4

Web Services and Enterprise Computing

Objectives

- To discuss how Web services can increase the efficiency of software development projects.
- To examine the benefits of using Web services to integrate applications.
- To explain how organizations can use Web services to create Web-enabled applications and corporate portals.
- To discuss the potential role of Web services in supply-chain management and customer-relationship management (CRM).
- To explain how Web services can enable B2B transactions and improve partner relationships.

Take the tone of the company that you are in.
Philip Dormer Stanhope, Earl of Chesterfield

Making mental connections is our most crucial learning tool, the essence of human intelligence: to forge links; to go beyond the given; to see patterns, relationship, context.
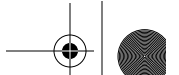Marilyn Ferguson

I have entered on an enterprise which is without precedent, and will have no imitator.
Jean-Jacques Rousseau

When you stop talking, you've lost your customer.
Estée Lauder

Outline

4.1 Introduction

In the preceding chapter, we examined ways in which companies can expand their businesses and increase revenue by creating, selling or managing enterprise Web services. However, many companies are waiting until standards mature and security and Quality of Service (QoS) concerns are resolved before deploying publicly accessible Web services. Instead, organizations are beginning with internal Web services implementations, such as using Web services to connect applications across departments. Other companies are making a limited number of Web services available to trusted business partners.[1]

This chapter investigates how organizations can create and consume Web services to improve communications and productivity. We begin by discussing how application developers and IT staffs can enhance the software-development process by incorporating Web services in corporate applications. We examine enterprise application integration (EAI) and ways in which Web services can improve integration projects. We then consider the use of Web services in specific enterprise software, such as corporate-portal, customer-relationship-management (CRM), supply-chain-management (SCM) and inventory applications. The chapter also contains case studies on companies—including Microsoft, British Telecom, Alliance Airlines and Nordstrom—that are using Web services to integrate systems and improve communication among departments, supply chains and partners.

4.2 Web Services and Corporate Software Development

Web services can improve corporate software development by reducing the time and expense involved in developing a software application. As companies adopt Web services, they are beginning to develop private UDDI or ebXML registries, which catalog the Web services maintained by a company or a group of partner companies. Instead of designing software "from scratch," programmers can use registries to locate existing Web services, then incorporate those services into applications. Programmers can find additional Web services by searching public registries, such as the UDDI Business Registry (discussed in
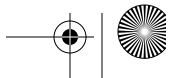
Chapter 7, UDDI, Discovery and Web Services Registries). A programmer might compile an e-commerce application from numerous publicly and privately held Web services, such as a Web service that processes credit-card payments and a Web service that provides driving directions to the company's closest store. Since the developer does not have to create new software to perform these tasks, the application can be completed faster and at less cost. According to Gartner, Web services could increase the efficiency of software-development projects by up to 30 percent.[2]

Web services also can decrease the complexity and cost of *integrating* applications, or connecting them to enable direct communication and information exchange. Forrester research estimates that, without using Web services, the average company spends up to one million dollars to research, test, implement and maintain software that can link two separate applications over the Internet.[3] By contrast, Web services facilitate less expensive and more flexible integration solutions—especially when connecting applications written in different languages for different platforms. Companies can employ Web services to integrate their own applications or to integrate with suppliers, distributors, partners and corporate clients. We discuss various forms of Web services-enabled application integration throughout this chapter.

Realizing these advantages, many organizations are beginning to adopt Web services. Figure 4.1 summarizes the results of a 2002 Jupiter Media Metrix survey, in which companies were polled regarding their plans to deploy Web services over the next year. The survey indicated that only 23 percent of companies had no plans to adopt Web services.

Web services are not an ideal solution for every software-development project. As we mention throughout this book, Web services security and QoS protocols are not fully developed. Therefore, some experts believe that Web services should not yet be used to transmit highly confidential or business-critical data across organizational boundaries.[1] Also, Web services are not recommended for systems that handle a large number of transactions, because processing SOAP messages can impede performance.[4] (We discussed Web service performance in Chapter 2, Web Services: A New Computing Paradigm.) Companies should implement Web services slowly, beginning with internal integration projects or services that are shared among trusted partners. Once Web services and security standards mature, companies might deploy Web services that are more widely accessible.[5]

Percentage of companies	Projected Web services implementation(s) within the next year
16 percent	Businesses planning to employ Web services to locate and communicate with new business suppliers, distributors or partners.
53 percent	Businesses planning to employ Web services to integrate and transact business with existing suppliers, distributors or partners.

Fig. 4.1 Percentages of companies that plan to implement Web services within the next year.[6] (Part 1 of 2.)

1. Web services networks can significantly increase the security and reliability of Web services. We discuss Web services networks in Chapter 3, Web Services Business Models.

Percentage of companies	Projected Web services implementation(s) within the next year
60 percent	Businesses planning to employ Web services to integrate applications and data sources within their organizations.
23 percent	Businesses that do not plan to employ Web services.

Fig. 4.1   Percentages of companies that plan to implement Web services within the next year.[6] (Part 2 of 2.)

4.3 Web Services and Enterprise Application Integration (EAI)

Large corporations often have many departments, each using applications and platforms that are best suited to the department's particular needs. Since most enterprise applications are designed to function independently, interdepartmental communication can be difficult. Before a company can automate B2B transactions and conduct e-business with suppliers, partners and clients, the company's internal applications and business processes should be integrated.[7] Companies traditionally integrated applications via point-to-point connections (direct connections between two systems). More recently, organizations have invested in *Enterprise Application Integration* (*EAI*)—infrastructures that link multiple applications and databases so that they can share information and business processes.

EAI typically uses *middleware* (software that links separate applications) to connect a company's many applications. A custom interface is built to link each separate application to the EAI system. Several types of EAI exist, including data integration, business-process integration and method integration.[8] *Data integration*, the most common form of EAI, involves linking databases to applications or other databases. *Business-process integration* and *method integration* involve connecting applications so that they can communicate and access each other's functionality. [*Note*: We discuss business processes and business-process management in Chapter 5, XML and Derivative Technologies.]

Figure 4.2 depicts an EAI infrastructure that integrates various applications and data sources—including a Web-application server, databases and *legacy applications* (older applications in which companies have invested significant resources).[2] Most EAI systems connect applications using *adaptors*, or software components that enable applications to communicate with other applications. This type of integration offers many benefits. For instance, imagine that a company provides a Web application that enables customers to check whether certain products are in stock. However, the Web application resides on the company's Web-application server, and the needed inventory data is maintained in a legacy application. EAI would allow the Web application to access and use the legacy application's data.

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2. Figure 4.2 address some aspects of EAI that are beyond the scope of this discussion. For additional information on EAI, readers can visit **eai.ittoolbox.com**.
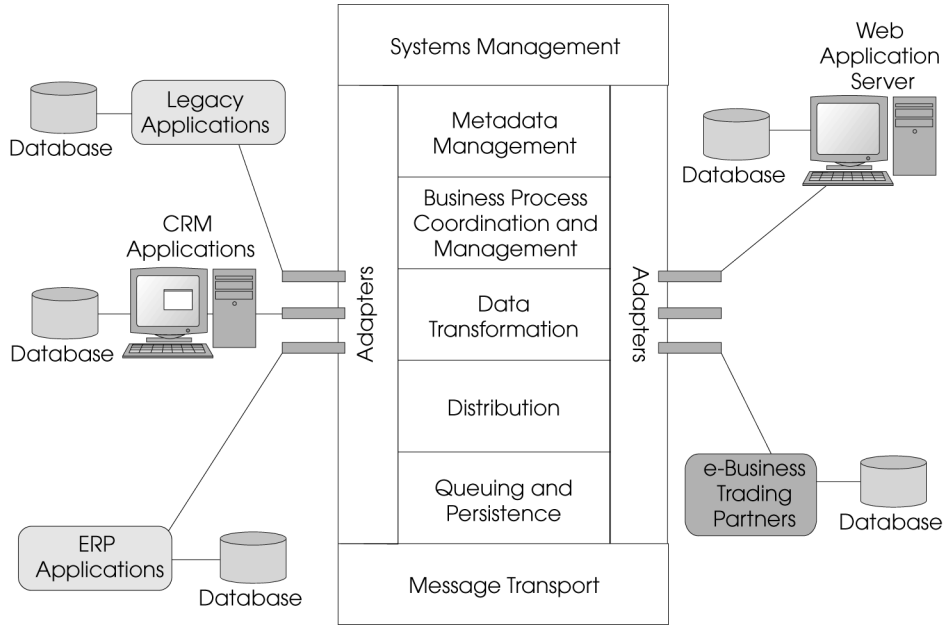
Fig. 4.2   EAI infrastructure. (Courtesy of Computer Sciences Corporation.)

There are several drawbacks to traditional EAI. Most EAI solutions aim to integrate an entire enterprise, including all relevant applications and data sources. Although this type of comprehensive integration improves overall communication, it makes EAI complex and expensive. Middleware products are usually costly, and most companies must hire specialized integration consultants to implement EAI solutions.[9] Furthermore, companies usually cannot reuse EAI interfaces for other purposes, such as integrating with partners.

As a result, some businesses are adopting Web services to integrate applications. Web services' open standards enable organizations to create reusable interfaces to applications. When packaged as a Web service or set of Web services, any application theoretically can communicate with any other application via SOAP messages. Thus, Web services provide a standard for linking all software, whereas traditional EAI links only specific applications. Many companies see internal integration as an appropriate first Web service implementation, because security and QoS concerns are lessened when Web services communicate only within an organization. According to a February 2002 Hurwitz Group survey, over 50 percent of IT managers reported that their first Web services projects involve or would involve integrating internal applications.[10] Many EAI software vendors are responding to this trend by enhancing their products to support Web services standards, such as SOAP, WSDL, UDDI and ebXML.[11]

Web services are less complex to develop and maintain than are most EAI systems, which means that integration projects require less time and money. Toolkits for designing and deploying Web services are significantly less expensive than most EAI solutions are.[12] Web services provide flexibility in that companies can start by connecting two or three applications, then integrate additional applications into the system as necessary. Also, Web
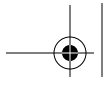
services allow companies to break applications into separate units, which makes integration more efficient. For example, a company can divide its human-resources software into units that deal with employee-contact information, employee salaries, employee reviews and so on. Each unit then is packaged as a separate Web service. If another application needs to access employee contact information, the application can communicate directly with the employee-contact-information Web service, rather than with the entire human-resources application.[13]

Although Web services technology can enable EAI, it does not constitute an entire EAI solution. Not all integration issues can be solved using Web services—for example, Web services might not provide the levels of security, reliability, performance and uptime required by some organizations.[14] For companies that have already developed integration solutions, it is usually less expensive to enhance current EAI systems than to adopt new technology.[15] Organizations that are implementing new EAI solutions should weigh the benefits and costs associated with Web services before forming an integration strategy.

The following sections describe companies that are adopting Web services to integrate internal applications. For information regarding EAI software vendors—including Vitria, SeeBeyond, Tibco, and webMethods—and their support for Web services standards, see Chapter 8, Web services Platforms, Vendors and Strategies.

4.3.1 Case Study: British Telecom

British Telecom (BT, **www.bt.com**) is a U.K.-based telecommunications company that provides local and long-distance phone service, mobile-communications service and Internet service. With more than 28 million exchange lines and 7 million mobile customers on three continents, BT relies heavily on the ability to communicate across different media and technologies.[16] In December 2001, BT adopted Web services to improve the company's technological infrastructure. The company chose Cape Clear Software (discussed in Chapter 8, Web Services Platforms, Vendors and Strategies) to design and implement a Web services solution.[17]

BT's computing infrastructure incorporates a diverse collection of technologies and platforms, including mainframes, CORBA, J2EE and *MQSeries*[3] technology. The incompatibility of various technologies limited interoperability between departments, and translation between platforms slowed BT's network. BT wanted its systems to be flexible and interoperable, but did not want to upgrade to an entirely new platform. Jon Calladine, BT's application-integration consultant, addressed these concerns: "We require a standard means for protecting our investment in existing systems while also enabling the development of new applications. While most IT platforms offer the means of interoperating, they are not inherently designed to do so. As a result they use proprietary protocols and increase the complexity of the development process."[18]

Using Cape Clear's *CapeConnect* Web services platform, BT created a solution that uses XML and SOAP messages to communicate across platforms. The standardization that Web services provide allowed the company to integrate previously incompatible objects, but did not force BT's developers to adopt new platforms or programming languages. Since Web services can be incorporated into existing software, the company did not have to

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3. MQSeries (now called WebSphere MQ) is IBM's middleware product line for application and business-process integration.

replace its infrastructure. BT's Web services implementation is not tied to a particular vendor's product line, and it provides the flexibility to add and integrate new applications as necessary.[19] Although BT has not completed its Web services project, the company is confident that Web services will facilitate effective communication among its existing heterogeneous systems.

4.3.2 Case Study: **Nordstrom.com**

Nordstrom is one of the most popular department stores in the United States. The company is also an e-commerce leader, offering a wide variety of products through its Web site, **nordstrom.com**. In December 2001, Nordstrom hired IONA Technologies (discussed in Chapter 8, Web Services Platforms, Vendors and Strategies) to improve communication between Nordstrom's e-commerce site and its other applications.[20]

Before adopting Web services, communication among Nordstrom's applications was limited due to the company's many disparate computing platforms. **Nordstrom.com** uses Microsoft software, but the company's *enterprise resource planning* (*ERP*) applications—which it employs to check inventory, place orders and organize company resources—run on Hewlett-Packard UNIX servers, and inventory data resides on IBM mainframes. The company considered connecting these systems using traditional middleware products, but decided that the available solutions were too expensive and time-consuming. Instead, Nordstrom is using Web services technology to ensure interoperable transactions among systems. Nordstrom's CTO, Paul Onnen, observed that Web services are more cost-effective because one Web service can be accessed by multiple applications: "The key with Web services is that you only have to build [them] a single time."[21] Web services also can be implemented quickly—**nordstrom.com** installed its first Web services in only a few hours.[22]

Nordstrom is using Web services to connect its e-commerce site to its gift-card-management and cosmetics-replenishment applications, which reside on legacy systems. The Web services that link **nordstrom.com** to the gift-card-management system allow customers to redeem Nordstrom gift cards through the Web site. The other Web services implementation is designed to improve Nordstrom's cosmetics-inventory system—when a customer purchases a cosmetics product from **nordstrom.com**, a Web service automatically updates the cosmetics-replenishment application to reflect the changed inventory. Although security concerns have caused Nordstrom to deploy Web services only on the company's private network, Nordstrom is happy with its Web services implementations. The company plans to use Web services to create a universal inventory system that connects each store's separate inventory applications. Onnen highlights why Web services will allow them to accomplish this goal: "I don't have to reinvent the wheel. We can define interfaces one at a time and use them over again multiple times."[23]

4.4 Corporate Portals and Knowledge Management

Corporate portals are browser-based applications that offer single-access points to information or applications aggregated from disparate sources. Companies usually implement corporate portals to improve communication with customers, partners and employees. For example, a company's customers and partners might query a portal to access information
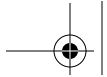
such as product availability and pricing. Employees typically use portals to perform various tasks, from retrieving corporate policies or human-resource information to booking work-related trips and accessing scheduling applications.[24]

As organizations grow more complex, they are developing portals that offer enhanced functionality, such as the ability to supply confidential information to users. When attempting to access sensitive data via a portal, users enter authorization information, such as usernames and passwords. After authenticating a user's identity, the corporate portal displays information appropriate for that user. For instance, a corporate portal might allow an authorized sales associate to view information on company products and services, but restrict the sales associate's access to fellow employees' personnel data. Likewise, a corporate portal might allow trusted business partners to view information about new or existing services while restricting access to information about the company's financial assets.

To facilitate business processes and ensure maximum security, corporate portals should be customized on the basis of users' identities, positions or job titles. As the technology evolves, portals will employ Web services to supply users with personalized information.[25] Web services also can link portals with disparate applications and data sources. For example, imagine that a company wants to connect its portal to a business partner's application, but the business partner uses a different programming platform that does not interoperate with the portal. In this scenario, the company could use Web services to enable communication between its portal and the partner's application. To address these kinds of interoperability issues, organizations that develop portal software are incorporating Web services standards into new versions of their products.

Portal users often want to access only content that pertains to a particular topic. In these cases, portals employ *portlets*, which are application modules that encapsulate specific, real-time information from a portal and present that information to a user.[26] Portlets often are proprietary programming components and therefore pose potential interoperability problems. As Web services standards develop, it is likely that many companies will incorporate Web services technologies to perform portlet functions.

A crucial aspect of creating effective portals is managing portal information. Without *content management*—rules for creating, storing and presenting content so that information is accessible and useful—portals can become "information dumps" that are difficult to navigate. However, when content is managed effectively, portals become significant *knowledge-management* tools. This means that businesses gain value from portals that present company information assets in a logical, useful manner.[27] Many software vendors that market portal solutions also offer content-management software, and other portal vendors are partnering with content-management vendors. For example, portal vendor Plumtree has partnerships with content-management vendors Interwoven and Documentum.[28]

Several major software vendors are including portal applications in their overall Web services strategies. These include BEA Systems, which has developed the *WebLogic Portal 7.0* for its *WebLogic Platform 7.0*; Microsoft, which has introduced the *SharePoint Portal Server* to be used with its .NET platform; and Sun Microsystems, which has created the *Sun™ ONE Portal Server* for its *Sun ONE* Web services initiative.[29] In addition, numerous portal and content-management vendors are enhancing their products by integrating support for Web services standards (Fig. 4.3).

Vendor	Application
Portal	
BEA, **www.bea.com**	WebLogic Portal
BroadVision, **www.broadvision.com**	One-To-One Portal
Epicentric, **www.epicentric.com**	Foundation Server
IBM, **www.ibm.com**	WebSphere Portal Server
Microsoft, **www.microsoft.com**	SharePoint Portal Server
Oracle, **www.oracle.com**	Oracle9iAS Portal Studio
Plumtree, **www.plumtree.com**	Corporate Portal
Sun, **www.sun.com**	Sun ONE Portal Server
Tibco, **www.tibco.com**	Active Portal
Content Management	
divine, **www.divine.com**	divine Content Server
Documentum, **www.documentum.com**	eContent Services for Portals
OnePage Inc., **www.onepage.com**	Content Connect Studio
Vignette, **www.vignette.com**	Vignette V6

Fig. 4.3   Portal and content-management vendors and their products that support Web services standards.

To promote standardization among corporate portals, several organizations—including Epicentric, Documentum and Instraspect—formed the *Web Services User Interface* (*WSUI*) initiative, which describes how organizations can leverage XML technologies to create portals that interact with Web services.[30] In October 2001, the WSUI specification was contributed to OASIS's *Web Services Component Model* (*WSCM*) Technical Committee, now called the *Web Services for Interactive Applications* (*WSIA*) Technical Committee. The WSIA TC is incorporating the WSUI specification in a Web services framework for interactive Web applications.[31] We discuss the role of XML in Web services in Chapter 5, XML and Derivative Technologies.

Another OASIS initiative is the *Web Services for Remote Portals* (*WSRP*) Technical Committee, which is defining a standard that will allow Web services to be "plugged into" platforms that aggregate content, such as corporate portals or other Web applications. The committee will work to define self-describing services that can be published and discovered in standard way.[32]

Many companies that supply content to other organizations are incorporating Web services in their content-delivery systems. By exposing content as Web services, a content provider can allow clients to access updated data directly and incorporate that data in Web sites and portals. For more information on this type of Web services implementation, see the feature, Case Study: Standard and Poor's.

Case Study: Standard and Poor's

Standard and Poor's (S&P, **www.standardandpoors.com**), a division of the
McGraw-Hill Companies, provides financial information, industry analysis and data on
fiscal performance and trends for the financial-services industry. The company's main
goal is to offer outside, objective resources that help individuals and corporations make
well-informed investment decisions.[33] To assess the performance of companies and in-
vestments, managers and business executives require the most up-to-date financial re-
porting possible. Thus, S&P constantly seeks out new ways to keep its clients
informed. In 1998, S&P began offering some of its printed material online—the com-
pany soon realized that the Web could vastly improve its ability to deliver financial in-
formation to clients.

As the Web evolved, S&P has experimented with new ways of delivering its infor-
mation and services—including the use of Web services technology. The company is
developing more than 60 Web services. Initially, S&P's Web services were available
only as a complete package, so interested customers had to purchase access to all 60 ser-
vices at once. However, the company now is packaging each Web service separately.
This enables customers to pick and choose the specific applications to which they sub-
scribe. S&P maintains over 40 Oracle databases to contain the services' information, and
each database is updated regularly to include current and accurate financial data.[34]

Using the Sun ONE platform (discussed in Chapter 8, Web Services Platforms,
Vendors and Strategies), S&P created each application as a modular J2EE component.
The component is packaged in a SOAP envelope and described using WSDL. The
SOAP envelope then is passed to an internal directory, from which other business units
within the company can access the information. These components also can be pub-
lished externally, which allows client businesses to incorporate the services on their
own Web sites or portals.[35] Examples of available S&P Web services include a quote
engine, rules-based screening tools, equity-quote services and financial calculators.

Through Web services, S&P can provide more current data and value-added ser-
vices to customers. Web services also allow S&P to attract new customers and expand
into new markets without significantly increasing the company's infrastructure. Since
S&P's Web services are available worldwide via the Internet, international customers
can access up-to-date financial reports and industry data, regardless of location.[36]

4.5 Web Services and Customer-Relationship Management

One way that companies can differentiate themselves from competitors is by providing supe-
rior customer service. *Customer-Relationship Management* (*CRM*) encompasses every as-
pect of interaction between an organization and its customers—including sales, service and
support. An effective CRM strategy combines technology and marketing to help companies
better understand their customers, identify profitable customers, resolve customers' concerns,
target customers with appropriate promotions and automate customer-service tasks.[37]

Data and application integration are crucial to successful CRM. Many companies store
customer data in decentralized databases, and it is common for different departments to
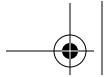
maintain duplicate information. One of CRM's main goals is to enable a company's employees to access a complete customer profile from a single application or location.[38] To accomplish this, the company's CRM system must facilitate communication among various corporate applications and databases. Also, as B2B partnerships become more common, many partner organizations want to integrate their CRM data.[39] This requires CRM systems to communicate remotely with applications that run on different platforms.

As we discussed in Section 4.3, traditional methods of linking applications and databases require expensive, customized connections. In a typical CRM implementation, integration represents 30 to 50 percent of the project's total cost.[40] Web services can provide a less expensive method of integrating customer data. Moreover, since Web services employ open standards, companies can more easily integrate their own customer data with that of partners. This allows organizations to develop more complete customer profiles, which helps marketing departments target customers with appropriate advertisements and promotions. As a company's CRM strategy evolves, it is relatively simple to integrate new applications and data sources into a Web services-enabled CRM system.[41]

Companies also can use Web services to communicate directly with customers. If Web services are used to link a company's internal databases to a Web application, customers can access data such as billing and order-status information over the Internet. A customer can directly query a company's database through its Web site and receive personalized, up-to-date information. In addition, Web services can be used to automate customer-service tasks, such as sending information regarding sales and promotions to customers on the basis of their preferences and purchasing histories.

As the software industry has embraced Web services, many CRM application vendors have modified their products to support Web services standards. In summer 2002, Siebel Systems (the CRM-application market leader, `www.siebel.com`) is due to release *Siebel 7.5*, which will provide support for SOAP and WSDL. Support for UDDI will be available in future versions of Siebel software. Other CRM software vendors are also adding support for Web services. For example, Oracle supports SOAP, UDDI, and XML; E.piphany (`www.epiphany.com`) supports SOAP and XML; and PeopleSoft (`www.people-soft.com`) exposes CRM-application functions to XML.[42] Other vendors, such as Onyx (`www.onyx.com`) and SAP (`www.sap.com`), are rebuilding their applications using XML and Web services, instead of merely offering support for standards.[43]

At this stage, most Web services capabilities provided by off-the-shelf CRM applications are too basic to facilitate meaningful communication. However, analysts expect that Web services will eventually provide a standard for integrating packaged CRM applications.[44] The following sections explore the experiences of two companies—Putnam Lovell Securities and Microsoft—that are integrating their customer data and CRM applications via Web services technology.

4.5.1 Case Study: Putnam Lovell Securities

Putnam Lovell Securities (`www.putnamlovell.com`) is an investment bank that targets financial institutions, private investment firms, brokerages, mutual-fund companies and insurance companies.[45] One of Putnam's functions is to provide research reports on particular investments, but the company lacked an effective method of supplying clients with current information.
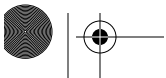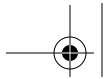
Putnam's problems were caused in part by its many disparate, unintegrated applications—**salesforce.com**, an ASP that specializes in CRM solutions, stores and manages Putnam's customer data, whereas Blue Matrix distributes financial research to Putnam clients. The inability of these applications to share data made it difficult for the company to analyze customer information and provide appropriate services. Putnam bankers had to request reports that might interest specific clients, then ship the reports via courier mail or e-mail. This process was expensive and inefficient, and reports were often out-of-date when they arrived.[46] Furthermore, the system made it impractical for Putnam employees to taylor reports to specific clients. Instead, Putnam sent composite reports, which were more costly to transmit and less valuable to customers.[47]

Putnam has adopted Web services technology to improve the company's integration and customer-service capabilities. Putnam hired Grand Central Communications (a Web services network discussed in Chapter 3, Web Services Business Models) to serve as an intermediary between **salesforce.com** and Blue Matrix, effectively integrating the two online applications. Through Grand Central's Web services network, Blue Matrix can query **salesforce.com** to determine which Putnam customers might be interested in a particular research report. **salesforce.com** analyzes Putnam's customer data and transmits a list of appropriate clients to Grand Central, which passes the information to Blue Matrix. Blue Matrix then sends the research report to appropriate clients via e-mail.[48]
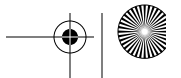
This automated system reduces mailing costs, improves efficiency and enables Putnam to distribute personalized research reports to clients. Putnam has realized many benefits from its Web services implementation, including cost savings, increased trading and higher customer-retention rates. The company is planning several additional Web services projects, which will automate tasks such as creating expense reports and updating employee contact information.[49]

4.5.2 Case Study: Microsoft Sales & Support IT Team (SSIT)

The Microsoft Sales & Support IT team (SSIT) is responsible for managing and controlling all of Microsoft's data-storage systems that contain information on account contacts, business opportunities, sales reports, customer support, sponsored events and marketing functions. Sales teams and representatives use each system to gather data on clients and sales performance. This enables the sales teams to analyze trends and forecast future results, as well as track individual client preferences and purchasing behaviors. Originally, each system had its own unique functionality and interface with which the sales teams interacted. This meant that employees had to know how to use five or more different systems before they could obtain a compete picture of a customer's account.[50] This type of infrastructure made tasks complex and time-consuming. Furthermore, the information in the systems was not always up-to-date, which impeded the staff's ability to provide effective customer-relationship management (CRM).

Working with .NET technology, SSIT set out to build an integrated data-retrieval infrastructure that would allow sales representatives to access data from a set of XML Web services. A Web-based tool called Account Explorer enables sales representatives to review a complete set of data on any one client from a central location.[51] Account Explorer calls various XML Web services to retrieve necessary information from the core data sys-

tems and present it in a unified, easy-to-read manner. By employing the system, managers can quickly analyze accounts and make appropriate, well-informed decisions about customers and sales trends.[52]

To further improve CRM, the SSIT group used Microsoft's Mobile Internet Toolkit to create a wireless version of the *Account Explorer* Web services. Using the wireless system, sales representatives can access customer information in the field using Pocket PC devices running on the Windows CE or Windows CE .NET platform. The ability to access information remotely from wireless devices further enhances sales performance and sales teams' decision-making capabilities, which improves overall CRM. We introduce Microsoft's Mobile Internet Toolkit in Chapter 9, .NET Web Services: A Conceptual Overview.

4.6 Web Services and B2B Collaboration

The preceding sections of this chapter focused on how Web services can facilitate integration and automation within an organization. However, as we discussed throughout this book's first three chapters, businesses also can employ Web services to communicate with other businesses. B2B Web services implementations extend data and application integration beyond corporate firewalls, enabling companies to share data and business processes with partners, suppliers, distributors and corporate clients. Using Web services, partners can gain access to each other's applications and data, which improves collaboration and strengthens relationships between businesses. Readers should note that deploying inter-organizational Web services can raise significant concerns regarding security and Quality of Service (QoS). We discuss QoS in Chapter 3, Web Services Business Models; security is examined in Chapter 11, Computer and Internet Security, and Chapter 12, Web Services Security.

A particularly significant B2B integration scenario involves using Web services to connect every member of a *supply chain*—i.e., a network of organizations involved in creating a particular product or service. A typical supply chain might include businesses that procure raw materials, businesses that process those materials into intermediate and finished products, businesses that transport and distribute the product during various production stages and businesses that market and sell the final product to customers (Fig. 4.4). *Supply-chain management* (*SCM*) organizes all these supply-chain members to better coordinate daily business interactions—including procurement, transactions, production and distribution.[53]
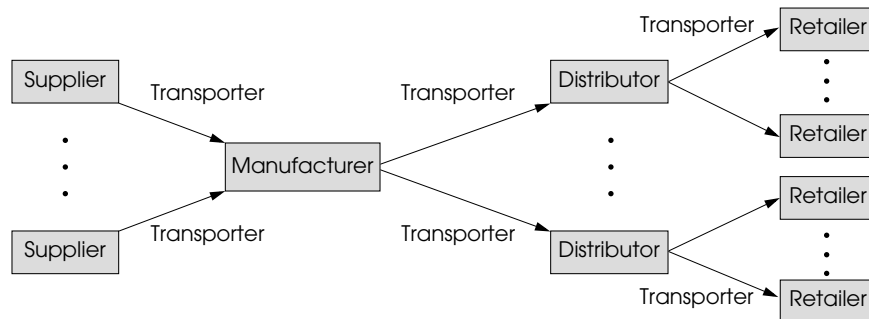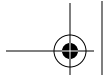

Fig. 4.4   Manufacturing supply-chain example.

Historically, integrating an entire supply chain's computing systems required every participant to adopt the same computing platform or integration solution. Since many supply-chain members interact with numerous different supply chains, true integration was expensive and, in most cases, impractical. Web services enhance the possibility for supply-chain integration by providing a relatively inexpensive, standardized method of platform-independent communication among applications.[54]

Integration improves a supply chain's ability to perform basic transactions—such as placing orders and confirming delivery times—over the Web or a shared network, instead of by fax or phone. This increases efficiency while reducing communications costs.[55] Moreover, businesses can package components of their applications as Web services, then allow suppliers and distributors to access those components directly. For example, imagine that a manufacturer exposes its inventory applications as a set of Web services and places the Web services in a private ebXML or UDDI registry (discussed in Chapter 7, UDDI, Discovery and Web Services Registries). Suppliers would use the registry to access the manufacturer's inventory system, then analyze the inventory data to determine when the manufacturer will need a new shipment of raw materials. This type of collaboration decreases uncertainty in the supply chain—if suppliers can determine when the manufacturer will need additional materials, the suppliers can deliver those materials at the exact time they are needed.[56] This enables the manufacturer to maintain less inventory of extra materials. Since storing inventory can cost up to 40 percent of the inventory's value, lowering inventories can result in significant savings.[57]

Web services can improve an organization's relationships with partners in similar ways. Through Web services, partners can create more flexible pricing contracts for complementary products or services. For example, most travel agencies maintain affiliations with hotels, airlines, car-rental agencies and tour groups. If a travel agency's computing system can communicate with partners' applications via Web services, the travel agency 's system can incorporate the most up-to-date prices for various travel and accommodation services. This enables the travel agency to adjust vacation-package costs to reflect fluctuations in air-travel, hotel and tour prices.[58]

As we discussed in Section 4.5, partners can link their CRM applications to exchange and share information about customers and purchasing patterns. This enables both partners to create more complete customer profiles, which improves customer service and facilitates the creation of personalized marketing campaigns. Partners also can employ Web services to notify each other automatically about new products or services, press releases and other business-critical information. In addition, Web services can be used to integrate partners' e-commerce applications. For instance, by using Web services to connect to a partner's purchasing application, an e-business can sell the partner's products or services through its own Web site. An example of this is the Web services implementation developed by Dollar Rent A Car and SouthWest Airlines, which we discussed in Chapter 3, Web Services Business Models.

In some cases, Web services can even enable partners and supply chains to automate B2B transactions. Automation involves one company's application or Web service accessing another company's Web service to request a particular business function, such as ordering materials or billing for services rendered. To enable automation, an application is programmed to perform certain actions on the basis of pre-established criteria—for example, if a sweater manufacturer's inventory of wool falls below a certain quantity, the
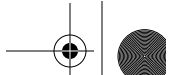
application would contact the wool supplier and order additional materials. This type of automation theoretically can reduce costs by limiting the human intervention necessary to perform business tasks. For more information on supply-chain Web services implementations and B2B automation, see the feature, Case Study: Alliance Airlines.[59]

Business culture must evolve significantly before automation of B2B transactions becomes commonplace. Many companies are not comfortable allowing computers to make business-critical decisions.[60] Managers worry that Web services do not yet provide sufficient security or QoS assurances. For example, what if an automated ordering system malfunctions and purchases the same supplies twice? To address these concerns, software vendors and standards organizations are developing XML-based business-process-management technologies, which help organizations define rules for secure, reliable, automated B2B transactions. We discuss many of these standards—including ebXML, Business Transaction Protocol (BTP) and Web Services Flow Language (WSFL)—in Chapter 5, Web Services and Derivative Technologies.

Case Study: Alliance Airlines

Alliance Airlines (**www.allianceairlines.com**) provides airline cargo-handling and scheduled interline road feeder services to over 110 international airline carriers.[61] In 2001, Alliance handled approximately 20,000 aircraft movements and 700 million pounds of cargo. However, before adopting Web services, Alliance's computing infrastructure was impeding the company's growth. Various Alliance departments used applications that ran on different platforms; these applications could not communicate with each other or with members of the company's supply chain. Company employees were forced to input data manually, which reduced efficiency and caused errors.[62]

Alliance hired SilverStream Software (discussed in Chapter 8, Web Services Platforms, Vendors and Strategies) to improve interdepartmental and supply-chain communication. Using Web services technology, SilverStream connected Alliance's various computing systems, allowing data to flow among applications. The *SilverStream eXtend*™ product suite enabled Alliance to develop 3A Track, a system through which Alliance's employees and supply-chain members can learn the status of cargo shipments. 3A Track traces the location of all cargo and communicates directly with airlines' and trucking companies' computing systems, providing real-time updates when shipments depart and arrive.

As a result of this upgrade, Alliance's clients have direct access to status information, which improves Alliance's relationships with its customers. Web services have improved the company's billing and accounting systems, enabling Alliance to eliminate many billing errors and shorten its billing cycle from 70 to 30 days.[63] Alliance's Web service implementation has also created a new revenue stream for the company. Prior to implementing Web services, Alliance was unable to charge fees for holding cargo at storage locations, because the company could not accurately track how long freight was stored. However, with 3A Track, detailed status information is available on all cargo. This enables Alliance to enforce service and storage fees.[64]

4.7 Summary

Web services can improve corporate-software development by reducing the time and expense involved in developing a software application. Instead of designing software "from scratch," programmers use registries to locate existing Web services, then incorporate those services into applications. However, Web services are not ideal for every software-development project. Web services security and QoS protocols are not fully developed, and Web services are not recommended for systems that handle a large number of transactions. Companies should implement Web services slowly, beginning with internal integration projects or services shared among a limited number of trusted partners.

Companies traditionally integrated applications via point-to-point connections (direct connections between two systems). More recently, organizations have invested in Enterprise Application Integration (EAI)—infrastructures that link multiple applications and databases so that they can share information and business processes. EAI is complicated and expensive, and EAI's custom interfaces are not reusable. Web services are less complex to develop and maintain than are most EAI systems, which means that integration projects require less time and money. Web services also allow companies to break applications into separate units, which makes integration more efficient.

Corporate portals are browser-based applications that offer single-access points to information or applications aggregated from disparate sources. Companies usually implement corporate portals to improve communication with customers, partners and employees. As the technology evolves, portals will use Web services to supply users with personalized information. Web services also can be used to link portals with disparate applications and data sources.

Customer-relationship management (CRM) encompasses every aspect of interaction between an organization and its customers—including sales, service and support. An effective CRM strategy combines technology and marketing to help companies better understand their customers, identify profitable customers, resolve customers' concerns, target customers with appropriate promotions and automate customer-service tasks. Web services can provide a less expensive method of integrating customer data. Since Web services employ open standards, companies can more easily integrate their own customer data with that of partners. This allows organizations to develop more complete customer profiles, which helps marketing departments target customers with appropriate advertisements and promotions.

B2B Web services implementations extend data and application integration beyond corporate firewalls, enabling companies to share data and business processes with partners, suppliers, distributors and corporate clients. Using Web services, partners can gain access to each other's applications and data, which improves collaboration and strengthens relationships between businesses. A particularly significant B2B integration scenario involves using Web services to connect every member of a supply chain. Web services enhance the possibility for supply-chain integration by providing a relatively inexpensive, standardized method of platform-independent communication among applications.

Web services also can improve an organization's relationships with partners. Through Web services, partners can create more flexible pricing contracts for complementary products or services. Web services can be used to integrate partners' e-commerce applications. In addition, partners can employ Web services to notify each other automatically about new products or services, press releases and other business-critical information. In some cases, Web services can even enable partners and supply chains to automate B2B transactions.
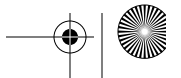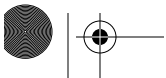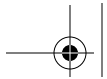
4.8 Internet and Web Resources

www.webservices.org/index.php/article/articleview/102/1/20
This article summarizes the results of a Jupiter Media Metrix survey in which businesses revealed their plans to deploy Web services over the next year.

www.webservioesarchitect.com/content/articles/samtani01.asp
The authors of this *Web Services Architect* article introduce basic EAI concepts and discuss how Web services can improve integration projects.

www.adtmag.com/article.asp?id=6403
In this article, the author relates various companies' experiences with Web services-enabled integration projects. The article is designed to help companies determine whether to adopt Web services for integration.

www.informationweek.com/731/31erall.htm
This *InformationWeek* article examines the benefits of corporate portals.

www.oasis-open.org/cover/wsui.html
This *XML Cover Pages* article discusses the WSUI initiative to standardize implementation of corporate portals.

www.oasis-open.org/committees/wsia/
This OASIS site provides information about the Web Services for Interactive Applications initiative, which currently is under development by an OASIS technical committee. The site also contains links to related documents and press releases.

www.oasis-open.org/committees/wsrp/
This OASIS site provides information about the Web Services for Remote Portals initiative. The site provides an overview of WSRP and contains links to relevant documents and press releases.

wwww.eaijournal.com/Article.asp?ArticleID=422&DepartmentID=1
This article from *eAI Journal* overviews how to integrate CRM technologies into existing corporate software.

www.ittoolbox.com/help/crmoverview.asp
A brief overview of CRM is provided in this IT Toolbox article. The article overviews the history of CRM, explains CRM's importance and provides statistics on the expected growth rate of CRM-enabled technologies.

silmaril.smeal.psu.edu/misc/supply_chain_intro.html
Written by professors at Penn State University, this article overviews supply-chain management and how businesses can make intelligent supply-chain decisions.

www.webservicesarchitect.com/content/articles/samtani02print.asp
This article defines business-to-business integration (B2Bi) and the role that Web services can play in integrating with partners, suppliers and customers.

www.zdnet.com/filters/printerfriendly/0,6061,2852816-92,00.html
The author of this article examines how companies can use Web services technology to improve relationships with partners.

www.microsoft.com/net/use/casestudies.asp
This site provides links Microsoft Web services case studies. Each case study describes how a particular company or organization is using Microsoft technology to build and maintain Web services.

**www-4.ibm.com/software/solutions/webservices/casestudies/**
This site provides links to IBM Web services case studies. Each case study describes how a particular company or organization is using IBM technology to build and maintain Web services.
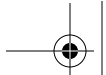
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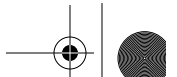
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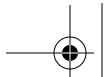
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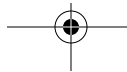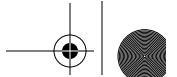
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