Lecture 8 – Documentation, Hypertext and MHEG

- **Document, Architecture and Multimedia integration;**
- **Hypertext, Hypermedia and Multimedia**
- **Hypermedia System: Architecture, nodes and Pointers;**
- **Document Architecture: SGML and ODA**
- **MHEG**

Introduction

- A Document consists of a set of structural information that can be in different forms of media
- During presentation it can be generated and recorded.
- A document is aimed at the perception of a human and is accessible for computer processing
- A multimedia document is a document which is comprised of information coded in at least one continuous (time dependent) medium and in one discrete (time independent) medium.
- Integration of the different media is given through a close relation between information units.
- This is also called synchronization.
- It is closely related to its environment of tools, data abstractions, basic concepts and document architecture.

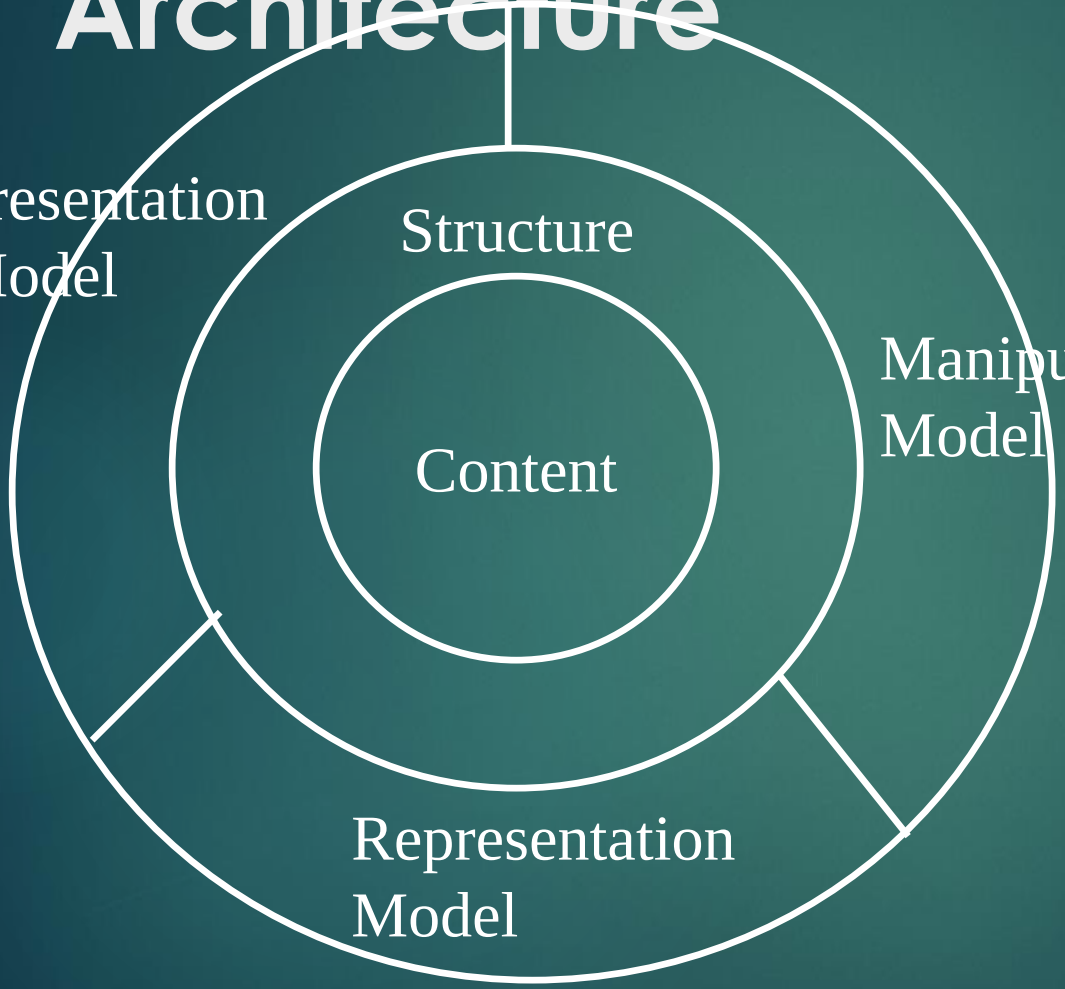
Documents

- Currently continuous and discrete data are processed differently:
  - Text is processed within an editor program as a type of a programming language (namely the type character)
  - A motion picture can be manipulated with the same editor program only through library calls.
- The goal of abstracting multimedia data is to achieve integration all media.
- This reduce the complexity of the program generation and maintenance that process multimedia data.
- Basic system concepts for document processing use multimedia abstractions and also serve as concepts for the information architecture in a documents
- Thus we use the terms document architecture and information architecture interchangeably.

Document Architecture

- Exchanging documents entails exchanging the document content as well as the document structure.
- This requires that both documents have the same document architectures.
- The current standardized architectures are :
  - The Standard Generalized Markup Language (**SGML**) and
  - The Open Document Architecture (**ODA**).
- There are also proprietary document architectures such as
  - DEC's Document Content Architecture (DCA)
  - IBM's Mixed Object Document Content Architecture (MO:DCA)
- Information architectures use their data abstractions and concepts.
- A document architecture describes the connections among the individual elements represented as models

Elements in Document Architecture

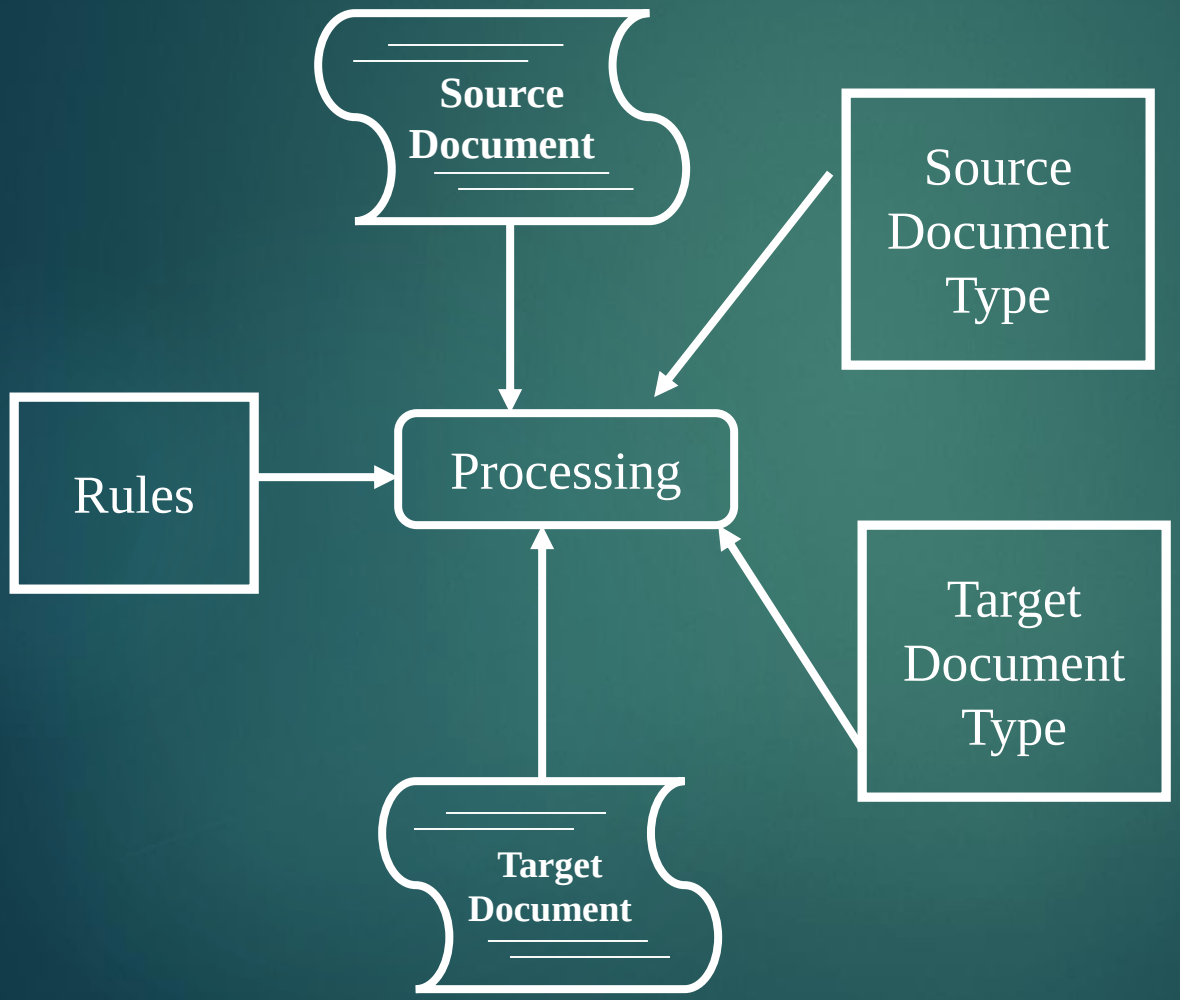


- The manipulation model describes all the operations allowed for creation, change and deletion of multimedia information.
- The representation model defines
  - Protocols for exchanging information between computers
  - Formats for storing data
- Presentation model describes the format for the presentation

Manipulation of Data

- The user becomes most aware of multimedia documents through tools for manipulation of multimedia data, such as editors, desktop publishing programs and other text processing programs
- A document undergoes the process shown in figure next.
- The information included in a document belongs to a certain document type.
  - Eg. Business letter
  - Internal Memorandum
- The same document can belong to other types which mainly influence the final representation.
- The transformation from the actual information to its final representation behaves according to rules specified

Manipulation of Data



- The user becomes most aware of multimedia documents through tools for manipulation of multimedia data.
- Such as editors, desktop publishing programs and other text processing programs
- The document undergoes the process shown aside.
- The information included in a document belongs to a certain document type. Eg. Business letter or internal memorandum

Manipulation of Multimedia Data

- The same document can belong to other types which mainly influence the final representation.
- The transformation from the actual information to its final representation behaves according to rules specified to the document architecture.
- The processing cycles of a traditional document and an interactive multimedia presentation are analogous.
- The document exists in a processable representation.
- The result is a final representation of the document.
- A typical example of this representation is the typesetting language PostScript™.
- The availability of hypertext and multimedia technology have changed the representation of documents although the processing cycle remains same.

Manipulation of Multimedia Data

- The output of interactive hypermedia documents will be mostly computer-supported.
- Therefore, the presentation of a documents will have to be not only final, but also be executable.
- While there are a broad range of processable formats, there are too few final representation formats.
- It has been internationally recognized that such a final representation is very important and, especially in a distributed, heterogeneous system environment.
- This exchange format for interactive multimedia presentation is called MHEG (Multimedia and Hypermedia Information Coding Expert Group)
- Using the main concept of Hypermedia and Hypertext for multimedia documents, SGML, ODA are presented.

Hypertext, Hypermedia and Multimedia

- Communication reproduces knowledge stored in the human brain via several media.
- Documents are one method of transmitting information.
- Reading a document is an act of reconstructing knowledge.
- In an ideal case, knowledge transmission starts with an author and ends with a reconstruction of the same ideas by a reader.
- Information loss is minimal.
- Knowledge must be artificially serialized before the actual exchange.
- Hence it is transformed into a linear document and the structural information is integrated into the actual content.

Hypertext and Hypermedia

- In the case of hypertext and hypermedia, a graphical structure is possible in a document which may simplify the writing and reading process.
- A book or an article on a paper has a given structure and is represented in a sequential form. Although it is possible to read individual paragraphs without reading previous paragraphs, authors mostly assume a sequential reading.
- Therefore many paragraphs refer to previous learning in the document.
- Novels, movies always assume a pure sequential reception.
- Scientific literature can consists of independent chapters, although mostly a sequential reading is assumed.
- Technical documentation consists often a collection of relatively independent information units.

Properties of Hypertext and Hypermedia

- Non Linear Information Chain
  - They have as a major property a non linear information link
  - There exists not only a reading sequence, but also the reader decides on his/her reading path.
  - The reader can start in a lexicon with a notion hypertext, then go through a cross reference to systems and finish with a description of AppleTalk.
  - By this association, through reference links, the author of the information determines the actual links
  - The structure is a tree where the reading path in this linear document is explained verbally and not through the structure.
  - A hypertext structure is a graph, consisting of nodes and edges.
  - The references to other chapters and literature citations are such pointers which build a tree-similar document to a graph.

Non Linear Information Chain cont…

- The nodes are the actual information units.
- They are the text elements, individual graphics, audio or video LDUs.
- The information units are shown at the user interface mostly in their own windows.
- The edges provide links to other information units.
- They are usually called pointers or links.
- A pointer is mostly a directed edge an includes its own information too.

Anchor

- The forward movement in linear sorted documents is called a navigation through the graph.
- At the user interface, the origin of pointer must be marked, so that the user can move to a further information unit.
- This origin of a pointer is called an anchor
- A main factor of the user interface is the concept of the anchor.

How can the anchor be represented properly

- A media-independent representation can happen through the selection of general graphical elements, such as buttons.
- In such an element, information about the destination node should be included.
- If the destination node is a text, a short, descriptive text of the content can be represented.
- In the case of an image, the image content can appear in minimized form on the screen.
- A visual representation of the video content can follow in form of a moving icon (MICON).
- This is a minimized motion picture which represents a characteristical portion of the video sequence of the destination node.
- If the content of the destination node consists of audio information, a visual representation of the audio content must follow.

Anchor cont…

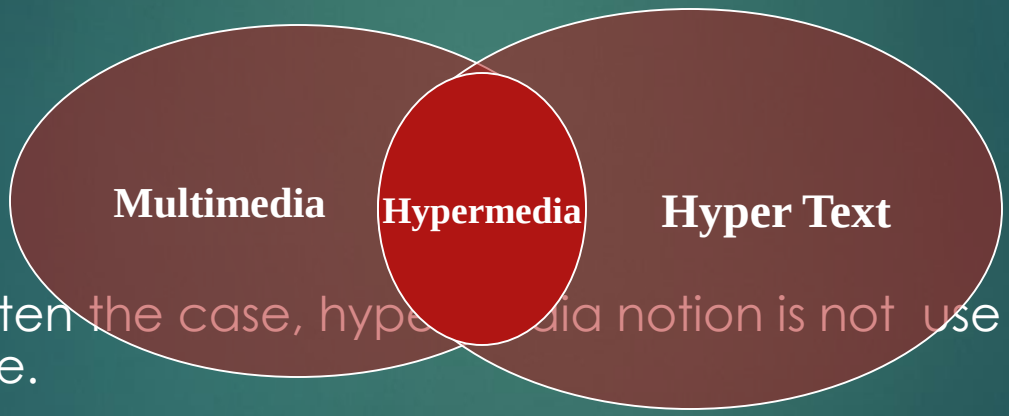
- In a text, individual words, paragraphs or text sections of different length can be used for representation.
- The positioning of the pointer to the marked area and double clicking in this area leads to a display of the destination node, connected with the clicked information.
- In images, specific graphical objects or simply areas are defined as selection objects, a specific marking can occur through a color or stripe.
- In a motion video, media-independent representation of the anchor are preferred.
- There can also be time changing areas used.
- Mostly, no spatial selection occurs and the particular shown image is conclusive.
- A time selection is supported.

Hypertext system

- This system is mainly determined though non-linear links of information.
- Pointers connect the nodes.
- The data of different nodes can be represented with one or several media types.
- In a pure text system, only text parts are connected.
- Hypertext as an information object which includes links to several media.
- Multimedia System
  - It contains information which is coded at least in a continuous and discrete medium

Hypermedia System

- Hypermedia System
  - Includes the non linear information links of hyper text systems and the continuous and discrete media of multimedia systems.



  - In often the case, hype dia notion is not use in its strongest sense.
  - Hypertext and hypermedia are used interchangeably.

Hypermedia System

- A hypermedia system includes the non-linear information links of hypertext systems and the continuous and discrete media of multimedia systems.
- There have been many international conferences covering this area since the late 1980s: Hypertext'87, Hypertext '89 etc.
- There exists a large number of conferences and workshops, in addition to these main international events, at the regional and national levels.

Hypermedia Systems: History

- The history of hypertext goes quite far back, although it has been only recently that hypertext systems came on the market.
- Vannever Bush is the originator of the main hypertext concept, the linked information structure.
- He described the first hypertext system MEMEX (Memory Extender).
- It was never implemented and remained in the paper only.
- He developed this idea in 1932.
- He published the first descriptive article as *We May Think* in 1945.

Hypermedia Systems- History

- Doug Englebart developed a project to augment the human capability Augument at the Stanford Research Institute (SRI) 1962-1976.
- One part of it is NLS(oN Line System), which has hypertext properties.
- NLS served as joint document storage for all created documents during this project.
- All scientists working on this project used it with its possibilities of pointers.
- At the end there were approximately 100,000 entries.

Hypertext System : History

- Ted Nelson used the notion Hypertext for the first time in 1965.
- In his system all information which human beings described at any time, was contained.
- His concepts described the access to local, as well as to remote data.
- It was not implemented with his global information content until now.
- Since the middle of 1960s, work on hypertext systems has been going on at Brown University, Providence, RI.
- In 1967, the *Hypertext Editing System* was developed under the leadership of Andries van Dam.
- This was the first run-able hypertext system.
- It needed 120 Kbyte main memory of a small IBM/360.

Hypermedia System - History

- It was sold and used for the documentation of the Apollo Mission.
- The successor project was FRESS (File Retrieval and Editing SyStem) in 1968.
- Both systems linked documents through pointers, the user interface was implemented through text.
- At Brown University from this time, successful research in the area of hypertext/hypermedia has continued.

Hypermedia System - History

- The *Aspen Movie Map* is the first important hypermedia system which supports continuous media.
- It was developed at the MIT Architecture Machine Group under the intensive cooperation of Andrew Lippman.
- This group was built up later on with other scientists as was known as the MIT Media Lab.
- With this application, a virtual drive through the city Aspen (Colorado) could be followed on the computer screen.
- The user could move in all four geographical directions as he/she desired.
- A joystick served as an input of the direction.
- The technique uses a large set of individual images which were stored on a video stick.

Multimedia System - Concept

- Hypertext systems differ from each other in their fundamental concepts
  - Unspecified systems were not developed for any specific application. They are determined to be used generally for the generation and reading of hypertext documents.
  - Application specific systems were developed for determined usages.

Systems: Architecture, Nodes and Pointers

- Architecture:
- The architecture of a hypertext system can be divided into three layers with different functionalities
  - Presentation Layer
    - At the upper layer all functions connected to the user interface are embedded.
    - Nodes and pointers are mapped to the user interface.
    - At the user interface, one or several parts of the document are visualized.
    - This layer determines which data are presented and how they are presented.
    - This layer takes over control of all inputs.

Systems: Architecture, Nodes and Pointers

- Hypertext Abstract Machine
  - The hypertext abstract machine (HAM) is placed between the presentation and storage layers.
  - It can expect from the underlying layer database functions for storage of multimedia data in a distributed environment.
  - It does not have to consider input and output of the upper layer.
  - HAM knows the structure of the document, it has the knowledge about the pointers and its attributes.
  - The data structure is constructed for the management of the document.
  - This layer has the least system dependency in comparison to the other two layers
  - This is the most suitable layer for standardization.

Systems: Architecture, Nodes and Pointers

- Storage Layer
  - The storage layer is the lowest layer.
  - All functions connected with the storage of data belongs to this layer.
  - The specific properties of the different discrete and continuous media need to be considered.
  - Functionalities from traditional database systems are expected
    - Persistence – data persists through programs and processes
    - Multiuser operations – Synchronizations, locks etc
    - Restoration of data after failure – Transactions
  - The nodes and pointers of a hypertext document are processed as data objects without any special semantics.

Systems: Architecture, Nodes and Pointers

- Unfortunately, in most current implementation, there is no clear division between the different layers.
- The reasons are
  - Shorter development time
  - Efficient implementation
  - Currently an incomplete

Nodes

- A node is an information unit (LDU) in a hypertext document.
- The main classification criterion of different realizations is the maximal stored data amount in one node
  - The maximal stored data amount can be limited and mapped onto the screen size.
  - The metaphor of note card, frame is introduced.
  - A video clip and audio passage could be limited to the duration of 20 sec (eg)
  - An author is forced eventually to distribute logical connected text content to several cards, although not desired.
  - Applying it to the video clips it could link to a close interconnection among the distributed sequences could get lost easily.

Nodes

- Window based systems with an unlimited data amount per node are the alternatives.
- Forward and backward scrolling of pages is offered analogous to other windows at the user interface.
- Intermedia is such a system.
- Here at every node the amount of data, coded as continuous media, is not limited with respect to its duration.
- Therefore, individual nodes can include a very different length although they appear to be equal
- For this problem two solution could be put forwards
  - Either it is switched between the nodes
  - Scrolling is used in one node with the usual mechanisms known window systems.

Pointers

- Pointers are the edges of a hypertext graph.
- Hypertext systems are classified according to different criteria with respect to edges.
- *Which information includes a pointer?*
  - ***Simple pointers*** link two nodes of the graph without containing any further information.
  - They are visible only through the relation between the nodes
  - ***Typed Pointers*** includes further information
  - Each pointer gets label.
  - Though this label, commentaries to the particular label are possible.
- One can use further semantics.

Pointers

- The following relations can be expressed though pointers:
  - *To Be:* Relation
  - *To present* :Demonstration
  - *To influence* : Consequences from a behavior can be described more closely.
  - *To need or to be needed* : This relation expresses a necessity
  - *To own* : Ownership is expressed.
  - *To include* : An inclusion relation is expressed in different meanings.
  - *To be similar* : Similarities can be explained.

Pointers

- *Who is responsible for the pointer?*
  - Implicit Pointers : A relation between nodes can be established automatically by a hypertext system.
    - The author determines the algorithm according to which pointers are created.
    - The system Intermedia automatically generates all pointers.
    - Query references are done automatically using main notions of an entry.
  - Explicit Pointers : The author creates all links
    - A pointer can be created at different times.

Tools

- A hypertext system consists of several necessary tools.
- Editors process information represented in different media.
- The generation, management, editing and deletion of pointers are supported.
- Search tools allow the search of desired information.
- Browser allows a shortened but clear representation of the nodes and edges.
- The nodes are described media dependently
- During navigation through a document, a proper support of the phenomena is needed.

SGML (Standard Generalized Markup Language) Architecture

- The SGML was supported mostly by American publishers.
- Authors prepare the text in a uniform way the title, tables, etc without the description of the actual representation
- The publishers specifies the resulting layout.
- The basic idea is that the author uses tags for marking certain text parts.
- SGML determines the form of tags but it does not specify their locations and meanings.
- User groups agree on the meaning of the tags.
- SGML makes a frame available with which the user specifies the syntax description in an object specific system.

SGML (Standard Generalized Markup Language) Architecture

- Here classes and objects, hierarchies of classes and objects, inheritance and the link to methods can be used by the specifications.
- SGML specifies the syntax but not the semantics

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<title>Multimedia – Technology </titile>
<author>Felix Getou </author>
<side> IBM </side>
<summary> This exceptional paper from
peter……</summary>
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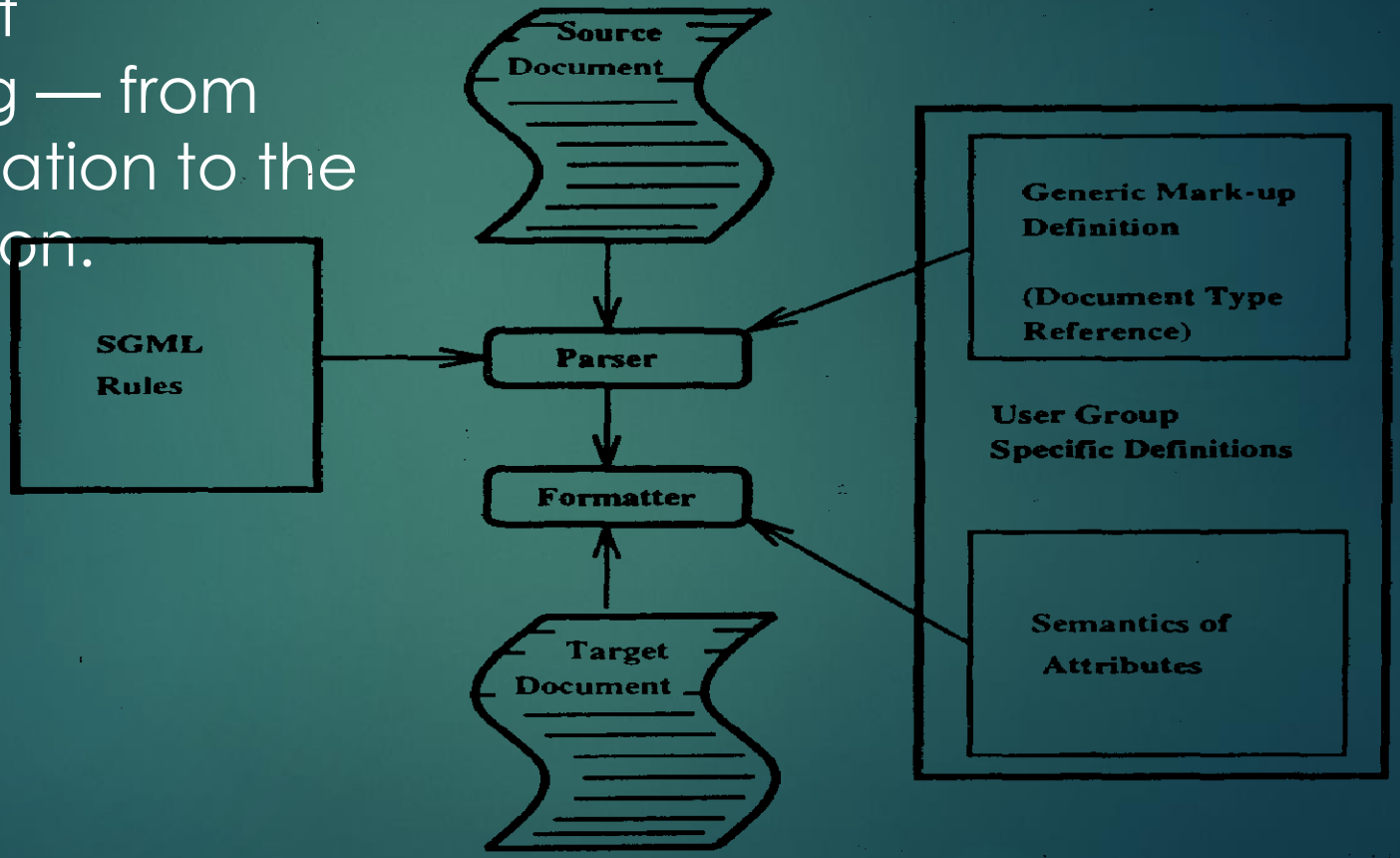
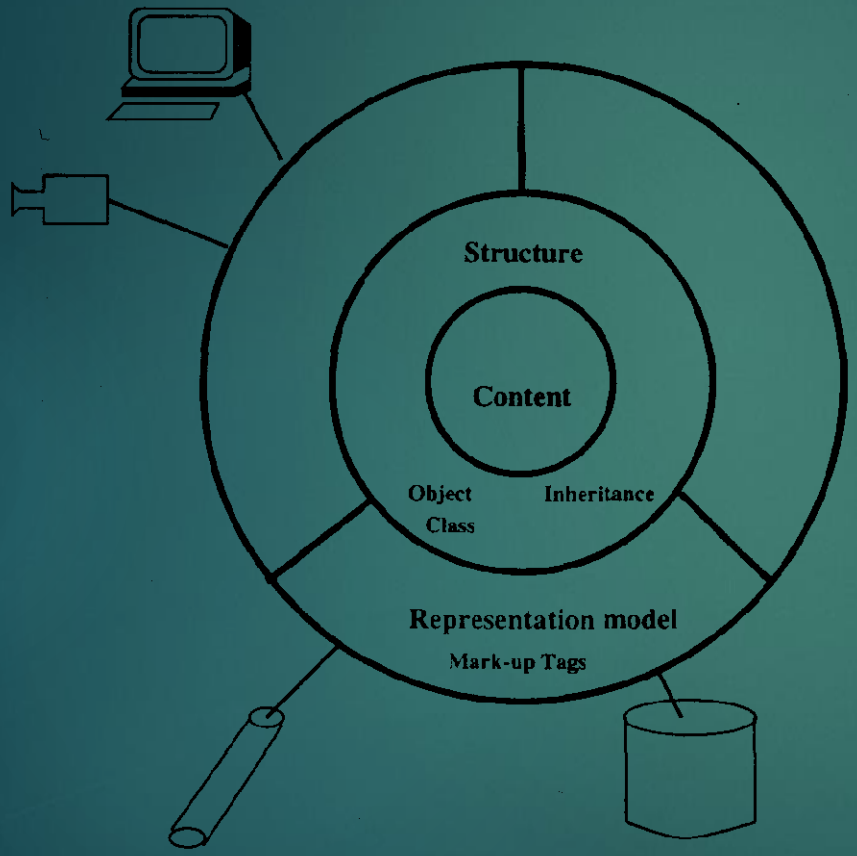
- This example shows an application of SGML in a text document

- Figure : SGML: Document processing — from the information to the presentation.



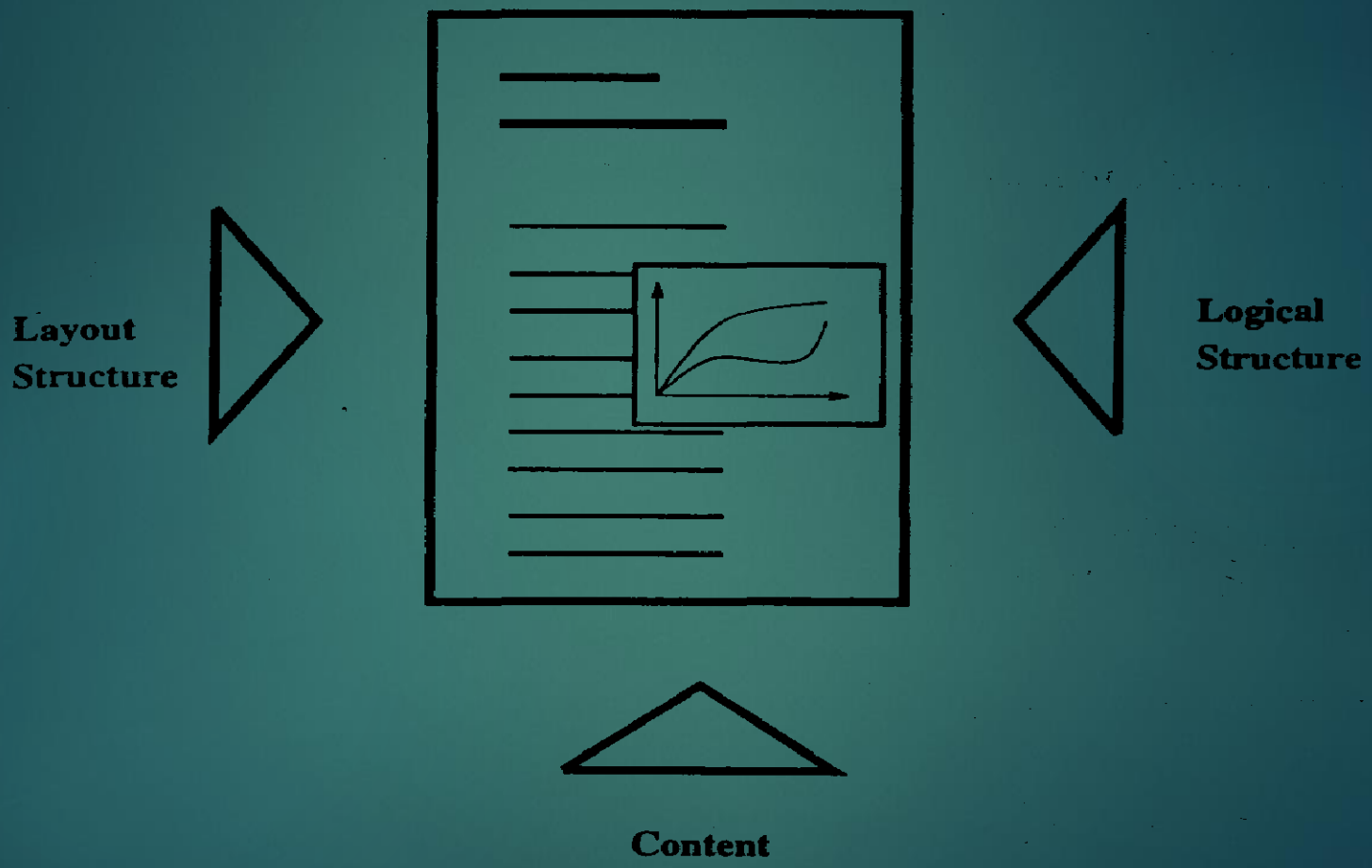


- Figure : SGML: Document architecture — emphasis on the representation model.

Documentation Architecture ODA

- Open Document Architecture (ODA) initially called office Document architecture as it supports mostly office oriented application.
- Main goal is to support the exchange processing an presentation of documents in open system.
- Used mainly by computer industry especially in Europe.

ODA cont…



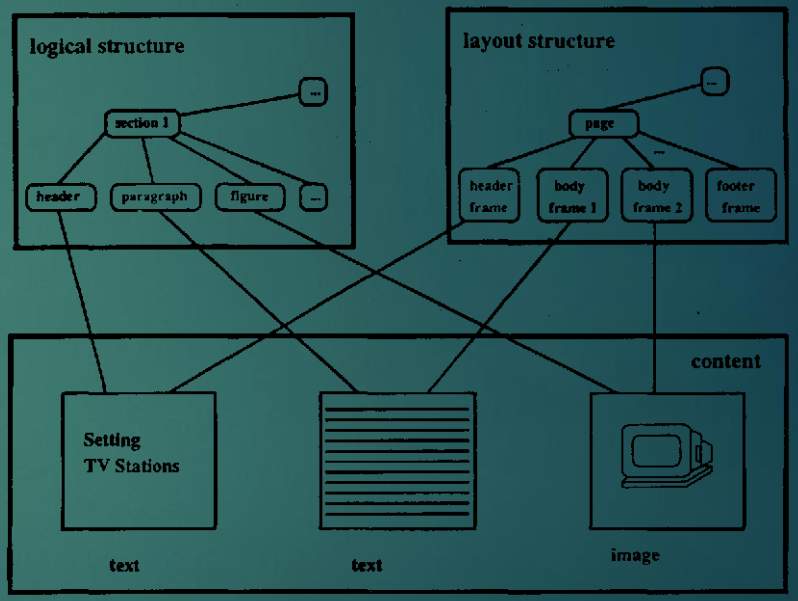
- Figure : ODA: Content, layout and logical view.

Content portions

- It describes for each medium
  1. The specification of the elements
  2. The possible access function.
  3. The data coding.
- LAYOUT STRUCTURE AND LOGICAL STRUCTURE
- Describes the co-operation of information units.
- Layout structure specifies mainly the representation of a documents
- The logical structure includes the partitioning of the content.

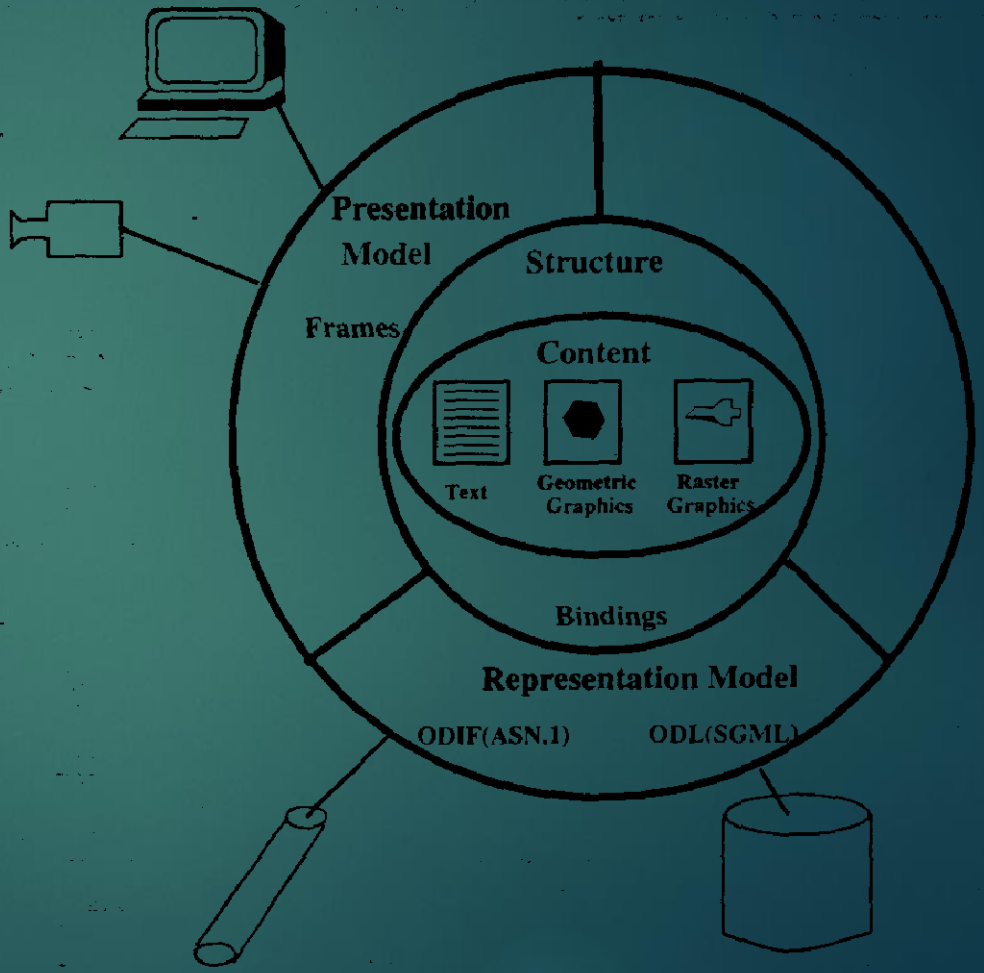
Layout Structure and Logical Structure cont…

- ODA distiinguishes the following layout and logical structures:
  - The generic logical and generic layout structure includes a set of default values
  - The specific logical and specific layout structure describes a concrete document.
- Figure : Relations among content and logical and layout structures



Information Architecture of ODA

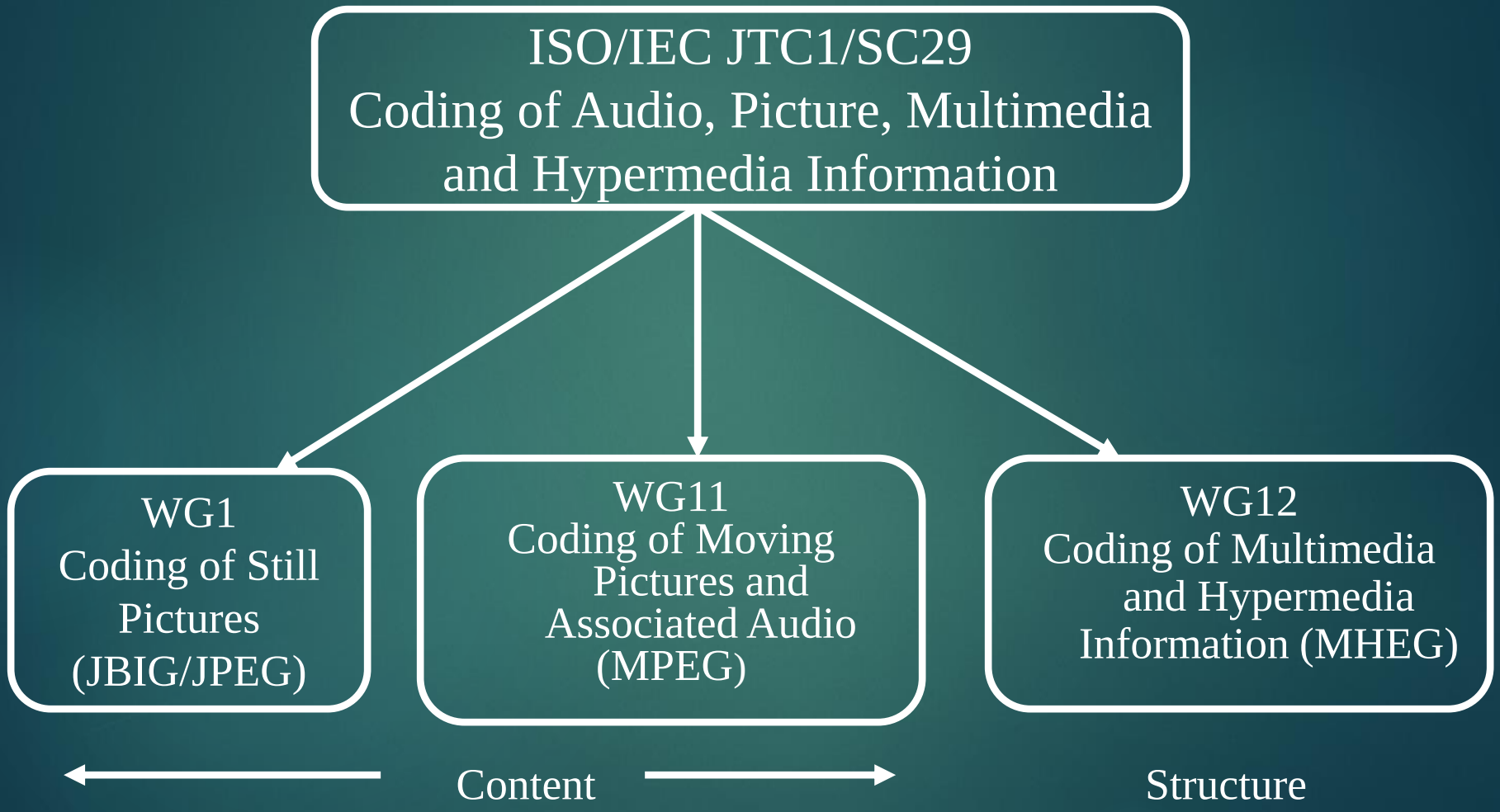
- Figure : ODA information architecture with structure, content, presentation and representation model.



MHEG

- ISO/IEC JTC1/SC29 (Coding of Audio, Picture, Multimedia and Hypermedia Information) works on the standardization of the exchange format for multimedia systems.
- The actual standards are developed at the international level in the three working groups cooperating with research and industry.

MHEG


ISO/IEC JTC1/SC29
Coding of Audio, Picture, Multimedia and Hypermedia Information
WG1
Coding of Still Pictures (JBIG/JPEG)
WG11
Coding of Moving Pictures and Associated Audio (MPEG)
WG12
Coding of Multimedia and Hypermedia Information (MHEG)
Content
Structure

MHEG

- The results of the working groups
  - The Joint Photographic Expert Group (JPEG)
  - The Motion Picture Expert Group (MPEG)
- These are of special importance in the area of multimedia systems.
- The contents in the form of individual information objects are described with the help of the above named standards.
- The structure is specified first through timely spatial relations between the information objects.
- The standard is the subject of the working group WG12.
- This is known as Multimedia and Hypermedia Information Coding Expert Group (MHEG).

MHEG

- The final MPEG standard will be described in three documents.
- The first part will discuss the **concepts and exchange format.**
  - The main concepts are covered in the first document.
- The second part part describes an **alternative of the exchange format.**
- The third part should present a reference architecture for a **linkage to the script language**.
  - The second and third documents are still in progress.

MHEG

- Further discussions about MHEG are based manly on the committee draft version, because
  - All related experiences have been gained on this basis
  - The basic concepts between the final standard and this committee draft remain to be the same
  - The finalization of this standard is still in progress.
- All these discussion is based on designing, implementing and improving the MHEG standard.