



E-commerce

business. technology. society.

Third Edition

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Chapter 3

The Internet and World Wide Web: E-commerce Infrastructure



Web 2.0: Mashups Propel New Web Services

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 “context” advertising?



The Internet: Technology Background

- Internet: An interconnected network of thousands of networks and millions of computers, linking businesses, educational institutions, government agencies, and individuals
- World Wide Web (Web): One of the Internet's most popular services, providing access to over 8 billion Web pages



The Evolution of the Internet 1961—The Present

- History of Internet can be segmented into 3 phases:
 - Innovation Phase—fundamental building blocks conceptualized and realized
 - Institutionalization Phase—providing funding and legitimization for Internet
 - Commercialization Phase—private corporations take over and expand Internet backbone and services



The Internet: Key Technology Concepts

- Federal Networking Council definition of Internet highlights three important concepts that are the basis for understanding the Internet:
 - Packet switching
 - TCP/IP communications protocol
 - Client/server computing



Packet Switching

- A method of slicing digital messages into packets, sending the packets along different communication paths as they become available, and then reassembling the packets once they arrive at their destination
- Uses routers: special purpose computers that interconnect the computer networks that make up the Internet and route packets to their ultimate destination
- Routers use computer programs called routing algorithms to ensure packets take the best available path toward their destination

Packet Switching

Figure 3.3, Page 121

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

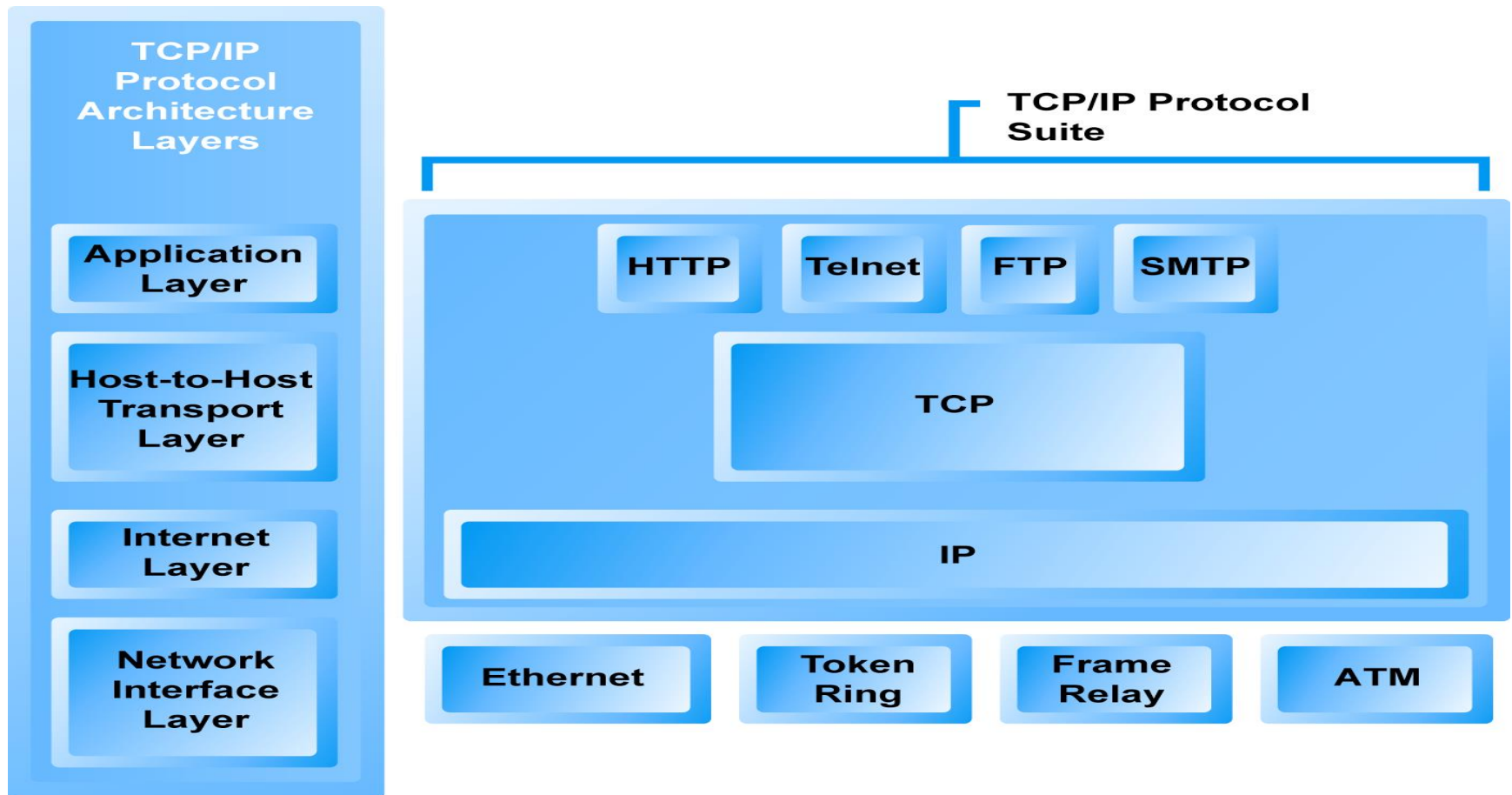
Header information added to each packet indicating destination, and other control information, such as how many bits are in the total message and how many packets

TCP/IP (Transmission Control Protocol/ Internet Protocol)

- Protocol: A set of rules for formatting, ordering, compressing, and error-checking messages
- 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
- IP: Provides the Internet's addressing scheme
- TCP/IP is divided into 4 separate layers:
 - Network Interface Layer
 - Internet Layer
 - Transport Layer
 - Application Layer

The TCP/IP Architecture and Protocol Suite

Figure 3.4, Page 122



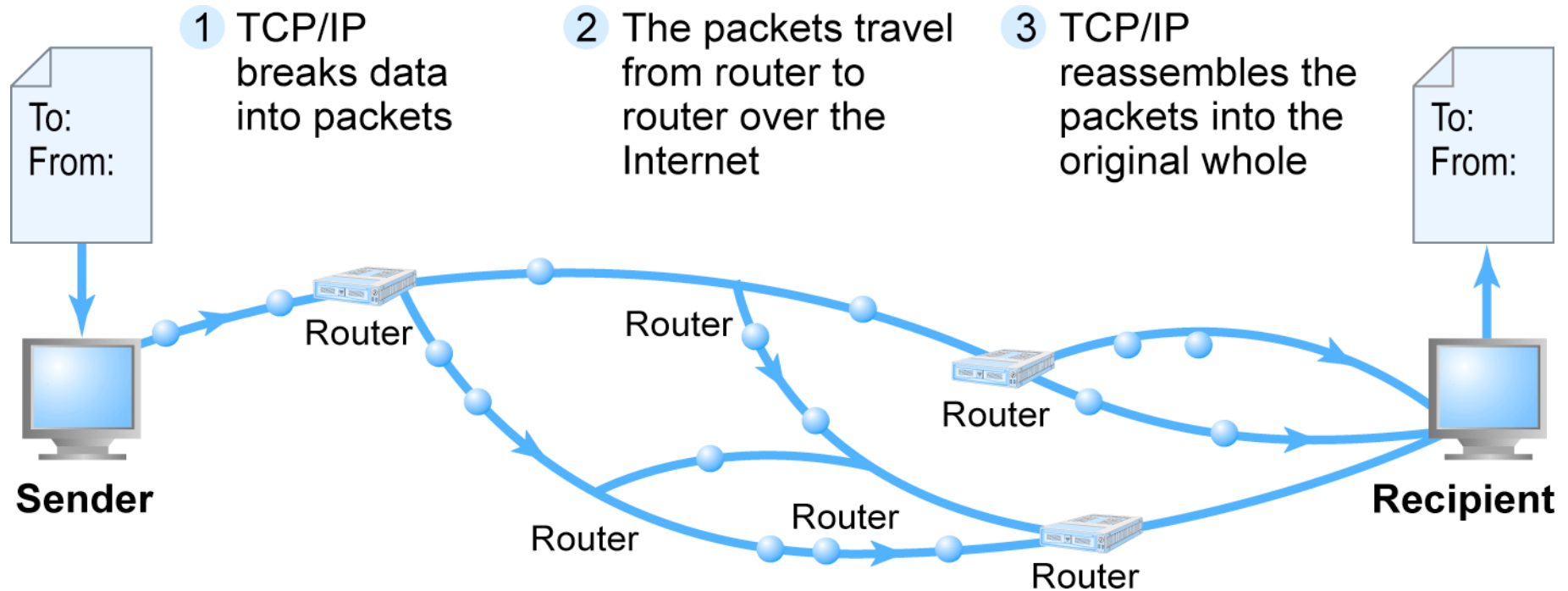


IP Addresses

- Internet address (also called IP address): a 32-bit number expressed as a series of four separate numbers marked off by periods, such as 201.61.186.227
- IPv4 the current version of IP. Can handle up to 4 billion addresses
- IPv6 (next generation of IP) will use 128-bit addresses and be able to handle up to 1 quadrillion addresses

Routing Internet Messages: TCP/IP and Packet Switching

Figure 3.5, Page 123





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): addresses used by Web browsers to identify location of content on the Web



Client/Server Computing

- Model of computing in which very powerful personal computers (clients) are connected in a network with one or more server computers that perform common functions for the clients, such as storing files, software applications, etc.



Insight on Business: Peer-to-Peer Computing Goes to Work 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?



Other 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: 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

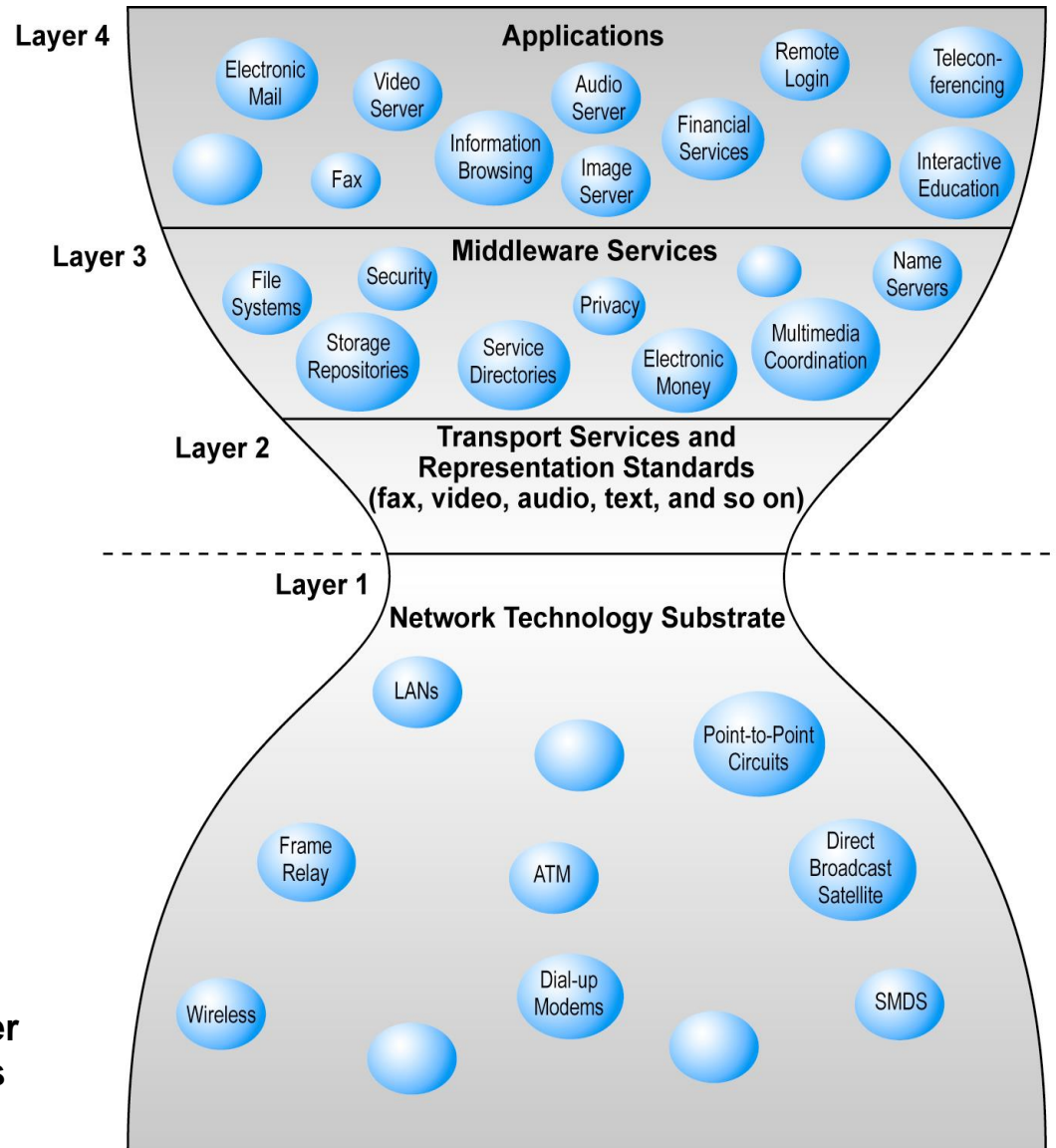


The Internet Today

- Client/server computing model, coupled with hourglass, layered architecture of Internet 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 132



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

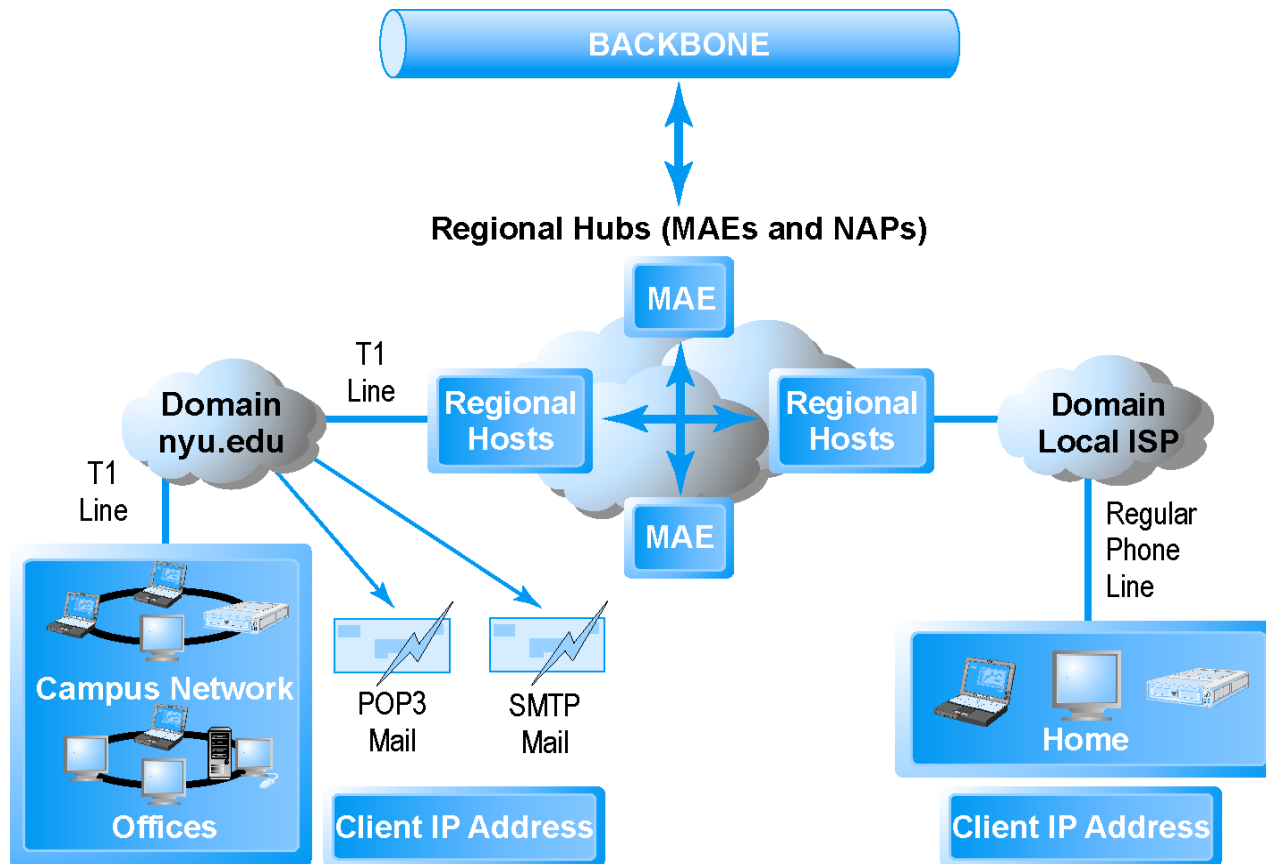


Internet Network Architecture

- **Backbone:** Consists of high-bandwidth fiber-optic cable owned by a variety of Network Service Providers (NSPs)
- **Internet Exchange Points (IXPs):** Hubs where backbones intersect with regional and local networks, and where backbone owners connect with one another
- **Campus area networks (CANs):** Local area networks operating within a single organization that leases Internet access directly from regional or national carrier
- **Internet Service Providers:** Lease Internet access to home owners and businesses

Internet Network Architecture

Figure 3.12, Page 133





Internet Service Providers (ISPs)

- Retail providers that deal with “last mile of service”
- Major national ISPs include AOL, MSN, and AT&T WorldNet, etc.
- Offer both narrowband (traditional telephone modem connection at 56.6 Kbps) and broadband (service based on DSL, cable modem, T1 or T3 telephone lines, and satellite)



Broadband Service Choices

- Digital Subscriber Line (DSL): Telephone technology delivers high-speed access through ordinary telephone lines
- Cable modem: Cable television technology piggybacks digital access to Internet on top of analog video cable line
- T1 and T3: International telephone standards for digital communication that offer guaranteed delivery rates
- Satellite: high-speed downloads, but no upload available



Intranets and Extranets

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



Who Governs the Internet?

- A number of different organizations that influence Internet and monitor its operations including:
 - 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)



Insight on Society: Government Regulation of the Internet Class Discussion

- Why should the government of France be permitted to censor the Web in France (or elsewhere)?
- Does the Chinese government, or the U.S. government, have the right to censor content on the Web?
- How is it possible for any government to “control” or censor the Web?
- 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: The second era of the Internet that is being built today by private corporations, universities, and government agencies
- To appreciate benefits of Internet II, you must understand limitations of the Internet's current infrastructure



Limitations of the Current Internet

- Bandwidth limitations
- Quality of service limitations
- Network architecture limitations
- Language development limitations
- Wired Internet limitations



The Internet2® Project

- Internet2: Consortium of more than 200 universities, government agencies, and private businesses that are collaborating to find ways to make the Internet more efficient
- Primary goals:
 - Create a leading edge very-high speed network for national research community
 - Enable revolutionary Internet applications
 - Ensure the rapid transfer of new network services and applications to the broader Internet community



Areas of Focus of Internet2

- Advanced network infrastructure
- New networking capabilities
- Middleware
- Advanced applications



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
- Private initiatives in fiber optics and wireless Internet services



Fiber Optics and the Bandwidth Explosion in the First Mile

- Fiber optics concerned with the “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



Photonics Technologies

- Photonics: Study of communicating with light waves
- Technologies that will have impact on achieving Internet II include
 - Dense Wavelength Division Multiplexing (DWDM)
 - Optical and fiber switches, and switching components
 - Optical integrated circuits
 - Optical networks
- Big Band: Next step in Internet access; will provide bandwidth of 10 Gbps +



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

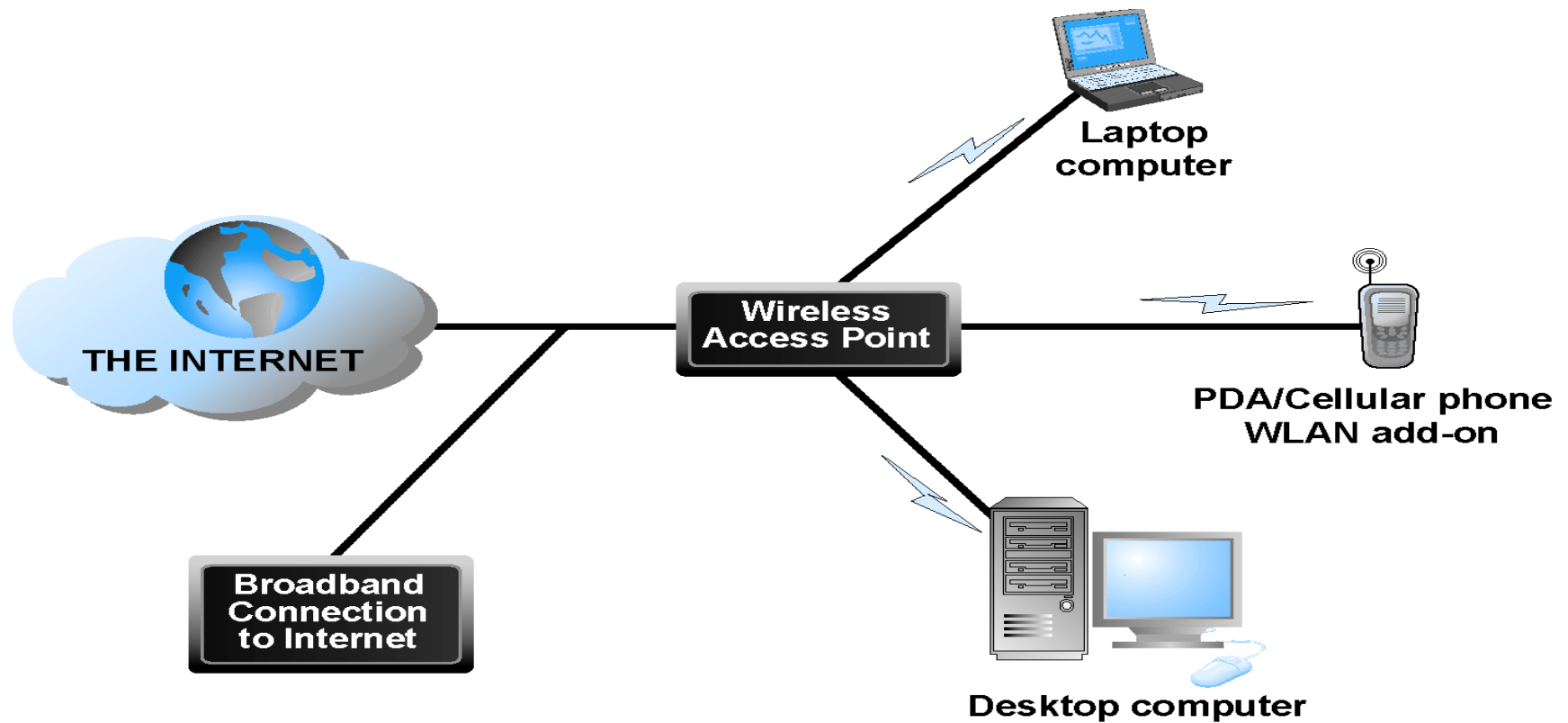
- Different standards
 - Global System for Mobile Communications (GSM): used primarily in Europe
 - Code Division Multiple Access (CDMA): used primarily in U.S.
- Third generation (3G) cellular networks
- Wireless Web protocols include:
 - Wireless Access Protocol (WAP)
 - iMode

Wireless Local Area Networks (WLANs)

- Wi-Fi: High-speed, fixed broadband wireless local area network. 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 of digital devices
- Ultra-Wideband (UWB): Low power, short-range high bandwidth network
- Zigbee: Short-range, low-power wireless network technology useful for remotely controlling digital devices

Wireless Local Area Network Hotspots

Figure 3.17, Page 153





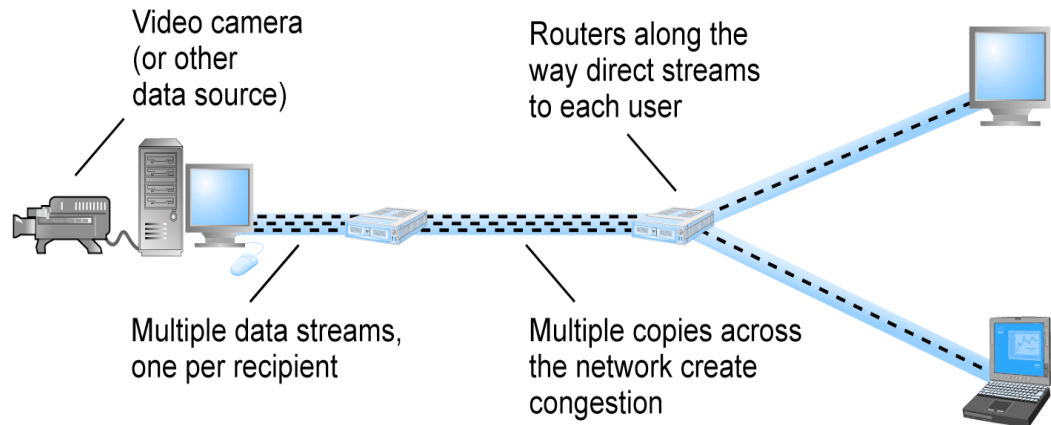
Benefits of Internet II Technologies

- IP Multicasting: set of technologies that enables efficient delivery of data to many locations on a network
- Latency solutions: diffserve (differentiated quality of service) will be able to assign 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

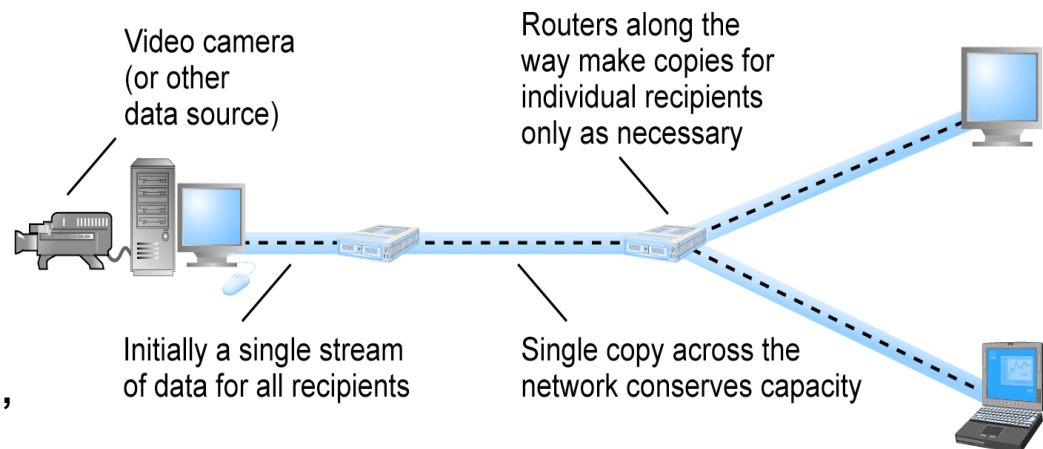
IP Multicasting

Figure 3.18, Page 156

A Unicast Streaming



B Multicast Streaming



SOURCE: Adapted from Internet2.edu, 2000; Cisco Systems, 2002.

Development of the Web

- 1989–1991: Web invented by Tim Berners-Lee at European Particle Physics Laboratory (CERN)
- 1993: Marc Andreessen and others at NCSA create Mosaic, a Web browser with a graphical user interface that could run on Windows, Macintosh, or Unix computer
- 1994: Andreessen and Jim Clark found Netscape, and create first commercial Web browser, Netscape Navigator
- August 1995: Microsoft introduces its version of Web browser, Internet Explorer



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

Markup Languages

- Generalized Markup Languages (GMLs) include:
 - Standard Generalized Markup Language (SGML)—an early GML
 - Hypertext Markup Language (HTML)—a GML that is relatively easy to use; provides fixed set of markup “tags” used to format a Web page
 - eXtensible Markup Language (XML)—new markup language specification developed by W3C that is 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 (88%) and Firefox (9%) dominate the market
- Other browsers include:
 - Netscape
 - Opera
 - Safari (for Apple Macintosh)



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

- One of the most used applications 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 (files attached to the e-mail message)
- Can be an effective marketing tool
- Spam: unsolicited e-mail. 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

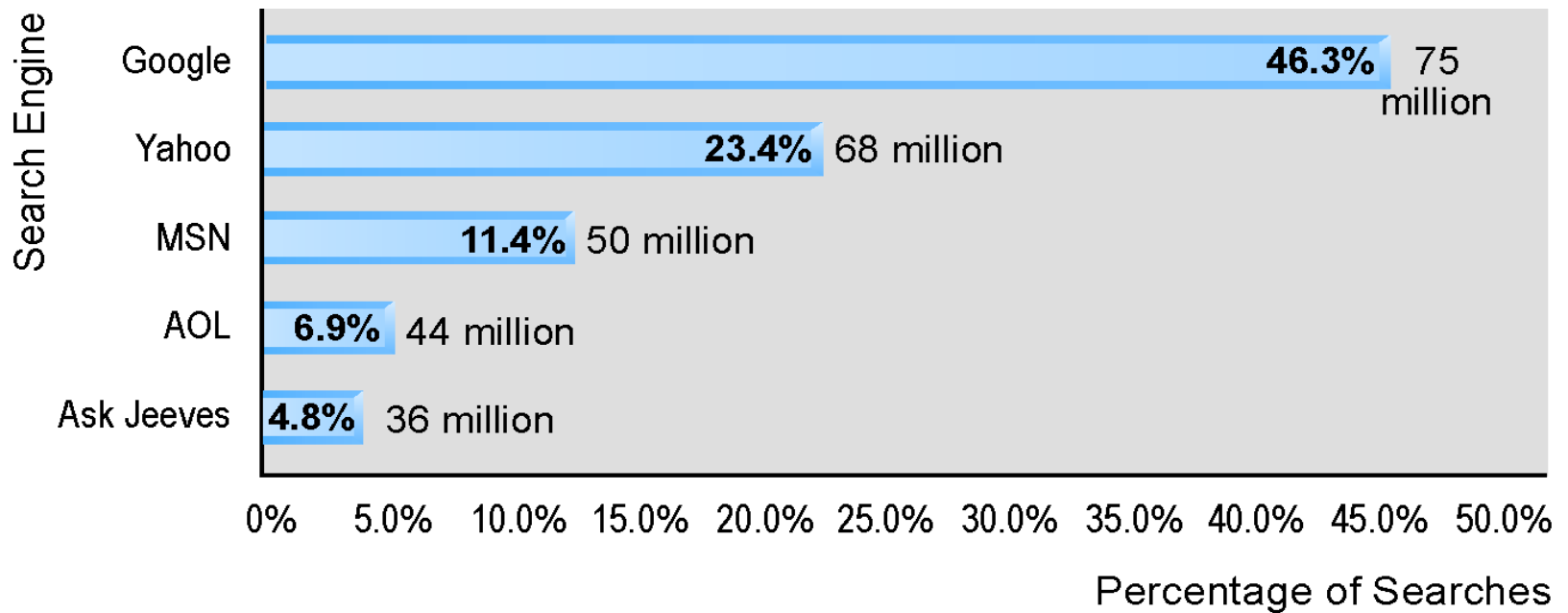


Search Engines

- Identifies Web pages that appear to match keywords (queries) entered by a user, and provides list of best matches based on one or more of a variety of techniques
- No longer simply search engines, but also shopping tools and advertising vehicles (search engine marketing)

Top Five Search Engines

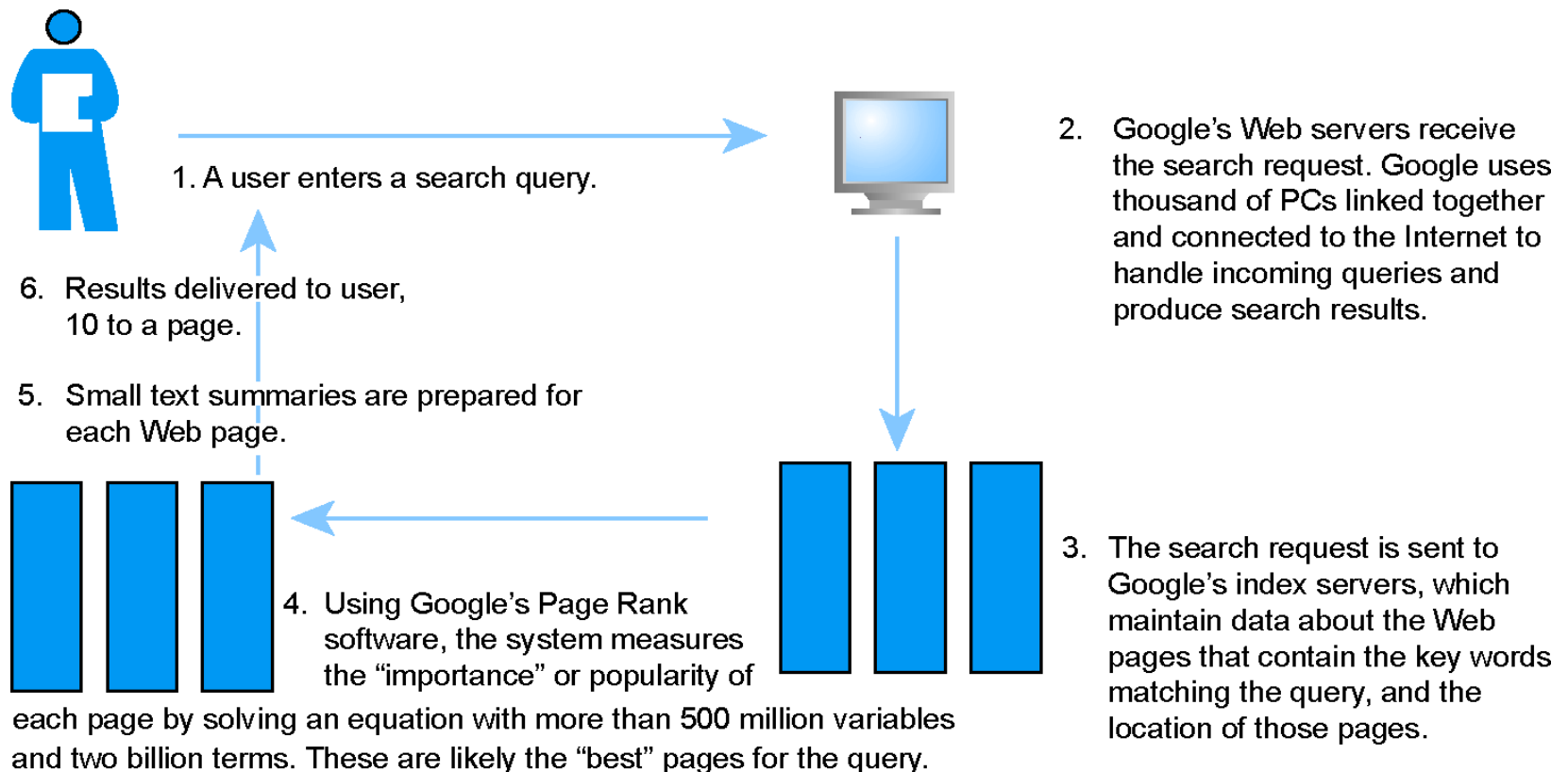
Figure 3.22, Page 168



SOURCE: Based on data from Sullivan, 2006; Pew Internet & American Life Project, 2005c; comScore Networks, 2006.

How Google Works

Figure 3.23, Page 169





Intelligent Agents (Bots)

- Software programs that gather and/or filter information on a specific topic and then provide a list of results
- Types include search bot, shopping bot, Web monitoring bot, news bot, chatterbot



Insight on Technology: Chatterbots Get a Job: Virtual Reps

Class Discussion

- What are chatterbots? Why would any firm use them?
- Have you experienced a chatterbot on the Web or telephone? Was this a useful or helpful experience?
- What are vReps? Why would a business use vReps?
- Verity is now owned by Autonomy Corporation (autonomy.com)



Other Internet and Web Features Relevant to E-commerce

- Online forums and chat: Enables users to communicate with each other via computer. Online chat occurs in real time (simultaneously); used in e-commerce to help develop community
- 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
- Cookies: small text file stored on user's computer with information about the user that can be accessed by Web site the next time user returns to the site



Internet II and E-commerce: Emerging Features and Services

- Weblogs (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 them; typically used for news
- Podcasting: Audio presentation stored as an audio file and available for download from Web



Internet II and E-commerce: Emerging Features and Services (cont'd)

- Wiki: Web application that allows a user to easily add and edit content on a Web page
- New music and Video services: Videocasts; digital video on demand; videocasts
- Internet Telephony: Technologies that use Voice Over Internet Protocol (VOIP) and Internet's packet-switched network to transmit voice and other forms of audio communication over the Internet



Internet II and E-commerce: Emerging Features and Services (cont'd)

- Video conferencing
- Online software and services: digital software libraries, distributed storage
- M-commerce applications