Web Services: Taking e-business to the next level.
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Executive summary

The emergence of Web services represents the next evolution of e-business. Web services are Internet-based, modular applications that perform a specific business task and conform to a particular technical format. A Web service can be anything—a restaurant review article, a real-time travel advisory, an entire airline ticket reservation process. The technical format ensures each of these self-contained business services is an application that will easily integrate with other services (from the same or different companies) to create a complete business process. This interoperability allows businesses to dynamically publish, discover and aggregate a range of Web services through the Internet to more easily create innovative products, business processes and value chains.

Web services offer new opportunities in the business landscape, facilitating a dynamic, global marketplace where businesses rapidly create innovative products and serve customers better. Whatever your business needs—billing, order management or customer relationship management—Web services have the flexibility to meet the demand, and allow you to accelerate outsourcing. In turn, you can focus on building core competencies to create customer and shareholder value. Application development is also more efficient because existing Web services, regardless of where they were developed, can easily be reused.

Many of the technology requirements for Web services exist today, such as open standards for business-to-business (B-to-B) applications, mission-critical transaction platforms and secure integration and messaging products. To enable robust and dynamic integration of applications, however, new industry standards and tools that extend the capabilities of today’s B-to-B interoperability are required. IBM is leading industry-wide efforts to develop such standards in partnership with other industry leaders and industry consortiums, providing you with the products and services you need to capitalize on the opportunities presented by Web services.

The key to taking full advantage of Web services is to understand what Web services are and how the market is likely to evolve. You need to be able to invest in platforms and applications today that will enable you to quickly and effectively realize these benefits. And you need to be able to customize Web services to meet your specific needs and increase business. This paper addresses the potential of Web services to meet e-business challenges and shows how IBM helps customers design and implement solutions to make that potential a reality.
Evolution of e-business: Where do we go from here?

You can offer innovative products and services through e-business. Open new markets. Cross geographical boundaries. Improve operations. And strengthen relationships with your customers, trading partners and suppliers. Today, sharing information between businesses and consumers around the world is a reality largely due to the World Wide Web. The Web provides a universal platform for presenting and indexing information, increasing the dissemination of content to unprecedented levels. This universal platform allows you to move beyond one-to-one business relationships and realize the benefits of participating in an e-marketplace model. This trend is manifested in independent e-marketplaces where companies participate with competitors to gain benefits such as industry-wide cost savings, in private corporate e-procurement solutions and in the greater Internet market where B-to-B commerce increasingly takes on the characteristics of syndication. Syndication is attractive because it can enable a company to market its assets — such as news or stock ticker services — to many Web sites with a minimal amount of new investment. In all these forms the e-marketplace model increases revenue opportunities, lowers costs, adds flexibility in bringing new products to market and offers customers increased and improved choices.

For the e-marketplace model to realize its full potential, e-businesses must be able to dynamically integrate rich business services. Today, business-to-business and business-to-marketplace connections cannot be established or altered on-the-fly to meet changing requirements, and syndication is largely confined to text-based information rather than transaction-based services.

Three primary challenges inhibit the evolution of B-to-B:

• The implementation of B-to-B partnerships requires customized connections between each party. Setting up these connections is costly and time-consuming, establishing a practical limit on the number of partnerships that can be implemented reasonably.

• The opportunity to dynamically license online business services to other portals, Web sites or third-party services is limited because packaging and publishing individual applications in a ready-to-use format is not easy.

• There is no global method for describing and finding business services, rather than just information, delivered over the Internet even though business practices and technology are increasingly intertwined.
Building just-in-time solutions
Web services are Internet-based applications that fulfill a specific task or set of tasks, which can be combined with other Web services to maintain workflow or perform business transactions. Because Web services are modular, businesses can customize them to create innovative processes and value chains delivering superior customer utility and ultimately increasing shareholder value. Users can access Web services online and offline through any touch point including PCs, cell phones and personal digital assistants. Web services communicate with each other, sharing information about their functions and roles in an application workflow, the inputs they require and the outputs they generate. The result is just-in-time integration of business applications.

Friendlyloans.com: an example of Web services
Both online processing of a loan application and credit verification, which represent single, discrete steps in the loan approval process, can be viewed as separate services as shown in Figure 2. From the loan applicant perspective, approval or denial constitutes the delivery of service. The bank approving the application on the other hand sees credit verification (which could be provided by a third party) as the delivery of service. Any functional need or benefit served by today’s packaged applications can be viewed as a service.

Building on today’s e-business platform
Web services are an evolution of e-business. They improve the ability to achieve e-business goals that IBM has been helping many of its customers address for years — get online fast, innovate to beat competitors to market, increase customer loyalty and improve supply chain performance. It is logical then that the foundation for Web services is already in some current e-business products and practices. For example, IBM offers the IBM WebSphere® software platform for e-business, a full line of standards-based products for B-to-B, business-to-consumer (B-to-C) and e-business models and integrated rapid development tools. To fulfill the full promise of Web services, the industry must build new capabilities. Any business must ask the important question: “How easy will it be for our e-business vendor to extend its current products to meet the requirements of Web services?”
Web services requirements

Value of open standards

To enable e-business at electronic speeds, you need an open standards-based infrastructure that facilitates Web services to be described, advertised, discovered and invoked on the Internet. This infrastructure must enable Web services to function together, across multiple platforms, middleware, messaging protocols and applications through specific conventions and protocols. Using such an infrastructure, Web services will dynamically collaborate, enabling e-business to perform at Web speeds and transforming business transactions and operations worldwide.

The Internet provides a universal platform for deploying and delivering applications on a global scale. Extensible Markup Language (XML) provides us with a universal data exchange standard that allows access to data irrespective of its format or location. Java™ technology provides a universal language to develop distributed applications and software components that are portable and facilitate “intelligent processing” of information exchange enabled by XML. However, a standard description framework for describing, publishing, accessing and invoking Web services at runtime is desired to enable dynamic transactions that integrate applications and processes just in time. This framework needs to be backed up by an infrastructure foundation consisting of scalable hardware, pervasive computing, middleware services, security services, network management, transaction processing, business process reengineering and application hosting and integration.

IBM is leading the effort to define and adopt the open industry standards contributing to the Web services format. IBM continues to play an active role in defining standards through participation with industry consortiums, open standards organizations and joint development efforts with other industry leaders. Universal Description, Discovery and Integration (UDDI) specification, developed by IBM, Microsoft and Ariba, and backed by IT industry leaders, gives businesses access to available Web services through a UDDI-enabled registry that serves as a matchmaker for service requesters and service providers.
Web Services Description Language (WSDL) specification, co-authored by IBM and Microsoft, and submitted to the UDDI steering committee, specifies a rich XML-based description language for extending applications and publishing them as Web services to be used by service brokers and search engines on the Internet. Using WSDL, businesses can expose specific application programming interfaces (APIs) of their software applications as services available on the Internet. These APIs can be used by other services to incorporate the functionality into their overall mission.

Finally, simple object access protocol (SOAP), co-developed by IBM and Microsoft, and currently under the consideration by the World Wide Web Consortium, allows businesses to invoke and utilize Web services published using WSDL and discovered through the UDDI registry. Using SOAP to invoke applications across the Internet and transcending corporate firewalls allows enterprises to integrate their business processes with those of their trading partners and suppliers. Figure 1 illustrates the roles of these three technologies for Web services.

![Figure 1. Web services technologies and their roles](image-url)
Technical information and details on these technologies, along with tutorials, sample code, demos illustrating how Web services work and technical white papers can be obtained at ibm.com/developer/webservices and by downloading the IBM Web services toolkit at alphaWorks.ibm.com/tech/webservicestoolkit. The WSDL toolkit can be downloaded at alphaWorks.ibm.com/tech/wedttoolkit.

**Value of a universal business services registry**

UDDI founders IBM, Ariba and Microsoft are also implementing a public global registry for Web services. Registration is available to any company that wants to register its business or search for products and services offered by other companies. As Web services become prevalent, the universal registry will help businesses locate each other and the services they need, in a way similar to the role fulfilled by search engines on the Web.

In the Universal Business Registry, companies can capture and find three types of information:

- **“White Pages” data** — general contact information about the company including addresses, fax numbers and Web sites addresses.

- **“Yellow Pages” data** — a categorization of the type of products and services the company provides along with the geographic locations they serve.

- **“Green Pages” data** — a new category of information to initially describe a company’s online payment terms. For example, the green page data might specify that a particular e-commerce site supports the RosettaNet standard for exchanging purchase orders. Ultimately, any Web service transaction interface can be described.

The Universal Business Registry provides a way for businesses to publish Web services by simply filling out an online form. The registry includes a central repository with global visibility for businesses of all sizes. It can be regularly culled for new vendors and services that meet particular needs and can be monitored for the popularity and growth of particular types of connections. The registry also serves as an e-commerce directory with entries that accelerate the ability for businesses to interact with each other.
Credit verification company: An example of Web services put to work

The Friendlyloans.com example shown in Figure 2 illustrates how Web services can be combined to create an integrated business process. A closer look at the integration process between the credit verification company, which we'll call CV, and its clients, such as Friendlyloans.com, helps illustrate the benefits of new open standards and a universal registry. Today, CV establishes relationships with certain finance and mortgage companies like Friendlyloans.com. CV engineers the integration of its application with each of its partner’s systems on an individual project basis. Using open standards-based Web services, CV can publish in a universal format the types of electronic connections it supports. Its customers then conform to one of those connection types (or choose another verification vendor) and more easily integrate with CV out of the gate. Each of the companies in the friendlyloans.com example can also leverage the universal directory by executing periodic searches to identify potential new trading partners.

While direct B-to-B connections are facilitated by standards and the directory, many other benefits can be realized through use of an e-marketplace. For example, let’s assume CV subscribes to an e-marketplace. In this case, the universal format helps CV package its verification application as a self-describing stand-alone service and publish that service to the e-marketplace, greatly expanding its market. Because the universal format allows any member bank or mortgage company to find and evaluate CV’s service for possible integration with its own application process, the result is a larger customer base and increased revenue for CV, and better choice at lower costs for the consuming banks.

An e-marketplace can also leverage the Universal Business Registry to provide CV with value-added services, such as prescreening of prospective clients according to the company’s e-marketplace profile and creation of business intelligence reports that help CV decide what new connection types and business services its clients need. Other types of third parties can provide value as well. For example, a service provider might guarantee different levels of quality of service for transactions while a vertical real estate portal might combine CV’s credit verification process with supplementary services such as real estate lawyers and escrow companies to increase the use of CV’s offering.
IBM is expanding on the UDDI specification and registry in its products and services to help its customers quickly leverage Web services technology into useful business applications. For example, IBM products such as IBM WebSphere Commerce Suite, including Service Provider and e-marketplace Edition already focus on meeting the needs of value-added brokers and the IBM WebSphere software platform will naturally evolve to incorporate new B-to-B standards and tools.
Value of a mission-critical transaction platform

Decreasing the friction associated with finding and integrating business services will result in an increase in the number of transactions executed. The ability to manage and respond to transactions depends on the infrastructure a business chooses, whether it is managed in-house or outsourced. For an e-business software platform to meet the transactional demands of Web services, it should have a proven track record in handling large and unpredictable levels of transactions. It should operate across a number of platforms, so that as the needs of the business grow the applications can be expanded to accommodate new types of hardware and operating systems. Integration technology provides assurance that the transactions will connect with legacy systems—both yours and your partners’.

IBM WebSphere software platform for e-business is based on an award-winning foundation that includes WebSphere Application Server and IBM MQSeries® messaging software. The application server is fine-tuned to reliably handle the tremendous volume of transactions these players experience today and can easily meet the demands of automated Web services. The MQSeries family provides industry-leading, reliable messaging and integration products. Foundation extensions in the WebSphere software platform include WebSphere Edge Server to manage Web server performance across a network and WebSphere Personalization, software that allows you to customize the user experience based on preferences and buying habits.

Value of maximizing development resources

Maximizing development resources is a critical business factor in every e-business project. As Web services emerge, you need to consider what will help your company generate better returns with its development time and money. Explore which vendors allow you to leverage existing skills by exploiting new technologies like Web services through evolving current tools and development models. This not only leverages your company’s current investments but also generates more predictable results by relying on proven tools and practices. Consider that Web services are a natural extension of Web application programming so look for leaders in this space and evaluate their tools strategies.

Look for a vendor that can improve your time to market. For example, IBM publishes best practices based on thousands of customer engagements. These e-business patterns provide businesses with a blueprint for developing solutions in particular industries and according to particular business models. IBM development tools themselves also feature rapid application development through high-level rules-based products that generate code for the developer and tight integration with the runtime products to shorten testing and deployment cycles.
Impact of Web services on your e-business

Web services technology allows companies to focus on their core business needs by providing flexible, best-of-breed application infrastructure that can accommodate rapidly changing conditions. Organizations can invoke and manage Web services that exist on the Internet and work seamlessly with existing applications and data sources. Implementing Web services enables businesses to focus on innovations that differentiate them in the marketplace. For example, when a company puts out a purchase request, the suppliers with whom they have agreements and guidelines in place would be notified of the request, read it, decipher it, match it against their capabilities and respond with a proposal electronically. Web services enable all of these transactions without extensive programming and customization.

Web services exist to help e-businesses run at electronic speeds. In essence, they enable just-in-time application integration. IBM can provide tools and services to help companies rework existing applications into Web services as well as create new ones from scratch. Extending current applications into Web services provides a new source of return on asset and new revenue opportunities. And with Web services architecture, as new and better applications emerge, they can replace specific components of the enterprise application integration (EAI) chain without disruptions. This is analogous to using “Lego” blocks to build a structure. Replacing one block doesn’t require dismantling the entire structure.

As mentioned earlier in this paper, Web services do not demand replacement of today’s e-business systems and processes. Web services represent an evolution of e-business that can open new revenue opportunities, lower costs and shorten time-to-market for new products and services. Although these goals will not be realized overnight, it is prudent to begin to plot a route that will enable a company, whether just starting up or well-established, to capitalize on Web services as they evolve.
Web services road map: Where to start, how to grow

**Phase I: smoother on-ramp**
In the first phase of adoption, Web services will ease the on-ramp or initial barrier to participating in the e-marketplace model in its various forms. Many business partners will still choose each other and negotiate terms primarily through human interactions, but the standard format of Web services will lower the costs associated with establishing B-to-B commerce interfaces and encourage an increase in the number of partnerships.

This format will be true for businesses of all types and sizes. Once a small business places an entry in the Universal Business Registry, it will receive global visibility. It will be able to immediately leverage the registry to find and sell goods and services with other small businesses. Public and private e-marketplaces that leverage the Universal Business Registry will also be able to provide economical on-ramps for their small business members benefiting all parties involved.

Large enterprises, e-marketplaces and vertical portals that begin to use the standard registry process to facilitate the connection of businesses to their services will decrease the resources needed to facilitate the on-ramp process.

Many of the Web services will be reworked versions of existing applications. Developers can immediately experiment with the Web services model by accessing information from the IBM Web services site for developers or downloading the IBM Web services and WSDL toolkits from alphaWorks.ibm.com.

**Phase II: value-added explosion**
During the second phase of adoption, e-marketplaces, portals and application service providers (ASPs) will be able to connect to each other much more efficiently, providing each of their member bases with access to more services and a greater number of selling opportunities. In addition, both private and public e-marketplaces will build on the Web services standards and implementations (like the UDDI registry) to free up a greater portion of their resources for development of premium services that perform tasks such as matching buyers and sellers, providing encryption and delivering business intelligence analysis.
**Long-term: just-in-time integration**

In the long term, as open standards become pervasive, their scope will encompass security features, authentication and payment systems. Automated search and discovery of services on the Internet will become more commonplace. Software and hardware products will incorporate full support for creating and invoking Web services according to predefined filters, and fully dynamic just-in-time business processes and application development will begin to emerge.

**Leveraging the phases of adoption**

Use these key questions to help you plan for implementing and using Web services in your business:

<table>
<thead>
<tr>
<th>PHASE I</th>
<th>PHASE II</th>
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<tr>
<td><strong>Business Questions</strong></td>
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<tr>
<td>Can Web services shorten project times and lower costs when creating connections with chosen partners?</td>
<td>What assets can be packaged into syndicated services? How should they be priced?</td>
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<tr>
<td>Are there areas to search for additional, possibly new or specialized, suppliers? Or channels for our services?</td>
<td>Where in the organization does it make sense to exploit e-marketplaces as the connection costs come down?</td>
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<tr>
<td>What basic services should be advertised in the global UDDI business directory?</td>
<td>What new aggregated, integrated services can be offered to increase customer acquisition and retention?</td>
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<tr>
<td><strong>Technology Questions</strong></td>
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<tr>
<td>Does our technology vendor understand our business?</td>
<td>Can my technology platform handle very large and unpredictable volumes of transactions?</td>
</tr>
<tr>
<td>Is our e-business technology built on open standards with a history of strong integration capabilities?</td>
<td>Do our development tools and runtime products make it easy to leverage Web services technology standards?</td>
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<tr>
<td>Is our e-business transaction platform support highly scalable and reliable?</td>
<td>Does our e-business platform vendor show a clear evolution path to Web services technology?</td>
</tr>
<tr>
<td>Does our technology vendor set new e-business trends or follow them?</td>
<td>Are application providers and integrators building Web services on our e-business vendor’s platform?</td>
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Leading open standards and practices

Because Web services are all about enabling technology and open standards to accelerate measurable business success, IBM is uniquely positioned to implement these next-generation application building blocks. IBM will help companies worldwide utilize Web services in four primary ways:

• Through the development and use of open standards
• With software that exploits Web services
• By offering consulting services
• By supporting IBM Business Partners

As IBM’s history with XML, Trading Partner Agreement Markup Language (tpaML) — and now UDDI — and active participation in the Java, Linux® and Apache projects demonstrate, IBM is the leader in setting e-business standards and advocating an open process for wide adoption of those standards. IBM will continue to dedicate resources to developing and implementing universal standards to remove the barriers of doing e-business in a heterogeneous world.

Current IBM software products are well positioned to help customers leverage Web services opportunities. These products lead the industry in incorporation of open standards, scalable transaction support and integration capabilities. Future versions of WebSphere software platform offerings, including IBM VisualAge® tools and MQSeries products, will support the necessary technology to enable Web services. Today, a preview version of a Web services tool kit is available for download on the IBM AlphaWorks® site at alphaWorks.ibm.com and as that technology is rolled into shipping products, an integrated set of tools for developing B-to-B services will be delivered. IBM is also exploring ways to enhance our servers and tools to make it easy for developers to expand UDDI taxonomy to build custom registries for use in e-procurement, e-marketplaces and portals.
Consulting services
IBM Global Services has a venerable track record in helping customers become e-businesses. Global Services consultants help companies leverage their existing infrastructure to enter new markets and become more efficient. They advise companies about how to establish an e-business platform that will take them to market quickly and grow with them over time. Expertise in e-business models and industry dynamics is now more valuable than ever.

The IBM jStart team has a proven track record in helping companies adopt new technologies. jStart consulting recently introduced a new Web services practice designed to help business executives and developers exploit this new technology. The jStart team will work with companies to define a road map and will leverage other IBM resources such as Global Services to best serve its clients.

Support for IBM Business Partners
IBM will focus on Web services in its IBM Business Partner program, helping businesses and developers to quickly leverage this opportunity with new solutions. Building on its strong existing partner network, IBM will provide software, hardware and hosted services that deliver business results to startups, small businesses, large corporations and developers. Existing programs such as the ASP Prime program, which helps software companies optimize their application for a hosted environment, are well positioned to extend their services to assist with Web services deployment.

Summary
Web services are an evolution of e-business, enabling the dynamic integration of business services, facilitating B-to-B and e-marketplace transactions and allowing collaboration between supplier, customer and trading partners. IBM provides a road map to guide the creation or evolution of your e-business so you can seize today’s opportunities while positioning your business to profit from tomorrow’s innovations.

For more information
To learn more about Web services, visit ibm.com/developerWorks/webservices.

To learn more about UDDI and to register your business with the Universal Business Registry, visit ibm.com/services/uddi.

To learn more about how IBM WebSphere software platform can help you e-business grow, visit ibm.com/websphere.

To learn more about IBM alphaworks technologies, visit alphaWorks.ibm.com.