A Comparison of B2B E-Service Solutions

Dan Jong Kim, Manish Agrawal, Bharat Jayaraman, and H. Raghav Rao

The Internet is evolving not only to provide information and e-commerce transactions, but also to act as the platform through which services are delivered to businesses and customers. These electronic services or *e-services* could become a key part of the value provided by many businesses [2, 5, 10]. At the core of this evolution is Extensible Markup Language (XML), which has emerged as the foundation of all architectures suggested for such services. XML simplifies the exchange of information by letting users define their own syntax and use underlying technologies of the Internet. However, while organizations can define XML syntax to solve their specific problems, the multitude of syntax (schemas) creates incompatibility problems with schemas developed by others. This is one of the reasons why major organizations are creating business-to-business (B2B) XML framework standards to enable interoperability.

To overcome these problems, efforts are underway to develop standards for e-services including eCo by a consortium led by CommerceNet; RosettaNet by a consortium that includes IBM, Microsoft, EDS, SAP, Cisco systems, Compaq and Intel; BizTalk by Microsoft; e-speak by Hewlett Packard (HP), and several others. Since these B2B interoperability standards are likely to be very important in the way businesses interact with each other in the future, an overview of these standardization efforts is certain to be of considerable importance to the IS community. This article describes the components (core modules of platforms for linking Internet-based service providers) of e-services and compares popular B-to-B e-commerce frameworks based on their support for e-service components.

E-services

In general, e-services focus on providing services through the Internet. E-services have been viewed as Internet-based customer service and online account management services and alternately as an overarching service-centric concept [4, 7, 11]. Synthesizing various definitions, we define an e-service as an integrated solution for customized

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services that are delivered through the Internet, enabling the dynamic discovery, composition, and delivery of services.

E-service components are business modules that represent basic independent e-business service processes or functions such as authentication, authorization, advertisement, negotiation, and process integration. A service component is a generic template of a service that provides the desired functionality such as service discovery, negotiations, and so forth. Component-based architectures have emerged as a standard paradigm in many areas of application development. The goal of a component-based e-service architecture is to provide interoperability of multi-vendor frameworks and to speed application development [8].

Figure 1 shows a conceptual view of B2B e-service architecture and components. There are 3 layers involved in an e-service architecture: an underlying information technology (hardware, software) infrastructure that provides basic computing and communication facilities for the upper layers, an e-commerce infrastructure that provides functionality to manage commercial transactions, and e-service frameworks that provide the real time discovery, composition and delivery of services. In this article, we focus on the e-service framework layer that integrates the components of e-service solutions

E-services deal with consumers and providers. Based on consumer requests, e-service providers can play the roles of matchmaking intermediary, service advertiser, service broker, service negotiator, service composer, and so on. To provide the best service to customers who request services, e-service providers can communicate with other e-service providers within or outside the e-service community. Based on negotiations (possibly automated) with other e-service providers, an e-service provider selects e-services based on selection criteria such as price, reputation, manageability, and so on. This multiservice provider approach provides a higher level of flexibility for the customers and represents the open virtual market place of e-service providers.

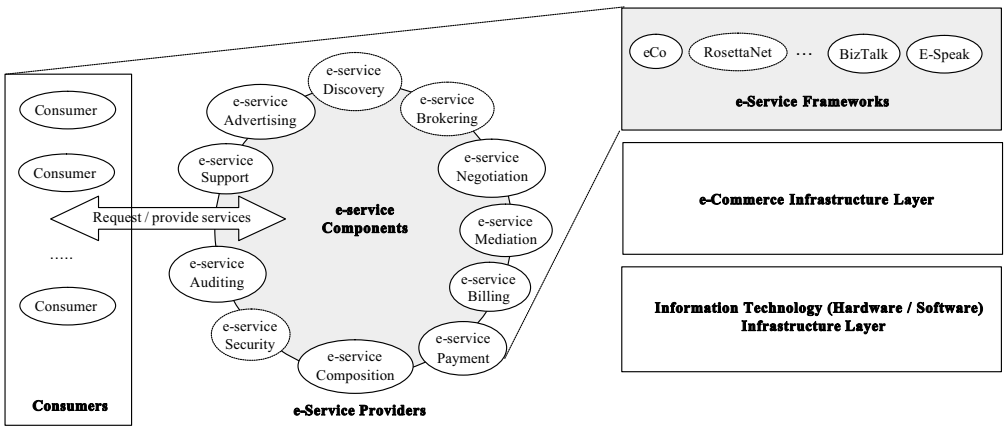

Figure 1. Conceptual view of B2B e-service components.

E-service Components

To develop a comparison scheme, we briefly describe the components involved in dynamically creating and delivering e-services. The e-service frameworks studied in this article support most of these components.

Service discovery. Service discovery refers to the identification, configuration, and use of computer services with minimal manual effort. Interest in the topic was initiated by the need to simplify the connection of mobile computers to peripheral services such as printing, high speed data access, data storage, faxing, and so on. "Service discovery suites" that look at discovery issues associated with information appliances include Bluetooth (www.bluetooth.com/), Jini, Salutation (www.salutation.org), UPnP or Universal plug and play, and SLP, or Service Location Protocol.

Service brokering. Brokering refers to the process of decomposing complex queries, recomposing partial answers, and synthesizing complete answers. Brokers gather method calls, parameters, return values, and manage connections to remote service instances [1]. The most popular broker architecture is the CORBA,[1] which allows applications to use remote services as if they were local applications. CORBA also includes naming services that work like yellow and white pages which, when used, allow service instances to offer services defined by their interfaces. Clients can use the naming service to locate and interact with custom application services.

Service negotiation. The typical scenario in the use of services follows the sequence of discovery, where consumers identify vendors who offer services that meet the parameters of interest; negotiation, where contract terms are finalized; and execution, where services are provided as negotiated. Software agents can use negotiations to make joint decisions involving the allocation of resources, adoption of policies, or any issue of mutual concern. In the general negotiation process, some parameters of the exchange are fixed and some others are determined through the negotiation process. However, as the negotiation process becomes more flexible, it also becomes more complex because more parameters need to be determined [6].

Service mediation. Mediators provide value-added information services for customers. These include selection of relevant information, optimization of access strategies, triggering actions based on exceptional values, and so on. A typical use of mediation is to reduce the volume of data sent to the customer, while maintaining its information content.

Service billing. Electronic bill presentment systems allow service providers to submit bills electronically to consumers. E-billing for services involves security issues such as authentication. IBM has developed a billing system called newgenpay (www.newgenpay.com). Another system called VCBA (Vicarious Certification and Billing Agent), where a billing agent manages all the billing for a service provider, is described in [12].

Service payment. Service payment enables payment processing between buyer and seller. Payment mechanisms include credit card, debit card, ACH, and wire transfer. Payment systems are typically developed in conjunction with bill-presentment systems such as newgenpay. Lack of consumer acceptance has led to the withdrawal of some systems such as e-wallet.

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[1]CORBA (Common Object Request Broker Architecture) is OMG's open, vendor-independent architecture and infrastructure that computer applications use to work together over networks.

Service composition. Composition of e-services is the ability of one business to compose e-services to provide value-added services to its customers. E-services offered by different companies can be dynamically combined to offer value-added services. E-service composition is typically designed, developed, and deployed by enterprises that want to offer services using third-party capabilities, either for internal use or to expose them as e-services to customers.

Service security. A number of classification schemes exist for security in electronic communities. Security includes availability, confidentiality, and integrity. Availability may be threatened by factors such as denial-of-service attacks, bandwidth issues, power failures, and other problems. Confidentiality refers to limited access of data and requires the implementation of access control measures. Integrity refers to protection of data against accidental or malicious modification.

Overview of E-service Frameworks

As described earlier, four of the major e-service frameworks include eCo, RosettaNet, Biztalk, and e-speak. Each framework enables service providers to use the Internet and XML to offer services. Here, we discuss these frameworks and compare them in terms of their support for the e-service components that have been described in the previous section.

Table 1 describes a general comparison of the B2B e-service frameworks in terms of target industries, metadata and ontology, and their standard XML efforts and legacy support.

	eCo	RosettaNet	BizTalk	E-Speak
Target Industries & Purpose	- General purpose - Providing standard service framework to enable the creation of marketplaces	- Electronic Components, IT & Semiconductor Manufacturing - Define supply chain business processes	- Design target for software vendors - Supporting XML based application integration	- General purpose - Enabling ubiquitous services over the Internet - Making existing resources available as services
Metadata and Ontology	- Commerce libraries define concepts like companies, services, catalogs, location, SIC codes etc Registry Environment contains: - Market Registry - Business Registry - Service Registry - Document and Information Item Registry	Provided through RosettaNet Technical Dictionary and RosettaNet Business Dictionary	BizTalk Schemas Library & Versioning - Describes the content and structure of a class of XML documents - XDR schema (XML Data Reduced) Namespace URI's Collection of Biztags - A set of XML tags BFC Server	Service vocabularies - Introspection Library - Negotiation Library - Matchmaking Library - Management Library
Standard XML efforts and Legacy Support	-Defines the DTD for the documents returned by published interfaces	- Detailed description of the documents exchanged in each step of a PIP.	- A comprehensive, language-neutral programming model - Support for the W3C XML, XML DOM, and Namespace recommendations - Support Legacy system and BizTalk documents based on Biztags	- XML based Document Exchange Model - Partners may agree upon the format of data exchanged

Table 1. General comparison of B2B e-service frameworks.

eCo. CommerceNet, a non-profit organization, initiated the eCo Framework Project in August 1998, with support from the U.S. Department of Commerce (NIST). The aim was to develop a specification that enabled e-commerce interoperability and the creation of electronic marketplaces. The eCo model[2] consists of 7 layers: Network, Market, Business, Service, Interaction, Document, and Information. Each layer has a published interface that defines the queries and responses available at the layer to create required functionality. The set of available queries may be extended as necessary. Implementation of the business layer is mandatory; other layers can be optionally implemented.

To leverage Internet protocols, published interfaces are queried using a simple URL-based protocol. Each published interface is identified by a unique URL. A query is performed by appending the desired query name to the end of the interface's base URL. As an example, in order to execute the query "BusinessGetServices" on the published interface with a base URL of "http://www.commerce.net/eco", an interested party would execute the URL "http://www.commerce.net/eco/BusinessGetServices."

RosettaNet. Founded in June 1998, RosettaNet (www.rosettanet.org) is a non-profit consortium of the world's leading Electronic Components, Information Technology, and Semiconductor Manufacturing companies. RosettaNet defines the components of the supply chain of these industries (including manufacturers, distributors, resellers, shippers, and end users) with the aim of standardizing communications between participants. Unlike eCo, RosettaNet focuses on facilitating peer-to-peer communications rather than on establishing marketplaces. Some key components of RosettaNet are briefly described below.

Partner Interface Processes (PIPs) define business processes between trading partners. For each process, PIPs define the start state, the end state, the participants and their roles, process controls such as authorization for each participant, documents exchanged, and the sequence of activities. Clusters of PIPs are used to align the business processes of supply chain partners, for example, order management includes PIPs to request prices and availability, report shipment status, notification of billing, and report the production status of components being manufactured. PIPs include all business logic, message flow, and message contents to enable alignment of partners. Dictionaries provide a common set of properties for PIPs. The RosettaNet technical dictionary (RNTD) provides common properties for defining products for PIPs. It is used primarily to search electronic catalogs, maintain technical information databases and automatically generate technical specification sheets. The business dictionary defines business properties, business data entities, and fundamental business data entities in PIPs. The RosettaNet implementation framework (RNIF) provides exchange protocols for implementing PIPs and defines the message format for exchanging business documents including headers, attachments, and digital signatures. This enables authentication, authorization, encryption, non-repudiation, and reliable message exchange between partners.

Biztalk. The BizTalk initiative led by Microsoft (www.microsoft.com/biztalk) consists of three components: the BizTalk 2000 server, the BizTalk Framework for exchanging XML documents over the Web, and BizTalk.org, a repository for XML schemas used between companies. The aim is to facilitate business process integration within and between organizations using Internet protocols. BizTalk includes a design framework for implementing an XML schema and a set of XML tags used in messages sent between

[2]Available at eco.commerce.net/specs/index.cfm

applications. For communication, it uses the simple object access protocol (SOAP), an XML/HTTP-based protocol for accessing services, objects, and servers in a platform-independent manner.

The BizTalk Framework consists of a business document, which is an XML stream containing the business transaction data; a schema, or set of metadata for describing the content and structure of a business document; BizTags, which specify how the document should be handled; and the BizTalk server, which processes the BizTags and their associated documents. Organizations can publish their industry schemas on the BizTalk.org repository. BizTalk can easily integrate with other published schemas such as RosettaNet.

E-Speak. The e-speak solution[3] was developed by HP to provide an open, integrated platform for e-services with features such as service discovery, negotiation, and service composition. To use e-speak, providers have to register the service with a host system by creating a description of the service that consists of its specific attributes. Users describe the type of service they want and e-speak aims to automatically discover registered services that have the desired attributes. The platform consists of the E-speak Service Framework Specification (SFS) and the E-speak Service Engine. The SFS defines standard business interactions and conventions using XML documents that allow e-services to dynamically discover and negotiate with each other, and compose themselves into more complex services. Any SFS-compliant e-service can dynamically collaborate with any other compliant e-service. The service engine is a high-performance software implementation of the SFS, which allows providers to register their offerings and capabilities, and performs service discovery, negotiation, monitoring, and composition. (For more information on e-speak, see *Communications,* July 2003, Vol. 46, No. 7, 112–118)

Comparison of B2B e-service frameworks. Table 2 provides a summary comparison of the B2B e-service frameworks in terms of components. In addition to the general differences, the frameworks all differ with respect to the components; these differences are highlighted in the tables.

Conclusion

There is no single framework that addresses all elements of the interactions among business partners in a B2B environment. For example, the BizTalk initiative aims to define a set of guidelines for publishing schemas in XML and for using XML messages to easily integrate software programs. The RosettaNet consortium focuses on standardizing business processes within the IT industry's supply chain and to facilitate the interactions between partners. The eCo Framework Project promotes integration of e-commerce services through marketplaces by creating uniform service interfaces. E-speak enables ubiquitous availability of services over the Internet.

It is important for users to understand these underlying differences as they evaluate the different platforms to create e-services. Given the open nature of XML standards and the diversity of platforms, it might even be possible that end-users will find it useful to combine platforms to create viable services. This article identifies the components of e-service frameworks and provides a comparison of four major frameworks based on several dimensions including purpose, target industries, and important e-service com-

[3]www.hp.com/e-speak; Personal communication, Kannan Govindrajan, HP, 2001.

	eCo	RosettaNet	BizTalk	E-Speak
Service Discovery	- Strongly emphasized - Extensive querying interfaces to the documents in the market place.	- Static and dynamic catalog functions by defining related PIPs	-- Not emphasized	- Very strongly emphasized - Discovery of new services - Dynamic advertising and discovery
Service Brokering	Facilitated through common interfaces	Extensively supported through PIPs	Allows extension	Dynamic brokering
Service Negotiation	- Negotiation services application module allows buyer and seller to post offers.	Unspecified	Unspecified	- Matching user requests to the right service providers to find the best matched service - Negotiation protocol - Multi-party negotiations
Service Mediation	Supported through type registries for markets	Unspecified	Allows extension	Unspecified
Service Billing	Unspecified	Extensively supported through PIPs	Unspecified	Monitoring, billing and management of e-services may be provided as a service
Service Payment	Unspecified	Extensively supported through PIPs	Unspecified	Unspecified
Service Composition	Registry environment supports composition of services	Not emphasized	Process Management - Orchestration engine for modeling - Messaging component for integration XLANG: an XML language for describing processes	Collaborative Process Management - DySCo (Dynamic Service Composer) - Peer-to-peer process management CPDL (Collaborative Process Definition Language)
Service Security	Optional, based on TCP/ IP	Extensive support through RNIF	Leverages existing standards - SSL & S/MINE - PKCS (Public-Key Cryptography System) Digital signature and encryption	Security manager - PSE (Private Security Environment) - SLS (Session Layer Security) - Message integrity and authentication Delegation of authorization

Table 2. Components-based comparison of B2B e-service frameworks.

ponents such as discovery, brokering, negotiation, mediation, billing, payment, composition, and security.

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