



E-commerce

business. technology. society.

Fifth Edition

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Chapter 3

The Internet and World Wide Web: E-commerce Infrastructure

All Mashed Up

Class Discussion

- What are Web mashups and what technology makes them possible?
- Why would Google and others allow their software to be combined with other software?
- What is the potential benefit to consumers?
- If mashups ultimately make money, how will the revenues be divided?
- Why would mashups be supportive of contextual advertising?

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)

- One of the Internet's most popular services
- Provides access to around 40 - 50 billion Web pages

The Evolution of the Internet 1961—The Present

- Three phases of Internet development
 - Innovation Phase, 1964 – 1974
 - Creation of fundamental building blocks
 - Institutionalization Phase, 1975 – 1995
 - Large institutions provide funding and legitimization
 - Commercialization Phase, 1995 – present
 - Private corporations take over, expand Internet backbone and local service

The Internet: Key Technology Concepts

- Federal Networking Council defines Internet as network that :
 - Uses IP addressing
 - Supports TCP/IP
 - 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

Packet Switching

- Slices digital messages into packets
- Sends packets along different communication paths as they become available
- 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

Packet Switching

Figure 3.3, Page 128

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

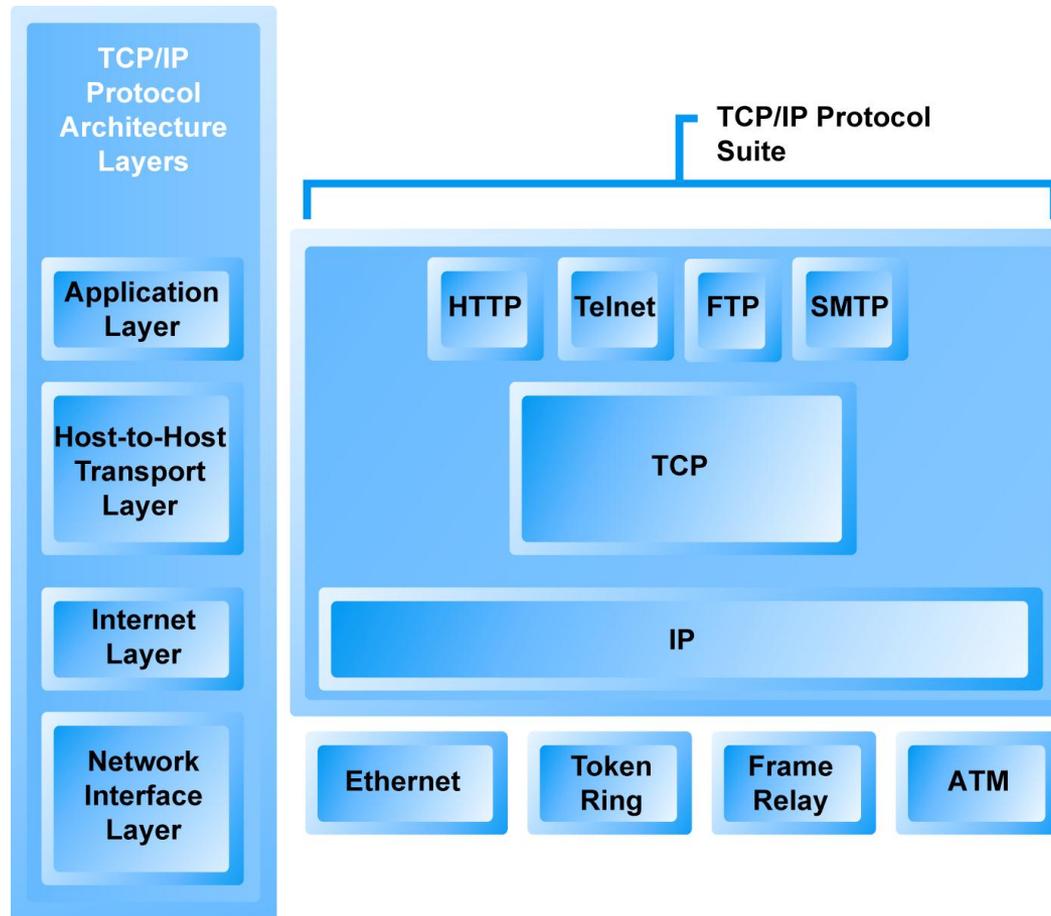
Header information added to each packet indicating destination, and other control information, such as how many bits are in the total message and how many packets

TCP/IP

- Transmission Control Protocol (TCP):
 - 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):
 - Provides the Internet's addressing scheme
- Four TCP/IP layers
 - Network Interface Layer
 - Internet Layer
 - Transport Layer
 - Application Layer

The TCP/IP Architecture and Protocol Suite

Figure 3.4,
Page 130



Internet (IP) Addresses

■ IPv4:

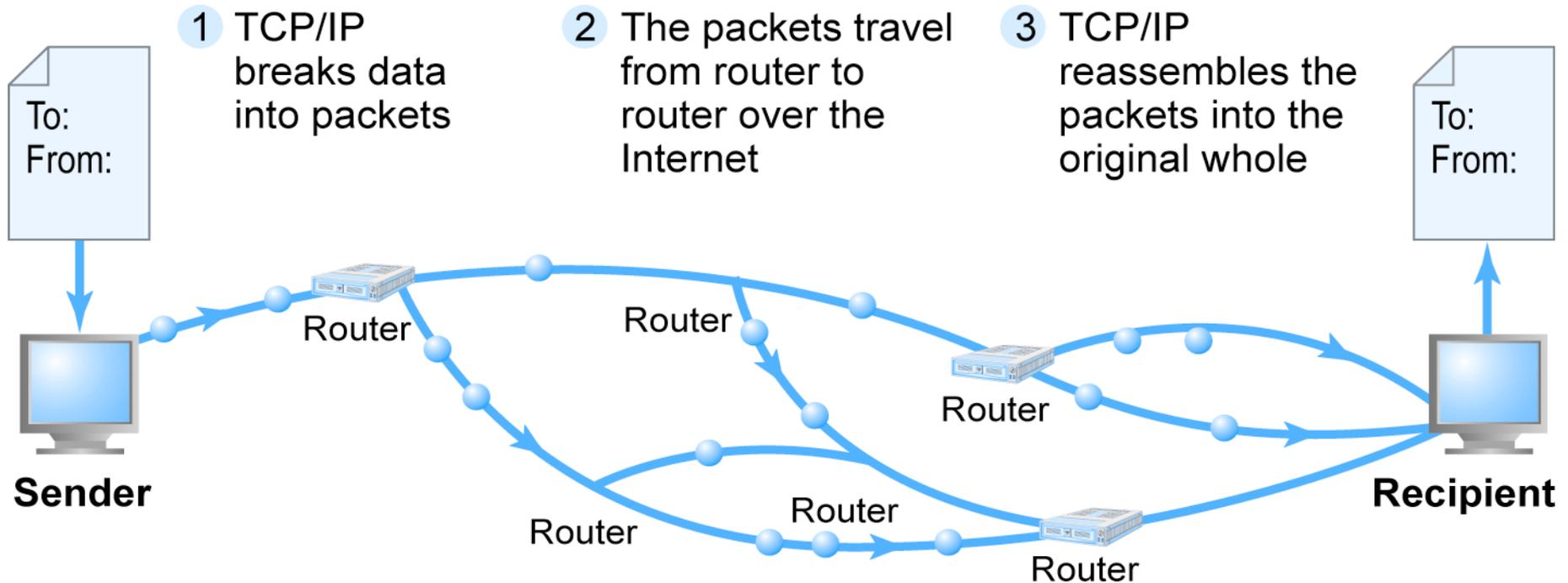
- 32-bit number
- Expressed as series of four separate numbers marked off by periods
 - e.g., 201.61.186.227

■ IPv6:

- 128-bit addresses
- Able to handle up to 1 quadrillion addresses (IPv4 can only handle 4 billion)

Routing Internet Messages: TCP/IP and Packet Switching

Figure 3.5, Page 131



Domain Names, DNS, and URLs

- Domain name
 - IP address expressed in natural language
- Domain name system (DNS)
 - Allows numeric IP addresses to be expressed in natural language
- Uniform resource locator (URL)
 - Address used by Web browser to identify location of content on the Web

Client/Server Computing

- Model of computing
- Powerful personal computers (clients) connected in network with one or more servers
- Servers perform common functions for the clients
 - Storing files, software applications, etc.

Cloud Computing

- Model of computing
- Firms and individuals obtain computing power and software over Internet, rather than purchasing and installing locally
 - e.g., Google Apps
- Fastest growing form of computing
- Radically reduces costs of:
 - Building and operating Web sites
 - Infrastructure, IT support

Other Internet Protocols and Utility Programs

- Internet protocols
 - HTTP
 - E-mail: SMTP, POP3, IMAP
 - FTP, Telnet, SSL
- Utility programs
 - Ping
 - Tracert
 - Pathping

Insight on Business

**Peer-to-Peer Networks Rescue
Hollywood and TV Studios
Class Discussion**

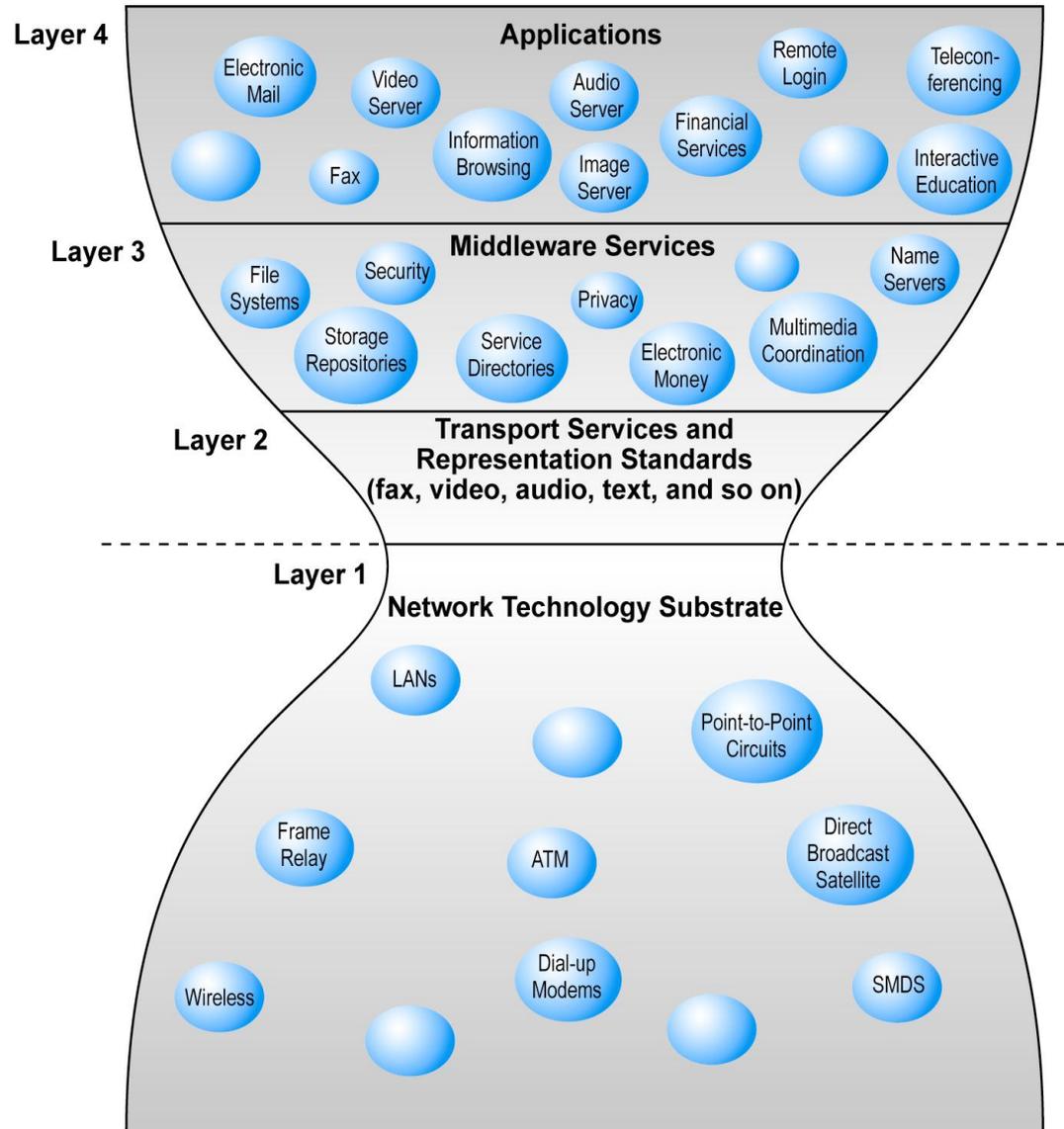
- How does Peer-to-Peer (P2P) networking differ from client/server networking?
- Why is P2P networking a potential money-saver for corporations and other organizations?
- What are some illegal uses of P2P networking?
- What are some legal uses of P2P networking?
- Why does P2P networking permit users to remain anonymous? Is this a good thing?

The Internet Today

- 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

The Hourglass Model of the Internet

Figure 3.11, Page 140



SOURCE: Adapted from Computer Science and Telecommunications Board (CSTB), 2000.

Internet Network Architecture

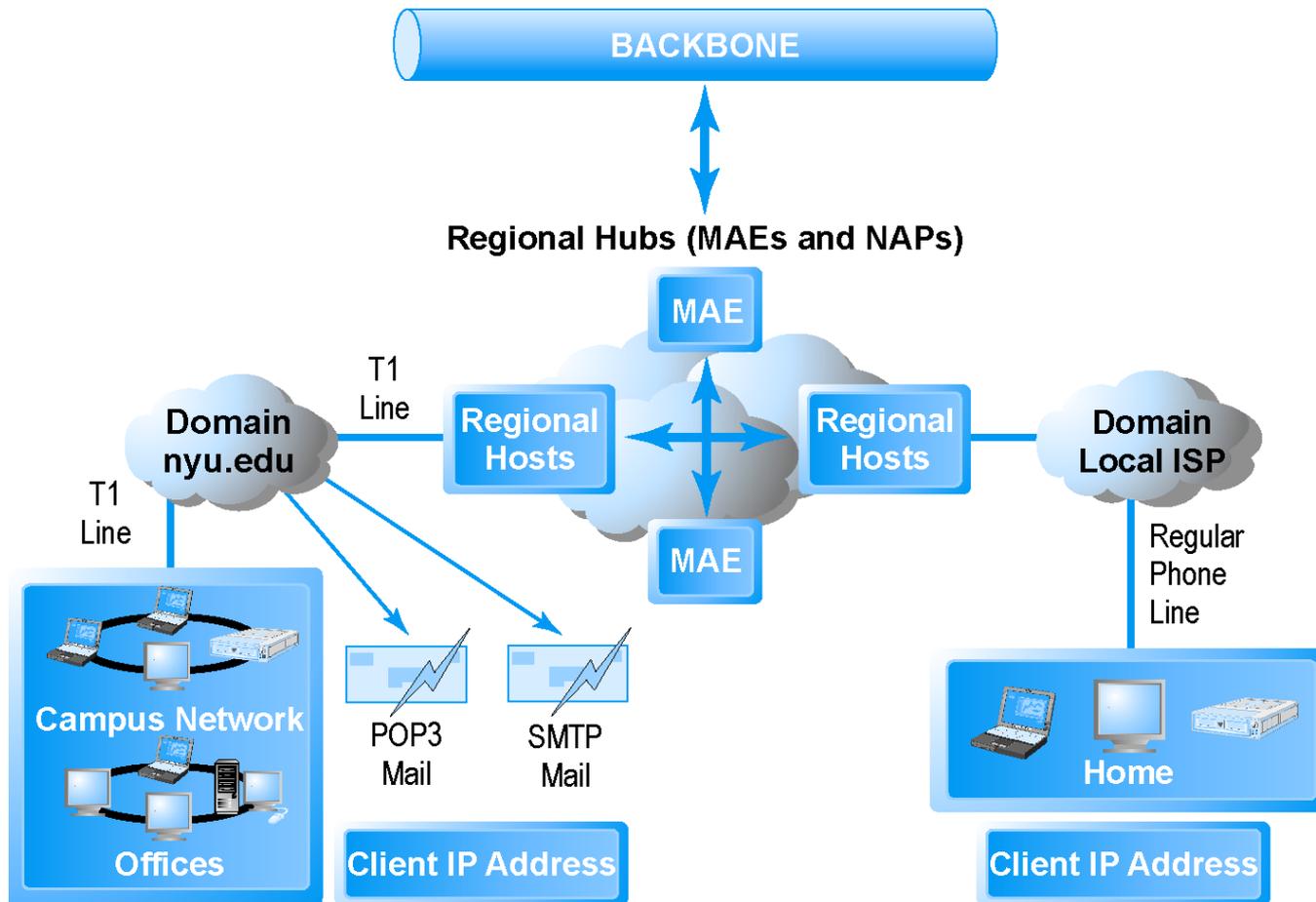
- **Backbone:**
 - High-bandwidth fiber-optic cable networks
 - Private networks owned by a variety of Network Service Providers (NSPs)
 - Bandwidth: 155 Mbps – 2.5 Gbps
 - Built-in redundancy
- **IXPs:** Hubs where backbones intersect with regional and local networks, and backbone owners connect with one another
- **CANs:** LANs operating within a single organization that leases Internet access directly from regional or national carrier

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)

Internet Network Architecture

Figure 3.12, Page 141



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
- Satellite:
 - High-speed downloads, slower uploads

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

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)

Insight on Society

Government Regulation of the Internet

Class Discussion

- How is it possible for any government to “control” or censor the Web?
- Does the Chinese government, or the U.S. government, have the right to censor content on the Web?
- How should U.S. companies deal with governments that want to censor content?
- What would happen to e-commerce if the existing Web split into a different Web for each country?

Internet II: The Future Infrastructure

- Internet II: Second era of Internet being built by private corporations, universities, government agencies
- Current Internet suffers from number of limitations, including:
 - Bandwidth limitations
 - Quality of service limitations
 - Network architecture limitations
 - Language development limitations
 - Wired Internet limitations

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

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

- GENI Initiative:
 - Proposed by NSF to develop new core functionality for Internet
- Most significant private initiatives:
 - Fiber optics
 - Mobile wireless Internet services

Fiber Optics and the Bandwidth Explosion in the First Mile

- Fiber optics concerned with “first mile” or backbone Internet services that carry bulk traffic over long distances
- Older transmission lines being replaced with fiber-optic cable
- Right now, much of fiber-optic cable laid in United States is “dark”, but represents a vast digital highway that can be utilized in the future

The Last Mile: Mobile Wireless Internet Access

- Wireless Internet access concerned with the “last mile”—from Internet backbone to user’s computer, cell phone, PDA, etc.
- Two different basic types of wireless Internet access:
 - Telephone-based
 - Computer network-based

Telephone-based Wireless Internet Access

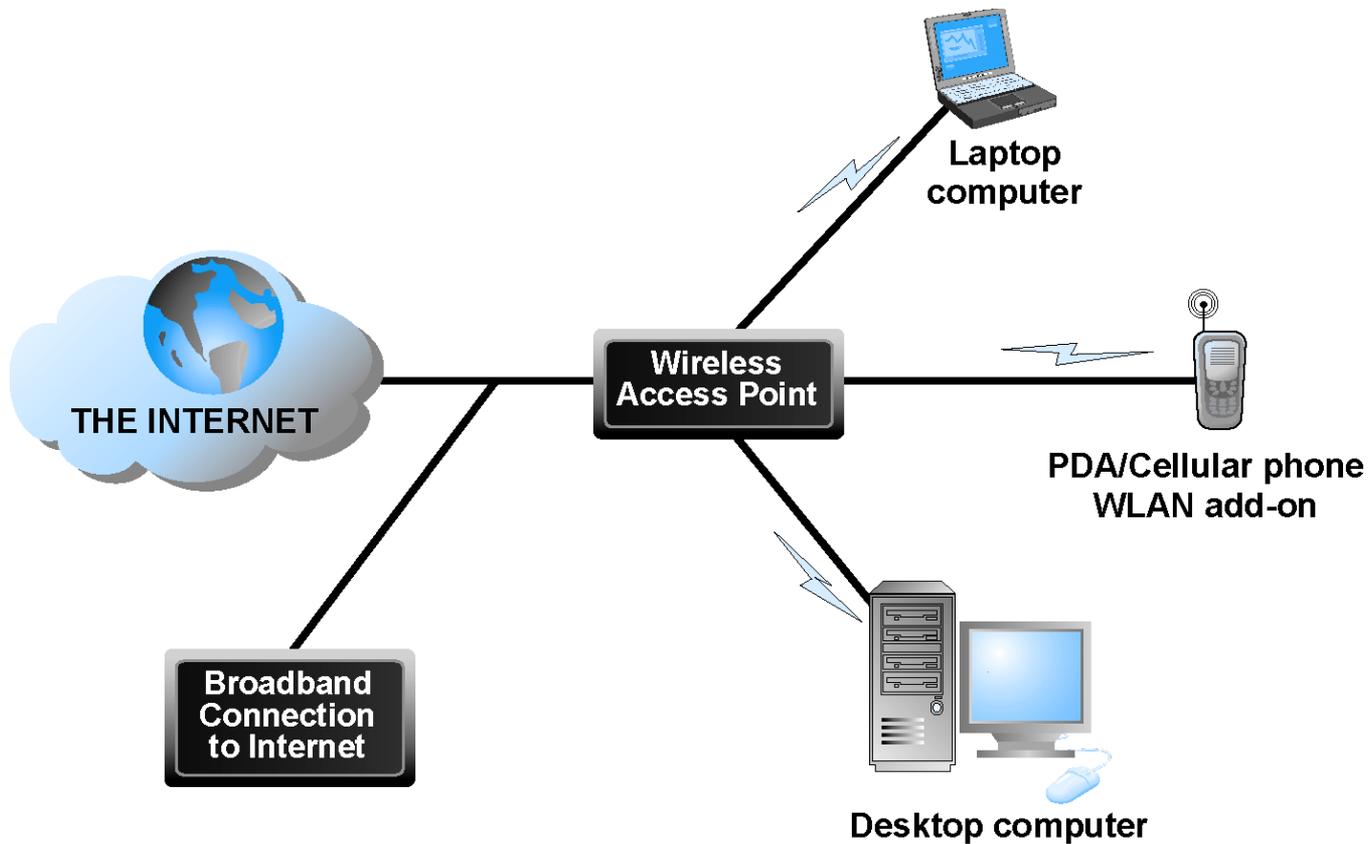
- Competing standards
 - Global System for Mobile Communications (GSM): used primarily in Europe
 - Code Division Multiple Access (CDMA): used primarily in U.S.
- Evolution:
 - 2G cellular networks: relatively slow, circuit-switched
 - 2.5G cellular networks: interim networks
 - 3G cellular networks: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

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

Wi-Fi Networks

Figure 3.16, Page 160



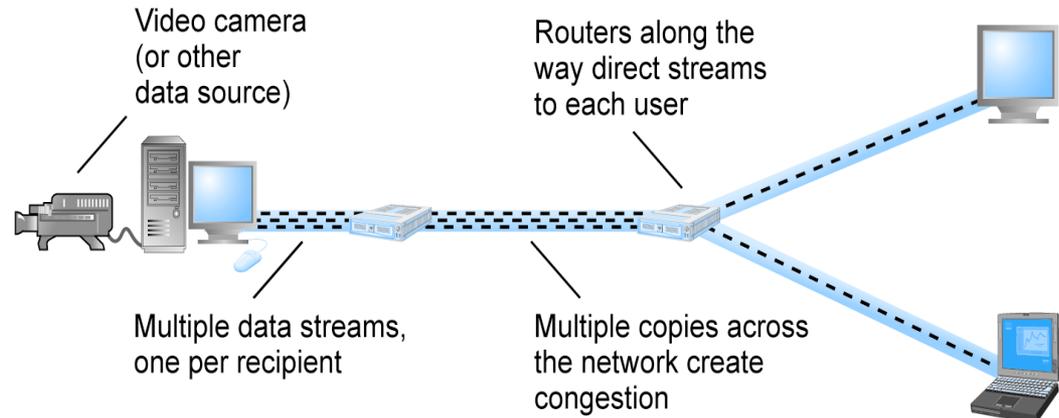
Benefits of Internet II Technologies

- IP multicasting: Enables efficient delivery of data to many locations on a network
- Latency solutions: diffserv (differentiated quality of service) 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

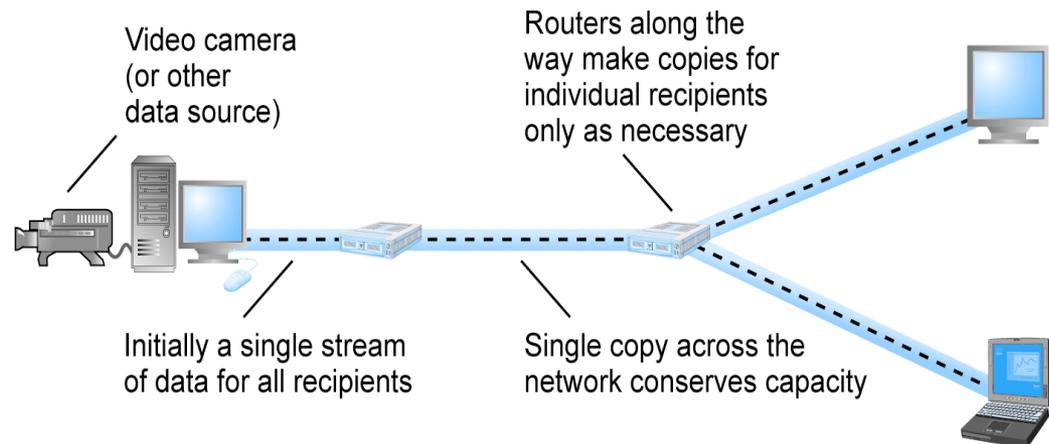
IP Multicasting

Figure 3.17, Page 163

A Unicast Streaming



B Multicast Streaming



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

Development of the Web

- 1989–1991: Web invented by Tim Berners-Lee at CERN
- 1993: Marc Andreessen and others at NCSA create Mosaic, Web browser with GUI that runs on Windows, Macintosh, or Unix
- 1994: Andreessen, Jim Clark found Netscape; create first commercial Web browser, Netscape Navigator
- August 1995: Microsoft introduces Internet Explorer, its version of Web browser

Hypertext

- A way of formatting pages with embedded links that connect documents to one another, and that also link pages 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>

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
- eXtensible Markup Language (XML)
 - New markup language specification developed by W3C
 - Designed to describe data and information
 - Tags used are defined by user

Web Servers and Web Clients

- Web server software:
 - Enables a computer to deliver Web pages written in HTML or XML to clients on network that request this service by sending an HTTP request
 - Basic capabilities: Security services, FTP, search engine, data capture
- Term “Web server” also used to refer to physical computer that runs Web server software
- Web client: Any computing device attached to the Internet that is capable of making HTTP requests and displaying HTML pages

Web Browsers

- Primary purpose to display Web pages
- Internet Explorer (73%) and Firefox (19%) dominate the market
- Other browsers include:
 - Netscape
 - Opera
 - Safari (for Apple)
 - Google's Chrome

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

E-mail

- Most used application of the Internet
- Uses a series of protocols to enable messages containing text, images, sound, video clips, etc., to be transferred from one Internet user to another
- Also allows attachments
- Can be an effective marketing tool
- Spam a worsening problem

Instant Messaging

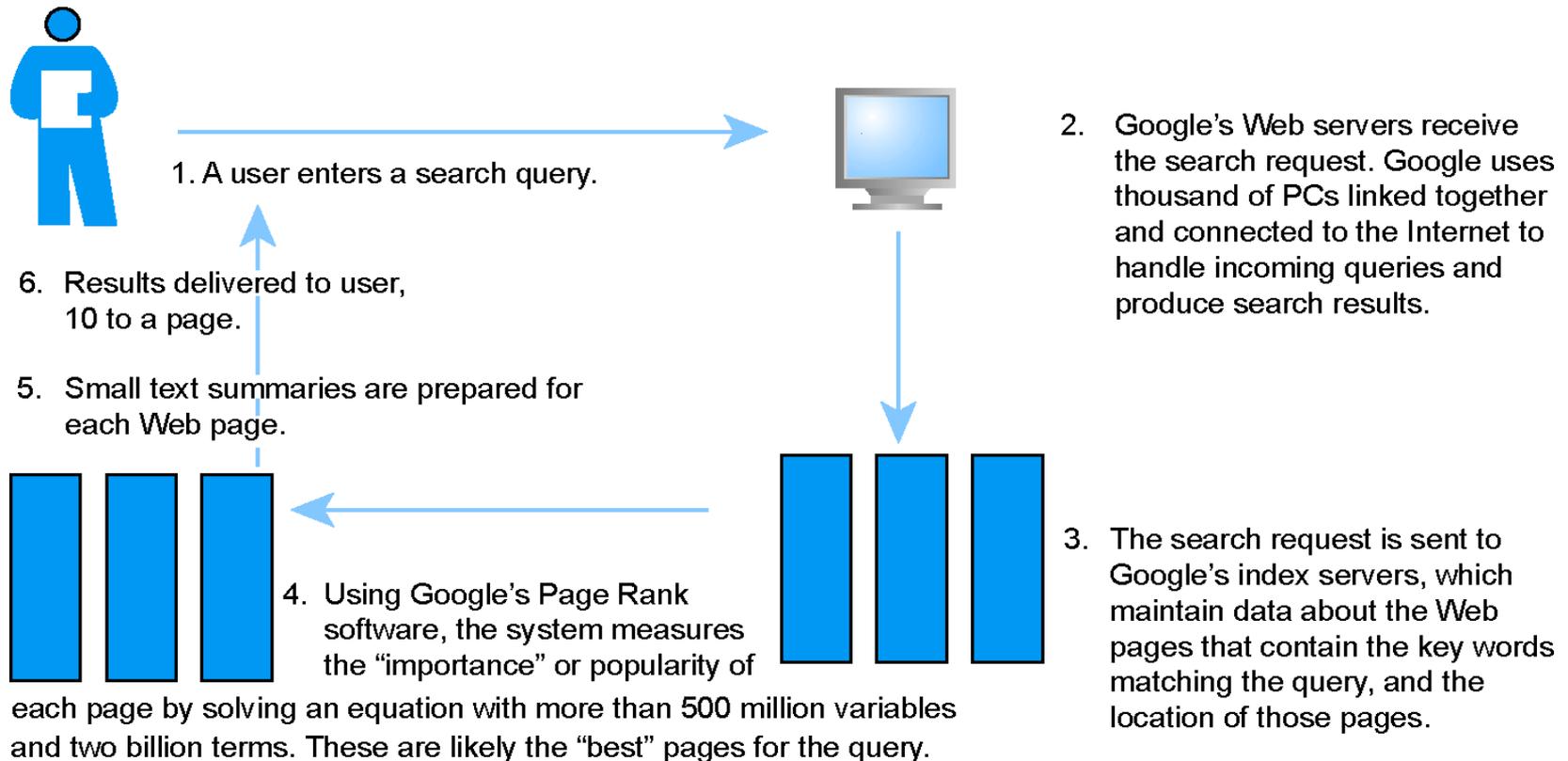
- One of fastest growing forms of online human communication
- Displays words typed on a computer almost instantly, and recipients can then respond immediately in the same way
- Different proprietary systems offered by AOL, MSN, Yahoo, and Google

Search Engines

- Identify Web pages that appear to match keywords (queries) entered by a user, and provide list of best matches based on one or more techniques
- Today, also serve as:
 - Shopping tools
 - Advertising vehicles (search engine marketing)
 - Tool within e-commerce sites
- Outside of e-mail, most commonly used Internet activity

How Google Works

Figure 3.22, Page 175



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
 - Chatterbot

Online Forums and Chat

- Online forum:
 - Also known as message board, bulletin board, discussion, 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

Streaming Media and Cookies

■ 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



Insight on Technology
Chatterbots Meet Avatars
Class Discussion

- What are chatterbots? Why would any firm use them?
- Have you experienced a chatterbot on the Web? Was this a useful or helpful experience?
- What are avatars? Why would a business use avatars?
- Visit a business center on the Second Life web site. Do you think it is worthwhile for businesses to set up such business centers? Why or why not?

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):

- Allows users to have digital content automatically sent to them; typically used for news

■ Podcasting:

- Audio presentation stored as an audio file and available for download from Web

Web 2.0 Features and Services (cont'd)

- Wiki:
 - Allows user to easily add and edit content on Web page
- New music and video services:
 - Videocasts
 - Digital video on demand
- Internet Telephony:
 - Use Voice Over Internet Protocol (VOIP) and Internet's packet-switched network to transmit voice and other forms of audio communication over the Internet

Web 2.0 Features and Services (cont'd)

- Internet television (IPTV)
- Video conferencing
- Online software and Web services:
 - Web apps, widgets and gadgets, digital software libraries, distributed storage
- M-commerce applications



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