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Web Services and Workflow Modeling

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ABSTRACT

"Web services" is an emerging field on the Internet. Recent surveys indicate that majority of large companies have started experimenting the technology. The paper aims to explore the role of workflow modeling in the world of Web services. What are the features of workflow modeling in the Web services environment? What are the differences of the workflow concept used in Web services and in workflow modeling management systems? What are the implications of this new paradigm to the professionals of management information systems? These are some of the questions to be discussed in this paper.

INTRODUCTION

Recently there is a proliferation of activities on the subject of "Web services". Once may find all the Information about such activities from a few Web sites, e.g., http://www.w3.org/, www.WebServices.org, and the Web sites of all major software companies. "Web services" is not an abstract concept; it actually could be build with proper tool available now. Some companies are providing such services now, see www.xmethods.net. A report from the FactPoint Research and Consulting Group (2002) indicates how well received of the idea of Web services by Fortune 1000 companies. The report says:

"Almost half of the respondents to our survey this spring are already piloting or deploying live applications based on Web services. In fact, Fortune 1000 companies are the most aggressive adopters of Web services applications. They are clearly convinced that Web services are a strategic technology."

So the present state of technology does allow companies and individuals creating Web services. Microsoft Visual Studio .Net - a popular development tool for creating Web services has been on the market for almost a year. Java 2 Enterprise Edition (J2EE) is also a development tool. Some small scale demonstration projects could be found at many Web sites, including Microsoft. For example, BasicOptionPricing by WebserviceX.NET for European call and put options, the Black Scholes analysis, adjusting for payouts of the underlying American options. However, business use of Web services technology and implementation is still in its early infancy, the realization of its full impact to the business world remains many years away.

Our focus is to explore the role of workflow modeling in the business application development with Web services. We begin with an explanation "Web service" and "workflow modeling".

WHAT IS "WEB SERVICES"?

The phrase "Web Service" has been defined in many different ways. For example,

> *Web services encompass a vision of a fully integrated computing network that include PCs, servers, handheld devices, programs, applications and network equipment, all working together. This network can perform distributed computation with the best-matched device for the task and deliver the information on a timely basis in the form needed by the user.*
> *(Castro-Leon, 2002)*

Castro-Leon extrapolates that "under Web services, almost any program can be viewed as a building block to build more complex functions. In a recursive fashion: the new system could, in turn, become a building block for an even more complex system." This statement is most intriguing because it points out the possibility of building any applications using any programs on the Internet.

Stated in another way (Ambrosio, 2002), "Web services" has a goal of making different software-based systems work together over the Web on Internet. From the business point of view, the services allow software and data to communicate with each other, internally or externally, via the internet without manual intervention." Under this paradigm, the existing infrastructure of information technology could be re-used, and the cost of system integration would be drastically cut.

Another useful definition is found from W3C (2002) on a working draft of Web Services Architecture. They define

"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 protocols."

WORKFLOW MODELING AND WORKFLOW MANAGEMENT SYSTEM

The Website of the Workflow Management Coalition (WfMC): www.wfmc.org is a definitive source of information for the concept of workflow and its management systems. The coalition attempts to define a unified concept of workflow and how it should be managed within and across the boundaries of organizations. The concept of workflow as defined by WfMC is:

> *The automation of a business process, in whole or part, during which documents, information or tasks are passed from one participant to another for action, according to a set of procedural rules.*

A WfMC white paper (1998) defines a business process as "a set of one or more linked procedures or activities which collectively realize a business objective or policy goal, normally with the context of an organizational structure defining functional roles and relationships." For example, "getting a loan" and "making a course registration" both are business processes involving procedures and activities. A business process may have *sub-processes*. Each process/sub-process consists of *activities*, and that in turn, consists of *work items*. An activity may be manual or machine dependent and is considered as a logical step in the process, (e.g., filling out an application,) and normally is handled by workflow participants. After completion (may be partial completion) of an activity, work items are passed to another participant or a process. Workflow specifies the order of activities that may be performed, according to a set of procedural rules, in a business process.

Casati et al (1997) developed a workflow description language in which a business process is viewed as a set of tasks and relationships among tasks. Tasks are elementary work units to be done by a person, by a software system or by both of them. Therefore, the two terms 'task' and 'activity' are equivalent. A workflow specifies which tasks should be executed, in which order, who may be in charge of them, which operations should be performed by external systems or databases. In the example of 'getting a business loan' process, check client's credit, review client's employment status, calculate the loan's limit, are tasks that may be required.

WHAT IS A WORKFLOW MANAGEMENT SYSTEM?

Now we look at the notion of the workflow management system (WfMS) because it helps to explain the difference from a business application system. The defining concept of a workflow management system as found in Allen (2001) is:

> *A system that defines, creates and manages the execution of workflow through the use of software, running on one or more workflow engines, which is able to interpret the process definition, interact with workflow participants and, where required, invoke the use of IT tools and applications.*

In essence, WfMSs should be implemented as software that is capable of 1) interpreting the process definition, 2) interacting with workflow participants, and 3) invoking IT tools and applications. A rigorous process definition language has been proposed by Casati et al (1997). A WfMS basically consists of a business process enactment component and a task-processing component. The task- processing component checks, executes, and reports task's status to the workflow engine. The business process (a set of tasks) enactment component reacts to events by activating tasks, assigning them to agents, and work with other systems of databases. This component works as a workflow control center with scheduling and assignment capabilities and is usually called the workflow engine.

THE DIFFERENCES BETWEEN WEB SERVICES AND WORKFLOW MANAGEMENT SYSTEMS

"Web services" has a goal of creating a new piece of business application system by composing from existing system components within and across organization boundaries on the Internet. So, the first characteristic is that the new application has to be built on the Internet. Second, it has to interact with the existing system components on the Internet regardless of the language used by system components. Developing Web services under these two fundamental conditions requires establishing a workable infrastructure in which software components are described at a semantic level and invoked by application programs or other Web services. The infrastructure consists of Internet standards such as HTTP, XML, SOAP, WSDL, and UDDI. (Curbera et al 2002). A brief explanation of each standard and their relationships is shown in Figure 1.

Although the basic workflow concept used in Web services and WfMSs are the same but the implementation circumstances are different. In composing a Web service from other Web services there is a need for conceptual workflow analysis before it could begin with orderly construction. Because Web services are built upon the special infrastructure, new languages are developed for workflow modeling purposes, for example, the recently announced Business Process Execution Language for Web Services (BPEL4WS) by IBM and Microsoft.

The goal of WfMC is to support the users of workflow technology for all purposes. Under the influence of new Internet technologies, WfMS is also evolving into distribution of work among organizations from its earlier role of managing the distribution of work between people. The Workflow Management Coalition (WfMC) has announced the release of its Workflow Standard *XML Process Definition Language - XPDL 1.0* (Marin, et al, 2002). Together with other WfMC standards, XPDL (also based on XML specification) provides a framework for implementing business process management and workflow engines, and for designing, analyzing, and exchanging business processes.

The standards developed by BPEL4WS and by XPDL are different. BPEL4WS centers on issues of importance in defining Web services; however, XPDL has emphasis on the issues of distribution of work. A detailed comparison may be found in (Shapiro, 2002). Interestingly, according to Fischer (2002) WfMC has not only developed XPDL specification that essentially contains all features of BPEL4WS, and also a Wf-XML, the process execution standard. In addition, XPDL is only one of five functional interfaces to a workflow service as identified by WfMC (1998). The WfMC's standards form a superset of all workflow standards.

So far we only mentioned two workflow modeling languages, there are other languages developed or under development by software companies, e.g., BPML – the Business Process Markup language is developed by the Business Process Management Initiative. Clearly for the benefit of end users, all existing workflow language standards should unify into one.

AN EXAMPLE OF WORKFLOW FOR WEB SERVICES

Workflow modeling languages for Web services such as BPEL4WS is a product of collaborative effort between IBM and Microsoft. BPEL4WS actually inherits the languages of IBM's WSFL (Web Services Flow Language, and Microsoft's XLANG (Web Services for Business Process Design). Therefore BPEL4WS has features from its predecessors. WSFL consists of flow models and global models. Flow models use acyclic graph to describe sequence of functionalities provided by a set of Web services in order to achieve a new business process. Global models describe how a set of Web services interact with each other. XLANG on the other hand uses a block structured language format. These two models provide a high-level platform for defining workflow between system components and the related traffic management, and they are generic features in workflow modeling languages. To give a hypothetical example of a loan application Web services and how an acyclic graph may be applied to describe the composite service, we first assume that a credit check web service at CreditCheck.com, an internal developed customer asset estimation service named CustomerAE.service, and a loan decision and recommendation service at LoanDecision.com are available. A composite Web service expressed graphically is shown in Figure 2.

IMPLICATIONS IN THE PRESENCE OF WEB SERVICES

In an October 2002 survey conducted by Evans Data Corp (2002), the most important reasons to adopt web services are:

1. 24% opted for "Common fabric for systems and application integration"
2. 24% - Mechanism for integrating processes with partners & customers

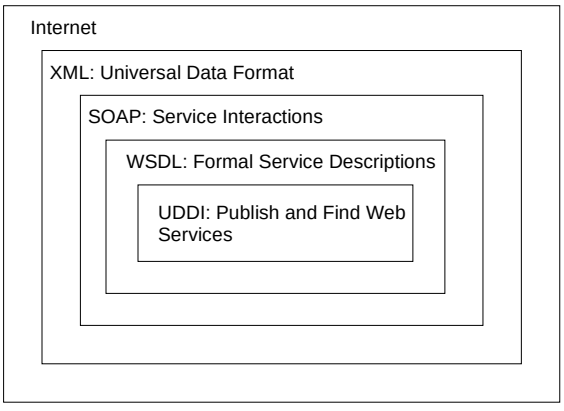

Figure 1. Fundamental Infrastructure of Web Services

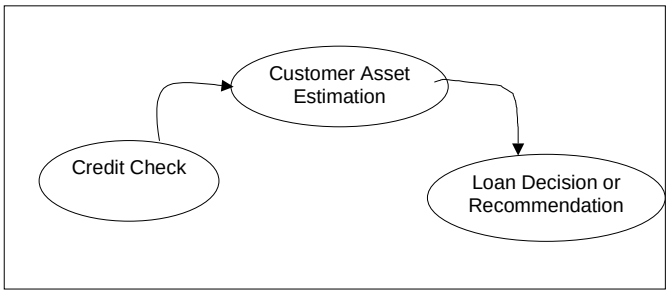

Figure 2. A Workflow Graph for Loan Application Web Services

3. 19% - Modular code components that can be reused
4. 16% - Reduced development and maintenance time
5. 10% - Ability to extend the life and value of legacy systems
6. 7% - High-profile vendor promotion and evangelism

The survey result provides some basis for our inference in the presence of Web services.

MIS Professionals

From item 1, MIS professionals need to expand their business problem analysis beyond their organization boundaries. This is because the new Web Services standards at the higher level are built upon the notion of business rules, business processes, and workflow concepts. A business application system is a system of components of business processes. A business process defines a procedure for conducting a business activity. A well prepared business procedure is defined by a set of clearly stated business rules. The ability to effectively use services/processes within or external to an organization requires a good understanding of all business processes involved. This is an area where MIS professionals can play an important role.

Patterns of Web Services

Although Web services is designed to be able to integrate various services based on the Internet, but in business applications the interest is to solve business problems. Due to significant differences in business operations among business organizations, it is not surprising that there will be patterns of Web services developed for each type of business. Like WfMSs, Allen (2001) classifies WfMS by production, autonomous workflow engines, embedded workflow, administrative, collaborative, and ad-hoc categories. The need to study Web service by type of business or industry is further supported by the fact that there are about 400 standards consortia working on XML definitions for the business processes (Castro-Leon, 2002). Similar situation is expected to occur in Web services applications (item 2 above).

Fast Development for Complex Systems

Complex business application systems, e.g., the supply chain management system, involving multi-process, and multi-workflow are also being developed. It is easy to imaging that complex projects come with high degree of difficulty and cost. Web service technology allows the work to be decentralized and distributed among intra/inter-organizational systems and then integrated. Since critical business components may be available on Internet, thus the use of such components (items 3 and 4 above) with Web services would accelerate the speed of system development.

Increased Reusability and Decreased Cost

Services on the Internet could be potentially reused (item 4) by any other services though the Web services framework. This includes currently inaccessible services due to lack of the infrastructure for delivering such services on the Internet. With Web services fully established, all services on the Web become reusable resources. Since services are available on the Internet, they would be widely used. The fact that services could be made available on demand without reinventing the wheels, the cost of developing a business application would go down necessarily.

Legacy Applications Modernization

Item 5 indicates that Web services may be the most promising way to tap and support huge database of end users that are on mainframes and midrange-class server systems across enterprises. Another application of Web services on enterprise legacy systems is to achieve standardization across all their platforms, software, and hardware. These applications of Web services are internal integration activities to an enterprise and therefore they are expected to be most active in the next few years.

CONCLUSION

This paper examines some aspects of Web services at a high level view. We briefly discussed the technology of Web services and its implications. Web services is being developed at a very rapid pace by the software industry. This technology will influence the way we work and interact in the near future. For MIS professionals this is a new area for work and research.

REFERENCES

Allen, R. (2000), Workflow: An Introduction, in The Workflow Handbook 2001, edited by Fisher, L., Workflow Management Coalition.

Ambrosio, J. (2002). Web Services: Report from the Field. Application Development Trends, Vol. 9, No. 6, June, 2002.

Casati, F., Ceri, S., Pernici, B., and Pozzi, G., (1997), Advances in Object-Oriented Data Modeling, edited by Papaxoglou, M., Spaccapietra, S., and Tari, Z., The MIT Press.

Castro-Leon, Enrique (2002). A perspective on Web Services, http://webservices.org/article/articleprint/113/-1/24/ of IntelPublishing.

Evans Data Corp. (2002). Enterprise Development Management Issues 2002: Vol. 2. http://www.EvansData.com.

Hollingsworth, D., (1995). Workflow Management Coalition - The Workflow Reference Model, Doc. # TC00-1003. The Workflow Management Coalition.

Marin, M., Norin, R., and Shapiro, R. Edited. (2002); *Workflow Process Definition Interface — XML Process Definition Language*. Document Number: WFMC-TC-1025. Document Status: 1.0 Final Draft.

Fischer, L. (2002). The WfMC Heralds BPEL4WS Standards for Business Process Management Industry. URL: http://xml.coverpages.org/WfMC-Heralds-BPEL4WS.html.

Plummer, D. et al. (2001). Requirements for Web Services: Terms and Technology, Gartner Research Note COM-12-7087.

Shapiro, R. (2002). "A Comparison of XPDL, BPML, and BPEL4WS." Published by ebPML.org. 'Rough Draft' version 1.4.

WfMC , (1998), Workflow and Internet: Catalysts for Radical Change, A white paper by Workflow Management Coalition, www.wfmc.org.

W3C (2002), Web Services Architecture, W3C Working Draft. http://www.w3.org/TR/2002/WD-ws-arch-20021114/.