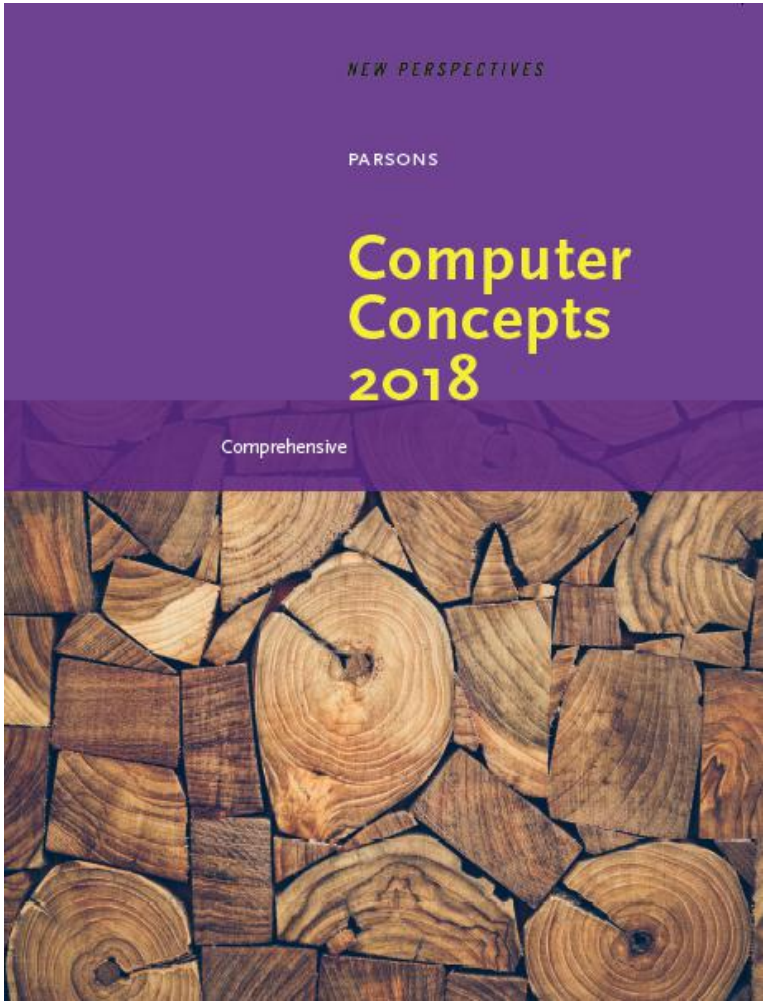
Computer Concepts 2018



Module 8

The ICT Industry

Module Contents

- Section A: ICT Industry Basics
- Section B: The Computer Industry
- Section C: The Telecom Industry
- Section D: Tech Careers
- Section E: ICT Laws and Ethics

Section A: ICT Industry Basics

- ICT Core Industries
- ICT Goods and Services
- Technology Life Cycles
- Disruptive Technology
- ICT and Productivity
- ICT and National Security

Section A: Objectives (1 of 2)

- List six core ICT industry components and provide examples of businesses in each
- List four reasons why the ICT industry is one of the world's largest economic sectors
- Draw a timeline showing stock market trends for the ICT industry through boom and bust cycles between 1988 and the present year
- Give at least three examples of ICT consumer goods and three examples of ICT capital goods
- Distinguish between outsourcing and offshoring

Section A: Objectives (2 of 2)

- Explain how Moore's law is related to the declining price of ICT products
- Draw diagrams representing the product life cycle, Rogers' bell curve, and the Gartner Hype Cycle
- Summarize the global influence of ICT
- Provide at least three examples of disruptive technologies and explain their benefits as well as their drawbacks
- List four of the six national security functions provided by the ICT industry
- Explain the connection between cyberwarfare and the Tallinn Manual

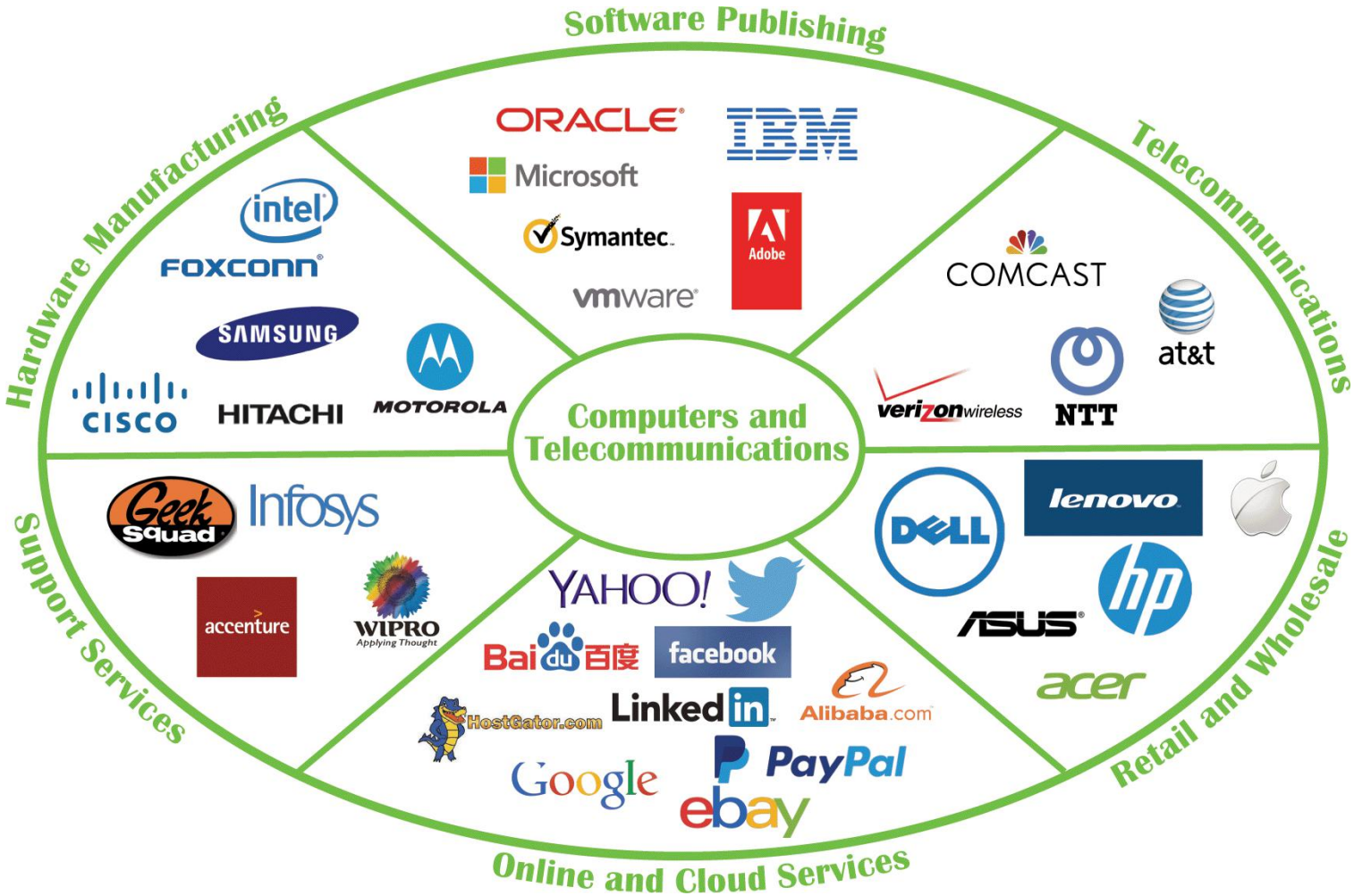
ICT Core Industries (1 of 5)

- As the computer industry expanded beyond number crunching to data storage and decision support, the IT (Information Technology) industry evolved
- The **ICT industry** is a result of that evolution; a convergence between the IT industry and the telecommunications industry
- Companies and businesses create jobs, develop products, and offer services that drive the economy; they are classified into **economic sectors** according to the types of goods and services they provide

ICT Core Industries (2 of 5)

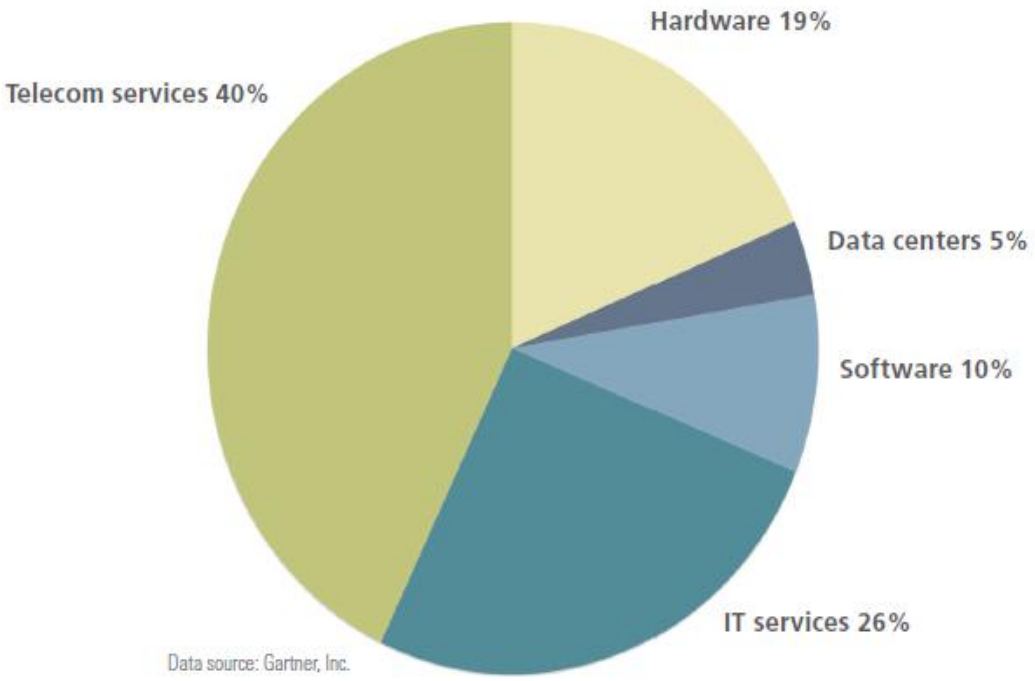
- The **information industry** has three major facets: content, computers, and telecommunications
- The focus of Unit 8 is the ICT industry, which is made up of businesses that focus on digital equipment, software, and communications technologies

ICT Core Industries (3 of 5)



ICT Core Industries (4 of 5)

- ICT is one of the world's largest economic sectors; revenues exceed those of the oil and gas industry and the world's airlines



ICT Core Industries (5 of 5)

- The ICT industry has fueled the economies of many countries and was not as deeply affected as some sectors of the economy during the 2009 global recession
- The so-called dot-com bubble was fueled by a frenzy of online business startups called **dot-coms**
- A dot-com bubble that began in the late 1990s burst with devastating effects on ICT stock values; a **stock market bubble** refers to a sharp rise in stock values that is later followed by a sudden decline

ICT Goods and Services (1 of 5)

- In economics, **goods** are things that can be used or consumed, whereas **services** are intangible actions performed for a consumer
- ICT goods and services can be distributed locally, nationally, or internationally and are purchased by individuals and corporations
- **Consumer goods**, such as laptops, are purchased by individuals; **capital goods** are raw materials used by businesses to make consumer goods

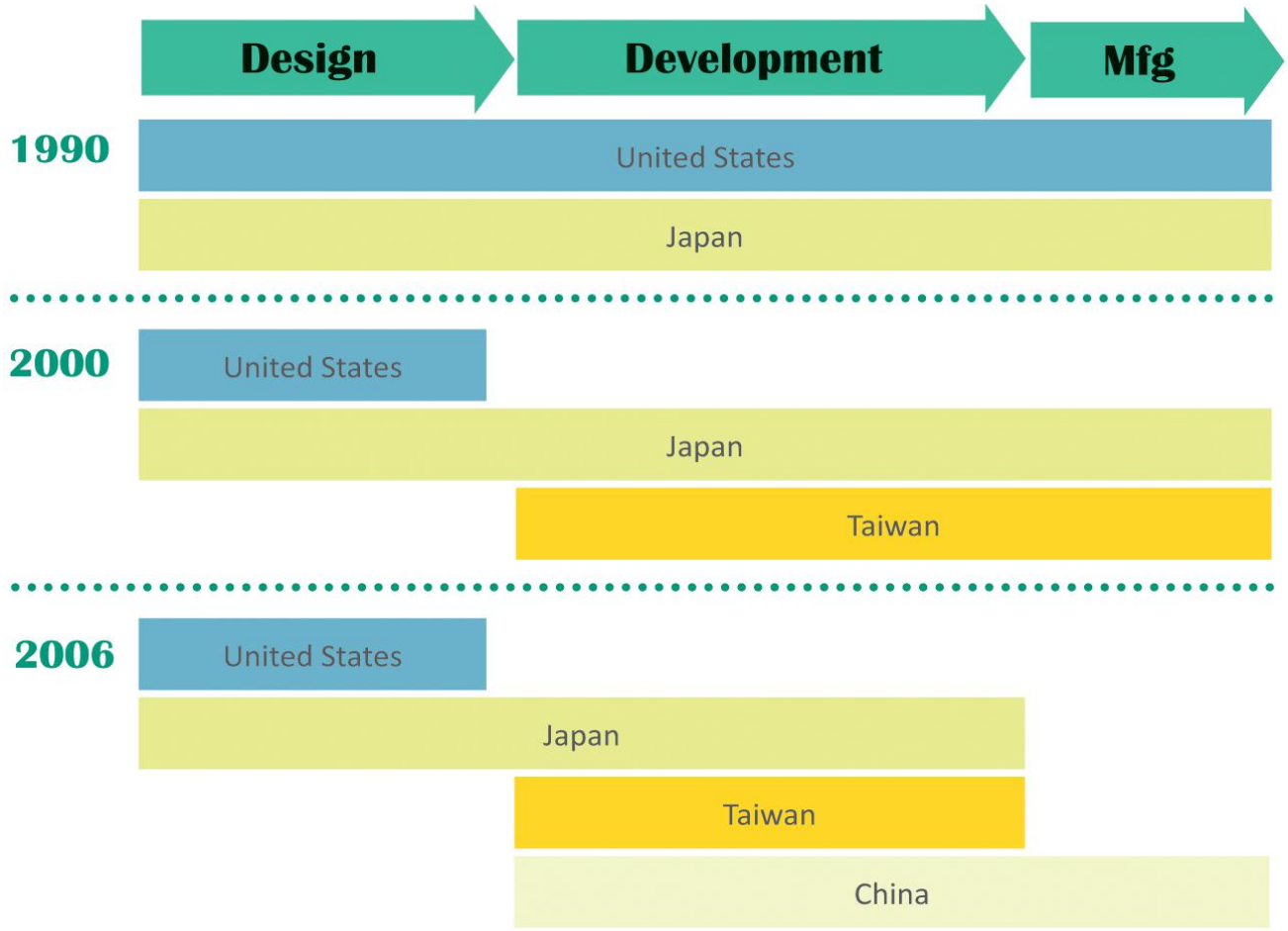
ICT Goods and Services (2 of 5)

- The terms *outsourcing* and *offshoring* are often used interchangeably, but they are slightly different
  - **Outsourcing** is the use of components or labor from outside suppliers
  - **Offshoring** relocates business processes, such as manufacturing and customer support, to lower-cost locations in other countries

ICT Goods and Services (3 of 5)

- Until the 1990s, ICT companies performed all phases of product development in house
- Prototyping and mass production moved to Taiwan, then to China
- Outsourcing and manufacturing efficiencies contributed to falling prices of ICT goods and services

ICT Goods and Services (4 of 5)



Adapted from
Dedrick and Kraemer, Globalization of Innovation

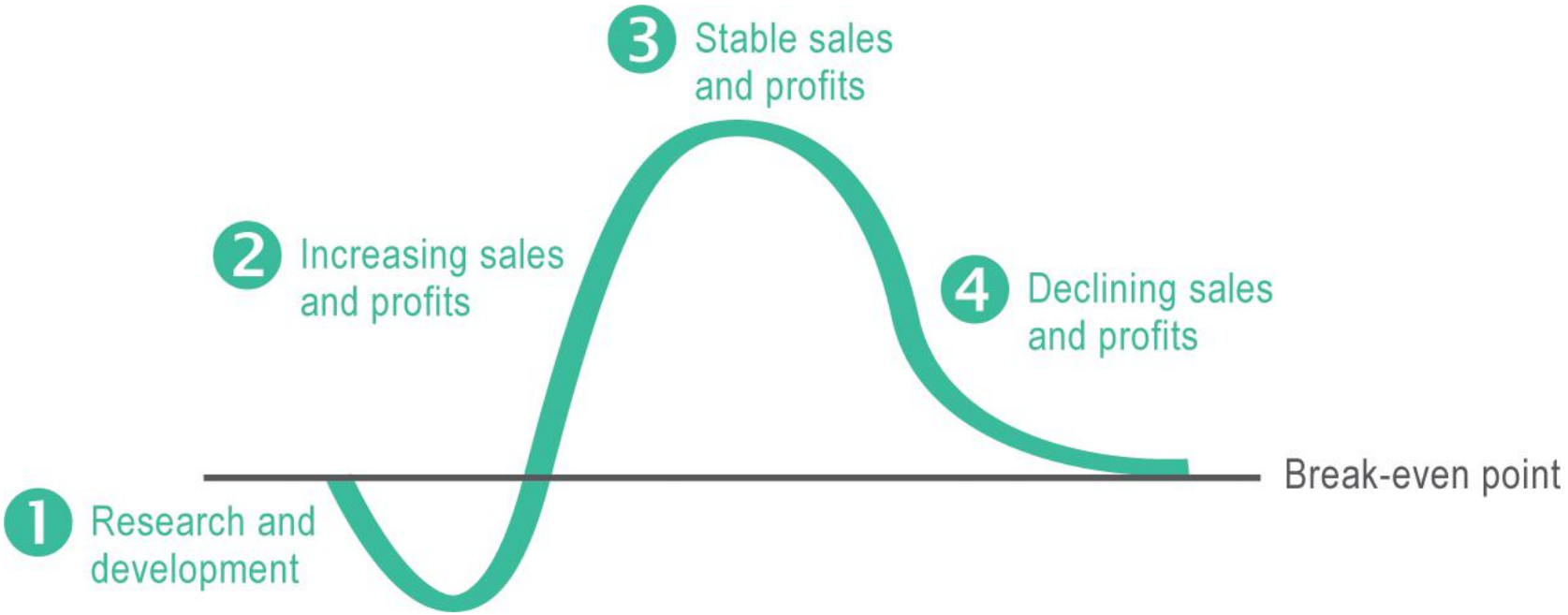
ICT Goods and Services (5 of 5)

In 1995, $1,800 purchased a desktop computer with a 33MHz processor, 8MB of RAM, a 200 MB hard disk, a CD drive, and a bulky CRT monitor with a maximum 1024×768 resolution.

In 2015, $500 paid for a laptop computer with a 1.7Ghz processor, 4GB RAM, a 500 GB hard disk, and an integrated 15” screen with a maximum 1600×900 resolution.

Technology Life Cycles (1 of 3)

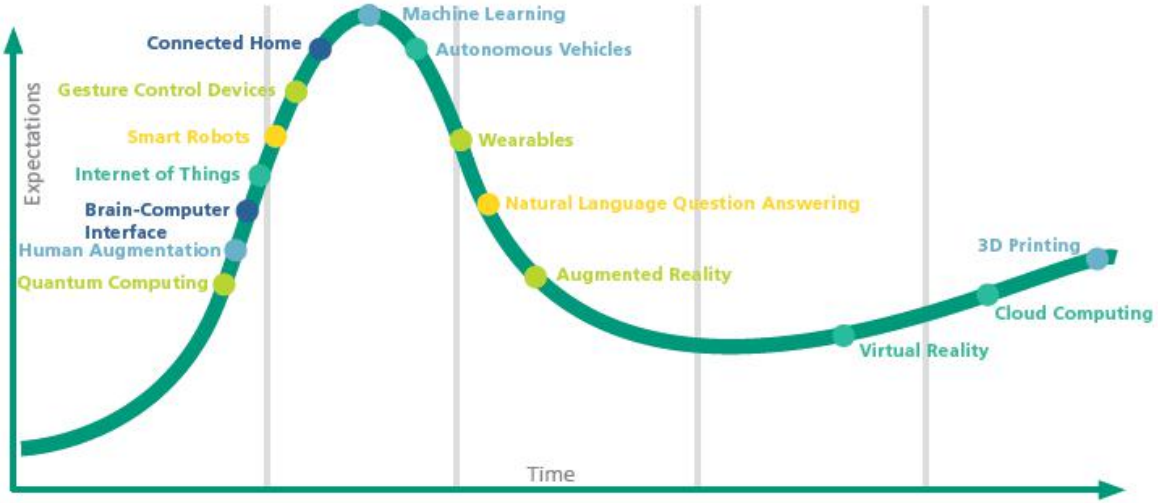
- The **product life cycle** (PLC) maps the expected profitability of a product from its inception to its demise



Technology Life Cycles (2 of 3)

- To try and track a product's life cycle, analysts and sociologists devised the following:
  - **Moore's law** – Gordon Moore, co-founder of Intel Corp., predicted that technological innovation would double the number of transistors in an integrated circuit every two years without raising its cost
  - **Rogers' bell curve** – frequently used to describe patterns in the way consumers adopt technology products; developed by a team of sociologists including Everett M. Rogers
  - **Gartner Hype Cycle** – represents the position of a product during its life cycle of publicity or "hype"; developed by analysts at Gartner, Inc.

Technology Life Cycles (3 of 3)



Technology Trigger

Early announcements regarding a technology breakthrough trigger publicity and speculation about potential products and applications.

Peak of Inflated Expectations

Success stories for early prototypes are highly publicized, leading to increasing speculation, much of which is unrealistic.

Trough of Disillusionment

The technology does not fulfill inflated expectations. In this crucial phase, the technology may be abandoned or mutate into an unintended form.

Slope of Enlightenment

The realistic potential of the technology becomes understood, and refinements of earlier developments begin to show stable benefits.

Plateau of Productivity

The technology spreads into the mainstream, based on demonstrated benefits.

Disruptive Technology (1 of 2)

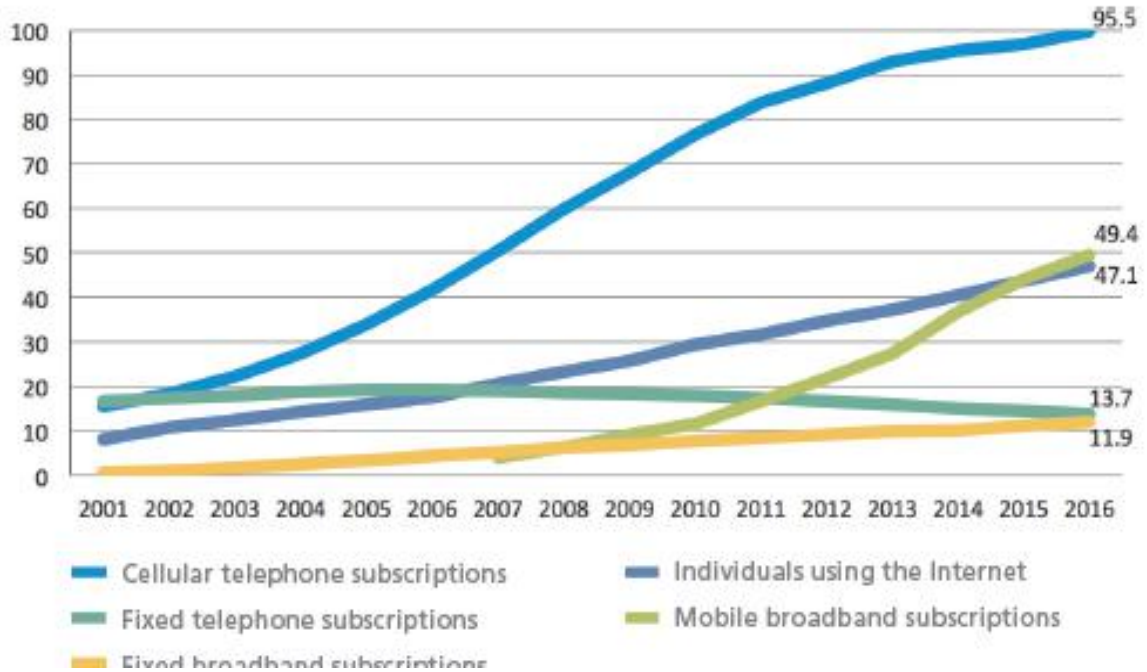
- **Disruptive technology** displaces an existing business process, market, industry, or product
- Flat-screen LCD technology replaced CRT displays.
- Digital photography replaced film photography, which affects camera manufacturers, film manufacturers, and photo processing shops.
- Computers with word processors replaced typewriters.
- Digital publishing and Web-based access to information have had a devastating effect on newspapers.

Disruptive Technology (2 of 2)

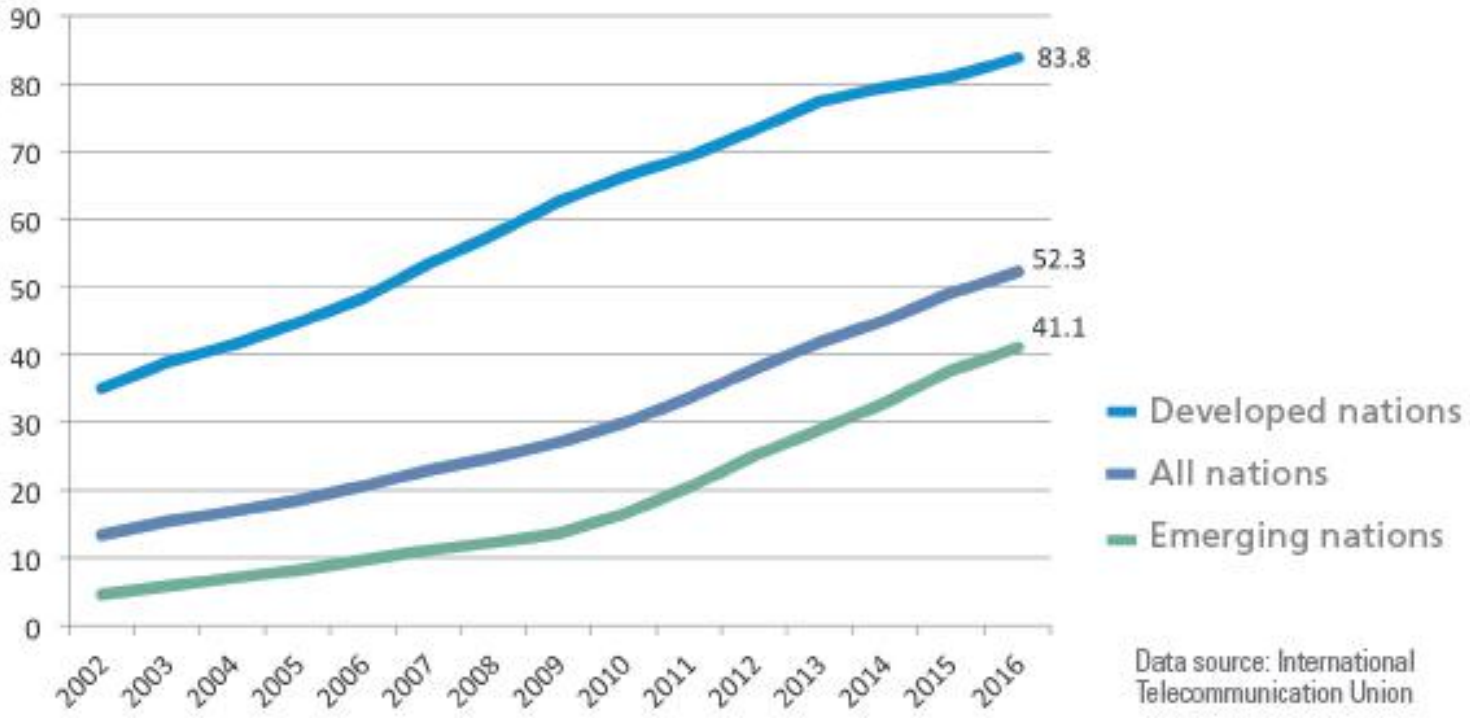
- Movies replaced radio as a form of entertainment. Movies were then disrupted by television, which in turn has been disrupted by download and streaming technology.
- The telegraph was disrupted by the tele-phone system, long distance by VoIP, and land line service by cellular service.
- Smartphones have the potential to replace devices such as MP3 players, portable game consoles, point-and-shoot cameras, personal video players, voice recorders, handheld GPS devices, wristwatches, paper maps, and handheld calculators.

ICT and Productivity (1 of 4)

- In the context of economics, **productivity** is a measurement of the amount of output that is produced per unit of input

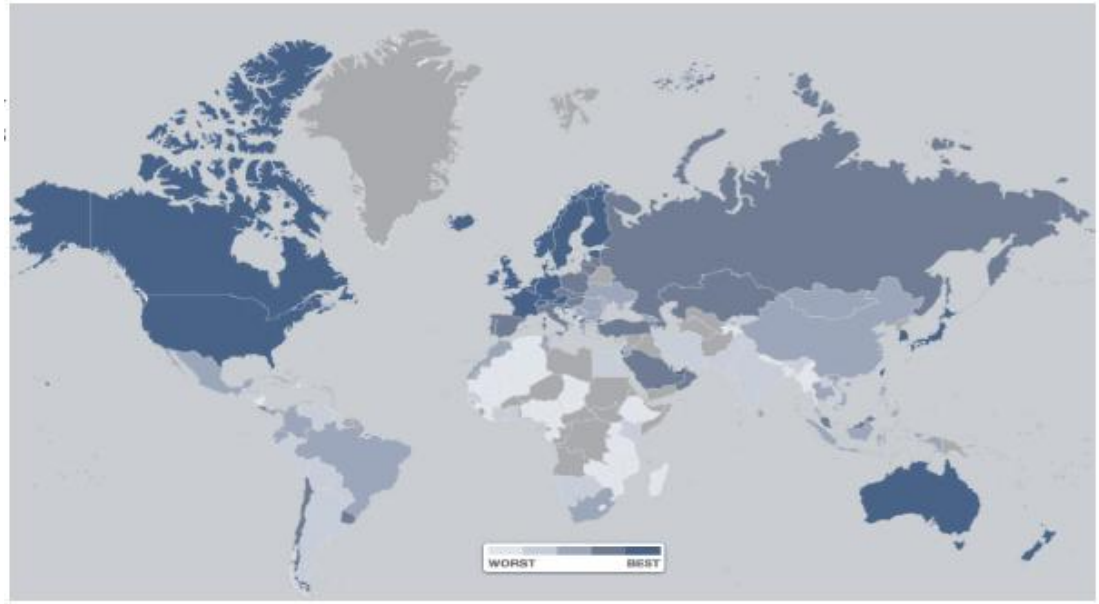


ICT and Productivity (2 of 4)



ICT and Productivity (3 of 4)

- The World Economic Forum produces an annual report on the global influence of the ICT industry and identifies how well countries leverage ICT technologies



ICT and Productivity (4 of 4)

- Economists use indicators, such as **GDP** (gross domestic product), to measure the total output of a nation
- Between 2011 and 2013 digitization boosted world economic output by US$193 billion and created 6 million jobs during that period
- These factors are a compelling argument for national investment in digital technologies

ICT and National Security (1 of 4)

- Programs of surveillance, espionage, and sabotage are carried out today using cyberwarfare hacking tools
- The ICT industry plays a major role in national security for countries throughout the world
- Infiltrating and disabling computers storing sensitive corporate, government, or military data could create chaos and temporarily weaken military defenses

ICT and National Security (2 of 4)

Jam communications satellites	Pilots, ship captains, and military units rely on satellite-based GPS, communications, surveillance, navigation, and missile warning.
Shut down power grids including nuclear generators	Massive power outages can disrupt military defense operations and cause civilian chaos.
Disrupt air traffic control	Without air traffic control systems, flights are grounded.
Shut down water and fuel pipelines	A lack of water and fuel creates chaos, especially in major cities.
Disrupt financial assets such as banking networks and the stock market	Without banking networks, consumers cannot obtain cash or make credit card purchases.
Cut off Internet access with DDoS attacks	Both civilian and military communications can be cut off during a massive DDoS attack.
Industrial espionage	Cyber break-ins at companies that develop military weaponry are especially dangerous.
Interfere with SCADA control devices	Malware that randomly targets SCADA devices can shut down power plants, dams, and manufacturing facilities.

ICT and National Security (3 of 4)

- The U.S. Department of Homeland Security identifies six national security functions supplied by the ICT sector:
  - Provide ICT products and services, such as servers, computers, and routers that are used in military and civilian installations
  - Provide incident management capabilities
  - Provide domain name resolution services
  - Provide identity management and trust support services
  - Provide Internet-based content, information, and communications services
  - Provide Internet routing, access and communications services

ICT and National Security (4 of 4)

- **Cyberwarfare** is the use of ICT technology to carry out politically motivated attacks designed to infiltrate, sabotage, or damage an opponent's information systems and defensive capabilities
- Recent examples of cyberwarfare include the Stuxnet virus that disabled Iranian nuclear centrifuges
- The international, non-binding document called the **Tallinn Manual** is a cyber equivalent of the Geneva Convention; it sets out rules for conducting and responding to cyberwarfare

Section B: The Computer Industry

- Manual Calculators
- Mechanical Calculators
- Computer Prototypes
- Commercial Computers
- Personal Computers

Section B: Objectives (1 of 2)

- Explain how algorithms apply to manual and mechanical calculators
- Name five mechanical calculators that were significant innovations leading to the first computer technology
- List five prototype computers and describe how their technology contributed to the technology used in modern-day computers
- List the key hardware and software developments during the first, second, third, and fourth computer generations
- Define von Neumann architecture

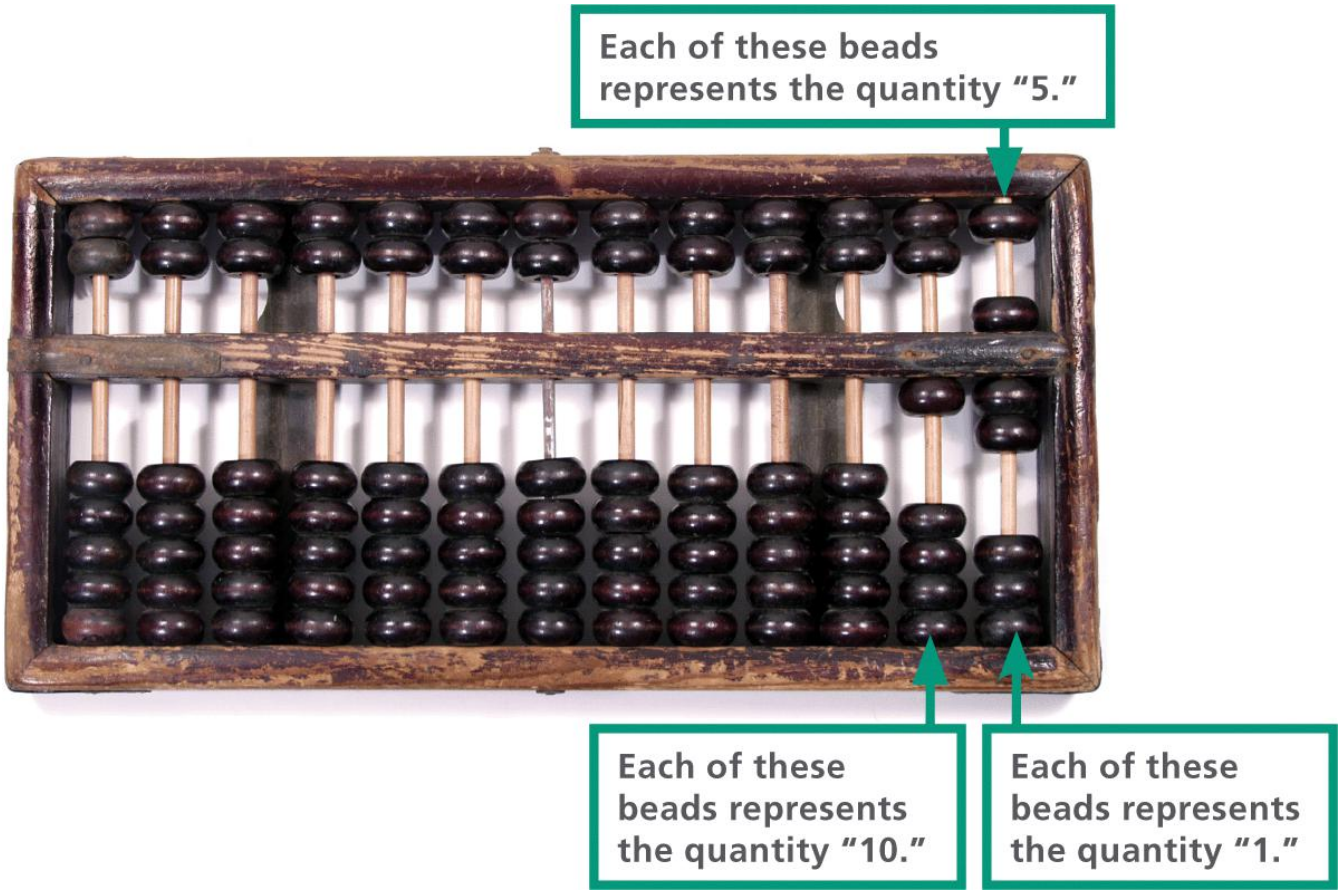
Section B: Objectives (2 of 2)

- Describe the hobbyist phase of the personal computer era
- List key hardware devices in the emerging personal computer era

Manual Calculators (1 of 2)

- A **manual calculator** is a device that assists in the process of numeric calculations but requires the human operator to keep track of the algorithm
- An algorithm is the step-by-step process by which numbers are manipulated; even simple paper-and-pencil addition requires an algorithm
- A manual calculator called an **abacus** was used in ancient Rome, Greece, India, China, and Japan; only as the last century came to a close was the abacus replaced by handheld digital calculators

Manual Calculators (2 of 2)



Mechanical Calculators (1 of 4)

- A mechanical calculator implements algorithms autonomously
- Mechanical calculators were developed as early as 1623
- **Schickard's Calculator** had a series of interlocking gears; each of the ten spokes on a gear represented a digit; every time a gear completed a full circle, it moved the next gear one notch to the left to "carry the 1"
- In 1642, a Frenchman named Blaise Pascal developed the **Pascaline**, a mechanical device that could be used to perform basic arithmetic

Mechanical Calculators (2 of 4)

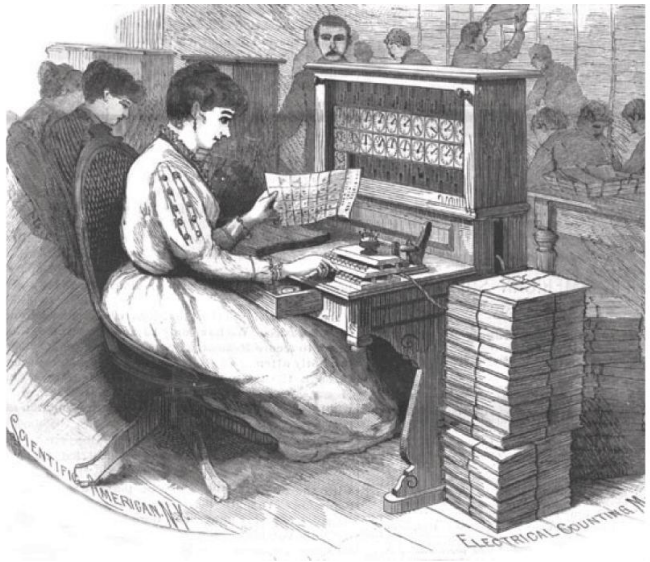
- Thomas de Colmar's **Arithmometer** became the first mass-produced mechanical calculator
- Charles Babbage's **Analytical Engine** was an all-purpose computing device; historians believe that its design embodies many of the concepts that define modern computers, including:
  - Memory
  - A programmable processor
  - An output device
  - User-definable input of programs and data

Mechanical Calculators (3 of 4)

- In 1890, Herman Hollerith won the U.S. Census Bureau's competition to find a way to tabulate the census
- Hollerith won the competition with a design for an electronic punched card tabulating device
- The device used cards with designated areas representing data fields, such as "nationality"; once punched, the cards were fed into a reader that used an array of metal rods to electronically read data from the cards, tabulate the results, and display them on a series of dials

Mechanical Calculators (4 of 4)

- Hollerith incorporated the Tabulating Machine Company in 1896; in 1924, the name was changed to International Business Machines—better known as IBM



Source: American Memory archives of the Library of Congress

Source:Computer History Museum

Computer Prototypes (1 of 4)

- Figuring out who invented the computer isn't easy because modern digital computers evolved from prototypes developed between 1936 and 1946 by various individuals and teams
- The **Atanasoff-Berry Computer** (ABC) was the first computing device to use vacuum tubes instead of mechanical switches as processing circuitry
- Its design also incorporated the idea of basing calculations on the binary number system
- Even though the ABC is often considered the first electronic digital computer, the work of its inventor was largely ignored

Computer Prototypes (2 of 4)

- Other computer prototypes followed:
  - **Z3** used vacuum tubes and was designed to work with binary numbers; built in Nazi Germany during World War II
  - **Harvard Mark I** officially named the IBM Automatic Sequence Controlled Calculator; used decimal rather than binary representation, which is used by today's computers
  - **Colossus** developed in 1943 by British engineers; an electronic device designed to decode intercepted messages that were sent from the Nazi High Command to field officers

Commercial Computers

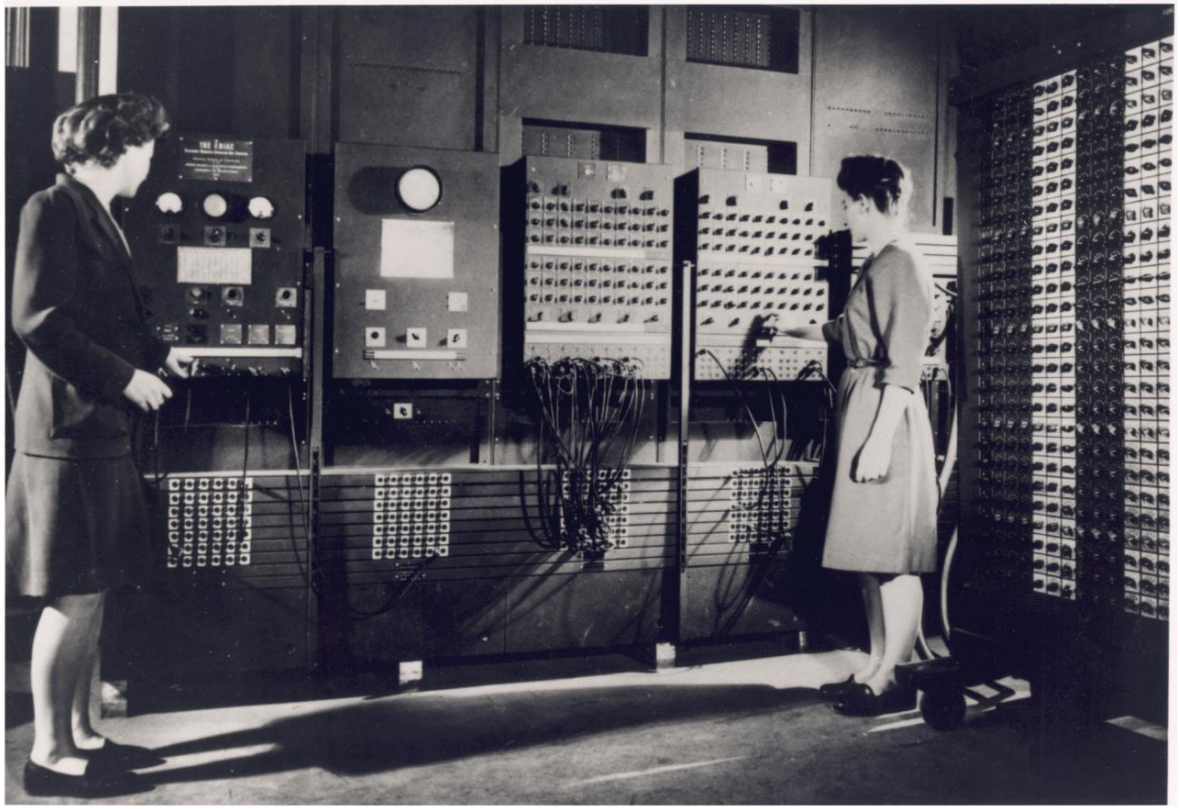
akg-images/Newscom

Computer Prototypes (3 of 4)

- **ENIAC** (Electronic Numerical Integrator and Computer) was designed for the U.S. Army during WWII, but wasn't finished until three months after the war ended
- ENIAC was over 100 feet long and 10 feet high and weighed 30 tons!
- Containing over 18,000 vacuum tubes and consuming over 174,000 watts of power, it was programmed by manually connecting cables and setting 6,000 switches—a process that usually took two days to complete
- ENIAC's memory held both programs and data. This feature became known as **von Neumann architecture** after the mathematician, John von Neumann

Computer Prototypes (4 of 4)

- ENIAC's first programmers were a team of six women



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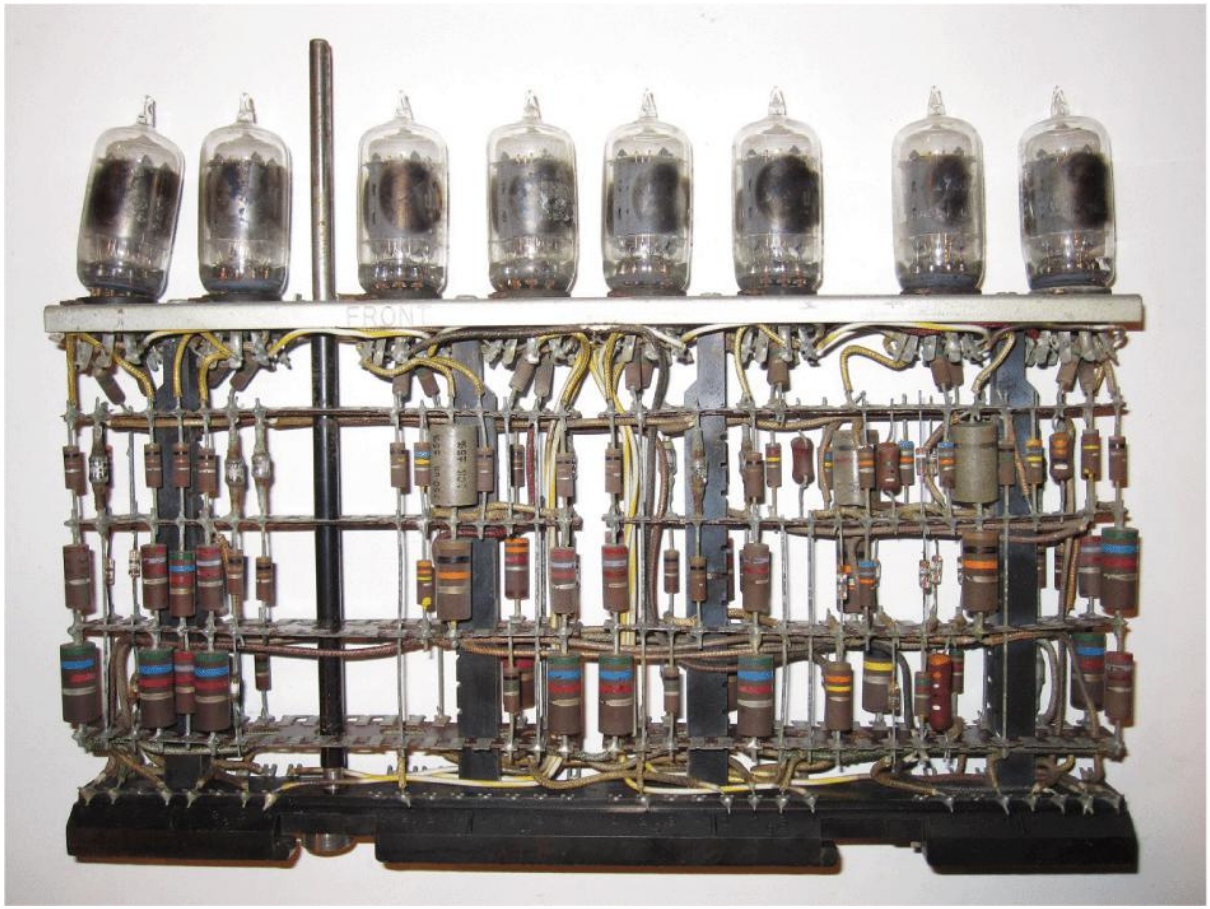
Commercial Computers (1 of 5)

- A computer called **UNIVAC** is considered by most historians to be the first commercially successful digital computer
- At 14.5 feet long, 7.5 feet high, and 9 feet wide, UNIVAC was physically smaller than ENIAC but more powerful
- As technology evolved, relay switches and vacuum tubes were replaced with smaller, less power-hungry components

Commercial Computers (2 of 5)

- **First-generation computers**, such as UNIVAC, can be characterized by their use of vacuum tubes to store individual bits of data
- A **vacuum tube** is an electronic device that controls the flow of electrons in a vacuum
- Each tube can be set to one of two states; one state is assigned a value of 0 and the other a value of 1

Commercial Computers (3 of 5)



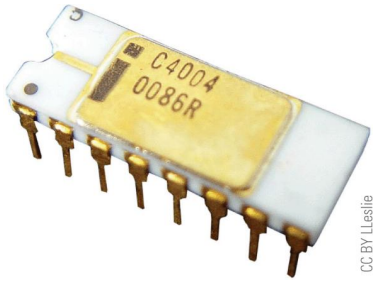
Courtesy of vintchip.com

Commercial Computers (4 of 5)

- **Second-generation computers** used transistors instead of vacuum tubes
- **Transistors** regulate current or voltage flow and act as a switch for electronic signals
- Transistors performed functions similar to vacuum tubes, but they were much smaller, cheaper, less power-hungry, and more reliable

Commercial Computers (5 of 5)

- **Third-generation computers** became possible in 1958, when integrated circuits were developed
- IBM 360 offered integrated circuit technology; the first orders for these computers were filled in 1965
- **Fourth-generation computers** appeared in 1971 with the development of the first general-purpose microprocessor called the Intel 4004
- Intel's 4004 was smaller than a cornflake but matched the computing power of ENIAC



Personal Computers (1 of 6)

- In the 1970s, many hobbyists built their own computer systems based on integrated circuit and microprocessor technologies
- The **Mark-8** and the **MITS Altair** were some of the first personal computers to be developed
- The Altair was sold as a kit for $395; it had no keyboard, no monitor, and no permanent storage device

Personal Computers (2 of 6)

- In 1976 Apple Computer Co. was founded by Steve Jobs and Steve Wozniak
- Apple released several computers during the 1970s and 1980s, including:
  - **Apple I** – a kit containing a system board with 4 KB of RAM that sold for $666.66
  - **Apple II** – featured color graphics, expansions slots, a disk drive, a 1.07 MHz 6502 processor, and 16 KB of RAM for $1,195

Personal Computers (3 of 6)

- **Apple Lisa** – introduced in 1983, it made computers even easier for the average person to use; its key feature was a graphical user interface; at $10,000 it proved too expensive for most consumers
- **Apple Macintosh** – featured a graphical user interface; it became the computer of choice for desktop publishing; cost was $2,495

Personal Computers (4 of 6)

The Apple II was the most popular computer of its time.

The Apple Macintosh computer popularized graphical user interfaces.

Personal Computers (5 of 6)

- In 1981, IBM began marketing what it called a personal computer or PC
- The $3,000 **IBM PC** had a 4.77 MHz Intel 8088 processor, 16 KB of RAM, and floppy disk drives
- The operating system used on these computers was called PC-DOS and was created by a young entrepreneur named Bill Gates

The IBM PC was launched in 1981 and evolved into today's popular Windows-based PCs.

Personal Computers (6 of 6)

- 1950-1980
  - Big computers for big business
- 1980-2010
  - Big computers for big business
    - Desktops and laptops for business and personal use
- 2010-Future
  - Big computers for big business
    - Desktops and laptops for business and personal use
      - Handheld devices for personal use

Section C: The Telecom Industry

- Telegraph
- Telephone
- Radio
- Cellular Phones
- Television

Section C: Objectives (1 of 2)

- List six technologies in the telecommunications sector in the order they were invented
- Sketch a timeline of key events in the evolution of the telegraph and show how they relate to the Gartner Hype Cycle
- Explain the concept of common carrier, and list the communications industries that are included in this classification
- Explain how the telephone industry evolved into a significant component of the Internet backbone

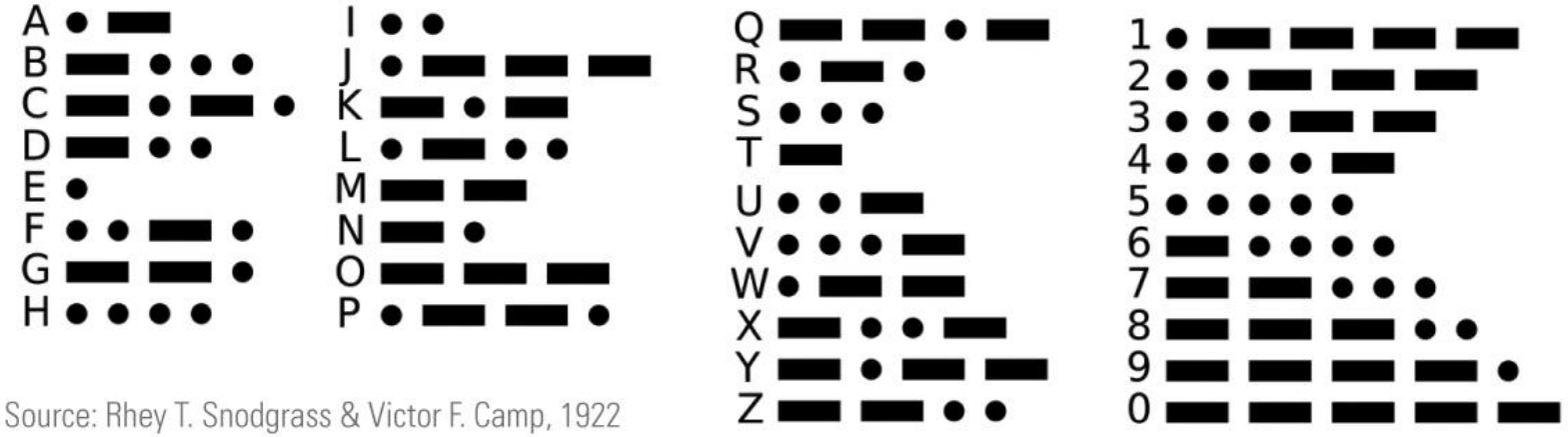
Section C: Objectives (2 of 2)

- Describe at least two contributions that the radio industry made to modern telecommunications
- List the major characteristics that differentiate 1G, 2G, 3G, and 4G cellular service
- Sketch a timeline of key events in the television industry and explain how they affect modern Internet access

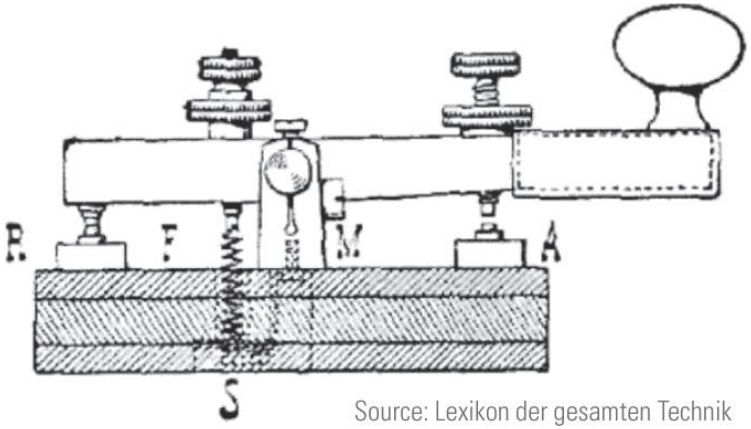
Telegraph (1 of 2)

- **Telegraphy** refers to transmitting text or symbolic information over long distances without the use of a living carrier
- The **telegraph** was built in 1816 using a cable connected at either end to dials marked with the letters of the alphabet
- In 1837, U.S. inventor Samuel Morse developed a telegraph system that transmitted data using his **Morse code** alphabet, a binary encoding system based on dots and dashes

Telegraph (2 of 2)



Source: Rhey T. Snodgrass & Victor F. Camp, 1922



Source: Lexikon der gesamten Technik

Telephone (1 of 3)

- A **telephone** is, very simply, a device that transmits human voices over a distance using cables or airborne signals
- The first telephone was invented and patented by Alexander Graham Bell in 1876
- Telephones evolved through several design form factors, including box phones and phones with rotary dialers

Telephone (2 of 3)

1890-1910

Early box phones had no dialing mechanism. Turning the crank alerted the operator, who would ask for the number.

1890-1930

Candlestick telephones separated the microphone/transmitter from the speaker/receiver.

1940-1970

Rotary telephones included a rotary dialer; the handset included both a speaker and a microphone.

1960-2010

Trimline telephones introduced touch-tone dialing in 1963.

Telephone (3 of 3)

- A **telephone exchange** managed connections between callers
- The world's first commercial telephone exchange opened in 1877, in Germany
- Its manual switch board was controlled by a switchboard operator
- Automated exchanges, developed in 1900, eliminated the need for human operators
- A **common carrier** is any person or company that transports goods, passengers, or electronic signals over regular routes at set rates

Radio

- A **radio** is a device that sends and receives sound as electromagnetic waves
- Like computers, radios originally used vacuum tubes but moved on to new technologies like the transistor
- Radio technology is the basis for cell phones, Wi-Fi, Bluetooth, and near-field communications (NFC)—all indispensible tools of the digital age

Cellular Phones (1 of 4)

- A **cellular telephone** is a device that uses a low-power radio transmitter to carry out two-way voice communications
- Two-way radio technology went portable during WWII
- In 1984 Motorola brought to market the first cell phone model named the Motorola DynaTAC 8000X; it weighed almost 2 pounds and was more than 12 inches long

Cellular Phones (2 of 4)

DynaTAC 8000X
1984

Flip Phone
1996

Smartphone
2007

Cellular Phones (3 of 4)

- 1G(1984)
  - Basic voice service
  - Analog-based protocols
    - 2.4 kbps
- 2G(1991)
  - Designed for voice
  - Improved coverage and capacity
  - First digital standards(GSM, CDMA)
    - 64kbps

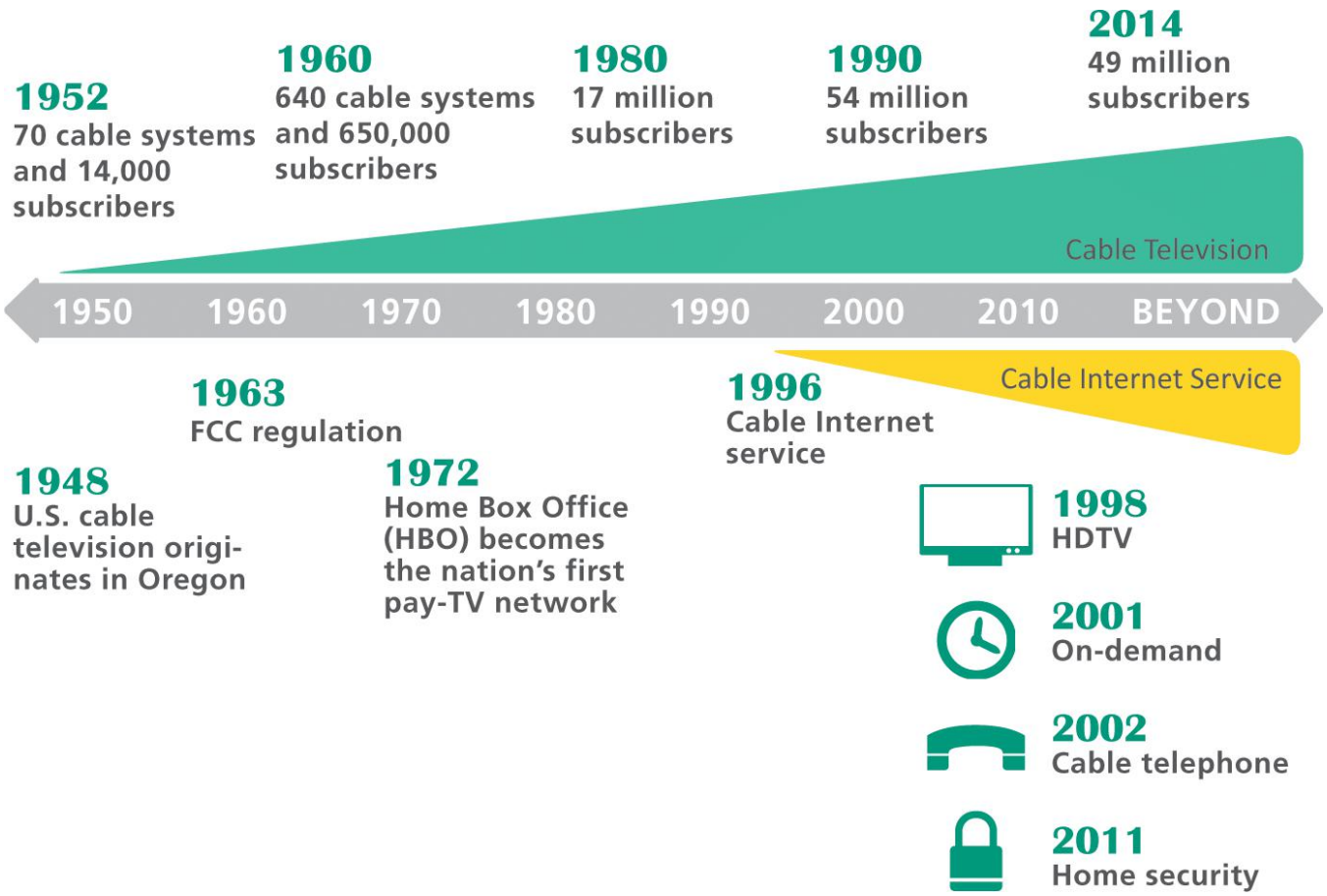
Cellular Phones (4 of 4)

- 3G(2001)
  - Designed for voice with some data (multimedia, text, Internet)
  - First mobile broadband
    - 2,000kbps
- 4G(2011)
  - Designed primarily for data
  - IP-based protocols(LTE)
  - True mobile broadband
    - 100,000kbps

Television (1 of 2)

- Television is a technology designed to send moving images over a distance
- Beginning with black-and-white sets, televisions progressed to colored programming and eventually transitioned to **digital television** (DTV)
- **Pay television** is a popular subscription service in which consumers pay to receive a selection of television channels

Television (2 of 2)



Section D: Tech Careers

- Jobs and Salaries
- Education
- Certification
- Resumes

Section D: Objectives (1 of 2)

- Differentiate between tech sector, STEM, and computer industry careers
- List at least seven occupations within a typical IT department
- Give an example of the titles used for various levels of career advancement in a tech job

Section D: Objectives (2 of 2)

- Explain how contract workers differ from employees
- List the five computing disciplines recognized by the ACM
- Explain the relative merits of a college degree compared to certification, internships, badges, open source projects, and nanodegrees
- List six resume formats, and describe when they are best used

Jobs and Salaries (1 of 12)

- Tech sector careers are part of a broad set of information, technology, and communications industries
- The classification **technology workers** encompasses jobs, such as:
  - Telephone cable installers
  - Radio broadcasters
  - Computer programmers
  - Web designers
  - Software developers

Jobs and Salaries (2 of 12)

- A different classification of tech sector careers comes from **STEM** (science, engineering, technology, and math)
- STEM is increasingly used to define an employment sector that includes jobs in:
  - Biology
  - Chemistry
  - Information Technology
  - Engineering
  - Math
  - Physics

Jobs and Salaries (3 of 12)

- A third classification of tech sector careers focuses on computer professionals
- A **computer professional** is anyone whose primary occupation involves the design, configuration analysis, development, modification, testing, or security of computer hardware or software
- Many computer professionals work in an IT department—the wing of a business or organization responsible for computer, data, software, and support services; a **chief information-officer** (CIO) heads the IT department

Jobs and Salaries (4 of 12)

- A **systems analyst** investigates the requirements of a business or an organization, its employees, and its customers in order to plan and implement new or improved computer services. This job requires the ability to identify problems and research technical solutions. Good communication skills are essential for interacting with managers and other employees.

Jobs and Salaries (5 of 12)

- A **computer programmer** (sometimes described as a programmer/analyst) designs, codes, and tests computer programs. In addition, programmers modify existing programs to meet new requirements or eliminate bugs. Computer programming requires concentration and a good memory for the countless details that pertain to a programming project. Programming projects range from entertainment and games to business and productivity applications. Programmers get satisfaction from devising efficient ways to make a computer perform specific jobs, tasks, and routines.

Jobs and Salaries (6 of 12)

- A **security specialist** analyzes a computer system's vulnerability to threats from viruses, worms, unauthorized access, and physical damage. Security specialists install and configure firewalls and antivirus software. They also work with management and employees to develop policies and procedures to protect computer equipment and data. Computer security jobs are punctuated by crises when a virus hits or a security breach is discovered. A security specialist must have a wide-ranging knowledge of computers and communication protocols that can be applied for a quick resolution to any crisis that occurs.

Jobs and Salaries (7 of 12)

- A **database administrator** analyzes a company's data to determine the most effective way to collect and store it. Database administrators create databases, data entry forms, and reports. They also define backup procedures, provide access to authorized users, and supervise the day-to-day use of databases.
- A **network administrator** plans, installs, and maintains one or more local area networks and may also manage cloud resources. These specialists provide net-work accounts and access rights to approved users.

Jobs and Salaries (8 of 12)

They troubleshoot connectivity problems and respond to requests from network users for new software. Network administrators might be responsible for maintaining the security of a network, plus they often pick up Web master duties to maintain an organization's Web site.

- A **computer operator** works with system software for network servers, mainframes, and supercomputers. Computer operators monitor computer performance, install software patches and upgrades, perform backups, and restore data as necessary.

Jobs and Salaries (9 of 12)

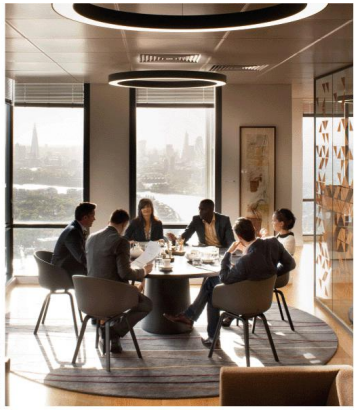
- A **technical support specialist** troubleshoots hardware and software problems. Good interpersonal skills and patience are required for this job.
- A **Web site developer** creates, tests, posts, and modifies Web pages. A good sense of design and artistic talent are required for this job, along with an understanding of how people use graphical user interfaces. Familiarity with Web tools, such as HTML and JavaScript, is becoming more important for this job, as is a knowledge of computer programming and database management.

Jobs and Salaries (10 of 12)

- A **social networking analyst** manages an organization's online reputation by establishing and maintaining social media sites and evaluating analytics to support its mission. This occupation requires familiarity with social networking sites and an ability to interpret statistical metrics obtained from analytical tools.

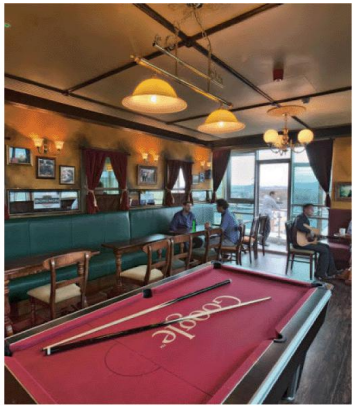
Jobs and Salaries (11 of 12)

- The U.S. Bureau of Labor and Statistics predicts that in the decade 2012–2022, employment in the information and technology sector could grow by 18%, generating 650,000 new jobs
- An unknown number of these jobs will be outsourced, which may negatively affect U.S. workers but will benefit offshore workers



Source: IBM

IBM London



Source: Google

Google Dublin

Jobs and Salaries (12 of 12)

- Workers in many industries are interested in becoming a **telecommuter** who uses available technology to work from home or an off-site location
- Telecommuters tend to be more productive and work longer hours because they have no commute time and are not interrupted by routine office chatter
- Finding a job in the IT industry is similar to finding a job in most other industries
  - Use online job listing sites (Tech Jobs, ComputerJobs.com)
  - Network (in person or via email)
  - Use social networking tools (LinkedIn)

Education (1 of 4)

- Computer science is only one of many computer-related degrees that colleges and universities offer
- According to the Association for Computing Machinery (ACM), there are five major computing disciplines:
  - Computer engineering
  - Computer science
  - Information systems
  - Information technology
  - Software engineering

Education (2 of 4)

DEGREE	CURRICULUM	CAREERS
Computer engineering focuses on the design of computer hardware and peripheral devices, often at the chip level.	This degree involves basic studies in calculus,chemistry, engineering, physics, computer organization, logic design, computer architecture, microprocessor design, and signalprocessing.	Working at a chip manufacturer, such as Intel, Motorola, IBM, AMD, or Texas Instruments.
	Students learn how to design new computercircuits, microchips, and other electroniccomponents, plus they learn how to designnew computer instruction sets and combineelectronic or optical components to providepowerful, cost-effective computing.	
Computer science focuses on computer architecture and how to program computers to make them work effectively and efficiently.	This degree involves courses in programming, algorithms, software development, computer architecture, data representation, logic design, calculus, discrete math, and physics.	Computer programmers, with good possibilities for advancement to software engineers, object-oriented/ GUI developers, and project managers in technical applications development.

Education (3 of 4)

DEGREE	CURRICULUM	CAREERS
	Students investigate the fundamental theories of how computers solve problems, and they learn how to write application programs, system software, computer languages, and device derivers.	Also, theorists, inventors, and researchers in fields as diverse as artificial intelligence, virtual reality, and computer games.
Information systems degree programs, typically offered by a university's college of business, focus on applying computers to business problems.	degree involves coursework in business, accounting, computer programming, communications, systems analysis, and human psychology.	Programming or technical support jobs, with good possibilities for advancement to systems analyst, project manager, database administrator, network manager, or other management positions.
	This degree is recommended for students who want to become computer professionals but lack strong math aptitude.	

Education (4 of 4)

DEGREE	CURRICULUM	CAREERS
Information technology degree programs focus on computer equipment and soft- ware used by businesses.	This degree involves hands-on coursework with hardware, networks, Web pages, multimedia,email systems, and security.	Network specialists and administrators, systems analysts, forensic technicians, and help desk technicians.
Software engineering takes a disciplined approach to developing software that is reliable,efficient, affordable, user-friendly, and scalable.	This degree involves studying statistics, software design, programming, systems analysis and courses from information systems and computer science curricula.	Programmers, analysts, or managers on large-scale, safety-critical applications.

Certification (1 of 4)

- Approximately 300 computer-related certification exams are offered in areas of specialty that range from desktop publishing to network installation
- Certification exams can be divided into several categories, including the following:
  - General computer knowledge
  - Software applications
  - Database administration
  - Networking and cloud
  - Computer hardware
  - Computer security

Certification (2 of 4)

- **AP Exam**
  - Students who pass the AP Computer Science exam in high school have a head start on their college-level courses and may increase their chances of acceptance into an elite computer science program.
- **Open Source Projects**
  - Participants in open source community projects get experience and make con-nections with other professionals that can be valuable resources during a job hunt. You can find projects at GitHub, SourceForge, OpenHatch, and Open Hub.

Certification (3 of 4)

- **Internships**
  - Internships are resume builders. Look for opportunities during summer break or for an after-school job. Working in the field before graduating adds relevant work experience to your list of qualifications.
- **Badges**
  - Badges are inspired by videogame awards and Boy Scout patches. Online education providers, such as Khan Academy and OpenStudy, offer badges to students who complete various milestones.

Certification (4 of 4)

- **Nanodegrees**
  - Nanodegrees are awarded upon completion of one or more targeted online courses. These offshoots of MOOCs (massive open online courses) offer self-study training to career-minded individuals who might not have the time or means to complete a traditional degree program.

Resumes (1 of 3)

- Job seekers need to produce resumes in a variety of formats, including the following:
  - Print
  - Email
  - HTML
  - LinkedIn
  - Online job service
  - Web portfolio (a hypertext version of your resume)

Resumes (2 of 3)

- Be clear and concise.
  - Eliminate unnecessary words, phrases, and sentences.
  - Be efficient with words when describing tasks, duties, titles, and accomplishments.
  - Be brief and to the point without selling yourself short.
- Place the most Important point first.
  - List your qualifications by importance and relevance to the job you seek.
  - Summarize skills at the top of the resume.
  - Use a bold font to emphasize skills and accomplishments that are required for the position you seek.

Resumes (3 of 3)

- Include pertinent information about training, certification, and professional affiliations, but avoid personal information, such as church affiliation and hobbies, that is not directly related to the job.

- Use language effectively.
  - Target terms and wording to prospective employers.
  - Use industry jargon wherever appropriate.
  - Use action verbs to maintain the reader's interest.
  - Use past and present tenses consistently.
  - Double-check grammar and spelling.
  - When posting information in a database, use nouns that describe your skills.

Section E: ICT Laws and Ethics

- ICT Laws
- ICT Ethics
- Ethical Decision Making
- Whistleblowing

Section E: Objectives (1 of 2)

- List at least five significant areas of information technology law
- Explain the purpose of the following: Computer Fraud and Abuse Act, Electronic Communication Privacy Act, Communications Decency Act, Digital Millennium Copyright Act, and USA PATRIOT Act
- Supply an example of an ethical dilemma that involves copyright
- Supply examples of ethical dilemmas that involve privacy and confidentiality

Section E: Objectives (2 of 2)

- Explain what technology professionals should consider before using resources at work for their personal projects
- Explain the context in which technology professionals have social responsibility
- List five resources for ethical decision making
- Provide at least three examples of whistleblowing related to information technology
- Explain the ethical dilemma faced by whistleblowers

ICT Laws (1 of 2)

- **Information technology** law is the legal framework that applies to the collection, storage, and distribution of digital information
- Some of the most significant areas of information technology law include the following:
  - Copyright and intellectual property
  - Domain names
  - Patents
  - Cybercrime
  - Software and computer contracts
  - Privacy
  - Communication

ICT Laws (2 of 2)

United States Copyright Act (1976) extends copyright protection beyond print media to "original works of authorship fixed in any tangible medium of expression, now known or later developed, from which they can be perceived, reproduced, or otherwise communicated, either directly or with the aid of a machine or device."

Fair Use Doctrine, a part of the U.S. Copyright Act, generally allows copying if it is for educational or personal use, if only a portion of the original work is copied, and if it does not have a substantial effect on the market for the original work.

Sony Corp. v. Universal City Studios (1984) sets a precedent that companies are not liable for user infringements, such as using VCRs to make unauthorized copies of videotapes, so long as the technology has valid, non-infringing uses, such as copying personal home videos. In recent cases, the defense for peer-to-peer file sharing networks was based on this decision.

Computer Fraud and Abuse Act (1986 amended in 1994, 1996, 2001, and USA PATRIOT Act) makes it a criminal offense to knowingly access a computer without authorization; transmit a program, information, a code, or a command that causes damage; or distribute passwords that would enable unauthorized access.

Electronic Communications Privacy Act (1986) extends telephone wiretap laws by restricting government agents and unauthorized third parties from tapping into data transmissions without a search warrant. The law does not apply to data, such as email, transmitted on employer-owned equipment.

Health Insurance Portability and Accountability Act (1996) requires health care providers to take reasonable procedural and technical safeguards to insure the confidentiality of individually identifiable health information.

Communications Decency Act (1996) protects ISPs from liability for defamatory statements made by customers. Prohibits material deemed offensive by local community standards from being transmitted to minors. The latter section was overturned in 2002.

Digital Millennium Copyright Act (1998) makes it illegal to circumvent copy-protection technologies, such as those used to prevent unauthorized copying of software CDs, music CDs, and movie DVDs. In addition, it is illegal to distribute any type of software-cracking technology that would be used by others to circumvent copy protection. Protects ISPs against copyright infringement by subscribers if the ISP takes prompt action to block the infringement as soon as it discovers illegal activity.

Children's Online Privacy Protection Act (1998) regulates the types of data that can be collected and posted online with regard to children under the age of 13.

Gramm-Leach-Bliley Act (1999) requires financial institutions to protect the confidentiality and security of customers' personal information.

Children's Internet Protection Act (2000) requires schools and libraries that receive federal funds to implement filtering software that protects adults and minors from obscenity and pornography.

USA PATRIOT Act (2001) enhances the authority of law enforcement agents to preempt potential terrorist acts by various means, such as monitoring electronic communications without first obtaining a search warrant in situations where there is imminent danger. Offers safe harbor to ISPs that voluntarily disclose potentially threatening activities of users. Increases maximum penalties for hackers.

Homeland Security Act (2002) establishes a Department of Homeland Security with an agency to monitor threats to the communications infrastructure, including the Internet, and exempts from the Privacy Act any information about infrastructure vulnerabilities to terrorism submitted by individuals or non-federal agencies.

Sarbanes-Oxley Act (2002) establishes financial reporting regulations to prevent corporate fraud. Requires full disclosure in accounting systems and protects corporate whistleblowers.

CAN-SPAM Act (2003) establishes national standards for sending commercial email by requiring senders to use a valid subject line, include the sender's legitimate physical address, and provide an opt-out mechanism.

Green v. America Online (2003) interprets sections of the Communications Decency Act to mean that ISPs are not responsible for malicious software transmitted over their services by hackers.

MGM v. Grokster (2005) refines the precedent set in the 1984 *Sony Corp. v. Universal City Studios* case. Companies that actively encourage infringement, as seemed to be true of peer-to-peer file sharing networks such as Grokster, can be held accountable for user infringement.

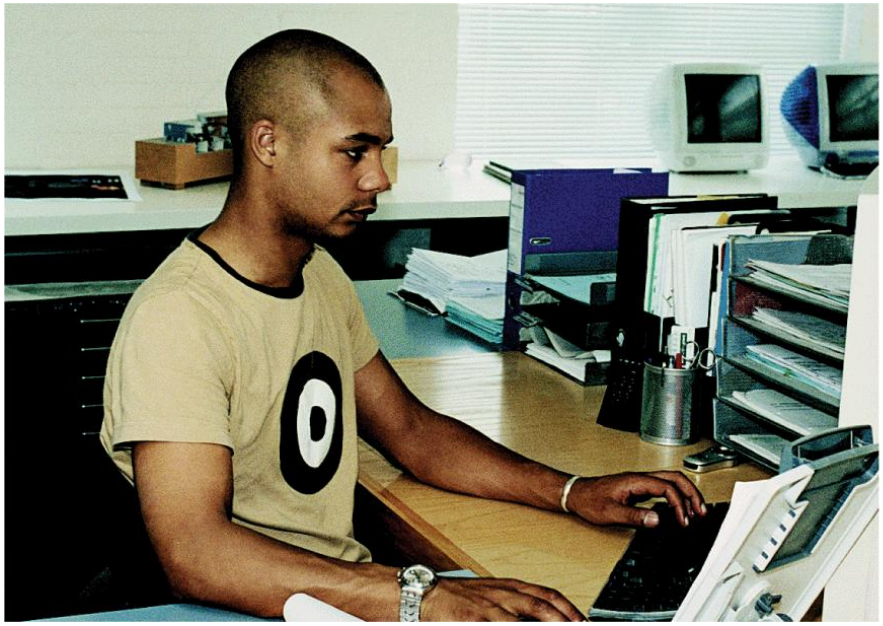
Authors Guild v. HathiTrust (2014) allows Google and local libraries to copy and store millions of copyrighted works and display their contents in the context of search engine results.

ICT Ethics (1 of 2)

- The term **professional ethics** refers to on-the-job choices and actions that reflect a person's values
- **Confidentiality** is the obligation not to disclose willingly any information that should be kept private
- **Proprietary information** includes knowledge about company finances, procedures, products, and research that competitors would find valuable
- A **non-compete clause** is designed to prevent employees from divulging proprietary information to competitors

ICT Ethics (2 of 2)

- It's never a good idea to use facilities at work for personal activities unless you have a specific agreement with your employer and your activities do not breach your employment contract



David Ellis/Getty Images

Ethical Decision Making (1 of 3)

- Ethical decisions that you make on the job can have long-term consequences for your career and lifestyle, so it is important to approach these decisions seriously
- **Use the following strategies when making decisions at work:**
  - Talk to people whose judgment you respect
  - Consider what the most ethical person you know would decide to do
  - Think about what you would do if your actions were made public
  - Look at the problem from the opposite perspective
  - Consult a code of professional ethics

Ethical Decision Making (2 of 3)

- A code of ethics is a set of guidelines designed to help professionals thread their way through a sometimes tangled web of ethical on-the-job decisions
- Some codes of ethics are short and concise, whereas others are long and detailed
- Most codes contain principles similar to those from the Computer Ethics Institute (CEI)
- Do not use a computer to harm other people
- Do not interfere with other people's computer work
- Do not snoop around in other people's files

Ethical Decision Making (3 of 3)

- Do not use a computer to steal
- Do not use a computer to bear false witness
- Do not use or copy software for which you have not paid
- Do not use other people's computer resources without authorization
- Do not appropriate other people's intellectual output.
- Think about the social consequences of the programs you write
- Use a computer in ways that show consideration and respect

Whistleblowing (1 of 3)

- A widely accepted definition of **whistleblowing** is the disclosure by an employee (or professional) of confidential information that relates to some danger, fraud, or other illegal or unethical conduct connected with the workplace
- A whistleblower is someone in an organization who decides to speak out against on-the-job activities that are contrary to the mission of the organization or threaten the public interest

Whistleblowing (2 of 3)

- Employee advocates have the following suggestions for reducing the risk of career repercussions that are often experienced by whistleblowers:
  - Examine your motives
  - Try the normal chain of command
  - Collect evidence to back up your accusations
  - Record events as they unfold
  - Act ethically

Whistleblowing (3 of 3)

- Be ready to accept repercussions
- Establish a support network
- Consult a lawyer
- Consider your strategy