

Application of Distributed Search in Databases for Web Services

Elena Ivanova¹

Abstract – Distributed search in WAN environment is considered Databases, located in different places and hosts are targeted by web applications. Standardisation issues are under considerations.

Keywords – Database, Internet, SOAP, PHP,MySQL

I. Introduction

Communication and information exchange is the need of the today's world of extreme competition on the business front. This need for information exchange brings in another need to make this information selectively visible, and its visibility to be changed on-the-fly.

In reply to these problems occurs the idea of Web Services. It is not, of course, the first solution to the problem. RMI (Remote Method Invocation), CORBA (Common Object Request Broker Architecture) and others also address the same problem space.

In general, Web services are modular applications or functions, which are generally independent and self-describing, that can be discovered and called across the Internet or an enterprise intranet [2].

Web Services is based on the already existing and well-known HTTP protocol, and uses XML as the base language. This makes it a very developer-friendly service system. However, most of the other technologies such as RMI and CORBA involve a whole learning curve.

II. Classification

Web Service implementations can be organized into the following three basic models [2]:

1. Enterprise Application Integration – it is the use of Web Services within a single organization. According to this first level, the firm may develop libraries of reusable programming building blocks to speed application development. Such Web Services may be components of company-specific program logic or commonly used application functions, such as currency conversions or date calculation (one-tier model-see Fig. 1).

2. Single Partner Integration – the next level extends application integration reach beyond the enterprise. Web services are shared between organizations that likely have formal partnerships. Components of core business applications

¹Elena Ivanova is with Institute of Computer and Communication Systems - Bulgarian Academy of Sciences, Acad. G. Bonchev bl.2, 1113 Sofia, Bulgaria, e-mail: e.ivanova@hsh.iccs.bas.bg

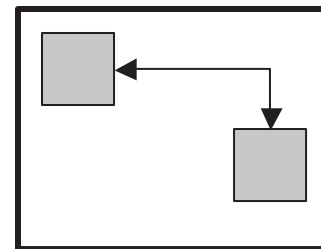


Fig. 1. One-tier model

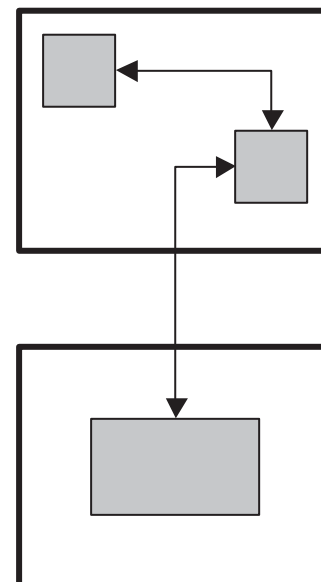


Fig. 2. Two-tiers model

are exposed as Web services and shared, which facilitates inter-organizational collaboration.

Applications may be constructed using multiple Web services, from various sources, which work together regardless of where they actually reside or how they were implemented (two-tiers model-see Fig. 2).

3. Multiple Partner Integration-the third level. It is an advanced evolution of the previous model and requires the most complex levels of application collaboration. Application integration is extended to and coordinated with multiple business partners. This may entail integrating simple information sources, such as weather forecasts, sports scores, horoscopes, or complex, critical capabilities, such as credit card verification or user authentication services. The web services themselves may be exposed between trusted business partners or discovered in services directories (three-tiers model-see Fig. 3).

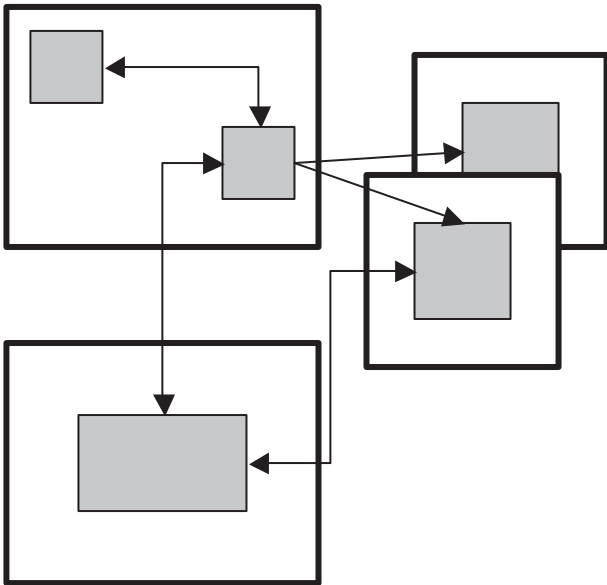


Fig. 3. Three-tiers model

III. Architecture and technologies

The applications implement Web services are based on service-oriented architecture. This architecture includes[1]:

- 1 a standard way for communication
- 2 a uniform data representation and exchange mechanism
- 3 a standard meta language to describe the services offered
- 4 a mechanism to register and locate Web Services-based applications (Fig. 4).

The mapping between the different layers of the Web Services architecture and the technologies used is listed in Table 1.

ble 1.

XML is used in the Web Services architecture as the format for transferring information/data between a Web Services provider application and a Web Services client application.

Extended Markup Language (XML) is a meta language that has a well-defined syntax and semantics. The syntax and semantics “self describing” features of XML make it a simple, yet powerful, mechanism for capturing and exchanging data between different applications

Table 1.

Layer	Technology
Uniform data representation and exchange	XML
Standard communication channel	SOAP
Standard meta language to describe the services offered	WSDL
Registering and locating Web Services	UDDI

The Simple Object Access Protocol (SOAP) is the channel used for communication between a Web Services provider application and a client application. The simplicity of SOAP is that it does not define any new transport protocol; instead, it re-uses the Hyper Text Transfer Protocol (HTTP) for transporting data as messages. SOAP is the method for sending messages across different modules. This is similar to how someone communicates with the search engine that contains an index with the Web sites registered in the index associated with the keywords.

Web Services provider applications advertise the different services they provide using a standard meta language called the Web Services Description Language (WSDL). WSDL is based on XML and uses a special set of tags to describe a provided Web service and where to locate it. Client applications obtain information about a Web service prior to accessing and using a Web service of a Web Service provider. WSDL is the method through which different services are described in the UDDI. This maps to the actual search engine in our example.

Web Services application providers are listed in a registry of service providers using UDDI. Similarly, client applications locate Web Services application providers using UDDI. Like in the case of WSDL, UDDI also is based on XML. This is analogous to the index service for the search engine,

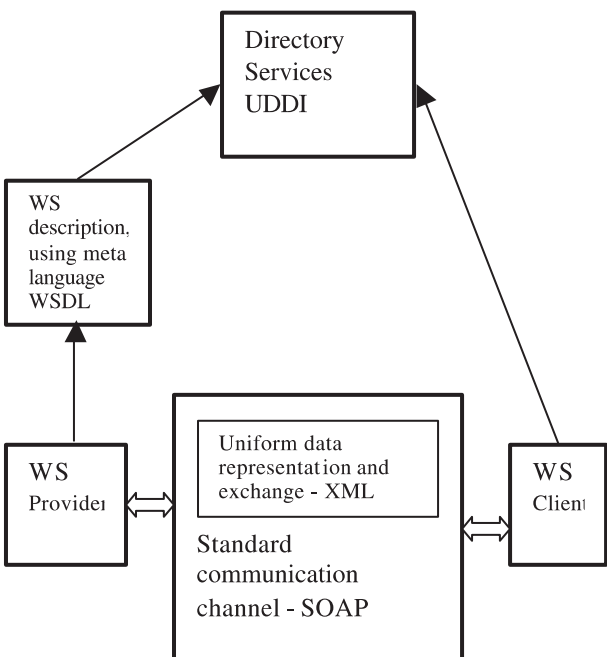


Fig. 4. Architecture of Web Services

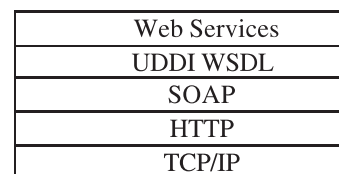


Fig. 5.

in which all the Web sites register themselves associated with their keywords.

These technologies form The Web Services Protocol Stack (Fig. 5).

IV. Application

A. Description of the Database

Our distributed database, named LearningDB, consist of information about students, teachers and other academic data in one university. The tables of the database can be stored on different machines and can be managed from different database servers. We use MySQL Server and ODBC as a server to Access' tables. The used tables are listed below.

Field	Type
usr	Varchar(40)
pass	Varchar(40)

Fig. 6. Table admin

Field	Type
Fid	Int(10)
FName	Varchar(40)
Phone	Varchar(40)

Fig. 7. Table faculty

Field	Type
Sid	Int(10)
LastName	Varchar(40)
FirstName	Varchar(40)
Fid	Int(10)

Fig. 8. Table students

Field	Type
Tid	Int(10)
LastName	Varchar(40)
FirstName	Varchar(40)
Subject	Varchar(40)
Fid	Int(10)

Fig. 9. Table teachers

B. Structure of the Application

The main goal of our application is to obtain a selective search in the database. This functionality is implemented by software decision, based on the SOAP protocol and realized by PHP programming language. The structure of the application is shown on Fig. 10.

SoapServer, the program that client communicates with by using SOAP protocol, is located on the machine (called end point), where the relevant database is stored. The program-client and the program SoapServer is using two base classes, named class.soap_client and class.soap_server, developed by

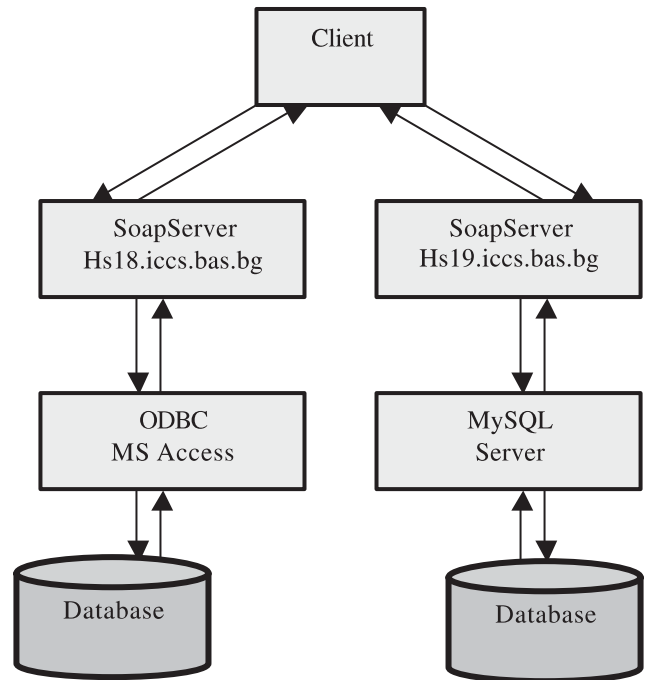


Fig. 10. Structure of the application

Nusphere corp. [1]. The other used class DBFunctions describes the connection to Database Server and the manipulations on the data, included in Database. Because of the two kinds of databases-MySQL and MS Access, two classes DB-Functions are presented according to them. In SoapServer program two functions - "List" and "Search", are developed as web services. Apart from this, the user must have a valid username and password in order to use these services. The table *admin* comprise authentication information.

C. Software components of the application

- 1 Apache web server (<http://www.apache.org>) is an open-source HTTP server, developed by Apache Software Foundation, for various operating system, such as UNIX and WINDOWS.
- 2 MySQL Server (<http://www.mysql.org>) is an open-source database server, developed, distributed and supported by MySQL AB.
- 3 ODBC (Object DataBase Connectivity) is a programming interface that enables applications to access data in database management systems that use SQL as a data access standard. In this case the database is associated with DSN-Data Source Name.
- 4 PHP (<http://www.php.net>), a widely-used Open Source server-side scripting language, is especially suited for Web development and can be embedded into HTML.
- 5 The admin.php script, that is used for authentication of the users. The source code below is the base part of the program.

```

// Connect to the Database
if (!$link=mysql_pconnect("localhost","usr", "pass"))
{
    DisplayErrMsg();
    exit();
}
// Select the Database
if (!$mysql_select_db("LearningDB", $link)) {
    DisplayErrMsg(sprintf());
    exit();
}
$query="select * from admin where usr='$username' ";
//Execute the query
$result=mysql_query($query);
$line=mysql_fetch_array($result);
while ($line[pass]!=$password){
    DisplayErrMsg("Invalid input data"); exit();
}

```

6 Two php classes soap_client and soap_server, developed by Nusphere corp. (<http://www.nusphere.com>) .

7 The main client script is search_soap.php, by which the user can obtain the selective search into the database. The base code of the program is listed bellow.

```

//Pass the relevant end-point
$SoapServerURL="http://".$URL[j]."/Server/
SOAPServer.php";
// instantiate soap client object
$soapclient = new soapclient("$SoapServerURL");
//Invoke the service
if ($hits = $soapclient->call("search",
array("pattern"=>$pattern), "urn:nusphere-web-services"))
{ foreach($hits as $data){
    $result .= "$data[FirstName]
$data[LastName]br>"; }
else {
    // report error
    print "error:<br>";
}

```

8 The SoapServer program, which is used for communication with the client on one hand, and with the database server on the other hand.

The application, named LearningPro, can be reach at <http://hs18.iccs.bas.bg> .

```

//Call the add_to_map() method for each "service"
(function)
// Write method
// This method returns an associative array of all the
records
$server->add_to_map(
    "List", // function name
    array(), // array of input types
    array("array") // array of output types);

```

```

function List(){
    global $contact;
    $contacts = array();
    $$Sql = "SELECT LastName, FirstName,Subject
    FROM teachers
    ORDER BY LastName";
    $ResultList = $contact->DB_Query($Sql);
    while ($Row = mysql_fetch_assoc($ResultList)){
        $contacts[] = new
        soapval("contact", "SOAPStruct", $Row);
    }
    return $contacts; }
// This method accepts a pattern as argument and
// returns associative array of matching items
$server->add_to_map(
    "search", // function name
    array("string"), // array of input types
    array("array") // array of output types
);
function search ($pattern){
    global $contact;
    $matches = array();
    $$Sql = "
    SELECT FirstName, LastName, Subject,
    FName,Phone
    FROM teachers, faculty
    WHERE teachers.Fid = faculty.Fid
    AND (FirstName regexp '$pattern'
    OR LastName regexp '$pattern'
    OR Subject regexp '$pattern'
    OR FName regexp '$pattern')
    ORDER BY teachers.LastName";
    $ResultList = $contact->DB_Query($Sql);
    while ($Row = mysql_fetch_assoc($ResultList)){
        $matches[] = $Row;
    }
    return $matches; }
// Call the service method to initiate transaction
// and send response
$server->service($HTTP_RAW_POST_DATA);

```

V. Conclusion

The application of distributed search in databases, based on SOAP protocol and develop as a web service, was presented. Selective search in two kind of databases was explained and proposed.

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