Technical Specification Group Services and System Aspects *TSGS#8(00)0451*
Meeting #9, Kapolei, Hawaii, USA, 25-28 September 2000

Source: **TSG SA WG2**
Title: **CRs on 23.121 v.3.3.0**
Agenda Item: **7.2.3**

The following Change Requests (CRs) have been approved by TSG SA WG2 and are requested to be approved by TSG SA plenary #9.
Note: the source of all these CRs is now S2, even if the name of the originating company(ies) is still reflected on the cover page of all the attached CRs.

NOTE: THE "R4 or R5" CRs ARE INTRODUCING IM SUBSYSTEM IN 23.121. IT SHOULD BE CLARIFIED BY SA #9 IF THEY ACTUALLY APPLY TO R4 OR TO R5.

CRs on 23.121 v.3.4.0

Spec	Rel	CR #	Cat	Title	S2 tdoc #
23.121	R99	059r2	F	Correction to Data Retrieve protocol stacks endpoints	S2-001537
23.121	R4 or R5	056	B	Architectural Principles for Release 2000	S2-001256
23.121	R4 or R5	060r2	F	Correction to Data Retrieve protocol stacks endpoints	S2-001538

3GPP TSg SA2 Meeting
Vancouver, Canada, 16-18 Aug 2000

***Document* S2-001256**
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

23.121	**CR**	**056**	Current Version:	3.3.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to: TSG#9 *list expected approval meeting # here ↑*

for approval [ ] for information [ ]

strategic [ ] non-strategic [ ] *(for SMG use only)*

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: *(at least one should be marked with an X)* (U)SIM [ ] ME [X] UTRAN / Radio [ ] Core Network [X]

Source: Lucent **Date:**

Subject: Architectural Principles for Release 2000

Work item: Call Control and Roaming to support IP Based Multimedia Services in UMTS, Enable Bearer Independent Circuit Switched Domain

Category: *(only one category shall be marked with an X)*

F	Correction	[ ]	**Release:**	Phase 2	[ ]
A	Corresponds to a correction in an earlier release	[ ]		Release 96	[ ]
B	Addition of feature	[X]		Release 97	[ ]
C	Functional modification of feature	[ ]		Release 98	[ ]
D	Editorial modification	[ ]		Release 99	[ ]
				Release 00	[X]

Reason for change:

To add the requirements from 23.821 for the IP Multimedia Subsystem and for the support of a bearer independent Circuit Switched domain.

In addition references to Release 99 were removed.

Clauses affected:

Section 2: Addition of missing references

A definitions section has been added to cover the new definitions from 23.821.

All: Changed old terminology of IP domain and PSTN/ISDN domain to PS and CS domains respectively.

Addition of text from 23.821v1.0.0 section 5.1 to new section 4a. The principles have been numbered to add reference.

Section 4.1, now contains the requirement for the option of IP transport for MAP and CAP based interfaces.

Addition of text from 23.821v1.0.0 section 5.3.6.1 to new section 4.12 “Support of bearer independent circuit switched services”

Addition of text from 23.821v1.0.0 section 5.4.15 (protocol stack) to new section 4.12 “Support of bearer independent circuit switched services”

Addition of text from 23.821v1.0.0 section 6.2 to new section 8 “Support of IP Multimedia Services”

Addition of text from 23.821v1.0.0 section 6.3 to new section 8 “Support of IP Multimedia Services”

Addition of text from 23.821v1.0.0 section 6.4 to section 5

Addition of text from 23.821v1.0.0 section 11.1 to new section 7

Other specs affected:				
	Other 3G core specifications		→ List of CRs:	
	Other GSM core specifications		→ List of CRs:	
	MS test specifications		→ List of CRs:	
	BSS test specifications		→ List of CRs:	
	O&M specifications		→ List of CRs:	

Other comments:

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<--------- double-click here for help and instructions on how to create a CR.

3G TS 23.121 V.3.3.0 (2000-03)

Technical Specification

3rd Generation Partnership Project; Technical Specification Group Services and Systems Aspects; Architectural Requirements for Release 1999 (Release 1999)

1 Scope

The present document covers issues related to the evolution of the GSM platform towards UMTS with the overall goal of fulfilling the UMTS service requirements, the support of the UMTS role model, support of roaming and support of new functionality, signalling systems and interfaces.

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.

[1] 3G TS 22.001: "Services Principles".

[2] 3G TS 23.002: "Network Architecture".

[3] 3G TS 23.060: "General Packet Radio Service (GPRS) Service description; Stage 2".

[4] ETSI TC-SMG GSM 11.14.

[5] ETSI TC-SMG GSM 30.01.

[6] 3G TS 23.101: "3rd Generation mobile system Release 1999 Specifications"

[7] TG.3x6.

[8] UMTSYY.01, UE-UTRAN Radio Interface Protocol Architecture – Stage 2.

[9] UMTSYY.03, Description of UE states and Procedures in Connected Mode.

[10] C. Perkins, Editor, RFC 2002, "IP Mobility Support", October 1996.

[11] B. Aboba and M. Beadles, RFC 2486, "The Network Access Identifier", January 1999.

[12] Pat R. Calhoun and Charles E. Perkins, "Mobile IP Network Address Identifier Extension", February 1999. Work in progress (http://www.ietf.org/internet-drafts/draft-ietf-mobileip-mn-nai-00.txt).

[13] http://www.ietf.org/html.charters/mobileip-charter.html

[14] 3G TS 23.009: "Handover Procedures".

[15] 3G TS 23.228: “IP Multimedia Subsystem”.

3 Definitions, symbols and abbreviations

3.1 Definitions

Editors note: Reference to Definition document required.

For the purposes of the present document, the following terms and definitions apply:

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

3.2 Symbols

3.3 Abbreviations

CN Core Network

CS Circuit Switched

CSCF Call/Session Control Function

CS-MGW Circuit Switched Media Gateway

IM IP Multimedia

IP Internet Protocol

MGCF Media Gateway Control Function

MGW Media Gateway

PS Packet Switched

SGW Signalling gateway

4a Architectural Principles

The following principles apply to the GSM/UMTS Reference Architecture:

1. **Transport Independence (to control heterogeneous bearer mechanisms)**: The GSM/UMTS CN reference architecture shall be independent of the underlying transport mechanism (e.g. STM, ATM or IP). Further more the operators shall have the freedom to utilise a single or any combination of transport technologies.

2. **Standardised alternatives for transport mechanisms:** The alternatives for the signalling transport (e.g. SS7, SIGTRAN) for the service control, call control and bearer control protocols as well as the alternatives for the user plane transport shall be standardised for the relevant transport mechanisms.

3. **Decomposition of network functions:** The GSM/UMTS reference architecture all-IP option shall be defined in terms of separate functions and clear interfaces such that it is possible to separate transport from signaling. [With the objective of the separation of call/session, mobility and service control. This topic needs further study.] Thus operators shall have the freedom to provision, dimension and upgrade these network functions in a modular fashion. This modularity shall give operators flexibility and scaleability of network implementations.

4. **Flexible traffic processing function placement:** The GSM/UMTS reference architecture shall allow operators to place the traffic processing function in the most practical, cost-effective part of the network

5. **Use of internet protocols:** The GSM/UMTS reference architecture shall use, as appropriate, existing/evolving internet protocols e.g. to support multi-media services, interoperability with other next generation fixed or mobile networks (NGNs), and media gateway controllers.

6. **Support for a variety of mobile equipment:** The GSM/UMTS reference architecture shall support a range of different terminal types (simple speech only terminals, multi-media terminals, PDAs, Laptop, etc.). One particular aspect is that not all terminals may be able to support end-to-end IP capabilities, e.g. CS voice only terminals.

7. **Independence of access technology:** The GSM/UMTS reference architecture shall be designed to ensure that a common core network can be used with multiple wireless and wireline access technologies (e.g. xDSL, Cable, Wireless LAN, Digital Broadcast, all IMT2000 radio access technologies).

8. **Support for roaming onto other 2G and 3G mobile networks:** The GSM/UMTS reference architecture shall be designed to facilitate roaming between different network types.

9. **Support of Service Requirements:** The GSM/UMTS reference architecture shall include mechanisms for operators and third-parties to rapidly develop and provide services and for users to customise their service profile.

10. **Support of regulatory requirements:** The GSM/UMTS reference architecture shall include features to support regulatory requirements such as legal intercept, number portability, other regional requirements. To all terminal types and communication type (CS and PS) as appropriate.

11. **Insertion of a new IP multimedia CN Subsystem** with standard interface(s) with the service environment at home that can also be used in roaming cases.

12. **Separation between Bearer level, Call control level and Service level:**

    a) Use of different access technology to connect the "IP multimedia CN Subsystem": The IP multimedia domain is connected to the bearer network at a fixed reference point (anchor point) thus hiding the micro mobility of the UE (it does not hide roaming). This reference point shall be independent from the access technology that can be GPRS, UMTS PS or any relevant wireless, wired-line access technology as long as they provide transport of user packets up to this reference point and as they hide micro-mobility of the UE. As a consequence, the behaviour of the multimedia call control server (CSCF) can be the same whatever the access technology (radio or wired-line). Multimedia call control/mobility management shall not be aware of the access technology: the multimedia Call Control (CSCF) does not handle notions such as Hand-Over, RA, …

    b) The access to the IP Multimedia CN Subsystem is supported by the PS domain at the Gi interface: The PS domain provides bearers that are used by the UE for its signalling and provides user plane exchanges with multimedia (SIP) call control servers (CSCF) and gateways. These servers / gateways are located behind the GGSN acting as an anchor point for the mobility which means that when the terminal is moving, the call control server is not changed as long as the UE is registered on this server. The bearer network is made up of radio access (e.g. UTRAN, GERAN,…) and of a backbone (SGSN and GGSN).

13. **The specifications need to support both circuit-mode and packet-mode domains**

    a) Considering the traffic mix resulting from the set of 3G services and the need for flexible evolution paths, it is necessary to have separate circuit switched domain and packet switched domain.

    b) Each domain will handle its own signalling traffic, switching and routing.

14. **Keep network functions separate from radio access functions**

    a) The same network should support a variety of access choices, and access technologies may evolve further. Therefore network functions such as call control, service control, etc. should remain separate from access functions and ideally should be independent of choice of access. This implies that the same CN should be able to interface with a variety of RANs.

15. **Separate functions that are likely to evolve independently.** The following bullets in the list are examples of major functions that may need to evolve independently. Further discussions are needed to establish an agreed list.

    a) Bearer control in both access and network

    b) Multimedia control for multimedia sessions

    c) Switching and routing

    d) PS Mobility management, session control and access security functions

    e) CS Call Control, Mobility Management and access security functions

    f) Security functions

    g) Control for and the traffic processing e.g. voice

    h) location-based service functionality

i) Service control:

j) service capabilities, VHE for roamers

k) Mail services control

l) location-based services

m) Service features and applications

16. **Break down mobility management into a set of independent functions.** Mobility management will be a complex function in R'00. By breaking it down into independent components it will become more manageable. The list below is a suggested breakdown:

    a) Inter-domain mobility: Location of the user in terms of the domain (CS)/sub-system (IP Multimedia) currently serving the user.

    b) CSCF roaming: Location of the user in terms of the CSCF currently serving the user. The user may be within any wireless or fixed network.

    c) Change of Network Point of Attachment: Location of the user in terms of the address at which the user can be fund, depending on the registred mode. The user may be within any wireless or fixed network.

    d) Radio Access Mobility : Location management and management of the terminal associated with changes in RA/LA within a system, or associated with changes in cell and RNC within RA/LA.

    Radio Access Mobility can referred to as "micro-mobility" as opposed to the other types of mobility which have an impact on the IP multimedia sub-system.

17. **The PS CN domain provides the PS Connectivity services to IP terminals.** The PS domain maintains the service while the terminal moves and hides these moves to the other subsystems (i.e. IP multimedia CN Subsystem) using its bearer level service.

18. **Speech support in the CS CN domain:** R00 features to enhance speech support (e.g. TrFO/OoBTC: speech quality, transmission efficiency) in CS CN should consider a common solution for both UTRAN-speech (Iu i/f with codec in core) and GSM-speech (A i/f with codec in RAN).

19. **Resource Allocation Principles:** Release 2000 architecture shall be based on the principle that all resources within a network operator's network be managed by network elements within that network operator's network.

    a) For calls that terminate on a network operator's Media Gateway (MGW), ports are allocated exclusively by the Media Gateway Control Function (MGCF) within that network operator's network. When multiple MGCFs exist within the network operator's network, choice of the proper MGCF for handling a call shall be made by a function within that network operator's network.

    b) Authorization for bearer resources in a network operator's network is performed by a CSCF within that network operator's network. When call control is performed by a CSCF in the subscriber's home network, this authorization function shall be performed by a CSCF in the same network as the bearer resources being reserved.

4 Working assumptions

Information flows provided in the present document are for information only. They do not constrain implementation.

4.1 General

The phase 1 UMTS~~/Release '99~~ GSM standards should provide the capability to support:

- a core network based on an evolved 2G MSC and an evolved SGSN;
- an optionally evolved Gs interface;
- mobile IPv4 with Foreign Agent care-of addresses to end users over the UMTS/GPRS network, where the FA is located in the GGSN;
- class A GSM' mobiles;
- transcoder location shall be according to 23.930;
- UMTS/IMT2000 Phase1 ~~(Release 99)~~ network architecture and standards shall allow the operator to choose between Integrated and Separated core networks for transmission (including L2);
- the UMTS standard shall allow for both separated and combined MSC/VLR and SGSN configurations;
- the UE shall be able to handle separated or combined MSCs and SGSNs;
- there can be several user planes to these CN nodes.

The following general concepts should be followed:

- separate the layer 3 control signalling from the layer 2 transport discussion (do not optimise layer 3 for one layer 2 technology);
- MSC-MSC layer 3 call control is out of scope of standardisation in ~~SMG~~3GPP;
- as future evolution may lead to the migration of some services from the CS-domain to the PS-domain without changes to the associated higher-layer protocols or functions. UMTS ~~release 99~~ shall provide the flexibility to do this in a way that is backwards compatible with ~~release 99~~ UEs compliant to an earlier release provided this does not introduce significant new complexity or requirements in the system.
- In line with principle 2 in section 4a, the specifications shall support the option of IP transport for the MAP and CAP based interfaces.

4.2 Iu Interface

This is the reference point between UTRAN and the core network. This reference point is realized by one or more interfaces:

- Between UTRAN and SGSN, transport of user data is IP based.
- Between UTRAN and SGSN, transport of signalling is based on IP or SS#7.
- Between UTRAN and MGW, transport of user data is based on different technologies (e.g., IP, AAL2), and includes the relevant bearer control protocol in the interface.
- Between UTRAN and MSC server, transport of signalling is based on IP or SS#7.

It shall be possible to have a CS domain node supporting Iu interfaces of different releases of the 3GPP specifications.

- Transport protocol across the Iu interface for UTRAN shall be according to 23.930.
- The UTRAN shall support two logically separate signalling flows via Iu to combined or separate network nodes of different types (MSC and SGSN).
- The UTRAN shall contain a "domain distribution function" to route transparent application-level control signalling from the UE to the correct core network domain. The UE shall indicate the type of application being addressed (e.g. via a protocol discriminator). The UTRAN shall map this on to the correct Iu instance to forward the signalling.
- UTRAN-services (including radio access bearers) shall be independent from the core network domain used to access them. Either core network domain can access any appropriate UTRAN-service (e.g. it should be possible to access a "speech" radio access bearer from the PS-domain).
- The protocol architecture for the User Plane of the Iu interface towards the ~~IP~~ PS domain shall be based on the same principles as for the (evolved) Gn interface, i.e. the user plane part of GTP over UDP/IP shall be used for tunneling of end user data packets over the Iu interface. If the Iu data transport bases on ATM PVCs then the Iu IP layer provides the Iu network layer services, e.g. routing, addressing, load sharing and redundancy. In this case an IP network may be configured to transfer Iu data units between RNSs and 3G-SGSNs.
- One or several AAL5/ATM Permanent VCs may be used as the common layer 2 resources between the UTRAN and the 'PS~~IP~~ domain' of the CN. The reason for usage of several permanent AAL5/ATM VCs may e.g. be for load sharing and redundancy. It is also possible to use one switched VC per user flow (PDP context or radio access bearer). Switched VCs may be used, however the standardization of the procedures and protocols for use of Switched VCs is outside the scope of the 3GPP. If operators use switched VC, the specification of procedures and protocol for switched VCs are up to operators and out of scope of the UMTS/IMT-2000 specification.

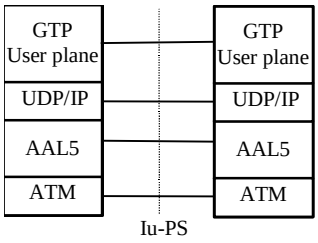


Figure 4.1: Protocol Architecture for the Iu user plane towards the ~~IP~~ PS domain

- Charging functionality is located at the 3G-SGSN. On the other hand, only RNC can identify the actual packet volume successfully transferred to a UE. In order for 3G-SGSN to provide the volume based charging for ~~IP~~ PS domain, the standard shall support the following procedures over Iu interface.
- The RNC indicates the volume of all not transferred downlink data (discarded or forwarded to 2G-SGSN) to the 3G-SGSN so that the 3G-SGSN can correct its counter. Partially transferred packets are handled as not transferred.
- The RNC delivers to the 3G-SGSN the discarded or forwarded volume accumulated over an implementation dependent time and not per discarded or forwarded packet.
- The 3G-SGSN can ask the RNC to provide the volume of buffered downlink data to correct its counter at any time the 3G-SGSN wants.

4.2.1 Iu Control Plane

For transport of RANAP messages over Iu an SCCP protocol shall be used for both packet and circuit switched domains. The SCCP protocol shall fully comply with ITU-T white book. RANAP protocol shall be designed to use this service according to the ITU-T standard. Iu shall be designed so that RANAP is not impacted by alternatives for SCCP message transport on layers below SCCP.

In the circuit switched domain SCCP messages shall be transported on a broadband SS7 stack comprising MTP3b on top of SAAL-NNI. ~~In this domain no other alternatives are standardised in release 99.~~

In the packet switched domain the UMTS standard shall allow operators to chose one out of two standardised protocol suites for transport of SCCP messages.

1) Broadband SS7 stack comprising MTP3b on top of SAAL-NNI.

2) IETF/Sigtran CTP protocol suite for MTP3 users with adaptation to SCCP. The protocol suite shall fully comply with the IETF standards developed by the Sigtran working group. No UMTS specific adaptations shall be standardised below the SCCP protocol.

The grey colour denotes protocols being developed by the IETF sigtran group.

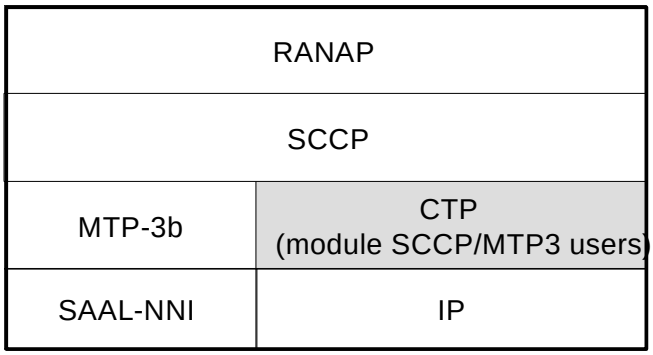


Figure 4.2: RANAP protocol stack options

4.2.2 Iu User plane

- The standard shall support that the user data flows transported over the Iu reference point to/from the ~~'IP~~ PS domain~~'~~ shall be multiplexed on top of common layer 2 resources.

- If the Iu data transport bases on ATM PVCs then the Iu IP layer provides the Iu network layer services, e.g. routing, addressing, load sharing and redundancy. In this case an IP network may be configured to transfer Iu data units between RNSs and 3G-SGSNs.

- One or several AAL5/ATM Permanent VCs may be used as the common layer 2 resources between the UTRAN and the 'IP domain' of the CN. The reason for usage of several permanent AAL5/ATM VCs may e.g. be for load sharing and redundancy. It is also possible to use one switched VC per user flow (PDP context or radio access bearer).

- A tunnelling protocol is used on top of this common layer 2. This tunnelling protocol corresponds to an evolution of the user plane part of the GTP protocol used in GPRS put on top of UDP/IP.

- The user data plane in the UMTS network is made up of two tunnels:

  - a first IP/UDP/GTP tunnel between RNC and 3G SGSN on Iu;

  - a second IP/UDP/GTP tunnel between GGSN and 3G SGSN on Gn.

This architecture:

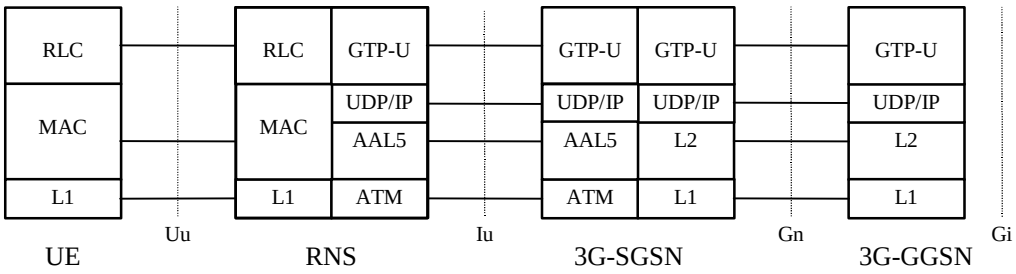
- provides hierarchical mobility;

- allows having the RNC directly connected on the PS~~IP~~ domain backbone;

- ensures that all traffic is routed through 3G-SGSN that may perform functions such as charging and Lawful Interception;

- would allow to have different protocols (or protocol version) on Gn and Iu if needed in the future.

The protocol stack is shown in figure 4.3.



Note: Protocol layers above RLC and GTP-U are FFS

Figure 4.3: Protocol Architecture for ~~IP~~ PS domain user plane

4.2.2.1 Principles of User Data Retrieve in UMTS and at GSM-UMTS Hand-Over for PS Domain

4.2.2.1.1 Requirements for Data retrieve at GPRS/UMTS handover

The same reliability as in inter 2G-SGSN RA update case has to be provided at GPRS to/from UMTS handover. Therefore, the data retrieval should be ensured between 2G-SGSN and SRNC as it is ensured between two 2G-SGSNs.

Between two 2G-SGSNs, data retrieve is carried out via the Gn interface i.e. via GTP-u[1]/UDP/IP. In order that the 2G-SGSN is not modified for data retrieve with the SRNC, the 2G-SGSN should keep the same protocol stack.

4.2.2.1.2 Adopted solution for data retrieve at GPRS-UMTS handover

For Control Plane: Since some parameters transported by GTP-c are CN related only (e.g. CN classmark,…), it is necessary to terminate GTP-c signalling exchanged with the 2G-SGSN in the 3G-SGSN, and to use RANAP signalling on Iu between 3G-SGSN and SRNC.

For User plane: As Charging of the retrieved data is to be carried out at 3G-SGSN, data exchanged between SRNC and 2G-SGSN are handled by the 3G-SGSN (two GTP pipes: SRNC - 3G-SGSN and 3G-SGSN - 2G-SGSN). This ensures that:

- 3G-SGSN can increment charging counters for user data sent from 2G-SGSN to SRNC;
- 3G-SGSN can decrement charging counters for user data sent from SRNC to 2G-SGSN avoiding that such data are charged twice (in 3G-SGSN and in 2G-SGSN).

[1] GTP-u stands for GTP user plane protocol

In RRC Idle mode it is the broadcasted MM system information (e.g. information about the present Location Area and present Routing Area) that determines when the UE initiates a location registration procedure towards the CN. An UE in state CS-IDLE will in RRC Idle mode, initiate Location Area update towards the CN when crossing LA border. An UE in state PS-IDLE will in RRC Idle mode initiate Routing Area update towards the CN when crossing RA border.

In RRC Connected mode, the UE receives the MM system information on the established RRC connection. (I.e. the broadcasted MM system information is not used by the UE in the RRC connected mode.) An UE in state CS-IDLE will, in RRC Connected mode, initiate Location Area update towards the CN when receiving information indicating a new Location Area. An UE in state PS-IDLE will, in RRC Connected mode, initiate Routing Area update towards the CN when receiving information indicating a new Routing Area. An UE in state CS-CONNECTED will, in RRC Connected mode, not initiate Location Area update towards the CN. An UE in state PS- CONNECTED will, in RRC Connected mode, not initiate Routing Area update towards the CN.

In CS-DETACHED mode the UE will not initiate any Location Area update and this independent of the RRC mode. In PS-DETACHED mode the UE will not initiate any Routing Area update and this independent of the RRC mode.

In additional to normal location registration when changing registration area, the UE may (network options) perform CS periodic registration when in CS-IDLE state and PS periodic registration when in PS-IDLE state. The respective periodic registration may be on/off on Location Area respective Routing Area level.

On the Mobility Management level, IMSI and CS related TMSI are used as UE identities in the CS service domain, and IMSI and PS related TMSI are used as UE identities in the PS service domain. The IMSI is the common UE identity for the two CN service domains.

A signalling connection between the UE and the CN refers to a logical connection consisting of an RRC connection between UE and UTRAN and an Iu signalling connection ("one RANAP instance") between the UTRAN and the CN node. The CS service domain related signalling and PS service domain related signalling uses one common RRC connection and two Iu signalling connections ("two RANAP instances"), i.e. one Iu signalling connection for the CS service domain and one Iu signalling connection for the PS service domain.

4.3.1.1 Use of combined procedures for UMTS

The use of separated PS and CS mobility mechanisms within the UE and within the CN may lead to non-optimal usage of the radio resource (for example a UE in PS idle and CS idle state would perform both location updates (for the CS mechanism) and Routing area updates (for PS mechanisms)).

UMTS should optimise the use of radio resources., The use of combined updates (similar to the current GSM/GPRS Gs combined update mechanism) may enable this. To offer flexibility in the provision of mobility management for UMTS, it should be possible to use combined mechanisms for location management purposes as well as for attach/detach status purposes.

From the UE perspective it should be possible for the UE to perform combined update mechanisms (operator option). UMTS Phase 1 ~~R99~~ terminals should support the use of both combined and separate mechanisms. The support of this feature by all UMTS mobiles will also ease evolution of UMTS MM in the future.

In the UMTS specifications the RAN will not co-ordinate mobility management procedures that are logically between the core network and the MS. This includes: location management, authentication, temporary identity management and equipment identity check.

4.3.2 Description of the Location Management and Mobility Management Concept

4.3.2.1 Area concepts

For the mobility functionality four different area concepts are used. Location Area and Routing Area in the CN as well as UTRAN Registration Area and Cell areas in the UTRAN.

- After a successful switch at the Anchor MSC, a release indication is sent towards the Source RNC. This will imply release of all UTRAN resources that were related to this UE.

- The Anchor MSC will then send a Prepare SRNC Relocation Request to the applicable non-anchor MSC (MSC2) including the information received from the Source RNC.

- The non-anchor MSC will send a SRNC Relocation Request message to the target RNC. This message includes information for building up the SRNC context, transparently sent from Source RNC (UE id., no of connected CN nodes, UE capability information), and directives for setting up Iu user plane transport bearers.
When Iu user plane transport bearers have been established, and target RNC has completed its preparation phase, SRNC Relocation Proceeding 1 message is sent to the non-anchor MSC.

- The Prepare SRNC Relocation Response that is sent from non-anchor MSC to Anchor MSC will contain the SRNC Relocation Proceeding 1 received from target RNC.

- When the SRNC Relocation Proceeding 1 has been received in the Anchor MSC, the user plane transport bearers has been allocated the whole path between target RNC and Anchor MSC and the Anchor MSC is ready for the SRNC move, then the Anchor MSC indicates the completion of preparation phase at the CN side for the SRNC relocation by sending the SRNC relocation proceeding 2 message to the Source RNC.

- When the source RNC has received the SRNC Relocation Proceeding 2 message, the source RNC sends a SRNC Relocation Commit message to the target RNC. The target RNC executes switch for all bearers at the earliest suitable time instance.

- Immediately after a successful switch at RNC, target RNC (=SRNC) sends SRNC Relocation Complete message to the non-anchor MSC. This message is included by the non-anchor MSC in the Complete SRNC relocation message that is sent to the anchor MSC. Upon reception of this message, the Anchor-MSC switches from the old Iu transport bearers to the new ones.

- After a successful switch at the Anchor MSC, a release indication is sent towards the Source RNC. This will imply release of all UTRAN resources that were related to this UE.

- When the target RNC is acting as SRNC, it will send New MM System Information to the UE indicating e.g. relevant Routing Area and Location Area. Additional RRC information may then also be sent to the UE, e.g. new RNTI identity.

- When receiving new MM system information indicating a new Routing Area, the UE will in this case initiate a Routing Area update procedure towards the SGSN.

- Before point (a), in Figure 4-24, the connection is established between UE and Anchor MSC via Source RNC.

- After point (b), in Figure 4-24, the connection is established between UE and Anchor MSC via Target RNC and Non-anchor MSC.

4.3.14.2.3 SRNS relocation (UE connected to a single CN node, 3G_SGSN) followed by Location Registration in new Location Area

This is described in TS 23.060.

Figures 4.25, 4.26, 4.27, 4.28, 4.29 and 4.30: (void).

4.3.14.3 Comparison between UMTS and GSM

For the ~~PSTN/ISDN~~CS domain, the proposed UMTS MM concept is in principle identical to the GSM MM.

For the ~~IP~~ PS domain, the differences between the proposed UMTS MM concept and the GSM GMM are more extensive, such as:

- GSM GMM-Ready state where "Cell update" is replaced in UMTS by UMTS PS-CONNECTED state where SGSN is maitaining a connection toward UTRAN and the UE location is tracked by UTRAN (i.e. not on MM level);

- GSM GMM-standby state corresponds to UMTS PS-IDLE state. In both case, "Routing area update" is performed and SGSN is paging in the routing area;

- a UMTS PS-CONNECTED state is introduced and in this state the UE mobility towards the CN will be handled by UTRAN-CN procedures, i.e. not on MM level.

Figure 4.31 provides illustration of the above bullets.

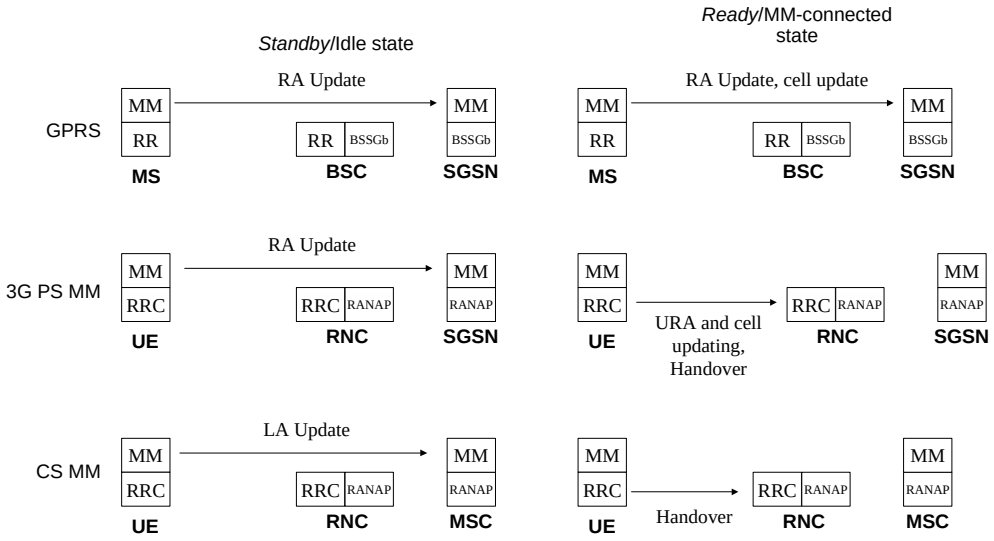


Figure 4.31: The states written in italics correspond to those defined in GSM with GPRS

4.3.14.3.1 PS -idle state

The RA update procedure is utilised to update the whereabouts of the UE into SGSN. The updating into SGSN takes place irrespectively of the CS MM state in MSC.

4.3.14.3.2 PS -connected state

The URA and cell updating and handover procedures presented in figure 4.31 are based on UMTS YY.03 [2]. In brief, the aim in [2] is to introduce functionality that caters for the same functionality as standby/ready in GPRS. The RRC shall be designed in such a fashion, which allows the state of the RRC connection to define the level of activity associated to a packet data connection. The key parameters of each state are the required activity and resources within the state and the required signalling prior to the packet transmission. The operator configurable RRC_connection_release timer can be used to release RRC connections in case of very low level of activity and in case the QoS requirements e.g. delay requirement allow the release of the RRC connection.

The cell update and URA update between UE and RNC are used when the UE is in RRC common channel state, i.e. when the above mentioned parameters allow to scale down the resources reserved for the UE (for a more detailed description on this, see [2]). For example, the purpose of the cell update procedure is to allow the UE to inform its current location in the corresponding RRC state. According to [2] the cell update procedure replaces handover in the corresponding RRC substate.

A significant deviation from GPRS is the introduction of the handover procedures for connections supporting traffic into PS~~IP~~ domain (in RRC cell connected state, see [2]).

The UE moves to PS-IDLE state in case of expiry of RRC_connection_release timer or an RRC connection failure.

4.3.14.4 Issues for further study

List of issues that are for further study related to this chapter and is the following:

- more details are required with regards to the differences with regards to the "~~IP~~PS-domain" MM compared to GPRS MM, especially considering roaming and handover to/from UMTS to GSM/GPRS;

- more details should be provided with regards to the logical relations between UE-CN and UTRAN-CN, and how these relate to the physical interconnection between UTRAN and the CN nodes(s), namely whether one logical/physical Iu can be used to interconnect the UTRAN with the CN.

4.3.15 Combined update towards the HLR for a combined 3G-(MSC/VLR+SGSN) configuration

~~NOTE: Combined location update procedures are not a high priority architectural requirement for UMTS R99.~~

4.3.15.1 Motivation

In order to optimise the signalling load within the network, reduce operating and maintenance costs and creating the possibility to combine cs and ps handover it is essential to open the door in the specifications for combined 3G-(MSC/VLR+SGSN) solutions.

4.3.15.2 Technical description

For the area concept discussed for the time being, four different cases have to be distinguished:

- change of UTRAN Registration Area (URA) within the same Routing Area (RA);
- change of URA and RA within the same Location Area (LA);
- change of URA, RA, or LA within the same node;
- change of URA, RA, or LA, and node.

If the user has at least one activated PDP context, then the new UMSC shall send an SGSN Context Acknowledge message to the old SGSN. This informs the old SGSN that the new UMSC is ready to receive data packets belonging to the activated PDP contexts.

The old SGSN starts tunnelling of buffered N-PDUs to the new UMSC. However, the possibility of this happening is remote since the UE is in MM-idle indicating that it was not in active communication.

The new UMSC sends Update PDP Context Request to the GGSNs concerned. The GGSNs update their PDP context fields and return an Update PDP Context Response (TEID).

The new UMSC informs the HLR of the change of SGSN/MSC by sending Combined Update Location (UMSC Number, UMSC Address, IMSI) to the HLR.

The HLR sends Cancel Location (IMSI, Cancellation Type) to the old SGSN and MSC. The old SGSN acknowledges with Cancel Location Ack (IMSI).

The HLR sends Insert Subscriber Data (IMSI, PS and CS subscription data) to the new UMSC. The new UMSC validates the UE's presence in the (new) RA. If due to regional subscription the UE is rejected, the UMSC rejects the Attach Request with an appropriate cause and returns an Insert Subscriber Data Ack (IMSI, UMSC Area Restricted Due To Regional Subscription) message to the HLR. If all checks are successful then the UMSC constructs an MM context for the UE and returns an Insert Subscriber Data Ack (IMSI) message to the HLR.

The HLR acknowledges the Update Location by sending Update Location Ack (IMSI) to the new UMSC.

The new UMSC validates the UE's presence in the new RA. If due to regional, national or international restrictions the UE is not allowed to attach in the RA or subscription checking fails, then the UMSC rejects the routing area update with an appropriate cause. If all checks are successful then the new UMSC establishes MM and PDP contexts for the UE. The new UMSC responds to the UE with Routing Area Update Accept (P-TMSI, TMSI, P-TMSI Signature).

The UE confirms the reallocation of the TMSIs by sending Routing Area Update Complete to the UMSC.

4.3.16 UTRAN coordination

The UTRAN coordinates the resource allocation of an UE attached to both PS and CS services. The UTRAN shall reject or downgrade a connection which cannot be granted [3]. The cause might be congestion on the radio interface, or the existence of other connections between this UE and the other CN.

The UTRAN use the IMSI to identify a UE. The IMSI is transferred from the Core Network to the UTRAN with the common ID procedure. When an Iu connection is established, the Core Network shall perform the RANAP common ID procedure toward UTRAN as soon as the UE is identified (IMSI). The IMSI is only stored in the UTRAN for the duration of the RRC Connection.

4.4 UMTS call control

4.4.1 Technical Requirements

The following technical requirements are applied to support multimedia in GSM/UMTS.

P1) GSM/UMTS shall enable the provisioning of multimedia services and multivendor interworking between UE and network.

P2) Basic voice and PDP-context establishment shall be based on GSM CC/SM respectively.

P3) Handover and roaming to and from GSM shall be supported provided GSM is capable of supporting the ongoing media service.

P4) Ideas, concepts and procedures developed by other fora e.g. other standards bodies such as ITU, IETF etc. shall be included or referenced in GSM/UMTS when found suitable.

P5) To ensure multi-vendor inter-working and UE roaming, a single standardised multimedia protocol for CS domain and a single standardised multimedia protocol for PS domain shall be selected for GSM / UMTS ~~R99~~. This does not preclude the selection of other protocols by UMTS in the future.

SIP (Session Initiated Protocol) from the IETF shall be the multimedia call control supported over the PS domain, where the network functional entities for Multimedia support are within the PLMN.

It shall be possible to support other multimedia protocols e.g. H.323 transparently over the PS domain ~~shall be the multimedia call control model for the PS domain in UMTS R99~~. In these cases, the Multimedia functional entities shall be outside of the PLMN. Support of terminating calls for these protocols are outside the scope of these specifications.

P6) For multimedia services the standardized multimedia protocol shall be run transparently via a PDP-context or a circuit-switched connection established using GSM SM/CC . This allows transparent hand-over and roaming between GSM and UMTS provided that GSM supports the QoS requirements.

Figure 4.36 illustrates the realisation of the multimedia service based on P6). 'Multimedia Protocol' indicates the functionality either inside the communicating user's terminal or a ~~gateway~~ server (e.g. ~~H.323 Gateway~~SIP server)~~/GK~~. It is essentially a control function both for user plane and control plane for the multimedia communication.

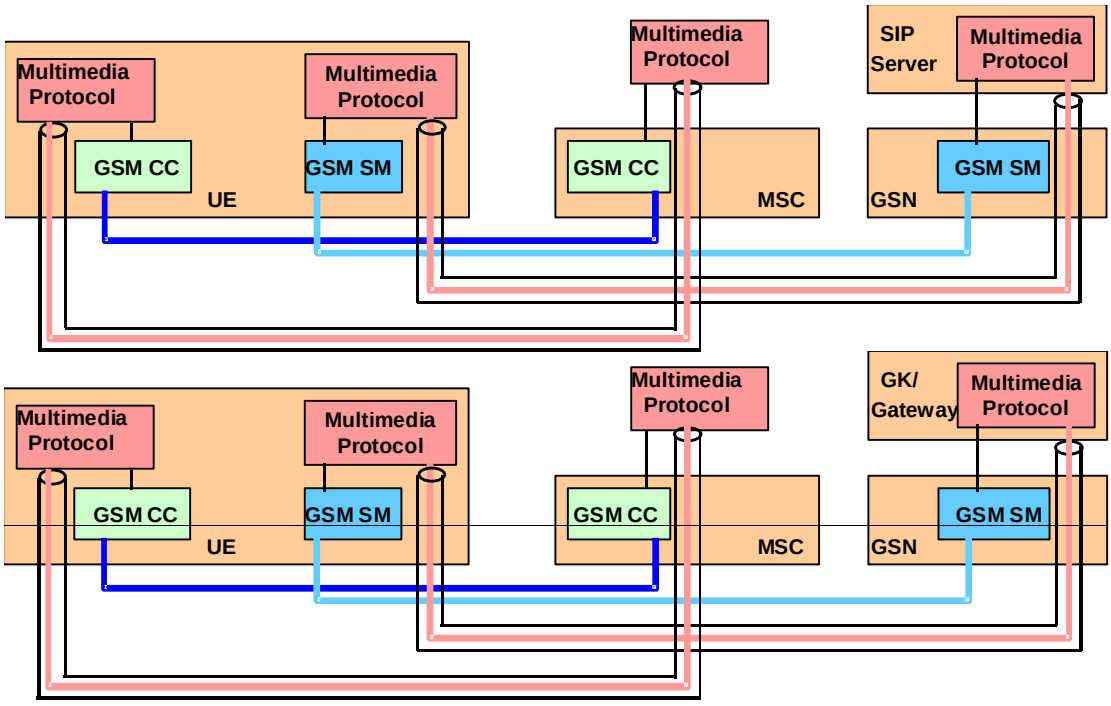


Figure 4.36: Support of multimedia making use of GSM SM/CC

Based on the requirements listed above, GSM CC/SM represented by GSM 04.08 forms a solid foundation for UMTS CC/SM ~~for Release 99~~. UMTS CC/SM ~~for Release 99~~ is to be developed from GSM CC/SM by introducing some well defined enhancements.

Existing (and future) multimedia protocols can be supported by the UMTS CC/SM as application layer protocols, with no (or in some instances only minor) impact to UMTS CC/SM.

4.4.2 Architecture for Multimedia

~~In order to include multimedia in release 99 an~~An architecture for multimedia is required. Subclauses 4.4.2.1 and 4.4.2.2 detail the architecture for UMTS multimedia. ~~It is recognised that it may not be possible to include all the functionality included in this architecture in release 99.~~

4.4.2.1 Packet Switched Domain

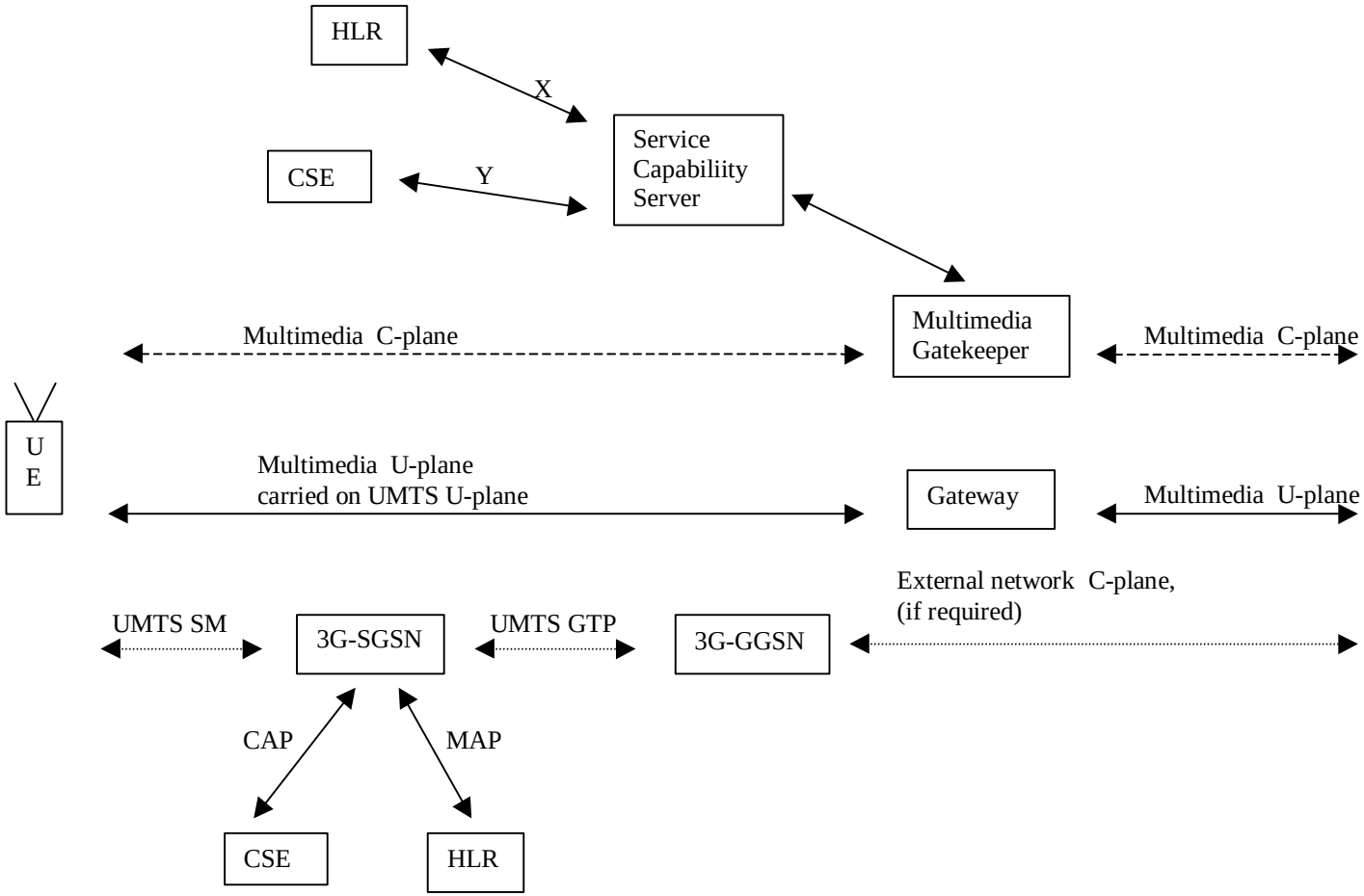


Figure 4.37: Multimedia architecture PS Domain

The multimedia C-plane and U-plane are run transparently over a PDP-context between the UE and multimedia gatekeeper and gateway.

The multimedia U-plane runs between the UE and the multimedia gateway. The multimedia gateway maps the multimedia U-plane on to the U plane in the external network eg. Internet, PSTN. In some cases, such as a UMTS to UMTS call this may unnecessary.

The multimedia control protocol is run between the UE and multimedia gatekeeper. The multimedia gatekeeper is responsible for establishing a multimedia C plane connection on the terminating network.

The service capability server is functionally distinct from the multimedia gatekeeper. It is responsible for creating multimedia services. The standardisation of the interface between the service capability server and the multimedia gatekeeper is for further study. The service capability server may require interfaces to the HLR and CSE (Camel Service Environment) in order to enable interactions between multimedia services and the services provided by these platforms. In this case the interfaces X and Y in figure 4.37 will require standardisation~~, (It is not proposed that this be included in release 99). The handling of MT communications is for further study.~~

Services can be delivered at two levels:

- bearer level services are those which correspond to the UMTS bearer service and are delivered via the SGSN, HLR and CSE. Examples of bearer level services are pre-paid or barring of PDP context establishment (for the UMTS bearer service);

- multimedia level services are delivered via the multimedia gatekeeper and service capability server possibly in combination with the HLR and CSE. Examples of multimedia services are video conferencing, call forwarding and pre-paid (of the multimedia component).

The multimedia gatekeeper and service capability server may be located within or external to the UMTS PLMN. ~~The implications of the location of the multimedia gatekeeper and service capability server are for further study.~~When located inside the PLMN, the Multimedia entities form part of the IP Multimedia Subsystem described in [15]

4.4.2.2 Circuit Switched Domain

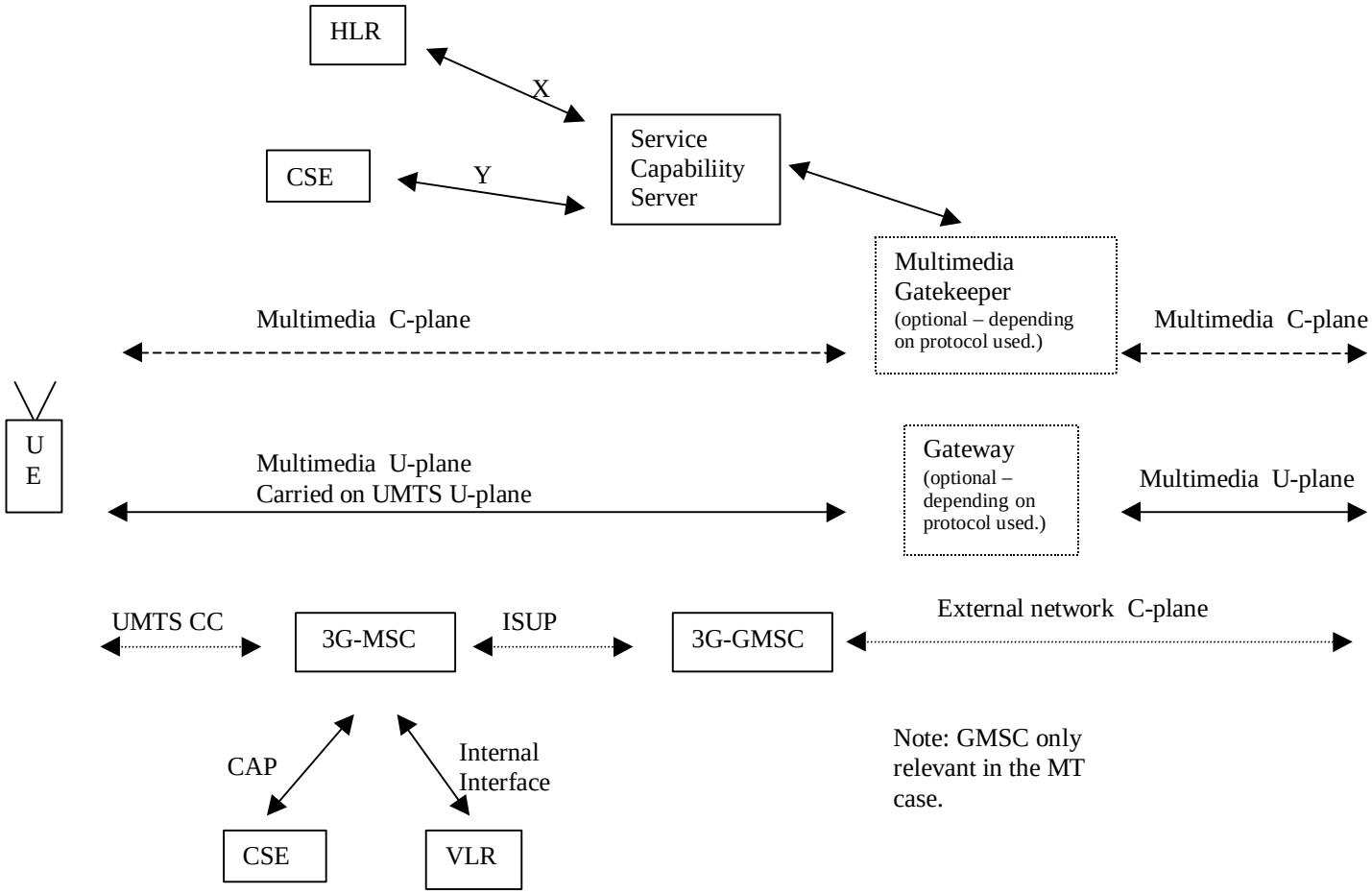


Figure 4.38: Multimedia architecture CS Domain

The multimedia C-plane and U-plane are run transparently over a bearer between the UE and destination or optionaly the multimedia gatekeeper and/or gateway if present.

The multimedia U-plane runs between the UE and destination. Optionaly the multimedia U-plane is terminated at the the multimedia gateway, which interworks with the external network.

The multimedia control protocol is run between the UE and the destination. Optionally the multimedia gatekeeper is responsible for establishing a multimedia C plane connection on the fixed network.

The service capability server is functionally distinct from the multimedia gatekeeper. It is responsible for creating multimedia services. The standardisation of the interface between the service capability server and the multimedia gatekeeper is for further study. The service capability server may require interfaces to the HLR and CSE (Camel Service Environment) in order to enable interactions between multimedia services and the services provided by these platforms. In this case the interfaces X and Y in figure 4.38 will require standardisation~~, (It is not proposed that this be included in release 99)~~. The handling of MT communications is for further study.

Services can be delivered at two levels:

- bearer level services are those which correspond to the UMTS bearer service and are delivered via the MSC, HLR and CSE. Examples of bearer level services are pre-paid or call barring (for the UMTS bearer service);
- multimedia level services are delivered via the multimedia gatekeeper (if present) and service capability server possibly in combination with the HLR and CSE. Examples of multimedia services are video conferencing, call forwarding and pre-paid (of the multimedia component). If there is no multimedia gatekeeper network level multimedia services can not be provided.

The multimedia gatekeeper and service capability server may be located within or external to the UMTS PLMN. The implications of the location of the multimedia gatekeeper and service capability server are for further study.

4.4.3 Typical Scenarios for Multimedia Control and User Plane

Two typical call scenarios to support multimedia services, H.324 and H.323, respectively, are presented as examples. As an assumption, the calls are between the peer multimedia terminals over an IMT-2000 network. As shown in the following subclauses, the multimedia signalling protocol and data transmission for both call scenarios can be performed end-to-end on the IMT-2000 user plane and is thereby transparent to the IMT-2000 Core Network. The IMT-2000 operators still control the multimedia service towards the end-user by providing the service via a service node (gateway, gatekeeper or application server) inside its own domain. Some other call scenarios e.g. IMT-2000 to ISDN/PSTN and/or IMT-2000 to the IP network can also be illustrated in a similar fashion.

4.4.3.1 H.324M to H.324M Call

In figure 4.39, the H.324M IMT-2000 terminal initiates the call set-up procedure by sending a 04.08 SET-UP message to the originating MSC/VLR.

After the received 04.08 SETUP message, the originating MSC/VLR sends an ISUP Initial Address Message (IAM) to the terminating MSC/VLR. The terminating MSC/VLR performs a 04.08 SETUP procedure towards the H.324M UMTS terminal. The communication link is now established between the two H.324M endpoints.

The logical channels can now be established using the H.245 open logical channel procedure.

No gateway is needed in this case. This case is simple to support and requires little standardization.

The 04.08 Bearer Capability is used to indicate 64 kbits/s bit transparent case described in GSM 07.01 can be used, as well as H.223/H.245.

The 04.08 LLC is used to indicate H.223/H.245. This makes the called IMT-2000 mobile terminal activate its H.324M application when receiving the SETUP (LLC:H.223/H.245).

Table 4.2

Information Transfer Capability	Unrestricted Digital Information
Sync/Async	Synchronous
Connection Element	Transparent
Fixed Network User Rate	64 kbit/s

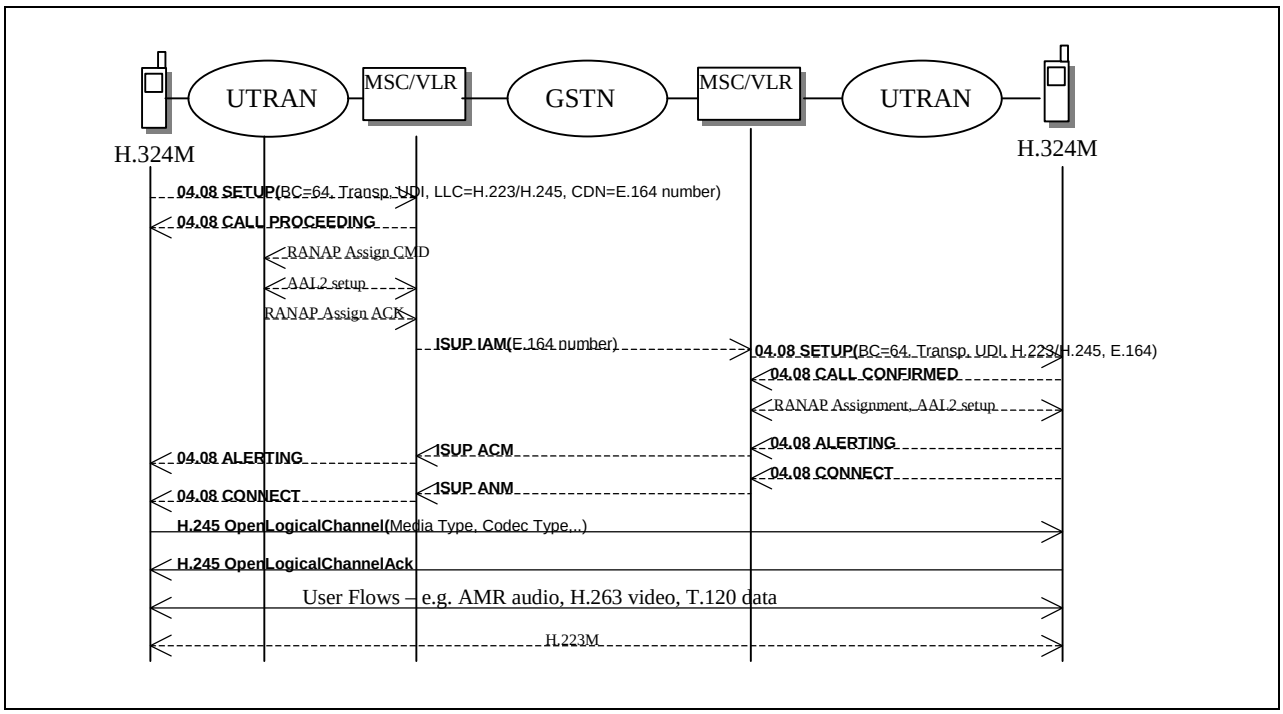


Figure 4.39: UMTS H.324M - UMTS H.324M call example

4.4.3.2 IMT-2000 H.323 to H.323 call

Figure 4.40 shows a Multimedia Call between two H.323 terminals within an IMT-2000 operator domain. It is assumed that a PDP Context using a Best Effort (BE) Radio Access Bearer (RAB) from terminal A towards the Gatekeeper (GK) and one from terminal B towards GK have already been established for H.323 registration in this figure. Terminal A and B now performs Gatekeeper Identification and Gatekeeper Registration using a BE RAB. Thereafter, the terminal A sets up a Real Time (RT) Radio Access Bearer (RAB) to decrease the time for the H.323 control signalling. This need of a Real Time Radio Access Bearer can be indicated from the terminal application to the mobile terminal through the Application Programming Interface (API). The terminal A performs PDP Context activation (see figure bellow) to set up the Real Time Radio Access Bearer. From now on, the established Real Time Radio Access Bearer can be used for H.225.0 RAS control signalling and Q.931 control signalling. After the Real Time Radio Access Bearer is established, the H.323 terminal A performs an Admission Request (ARQ) towards the Gatekeeper. If the terminal A is admitted the Gatekeeper answers with AdmissionConfirm (ACF) otherwise AdmissionReject (ARJ). Terminal A initiates the H.323 connection by sending a Q.931 Setup message to the Gatekeeper when the ACF has been received. The Gatekeeper answers with a Q.931 Call Proceeding to terminal A and sends a Q.931 Setup message to terminal B on a Best Effort (BE) Radio Access Bearer (RAB). Terminal B performs PDP Context Activation to SGSN and GGSN to set up a Real Time Radio Access Bearer and performs an Admission Request towards the Gatekeeper on this Real Time Radio Access Bearer. After this terminal B answers the received Q.931 Setup message with a Q.931 Alert and Connect message to the Gatekeeper on receipt of the Admission ConFirm (ACF) message. The Gatekeeper forwards these two messages to the terminal A. The Real Time Protocol (RTP) is now established between the terminal A and B for transmission of audio, video or data streams (see figure 4.40). The Gatekeeper relays the data streams but is not always completely transparent. The Gatekeeper can perform interworking functions e.g. Network Address Translation (NAT) etc between different networks. The voice transcoding is performed end-to-end in the H.323 terminal.

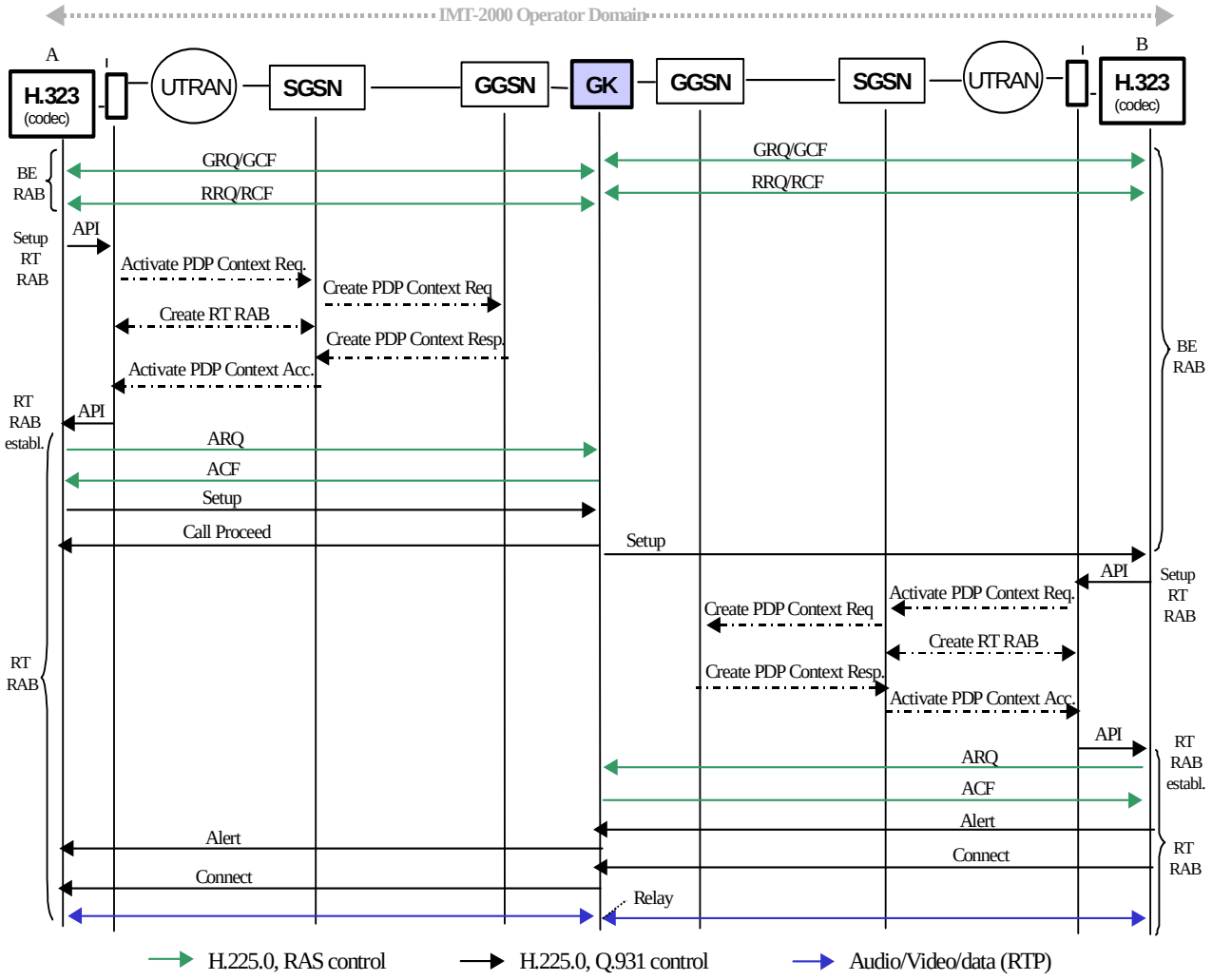


Figure 4.40: IMT-2000 H.323 – H.323 call example

4.5 Core network layer 3

In UMTS/GPRS, it should be possible for operators to use different packet switching protocol (e.g. ATM-SVC) under single GTP standard.

Between GSNs GTP uses UDP/IP (or TCP/IP) for addressing regardless whether IP routing or ATM-SVC switching is used. The use of ATM-SVC will not impact on GTP standardisation.

4.9.1 Protocols and architecture

The LLC layer is only applicable for GPRS and not for UMTS. Due to that, there is a need to reconsider the functionality which is done at LLC in GPRS. There are two alternative described below.

- Use U-plane as the alternative of LLC functionality.
- Use C-plane as the alternative of LLC functionality.

It is too much to establish U-plane connection to transfer small amount of data when focusing on the resource of the entire system.

If C-plane was used for data transfer, it can save resource compared with establishing U-plane connection(by using common channel, efficient use of radio resource is possible). It also possess the advantage of making it possible to use same SMS transfer procedure for CS domain and PS domain. Therefore, it comes to a conclusion that the C-plane shall be used for SMS transfer in UMTS system.

The C-plane is a signalling connection between UE and MSC or SGSN, respectively. Establishment of a secure signalling connection is offered by the GMM in the PS domain and by the MM in the CS domain. SMS is a user of that secure signalling connection.

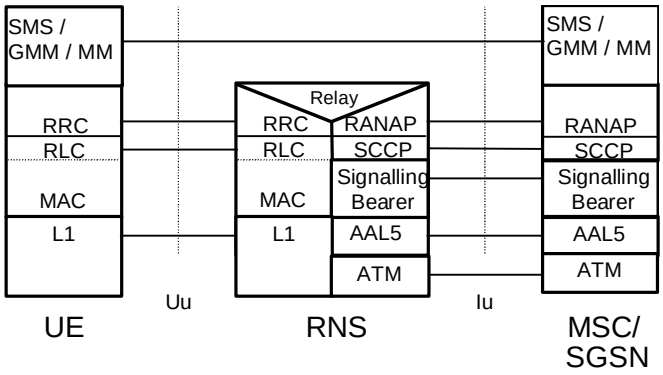


Figure 4.45: Protocol architecture for 3G SMS for both a CS service domain and a PS service domain

4.10a Cell Broadcast Service in UMTS

The *Cell Broadcast Service* (CBS) is defined as a UMTS ~~R99~~ requirement to guarantee the continuity of the corresponding GSM services. It shall be provided seamlessly (as far as the user or the users terminal equipment is concerned) across the UMTS and GSM network.

4.10a.1 Network Architecture

Figure 4.45a proposes a straight forward adoption of the GSM cell broadcast architecture in UMTS.

The basic network structure replaces the GSM BSS with the UTRAN containing the RNC and the Node B. The cell broadcast center (CBC) is part of the core network and connected via the IuBC reference point to the RNC. On the logical interface between the CBC and the RNC a mandatory protocol shall be defined to meet the requirements defined in 3GPP TS 23.041. Based on this architecture and the current requirements for cell broadcast the core network elements like MSC, VLR, HLR etc are not involved for the service delivery.

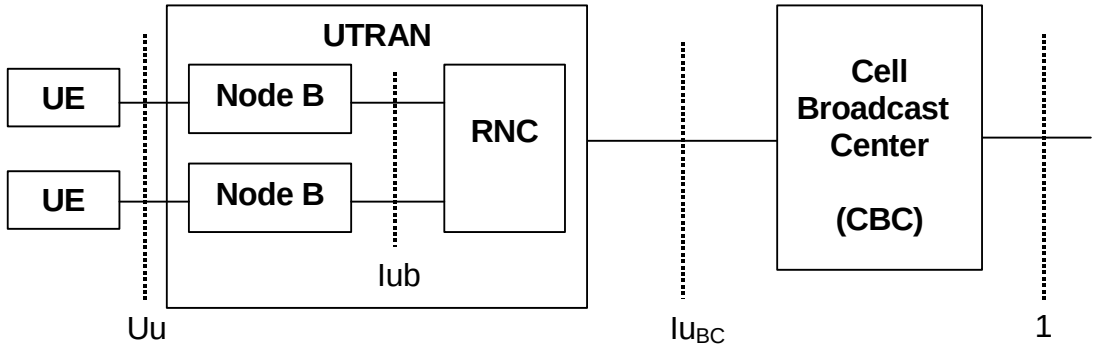


Figure 4.45a: Architecture for the Cell Broadcast Service in UMTS

IuBC is the reference point between the CBC and the RNC. The protocol stack between the CBC and the RNC is given in figure 4.45b.

a) networks which provide the functionality of CS Service Domain and PS Service Domain;

b) networks which only provide the functionality of the CS Service Domain;

c) networks which only provide the functionality of the PS Service Domain.

The following terminal configurations shall be allowed:

a) terminals which are able to access both to the CS Domain and PS Domain;

b) terminals which are only able to access to the PS Domain;

c) terminals which are only able to access to the CS Domain.

It shall be noted that e.g. terminal which is only able to access to the PS Domain supports only mobility management, protocols etc. of that particular domain. The different configurations given above shall not prevent CS-type services from being delivered over the PS domain.

4.12 General Principles for Use of CS-MGW Resources

The following principles for use of CS-MGW resources apply:

1. it shall not be necessary to have the CS-MGW co-located with the MSC Server;
2. the CS-MGW resources need not be associated with any particular MSC Server (see note 1);
3. it shall be possible for any MSC Server to request resources of any CS-MGW in the network (see note 1);
4. it shall be possible for an RNC to connect to the CS-MGW indicated by the MSC server;

Note 1: For points 2 and 3 above, issues related to O&M procedures such as where notification of restart of a CS-MGW should be sent to, need to be considered. Extensions to H.248 may be required.

5 UMTS to UMTS handover for circuit switched services

For UMTS to UMTS Inter-MSC Hand-Over / SRNS relocation the MAP E interface transporting RANAP messages shall be used.

~~[Ed note: signaling flows are to be provided and be in line with "GSM to UMTS handover for circuit switched services"]~~For handover of circuit-switched services involving the change of CN equipment (only CS-MGW or CS-MGW and MSC-server) the anchor principle shall be applied.

- The first MSC Server involved in a call will become the Anchor MSC Server for this call during and after handover , and will remain in the call until the call is released. Every subsequent handover (Intra and Inter) will be controlled by this MSC Server.
- The first CS-MGW involved in a call will become the Anchor CS-MGW for this call during and after handover , and will remain in the call until the call is released. The Nc interface is anchored in the CS-MGW, the correlation between MGW to PSTN and the MGW to UTRAN remain fixed until the call is released.

6 Interoperability between GSM and UMTS

The requirements for GSM - UMTS interoperability is defined in 22.129.

UMTS is a system supporting handovers between GSM and UMTS in both directions. To support these handovers effectively, the following is required from a dual mode MS/UE supporting simultaneous ISDN/PSTN and packet service in GSM/UMTS.

Depending upon the solution adopted for GSM-UMTS handover, the MS/UE supporting simultaneous ISDN/PSTN and packet service may be required to perform appropriate update into CN depending on the activity of the UE once the handover between GSM and UMTS is completed. This update is needed to avoid any severe interruptions on the accessibility of packet services after the handover.

The nature of the update to be made after the handover in both direction, i.e., from GSM to UMTS and from UMTS to GSM, from MS/UE depends on the activity of the UE in the following way:

- ISDN/PSTN connection: RA update only (if RA is changed);
- Packet connection: LA and RA update (if RA and LA are changed).

Both ISDN/PSTN and packet connection: RA update only (if RA is changed).

6.1 Circuit Switched Handover and Roaming Principles

Introduction of a UMTS Core Network necessitates the inter-connection with legacy systems to allow inter-PLMN roaming and handover.

For ease of convergence with the existing networks and the introduction of dual mode handsets, roaming and handover to/from UMTS should be performed in the simplest manner that requires as little change as possible to the legacy networks and standards, i.e. inter-MSC handover functionality.

These principles provide - from a user perspective - transparency of handover and roaming. In addition, operators providing UMTS services should also allow access to legacy networks using existing subscriber profiles and network interfaces.

Illustrated in figure 6.1 shows the introduction of a UMTS Core Network for UMTS phase 1 network configuration. Notice that it leaves the current GSM specifications mainly untouched whereupon the UMTS core network acts towards

the GSM MSC like a GSM MSC by providing for example MAP/E for handover purposes. ~~Further, it should be observed that GSM subscriptions belong to the HLR whilst UMTS subscriptions exist in the HLR release 99.~~

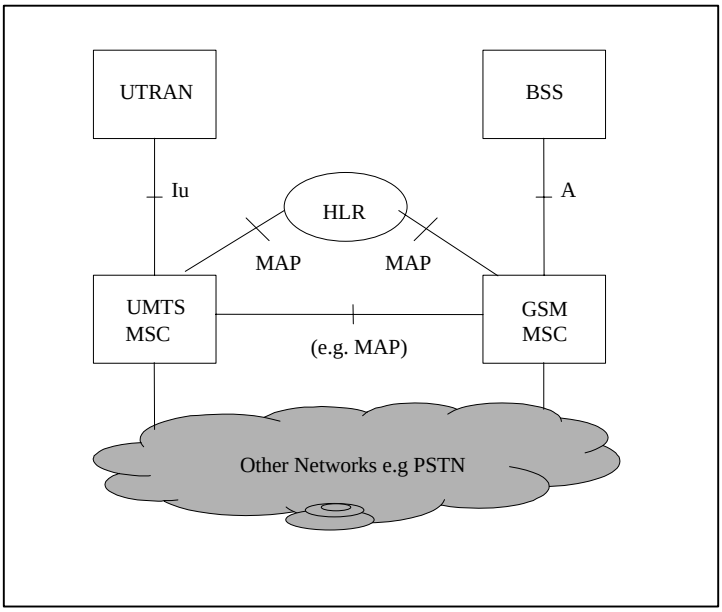


Figure 6.1: Inter-Operability between GSM and UMTS

NOTE 1: No physical implementation should be taken from the figure. As a further note, no interworking functions are shown to ease clarity, but however should not be precluded.

From figure 6.1 it can be seen that the information exchanged over the Iu must provide the necessary parameters to enable the core networks to communicate via for example the MAP interface for handover purposes.

NOTE 2: From the above diagram, existing interfaces are used towards the HLR to allow for subscription management based on today's principles using the already defined user profile, providing seamless roaming between the 2nd generation system and UMTS.

The existing GSM handover procedures should be re-used to minimise the effects on existing GSM equipment.

- The anchor concept in GSM for inter-MSC handover should be used for inter-system handover between UMTS and GSM.
- The signalling over the A-interface and over the MAP/E-interface should be the same as in GSM phase 2+ with possibly addition of some new or updated information elements in some messages.
- For the set up of the handover leg (user plane) standard ISUP/POTS should be used in line with the principles used in GSM.
- The control signalling over the Iu-interface at handover between UMTS and GSM should be based on the A-interface signalling at inter-MSC handover in GSM.
- The signalling over the Iu-interface at call set up to/from a dual mode UMTS/GSM mobile station, shall include GSM information elements needed for handover from UMTS to GSM. In the corresponding way the signalling over the A-interface at call set up to/from a dual mode UMTS/GSM mobile shall include UMTS elements needed for handover from GSM to UMTS. The data are needed to initiate the handover towards the new BSS/RNC.
- A target cell based on CGI is sent to the MSC from UTRAN at handover from UMTS to GSM. The CGI points out the target MSC and target BSC.
- A target cell based on CGI is sent to the MSC from the BSS at handover from GSM to UMTS. The CGI points out the target UMTS MSC and target RNC (UMTS MSC does the translation from CGI to RNC identity).

6.1.1 UMTS to GSM handover for circuit switched services

UMTS to GSM handover for circuit switched services is detailed in 23.009.

6.1.2 GSM to UMTS handover for circuit switched services

UMTS to GSM handover for circuit switched services is detailed in 23.009.

6.2 Packet Switched Handover and Roaming Principles

The introduction of a UMTS core Network illustrates the requirement for inter-connection with the legacy GSM system to allow inter-PLMN roaming and handover.

Even though there is no current GPRS deployment, the operator may decide to deploy a GPRS network prior to the deployment of a UMTS network. Therefore, the introduction of a UMTS Core Network may require to be inter-connected to the legacy packet network.

As in the circuit switched case, roaming and handover to/from UMTS should be performed in the simplest manner that requires as little change as possible to the GPRS network and standards, i.e. inter-GSN handover functionality. In addition, access is provided to the GPRS network using the existing subscriber profiles and current network interfaces.

A similar figure to figure 6.1 is illustrated in figure 6.2. Notice that it also leaves the current GPRS specifications mainly untouched whereupon the UMTS core network acts towards the GSN like a GSN by providing for example Gn. ~~Further, it should be observed that GPRS subscriptions belong to the HLR whilst UMTS subscriptions exist in the HLR release 99.~~

For handover in the UMTS to GSM GPRS direction the intention is to re-use the handover principles of GSM GPRS today in order to limit the changes in GSM GPRS and to take the changes if any on the UMTS side. The below specified messages is standard GSM 2+ messages (when applicable).

6.2.2.1 Handover from UMTS to GSM GPRS

Handover from UMTS to GSM GPRS is detailed in 23.060.

6.2.2.2 Handover from GSM GPRS to UMTS

Handover from GSM GPRS to UMTS is detailed in 23.060.

7. IP Version Issues

The UMTS/GSM architecture will be designed to support IPv4 / IPv6 based on the statements below.

- IP transport between network elements of the IP Connectivity services (between RNC, SGSN and GGSN) and IP transport for the CS Domain.
  - Both IPv4 / IPv6 are already options within R99 for IP connectivity. No change moving to R00
- IP Multimedia CN subsystem elements (UE to CSCF and the other elements e.g. MRF):
  - The architecture shall make optimum use of IPv6.
  - The R00 IM CN subsystem shall exclusively support IPv6.
  - The R00 UE shall exclusively support IPv6 for the connection to R00 IM services.

[Editor's note: The exact set of the functionality available in the whole Ipv6 protocol suite (such as IPSec, IP multicast etc.) that will be mandated in R00 standards is FFS.]

- Access to existing data services (Intranet, Internet,…):
  - The UE shall be able to access IPv4 and IPv6 based services.

8 Support of IP Multimedia Services

8.1 Context Activation and registration

The IP address is allocated to UE either by GPRS or some other means e.g. by DHCP The UE shall use IP addresses assigned to it for, but not limited to, the following:

- the exchange application level signaling (e.g., registration, CC) with the serving CSCF from the access network currently used,
- application level registration to IP MM CN subsystem as an address used to reach the UE *[Editor's Note: The use of DNS names, NAI (Network Access Identifier RFC2486) and SIP URL instead of IP address for application level registration is FFS]*,
- an address used to reach the UE for multimedia calls.

In GPRS, the terminal is associated with an IP address when the primary PDP context is activated. The IP address used for the purpose described above can be:

- the IP address obtained by the UE during the activation of a primary PDP context (e.g. if the UE does not have any existing PDP context active or desires to use a different IP address)
- the IP address of one of the already active PDP contexts.

In the following, a description of the order in which the registration procedure is executed need and how the IP address is allocated is shown. Figure 6-3 shows what procedures and in which order they are performed during the registration.

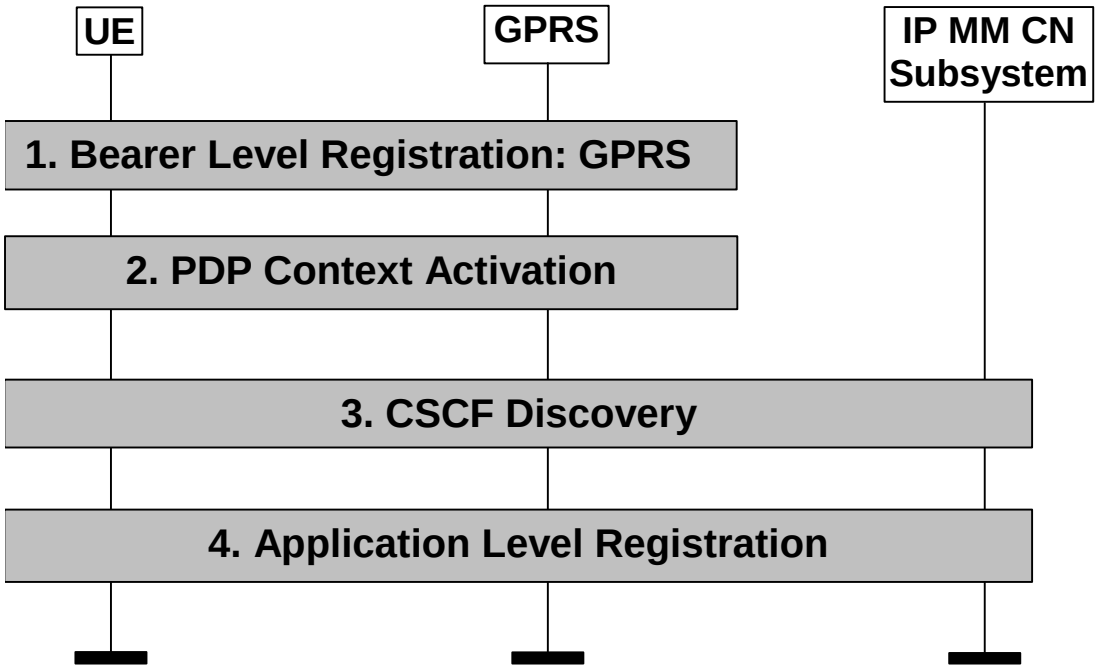


Figure 8-1: Registration

The following steps are performed:

1. the bearer level registration is performed (e.g. when the terminal is switched on or upon explicit indication from the user).

2. the PDP context activation is done. The UE has two options:

   - activate a primary PDP context and obtain a new IP address (e.g. if the UE does not have any existing PDP context active or desires to use a different IP address)

   - activate a secondary PDP context and re-use the IP address of one of the already active PDP contexts.

3. UE performs the CSCF discovery procedure, where the UE performs a CSCF discovery to select the CSCF to register with. *[Editor's note: Details regarding the CSCF discovery procedure are FFS]*.

There can be time gaps between these procedures and the following one. For instance, the UE may perform PDP context activation and the CSCF discovery, but not the application level registration. The UE may use the activated PDP context for other types of signalling, e.g. for CSCF discovery.

4. UE performs application level registration by providing the IP address obtained at step 2 to the CSCF selected at step 3. The IP address used for signalling purposes is allocated in association with PDP context activation and not on an incoming call basis. *[Editor's note: When and how often the UE should update application level registration is FFS]* The selected CSCF becomes the serving-CSCF. Note that the S-CSCF can be either in the home or visited network. *[Editor's note: Where the association of the IP address used by the UE and application level identifier is held in the network is FFS.]* From the S-CSCF point of view, the IP address provided by the UE is the address where the UE is reachable for mobile-terminated call control signalling and any other type of mobile terminated signaling.

Whether the procedures are activated individually by the UE or some of them are performed automatically depends on implementation of the terminal and on the UE's configuration. For instance, the multimedia application in the UE could start the application level registration and steps 2-4 would have to be executed in response to support the operation initiated by the application. Interaction with the UE may happen during these steps.

8.2 Location Management

8.2.1 Registration concepts for a R00 Subscriber Roaming Into a Circuit-Switched Network Domain

Figure 6-4 shows the registration concept for a R00 subscriber roaming into a UMTS/GSM CN domain .

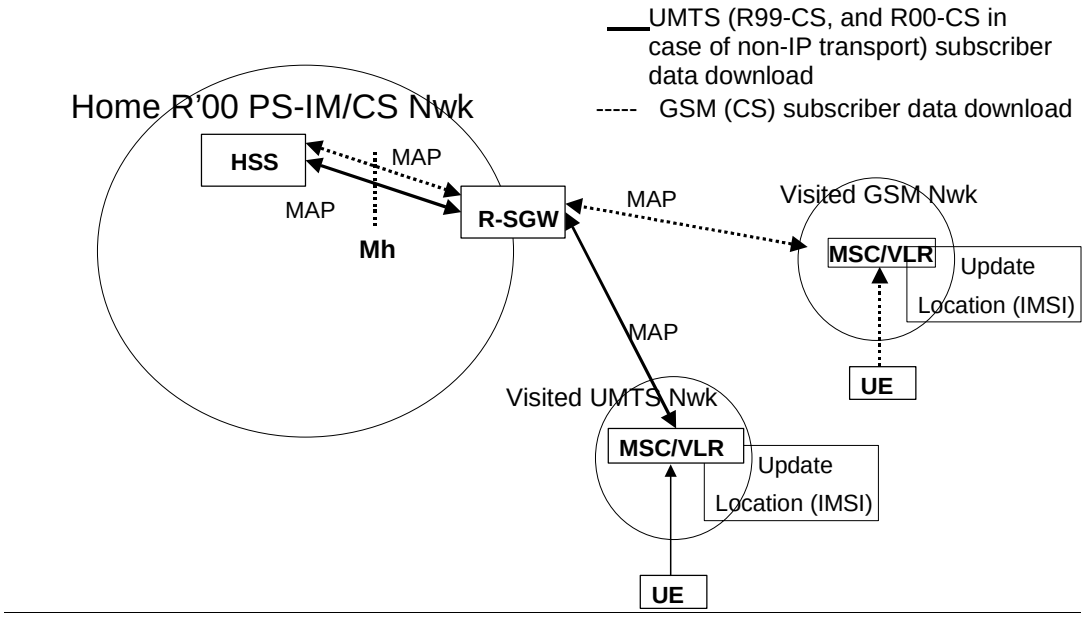


Figure 8-2: A roaming model for registration in a CN domain

The detailed message sequence chart for a UMTS R00 subscriber roaming into a CN domain is shown in Figure 6-5.

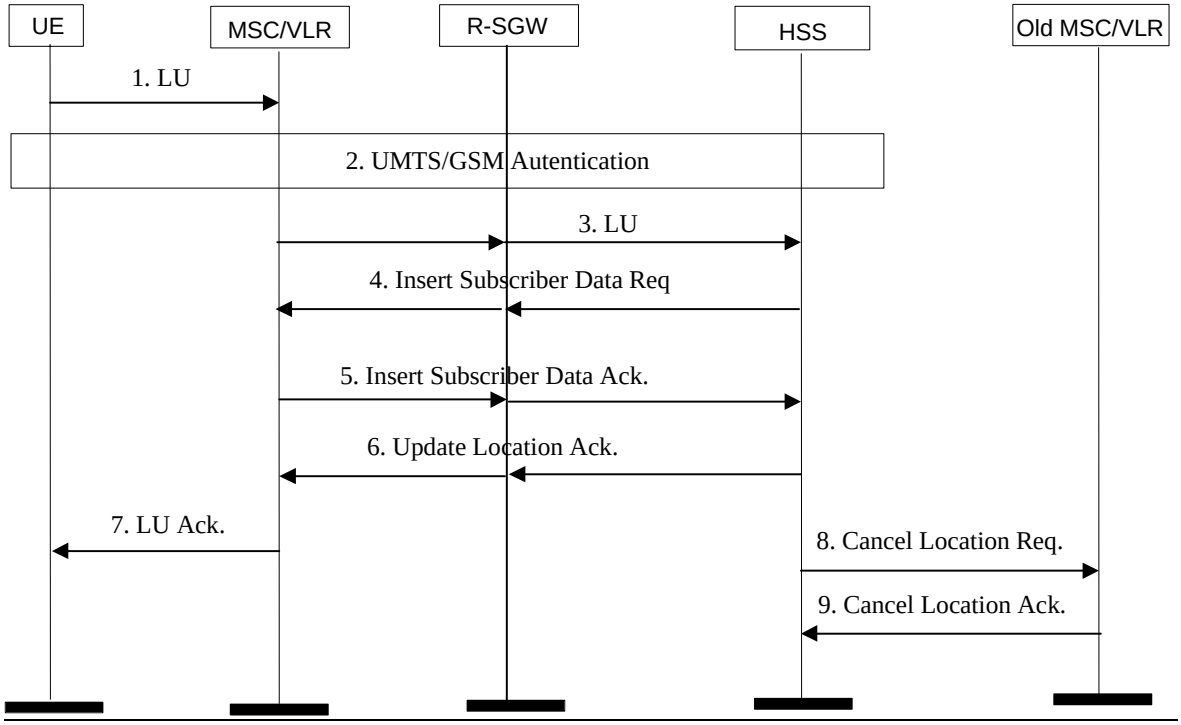


Figure 8-3: Message sequence for roaming into a CN domain

1. The UE initiates the UMTS R99/GSM Location Update procedure with the MSC/VLR of the visited network. The LU message contains the IMSI of the subscriber.

2. The UMTS/GSM authentication is performed as per the existing UMTS R99/GSM specifications.

3. The MSC/VLR initiates the MAP Location Update procedure towards the HSS of the user via R-SGW. The HSS stores the VLR address etc. The message contains IMSI and other parameters as defined in UMTS R99/GSM specifications. The message is passed through the R-SGW transparently while the SS7 to/from IP conversion is performed in R-SGW.

4. The HSS provides the subscriber data for the roaming user to VLR by sending MAP Insert Subscriber Data message via R-SGW. The message contains IMSI and other necessary parameters as defined in the UMTS/GSM specification. The message is passed through the R-SGW transparently while the SS7 to/from IP conversion is performed in R-SGW.

5. The serving VLR then acknowledges the receipt of the subscriber data to the HSS via R-SGW.

6. The HSS acknowledges the completion of location updating procedure to the MSC/VLR via R-SGW.

7. The MSC/VLR acknowledges the completion of location updating procedure to the UE.

8. The HSS sends the MAP Cancel Location message to the old MSC/VLR (optional procedure).

9. Location cancellation is acknowledged to the HSS by the old MSC/VLR.

NOTE 1: The steps 8 and 9 above assume that the UE was previously registered to a CN domain .

NOTE 2: The MAP messages between the MSC/VLR and HSS are passed transparently via R-SGW. The R-SGW does not interpret the MAP messages in anyway, but performs only the lower level conversion between SS7 and IP. This is in accordance with the 3GPP definition for R-SGW.

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23.121	**CR** r~~21~~	**059**	Current Version:	3.3.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to:	~~TSG#14~~ SA#09	for approval	X	strategic		(for SMG use only)
list expected approval meeting # here ↑		for information		non-strategic		

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from:* ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

Proposed change affects: *(at least one should be marked with an X)* (U)SIM [ ] ME [ ] UTRAN / Radio [ ] Core Network [X]

Source: Alcatel **Date:**

Subject: Correction to Data Retrieve protocol stacks endpoints

Work item: UMTS

Category: *(only one category shall be marked with an X)*

F	Correction	X	**Release:**	Phase 2	
A	Corresponds to a correction in an earlier release			Release 96	
B	Addition of feature			Release 97	
C	Functional modification of feature			Release 98	
D	Editorial modification			Release 99	X
				Release 00	

Reason for change:

This CR corrects the protocol stack endpoints for data retrieve procedure. In 23.121, it is stated that forwarded N-PDUs from Source RNC to Target RNC always go through SGSN's. The protocol stacks show that no SGSN function is used since only IP routing is performed. As it is agreed that RNC's and SGSN's could be connected by an IP transport network, the IP datagrams may not be routed via the SGSN's since their destination IP address is the Target RNC: there is no routing constraints in the IP network.

If this CR is not accepted, it may not be possible to connect RNC and SGSN via an IP Network. Therefore, there will be inconsistencies.

Clauses affected: 4.2.1.5

Other specs affected:

Other 3G core specifications		→ List of CRs:	Another CR (060) Tdoc ~~1478~~ 1538 is provided for R00.
Other GSM core specifications		→ List of CRs:	
MS test specifications		→ List of CRs:	
BSS test specifications		→ List of CRs:	

O&M specifications ☐ → List of CRs:

Other comments:

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4.2.2.1.4 Adopted solution for data retrieve in UMTS

Data Retrieve procedure at SRNS relocation shall be carried out through the Iu interface: data exchanged between source and target SRNC are carried over Iu at ATM layer. They are routed at IP layer towards the target SRNC and there is one single GTP tunnel between the source SRNC and the target SRNC.

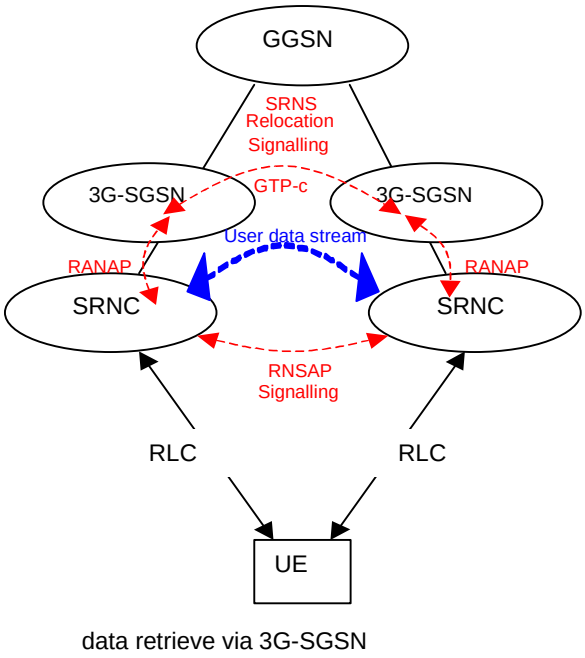
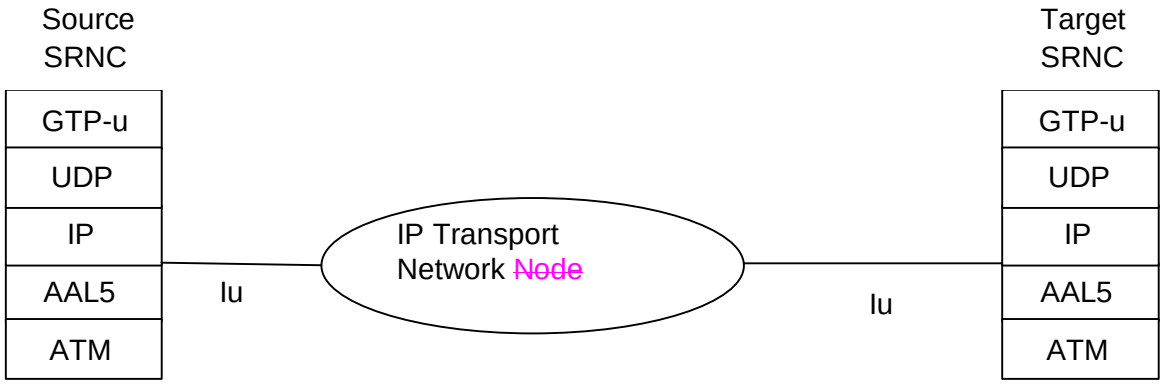


Figure 4.5: User data Retrieve in UMTS

4.2.2.1.5 User plane protocol stacks for UMTS data retrieve

The user plane for data retrieve between two RNCs is based on GTP-u/UDP/IP. The GTP connections are terminated in the source SNRC and the target SRNC as described in figure 4.6.



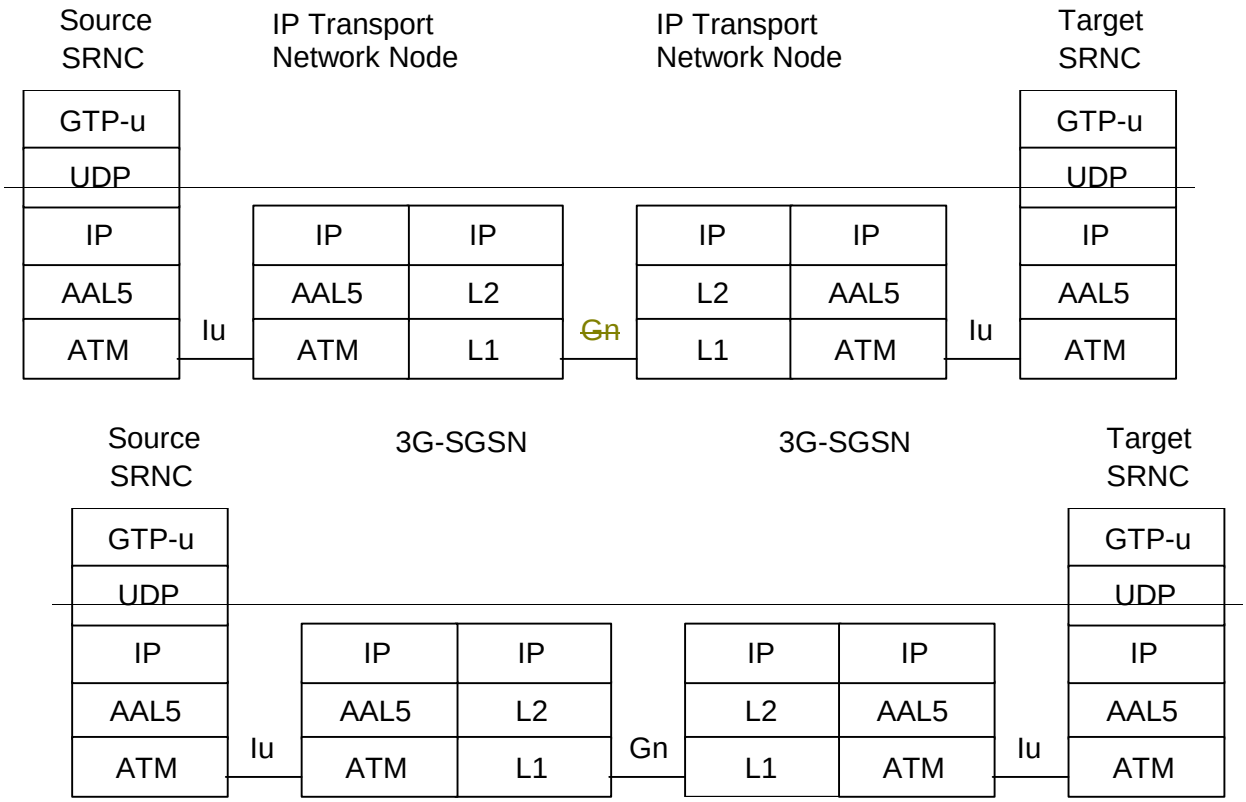


Figure 4.6: User plane protocol stack for data retrieve in UMTS

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Document S2-001513

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23.121	CR	r2~~1~~	060	Current Version:	3.3.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

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Clauses affected: 4.2.1.5

Other specs affected:

Other 3G core specifications	→ List of CRs:	This is the R00 shadow of Tdoc ~~1477~~ 1537 (for R99)
Other GSM core specifications	→ List of CRs:	
MS test specifications	→ List of CRs:	

BSS test specifications		→ List of CRs:	
O&M specifications		→ List of CRs:	

Other comments:

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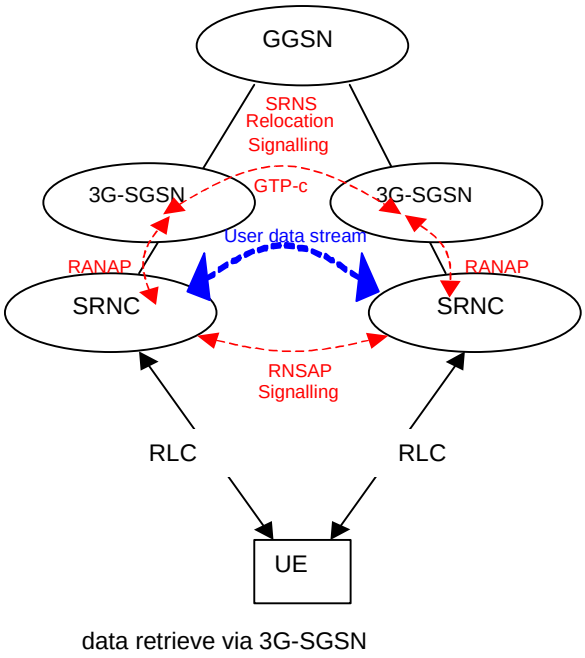

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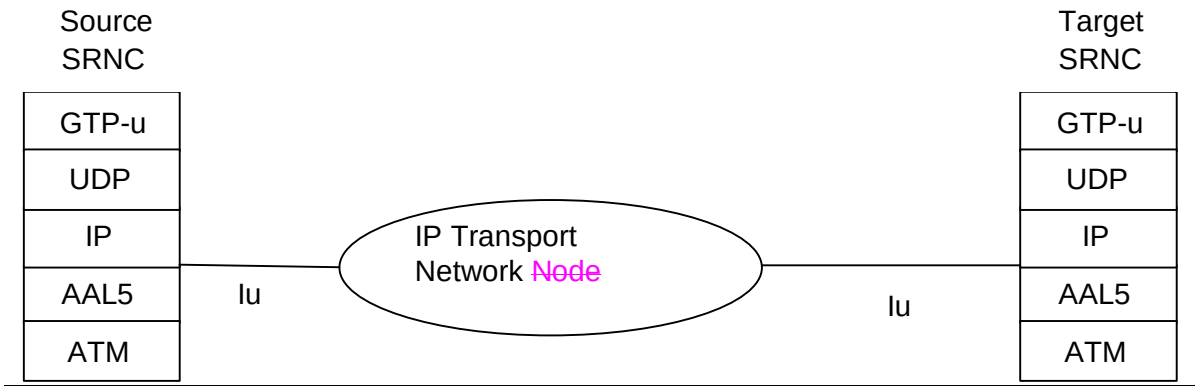

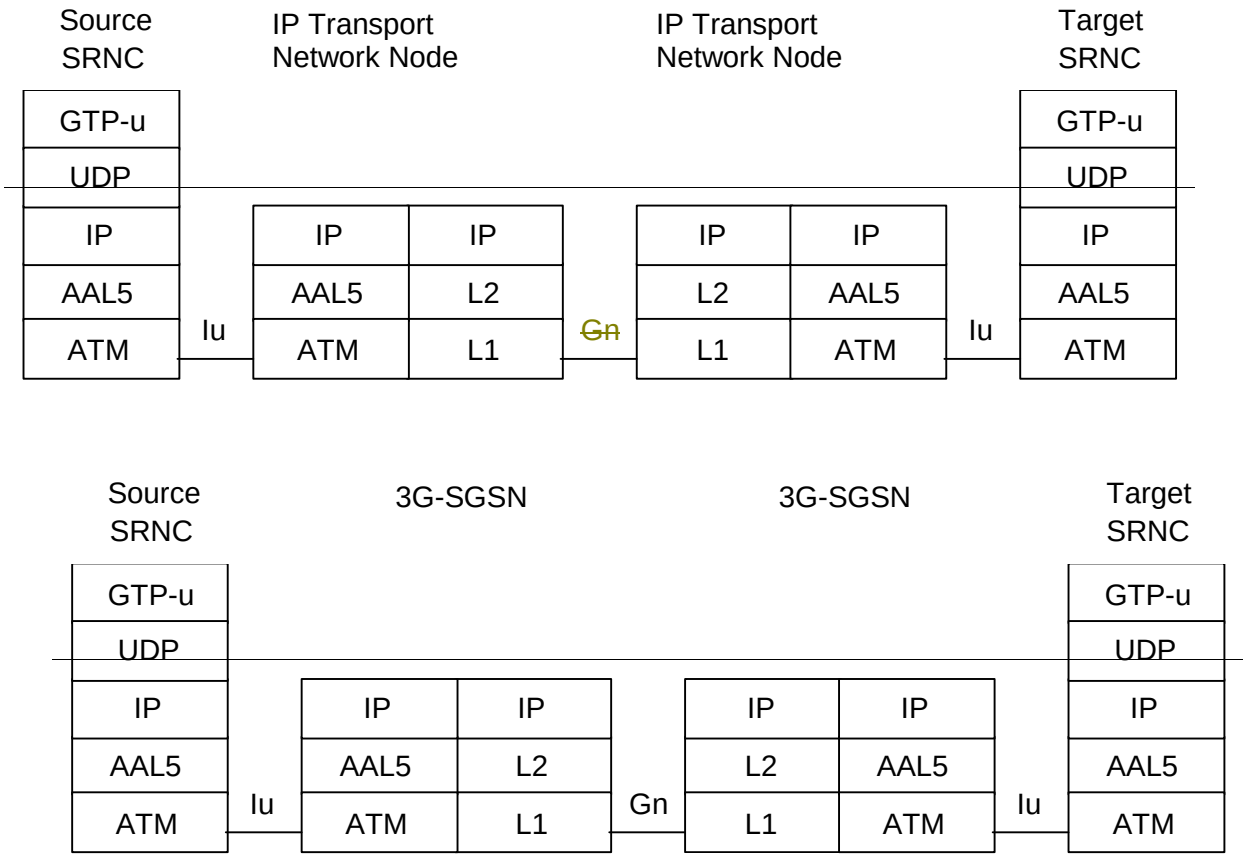

Figure 4.6: User plane protocol stack for data retrieve in UMTS