

An Environment for the Collaborative Revision of Digital Theses

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Abstract

We present Zeus, an environment designed to aid in the creation of a repository of digital theses. Zeus is an asynchronous cooperative toolset which allows the revision and annotation of digital theses over the Internet. With Zeus, students working on their theses (and their academic committees) are provided with a highly personalizable environment which simplifies the process of reviewing electronic documents. Participants of the process of producing and publishing a thesis can work together without regard of time and place constraints.

1. Introduction

University Digital Libraries for All (U-DL-A) is an initiative set out to explore the issues in the development of digital library environments. One of the major repositories under construction as part of U-DL-A's development plan is a collection including all the theses produced at our university.

A "digital thesis requirement" allows students to turn in only a digital version of their thesis. A digital collection of theses and a wide range of information retrieval services are currently under development. Theses will be available to everyone via the Web.

For each thesis project, a committee is formed consisting of one advisor and two members for the reviewing process. Students turn in a clean version of the document to their advisor, who makes corrections and returns the thesis to the students. This transaction is repeated as needed. When the writing process ends, students deliver the document to the members for the final edition. Finally, the thesis is published if the advisor and members give their approval.

We distinguish four main problems in the reviewing process:

1. Wasting resources (by printing multiple copies of the thesis);

2. Synchronizing schedules (whenever students and their committees need to get together);
3. Risking the integrity of working documents; and
4. Subutilizing existing technology (by relying mainly on handwritten annotations on printed thesis drafts).

In order to address these problems we undertook the development of a cooperative set of tools we termed Zeus. As we describe in the following sections, Zeus is an asynchronous groupware environment for helping students, advisors and members in the process of reviewing and editing theses over the Internet. The current implementation of Zeus allows users to handle document versions and annotations made to the various sections and components of each document.

2. The Zeus cooperative revision environment

Zeus is a web-based cooperative environment designed specifically to support the process of reviewing, annotating and publishing a thesis in a digital library. Zeus allows students to upload their theses to a server, grant appropriate permissions to reviewers and generally synchronize their activities with advisors and other committee members. In Zeus, advisors and members can annotate and comment the thesis using a highly personalizable interface. A student can create a new version of a given thesis by following the suggestions made by reviewers. This process continues until the thesis is ready for publication in the digital library. In this context, participants in the edit/review process do not need to be concerned of scheduling conflicts, misplacing documents, or the geographical distances among them.

2.1. The Design of Zeus

The main goals of Zeus are:

1. To develop an environment to support the collaborative edition and publication (in a digital library) of theses over the Internet;

2. To provide a highly personalizable user interface so individual proofreading and annotation styles can be accommodated;
3. To provide mechanisms for controlling multiple versions of documents, and
4. To provide appropriate concurrence control mechanisms to make sure users can work on shared objects as permitted by their schedules.

As noted previously, a user of Zeus can play one of three possible roles at any given time: student, advisor or member. Users interact with documents and with other users through three major system components, designed to aid throughout the different stages of the thesis writing process: composition, annotation, and visualization. The interactions among users and these components are shown in Figure 1.

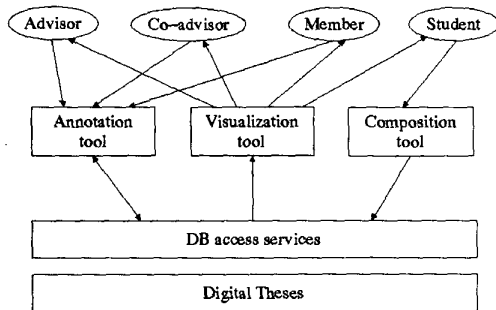


Figure 1. The Architecture of Zeus.

Depending on the user's role, Zeus will present the appropriate user interface and only those tools and options applicable at any given time. Users are also allowed to access some specific functionality according to permissions granted by other users. The main issues considered in the design of each of the major system components are described next.

2.2. Color codes for the reviewing process

We soon realized that replicating existing work practices and bringing them to the digital medium would not work well. Considering our initial experiences, we decided to introduce simple color codes to convey the meaning of proofreading notations. Any component of the thesis would be amenable to be selected and marked with any color (using only mouse and keyboard). Every reviewer should be able to define a preferred set of colors and to assign a meaning to each color as desired. The interface should clearly indicate the meaning of each of the colors used by reviewers. Additionally, arbitrary text annotations could be associated with any of the marked portions of a thesis. As discussed below, this strategy proved to be successful for most of the scenarios

occurring in the production of a thesis in a digital medium, providing a simple yet effective means for communication among users.

Based upon observation of typical proofreading practices, we defined five default actions, represented as buttons in the graphical interface. More actions could be added as needed. In order to help the user remember the associations between colors and actions, we suggested a limit of nine available actions at a given time. The default buttons selected for the interface are:

- Red, to indicate arbitrary comments associated with the selected area;
- Light blue, to indicate the existence of material that should replace the selected area;
- Purple, to indicate the existence of material that should be inserted at some point in the document;
- Pink, to indicate the selected area should be eliminated from the document;
- Green, to indicate spelling errors in the selected text area.

As new actions (buttons) are created, the desired colors could be selected and associated to an action indicated by a button label. A new button should appear on a tool bar. For example, we could add a navy blue button to mean "*find a synonym.*"

The *insert button* would tell the author to add a given text into a specific location in the document. Marking an area of the document and selecting this button would request a new text from the user to be inserted at the point indicated by some special character in the document. The *replace button* would have a similar behavior. Marking text and selecting this button would require the introduction of a replacement text. This replacement comment will be hidden until the student clicks on the blue text.

In this way the document remains clear and legible, displaying only text in different colors. There should be also an option for the reviewer to indicate final approval of the thesis. This typically means the thesis is ready for inclusion in the digital library and the student can present an oral examination.

As for database issues, annotations made by the reviewers can be stored as masks for the same document. In this way, a document version is saved only once and the annotations mask for each reviewer can be presented at the user's request.

3. Zeus implementation

Zeus makes use of some of the services already implemented as part of U-DL-A and adds new functionality [9]. All three major components mentioned in the previous section have been implemented. Zeus'

interface has been implemented using Java and the Swing API. We rely on the Informix Universal Server data base management system which is accessed through a JDBC-compliant class library developed by our research group .

3.1. Composition Tool

This tool allows the student to upload a thesis (or thesis draft) into Zeus' workspace. The student does this by selecting each of the document sections to be uploaded (files in HTML format in the current implementation). Document sections can be uploaded from Internet locations (URL's). Sections considered here include those required for theses at UDLA (such as cover page, table of contents, acknowledgments page, chapters and appendices). Since Zeus customizes menus according to user roles, only students can access this function. All sections are stored in the database, creating a new version of any section previously stored.

Once all the thesis sections have been uploaded, the student may grant review permissions to the thesis committee. When a document is being reviewed, it is not possible to upload a new version until it is released by the reviewer.

If a document has been released to be reviewed, the corresponding advisor and/or members will be notified. A similar notification is issued for the student when reviewers are done with their annotations.

Version management in the current implementation of Zeus is quite simple. When the students turn in their thesis to any committee member, a new version cannot be uploaded until the reviewers explicitly release the current document (after annotating it). Once the thesis is given final approval, this tool will automatically incorporate the thesis into the digital library.

3.2. Annotation Tool

Using this tool, advisors and members can make comments and annotations to the document. Reviewers can select thesis from a list of authors (i.e. the students for whom they serve as advisors or members and who have released a thesis draft using the composition tool described previously).

Initially, reviewers can use the default buttons with predefined meanings (comment, insert, replace, delete, spell check) to revise a thesis. They can also add new buttons and actions as desired to complete their reviews as shown in Figure 2. When the review is finished, the reviewer sets the permissions for the student to be able to view the document.

A list of annotations is generated and can be ordered by correction type or by chapter. For example the list by

correction will show: "find synonyms (3) in chapter 1, (4) in chapter 2."

Even though these annotations and comments could directly modify the document, this is not performed by the system because the student should make the final decision of whether or not any annotations are incorporated to the document.

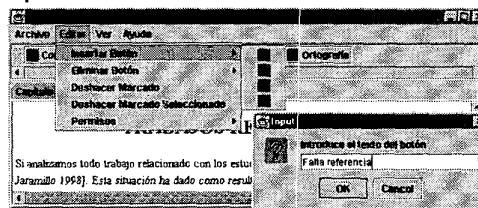


Figure 2. Creating a new button.

As an example of how this tool works, consider the case of an explicit comment that the reviewer would like to make on a given sentence or paragraph (see Figure 3). The reviewer selects the text and clicks on the "comment" red button. A comment window will pop up and the comment is introduced. The selected text then appears in the color of the *comment button* (red in this case). When the student clicks on that text (using the visualization tool) the comment will be displayed on a window.

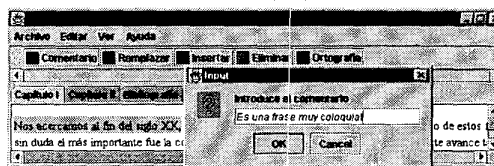


Figure 3. The annotation tool.

3.3. Visualization tool

This tool displays all the annotations and comments for inspection by students and reviewers. Students may select the comments to be seen (advisor, member1, member2, ...). The tool loads the sections and the corresponding masks. Since every reviewer can assign different meanings to the colors of the buttons, the mask includes color buttons and annotations. The document is displayed using the color conventions and toolbar as defined by the corresponding reviewer. If two or more reviewers are selected, their annotations are displayed on different frames. Annotations are "hidden" linked to their corresponding text color. When the user clicks on the colored text, comments will appear. Reviewers can also use this tool for checking if annotations previously made were applied to the current version.

4. Usability tests

The Zeus environment is undergoing various usability tests. An initial evaluation considered 8 faculty members and 15 students. We applied questionnaires to users who tried various tasks using Zeus and the preliminary results were encouraging. Aspects of Zeus that were evaluated included: tools for annotation, definition of color codes, interface complexity, system advantages, system disadvantages, and suggestions for improvements.

Before initiating each evaluation, professors were briefed on Zeus and were asked to comment about their expectations. Most of them answered that it would be very difficult for Zeus to emulate what they do on paper. After trying Zeus, we asked them to review one section of a chapter. They were able to revise and annotate easily and their opinion changed. Comments they made included: Zeus included almost all the resources needed to annotate a thesis, the color code was a good idea because the meaning of the annotations was clear. They did not like reading directly from the computer's display and the university's network instability. They would like to make graphical comments on pictures, and using a standalone version of Zeus (due to network problems).

The students did the evaluation in the same way as professors. Their general comments included: they liked the color codes, the interface was easy to understand, and they did not like reading directly from the computer's display. In addition to these comments they noted some advantages with this tool which could even motivate them to read from computer screens. These advantages are: lower printing costs, readable annotations, time savings derived from remote collaboration, and wider dissemination for a thesis.

5. Related work

The work on Zeus has been preceded and enriched by research on various related areas. On the annotations area, related work include PREP [6,5], Linneaus [2], and the research by Marshall [4]. In the area of document management in distributed environments some related projects are documented in [3] and [7]. COARSY [8] and AllianceWeb [1] are related web-accessible tools for collaborative writing.

6. Ongoing and future work

We have learned a lot from this first version of Zeus and we intend to make this a robust service. Some of the work we plan to undertake in the future includes: implementing other ways of reviewing, such as graphical notation over figures; supporting different input document

formats, including XML, RTF, DOC; displaying annotations via lists ordered by chapter or by correction type; managing versions at a lower granularity level (by element, not by document); adding synchronous communication tools for students and reviewers, and supporting voice annotations.

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