

Chapter.1

- ✦ **MULTIMEDIA DEFINED** development, integration, and delivery of any combination of text, graphics, animation, sound or video through a digital processing device.

✦ FORMS OF MULTIMEDIA

1. **Interactive:** User is a participant in the flow of information
 - **Basic interactivity:** Includes menu and button options to access content.
 - **Adaptive or Intellimedia:** Adapt the information flow to the needs or interests of the users.
 - **Immersive:** Draws users into an alternate world.
2. **Non-Interactive**
 - User has no control over the flow of information.
 - User is an observer of information.
 - Developer establishes the sequence of media elements and how they are presented.
 - Examples include: Information kiosks | Digital animations.

VANNEVAR BUSH (1890 - 1974)

- ✦ **Memex |1945** A hypothetical machine to make the work of scientists more effective and efficient in grasping the “growing mountain of research

✦ MEMEX I — FEATURES

- Massive storage capacity.
- Multimedia input devices such as “**vocoder**” and “**cyclops camera**.”
- Automatic mathematical calculations and logical reasoning.
- New method to store and access information by associations.

- ✦ **MEMEX II – 1959** Extended the original proposals of Memex I by considering new technical developments **such as:**

1. Magnetic tape
2. Transistor
3. Digital computer.

✦ MEMEX II — FEATURES

- Professionally maintained associational databases delivered by tape or facsimile.
- Trails would be color-coded to reflect age and reinforced by repetitive use.
- Combined with a digital computer, Bush believed the Memex II could learn from experience and even demonstrate a form of judgment.

ALAN TURING (1912-1954)

- Proposed an abstract machine known as the “Turing Machine.”
- The “machine” was a means of defining an “effective procedure.”
- **The imaginary device had three components:**
 1. An infinitely long tape consisting of single row of squares
 2. A read/write head that moved along the tape one square at a time
 3. A set of instructions.

TURING MACHINES

- **Single Purpose “Turing Machine.”**; Can carry out a specific set of instructions or “effective procedure.”
- **“Universal Turing Machine” (UTM).** Can accept a description of a single purpose machine and imitate its behavior.
 - **Implication of the UTM:** If we can think of a way to do something, the computer can do it.

DOUGLAS ENGELBART

- Proposed practical applications of computers beyond the normal mathematical and sorting functions.
- Developed innovations for human-computer interactivity in the NLS (oNLineSystem). These included:
 1. Mouse
 2. Multiple screen areas for text editing
 3. Email.

THEODORE NELSON Coined terms hypertext and hypermedia.

- **Hypertext:** interactive text linked to other textual information.
- **Hypermedia:** extends interactive linking to other media
- **Initiated Xanadu Project:**
 - A dynamic, expanding, hypertext library available to everyone.
 - Supported collaborative editing, tracking changes, crediting, and rewarding contributors.

Basic components of WWW: 1. Server computer | 2. Client computer | 3. Browser software | 4. HTML scripting language.

Factors influencing the revolution:

1. Technical breakthroughs in hardware and software.
2. Integration of computers with other devices.
3. Digital merger of disparate technologies and industries.
4. Further development of wireless communications & mobile devices.
5. Expansion of creative opportunity.

Chapter.2

CODING DIGITAL INFORMATION

- **Symbols** represent something else. || Organized and understood by a conventional standard.
- **Data** are the givens of experience. || Measurements, facts, observations.
- **Information** is data made useful, interpreted, and applied to produce understanding.

Common code

- **ASCII, a 7 bit code.** 128 letters, numbers, and symbols in English language.
- **ASCII-8, an 8 bit code.** 256 letters, numbers, and symbols in English language.
- **Unicode, a 16 bit code.** Over 65,000 different characters.
- **24-bit color.** Displays the full range a human eye can perceive.
- **16-bit sound.** Plays the full decibel range the human ear can perceive.

DIGITAL FILES A container for binary codes. || **File formats** define how instructions and data are encoded in the file.

- **Sample formats that define data differently:**
 1. Word file format
 2. Acrobat file format
 3. Media player file format.

ALL ABOUT FILES

1. **File size** Measured in units of bytes. | Kilo Bytes, Mega Bytes, Giga Bytes.
2. **File extensions** Series of letters to designate the file format. | .fla, .exe, .rtf, .jpg
3. **File compatibility** Ability to use the file in a different platform of hardware and software.

FILE TYPES

1. **Program files;** Contain executable instructions.
2. **Data files;** Can hold text, images, sounds, video, animation.

DATA FILE COMPATIBILITY

- **Cross-platform compatible files.** Open and use on any computer hardware and software configuration.
- **Files that are native or specialized to the application that created the data file.** Require source application to open the file.

FILE MAINTENANCE Data loss and destruction impacts multimedia project completion.

- **Effective file maintenance involves:** 1. Identification 2. Categorization 3. Preservation

Sampling analyzes a small portion of the analog source and converts it to digital code.

Factors that influence sample quality

- **Sample Resolution.**
 - Number of bits used to represent digital sample.
 - **Quantization** is process of rounding off the value of a sample to the nearest available digital code.
- **Sample Rate.**
 - Number of samples taken in a given unit of time (sounds) or space (images).
 - **Spatial resolution** describes sample rate in image files.

DIGITAL ENCODING

- **Description-based encoding** A detailed representation of the discrete elements that comprise the media.
- **Command-based encoding** A set of instructions the computer follows to produce the digital media.

MEDIA ENCODING COMPARED

Description	Command
Advantages	
Represent natural scenes and sounds.	File sizes are small.
Supports detailed editing.	Scaled without distortion.
Limitations	
Large file sizes.	Not appropriate for detailed photographs and natural sounds.
Lose quality if enlarged.	Requires knowledge of music and vector image creation.

MAJOR TYPES OF COMPRESSION

- **Lossy**
 - Number of bits is reduced and some data is lost.
 - Lossy strategies include MP3 and JPEG compression.
- **Lossless**
 - Efficient encoding reduces file size without loss of original data.
 - Lossless strategies include RLE and GIF compression.

DIGITAL INFORMATION — ADVANTAGES

1. Reproduction without generation decay.
2. Editing and re-editing much easier than with analog media.
3. Integration of media using cut, copy, paste more efficient.
4. Distribution over Internet - nearly everyone can be reached by anyone else.

DIGITAL INFORMATION — CHALLENGES

1. File sizes are large.
2. Digital media is processor intensive.
3. Absence of media standards renders data files incompatible.
4. Some media requires high bandwidth to distribute on networks.
5. Concern for longevity and future accessibility of digital data.

Chapter.3

Component of COMPUTER SYSTEMS integrated set of hardware and software designed to process data and produce a meaningful result. **And the Basic functions: Input | Processing | Storage | Output | Transmission**

TYPES OF COMPUTER SYSTEMS

1. **Supercomputer.** Offers the fastest processing speeds and performs the most complex calculations.
2. **Mainframe computer.** Provides multi-user computing to large organizations for tasks such as managing extensive databases, financial transactions, and communications.
3. **Personal computer.** Provides computing to a single user performing multiple tasks.

COMPUTER PLATFORM

- **Platform is a combination of hardware and operating system.**
Windows/PC platform. & Macintosh platform. & Mobile Computing platform.
- **Cross-platform compatibility.:** Ability of an application to run on different hardware and operating systems.

SYSTEM UNIT: Contains the components used to electronically process and store data.

- **Central Processing Unit. & Primary memory. & Expansion slots. & System board circuitry.**

CENTRAL PROCESSING UNIT (CPU)

- Consists of millions of integrated transistors that execute program instructions and manipulate data.
- **Sets of transistors include:** 1. Control Unit 2. Arithmetic Logic Unit 3. Registers 4. Cache.

CPU AT WORK

- Processing data and instructions is systematically executed in a machine cycle.
- **Four steps in the cycle:** 1. Fetch 2. Decode 3. Execute 4. Store.

CPU FEATURES

1. **Clock speed** Rate the CPU carries out basic instructions. || Measured in megahertz (MHz) or gigahertz (GHz).
2. **Word size** Number of bits the processor can manipulate in one machine cycle.
 - 64-bit processor can execute more data than a 32 bit processor.
3. **Bus width** The width of the electronic pathway that moves data and instructions to the processor.
 - A bus 64 bits wide carries more data than a bus 16 bits wide.
4. **Pipelining** Method to increase processing speed by launching more than one instruction in a single machine cycle.
5. **RISC** Reduced Instruction Set Computer chips eliminate complex embedded microcode.
6. **Multi-processing** Combination of multiple processors to execute instructions simultaneously.

APPROACHES TO Multi-Processing

1. **Multiple processors ;** CPU + graphics co-processor.
2. **Multi-core processors ;** Two or more logic cores on a single CPU chip to execute different tasks.
3. **Parallel processing ;** Linking multiple processors together to operate simultaneously on the same task.

PRIMARY MEMORY: Electronic storage locations for data and instructions directly addressed by the CPU.

- **Random Access Memory (RAM)**
 - o Volatile storage area for operating system, software applications, and user data.
 - o Capacities are measured in megabytes or gigabytes on personal computers.
- **Read Only Memory (ROM)** Non-volatile electronic storage for frequently used instructions such as the computer's boot sequence.

CACHE MEMORY High speed electronic storage to optimize the performance of the CPU.

- **Level 1 or Primary Cache** stores data and instructions on the CPU chip.
- **Level 2** Cache positioned between the CPU and RAM.

SYSTEM BOARD Electronic circuit board at the base of the system unit.

- **Manages flow of electronic bits to:**
 - CPU | RAM | Expansion slots | Video card | Analog - Digital converters | I/O interface ports.

HARDWARE INTERFACE: Point of union between the system board and peripheral devices.

- **Data flows to the system board** in Parallel transmission or Serial transmission.

INTERFACE PORTS Ports are external to the system unit. **And** Peripherals are plugged into the ports.

- **Common ports include:**
- **VGA or SVGA & USB & IEEE 1394 (FireWire) & Thunderbolt & Audio input/output & Network port.**

Thunderbolt advantages:

1. Higher transfer rates
2. Eliminates need for separate video port
3. Increases power to peripheral devices.

PERIPHERAL DEVICES Hardware components to input, output, store data and applications for the processor.

SECONDARY STORAGE Holds data and instructions outside the system unit for long periods of time.

- **Advantages over primary storage:**
 1. Nonvolatile storage
 2. Expandable
 3. Portable
 4. Inexpensive.
- **Five Main Uses**
 1. Saving data during edit process.
 2. Distribute data and applications.
 3. Archive data and applications.
 4. Backup data and applications.
 5. Transport data and applications.

HARD DRIVE PERFORMANCE

- **Storage capacity** | Measured in gigabytes or terabytes.
- **Access time** | Measured in milliseconds, the time to locate data on the platter.
- **Transfer rate** | Measured in bytes, the speed of data transfer from the platter to RAM.

MAGNETIC OPTIONS

- Fixed internal hard drive. -- Portable hard drive. -- Cartridge drive.
- RAID drive. -- Magnetic tape drive.

MAGNETIC STORAGE

- **Benefits** 1. Large storage capacity 2. Fast access to data 3. Economical.
- **Challenges:** 1. Limited durability 2. Easily damaged.

OPTICAL RECORDING

- **Data is organized in:**
 - o **Tracks** — addressing scheme on CD.
 - o **Frame** — physical format of the data.
 - o **Sessions** — single recorded segment on CD.

Compact Disc Formats

- Led to rapid development of drives to accept all CD formats.
- CD-DA (Digital Audio format). | CD-ROM (Read-Only format).
- CD-R (Recordable format). | CD-RW (Re-Writable format).

OPTICAL DRIVE Data is read using:

- **CLV** — Constant Linear Velocity & **CAV** — Constant Angular Velocity.

DIGITAL VERSATILE DISC (DVD) Optical storage that uses:

1. More precise laser light
 2. Multi-layer storage
 3. New video compression methods
 4. Improved error detection and correction.
- **Result.** Higher storage capacity than compact disc

DVD FEATURES

- **MPEG2 compression.** Compresses video at 40:1 ratio without compromising video quality.
- **Improved error detection/correction.** CDs use 33% storage for ECC/EDC (error detection and correction).
- **DVDs reduce this to 13% of the storage.**

DVD FORMATS

- Standards vary by player and data.
- **DVD recordable formats:**
 1. DVD-R: compatible with most players & drives
 2. DVD-RW: playable in many DVD drives and players
 3. DVD-RAM: Removable storage for computers.

SOLID-STATE STORAGE

- **Benefits:**
 1. Lightweight
 2. Small
 3. Low power requirements
 4. More durable than devices with movable parts.
- **Disadvantages:**
 1. More expensive than magnetic
 2. Storage
 3. Limited capacity
 4. Limited life expectancy.

Storage in the Cloud

- **The “cloud”** is a metaphor for a network server generally accessed via the Internet.
- Users maintain accounts to store, maintain, and manage data remotely.
- **Benefits of networked storage include:**
 1. Portability
 2. Ubiquitous access.
- **Challenges include:**
 1. Security and reliability of the server.
 2. Access to data is dependent on the performance of a remote server and network connections.

SECONDARY STORAGE & Future of Digital Data

- **Practical issues surrounding the migration of data to secondary storage include:**
 1. Effective and efficient data management.
 2. Enduring file formats over the years.
 3. Ability to access the data on the storage media
 1. Hardware requirements
 2. Software dependence.
 4. Data longevity.

INPUT DEVICES Capture and transmit data and instructions to the system using for processing and storage.

- **Categories:** 1. Keyboard 2. Pointing devices 3. Scanning devices 4. Image capture 5. Audio capture.
- **Keyboard.** Capture user text and commands.
- **Pointing device.** Relies on graphic interface to click or select the input.
- **Devices include:**
 1. Fingers
 2. Mouse
 3. Pointing stick
 4. Stylus
 5. Touch screens
 6. Touch pads
 7. Trackball.

INPUT DEVICES: SCANNER Captures text or graphics using a light-sensing device called a Charge-Coupled Device (CCD).

- **Types of scanners include:** 1. Flatbed 2. Hand held 3. Sheet fed 4. Slide.
- **Scanner quality depends on:** 1. Spatial resolution 2. Color resolution (bit depth).

SCANNER & OCR Optical Character Recognition is a process that converts printed text into an editable word processed digital file.

DIGITAL CAMERA Benefits include:

1. Instant review of image
2. Re-capture the image if necessary
3. High quality spatial and color resolution.

SOUND CAPTURE: Devices to transform analog waveforms to digital files.

- Microphones ; External vs. internal || CD & Tape players || Digital Recorders.

GRAPHICS TABLET Flat drawing surface for freehand image creation and User draws or traces image with a stylus then enhances the image using software interface.

OUTPUT DEVICES

- Present processed data in a useful form.
- **Devices include:** 1. Screen display 2. Audio speakers 3. Hard copy.

SPEAKER SYSTEMS Speakers or headsets are plugged into the soundboard where digital data is converted to analog waveforms.

- **Sound card circuitry performs four processes:**
 1. Converts digital sound data into analog with DAC. (digital to analog converter)
 2. Records sound in digital form with analog ADC.
 3. Amplifies signal.
 4. Creates digital sounds using a synthesizer.

PRINTERS Two basic printing technologies:

1. **Impact print head makes contact with the paper.** Dot-matrix printer. & Used for multi-part forms and low-cost output requirements.
2. **Nonimpact, print head does not contact paper.** Laser printer & Ink-jet printer & Photo printer.

NON-IMPACT PRINTERS

- ✚ **Ink-jet printer.**
 - Line printer that delivers high quality color.
 - Output quality determined by Printer resolution measured in dots/inch & Paper quality.
- ✚ **Photo printer.**
 - Delivers photo-lab-quality output directly from camera or card.
 - Use inkjet cartridges or dye sublimation process to print image.
- ✚ **Laser printer.**
 - Fuse text and image to paper one page at a time.
 - High quality output resolutions of 600 to 2400 dpi.
 - Deliver high quality color output using cyan, magenta, yellow, and black toner.
- ✚ **Multifunction printer.** Combines printer, scanning, fax, and copier technology in one device.

NETWORKS A collection of computers connected through a communication link to share resources.

- **Two main categories:**
 1. **WAN** Covers wide geographic area using communication lines of an external service provider.
 2. **LAN** Computers and peripherals connected within an organization on privately owned communication lines.

INTERNET A network of networks built on TCP/IP protocols.

- **Common Internet protocols:** 1. eMail — smtp 2. File transfer — ftp 3. Web — http.

NETWORKS

- **Ethernet.** ; Protocol to control flow of data on LAN.
- **WiFi & Bluetooth** ; Mobile computing network standards.

Chapter.4

- **SOFTWARE** A collection of computer programs that govern the operation of a computer.
- **Program:** list of instructions that can be carried out by the computer.
- **Three categories of software:** 1. Operating systems 2. Programming languages 3. Applications.

OPERATING SYSTEM

- **Collection of programs that:**
 - Provides a user interface | Manages computer resources | Executes application programs.
 - **User interface: a means to communicate with the programs and hardware.**
 - Command line interface | Graphical user interface (GUI) | Natural user interface (NUI).
 - **Manages computer resources such as:**
 - Processor | Memory | Peripheral devices | Networks.

MANAGE COMPUTER RESOURCES

- 1) **Manage the processor:** Controls how and when programs are executed.
 - **Control methods:** Single user, single tasking & Single user, multi-tasking
- 2) **Manage memory:** Controls how much memory is accessed and used by application programs.
 - **Virtual memory:** operating system assigns a portion of the hard disk to simulate RAM.
 - **Problem:** access to files in virtual memory is slowed. **Solution:** install more RAM.
- 3) **Control peripherals** : Built-in programs control devices such as monitors, printers, storage drives.

- Additional device drivers can be downloaded or come with the installation CD.
- 4) **Plug and Play** : Operating system senses that a new device is plugged into the system board and immediately responds to "play" the device.
- 5) **Manage access and security of network computers through:**
 - Built in protocols to connect to WANs (TCP/IP) & Built in protocols to connect to LANs (Ethernet)
 - Support for Wi-Fi and Bluetooth connectivity & Network firewall protection.
- 6) **Utility programs:** Tools to optimize operating system functions such as:
 - CD and DVD recording | Screen savers | Speech recognition for basic commands
 - Text editors | Multimedia utilities.
- **Disk management utility**
 - Partition and format drives. | Defragment and detect disk errors.
- 7) **File management:** Operating systems govern storage and retrieval of files.
- **Basic file management includes:** Copy | Delete | Rename | Move.

PROGRAMMING LANGUAGES

Low-Level Languages. Programs are written for a specific computer system.

- **Machine code** — binary code the processor directly executes.
- **Assembly code** — text abbreviations for binary commands.
- Requires a program (assembler) to convert the abbreviations to binary code.

Two methods to convert to machine code:

1. Interpreter converts and executes one line of code at a time.
2. Compiler converts entire program to an executable file.

Approaches to Programming

1. **Procedural approach:** Follows a series of computational steps that focus on a specific result.
- Divides complex tasks into subroutines, functions that can be reused within a single program environment.
2. **Non-procedural:** Maximizes programmer productivity by recycling modules from one program into other applications.

Two Non-procedural options

1. **Object-Oriented languages.** Modular approach reduces time to recode similar object routines.
2. **Visual programming.** Use graphical interface to expedite programming process. And Enables Rapid Application Development.

APPLICATION SOFTWARE **Two main categories for multimedia development.**

1. **Media-specific applications.** Create and edit specific media content.
2. **Authoring applications** Tools to integrate media components and provide a user interface.

MEDIA-SPECIFIC APPLICATIONS

- 1) **Text media applications include:** Word processors | Text editors | Portable document generators.
- 2) **Graphics media applications include:** Paint programs | Draw programs | 3-D imaging applications
- 3) **Sound media;** Sound capture applications. | Synthesized sound applications.
- 4) **Video applications combine:** Source material | Synchronize clips to sound track | Add special effects | Save as a digital video.
- 5) **Animation applications.** Software to create and edit animated sequences. Objects are drawn or imported into the software where they are manipulated in a series of frames.
- 6) **Media utilities.** Add functionality to media-specific applications such as file compression and file conversion.

AUTHORING SOFTWARE

- Programs designed to facilitate the creation of multimedia products.
 - Assemble media elements | Synchronize content | Design user interface | Provide user interactivity.
- Authoring metaphors are:** Card based & Timeline & Icon

Chapter.5

POWERS OF TEXT

- **Multimedia developers value text for:** Universality | Clarity | Efficiency | Powers of abstraction, engagement, and suggestion. The Developers can explore new uses for text in a media-rich environment.

TEXT TRADITION

- **Typeface** is a family of characters sharing a common design.
- **Typefaces are commonly categorized as:** **Serif** | **Sans serif** | **Script** | **Symbols.**
- **Style: appearance of characters such as:** **Bold** & **Italic** & **Underline.**
- **Point size:** measure of type size.
- **Font**
- Complete set of characters of a particular typeface, style, and size.

- **Monospaced fonts:** same width assigned to each character.
- **Proportional fonts:** adjust width based on shape.
- **Case** Upper and lower case.
- **Weight** Line thickness of the typeface. & Arial Black has heavier weight.
- **Kerning** Adjusting spacing between specific letters.
- **Tracking** Adjusting spacing between all characters.
- **Condensed/extended text** Narrow width of text / widen width of text.
- **Leading** Spacing between lines.
- **Alignment & Justification**
- Alignment positions text relative to document's margins.
- Justification adjusts line length to produce straight edges on left and right margins.

FONT TECHNOLOGIES Two techniques for displaying text on computer: **Bitmapped fonts & Outline fonts.**

BITMAPPED FONTS

- **Advantages**
 1. Precise control over letter appearance.
 2. Letters can be edited at pixel level.
- **Disadvantages**
 1. Letters can't be easily scaled.
 2. Requires separate bitmaps for each typeface, style, and point size to be used.
 3. Requires large storage capacities.
 4. Limits flexibility in use of text fonts to those stored on the computer.

OUTLINE FONTS Store a description of the character to be displayed. And Description is a series of commands to create the letter on the computer display.

Outline font technology: Adobe Postscript & TrueType

- **Advantages**
 1. Fonts are easily scaled.
 2. Requires smaller storage capacity.
- **Disadvantages**
 1. Commands can't be edited to create unique characters.
 2. Font families are controlled through license of Postscript and TrueType fonts.

✚ **JAGGIES and TEXT** Text is displayed on a monitor as a pattern of pixels.

✚ **MULTIMEDIA TEXT**

- **Two main forms:**
 1. **Editable:** text produced by word processors or text editors.
 - Easy to alter content.
 - Can search and spell check.
 2. **Graphics:** image of text that can be manipulated to produce a wide range of artistic effects.
 - Make original word picture.
 - Solves problem of installed fonts.
- ✚ **MULTIMEDIA TEXT and SOUND**
 - **Speech recognition:** software analyzes human speech and converts words to editable text.
 - **Speech synthesis:** software analyzes text and reproduces it as spoken words.
- ✚ **TEXT & INTERACTIVITY**
 - Structure consists of: **Nodes || Link anchor || Link markers**
 - **Hypermedia** is an information structure based on linked media.
- ✚ **TEXT FOR THE WWW**
 - **HTML:** hypertext markup language.
 - Contains "tags" used to specify the structure of the document and format the text and media.
 - **HTML limitations:**
 - Limited set of tags to create a page.
 - Difficult to precisely define a page appearance.
 - Some browsers and client computers may present the html page differently from other browsers.
- ✚ **PORTABLE DOCUMENT FORMAT**
 - **Require a reader program to view the file and an application to convert a document to pdf format.**
 1. Adobe Acrobat Reader is a free download.
 2. PDFCreator is a free open source converter.
- ✚ **ADDING TEXT TO MULTIMEDIA APPLICATION**

Several methods to incorporate text in an authoring application.

 1. Direct entry in a text box or text field.
 2. Copy and paste from existing text source.
 3. File import for large text files.
 4. Scan text with OCR application for text that exists only in print media.
- ✚ **GUIDELINES for TEXT in Multimedia Applications**
 - Be selective || Be brief. || Make text readable. || Be consistent. || Be careful | Be respectful.
 - Combine text with other media. || Make text interactive.