CHAPTER 1 OVERVIEW OF BHARTI AIRTEL

1.1 INTRODUCTION

Bharti Airtel Limited is an Indian global telecommunications services company based in New Delhi, India. It operates in 18 countries across South Asia and Africa. Airtel provides GSM, 3G and 4G LTE mobile services, fixed line broadband and voice services depending upon the country of operation.

It is the largest mobile network operator in India and the third largest in the world with 400 million subscribers. Airtel was named India's second most valuable brand in the first ever Brandz ranking by Millward Brown and WPP plc.

Airtel is credited with pioneering the business strategy of outsourcing all of its business operations except marketing, sales and finance and building the 'minutes factory' model of low cost and high volumes.

The strategy has since been adopted by several operators.

Airtel's equipment is provided and maintained by Ericsson and Nokia Solutions and Networks whereas IT support is provided by IBM.

FOUNDATIONAL HISTORY

In 1992, Airtel successfully bid for one of the four mobile phone network licenses auctioned in India.

The license was finally approved by the Government in 1994 and he launched services in Delhi in 1995, when Bharti Cellular Limited (BCL) was formed to offer cellular services under the brand name AirTel. Within a few years, Bharti became the first telecom company to cross the 2-million mobile subscriber mark. Bharti also brought down the STD/ISD cellular rates in India under brand name 'Indiaone'. Bharti Enterprises went public in 2002, and the company was listed on Bombay Stock Exchange and National Stock Exchange of India. In 2003, the cellular phone operations were re-branded under the single Airtel brand. Airtel launched "Hello Tunes", a Caller ring back tone service (CRBT), in July 2004 becoming to the first operator in India to do so. In 2005, Bharti extended its network to Andaman and Nicobar.

CHAPTER 2 TECHNOLOGICAL OVERVIEW OF AIRTEL

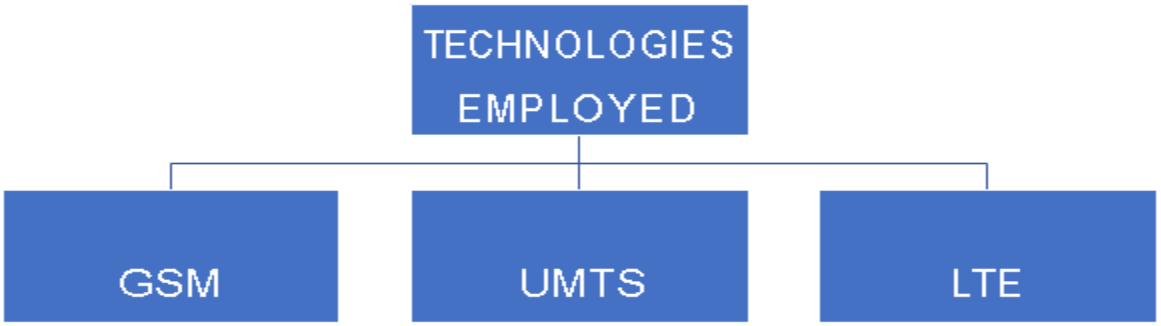

Fig 2.1: Different Network Technologies

2.1 GSM

GSM stands for Global System for Mobile Communication. 2G networks developed as a replacement for first generation (1G) analog cellular networks, and the GSM standard originally described as a digital, circuit-switched network optimized for full duplex voice telephony.

This expanded over time to include data communications, first by circuit-switched transport, then by packet data transport via GPRS (General Packet Radio Services) and EDGE (Enhanced Data rates for GSM Evolution, or EGPRS).

A GSM network comprises of many functional units. These functions and interfaces are explained in this chapter.

The GSM network can be broadly divided into:

The Mobile Station (MS)

The Base Station Subsystem (BSS)

The Network Switching Subsystem (NSS)

The Operation Support Subsystem (OSS)

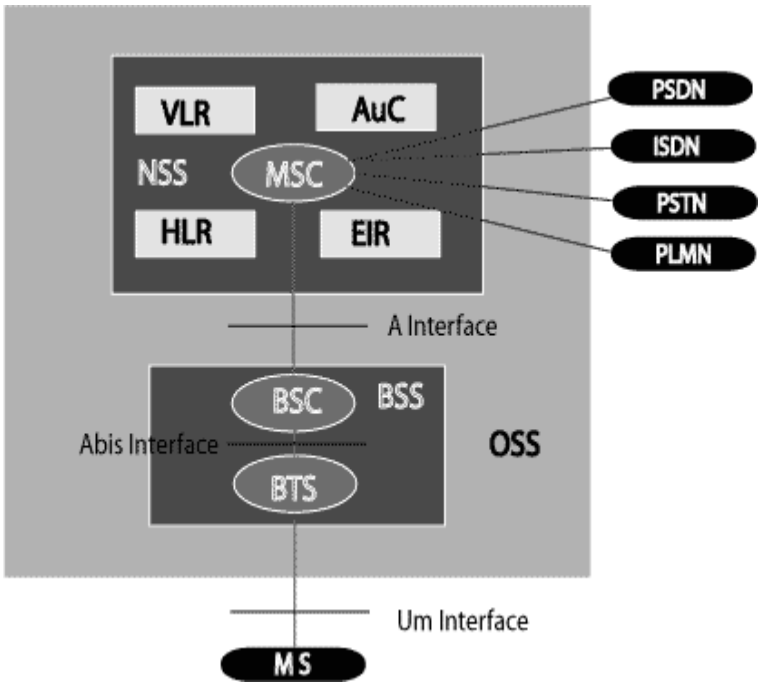

Fig. 2.2: Typical Architecture in GSM

2.1.1 MOBILE STATION

Mobile stations (MS), mobile equipment (ME) or as they are most widely known, cell or mobile phones are the section of a GSM cellular network that the user sees and operates.

In recent years, their size has fallen dramatically while the level of functionality has greatly increased. A further advantage is that the time between charges has significantly increased. There are a number of elements to the cell phone, although the two main elements are the main hardware and the SIM.

The hardware itself contains the main elements of the mobile phone including the display, case, battery, and the electronics used to generate the signal, and process the data receiver and to be transmitted.

It also contains a number known as the International Mobile Equipment Identity (IMEI). This is installed in the phone at manufacture and "cannot" be changed. It is accessed by the network during registration to check whether the equipment has been reported as stolen.

The SIM or Subscriber Identity Module contains the information that provides the identity of the user to the network.

It contains are variety of information including a number known as the International Mobile Subscriber Identity (IMSI).

Mobile equipment is also used to measure the signal parameters such as the RSSI, the Received Signal Strength Indicator, the voice quality, data throughput and is the end of the service established from PLMN, ISDN, through the MSC.

2.1.2 BASE STATION SUBSYSTEM (BSS)

The Base Station Subsystem (BSS) section of the GSM network architecture that is fundamentally associated with communicating with the mobiles on the network. It consists of two elements:

Base Transceiver Station (BTS):

The BTS used in a GSM network comprises the radio transmitter receivers, and their associated antennas that transmit and receive to directly communicate with the mobiles. The BTS is the defining element for each cell. The BTS communicates with the mobiles and the interface between the two is known as the Um interface with its associated protocols.

Base Station Controller (BSC):

The BSC forms the next stage back into the GSM network. It controls a group of BTSs, and is often co-located with one of the BTSs in its group. It manages the radio resources and controls items such as handover within the group of BTSs, allocates channels and the like. It communicates with the BTSs over what is termed the Abis interface.

2.1.3 NETWORK SWITCHING SUBSYSTEM (NSS)

The GSM system architecture contains a variety of different elements, and is often termed the core network. It provides the main control and interfacing for the whole mobile network. The major elements in the NSS are linked together through the BSS and the OSS which is the main interface to provide the end to end services. Call routing and call diverting are the functions of the NSS.

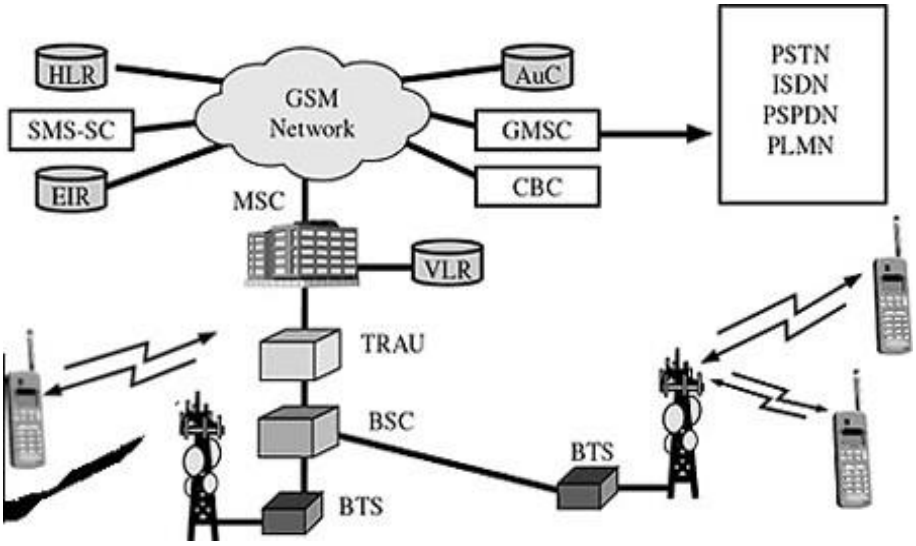

Fig. 2.3: Components of a GSM Network

The additional components of the GSM architecture comprise of databases and messaging systems functions:

HOME LOCATION REGISTER (HLR):

The Home Location Register (HLR) is the main database of permanent subscriber information for a mobile network. Maintained by the subscriber's home carrier (or the network operator where the user initiated the call), the HLR contains pertinent user information, including address, account status, and preferences. The HLR interacts with the Mobile Switching Center (MSC), which is a switch used for call control and processing.

VISITOR LOCATION REGISTER (VLR):

The Visitor Location Register (VLR) is a database in a mobile communications network associated to a Mobile Switching Centre (MSC). The VLR contains the exact location of all mobile subscribers currently present in the service area of the MSC. This information is necessary to route a call to the right base station. The database entry of the subscriber is deleted when the subscriber leaves the service area.

EQUIPMENT IDENTITY REGISTER (EIR):

The Equipment Identity Register (EIR) is a database that contains a record of the all the mobile stations (MS)that are allowed in a network as well as a database of all equipment that is banned, e.g. because it is lost or stolen. The identity of the mobile station is given by the International Mobile Equipment Identity (IMEI).

Each time a call is made, the MSC requests the IMEI of the mobile station, which is then send to the EIR for authorization.

AUTHENTICATION CENTER (AUC):

The Authentication Centre (AUC) is a function in a GSM network used for the authentication a mobile subscriber that wants to be connected to the network. Authentication is done by identification and verification of the validity of the SIM. Once the subscriber is authenticated, the AUC is responsible for the generation of the parameters used for the privacy and the ciphering of the radio link. To ensure the privacy of the mobile subscriber a Temporary Mobile Subscriber Identity (TMSI) is assigned for the duration that the subscriber is under control of the specific Mobile Switching Centre (MSC) associated with the AUC.

SMS SERVING CENTER (SMS SC):

A Short Message Service Center (SMSC) is a network element in the mobile telephone network. Its purpose is to store, forward, convert and deliver Short Message Service (SMS) messages. The full designation of an SMSC according to 3GPP is Short Message Service - Service Center (SMS-SC).

Basic Trajectories of SMS are:

From mobile to another mobile - referred to as MO-MT (Mobile Originated - Mobile Terminated)

From mobile to a content provider (also known as Large Account / ESME) - referred to as MO-AT (Mobile Originated - Application Terminated)

From application to a mobile - referred to as AO-MT (Application Originated - Mobile Terminated)

GATEWAY MSC (GMSC):

The Gateway Mobile Switching Centre (GMSC) is a special kind of MSC that is used to route calls outside the mobile network.

Whenever a call for a mobile subscriber comes from outside the mobile network, or the subscriber wants to make a call to somebody outside the mobile network the call is routed through the GMSC. In practice, the GMSC is just a function that can be part of a MSC.

TRANSCODER AND ADAPTATION UNIT (TRAU):

Transcoder and Rate Adaptation Unit, or TRAU, performs transcoding function for speech channels and RA (Rate Adaptation) for data channels in the GSM network. The

Transcoder/Rate Adaptation Unit (TRAU) is the data rate conversion unit. The PSTN/ISDN switch is a switch for 64 kbit/s voice.

Current technology permits to decrease the bit-rate (in GSM radio interface it is 13 kbit/s for full rate and 6.5 kbit/s for half rate). Since MSC is basically a PSTN/ISDN switch its bit-rate is still 64 kbit/s. That is why a rate conversion is required in between the BSC and MSC.

2.1.4 OPERATION AND SUPPORT SUBSYSTEM (OSS)

The OSS or operation support subsystem is an element within the overall GSM network architecture that is connected to components of the NSS and the BSC. It is used to control and monitor the overall GSM network and it is also used to control the traffic load of the BSS.

It must be noted that as the number of BS increases with the scaling of the subscriber population some of the maintenance tasks are transferred to the BTS, allowing savings in the cost of ownership of the system.

2.1.5 CHANNELS AND CALL FLOW

TDMA divides one radio frequency channel into consecutive periods of time, each one called a "TDMA Frame". Each TDMA frame contains eight shorter periods of time known as “Time Slots”. TDMA timeslots are called "Physical Channels" as they are used to physically move information from one place to another.

The radio carrier signal between the MS and the BTS is divided into a continuous stream of timeslots which in turn are transmitted in a continuous stream of TDMA frames.

These channels are ultimately responsible for identification of frequencies, triangulation of locations, adjustment of doppler shift. It is important to attain correct time slots to ensure proper synchronization between the BTS and the MS.

The timeframe, the packet density and other parameters vary according to operators and are kept confidential as they can be adjusted.

(Refer to next page for figure)

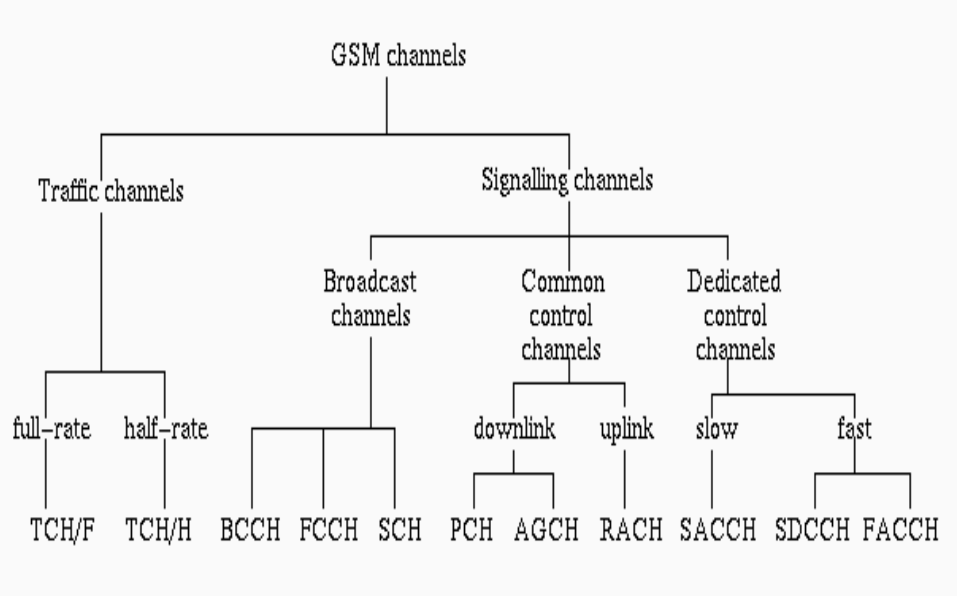

Fig 2.4: GSM's Channel

As shown in the figure there is two main types of channels in the GSM i.e. Traffic channels and signalling channels.

Traffic channels carry speech or data. There are two main categories here, Full rate (13 kbps) and half rate.

Signaling channels used to for control/command/signaling. Control channels are divided into three categories.

2.1.6 BROADCAST CHANNELS

As the name suggests they are point-to-multipoint and downlink only channels.

Frequency correction control channel (FCCH): This is transmitted by BTS to MS. This helps MS tune its local oscillator to exact RF carrier frequency of the BTS cell. All zero sequences are transmitted here which will produce fixed tone at the output of Gaussian minimum shift keying modulator. The frequency value will be about 67.7075 KHz.

Synchronization channel (SCH): This carry BSIC (Base transceiver station identity code) and Frame number which helps MS tune to specific (Frequency, Ts) physical slot on TDMA frame in GSM network.

Broadcast control channel (BCCH) carries CGI, MNC, MCC which is received by MS. It is compared with SIM information, once verified OK connection is established with the network.

2.1.7 COMMON CONTROL CHANNELS

They are point-to-multipoint and downlink only channels except RACH which is used in uplink.

Paging channel (PCH): When someone is calling mobile phone, this channel sent information on downlink to alert called mobile phone. This is known as mobile phone terminated call.

Random Access channel (RACH): used in mobile originated call. When mobile wants to call some other mobile phone, control information is sent on this channel.

Access Grant Channel (AGCH): Transmitted by BTS to MS once network approves request of mobile by RACH.

Cell Broadcast channel (CBCH): Used to carry the short message service cell broadcast.

2.1.8 DEDICATED CONTROL CHANNELS

They are bidirectional and point-to-point Channels.

Standalone dedicated control channel (SDCCH): Used for call setup, call establishment and call management.

Slow associated control channel (SACCH): It is used for control and supervisory signals associated with the traffic channels.

Fast associated control channel (FACCH): It is used for control requirements such as hand off / handovers.

Hence, these are the GSM channels that are required for the CM services in 2G. The GSM voice Channels offer a rate of 12.2. to 19.6 kbps rate of speech facility.

Thus, for a single voice slot in the TDMA frame the speech codec rate will be 12 to 19 kbps depending upon the codec rate chosen whether half or full rate.

Half rate provides a rate of around 6.5 kbps whereas full rate provides a rate of 13.5 kbps. Enhanced full rate also provides a rate of 13.5 kbps but with an improved speech quality.

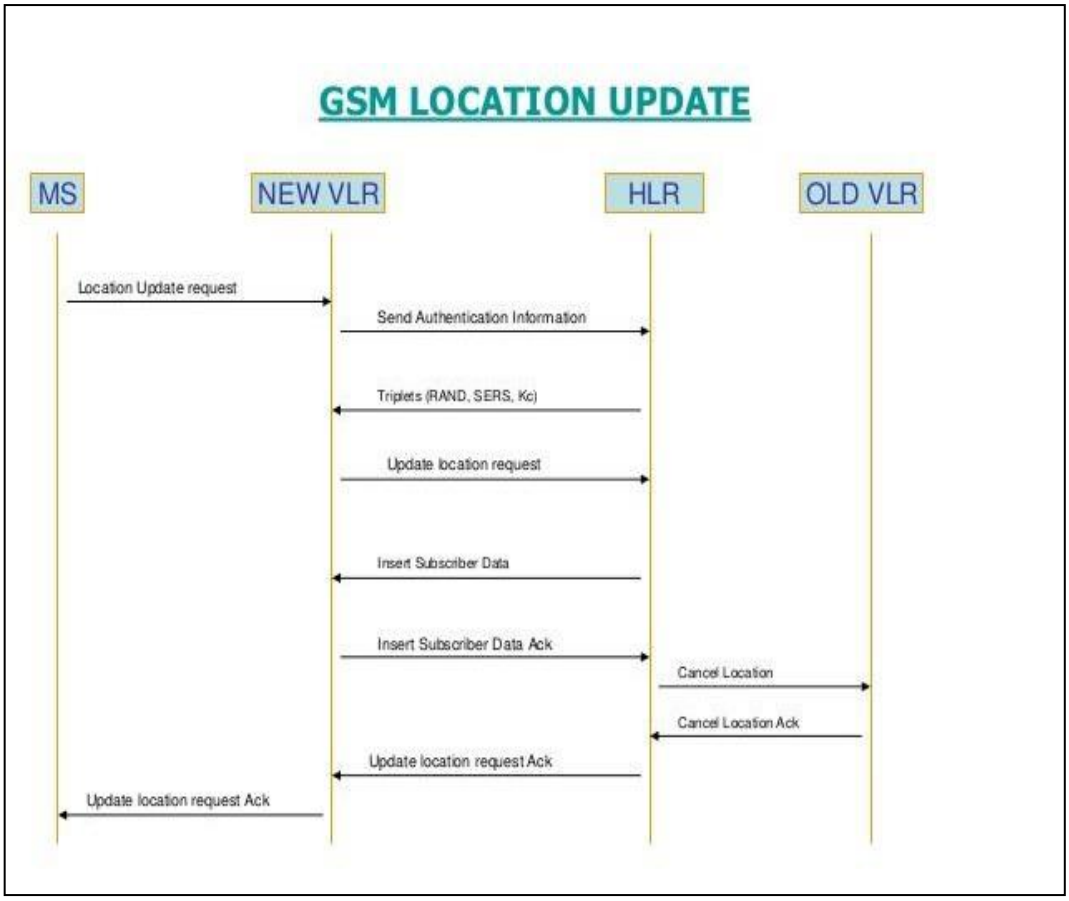

Fig 2.5: GSM Location Update

CALL FLOW STEPS:

- The MSC/VLR knows which LA the MS is located in. A paging message is sent to the BSC that is controlling the LA.
- The BSC distribute the paging message to the BTS in the desired LA. The
- BTS transmits the message over the Air interface using PCH.
- When the MS detects a PCH identifying itself, it sends a request for a signalling channel using RACH.
- The BSC uses AGCH to inform the MS of the signalling channel (SDCCH
- and SACCH) to use.
- SDCCH and SACCH are used for call set-up. A TCH is allocated and the
- SDCCH is released.
- The MS and BTS switch to the identified TCH frequency and time slot.

- The MS generates ring tone. If the subscriber answers, the connection is established. During the call, signals can be sent and received by the MS using SACCH.

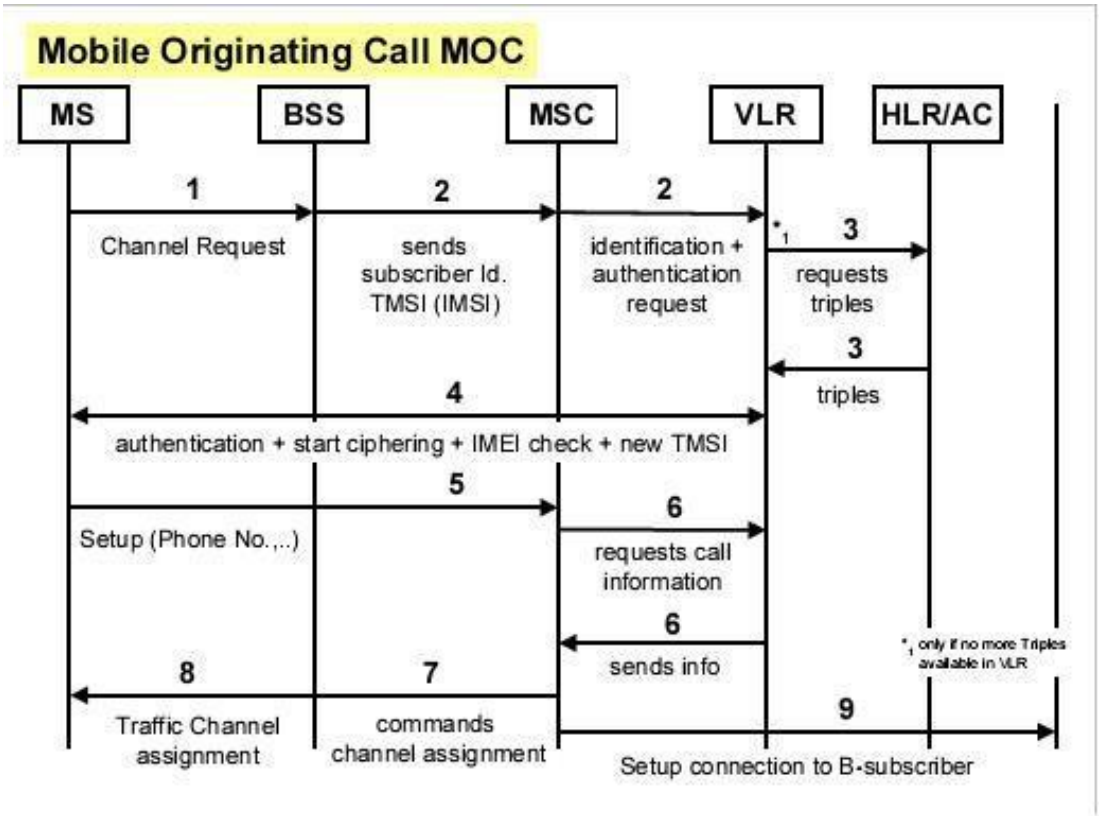

Fig 2.6: Mobile Call Origination

2.2 UMTS:

UMTS (Universal Mobile Telecommunications Service) is a third-generation (3G) broadband, packet-based transmission of text, digitized voice, video, and multimedia at data rates up to 2 megabits per second (Mbps).

UMTS offers a consistent set of services to mobile computer and phone users, no matter where they are located in the world. UMTS is based on the Global System for Mobile (GSM) communication standard.

It is also endorsed by major standards bodies and manufacturers as the planned standard for mobile users around the world.

Once UMTS is fully available, computer and phone users can be constantly attached to the Internet wherever they travel and, as they roam, will have the same set of capabilities.

Users will have access through a combination of terrestrial wireless and satellite transmissions. Until UMTS is fully implemented, users can use multi-mode devices that switch to the currently available technology (such as GSM 900 and 1800) where UMTS is not yet available.

Previous cellular telephone systems were mainly circuit-switched, meaning connections were always dependent on circuit availability.

A packet-switched connection uses the Internet Protocol (IP), meaning that a virtual connection is always available to any other end point in the network.

The electromagnetic radiation spectrum for UMTS has been identified as frequency bands 1885-2025 MHz for future IMT-2000 systems, and 1980-2010 MHz and 2170-2200 MHz for the satellite portion of UMTS systems.

User Equipment is composed of Mobile Equipment (ME) and USIM. Radio Access Network is composed of NodeB and RNC.

Core Network is composed of circuit switched and packet switched functional modules. For Circuit switched (CS) operations MSC and GMSC along with database modules such as VLR, HLR will be available.

For packet switched (PS) operations SGSN and GGSN will serve the purpose. GMSC will be connected with PSTN/ISDN in CS case. GGSN is connected with Packet Data Network (PDN) for PS case.

2.2.1 3G UMTS NETWORK CONSTITUENTS

The UMTS network architecture can be divided into three main elements:

User Equipment (UE):

The User Equipment or UE is the name given to what was previous termed the mobile, or cellphone. The new name was chosen because the considerably greater functionality that the UE could have. It could also be anything between a mobile phone used for talking to a data terminal attached to a computer with no voice capability.

Radio Network Subsystem (RNS):

The RNS also known as the UMTS Radio Access Network, UTRAN, is the equivalent of the previous Base Station Subsystem or BSS in GSM. It provides and manages the air interface for the overall network.

Core Network:

The core network provides all the central processing and management for the system. It is the equivalent of the GSM Network Switching Subsystem or NSS.

The core network is then the overall entity that interfaces to external networks including the public phone network and other cellular telecommunications networks.

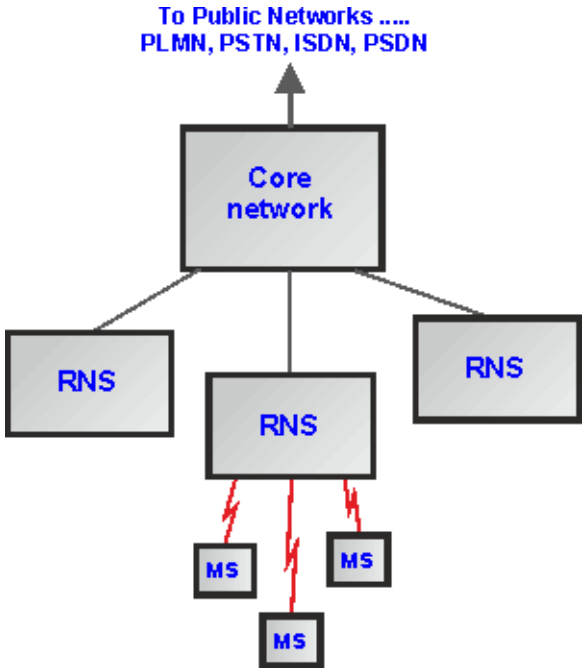

Fig. 2.7: Components of a UMTS Network

The USER Equipment or UE is a major element of the overall 3G UMTS network architecture. It forms the final interface with the user. In view of the far greater number of applications and facilities that it can perform, the decision was made to call it a user equipment rather than a mobile.

However, it is essentially the handset (in the broadest terminology), although having access to much higher speed data communications, it can be much more versatile, containing many more applications. It consists of a variety of different elements including RF circuitry, processing, antenna, battery, etc.

There are several elements within the UE that can be described separately:

UE RF CIRCUITRY:

The RF areas handle all elements of the signal, both for the receiver and for the transmitter.

One of the major challenges for the RF power amplifier was to reduce the power consumption. The form of modulation used for W-CDMA requires the use of a linear amplifier.

These inherently take more current than nonlinear amplifiers which can be used for the form of modulation used on GSM.

Accordingly, to maintain battery life, measures were introduced into many of the designs to ensure the optimum efficiency.

BASEBAND PROCESSING:

The base-band signal processing consists mainly of digital circuitry. This is considerably more complicated than that used in phones for previous generations. Again, this has been optimized to reduce the current consumption as far as possible.

BATTERY:

While current consumption has been minimized as far as possible within the circuitry of the phone, there has been an increase in current drain on the battery.

With users expecting the same lifetime between charging batteries as experienced on the previous generation phones, this has necessitated the use of new and improved battery technology.

Now Lithium Ion (Li-ion) batteries are used. These phones to remain small and relatively light while still retaining or even improving the overall life between charges.

UNIVERSAL SUBSCRIBER IDENTITY MODULE, USIM:

The UE also contains a SIM card, although in the case of UMTS it is termed a USIM (Universal Subscriber Identity Module). This is a more advanced version of the SIM card used in GSM and other systems, but embodies the same types of information.

It contains the International Mobile Subscriber Identity number (IMSI) as well as the Mobile Station International ISDN Number (MSISDN). Other information that the USIM holds includes the preferred language to enable the correct language information to be displayed, especially when roaming, and a list of preferred and prohibited Public Land Mobile Networks (PLMN).

The USIM also contains a short message storage area that allows messages to stay with the user even when the phone is changed.

Similarly, "phone book" numbers and call information of the numbers of incoming and outgoing calls are stored.

The UE can take a variety of forms, although the most common format is still a version of a "mobile phone" although having many data capabilities. Other broadband dongles are also being widely used.

222 3G UMTS RADIO NETWORK SUBSYSTEM

This is the section of the 3G UMTS / WCDMA network that interfaces to both the UE and the core network. The overall radio access network, i.e. collectively all the Radio Network Subsystem is known as the UTRAN UMTS Radio Access Network.

The radio network subsystem is also known as the UMTS Radio Access Network or UTRAN.

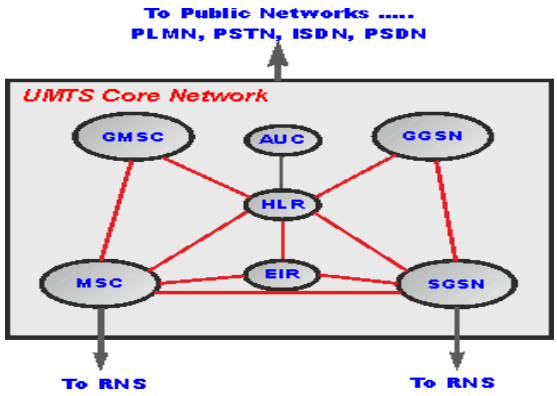

Fig. 2.8: Core of a UMTS Network

The 3G UMTS core network architecture is a migration of that used for GSM with further elements overlaid to enable the additional functionality demanded by UMTS.

In view of the different ways in which data may be carried, the UMTS core network may be split into two different areas:

Circuit switched elements:

These elements are primarily based on the GSM network entities and carry data in a circuit switched manner, i.e. a permanent channel for the duration of the call.

Packet switched elements:

These network entities are designed to carry packet data. This enables much higher network usage as the capacity can be shared and data is carried as packets which are routed according to their destination.

Mobile switching center (MSC):

This is essentially the same as that within GSM, and it manages the circuit switched calls under way.

Gateway MSC (GMSC):

This is effectively the interface to the external networks.

Serving GPRS Support Node (SGSN):

As the name implies, this entity was first developed when GPRS was introduced, and its use has been carried over into the UMTS network architecture. The SGSN provides a number of functions within the UMTS network architecture.

MOBILITY MANAGEMENT:

When a UE attaches to the Packet Switched domain of the UMTS Core Network, the SGSN generates MM information based on the mobile's current location.

Session management:

The SGSN manages the data sessions providing the required quality of service and also managing what are termed the PDP (Packet data Protocol) contexts, i.e. the pipes over which the data is sent.

Interaction with other areas of the network:

The SGSN is able to manage its elements within the network only by communicating with other areas of the network, e.g. MSC and other circuit switched areas.

BILLING:

The SGSN is also responsible billing. It achieves this by monitoring the flow of user data across the GPRS network. CDRs (Call Detail Records) are generated by the SGSN before being transferred to the charging entities (Charging Gateway Function, CGF).

Gateway GPRS Support Node (GGSN):

Like the SGSN, this entity was also first introduced into the GPRS network. The Gateway GPRS Support Node (GGSN) is the central element within the UMTS packet switched

network. It handles inter-working between the UMTS packet switched network and external packet switched networks, and can be considered as a very sophisticated router. In operation, when the GGSN receives data addressed to a specific user, it checks if the user is active and then forwards the data to the SGSN serving the particular UE.

HOME LOCATION REGISTER (HLR):

This database contains all the administrative information about each subscriber along with their last known location. In this way, the UMTS network is able to route calls to the relevant RNC / Node B. When a user switches on their UE, it registers with the network and from this it is possible to determine which Node B it communicates with so that incoming calls can be routed appropriately. Even when the UE is not active (but switched on) it re-registers periodically to ensure that the network (HLR) is aware of its latest position with their current or last known location on the network.

EQUIPMENT IDENTITY REGISTER (EIR):

The EIR is the entity that decides whether a given UE equipment may be allowed onto the network. Each UE equipment has a number known as the International Mobile Equipment Identity. This number, as mentioned above, is installed in the equipment and is checked by the network during registration.

AUTHENTICATION CENTRE (AUC):

The AuC is a protected database that contains the secret key also contained in the user's USIM card.

CHAPTER 3 QUALITY ANALYSIS AND SOLUTIONING IN TELECOM

3.1 THREE TIER CO-ORDINATION

The functioning and monitoring of the mobility network can be divided into three categories:

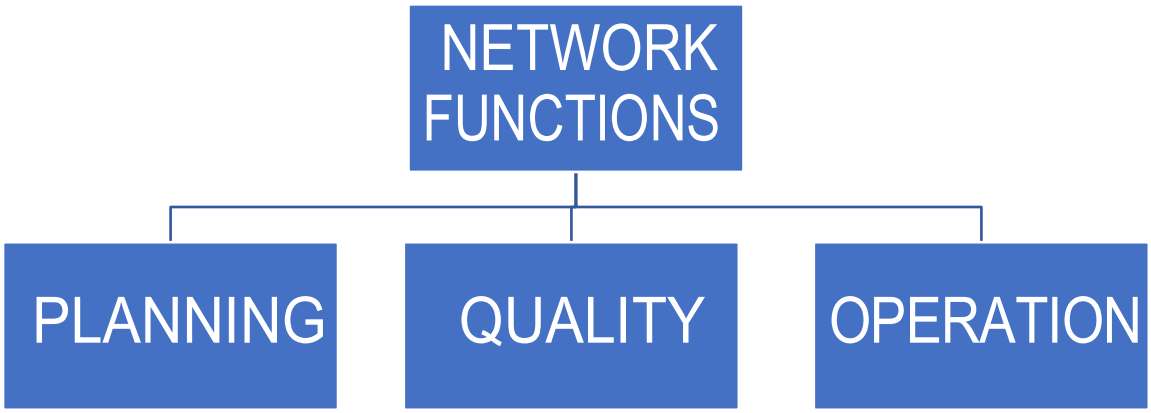

Fig. 3.1: Three Tier Process

3.1.1 PLANNING TEAM

The planning team is responsible for establishing new sites or BTSs, BSCs and MSCs.

They can plan the same both indoor as well as outdoors.

They are responsible for initiating construction on the site, to establish a constant power source, to check if there will be no electromagnetic or EM interference to the site or because of the site to other equipment in proximity and to calibrate radiation levels within the sanctioned and safe limits.

3.1.2 OPERATIONS AND MAINTAINENCE TEAM

They are responsible for the constantly monitoring and checking for alarms or status updates from the BTS through optic fibre transmission cables on the NMS or the Network Management System. They are required to keep the hardware equipment on site at 100% operational status. These checks are mandatory so as to prevent spurious radiation and outages.

The three-tier approach to the functioning of the mobility network is closely synced. The tasks are so divided that the quality team constantly monitors the network which can be termed on a daily, weekly and monthly basis.

The fundamental component of the quality analysis is set into the network analysis on a daily basis which gives the pattern of usage of each and every cell / sector in the defined location / zone.

The KPIs or the Key Performance Indicators are the main parameters which are monitored to give an overview of the status of the network of a region on a given instant.

This continuous process sets the pace for fault diagnosis and correction. This may involve the maintenance / replacement of components which are spread throughout the network layer which is controlled by the Operations functions. This also involves the optimization of cells / sectors.

The Planning function is put into use to plan a new BTS, transmission line or provide a new sector / cell and make the desired deployment.

3.2 PRE-REQUISTE KNOWLEDGE FOR QUALITY ANALYSIS

The quality function is the most critical to any network provider / operator as it is needed for sustained communications. The clear conceptual knowledge of the GSM / UMTS and the LTE network is needed. The architectural framework and the information of the parameters of the functions is required so as to assess the status of the network.The quality function contains of the systematic process of call setup, call establishment, call sustainability and the termination. This process has been termed as call flow.

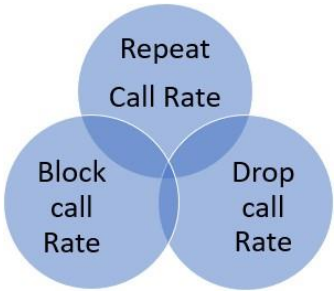

Fig. 3.2.: Quality Index

3.2.1 QUALITY INDEX

QUALITY INDEX DEPENDS UPON THE SUM OF BLOCKED, REPEATED OR DROPPED CALLS. THE IDEAL SUM FOR WHICH IS NULL OR ZERO.

Q.I = B.C.R + R.C.R +

D.C.R WHERE,

BLOCKED CALLS = TOTAL NO. OF BLOCKED CALLS / ATTEMPTED

DROPPED CALLS = TOTAL NO. OF DROPPED CALLS / CALLS SUCCESS

REPEAT CALLS = TOTAL NO. OF CALLS REPEATED / CALLS SUCCESS

CALCULATION OF QUALITY INDEX:

CALL ATTEMPT (A)	CALL SUCCESS (B)	CALL BLOCK (C)	CALL DROP (D)	CALL REPEAT (E)	C/A BCR	D/B DCR	E/B RCR
100	98	2	5	1	0.02	0.051	0.010
100	97	3	2	2	0.03	0.02061	0.02061

Table 3.1: Calculation of Quality Index

3.3 THREE TIER CO – ORDINATION PROCESS

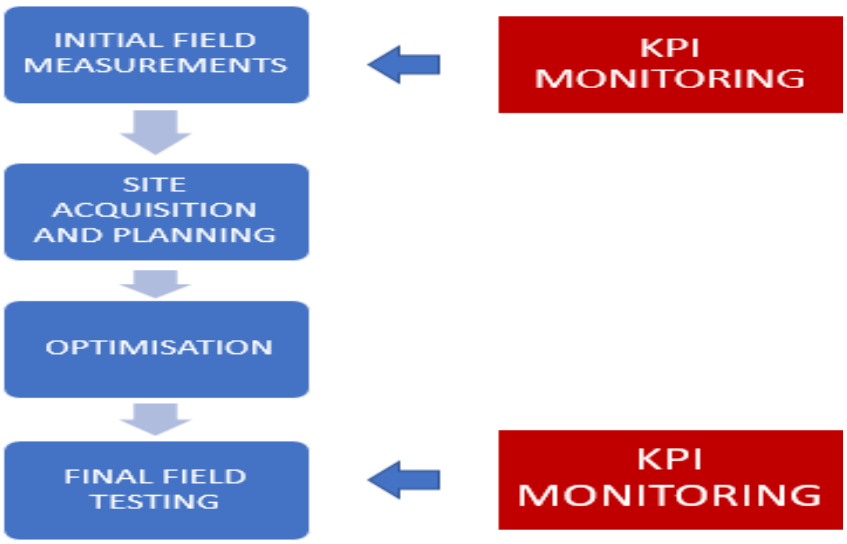

Fig. 3.6: Co-ordination Process

The co-ordination process between the three components, PLANNING, OPERATIONS and QUALITY has been depicted above. As there is a continuous increase of the number of users

and spectrum is limited. Also because of high usage and constantly changing network densities, that is the varying high usage hours differ for each BTS in a given region.

The terms defining the usage statistics are listed as:

BBH: Known as **BOUNCING BUSY HOURS**, this state the hour in which the highest usage is measured for any day. The readings are on the hour or half hour. The selected clock hour will vary from day to day, depending on the measured usage.

NBH: Known as **NETWORK BUSY HOURS**, this shows the average number of highest usage hours for any BTS.

These inputs are obtained constantly from the OSS.

Other methods of obtaining sectoral inputs are by conducting drive tests and surveying to obtain the parameters of signal quality, signal level, proximity to other BTS. These testing methods tell us whether the call is falling back to frequently or is switching excessively between two or more technologies.

These testing methods may be conducted in DEDICATED mode or in IDEAL mode by which it means that it is simply if a call is active or a call has not been established. These tests enable us to get the real-time details of any location.

After the tests have been done it can be identified as to where there is a possibility of improvement of the signal strength and power. It gives a detailed picture as to where the call is getting dropped or if a handover is taking place or not.