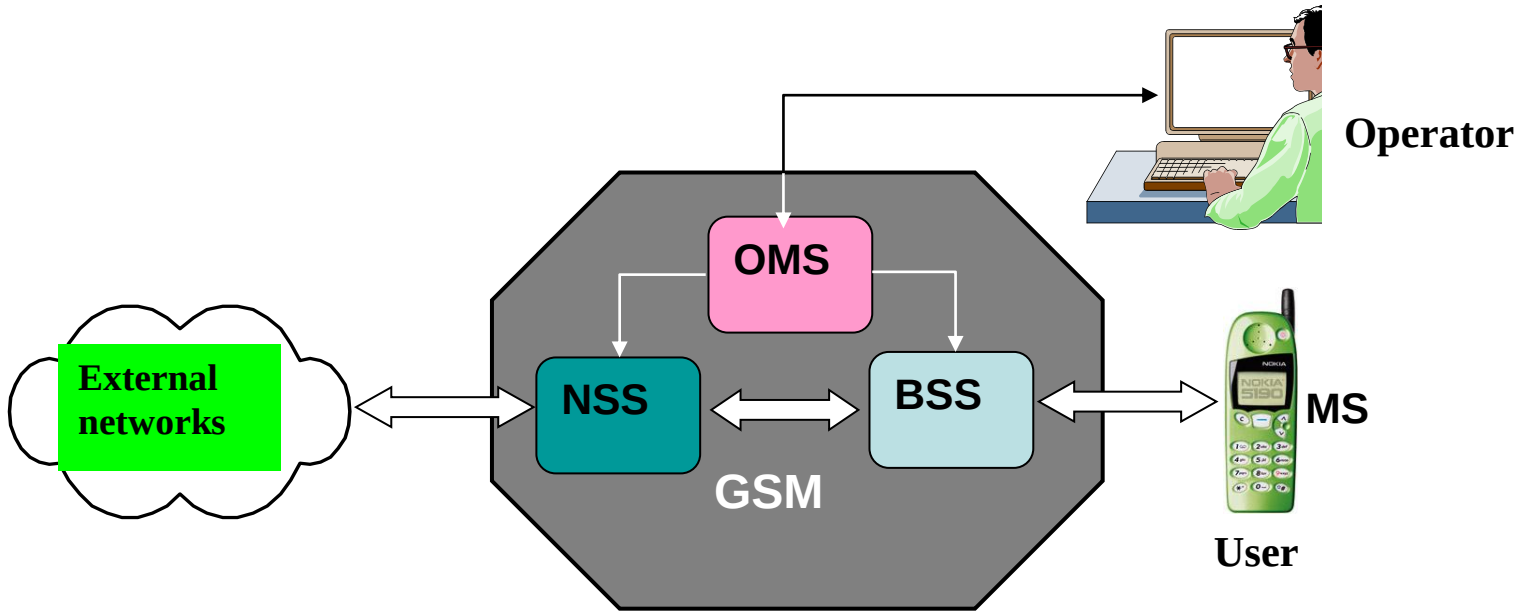
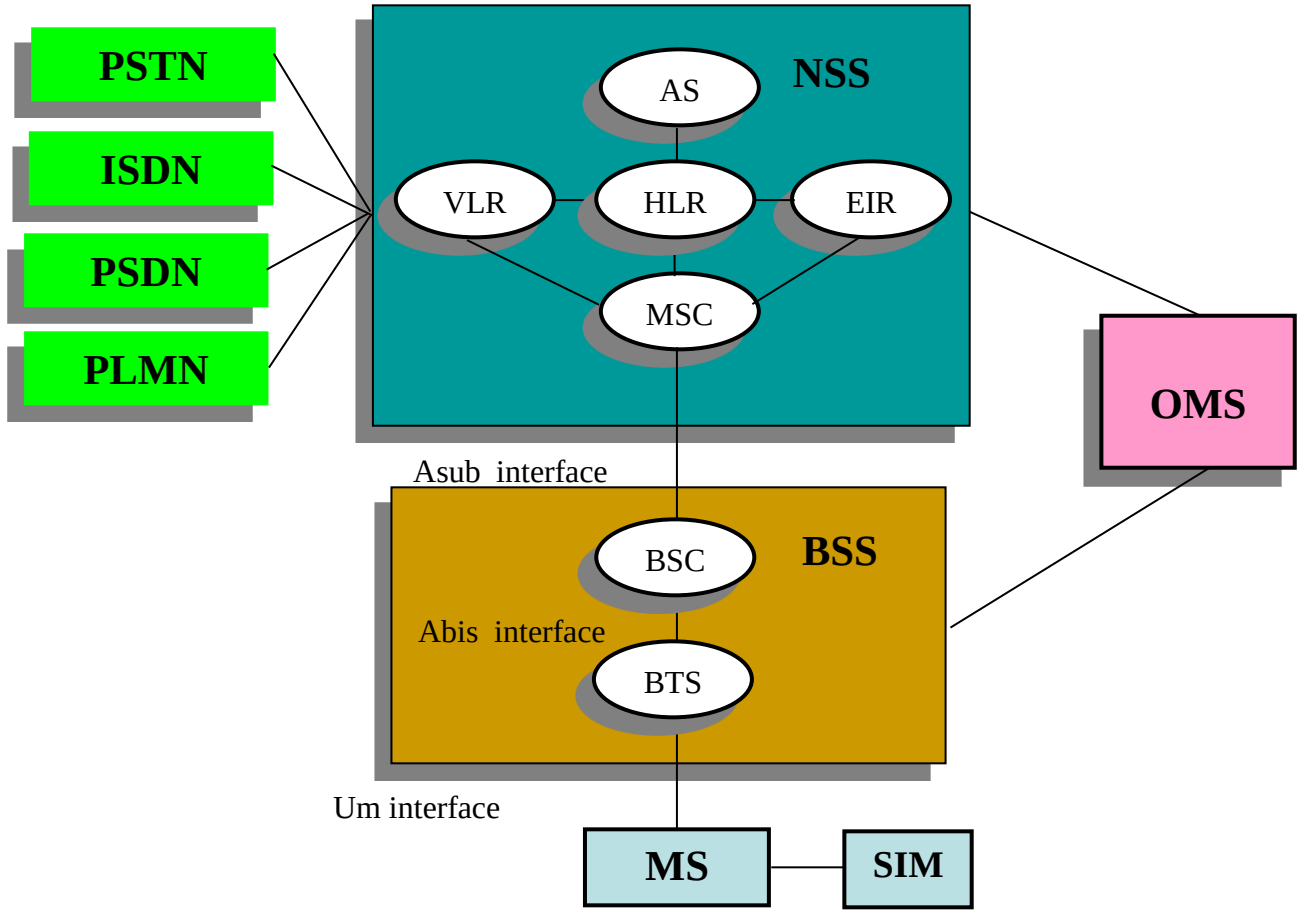
GSM ARCHITECTURE



Mobile Station (MS),
Base Station Subsystem (BBS),
Network and Switching Subsystem (NSS),
Operation Management Subsystem (OMS).

External networks ←→ NSS ←→ BSS ←→ MS ←→ Users


PSTN
ISDN
PSDN
PLMN
NSS
AS
VLR
HLR
EIR
MSC
OMS
Asub interface
BSS
BSC
Abis interface
BTS
Um interface
MS
SIM

BSS components and interfaces

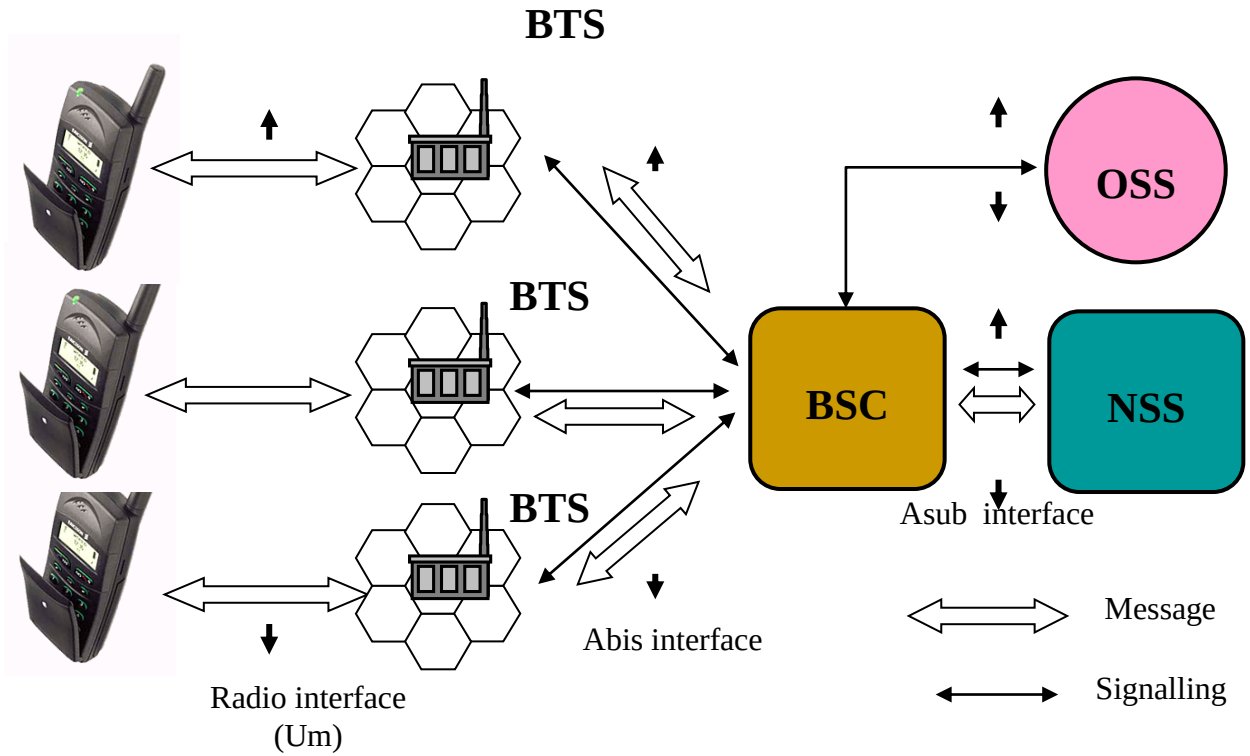
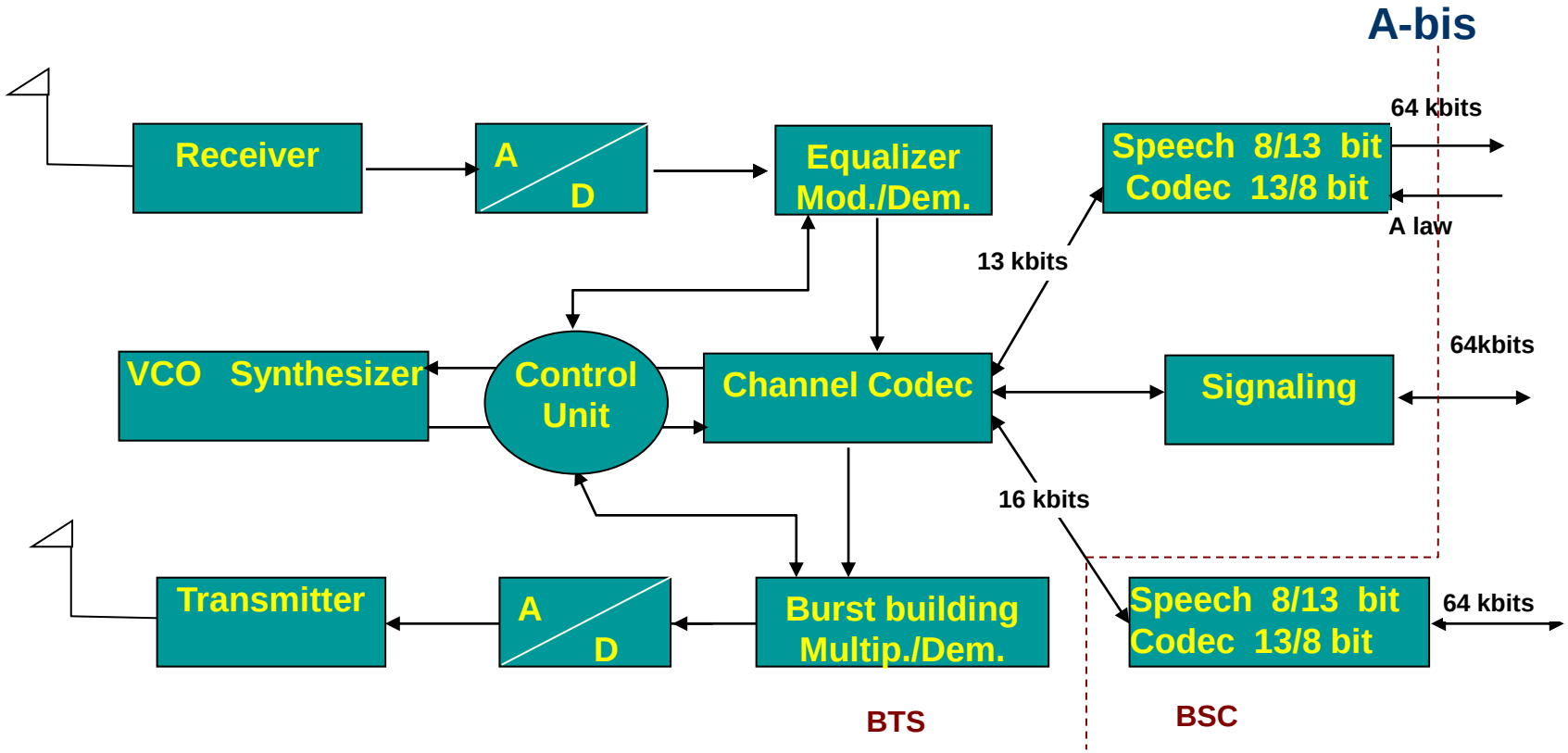


Figure 4.12

Base Station

BLOCK DIAGRAM OF A BASE STATION



Radio Frequency channels for GSM D900

890-915 MHz for uplink, *MC to BS*

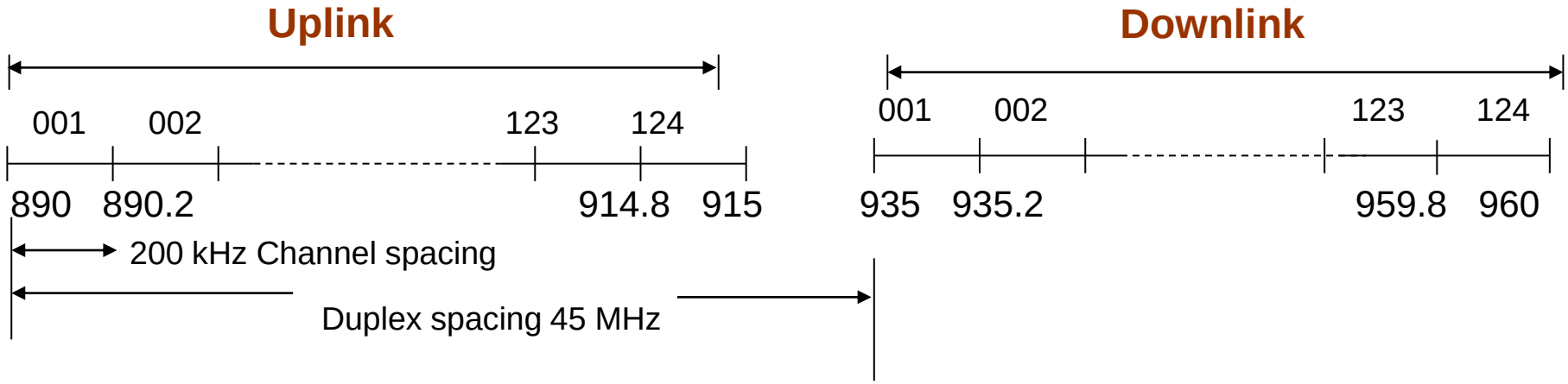
935-960 MHz for downlink, *BS to MS*

fup(n)=(890+0,2xn) MHz (with,ARFCN 1≤n≤124)

fdown(n)=fup(n)+45MHz

Radio frequency channel spacing: 200 kHz; Duplex spacing: 45 MHz

CHANNEL DISTRIBUTION FOR D900



GSM EXTENDED BAND (E-GSM 900)

880-915 MHz for uplink ; 925-960 MHz for downlink
With FDMA 124 (174 for extended band)

Fup(n)=(890+0.2 x n)MHz (with ARFCN 0≤n≤124) and
fup(n)=(890+0,2xn) (n-1024) (with ARFCN 975≤n≤1023)

fdown (n)=fup (n)+45 MHz

Radio frequency channel spacing: **200 kHz; Duplex spacing: 45 MHz**

GSM 1800

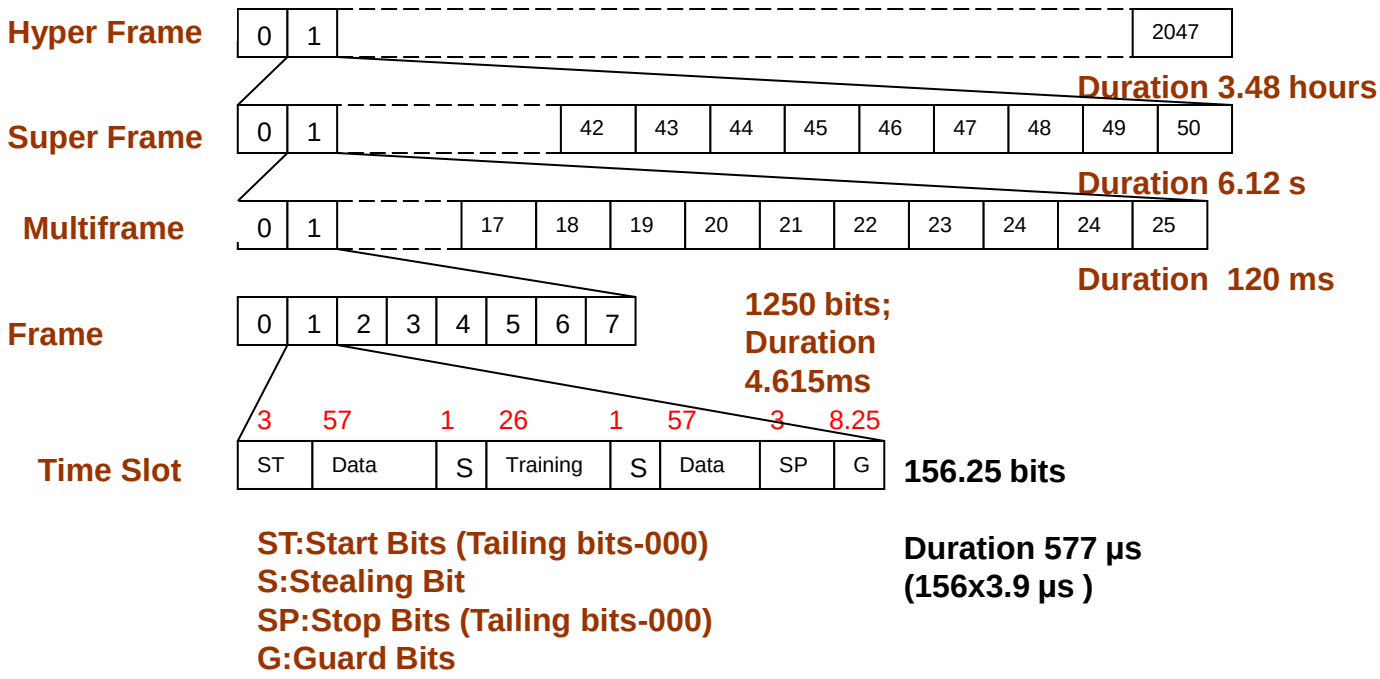
1710-1785 MHz for uplink; 1805-1880 MHz for downlink
Duplex spscing is 95 MHz with 374 channels 200 kHz spacing

Numberd with 512-885

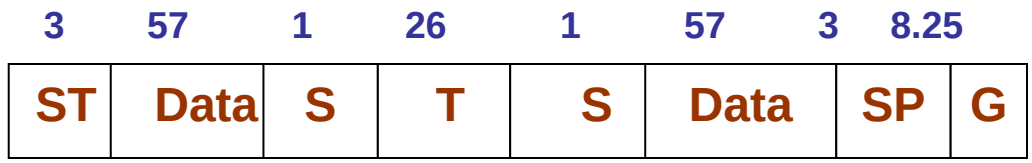
fup(n)=(1710+0,2xn) (n-511) (with,ARFCN 512≤n≤885

fdown(n)=fup(n)+95MHz

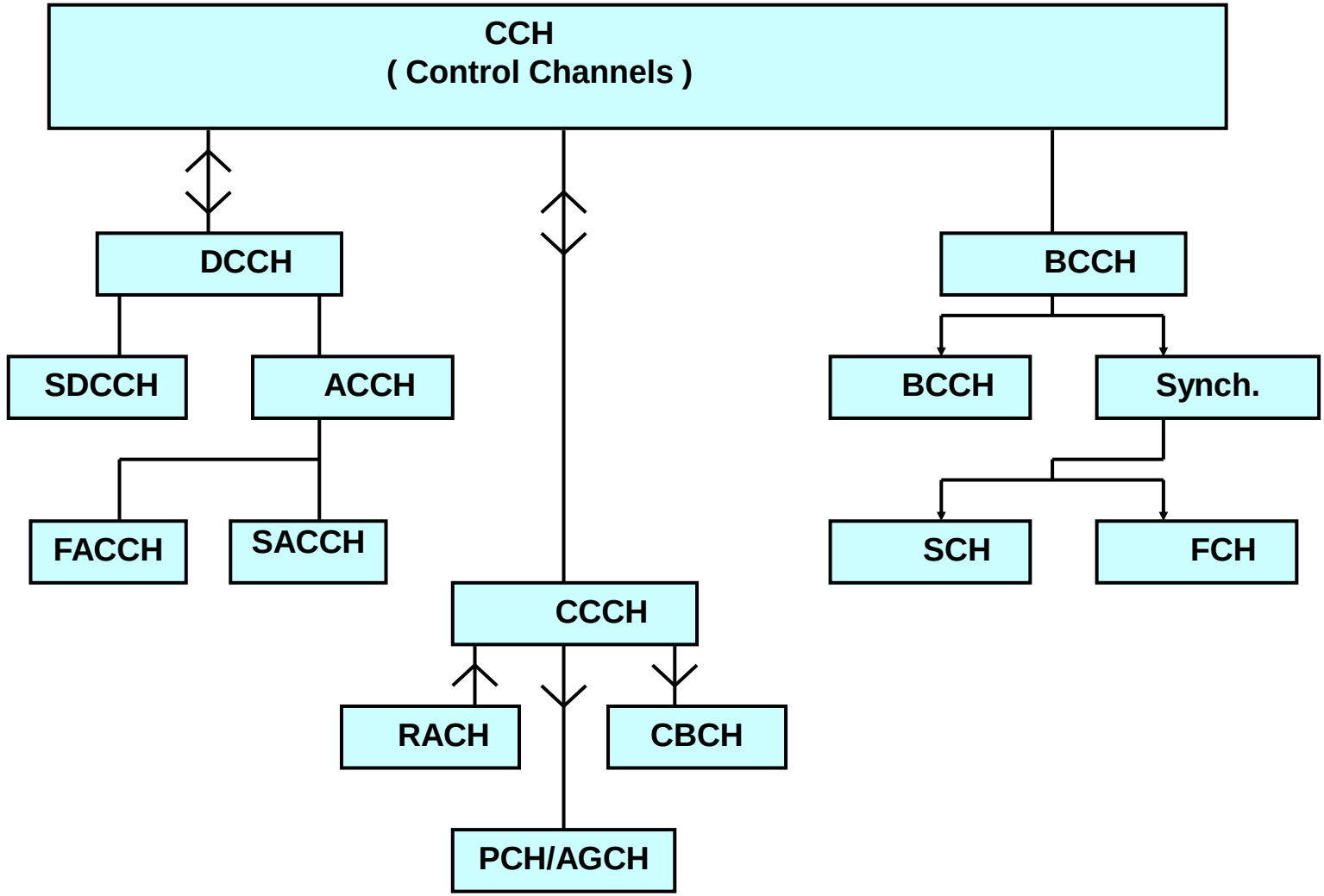
GSM FRAME STRUCTURE



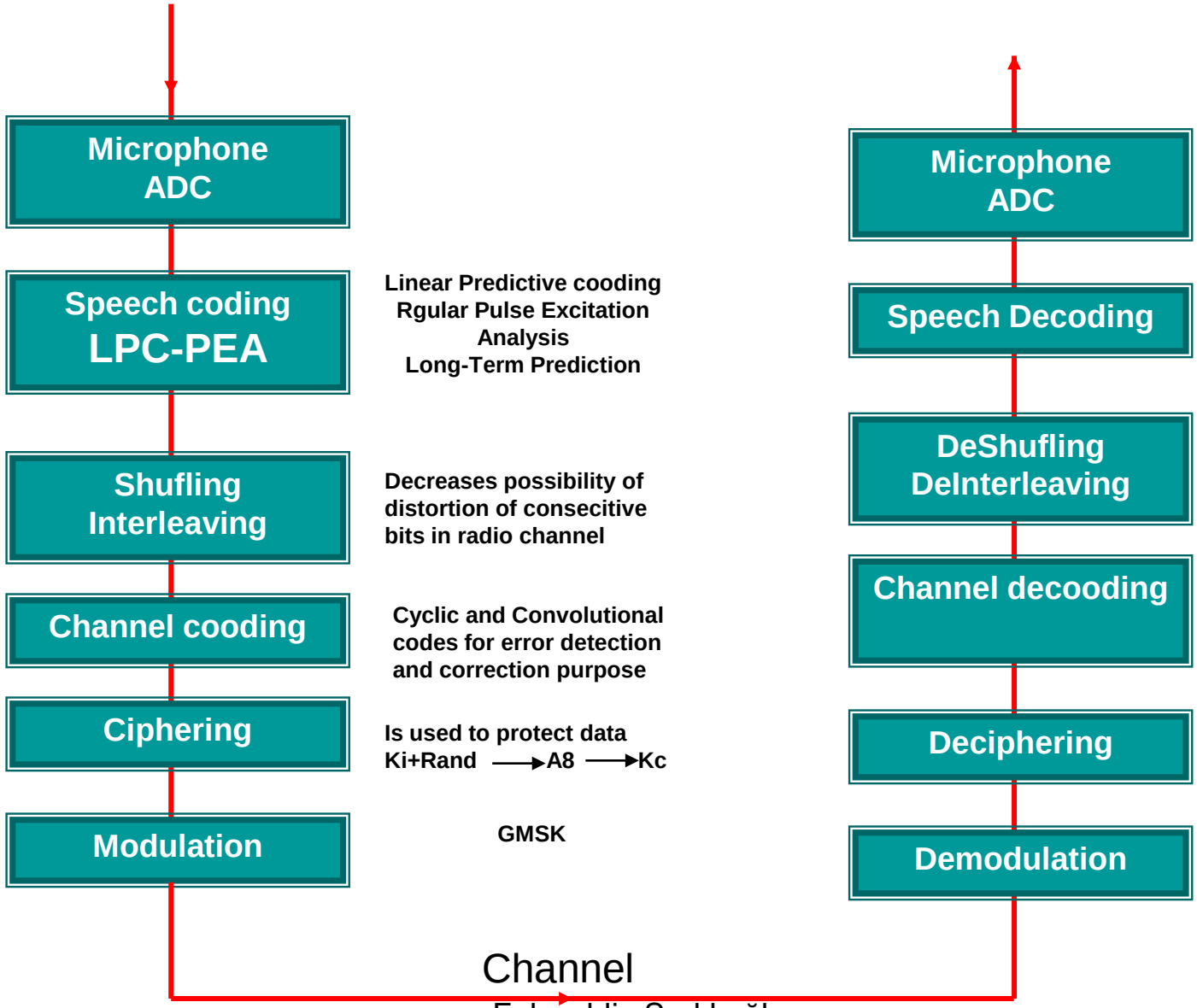
Normal burst



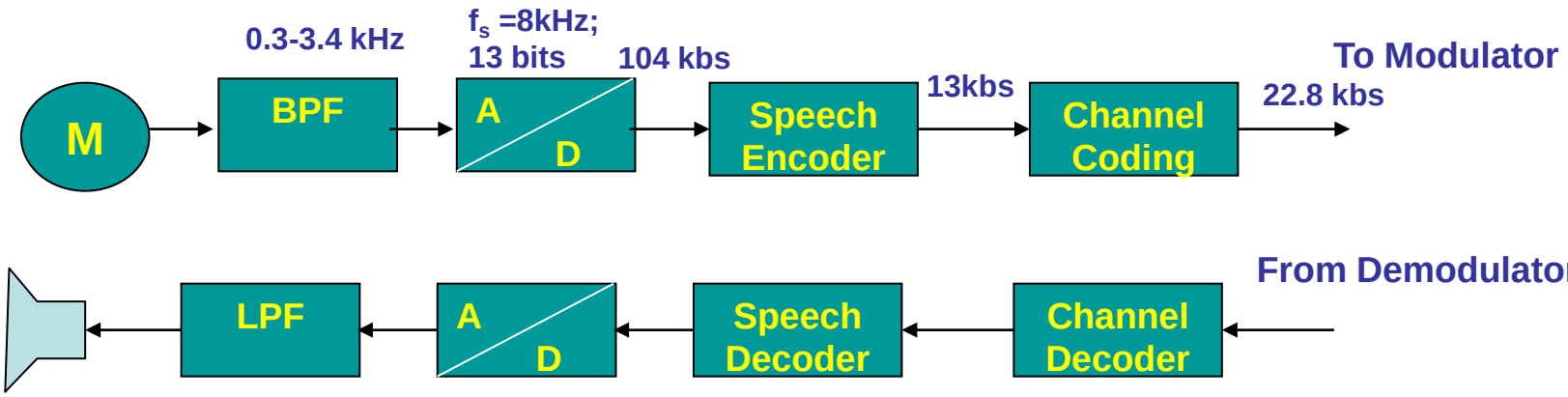
Control Channels



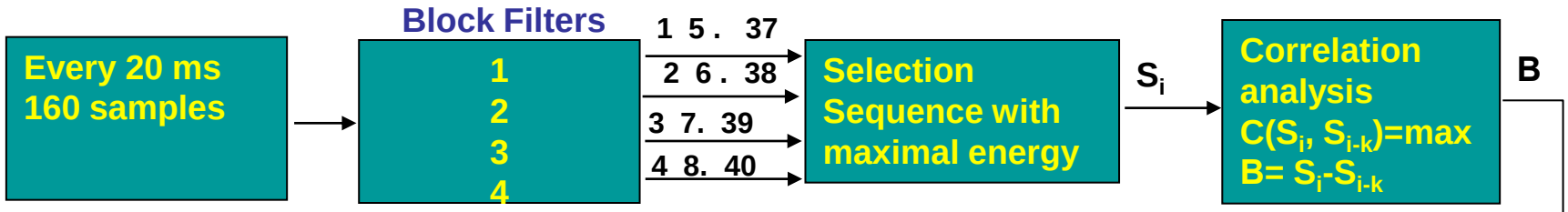
GSM PHYSICAL LAYER



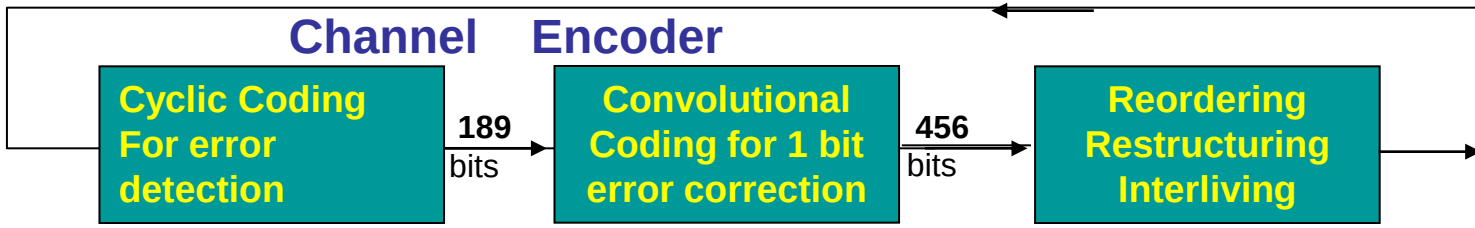
Speech and Channel Coding



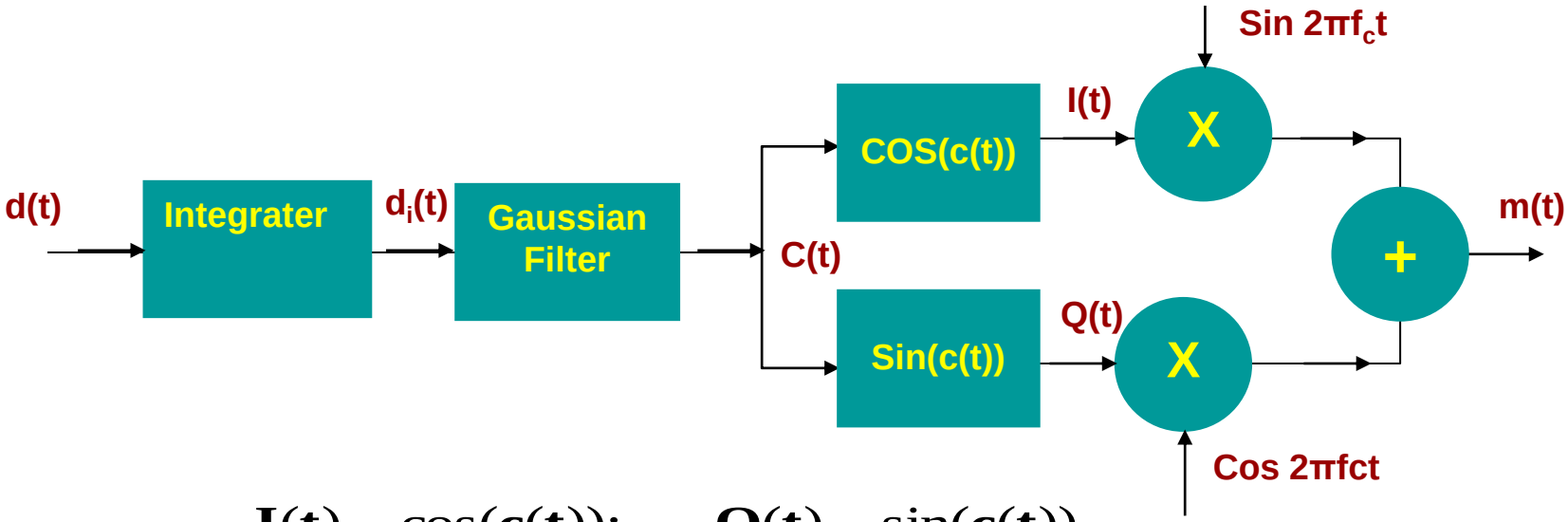
Speech Encoder



Channel Encoder

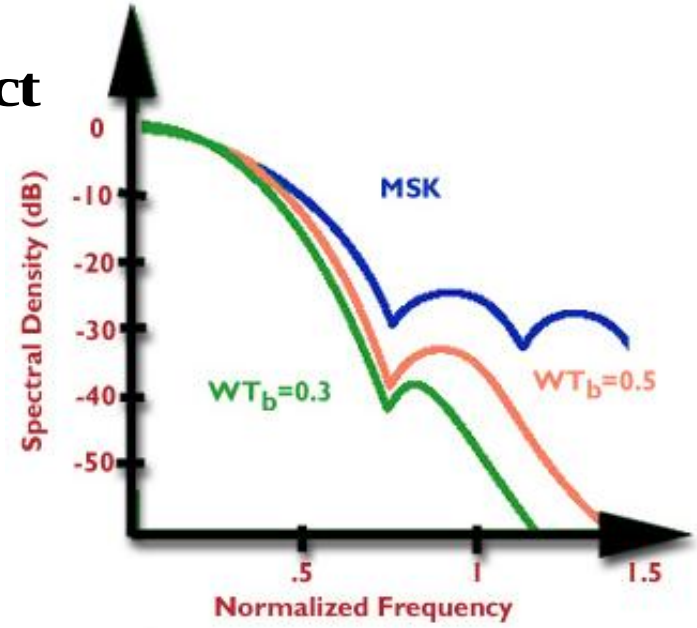


GMSK MODULATION

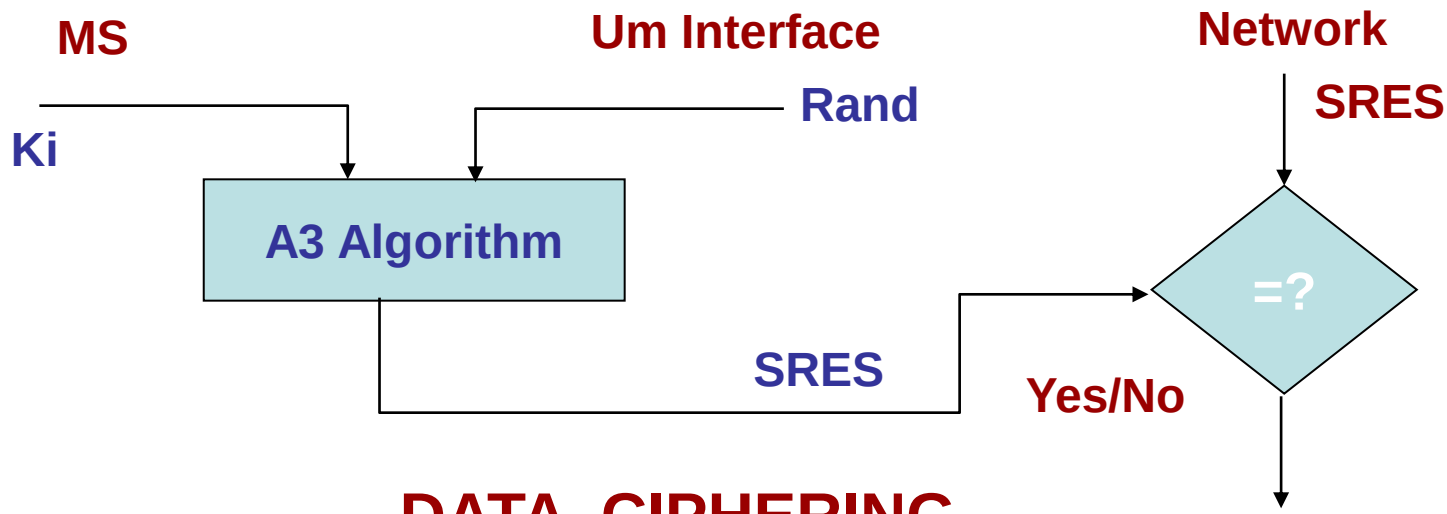


$$\mathbf{I(t)} = \cos(\mathbf{c(t)}); \qquad \mathbf{Q(t)} = \sin(\mathbf{c(t)})$$

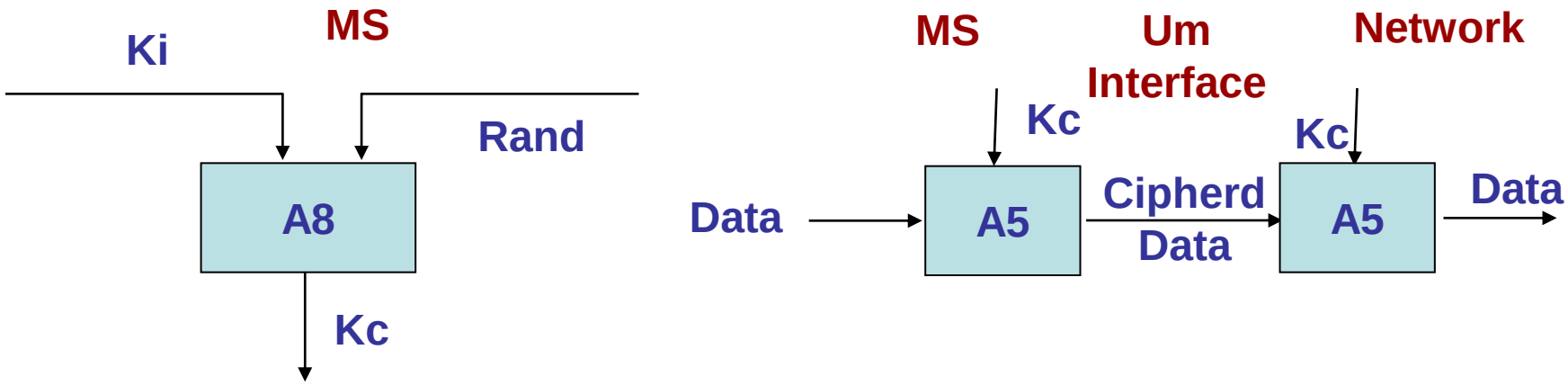
$$\mathbf{m(t)} = \mathbf{I(t)}\sin 2\pi\mathbf{fct} + \mathbf{Q(t)}\cos 2\pi\mathbf{fct}$$



AUTHOINTICATION MS



DATA CIPHERING



Convolutional Coding

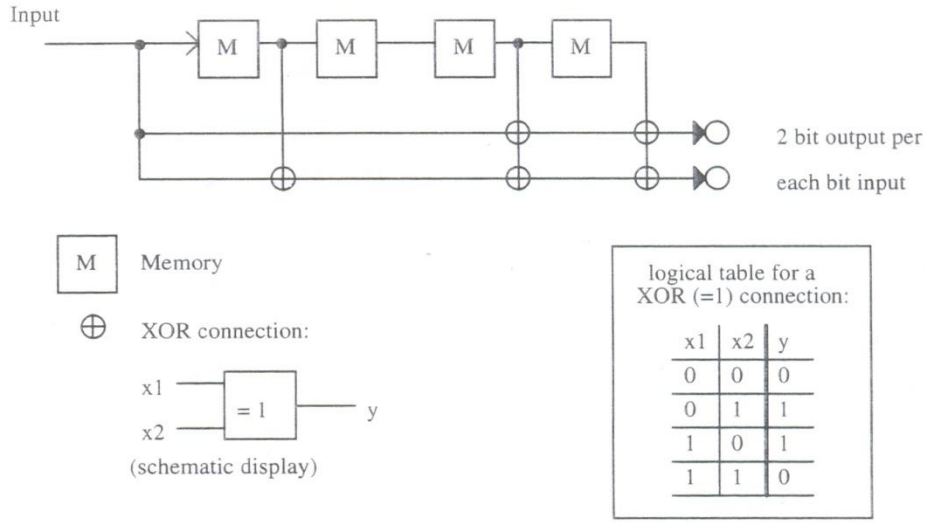


Figure 5.27 Convolutional coding.

Bit stream (input)	1 0 1 1 0 0 0 1 1 0 1 0 1
Adding of four 0 bits (M)	1 0 1 1 0 0 0 1 1 0 1 0 1 **0 0 0 0**
Delay of one bit (M2)	0 1 0 1 1 0 0 0 1 1 0 1 0 1 0 0 0 0
Delay of two bit (M3)	0 0 1 0 1 1 0 0 0 1 1 0 1 0 1 0 0 0 0
Delay of three bit (M4)	0 0 0 1 0 1 1 0 0 0 1 1 0 1 0 1 0 0 0 0
Delay of four bit (M5)	0 0 0 0 1 0 1 1 0 0 0 1 1 0 1 0 1 0 0 0 0
1st stage (M + M4 + M5)	1 0 1 0 1 1 0 0 1 0 0 0 0 1 0 0 0
2nd stage (M + M2 + M4 + M5)	1 1 1 1 0 1 0 0 0 1 0 1 0 0 0 1 1
Output of the convolutional code	11101110011100000110001000010010 1 0

Figure 5.28 Example of a convolutional code.

Functional Sequence of Basic Call Types

Mobile Originated Call (MOC) to the fixed network

Before an MOC begins a location registration and with it an authentication must have taken place.The MS sends the call setup information dialed by the mobile subcriber to the MSC (1). The MSC requests call information from the VLR (mainly about any relevant restictions) concerning the mobile subscriber identified by the IMSI (2). After assigning a traffic channel, the MSC then informs PSTN.

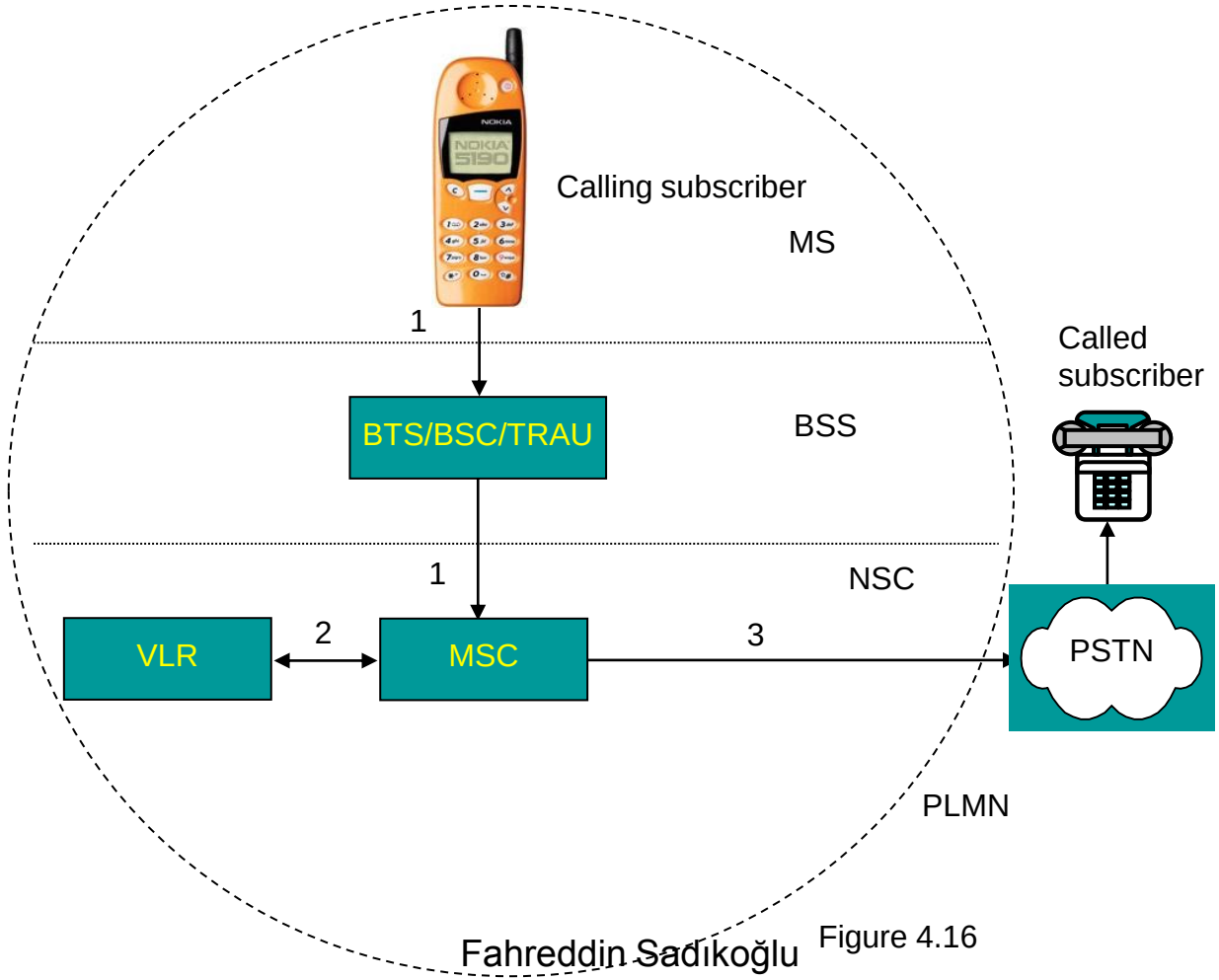
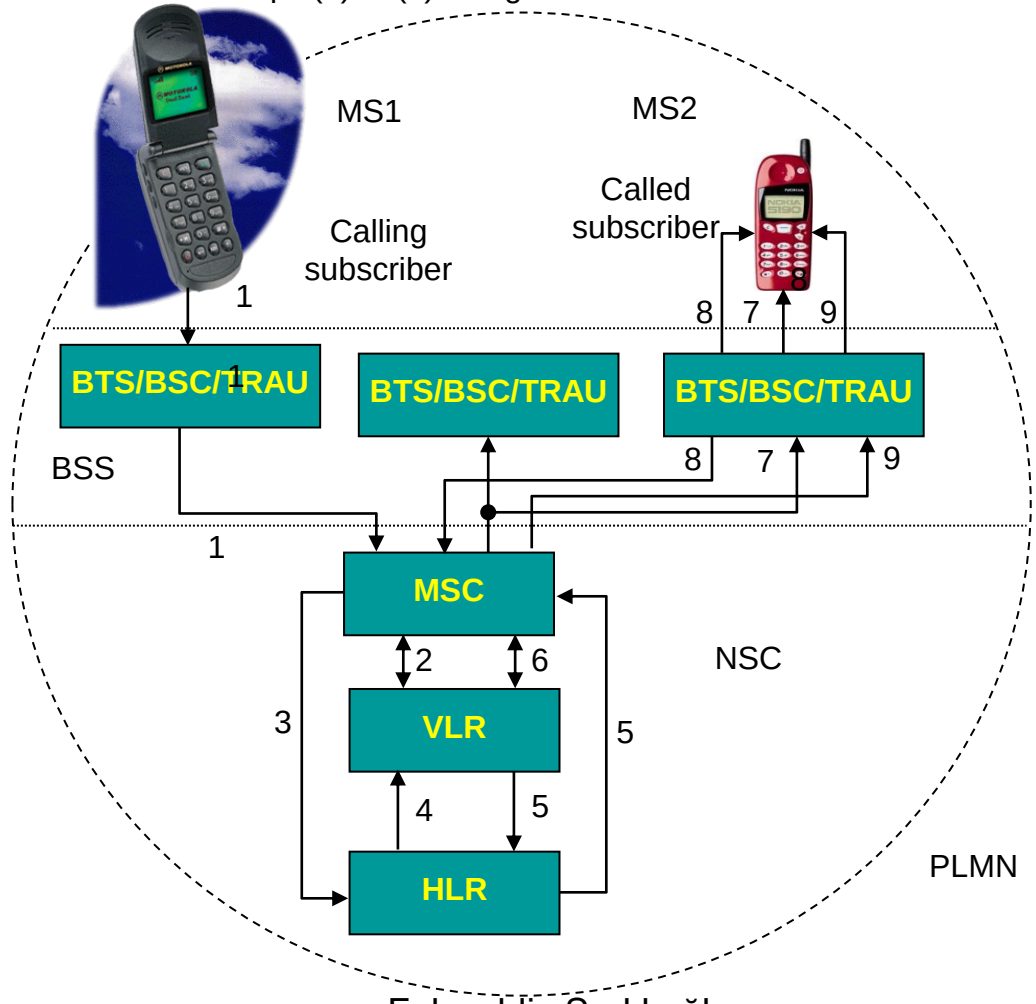


Figure 4.16

Mobile Internal Call (MIC)

The MS1 sends the call setup information dialed by the mobile subscriber (MSISDN) to the MSC (1). The MSC requests informaton about the calling mobile subscriber MS2 from the VLR (2). The MSC uses the dialling information (MSISDN) to establish the HLR and sets up signalling connection to it (3). The HLR sends a request to the VLR in whose area the called mobile subscriber MS2 is currently roaming (4). The VLR sends the requested MSRN back to the HLR. The HLR forwards the MSRN to the MSC (5). Steps (6) to (9) are the same as steps (6) to (9) in Figure 7.17.



Mobile Terminating Call (MTC) From The Fixed Network

A call for mobile subscriber arrives at the GMSC (1). The GMSC uses the dialing information (MSISDN) to es tablish the HLR and sets up a signaling connection to it (2). The HLR sends a requested VLR in whose area the called subscriber is currently roaming (3). The VLR sends the requested MSRN back to the HLR. The HLR forwards the MSRN to the GMSC (4). On the basis of the MSRN the GMSC sets up the connection request to the MSC, i.e. the MSC in whose area the mobile subcriber is roaming at this point in time (5).

As the MSC does not know the mobile subscriber up to this point, the MSC requests the mobile subscriber information for the call setup from ıts VLR (6). The MS is now called by means of paging to all BTS/BSCs in the locatıon area, as the radio cell in which the MS is located is not known to the MSC (7). If there is a response to the paging, this information is transmitted to the MSC (8). Finally the connection to the MS is set up (9).

Figure7.17 shows the call sequence of an MTC .