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Web Services Adoption Model for the Organization Focusing Various Issues Involved

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Abstract

Web services form integral part in dynamic e-business domain. Currently, many organizations are seriously evaluating the option of adopting Web services technology. So the organizations are trying to analyse the impact on the total cost if a substantial cost is incurred in adopting the Web services. The model proposed for the senior management identifies the critical issues involved in the adoption along 2 domains – VPNs & internet. The evaluation is done on the organizations current level of information technology sophistication. An experiment has been conducted to find the strategy which shows a distinct benefit on the cost incurred for allocating resources to pursue Web services adoption.Alternative strategies are being evaluated under both scenarios with different combinations of weights and diffusion levels of the critical issues. The results will suggest that different strategies should be employed, while organizations consider their existing organizational IT status and focus area. This work provides necessary guidelines for senior management to utilize available resources effectively and efficiently for adopting Web services.

I. INTRODUCTION

The work is intended to evaluate the potential of web services in generating value to the business, and not dive in the technical side of the technology. But to do so, it is necessary to understand sometechnical issues and evolution of the web services' components, structure, and standards, because the development and deployment of web services are in great part related to them.

Web services are becoming increasingly important to the IT-Business, especially since the advent of service-oriented architecture. IT users are looking for a way to increase the flexibility of their IT systems so as to be able to react quickly to changes in their environments. If a competitor comes up with a new marketing approach, they have to be able to follow that approach in a short period of time. Adaptability of the IT systems has become critical to the survival of a company.

The management of a company's IT infrastructure involves an effort to maintain and support legacy systems and implement new systems to meet emerging business needs, while ensuring that the overall IT infrastructure is dynamic and flexible enough to enable rather than inhibit changes in business direction and strategy [2]. To

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accomplish those tasks many tools have been developed or made available by vendors.

An earlier adoption of a technology can ensure a longer stream of benefits, but the company can also be stuck with an inferior technology in the future [7], specially when adoption of standards are a fundamental piece in the processes, as in the web services.

Although web services have the potential of being used in the integration of inter and intra systems organizations, it isimportant to have in mind that the challenges to the integration are not only related to the available technologies itself. Over the years many IT departments have carried out the requests made by different corporate functions and tried out pledges of diverse vendors about new solutions, resulting in the development of a myriad of information systems that do not talk to one another [8]. Many organizations have independent IT initiatives, each one with

particular business applications, technologies, cultures, data definitions, and orientation. Projects costs soar because teams are isolated and do not reuse each other's components. The development of more and more isolated systems creates redundancy, inconsistency and non-interoperability, increasing the costs of running the banks' operations.

From a business perspective there are many dimensions that must be examined when considering the move to a web services model, as issues of cost (both short term and long term), timing, flexibility, control, maintenance, support, staff and return on investment to name a few [1].

II. WHAT ARE WEB SERVICES

Web Services are network-based software applications developed to interact with other applications using Internet standard technologies and connections to seamlessly perform business process.

Web service can be considered as a set of agreed-on standards, allowing it integrateand communicate, via a network (internet, extranet, intranet), with diverse applications written in different programming languages and running on different operating systems and hardware without the need of close knowledge of each other's IT systems.

III. NEED TO OPT FOR WEB-SERVICES

Web services provide a standard that allow applications to communicate with one another and share information on the Web. A growing number of technology companies presently focus their efforts on the creation of Web services. As of now, most of the small, medium, and large businesses are looking toward the objectives of shorter-term return on investments while leveraging existing infrastructure. Today, there is a strong linkage between Web services technologies and the business integration challenges.

Web services present significant opportunities for organizations to quickly and cost-effectively adopt solutions and industry standards that keep pace with their rapidly changing business requirements.

IV. WHEN TO OPT FOR WEB-SERVICES

The value of most web services typically increases over time. This is due to the network effect. They are of little value when no one else has the technology to use them, but a tipping point occurs after which adoption increases rapidly. At some point, in fact, the cost of not having an implementation of the web service becomes substantial.

Cost is the other criterion. It's always less expensive to develop an application as the technologies on which it's based mature. It's less expensive to develop an application once third-party tools become available. Likewise, it's more expensive to hire contractors and consultants in the early stage of a new technology than to later hire employees.

But it will take time to develop the web service, so we need to determine the point at which we must begin development. This process is illustrated below. We move backwards from the desired launch dateby the

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amount of time it will take to develop the service (lead time). This gives us the start time at which development must begin in order to deploy on schedule. In order to deploy the desired web service somewhat prior to widespread use of such services, the organization must begin development immediately upon the publication of the standards that address the underlying technologies.

Note also, that the development team should be prepared for problems with product interoperability, and that the company should not expect to hire employees who have previously been exposed to the recently standardized technologies required to build the web service.

Using an analysis such as shown above, it should be possible to avoid starting a web-service implementation project too late. But it's also possible to avoid starting too early. That's critical for minimizing IT waste and maximizing ROI.

Consider what would happen if the company in the above example were to begin development as soon as the first developer tools became available. The company will spend substantially more than is required, and development process will suffer from a lack of documentation, slippery standards and a shortage of experienced staff or contractors. The development costs will be increased due to starting too early.

It's not a matter of "later is always better," for clearly, once value exceeds costs, you'll experience a loss from investing too late. The key is to optimize the timing and start neither too early nor too late.

A model we propose follows the methodology begins with the following steps :

1.Map the cost-indicator curve to actual dates for the web service you're planning.

2.Determine at what stage it's appropriate for your organization to deploy web services (innovator, early adopter, early majority, late majority), and attempt to draw a value curve that intersects the cost curve.

3.Working backwards from that intersection (the optimal deployment date), create a plan and schedule to develop the required services.

V. ISSUES INVOLVED IN WEB SERVICE ADOPTION

5.1 Standards issues

Standard issues are those related to the lack of standards or standards immaturity and lack of critical mass of business partners behind specific standards.

5.1.1. Non-maturity and lack of standards

Up to now, web services technology is not mature, with the underlying technologies as XML, SOAP, WSDL, and UDDI being relatively new [1]. Many companies are waiting for the definition and maturity of standards before adopting them. They are not willing to dare the uncertainty of adopting a standard and see another one to be created, making it obsolete [10]. Such situation would not only make it difficult the interoperability with other companies, but also, lock in the company to a vendor, since most of the vendors are to adopt the agreed-on standard. Adopting standards that are abandoned or fail to evolve will require future changes and upgrades to allow integration with customers and suppliers. Then, at this point, it is crucial to be backed for trustful vendors, in order to reduce the risk of seeing the market and standards evolved in a different path.

5.1.2. Semantic Issues

It is important to align data definitions, jargon, and vocabulary words within and across organizations [2], solving concerns about the semantic and context of the information. Such definitions are critical to the interoperability of systems and the implementation of web services. Different systems show different specifications as to units of measure, different time references, and different definitions of terms, demanding a time-consuming analysis, being prone to

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error consolidation. With machine-to-machine interactions without an established semantic, it could be even worse. The XML language provides syntactic interoperability, which means allowing applications and web services to identify the structure of the exchanged messages. However, it does not provide interpretation of the content of those messages. [5]. The lack of XML semantics proves to be an obstacle for the development of web services to act autonomously on the electronic commerce.

Standardizing the context and semantics of XML documents is one of the most difficult integration challenges to be overcome [63]. If standards are not achieved, each two companies will need to agree on the semantic to be used, which eliminates great part of web services benefits. There is a lack of consistency about definitions among areas of the same company. The achievement of a global data definition throughout the company is quite difficult to implement and can be cumbersome. Then, it is necessary to clearly define the limited set of standard data definition to guarantee the level of interoperability desired.

5.2 Technical issues

Technical issues are those relative to the operation of web services as to security, reliability, and performance.

5.2.1. Security

In web services, companies face the trade-off between flexibility and security and stability.In an initial phase of adoption of a new technology, this tradeoff is more evident as in the case of web services. Since SOAP is more commonly transported in HTTP, any potential threat to HTTP will be inherited by SOAP. An additional concern in dealing with text-based XML documents - unlike conventional middleware data wrapped in binary documents - is that, if intercepted in transit, it can provide information of data and the structure of the data [11], since XML-documents are structured and marked with tags. Thus, the advantage of being extremely readable applications to computers as well as to humans is also a high risk. The security concerns are still waiting for the establishment of reliable standards [12] [13]. The information security can be divided in the following logical components: confidentiality, integrity, authentication, authorization, and privacy [14][15][7][16], and each of them present challenges to the implementation of web services.

5.2.2. Performance issue

Another concern in dealing with XML is that, since it is a text-based document, it is heavier than binary data. In general the XML quadruplicates the size of the messages, but it can be 20 times larger than a non-XML version, due to the inclusion of tags embedding metadata. The processing speed of an XML-document is still at a factor between 10 and 20 times slower than that of an optimized binary protocol. Sending and receiving are affected because parsing and processing text-based messages are moretime-consuming and expensive. Transmission is more time consuming due to the size of the messages [18][13]. The increase in the volume of information to be exchanged increases with the use of XML, what can overload the network in the presence of a large number of services, penalizing the scalability of the web service model [8]. Considerations about its adoption must balance these performance issues, including the need and costs of storage, communication, and faster processors, with the advantages as the most understandable format, interoperability of applications, using different technologies, data quality, and single entry of data to support multiple applications.

5.2.3. Quality of Service and Reliability issue

An application could be composed by multiple web services, each one with different degrees of reliability and security. But the unreliability of any one of the web services used by the application could cause the

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downfall of each other. By making various applications base themselves on web services, there is a risk of having a fault in a component, making you bring down many more dependable applications than in a point-to-point integration. It is more difficult to guarantee the quality of service of an application over the internet and define parameters to availability, performance, and reliability [4]. Furthermore, one supposed service composed by services offered by many different companies raise issues as to thedefinition and agreement on responsibilities, procedures, and time for diagnose and maintenance in case of failure. In case of the failure of a banking service, the customer has no interest in the composition of the service, and the brand and reputation at stake are those of thefinancial institution. The companies offer a quality, security, and reliability of service that they are not willing to give up while adopting a new technology, since the customers are not concerned about what is going on with the technology, but about what is going on with the services and products offered to them.

5.2.4. Transactions issues

Some of the obstacles to be overcome as of the adoption of web services are related to the transactions [9]. So far, the concept of ACID transactions has had a fundamental role in the development of current enterprise applications. A system that conforms to these so-called ACID properties guarantees the reliability of its transactions and has the properties like atomicity, consistency, isolation & durability.

However, these properties are suited to short-term activities executing on closely-coupled applications and environments. Ina loosely-coupled environment, like the web services, they are too inflexible and restricting for many applications. Acid-based transactions span some seconds or few minutes at the most and block the application during this time whereas web-services transactions are much more complex and may last quite long. If the concepts of ACID transaction are to apply to web services, some systems would be locked for many hours until the end of thetransaction. Additionally, ACID transactions are conceived to run in more reliable environments, in which failures are relatively infrequent [7]. Problems of transactions involving multiple parties as in hotel reservations, airlines, and car rentals simultaneously have been solved by close coupling the systems, but there is not yet a solution or standard to solve the problem using loose coupled systems as in the case of web services.

5.3 Vendor and Skill issues

Vendor and skill issues include the lack of vendors support and financial institutions' in-house skills mainly in the area of external web services, security and emerging standards. Web services implementation requires not so simple specifications, tools and techniques; some of them are still to come up during the future implementations and proofs of the concept. Up to now, vendors have not been able to offer solutions to meet many needs of the companies in deploying web services. Most of the emerging standards are not fully supported by vendors, making it difficult for the companies to dare the hurdles of adoption. Moreover, many of the needed solutions to the deployment of web services are not yet offered by well-known vendors. Deciding to acquire new technologies solutions of small suppliers' present the risks of getting the supplier to go out of business or get stuck to loser-standards, since such suppliers have less power to push towards the adoption of their solutions as standards. However, companies intending to be early adopters are going to run these risks by previously fully assessing the vendors' capabilities and selecting the most prone ones to have an active participation in the definition of standards and to keep themselves in the market.

5.4 Financial Issues

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Being it a new non-completely-developed technology, it is difficult to have a clear idea about the return on the application's investment. Although some companies have claimed huge savings through the implementation, there is still not enough data to draw a complete picture and the benefits of the investment can still beconsidered theoretical. The implementation of web services can demand costs in terms of new software, hardware, networking infrastructure [1] and related personnel and administrativeexpenses. The deployment of web services demands adaptation in applications to allow inclusion of the new standards. The different performance of processing the documents based on such new standards can demand more powerful processors and storage, as in the case of processing XML-documents. Although the internet was supposed to be used as the data-network infrastructure, the connection interoperability among companies can bring up new networking expenses. These amounts and the related personnel, administrative, and maintenance expenses must be taken into account so the possible return on the investment can be analyzed.

5.5 Contractual and Legal Issues

Aspects as contracts and agreements to make use of the third parties' web services must still be brought up to discussion. There have been attempt to create solutions to automatize business contracts (parts or all) in the e-commerce, enabling software agents in the electronic marketplace to create, compose, modify, discover, evaluate, negotiate, and monitor contracts with substantial automation and modularity. Those e-contracts could be used in agreements about web services, but they are still under development. In addition, companies need to be on alert as to the possible dispute resolutions, involving contracts and jurisdictional matters in the use of web services.

5.6 Partners Issues

The security is not the only challenge to be overcome in the use of web services to integrate partners. Some companies find it difficult to connect to its partners, because the latter would need to process XML and SOAP messages; however, many of them, as some car dealers, are neither able nor willing to do so due to work and costs demanded. Some issues can also be faced in connection with customers that might not be willing to invest in connectivitywith the financial services, as demanded by some solutions proposed so far.

VI. CONCLUSION

The hype and confusion surrounding web services have led to scepticism about the future of the technology. Although many of the early uses of web services are expected to focus on increasing efficiencies, the model that we have discussed points towards the potential of harnessing the technology for revenue growth.

We believe recognition of the potential implications of the "new" architecture by senior managers in an enterprise is the first step towards the development and deployment of web services. In this area, management needs to have a shared vision on the long-term business implications of the new IT architecture.

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