An Ontology-Driven Management of Change

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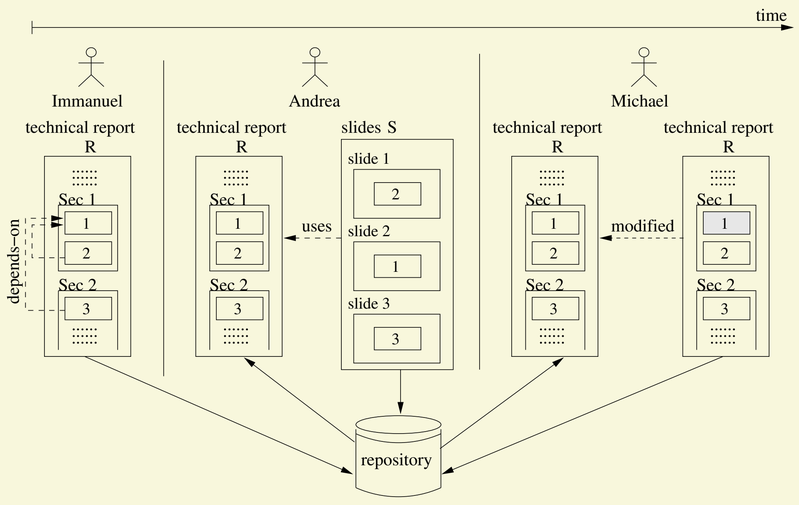
KWARC: Knowledge Adaptation and Reasoning for Content

Introduction

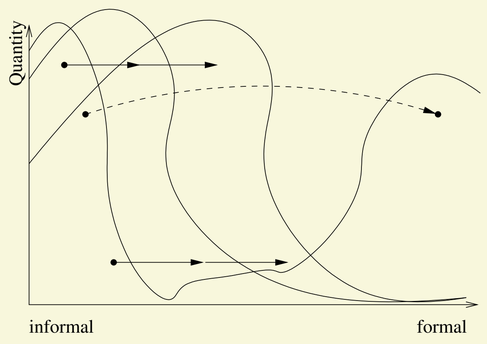
Context

- Current DMSs are designed to coordinate the collaborative creation and maintenance process of documents through the provision of a centralized repository.
- Relations between and within documents and effects of changes are largely neglected.



Goal

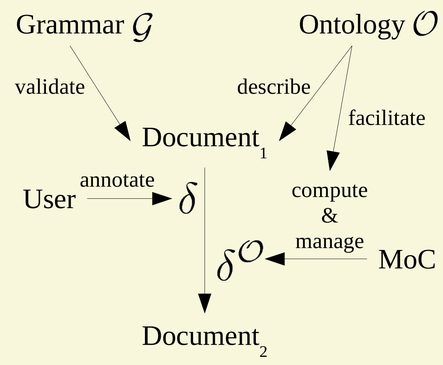
- Avoid inefficiencies, conflicts, and delays.
- Foster collaboration by consistent information reuse.
- Improve information harvesting.
- Provide management of change (MoC) for arbitrary XML documents ranging from *informal*, e.g. instruction or construction manuals, to *formal* documents.
- Lead authors to annotate informal documents more and more with structural semantics:



The flatter a document the less the assistance!

Approach

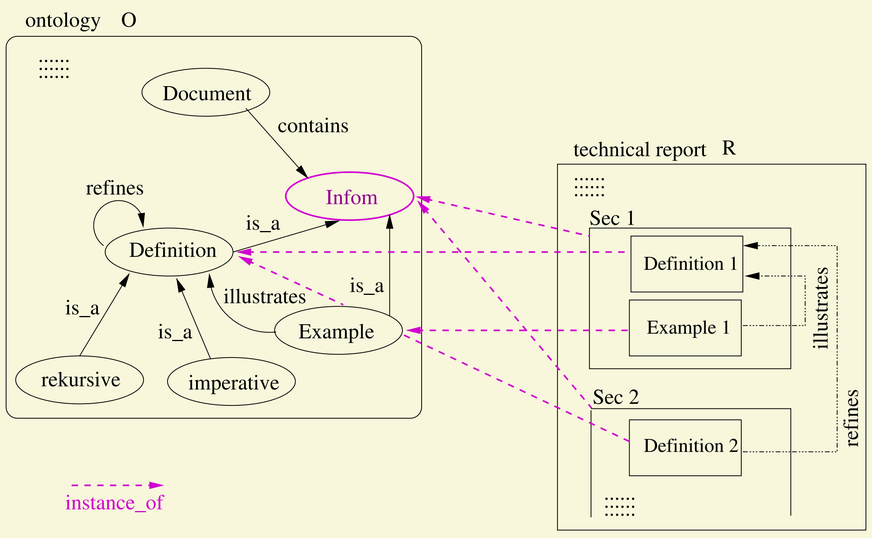
- NarCons: Two-layered, two-dimensional structured view of documents.
- OMDoc System's Ontology [Krieg-Brückner&Mahnke].
- Equivalence classes of change relations.
- Reasoning on annotated two-valued documents states.
- Capture the structural semantic closure (SSC), denoted by $\delta^{\mathcal{O}}$, of each structural difference δ.



NarCons: Two-layered, Two-dimensional Structured View of Documents

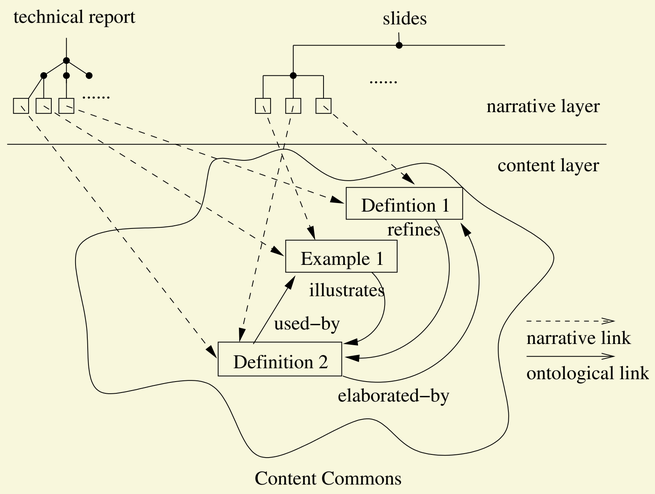
The concept of Infoms (information unit atoms)

- Consider documents as structured collections of informations units, say "*tangible/visual text fragments potentially adequate for reuse*"
- Identification of information units and non-structural relations based on the notion of a System's Ontology.
- Ontological relations to capture semantic interrelations even between (fragments of) informal documents.
- Basis for a interdisciplinary information pool.



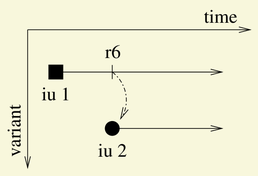
Two-layered

- Separation of documents into two layers: A narrative and a content.
- Layers consist of Infoms, structured by ontological relations.
- Reuse Infoms from a information pool in different information products.
- Narrative links refer to respective Infoms.
- Computation of effects of changes by making information units and relations between them explicit.

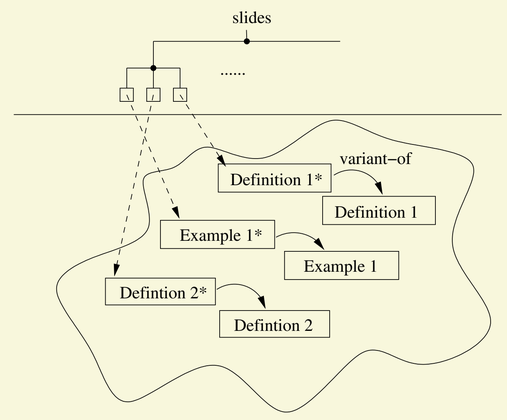


Two-dimensional

- Following the MMiSS project [Krieg-Brückner&Mahnke], extending the well-known concept of versions and revisions by the concept of variants.
- Life-cycle of documents no longer only along a horizontal time line but also along a vertical line of variants.



- Expand coverage "in-the-breadth" and "in-the-depth".



MoC on NarCons

Computation of Structural Differences

- W.l.o.g. document formats explicitly identify the underlying language $\mathcal{L} := \langle \mathcal{G}, \mathcal{O} \rangle$.
  - $\mathcal{G}$ grammar, e.g. an XML Schema.
  - $\mathcal{O}$ ontology specified semantic interrelations
- Computation of structural differences via XML-`diff` tools adapted to operate on NarCons
- $\mathcal{M}$`Diff` based on a model $\mathcal{M}$ for NarCons

$$\mathcal{M}\texttt{Diff} : \mathcal{D} \times \mathcal{D} \to \Delta$$

where $\mathcal{D}$ NarCon, and Δ `diff`-script.

Change Relation Classifications $\mathcal{CR}$

- Authors annotate $\delta \in \Delta$ by $\alpha \in \mathcal{CR}$.
- ∇ classified `diff`-script.

Computation of Structural Semantic Closures

- Computation of SSC for each $\delta \in \nabla$

$$\mathcal{O}\texttt{Diff} : \nabla \to \nabla^{\mathcal{O}} \ : \ (t_1, t_2, (\delta, \alpha)) \to (t_1, t_2, (\delta, \alpha, \Sigma))$$

Σ denotes the set of semantically affected Infoms w.r.t. δ

$$\Sigma := \{(iu, \texttt{trace}(iu)) | iu \in \mathcal{IU}_{\mathcal{O}}\}$$

$\mathcal{IU}_{\mathcal{O}}$: set of Infoms regarding $\mathcal{O}$
$\texttt{trace}(iu)$: path of ontological links leading to additional effected information units

- Computation of Σ via change-relations calculus $\mathcal{CRC}$.