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Module 3

Total - 25m

1) Explain MAC protocol - 5m
2) Give the diff bet^n Internet protocol and transport layer - 2m or 5m
* 3) What is mobile IP and explain its process - 2m / 5m / 10m
* 4) Explain reverse tunnelling 2m/5m
* 5) Explain Mobile TCP 10m
* 6) Explain Indirect TCP, Snooping TCP & mobile TCP
(1 Type for 2m & 2 Type for 5m, 3 Type for 10m)

Module 4

Total - 15m

* 1) Explain Infrastructure and adhoc network 5m
2) Explain IEEE 802.11 system architecture 5m / 10m
3) Explain IEEE 802.11 protocol architecture 5m/10m
* 4) Give diff. bet^n 802.11 A and 802.11 B 5m
* 5) Write Short note on Wifi Security 5m
* 6) Write a Short note on wireless LAN threads 5m

* 7) Explain WEP, WPA. (2m/5m)

* 8) Explain Bluetooth and its two topology (Piconet and Scatternet) (2m/5m/10m)

* 9) Explain Bluetooth Architecture (diagram, explanation) (5m/10m)

10) Explain Bluetooth Protocol Stack (diagram, explanation) (5m/10m)

A mobile network can be defined as a communication network that is spread out over an area around the world.

Medium Access Control

- MAC is a sublayer of data link layer (dll) in seven layer OSI network reference model.
- MAC is responsible for the transmission of data packets to and from the nic interface card and to and from another remotely shared channel.
- MAC address is a hardware address use to uniquely identify each node of nic.

Functions performed in the MAC Sublayer:

① Addressing: MAC sublayer performs the addrasing of destination station and conveyance of source-station addressing information.

② Transparent data transfer: It performs the data transparency over data transfer of LLC, PDUs or equivalent info in Ethernet Sublayer.

③ Protection - MAC Sublayer Function is to protect data against error, generally by means of generating and checking frame check sequence.

Access control - Control of access to the physical transmission medium from unauthorized medium access.

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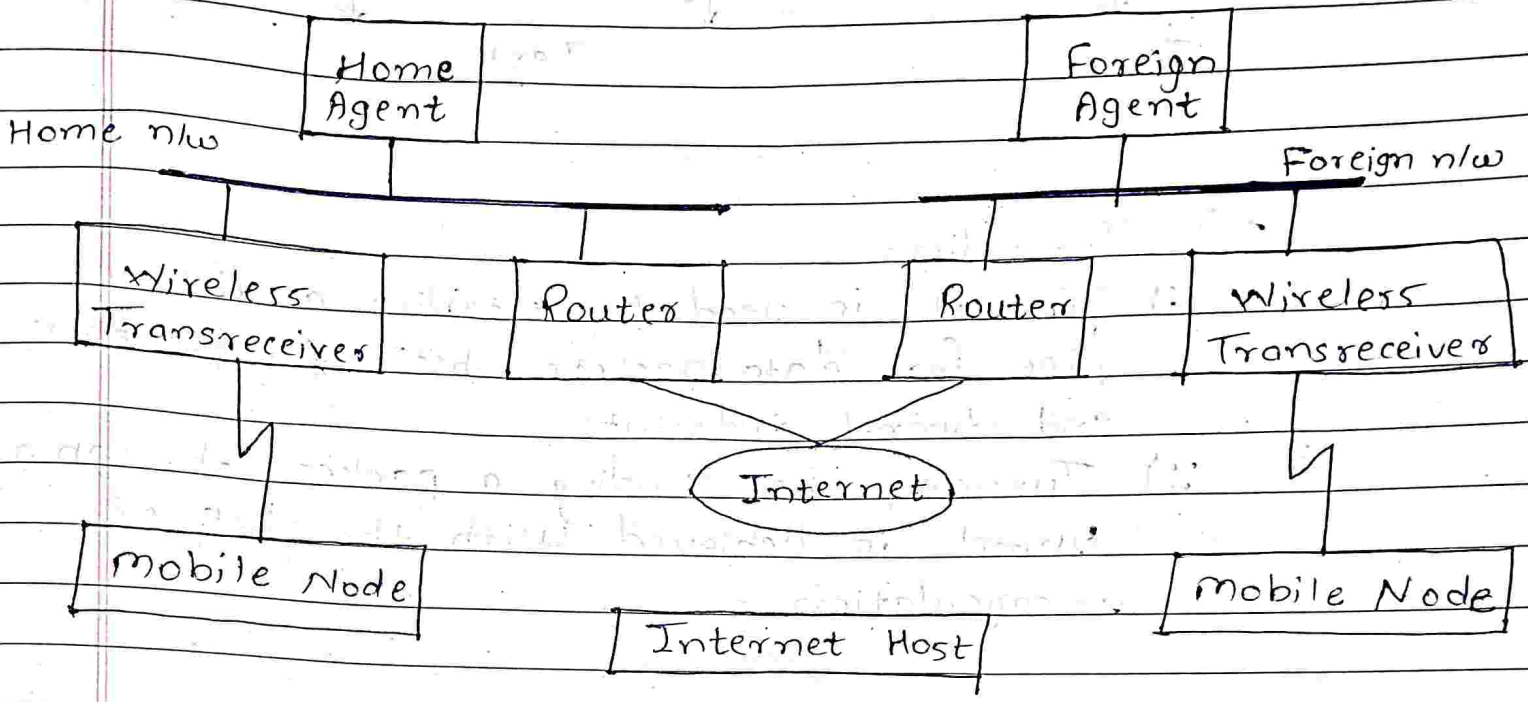
* module-3 *

3) What is mobile IP and explain its process.

→

Mobile IP is a communication protocol that allows the users to move from one n/w to another with the same IP address.



Process of Mobile IP :-

1) Agent Discovery -

During the agent discovery phase the HA and FA advertise their service on the network.

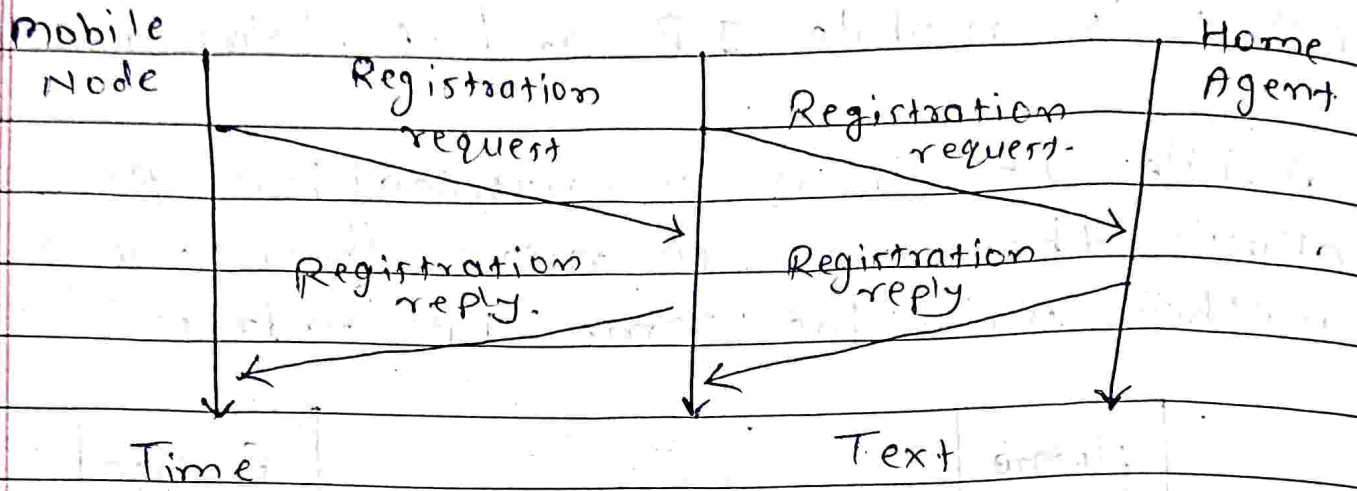
Two methods -

i) Agent advertisement

ii) Agent Solicitation

2) Registration -

Main purpose of registration is to inform the home agent of current location for correct forwarding of packets.



3) Tunneling

i) Tunnel is used to establish a virtual pipe for data packets bet^{n} tunnel entry and tunnel endpoint.

ii) Tunneling i.e Sending a packet through a tunnel is achieved with the help of encapsulation.

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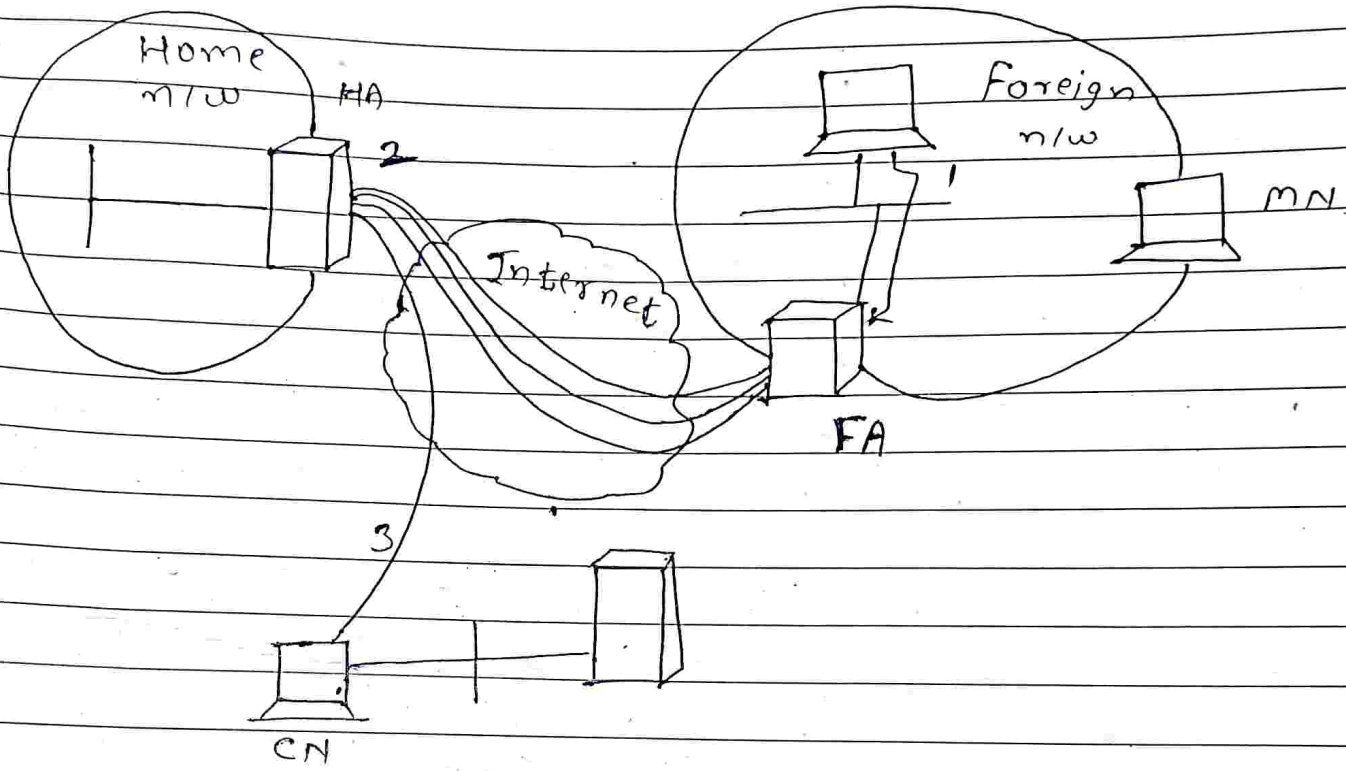
* Reverse Tunelling



There may be a situation where it is not feasible for mobile node to send packets directly to internetwork via foreign agent, then in that case optional feature called Reverse Tunnelling is used if it supported by MN, HA and FA.

* Reverse tunneling is used in following Scenario

1) Ingress filtering / firewall.
2) Multi-cast
3) Time-to-leave

MH - Mobile Host
SH - Supervisory Host
FH - Foreign Host.

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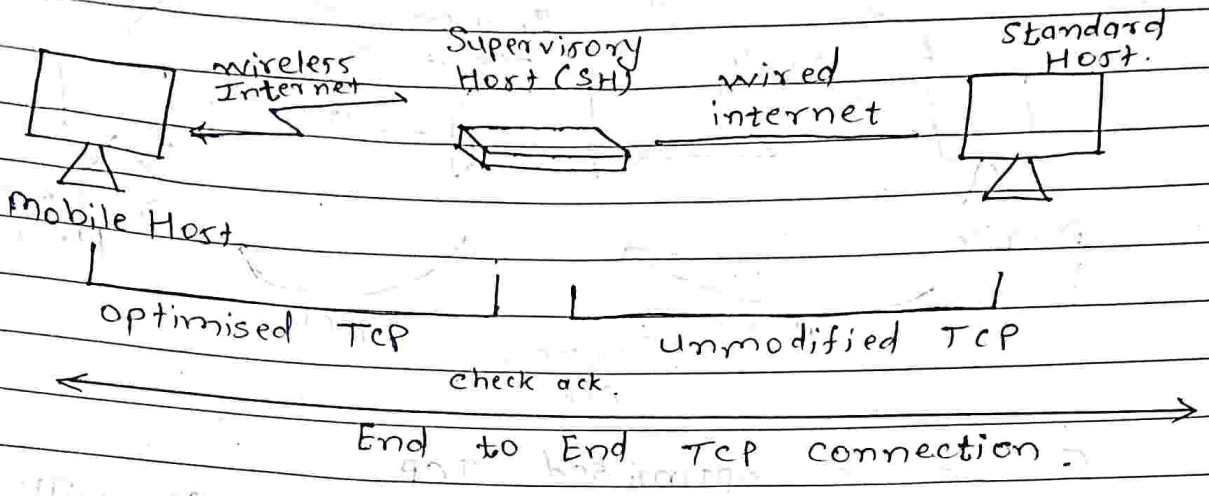
Q.5] Mobile TCP



- The Transmission Control Protocol (TCP) is one of the core protocols of internet protocol.
- Trier to avoid the Sender window from Shrinking or reverting to Slow Start.

TCP → Wired (Fixed Host ↔ Supervisory Host)
TCP → Wireless (Supervisory Host ↔ Mobile Host)

↳ many (MH) are connected to SH through several Bare Station (BS)

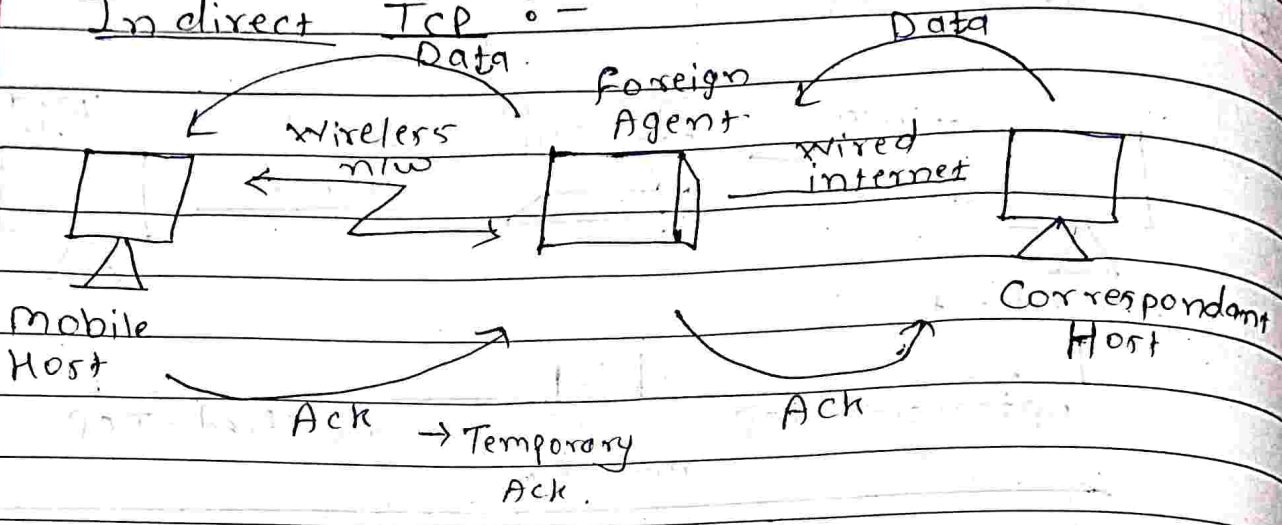
↳ (SH) Supervises all packets transmitted to (MH) and Ack sent by MH.

↳ If Ack is not received by FH, SH decides that MH is disconnected and sends FH window size to zero.

↳ When SH noticer that the MH is connected it sets full window size of the Sender FH.

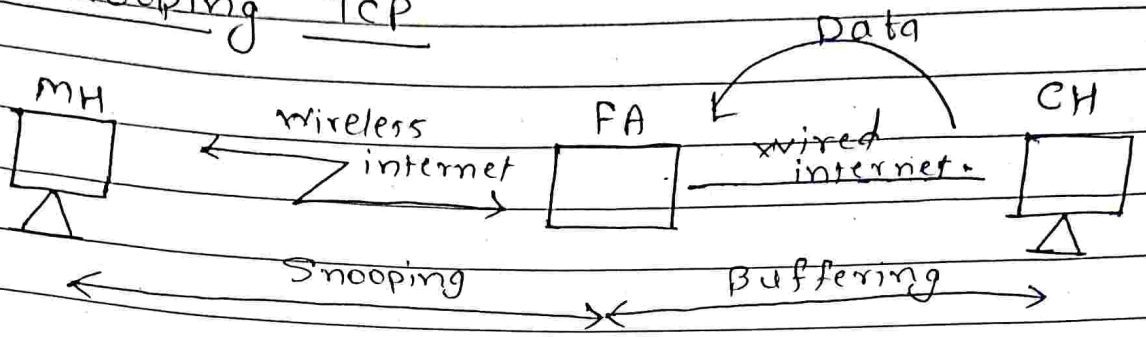
Q. 6)

Indirect TCP :-



① It is optimised TCP
② CH sends the data to FA, FA will send Acknowledgment.
③ CH recognised the data with MH.
④ FA sends data to MH.
⑤ MH sends Ack to FA (Temporary Ack) means not sends to CH.
⑥ If MH not send Ack means data is not send to MH.
⑦ So FA will retransmits the data to MH is called as indirect TCP

Snooping TCP



End to end TCP connection

① Snooping provides the end to end TCP connection.
② So here we added snooping TCP approach.
③ Snooping watch the every packets in both the directions.
④ Snoop layer look at every packet in connection.
⑤ Buffering stores the data.
⑥ CH sends data to FA. FA not send ack to CH.
⑦ FA Stores the data (D_1, D_2, D_3)
⑧ FA sends data to MH one by one.
(only D_1 to MH) (D_2 to MH) (D_3 to MH)
⑨ MH send Ack to FA & FA will send Ack to CH.
⑩ Now FA sends data to MN but MN not send ack then FA retransmit the data.
⑪ Then MN will send Ack to CH data will get.

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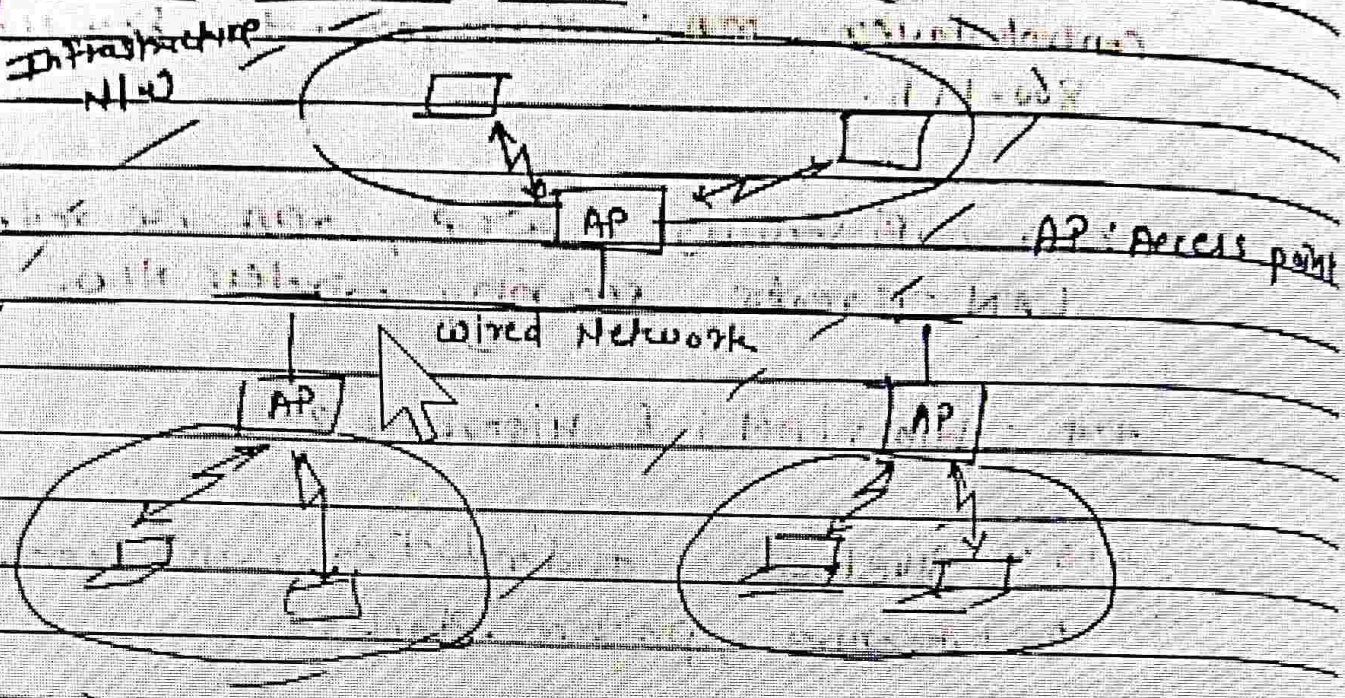
Network architecture of wireless nlw.

WLAN can broadly classified into two types, namely Infrastructure networks and Adhoc LANs.

Infrastructure Networks



(1) Infrastructure nlw contains special nodes called Access point (APs), which are connected via existing nlw.

(2) APs are special in the sense that they can interact with wireless nodes as well as with existing wired nlw.

(3) APs also act as bridges with other networks.

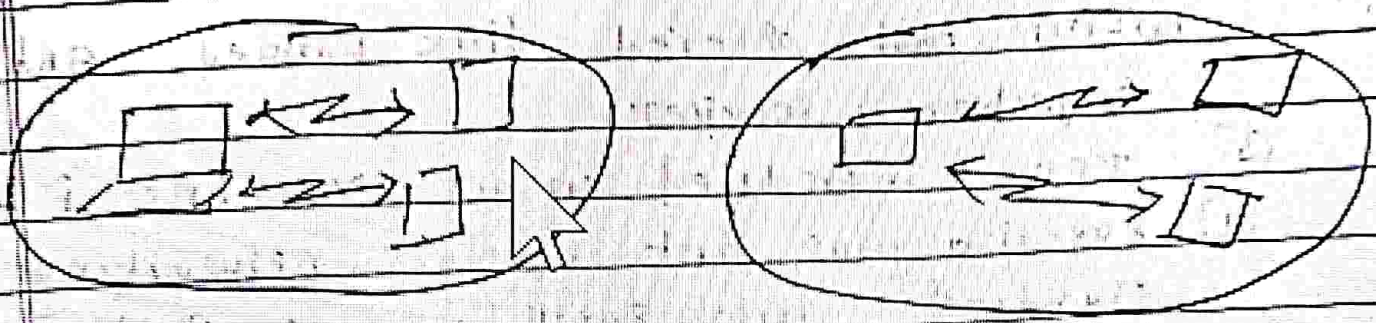
In above diagram.

→ Three infrastructure based wireless nlw

→ Infrastructure based nlw provides access to other networks, it include forwarding functions, medium access control functions etc.

- In this communication takes place between wireless nodes and access points.
- Wireless nodes cannot directly communicate with each other.

Ad hoc Networks



- Ad hoc LANs do not need any fixed infrastructure.
- Each node can communicate directly with other nodes and access point is not needed in this.
- Nodes within ad hoc n/w can communicate only if they are coverage range of each other.
- They can also communicate if other nodes can forward their message.

IEEE 802.11

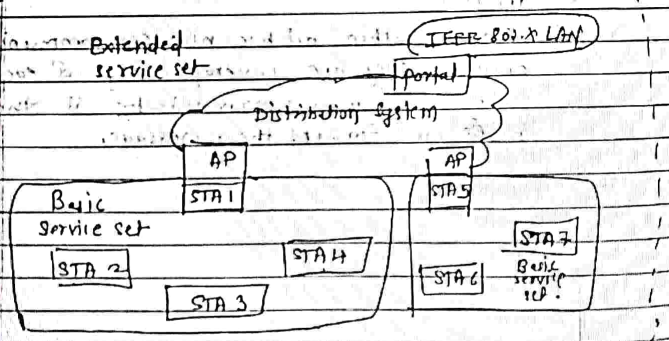
① IEEE 802.11 is a set of standards for wireless local Area Network (WLAN) computer communication.

② The primary goal of standard was to provide the specification for simple and robust WLAN that offered time-bonded and asynchronous services.

③ IEEE introduced various versions of 802.11.

④ 802.11 a was first wireless networking standard, but 802.11 b was first widely accepted one.

IEEE 802.11 System Architecture



Station (STA)

- STA is most basic component of the wireless network.
- A station is any device that contains the functionality of 802.11 protocol.
- Station could be a laptop, PC, handheld device or access point.
- Stations may be mobile, portable or stationary.
- All stations support the 802.11 station services of authentication, privacy and data delivery.

Access Point

- The access point that controls the medium access can also provide access to other nlw.
- It is typically a station integrated into wireless LAN and the distribution system.

function

① Time Synchronization.
② Power management support
③ Point coordination function

Basic Service set (BSS)

① The BSS consists of group of station and access point within the same radio coverage.
② All stations in the BSS communicate with access point and no longer communicate directly.

(3) Different BSSs are connected to each other via a distribution system.

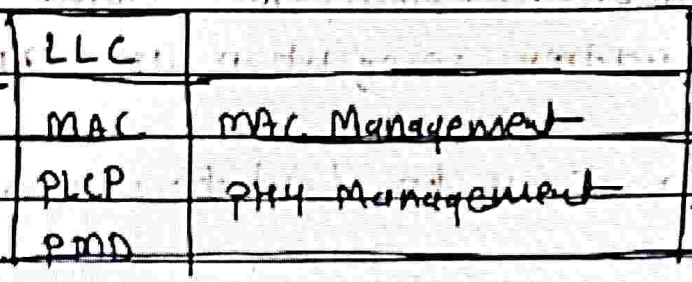
* Extended Service Set (ESS)
- An ESS is formed by two or more basic service sets interconnected by distribution system.
- Each ESS has its own ESSID which is used to separate different nlw.

* Distribution System (DS)
- It connects several BSSs to form a single nlw and thus extends the wireless coverage area.
- The DS is not really part of 802.11 standard.
- The DS could consist of bridged IEEE LANs, wireless links or other nlw.

DS offers services such as;
Distribution service, that is used to exchange MAC frames from stations in one BSS to stations in another BSS.

IEEE 802.11 Protocol Stack.

IEEE 802.11 Standard covers only the physical layer (PHY) and the medium access layer (MAC).



IEEE 802.11 Protocol Architecture.

(A) Physical layer (PHY)

functions of physical layer.

1. Encoding / decoding of signals.
2. Preamble generation / removal for synchronization
3. Bit transmission
4. It also specifies the transmission medium

Physical layer is further divided into PLCP and PMD.

(i) Physical layer Convergence Protocol (PLCP)
- PLCP sub layer provides a carrier sence signal called as clear channel assesment (CCA)
- It provides a common PHY-SAP (Service Access Point) independent of the underlying transmission technology used.

(ii) Physical medium Dependent (PMD)
This sub layer handles modulation and encoding / decoding of signals.

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(B) MAC layer.

functions.

- on transmission, assemble data into frame with address and error detection fields.
- on reception, disassemble frame and perform address recognition and error detection.
- Govern access to LAN transmission medium.

(C) MAC Management-

- Authentication
- Encryption
- Power management.

(D) Station management.

- This layer interacts with both the management layer (PHY and MAC)
- It is responsible for additional higher layer functions such as controlling the bridging of different BSSs and interaction with the distribution system.

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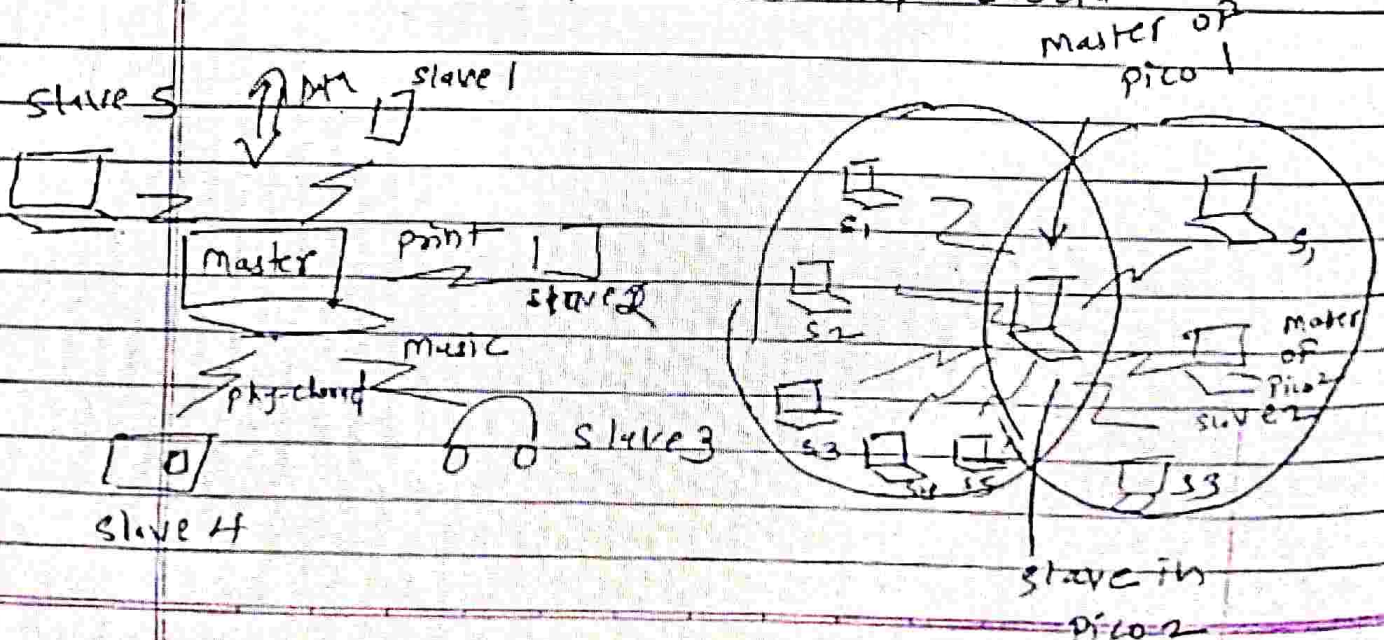
Bluetooth :

- Bluetooth is an industrial specification for wireless personal Area Networks (WPAN).
- Bluetooth specifications are developed and licensed by Bluetooth Special Interest Group (SIG).
- It provides a way to connect and exchange information between devices such as mobile phones, laptops, personal computers, printers and video game.

Characteristics :

1. It operates in 2.4 GHz
2. operating range is 10 meters or less. can be extended up to 100 meters.
3. Data rate is about 730 kbps.
4. It uses Time Division Duplex (TDD) for send / receive separation.



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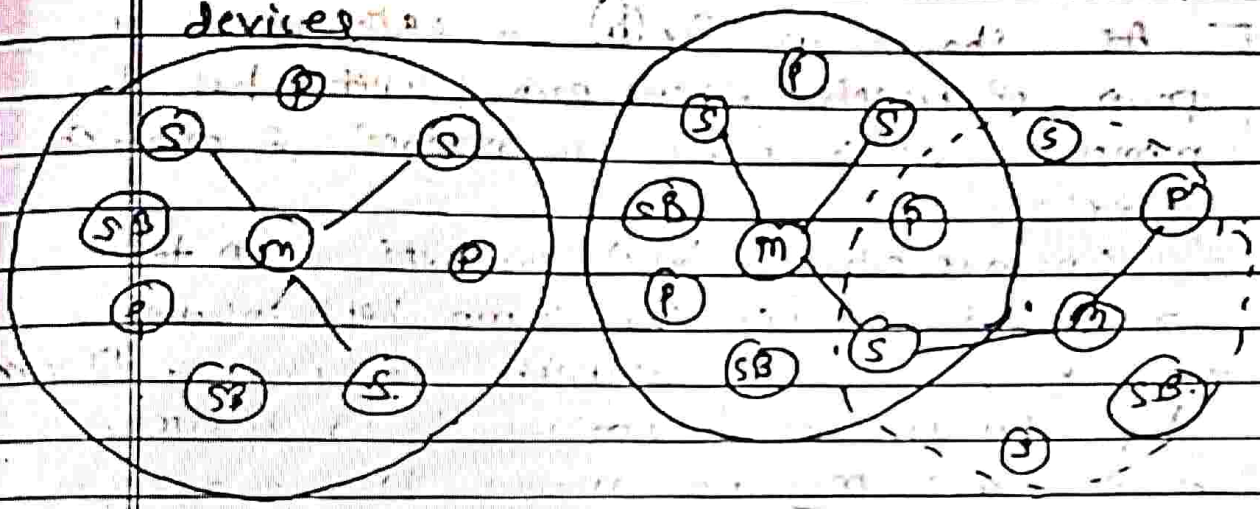
Piconet and Scatternet (Topology in BLUETOOTH)

A piconet is a collection of Bluetooth enabled devices.



M: master, S: slave
P: Parked SB: Standby

(a) Piconet (b) Scatternet.

- Each Piconet has a single master and one or more slaves.
- A master can connect to 7 active slaves and up to 255 parked slaves per piconet.
- Thus, an Active member address (AMA) is of 3 bits whereas a parked member Address (PMA) is of 8 bits.
- The master device initiates communication.
- The master gives its clock and device ID to all the slaves in the piconet.
= Hopping pattern is determined by device ID while phase in hopping pattern is determined by clock.
- All devices in a piconet hop together.

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- The communication may be point to point or point to multipoint.
- As shown in Fig (b) a scatternet is a group of piconets where each piconet has a member which is also a member of another piconet.
- communication bet'n piconets can take place via devices that jump bet'n piconets.
- Each piconet is scatternet can use a different hop pattern as determined by its master.
- A device may be master in one piconet and slave in another.

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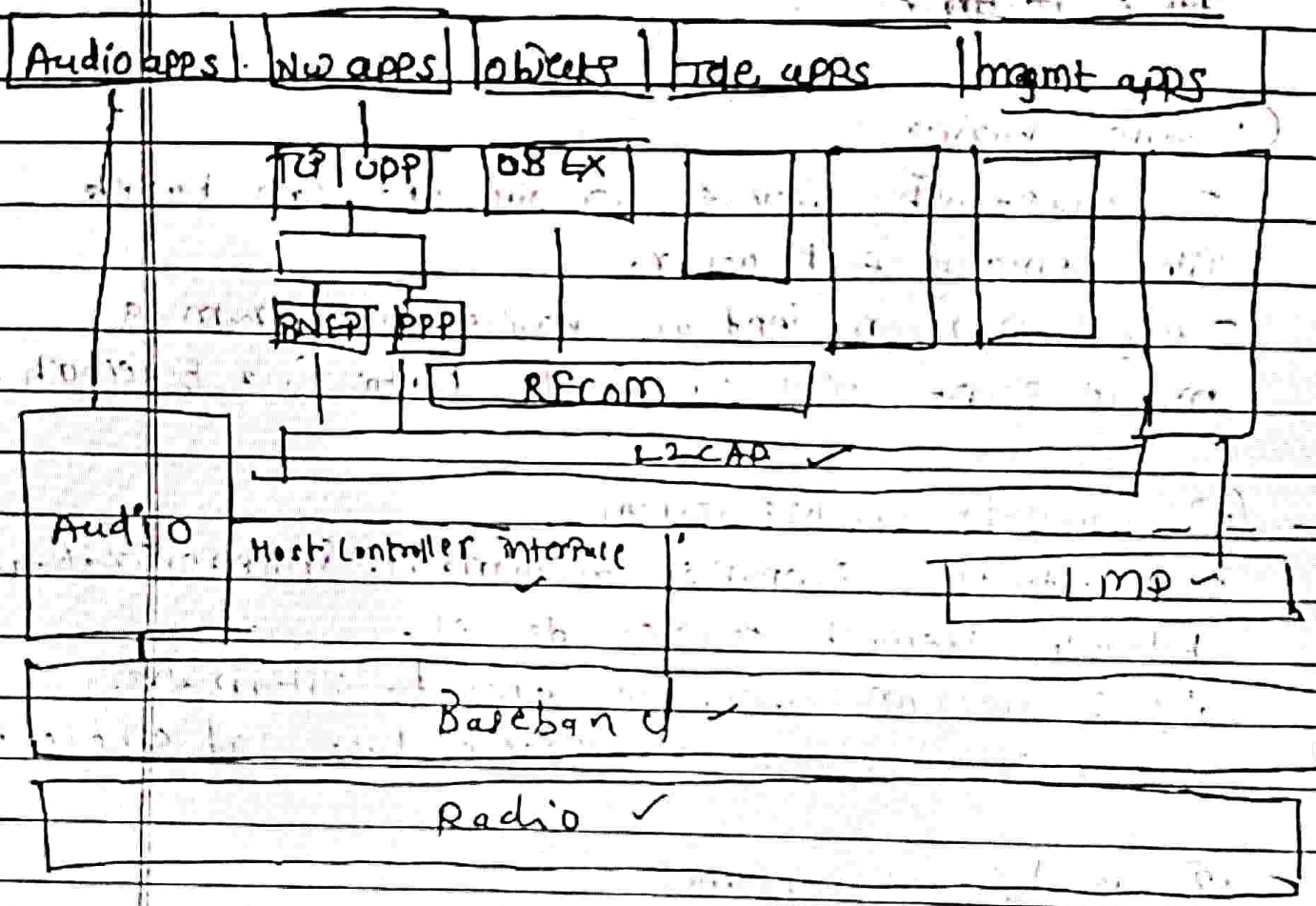
WPA (wiFi Protected Access)

- WPA was used as a temporary security enhancement for WEP.
- The WPA was formally adopted in 2003.
- The most common WPA configuration is WPA-PSK (Pre shared key).
- The keys used by WPA are 256 bits
- Temporal key Integrity Protocol or TKIP is used for encryption.
- WPA enterprise uses an authentication server for keys and certificates generations

WPA2 (wiFi Protected Access 2)

- It was introduced in 2004.
- The most important improvement of WPA2 over WPA was the usage of AES (Advanced Encryption standard)
- It must be good enough to protect home networks.

Bluetooth Protocol stack / Architecture



AT - Attention sequence
OBEX - Object Exchange
TCS BIN - Telephony control protocol Specification Binary
BNEP - Bluetooth Nlw Encapsulation protocol
SDP - Service discovery protocol
RFCOMM - Radio Frequency comm.
LMP - Link Management protocol

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The various layers and protocols of core specification are as follows.

Radio Layer -
- Bluetooth operates in the 2.4 GHz.
- It uses FHSS with a typical hopping rate of 1600 hops/s.
- It uses Time division duplex (TDD) for send/receive separation.
- Operating range is 10 meters or less.

Baseband Layer -
- It is a part of the bluetooth system that specifies or implements the medium access and physical layer procedure between bluetooth devices.

This layer is responsible for the following functions
- Connection establishment
- Packet formats
- Timing
- Frequency selection
- Basic QoS parameter
- Power management

Link Manager Protocol (LMP)
The LMP manages the following aspects of the radio link between the devices.
- Authentication, encryption
- Clock synchronization
- Power control

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Host Controller Interface (HCI)

- The HCI is standardized interface between the host controller and the host and also provides a communication protocol between them.
- It defines the set of functions of a bluetooth module that are accessible to the host and its application.
- HCI can be seen as a h/d / s/w boundary.
- Implementation of HCI is not mandatory and in some fully integrated systems it may not even be necessary.

Logical link control and Adaptation protocol (L2CAP)

- It is responsible for adaptation of the higher layers to the baseband layer.

It provides three different types of logical channels on top of the baseband layer.

1. Connectionless channels, typically used for broadcast from master to slaves.
2. Connection-oriented channels, these are bi-directional with QoS flow specification.
3. Signaling channels, use to exchange signaling messages between L2CAP entities.

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Service Discovery protocol (SDP)

- SDP allows devices in the bluetooth environment to locate the available services.
- SDP is adapted to highly dynamic environment.
- SDP defines only the discovery of services and not say anything about their usage.

SDP transaction is as follows.

- client sends a request to search for a service of interest.
- server responds with list of available services that match the clients criteria.
- The client uses this list to retrieve additional service attributes for the service interest.

The various layers and protocols of the profile specifications are:

Radio Frequency Communication (RFcomm)

- It is primarily, cable replacement protocol that provides a serial line interface to the existing application.
- RFcomm supports multiple serial port over a ~~bind~~ single physical channel.

Telephony control Protocol specification Binary (TCS-BIN)

- It describes a binary, packet based, bit-oriented protocol that defines call control signaling for the establishment of voice & data calls between bluetooth devices

	IEEE 802.11a	IEEE 802.11b
Frequency band	5.7 GHz	2.4 GHz
Average Theoretical speed	54 Mbps	11 Mbps
Modulation	OFDM	CCK modulated with QPSK
Channel bandwidth	20 MHz	20 MHz
Coverage radius	35 m	38 m
Unlicensed spectrum	Yes (it depends on countries)	Yes
Radio Interference	Low	High
Introduction cost	Medium-Low	Low
Device cost	Medium-Low	Low
Mobility	Yes	Yes
Current use	Medium	High
Security	Medium	Medium