@cn:Chapter 5
@ct:Wireless Applications
@ics:B@ic:ack in 2000, everyone was excited about wireless handheld devices and services. As reported in an <I>Upside Today<I> article entitled “Wireless Craze,” wireless proponents used forecasts from research houses to show the world the market’s potential. The Yankee Group reported that there were 469 million wireless users worldwide at the end of 1999 and predicted that the number would increase to 1.26 billion by 2005. Datacomm Research predicted that shipments of “smart” phones and handheld Internet devices would exceed 350 million units globally by 2003. International Data Corporation (IDC)[[Au: Okay?]] predicted that U.S. wireless Internet users would increase to 61.5 million in 2003 from 7.4 million in 1999. Those predictions of hockey-stick growth seemed to promise a wireless nirvana. Still, concern about growth was evident on some people’s faces (Figure 5.1).
$ For the most part, predictions about growth in the number of wireless-device subscribers have been on track. However, the uptake in wireless Internet and wireless applications has been a much less remarkable trend. In 2000, the Yankee Group reported that mobile-phone penetration in the United States had reached 38 percent, with penetration of 6 percent for new browser-enabled wireless phones. [[Au: Update?]]Actual use of the browsing capability, however, trailed far behind, at just 0.3 percent penetration (Table 5.1). The prediction was for the gap between the penetration and use of browser-enabled phones to continue for the next few years, as usage penetration would rise to only 7 percent by 2003 before shooting up to 20 percent by 2005. This dire prediction may be too pessimistic.
@h1:Argument for Applications
@$:The buildup surrounding the wireless Internet has subsided considerably, and now companies are focusing on how wireless technologies really do add value. Although users may occasionally browse Web sites on a mobile device while out and about, surfing Web sites on the tiny screen of a mobile phone or personal digital assistant (PDA) just does not provide the same user

experience as viewing them on a computer monitor. As discussed in Chapter 2, other factors have contributed to the slow uptake of wireless applications including competing standards, turf wars, and high coordination costs between players in the tightly interlinked value chain. In addition, technological barriers, including security and slow data rates for 2G networks (which affect response times for applications), are being overcome as security solutions become more mature and 2.5G networks are being rolled out. Very soon, the only factors retarding the value of wireless applications will be the quality and utility of the applications themselves. When the market matures to that point, customer needs, instead of technology constraints, will drive wireless applications.

So how does wireless technology add value to applications? Wireless can bring at least two extras to the table: real-time interaction and location information. It can promise that no matter where users are, they will be able to interact with information in real time. No more being glued to a desktop computer while waiting for that urgent e-mail. Location information can be useful simply to locate the nearest Chinese restaurant or to monitor the progress of truck shipments. A portable device also can increase the personalization of interactions since it can carry user profiles anywhere (e.g., a user’s preferred credit-card information). For full impact, wireless applications need to take advantage of these value-adds over desktop applications.

Differences in usage patterns have also become evident. Research suggests that PC users tend to access the Web 3 to 4 times a day for periods of 20 to 60 minutes on each occasion. For wireless devices, the model is a higher frequency of usage, such as 10 times a day, but for only 3 to 4 minutes each time. So the focus now is on streamlining interactions with wireless applications and targeting focused tasks as opposed to general surfing.

The market for wireless data applications is still relatively new. Enabling technologies such as location-based

services and other personalization features [[Au: Repetition]] will allow the fine-tuning of current applications, and innovative applications will emerge to meet the needs of consumers as well as businesses. The enterprise market offers an especially exciting opportunity, as demand for wireless business applications is increasing for several reasons:

@bl: • Incremental revenue through increasing market share and frequency of use.

@bl2i: • Improved productivity through greater effectiveness and efficiency, faster decision-making processes, and reduced costs.

@blfi: • Greater customer loyalty through personalized content and services.

@$: A recent Forrester Research report[[Au: Need specific ref. cite]] noted that 40 percent of Fortune 2,500 businesses in the United States had equipped or were equipping their workforces with wireless tools and that an additional 30 percent were considering it.

The constituents of the wireless value chain are all working to drive new innovations; the high motivation of wireless carriers to stabilize declining average-month revenues per user will spur other firms in the chain to try to fulfill the carriers' desires. The demand and technology are now falling in line with the motivation by the players in the value chain to position this market for growth. And herein lies the opportunity: compelling applications will be the primary driver of that growth.

@h1:Framework

@$:Since a lot of hype has surrounded the convergence of wireless and the Internet, this section examines specific applications that will be driving wireless data traffic. Segmenting the market in terms of industry verticals is a systematic way to analyze the opportunities. Vertical applications are customized solutions for the needs of a particular industry. For example, specific applications in the health care industry include electronic prescriptions, which are transmitted wirelessly from a doctor's

PDA to a pharmacy. This application is not relevant to other industries although the underlying technologies could be used for other purposes.

On the other hand, some applications could be used universally across industry verticals and by consumers, much like word processing or the telephone. These horizontal wireless applications include knowledge applications, communication, m-commerce, and telemetry and tracking. Knowledge applications include personal information management, as well as office tools such as document sharing. Communication includes applications for sending messages between people, such as short message service (SMS) and e-mail. Mobile commerce (m-commerce) includes any applications that aid commerce, such as those that support buying and selling or even advertisements. Finally, telemetry and tracking allows either tracking or transmittal of data from remote sources and includes applications that shipping companies use to monitor the progress of trucks toward their destinations. Figure 5.2 summarizes the vertical and horizontal application areas.

@h1:Horizontal Wireless Applications

@$:Many horizontal wireless applications already exist in some shape or form. Mobility mainly enhances the accessibility and the potential integrity of data and communications through real-time interaction. Consequently, most of the exciting horizontal wireless applications are extensions of existing computing applications. However, wireless can also add context, such as location and personalization, which enables more powerful applications. As costs decrease over time, horizontal applications have the potential to become widely used consumer applications.

The following section provides a detailed discussion of the four horizontal applications: knowledge, communications, m-commerce, and telemetry and tracking.

@h2:Knowledge Applications@$:Businesses have used specialized wireless applications for more than a decade. Many of these wireless devices and applications are extensions of the wire-line

platforms for general-purpose business applications, but they also include new uses that have been spurred by the ability to access and update information in real time. Many of the applications are professional-management or personal-information-management tools to increase the productivity and efficiency of people in the workplace, in their personal lives, or both.

The cost-savings model of business adoption is based on the idea that widespread use of wireless-enabled devices will occur when the benefit derived from employee access to instant information clearly exceeds the installation and operational costs of corporatewide wireless networks. In addition, rapid adoption of wireless models will occur where businesses obtain a competitive advantage is obtained by being able to access information in new ways and from locations that are not easily available in the wire-line world.

@h3s:Value Proposition of Knowledge Applications.@h3:|em|The main customer need that knowledge applications meet is instantaneous and ubiquitous access to business-critical data. Enterprises will demand this productivity-enhancement value proposition, and will have large ROI (return on investment) expectations on implementation. Most enterprise customers will be agnostic to the technology that suppliers use for wireless data transmission; they will look for end-to-end solutions that meet their mobile data bandwidth, availability, and security requirements. Thus, the same enterprise applications and device will have to work seamlessly between the wireless LAN in the office, the broadband wireless system at home, and the preferred carrier’s public network everywhere else. The information that the application accesses, displays, and modifies may vary in content and richness depending on the bandwidth of the network to which the device is linked, but for fast adoption, the change in functionality must be intuitive and transparent to the user.

@$: The pull for instant information at the fingertips will be especially strong within the manufacturing and service industries, where it can provide efficiency improvements or competitive advantages. Corporate information available on

personal computers (desktops and laptops) will be extended to a mobile handheld device that employees can carry with them to meetings within and outside their corporate offices. This will happen as the corporate intranet extends beyond the PCs into mobile handheld devices.

The following five applications are in the forefront of the adoption curve in the knowledge-management space:

@nls: 1. @nl:Corporate database access and entry of data.

@nls: 2. @nl2i:Intranet access and entry of information for applications such as network-hosted calendars, to-do lists, address files, and memos.

@nls: 3. @nl2i:Access to supply chain-management applications.

@nls: 4. @nl2i:Access to customer-relationship-management (CRM) applications.

@nls: 5. @nlfi:Training or troubleshooting materials that can be pulled on demand by workers in the field.

@$: Providing people with wireless data access can enhance the productivity of a mobile sales force. For example, integrating wireless functionality into CRM (customer relationship management) products [[Au: Explain—what products are you referring to?]] provides an additional level of sales-force automation. Also, With always-on connectivity, sales representatives can be better informed about their customers, access the information needed to complete sales, and communicate any status to the central office in real time. Such applications will be even more effective by providing real-time inventory and product-availability data to the sales personnel. These applications focus on enhancing customer satisfaction, shortening the sales process, and improving the information flow within an organization.

Westinghouse mobile satellite terminals and dome antennas provide AT&T Network Computing Services maintenance crews with seamless communication regardless of location. The technicians have access to data-communications services, mobile telephone, and fax to help troubleshoot problems. Sears has equipped its

home-repair service crews with PDAs that operate on Motient’s network using both terrestrial and satellite connectivity. It allows the technicians to access real-time information about pricing, schedule changes, inventory, and routing, not only improving their efficiency but also providing better customer service. The connectivity optimizes workforce utilization by prioritizing customers and fulfilling rush orders.
@h3s:Challenges.@h3:|em|Wireless knowledge applications will essentially be extensions of desktop applications. The challenges faced by widespread implementation and adoption of such extensions are related to technology, user experience, and cost. A typical system is shown in Figure 5.3. The technology already exists to extend applications into the wireless environment. For example, there are content-transformation tools that can take HTML Web pages and transform them into Wireless Markup Language (WML) cards for presentation to wireless devices. The biggest technological challenges are related to security and to speeding up the response times for applications. The 2.5G services will help with response times, but security will have to evolve through stronger encryption technologies and digital signatures.
@$: The biggest challenge from the user’s standpoint is taking the experience and expectations from desktop applications and transforming them into something reasonable on a wireless device. Limited screen sizes, presentation area, and keypads will force applications developers to think of application extensions to the mobile domain as <I>complements<I>, not as <I>substitutes<I>, for the core use of an application on a desktop computer.

Cost will also be factored into the purchase of systems or services to enable wireless access to knowledge applications, and there will be competition to bring the cost of solutions down. For some applications, customers will seek solutions that use no-service-cost wireless local-area-network technology to interact with knowledge applications while in the office but that also allow seamless switching to access through 2.5G or 3G networks outside the office. At any rate, it is likely that wireless access soon will be narrowly targeted at specific knowledge

applications such as CRM and field-service-support tools, which are the areas of immediate opportunity. In the long run, the challenge will be to reduce the cost until the return from everyone’s having wireless access to the full range of desktop knowledge applications is similar to the return from everyone’s having a computer.
@h3s:Summary.@h3:|em|The adoption rate will initially be driven by the need for constant access to specific business applications as well as by the decreasing cost of implementation. The adoption rate should be high since corporate implementation can drive the standardization of platforms and applications.
@$: “Smart” network architecture for enterprise information systems and intranets will facilitate the adoption of knowledge applications: The data and applications will reside on nodes of the corporate data network. Wireless devices will access knowledge applications on an as-needed basis after an employee login, as neither data nor applications are stored on the device itself. This system will enhance the security of corporate data in case of loss of the wireless device, as well as reduce the processing and data-storage requirements of the access device. It will also allow the device to be interoperable between employees and applications. The availability of low-cost (under $200) devices that can operate across multiple wireless transmission protocols such as 802.11, and 2.5G or 3G, will facilitate the widespread adoption of knowledge applications.
@h2:Communications
@$:This section concentrates on communication and messaging, mainly text. Voice communications, while important, are excluded because the focus is on text-messaging applications such as SMS (short message service) and wireless access to e-mail. The popularity of messaging is evident in many ways. The GSM (Global System for Mobile Communication) Association estimated that at the end of September 2001 nearly 750 million SMS messages were being sent <I>per day.<I> This service is a major contributor of revenue and profits to many European mobile operators. Electronic mail (e-mail) is a killer application in the wired world, and

wireless access to e-mail is a highly desired mobile application, as proven by the popularity of the research-in-motion (RIM) Blackberry pager and similar devices. In addition, a survey from Jupiter Communications showed that 50 percent of those surveyed wanted e-mail on their mobile device. Market estimates hover around $10 billion, a significant figure.

@h3s:Value Proposition of Communication Applications.@h3:|em|Text communication in the form of e-mail has existed since the 1970s, but it did not become popular until the Internet’s growth spurt in the 1990s. Millions of people use e-mail, and therefore the application has proven value for a huge number of consumers and enterprises.

@$: On one level, text communication has intrinsic value. First, it allows users to process information in parallel. It is easy to decide which piece of information is important on a page of text. On the other hand, people process voice communication serially. They must listen to voice mail in the order it was recorded to find the information of interest. Second, text is easy to reference (e.g., it is generally preferable to read driving directions than to listen to them). The real value, above and beyond the intrinsic value of text communication, is that it is a networked application, and many people are attached to the network. If only two people in the world had e-mail, it would be merely a novelty. However, as more and more people get e-mail, it becomes more and more useful. The value of the application increases with the size of the network (Figure 5.4). When wireless text communication was created, millions of people were already tied to the network. Thus, it became merely an extension of the existing e-mail network but added an aspect of portability that previously did not exist.

@h3s:Challenges.@h3:|em|Text communication is already viable, and several companies are competing in this space. Those offering solutions for wireless access to e-mail include RIM, OmniSky, and Palm.net. RIM offers a full, end-to-end solution by providing server software, hardware (Blackberry device), and software for

the Blackberry. Both Omnisky and Palm.net provide the client software that runs on either Palm or Windows CE devices. The infrastructure behind e-mail was in place, and access was extended to wireless devices.

@$: Short-message service (SMS) has existed for several years. Its rapid adoption was facilitated by its incorporation into the global system for mobile communications (GSM) standard, which not only sets standards for air interface protocols, but also core features. Unlike today's mobile e-mail, SMS messages are transmitted in the control band of cell phones, a small amount of bandwidth that voice transmission does not use. The original intention was for telephone companies to use the control band to send messages to their mobile users.

Nonetheless, horizontal wireless applications face technological obstacles that hinder their adoption by consumers and mobile workers. Some of them are applicable not only to the marketing of communications applications, but also to the adoption of wireless solutions among different horizontal and vertical markets. The main obstacle to the deployment of wireless communication or mobile-commerce tools is the lack of security for data transmissions among wireless networks. The risk of violation or distortion of critical information by others limits the demand for wireless communication tools. In the United States, multiple standards and dated circuit-switched network configurations constrain the development of a secure communications environment.

Small screens and the limited scope of input capabilities have been obstacles to handling a broad range of data patterns through wireless devices. At first glance, there seem to be two contradicting attributes in wireless communications that the industry must reconcile to optimize the value proposition: the size of the equipment and the interfacing features provided. The development of speech-to-text converters may eventually optimize both attributes.

In addition, mobile users need filtering tools to facilitate the efficient screening of messages. Because the information they

may require in the field is time critical, junk mail may damage the functionality that wireless is intended to provide. Potential customers are unlikely to be interested in paying to be bothered.

When attempting to integrate horizontal communications platforms with enterprise systems--an accomplishment that may leverage the deployment of horizontal wireless communications platforms--corporations find four challenges:

@nls: 1. @nl:Mobile workers handle diverse devices with different operating systems that make the integration of individuals into internal legacy systems difficult.

@nls: 2. @nl2i:When wireless workers do not have PCs, firms may find synchronization with central data stores costly.

@nls: 3. @nl2i:Corporations need the capability of maintaining software remotely to achieve cost efficiency.

@nls: 4. @nl2i:Diverse personal end-enterprise communications media should be integrated or synchronized with a single mobile device/operating system (unified messaging).

@h2:Summary

@$:Though the United States is behind in the adoption curve for text messaging, rapid growth is certain for this method of communication. Wireless carriers support SMS messaging at much lower cost than when handling voice calls and can count on SMS to generate revenues that compensate for declining revenues from voice calls. Some issues, however, pose doubts about the ability of horizontal wireless-communications applications to capture significant value. Both e-mail and messaging are basic tools with a low degree of complexity. These applications will soon be commoditized and become part of the ante to play in the game. If so, value will be captured by e-mail/messaging service providers or by those players that develop ancillary technical-support technologies to improve speed, variety, and security of transmitted information, not by the companies that develop solutions for these applications. Also, as prices for these services decrease, end customers will find text-communication services more attractive and valuable.

@h3s:M-Commerce.@h3:|em|Mobile-commerce applications facilitate monetary transactions via a mobile device. In the United States, people think of mobile commerce as traditional electronic commerce via a mobile device (e.g., using an Internet-enabled mobile phone to purchase a book from Amazon.com while waiting for the train). It is not surprising that true mobile commerce has failed to take hold here. Compared with e-commerce, the m-commerce experience is slow, lacks depth and graphical aids, has costly charges per minute, and is hampered by the difficulty in entering payment information. Generally, it is easier to call a customer-service representative and place an order over the phone. However, as operators move to 2.5 and 3G systems, m-commerce will improve because of faster downloads and response times. During 2000, businesses and consumers spent an estimated $210 million for advertising, applications, and transactions, and this figure should increase in the upcoming years [[Au: Update?]].

@$: Mobile payment services will probably evolve until one or two standards emerge; increased consumer acceptance will then establish them as common wireless alternatives. Early attempts at mobile payments have involved using a traditional bank credit or debit card in conjunction with a cell phone. After ordering a product by phone or over the Internet, the customer receives an SMS message with the price and completes the payment transaction by inserting the bankcard into the phone’s slot and keying in a password.

Companies are also pursuing mobile-payment services that do not require smart cards. Sonera, formerly Finnish Telecom, has orchestrated a cardless “pay-by-GSM phone.” Customers purchase an item by dialing a special number provided at the point of sale (e.g., a parking meter). The network operator acts as a clearinghouse and credits the customer’s predetermined billing account. Bluetooth technology, which allows nearby devices to communicate via high-speed, short-distance radio waves, is also expected to play an important role in mobile payments at point-of-sale locations.

Another promising concept, still in its experimental stages, is mobile cash: A wireless network loads cash onto a mobile device, typically through a smart card. Telephone companies (e.g., NTT DoCoMo and Sonera) and credit-card companies (e.g., MasterCard and Visa) are rapidly building microbilling and electronic-wallet businesses. Two such services are PayPal and Remit.com, which enable individuals and businesses to transfer money to each other from their banking or credit-card accounts.
@h3s:Value Proposition of M-Commerce Applications.@h3:|em|The next generation of mobile commerce will be a much better value proposition for both the consumer and the seller. Bluetooth and location-based technologies will enhance the functionality of wireless devices, enabling mobile commerce to offer unique benefits over electronic commerce. Location technology will enable retailers to send time-sensitive and location-sensitive coupons to shoppers. Consumers will be able to use their phones as electronic wallets to beam money to friends or to pay for goods in stores or at vending machines. Over time, mobile devices could become a vehicle for transmitting digital money, tracking transactions, and compiling spending reports for their users (see Table 5.2).
@$: Mobile commerce is a significant opportunity for all parties involved. On the consumer side, traditional e-commerce sites have been expanding their reach to a new channel, the mobile customer. As enabling technologies become integrated in devices and networks, the prospect of m-commerce becomes drastically more compelling. For example, location services could make it easy to find nearby restaurants and order off the menu before arriving for pickup. Transactions could become more convenient and efficient with Bluetooth-enabled devices. In February 2001, Holiday Inn unveiled its first hotel with Bluetooth-enabled room-service menu downloads and checkout. In a vote of confidence for the technology, Bass Hotels, Inc., plans to use Bluetooth in all of its properties, which include the Crowne Plaza and Intercontinental chains as well as the Holiday Inn chain.

Mobile commerce has seen significant development in vertical business markets from finance to government. As technology advances and new applications emerge, wireless commerce can be leveraged across vertical markets to address a much larger customer base. These applications include wireless hosting, or gateway services, that convert information from a firm’s legacy system into a form viewable on a mobile device.

Mobile commerce has received tremendous press over the past year and a half[[Au: Clarify time ref. meant]]. The question remains not if, but when, m-commerce applications will really offer to the consumer the value that they proclaim.
@h3s:Challenges.@h3:|em|Mobile commerce is less an application than a network of enabling technologies that facilitate transactions. Technology can meet the challenges for m-commerce in three main areas: transaction enablers, security providers, and translation/integration services (Figure 5.5).
@h4s:Transaction enablers.|em|@h4:Transactions occurring between the customers and their carrier provider will pave the way for broad-based mobile-commerce applications. Effective billing technology is the most important missing component of any broad-based m-commerce solution. Real-time billing will most likely fill that void. This solution is already in place and is being used in prepaid wireless; it could serve as a driving force behind the imminent convergence of the wireless horizontals.
@$: Real-time billing for m-commerce can be adapted from prepaid wireless to create a payment model in the form of an integrated prepaid wallet. Using a credit card or check, a customer would be able to fund a prepaid account through either a “wallet provider” or an operator. Once the account was established, the subscriber would be able to make calls, send and receive text messages, and purchase goods and services by phone. A customer could simply enter an ID code into the phone to request a ringing tone, a simple video game, or a song from a content provider. The content provider would then validate the code, check the account balance, deliver the service, and debit the subscriber’s prepaid account.

The demand from the rapidly growing youth market and the limitations to other solutions make this real-time billing solution even more likely. If current growth rates in the youth segment continue, the revenue forecasts for mobile entertainment transactions are substantial. According to the Yankee Group, revenue from graphics, games, audio, and video will reach $1.13 billion by 2005, up from just $41 million in 2000. Within this same time frame, prepaid wireless is expected to continue capturing a larger percentage of wireless subscribers, with the number expected to reach 18.3 million between 2001 and 2003[[Au: Update?]]. The increasing popularity of prepaid phone solutions makes it likely that real-time billing technology coupled with teenagers' need to be "cool" will drive m-commerce forward.
@h4s:Security providers.|em|@h4:Security is a necessary enabling technology for conducting m-commerce. As mobile commerce becomes more widely adopted, security will be a significant challenge. Unlike computers in the wired world, mobile devices have limited memory, rendering traditionally strong encryption and authentication technology impractical. Although most software developers have access to a scaled-down version of secure socket layer (SSL) for wireless devices, the wide variety of devices, each with its own security protocol, will make things more challenging. Although the wireless application protocol (WAP) has its own security--wireless transport-layer security (WTLS)--a point of weakness occurs at the wireless gateway, where the wired world meets the wireless world. The gateway server must decrypt the information received from the wired Internet and re-encrypt that information in WTLS. Companies hosting their gateway servers behind firewalls get around that complication.
@$: Wireless devices, unlike their landline counterparts, have a much higher chance of being lost or stolen. This presents an additional challenge to security providers—authentication. How does a merchant know that the person making the purchase is actually the person who owns the device? This will become a critical issue for point-of-sale transactions (at the cash

register) and is also a grave concern for enterprise customers who may put valuable company information at risk.
@h4s:Translation/integration.|em|@h4:Though the technology for automated translation of HTML pages to WML cards exists, improvements will be necessary to ensure an satisfactory user experience on wireless devices. As with wireless knowledge applications, creating a complementary m-commerce user experience for e-commerce applications will be necessary, since the richness of regular Internet content will not be replicable. In the short term, application developers will struggle with the tradeoffs of reducing implementation effort by writing generalized applications versus customizing the user experience on the basis of the access device (computer or wireless).
@h3s:Summary.@h3:|em| The addition of incremental enabling technologies such as location-based services, Bluetooth, and ultimately broadband to communications devices will rapidly enhance their value in m-commerce. Furthermore, improvements in security will make hosted applications a useful and viable reality for businesses.
@$: As discussed in Chapter 4, location-based services will also expand m-commerce. The face of mobile commerce could change for the consumer with the establishment of these services. Because location information is unique to mobile devices, it can add value to other applications. For example, retailers will be able to send out time- and location-sensitive coupons directly to users' mobile devices. These customers can then go to the store offering the promotion and receive discounted opportunities. Highway hotels will be able to send pricing and availability information to midnight drivers on the nearby thruway to help fill empty rooms.

Additionally, once broadband becomes a reality, the mobile-shopping experience could become graphically rich. Current thinking is that m-commerce will be tailored to purchases and services that people perform during downtime, like banking or bill paying, or time-sensitive purchases, like stock trading. The simple text-based interface of today precludes many online

retailers from doing business via wireless devices. When broadband is available, m-commerce may be able to offer a user experience more like that of regular e-commerce.

Limitations in screen size, keypad size, and security make it unrealistic to expect widespread Web browsing and purchasing to occur on wireless devices in the near future, but simpler transactions will proliferate the landscape. In the important youth segment, “m-tertainment”—MP3s, ringing tones, videos, games, and other low-price items--will drive m-commerce applications. Offerings such as these are perfectly suited for the real-time billing technology that already exists. As a result, more and more services will emerge and eventually rival today’s information and “infotainment” portals.

The integrated prepaid-wallet mode provides customers with a simple payment vehicle that leverages the highly effective microtransaction-payment services [[Au: Define]] which are already available. With real-time, microtransaction billing already in place, and a youthful consumer base for m-commerce goods and services, applications that bring the merchants and the carriers together are all that is necessary. This model provides value for both consumers and carriers. For consumers, it will provide convenient, low-priced features. On the carrier side, it will generate revenue incrementally but at lower margins than the ones associated with the delivery of voice and data services. The model’s attractiveness lies in supplementing revenues from existing services by increasing a prepaid customer’s lifetime value. The more a customer buys wirelessly, the more that customer will then use voice and data. Therefore, this will increase the average revenue per user for the carriers.

Members of the wireless value chain are excited about the opportunities in m-commerce because the devices and services allow them to create a greater affinity with end customers. As m-commerce becomes integrated into everyday purchasing, people’s dependency on wireless devices and services could grow exponentially, which would be a boon to the entire industry. That

is why the industry is pushing forward the cause of m-commerce, and persistence will eventually make it a reality.

@h2:Telemetry and Tracking

@$:Telemetry and tracking refer to applications for automatic measurement and transmission of data from remote sources for control, tracking, and other purposes. The transmitted information could be readings from utility meters at various customer sites or data to track the location of a car or truck. These applications are being adopted in industries where assets such as goods and vehicles need to be managed in real time to improve operational efficiencies and customer service. One of the biggest impacts is expected to be in logistics.

Wireless technologies can provide a flexible platform for information exchange between the central-intelligence unit of a firm and mobile assets such as physical goods, and people such as field-service personnel and traveling salespeople. They can use the information exchange to meet unforeseen customer needs, improve communication, increase efficient utilization of assets, and instantaneously redeploy if the need arises.

Mobility and time sensitivity are the two main drivers that add value in the wireless space. The value in logistics will come from efficiently managing mobile assets because existing hardwired platforms fail. We term this set of applications “mobile-asset management.” Figure 5.6 illustrates a typical network. For example, a trucking company that can track the location and capacity use of its trucks can easily redeploy or reroute its fleet to improve use and customer service. This typical example of a location- and time-sensitive situation is also a perfect opportunity for wireless deployment.

Forrester research estimates the total worldwide corporate expenditure associated with managing material and product flows in the vendor-to-customer supply chain was $2 trillion in 2000[[Au:Update?]]. These expenditures include the entire value chain associated with a product and inbound freight, warehousing, inventory management, outbound freight, customer service, and administrative and information-systems costs. Administrative and

information-systems costs associated with managing the global supply chain average 7 percent to 10 percent of the total expenditure, or $140 billion to $200 billion. Numerous studies, including periodic reports by industry analysts, indicate that enhanced electronic management of information flows between enterprises can reduce administrative costs by at least 20 percent. That would put the cost savings associated with enhanced-value network communications to be around $28 billion.

Telematics, which is the marriage of wireless and automobiles, has garnered considerable consumer attention. The idea is not only to allow access to tracking-oriented data that enhances the driving experience and makes it safer (e.g., mapping and location-specific information), but also to access personal-information-management and communications tools. Safety is currently the main selling point for adoption, although systems like GM’s OnStar and Ford’s WingCast offer drivers directions, local directory services, and financial information, in addition to emergency services. Eventually, a person could look up the address of a business and receive directions while monitoring traffic conditions and keeping up with e-mail that might include a meeting-cancellation notice. The dealer’s repair shop could perform remote diagnostics on cars. Automobile makers are not only excited about creating closer relationships with their customers through these services, but are also attracted by the possibility of a recurring revenue stream after a car has been purchased. UBS Warburg expects telematics will be a $47.2 billion industry by 2010, as worldwide revenue grows from about $4 billion this year[[Au: What year is meant? Need to identify for reader]].

While mobile-asset management and telematics are two of the most visible growth areas for telemetry and tracking applications, it is not because of the unique value proposition that they offer over landline solutions.

@h3s:Value Proposition of Telemetry and Tracking Services.@h3:|em|Telemetry and tracking applications inherently deal with remote people, goods, and devices. In such situations,

wireless solutions are more cost-effective for data exchange than landline solutions, so this category of applications not only will include extensions of landline applications, but also will spur many new applications.
@$: Apart from telematics, telemetry and tracking applications will have their biggest impact in the business space where the emphasis on constantly improving productivity and efficiency will highlight their value. The value of wireless applications in mobile-asset management comes from three main factors:
@nl: 1. <I>Context-sensitive information is available anytime and anywhere.<I>|en|(A trucking company will keep track of its truck locations and their capacity use to optimize customer service and capacity use.)
@nl2i: 2. <I>User has an application-based choice of synchronous or asynchronous information dissemination.<I>|en|(Automatic meter reading will be synchronous when the technician is always connected to the central database, whereas a traveling salesperson will probably be asynchronous when pulling time-sensitive information as and when required.)
@nlfi: 3. <I>Anytime, anywhere capabilities of wireless make it the most efficient tool for executing communications in the mobile-asset-management industry.<I>|en|(This is a given because of the inherently vast geographic expanse of this industry.)
@$:The application landscape in wireless has been facilitated by PDA technology, which has made the devices cheaper, smaller, and more robust for industrial applications. Economies of scale, competition, and process innovations have reduced costs making corporations more receptive to wireless solutions such as the following examples.
@h4s:Package tracking.|em|@h4:The shipping industry has long been focused on wireless applications. Traditionally, one of the biggest concerns for shippers was inadequate tracking information once a customer shipped a package. For delivery companies like United Parcel Service, Federal Express, and McKesson, customer litigation and complaint processing added to the problem. With the primitive paper system, it was extremely costly to reproduce

images of delivery receipts, and the shipper occasionally would forget to get the customer’s signature. The need for readily available tracking information has made wireless tracking of packages one of the biggest and most successful applications in mobile-asset management. The field-delivery staff is equipped with a wireless handheld device that can scan the barcodes on packages, collect customer signatures, and be constantly synchronized with the central database of the shipping company. Companies such as AvantGo provide solutions for real-time connectivity between the handhelds and company databases. The shippers can access their package information not only via the Web, but also through their PDAs and cell phones. By implementing this system, McKesson reduced its point-of-delivery legal claims by 50 percent and achieved 100 percent reduction in receipt-search and image-manifestation costs[[Au: Source?]].
@h4s:Automatic vehicle location (AVL).|em|@h4:The AVL solutions can graphically represent a truck fleet on a map. They allow companies to track, manage, and communicate with their mobile assets in real time. By monitoring, the mobile-asset-management solutions provider can deliver improved customer service, optimize the capacity of mobile assets, and provide real-time information to clients about their order status.
@$: In March 2001, Office Depot, Inc., the world’s largest supplier of office products, announced its rollout of a wireless mobile-computing transportation and mobile-asset-management system (powered by Aether Systems, Inc., and Symbol Technologies, Inc.) to Office Depot’s fleet of more than 2,000 delivery trucks. This real-time delivery and tracking system allows Office Depot to ensure that customers get what they want, when they want it. The company uses Symbol’s SPT 1700 Palm O/S handheld computing devices and its Mobile Gateway on-board data-transaction systems for its wireless proof-of-delivery and package-tracking system. Its empowered mobile workforce feeds off the wireless network called Office Depot Signature Tracking and Reporting System (OD S.T.A.R.). Drivers use handheld devices to reconcile inventory on

the truck and complete the transaction by capturing the customer signature[[Au: Cxs. OK? System now in use?]].

The AVL solution can help in remote driver-performance tracking by collecting location information as a function of time and distance. It can allow corporations to monitor fuel costs and employees’ driving speed, and ensure conformity to company policies. The information can also be used for performance comparisons between employees or different sets of fleet vehicles. In addition, the wireless data-communication link between the vehicle and central control station can track vehicle diagnostic information. The system could be automated such that the central-database intelligence could prompt for vehicular problems before they occur.

@h3s:Challenges.@h3:|em| The huge geographic distances between utility meters and remote sources in cars are a serious challenge to the omnipresence of wireless connectivity. Network operators such as Sprint PCS, AT&T Wireless, and Verizon have built nationwide networks that provide coverage at least in major cities and on highways. Satellite networks such as the one set up by Globalstar can provide coverage for remote locations. Global position system (GPS) technology can track fleet vehicles. Motient and Aether Systems offer wireless fleet-management services that combine terrestrial and satellite networks. These kinds of effective solutions fill a critical need.

@$: In the mobile-asset-management domain, end-to-end solutions providers are becoming more prevalent, making it easier for companies to implement telemetry and tracking systems. For example, UPS, which holds leadership in package shipping, also provides solutions for supply chain management and critical-parts delivery. The next challenge will be to manage the many partnerships and alliances that can enable a company to leverage its core competency and increase the productivity of its assets. Manugistics provides Enterprise Profit Optimization Solution®, which helps enhance organizational profitability by simultaneously optimizing the supply and demand sides of an organization’s business. To be cutting edge, solutions must

enable organizations to track their performance. Companies that physically transfer goods in any part of their supply chain cycle must be able to track mobile assets in real time to improve resource use. Companies like Aether Systems that can provide enabling software and services will form the backbone for executing such solutions.

In telematics, interface technology that allows the safe operation of vehicles and interactions with all the applications will be critical to adoption. Solutions will enter the market at different price points. Small, mounted screens will probably sell at a lower price point, whereas heads-up displays will be prevalent in luxury cars. In addition, voice interfaces are attractive because they allow hands-free operation. In the near term, however, user expectations will probably exceed the capabilities of voice interfaces, and that will be a challenge.

@h2:Summary

@$:As the geographic reach of remote monitoring increases and the cost comes down, remote monitoring and servicing of assets will become more of a reality. Automobile companies will soon provide remote diagnostics and send customers reminders about maintenance needs. But what if General Electric could do that with washers, dryers, refrigerators, and even lightbulbs? Though the example of a lightbulb may seem extreme, General Electric would be able to structure business service contracts for automatic shipments of lightbulbs to the customer’s maintenance department indicating the location of burned-out bulbs. This concept allows consumer-goods companies to structure recurring revenues for what was formerly a single revenue stream at the time of purchase. Even though it may take time to realize this business model with inexpensive goods, it will be a near-term reality for high-priced goods. This is already obvious in the automobile industry.

With mobile-asset management tools, firms will experience productivity and efficiency gains through better management of mobile resources. On average, the time that a product actually gets worked on during manufacture is less than 5 percent. This high proportion of work-in-progress (WIP) time is largely non-

value-added for the product, and it holds immense opportunity for productivity improvement. Wireless technologies are central to that goal and have evolved to a level where they are ripe for mobile-asset management. The very nature of mobile-asset-management operations requires wireless connectivity for efficient communication. As an early adopter of wireless technology, the mobile-asset-management industry has demonstrated the value-added potential. The customer need is clear here. The technology is mature enough for nationwide deployment, and there is a high level of collaboration among the players. The established leadership of service organizations like FedEx and UPS gives them scale to become efficient solutions providers. Companies that leverage such solutions to cut costs, improve their customer service, and optimize their use of resources will benefit in the future.

@h1:Vertical Wireless Applications

@$:This section discusses the effect of wireless technologies on applications that are specific to particular industry verticals. Wireless applications are having an exciting impact on industries, and revenue forecasts for mobile data in 2002[[Au: Update?]] show that several industries are predicted to reach $200 million and up (Figure 5.7). The two verticals that are likely to spend the most on mobile data are financial services and health care, so this section covers those two industries as well as government services. We also consider the value proposition of bringing wireless to these verticals and other factors that will affect adoption.

@h2:Financial Services

@$:Of all the existing and potential wireless applications, m-commerce in general and financial services in particular will likely be the big winners. Such financial services include banking, stock trading, financial and information analysis, and insurance. Wireless communication services have grown exponentially in the past few years, especially in Asia and Europe. As new technologies overcome existing limitations, consumers are using the wireless channel more often for

communication as well as for gathering information or conducting transactions over the mobile Internet. Newer technologies and networks will allow a much richer customer experience, including interactive video, graphics, and always-on capability. This new mobile delivery channel offers financial institutions an opportunity to proactively engage their customers with additional services and products.

But despite the ubiquity and convenience of accessing the wireless channel over the past couple years, many companies have been reluctant to fully embrace this new technology. Because the restricted interface of slimmed-down devices and slow network speeds can discourage the mobile user from browsing the Internet, current applications end up stripping out much of their marketing and navigation material. As a result, mobile users are likely to carry out transactions for which there is limited context and navigational overhead. Relative to most other wireless data applications, financial services are simple to operate, highly focused, and require little navigation time. That is precisely why consumers have embraced them.

This section first provides a brief overview of the evolution and recent developments of wireless financial services and takes a look at how segments of the financial-services spectrum will translate into meaningful applications for the mobile consumer. The players along the wireless value chain are described, as well as the core competencies that these players must develop and capitalize on for success. Finally, we suggest how the wireless financial-services industry may evolve in the next three to five years.

@h2:Value Proposition of Wireless Financial Services

@$:Wireless financial services offer consumers a new level of convenience in a busy world—the avoidance of latency in accessing financial information and greater flexibility in making decisions because they no longer have to be sitting at a PC. Financial services have been the early adopters of wireless applications for several reasons:

@bl: • The time and location sensitivity of mobile devices and networks provides significant appeal and value by delivering time-critical information and execution capabilities to the user (e.g., buying or selling a stock when it breaks through a specified limit).

@bl2i: • The consumer has the convenience of performing simple financial and housekeeping transactions, such as bill payments and account transfers, during downtime (e.g., while waiting for a plane or train).

@blfi: • The mobile device is an efficient means for making payments to retailers and to other creditors.

@$: Thus, the increasing popularity of the mobile Internet coupled with the need for convenience in deciding when and how customers conduct financial transactions presents a compelling lifestyle proposition. Figure 5.8 highlights the results of a pilot mobile-banking study conducted by the Bank of Montreal in which the average user session lasted 3.5 minutes, indicating that most users go on air to accomplish specific tasks quickly.

@h2:Market Size

@$:According to a report by Celent Communications, there were 10 million users of wireless financial services in 2000. That number is projected to increase to 150 million by 2004[[Au: Any update?]]. The leaders in wireless financial services worldwide are Europe and Asia (Figure 5.9), where movement by banks and brokerages into mobile financial services has been aggressive. Only about 10 percent to 15 percent of the estimated $900 million annual market for wireless financial applications emanates from the United States. The main reasons for this poor showing are excessive technical standards, incompatible analog and digital networks, and the plethora of mobile devices (PDAs, cell phones, pagers, etc.) in the United States. Demographics and culture play a big part in adoption rates and profiles as well. Americans are apt to compare the mobile experience with their tethered Internet experience and find it inferior. European and Asian users, on the other hand, are awed by access to financial information over the

Internet via their mobile devices, since these areas have relatively low PC Internet penetration. In Japan, more people access the Internet through mobile phones than through PCs.
@$: As was the case with the Internet a few years ago, many new, small companies have assumed pioneering roles in developing and deploying financial services. One financial-services pioneer in the mobile space, MeritaNordbanken, offered mobile bill payment as early as 1992. But larger financial institutions-- faced with eroding profit margins, the rising costs of customer service, reduced customer loyalty, and the increasing burden of supporting multiple channels--were slow to adopt these services initially. By 1999, however, over 90 percent of the banks in Europe offered some form of mobile banking. Surveys indicate that only about half of the hundred largest U.S. financial institutions intend to offer wireless services by 2004. Spending on the development and marketing of wireless financial services in North America is expected to increase from about $15 million in 1999 to $40 million by 2003[[Au: Update?]].

Affluent customers and businesses are more likely to need financial services at the moment, given their varied financial portfolios and the greater likelihood of their owning cell phones and PDAs. This channel also appeals to technically savvy younger people who are on the move, as well as to those with limited access to bank branches.

Despite the obvious attraction, developing successful offerings in this new medium is difficult. It requires access to large amounts of capital, widely accepted technologies, huge databases, fast transaction speeds, and excellent end-to-end security. The services offered today by financial institutions worldwide are largely basic and undifferentiated. Although the capability of accessing information and conducting transactions anytime, anywhere, opens up a wide range of possibilities, few firms have exploited them. The wireless financial offerings available today are thus simply an extension of their Web offerings. Financial institutions are only now reaching a critical point in overcoming some of these challenges and

acknowledging the Internet as a mainstream channel rather than an alternative to traditional channels such as branches, ATMs, or customer-service call centers. It is simply a matter of time until they overcome all the challenges in the wireless space as well and offer meaningful services with a broader application and adoption over the long term.
@h3s:Spectrum of Financial Applications.@h3:|em|Most people still think only of stock trading when they hear the phrase <I>wireless financial applications.<I> Although trading is certainly an important element, it is not the most important one. The services that can be extended onto a mobile platform are considerable in every area of financial applications. This section briefly surveys existing and promising financial offerings and the key players in each segment—retail brokerage, retail banking, investment banking, and other financial services (including insurance and real estate).
@$:Retail brokerage. Retail brokering emerged as one of the first killer applications for mobile devices and is probably the most mature of all wireless financial segments. Customers who trade frequently appreciate the timeliness and accessibility of mobile broking because they can react swiftly to changing market conditions. The initial offerings of brokerage applications were information-based services such as real-time stock quotes, stock charts, news clips and alerts, and account information. With the ability to offer secure transactions, however, these applications have evolved to include account management and simple transactions such as stock and option trading.
@h4s:Retail banking.|em|@h4:European banks were quick to offer information-based banking that allowed customers to view account data, check credit-card balances, or access interest-rate information. The rollout of these services was so fast that by 1999 almost 90 percent of European banks offered some form of wireless banking. Although banking transactions don’t usually involve as much time sensitivity or urgency as brokerage activities, they are still highly desired applications for over-the-air use according to a study by the Boston Consulting Group

in 2000. In North America, the Bank of Montreal, Bank of America, Harris Bank, and Citibank were among the first players to jump-start basic mobile banking. Over the past year or so,[[Au: What year is meant?]] banks have been incorporating transactional capabilities such as bill payment, fund transfers, PIN changing, and credit applications. The complexity of services will increase significantly as banks continue their transition to wireless applications.

@h4s:Investment banking.|em|@h4:Investment banks are beginning to explore mobile commerce both as a productivity tool for their employees and as a value-added service for institutional and individual clients. In sales and trading, investment banks are providing just-in-case applications that allow their clients to stay in touch with world markets at all times. Traders can receive news and alerts for rate changes, earnings announcements, and analyst ratings at any time and at any location. In corporate finance and advising, wireless applications will soon provide round-the-clock financial information and advice to key decision makers within client organizations. J.P. Morgan & Co. offers a service called SynDirect Wireless that allows bond issuers to wirelessly contact investors to sell bonds and enables investors to place orders and track their bonds’ performance. As bankers and clients use Internet-enabled mobile devices more frequently, the devices will undoubtedly become an attractive channel for service delivery.

@h4s:Other financial services.|em|@h4:Although banks and brokerages have been the first to deliver services to wireless devices, companies in other financial-services sectors such as insurance, mortgage and consumer loans, financial advisory services, and credit cards are entering the market. Because these financial segments are typically research intensive, the main challenge for companies in this space is to offer meaningful services to the user. Financial firms might be able to employ push-based services that alert users about offerings that fit their preferences at the time of need. For example, mortgage and

consumer-loan experts might be able to offer customers loan options or credit applications at model homes or car dealerships.
@$: Diversified financial institutions have a tremendous opportunity to provide their clients with rich, tailor-made mobile applications that could serve as a one-stop shop for information and advice. Other institutions could use the medium to become a full-service “mobile concierge,” offering integrated financial advice, travel, and credit-card services. Credit-card companies could use m-commerce to cross-sell other financial services or third-party products and services. However, the evolution of such applications will probably occur only after the widespread use of wireless banking and brokerage services.

Figure 5.10 indicates the level of interest of cell-phone users in financial services according to a survey conducted by American Banker and Gallup. Industry experts believe that most consumers still don’t have a frame of reference to answer the survey questions, but once they experience wireless financial services, their reactions are usually positive. Hence these numbers probably represent a lower boundary on the expected popularity of these applications.

@h3s:Competitive Landscape.@h3:|em|The preceding section discussed financial applications as well as the companies that are playing a major role in those segments. Some of those companies are mapped out across the wireless value chain in Figure 5.11. The next section describes how the offerings of various firms, as well as their cooperative and competitive interactions, are changing the landscape of application and service providers.

@h3s:Initial Trends and Observations.@h3:|em|Although the wireless finance industry is still in its infancy, a few key trends have emerged that are likely to take hold and forever alter the competitive landscape. This trend is evident across most other mobile applications as well.

@h4s:Companies are expanding beyond their traditional industry boundaries.|em|@h4:The potential of wireless services is inviting a huge onslaught from nonfinance companies that want to partake

in this lucrative sector. To create additional revenues, companies are increasingly cutting across industry and segment boundaries. Obvious new entrants are the mobile-network operators that have an existing relationship with their customers, who will soon also become financial users. NTT DoCoMo, in Japan, charges a 9 percent fee for all goods and services purchased though its I-Mode service. It also offers microbilling services that generate fees ranging from 5 percent to 15 percent of a transaction.
@$: Another example, PayPal, started out a few years ago as a person-to-person payment service via e-mail in the United States. Since then, PayPal has amassed a large consumer and business-customer base that now transacts over the wireless medium as well. PayPal’s execution costs are only a few cents per transaction, making them much cheaper than credit-card payments. It has also started offering its customers interest on deposits and insurance-fraud protection, as well as a branded credit card. Such trends promise to change the broader financial industry.
@h4s:Firms are partnering across the value chain.|em|@h4:Partly in response to the trend outlined previously, as well as to endear themselves to customers by providing a wider range of services, companies all across the value chain are teaming up with each other. L.M. Ericsson and IBM are joining forces to deliver financial solutions over wireless networks. The partnerships between Fidelity and Palm in the United States offer wireless stock trading, and Barclays Bank and BT Celnet offer secure wireless financial transactions in the United Kingdom.
@h3s:Key Success Factors.@h3:|em|As mentioned, most of the wireless services in the financial space are simply an extension of Web services. It is only a matter of time until activities such as trading and bill payment become commodities. As useful as these services are, they do not fully exploit the anytime, anywhere information and execution of the wireless medium. To extract the maximum benefits from m-commerce, financial institutions need to understand the key strategy and technology drivers of the market. Financial institutions will have to

develop the following competencies to be competitive in this space.

@h4s:Increasing customer loyalty.|em|@h4:Thus far, many companies have ventured into mobile services to enhance their revenues. Instead, firms should view mobile services initially as a cost of doing business. This mind-set will prevent financial institutions from pursuing distracting efforts, such as creating lifestyle portals, or from leaving out services that do not directly add to the top line. They must focus on offering basic services that fulfill immediate needs of their customers.

@h4s:Differentiating services immediately.|em|@h4:Another important competency that creates customer loyalty is developing services that provide greater value to customers than they can get elsewhere. This approach will gain importance because many of the basic services currently offered will soon become commodities. Companies can do this by offering innovative services as well as device-specific applications. Examples of innovative, value-added features include access to analyst voice recordings or the ability to post to, and view messages from, financial advisers. Financial institutions should also offer services that exploit the strengths of each type of device rather than cater to the least common denominator of devices. For example, mobile phones are better equipped and should therefore be used for alerts or one-touch access to live specialists, whereas PDAs can be targeted for graphical and text-intensive applications.

@h4s:Alleviating users’ concerns about the security of financial applications.|em|@h4:The big hurdle facing companies—especially financial firms—that plan to offer m-commerce applications is providing security, privacy, and control of user information. Not surprisingly, nearly 85 percent of customers are worried about the security of wireless transactions. Several vendors offer solutions using biometrics, such as voiceprints, and new technologies, such as elliptical-curve cryptography (ECC), that seem promising and will accelerate the adoption of these services. Customer education regarding mobile-security issues

will have to become a crucial component of all marketing activities.

@h3s:Future Outlook.@h3:|em| Financial institutions that want to surge forward must develop and launch offerings in mobile banking and commerce services as soon as possible to remain competitive, as well as to protect mediation. Few financial institutions will fail to exploit the mobile opportunity over the next several years. Many firms still view mobile data technologies as somewhat immature. Global standards for delivering mobile Internet services will soon be accepted, however, and that will revolutionize the industry. Financial institutions have the wealth, power, and prestige to help implement wireless financial services successfully.

@$: Despite the turmoil in the wireless industry, it is still a matter of when, not if, there will be a deployment of more advanced networks and, hence, more services. Although the recent economic slowdown and the hesitation of mobile operators to rush into launching 3G networks gives players some breathing space, there is no time for them to be complacent and delay the inevitable. The dot-com bust also makes it imperative that financial firms offer even more meaningful services to consumers. Firms will exploit the possibilities of accessing information and conducting transactions in a time-sensitive, location-dependent environment. A Forrester Research survey [[Au: Identify year]] found that 70 percent of banks and brokerages ranked wireless service as a key component of their overall strategies for the next two years.

Killer financial application. The future belongs not to one or two killer applications, but to a suite of them. Here, suite does not refer to a hodgepodge of applications, but to a meaningful collection of related personalized applications that are congruent with the offerings of the firm and its partners. Tapping successfully into the financial promise of m-commerce will require companies to understand and address its unique strategic and technological challenges. Firms will progress from simple informational and transactional services to “relationship-

building” applications, as shown in Figure 5.12. Financial institutions must address the following issues to develop comprehensive business and technology strategies for financial applications.

Importance of personalization. Financial firms will leverage the advantages of personalization to drive customer loyalty and increase switching costs. Personalization could take many forms such as storing user-driven quote lists or exchange-rate information. Such tools create dependencies and increase the switching costs for the customer. Personalization, however, is the opposite of packaged solutions that some software firms are offering to banks and brokerages for their mobile customers. The solutions offer extremely basic or generalized services that do not capture the level of service to which customers are accustomed. Successful mobile applications will seamlessly integrate basic user-friendliness with that previous experience of service.

The same argument applies to financial companies’ use of middleware applications that attempt to deliver their content to all types of devices. Because they tend to end up satisfying the lowest common denominator of device capabilities, the development of services for each family of devices must continue to be a priority.

@h4s:Partnering across the value chain.|em|@h4:The emerging trend of companies partnering across the financial value chain will continue where it makes economic and business sense. Financial operators will partner with mobile operators to gain early visibility in this market. Partnerships with other mobile content providers will also remain a necessity. Alliances with technology providers will allow financial firms to remain ahead of emerging technologies and standards. The joint trial between telecommunications giant Motorola and MasterCard International, the leading credit-card network, demonstrates that complex financial transactions using a credit card can be securely carried out with a mobile phone. Such partnerships will draw more traffic to the wireless offering of the financial companies and

allow them to exploit brand and billing relationships. Brand names that are associated with trustworthy and reliable fulfillment will translate effectively into the wireless domain.
@h4s:Open access to the Internet.|em|@h4:At the moment, many mobile-network operators are pushing their own or only their partner’s portals to customers, as the Palm VII device can access only a small smattering of sites. An open model will replace this closed model of access, just as happened on the Internet a few years ago, and customers will use their mobile devices to access any site or service. Although firms may give a prominent position on the interface to their partners, they will be unable to curtail their customers’ wireless Web reach.
@h4s:Integration of wireless with other delivery channels.|em|@h4:A wireless m-commerce strategy must be incorporated into an overall strategy that leverages, and is leveraged by, the other channels that institutions offer. Since accessing time-critical information on a mobile device is much quicker than going to a branch or an ATM, firms should encourage customers to view the mobile channel as the primary source of time-sensitive, location-independent information. Financial institutions will therefore position the wireless channel to be the main point of contact with the customer and then transition customers to other points as necessary. Firms can use the wireless channel to selectively drive traffic to other channels for information-heavy content. This will become a major source of cross-selling products and services and also improve the customer experience.
@h4s:Global outlook.|em|@h4:The pioneering and leadership of Asia and Europe in this industry will continue for the foreseeable future. Those markets will likely achieve criticality for many of the popular brokerage and banking applications within the next two to three years. Until recently, industry experts were predicting that in the United States the Internet was a dress rehearsal for wireless applications. They assumed that American firms would quickly combine Internet business models with European technical and marketing experiences to become the

dominant global player in m-commerce and wireless financial applications. The slowdown in the rollout of technology-unifying 3G networks, however, pushes this possibility beyond the realm of the next three to five years. The United States, instead, will probably continue to offer fragmented, yet innovative, financial services to a growing user base[[Au: Any update?]].
@h3s:Summary.@h3:|em|The changes wrought by wireless communications and the Internet are encouraging thinking and sparking new businesses in the financial arena. Nevertheless, only a few big financial institutions have the resources to champion a new technology that must contend with an evolving communications infrastructure and an embryonic user base. That fact, however, doesn’t tarnish the market potential for this nascent industry. An increase in users will occur as device and network technologies improve, data-capable devices approach ubiquity, and user-friendly brokerage content becomes commonplace in the wireless channel. Security may also become less of an issue as biometric authentication technology continues to drop in price. That in turn should help financial institutions and consumers feel more comfortable with conducting sensitive transactions over the wireless channel.
@h2:Health Care
@$:There are many ways in which wireless technology can and does add value in the enormous health care sector. The main driver behind the adoption of wireless technology is the desire to reduce the notorious inefficiency and to improve patient care. Wireless technology can add significant value in both areas. Our framework for analyzing the industry, however, reveals some significant obstacles to widespread adoption of wireless technologies in this industry.
@h3s:Market Size.@h3:|em|The health care industry is enormous, representing one-seventh of U.S. gross domestic product (GDP), with over $1.5 trillion in expenditures in 1997 and a growth rate of 5 percent a year.

@$: The industry has several constituents, all of which are or will be affected by wireless technology. The market for wireless health care applications includes the following consumers:
@bl: • <I>Doctors.<I>|en|Wireless handheld devices will deliver various useful applications for prescribing drugs, maintaining patient histories, sending and receiving laboratory tests and results, improving “charge capture,” and dictation. Only about 1 percent to 2 percent of the more than 600,000 medical doctors in the United States use PDAs to conduct transactions, though 15 percent to 20 percent of them use PDAs for other purposes, such as schedulers and address books[[Au: Source for data?]].
@bl2i: • <I>Patients.<I>|en|Telemetry systems will allow remote monitoring of patients through wireless monitoring systems.
• <I>Hospitals.<I>|en|Wireless LANs will dominate the information-technology infrastructure of hospitals.
• <I>Insurance companies/HMOs.<I>|en| Documentation and transfer of information between doctors, patients, and insurers will be digitized and take place in a wireless environment.
• <I>Pharmacies.<I> Orders for prescription drugs will be placed wirelessly, improving accuracy and reducing paperwork.
• <I>Pharmaceutical companies.<I>|en|Handheld m-commerce applications for sales representatives of pharmaceutical companies will improve efficiency in tracking orders and checking inventory.
@blfi: • <I>Government regulators (federal and state).<I>|en|Wireless applications will streamline the process for complying with Health Care Finance Administration (HCFA) regulations.
@$: In considering the market size in wireless health care, it is important to keep in mind who actually funds most of that care: insurance companies and the federal government (through the HCFA and Medicare). The complicated documentation requirements of those organizations lie behind what many see as the enormous

market opportunity for wireless and other technology applications in the industry.

Myriad government regulations require specific types of forms for medical care and drugs covered by Medicare. The HCFA regulations require doctors to classify any type of care into one of five levels, though the five levels vary depending on the stage of the consultation (initial, follow-up, etc.). Failure to properly classify types of treatment can result in more than denial of Medicare coverage. The federal government fined the University of Pennsylvania medical system $20 million for billing at a higher level of service under the HCFA than its backup documentation supported. To avoid such penalties, many health organizations choose always to err on the low side of the HCFA regulations by billing for smaller amounts of service and leaving money on the table. The opportunity to eliminate underbilling is the goal of many companies trying to enter the wireless health care market.

Insurance companies, as private payers, have another set of documentation requirements for doctors and hospitals to ensure that the care given and drugs prescribed conform to policy limitations. The allowable drugs that the policy will cover for any individual is contained in a document called a <I>formulary.<I> When doctors prescribe nonformulary drugs, there is generally a dispute between the doctor and the insurance company about cost coverage. Such disputes form a routine part of the practice of medicine in the United States, and the wasted time probably results in billions of dollars of unnecessary transaction costs. Thus, the potential market size for wireless applications in health care is enormous. Indeed, the sheer size of the industry has drawn more attention from investors than the technology or the benefits that can be derived from wireless in the industry.

@h3s:Spectrum of Health Care Applications.@h3:|em|Numerous applications are already available for point-of-care health care workers, particularly physicians. Many companies in the wireless area are attempting to address the inefficiencies in handling

paperwork related to the myriad regulations and documentation requirements. In fact, wireless PDA applications for physicians that streamline day-to-day activities and reduce the paper burden are easily the most active area of wireless investment and product development in health care. Many of these applications are already viable. The following paragraphs describe some of them (all of which run on either a Palm or Pocket PC-based PDA).
@h4s:“E-prescribing.”|em|@h4:This application allows physicians to electronically write, order, and renew prescriptions, as well as review critical information relating to adverse drug effects or drug interactions. There is tremendous value-added in this service. E-prescribing helps ensure formulary compliance by having the formulary for each patient available in real time at the time of prescription. This saves physicians the hassle of having to look in the formularies to confirm coverage. Drugs that are covered are shown on the screen of the PDA. Further, e-prescribing allows doctors to check drug interactions automatically, which will help eliminate a serious area of medical malpractice: prescribing drugs that may have fatal or very harmful interactions with drugs the patient is already taking. E-prescribing has benefits for pharmacies as well, in that prescriptions will be printed out in clear form rather than handwritten, greatly reducing time-consuming callbacks to doctors to clarify instructions.
@h4s:Charge capture.|em|@h4:This is another important added value of wireless applications in health care. Industry studies and HCFA data indicate that practicing physicians are losing more than $25 billion a year in denied or reduced fee-for-service claims. A typical physician with average annual billings of $650,000 is currently losing an estimated $35,000 to $100,000 in annual collected revenue because of claim denials; lost billings average approximately $60,000 per physician. Those lost billings are a direct result of inadequate documentation, invalid codes for procedures or tests, and failure to bill for services rendered outside the office setting. Further, overhead related to

claims submission and collection consumes in excess of 40 percent of doctors’ revenues[[Au: Specific source for data?]].
@$: To further complicate the situation, recent legislation, including the Health Insurance Portability and Accountability Act (HIPAA), has increased the detail and paperwork that the HCFA requires for reimbursement. The charge-capture application does not eliminate such problems, but it represents an opportunity to reduce lost billings significantly. The application allows physicians to more accurately and carefully track the procedures they perform and gives them a suggested HCFA level of care based on the inputs. Using a clear, intelligible format, doctors will be able to enter all the procedures that they followed at the time of care, and the information will be wirelessly transmitted to doctors’ record-keeping systems.
@h4s:Real-time laboratory orders and results.|em|@h4:Another significant function that has not been fully implemented is the use of wireless applications to order laboratory tests and receive and view results on a real-time basis. The technology for this application already exists.
@h4s:Libraries.|em|@h4:Doctors will be able to wirelessly access databases containing vast amounts of information. They will be able to pull it up almost instantly on their handheld devices, sparing them book- or desk-based research while treating patients.
@h4s:Regulations and HCFA rules.|em|@h4: Physicians will be able to access and display formularies, drug-use reviews, treatment guidelines, and other rules relevant to their practice areas from their wireless PDAs without the need for book or desk-based research.
@h4s:The future—telemetry applications.|em|@h4:It is not hard to imagine the day when wireless telemetry will allow wireless remote patient monitoring and patient self-monitoring for many conditions. Thousands of people’s pacemakers can now be monitored over phone lines. In the future, telemetry devices should be able to monitor the status of almost every kind of ailment to allow patients under the threat of remission the hope that diseases can

be caught early enough to stop them. As wireless devices increasingly monitor health and other advances in biotechnology occur, patients' interactions with their physicians will be fundamentally altered. New understandings of the human genome will identify the proneness of some patients to certain illnesses, and rather than visiting a doctor to see whether a likely disease has developed, patients could be monitored through wireless telemetry devices embedded in their bodies. The image of people carrying wireless monitoring devices in their bodies creates associations with the part-human/part-machine cyborgs of science fiction lore, but advances in technology make this possibility less and less a fantasy.
@$:The future—additional technology changes that will affect wireless health care. Because wireless applications in health care are generally not data intensive, their adoption is not dependent on 3G or other high-bandwidth solutions. More significant for health care will be the widespread adoption of Bluetooth. This technology offers the prospect of physicians' being able to walk into a hospital room and instantly have access on their handheld devices to the heart monitor on the screen in front of them. If they want to do an independent analysis of the data, handhelds will provide that opportunity. The ease of printing and transferring information that Bluetooth promises will certainly facilitate the transition to wireless use throughout the industry. Also, many hospitals in older buildings can be more cheaply outfitted with wireless technology than with wire-line technology.

@h3s:Key Success Factors.@h3:|em|The health-care industry is infamous for its Byzantine nature and staggering inefficiency, and one would think that given those enormous inefficiencies, doctors would be ready to help eliminate the waste. The problem that complicates the situation, however, is the same problem that complicates much of the health care system: The entities paying for the care are not connected to the point of care. Thus, there is not always a tight link between the people who would be most

likely to use the new wireless applications (doctors and other caregivers) and the entities that would benefit most from them financially (insurance companies, through reduced claims).

@$: Doctors are notoriously technology shy, and the inconvenience of disrupting their routine to learn a new technology or application has been a massive barrier to any company trying to enter this space. Further, the benefits to be derived from many of these applications are not easy to quantify for many physicians because the technologies are new. As a result, many wireless health care companies have had a difficult time convincing doctors that the net benefits are worth paying the typical subscription costs of $100 to $200 a month.

Still, some forces at work in the health care industry could dramatically accelerate the rate of adoption of wireless technology:

@bl: • Widespread insurance discounting for use of the applications. Insurance companies might be willing to give significant discounts to doctors who employ e-prescribing applications because of the reduced incidence of malpractice resulting from improper prescriptions. Some insurers are already helping defray the costs of these services, presumably with the intention of finding out whether they actually result in fewer claims against the doctors who use them.

@bl2i: • Changes in the standard of care required under medical malpractice law that will make prescription-management applications a virtual requirement for all physicians. In the area of medication management (prescription services), the standard of minimum care as defined by common-law malpractice law could soon include applications that check drug interactions and scan relevant databases and client information for possible complications or adverse reactions. If medical malpractice law creates an incentive to adopt these applications, usage could become almost universal.

• Endorsement of the applications by the HCFA. A gigantic boost in adoption would occur if the HCFA endorsed these

applications, as this approval would achieve a long-sought consistent and predictable manner of communicating with the HCFA.
@h3s:Summary.@h3:|em|The key driver in wireless adoption is in the cost/benefit category. The potential market is enormous, and the technologies already largely exist for many applications and functions. The question comes down to whether insurance companies will create incentives and whether changes in the standard of care will virtually require wireless technology from a cost/benefit perspective. Some of the wireless applications that have been or are being developed promise to alter in fundamental ways how physicians practice medicine and could result in dramatic cost savings. Companies such as Allscripts, which is well positioned to ride out the ups and downs of the market and still be in the game as adoption rates escalate, should be able to capture a large portion of this value. Companies such as Data Critical, which is exploring medical telemetry devices as well as the physician applications Allscripts provides, may capture value resulting from major changes in physicians' interactions with patients. The widespread adoption of telemetry technology is a long way off, but those companies positioned to help drive the changes could also capture tremendous value in the future.
@h2:Government
@$:Wireless applications are finding a fertile environment for deployment and development in government public-safety organizations such as police, fire department, and medical emergency services. The communication platform of these organizations is migrating from old radio- and paper-based systems to new mobile open systems. Public-safety organizations have been early adopters of wireless solutions to support their operations because their mobile workforces have a critical need to access the most-up-to-date databases from anywhere in the field.
@h3s:Market Size and Applications.@h3:|em|Based on data from the U.S. Bureau of Labor statistics, the market potential for wireless solutions for the government is estimated at around 4 million users and over $1 billion in revenues by 2003. The

existing applications support multiple purposes, such as dispatching, remote data access, field data collection and reporting, on-site inspections and scheduling, and management of personnel and resources.

@$:Wireless solutions for police. Police departments are finding wireless applications are key tools for accessing crime and drivers' databases from the field online. The law-enforcement function--the significant workload of police departments--is driving the development of wireless applications in the public sector because officers in the field need efficient mobile solutions to support quick and broad data access. Traditionally, police officers have relied on a central computer system at headquarters to check criminal and drivers' records, which easily saturated the police communications centers (911). Mobile technologies ease the load on such centers, providing officers with quick response times at their locations, helping them to make rapid decisions on appropriate actions. Public-safety organizations also find wireless applications are a way to get immediate service and dispatch data to their remote workforces.

Other potential users. Traditionally, federal agencies have been slow to adopt wireless technologies other than voice applications because of their high cost and limited coverage and capacity. Other government services that are relying increasingly on mobile solutions are public works, municipal services, health agencies, and courts.

@h3s:Technology Viability.@h3:|em|The technology for government wireless solutions already exists for many applications, although it is limited by the usual bandwidth considerations. Most of the applications in police work, however, are not extremely data intensive, and therefore bandwidth is not a severely constraining factor. Companies such as Aether Systems are already deploying technologies that enable all the functions described previously. As in the other verticals examined, the limiting factor in government applications does not appear to be technology; instead, it is whether the companies selling the technology and

applications can convince consumers (police and fire departments, etc.) that the benefits are worth the investment.
@h3s:Key Success Factors.@h3:|em|The critical driver in this vertical is the same as in the other two. Vertical wireless applications could provide many benefits, both in the performance of public organizations and for the final users (the citizens) of the services. The main problem is helping industries and government entities, which have not required technological sophistication in the past, recognize the advantages the technologies offer. There are several ways that government entities could gain cost efficiency through wireless applications.
@h4s:Cost of communications.|em|@h4: Although deploying equipment and wireless devices requires an initial investment, there would be less overhead in supplying communications support to the mobile workforce. Fewer people would be needed in central headquarters to facilitate the interface/communications with the employees in the field. Wireless could also improve the quality and timing of information, optimizing the resources available in the field. Handling more precise information allows the mobile workforce to allocate its time more efficiently to deliver a better and cheaper service to the community.
@h4s:Increased security features.|em|@h4:Wireless applications for police will not only optimize the cost and quality of their services, but also improve the security of police officers by providing information that may reduce the risk in performing dangerous duties.
@h4s:Crime prevention/awareness.|em|@h4: Prospective offenders who perceive the faster response time of police departments derived from wireless technologies may lose incentive to break the rules. Thus, enhanced communications not only improve the quality of the police actions once an offense is committed, but also facilitate prevention.
@h4s:Better services for citizens.|em|@h4: Finally, all the improvements in cost and quality will improve the welfare of taxpayers, who will enjoy increased safety and a better response

of government organizations to health, fire, or environmental emergencies.

@$: Although these are legitimate areas of cost improvement and efficiency, the difficulty is quantifying them and presenting a viable value proposition to consumers. Companies that are selling and hosting these applications in government services have found it to be a tough sell. Quantifying the value of the offering is customer specific and requires a customized detailing of how the technology investment can save money. Because there is no precedent, that task often proves difficult, if not impossible, except in terms of speculation.

@h3s:Summary.@h3:|em|Given that traditional communication systems in government organizations support only limited remote online access to central databases, wireless applications that promise efficiency and integration in a safety organization’s mobile workforce are likely to have some success in the next few years. Efficiencies in such areas may offset the costs of deploying the technologies and training the workforce. The process will almost certainly take several years, however, given the low level of technological sophistication of the government consumers and the generally slow bureaucratic pace of innovation in the public sector.

@$: Overall in government applications, the limiting factor in growth is once again the cost/benefit proposition to the consumer. The market is large, and the technologies exist to cater to that market, but it is difficult to quantify the benefits to the consumers in a convincing way. Additionally, government consumers are generally slow to recognize the benefits of, and to adopt, new technologies.

@h2:Future Trends—Vertical Applications Become Horizontal

@$:Though the wireless application framework has been presented statically with a clear delineation between horizontal and vertical applications, in reality applications are much more dynamic. In particular, the path of some wireless applications will start in verticals and then will migrate across them. Initially, major companies in a particular industry will identify

a need for a customized application. The costs of such an application will often be large, but the benefits, which are also larger, will drive adoption. The slow rate of adoption ends up being a function of high costs of adoption and the lack of a compelling value proposition. Over time, as costs come down and adoption increases, the value of the vertical applications will become obvious, and companies will realize that they need to adopt or be left at a competitive disadvantage.

The barriers to horizontal adoption are deeper and relate to issues within the different verticals. The tailored solutions for most industry verticals are often based on proprietary systems and are not easily transported, which will hinder their widespread adoption for the near future. In trying to discern when the bulk of the shift from verticals to horizontals will occur, there are two important factors to consider: standardization and broad functionality. Looking at any technology as it relates to these factors makes it easier to see how industry-specific technologies will begin to move across vertical markets.

@h3s:Standardization.@h3:|em|Standardization of the infrastructure behind the application drives down the costs to the user. At a lower cost, the application addresses a much larger market, and what was once useful in one industry is now worth paying for in another. Figure 5.13 shows that as the cost to the user drops, the addressable market increases and the application migrates into horizontal territory.

@$: The cost of the application drops as the infrastructure standardizes because economies of scope accompany standards. Once a company owns a PC, the marginal cost of adding an additional application is small. The cost of the PC, or underlying infrastructure, is amortized over the benefits received from the numerous applications it can run. Therefore, the benefit no longer needs to be as large as it was for the vertical application because the costs are now much smaller. For the vertical application, the benefits had to cover the cost of not only the application, but also the underlying infrastructure.

In wireless, a vast number of standards exist today. On the hardware side, there are many devices, each with different screen sizes and resolutions. On the software side, there are competing operating systems including Palm OS, RIM OS, Motorola OS, EPOCH, and Windows CE. Even the networks have multiple standards: TDMA, CDMA, iDEN, GSM, and Mobitex. Contrast that with the wired world, where hardware screen sizes are standardized, the operating system has converged on Windows, and the network has conformed to TCP/IP, and it is clear that wireless has a long way to go before achieving standardization. The alphabet soup of standards will hinder progress down the cost curve; consequently, it may also slow the adoption of horizontal applications.

@h3s:Broad Functionality.@h3:|em|The second factor that will influence widespread adoption of applications across industries is broad functionality. An application created for a vertical likely has some functionality that is specific to that vertical and some functionality that is useful to many industries. Before a vertical application starts its migration, a modified version must be created that removes the industry-specific functionality. Not every vertical application has enough common functionality to drive demand in the broad market. The process is more akin to natural selection. Whereas it is possible to discover a horizontal application for businesses, it is more likely that a vertical application will be modified to target a larger market.

@$: One example is the spreadsheet. Conceived from accounting research, large accounting organizations used such applications to process accounting information on mainframes. It wasn’t until the advent of the PC that VisiCalc was created to address the large market for spreadsheets.

@h3s:Crossing the Chasm and Competition in the Value Chain.@h3:|em|Geoffrey Moore, in his book <I>Inside the Tornado,<I> explains that in an early market period, margins are typically high and solutions tend to be custom. Product leadership is key during this phase, since innovators and early adopters are attracted to leading products and applications. The foundation for growing a customer base is built in this early

cycle, and as Sun-Tzu (the author of <I>The Art of War<I>) states, “Opportunities multiply as they are seized.” The market for mobile data has seen adoption by many innovators and early adopters. Many early winners in the value chain have been either enabling-software and services companies or solutions providers that have cobbled together leading-edge solutions for specific industries or a narrow set of horizontal applications such as messaging. Moore also writes in <I>Inside the Tornado<I> that as the early majority is adopting a product, margins start decreasing. Solutions are still somewhat customized, but operational excellence becomes key as well as product leadership. As the product moves to the late majority, low margins can be expected, and products tend to be standardized. At that point, operational excellence and customer intimacy play a bigger role. Dell Computer is an excellent example in the now-mature PC industry.

@$: In much the same way, the wireless value chain will see a change in competition as the market matures and applications become more standardized—either as extensions of already existing wired horizontal applications or modifications of applications that were previously isolated to a vertical. This will put increasing pressure for operational excellence on wireless carriers, device makers, and solutions providers. Carriers will have to use their allocated bandwidth more effectively; device makers will see deteriorating margins that they can combat only with continuous incremental innovations; and solutions providers will have to create standard core-product platforms that they can modify to fit the needs of customers.

Customer intimacy will play a larger and larger role, particularly in the case of <I>consumer<I> adoption of wireless applications. The phenomenal success of I-mode in Japan is a tantalizing example of strong branding and widespread consumer adoption of mobile data. This chapter concludes with a discussion of I-Mode and the technological, cultural, and business challenges that will factor into the adoption of similar services and applications in the United States.

@h1:I-Mode: Killer APP in Japan

@$:After the deregulation of the Japanese telecommunication industry in 1992, the telecommunications giant NTT spun off DoCoMo, maintaining two-thirds ownership. To date, DoCoMo's greatest success has been I-Mode (information mode), a wireless data service.

Since its entry into the market, I-Mode has experienced phenomenal growth, the number of subscribers overtaking Nifty, the Fujitsu-owned competitor, within a year of its launch in February 1999. Subscribers now exceed 20 million. In comparison, Nifty won its 3.5 million customers over 15 years. New customers continue to come in at the rate of 50,000 to 70,000 new ones every day. I-Mode users represent more than half of the wireless Internet users worldwide according to Eurotechnology.com. An additional 5 million Japanese use WAP phones. Users of the I-Mode service access the Internet an average of 10 times a day according to DoCoMo. The service has been so popular that DoCoMo had to stop shipping phones and promoting the service in early 2000 to catch up with the demand. It had serious uptime problems as late as fall 2000[[Au: Any update?]].

I-Mode now commands upward of 70 percent market share (Figure 5.14). Two other players round out the wireless data market in Japan. KDDI markets a service called EZWeb, based on WAP protocols. The 68 kbs packet-based service gives KDDI superior voice quality and supports higher-speed data transfer rates than I-Mode's 9.6 kbs offering, though voice quality and speed have not compromised I-Mode's strong market position. Japan Telecom's J-Phone also offers its J-SkyWalker service, based on its own protocol, called Mobile Markup Language.

DoCoMo's significant market power has helped it maintain its dominant position by influencing the development of both phones and content. DoCoMo works with phone manufacturers to design I-Mode phones that are user-friendly and light and that boast the latest in technological advances. In January 2000 DoCoMo introduced phones with color screens capable of 256-bit color graphics that can display animated GIF files just like Web

browsers. In addition, the extensive market penetration of I-Mode makes the I-Mode application a must for content developers:

@bh:The I-Mode Concept

@bbl:

- Adapted Netscape’s business model with a low entrance threshold including low fees. AOL’s model: proprietary portal[[Au: Clarify meaning—adapted AOL’s model?]].
- Focuses on fresh, interesting, entertaining content, not technology.
- Uses strong I-Mode branding, not technology specific, open to future technologies.
- Includes content provided by alliance partners and other voluntary sites.
- Sells information, transactions, and entertainment in small, convenient, inexpensive packets.
- Uses successful micropayment system through NTT DoCoMo phone bill.
- Easily creates I-Mode Web sites on existing Internet.
- Accelerated introduction of 3G to Japan, bringing 200 times the current bandwidth.

@h2:Business Model

@$:DoCoMo’s emphasis on developing a compelling business model and using technology to support that business model significantly affected I-Mode’s success. When it came to technology, the operator had little choice: Since the WAP option was not available, DoCoMo had to implement HTML-based technology. That helped to broaden the applications available on I-Mode. The initial hurdle that the I-Mode team faced was to convince management that DoCoMo should target I-Mode to consumers rather than to PC and Internet-friendly business users. Once focused on consumers, developers selected services they thought would be useful to people on the go—bank balances, restaurant reviews, and related information were available at the touch of a button. To encourage use, the developers concentrated on developing user-friendly software. I-Mode technology made mobile surfing and access easy through a customer-focused interface and a continuous Internet connection whenever the phone is on.

DoCoMo realized that cost was a major factor that had limited the adoption of the wired Internet but recognized the potential for widespread acceptance and demand for Internet services. To attract this market, it developed a sophisticated micropayment system, charging users according to the amount of data downloaded and not the time online. The packet-switching technology facilitated that charging structure. To expand content, DoCoMo does not charge content providers like Disney anything (except for bill-collection services). It operates a billing system that records the customer's traffic and subscription costs (along with any charges made by content providers) all on one bill. DoCoMo then collects revenue, including its 9 percent fee on charged content, and distributes what is due to the content providers.

The average I-Mode customer generates revenue of $17 per month, composed of the following charges:

@mcl:Subscription Fees $3

Traffic Costs $12 ($0.003 per data packet of 128 bytes)

Commission $2 (9 percent of amount content providers charge for downloading applications or services)

@bh:I-Mode: The Essentials

@bbl:

- Over 80 percent of the world's wireless Internet users are in Japan.
- I-Mode's brand is not fixed to a single technology.
- I-Mode makes DoCoMo Japan's largest Internet Service Provider.
- It is a benchmark for m-commerce and micropayment platforms.
- The technology uses packet-switched (Internet protocol, always on, no dial-in) overlay over circuit-switched digital voice mobile.
- I-Mode uses cHTML (subset of HTML), not WAP.

@h1:Services

@$:A competitive advantage of I-Mode is the service and content available at the user's fingertips with relative ease. Transactions fall into four categories:

@nl: 1. <I>M-commerce.<I>|en|Banking, books and CDs, trading, airline and concert tickets. Sony’s online store now also takes orders via I-Mode. The stockbroker DLJ Direct receives 30 percent of its transactions in Japan over I-Mode. Japan Airlines and Nippon Travel get 10,000 reservations per month over I-Mode.
@nl2i: 2. <I>Database access.<I>|en|Telephone and restaurant directories.
3. <I>Weather, news, and stock information.<I>
@nlfi: 4. <I>Entertainment.<I> Games, karaoke, and club events.
@$: A survey by Information Communications, an NTT subsidiary, shows that the sites that help the user explore I-Mode are now becoming the most popular. I-Mode designates 10 to 20 official I-Mode sites from the thousands of applications it receives each month. Many of the most popular applications are among the 16,000 or so unofficial sites. For example, one popular site helps the user trick the system to send and receive longer text messages than DoCoMo allows. Some other popular sites on I-Mode include:
@bl: • <I>Yamaha Corporation.<I>|en|Maintains a site enabling users to download hit songs to use as dial tones.
@bl2i: • <I>Olympus.<I>|en|Has launched a camera designed to transmit digital photos when connected to an I-Mode phone.
@blfi: • <I>DoCoMo.<I>|en|Launched a global positioning system that tells users where they are and gives directions to a destination.
@$: Although 95 percent of I-Mode users purchase content or use premium sites primarily for entertainment (various cartoon sites are especially popular), 43 percent of I-Mode traffic is e-mail messages, despite a 250-characters-per-message limit, underscoring the importance of the traditional network killer app. A survey by InfoCom Research found that I-Mode phone users spend 34.2 percent of their total use time making and receiving calls (an average of 3.67 calls per day); 41.8 percent send e-mail (an average of 9.08 e-mail messages sent and received per day); and 24 percent surf I-Mode sites. Only 26.2 percent use I-Mode at work or school[[Au: Source for data, with date?]] .

@h2:Factors Driving I-Mode’s Success
@bh:Success Factors
@bbl: • Content is compelling and attractive, with frequent updates to encourage multiple accesses per day.
• Micropayment via NTT phone bill attracts partners and makes m-commerce easy for the consumer.
• Market is focused on entertainment, not technology.
• DoCoMo has a large market share.
• Japanese people love gadgets, and Japanese youth have a high rate of technology adoption.
• Japanese people walk and take trains, giving them more time to access I-Mode content. In the United States, people primarily drive cars for transportation and cannot use the wireless Internet while driving.
• Packet switching eliminates wait time for access and connection-based fees.
@$:Mobile data requires the integration of the programming environment, content, transport, and the end-user terminal. No carrier outside Japan has executed end-to-end service to the same extent as DoCoMo. I-Mode destroyed one great wireless data myth—that you need a lot of bandwidth for a successful wireless operation. The following elements have contributed to I-Mode’s accomplishments:
@bl: • <I>Market power.<I>|en|The company leveraged its channel dominance to get handset developers such as Sony, Sharp, Kyocera, and even Nokia to do its bidding. Thereby I-Mode was able to provide phones that were technologically advanced, appealing to consumers who wanted cutting-edge technology. At an industry show in Japan,[[Au: State year]] close to 40 new I-Mode devices were on display, resembling everything from a traditional cell phone to a cosmic egg to a TV-like palm device. Sony is rolling out the Cybershot, a camera that will allow consumers to transmit digital images to color I-Mode cell phones from PCs through Sony’s i-Jump network service. Other companies are offering photo-printing services that work with I-Mode phones. DoCoMo, Oki Electric, NTT Data, Mizuho Financial Group,

Microsoft, and others are collaborating on the first secure-payment system for I-Mode.

@bl2i:

- <I>Consumer focus.<I>|en|DoCoMo recognized the tremendous opportunity to connect consumers to the Internet when landline access was limited. After seeing the potential, DoCoMo's concentration on connecting with young consumers, early adopters of mobile technologies, tapped a lucrative market. In addition, it realized that an application capitalizing on the large amount of idle time that the Japanese spend commuting, could be very successful.
- <I>Brand development.<I>|en|In its marketing, DoCoMo did not refer to established interactive mediums such as the Web. Instead, it focused on services that are available uniquely on I-Mode, such as the ability to send messages to friends, which created strong brand awareness among consumers.
- <I>User interface.<I>|en|To create a better consumer experience, DoCoMo developed a friendly and intuitive user interface. For example, train schedules are retrievable in two clicks. Packet-switching technology made mobile surfing and access easy, since the customer is connected whenever the phone is on and it takes only one button to enter the I-Mode services. Compact HTML is flexible enough to accommodate multibyte kanji characters and other graphical elements, further improving the user interface. Because only 13 percent of Japanese have access to the Internet through a home computer, they were more accepting of Internet access on a small phone screen.
- <I>Content quality.<I>|en|The development team focused on including content that would be valuable to individuals on the go. I-Mode was also attractive to content developers since, unlike WAP, it allows site designers to write programs in a stripped-down version of HTML. That further encouraged the development of content and the creation of valuable unofficial I-Mode sites. The media director of DoCoMo, T. Natsuno, says quality of content has been the key to I-Mode's success. He emphasizes that content should change, encourage repeat visits (e.g., games), and have an easily recognizable benefit. To help

establish this quality content at the start of the service, I-Mode signed up 67 application alliance partners (AAPs), which are similar to online content partners and are part of the I-Mode on-screen real estate. I-Mode now has several thousand content partners, including many thousands of unofficial offerings (independently established I-Mode-compatible sites). DoCoMo recently allied with Sony to jointly develop PlayStation and I-Mode technologies, further strengthening its strong content position.

- <I>Economical positioning.<I>|en|DoCoMo took advantage of the high cost of installing and maintaining a landline connection by developing an economical cost structure. A new telephone line connection costs $600 (72,000 yen) in Japan before usage charges; by contrast, I-Mode costs $28 for the connection, and monthly bills average $17. For the wireless version, the cost is linked to data downloaded and not to time online, which allows users to explore I-Mode without incurring high expenses. The company built a packet-data overlay on its PDC network to facilitate the charging structure.
- <I>Existing customer base.<I>|en|As a preexisting provider of mobile voice services to the Japanese market, NTT DoCoMo had an established customer base. At the launch of I-Mode, all but the most basic phone came equipped with I-Mode, thereby removing the impact of switching costs. That is particularly important in the Japanese market, where mobile phones are often perceived as a fashion accessory and regularly updated.

@bh:I-Mode Service Classics

@bbl:
- iBanking—mobile banking.
- iTrade—credit cards, securities, share trading, insurance.
- iTravel—hotel, car, and airline reservations, directions.
- iTicket—event tickets, apartment rental, employment postings.
- iGourmet—restaurants, recipes.

- iMode mail—e-mail, 250-character limit, 50-message memory.
- iNews—news and information.
- iTown—town information.
- iEntertainment—mobile karaoke, games, cartoons.
- iTool—dictionary, telephone directory.
- iAnime—animated cartoons, pals, and pets for download onto the mobile screen.
- iMelody—ringing.

@h2:Future of I-Mode

@$:As part of a strategy to transport I-Mode outside Japan, DoCoMo has made many strategic overseas investments and alliances in North and South America, Europe, and Asia, most notably with AOL. [[Au: Update.]]DoCoMo [[Au: When?]]purchased a 16 percent stake in AT&T. NTT DoCoMo and AT&T Wireless plan to jointly develop the U.S. mobile multimedia market by leveraging the nationwide network infrastructure of AT&T Wireless and the I-Mode–based mobile Internet technology and related business know-how. Additionally, an NTT subsidiary, NTTCommunications, [[Au: When?]]acquired the U.S. network-services provider Verio, which hosts more than 400,000 Web sites, in a move to promote the development of I-Mode-enabled Web sites. [[Au: Update.]]NTT is under domestic pressure to expand broadband access in Japan, which lags not only behind Europe and the United States, but also behind Korea and Taiwan.[[Au: Update to avoid being outdated by publication.]] DoCoMo has put in place a value chain that will serve the operator well when 3G services come online[[Au: What year?]]. It includes $7.6 billion to build the world’s first Wireless-CDMA network, which is due to open for service in April[[Au: What year?]]. Initially the 3G service will run at 386 kbs, rising to 2 Mbs by 2003. That means that 3G services will be launched in Japan approximately two years earlier than in the United States, giving DoCoMo a strong technological lead.[[Au: Need to clarify time frame throughout this section.]]

@h1:Wireless Market in the United States

@$:Because of all this momentum, tremendous growth is projected for information services for cell phones.

@bl: • Gartner Group projects that by 2004, 95 percent of new mobile phones will be WAP-enabled.

@bl2i: • [[Au: Update]].

• A Strategis Group survey found 34 percent of wireless users were interested in a wireless portal service. The study predicted that the number of wireless portal users would grow to nearly 183.7 million worldwide in the following five years [[Au: Need year of study as ref. point]].

@blfi: • An AOL/Roper Starch Worldwide study found: “More than half of Internet users said they would be interested in using small, non-PC Internet devices to go online from anywhere.”[[Au: Date?]]

@$: Yet all is not rosy for mobile-phone services. Concerns over privacy, security, and the usability limitations of current Web-browsing phones may limit the rapid adoption of services in the United States.

@bl: • Forrester Research found that 72 percent of U.S. households have no interest in receiving data like news, weather, and sports scores on their wireless phones and that nearly 75 percent say they are not comfortable with the concept of mobile e-commerce[[Au: Source note?]].

@blfi: • Allied Business Intelligence (ABI) found that less than 5 percent of a sample that included both cell-phone users and nonusers say the cell phone would be a good Internet access tool, whereas 40 percent think it would not be[[Au: Source Note?]].

@$: Since Sprint’s introduction of PCS phone services in 1994, the U.S. wireless industry has evolved from a niche player that offered expensive voice services on clunky equipment to a nearly ubiquitous presence in corporate and consumer America. At the same time, non–voice-based information services, including mobile commerce, have proliferated on wireless phones, though they have yet to achieve their market potential. For example, Sprint customers can send gifts using the recipient’s e-mail address.

Most new cell phones have the ability to receive e-mail and other short messages and to act as pagers. The newest models add limited Web-browsing ability and even e-commerce capabilities. In fact, more than half (58 percent) of all cell phones bought at retail in Q4 2000 were Net ready—a 10-fold jump from the same period a year before, according to the NPD Group. Despite these inroads, however, U.S. wireless phone capabilities have continued to lag behind overseas goods and services [[Au: Need to update info in this paragraph]].

Unlike the Japanese, the American market remains highly fragmented, with service providers, hardware manufacturers, and content developers vying for consumers. The competitive environment has kept costs to consumers down and impeded the development of a consistent technological standard.

@h2:U.S. Consumers

@$:The Wireless Commerce Monitor data shows that information services provided through a wireless device are still on the relatively flat part of the early adoption curve in the United States, with overall use of wireless information services by less than 10 percent of wireless phone users. At the same time, industry beliefs suggest that large-scale opportunities exist in the wireless information arena. Topping most predictions for areas of growth are traffic/directions and e-mail/text messaging.

However, ConStat Research has illustrated that although users in the United States are willing to receive e-mail and short text messages on their traditional wireless handsets, most are absolutely unwilling to peck out even the shortest of messages using a numeric keypad. Voice-recognition systems may provide a partial solution to this problem, but it is questionable whether these systems will adequately replicate these functions.

@h3s:Young Consumers.@h3:|em|Children and young adults ages 10 to 24 may be the fastest growing U.S. market for wireless voice and data services over the next several years, according to surveys by Cahners In-Stat Group. Young wireless subscribers will jump from 11 million [[Au: Year?]] to more than 30 million in 2004,

and the number of users will rise from nearly 24 million to 43 million. That means that by 2004, half of U.S. youths will own a wireless phone and nearly three out of four will use one. [[Au: Update.]]@$: Although this group represents a high credit risk to carriers, youth actually have significant spending power, as 10-to-17-year-olds alone spend $50 billion annually, In-Stat estimates. Other sources estimate that [[Au; Identify year]] youth between 12 and 19 spent as much as $105 billion of their own money. Even lacking credit histories, these consumers are lucrative targets for wireless carriers.

Non–college-attending young adults ages 18 to 24 could be the largest segment of the youth wireless market. This group would probably embrace wireless services enthusiastically because its members enter the job market early and have significant disposable income. InStat surveys suggest that the wireless Internet may lure this segment most easily with content such as shopping, news, sports, entertainment, education, and opinion polls.

Carriers in the United States hope American youths will take to wireless services as enthusiastically as their counterparts in Japan, where 60 percent to 70 percent of teens use wireless e-mail. According to the U.S. Census Bureau, there are approximately 60 million people in this country between the ages of 10 and 24, making it an ideal segment to target for wireless services, even though several cultural and environmental differences exist between Japan and the United States. According to a nationwide survey compiled in December 2000, a cell phone was the number one item on American [[Au: As meant?]] teens’ wish lists. It is the hottest coming-of-age badge among today’s teens. According to a national study by Teenage Research Unlimited[[Au: As of what date?]], 6 million teens in the United States own one. Cellular companies are hoping to connect with Generation Y by offering a colorful assortment of phones that provide both flash and function.

Companies like the start-up wireless carrier Talking Drum are hoping to cash in. It markets Kode, a wireless communication

network oriented toward youth culture. “We’re really kind of pushing the envelope on technology, on fashion and music, and the kids pick up on it like that. So that’s why we build Kode around youth culture and communications.”[[Au: Source note?]] Although these phones provide Internet access, voice functions remain the most popular—especially group chat functions that allow as many as five users to talk at once. Talking Drum launched Kode in November[[Au: Provide year]] in Sacramento, California, targeting 30,000 of the city’s teenagers and hoping to attract 2 percent of them as subscribers by the end of the year. The company has not released subscription information but says it is on track.[[Au: Update?]]

Another company targeting the youth market is Cybiko, a handheld-device manufacturer that aims to fill the gap between Palm handhelds and GameBoy. The Cybiko looks like a walkie-talkie with a small keyboard, performs organizer functions, and allows users to communicate with other Cybikos within 300 feet. Users can download games from the Web at no charge and purchase an MP3 player that fits into the device’s expansion slot. In an interview with LocalBusiness.com, the founder of Cybiko, Don Wisniewski, commented: “We have a very fickle group to market to. They’re not only interested in technology and efficiency, but into fashion.”

@h2:Network Access

@$:Network infrastructure in the United States has differed from that in other countries, affecting the development of wireless services. Current wireless networks are either 1G (analog) or 2G (digital, such as PCS). They typically support data access at 9.6 kbps, but some support 19.2 kbps. Since wired modem access averages above 28.8 kbps, and Web sites are becoming more and more graphics intensive, some content modification is necessary for wireless devices. Other modifications are necessary because of the small screen size. The next generation of wireless networks will deliver increased bandwidth, though it is unclear exactly how fast they will get and by when. Some network vendors are targeting so-called 2.5G technologies such as GPRS and

enhanced data rates for GSM evolution (EDGE), which can increase maximum bandwidth to 384 kbps and will serve wireless devices large enough to support video transmissions. DoCoMo is preparing to offer similar video services in Japan over its I-Mode phones. Others are waiting for 3G, which promises speeds up to 2 Mbps.
@h2:Choosing a Standard
@$:The fragmented market structure has precipitated competing standards. In the United States, a battle over the transmission protocols used in cell-phone telephony is being waged among code-division multiple access (CDMA), time-division multiple access (TDMA), and global system for mobile communications (GSM); whereas GSM predominates in the rest of the world. All sorts of standards for fixed wireless networking also contend for supremacy. The two most important standards in the near future for the wireless marketplace are WAP and I-Mode:
@bh:WAP versus I-Mode
@bbl:
- I-Mode uses a modified version of HTML (cHTML). Thus it is easy and straightforward to build Web sites for it. WAP uses its own language, so barriers to creation of WAP Web sites are higher.
- I-Mode is always on; there is no need for dial-up, and no fees are associated with connection time. WAP uses circuit switching (dial-up). Users must wait to dial up and are charged per minute of connection time.
- WAP services are limited to lines of text and simple monochrome graphics. I-Mode already allows color, GIF animation and Java-enabled games, software, and security.

[[Duplicate copy]]@h3s:WAP Problems.@h3:|em|Critics are quick to point out WAP’s most glaring fault: By trying to turn the phone (an audio device) into a browser (a visual device), WAP goes against the very nature of the device, which is to deliver audio information. People are not used to watching their phones, and thus using WAP requires a behavior change. Some critics have gone so far as to state that WAP solves a problem nobody cared about:

how to turn an audio phone into a visual browser. Even Phone.com, one of the inventors of WAP, has said it expects to eventually move away from the technology.

@$: A related problem is reducing rich, multimedia content designed for large PC screens to fit the small windows on most wireless devices. Some critics call this the “Honey, I Shrunk the Web” syndrome. It is a given that not all Web content is appropriate for delivery to wireless devices. Despite Macromedia’s recent introduction of pocket Flash, most multimedia-intense sites will be left out of the wireless revolution.

Of more concern is the growing tendency of vendors to tweak the WAP standard just enough to compromise interoperability. Other concerns revolve around security. Gartner’s Vice President, John Pescatore, believes that as mobile phones become smarter, attacks through software updates and simple scripting will increase because wireless vendors have taken shortcuts that leave systems vulnerable. Since wireless phones and PDAs are single-user devices, they typically do not implement the same file-access security as other computing platforms. In addition, the limited computing resources available on wireless platforms make tight security or antivirus measures difficult. Of course, security involves more than just protection against viruses. Ensuring secure, private transactions is essential for developing m-commerce. Baltimore Technologies sells a wireless device to gateway data-transfer technology called wireless-transport security layer (WTLS) that guarantees authentication and the integrity and confidentiality of data.

Another problem with WAP is uneven support for the evolving standard. Some critics claim that phone manufacturers, who are releasing new models and microbrowsers on an almost monthly basis, do not even support WAP the same way in different iterations of the same phone. For example, several versions of the Nokia 7110 microbrowser are available, each version supporting WML code differently. This inconsistency makes for a less-than-optimal user experience and makes service developers’

lives difficult as well. The complicated process of signing up for a new WAP service on a phone further impedes usability.

A final concern is that the initial version of WAP, at least as implemented in Europe, is not always on. European users endure a dial-up delay because WAP is a circuit-switched protocol and thus requires establishing an Internet session. As a final insult, Europeans must pay connect charges to use WAP features. Leave the phone on by accident, and a 16-hour mistake could cost $250.

@h3s:I-Mode: Threat to WAP Standard?.@h3:|em|I-Mode’s entry into the American market opens the standards competition further. Given the limitations and criticisms of WAP, some form of accommodation or convergence with the I-Mode standard seems likely. A major factor that could limit I-Mode’s expansion is its proprietary technology. WAP is an open standard that any manufacturer can adopt. DoCoMo, on the other hand, controls I-Mode, at least so far. If the two standards do not converge, it might be tough for DoCoMo to make a go of it in the United States. The short-term future in Europe and the United States appears to be WAP. Hardly a day goes by without another WAP device being announced. But the cost of the service, combined with the inconvenience of completing a dial-up may lead consumers to demand sweeping changes that could open the door for I-Mode.

@h3s:Transferring I-Mode to the United States.@h3:|em|Wireless Internet on a phone platform has yet to catch on in the United States. Although I-Mode has many advantages over WAP, several of its features are unlikely to be accepted in this country. It is still questionable whether Americans would be willing to type on such a small keypad for e-mail and Internet access. A voice-recognition phone is a possible solution, but a better answer might be a stylus-operated system, which would avoid issues associated with consumer technology adoption. In fact, PDAs have been widely accepted in the United States, and wireless Internet on the Palm now makes up 1 percent of wireless access worldwide.

For I-Mode to succeed in the United States, an alteration in content is also necessary. American consumers have, on average,

less downtime for viewing content than their Japanese counterparts. Meanwhile, high-graphic game devices such as the GameBoy already exist to fill single-user game needs. Thus, multiple-player games should be targeted heavily to interaction-thirsty teens and may prove the killer app of the United States. As in Japan, entertainment content can function as the gateway to other mobile Internet content. Over time, as users grow used to the medium, they will demand other, more complex content. Also over time, the user group profile will expand from specific groups like youngsters and businesspeople to include a large part of the population. When the homogeneity of the users decreases, so will the homogeneity of the content.

Pricing must be approached differently in the United States. Wireless carriers have discovered that American consumers prefer transparent, flat-rate billing plans. Analysts of the American mobile Internet market have questioned whether it will be possible to charge users for content. Among other things, they claim that the users have been spoiled by the free content on the fixed Internet and will therefore be reluctant to pay on the mobile Internet. Although that is true, users would probably be willing to pay for certain premium services if specific fundamental requirements were fulfilled. The most important of these would be a convenient micropayment system. The second requirement would be to keep all charges so small that users would not hesitate to pay. If users perceive payment as a hassle, they will not bother to buy the content.

Components of the Japanese billing systems do have value in the realm of online shopping. For example, a teen could buy a book over a wireless phone without a credit card and simply pay for the item as part of the monthly phone bill. This service is also likely to appeal to business travelers, who normally pay for expenses in advance and seek reimbursement later. Using the micropayment system, travelers could pay for airline, hotel, and car rentals and provide the employer with the itemized charges on their monthly phone bill.The service also needs to offer competitive family plans, similar to the Family Plan and Family

Talk programs offered by AT&T and Sprint respectively. Most parents in the United States purchase wireless phones for their teens as a security measure as well as to have unlimited access to their child. DoCoMo must satisfy these needs in a competitive service plan. In addition, DoCoMo may consider integrating other security features into its devices (e.g., audible alarms).

In addition to the flat-rate system, I-Mode should have optional services that users can charge to prepaid calling cards. This would allow teens to make purchases that parents might not be willing to pay for under the flat-rate plan. These optional services could include music downloads, premium games, and live-concert access.

Marketing should focus on the image-motivated consumer, differentiating I-Mode from other business-focused wireless Internet providers in the United States. This might be best accomplished by cross-promotions with other popular teenage items(e.g., color-coordinated phones, nail polish, and hair colors). Most important from a marketing perspective is the need for I-Mode to develop a brand name and customer base. Established services such as WAP will always have some advantages because they have been in existence for a long time. An emerging service must put forth more effort and resources to reach the market with a product and establish a customer relationship.

I-Mode should enter the market as soon as possible to gain useful experience about the characteristics of the medium and its users. However, I-Mode should launch on a small scale until it has fully tested the concept. As soon as there is evidence of its becoming successful, it can move forward on a larger scale. Release of I-Mode services should be staggered, focusing first on the western states, which have the highest growth in the young-adult segments and also high adoption rates of new technology. Early promotions should include free phones to reduce switching costs.

@bh:Recommendations

@bunl:<I>Applications:<I>|en|Focus on multiuser interface gaming, e-mail with attachment capability, music, movie, and online

shopping applications. Form alliances with already popular content providers and retailers.
<I>Launch:<I>|en|Consider launching first in western states, which have the fastest growing population of young adults and high first adopter rates.
<I>Pricing:<I>|en|Implement tiered flat-rate system. Create add-on plans/calling cards for premium content.
<I>Product:<I>Develop phones with larger screens and keypads or stylus/voice recognition functionality. Consider accessory devices such as foldout keypads. Promote compatibility with PDAs and PCs. Consider adding personal security features such as audible alarms.
<I>Promotion:<I>|en|Give complimentary phones to early subscribers. Develop competitive family plans. Focus on image-based advertising targeted toward young consumers. Cross-promote with cosmetic/clothing companies.
@h1:Conclusion
@$:This chapter discussed a framework for applications providing detail on both horizontal and vertical application areas. Many applications will start in verticals as customized applications for a particular industry before crossing industries horizontally. This trend will surely happen, much as it did in the PC industry. However, many wireless applications will end up being simple extensions of applications that already exist on PCs. This is especially true with knowledge and communications applications. The question is whether taking the desktop user experience and simply shrinking it for the smaller displays on wireless devices will really work. For some applications, maybe it will; but for many it won’t. Application developers will need to be cognizant of how wireless access to applications can complement both the desktop experience and interaction with an application, instead of viewing it as a replacement.

Security is a concern across all applications, but especially for m-commerce and applications that will pass corporate data. Since the industry wants wireless devices and applications to become a prominent part of their customers’

lives, it is working constantly to improve security technologies. Thus, these issues will likely decrease over time.

New business models will emerge as the technologies get cheaper and more ubiquitous. Telemetry applications may allow makers of goods to sign people up for service contracts that include remote monitoring and diagnostics. This is already happening in the automobile industry at companies like GM and Ford. Producers of goods will be attracted to this business model because it is an opportunity to gain recurring revenues from a transaction that previously included only the revenue stream at the time of purchase. It will first occur with costly goods such as automobiles or home appliances but could eventually extend to cheaper goods, such as lightbulbs.

Finally, I-Mode is a phenomenal consumer success in Japan, but some adjustments will be necessary to achieve similar success in the United States. Although many widely used applications in Japan, such as e-mail, will also be popular in the United States, application design must reflect that U.S. wireless-device consumers have less downtime than Japanese users, many of whom have lengthy train commutes. Billing for the use of applications and content will be a critical issue in adoption, and micropayments and simpler billing plans will be helpful in making I-Mode a success.

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