

Framework for on-demand e-learning resources allocation and distribution: OERAD

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Abstract: *In this paper we present a framework for an on-demand e-learning management system that will make use of broadband network for the delivery of distributed "Educational Activities" such as distributed courses, tutoring sessions, lectures, workshops, etc. Our scheme is tailored towards personalized learning using distributed information in a dynamic and heterogeneous learning setting. We imagine a connected network of learning management entities and educational systems where learners are individually supported in accessing distributed resources or taking a course or other learning activities. These activities are delivered for either the self-study approach and in presentational environment.*

Keywords: *e-learning, LOM models, e-books, synchronous collaboration, educational activities, dynamic and heterogeneous learning.*

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1. Introduction

The advancement in the broadband Internet is enabling innovative forms of collaboration among educational institutes, which will improve the overall effectiveness of the educational system. It allows effective sharing of educational activities in synchronous collaboration such as video conferencing, remote presentation, tutorials learning, and other types of activities.

Despite the fact that presentational education is more popular than the tutored approach, the second approach is gaining more interest and would be valuable even in the school model too. Consequently, a hybrid learning approach is considered a key element of future e-learning education [1,2,3].

LOM (Learning Object Metadata) [4] models are more suitable to the self study approach than presentational environment. Enhanced and well developed models are needed to better identify and provide learning

resources such as, educational materials, testing, evaluations, and other learning activities. "Educational materials" include all units of content that can be stored and transferred via digital or non-digital forms. These units are semi-static and reusable. They include books (e-books), lectures recorded on video tapes, or on CD-ROM.[5,6].

Educational Activity includes events to enhance skills or knowledge conducted by educators and learners. This includes preparing the educational materials, communication infrastructure, meeting place, etc. The proposed scheme includes users (learners), network with management capabilities to provide on-demand functionalities based on load, and distributed and not connected resource repositories.

The main idea of such a system is to handle distributed electronic content, exchange educational materials, to personalize learning support in a distributed environment, the integration of services with other

supporting services, and the transparent integration of heterogeneous resource repositories.

2. Review of Existing systems

In this section, we provide background of some platforms that gained popularities and similar functionalities to the proposed scheme.

2.1 EDUCANEXT 2.0

EDUCANEXT [7] is a multilingual service dedicated to the collaboration amongst academic institutions and e-learning providers for the creation and exchange of learning resources. This collaboration is aimed to further the advancement of higher education and research and is provided through a portal by which members can participate in the activities of the service. Registered members to the EDUCANEXT who accept the mission and code of behavior can participate in different activities that includes:

- Propose, Collaborate, and create learning resources to be shared among the members.
- Exchange educational activities.
- The ability to distribute electronic content to different organizations under all types of licenses.

These activities enable this community of educational entities to produce, create, and share a repository of highly accepted resources.

Version 2.0 is a new major release of EDUCANEXT which contains features that follow common standards (XML configuration files, JSP as template technology, SOAP for communication with delivery systems).

In this new version it will be easier to maintain the software in the future and it prepares the grounds for implementing the service as an open-source.

EDUCANEXT 2.0 has implemented other features that include *Provision Components* that is a user interface for entering the descriptions of learning resources. It has been extended regarding usability which includes selection fields with multiple

selections that opens an external popup for selecting values. Also, date values have been replaced with a date picker. It also implemented a *Search Engine* that is based on the open-source framework Apache License for improvement of searchable materials and resources. In addition, a *Learning Resource details* features to show a list of learning resources that other users have also visited, depending on whether enough such data is available. The personalization data in the user profile (favorite discipline, preferred language) is used in the browse catalogue as well as the most recently added learning resources. EducaNext automatically detects the platform language from the browser's settings. Last, an *Evaluation Engine* to evaluate the component which enables users to evaluate learning resources with questionnaires after learning resources have been consumed.

2.2 The Universal Brokerage Platform

UBP [8] is an open platform that integrates users and learning resources repositories. It is based on XML\ RDF metadata representation in addition to the IEEE LOM standard [4].

The UBP includes elements to support activities in order to organize, manage, bookings, and delivery. These elements include educational elements, educators, schedules, and delivery platform. The UBP also includes a generic interface to accommodate the integration of other content delivery servers or platforms. This interface is known as DME (Delivery Management Engine) that is responsible for checking the delivery requirements, system availabilities, security access, availability of resources, and the bookkeeping services. Several platforms are integrated in UBP such as Hyperware, AllWeb, IMC, Apache Server, Real server for audio/video streaming, and ISABL application for video conferencing.

2.3 Hypervideo

Detail-on-demand video [10] is based on revealing additional related materials to the currently running video. This is similar to some DVD's that include links to other scenes with the ability to jump from one scene to another. This is suitable for interactively training users and those who require navigation to needed parts. In addition, it is also suitable for typical video summarization.

Hyper-Hitchcock is a manipulation environment that allows users to sequence and create links between different segments of video [11].

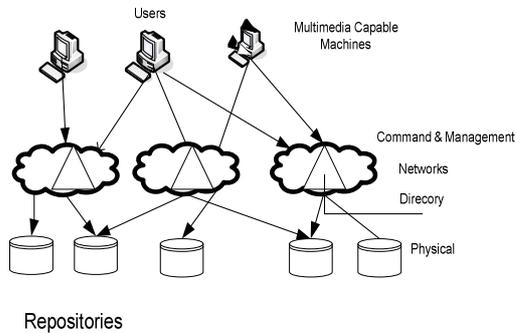


Figure 1. The Architecture of the proposed scheme

2. The Architecture

The OERD is an open platform architecture that integrates users and learning resources via a communication and management services. The model is made up of three layers as shown in Figure 1, the user layer, communication and Management layer, and the physical layer.

The main characteristics of the proposed model are:

- Distributed electronic content such as free distribution and academic distribution.
- Exchange Educational materials such as e-books, recorded lectures, presentations, lecture notes, case studies, and quizzes, etc.
- To personalize learning support in a distributed environment.
- The integration of services with other supporting services to provide personalized access to resources in an e-learning network.
- The transparent integration of heterogeneous resource repositories.

Our framework should be able to handle such a distributed environment that has the following properties:

- Resources can be allocated and reallocated on demand.
- Resources providers can join in or removed in a controlled manner.
- The ability to authorize resources by different people with different affiliations, background, domain, expertise, and needs.
- The maintenance of resources is achieved by providers.
- Resource features and user's features can be maintained in human resource Management system, task management system, or user modeling servers.
- The ability to accommodate users with different and a wide range of characteristics

In the next three sections we detail the functions of each layer and the services provided in addition to the minimal requirements needed to achieve the goals of the proposed model.

3.1 The User Layer

The user layer provides the interface for the two types of users, learners and creators of learning resources. The interface allows users to initiate sessions to view resources or to participate in events such as seminars. The generic interface deals with learning objects in a transparent manner. The availability of additional related materials are indicated through the interface, so users can request their delivery or the delivery of other materials. Hyperlinks to additional materials are displayed through out the session depending on availability and access rights. Upon session initiation, access rights are checked and availability of materials is determined.

Creators of materials or owners of existing learning resources are presented with different interface that allows them to reach materials they for appending, updating, or even to create new materials. Depending on access rights, they can also update materials owned by others.

Appending to existing materials is subject to ownership rights and access rights which is determined upon material modification requests.

3.2 Communication and Management Layer

This layer is responsible for the interconnection between users to the repositories, and to the delivery

of materials to the specific requester. This transparent function of the communication and management layer is also coordinated with an internal agent or a global directory to locate the distributed content of resources. The global directory is updated with every modification to an existing resource or with the addition or deletion of materials. Furthermore, this directory is replicated at each management site to provide faster and more consistent searchable data.

Additional functionalities of the communication and management layer include booking services for audience interaction, control of interaction, access rights to specific resources, fair distribution and use of resources, load balancing, on-demand request handling for the distributed and maybe replicated and shared materials.

In this layer, as depicted in figure1, users are semi connected to networks, therefore, it is the layer's responsibility to insure that users belonging to certain networks can access resources located at other networks repositories.

The communication in our proposed model can use UDP and TCP connections to provide for user connectivity and for media components to be broadcasted in uni-cast or multi-cast networks.

While some learning materials impose greater demand on the network due to size or other factors, such as video teleconferencing or streaming, this layer is responsible to handle such cases. These cases might include users with full participation needs or user with viewable preferences.

3.3 The Physical Layer

This layer is made up of a number of physical data storage elements that might include a complete set of learning resources, parts or segments of the resources, or a replicated segment. All elements are a stand alone physical storage but also viewed as large single

repositories that serve the needs of users. The whole and single view is achieved by the communication and management layer to provide a transparent interaction. Any modification to the repositories (creation, addition, deletion, or update) is automatically reflected on the global directory. Some resources might be replicated on more than a single element to provide faster access, cheaper cost, and for load balancing.

4. Simple Scenario

To motivate our approach, we describe a simple scenario to illustrate a user session. A student who attends a registered institution, requests to view materials on a multimedia course with emphasis on video and video representation. After submitting his request, the management and communication services locate resources on local and other repositories. The retrieved materials are highlighted and sorted according to most frequently requested materials. Upon the selection of a single resource, hyperlinks are uploaded to include further material that might of interest or constitute a continuation to the requested materials. The materials would be allocated to our user based on his demand, cost, and availability also, taking into account the likelihood of requesting additional materials or similar materials. Our user can always interrupt the current viewable materials to request further or different materials. Before termination the session, the user can include his evaluation to that might be appended into the global directory. This Scenario also applies to the stand-alone approach, by which a remote user can log into the system and the same procedure would apply to him. However, in the presentational approach, this model would provide multiple contents either from the local network ,which is part of the system, or initiates the on-demand capabilities to provide content or additional content from other servers on the entire network. This work can also be extended to multi-cast presentations either remotely or on some other premises, taking into account the bandwidth requirements for the materials presented (audio, or video).

5. Conclusions

We have described the building blocks and architecture of an e-learning platform that would provide a consistent access to different types of users. We also showed the interaction among users, resources, and repositories in a networked environment with on-demand capabilities. We think that our scheme provides a high degree of

interaction and provides a suitable environment for a number of institutions to collaborate on providing learning materials for the different types of users, and the opportunity for resources creators to collaborate in a transparent manner.

Currently we are focusing on building the user interface for our scheme, and on building the remaining blocks of our scheme.

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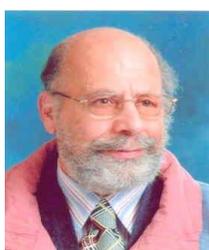
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