

December 2002

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Recommended Citation

Ratnasingham, Pauline and Pavlou, Paul, "THE ROLE OF WEB SERVICES IN BUSINESS TO BUSINESS ELECTRONIC COMMERCE" (2002). *AMCIS 2002 Proceedings*. 306.
<http://aisel.aisnet.org/amcis2002/306>

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THE ROLE OF WEB SERVICES IN BUSINESS TO BUSINESS ELECTRONIC COMMERCE

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Abstract

The Internet has accelerated the adoption of electronic collaboration and commerce among organizations. The next stage in e-business will be the integration of collaboration and commerce activities with value-added and knowledge services. This stage calls for Web services, which are modular Internet-based business functions that perform specific business tasks to facilitate business interactions within and beyond the organization. Businesses can experience time and cost savings by logging on to a Web service provider and requesting the service they require, as opposed to investing in exclusive technologies. This study argues that Web services engender several performance outcomes. Web services are a significant enabler of interfirm collaboration by promoting technology trust between enterprises, which is described as control safeguards and assurances embedded as protocols in Web services.

Introduction

A new promise about the potential of the Internet has emerged – Web services. This promise goes by many different names – IBM touts “Web Services,” Microsoft calls it “.Net”, Oracle refers to “Network Services”, and Sun talks about “Open Network Environment” (Hagel and Brown, 2001; Lachal, 2001). We define Web services as “modular Internet-based business functions that perform specific business tasks to facilitate business interactions within and beyond the organization.” Firms can now lease their information technologies as Web services, rather than owning and maintaining their own systems. The future of e-business is about connectivity of people, applications, and data (Fieldman, 2002). Hence, the evolution of B2B e-commerce is moving towards Web services that aim to integrate requesters, providers and brokers.

Whereas the traditional notion of trust focused on trading partner relationships, trust in Web services incorporates the notion of technology trust, which is defined as “the subjective probability by which organizations believe that the underlying technology infrastructure is capable of facilitating transactions according to their confident expectations.” Technology trust is based on technical safeguards, protective measures, and control mechanisms that aim to provide reliable transactions from timely, accurate, and complete data transmission (Cassel and Bickmore, 2000). In this paper, we propose that technology trust is also embedded in Web services. This view is consistent with other researchers who proposed institution-based trust (Zucker, 1986), and structural assurances (McKnight et al., 1998). This study examines technology trust in Web services, aiming to answer the following research question: How and why do Web services engender technology trust and what is their impact on performance outcomes?

Conceptual Development

What are Web Services?

Web services are derived from emerging standards that describe a service-oriented architecture on the Internet, enabling online exchanges to take place in a distributed network environment. Table 1 provides selected definitions of Web services.

Table 1. Definitions of Web Services

Definition of Web Services	Source
Web services are Internet-based services that provide significant cost savings over traditional, internal systems and offering new opportunities for collaboration among companies.	Hagel and Brown (2001)
A Web service is a software architecture that facilitates business interactions within and beyond the enterprise.	Paratech International (2001)
A Web service is an Internet based modular applications which performs a specific business task and conforms to a specified technical format	Mougin and Barriolade (2001)
A Web service is a loosely coupled, reusable software components that semantically encapsulate functionality, are distributed and are programmatically accessible over standard Internet protocols	The Stencil Group (2001)
Web services are self-contained modular applications that can be described, published, located, and invoked over the Web	IBM Corporation (2000)
A Web service is a collection of functions that are packaged as a single entity and published on the network for use by other programs.	Glass (2000)

Traditional B2B Applications versus Web Services

In the early stages of B2B e-commerce adoption, matchmaking systems brought together buyers and sellers through centralized exchange systems. The business operations were well-defined, perceived to be secure with pre-arranged trading agreements implemented for EDI, Internet-based EDI, and extranet systems. These traditional B2B applications demanded a relationship with selected trading partners that are long-term, proprietary, and transactions are were dominated by high volumes. On the contrary, the Web services architecture is completely different. Constructed on the Internet, it is an open rather than a proprietary architecture (Dumbill, 2002). Instead of building and maintaining unique internal systems, organizations can rent or outsource the functionality they need – whether it is data storage, processing power, or specific applications from outside service providers. Web services are flexible, decentralized, open, unmonitored, shared Internet based applications that allow firms to create new products and services faster than existing methods that consist of dynamic assembly of loosely coupled components (e-services, legacy data) (Fieldman, 2002; Glass, 2000). Table 2 presents the difference between traditional B2B applications and Web services.

Table 2. Comparison between a Traditional B2B Applications and Web Services

Traditional B2B Applications	Web Services
Centralized	Decentralized
Contained and controlled	Open and unmonitored
Limited, defined user base	Unknown, unlimited user base
Secure (risk minimized)	Exposed (open to random events)
Proprietary	Shared
Fixed, well-defined, compiled	Built dynamically, on-the-fly
Incremental scale based on known demand	Unlimited scale, based on unknown, unpredictable demand
Staged, periodic changes	Continuous, ad hoc changes

The Web Services Architecture

The Web services architecture is made up of three layers of technology (Hagel and Brown, 2001). At the foundation, (the bottom layer) is the software standards and communication protocols that provide a common language for Web services and enables applications to be connected. The service grid, (the middle layer) provides a set of shared utilities from security to third-party auditing, to billing and payment that makes it possible to carry out mission critical business functions and transactions over the

Internet. In short, the service grid plays two roles. First, it helps Web services users and providers to find and connect with one another, and second, it creates trusted environments essential for carrying out mission-critical business activities. Finally, the top layer consists of a diverse array of application services. It is in this top layer where the day-to-day operations will be most visible to employees, customers, and trading partners.

Web Services - A Technology Perspective

By abstracting the underlying operating systems, source code, and even the network, Web services obviate traditional notions of applications, such as compatibility and portability. Web services enable intelligent dialog between services, regardless of how they were compiled and run. The removal of many traditional interoperability barriers enables many business relationships to be easily built, deployed, and configured (Paratech International, 2001). Web services provide sophisticated software packages that enable electronic storefronts and catalog-based sell side solutions to integrate. They come with comprehensive catalog management tools, navigation and search facilities, and rule base personalization to connect with back-end systems for automated price inquiries, order processing, or synchronization of customer records.

Web Services - A Business Perspective

A Web service represents a unit of business application, or system functionality. Each discrete Web service can be deployed across the Internet. Multiple services can be combined or assembled to deliver new services. This modular approach gives companies the flexibility during system design. By reassembling a few services into a new configuration, an organization can create a new service to support a different business objective. Web services are applicable to all Web environments, intranet or extranets. Web services can support B2C, B2B, department-to-department, or peer-to-peer interactions. Web services are independent, can exist on any platforms, communicate seamlessly, are self-contained with self-describing features, and easy-to-use. Finally, Web services can be shared and reused so that existing systems need not be replaced.

Web Services and Performance Outcomes

The Web services architecture supports a more flexible collaboration between an organization and its business partners. When traditional systems communicate to each other, they do so through dedicated point-to-point connections. However, Web services enable everyone to share the same standards for data description and connection protocols, allowing applications to communicate freely with other applications without costly reprogramming. Thus, the openness and modularity of Web services enables organizations to (a) dramatically reduce application development upgrade time and costs and (b) integrate without having to rewrite existing applications. Furthermore, Web services are registered and can be located through a Web service registry that is easily accessible. The interface acts as a liaison between the Web, and the actual application logic that implements the service. It enables the delivery of new applications and adds new services quickly and easily thus reducing development and deployment of time. Hence, Web services represent an efficient way to manage IT, allowing organizations to purchase only the required functionality. The new architecture substantially reduces IT investments, shifting the responsibility of maintaining the systems to outside providers. It also reduces the need for employing numerous IT specialists and the risk of organizations using obsolete technologies. Most organizations experience immediate benefits by improving their internal business processes. Based on the above arguments we propose that the implementation of Web services is positively associated with performance outcomes.

Technology Trust in Web Services

Web services run on the Internet, which is an inherently insecure environment. The existing Web services standards leave key issues such as security to vendors to resolve. Web services create technical challenges for IT departments, such as (a) security and authentication, (b) content management and publications, (c) reliable systems, (d) messaging and data, (e) complex interaction, (f) transactions, and (g) timely and accurate responses to requests (Orchard, 2002). Hence, attention must be paid to rigorous authentication, integrity, non-repudiation, encryption, and security matters. Key threats include (i) the security of information that is shared between the broker, the requester, the provider, (ii) the security of the network, and (iii) the security of the programming model at design time.

Trust in e-business also incorporates the notion of technology trust, which is defined as “the subjective probability by which organizations believe that the underlying technology infrastructure is capable of facilitating transactions according to their confident expectations” (Ratnasingam and Pavlou, 2002). The dynamic nature of the Web services architecture presents new

opportunities for technology trust building. Web services provide a medium for the delivery of trust services, such as authentication and authorization. For example, Entrust has been a strong supporter of open standards and supports the XML Trust Center as a resource for the development of interoperable trust standards. Similarly, Pricewater House applies their Web service software that provides a secure platform to Netegrity's, presenting resources for interactive e-business. The platform integrates access control, single sign-on, identity management, portal, and provisioning services for rapidly building, managing, and delivering interactive e-business portals for departments, enterprises and extranets.

The impact of technology trust in Web services implies that security services such as; digital signatures, encryption mechanisms, authorization mechanisms, and best business practices enforce quality and standards. Following Ratnasingam and Pavlou (2002), we identify seven dimensions of technology trust, and relate it to Web services in Table 4. Based on the above arguments we propose that technology trust is positively associated with performance outcomes in Web services.

Implications for Practice

The shift to Web services requires broad organizational and managerial changes as well as the development of new technology, promoting broad organizational and managerial changes. A big impact is achieved in IT departments by moving into two dimensions (1) outsourcing many traditional IT activities as credible and reliable providers of service emerge, and (2) leveraging internal capabilities to design distinctive Web services that can be sold to other organizations. The Web services architecture should be initially viewed as an adjunct to the current existing system. Managers will assume a new role from leadership command and control style to negotiating, persuading, and influencing style.

Table 3. Technology Trust Dimensions and their relationships with Web Services

Technology Trust Dimensions	Relationship to Web Services
(1) <u>Confidentiality</u> aims to protect transactions against unauthorized reading, copying, or disclosure through encryption.	Web services use encryption, user IDs and passwords to maintain the confidentiality of transactions and messages exchanged between the requesters, providers and brokers.
(2) <u>Authentication</u> provides transaction quality of being authoritative, valid, true, genuine, and worthy of acceptance.	Web services use the standard authentication protocol (HTTP) along with SSL as a customary choice, although over time large corporations using Web services for sensitive information and financial transactions can move to digital certificates.
(3) <u>Integrity</u> aims to provide accuracy and assurance that transactions have not been altered or deleted.	Web services use reliable messaging to enforce integrity ensuring that the message was only sent once, thus avoiding duplication (Snell, 2001). In addition, dependency spheres are a new type of transaction context that allows both synchronous and asynchronous distributed messaging style exchanges to occur within a single transaction.
(4) <u>Non-repudiation</u> protects the trading partners acknowledgement procedures.	Web services use reliable messaging to ensure that both the provider and requester of a service know whether or not a message was actually sent.
(5) <u>Availability</u> protects transactions against weaknesses in the transmission media	Web services use features that enable the logging, configuration, and deployment of a certain utility via Web access thus enforcing availability mechanisms.
(6) <u>Access Controls</u> provide authorization mechanisms and assure that transactions are sent and received without interruption.	Web services use conditional messaging to establish various conditions that apply to how and when a message is delivered. Conditional messages are based on rules implemented on the application layer, allowing companies to dynamically integrate their business processes within defined constraints and conditions.
(7) <u>Best business practices</u> focus on policies, procedures, standards, and top management commitment.	Web services use open standards such as XML, SOAP, UDDI and WSDL that allow Web services to be described, advertised, discovered, and involved on the Internet across multiple platforms.

Discussion

B2B e-commerce is entering a phase of technological maturity in which major open standards are adopted to enable interfirm integration and collaboration. Web services are a significant enabler of this move toward interfirm cooperation by promoting technology trust between enterprises through their deployment and use. This paper contributes to theory by explicating the role of Web services in B2B e-commerce as a means of building technology trust and indirectly influencing performance outcomes. Our next phase is to examine organizations that play the role of Web service providers, brokers, and requesters using case studies, which provide the opportunity for in-depth analysis of the nature and role of Web services.

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