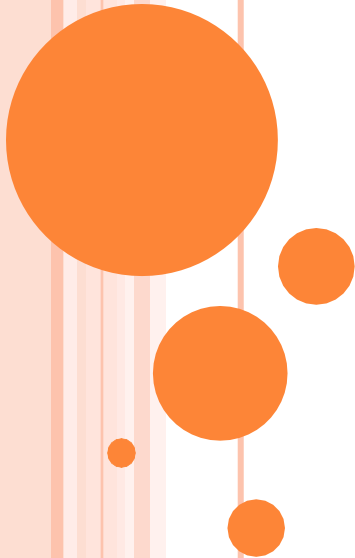




GSM ARCHITECTURE

CONTENTS

- **GSM-introduction**
- **GSM Services**
- **Architecture**
- **Security in GSM**
- **Characteristics of GSM standard**
- **Advantages of GSM**
- **Future of GSM**



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 .



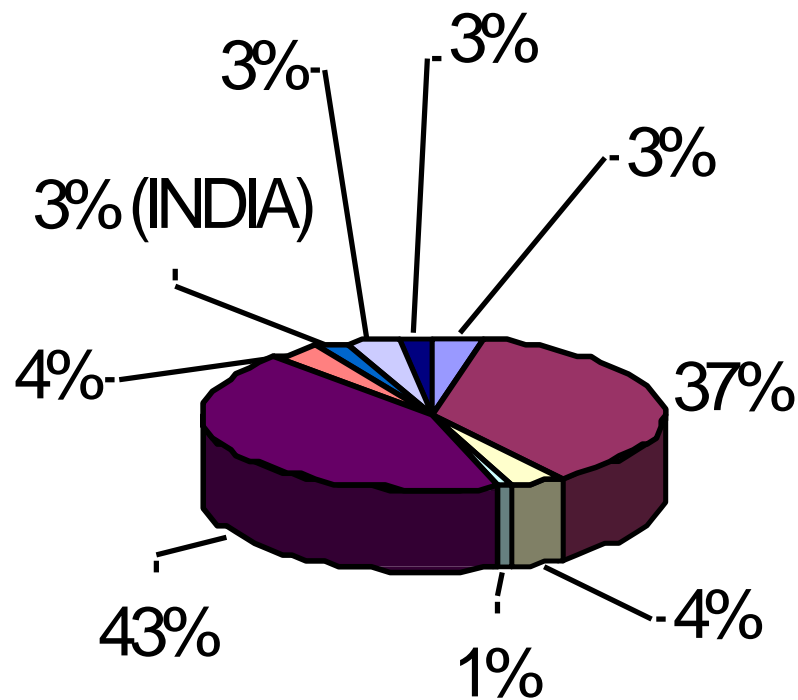
GSM: HISTORY

- 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 “ **G**lobal **S**ystem for **M**obile 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 IN WORLD

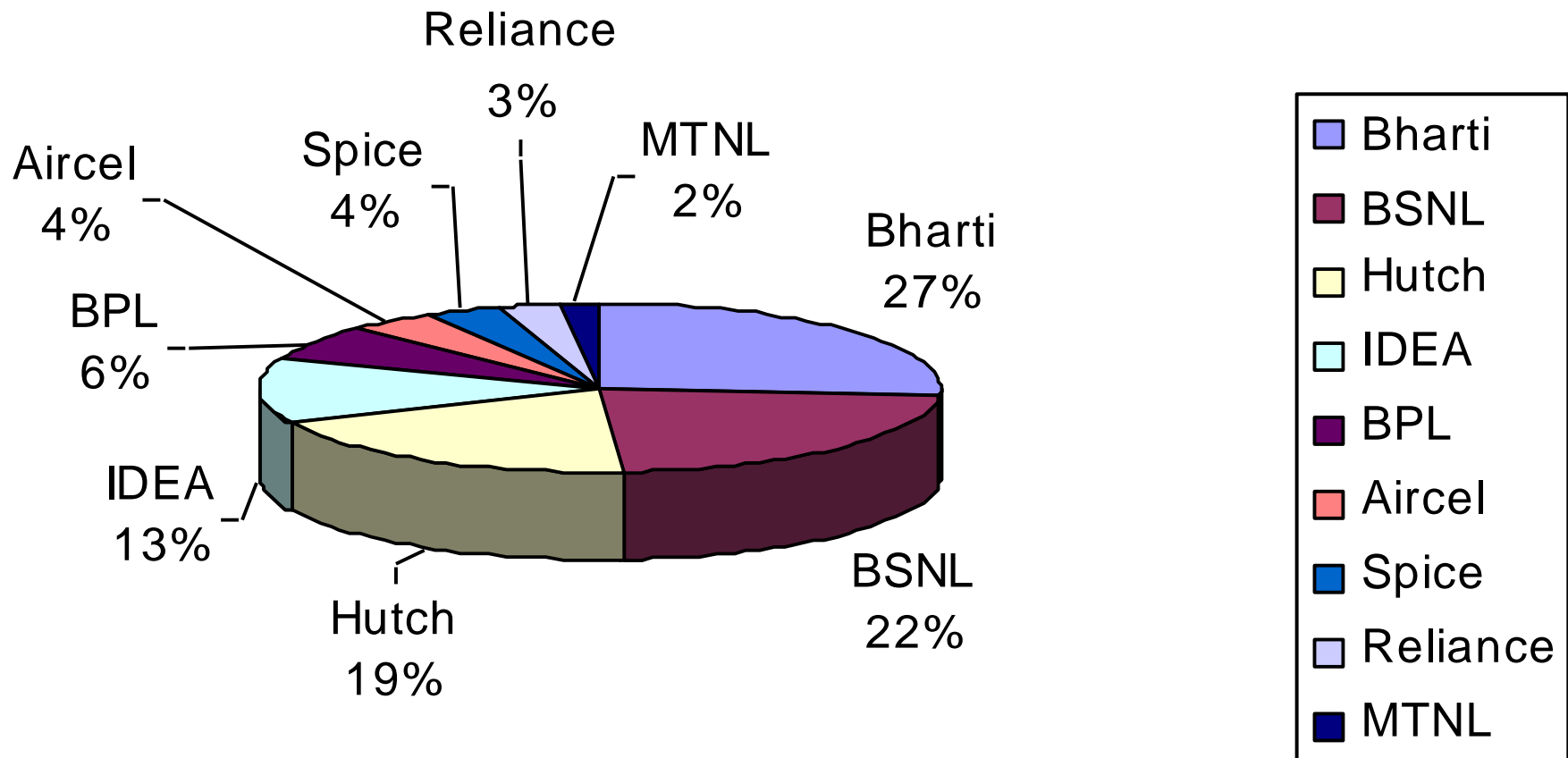
Figures: March, 2005



- Arab World
- Asia Pacific
- Africa
- East Central Asia
- Europ
- e
- Russi
- a India
- North America

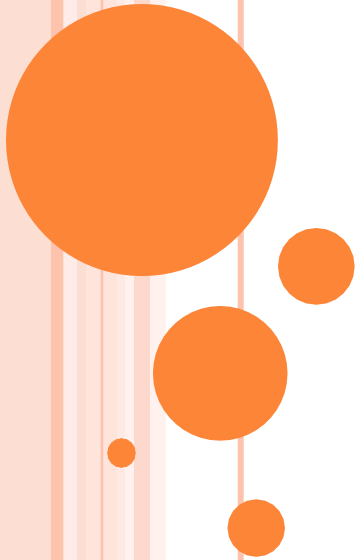
GSM IN INDIA

Figures: March 2005



GSM SERVICES

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



TELE SERVICES

- Telecommunication services that enable 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



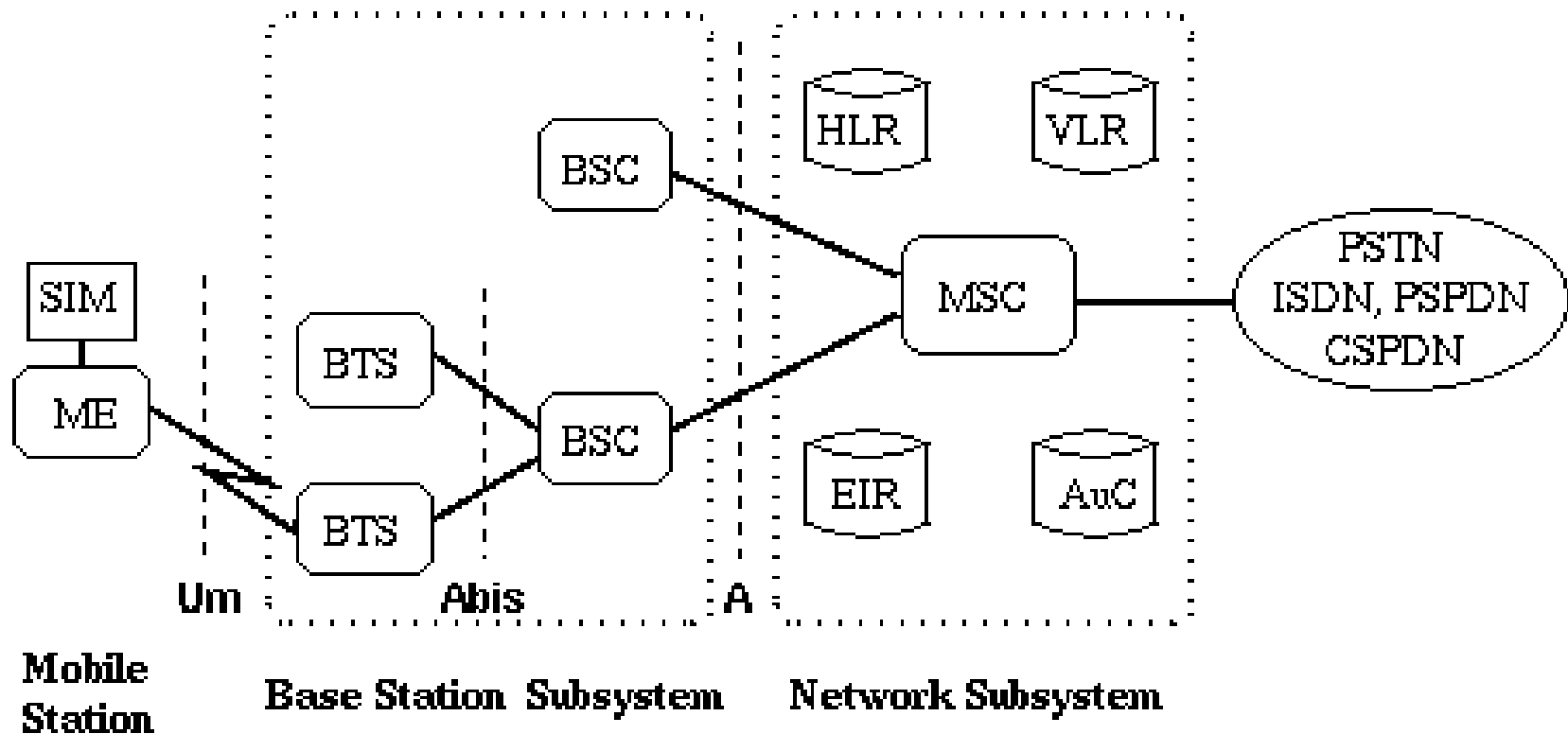
SUPPLEMENTARY SERVICES

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 SYSTEM 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 SYSTEM ARCHITECTURE-I

- **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)



SYSTEM ARCHITECTURE

MOBILE STATION (MS)

The Mobile Station is made up of two entities:

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



MOBILE EQUIPMENT

- 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



SYSTEM ARCHITECTURE

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 STATION (BTS):

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



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



SYSTEM ARCHITECTURE NETWORK SWITCHING SUBSYSTEM(NSS)

- ❑ 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



HOME LOCATION REGISTERS (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.



VISITOR LOCATION REGISTERS (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.



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



OPERATION 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 :
 - configuration management
 - fault report and alarm handling
 - performance supervision/management
 - storage of system software and data



SECURITY IN GSM

- 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



CHARACTERISTICS OF GSM STANDARD

- Fully digital system using 900,1800 MHz frequency band.
- User/terminal authentication for fraud control.
- Full international roaming capability.
- Low speed data services (upto 9.6 Kb/s).
- Compatibility with ISDN.
- Support of Short Message Service (SMS).



ADVANTAGES OF GSM OVER ANALOG SYSTEM

- Reduced RF transmission power and longer battery life.
- International roaming capability.
- Better security against fraud (through terminal validation and user authentication).
- Encryption capability for information security and privacy.



GSM 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



FUTURE OF GSM

- 2nd Generation
 - GSM -9.6 Kbps (data rate)
- 2.5 Generation (Future of GSM)
 - HSCSD (High Speed ckt Switched data)
 - Data rate : 76.8 Kbps (9.6 x 8 kbps)
 - GPRS (General Packet Radio service)
 - Data rate: 14.4 - 115.2 Kbps
 - EDGE (Enhanced data rate for GSM Evolution)
 - Data rate: 547.2 Kbps (max)
- 3 Generation
 - WCDMA(Wide band CDMA)
 - Data rate : 0.348 – 2.0 Mbps





ANY QUERY ?

