

Minufiya University
Faculty of Electronic Eng.
Dep. of Electronics and
Electrical Comm. Eng
**Introduction to
GSM**



By
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Introduction

Principles of telecommunications

Mobility
Flexibility
Convenience

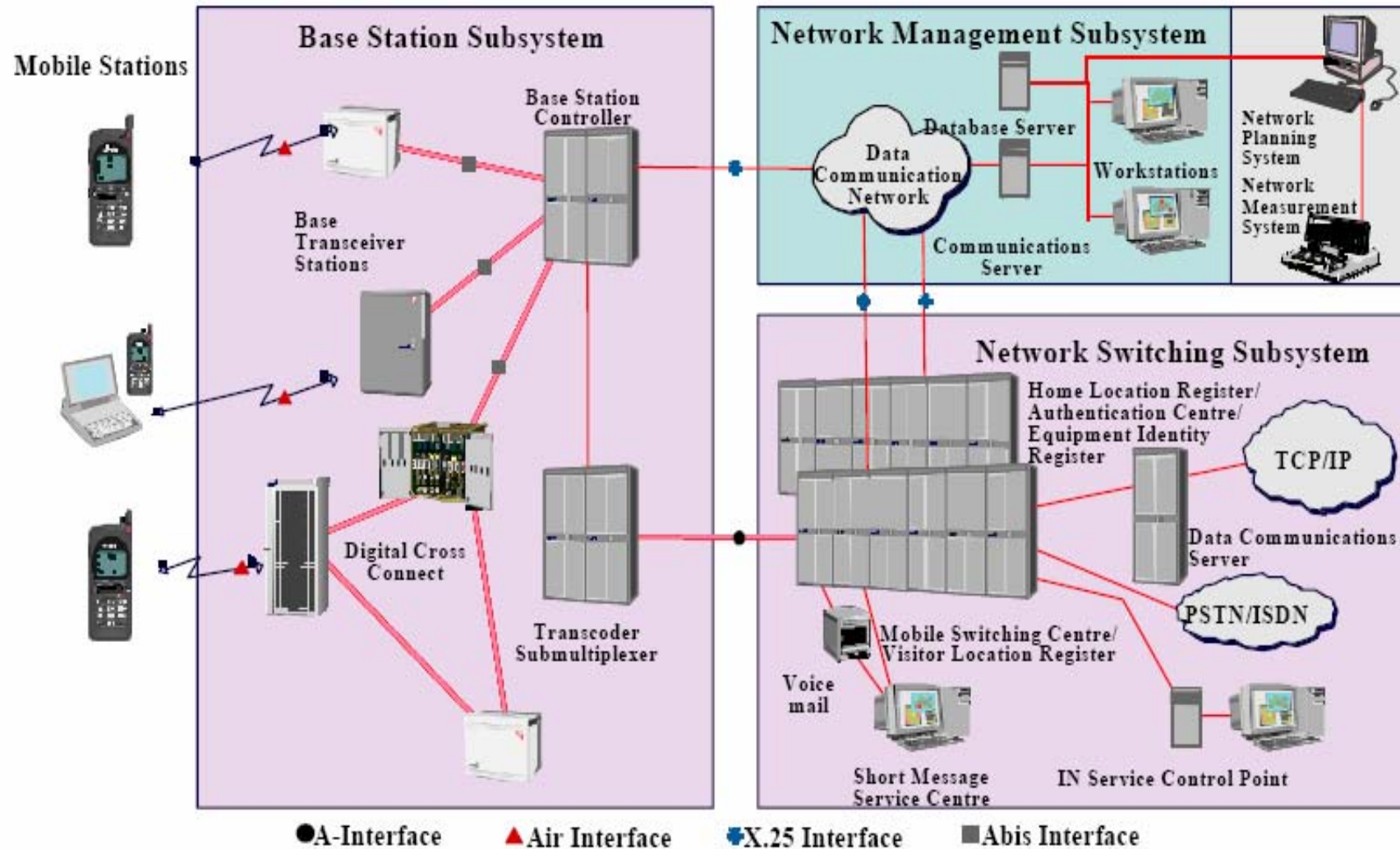
- **Where** is the subscriber
- **Who** is the subscriber
- **What** does the subscriber want



Information about the subscriber

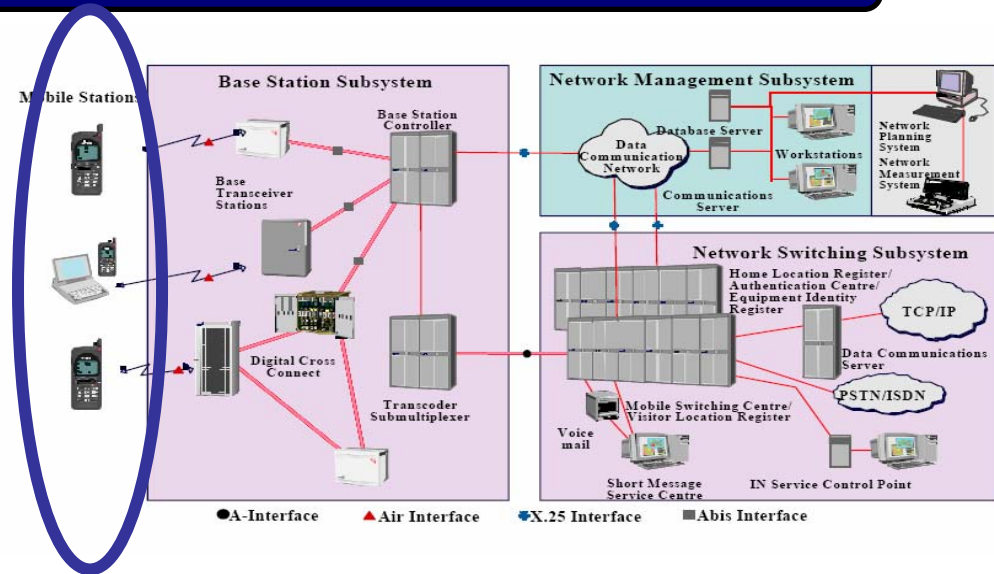


GSM Architecture



GSM Architecture

MS



MS=ME+SIM

ME Provides IMEI which avoids the ME to be stolen.

SIM Provides IMSI which specifies user capability.

GSM Architecture

BSS

NSS



TC



BSC

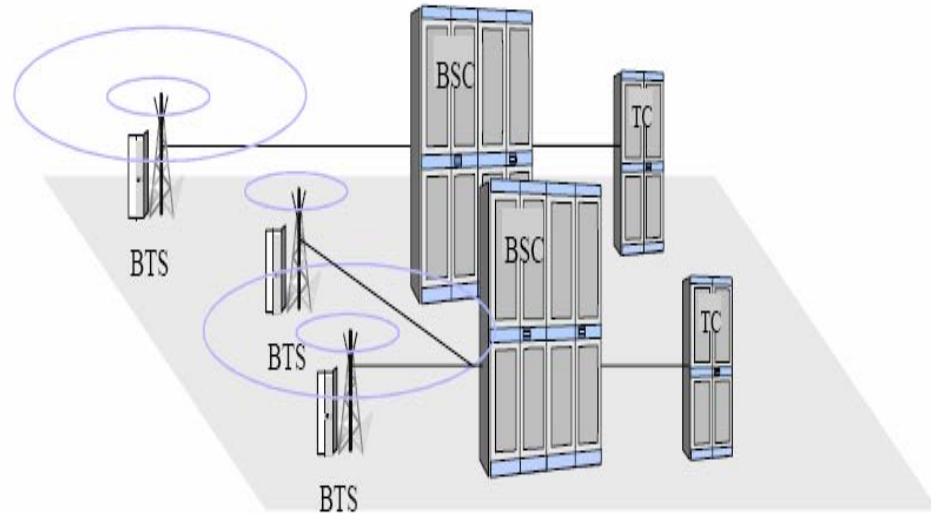
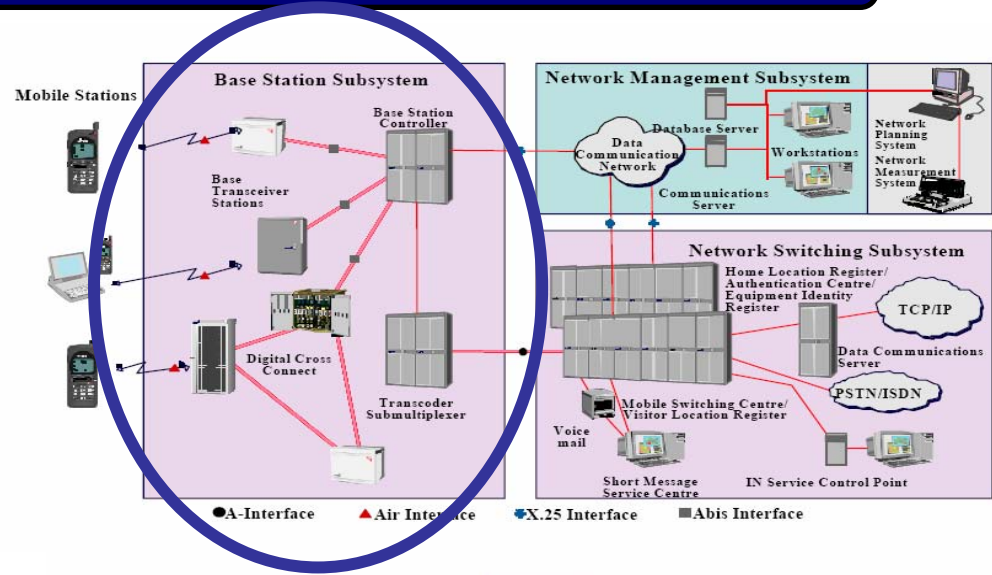
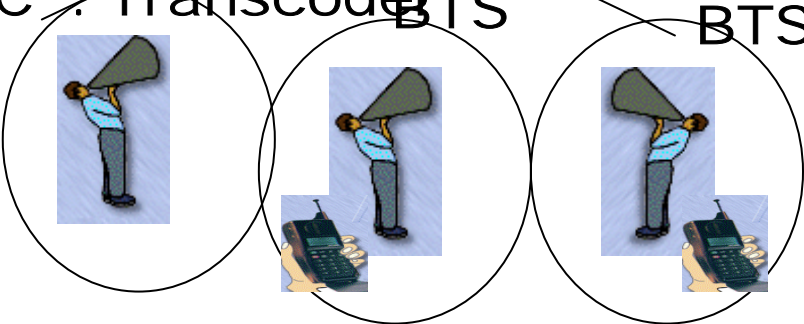
BTS: Base Transceiver Station

BSC: Base Station Controller

TC: Transcoder

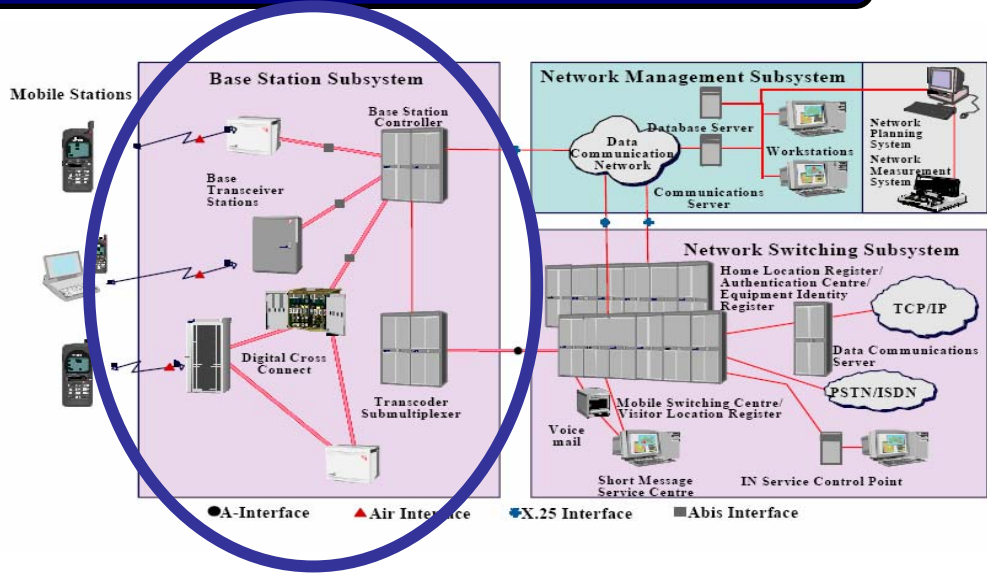
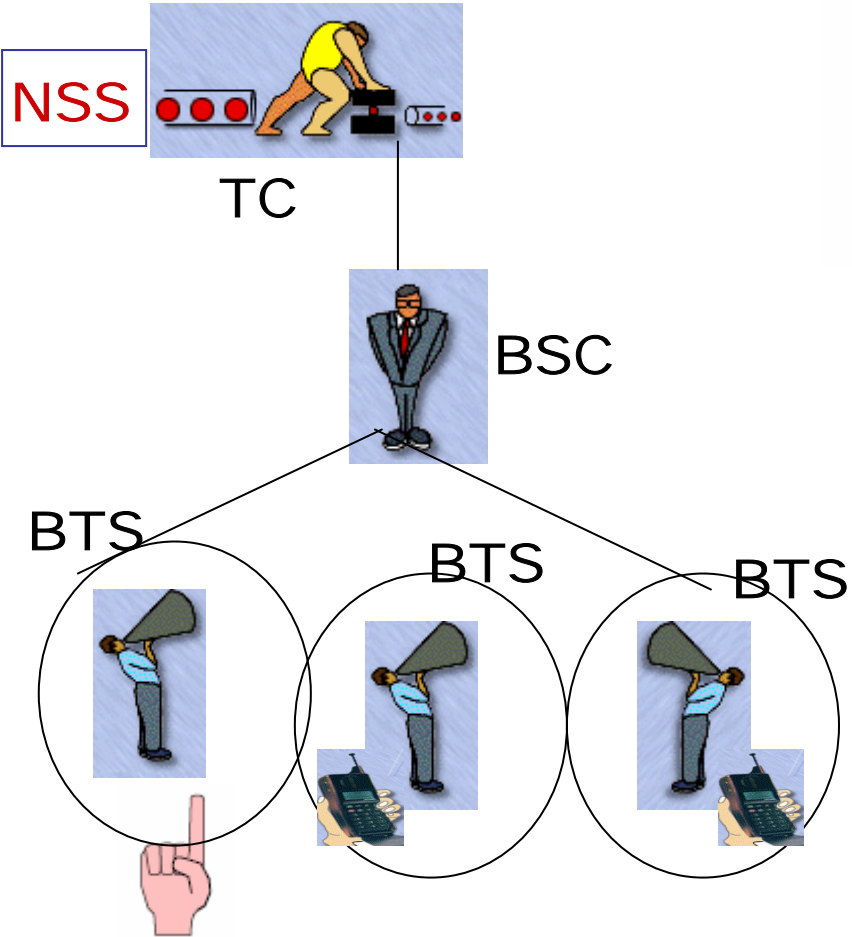
BTS

BTS



GSM Architecture

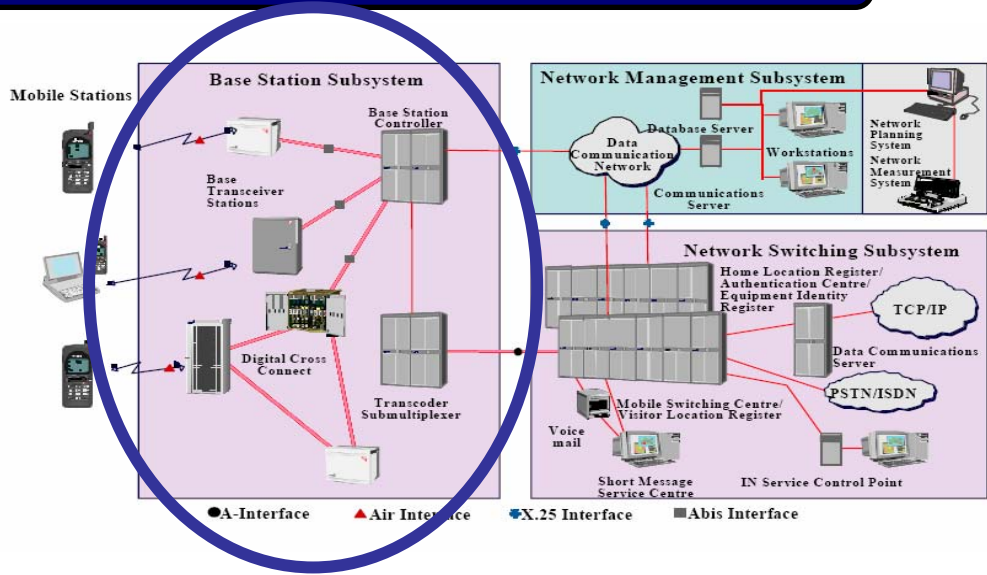
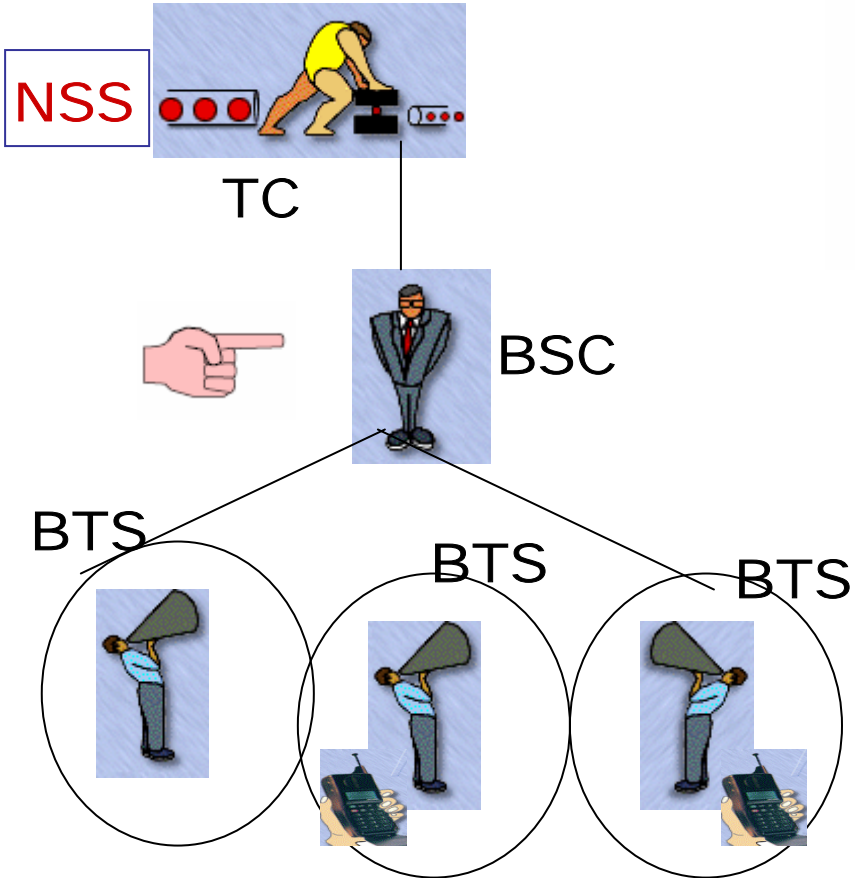
BSS



- *Provides the Radio Link to the mobile station (MS), to enable the user of the MS to initiate or receive and to maintain a telephone call.
- *Each BTS defines the area of coverage.
- *Ciphering.
- *Interfaces.

GSM Architecture

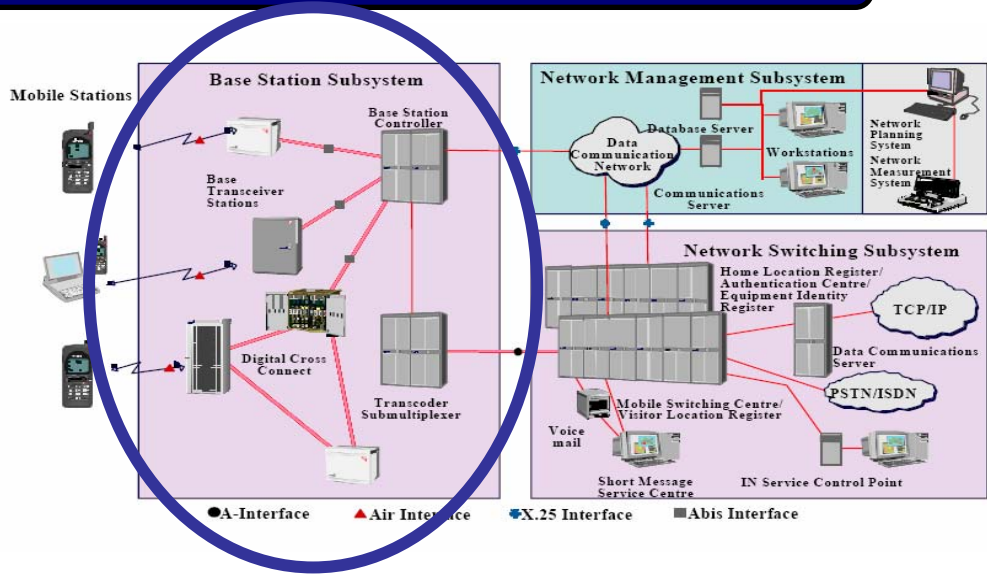
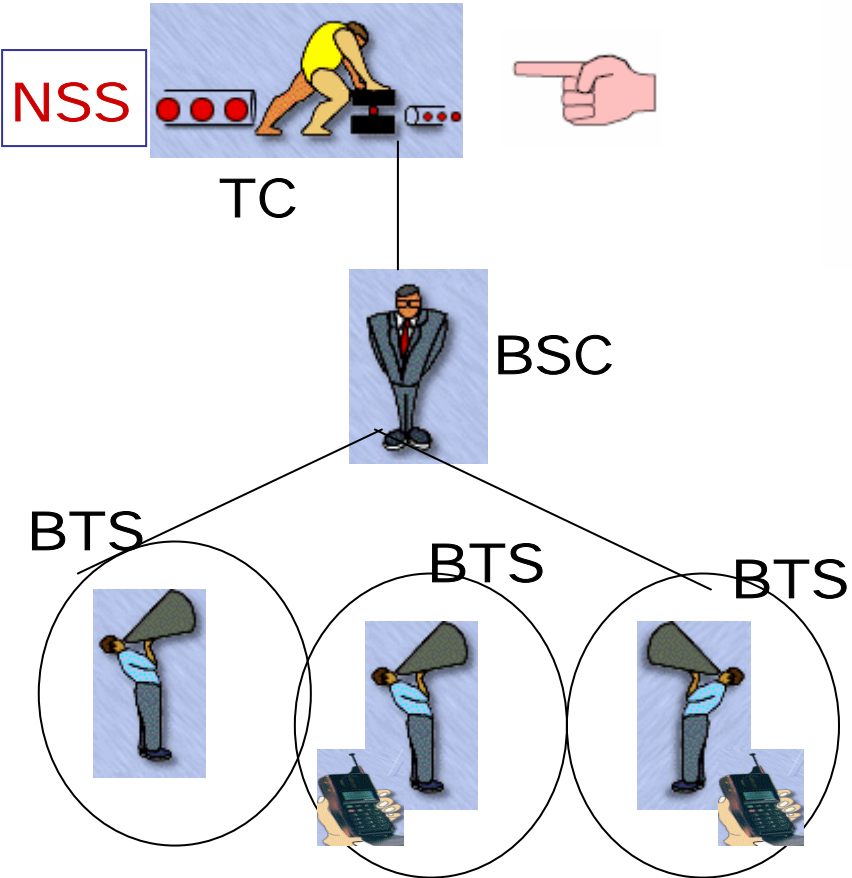
BSS



- *Controls One or more BTS.
- *controls TC.
- *Connection between MS & NSS
- *Controls Handover perform by its BTS without involving NSS.
- *Interfaces.

GSM Architecture

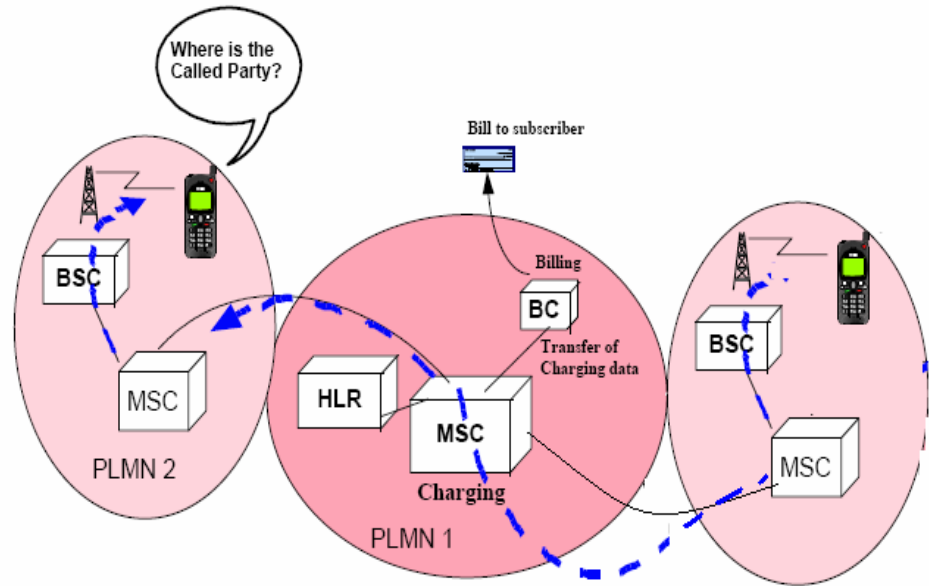
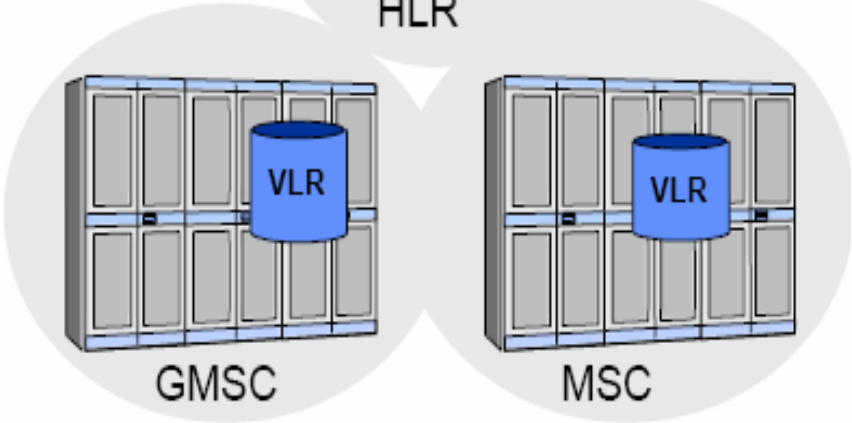
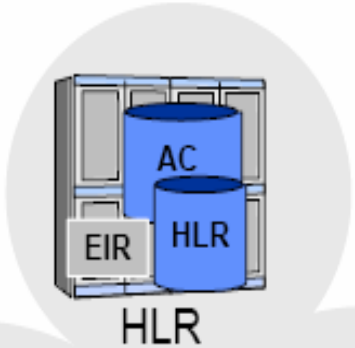
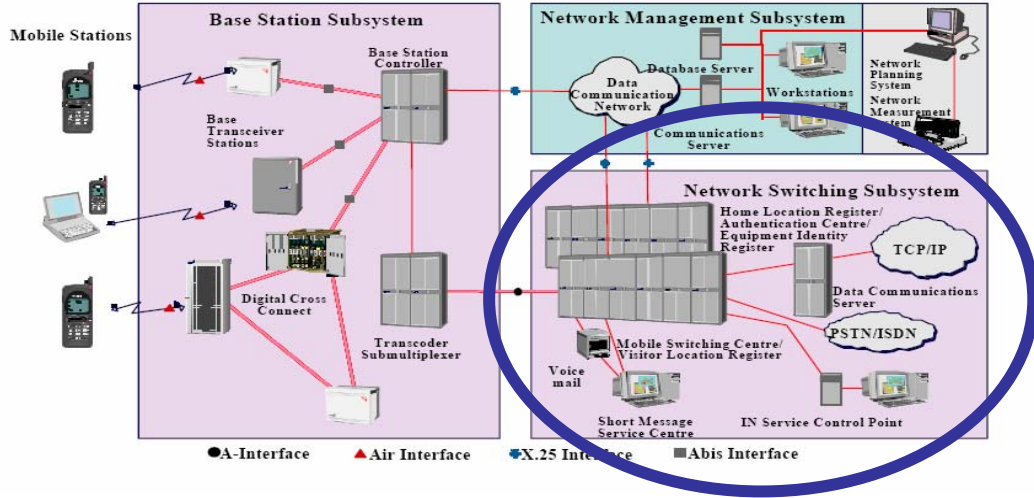
BSS



■ The Transcoder is required to convert the speech or data output from the NSS (64 K bit/s PCM), into the form specified by GSM specifications (13 K bit/s FR, 5.6 K bit/sec HR).

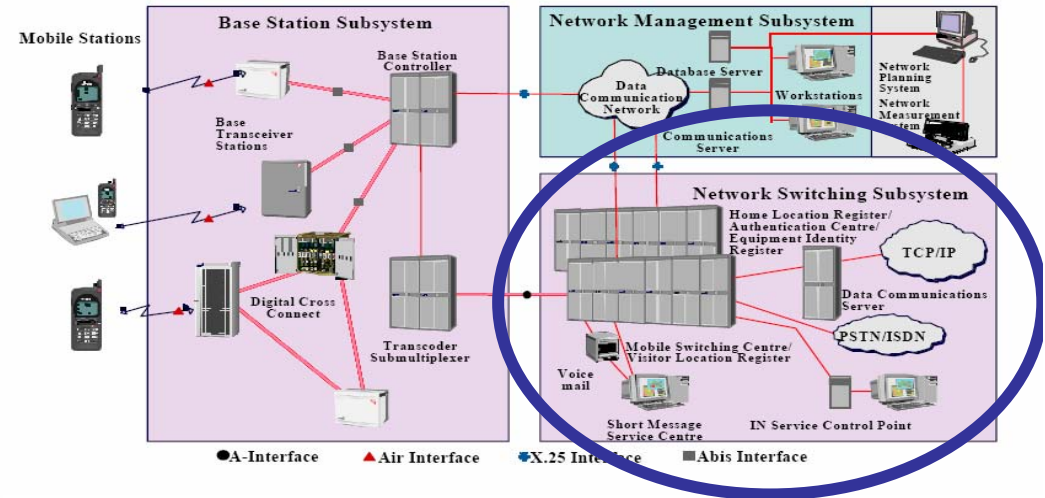
GSM Architecture

NSS

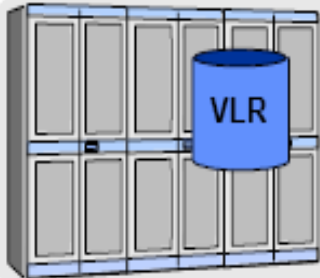


GSM Architecture

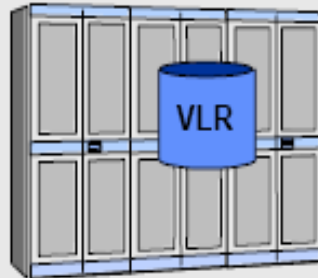
NSS



HLR



GMSC



MSC

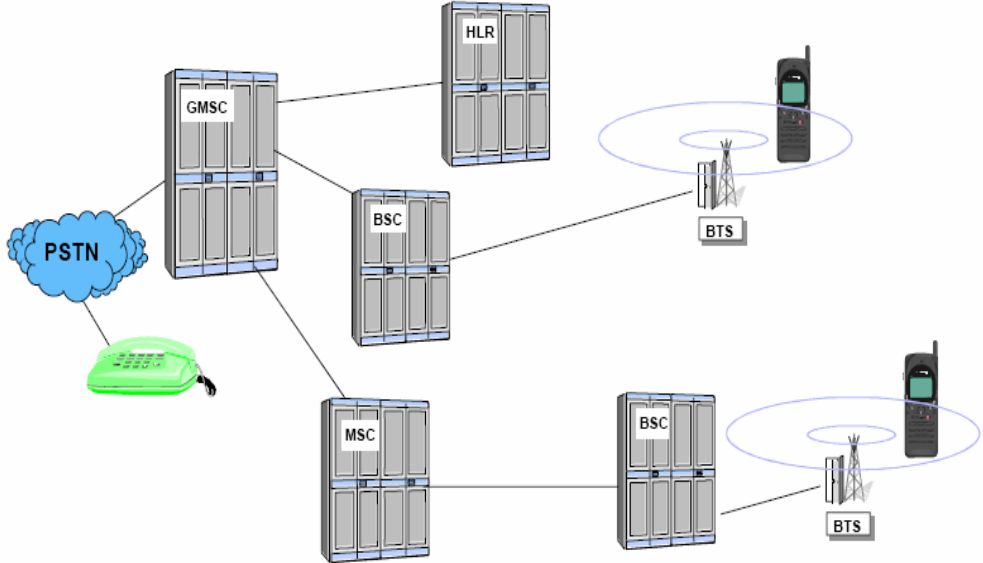
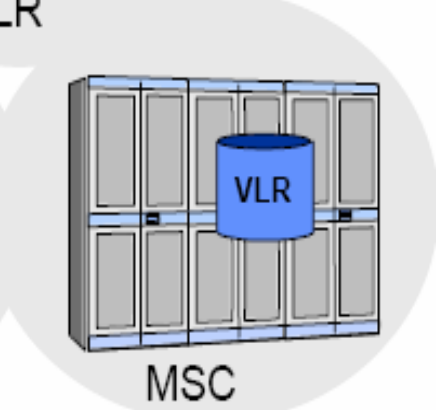
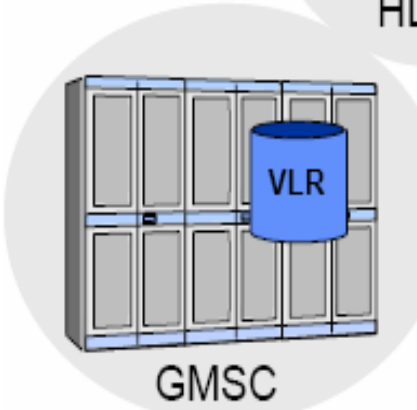
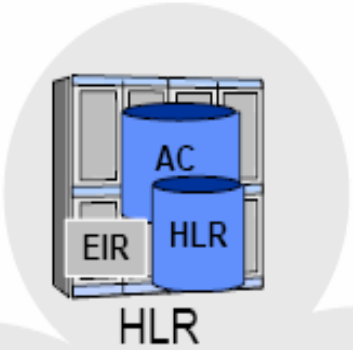
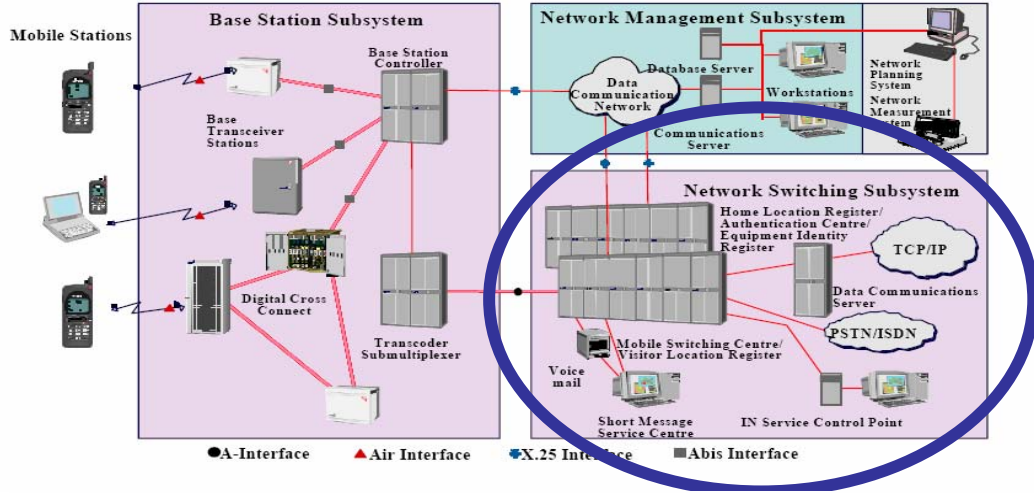


VLR (Visitor Location Register)

- *Temporary inf.
- *Subscriber ID
- *Sec. and auth. inf. Of SIM.
- *Services available.
- *Location registration and updates.

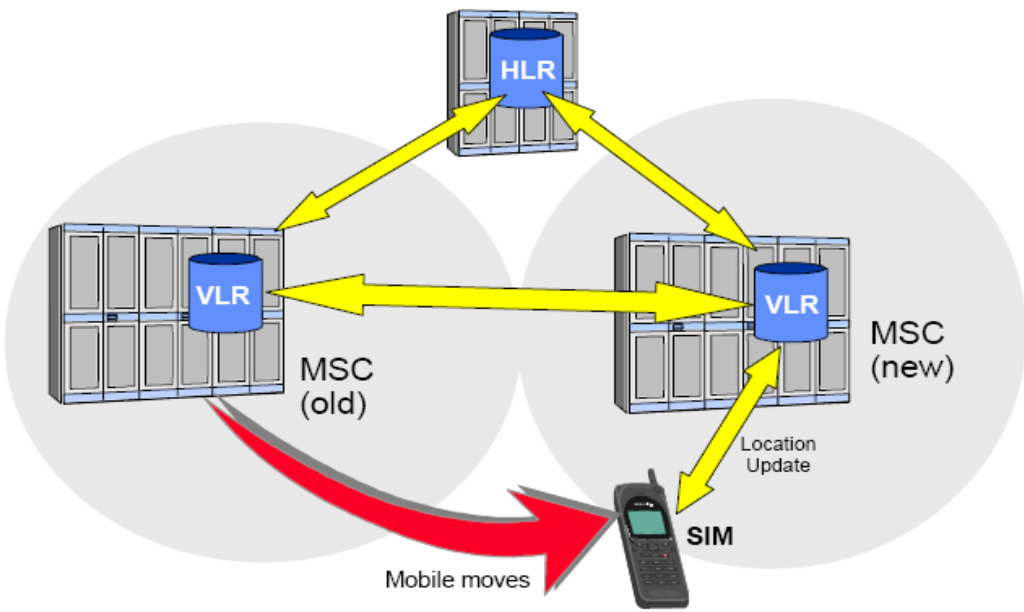
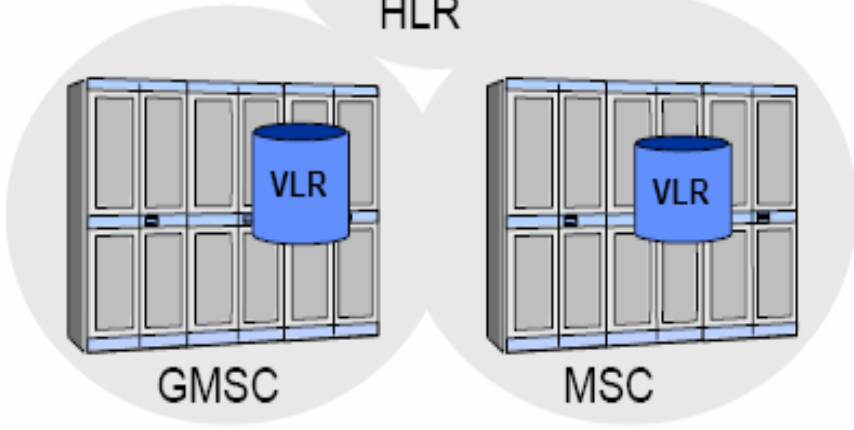
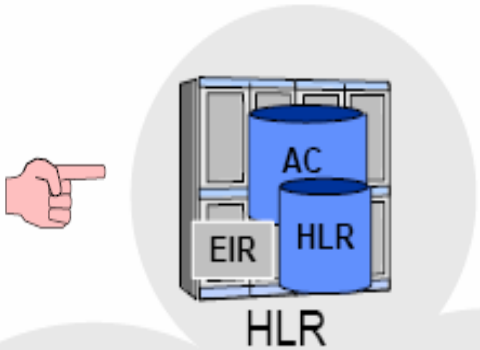
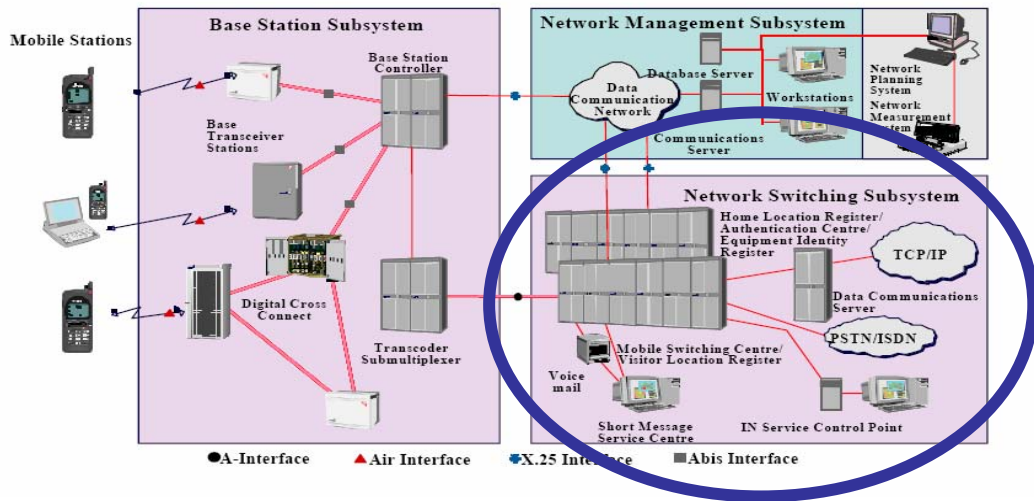
GSM Architecture

NSS



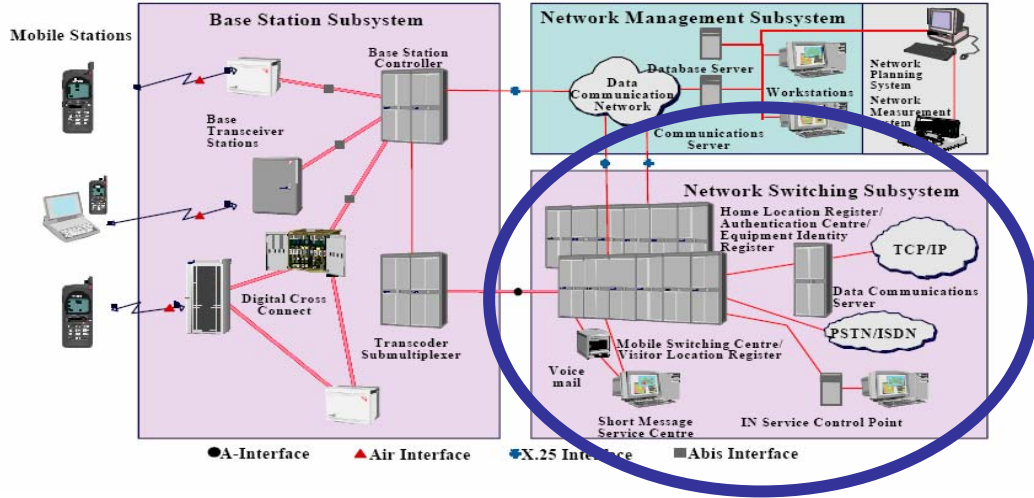
GSM Architecture

NSS

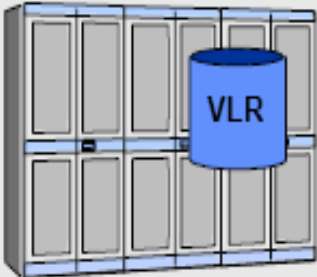


GSM Architecture

NSS



HLR



GMSC

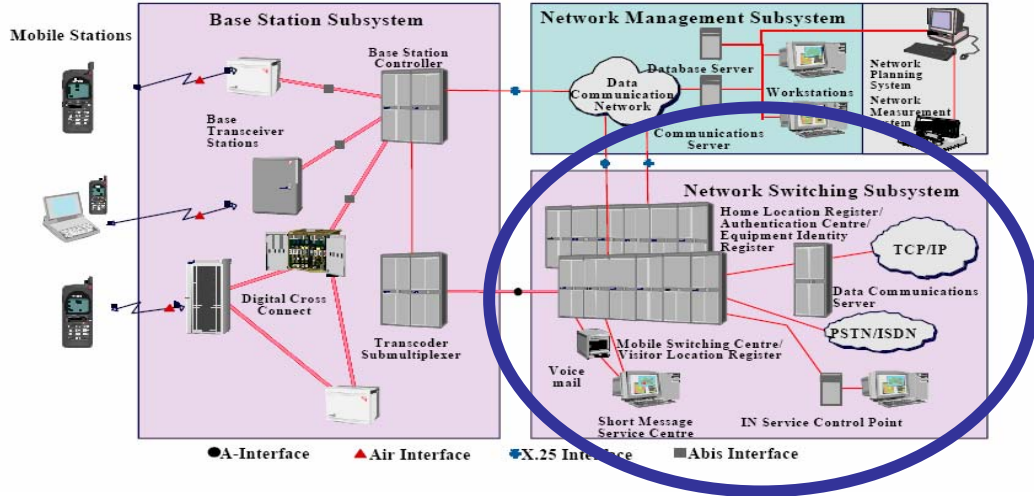


MSC

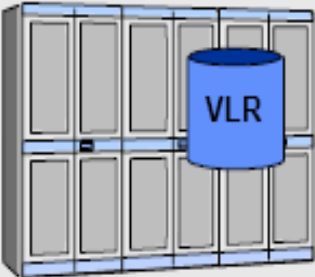
AC (Authentication Center)
*Provides security inf. To the network so that we can verify the SIM cards.

GSM Architecture

NSS



HLR



GMSC



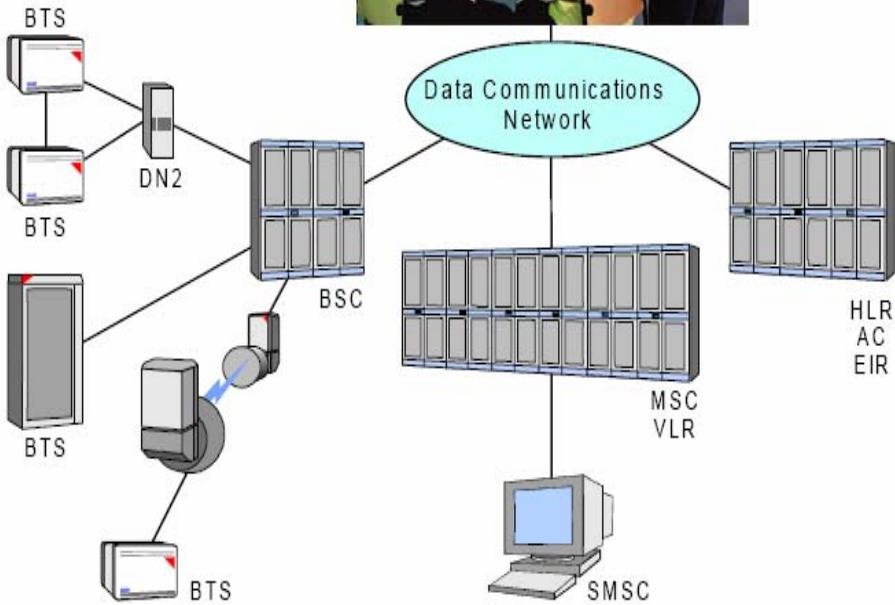
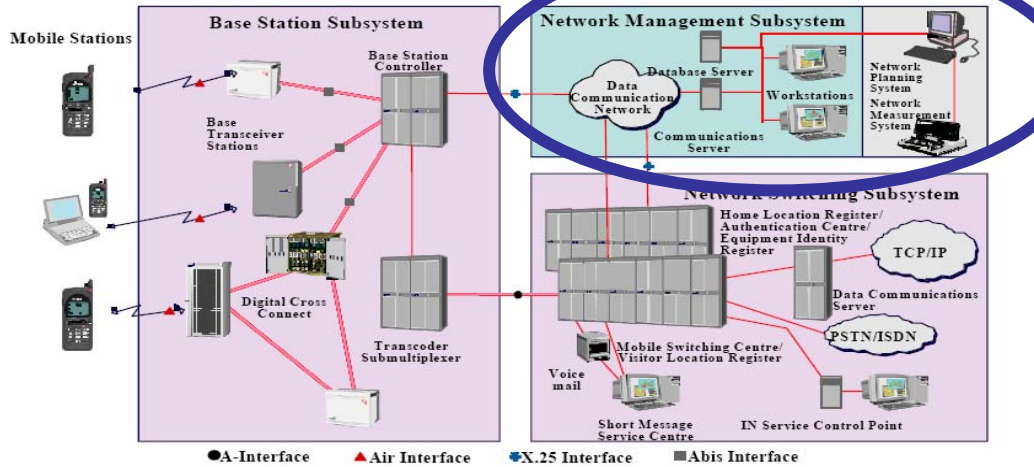
MSC

EIR (Equipment Identity Register)
 *IMEI security reasons.

White list
 Grey list
 Black list

GSM Architecture

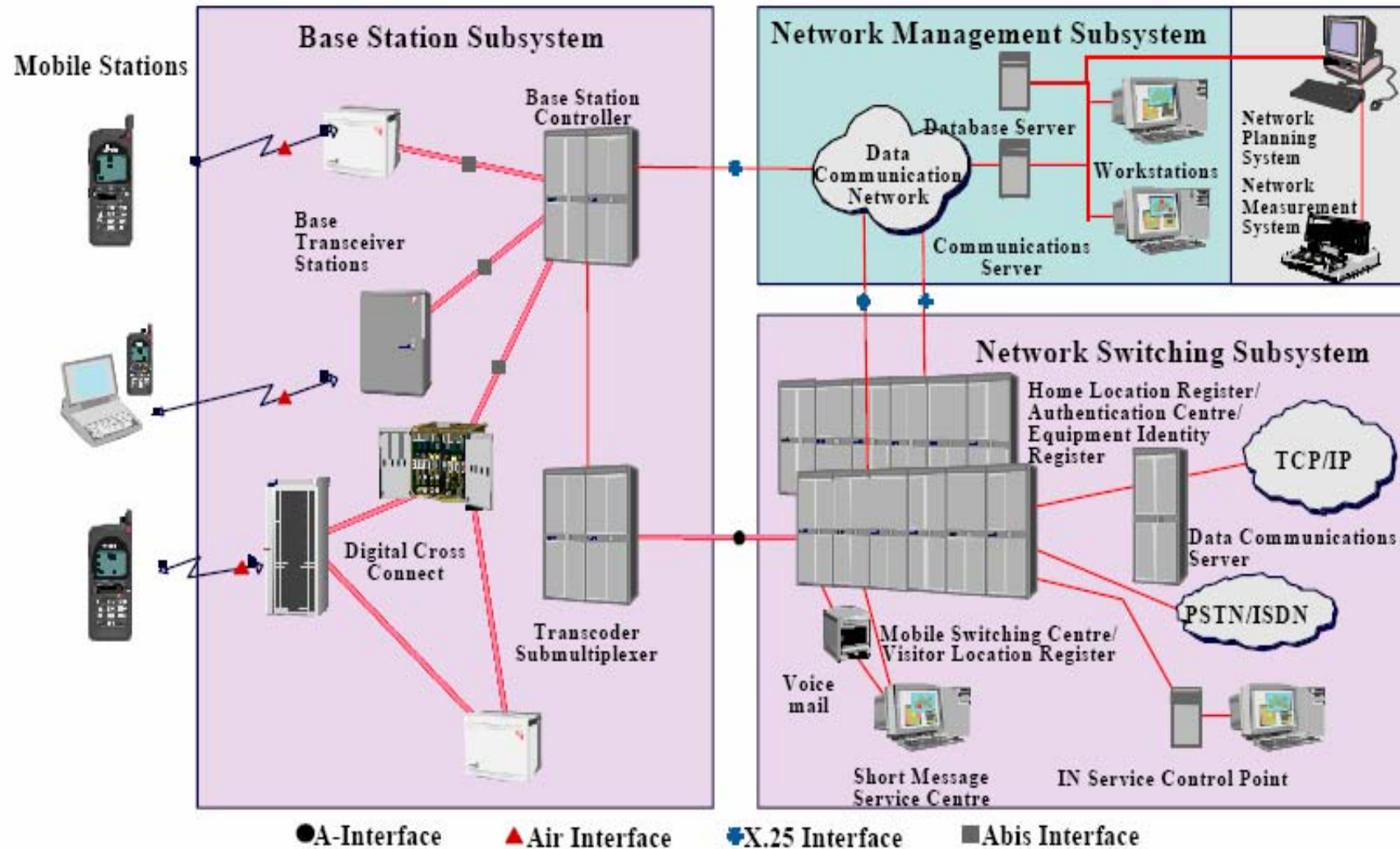
NMS



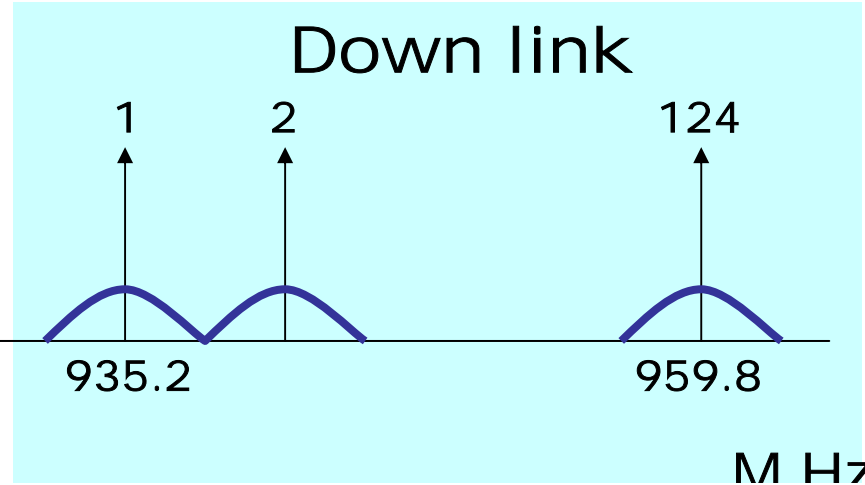
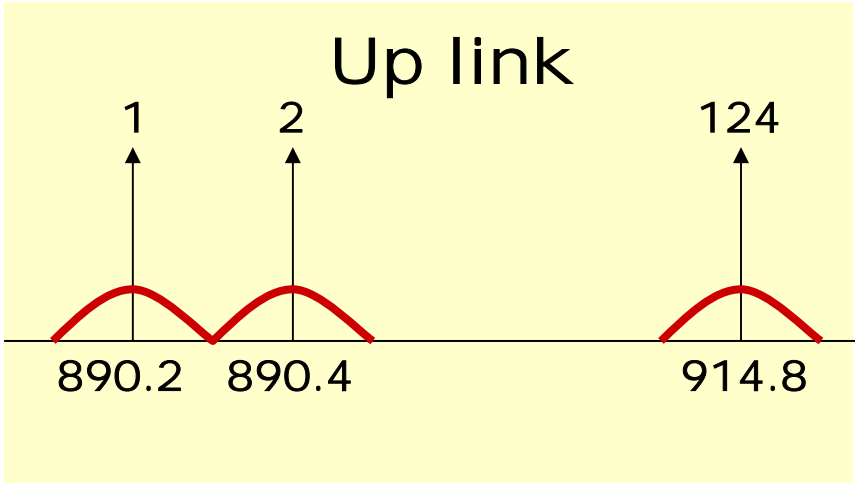
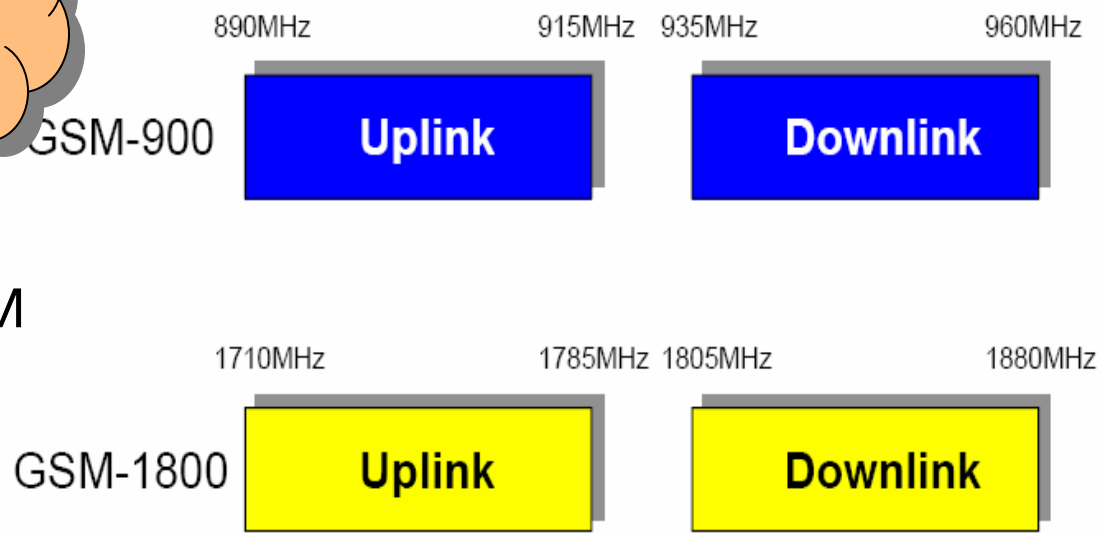
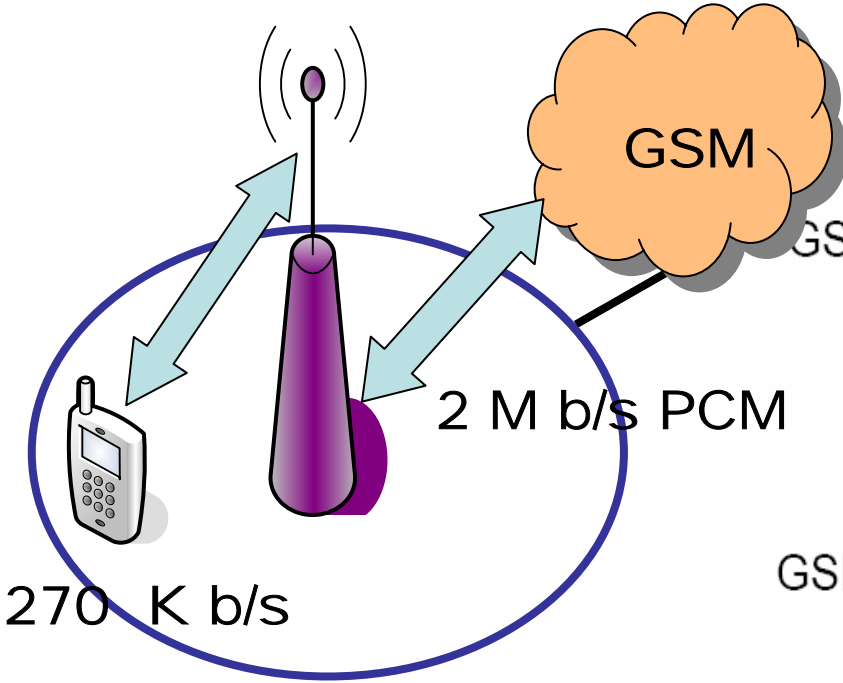
Configuration management.



GSM Architecture



GSM Air Interface



M Hz

GSM Air Interface

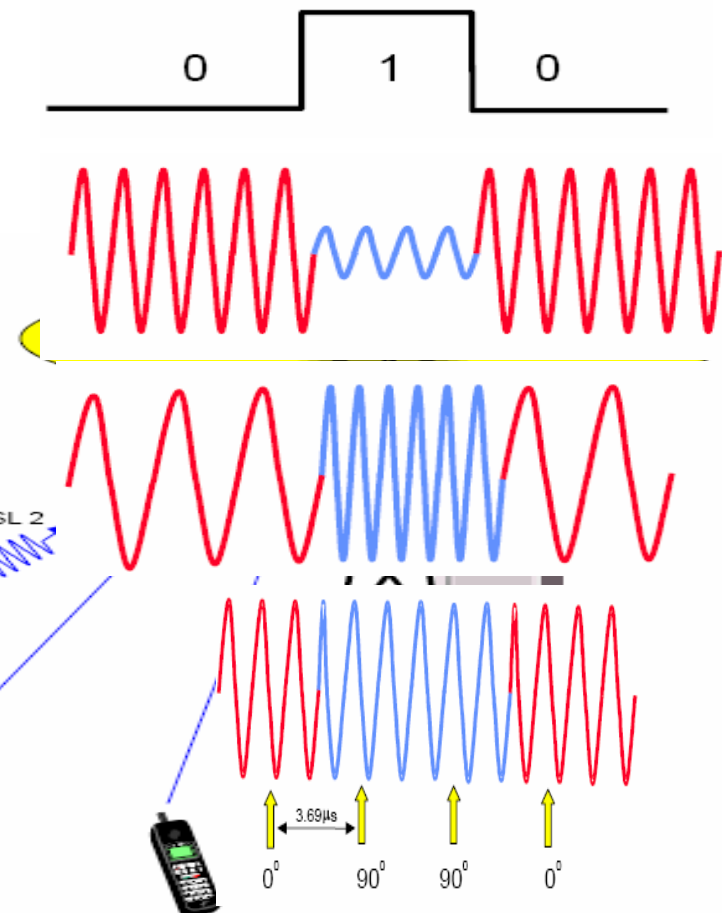
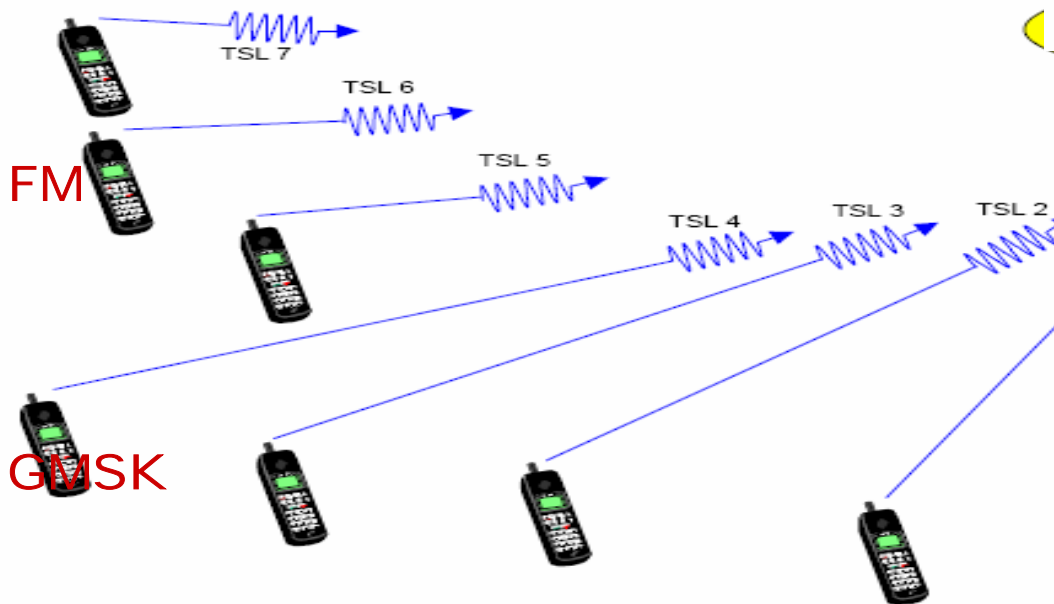
GSM transmission

Digital >>> TDMA, FDMA
Analog ch. >> analog modulation

AM

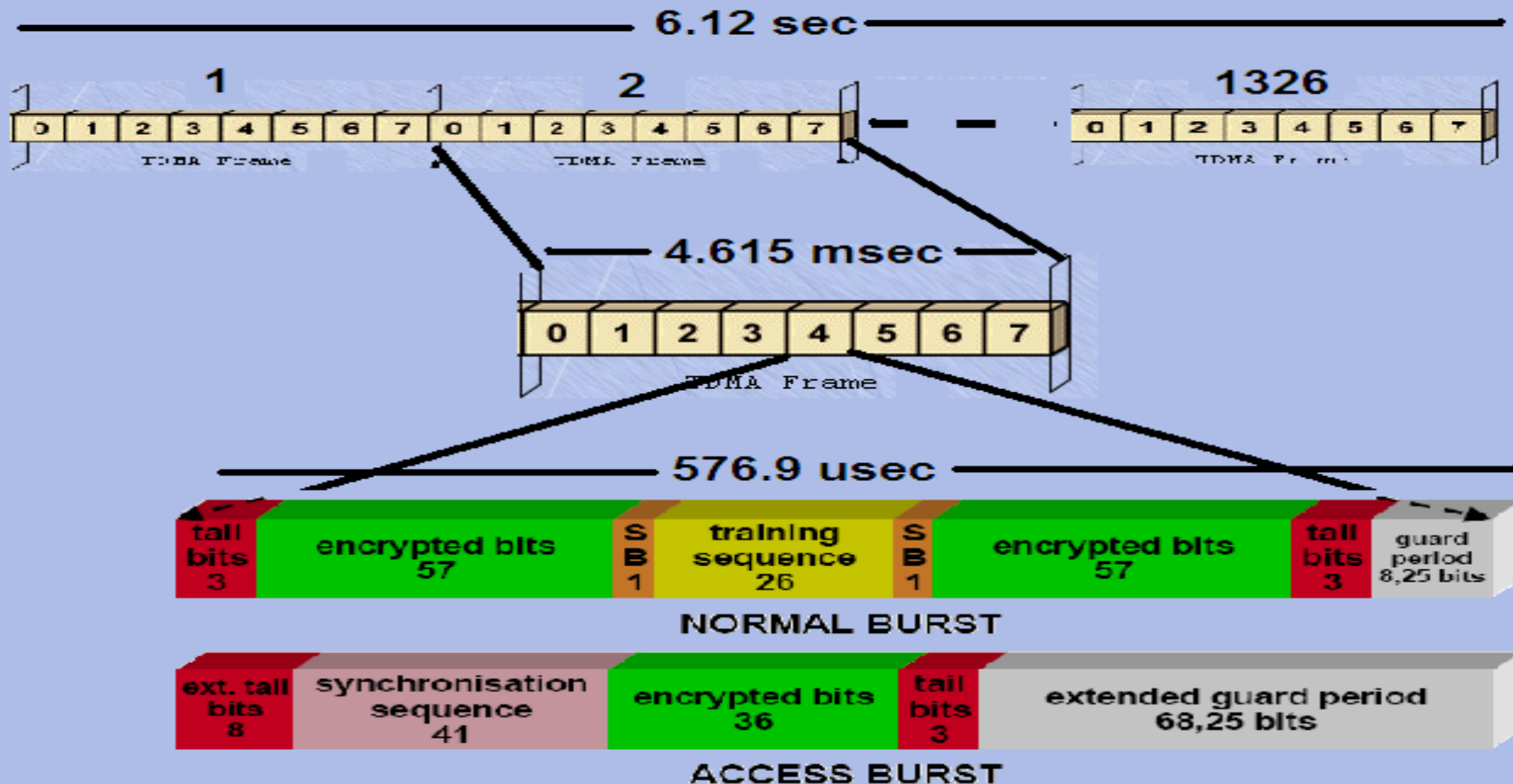
FM

GMSK



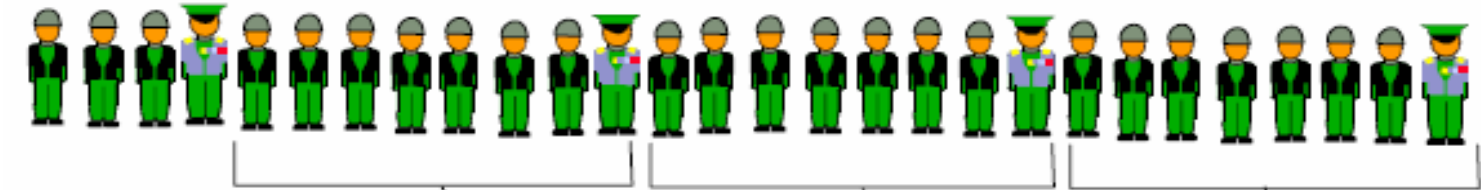
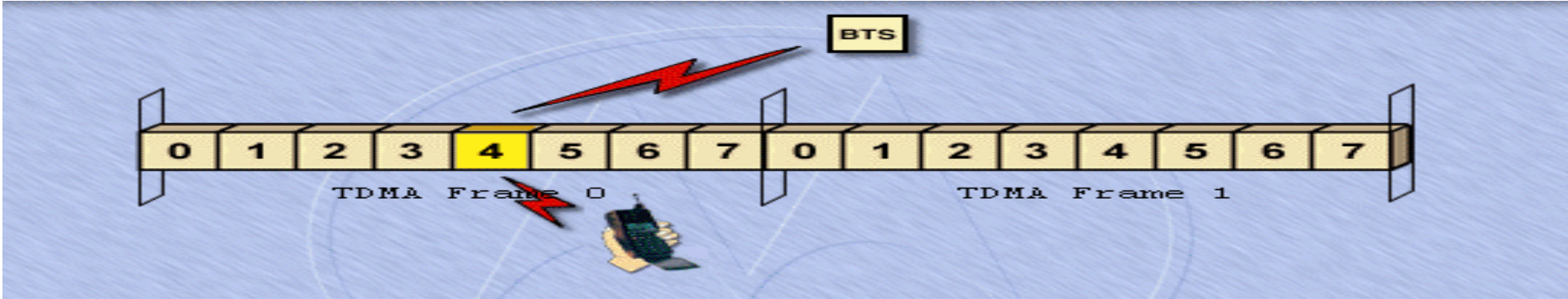
GSM Air Interface

Physical and logical channels

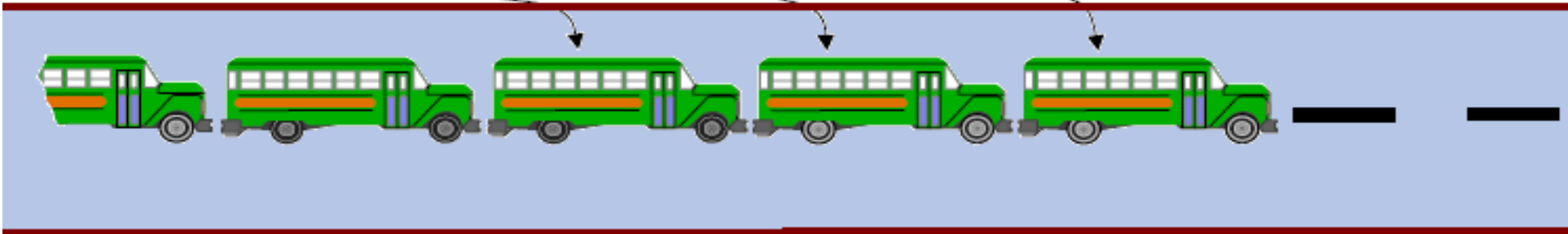


GSM Air Interface

Physical and logical channels

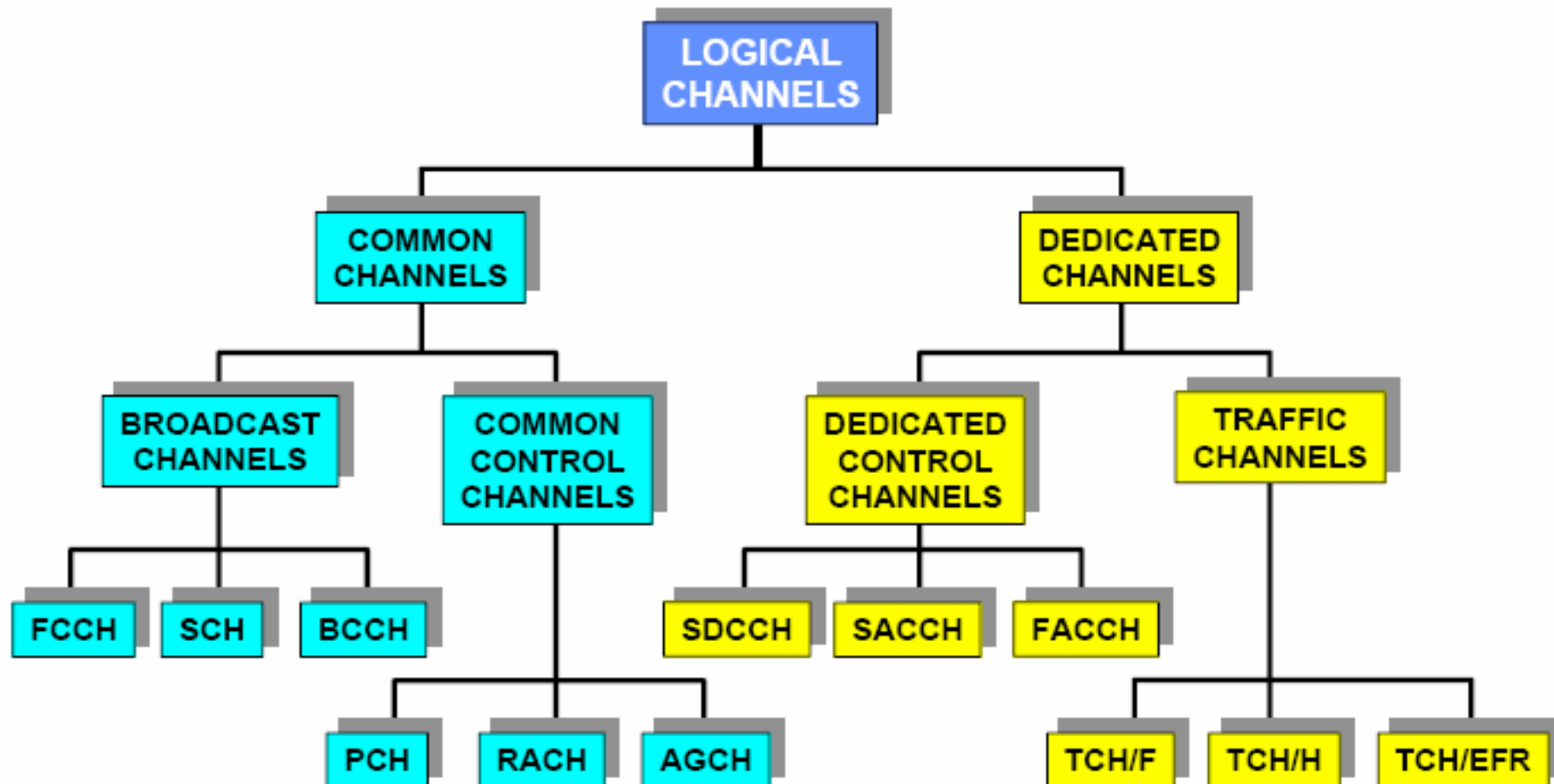


*Physical
*Logical
Common
Dedicated



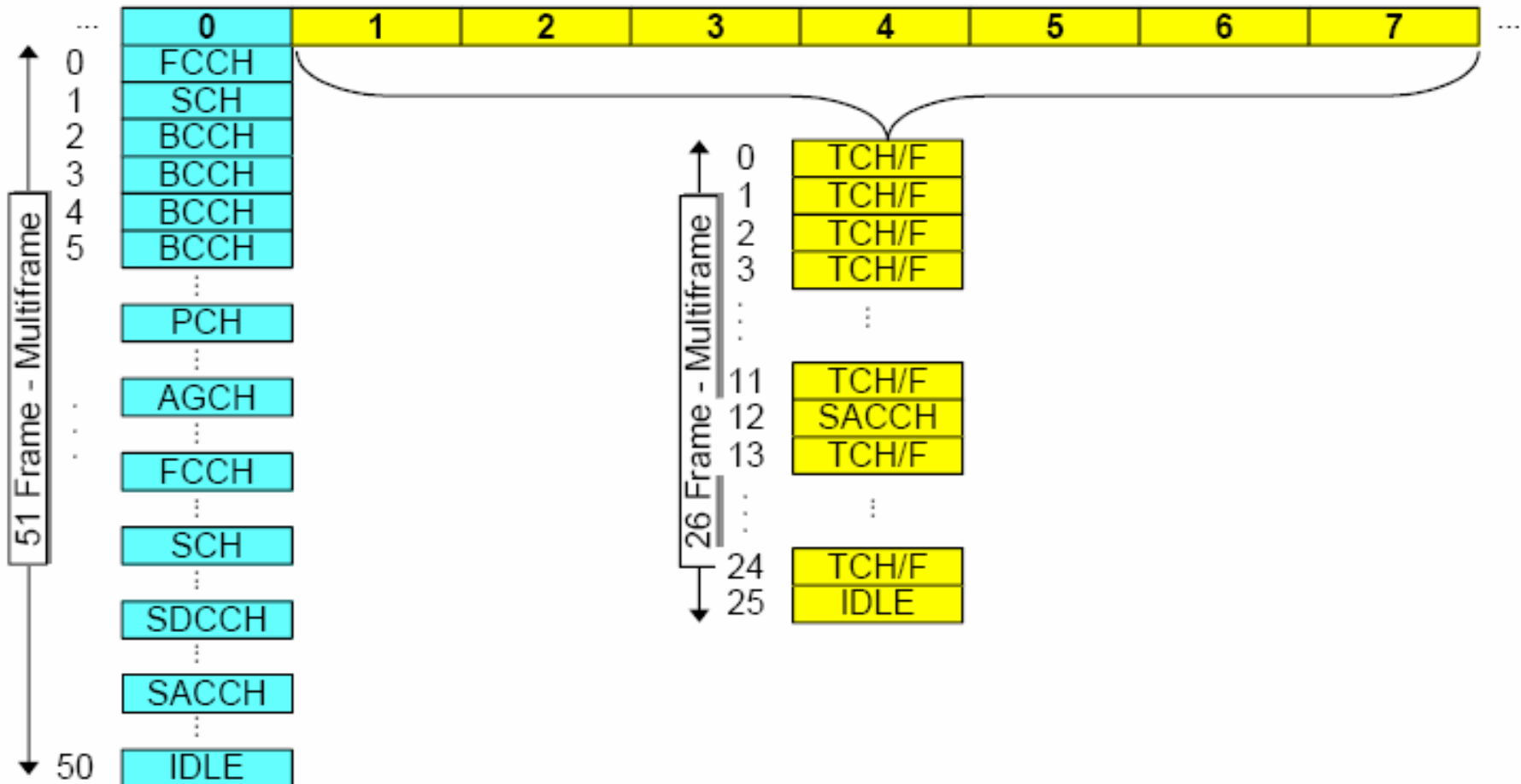
GSM Air Interface

Physical and logical channels



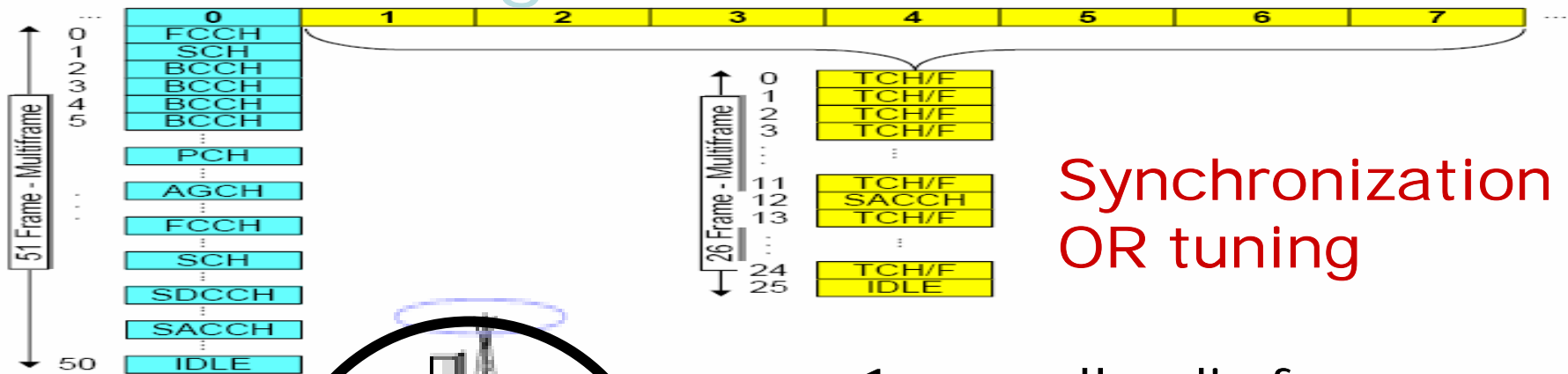
GSM Air Interface

Physical and logical channels

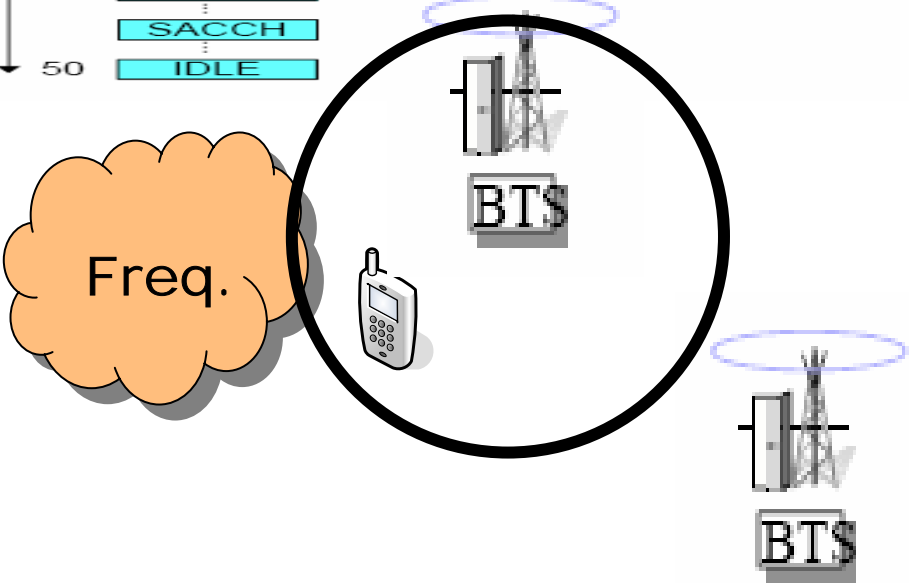


GSM Air Interface

Physical and logical channels



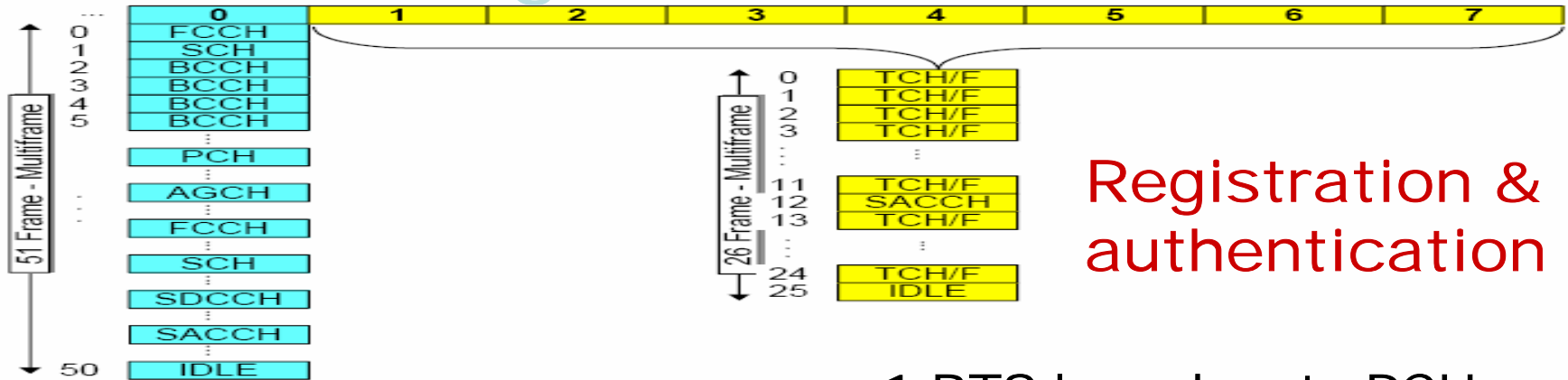
Synchronization OR tuning



- 1-scan all radio freq.
- 2-select the best quality.
- 3-synch. With the net.
 - BSIC
 - TDMA frame no.
- 4-BCCH (freq. cell & nei., inf. About the surrounding cells, FH,

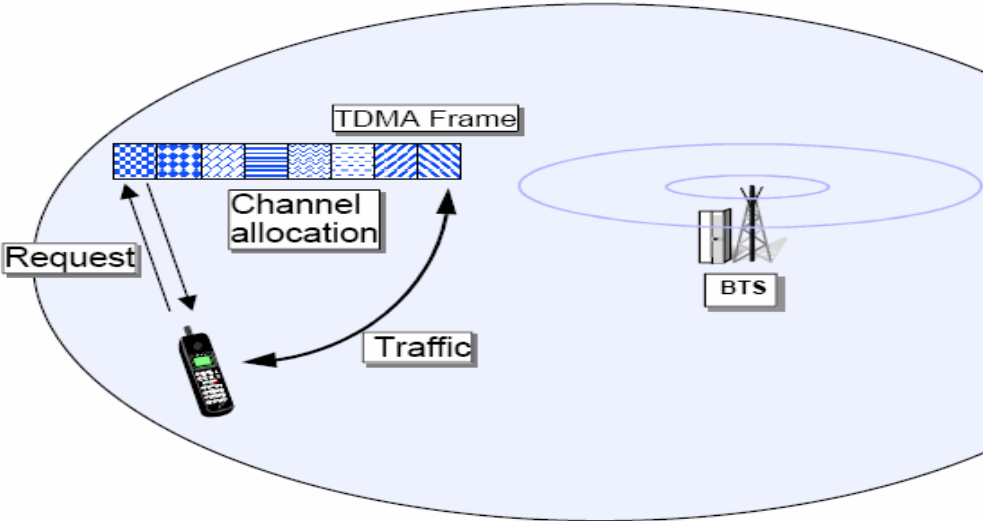
GSM Air Interface

Physical and logical channels



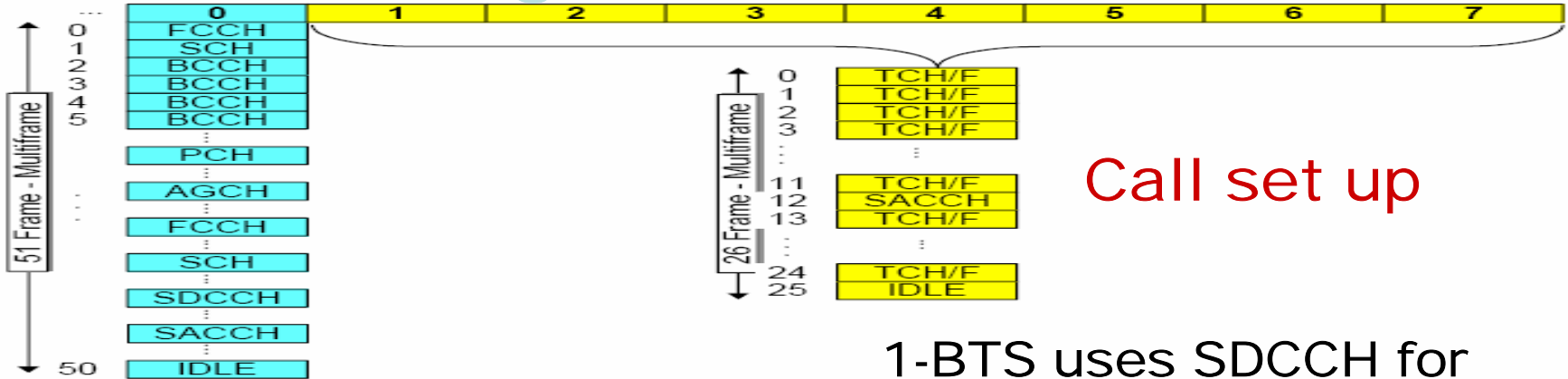
Registration & authentication

- 1-BTS broadcasts PCH
- 2-MS makes CH req. connection (RACH)
- 3-BTS responds by AGCH.
- 4-MS has its dedicated ch. (SDCCH).



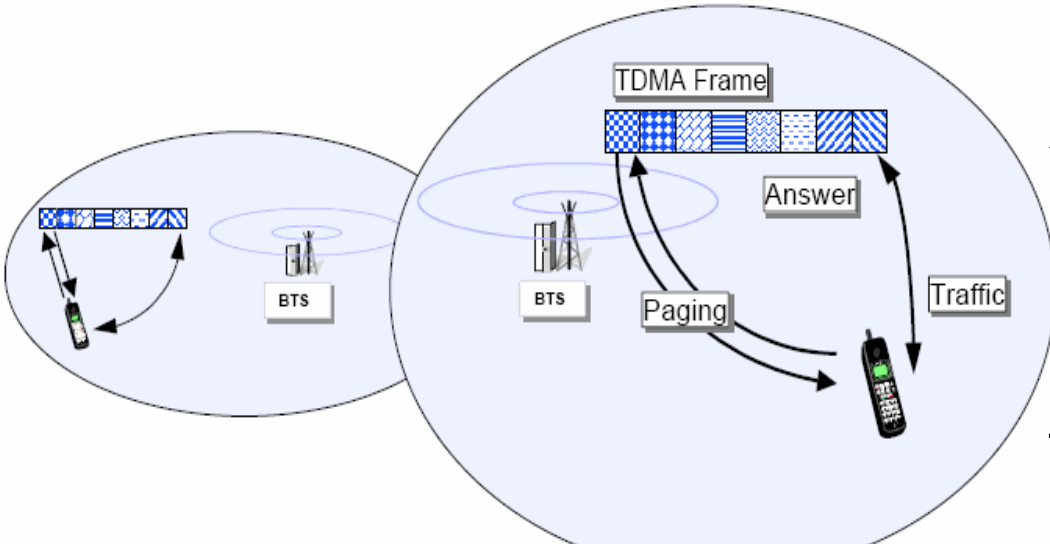
GSM Air Interface

Physical and logical channels



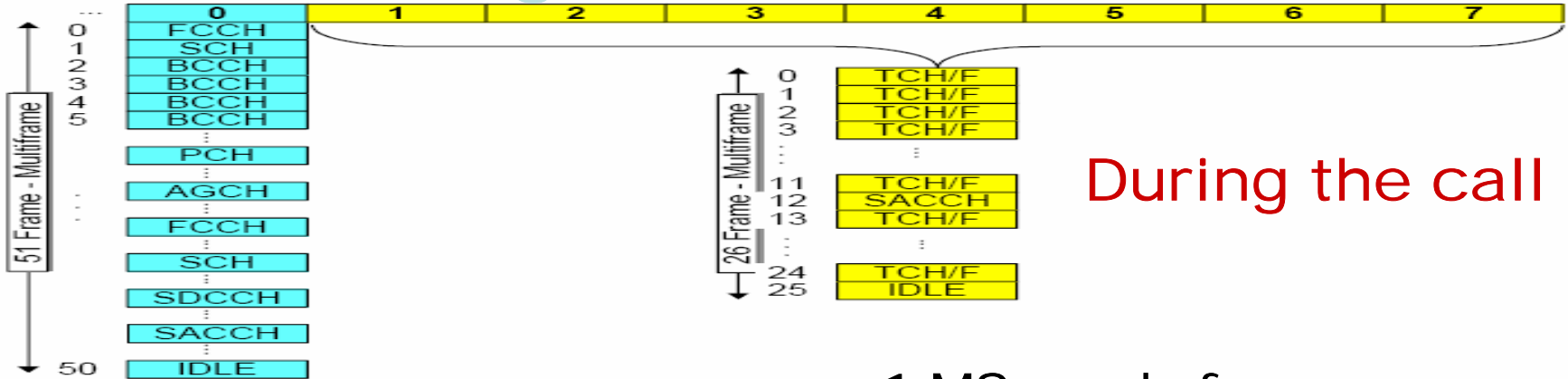
Call set up

- 1-BTS uses SDCCH for paging and LA.
- 2-MS responses with service or CH req.
- 3-Network ack. And authentication is again needed.
- 4-MS sends its traffic by TCH (HR 5.6kb/s, FR 13 Kb/s EFR 13 Kb/s).



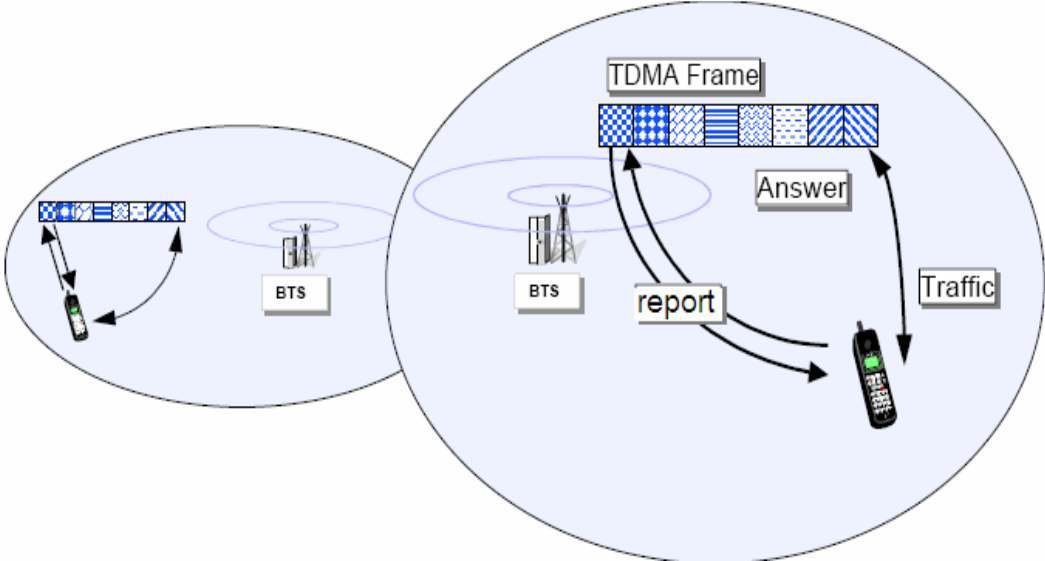
GSM Air Interface

Physical and logical channels



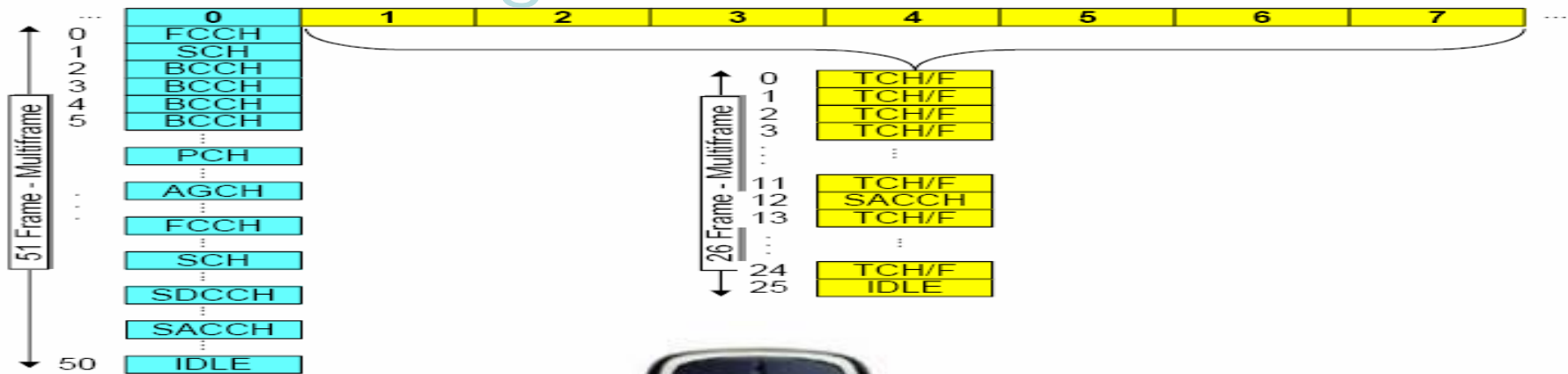
During the call

- 1-MS sends freq. measurements report to BSC by SACCH.
- 2-BSC response if HO required by FACCH.



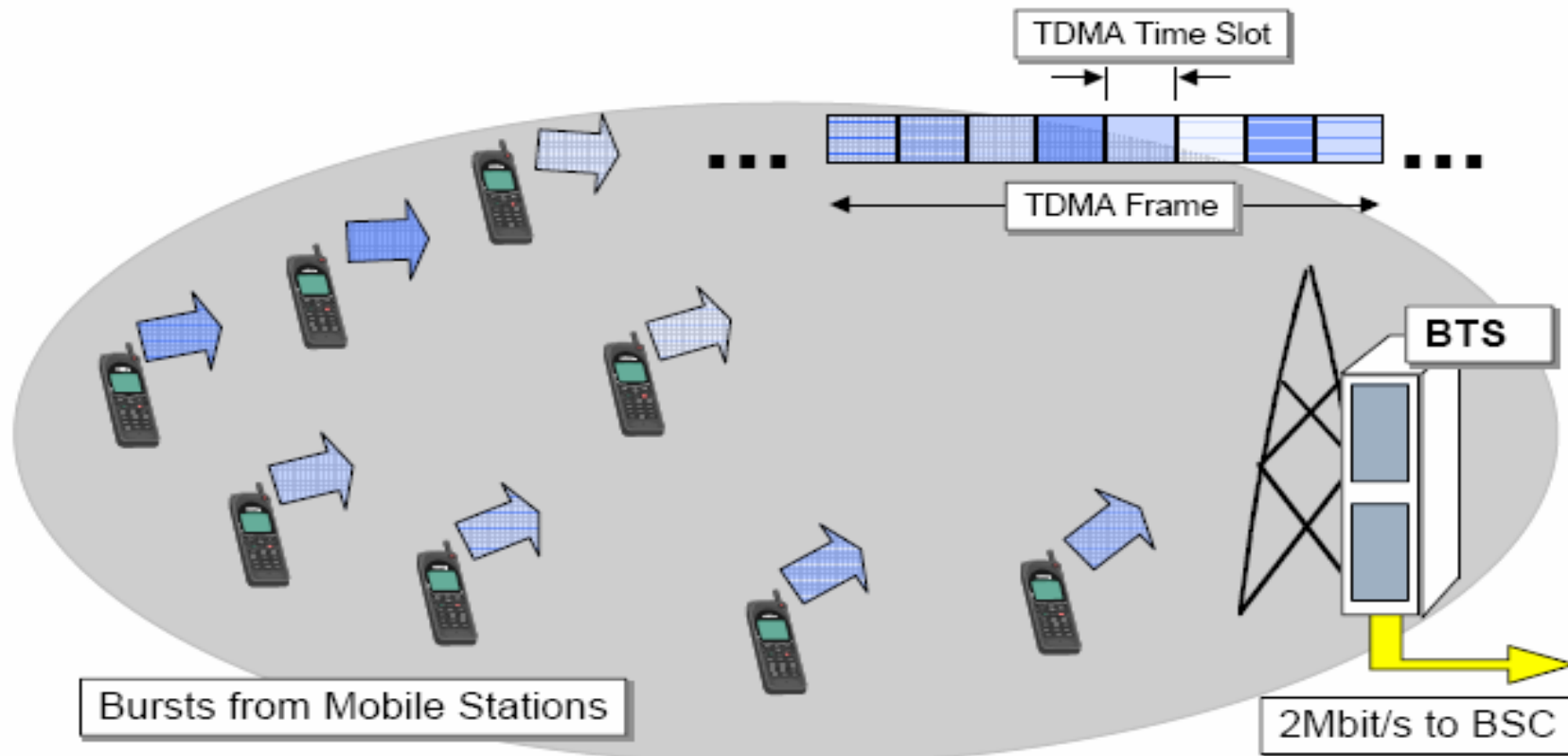
GSM Air Interface

Physical and logical channels



GSM Air Interface

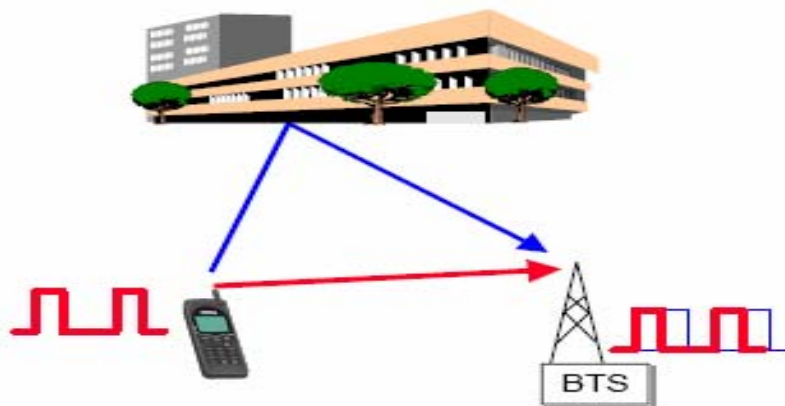
Propagation problems



GSM Air Interface

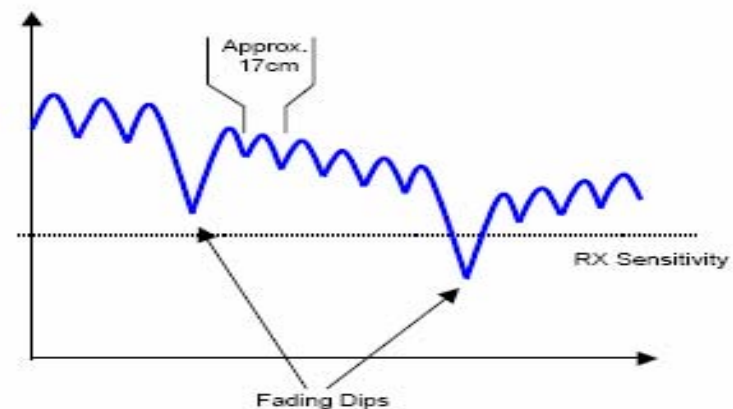
Propagation problems

1-Multipath Propagation.



Inter Symbol Interference

- 1-equilization
- 2-channel coding
- 3-interleaving
- 4-FH
- 5-antenna diversity



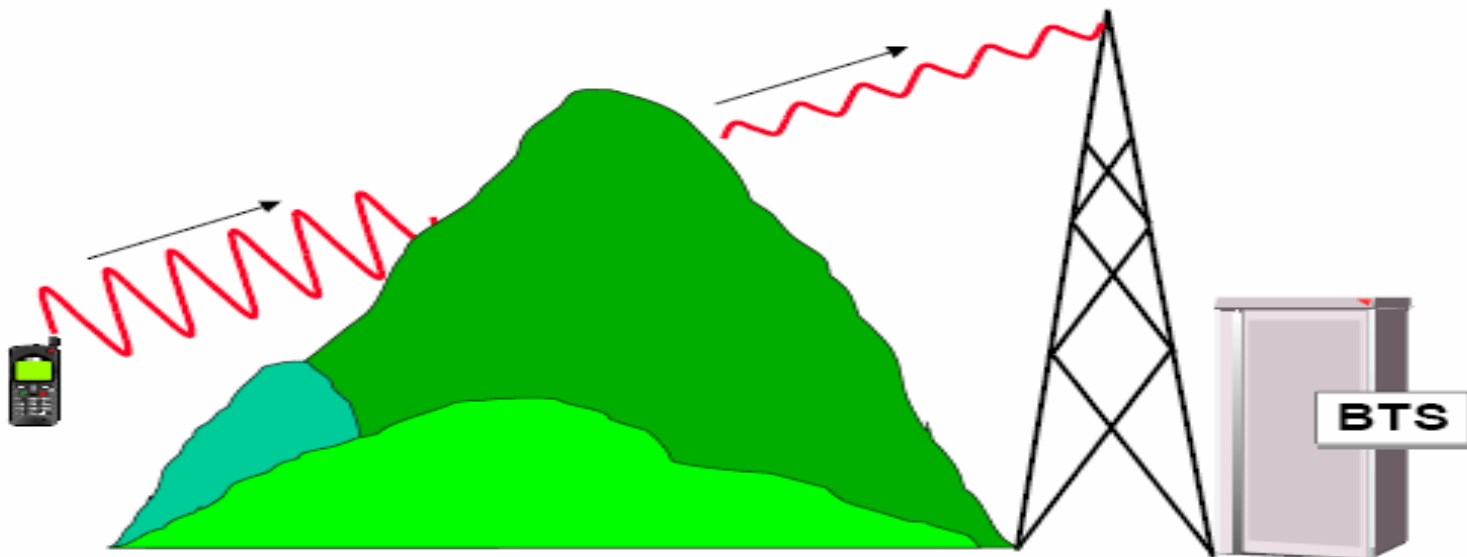
Fading dips caused by multipath propagation

GSM Air Interface

Propagation problems

1-Multipath Propagation.
2-Shadowing.

1-adaptive power control
"SACCH"

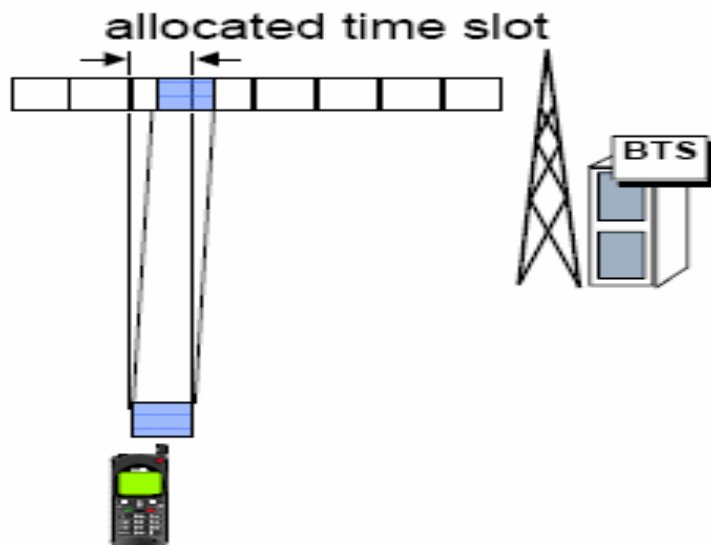


GSM Air Interface

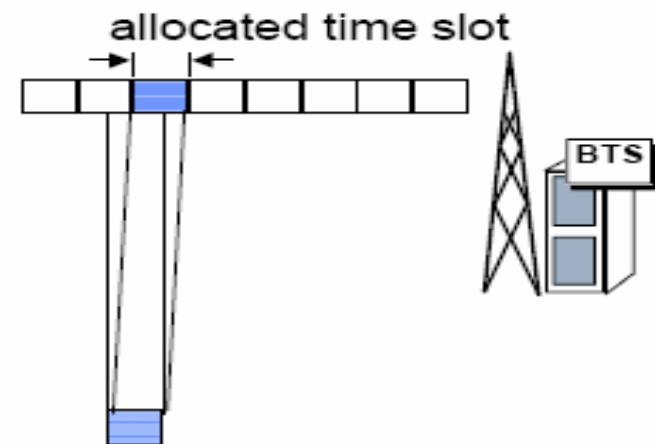
Propagation problems

- 1-Multipath Propagation.
- 2-Shadowing.
- 3-Propagation Delay.

1-adaptive frame alignment



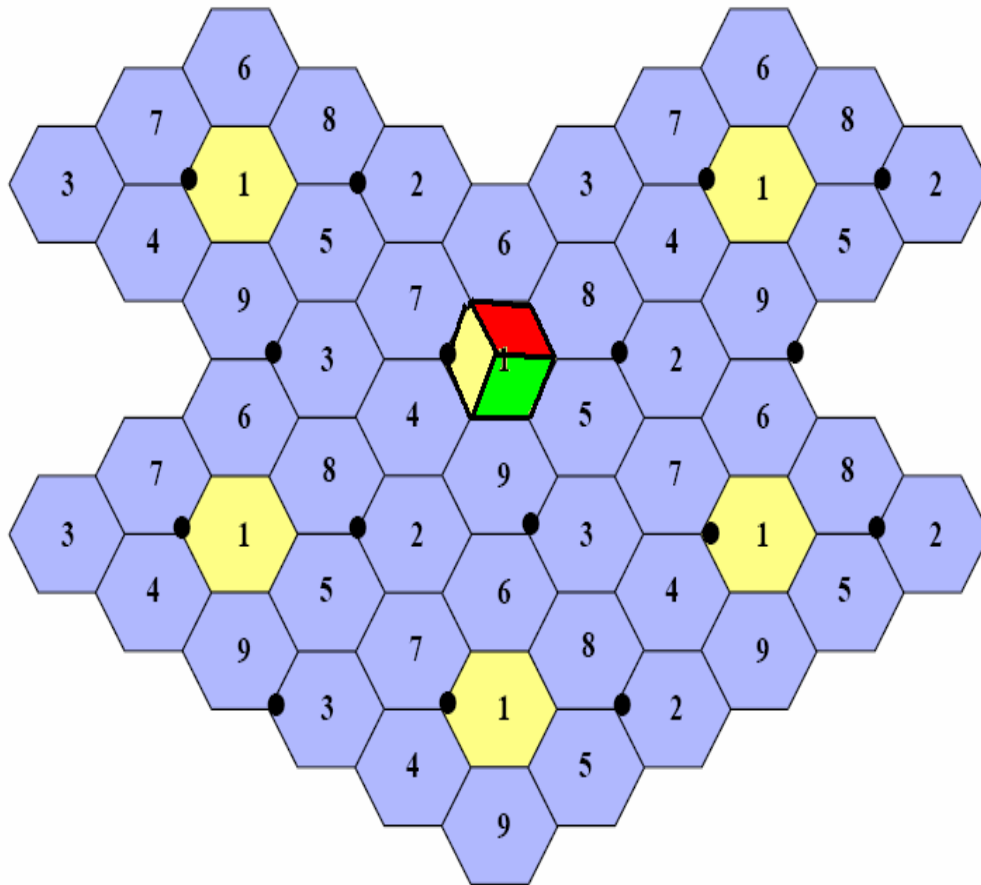
Effect Due to Propagation Delay



Solution Using Adaptive Frame Alignment

GSM Air Interface

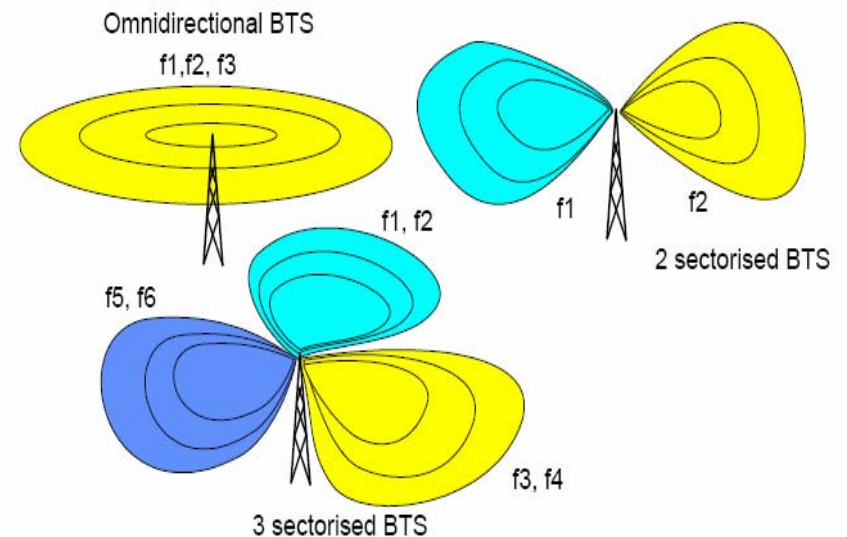
Radio Planning



Cell radius

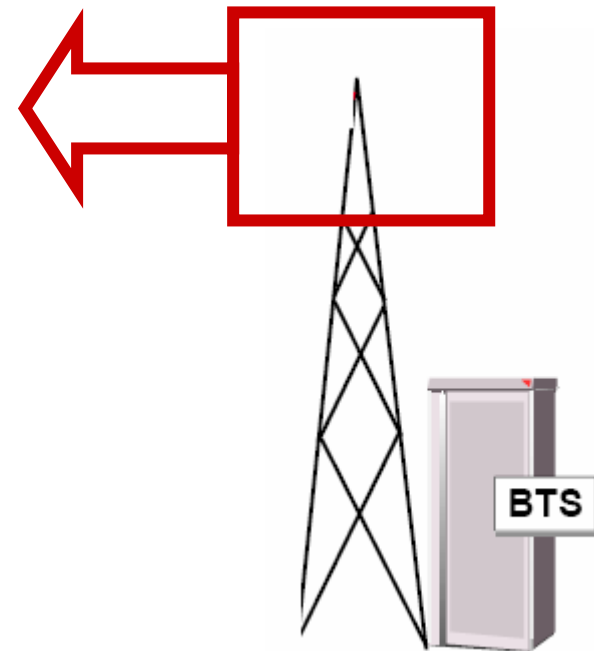
max. cell radius is 35 Km
GSM900 > GSM 1800

Frequency reuse BTS sectorization



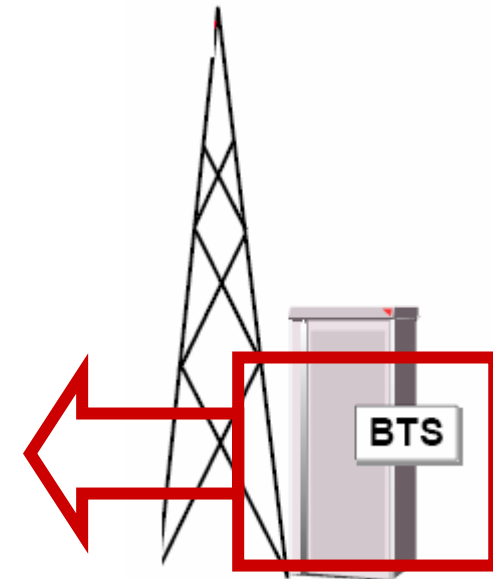
GSM Air Interface

BTS



GSM Air Interface

BTS



GSM Air Interface

BTS



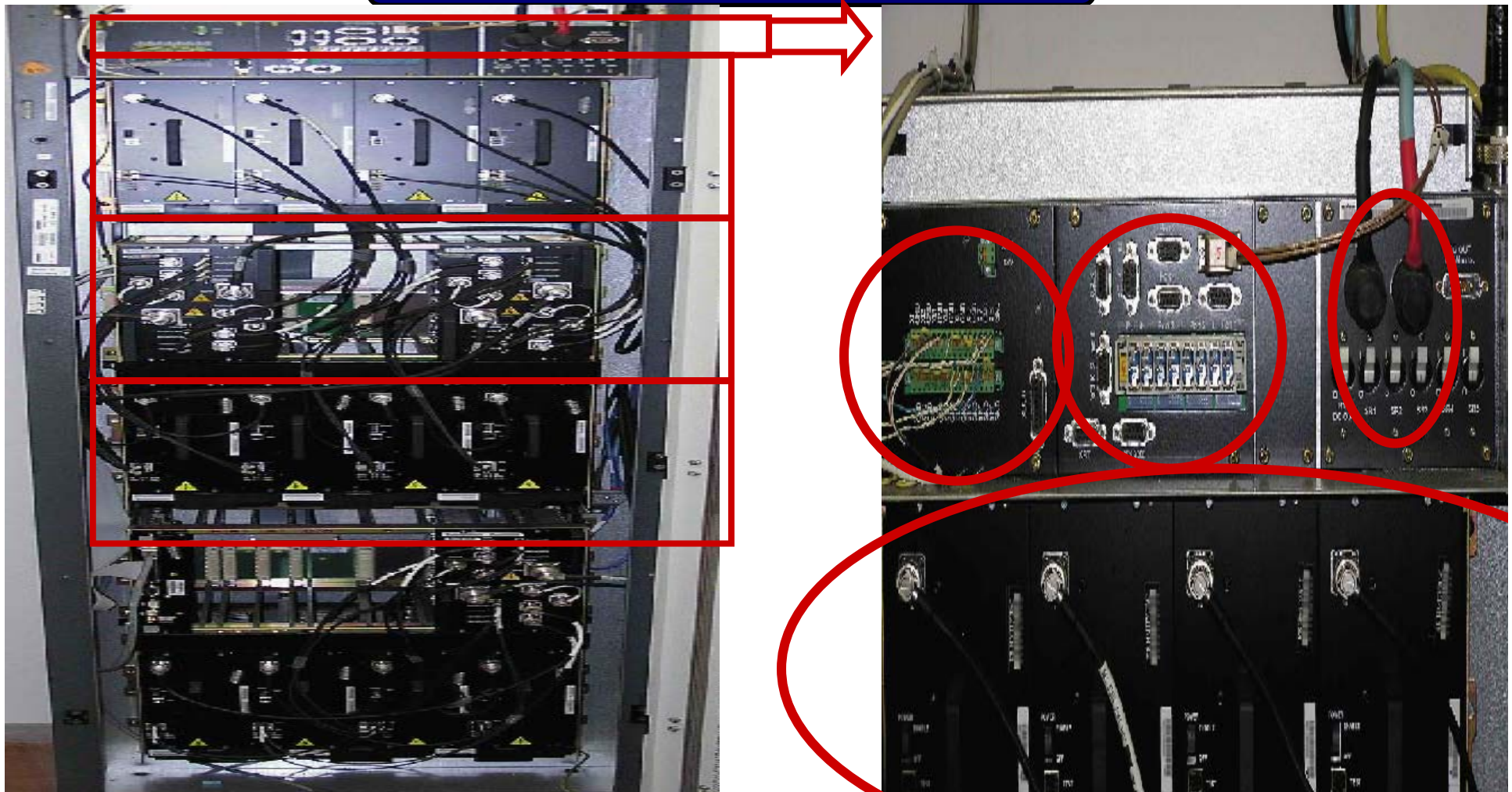
GSM Air Interface

BTS



GSM Air Interface

BTS



Summery

GSM Architecture

MS
BSS
NSS
NMS

GSM Air
Interface

Freq. bands
GSM transmission
Physical & logical ch.
Propagation problems
Radio planning
BTS



Time over

Really Thank you