

SIXTH SEMESTER DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY -
MARCH, 2013

MOBILE COMPUTING

(Common for CT, CM & IF)

(Maximum Mark:100)

(Time: 3hr)

PART - A

I. Answer the following questions in one or two sentences .Each question carries two mark.

1. Differentiate uplink and downlink frequencies.

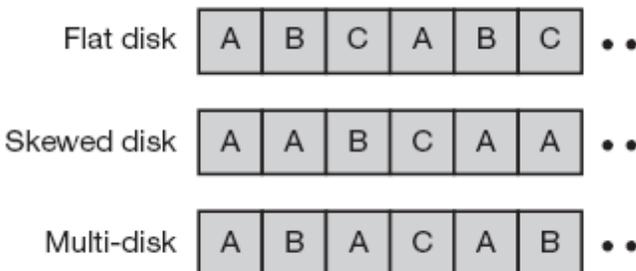
In satellite telecommunication, a downlink is the link from a satellite down to one or more ground stations or receivers an uplink is the link from a ground station up to a satellite

2. Give the expansion of PDA and LLC.

PDA-Personal Digital Assistant

LLC-Logical Link Control

3. Draw the skewed disk and multi-disk broadcast patterns.



4. Name the different classes of devices in a Bluetooth piconet.

One device in the piconet can act as **master** (M), all other devices connected to the master must act as **slaves** (S).

5. List the goals of VPN.

- Extends geographic connectivity
- Boosts employee productivity

- Improves Internet security
- Scales easily

PART – B

II. Answer any five of the following. Each question carries 6 marks.

1. Explain SDMA and CDMA.

Space Division Multiple Access (SDMA) is used for allocating a separated space to users in wireless networks. A typical application involves assigning an optimal base station to a mobile phone user. The mobile phone may receive several base stations with different quality. A MAC algorithm could now decide which base station is best, taking into account which frequencies (FDM), time slots (TDM) or code (CDM) are still available (depending on the technology).

Code division multiple

access (CDMA) systems use exactly these codes to separate different users in code space and to enable access to a shared medium without interference. The main problem is how to find “good” codes and how to separate the signal from noise generated by other signals and the environment.

2. List the characteristics of GSM.

Quality

With digital, sound quality is sharp and clear. Background sounds and static are vastly reduced and crossed-line conversations are also eliminated. In comparison with analogue there are also far fewer dropouts, and overall the quality is more like that of a fixed telephone.

Security

Unlike analogue, everything you say and send within the digital network is safe and secure. Some features are user authentication that prohibits unauthorised access, encryption key distribution that guarantees the privacy of the call and caller identification restrictions that can prevent the delivery of the calling users number to the receiver.

Convenience

With digital, better technology means better battery life. You get up to twice as much talk time from each battery charge, compared with analogue. In addition the digital service allows more calls to be handled at any one time, therefore reducing congestion in areas of dense population and high usage.

Roaming

With digital, you are able to use your mobile phone, and number in other countries around the world who operate a GSM network

3. Give the ideas of MEO and HEO.

MEOs can be positioned somewhere between LEOs and GEOs, both in terms of their orbit and due to their advantages and disadvantages.

- **Advantages:** 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.

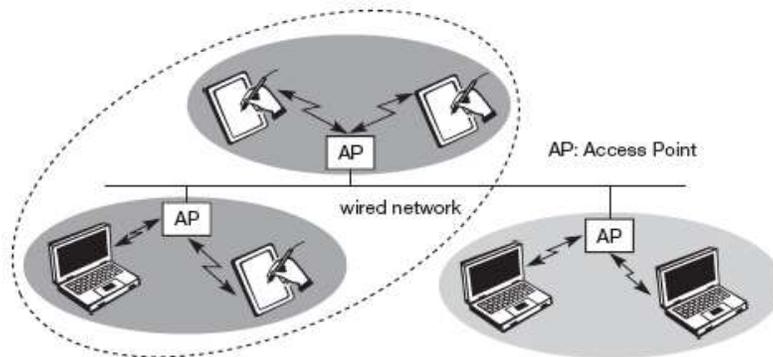
- **Disadvantages:** Again, due to the larger distance to the earth, delay increases to about 70–80 ms. The satellites need higher transmit power and special antennas for smaller footprints.

A highly elliptical orbit (HEO):

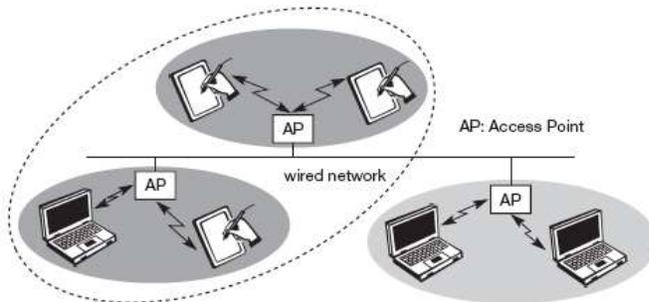
Is an elliptic orbit with a low-altitude (often under 1,000 kilometres (540 nmi)) perigee and a high-altitude (often over 35,786 kilometres (19,323 nmi)) apogee. The 'highly elliptical' term refers to the shape of the ellipse, and to the eccentricity e of the orbit, not to the high apogee altitude.

Such extremely elongated orbits have the advantage of long dwell times at a point in the sky during the approach to, and descent from, apogee. Visibility near apogee can exceed twelve hours of dwell at apogee with a much shorter and faster-moving perigee phase. Bodies moving through the long apogee dwell can appear still in the sky to the ground when the orbit is at the right inclination, where the angular velocity of the orbit in the equatorial plane closely matches the rotation of the surface beneath. This makes these elliptical orbits useful for communications satellites.

4. Differentiate infrastructure network and ad-hoc networks.



Many WLANs of today need an **infrastructure** network. Infrastructure networks not only provide access to other networks, but also include forwarding functions, medium access control etc. In these infrastructure-based wireless networks, communication typically takes place only between the wireless nodes and the access point but not directly between the wireless nodes.

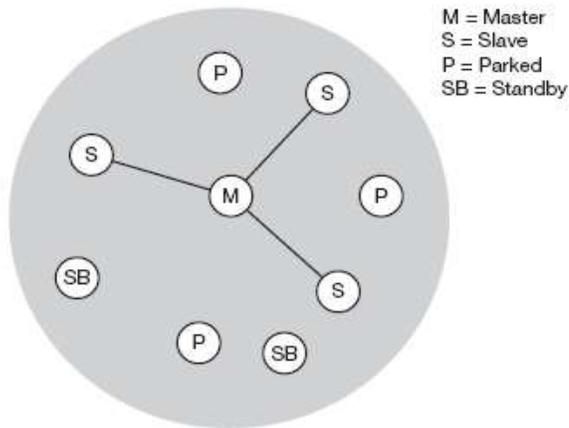


Ad-hoc wireless networks, however, do not need any infrastructure to work.

Each node can communicate directly with other nodes, so no access point controlling medium access is necessary.

5. Give the Overview of the formation of a piconet.

A very important term in the context of Bluetooth is a **piconet**. A piconet is a collection of Bluetooth devices which are synchronized to the same hopping sequence. One device in the piconet can act as **master** (M), all other devices connected to the master must act as **slaves** (S). The master determines the hopping pattern in the piconet and the slaves have to synchronize to this pattern. Each piconet has a unique hopping pattern.



6. **Write a short note on mobile operating system.**

A mobile operating system, also called a mobile OS, is an operating system that is specifically designed to run on mobile devices such as mobile phones, smartphones, PDAs, tablet computers and other handheld devices. The mobile operating system is the software platform on top of which other programs,

Much like the Linux or Windows operating system controls your desktop or laptop computer, a mobile operating system is the software platform on top of which other programs can run on mobile devices.

A mobile operating system, also called a mobile OS, is an operating system that is specifically designed to run on mobile devices such as mobile phones, smartphones, PDAs, tablet computers and other handheld devices called application programs, can run on mobile devices.

7. **State the characteristics of CDMA 2000.**

CDMA2000 (also known as C2K or **IMT Multi-Carrier (IMT-MC)**) is a family of 3G^[1] mobile technology standards, which use CDMA channel access, to send voice, data, and signaling data between mobile phones and cell sites. The name CDMA2000 actually denotes a family of standards that represent the successive, evolutionary stages of the underlying technology. These are, in order of evolution:

- CDMA2000 1xRTT
- CDMA2000 1xEV-DO: Release 0, Revision A, Revision B
- CDMA2000 1xEV-DO Revision C or Ultra Mobile Broadband (UMB)

- CDMA2000 1xEV-DV

All are approved radio interfaces for the ITU's IMT-2000. CDMA2000 has a relatively long technical history and is backward-compatible with its previous 2G iteration IS-95 (cdmaOne). In the United States, *CDMA2000* is a registered trademark of the Telecommunications Industry Association (TIA-USA)

PART – C

(Answer one full question from each unit, each question carries 15 mark)

Unit -1

III. (a) List and Explain the various channel allocation techniques used in cellular systems.

In the case of a heavy load in one cell and a light load in a neighboring cell, it could make sense to 'borrow' frequencies. Cells with more traffic are dynamically allotted more frequencies.

This scheme is known as **borrowing channel allocation (BCA)**, while the first fixed scheme is called **fixed channel allocation (FCA)**. FCA is used in the GSM system as it is much simpler to use, but it requires careful traffic analysis before installation. A **dynamic channel allocation (DCA)** scheme has been implemented in DECT. In this scheme, frequencies can only be borrowed, but it is also possible to freely assign frequencies to cells. With dynamic assignment of frequencies to cells, the danger of interference with cells using the same frequency exists.

(b) Explain any five mobile and wireless devices.

Many types of mobile computers have been introduced since the 1990s including the:

- Portable computer (discontinued)
- Personal digital assistant/Enterprise digital assistant (discontinued)
- Ultra-Mobile PC (discontinued)
- Laptop
- Smartphone
- Tablet computer
- Wearable computer
- Carputer

- A portable computer (discontinued) is a general-purpose computer that can be easily moved from place to place, but cannot be used while in transit, usually because it requires some "setting-up" and an AC power source. The most famous example is the Osborne 1. Portable computers are also called a "transportable" or a "luggable" PC.
- A personal digital assistant (PDA) (discontinued) is a small, usually pocket-sized, computer with limited functionality. It is intended to supplement and to synchronize with a desktop computer, giving access to contacts, address book, notes, e-mail and other features.



A Palm TX PDA

- An ultra mobile PC (discontinued) is a full-featured, PDA-sized computer running a general-purpose operating system.
- A tablet computer that lacks a keyboard (also known as a non-convertible tablet) is shaped like a slate or a paper notebook. Instead a physical keyboard it has a touchscreen with some combination of virtual keyboard, stylus and/or handwriting recognition software. Tablets may not be best suited for applications requiring a physical keyboard for typing, but are otherwise capable of carrying out most of the tasks of an ordinary laptop.
- A smartphone has a wide range of features and install-able applications.
- A carputer is installed in an automobile. It operates as a wireless computer, sound system, GPS, and DVD player. It also contains word processing software and is bluetooth compatible.^[5]
- A Pentop (discontinued) is a computing device the size and shape of a pen. It functions as a writing utensil, MP3 player, language translator, digital storage device, and calculator.^[6]

OR

IV. Name and explain the application of mobile computing.

Vehicles

Today's cars already comprise some, but tomorrow's cars will comprise many wireless communication systems and mobility aware applications. Music, news, road conditions, weather reports, and other broadcast information are received via digital audio broadcasting (DAB) with 1.5 Mbit/s. For personal communication, a universal mobile telecommunications system (UMTS) phone might be available offering voice and data connectivity with 384 kbit/s. Emergencies Just imagine the possibilities of an ambulance with a high-quality wireless connection to a hospital. Vital information about injured persons can be sent to the hospital from the scene of the accident. All the necessary steps for this particular type of accident can be prepared and specialists can be consulted for an early diagnosis.

Business

A travelling salesman today needs instant access to the company's database: to ensure that files on his or her laptop reflect the current situation, to enable the company to keep track of all activities of their travelling employees, to keep databases consistent etc. With wireless access, the laptop can be turned into a true mobile office, but efficient and powerful synchronization mechanisms are needed to ensure data consistency.

Unit – II

V. (a) Give an overview of broadcasting system.

Unidirectional distribution systems or broadcast systems are an extreme version of asymmetric communication systems. Quite often, bandwidth limitations, differences in transmission power, or cost factors prevent a communication system from being symmetrical. **Symmetrical communication systems** offer the same transmission capabilities in both communication directions, i.e., the channel characteristics from A to B are the same as from B to A (e.g., bandwidth, delay, costs). Examples of symmetrical communication services are the plain old telephone service (POTS) or GSM, if end-to-end communication is considered. In this case, it does not matter if one mobile station calls the other or the other way round, bandwidth and delay are the same in both scenarios.

This symmetry is necessary for a telephone service, but many other applications do not require the same characteristics for both directions of information transfer. Consider a typical client/server environment. Typically, the client needs much more data from the server than the server needs from the client.

Today's most prominent example of this is the world wide web. Millions of users download data using their browsers (clients) from web servers. A user only returns information to the server from time to time. Single requests for new pages with a typical size of several hundred bytes result in responses of up to some 10 kbytes on average.

(b) Explain the component of operation subsystem in GSM system architecture.

The third part of a GSM system, the **operation subsystem (OSS)**, contains the necessary functions for network operation and maintenance. The OSS possesses network entities of its own and accesses other entities via SS7 signaling

Operation and maintenance center (OMC): The OMC monitors and controls all other network entities via the O interface (SS7 with X.25). Typical OMC management functions are traffic monitoring, status reports of network entities, subscriber and security management, or accounting and billing. OMCs use the concept of **telecommunication management network (TMN)** as standardized by the ITU-T.

Authentication centre (AuC): As the radio interface and mobile stations are particularly vulnerable, a separate AuC has been defined to protect user identity and data transmission. The AuC contains the algorithms for authentication as well as the keys for encryption and generates the values needed for user authentication in the HLR. The AuC may, in fact, be situated in a special protected part of the HLR.

• **Equipment identity register (EIR):** The EIR is a database for all IMEIs, i.e., it stores all device identifications registered for this network. As MSs are mobile, they can be easily stolen. With a valid SIM, anyone could use the stolen MS. The EIR has a blacklist of stolen (or locked) devices.

OR

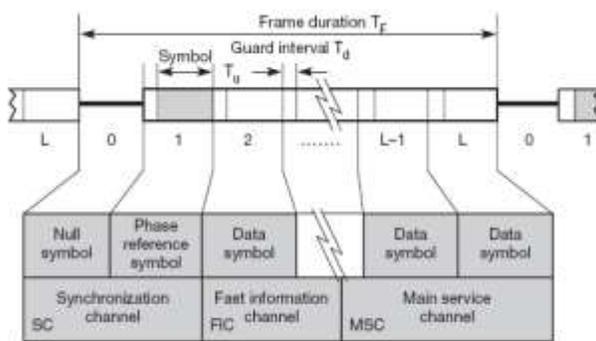
VI. Discuss about the digital audio broadcasting.

DAB systems can use **single frequency networks (SFN)**, i.e., all senders transmitting the same radio program operate at the same frequency. Today, different senders have to use different frequencies to avoid interference although they are transmitting the same radio program. Using an SFN is very frequency efficient, as a single radio station only needs one frequency throughout the whole country. Additionally, DAB transmission power per antenna is orders of magnitude lower compared to traditional FM stations. DAB uses VHF and UHF frequency bands (depending on national regulations), e.g., the terrestrial TV channels 5 to 12 (174–230 MHz) or the L-band (1452–1492 MHz). The modulation scheme

used is **DQPSK**. DAB is one of the systems using **COFDM** with 192 to 1536 carriers (the so-called **ensemble**) within a DAB channel of 1.5 MHz. Additionally, DAB uses FEC to reduce the error rate and introduces **guard spaces** between single symbols during transmission. COFDM and the use of guard spaces reduce ISI to a minimum. DAB can even benefit from multipath propagation by recombining the signals from different paths. DAB uses two basic transport mechanisms:

Main service channel (MSC): The MSC carries all user data, e.g. audio, multimedia data. The MSC consists of **common interleaved frames (CIF)**, i.e., data fields of 55,296 bits that are sent every 24 ms (this interval depends on the transmission mode (ETSI, 2001a)). This results in a data rate of 2.304 Mbit/s. A CIF consists of **capacity units (CU)** with a size of 64 bits, which form the smallest addressable unit within a DAB system.

• **Fast information channel (FIC):** The FIC contains **fast information blocks (FIB)** with 256 bits each (16 bit checksum). An FIC carries all control information which is required for interpreting the configuration and content of the MSC.



Unit – III

VII. (a) Give the merits and demerits of WLAN.

Advantages of WLANs are:

- **Flexibility:** Within radio coverage, nodes can communicate without further restriction. Radio waves can penetrate walls, senders and receivers can be placed anywhere (also non-visible, e.g., within devices, in walls etc.). Sometimes wiring is difficult if firewalls separate buildings (real firewalls made out of, e.g., bricks, not routers set up as a firewall). Penetration of a firewall is only permitted at certain points to prevent fire from spreading too fast.
- **Planning:** Only wireless ad-hoc networks allow for communication without previous planning, any wired network needs wiring plans. As long as devices follow the same standard, they can communicate.

For wired networks, additional cabling with the right plugs and probably interworking units (such as switches) have to be provided.

- **Design:** Wireless networks allow for the design of small, independent devices which can for example be put into a pocket. Cables not only restrict users but also designers of small PDAs, notepads etc.

Wireless senders and receivers can be hidden in historic buildings, i.e., current networking technology can be introduced without being visible.

- **Robustness:** Wireless networks can survive disasters, e.g., earthquakes or users pulling a plug. If the wireless devices survive, people can still communicate. Networks requiring a wired infrastructure will usually break down completely.

Cost: After providing wireless access to the infrastructure via an access point for the first user, adding additional users to a wireless network will not increase the cost

disadvantages:

- **Quality of service:** WLANs typically offer lower quality than their wired counterparts. The main reasons for this are the lower bandwidth due to limitations in radio transmission (e.g., only 1–10 Mbit/s user data rate instead of 100–1,000 Mbit/s), higher error rates due to interference (e.g., 10⁻⁴ instead of 10⁻¹² for fiber optics), and higher delay/delay variation due to extensive error correction and detection mechanisms.

- **Proprietary solutions:** Due to slow standardization procedures, many companies have come up with proprietary solutions offering standardized functionality plus many enhanced features (typically a higher bit rate using a patented coding technology or special inter-access point protocols). However, these additional features only work in a homogeneous environment, i.e., when adapters from the same vendors are used for all wireless nodes. At least most components today adhere to the basic standards IEEE 802.11b or (newer) 802.11a.

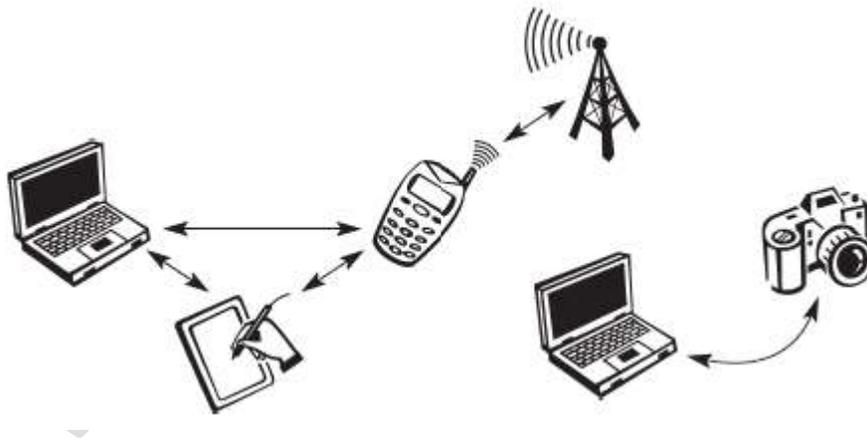
- **Restrictions:** All wireless products have to comply with national regulations. Several government and non-government institutions worldwide regulate the operation and restrict frequencies to minimize interference. Consequently, it takes a very long time to establish global solutions like, e.g., IMT-2000, which comprises many individual standards. WLANs are limited to low-power senders and certain license-free frequency bands, which are not the same worldwide.

- **Safety and security:** Using radio waves for data transmission might interfere with other high-tech equipment in, e.g., hospitals.

(b) Present the concept of Bluetooth technology.

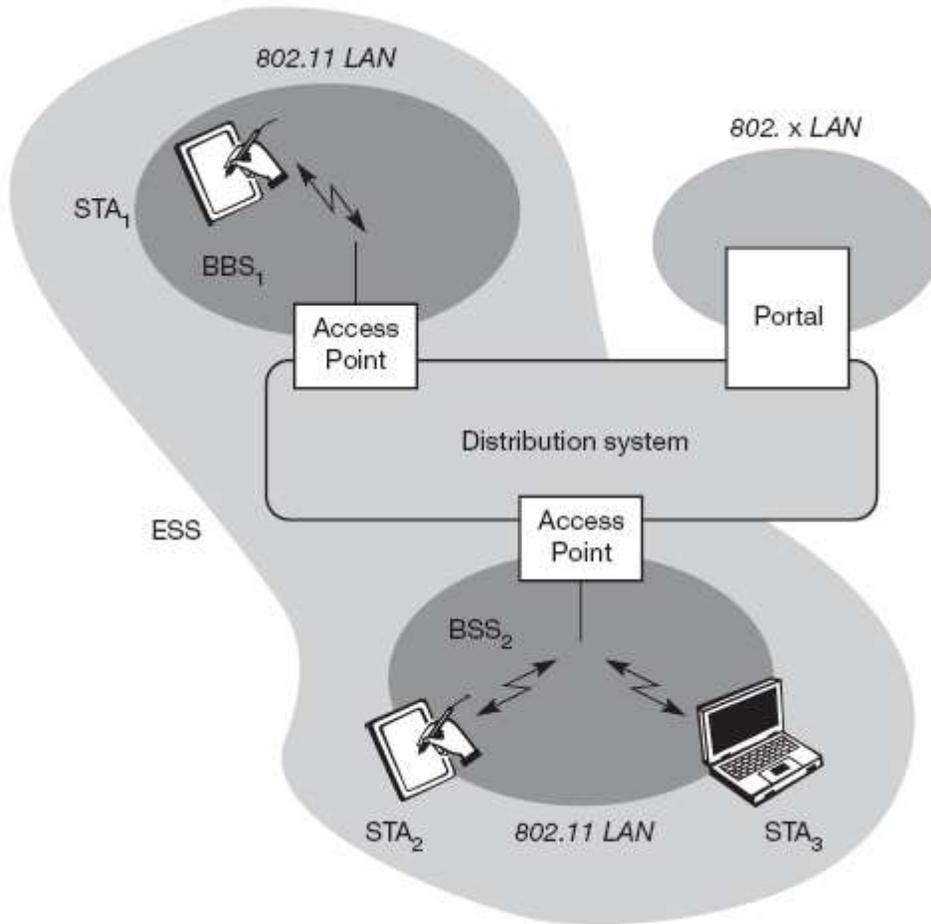
Bluetooth development started, a study group within IEEE 802.11 discussed **wireless personal area networks (WPAN)** under the following five criteria:

- **Market potential:** How many applications, devices, vendors, customers are available for a certain technology?
- **Compatibility:** Compatibility with IEEE 802.
- **Distinct identity:** Originally, the study group did not want to establish a second 802.11 standard. However, topics such as, low cost, low power, or small form factor are not addressed in the 802.11 standard.
- **Technical feasibility:** Prototypes are necessary for further discussion, so the study group would not rely on paper work. User scenarios Many different user scenarios can be imagined for wireless piconets or WPANs:
 - **Connection of peripheral devices:** Today, most devices are connected to a desktop computer via wires (e.g., keyboard, mouse, joystick, headset, speakers). This type of connection has several disadvantages: each device has its own type of cable, different plugs are needed, wires block office space. In a wireless network, no wires are needed for data transmission. However, batteries now have to replace the power supply, as the wires not only transfer data but also supply the peripheral devices with power.
 - **Support of ad-hoc networking:** Imagine several people coming together, discussing issues, exchanging data (schedules, sales figures etc.). For instance, students might join a lecture, with the teacher distributing data to their personal digital assistants (PDAs).



OR

VIII. Explain IEEE 802.11 WLAN system architecture in detail.



System architecture Wireless networks can exhibit two different basic system architectures infrastructure-based or ad-hoc. shows the components of an infrastructure and a wireless part as specified for IEEE 802.11. Several nodes, called **stations (STAi)**, are connected to **access points (AP)**. Stations are terminals with access mechanisms to the wireless medium and radio contact to the AP. The stations and the AP which are within the same radio coverage form a **basic service set (BSSi)**. The example shows two BSSs – BSS1 and BSS2 – which are connected via a **distribution system**. A distribution system connects several BSSs via the AP to form a single network and thereby extends the wireless coverage area. This network is now called an **extended service set (ESS)** and has its own identifier, the ESSID. The ESSID is the ‘name’ of a network and is used to separate different networks. Without knowing the ESSID (and assuming no hacking) it should not be possible to participate in the WLAN. The distribution system connects the wireless networks via the APs with a **portal**, which forms the interworking unit to other LANs.

IX. (a) Write a note on VoIP.

VOIP is an acronym for Voice Over Internet Protocol, or in more common terms phone service over the Internet. If you have a reasonable quality Internet connection you can get phone service delivered through your Internet connection instead of from your local phone company.

Some people use VOIP in addition to their traditional phone service, since VOIP service providers usually offer lower rates than traditional phone companies, but sometimes doesn't offer 911 service, phone directory listings, 411 service, or other common phone services. While many VoIP providers offer these services, consistent industry-wide means of offering these are still developing.

A way is required to turn analog phone signals into digital signals that can be sent over the Internet.

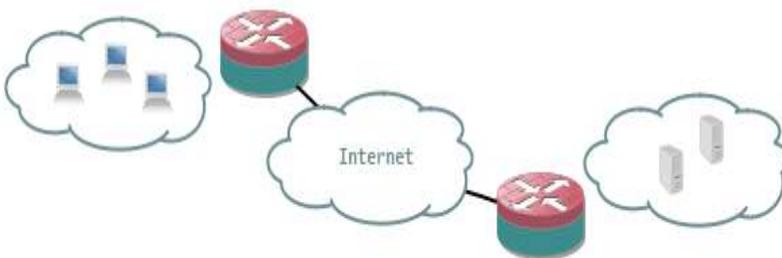
This function can either be included into the phone itself (See: VOIP Phones) or in a separate box like an ATA

Ordinary Phone ---- ATA ---- Ethernet ---- Router ---- Internet ---- VOIP Service Provider

It is also possible to bypass a VOIP Service Provider and directly connect to another VOIP user. However, if the VOIP devices are behind NAT routers, there may be problems with this approach.

IP Phone ----- Ethernet ----- Router ---- Internet ---- Router ---- Ethernet ---- IP Phone

(b) List and explain the different types of VPN.

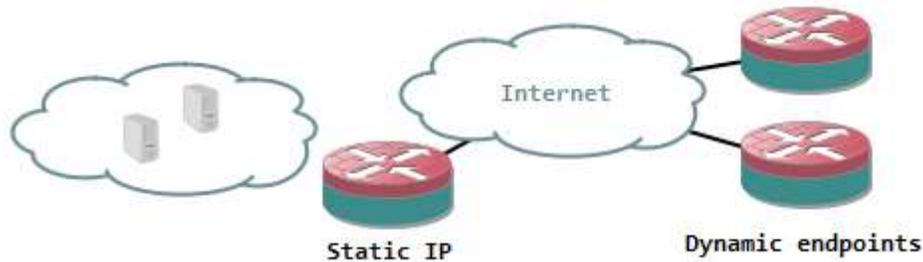


site-to-site VPN

Often abbreviated to S2SVPN. It's a connection between two sites and encrypts all traffic between two (or multiple) subnets. There are two types of S2SVPN:

- Policy-based: interesting traffic triggers an ACL and is encrypted and sent to the remote VPN peer.
- Routed: traffic is routed into an encrypted tunnel to the remote VPN peer.

For a detailed explanation and configuration, Jeremy made some excellent posts about this on Packetlife: Part 1 for policy-based and Part 2 for routed.



DMVPN

A dynamic multipoint VPN is not a protocol but more a technique using different protocols. One or more central hub routers are required, but the remote (spoke) routers can have dynamic IPs and more can be added without having to modify the configuration on the hub router(s), or any other spoke routers. The routers use a next-hop resolution protocol, combined with a dynamic routing protocol to discover remote peers and subnets. The VPN itself is a mGRE tunnel (GRE with multiple endpoints) which is encrypted.

OR

X. Explain idea, applications, and advantages of WiMAX.

Wimax Advantages

Wimax stands for Worldwide Interoperability for Microwave Access services brings long time term evolution in wireless data market. **WiMax Technology** is facing many hurdles in market while it has some great **advantages** which make it a technology of today's

As it is possible to use WiMAX over longer distances, this technology may come in handy in creating city wide networks. It is also better suited than WiFi for large area public places like airports, college and university campuses and large office set ups. It also provides for greater mobility to users. This way WiMAX may be a good option for people on the move using gadgets like laptops, iPods and PDAs.

As WiMAX follows a point-to-multipoint architecture, it is an ideal solution for delivering broadband to places where it would not be viable to establish wired connections. Rural areas and high rises are examples for this situation. Currently this last mile part of the connectivity is the biggest stumbling block to broadband providers, in terms of cost and manpower requirements. WiMAX can bring down the costs and subsequently make internet connectivity cheaper to the end user.

Wimax Applications

Wimax network provides the ability for service provider to deploy new era broadband service. **Wimax applications** are most effective than today. It provides a broad customer base, while adding up a mobility feature to those services. **Wimax technology applications** are a mean of service providers to present data, video, voice, mobile and internet access. There are various benefits of **Wimax technology** such as it provides simple based prospective cost saving and service efficiency but to be capable to allow VoIP calling, mobile devices, video making and high speed data transfer.