



# Wireless, Mobile Computing, and Mobile Commerce



## Chapter Outline

1. Wireless Technologies
2. Wireless Computer Networks and Internet Access
3. Mobile Computing and Mobile commerce
4. Pervasive Computing
5. Wireless Security





## Learning Objectives

- Discuss the various types of wireless devices and wireless transmission media.
- Describe Bluetooth, Zigbee, Wi-Fi and WiMax.
- Discuss the major M-commerce applications.
- Define pervasive computing.
- Describe the two technologies underlying pervasive computing.



## Wireless Technologies

- **Wireless devices** are small enough to easily carry or wear, have sufficient computing power to perform productive tasks and can communicate wirelessly with the Internet and other devices.
  - Include PDAs, cellular phones, smart phones.
- **Wireless Application Protocol (WAP)** is the standard that enables wireless devices with tiny display screens, low bandwidth connections and minimal memory to access Web-based information and services.



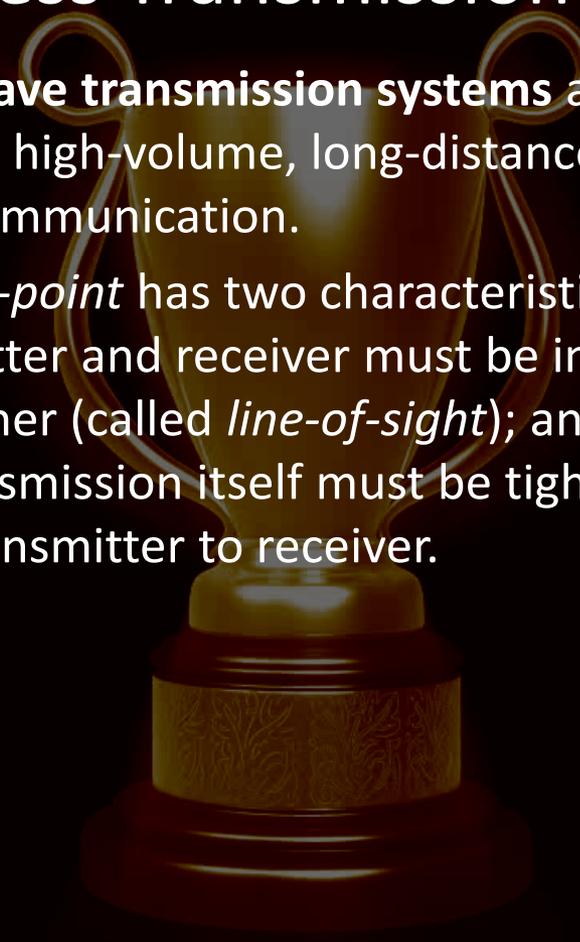
# Wireless Technologies (Continued)

- ❖ **Microbrowsers** are Internet browsers with a small file size that can work within low-memory constraints of wireless devices and the low bandwidths of wireless networks.
  - ❖ **Pager** is a one-way, wireless messaging system; it alerts the user when it receives an incoming message.
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## Wireless Transmission Media

- ❖ **Microwave transmission systems** are widely used for high-volume, long-distance, point-to-point communication.
- ❖ *Point-to-point* has two characteristics: first, the transmitter and receiver must be in view of each other (called *line-of-sight*); and second, the transmission itself must be tightly directed from transmitter to receiver.





# Wireless Transmission Media (Continued)

- ❖ **Satellite transmission** systems make use of communication satellites; three types of satellites, each in a different orbit:
- ❖ **Geostationary (GEO)**
- ❖ **Medium-earth-orbit (MEO)**
- ❖ **Low-earth-orbit (LEO)**



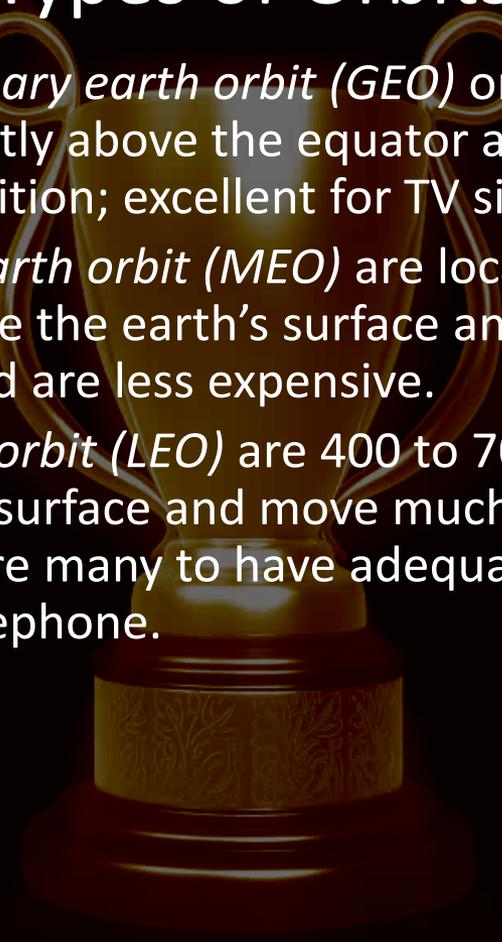
# Wireless Transmission Media (Continued)

- ❖ **Footprint** is the area of earth's surface reached by a satellite's transmission – overcomes the limitations of microwave data relay stations.
- ❖ **Broadcast transmission** allows satellites to send signals to many receivers at one time.
- ❖ **Propagation delay** is a brief pause in transmissions from GEO satellites which make two-way telephone conversations difficult.



## Types of Orbits

- ❖ *Geostationary earth orbit (GEO)* orbits 22,300 miles directly above the equator and maintains a fixed position; excellent for TV signals.
- ❖ *Medium earth orbit (MEO)* are located 6,000 miles above the earth's surface and move; used for GPS and are less expensive.
- ❖ *Low earth orbit (LEO)* are 400 to 700 miles above the surface and move much quicker so they require many to have adequate coverage; use for telephone.





# Global Positioning Systems

GPS is a wireless system that uses satellites to enable users to determine their position anywhere on the earth; supported by 24 shared satellites worldwide.



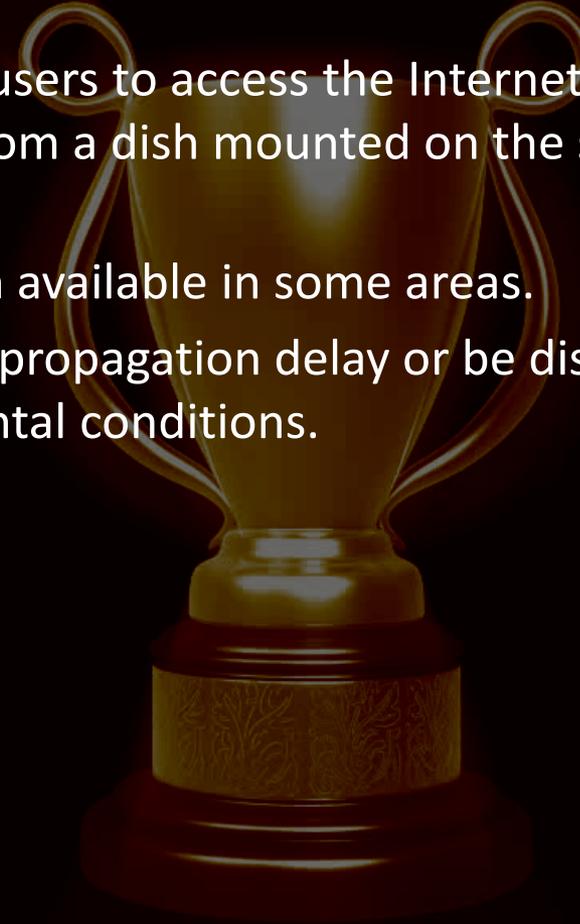


## Internet over Satellite (IOS)

IOS allows users to access the Internet via GEO satellites from a dish mounted on the side of their homes.

Only option available in some areas.

Can have a propagation delay or be disrupted by environmental conditions.





## Radio

- ❖ Radio transmission uses radio-wave frequencies to send data directly between transmitters and receivers.
- ❖ Satellite radio (digital radio) offers uninterrupted, near CD-quality music that is beamed to your radio from space. (XM satellite radio uses GEO; Sirius uses MEO)
- ❖ Infrared light is red light that is not commonly visible to human eyes; common uses in remote control units for TVs, VCRs, DVDs, CD players.

# Wireless Computer Networks and Internet Access

- ❖ IEEE standards for wireless computer networks include:
- ❖ IEEE 802.15 (Bluetooth) for wireless personal area networks (PANs) and 802.15.4 (Zigbee).
- ❖ IEEE 802.11 (Wi-Fi) for wireless local area networks (WLANs)
- ❖ IEEE 802.16 (Wi-Max) for wireless metropolitan area networks (WMANs)
- ❖ IEEE 802.20 (proposed) for wireless wide area networks (WWANs).



## Bluetooth

- ❑ **Bluetooth** is used to create small PANs: can link up to 8 devices within a 10-meter area; uses low-power, radio-based communications; can transmit up to 1 Mbps.
- ❑ **Personal area network (PAN)** is a computer network used for communication among computer devices (e.g., telephones, PDAs, smart phones) close to one person.



## Zigbee

- ❖ **Zigbee** targets applications that need low data transmission rates and low power consumption:
- ❖ moves data only one-fourth as fast as Bluetooth;
- ❖ Can handle hundreds of devices at once;
- ❖ most promising application is meter reading.
- ❖ Current focus is to wirelessly link sensors that are embedded into industrial controls, medical devices, smoke and intruder alarms and building and home automaton.



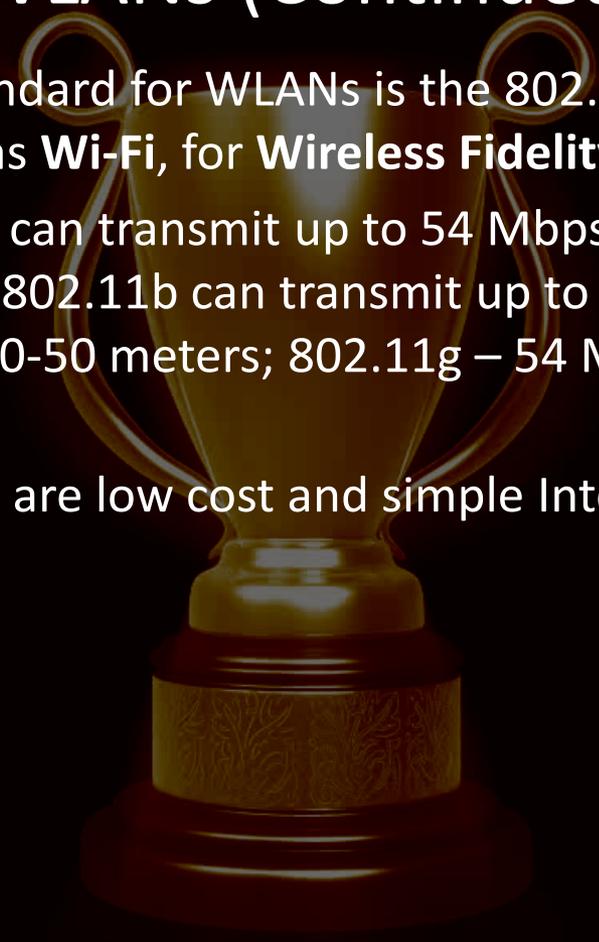
# Wireless Local Area Networks (WLANs)

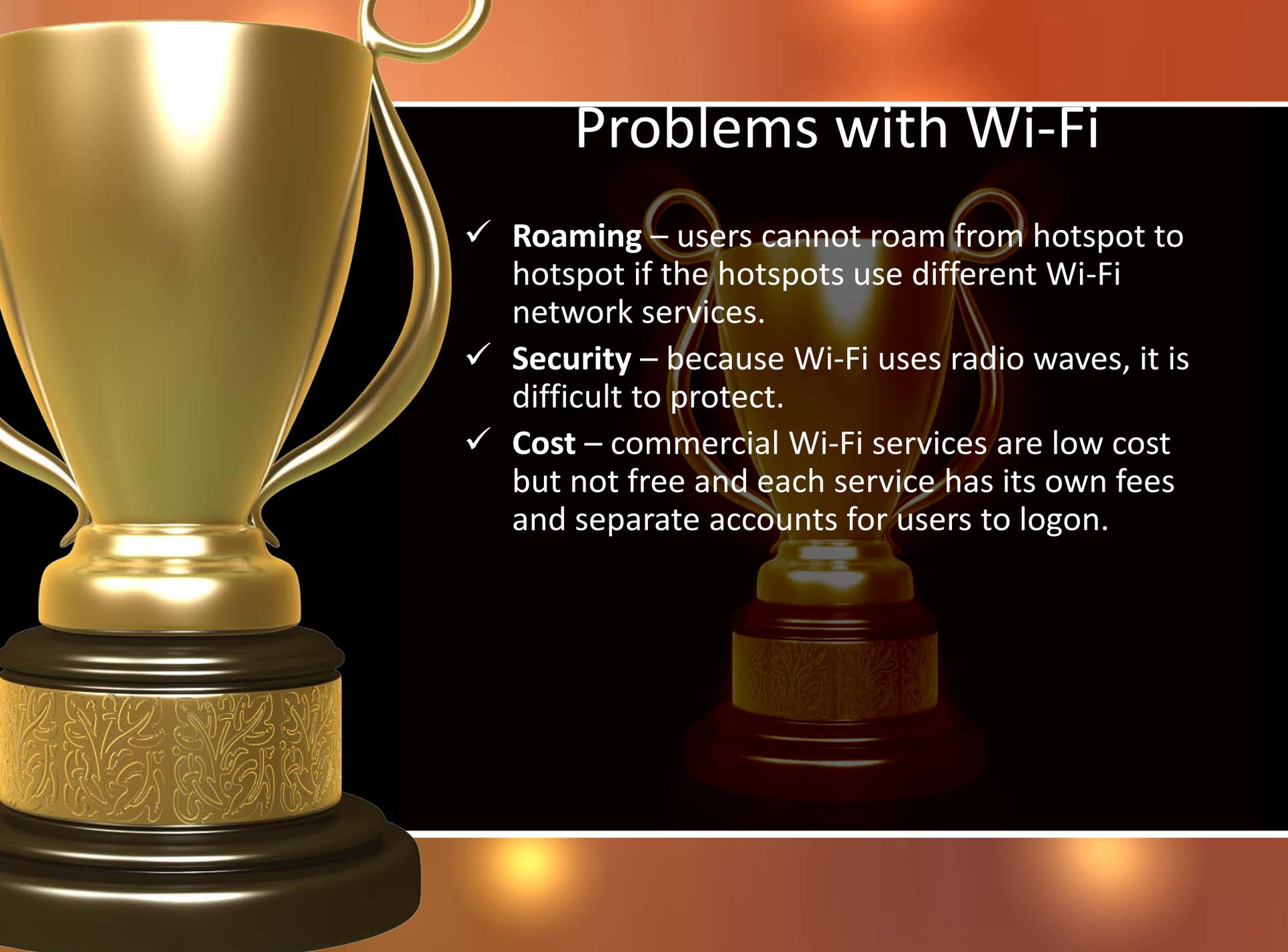
- ❖ **WLAN** requires a transmitter with an antenna, called a **wireless access point**, that connects to a wired LAN or to satellite dishes that provide an Internet connection.
- ❖ **Wireless network interface card (NIC)** is needed to communicate wirelessly and has a built-in radio and antenna.
- ❖ **Hotspot** a wireless access point that provides service to a number of users within a small geographical perimeter (up to a couple hundred feet).



## WLANs (Continued)

- IEEE standard for WLANs is the 802.11 family, known as **Wi-Fi**, for **Wireless Fidelity**.
- 802.11a can transmit up to 54 Mbps within 30 meters; 802.11b can transmit up to 11 Mbps within 30-50 meters; 802.11g – 54 Mbps, 50 meters.
- Benefits are low cost and simple Internet access.





# Problems with Wi-Fi

- ✓ **Roaming** – users cannot roam from hotspot to hotspot if the hotspots use different Wi-Fi network services.
- ✓ **Security** – because Wi-Fi uses radio waves, it is difficult to protect.
- ✓ **Cost** – commercial Wi-Fi services are low cost but not free and each service has its own fees and separate accounts for users to logon.



## WiMax

- ❑ **Worldwide Interoperability for Microwave Access**, popularly known as **WiMax**, is the name for IEEE standard 802.16.
- ❑ Wireless access range of up to 31 miles;
- ❑ Data transfer rate of 75 Mbps;
- ❑ Secure system that offers voice and video.





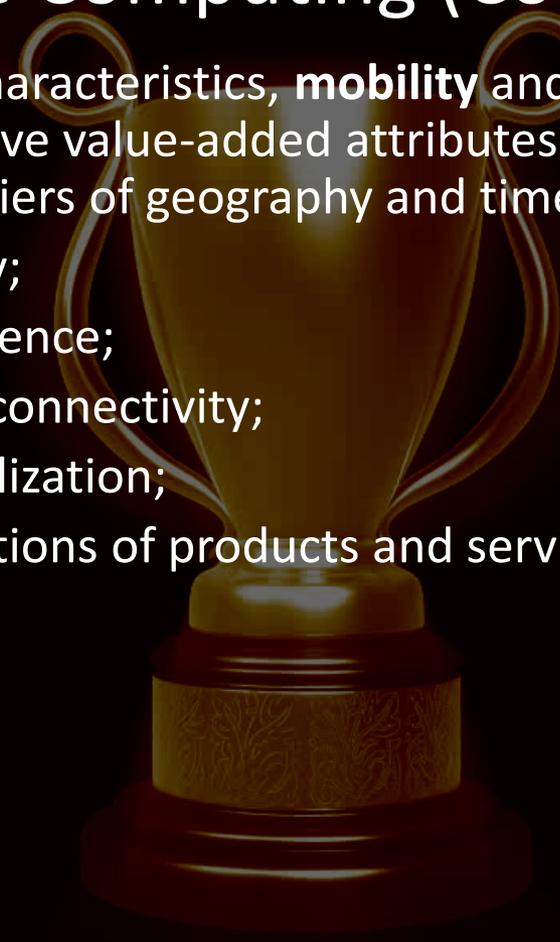
## 7.3 Mobile Computing and Mobile Commerce

- ❖ **Mobile computing** refers to real-time, wireless connection between a mobile device and other computing environments, such as the Internet or an intranet and have 2 major characteristics that differentiate it from other forms of computing.
- ❖ **1 Mobility** – users carry a mobile device and can initiate a real-time contact with other systems from wherever they happen to be.
- ❖ **2 Broad reach** – users can be reached instantly when they carry an open mobile device.



## Mobile Computing (Continued)

- ❖ The 2 characteristics, **mobility** and broad reach, create five value-added attributes that break the barriers of geography and time:
- ❖ Ubiquity;
- ❖ Convenience;
- ❖ Instant connectivity;
- ❖ Personalization;
- ❖ Localizations of products and services.





## Mobile Commerce

- ✓ M-commerce refers to e-commerce (EC) transactions that are conducted in a wireless environment especially via the Internet.
- ✓ The development of m-commerce is driven by the following factors:
  - ✓ Widespread availability of mobile devices
  - ✓ No need for a PC
  - ✓ The “Cell phone culture”
  - ✓ Declining prices
  - ✓ Bandwidth improvement



# Mobile Commerce Applications

- ❖ **Financial Services**
- ❖ **Mobile Banking**
- ❖ **Wireless Electronic Payment Systems**
- ❖ **Micropayments**
- ❖ **Mobile (Wireless) Wallets**
- ❖ **Wireless Bill Payments**



## Intrabusiness Applications

- Accessing Information
- Mobile Portal** aggregates and provides content and services for mobile users that include news, sports, email, entertainment, travel and restaurant information; community services; and stock trading.
- Voice Portal** is a Web site with an audio interface and can also be accessed through a standard or cell phone.





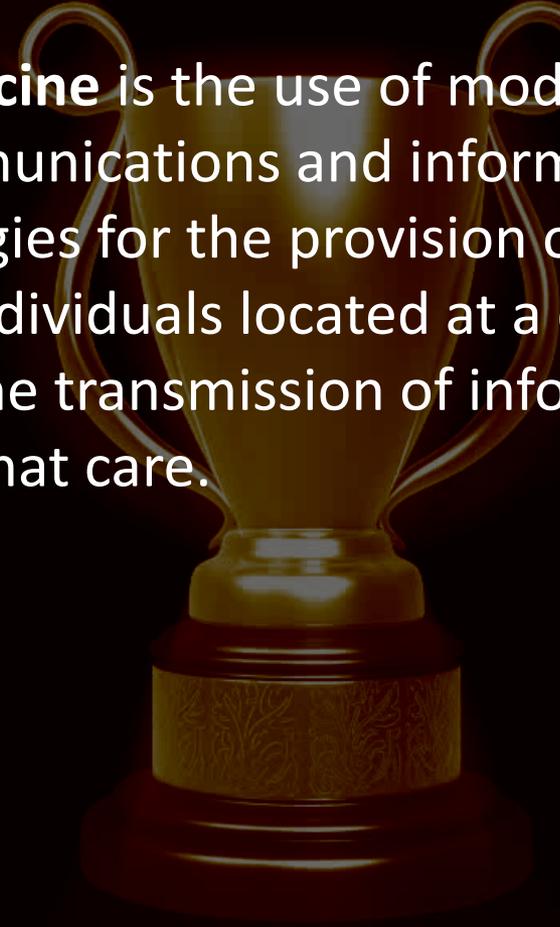
## Location-based Applications

- ✓ **Shopping from Wireless Devices** – online vendors allow customers to shop from wireless devices.
- ✓ **Location-based Advertising** is when marketers know the current locations and preferences of mobile users, they can send user-specific advertising messages to wireless devices about nearby shops, malls and restaurants.
- ✓ **Location-based Services** provide information to customers about local services and conditions via cell phones.



## Wireless Telemedicine

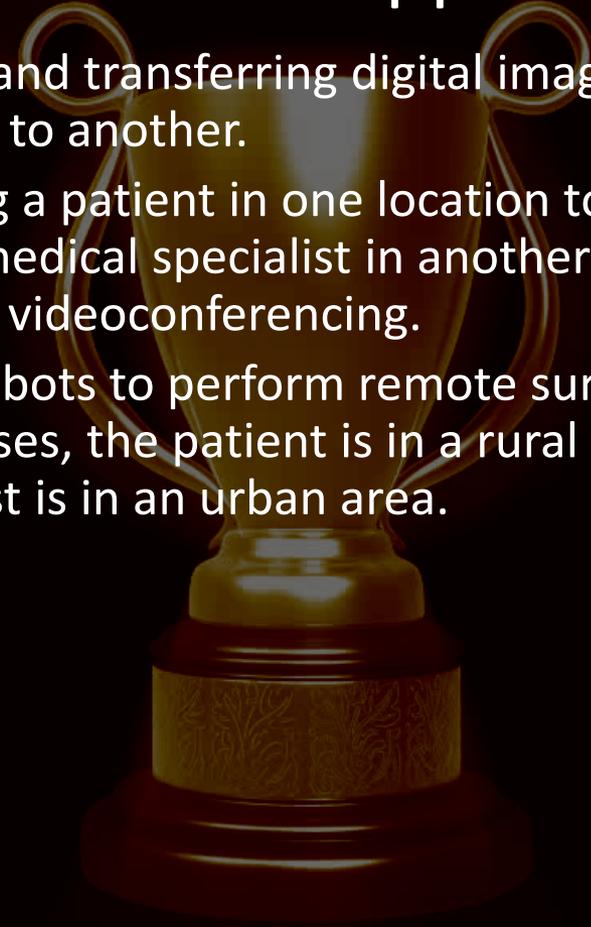
**Telemedicine** is the use of modern telecommunications and information technologies for the provision of clinical care to individuals located at a distance and for the transmission of information to provide that care.





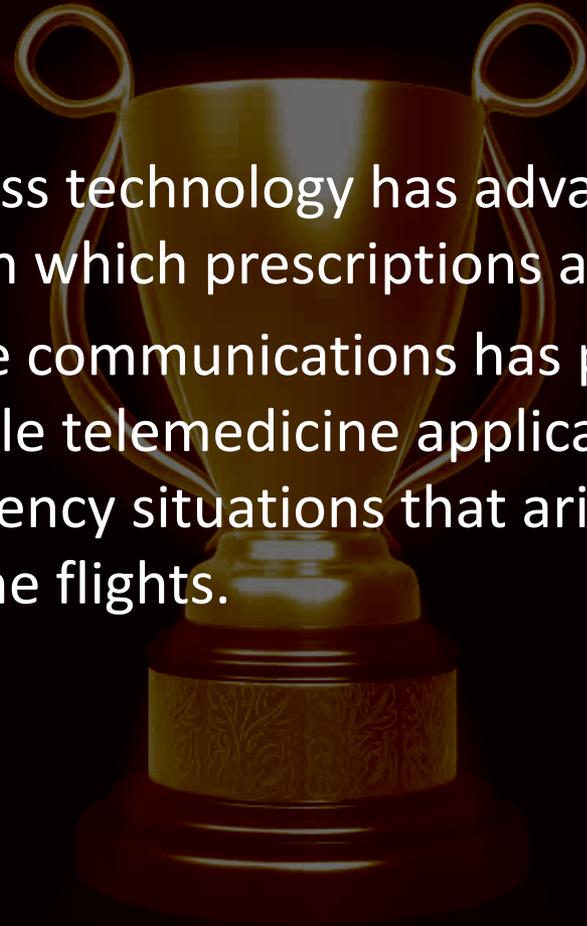
## Telemedicine Applications

- ✓ Storing and transferring digital images from one location to another.
- ✓ Allowing a patient in one location to consult with a medical specialist in another in real time through videoconferencing.
- ✓ Using robots to perform remote surgery, in most cases, the patient is in a rural area and the specialist is in an urban area.



# Wireless Telemedicine (Continued)

- ❑ Wireless technology has advanced the ways in which prescriptions are filled.
- ❑ Mobile communications has provided a valuable telemedicine application for emergency situations that arise during airplane flights.





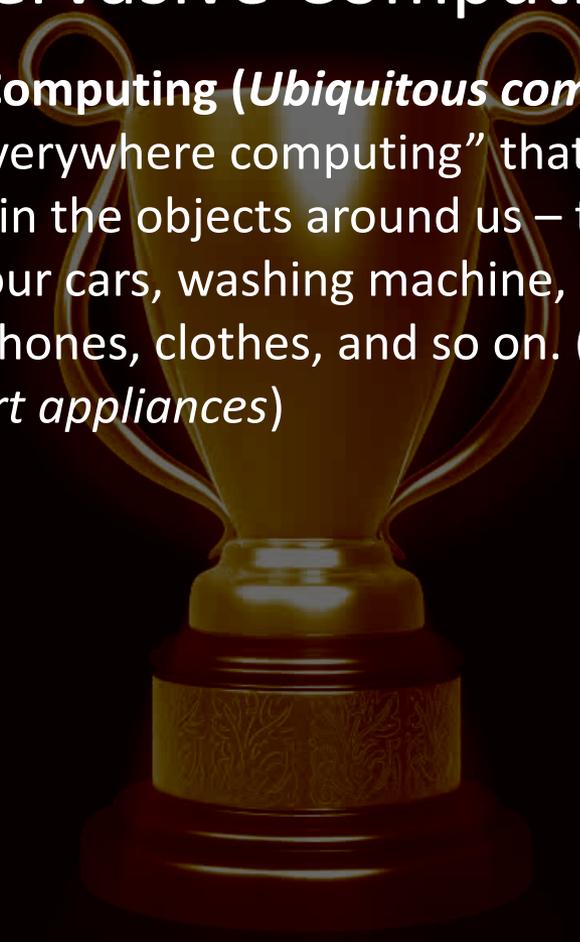
## Telemetry Applications

- ❑ **Telemetry** is the wireless transmission and receipt of data gathered from remote sensors.
- ❑ Technicians can use *telemetry* to identify maintenance problems in equipment;
- ❑ Doctors can monitor patients and control medical equipment from a distance;
- ❑ Car manufacturers use telemetry for remote vehicle diagnosis and preventive maintenance.



## Pervasive Computing

**Pervasive Computing (*Ubiquitous computing*)** is invisible “everywhere computing” that is embedded in the objects around us – the floors, the lights, our cars, washing machine, microwave oven, cell phones, clothes, and so on. (e.g., *smart home, smart appliances*)





## Radio Frequency Identification

- ❑ RFID Technology allows manufacturers to attach tags with antennas and computer chips on goods and then track their movement through radio signals.
- ❑ Auto-ID create a network that connects computers to objects, an Internet of “things”.
- ❑ This Internet of things will provide the ability to track *individual* items as they move from factories to store shelves to recycling facilities.
- ❑ The problem with RFID has been the expense.

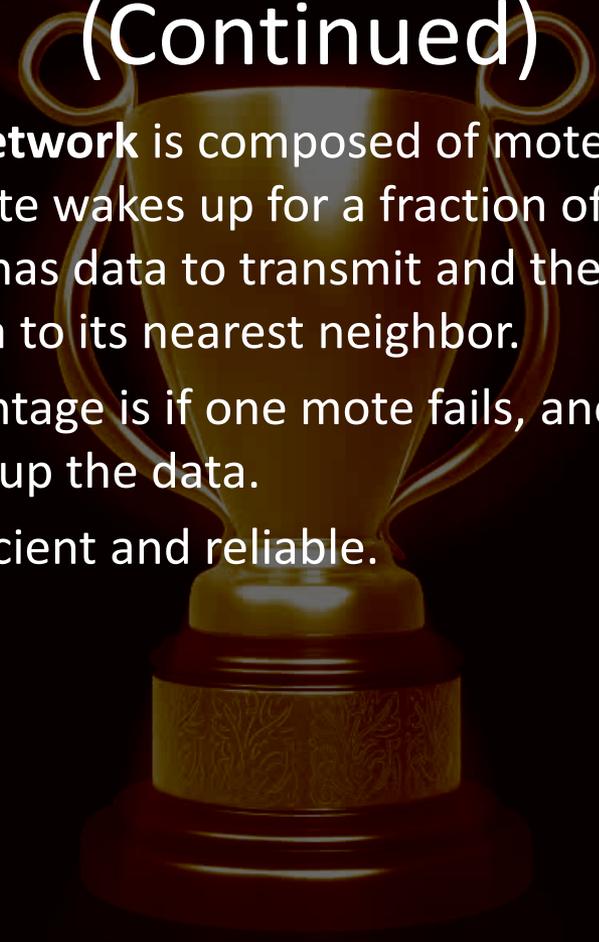


# Wireless Sensor Networks (WSNs)

- ❑ **Wireless Sensor Networks** are networks of interconnected, battery-powered, wireless sensors called *motes* that are placed into the physical environment.
  - ❑ **Motes** collect data from many points over an extended space.
  - ❑ Each **mote** contains processing, storage, and radio frequency sensors and antennae.
  - ❑ **Motes** provide information that enables a central computer to integrate reports of the same activity from different angles within the network.



# Wireless Sensor Networks (Continued)

- ❖ **Mesh Network** is composed of motes, where each mote wakes up for a fraction of a second when it has data to transmit and then relays that data to its nearest neighbor.
  - ❖ An advantage is if one mote fails, another one can pick up the data.
  - ❖ Very efficient and reliable.
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# Wireless Security

## Four major threats

1. *Rogue access point* is an unauthorized access point to a wireless network.
2. *War driving* is the act of locating WLANs while driving around a city or elsewhere.
3. *Eavesdropping* refers to efforts by unauthorized users to try to access data traveling over wireless networks.
4. *RF (Radio frequency) jamming* is when a person or a device intentionally or unintentionally interferes with your wireless network transmissions.



## Wireless Security (Continued)

- ❑ To avoid those previously mentioned threats implement the following solutions:
  - ❑ Detect unauthorized access points with devices from NetStumbler;
  - ❑ Block your SSIDs;
  - ❑ Encrypt wireless transmissions with Wi-Fi Protected Access (WPA);
  - ❑ Know who is using your network and what they are doing on it;
  - ❑ Automatically shift to a different wireless channel when there is interference.