

Unit No. 02 - Wireless Standard

what are hidden station & exposed station
problems in WLAN?

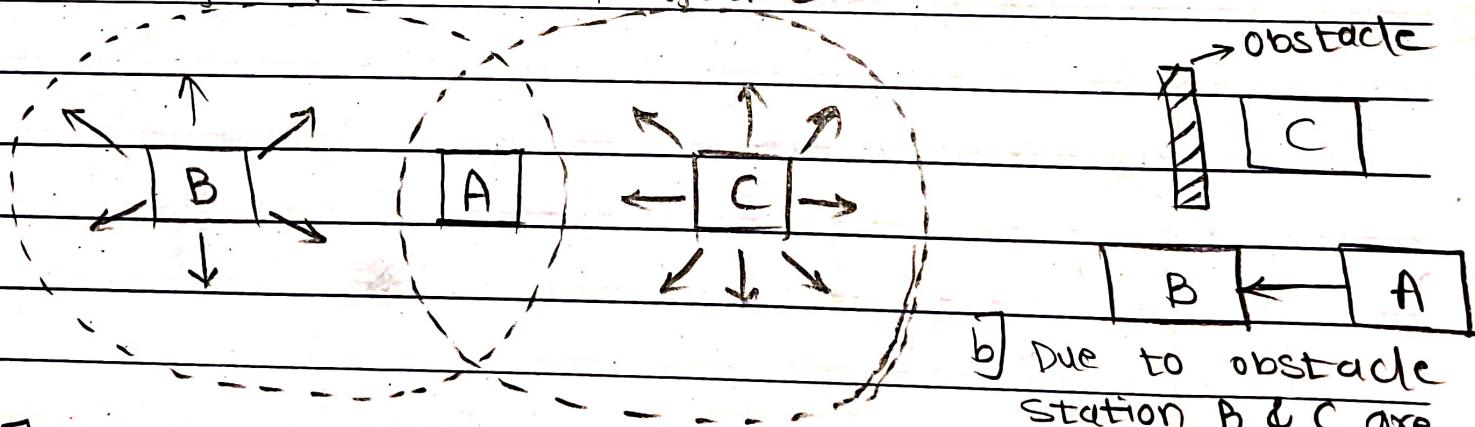
The hidden station problem occurs when a station may not be aware that the other station is transmitting because of either range problem or obstacle.

In this situation collision may occur but may not be detected.

Below Fig illustrated the hidden station problem where A, B & C are three wireless networks.

Range of B

Range of C



b) Due to obstacle
station B & C are
hidden from each
other.

a) Station B & C are not in each
other's range

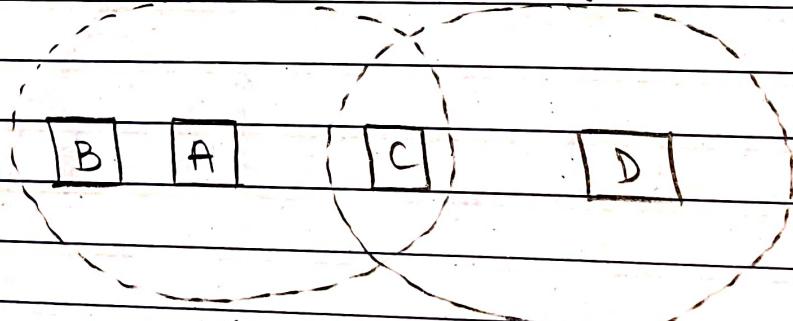
Station A is in the range of both stations i.e. B & C, but station B & C are not in each other's range.

In above fig station A but as B & C are hidden from each other station C concludes that the medium is free and it transmits its data to A and hence collision occurs at station A and will wipe out frames from station B.

- The problem in which station is not able to detect an already transmitting station which is too far away is called as hidden station problem.
- Exposed station problem

- Exposed station problem is similar to hidden station problem.
- In this problem, the station refrains from using the common medium even when no one is using it.
- Below fig shows the exposed station problem where A is sending station and B is destination. A is sending to B.

Range of A Range of C



Exposed station Problem

- Station C wants to send the data to D & it is possible to do without interfering bet' A & B.
- Station C is in the range of station A, which means station C is exposed to A.
- Therefore C listens what A is transmitting & decides to refrain itself from sending to D. This causes wastage of channel capacity.

Q.2 Compare Ethernet (wired LAN) & wireless networks.

Parameter	Wired LAN	Wireless LAN
1. IEEE Standard	IEEE 802.3	802.11
2. Communication medium	Coaxial cable	Infrared / RF waves
3. Use of spread spectrum technique	Not Used	Used
4. Addressing	Simple	Complicated
5. Efficiency	High	Low
6. Noise problem	Low	High
7. Range	Long	Short
8. Access Algorithm	CSMA/CD	CSMA/CA

Q. 3

No	Parameter	Bluetooth	WiFi (802.11)	WiMAX (802.16)
1.	Protocol	802.15	802.11	802.16
2.	Standard	Bluetooth	WiFi	WiMAX
3.	Performance	Moderate	High	High
4.	Coverage	Within reach	Within a building	Within a city
5.	Frequency Range	2.4 - 2.483 GHz	5.15 - 5.35 GHz	10. - 66 GHz
6.	Cell Radius	1 - 10 m	1 - 500 m	1 Km - 50 Km
7.	Modulation	FHSS	OFDM, DSSS	QPSK
8.	Application	Cable replacement of peripheral devices	Mobile extension of wired networks	Fixed wireless betn home, businesses & internet

- Bluetooth is a wireless personal area network (WPAN) technology which is used for exchanging data over the internet.
- It operates in the unlicensed industrial, scientific and medical bands (ISM) at 2.4 GHz to 2.485 GHz.
- Maximum 7 devices are connected at the same time. It ranges upto 10 meter.
- It provides data rates upto 1 Mbps to 3 Mbps depending upon the version.
- The spreading technique which is uses is FHSS (Frequency Hopping Spread Spectrum)

• Disadvantages of Bluetooth:

1. Bluetooth communication does not support routing.
2. The issue of handoffs have not been addressed.
3. Due to its master slave configuration, many times performance degradation takes place due to bottlenecking at the master.
4. It has very short range.
5. It provides low bandwidth and therefore data transfer speed is low.
6. Interference with WLAN is unavoidable as WLAN and bluetooth both operate in same ISM band.
7. Battery draining is the main problem of bluetooth security.

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Q. 2

2]

$$\rightarrow S = 1, 4, 5, 6, 3, 2, 8, 9, 1, 2, 3, 14, 3, 1, 12, 3, 13$$

$$h(k) = (6k + 1) \bmod 5$$

- WLAN :

WLAN is a wireless computer network that links two or more devices using wireless communication to form a local area network within a limited area such as home, school, campus or office building.

Architecture of WLAN :

AP → Access Point

BSS → Basic Service Set

Distributed System

Gateway or Server

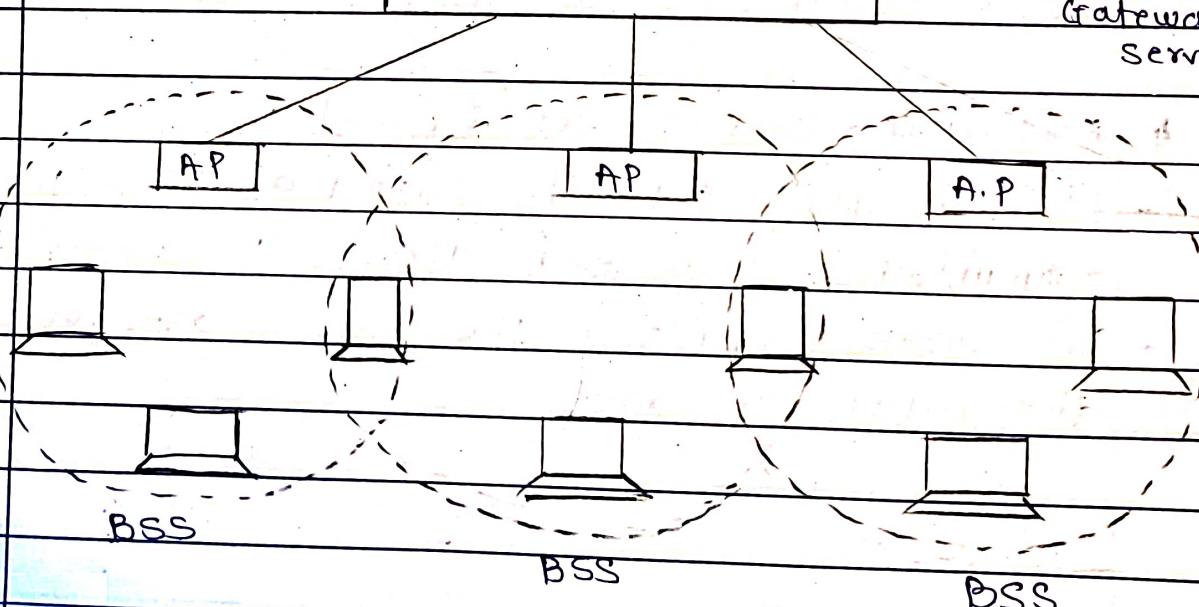


Fig. WLAN Architecture

• Components of WLAN :-

1. Station :-

- Any component that can connect into a wireless medium in a network are referred to as station.
- Wireless station could be any mobile device such as ip phones, laptops or smartphones.

2. Access Point (A.P) :-

In a network with base station all communication are passed through the base station. The base station is also called as Access Point in 802.11 terminology.

3. Basic Service Set (BSS) :-

- BSS is the building block of WLAN architecture.
- BSS is the set of all stations that can communicate with each other at physical layer.
- In BSS, wireless station could be mobile or stationary.
- There are two types of BSS architecture in WLAN.

1. ADHOC Network Architecture

2. Infrastructure Network Architecture

4. Extended Service Set (ESS) :-

- ESS is the set of connected BSS that can communicate with each other.
- The access points in the ESS are connected by distributed system.

5. Distributed System :-
- The distributed system connects access point in an extended service set.
 - The concept of distributed system is to increase network coverage through roaming between cells.

Q. Describe the MAC layer mechanism of IEEE 802.11

- IEEE 802.11 MAC sublayer provides an abstraction of the physical layer to the logical link control layer & upper layers of the OSI network. It is responsible for encapsulating the frames & describing the frame format.
- IEEE 802.11 specifies two medium access control (MAC) protocols. First is Distribution co-ordination function (DCF) and second is Point co-ordination function (PCF).
 - Out of these two DCF is fully distributed scheme which is suitable for adhoc networking whereas PCF is an optional centralized scheme.
 - DCF is mandatory technique which is used to prevent collision in IEEE 802.11 WLAN standard. It is a medium access control (MAC) sublayer technique used in the areas where carrier-sense multiple access with collision avoidance (CSMA/CA) is used.
 - PCF is an optional technique which is used to prevent collision in IEEE 802.11 WLAN including WiFi. PCF is used additionally along with the mandatory DCF. It is used in centralised control system & is present in the access point (AP) of the wireless network.

- IEEE 802.11 MAC addressed the hidden station problem by adding two additional frames RTS (Request to send) & CTS (Clear to send).
- Here source send the RTS and destination replies with CTS.
- Other nodes that overhear the RTS & CTS messages will suspend their transmission for a certain time period indicated in the RTS / CTS frames.
- The source station retransmits the RTS frame if RTS / CTS handshake fails.
- The system treat this as a collision and retransmit the frame.
- For avoiding faulty consecutive transmissions the retry counters & timers are employed to limit the lifetime of the frame.

Q. Explain bluetooth architecture with diagram.

→ Bluetooth is a wireless personal area network (WPAN) technology which is used for exchanging the data over the internet.

There are two types of Bluetooth networks

- i) Piconet
- ii) Scatternet

I] Piconet :-

- Piconet is a small bluetooth network, which is formed with 8 stations, one is the master node and the rest are slave nodes (maximum 7 slaves).
- Master node is the primary stations that managed the small network.



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- The slave nodes are the secondary stations that are synchronized with the primary stations.
- Communication takes place b/w the master & the slave in either one to one or one to many manner. No direct communication takes place between the slaves.

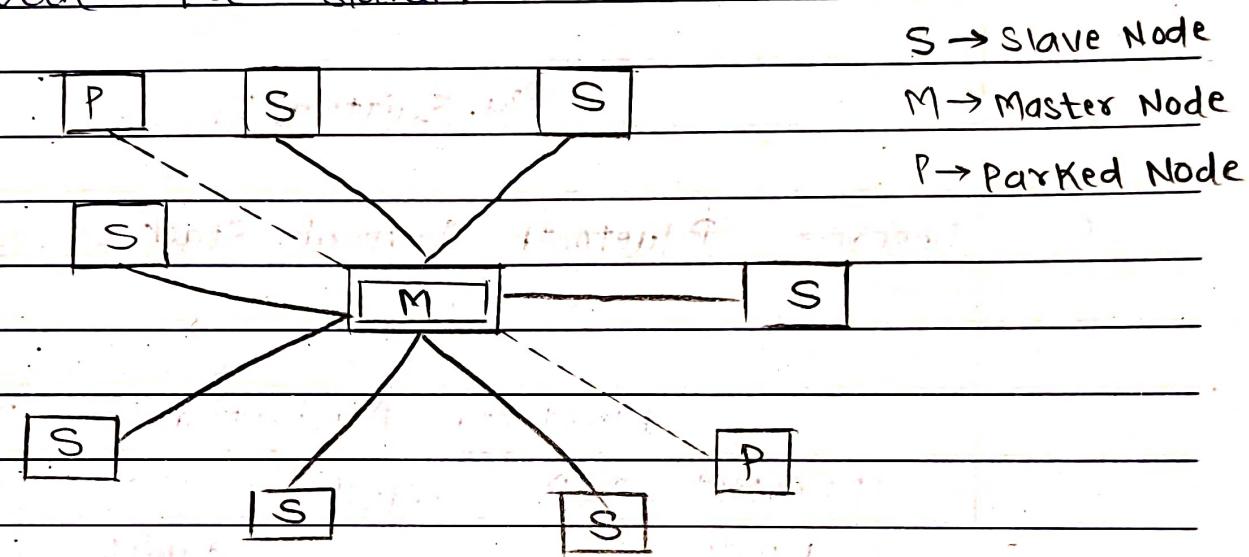


Fig. Piconet

2] Scatternet :

- Scatternet is the interconnected collection of two or more piconets that support communication b/w more than 8 devices.
- Slave in the first piconet act as a master in the second piconet.
- It will receive the messages from the master in the first piconet by acting as a slave and then deliver the messages to the slave in the second piconet.
- So the same device act as a slave in first piconet and as a master in the second piconet.

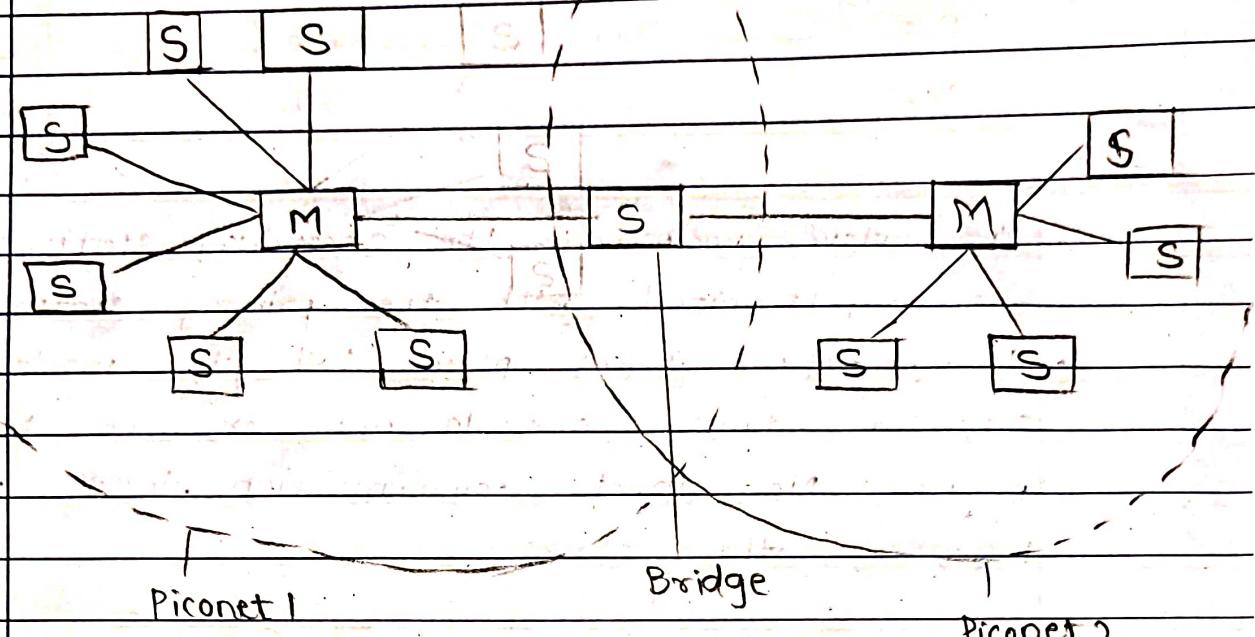


Fig. Scatternet.

Q. Describe Bluetooth Protocol Stack.

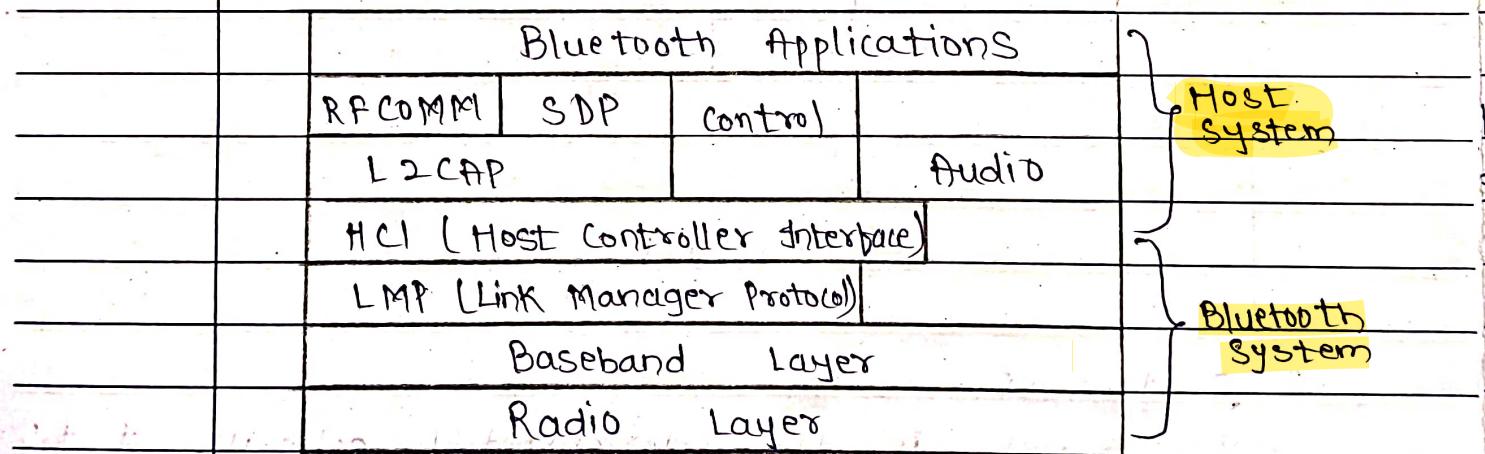


Fig. Bluetooth Protocol Stack

In this protocol stack there are 7 layers :

1] Radio layer :

- It is the lowermost layer of the bluetooth protocol stack.
- It defines the requirement of Bluetooth transceiver device operating in the 2.4 GHz ISM band.

- This band is divided into 79 channels of 1 MHz each.

2] Baseband Layer :-

- Baseband layer is the physical layer of the bluetooth.
- It manages physical channels & links apart from other services like error correction, data whitening, hop selection and Bluetooth security. It also manages asynchronous & synchronous links, handle packets and does paging.

3] Link Manager Protocol (LPM)

- LPM is used in link control / configuration, link setup and also in the security aspects such as authentication, link-key management and data encryption.
- LPM offers mechanism for QoS measurement and Received Signal Strength Indication (RSSI)

4] Host Controller Interface (HCI)

- It is interface b/w L2CAP & EPP/LMP.
- Host system uses the HCI interface to send the command packets such as setting up a connection, starting an inquiry, to the Link Manager.

5] Logic Link Control & Adaptation Protocol (L2CAP)

- The L2CAP protocol is approximately equivalent to LLC sublayer in the wired LANs.
- L2CAP provides connection oriented & connection less^{data} services to upper layer protocol with protocol multiplexing capability, segmentation & reassembly operations & group abstraction.

8] RFCOMM :-

RFCOMM is the transport protocol. It is defined for the purpose of cable replacement.

9] Service Discovery Protocol (SDP)

Service Discovery Protocol (SDP) provides Bluetooth entities with method to find which services are available from each other.