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RELEASE NOTE

Report GSM 11.31

Home Location Register Specification

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1. Reason for changes

No changes since the previously distributed version.

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Home Location Register Specification

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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".

0. SCOPE

The scope of this report is to give guidelines concerning the specification of the Home Location Register (HLR). In the case of discrepancy between this report and the approved core GSM recommendations the later shall prevail. Each function is specified as either mandatory or optional.

The different functions provided by the HLR are identified with an indication of the relevant recommendations where the definitive specifications can be found.

The purpose of this report is to give an overview of the HLR functions needed to implement the GSM system, in order to help both the Administrations/Operators in the procurement of their equipments and the manufacturers tendering the HLR.

A list of the contents which may be found in a national specification for such equipment is given as an appendix to this report. Note that some items in this list are not specified by GSM, but are left to the discretion of the operators.

1. INTRODUCTION

The HLR, as described in this and all other GSM recommendations, is not a physical entity and need not be implemented as such, it is, rather, a set of functions which are required to manage the mobile nature of subscribers belonging to the HLR.

The HLR provides a known, fixed location to provide the variable routing information, subscription state, supplementary service activation state and other information about an inherently mobile subscriber.

Functionally the HLR will always point to a VLR and the VLR will point to the MS location area, though in actual implementation it would be possible to implement some VLR functions in a physical entity looking more like a HLR e.g. storing TMSI, location area identification and other VLR functions relating to home subscribers.

HLR functions may be incorporated into a single physical entity or distributed or combined with other PLMN entities such as a MSC.

2. DEFINITIONS

The term Home Location Register (HLR) is defined in Recommendation GSM 01.04 and a more full description can be found in Recommendations GSM 03.02 and 09.02.

3. ARCHITECTURE

The network architecture is defined in Recommendation GSM 03.02 where it is shown how the HLR is related to other functional entities of the PLMN. Several configurations are presented in order to meet various national needs and allow flexibility for future development of PLMNs. In particular the HLR is shown both as a stand-alone entity with interfaces in the PLMN, and as incorporated into a MSC.

Irrespective of national solutions the requirements specified below as mandatory are required in order to allow full connectivity of PLMNs nationally and internationally.

4. INTERFACE

The HLR must support signalling to and from MSCs, and VLRs (both of the home and other PLMNs).

Depending on the capabilities of exchanges in public switched networks, the HLR may support signalling to these networks in order to accommodate the interrogation procedure of Recommendation GSM 03.04. Normally, these interfaces will require Signalling System no 7 MAP.

The signalling used to provide information transfer between a HLR and OMC is a national matter. However, international standards are emerging which will facilitate the transfer of such information between HLRs and different OMC implementations, using standard protocols. These standards will be embodied in the Telecommunication Management Network (TMN) concept - this is described in Recommendation GSM 12.00. Also, Recommendations GSM 12.01 and 12.14 define information transfer principles with other O&M entities.

4.1. Support of Mobile Application Part (MAP)

Interfaces within a PLMN are a national matter and would preferably use MAP(GSM 09.02).

Interfaces between PLMNs are mandatory and must use MAP.

MAP may also be required for the transfer of charging information to the HLR after call termination.

5. FUNCTIONS OF THE HLR

5.1. Organization of subscriber data

The HLR must store subscriber data for home MSs. Recommendation GSM 03.08 gives the full description.

The HLR should also be able to store data corresponding to operator selected denial of service to the subscriber and indicate to the VLR that calls to and/or from that subscriber are not allowed.

5.2. Call handling functions of the HLR

See Recommendations GSM 03.01, 03.02 and 03.04.

The routing function of the HLR is described in Recommendation GSM 03.04. See also Recommendation GSM 09.02 for detailed procedures.

See paragraph 5.3 for handling of supplementary services.

5.2.1. Incoming

When a MS is called the relevant HLR is interrogated to find the MSRN allocated to that MS. The HLR may or may not have the MSRN stored. If there is no stored MSRN the HLR obtains a MSRN from the VLR for the purpose of this call setup. The MSRN is sent to the interrogating node. The call is then routed according to this MSRN.

5.2.2. Outgoing

The HLR is not normally involved with outgoing calls however the VLR may request more information from the HLR, such as more Rand,SRES,Kc vectors.

5.3. Handling of supplementary services

There follows a brief overview of the main functions required in the HLR for supporting the services described in Recommendations GSM 02.04 and GSM 03.11 that are to be included in Phase 1 implementation. For implementation details refer to Recommendations GSM 03.11, 03.82 and 03.88.

In addition to these supplementary services the HLR is required to be able to receive a MAP IA5 string sent from one of its MSs when the MS cannot interpret the supplementary service number dialled into it by the user. The action to take on receiving this string is a national matter.

Supplementary service	HLR Function required
Call forwarding unconditional	MAF007.
Call forwarding on mobile subscriber busy	No specific function required.
Call forwarding on no reply	No specific function required.
Call forwarding on mobile subscriber not reachable	MAF010.
Barring of all outgoing calls	No specific function required.
Barring of outgoing international calls	No specific function required.
Barring of outgoing international calls except those directed to the home PLMN country	No specific function required.
Barring of all incoming calls	MAF022
Barring of incoming calls when roaming outside the home PLMN country	MAF023

A list of the parameters which must be stored in the HLR to handle supplementary services is included in recommendation GSM 03.11.

5.4. Short Message Service Handling

Mobile Terminated (MT) Short Messages will be stored in the Service Centre (SC) and forwarded at the earliest opportunity to the MS concerned. If it is not possible to contact the MS (e.g. MS out of coverage) the HLR may store the SC address(es) and the MSC indicates to the VLR concerned, if appropriate, that there are messages waiting. Once the MS is located, this could be a page response, call origination or location updating, the HLR is informed which in turn informs the relevant SCs. At this point all message waiting indications are erased and the SCs attempt to send their Short Messages to the MS.

The procedures related to the point-to-point Short Message Service (SMS) are given in recommendation GSM 03.40.

5.5. Authentication

The HLR will provide authentication parameters to the Visitor Location Register (VLR) by the procedures defined in Recommendation GSM 09.02 and GSM 03.20. If the VLR and the HLR are in different PLMNs, these parameters consist of a set of RAND/SRES vectors (Random Number/Signed Response Vectors). If the VLR and the HLR are in the same PLMN, it is a national choice whether to provide the authentication key to the VLR or a set of RAND/SRES vectors.

5.6. Location registration

The definition of location registration is contained in Recommendation GSM 03.01.

This function is described in detail in Recommendation GSM 03.12. The procedures for location registration are defined in Recommendation GSM 09.02.

5.7. Support of encryption

The HLR may store the keys required in Recommendation GSM 03.20. If the keys are stored in other functional entities (e.g. authentication centre) the HLR must retrieve the key from that entity whenever it is required.

The ciphering key Kc is transferred to the VLR together with the RAND/SRES vectors, see Recommendation GSM 03.20. The management of the key is described in Recommendation GSM 03.20. As an option the subscriber key Ki can be sent to the VLR but this is less secure and should be avoided, particularly between PLMNs.

5.8. Charging

The HLR must be able to receive charging information messages coming from other PLMNs for its home MSs; see Recommendation GSM 09.02.

6. RESTORATION OF HLRs

Recommendations GSM 03.07 and 09.02 contain restoration procedures to be used after outage of the HLR itself or after outage of a VLR.

7. OPERATION AND MAINTENANCE

General aspects of O&M matters are dealt with in the 12 series of the GSM recommendations; Recommendation GSM 12.14 presents the general principle of HLR maintenance.

8. PERFORMANCE OBJECTIVES

Performance objectives for HLRs are given in Recommendation GSM 03.05.

9. QUALITY CONTROL

This is a national matter.

10. ACCEPTANCE TESTING

This is a national matter.

11. ENVIRONMENTAL CONDITIONS

This is a national matter.

HLR structure cross reference and indication of responsibility

Item	Responsibility	GSM.ref
0. SCOPE		
1. INTRODUCTION		
2. DEFINITIONS	GSM	01.04
3. ARCHITECTURE	GSM	03.02
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Between PLMNs	GSM	03.04 09.02
4.1 Support of Mobile Application Part (MAP)	GSM	09.02
5. FUNCTIONS OF THE HLR		
5.1. Organization of subscriber data	GSM	03.08
5.2. Call handling functions of the HLR	GSM	03.01 03.02 03.04 09.02
5.3. Handling of supplementary services		
Call forwarding unconditional	GSM	02.04 03.11 03.82
Call forwarding on mobile subscriber busy		
Call forwarding on no reply		
Call forwarding on mobile subscriber not reachable		
Barring of all outgoing calls		02.04 03.11 03.88
Barring of outgoing international calls		
Barring of outgoing international calls except those directed to the home PLMN country		
Barring of all incoming calls		
Barring of incoming calls when roaming outside the home PLMN country		
5.4. Short Message Service Handling	GSM	03.40

5.5. Authentication	GSM	03.20 09.02
5.6. Location registration	GSM	03.01 03.12 09.02
5.7. Support of encryption	GSM	03.20
5.8. Charging	National matter	09.02
6. RESTORATION OF HLRs	GSM	03.07 09.02
7. OPERATION AND MAINTENANCE	National matter	12.00 12.14
8. PERFORMANCE OBJECTIVES	National matter	03.05
9. QUALITY CONTROL	National matter	
10. ACCEPTANCE TESTING	National matter	
11. ENVIRONMENTAL CONDITIONS		