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Contents

Foreword

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The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

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- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
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Introduction

In the past, operators within a country or a region deployed single system networks and, consequently, users got service from a single system terminal. Multi mode terminals were sometimes deployed to maximise coverage, particularly during times of transition between radio access technologies (e.g. cdma/AMPS), but the same core network was always used.

In the future it is likely that operators will operate more than one system and the core networks will be different. This may happen either through choice or company merger/acquisition. There will be cases where operators have different systems in the same geographic area and cases where operators use different systems in different regions. It is also likely that there will be roaming agreements between operators of different systems. Therefore, the market for multi system terminals will increase and consideration is needed in 3GPP if new standardisation will be required or not.

Leaving system selection unspecified could lead to differences between vendor implementations. Whereas this may in itself not be a problem, it needs to be ensured that 3GPP specifications are followed by multi system terminals with 3GPP capability and that no harm to 3GPP networks is caused.

1 Scope

The present document studies the behaviour of a multi system terminal that supports both 3GPP and non-3GPP systems. Particular issues handled include, but are not restricted to:

- Whether the system selection or PLMN selection should take higher priority in a multi system terminal.
- Criteria for system change.
- Interaction between the user's and the operator's preferences.
- Support of automatic and manual system selection mode.
- Different methods of system selection and their impact on 3GPP specifications.
- Some areas for possible standardization, to ensure 3GPP compliance and protection of 3GPP networks.

The present document treats non-3GPP networks in a generic way but it applies mainly to the case of 3GPP2/3GPP compliant terminals.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document.*

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 22.011: "Service accessibility".

3 Definitions and abbreviations

3.1 Definitions

Multi mode terminal: Terminal which supports multiple access technologies and accesses 3GPP core network (e.g. GSM/UMTS).

Multi system terminal: Terminal which supports both the 3GPP system and non-3GPP system(s).

Non-3GPP system: Mobile telecommunications system, having non-MAP core network, with specifications which are outside the control or influence of 3GPP.

3GPP system: MAP core network and various access networks.

3GPP2 system: IS-41 core network and various cdma access network .

Other definitions are given in 3GPP TR 21.905 [1].

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

PRL Preferred Roaming List

GAIT GSM/ANSI-136 Interoperability
R-UIM Removable User Interface Module (a 3GPP2 abbreviation)

Further abbreviations are given in 3GPP TR 21.905 [1].

4 Categories of multi system terminals

4.1 Common characteristics

- 3GPP and non-3GPP system(s) in the same terminal.

Benefit to the user

Increased coverage area.

Wider range of services

Can use one terminal for both systems.

4.2 Category 1 - Manual switching

- The user manually selects system.
- Separate 3GPP and non-3GPP identities (e.g. USIM and R-UIM).
- When in 3GPP system, terminal does not scan non-3GPP systems and vice versa.

4.3 Category 2 - Automatic switching by an overlay function

- When in 3GPP system, terminal scans non-3GPP systems and vice versa.
- Terminal does not suspend operation on a system while it scans for the other (i.e. dual transceivers).
- Scanning information is passed to an overlay function which decides if to change system.
- System is changed by selecting USIM or R-UIM in the case of 3GPP2 [depending on user and/or operator"s preferences].

4.4 Category 3 - Selection method of one system to extended to another

4.4.1 Example A, extended PLMN list

- The 3GPP network selection mechanism could be extended to non-3GPP networks.
- Non 3GPP entries (e.g. cdma2000, SSID) could be contained in the 3GPP Preferred PLMN+RAT List.

Note 1: Significant work would be needed in 3GPP and GSM-A to allow non-3GPP network information to be contained in the PLMN list. However, one implementation specific solution may be for a dummy entry 'switch to PRL' to be placed in the preferred PLMN list.

4.4.2 Example B, extended PRL

- The 3GPP2 network selection mechanism could be extended to non-3GPP2 networks.
- GSM/W-CDMA or SSID information could be contained in the 3GPP2 PRL.

Note 2: Work is being done in 3GPP2 on this method.

4.5 Category 4 – Multiple systems operational simultaneously

- User can access the internet directly via WLAN while the terminal is connected to the cellular network at the same time.

Note 1: While connected to the 3GPP network, the terminal will follow 3GPP specifications.

- 3GPP and 3GPP2 parts of the terminal may be active at the same time (e.g. for different applications).

5 Use cases

5.1 Roaming cases

Example 1: Luke, who has a multi system terminal, uses the services of his 3GPP operator A. While on vacation in another country, the available networks are the 3GPP network of operator B, offering very basic 3GPP functionalities, and the non 3GPP network of operator C, offering equivalent services compared to operator A. Ideally, Luke would like his device to select the non-3GPP operator C to be able to take advantage of the similarity of services. If his device selects operator B, Luke can select operator C manually if he wishes.

Example 2: Andrew, who has a multi system terminal, uses the services of his 3GPP operator A. While on vacation in another country, the available networks are the 3GPP network of operator B, offering a wide range of 3GPP functionalities, and the non 3GPP network of operator C, offering equivalent services compared to operators A and B. Ideally, Andrew would like his device to select 3GPP operator B because services should generally work better in the same system (e.g. no transcoding). If his device selects operator C, Andrew can select operator B manually if he wishes.

Example 3: Leia, who has a multi system terminal, uses the services of her 3GPP operator A. While on vacation in another country, the available networks are the 3GPP network of operator B, and the non 3GPP network of operator C. Operator A and C have a commercial alliance. Therefore, operator A would prefer that the non 3GPP operator C will be selected. Leia can select operator B manually if she wishes.

Example 4: Harry, who has a multi system terminal, uses the services of his 3GPP operator A. While on vacation in another country, the available networks are the 3GPP network of operator B, and the non 3GPP network of operator C. Operator A and C are in fact owned by the same company. Therefore, operator A would like to be sure that the non 3GPP operator C will be selected. Harry can select operator B manually if he wishes.

Note: In the above examples it is assumed that there are roaming agreements between operators A, B and C.

5.2 Non-roaming cases

Example 5: Ana, who has a multi system terminal, uses the services of operator A. Operator A operates both 3GPP and a non-3GPP system in the same area. Operator A wishes to control when Ana uses each system for reasons of load sharing and to ensure that Ana gets the best possible user experience. Ana can manually select either system.

Example 6: Paul, who has a multi system terminal, uses the services of operator A. Operator A operates a 3GPP system. Paul"s terminal is capable of accessing the internet via WLAN (not I-WLAN), e.g. for web browsing and VoIP. Paul has a tariff with operator A that allows him to connect to the internet via WLAN and use the services of an ISP.

6 Considerations for multi system terminals

6.1 General categorization of usage

Multi system terminals will be used:

a) When an operator deploys more than one system in the same geographic area.

b) When an operator operates different systems in different geographic areas, or has roaming agreements with operators of other systems in different geographic areas.

6.2 Subscription aspects

There are two kinds of subscription from a user"s perspective: single subscription to an operator and multiple subscriptions to multiple operators.

In the single subscription case, a user subscribes only to a single operator and either

- the operator deploys several systems, or
- the operator deploys one of the systems and has a roaming agreement with operators deploying other systems.

An interworking function is required because of the different core networks used. A practical example of this scenario is GAIT.

In the multiple subscriptions case, a user could select operators for each system by himself and subscribe to them all, or one operator could organise other subscriptions on his behalf and take care of call forwarding. The latter is more likely. For example, in an early deployment of multi system terminals, there is a subscription with a cdma1x operator who also provides a GSM subscription (SIM) and deals with call forwarding but there is a close commercial link between the two operators and the user only deals with one of them.

Multiple subscriptions to one operator is another possible combination.

6.3 MMI aspects

A user should be able to configure the multi system terminal to any one system manually.

One possible implementation would display the system name along with the network name.

No new standardisation for MMI is expected.

6.4 Charging aspects

The charging mechanisms associated with each system will be used.

Handover between systems may require a review of charging specs (anchor principle).

6.5 Security aspects

The security mechanisms associated with each system will be used.

6.6 Target time to select system

The time taken to do network and system selection may be longer than it already is for a single system terminal.

6.7 System preference settings

User experience is important issue of system selection. Multi system terminal should use the most suitable access system for services (e.g. PS for internet access) while considering the cost.

The operator preference settings (parameters, default behaviour for system selection) will be important. The three reasons that influence the operator"s preference are (in order of importance):

1. Commercial. In roaming situations, commercial factors will also determine the home operator"s preference for selection of system. For example, when a partner network is found in another system and non-partner networks in the

same system, preference will be towards the former. This case could be handled by defining default behaviour (e.g. "always select home network") or detailed multi system preference lists.

2. Load sharing. If an operator operates more than one system in the same geographic area, loadsharing factors will determine the operator"s preference for system selection.

3. Customer experience. Services provided by the home operator (e.g. SS, MMS, MBMS, LCS, IMS, PoC, etc) may work better when the terminal roams in networks of the same system that the home operator has. This may be because of transcoding. Therefore the home operator may be interested in preferring the same system if there are no over-riding commercial factors.

New methods for setting and updating the system selection parameters should not require new heavy machinery. Mechanisms that reuse the already existing mechanisms (e.g. SIM toolkit, OMA device management) should be preferred. Update and setting of system parameters is duty of the operator.

6.8 System selection

6.8.1 Overview

System selection could be divided into 3 cases: switch-on or recovery from lack of coverage, user reselection and system switching.

In the case of an overlay functionality, that overlay functionality should contain a mechanism to indicate a user and/or an operator preference to decide which system (i.e. GSM/UMTS or CDMA) to choose to access, i.e. which application (R-UIM or USIM) will be selected in priority. This mechanism should occur before the identity module of either technology is selected. The existing network-specific selection procedure will then control the initial network selection.

6.8.2 Switch-on or recovery from lack of coverage

Operator defined default rules are needed.

6.8.3 User reselection

Manual reselection should be possible.

An application should not initiate reselection without the permission of the user.

6.8.4 System switching

The overlay function is supposed to make decisions on when to switch from one system (e.g. 3GPP) to another system (e.g. 3GPP2). It also should have possibility to return to other systems.

Background scan could be allowable or not, and if allowable, could be automatic or manual. The result of a background scan could be displayed to the user or used for automatic reselection of system.

The need for automatic or manual scan will depend on the situation. In the case where an operator deploys multiple systems in the same area, it will be acceptable for operators to allow the automatic scan, because after the search the terminal will still be connected to the same operator.

In roaming cases, background scans could lead to display or attempted connection to a system that the user can not access. Roaming agreements between operators could be reflected in the system list resulting from a background system scan.

Unless system and network priorities are specified, there will be cases when the terminal stays in a visited network even though the home network is available in another system. The home operator will need to determine which is most important, to be in the same system or the home network.

Background scan should naturally be done in both directions.

Background scanning must not lead a 'ping-pong' situation.

Whether, and for how long, user manual preference settings are retained is also an issue. Further consideration will be required for the length of time that user preferences can override operator preferences, and if user preference settings are retained after an event (recovery from lack of coverage, power-off).

7 Conclusion

7.1 Overview

In this study there are four different categories defined,

- Category 1- Manual Switching,
- Category 2 - Automatic switching with an overlay function,
- Category - 3 Extending the selection of one system to another, and
- Category - 4 Multiple systems operating simultaneously.

The different categories have increasing level of interaction between the 3GPP and non-3GPP systems starting with category 1 which does not have any interaction at all and the selection between the systems is done manually.

There are, and will be even more, terminals supporting both 3GPP specifications and non-3GPP specifications and it is important that the 3GPP specifications do not prohibit the use of these terminals.

It is not important that different categories of Multi System terminal are implemented as long as they behave as the home network operator wants them to.

It is important that Multi System terminals with 3GPP capability must be compliant with 3GPP specifications when in 3GPP mode and that there are no adverse affects on networks due to different categories.

There are requirements in TS 22.011 Release-7 to cover categories 1 and 2. Categories 3 and 4 may require closer co-operation between standardization bodies. Functionality beyond system selection, such as interworking or handover between different systems would also require close co-operation. No further standardization in 3GPP is envisaged at the moment.

It is recognised that other standardisation bodies may do work on specifications for multi system terminals when in non-3GPP mode.

It should not be the intention of one standardization group to impose requirements of its system on the other.

7.2 General requirements for system selection

The method of system selection must provide means for the operator to set system preferences. It may also allow user to set system preferences but more consideration is needed in this area.

The method of system selection must, having switched to a different system, be capable of switching back to the original system.

The method of system selection should allow manual system selection as this is likely to be a regulatory requirement in some regions.

Annex A:
Change history

Change history											
TSG SA#	**SA Doc.**	**SA1 Doc**	**Spec**	**CR**	**Rev**	**Rel**	**Cat**	**Subject/Comment**	**Old**	**New**	**WI**
2004-06			22.936					Initial TR skeleton provided to SA1		0.1.0	
2004-10			22.936					Output of drafting group in SA1#26	0.1.0	0.2.0	
2005-01			22.936					Output of drafting group in SA1#27	0.2.0	0.3.0	
2005-07			22.936					Output of drafting group in SA1#29	0.3.0	0.4.0	
2005-07			22.936					Output of SA1#29	0.4.0	1.0.0	
2005-10			22.936					Output of drafting group in SA1#30	1.0.0	1.1.0	
SP-30	SP-050759	S1-051241	22.936					Raised to version 2.0.0 for presentation to SA #30	1.1.0	2.0.0	
SP-30	SP-050759	S1-051241	22.936			Rel-7		Approved at SA #30 for Rel-7	2.0.0	7.0.0	
SP-31	SP-060043	S1-060291	22.936	0001	-	Rel-7	F	Revision of the Scope of TR22.936	7.0.0	7.1.0	BMSU
SP-42	-	-				Rel-8		Updated from Rel-7 to Rel-8	7.0.0	8.0.0	
SP-46	-	-	-	-	-	-	-	Updated to Rel-9 by MCC	8.0.0	9.0.0	
2011-03	-	-	-	-	-	-	-	Update to Rel-10 version (MCC)	9.0.0	10.0.0	
2012-09	-	-	-	-	-	-	-	Updated to Rel-11 by MCC	10.0.0	11.0.0	
2014-10								Updated to Rel-12 by MCC	11.0.0	12.0.0	

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