

Multimedia Content Management

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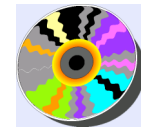
The lecture is partially based on previous lectures of J.W. Schmidt and H.W. Sehring

MMCM

- Prerequisites:
 - ◆ Discrete Mathematics:
 - Set theory, relations, functions
 - Elementary logic
 - ◆ Linear Algebra, Analysis
 - ◆ Elementary Programming Knowledge
 - ◆ Introduction to Databases
- Today:
 - ◆ Organizational Aspects
 - ◆ Introduction, Motivation

IC-Technology for „Multimedia“

- Medium (sing.), media (pl.)
- Distinguish possible meanings:
 - ♦ **Storage medium**
 - a means for storing information (e.g., harddisc, CD)
 - ♦ **Transmission medium:**
 - a means for transmitting information (e.g., fiber optic, coaxial cable)
 - ♦ **Input/output medium**
 - a means for converting information (e.g., loudspeaker, microphone)
 - ♦ **Representation medium**
 - a means for expressing information (e.g., air pressure, light intensity)
- In this lecture:
 - ➔ **Perception medium**
a means (of humans) for perceiving content



Perception Media

- Modalities

- ◆ Seeing (visual): still image, diagram, animation, video



- ◆ Hearing (audio): music, speech, acoustic signals



- ◆ Reading (textual): text



- ◆ Less common :

- Feeling (tactile): braille, force feedback (mostly games)


- Taste, smell: next big wave?

Multimedia: Combination of several Media

- Compound digital artifacts (documents);
- “Multimedia documents”: Parts may be of different media
 - ◆ *Spatial composition*
 - e.g., page layout (text, image, animation)
 - ◆ *Navigation* between documents / pages
 - e.g., hypertext, library
 - ◆ *Synchronization* of time dependent media
 - Time-dependent media: e.g., video, audio, animation
 - e.g., movie: images, sound/voice tracks, and subtitles



Digital Multimedia Documents

- Digital:
 - ◆ Parts of a multimedia document may be of different media 
 - ◆ But all media can be represented and communicated as bits & bytes
- =>
 - ◆ Digital technology allows for uniform storage, processing, transmission, I/O interface, ..
 - Storage: e.g., CD
 - Processing: e.g., PC
 - Transmission: e.g., LAN, Internet
 - Input/Output: e.g., USB



Business Stories: UMTS

- **UMTS**

- ◆ Huge investment by network suppliers
 - in Germany, total of 100 billion DM: DM 1.500 per citizen!
- ◆ Voice and SMS are not enough: bandwidth wants to be used (sold)
 - music on demand, video on demand
 - consuming “canned” media broadcasts
 - may use other output devices than mobile phone (e.g. connected laptop)
 - live video conferencing
 - interactive services: WAP and beyond (MMS, i-mode)
 - hypertext browsing including graphical layout & media content
 - route planning (transmitting maps, evaluation of user location)
 - querying event timetables (transport, culture) and ticketing
 - mobile payment
- ◆ Business: Provide content and services for mobile devices



Business Stories: Napster (1)

- **Napster** – “World’s leading file sharing community”
 - ◆ Millions of users (last year, >200.000 per day)
 - ◆ Users locate and share each other’s media files
 - Searching by file name (only!)
 - Transmission (download) feasible because of
 - Compression (MP3)
 - Increasing internet bandwidth, especially “last mile” (ISDN, DSL)
 - Decreasing online costs for end users (flatrates etc. – or not!)
 - ◆ Users communicate tastes and interests (*rating*)
 - Instant messaging
 - Chat
 - Hotlists

Business Stories: Napster (2)

- Lessons to be learned for Multimedia Content Management
 - ◆ Query: Effective search needs information about content of media files
 - Insufficient: only name and pseudonymous source
 - ◆ Lack of quality assurance is harmful
 - Spammers: publishing bogus content under attractive name
 - Option for QA: Approval (“Rating”) by trusted authority / authorities
 - Quality requirements rise when users have to pay
 - ◆ Transmitting Multimedia requires compression and high bandwidth
 - ◆ Digital Multimedia touches copyright issues
 - Digitalized media can be copied easily (too easily for some)
 - ◆ (Opinions about) multimedia contents build communities

From Multimedia Documents to Content

- An observation:
in documents *content*, *structure*, and *layout* can be separated.

A layouted document:

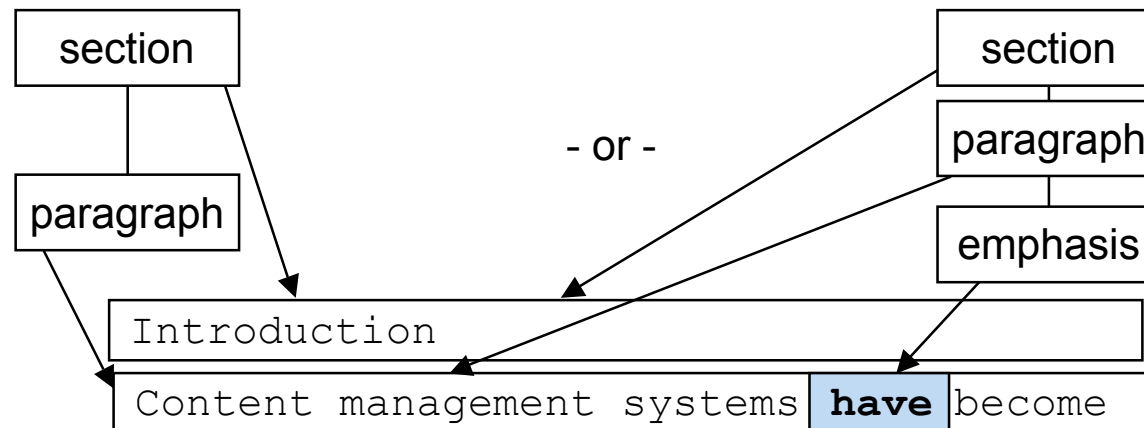
1. Introduction

Content management systems *have* become

Its content:

Introduction
Content management systems have become

Its structure:



Generalization to Non-textual Media

- What is the content of images, movies, sounds, ...?
 - ◆ Perception: pixels, shapes, colors, ...
 - ◆ Cognition: represented entities, meaning, ergonomics, ...
 - ◆ Formalization: feature vectors, waveforms, ...
- What is the structure of images, movies, sounds, ...?
 - ◆ temporal, spatial, logical, ... sequence of contents
 - ◆ structuring depends of the usage of media documents

Generalization to Multimedia

- Different structures are overlaid \Rightarrow multidimensional structure
 - ♦ A movie consists of images in a temporal ordering.
 - ♦ Each image consists of spatially ordered shape, color, ...
- Complex layout:
 - ♦ “Players”: software to display a documents of a certain medium
 - ♦ Integration: documents integrating various media
 - HTML
 - SMIL

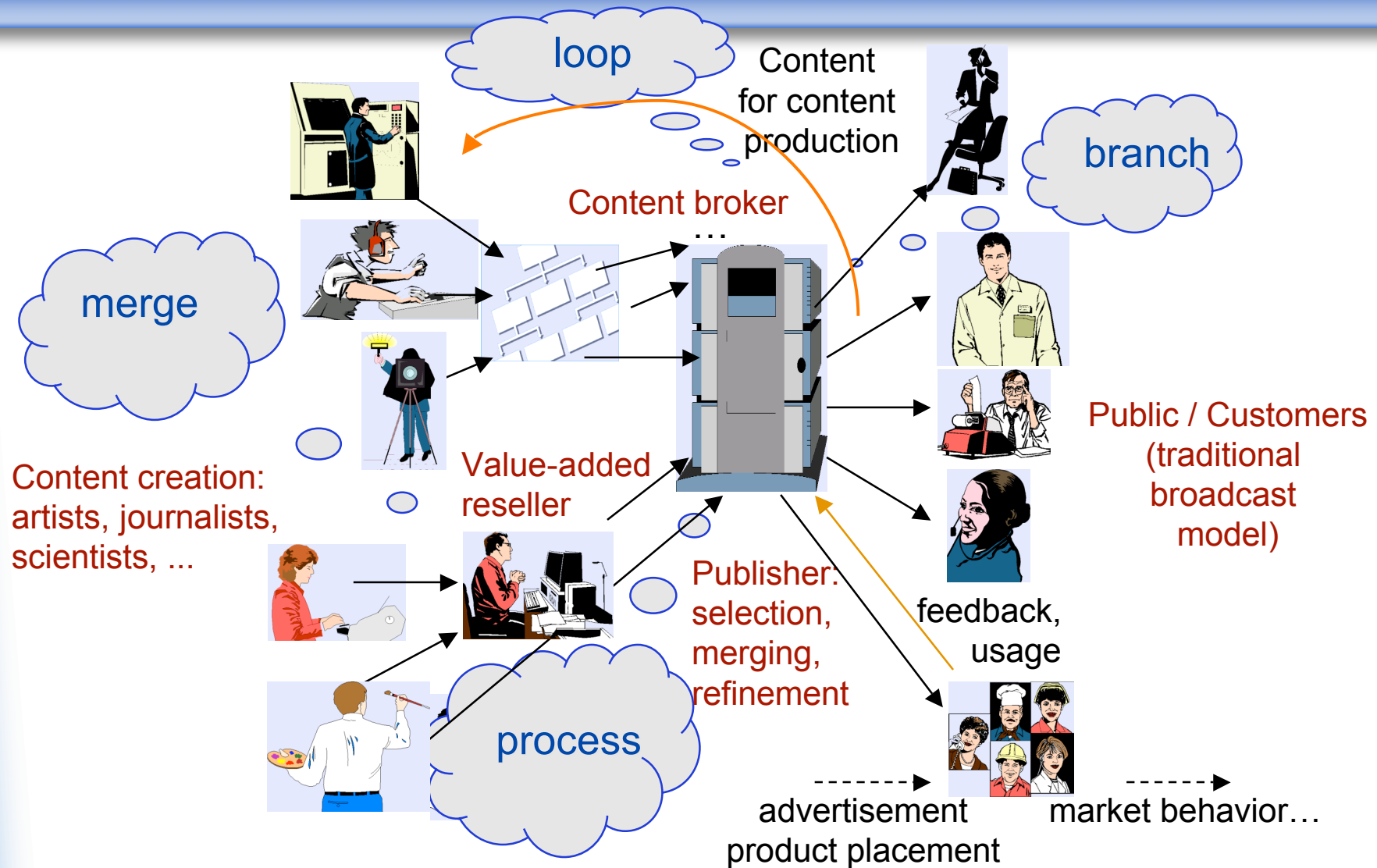
Content Management Requirements

- **Management of large quantities of content**
 - ♦ storage: persistence, retrieval
 - ♦ import / export of content from / to documents, data, ...
- **Management of structures**
 - ♦ based on definitions for *classes* of similar content
 - ♦ sometimes referred to as a content *model*
- **Content editing**
 - ♦ maintaining consistency during concurrent editing activities
 - ♦ rights management
 - ♦ quality assurance (accuracy, actuality, ..., consistency of structure, ...)
- **Publishing of multimedia documents**
 - ♦ cross-media publishing, multimodal access ⇒ repository content automatically laid out
 - ♦ considering preferences of consumers, media technology, presentation devices, ...

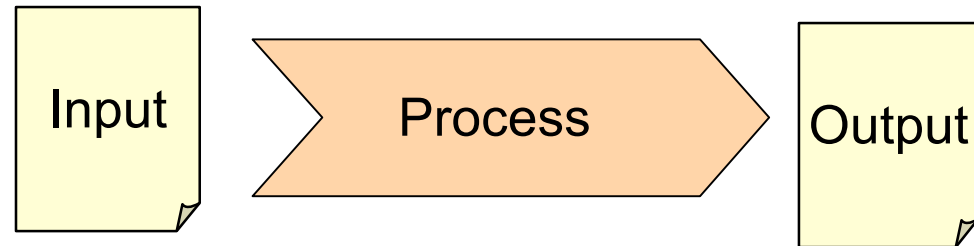
User Created Content

- ◆ Analogy to DTP in the 80s
 - Everybody can do it
 - Everybody did it when it was new
- ◆ New medium: no established social protocols
 - => new players, “just playing” may become serious
- ◆ High number of authors => high number of artifacts
 - Structure and economic exploitation comes “after the fact”
 - Web index (e.g. yahoo), search engines
- ◆ Wide spectrum of quality
 - No guaranteed quality (-> Napster, YouTube)
 - Some excellent products / communities (e.g., SelfHTML)
 - Opportunity for “free speech” – equal audience for (almost) everybody

Content Commerce: The Content Economy



Basic Scheme in the Content Economy



- Basic Scheme:
 - ◆ Content is transformed by a processor.
 - ◆ Transformation can be:
 - Temporal (storage)
 - Spatial (transmission)
 - Qualitative (added value)
 - ...
 - ◆ Processor takes content as input.
 - ◆ Produces content or documents as output.

Patterns of Content Processing

- The process steps can be combined in several ways:
 - ◆ Sequential composition
 - ◆ Parallel processes
 - ◆ Branching
 - ◆ Merging
 - ◆ Loops

Construction of High-Level Services from Basic Processors

- At best, simple services are implemented using the aforementioned basic constructs.
 - ◆ MMDB for storing content
 - ◆ CMS for adding value
 - ◆ Play out servers, shop systems, ... for publication
 - ◆ Rule based engines, recommendation engines, ... for feedback
- From this base, high-level services are constructed through deployment.
 - ➔ Component ware.
 - ➔ This allows to keep single services simple and highly specialized.
 - ➔ At the same time, service providers can assemble the services they are going to offer.

Import from non-digital source

- A non-digital source is digitalized using an appropriate input medium, and the digital multimedia document is imported into the MMCMS.
 - ◆ Optionally, the non-digital source is tagged or described to allow its identification from the MMCMS.
- Since input media are generally not lossless, digitizing may require manual assistance.
 - ◆ The original source will usually be preserved to allow later re-import, or if the digitized document only serves as an icon.

Import from digital MM Production Tool

- A content author has created a new digital (multi)media document. Without interrupting the work process, the author passes the document on to the MMCMS. The document is assumed to be stored entirely within the MMCMS.
- Import may require a transformation into the MMCMS' native format. If this transformation is not lossless, the original may be preserved inside or outside the MMCMS.
- Options, e.g.,:
 - ◆ Save the file on a special network drive
 - ◆ Upload the file through a web form
 - ◆ Upload the file through a MMCMS client application

Import from another MMCMS

- A (multi)media document was exported by another MMCMS (e.g., a content broker or value adder) and is made available in some neutral exchange format. It is to be imported into this MMCMS.
- Specializations:
 - ◆ Who takes the initiative: Pull vs. Push ?
 - ◆ Single action vs. continuous content flow
 - ◆ First import of a document vs. update of a document (may require merging)
 - ◆ Express links between documents from the same source
- Options:
 - ◆ Exchange format (e.g. XML)
 - ◆ Exchange protocol (e.g. W3C-ICE: Information and Content Interchange Protocol)
 - ◆ Connection (e.g. file system, FTP, HTTP)

Importing Compound Documents

- A complex compound document is to be imported into the MMCMS.
- This documents consists of several parts, which may belong to different media, and may be connected through spatial or temporal composition or through navigation links.
- The parts and their connections have to be split up and mapped to the importing MMCMS' content structures. It may be desired to import only part of the structure.

Examples

- Examples:
 - ◆ Scanned page containing diagrams, photos and text (all in one raster graphic)
 - May require manual separation
 - ◆ Web page consisting of multiple objects
 - Objects are already digitally represented and in adequate formats
 - But: Differentiate between layout graphics and graphical content
 - ◆ Book consisting of several chapters, sections, paragraphs, figures etc.
 - Automatic mapping (e.g. through XML/XSL) may be possible

Preprocessing to facilitate later retrieval (1)

- Store metadata, i.e., structured content describing the imported semi-structured content
 - ◆ Import source
 - Use stable ID (e.g. library signature, URL)
 - ◆ Parameters of import transformation (if applicable, e.g. digitizing)
 - ◆ Date of import

Preprocessing to facilitate later retrieval (2)

- (Semi-)Automatically extract description data
 - ◆ Optical Character Recognition – text from raster graphics, for full text search
 - ◆ Key Frame Extraction – still images from video
 - ◆ Speech recognition – text from sound, for full text search (incomplete OK)
 - ◆ Tracing – vector graphics from raster graphics
 - ◆ Thumbnail creation – small raster graphics from graphics
 - ◆ Keywords – significant words from text
 - ◆ Classification – classify text content according to similarity with other texts