MOTOROLA

Chapter 4

GSM Terrestrial Interfaces

GSM Terrestrial Interfaces

Section Objectives

On completion of this course the student will be able to:

- Identify the protocols used on the terrestrial interfaces between the GSM system entities.

Introduction

The *terrestrial interfaces* comprise all the connections between the GSM system entities, apart from the Um, or air interface.

They are represented on the diagram opposite by the lines that connect the various entities together.

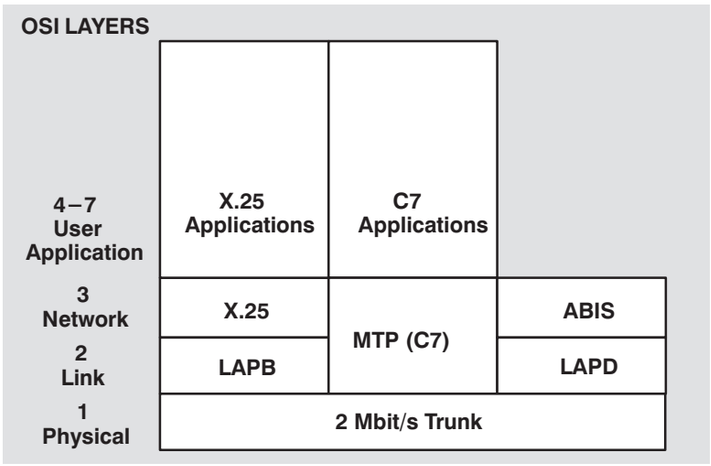
The GSM terrestrial interfaces and message-transport mediums all conform to ITU-TSS specifications widely used throughout the world. As we stated previously, it is from this use of standardized interfaces that the flexibility of GSM largely derives.

The terrestrial interfaces transport the traffic across the system and allow the passage of the thousands of data messages necessary to make the system function. They transport the data for software downloads and uploads, the collection of statistical information and the implementation of operations and maintenance commands**.**

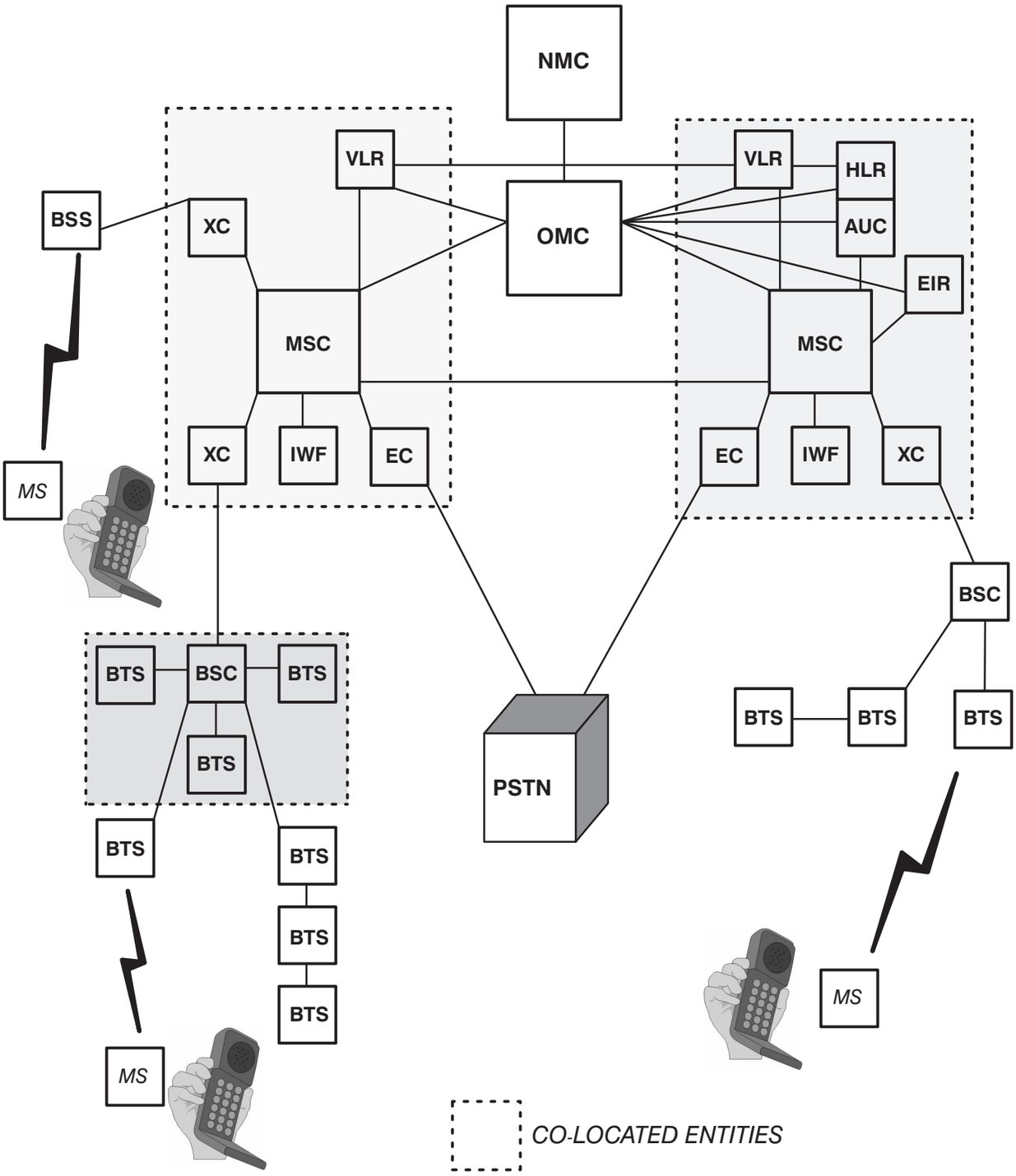
The standard interfaces used are as follows:

- 2 Mbit/s.
- Signalling System ITU-TSS #7 (“C7” or ‘‘SS#7”).
- X.25 (packet switched data); (LAPB).
- A bis using the LAPD protocol (Link Access Procedure “D”).

Whatever the interfaces and whatever their function, they will often share a common physical bearer (cable) between two points, for example, the MSC and a BSS.



The GSM System



2 Mbit/s Trunk 30-channel PCM

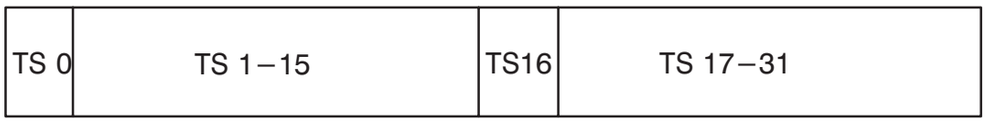
This diagram opposite shows the logical GSM system with the 2 Mbit/s interfaces highlighted. They carry traffic from the PSTN to the MSC, between MSCs, from an MSC to a BSC and from a BSC to remotely sited BTSs. These links are also used between the MSC and IWF.

Each 2.048 Mbit/s link provides thirty 64 kbit/s channels available to carry speech, data, or control information.

The control information may contain C7, LAPD or X.25 formatted information.

These 2 Mbit/s links commonly act as the physical bearer for the interfaces used between the GSM system entities.

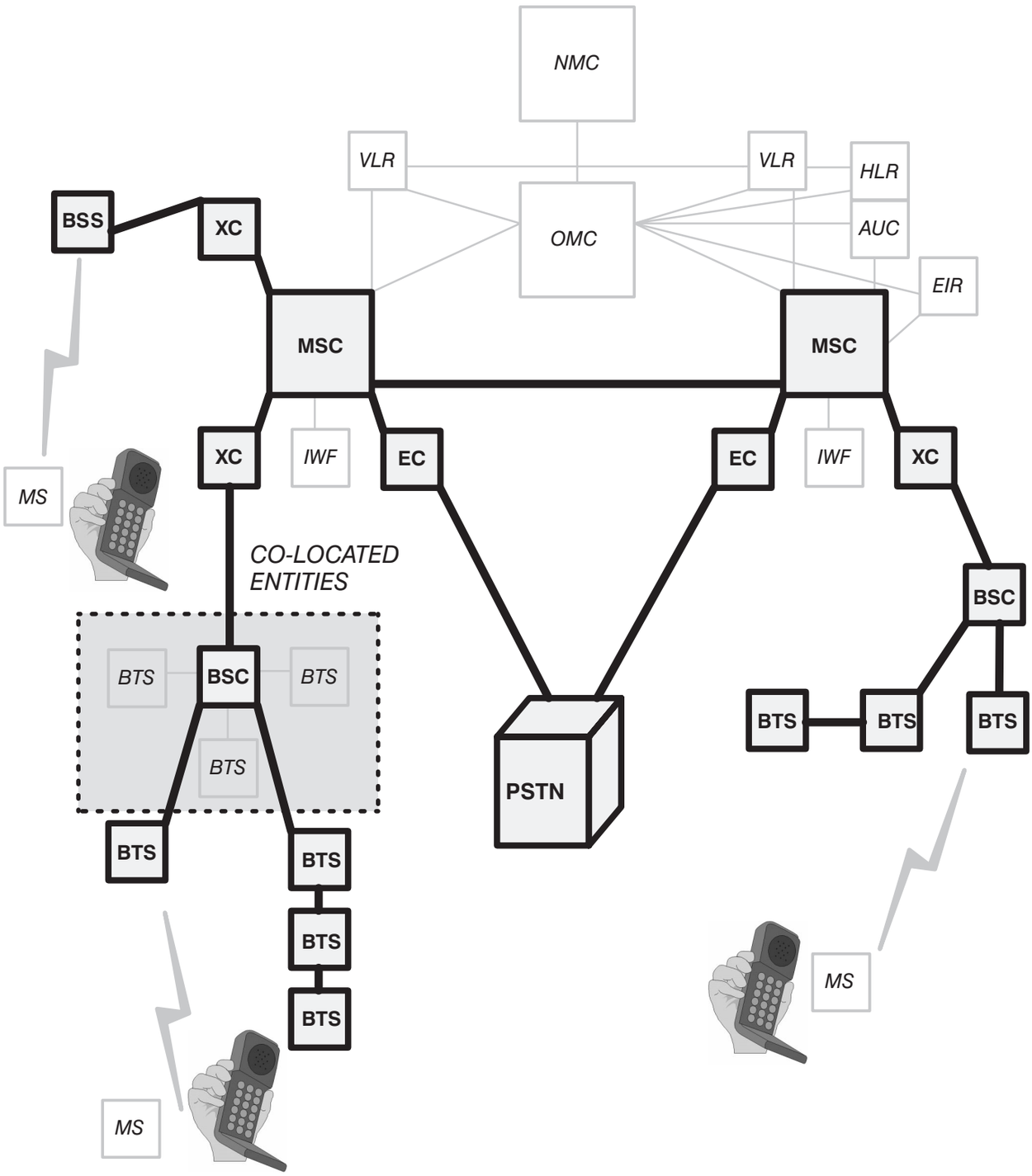
Typical Configuration



TS#	Used for
0	Frame Alignment/ Error Checking/ Signalling/ Alarms
1–15	Traffic
16	Signalling (other TS may also be used)
17–31	Traffic

TS = Timeslot

2 Mbit/s Trunks

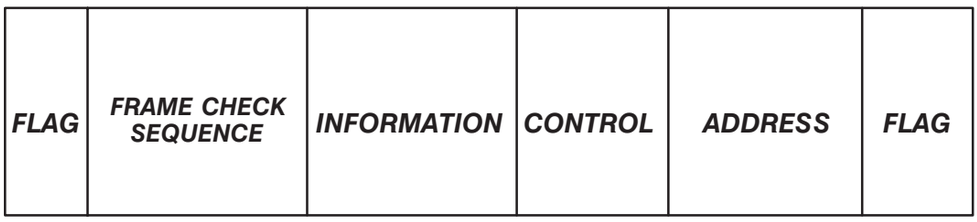


X.25 Interfaces

The diagram opposite shows the X.25 packet data connections of the system.

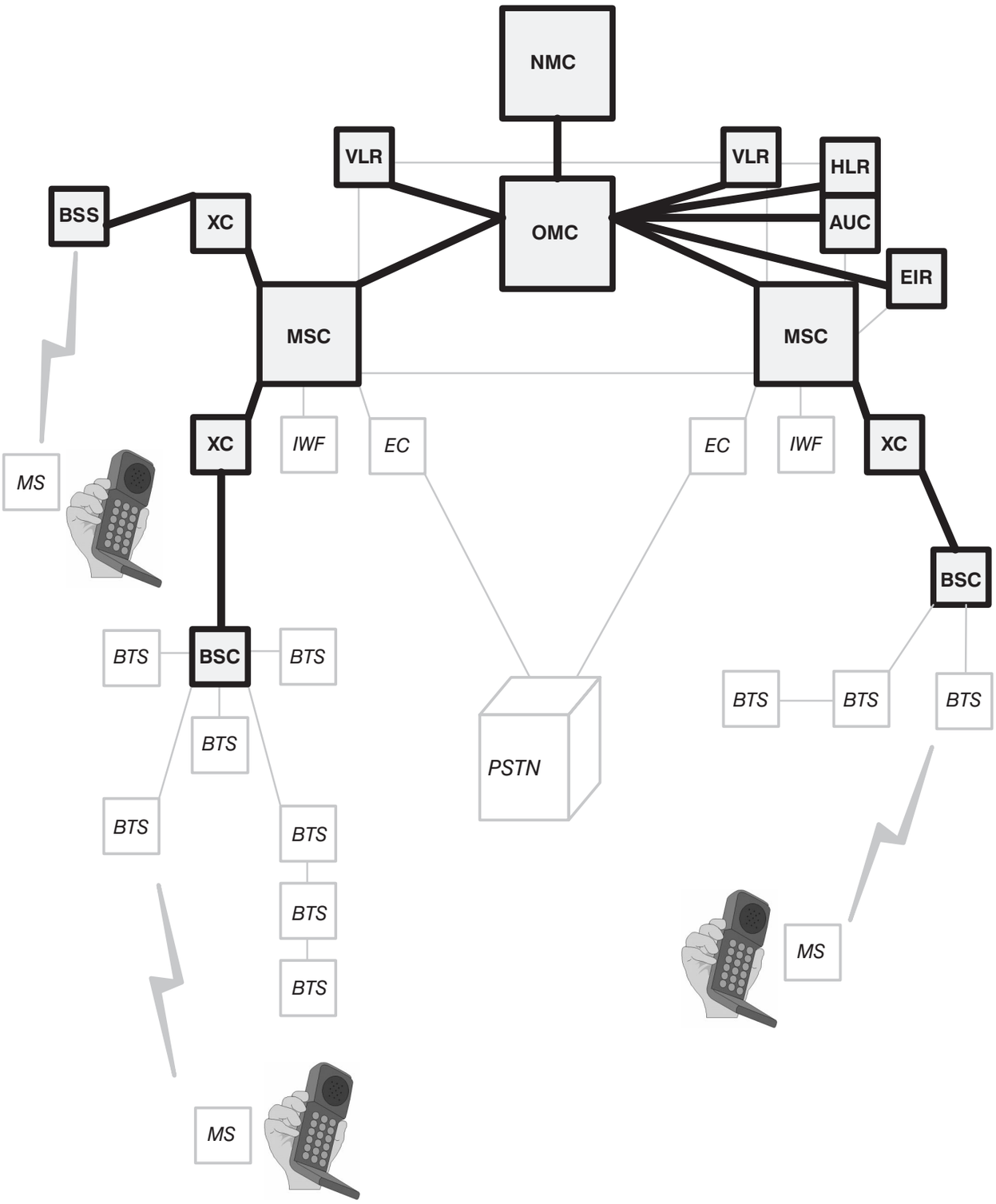
The X.25 packets provide the OMC with communications to all the entities over which it has control and oversight. Remember that these X.25 connections will commonly be contained within 2 Mbit/s links using a dedicated timeslot.

Note that the X.25 connection from the OMC to the BSS may be “nailed through” (or permanently connected by software) at the MSC, or may be supported by a completely independent physical route.



last bit **(LAPB FRAME)** first bit

X.25 Interfaces



ITU-TS Signalling System #7

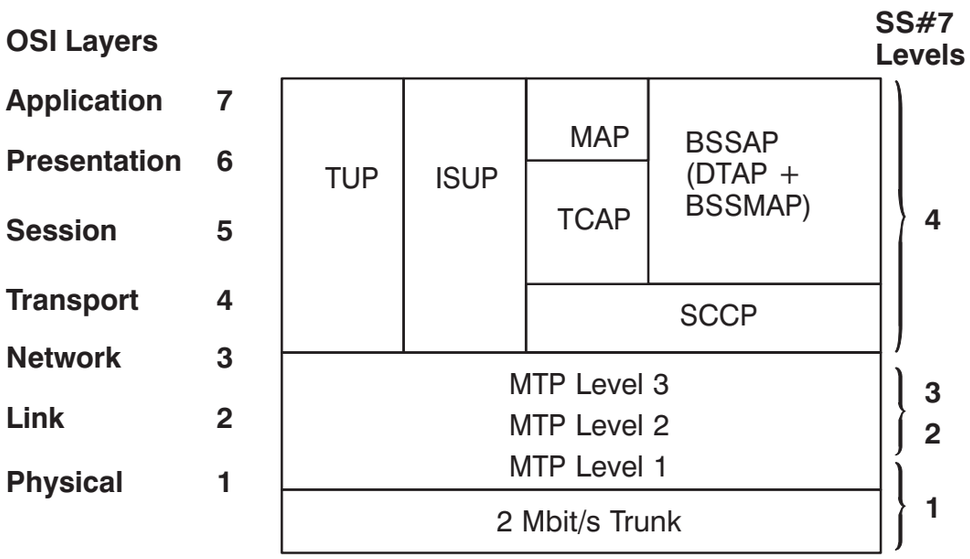
The diagram opposite illustrates the use of C7 in the GSM system; carrying signalling and control information between most major entities, and to and from the PSTN.

The following message protocols, which are part of C7, are used to communicate between the different GSM network entities:

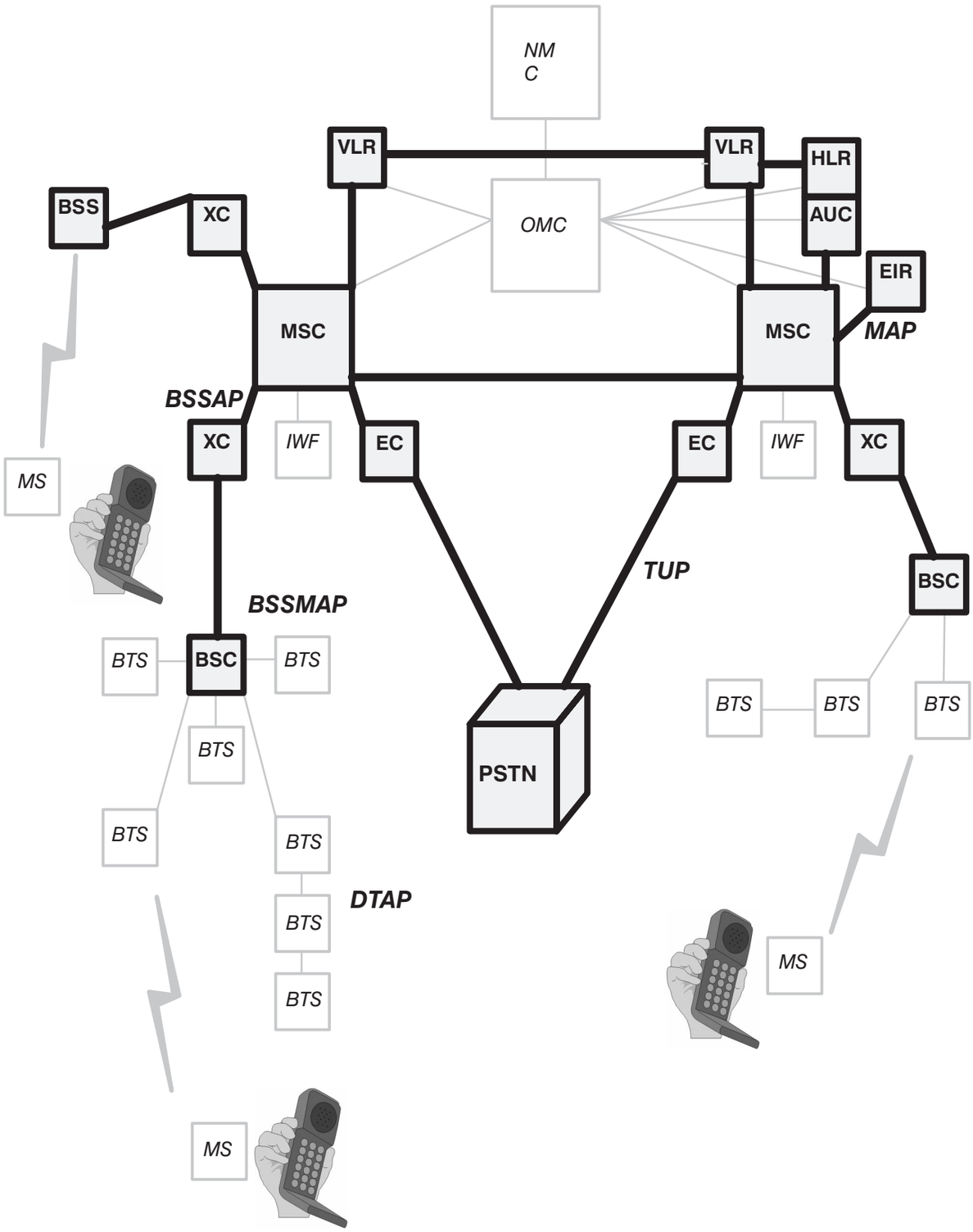
- Interfacing the PSTN, the MSC performs call signalling functions using the Telephone User Part (TUP)**,** or interfacing the ISDN, the ISDN User Part (ISUP).
- Between the MSC and the BSC, the Base Station System Management Application Part (BSSMAP) is used. The Direct Transfer Application Part (DTAP) is used to send messages between the MSC and the mobile (MS). MAP is used between the MSC and the VLR, EIR, and HLR.

Acronyms:

BSSAP	Base Station System Application Part
BSSMAP	Base Station System Management Application Part
DTAP	Direct Transfer Application Part
ISUP	ISDN User Part
MAP	Mobile Application Part
SCCP	Signalling Connection Control Part
TUP	Telephone User Part
TCAP	Transaction Capabilities Application Part



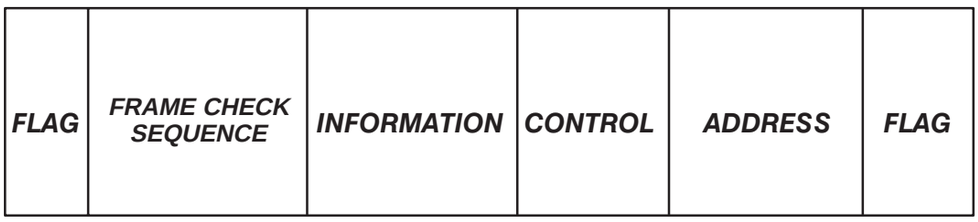
C7 Interfaces



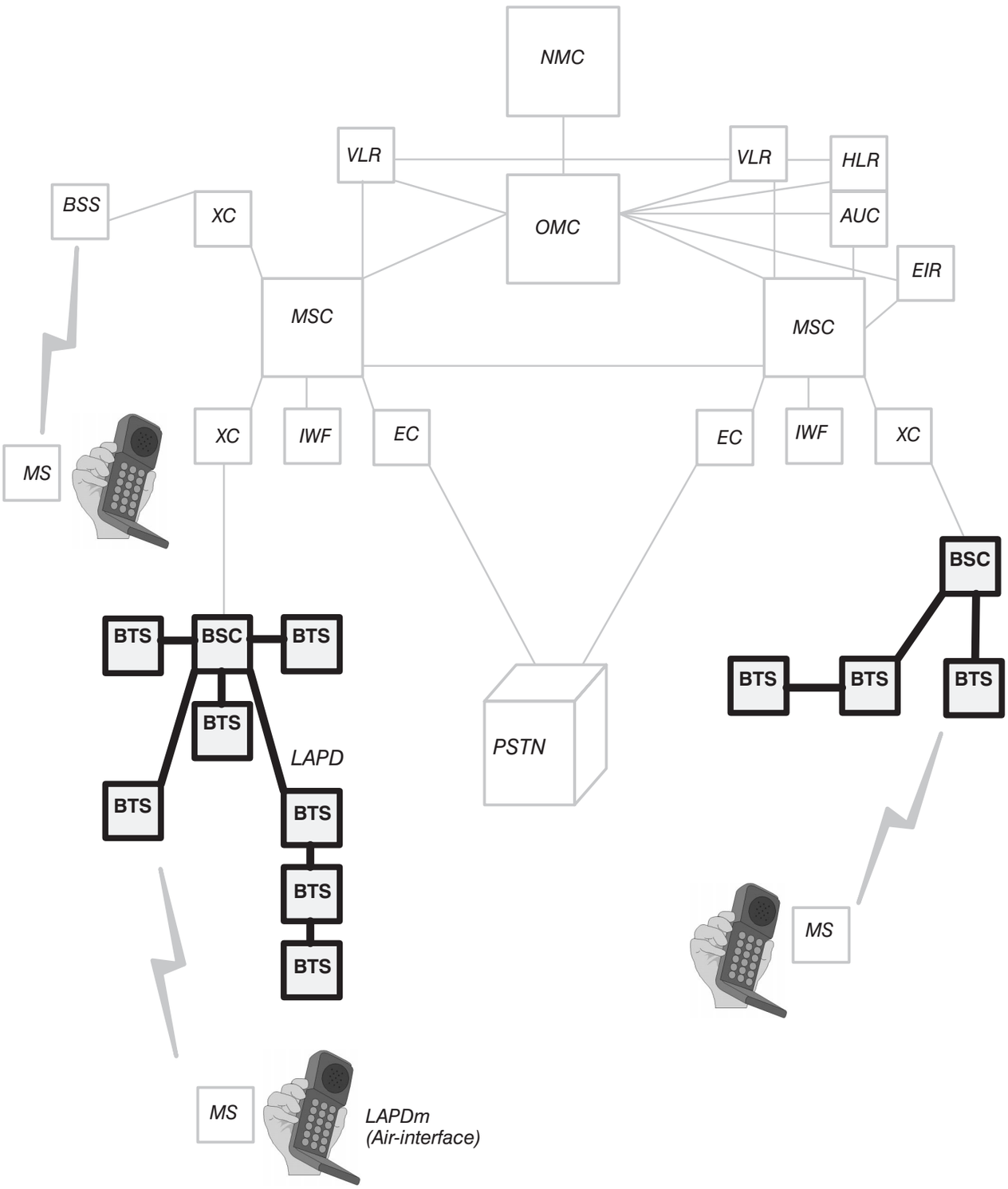
A-bis (LAPD) Interfaces

Because of the specific nature of the signalling and control information passing over the 2 Mbit/s links between the BSC and remotely sited BTS, a different type of interface is required. GSM has specified the use of LAPD. This protocol uses the standard frame structure shown below.

The GSM specifications for this interface (termed “A-bis”) are not very specific and therefore interpretations of the interface vary. This means that one manufacturers BTS will not work with another manufacturer’s BSC. As we have already mentioned, the functionality split between the BTS and BSC is also largely in the hands of the manufacturer and therefore it is unlikely that they would operate together, even if this interface were rigidly enforced by the specifications.



A-bis (LAPD) Interfaces



Interconnections

The interface between the BSC and the MSC is a standardized ITU-TSS signalling system N^{o}7 (C7) interface, referred to as the A interface.

The interface supports the following connections:

- BSC–MSC, BSC–BTS and MSC–MS.
- Operation and Maintenance interface.
- All call processing functions.

These interfaces are commonly transported on a physical bearer, the 2 Mbit/s link.

Each of these 2 Mbit/s links provide 32 x 64 kbit/s channels (timeslots), the first channel (TS0) is used for frame alignment, leaving 31 channels available for carry “traffic channels” or “signalling interfaces”.

The signalling protocols used between GSM networks are:

- X.25 (LAPB), 1 x 64 kbit/s timeslot.
- C7 (SS7), 1 x 64 kbit/s timeslot (BSSAP, MAP, TCAP, SCCP, MTP).
- LAPD, 1 x 64 kbit/s timeslot.

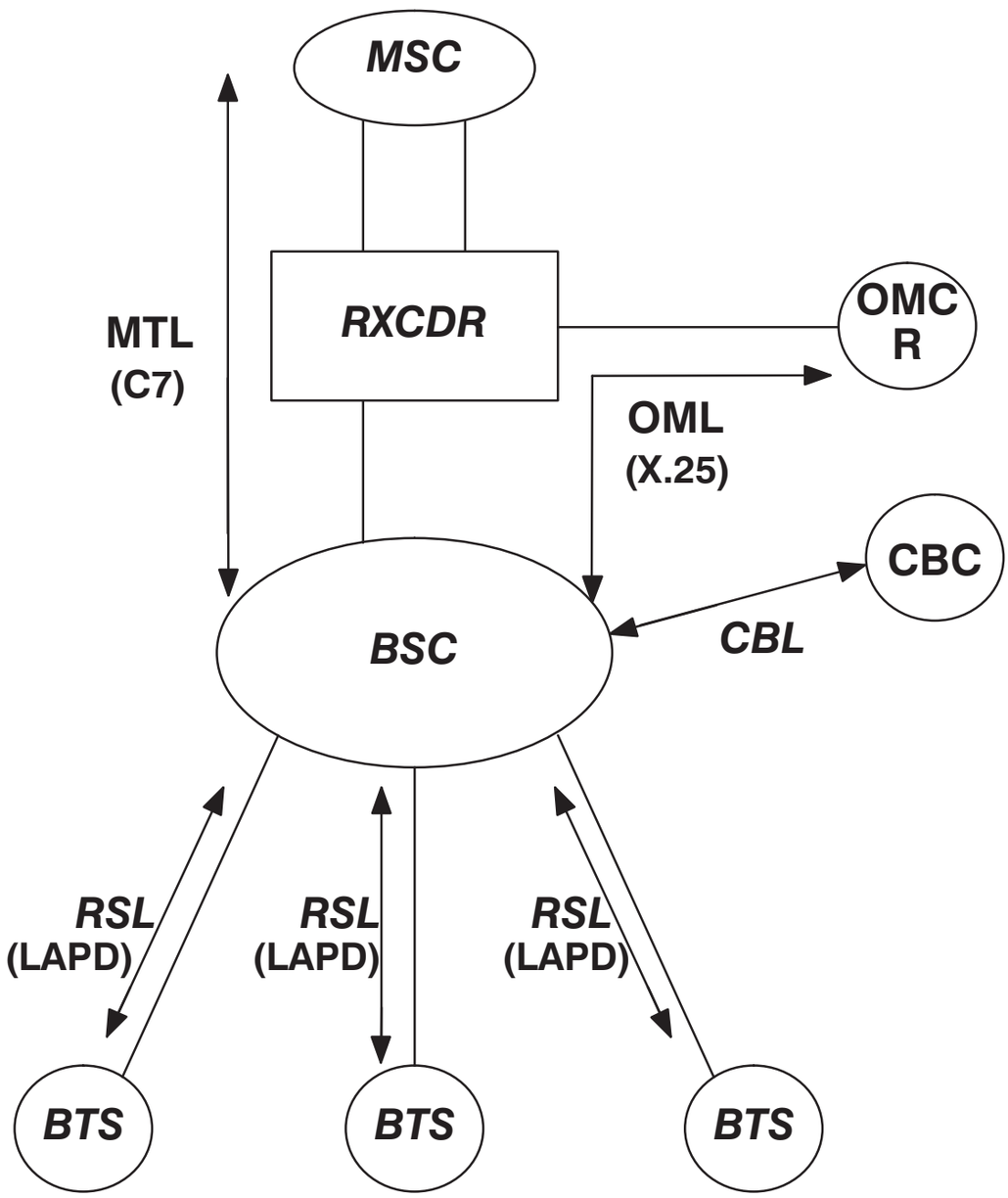
The X.25 protocol is used between the BSC–OMC.

The C7 link is between the BSC–MSC, dependent on what type of signalling is required will depend on which part of the C7 protocol will be used (for example, MSC–MS will use a subset of BSSAP called DTAP to transfer messages).

The LAPD protocol is used between the BSC–BTS, this is normally 64 kbit/s as stated but some manufactures offer 16 kbit/s links as well.

The link between the BSC–CBC does not use a specified protocol. The choice of protocol is decided between the PLMN provider and the CBC provider. (Typically X.25 or C7 may be used.)

BSC Connections



Interface Names

Each interface specified within the GSM system has a name associated with it. The diagram opposite illustrates the names of all the interfaces specified by GSM.

Name	Interface
Um	MS ⇔ BTS
A-bis	BTS ⇔ BSC
A	BSC ⇔ MSC
B	MSC ⇔ VLR
C	MSC ⇔ HLR
D	VLR ⇔ HLR
E	MSC ⇔ MSC
F	MSC ⇔ EIR
G	VLR ⇔ VLR
H	HLR ⇔ AUC

The GSM System Interface Names