Lecture notes: Essential Computer concepts

What is a computer?

- An electronic device that accepts data (input), manipulates (processes) that data to produce information (output) and store it for future use (storage). It operates under the control of a set of instructions (programs or software).
- A “computer system” is a combination of hardware and software.
  - Hardware – the physical components which include the system unit which houses many of the circuitry and peripheral devices that perform input, output, and storage functions.
  - Software – a set of instructions that directs the activity of the hardware.

What do computers look like?

- It might not always be so easy to identify a “gadget” as a computer, but if it performs the 4 basic functions (processing, input, output, and storage), it can be classified as a “computer”. There are 4 basic types of computers: Personal, Hand-held, Mainframe, and Supercomputers.
- Personal Computers
  - Typically single-user devices used at home or work to accomplish general computing tasks like typing papers, preparing reports or presentations, or modifying budgets.
  - Types of personal computers
    - Desktop – designed to sit on a desk usually with a full size keyboard and monitor
    - Notebook or laptop – small, lightweight, portable computers.
    - Tablet – notebook computers with touch screen capabilities allowing users to write “notes” directly on the screen with a stylus.
    - Subnotebook – smaller version of a notebook that usually has some limitations such as smaller screen, keyboard or limited storage.
    - Slate – thin computer with no external mouse or keyboard. Touch screen capability.
  - Note that many game consoles perform the same functions as personal computers.
- Hand-held Computers
  - Small computers that fit in the palm of the hand. Usually have more limited capabilities than a personal computer.
  - Types of hand-held computers
    - Smartphones, MP3 players, some e-readers
• Mainframe Computers
  o Typically used in medium to large businesses or government agencies (Examples: banks, schools, airline companies).
  o Provide centralized storage and processing for large amounts of data and can accommodate many users.

• Supercomputers – the largest and fastest of computers and continue to evolve.
  o Used by very large businesses and government agencies to process tremendous amounts of data.
  o A supercomputer might be used in research to perform simulations or make predictions.

What are the essential computer components?

• Processing
  o Modifying data to produce information.
  o Performed by electronic components on the motherboard (main circuit board which connects many of the electronic components of a computer).
  o The Central Processing Unit (CPU) is the main component responsible for executing instructions from software (also called programs) to manipulate data into information. This manipulation includes sending information to output devices or getting data from input devices.
  o Everything you do on a computer requires some processing. This means for everything you do, there is a set of instructions (program) that directs the hardware and processing components on how to respond.

• Peripheral devices – hardware components that provide various input, output, communication, and storage functions. Functionality for many peripheral devices is provided by expansion cards (modem, network, video, audio) which plug into the motherboard.

• Input devices – allow the user to insert data or issue commands by converting the input into electrical signals that the computer can understand.
  o Examples: Keyboard, mouse, microphone, scanner

• Output devices – present the information resulting from processing (monitor, printer, speakers).
  o Examples: Monitor, printer, speakers

• Storage – temporary and permanent storage of data and programs.

How is data stored on a computer?

• Electronic components in the computer transmit patterns of electric signals. There are only two electric signals: on and off. An “off” signal is represented by a zero (0) and an “on” signal is represented by a one (1). So patterns of zeroes and ones (binary digits)
are combined in such a way that the computer can interpret, manipulate, process, and transmit. For example, the pattern 01000001 might represent the letter ‘A’ whereas the pattern 01100001 might represent ‘a’.

- Data can be stored temporarily or permanently. In either case, the data is translated into a form that can represent patterns of 0s and 1s.
- Temporary storage (RAM, memory, or primary storage), is used to store data and instructions that are currently in use. RAM is erased when the power is turned off. That’s why it is important to often save your work to a more permanent storage device.
- Permanent storage (hard drive, USB drive, network drives, CDs, DVDs, etc…) is used to store data and instructions when they are not in use. Data stored on these devices are retained even after the power is turned off. Several devices (called removable storage devices) can be moved from one location to another.
- Files: Data and programs stored on permanent storage devices are stored in files. A file is a named collection of data such as a document, or photo.
- File management refers to the organization of files - much like you would organize your school notes and handouts into a notebook or several notebooks.

**Why so many different storage choices?**

- Different storage devices provide different benefits and drawbacks.
- Temporary storage (memory or RAM) is fast so processing can occur quickly. But RAM is erased when the computer is turned off.
- Permanent storage provides a place to keep your files while you are not working on them allowing you to access them over and over again. Most permanent storage is slower than temporary storage which is why files are loaded into memory while in use.
- The hard drive of a computer is the most common permanent storage device. It’s where most programs are installed. It’s faster than many removable devices, but moving a hard drive from one location to another is not practical.
- Removable devices provide portability by allowing you to move files from one computer to another. USB drives are a popular removable storage device.

**What is a byte?**

- A byte is series of eight bits (binary digits) that can be used to represent data such as a letter, number, or color.
- The term ‘byte’ is used to describe the size of files or capacity of storage or memory.
  - Kilobyte (MB) – approximately 1,000 bytes and is usually used to describe the size of some files.
  - Megabyte (MB) – approximately one million bytes and is usually used to describe the size of some files.
- Gigabyte (GB) – approximately one billion bytes and is usually used to describe the capacity of hard drives, USB drives, and memory.
- Terabyte (TB) – approximately one trillion bytes and is usually used to describe the capacity of hard drives.

**What is software?**

- Software programs contains instructions that:
  - tell the computer hardware how to respond to input, produce output, process data, and store data.
  - tell the processor how to manipulate data. For example the instructions might do mathematical operations, change colors in a picture, play audio or video, or format a document.
- Two basic categories: System software and Application software

**What is system software?**

- Consists of many programs that tell the computer how to carry out basic functions such as getting input from a keyboard, sending output to a printer, or loading data and instructions into memory.
- Categories of system software
  - Operating Systems: manages the computer’s resources
    - Loads data and instructions into memory
    - Saves files to permanent storage devices
    - Coordinates use of resources to reduce conflicts
    - Many more functions
    - Provides a user interface (how users interact with the computer)
      - Graphical user interface (GUI): uses images and mouse cursor to point and click one items to enter data or issue commands.
  - Device drivers: A set of programs that work in conjunction with the operating system to handle communication between the computer and its peripherals. For example, when you add a printer to a computer, a device driver is installed on the computer to facilitate how the operating system communicates with that printer.
  - Utilities: A special type of system software programs that perform specific tasks to reduce burden on the operating system. Examples include programs that backup the hard drive, allow you to modify computer settings, or test for errors. The Windows Control Panel provides access to many Windows Utilities.
  - Programming Language: used to write computer instructions or programs that tell the computer how to accomplish a task.
Which operating system (OS) should I use?

- The OS you use depends on the type of computer you use.
- There are three main operating systems that run on most personal computers: Windows, MAC OS, and Linux.
  - Windows can be used on a majority PCs
  - MAC OS is used on Apple computers
  - Linux is available as a free download and can be used on almost all types of personal computers. Linux is also programmatically customizable meaning advanced users can modify the operating system to add capabilities or efficiency to their operating system.
- When you purchase a new computer, it typically comes with the OS already installed.
- Hand held computers / cell phones usually use a mobile version of an existing OS or an OS designed specifically for the device.

What is Application Software?

- Application software allows you (the user) to complete specific tasks like typing a report, keeping track of inventory, or planning a budget.
- Example: “There’s an App for That”.1 “App” in this case is short for “Application”. And if you own a smart phone, you probably know that you can get an “App” to do almost anything. Each application is a program designed to accomplish a specific task. “Apps” on your personal computer might include a word processor, database program, spreadsheet program, or presentation software.

What is Data Communication?

- Transmission of data from one computer to another or a peripheral device.
- Examples
  - Within a computer, data and instructions are sent and received to the various components (RAM, CPU, disk drives, etc...) via pathways called the data bus on the motherboard.
  - External devices are connected to the internal data bus via ports and cables.
  - Cables plug into ports (usually in the back of the computer).
  - Ports are connected to expansion cards (or controller cards).
  - The controller cards plug into expansion slots on the motherboard.
  - See figure A-16 on page Concepts 17 for different types of ports available on most computers.

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1 Apple catchphrase used to market the iPhone in 2009
What are Networks?

- Connects computers and computing devices together so that data and resources can be shared.
- Requires special hardware and software
  - Network interface card (NIC) – plugs into the motherboard, providing a port for cable connections. Or in the case of a laptop, the card could be wireless or built into the motherboard.
  - Network software – software that provides a standard set of rules (protocol) for communications across the network. This software is included in many operating systems like Windows or Macintosh.

When would I Use a Network?

- Home: Share printer, share files, share Internet access, play games.
- Work: Share printers and other hardware, access special software
- School: Access printers, special files and programs, Internet

How do I access on a network?

- A username and password are usually required to login to your network account.
- Your account “permissions” or settings determine your access to files, printers, programs or other devices.
- Example: At school, when you login your network account, you have access to printers in the classroom or lab and network storage drives. If you login to your work or home network, you will have different devices and storage drives.

What are the Different Types of Networks?

- LAN (local area network)
  - All components of the network are located in the same general location (usually the same building).
  - Data and programs stored on a LAN are usually only available when “logged onto” the network. Sometimes this requires being “on location” sometimes your network account can be configured for off-site access.
- WAN (wide area network)
  - More than one LAN connected together, or a network that is spread over a large area (like a city or county).
  - The Internet is an example of a WAN.
  - Like a LAN, you typically login to a WAN and access to data and programs are determined by your account configuration.
• PAN (personal area network)
  o Usually wireless
  o Allows devices to communicate within a short distance (Bluetooth, infrared).

• Wireless – network connections are accomplished using radio waves instead of wires.

What Do I Need to Know About Computer Security?

• Refers to steps users take to protect computer hardware, data, and programs.

• Malware is a broad term that describes any program that is intended to cause harm or convey information to others without the owner’s permission.
  o Viruses, worms, trojans – programs transferred to a computer designed to cause damage
  o Spyware tracks a computer user’s Internet usage and sends this data back to the company or person that created it without the computer user’s permission or knowledge.
  o Rogue software – fake security software that can expose your computer to malware or just take your money.

• Malware may be transferred by e-mail, files, installation of software, or just surfing the web.

• Antivirus software searches executable (program) files for the sequences of characters that may cause harm and disinfects the files by erasing or disabling those commands.

• Anti-spyware software detects and removes spyware.

• A firewall prevents other computers on the Internet from accessing a computer and prevents programs on a computer from accessing the Internet without the computer user’s permission. A firewall can be either hardware or software solution.

• Phishing and Spoofing
  o Spoofing – creating a “spoofed” site which is a site that looks like a legitimate business web site and designed to get users to enter personal information, like credit card numbers and passwords, so thieves can steal this information.
  o Phishing – soliciting (usually through e-mail) people to visit a spoofed web site with the intent of stealing personal information.

How do I Guard against Phishing and Spoofing?

• Most legitimate businesses will not send you an e-mail asking for personal information.

• Some e-mail providers or programs may have settings to block some phishing e-mails (but not all).

• If the e-mail seems strange, it probably is not legitimate. If you are not sure, look up the company phone number (don’t use one from the e-mail) and give them a call.

• Look for spelling and grammar errors.

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• Point (DON’T CLICK) to the link contained in the e-mail. The URL of the link will be displayed in the status bar. In many cases the URL will be very different than the actual business URL.

Other resources

• [www.howstuffworks.com](http://www.howstuffworks.com)
  Many great articles on computer hardware and software

• [www.microsoft.com](http://www.microsoft.com)
  Lots of help and how-to articles, videos, and training exercises for Windows and Office

• [www.microsoft.com/protect/videos/default.mspx](http://www.microsoft.com/protect/videos/default.mspx)
  Several short videos on protecting your computer

• [www.google.com](http://www.google.com) (or any search engine)
  Type in search words to find exactly what you are looking for.