

Standardized Web Services

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Abstract

In this paper we discuss about web services and web service standards. We first discuss what web services are, and then we describe the usage, architecture, and standards. We conclude by giving examples and citing the future of the web.

Keywords

Web Services, web service standards, e-business

1. Introduction

The web has evolved in stages. The first stage of the web was the document web consisting of static HTML pages and documents. Businesses soon discovered the web as a good channel to make their presence known and advertise their products and services. The second stage of the web's evolution was the application web. The application web was more dynamic and provided dynamic content for the users with business logic and programming languages. The application web personalized the user experience and started the E-Business revolution. The next evolution of the web was a result of the E-Business growth. This is the service web. Businesses needed to use the services created by other businesses by integrating processes and services. The service web is now maturing as more and more web services are being deployed and used by processes and other web services.

2. Web Services

The definition of a Web service found in the requirements document of W3C Web Services Architecture group is as follows: A Web service is a software system identified by a URI, whose public interfaces and bindings are defined and described using XML. Its definition can be discovered by other software systems. These systems may then interact with the Web service in a manner prescribed by its definition, using XML based messages conveyed by Internet protocols¹. Web services are the next step in distributed computing. They allow companies to reduce the cost of doing e-business, to deploy solutions faster and open up new opportunities. Web services are about program-to-program interaction. They allow applications to be integrated rapidly, easily and less expensively. Heather Kreger from the IBM Software Group proposes that web service is an interface that describes a collection of operations that are network-accessible through standardized XML messaging. A web service is described using a standard, formal XML notion, called its service description. It covers all the details necessary to interact with the service, including message formats (that detail the operation), transport protocols and location². This standardization in the service description makes it possible for applications to access the web services and use them like a distributed computing environment. Web Services Description Language (WSDL) is the XML format used to

¹ W3C Working Group, Web Services Architecture Requirements. <http://www.w3.org/TR/2004/NOTE-wsa-reqs-20040211/#id2604831>

² Heather Kreger, IBM Software Group, Web Services Conceptual Architecture (WSCA 1.0). <http://www-306.ibm.com/software/solutions/webservices/pdf/WSCA.pdf>

describe a web service. Simple Object Access Protocol (SOAP) is the current standard used to invoke a web service, and Universal Description, Discovery and Integration (UDDI) is the registry used to find a web service and use it.

2.1 E-Business and Web Services

With the growth of e-businesses, the services that are offered by vendors have also grown. For instance, some e-businesses that currently provide web services include but are not limited to, credit card verification facilities, travel agencies, car rental, information services, packaging and delivery agencies, and other services sector. The scope of using web services is very wide. Consider a web portal, where web users log on to get a variety of information at the same place. The portal could be connected to a lot of other web services it gathers data from, thus, saving the user's time from visiting individual pages, instead presenting all the interested information in the same place.

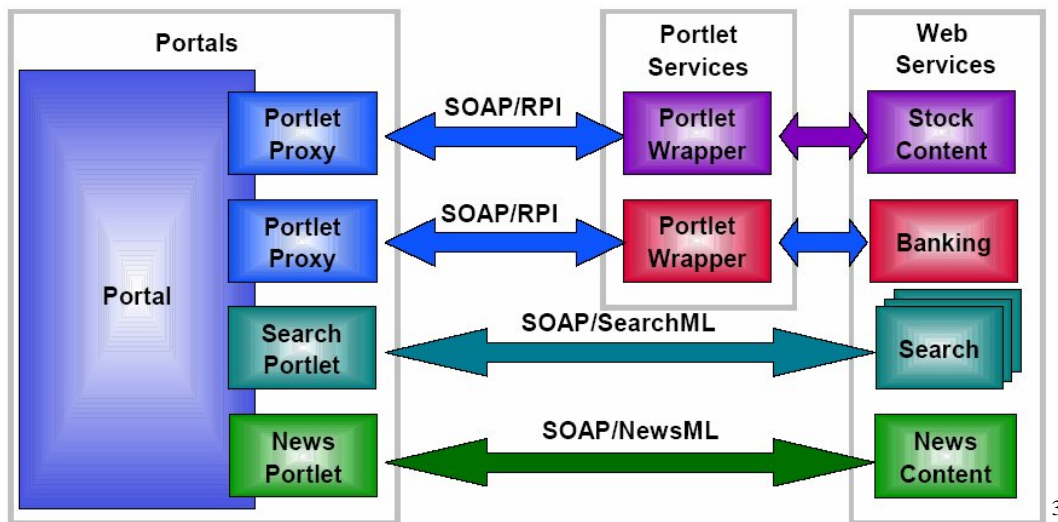


Figure 1: Example of portals and portlets using web services.

In e-business, customer chain management and supply chain management are now the most important issues. E-businesses attempt to eliminate delays, provide the best and more personalized service, save money in production by knowing what and when the customers need by bringing the suppliers and customers closer. For instance when a customer buys a product online, the system may automatically order the required spare parts from the supplier, check the customer's credit, provide the sales information to the sales department, accounting information to the accounts department, and shipping and packaging information to the courier agency all in the same instance. As evident, businesses need to integrate all their chains, internal and external to stay ahead of the competition. In the days before web services, when an order was received, data entry operators would be required to manually visit and enter the data into all external web sites and internal and external databases that were required for the completion of the order. Now a computer program or application can send all the required information to all the necessary parties, check the availability of services, make other checks as required and provide the customer with satisfying and more personalized experience. Today's businesses especially e-businesses are about just-in-time services. This means, a service or product needs to be customized for the customer as and when required. Customers are

³ Image taken from <http://www-306.ibm.com/software/solutions/webservices/pdf/WSCA.pdf>

no longer willing to wait for days to receive a quote from the company for a customized product. They demand the information and services immediately. Business to business transactions are growing towards standardized web services. It's easier for a business application to access the information they need from a partner using a standardized web service, rather than to have a person log in to the partner's business system to get the same piece of information. Integration and availability of all the required information from the internal as well as external sources is the key to success in e-business, and web services is just the answer.

3. Web Services Architecture

One of the major advantages of web services is interoperability. Since web services use XML based invocation and response, they can operate with any program written in any programming language that can support the XML based request-response framework. The WSDL implementation effectively hides the programming implementation used in the service. The service requestor sees only the description of the service, and the necessary inputs and the output the service provides. The technical details like how the service is actually implemented and what programming language is used are unimportant. This enables disparate businesses having disparate business software to exchange information seamlessly. The same web service may be used by a number of applications like web pages, supply chain management software, customer chain management software, higher management report generators etc. The implementation of the service does not affect the service-requestor in any manner. The input supplied to the web service as well as answers provided by it are in XML (SOAP), providing interoperability through networks, platforms, middleware and systems. Web services can also access other web services, making complex business logic implementations across systems achievable.

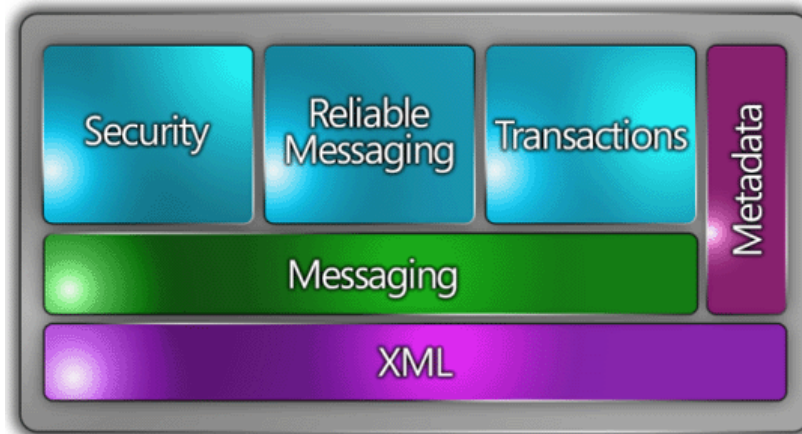


Figure 2: Schematic overview of the WS-* architecture

MSDN describes the architecture of web services admirably. The basic requirements of a web service are security, reliable messaging, transactions, attachment, discovery etc. As can be seen from figure 2, the bottom layer consists of XML. The messages to be sent is on top of the XML layer and other requirements like security, reliable messaging, and transactions are placed on top of the messaging layer. This

⁴ Schematic overview of WS* architecture from http://msdn.microsoft.com/webservices/default.aspx?pull=/library/en-us/dnwebsrv/html/wsmsplatform.asp#wsmplat_topic6

architecture assists in incremental development of web services solutions. It provides the ability for the composition of new protocols, since only individual requirements are needed. Thus, when new protocols are added to the architecture, backward compatibility could be easily maintained.

4. Web Services Standards.

World Wide Web Consortium (W3C) has come up with some standards and recommendations for web services. The standards are in the process of being developed. Various organizations like IBM and Microsoft have taken lead in standardizing web services. Below we discuss briefly the standards used by web services.

4.1 SOAP

SOAP or simple object access protocol is a standard for sending and receiving messages on the internet. SOAP message is formally specified as an XML infoset, which gives an abstract description of its content. SOAP was initially proposed as a way of implementing Remote Procedure Calls or RPC over HTTP. A standard was later adapted by most vendors which can be used to send messages over various internet protocols. The W3C has now released a proposed recommendation for SOAP version 1.2. A SOAP message consists of three parts, an XML envelope, a method for encoding parameters as XML, and the message binding. The envelope conveys the host, encoding style used and other information pertaining to message delivery. The method or message body calls a particular service on the host, and encodes the required parameters in it. The binding defines the binding of the abstract properties defined in the web service. SOAP is a simple XML structure that can be used to send and receive messages. Java and .Net have been working on developing packages that implement it. This means accessing a SOAP message can be made as easy as making any other function call.

4.2 WSDL

Web Services need to be accessed by programs, applications and other web services. For this reason it is very important that the programmatic interface of the web service be precisely defined. WSDL or the Web Services Description Language is for web services what Interface Definition Language (IDL) is for distributed computing. It is an XML based description of elements essential to describe a web service. According to W3C, the description components are as follows:

- {interfaces} OPTIONAL: A set of Interface components.
- {bindings} OPTIONAL: A set of Binding components.
- {services} OPTIONAL: A set of Service components.
- {element declarations} OPTIONAL: A set of Element Declaration components.
- {type definitions} OPTIONAL: A set of Type Definition components.⁵

XML representation of the description component is as follows:

```
<description
  targetNamespace="xs:anyURI" >
  <documentation />*
  [ <import /> | <include /> ]*
  <types />?
  [ <interface /> | <binding /> | <service /> ]*
</description>6
```

⁵ Properties of description components are as defined in WSDL 2.0 candidate recommendation document <http://www.w3.org/TR/wsd120/>

WSDL allows importing of abstract definitions. Thus a document may be constructed from various abstract definitions available for the service. For instance, the hotel industry may define a standard description for hotels. Some hotels implementing a web service may import parts of this document and specify concrete bindings.

4.3 UDDI

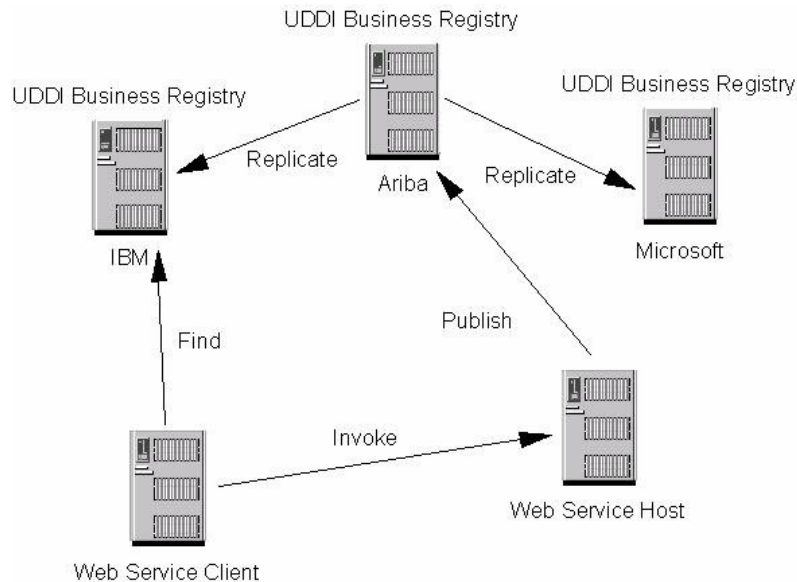


Figure 3: UDDI Business Registry Network

One problem about using a web service is how to find it. Where can we get a web service and how can we access it, are very important questions. The answer is provided by UDDI. Universal Description, Discovery and Integration is basically an online registry or directory that provides web services a uniform way to describe their services, so other services can find them and understand the methods and parameters required to integrate them. Figure 3 above shows how a UDDI Business Registry Network is used by service providers and users.

With these standards in place, use of web services by applications has become possible. Applications can search for a web service that implements the functionality required by the application using UDDI, find out how to use the service with the help of descriptions in WSDL, and send and receive messages from a remote service using SOAP.

5. Examples and Conclusion

Google is a major player in the web services market. They offer variety of web services including web search, credit card services, news and RSS feeds, maps and Google Earth services, finance services and even mail services. The Google personalized home page is a portal which offers integration of a wide variety of services. Most of Google's applications are web services which can be easily integrated by other applications and used seamlessly. Microsoft has made a major effort to move towards web services. They are currently using web services in all their major products including operating systems like Windows Vista and Windows Server R2, MSN offerings like

⁶ XML Representation of Description Component as defined in WSDL 2.0 candidate recommendation document http://www.w3.org/TR/wsd120/#component_model

⁷ Figure 3: UDDI Business Registry Network from http://www-128.ibm.com/developerworks/websphere/library/techarticles/0307_ryman/ryman.html

MSN Money Quotes, myMSN communities, MSN Encarta, all MSN RSS feeds, Xbox Live, Microsoft Office, SQL Server, Virtual Earth etc. Amazon provides web services in the form of Amazon search services like product search and price search etc. All major financial institutions and other businesses have already adapted or are now adapting web services. Shipping, packaging and logistics solution providers like FedEx use web services for integration with client systems. Thus when an order is placed with a client, the appropriate logistic operation is automated.

The infrastructure for the service web is in place. More and more businesses are turning towards the service web to make business decisions faster, integrate the customer chain and the supply chain, and provide solutions and services to their customers like never before. E-businesses are emerging as one of the biggest markets in the world. The way the world conducts their business is changing and web services and other new web standards are carving the road to success. The new web is about program-to-program interaction, where the applications bring in the data they need from other applications and feed other applications with data where required. This application to application talking has been made possible by standardized web services. They are the basis of the next generation of business.