3GPP TS 23.221 ~~V0~~V1.~~0~~10.~~5~~ 0 (2000-11)

Technical Specification

3rd Generation Partnership Project;
Technical Specification Group Services and System Aspects;
Architectural requirements;

(Release 5)

GLOBAL SYSTEM FOR
MOBILE COMMUNICATIONS

~~*Remove GSM logo from the cover page for pure 3rd Generation documents.*~~

~~*Select keywords from list provided in specs database.*~~

Keywords

<keyword[, keyword]>

3GPP

Postal address

3GPP support office address

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

Internet

http://www.3gpp.org

Contents

Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

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

Version x.y.z

where:

- x the first digit:
  - 1 presented to TSG for information;
  - 2 presented to TSG for approval;
  - 3 or greater indicates TSG approved document under change control.
- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

Introduction

This clause is optional. If it exists, it is always the third unnumbered clause.

1 Scope

This document covers details the architectural requirements for the GSM and UMTS systems. In particular it details the high level requirements for the Circuit Switched (CS) Domain and the stage 2 procedures that span moreone than one domain/subsystem within UMTS and GSM. The reference model to which these procedures apply can be found within 3G TS 23.002 [12]. Detailed architectural requirements within the subsystems are contained within the remainder of the 23 series of specifications e.g. the requirements for the Packet Switched (PS) domain are contained within 3G TS 23.060 [23] and the requirements for the Bearer Independent CS Core Network are contained in 3G TS 23.205[14].

Editor's note: Now that 23.121 only applied to UMTS. With the introduction of GERAN in R4 most of this document applies to both GSM and UMTS. Are there sections that apply to only UMTS?

Editor's Note: To facilitate the split of this document into a release 4 and release 5, the text added for these two releases have been marked through editor's notes. All unmarked text applies to R99 onwards. It is intended that a single document will be presented to SA#11 as v2.0.0 and the split to the two releases will be handled by the editor.

2 References

Editor's note: Not revised in this draft.

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.

This specification may contain references to pre-Release-4 GSM specifications. These references shall be taken to refer to the Release 5Release 5Release 5 version where that version exists. Conversion from the pre-Release-4 number to the Release 4 (onwards) number is given in subclause 6.1 of 3GPP TR 41.001.

[12] 3GPP TS 23.002: "Network Architecture".

[23] 3GPP TS 23.060: "General Packet Radio Service (GPRS) Service description; Stage 2".

[35] 3GPP TS 23.012: "" Location management procedures""

[46] 3GPP TS 23.101: "3rd Generation mobile system Release 1999 Specifications"

[57] 3GPP TS 25.331: "" Radio Resource Control (RRC) Protocol Specification"";

[6] 3G TS 25.301: "Radio interface protocol architecture"

UMTS YY.01:, "UE UTRAN Radio Interface Protocol Architecture Stage 2"

[68] UMTSYY.01, UE UTRAN Radio Interface Protocol Architecture Stage 2.

[79] 3G TS 25.303: "UE functions and inter-layer procedures in connected mode"UMTSYY.03:, "Description of UE states and Procedures in Connected Mode."

[816] 3GPP TR 21.905: "3G Vocabulary".

[917] 3GPP TS 25.413: "" UTRAN Iu interface RANAP signalling""

[1018] 3GPP TS 25.410: "" UTRAN Iu Interface: General Aspects and Principles""

[11] 3G TS 23.228 “IP Multimedia Subsystem – Stage 2”

[12] GERAN Stage 2

[13] 3G TS 23.153 ,"Out of Band Transcoder Control - Stage 2".

[14] 3G TS 23.205, “Bearer Independent CS Core Network – Stage 2”

[15] 3G TR 25.931: "“ UTRAN Functions, examples on signalling procedures"”

[16] RFC2766 "Network Address Translation - Protocol Translation (NAT-PT)", G. Tsirtsis, P. Srisuresh. February 2000.

[17] RFC2893 ”Transition Mechanisms for IPv6 Hosts and Routers”, R. Gilligan, E. Nordmark, August 2000.

3 Definitions, symbols and abbreviations

3.1 Definitions

Editor’s note: Not revised in this draft.

For the purposes of the present document, the terms defined in 3GPP TR 21.905 [8~~16~~] apply:

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

3.2 Symbols

Editor’s note: Not revised in this draft.

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

3.3 Abbreviations

Editor’s note: Not revised in this draft.

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

CN	Core Network
CS	Circuit Switched
CSCF	Call/Session Control Function
CS-MGW	Circuit Switched Media Gateway
IM	IP Multimedia
IP	Internet Protocol
IPSec	IP Security protocol
LA	Location Area
MGCF	Media Gateway Control Function
MGW	Media Gateway
MSC	Mobile Switching Centre
NAT	Network Address Translator
PS	Packet Switched
RA	Routing Area
RNC	Radio Network Controller
SGW	Signalling gateway
SRNS	Serving Radio Network Subsystem
UE	User Equipment

4 Architectural principles

Editor's note: Need to determine which of these apply to release 5 only.

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 is a complex function. 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:** 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:** IM subsystem 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 UMTS/GSM domains and subsystems

4.1 Circuit switched (CS) core network domain

4.1.1 UMTS to UMTS handover for circuit switched services

Editor's note: The second sentence is for R4

For UMTS to UMTS Inter-MSC Hand-Over / SRNS relocation the MAP E interface transporting RANAP messages shall be used. Alternatively, in the case of intra-PLMN handover, the SRNS relocation between two MSC-areas may be executed as intra-MSC SRNS relocation. In such a case this will be performed by utilising a direct SCCP connection between the target RNC located in the target MSC-area and the MSC server already involved in the call.

Editor's Note: The following text is for Release 4 onwards

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.

4.1.2 General principles for use of CS-MGW resources

Editor's Note: The following text is for Release 4 onwards

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.

The specification of the Bearer Independent CS CN which uses the CS-MGW is in TS 23.205 [14].

4.1.3 Transcoder location

Editor's Note: The following text is for Release 4 onwards

In UMTS trancoders are located in the core network. They may be located in the MGW at the border to the UTRAN (i.e the MGW at the Iu interface) or at the MGW at the edge of the core network (e.g. at the edge towards the PSTN/ISDN) [13].

4.2 Packet Switched (PS) core network domain

The requirements for the PS domain are in 23.060[2].

4.3 IP Multimedia subsystem (IMS)

editor's note: This section is for Release 5 onwards.

The requirements for the IMS are in 23.228[11]

4.4 UTRAN

The requirements for the UTRAN are in the 25-series.

4.5 GERAN

Editor's Note: This section is for Release 4 onwards.

The requirements for the GERAN are in [12]

5 IP addressing

5.1 IP version issues

~~Editor's note: Rewrite as general section on IP address management. Need to include in this material from 23.228 clause 4.3.~~

The UMTS/GSM architecture ~~will be designed to~~shall 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 options for IP Connectivity~~.~~

Editor's Note: The text in the following bullet is for Release 5 onwards

- IP Multimedia CN subsystem elements (UE to CSCF and the other elements e.g. MRF):
  - The architecture shall make optimum use of IPv6.
  - The IM CN subsystem shall exclusively support IPv6.

- The UE shall exclusively support IPv6 for the connection to 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.

5.2 Interoperability between IPv4 and IPv6 networks

Editor's Note: This section is for Release 4 onwards.

As described in TS 23.228 [11] the IM CN Subsystem is based only on IPv6. Thus, it is needed to describe how these mobiles can connect to legacy IPv4 services. This section describes three different interworking scenarios: UE is IPv4 and IPv6 capable, IPv6 only UE, and IPv6 UE connected via IPv4 network to an IPv6 device. These scenarios are examples of IPv6 and IPv4 interworking. The scenarios presented below only considered cases of a Transition Gateway (TrGW) for generic services and specialist services may require additional functionally at the application level.

5.2.1 IPv4/IPv6 Mobile connecting to IPv4 and IPv6 networks

An installation where the UE has both IPv4 and IPv6 stacks is shown in Figure 5-1. As depicted, the terminal connects to the IPv4 device directly using an IPv4 PDP Context. Hence, the UE appears to be a standard IPv4 node to the external IPv4 network. This scenario does not need any specific transition support from the network. However, it requires both versions of IP at the UE. The GGSN in this scenario may be different for the IPv6 and the IPv4 connections.

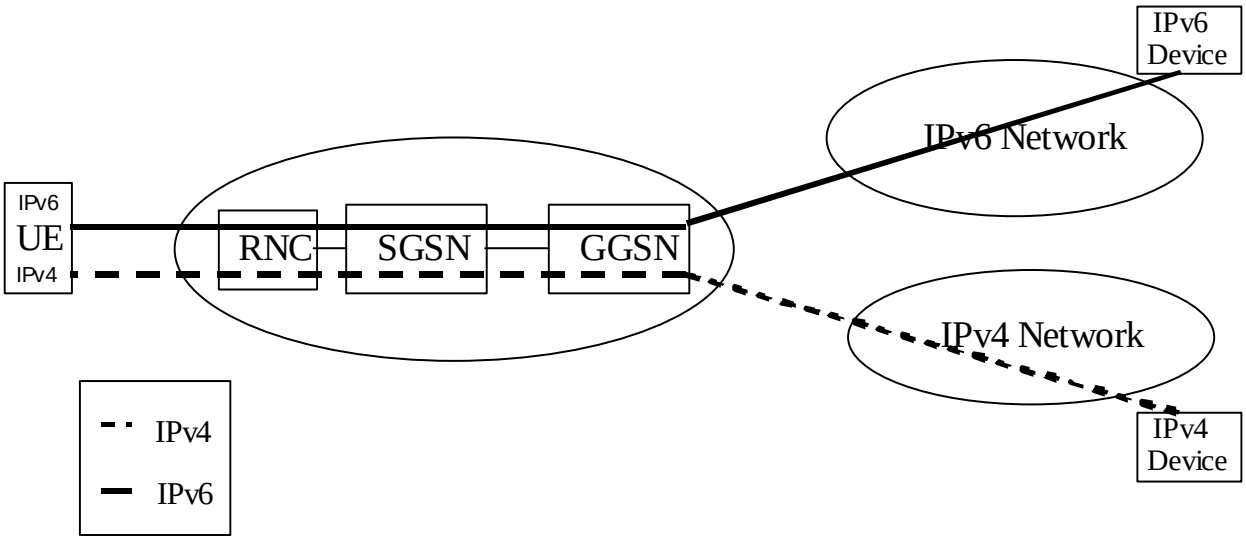

Figure 5-1 UE with IPv4 and IPv6 capability connecting to IPv4 and IPv6 networks

5.2.2 IPv6 only Mobile connecting to IPv4 network

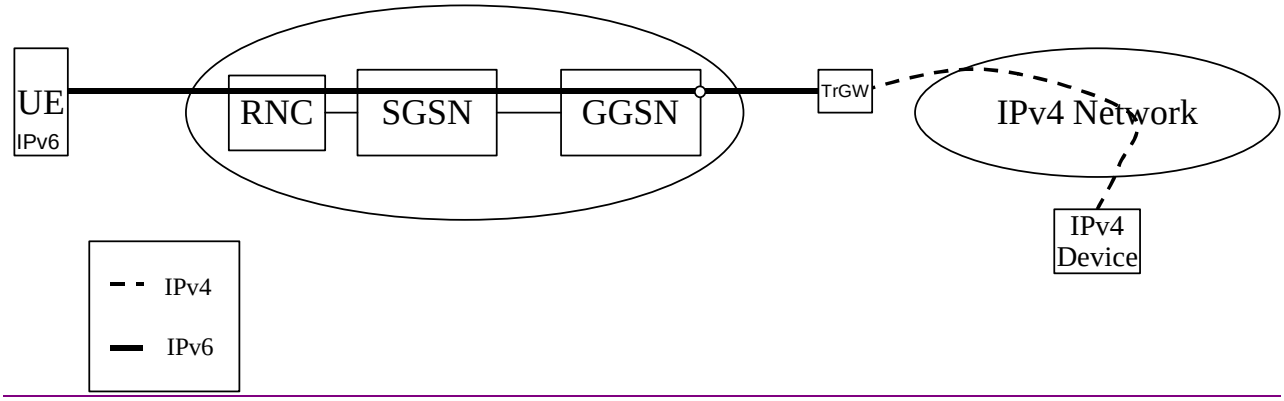

Figure 5-2 IPv6 only mobile connecting to IPv4 data services

Figure 5-2 shows an IPv6 only terminal connected to an IPv4 device. The UE us using an IPv6 PDP Context for access to a Transition Gateway (TrGW) that translates the IPv6 packets to IPv4 and vice versa. The TrGW may be implemented as a Network Address Translation – Protocol Translation (NAT-PT) [16] to convert IPv6 traffic coming from the UE to IPv4 traffic and vice versa.

NAT-PT is a combination of NAT-like address translation and IP header conversion as described in [16]. NAT-PT uses a pool of IPv4 addresses for assignment to IPv6 nodes on a dynamic basis as sessions are initiated across v4-v6 boundaries. NAT-PT binds addresses in the v6 network with addresses in the v4 network to provide transparent routing of packets traversing address realms. This requires no changes to end nodes and IP packet routing is completely transparent to them. It does, however, require NAT-PT to track the sessions it supports and mandates that inbound and outbound packets pertaining to a session traverse the same NAT-PT device.

5.2.3 IPv6 Mobile connected to an IPv6 Device via an IPv4 network

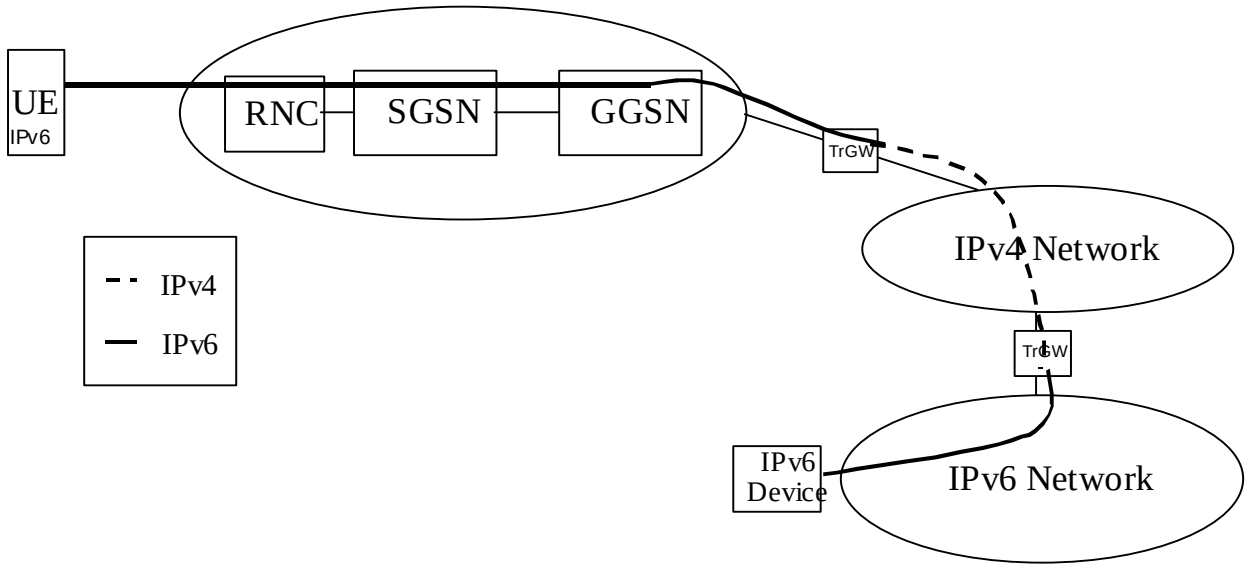

Figure 5-3 IPv6 mobile connected to an IPv6 device via an IPv4 network

Figure 5-3 shows a case where an IPv4 network lies between two IPv6 domains. The IPv6 domains can be interconnected using IETF standard mechanisms such as automatic or configured tunneling of IPv6 over IPv4 [17].

5.2 Address management

Editor's Note: The following text (as worded) is for Release 5 onwards. Should some of this not apply for release 4.

The UMTS network may be implemented as a number logically separate IP networks which contain different parts of the overall system. In this discussion each of these elements is referred to as an "IP Addressing Domain". Within an "IP Addressing Domain" it is required that the nodes within the domain are part of a consistent non-overlapping IP-address space. It is also required that IP packets may be routed from any node in the domain to any other node in the domain using conventional IP routing. In a real implementation an IP Addressing Domain may be a physically separate IP network or an IP VPN.

IP Addressing Domains may be interconnected at various points. At these points of interconnect gateways, firewalls or NATs may be present. It is not guaranteed that IP packets from one IP Addressing Domain can be directly routed to any interconnected IP Addressing Domain. Rather inter-Domain traffic may be handled via firewalls or tunnels. This implies that different IP Addressing Domains can have different (and possibly overlapping) address spaces.

Figure 5-4 below shows an example of the IP Addressing Domains involved in PS-domain and IP-subsystem services.

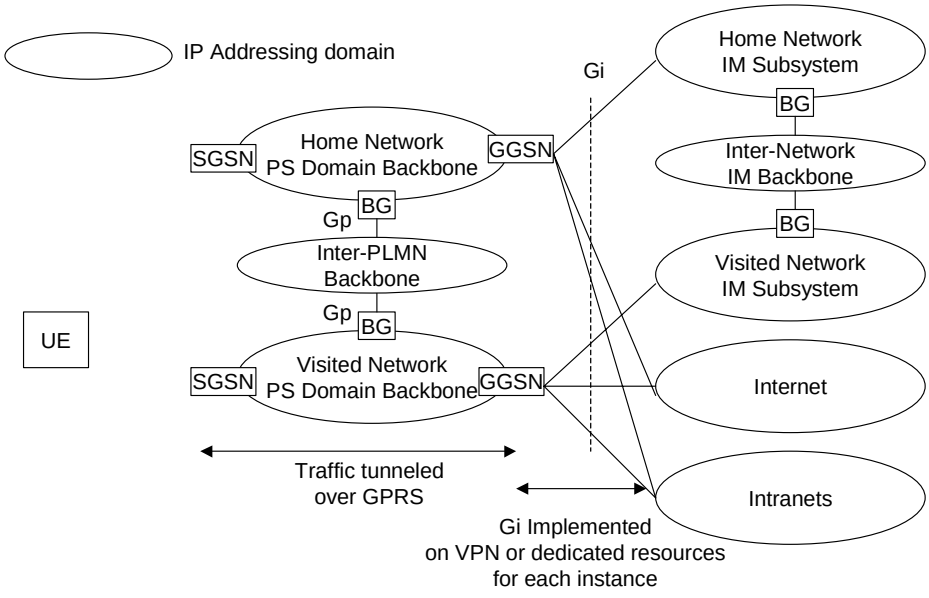

Figure 5-4 – IP Addressing Domains Involved In PS-Domain and IM Services

Though UMTS permits the possibility of using different IP Addressing Domains as shown above it is possible that several different IP Addressing Domains fall under a common co-operative management regime. In this case the different IP Addressing Domains may be implemented as a single administrative domain at the operator's discretion, thus using a common IP-address space.

A UE accessing services in either an IM subsystem, the Internet, or an external Intranet requires an IP address that is part of the target network's IP Addressing Domain. For each of these IP networks, the IP address is linked to a specific PDP context, or set of PDP contexts sharing this IP address.

When the UE establishes the PDP context to access an IP network, it may use an existing PDP context if it has an active context with a compatible IP addressing domain and quality of service profile.

5.3 IP addressing and routing for access to IM-subsystem services

Editor's Note: The following text is for Release 5 onwards.

This section deals with a UE making access to IM-subsystem services only and via UMTS.

Editors Note: How a UE can access IM subsystem services via other access types, or make simultaneous access to services in other IP networks is FFS.

A UE accessing IM-Subsystem services requires an IP address which is logically part of the Serving Network IM Subsystem IP Addressing Domain. This is established using an appropriate PDP-context. For routing efficiency this context should be connected through an GGSN in the visited network An example of the connection between the UE and the Visited Network IM Subsystem is shown below in figure 5-5:

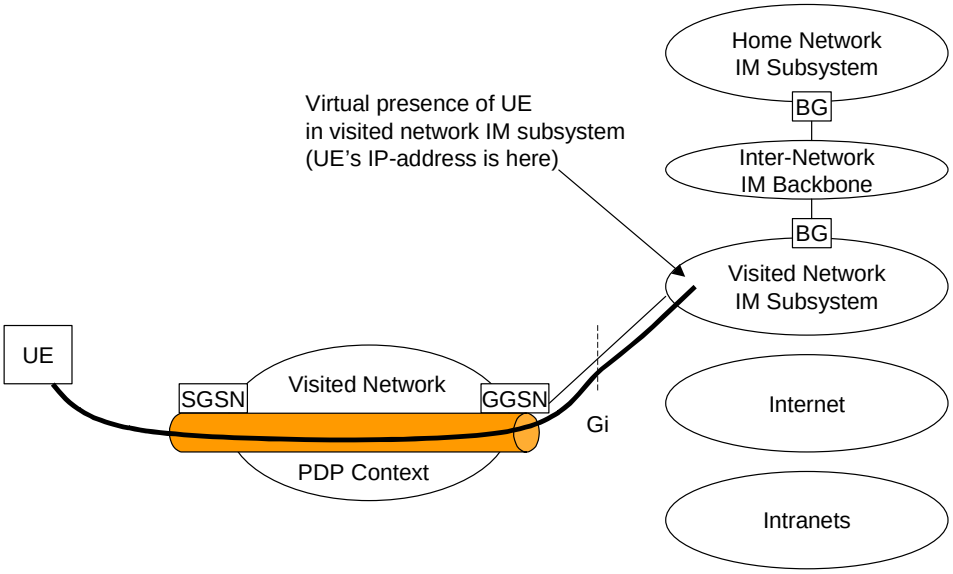

Figure 5-5 UE Accessing IM Subsystem Services in the visited network

5.4 Simultaneous access to multiple services

Editor's Note: The following text (as worded) is for Release 5 onwards. Should some of this not apply for release 4.

A UE can have multiple services active simultaneously. When the services are part of different IP addressing domains, separate PDP contexts and IP addresses are required. The UE shall support multiple IP addresses when simultaneous PDP contexts are activated that require separate IP addresses for different addressing domains.

Figure 5-6 shows an example of a connection between a UE and an Internet/Intranet service that is not available in the Visited Network with a simultaneous connection to the Visited Network's IM Subsystem. In this example, there may be two IPv6 addresses allocated, or one IPv4 address allocated for internet/Intranet access and oneIPv6 address for IM subsystem access..

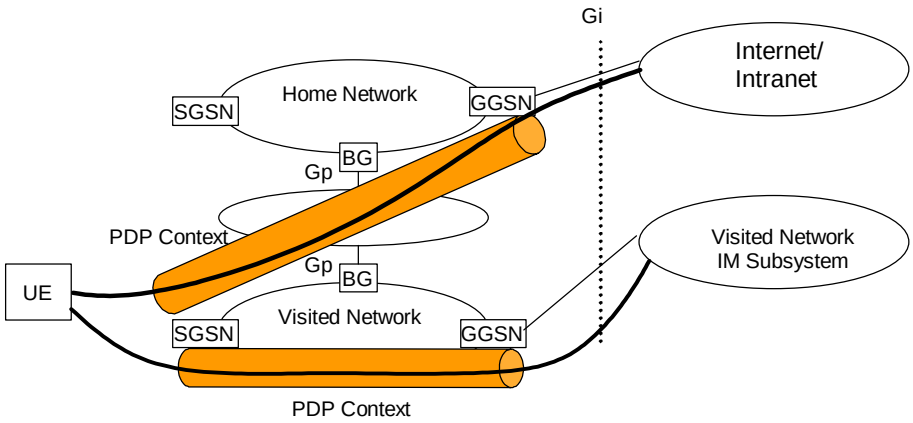

Figure 5-6 UE Accessing Home Internet/Intranet Services and Visited Network IM

-

6 Mobility management

6.1 Introduction

From a logical point of view, the CN encompasses two domains, a ~~PSTN/ISDN~~CS domain and a~~n IP~~ PS domain. It shall be possible to connect the UTRAN either to both these CN domains or to one of the CN domains.

A single RRC connection (between UTRAN and UE) shall carry all user plane and signalling flows to/from a UE. This is regardless of where in the CN they originate/terminate.

UMTS shall support compatibility with GSM network from the point of view of roaming and handover. For the LM/MM functionality point of view this implies among other things the following:

a) IMSI shall be used as the common user identity in the two CN domains;

b) common MAP signalling will be applied to both GSM and UMTS. The GSM MAP mobile service operations shall be evolved and re-used as far as possible (including extensions if required). This should not stop new MAP signalling operations being developed and applied to both GSM and UMTS;

c) radio network parameters and radio resource management should be isolated in the UTRAN.

The LM/MM techniques used in UMTS should minimise radio resource usage of the UTRA.

6.2 Location management and mobility management concept overview

6.2.1 Non-combined procedures

From a logical point of view, the Core Network (CN) consists of two service domains, a CS service domain ~~(earlier named PSTN/ISDN domain)~~ and a PS service domain ~~(earlier named IP domain)~~ or one of these domains.

Each service domain has its own service state machine. An UE, that is supporting both CS services and PS services, has a CS service state machine and a PS service state machine. The two peers of the service state machine are working independently to each other, although associated to the same UE. The UE-CN signalling aims to keep the peer entities synchronised.

As an introduction, figure 6.1 and figure 6.2 give an overview of the UE registration and connection principles within the UMTS when the CN consists of two separate PS and CS service nodes or one combined CS and PS service node.

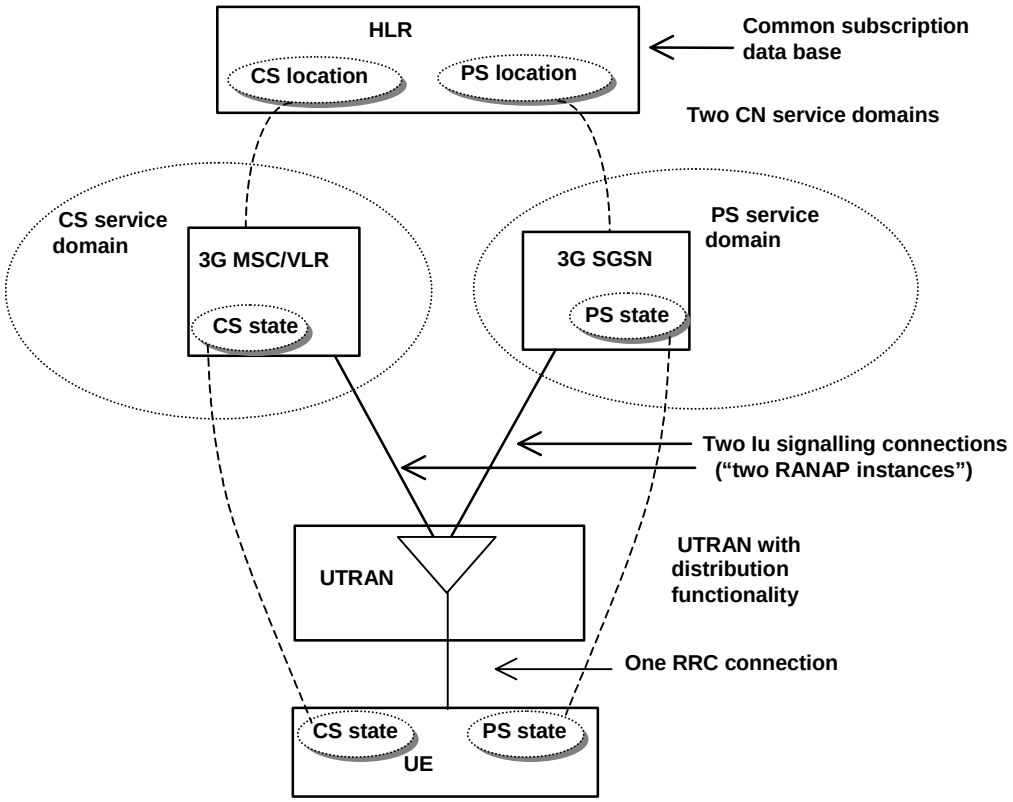

Figure 6.1: Overview of the UE registration and connection principles within UMTS for the separate CN architecture case

In the separate CN architecture case, the CN consists of both a CS service domain with evolved MSC/VLR, 3G_MSC/VLR, as the main serving node and an PS service domain with evolved SGSN/GGSN, 3G_SGSN and 3G GGSN, as the main serving nodes.

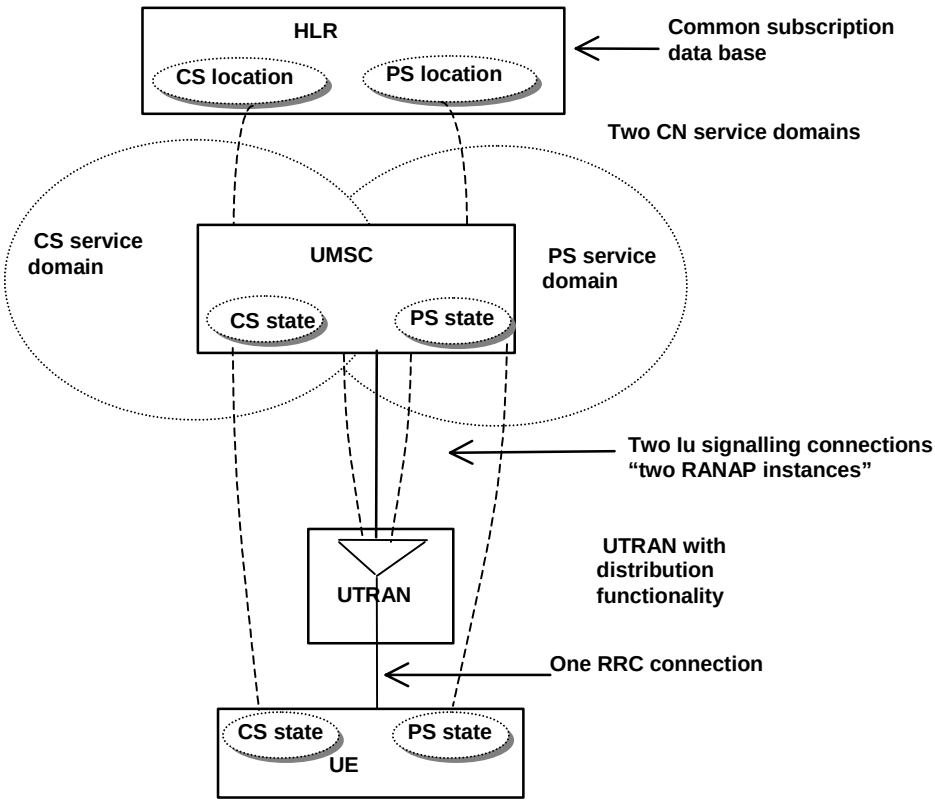

Figure 6.2: Overview of the UE registration and connection principles within UMTS for the integrated CN architecture case

In the integrated CN architecture case, the CN consists of both a CS service domain and an PS service domain with an UMSC as the main serving node.

The main PS service states are PS-DETACHED, PS-IDLE and PS-CONNECTED. The main CS service states are CS-DETACHED, CS-IDLE and CS-CONNECTED. For the respective service domain there are specific related MM system information controlling the Mobility Management functionality of the UE.

The aim of UTRAN is to offer one unified set of radio bearers which may be used for bursty packet traffic and for traditional telephony traffic. This leads to the conclusion that only one logical control channel structure will be used for all kind of traffic. The radio resource handling is UTRAN internal functionality and the CN does not define the type of radio resource allocated.

The Radio Resource Control (RRC) has two modes, RRC Connected mode and RRC Idle mode. The RRC mode describes which identity is used to identify the UE. In RRC Idle mode the UE is identified by a CN associated identity. In RRC Connected mode the UE is assigned a Radio Network Temporary Identity to be used as UE identity on common transport channels. When the UE is allocated dedicated transport channels, it uses the inherent addressing provided by these transport channels.

In PS-CONNECTED state the UE is in RRC Connected mode. In CS-CONNECTED state the UE is in RRC Connected mode.

For the mobility functionality, four different area concepts are used. Location Areas and Routing Areas are used in the Core Network. UTRAN Registration Areas and Cell Areas are used in UTRAN. Location Areas are related to CS services. Routing Areas are related to PS services.

One Location Area is handled by one CN node. For an UE that is registered in a Location Area, this implies that the UE is registered in the specific CN node handling this specific Location Area. One Routing Area is handled by one CN node. For an UE that is registered in a Routing Area, this implies that the UE is registered in the specific CN node handling this specific Routing Area. Location Area is used by the 3G_MSC/VLR for paging the UE. Routing Area is used by the 3G_SGSN for paging the UE. UTRAN Registration Areas and Cell Areas are only visible in UTRAN and used in RRC-Connected mode.

For the relations between Location Area (LA) and Routing Area (RA) is described in subclause 4.3.2.

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.

6.2.2 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 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.

6.3 Description of the location management and mobility management concept - area concepts

6.3.1 Introduction

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.

6.3.2 Location areas

For CS services, the CN uses Location Areas (LA). Location Area is used e.g. at CN initiated paging related to CS services. A CS service related temporary identity, CS –TMSI, may be allocated to the UE. This temporary identity is then unique within a LA.

6.3.3 Routing areas

For PS services, the CN uses Routing Areas (RA). Routing Area is used e.g. at CN initiated paging related to PS services. A PS service related temporary identity, PS-TMSI, may be allocated to the UE. This temporary identity is then unique within a RA.

6.3.4 UTRAN internal areas

UTRAN internal areas are used when the terminal is in RRC-Connected mode (see chapter 3.3). The areas are used at e.g. UTRAN initiated paging. UTRAN internal area updating is a radio network procedure and the UTRAN internal area structure should not be visible outside UTRAN. In RRC connected mode, the UE position is known on cell level or on UTRAN Registration Area (URA) level. RNTI is used as a temporary UE identifier used within UTRAN and allocated at RRC connection establishment.

6.3.5 Relationship between the different areas

The following area relations exist (see figure 6.3):

- there may not be any relation between URA and LA respectively between URA and RA. The URA concept is defined in 3G TS 25.331 [5~~7~~];
- one RA consists of a number of cells belonging to RNCs that are connected to the same CN node;
- one LA consists of a number of cells belonging to RNCs that are connected to the same CN node;
- one RA is handled by only one CN serving node, i.e. one UMSC or one 3G_SGSN;
- one LA is handled by only one CN serving node, i.e. one UMSC or one 3G_MSC/VLR.

The GSM defined relations between LA and RA applies i.e. the following relations between LA and RA are possible:

- RA and LA is equal;
- one RA is a subset of one, and only one, LA, meaning that a RA do not span more than one LA.

The mapping between one LA and RNCs is handled within the MSC/VLR owning this LA. The mapping between one RA and RNCs is handled within the SGSN owning this RA. The mapping between LA and cells respective between RA and cells is handled within RNC.

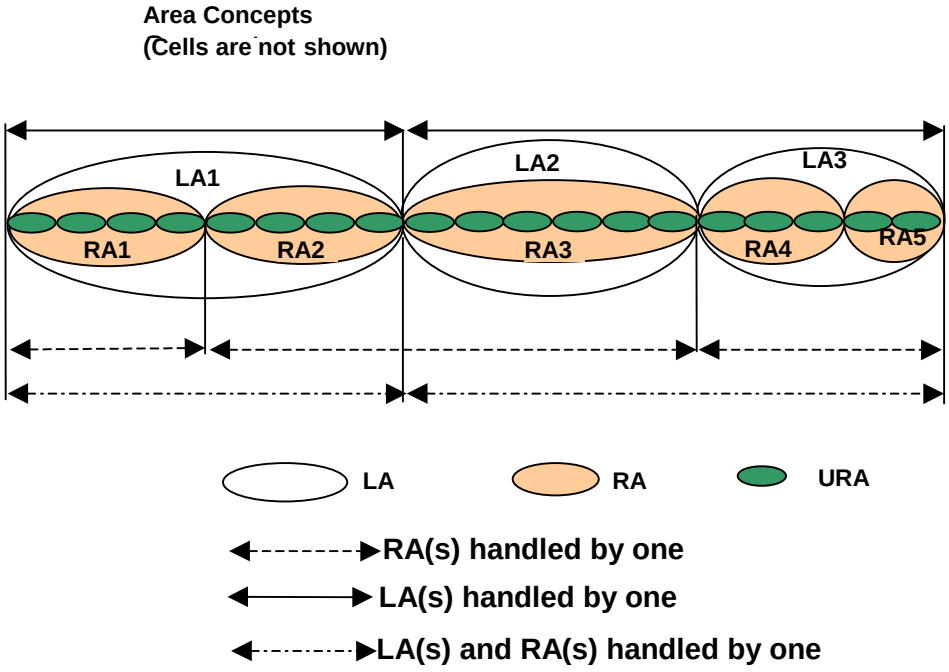

Figure 6.3: Relationship between different areas

6.3.6 Hierarchical tracking concept

A packet UE (in RRC connected mode) is tracked at the cell level by RNC during an active connection.

A packet UE (in RRC connected mode) is tracked at the URA level by RNC when no data are actively transfer, and the probability of data transfer is quite high.

A packet UE (in PS-Idle state) is tracked at the Routing Area level by SGSN when no data is actively ~~transfered~~transferred and the probability of data transfer is quite low. The network operator should be able to optimise paging and updating load by ~~controling~~controlling the size of the different areas and the probability of data transfer (controlled by the RRC_connection_release timer). For example, one operator may decide that URA are small, and that RRC connection are released after a relatively short time of inactivity, so that most attached packet UE are tracked in the Routing Area level (optimum for packet UE mainly using client-server type of service).

Another operator may decide that URA are large, and that RRC connection are released only if RRC connection is lost, so that most attached packet UE are tracked at the URA level.

The procedure for the releasing of the RRC connection can be found in 3G TS 23.060 [~~3~~2] under the Iu release procedure. The URA update procedures can be found in 3G TS 25.331 [5~~7~~].

6.4 Relationship between MM and SM states for an UE

When a UE is attached to PS service, it may have or not some PDP context established.

If the UE has no PDP context established (SM-Inactive), no radio access bearer are established for PS service. The UE is in RRC connected mode, only if the state is UMTS CS-CONNECTED state or UMTS PS-CONNECTED state (i.e. only a PS signaling connection is established).

If the UE has at least one PDP context established (SM-Active), the UE may be in UMTS PS-CONNECTED state or in UMTS PS-IDLE state.

NOTE: The PDP context status is not modified by the release of the RRC connection, except if the release of the connection is due to an RRC failure which do not permit to maintain the negotiated QoS (e.g. a real time connection).

6.5 Requirement in case of temporarily loss of coverage of packet UE

A packet attached UE using non-real time bearer shall not lose its PDP context in case of temporarily loss of coverage. AUE specific Mobile Reachable Timer should monitor how long PDP context(s) are kept after a UE has lost coverage.

6.6 MM functionality in different UE service states

Below are the main UE service states and related MM functionality described. For the determination on when LA or RA is changed, see chapter on "Handling of MM system information".

CS service states and related MM functionality:

- CS-DETACHED: The UE is not reachable by the network for CS services. The UE does not initiate LA updates at LA changes and no periodic CS service updates;
- CS-IDLE: The UE is reachable by paging for CS services. The UE initiates LA updates at LA changes. The UE may initiate periodic CS service updates and this depending on the CS periodic update state of the present LA;
- CS-CONNECTED: The UE has a signalling connection for CS services established between the UE and the CN. The UE does not initiate LA update (even not when the present LA changes) and no periodic CS service updates.

PS service states and related MM functionality:

- PS-DETACHED: The UE is not reachable by the network for PS services. The UE does not initiate RA updates at RA changes and no periodic PS service updates;
- PS-IDLE: The UE is reachable by paging for PS services. The UE initiates RA updates at RA changes. The UE may initiate periodic PS service updates and this depending on the PS periodic update state of the present RA;
- PS-CONNECTED: The UE has a signalling connection for PS services established between the UE and the CN. The UE initiates RA update when RAI in MM system information changes. No periodic PS service updates.

There may also be a NULL state. In the UE, this state corresponds to power off or maybe a "no SIM" condition. In the CN, the NULL state correspond to CS-DETACHED and PS-DETACHED.

For each state transition there can be several events that triggers the transition. Some of them are described below.

NOTE: Some of these may coincide, e.g. moving from CS-IDLE to CS-DETACHED and moving from PS-IDLE to PS-DETACHED.

Moving from CS-IDLE to CS-CONNECTED:

The state transition from CS-IDLE to CS-CONNECTED is performed when a signalling connection is established between UE and CN for CS services. In GSM this state transition is triggered by the message CM_SERVICE_REQUEST or PAGE_RESPONSE.

Moving from CS-CONNECTED to CS-IDLE:

The state transition from CS-CONNECTED to CS-IDLE is performed when the signalling connection for CS services is released, e.g. at call release and no other CS service is ongoing. A radio link failure may also trigger this state transition.

Moving from CS-IDLE to CS-DETACHED:

The transition from CS-IDLE to CS-DETACHED may be triggered by some action from the user of the UE but an expiring timer in the network could also trigger it. The UE is marked as CS_DETACHED in the CN and then as a consequence no CS service establishment is possible.

Moving from PS-IDLE to PS-CONNECTED:

The state transition from PS-IDLE to PS-CONNECTED is performed when a signalling connection is established between UE and CN for PS services.

Moving from PS-CONNECTED to PS-IDLE:

The state transition from PS-CONNECTED to PS-IDLE is performed when the signalling connection for PS services is released, e.g. at release of a PS service, no other PS service is ongoing and at release of the RRC connection in case of very low level of activity. A radio link failure may also trigger this state transition.

Moving from PS-IDLE to PS-DETACHED:

The transition from PS-IDLE to PS-DETACHED may be triggered by some action from the user of the UE but an expiring timer in the network could also trigger it. The UE is marked as PS_DETACHED in the CN and then as a consequence no PS service establishment is possible.

6.7 The RRC state machine

The RRC state machine is a description model of how the UE and the UTRAN co-operate regarding RRC functionality. The RRC state describes the state of the UE in the UTRAN. Here follows a brief description of the RRC state machine, for more information see ~~UMTS YY.01~~TS 25.301 [~~[8~~6] and ~~UMTS YY.03~~TS 25.303 [7~~9~~].

NOTE: RRC idle mode and RRC connected mode refer to the UE idle mode and UE connected mode respectively in ~~UMTS YY.01~~TS 25.301 [6~~8~~] and ~~UMTS YY.03~~TS 25.303 [7~~9~~].

The RRC state machine exists as peer entities, one in the UE and one in UTRAN. Apart from transient situations and error cases they are synchronised. Figure 6.4 illustrates the main modes/states of the RRC state machine.

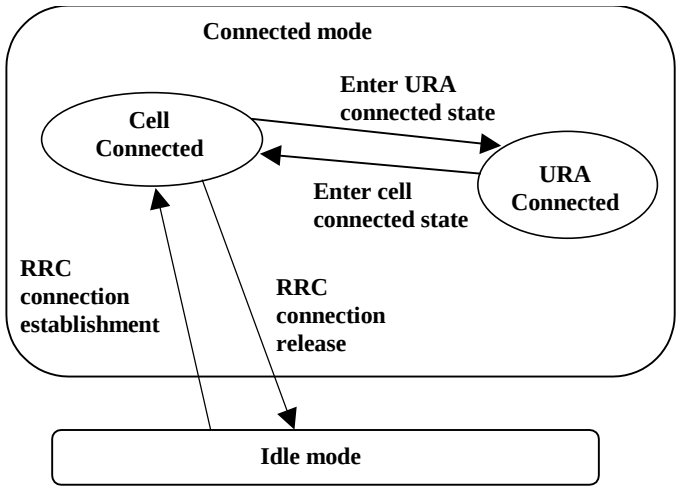

Figure 6.4: RRC modes, main RRC states and main mode/state transitions

RRC-Idle_mode:

In the Idle mode there is no connection established between UE and UTRAN. There is no signalling between UTRAN and the UE except for system information that is sent from UTRAN down link on a Broadcast channel to the UE. The UE can also receive paging messages with a CN identity on the PCH. There is no information on the UE stored in UTRAN in this state.

RRC-Connected_mode:

In the Connected mode the main states are Cell Connected state and URA connected state. In this mode there is one RNC that is acting as Serving RNC (SRNC), and an RRC connection is established between the UE and this SRNC.

- When the UE position is known on cell level, the UE is in the cell connected state. When in cell connected state, the RRC connection mobility is handled by handover procedures.
- When the UE position is known on URA level, the UE is in the URA connected state. The URA contains a set of cells. URA updating procedures provides the mobility functionality in this state. In URA connected state no dedicated radio resources are used.

6.8 Relationship between CS and PS service states and RRC state for an UE

During non-transient conditions the following relations are valid between service states and RRC modes for an UE:

- when in either CS-CONNECTED state or PS-CONNECTED state, or in both CS-CONNECTED state and PS-CONNECTED state, then the UE is in RRC connected mode;
- when in neither CS-CONNECTED state nor PS-CONNECTED state, then the UE is in RRC idle mode.

Figure 6.5 and figure 6.6 illustrate two examples on the relations between the RRC states and CS/PS service states. These figures illustrate the separated CN case.

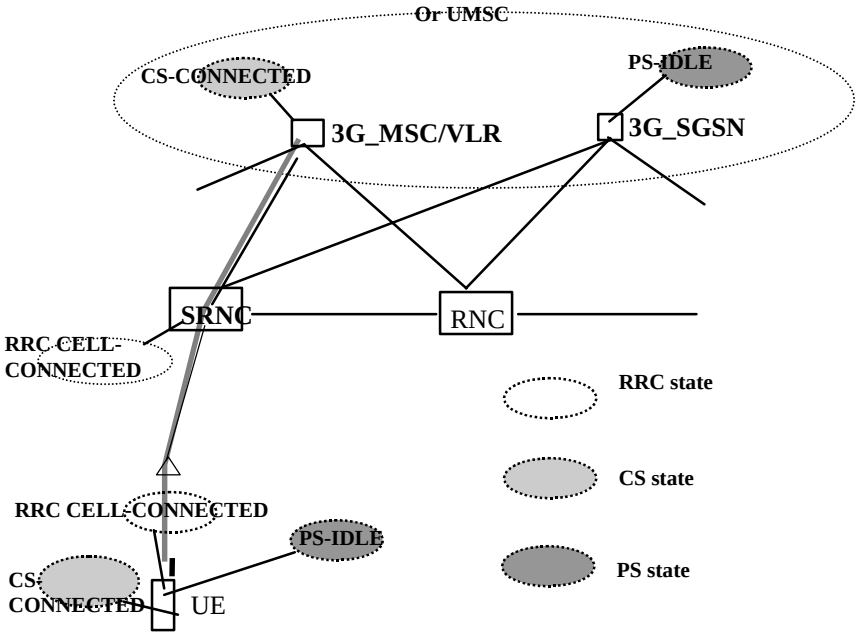

Figure 6.5: UE in CS-CONNECTED state and PS-IDLE state

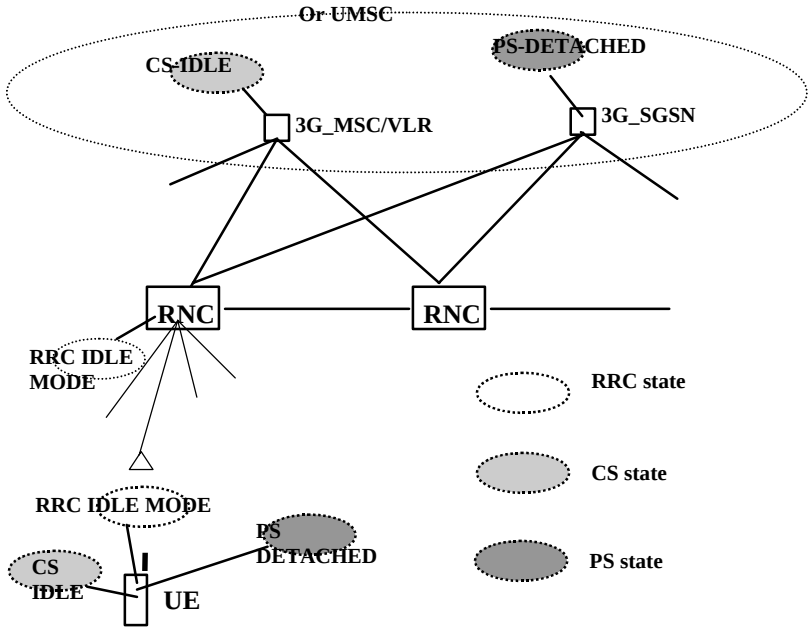

Figure 6.6

6.9 Service registration and location update

6.9.1 Introduction

Editor's note: Informative text leading to understanding of 6.14. Need to determine if this text needs to be placed with 6.14.

Service registration (attach) in the respective CN service domain is done initially (after UE being detached due to e.g. power off). When a registration area is changed a location update is performed. In addition, periodic registration can be performed. Here follows descriptions of when the respective CN registration area is changed.

NOTE: It is not here defined which different registration procedures that are needed.

6.9.2 Location area update

Editor's note: Either the section could be removed completely or the first paragraph could be kept (including a reference to 23.012). Maybe the second alternative is the preferred one.

Location area update is initiated by the UE to inform the CS service domain of the core network that the UE has entered a new location area. In case the new location area is in an area served by another CN node, the location area update also triggers the registration of the subscriber in the new CN node and a location update for CS services towards the HLR.

Location area update is only initiated by the UE when the UE is in state CS-IDLE, and this independently of the PS state. If the UE is CS-IDLE but RRC connected, which means that the UE is in PS-CONNECTED state, location area update is initiated by the UE when it receives information indicating a new location area (see also the chapter "Handling of MM system information").

6.9.3 Routing area update

Routing area update is initiated by the UE to inform the PS service domain of the core network that the UE has entered a new routing area. In case the new routing area is in an area served by another CN node, the routing area update also triggers the registration of the subscriber in the new CN node and a location update for PS services towards the HLR.

Routing area update is initiated by the UE when the UE is in state PS-IDLE, and this independently of the CS state. If the UE is PS-IDLE but RRC connected, which means that the UE is in CS-CONNECTED state, routing area update is initiated by the UE when it receives information indicating a new routing area (see also the chapter "Handling of MM system information").

When the UE is in PS-CONNECTED state the UE initiates RA update when RAI in MM system information changes.

6.9.4 Combined updates

The GSM radio interface combined procedures and their support via the Gs interface is the starting point for the support of combined updates.

6.10 Paging initiated by CN

Editor's note: Clause should be rewritten to substantially refer to 25.413 and 25.331.

Here follows a possible solution with a page co-ordination within the UTRAN. Other alternatives are possible.

- A CN node requests paging only for UE in CS-IDLE state or PS IDLE state. In the separate CN architecture, paging from a CN node is done independent of the service state of the UE in the other CN service domain.
- In this alternative with page co-ordination in UTRAN, the UE does not need to listen to the PCH (Page Channel) in RRC connected mode (at least not when UE is allocated a dedicated channel).
- At each page request received from a CN node, the RNC controls whether the UE has an established RRC connection or not. For this, the context that is build up in the SRNC for UE in RRC connected mode must contain the IMSI, i.e. the UE identity common for the two CN domains.

- If no context is found for the UE, "normal PCH paging" is performed. This implies transfer on the Paging channel of a page message indicating the UE paging identity received from the CN and a CN service domain type indication.

- If a context is found, a "CN paging message" is transferred using the existing RRC connection. This message indicates then the UE paging identity received from the CN and a CN service domain type indication.

- In case of a single CN element, paging may be (but not mandatory) co-ordinated at the CN.

NOTE: The RNC might use another identity e.g. TMSI, P-TMSI, or other radio related identity, to page the mobile.

6.11 Signalling connection establishment

A signalling connection between the UE and a CN node refers here to a logical connection consisting of an RRC connection between UE and UTRAN and an Iu signalling connection between UTRAN and the CN node. The signalling connection is used for transfer of higher layer (MM, CM) information between the UE and the CN node.

At a CM service request to one of the CN service domains, UE will only request establishment of a new signalling connection when no such connection exists towards the applicable CN service domain.

If no RRC connection exists, this is established in conjugation with (before) the transfer of the signalling establishment request. At the RRC connection establishment, an UE context is built up in the SRNC.

If an RRC connection is already established, the UE will send the signalling establishment request using that RRC connection.

At reception of the signalling establishment request, the SRNC will establish an Iu connection towards the CN node indicated by the CN service domain type received from UE.

6.12 Relations between SRNS relocation and location registration

This chapter is included in order to clarify the need for separate handling of MM registration area (LA and RA) information in RRC idle mode respective in RRC connected mode. The following example illustrates relations between SRNC relocation, registration area (LA/RA) change and location/routing area updates. As shown in the example, this is equally applicable for a UMSC as well as the 3G-MSC/VLR and 3G-SGSN.

NOTE 1: The example is based on the assumptions that one RNC can set up Iu connections to only one 3G_MSC/VLR (or UMSC) and only one 3G_SGSN (or UMSC), and that the CN node is configured to only send page to the RNC(s) that is controlling cells within the relevant LA/RA.

Preconditions (see figure 6.7):

- LA1 (Location Area 1) is handled by 3G_MSC/VLR1 (or UMSC1) and LA2 is handled by 3G_MSC/VLR2 (or UMSC2);

- RA1 (Routing Area 1) is handled by 3G_SGSN1 (or UMSC1) and RA2 is handled by 3G_SGSN2 (or UMSC2);

- UE is registered in LA1 in 3G_MSC/VLR1 and in RA1 in 3G_SGSN1;

- the UE is in PS-CONNECTED state and a signalling connection exists between UE and 3G_SGSN1;

- the UE is in CS-IDLE state and no signalling connection exists between UE and 3G_MSC/VLR1;

- RNC1 is acting as SRNC and RNC2 is acting as DRNC;

- UE is in RRC cell connected state and with dedicated channels established to cells within both RNC1 and RNC2. UE does not listening to the PCH;

- the registration area information sent to the UE indicates LA1 and RA1.

The UE can always (at least in normal working states) identify the present available registration area (LA respective RA) associated with the respective CN service domain. The determination of the present area differs depending on the state of the UE. For UE in RRC idle mode (UE with no ongoing communication with the network) it is the cell selection mechanism in the UE that is used. For UE in RRC connected mode it is the UTRAN that determines the area (although a change can implicit be initiated by the UE).

It is the network that supplies the MM system information to the UE. For UE in RRC idle mode the MM system information is provided by the system information broadcasting function. For UE in RRC connected mode, the MM system information is supplied by the SRNC to the UE at each change of this information. This leads to that in RRC connected mode, the MM registration area (e.g. LA and RA) information sent on broadcast channel is not used.

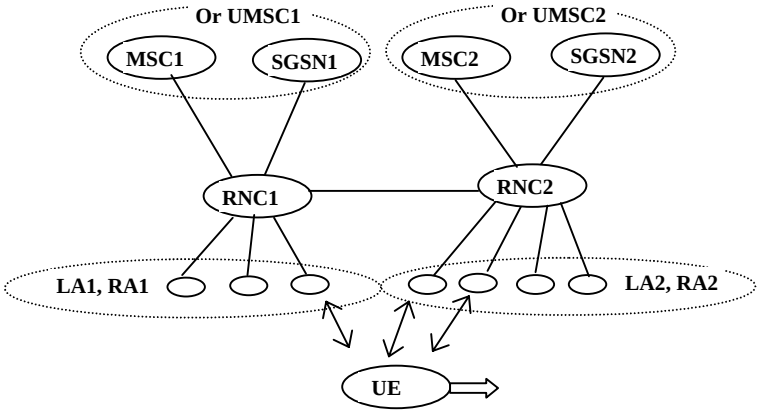

Figure 6.7: Illustration of the preconditions in the described example

In figure 6.7 MSC stands for 3G_MSC/VLR and SGSN for 3G_SGSN.

The UE moves now further towards right, leaving the coverage area of cells controlled by RNC1, and resulting in that the UE has dedicated channel(s) established to cell(s) within only RNC2. This may result in the following sequence of events:

- the SRNC (RNC1) may decide to perform an SRNC relocation resulting in that the RNC2 becomes SRNC. The change of SRNC will in this example also imply a change of SGSN (or UMSC) with an update of the UE location registration for the PS service domain;

- after this SRNC relocation or combined with this procedure, the MM registration area information sent to the UE is changed and indicates now LA2 and RA2;

NOTE 2: The MM registration area information need not be sent for every SRNS relocation, nor does it preclude MM registration area information being sent in other occasions.

- the changed MM registration area information will result in that the UE initiates a location update, which results in a registration change from LA1 in 3G_MSC/VLR1 to LA2 in 3G_MSC/VLR2.

The area information can not be changed to indicate LA2 unless SRNC relocation has been performed. This since the location update signalling will be sent from the UE, by using the established RRC connection to SRNC, and then to the 3G_MSC/VLR to which the SRNC belongs.

6.13 Requirements on identifiers for UMTS and GSM

Editor's note: Need to be redrafted as requirements on equipment.

1a) The format of the UMTS Location Area Identifier and UMTS TMSI shall not prevent a dual mode GSM-UMTS mobile which was last location updated over the GSM radio interface (i.e. has a GSM LAI and GSM TMSI), from performing a location update (or other signalling) over the UMTS radio interface to a UMTS MSC.

1b) The format of the UMTS Location Area Identifier and UMTS TMSI shall not prevent a dual mode GSM-UMTS mobile which was last location updated over the UMTS radio interface (i.e. has a UMTS LAI and UMTS TMSI), from performing a location update (or other signalling) over the GSM radio interface to a GSM MSC.

1c) The format of the UMTS Routing Area Identifier and UMTS P-TMSI shall not prevent a dual mode GSM-UMTS mobile which was last routing area updated over the GSM radio interface (i.e. has a GSM RAI and GSM P-TMSI), from performing a routing area update (or other signalling) over the UMTS radio interface to a UMTS SGSN.

1d) The format of the UMTS Routing Area Identifier and UMTS P-TMSI shall not prevent a dual mode GSM-UMTS mobile which was last routing area updated over the UMTS radio interface (i.e. has a UMTS RAI and UMTS P-TMSI), from performing a routing area update (or other signalling) over the GSM radio interface to a GSM SGSN.

2) The standard shall support means by which an operator can configure GSM and UMTS cells to be members of the same registration area (i.e. the mobile can receive paging from whichever cell it is camped on and does not need to location update (or routing update) just because the mobile has changed from a UMTS to a GSM cell).

3a) The standard shall support means by which an operator can allocate GSM and UMTS LAIs which enable GSM MSCs to be able to contact UMTS MSCs and vice versa.

3b) The standard shall support means by which an operator can allocate GSM and UMTS RAIs which enable GSM SGSNs to be able to contact UMTS SGSNs and vice versa.

4) The standard shall support means by which an operator can ensure that the IMSI does not need to be sent over the radio interface when the mobile station moves from a GSM cell to a UMTS cell (and vice-versa).

5) The standard shall support means by which an operator can ensure that the IMSI does not need to be sent over the radio interface when a USIM is moved from a UMTS mobile station to a GSM mobile station (and vice-versa).

6) The standard need not support means by which an operator can ensure that the IMSI is not sent over the radio interface when a GSM SIM is moved from a GSM mobile station to a UMTS mobile station (and vice-versa).

6.14 Use of TMSI signature - MM system information

Editor's note: Captured in 24.008, 25.331 and 25.413. See if can highlight references and reduce amount of text substantially.

The system information that is needed for the Mobility Management functionality contains parameters such as:

- MCC, MNC, LAC, RAC, Periodic Location Area Update timer, and Periodic Routing Area Update timer;

- in each UMTS cell (UTRAN cell) the network broadcasts MM system information on the broadcast channel. In RRC idle mode, when the UE camps on one cell, it receives all MM system information valid for this cell on the broadcast channel of the cell. The received MM system information is then the "current MM system information";

- in RRC connected mode, it is the responsibility of the SRNS to control the current MM system information valid for the UE. At any changes, the established RRC connection is used for transferring the new MM system information to the UE. E.g. at SRNS relocation, the new SRNS shall have logic for sending applicable MM system information to the UE. This information is determined by e.g. the Location Areas and the Routing Areas handled by the respective CN node to which the SRNS can set up Iu signalling connections. At reception of new MM system information from the SRNC on the established RRC connection, the UE uses this new information as the "current MM system information";

NOTE: The MM system information need not necessarily be sent for every SRNSs relocation, nor does it prelude MM system information being sent on other occasions.

- at the RRC connection establishment, the UE uses the broadcasted MM system information of the cell where the establishment is made as the "current MM system information";

- when the UE leaves the RRC connected mode and enters RRC idle mode, the UE uses the broadcasted MM system information of the chosen cell, which is determined by the UE idle mode cell selection/re-selection process that is then performed, as the "current MM system information";

- the "current MM system information" is used by the MM functionality in the UE respecting the rules for the UE service state of the respective MM state machine, see subclause 7.3.3;

- MM functionality in different UE service states and subclause 7.3.6 Service registration and location update.

6.15 Signalling procedures

6.15.1 Idle mode procedures

The signalling procedures shown in the following subclauses do not represent the complete set of possibilities, nor do they mandate this kind of operation. The standard will specify a set of elementary procedures for each interface, which may be combined in different ways in an implementation. Therefore these sequences are merely examples of a typical implementation. By default the combined procedures as defined in GSM 03.60 are also applicable when using Gs.

Furthermore the list of parameters may not be complete, but should only be seen as examples of possible information carried by the messages.

6.15.1.1 Location Area update

~~Editor's note: Move to 23.012. Would probably need to appear in general description area, or add a section for signalling flows. Refers back to GSM 09.02. Need to a CR to 23.012 to be generated before can delete text.~~

Figure 6.8 shows location registration when changing Location Area including change of 3G-MSC/VLR and when the UE is in MM idle state towards the 3G_MSC/VLR.

The illustrated transfer of MM signalling to/from the UE uses an established RRC connection. This RRC connection can have been established beforehand due to ongoing interwork between UE and 3G-SGSN or be established only for this location registration procedure towards the 3G_MSC/VLR.

For each indicated MM message sent in this case to/from UE, the CN discriminator indicates 3G_MSC/VLR.

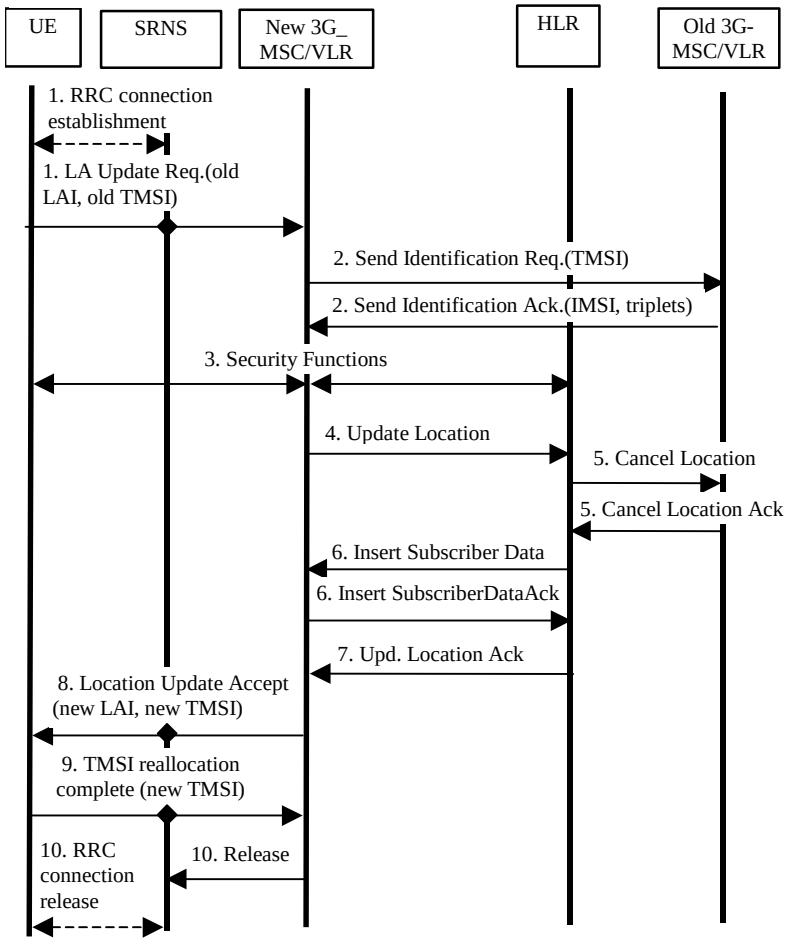

Figure 6.8: Interface information transfer for location update when changing VLR area

- The RRC connection is established, if not already done. The UE sends the initial message Location Area Update Request (old TMSI, old LAI, etc.) to the new 3G_MSC/VLR. The old TMSI and the old LAI are assigned data in UMTS. The SRNS transfers the message to the 3G_MSC/VLR. The sending of this message to 3G_MSC/VLR will also imply establishment of a signalling connection between SRNS and 3G_MSC/VLR for the concerned UE. The UTRAN shall add the RAC and the LAC of the cell where the message was received before passing the message to the MSC.

- The new 3G_MSC/VLR sends an Send Identification Request (old TMSI) to the old 3G_MSC/VLR to get the IMSI for the UE. (The old LAI received from UE is used to derive the old 3G_MSC/VLR identity/address.) The old 3G_MSC/VLR responds with Send Identification Ack. (IMSI and Authentication triplets).

- Security functions may be executed.

- The new 3G_MSC/VLR inform the HLR of the change of 3G_MSC/VLR by sending Update Location (IMSI, MSC address, VLR number) to the HLR.

- The HLR cancels the context in the old 3G_MSC/VLR by sending Cancel Location (IMSI). The old 3G_MSC/VLR removes the context and acknowledges with Cancel Location Ack.

- The HLR sends Insert Subscriber Data (IMSI, subscription data) to the new 3G_MSC/VLR. The new 3G_MSC/VLR acknowledges with Insert Subscriber Data Ack.

- The HLR acknowledges the Update Location by sending Update Location Ack. to the new 3G_MSC/VLR.

- The new 3G_MSC/VLR validates the UE presence in the new LA. If due to regional, national or international restrictions the UE is not allowed to attach in the LA or subscription checking fails, then the new 3G_MSC/VLR rejects the location area update with an appropriate cause. If all checks are successful, then the new 3G_MSC/VLR responds to the UE with Location Area Update Accept (new TMSI, new LAI).

- The UE acknowledges the new TMSI with a TMSI reallocation Complete. (TMSI can optionally be reallocated with the TMSI reallocation procedure).

- When the location registration procedure is finished, the 3G_MSC/VLR may release the signalling connection towards the SRNS for the concerned UE. The SRNS will then release the RRC connection if there is no signalling connection between 3G_SGSN and SRNS for the UE.

6.15.1.2 Routing Area Update

The routing area update procedure is detailed in 3G TS 23.060[2].

6.15.1.32 Periodic registration towards both CN nodes without use of Gs

Periodic registration for the CS domain is specified in 3G TS 23.012 [35]. Periodic registration for the PS domain is covered in 3G TS 23.060 [23]. In the case of a combined node, this procedure does not apply.

6.15.1.43 Periodic registration with use of Gs/UMSC

Periodic registration for the PS domain is covered in 3G TS 23.060 [23]. Only RA Update req. registration is required from the UE to the UMSC/3G-SGSN. This procedure applies for a combined UMSC/3G-SGSN.

6.15.1.54 UE initiated combined detach procedure when using Gs/UMSC

UE initiated Combined Detach Procedure when using Gs/UMSC is specified in 3G 23.060 [23]. The UE specifies which form of detach is required, i.e., PS Detach only, CS Detach only or combined Detach. This procedure applies for a combined UMSC/3G-SGSN.

6.15.2 SRNS Relocation

SRNS relocation is covered in 25.413 [917] and 3G TS 23.060 [32].

NOTE: Examples of UTRAN signalling are given in TR 25.931 [15].

6.16 UTRAN coordination

Eeditor's Note: Need to confirm that ref[3] below is to 23.060. (Reference number is carried in from text from 23.121.

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.

There are two functions that are co-ordinated.

1) Paging coordination is described in 5.9.1 of 25.410 [108]; and

2) Relocation coordination that is described in 8.7.5 in 25.413 [917].

7 Call control

Editor's note: Need to keep fig. 4.36. Remainder of text needs substantial revision if kept.

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 . 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 6.9 illustrates the realisation of the multimedia service based on P6). 'Multimedia Protocol' indicates the functionality either inside the communicating user's terminal or a server (e.g. SIP server). It is essentially a control function both for user plane and control plane for the multimedia communication.

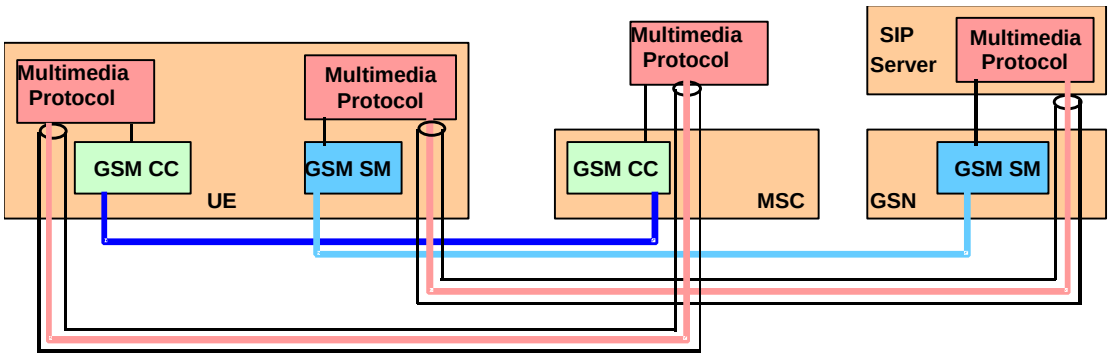

Figure 6.9: Support of multimedia making use of GSM SM/CC

Based on the requirements listed above, GSM CC/SM represented by GSM 04.08 forms a solid foundation for UMTS CC/SM. UMTS CC/SM 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.

8 Support of IP multimedia services

Editor's note: This clause will only be included in release 5, and will not be included in the release 4 version of this document.

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 signalling (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 8.1 shows what procedures and in which order they are performed during the registration.

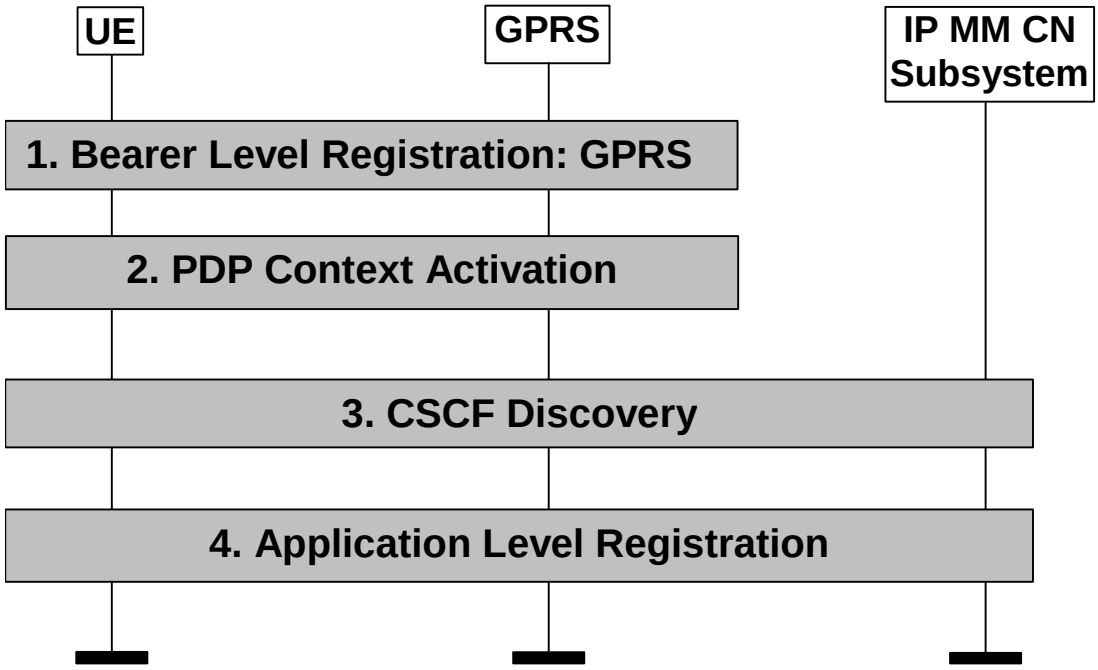

Figure 8.1: Registration

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 subscriber roaming Into a circuit-switched network domain

Figure 8.2 shows the registration concept for a subscriber roaming into a UMTS/GSM CN domain .

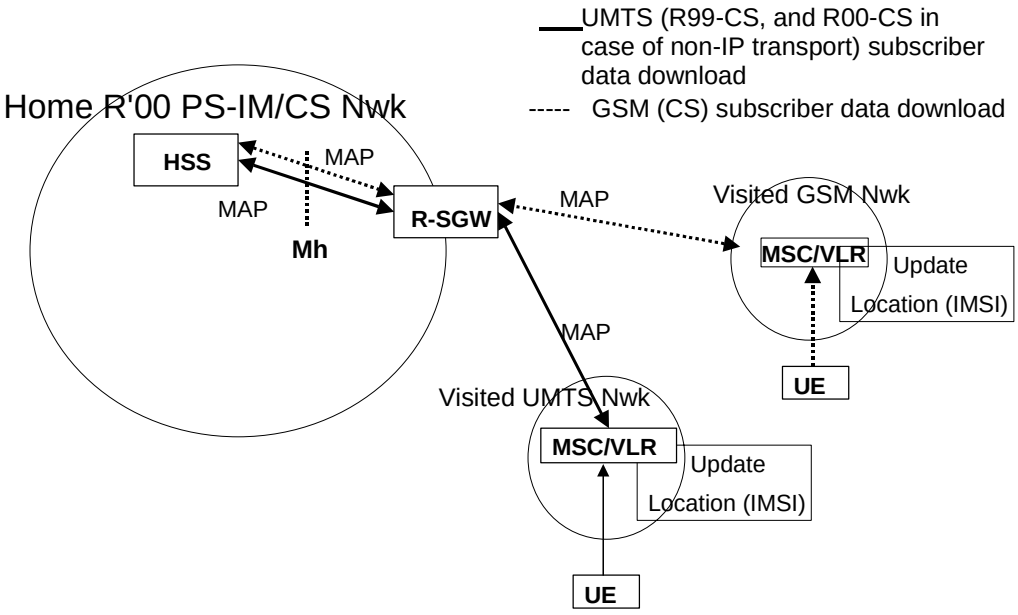

Figure 8.2: A roaming model for registration in a CN domain

The detailed message sequence chart for a UMTS subscriber roaming into a CN domain is shown in figure 8.3.

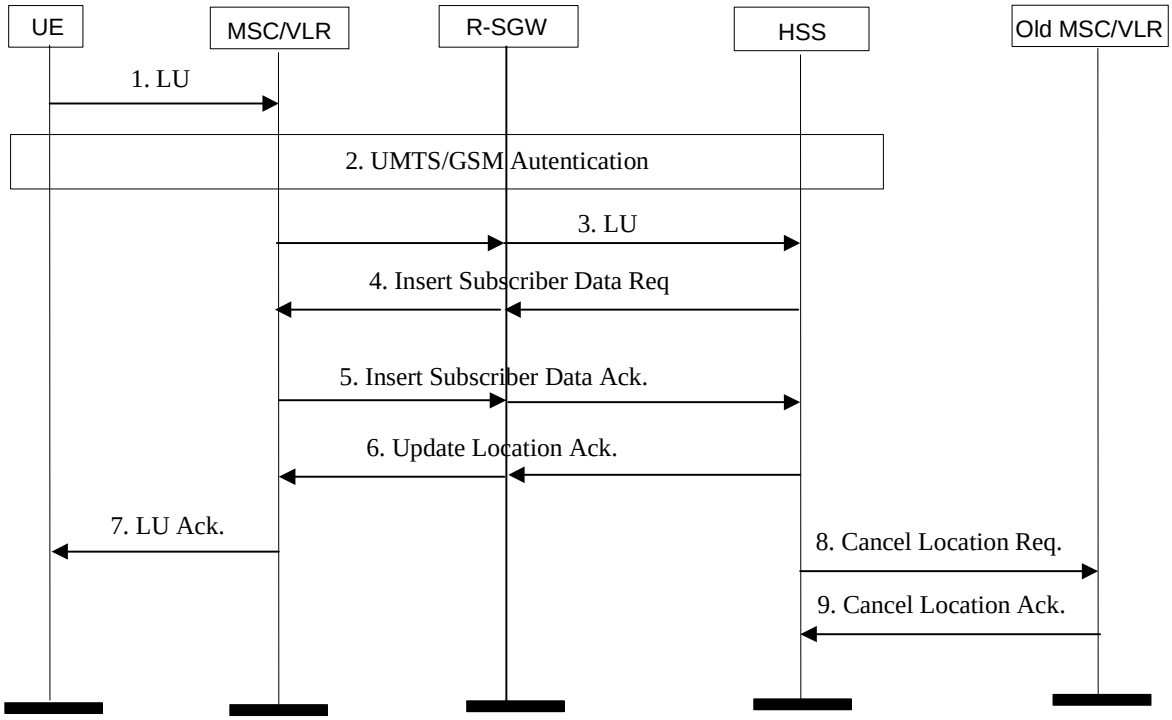

Figure 8.3: Message sequence for roaming into a CN domain

1. The UE initiates the 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 / 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 / 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.

9 Other issues

Editor's note: This is a holding clause for material that has been proposed to be moved, but still requires discussion. The clause numbering has been chosen for ease of transfer from the old version.

9.2 Iu User plane

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

Editor's note: The material in this subclause should move to 23.060, which it already partially duplicates; drafting is required to ensure material is not list in transfer.

9.2.1.1 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.

9.2.1.2 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).

This solution is shown in figure 9.1.

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

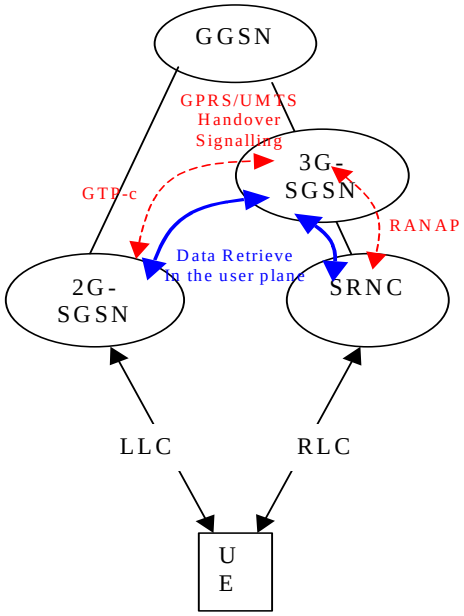

Figure 9.1: Data retrieve between GPRS and UMTS

9.2.1.3 Requirements for data retrieve in UMTS

NOTE: This subclause deals with the case of SRNS relocation and of UMTS hard hand-over (when this hard hand-over involves also the CN i.e. involves a change of Serving RNC).

Since:

- there is no buffering in the 3G-SGSN;
- there is an ARQ mechanism in the Serving RNC (the RLC layer) similar to the LLC layer in the 2G-SGSN;
- the data reliability is ensured by the transfer of non-acknowledged user data from the Source RNC to the Target RNC. This transfer ("data retrieve") can be performed with a mechanism similar to the one used between 2G-SGSNs in GPRS;
- the Data retrieve between two RNCs belonging to the same UTRAN is required for non real-time data services during a SRNS relocation procedure;
- regarding the SRNS Relocation procedure Control Plane, SRNS relocation procedure uses both RANAP signalling over the Iu and RNSAP signalling over the Iur.

Regarding the user plane, some requirements can be listed:

Synchronisation:

Since the 3G-SGSN does not buffer downstream data, the source RNC may have to buffer all GTP frames that are not yet transmitted or acknowledged at RLC layer. It also has to buffer all GTP frames that continue to arrive from the GGSN (the GGSN continues to send them to the source RNC as long as its PDP context has not been updated by the SGSN. Furthermore, data that are sent by the GGSN may take a certain time to get to the source RNC).

This means that:

The target RNC has to start as Serving RNC just after having received SRNS Relocation Commit message from the source RNC even if all downstream data have not been retrieved yet.

The user data retrieve may last a relatively long time. A timer is armed in the Source SRNC at the beginning of the data transfer phase. The contexts related to the UE in the Source SNRC will be released when the timer expires, i.e. when downstream data from GGSN is considered as finished.

Data reliability:

Depending upon the required reliability, there could be a need for a layer 2 protocol or not. In the GPRS, the user data is transfer via GTP/UPD/IP if the user-to-user data is IP-based, and via GTP/TCP/IP if the user-to-user data is X25-based. Here, only GTP/UDP/IP is considered.

Multiplexing of PDP contexts during data retrieve:

Several SRNS Relocation procedures for different users and/or different bearers may be carried out simultaneously and independently. GTP is used to differentiate the data retrieve contexts.

Associated signalling:

Considering signalling, there are two kinds of signalling:

Signalling linked with transmission of CN parameters. This corresponds to signalling exchanged on Gn between 3G-SGSNs during the (first) phase of resources for the SRNS relocation.

Signalling linked with the transmission of the sequence numbers of the acknowledged protocol (RLC) between SRNC and UE. This can be done over Iur when the source SRNC actually hands-over the role of SRNC (when sending the RNSAP "Relocation commit" to the target SRNS).

9.2.1.4 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.

This solution is shown in figure 9.2.

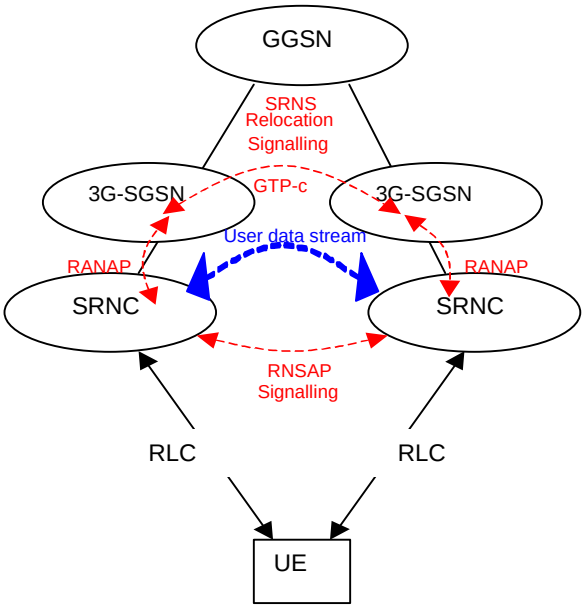

Figure 9.2: User data Retrieve in UMTS

9.2.1.5 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 9.3.

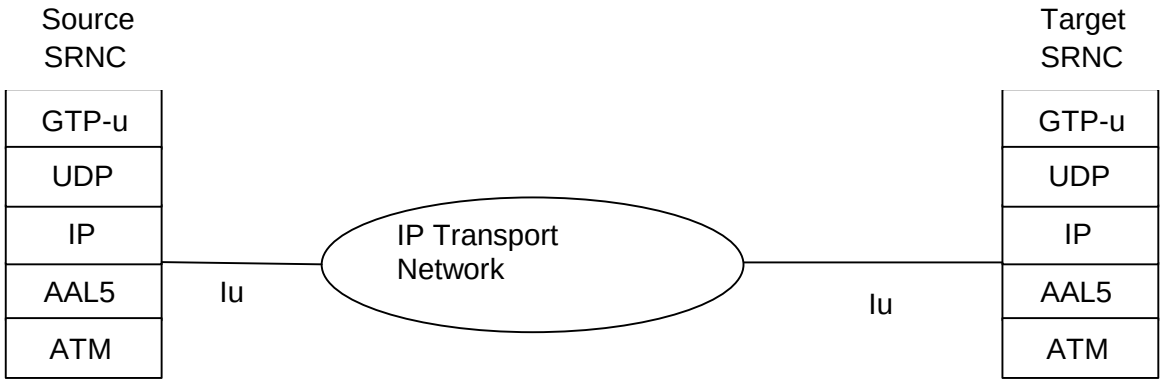

Figure 9.3: User plane protocol stack for data retrieve in UMTS

9.2.1.6 User plane protocol stacks for data retrieve between UTRAN and 2G-SGSN

The user plane for data retrieve between UTRAN and 2G-SGSN is based on GTP-u/UDP/IP. The protocol stack and the GTP connections termination points are described in figure 9.4.

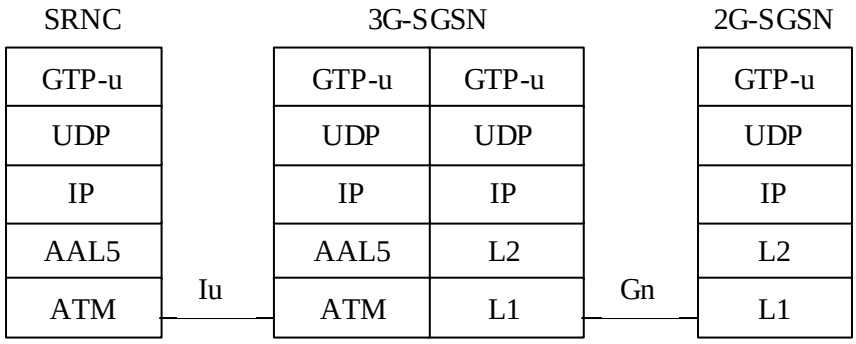

Figure 9.4: User plane protocol stack for data retrieve between GPRS and UMTS

9.7 Alternate access technologies to UTRAN

9.7.1 Introduction

Editor's note: Is this still the way 3GPP wishes to handle this issue. Should this clause be retained or deleted.

BRAN Access

The evolved GPRS network should allow for various radio access networks. As stated in 3G TS 23.101 [6], a modular approach in UMTS evolution is recommended. This is also in line with the recommendation from GMM. Thus, the infrastructure domain, which encompasses the core network domain and the access network domain, allows for different access techniques/networks to be used. This scenario focuses on EP BRAN HIPERLAN 2 as a complement to GSM BSS and UTRAN in order to provide broadband data services in hot spot environments.

ETSI Project BRAN (Broadband Radio Access Networks) is developing specifications for broadband wireless access systems that support data rates around 25 Mbit/s for several applications. The primary focus for HIPERLAN 2 is to provide short range wireless broadband access with controlled quality of service for use within buildings and on-campus using unlicensed radio spectrum in the 5 GHz band. HIPERLAN 2 shall provide a range of 30-50 m in a typical indoor environment and up to 150-200 m in a typical outdoor environment.

The HIPERLAN 2 specifications are expected to be finalised during 2000, hence it will be possible to introduce BRAN access in UMTS phase 1.

9.7.2 Advantages of attaching HIPERLAN 2 to UMTS

Provide UMTS with a complementary access technology for broadband data services for indoor and hot spots environments.

UMTS mobility infrastructure enables roaming also for HIPERLAN 2 terminals.

Easier multi-mode UMTS/HIPERLAN 2 service integration, enables e.g. network support for a one number service and the use of a common service platform.

UMTS subscriber management may be reused for HIPERLAN 2.

Enables the reuse of investments in core network technologies.

9.7.3 HIPERLAN 2 UMTS Interworking

UMTS will incorporate a new generic radio access network, the UMTS Radio Access Network (URAN). The URAN may include several different realisations, of which the UTRAN (UMTS Terrestrial Radio Access Network) is one. The Iu reference point forms the boundary between URAN and the UMTS core network. By connecting HIPERLAN 2 to the Iu interface, HIPERLAN 2 will form a complimentary realisation of the URAN concept for broadband data services. UMTS interworking will provide HIPERLAN 2 with roaming support using the UMTS mobility infrastructure.

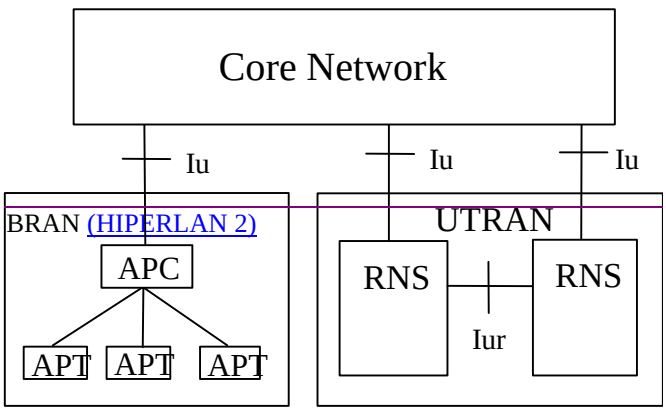

Figure 9.5: HIPERLAN 2 UMTS interworking

~~A HIPERLAN 2 realisation of URAN should provide the same logical interface to the higher layers (i.e. layers belonging to the non-access stratum) as UTRAN. Hence, no changes in higher layers should be required. UMTS authentication, security and location management can be used over HIPERLAN 2. UMTS bearer setup requests should be mapped to the corresponding HIPERLAN 2 DLC connection. A USIM (User Service Identity Module) may be needed in a BRAN terminal supporting UMTS interworking. Handovers within a HIPERLAN 2 subsystem should be invisible to the core network. Handovers between UTRAN and HIPERLAN 2, in case of dual mode terminals, should be supported via the core network.~~

~~9.7.4 Related actions~~

~~The same protocols over the Iu interface should be used for both UTRAN and HIPERLAN 2. However, some impact of connecting a broadband access network, capable of bit rates in the order of 100 Mbit/s, can be expected. Therefore the Iu must be flexible and future proof. Guidance and co-operation with EP BRAN on these matters should be sought.~~

Annex A (informative): ~~Summary of modifications to 23.221~~Comparison of 23.221 to 23.121

Editor's note: This annex is regarded as a temporary annex which will be removed before publication.

It has been agreed that 23.121 should remain a specification that pertains only to release 99, and that material for subsequent releases ~~2000 (now release 4 and release 5)~~ should be placed in a new document. Changes agreed so far cover release 4 and release 5 features.

~~We have reviewed~~ 23.121 has been reviewed to identify which material should be transferred to ~~this new document~~23.221. In doing this, ~~we have~~it has been noted that material that falls into a number of categories.

1. Material which is a checklist of changes that need to be made to other specifications in order to provide the release 99 capabilities. ~~We believe that t~~This material need not be included. This material could also possible be deleted from 23.121 release 99 (possible after checking that the list has been completed)

2. Material which has been duplicated in other specifications, sometimes in more detail and sometimes in less. ~~We believe that t~~This material need not be included. There may be a need to analyse the other specifications to ensure complete inclusion.

3. Material which has was not implemented in release 99, and is not yet stable for release 3 and release 4. This at least should require further contribution and discussion in release 4 and release 5. In release 99 it should ~~ptentially~~ be deleted.

As a result of this analysis, and by not transferring material which is covered elsewhere or is not valid, we believe that that resultant release 4/5 document would have a scope that would cover:

1. General system requirements.

2. Detailed requirements for issues of interrelation between the packet-switched domain and the circuit-switched domain, and for specification of requirements that are common to the packet-switched domain and circuit switched domain. It may be possible to simplify existing material in this category by reference to specifications for the individual domains, and then specifying the interrelationship between those two specifications for the required capability.

3. Specification of IP addressing issues.

4. The scope of the document has been extended to allow the inclusion of high level CS domain requirements.

The following indicates the key to the colour codes in the cells below.

No current progress, or no change required	Change on hold pending discussion	All changes to other documents complete and changes to this document complete.	All changes to other documents complete and changes to this document complete. Agreed at working group level.

Clause in 23.121	Title	Reason for existence of text	New location
	Foreword	---	---
1	Scope	---	---
2	References	---	---
3	Definitions	---	---
4a (release 4 or 5 only)			
4	Working assumptions		Determine if these are principles that need to be kept, or determine if these have now been implemented as requirements, and can therefore be deleted. Remainder of document is written from these, but as Release 99 is now frozen, the specifications based on them cannot change, and therefore the list is redundant. Not included
4.1	General	Principles that should already have been implemented in other specifications as requirements	Not included ~~Delete~~
4.2	Iu Interface	Should already be covered in Iu specification. 2G→ 3G evolution should be in 23.060.	Not included~~Delete~~
4.2.1	Iu Control Plane	Requirements possibly already in 25.410. Comment that they are included in 4.5.1.1 in 25.410 and in 5.2 and 5.3 in 25.412	Not included~~Delete~~
4.2.2	Iu User plane	Ditto. Comment that they are included in They are included as I see it in 4.5.2.2 in 25.410 and in 23.060(?)	Not included~~Delete~~
4.2.2.1	Principles of User Data Retrieve in UMTS and at GSM-UMTS Hand-Over for PS Domain	Requirements already in 23.060 clause 6.13. Other than that, user plane and data forwarding is not so well described in 23.060.	Initial proposal to delete. Adding the figures to 23.060 would add clarity to 23.060. ~~*Understand the figures came from Alcatel originally*~~. After discussion retain in 23.221 with editor's note to review placement when contents are clearer. Moved to clause 9.2.1 in new document.
4.2.2.1.1	Requirements for Data retrieve at GPRS/UMTS handover	Ditto	~~Ditto~~ Moved to clause 9.2.1.1 in new document.
4.2.2.1.2	Adopted solution for data retrieve at GPRS-UMTS handover	Ditto	~~Ditto~~ Moved to clause 9.2.1.2 in new document.
4.2.2.1.3	Requirements for data retrieve in UMTS	Ditto	~~Ditto~~ Moved to clause 9.2.1.3 in new document.
4.2.2.1.4	Adopted solution for data retrieve in UMTS	Ditto	~~Ditto~~ Moved to clause 9.2.1.4 in new document.
4.2.2.1.5	User plane protocol stacks for UMTS data retrieve	Ditto	~~Ditto~~ Moved to clause 9.2.1.5 in new document.
4.2.2.1.6	User plane protocol stacks for data retrieve between UTRAN and 2G-SGSN	Ditto	Ditto Moved to clause 9.2.1.6 in new document.
4.2.2.2	Packet buffering in SRNC and transmission of not yet acknowledged downstream packets at SRNC relocation	Requirements are not in 23.060 in so many words. The intent is covered in clauses 9.3 and 9.4	~~Delete~~Not included
4.2.2.3	Load sharing	Ditto	~~Ditto~~Not included

Clause in 23.121	Title	Reason for existence of text	New location
4.3	UMTS Mobility Management (UMM)	Cross domain issue	23.221 Moved to clause 6.1 in new document
4.3.1	Location Management and Mobility Management concept overview	Cross domain issue	23.221 Moved to clause 6.2.1 in new document
4.3.1.1	Use of combined procedures for UMTS	Cross domain issue	23.221 Moved to clause 6.2.2 in new document
4.3.2	Description of the Location Management and Mobility Management Concept	Cross domain issue	23.221 Moved to clause 6.3.1 in new document
4.3.2.1	Area concepts	Cross domain issue	23.221 Moved to clause 6.3.1 in new document
4.3.2.1.1	Location areas	Cross domain issue	23.221 Moved to clause 6.3.2 in new document
4.3.2.1.2	Routing areas	Cross domain issue	23.221 Moved to clause 6.3.3 in new document
4.3.2.1.3	UTRAN internal areas	Cross domain issue	23.221 Moved to clause 6.3.4 in new document
4.3.2.1.4	Relationship between the different areas	Cross domain issue	23.221 Moved to clause 6.3.5 in new document
4.3.2.1.5	Hierarchical tracking concept	Cross domain issue	23.221 Moved to clause 6.3.6 in new document
4.3.3	Relationship between MM and SM states for an UE	Cross domain issue	23.221 Moved to clause 6.4 in new document
4.3.4	Requirement in case of temporarily loss of coverage of packet UE	Cross domain issue	23.221 Moved to clause 6.5 in new document
4.3.5	MM functionality in different UE service states	Cross domain issue	23.221 Moved to clause 6.6 in new document
4.3.6	The RRC state machine	Essential to integrity of remaining clauses at this level.	23.221 Moved to clause 6.7 in new document
4.3.7	Relationship between CS and PS service states and RRC state for an UE	Cross domain issue	23.221 Moved to clause 6.8 in new document
4.3.8	Service registration and location update	Cross domain issue. Informative text leading to understanding of 4.3.14	S2 to determine if this text stays. Moved to clause 6.9 and 6.9.1 in new document
4.3.8.1	Location area update	Either the section could be removed completely or the first paragraph could be kept (including a reference to 23.012). Maybe the second alternative is the preferred one.	Moved to clause 6.9.2 in new document
4.3.8.2	Routing area update		Moved to clause 6.9.3 in new document
4.3.8.3	Combined updates		Moved to clause 6.9.4 in new document
4.3.9	Paging initiated by CN	The detail is substaintially covered in 25.413 and 25.331.	23.221. Clause should be rewritten to substantially refer to 25.413 and 25.331. Moved to clause 6.10 in new document
4.3.10	Signalling connection	Essential to integrity of	23.221

Clause in 23.121	Title	Reason for existence of text	New location
	establishment	remaining clauses at this level.	Moved to clause 6.11 in new document
4.3.11	Relations between SRNS relocation and Location registration	Issues common to both PS and CS	23.221 Moved to clause 6.12 in new document
4.3.12	Requirements on Identifiers for UMTS and GSM	Issues common to both PS and CS	23.221. Need to be redrafted as requirements on equipment Moved to clause 6.13 in new document
4.3.13	Use of TMSI signature	No text	--- Moved to clause 6.14 in new document
4.3.13.1	IMSI attach	No text	--- Moved to clause 6 in new document
4.3.13.2	Location Area update	No text	--- Moved to clause 6 in new document
4.3.13.3	MM System Information	Captured in 24.008, 25.331 and 25.413	See if can highlight references and reduce amount of text substantially. Moved to clause 6 in new document
4.3.13.4	IMSI detach procedure	No text	---
4.3.14	Signalling procedures	No text	--- Moved to clause 6.15 in new document
4.3.14.1	Idle mode procedures		Moved to clause 6.15.1 in new document
4.3.14.1.1	Location Area update		~~Move to 23.012. Would probably need to appear in general description area, or add a section for signalling flows.~~ ~~Refers back to GSM 09.02~~ Moved to clause 6.15.1.1 in new document. Kept as part of the rescope
4.3.14.1.2	Routing Area update	GPRS requirements	~~Delete.~~ 23.060 clause 6.9.1.2 does cover this issue. Reference added
4.3.14.1.3	Periodic Registration towards both CN nodes without use of Gs	Probably cross domain issue.	Captured independently in 23.012 and 23.060 so rewrite for 23.221 to reference these documents, and say that both can occur together. In case of combined node, only perform one update. Moved to clause 6.15.1.2 in new document
4.3.14.1.4	Periodic Registration with use of Gs/UMSC	Probably cross domain issue.	Captured independently in 23.012 and 23.060 so rewrite for 23.221 to reference these documents, and say that both can occur together. In case of combined node, only perform one update. Moved to clause 6.15.1.3 in new document
4.3.14.1.5	UE initiated Combined Detach Procedure when using Gs/UMSC	Cross domain issue	The issue is captured in 23.060 but need statement in 23.221 to reflect combined node. Moved to clause 6.15.1.4 in new document
4.3.14.2	SRNS Relocation	Requirements are already covered in 25.832, 25.413 and 23.060. Note however that 25.832 is a TR and cannot be normatively referenced in a TS.	Reference to other documents made. ~~Delete otherwise~~ Moved to clause 6.15.2 in new document
4.3.14.2.1	SRNS relocation principles	Ditto	~~Ditto~~Not Included
4.3.14.2.2	SRNS relocation (UE connected to a single CN node, 3G_MSC/VLR)	Ditto – also covered in 23.009	~~Ditto~~Not included

Clause in 23.121	Title	Reason for existence of text	New location
	followed by Location Registration in new Routing Area		
4.3.14.2.3	SRNS relocation (UE connected to a single CN node, 3G_SGSN) followed by Location Registration in new Location Area	Ditto	~~Ditto~~Not Included
4.3.14.3	Comparison between UMTS and GSM	Well understood concepts not requiring further explanation.	Not Included~~Delete~~
4.3.14.3.1	PS -idle state	Well understood concepts not requiring further explanation.	Not Included~~Delete~~
4.3.14.3.2	PS -connected state	Well understood concepts not requiring further explanation.	Not Included~~Delete~~
4.3.14.4	Issues for further study		Not Included~~Need to be closed. Is there a CR that did not get implemented? CR57 (see S2-000499 and SP-000088 deleted this clause, but this part of the CR does not appear to have been implemented.~~
4.3.15	Combined update towards the HLR for a combined 3G-(MSC/VLR+SGSN) configuration	Not put into release 99. Should be on hold until work item on ISN or combined MSC/SGSN is put into specifications.	Should be deleted from Release 99 version of 23.121. CN rejected the work item for release 4, and therefore should be deleted from release 4/5.
4.3.15.1	Motivation	Ditto	Not Included~~Ditto~~
4.3.15.2	Technical description	Ditto	Not Included~~Ditto~~
4.3.15.3	Requirements on UTRAN	Ditto	Not Included~~Ditto~~
4.3.15.4	List of MAP services for location management between the HLR and MSC-VLR/SGSN for GSM/GPRS	Ditto	Not Included~~Ditto~~
4.3.15.5	Signalling procedures for combined update towards HLR	Ditto	Not Included~~Ditto~~
4.3.15.6	Combined attach case where the previous attach was towards 2 CN elements	Ditto	Not Included~~Ditto~~
4.3.15.7	Combined location/routing area update where the previous LA/RA belonged to a 2 CN element	This clause is outside the scope of the main clause, as it is an update to a single CN element, not to one in both domains.	Not Included~~Delete Note that this clause has lost the enumeration in the text that ties it to figure 4.35. This may need correction in release 99 if it is kept. Comment that this is not part of release 99 and therefore should be deleted from 23.121 as well.~~
4.3.16	UTRAN coordination	Cross domain issue. Comment that there are two functions that are co-ordinated. 1) Paging co-ordination that is described in 5.9.1 in 25.410 and 2) Relocation co-ordination that is described in 8.7.5 in 25.413.	23.221. Needs to reference 8.7.5 in 25.413 and 5.9.1 in 25.410 for further details. Moved to clause 6.16 in new document
4.4	UMTS call control	No text	--- Moved to clause 7 in new document
4.4.1	Technical Requirements	Comment that a few things including fig 4.36 might be moved to 23.228 but a lot is completely out of date. It is very much inspired of H.323 also the CS part (which is wrong).	Need to keep fig. 4.36. Remainder of text needs substantial revision if kept. Moved to clause 7 in new document
4.4.2	Architecture for Multimedia	Do we need to keep this section at all? It does do the interaction on the CS side and in both does	Not Included~~Delete.~~

Clause in 23.121	Title	Reason for existence of text	New location
		indicate the bearers? Should be retained in 23.121 but not in 23.221.	
4.4.2.1	Packet Switched Domain	Ditto. Retain in 23.121	Not IncludedDitto
4.4.2.2	Circuit Switched Domain	Ditto. Partly wrong and is of no value.	Not IncludedDelete from 23.121 and from 23.221.
4.4.3	Typical Scenarios for Multimedia Control and User Plane		Not IncludedDelete as subclauses are also deleted.
4.4.3.1	H.324M to H.324M Call	None.	Not IncludedDelete. Covered by 23.972
4.4.3.2	IMT-2000 H.323 to H.323 call		Deleted in existing CR
4.5	Core network layer 3	Delete. Replaced by new item on transport independence in 4a.	Not IncludedDelete
4.6	Structure of radio interface layer 3	Should already be covered by Iu specs in RAN3. See 25.410 figure 6.3 and 23.060	Not IncludedDelete
4.7	Alternate Access technologies to UTRAN	A simpler and cheaper solution would be to use Mobile IP and have the common access point outside PLMN (i.e. HA on Gi).	Not IncludedDelete Moved to 9.7 and 9.7.1 in new document. Deleted
4.7.1	Advantages of attaching HIPERLAN 2 to UMTS	Ditto. Comment that there are only disadvantages.	Ditto Moved to 9.7.2 in new document
4.7.2	HIPERLAN 2 UMTS Interworking	Ditto	Ditto Moved to 9.7.3 in new document
4.7.3	Related Actions	Ditto	Ditto Moved to 9.7.4 in new document
4.8	Location of the IP compression function in UMTS	Already covered by 23.060 and implemented in SNDCP and PDCP documents	DeleteNot Included
4.8.1	Functional role of SNDCP / PDCP	Ditto	Not IncludedDitto
4.8.2	Position for header compression	Ditto	Not IncludedDitto
4.8.3	Implied protocol stack	Ditto	Not IncludedDitto
4.9	Short Message Service for UMTS	Should be in an S1 document and surely must be – Comment that Yes, there are. 22.003 states: “SMS MT/PP teleservice can be provided via both the CS and PS domains.” This is also for MO. 22.105 states: “A short message service point to point shall be supported. The short message service shall be provided seamlessly (as far as the user or the users terminal equipment is concerned) across the UTRAN and GSM access network.”	Not IncludedDelete
4.9.1	Protocols and architecture	Service is now specified for UMTS. This section does not specify any requirements. 23.040 does not have as clear a diagram	Not IncludedDelete. Move diagram to 23.040. Further investigation suggests that 24.011 may be a better location. Liaison required to T3 (owners of 23.040) and N1 (coowners of 24.011) suggesting material is incorporated in one of these documents.
4.10a	Cell Broadcast Service in UMTS	22.105 has the following requirement: “A short message service cell broadcast shall be provided seamlessly (as far as the user or the users terminal	Could be deleted since it is cCovered in 23.002. Deleted.Not included

Clause in 23.121	Title	Reason for existence of text	New location
		equipment is concerned) across the UTRAN and GSM network."	
4.10a.1	Network Architecture		Move to 23.002. Fig. 4.45a is already included there. Fig 4.45b is in 23.041 fig. 5. Fig. 4.45c should therefore also be in that document. Deleted
4.10	Mobile IP for UMTS/GPRS End Users		
4.10.1	Mobile IP for UMTS/GPRS End Users	Addressing concepts	All this section should be in 29.061 (interworking with PDN). Note that figure 4.47 and associated text is already there (figure 11[c]) and with more accurate information. ~~Delete.~~Not Included
4.10.1.1	Alterations of and Additions to Current GPRS Standards	Noting changes to other specifications	~~Delete.~~Not Included
4.11	Allowed network and terminal configurations	Configuration options.	Move to 23.002. ~~Delete.~~
4.12 (release 4 only)		Only talking about the CS-MGW	~~Move to 23.205~~ ~~Liaison statement required to N4.~~ ~~Delete.~~Kept when scope was extended
5	UMTS to UMTS handover for circuit switched services	Fully covered in 23.009	~~Delete.~~Kept when scope was extended
6	Interoperability between GSM and UMTS	22.129 is the stage 1 requirement – A CR to 22.129 is pending (Nokia and Orange) with a clean-up to match what was actually included in release 99..	This material is probably already captured by 23.009. Packet bits are in 23.060. ~~Delete.~~Not Included
6.1	Circuit Switched Handover and Roaming Principles	Ditto. Comment that 23.009 completely covers the bullets. The last bullet is not correct. The target RNC is used. But this is included in 23.009 and 29.002 (MAP).	This material is probably already captured by 23.009. Packet bits are in 23.060. ~~Delete.~~Not included
6.1.1	UMTS to GSM handover for circuit switched services	Ditto. Just a reference to 23.009	This material is probably already captured by 23.009. Packet bits are in 23.060. Not included~~Delete.~~
6.1.2	GSM to UMTS handover for circuit switched services	Ditto. Just a reference to 23.009	This material is pribably already captured by 23.019. Packet bits are in 23.060. Not included~~Delete.~~
6.2	Packet Switched Handover and Roaming Principles	Ditto	This material is pribably already captured by 23.060. Packet bits are in 23.060. Not included~~Delete.~~
6.2.1	Implications	Ditto	This material is pribably already captured by 23.060. Not included~~Delete.~~
6.2.2	Signalling procedures	Ditto	This material is pribably already captured by 23.060. Packet bits are in 23.060. ~~Delete.~~y
6.2.2.1	Handover from UMTS to GSM GPRS	Just reference to 23.060	Not included~~Delete~~
6.2.2.2	Handover from GSM GPRS to UMTS	Just reference to 23.060	Not included~~Delete~~
7 (release 4 only)	IP version issues	IP address management	Rewrite as general section on IP address management. Need to include in this material from 23.228 clause 4.3.
8 (release 4 only)	Support of IP multimedia services	Cross domain issue	23.221 Clause 8 in new document

Clause in 23.121	Title	Reason for existence of text	New location
Annex A (informative) :	Reduction of UMTS signalling	Covered by 23.119	Not includedDelete
A.1	GLR Concept	Ditto	Ditto
A.1.1	Overview of the GLR Concept	Ditto	Ditto
Annex B (informative) :	Change History	---	Now annex C

Annex B (informative): Change history

~~*It is usual to include an annex (usually the final annex of the document) for specifications under TSG change control which details the change history of the specification using a table as follows:*~~

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
					Version 0.0.1 Is version 3.4.0 of 23.121 incorporated into the new document template but reflecting changes to the document number and title. This version therefore also incorporates approved CR060 to 23.121		
					Version 0.0.2 incorporates approved CR056 to 23.121		
					Version 0.0.3 incorporates additions and deletions according to annex B		
					Version 0.0.4 makes no changes to the V.003 text, but moves the clauses into the new layout. There are therefore no revision marks in this version. Hanging paragraphs have had new clause headers added. Figures have been renumbered.		
					Version 0.0.5 amends the scope, adds references. Ensures all figures are referenced in text. Remaining release 99 references deleted.		
					Version 0.1.0 incorporates the changes agreed at S2#15. a) The scope has been expanded to allow the inclusion of high level CS domain issues.		
					Version 1.0.0 produces for presentation to SA#10. Same content as v.0.1.0		