

# *GSM Architecture*



# Network Structure

- **Cell**

A cell is the basic unit of a cellular system and is defined as the radio coverage given by one BTS.



# Network Structure

## **LOCATION AREA**

**A LA is defined as a group of cells. Within the network, a subscriber's location is known by the LA which they are in.**

**The identity of the LA in which an MS is currently located is stored in the VLR. (LAI)**



# Network Structure

- **MSC Service Area**

An MSC Service Area is made up of LAs and represents the geographical part of the network controlled by one MSC.



# Network Structure

- **PLMN SERVICE AREA**

A PLMN service area is the entire set of cells served by one network operator and is defined as the area in which an operator offers radio coverage and access to its network.

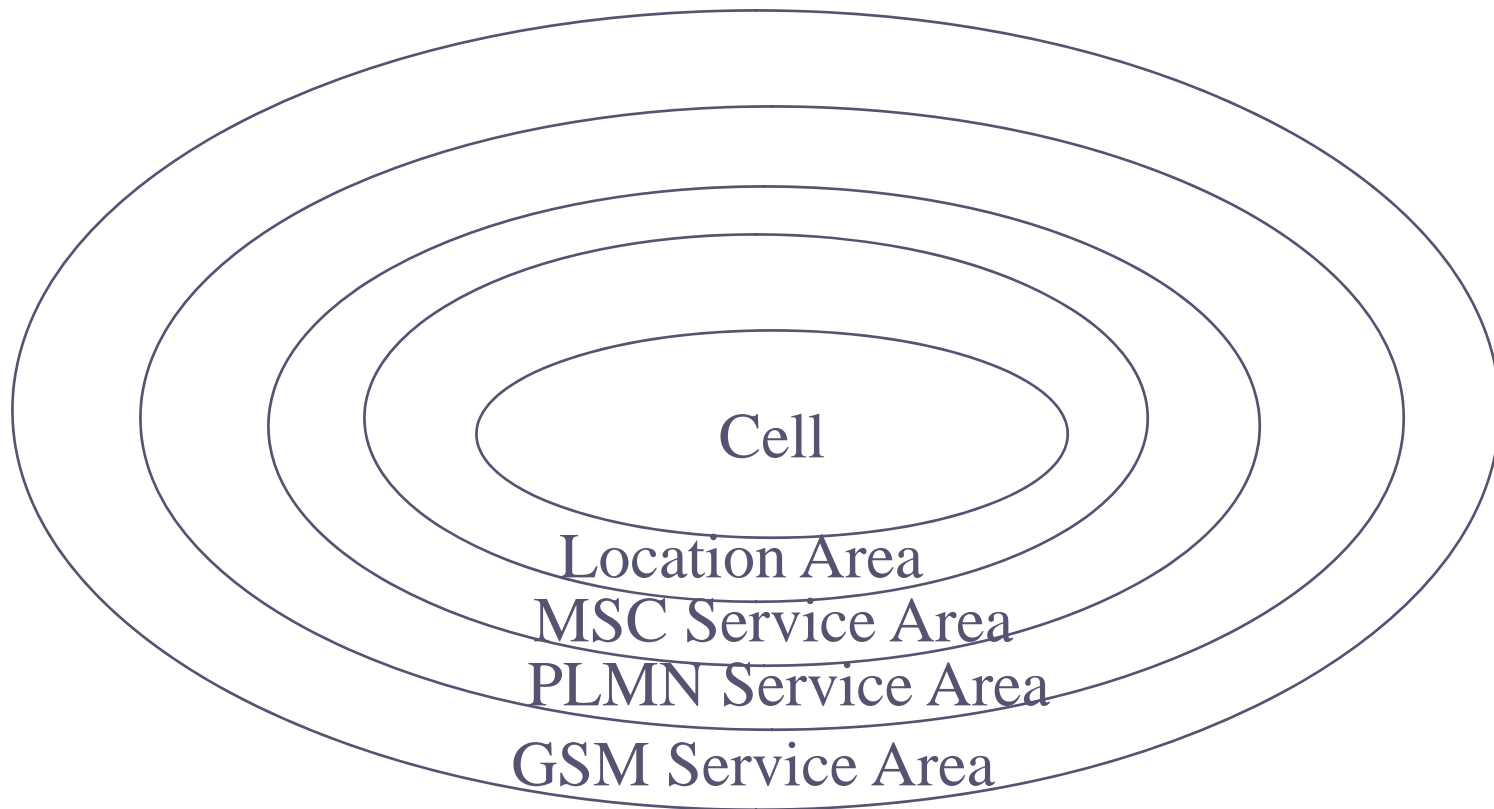


# Network Structure

- **GSM SERVICE AREA**

The GSM service area is the entire geographical area in which a subscriber can gain access to a GSM network.

# Relation between areas in GSM





# **Mobile Station**

**GSM MSs consist of:**

- **Mobile Equipment**
- **Subscriber Identity Module**





# Functions of Mobile Station

- Voice and data transmission & receipt
- Frequency and time synchronization
- Monitoring of power and signal quality of the surrounding cells
- Provision of location updates even during inactive state



# Mobile Station

- Can receive, store, send SMS up to 160 characters.
- MS identified by unique IMEI shown on pressing \*#06#.
- Power levels of 20W, 8W, 5W, 2W and .8W



# SIM

SIM has microprocessor and memory.

Fixed data stored for the subscription:

- IMSI,
- Authentication Key,  $K_i$
- Security Algorithms:  $k_c, A_3, A_8$
- PIN & PUK




# Network Identities

- IMEI
- MSISDN
- IMSI
- TMSI
- MSRN

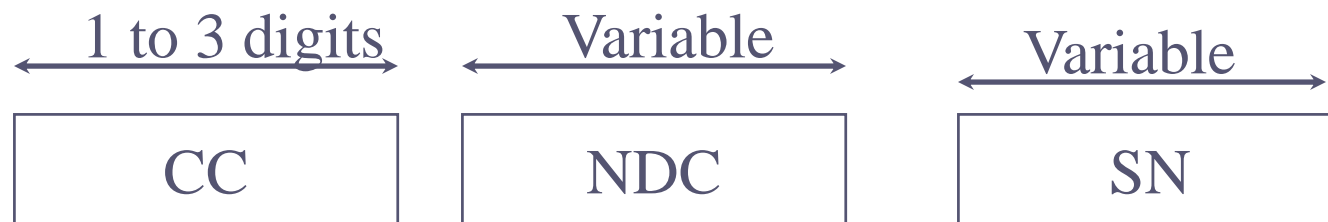


# IMEI

- **International Mobile Equipment Identity**
  - The IMEI is an unique code allocated to each mobile equipment. It is checked in the EIR.
  - IMEI check List
    - White List
    - Grey List
    - Black List
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# MSISDN

- **Mobile Station ISDN Number**
- The MSISDN is registered in the telephone directory and used by the calling party for dialing.
- MSISDN shall not exceed 15 digits.
- NDC--National Destination Code
- SN--Subscriber Number





# IMSI

- **International mobile subscriber Identity**
- The IMSI is an unique identity which is used internationally and used within the network to identify the mobile subscribers.
- The IMSI is stored in the subscriber identity module (SIM), the HLR, VLR database.



## Temporary Mobile subscriber Identity

- TMSI is a temporary IMSI no. made known to an MS at registration.
- The VLR assigns a TMSI to each mobile subscribers entering the VLR area.
- Assigned only after successful authentication.



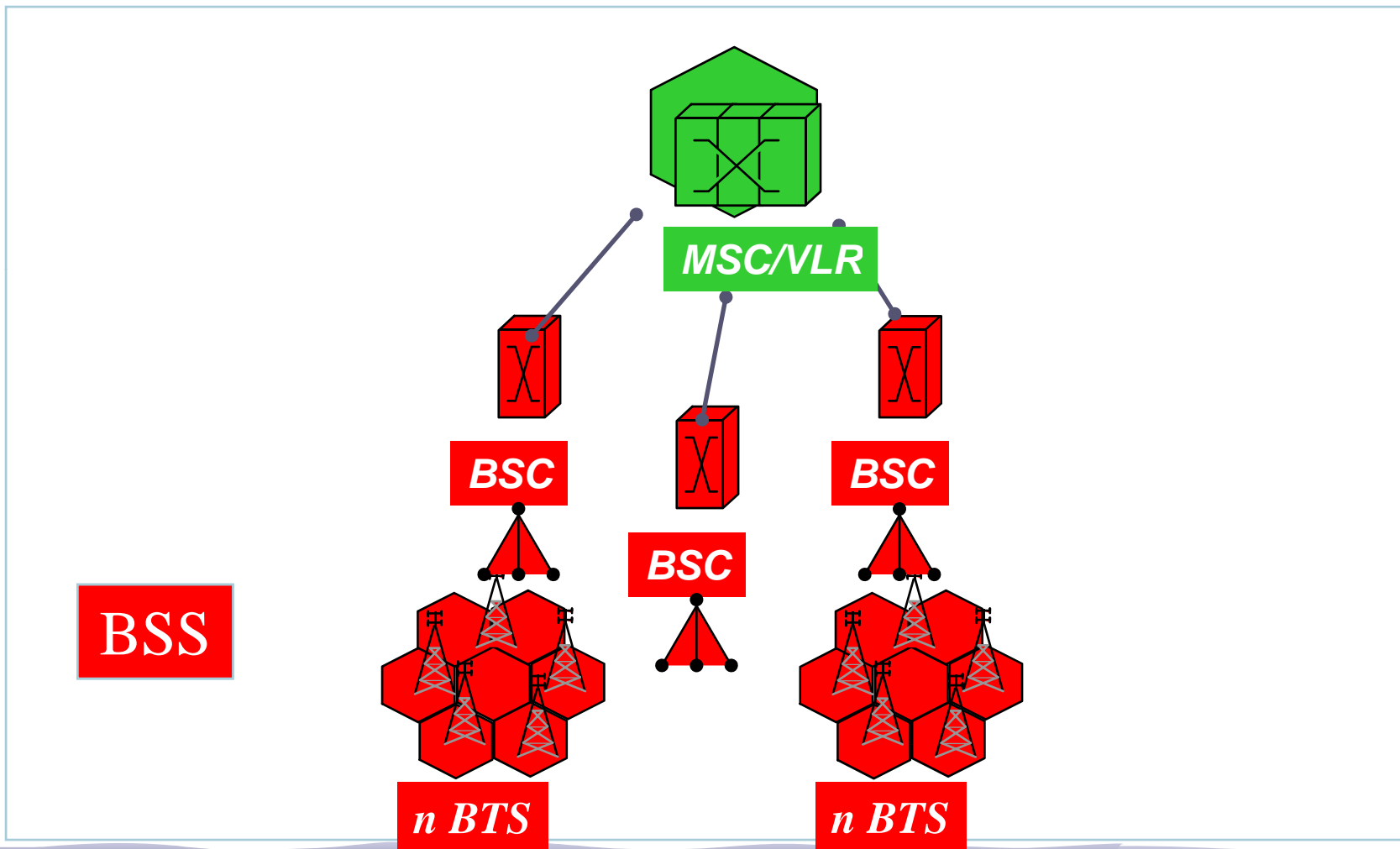


# MSRN

## Mobile Station Roaming Number

- The MSRN is used in the GMSC to set up a connection to the visited MSC/VLR.
- MSRN--is a temporary identity which is assigned during the establishment of a call to a roaming subs.

# BASE STATION SYSTEM (BSS)





## **FUNCTIONS OF BTS** (Base Transceiver Station)

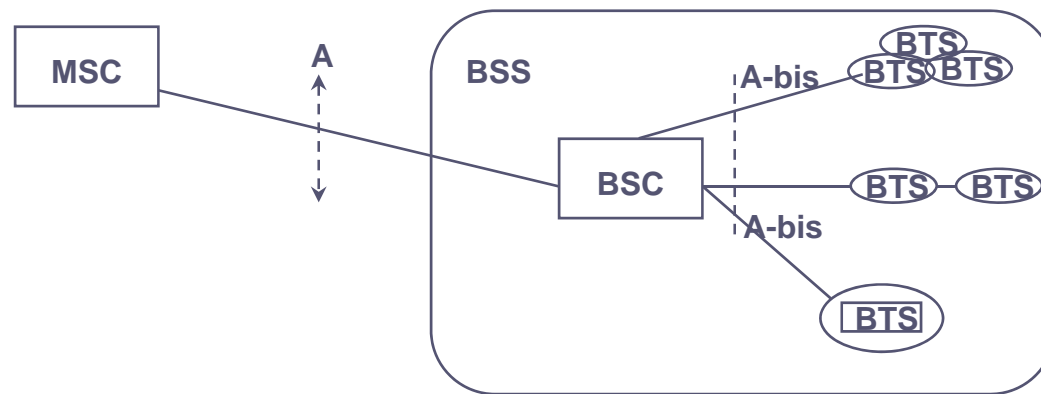
- Radio resources
- Signal Processing
- Signaling link management
- Synchronization
- Local maintenance handling
- Functional supervision and Testing



# **FUNCTIONS OF BSC**

- **Radio Resource management**
- **Internal BSC O&M**
- **Handling of MS connections**

# MSC-BSS Configurations

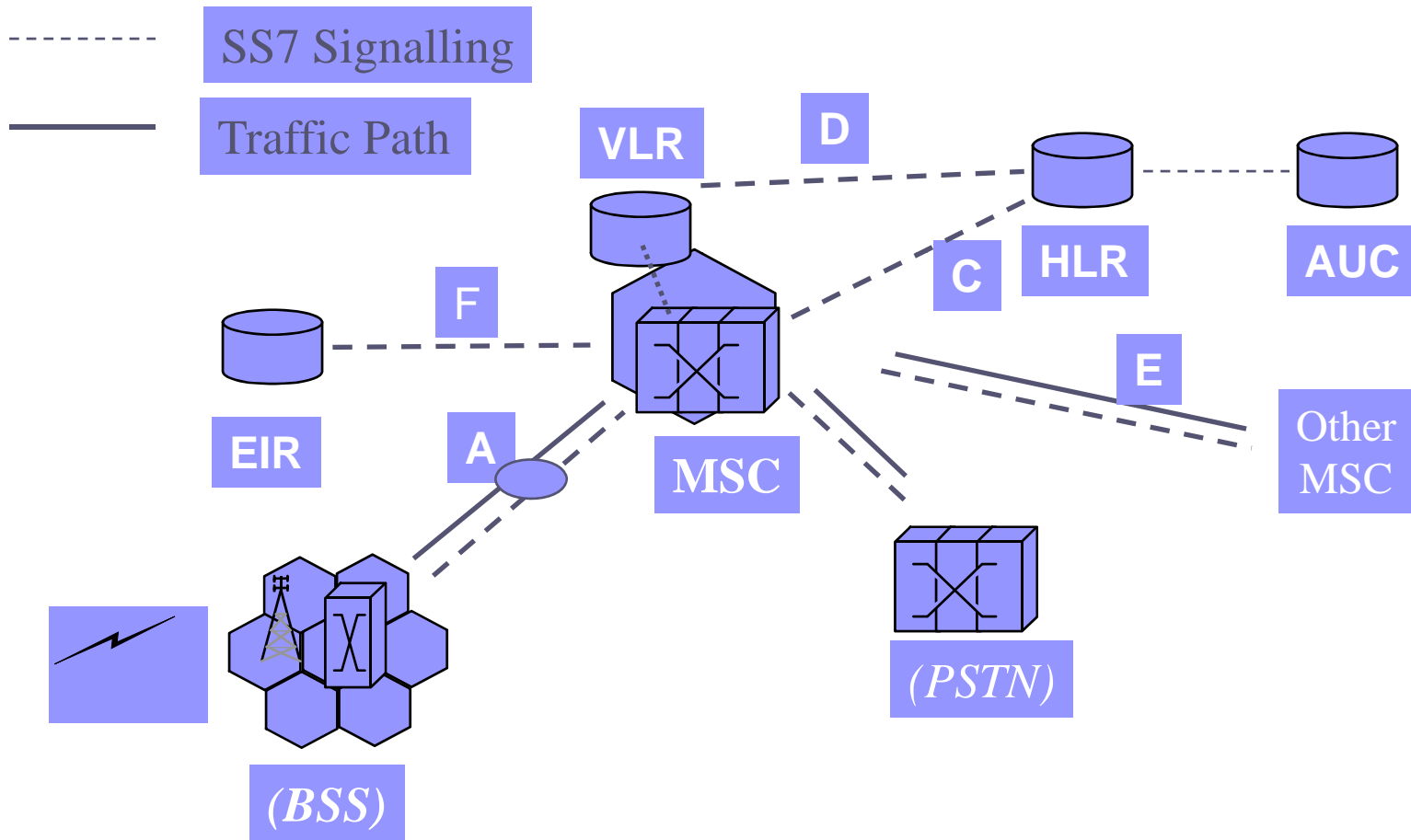




# Transcoder


Is a device that takes 13 KBPS speech data and multiplexes four of them into standard 64 Kbps data.

# Switching System (SS)





# MSC Functions

- **Switching and call routing**
  - **Charging**
  - **Service provisioning**
  - **Communication with HLR**
  - **Communication with VLR**
  - **Communication with other MSCs**
  - **Control of connected BSCs**
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# MSC Functions

- Echo canceller operation control
- Signaling interface to databases like HLR, VLR.
- Gateway to SMS between SMS centers and subscribers
- Handle interworking function while working as GMSC



## **VISITOR LOCATION REGISTER (VLR)**

- It contains data of all mobiles roaming in its area.
- One VLR may be incharge of one or more LA.
- VLR is updated by HLR on entry of MS its area.
- VLR assigns TMSI which keeps on changing.




## Data in VLR

- IMSI & TMSI
- MSISDN
- MSRN.
- Location Area
- Supplementary service parameters
- MS category
- Authentication Key



## Home Location Register(HLR)

- Reference store for subscriber's parameters, numbers, authentication & Encryption values.
  - Current subscriber status and associated VLR.
  - Both VLR and HLR can be implemented in the same equipment in an MSC.
  - one PLMN may contain one or several HLR.
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# Home Location Register(HLR)

- **Permanent data in HLR**
  - *Data stored is changed only by commands.*
  - IMSI , MS-ISDN number.
  - Category of MS ( whether pay phone or not )
  - Roaming restriction ( allowed or not ).
  - Supplementary services like call forwarding
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# Home Location Register(HLR)

- **Temporary data in HLR**
  - *The data changes from call to call & is dynamic*
  - MSRN
  - RAND /SRES and Kc
  - VLR address , MSC address.
  - Messages waiting data used for SMS
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## EQUIPMENT IDENTITY REGISTER ( EIR )

- This data base stores IMEI for all registered mobile equipments and is unique to every ME.
- Only one EIR per PLMN.
- ***White list*** : IMEI , assigned to valid ME.
- ***Black list*** : IMEI reported stolen
- ***Gray list*** : IMEI having problems like faulty software, wrong make of equipment etc.



# **AUthentication Center (AUC)**

**To authenticate the subs. attempting to use a network.**

**AUC is connected to HLR which provides it with authentication parameters and ciphering keys used to ensure network security.**





# **AUC Functions**

**To perform subscriber authentication and to establish ciphering procedures on the radio link between the network and MS.**



# AUC Functions

Information provided is called a  
**TRIPLET** consists of:

1. RAND(non predictable random number)
  2. SRES(Signed response)
  3. KC(ciphering key)
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# **Operations and Maintenance Centre**

## **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 Of OMC

- O&M data function
  - Configuration management
  - Fault report and alarm handling
  - Performance supervision/management
  - Storage of system software and data
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