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RELEASE NOTE

Recommendation GSM 03.01

Network Functions

Previously distributed version : 3.1.1 (Release 1/90)
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1. Reason for changes

No changes since the previously distributed version.

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ETSI-GSM

Technical

Specification

GSM 03.01

Version 3.1.1

European digital cellular telecommunication system (phase 1);

Network Functions

ETSI

PREFATORY NOTE

ETSI has constituted stable and consistent documents which give specifications for the implementation of the European Cellular Telecommunications System. Historically, these documents have been identified as "GSM recommendations".

Some of these recommendations may subsequently become Interim European Telecommunications Standards (I-ETSs) or European Telecommunications Standards (ETSs), whilst some continue with the status of ETSI-GSM Technical Specifications. These ETSI-GSM Technical Specifications are for editorial reasons still referred to as GSM recommendations in some current GSM documents.

The numbering and version control system is the same for ETSI-GSM Technical Specifications as for "GSM recommendations".

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1. SCOPE

This recommendation defines network functions which are necessary to support services and facilities provided by PLMNs. A summary of the network functions is given in Table 1, where also an indication is given whether the network must support the function. The table also indicates whether or not a function requires internetworking signalling between PLMNs (i.e. use of Mobile Application Part, Recommendation GSM 09.02).

((All functions require signalling on the radio path as specified in Recommendation GSM 04.08.))

2. NETWORK FUNCTIONS FOR BASIC SERVICE PROVISION

2.1. Call handling

This set of functions enables the establishment of communications between a mobile subscriber and another network subscriber in one of the following types of network PSTN, ISDN, PSPDN, CSPDN and other PLMNs.

2.1.1. Call from a mobile subscriber registered in VLR

This is the normal case where the call is routed according to the dialled number. After the call, the MSC will send the charging information to the HLR, a billing entity and/or store the charging data on tapes or discs as described in Recommendation GSM 12.05.

2.1.2. Call from a mobile subscriber not registered in VLR

When the VLR receives a request for call set-up parameters from an MSC for an MS originating call, where the MS is not registered in the VLR, the VLR shall initiate a location updating procedure towards the HLR and in response parameters are given concerning category, services and restrictions. The call is then set up as in 2.1.1. This case only happens when a VLR or an MS failure has occurred.

2.1.3. Call to a mobile subscriber

The call is routed (re-routed or forwarded) according to location data obtained from the HLR to the actual MSC and the MS is paged over the standardised radio interface.

TABLE 1

Overview of network functions

CLASS OF NETWORK FUNCTION (NF)	NETWORK FUNCTION	NETWORK SUPPORT	INTERWORKING WITH MAP
NF for basic service provision	Call handling	M	X
	Subscriber authentication	M	X
	Emergency calls	M	-
	Supplementary services	M	X
	Signalling information element confidentiality	M	X
Additional NF for call handling	Queuing	O	-
	OACSU	O	-
	Security related services	M	X
	Discontinuous reception	M	-
	DTMF	M	-
NF for supporting cellular operation	Location registration	M	X
	Handover -in the same BSS -in the same MSC -in the same PLMN	M M M	- - X
	Call re-establishment	M	-
Network management oriented NF		M*	X

* The function will not be fully specified by GSM (national specifications will complement).

2.1.4. Call handling functions in HLR

The functions of the HLR are defined in Recommendation GSM 11.31.

The HLR must accommodate call routing functions as described in 2.1.3.

The HLR must also support control functions for handling of supplementary services as described for each service in Recommendation GSM 03.11.

2.1.5. Call handling functions in VLR

The functions of the VLR are defined in Recommendation GSM 11.32.

The VLR must provide subscriber parameters to the MSC as required for call handling.

The VLR must also support control functions for handling of supplementary services as described for each service in Recommendation GSM 03.11.

2.1.6. Call handling functions in MSC

The MSC must perform normal call routing and call control functions. The MSC will obtain subscriber parameters from its associated VLR.

The MSC must also be capable of performing handover as defined in section 3.2.

In some cases, the MSC must be able to act as a gateway MSC.

2.2 Subscriber identity authentication

The purpose of subscriber identity authentication is defined in Recommendation GSM 02.09.

The authentication mechanism is defined in Recommendation GSM 03.20 and corresponding procedures on the MS-BSS interface are defined in Recommendation GSM 04.08.

2.3 Emergency call

2.3.1 General

The land mobile system should be capable of efficient handling of emergency calls from mobile stations. The signalling

procedures on the radio path for emergency calls are given in
Recommendation GSM 04.08.

2.3.2 Routing

The call should be routed automatically to an appropriate
emergency centre based on the geographical location of the
mobile station (e.g. based on the identity of the cell on which
the call is established).

{{2.3.3 Use of IMEI

The network support of emergency calls from MSs which use the
International Mobile Equipment Identity (IMEI) as the only means
of identification (e.g. in card operated stations without the
card) is a PLMN operator option.}}

2.4 Supplementary services

PLMN may offer supplementary services as shown in Recommendation
GSM 02.04. The support of supplementary services will require
control procedures in HLRs, VLRs and MSCs in addition to the
control procedure in the fixed network. The technical
realisation of supplementary services is given in Recommendation
GSM 03.11.

2.5 Signalling information element confidentiality

A procedure should be implemented providing for the
confidentiality of signalling information elements on the radio
path. In recommendation GSM 02.09 the signalling information
elements which need to be protected are given.

The Encryption Key is calculated in both the MS and the network.
Detailed information is given in Recommendation GSM 03.20.

3 NETWORK FUNCTIONS FOR SUPPORTING CELLULAR OPERATION

3.1 Location registration

3.1.1 Definitions

Location registration means that the PLMNs keep track of where mobile stations are located in the system area. The location information is stored in functional units called location registers. Functionally there are two types of location registers:

- the home location register where the current location and all subscriber parameters of a mobile station are permanently stored,

- the visitor location register where all relevant parameters concerning a mobile station are stored so long as the station is within the area controlled by that visited location-register.

See also Recommendation GSM 03.02 where the network architecture is described.

3.1.2 Procedures

Procedures related to location registration are specified in Recommendation GSM 03.12.

They comprise :

i)   location register updating which enables the MS to inform the network that its location has to be updated, i.e. the MS has received a location area identity which is different from that contained in its memory. In order to avoid unnecessary updating, the current location area identity should be stored in a non-volatile memory in the MS ;

ii)   location cancellation which is used to delete an MS from a previous VLR ;

iii)   periodic location updating which enables the location of silent and stationary MSs to be updated at a reasonable rate;

iv)   as a network option, IMSI detach/attach operation which will enable MSs to inform the network that they have entered a power down/power up or a card removed/inserted state.

The procedures also include mechanisms for restoration of location registers after failure. These procedures are defined in Recommendation GSM 03.07.

3.1.3 Information stored in location registers

Information to be stored in location registers is listed in Recommendation GSM 03.08.

3.2 Handover

3.2.1 Definitions

The following case are required :

i)   handover between physical channels of the same Base Station System (BSS). This capability could be used in the following situations:

- when the physical channel carrying the call is subject to interference or other disturbances

- when a physical channel or channel equipment carrying a call has be to be taken out of service for maintenance or other reasons.

ii)   handover between Base Station Systems (BSSs) of the same MSC.

iii)   handover between BSSs of different MSCs of the same PLMN.

Cases ii) and iii) are used in order to ensure continuity of the connection when an MS moves from one BSS area to another.

For case iii) two procedures are defined :

a)   basic handover procedure where the call is handed over from the controlling MSC (MSC-A) to another MSC (MSC-B).

b)   subsequent handover procedure where the call is handed over from MSC-B to MSC-A or to a third MSC (MSC-B').

3.2.2 Procedures

The procedures are described in Recommendation GSM 03.09.

3.3 Call re-establishment

Re-establishment of a call may be performed when a traffic channel (TCH) has been lost during the call, e.g. when a handover could not be completed in time.

Call re-establishment is only performed on TCHs and when the call is in the connected state (see Recommendation GSM 04.08). The procedures are specified in Recommendation GSM 04.08.

4. ADDITIONAL NETWORK FUNCTIONS FOR CALL HANDLING

4.1 Queuing

As a PLMN option MS originating and/or MS terminating calls may be queued at the BSS. (Note: this queuing is additional to that for normal call handling). However, the following conditions must be met.

- for MS originating calls not queuing indication will be provided to the MS. The queuing will thus be seen as a delayed call set-up for the MS.

- for MS terminating calls the queuing must not conflict with abnormal release conditions in the fixed network. In general, calls that may have passed international circuits should not be queued, i.e. it should not be applied to calls where the originating network is not known to the PLMN.

4.2 Off-air-call-set-up (OACSU)

4.2.1 General

OACSU may be implemented in PLMNs in order to increase the call handling capacity of the PLMN.

OACSU may be implemented in PLMNs on an optional basis subject to the following conditions :

i)   OACSU should not be used for calls to an international number,

ii) OACSU should not be used for incoming international calls, except where bilateral agreement has been reached to allow such an application of OACSU. For the avoidance of doubt, OACSU shall not be applied to calls where the call type or originating network is not known by the PLMN,

iii)   foreign MSs not supporting the OACSU procedure should be
       allowed to access the PLMNs where OACSU is used,

iv)   MSs supporting OACSU should be capable of operating in
       PLMNs where OACSU is not implemented,

v)   OACSU should only be used for telephone calls.

4.2.2. Signalling procedures

Signalling procedures supporting OACSU are specified in
Recommendation GSM 04.08.

4.3 Security related services

PLMNs will offer two security related services on the radio
path: confidentiality of the user identity and confidentiality
of user data.

4.3.1 Subscriber identity confidentiality

This service provides for the privacy of the identities of
subscribers. An intruder cannot identify which subscriber is
using a certain resource on the radio path. Instead of IMSI a
temporary identity is used. This identity (TMSI) is a local
number only valid in a given location area. The TMSI is
allocated by the VLR and is sent to the MS in a ciphered mode.

The structure of the TMSI is defined in Recommendation GSM
03.03.

4.3.2 User data confidentiality

This service provides for the confidentiality of the user data
transmitted on a traffic channel. Encryption/decryption of the
user data is done in the MS and BSS with a key which is
calculated in both the MS and network. Detailed information is
given in Recommendation GSM 03.20.

4.4 Discontinuous reception

Discontinuous reception is a technique used to reduce the
average battery consumption of mobile stations. The operation of
the technique is specified in Recommendation GSM 03.13. This
function must mandatory be supported by the network, but is
optional for mobile stations.

4.5 Support of DTMF

DTMF is supported as defined in Recommendation GSM 03.14.

5 NETWORK MANAGEMENT ORIENTED NETWORK FUNCTIONS

Network management functions are dealt with in the 12 series of GSM Recommendations. An overview is given in Recommendation GSM 12.00.