Management of Lightweight Semantic Content for an Adaptive Web-based (Learning) Portal

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With the emergence of the Semantic Web initiative [2] the need for semantic descriptions (metadata) necessary for machine-readable processing of the Web content is significantly increased. Semantics is required on the Web in order to enable advanced functionality (e.g., intelligent search or content adaptation). However, it is reported that there is still a lack of semantic data on the Web [3]. One of the possible reasons is difficulty of manual metadata creation and maintenance.

Moreover, nowadays in relation to the Web 2.0, a passive user is changing into an active author – a contributor – who tags, rates or assesses the content [1]. User-generated annotations are becoming an intrinsic part of the Web content. The content management as such faces new challenges related to metadata and collaborative aspects of the Web. It is important to design tools, which facilitate the management of content enriched with semantics and user annotations for a user (e.g., a teacher, or a domain expert).

We designed COME^{2}T tool, which supports management of semantically enhanced and collaboratively created content and, moreover, it is architectonically adapted for this purpose. COME^{2}T tool (COllaboration- and MEtadata-oriented COntent Management EnvironmenT) is a service designed to be utilized by other systems for advanced management and maintenance of existing content (see Figure 1). Its functionality covers three areas: (i) documents, (ii) semantics, and (iii) annotations, particularly focusing on management of user annotations and content metadata.
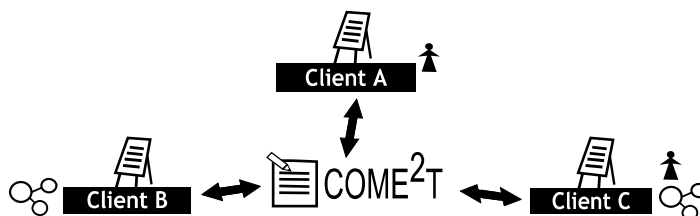

Figure 1. COME^{2}T tool is used by multiple clients for managing content metadata and/or user annotations.

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Documents. COME^{2}T stores XML-based documents in repositories according to their topic or other criteria. It is also possible to import and export whole repositories including all file attachments associated to the documents. Support for document editing is focused mainly on easy modifications, such as error correction or addition of content. The system offers a comfortable working environment and helps to create valid XML content. Documents are versioned and it is possible to revert them to the state of any available version.

Annotations. Annotations can be added by users to highlight some errors or inaccuracy or to select certain fragment of a document and assign a comment or a remark. Annotations can be crucial for document editor who edits documents based on their content. The system notifies about potential conflicts that occur between annotation and edited document's content. If existing annotations no longer match document's content, a user can easily remove or modify them. Annotations are visualized in different forms (in table, using the annotation strip displayed next to the document reflecting actual text position) in order to facilitate manipulation.

Content metadata. Metadata consists of set of *Relevant Domain Terms* (RDT) and relations between them. They can be created, edited and assigned to documents. Furthermore, it is possible to make relations between documents. The existence of more metadata variants allows users to choose interconnections, which would be applied for aggregate documents. More metadata variants can be assigned to one repository in order to create more semantic descriptions for different purposes. Metadata are separated from documents and can be independently processed. With the aim to make the work with lots of interconnections easier, the system allows to work with them in the form of tables or a transparent interactive graph. This graph is represented by a set of nodes and edges, which connects them. In our case, nodes are relevant domain terms, while edges represent different relationships between these nodes. We are promoting ease of use by making graph interface as much user friendly as possible.

We use adaptive web-based learning portal ALEF [4] to verify our solution. The content of this portal consists of documents referred to as learning objects and lightweight semantics based on relevant domain terms descriptions. An important distinguishing feature is ability to assign various forms of annotations by students. In the case of ALEF, lightweight semantics is used by adaptation engine to perform recommendation for students. Rigid content management disabled to flexibly change and update learning content according to the teacher's needs. Many errors remained in the content and overall quality of content was reduced. By introducing COME^{2}T the learning content will be conveniently managed separately from ALEF and allowing sending change updates independently from other activity flows in ALEF.

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