AulaNet: An Object-Oriented Environment for Web-Based Education[1]

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Abstract: As yet there are no specialists in the application of information technology to education and training. However, this is one of the fastest growing areas on the Internet, due to the recent perception of the enormous potential for the use of Web resources for this purpose. This potentiality has attracted the attention of researchers in industry and the academic world, which are currently developing various models and products for Web-based education and training. This paper presents AulaNet, an environment for the creation and maintenance of Web-based courses designed for the layman, highlighting its architecture and design model.

1. AulaNet Description

AulaNet [Lucena et. al. 98] is a software environment based on the Web developed at the Software Engineering Laboratory, LES, for creating and assisting distance courses. It was conceived from the experience gained in three courses during the second semester of 1997 (http://www.les.inf.puc-rio.br/socinfo, http://www.les.inf.puc-rio.br/icc, http://www.les.inf.puc-rio.br/transcal), and is based on the following basic premises:
1. The courses created must posses great capacity of interactivity, in order to encourage intense participation by the student in the learning process ("learningware").
2. The author of the course does not need to be a specialist on the Internet.
3. The resources offered by the creation of the courses must correspond to those available in a conventional classroom, plus others normally available in a Web environment.
4. It must be possible to re-use the contents already existing in digital media, through importing archives, for example.
Attending to the above premises led to the formulation of the concept of an *Apprenticeship Development Process* (ADP), which demands that the author previously specifies the teaching resources he will use while developing the course, as can be seen in [Fig. 1].

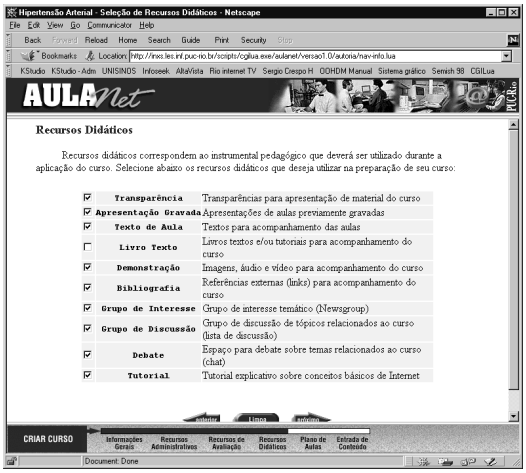

Figure 1. AulaNet authoring site: selection of teaching resources

[1] International Conference of the Learning Sciences (ICLS'98), 304-306, Atlanta, USA, 1998.

With AulaNet it will be quite easy to create distance courses through the Internet, which have a high level of interactivity and intense student participation, without the author needing to be an expert in Web environments. Furthermore, the course created will use contents that already exist that have been recorded on a digital medium. At the present moment there are more than 100 authors developing courses using AulaNet (from 21 institutions) and 316 students are attending the 39 courses being offered this semester (http://les.inf.puc-rio.br/aulanet).

2. Architecture

The architecture of AulaNet is based on the Web, where the environment interface is being developed, and CGI (Common Gateway Interface), which implements all the features of the server. [Fig. 2] is a view of this architecture in layers.

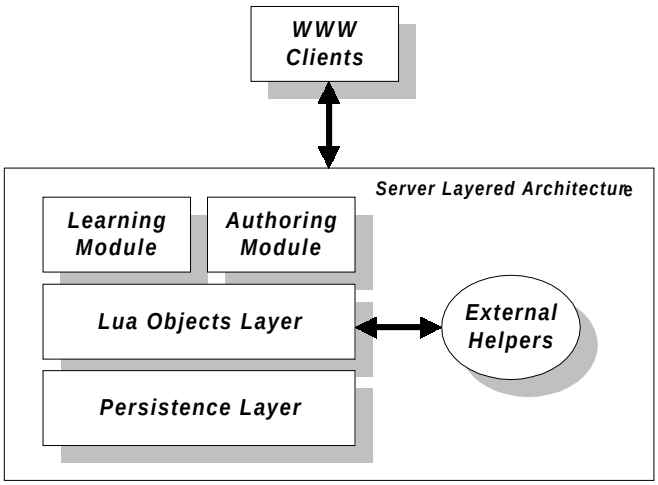

Figure 2. AulaNet layered architecture

All the objects manipulated by the environment, like for example courses, students, institutes and departments, are stored in a relational database, that is responsible for the persistence of these objects. A Lua [Ierusalimschy, Borges, and Hester 97] objects layer provides the CGI interface between the database and the application. This layer is responsible for the manipulation of all information about the environment and for the integration of AulaNet with external helpers, used to perform some of its services like discussion groups (list server) and transference of archives via the Web (file upload).
The Lua objects layer is also responsible for the definition of the application interface of the AulaNet services. It works like a facade, as defined in the Facade Design Pattern [Gamma et. al. 95]. The mapping of the AulaNet objects and the relational persistence system is also carried out at this layer. AulaNet authoring and learning modules were implemented in CGILua [Ierusalimschy, Borges, and Hester 97]. Their respective interfaces are responsible for validating data on the client's side using JavaScript code. In this way the processing of AulaNet is distributed, as the clients are responsible for validating the input data while the servers are responsible for the persistence, manipulation of information and navigation control.

2.1 Design Model

We present the AulaNet™ design model through OMT [Rumbaugh et. al. 91] diagrams, which describe the object-oriented class structure for the Lua objects layer. AulaNet allows several institutions to use the same environment simultaneously. Each institution may have several departments. The courses are related to institutions and each course has assigned actors. A course consists of a selection of services. This design structure is presented [Fig. 3].

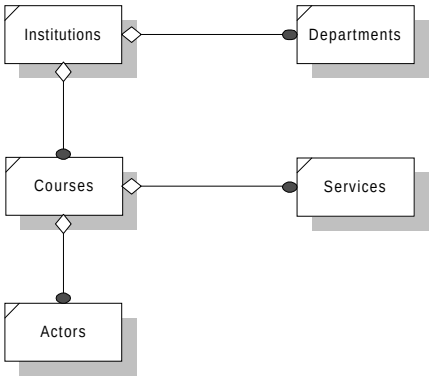

Figure 3. AulaNet OMT class diagram

The AulaNet environment is composed of two sites: a learning site and an authoring site. The students use the learning site to attend a specific course, while the authors use the authoring site to create and maintain the courses. The class structure that implements both sites is shown in [Fig. 4], where the class idioms represent the support to multiple languages (English, Portuguese, etc).

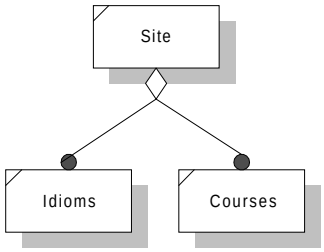

Figure 4. AulaNet site class structure

3. References

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[Lucena et. al. 98] Lucena, C., Fuks, H., Milidiu, R., Macedo, L., Santos, N., Laufer, C., Ribeiro, M., Fontoura, M., Noya, R., Crespo, S., Torres, V., Daflon, L., & Lukowiecki, L. (1998). AulaNet™ - An Environment for the Development and Maintenance of Courses on the Web, *International Conference on Engineering Education, 1998*, Rio de Janeiro, Brazil.

[Rumbaugh et. al. 91] Rumbaugh, J., Blaha, M., Premerlani, W., Eddy, F., & Lorensen, W. (1991). *Object-Oriented Modeling and Design*, Englewood Clifs, NJ: Prentice Hall Inc.