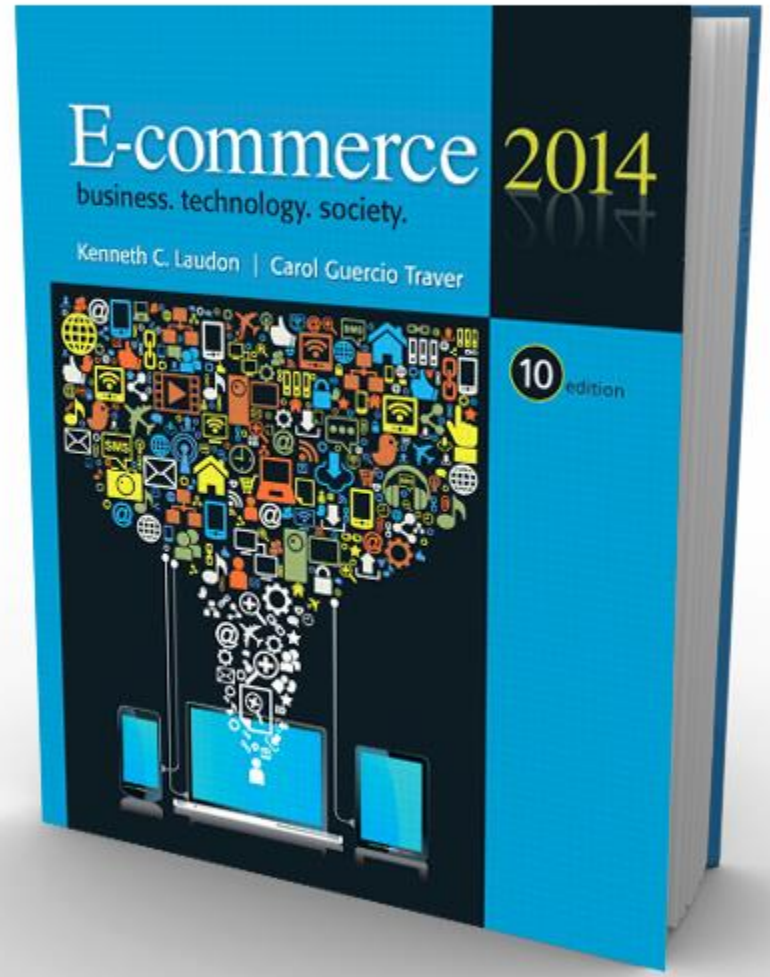

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Chapter 3

E-commerce Infrastructure: The Internet, Web, and Mobile Platform

Agenda

- Internet: Technology Background
- Internet Today
- Future Internet Infrastructure
- Internet and Web: Features and Services
- Mobile Apps

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 billions, possibly trillions, of Web pages

The Evolution of the Internet 1961–Present

- **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

- **Internet defined as network that:**
  - Uses IP addressing
  - Supports TCP/IP
  - Provides services to users, in manner similar to telephone system
- **Three important concepts:**
  - 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
  - **Routing algorithms** ensure packets take the best available path toward their destination
- **Less expensive, wasteful than circuit-switching**

Packet Switching

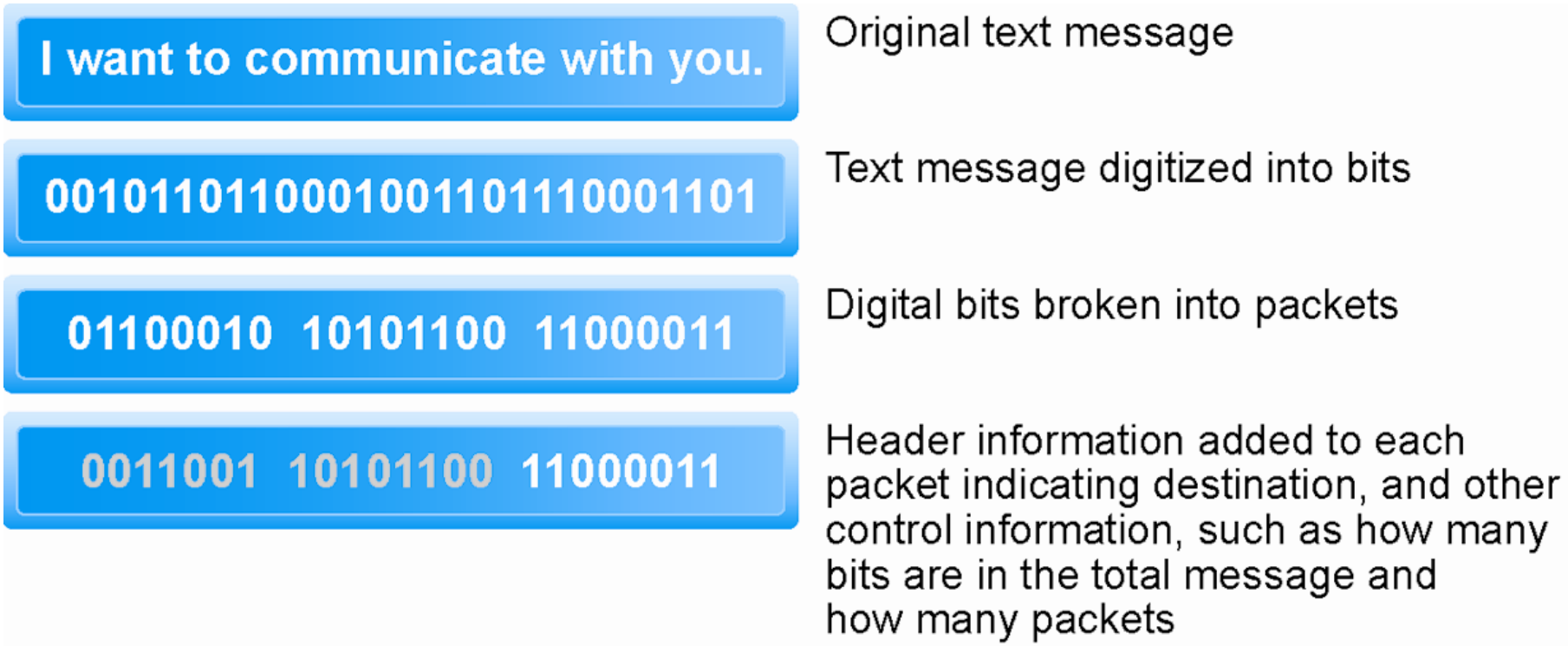

Figure 3.3, Page 117

TCP/IP

- **Transmission Control Protocol (TCP)**
  - Establishes connections among sending and receiving Web computers
  - Handles assembly of packets at point of transmission, and reassembly at 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

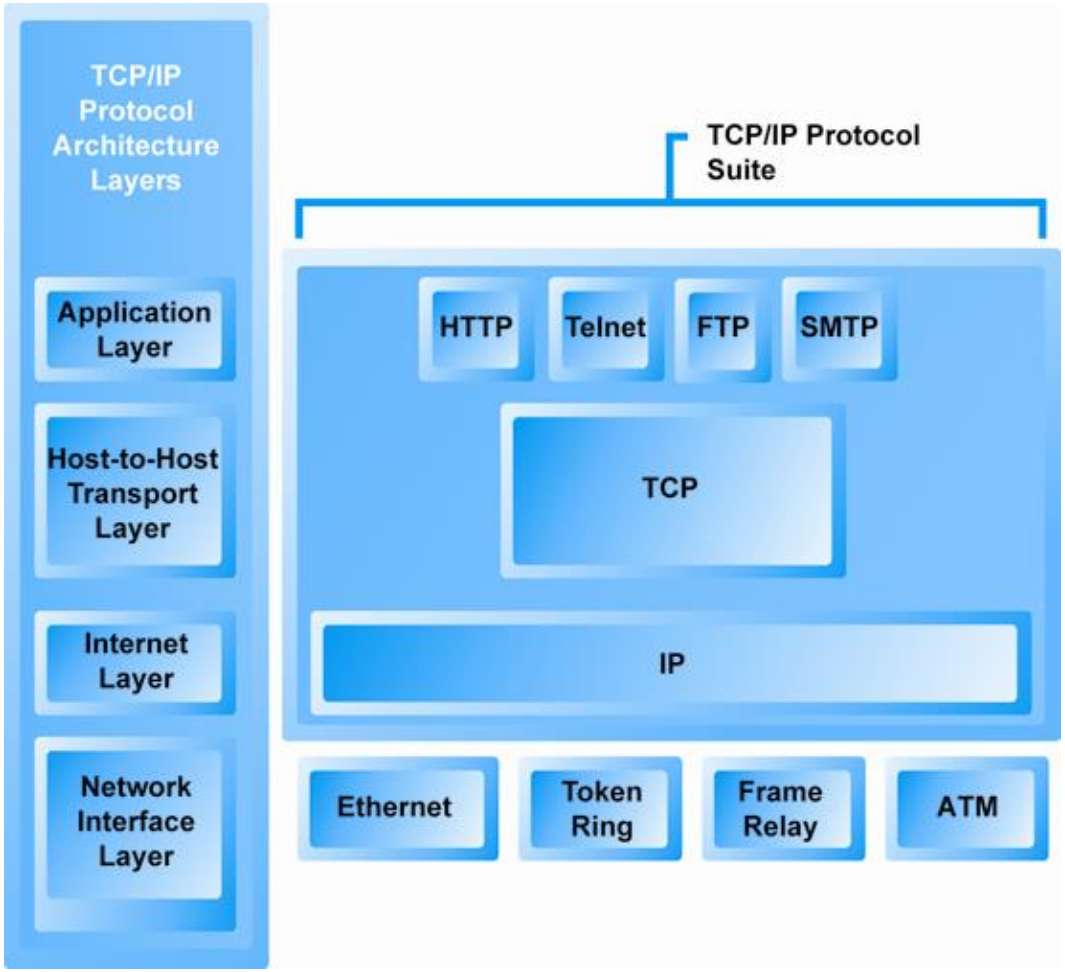

Figure 3.4, Page 119

Internet (IP) Addresses

- **IPv4**
  - 32-bit number
  - Four sets of numbers marked off by periods: 201.61.186.227
    - Class C address: Network identified by first three sets, computer identified by last set
- **IPv6**
  - 128-bit addresses, able to handle up to 1 quadrillion addresses (IPv4 can handle only 4 billion)

Routing Internet Messages: TCP/IP and Packet Switching

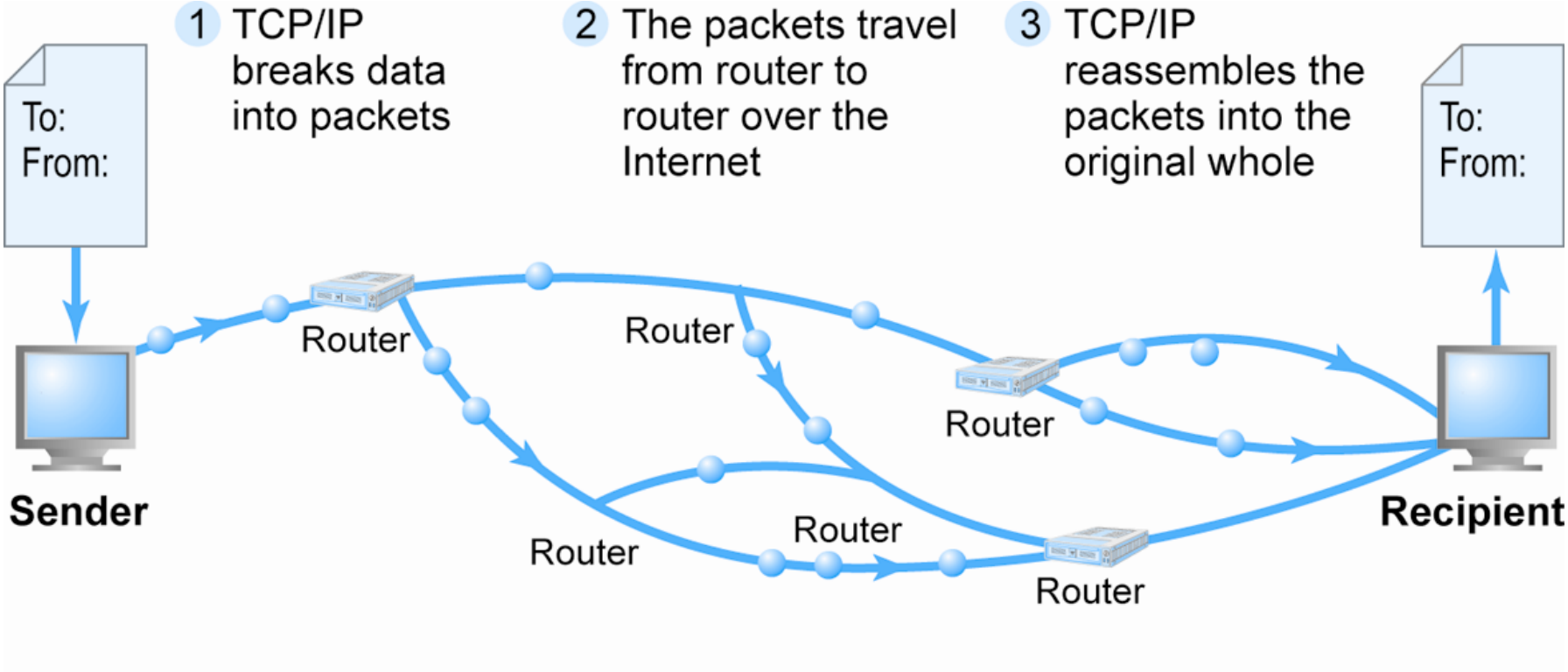

Figure 3.5, Page 120

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
  - For example: http://www.azimuth-interactive.com/flash_test

Client/Server Computing

- **Powerful personal computers (clients) connected in network with one or more servers**
- **Servers perform common functions for the clients**
  - Storing files
  - Software applications
  - Access to printers, and so on

The New Client: The Mobile Platform

- **In a few years, primary Internet access will be through:**
  - Tablets
    - Supplementing PCs for mobile situations
  - Smartphones
    - Disruptive technology:
      - Shift in processors, operating systems
    - 33% of all cell phones

Cloud Computing

- **Firms and individuals obtain computing power and software over Internet**
  - Example: Google Apps
- **Fastest growing form of computing**
- **Radically reduces costs of:**
  - Building and operating Web sites
  - Infrastructure, IT support
  - Hardware, software

The Internet Today

- **Internet growth has boomed without disruption because of:**
  - Client/server computing model
  - Hourglass, layered architecture
    - Network Technology Substrate
    - Transport Services and Representation Standards
    - Middleware Services
    - Applications

The Hourglass Model of the Internet

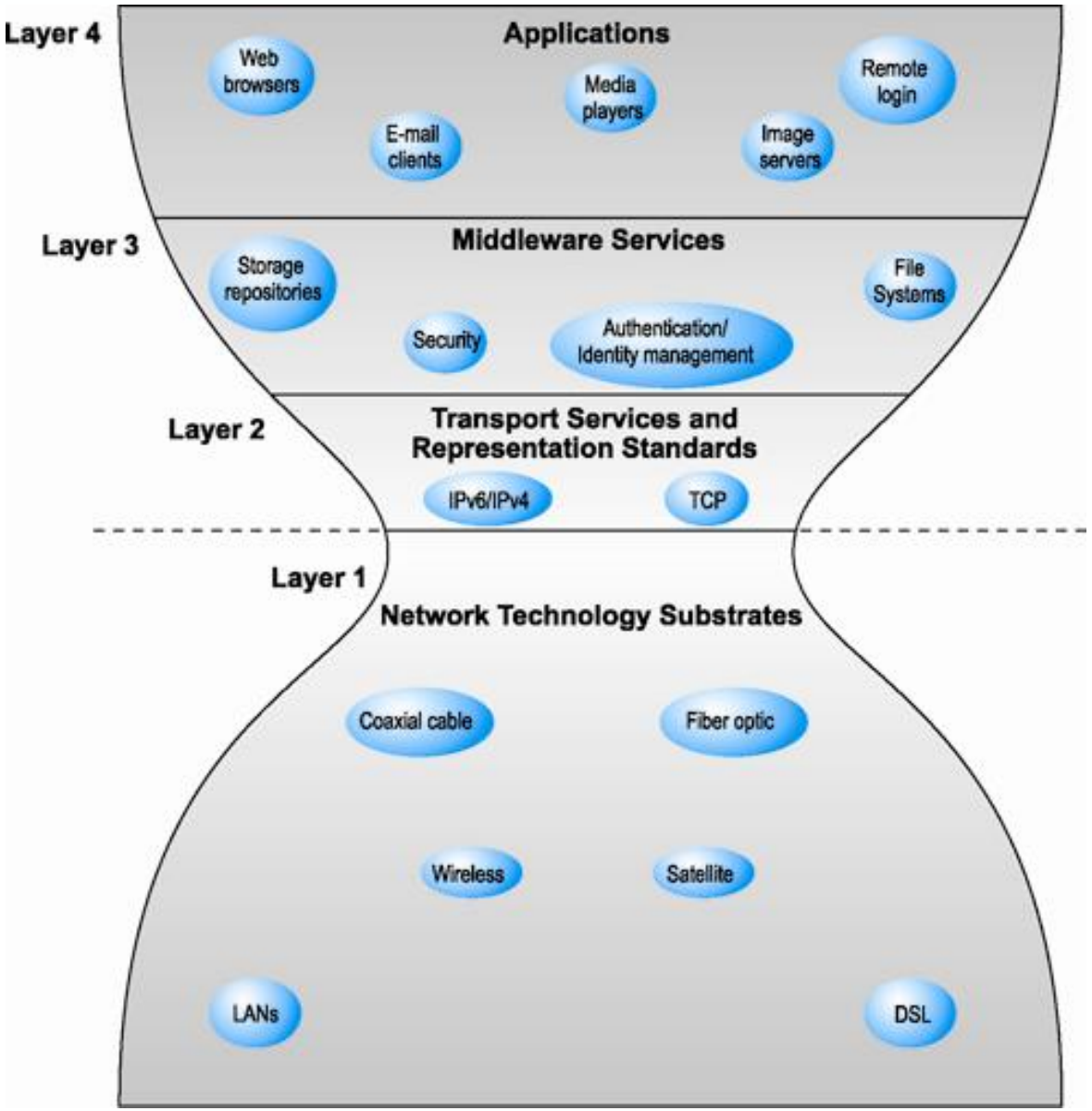

Figure 3.11, Page 128

Internet Network Architecture

- **Backbone**
  - High-bandwidth fiber-optic cable networks
  - Private networks owned by a variety of 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

Internet Network Architecture

MAEs – Metropolitan Area Exchange
NAPs – Network Access Points
POP – Post Office Protocol
SMTP– Simple Mail Transfer Protocol

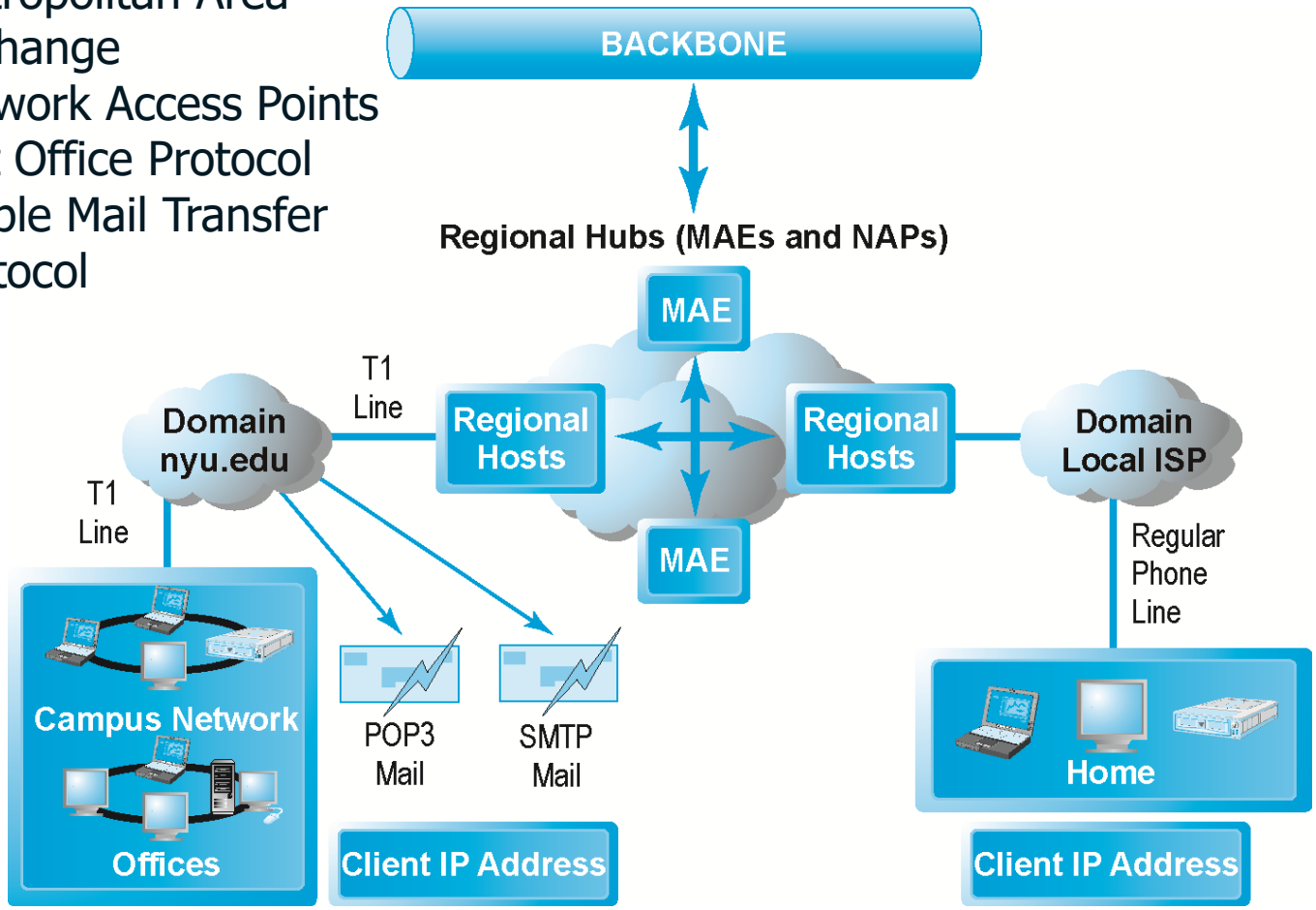

Figure 3.12, Page 129

Internet Service Providers (ISPs)

- **Provide lowest level of service to individuals, small businesses, some institutions**
- **Types of service**
  - Narrowband (dial-up)
  - Broadband
    - Digital Subscriber Line (DSL)
    - Cable modem
    - T1 and T3
    - Satellite

Intranets

- **Intranet**
  - TCP/IP network located within a single organization for communications and processing
  - Used by private and government organizations for internal networks
  - All Internet applications can be used in private intranets

Who Governs the Internet?

- **Organizations that influence the Internet and monitor its operations include:**
  - Internet Corporation for Assigned Names and Numbers (ICANN)
  - Internet Assigned Numbers Authority (IANA)
  - Internet Engineering Task Force (IETF)
  - Internet Research Task Force (IRTF)
  - Internet Engineering Steering Group (IESG)
  - Internet Architecture Board (IAB)
  - Internet Society (ISOC)
  - Internet Governance Forum (IGF)
  - World Wide Web Consortium (W3C)
  - Internet Network Operators Groups (NOGs)

Government Regulation and Surveillance of the Internet

- 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?

Limitations of the Current Internet

- **Bandwidth limitations**
  - Slow peak-hour service
- **Quality of service limitations**
  - Latency
- **Network architecture limitations**
  - Identical requests are processed individually
- **Wired Internet**
  - Copper and expensive fiber-optic cables

The Internet2 Project

- **Consortium of 350+ institutions collaborating to facilitate revolutionary Internet technologies**
- **Primary goals:**
  - Create leading-edge very-high speed network for national research community
  - Enable revolutionary Internet applications
  - Distributed and collaborative computing environments for sciences, health, arts, and humanities initiatives

The First Mile and the Last Mile

- **GENI – (Global Environment for Network Innovations) Initiative**
  - Proposed by NSF (National Science Foundation) to develop new core functionality for Internet
- **Most significant private initiatives**
  - Fiber optic trunk-line bandwidth - First mile
  - Wireless Internet services - Last mile

Fiber Optics and the Bandwidth Explosion in the First Mile

- **"First mile": Backbone Internet services that carry bulk traffic over long distances**
- **Fiber-optic cable: hundreds of glass strands that use light to transmit data**
  - Faster speeds and greater bandwidth
  - Thinner, lighter cables
  - Less interference
  - Better data security
- **Substantial investments in fiber optic by telecommunications firms in last decade**
  - Enable integrated phone, broadband access, video services

The Last Mile: Mobile Internet Access

- **"Last mile": From Internet backbone to user's computer, smartphone, and so on**
- **Two different basic types of wireless Internet access:**
  - Telephone-based (mobile phones, smartphones)
  - Wireless local area network (WLAN)-based

Wireless Internet Access Network Technologies

- **Wi-Fi**
  - High-speed, fixed broadband wireless LAN (WLAN)
  - Wireless access point ("hot spots")
  - Limited range but inexpensive
  - For-profit Wi-Fi networks: Boingo, AT&T Wi-Fi Services
- **WiMax**
  - High-speed, medium range broadband wireless metropolitan area network
- **Bluetooth**
  - Personal connectivity between devices and to Internet
  - Low-speed, short range connection

Wi-Fi Networks

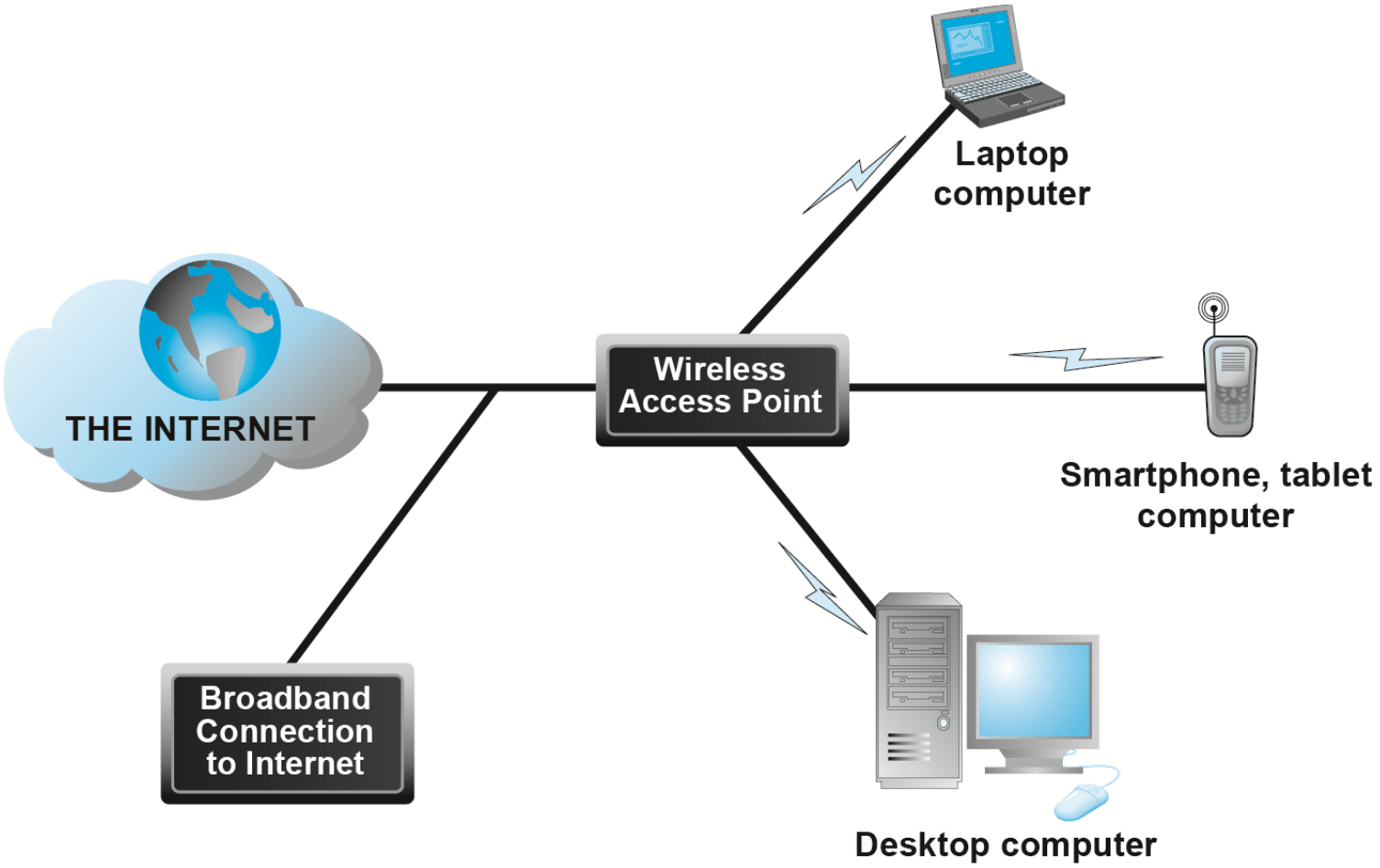

Figure 3.15, Page 145

The Future Internet

- **Latency solutions**
  - diffserv (differentiated quality of service)
- **Guaranteed service levels and lower error rates**
  - Ability to purchase the right to move data through network at guaranteed speed in return for higher fee
- **Declining costs**
- **The Internet of Things (IoT)**
  - Objects connected via sensors/RFID to the Internet
  - Spearheaded by EU and China

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**

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

Markup Languages

- **Hypertext Markup Language (HTML)**
  - Fixed set of pre-defined markup "tags" used to format text
  - Controls look and feel of Web pages
  - HTML5 the newest version
- **eXtensible Markup Language (XML)**
  - 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 to clients on a network that request this service by sending an HTTP request
  - Apache, Microsoft IIS
  - Basic capabilities: Security services, FTP, search engine, data capture
- **Web server**
  - May refer to either Web server software or physical server
  - Specialized servers: Database servers, ad servers, and so on
- **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—54% of market**
- **Mozilla Firefox—20%**
  - Open source
- **Other browsers**
  - Google Chrome—19%
  - Apple's Safari—5%

The Internet and Web: Features

- **Features on which the foundations of e-commerce are built:**
  - E-mail
  - Instant messaging
  - Search engines
  - Online forums and chat
  - Streaming media
  - Cookies

E-mail

- Most used application of the Internet
- Uses series of protocols for transferring messages with text and attachments from one Internet user to another

Instant Messaging

- Displays words typed on a computer almost instantly, and recipients can respond immediately in the same way

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**

How Google Works

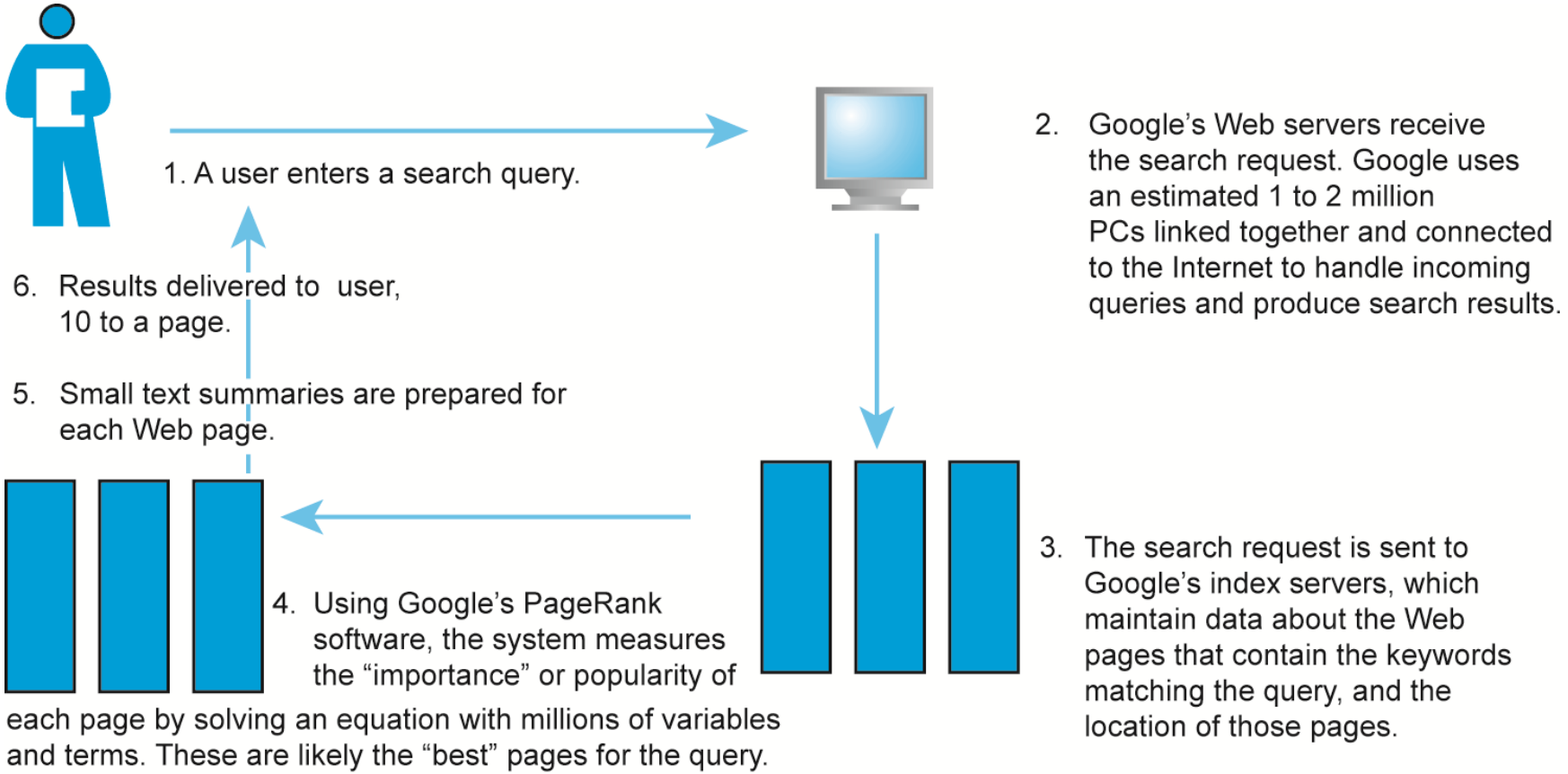

Figure 3.20, Page 161

Online Forums and Chat

- **Online forum**
  - Also known as a message board, bulletin board, discussion board, discussion group, board, or forum
  - Web application that enables Internet users to communicate with one another, 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

- 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

Cookies

- Small text files 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

Web 2.0 Features and Services

- **Online Social Networks**
  - Services that support communication among networks of friends, peers
- **Blogs**
  - Personal Web page of chronological entries
- **Really Simple Syndication (RSS)**
  - Program that allows users to have digital content automatically sent to their computers over the Internet

Web 2.0 Features and Services

- **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
- **Music and video services**
  - Online video viewing
  - Digital video on demand

Web 2.0 Features and Services

- **Internet telephony (VoIP)**
  - Voice over Internet Protocol (VoIP) uses Internet to transmit voice communication
- **Video conferencing, video chatting, and telepresence**
- **Online software and Web services**
  - Web apps, widgets, and gadgets

Intelligent Personal Assistants

- **Software that interacts with the user through voice commands**
- **Features**
  - Natural language; conversational interface
  - Situational awareness
  - Interpret voice commands to interact with various Web services
- **Examples:** Siri, Google Now

Mobile Apps

- **Use of mobile apps has exploded**
  - More than 60% of online shoppers are mobile shoppers as well
- **Increased use/purchasing from tablets**
- **Platforms**
  - iPhone/iPad (iOS), Android, Blackberry
- **App marketplaces**
  - Google Play, Apple's App Store, RIM's App World, Windows Phone Marketplace

Thank You!

Class Discussion

Google Glass: Augment My Reality

- **Have you used any augmented reality applications? If so, has it been useful; if not, is it a service that seems interesting? Why or why not?**
- **Are there any privacy issues raised by augmented reality applications?**
- **What are the potential benefits of augmented reality applications? Are there any disadvantages?**
- **What revenue models could work for providers of augmented services?**

Is HTML5 Ready for Primetime?

- What features of HTML5 are changing the way Web sites are built?
- Is HTML5 a disruptive technology, and if so, for whom?
- Are there any disadvantages in Web sites and mobile apps moving to an HTML5 platform?

Apps for Everything: The App Ecosystem

- What are apps and why are they so popular?
- Do you use any apps regularly? Which ones, and what are their functions?
- What are the benefits of apps? The disadvantages?
- Are there any benefits/disadvantages to the proprietary nature of the Apple platform?