

# Dynamic e-Business: Trends in Web Services

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**Abstract.** In the last couple of years, the concept of a web service (WS) has emerged as an important paradigm for general application integration in the internet environment. More particularly, WS is viewed as an important vehicle for the creation of dynamic e-business applications and as a means for the J2EE and .NET worlds to come together. Several companies, including Microsoft, have been collaborating in proposing new WS standards. The World Wide Web Consortium has been the forum for many WS-related standardization activities. Many traditional concepts like business process management, security, directory services, routing and transactions are being extended for WS. This extended abstract traces some of the trends in the WS arena. After the TES2002 workshop is over, more information could be found in the presentation material at [http://www.almaden.ibm.com/u/mohan/WebServices\\_TES2002\\_Slides.pdf](http://www.almaden.ibm.com/u/mohan/WebServices_TES2002_Slides.pdf)

## 1 Introduction

With the popularity of the world wide web has come the need for businesses to exploit the web not only for disseminating information but also for improving their *interactions* with their customers, distributors, suppliers and partners. This way of integrating applications and conducting business using the internet has come to be called *dynamic e-business* [7]. The web service (WS) paradigm has emerged as an important mechanism for interoperation amongst separately developed distributed applications in such a dynamic e-business environment. One definition of WS is: *Web services are a new breed of web application. They are self-contained, self-describing, modular applications that can be published, located, and invoked across the web. Web services perform functions, which can be anything from simple requests to complicated business processes. Once a web service is deployed, other applications (and other web services) can discover and invoke the deployed service.* XML messaging is used to interact with a WS.

WS is also viewed as an important interoperability mechanism for the J2EE [15] and Microsoft's .NET [26] worlds to come together. WS has become so popular that, in addition to conferences and workshops, even magazines devoted to WS are currently in existence (see, e.g., [17]). In this extended abstract, I trace some of the trends in the WS arena and provide pointers to numerous papers, specifications and web sites

for much more detailed information. Links to a number of tutorials on WS topics can be found in [25].

The World Wide Web Consortium (W3C) has been the sponsoring organization for many WS-related standardization activities [18]. In May 2000, IBM, Microsoft and others released the specification for SOAP 1.1 (Simple Object Access Protocol) [2]. SOAP is an XML-based protocol for information exchange in a decentralized, distributed environment like the internet. It is essentially a flexible form of the traditional remote procedure call (RPC) mechanism for use in the web context. While SOAP was originally designed to work using HTTP and be able to tunnel through firewalls, more recently, other transport protocol bindings have been proposed for SOAP. In March 2001, IBM, Microsoft and Ariba submitted to W3C the Web Services Description Language (WSDL) specification [3] as a starting point for standardization activities. WSDL is a language intended to be used to describe interfaces of web services and to describe how to interact with them. UDDI is intended to be the means for publishing and discovering services on the web [16].

## **2 Business Process Management**

Business process or workflow management is one area where pre-existing work [13] is being extended to take into account WS requirements [30]. Just recently, BEA, Sun, Intalio and SAP have released the specification for what has been called Web Service Choreography Interface (WSCI) [1]. WSCI is an interface description language based on WSDL for describing the flow of messages exchanged by a WS participating in choreographed interactions with other WSs. It is an attempt to standardize an XML-based syntax for service choreography. IBM and Microsoft are also currently working together on a similar proposal that would merge IBM's WSFL [22] and Microsoft's XLANG [19]. The relationship between WSCI and related technologies like WSFL, XLANG, ebXML's BPSS, BTP, BPMI.org's Business Process Modeling Language (BPML), HP's Web Service Conversation Language (WSCL), XML Pipeline Definition Language and OMG's Enterprise Distributed Object Computing (EDOC) has been discussed in [24].

## **3 Implementations**

Many software vendors are actively working on supporting WS in their products. This is especially true of the application server vendors [15]. In July 2000, IBM released on its alphaWorks site a WS toolkit which has been steadily enhanced with additional functionality ever since [5, 9]. This kit includes a run-time environment, a demo and examples to help users in designing and executing applications that are built by combining web services. IBM has also released what is called the WebSphere SDK (WSDK) for Web Services [10]. IBM has also developed the Web Services Invocation Framework (WSIF) for supporting the invocation of web services without worrying about transport protocols or the locations of the services [6]. WSIF frees a soft-

ware developer from the constraints of having to develop services for particular transport protocols or service environments. To enable quicker adoption and standardization IBM has donated the WSIF source code to the Apache XML project under the auspices of the Axis work.

IBM's DB2 has been extended to include support for WS [12]. Consequently, now it is possible to very easily make existing DB2 stored procedures available across the web as services. In July 2001, IBM released the Beta version of Web Services Object Runtime Framework (WORF) [4]. WORF allows the DB2 XML Extender to support WS.

In June 2002, BEA released WebLogic Workshop which allows even developers with no knowledge of J2EE to develop WSs using visual controls [32]. Recently, Google has made available a SOAP-based web service to access its search engine from applications [8]. On the IBM developerWorks web site, demo applications of some public web services can be found [11].

#### **4 Work in Progress**

Microsoft has released the specification for an asynchronous routing protocol, called WS-Routing, for SOAP messages over a variety of protocols like HTTP, TCP and UDP [28]. The entire route for a SOAP message (as well as a return route) can be described directly within the SOAP envelope. WS-Routing supports one-way messaging, two-way messaging (e.g., request/response and peer-to-peer conversations) and long-running dialogs. It does not define any reliability or retransmission policies. Other groups are extending transaction management concepts like JTS to make web service invocations become transactional. In this context, IBM has defined a reliable version of HTTP called HTTPR [23]. A draft of a specification for WS for J2EE has just been released [20]. It relies on JAX-RPC as the base technology. Research work is currently in progress in IBM Almaden and IBM Tokyo to extend existing support for caching [14] to deal with results of invocations of WS.

WS is becoming more popular in the intranet environment compared to the internet environment [27]. Private UDDI directories are being used to enable this. They are also being used within a company to catalog information regarding the partner companies whose services the former makes use of. They are also useful for keeping track of services developed within the company itself by various groups of people for intra-company usage. A rating system for trustworthiness and quality of service is needed for companies whose services are made available via a public UDDI directory. Another crucial feature is security. Work is currently in progress to add security to WS [21, 31]. In April 2002, IBM, Microsoft and VeriSign defined the specification for WS-Security [29]. It defines a set of SOAP headers that could be used to specify security measures like encryption and digital signatures for WS. It also defines a general mechanism for passing around a set of arbitrary security tokens.

Once the 3<sup>rd</sup> VLDB Workshop on Technologies for E-Services (TES2002) is over, the slides of the talk for which this extended abstract has been written will be available at [http://www.almaden.ibm.com/u/mohan/WebServices\\_TES2002\\_Slides.pdf](http://www.almaden.ibm.com/u/mohan/WebServices_TES2002_Slides.pdf)

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