

## Lecture 2.02 - Overview of Wireless Networks

### Types of Wireless Networks

#### Mobile

Examples of mobile networks:

- Cellular network
- IEEE 802.16
- Land Mobile Radio
- Satellite
- VANETs
- Location-aware services

Should be a seamless browsing experience for a user on the go. Most likely using the wireless medium.

#### Nomadic

- A network that is considered to be semi-portable
- It provides coverage to users within range
- The Antenna are usually fixed
- User is changing their point of connection to the network

Examples:

- Wireless local area networks (WLAN)
- Hot Spots
- Wireless ISPs
- Tech: 802.11, Bluetooth

### Open Systems Interconnection model (OSI)

#### Physical Layer

Handles communication impairments:

- noise
- interference
- fading
- shadowing
- path loss

Does this via:

- coding
- diversity
- power control

- waveform selection

Responsible for:

- Modulation
- frequency selection
- signal detection
- encryption

### **DataLink Layer**

- Responsible for mediating access to the wireless medium (Physical layer stuff)
- Handles problems that occur due to bit errors
- ensures a nice flow of information so neither the sender or receiver are overwhelmed
- mediates access to the network layer
- performs frame synchronization

This is where Medium Access Control (MAC) is

### **Network Layer**

- Addressing and routing is performed in this layer. Redirection to deal with mobility as well.
- Handoff between different networks
- In charge of selecting the best logical path for data to be routed down
- Routing through multiple hops in an ad-hoc network
- Internet Protocol (IP) is in the Network Layer

### **Transport Layer**

- Reliable end to end transmission
- Flow and congestion control

TCP/UDP is in this layer.

### **Application Layer**

- Deals with application specific exchange of messages
- Responsible for displaying received information to the user

### **Frequencies**

The lower the frequency the lower the attenuation with distance and vice versa

Broadcast TV and Radio:

- Broadcast TV: 54 to 88MHz, 174 to 216MHz, 470 to 806MHz
- FM Radio: 88 to 108MHz Digital TV: same as broadcast TV

Cellular and PCs:

- 2G cellular phone: 800-900MHz
- 3G Broadband Wireless: 746-794MHz, 1.7-1.85 GHz, 2.5-2.7GHz

WLANS, WPANs, fixed wireless:

- WLAN: 2.4GHz, 5GHz
- Bluetooth: 2.45GHz
- Local Multi-point Distribution Services (LMDS): 27.5-31.3 GHz

Regulators:

- International Telecommunications Union (ITU)
- Federal Communications Commission (FCC)(US)
- ComReg (Ireland)

Some degree of harmonization does occur when the ITU meets to discuss spectrum allocation

### **Dynamic Spectrum Access**

Spectrum is inefficiently used.

Cannot take spectrum back easily from licensed ands

Spectrum re-farming from TV bands due to the switch to the more efficient digital TV.

Dynamic Spectrum Access allows operation in licensed bands, as long as you don't interfere with the holder of the license. (Used by cognitive radios)

### **The complementarity between wired and wireless systems**

Wireless and optical wireless networks can be thought of as complementary.

Optical fiber does not go everywhere, but where it does go, it provides a huge amount of available bandwidth.

Wireless access networks, on the other hand, potentially go almost everywhere, but provide a highly bandwidth constrained transmission channel, susceptible to a variety of impairments.

Combined use of the two can make use of all possible benefits

### **Acronyms**

- WPAN: wireless personal area network
- WLAN: Wireless local area network
- LMDS: Local Multi-point Distribution Services
- ITU: International Telecommunications Union
- FCC: Federal Communications Commission

- VANET: Vehicular Ad-Hoc Networks