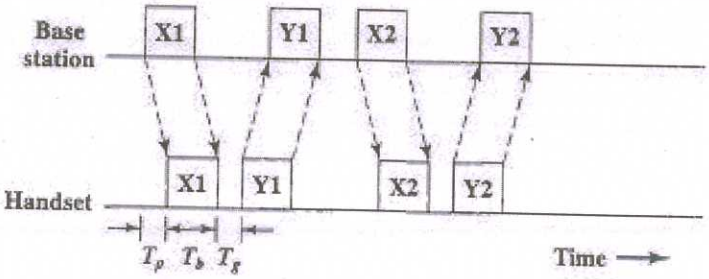
SCHEME OF VALUATION
(Scoring Indicators)

		PART-A			
I	1	*D* = minimum distance between centers of cells that use the same frequency band (called cochannels) *R* = radius of a cell *d* = distance between centers of adjacent cells *(d = V3R)* *N* = number of cells in a repetitious pattern (each cell in the pattern uses a unique set of frequency bands), termed the **reuse factor**	0.5x2	2	**10**
	2	The **elevation angle** *e* of the earth station is the angle from the horizontal(i.e., a line tangent to the surface of the earth at the antenna's location) to the point on the center of the main beam of the antenna when the antenna is pointed directly at the satellite.	2	2	
	3	The Wireless Application Protocol (WAP) is a universal, open standard developed by the WAP Forum to provide mobile users of wireless phones and other wireless terminals such as pagers and personal digital assistants (PDAs) access to telephony and information services, including the Internet and the Web.	2	2	
	4	Adhoc network is a Peer-to-peer network which is set up temporarily to meet some immediate need E.g. group of employees, each with laptop or palmtop, in business	2	2	
	5	Piconet is the basic unit of Bluetooth networking. It consist of a master and from one to seven active slave devices. The master makes the determination of the channel and phase	2	2	
		PART-B			
II	1	Each AMPS-capable cellular telephone includes a *numeric assignment module*(NAM) in read-only memory. The NAM contains - The telephone number of the phone- assigned by the service provider The serial number of the phone - assigned by the manufacturer. The MTSO - uses the phone number - for billing purposes. If the phone is used in a remote city - the service is still billed to the user's local service provider. When a call is placed - the following sequence of events occurs: 1. The subscriber initiates a call 2 The MTSO verifies the number 3.If the called party answers MTSO establishes a circuit 4.When one party hangs up MTSO releases the circuit	3 3	6	
	2	Advantages of CDMA			

3	CDMA has a soft capacity. The greater the number of codes, the more the number of users. It has the following advantages – CDMA requires a tight power control, as it suffers from near-far effect. In other words, a user near the base station transmitting with the same power will drown the signal latter. All signals must have more or less equal power at the receiver Rake receivers can be used to improve signal reception. Delayed versions of time (a chip or later) of the signal (multipath signals) can be collected and used to make decisions at the bit level. Flexible transfer may be used. Mobile base stations can switch without changing operator. Two base stations receive mobile signal and the mobile receives signals from the two base stations. Transmission Burst − reduces interference. Disadvantages of CDMA The disadvantages of using CDMA are as follows – The code length must be carefully selected. A large code length can induce delay or may cause interference. Time synchronization is required. Gradual transfer increases the use of radio resources and may reduce capacity. As the sum of the power received and transmitted from a base station needs constant tight power control. This can result in several handovers. The actual data rate on the channel must be greater than twice the data rate required by thetwo end systems. Effective bits transmitted per second: R = B/2(Tp+Tb+Tg) R = effective data rate B = size of block in bits Tp = propagation delay Tb = burst transmission time Tg = guard time	3 6 3 6 3		



T_p = Propagation delay
T_b = Burst transmission time
T_g = Guard time

Figure 11.1 Transmission Using Time Division Duplex

The effective number of bits transmitted per second,or effective data rate, is

$$R = \frac{B}{2(T_p + T_b + T_g)}$$

The actual data rate, A, on the medium can easily be seen to be

$$A = B/T_b$$

Combining the two, we have

$$A = 2R\left(1 + \frac{T_p + T_g}{T_b}\right)$$

4	Wireless Application Protocol (WAP) Open standard providing mobile users of wireless terminals access to telephony and information services Wireless terminals include wireless phones, pagers and personal digital assistants (PDAs) Designed to work with all wireless network technologies such as GSM, CDMA, and TDMA Based on existing Internet standards such as IP, XML, HTML, and HTTP Includes security facilities	3 3	6	

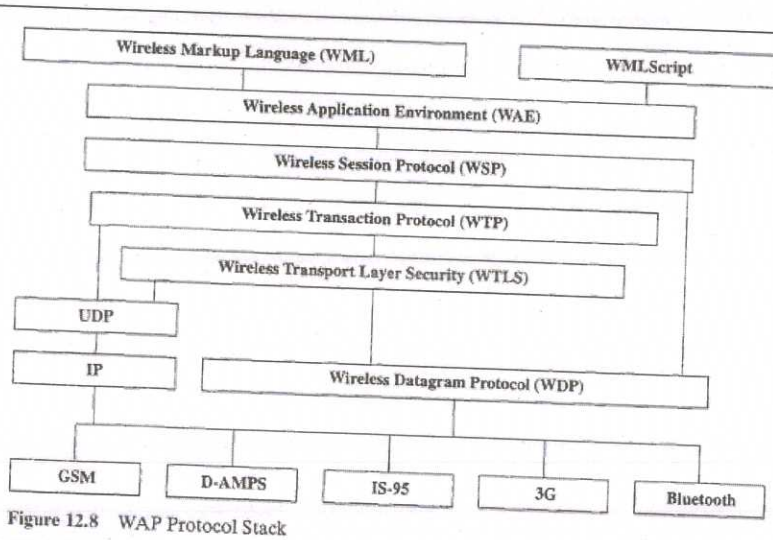


Figure 12.8 WAP Protocol Stack

5 In Single-cell wireless LAN all the wireless end systems are within range of a single control module.In multiple-cell wireless

LAN there are multiple control modules interconnected by a wired LAN. Each control module supports a number of wireless end systems within its transmission range.

6 6

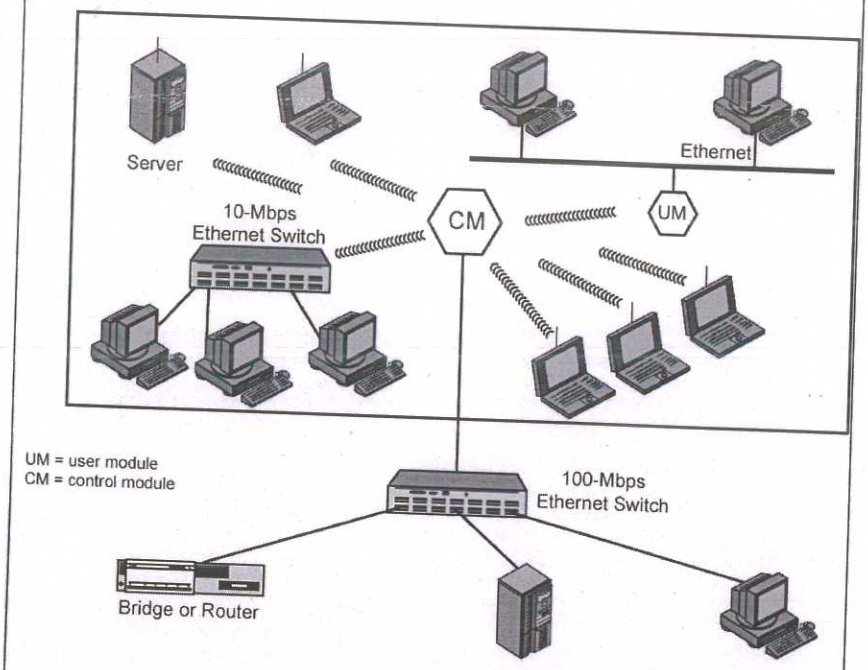
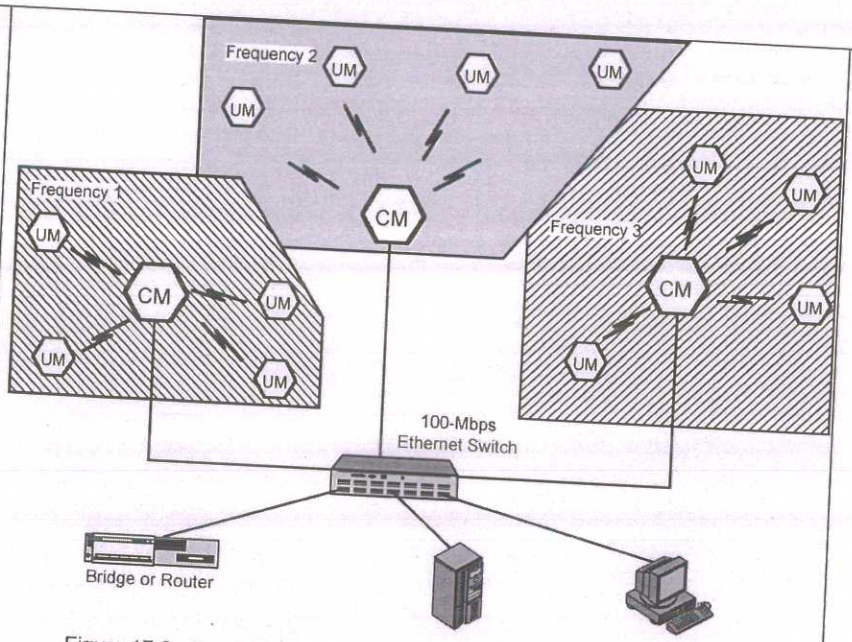
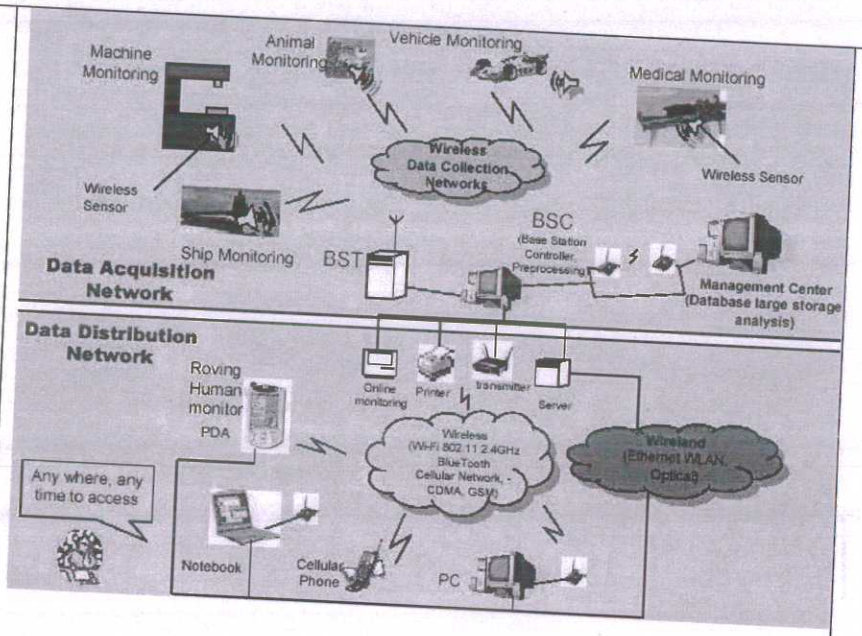


Figure 17.1 Example Single-Cell Wireless LAN Configuration

	 Figure 17.2 Example Multiple-Cell Wireless LAN Configuration			
6	1)Infrared (IR) LANs: Individual cell of IR LAN limited to single room. IR light does not penetrate opaque walls 2) Spread spectrum LANs: Mostly operate in ISM (industrial, scientific, and medical) bands. No Federal Communications Commission (FCC) licensing is required in USA 3)Narrowband microwave: Microwave frequencies but not use spread spectrum. Some require FCC licensing	6	6	
7	A Wireless sensor network can be defined as a network of devices that can communicate the information gathered from a monitored field through wireless links. The data is forwarded through multiple nodes, and with a gateway, the data is connected to other networks. WSN is a wireless network that consists of base stations and numbers of nodes (wireless sensors).These networks are used to monitor physical or environmental conditions like sound, pressure, temperature and co-operatively pass data through the network to a main location.	6	6	



PART-C

III a

Cell splitting:

In practice, the distribution of traffic and topographic features is not uniform, and this presents opportunities of capacity increase. Cells in areas of high usage can be split into smaller cells.

To use a smaller cell, the power level used must be reduced to keep the signal within the cell.

Also, as the mobile units move, they pass from cell to cell, which requires transferring of the call from one base transceiver to another. This process is called a *handoff* As the cells get smaller, these handoffs become much more frequent. 3

Below Figure 10.3 indicates schematically how cells can be divided to provide more capacity. A radius reduction by a factor of *P* reduces the coverage area' and increases the required number of base stations by a factor of *p2.* 2

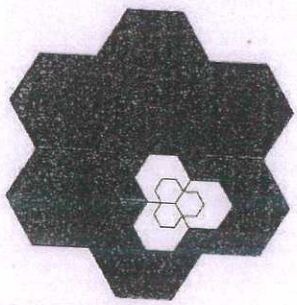
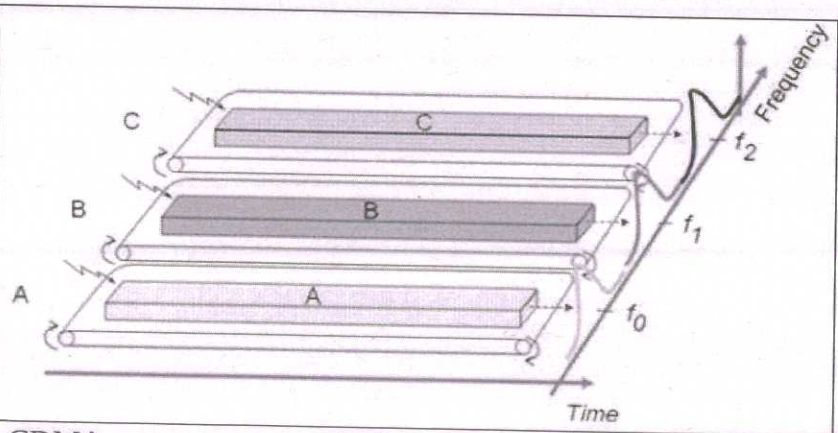
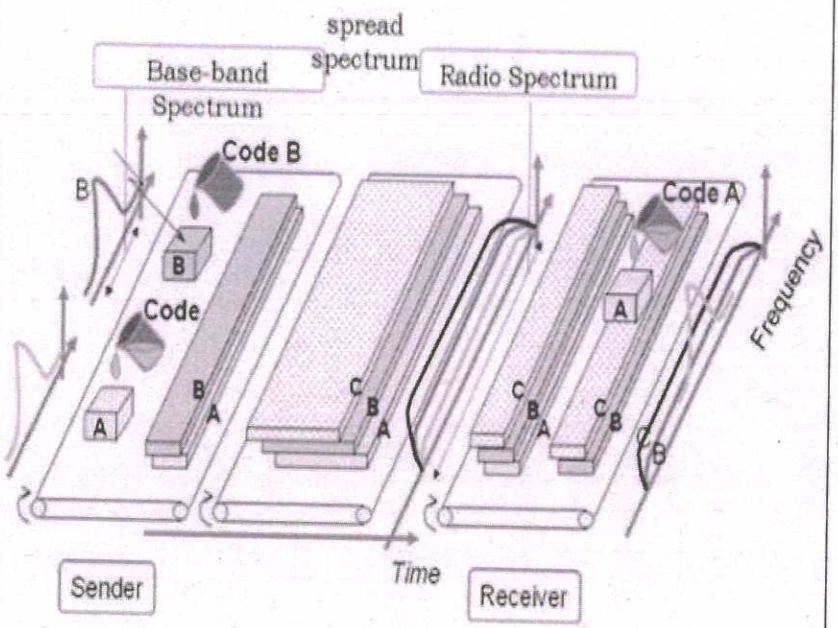
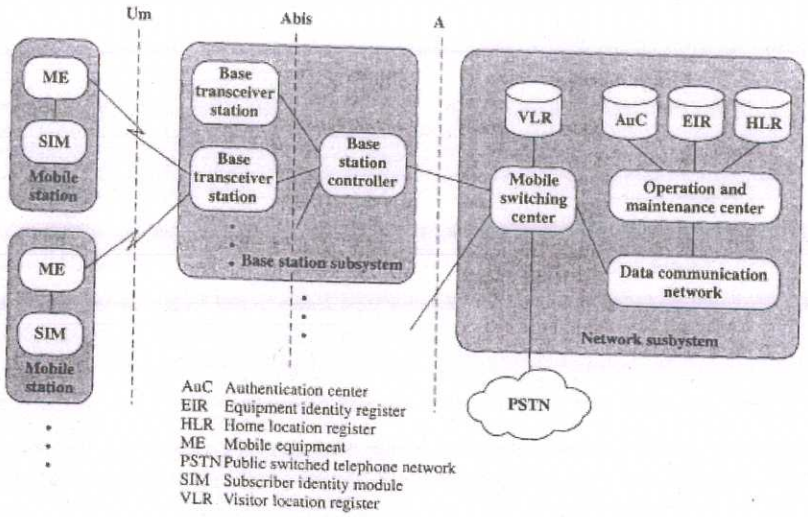


Figure 10.3 Cell Splitting

8

Cell sectoring: With cell sectoring, a cell is divided into a number of wedge shaped sectors, each with its own set of channels, typically 3 or 6 sectors per cell.Each sector is 3

				15
b	CDMA Code Division Multiple Access system is very different from time and frequency multiplexing. In this system, a user has access to the whole bandwidth for the entire duration. The basic principle is that different CDMA codes are used to distinguish among the different users. Techniques generally used are direct sequence spread spectrum modulation (DS-CDMA), frequency hopping or mixed CDMA detection (JD-CDMA). Here, a signal is generated which extends over a wide bandwidth. A code called **spreading code** is used to perform this action. Using a group of codes, which are orthogonal to each other, it is possible to select a signal with a given code in the presence of many other signals with different orthogonal codes. 	3.5 3.5	7	

	assigned a separate subset of the cell's channels, and directional antennas at the base station are used to focus on each sector.			15
b	GSM Architecture  Explanation of each component	4 3	7	
IV a	FDMA Frequency Division Multiple Access (FDMA) is one of the most common analog multiple access methods. The frequency band is divided into channels of equal bandwidth so that each conversation is carried on a different frequency. In FDMA method, guard bands are used between the adjacent signal spectra to minimize crosstalk between the channels. A specific frequency band is given to one person, and it will received by identifying each of the frequency on the receiving end. It is often used in the first generation of analog mobile phone.	4 4	8	

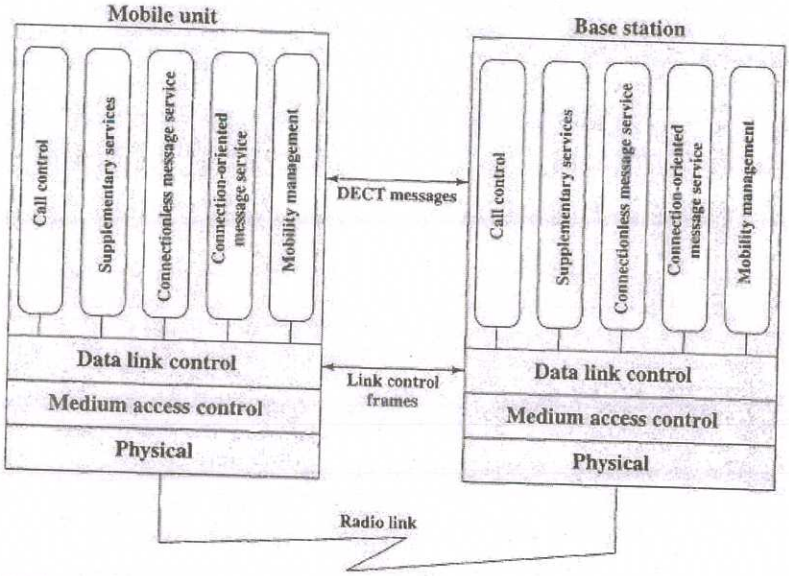


Figure 11.2 DECT Protocol Architecture

15

b

Tunneling

Home agent intercepts IP datagrams sent to mobile node's home address

Home agent informs other nodes on home network that datagrams to mobile node should be delivered to home agent

Datagrams forwarded to care-of address via tunneling

Datagram encapsulated in outer IP datagram

For example, suppose that R3 in below Figure is acting as the home agent for a mobile node that is attached to a foreign network elsewhere on the Internet.

That is, there is a host H whose home network is LAN Z that is now attached to some foreign network.

If host D has traffic for H, it will generate an IP datagram with H's home address in the IP destination address field.

The IP module in D recognizes that this destination address is on LAN Z and so passes the datagram down to the link layer with instructions to deliver it to a particular MAC-level address on Z.

Prior to this time, R3 has informed the IP layer at D that datagrams destined for that particular address should be sent to R3.

Thus, D inserts the MAC address of R3 in the destination MAC address field of the outgoing MAC frame.

Similarly, if an IP datagram with the mobile node's home address arrives at router R2, it recognizes that the destination address is on LAN Z and will attempt to deliver the datagram to a MAC-level address on Z.

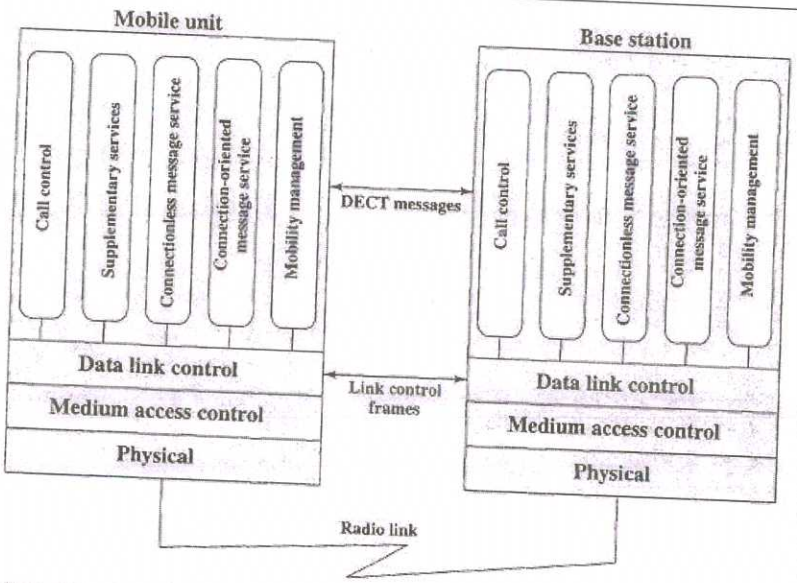
Again, R2 has previously been informed that the MAC-level

3.5

7

V a	**1. Geostationary or geosynchronous earth orbit (GEO)** GEO satellites are synchronous with respect to earth. Looking from a fixed point from Earth, these satellites appear to be stationary. 1) The satellite should be placed 37,786 kms (approximated to 36,000 kms) above the surface of the earth. 2) These satellites must travel in the rotational speed of earth, and in the direction of motion of earth, that is eastward. 3) The inclination of satellite with respect to earth must be 0^0 **2.Low Earth Orbit (LEO) satellites:** These satellites are placed 500-1500 kms above the surface of the earth. As LEOs circulate on a lower orbit, hence they exhibit a much shorter period that is 95 to 120 minutes. LEO systems try to ensure a high elevation for every spot on earth to provide a high quality communication link. Each LEO satellite will only be visible from the earth for around ten minutes. Using advanced compression schemes, transmission rates of about 2,400 bit/s can be enough for voice communication. **3.Medium Earth Orbit (MEO) satellites:** MEOs can be positioned somewhere between LEOs and GEOs, both in terms of their orbit and due to their advantages and disadvantages. Using orbits around 10,000 km, the system only requires a dozen satellites which is more than a GEO system, but much less than a LEO system. These satellites move more slowly relative to the earth"s rotation allowing a simpler system design (satellite periods are about six hours). Depending on the inclination, a MEO can cover larger populations, so requiring fewer handovers.	3 3 2	8	15
V b	The performance of a satellite link depends on three factors: **Distance** between earth station antenna and satellite antenna In the case of the downlink, terrestrial distance between earth station antenna and the "aim point" of the satellite atmospheric attenuation **Satellite Footprint** Satellite Footprint At microwave frequencies, which are used in satellite communications, highly directional antennas are used.	5		

	The center point of that area will receive the highest radiated power, and the power drops off as you move away from the center point in any direction. **Atmospheric Attenuation** The primary causes of atmospheric attenuation are oxygen, which is of course always present, and water.Attenuation due to water is present in humid air and is more pronounced with fog and rain. Another factor that affects attenuation is the angle of elevation of the satellite from the earth station	2	7	
VI a	**DECT Frame Format** 1. Preamble (16 bits) – alert receiver 2. Sync (16 bits) – enable receiver to synchronize on beginning of time slot 3. A field (64 bits) – used for network control A Field Logical Control Channels a. Q channel – used to broadcast general system information from base station to all terminals b. P channel – provides paging from the base station to terminals c. M channel – used by terminal to exchange medium access control messages with base station d. N channel – provides handshaking protocol e. C channel – provides call management for active connections 1. B field (320 bits) – contains user data B field transmits data in two modes Unprotected mode - used to transmit digitized voice Protected mode - transmits non-voice data traffic 1. X field (4 bits) – parity check bits 2. Guard (60 bits) – guard time, Tg **DECT protocol architecture**	4 4	8	



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15

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Again, R2 has previously been informed that the MAC-level

3.5

7

address it needs corresponds to R3.

For traffic that is routed across the Internet and arrives at R3 from the Internet, R3 must simply recognize that for this destination address, the datagram is to be captured and forwarded.

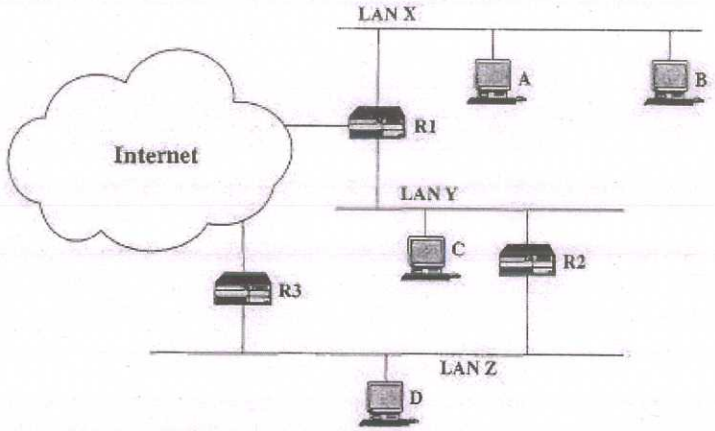


Figure 12.6 A Simple Internetworking Example

3.5

VII a.

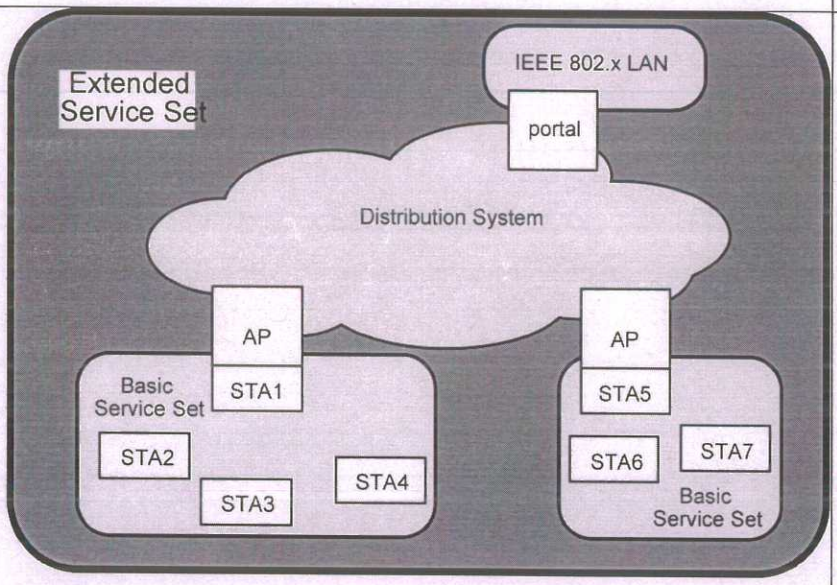


Figure 17.4 IEEE 802.11 Architecture

Fig-4 Exp-4

8

The smallest building block of a wireless LAN is a basic service set (BSS), which consists of some number of stations executing the same MAC protocol and competing for access to the same shared wireless medium. A BSS may be isolated or it may connect to a backbone distribution system (DS) through an access point (AP). The AP functions as a bridge and a relay point. In a BSS, client stations do not communicate directly with one another. Rather, if one station in the BSS wants to communicate with another station in the same BSS, the MAC frame is first sent from the originating station to the AP, and then from the AP to the destination station. Similarly, a MAC frame from a station in the BSS to a remote station is sent from

	the local station to the AP and then relayed by the AP over the DS on its way to the destination station. The BSS generally corresponds to what is referred to as a cell in the literature. The DS can be a switch, a wired network, or a wireless network. When all the stations in the BSS are mobile stations, with no connection to other BSSs, the BSS is called an independent BSS (IBSS). An IBSS is typically an adhoc network. In an IBSS, the stations all communicate directly, and no AP is involved. An extended service set (ESS) consists of two or more basic service sets interconnected by a distribution system. Typically, the distribution system is a wired backbone LAN but can be any communications network. The extended service set appears as a single logical LAN to the logical link control (LLC) level.			
VII b.	Wireless LAN requirements —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 • 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	7	7	**15**
VIII a.	The DCF sublayer makes use of a simple CSMA (carrier sense multiple access) algorithm, which functions as follows. If a station has a MAC frame to transmit, it listens to the medium. If the medium is idle, the station may transmit; otherwise the station must wait until the current transmission is complete before transmitting. The rules for CSMA access are as follows:			

	1. A station with a frame to transmit senses the medium. If the medium is idle, it waits to see if the medium remains idle for a time equal to IFS. If so, the station may transmit immediately. 2. If the medium is busy (either because the station initially finds the medium busy or because the medium becomes busy during the IFS idle time), the station defers transmission and continues to monitor the medium until the current transmission is over. 3. Once the current transmission is over, the station delays another IFS. If the medium remains idle for this period, then the station backs off a random amount of time and again senses the medium. If the medium is still idle, the station may transmit. During the backoff time, if the medium becomes busy, the backoff timer is halted and resumes when the medium becomes idle. 4. If the transmission is unsuccessful, which is determined by the absence of an acknowledgement, then it is assumed that a collision has occurred.	4		

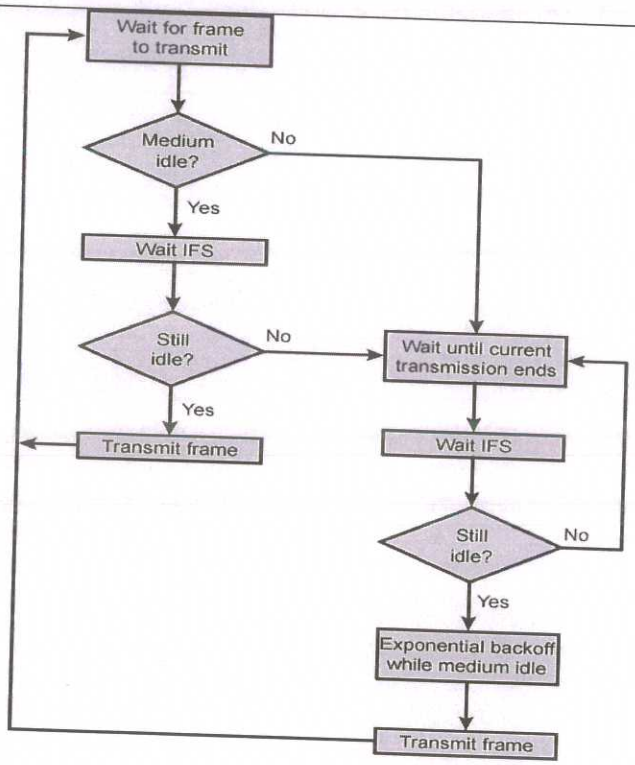


Figure 17.6 IEEE 802.11 Medium Access Control Logic

4

VIII b. Wireless LAN applications

1)LAN Extension

Saves installation of LAN cabling

Eases relocation and other modifications to network structure

2)Cross-Building Interconnect

Connect LANs in nearby buildings

Point-to-point wireless link

Connect bridges or routers

3)Nomadic Access

Link between LAN hub and mobile data terminal

4)Ad Hoc Networking

Peer-to-peer network

Set up temporarily to meet some immediate need

7 7 15

IX a. Bluetooth is defined as a layered protocol architecture consisting of core protocols, cable replacement and telephony control protocol, and adopted protocols.

I)The core protocols form a five-layer stack consisting of the following elements:

1)Radio: Specifies details of the air interface, including.

frequency, the use of frequency hopping, modulation scheme, and transmit power.

2)Baseband: Concerned with connection establishment' within a piconet, addressing, packet format, timing, and power control.

3)Link manager protocol (LMP): Responsible for Iink setup between Bluetooth devices and ongoing link management. This includes security aspects such as authentication and encryption, plus the control and negotiation of baseband packet sizes.

4)Logical link control and adaptation protocol (L2Ci P): Adapts upper-layer protocols to the baseband layer. L2CAP provides oth connectionless and connection-oriented services.

5)Service discovery protocol (SDP): Device information, services, and the characteristics of the services can be queried to enable the establishment of a connection between two or more Bluetooth devices.

Fig-4 Exp-4

8

II)Cable replacement protocol

–RFCOMM enables the replacement of serial port cables with the minimum of modification of existing devices

III)Telephony control protocol

–Telephony control specification – binary (TCS BIN) is a bit-oriented protocol that defines the call control signaling for the establishment of speech and data calls between Bluetooth devices.

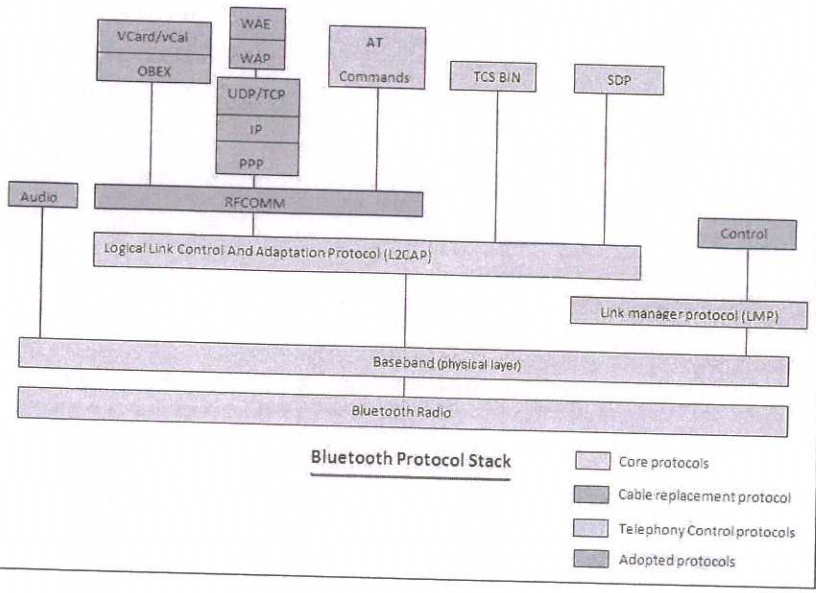
IV)Adopted protocols

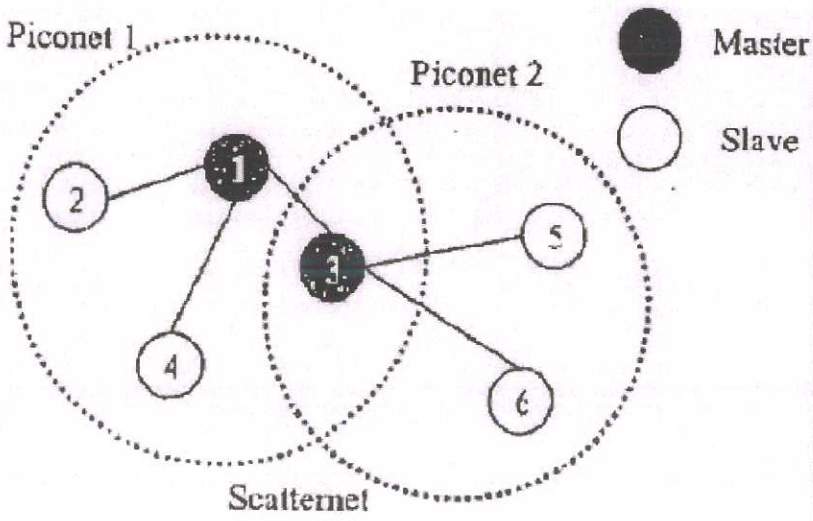
–PPP

–TCP/UDP/IP

–OBEX

–WAE/WAP



IX b.	Applications 1)Data and voice access points –Real-time voice and data transmissions 2)Cable replacement –Eliminates need for numerous cable attachments for connection 3)Ad hoc networking –Device with Bluetooth radio can establish connection with another when in range	7	7	15
X a.	IEEE 802.15.3 •High data rate WPANs –Digital cameras, speakers, video, music •Piconet coordinator (PNC) –Sends beacons to devices to connect to the network –Uses superframes like 802.11 –QoS based on TDMA –Controls time resources but does not exchange data •802.15.3c –Latest standard –Uses 60 GHz band, with same benefits as 802.11ad –Single-carrier and OFDM PHY modes	8	8	
X b.	The basic unit of networking in Bluetooth is a piconet, consisting of a master and from one to seven active slave devices. The master makes the determination of the channel and phase that shall be used by all devices on this piconet. A device in one piconet may also exist as part of another piconet and may function as either a slave or master in each piconet. This form of overlapping is called a scatternet.  	7	7	15