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Managing Geography Learning Objects using Personalized Project Spaces in G-Portal

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Abstract. The personalized project space is an important feature in G-Portal that supports individual and group learning activities. Within such a space, its owner can create, delete, and organize metadata referencing learning objects on the Web. Browsing and querying are among the functions provided to access the metadata. In addition, new schemas can be added to accommodate metadata of diverse attribute sets. Users can also easily share metadata across different projects using a "copy-and-paste" approach. Finally, a viewer to support offline viewing of personalized project content is also provided.

1 Introduction

Digital libraries (DLs) are no longer static repositories of information in which access is limited to searching and browsing. As the amount of digital content grows, there is increasing recognition that DLs will play important roles in education, research and work. Correspondingly, access mechanisms in DLs have also become richer, providing a greater array of services for users to interact and manipulate content including annotations, user contributions and workspaces [3, 6].

Such services are especially needed in educational digital libraries that are typically designed to support classroom learning. Here, the mode of learning no longer adopts a traditional approach in which the teacher fills students with deposits of information deemed to be knowledge and the students store these pieces of information intact until needed [8]. Instead, a constructivist approach is usually taken in learning activities that are characterized by active engagement, problem-solving, inquiry, and collaboration with others so that each individual constructs meaning and hence knowledge of the information gained.

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Consider a class of students attending a course in a university or high school. The students are required to complete a project that involves the acquisition of course content from the teacher, gathering of other reference materials from the library or other sources, making sense of all the available information, synthesizing content, writing the project report and submitting the completed project for grading. Throughout these activities, the role of traditional DLs is usually confined to the provision of referenced materials. While access to library collections has been made much simpler by Web-based interfaces and digitized content, there is still a significant gap to bridge when DLs are to be included as part of learning process. Crucial to the design of such DLs is the need for an integrated work environment where users may store personal or group information objects relevant to a particular task at hand [7].

In this paper, we describe G-Portal [4], a digital library of geospatial and georeferenced resources. We focus on the system's support for personalized learning activities. Known as the personalized project space, it is a key feature that allows its owner, the learner, to gather and organize metadata about geography-related learning objects relevant to his/her learning goals. Our previous work on G-Portal has dealt with the design and implementation of a public portal space and features to manage geography learning objects on the Web. Querying, classification, annotation and map browsing are among the functions provided to manipulate these objects. These functions are now made available in the personalized project space. In addition, functions to support the acquisition of new metadata content, synthesizing knowledge relevant to a topic, exporting of personalized project content and creating (and referencing) project contexts have been implemented to make G-Portal a full-featured integrated learning environment for geography and earth system science.

2 An Overview of G-Portal

G-Portal is a Web-based digital library of geospatial and georeferenced resources and provides a variety of services to access and manage them [4]. The resources maintained by G-Portal comprise mainly metadata records that describe the actual resources, such as Web pages, images and other objects that are accessible on the Web. Other types of information managed by G-Portal include semi-structured data records and annotations.

Each resource contains among other attributes, a location attribute (if available) storing its geospatial shape and position, and a link to the corresponding actual resource. G-Portal provides a map-based interface that visualizes resources with location attributes on a map (see Figure 1). This interface makes resources with known geographical locations easily and intuitively accessible and helps users discover the spatial relationships between resources. For resources without a location attribute, G-Portal provides a classification-based interface that organizes resources based on a customizable taxonomy. A query interface that supports searches for resources based on keywords and spatial operators is also available.

G-Portal organizes resources into projects in which each project contains a collection of resources that are relevant to a specific topic or learning activity. Within each project, resources are further grouped into layers for finer grained organization. Each

layer serves as a category to store logically related resources. For example, a project studying flora and fauna in nature trails may include rivers, lakes and hills in a map layer, flora and fauna information in another, and annotations in a separate layer.

G-Portal is developed as a Java applet with all projects, layers and resources stored within a database server that supports XML and spatial operations. G-Portal can therefore be accessed from any Java-enabled Web browser, making it possible for users to easily access and manipulate personalized project space anywhere, anytime.
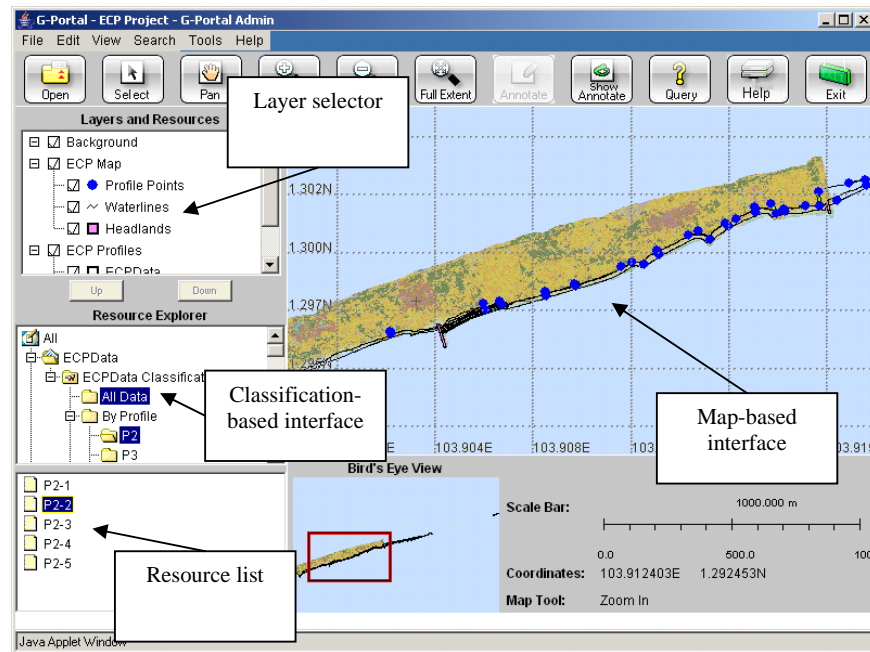

Fig. 1. The G-Portal interface

3   Personalized Project Spaces

While G-Portal's existing project feature appears to be a good place to manage objects relevant to a learning activity, there are a few limitations. Firstly, these are public projects and are not user customizable, but are created by administrators to serve the general needs of all G-Portal users. As such, they do not cater towards supporting individual or group learning. In addition, no provision is made for carving out projects that only a certain user or group can access. The personalized project space was therefore developed to address these issues so as to better support learning activities with G-Portal.

3.1 Project Configuration

A personalized project is provided to each user (or group of users) to allow the creation of personal collections of resources and annotations relevant to a particular learning activity or need. A personalized project has the same basic features as any project in G-Portal but only its owner can modify the contents of the project. When a personalized project is first created, new layers have to be created to organize metadata records. G-Portal therefore provides features to create/delete layers.

Once layers are created, metadata are organized according to the needs of the user by assigning them to appropriate layers. In addition, metadata can be assigned spatial locations and be displayed in the map-based user interface under different layers. For example, metadata of buildings and roads can be displayed in one layer while that of parks and lakes can form another layer. Metadata can also be organized under one or more category hierarchies and made viewable via the classification-based interface.
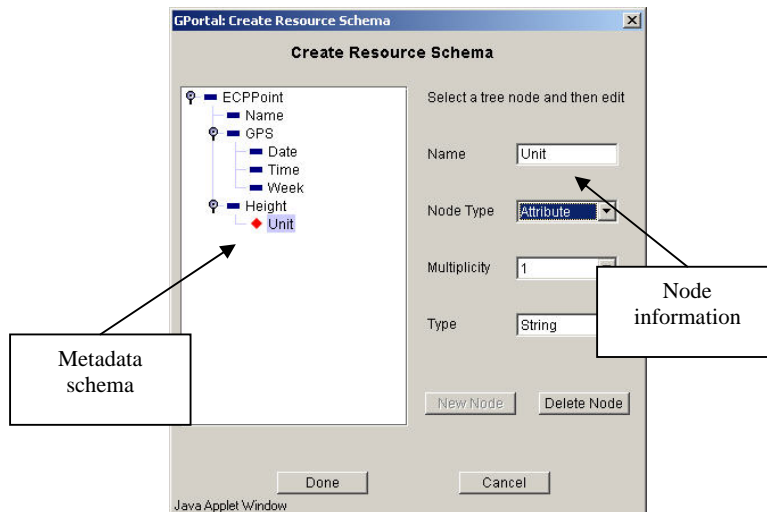

Fig. 2. Metadata schema creation

3.2 Metadata Creation

Every resource in G-Portal is created using a resource schema that serves as a template for describing resources. In a personalized project, schemas can be either predefined or user-defined to meet the needs of a learning activity for a user (or group of users). As shown in Figure 2, G-Portal provides a facility to create new metadata schemas if the required schemas are not defined yet. Each schema is represented as a tree structure with nodes representing metadata elements and multiplicity constraints. New metadata schemas are required when users wish to add metadata of new formats

into their personalized projects. Due to its personal usage nature, these schemas are not subject to a formal review and registration process.

Once schemas are defined, users can create new metadata records (resources) using G-Portal's built-in metadata editor (see Figure 3). Like schemas, metadata records are represented as a tree structure. Creating a new metadata record involves specifying the metadata schema to use causing the editor to ensure that only valid metadata can be created. Users then complete the metadata fields with relevant content.
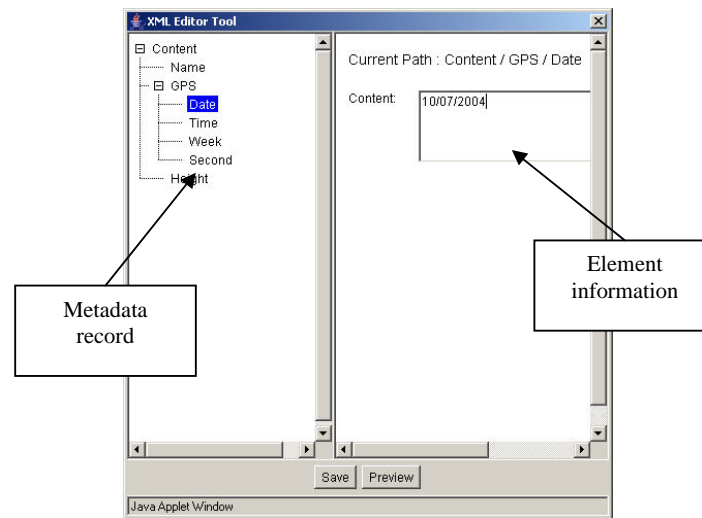
Fig. 3. Metadata creation

3.3 Sharing Metadata Records

Resources in public projects are often useful for reference within a personalized project. For example, a teacher might maintain a public project containing information for an entire semester's course in geography. A student working on a particular learning activity may need to include existing metadata records in the public project into his/her own personalized project. To facilitate easy transfer of these metadata records, a copy-and-paste function is supported. With this facility, users can simply select metadata records of interest from one or more public or group accessible projects, copy and then paste them into their personalized projects. No records are duplicated in this process and G-Portal simply provides links to them. These operations are similar to existing copy-and-paste functions in desktop applications. Through this copy-and-paste process, metadata records can therefore be shared across projects.

4 The G-Portal Project Viewer

There may be occasions when Internet connections are not available but access to a project's resources is necessary. Such a situation may occur when, for example, a student is on a field trip to a remote area, or when the project resources are to be referenced by someone who has no access to the G-Portal server. G-Portal therefore supports offline viewing of project content through a desktop viewer application. An export function is also developed to export projects to local storage to complement the offline viewer.

4.1 Exporting Projects

Prior to offline viewing, the project, be it public, group or individually accessible, has to be exported to local storage. This is accomplished through a feature in the application version of G-Portal, namely, the G-Portal Viewer. Here, the exporting operation requires the G-Portal Viewer to be connected to Internet. The entire project including all resources and resource organization information (layers and schemas) are packaged into a project file and saved to the user's computer. When invoked, the G-Portal Viewer then accesses the package and displays the personalized project offline. The Viewer is very much similar to the G-Portal applet except that functions for modifying project content are disabled to protect the integrity of project data stored in the G-Portal server.

4.2 Context Creation and Referencing

G-Portal provides a host of navigation facilities for exploring content in the map-based and classification-based interfaces. In large projects, extensive navigation might lead to users being lost in "project-space", a phenomenon not unlike that found in hypertext navigation.

   The context is thus another important feature in the G-Portal Viewer. A context refers to the registration of a map extent (a specific map area) and its associated metadata records for future reference and is similar to the idea of bookmarking. Figure 4 shows the dialog for saving a context. Users specify the context's unique name and description as well as the resources to be saved.

   Referencing contexts can be done in two ways. The first is through the G-Portal Viewer in which a user can select from a list of previously registered contexts to visit. The second approach is to launch the G-Portal viewer with a specified context by embedding a link to the context in a document, such as a Microsoft Word file or HTML file. This approach is particularly useful in that it provides seamless access to personalized projects from other applications. An example of its use would be for a student to complete a project using a certain application (e.g. Microsoft Word) but make references to information found in a G-Portal project. Teachers, graders and other students can then view the report as well as the referenced resources using the G-Portal Viewer.
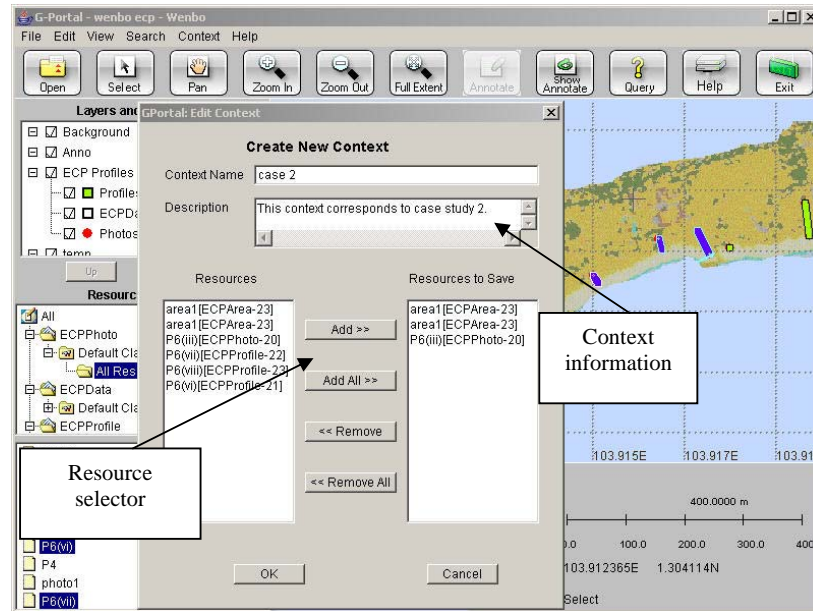
Fig. 4. Saving a context

5 Related Work

G-Portal shares similar goals with existing digital libraries such as ADEPT [1], DLESE [9] and CYCLADES [5]. ADEPT supports the creation of personalized digital libraries of geospatial information ("learning spaces") but owns its resources unlike in G-Portal where the development of the collection depends mainly on users' contributions as well as on the discovery and acquisition of external resources (such as geography-related Web sites). Our model is similar to DLESE although the latter does not support an interactive map-based interface or an environment for online learning. CYCLADES provides a suite of tools for personalizing information access and collaboration but is not targeted towards education or the uniqueness of accessing and manipulating geospatial and georeferenced content.

6 Conclusion

Digital libraries are beginning to play key roles in education. The G-Portal digital library represents a step in this direction and provides a suite of tools for supporting geography and earth system science education. In the paper, we have described the concept of personalized spaces in G-Portal and showed how its features can be used

to support learning activities. With users having the flexibility to create and manipulate personalized content, we believe that a better integration between digital library content and learning activities can be achieved.

As part of ongoing work, we are evaluating the use of G-Portal in various field study projects. An initial qualitative study with undergraduate students using G-Portal to investigate a stretch of the local coast and solve geographical problems related to erosion was conducted. Results suggest that G-Portal was useful in supporting information discovery and learning [2]. Future work would involve larger cross-sectional studies with more students and teachers, working on more tasks, as well as longitudinal studies that track the learning experiences of students as they use the system.

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