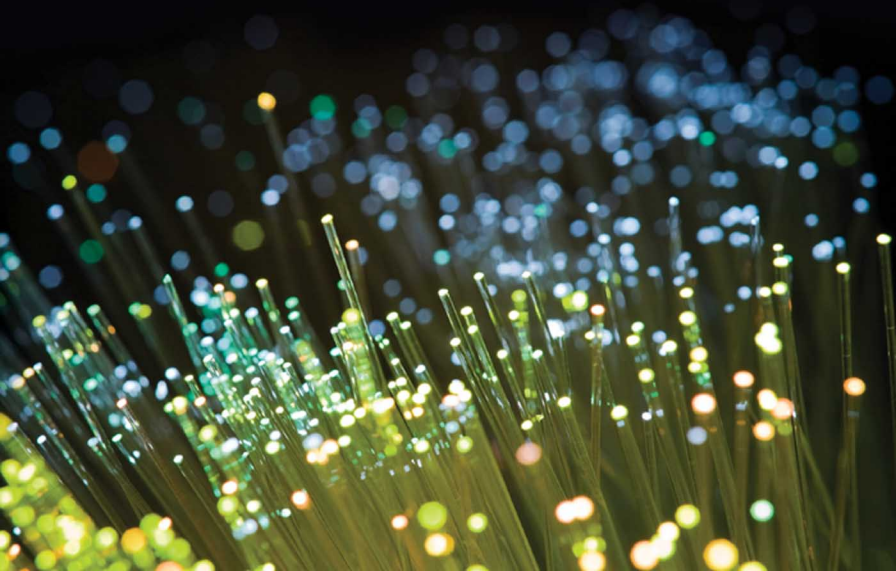
USING INFORMATION TECHNOLOGY

A Practical Introduction to Computers & Communications *11e*

Brian K. Williams
Stacey C. Sawyer



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Eleventh Edition

A Practical Introduction to Computers & Communications

BRIAN K. WILLIAMS | STACEY C. SAWYER

Mc Graw Hill Education

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To the Instructor

INTRODUCTION: Not Just a Revision, a Reimagining

The tumultuous changes in the landscape of information technology over the last two years have led us to make extensive modifications in this edition of *Using Information Technology*—to do **not just a revision but a remaking and reimagining** of this introductory computer concepts book.

In addition, because of the rise in distractions, stresses, and information overload on students, we have made every effort **to increase the readability, teachability, and memorability** of our material**—**using more storytelling, more headings, more mnemonic aids.

CONTENT CHANGES IN THIS EDITION: Addressing New Paradigms

Throughout its 18-year history, *Using Information Technology* has been written and substantially **revised around historic paradigm changes**—in the *First Edition* the impact of digital convergence, or the fusion of computers and communications; in the *Fourth Edition* the new priorities of cyberspace imposed by the Internet and World Wide Web; in the *Seventh Edition* the ascendancy of the "Always On" generation of students, who are at ease with but not always knowledgeable about digital technology.

In this *Eleventh Edition,* **we address the following history-altering developments:**

- **The explosion of mobile computing:** In the United States there are now more smartphones, tablets, laptops, and other such portable devices than there are people.
- **The rise of "the cloud":** Moving data storage and processing from desktops and laptops to online servers is changing the economics and availability of computing power.
- **The boom in Big Data:** The growth in servers, software sophistication, and data collection methods results in 2.5 quintillion bytes of data being created every day.
- **The evolution of artificial intelligence:** Supercomputers, mammoth databases, and powerhouse software make AI a force that's sure to alter nearly every field of human endeavor.
- **The acceleration in computer threats:** Every day the efforts of black-hat hackers, virus writers, and cyberwar makers threaten to sabotage our major institutions.
- **The shrinking of privacy:** Search companies, mobile carriers, and retailers track our Internet patterns, cellphone usage, and shopping habits to learn more and more about us.
- **The increase in government surveillance:** Cyberspying by U.S. agencies, as well as by foreign governments, challenges individual and institutional freedom and security.

The extensive content changes for this edition are described beginning on p. xx.

PRESENTATION CHANGES IN THIS EDITION: Making the Material Easier to Learn

To help students realize the valuable education they have paid for, we have done our best to make this text **practical, readable, and current** by presenting information in ways that *motivate, entertain, and get quickly to the point* by using **the following new features:**

- **We teach concepts by referring to what students already know:** Most students come to this book **already knowledgeable about mobile technology.** In this edition, then, we introduce new concepts by building on the student's existing knowledge.
- **We present compelling examples through storytelling:** Most people seem to learn more from stories than from having facts thrown at them. This edition offers **a new feature called TECH TALES, which provide "*mini-cases,*" business related and otherwise, to illustrate concepts.**
- **We expand the use of headings:** Our approach is to have frequent headings as organizers. In this edition, **each chapter is divided into two units, UNIT A and UNIT B, to help students get a better grasp of the material.** We've also added more subheadings throughout.
- **We open each chapter with an overview—a CHAPTER FORECAST:** Every chapter opens with a short summary, to give the student a clear vision of the road ahead.

MOTIVATING THE UNMOTIVATED & TEACHING TO A DISPARITY OF BACKGROUNDS

As authors, we find information technology tremendously exciting, but we recognize that many students take the course reluctantly. And we also recognize that many students come to the subject with attitudes ranging from complete apathy and unfamiliarity to a high degree of experience and technical understanding.

To address the problem of **motivating the unmotivated and teaching to a disparity of backgrounds,** *Using Information Technology* offers unequaled treatment of the following:

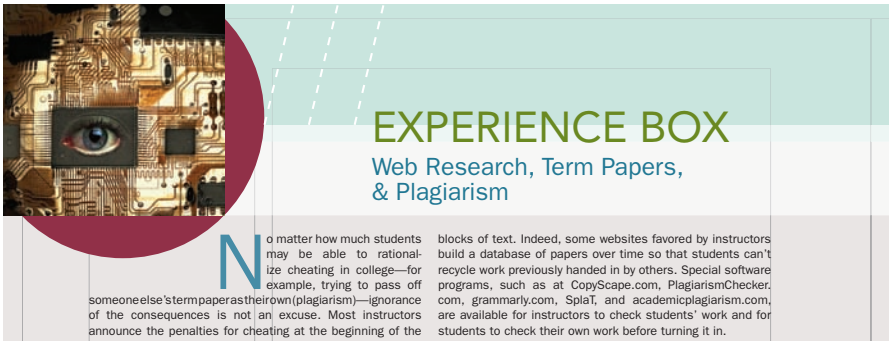
1. **Practicality**
2. **Readability**
3. **Currentness**
4. **Three-level critical thinking system**

We explain these features on the following pages.

FEATURE 1: Emphasis on Practicality

This popular feature received overwhelming acceptance by both students and instructors in past editions. **Practical advice,** of the sort found in computer magazines, newspaper technology sections, and general-interest computer books, is expressed not only in the text but also in the following features:

- Experience Box
- Practical Action Box
- Survival Tips

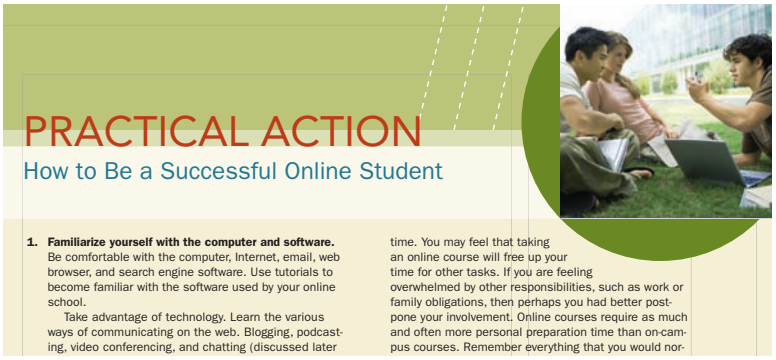


Experience Box

Appearing at the end of each chapter, the Experience Box has optional material that may be assigned at the instructor's discretion. However, students will find the subjects covered are of immediate value.

Examples: "Web Research, Term Papers, & Plagiarism," "Getting Help from Tech Support," "How to Buy a Laptop," and "How the Rise of the Robots Will Affect Future Employment."

Practical Action Box


PRACTICAL ACTION

How to Be a Successful Online Student

1. **Familiarize yourself with the computer and software.** Be comfortable with the computer, Internet, email, web browser, and search engine software. Use tutorials to become familiar with the software used by your online school.

Take advantage of technology. Learn the various ways of communicating on the web. Blogging, podcasting, video conferencing, and chatting (discussed later

time. You may feel that taking an online course will free up your time for other tasks. If you are feeling overwhelmed by other responsibilities, such as work or family obligations, then perhaps you had better postpone your involvement. Online courses require as much and often more personal preparation time than on-campus courses. Remember everything that you would nor-

This box consists of optional material on practical matters.

Examples: "How to Be a Successful Online Student," "Evaluating & Sourcing Information Found on the Web," "Tips for Avoiding Spyware," "Utility Programs: Specialized Programs to Make Computing Easier," "Social Networking: The Downside," "Help in Building Your Web Page," "Storing Your Stuff: How Long Will Digitized Data Last?," "Starting Over with Your Hard Drive: Erasing, Reformatting, & Reloading," "Telecommuting & Telework: The Virtual Workplace," "The Consequences of Choice Overload," "Online Viewing & Sharing of Digital Photos," and "Is the Boss Watching You? Trust in the Workplace."

Survival Tips

In the margins throughout we present utilitarian **Survival Tips** to aid students' explorations of the infotech world.

Examples: "Broadband: Riskier for Security," "Connection Speeds," "Finding Things on a Web Page or in a Web Document," "Urban Legends & Lies on the Internet," "Social-Networking Privacy," "Control Those Cookies!" "New Software & Compatibility," "What RAM for Your PC?," "ATMs & Fraud/Safety," "Firewalls," "E-Book Cautions," "Alleviating Info-Mania," "Fraud Baiters," and "What Happens to Your Smartphone Data?"

Survival Tip

New Software & Compatibility

Pay attention to compatibility requirements when you obtain new software. The system requirements for running the software will be listed on the box or included with the downloaded information. When it is time to update the software, you can usually do that by paying a small upgrade fee to the software manufacturer and then downloading the new version and/or obtaining a new CD/DVD.

FEATURE 2: Emphasis on Readability & Reinforcement for Learning

We offer the following features for reinforcing student learning:

Interesting Writing—Based on Good Scholarship

Where is it written that textbooks have to be boring? Can't a text have personality?

Actually, studies have found that textbooks **written in an imaginative style** significantly improve students' ability to retain information. Both instructors and students have commented on the distinctiveness of the writing in this book. In this edition, we have added **Tech Tales, stories or mini-cases, to illustrate concepts.** We also employ a number of journalistic devices—colorful anecdotes, short biographical sketches, and interesting observations—to make the material as engaging as possible. In addition we use real anecdotes and examples rather than fictionalized ones.

Finally, **unlike most computer concepts books, we provide references for our sources—see the endnotes in the back of the book. Many of these are from the year preceding publication.** We see no reason why introductory computer books shouldn't practice good scholarship by revealing their information sources. And we see no reason why good scholarship can't go along with good writing—scholarship need not mean stuffiness.

Key Terms AND Definitions Emphasized

To help readers avoid confusion about important terms and what they actually mean, we print each key term in **red bold** and its definition in **black boldface.** ***Example:*** "**Data consists of raw facts and figures that are processed into information.**"

Material in Easily Manageable Portions

Major ideas are presented in **bite-size form,** with generous use of advance organizers, bulleted lists, and new paragraphing when a new idea is introduced. Most **sentences have been kept short,** the majority not exceeding 22–25 words in length.

"Terms & Explanations" Displayed in Easily Reviewable Form

To help students review the technical terms and vocabulary used in computing, we have created at the end of every chapter a section titled "Terms & Explanations," which not only gives the meaning of every key term introduced in the chapter but also explains why it is important. See, for example, pages 239, 296, and 359.

Emphasis throughout on Ethics

See Ethics examples on pages 38, 81, 96,146, 236, 264, 344, and 353.

Many texts discuss ethics in isolation, usually in one of the final chapters. We believe this topic is too important to be treated last or lightly, and users have agreed. Thus, **we cover ethical matters throughout the book,** as indicated by the special icon shown at left. ***Example:*** We discuss such all-important questions as online plagiarism, privacy, computer crime, and netiquette.

Emphasis throughout on Security

See Security icons on pages 38, 96, 120, 229, 230, 263, 271, 275, 315, 334, 343, 347, 353, and 357.

In the post 9-11 era, security concerns are of gravest importance. Although we devote several pages (in Chapters 2, 6, and 9) to security matters, we also reinforce student awareness by **highlighting with page-margin Security icons instances of security-related material throughout the book.** ***Example:*** In one case, we use the special icon shown at left to highlight the advice that one should pretend that every email message one sends "is a postcard that can be read by anyone."

"More Info!" Icons Help Students Find Their Own Answers to Questions

GPS & Cellphone Tracking

Cellphone companies may be tracking your every move and compiling information about you . . .

www.bloomberg.com/news/2013-06-06/carriers-sell-users-tracking-data-in-5-5-billion-market.html

In addition, our **"More Info!" feature encourages students to get actively involved in the material.**

Examples: "Finding Wi-Fi Hot Spots," "Do You Need to Know HTML to Build a Website?," "Blog Search Engines," "Some Online Communities," "Links to Security Software," and "Where to Learn More about Freeware & Shareware."

Eight Timelines to Provide Historical Perspective

See timelines beginning on pages 16, 50, 164, 194, 254, 304, 416, and 532.

Some instructors like to see coverage of the history of computing. Not wishing to add greatly to the length of the book, we decided on **a student-friendly approach: the presentation of eight pictorial timelines showing the most significant historical IT events.** These timelines, which occur in most chapters, appear along the bottom page area. (See the example at the bottom of this page.) Each timeline repeats certain "benchmark"

1984	1990	1994	1998	2000	2001	2002	2003
Apple Macintosh; first personal laser printer	Laptops become very popular	Apple and IBM introduce PCs with full-motion video built in; wireless data transmission for small portable computers; first web browser invented	PayPal is founded	The "Y2K" nonproblem; the first U.S. presidential webcast	Dell computers becomes the largest PC maker	Friendster	Facebook; MySpace

events to keep students oriented, but **each one is modified to feature the landmark discoveries and inventions appropriate to the different chapter material.** ***Examples:*** In Chapter 3 on software, the timeline features innovations in operating systems. In Chapter 6 on communications, the timeline highlights innovations in data transmission.

FEATURE 3: Currentness

Reviewers have applauded previous editions of *UIT* for being **more up to date than other texts.** For example, we have traditionally ended many chapters with a forward-looking section that offers a preview of technologies to come—some of which are realized even as students are using the book.

Among the new topics and terms covered in this edition are: *Accelerated Graphics Port (ACP) bus, air mouse, AMOS, Apple iCloud, apps, Big Data, Bootcamp, booting from the cloud, Bring Your Own Device (BYOD) policy, bug bounty, business-to-consumer (B2C) commerce, Chrome, Chrome OS, Chromebook, cloud-based apps, computational AI, condensed keyboards, consumer-to-consumer (C2C) commerce, conventional AI, convertible tablets, cyberattacks, Dashboard, data centers, Detrx keyboard, distributed denial of service, drones, email bombs, embedded Linux OS, EMV cards, eSATA ports, ethical hackers, ExpressCards, FireWire bus, FISA court, Google Apps, Google Glass, heuristics, hybrid tablets/PCs, Instagram, iPhone 5, iPhone iOS, KALC keyboard, Kinect, Leap Motion, LTE telecommunication standards, machine learning, massive open online courses (MOOCs), mesh networks, metadata, Microsoft Xbox One, Mountain Lion, Mozilla Firefox OS, multitouch screens, National Security Agency (NSA), Nintendo Wii U, octa-core processors, online dating, passphrases, personal browser, Pinterest, Pokki, power-line network, predictive search apps, robots grouped by application, robots grouped by locomotion, Privacy and Civil Liberties Oversight Board, self-driving cars, selfies, semantic markup, showrooming, slate tablets, Snapkeys Si, Sony PlayStation 4, Spotlight, Surface tablet, T3 lines, T4 lines, T5 lines, texting, threaded discussion, tree networks, trolls, wearable technology, Web 1.0, Web 3.0, Web app, WiMax, Windows 7, Windows 8, Windows Phone 8, Windows RT, Windows Server 2012,* and *wireless Internet service provider (WISP).*

Material has also been updated on the following: *Android, artificial intelligence (AI), cellphone malware, cloud computing, cyberwarfare, data collection on consumers by business, e-readers, gesture interface, government spying, image-capture devices, image-compression technology, improved digital cameras, Internet usage, Mac OS X, malware, metadata mining, mobile-payment services, nanotechnology, online (distance) learning, passwords, privacy, 3-D printers,* and *tablets.*

A complete update of the chapter-by-chapter changes from the previous edition begins on p. xx.

FEATURE 4: Three-Level System to Help Students Think Critically about Information Technology

This feature has been well received. More instructors are familiar with **Benjamin Bloom's *Taxonomy of Educational Objectives,*** describing a hierarchy of six critical-thinking skills: (a) two lower-order skills—*memorization* and *comprehension*—and (b) four higher-order skills—*application, analysis, synthesis,* and *evaluation.* Drawing on our experience in writing books to guide students to college success, we have implemented Bloom's ideas in a three-stage pedagogical system, using the following hierarchical approach in the Chapter Review at the end of every chapter:

Stage 1 Learning—Memorization: "I Can Recognize and Recall Information"

Using self-test questions, multiple-choice questions, and true-false questions, we enable students to test how well they recall basic terms and concepts.

Stage 2 Learning—Comprehension: "I Can Recall Information in My Own Terms and Explain It to a Friend"

Using open-ended, short-answer questions, we enable students to re-express terms and concepts in their own words.

Stage 3 Learning—Applying, Analyzing, Synthesizing, Evaluating: "I Can Apply What I've Learned, Relate These Ideas to Other Concepts, Build on Other Knowledge, and Use All These Thinking Skills to Form a Judgment"

In this part of the Chapter Review, we ask students to put the ideas into effect using the activities described. The purpose is to help students take possession of the ideas, make them their own, and apply them realistically to their own ideas. **Our web exercises are also intended to spur discussion in classroom and other contexts.**

Examples: "Using Text Messaging in Emergencies," "What's Wrong with Using Supermarket Loyalty Cards?," and "Are You in the Homeland Security Database?"

RESOURCES FOR INSTRUCTORS

Online Learning Center

The Online Learning Center *(www.mhhe.com/uit11e)* is designed to provide students with additional learning opportunities and instructors with additional teaching tools. For instructors, the website includes PowerPoint presentations for each chapter. For the convenience of instructors, all the following resources are available for download.

To help maintain high quality in the supplements, the textbook authors have personally updated the Instructor's Manual, Testbank, and PowerPoint presentation.

Instructor's Manual

The electronic Instructor's Manual, which is available as part of the Instructor's Resource Kit, helps instructors create effective lectures. The Instructor's Manual is easy to navigate and simple to understand. Each chapter contains a chapter overview, lecture outline, teaching tips, additional information, and answers to end-of-chapter questions and exercises.

Testbank

The format of the Testbank allows instructors to effectively pinpoint areas of content within each chapter on which to test students. The test questions include learning difficulty level, answers, and text page numbers, as well as the learning objective head under which the question content falls and the level of Bloom's Taxonomy that applies to the question.

EZ Test

McGraw-Hill's EZ Test is a flexible and easy-to-use electronic testing program. The program allows instructors to create tests from book-specific items. It accommodates a wide range of question types, and instructors may add their own questions. Multiple versions of the test can be created and any test can be exported for use with course management systems such as WebCT, BlackBoard, or PageOut. EZ Test Online is a new service and gives you a place to easily administer your EZ Test–created exams and quizzes online. The program is available for Windows and Macintosh environments.

PowerPoint Presentation

The PowerPoint presentation includes material that expands on main topics from the text, allowing instructors to create engaging classroom sessions. Each chapter's presentation includes helpful illustrations that emphasize important concepts.

CHAPTER-BY-CHAPTER CHANGES FROM THE PREVIOUS EDITION

1. Introduction to Information Technology: The Future Now

UNIT 1A: THE MOBILE WORLD, INFORMATION TECHNOLOGY, & YOUR LIFE. **Chapter introduction and Section 1.1 repurposed to stress importance of mobile computing. Smartphones, tablet computers, and social networks introduced. Concept of database introduced.** Material updated on high-paying salaries and attractiveness of IT

careers. N**ew material added: "Starting Up Your Own Venture," social media in job hunting, and technology in your personal life, including online dating sites.** Obsolete chart deleted on technology areas that people devote their time to. Subsections deleted on leisure and on college students and the e-world.

UNIT 1B: THE BASICS OF INFORMATION TECHNOLOGY. Former Section 1.1, "The Practical User," now Section 1.3. Material updated on fastest supercomputers. **New material added on mobile devices, Big Data, machine learning, algorithms, and overview of artificial intelligence.**

Tech Tales added: "The Rise of Mobile Computing: The Getting-Smarter Smartphone," "Technology in Education: Adjusting Instructor Presentations to the Students," "New Telemedicine: The Doctor Will See You Now—Right Now," "What Apps Do You Really Need?," and "Artificial Intelligence: The Use of Algorithms to Create a Hit Song."

2. The Internet & the World Wide Web: Exploring Cyberspace

UNIT 2A: THE INTERNET & THE WEB. **New material on T4, T5 lines, username and password, desktop browsers.** Chrome added to bookmarks discussion. **New material on wikis and Wikipedia added under smart web searching.** Obsolete material deleted about desktop search engines.

UNIT 2B: THE RICHES & RISKS OF INTERNET USE. Reorganization of material and **new material added** on email, instant messaging, and other ways of communicating over the Internet and on discussion groups and FTP. Obsolete material deleted on listservs. **New material added to e-commerce discussion, B2C, C2C, showrooming.** Under Web 2.0, **new material on Web 1.0 and other data.** Practical Action box, "Social Networking: The Downside," repurposed and **new material added. New section added: "Malware: The Viciousness of Viruses," with introduction of antivirus software. New section added, "Passwords," with practical suggestions.**

Tech Tales added: "How a World-Shaking Technology Came About: Tim Berners-Lee Invents the World Wide Web," "The Continuing Development of Browsers: The War for Smartphones & Tablets," "Web Imaging & Aerial Mapping: Google Earth," "Animation: Making of 'Fetch,' a Mobile Game," "The Rise of the Blogosphere: 'Writing Out Loud,'" "Changing Retail Practices: The Fight against 'Showrooming,'" and "How Difficult It Is to Keep Your Emails & Texts Private."

3. Software: Tools for Productivity & Creativity

UNIT 3A: SYSTEM SOFTWARE: THE POWER BEHIND THE POWER. Obsolete introductory material replaced with discussion of cloud computing and Google Apps. Immediate distinction made between application and system software. **Subsection added, "Booting from the Cloud."** Under Mac OS, **material added about OS X Lion.** Under Microsoft Windows, **material added on different types of Windows 8, as well as 8.1.** Excess material on Linux deleted. **Embedded operating systems discussion expanded on smartphone OSs.** Panel 3.19 added on market share of top smartphone OSs.

UNIT 3B: APPLICATION SOFTWARE: GETTING STARTED. Discussion of sources of software reorganized for clarity. **New material and subhead added, "Web Application" software.** Discussion of types of files moved from end of chapter to here under "3.6 Data Files & Program Files." Section on importing and exporting moved to later in this section. Section on compression moved here from end of chapter. New Section 3.10, "Software Suites & Integrated Packages," with material moved from later in chapter on software suites and integrated suites and **new material added on productivity suites.**

Tech Tales added: "The War for Dominance in Mobile Operating Systems," "New Technology to Replace the Mouse: The Gesture Interface," "China Adopts Linux as Its National Standard," "Software Evolution: 40 Years of Blasting Space Aliens—The Incredible Growth in Videogames," and "Free Software for Cash-Strapped Students."

4. Hardware: The CPU & Storage—The Source of Computing Power

UNIT 4A: PROCESSING: THE SYSTEM UNIT, MICROPROCESSORS, & MAIN MEMORY. Obsolete introduction replaced with material about sales plummeting on PCs

compared to mobile devices. Obsolete illustration material deleted on making of a chip. Material reorganized under "Miniaturization Leads to Mobility." **New section "The System Unit," with new material about desktop PC, laptop, notebook, tablet, and handheld system units.** Obsolete material on advertisement for a PC deleted. Material reorganized for better comprehension under heading, "4.3 Inside the System Unit: Power Supply, Motherboard, & Microprocessors." Under multicore processors, **material added** on **octa-core processors. Material added on processors for data centers.** Recast material on processing speed into section, "The System Clock & Processing Speeds." Old material on MIPS, flops, and milliseconds deleted. Old head about more on the system unit retitled "The Central Processing Unit & the Machine Cycle," and material resequenced so word size discussed later. New section created, "4.5 Memory," and material reorganized and added to. **Material added on MRAM;** material deleted on SDRAM and DDR-SDRAM. Material deleted on interleaving, bursting, pipelining, superscalar architecture, and hyperthreading. Old head about ports and cables retitled "4.6 Expansion Cards, Bus Lines, & Ports," with **new material added.**

UNIT 4B: SECONDARY STORAGE. Obsolete coverage of magnetic tape deleted. **New material added on perpendicular recording technology.** Material on flash memory and solid-state memory moved ahead of smart cards, and term flash memory drive replaced by USB flash drive. **LaserCard added** under discussion of smartcards. Obsolete material on optical memory cards deleted. Section on online secondary storage recast as **"Cloud Storage" and new material added.** Under "4.8 Future Developments in Processing & Storage," obsolete introductory material deleted, and **new material added** throughout. Obsolete material deleted on higher-density disks, and **new material added on image-compression technology.**

Tech Tales added: "Vacuum Tubes Still Beat People Power," "The Fabulous Fab—What Does It Take to Support a Chip Manufacturing Plant?," "Where Are Data Centers Located?," "The World's DVD Zones," and "Nanotechnology, the Movie."

5. Hardware: Input & Output—Taking Charge of Computing & Communications

UNIT 5A: INPUT HARDWARE. Obsolete material on ATMs and kiosks deleted. **New material added on wearable technology,** including Google's Glass. Under "5.1 Keyboards," **new terms introduced—enhanced keyboards, Ketrix, Snapkey Si, CALC. Tactile keyboards distinguished from touch screen, wired from wireless** (infrared, radio frequency)**.** In discussion of terminals, Internet terminals deleted and ATMs, POS terminals, and **mobile data terminals added.** Under "5.2 Pointing Devices," **wireless mouse and air mouse added.** Under variations of the mouse, touch screen deleted and pointing stick added; touch screen made a separate category. New heading created, "5.3 Source Data-Entry Devices," including scanners, bar-code readers, RFID tags, mark recognition and character recognition devices, audio-input devices, speech-recognition systems, webcams and video-input cards, digital cameras, sensors, and biometric input devices. Discussion of RFID moved to follow bar-code discussion. Obsolete material on fax machines deleted. **New section added, "Image-Capture Devices,"** with discussion of digital cameras and webcams. Audio-input devices now follows image-capture discussion. Heading on human-biology input devices now reads "Biometric-Input Devices." Futuristic material moved from end of chapter to new section, "5.4 The Future of Input," and **new material added under input from remote locations, on source data automation, speech recognition, touch and gesture recognition, pattern-recognition and biometric devices, and brain-wave devices; material added on designs that imitate the physical world.**

UNIT 5B: OUTPUT HARDWARE. Obsolete introductory material deleted. Under "5.5 Softcopy Output: Display Screens," features of screens are described first, including size and aspect ratio, screen clarity with refresh rate, then types of screens, including flat-panel displays (both passive and active matrix), **new material on plasma display,** and CRT; **new material on multiple screens.** New section heading, "5.6 Hardcopy Output: Printers." New section heading, "5.8 The Future of Output," which includes the principal heads "More Unusual Forms of Output," **with added material;** "More Data Used in Output," including **coverage of Big Data;** and "More Realistic Output," **with new coverage on microreplication, printers using reduced ink, more realistic animation, and latest on**

three-dimensional printing. New material added on health and ergonomics. Some obsolete material deleted and **new material added to Experience Box,** "Good Habits: Protecting Your Computer System, Your Data, & Your Health."

Tech Tales added: "Loren Brichter, Popularizer of 'Pull to Refresh' & the 'Cell Swipe,'" "RFID Tags for Security," "'Know What I'm Sayin'?,' The Uses of Speech-Recognition Systems," "Sensors Get Data We Never Had Before," "Input & Output Together: Paving the Way for the Self-Driving Car," "Dreams of 3-D Printing," "Painful Technology for College Students," and "Can Cellphones Cause Cancer?"

6. Communications, Networks, & Cyberthreats: The Wired & Wireless World

UNIT 6A: NETWORKS & WIRED & WIRELESS MEDIA. Obsolete introductory material deleted. Four ways of accessing the Internet identified: telephone modem, high-speed phone lines, cable modem, and wireless modem. Disadvantages of networks deleted for space reasons. Under LANS, **wireless LAN (WLAN) added as one type of LAN.** Discussion reduced of home area network, home automation network, garden area network, and personal area networks, now made examples of LANs. Material reorganized to contrast client-server and peer to peer. Material reorganized as "Intranets, Extranets, VPNs, & Firewalls"; material on firewalls moved here from late in chapter. Under "Switches," definition modified and material reduced. Under "Network Topologies," material on **tree network and mesh network topologies added.** Ethernet redefined and description edited for clarity. Under "6.3 Wired Communications Media," subheads added on "Phone Line Network" (instead of HomePNA) and "Power Line Network" (instead of HomePlug). Under discussion of 4G, **material added on LTE.** Technical discussion of Wi-Fi reduced for readability and Wi-Fi standards summarized in a table (Panel 6.16); **WiMax added.** Practical Action box moved from end of section, "Virtual Meetings: Linking Up Electronically."

UNIT 6B: CYBERTHREATS, SECURITY, & PRIVACY ISSUES. **Unit considerably expanded to cover new issues.** Material added on BYOD (bring your own device) policy. Practical Action box deleted, "WikiLeaks & DDoS." Section 6.5 retitled and **new material added, "6.5 Cyberintruders: Trolls, Spies, Hackers, & Thieves." Cyberattacks introduced and defined.** Discussion of hackers moved here from later in the chapter, with new subheads, "Malicious Hackers," "Benign Hackers," and "Benevolent Hackers." Material on "Thieves" moved here from Chapter 9. Section formerly on cyberthreats reorganized and now titled "Section 6.6 Cyberattacks & Malware," with subheads "Denial-of-Service Attacks," "Viruses," "Worms," "Trojan Horses," "Rootkits & Backdoors," "Blended Threats," "Zombies," "Ransomware," "Time, Logic, & Email Bombs," and "Phone Malware." Former section on how malware is spread and Practical Action box "Ways to Minimize Virus Attacks" material relocated to Chapter 2. Practical Action box "How to Deal with Passwords" deleted and material relocated to Chapter 2. New section created with material from Chapter 8, "6.7 Concerns about Theft," with principal headings "The Threat to Privacy" and "Identity Theft." **Definition of privacy added** and subheads "Name Migration," "Résumé Rustling & Online Snooping," "Government Prying & Spying." Under identity theft appears material from Chapter 8. Experience Box added, "Guarding Your Privacy & Preventing Your Identity from Getting Stolen," using old material from Chapter 8.

Tech Tales added: "Recording Music: From Analog Life to Digital Life," "'Gotcha, Thief!' & Other Uses of GPS," "Microsoft Pays 'Bug Bounties' to White-Hat Hackers," "Too-Good-to-Be-True Deals Online," "The Love Bug & Other Viruses," "Famous Worms: Klez, Conficker, & Stuxnet," and "The Weird Experience of Identity Theft."

7. Personal Technology: The Future Is You

UNIT 7A: PERSONAL DEVICES FOR IMPROVING PRODUCTIVITY AT SCHOOL & WORK. Chapter sections resequenced: "7.1 Convergence, Portability, & Personalization," "7.2 Smartphones," "7.3 Tablets & E-Readers," "7.4 Portable Media Players." Obsolete introductory material deleted and replaced. In-text material converted to Practical Action box, "The Consequences of Choice Overload." Material on multitasking moved to Section 7.3. Under "7.2 Smartphones: More Than Talk," principal headings are "How Do

Cellphones & Smartphones Differ?" with **new material;** "How a Mobile Phone Works," and "Using Mobile Phones in College." **New material on mobile phone OSs, apps, display areas, keyboards and voice commands, output, and GPS technology.** Obsolete material deleted on email, Internet access, QR codes, radio, and music. **New material on benefits and drawbacks of mobile phones in college.** Under "7.3 Tablets & E-Readers," two technologies discussed in one section, with **new material on tablet types and OSs.** Earlier material on multitasking from first section made into Practical Action box, "Multitasking—Good for Productivity?" **New material added to** discussion of how an e-reader works and drawbacks of e-readers**.** Under "7.4 Portable Media Players," **new material distinguishing among uses of music players, media players, and smartphones.** Under portable media players, subheads reorganized: "Storage Methods" (flash memory drive and hard-disk drive), "Sampling Rate," "Transferring Files," "Battery Life," "Display Screens," "Other Features," and "MP3 in Your Car."

UNIT 7B: PERSONAL DEVICES FOR ENRICHING LEISURE & LIFE. Chapter sections resequenced: "7.5 Digital Cameras," "7.6 High-Tech Radio," "7.7 Digital Television," "7.8 Videogame Systems." Under digital cameras, discussion of storage expanded. **Material added** to Practical Action box, "Online Viewing & Sharing of Digital Photos." Under societal effects of digital cameras, subheads and **new material added** about photos no longer just of special events and whether photo gazing gives skewed impressions of others. Under "7.8 Videogame Systems," **new material added.** Some **new material added** to Experience Box, "The 'Always On' Generation."

Tech Tales added: "The Ruggedized Tablet for Splashes & Spills," "The Rise of the Selfie: What Does It Mean?," "Pandora's Music Genome Project," and "Using Your Xbox to Order Pizza."

8. The Era of Big Data: Databases, Information Systems, & Artificial Intelligence

UNIT 8A: FILES & DATABASES. Obsolete introductory material deleted. **New material added about Big Data.** Under discussion of data dictionary, **metadata added and defined.** Under discussion of data mining, some obsolete in-text examples deleted.

UNIT 8B: BIG DATA, INFORMATION SYSTEMS, & ARTIFICIAL INTELLIGENCE. **Unit considerably expanded to cover new issues. New introductory material to distinguish between data mining and Big Data.** Old section, "8.5 Databases & the Digital Economy," repurposed as "8.5 The Evolving World of Big Data," with **new material added.** Old material on e-commerce either moved to Chapter 2 or deleted. **New principal head added, "Three Implications of Big Data," with new material. New principal head added, "The Uses of Big Data," with new material** and subsection heads, "Big Data in Medicine: Using Varieties of Old & New Data," "Smarter Junk Mail: Refining Measurement," "Netflix's Original TV Programming: Making Better Management Decisions." **Artificial intelligence redefined and new material and principal head added, "Conventional AI versus Computational Intelligence,"** with subheads, "Conventional AI: Based on Machine Learning" and "Computational Intelligence: Based on Heuristics," with **machine learning and heuristics defined and discussed.** Discussion of material from later in the chapter moved here under principal head "Weak AI versus Strong AI." Main areas of AI reorganized and discussed in following order: expert systems, natural language processing, intelligent agents, pattern recognition, virtual reality and simulation devices, robotics, fuzzy logic, and neural networks, followed by discussion of artificial life. Under discussion of robotics, **new material and subheads added, "Robots Grouped by Locomotion System" and "Robots Grouped by Application." New principal section added, "Neural Networks,"** using material formerly part of Panel 8.18, which now contains only genetic algorithms and cyborgs as examples of two other types of AI. Existing text material put beneath new section head, "8.8 Artificial Life, the Turing Test, & the Singularity." Old section "8.8 Databases: Concerns about Privacy & Identity Theft" deleted, and its material redistributed to Chapters 6 and 9. Old Experience Box, "Preventing Your Identity from Getting Stolen," deleted, and its contents moved to Chapter 6. **New Experience Box added, "How the Rise of Robotics Will Affect Future Employment," with new material.**

Tech Tales added: "Databases Everywhere," "How Amazon.com Used Databases to Become the World's Largest Online Bookstore," "The Uses of Data Mining," "The Brute Force of Weak AI," "Some Interestingly Named Expert Systems," "Using Virtual Reality & Simulation for Training, Treatment, & Research," "All Types of Robots," "Applying Fuzzy Logic to Elevators," and "A Scene from the Turing Test."

9. The Challenges of the Digital Age: Society & Information Technology Today

UNIT 9A: SECURITY, PRIVACY, & SURVEILLANCE CONCERNS. **Unit considerably expanded to cover new issues.** Old section "9.1 Truth Issues" now section "9.4 Truth Issues" in Unit 9B. In new "9.1 Security Issues," obsolete introductory material deleted; **new material added on predictive apps in relation to privacy issues,** and principal headings reorganized to combine two sections, on errors and accidents and on natural hazards, as "Errors, Accidents, & Natural Hazards." Under discussion of theft of hardware, in-text bulleted list converted to Panel 9.2, "Keeping your mobile devices safe." **New material added to discussion of theft of software.** Material on theft of online music and movies converted to a subsection, "Theft of Intellectual Property," with **extra material added.** Material in old section on "Taking Over Your PC: Zombies, Botnets, & Blackmail" moved to Chapter 6. Under discussion of crimes of malice, **new material on attacks on infrastructure** added to attacks on power-control systems. Under discussion of attacks on the Internet, old material on border gateway protocol replaced with new material. Material in old section "Computer Criminals" deleted here and moved to Chapter 6. Old section "9.3 Security Safeguards" now Section 9.2. Under discussion of passwords, **new material added on saving passwords in software with encrypted file and in using fingerprint readers for master passwords.** Under discussion of physical traits, material on biometric devices moved here from Chapter 6. Under discussion of encryption, lots of text discussion moved to considerations of surveillance later in the chapter. **New section added, "9.3 Privacy & Surveillance: Data Collectors & Spies,"** beginning with discussion of federal privacy laws, moved here from Chapter 8. Main threats to privacy listed under principal heads "Business & Cyberspying," "Government & Cyberspying," and "Spying, Hacking, & Cyberwarfare by Foreign Governments & Groups." Under "Business & Cyberspying," **new material under new subheads, "How Businesses Obtain & Use Data about Us" and "Who Owns Your Data & What Are Your Rights?"** Under "Government & Cyberspying," some old material from Chapter 8 and **new material appears under subheads "Local Police Data Collection," "A National Identity Card?," "The National Security Agency: The Rise of the Surveillance State?" (covering NSA, FBI, FISA court, secret mining of metadata), and "Drones: Snooping from the Skies."** Under "Spying, Hacking, & Cyberwarfare by Foreign Governments & Groups," **mostly new material under subheads "Cyberspying by Foreign—& the U.S.—Governments" and "Cyberattacks & Cyberwarfare."**

UNIT 9B: OTHER SOCIAL, ECONOMIC, & POLITICAL ISSUES. **New introductory material on technology as disrupter of nearly everything.** New section "9.4 Truth Issues: Manipulating Digital Data" was formerly Section 9.1. New Section "9.5 Quality-of-Life Issues: The Environment, Mental Health, Child Protection, & the Workplace" was formerly Section 9.4. Under discussion of stress, **new material added about effect of mobile devices.** Discussion of online sexual predators reduced and replaced with **new material under new subhead, "Sexting."**

Tech Tales added: "How Slow Perceptions Lead to Errors: Texting While Driving," "Glitches in the System: How Electrical & Mechanical Problems Can Make Computers Fail," "The Risks of Natural Hazards: How Bad Can It Get?," "Stealing Music & Movies," "The Nigerian Letter, a Classic Internet Scam," "Police Use of License Plate Scanners," "Cyberattacks That Challenge Governments & Corporations," "Is It Fraudulent to Manipulate Sound?," "Is It Fraudulent to Manipulate Photos?," and "Gambling in the New IT World."

10. Building Systems & Applications: Software Development, Programming, & Languages

UNIT 10A: SYSTEMS DEVELOPMENT & PROGRAMMING. Introductory material replaced by **new material on how learning systems development and programming can be a great career booster.** Under "10.1 Systems Development & the Life Cycle of a Software Project," **introductory material added on creation of apps. New material:** Developing a businesswide plan to utilize mobile devices is applied to the six phases of systems development.

UNIT 10B: PROGRAMMING LANGUAGES. **New introductory material on software developers being in explosive demand.**

Tech Tales added: "'Bring Your Own Device' to Work: Applying Systems Analysis & Design to the BYOD Trend," "Stumbles on the Road to Progress: When Big Systems Fail," "Who Decides When Programs Are Okay to Go? The Release Engineer," and "Student Entrepreneurs Create a New App in Five Days with 'Premade Programming Lego Blocks.'"

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1

INTRODUCTION to INFORMATION TECHNOLOGY: The Future Now

Chapter Topics & Key Questions

UNIT 1A: *The Mobile World, Information Technology, & Your Life*

1.1 **Information Technology & Your Life: The Future Now** What is information technology, and how does it affect education, health, money, leisure, government, and careers?

1.2 **Information Technology Is Pervasive: Cellphones, Email, the Internet, & the E-World** How does information technology facilitate email, networks, and the use of the Internet and the web; what is the meaning of the term *cyberspace?*

UNIT 1B: *The Basics of Information Technology*

1.3 **The Practical User: How Becoming Tech Smart Benefits You** What does being *tech smart* mean, and what are its practical payoffs?

1.4 **The "All-Purpose Machine": The Varieties of Computers** What are the different sizes of computers, and what are clients and servers?

1.5 **Understanding Your Computer** What four basic operations do all computers use, and what are some of the devices associated with each operation? How does communications affect these operations?

1.6 **Where Is Information Technology Headed?** What are three directions of computer development and three directions of communications development?

Download the free UIT 11e App for key term flash cards quizzes and a game, *Over the Edge*

CHAPTER FORECAST

In this chapter we begin by discussing how computing and the Internet affect your life. We then discuss smartphones, the Internet, the World Wide Web, and other aspects of the electronic world (e-world). Next we describe how being smart about information technology can benefit you, and then we cover the varieties of computers. We then explain three key concepts behind how a computer works and what goes into a personal computer, both hardware and software. We conclude by describing three directions of computer development and three directions of communications development. All these concepts are discussed in greater detail in subsequent chapters.

UNIT 1A: *The Mobile World, Information Technology, & Your Life*

"Mobile computing . . . will be the catalyst that brings society the most dramatic changes of the Information Revolution."

So writes Michael Saylor, author of *The Mobile Wave.*[1] The information revolution that began with writing on clay tablets, then continued through the invention of the printing press, radio and TV, and room-size and desktop computers, is now at a "tipping point," he asserts. Now mobile devices such as **smartphones**—**cellphones with built-in applications, multimedia capability, and Internet access**—and **tablet computers**—**wireless portable computers primarily operated by a touch screen**—are changing nearly everything we do.

Consider the example below, the first in a number of *"mini-cases,"* business related and otherwise, that we present in this book:

TECH TALES The Rise of Mobile Computing: The Getting-Smarter Smartphone

While growing up, Nick Bilton noticed that as his father aged, his wallet expanded as he added new credit cards, membership cards, family photos, stamps, tickets, and other things—until it became so large that he would pull it out of his back pocket when he sat down, "dropping it on the table like a brick," Bilton says.[2]

However, for Bilton, a *New York Times* technology columnist, it's been the reverse experience: Each year his wallet has become slimmer. "Things that once belonged there have been [taken over] by my smartphone," he reports, to the point where "I realized I didn't need to carry a wallet anymore. My smartphone had replaced almost everything in it."

Today Bilton's address books, calendars, maps, music players, and photos have all been absorbed into his smartphone. So have most identification cards—customer cards, gym membership ID, insurance cards, and so on—which now exist as photos carried in the phone. Movie tickets, coupons, and airline boarding passes also can be stored as replicas.

The only two non–mobile phone items Bilton carries are his driver's license and a bank debit card (instead of cash). "But I'm confident," he says, "that those, too, will disappear someday" and become part of the smartphone. ■

It would be simplistic, however, to predict that we'll be doing *all* our computing on just smartphones and tablets anytime soon. As one writer points out, "Heavier productivity tasks—like, you know, typing—are still much easier to pull off on standard laptops and desktops."[3] Moreover, the uses of smartphones and other portable devices

cannot be truly mastered without understanding their huge supporting infrastructure of computing and communications technologies—the subjects of the rest of this book.

Even so, people ages 16 to 39, members of the "Millennial Generation," who generally spend eight hours a day or more looking at various screens—on cellphones, on computers, on TVs—generally have a head start on computer technology.[4] They are, as one anthropologist called them, "digital natives" or computer-technology natives, constantly busy with text messaging, email, and the *Internet,* the global "network of networks," and its most well-known feature, the multimedia *World Wide Web*—the "Web" or "web," with its massive collection of *websites,* or related collections of files.[5] Indeed, among college students, 98% are Internet users and 92% are wireless (laptop or cellphone) users.[6] While their parents continue to shop in retail stores (often using clipped-out paper coupons), Millennials are more likely than older shoppers (by 50% vs. 21%[7]) to check out brands on **social networks**—**sites on the World Wide Web such as Facebook and Twitter that (as we'll describe) allow users to interact and develop communities around similar interests**—and use mobile devices to research products and compare prices.

"Well, I keep busy." Multiple electronic devices allow people to multitask, or do multiple tasks simultaneously—sometimes too many tasks.

In addition, Millennials are 2½ times more likely than older generations to be early adopters of technology.[8] This is a good thing, because we live in what Tom Peters, author of *In Search of Excellence,* calls *discontinuous times,* or "a brawl with no rules," where dealing with change is an ongoing challenge.[9] Others speak of the "disruptive" effect of computers and their software that "is going to eat not just the technology industry but every industry systematically."[10]

What are the developments that have led to these turbulent times? The answer is *information technology.* **Information technology (IT) is a general term that describes any technology that helps produce, manipulate, store, communicate, and/or disseminate information.** Of the top 30 innovations from 1969 to 2009, according to a panel of professionals at the University of Pennsylvania's Wharton School, *most were related to information technology.*[11] *(• See Panel 1.1.)* Among the first items on their list, for example, are (1) the Internet, broadband, and the World Wide Web; (2) PC and laptop computers; (3) mobile phones (cellphones); and (4) email. Indeed, the Internet, along with semiconductors

panel 1.1

Top innovations in recent years

The majority (23 of the 30) are in the field of information technology.

1. Internet, broadband, World Wide Web
2. PC and laptop computers
3. Mobile phones
4. Email
5. DNA testing and sequencing
6. Magnetic resonance imaging
7. Microprocessors
8. Fiber optics
9. Office software
10. Laser/robotic surgery
11. Open-source software
12. Light-emitting diodes
13. Liquid crystal display
14. GPS devices
15. E-commerce and auctions
16. Media file compression
17. Microfinance
18. Photovoltaic solar energy
19. Large-scale wind turbines
20. Internet social networking
21. Graphic user interface
22. Digital photography
23. RFID and applications
24. Genetically modified plants
25. Biofuels
26. Barcodes and scanners
27. ATMs
28. Stents
29. SRAM flash memory
30. Antiretroviral treatment for AIDS

To be more than just a new invention, an event was defined as an innovation if it created more opportunities for growth and development and if it had problem-solving value.
Source: Adapted from "A World Transformed: What Are the Top 30 Innovations of the Last 30 Years?" *Knowledge@Wharton,* February 18, 2009, *http://knowledge.wharton.upenn.edu/article.cfm?articleid=2163* (accessed May 10, 2013).

(processors), is said to rank among the 15 greatest innovations in all history, as important as the invention of the number zero, money, printing, and participatory democracy.[12]

Unlike previous generations, you live in a world of *pervasive computing* or *ubiquitous computing*—computing is everywhere. The basis for this phenomenon is the Internet, the "Net" or "net," that sprawling global connection of smaller computer networks that enable data transmission at high speeds. Everything that presently exists on a personal computer, experts suggest, will move onto the Internet, giving us greater mobility and involving the Internet even more closely in our lives.[13] Already, in fact, the United States has more devices connecting to the Internet than it has people—425 million smartphones, tablets, personal computers, and gaming consoles divided among the USA's 311.5 million residents.[14]

1.1 INFORMATION TECHNOLOGY & YOUR LIFE: The Future Now

Information technology affects almost all aspects of our lives, including education, health, finance, recreation and entertainment, government, jobs and careers, and your personal life.

This book is about computers, of course. But not just about computers. It is also about the way computers communicate with one another. When computer and communications technologies are combined, the result is *information technology,* or "infotech." *Information technology (IT),* we said, is a general term that describes any technology that helps produce, manipulate, store, communicate, and/or disseminate information. IT merges computing with high-speed communications links carrying data, sound, and video. Examples of information technology include personal computers but also various forms of handheld devices, televisions, appliances, and other machines.

Two Parts of IT: Computers & Communications

Information technology comprises both computer technology and communications technology.

Note that there are two important parts to information technology—computers and communications.

COMPUTER TECHNOLOGY You likely know what a computer is, but to get to a formal definition: **a computer is a programmable, multiuse machine that accepts data—raw facts and figures—and processes, or manipulates, it into information we can use,** such as summaries, totals, or reports. Its main purpose is to speed up problem solving and increase productivity.

COMMUNICATIONS TECHNOLOGY **Communications technology, also called *telecommunications technology*, consists of electromagnetic devices and systems for communicating over any distance.** The principal examples are telephone, radio, satellite, broadcast television, and cable TV. We also have communication among computers—which is what happens when people "go online" on the Internet. **Online means using a computer or some other information device, connected through a network, to access information and services from another computer or information device. A network is a communications system connecting two or more computers; the Internet is the largest such network.**

Information technology is already affecting your life in multiple ways, of course, and will do so even more in the future. Let's consider how.

Education: The Promise of More Interactive & Individualized Learning

Education has become heavily involved in information technology.

Education pays, with recent college graduates having lower rates of unemployment, higher earnings, and better career prospects than their lesser educated peers.[15] At every

level, the education system benefits from information technology, whether it's online systems allowing families to track their elementary students' grades, high schools enabling use of smartphones for students to get help on assignments, or colleges offering free online education.[16]

TECH TALES Technology in Education: Adjusting Instructor Presentations to the Students

In her physics classes at the Massachusetts Institute of Technology, Professor Gabriella Sciolla's high-tech classroom has whiteboards and huge display screens instead of blackboards. The professor can make brief presentations of general principles and then throw out multiple-choice questions that students "vote" on, using wireless "personal response clickers."

These devices transmit the answers to a computer monitored by the professor, helping her gauge the level of understanding in the room. "You know where they are," she says. She can then adjust, slow down, or engage students in guided discussions of their answers.[17]

In her mathematics classes at Hillcrest High School in Greenville, South Carolina, teacher Jennifer Southers has flipped education upside-down. Instead of coming to school and listening to a lecture in class and then going home to try out what they learned, her students first listen to an online video lecture at home before class and then come to class where they can apply their knowledge with their teacher there to help them.

"The level of frustration has almost disappeared completely on those lessons when we do that," says Southers.[18]

Survival Tip

Online Colleges and Accreditation

For-profit institutions are not accredited by the same standards as traditional not-for-profit universities. Often the course work in these proprietary schools is not eligible for transfer into traditional schools. For more information on how schools are accredited:

www2.ed.gov/admins/finaid/accred/index.html

http://ope.ed.gov/accreditation/

www.guidetoonlineschools.com/online-schools

http://chronicle.com/article/Online-Programs-Face-New/129608/

www.prweb.com/releases/2012/non-profit/prweb9090071.htm

http://distancelearn.about.com/od/onlinecourses/a/Are-For-Profit-Online-Colleges-A-Rip-Off.htm

THE USES OF INFORMATION TECHNOLOGY IN COLLEGE When properly integrated into the curriculum and the classroom, information technology can (1) allow students to personalize their education, (2) automate many tedious and rote tasks of teaching and managing classes, and (3) reduce the teacher's workload per student, so that the teacher can spend more time on reaching individual students.[19] For instance, **email, or "*electronic mail*," messages transmitted over a computer network, most often the Internet,** are used by students to set up appointments with professors (62%), discuss grades (58%), or get clarification of an assignment (75%).[20]

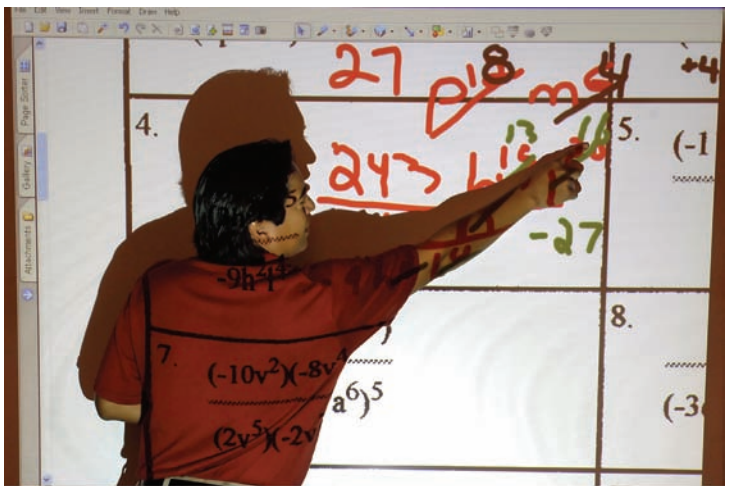
more info!

From now on, whenever you see the **more info!** icon in the margin, you'll find information about Internet sites to visit and how to search for terms related to the topic just discussed.

Besides using the Internet to help in teaching, today's college instructors also use *presentation graphics software* such as PowerPoint to show their lecture outlines and other materials on classroom screens (as we discuss in Chapter 3). In addition, they use Blackboard, It's Learning, Inc., and other *course-management software (CMS)* (or learning management systems) for administering online assignments, individual learning plans, schedules, examinations, and grades.

ONLINE LEARNING One of the most significant developments in education at all levels is the rise of **distance learning, or online learning, or e-learning, the names given to online education programs,** which at the college level counted over 6.7 million students taking at least one online course in 2012.[21] A relatively recent development was the appearance of free online courses called *massive open online courses,* or *MOOCs.*[22] Examples are courses offered by companies such as Coursera, edX, Udacity, and Udemy, which feature offerings from Princeton, Stanford, Brown, Duke, Columbia, and other universities.

E-learning has also propelled the rise of for-profit institutions, such as Colorado Technical



Interactive education. Interactive whiteboard math class. A whiteboard is a white surface with multitouch, multiuser, and pen/stylus functionalities that also displays the contents of a computer screen. A projector projects the computer's desktop onto the board's surface. The board is typically mounted to a wall or floor stand.

Avatar. The simulated depictions of humans are a staple not only of videogames but also of computerized training programs. (What culture does "avatar" come from? See *www.answers.com/topic/avatar?cat=technology*.)

more info!

Online Colleges

The following websites provide detailed information about getting college degrees online:

www.onlinecollegedegrees.net/

www.earnmydegree.com/index.html

www.classesusa.com/indexall/?campusType=online

www.guidetoonlineschools.com/

www.usdla.org/

http://distancelearn.about.com/ (includes information about bad programs, called *diploma mills*)

www.distancelearning.com/

www.elearners.com/resources/

more info!

Carnegie Learning's Cognitive Tutor Software

www.carnegielearning.com/specs/cognitive-tutor-overview/

Institute, Kaplan University, Strayer University, and the University of Phoenix. More than a third of institutions of higher education—and 97% of public universities—offer online courses, and many have attracted on-campus students, who say they like the flexibility of not having to attend their classes at a set time.[23]

E-learning has been put to such varied uses as bringing career and technical courses to high school students in remote prairie towns, pairing gifted science students with master teachers in other parts of the country, and helping busy professionals obtain further credentials outside business hours.

TUTORING, SIMULATION, & AVATARS But the reach of information technology into education has only begun. "Intelligent tutoring systems" software is now available that gives students individualized instruction when personal attention is scarce—such as the software Cognitive Tutor, which not only helps high school students to improve their performance in math but also sparks them to enjoy a subject they might have once disliked.

In colleges, more students may use interactive simulation games, such as McGraw-Hill's Business Strategy Game, to apply their knowledge to real-world kinds of problems. And employees in company training programs may find themselves engaged in mock conversations with **avatars—computer depictions of humans,** as are often found in online videogames—that represent imaginary customers and coworkers, combining the best parts of computer-based learning with face-to-face interaction. An avatar is also part of your online representation of yourself; it gives other users a "face" to go with your username ("online name").

Health: High Tech for Wellness

Computers are now often used in the fields of health and medicine.

"Digital technology—on phones and tablets, in electronic record keeping, and in a host of clinical innovations—is transforming medicine in virtually every way," says one account. "Not the least of the changes is the shifting relationship between doctors and patients."[24] (For now we use the word *digital* to mean "computer-based.")

TELEMEDICINE *Telemedicine*—medical care delivered via telecommunications—has been around for some time. For example, physicians in rural areas lacking local access to radiologists have used "teleradiology" to exchange computerized images such as X-rays via telephone-linked networks with expert physicians in metropolitan areas. Now telemedicine is moving to an exciting new level, as the use of digital cameras and sound, in effect, moves patients to doctors rather than the reverse.

PRACTICAL ACTION

How to Be a Successful Online Student

1. **Familiarize yourself with the computer and software.** Be comfortable with the computer, Internet, email, web browser, and search engine software. Use tutorials to become familiar with the software used by your online school.

   Take advantage of technology. Learn the various ways of communicating on the web. Blogging, podcasting, videoconferencing, and chatting (discussed later in the book) are tools that will help you with online studying.

2. **Do you have regular access to the Internet?** Do you have your own email account? It is necessary to maintain regular communication with the instructor with whom you are taking the course. *You must be able to answer your email quickly* during the school week, which means within 24 hours after receipt. And you should be able to successfully send and receive email with attachments. Students must have a reliable Internet service provider (ISP) and email account before the start of class. (Students are often required to use a school email account.)

3. **Read every document within your syllabus within the first five days of your online course.** This is usually the time to begin introducing yourself to your classmates and instructor and to start asking questions concerning the expectations described in the syllabus. You need to know what is expected of you.

   Know how to find assignments and course material, as well as be able to participate in and post to discussions and send emails with attachments.

4. **Are you comfortable working on your own? Are you self-motivated?** You will have flexible use of the time to spend on course work. Due dates are set by the instructor. Flexibility and independence are agreeable to some, but for others it is difficult to self-start. Be honest with yourself about your capabilities.

   It is the student's responsibility to take the course seriously and to be able to budget time to receive a successful grade. Make a schedule and stick to it.

5. **Can you make deadlines?** Your instructor is counting on you to finish your work on time. Your communication may be virtual (online), but your tasks and assigned deadlines are not.

   Be consistent in the amount of time you take to read and study. Every week you will be expected to read sections in your textbook.

   Try not to get behind in your class work; try to stay on course or ahead. Some online learning programs move at an advanced rate; missing one week is like missing two in a traditional classroom.

6. **Is this the right time for you to take an online class?** You should be confident that you can set aside enough time for your online course assignments and study time. You may feel that taking an online course will free up your time for other tasks. If you are feeling overwhelmed by other responsibilities, such as work or family obligations, then perhaps you had better postpone your involvement. Online courses require as much and often more personal preparation time than on-campus courses. Everything that you would normally communicate by speech in class must be typed in an online course.

7. **You will need good written communication skills.** Remember, your primary means of communication is through writing. Being able to send well-structured messages and essays will help with the communication process.

8. **Pay attention to detail, particularly when following written directions.** Assignments, projects, and so on are posted in written form. Grades are drawn from work accomplished as directed. When grading assignments, the instructor will look for competence in the work submitted. This means that all the required steps were followed and presented in a professional manner.

9. **Create a private study area.** This will help you to focus on your studies without distractions and ensure that others do not to disturb you while you are in your study area. Keep all your study materials here, so you know where to look for them.

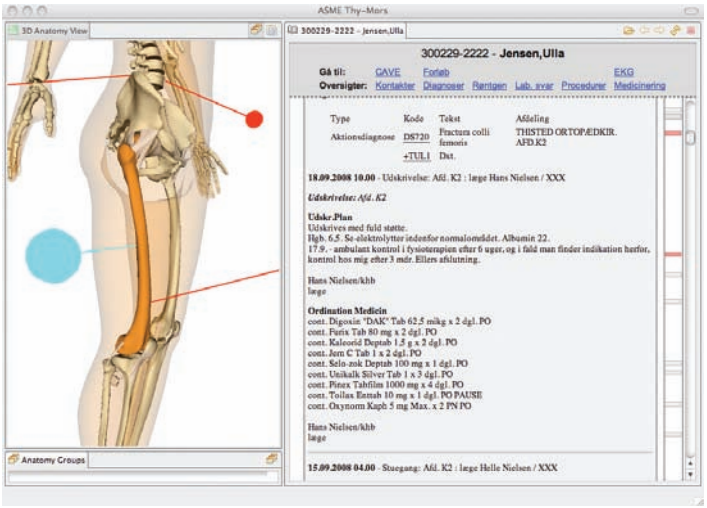
10. **Interact with your peers.** Contribute and exchange your ideas, perspective, and comments with your online classmates. Join online student communities and blogs.

11. **Interact with your faculty.** Constantly stay in touch with your professors. Consult them if you have technical difficulties or problems in understanding something related to the course. Since your professors cannot see you, you must be absolutely clear in expressing your ideas and needs.

12. **Evaluate and test yourself.** Take tests after thorough preparation. Don't hurry to take the tests; time them carefully. Have your work evaluated by fellow classmates.

13. **Netiquette: Remember the dos and don'ts.** When you are online, be careful of netiquette (online etiquette). Both the real world and the virtual world are inhabited by people, so the same rules apply. Never be rude or disrespectful. Respect the privacy of other people.

Source: Adapted from *www.olhcc.edu/Documents/academics/1%20Online%20Courses%20Are%20You%20Ready.pdf*; *www.brighthub.com/education/online-learning/articles/26877.aspx*; and *www.onlinedegreedirect.com/onlinedegreedirect-articles/10-Easy-Ways-to-Become-a-Good-Online-Student.htm*.



High-tech medicine. (*left*) Screenshot of the visual patient record software pioneered at Thy-Mors hospital. This patient has had a fracture of the femur in the right leg. This computer-based image shows a close-up view of the treated area. A click on the arrow on the highlighted femur would show the pertinent medical information from the record on the right panel. The tool allows doctors to easily zoom in and out on a particular body region or part and choose between many different views. (*top right*) Open heart surgery is seen on a computer monitor as an Israeli medical team repairs a congenital defect in a boy's heart at the Wolfson Medical Center in Tel Aviv. (*bottom* right) Ultralight Anthropomorphic Hand compared with a human hand. This artificial hand is for use as a prosthetic or as an attachment on a humanoid robot. Unlike conventional alternatives, it performs human-like movements and can grasp a wide range of objects. The hand uses hydraulic fluid actuators, positioned in the fingers and wrist. These allow flexibility of movement and are also self-adapting, ensuring that the hand's grasp is never too hard or soft. The actuators also ensure that the hand is lightweight and inexpensive to produce. The surface of the hand is soft to the touch, making it feel more natural. It was developed at Forschungszentrum Karlsruhe, Germany.

more info!

Health Websites

Some reliable sources:

www.medlineplus.gov
www.nimh.nih.gov
www.womenshealth.gov/
www.mayoclinic.com
www.nationalhealthcouncil.org
www.yourdiseaserisk.wustl.edu/

TECH TALES New Telemedicine: The Doctor Will See You Now—Right Now

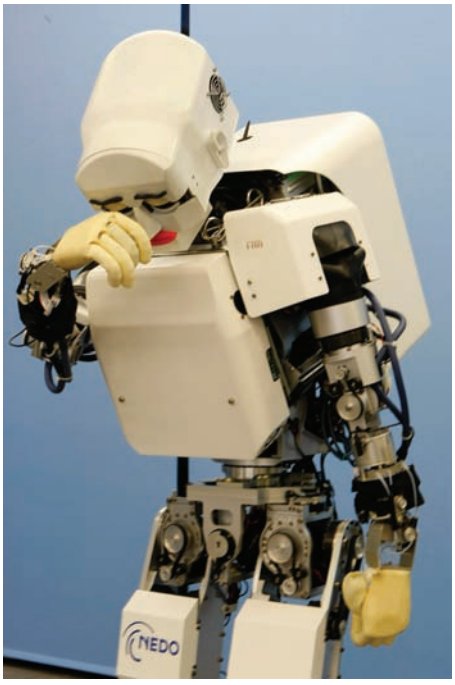
New York technology writer Michael Wolff had a rotten cold and his regular doctor was on vacation. So he used a program called ZocDoc. "I entered my particulars: my ZIP code, my malady, my insurance," he wrote. "And bingo, I had my choice of doctors in the vicinity and available appointments that day. I chose an ear-nose-and-throat man a 10-minute walk from my house."[25]

Similarly, Anna Keyes, an employee of a Houston-based Caterpillar dealer, who couldn't shake chest congestion, walked down the office hallway and, with the help of a clinical paramedic, connected to a physician 20 minutes away, who examined her with an Internet-linked stethoscope and a handheld video camera. In 20 minutes, she was back at her desk with the diagnosis of an allergy and a prescription to cope with it.[26]

Image transfer technology allows radiologic images such as CT scans and MRIs to be immediately transmitted to electronic charts and physicians' offices.[27] Patients in intensive care, who are usually monitored by nurses during off-times, can also be watched over by doctors in remote "control towers" miles away. Recent telemedicine innovations include use of smartphones to enable doctors to take an electrocardiogram almost anywhere and to help patients track for signs of skin cancer.[28]

Electronic medical records and other computerized tools enable heart attack patients to get follow-up drug treatment and diabetics to have their blood sugar measured. Software can compute a woman's breast cancer risk.

ROBOT MEDICINE Various **robots—automatic devices that perform functions ordinarily performed by human beings,** with names such as ROBO DOC, RoboCart,



Robots. (*top left*) A humanoid robot, HRP-2 Promet, developed by the National Institute of Advanced Industrial Science and Technology and Kawada Industries, Inc. Five feet tall, it performs traditional Japanese dancing. Priced at $365,000, the robot can help workers at construction sites and also drive a car. (*top right*) Lexie Kinder, 9, who was born with a chronic heart disease that makes attending school risky, smiles in class through a robot called a VGo, at Alice Drive Elementary School in Sumter, S.C. A robot takes the place of a sick student in the classroom. (*bottom right*) Humanoid robot KOBIAN displays an emotion of sadness during a demonstration at Waseda University in Tokyo, Japan. KOBIAN, which can express seven programmed emotions by using its entire body, including facial expressions, has been developed by researchers at Waseda's Graduate School of Advanced Science and Engineering.

TUG, and HelpMate—help free medical workers for more critical tasks. The four-armed da Vinci Si surgical robot, for instance, can do the smallest incisions and stitches for complex surgery deep inside the body, so that surgery is less traumatic and recovery time faster.[29] Hydraulics and computers are being used to help artificial limbs get "smarter,"[30] and pressure-sensitive artificial skin made of tiny circuits is expected to improve limbs' effectiveness.[31] An international team of researchers at of Tel Aviv University is working on a biomimetic computer chip for brain stimulation that is programmable, responsive to neural activity, and capable of bridging broken connections in the brain. This device could be used to replace diseased or damaged brain tissue, restore brain functions lost to aging, and even treat epilepsy, chronic pain, and Parkinson's disease.[32]

HEALTH SELF-HELP Want to calculate the odds on how long you will live? Go to *www.livingto100.com*, an online calculator developed by longevity researchers at Harvard Medical School and Boston Medical Center. Want to gather your family health history to see if you're at risk for particular inherited diseases? Go to *www.hhs.gov/familyhistory* to find out how.

One in three Americans has also gone online to figure out a medical condition, and 59% of adults say they have looked online for health information in the past year.[33] (However, some online health information can be misleading and even dangerous.) Some cancer patients have created fund-raising sites on the web to raise money to pay for their out-of-pocket costs, an activity known as *crowdfunding*.[34]

more info!

Crowdfunding

Some information on successful crowdfunding:

www.cfpa.org/

http://mashable.com/category/crowdfunding/

www.startupexemption.com/crowdfunding-101#axzz2NR6m7NJa/