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Abstract of document:

This TR records open issues and agreed understanding and solutions to be used for the provision of CS data bearer services.

Changes since last presentation to TSG CN:

No previous presentation

Outstanding Issues:

Handover from GSM to UMTS.

Lower rates for NT data

Contentious Issues:

User plane protocol used between the 2G and 3G MSCs in case of a handover fro GSM to UMTS.

Need for lower data rates for NT data.

See also Submission form for CS data WI.

3G TR 23.910 V1.0.0 (1999-12)

Technical Report

3rd Generation Partn
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(3G TR 23.910 version 0.1.0)

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Contents

Foreword

This Technical Report has been produced by the 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 this TS, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version 3.y.z

where:

- x the first digit:
  - 1 presented to TSG for information;
  - 2 presented to TSG for approval;
  - 3 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 specification;

Introduction

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

No text block identified.

1 Scope

The present document provides an overview of the architecture and issues related to the provision of Circuit Switch Bearer Services in a 3G mobile network.

2 References

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

[1] GSM TS 03.10: "GSM Public Land Mobile Network (PLMN) connection types"

[2] 3G TS 21.905: "3G Vocabulary"

[3] 3G TS 22.100: "UMTS Phase 1"

[4] 3G TS 22.002: "Bearer Services Supported by a GSM PLMN"

[5] 3G TS 22.101: "Service Principles"

[6] 3G TS 22.105: "Services and Service Capabilities"

[7] 3G TS 23.002: "Network Architecture"

[8] 3G TS 23.034: "High Speed Circuit Switched Data (HSCSD) -Stage 2"

[9] 3G TS 23.101: "General UMTS Architecture"

[10] 3G TS 23.107: "Quality of Service, Concept and Architecture"

[11] 3G TS 24.022: "Radio Link Protocol (RLP) for Data and Telematic Services on the Mobile Station - Base Station System (MS-BSS) Interface and the Base Station System - Moile-services Switching Centre (BSS-MSC) Interface"

[12] 3G TS 25.322: "Radio Link Control (RLC) Protocol Specification".

[13] 3G TS 25.415: "UTRAN Iu Interface user plane protocols"

[14] 3G TS 27.001: "General on Terminal Adaption Functions (TAF) for Mobile Station (MS)"

[15] 3G TS 29.007: "General Requirements on Interworking between the PLMN and the ISDN or PSTN"

3 Definitions, symbols and abbreviations

Delete from the above heading those words which are not applicable.

Subclause numbering depends on applicability and should be renumbered accordingly.

3.1 Definitions

For the purposes of the present document, the following terms and definitions given in 3G TS 21.905 and the following apply.

Definition format

***<defined term>**: <definition>*.

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

3.2 Symbols

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

Symbol format

<symbol> <Explanation>

3.3 Abbreviations

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

Abbreviation format

<ACRONYM> <Explanation>

4 General

CS data services in UMTS (UMTS Bearer Services) are build on services provided by the Access Network. These Radio Access Bearer Services are invoked through the RNL-SAP provided by the Iu User Plane to the Non-access stratum on the Core Network side, and the corresponding SAP provided by the RLC to the Non-access stratum on the Terminal side. Transport within the CN (the CN Bearer services) is outside the scope of this document. Interworking with External Bearer services is within the scope of this document. See Figure 1.

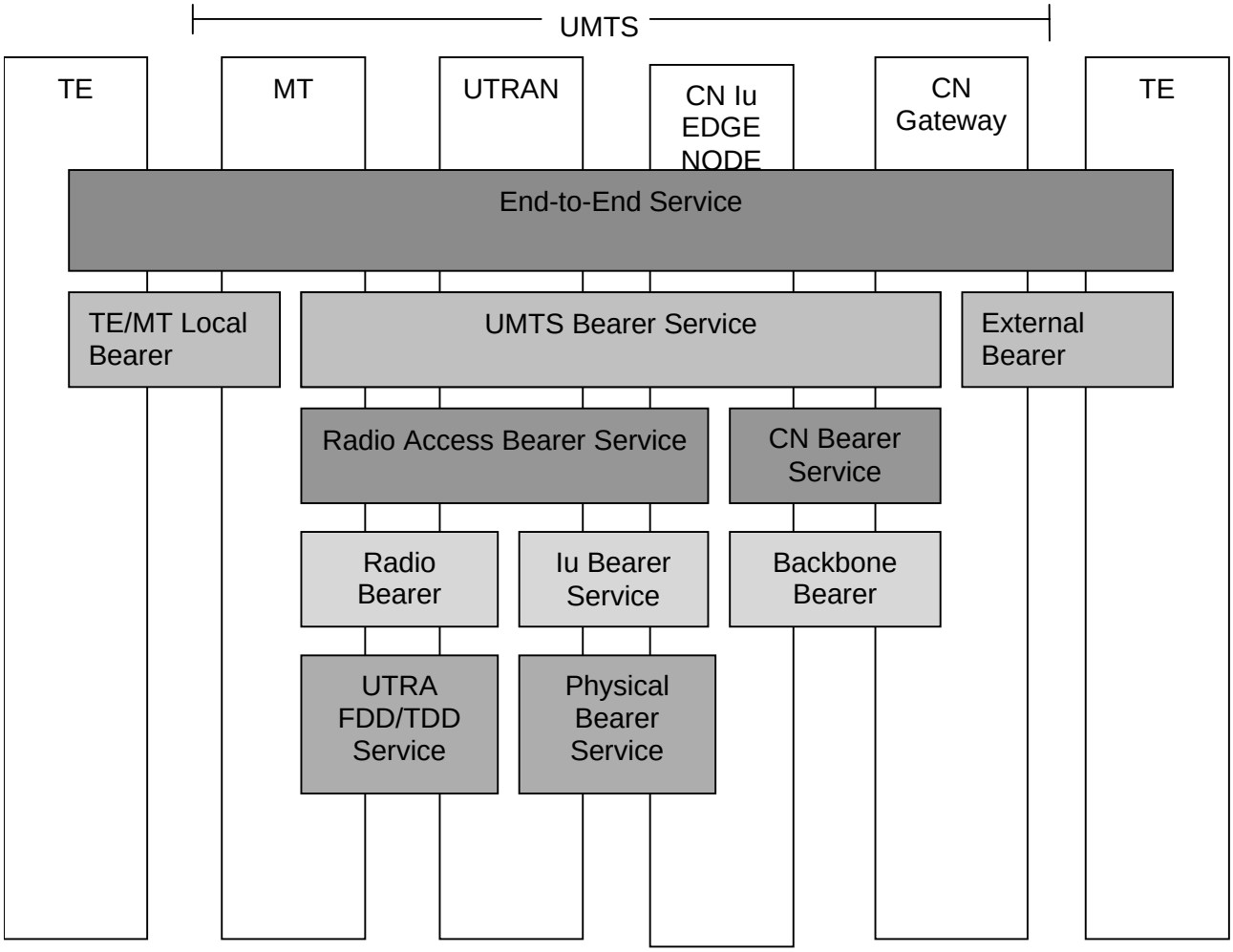

Figure 1

5 UMTS Bearer Services

The UMTS bearer services are described by the UMTS BC-IE. Five services (or services categories) are currently distinguishable from the UMTS BC-IE:

- Speech
- Transparent Data for support of Multimedia
- Transparent Data
- Non-transparent Fax
- NT data

Speech is currently not in the scope of this document.

Each UMTS bearer service is supported by a Radio Access Bearers (RAB). The RABs in turn are described by the QoS parameters. There may be one or several RAB candidates for supporting a UMTS bearer service. The possible candidates are described by a mapping of the BC-IE to RAB QoS described in Section 5.2.

5.1 UMTS Bearer Services in Release 99

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5.1.1 Transparent Data

This service is distinguished by the following BC-IE parameters:

- ITC = UDI or 3.1 kHz audio or Other ITC = RDI
- CE = transparent

This service may also be used for multimedia, in which case

- Other rate adaptation = H.223 and H.245

For this service the FNUR is restricted to:

- 64 kbit/s, in case ITC = UDI
- 56 kbit/s in case Other ITC = UDI or RDI
- 33.6 kbit/s, in case ITC = 3.1 kHz audio
- 28.8 kbit/s, in case ITC = 3.1 kHz audio
- 32 kbit/s, in case ITC=UDI

Note: V.90 is not supported in transparent mode, because asymmetric user rates are not supported in transparent mode.

5.1.2 Non-Transparent Fax

This service is distinguished by the following BC-IE parameters:

- ITC = Fax Group 3

WAIUR shall not be more than 28.8 kbit/s. The possible AIURs are limited to 14.4 and 28.8 kbit/s.5.1.3 NT Data

This service is distinguished by the following BC-IE parameters:

- ITC = UDI or 3.1 kHz audio or Other ITC = RDI
- CE = non-transparent

The possible AIURs are limited to 14.4, 28.8, and 57.6 kbit/s.

5.2 BC-IE to RAB QoS Mapping

Since UMTS bearer services are described by BC-IEs and RABs by QoS parameters, this section provides implicitly a mapping between the UMTS bearer services and the possible RABs that support them. The QoS mapping is based on TS 23.107

5.2.1 Non-transparent services, including Fax

Service identified by the BC IE	**Non-transparent data**	**Comments**
Traffic Class	Streaming	
Maximum bit rate (1)	14.4, 28.8, 57.6 kbit/s	Maximum bit rate is set to the highest value ≤ WAIUR (note 1)
Guaranteed bit rate	14.4 kbit/s	
Delivery Order	Yes	
Maximum SDU size	576 bits	
Transfer Delay	< 250 ms	Subject to operator tuning
Traffic Handling Priority	-	Not applicable
Source statistics descriptor	Unknown	
SDU Parameters		
SDU error ratio	< 10 %	Subject to operator tuning
Residual bit error ratio	10^{-3}	Subject to operator tuning.
Delivery of erroneous SDUs	No	
Subflow SDU size parameters		
Rate Control Allowed	Yes	
Subflow SDU size	576 bit	

Note 1: In case the WAIUR is less than 14.4, the maximum bit rate is set to 14.4. .

5.2.2 Transparent Data, including Multimedia

Service identified by the BC IE			**Transparent data and BS for support of multimedia service**	**Comments**
Traffic Class			Conversational	
Maximum bit rate			= guaranteed bit rate	
Guaranteed bit rate			FNUR = 64 .. 28.8 kbit/s	GBR for FNUR=56 kbit/s is 64 kbit/s
Delivery Order			Yes	
Maximum SDU size			640 .. 280 bits (depending on the FNUR)	
Transfer Delay			< 200 ms	Subject to operator tuning
Traffic Handling Priority			-	Not applicable
Source statistics descriptor			Unknown	
SDU Parameters				
	SDU error ratio		-	Not applicable
	Residual bit error ratio		10^{-4}	Subject to operator tuning.
	Delivery of erroneous SDUs		-	No error detection in the core network
	Subflow SDU size parameters			
		Rate Control Allowed	No	
		Subflow SDU size	Maximum SDU size	

Note 1: In case the FNUR = 56 kbit/s, the GBR is set to 64 kbit/s. Last bit in each data octet is set to 1.

6 Iu User Plane

6.1 NT services

The Iu user plane is used in support mode, see 25.415. Each SDU corresponds to one RLP frame and, consequently, is 576 bits long. The range of AIUR values is 14.4, 28.8. 57.6, limited by the maximum bit rate, and varies with the transmission period on the Uu interface, which is 10, 20, or 40 ms. The Iu UP signals to the CN when the transmission

period changes. The Iu UP primitive Iu-UP -DATA-REQUEST is invoked each time an RLP frame is ready to be sent from the CN towards the MS. DTX indication is not used.

6.2 T services

- The Iu UP is used in transparent mode, see 25.415. The payload of the Iu frame will consist of user data bits only-

The payload (SDU) size is fixed, determined by the bit rate. The SDU size is determined by the number of user data bits transmitted in 10 ms. AAL2 is used. The AAL2 SCCP layer must be supported for segmentation and re-assembly.

The primitive Iu-UP_UNIT-DATA-REQUEST is invoked at regular intervals in order to have a constant bit rate (every 10 ms) .

See N3-99389 and N3-490 for further discussion on the handling of delay, cell loss, etc.

7 RLC

The RLC shall be used in transparent mode for T and NT services.

8 Initial Synchronisation and resynchronisation

8.1 Modem services (3.1 kHz audio)

8.1.1 Transparent Case

The IWF does not send any SDUs down link until the modem connection has been established and the modems have synchronised. Thereafter the IWF through connects, mapping data from the fixed network side onto SDUs that are sent toward the MS, and mapping data in the received SDUs to the fixed network side. .

The MS sends no SDUs until an SDU is received at the transmission SAP. Until the first access stratum SDU is received, CT 106, 107 and 109 remain in the OFF condition. At the reception of the first SDU, CT 106, CT 107 and CT 109 are changed from OFF to ON at the DCE/DTE (TE/TAF) interface. The data in the received SDUs are mapped to CT 104 and data on CT 103 are mapped to SDUs sent toward the RNC.

8.1.2 Non-Transparent Case

At the IWF, the synchronisation of modems on the transit network is performed after establishement of the physical connection. The RLP establishment may be initiated by the IWF, but is normally initiated by the MS. If the modems synchronise before the RLP has been established, the IWF stores the information received from the other modem in the L2R buffers.

The MS initiates the RLP after the physical connection has been established. When the RLP link has been established, CT107 at the DCE/DTE interface will be changed from "OFF" to "ON". From this time the information from/to the RLP, including status changes, will be mapped by the L2R entity.

8.2 Digital services

8.2.1 Transparent case

The procedures are the same as for the modem case, but, depending on implementation, the IWF may through connect before the fixed network leg has been synchronised.

8.2.1 Non-Transparent case

The procedures are the same as for the modem case.

8.3 Loss of synchronisation

The PLMN side is not synchronous so loss of synchronisation is not possible. For T services, SDUs may be lost or arrive irregularily, which handling is implementation dependent.

Loss of synchronisation on the fixed network side is handled as in GSM.

9 Call Control

BC-IE negotiation procedures and mapping to ISDN are specified in 27.001 and 29.007. BC-IE parameter values shall be restricted as indicated in Section 5.1. See also 3G TS 27.001, Annex B, Table B.5a for further details on the validity of parameter values in GSM.

10 Handover Issues

10.1 Signalling issues

10.1.1 BC Information Lost during Handover from GSM to UMTS.

In the case of inter-MSC handover from GSM to UMTS, the serving GSM MSC/VLR sends a MAP message Prepare Handov carrying the BSSMAP message Handover Request. This message includes the parameter Channel Type, indicating whether ra resources are to be allocated for speech or data (parameter 'Speech or data indicator') and, among other data, the type of data service (transparent/non transparent) and the user rates (both included in the parameter 'Channel rate and type').

As no other bearer capability related parameters are received, it is not possible to distinguish between any other services than 'speech', 'data transparent' and 'data non-transparent'.

The mapping into QoS radio access parameters would be done as described in Section 5.2 , limited to the services 'speech', 'data, non-transparent' and 'data, transparent'.

10.1.2 Handover from UMTS to GSM

In case a UMTS call is set up in the CN, the BC IE parameters are mapped into QoS RAB parameters at call setup.

If the CN has to perform a handover towards GSM, the non-anchor MSC needs to perform an assignment based on GSM traffic channel parameters.
Assuming that the BSSMAP protocol is used in case of handover from UMTS to GSM:

a) The anchor MSC maps QoS parameters into GSM traffic channel parameters.

A mapping consists of using the original BC IE and perform a second mapping, into GSM specific BSSMAP traffic channel parameters, according to existing GSM procedures.
This requires that the BC IE is coded according to GSM protocol requirements, i.e. all those parameters ignored in UMTS should nevertheless be correctly specified by the UE in order to perform a handover to GSM according the above specified principles.

10.2 User Plane issues

10.2.1 Protocol Conversion between Anchor MSC and Target MSC

This issue is FFS.

The handover scenarios from 2G to 3G PLMNs is discussed based on a GSM TCH/F14.4 multislot environment. Such an environment provides the highest user rates possible in GSM, on the other hand it has the highest complexity.

The figures show both the transparent and the non-transparent services. In case of transparent services the RLP function is no used.

At call setup standard GSM procedures are executed. Before the handover the protocols supported by 2G MSC are the standa A-i/f protocols (i.e. A-TRAU, RLP), the configuration is shown in the following figure.

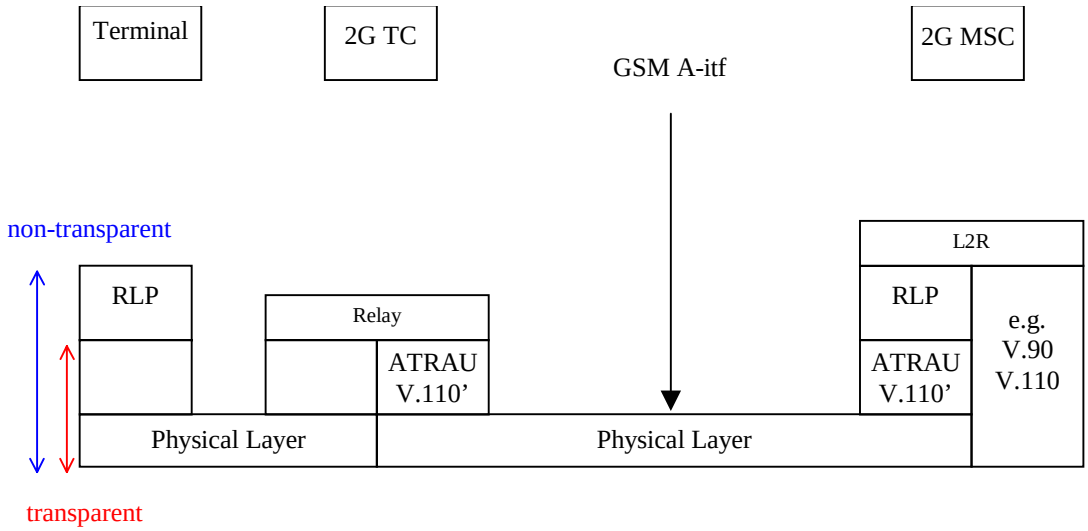

Figure 2: Configuration before the handover

Configuration after handover:

N3 assumes that for Inter-MSC HO from 2G to 3G the anchor MSC concept is used, i.e. the IWF remains in the anchor 2G MSC. This means that 2G MSC/IWF expects to receive the GSM A-itf protocols, the configuration is shown in the following figure.

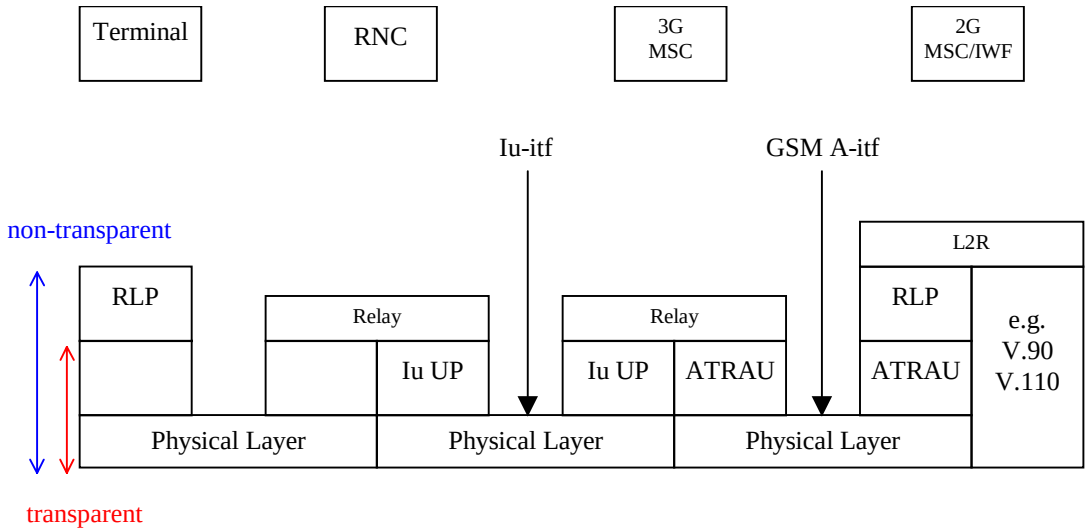

Figure 3: Configuration after the handover from 2G to 3G MSC

The relay function in 3G MSC has to convert the Iu UP protocols to the GSM A-interface protocols. In uplink direction this results in the following requirements on the relay function in 3G MSC:

1) termination of Iu UP (AAL2) and conversion into A-TRAU or modified V.110 frames (as defined in 04.21 and 08.20)

2) Split/Combine function (as defined in 04.21) has to be applied, the Split/Combine function distributes the A-TRAU/V.110' frames in 16kbit/s substreams. Eventually Padding has to be applied. In case of a non-transparent service complete RLP frames (each consisting of two A-TRAU or four V.110' frames) have to be distributed.

3) 16kbit/s substreams (up to four) have to be multiplexed in one 64kbit/s channel (Multiplexing function as defined in 08.20)

For each user rate another combination of the above mentioned functions has to be applied.

Such a functionality is very complex, complicated to control and not at all flexible as for every user rate another combination to be applied

Possible simplification:

Another possibility would be to change the 2G MSC and to define a suitable protocol between 3G and 2G MSC that should fu the following requirements:

1) an unique frame format should be used for all user rates

2) a plain 64kbit/s channel without substreams should be used

3) the overhead for synchronisation etc. should be kept small

4) to limit the changes to 2G MSC/IWFs it should be easy to implement the protocol in 2G MSC/IWF

There are three proposals for such a protocol:

1) An A-TRAU (ref. GSM TS 08.20) based solution, described in Tdoc N3-99403

2) A CPS-Packet based solution, described in Tdoc N3-99390

3) An X.31 based solution, described in Tdoc N3-99477