Adopting Web Services for B2B e-Collaboration: Research Directions

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INTRODUCTION

Web services technology is moving into the mainstream. HTTP-based integration is proving more useful than prior approaches for integrating heterogeneous and distributed systems. Web service architectures are quickly moving beyond their initial XML (Extensible Markup Language)/SOAP (Simple Object Access Protocol)/UDDI (Universal Description, Discovery and Integration) architectures. They are becoming more complex. With added specifications, web services are creating a service-oriented computing paradigm with its attendant terms and concepts: such as web service networks, web services management platforms and service-oriented architectures among others. Aided by web services, B2B integration topologies are growing in diversity, from pure P2P (peer to peer) to hub and spoke exchanges, with several variations in between. Web services are now the primary technical direction enabling this diversification of business-to-business (B2B) collaborations (e-collaboration) among value chain partners. They emerge as the foundation for the development of a new generation of B2B applications and the architecture for integrating enterprise applications (Kreger, 2003). Web services promise to increase these partnering companies' flexibility, agility, competitiveness, as well as opportunities to reduce development cost and time.

This research-in-progress paper examines major trends of web services development in the context of B2B e-collaboration and identifies directions for future research in this area.

BACKGROUND RESEARCH

E-Collaboration

Businesses are moving toward an e-business web model in which collaboration among members of the participating network of suppliers, distributors, service providers, and customers produces value for customers. Such Internet-enabled industry value chains redefine e-business as collaborative commerce. In this environment, companies participating in the e-business web become virtual enterprises.

Virtual enterprises are characterized by rapid exchange of information within a virtual network of suppliers, customers and partners, working together to create value added processes (Burn et al., 2000). Virtual market necessitates the establishment of appropriate inter-organizational systems to facilitate communication, co-ordination and collaboration (Marshall et al., 1999). They bring both new IT-enabled intermediation and integrated virtual supply chain (Burn et al., 2000). Internet facilitates supply chain integration through greater coordination and collaboration among all members of a

company's supply chain (Lee & Whang, 2001; Sakaguchi et al., 2002). Such integration emphasizes information sharing, transparency, data integrity and flexibility. Companies are motivated to pursue e-collaboration by clear incentives, such as overall cost and time reduction, real-time communication, lead-time reduction, and improved collaborative planning and forecasting.

Options of e-Collaborations

Companies have various options to pursue e-collaborations. Ranganathan (2003) has mapped B2B exchanges according to one-to-many or many-to-many linkages. Each option presents different value propositions and constraints.

- One-to-many linkages are single firm operated private exchanges. They help connect a firm to its customers, suppliers or both. Private exchanges can be further classified into buyer based or seller based exchanges. Buyer based exchange help forge a strong collaboration with suppliers and a seller based exchange helps collaborate with the end customers. One-to-one proprietary linkages between partnering firms serve as a traditional form of B2B collaboration, which represent point-to-point integration through EDI or EAI.
- Many-to-many linkages are e-marketplaces where many firms come together in a virtual market to perform business. Many-to-many linkages are further classified into independent exchanges and consortia based exchanges depending on the number of players involved. Independent exchanges involves one private firm acting as an intermediary and consortia based exchanges are joint ventures where participating industry players seek to attain specific goals through cooperation.

Web Services Growth

Web services can be thought of as a means by which an application service may be provided to other applications on the Internet. XML is the foundation technology in web services, as all access to the services are delivered in XML documents via HTTP. Web services are described in the Web Services Description Language (WSDL). Web services can optionally be registered in the UDDI repository where the other applications can both register and discover services. Web services can be revealed and accessed both within a company and between companies.

Web services are moving into the mainstream. In a February 2002 Gartner survey, 27 percent of the IT respondents indicated that they would be using web services in a systems integration project within twelve months. By February 2003, that number had risen to 42 percent (Cantera, 2003). The technology research firm, IDC predicts that web services will spur software, hardware and service sales of $21 billion in the U.S. by 2007 (Muse, 2003).

Web services technologies address heterogeneity problems that previous technology could not overcome. For years, Information Technology (IT) organizations have sought increased system reuse and interoperability between systems (Lim & Wen, 2003). Since web services operate via the HTTP protocol, they are more firewall friendly than older object-oriented technologies. With UDDI, web services have a consistent approach to introspection which older object-oriented technologies do not. And with SOAP, access to

objects can be standardized as well, unlike object-oriented technologies such EJP, CORBA and COM+.

Web services are now increasing in sophistication. Service-oriented computing (SOC) and service-oriented architectures are taking web services beyond supporting simple XML interactions to more robust business interactions within and across enterprises (Curbera, et al, 2003). Specifications for quality of service and service composition such as BPEL for Web Services (BPELWS) currently authored by IBM, Microsoft and BEA, WS-Coordination, WS-Transaction, WS-Security, WS-Reliable Messaging, and WS-Policy will allow for far richer, higher-level delivery of computing services via a web services management platform (WSMP). Papazoglou and Georgakopolous (2003) describe three layers of services: basic services, composite services, and managed services. Basic services manage publication, discovery, selection and binding. Composite services facilitate coordination, conformance, monitoring and quality of service. Managed services provide market certification, rating, SLA and operations support.

MAJOR TRENDS IN WEB SERVICES DEVELOPMENT

Six trends of web services technology are likely to affect B2B e-collaboration:

1. Web services will be increasingly used within private exchanges. Factors include: the need for companies to maintain agile relationships with partners (dynamism) and the need to protect the identity of services the business offers from anonymous access and to cement relationships through business agreements, not simply through business process integration. Web services are a more dynamic architecture for enabling a business to rapidly adjust its services, and the private exchange (trading agreements with a small number of partners) allows companies to maintain some level of secrecy in services. (Plummer & Andrews 2001)

2. Peer-to-peer (P2P) technologies are related to and overlap web services. P2P computing is characterized by distributed computing nodes that act as equals and supply computing services without assumptions of hierarchy or control. Web service architecture may not be P2P. For example, the centralized UDDI discovery model within web services could be replaced with a distributed one, borrowing P2P's distributed discovery model (Samtami & Sadwadhwani, 2002). Web services can use P2P architectures in a variety of ways. In B2B environments, P2P marketplaces can eliminate the middleman, the centralized exchange. Buyers and sellers could search for products and services collaboratively through web services.

3. Web service network (WSN) providers are emerging to support different business needs. A WSN is "an intermediary brokering service that supports digital collaboration between applications base on web services standards." A WSN provides security, services tracking, integration and application services, and trading partner services such as provisioning, nonrepudiation and support. WSN's support different topologies (Lheureux 2002): (a) hub and spoke topology in which a management platform is resident within the WSN; (b) hub and spoke

topology in which each partner maintains unilateral control over web services provisioning and security; (c) unilateral peer-to-peer (P2P) topology; (d) facilitated P2P topology; and (e) facilitated switched-based WSN topology. Companies will begin to consider a WSN product to manage the exchange of web services between applications in its internal environment and a WSN service to manage the exchange of web services with trading partners (Lheureux 2002).

4. While initial implementation of web services may be simple, over time business-to-business integrations will become complex. To alleviate the challenges in managing meshed and chained web services, web services management platforms are likely to be mainstream technologies by 2006 (Smith, et al, 2003). This increase is also being fueled by Microsoft's aggressive distribution programs, and entry into the web services management market by major vendors such as Helwett-Packard. Business process integration may be aided by the increased adoption of Business Process Execution Language (BPEL) or other standards such as business process management (BPM) for web services flow composition (Smith, et al, 2003).

5. Web services may contribute to the decline of ERP vendors. Reasons include web services' ability to integrate dissimilar systems and to enable rapid acquisition of innovative applications. Web services can reduce large development budgets. Web services allow companies to implement change at a pace the organization can absorb, not the pace the ERP vendor demands. Web services accept diversity in architecture. Adoption rates are slow, however, and will only increase after IT is restructured to shift attention away from computing and on to communications. (Strassman 2003).

6. Because web services can be layered on top of existing software applications and accessed across a value chain, web services are a modest, incremental technology investment with a fast return. Development time for solutions is in weeks, not months. Different industries will have different drivers for Web Services. For example, financial services will need business process improvements over the next four or five years and web service solutions that allow for value chain integration and collaboration while streamlining business processes. Some companies will find a way to offer their core competencies as a web service to customers, enhancing revenue streams. (Boynton 2003).

RESEARCH DIRECTIONS

Information technology is again shaping and accelerating the convergence of many forces. Various standards bodies are creating new, higher-level specifications. Nearly every major vendor has committed to a web services architecture strategy. P2P technologies and web services are beginning a natural blending. Service-oriented computing and web services architectures are allowing companies to deliver more business services across the Internet. Web services technology is supporting a wide variety of relationships from direct to diffuse across simple or complex value chains.

Despite the challenges web services are facing in reaching ubiquity, already they are allowing a rich arrangement of B2B collaborations and new dimensions of competition.

Based on the above review, we identify five directions for future research on the impact of web services on e-collaboration and power relationships in value chain.

1. Emergence of new B2B intermediaries: How will Web Services Networks affect the formation of new types of intermediaries?
2. Decrease in B2B exchanges: How does the deployment of web services affect different options of traditional B2B models and dynamics?
3. Increased adoption of web services architecture: To what extend will the increases in web services architecture shift the power relationship toward P2P-based private exchanges and away from centralized B2B exchange for value chain integration.
4. Process integration: How will companies reconfigure their e-business processes to achieve web services enabled e-collaboration? Will process become loosely coupled to achieve flexibility? What processes are likely to adopt web services technology first? How will the internal process be redesigned to meet external demand?
5. Pre-conditions for early adoption. What organizational factors influence early adoption of web services for e-collaboration? Is e-business transformation a pre-condition? Is the experience in integrated enterprise applications essential for adoption of web services for e-collaboration?

These research questions call for empirical studies through case analysis, industry surveys, and longitudinal analysis of the market trends.

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