15 mark

Explain with a block diagram in detail how different services are provided by GSM. Discuss in detail about the digital cell phone components.

GSM is the most successful digital mobile telecommunication system in the world today. It is used in more than 190 countries. GSM permits the integration of different voice and data services and the inter working with existing networks. Services make a network interesting for customers.

GSM has defined three different categories of services:

1. **Telephony (also referred as tele-services) Services**
2. **Data (also referred as bearer services) Services**
3. **Supplementary Services**

1. Tele-Services or Telephony Services :

GSM mainly focuses on voice-oriented Teleservices. These comprise encrypted voice transmission, message services, and basic data communication with terminals as known from the PSTN or ISDN

- **Voice Calls: The most basic Tele-Services supported by GSM is telephony. This includes full rate speech at 13 Kbps and emergency calls, where the nearest emergency service provider is notified by dialing three digits.**
- **VideoText and Facsimile: Another group of Tele-Services includes Videotext access, Teletext transmission, and Facsimile alternate speech and facsimile Group 3, automatic facsimile Group 3 etc.**
- **Short Text Messages: SMS service is a text messaging which allow you to send and receive text messages on your GSM mobile phones.**
- **Multimedia Message Services:**
- **Location Based Services:**

2. Data Services or Bearer Services

Using your GSM phone to receive and send data is the essential building block leading to widespread mobile Internet access and mobile and mobile data transfer. GSM currently has a data transfer rate of 9.6k. New development that will push up data transfer rated for GSM users HSCSD are now available.

3. Supplementary Services

Supplementary services are provided on top of TeleServices or bearer services, and include features such as caller identification, call forwarding, call waiting, multi-party conversation. A brief description of supplementary services is given here:

- **Multiparty Service or conferencing: The multiparty service allows a mobile subscriber to establish multiparty conversations. That is, conservation between three or more subscribers to setup a conference calls. This service is only applicable to normal telephony.**
- **Call Waiting: This service allows a mobile subscriber to be notified of an incoming call during a conversation. The subscriber can answer, reject or ignore the incoming call. Call waiting is applicable to all GSM telecommunications services using circuit switched connection.**
- **Call Hold: This service allows a mobile subscriber to put an incoming call on hold and then resume this call. The call hold service is only applicable to normal telephony.**
- **Call Forwarding: The call forwarding supplementary service is used to divert calls from the original recipient to another number, and is normally set up by the subscriber himself. It can be used by the subscriber to divert calls from the Mobile Station when the subscriber is not available, and so to ensure that calls are not lost. A typical scenario would be a salesperson turns off his mobile phone during a meeting with customer, but does not wish to lose potential sales leads while he is unavailable.**
- **Call Barring: The concept of barring certain type of calls might seem to be a supplementary disservice rather than service. However, there are times when the subscriber is not the actual user of the Mobile Station, and as a consequence may wish to limit its functionality, so as to limit charges incurred. If the subscriber and users and one and same, the call barring may be useful to stop calls being routed to international destinations when they are route. The reasons for this are because it is expected that are roaming subscriber will pay the charges incurred for international re-routing of calls. So, GSM devised some flexible services that enable the subscriber to conditionally bar calls**

GSM System Architecture

The GSM framework is made up of three primary linked subsystems. They are as follows: 1) Base station subsystem (BSS), 2) Network and switching subsystems, and 3) Operation support subsystem (OSS). Through specific network interfaces, the subsystems communicated with one another and with the users.

The mobile station (MS) is also a subsystem, although it is typically regarded to be part of the BSS for architectural purposes. The BSS, also known as the radio subsystem, offers and controls radio transmission routes between the mobile switching centre and the base station (MSC). The BSS also controls the radio interface between mobile stations and all GSM subsystems. Each BSS is composed of numerous base station controllers (BSCs), which connect the MS to the NSS through MSCs.

NSS manages system switching and connects MSCs to other networks such as PSTN and ISDN.

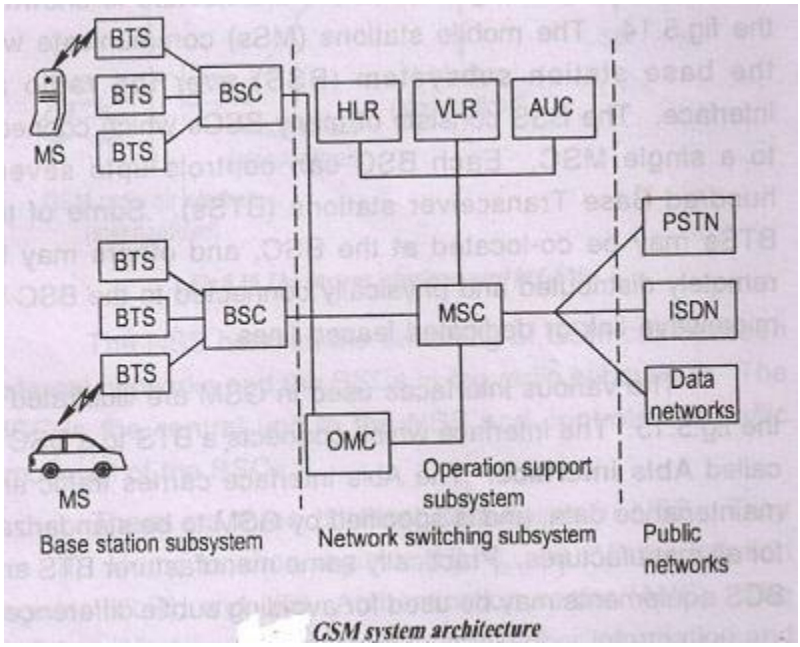


Figure: GSM Architecture

The OSS permits engineers to monitor, diagnose, and troubleshoot all elements of the GSM system and hence supports its operation and maintenance. This subsystem communicates with the others in the GSM network.

The picture is a block schematic of the GSM architecture. The radio air interface connects the mobile stations (MSs) to the base station subsystem (BSS). The BSS is made up of several BSCs that are linked together by a signal MSC. Each BSC may manage hundreds of Base Transceiver Stations (BTSs). Some BTSs may be co-located at the BSC, while others may be dispersed widely and physically linked to the BSC through a microwave connection or special leased lines.

The picture represents the various interfaces used in GSM. The interface that links a BTS to a BSC is known as the Abis interface. GSM has standardised the Abis interface for all

manufacturers, which transfers traffic and maintenance data. BTS and BSC equipment from the same vendor might be used to minimise small differences.

The NSS is in charge of routing GSM calls between external networks and the radio subsystem's BSCs. The MSC is the NSS's core unit, and it manages traffic between all of the BSCs.

NSS has three databases. They are as follows: 1) Home location registers (HLR), 2) Visitor location registers (VLR), and 3) Authentication centres (AUC). The HLR is a database containing subscriber and location information for each user who lives in the same city as the MSC. Each GSM user in a certain GSM market is given a unique international mobile subscriber identifier (IMSI). Each home user is identified by this number.

The OSS provides support for one or more operation maintenance centres (OMC), which monitor and maintain the operation of each MS, BS, BSC, and MSC in a GSM system.

The OSS performs three functions: 1) maintain all telecommunications hardware and network operations with a specific market, 2) manage all pricing and invoicing procedures, and 3) manage all mobile equipment in the system.

Digital cell phone components

1. Antenna Switch

- **Identification**: It is found in the Network Section of a mobile phone / smartphone (*Android and iPhone*) and is made up of metal and non-metal. In GSM sets it is found in white color and in CDMA sets it is found in golden metal.
- **Work / Function**: It searches network and passes forward after tuning.
- **Faults**: If the Antenna Switch is faulty then there will be no network in the mobile phone.

Cell Phone Antenna Switch

2. P.F.O(*Power Frequency Oscillator*)

- **Identification**: It is found near the Antenna Switch in the Network Section on the Motherboard of a Mobile Phone or Smartphone. It is also called P.A (*Power Amplifier*) and **B**and **P**ass **F**ilter.
- **Work / Function**: It filters and amplifies network frequency and selects the home network.
- **Faults**: If the PFO is faulty then there will be no network in the mobile phone. If it gets short then the mobile phone will get dead.

Cell Phone PFO

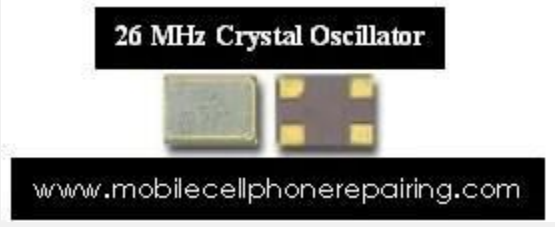
3. RF IC / Hagar / Network IC

- **Identification**: This electronic component found near the PFO in the Network Section of a Mobile Phone. It is also called RF signal processor.
- **Work / Function**: It works as transmitter and receiver of audio and radio waves according to the instruction from the CPU.
- **Faults**: If the RF IC is faulty then there will be problem with network in the mobile phone. Sometimes the mobile phone can even get dead.

Cell Phone Network IC / RF IC

4. 26 MHz Crystal Oscillator

- **Identification**: It is found near the PFO in the Network Section of a Mobile Phone. It is also called Network Crystal. It is made up of metal.
- **Work / Function**: It creates frequency during outgoing calls.
- **Faults**: If this crystal is faulty then there will be no outgoing call and no network in the mobile phone.



Mobile Phone 26 MHz Crystal Oscillator

5. VCO (*Voltage Controller Oscillator*)

- **Identification**: It is found near the Network IC in the Network Section of a Mobile Phone.
- **Work / Function**: It sends time, date and voltage to the RF IC / Hager and the CPU. It also creates frequency after taking command from the CPU.
- **Faults**: If it is faulty then there will be no network in the mobile phone and it will display "*Call End*" or "*Call Failed*".

Mobile Phone VCO

2 MARK:

1. List the types of OSI layer.

- Physical Layer.
- Data Link Layer. ...
- Network Layer. ...
- Transport Layer. ...
- Session Layer. ...
- Presentation Layer.
- Application Layer.

2. Are cell phones analog or digital?

Analog line, also referred to as POTS (Plain Old Telephone Service), support standard phones, fax machines, and modems. These are the lines typically found in small offices. **Digital lines are found in large, corporate phone systems or cell phones**.

3. How does a mobile device work?

A microchip in the phone modulates (or varies) a radio wave using the electrical signal. The radio wave travels through the air to a nearby cell tower; the tower sends your voice to the person you are calling and the process is reversed so that the person on the other end can hear your voice.

4. Trojan: why is it so dangerous?

A Trojan is a type of virus that **can have highly destructive effects: from deleting files to destroying all the contents of the hard disk**. Trojans can also capture and resend confidential data to an external address or open communication ports, allowing an intruder to control the infected computer remotely.

5. List information retrieval models

Types of Information Retrieval (IR) Model
Boolean, Vector and Probabilistic are the three classical IR models.