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Organization of Subscriber Data

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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".

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#### 0. SCOPE

The scope of this Recommendation is to provide details concerning information to be stored in home location registers and visitor location registers concerning mobile subscriber.

Section 2 contains all details concerning definition of the parameters, the storage capacity required and where the parameter is to be stored.

Table 1 in section 3 gives a summary overview and section 4 identifies the reference information required for accessing the information.

#### 1. INTRODUCTION

#### 1.1 Definition

The term subscriber data is used to designate all information associated with a subscription which is required for service provisions, identification, authentication, routing, call handling, charging, operation and maintenance purposes. Some subscriber data are referred to as permanent subscriber data, i.e. they can only be changed by administration means. Other data are temporary subscriber data which may change as a result of normal operation of the system. Some data are referred to as flexible length data, i.e. further values than those listed may be required in the future.

#### 1.2 Storage facilities

Subscriber data is stored in two types of functional unit:

Home location register (HLR) which contains all permanent subscriber data and all relevant temporary subscriber data for all mobile subscribers permanently registered in the HLR.

Visitor location register (VLR) which contains all subscriber data required for call handling and other purposes for mobile subscribers currently located in the area controlled by the VLR.

Note:

It is for further study whether or not other types of functional units containing mobile subscriber parameters are to be included in this Recommendation. Such units could include encryption key distribution centres, maintenance centres, etc.

#### 2. DEFINITION OF SUBSCRIBER DATA

#### 2.1 Data related to identification and numbering

#### 2.1.1 International mobile subscriber identity (IMSI)

is defined in Recommendation GSM 03.03. It consists of three parts MCC, MNC and MSIN. The MCC consists of 3 digits and the MNC consists of 2 digits. The IMSI has variable length depending on national requirements. The maximum length is 15 digits.

Only numerical characters (0 through 9) are used in the IMSI.

IMSI is permanent subscriber data. IMSI is stored in both HLR and VLR.

#### 2.1.2 International mobile station ISDN number

is defined in Recommendation GSM 03.03. It is a PSTN/ISDN number and has a variable length which complies with the requirements of the ISDN/ISDN in each country. The length is limited to 15 digits.

The international mobile station ISDN number is permanent subscriber data.

International mobile station number is stored in both HLR and VLR.

#### 2.1.3 Temporary mobile subscriber identity (TMSI)

is defined in Recommendation GSM 03.03. The TMSI is assigned by the VLR and is used for identification of a mobile subscriber within the area controlled by the VLR. The length of TMSI is limited to 4 octets.

The TMSI is temporary subscriber data.

The TMSI is stored in the VLR.

#### 2.1.4 Local Mobile Station Identity (LMSI)

is defined in Recommendation GSM 03.03. The LMSI is assigned by the VLR and is used as a search key in the VLR to get the corresponding user data. The length of the LMSI is 4 octets. The LMSI is optional temporary subscriber data. The LMSI is stored in both VLR and HLR.

#### 2.2 Data related to Mobile Station types

#### 2.2.1 Mobile Station Category

The following categories should be supported:

- payphone
- not payphone

Only one category is assigned for each IMSI.

Mobile Station Category is permanent subscriber data.

It is flexible length data.

Mobile Station Category is stored in HLR and VLR.

#### 2.3 Data related to authentication and ciphering

#### 2.3.1 Individual Subscriber Authentication key

The Individual Subscriber Authentication Key Ki is defined in Rec. GSM 03.20. The length of Ki is 128 bits.

Note: The key Ki is used to calculate the parameter SRES (see section 2.3.2). The key is stored in the SIM and therefore available in the MS.

The Individual Subscriber Authentication Key is permanent subscriber data.

The key Ki is stored in the Authentication Centre (AUC). However, this is not visible to entities in another PLMN.

Note: Optionally, in some PLMNs, the key Ki may be stored in the HLR and possibly in the VLR.

#### 2.3.2 RAND, SRES and Kc

are a triplet of vectors used for authentication and encryption as defined in Recommendation GSM 03.20.

RAND consists of 128 bits, SRES consists of 32 bits and Kc consists of 64 bits.

If required, a set of 5 triplet values are calculated in the AUC (see Rec. GSM 12.03), provided to and stored in the HLR and sent to the VLR on request. They are temporary subscriber data.

If Ki and the appropriate algorithms are stored in the HLR or VLR, these Note: entities then can also calculate the triplet values.

#### 2.3.3 The Cipher Key Sequence Number (CKSN)

is used to ensure authentication information (Kc) consistency between the MS and the VLR.

CKSN consists of 1 octet and is a temporary subscriber data. It is stored in the VLR.

For handling refer to Recommendation GSM 09.02.

#### 2.4 Data related to roaming

#### 2.4.1 Mobile station roaming number

is defined in Recommendation GSM 03.03. It is a PSTN/ISDN number and has a variable length which complies with the requirements of the PSTN/ISDN in each country. The maximum number of digits will be 15 digits.

Note: See CCITT Recommendation E 165 for the time, T, when the length of the

international ISDN number is increased to 15 digits.

There may be more than one mobile station roaming number per IMSI

The mobile station roaming number is temporary subscriber data.

The mobile station roaming number is stored in VLR; it may also be stored in the HLR as described in Recommendation GSM 03.02 annex 1.

If an MSRN is allocated on a per call basis, its lifetime must be controlled by a timer, whose value must exceed 90 seconds. After expiry of this time, the MSRN can be reallocated. This timer is to prevent blocking of an MSRN when a call setup fails before arriving in the MSC.

If an MSRN is allocated on a location update basis, it is freed by location cancellation. After this freeing, the MSRN shall not be reallocated for at least 90 seconds.

#### 2.4.2 Location area identification

is defined in Recommendation GSM 03.03. It consists of three parts: MCC, MNC and LAC. MCC consists of 3 digits and MNC consists of 1 or 2 digits. MCC and MNC is composed of numerical characters (0 through 9). LAC may have a variable length up to a maximum of 2 octets and may be coded using full hexadecimal representation.

The overall length of the location area identification is five octets maximum.

The location area identification is temporary subscriber data.

The location area identification is stored in VLR.

#### 2.4.3 VLR number

is defined in Recommendation GSM 03.03. It is a PSTN/ISDN number and has variable length which complies with the requirements of the PSTN/ISDN in each country. The length is limited to 15 digits.

The VLR number is temporary subscriber data.

The VLR number is stored in HLR.

#### 2.4.4 MSC number

This address refers to the visited MSC and is defined in Recommendation GSM 03.03. It is a PSTN/ISDN number and has variable length which complies with the requirements of the PSTN/ISDN in each country. The length is limited to 15 digits.

The MSC number is temporary subscriber data.

The MSC number may optionally be stored in HLR and VLR.

#### 2.4.5 Roaming restriction

is a parameter which can take either of the following values:

- roaming allowed,
- roaming not allowed,

The parameter is established in the HLR depending on location updating information and may be associated with other parameters indicating the area in the GSM system area where the mobile subscriber is allowed to roam. These parameters are subject to national choice.

The roaming restriction parameters is temporary subscriber data and is contained in the HLR.

#### 2.4.6 HLR number

is defined in Recommendation GSM 03.03. It is a PSTN/ISDN number and has variable length which complies with the requirements of the PSTN/ISDN in each country. The length is limited to 15 digits.

The HLR number may be stored in the VLR.It is received as a mandatory parameter in the updating location accepted message. This data may be needed to retrieve subscribers to be restored after HLR reset.

The HLR number is temporary subscriber data.

The HLR number may optionally be stored in VLR

#### 2.4.7 Subscription restriction

is a parameter indicating whether or not certain restrictions apply to the subscription. The parameter takes either of the following values (see also Recommendation GSM 02.13):

accessible area for service :

- all GSM PLMNs,
- one national and all foreign GSM PLMNs,
- regional restricted (part of a GSM PLMN in one country),
- regional restricted plus all other GSM PLMNs.

The subscription restriction is permanent subscriber data and is stored in the HLR.

#### 2.5 Data related to basic services

#### 2.5.1 Provision of bearer service

is a parameter identifying whether a bearer service is provisioned to the mobile subscriber or not. This provision can be achieved through subscription of the mobile subscriber or the bearer service can be generally available. The parameter "provision of bearer service" must be set for the bearer service defined in Recommendation GSM 02.02 for which a subscription is required.

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Provision of bearer service is permanent subscriber data and is stored in the HLR and VLR.

#### 2.5.2 Provision of teleservice

is a parameter identifying whether a teleservice is provisioned to the mobile subscriber or not. This provision can be achieved through subscription of the mobile subscriber or the teleservice can be generally available. The parameter "provision of teleservice" must be set for the teleservices defined in Recommendation GSM 02.03 for which a subscription is required.

Provision of teleservice is permanent subscriber data and is stored in the HLR and VLR.

#### 2.5.3 Bearer capability allocation

is a parameter stored against each ISDN number in the case when the Home PLMN allocates one directory number per teleservice and bearer service. In this case it is used to permit the establishment of the correct bearer capability on the connection to the MS. (See Recommendation GSM 09.07). The bearer capability allocation is not required when the Home PLMN only allocates one directory number per subscriber for all bearer and teleservices. It is optional data in both HLR and VLR.

#### 2.6 Data related to supplementary services

#### 2.6.1 Provision parameters

#### 2.6.1.1 Provision of supplementary service

is a parameter identifying whether a supplementary service is provisioned to the mobile subscriber or not. This provision can be achieved through subscription of the mobile subscriber or the supplementary service can be generally available.

The parameter provision of supplementary service must be set for the supplementary services defined in Recommendation GSM 02.04.

For each supplementary service the parameter takes one of the following values:

- provisioned.
- not provisioned.

The provision of supplementary service parameter is permanent subscriber data, and is stored in the HLR and VLR.

The parameter structure is for further study.

Note:

Not all of the above mentioned supplementary services may be available in all GSM PLMNs, but the provision of supplementary service parameter must be stored for all supplementary services described in Recommendation GSM 02.04 (as listed above) in all GSM PLMNs.

#### 2.6.1.2 CUG interlock code

is a parameter associated with each CUG. The interlock code is the same as the one defined for ISDN.

The parameter is permanent subscriber data.

It is stored for each CUG in the HLR. The interlock code of the preferential CUG is stored in the VLR.

#### 2.6.1.3 CUG Index

is a parameter associated to each CUG and subscriber.

The CUG index consists of 4 digits.

The parameter is permanent subscriber data.

The CUG index is stored in the HLR for each CUG of which the MS is a member. The CUG index of the preferential CUG is stored in the VLR.

#### 2.6.2 Subscription options

For some supplementary services the mobile subscriber has to indicate the value of subscription options at subscription time. The options are only required if the supplementary services to which to they are applicable are provisioned. The following subscription options are used:

#### 2.6.2.1 The per call basis subscription option

is required for the supplementary service "calling number identification restriction". It indicates whether the supplementary service is used either on a per call basis or for a permanent period.

If the mobile subscriber is provisioned with this supplementary service, this subscription option is stored in the HLR and the VLR and it can take one of the following two values:

- on a per call basis,
- for a permanent period.

This subscription option is permanent subscriber data.

2.6.2.2. [Spare]

2.6.2.3. [Spare]

#### 2.6.2.4 The notification to the calling party subscription option

is only required for call forwarding services. It indicates whether the calling party should receive a notification when a call is forwarded, and if so, with or without the forwarded-to number.

The subscription option can take one of the following values:

- no notification,
- notification

The subscription option is stored in the HLR and the VLR (except for call forwarding unconditional) and it is permanent subscriber data.

This subscription option applies collectively to all Basic services to which the supplementary service is applicable.

2.6.2.5. [Spare]

2.6.2.6. [Spare]

#### 2.6.2.7 The subscription option notification to the forwarding party

is only required for call forwarding on mobile subscriber busy and for call forwarding on no reply. It indicates whether the forwarding party should receive a notification when a call is forwarded, and if so, with or without the calling number identity.

The subscription option can take one of the following three values:

- no notification,
- notification with calling number identity,
- notification without calling number identity.

It is stored in the HLR and the VLR for these two call forwarding services and it is permanent subscriber data.

This subscription option applies collectively to all Basic services to which the supplementary service is applicable.

#### 2.6.2.8 The user-to-user signalling service indicator

is only required for user-to-user signalling. It indicates the services within user-to-user signalling to which the mobile subscriber has subscribed.

It can take one or more of the following three values:

- service 1,

- service 2.
- service 3.

The subscription option is permanent subscriber data. It is stored in the HLR and the VLR.

#### 2.6.2.9 The CUG facilities subscription option

is required for the supplementary service closed user group. It indicates the facilities for the CUG member. It can take one of the following 4 values:

- CUG only facilities,
- CUG with outgoing access,
- CUG with incoming access,
- CUG with both incoming and outgoing access.

The subscription option is permanent subscriber data. It applies to all CUGs of which the mobile subscriber is a member. The subscription option is stored in HLR and VLR.

#### 2.6.2.10 The preferential CUG facility

is required for the supplementary service CUG. It indicates whether a preferential CUG facility is provided, and if so, to what CUG index it applies. It can take one of the following values:

- no preferential CUG,
- preferential CUG with CUG index number.

The option is permanent subscriber data and it is stored in the HLR and VLR.

#### 2.6.2.11 The subscription option barring of incoming calls within a CUG

is required for the supplementary service CUG. It indicates whether incoming

calls are barred to a CUG member for calls within the CUG. It can take one of the following two values:

- no barring
- barring.

The option is permanent subscriber data and it is stored in the HLR. It is applicable to each CUG separately.

#### 2.6.2.12 The subscription option barring of outgoing calls within a CUG

is required for the supplementary service CUG. It indicates whether outgoing calls are barred from a CUG member for calls within the CUG.

It can take one of the following two values:

- no barring,
- barring.

The option is permanent subscriber data and it is stored in the HLR. It is applicable to each CUG separately. Only for the preferential CUG it is stored in the VLR.

#### 2.6.2.13 The subscription option maximum number of conferees

is required for conference calling. It indicates the maximum number of conferees allowed in a conference call, which should not exceed 10.

The subscription option is stored in HLR and VLR and it is permanent subscriber data.

#### 2.6.2.14 The control of barring services subscription option

is required for all call barring services. It indicates whether the mobile subscriber can make use of a control procedure with password to handle the supplementary service.

It can take one of the following two values:

- controlled by subscriber using password,
- controlled by service provider

It is stored in the HLR and is permanent subscriber data.

This subscription option applies to all Call Barring supplementary service.

#### 2.6.2.15 The subscription option hunt group access selection order

is for further study.

#### 2.6.3 Registration parameters

#### 2.6.3.1 Forwarded-to number

is a parameter associated with call forwarding services. It indicates the ISDN number to which the mobile subscriber wants the incoming calls to be forwarded.

The forwarded-to number is temporary subscriber data. The maximum length of the parameter is 15 digits. The inclusion of subaddresses is for further study.

This parameter applies separately to each Basic service to which the supplementary service is applicable.

For call forwarding unconditional the parameter is only stored in HLR.For all other call forwarding services the parameter is stored in both HLR and VLR.

#### 2.6.3.2 Registration status

is a parameter associated with call forwarding services and call barring services. It indicates if the necessary data for subsequent activation of the supplementary service are present.

It can take one of the following two values:

- registered,
- erased.

This parameter applies separately to each Basic service to which the supplementary service is applicable.

It is stored in both HLR and VLR. It is temporary subscriber data.

#### 2.6.3.3 The no reply condition timer

is only required for call forwarding on no reply. It indicates the period during which the incoming call is not answered before it is forwarded. The timer may take values in the range 5 - 30 seconds in steps of 5 seconds.

The parameter is temporary subscriber data and applies separately to each Basic service to which the supplementary service is applicable.

The parameter is stored in both HLR and VLR.

#### 2.6.3.4 Call barring password

is a parameter associated with all call barring services.

If the subscription option "control of barring services" has been set to "controlled by service provider" the parameter "call barring password" is not needed. The length of the password is 4 digits (values between 0000 and 9999).

It is stored in the HLR. It is temporary subscriber data. The password is valid for all Basic services to which call barring applies.

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#### 2.6.4 Activation parameters

#### 2.6.4.1 Activation status

is a parameter associated with all supplementary services. It indicates whether the supplementary service is activated (by the subscriber or because the subscription options are met and the supplementary service is registered) or not.

For the following supplementary services the "activation status" parameter is identical to the "provision of supplementary service" parameter (see section 2.6.1.1) and does not have to be stored separately:

- calling number identification presentation,
- connected number identification presentation,
- closed user group,
- reverse charging,
- call hold.
- call transfer,
- three party service,
- conference calling.

#### For further study are:

- connected number identification restriction,
- malicious call identification,
- advice of charge,
- freephone service,
- mobile access hunting.

The parameter can take one of the following two values:

- activated.
- deactivated.

It is temporary subscriber data and it is stored in HLR and VLR for all supplementary services listed in section 2.6.1.1 except the ones listed above.

#### 2.7 Mobile station status data

#### 2.7.1 IMSI detach flag

is a parameter indicating that the MS is in the IMSI detached state. The parameter takes the following values:

- IMSI detached flag not set,
- IMSI detached flag set.

The parameter is temporary subscriber data.

If required, the parameter is stored in VLR.

#### 2.7.2 Restoration flags

In the case of VLR or HLR failure, location register data have to be restored as described in Recommendation GSM 03.07. The following flags are used for this purpose:

#### 2.7.2.1 Radio Confirmation Indicator

The radio confirmation indicator is a flag indicating whether the MS location has been confirmed in a VLR by a radio contact since last VLR or HLR failure.

It is temporary subscriber data, stored in the VLR.

#### 2.7.2.2 HLR confirmation indicator

is a flag indicating whether the MS location has been confirmed by the HLR since last VLR or HLR failure. It is temporary subscriber data, stored in VLR.

#### 2.7.2.3 MSRN flag.

If MSRNs are stored in the HLR, they are marked "to be checked" with this flag in the case of VLR or HLR failure.

The MSRN flag is temporary subscriber data stored in HLR.

#### 2.7.2.4 Check supplementary services flag

In case of HLR failure, supplementary service status may need to be checked. The Check Supplementary Service flag is set in the HLR while this information has not been given to the MS. It is temporary subscriber data and is stored in the HLR.

#### 2.8 Data related to access control

#### 2.8.1 Access priority class

is a parameter used to support the access control described in the recommendation GSM 02.11.

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The parameter takes the values defined in recommendation GSM 02.11. However, only the classes for specific high priority users need to be stored in the location registers.

The parameter is permanent subscriber data and is stored in the HLR and VLR.

#### 2.9 Data related to handover

#### 2.9.1 Handover number

is defined in Recommendation GSM 03.03, and its use is specified in Recommendation GSM 03.09. It is a PSTN/ISDN number of a variable length which complies with the requirements of the PSTN/ISDN in each country.

The Handover Number may be stored in the VLR, and is temporary subscriber data.

#### 2.10 Data related to short message support

#### 2.10.1 Messages Waiting Data

is defined in recommendation GSM 03.40. Messages Waiting Data is list of E.164 addresses, identifying a set of Service Centres containing short messages waiting to be delivered to the MS. Each SC address is stored together with a reference to the MSIsdn number originally used by the SC as a destination address for the Short Message. The list may consist of 0 through 7 different SC adresses.

The Messages Waiting Data may optionally be stored in the HLR, and is temporary subscriber data.

#### 2.10.2 Messages Waiting Flag

is defined in recommendation GSM 03.40. The Messages Waiting Flag indicates whether or not there exists one or more SC containing messages waiting to be delivered to the MS.

The Messages Waiting Flag is stored in the VLR, and is temporary subscriber data.

#### 3. SUMMARY OF DATA STORED IN LOCATION REGISTERS

Table 1 gives an overview of data that may be stored in location registers. In the Table M= mandatory means that this parameter is stored for all subscribers and C= conditional means that the parameter is subject to some condition (e.g. subscription). The type indication indicates whether the subscriber data is temporary (T) or permanent (P) data.

#### 4. ACCESSING SUBSCRIBER DATA

It shall be possible to retrieve or store subscriber data concerning a specific MS from the HLR by use of each of the following references :

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- international mobile subscriber identity,
- international mobile station ISDN number.

It shall be possible to retrieve or store subscriber data concerning a specific MS from the VLR by use of each of the following references :

- international mobile subscriber identity,
- mobile station roaming number,
- temporary mobile subscriber identity.

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TABLE 1
Overview of data stored in location registers

PARAMETER	SECTION	HLR	VLR	TYPE
	2.1.1	М	М	Р
MSI	2.1.2	M	M	P
nternational MS ISDN number	2.1.3	-	С	T
rmsi	2.1.4	C	С	T
_MSI	2.2.1	C	С	P
Mobile Station Category	2.3.1	Č	С	Р
Authentication key	2.3.2	M	M	Т
RAND/SRES and Kc	2.3.2	-	M	Т
Cipher Key Sequence Number	2.3.3 2.4.1	C	M	T
MS roamingnumber (Note 1)		-	M	Ť
Location area id	2.4.2	M	-	Ť
VLR number	2.4.3	C	C	Ť
MSC number	2.4.4	M	-	Ť
Roaming restriction	2.4.5		C	÷
HLR number	2.4.6	•		P
Provision of bearer service	2.5.1	М	М	P
Provision of teleservice	2.5.2	M	M	P
BC allocation	2.5.3	C	С	
Subscription restriction	2.5.4	C	-	Р
Provision of suppl.serv.	2.6.1.1	M	M	P
CUG interlock code	2.6.1.2	C	C	Р
	2.6.1.3	С	C	P
CUG index	2.6.2.1	С	00000	P
Per call basis subscription	2.6.2.4	С	С	P
Notification to calling party	2.6.2.8	CCC	С	Р
User-to-user signalling service ind.	2.6.2.9	С	С	P
CUG facility	2.6.2.10	С	С	P
Preferential CUG facility	2.6.2.11	С	•	P
Barring incoming calls within CUG	2.6.2.12	C	С	P
Barring outgoing calls within CUG	2.6.2.13	С	С	P
Maximum number of conferees	2.6.2.14	C	С	Р
Control of barring services	2.6.2.15	FS	FS	FS
Hunt group access selection order	2.6.3.1		С	T
Forwarded-to number	2.6.3.2	C	C	Т
Registration status	2.6.3.3	Č	C	Т
No reply condition timer	2.6.3.4	Č	•	Т
Call barring password	2.6.4.1	Č	С	Т
Activation status	2. <del>5</del> .4.1 2.7.1		č	Т
IMSI detached flag		-	M	Ť
Radio Confirmation Indicator	2.7.2.1	_	M	Ť
HLR Confirmation Indicator	2.7.2.2	_	Ċ	Ť
MSRN flag	2.7.2.3	M	-	Ť
Check Suppl. Services flag	2.7.2.4	C	C	P
Access priority class	2.8.1	-	Č	Ť
Handover Number	2.9.1	C	•	τ
Messages Waiting Data	2.10.1	-	М	Ť
Messages Waiting Flag	2.10.2	•	IVI	

Note 1. See section 2.4.1

See section 3 for explanation of M,C,T and P in table.