

A Literature Survey on GSM Network Identities

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Abstract

Network identities are numbers that a GSM network uses to locate a mobile subscriber when it is establishing a call to that subscriber. As the network relies on these identities to route calls to subscribers, it is important that each identity is unique and correct. Here we study the various network identities involved both at the subscriber's end as well at the service provider end.

Keywords

MSISDN, IMSI, TMSI, IMEI, MSRN, IMEI

I. Subscriber-Related Identities

Mobile Station ISDN number (MSISDN)

The Mobile Station ISDN number (MSISDN) uniquely identifies a mobile telephone subscription in the PSTN numbering plan. This is the number dialed when calling a mobile subscriber. As the MSISDN is the actual telephone number of the mobile subscriber, it is the only network identity that subscribers are aware of. All other network identities discussed in this chapter are for internal network use and subscribers do not need to be aware of them.

CME 20 MSISDN

In CME 20, the MSISDN consists of the following:

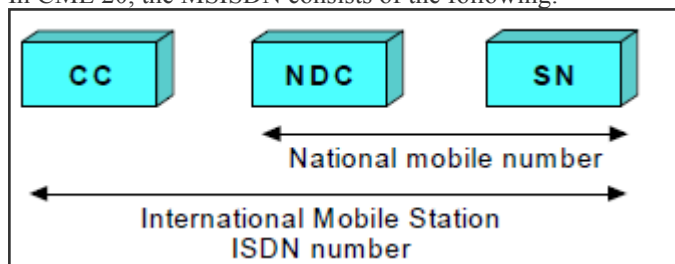


Fig:1.1 : CME 20 MSISDN

CC Country Code
 NDC National Destination Code
 SN Subscriber Number

An NDC is allocated to each PLMN. For example, in Ireland the NDC's 086 and 087 indicate the PLMN's of two different network operators. 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. A German subscriber calling an Irish GSM subscriber would dial the following number:

International prefix in Germany	CC	NDC	SN
00	353	87	1234567

CME 20 MSISDN

CMS 40 MSISDN

In CMS 40, the MSISDN consists of the following:

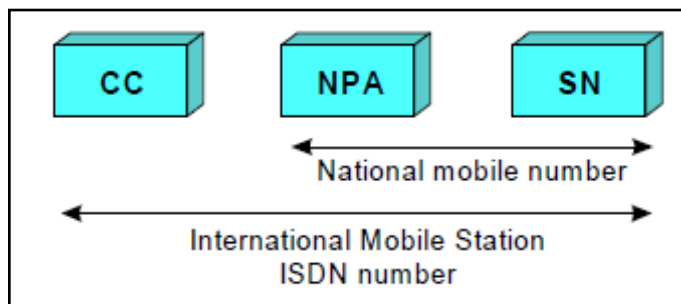


Fig:1.2

CMS 40 MSISDN

CC Country Code

NPA Number Planning Area

SN Subscriber Number

The NPA is allocated to each GSM 1900 PLMN. The length of MSISDN is determined by the structure and operating plan for each operator. The maximum length is 15 digits, prefixes not included. A Swedish subscriber calling a Canadian GSM 1900 subscriber would dial the following number:

International prefix in Sweden	CC	NDC	SN
00	1	514	555 1234

International Mobile Subscriber Identity (IMSI)

The International Mobile Subscriber Identity (IMSI) is a unique identity allocated to each subscriber that facilitates correct subscriber identification over the radio path and through the network. It is used for all signaling in the PLMN. All network related subscriber information is connected to an IMSI. The IMSI is stored in the SIM, the HLR and in the serving VLR. The IMSI consists of three different parts:

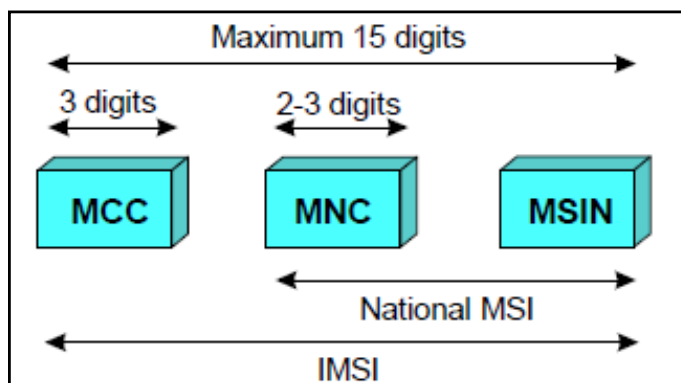


Fig:1.3 : IMSI

MCC Mobile Country Code
MNC Mobile Network Code
MSIN Mobile Station Identification Number

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

Temporary Mobile Subscriber Identity (TMSI)

The Temporary Mobile Subscriber Identity (TMSI) is a temporary IMSI number made known to an MS at registration. It is used to protect the subscriber’s identity on the air interface. The TMSI has local significance only (that is, within the MSC/VLR area) and is changed at time intervals or when certain events occur such as location updating. Every operator can chose TMSI structure, but should not consist of more than 8 digits

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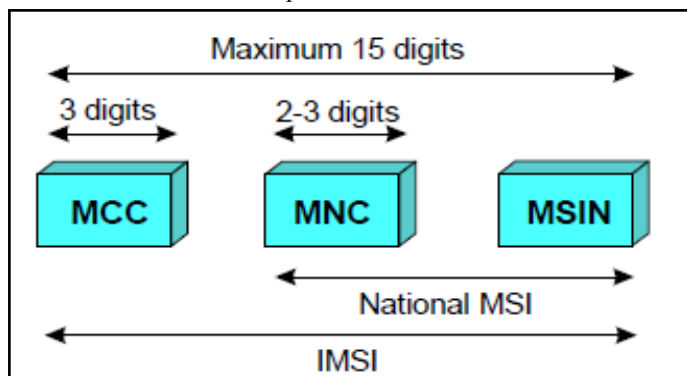


Fig: 1.4

IMSIMCC Mobile Country Code
MNC Mobile Network Code
MSIN Mobile Station Identification Number

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

II. Subscriber Identity Confidentiality

Subscriber identity confidentiality means that the IMSI is not disclosed to unauthorized individuals, entities or processes. This function protects a subscriber’s identity when the subscriber is using PLMN resources. It also prevents tracing the mobile subscriber’s location by listening to the signaling exchanges on the radio path.

Subscriber Identity Confidentiality Procedure

Each time a mobile station requests a system procedure (e.g. location updating, call attempt or service activation), the MSC/VLR can allocate a new TMSI to an IMSI. The MSC/VLR transmits the TMSI to MS that stores it on the SIM card. Signaling between MSC/VLR and MS utilizes only the TMSI from this point on. Thus, the real subscriber identity, IMSI, is not transmitted over the radio path again. TMSI is half the length of IMSI; thus allowing twice as many MS’s to be paged in the same paging message. IMSI is only used in cases when location updating fails or when the MS has no allocated TMSI.

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III. Equipment-Related Identities

International Mobile Equipment Identity (IMEI)

The International Mobile Equipment Identity (IMEI) is used to uniquely identify MS equipment to the network. The IMEI is used for security procedures such as identifying stolen equipment and preventing unauthorized access to the network. According to the GSM specifications, IMEI has a total length of 15 digits, and consists of the following:

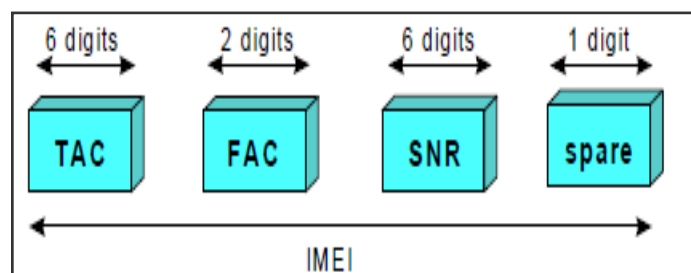


Fig: 1.5

IMEI

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 digit for future use. When transmitted by the MS this digit should always be zero

International Mobile Equipment Identity and Software Version number (IMEISV)

The International Mobile Equipment Identity and Software Version number (IMEISV) provides a unique identity for every MS and also refers to the version of software which is installed in the MS. The version of software is important as it may affect the services offered by the MS or its speech coding capabilities. For example, mobile networks need to know the MS speech coding capabilities when a call is being made (i.e. half rate/full rate, etc.). This will be indicated by the IMEISV. The IMEISV consists of the following:

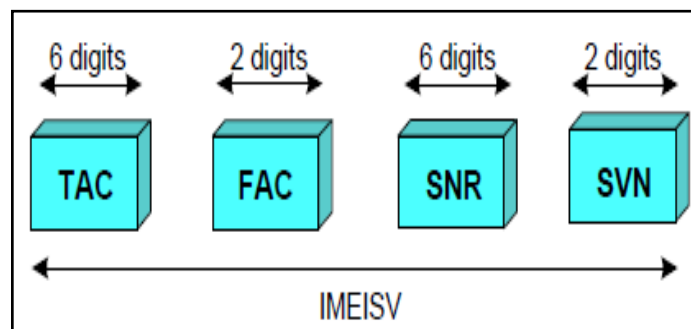


Fig: 1.6

IMEISV

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 – 182 – EN/LZT 123 3321 R3B

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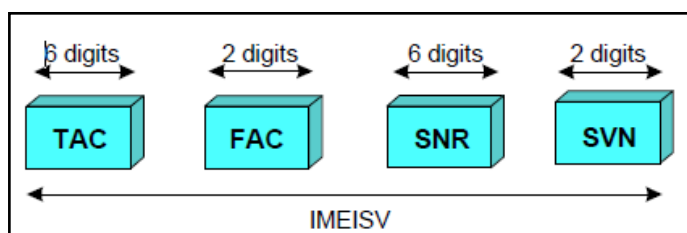


Fig: 1.7

IMEISV

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IV. Location-Related Identities

Mobile Station Roaming Number (MSRN)

The Mobile Station Roaming Number (MSRN) is a temporary network identity which is assigned during the establishment of a call to a roaming subscriber. More information about the use of MSRN can be found in the “Traffic Cases” section later in the book. The MSRN consists of three parts:

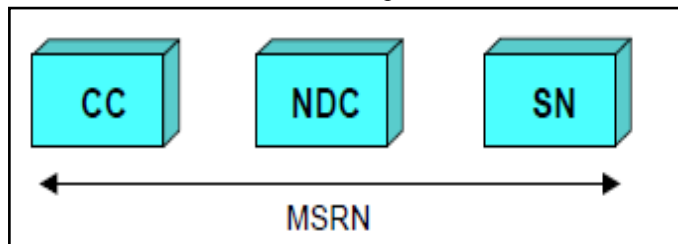


Fig: 1.8

MSRN

Note: In this case, SN is the address to servicing MSC/VLR. SN= Servicing Node

Location Area Identity (LAI)

The Location Area Identity (LAI) is a temporary network identity, which is also required for routing. The two main purposes of the LAI are:

1. Paging, this is used to inform the MSC of the LA in which the MS is currently situated
2. Location updating of mobile subscribers The LAI contains

the following:

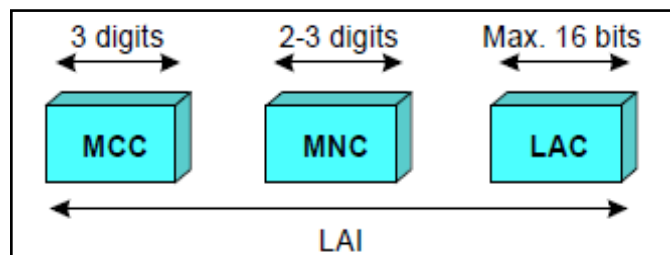


Fig: 1.9

LAI

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

Cell Global Identity (CGI)

The Cell Global Identity (CGI) is used for identifying individual cells within a LA. Cell identification is achieved by adding a Cell Identity (CI) to the LAI components. The CI has a maximum length of 16 bits. The CGI consists of:

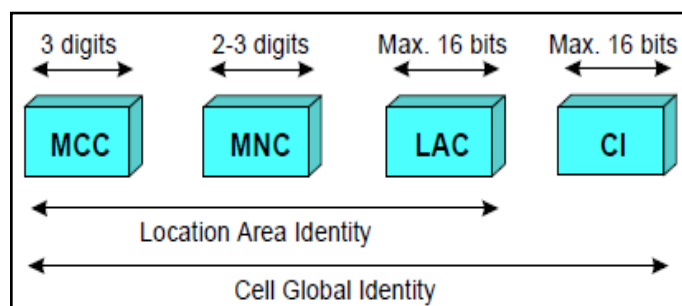


Fig: 1.10

CGI

Base Station Identity Code (BSIC)

The Base Station Identity Code (BSIC) enables MS's to distinguish between different base stations sending on the same frequency. The BSIC consists of:

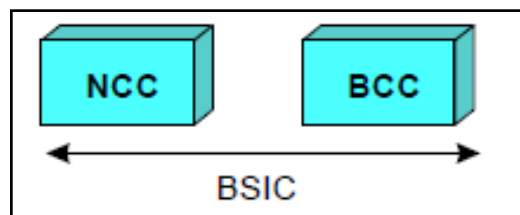


Fig: 1.11

BSIC

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 RBS using the same control frequencies

Location Number (LN)

The Location Number (LN) is a number related to a certain geographical area, which the network operator specifies by “tying” the location numbers to cells, location areas, or MSC/VLR service

areas. The LN is used to implement features like regional/local subscription and geographical differentiated charging. The LN consists of the following:

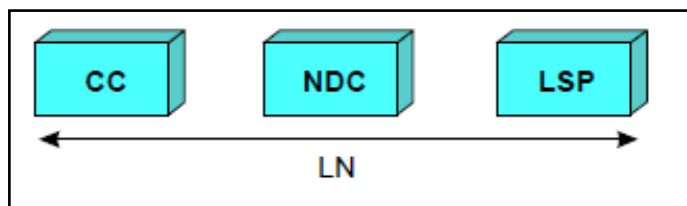


Fig: 1.12

LN
LSP Locally Significant Part

Regional Subscription Zone Identity (RSZI)

For each regional subscription, zones/regions need to be defined. This is achieved by using the Regional Subscription Zone Identity (RSZI). The RSZI consist of the following:

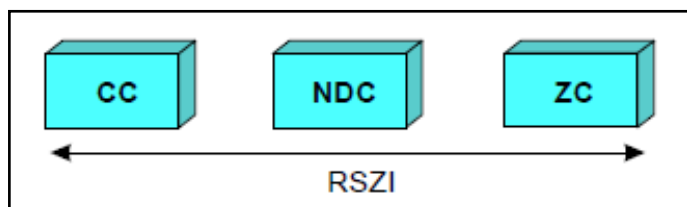


Fig: 1.13

RSZI
ZC The length of the Zone Code, is two octets

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