

# MOBILE AND WIRELESS COMMUNICATION

Course code	ESC-CSE-308G				
Category	Engineering Science Course				
Course title	Mobile and wireless communication				
Scheme and Credits	L	T	P	Credits	Semester 6
	3	0	0	3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

## Objectives of the course:

- Understand the wireless/cellular radio concepts such as frequency reuse, handoff and interference between mobiles and base stations.
- Identify the techno-political aspects of wireless and mobile communications such as the allocation of the limited wireless spectrum by regulatory agencies.
- Understand the information theoretical aspects such as channel capacity, propagation effects, modeling the impact of signal bandwidth and motion in mobile systems.
- Describe the current and future Mobile Communication Systems, GSM, Satellite, Broadcasting, Bluetooth, Wireless LANs, Mobile Adhoc Networks.
- Describe the mobility support mechanism, WWW and WAPs.

## UNIT 1

**Introduction:** Application, History, Market Scenario, Reference Model and Overview, Wireless Local Loop and Cellular system.

**Wireless Transmission:** Frequencies, Signals, Antennae, Signal Propagation, Multiplexing, Modulation, Spread Spectrum.

**MAC Layer:** Specialized MAC, SDMA, FDMA, TDMA – Fixed TDM, Classical ALOHA, Slotted, ALOHA, CSMA, DAMA, PKMA, Reservation TDMA. Collision Avoidance, Polling, Inhibit Sense Multiple Access, CDMA.

**Broadcasting:** Unidirectional Distribution Systems, Digital Audio Broadcasting, Digital Video Broadcasting, Convergence of Mobile and Broadcasting Techniques.

## UNIT 2

**GSM:** Mobile Services, Architecture Radio, Interface, Protocol, Localization, Calling Handover, Security, New data services.

**Wireless LAN:** IEEE 802 11- System and Protocol Architecture, Physical Layer, MAC Layered Management.

**Bluetooth:** User scenarios, Physical layer, MAC Layer, Networking, Security and Link Management. Wimax

## UNIT 3

**Mobile Network Layer:** Mobile IP-Goals, Assumptions, Requirement, Entities, Terminology, IP Packet delivery, Agent Advertisement and Discovery, Registration, Tunneling, Encapsulation, Optimization, Reserve Tunneling, Security, IPv6 , DHCP.

**Mobile Adhoc Networks:** Routing, Destination Sequence Distance Vector, Dynamic Source Routing, Hierarchical algorithms, Performance Metrics.

**Mobile Transport Layer:** Traditional TCP, Indirect TCP, Snooping, TCP, Mobile TCP, Fast-retransmission TCP, Transaction oriented TCP.

## UNIT 4

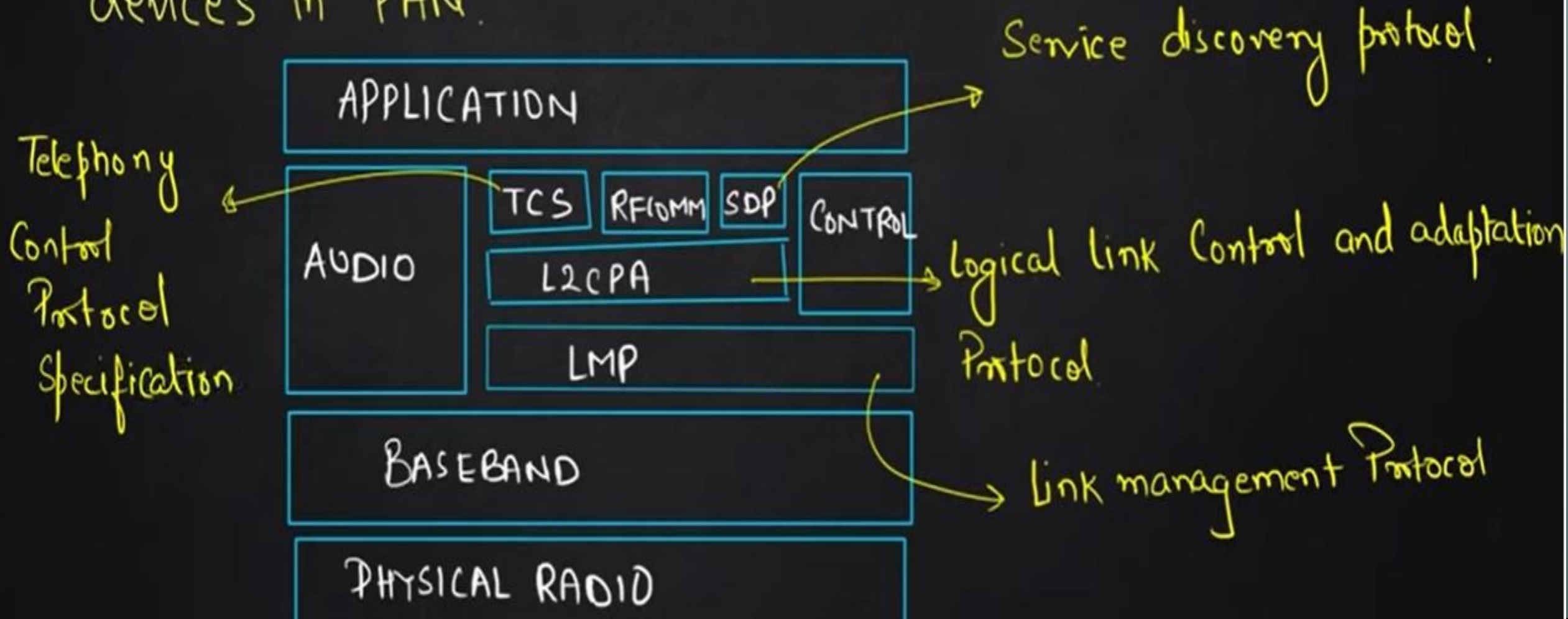
**Satellite Systems:** History, Applications, GEO, LEO, MEO, Routing, Localization, Handover in Satellite System.

**Support for Mobility:** File System, WWW, HTML, System Architecture.

**WAP:** Architecture, Wireless Datagram, Protocol, Wireless Transport Layer Security, Wireless Transaction Protocol, Application Environment, Telephony Applications.

# Bluetooth Protocol Stack:-

↳ Makes possible Comm<sup>n</sup> of both data and control among many devices in PAN.

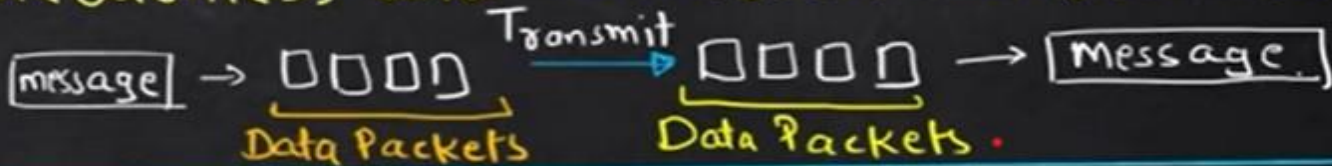




## Functions of Layers:-

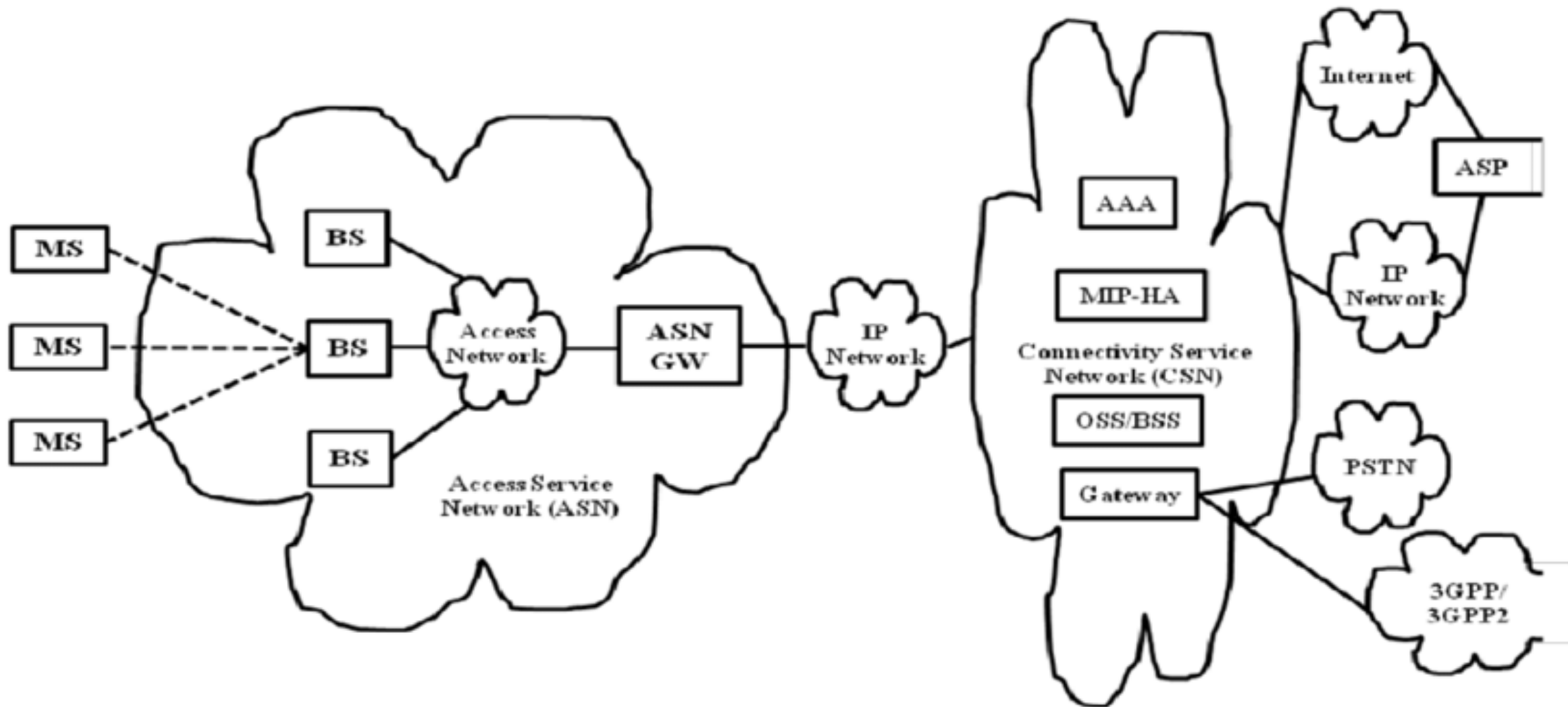
LAYER	FUNCTIONS
RADIO	<ul style="list-style-type: none"><li>→ Defines Req. on Bluetooth Transceiver Devices.</li><li>→ Specifies transceiver characteristics: modulation technique, Tolerance etc.</li></ul>
BASEBAND	<ul style="list-style-type: none"><li>→ Physical Layer, <u>Link Establishment</u>, <u>Power Control</u>.</li><li>→ Defines packet format and timing issues.</li></ul>
LMP	<p>Data Link Layer, Responsible for <u>Link Setup</u> b/w Bluetooth devices</p> <ul style="list-style-type: none"><li>→ <u>Authentication</u>, <u>Link Configuration</u>.</li></ul>



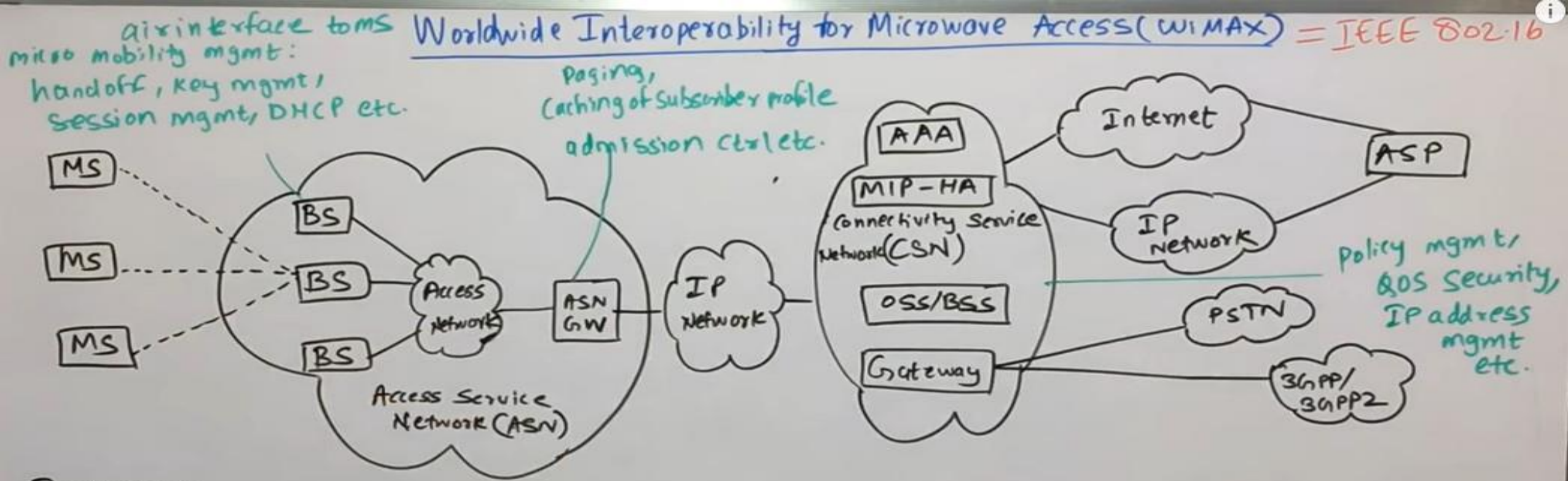
LAYER	FUNCTIONS
L2CAP	<p>Provides Connectionless and Connection oriented data services.</p> <p>↳ to upper layer protocols</p>  <pre> graph LR     Message1[message] --&gt; DP1[Data Packets]     DP1 -- Transmit --&gt; DP2[Data Packets]     DP2 --&gt; Message2[message]           </pre>
SDP	Helps mobile appl <sup>n</sup> <u>discover</u> which Services are available on which device and <u>characteristics</u> of the Service can also be determine.
RFComm Radio Freq. Comm <sup>n</sup>	<p>Helps achieving <u>TCP/IP</u> Connectivity realization.</p> <p>→ Also provide emulated <u>RS232</u> <u>Serial port</u>.</p> <p>→ Simplify connectivity with other small devices without using wires. } wireless</p>

LAYER	FUNCTIONS
TCS	Defines Call Control Signals for establishing a voice Conn <sup>n</sup> blw Bluetooth devices.

## IP-Based WiMAX Network Architecture







### Features:-

Speed: 46 Mbps Downlink & 4 Mbps Uplink

Bandwidth: 3.5 MHz to 10 MHz

Range: upto 50 km optimized to 1.5 km - 5 km

Data Transfer: 120 kmph.

Cell Radius: 5 km

Cell Capacity: 100 - 200 users

Duplexing mode: TDD, FDD → TDD focused.

Legacy: IEEE 802.16 a, 802.16 b, 802.16 c, 802.16 d

Handover: Optimized Hard Handover.



# BENEFITS OF WIMAX

- Speed
  - Faster than broadband service
- Wireless
  - Not having to lay cables reduces cost
  - Easier to extend to suburban and rural areas
- Broad Coverage
  - Much wider coverage than WiFi hotspots

## Difference Between WiMAX and Wi-Fi

<b>WiMAX</b>	<b>Wi-Fi</b>
It is used for deploying Wireless Broadband Networks.	It is used for deploying Wireless LAN networks.
It uses 2-11 GHz frequency.	It uses 2.5 GHz or 5 GHz frequency.
It has an adjustable Channel Bandwidth.	It has a fixed Channel Bandwidth of 25MHz.
It uses Full Duplex Communication Protocol.	It uses Half Duplex Communication Protocol.
It uses 3DES/AES encryption.	It has optional RC4 encryption.
Both of them uses QPSK, BPSK modulation techniques for transmission.	

# GSM [Global System for Mobile Communication]

→ GSM is based on set of standards formulated in the early 1980's by companies Nokia, Motorola etc.

→ The goals of GSM are:-

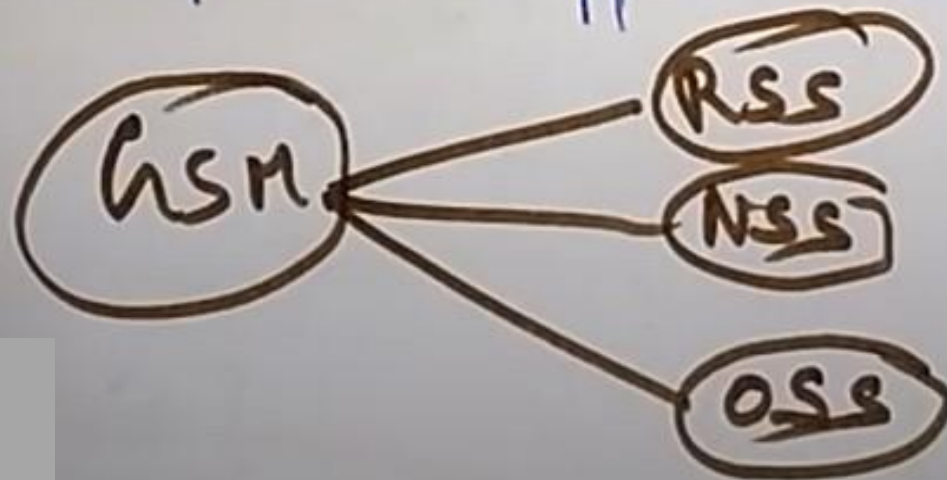
1. Supports international roaming
2. clear voice clarity
3. Ability to support multiple handheld devices
4. Spectral / frequency efficiency
5. Low powered handheld devices
6. ease of accessing the Network
7. International ISDN compatibility



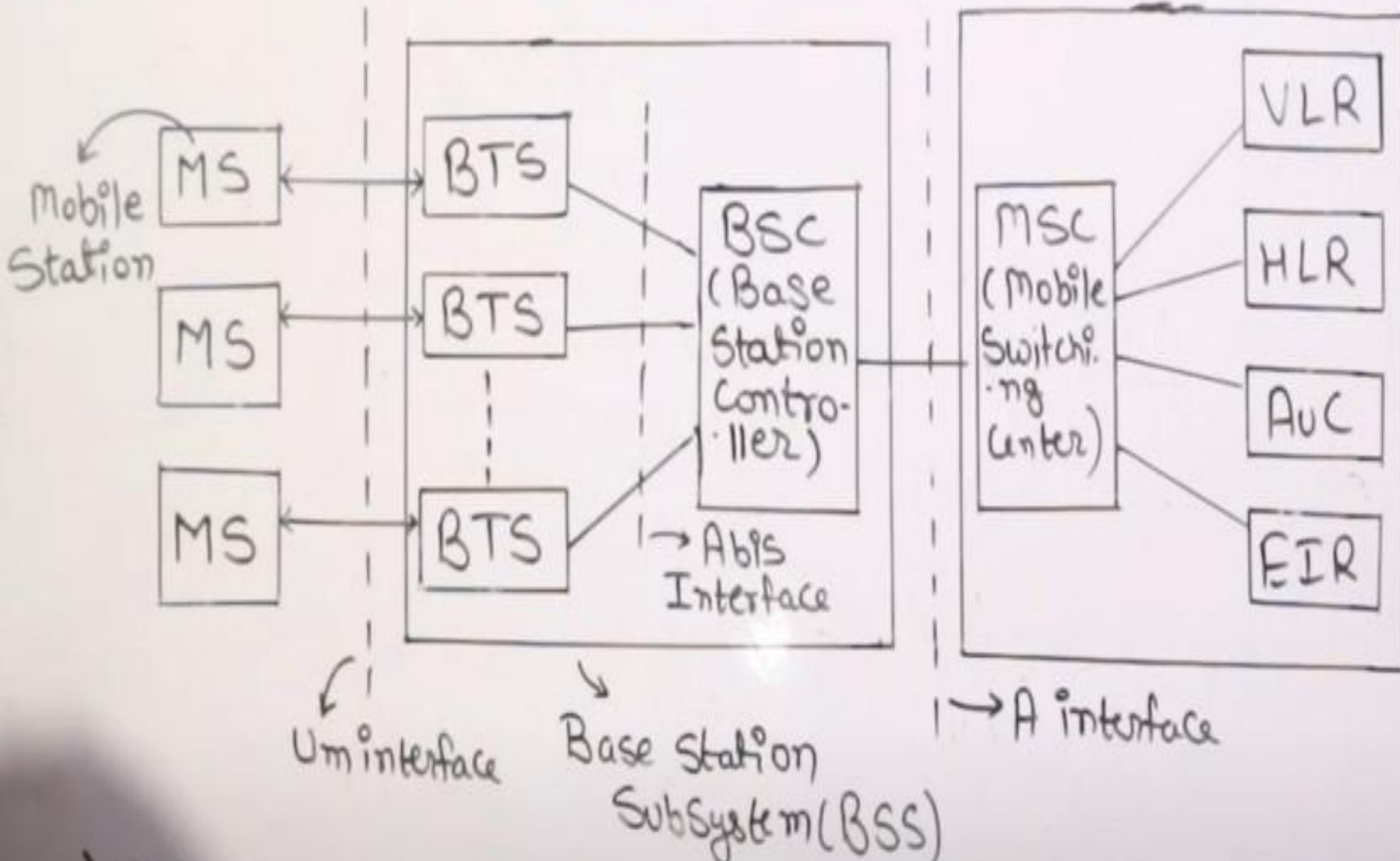
# GSM Architecture

⇒ GSM N/w can be broadly divided into

- ★ Radio / Base station Subsystem (RSS / BSS)
- ★ Network switching Subsystem (NSS)
- ★ The operation support subsystem (oss)



# GSM Architecture



7) Authentication Center (AUC)

8) Equipment Identity Register (EIR)

## I) HLR :-

- Stores permanent data about subscribers (profile, location info, status)
- Subscription info. of Registered user is stored.

## VLR :-

- Stores Temporary Info.
- Integrated with MSC.
- Works in co-ordination with HLR.

## III

## AuC :-

- Protected database
- Stores a copy of Secret Key.
- Used for Authentication.
- Protects from different type of fraud.

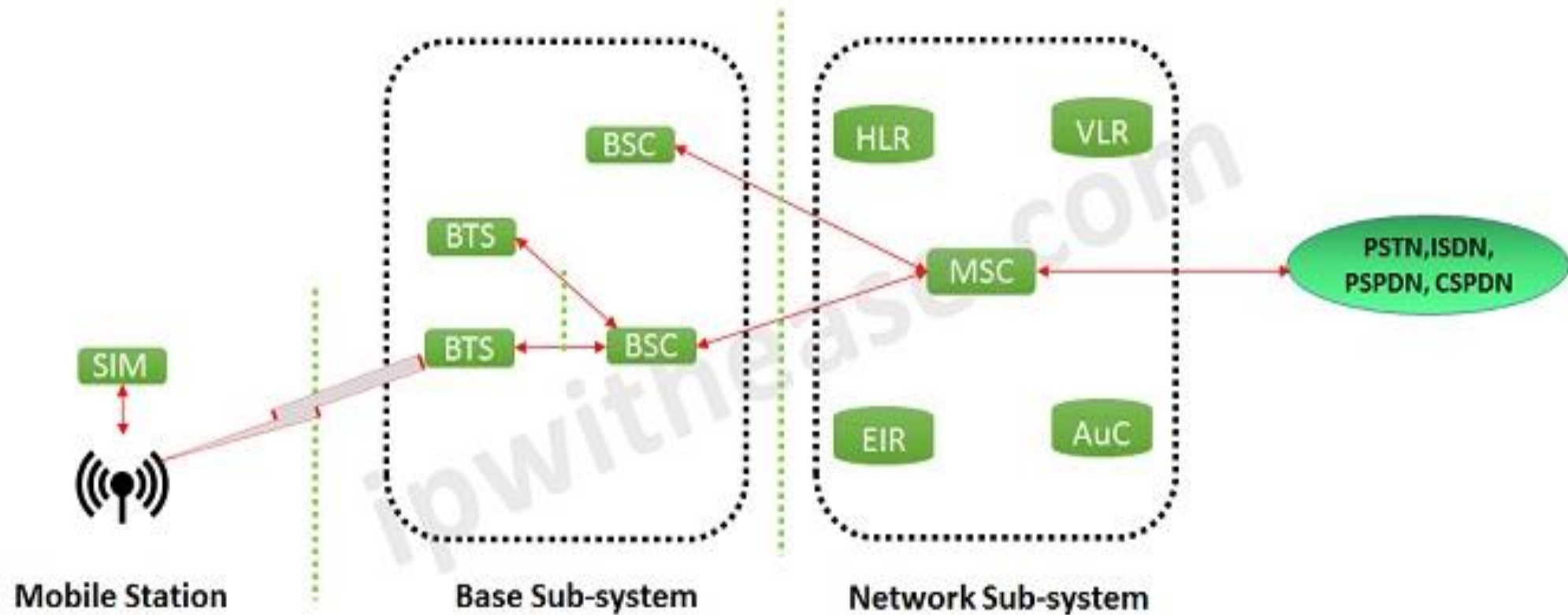
## IV

## EIR :-

- Equipment Identity Register
- Db that contain list of all valid mobile on n/w.
- IMEI used to identify each MS
- IMEI is marked as invalid in case of Stolen.



# What is GSM Technology?



WORKING OF GSM



# IEEE 802.11 Architecture

- ▶ IEEE 802.11 is a standard for WLAN.
- ▶ IEEE **802.11b** commonly called as **Wi-Fi**.
- ▶ **Advantages** of IEEE 802.11 architecture:-
  - It is flexible and support small as well as large networks
  - It provide power saving and long battery life of the equipment without loss of network connection
  - Robust
  - User Mobility

# IEEE 802.11 Architecture

► In the IEEE 802.11, the **Two network** architectures defined

1. Infrastructure Network
2. Point-to-Point Network (Ad-hoc)



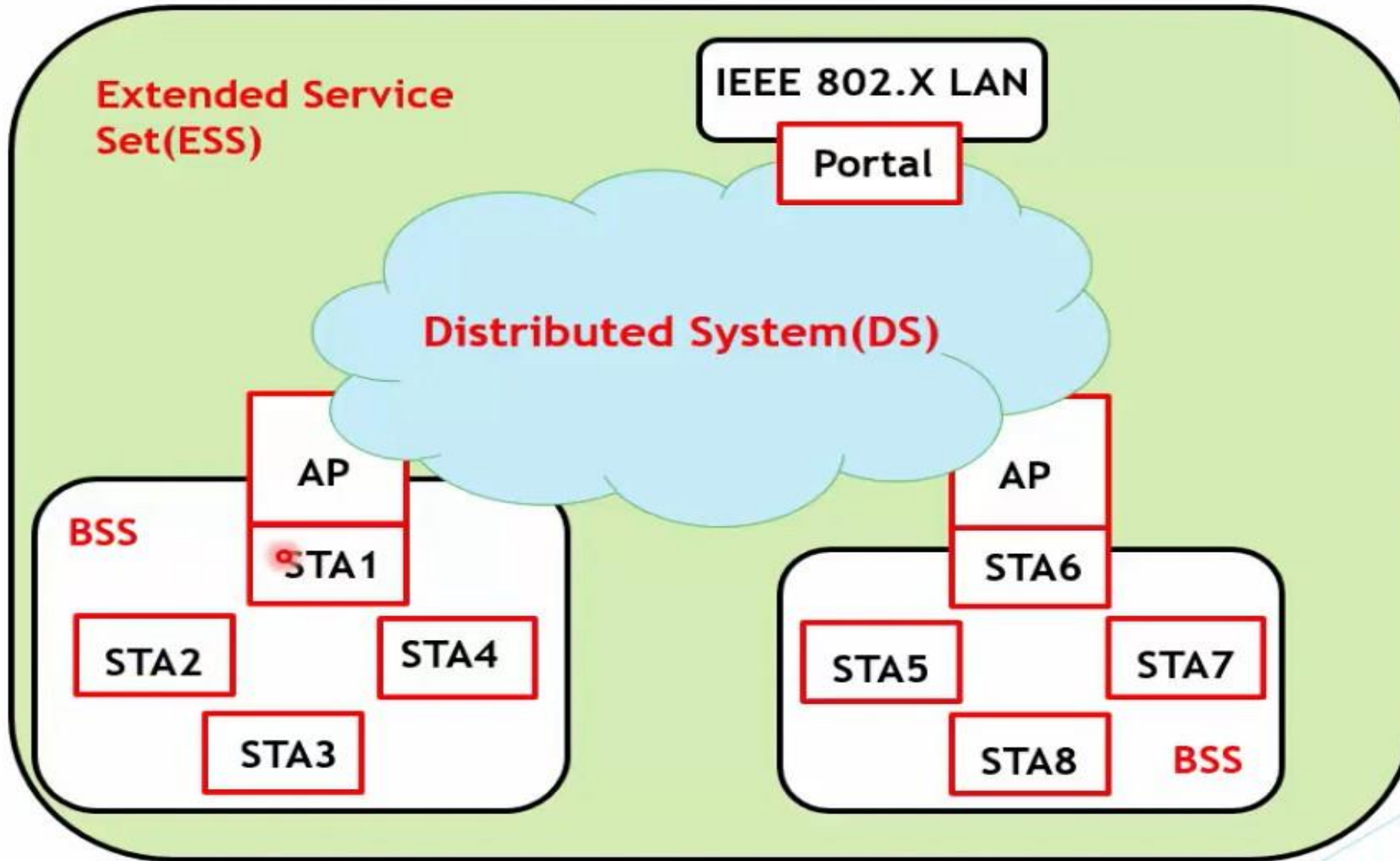
**Ad-hoc Network**



**Infrastructure Network**



# IEEE 802.11 Architecture



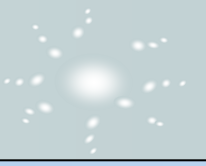
Here,  
**BSS**-Basic Service Set  
**STA**-Station  
**AP**-Access Point

IEEE 802.11 Architecture

# IEEE 802.11 Services

Service	Provider	Used to Support
Authentication	Station/AP	LAN access and Security
Deauthentication	Station/AP	LAN access and Security
Privacy	Station/AP	
MSDU Delivery	Station/AP	MSDU Delivery
Association	Distributed System	MSDU Delivery
Disassociation	Distributed System	MSDU Delivery
Reassociation	Distributed System	MSDU Delivery
Integration	Distributed System	MSDU Delivery
Distribution	Distributed System	MSDU Delivery

Here,  
MSDU-MAC Service  
Data Unit



THANKS