3GPP TSG_CN#6 **NP-99440**
ETSI SMG3 Plenary Meeting #6,
Nice, France
13th – 15th December 1999

Agenda item: **5.1.3**

Source: **TSG_N WG1**

Title: **TR on Work Item MS Classmark**

Introduction:

This document contains TR agreed by **TSG_N WG1** and forwarded to **TSG_N Plenary** meeting **#6** for approval.

Two Documents are attached:

- Presentation of TR 23.814

- N1-99F47	TR 23.814 v.1.0.0	R99	1.0.0	MS Classmark	N1	agreed

Presentation of Specification to TSG or WG

Presentation to: TSG CN Meeting #<6>

Document for presentation: TR 23.814, Version <1.0.0>

Presented for: Approval

Abstract of document:

UMTS MM protocol will be developed based on Release 98 of GSM04.08 incorporated new requirements from UMTS. This work needs to be done carefully with considering the balance of smooth migration from GSM and technical improvement.

Requirements in this TR mainly come from the concept of clear separation between Radio Access Network and Core Network and Improvement of signalling efficiency

Clear separation of radio access network technology and core network technology is one of prime requirement of UMTS. This concept enables the system to be developed independently from other sub-system technology. This causes easy evolution of the system applying suitable technology to the sub-system at the moment. Another advantage of the concept is that it achieves modularity of several radio system to UMTS core network. Depending on the environment, suitable radio access system can be different. The possible candidates are, for example, GSM RR, URAN, USRAN, BRAN, MMAC,...

MM protocol is located upon Non-access stratum, which is a strata independent from access system technology. More clear separation than GSM is required.

Changes since last presentation to TSG-CN Meeting #6:

- PS classmark handling description.
- Necessary information list for core network classmark.
- Classmark handling during inter-system handover.

Outstanding Issues:

- Necessity of SS screening indicator in MS CM2 (N1)
- How does the network decide which security parameters and procedures to use? (S3 is working on this)

Contentious Issues:

None

3GPP/SMG Meeting #9

Bad Aibling, Germany, 30 Oct- 3-Dec. 1999 ***N1-99F47***

3G TR 23.814V1.0.0 (99-12)

Technical Report

3rd Generation Partnership Project; Technical Specification Group CN; Separating RR and MM specific parts of the MS Classmark (3G TR 23.814 version 1.0.0)

Reference

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3GPP

Postal address

3GPP support office address

650 Route des Lucioles - Sophia Antipolis
Valbonne - FRANCE
Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Internet

http://www.3gpp.org

Table of Contents

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Foreword

This Technical Report (TR) has been produced by the 3GPP TSG CN WG1 of the 3rd Generation Partnership Project (3GPP).

This document is to define the basic issues related to the Classmark handling in UMTS core network.

Should 3GPP TSG CN WG1 modify the contents of this TR it will then be republished by 3GPP with an identifying change of release date and an increase in version number as follows:

Version 1.x.y

where:

1 indicates sent to TSG CN for Information

x the second digit is incremented for all other types of changes, i.e. technical enhancements, corrections, updates, etc.

y the third digit is incremented when editorial only changes have been incorporated in the specification.

1 Scope

This technical report covers the requirement for all aspects of Classmark handling issue from the viewpoint of R99 UMTS core network to be a basis for the protocol design. The Classmark handling in RAN is studied only when it is supposed to have some impact on core network.

2 References

[To be provided]

3 Definitions and Abbreviations

3.1 Definitions

Editors note : Reference to Definition document required.

For the purposes of the present document, the [following] terms and definitions [given in ... and the following] apply.

<defined term>: <definition>.

example: text used to clarify abstract rules by applying them literally.

3.2 Abbreviations

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

MS-CM MS Classmark

MM Mobility Management

BRAN, Broadband Radio Access Network

MMAC Multi-Media Access

USRAN UTMS Satellite Radio Access Networ

URAN UMTS Radio Access Network

PS Packet Switch

CS Circuit Switch

4 Principle

UMTS MM protocol will be developed based on Release 98 of GSM04.08 incorporated new requirements from UMTS. This work needs to be done carefully with considering the balance of smooth migration from GSM and technical improvement.

Requirements in this TR mainly come from;

- Concept of clear separation between Radio Access Network and Core Network
- Improvement of signalling efficiency

Clear separation of radio access network technology and core network technology is one of prime requirement of UMTS. This concept enables the system to be developed independently from other sub-system technology. This causes easy evolution of the system applying suitable technology to the sub-system at the moment. Another advantage of the concept is that it achieves modularity of several radio system to UMTS core network. Depending on the environment, suitable radio access system can be different. The possible candidates are, for example, GSM RR, URAN, USRAN, BRAN, MMAC,...

MM protocol is located upon Non-access stratum, which is a strata independent from access system technology. More clear separation than GSM is required.

In general, protocol seeks for the efficiency. This will be achieved as far as possible.

5 Consideration of GSM

5.1 Parameter Structure

Various information is packed in MS Classmark in GSM, therefore location of RAN and CN information fields depend on each other. For the independent development of RAN and CN, it would be reasonable information for both sub-systems to be placed separately in different parameters. If they are packed in a parameter, interpretation of the information requires presumption of data structure of another sub-system (i.e., GSM CN and GSM RAN).

5.2 Notification Procedure

Paging Response message and *CM Service Request* message can carry only *MS Classmark 2* IE because of available length constraint, therefore further information such as *MS Classmark 3 IE* should be got using Classmark Interrogation procedure.

If another mobile station Classmark is defined, it will not be included in neither of *Paging Response* message nor *CM Service Request* message but these parameters are retrieved by Classmark interrogation procedure, which requires one more round trip at air interface.

This procedure is because of a specific radio procedure applied to GSM. The procedure is that initial layer 3 information (i.e., *CM Service Request*, *Paging Response*...) is sent on the UUI filed of *SABM*, which establishes layer 2 connection. This procedure is specific to GSM radio system.

Some problems are seen in it. First one is that MM procedure is too much dependent on specific radio system procedure, and next is Classmark interrogation procedure causes more radio traffic and delay of service provisioning to a user.

6 MS Classmark Restructuring

6.1 MS Classmark Configuration Overview

UMTS MS Classmark can be categorised into RAN related Classmark and CN related Classmark. RAN related Classmark is newly defined for UTRAN, and CN related Classmark is composed of CN related field of *MS Classmark 2* IE and potentially new information, which will be specified into the current spare bits and additional octets if needed. The *MS Classmark 2* IE is identical to one used for GSM (i.e., UMTS and GSM share same IE).

The overview of the MS Classmark configuration concept is illustrated as Figure 1.

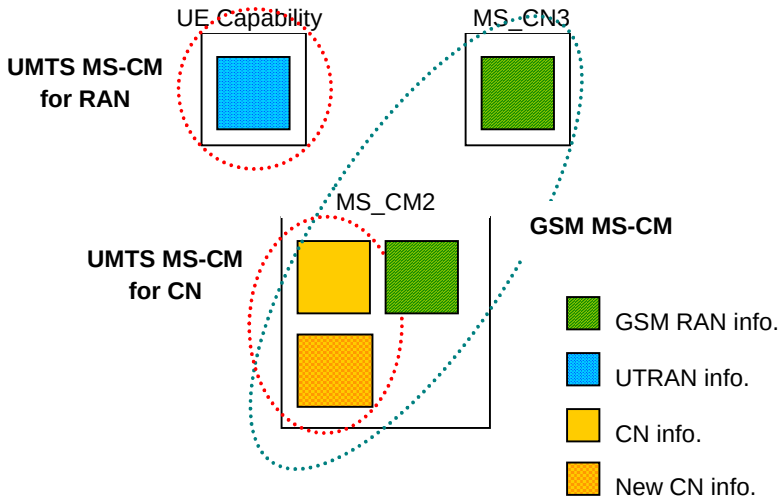

Figure 1 Overview of MS Classmark Configuration

6.2 Parameter Structure

6.2.1 Separation of RAN and CN information

Considering the clear separation of radio access network and core network, mobile station Classmark should be separately defined as new parameters in principle.

Reason to have different MS Classmark parameters for RAN and CN is that radio access network for UMTS is not necessarily one so that it is predicted to emerge more different systems. If we capture all the radio information in a same parameter, unnecessary information will increase endlessly. Considering the case, it shall be necessary to have different parameter by every radio system.

Mobile station Classmark for each RAN shall be independently defined in each system for the protocol independence and efficiency.

6.2.2 Limitation of length

As UMTS is after the radio independent MM protocol, the limitation of IE length specific to a radio system is desired to be put away.

Layer 3 procedure should be designed to be independent from Layer 2 procedure. Procedure of Non-access stratum should be free from constraint of specific radio access network procedure. If we need to have limitation of length, this is to be determined as appropriate for MM protocol.

If the length of MS Classmark 2 becomes too long to be sent in a single GSM radio frame, the UE sends only the first 4 octets of it (excluding IEI) in the CM service invocation, and the complete MS Classmark 2 + MS Classmark 3 in the subsequent Classmark Update message (controlled early Classmark sending). This behaviour concerns the UE only when it is roaming in GSM.

6.2.3 Core Network Related Information in MS Classmark 2

For UMTS, the mandatory core network related information consists of the following information in MS Classmark 2 IE:

- Revision level
- CM service prompt,
- USC2 alphabet preference
- SS screening indicator (foreseen for future use)

GSM and UMTS shall share *MS Classmark 2 IE*.

8	7	6	5	4	3	2	1	
Mobile station classmark 2 IEI								octet 1
Length of mobile station classmark for UMTS contents								octet 2
0 spare	Revision level		ES IND	A5/1	RF power capability			octet 3
0 spare	PS cap.	SS Screen Indicator		SM cap.	VBS	VGCS	FC	octet 4
CM3	0 spare		UCS2 *Note	SoLSA	CMSP	A5/3	A5/2	octet 5

Figure 2 Mobile Station Classmark 2 information element

Note: Only this field is not originally located in *MS Classmark 2 IE* but copied from MS Classmark 3.

Additional core network related information would make use of the spare field. It should be noted that fields containing radio specific information would be left unused for UMTS core network purpose. If there is no field available in the IE for core network related information, *Core Network Classmark Extension IE* shall be defined to capture the additional information.

Same set of core network related information should be stored in both the GSM Classmark and the UMTS Classmark even if a feature would not be supported by a certain radio system.

6.3 One Way Notification Procedure

All the necessary information of UE should be sent in a message considering efficiency of radio resource and reduction of delay.

In UMTS, setup procedure of RRC connection and MM connection is clearly separated so that RRC connection has been established when initial non-access stratum message is sent. This procedure makes it possible to send more octets at the first message than it is in GSM so that the limitation of maximum number of the length is not so critical.

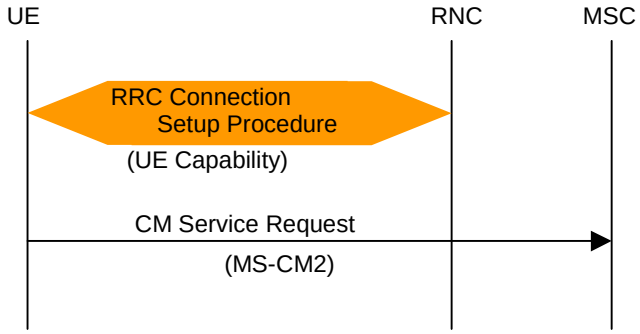

Figure 3 One Way Notification Procedure

6.4 Security Information Handling Procedure

Security related information (i.e., UEA and UIA) is radio specific information so that it should be excluded from MS Classmark for CN. The procedure to handle the information is as follows;

1) A UE sends supporting UEA and UIA to RNC when it establishes RRC connection.
2) The UE sends initial L3 message, which causes security procedure.
3) After the authentication procedure completed successfully, the CN node sends security mode command, which may includes allowed UIA and UEA if the CN node wants to restrict them.
4) The RNC chose UEA and UIA to use among the algorithms which are supported by the UE and allowed by the CN node.
5) The security control procedure is executed, and selected UIA and UEA are reported from the RNC to the CN node if necessary.

This procedure is applied only to UMTS.

7 CS Classmark Handling Procedure

7.1 General Concept

It is very important to keep a harmonisation between compatibility issue and technical improvement when we consider the development of system.

A dual mode (GSM/UMTS) MS under a GSM coverage, shall implement “Controlled Early Classmark sending “ function, in order to send Classmark information (MS Classmark 2 and MS Classmark 3).

7.2 CM Service Invocation

7.2.1 Classmark Sending Criteria for UE

7.2.1.1 Core Network Classmark

UMTS MS Classmark for Core Network is composed of radio independent part of *MS Classmark 2 IE*. This IE is set in *CM Service Request* message, *CM Re-establishment Request* message, *Location Updating Request* message or *Paging Response message* unconditionally and sent to MSC.

7.2.1.2 UTRAN Classmark

If serving RAN is the UTRAN, MS Classmark for UTRAN (i.e., UE Capability Information) is sent to RNC in RRC procedure when the UE establishes the RRC connection. This information shall be never included in MM messages.

7.2.1.3 GSM RAN Classmark

GSM RAN Classmark is composed of radio specific part of *MS Classmark 2* IE and *MS Classmark 3* IE with R99 enhancements. The *MS Classmark 2* IE is sent to the MSC via the GSM BSS if serving RAN is the GSM RAN.

Under GSM RAN area, the *MS Classmark 3* IE is sent by the MS through the "Controlled Early Classmark sending" procedure, and stored in both the GSM BSS and the MSC, on each connection establishment.(*CM Service Request*, *CM Re-establishment Request*, *Paging Response*).

Under UTRAN area, the *MS Classmark 3* IE is interrogated by the RNC when it determines necessary. The timing to invoke the interrogation procedure is out of scope of this TR.

If the length of MS Classmark 2 becomes too long to be sent in a single GSM radio frame, the UE sends only the first 4 octets of it (excluding IEI) in the CM service invocation, and the complete MS Classmark 2 + MS Classmark 3 in the subsequent Classmark Update message (controlled early Classmark sending). This behaviour concerns the UE only when it is roaming in GSM.

7.2.2 Served by UMTS MSC

7.2.2.1 UMTS RNC Area

CM service invocation procedure under UMTS-RNC and UMTS MSC is shown in Figure 4.

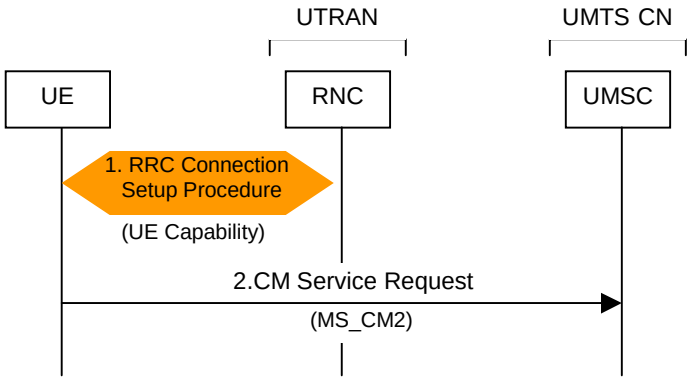

Figure 4 CM Service Invocation under RNC

Procedure:

0. The UE detects that it is under UTRAN area and served by UMTS MSC at the moment by broadcast information.
1. The UE starts RRC connection setup procedure, and during the procedure *UE Capability* IE is sent to the RNC.
2. After the establishment of the RRC connection, The UE sends *CM Service Request* message to the MSC with *MS Classmark 2* IE.

7.2.2.2 GSM BSS Area

CM service invocation procedure under GSM-BSS and UMTS-MSC is shown in Figure 5.

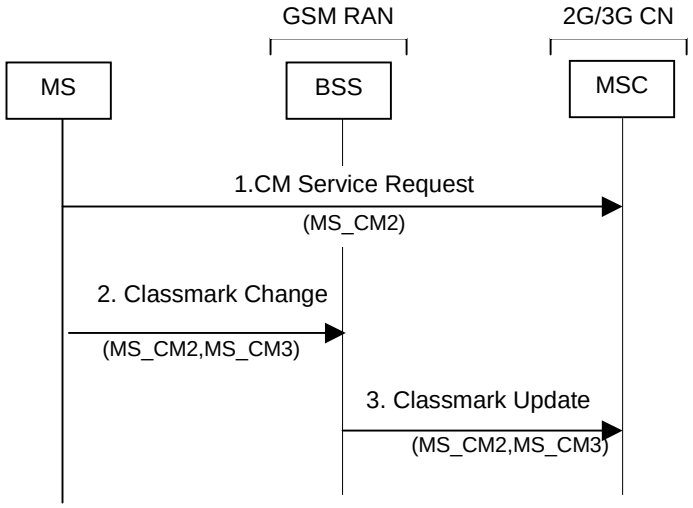

Figure 5 CM Service Invocation under BSS

Procedure:

0. The MS detects that it is under GSM BSS area and served by UMTS MSC at the moment by broadcast information
1. The MS sends *CM Service Request* message to MSC via BSS with *MS Classmark 2* IE.
2. The *"Early Classmark handling"* procedure leads to sending of Classmark Change message by the MS, which includes extra Classmark informations (i.e., *MS Classmark 3* IE), in addition to *MS Classmark 2* IE .
3. BSS memorize the received *MS Classmark 2* IE and *MS Classmark 3* IE and relays them to MSC by *Classmark Update* message.

7.2.3 Served by GSM MSC

Note: This connecting pattern is out of scope of this TR.

7.3 Inter Radio System Handover

7.3.1 General Procedure

- MS Classmark for CN is transferred to CN in CM service invocation procedure (e.g. CM Service Request, Paging Response etc.) and it is not influenced by handover.
- The source RAN side shall be able to adapt to the requirement of the target RAN side for inter system handover => Classmark informations needed by target RAN must be provided by source RAN .

  The way in which the source RAN entities retrieves the target RAN Classmark informations is out of the scope of this study. Nevertheless, these information are sent to CN for retransmission, to target RAN, on decision by RAN, to perform handover (it is RAN responsibility to get them in due time).

- UMTS RAN Classmark is stored in RAN and is delivered from source UMTS/GSM RAN to target UMTS RAN, and GSM RAN Classmark is stored in CN (for intra-GSM handovers) and is delivered from source UMTS RAN to the target GSM RAN.
  - For UMTS => GSM handover: GSM RAN Classmark must be provided as explicit parameters in Relocation Required message for setting Handover Request parameters. (« Source RNC to target RNC» transparent field is not interpreted by the CN).GSM RAN Classmark is stored in MSC.
  - For GSM => UMTS handover: UMTS RAN Classmark must be provided in « Old BSS to New BSS information» transparent field of Handover Required message, and entirely copied by MSC, in « Source RNC to target RNC» transparent field of Relocation Required message

- For 3G RAN => 3G RAN handover: UMTS RAN Classmark must be provided in « Source RNC to target RNC» transparent field of Relocation Required message.

According previous assumptions, following figures show how Classmark informations are transferred:

7.3.2 Handover between 3G RANs

In this case, UMTS RAN Classmark of the target radio system is transparently transferred via 3G-MSC.

Handover procedure between 3G RANs is shown in Figure 6.

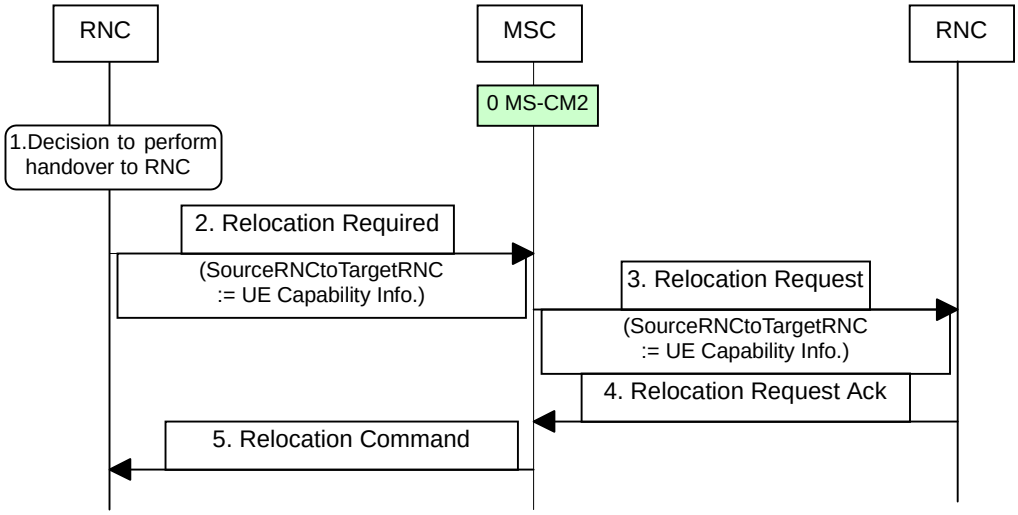

Figure 6 Handover from UMTS to UMTS

0. The 3G-MSC has previously stored *the MS Classmark 2* IE.
1. RNC decides initiation of handover to another RNC.
2. RNC initiates the preparation of UMTS to UMTS Handover by sending the RANAP message *Relocation Required* to 3G-MSC with *"Source RNC to target RNC transparent field"* parameter containing ***UE Capability Information***
3. 3G-MSC requests target RNC to process Handover, by sending *Relocation Request* with the *"Source RNC to target RNC transparent field"* parameter got from the *Relocation Required*
4. The next steps of the handover do not involve Classmark.

7.3.3 Handover from 3G RAN to GSM

Handover procedure from 3G RAN to GSM BSS is shown in Figure 7.

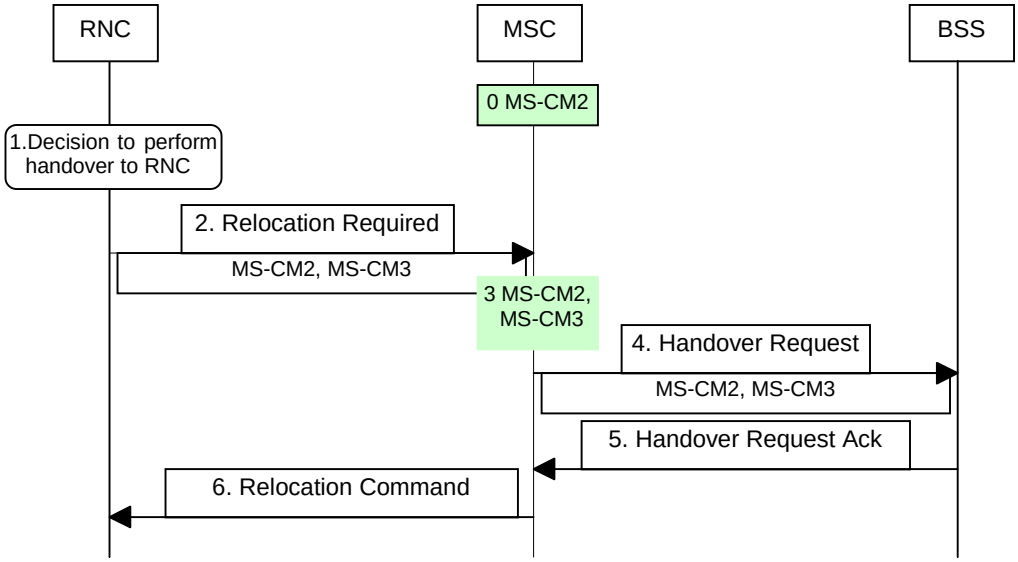

Figure 7 Handover from UMTS to GSM

0. The 3G-MSC has previously stored the MS Classmark 2

1. On decision to handover to GSM, the RNC has to get MS Classmark 2 and MS Classmark 3 from the MS

2. RNC initiates the preparation of UMTS to GSM Handover by sending the RANAP message Relocation Required to 3G-MSC with MS Classmark 2 and MS Classmark 3 parameters.

3. 3G_MSC stores MS Classmark 2 and MS Classmark 3.

4. 3G-MSC requests target BSS to process Handover, by sending Handover Request with MS Classmark 2 and MS Classmark 3parameters retrieved from Relocation Required

   These parameters are stored in the 3G-MSC for further intra-handover from BSS to BSS.

5. The next steps of the handover do not involve Classmark.

7.3.4 Handover from GSM to 3G RAN

Handover procedure from GSM to UMTS is shown in Figure 8.

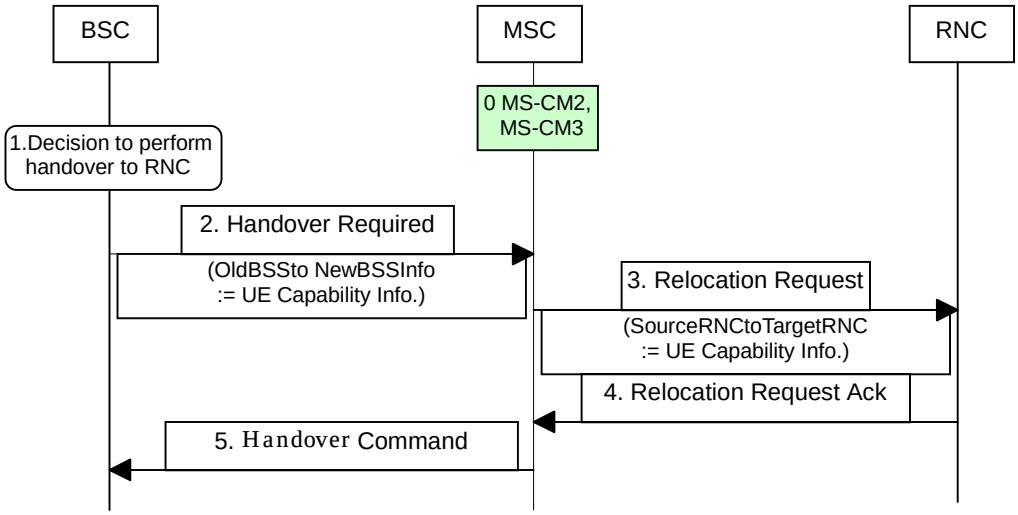

Figure 8 Handover from GSM to UMTS

0. The 3G-MSC has previously stored the MS Classmark 2 and MS Classmark 3

1. On decision to handover to RNC, the BSS has to get *UE Capability Information* from the MS

2. BSS initiates the preparation of GSM to UMTS Handover by sending the BSSMAP message Handover Required to 3G-MSC with in *"Old BSS to new BSS transparent field"* parameter containing *UE Capability Information*.

3. 3G-MSC requests target RNC to process Handover, by sending Relocation Request: the in *"Old BSS to new BSS transparent field"* is copied in the *"Source RNC to target RNC transparent field"* of the *Relocation request* message

4. The next steps of the handover do not involve Classmark.

8 UMTS Handling of PS Classmark

8.1 Proposed Working assumption

- The "MS network capability" parameter is a common UMTS and GSM R99 CN parameter and shall be stored in SGSN: today there is no need to define a specific UMTS CN parameter.
- The specific UMTS PS RAN parameter named "UE PS Capability Information "shall be stored in RNC.
- The UMTS ciphering capabilities are RAN specific informations and are included in the "UE PS Capability Information "

8.2 Classmark structure

In UMTS Classmark is divided into:

- "UE PS Capability Information " specific to UMTS radio part
- "MS network capability" : same parameter than GPRS and independent from UMTS radio part. This parameter contains MS GPRS ciphering capabilities while UMTS ciphering capabilities are in "UE PS Capability Information ". Keeping GPRS ciphering capabilities in "MS network capability" is required for UMTS => SGSN handover, because 2G-SGSN handles ciphering, and

SGSN Context response message from 3G-SGSN to 2G-SGSN transfers only “MS network capability“ parameter.

8.3 Classmark notification

“MS network capability“ is unconditionally sent in ATTACH REQUEST messages to 3G-SGSN.

“UE PS Capability Information“ is sent to RNC in RRC procedure when the UE establishes the RRC connection

The "MS Radio Access capability" parameter is unconditionally sent in ATTACH REQUEST and RA UPDATE REQUEST messages to 3G-SGSN. This parameter can be sent with dummy values. It is only sent for compatibility reasons. (The "MS Radio Access capability" parameter is mandatory in ATTACH REQUEST and RA UPDATE REQUEST messages for GSM). The 3G-SGSN ignores this parameter.

8.3.1 ATTACH REQUEST under RNC

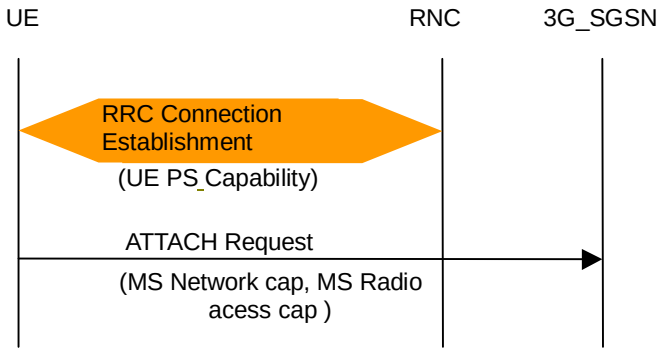

Figure 9 ATTACH REQUEST under RNC

The 3G-SGSN memorizes the received *“MS Network cap”* parameter. It ignores the "MS radio access capabilities" parameter.

RNC memorizes the received “UE PS Capability” parameter.

8.3.2 RA-UPDATE REQUEST under RNC

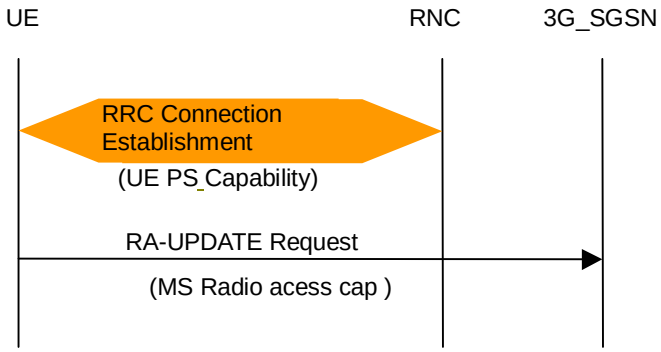

Figure 10 RA-UPDATE REQUEST under RNC

RNC memorizes the received “UE PS Capability” parameter.

The 3G-SGSN ignores the "MS radio access capabilities" parameter.

8.4 Inter Radio System Handover on PS Domain

8.4.1 Inter SGSN Handover from UMTS to GPRS

Decision from RNC to perform handover to GSM area, leads to sending by UE a RA-UPDATE Request.under GSM BSS area.

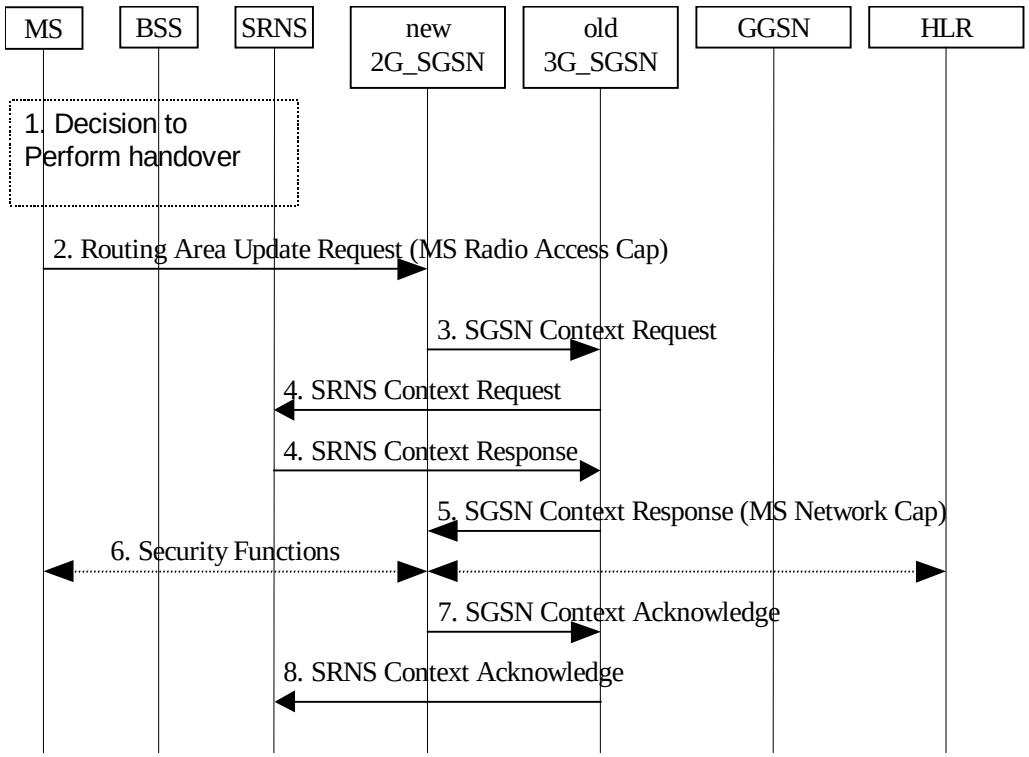

Figure 11 Inter SGSN Handover from UMTS to GPRS

Before handover:

The *"UE PS Capability"* parameter is stored in RNC.

The "MS Network cap" parameter is stored in 3G SGSN

On RA-UPDATE Rqst, 2G-SGSN receives "MS Radio Access cap" and stores it .

The "MS Network cap" parameter is transferred to 2G SGSN on SGSN Context response and contains MS GPRS ciphering capabilities.

8.4.2 Inter SGSN Handover from GPRS to UMTS

Decision from BSS to perform handover to UMTS area, leads to sending by UE a RA-UPDATE Request.under RNC area.

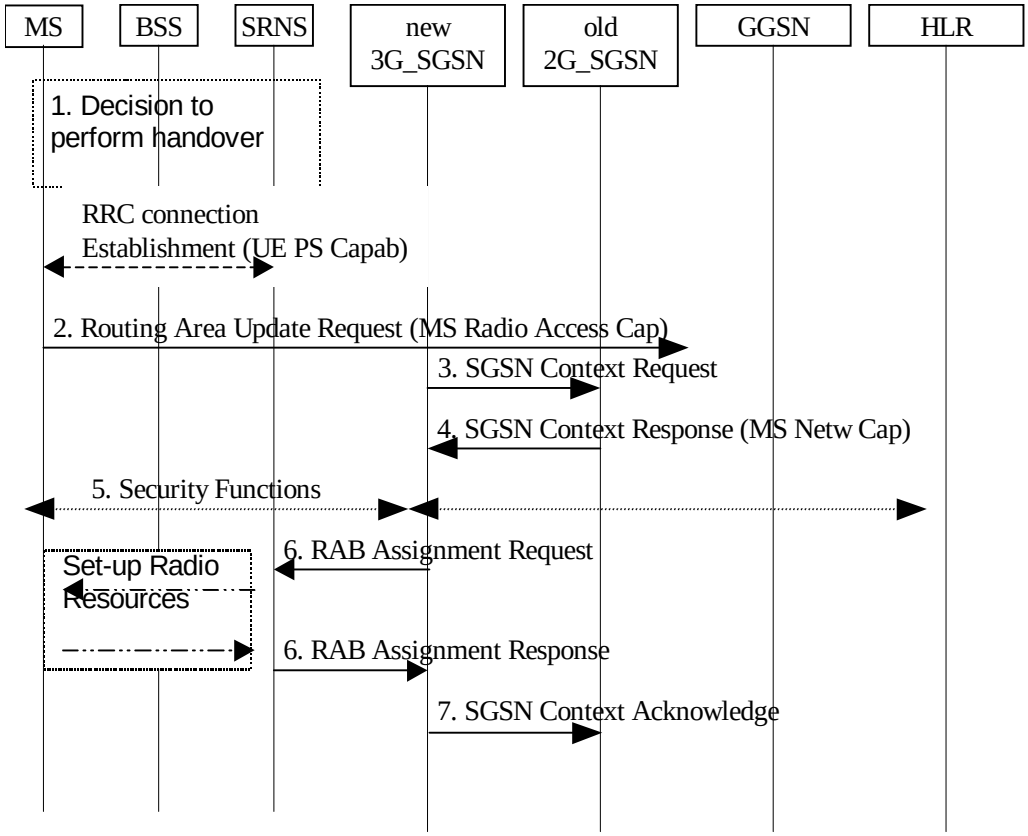

Figure 12 Handover from GPRS to UMTS

Before handover:

The “MS Radio Access cap“ and the “MS Network cap“ parameters are stored in 2G-SGSN.

The *“UE PS Capability“* is transferred to RNC on RRC connection Establishment for RA Update on RNC, and contains UMTS ciphering capabilities.

The 3G-SGSN ignores the "MS radio access capabilities" parameter received in Routing Area Update Request.

The “MS Network cap“ parameter is transferred to 3G SGSN on SGSN Context response.

History

Document history		
V0.0.1	March 1999	First version of TR capturing contributions related to this issue.
V0.1.0	April 1999	-
V0.2.0	June 1999	Approved version as working assumption. - Present condition remains mandatory - Common message is applied both for GSM and UMTS
V0.2.1	June 1999	Editorial modifications to V0.2.0 captured
V0.3.0	August 1999	Classmark field definition is incorporated. Alternative for Classmark transfer procedure is captured
V0.4.0	September 1999	Output version from N1#7.
V0.4.1	September 1999	V0.4.0 with editorial modification and clarification.
V0.4.2	October 1999	Input version to N1#8
V0.5.0	October 1999	Output version from N1#8.
V0.5.1	November 1999	V0.5.0 with editorial modifications - Terminology alignment - Deletion of interrogation procedure in MM - Adding Security information handling procedure
V1.0.0	December 1999	Output version from N1#9. Inclusion of: - Handling of PS Classmark - Mandatory Information for CM2 Version for Approval

Editor:

Fumihiko YOKOTA, Fujitsu Limited

E-mail: yokota@ss.ts.fujitsu.co.jp