Chapter 9

Mobile Commerce and Pervasive Computing

Learning Objectives

1. Define mobile commerce and understand its relationship to e-commerce.
2. Understand the mobile computing environment that supports m-commerce.
3. Describe the four major types of wireless telecommunications networks.
4. Discuss the value-added attributes and fundamental drivers of m-commerce.
5. Discuss m-commerce applications in finance, advertising, and provision of content.

Learning Objectives

6. Describe the application of m-commerce within organizations.
7. Understand B2B and supply chain management applications of m-commerce.
8. Describe consumer and personal applications of m-commerce.
9. Understand the technologies and potential application of location-based m-commerce.
10. Describe the major inhibitors and barriers of m-commerce.
11. Discuss the key characteristics and current uses of pervasive computing.

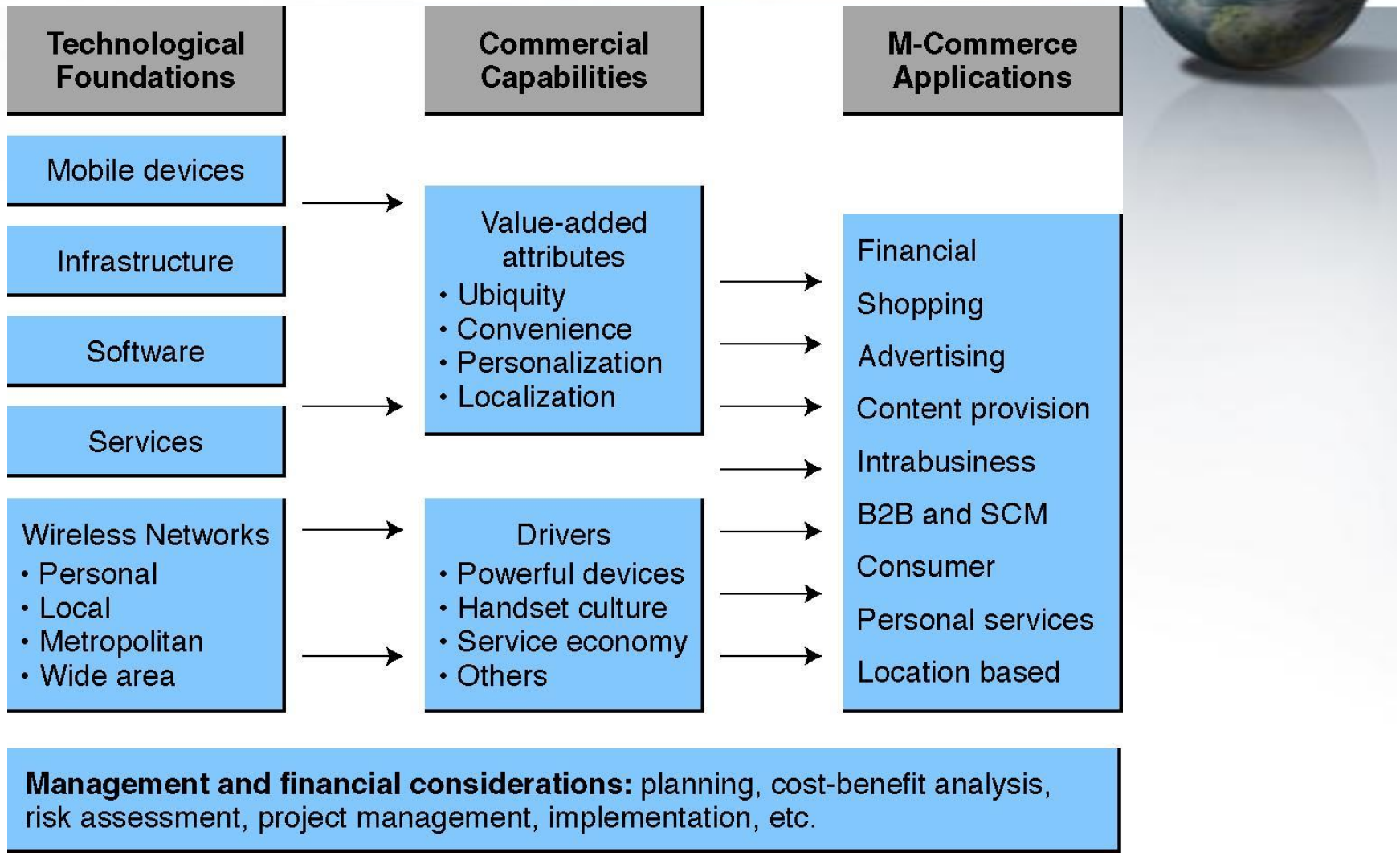
Mobile Computing

- Overview of Mobile Commerce

  mobile commerce (m-commerce, m-business)

  Any business activity conducted over a wireless telecommunications network

Exhibit 9.1 The Mobile Commerce Landscape



Mobile Computing

- Mobile Computing Devices

  personal digital assistant (PDA)

  A handheld computer principally used for personal information management

  smartphone

  Internet-enabled cell phones that can support mobile applications

  blackberry

  A handheld device principally used for e-mail

Mobile Computing

- Mobile Computing Devices

  wireless mobile computing (mobile computing)

  Computing that connects a mobile device to a network or another computing device, anytime, anywhere

  synchronization

  The exchange of updated information with other computing devices

Exhibit 9.2 The Wireless Mobile Environment

	Wired	Wireless
Mobile	Laptop computer PDA	Cellular phone Wireless laptop or PDA Blackberry, smartphone, Ogo, etc.
Fixed	Desktop computer Landline phone Cable television	Free-to-air television Amateur radio Commercial radio

Mobile Computing

- Mobile Computing Software

  microbrowser

  Wireless Web browser designed to operate with small screens and limited bandwidth and memory requirements

  Wireless Application Protocol (WAP)

  A suite of network protocols designed to enable different kinds of wireless devices to access WAPreadable files on an Internet-connected Web server

Mobile Computing

Wireless Markup Language (WML)

A scripting language used to create content in the WAP environment; based on XML, minus unnecessary content to increase speed

Compact Hypertext Markup Language (cHTML)

A scripting language used to create content in i-mode

Mobile Computing

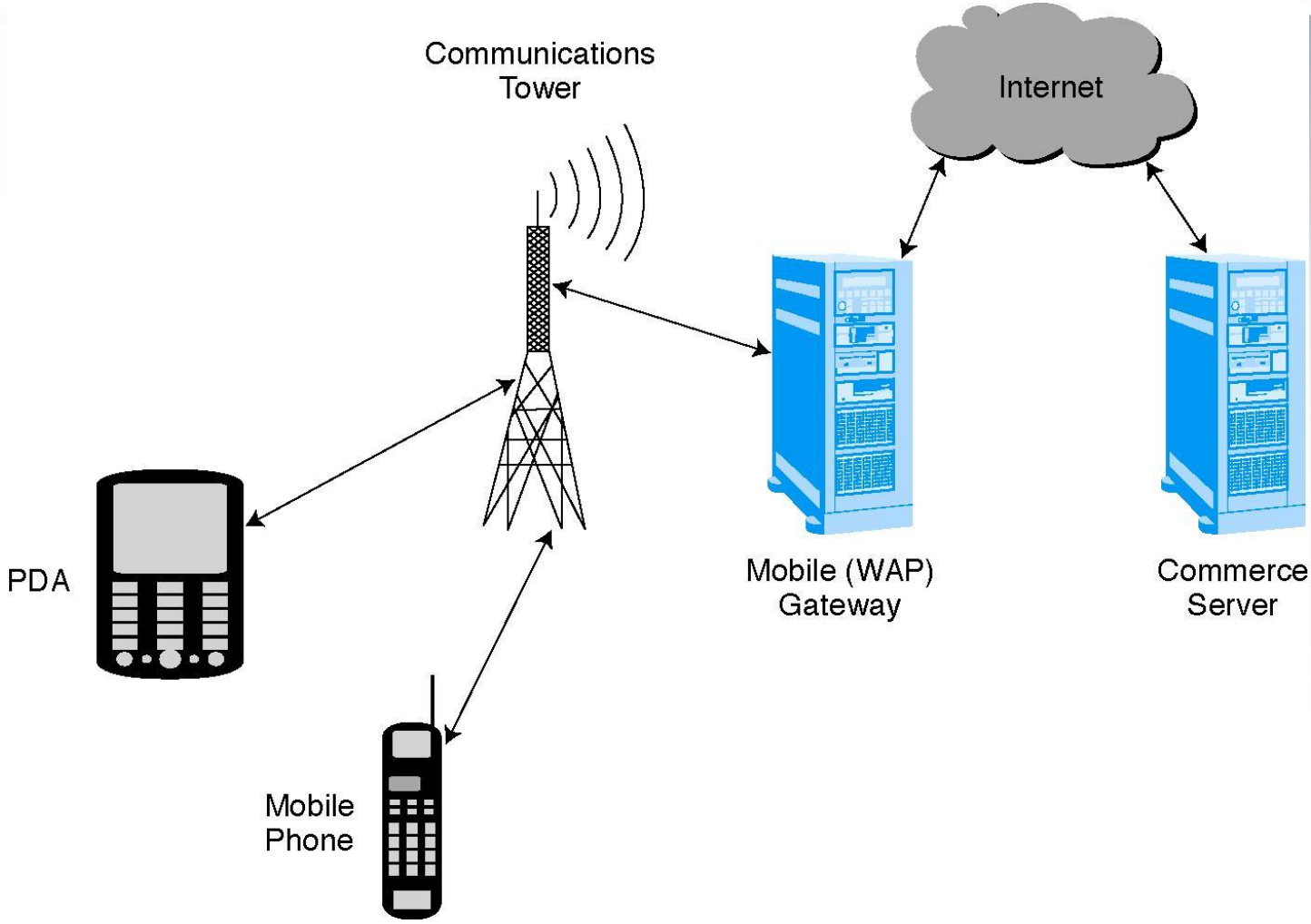
Extensible Hypertext Markup Language (xHTML)

A general scripting language; compatible with HTML; set by W3 Consortium

Voice XML (VXML)

An extension of XML designed to accommodate voice

Exhibit 9.4 WAP Architecture



Mobile Computing

- Mobile Computing Services
  - **Short Message Service (SMS)**
  - A service that supports the sending and receiving of short text messages on mobile phones
  - **Enhanced Messaging Service (EMS)**
  - An extension of SMS that can send simple animation, tiny pictures, sounds, and formatted text
  - **Multimedia Messaging Service (MMS)**
  - The next generation of wireless messaging; MMS will be able to deliver rich media

Mobile Computing

- Mobile Computing Services

micropayments

Electronic payments for small-purchase amounts (generally less than $10)

global positioning system (GPS)

A worldwide satellite-based tracking system that enables users to determine their position anywhere on the earth

Mobile Computing

- Mobile Computing Services

interactive voice response (IVR)

A computer voice system that enables users to request and receive information and to enter and change data through a telephone

voice portal

A Web site with an audio interface that can be accessed through a telephone call

Wireless Telecommunications Networks

- Personal Area Networks

  personal area network (PAN)

  A wireless telecommunications network for device-to-device connections within a small range

  Bluetooth

  A set of telecommunications standards that enables wireless devices to communicate with each other over short distances

Wireless Telecommunications Networks

- Wireless Local Area Networks

  wireless local area network (WLAN)

  A telecommunications network that enables users to make medium-range wireless connections to the Internet or another network

  Wi-Fi (wireless fidelity)

  The common name used to describe the IEEE 802.11 standard used on most WLANs

Wireless Telecommunications Networks

- Wireless Local Area Networks

  802.11b

  The most popular Wi-Fi standard; it is inexpensive and offers sufficient speed for most devices; however, interference can be a problem

  802.11a

  This Wi-Fi standard is faster than 802.11b but has a smaller range

  802.11g

  This fast but expensive Wi-Fi standard is mostly used in businesses

Wireless Telecommunications Networks

- Wireless Local Area Networks

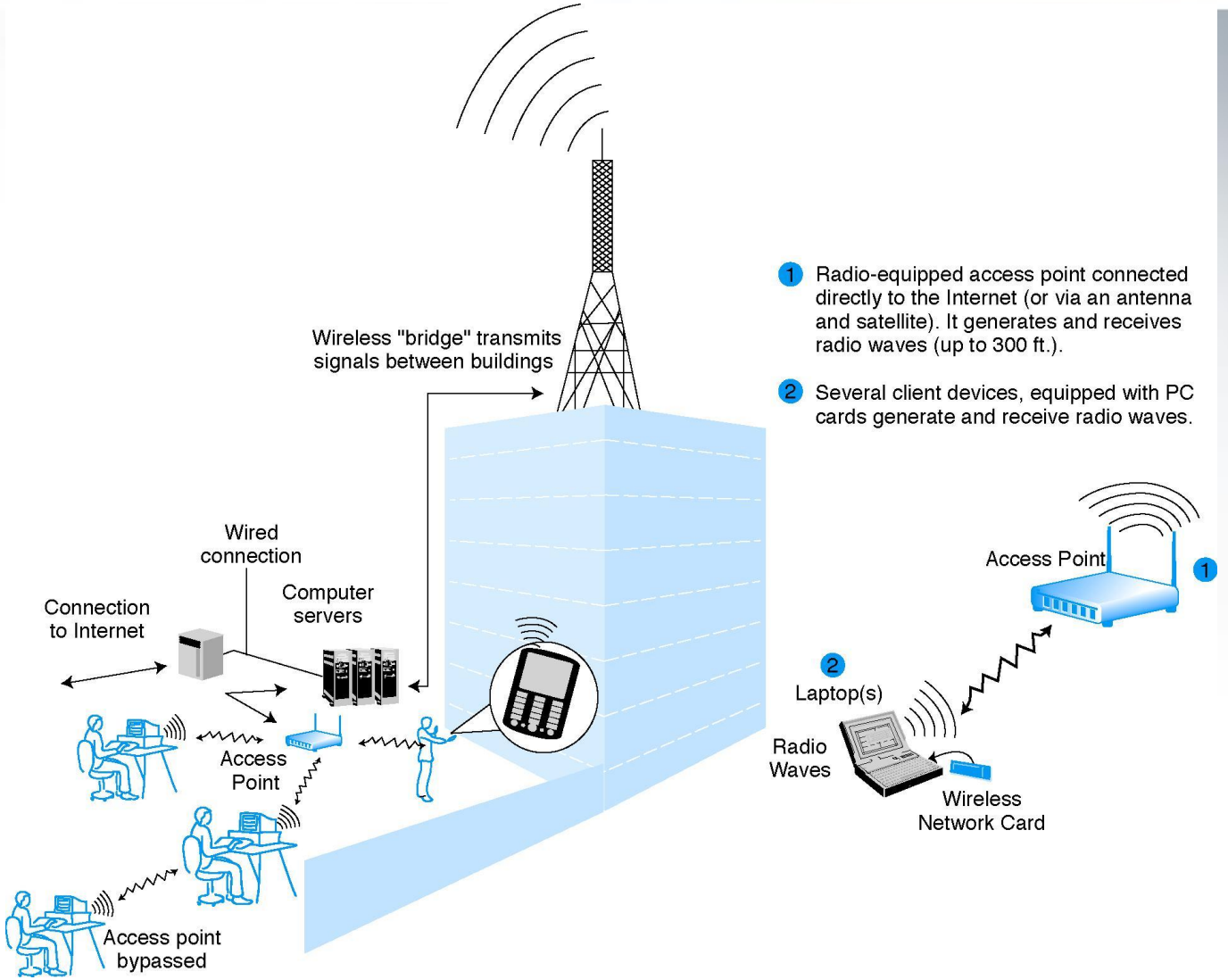
wireless access point

An antenna that connects a mobile device to a wired LAN

hotspot

An area or point where a wireless laptop or PDA can make a connection to a wireless local area network

Exhibit 9.5 How Wi-Fi Works



Wireless Telecommunications Networks

- Wireless Metropolitan Area Networks

WiMax

A wireless standard (IEEE 802.16) for making broadband network connections over a large area

wireless metropolitan area network (WMAN)

A telecommunications network that enables users to make long-range wireless connections to the Internet or another network

Wireless Telecommunications Networks

- Wireless Wide Area Networks

wireless wide area network (WWAN)

A telecommunications network that offers wireless coverage over a large geographical area, typically over a cellular phone network

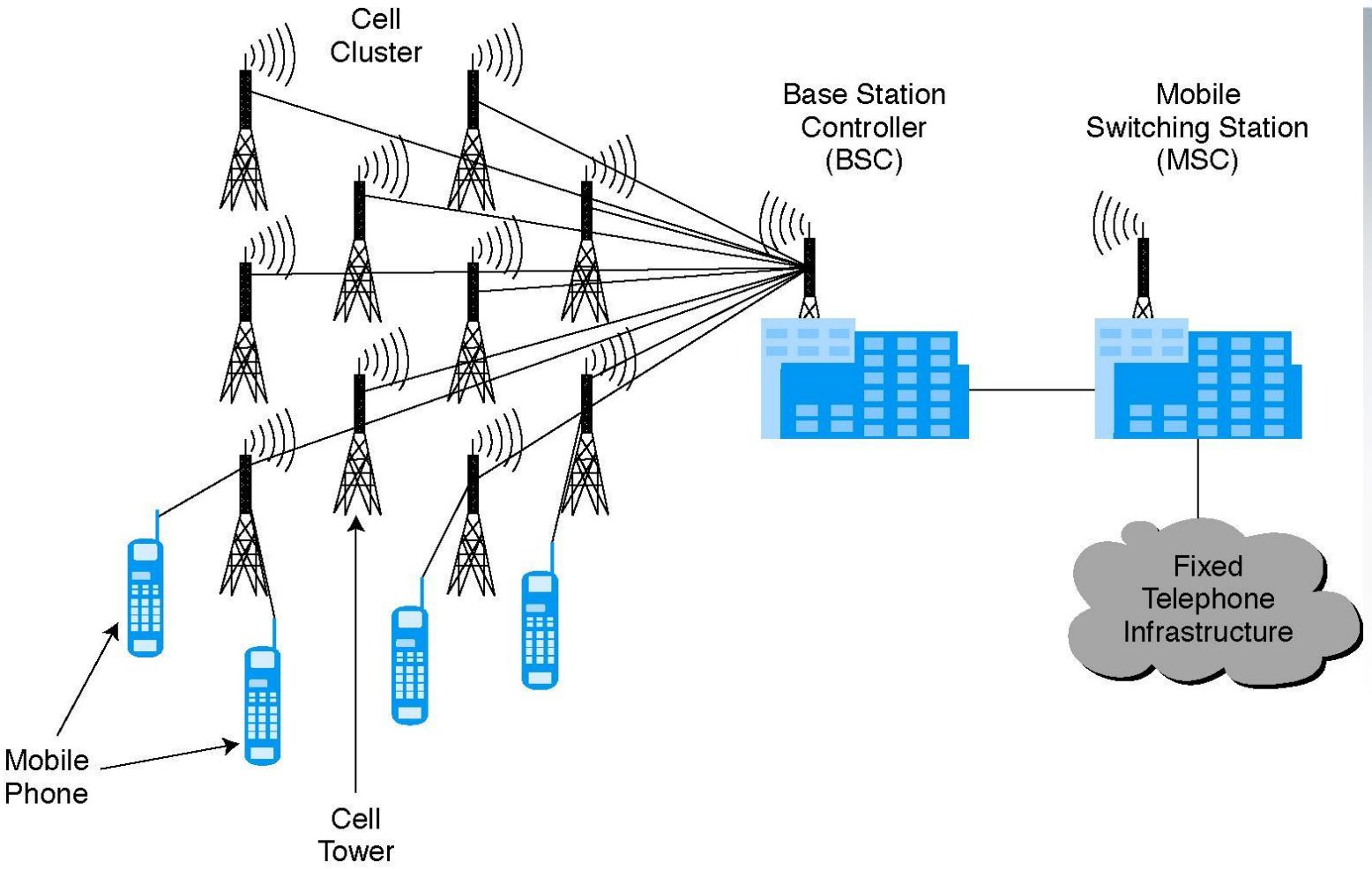
Wireless Telecommunications Networks

- Wireless Wide Area Networks
  - Physical Topology of a WWAN

subscriber identification module (SIM) card

An extractable storage card used for identification, customer location information, transaction processing, secure communications, and the like

Exhibit 9.6 Cellular Telephone Network



Wireless Telecommunications Networks

- WWAN Communication Bandwidths
  - **1G.** The first generation of wireless technology, which was analog based
  - **2G.** The second generation of digital wireless technology; accommodates voice and text
  - **2.5G.** An interim wireless technology that can accommodate voice, text, and, limited graphics
  - **3G.** The third generation of digital wireless technology; supports rich media such as video
  - **4G.** The expected next generation of wireless technology that will provide faster display of multimedia

Wireless Telecommunications Networks

- Wireless Wide Area Networks
  - WWAN Communication Protocols
    - Frequency Division Multiple Access (FDMA)
    - Time Division Multiple Access (TDMA)
    - Code Division Multiple Access (CDMA)
  - WWAN Network Systems

    Global System for Mobile Communications (GSM)

    An open, nonproprietary standard for mobile voice and data communications

Mobile Commerce

- Attributes of M-Commerce
  - Ubiquity
  - Convenience
  - Interactivity
  - Personalization
  - Localization

Mobile Financial Applications

- Mobile Banking
- Wireless Electronic Payment Systems
  - Wireless Wallets

    m-wallet (mobile wallet)

    Technologies that enable cardholders to make purchases with a single click from their wireless device
- Wireless Bill Payments
  - A number of companies now provide the option of paying bills directly from a cell phone

Mobile Shopping, Advertising, and Content Provision

- Wireless Shopping
  - An increasing number of online vendors allow customers to shop from wireless devices
  - Enables customers to use cell phones or wireless PDAs to:
    - Perform quick searches
    - Compare prices
    - Use a shopping cart
    - Order
    - View the status of their order

Mobile Shopping, Advertising, and Content Provision

- Targeted Advertising
  - Marketers send user-specific advertising messages to wireless devices
  - Location-sensitive advertising informs buyers about shops, malls, and restaurants close to where the mobile device owner is located

    mobile portal

    A customer interaction channel that aggregates content and services for mobile users

Mobile Intrabusiness Applications

- Support of Mobile Employees

  sales force mobilization

  The process of equipping sales force employees with wireless computing devices

  – Job Dispatch

    wearable devices

    Mobile wireless computing devices for employees who work on buildings and other climbable workplaces

Mobile Intrabusiness Applications

- Customer Support

  Mobile access extends the reach of CRM to both employees and business partners on a 24/7 basis, to any place where recipients are located

Mobile Intrabusiness Applications

- Non-Internet Intrabusiness Applications
  - Wireless networking, used to pick items out of storage in warehouses
  - Delivery-status updates
  - Collection of data
  - Monthly pay slips sent as SMS messages sent to employees' mobile phones
  - Property adjusters report from the scene of an accident
  - Sales representatives check orders and inventories during their visits to customers

B2B M-Commerce and Supply Chain Management

- Use of wireless communication to share information along the supply chain and to collaborate with partners
- By integrating the mobile computing device into supply chain communications, it is possible to:
  - Make mobile reservations of goods
  - Remotely check availability of a particular item in the warehouse
  - Order a customized product from the manufacturing department
  - Provide secure access to confidential financial data from a management information system

Mobile Consumer and Personal Service Applications

- Mobile Games
- Wireless Telemedicine
- Other Mobile Computing Services for Consumers
- Non-Internet Mobile Applications for Consumers

Location-Based Mobile Commerce

location-based m-commerce

Delivery of m-commerce transactions to individuals in a specific location, at a specific time

- The services provided through location-based m-commerce focus on five key areas:
  - Location
  - Navigation
  - Tracking
  - Mapping
  - Timing

Location-Based Mobile Commerce

Global Positioning System (GPS)

A worldwide satellite-based tracking system that enables users to determine their position anywhere on the earth

geographical information system (GIS)

An information system that integrates GPS data onto digitized map displays

Location-Based Mobile Commerce

- Emergency Response Cell Phone Calls

  wireless 911 (e-911)

  In the United States, emergency response calls from cellular phones

  automatic crash notification (ACN)

  Device that automatically sends the police the location of a vehicle that has been involved in a crash

Location-Based Mobile Commerce

telematics

The integration of computers and wireless communications to improve information flow using the principles of telemetry

- Barriers to Location-Based M-Commerce
  - Accuracy of devices
  - The cost-benefit justification
  - Limited network bandwidth
  - Invasion of privacy

Security and Other Barriers to Mobile Commerce

- M-Commerce Security Issues
  - Malicious Code
  - Transaction Security
  - Wireless Communication
  - Physical Security of Mobile Devices
  - Ease of Use
- Technological Barriers to M-Commerce
- Ethical, Legal, and Health Issues in M-Commerce

Security and Other Barriers to Mobile Commerce

- Project Failures in M-Commerce
  - Do not start without appropriate infrastructure
  - Do not start a full-scale implementation; use a small pilot for experimentation
  - Pick an appropriate architecture (e.g., some users do not need to be persistently connected)
  - Talk with a range of users, some experienced and some not, about usability issues
  - Users must be involved; hold biweekly meetings if possible
  - Employ wireless experts
  - Wireless is a different medium from other forms of communication. Remember that people are not used to the wireless paradigm

Pervasive Computing

- Overview of Pervasive Computing

  pervasive computing

  Invisible, everywhere computing that is embedded in the objects around us

  – Principles of Pervasive Computing
    - Decentralization
    - Diversification
    - Connectivity
    - Simplicity

Pervasive Computing

- Overview of Pervasive Computing

  contextual computing

  The enhancement of a user's interactions by understanding the user, the context, and the applications and information required

Pervasive Computing

- Pervasive Computing Initiatives

  radio frequency identification (RFID)

  Technology that uses radio waves to identify items

  electronic product code (EPC)

  An RFID code that identifies the manufacturer, producer, version, and serial number of individual consumer products

Pervasive Computing

- Pervasive Computing Initiatives
  - Smart Homes
    - Lighting
    - Energy management
    - Water control
    - Home security and communications
    - Home entertainment
  - Smart Appliances
  - Smart Cars
  - Smart Clothes

Pervasive Computing

- Pervasive Computing Initiatives

  sensor network

  A series of interconnected sensors that monitor the environment in which they are placed

  – Sensor networks can:
    - Protect the environment
    - Public safety
    - Monitor business and agricultural areas

Pervasive Computing

- Barriers to Pervasive Computing
  - For pervasive systems to be widely deployed, it is necessary to overcome many of the technical, ethical, and legal barriers associated with mobile computing

Managerial Issues

1. What's our timetable?
2. Which applications first?
3. Is it real or just a buzzword?
4. Which system to use?

Summary

1. What is m-commerce?
2. Characteristics of mobile devices.
3. Wireless software development is difficult.
4. M-commerce support services.
5. Wireless telecommunications networks.
6. Value-added attributes of m-commerce.
7. Drivers of m-commerce.

Summary

8. Finance, advertising, and content-providing applications.
9. Intrabusiness applications.
10. B2B and SCM applications.
11. Consumer applications.
12. Location-based commerce.
13. Limitations of m-commerce.
14. Pervasive computing.