Chapter 8
Mobile Computing and Commerce and Pervasive Computing

Learning Objectives

Upon completion of this chapter, you will be able to:

1. Discuss the value-added attributes, benefits, and fundamental drivers of m-commerce.
2. Describe the mobile computing environment that supports m-commerce (devices, software, services).
3. Describe the four major types of wireless telecommunications networks.
4. Discuss m-commerce applications in finance.
5. Describe m-commerce applications in shopping, advertising, and provision of content.
6. Discuss the application of m-commerce within organizations and across the supply chain.
7. Describe consumer and personal applications of m-commerce.
8. Understand the technologies and potential application of location-based m-commerce.
9. Describe the major inhibitors and barriers of m-commerce.
10. Discuss the key characteristics, critical technologies, and major applications of pervasive computing.

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Section 8.1 Review Questions

1. Briefly describe the value-added attributes of m-commerce.

   In the traditional computing environment, users require a desktop computer and networked computers are connected to each other, to networks, to servers, and to peripheral devices, such as printers, via wires and cables. This situation has limited the use of computers and has created difficulties for people who need to be mobile in their work. Specifically, salespeople, field service employees, law enforcement agents, inspectors, utility workers, and executives who travel frequently can be more effective if they can use information technology while at their jobs in the field or in transit. Additionally, most people want to be able to connect to the Internet or use mobile telephone services anyplace, anytime.

2. List and describe the mobile devices used in m-commerce.

   Wireless portable computer: A laptop or notebook computer with the full functionality of a desktop computer, including Microsoft can become wireless with the addition of a wireless Internet connectivity and a wide range network card.

   Tablet PC: A favorite of salespersons and “meeting warriors”; a tablet PC typically includes a stylus, handwriting recognition software, a virtual on-screen keyboard, and an attachable keyboard for data entry.

   Palmtop: Early palmtop computers had limited functionality and poor usability factors. The OQO features a thumb keyboard, miniature joystick mouse, thumb-wheel scroll device, a stylus-sensitive touch screen, microphone, Wi-Fi antenna, Bluetooth transmitter, and a 2-inch, 20Gb hard drive.

   Personal digital assistant (PDA): The first handheld computing device has come a long way from its humble calendars, address books, and task lists Windows Mobile beginnings. Modern PDAs feature color screens, tiny keyboards, and many are mobile telephones, too. Indeed, PDAs are converging with smartphones.

   Smartphone: All major cell phone manufacturers now make Internet-enabled cell phones. Modern smartphones, such as the Nokia 3510i, feature color screens, cameras, and innovative keyboard designs for ease of text entry.

   Blackberry: A handheld device for e-mail. A screen, tiny keyboard, and innovative interface keep office workers connected to e-mail while traveling or at leisure.

   Ogo: Targeted at the “thumb tribe” (younger users who use text messaging), this inexpensive handheld device just sends and receives text. Slightly larger than a cell phone, the Ogo includes a thumb keyboard and special navigation keys for messaging.
Section 8.2 Review Questions

1. Briefly describe some of the key differences and similarities among the major mobile devices.

All devices focus on the use of both internal applications and applications that access the Internet. Differences occur in many areas, but concentrate on the balance of local to Internet based applications, the physical capabilities of the device and the interfaces used to access Internet applications.

2. Why is it difficult to develop software and services for mobile devices?

In addition to the typical difficulties in creating applications, mobile applications are limited by the physical abilities of the device, its ability to display information and connectivity limitations.

3. Briefly describe the types of messaging services offered for mobile devices.

- Short Message Service (SMS) is a service that supports the transmittal of short text messages (up to 160 characters) between mobile phones on a cellular telephone network. SMS is frequently referred to as text messaging or simply texting.
- Enhanced Messaging Service (EMS) is an extension of SMS that can send tiny pictures, simple animations, sounds, and formatted text.

4. What are the distinguishing features of PANs, WLANs, WiMax, and WWANs?

A PAN (personal area network) is a wireless telecommunications network for device-to-device connections within a very short range.

AWLAN (wireless local area network) is a telecommunications network that enables users to make short-range wireless connections to the Internet or another network.

WiMax (Worldwide Interoperability for Microwave Access), is a wireless standard (IEEE 802.16) for making broadband network access widely available over a large area of up to 50 kilometers (31 miles). WiMax seems ideal for the delivery of high broadband speeds to rural areas of the United States and other developed countries and to cities and towns in developing countries without a mature communications infrastructure.

WWAN is a telecommunications network that provides access over a wide network such as a cellular network. WWAN bandwidths are described on page 371 and include 1G through 4G.

5. Define 3G. Why is it important for the adoption of mobile applications and services?
The third generation of digital wireless technology, which will support rich media such as video. 3G utilizes packet switching in the high 15 to 20 MHz range. All 3G networks aim to offer efficient spectrum utilization and worldwide connectivity or global roaming.

Section 8.3 Review Questions

1. **Describe some of the services provided by mobile banking.**

Customers can use their mobile handsets to access account balances, pay bills, and transfer funds using SMS. Of special interest to banking customers are financial-alert applications (e.g., a loan payment is due, a scheduled rental payment has not been made, a bank balance has fallen below a specified amount).

2. **Discuss proximity-based wireless payments. How have they been used in the transportation arena?**

The mobile payment provides the capability for customers to use their mobile handsets to make micropayments, electronic payments for small-purchase amounts, generally less than $10. Cellular telephone companies already have mechanisms for billing small amounts (e.g., send a text message for 10 cents) and charging them to the phone owner’s account. Accordingly, many mobile commerce transactions may use micropayment services offered by mobile network providers. These work well for making small payments for transportation such as bus fare.

3. **What are the basic processes used in handling mobile remote payments?**

The process is detailed on page 350.

Section 8.4 Review Questions

1. **How are traditional media and mobile marketing campaigns alike?**

Both seek to sell a product or service and target customers. In the case of mobile marketing, the targeting may be based on demographics or proximity.

2. **What type of campaign was recently used by Armani Exchange (A/X)? What were the underlying goals of the campaign?**

The campaign was promoting the brand, and used a sweepstakes as a method of creating interest, while using an opt-in system for users.

3. **Summarize the basic principles in the Global Code of Conduct from the Mobile Marketing Association.**

The code includes the following major sections: notice, choice and consent, customization and constraint, security, and enforcement and accountability.

Section 8.5 Review Questions
1. Describe the major segments of the mobile workforce. How quickly is this workforce growing?
The mobile workforce is defined as individuals who spend at least 25% of their time away from the office. This can include individuals who travel to do repair or deliveries, as well as those you travel for sales or other reasons. This group is growing rapidly.

2. What are some of the common benefits of mobile SFA, FFA, and CRM?
Each allows the worker the ability to access information away from the office, and each provides the firm with the ability to better understand what each worker is doing.

3. What are some of the challenges that companies incur when they try to implement solutions for the mobile workforces?
There are many challenges including issues with the network being used, application performance, device management, and bandwidth (see page 356).

Section 8.6 Review Questions

1. Briefly describe the growth patterns of the various segments of mobile entertainment. The market is divided by different use patterns and applications. Each of these areas is growing, but at a different pace as seen in Exhibit 8.4

2. Discuss the basic components of the mobile music market. This market can focus on direct to device sales and sales to PCs that are then synced to devices. There is heavy cost pressure in this market. In direct to device sales there is also a notable sub-market in ringtone sales.

3. What are some of the key barriers to the growth of the mobile games market? Key barriers include the processing power and display abilities of the devices themselves.

4. Discuss some of the key legal issues impeding the growth of mobile gambling. The issues revolve around the legality of the service in different areas as the user travels, as well as the resulting payments issues.

Section 8.7 Review Questions

1. Describe the key elements of the l-commerce infrastructure. The key elements include devices, mobile networks, positioning, service provider, and data provider.

2.

3. What is GPS? How does it work?
The global positioning system (GPS) is a worldwide satellite-based tracking system that enables users to determine their position anywhere on the earth.
4. What are some of the basic questions addressed by location-based services?
These questions focus on the utility of products and services based on the current location of a customer.

5. How are location-based services being integrated with social networking?
Individuals can now identify location in messages and can socialize based on location.

6. What are some of the key barriers to l-commerce?

- Accuracy of devices. Some of the location technologies are not as accurate as people expect them to be.

- The cost-benefit justification. For many potential users, the benefits of location-based services do not justify the cost of the hardware or the inconvenience and time required to utilize the service.

- Limited network bandwidth. Wireless bandwidth is currently limited; it will be improved as 3G technology spreads.

- Invasion of privacy. When “always-on” cell phones are a reality, many people will be hesitant to have their whereabouts and movements tracked throughout the day, even if they have nothing to hide.

Section 8.8 Review Questions

1. How is m-commerce security similar to e-commerce security? How is it different?
Basic security goals of confidentiality, authentication, authorization, and integrity are just as important for m-commerce as they are for e-commerce but are more difficult to ensure.

2. Discuss the role that usability plays in the adoption of m-commerce.
Because of their mobile nature, current mobile devices generally have small screen sizes and may be difficult to use because of this. Since ease-of-use is driving many IT advancements, mobile commerce must be similarly easy to use.

3. Discuss a few of the technical limitations of m-commerce.
See Exhibit 8.6, page 366. The technical limitations include lack of the standardized security protocol, insufficient bandwidth, 3G licenses, transmission and power consumption limitations, and WAP limitations.

4. Describe the potential impact of mobile devices on the workplace.

Mobile devices can impose isolation on a workforce. Personal nature of mobile device raises ethical and legal issues in the workplace.

Section 8.9 Review Questions
1. Define pervasive computing.

Pervasive computing is invisible, everywhere computing; computing capabilities being embedded into the objects around us.

2. List four principles of pervasive computing.

- Decentralization. The decentralization of computing that began with the transition from the centralized mainframe computer to the personal computer will continue in pervasive computing.

- Diversification. Computing devices will evolve from a fully functional one-computer does-all paradigm to one in which specialized, diversified devices will suit the requirements of an individual for a specific purpose.

- Connectivity. The independent pervasive computing devices—tags, sensors, badges—will be seamlessly connected to the network or to each other.

- Simplicity. These devices must be designed for simplicity of use. Intuitive interfaces, speech recognition, one-handed operation, instant on, and always connected are a few of the requirements for high but simple usability.

3. What is the Internet of Things?

The belief that everything will be trackable and thus objects will be able to be found and evaluated individually.

4. Describe how RFID works. What role does EPC play in RFID?

Radio frequency identification (RFID) technology uses radio waves to identify items. RFID tag remains inactive until radio frequency energy from the radio transmitter hits its antenna, giving the chip enough power to emit a 96-bit string of information, which is read by the radio receiver.

The reader passes this information to a computer for processing, either wirelessly or through a docking station. The EPC can be attached to the RFID signal, and can include an electronic product code that specifies the manufacturer, producer, version, and serial number of each (product) item.

5. Describe some of the current tracking applications of RFID.

RFID can be used to track a large variety of objects, such as merchandise in a warehouse or store, as well as equipment used by employees and customers.

6. How does a sensor network work?
A sensor network is a series of interconnected sensors. As a network, they monitor the environment in which they are placed and report back on defined actions within that environment.

7. Describe some of the applications of sensor networks. A number of applications that allow for control of a distributed system are detailed in Exhibit 8.8.

8. In what ways can pervasive computing impinge on an individual’s right to privacy? By providing tracking information, these systems could potentially store information about personal movements and purchasing decisions.

Answers to EC Application Case Questions

EC Application Case 8.1 - CLOSING THE DIGITAL DIVIDE WITH MOBILE MICROFINANCE

1. What is microfinance?

Microfinance refers to the provision of financial services to poor or low-income clients, including consumers and the self-employed.

2. What problem is Grameen Koota trying to solve by adopting mobile loans and payments?

They are hoping to make the maintenance and reporting on these loans easier.

3. How will mobile loans and payments work for organizations like Grameen Koota?

The system would allow them to process more loans and payments, with an easier process.

EC Application Case 9.2: WI-FI SENSOR NET AIDS WINEMAKERS

1. How is the Wi-Fi sensor net contributing to Pickberry’s core competency of grape production?

Pickberry wants information that can help them workout what grape growing conditions produce good quality grapes. Sensors that monitor the conditions known to be key influences on grape quality have been placed throughout the vineyard. A sensor communicates its data to a central server by hopping from one Wi-Fi access point to
another. The analysis engine on the server has a series of alerts built in that tells the growers when particular levels of indicators, such as soil moisture or temperature, are reached. Then corrective action can be taken.

2. **Why is Wi-Fi such an important part of this solution?**

Wi-Fi provides data from 30 acres back to home base without having to run cables and without having to have radio transmitters that are powerful enough to make the leap from one end of the field to the other.

3. **What are the results for Pickberry, the environment, and for the wine industry?**

The data helped the Pickberry grape growers know much more about the health of their vines in different parts of the vineyard. The analysis also was used to reduce the application of fungicides to control mildew. The data also helped the viticulturists work out the conditions that produce the best grapes.

**Answers to Discussion Questions**

1. **Discuss how m-commerce can expand the reach of EC.**

Student answers will vary. Mobile commerce eliminates the barrier of physical location in electronic commerce by allowing individuals to conduct commerce from any location at any time.

2. **Which of the m-commerce limitations listed in this chapter do you think will have the biggest near-term negative impact on the growth of m-commerce? Which one will be minimized within 5 years? Which ones will not?**

Student opinions will vary.

3. **Describe the ways in which Wi-Fi is affecting the use of cell phones for m-commerce.**

Some will argue that increased Wi-fi decreases the need for mobile networks for commerce.

4. **WiMax, municipal Wi-Fi, and WWAN are all used to provide wide area access to the Internet. Which of these technologies is likely to survive into the future? Why or why not?**

Each technology offers benefits that may be more advantageous based on the region in which it is used. Student opinions on these technologies will vary.

5. **Discuss the factors that are critical to the overall growth of mobile banking and mobile payments.**
Critical factors include acceptance by individuals (based on ease of use, convenience, and perception of security) and a critical mass of sales locations and vendors.

6. Suppose you worked for a fashion retailer and were in charge of a new mobile advertising campaign designed to generate sales for a new clothing line. Describe the basic elements of your campaign and guidelines you would use to conduct it.

Individual student plans will vary based on assumptions, but may resemble the plan conducted by A/X.

7. What is the relationship between mobile sales force automation, mobile field force automation, and mobile CRM?

Each allows the worker the ability to access information away from the office, and each provides the firm with the ability to better understand what each worker is doing.

8. Why are many of the more popular mobile gambling sites located on small island countries?

This is to circumvent the legal issues surrounding their use.

9. How are GPS and GIS related?

GIS displays maps and directions, and GPS displays physical locations. When GPS and GIS are integrated, users can find where they are and receive directions from a map.

10. Location-based services can help a driver find his or her car or the closest gas station. However, some people view location-based services as an invasion of privacy. Discuss the pros and cons of location-based services.

Student responses will vary, but will focus on the tradeoffs between convenience and privacy.

11. Describe some of the activities that are being monitored by RFID and sensor networks.

RFID can be used to track a large variety of objects, such as merchandise in a warehouse or store, as well as equipment used by employees and customers.

Internet Exercises
(Note: URLs may change over time; please check the Internet Exercises on the Turban Web site for possible updates: www.prenhall.com/turban.)
1. **Learn about smartphones** by visiting vendors’ sites such as Nokia, RIM, Apple, Motorola, and others. List the capabilities the various devices from these vendors offer for supporting m-commerce. In the future, what sort of new capabilities will be provided by smartphones?

   Student responses will vary.

2. **Research the status of 3G and the future of 4G** by visiting 3gnewsroom.com (you can find information on 4G by searching for the term at the site). Prepare a report on the status of 3G and 4G based on your findings.

   Student answers will vary based on when the report is made.

3. **You’ve been asked to put together a directory of Wi-Fi hotspots** in your local area. There are a number of sites, such as hotspot-locations.com, that offer search capabilities for finding hotspots in a given area. Construct a list of sites that offer this feature. Using these sites, create a directory for your area. Knowing what you do about the Wi-Fi sites in your area, which of the sites seems to produce the best list?

   Student answers will vary.

4. **Enter mapinfo.com and download their white paper on location intelligence** (found in the Highlights section of the homepage). Based on the white paper, discuss the role that location intelligence plays in retail, financial applications, insurance, government, and communications.

   Student responses will vary.

5. **Most of the major social networking sites provide mobile capabilities.** The same is true for newer startups like Loopt and GyPSii. Compare and contrast the types of social networking capabilities provided by the major sites and the start-ups.

   Student responses will vary.

6. **Juniper Research has created a variety of white papers dealing with different segments of the mobile entertainment market (e.g., mobile games).** Go to juniperresearch.com/index.php and download a white paper dealing with one of these segments. Use the white paper to develop a written summary of the market segment you selected—the size of the market, the major vendors, the factors encouraging and impeding its growth, and the future of the market segment.

   Student responses will vary.
7. Enter gpshopper.com. What sorts of products and services do they provide? One of their products is Slifter. Go to slifter.com and run the demo. Enter nearbynow.com. Compare the products and services they provide with those offered by GPShopper.

Student responses will vary.

8. Find information about Google Maps for mobile devices. Also review the capabilities of Google SMS and other Google applications. Write a report on your findings.

Student responses will vary.

9. Provide a general description of the EPC identification standard. What role do EPCGlobal (epcglobalinc.org) and the Auto-ID Labs (autoidlabs.org) play in this standard? EPCGlobal has developed a set of policies for the use of EPCs. What are these policies and how are they enforced?

Student responses will vary.

10. Crossbow (xbow.com) and Dust Networks (dustnetworks.com) offer products for building sensor technology applications. Compare and contrast the products offered by the two companies, including the types of network protocols used by each and the type of applications to which they are well suited.

Student responses will vary.

Team Assignments and Role Playing

1. Each team should examine a major vendor of mobile devices (Nokia, Kyocera, Motorola, Palm, BlackBerry, etc.). Each team will research the capabilities and prices of the devices offered by each company and then make a class presentation, the objective of which is to convince the rest of the class why one should buy that company’s products.

Student reports will vary.

2. Each team should explore the commercial applications of m-commerce in one of the following areas: financial services, including banking, stocks, and insurance; marketing and advertising; manufacturing; travel and transportation; human resources management; public services; and health care. Each team will present a report to the class based on their findings. (Start at mobiforum.org.)

Student reports will vary.

3. Each team will investigate a global organization involved in m-commerce, such as gmcforum.com, wimaxforum.com and openmobilealliance.com. The teams will
investigate the membership and the current projects the organization is working on and then present a report to the class based on their findings.

Student reports will vary.

4. Each team will investigate a standards-setting organization and report on its procedures and progress in developing wireless standards. Start with the following: atis.org, etsi.org, and tiaonline.org.

Student reports will vary.

5. Each team should take one of the following areas—homes, cars, appliances, or other consumer goods such as clothing—and investigate how embedded microprocessors are currently being used and will be used in the future to support consumer-centric services. Each team will present a report to the class based on their findings.

Student reports will vary.

6. Address the following topics in a class discussion:

   a. Discuss how m-commerce can solve some of the problems of the digital divide (the gap within a country or between countries with respect to people’s ability to access the Internet).

   b. Discuss what Weiser meant when he said that computers would become invisible.

Student reports will vary.

Closing Case: WAL-MART TURNS TO MOBILE FOR WEATHER ALERTS

1. Why was Wal-Mart interested in instituting an automated weather alert system?

The firm wanted to be able to alert employees and others about disruptive and dangerous weather.

2. How does the Smart Notification Weather Service work? Why is it more precise, accurate, and relevant than the NWS tracking system?

The system aggregates information from multiple partners and sends it to subscribers. The aggregation of information provides a more detailed description of conditions than the NWS.
3. What are the benefits of the Smart Notification Weather Service for Wal-Mart?

The system allows for better decision making in relation to store operations and employee safety.