

## BTM 200

### CHAPTER 2: LOOKING AT COMPUTERS: UNDERSTANDING THE PARTS

#### Understanding Digital Components:

- **COMPUTER:** Data Processing Devices. (ex: giving your infos to university and then comp. prints them on ID card in organized way)
- Computers have 4 major functions:
- **INPUT:** gathers data + allow users to enter data.
- **PROCESS:** manipulates, calculates, organizes data into info.
- **OUTPUT:** displays data + info. in a suitable form for users.
- **STORAGE:** saves data + info. for later use.
- Diff. between data vs info.:
- **DATA:** representation of fact, figure, idea. Can be a number, word, picture, sound. (ex: names, phone numbers, etc.)
- **INFORMATION:** data organized or presented in meaningful fashion. (ex: names associated with phone numbers in a contact listing.)

INPUT DATA ----->PROCESSING DATA INTO INFO. ----->OUTPUT INFORMATION

#### Bits and Bytes: The Language of Computers:

- Computers only work w/ numbers (not words).
- **BINARY LANGUAGE:** only two digits: 0 & 1 = called binary digit or bit. Put together = Bytes. 0= no electric current/ 1= electric current.
- **BYTES:** combination of bits. Can be small or quite large. Always 8 bits series.
- Bits & Bytes are used to to represent the quantity of data and info. that a computer inputs and outputs.
- Bytes are stored in hardware and software.
- **HARDWARE:** any part of computer you can physically touch.
- **SOFTWARE:** set of computer programs making hardware perform various tasks. There are 2 types: Application Software & System Software.
- **APPLICATION SOFTWARE:** set of programs used on a computer helping to carry out tasks. (ex: type a document, create a spreadsheet, edit digital photos, etc.)
- The most common type of System Software is **OPERATING SYSTEM (OS)**, the program controlling how your computer system functions + managing the hardware (monitor, printer, etc.)

#### Distributed Computing: Putting Your Computer to Work While You Sleep:

- **DISTRIBUTED or GRID COMPUTING:** creation of software facilitating the work of devices, tablets, smartphones, together. Efficiently creates cheap supercomputer for

research. You can register your computer into system to help astronomers research = big data downloaded super fast.

### Types of Computers:

- 2 basic designs of computers: portable or stationary.
- Portable Computers Types:
- **TABLET COMPUTER:** flat multitouch-sensitive screen + on-screen keyboard or can connect to separate keyboards.
- **LABTOP or NOTEBOOK COMPUTER:** portable computer w/ all devices integrated in single compact case.
- **ULTRABOOK:** lightweight laptop computer made to compete with MacBook Air. Low-power processors, solid-state drives, extended battery life without sacrificing perfo.
- **2-IN-1 PC:** similar to laptop, but monitor swivels + folds flat, can be used as both laptop or tablet computer.
- **CHROMEBOOK:** uses Google Chrome OS made to be connected to Internet all the time. Docs and Apps are made to be stored primarily in Cloud.
- **DESKTOP COMPUTER:** stationary computer. most of them made of separate case/tower, the **SYSTEM UNIT**, containing main components + devices. a **PERIPHERAL DEVICE** is a component, such as monitor/keyboards, connected to computer. a **ALL-IN-ONE COMPUTER**, like Apple iMac, sometimes also incorporate touchscreen technology.

BYTE (B)	KILOBYT E (KB)	MEGABYT E (MB)	GIGABY TE (GB)	TERABY TE (TB)	PETABY TE (PB)	EXABYT E (EB)	ZETTABY TE (ZB)
1	1000	1 million	1 billion	1 trillion	1 million GB	1 billion GB	1 trillion GB

- Other types of computers:
- **MAINFRAME:** large expensive computer supporting many users simultaneously. Often used in businesses w/ large data amounts (ex: insurances cies). It executes many programs at the same time.
- **SUPERCOMPUTER:** specially designed computer that can perform complex calculations rily fast, used when complex models require intensive math calculations (ex: weather, atomic energy, etc.), made to run few programs as quickly as possible.
- **EMBEDDED COMPUTER:** special computer chip residing in other device (ex: car, thermostat, drones, etc.), self-contained computer devices w/ own programming + not receiving input or interacting w/ other systems.
- **SMARTPHONES:** offer many features for day-to-day life, apps, web, camera, media players, etc. has a CPU, memory & storage like a computer.

- each part of your computer has a special function.

INPUT----->PROCESSING----->STORAGE/OUTPUT

- **INPUT DEVICE:** lets you enter data + instructions into computer.

### Keyboards and Touch Screens:

- **KEYBOARD:** input device used to enter typed data + commands, but now often touch also.
- **TOUCH SCREENS:** display screens responding to commands initiated by touching them with your fingers or **STYLUS**, input device looking like a pen. uses virtual keyboards.
- **QWERTY KEYBOARD:** keyboard layout now considered inefficient because it slows typing speed. (everyone using it = hard to change. Dvorak keyboard not popular by example...)
- Physical keyboards are wired or wireless.
- Wireless technology uses **RADIO FREQUENCY (RF)**, a radio transmitter sending signals by device or bluetooth.
- **BLUETOOTH TECHNOLOGY:** connects with peripheral devices.
- Other types of keyboards = Flexible Keyboard (rollable) & Virtual Keyboard (matchbox size).
- Useful keys of a regular physical keyboard:
- **FUNCTION KEYS (F KEYS):** shortcut keys to perform special tasks in software programs.
- Multimedia Control
- **TOGGLE KEYS:** keys whose function changes between 2 options (ex: caps lock key).
- Internet Controls
- **NUMERIC KEYPAD:** lets your enter numbers quickly.
- Cursor Control Keys
- **ALT KEY:** works with other keys to execute shortcuts + special tasks.
- **WINDOWS KEY:** used alone, launches start menu, used w/ other keys, performs shortcuts.
- **CONTROL (CTRL) KEY:** used w/ other keys to perform shortcuts.
- Knowing how to use shortcuts + special keys will make you more efficient at typing.

### Mice and Other Pointing Devices:

- **MOUSE:** device used to enter user responses and commands. Most ppl are familiar w/ the **OPTICAL MOUSE**, using internal sensor/laser detecting movements. Sensors send signals to computer.
- Wireless mice usually connects w/ bluetooth or receiver plugged into usb port.
- **TOUCH MOUSE:** mouse w/ touch surface only.
- **TOUCH PAD/ TRACK PAD:** included device at the bottom of keyboard.

- Games controllers are also a type of input devices.

### Images and Sounds Input:

- Digital input devices transmit data to computer or internet when connected together.
- **SCANNERS:** also inputs images, similar to photocopy machine but transform into digital.
- **NEAR FIELD COMMUNICATION (NFC):** connects devices by proximity of each other (ex: credit card payment with smartphones.)
- Touch-screen technology initially developed in 1971. For ATMs and fast-food order displays.
- Touch techno. on monitors and displays only became popular with iPods in 2007.
- Touch is transformed into a command by 3 different systems on a responsive glass panel, controller, and software driver combined with a display and computer processor:
- **RESISTIVE SYSTEM:** maps exact location of pressure point.
- **CAPACITIVE SYSTEM:** uses change in electrical charge on panel to generate a location.
- **SURFACE ACOUSTIC WAVE SYSTEM:** uses two transducers placed on x and y axes of monitor, reflectors reflect electric signal, display's software translates touch to operating system.
- Touch surfaces work with fingers or specific tools, objects usually aren't very responsive. Basically, touch technology works with coordinates to locate into space.
- Devices such as a **WEBCAM** capture videos + can transmit them live (with apps like skype, oovoo, etc.) video sound input is also recorded and transmitted through a **MICROPHONE (MIC)**, capturing sound waves and formatting them in digital form.
- Speakers are output devices providing surround sound system + can be wireless.
- Headphones + Earbuds keep from distracting ppl around.
- It is also possible to give commands with voice, sounds, etc.
- **INTELLIGENT PERSONAL ASSISTANT:** software using voice recognition software agents to give commands (ex: Siri).
- Microphones Types:
  - **CLOSE TALK:** headset, hands free.
  - **OMNIDIRECTIONAL:** picks up sounds from all directions.
  - **UNIDIRECTIONAL:** picks up sounds from one direction.
  - **CLIP-ON (LAVALIER):** clips to clothing, wireless.

### Monitors:

- **MONITOR:** is a **DISPLAY SCREEN**, displaying texts, graphics, and videos as soft copies.
- Different Types of Monitors:
  - **LIQUID CRYSTAL DISPLAY (LCD):** also called Flat-Panel Monitor, is light, energy efficient.
  - **LIGHT-EMITTING DIODE (LED):** energy efficient + color accuracy, thinner than lcd.

- **LEGACY TECHNOLOGY:** no longer popular technology like Cathode Ray Tube (CRT) monitors. Still functional but outmoded
- **ORGANIC LIGHT-EMITTING DIODE DISPLAYS (OLED):** use organic compounds producing light when exposed to electric current + no need for backlight. Very thin display + little power required + environmentally friendly + brighter (used in smartphones, iPods, digital cameras).
- Cies like LG working on transparent + flexible screens using OLED who would have **AUGMENTATIVE REALITY (AR)**, view of real-world envir. w/ elements augmented by sensory input.
- **PIXELS:** millions of tiny dots illuminated by light waves by fluorescent panel at back of screen. 4K (Ultra HD) resolution means subpixels.
- LCD Monitors work w/ pixels + two or more material sheets filled w/ liquid crystal solution (fluorescent panel). Light shining through creates images.
- 6 Different Aspects to Consider When Shopping for Monitor:
- **ASPECT RATIO:** width-to-height proportion of monitor.
- **SCREEN RESOLUTION:** clearness/ sharpness of image, nb of pixels on screen.
- **CONTRAST RATIO:** diff. in light intensity between brightest white and darkest black of monitor.
- **VIEWING ANGLE:** distance in degrees from side to side before image degrades
- **BRIGHTNESS:** pure white amount of light (measured in nits or cd/m<sup>2</sup>).
- **RESPONSE TIME:** time of pixel to change color.
- HDMI Cables enhance HDTV viewing (Full-Size, Mini or Micro).
- **PROJECTOR:** used to show output to large amount of ppl.

#### Printers:

- **PRINTER:** produces physical hard copies of input.
- 2 Types of Printers:
- **NONIMPACT PRINTER:** inkjet or laser, marking paper without touching it.
- **IMPACT PRINTER:** has tiny hammer-like keys striking paper w/ inked ribbon (legacy technology).
- **CMYK:** inkjet's four-color printing process (cyan, magenta, yellow, key (black)), using subtractive color model.
- **LASER PRINTER:** uses laser beams + static electricity to tone paper.
- Printers use Wi-Fi or bluetooth to connect w/ devices (ex: Apple has iOS AirPrint feature) (Non-Apple = Presto or Thin-Print)
- Specialty Printers:
- **ALL-IN-ONE PRINTER:** built for space-saving convenience w/ printer, scanner, copier + fax included.
- **LARGE FORMAT PRINTER:** generates any oversized infographic images, using various types of ink. Also called a **PLOTTER**.

- **THERMAL PRINTER:** works by melting wax-based ink on paper, **THERMAL WAX TRANSFER PRINTING**, or burning dots on coated paper, **DIRECT THERMAL PRINTING**.
- What to Consider When Choosing Printer:
- **SPEED:** PPM per min.
- **RESOLUTION:** DPI per inch.
- **COLOR OUTPUT:** nb of cartridges.
- **COST OF CONSUMABLES:** cost of paper, ink, etc.
- Weight + whiteness + opacity + texture of paper impact resulting quality.
- **3-D PRINTING:** used in architecture, engineering, health, arts, etc.

### Processing, Storage and Connectivity: The Motherboard and Memory:

- **MOTHERBOARD:** main circuit board containing central electronic components of computer, like CPU, memory (RAM) modules, and many circuit boards + **EXPANSION (ADAPTER) CARDS**, circuit boards providing additional functionalities. Also, ports + slots for cards.
- **SOUND CARD:** connections for speakers and microphone.
- **VIDEO CARD:** connection for monitor.
- **NETWORK INTERFACE CARD (NIC):** enables computer to connect with others or cable modem for high-speed Internet. Can also include USB + Thunderbolt ports.
- **RANDOM ACCESS MEMORY (RAM):** where data + programs are stored in computer = bunch of small cards plugged in slots called **MEMORY CARDS** or **MEMORY MODULES**. RAM is temporary storage, called **VOLATILE STORAGE**, erasing when computer gets turned off.
- **READ-ONLY MEMORY (ROM):** permanent storage, called **NONVOLATILE STORAGE**, containing infos. about start up of computer, etc.
- **CACHE MEMORY:** auxiliary memory from which high-speed retrieval is possible.

### Processing:

- **CENTRAL PROCESSING UNIT (CPU or PROCESSOR):** “brains” of computer controlling all functions performed by computer’s other components + processing all commands issued by software + can perform many tasks simultaneously (billions of tasks per second).
- CPU is measured in Hertz (Hz) calculating machine cycles per second (Gigahertz (GHz) or Megahertz (MHz)).
- **MACHINE CYCLE:** processing of CPU getting data or instructions from RAM.
- Nb of cores, processing paths, also defines the performance of CPU (ex: Single, Dual, Quad, Ten, etc.)
- **HARD DISK DRIVE (HDD):** primary device for permanent storage of software + documents.

- **INTERNAL HARD DRIVE:** within system unit holding all stored programs + data.
- **EXTERNAL HARD DRIVE:** similar but outside system unit, has to be connected via a port to computer.
- **SOLID-STATE DRIVE (SSD):** has no moving parts so more efficient silent, little heat, little power, less fragile.
- **DRIVE BAY:** permanent storage devices located in desktop or laptop.
- 2 Types of Drive Bays:
- **INTERNAL DRIVE BAYS:** can't be seen or accessed from outside system unit, reserved for internal hard drives.
- **EXTERNAL DRIVE BAYS:** can be seen or accessed from outside system unit, can be used to install additional drives (houses DVD + Blue-Ray drives by example).

### Cloud Storage:

- Convenient option when access to files via different devices is required.
- Cloud = Internet. Windows, Linux and OS X accessible through a "Dropbox" (ex: iCloud, Google Drive, etc.)

### Portable and Optical Storage Options:

- **FLASH DRIVE:** also referred as **JUMP DRIVE**, **USB DRIVE** or **THUMB DRIVE**, uses solid-state flash memory storing information on an internal memory chip. Can be wireless also and used with Wi-Fi.
- New USB:
- **USB 3.1 & USB-C:** 10Gbps.
- **FIREWIRE 800:** Serial bus, 1 bit at the time, 9 conductors. 800Mbps.
- **THUNDERBOLT:** 20Gbps.
- **FLASH MEMORY CARD:** such as a SD Card, used to transfer digital data from digital devices + can be extremely small.
- **OPTICAL DRIVE:** can read and write CD, DVD, Blue-Ray discs. Streaming is more popular now, so most computers are getting rid of Optical Drives.
- **CD:** Compact Disc
- **DVD:** Digital Video Disc
- **BD:** Blue-Ray Disc

### Computer Ports:

- **PORT:** place where peripheral device attaches to computer so data can be exchanged.
- **THUNDERBOLT PORTS:** can connect up to 6 different peripherals to computer.
- **UNIVERSAL SERIAL BUS (USB):** most common type to connect input/output devices.
- **CONNECTIVITY PORT:** gives access to Internet + networks called **ETHERNET PORT**.

- **HIGH-DEFINITION MULTIMEDIA INTERFACE (HDMI):** compact audio/video interface carrying uncompressed digitals making it HD.
- **VIDEO GRAPHICS ARRAY (VGA) & DIGITAL VIDEO INTERFACE (DVI) PORTS:** connect to older LCD monitors.
- It's possible to add **EXPANSION CARDS** or **EXPANSION HUBS** to your slots for additional connections.

### Power Controls:

- **POWER SUPPLY:** housed inside system unit, transforms voltages required by computer chips.
- **COLD BOOT:** powering computer from a completely turned off state.
- **SLEEP MODE:** keeps data in RAM so when computer restarted it's quickly accessible = greatly reduced power consumption.
- **HIBERNATE:** similar to Sleep, but data stored on hard drive, very-low power needed.
- **WARM BOOT:** restarting system while it's powered.
- **BOOT PROCESS:** PC going through several internal processes before it's ready to use.
- **BOOT LOADER:** small computer program designed to find + launch PC's operating system.
- **BIOS:** Basic Input Output System.
- **POST:** Power-On Self-Test. Small computer program performed when PC is turning on.

### Ergonomics:

- **ERGONOMICS:** science that deals w/ design + locations of machines + furniture comfy + safe for ppl. In computing, means how you set up computer + equipment.
- Important cuz long time spent on computing devices subjects to injuries to joint, tendons, muscles, etc.
- Guidelines to avoid injuries:
- MONITOR POSITION
- ADJUSTABLE CHAIR
- PROPER POSITION WHILE TYPING
- TAKE BREAKS
- ADEQUATE LIGHTNING
- **ASSISTIVE or ADAPTIVE TECHNOLOGY:** products for ppl w/ disabilities.

## CHAPTER 4: APPLICATION SOFTWARE: PROGRAMS THAT LET YOU WORK AND PLAY

### Software Basics:

- **SOFTWARE:** set of instructions telling your computer what to do.
- **PROGRAM:** provides means for us to interact w/ computer.
- 2 Types of software:

- **APPLICATION SOFTWARE:** used to do tasks at home, school, work.
- **SYSTEM SOFTWARE:** helps run computer + coordinates instructions between application software and hardware's devices. Includes operating system (ex: windows, os x), utility programs (managing system resources).
- Other possible types of software include web browsers, virus protection, backup and recovery software, etc.
- Application Software has 3 Main Categories:
- **PRODUCTIVITY SOFTWARE:** writing, presentation, database, spreadsheet, finances, etc.
- **BUSINESS SOFTWARE:** accounting, projects, Customer Relationship Management (CRM), Enterprise Resource Planning (ERP), e-commerce, computer-aided design, etc.
- **MULTIMEDIA & EDUCATIONAL SOFTWARE:** image + video editing, drawing, audio, app creation, educ. + reference, etc.

### Basic Types of Apps and Software:

- Software is usually preinstalled w/ os + as.
- 2 Main Types of Software Can Be Run on Computer:
- **PROPRIETARY (OR COMMERCIAL) SOFTWARE:** software you buy (ex: Microsoft Office applications).
- **OPEN SOURCE SOFTWARE:** free software available w/ few licensing + copyrights. Supported & and updated by communities of users across websites + newsgroups.

### Trends in IT: Mobile Payment Apps: The Power of M-Commerce (Mobile Commerce):

- Use of apps on smartphones and tablets to buy + sell products is very popular = purchases on mobile devices rising +++.
- Easy to pay w/ payment apps like Android Pay, Apple Pay, Samsung Pay, waving device at Near Field Communication (NFC) compatible terminals.
- Most payment apps use **TOKENIZATION**, which substitutes **TOKENS**, one-use-only numbers, for the transaction.
- Other payment apps created are used for coupons, gift cards, loyalty programs + use tokenization to safeguard credit cards infos.
- 3 Types of Both Proprietary & Open Source Apps:
- **LOCAL APPS:** don't require Internet to be fully functional once installed.
- **MOBILE APPS:** connected instantly to Internet to function.
- **WEB-BASED APPS:** obtained through **SOFTWARE AS A SERVICE (SAAS)**, vendor hosts the software online, accessible on Internet without being installed on devices (ex: Gmail, Google Docs, etc.)

### Productivity Software:

- It's cheaper for proprietary software to buy **SOFTWARE SUITE**, instead of individual programs.
- 3 Main Productivity Software Suites:
- **MICROSOFT OFFICE**: Standard proprietary software suit for Windows.
- **APACHE OPENOFFICE**: Open source productivity suite similar to Microsoft Office, installation file is downloadable on OpenOffice.
- **APPLE IWORK**: Productivity suite made especially for Apple computers.
- Web-based online suites are available anywhere as long as you have Internet, easy for sharing files + present them.
- Programs work well together in a suite cuz same toolbars, common features, menus.

### Word Processing Software:

- **WORD PROCESSING SOFTWARE**: create + edit documents.
- Those programs have a very wide variety of tools that we should learn to use.
- Formatting options allow making documents look professional by editing their appearances.

### Spreadsheet Software:

- **SPREADSHEET SOFTWARE**: allows performing calculations + perform numerical analysis.
- Those programs are useful cuz they can automatically recalculate formulas + functions in spreadsheet when inputs change (ex: add additional row, change a value, totals, etc.) = effects are seen immediately.
- **WHAT-IF ANALYSIS**: immediate effects shown make it possible to quickly test different assumptions.
- **WORKSHEET**: grid w/ columns + rows + **CELLS**, individual boxes.
- Several Types of Data Can Be Put in Cells:
- **TEXT**: often used to label + identify contents.
- **VALUES AND DATES**: numerical data often basis of calculations.
- **FORMULAS**: equations to make calculations.
- **FUNCTIONS**: formulas programmed in spreadsheet software, from simple to complex calculations without knowing exact formula = built-in functions.
- Spreadsheet software can also create variety of charts + graphs.
- **SPARKLINES**: small charts fitting in a single cell making it easy to show data trends.

### Presentation Software:

- **PRESENTATION SOFTWARE**: can create slide show = high-quality presentations without a lot of training. Possibility to embed videos, effects, images, without editing.
- Tips to Design a Good Presentation:

- **Be Careful With Color** = dark text on light background, avoid clashes.
- **Use Bullets for Key Points** = not more than 4-6 points per slide, avoid sentences + paragraphs.
- **Use Images** = illustrates thought or point, if text on image, has to be easy to read.
- **Consider Font Size & Style** = font size large enough to see from far, avoid script + fancy styles + not more than 2 font styles per presentation.
- **Keep Animations and/or Background Audio to Minimum:** can be distracting.

### Database Software:

- **DATABASE SOFTWARE:** used for storing and organizing data (ex: Oracle, MySQL, Access).
- In Excel, Fields>Records>Tables:
- **FIELD:** data category.
- **RECORD:** group of related fields.
- **TABLE:** group of related records.
- Useful for generating reports for more complicated data w/ many tables.
- Businesses can use those apps to keep track of products, clients, invoices, personal information, purchases, etc.

### Note-Taking Software:

- **NOTE-TAKING SOFTWARE:** used to organize research, brainstorming, collaboration, information, etc. (ex: OneNote).
- Useful to make digital notebooks w/ point forms + retrieve links and infos.
- Alternative Note-Taking Apps:
- **EVERNOTE:** easy collab, web-based.
- **AUDIONOTE:** synchronizing note taking + voice recording.
- **SIMPLENOTE:** using tags, web-based + app available.
- **NOTABILITY:** pdf annotations.

### Personal Information Manager Software:

- **PERSONAL INFORMATION MANAGER (PIM) SOFTWARE:** helps manage emails, contacts, calendars, and tasks in one place (ex: Outlook).
- Allows you to create to-do lists + reminders.

### Microsoft Office Productivity Software Features:

- **WIZARD:** walks you through steps necessary to a complicated task. Wizards ask you questions, based on responses, helps you complete portion of task (ex: when installing a software)

- **TEMPLATE:** predesigned forms included in many productivity apps + basic structures for different documents.
- **MACRO:** small program grouping series of commands so they will run as a single one, automate frequent routine task or complex series.

### **Personal Finance Software:**

- **FINANCIAL PLANNING SOFTWARE:** helping manage daily finances + electronic checkbook register + automatic payment tools + create budgets and analyze spending patterns.
- Quicken and Mint are market leaders for financial planning software, offering advices and how to better manage your finances + keeping track of investment portfolio. Mint allows connecting with any private devices + connecting w/ other users if wanted.
- Taxes preparation software is also a form of personal finance. (ex: Intuit Turbo Tax, H&R Block Tax, etc.)

### **Small Business Software:**

- **ACCOUNTING SOFTWARE:** helps owners manage their finances efficiently w/ efficient tools.
- **DESKTOP PUBLISHING (DTP) SOFTWARE:** allows professionals to design books + other publications requiring complex layouts.
- **WEB AUTHORIZING SOFTWARE:** allows even novice to design interesting + interactive web pages without knowing html codes (ex: Adobe InDesign, Adobe Dreamweaver, Microsoft Visual Studio).
- Possibility to convert documents to web pages also.
- Financial planning software are used to manage daily finances, electronic checkbook registers, and automatic bill payment tools.

### **Software for Large and Specialized Businesses:**

- **VERTICAL MARKET SOFTWARE:** applications tailored for specific needs of particular company/industry.
- **COMPUTER-AIDED DESIGN (CAD):** creating automated designs, technical drawings, 3-D model visualizations.
- Different uses of CAD software includes:
  - **Architects** use it to build virtual models.
  - **Engineers** use it to design components + models.
  - **3-D printing** for objects.
  - **Medical Engineers** use it to create anatomically accurate solid models of human body, implants, etc.
- Collaboration Tools:
  - **UBERCONFERENCE:** facilitates group conference calls up to 10 callers.

- **TRELLO:** made for managing projects with lists + description of tasks and attribution of work between individuals.
- **SCRIBBLAR:** multiuser whiteboard w/ live audio chat + virtual brainstorm sessions.

### Digital Image-Editing, Video-Editing, and Drawing Software:

- **MULTIMEDIA SOFTWARE:** includes digital image, video, audio editing to produce computer games, animations and movies.
- Multimedia & Educational Software include Drawing, Digital-Image + Video-Editing, Digital Audio, Educational and Reference, App Creation Software.
- **IMAGE-EDITING SOFTWARE:** tools for basic modification to digital photos.
- **VIDEO-EDITING SOFTWARE:** tools to refine videos.
- **DRAWING (ILLUSTRATION) SOFTWARE:** tools to create 2-D, line-based drawings, diagrams, nonphotographic drawings, animations and illustrations.

### Digital Audio Software:

- There are different types of audio files such as music, audiobooks, podcasts, **COMPRESSED** files that are easy to transfer from Internet to computer.
- Most common types include **MP3, MPEG-1, AUDIO LAYER 3, AAC, WMA.**
- **UNCOMPRESSED** files include **WAV, AIFF**, found on CDs = much larger files w/ much better quality.
- **AUDIO-EDITING SOFTWARE:** tools for basic editing of audio files.

### Dig Deeper How Cloud Computing Works:

- **CLOUD COMPUTING:** refers to storing data, files, and apps on the web and being able to access and manipulate them on any Internet connected devices.
- 2 Sides of Cloud Computing:
- **FRONT END:** involves web browser, seen by users.
- **BACK END:** consists of various data centers and server farms housing Cloud files + programs = full of computers + servers created around the world designed to work together.
- Chromebook is the first computer w/ only cloud storage.
- Important Considerations about Cloud Computing:
- **SECURITY AND PRIVACY:** based on trusted passwords and security systems, but caution is always warranted.
- **BACKUP:** even if icloud is a backup itself, always good idea to have an offline backup also.
- **ACCESS ISSUES:** possible failures can be inconveniences to access files, use offline backup.

### App Creation Software:

- Electronic Arts are a very lucrative industry generating billions of dollars.
- Beginner apps exist to create video games and apps (ex: Unity, RPG Maker VX, GameMaker, etc.) (ex: MIT's App Inventor, Scratch, Corona SDK, Swift, etc.).
- Application Programming Interfaces (API), used for building blocks, writing computer code, etc.

### **Educational and Reference Software:**

- Made to help master, study, design, create, plan, or learn new skills.
- Some are made for test preparation, simulation, instructional, trip planning, home design/improvement, course management, brain training, or genealogy.
- **SIMULATION PROGRAMS:** experience or control software as if actual event so safely gaining experience without potential dangerous situations.
- **COURSE MANAGEMENT SOFTWARE:** runs online courses, sometimes by individually created websites.

### **Getting Software:**

- Can be bought in stores or download websites.
- **APP MARKETPLACES (APP STORES):** for purchase + download of software. Apps are written for specific operating systems + mobile software or software possible to install on desktop + laptop computers.
- 3 Main App Stores:
- **GOOGLE PLAY:** for Android OS.
- **APP STORE:** for Apple OS X.
- **WINDOWS STORE:** for Windows 8.
- **FREWARE:** copyrighted software that can be used for free.
- **BETA VERSION:** app still in development can be on trial period.
- **GOLD VERSION:** final beta version.
- **RESTORE POINT:** possibility to return to system you had before software installation in protection tools.

### **Software Licenses:**

- When you buy an app, you buy a license to use it, the app doesn't belong to the customer.
- **SOFTWARE LICENSE (END USER LICENSE AGREEMENT (EULA)):** agreement between you, the user + software company = legal contract saying warranty comes w/ software + forbidden to copy.
- EULA is used for ultimate owner software, whether copies can be made, the number of installations allowed, and warranties.

- Licensing Bundles allow several computers in same household to install software legally. (ex: Apple offers Family Pack Software License Agreement for 5 users).
- **CONCURRENT LICENSES:** limit the nb of users accessing software at any given time.
- **SOFTWARE PIRACY:** happens when making more copies of software than license authorizes. Often made w/ installations disks.
- Business Software Alliance (BSA) says it is unethical + illegal to pirate software. Also has financial impacts = money loss decreases financing available for software R&D + increases up-front costs to legitimate consumers.
- The BSA has free third-party audit tools made to detect fraudulent software.
- **GNU GENERAL PUBLIC LICENSE:** free license software required to grant rights to modify + redistribute software.
- **COPYLEFT:** concept of redistribution modified open source software under same terms as original version, also free software.

### Getting the Right Software for Your System:

- **SYSTEM REQUIREMENTS:** specify minimum recommended standards for operating system, processor, RAM, and hard drive capacity.
- **SOFTWARE UPDATES (SOFTWARE PATCHES):** small enhancements to software + fix program bugs.
- Vendors make it possible to open files between newer and older versions of software.
- Important to verify the compatibility, if a newer version is needed, system requirements, and if backwards compatible.

### Installing and Uninstalling Software:

- **FULL INSTALLATION (TYPICAL INSTALLATION):** copies all most commonly used files + programs from distribution disc to computer's hard drive.
- **CUSTOM INSTALLATION:** you can decide which features you want installed + saved on hard drive.
- Computers have functions made to uninstall software.
- Preinstalled software is hard to retrieve if computer crashes, so recovery utility is a good way to backup necessary software.
- **BLOATWARE:** software put by manufacturers on computer you don't want/need.
- You can uninstall preinstalled antivirus software, unwanted toolbars, manufacturer-specific software.
- Overall, there are 4 main types of apps = proprietary, open source, web-based, and freeware.

### EXTRA INFORMATION ABOUT EXCEL + ACCESS (GIVEN IN VIDEO UNIT 4):

- Business productivity has to be using APPLICATION SOFTWARE efficiently + effectively.
- Excel = Spreadsheets = Infos. (ex: use of functions in tables)

- Access = Database = Relating infos between them. (ex: tables relating to each other)
- Important to be able to extract information from database + understand them properly.
- Important to learn proper practice of ORGANIZATION + PRESENTATION of data + infos.
- CHARTS/ STATS/ TABLES/ ETC. = APPLICABILITY TOOLS.
- Important to learn how to do good presentation with Access' output results.
- In BTM, the Mini-Cases are practices of that = producing solutions.

## CHAPTER 5: SYSTEM SOFTWARE: THE OPERATION SYSTEM, UTILITY PROGRAMS AND FILE MANAGEMENT

### Operating Systems Fundamentals:

- Operating system are essential for computer to operate, ALL devices have one.
- Common Operating Systems:
- **WINDOWS:** developed by Microsoft. (laptops, tablets, desktops, all-in-ones, cellphones.)
- **OS X:** developed by Apple (laptops, desktops, all-in-ones.)
- **IOS:** developed by Apple (tablets, iPhones, iPod touches.)
- **ANDROID:** developed by Google (cellphones, tablets.)
- **LINUX:** developed by Open Source. (laptops, desktops, tablets.)

### Operating System Basics:

- **OPERATING SYSTEM (OS):** group of programs controlling how computer functions.
- It has 3 primary functions:
- **Manages** computer's hardware, processor, memory, storage devices, and peripheral devices like a printer.
- **Provides** a consistent need for application software to work with central processing unit (CPU).
- **Is** responsible for the management, scheduling, and coordination of tasks.
- **USER INTERFACE:** way to interact w/ OS through desktop, icons, menus, etc.
- **UTILITY PROGRAM:** small program performing many of the "housekeeping" tasks of computer like system maintenance and file compression. Usually bundled in each OS, but possible to buy standalone utility programs for more features.
- OS were initially designed to perform only one task at a time with one single user, it is called **SINGLE-USER, SINGLE-TASK OPERATING SYSTEM.**
- **MULTITASK:** performing more than one process at time + providing networking possibilities, called **MULTIUSER, MULTITASKING.**

### Operating Systems for Machinery, Networks, and Business:

- **REAL-TIME OPERATING SYSTEM (RTOS):** performing repetitive series of specific tasks in an exact amount of time, also called **EMBEDDED SYSTEMS**, requiring minimal interaction. They have programs specially written for the needs of devices and their functions to perform and record precise results = no commercial software available.
- **MULTIUSER OPERATING SYSTEM (NETWORK OPERATING SYSTEM):** lets more than one user access computer system at a time by handling + prioritizing requests from multiple users.
- **NETWORKS:** groups of computers connected together so they can communicate + share resources.
- **SERVER:** computer managing networks resources such as printing and communications.
- Networks need multiuser OS cuz many users simultaneously using server (often in small businesses and at home).
- Larger networks have servers managing all user requests.
- **UNIX:** multiuser, multitasking OS used as network OS, also used on PCs. Developed in 1969, initially Unix Code wasn't anyone's propriety = no company owned it. Now belongs to Open Group, but if paying a fee anyone can use Unix + modify code to fit their hardware.
- Mainframes and Supercomputers also require multiuser OS. (ex: Unix, Linux of System z, IBM's z/OS, etc.)

### Operating Systems for Personal Use:

- Dominant OS for smartphones are Apple and Android. Blackberry and Symbian don't really impact markets anymore RIP.
- Dominant OS for tablets are Apple, Android and Windows.
- Kindle Fire is a customized version of Android.
- Gaming consoles and iPods have system software developed specially for their needs such as game controllers.
- Dominant OS for personal computers are Microsoft Windows, Apple OS X, and Linux (Open Source OS) = similar features but all different features.
- **WINDOWS:** OS incorporating user-friendly, visual interface w/ improved functionality + friendliness, good Internet capabilities, supporting home networks, enhancing file privacy + security.
- **WINDOWS 10:** optimized interface for touchscreen devices + designed to run across all kinds of devices.
- **MAC OS:** first commercially available OS to incorporate ability to interact w/ computer user-friendly point-and-click technology. Mountain Lion version = much improved version w/ Windows-based interface + based on Unix OS very stable and reliable. Mac OS requires updates to protect computer.
- **LINUX:** Available in packages such as **DISTRIBUTIONS** or **DISTROS**, including **LINUX KERNEL**, the code providing its basic functionality.

- **DISTROWATCH.COM:** Tracks Linux distros + provides helpful tips for beginners on choosing one.
- **PLATFORM:** combination of OS + a specific processor.
- It is possible to have many OS on your computer because they have different features, can create “Virtual Drives” w/ virtualization software such as Parallels or VMware Fusion.
- **PARTITION:** separate section on hard drive to install another OS.
- Cloud memory often used to store things like with Microsoft Account on OneDrive Account and with AppleID on iCloud System.
- **GOOGLE CHROME OS:** web-based OS only on Chromebooks. Different from Google Chrome Browser used on various OS.
- Smartphones use Android, iOS, and Windows.

### The User Interface:

- OS coordinates + directs flow of data and information through computer system.
- **COMMAND-DRIVEN INTERFACE:** when you need to enter commands to communicate with computer system.
- **MICROSOFT DISK OPERATING SYSTEM (MS-DOS or DOS):** first interface allowing interacting w/ computer. DOS was complicated to understand for the average user.
- **MENU-DRIVEN INTERFACE:** where commands are chosen from menus displayed on screen.
- **GRAPHICAL USER INTERFACE (GUI):** (pronounced “gooey”), currently used by most OS, displaying graphics + point-and-click technology of mouse or cursor, making it user-friendly +++.
- Overall the Operation System:
  - **Manages** computer hardware and peripherals.
  - **Provides** a consistent interaction between applications and the CPU.
  - **Manages** the processor.
  - **Manages** memory and storage.
  - **Provides** user interface.
- Linux-based OS doesn’t use GUI, free to choose commercially available and free interfaces such as GNOME or KDE w/ different look + feel.

### Hardware Coordination:

- **EVENT:** Each action you command your OS to execute.
- **INTERRUPT:** Signal produced to tell device this particular event needs immediate attention, such as printing a document.
- **INTERRUPT HANDLER:** Special numerical code prioritizing requests + placing them in interrupt table in RAM memory.
- **PREEMPTIVE MULTITASKING:** OS processing tasks by the priority established by system.

- **STACK:** “Memo” in a special location in RAM memory telling CPU to temporarily interrupt an ongoing task.
- OS also coordinates multiples activities for peripheral devices.
- **BUFFER:** Temporary storage section in RAM memory for task requests coming from peripheral devices.
- **SPOOLER:** Program helping coordinate print jobs sent to printer + indicates if printer available.
- **QUEUE:** Line of print jobs waiting to execute requests in order.

### Memory and Storage Management:

- Instructions are temporarily stored in RAM memory until they’re not needed anymore and getting rid of the temporary storage.
- **VIRTUAL MEMORY:** RAM has a limited capacity, if full, computer borrows space from hard drive.
- **SWAP FILE (PAGE FILE):** temporary storage area on hard drive where data or instructions that haven’t been recently used are put, if needed later, they’re swapped back to RAM.
- **PAGING:** process of swapping files.
- **THRASHING:** Excessive paging making computer sluggish.
- OS has a file-management system keeping track of name + location of each file saved and program installed.

RAM-----DATA + INSTRUCTIONS NOT USED IN A WHILE-----LOCATION OF THE SWAP FILE  
 OS  
 LOCATION OF THE SWAP FILE-----DATA + INSTRUCTIONS NEEDED NOW -----RAM

### Hardware and Peripheral Device Management:

- **DEVICE DRIVER:** facilitates communication between device and OS = translates commands.
- **PLUG AND PLAY (PNP):** software + hardware standard designed to facilitate installation of new hardware in PCs included in OS.
- Possible it is required to update device driver to be able to install the required programs + can cause problems sometimes but usually device removable if problems occur.

### Ethics in IT: The Great Debate: Is Mac OS X Safer Than Windows?

- More developed viruses on Windows because more users + mac users wealthier cuz more expensive buuuut apple installed preventive restrictions so viruses cannot install by themselves.
- App Sandbox = controls apps sold on app store.

- Scareware = scam makes user believe there is something wrong with computer.
- Extra Security Precautions:
- **Set** OS to download updates automatically.
- **Use** third-party antivirus/anti-malware.
- **Be** aware of social engineering techniques.

### Software Application Coordination:

- **APPLICATION PROGRAMMING INTERFACE (API):** blocks of code needed for interaction between computers programs and CPU.
- If APIs similar, facilitates exchange between similar code blocks.

### The Boot Process:

- Boot process has four principle steps to start up computer + handle possible errors in booting.
- STEP 1: ACTIVATING BIOS:
- CPU activates BIOS.
- **BASIC INPUT/OUTPUT SYSTEM (BIOS):** manages data exchange between OS and all I/O devices attached to system + loads OS into RAM. BIOS are stored in ROM permanently.
- STEP 2: PERFORMING THE POWER-ON SELF-TEST:
- **POWER-ON SELF-TEST (POST):** ensures all peripheral devices are attached + operational.
- BIOS compares results w/ POST to make sure everything is alright in hardware CMOS.
- **COMPLEMENTARY METAL-OXIDE SEMICONDUCTOR (CMOS):** special kind of memory using almost no power + contains all essential information about system's memory.
- STEP 3: LOADING THE OS:
- BIOS go through preconfigured list of devices in its search for the drive w/ system files + loading them into RAM.
- **SYSTEM FILES:** main files of OS.
- **KERNEL (SUPERVISOR PROGRAM):** essential component of the OS + manages processor.
- Kernel gets loaded in RAM, is it **MEMORY RESIDENT**, cuz always in RAM when computer turned on. **NONRESIDENT** means it gets moved into RAM only when needed.
- STEP 4: CHECKING FURTHER CONFIGURATIONS AND CUSTOMIZATIONS:
- OS checks registry for other system components.
- **REGISTRY:** contains all customized settings used by OS + by other applications + what should be loaded first.

- **AUTHENTICATION:** login name + password required at end of boot process + blocks unauthorized users.
- **MICROSOFT ACCOUNT:** email address + password, giving access to configuration settings, etc.

### Handling Errors In the Boot Process:

- Some useful tips if errors occur can be to uninstall/reinstall software, access Windows Advanced Options Menu to return to the last boot configuration desired, or simply try resetting computer.
- **RESET THIS PC:** utility program in Windows 10 diagnosing + fixing errors when computer behaving improperly.
- When PC is Reset, the following occurs:
- **All files** are kept.
- **All apps** downloaded from Windows store are kept.
- **All apps** downloaded from Internet/DVDs are removed.

### Using System Software: Using Windows 10:

- Desktop features taskbar, which can be accessed with a mouse/touch-enabled devices/keystrokes.
- Windows Icon (Start Button) = **START MENU**, shows access to most used programs and apps (right side = software + apps)/ left side = most used programs)
- Task View allows to see the different windows opened + snapping options allow to have up to four different windows showing simultaneously.
- **VIRTUAL DESKTOPS:** allows to organize groups of windows in different displays + no limit of amount of desktops created.

### Mac and Linux Interfaces:

- OS X and Windows 10 are very similar.
- OS X start menu is called **DOCK**, containing icons.
- OS X and IOS make data + task transfer between devices seamless.
- Linux's **UBUNTU**, is different but similar, like using icons + apps. It is not as popular because Linux is an Open Source OS, so almost no technical support is provided or existing.

### File Management: Organizing your files:

- **FILE MANAGEMENT:** organizational structure to your computer's contents.
- OS organized in hierarchical directory structure composed of drives, libraries, folders, subfolders, and files.
- Hard drive = **C: DRIVE**, where files stored permanently.

- Each additional storage drive will be D, E, F, etc.
- **ROOT DIRECTORY:** is the C: Drive, at top of computer's filing structure.
- **FILE:** Collection of program instructions or data stored and treated as one unit.
- **FOLDER:** Collection of Files.
- **FILE EXPLORER:** Windows main tool to find, view, manage computer contents.
- File Explorer is divided in panes/sections:
- **NAVIGATION PANE:** on the left showing contents of computer + most commonly accessed areas + organized by favorites + libraries.
- **FILE LIST:** on the right displaying the contents of selected item in the navigation pane.
- **FILE PATH:** starts from the device and goes all the way to the folder when file is saved when searching for it.
- **PATH SEPARATOR:** list of sections getting to desired file.

### Working With Files and Folders:

- View Tab in File Explorer offers you different ways to view the folders and files:
- **DETAILS VIEW:** most interactive view, list form + additional information in columns alongside file name.
- **ICONS VIEW:** number of icon views displaying files + folders in sizes, showed as **LIVE ICONS**, meaning icon shows preview of actual contents of specific folder without opening it.
- Creating folders = key to organization.

### Naming Files:

- **EXTENSION/FILE TYPE:** follows file name/period/dot = identifying file category.
- Files have to be uniquely named.
- Important to name conventions.
- Up to 255 characters finale name.

### Copying, Moving, and Deleting Files:

- **RECYCLE BIN:** Is a desktop folder where files go before being permanently removed from system or **TRASH** for Apple.
- Files can be backed up even if "permanently deleted" in File History or RestoreIT or Norton Online Backup.

### File Compression:

- **FILE COMPRESSION:** Makes a large file more compact = easier + faster to send/upload/save it.
- **FILE COMPRESSION UTILITY:** takes out redundancies in file to reduce size.
- Compression's algorithm replace repeated pattern of letters w/ shorter placeholder = placed in a temporarily file called **DICTIONARY**.
- Files can be reduced up to 50% + can be decompressed.

## Utility: Programs:

- 3 Types of Utility Programs:
- **Those** included w/ OS.
- **Those** sold as stand-alone programs.
- **Those** offered as freeware.
- **FIREWALL**: blocks traffic between computer and networks.

## Windows Administrative Utilities:

- **DISK CLEANUP**: Removing unnecessary files from hard drive (ex: recycle bin and temporary files).
- **TASK MANAGER**: Checking programs when nonresponsive.
- **DISK DEFRAGMENTATION**: Rearranging fragmented data so related file pieces are unified, needed if disk is more than 10% fragmented.
- **TRACKS**: Hard disks in concentric circles.
- **SECTOR**: Pie-shaped wedges of a track.
- **CLUSTERS**: smallest segments within sectors identifying data.
- Apple computers don't have a defragmentation utility, need to use iDefrag, external system from Coriolis Systems.

## Files and System Backup Utilities

- **FILE HISTORY**: utility for Windows automatically creating a duplicate of your libraries, desktop, contacts, and favorites. It copies them in another storage device, such as a hard drive.
- Windows 10 also has recovery tools allowing you to complete backups of entire system.
- **SYSTEM RESTORE**: allows rolling system settings back to a specific date when everything was working properly.
- **SYSTEM RESTORE POINT**: snapshot of entire system's settings.
- Apple OS X has utility called **TIME MACHINE** doing the same thing + backing information up in **TIME CAPSULES**, hard disk drives w/ wireless connectivity.

## Accessibility Utilities:

- Windows has an **EASE OF ACCESS CENTER**, which is a centralized location for assistive technology + tools to adjust accessibility settings.
- Ease of Access Center Tools are:
- **MAGNIFIER**: separate window showing magnified screen portion.

- **NARRATOR:** reads what's on screen.
- **SPEECH RECOGNITION:** allowing to dictate text + control vocally.
- **ON-SCREEN KEYBOARD:** allowing to type w/ pointing device.
- **HIGH CONTRAST:** color schemes invert screen colors.

### Defining Ethics and Examining Ethical Systems:

- **ETHICS:** study of general nature of morals + the specific moral choices individuals make (right/wrong).
- Subtle distinctions between fairness/equity.
- Five Major Ethical Systems:
  - **RELATIVISM:** no universal truth, dictated by cultural tastes/customs.
  - **DIVINE COMMAND THEORY:** God knows it all.
  - **UTILITARISM:** actions judged by consequences + should provide greater happiness but for the greater good.
  - **VIRTUE ETHICS:** moral are internal, be a well-behaving person.
  - **DEONTOLOGY (DUTY-BASED):** focus on moral duties + rights applied equally to everyone.
- Laws are written standards applying to everyone enforced by government and interpreted by court.
- Ethics provide unwritten guidelines for people to follow.
- Unethical behaviour isn't necessarily illegal vs. illegal behaviour isn't necessarily unethical.
- **UNETHICAL BEHAVIOUR:** not conforming to set of approved standards.
- **AMORAL BEHAVIOUR:** no sense of right/wrong + no interest in moral consequences of actions.
- All ethical decisions are greatly influenced by personal ethics, not a "best" one existing.

### Personal Ethics:

- **PERSONAL ETHICS:** set of formal and informal ethics principles used to make decisions in life.
- Influenced by family + religion affiliation + life experience + teachers.

### Define Your Own Personal Values:

- If Hesitating What Your Personal Ethics Are:
  - **Describe** Yourself.
  - **List** the key principles you believe in.
  - **Identify** external influences.
  - **Consider** why.
  - **Prepare** statement of values.

### **Benefits to Ethical Living:**

- If Decisions and Ethics are in conflict = stress + anger.
- Happiness itself is a result of living ethically.
- **POSITIVE PSYCHOLOGY**: field of psychology looking studying causes of happiness.

### **Personal Ethics and Your Work Life:**

- Personal ethics change in work environment because boss expecting individuals to follow business's rules.
- **WHISTLE-BLOWERS**: ppl reporting businesses to regulatory agencies for committing illegal acts or exposing unethical acts committed by employers through various media outlets.
- Illegal behaviour might affect shareholders + profits.

### **Technology and Ethics: How One Affects the Other:**

- Technology moves faster than rules can be formulated to govern it.
- Ethics and Technology affect each other. Ethical considerations are complex + never clear-cut.
- Six Ethics in Computing:
- **SOCIAL JUSTICE** (robotic ethics)
- **INTELLECTUAL PROPERTY** (3D printers)
- **PRIVACY** (implanted data chips)
- **PROPERTY RIGHTS** (ownership of outer space)
- **ELECTRONIC INFORMATION ACCESS** (business and free speech)
- **COMPUTER ABUSE** (hacking)

### **Social Justice: Who Sets the Ethics for Robots?: Summary of the Issue:**

- **ROBOT SWARMS**: group of robots programmed to work together + do tasks without human intervention.
- Who's going to take responsibility when accidents happen caused by robots?
- What is best for society at whole?
- Point: Individuals Should Have the Right to Set Ethics for Robotic Systems They Own.
- Counterpoint: Robotic Ethics Should Be Controlled by the Governments or Manufacturers.

### **Intellectual Property: 3D Printing: Who Is Responsible When Things Go Awry?: Summary of the Issue:**

- Cost of 3D printers dropping = soon to be practical + effective.
- Patents protect intellectual property.
- Who's going to take responsibility for possible flaws in printing causing accidents?
- How do we preserve intellectual property rights?
- Point: Regulating 3D Printing Protects Designers and the Public.
- Counterpoint: Unregulated 3D Printing Encourages Creativity.

**Privacy: Human-Implanted Data Chips: Protection of Orwellian Nightmare?: Summary of the Issue:**

- Many ppl perceive privacy as a basic human right.
- VeriChip (now PositiveID) is FDA approved since 2004.
- Chip implanted in human body makes many ppl extremely uncomfortable.
- Very debatable + sensitive topic.
- Point: Chip Implants Would Benefit Society.
- Counterpoint: Chip Implants Would Lead to An Erosion of Personal Privacy.

**Property Rights: Mining an Asteroid: Who Owns Outer Space?: Summary of the Issue:**

- Development of technology hardware requires lots of rare metals.
- Outer Space solids like asteroids + other planets = possible wealthy source of minerals + metals.
- **OUTER SPACE TREATY (OST):** 1967 treaty resulting from cold war = major law governing ownership of extraterrestrial territory.
- Who owns the moon?
- Point: Outer Space Belongs to the Human Race.
- Counterpoint: Outer Space Can Be Claimed by Private Companies.

**Electronic Information Access: Should Everyone Have Free Access to Uncensored Information?: Summary of the Issue:**

- **BAIDU.COM:** Leading Chinese search engine.
- Many countries have their Internet blocked by government restrictions like India and China.
- Financial Results versus Social Implications?
- Point: US Companies Should Comply With Local Laws in Foreign Countries.
- Counterpoint: US Companies should Put What is Right Ahead of What is Financially Expedient.

**Computer Abuse: Hacktivism: Civil Disobedience or Terrorism?: Summary of the Issue:**

- Civil disobedience + right to assemble and protest = basic liberties for Americans.

- **HACKTIVISM:** involves using computers + networks in subversive way to promote agenda related to causes like free speech, human rights, information freedom = computer hacking for social change.
- Cyberterrorism.
- Is it civil disobedience 21st-century style?
- Point: Hacking is A Natural Extension of Civil Disobedience.
- Counterpoint: Hactivism is Illegal and Therefore Wrong.

### Using Computers to Support Ethical Conduct:

- Positive tool for ethical conduct such as being a tool for charitable organizations, fundraising activities, etc.
- Also useful when individuals gone missing in crisis situations like natural disasters, terror attacks, etc.

## CHAPTER 6: UNDERSTANDING AND ASSESSING HARDWARE: EVALUATING YOUR SYSTEM

### Your Ideal Computing Device: Moore's Law:

- New technologies emerge quickly.
- **MOORE'S LAW:** pace at which CPUs improve, named after Gordon Moore, the cofounder of Intel CPU chip = predicts number of transistors inside CPU increasing so fast it doubles every two years.
- **DYNAMIC RANDOM ACCESS MEMORY (DRAM):** capacity of memory chips.
- Three Types of Technology Users:
- **CASUAL USER:** using Internet + office.
- **POWER USER:** needs fast powerful processing, storage + creates programs.
- **MOBILE USER:** needs lightweight device + long battery life.

### Selecting a Computing Device:

- **SYSTEM EVALUATION:** evaluates subsystems to see if system is still good enough or should change computer.
- Huge number of choices: Tablets, Ultrabooks, Netbooks, 2-in-1s, Laptops, Desktops.

### How the CPU works:

- CPU is composed of two units: the control unit and the arithmetic logic unit (ALU).
- **CONTROL UNIT:** coordinates activities of all other computer components.
- **ARITHMETIC LOGIC UNIT (ALU):** performing all arithmetic calculations + making logic and comparison decisions.

- CPU fetches data, decodes it, executes the instruction, and stores the results in RAM before fetching next information (Machine Cycle process).
- Clock Speed, Multiple Cores, and Amount of Cache Memory make CPU different from one to another.
- **CLOCK SPEED:** amount of instructions processed every second.
- **OVERCLOCKING:** running CPU at faster speed than manufacturer recommends.
- Multi-Core Processing = like you would clone yourself to work at a faster pace.
- **LIQUID COOLING:** removing heat of computer w/ water-cool system = liquid tube placed in contact w/ heat producing parts of system = liquid picks up heat and carries it to radiator + fan blows across the fins of radiator efficiently dispersing the heat. Sealed-water cooling solutions also available.
- **HYPERTHREADING:** new set of instructions starting before previous set has finished.

### Measuring CPU Performance:

- **CPU BENCHMARKS:** measurements used to compare performance between processors. Often published on **CPUBENCHMARK.NET**
- **CPU USAGE:** percentage of time CPU is working.
- **CPU USAGE GRAPH:** records CPU usage for the past minute.
- **TOWER DESIGN:** changing the shape of case holding the computer parts like Apple's Mac Pro 10 inches cylinder built around triangular collection of printed circuit boards allowing constant air flow from bottom to top, cooling all computer components w/ a single fan.

### Random Access Memory:

- RAM is volatile storage and ROM is non-volatile storage.
- RAM so much faster than mechanical hard drive.
- Resource monitor indicates how storage is used in computer.
- There are different types of RAM such as:
- **DOUBLE DATA RATE 3 (DDR3):** memory modules available in several different speeds.
- **DOUBLE DATA RATE 4 (DDR4):** used by high-performance systems.
- **DOUBLE DATA RATE 5 (DDR5):** used w/ high performance video graphics cards + fast data transfer rate.
- **MEMORY MODULES (MEMORY CARDS):** small circuit boards holding series of RAM chips fitting in special slots on Motherboard.
- **DUAL INLINE MEMORY MODULE (DIMM):** small circuit boards holding several memory chips used by most memory modules in today's systems.

- **PHYSICAL MEMORY:** amount of RAM actually sitting on memory modules in computer.
- **SUPERFETCH:** memory-management technique used by Windows, monitoring most used applications + preloading them to system memory so ready to use.
- In 4GB RAM: 1.1GB used to run hardware systems. 0.98GB used to run programs. 17GB used to hold cache data + files ready for quick access. 0.2GB unused.

#### **Adding RAM:**

- Easy to add = following installation instructions that come w/ RAM module + lining up notches and push memory module in place.
- Relatively inexpensive system upgrade.

#### **Types of Storage Drives:**

- **MECHANICAL HARD DRIVE:** has largest capacity of any storage device + most storage per dollar = more economical device than other options.
- Hard drive is composed of several coated, round, thin plates of metal stacked on a spindle. Each plate is called a **PLATTER**.
- When data is saved to hard drive platter, a pattern of magnetized spots is created on iron oxide coating of each platter. When spots aligned in one direction = means 1, when aligned in other direction = means 0.
- **ACCESS TIME:** time taken by storage device to locate data and make it available for processing = faster than optical drives.

#### **Solid State Drives (SSD):**

- SSD used electronic memory + has no mechanical motors/moving parts = incredibly fast access times.
- No noise, very little heat, very little power = popular option for Ultrabooks.

#### **Solid State Hybrid Drives (SSHD):**

- Combination of SSD + mechanical hard drive.
- Small amount of SSD storage but can have huge impact on system boot time.

#### **Optical Drives:**

- **OPTICAL DRIVES:** disc drives using laser to store + read data = data is saved on CD/DVD/BD, **OPTICAL MEDIA.**
- Data is read by laser beam w/ pits and nonpits, called **LANDS.**
- Blu-ray discs get their name because read w/ blue laser light, means shorter wavelength + focusing more tightly + pack more information on disc.
- Optical Drives are not as useful as they used to be because everything now is becoming digital = it is not necessary to own one.

### Dig Deeper How Hard Drives Work:

- **LOW-LEVEL FORMATTING:** process where concentric circles, called **TRACKS**, and pie-shaped wedges, called **SECTORS**, are created in magnetized surface of each platter, setting up grid-like patterns identifying file locations on hard drive.
- **HIGH-LEVEL FORMATTING:** establishes catalog that computer uses to keep track where files are located on hard drive.
- **READ/WRITE HEAD:** moves from outer edge of spinning platter to center up to 50 times per second, to retrieve/record magnetic data to and from platter.
- Access Time is the Sum of Two Factors:
- **SEEK TIME:** time taken by read/write heads to move over surface of disk to the correct track.
- **LATENCY (ROTATIONAL DELAY):** waiting time for the correct sector to spin to read/write head.
- The heads don't touch the platters, there is a thin cushion of air in between of 0.5 micro inches.
- **HEAD CRASH:** stoppage of hard drive often resulting in data loss.
- Modern technology continues to increase quantities of data that can be stored in small places.

### Storage Needs:

- **REDUNDANT ARRAY OF INDEPENDANT DISKS (RAID):** set of strategies for using more than one drive in system.
- **RAID 0:** time taken to write file cut in half = for those most concerned w/ performance.
- **RAID 1:** "mirror" effect of having two drives = everything written on first drive is also written on second.
- Raid 1 + Raid 0 configurations are available on many desktop systems + beginning to appear on laptop computers.

### Video Cards:

- **VIDEO CARD (VIDEO ADAPTER):** is an expansion card installed inside system unit to translate binary data in images.
- Screen Resolution Dialog Box = Advanced Settings.

- Modern Video Cards Let You Connect to:
- **DVI PORTS:** for digital LCD monitors.
- **HDMI PORTS:** for high-definition TVs, Blu-Ray Players, or Gaming Consoles.
- **DISPLAY PORTS:** for digital monitors or projectors.
- **VIDEO MEMORY:** all video systems have their own RAM, including **GRAPHICS DOUBLE DATA 3 (GDDR3)** or **GRAPHICS DOUBLE DATA RATE 5 (GDDR5)** memory. They also need their own fan/cooling system.
- **GRAPHICS PROCESSING UNIT (GPU):** separate processing chip specialized to handle 3-D graphics/images/videos processing w/ incredible efficiency + speed.

-----CPU----->

VS.

-----CPU----CPU//GPU----->

### Sound Cards:

- **SOUND CARD:** expansion card attaching Motherboard inside your system unit = enables computer to drive speaker system.
- **3-D SOUND CARD:** better at convincing human ear that sound is omnidirectional but not surround sound.
- **SURROUND SOUND:** type of audio processing making the listener experience sound as if it were coming from all directions by using multiple speakers (ex: Dolby Digital EX, Dolby Digital Plus, or Dolby TrueHD, Dolby Digital 7.1, etc.).
- To set up surround-sound on your computer you need two things:
- Surround-sound speakers.
- Sound Card Dolby Digital compatible.
- **AUDIO MIDI INTERFACE BOX: MIDI** is an electronics standards allowing different kinds of electronic instruments to communicate w/ each other + w/ computers. **AUDIO INTERFACE BOX** attaches to computer through USB port + add jacks for connecting guitars and microphones.

### Maintaining System Reliability:

- Things You Can Do to Ensure System Stays Reliable:
- Install reliable antivirus package.
- Run spyware and adware removal programs.
- Clear out unnecessary files.
- Run disk defragmenter utility of hard drive.
- Automate key utilities.
- Troubleshooting Steps:
- Try system restore.
- Windows refresh on system.
- Check if enough RAM.

- Visit Microsoft knowledge base.
- Search Google.
- Performance problems can be avoided by proper upkeep + maintenance.

### Getting Rid of Your Old Computer:

- Ways to Throw Away Your Computer:
- Manufacturer's recycling program alliances w/ nonprofit organization.
- Donations sites.
- Authorized computer-recycling centers.
- Environmental hazards are factors to be careful with when throwing away computers (ex: Mercury, Cadmium, etc.).
- Important to carefully remove all data from hard drive.

## CHAPTER 7: NETWORKING: CONNECTING COMPUTING DEVICES

### Networking Fundamentals: Understanding Networks:

- **KARMA WIFI:** allowing you to have your own, **PERSONAL HOTSPOT**, sharing the connection while **EARNING MORE DATA** as you do. You need to buy a karma device + set up account = 100MB for each user connecting to your device.
- **COMPUTER NETWORK:** two or more computers connected together via software + hardware so they can communicate.
- **NODE:** each device connected to a network (includes router devices).
- Benefits of Networks:
- **SHARING AN INTERNET CONNECTION:** sharing high-speed Internet connection coming into home.
- **SHARING PRINTERS & OTHER PERIPHERALS:** no physical connections required.
- **SHARING FILES:** various sharing options through networks.
- **COMMON COMMUNICATIONS:** computers running different OSs communicating on same network.
- **NETWORK ADMINISTRATION:** requires task like Installing, Monitoring, Updating & Configuring the Network.
- **DATA TRANSFER RATE (BANDWIDTH):** max speed at which data can be transmitted between two nodes on network (in Mbps)
- **THROUGHPUT:** actual speed of data transfer achieved (always less or equal to dtr in Mbps).
- Networks are classified by:
- **Distance** between Nodes.
- **Way** in which network is managed + administrated.
- **Set of Rules, Protocol**, used to exchange data between Nodes.

### Network Architectures Defined by Distance:

- **NETWORK ARCHITECTURE (NETWORK DESIGN):** distance between two nodes is one type.
- Common Types of Network:
- **PERSONAL AREA NETWORK (PAN):** used for devices close to one another.
- **LOCAL AREA NETWORK (LAN):** small geographic area.
- **HOME AREA NETWORK (HAN):** connecting all the LANs in one home.
- **METROPOLITAN AREA NETWORK (MAN):** usually an entire city, possibly using WIMAX. Providing extended Wi-Fi connections.
- **WIDE AREA NETWORK (WAN):** large physical distance = collection of LANs.

#### Network Architecture Defined by Levels of Administration:

- Can be administrated centrally or locally:
- **CENTRAL ADMINISTRATION:** tasks on one computer can affect the others connected like a **CLIENT/SERVER NETWORK**, server providing information and client doing the requested tasks (10 or more nodes).
- **LOCAL ADMINISTRATION:** maintenance must be performed on each single device, like in a **PEER-TO-PEER (P2P) NETWORK**, where all nodes are peers (equals), most common home network.
- **WEARABLE TECHNOLOGY:** incorporated in things we wear (ex: fitbit, jawbone, iWatch, etc.)

#### Ethernet Protocols:

- **ETHERNET NETWORK:** means by which the nodes communicate using protocol.
- Developed by Institute of Electrical & Electronics Engineers (IEEE) = creating standards for better data transmission so manufacturers work well between each other.
- **GIGABIT ETHERNET:** standard for wired Ethernet networks, also known as **WIRELESS FIDELITY (WIFI)**.
- Currently used is version 802.11ac, operating at 5 GHz frequency, means its more resistant to interferences.
- **WIGIG:** 802.11ac + 802.11ad working in tandem.
- **SUPER WIFI (WHITE-FI):** 802.11af being developed.
- **LOW POWER WIFI:** 802.11ah being developed.
- **BACKWARD COMPABILITY:** ability of current devices to work w/ earlier standards.
- **INTERNET BACKBONE:** 100GbE used for major transmission lines.
- All Networks must include:
- **Means** of connecting the nodes on network.
- **Special Hardware** devices allowing nodes to communicate to send data.
- **Software** allowing networks to run.

#### Transmission Media:

- **TRANSMISSION MEDIA:** wired or wireless connection of all network nodes to each other.
- Types of Cables:
- **TWISTED-PAIR CABLE:** made of copper wires surrounded by plastic jacket = normal telephone cable but does not work for LAN or HAN.
- **UNSHIELDED TWISTED-PAIR (UTP) CABLE:** used for networks, four pairs of wires to reduce electrical interference (most used one).
- **COAXIAL CABLE:** single copper wire surrounded by plastic layers, used for cable TV.
- **FIBER-OPTIC CABLE:** made of plastic or glass fibers transmitting data extremely fast.
- **RADIO WAVES:** transmission media connecting nodes.
- 3 Main Types of UTP in wired home Ethernet Networks:
- **CAT E5:** cheapest, sufficient for a home.
- **CAT 6:** best choice for a home.
- **CAT 6A:** ultrafast, not required for a home.
- Wi-Fi is basically a standard itself for wireless network, is usually slower than wired because:
  - Possible interferences.
  - Other wireless networks.
  - Certain building materials.
  - Throughput varies w/ distance.
  - Coded signals protecting data.
  - You can use both wired and wireless to rely devices.

#### Basic Network Hardware:

- **NETWORK ADAPTER:** installed inside devices allowing connecting to network.
- **NETWORK INTERFACE CARD (NIC):** adapter for wireless connection.
- **MODEM:** connecting network to Internet, **CABLE MODEM** or **DSL MODEM**.
- **PACKETS:** bundles of data sent through networks.
- **NETWORK NAVIGATION DEVICES:** facilitate control of data flow through network.
- **ROUTER:** transferring packets between two or more networks.
- **SWITCH:** network traffic signal, integrated in all routers, keeping track of bundles so network keeps working efficiently.
- **INTERNET OF THINGS (IOT):** interconnection of uniquely identifiable embedded computing devices transferring data over network without requiring human-to-human or human-to-computer interactions. Things can be anything.
- Interconnectivity of IOT = we all become nodes, we generate data without knowing it = creating privacy + ethical issues.

#### Network Software:

- Home networks require P2P network software.

- **NETWORK OPERATING SYSTEM (NOS):** useful for client/server network to handle information requests, Internet access, and use of peripherals by other network nodes.

### Wired Broadband Internet Connections:

- **BROADBAND:** type of high speed Internet connection w/ faster throughput. Data transfer speed between 1 to 500 Mbps.
- **DIAL-UP INTERNET:** Internet transmission w/ 56 Mbps.
- **INTERNET SERVICE PROVIDERS (ISPs):** specialized providers.
- Common Wired Broadband Internet Connection Options:
- **CABLE:** cable connections are shared so speed can drop during high-usage periods.
- **DSL (DIGITAL SUBSCRIBER LINE):** Speed drops as distance from the main signal source increases. Twisted-Pair cable splitting in three-lane highway: one for voice data, the two others for sending + receiving data.
- **FIBER-OPTIC SERVICE:** transmits data via light signals, don't degrade over long distances. Bundles of thin plastic or pure glass strands called OPTICAL CABLES, big amount of data transmitted very fast + converted to electrical pulses transmitting data signals to computer.
- **SATELLITE BROADBAND:** mostly used in rural/mountain areas where other connections are unavailable or costly.
- **SATELLITE INTERNET:** satellite dish connected w/ coaxial cable. Satellites connect w/ the company's one by geosynchronous orbit far above earth.

HOME SATELLITE <----->OUTERSPACE SATELLITE<----->COMPANY'S SATELLITE

- **CABLE INTERNET:** Broadband service transmitting data over coaxial cables.
- **CABLE TV:** One-way signal w/ programmed signals for television.

### Wireless Internet Access:

- **MOBILE BROADBAND:** Wireless options are also available such as cellular networks 3G or 4G LTE when Wi-Fi is unavailable.
- Wireless Internet access can easily be found anywhere.
- **NET NEUTRALITY:** All Internet data treated equally = types of user, content, communication mode, etc. = Internet open and free for everyone.
- **MOBILE HOTSPOT:** lets you connect more than one device to Internet but require access to a data plan (you can turn your phone into a hotspot cuz built-in Internet equipment).

### Dial-Up Connections:

- Dial-Up is the less costly way to access Internet (but 600 times slower than fiber-optic), still available in some rural areas. When in use, telephone connection is tied up.

## Planning Your Home Network:

- Routers and Network devices need to be updated every few years to catch with technology improvement and speed of networks.

## Connecting Devices to a Network:

- Most home wireless routers can support up to 253 wireless connections at the same time but that means less bandwidth for every device added (pizza slices example).
- You can add a Switch to Router for more connections.
- Every device providing Internet network (like a Router) has an IP address.

WINDOW  
S:

APPLE:

AirPort

802.11n Extreme

802.11ac Airport  
Express

## Specialized Home Networking Devices:

- **NETWORK-ATTACHED STORAGE (NAS):** specialized devices designed to store + manage all network data = centralization of data.
- NAS are widely marketed for home networks, kinda like specialized external hard drives connected to router or switch = backup.
- **AIRPORT TIME CAPSULE:** Apple wireless router combined w/ hard drive, very similar to Airport Router, also a NAS device.
- **MESH NETWORK:** emerging technology using small radio transmitters instead of routers as nodes. Only one node needs to be connected physically to network connection, others share wirelessly with each other + can be extend almost endlessly = “mesh” of connectivity. Easy to install, accommodate more nodes, can create networks in outdoor and unstructured venues.
- **HOME NETWORK SERVER:** more sophisticated NAS specialized devices designed to store, share, back up files on computers connected to network, all accessing server.
- Home Servers often handle:
  - Automatically back up all computers connected to network.
  - Act as repository for files to be shared across network.
  - Function as access getaway allowing any computer on network to be accessed from remote location via Internet.

- **NETWORK-READY DEVICE (INTERNET-READY DEVICE):** can be connected directly to Internet wired/wireless like game consoles, Blu-ray players, DVRs, smart TVs, etc.
- Home networks can be used to enhance home security w/ like cameras, home gadgets, etc.

### Configuring Software For Your Home Network:

- Steps before configuring Windows 10 Network:
- Making sure network adapter on each node.
- Plug all cables.
- Making sure modem connected to Internet and Router.
- Turn on equipment: first broadband modem, second router, third all computers + peripherals.
- **HOMEGROUP:** Software device making it easier computers on Windows network to share peripherals + information.
- **SMART HOME:** concept where devices + appliances are automated/controlled by apps installed on smartphones/tablets = wireless connectivity. Working w/ schedules, sensors, geolocation settings, etc.
- WeMo, IFTTT = hubs to control everything from your smartphone/tablet.

### Troubleshooting Wireless Network Problems:

- Maximum distance for 802.11n or 802.11ac is about 350 feet, obstacles also decrease throughput.
- **WIRELESS RANGE EXTENDER:** amplifies wireless signal to home parts w/ poor connectivity.
- Three Main Problems Are:
- Range
- Speed (Throughput)
- Range Extender needed.

### Securing Wireless Networks:

- **PIGGYBACKING:** connecting to network without owner's permission = illegal.
- Precautions For Secure Wireless Networks:
- **CHANGE NETWORK NAME (SERVICE SET IDENTIFIER (SSID)):** server gives default name to router.
- **DISABLE SSID BROADCAST:** harder for hacker to detect network.
- **CHANGE DEFAULT PASSWORD ON ROUTER:** change password for something hard to guess.

- **TURN ON SECURITY PROTOCOLS:** use Wired Equivalent Privacy (WEP) or Wi-Fi Protected Access (WPA), both using **ENCRYPTION**, translating data into code. WPA is stronger than WEP.
- **CREATE A PASSPHRASE:** forced to create a security encryption key, a **PASSPHRASE**. It will be required to decrypt (decode) data transmissions.
- **IMPLEMENT MEDIA ACCESS CONTROL (MAC):** each network adapter on network has a unique number (like a serial number) assigned by manufacturer, called a **MEDIA ACCESS CONTROL** address = restricting network to only few MAC.
- **LIMIT YOUR SIGNAL RANGE:** lower signal to home range only.
- **APPLY FIRMWARE UPGRADES:** router has read-only memory w/ software written to it, called **FIRMWARE**. Needs to be upgraded through manufacturer's website when bugs occur.

### Technology in Focus Under the Hood:

- Important to know how to recognize the hardware pieces for a better understanding of technology advancements.

### Electrical Switches:

- Computers understand only two states of existence, on and off.
- **ELECTRICAL SWITCHES:** devices inside computer flipped between 1 and 0, signifying on and off.
- Switches keep being smaller and faster so more data can be stored + manipulated quickly.

### Vacuum Tubes:

- **VACUUM TUBES:** first switches created = created for the first high-speed digital computer, **ELECTRONIC NUMERICAL INTEGRATOR AND COMPUTER (ENIAC)** in 1945, blocking electric current but take a lot of space, energy + easily burned out.
- Two Major Revolution Since:
- Invention of Transistor.
- Fabrication of Integrated Circuits.

### Transistors:

- **TRANSISTORS:** electrical switches built out of layers of material made with **SEMICONDUCTOR**, meaning a electricity conductor or an insulator. Silicon with added chemicals is used for transistors.

### Integrated Circuits:

- **INTEGRATED CIRCUITS (CHIPS):** tiny regions of semiconductor supporting huge amount of transistors, quarter inch size.
- **MICROPROCESSORS:** small chips containing CPU.
- Intel 4004 is the first complete microprocessor invented in 1971.

### Number Systems:

- **NUMBER SYSTEM:** organized plan for representing a number.

### The Base-10 Number System:

- **BASE-10 NUMBER SYSTEM:** also called, **DECIMAL NOTATION** is the system used to represent all numerical values.

### The Base-2 (or Binary) Number System:

- **BINARY NUMBER SYSTEM:** numbering system to the use of 0 and 1 as the two options understood by computer = Base-2.
- **REPRESENTING INTEGERS:** sums of power of 10.
- **HEXADECIMAL NOTATION:** base-16 number system w/ 16 digits.
- **AMERICAN STANDARD CODE FOR INFORMATION INTERCHANGE (ASCII):** standard code for binary code.
- **UNICODE:** representing letters and characters using 16 bits so can express more symbols.
- **FLOATING-POINT SYSTEM:** describing how numbers and fractional parts should be represented in binary number system, using 32-bit system.
- All Data Inside Computer Is Stored as Bits:
- Positive and Negative Integers.
- Decimal.
- Letters and Symbols.
- These number systems exist so computers can store different types of information.

### How the CPU Works: The Machine Cycle:

- **MACHINE CYCLE (PROCESSING CYCLE):** steps to performing tasks asked to the CPU.
- Steps:
- **FETCH:** binary code moved from RAM to CPU.
- **DECODE:** binary code transformed into commands CPU can understand.
- **EXECUTE:** CPU performing work requested.
- **STORE:** results stored in **REGISTERS**, special memory storage built in CPU, which are most expensive + fastest memory in computer.

## The Control Unit and the System Clock:

- **CONTROL UNIT:** manages switches inside CPU, w/ each beat of system clock it moves the switches to the correct on/off settings + performs work of that stage.
- **SYSTEM CLOCK:** internal clock made of special crystal acting like a metronome.
- **CLOCK CYCLE:** pace of process-to-process of computer.
- **CLOCK SPEED:** pace measured in hertz (Hz) like gigahertz (GHz) = how many times something happens per second.

## Machine Cycle Stages:

- **THE FETCH STAGE (STAGE 1):**
  - when launching a program, or its essential parts, it is transferred from hard drive to RAM.
  - RAM is easily accessible for CPU to access data and program instructions.
  - CPU chip's storage area is generally pretty small.
  - **CACHE MEMORY:** CPU doesn't fetch all data from RAM, it goes in cache memory.
  - Modern CPU has different types of Cache Memory:
    - **LEVEL 1 CACHE:** block memory built onto CPU chip to store data + commands that have just been used.
    - **LEVEL 2 CACHE:** located a little further from CPU chip, contains more storage area than level 1.
    - **LEVEL 3 CACHE:** bigger storage can have enough space for some entire programs to be transferred to the CPU for execution.
  - More cache storage = better performance.
- **THE DECODE STAGE (STAGE 2):**
  - Collection of commands, **INSTRUCTION SET**, specific CPU can execute.
  - **ASSEMBLY LANGUAGE:** all commands in an instruction set written in language = easier for human than binary language.
  - CPUs often have similar commands:

CPU INSTRUCTION:	ADD	SUB	MUL	DIV	MOVE	STORE	EQU
FUNCTION:	Add	Subtract	Multiply	Divide	Move data from RAM	Move data to a CPU register	Check if equal

- **MACHINE LANGUAGE:** long strings of binary codes to set up hardware in CPU.

- **THE EXECUTE STAGE (STAGE 3):**
- **ARITHMETIC LOGIC UNIT (ALU):** part of CPU performing math operations.
- **WORD SIZE:** number of bits a computer can work with at the same time.
  
- **THE STORE STAGE (STAGE 4):**
- ALU results stored in registers = entire instruction has been completed.

#### **Making CPUs Even Faster:**

- Processor manufacturers can increase CPU performance in many different ways:
- Using pipelining.
- Designing CPU's instruction set so contains specialized instructions for handling multimedia + graphics.
- Including multiple independent processing paths inside CPU.

#### **Pipelining:**

- **PIPELINING:** technique allowing CPU to work on more than one instruction at same time = boosting performance.
- Requires more transistors + more complicated hardware design.
- **SYSTEM ON A CHIP (SOC):** integrates all computer circuitry into a single chip.

#### **Specialized Multimedia Instructions:**

- **ADVANCED ENCRYPTION STANDARD (AES):** instruction set making CPU deliver faster data protection.

### Multiple Processing Efforts:

- Intel uses multi-core processors in personal computer, like Quadcore by example = four separate parallel processing paths.
- Many high-end servers use complete separate CPU chips on Motherboard.
- Supercomputers have multiple processors making them biggest and most powerful computers.
- **PARALLEL PROCESSING:** large network of computers working on portions of same problem simultaneously.
- CPUs will continue to get smaller and faster in the future so they consume less power + possibility of creating more powerful portable computing devices.

## CHAPTER 9: SECURING YOUR SYSTEM: PROTECTING YOUR DIGITAL DATA AND DEVICES

### Threats to Your Digital Assets:

- **BIOMETRICS AUTHENTICATION:** scanners using finger vein authentication technology to verify your identity + don't leave residue on scanners so can't be duplicated.
- **CYBERCRIME:** any crime perpetrated primarily through the use of a computer.
- Cybercrimes are performed by **CYBERCRIMINALS** and include various types.
- **MESSAGING, MALWARE, AND MOBILE ANTI-ABUSE WORKING GROUP (M3AAWG)** found that half of email users have open a spam at least once.

### Identity Theft:

- **IDENTITY THEFT:** occurs when thief steals personal information.
- Types of Identity Theft Scams:
  - Counterfeiting credit/debit cards.
  - Request address changes.
  - Opening new credit cards/bank accounts + writing bad checks/not paying credit card balances.
  - Obtaining medical services.
  - Buying home with mortgage then reselling house + absconding with the money.
- Methods used by thieves to obtain personal information:
  - Stealing purses/wallets/bags/etc.
  - Stealing mail.
  - Posing as bank/credit company representatives.
  - Installing skimming devices on ATM machines.

### Hacking:

- **HACKER:** commonly defined as anyone who unlawfully breaks into a computer system personal/network.
- Three Types of Hackers:
- **WHITE-HAT HACKERS (ETHICAL HACKERS):** breaking into systems for nonmalicious reasons, such as testing possible security issues.
- **BLACK-HAT HACKERS:** breaking into system to destroy information or illegal gain.
- **GREY-HAT HACKERS:** cross between white and black, breaking into systems to flaunt their expertise to system administrator or to attempt to sell repair services of security breaches.

### Hacking Tools and Attack Types:

- Data that isn't stored in a computer can be captured with a **PACKET ANALYZER (SNIFFER)**, capturing each packet travelling on Internet network, or a **KEYLOGGER**, capturing all keystrokes made on computer.
- Installing a firewall and using data encryption on a wireless network protect from hackers to "sniff" in your personal information.
- **TROJAN HORSE:** program appearing to be useful/desirable but while running it's doing something malicious without user knowing it.
- **BACKDOOR PROGRAM** and **ROOTKITS:** allow hackers to gain access to computer + take almost complete control of it.
- **ZOMBIE:** computer controlled by a hacker w/ backdoor program, often used to launch "Denial-of-service attacks" on other computers.

### Denial-of-Service Attacks (DoS):

- **DISTRIBUTED DENIAL-OF-SERVICE (DDOS):** launching DoS attacks from more than one zombie at the same time.
- **BOTNET:** large group of software programs called robots of bots running simultaneously on zombie computers.

### How Hackers Gain Computer Access:

- **EXPLOIT KITS:** software program running on servers searching for vulnerabilities such as security holes in browsers. Fought by antivirus.
- Hackers can also reach computer with Internet connection = "two ways street".

- **LOGICAL PORTS:** virtual communications gateways/paths allowing computer to organize requests for information like HTTP (logical port 80) by example.
- **GEOTAG:** piece of data attached to photos indicating location of photo.

### Virus Basics:

- **VIRUS:** computer program attaching itself to another computer program (known as “host” program) + attempting to spread to other computers when files exchanged.
- Viruses are threatening because they’re built to evade detection + can spread to phones/tablets/other devices/etc.
- Nb of viruses attacking Apple is on the rise.
- Viruses need human interaction to operate because often hiding in files = need to be opened/executed to infect.
- Steps of Virus’ Spreading:
- Virus Creation.
- Initial Virus Infection.
- Virus spreads to another computer.
- Virus infects connected devices to computer.
- Other computers susceptible to infection.
- Symptoms of infection:
- Existing icons/files suddenly disappear.
- Usual browser displays unusual page or new toolbars.
- Odd messages, pop-ups, images displayed.
- Data files become corrupt.
- Programs stop working properly.
- System shuts down unexpectedly.

### Types of Viruses:

- Six Broad Categories of Viruses:
- **1. BOOT-SECTOR VIRUSES:** replicate itself onto hard drive’s master boot record, often transmitted by flash drive left in USB port.
- **MASTER BOOT RECORD:** program executing whenever computer boots up + ensuring virus will be loaded in memory immediately.
- **2. LOGIC BOMBS & TIME BOMBS:** Logic bomb is a virus triggered when certain logical conditions are met. Time bomb is a virus triggered by passage of time or certain date. Effects range between annoying messages to reformatting hard drive = complete data loss.
- **3. WORMS:** even if called virus, works independently from host file execution + much more active in spreading itself, can even affect routers. Usually generate lots of data traffic = slows down Internet.

- **4. SCRIPT & MACRO VIRUSES:** A Script is a miniprogram executed without user knowing it hidden on websites = malicious script. A Macro virus attaches itself to document using macros.
- **MACRO:** short series of commands usually automating repetitive tasks. Macro languages now so sophisticated that virus can be written in them.
- **5. EMAIL VIRUSES:** use address book in victim's email system to distribute virus.
- **6. ENCRYPTION VIRUSES (RANSOMWARE):** infect computer by running a program searching for common types of data files + compress them using complex encryption key rendering files unusable. Then send message asking to send payment for program to decrypt files = files are in "hostage".

#### **Additional Virus Classifications:**

- Virus can also be classified by methods taken to avoid detection by antivirus software:
- **POLYMORPHIC VIRUS:** changes its own code or periodically rewrites itself + often infect .EXE files.
- **MULTIPARTITE VIRUS:** designed to infect multiple file types in effort to fool antivirus software looking for it.
- **STEALTH VIRUS:** temporarily erases code from files it resides then hides in active memory of computer.

#### **Malware: Adware and Spyware:**

- **MALWARE (GRAYWARE):** software w/ malicious intent = 3 different types: adware, spyware, and viruses.
- **ADWARE:** software displaying sponsored advertisements in section of browser window or pop-up box.
- **SPYWARE:** unwanted piggyback program usually downloading w/ other software installed from Internet + runs in background of system = transmits personal information, habits + tracks cookies.
- Many anti spyware packages are available.
- **KEYSTROKE LOGGER (KEY LOGGER):** spyware program monitoring keystrokes to steal passwords, logging IDs, and credit card information.

#### **Spam:**

- **SPAM:** unwanted/junk mail.
- **SPIM:** unsolicited instant messages.
- **SPAM FILTER:** option that can be selected in email account = catches up to 95% of spam.
- Other Ways To Prevent Spam:
- Read privacy policy of website.
- Don't reply to spam to remove email from spam list.

- Subscribe to email forwarding service such as **VERSAFORWARD** or **SNEAKEMAIL**, screening emails + forwarding only messages designated okay to accept.

### **Cookies:**

- **COOKIES:** small text files some websites automatically store on hard drive when visiting them.
- Cookies enable companies to identify different users' preferences but do not represent security threat.
- Advertisers using cookies = may create feeling of privacy being invaded.
- Possible to periodically delete cookies or block certain types in browser configuration. **POWERFUL COOKIES** can also help monitor cookies.
- American Management Association surveyed that employers monitor emails, web surfing, keystrokes & keyboard time, computer files + check activities using video surveillance = ethical for employers to monitor their employees if they paid for equipment used.
- **CYBERLOAFING:** means using computer for nonwork activities while being paid to do job.
- **MULTISHIRKING:** employees doing multiple nonwork tasks at the same time

### **Social Engineering:**

- **SOCIAL ENGINEERING:** any technique using social skills to generate human interaction enticing individuals to reveal sensitive information, like telephone scams by example because easier to manipulate someone without having to look at them.
- **PRETEXTING:** creating legitimate scenario to make request credible, most common form is called **PHISHING**.
- **PHISHING:** lures Internet user to reveal personal information leading to possible identity theft = usually an email stating to update/confirm an account information.
- **PHARMING:** occurs when malicious code is planted in computer by viruses or malicious websites altering browser's ability to find web addresses = users directed to bogus websites.
- Guidelines to avoid to scamming schemes:
  - Never reply to email asking for personal information.
  - Don't click on email link to website, instead type address in browser.
  - Check w/ company asking for information.
  - Never give information on Internet unless secure website.
  - Use phishing filters.
  - Use Internet security software constantly being updated.

### **Scareware:**

- **SCAREWARE:** type of malware downloading on computer trying to convince user computer infected w/ virus or other type of malware = directing to website selling fake removal antivirus tools providing little or no value. Can also use encryption method to do extortion.
- Scareware is a form of social engineering because using people's fear of viruses to convince them to part w/ money + extremely difficult to remove from computer and interfere w/ operation of legitimate security software.

**Computers in Society: Spear Phishing: The Bane of Data Breaches:**

- **DATA BREACH:** occurs when sensitive/confidential information is copied/transmitted/viewed by an individual not authorized to handle data intentionally or unintentionally.
- Data Breaches are quite common posing serious risks to people w/ data compromised.
- **SPEAR PHISHING:** Targeted attacks to individuals having a relationship w/ company targeted.

**Protecting Your Digital Property:**

- Ways to Keep Hackers and Viruses Away:
- Preventing hackers to access computer.

PORT NUMBER	21	23	25	53	80	443
PROTOCOL USING THE PORT:	FTP (File Transfer Protocol) control	Telnet (Unencrypted Text Communications)	SMTP (Simple Mail Transfer Protocol)	DNS (Domain Name System)	HTTP (Hypertext Transfer Protocol)	HTTPS (HTTP with Transport Layer Security (TLS) encryption)

- Using techniques to prevent virus infections from reaching computer.
- Protecting digital information so can't be accessed.
- Hiding activities from prying eyes.

**Common Logical Ports:**

**Firewalls:**

- **FIREWALL:** software program or hardware device designated to protect computers from hackers. A firewall specially designated for home network is called **PERSONAL FIREWALL** = open/close logical ports.
- Both software and hardware firewall equally good.

### Types of Firewalls:

- Security Suites such as Norton Security, McAfee Security, Trend Micro Internet Security Suite include firewall software + Windows and OS X do too.
- Two firewalls running at the same time can conflict w/ each other and cause computer to slow down or freeze up.
- Many routers sold for home networks include firewall protection allowing to adjust settings to allow access to specific ports if needed.

### How Firewalls Work:

- Firewalls protect in two major ways:
- Blocking access to logical ports.
- Keeping computer's network address secure.
- **PACKET FILTERING:** process where firewalls can be configured to filter out packets sent to specific logical ports.
- **LOGICAL PORT BLOCKING:** process where firewalls can be configured to ignore requests originating from Internet asking to access certain ports.
- **INTERNET PROTOCOL ADDRESS (IP ADDRESS):** every computer connected to Internet has a unique address assigned to router by Internet Service Provider (ISP) but each device on home network has its own.
- **NETWORK ADDRESS TRANSLATION (NAT):** process used by firewalls to assign internal IP addresses on network = can't be detected by hackers.

### Knowing Your Computer is Secure:

- Possible to scan computer's vulnerabilities through website using **SHIELDSUP** and **LEAKTEST** programs = free + easy to run to pinpoint security vulnerabilities of system connected to Internet.

### Preventing Virus Infections:

- Two Main Ways To Protect Computer From Viruses:
- Installing antivirus software.
- Keeping software up to date.

### Antivirus Software:

- **ANTIVIRUS SOFTWARE:** specially designed to detect viruses + protect computer and files from harm.
- Active virus scan should be ran on entire system once a week or can configure software to run scans at times system isn't being used like during the night.
- Main Functions of Antivirus Software:
- **DETECTION:** antivirus software looks for virus signature in files. **VIRUS SIGNATURE** is a portion of virus code that is unique to particular computer virus.
- **STOPPING VIRUS EXECUTION:** if virus signature or suspicious activity detected, stops file and virus execution + notifies user. Virus is placed in secure area in hard drive, this procedure is known as **QUARANTINING**.
- **PREVENTION OF FUTURE INFECTION:** most antivirus software will attempt to prevent infection by **INOCULATION**, meaning recording key attributes of computer files + keeping those statistics in safe place in hard drive.
- Antivirus software is now being created for smartphones.
- Popular Programs are Symantec, Kaspersky, AVG, and McAfee.

#### **Software Updates:**

- **DRIVE-BY DOWNLOAD:** viruses exploiting OS weaknesses to set up attacks from malicious websites downloading harmful software to computer.
- Windows 10 now automatically downloads updates whenever Microsoft makes them available. Mac OS X also has a similar utility to gather updates.

#### **Authentication: Passwords and Biometrics:**

- Password-cracking programs have become more sophisticated = creating secure password is now more important than ever.
- Guidelines To Create Strong Passwords:
- Don't use easily deduced components related to your life.
- Use passwords at least 14 characters long.
- Don't use words found in dictionary.
- Use mix of upper and lowercase letters and symbols.
- Never tell anyone password or write it down to place others might see it.
- Change passwords on regular basis.
- Don't use same password for every account.

#### **CAPTCHA: Keeping Websites Safe from Bots:**

- Bots are used to make tasks easier on Internet but can also be used for malicious or illegal purposes because perform some computing tasks faster than humans.

- **CAPTCHA (COMPLETELY AUTOMATED PUBLIC TURING TEST TO TELL COMPUTERS AND HUMANS APART) PROGRAMS:** used to generate distorted text + require to be typed into a box.
- Possible to use websites to create strong passwords or to check to strength of passwords.
- Windows allow to use picture passwords meaning selecting a picture and draw three gestures on it.

### **Managing Your Passwords:**

- Password-management software remembers all passwords for user, like Microsoft Edge by example using “auto complete”.

### **Biometric Authentication Devices:**

- **BIOMETRIC AUTHENTICATION DEVICE:** device reading unique personal characteristics such as fingerprint or iris pattern to convert it into digital code = high level of security + eliminate possible human error occurring in password protection. Can also use voice authentication or facial recognition systems now widely offered on laptops and smartphones.

### **Anonymous Web Surfing: Hiding from Prying Eyes:**

- Browsers often have privacy tools allowing surfing Internet anonymously.
- **IRONKEY PERSONAL FLASH DRIVES:** provide higher level of surfing privacy when plugged in USB port = Internet history + browser caches will be stored on flash drive instead of computer. Comes with preloaded software designed to shield IP address + password-management tools to store all login information + encrypt it.
- Advantages to use Linux-based OS on public or work computer:
- Reduces chances that drive will become infected by any malware running on computer.
- Virus and hacking attacks are far less likely to happen on Linux than Windows.
- Avoid reading and writing the hard disk of computer.
- **PENDRIVELINUX:** excellent website resource offering many different versions of Linux for download + includes step-by-step instructions on how to install them on flash drive. For Mac, Elementary OS Luna distro of Linux provides close approximation of OS X.
- **VIRTUAL PRIVATE NETWORKS (VPNs):** are secure networks established in public Internet infrastructure using specialized software, servers, and data transmission protocols = sending data on public Internet as if it was a private network.

### **Multi-Factor Authentication: Don't Rely Solely on Passwords:**

- Three Independent Authentication Factors:
- **KNOWLEDGE FACTOR:** something the user knows.

- **POSSESSION FACTOR:** something the user has.
- **INHERENCE FACTOR:** something only the user is.
- **MULTI-FACTOR AUTHENTICATION:** requires two out of the three factors demonstrated before authorization is granted.

### Protecting Your Personal Information:

- Social security number, phone number, date of birth, and street address are four key pieces of information that thieves need to steal identity.

### Backing Up Your Data:

- Data on Computer Faces Three Major Threats:
- Unauthorized Access.
- Tampering.
- Destruction.
- **BACKUPS:** copies of files to replace originals if lost or damaged.
- Two Types of files need backups:
- **PROGRAM FILES:** files to install software.
- **DATA FILES:** files created or purchased.
- Two Main Options To Back Up Files:
- **INCREMENTAL BACKUP (PARTIAL BACKUP):** involves backing up files created or changed since last backup performed.
- **IMAGE BACKUP (SYSTEM BACKUP):** involves all system, application, data files being backed up.
- Three Main Choices for Where To Back Up Files:
- Online (in the Cloud).
- External Hard Drives.
- Network-Attached Storage (NAS) Devices and Home Servers.
- To set up File History, connect external drive to network + use File History utility.
- To do Image Backup, connect external drive to network + use System Image Backup utility.
- For Apple, Time Machine of the OS X simply asks if complete backup is wanted on external drive + does it completely.

### Environmental Factors and Power Surges:

- Computers are delicate devices + can be damaged by adverse effects of abuse or poor environment.
- **POWER SURGE:** electrical current supplied in excess of normal voltage.
- Power Surges can be caused by old or faulty wiring, downed power lines, lightning strikes, or malfunctions at electrical company substations.

- **SURGE PROTECTOR:** device protecting computer against power surges, should be replaced every 2-3 years.
- **WHOLE-HOUSE SURGE PROTECTOR:** protects all electrical devices in the house.

### Preventing and Handling Theft:

- Four Main Security Concerns With Mobile Devices:
- Keeping them from being stolen.
- Keeping data secure in case stolen.
- Finding device if stolen.
- Remotely recovering and wiping off data off stolen device.

### Keep Them Safe: Alarms:

- Motion alarm software is a good, inexpensive theft deterrent.

### Keeping Mobile Device Data Secure:

- Encrypting data on mobile device makes it extremely difficult/impossible for thieves to obtain sensitive data from stolen equipment = transforming data into algorithm using Safe App by example.

### Software Alerts and Data Wipes:

- Theft-tracking devices enable to alert authorities of computer's location if stolen + also exist for smartphones.

### Computer Forensics: How It Works:

- **FORENSIC:** means that something is suitable for use in a court of law.
- **COMPUTER FORENSICS:** involves identifying, extracting, preserving, and documenting computer evidence. It is performed by **COMPUTER FORENSIC SCIENTISTS**, relying on specialized software to collect their evidence.
- **PHASE 1: OBTAINING AND SECURING COMPUTER DEVICES:** implies seizing with great care computer equipment believed by law enforcement officials to contain pertinent evidences w/ a specific warrant allowing to seize evidences.
- **PHASE 2: CATALOGING AND ANALYZING THE DATA:** it is critical to preserve data exactly like it was found + make copy of all computer systems and storage devices collected. Forensic scientists recover and catalogue all files, even deleted ones, using

tools such as **SIFT**, **ENCASE**, and **FTK**. Every step of process is documented because proof might be needed in court about investigation.