



GSM ARCHITECTURE



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What is GSM ?

Global System for Mobile (GSM) is a second generation cellular standard developed to cater voice services and data delivery using digital modulation .

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History of GSM

- Developed by Group Spéciale Mobile (founded 1982) which was an initiative of CEPT (Conference of European Post and Telecommunication)
- Under ETSI, GSM is named as “ **Global System for Mobile communication** “ in 1989
- Full set of specifications phase-I became available in 1990
- Phase 2 of the GSM specifications occurs in 1995. Coverage is extended to rural areas

GSM SERVICES

- **Tele-services**
- **Bearer or Data Services**
- **Supplementary services**

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TELE SERVICES

Telecommunication services that enables voice communication via mobile phones

- Offered services
 - Mobile telephony
 - Emergency calling

BEARER SERVICES

- Include various data services for information transfer between GSM and other networks like PSTN, ISDN etc at rates from 300 to 9600 bps
- Short Message Service (SMS)
 - up to 160 character alphanumeric data transmission to/from the mobile terminal
- Voice mailbox

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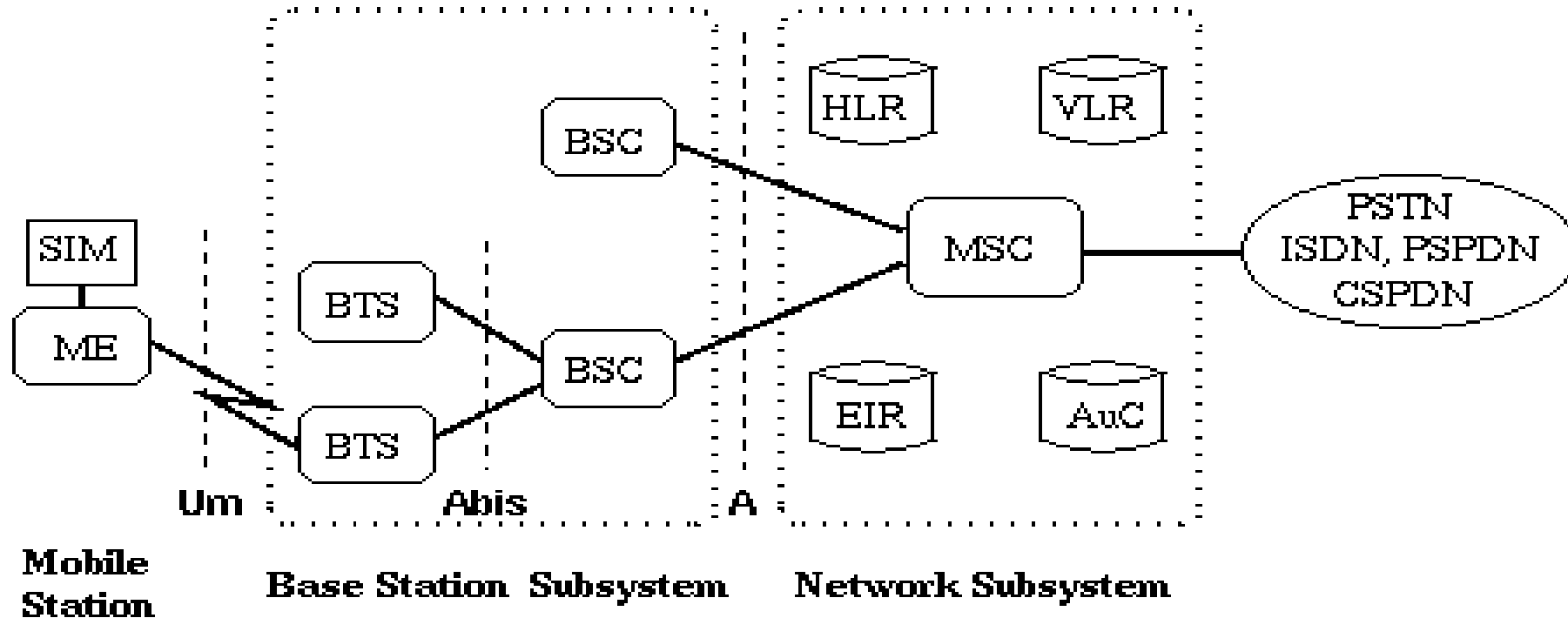
SUPPLEMENTARY SERVICES

Call related services :

- Call Waiting- Notification of an incoming call while on the handset
- Call Hold- Put a caller on hold to take another call
- Call Barring- All calls, outgoing calls, or incoming calls
- Call Forwarding- Calls can be sent to various numbers defined by the user
- Multi Party Call Conferencing - Link multiple calls together

GSM ARCHITECTURE

GSM ARCHITECTURE



SIM Subscriber Identity Module
ME Mobile Equipment
BTS Base Transceiver Station

BSC Base Station Controller
HLR Home Location Register
VLR Visitor Location Register

MSC Mobile services Switching Center
EIR Equipment Identity Register
AuC Authentication Center

GSM Architecture

- **Mobile Station (MS)**
 - Mobile Equipment (ME)
 - Subscriber Identity Module (SIM)
- **Base Station Subsystem (BSS)**
 - Base Transceiver Station (BTS)
 - Base Station Controller (BSC)
- **Network Switching Subsystem(NSS)**
 - Mobile Switching Center (MSC)
 - Home Location Register (HLR)
 - Visitor Location Register (VLR)
 - Authentication Center (AUC)
 - Equipment Identity Register (EIR)

MOBILE STATION (MS)

The Mobile Station is made up of two entities:

1. Mobile Equipment (ME)
2. Subscriber Identity Module (SIM)

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MOBILE EQUIPMENT (ME)

- Portable, vehicle mounted, hand held device
- Uniquely identified by an **IMEI** (International Mobile Equipment Identity)
- Voice and data transmission
- Monitoring power and signal quality of surrounding cells for optimum handover
- Power level : 0.8W – 20 W
- 160 character long SMS.

SUBSCRIBER IDENTITY MODULE (SIM)

- Smart card contains the International Mobile Subscriber Identity (**IMSI**)
- Allows user to send and receive calls and receive other subscribed services
- Protected by a password or PIN
- Can be moved from phone to phone – contains key information to activate the phone

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BASE STATION SUBSYSTEM (BSS)

Base Station Subsystem is composed of two parts that communicate across the standardized **Abis** interface allowing operation between components made by different suppliers

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

BASE TRANSCEIVER SYSTEM (BTS)

- Encodes, encrypts, multiplexes, modulates and feeds the RF signals to the antenna.
- Communicates with Mobile station and BSC
- Consists of Transceivers (TRX) units

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BASE STATION CONTROLLER (BSC)

- Manages Radio resources for BTS
- Assigns Frequency and time slots for all MS's in its area
- Handles call set up
- Handover for each MS
- It communicates with MSC and BTS

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NETWORK SWITCHING SUBSYSTEM (NSS)

- Manages Radio resources for BTS
- Assigns Frequency and time slots for all MS's in its area
- Handles call set up
- Handover for each MS
- It communicates with MSC and BTS

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BASE STATION CONTROLLER (BSC)

- The system contains the following functional units

Mobile Switching Center (MSC)

Home Location Register (HLR)

Visitor Location Register (VLR)

Authentication Center (AUC)

Equipment Identity Register (EIR)

MOBILE SWITCHING CENTER (MSC)

- Heart of the network
- Manages communication between GSM and other networks
- Billing information and collection
- Mobility management
 - Registration
 - Location Updating
 - Inter BSS and inter MSC call handoff

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HOME LOCATION REGISTER (HLR)

- Stores information about each subscriber that belongs to its MSC in permanent and temporary fashion.
- As soon as mobile subscriber leaves its current local area, the information in the HLR is updated.
- database contains IMSI, MSISDN, prepaid/ postpaid, roaming restrictions, supplementary services.

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VISITOR LOCATION REGISTER (VLR)

- Temporary database which updates whenever new MS enters its area, by HLR database
- Assigns a TMSI to each MS entering the VLR area which keeps on changing.
- Controls those mobiles roaming in its area
- Database contains IMSI, MSISDN, Location Area, authentication key

AUTHENTICATION CENTER (AUC)

- Contains the algorithms for authentication as well as the keys for encryption.
- Protects network operators from fraud.
- Situated in special protected part of the HLR.

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EQUIPMENT IDENTITY REGISTER (EIR)

- Stores all devices identifications registered for this network.
- Database that is used to track handsets using the IMEI (International Mobile Equipment Identity)
- Prevents calls from stolen, unauthorised or defective mobile devices

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OPERATION AND MAINTENANCE CENTER (OMC)

- The centralized operation of the various units in the system and functions needed to maintain the subsystems.
- Dynamic monitoring and controlling of the network.
- Functions :
 - configuration management
 - fault report and alarm handling
 - performance supervision/management
 - storage of system software and data

SECURITY

- On air interface, GSM uses encryption and TMSI instead of IMSI.
- SIM is provided 4-8 digit PIN to validate the ownership of SIM
- 3 algorithms are specified :
 - A3 algorithm for authentication
 - A5 algorithm for encryption
 - A8 algorithm for key generation

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APPLICATIONS

- Mobile telephony
- GSM-R
- Telemetry System
 - Fleet management
 - Automatic meter reading
 - Toll Collection
 - Remote control and fault reporting of DG sets
- Value Added Services



Thank You