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FACULTY OF EGINEERING AND TECHNOLOGY

WSN (MCS-033)

LECTURE -6

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OUTLINE

- WAN in wireless communication
- Frequency division multiple-access (FDMA)
- Time division multiple-access (TDMA)
- Code division multiple-access (CDMA)
- Space division multiple access (SDMA)
- MCQ
- Reference

WAN IN WIRELESS COMMUNICATION

What is WAN in wireless communication?

According to the requirements for the users and computers in a commercially driven environment various methods have been implemented in the wireless communication across the world. So, it has become inevitable in the computer field to communicate the users from one location to another location of users and computers. This has given rises to WAN which are used to connect LANs (Local Area Networks). These LANs come under the small scale networks providing networks within a single building or campus.

WANs are referred as Wide Area Networks which cover a wider area networks wirelessly to provide service to larger geographical areas. The wireless network that covers smaller areas with low power transmission is Wireless Personal Area networks , it is also applicable for networking of portable and mobile computing devices such as PCs, Personal Digital Assistants (PDAs).

Fundamentals of WLANs

The issues that arise technically in WLANs can be appreciated by differentiating between wired networks and wireless networks. The use of WLANs and their design goals are then studied. The different types of WLANS, their components and their basic functions are also detailed.

IEEE 802.11 Standard

This section gives introduction of a prominent standard ion WLANs, the IEEE 802.11 standard. The layers called the medium access control (MAC) and the physical layer mechanisms are very well explained. This section also covers some of the functions which are optional such as security and quality of service (QoS).

HIPERLAN Standard

This section gives you detailed study on another WLAN standard, HIPERLAN standard, which is a European standard based on radio access.

Bluetooth

This section deals with the Bluetooth standard, which helps in communicating with each other through personal devices in the absence of infrastructure.

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WLAN Fundamentals

Here both the portable terminals and mobile terminals can access mobility from one place to another. Portable terminals are accessed only when they are in stationary.

Mobile Terminals (MTs), on the other hand, are more powerful, and can be accessed when they are in motion. The main objective of WLANs is to support mobile work stations.

WLAN Uses

Wireless computer networks provide multiple functionalities. Due to the flexibility of WLANs they can be configured in various topologies depending upon the applications. Some possible uses of WLANs are described below.

Users can access the internet, check e-mail, and receive Instant Messages on the move.

In the earthquakes affected areas or any other disasters occur, it is very difficult to have suitable infrastructure there. In such locations WLAs are very effective to set up the networks.

For historic buildings and other high permitted areas it is very difficult to set up wiring in such places. Due to its architectural design also it might not be suitable to efficient wiring. In such cases where the computer networks are necessary WLANs are the networks which provide wireless networks.

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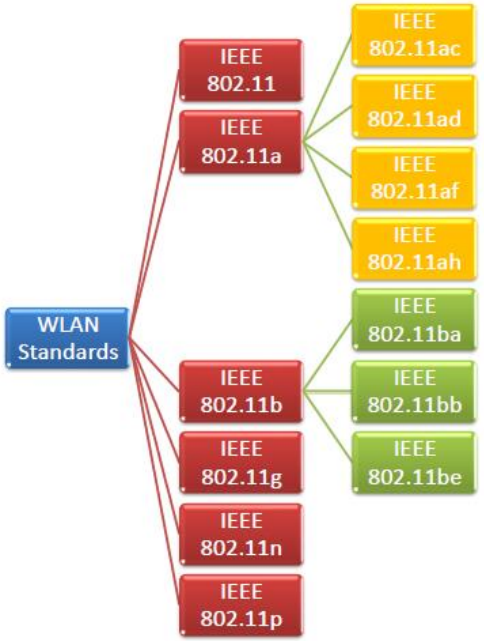
Design Goals

1. **Operational simplicity**
2. **Power efficient operation**
3. **License-free operation**
4. **Tolerance to interference**
5. **Global Usability**
6. **Security**
7. **Safety requirements**
8. **Quality of service requirements**
9. **Compatibility with other technologies and applications**

IEEE 802.11 Standards or Wireless LAN

IEEE 802.11 standard, popularly known as WiFi, lays down the architecture and specifications of wireless LANs (WLANs). WiFi or WLAN uses high frequency radio waves for connecting the nodes.

There are several standards of IEEE 802.11 WLANs. The prominent among them are 802.11, 802.11a, 802.11b, 802.11g, 802.11n and 802.11p. All the standards use carrier-sense multiple access with collision avoidance (CSMA/CA). Also, they have support for both centralised base station based as well as ad hoc networks.



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IEEE 802.11

IEEE 802.11 was the original version released in 1997. It provided 1 Mbps or 2 Mbps data rate in the 2.4 GHz band and used either frequency-hopping spread spectrum (FHSS) or direct-sequence spread spectrum (DSSS). It is obsolete now.

IEEE 802.11a

802.11a was published in 1999 as a modification to 802.11, with orthogonal frequency division multiplexing (OFDM) based air interface in physical layer instead of FHSS or DSSS of 802.11. It provides a maximum data rate of 54 Mbps operating in the 5 GHz band. Besides it provides error correcting code. As 2.4 GHz band is crowded, relatively sparsely used 5 GHz imparts additional advantage to 802.11a.

Further amendments to 802.11a are 802.11ac, 802.11ad, 802.11af, 802.11ah, 802.11ai, 802.11aj etc.

IEEE 802.11b

802.11b is a direct extension of the original 802.11 standard that appeared in early 2000. It uses the same modulation technique as 802.11, i.e. DSSS and operates in the 2.4 GHz band. It has a higher data rate of 11 Mbps as compared to 2 Mbps of 802.11, due to which it was rapidly adopted in wireless LANs. However, since 2.4 GHz band is pretty crowded, 802.11b devices faces interference from other devices.

Further amendments to 802.11b are 802.11ba, 802.11bb, 802.11bc, 802.11bd and 802.11be.

IEEE 802.11g

802.11g was indorsed in 2003. It operates in the 2.4 GHz band (as in 802.11b) and provides a average throughput of 22 Mbps. It uses OFDM technique (as in 802.11a). It is fully backward compatible with 802.11b. 802.11g devices also faces interference from other devices operating in 2.4 GHz band.

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IEEE 802.11n

802.11n was approved and published in 2009 that operates on both the 2.4 GHz and the 5 GHz bands. It has variable data rate ranging from 54 Mbps to 600 Mbps. It provides a marked improvement over previous standards 802.11 by incorporating multiple-input multiple-output antennas (MIMO antennas).

IEEE 802.11p

802.11 is an amendment for including wireless access in vehicular environments (WAVE) to support Intelligent Transportation Systems (ITS). They include network communications between vehicles moving at high speed and the environment. They have a data rate of 27 Mbps and operate in 5.9 GHz band

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