1. What is Multimedia?

Multi: means "Many"

Media: "Medium" or means by which information is stored, transmitted, presented.

Multimedia is the technology of combining various content forms (text, audio, graphics, animation, and video) to create, store, transmit, and present content that uses these combination of media elements in an **interactive** or **non-interactive** way.

In today's digital world, multimedia content is recorded and played, displayed, or accessed by digital information content-processing devices, ranging from smartphones, tablets, laptops, personal computers, smart TVs, and game consoles.

2. Types of Multimedia

- **Linear Multimedia:** Users watch or listen in sequence without interaction (movies, TV).
- **Non-linear Multimedia (Interactive):** Users control the flow of information (video games, e-learning).

3. Components and Applications of Multimedia

The multiple modalities of text, audio, images, drawings, animation, video. list of multimedia applications across multiple modalities (means). Here's a categorized explanation of some applications:

1. **Videoconferencing**: technology allows real-time audio and video communication between two or more participants in different locations. Modalities used are audio, video, interactivity. Enables real-time communication among participants in different locations, supporting meetings, online classes, and collaborative work. Example likes Zoom, Microsoft Teams, or Google Meet.

2. **Tele-medicine**: Allows remote diagnosis and treatment of patients using video calls, medical imaging, and sensor data. Modalities used are audio, video, images, text (data transmission). Example are Remote consultations, virtual patient monitoring, and AI-assisted diagnostics.
3. **A web-based video editor**: it is cloud-based tools that enable users to edit, annotate, and publish videos collaboratively. Modalities used are video, audio, text, animation, interactivity. Example are WeVideo, Clipchamp, or Adobe Express Video Editor.
4. **Augmented Reality (AR) Multiplayer Online Games**: Combines real-world environments with virtual objects in real time, allowing multiplayer interaction through GPS-aware devices. Modalities used are video, animation, graphics, interactivity. Example: Pokémon GO**,** Ingress.
5. **Intelligent Camera Systems (Storyboard Assistance):** Smart cameras analyze scenes and suggest optimal next shots. Modalities used are images, video, animation, interactivity. Example is Storyboard AI.
6. **Semantic Image and Video Search**: Uses computer vision and deep learning to identify and retrieve specific visual content from massive databases based on object meaning or context. Modalities used are images, video, text, AI-driven semantics. Like facial recognition databases.
7. **Visual Cues in Videoconferencing**: Tracks participants' gaze direction and attention to improve communication realism and engagement in video meetings. Modalities used are Video, animation, interactivity. Like NVIDIA Broadcast.
8. **Editable and Distributed Multimedia Components:** Provides user control over multimedia components allowing editing, rearranging, or deleting media elements dynamically. Modalities used are text, images, video, graphics, interactivity.

4. Hypermedia, WWW, and Internet

Multimedia, however, is not simply about putting different media together; rather, it focuses more on the **integration** of them so as to enable **rich interaction among them**, and as well between media and human beings.

We may think of a **book as a linear medium**, basically meant to be read from beginning to end. In contrast, a **hypertext system is meant to be read nonlinearly**, by following links that point to other parts of the document, or indeed to other documents. Figure 1 illustrates this familiar idea.

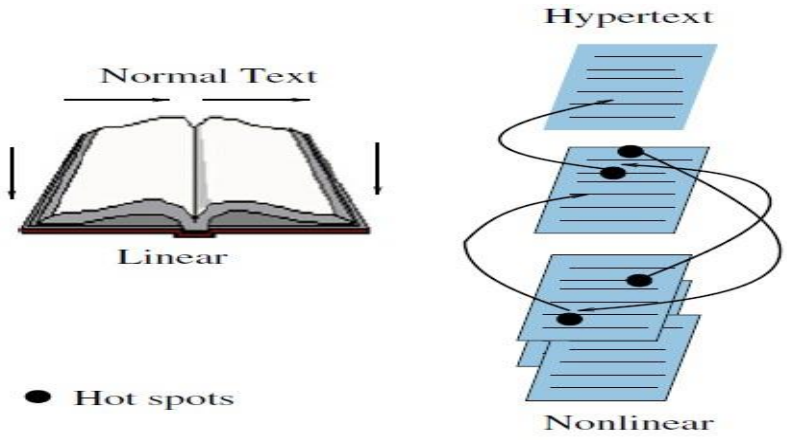


Figure 1: Normal text and Hypertext

1. **On-Line System (NLS)** an early hypertext program to enhance human abilities through computer technology (**1968)**. NLS consisted of such critical ideas as an outline editor for: *idea development, hypertext links, teleconferencing, word processing, and e-mail, and made use of the mouse pointing device, windowing software,* as shown in Figure 2.

Figure 2: On-Line System

2. **Hypermedia** includes a wide array of media, such as graphics, images, and especially the continuous media like sound and video, and links them together. The World Wide Web (**WWW or simply Web**) is the best example of a **hypermedia application**, which is also the largest.

Amazingly, this most predominant networked multimedia applications have its roots in nuclear physics. In **1990**, Tim Berners-Lee proposed the World Wide Web to CERN (European Center for Nuclear Research) as a means for organizing and **sharing their work and experimental results**. With approval from CERN, he started developing a hypertext server, browser, and editor on a NeXTStep workstation. His team invented the **hypertext markup language** (HTML) and the **hypertext transfer protocol** (HTTP) for this purpose, too.

5. A markup language

It is language used to structure, describe, and format text and data within a document. Markup languages are primarily used to control how text is displayed, structured, and processed by computers, web browsers or document processors.

6. Types of Markup Languages:

- **Presentational Markup**: used to describe **how** content should be presented or displayed, like HyperText Markup Language (HTML).
- **Semantic Markup**: describes the **meaning** or **structure** of the content rather than how it should look, like Extensible Markup Language (XML).

7. HyperText Markup Language (HTML)

General markup language (GML) for IBM, is a type of language used to annotate a document's content in a way that distinguishes its structure, format, and meaning. In 1986, the International Organization for Standardization (ISO) released a final version of the **Standard Generalized Markup Language** (SGML), mostly based on the earlier GML. SGML is the foundation of many markup languages, including **HTML and XML**.

HTML is the standard markup language used to create and structure content on the web. It provides the basic building blocks for web pages, allowing developers to define the structure and layout of text, images, videos, links, forms, and other elements within a browser. Since it uses ASCII, it is portable to all different (even binary incompatible) computer hardware, which allows for global exchange of information. As of 2020, the current version is HTML5. HTML uses tags to describe document elements. The **tags** (**fundamental building blocks**) are in the format <token params> to define the start point

of a document element and </token> to define the end of the element. Some elements have only inline parameters and don't require ending tags.

HTML divides the document into a HEAD and a BODY parts as follows:

<HTML> <HEAD> ... </HEAD> <BODY> ... </BODY> </HTML>	<html> <body> My First Heading My first paragraph. </body> </html>

The HEAD describes document definitions, which are parsed before any document rendering is done. These include page title, resource links, and meta-information the author decides to specify. The BODY part describes the document structure and content. Common structure elements are paragraphs, tables, forms, links, item lists, and buttons. A very simple HTML page is as follows:

A sample web page.

</HTML>
<META NAME = "Author" CONTENT = "Cranky Professor">
</HEAD> <BODY>
<P>
We can put any text we like here, since this is a paragraph element.
</P>

</BODY>

</HTML>

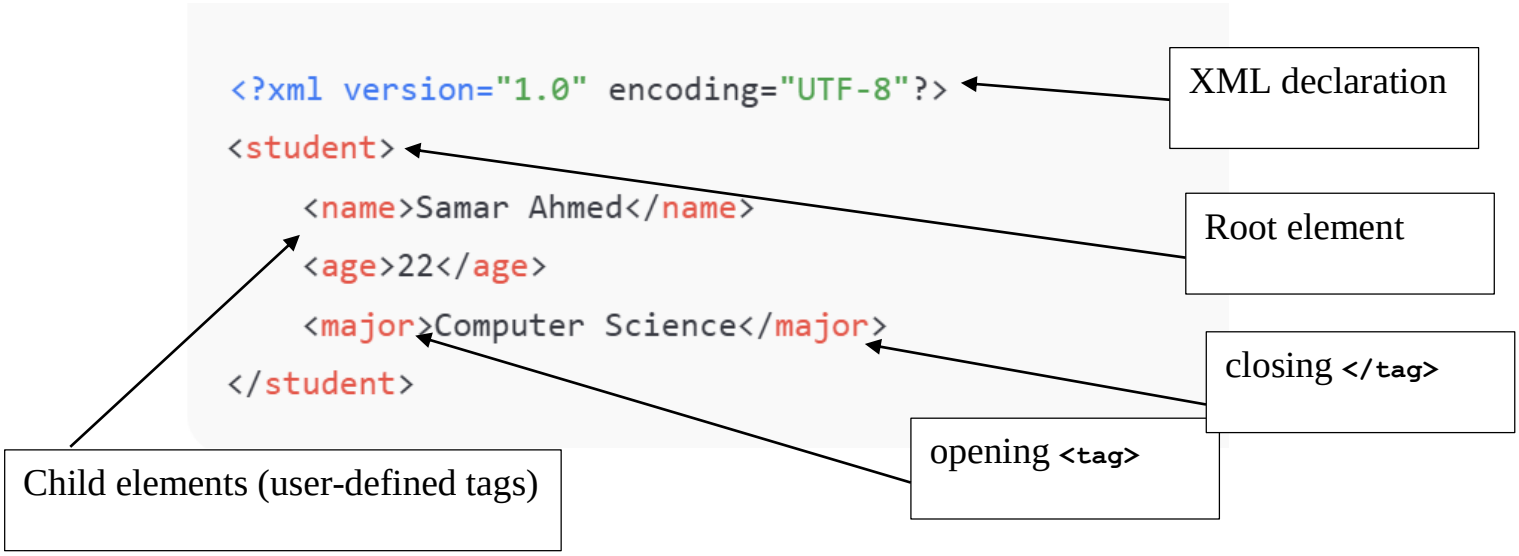
Naturally, HTML has more complex structures and can be mixed with other standards. The standard has evolved to allow integration with script languages, dynamic manipulation of almost all elements and properties after display on the client side (*dynamic HTML*), and modular customization of all rendering parameters using a language called Cascading Style Sheets (CSS).

8. Extensible Markup Language (XML)

It is a flexible, text-based markup language designed to store, organize, and transport data in a format that is both human-readable and machine-readable. It is called "extensible" because users can create their own tags in a hierarchical, it highly adaptable for various applications such as document storage, data exchange, and configuration, unlike fixed tag sets in HTML.

XML's main goal is to separate data from presentation meaning it focuses on what the data is, not how it looks. It is commonly used for data exchange between different systems and platforms (e.g., between applications, databases, and web services).

XML syntax looks like HTML syntax, although it is much stricter. All tags are lowercase, and a tag that has only inline data has to terminate itself, for example, <token params/>. As an **example of an XML document structure**, here is the definition for a small XHTML document:



All XML documents start with "<?xml version="1.0" encoding="UTF-8"?> "is a special tag. Must have a root element enclosing all others and properly nested elements. Every opening tag must have a closing tag. Tags are case-sensitive for example (<Name> ≠ <name>). Based on DTD (Document Type Definition) which is a set of rules that defines the structure, elements, and attributes of an XML document. It tells the XML parser what elements can appear, in what order, and what attributes they can have, ensuring that the XML document is valid and well-formed.

9. Characteristic of XML

- XML is Extensible so the user can define his own tags,
- XML structured cause it follows a hierarchical, tree-like structure.
- Self-descriptive, each piece of data is labeled with meaningful tags.
- Platform-independent, works across different operating systems.
- Text-based: Easy to read, edit, and transmit over the internet.

In addition to XML characteristic, the following XML-related specifications are standardized for handling and manipulating how XML works as a complete data system:

- **XML Protocol**: Used to exchange XML information between processes. It is allowing interposes communications across networks.
- **XML Schema**: A more structured and powerful language for defining XML data types (tags). It defines the structure and rules for an XML document. Unlike a DTD, XML schema uses XML tags for type definitions.
- **XSL** (**Extensible Stylesheet Language**): is used for **transforming and styling XML documents**, having three parts: *XSL Transformations* (XSLT), *XML Path Language* (XPath), and *XSL Formatting Objects*.

10.Difference Between XML and HTML

Feature	XML	HTML
Purpose	Store and transport data	Display data in browsers
Tag Definition	User-defined	Predefined
Error Handling	Strict (must be well-formed)	Flexible
Focus	Content & structure	Presentation & layout