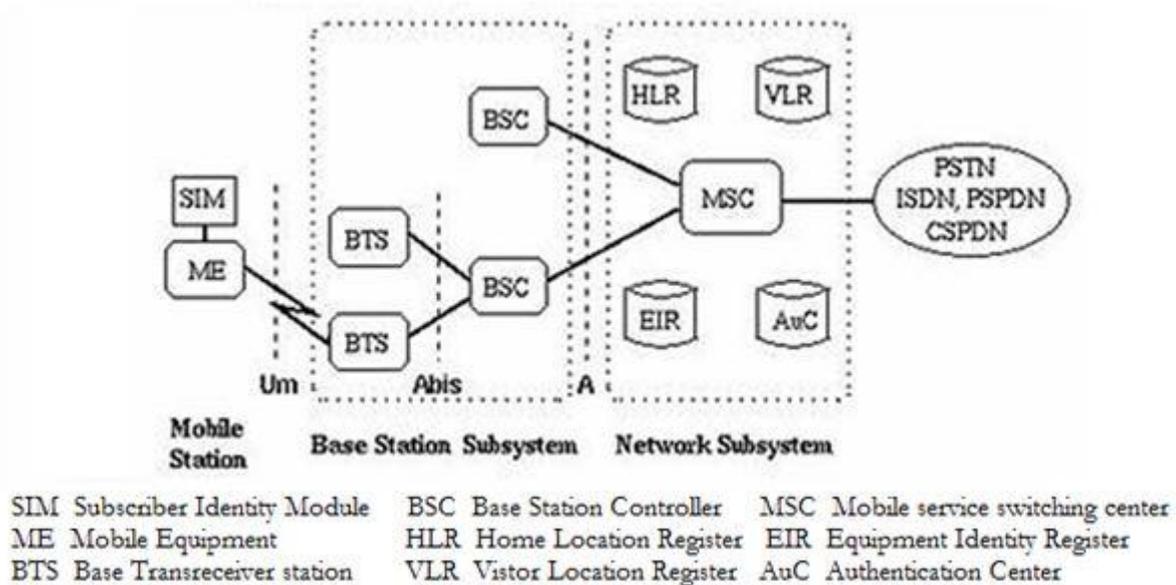


Explain GSM architecture with a neat block diagram, highlighting all the interfaces



- The GSM network architecture consists of three major subsystems:
- Mobile Station (MS)
- Base Station Subsystem (BSS)
- Network and Switching Subsystem (NSS)
- The wireless link interface between the MS and the Base Transceiver Station (BTS), which is a part of BSS. Many BTSs are controlled by a Base Station Controller (BSC). BSC is connected to the Mobile Switching Center (MSC), which is a part of NSS. Figure shows the key functional elements in the GSM network architecture.

1. Mobile Station (MS):

A mobile station communicates across the air interface with a base station transceiver in the same cell in which the mobile subscriber unit is located. The MS communicates the information with the user and modifies it to the transmission protocols if the air-interface to communicate with the BSS. The user’s voice information is interfaced with the MS through a microphone and speaker for the speech, keypad, and display for short messaging, and the cable connection for other data terminals. The MS has two elements. The Mobile Equipment (ME) refers to the physical device, which comprises of transceiver, digital signal processors, and the antenna. The second element of the MS is the GSM is the Subscriber Identity Module (SIM). The SIM card is unique to the GSM system. It has a memory of 32 KB.

2. Base Station Subsystem (BSS):

A base station subsystem consists of a base station controller and one or more base transceiver station. Each Base Transceiver Station defines a single cell. A cell can have a radius of between 100m to 35km, depending on the environment. A Base Station Controller may be connected with a BTS. It may control multiple BTS units and hence multiple cells. There are two main architectural elements in the BSS – the Base Transceiver Subsystem

(BTS) and the Base Station Controller (BSC). The interface that connects a BTS to a BSC is called the A-bis interface. The interface between the BSC and the MSC is called the A interface, which is standardised within GSM.

3. Network and switching subsystem (NSS)

The NSS is responsible for the network operation. It provides the link between the cellular network and the Public switched telecommunicates Networks (PSTN or ISDN or Data Networks). The NSS controls handoffs between cells in different BSSs, authenticates user and validates their accounts, and includes functions for enabling worldwide roaming of mobile subscribers. In particular the switching subsystem consists of:

- Mobile switch center (MSC)
- Home location register (HLR)
- Visitor location Register (VLR)
- Authentications center (Auc)
- Equipment Identity Register (EIR)
- Interworking Functions (IWF)

The NSS has one hardware, Mobile switching center and four software database element: Home location register (HLR), Visitor location Register (VLR), Authentications center (Auc) and Equipment Identity Register (EIR). The MSC basically performs the switching function of the system by controlling calls to and from other telephone and data systems. It includes functions such as network interfacing and common channel signalling.

HLR:

The HLR is database software that handles the management of the mobile subscriber account. It stores the subscriber address, service type, current locations, forwarding address, authentication/ciphering keys, and billings information. In addition to the ISDN telephone number for the terminal, the SIM card is identified with an International Mobile Subscriber Identity (IMSI) number that is totally different from the ISDN telephone number. The HLR is the reference database that permanently stores data related to subscribers, including subscriber's service profile, location information, and activity status.

VLR:

The VLR is temporary database software similar to the HLR identifying the mobile subscribers visiting inside the coverage area of an MSC. The VLR assigns a Temporary mobile subscriber Identity (TMSI) that is used to avoid using IMSI on the air. The visitor location register maintains information about mobile subscriber that is currently physically in the range covered by the switching center. When a mobile subscriber roams from one LA (Local Area) to another, current location is automatically updated in the VLR. When a mobile station roams into a new MSC area, if the old and new LA's are under the control of two different VLRs, the VLR connected to the MSC will request data about the mobile stations from the HLR. The entry on the old VLR is deleted and an entry is created in the new VLR by copying the database from the HLR.

AuC:

The AuC database holds different algorithms that are used for authentication and encryptions of the mobile subscribers that verify the mobile user's identity and ensure the confidentiality of each call. The AuC holds the authentication and encryption keys for all the subscribers in both the home and visitor location register.

EIR:

The EIR is another database that keeps the information about the identity of mobile equipment such the International mobile Equipment Identity (IMEI) that reveals the details about the manufacturer, country of production, and device type. This information is used to prevent calls from being misused, to prevent unauthorised or defective MSs, to report stolen mobile phones or check if the mobile phone is operating according to the specification of its type.

White list:

This list contains the IMEI of the phones who are allowed to enter in the network.

Black list:

This list on the contrary contains the IMEI of the phones who are not allowed to enter in the network, for example because they are stolen.

Grey list:

This list contains the IMEI of the phones momentarily not allowed to enter in the network, for example because the software version is too old or because they are in repair.

IWF-

Interworking Function: It is a system in the PLMN that allows for non speech communication between the GSM and the other networks. The tasks of an IWF are particularly to adapt transmission parameters and protocol conversions. The physical manifestations of an IWF may be through a modem which is activated by the MSC dependent on the bearer service and the destination network. The OSS (Operational Support Systems) supports operation and maintenance of the system and allows engineers to monitor, diagnose, and troubleshoot every aspect of the GSM network.

Fig below shows GSM architecture. The network mainly consist of User Equipment (UE), Base transceiver station (BTS), Mobile switching center (MSC). The GSM contains most of the necessary capabilities to support packet transmission over GSM. The critical part in the GPRS network is the mobile to GSN (MS-SGSN) link which includes the MS-BTS, BTS-BSC, BSC-SGSN, and the SGSN-GGSN link the following Fig. shows block diagram of GSM architecture.

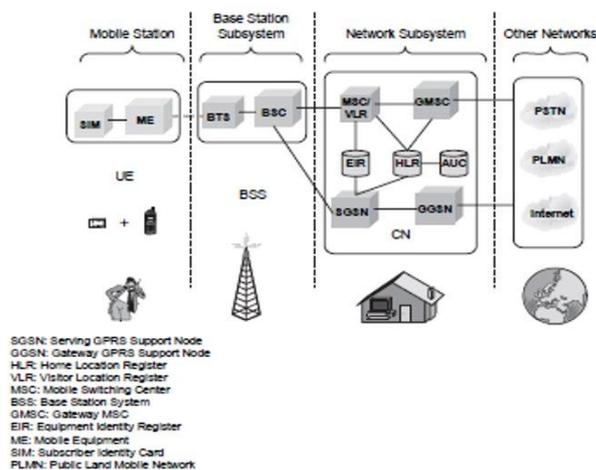


Figure architecture in GSM.

User Equipment (UE)—These are the users. Number of users are controlled by one BTS

1. The mobile stations (MS) communicate with the base station subsystem over the radio interface.
2. The BSS called as radio subsystem, provides and manages the radio transmission path between the mobile stations and the Mobile Switching Centre(MSC).It also manages radio interface between the mobile stations and other subsystems of GSM.
3. Each BSS comprises many Base Station Controllers(BSC) that connect the mobile station to the network and switching subsystem (NSS) through the mobile switching center
4. The NSS controls the switching functions of the GSM system.It allows the mobile switching center to communicate with networks like PSTN, ISDN, CSPDN, PSPDN and other data networks.
5. The operation support system (OSS) allows the operation and maintenance of the GSM system. It allows the system engineers to diagnose, troubleshoot and observe the parameters of the GSM systems. The OSS subsystem interacts with the other subsystems and is provided for the GSM operating company staff that provides service facilities for the network.

Base station(BSS)-- The following stations subsystem comprises of two parts:

1. Base Transceiver Station (BTS).
2. Base Station Controller(BSC).

The BSS consists many BSC that connect to a single MSC. Each BSC controls upto several hundred BTS.

Base Transceiver Station(BTS)-BTS

It has radio transceiver that define a cell and are capable of handling radio link protocols with MS.

Functions of BTS are

1. Handling radio link protocols
2. Providing FD communication to MS.
3. Interliving and de- interliving.

Base station controller(BSC) It manages radio resources for one or more BTS.It controls several hundred BTS all are connected to single MSC.

Functions of BSC are

- To control BTS.
- Radio resource management
- Handoff management and control
- Radio channel setup and frequency hopping

Network subsystem(NSS)

- 1.It handles the switching of GSM calls between external networks and indoor BSC
- 2.It includes three different data bases for mobility management as

A .HLR (Home Location Register)

B .VLR (Visitor Location Register)

C. AUC (Authentication center)

Mobile switching center (MSC)--

It connects fix networks like ISDN ,PSTN etc.

Following are the functions of MSC

1. Call setup, supervision and relieves

2. COLLECTION OF BILLING INFORMATION

3. Call handling / routing
4. Management of signalling protocol
5. Record of VLR and HLR

HLR (Home Location Register) - Call roaming and call routing capabilities of GSM are handled. It stores all the administrative information of subscriber registered in the networks. It maintains unique international mobile subscriber identity (IMSI).

VLR (Visitor Location Register) - It is a temporary data base. It stores the IMSI number and customer information for each roaming customer visiting specific MSC.

Authentication center - It is a protected database. It maintains authentication keys and algorithms. It contains a register called as Equipment Identity Register.

Operation subsystem (OSS) - It manages all mobile equipment in the system 1) management for charging and billing procedure 2) To maintain all hardware and network operations