

Research Article

A Web Services Created Online Training and Assessment Scheme

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Abstract

The Web Services are application components, communicate using open protocols and self-contained and self-describing. HTTP and XML is the basis for Web services. A Web Services Created Online Training and Assessment Scheme is introduced and applied in this paper. The scheme includes five modules which are System Management Module, Item Bank Management Module, Online Training Module, Online Exam Module and Statistical Analysis Module. And the design idea, the system architecture as well as the realizing methods of the system are also introduced in detail.

Keywords: WSDL; DCOM; HTTP; XML; Web Services; Online Training.

1. Introduction

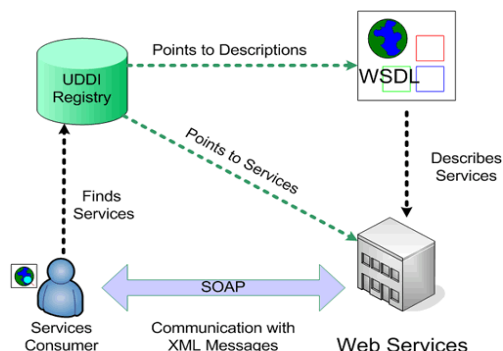
In recent times, many institutes have constructed Campus Network, and using these resources to carry out online instruction has broad application aspects. According to the developing trend of distance education, realizing the online training and exam is imperative. Most existing Online Training and Assessment Scheme are developed with traditional technology. Those systems have severe disadvantages in many aspects including platform-cross usage, dynamic distributed management, and automatic maintenance and so on, and these disadvantages will certainly bring lots of trouble to maintaining and upgrading the systems. Whereas introducing the Web Services technology into the systems can overcome these shortages.

2. Web Services Technology

2.1 Web Service Introduction and the Web Service Protocol Stack

A web service is a collection of open protocols and standards used for exchanging data between applications or systems. Software applications written in various programming languages and running on various platforms can use web services to exchange data over computer networks like the Internet in a manner similar to inter process communication on a single computer. Web Services can be created regardless of programming language. A Web service is

an interface that describes a collection of operations that are network accessible through standardized Extensible Markup Language (XML) messaging. A Web Service is programmable application logic accessible using standard Internet protocols. Web Services combine the best aspects of component-based development and the Web. Like components, Web Services represent black-box functionality that can be reused without worrying about how the service is implemented. Unlike current component technologies, Web Services are not accessed via object-model specific protocols, such as Distributed Component Object Model (DCOM), Remote Method Invocation (RMI). Instead, Web Services are accessed via ubiquitous Web protocols (ex: HTTP) and data formats (ex: XML). The architecture of a Web Services stack varies from one organization to another. The number and complexity of layers for the stack depend on the organization. Web services are built by using various related technologies. Web Service figer1



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Figure1: Webservice Introduction

Figure1.1 illustrates the stack of specific, complementary standards on which web services are generally based on.

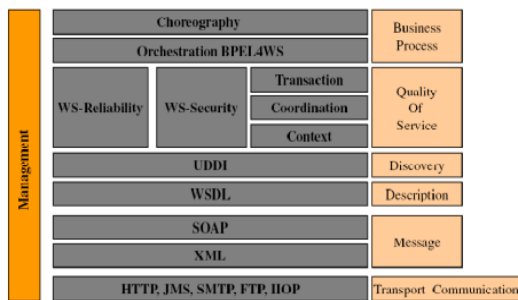


Figure 1.1 Web Service Technology

2.2 Web Services work process

The programmer builds a web service using a specific programming language. This service is published using a Web Services Description Language (WSDL) interface. This service can be invoked by a consumer “client” using this interface. Web services are presented to clients as a set of operations that provide business logic on behalf of the provider. Web services must be deployed on a server container to be available for consumers.

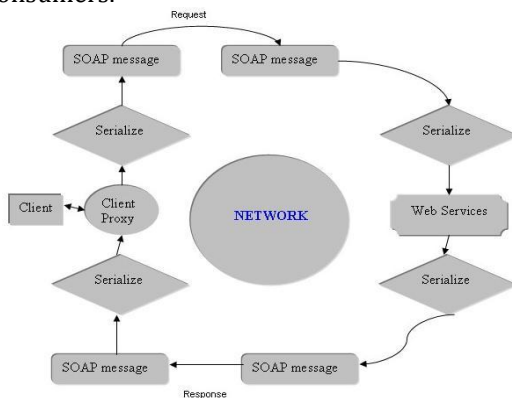


Figure 2 A Simple Web Service Work Process

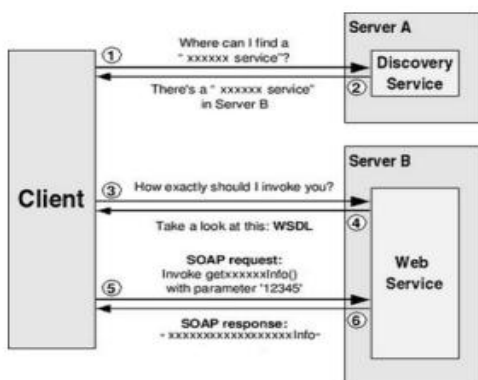


Figure 2.1 A Simple Web Service Work Process

On the client side, a remote object that represents the remote service must be generated. This allows clients

to invoke the operations defined on the server side. The developer has not to care about creating or parsing SOAP messages. That task is performed by the web service’s APIs runtime system. .Net web services for example can be invoked by any web service client and vice versa. The simple work process is shown in figure2 and figurer2.1

2.3 Web Services Architecture

There are three major roles within the web services architecture:

2.3.1 Service provider

This is the provider of the web service. The service provider builds the service and makes it available on the Internet for consumers.

2.3.2 Service requester

This is any consumer of the web service. The requestor invokes an existing web service by opening a network connection and sending an XML-SOAP.

2.3.3 Service registry

It is a centralized directory of services. The registry is used as a central place where providers or developers can publish new services or find existing ones. It therefore serves as a centralized clearinghouse for companies and their services.

The Web Services Architecture includes Service Processes, Service Description, Service Invocation and Service Transport. Service Processes: This part of the architecture generally involves more than one Web service. For example, discovery belongs in this part of the architecture, since it allows us to locate one particular service from among a collection of Web services. Service Description: One of the most interesting features of Web Services is that they are self-describing. This means that, once you’ve located a Web Service, you can ask it to ‘describe itself’ and tell you what operations it supports and how to invoke it. This is handled by the Web Services Description Language (WSDL).

Service Invocation: Invoking a Web Service involves passing messages between the client and the server. SOAP (Simple Object Access Protocol) specifies how we should format requests to the server, and how the server should format its responses. In theory, we could use other service invocation languages, such as XML-RPC or even some ad hoc XML language. However, SOAP is by far the most popular choice for Web Services. Service Transport: Finally, all these messages must be transmitted somehow between the server and the client. The protocol of choice for this part of the architecture is HTTP, the same protocol used to access conventional web pages on the Internet. Again, in theory we could be able to use other protocols, but HTTP is currently the most used one.

3. System Model and Work Progress

3.1 System Architecture

According to the requirements of the Online Training and Assessment Scheme, the system should include five modules which are System Management Module, Item Bank Management Module, Online Training Module, Online Exam Module and Statistical Analysis Module. By using modeling method, we analyze the organization relations, the cooperation relations, and the business relations of the Online Training and Assessment Scheme. And we realize each function model of the system by using a set of Web Services respectively. These Web Services can be distributed to different host computers, and the whole system becomes a distributed network system.

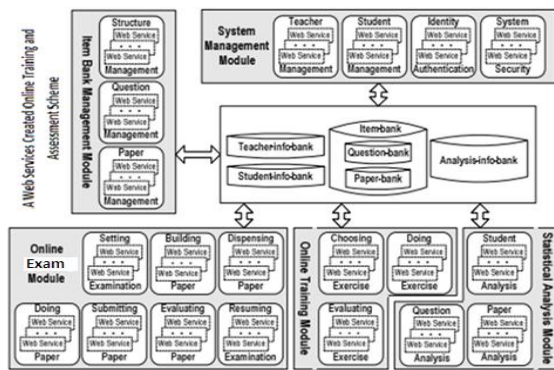


Figure 3 System Architecture

3.2 System Components

The System Management Module includes Teachers Management, Students Management, Identity Authentication and System Security. Using Teachers Management, the system administrators can set the basal information of the teachers and create the Teacher-info-bank. Using Students Management, the administrators can set the basal information of the students and create the Student-info-bank. Using Identity Authentication, the administrator can set the identities of the teachers and students. Using System Security, the administrators can maintenance the self-information, backup the system information and restore the system information.

The Item Bank Management Module includes Structure Management, Question Management and Paper Management. Using Structure Management, the teachers can create and maintenance the knowledge structures as tree-model. Using Question Management, the teachers can create and maintenance the Question-bank. Using Paper Management, the teachers can create and maintenance the Paper-bank. The methods of adding papers to the Paper-bank include uploading the ready papers, compounding the papers with the questions in Question-bank manually, compounding the papers with the questions in Question-bank automatically, and so on.

The Online Exam Module includes Setting Examination, Building Paper, Dispensing Paper, Doing Paper, Submitting Paper, Evaluating Paper and Resuming Examination. Using Setting Examination, the teachers can set the information of the Examination such as beginning time, end time, exam rules, exam rank, and so on. Using Building Paper, the teachers can build the paper for the exam and create the exam interface. Using Dispensing Paper, the teachers can dispense the paper and the exam interface to the student clients. Using Doing Paper, the students can do the paper and the teachers can invigilate. Using Submitting Paper, the students can submit the finished paper and the teachers can collect the not submitted papers when the exam is end. Using Evaluating Paper, the objective questions of the paper can be evaluated automatically and the subjective questions of the paper can be evaluated by the teachers. Then, the teachers count the performance and send it to the database. Using Resuming Examination, the Examination can be restored to the status before the system error occurred, such as network interrupt, system error, re-login, and so on.

The Online Training Module is a platform which provides the environment of self-study to the students. After logged in the system, the students can choose exercises and do exercises. After finished the exercises, the students can get the answers from the system and evaluate the exercises oneself. Then, the students submit the training information to the system.

The Statistical Analysis Module includes Student Analysis, Question Analysis and Paper Analysis. According to the records of the exam and training's instance, the teachers can sum up the performance of students and analyze the study instance of students by using Student Analysis. According to the answers of students for these questions, the teachers can analyze whether the property values of questions are right and modify the property values of questions dynamically by using Question Analysis. According to the answers of students, the teachers can analyze whether the property values of papers are right and modify the property values of papers dynamically by using Paper Analysis.

3.3 Work Process

Online Exam Module and Online Training Module are the major modules of the system.

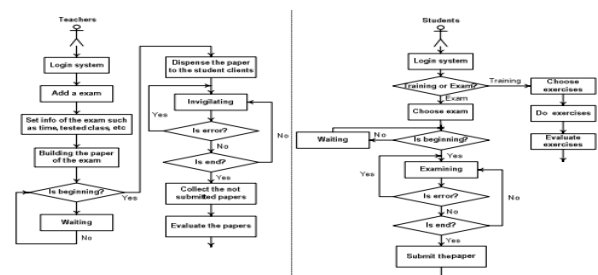


Figure 4 The Work Process of Online Training Module and Online Exam Module

4. System Implementation and System Advantages

4.1 System Implementation

The system is developed with Microsoft .NET Framework4.0. Microsoft .NET Framework is a Windows Component. It includes the sustain for Web Services , Web program (ASP.NET), data access (ADO.NET) , intelligent device program (Windows Forms) ,etc. The software used in the system include: Windows8, IE11.0, and Microsoft Visual Studio .NET 2012 Enterprise Edition.

In the Visual Studio.NET framework, a web service is a class that inherits from the System. Web Services. WebService class. We annotate our public methods as a Web Method. The ASP.NET runtime does the rest: it publishes and invokes these methods. The following C# fragment gives a hint of the programming style.

```
[WebService (Namespace=http://xxxxxx.org/)]
public class
yourService : System.Web.Services.WebService {
[WebMethod]
public string echo(string name) {
return name;}
}
```

The client invokes this method as:

```
ourService os = new yourService();
string ans = ts.echo("xxxxx xxxxxx!");
```

All parameters are marshaled into an XML SOAP message. The framework provides marshaling for the standard data types (numbers, strings, dates, arrays, lists...) but more advanced constructors like dataset have not yet been standardized by the W3C. In essence, you can pass any object and return any object type that has a standardized serialize. Realistically, only atomic-data and SOAP-specified constructors like array and structure can be marshaled over the wire in a vendor-neutral way. A Class reference is an example of something that cannot be passed there is currently no open way to transmit a class over the wire to a different platform. If you are willing to restrict yourself to .Net clients, then you can pass a much richer set of objects. Indeed, in .Net each class can provide its own serialize interface but this will not work outside the .Net universe.

For the Web Services of our system, we define web service methods that take simple data-types as parameters, e.g. integers, strings, real numbers, and dates. The Web Service methods return the same list of simple data-types, an array of simple data-types, a structure of simple data-types or arrays of simple data-types, or a complicated structure of arrays, structures, or arrays of structures.

4.2 Benefits of using Web Services

The advantages of the Web Services Based Online Training and Assessment Scheme are listed as follows:

Reusability: A Web service is a component which can be remotely accessed using HTTP. Web Services provide a means to make a pre-existing code available through Internet. As a result, the program's functionalities can be invoked by other applications.

Stability: The system based on Web Services uses HTTP for transmitting messages. This is a major advantage for an Internet-scale application, since most of the Internet's proxies and firewalls won't mess with HTTP traffic, unlike CORBA etc., which usually has trouble with firewalls.

Interoperability: Web Services enable the share of data and the communication between different applications. For example, .NET applications can interact with Java web services and vice versa. Thus, applications become platform and technology independent.

Security: The Web Services platform builds the reliable protocol layer by using the method of expanding the message disposing layer SOAP. Thus the system better solves the irresponsible problem of HTTP. The Web Services based distance education system has higher security.

Standardized Protocol: Web Services uses industry standard protocol for the communication. All the four layers (Service Transport, XML Messaging, Service Description and Service Discovery layers) use well defined protocol in the Web Services protocol stack. This standardization of protocol stack gives the business many advantages like wide range of choices, reduction in the cost due to competition and increase in the quality.

Independence: Web Services are platform-independent and language-independent, since they use standard XML languages. This means that the client program can be programmed in C++ and running under Windows, while the Web Service is programmed in Java and running under Linux.

Flexibility: The system function models realized by using Web Services technology can be organized according to need and can be distributed according to performance, thus we can organize logic network automatically according to different users.

Conclusions

The Online Training and Assessment Scheme proposed in this paper have the characteristics: high security, easy operation, powerful interaction, easy maintenance and management, etc. Through the actual results of operations in some elementary and secondary schools, the system is feasible and highly efficient, and it also adapts to School and Universities.

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