Wireless Technology Computing

Wireless,
Mobile
Computing and
Mobile
Commerce

Wireless Devices

- Easy to carry or wear,
- Have sufficient computing power to perform productive tasks
- Communicate wirelessly with the Internet and other devices.
  - E.g.PDAs,
  - cellular phones,
  - smart phones.
  - **Standard is the Wireless Application Protocol (WAP)**
    - Tiny display screens,
    - low bandwidth connections
    - minimal memory to access Web-based information and services.

Wireless Technologies (Continued)

- **Microbrowsers**
  - Internet browsers with a small file size
    - can work within low-memory
    - low bandwidths of wireless networks.
- **Pager** is a one-way (simplex)
  - wireless messaging system
  - alerts the user when it receives an incoming message.

Wireless Transmission Media

- **Microwave transmission systems**
  - used for high-volume,
  - long-distance,
  - point-to-point communication.
    - *Point-to-point*
      - transmitter and receiver must be **line-of-sight**
      - transmission must be directed from transmitter to receiver.

Wireless Transmission Media (Continued)

- **Satellite transmission** :
  - **Geostationary (GEO)**
    - **~22,300 mile**
    - **3 satellites min.**
  - **Medium-earth-orbit (MEO)**
    - **~6,000 miles**
    - **More than 3 satellite**
    - **Need tracking**
  - **Low-earth-orbit (LEO)**
    - **~4-700 miles**
    - **Many satellite**
    - **Need tracking**

Wireless Transmission Media (Continued)

- **Footprint**
  - area of earth's surface reached by a satellite's transmission – overcomes the limitations of microwave data relay stations.
- **Propagation delay**
  - is a brief pause in transmissions from GEO satellites which make two-way telephone conversations difficult.

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.
- Russian effort at GPS
- European effort at GPS

Radio

- **Traditional 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)

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).
    - **Range in feet**.
  - IEEE 802.11 (Wi-Fi) for wireless local area networks (WLANs).
    - **Range in feet.**
  - IEEE 802.16 (Wi-Max) for wireless metropolitan area networks (WMANs).
    - **Range in miles**.
  - IEEE 802.20 (proposed) for wireless wide area networks (WWANs).

Bluetooth

- Used to create small PANs (Personal Area Networks):
  - 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.
- 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.
  - Need a **Wireless network interface card (NIC)** and,
    - a built-in radio and antenna.
  - **Hotspot** a wireless access point
    - 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 (**Wi-Fi**, for **Wireless Fidelity)**.

  Low cost!

	IEEE 802.11	**IEEE 802.11b**	**IEEE 802.11g**
Data Rate	54Mbps	11Mbps	54Mbps
Distance	100 feet	100-150 feet	150 feet

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
  - low cost (not free)
  - each service has its own fees and separate accounts for users to logon.

WiMax

- **Worldwide Interoperability for Microwave Access**, (**WiMax)**, or 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.

Mobile Computing and Mobile Commerce

- **What is it?** Real-time, wireless connection between a mobile device and other computing environments (Internet or intranet)
- **Mobility**: users carry a mobile device and can initiate a real-time contact with other systems from wherever they happen to be.
- **Broad reach**: users can be reached instantly when they carry an open mobile device.

Mobile Commerce (MC)

- **Transactions in a wireless environment via the Internet.**
- **MC is driven by:**
  - **Widespread availability of mobile devices**
  - **No need for a PC**
  - **The “Cell-phone culture”**
  - **Declining hw prices**
  - **Bandwidth improvement**

Mobile Commerce Financial Applications Using Cell Phones

- **Mobile Banking**
  - Wireless account information
- **Wireless Electronic Payment Systems**
  - Wireless payments (parking meter payments, sports tickets, order food/drinks for your stadium seat)
- **Micropayments**
  - Payments for small purchases (taxi, public x-port fares, vending machines)
- **Mobile (Wireless) Wallets**
  - For wireless shopping (one click purchases)
- **Wireless Bill Payments**
  - For payment of utility bills

Intrabusiness Applications for Information Access Using Mobile Services

- **Mobile Portal**
  - **Aggregated content** and services
    - news, sports, email, entertainment, travel and restaurant information
    - community services
    - stock trading.
  - **Voice Portal**
    - Web site with an audio interface and,
    - Accessible via land-line **or** cell phone.

Location-based Applications

- **Shopping from Wireless Devices** – online vendors allow customers to shop from wireless devices.
- **Location-based Advertising & services**
  - marketers know the current locations and preferences of mobile users, and
  - they send user-specific advertising messages to wireless devices about nearby shops, malls and restaurants.
  - they send users info. about available services

Wireless Telemedicine

- Mobil technologies to dispense med. care
- Storing and transferring med. digital images.
- Consult with a medical specialists remotely, in real time through videoconferencing.
- Using robots to perform remote surgery.

Wireless Telemedicine (Continued)

- Dispense prescriptions to distant locations.
- Telemedicine application for emergency situations during
  - airplane flights
  - arctic/antarctic exploration,
  - mountaineering expeditions,
  - third world medical emergencies.

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; e.g. remote manufacturing.
  - Doctors can monitor patients and control medical equipment from a distance; (Australia, expeditions, remote resource exploration sites)
  - Car manufacturers use telemetry for remote vehicle diagnosis and preventive maintenance. (On-star)

Pervasive Computing or *Ubiquitous computing*

- **Invisible** “everywhere computing” that is embedded in the objects around us –
  - floors, lights, cars, appliances, cell phones, clothes, toys, etc.
  - *smart home,*
  - *smart appliances*

Radio Frequency Identification

- **RFID Technology** for tracking of goods through radio signals. (WalMart)
- **Auto-ID** create a network that connects computers to objects, an **Internet of “things”**.
  - Provide the ability to track *individual* items from factories to store shelves to recycling facilities.
- **RFID** is expensive (chips are cheep but tracking antennas are expensive)

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,
    - radio frequency sensors and antennas.
  - **Motes** provide information that enables a central computer to integrate reports of the same activity from different points in the network.

Wireless Sensor Networks (Cont'd)

- **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.

Wireless Security

- **Potential problems with wireless systems:**
  - ***Rogue access point*** –
    - unauthorized access point to a wireless network.
  - ***War driving*** –
    - the act of locating WLANs while driving around a city or elsewhere.
  - ***Eavesdropping*** –
    - efforts by unauthorized users to try to access data traveling over wireless networks.
  - ***RF (Radio frequency) jamming*** –
    - intentionally or unintentionally interfere with wireless network transmissions.

Wireless Security (Continued)

- **Potential solutions to wireless security threats**:
  - **Detect** unauthorized access points with devices from NetStumbler;
  - Block 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.

END Wireless Computing