

The Wireless Web

The **wireless web** represents the combination of two innovative technologies—**wireless** communications and the **Internet**. The Cahners In-Stat Group predicts that the wireless data market will grow from 170 million subscribers worldwide in 2000 to greater than 1.3 billion in 2004.¹ As a result, more than 1.5 billion handsets, personal digital assistants, and Internet appliances are expected to bring substantial benefit to consumers, producers, and the economy as a whole. This chapter explores the application of wireless technology to **business-to-consumer (B2C)**, **business-to-business (B2B)**, and **business-to-employee (B2E)** opportunities and examines how supporting technologies including high-speed networks, synchronization, and voice recognition play a role in realizing the potential of the wireless web.

What Is the Wireless Web?

The wireless web represents the convergence of two technologies—the web, which has radically changed how we do business, interact, and entertain ourselves; and wireless technology, which through the **cell** phone has added a mobile dimension to e-commerce and enterprise computing.

Forecasts from the Cahners In-Stat Group are that the wireless data market will grow from about 170 million subscribers worldwide in 2000 to greater than 1.3 billion in 2004,² while the sales

The wireless web is where wireless and the Internet meet.

1.3 billion wireless users by 2004

¹ “Wireless Data Users to Reach 1.3 Billion by 2004,” Wireless Developer Network web site at www.wirelessdevnet.com/news/2000/235/news3.html

² Wexler, Joanie, “Mobile network strategies,” September 20, 2000, NetworkWorldFusion web site at <http://www.nwfusion.com/newsletters/wireless/2000/0918wire2.html>

of **personal digital assistants (PDAs)** and net-enabled cell phones are expected to rise from \$10 billion in 2000 to \$73 billion in 2005.³

Wireless is not the conventional web.

Wireless is not just the Internet without wires. To expect a desktop web surfing experience from the small screens on increasingly more portable mobile devices misses the point of what wireless web connectivity is all about.

Wireless is more than lack of cables.

In the early 1900s, the term “horseless carriage” was used to describe what is now the automobile. It wasn’t so much about getting rid of horses as it was about opening up new modes of transport and urban life. Wireless isn’t so much about cables, or the lack thereof, as it is about new dimensions of anytime-anyplace connectivity, freeing the Internet from location and time, and opening up new ways to extend existing applications as well as create new ones.

Wireless opens up new points of entry to the web.

Figure 1.1 illustrates how wireless introduces new points of contact to the web—the servers, enterprise data repositories, and **intranets** that make up the fabric of the conventional wired web. Adding wireless devices such as cell phones, PDAs, pagers, and portable computers creates new opportunities for efficiently utilizing an increasingly mobile workforce and for building trusted and sustainable relationships with customers and suppliers.

Before looking at these opportunities in more detail, let’s explore how wireless augments the potential of the Internet.

³ Cohn, Michael, “The great mobile-computing land rush—handhelds get down to business,” December 1, 2000, *Internet World* web site at <http://www.internetworld.com/120100/12.01.00feature1.jsp>

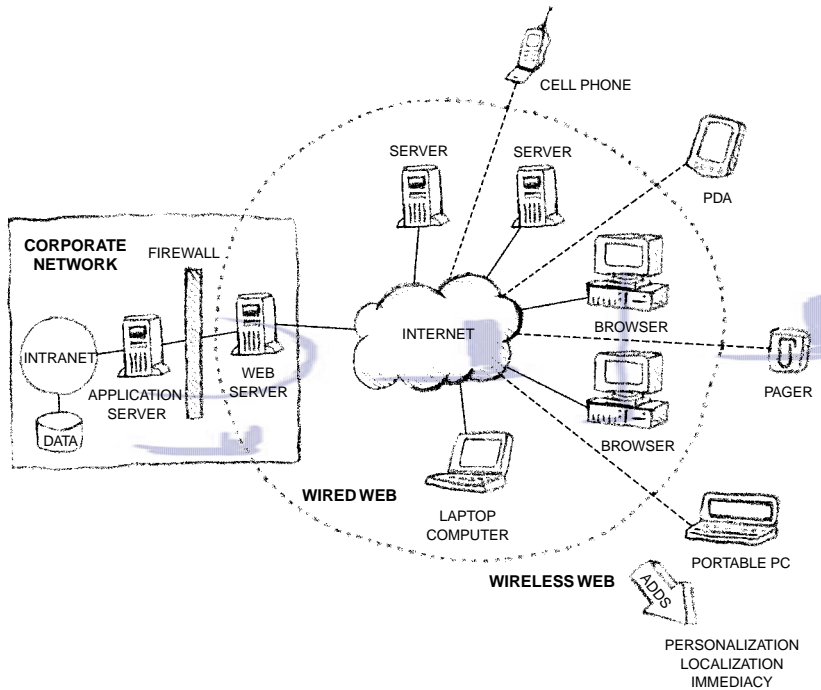


Figure 1.1 Wireless connections extend the wired web.

The Wireless Advantage

Wireless brings three new dimensions to the web: localization, personalization, and immediacy. The net effect is new opportunities for building trusted and sustainable relationships with customers and suppliers as well as efficiently utilizing an increasingly mobile workforce.

Localization

Localization is the ability to geographically locate wireless devices using either the **global positioning system (GPS)** or taking advantage of sophisticated cellular triangulation techniques to pinpoint location to within several feet. Travel-related software has been one of the first application areas to take advantage of

Wireless adds new dimensions of localization, personalization, and immediacy to the web.

Wireless can know where you are.

localization. Wirelessly connected users can enter their street location on a PDA and receive information about nearby shops, restaurants, or clubs, sorted by distance and with walking directions. On the enterprise side, application servers now use localization to activate database triggers and push location-specific responses to mobile users.

Personalization

*Wireless can know
who you are.*

Because wireless network providers already track user identity for billing purposes, applications can leverage this information to personalize content based on user preferences and/or patterns of use. For wireless consumer applications, tailoring content based on individual preferences and need opens up new value-added opportunities for *cross-selling* related item sales and *up-selling* more expensive variants of the initial product of interest.

Immediacy and Push

*Content is delivered
when needed.*

Another major advantage of wireless is its ability to immediately deliver or *push* information to users when they need it rather than when it's requested. On the desktop web, users initiate requests, pulling information from servers. With always-on wireless computing, servers can push information to users, similar to cellular services pushing the time to your phone every minute. Candidates for wireless push include e-mail header alerts, full-text e-mail, paging, and file downloads.

Wireless Constraints

*Wireless is limited
by devices.*

Despite the potential of wireless to deliver immediate, localized, and personalized content to mobile users, application providers are constrained by the limitations of mobile devices and networks (see Table 1.1). The small screens available on most cell phones and PDAs provide only a few lines of text, and the limited **bandwidth**

Table 1.1 The Pros and Cons of Current Second-Generation Mobile Wireless

Pros	Cons
Personalized	Small screens
Localized	Low bandwidth
Immediate	Diverse standards

of most wireless networks greatly constrains the amount of information that can be delivered to wireless devices.

As a result, it's inevitable that wireless technology undergoes some of the same growing pains experienced by other emerging technologies (see the sidebar "The Cycle of New Technologies"). Disillusionment with early wireless services can be attributed to limitations of **second-generation (2G)** networks. Moving to a plateau of productivity will require **third-generation (3G)** high-speed bandwidth to give users full access to the rich content and commercial possibilities of the web. (See Chapter 5 for a more detailed discussion of 3G.)

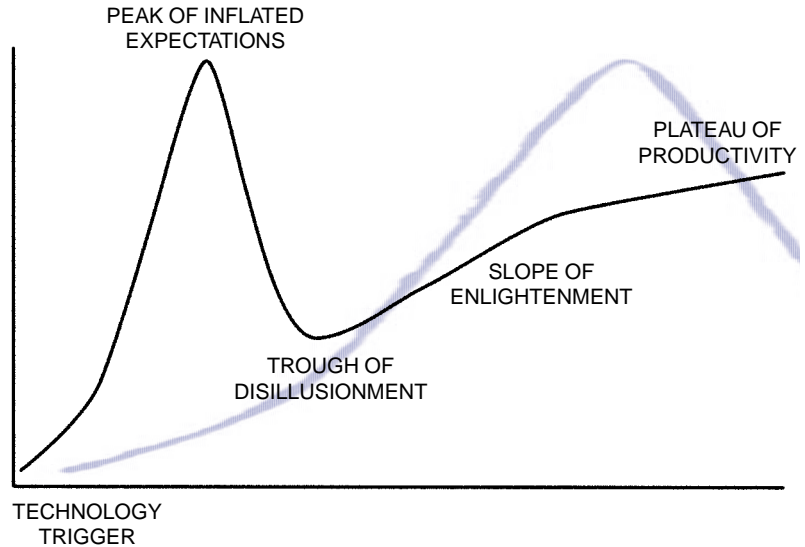
Wireless technology may be following a common technology introduction cycle.

The Cycle of New Technologies

Figure 1.2 shows the hype cycle of new technologies. After a technology is first introduced, a period of inflated expectations follows, with excitement and anticipation of what the new technology may bring. Fueled by marketing hype and the rush to get the technology to market, the initial burst of enthusiasm is then usually dashed by the initial implementation, leading to a trough of disillusionment. As designers and marketers begin to understand customer needs, problems are resolved, and more

Figure 1.2 The stages of introducing a new technology⁴

HYPE CYCLE OF NEW TECHNOLOGIES



realistic expectations lead to a slope of enlightenment and ultimately to a plateau of productivity.

In the early 1990s, the hand-held computer was greeted with enthusiasm when the Apple Newton emerged on the scene. However, user frustration with the Newton's size and less-than-stellar handwriting recognition had some people doubting that hand-held devices even had a future. But then the Palm Pilot came along and created the PDA market.

⁴ "Travelling at the Speed of Hype—GartnerGroup Predicts an End to E-business by 2008," November 1, 1999, Gartner Interactive web site at <http://www.gartnerweb.com/public/static/aboutgg/pressrel/hype110299.html>

Wireless Application Opportunities

Despite the current bandwidth limitations of 2G wireless networks, there is opportunity to lay the groundwork for the real revolution when it arrives. Although much of the early hype surrounding wireless technology has been centered on delivering services to consumers, Figure 1.3 shows three major areas to which wireless functionality can be applied.

Three wireless opportunities: B2C, B2B, and B2E

- ❑ **Business-to-consumer (B2C) interaction.** Companies reach out directly to consumers.

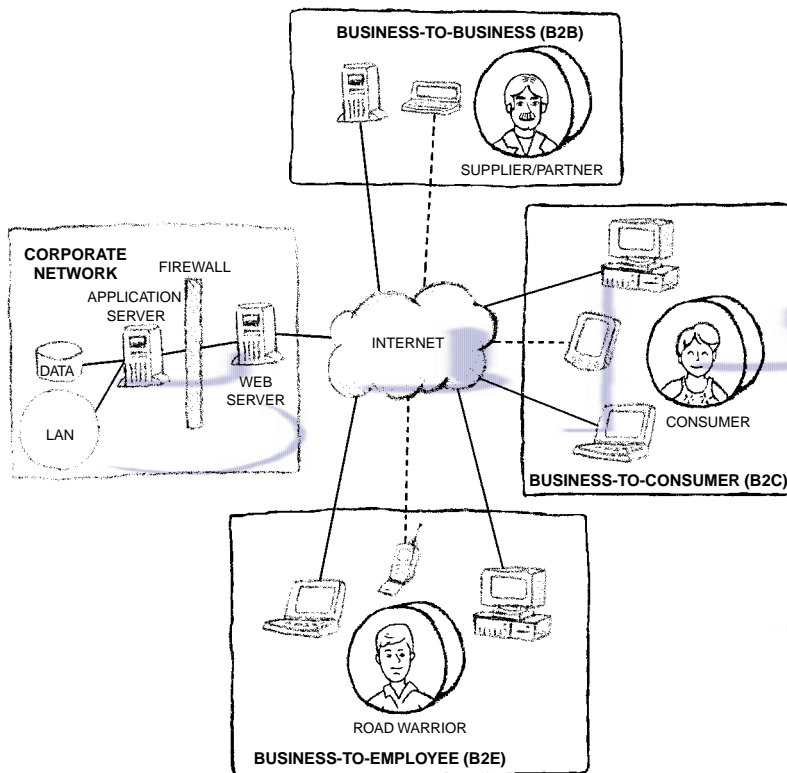


Figure 1.3 Wireless opens up opportunities for business-to-consumer (B2C), business-to-business (B2B), and business-to-employee (B2E) enterprise integration.

- ❑ **Business-to-business (B2B) commerce.** Opens connections to suppliers and partners. Opportunities in this area include using wireless for supply chain management (SCM) and enterprise resource planning (ERP).
- ❑ **Business-to-employee (B2E) interaction.** Introduces efficiencies into an organization by making corporate data available to mobile workers.

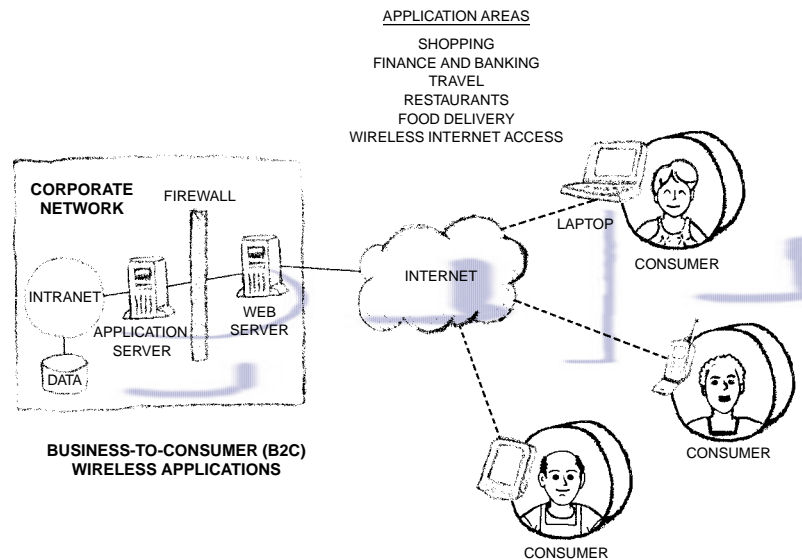
In the following sections, we explore how wireless can be applied to each of these areas.

Business-to-Consumer (B2C)

Although the wireless consumer market is in its infancy, numerous wireless applications are emerging in search of the killer consumer application.

As listed in Figure 1.4, consumer applications fall into several major application areas.

Figure 1.4 Business-to-consumer (B2C) wireless applications



Shopping Amazon.com has leveraged its expertise with personal services, moving into wireless with its Amazon Anywhere offering for cell phones and PDAs. Amazon's wireless service focuses on text, avoiding the graphics that appear on the desktop web site.

Finance and Online Brokerage In the banking arena, Credit Suisse, the Swiss bank, offers online brokerage services that include account monitoring and securities trading in real time on the Frankfurt, Zurich, and New York stock exchanges. Users with **Wireless Application Protocol**-enabled (or **WAP**-enabled) devices access secure servers that sit behind **firewalls** at the Zurich data center. Data is encrypted using 128-bit **encryption**, and as an extra level of security, users are authenticated with passwords before any transactions are initiated.

Travel In travel, wireless application provider EasyReservations (see the "Resources" section, later in this chapter, for web addresses to this and other organizations and products discussed in this chapter) enables users to book hotel and travel arrangements by entering city codes on their cell phones. The wireless site uses profile information that users provide when they register for the service. A provider called HotelGuide.com offers a multi-lingual service that enables users to compare hotel rates worldwide.

Restaurants Locating nearby restaurants is a natural fit for wireless' ability to provide localized services. The popular print-based *Zagat's Guide to Restaurants* has made more than 20,000 restaurants available over the conventional web and has now turned to wireless. With a few keystrokes on a cell phone, users can find nearby restaurants and make dining decisions based on price and reviews.

e-street.com is a wireless resource that enables users to find and share information on restaurants, shops, and services using user profiles to deliver personalized content.

Food Delivery Home food delivery is growing as an Internet-based service and is moving to wireless. Cake Avenue, based in Singapore, offers same-day delivery of gourmet cakes. Users can earn frequent-buyer “crumbs” that can be used as credit toward future purchases.

In France, Clicresto provides chef-prepared meals for immediate delivery to office or home. Users sign up using the desktop web or a portable telephone, and after users place their orders, the site personalizes its content so users can see their previous orders, saving ordering time for repeat items.

Laptop Internet Access Companies such as MobileStar and Wayport provide travelers with airport and hotel Internet connections. After inserting a card into their laptops, users can wirelessly connect to Internet access points provided by the airport or hotel, with service available on a per-use or per-year basis.

A recent alliance between MobileStar, Starbucks Coffee, and Microsoft is planning wireless Internet access for 70 percent of Starbucks' 4,000 stores by 2003.⁵ Cyber-caffeine aficionados will be able to plug a wireless **local area network (LAN)** card into their laptops and check e-mail while sipping their doppio macchiatos (a double espresso with a bit of froth).

⁵ Markoff, John, “Starbucks and Microsoft Plan Coffeehouse Web Access,” *New York Times*, January 4, 2001.

Business-to-Business (B2B)

Business-to-business interaction covers the range of activities between a company and its suppliers and partners.

As illustrated in Figure 1.5, wireless opportunities can be found in the areas of supply-chain management (SCM), enterprise resource planning (ERP—discussed in the section “Business-to-Employee,” later in this chapter), and **Collaborative Product Development (CPD)**. Jupiter Research has projected that e-marketplaces will account for 35 percent of B2B online commerce in the United States by 2005 with a concomitant \$2.2 trillion in spending.⁶

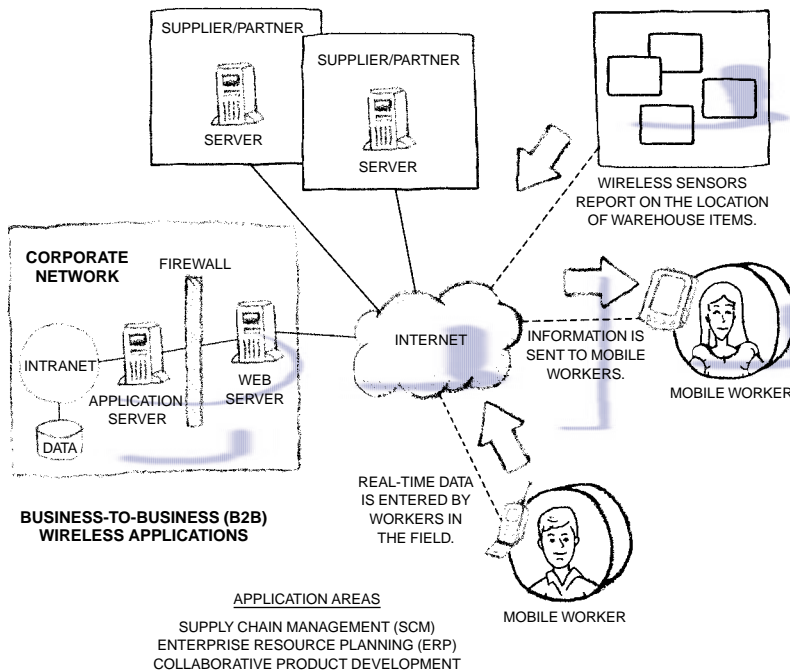


Figure 1.5 Business-to-business (B2B) wireless applications

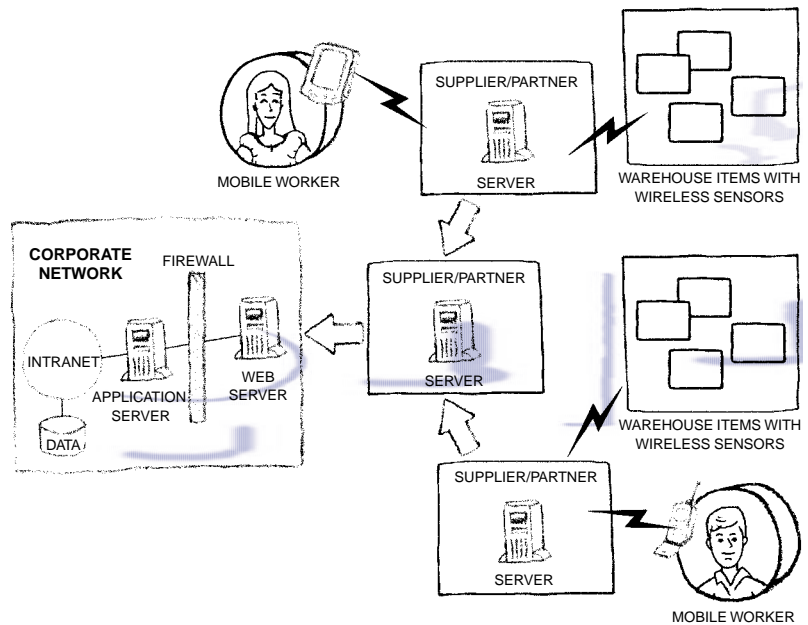
⁶ “Sleeping with the enemy,” *Intelligent Enterprise* 3, no. 18 (2000): p. 12.

SCM **Supply Chain Management** Supply chain management is the use of information technology to optimize the flow of products and services from source to customer. SCM focuses on cost savings in the movement and management of physical goods through the use of information technology. One approach is for companies to share production and forecasting information throughout a supply network, preventing over- and under-production, so that manufacturers can maintain just-in-time inventories (see Figure 1.6).

Wireless can feed data to and from the field.

Wireless connectivity adds to SCM in two ways. First, in terms of push technology, wireless makes corporate data immediately available to mobile workers. Second, wireless can facilitate the delivery of information from the field and feed it back to corporate databases.

Figure 1.6 Wireless technology can be used to improve supply chain management (SCM).



Information sharing is beneficial in theory, but when it means sharing with the competition, companies must weigh the benefits against the risks. In the automotive industry, Ford, GM, and Daimler Chrysler have united to create a third-party marketplace called Covisint that enables car makers and suppliers to meet production schedules while keeping inventories low.

Auto manufacturers and suppliers share information.

To ensure accurate inventory counts, supply chain vendors are attaching RF-emitting (or radio frequency-emitting) tags to warehouse items such as bins and equipment. Wireless sensors positioned on ceilings or along perimeter fences pick up the signals and can locate any tagged asset with ten feet. Location information is fed to a central database so that the exact state of the inventory is available at any given moment.

RF sensors accurately track inventory items.

The real-time monitoring of a corporation's inventory is advantageous, not just internally but also to supply chain partners. Not only are company operations more efficient, but real-time asset tracking opens up opportunities for supply chain partners to better manage their own commitments.

Collaborative Product Commerce Some manufacturers are pushing the supply chain envelope by including partners and suppliers during product design and development. **Collaborative Product Commerce (CPC)** is the term that describes the set of tools for managing all information surrounding design collaboration. The Aberdeen Group predicts that the CPC market will reach \$20 billion by 2005 from negligible levels in 2000.⁷ A key issue, though, is how much information to share with potential competitors.

CPC

⁷ Radding, Alan, "Developing products in sync," *Information Week*, no. 814 (November 27, 2000): p. 94.

Lotus Notes and wireless provide timely information dissemination.

CPC products range from Lotus Notes to software based on computer-aided design (CAD), workflow management, or e-procurement. Where timely information dissemination is crucial, wireless technology can be easily integrated into CPC systems, enabling designers and engineering staffs to view and comment on works-in-progress.

Business-to-Employee (B2E)

According to the Yankee Group, approximately one-third of the U.S. workforce, 43 million people, are currently mobile.⁸ Wireless connectivity opens up new opportunities for expanding the reach of an existing enterprise computing infrastructure.

Services Available to Support B2E

On the network carrier side, Sprint PCS supports software that enables mobile professionals to access e-mail attachments and documents from cell phones, pagers, PDAs, and notebook PCs. The service, ActiveNet,⁹ is server-driven and converts e-mail attachments into full text or summary form for wireless viewing.

Compaq has launched an initiative to enable mobile workers to access company intranets, e-mail, and the Internet from Compaq's iPAQ PocketPC and iPAQ BlackBerry devices. Compaq also provides secure wireless connections to e-mail available through Microsoft Exchange.

⁸ "Wireless Data Users to Reach 1.3 Billion by 2004," Wireless Developer Network web site at www.wirelessdevnet.com/news/2000/235/news3.html

⁹ Williams, Aisha M., "Partnerships Boost Sprint PCS Wireless Plans," November 6, 2000, in *InformationWeek.com News* at <http://www.informationweek.com/811/equinox.htm>

In the collaborative arena, Thin Air Apps is offering secure real-time access to Microsoft Exchange and Lotus Domino groupware via Palm-enabled PocketPCs, Research In Motion devices, **Symbian** hand-holds, and web-enabled cell phones. (See Chapter 2 for more information on Research In Motion.) Thin Air servers may be deployed from behind a firewall or accessed from one of Thin Air Apps' service provider partners.

In the database arena, Oracle's Application Server Wireless Edition provides personalized content to mobile devices. Other related initiatives include PeopleSoft's MobileStore that enables salespeople to access order information over a wireless phone, and SAP's Mobile Workplace¹⁰ and Handheld Sales applications for bringing corporate data to mobile workers.

Figure 1.7 illustrates the application of wireless to the enterprise. Some areas to which wireless can be applied in B2E include:

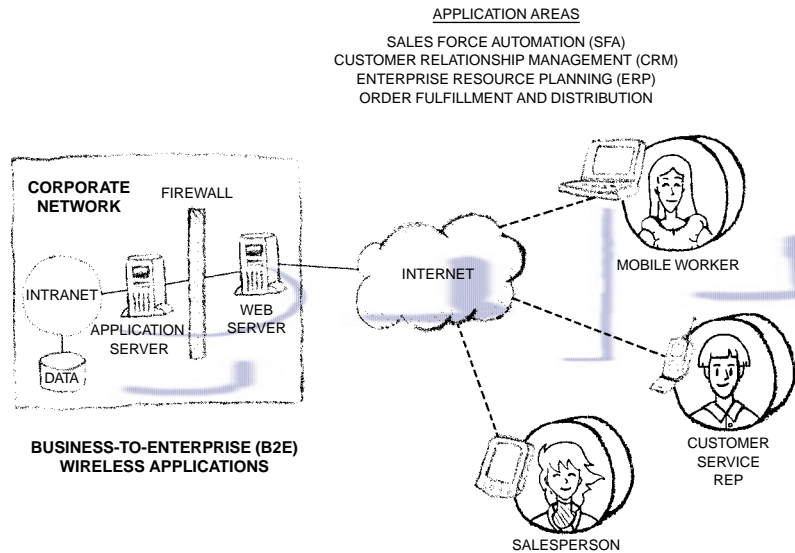
- Sales Force Automation (SFA)**
- Customer Relationship Management (CRM)
- Enterprise resource planning (ERP)
- Order fulfillment and distribution

Sales Force Automation Wireless sales management tools increase efficiency as well as mobility. Without returning to the office, a salesperson can gather and analyze information for a customer call using data from the company's inventory, the customer database, and accounts receivable.

SFA

¹⁰ Grygo, Eugene, "Wireless Apps Options Increase," July 6, 2000, InfoWorld.com web site at <http://www.infoworld.com/articles/hn/xml/00/07/06/000706hnsappalm.xml>

Figure 1.7 Business-to-Enterprise (B2E) wireless applications



CRM

agement tools enable an organization to utilize a single integrated system to manage prospects and customers effectively and consistently, regardless of where the interaction takes place. Outside sales, call centers, telemarketing, and direct marketing operations, as well as Internet applications, are included. A strong CRM system reduces the cost of sales through customer retention, improved targeting, and improved productivity across the enterprise.

ERP

Enterprise Resource Planning Wireless enterprise resource planning tools increase the effectiveness of managing enterprise resources such as human resources, machinery and equipment, legal positions, and financial situations.

Order fulfillment

Order Fulfillment and Distribution Wireless technology can be used to assure speedy delivery of ordered merchandise. AMR Research

reports that companies utilizing wireless can fill orders more quickly and typically save 3 to 5 percent of operating costs.¹¹

Next-generation fulfillment systems use radio frequencies to track equipment and wirelessly send data to a central database in real time. FedEx Ground is rolling out an \$80 million data collection system that includes installation of new on-van computers, enhanced hand-held scanners for capturing delivery information, and wearable ring scanners that enable delivery people to easily capture package status and location. The on-van computers are equipped with plug-in cards for wireless transmission between the van and a central computer. FedEx is using Ericsson wireless modems in two-thirds of its territory and Norcom Networks satellite modems in remote areas.

Wireless tracking enables real-time updates.

Technology Enablers

For wireless to reach its full potential requires supporting technologies that enable the Internet to blend into the fabric of wireless devices and networks. These include high-speed **digital** networks, synchronization technology, and voice used as a medium of interaction.

High-Speed Networks

Today's wireless networks are designed to transmit voice and brief text messages but can't provide the bandwidth that gives users full access to the rich content of the web. 3G wireless will be capable of combining the powerful technologies of wireless communication and the Internet. **Broadband** applications such as

3G wireless will provide always-on broadband connectivity.

¹¹ Robb, Drew, "Changing the name of the dot-com distribution game," *Information Week*, no. 817 (December 18, 2000): p. 130.

streaming audio and video are increasingly popular on the Internet as evidenced by the demand and growth in the cable and **digital subscriber line (DSL)** modem markets.

As these applications mature, wireless devices will need 3G capabilities to access existing Internet materials as well as yet-to-be-imagined applications. In addition, 3G technology will provide users with an always-on connection.

Third-generation promises speeds of from 144**Kbps** to 384Kbps for mobile users and 2**Mbps** for stationary connections. Another benefit of 3G is that networks based on different underlying 3G interfaces will harmonize with each other so that users will be able to travel around the world and still have high-bandwidth access. Combined with the Internet, 3G is expected to stimulate new opportunities for multimedia delivery to mobile devices as well as to offices and homes.

Synchronization

Synchronization maintains data consistency.

Delivering connectivity is one thing. Maintaining consistency is another. Synchronization is a technology for making two sets of data identical (see Figure 1.8). While most mobile devices provide some capability for synchronizing their data with network applications and desktop computers, almost all devices work with specific platforms, data types, and communications media.

The Palm PDA synchronizes through its hot-synch capability.

For example, the Palm PDA provides hot-synch capability between a PC and a Palm organizer, but not between the Palm and a cellular phone or back-end database. The net effect is many different, proprietary **protocols** that limit the potential of mobile devices. Synchronization is important in maintaining consistency in wireless B2E interaction. For mobile devices, synchronization can occur in two directions:

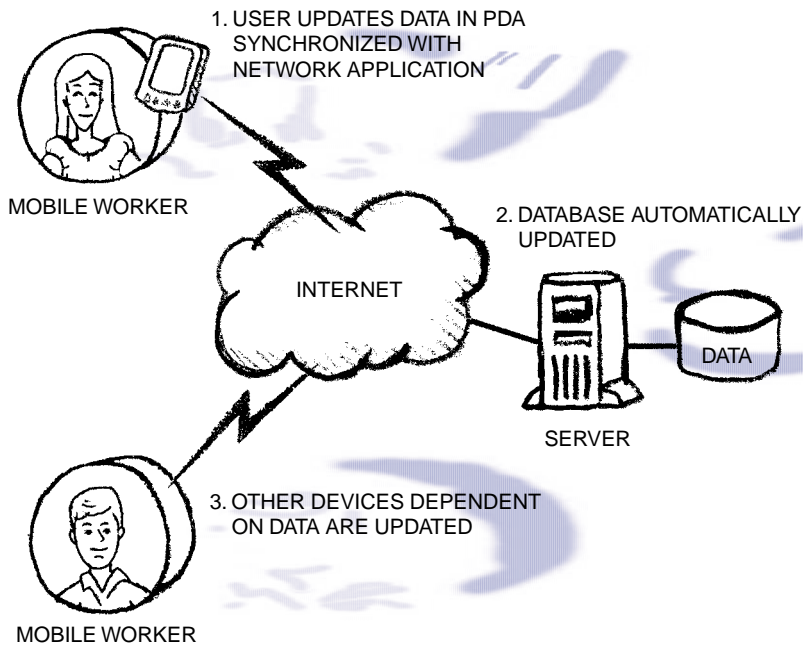


Figure 1.8 Synchronization technology can be used to keep mobile devices and databases up to date.

- Synchronize networked data with any mobile device.
- Synchronize a mobile device with any networked data.

SyncML: A Synchronization Standard SyncML is a protocol based on the **Extensible Markup Language (XML)**, supported by IBM, Lotus, Motorola, Nokia, Palm, Psion, and Starfish for synchronizing data across portable devices. SyncML defines a high-level protocol for sending messages between devices. SyncML is independent of any transport protocol such as **Hypertext Transport Protocol (HTTP)**, WAP, or infrared (IR) transport.

The SyncML standard protocol

SyncML supports the exchange of different kinds of data including:

- Personal data such as vCard for contact information, vCalendar, and iCalendar for calendars, to-do lists, and journal entries

- ❑ Collaborative data such as e-mail and network news
- ❑ Relational data
- ❑ XML and **Hypertext Markup Language (HTML)** documents
- ❑ Binary data (commonly referred to as *binary large objects* or *BLOBs*)

The SyncML 1.0 standard

SyncML recently released the SyncML 1.0 specification providing synchronization technology for mobile solutions. This protocol permits synchronization of both remote and local data. SyncML Reference Toolkit source code enables companies to bring SyncML-compliant products more quickly to the market.

Voice overcomes the constraints of small devices.

Voice

The challenge for wireless is how to deliver information on increasingly small mobile devices. Voice is one alternative that overcomes the small screen constraints of cell phones, pagers, and PDAs. Telephone support systems and help desks already make extensive use of voice to handle customer queries. Using voice with wireless is a natural next step. However, until recently, the proprietary nature of voice systems has discouraged third-party development because of the risk associated with single platform development.

The VoiceXML standard provides a platform for voice applications.

VoiceXML **Voice Extensible Markup Language (VoiceXML)** is an effort to standardize voice-driven applications across different platforms so that no matter how devices and networks change, the interactive voice components can be reused (see Figure 1.9). Technically, VoiceXML is a text-based language for creating automated voice services for wireless phones and voice-enabled devices. VoiceXML is based on XML (see Chapter 7 for details about XML). Because XML is text-based, voice programs can be moved across the Internet just as easily as web pages encoded with HTML.

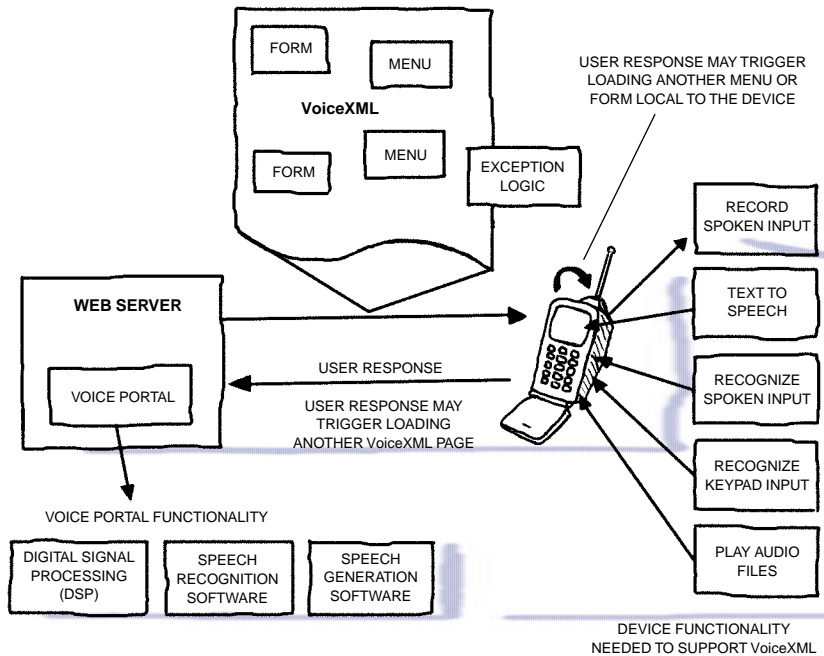


Figure 1.9
The VoiceXML specification assumes platform support for common voice-related functions.

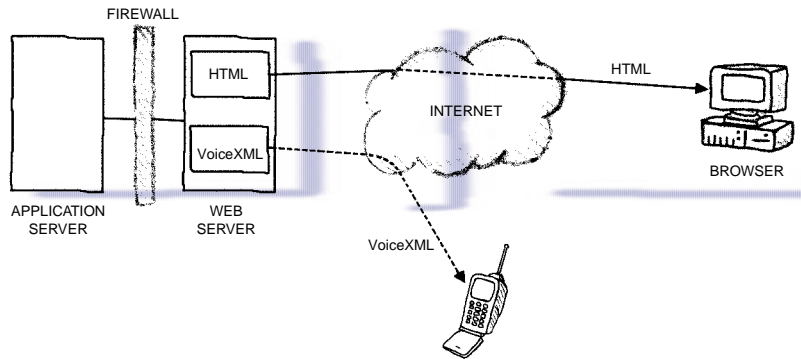
Using the familiar client-server web paradigm, web servers deliver not just “web pages” but “voice pages” that describe a series of interactive dialogs between a user and a cell phone or voice-enabled PDA (see Figure 1.10).

There are several advantages to having a standardized voice application language such as VoiceXML. First, a standard encourages third-party development because VoiceXML products will be usable on a multiplicity of devices. Second, because VoiceXML is based on XML, VoiceXML is accessible to experienced web content programmers. Third, servers can deliver VoiceXML documents to wireless devices just as easily as they deliver web pages. To the server, it’s just another web page.

VoiceXML documents describe conversations.

The advantages of voice for wireless

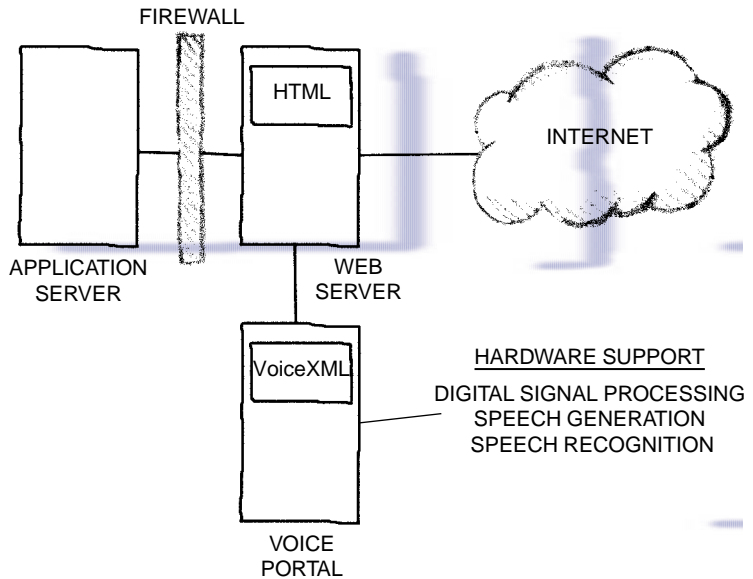
Figure 1.10
VoiceXML pages can be delivered from web servers to mobile devices just as easily as HTML pages are delivered to web browsers.



Voice Portals

Specialized servers called *voice portals* are becoming available that support server-side voice processing (see Figure 1.11). Intel, for example, has announced an integrated hardware and software voice portal that can be used

Figure 1.11
VoiceXML and corresponding support for hardware platforms



with a web server to deliver voice applications to mobile voice-enabled devices. Aimed at companies looking to deliver integrated voice and data services, the voice portal consists of an Intel server with specialized **digital signal processing (DSP)** circuitry for speech processing and recognition.

VoiceXML Documents A VoiceXML document is a text-based dialog between an end user and a VoiceXML-enabled device. VoiceXML defines two kinds of dialogs—forms and menus. A VoiceXML form defines a dialog for filling out web forms. A VoiceXML menu presents users with a choice of options, with the ability to transfer control to other menu dialogs based on user response (see Figure 1.12). If a selection leads to a dialog stored on the device, conversation continues immediately; otherwise, a new voice document is

VoiceXML supports forms and menus.

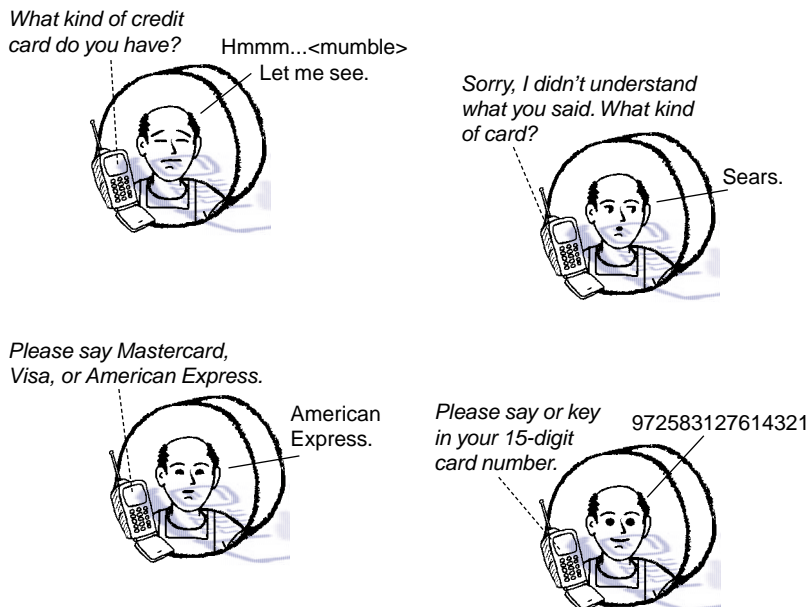


Figure 1.12 A dialog based on the delivery of a VoiceXML document to a wireless device (see Listing 1.1 for the corresponding Voice XML document)

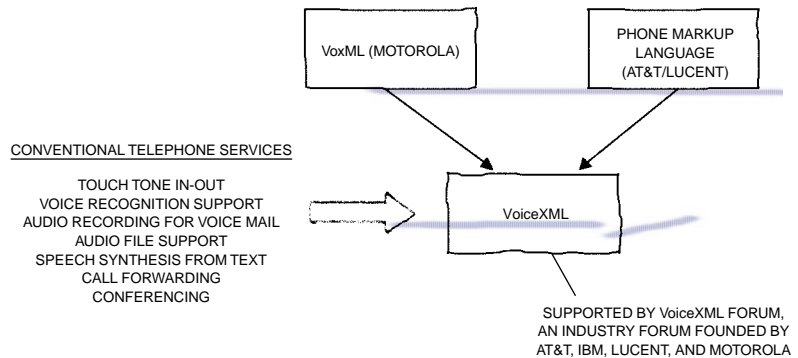
downloaded from the server. If verbal communication breaks down, VoiceXML can fall back to keypad or stylus data entry.

Origins of VoiceXML

The VoiceXML Forum is an industry organization founded by AT&T, IBM, Lucent, and Motorola. Its charter establishes and promotes VoiceXML as a standard for making Internet content and information accessible via voice and phone. VoiceXML has its roots in a research project called PhoneWeb at AT&T Bell Laboratories. After the AT&T/Lucent split, Lucent continued work on the project, now known as TelePortal, while AT&T developed its own phone markup language used to build call center and consumer telephone services that help customers configure and administer their telephone features.

Motorola embraced the markup approach to provide mobile users with timely information and hands-free access. By starting later, Motorola was able to base its VoxML language on XML. Joining forces, the companies announced VoxML technology in October 1998. Since the announcement, thousands of developers have downloaded the VoxML language specification and software

Figure 1.13
The evolution of
VoiceXML



development kit and can easily transition to VoiceXML. See Figure 1.13 for a depiction of industry convergence toward VoiceXML.

Applications Although VoiceXML is in its early stages, AT&T, Lucent, and Motorola have developed applications that illustrate the capabilities of VoiceXML. AT&T and its business customers have used VoiceXML to automate common business applications such as customer surveys, telephone e-commerce services, product promotion, and frequently asked question services. AT&T has also built a full consumer telephone service, which includes contributions from business partners for weather, news, and stock market data, as well as prototype consumer services that include prepaid calling cards and universal messaging. Lucent has demonstrated the use of voice markup to create banking, e-commerce, and a variety of interactive information retrieval and communications services. Motorola has used VoxML, the precursor to VoiceXML, to develop voice applications for BizTravel.com, CBS *MarketWatch*, and The Weather Channel.

*VoiceXML
applications*

Listing 1.1 provides an example of a VoiceXML document.

Listing 1.1 A VoiceXML document controlling the interaction between a user and a mobile commerce site (see Figure 1.12)

```
<form id=get_card_info>
<block> We now need your credit card type, number, and expiration
date.</block>
<field name="type">
<prompt count="1">What kind of credit card do you have?</prompt>
```

```
<prompt count="2">Sorry I didn't understand what you said. What
kind of card?</prompt>

<grammar>
visa {visa}
| master [card] {mastercard}
| amex {amex}
| american [express] {amex}
</grammar>
<help> Please say Mastercard, Visa, or American express. </help>
</field>
<!-- The grammar for type="digits" is built in. -->
<field name="num" type="digits">
<prompt count="1">What's your card number?</prompt>
<prompt count="2">Card number?</prompt>
<dtmf maxdigits=16/>
<catch event=HELP>
<if cond="type == 'amex'">
Please say or key in your 15 digit card number.
<else/>
Please say or key in your 16 digit card number.
</if>
</catch>
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Summary

As wireless technology seamlessly slips into the fabric of our daily lives, the term *wireless* may be dropped from our lexicon and replaced by *the web*, a single entity with wired access for high-bandwidth multimedia delivery and wireless connections for convenience and personalized services. However, the realization of a unified web will have to wait for the arrival of 3G networks to deliver the bandwidth for innovative applications in B2C, B2B, and B2E commerce.

Resources

Web

<http://www.wireless.com/>

A site for everything wireless.

<http://www.vindigo.com>

A web service for PCs or Palm PDAs. Tell it where you are or where you're going, and it finds the nearest and best places to eat, shop, and play.

<http://www.wired.com/news/wireless>

Wired magazine's wireless site.

<http://www.wirelessweek.com>

The Wireless Week web site provides breaking news and examines the issues facing today's wireless industry.

<http://uk.mobile.yahoo.com/>

Mobile Yahoo's site provides an interesting look into what's going on in Great Britain.

<http://www.cnp-wireless.com/links.html>

Even more links to wireless-related sites.

<http://www.AnywhereYouGo.com/ayg/ayg/Index.po>

Weekly updates of wireless news on a broad range of topics.

<http://www.oraclemobile.com>

Oracle's Application Server Wireless Edition has built-in location-based functionality.

http://www.microsoft.com/isn/ind_solutions/wireless_data.asp

Microsoft's wireless data page.

<http://www.coolwapsiteoftheday.com/112800.phtml>

A changing look at WAP.

<http://ww2.easyreservations.com>

A wireless service for reserving flights, hotels, and automobiles.

<http://www.hotelguide.com>

Hotel accommodations using WAP.

<http://www.zagat.com>

The popular restaurant guide is now available over wireless.

<http://www.e-street.com>

WAP city guide.

<http://www.cakeavenue.com>

Have a cake delivered or receive an e-mail reminder of a special event using wireless.

<http://www.clicresto.fr>

French site where users can order meals using "Le WAP."

<http://www.mobilestar.com>

MobileStar offers wireless LAN connectivity to hotels, meeting places, airports, and other places where business travelers converge.

<http://www.wayport.net>

Wayport offers wireless Internet access in airports and hotel public areas, and wired access in hotel guest rooms and meeting rooms.

http://www.sap.com/solutions/mobile_workplace/

SAP's Mobile Workplace.

<http://www.covisint.com>

Collaborative partner arrangement in the automotive industry.

<http://www.mobilecomputing.com/>

Mobile Computing's online magazine.

<http://www.syncml.org>

The official SyncML site.

<http://www.voicexml.org>

The official VoiceXML site.

<http://www.voicexmlreview.org/>

The "VoiceXML Review" is an e-zine sponsored by the VoiceXML Forum. It includes full-length feature articles, monthly columns, and news from the VoiceXML community.

<http://www.ddj.com/topics/xml/>

Dr. Dobb's XML site.

<http://developer.voicegenie.com/main.php>

The VoiceGenie Developer Workshop site includes tools, documentation, and resources to develop and test your own VoiceXML interactive phone application. A tutorial is available that shows how to use the audio tag in a VoiceXML application.

<http://www.crm-forum.com/>

Independent site for Customer Relationship Management.

<http://www.erpassist.com/>

Portal for ERP.

www.bettermanagement.com/supplychainauthority/

This Supply Chain Management Authority site provides a collection of white papers and articles.

www.cobolreport.com

Articles on legacy and emerging technologies.