



SNS COLLEGE OF ENGINEERING

Coimbatore – 35

An Autonomous Institution



DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

19EC601 / Wireless Communication

III ECE/ VI SEMESTER

Unit I - **FUNDAMENTALS OF WIRELESS COMMUNICATION**

Topic 2: WLAN, PAN



Wireless LAN

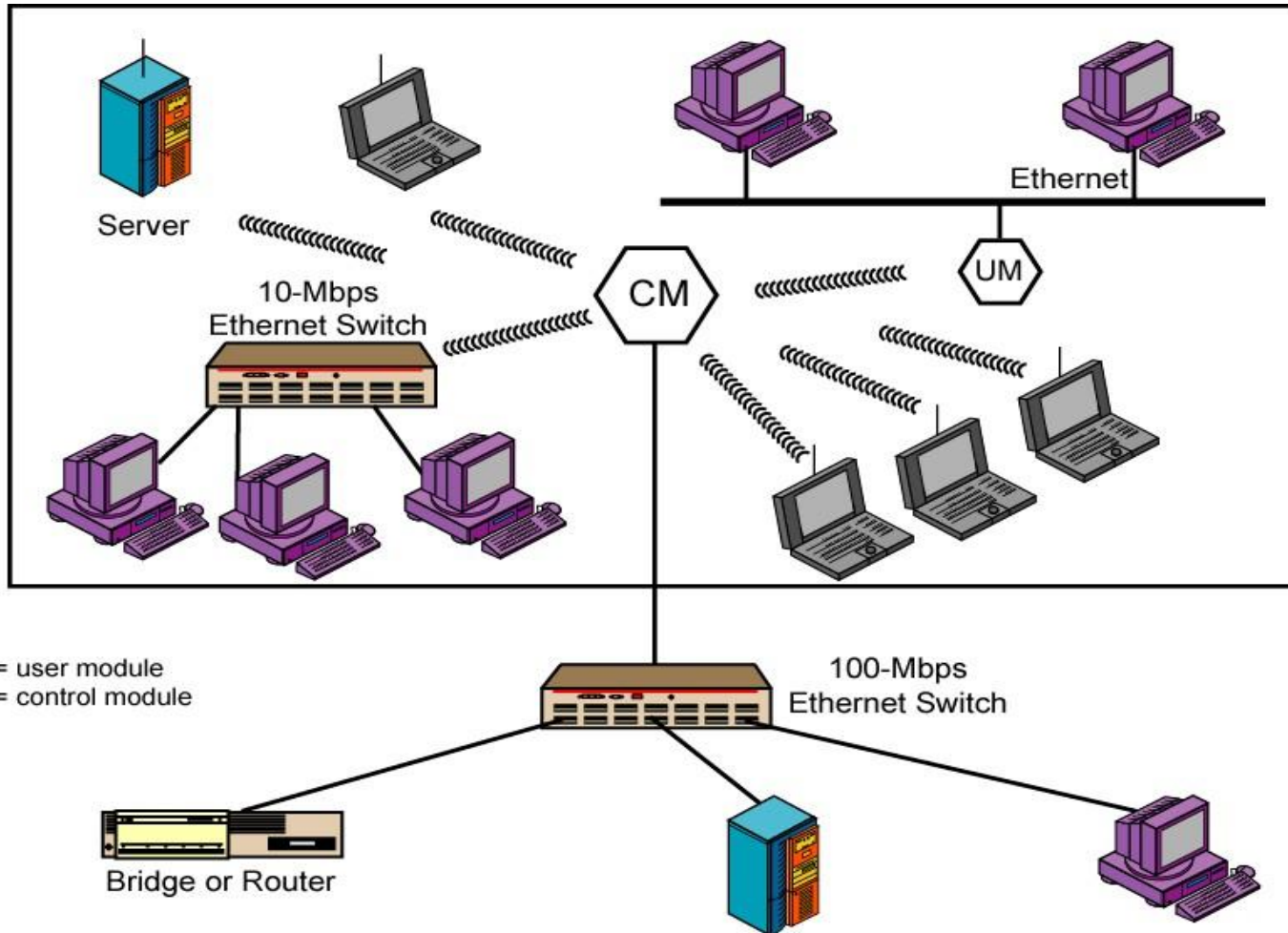
- A wireless LAN uses wireless transmission medium
- Used to have high prices, low data rates, occupational safety concerns, and licensing requirements
- Problems have been addressed
- Popularity of wireless LANs has grown rapidly



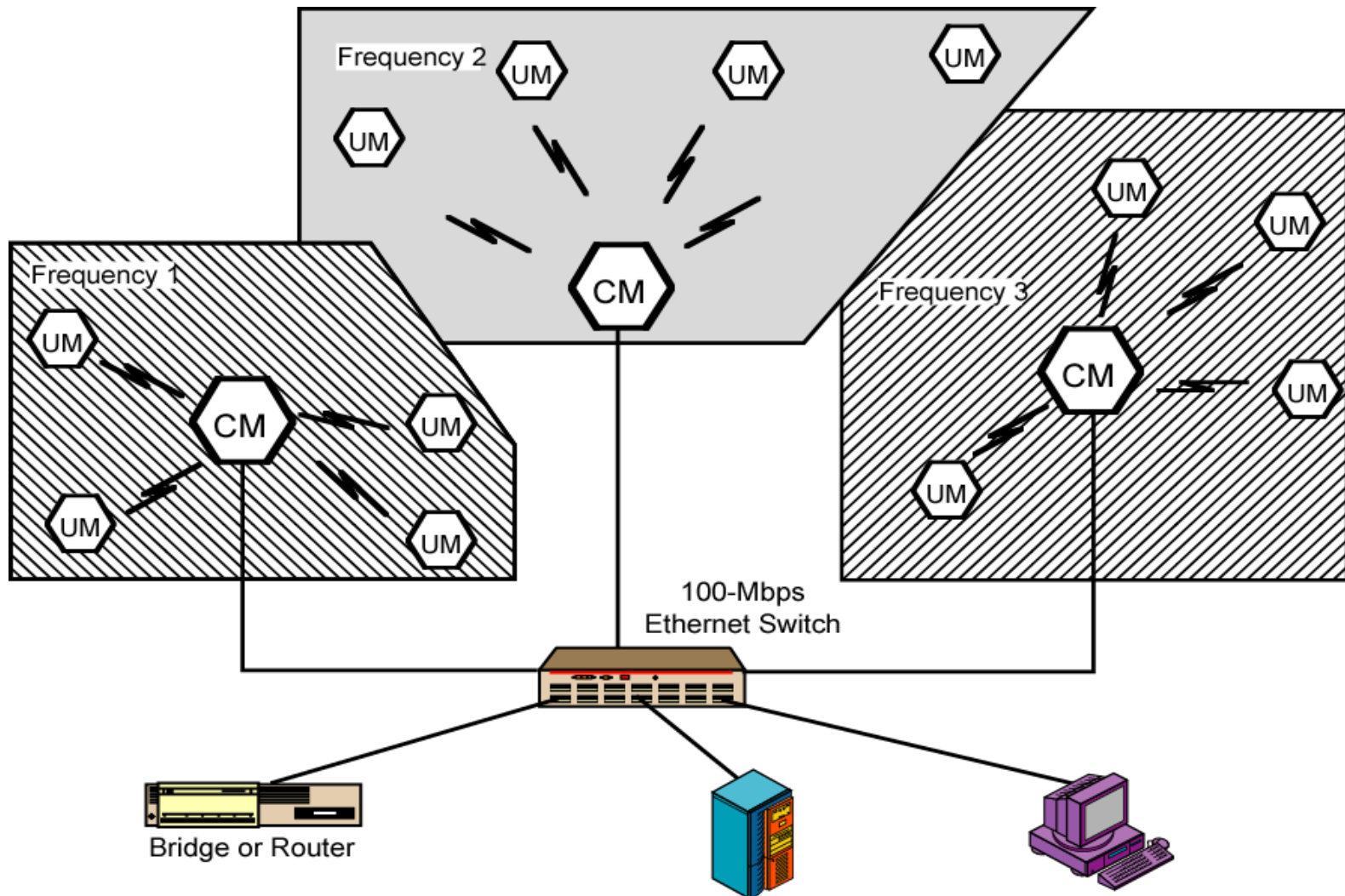
Applications

- Saves installation of LAN cabling
- Eases relocation and other modifications to network structure
- In some environments, role for the wireless LAN not needed
 - Buildings with large open areas
 - Manufacturing plants, stock exchange trading floors, warehouses
 - Historical buildings
 - Small offices where wired LANs not economical
- May also have wired LAN
 - Servers and stationary workstations

Single cell Wireless LAN



Multi cell Wireless LAN





Wireless LAN requirements

- Same as any LAN
 - High capacity, short distances, full connectivity, broadcast capability
- Throughput: efficient use wireless medium
- Number of nodes: Hundreds of nodes across multiple cells
- Connection to backbone LAN: Use control modules to connect to both types of LANs
- Service area: 100 to 300 m
- Low power consumption: Need long battery life on mobile stations
 - Mustn't require nodes to monitor access points or frequent handshakes
- Transmission robustness and security: Interference prone and easily eavesdropped
- Collocated network operation: Two or more wireless LANs in same area
- License-free operation
- Handoff/roaming: Move from one cell to another
- Dynamic configuration: Addition, deletion, and relocation of end systems without disruption to users

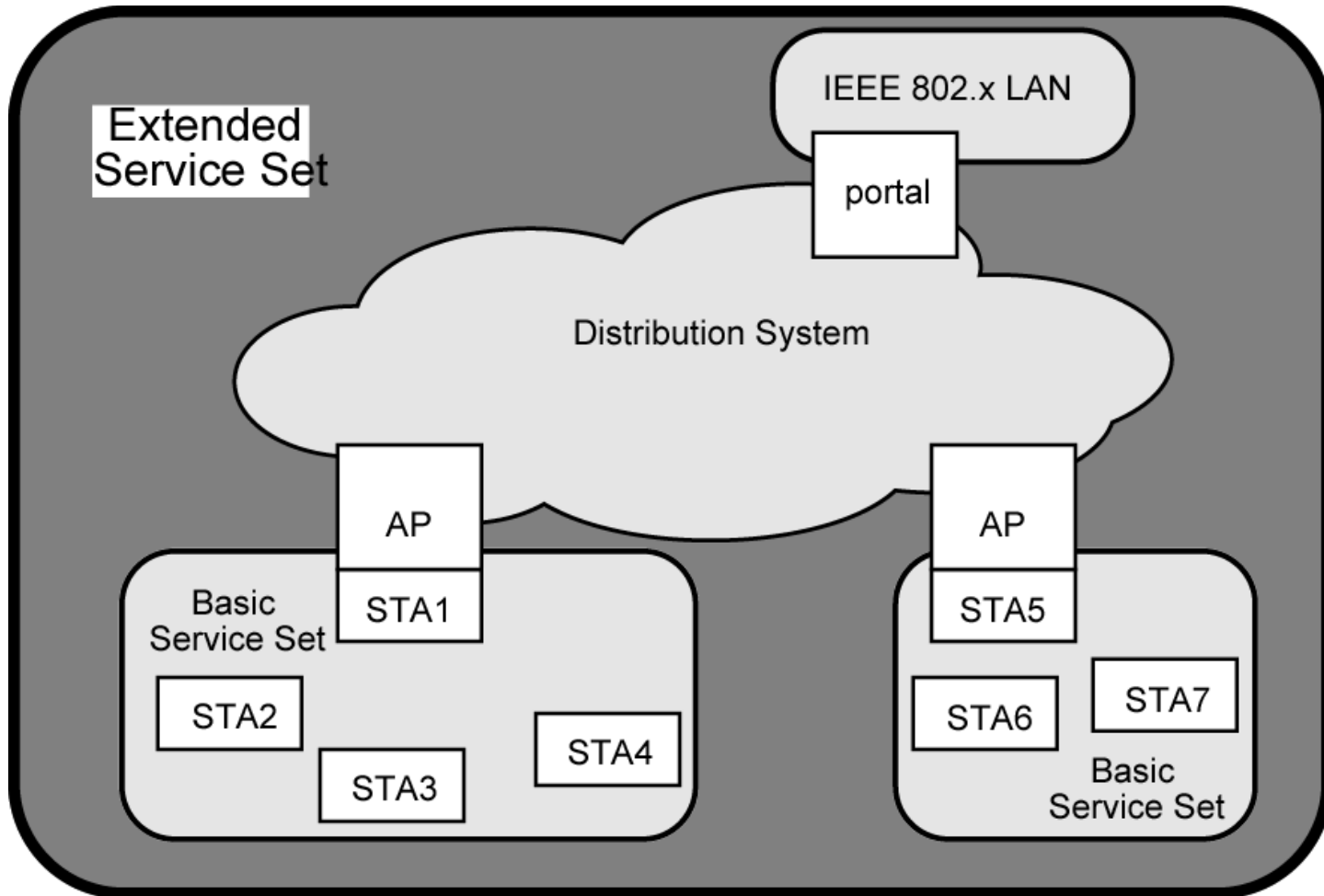


Wireless LAN Technology

- Infrared (IR) LANs: Individual cell of IR LAN limited to single room
 - IR light does not penetrate opaque walls
- Spread spectrum LANs: Mostly operate in ISM (industrial, scientific, and medical) bands
 - No Federal Communications Commission (FCC) licensing is required in USA
- Narrowband microwave: Microwave frequencies but not use spread spectrum
 - Some require FCC licensing



IEEE 802.11 architecture



STA = station
AP = access point



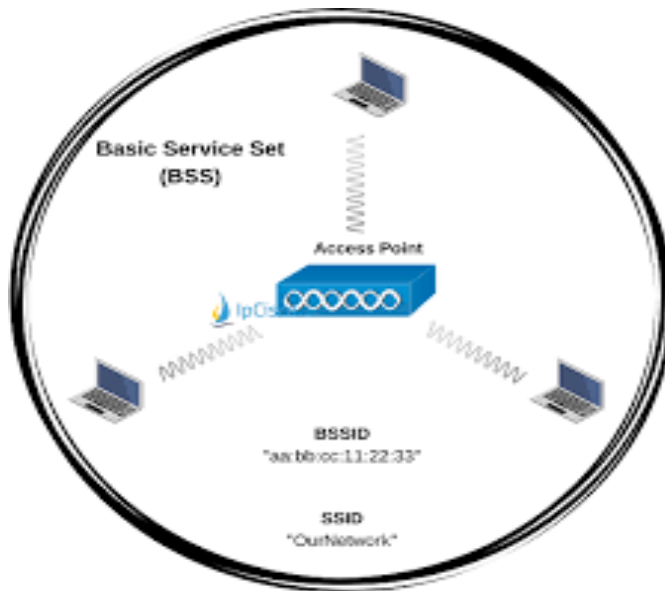
IEEE 802.11-BSS



- MAC protocol and physical medium specification for wireless LANs
- Smallest building block is basic service set (BSS)
 - Number of stations
 - Same MAC protocol
 - Competing for access to same shared wireless medium
- May be isolated or connect to backbone distribution system (DS) through access point (AP)
 - AP functions as bridge
- MAC protocol may be distributed or controlled by central coordination function in AP
- BSS generally corresponds to cell
- DS can be switch, wired network, or wireless network

Extended Service Set(ESS)

- Two or more BSS interconnected by DS
 - Typically, DS is wired backbone but can be any network
- Appears as single logical LAN to LLC





Access Point(AP)



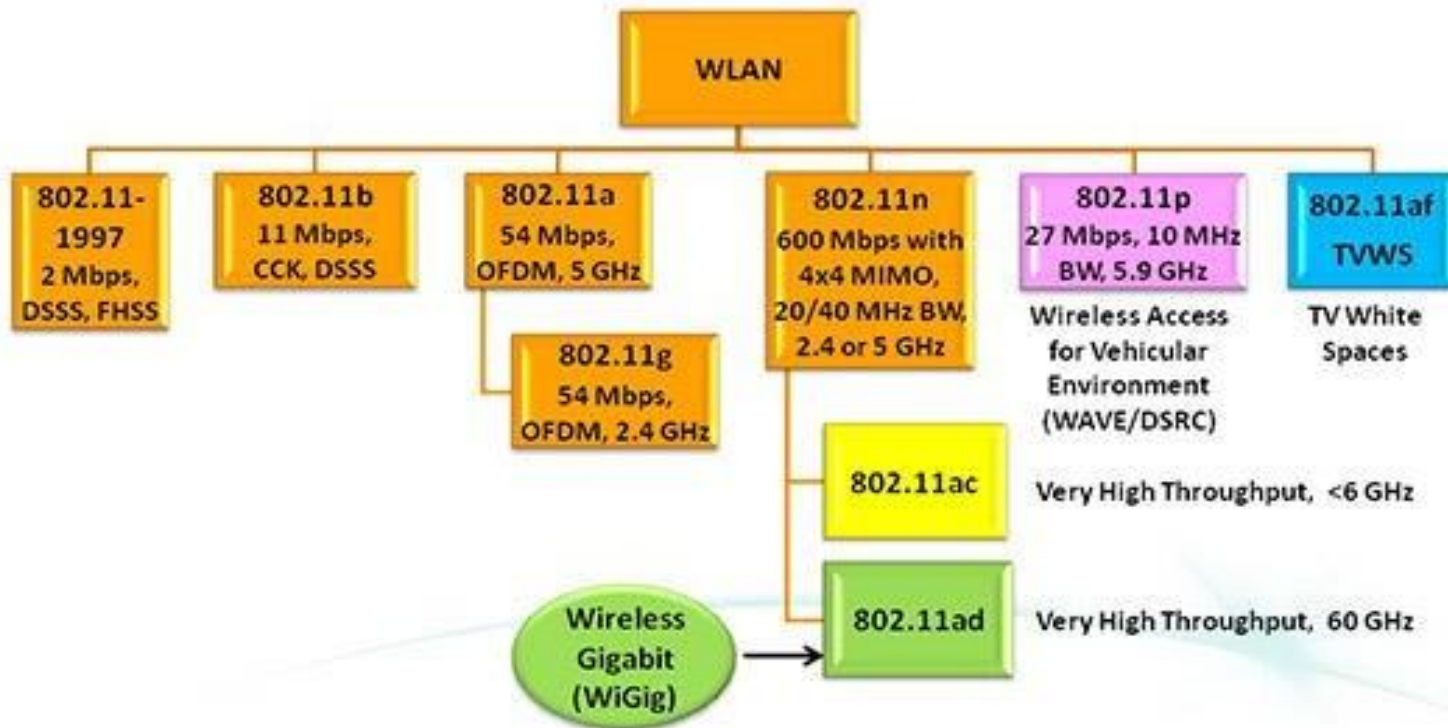
- Logic within station that provides access to DS
 - Provides DS services in addition to acting as station
- To integrate IEEE 802.11 architecture with wired LAN, portal used
- Portal logic implemented in device that is part of wired LAN and attached to DS
 - E.g. Bridge or router



Services

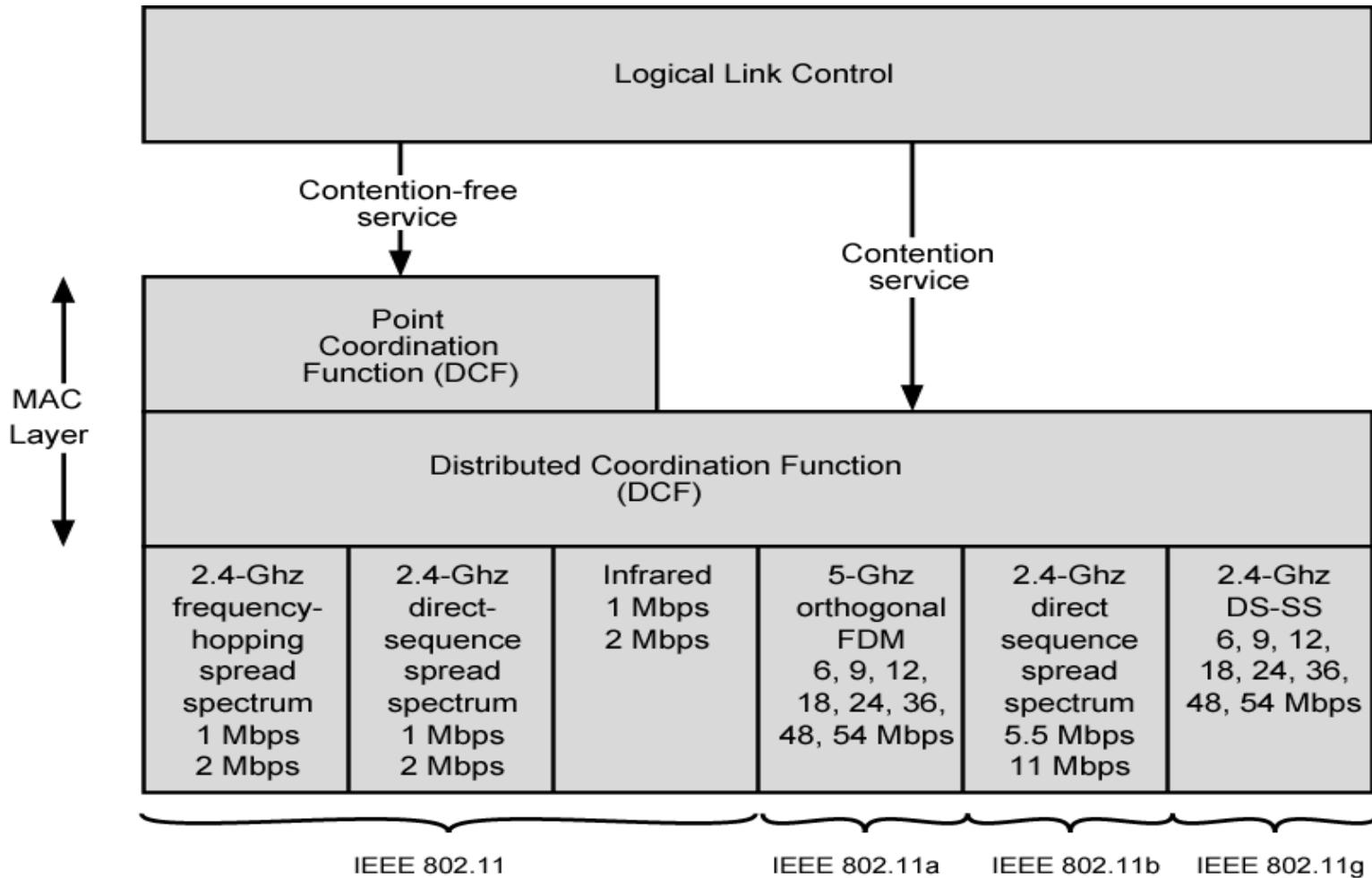
Service	Provider	Category
Association	Distribution system	MSDU delivery
Authentication	Station	LAN access and security
Deauthentication	Station	LAN access and security
Dissassociation	Distribution system	MSDU delivery
Distribution	Distribution system	MSDU delivery
Integration	Distribution system	MSDU delivery
MSDU delivery	Station	MSDU delivery
Privacy	Station	LAN access and security
Reassociation	Distribution system	MSDU delivery

IEEE 802.11 Standards Evolution



DSRC = Dedicated Short-Range Communications

Protocol Architecture





Distributed Coordinating Function



- DCF sublayer uses CSMA
- If station has frame to transmit, it listens to medium
- If medium idle, station may transmit
- Otherwise must wait until current transmission complete
- No collision detection
 - Not practical on wireless network
 - Dynamic range of signals very large
 - Transmitting station cannot distinguish incoming weak signals from noise and effects of own transmission
- DCF includes delays
 - Amounts to priority scheme
 - Interframe space



Point Coordinating Function



- Alternative access method implemented on top of DCF
- Polling by centralized polling master (point coordinator)
- Uses PIFS when issuing polls (IFS- Inter Frame Space)
 - PIFS smaller than DIFS
 - Can seize medium and lock out all asynchronous traffic while it issues polls and receives responses
- E.g. wireless network configured so number of stations with time-sensitive traffic controlled by point coordinator
 - Remaining traffic contends for access using CSMA



Point Coordinating Function



- Point coordinator polls in round-robin to stations configured for polling
- When poll issued, polled station may respond using SIFS
- If point coordinator receives response, it issues another poll using PIFS
- If no response during expected turnaround time, coordinator issues poll

ACTIVITY

Find the difference between two images





Wireless Personal Area Networks(WPAN)

- A WPAN (Wireless PAN) is a short-distance wireless network
- Specifically designed to support portable and mobile computing devices
- PCs, PDAs, wireless printers and storage devices, cell phones, pagers, set-top boxes, and a variety of consumer electronics equipment.
- Bluetooth is an example of a wireless PAN
- It allows devices within close proximity to join together in ad hoc wireless
- Many cell phones have two radio interfaces-one for the cellular network and one for PAN connections.



Wireless Personal Area Networks(WPAN)

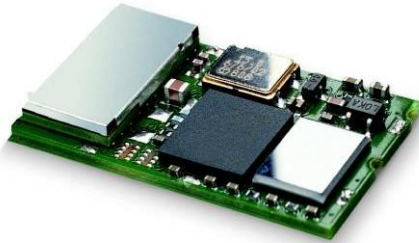
- A Bluetooth PAN is also called a piconet
- It is composed of up to 8 active devices in a master-slave relationship (up to 255 devices can be connected in 'parked' mode).
- The first Bluetooth device in the piconet is the master, and all other devices are slaves that communicate with the master.
- A piconet typically has a range of 10 meters, although ranges of up to 100 meters can be reached under ideal circumstances.



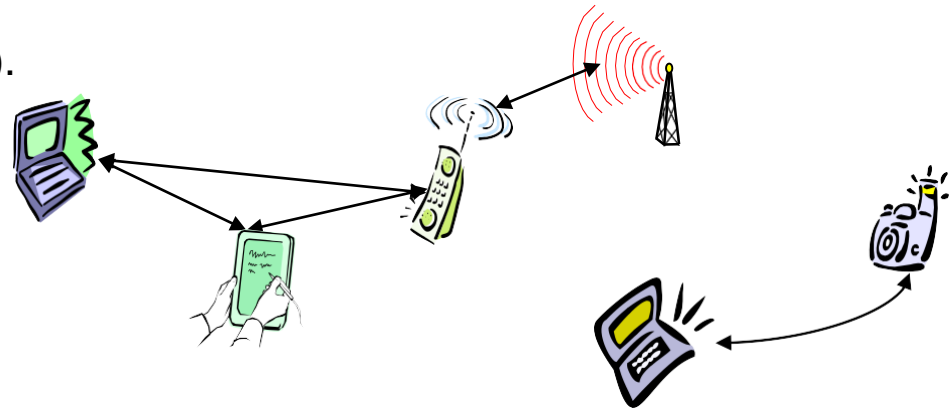
Wireless Personal Area Networks(WPAN)

- A wireless PAN consists of a dynamic group of less than 255 devices that communicate within about a 33-foot range.
- Unlike with wireless LANs, only devices within this limited area typically participate in the network
- No online connection with external devices is defined.
- One device is selected to assume the role of the controller during wireless PAN initialization, and this controller device mediates communication within the WPAN.

Bluetooth



One of the first modules (Ericsson).



Bluetooth



- A cable replacement technology
- 1 Mb/s symbol rate
- Range 10+ meters
- Single chip radio + baseband
 - at low power & low price point (\$5)



WPAN: IEEE 802.15-1 – Bluetooth



- Data rate
 - Synchronous, connection-oriented: 64 kbit/s
 - Asynchronous, connectionless
 - 433.9 kbit/s symmetric
 - 723.2 / 57.6 kbit/s asymmetric
- Transmission range
 - POS (Personal Operating Space) up to 10 m
 - with special transceivers up to 100 m
- Frequency - Free 2.4 GHz ISM-band
- Security -Challenge/response (SAFER+), hopping sequence
- Cost - 50€ adapter, drop to 5€ if integrated
- Availability -Integrated into some products, several vendors



WPAN: IEEE 802.15-1 – Bluetooth

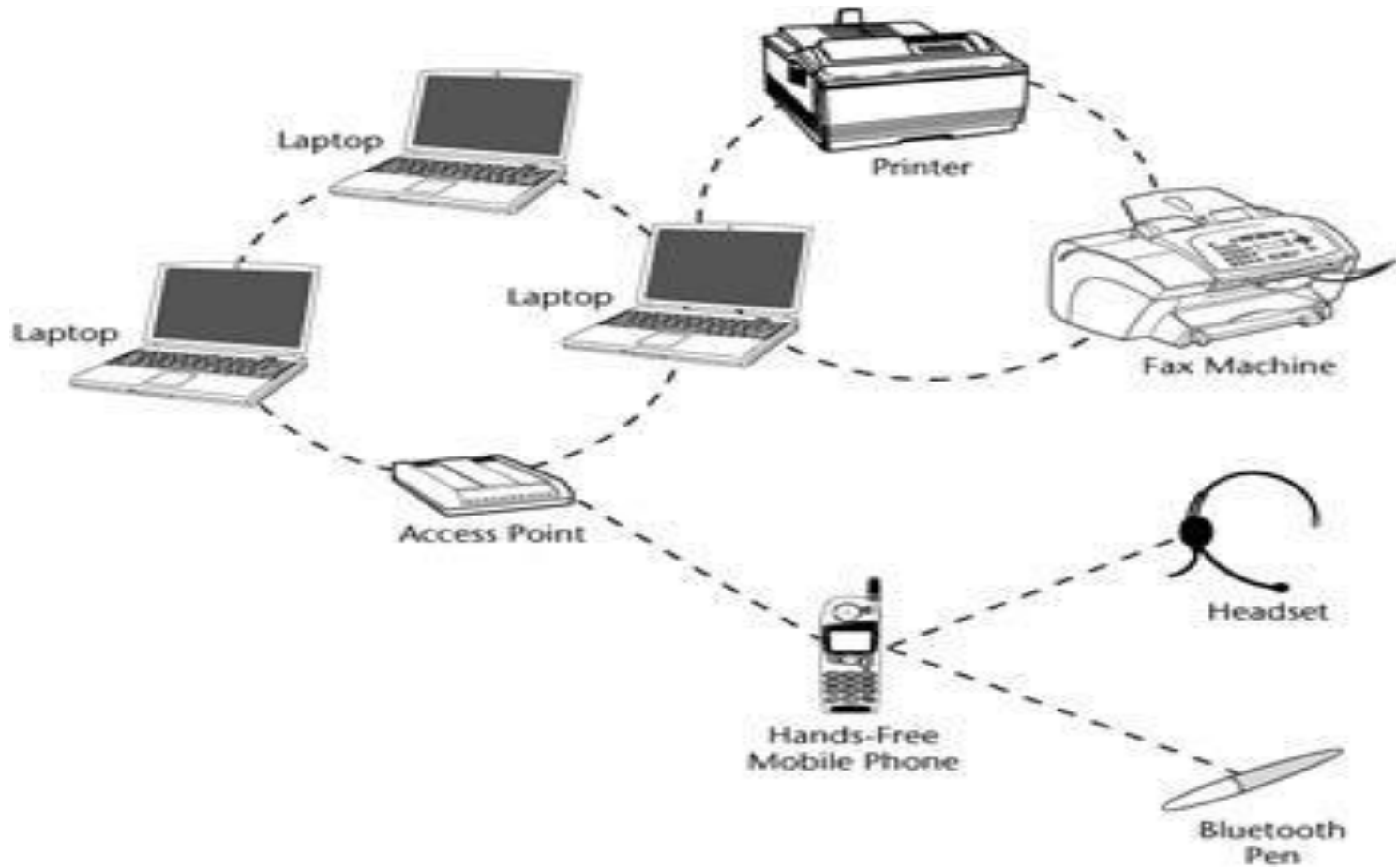


- Connection set-up time
 - Depends on power-mode
 - Max. 2.56s, avg. 0.64s
- Quality of Service
 - Guarantees, ARQ/FEC

Advantage: already integrated into several products, available worldwide, free ISM-band, several vendors, simple system, simple ad-hoc networking, peer to peer, scatternets

Disadvantage: interference on ISM-band, limited range, max. 8 devices/network&master, high set-up latency

WPAN





Assessment

- 1.State the advantages of WLAN
- 2.What is PAN?
- 3.Draw WLAN architecure

