Modeling network and web services resource using WSDL

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Abstract: *This paper explained decision for network and web services architecture between distributed network systems. The proposed method is based on Web services standard WSDL. Software solution for development of an application, which provides data access and exchange to various distributed networks is presented and explained.*

Key words: *communication protocols, database, networks, web services*

INTRODUCTION

The use of Web services on the World Wide Web is expanding rapidly as the need for application-to-application communication and interoperability grows. These services provide a standard means of network communication between different software applications involved in presenting dynamic context-driven information to the user. In order to promote interoperability and extensibility among these applications, as well as to allow them to be combined in order to perform more complex operations, network and web services resource architecture is needed. In this paper the author describes a set of requirements for network and web resource architecture used for Web services. These requirements are intended to guide the development of the reference architecture and provide a set of measurable constraints on Web services implementations by which conformance can be determined.

PHYSICAL IMPLEMENTATION

A. Theoretical part

WSDL (Web Service Description Language) [1] is an XML format for describing network services as a set of endpoints operating on messages containing either document-oriented or procedure-oriented information. The operations and messages are described abstractly, and then bound to a concrete network protocol and message format to define an endpoint. Related concrete endpoints are combined into abstract endpoints (services). WSDL is extensible to allow description of endpoints and their messages regardless of what message formats or network protocols are used to communicate. As communications protocols and message formats are standardized in the web community, it becomes increasingly possible and important to be able to describe the communications in some structured way. WSDL addresses this need by defining an XML grammar for describing network services as collections of communication endpoints capable of exchanging messages. WSDL service definitions provide documentation for distributed systems and serve as a recipe for automating the details involved in applications communication.

XML (Extensible Markup Language) [2] is a flexible way to create common information formats and share both the format and the data on the World Wide Web, intranets, and elsewhere. For example, computer makers might agree on a standard or common way to describe the information about a computer product (processor speed, memory size, and so forth) and then describe the product information format with XML. Such a standard way of describing data would enable a user to send an intelligent agent (a program) to each computer maker's Web site, gather data, and then make a valid comparison. Any individual or group of individuals or companies that wants to share information in a consistent way can use XML.

XML is "extensible" [3] because, unlike HTML, the markup symbols are unlimited and self-defining. XML is actually a simpler and easier-to-use subset of the Standard Generalized Markup Language (SGML), the standard for how to create a document

structure. It is expected that HTML and XML will be used together in many Web applications.

B. Structure of network and web services resource architecture.

A WSDL document defines services as collections of network endpoints, or ports. In WSDL, the abstract definition of endpoints and messages is separated from their concrete network deployment or data format bindings. This allows the reuse of abstract definitions: messages, which are abstract descriptions of the data being exchanged [4], and port types which are abstract collections of operations. The concrete protocol and data format specifications for a particular port type constitute a reusable binding. A port is defined by associating a network address with a reusable binding, and a collection of ports define a service. Hence, a WSDL document uses the following elements in the definition of network services:

- Types – a container for data type definitions using some type system (such as XSD).
- Message – an abstract, typed definition of the data being communicated.
- Operation – an abstract description of an action supported by the service.
- Port Type – an abstract set of operations supported by one or more endpoints.
- Binding – a concrete protocol and data format specification for a particular port type.
- Port – a single endpoint defined as a combination of a binding and a network address.
- Service – a collection of related endpoints.

Network and web services resource architecture is based on the ability to describe an operation of a web service that responds with an output message or a fault based on at least one or more input messages received. WSDL describes Web services starting with the messages that are exchanged between the requester and provider agents. The messages themselves are described abstractly and then bound to a concrete network protocol and message format. Web service definitions can be mapped to any implementation language, platform, object model, or messaging system [5]. Simple extensions to existing Internet infrastructure can implement Web services for interaction via browsers or directly within an application. The application could be implemented using COM, JMS, CORBA, COBOL, or any number of proprietary integration solutions. As long as both the sender and receiver agree on the service description, (e.g. WSDL file), the implementations behind the Web services can be anything.

The requester entity and provider entity agree on the service description (a WSDL document) and semantics that will govern the interaction between the requester agent and the provider agent [1]. This does not necessarily mean that the requester and provider entities must communicate or negotiate with each other. It simply means that both parties must have the same (or compatible) understandings of the service description and semantics, and intend to uphold them. Below are the proposed methods this can be achieved:

- The requester and provider entities may communicate directly with each other, to explicitly agree on the service description and semantics.
- The provider entity may publish and offer both the service description and semantics as "take-it-or-leave-it" "contracts" that the requester entity must accept unmodified as conditions of use.
- The service description and semantics may be defined as a standard by an interested in organization, and used by many requester and provider entities. In this case, the act of the requester and provider entities reaching agreement is accomplished by both parties independently conforming to the same standard.
- The service description and semantics may be defined and published by the requester entity, and offered to provider entities on a "take-it-or-leave-it" basis. This may occur, for example, if a large company requires its suppliers to provide Web services that conform to a particular service description and semantics. In this case, agreement is achieved by the

provider entity adopting the service description and semantics that the requester entity has published.

The following example shows the WSDL definition for network and web services resource architecture.

Table1. WSDL definition for network and web services resource architecture

```
<?xml version="1.0"?>
<definitions name="DataPlace" targetNamespace="http://hs19.iccs.bas.bg/DataPlace.wsdl"
xmlns:tns="http://hs19.iccs.bas.bg/DataPlace.wsdl"
xmlns:xsd1="http://hs19.iccs.bas.bg/DataPlace.xsd"
xmlns:soap=http://schemas.xmlsoap.org/wsdl/soap/
xmlns="http://schemas.xmlsoap.org/wsdl/">
  <types>
  <schema targetNamespace="http://hs19.iccs.bas.bg/DataPlace.xsd"
  xmlns="http://www.w3.org/2000/10/XMLSchema">
  <element name="DataPlaceRequest">
  <complexType><all>
  <element name="tickerSymbol" type="string"/>
  </all></complexType></element>
  <element name="DataPlace">
  <complexType><all>
  <element name="price" type="float"/>
  </all></complexType></element>
  </schema>
  </types>
  <message name="GetLastDataPlaceInput">
  <partname="body" element="xsd1:DataPlaceRequest"/>
  </message>
  <message name="GetLastDataPlaceOutput">
  <part name="body" element="xsd1:DataPlace"/>
  </message>
  <portType name="DataPlacePortType">
  <operation name="GetLastDataPlace">
  <input message="tns:GetLastDataPlaceInput"/>
  <output message="tns:GetLastDataPlaceOutput"/>
  </operation> </portType>
  <binding name="DataPlaceSoapBinding"type="tns:DataPlacePortType">
  <soap:binding style="document" transport="http://schemas.xmlsoap.org/soap/http"/>
  <operation name="GetLastDataPlace">
  <soap:operation soapAction="http://hs19.iccs.bas.bg/GetLastDataPlace"/>
  <input><soap:body use="literal"/>
  </input><output>
  <soap:body use="literal"/></output></operation>
  </binding>
  <service name="DataPlaceService">
  <documentation>My first service</documentation>
  <port name="DataPlacePort" binding ="tns:DataPlaceBinding">
  <soap:address location="http://hs19.iccs.bas.bg/DataPlace"/>
  </port></service>
</definitions>
```

C. Implementation of the network and web services resource architecture.

Software implementation of the network and web services resource architecture is based on an open source technologies PHP scripts language, Apache Web server, MySql databases [6]. For communication based on proposed method are developed a software module with PHP called wsdlserver.php. It is used for WSDL request and WSDL response, which are based on the proposed architecture. The other part of the software implementation (wsdldata.php) is used to prepare the data from databases in XML format [3]. It is needed because of the WSDL standard and proposed method specification. The software implementation defined the following steps:

- The calling application makes a procedure call on the XML client indicating the URI of the server, the procedure to be called on the server, and the parameters to be sent to that procedure.
- The XML client takes the method and parameters and builds an XML container for them; the XML container is the sent over HTTP as a POST request [7].
- XML server that receives the POST requests parses that XML container and determines the method to be called and the parameters to this method.
- The method is executed WSDL definition on the server and returns a result.
- The result is packaged as XML and the server returns the XML result container as the response of the POST request.
- The client parses the XML response container and returns the result to the calling application.
- The application processes the result.

Figure 1 presented structure of software implementation based on the network and web services resource architecture.

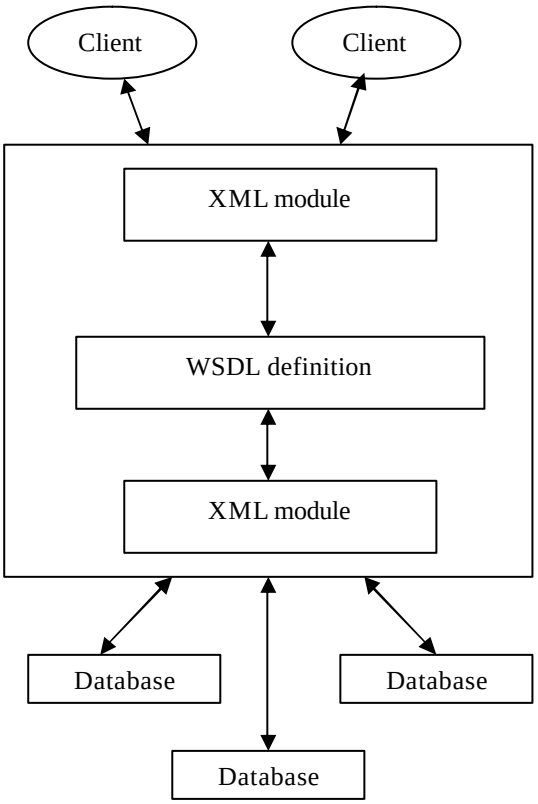

Fig.1 Structure of the software implementation.

The software implementation can be reach at http://hs19.iccs.bas.bg.

CONCLUSIONS

This paper explained decision for network and web services architecture between distributed network systems. The proposed method is based on Web services standard WSDL. Software solution for development of an application is presented and explained. The main aim of the proposed model is to provide data access to various clients via WSDL\XML web services. The example revolves around the XML transaction and supplier class, which allows for clients add, edit, and delete transactions within a database. It also allows various other system users to interact with the application. The below is the sequence of activities of the example:

- Define the Web Services using WSDL.
- Create XML architecture.
- Develop an Internet Explorer client.

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