

Multi-Layer Active Documents for the Semantic Web

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INTRODUCTION

Users' disorientation and cognitive overload are well known phenomena intrinsic to the idea of hypertext and studied since the early days [2]. The Semantic Web (SWeb in the following) with its layers of annotations can increase the cognitive overload when a document is accessed. As a matter of fact, in a SWeb framework, annotations can be added at different stages in a document lifetime. While commonly the SWeb aims to add *machine readable* markup to a page, its potentialities can be exploited also to create annotations for human users.

The many times a document can be annotated and the many pieces of knowledge potentially connected can then easily transform a SWeb document into an intricate set of connections. Moreover, the semantic consistence of the annotations (e.g. outgoing links) cannot be guaranteed when different heterogeneous schemas can be applied to the same document.

This paper proposes to organize the annotations into layers to offer functionalities specific to the user and the context of use as a way to limit the cognitive overload.

DEFINING A MULTI-LAYER DOCUMENT

The idea of layers was first introduced in the late 80s and has been recently revamped by Ben Shneiderman [4] who proposes multi-layer design to reduce interaction complexity. He focuses on multi-layer interfaces, different interfaces with an increasing number of features of increasing complexity to accommodate users learning stages. McGrenere, Baecker and Booth [3] applied the idea of layers to personalization: the user decides which features should be available at every layer.

We apply the idea of layers to annotated documents: a document can contain different layers of information that can be edited, visualized and used at different times or by different users. In other words different use(r)s could require the presentation or generation of different layers.

SEMANTICALLY ACTIVE DOCUMENT

Active documents have autonomous behaviour [1] and can be active in many ways: they can be able to act independently and autonomously, reacting to environment

changes, they can have their own goals and plans and follow some strategies [5].

We propose *semantically active documents*, an extension of the concept to the SWeb. In our vision, a semantically active document is able to exploit SWeb technologies to support users during all the document lifecycle. Semantically active documents know their annotations and are able to deal with the information contained.

Semantically active documents must provide a way to structure the overabundant information available when using SWeb technologies, for example by filtering the content accordingly to the appropriate layer or the user preferences. We propose a classification of the information using abstract classes. Example of classes are: (1) Business information, (2) Geographical information, (3) Semantic information (dictionary service and translation services), (4) Personal information.

The information should be grouped into layers and presented considering user profiles and the context in which it is used or visualized.

A SCENARIO

To better explain the framework described above, a possible scenario of use is outlined in this session.

An institution has to provide an annual report. Despite being used only once a year, a predefined template of its structure already exists. Each section has an expected author associated, e.g. the responsible will write the overview, the accountant will fill in the tables of the final balance and the projection for the coming year, the secretary will add changes in the personnel section. The semantically active document can check that the person filling a certain part has the rights to do it and can also solicit those contributions from the authors as the deadline approaches.

The accountant is filling in the final balance session: the system has located last year annual report and proposes the user to connect this year summary table with the projection compiled the year before. Similarly the table containing the budget for the coming year is connected with data located

outside the document and that can be used by the active document to automatically update its content.

In the front the list of the personnel is active and links names to personal pages. Should a person leave, the active document will try to keep the document consistent by tracing the person in the new position.

Different parts of the document contain different degree of sensitive information. This is captured by the layers that determine how the document should be presented to who, or in other words, which parts of the document should be opened to which reader. A public section is unrestricted and its content can be freely distributed, e.g. to journalists. Other parts of the document, e.g. projections and plan for the coming year, are instead crypted and accessible only to those who know the key. Depending on the reader's profile, the semantically active document is able to identify the level of details that that reader can access thus automatically selecting the default display layer.

A FRAMEWORK

We propose a framework for managing semantically active documents that support users during the creation, editing and visualisation of multi-layer documents. The system helps users accomplish their task, acting as a personal information management system. Information automatically gathered from other documents is made available to the user in a multilayered way. Filters to select the appropriate information describe the possible classes of information, the possible generic user profiles and the possible context of interaction. The preferred information sources are recorded in the user profile and used at this time by the information harvester for retrieving. An ontology describes the process of document manipulation during these three phases and the needs of services for each phase. Another (partition of the) ontology describes the application domain relevant to the document and the annotation schema. The system we envisage provides modalities of use for both the creation phase and the display phase of a document.

More complex situations could be envisaged that would allow exploiting the power of the Semantic Web. Special functionalities could be associated to parts of documents to allow automatic update. For example some tables and graphs could be produced using information from the Web and could be updated automatically by the system every time the document is opened.

When the document is accessed, filters are applied on the available annotation (and related services) to select the appropriate information to be displayed on the basis of the classes of information, the user profiles and the context of interaction. Semantic classes of information can be complemented with other information, e.g. about authorship. Preferences could not only derive from an

explicit user profile but also emerge from tracing user's behaviour.

More technical details about the proposed framework are available in the technical report "CS - 04 - 04" at URL <http://www.dcs.shef.ac.uk/research/resmes/>.

OPEN QUESTIONS

The motivation of this proposal is to simplify the view and use of the SWeb. However there is an intrinsic complexity in a multi-layer interaction as the user has to deal with different views of the document, of the interface, and of the semantic network. Probably an expert user would exploit this possibility of having different semantic views, but a novice could have difficulties in learning how to use the tool and in understanding the multi-layer architecture. This will be a matter of investigation through usability testing.

The reliability in retrieving and intrusiveness in proposing new information should also be considered. The acceptable level of intrusiveness is an open question worth researching.

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