



Wireless Communications

BY

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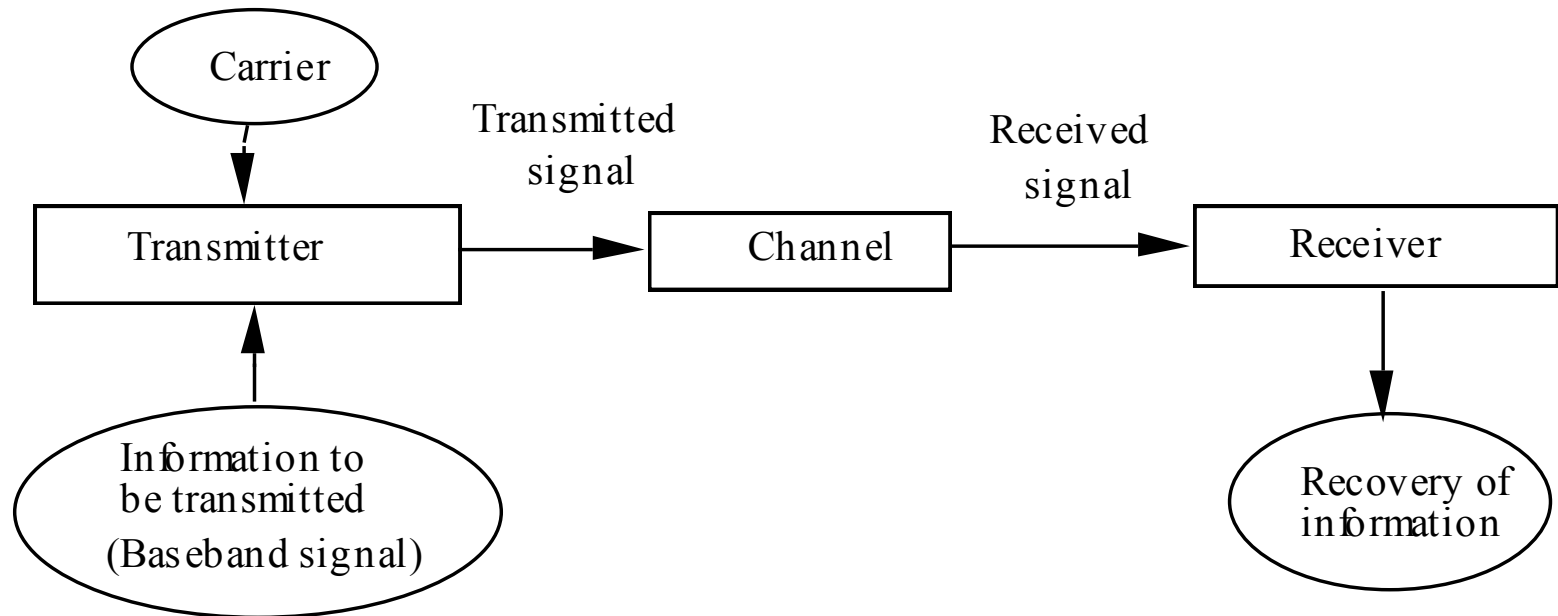
Outline

- Communication Systems
- Wireless Communications
- Current Wireless Systems
 - Cellular systems
 - Wireless LANs
 - Satellite Systems
 - Paging Systems
 - Bluetooth
 - Design challenges

COMMUNICATION SYSTEMS

- **Provide electronic exchange of multimedia data, Voice, data, video, music, email, web pages, etc.**
- **Communication Systems of today Radio and TV broadcasting, Public Switched Telephone Network (voice, fax, modem)**
 - **Cellular Phones**
 - **Computer networks (LANs, WANs, and the Internet)**
 - **Satellite systems (pagers, voice/data, movie broadcasts)**
 - **Bluetooth**

Block diagram of a Communication Systems



Objectives

- **Provide electronic exchange of multimedia information**
- **The information to be transmitted is electromagnetic wave or electrical signal may represent: multimedia data, Voice, data, video, music, email, web pages, etc.**
- **The frequency bandwidth occupied by the information signal is called the baseband, and the signal is often referred to as the baseband signal.**
- **Channel – is the medium by which the transmitted signal is propagated:**
- **Various layers of atmosphere, cable for telephone or data link, cable TV or**
- **Electrical signals are converted to a corresponding light signal that is propagated through a fiber optic channel**

Wireless Communications

- **Multimedia wireless Communications at any Time and Anywhere**
- **Brief history**
 - **Ancient Systems: Smoke Signals, Carrier Pigeons**
 - **Radio invented in the 1880s by Marconi**
 - **Many sophisticated military radio systems were developed during and after WW2**
 - **Cellular has enjoyed exponential growth since 1988, with more than 2 billion users worldwide today**
 - **Ignited the recent wireless revolution, 1980-2003**
 - **Growth rate tapering off**
 - **Is there a future for wireless?**

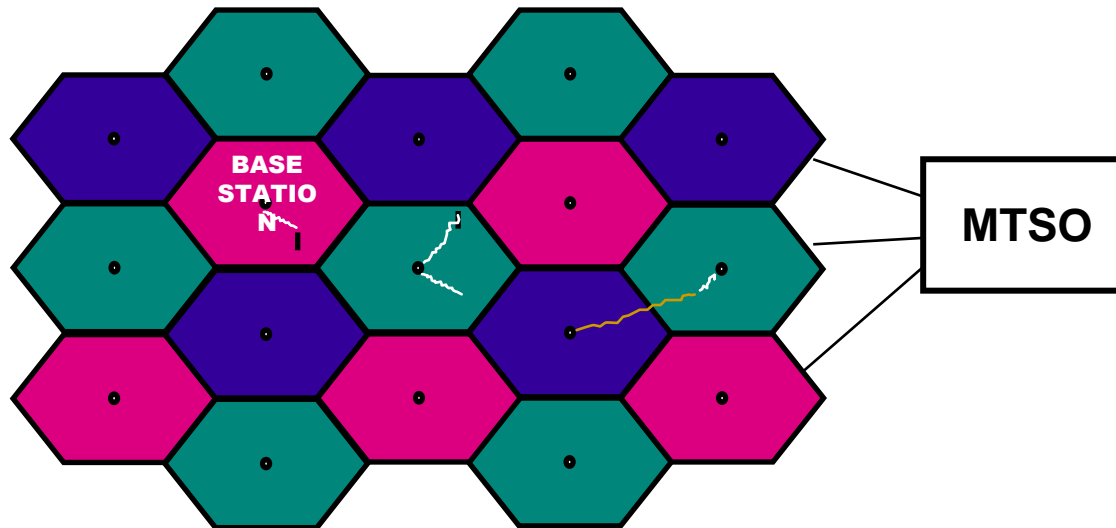
Current Wireless Systems

- Cellular systems
- Wireless LANs
- Satellite Systems
- Paging Systems
- Bluetooth
- Ultrawideband Radios
- Zigbee Radios

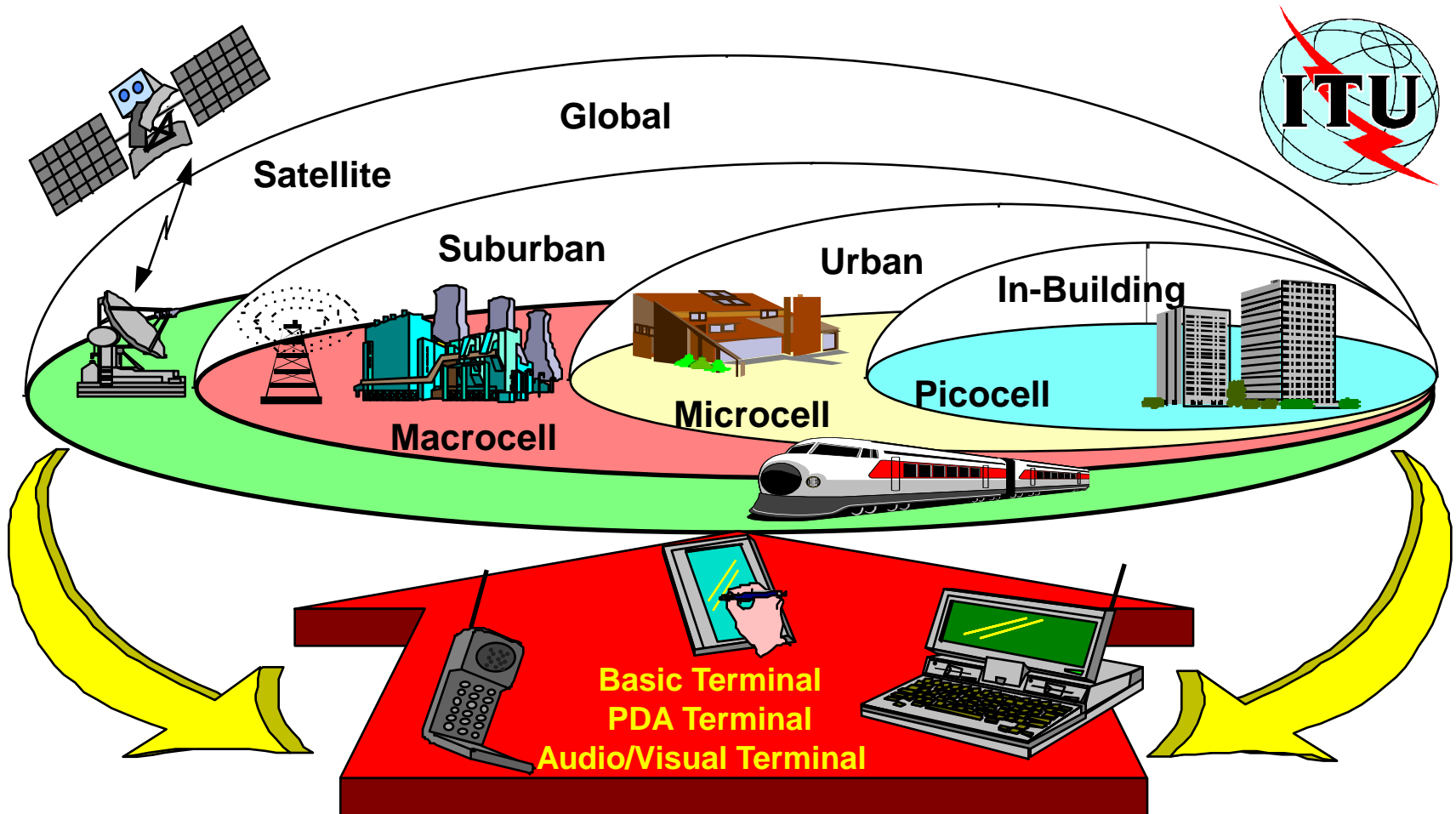
Cellular Systems:

Reuse channels to maximize capacity

- Geographic region divided into cells
- Frequencies/timeslots/codes reused at spatially-separated locations.
- Co-channel interference between same color cells.
- Base stations/MTSOs coordinate handoff and control functions
- Shrinking cell size increases capacity, as well as networking burden



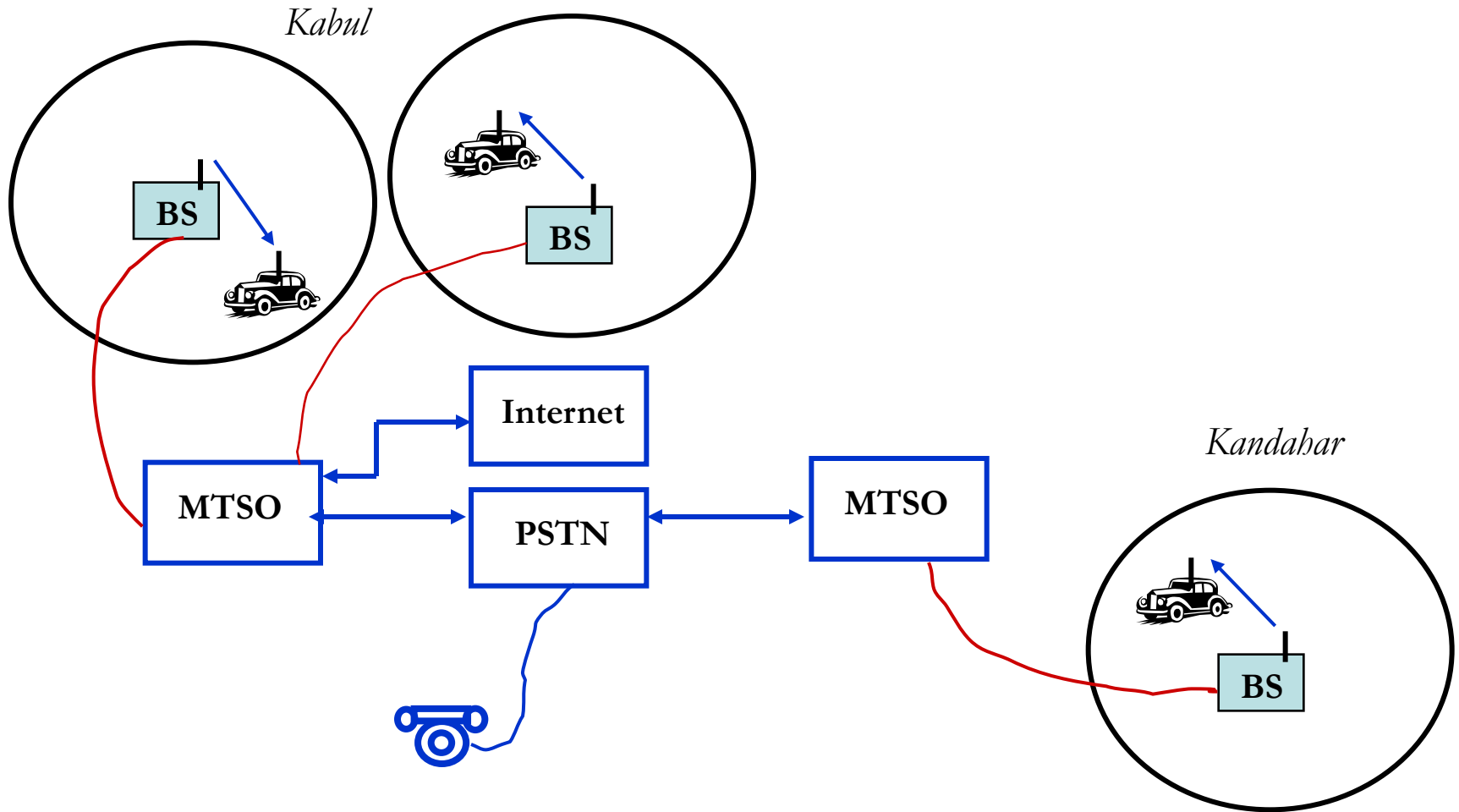
Type of Cells



Type of Cells

- **Cell radii can be vary from 10's of meters in buildings to 100's of meters in the cities, up to several km's in the countryside.**
- **Macrocells, provide overall area coverage**
- **Microcells, Microcell will focus on slow moving subscribers moving between buildings.**
- **Picocells, Would focus on the foyer of a theater, or exhibition centre.**

Cellular Phone Networks

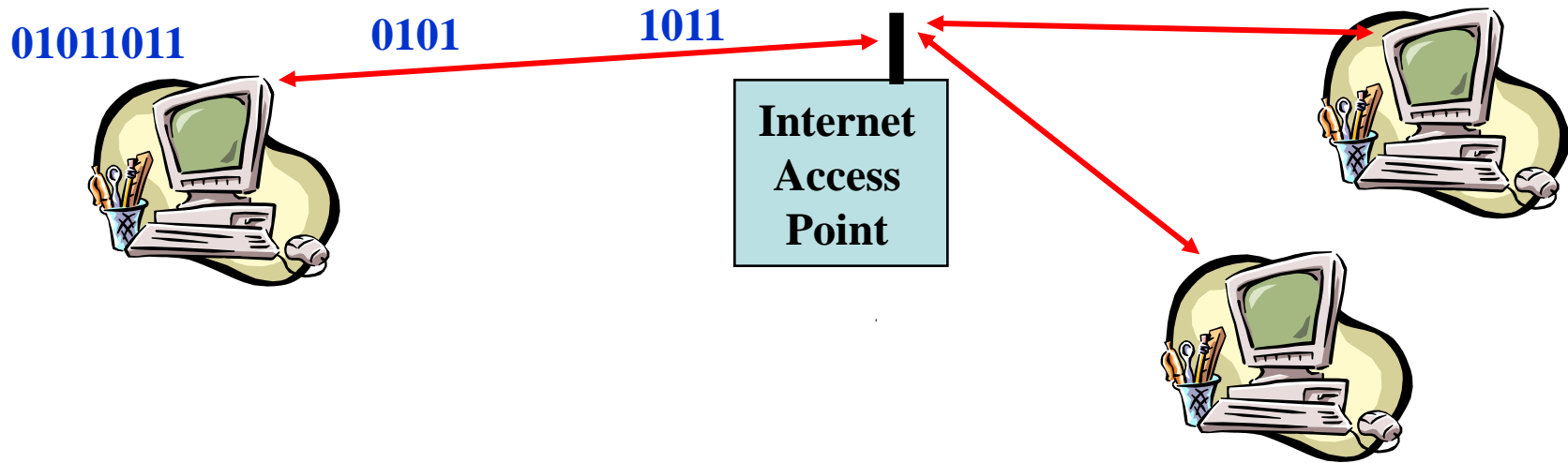


The Wireless Revolution

Cellular is the fastest growing sector of communication industry (exponential growth since 1982, with over 2 billion users worldwide today)

- Three generations of wireless
 - First Generation (1G): Analog 25 or 30 KHz FM, voice only, mostly vehicular communication
 - Second Generation (2G): Narrowband TDMA and CDMA, voice and low bit-rate data, portable units.
2.5G increased data transmission capabilities
 - Third Generation (3G): Wideband TDMA and CDMA, voice and high bit-rate data, portable units

Wireless Local Area Networks (WLANs)



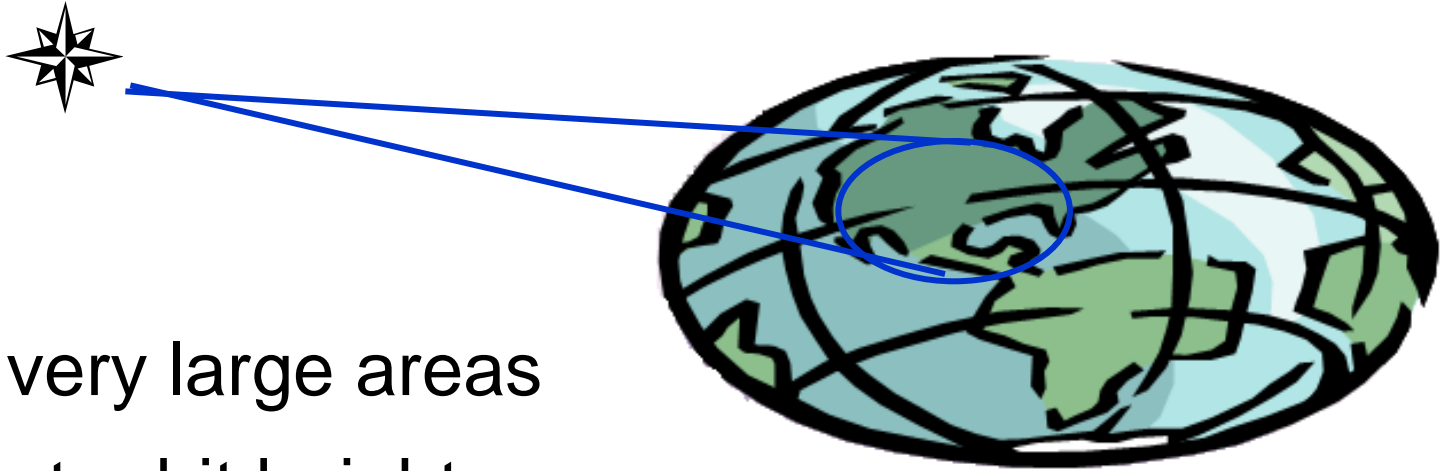
- WLANs connect “local” computers (100m range)
- Breaks data into packets
- Channel access is shared (random access)
- Backbone Internet provides best-effort service
- Poor performance in some apps (e.g. video)

Wireless LAN Standards

- 802.11b (**Current Generation**)
 - Standard for 2.4GHz ISM band (80 MHz)
 - Frequency hopped spread spectrum
 - 1.6-10 Mbps, 500 ft range
- 802.11a (**Emerging Generation**)
 - Standard for 5GHz NII band (300 MHz)
 - OFDM with time division
 - 20-70 Mbps, variable range
 - Similar to HiperLAN in Europe
- 802.11g (**New Standard**)
 - Standard in 2.4 GHz and 5 GHz bands
 - OFDM
 - Speeds up to 54 Mbps

**In 200?,
all WLAN
cards will
have all 3
standards**

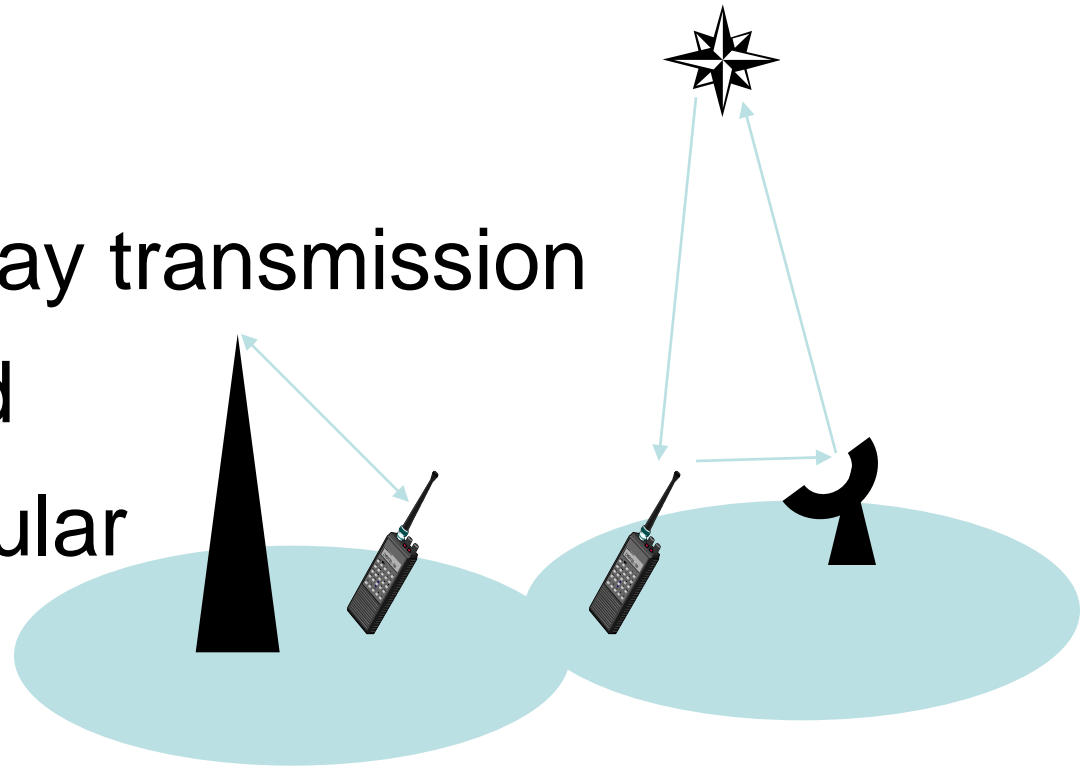
Satellite Systems



- Cover very large areas
- Different orbit heights
 - GEOs (39000 Km) versus LEOs (2000 Km)
- Optimized for one-way transmission
 - Radio (XM, DAB) and movie (SatTV) broadcasting
- Most two-way systems struggling or bankrupt
 - Expensive alternative to terrestrial system
 - A few ambitious systems on the horizon

Paging Systems

- Broad coverage for short messaging
- Message broadcast from all base stations
- Simple terminals
- Optimized for 1-way transmission
- Answer-back hard
- Overtaken by cellular



Bluetooth

- Cable replacement RF technology (low cost)
- Short range (10m, extendable to 100m)
- 2.4 GHz band (crowded)
- 1 Data (700 Kbps) and 3 voice channels
- Widely supported by telecommunications, PC, and consumer electronics companies
- Few applications beyond cable replacement

Design Challenges

- **Hardware Design**
 - Precise components
 - Small, lightweight, low power
 - Cheap
 - High frequency operations
 - System Design
- **Converting and transferring information**
 - High data rates
 - Robust to noise and interference
 - Supports many users
- **Network Design**
 - Connectivity and high speed
 - Energy and delay constrains

The END
Thank you for attention!

