TR <#> V 0.4.1(<1999-09>)

Technical Report

**3rd Generation Partnership Project (3GPP);
Technical Specification Group (TSG) CN;
Universal Mobile Telecommunications System (UMTS);
Separating RR and MM specific parts of the MS Classmark**

3GPP

Reference
<Workitem> (<Shortfilename>.PDF)

Keywords
<keyword[, keyword]>

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7.1 Definitions

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8 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.

9 Working Assumptions

Texts listed below are agreed working assumptions.

a) Radio access network technology and core network technology should be clearly separated in principle so that MM protocol, which is for CN, should be radio independent.

b) Mobile station capability related to RAN and CN need to be set in different parameters. Only CN related parameter should be present in MM message, and radio dependent information should not be included in MM messages except for GSM RAN Classmark.

c) Two RAN MS Classmark should be maintained both for UMTS and GSM. These are selectively used depending on the indication given by the CN and RAN.

d) Not to define several MS classmark IE (e.g. for location updating, for CM service invoking, etc.) Same Mobile station classmark IE should be applied both for Location updating and CM service invocation considering the reuse of same RR connection

Note: These WA may be outdated by what has been agreed in N1#7. See appendix.

10 Consideration of GSM

10.1.1 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).

10.1.2 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 message*, *Paging Response message* ...) 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.

11 MS Classmark Restructuring

11.1 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 *Core Network Classmark Extension (CN_CM_EXT) IE* which is newly defined. The *MS Classmark 2 IE* is identical to one used for GSM (i.e., UMTS and GSM share same IE). The *CN_CM_EXT IE* is also shared by UMTS and GSM for core network related information that can not be included in *MS Classmark 2 IE* because of length limitation of initial L3 messages in GSM.

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

Note: The *CN_CM_EXT IE* is for future use so that it may not be necessary to define from the first phase of UMTS (i.e., R99).
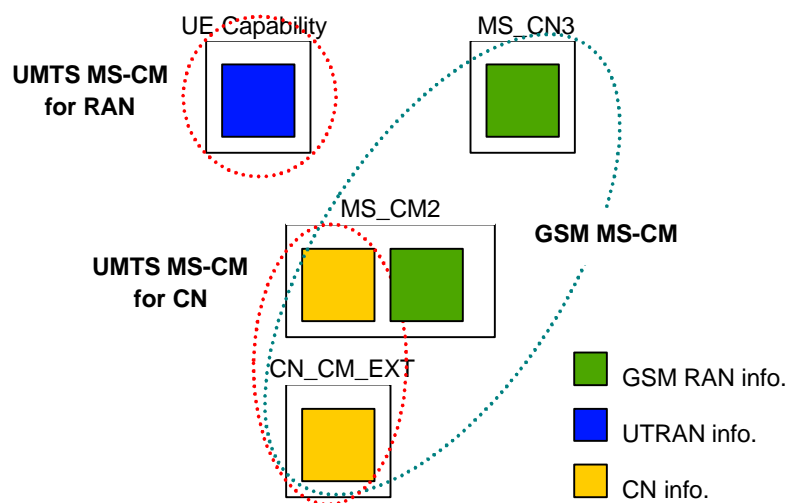

Figure 1 Overview of MS Classmark Configuration

11.2 Parameter Structure

11.2.1 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.

11.2.2 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.

This limitation of length should be abolished.

This principle will be applied only for newly defined IEs, for example *CN_MS_EXT IE*, because *MS Classmark 2 IE* is shared between GSM and UMTS so that the limitation of available length is still remaining.

11.2.3 Core Network Related Information in MS Classmark 2

Information categorised for CN are listed below. The information is picked up from one in *Mobile station classmark 2 IE* and *Mobile station classmark 3 IE*.

Note: Further check is required.

- Revision level
- SM capability
- VBS notification Reception
- VGCS notification Reception
- UCS2
- SS Screening Indicator
- CM Service Prompt

GSM and UMTS shall share *MS Classmark 2 IE*. The field containing radio specific information shall be disregarded by the UMTS MSC. The radio specific parts are shown as shaded in the figure below.

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	0 spare	0	UCS2 *Note	CMSP	A5/3	A5/2	octet 5

Figure 2 Mobile Station Classmark 2 information element

Additional core network related information will make use of the spare field. It should be noted that fields containing radio specific information will 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.

11.2.4 Classmark Interrogation Procedure

The classmark interrogation procedure is necessary like GSM, for example, in case of terminating call processing after location updating procedure. It shall be defined as a MM procedure since MS Classmark to be interrogated is NAS related information.

Note: If MS-CM for CN is set in *Location Updating Request message*, this classmark interrogation procedure is not necessary for above purpose. The probability of racing condition of terminating call and location updating, and increasing octets for MS-CM for CN in *Location Updating Request message* should be considered.

11.3 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.
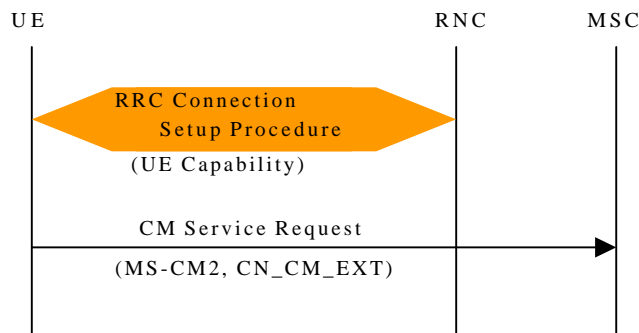

Figure 3 One Way Notification Procedure

12 Classmark Handling Procedure

12.1 General Concept

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

The CN broadcasts its type so that MS can select appropriate contents of MS Classmark parameter.

12.2 CM Service Invocation

12.2.1 Classmark Sending Criteria for UE

12.2.1.1 Core Network Classmark

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

Note: Necessity of MS Classmark 2 and CN_CM_EXT in Location Updating Request message is FFS.

12.2.1.2 UTRAN Classmark

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

12.2.1.3 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. In this case, the *MS Classmark 3 IE* is interrogated from the MSC, and stored in both the GSM BSS and the MSC.

Note: How the *MS Classmark 3 IE* to be informed to the MSC in case serving RAN is UTRAN is FFS. Two alternatives are identified as follows:
   a) The *CM Service Request message* always contains the *MS Classmark 3 IE.*
   b) GSM RAN Classmark Enquiry procedure is invoked by RNC or MSC. [when to interrogate?]
   c) The CM Service Request message contains the *MS Classmark 3 IE* if requested by broadcast information.

12.2.2 Served by UMTS MSC

12.2.2.1 UMTS RNC Area

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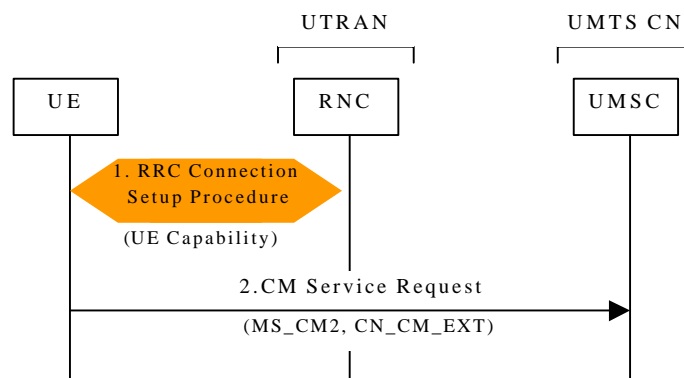

Figure 4 CM Service Invocation under RNC

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* and *CN_CM_EXT IE.*

12.2.2.2　　GSM BSS Area

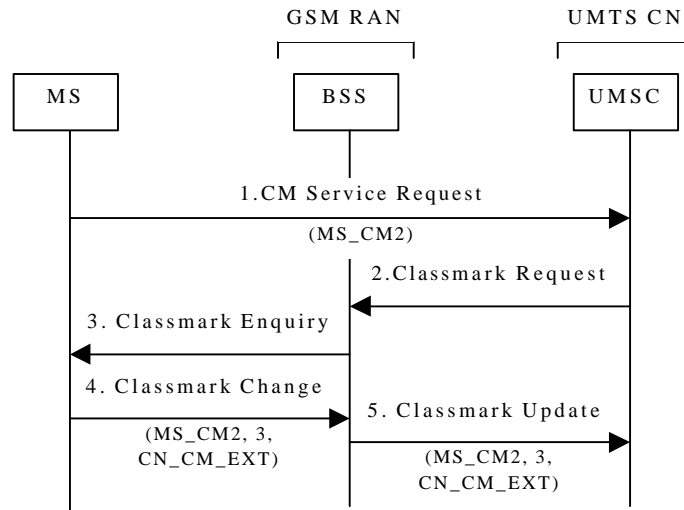CM service invocation procedure under GSM-BSS and UMTS-MSC is shown in Figure 5.

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*. The BSS memorizes the *MS Classmark 2 IE* at the relay process.

2. If the MSC determines that further MS classmark is necessary, classmark interrogation procedure is invoked.

3. Receiving the *Classmark Request message* from the MSC, the BSS send *Classmark Enquiry message* to get MS classmark from MS.

4. Receiving the *Classmark Enquiry message from BSS, MS send back MS Classmark 2* and *3 IE* to the BSS. The *CN_CM_EXT IE* may also be included in the message if necessary.

5. BSS memorize the received *MS Classmark 2 IE* and *MS Classmark 3 IE* and relays them to MSC by *Classmark Update message*. MSC get all the necessary MS capability information.

12.2.3 Served by GSM MSC

12.2.3.1　　UMTS RNC Area

CM service invocation procedure under UMTS-RNC and GSM MSC is shown in Figure 6.
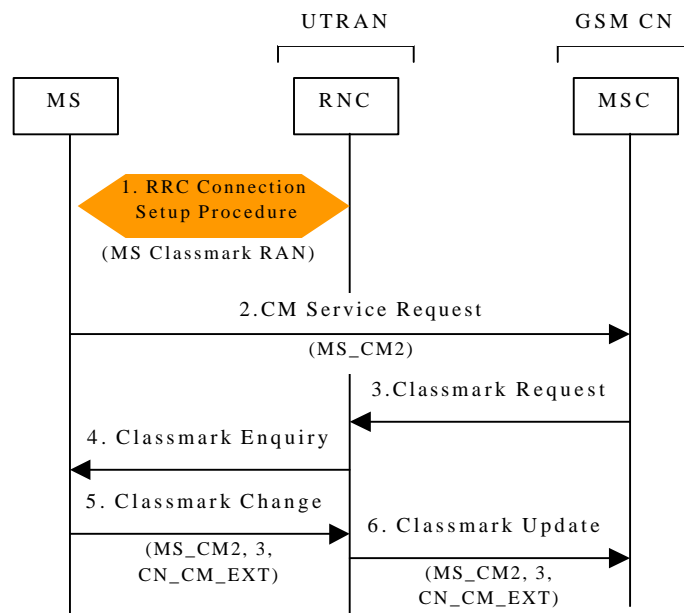
Figure 6 CM Service Invocation under RNC

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 MS Classmark for RAN is sent to RNC.

2. After the establishment of the RRC connection, The MS sends *CM Service Request message* to MSC via RNC with *MS Classmark 2 IE*. RNC transparently relays the message.

3. If the MSC determines that more MS classmark is necessary, classmark interrogation procedure is invoked.

4. Receiving the *Classmark Request message* from the MSC, the RNC send *Classmark Enquiry message* to get MS classmark from MS.

5. Receiving the *Classmark Enquiry message* from the RNC*, the* MS send back *MS Classmark 2* and *3* to the RNC. The *CN_CM_EXT IE* may also be included in the message if necessary.

6. RNC transparently relays the received *MS Classmark 2 IE* and *MS Classmark 3 IE* to MSC by *Classmark Update message*. MSC get all the necessary MS capability information.

Note : *Classmark Request message* from MSC may be replaced into appropriate message by IWF between GSM MSC and UMTS RNC. Further study is needed.

Note: MS-CM3 may be included in CM Service Request and Paging Response.

12.2.3.2   GSM BSS Area

CM service invocation procedure under GSM-BSS and GSM-MSC is shown in Figure 7.
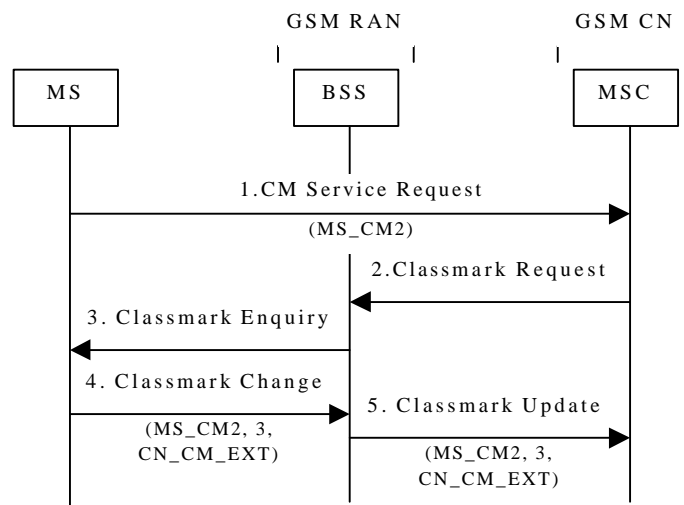
Figure 7 CM Service Invocation under BSS

Procedure:

0. The MS detects that it is under GSM BSS area and served by GSM MSC at the moment by broadcast information

1. The MS sends *CM Service Request message* to MSC via BSS with *MS Classmark 2 IE*. The BSS memorizes the *MS Classmark 2 IE* at the relay process.

2. If the MSC determines that further MS classmark is necessary, classmark interrogation procedure is invoked.

3. Receiving the *Classmark Request message* from the MSC, the BSS send *Classmark Enquiry message* to get MS classmark from MS.

4. Receiving the *Classmark Enquiry message from BSS, MS send back MS Classmark 2* and *3 IE* to the BSS. The *CN_CM_EXT IE* may also be included in the message if necessary.

5. BSS memorize the received *MS Classmark 2 IE* and *MS Classmark 3 IE* and relays them to MSC by *Classmark Update message*. MSC get all the necessary MS capability information.

12.3 Inter Radio System Handover

12.3.1 General Procedure

Assumption:

- 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.

- MT notifies the supporting radio information to RNC in RRC connection setup procedure or appropriate timing before handover.

- MS Classmark for 3G RANs is transparently transferred to target RAN in inter radio system HO procedure through Iu.

- The detail condition which classmark to be transferred needs to be studied because it would depend on the direction of handover (i.e., one directional or both directional)

- 3G RAN classmark is stored in RAN and delivered from source RAN to target RAN, and GSM RAN classmark is stored in CN and delivered from the MSC to the target RAN.

<div style="background-color: yellow; border: 2px solid black;">
Note: GSM RAN classmark may be handled like other RAN information (i.e., transferred from source 3G RAN to target GSM BSS). The procedure should be clarified.
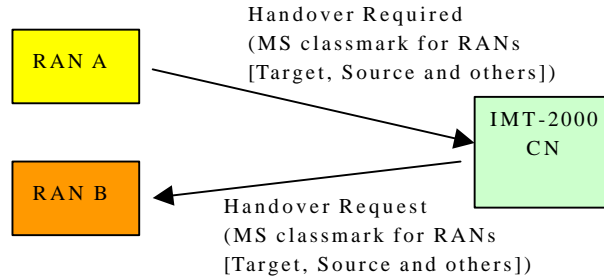</div>

Figure 8 Iu Procedure for Inter 3G Radio System Handover

If this approach is applied, radio information does not need to be sent to CN together with core network information in MS Classmark for CN. As a conclusion, MS capability information for radio access network does not need to be included in MM message.

GSM MS-CM is the special case, which needs to be considered for backward compatibility. If the target RAN is GSM, MS-CM information is delivered from MSC as in 2G GSM system.

12.3.2 Handover between 3G RANs

In this case, MS Classmark of the target radio system is transparently transferred via MSC.

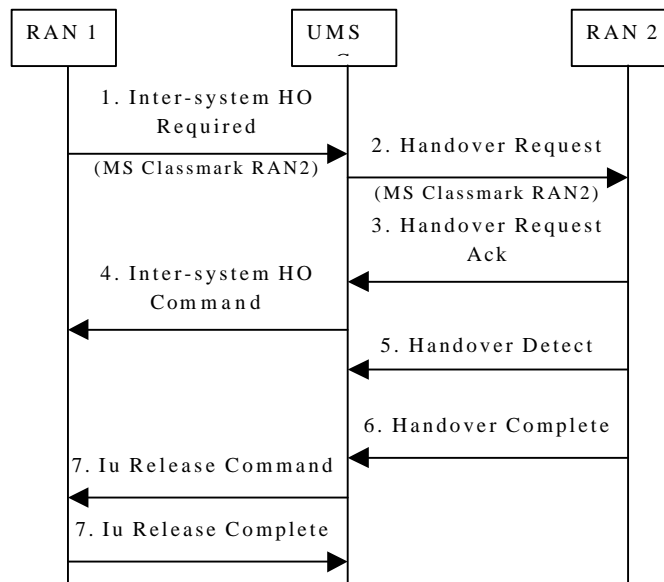Handover procedure between 3G RANs is shown in Figure 9.

Figure 9 Handover from UMTS to GSM

In this case, BSS does not requires any new capability at least MS classmark restructuring point of view.

12.3.3 Handover from 3G RAN to GSM

Handover procedure from 3G RAN to GSM RAN is shown in Figure 10.
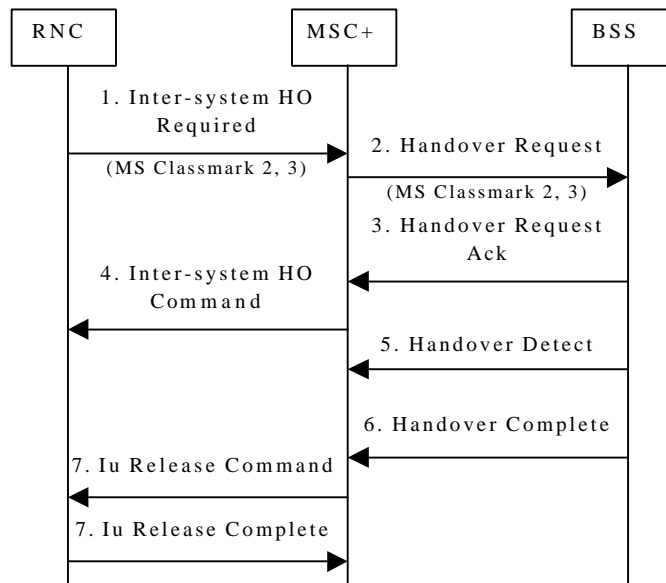

Figure 10 Handover from UMTS to GSM

In this case, BSS does not requires any new capability at least MS classmark restructuring point of view.

Note: Necessity of MS-CM in Handover Required is FFS.

12.3.4 Handover from GSM to 3G RAN

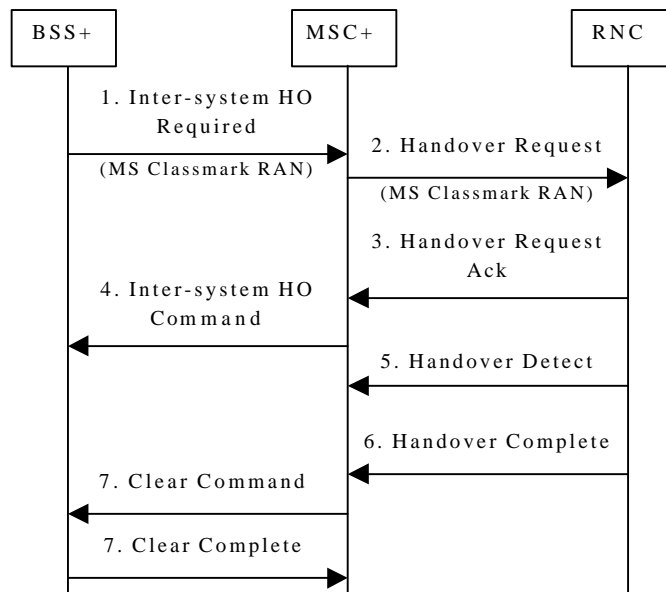Handover procedure from GSM to UMTS is shown in Figure 11.

Figure 11 Handover from GSM to UMTS

In this case, BSS requires small additional capability to handle MS Classmark for RAN. Note that other capability than regarding MS Classmark will be also needed.

Appendix

Text below is captured from draft N1#7 report. This text is informative and tentative information to clarify the background of modifications on this TR.

[begin quotation]

Working assumptions:

- The following working assumptions should be moved to the TR and presented preferably during this meeting. If that is not possible then email distribution is recommended.

- GSM MS CM2 becomes UMTS CN CM.

- GSM MS CM2 has got only 3 spare bits left, so this is just a starting point and an extension must be defined.

- Where is the RAN CM information for other RANs stored? MS or RAN or CN? -> MS CM for UTRAN in RAN and GSM RAN CM in MSC (as is done now in GSM)

- Single RAN CM or one for each RAN? This depends on where the RAN CM is stored. One big lump leaves no chance for interrogation of the data for the other RAN only if it is needed. But this is a TSGR issue anyway. -> We propose separate ones for each RAN for modularity.

-

Open issues:

- In which L3 messages is CN CM information to be sent?

- In which messages is the RAN CM information to be sent?

What is the criteria for the MS to send different CN / RAN CM information? -> The requirements for single mode network are reasonably clear: CN CM is sent always and the RAN CM based on the serving RAN. -> additionally the RAN CM for the other RAN in multimode network needs to be known. Does the MS send this always or only after enquiry or DL indication by the network? If so, is it RNC/BSS or MSC which initiates the enquiry?

[end quotation]

History

<table>
<tr><th colspan="3">Document history</th></tr>
<tr><td>V0.0.1</td><td>March 1999</td><td>First version of TR capturing contributions related to this issue.</td></tr>
<tr><td>V0.1.0</td><td>April 1999</td><td>-</td></tr>
<tr><td>V0.2.0</td><td>June 1999</td><td>Approved version as working assumption.
- Present condition remains mandatory
- Common message is applied both for GSM and UMTS</td></tr>
<tr><td>V0.2.1</td><td>June 1999</td><td>Editorial modifications to V0.2.0 captured</td></tr>
<tr><td>V0.3.0</td><td>August 1999</td><td>Classmark field definition is incorporated.
Alternative for classmark transfer procedure is captured</td></tr>
<tr><td>V0.4.0</td><td>September 1999</td><td>Output version from N1#7.</td></tr>
<tr><td>V0.4.1</td><td>September 1999</td><td>V0.4.0 with editorial modification and clarification.</td></tr>
</table>