Document management

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Why is document management important?

- Because the documents are important.
  - 90% of the information resources of the companies are stored in documents, not in databases. *(Deloitte and Touche)*
- Types of document management systems:
  - Web Content Management System,
  - Enterprise Content Management System (managing company business documents),
  - workflow system,
  - publication system,
  - corporate portal,
  - workgroup system,
  - electronic archive,
  - ...

Document management of yesterday (and today)

- „Traditional” methods of document management:
  - paper workflow (cabinets, binders, office assistants, messengers...),
  - e-mail,
  - floppy disks (ugh!), pen drives, network drives, ...
- Problems (revealing needs):
  - redundancy (the same information duplicated many times) vs. reuse,
  - outdated information,
  - problems with finding the right information,
  - problems with coordinating editorial teams,
  - difficult multimedia publication,
  - no personalization.

Even more problems with documents

- How to manage:
  - large documents?
  - complex documents?
  - valuable documents?
  - long-lasting documents?
  - frequently updated documents?

which are used in:

  - geographically dispersed organisations?
  - large-scale organisations (with numerous employees)?
  - highly specialised organisations?

- The solution:
  - content/document management systems (CMS/DMS),
  - search systems (IA, Information Access),
  - knowledge management systems (KMS) (or their simpler equivalents).

Cheap and effective: versioning systems

- Well known to programmers
- Typical functions:
  - central storage,
  - local copies (synchronized with the repository),
  - locking documents for edition and releasing the lock afterwards,
  - document versioning,
  - possibility of simultaneous edition of documents by many
  - people and merging the changes.
- The most popular:
  - CVS (Concurrent Versions System),
  - SVN (Subversion),
  - GIT.

Wiki-like solutions

- ≈ Web pages which can be edited “by anyone”.
  - should work directly in the browser, without any additional plugins,
  - simplified markup syntax can be used for editing.
- Some representatives: MediaWiki, MoinMoin, TiddlyWiki...

Architecture of a typical CMS

- the repository
  - centralised, neutral pool of resources,
- the application:
  - business logic,
  - workflow (process management),
  - search,
  - presentation/publication,
- user interface:
  - navigation,
  - editing system.

Repository functional requirements

- Repository – of documents:
  - possibility to store any document types,
  - versioning,
  - locking documents to edit:
    - pessimistic – conflicts are avoided at any cost, the document is locked immediately after it has been open to edit,
    - optimistic – conflicts are not frequent, so just the modification can be protected,
  - XML-enabled,
- – of metadata (information about the document – its authors, publication dates, version numbers...):
  - metadata usually stored outside documents – need of synchronization,
  - most likely: possibility of arbitrary metadata configuration (names, types, labels, display properties, ...)
  - sometimes: structured metadata (lists, hierarchies).

Workflow (or process)

- It’s all about “the automation of business processes which involves passing documents, information or tasks between employees according to predefined management procedures”. *Workflow Management Coalition, www.wfmc.org*
- Two methods:
  - the process is being steered by people,
  - the process is triggering actions.
- Setting up the process involves at least definition of:
  - subsequent work phases of the document (workflow states),
  - allowed transitions between states,
  - roles of users authorized to perform actions on the document in a given state.

Two main approaches to document management

- **Content management**:
  - all resources are available for (authorized) users
  - the user can decide which resources he/she uses
  - typical methods of access: navigation, search
- **Process management**:
  - strictly defined roles and competences
  - the user is executing tasks assigned by the system
  - the system passes the document to subsequent users
  - typical method of access: a task list

Variants of CMS/DMS

depending on actual needs...

- Document repository
  - storage and access, often also: versioning and history tracking, access control, metadata, search,
- Office document management (in a company or public institution)
  - tracking status of documents, status changes have formal consequences, access privileges depends on the status
  - often digital documents represent their physical counterparts
- Electronic archive
  - safeness and durability of stored documents is crucial
  - no change allowed, eventually we'll get another version to store
  - sole electronic documents or digitalised forms of something physical
    - different data formats

Variants of CMS/DMS – ctnd.

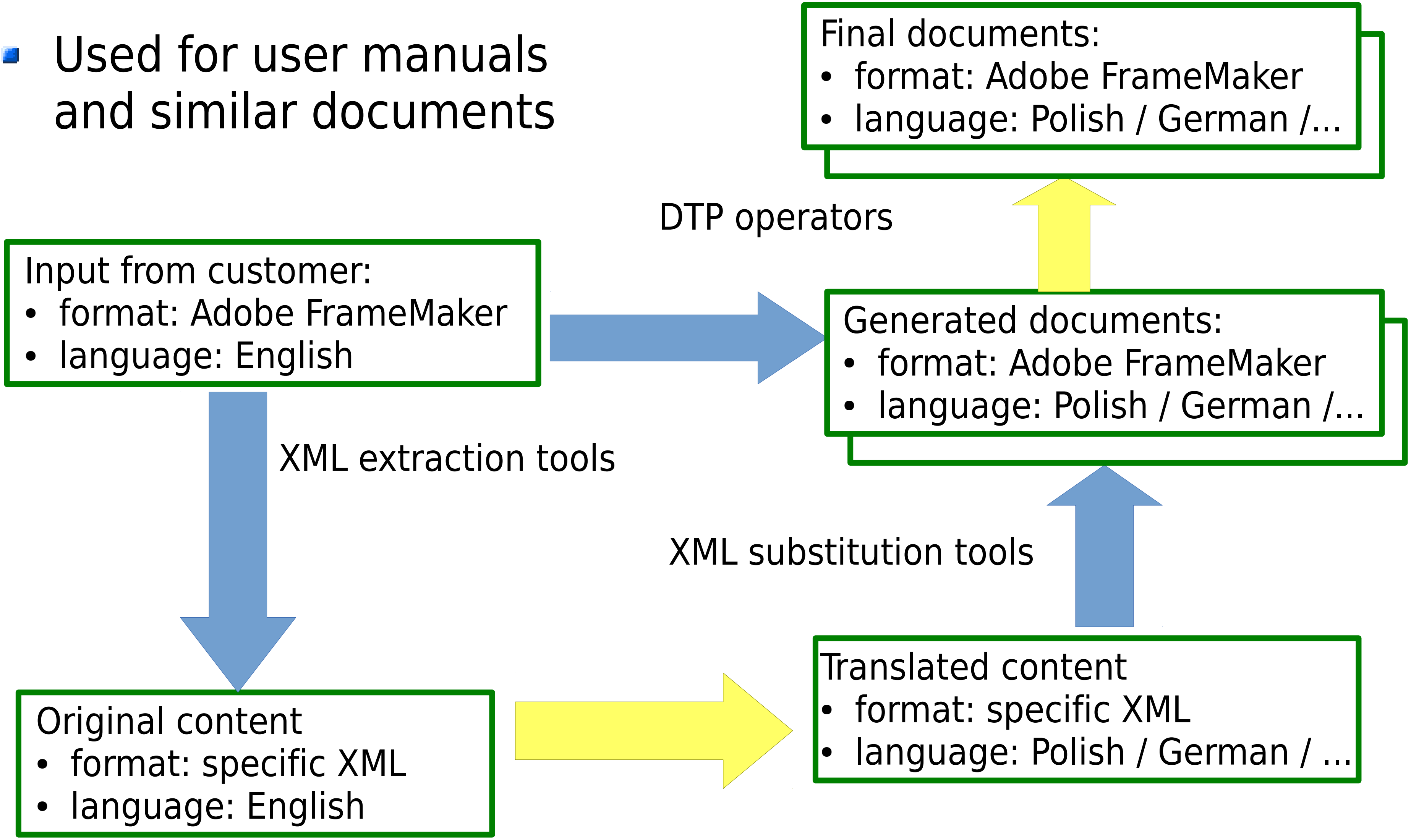
- Publishing system
  - the aim of processing a document is to publish it
    - more presentation/publication-related metadata
  - expected feature – publication tools
    - not so obvious in fact: different means of publication; sometimes we might not want to focus on a single publication, but rather to develop a universal content (knowledge) base
  - content may be shared among documents; rich relations between documents or content fragments
  - advanced content management issues: content variants, etc.
- Web content management
- Universal system
  - flexible, configurable in a high degree
  - more costly in deployment
- Specific system built on demand

Publication

- Should document managament system be at the same time the publication system (should contain the publication module)?
  - + it is the publication what we do it for!
  - + storing useful information coming from the typesetting system (e.g. where page breaks appeared) outside CMS does not make sense!
  - − the repository is independent and publication should be maintained by a specialized engine,
  - − document management processes should not depend on the shape of any future publication.

Real use case – translation workflow

- Used for user manuals and similar documents



Final documents:
- format: Adobe FrameMaker
- language: Polish / German /...

DTP operators

Input from customer:
- format: Adobe FrameMaker
- language: English

Generated documents:
- format: Adobe FrameMaker
- language: Polish / German /...

XML extraction tools

XML substitution tools

Original content
- format: specific XML
- language: English

Translated content
- format: specific XML
- language: Polish / German / ...

Translators translate single paragraphs, descriptions, etc. one by one

Office document management

- To facilitate receiving (registering), internal and external distribution of documents.
- Specific issues:
  - the process is subject to internal regulations – detailed
  - description of formal procedures,
  - classification of documents according to subject index,
- IT involved in either way:
  - traditional paper document circulation supported by a system
    - storing document metadata: documents identified with bar codes, RFID, ...
    - the system stores information on paper document storage (bookcase/shelf),
- electronic document management:
  - documents are created in electronic form,
  - paper documents are scanned (sometimes even OCR-ed) and saved in the system.

Document archive

- Specific issues:
  - the process conforming to the detailed archiving guidelines,
  - documents added according to the received register,
  - classification of documents according to subject index,
  - archiving categories:
    - A – document with permanent value, to be preserved
    - in the state archive,
    - Bn – document with temporary practical value, stored in the archive for n years (e.g. B50 – 50 years),
    - BEn – document is subject to expert evaluation after n years.
  - library of the archived resources,
  - controlled deletion of documents without any value (to the archive).

Use case: The Presidential Archive

- The system for managing archive resources from 1952 until present.
- Main archive contents:
  - 3 km of paper documents,
  - picture archive,
  - audio/video content (hundreds of hours of recordings).
- Solution:
  - customized system (basing on existing components),
  - dedicated GUI.

Links

- A general link is any type of relation between documents and their content (links = hyperlinks).
- Link types:
  - OO: between documents (treated as a whole),
  - CO: from content to the document (hyperlinks, subdocument inclusion),
  - CC: between content fragments (hyperlinks, version/variant management),
  - uni- or bidirectional,
  - with two or more ends (anchors),
  - described with metadata.
- Link storage options:
  - full link information in the document,
  - identifiers in the document, link information in the database,
  - full information in the database (with paths to document fragments).

Version management

- Purpose: possibility to return to some previous version of the document.
- Multilevel versioning:
  - revisions created automatically at document save:
    - every time,
    - at the release of the lock,
  - **releases** created on demand:
    - at any (crucial) moment of the document life,
    - at publication – to “freeze” all document components.
- Important: not just documents, but also:
  - metadata,
  - links,
  - ...

Variant management

- Variants are documents “differing slightly” and most likely semantically related.
- Two examples:
  - amendments of legal documents,
  - documentation of subsequent versions of some appliance.
- The main idea: avoiding redundancy of document parts common to all variants.

Content variants: an example

- Until 31 December 2010:

```
...
<article nr="212">
Book prices are not
subject to VAT.</article>
...
```

- After 1 January 2011:

```
<article nr="212">
Book prices are taxed at
a rate of 5% VAT.</article>
```

- In the document we insert:

```
<variant id="a3819"/>
```

- In a “versions database” we have:

```
<article nr="212" until="2010-12-31">
  Book prices are not
  subject to VAT.</article>
<article nr="212" from="2011-01-01">
  Book prices are taxed
  at a rate of 5% VAT.</article>
```

Enterprise search

- Enterprise search is not about searching the Web (i.e. “Google syntax”) or database search, but about indexing, querying and presenting of company documents to authorized users.
- Motto: search engine is the most important component of the document management system.
- Differences, compared with Internet search:
  - limited scope (usually intranet, familiar access rights etc., ...)
  - possibility to build on company standards (e.g. set of common metadata),
  - document ranking not that important,
  - need for searching various sources, various formats,
  - better relevance of the result list,
  - no garbage!

Search process

- User’s point of view:
  - target: „find me the best answer for a given question”,
  - enter the query,
  - wait for result list.
- System’s point of view:
  - analyze the query,
  - get access to data,
  - analyze data,
  - create the result list, apply user permissions,
  - order results,
  - present the list to the user.

But what is really happening when we search?

- Naive idea:
  - browse documents one by one,
  - if a document contains the element user was searching for
  - (metadata, word, phrase, pattern) – inform the user,
  - if results are to be sorted, collect them in some temporary
  - data structure and display only the matching ones after
  - checking all documents.
- Works for 100 documents. But what for 100,000?
  - Huge amounts of data cannot be searched effectively without indexing the content first.
  - Index is a data structure comparable to what we can find in (good) books, optimized for search and typically containing information:
    - on occurrence of a word in a document,
    - usually also about the exact place where it occurred.

Index properties

Important issues:

- the index must be up-to-date since it is a primary source of information returned to the user,
- frequency and method of synchronization of the index with indexed documents depends on application and technical constraints:
  - when incremental update is not feasible, the whole index must be rebuilt,
  - when systematic update is not possible, cyclical update must be performed,
- the process of indexing can generate additional data useful for result display (e.g. document summaries).

More search issues

- Tokenization
  - split text to words, but sometimes tokens should be shorter then words
    - dziesięciozłotowy
- Stopwords
  - typical approach: they are not important and may be not indexed
  - but sometimes... "this or that"
- Inflected words
  - The problem is not trivial, especially in Polish:
    „Dudek, obciąć pensję” vs. „Real obetnie pensję Dudkowi”.
- Spelling hints

Sorting the results

- What does it mean that the documents “matches” the query?
- The place of the result on the list results from many parameters – sometimes not very obvious:
  - occurrence of a word from the query in a document (appeared
  - in the lead = very important),
  - occurrence of a word in metadata, link texts (PageRank),
  - any advance on that?
  - ...
- Most popular model for representing documents and queries:
  - vector space made by all indexed words (each making a separate dimension).

Dialog-controlled search

- When some important search criteria (to be assigned to metadata/attributes in the model) are missing from the query and number of results is high, the system can automatically generate some additional questions to the user.
- The site of a used car dealer’s:
  - car make – Audi, Fiat, ...
  - model – make-dependent: A4, A6, A8, TT, ...
  - production year, price, mileage, colour, ...
- A query: Audi for less than 10,000 EUR.
- System help: a form showing additional criteria basing on indexed documents:
  - which model? A4, A6, A8? (no TT at that price),
  - which year?
  - which mileage? less than 100K, 100K-200K, over 200K?

Search user interface

Tips and tricks from designer’s notebook (M.O.):

- keep it simple, stupid:
  - no sophisticated help system can fight the intuition of user who would like “to start searching immediately”,
  - graphical design is worth investing in,
  - usability tests are more than necessary (for search form and result list).
- everyone should be happy:
  - most queries are no longer than 3 words and only 5% uses operators,
  - but: advanced users can need more, so “advanced search” is still needed.

More designer’s notebook hints

- metadata:
  - use the most important ones (e.g. document type/format) even in the simplest search form,
  - don’t overload the single result with metadata.
- result list:
  - add header information: terms which were searched for, number of results, spelling hints etc.,
  - limit the basic layout to most important metadata,
  - show document sizes (to alert users to large documents);
  - if multimedia content is found, add some visual player,
  - show the search context with query terms highlighted to make it clear why a certain result was retrieved,
  - use sorting, paging, grouping, filtering results.

More designer’s notebook hints

- less means more:
  - present data from different perspectives right on the first page by categorizing them,
  - allow search in returned results,
  - use tabs and filters to group the results,
  - maintaining taxonomies is costly, but having them is
  - appreciated by users,
- be careful about bells and whistles:
  - a hyperbolic tree is good for a demo, but does it really help in daily work?
  - one new component showing unobvious relations between data (an interesting metadata filter, context links etc.) will always pay for itself,
  - forget the grumblers – user must learn to use the new
  - interface — even the best-tested and most intuitive one.

Search performance and scalability

Two basic methods of dealing with extensive usage of a computer system:

- parallelizing installations,
- modularizing the system (e.g. separating index update from result retrieval, splitting the index into parts).

Note:

- 100% availability of a system is not possible in practice and improving it 10 times (e.g. from 99% to 99,9%) generates 10 times higher costs,
- a ratio of costs of improving availability to losses related to keeping it untouched should be always considered.
- Another important rule: avoid reacting to unrealistic threats.

Search and security

Two methods of controlling search result display:

- indexing content with access permissions (early binding) which automatically excludes protected documents from the result list,
- verification of permissions at resource access (late binding):
  - showing all documents on the list, checking permissions at access,
  - removing restricted documents from the result list even before displaying it,
  - or both!