Web Services Coordination Model for Federated Search in Learning Objects Repositories

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ABSTRACT

Current e-learning applications should allow a universal access to the educational information, guaranteeing a complete accessibility, independence of the standards, protocols or programming languages used. Thus, the universal reusability of learning objects will be promoted. One of the architectures that allows to obtain systems with these characteristics is Web Services Architecture. Nevertheless, the development of services-based applications is not synonymous of simple development projects. The reusability of already existing services is a hard task that should be coordinated across established processes, in order to guarantee a correct orchestration between all the services that compose the application.

Categories and Subject Descriptors

K.3.1 [**Computers and Education**]: Computer Uses in Education – *collaborative learning, distance learning.* H.3.5 [**Information Storage and Retrieval**]: Online Information Services – *Web-based services.*

Keywords

Learning Objects Repository, Web Service, SOA, Federated Search, services orchestration, business process choreography.

1. WEB SERVICES COORDINATION MODEL FOR FEDERATED SEARCH

Web services is a highly adaptable technology to the needs of service-oriented architecture (SOA) implementation [1]. Web services are modular applications that contribute business process logic as service that can be published, located and invoked in Internet. Based on XML, Web services can be developed using any programming language, protocol or platform.

It could be thought that SOA technology is useful in e-learning industry. Thus it might obtain accessibility and reusability of the educational information contained in different learning objects repositories distributed in Internet.

An example of service-oriented architecture designed for the e-learning industry is described in [2]. It is implemented using Web services, because they make possible the universal discovery of learning objects stored in different repositories or e-learning systems.

To solve the reusability problems of educational objects, we have developed a system named LORS (Learning Objects Reusability System). The objective of this system is to convert a set of distributed repositories into interoperable, and achieving the reusability of the stored learning objects. It is possible to incorporate LORS on any e-learning system to make its content accessible.

The system has been built using a SOA based architecture, and implemented using Java Web services and orchestration procedures. It offers, through only one interface, a transparent access to distributed objects in repositories based on different storage and metadata technologies, allowing its reusability and accessibility independently of its physical location. Figure 1 illustrates the elements that intervene in the system searching process. In table 1 is detailed the meaning of the elements.

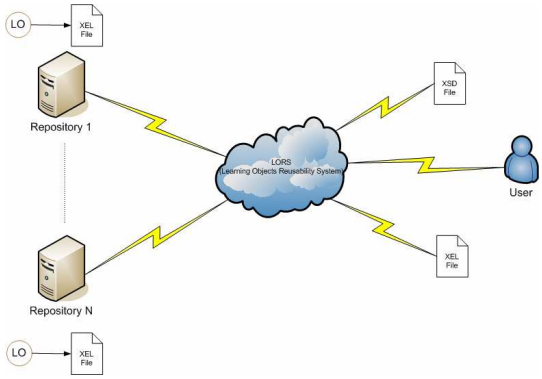

Figure 1. Federated search system.

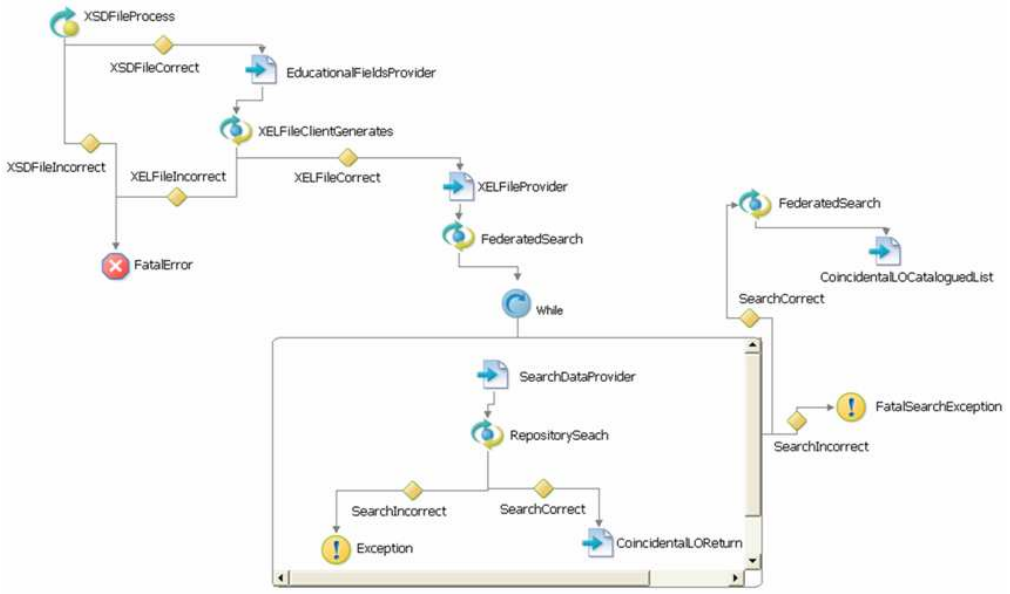

Figure 2. BPEL Model of federated search.

Table 1. Main elements in the system

Element	Description
XSD File	Represents the file in which the educational fields that the user will use in the search will be stored. The system is thought in order that it can be used under any metadata standard used by the repositories. Hence, only it will be necessary to change this file to adapt the system to use another set of metadata.
XEL File	Represents the file in which there have been extracted XSD file metadata presents in the learning object, and its respective values. This file will be used by the system during the searching process. There will be generated a XEL file for the user searching information, and one for each of LO that will be analyzed in the repositories.
Repositories	They represent the educational information stores distributed by Internet.
LOs	They represent the educational information that the user wants to obtain, only if these fulfil with the user conditions marked in the query form.

Figure 2 shows the part of the BPEL model [3] corresponding to the federated learning objects search in distributed repositories; this is the most important part of the system. The BPEL model showed has the meaning indicated in table 2.

Table 2. Web Services in federated search

Web Service	Description
XSDFile-Process	Web service that processes the XSD file. Once obtained its educational fields, they will be returned by the Web service by means of the **EducationalFieldsProvider** functionality.
XELFileClient-Generates	Web service that generates the client XEL file. It will receive as parameter the educational fields obtained of the **EducationalFieldsProvider** functionality, and will return the XEL file by means of the **XELFileProvider** functionality.
Federated-Search	Web service that creates an execution thread for every Repository to analyze, and of invoking for each of them, to its **RepositorySearch** Web service. It will receive as parameter the **XELFileProvider** functionality and will return the LOs suitable list by means of the **CoincidentalLOCataloguedList** functionality.
Repository-Search	Web service that will be associated with a repository. The searching information will be provided to this service by means of the **SearchDataProvider** functionality, and it will return those that fit in searching parameters marked by the user by means of the **CoincidentalLOReturn** functionality.

2. REFERENCES

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[3] OASIS Web Services Business Process Execution Language (WSBPEL), http://www.oasis-open.org

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