Appendix A

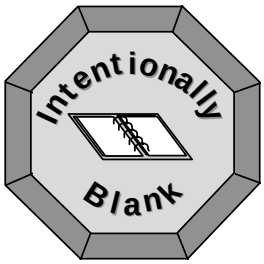
ID-numbers

This chapter is designed to provide the student with an overview of the identity numbers used in the network. It addresses identity number components, their functions, features, and required specifications.

OBJECTIVES:

Upon completion of this chapter the student will be able to:

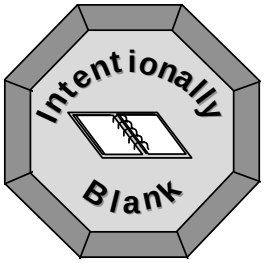
- describe the structure of the identity numbers used in the network
- describe when, why and how different identity numbers are used


Intentionally
Blank

Appendix A

Table of Contents

Topic **Page**


Intentionally
Blank

GSM IDENTITIES

To switch a call to a mobile subscriber, the right identities need to be involved. It is therefore important to address them correctly. The numbers used to identify the identities in a GSM network are described in this chapter.

Numbering plans are used to identify different networks. For a telephone number in the PSTN/ISDN network, numbering plan E.164 is used.

MOBILE STATION ISDN NUMBER (MSISDN)

The MSISDN is a number which uniquely identifies a mobile telephone subscription in the public switched telephone network numbering plan. These are the digits dialed when calling a mobile subscriber.

GSM 900/GSM 1800

In GSM 900/GSM 1800, the MSISDN consists of the following:

MSISDN = CC + NDC + SN

CC = Country Code

NDC = National Destination Code

SN = Subscriber Number

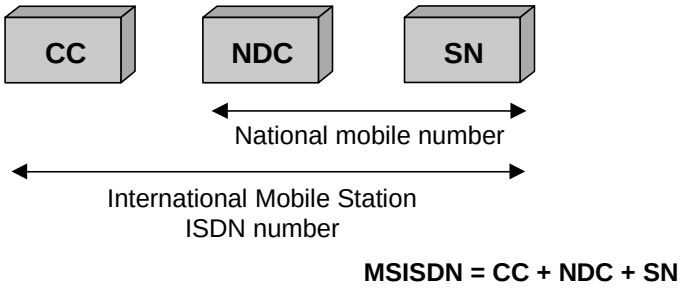


Figure A-1 MSISDN (GSM 900/GSM 1800).

A NDC is allocated to each PLMN. In some countries, more than one NDC may be required for each PLMN.

The international MSISDN number may be of variable length. The maximum length is 15 digits, prefixes not included.

Example:

A German PSTN subscriber calls a Swedish GSM PLMN subscriber:

Table A-1.

International prefix in Germany	Country Code	National Destination Code	Subscriber Number
00	46	705	86 06 73

The digits ‘705’ define the two or three digits, which identify the GSM 900/GSM 1800 PLMN area code.

The digits ‘860673’ define the six digits, which identify the mobile subscriber.

GSM 1900

In GSM 1900, the MSISDN consists of the following:

MSISDN = CC + NPA + SN

CC = Country Code

NPA = Number Planning Area

SN = Subscriber Number

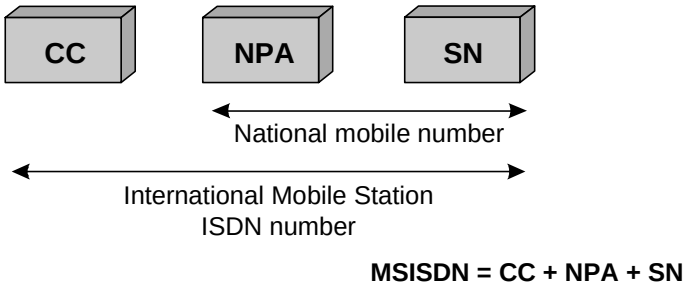


Figure A-2 MSISDN (GSM 1900).

The NPA is allocated to each GSM 1900 PLMN. The length of MSISDN depends on the structure and operating plan of each operator. The maximum length is 15 digits, prefixes not included.

INTERNATIONAL MOBILE SUBSCRIBER IDENTITY (IMSI)

The IMSI is a unique identity allocated to each subscriber to allow correct identification over the radio path and through the network and is used for all signaling in the PLMN. All network-related subscriber information is connected to the IMSI. The IMSI is stored in the SIM, as well as in the HLR and in the serving VLR.

The IMSI consists of three different parts:

IMSI = MCC + MNC + MSIN

MCC = Mobile Country Code

MNC = Mobile Network Code

MSIN = Mobile Station Identification Number

According to the GSM specifications, IMSI has a maximum length of 15 digits.

MNC expansion

In order to make it possible to define more than 100 operators under one MCC, the MNC is extended from two to three decimal digits in Ericsson's GSM system. The MNC parameter is also used in the Cell Global Identity and in the Location Area Identity.

In order to maintain backward compatibility and to allow the Ericsson BSS to be connected to equipment from other vendors, the Ericsson implementation has the possibility to switch from two to three MNC digits on both the air interface and the A-interface. A changeable exchange property is used to decide if the third digit is used.

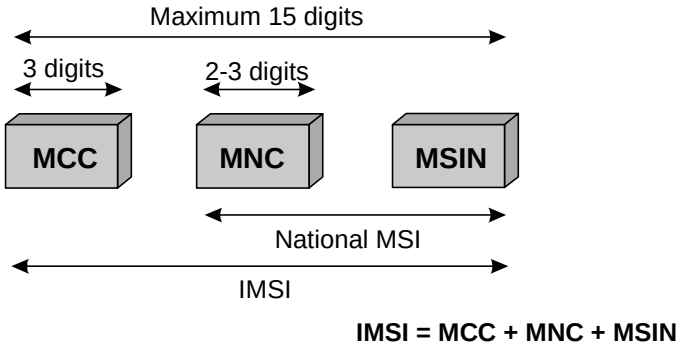


Figure A-3 IMSI.

TEMPORARY MOBILE SUBSCRIBER IDENTITY (TMSI)

The TMSI is a temporary number used instead of IMSI to identify a MS. The TMSI is used for the subscriber's confidentiality on the air interface. The TMSI has only local significance (that is, within the MSC/VLR area) and is changed at certain events or time intervals. The TMSI structure can be chosen by each operator but should not consist of more than four octets (8 digits).

INTERNATIONAL MOBILE EQUIPMENT IDENTITY (IMEI)

The IMEI is used for equipment identification and uniquely identifies a MS as a piece or assembly of equipment.

The IMEI consists of the following:

IMEI = TAC + FAC + SNR + spare

TAC = Type Approval Code, determined by a central GSM body.

FAC = Final Assembly Code, identifies the manufacturer.

SNR = Serial Number, an individual serial number of six digits uniquely identifies all equipment within each TAC and FAC.

spare = A spare bit for future use. When transmitted by the MS this digit should always be zero.

IMEI has the total length of 15 digits.

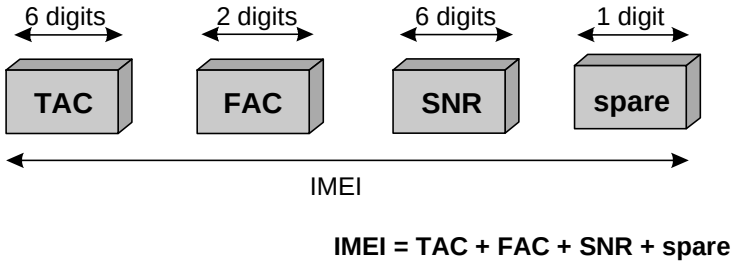


Figure A-4 IMEI.

INTERNATIONAL MOBILE EQUIPMENT IDENTITY AND SOFTWARE VERSION NUMBER (IMEISV)

The IMEISV consists of the following:

IMEISV = TAC + FAC + SNR + SVN

TAC = Type Approval Code, determined by a central GSM body.

FAC = Final Assembly Code, identifies the manufacturer.

SNR = Serial Number, an individual serial number of six digits uniquely identifies all equipment within each TAC and FAC.

SVN = Software Version Number, allows the mobile equipment manufacturer to identify different software versions of a given type approved mobile. SVN value 99 is reserved for future use.

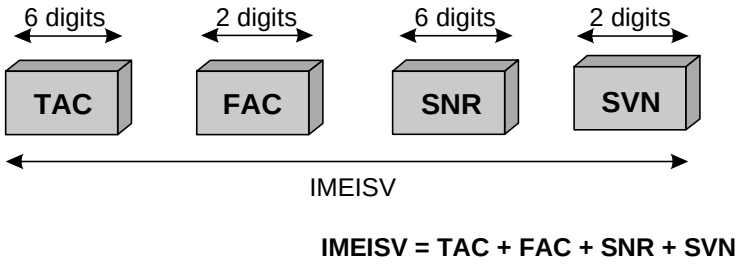


Figure A-5 IMEISV.

MOBILE STATION ROAMING NUMBER (MSRN)

A MSRN is used during the call setup phase for mobile terminating calls. Each mobile terminating call enters the GMSC in the PLMN. The call is then re-routed by the GMSC, to the MSC where the called mobile subscriber is located. For this purpose, a unique number (MSRN) is allocated by the MSC and provided to the GMSC. The MSRN is seized for the call setup phase only and released immediately afterwards. The call setup takes place in the following way:

1. GMSC receives a signaling message "Initial Address Message" for the incoming call (MSISDN).
2. GMSC sends a signaling message "Send Routing Information" to the HLR where the subscriber data is stored (MSISDN).
3. HLR uses MSISDN to find the subscriber data in the database. The Supplementary Service (Call forward unconditional not active) is verified. The VLR address that corresponds to the subscriber location and the IMSI are retrieved. HLR sends a signaling message "Provide Roaming Number" using the VLR address as the destination (IMSI).
4. VLR having received the message, requests MSC to seize an idle MSRN and to associate it with the IMSI received. VLR sends back the result to the HLR (MSRN).
5. HLR sends back the result to the GMSC (MSRN).
6. GMSC uses MSRN to re-route the call to the MSC. MSC receives a signaling message "Initial Address Message" for the incoming call (MSRN). MSC performs digit analysis on the received MSRN. The result is "Mobile terminating". The MSC finds the association between the MSRN and the IMSI. The MSRN is released and the IMSI is used for the final establishment of the call.

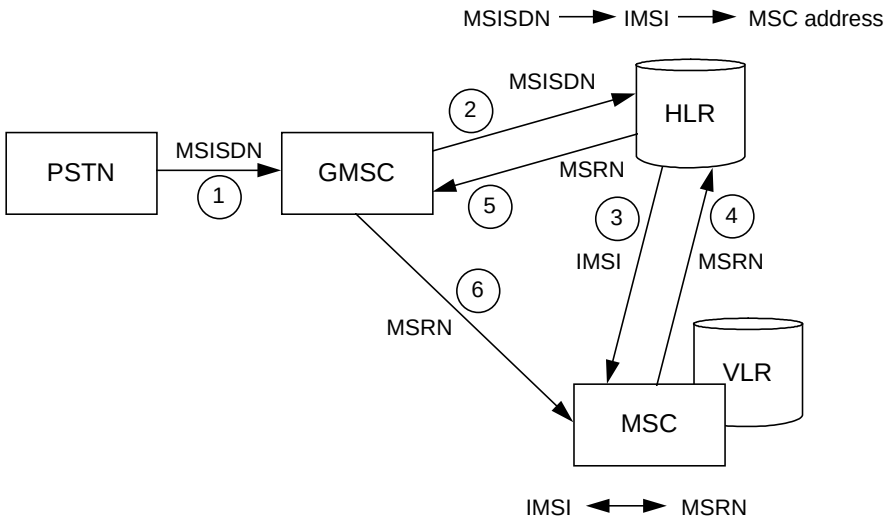


Figure A-6 The use of MSRN.

The interrogation call routing function (request for a MSRN) is a part of the Mobile Application Part (MAP). All data exchanged between the GMSC-HLR-MSC/VLR for the purpose of interrogation is sent over the signaling network.

The Mobile Station Roaming Number (MSRN) consists of three parts:

MSRN = CC + NDC + SN

CC = Country Code

NDC = National Destination Code

SN = Subscriber Number

NOTE: In this case, SN is the address to the serving MSC.

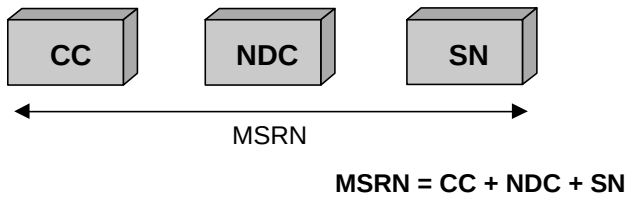


Figure A-7 MSRN.

LOCATION AREA IDENTITY (LAI)

The LAI is used for paging, to indicate to the MSC in which Location Area (LA) the MS is currently situated and also for location updating of mobile subscribers.

The LAI contains the following:

LAI = MCC + MNC + LAC

MCC = Mobile Country Code , same as IMSI MCC

MNC = Mobile Network Code, same as IMSI MNC

LAC = Location Area Code, the maximum length of LAC is 16 bits, enabling 65,536 different location areas to be defined in one PLMN.

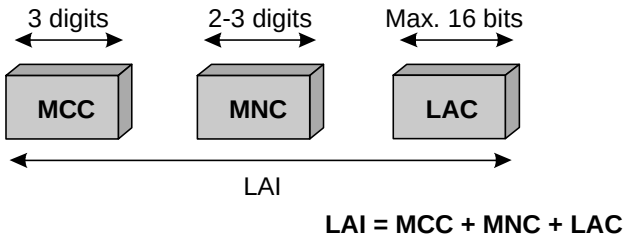


Figure A-8 LAI.

CELL GLOBAL IDENTITY (CGI)

The CGI is used for cell identification within a location area. This is done by adding a Cell Identity (CI) to the components of a LAI. CI has a maximum length of 16 bits.

CGI consists of:

CGI = MCC + MNC + LAC + CI

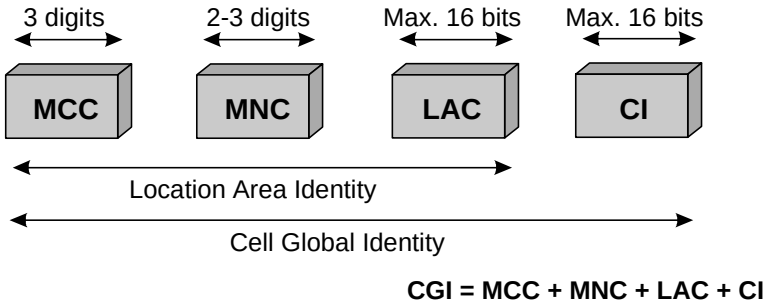


Figure A-9 CGI.

BASE STATION IDENTITY CODE (BSIC)

BSIC allows a mobile station to distinguish between different neighboring base stations.

BSIC consists of:

BSIC = NCC + BCC

NCC = Network Color Code (3 bits), identifies the PLMN. Note that it does not uniquely identify the operator. NCC is primarily used to distinguish between operators on each side of a border.

BCC = Base Station Color Code (3 bits), identifies the Base Station to help distinguish between BTS using the same BCCH frequencies.

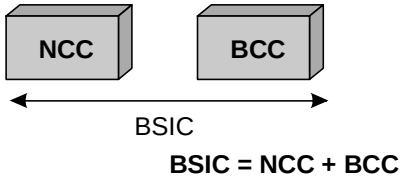


Figure A-10 BSIC.

LOCATION NUMBER (LN)

Location Number is a number related to a certain geographical area, as specified by the network operator by “tying” the location numbers to cells, location areas, or MSC/VLR Service Areas.

The Location Number is used to implement features like Regional/Local subscription and Geographical differentiated charging.

The LN consists of the following:

LN = CC + NDC + LSP

CC = Country Code

NDC = National Destination Code

LSP = Locally Significant Part

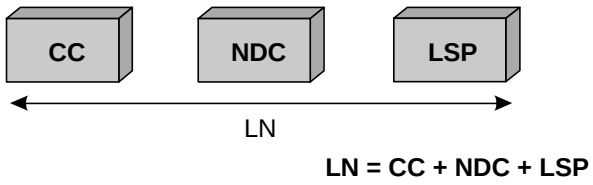


Figure A-11 LN.

REGIONAL SUBSCRIPTION ZONE IDENTITY (RSZI)

To make regional subscription possible, different zones must be defined. For each regional subscription different zones/regions need to be defined. To make this possible Regional Subscription Zone Identity is used.

The RSZI consist of the following:

RSZI = CC + NDC + ZC

CC = Country Code

NDC = National Destination Code

ZC = Zone Code

The length of the Zone Code, is two octets.

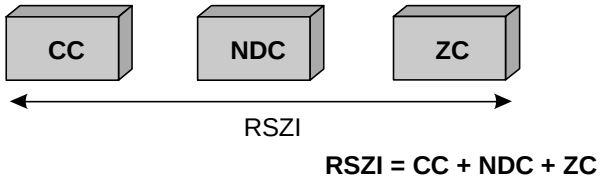


Figure A-12 RSZI.

ADDRESSING THE SWITCHING SYSTEM ENTITIES

GLOBAL TITLE (GT)

A Global Title (GT) is an address, such as dialed digits, which does not explicitly contain information that allows routing in the signaling network. This requires the SCCP translation function.

The GT is used for the addressing of signaling information. To distinguish between networks such as PSTN/ISDN and GSM PLMN, different numbering plans are used. The numbering plan for PSTN/ISDN is E.164. The address is then accompanied by a parameter: NP =1.

Each network entity is identified by its international PSTN/ISDN number, which has the following structure:

E.164: CC+NDC+SN

Note that SN is not a subscriber number. The CC, NDC and the SN identify the node within the whole GSM, as well as, the entity, that is, HLR, MSC, VLR, EIR or AUC.

At an incoming call to a mobile subscriber, the GMSC uses the received MSISDN to point out the appropriate HLR. The CC, NDC and one or more digits in the Subscriber Number contained in MSISDN identify the HLR.

MOBILE GLOBAL TITLE (MGT)

When a MS initiates location updating because of change of the MSC/VLR, communication with HLR takes place. IMSI is the only available data in VLR for addressing the HLR. Therefore, the IMSI must be used in some way to point out the HLR. A translation of IMSI takes place in MSC/VLR in order to create a Global Title (GT), an address which enables routing of the No. 7 signaling to the proper HLR. Since the GT derives from IMSI, it is called the Mobile Global Title.

Structure of the MGT

The MGT is of variable length and composed of decimal digits arranged in two specific parts. These specific parts are the E.164 and the E.212 part, together forming E.214 numbering plan (NP=7).

The E.164 part is used to identify the home country and the home PLMN of the MS.

The E.212 part is used to identify the subscriber's HLR. This part is composed of the MSIN.

The MGT is derived from the IMSI in the manner shown in Figure A-13.

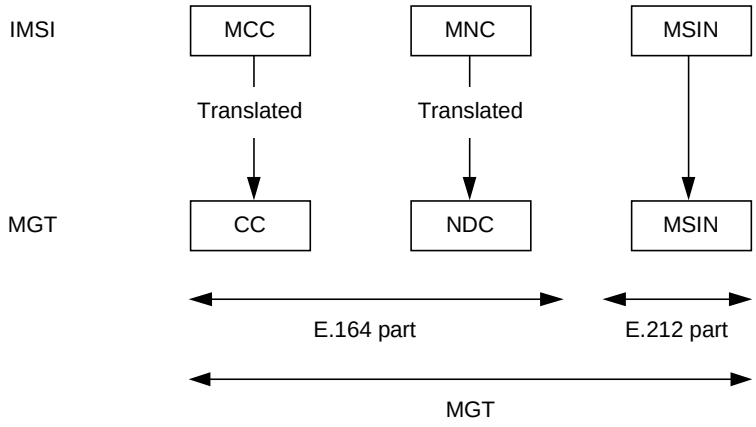


Figure A-13 Derivation of the MGT from the IMSI.

Within the MGT the CC is derived directly from the MCC and the NDC is derived either directly from the MNC, or from the MNC and some initial digits of the MSIN. The MSIN is mapped directly into the MGT up to its maximum length.

This translation is performed at the application level in the VLR. The MGT thus derived is used to address the HLR.