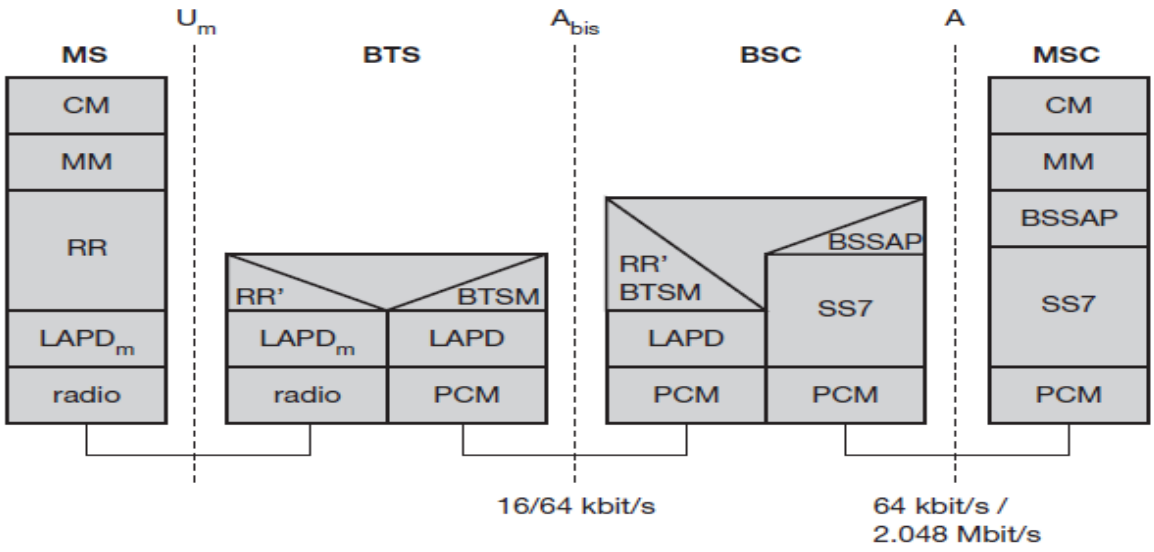
CS8601 –MOBILE COMPUTING

UNIT 2

MOBILE TELECOMMUNICATION SYSTEM

2.3.GSM Protocols:

The signaling protocol in GSM is structured into three general layers depending on the interface, as shown below. Layer 1 is the physical layer that handles all **radio**-specific functions. This includes the creation of bursts according to the five different formats, **multiplexing** of bursts into a TDMA frame, **synchronization** with the BTS, detection of idle channels, and measurement of the **channel quality** on the downlink. The physical layer at Um uses GMSK for digital **modulation** and performs **encryption/decryption** of data, i.e., encryption is not performed end-to-end, but only between MS and BSS over the air interface.



Protocol Architecture for Signaling

The main tasks of the physical layer comprise **channel coding** and **error detection/correction**, which is directly combined with the coding mechanisms. Channel coding makes extensive use of different **forward error correction (FEC)** schemes.

Signaling between entities in a GSM network requires higher layers. For this purpose, the LAPDm protocol has been defined at the Um interface for layer two. LAPDm has been derived from link access procedure for the D-channel (LAPD) in ISDN systems, which is a version of HDLC.

LAPDm is a lightweight LAPD because it does not need synchronization flags or checksumming for error detection. LAPDm offers reliable data transfer over connections, resequencing of data frames, and flow control.

The network layer in GSM, layer three, comprises several sublayers. The lowest sublayer is the radio resource management (RR). Only a part of this layer, RR', is implemented in the BTS, the remainder is situated in the BSC. The functions of RR' are supported by the BSC via the BTS management (BTSM). The main tasks of RR are setup, maintenance, and release of radio channels. Mobility management (MM) contains functions for registration, authentication, identification, location updating, and the provision of a temporary mobile subscriber identity (TMSI). Finally, the call management (CM) layer contains three entities: call control (CC), short message service (SMS), and supplementary service (SS).

SMS allows for message transfer using the control channels SDCCH and SACCH, while SS offers the services like user identification, call redirection, or forwarding of ongoing calls. CC provides a point-to-point connection between two terminals and is used by higher layers for call establishment, call clearing and change of call parameters. This layer also provides functions to send in-band tones, called dual tone multiple frequency (DTMF), over the GSM network. These tones are used, e.g., for the remote control of answering machines or the entry of PINs in electronic banking and are, also used for dialing in Data transmission at the modulation (PCM) systems. LAPD is used for layer two at Abis, BTSM for BTS management. Signaling system No. 7 (SS7) is used for signaling between an MSC and a BSC. This protocol also transfers all management information between MSCs, HLR, VLRs, AuC, EIR, and OMC. An MSC can also control a BSS via a BSS application part (BSSAP).

Localization and Calling

The fundamental feature of the GSM system is the automatic, worldwide localization of users for which, the system performs periodic location updates. The HLR always contains information about the current location and the VLR currently responsible for the MS informs the HLR about the location changes. Changing VLRs with uninterrupted availability is called roaming. Roaming can take place within a network of one provider, between two providers in a country and also between different providers in different countries.

To locate and address an MS, several numbers are needed:

Mobile station international ISDN number (MSISDN):- The only important number for a user of GSM is the phone number. This number consists of the country code (CC), the national destination code (NDC) and the subscriber number (SN).

International mobile subscriber identity (IMSI): GSM uses the IMSI for internal unique identification of a subscriber. IMSI consists of a mobile country code (MCC), the mobile network code (MNC), and finally the mobile subscriber identification number (MSIN).

Temporary mobile subscriber identity (TMSI):

To hide the IMSI, which would give away the exact identity of the user signalling over the air interface, GSM uses the 4 byte TMSI for local subscriber identification.

Mobile station roaming number (MSRN):

Another temporary address that hides the identity and location of a subscriber is MSRN. The VLR generates this address on request from the MSC, and the address is also stored in the HLR. MSRN contains the current visitor country code (VCC), the visitor national destination code (VNDC), the identification of the current MSC together with the subscriber number. The MSRN helps the HLR to find a subscriber for an incoming call. For a mobile terminated call (MTC), the following figure shows the different steps that take place.

Step 1: User dials the phone

Step 2: The fixed network (PSTN) identifies the number belongs to a user in GSM network and forwards the call setup to the Gateway MSC (GMSC).

Step 3: The GMSC identifies the HLR for the subscriber and signals the call setup to HLR

Step 4: The HLR checks for number existence and its subscribed services and requests an MSRN from the current VLR.

Step 5: VLR sends the MSRN to HLR

Step 6: Upon receiving MSRN, the HLR determines the MSC responsible for MS and forwards the information to the GMSC

Step 7: The GMSC can now forward the call setup request to the MSC indicated

Step 8: The MSC requests the VLR for the current status of the MS

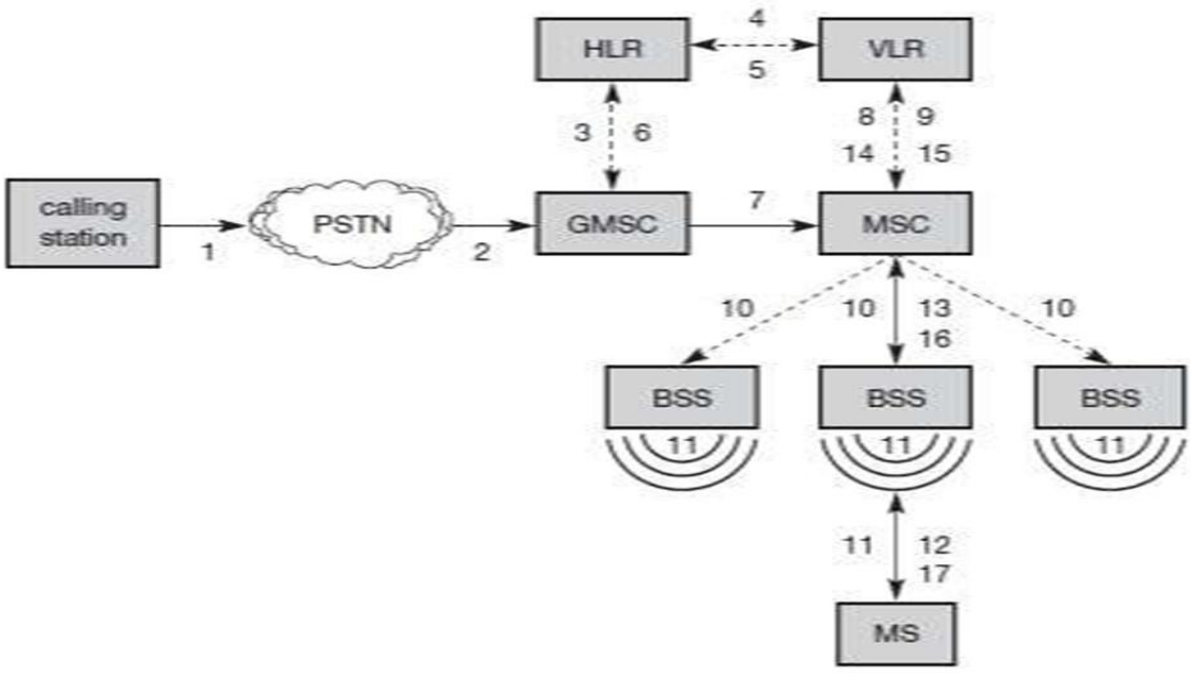
Step 9: VLR sends the requested information

Step 10: If MS is available, the MSC initiates paging in all cells it is responsible for.

Step 11: The BTSs of all BSSs transmit the paging signal to the MS

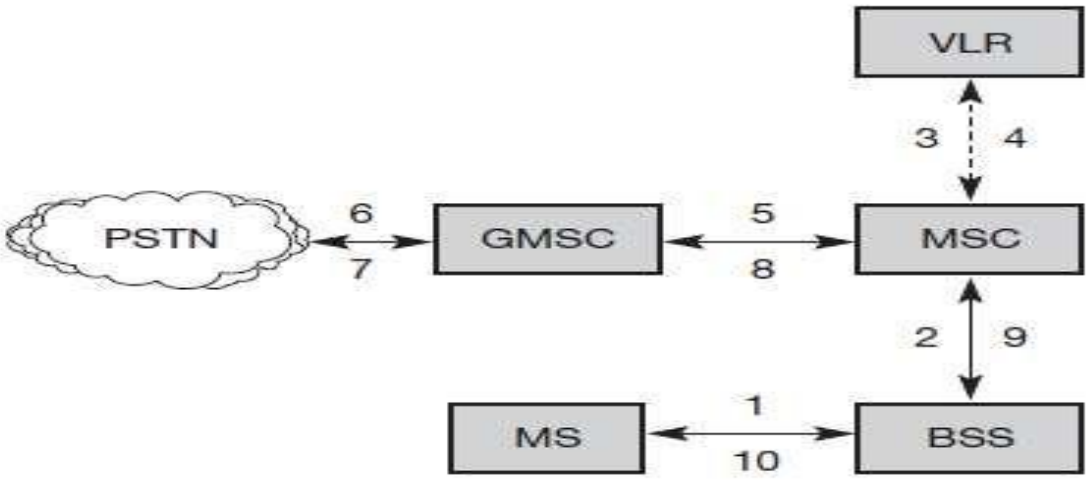
Step 12: Step 13: If MS answers, VLR performs security checks

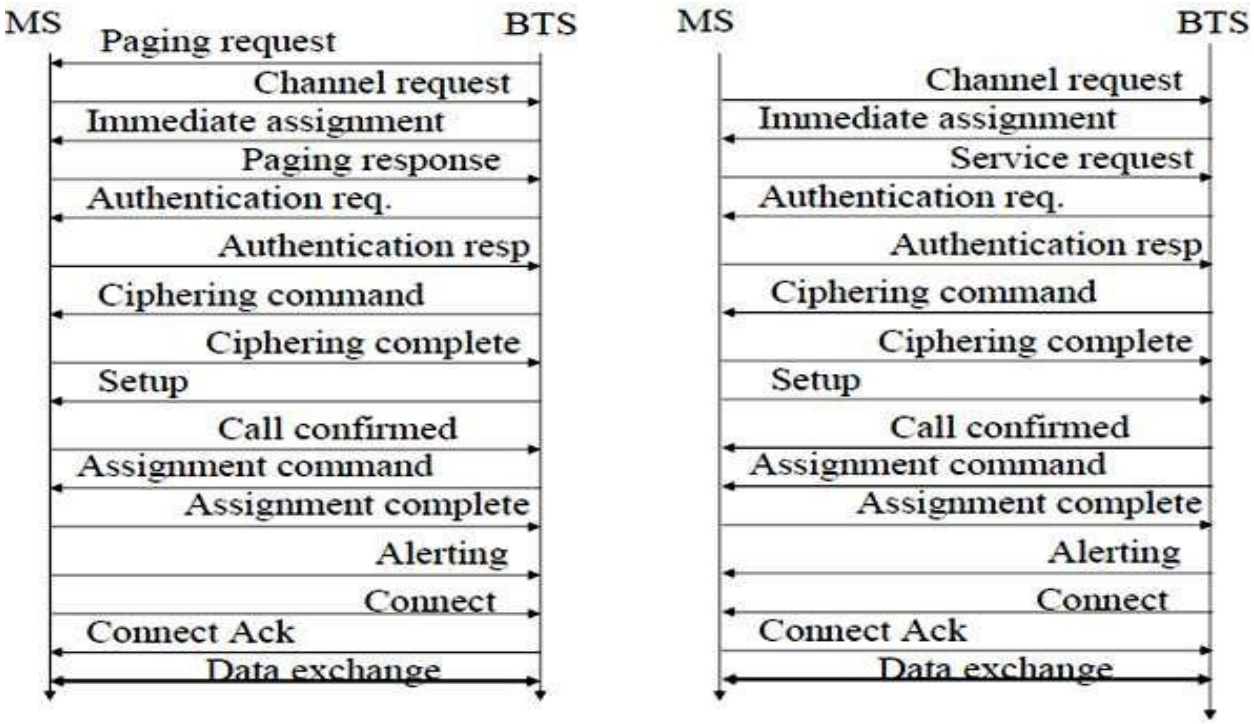
Step 15: Till step 17: Then the VLR signals to the MSC to setup a connection to the MS



For a mobile originated call (MOC), the following steps take place:

Step 1: The MS transmits a request for a new connection
Step 2: The BSS forwards this request to the MSC
Step 3: Step 4: The MSC then checks if this user is allowed to set up a call with the requested and checks the availability of resources through the GSM network and into the PSTN. If all resources are available, the MSC sets up a connection between the MS and the fixed network. In addition to the steps mentioned above, other messages are exchanged between an MS and BTS during connection setup (in either direction).





Message flow for MTC and MOC