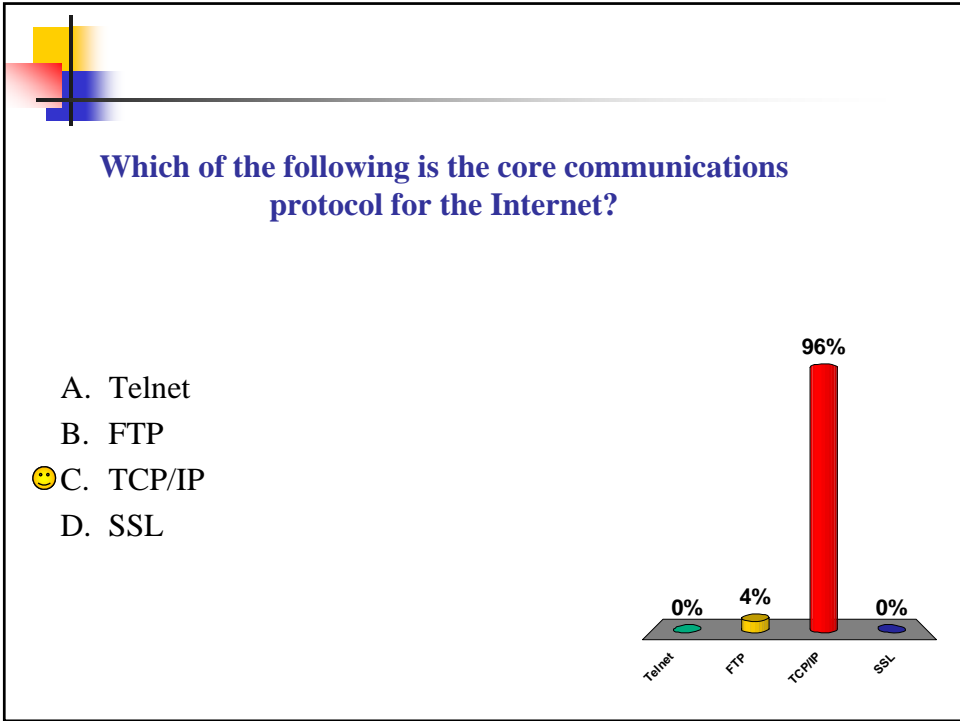
Figure 3.5, Page 133



No dedicated circuit

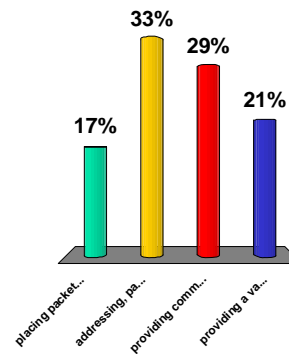
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Slide 3-10



The Internet Layer of TCP/IP is responsible for

- A. placing packets on and receiving them from the network medium
- 😊 B. addressing, packaging, and routing messages
- C. providing communication with the application by acknowledging and sequencing the packets to and from the application
- D. providing a variety of application with the ability to access the services of the lower layers



Domain Names, DNS, and URLs

- Domain name
 - IP address expressed in natural language
- Domain name system (DNS)
 - System for allowing numeric IP addresses to be expressed in natural language
- Uniform resource locator (URL)
 - Address used by Web browser to identify the location of content on the Web
 - Contains the protocol to be used when accessing the address, followed by its location
 - <http://www2.stockton.edu/> refers to the IP address 134.210.1.200
 - Protocol- http
 - Domain name: www2.stockton.edu/

Slide 3-14



Client/Server Computing

- A model of computing in which powerful personal computers (clients) are connected in network together with one or more servers
- Servers perform common functions for the clients
 - Storing files, software applications, etc.
- Clients accomplish tasks such as displaying graphics, storing files, processing files

Slide 3-15



Cloud Computing

- Model of computing in which firms and individuals obtain computing power and software over Internet, rather than purchasing and installing locally on their computers
 - e.g., Google Apps- suite of office software applications
- Fastest growing form of computing
- Radically reduces costs of:
 - Building and operating Web sites (necessary hardware infrastructure & software can be licensed as a service)
 - Infrastructure, IT support

Slide 3-16



Some Internet Protocols

- HTTP:
 - Used to transfer Web pages
- SMTP, POP, and IMAP:
 - Used to send and receive e-mail
- FTP:
 - Permits users to transfer files from server to client and vice versa
- Telnet:
 - Program that enables a client to emulate a mainframe computer terminal
- SSL:
 - Protocol that provides secure communications between client and server



Utility Programs

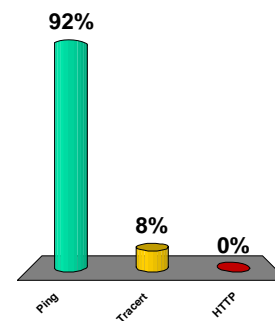
- Ping (Packet Internet Groper):
 - Utility program that allows you to check connection between client and server
- Tracert:
 - Utility program that allows you to follow part of a message sent from a client to a remote computer
- Pathping:
 - Utility program that combines functionality of Ping and Tracert
 - Provides the details of the path between two hosts and statistics for each node in the path based on samples taken over period of time

- Finding IP Address- An easy way
 - Start/Run/CMD (Dos prompt)
 - ping www.stockton.edu

```
C:\WINDOWS\system32\cmd.exe
C:\>ping www.stockton.edu
Pinging www.stockton.edu [134.210.1.200] with 32 bytes of data:
Reply from 134.210.1.200: bytes=32 time=24ms TTL=52
Reply from 134.210.1.200: bytes=32 time=25ms TTL=52
Reply from 134.210.1.200: bytes=32 time=37ms TTL=52
Reply from 134.210.1.200: bytes=32 time=25ms TTL=52
Ping statistics for 134.210.1.200:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 24ms, Maximum = 37ms, Average = 27ms
C:\>_
```

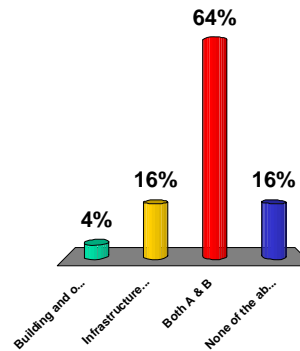
_____ is a utility program that allows you to check connection between client and server

1. 😊 Ping
2. Tracert
3. HTTP



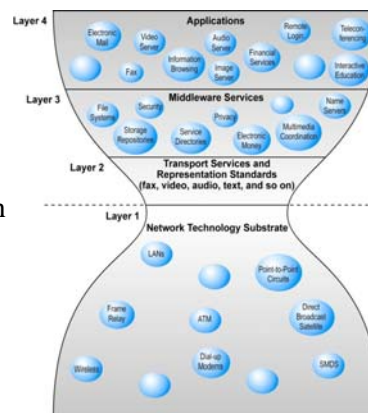
Cloud computing helps in reducing the costs of:

- A. Building and operating Web sites
- B. Infrastructure, IT support
- 😊 C. Both A & B
- D. None of the above



The Internet Today

- Client/server computing model
 - Highly extensible
 - Internet architecture is built in layers
 - Each layer can be changed (as necessary) without disturbing developments in other layers
- Client/server computing model, coupled with hourglass, layered architecture has allowed Internet to handle explosive growth without disruption
- **Hourglass/layered architecture – 4 layers:**
 - Network Technology Substrate
 - Transport Services and Representation Standards
 - Middleware Services
 - Applications



Slide 3-22



Internet Network Architecture

- **Backbone:**
 - High-bandwidth fiber-optic cable networks
 - Private networks owned by a variety of Network Service Providers (NSPs)
 - Bandwidth: 155 Mbps – 2.5 Gbps
 - Built-in redundancy

- **IXPs (Internet Exchange Points):**
 - Hubs where backbones intersect with regional and local networks, and backbone owners connect with one another

- **CANs (Campus Area Networks):**
 - LANs operating within a single organization that leases Internet access directly from regional or national carrier

Slide 3-23



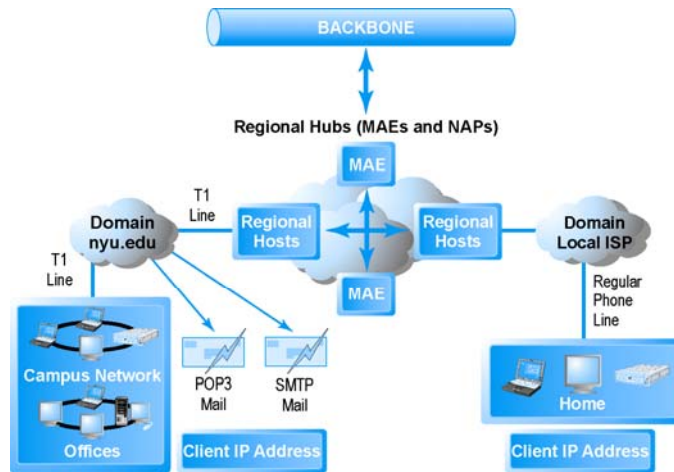
ISPs (Internet Service Providers)

- **ISPs: Lease Internet access to home owners and businesses**
- **Retail providers that deal with “last mile of service”**
- **Two types of ISP service**
 - **Narrowband** (traditional telephone modem connection at 56.6 Kbps)
 - **Broadband** (service based on DSL, cable modem, T1 or T3 telephone lines, and satellite)

Slide 3-24

Internet Network Architecture

Figure 3.12, Page 145



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Slide 3-25

Broadband Service Choices

- Digital Subscriber Line (DSL):
 - High-speed access through ordinary telephone lines
- Cable modem:
 - Piggybacks digital access to Internet on top of analog video cable line
- T1 and T3:
 - International telephone standards for digital communication; offer guaranteed delivery rates (1.54Mbps for T1 & 45 Mbps for T3)
- Satellite:
 - High-speed downloads, slower uploads

Slide 3-26



Intranets and Extranets

- Intranet
 - TCP/IP network located within a single organization for communications and processing
- Extranet
 - Formed when firms permit outsiders to access their internal TCP/IP networks

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Slide 3-27



Who Governs the Internet?

- Internet is governed by no one, and is above & beyond the law
- BUT WHAT ABOUT THE FOLLOWING?
 - It runs on public and private telecom facilities which are governed by law.
 - It is tied into a complex web of governing bodies, national legislatures and professional societies



Who Governs the Internet?

- Organizations that influence Internet and monitor its operations include:
 - Internet Architecture Board (IAB)
 - Internet Corporation for Assigned Names and Numbers (ICANN)
 - Internet Engineering Steering Group (IESG)
 - Internet Engineering Task Force (IETF)
 - Internet Society (ISOC)
 - World Wide Web Consortium (W3C)
 - International Telecommunications Union (ITU)

Please refer page 146-147 for their roles

Slide 3-29



The Internet2® Project

- Current Internet suffers from number of limitations, including:
 - Bandwidth limitations
 - Quality of service limitations- No guaranteed level
 - Network architecture limitations
 - Language development limitations
 - Wired Internet limitations

Slide 3-30



The Internet2® Project

- Consortium of 200+ universities, government agencies, and private businesses collaborating to find ways to make the Internet more efficient, faster
- Primary goals:
 - Create leading edge very-high speed network for national research community
 - Enable revolutionary Internet applications
 - Ensure rapid transfer of new network services and applications to broader Internet community

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Slide 3-31



The Larger Internet 2 Technology Environment: The First Mile and the Last Mile

- GENI Initiative:
 - Proposed by NSF to develop new core functionality for Internet
 - New naming, addressing and identity architecture
 - Enhanced capabilities
 - Additional security architecture and design that supports high availability
 - New Internet services & applications
- Most significant private initiatives:
 - Fiber optics
 - Mobile wireless Internet services

Slide 3-32



Fiber Optics and the Bandwidth Explosion in the First Mile

- “First mile”: Backbone Internet services that carry bulk traffic over long distances
- Older transmission lines being replaced with fiber-optic cable
- Much of fiber-optic cable laid in United States is “dark”, but represents a vast digital highway that can be utilized in the future
 - Photonic technologies expand capacity of existing fiber lines

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The Last Mile: Mobile Wireless Internet Access

- “Last mile”: From Internet backbone to user’s computer, cell phone, PDA, etc.
- Two different basic types of wireless Internet access:
 1. Telephone-based (mobile phones, smartphones)
 2. Computer network-based

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Slide 3-34



Telephone-based Wireless Internet Access

- Competing standards
 - Global System for Mobile Communications (GSM): used primarily in Europe
 - Code Division Multiple Access (CDMA): used primarily in U.S.
- Evolution:
 - 2G cellular networks: relatively slow, circuit-switched
 - 2.5G cellular networks: interim networks
 - 3G cellular networks: next generation, packet-switched
 - 3.5G (3G+)
 - 4G (WiMax, LTE)

Slide 3-35



Wireless Local Area Networks (WLANs)

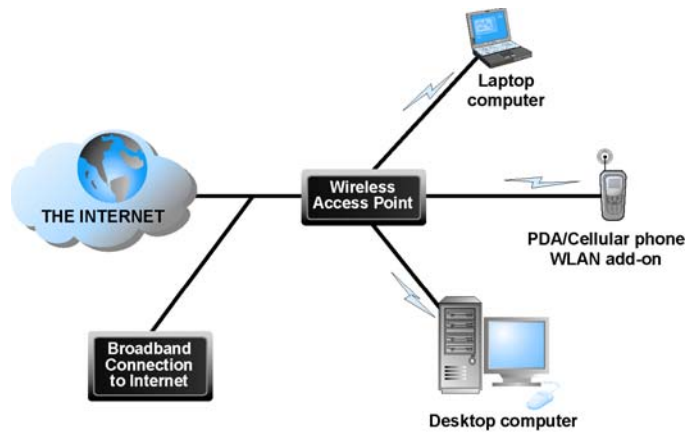
- Wi-Fi
 - High-speed, fixed broadband wireless LAN, different versions for home and business market, limited range
- WiMax
 - High-speed, medium range broadband wireless metropolitan area network
- Bluetooth
 - Low-speed, short range connection
- Ultra-Wideband (UWB)
 - Low power, short-range high bandwidth network
- Zigbee
 - Short-range, low-power wireless network technology for remotely controlling digital devices

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Wi-Fi Networks

Figure 3.16, Page 164



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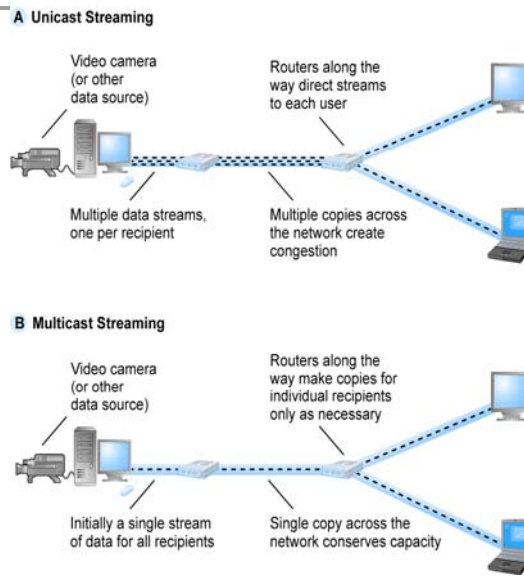
Benefits of Internet II Technologies

- IP multicasting:
 - Set of technologies that enables efficient delivery of data to many locations on a network
- Latency solutions:
 - **Challenge of packet switching**- Internet does not differentiate between high priority packets (video) and low priority (email)
 - **diffserv (differentiated quality of service)** – A new technology that assigns different levels of priority to packets depending on type of data being transmitted
- Guaranteed service levels:
 - Ability to purchase right to move data through network at guaranteed speed in return for higher fee
- Lower error rates
- Declining costs

Slide 3-38

IP Multicasting

Figure 3.17, Page 163



SOURCE: Adapted from Internet2.edu, 2000; Cisco Systems, 2007.

Slide 3-39

Development of the Web

- 1989–1991: Web invented
 - Tim Berners-Lee at CERN
 - HTML, HTTP, Web server, Web browser
- 1993: Mosaic Web browser w/GUI
 - Andreessen and others at NCSA
 - Runs on Windows, Macintosh, or Unix
- 1994: Netscape Navigator, first commercial Web browser
 - Andreessen, Jim Clark
- 1995: Microsoft Internet Explorer

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Slide 3-40



Hypertext

- Text formatted with embedded links
 - Links connect documents to one another, and to other objects such as sound, video, or animation files
- Uses Hypertext Transfer Protocol (HTTP) and URLs to locate resources on the Web
 - Example URL

<http://megacorp.com/content/features/082602.html>

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Slide 3-41



Markup Languages

- Generalized Markup Language (GML) – 1960s
- Standard Generalized Markup Language (SGML) – early GML , 1986
- Hypertext Markup Language (HTML)
 - Relatively easy to use
 - Uses fixed set of markup “tags” used to format Web pages
 - Purpose: Look and Feel
- eXtensible Markup Language (XML)
 - New markup language specification developed by W3C
 - Designed to describe data and information
 - Tags used are defined by user

Slide 3-42



Web Servers and Web Clients

- **Web server software:**
 - Enables a computer to deliver Web pages to clients on networks that request this service by sending an HTTP request
 - Apache and Microsoft IIS
 - Basic capabilities: security services, FTP, search engine, data capture
- **Web server**
 - Can refer to Web server software or physical server
 - Specialized servers: database servers, ad servers, etc.
- **Web client:**
 - Any computing device attached to the Internet that is capable of making HTTP requests and displaying HTML pages

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Slide 3-43



Web Browsers

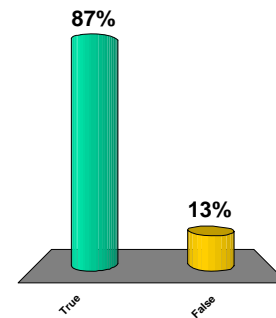
- Primary purpose to display Web pages
- Internet Explorer (67%) and Firefox (23%) dominate the market
- Other browsers include:
 - Netscape
 - Opera
 - Safari (for Apple)
 - Google's Chrome

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In the client server computing, it is easy to expand capacity by adding servers and clients

1. True
2. False



The Internet and Web: Features

- Internet and Web features on which the foundations of e-commerce are built include:
 - E-mail
 - Instant messaging
 - Search engines
 - Intelligent agents (bots)
 - Online forums and chat
 - Streaming media
 - Cookies



Features

- E-mail:
 - Most used application of the Internet
 - Uses series of protocols for transferring messages with text and attachments (images, sound, video clips, etc.) from one Internet user to another
 - Can be an effective marketing tool
 - Spam a worsening problem

- Instant messaging
 - Displays words typed on a computer almost instantly, and recipients can then respond immediately in the same way
 - Different proprietary systems offered by AOL, MSN, Yahoo, and Google
 - Meebo, Digsby: allow users to communicate across platforms

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Slide 3-47



Features

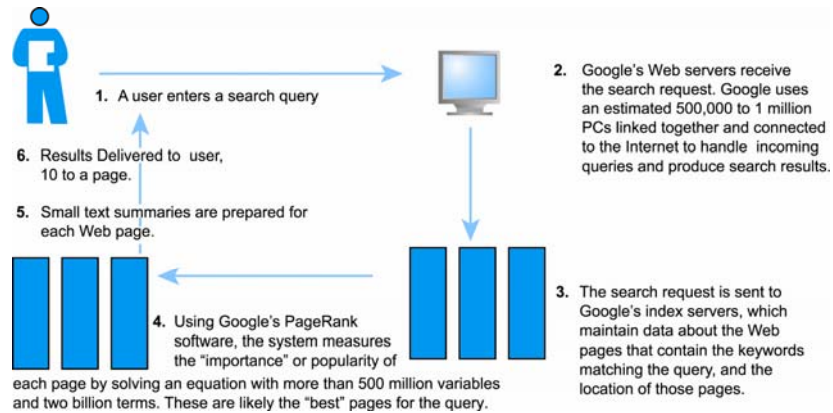
- Search Engines
 - Identify Web pages that match queries based on one or more techniques
 - Keyword indexes, page ranking
 - Also serve as:
 - Shopping tools
 - Advertising vehicles (search engine marketing)
 - Tool within e-commerce sites
 - Outside of e-mail, most commonly used Internet activity

- Intelligent agents (bots)
 - Software programs that gather and/or filter information on a specific topic and then provide a list of results
 - Search bot
 - Shopping bot
 - Web monitoring bot
 - News bot
 - Chatter bot

Slide 3-48

How Google Works

Figure 3.22, Page 180



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Features

- Online forum:
 - AKA message board, bulletin board, discussion group, board, or forum
 - Web application that enables Internet users to communicate with each other, although not in real time
 - Members visit online forum to check for new posts
- Online chat:
 - Similar to IM, but for multiple users
 - Typically, users log into chat room

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Slide 3-50



Features

- Streaming media
 - Enables music, video and other large files to be sent to users in chunks so that when received and played, file comes through uninterrupted
 - Allows users to begin playing media files before file is fully downloaded
- Cookie
 - Small text file deposited by Web site on user's computer to store information about user, accessed when user next visits Web site
 - Can help personalize Web site experience
 - Can pose privacy threat

Slide 3-51



Web 2.0 Features and Services

- Blogs
 - Personal Web page that typically contains a series of chronological entries by its author, and links to related Web pages
- Really Simple Syndication (RSS)
 - Program that allows users to have digital content automatically sent to their computers over the Internet
- Podcasting
 - Audio presentation stored as an audio file and available for download from Web
- Wikis
 - Allows user to easily add and edit content on Web page
- New music and video services
 - Videocasts
 - Digital video on demand

Slide 3-52

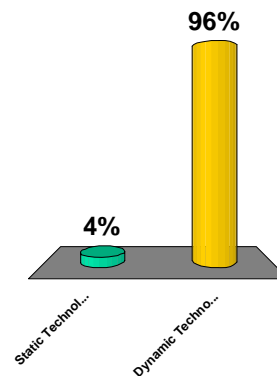
Web 2.0 Features and Services


- Internet telephony (VOIP)
 - Uses Voice Over Internet Protocol (VOIP) and Internet's packet-switched network to transmit voice and other forms of audio communication over the Internet
- Internet television (IPTV)
- Telepresence and video conferencing
- Online software and Web services
 - Web apps, widgets, and gadgets
 - Digital software libraries, distributed storage
- M-commerce applications
 - Beginning to take off

Slide 3-53

Is Internet a static technology or dynamic technology?

1. Static Technology
- 😊 2. Dynamic Technology





Which of the following is a Web application that enables Internet users to communicate with each other, although not in real time?

- A. Online chat
- 😊 B. Online forum
- C. IM
- D. VoIP

