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Technical Specification

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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.

1 Scope

The present document specifies the principles of interworking between the UMTS IM CN subsystem and BICC/ISUP based legacy CS networks, in order to support IM basic voice calls.

The present document addresses the areas of control and user plane interworking between the IM CN subsystem and CS networks through the network functions which include the MGCF and IM-MGW. For the specification of control plane interworking, areas such as the interworking between SIP and BICC or ISUP are detailed in terms of the processes and protocol mappings required for the support of both IM originated and terminated voice calls.

Other areas addressed encompass the transport protocol and signalling issues for negotiation and mapping of bearer capabilities and QoS information.

The present document specifies the mapping between 3GPP profile of SIP (as detailed according to 3GPP TS 24.229 [9]) and BICC or ISUP, as specified in 3GPP TS 29.205 [14] and ITU-T Q761 to Q764 [4] respectively.

The interworking between 3GPP profile of SIP and BICC or ISUP is in accordance with the ITU-T Q.1912. SIP [5]. Where required, extensions to the mapping requirements SIP to BICC/ISUP mappings are defined within the present document.

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] ITU Recommendation G.711: "Pulse code modulation (PCM) of voice frequencies".

[2] ITU-T Recommendation H.248: "Gateway Control Protocol".

[3] ITU-T Recommendation Q.701 to Q.709 "Specification of Signalling System No.7 – Message Transfer Part".

[4] ITU-T Recommendations Q.761 to Q.764 (2000) "Specifications of Signalling System No.7 ISDN User Part (ISUP)".

[5] ITU-T Recommendation Q.1912.SIP "Interworking between Session Initiated Protocol (SIP) and the Bearer Independent Call Control (BICC) or ISDN User Part (ISUP) Protocols".

Editor's Note: The above document cannot be formally referenced until it is published by the ITU-T.

[6] 3GPP TR 21.905 "Vocabulary for 3GPP Specifications".

[7] 3GPP TS 29.061 " Interworking between the Public Land Mobile Network (PLMN) supporting Packet Based Services and Packet Data Networks (PDN)".

[8] 3GPP TS 24.228 "Signalling flows for the IP multimedia call control based on SIP and SDP".

[9] 3GPP TS 24.229 " IP Multimedia Call Control Protocol based on SIP and SDP ".

[10] 3GPP TS 23.002 "Network Architecture".

[11] 3GPP TS 22.228 "Service requirements for the IP Multimedia Core Network Subsystem".

[12] 3GPP TS 23.228 "IP Multimedia subsystem (IMS)".

[13] 3GPP TS 29.007: "General requirements on interworking between the Public Land Mobile Network (PLMN) and the Integrated Services Digital Network (ISDN) or Public Switched Telephone Network (PSTN)".

[14] 3GPP TS 29.205: "Application of Q.1900 series to Bearer Independent CS Network architecture; Stage 3".[15] 3GPP TS 29.232 "Media Gateway Controller (MGC) – Media Gateway (MGW) Interface".

[16] RFC 791 "Internet Protocol".

[17] RFC 768 "User Datagram Protocol".

[18] RFC 2960 "Stream Control Transmission Protocol".

[19] draft-ietf-sip-rfc2543bis-03 (May 2001): "SIP: Session Initiation Protocol".

Editor's Note: The above document cannot be formally referenced until it is published as an RFC.

[20] draft- ietf-sigtran-m3ua-07 (July 2001): "SS7 MTP3-User Adaptation Layer (M3UA)".

Editor's Note: The above document cannot be formally referenced until it is published as an RFC.

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP TR 21.905 [6] and the following apply:

SS7 signalling function: A function in the CS network which has the capabilities to transport the SS7 MTP-User parts ISUP and BICC

SIP signalling function: A function in the IM CN subsystem which has the capabilities to transport SIP

3.2 Abbreviations

For the purposes of the present document, the abbreviations as specified in 3GPP TR 21.905 [6] apply.

4 General

4.1 General Interworking Overview

The IM CN subsystem shall interwork with BICC and ISUP based legacy CS networks, e.g. PSTN, ISDN, CS PLMNs, in order to provide the ability to support basic voice calls (see 3GPP TS 22.228 [11]), between a UE located in the IM CN subsystem and user equipment located in a CS network.

For the ability to support the delivery of basic voice calls between the IM CN subsystem and CS networks, basic protocol mapping between SIP (as specified in RFC 2543 [19]) and BICC or ISUP (as specified in 3GPP TS 29.205 [2] and ITU-T Q761 to Q764 [1] respectively) has to occur at a control plane level, in order that call setup, call maintenance and call release procedures can be supported. The MGCF shall provide this protocol mapping functionality within the IM CN subsystem.

In addition to the interworking requirements across the control plane, user plane interworking between IP and CS network (i.e. 64k PCM circuit switched bearer channel) shall also be supported by the functions within the MGW. The MGW resides in the IM CN subsystem and shall provide the bearer channel mapping. The MGCF shall provide the call control to bearer setup association.

Besides from the ability to support basic voice calls the IM CN subsystem shall interwork, at the control and user plane, with BICC and ISUP based legacy CS networks. The support of supplementary services shall be as defined in 3GPP TS 22.228 [11].

Signalling flows for UE originated and UE terminated procedures between the IM CN subsystem and CS networks shall be as specified in TS 24.228 [8].

5 Network characteristics

5.1 Key characteristics of ISUP based CS networks

The signalling interaction between the PLMN and ISDN shall be enabled by the BICC/ISUP interface. The interface between PLMN and CS network may occur at any point in a national network. The interworking functions shall be in accordance with 3GPP 29.007 [13].

This signalling interface shall be based on BICC Capability Set 2 (see 3GPP TS 29.205 [14] and ISUP (see ITU-T Q.761 to Q.764 [4]).

5.2 Key characteristics of IM CN Subsystem

The IM CN subsystem shall use SIP to manage IP multimedia sessions in a 3GPP environment, it shall also use IPv6 as the transport mechanism for both SIP session signalling and media transport.

The IM CN subsystem shall interwork with existing fixed and mobile voice networks, including PSTN, ISDN, and Mobile.

6 Interworking with CS networks

6.1 Interworking Reference Model

Figure 1details the reference model required to support interworking between the UMTS IM CN subsystem and CS networks for IM basic voice calls.

NOTE 1: The logical split of the signalling and bearer path between the CS network and the IM CN subsystem is as shown, however the signalling and bearer may be logically directly connected to the MGW.

NOTE 2: The SGW may be implemented as a stand-alone entity or it may be located in another entity either in the CS network or the MGW. The implementation options are not discussed in the present document.

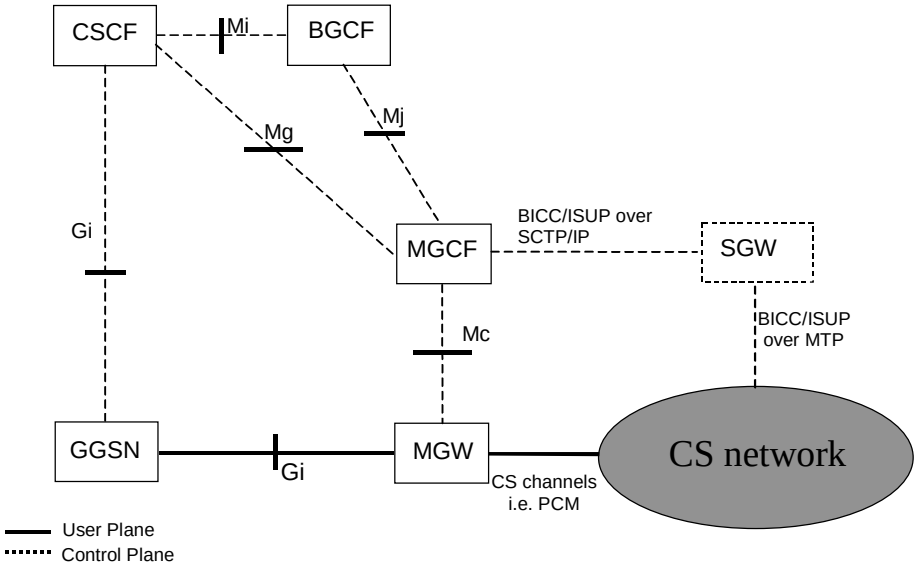

Figure 1: IM CN subsystem to CS network logical interworking reference model

6.1.1 Interworking reference points and interfaces

The reference points and network interfaces shown in figure 1 are as described:

Protocol for Mg reference point: The single call control protocol applied across the Mg reference point (i.e. between CSCF and MGCF) will be based on the 3GPP profile of SIP as defined in accordance with 3GPP TS 24.229 [9].

Protocol for Mc reference point: The Mc reference point describes the interfaces between the MGCF and MGW, and has the properties as detailed in 3GPP TS 23.002 [10].

Protocol for Mj reference point: The single call control protocol applied across the Mj reference point (i.e. between BGCF and MGCF) will be based on the 3GPP profile of SIP as defined in accordance with 3GPP TS 24.229 [9].

Protocol for Mi reference point: The single call control protocol applied across the Mi reference point (i.e. between CSCF and MGCF) will be based on the 3GPP profile of SIP as defined in accordance with 3GPP TS 24.229 [9].

Protocol for Gi interface: This is interface is detailed in accordance with 3GPP TS 29.061 [7] and is IP based.

6.1.2 Interworking Functional Entities

6.1.2.1 Signalling Gateway Function (SGW)

This component performs the call related signalling conversion to or from BICC/ISUP based MTP transport networks to BICC/ISUP based SCTP/IP transport networks, and forwards the converted signalling to or from the MGCF. The functionality defined within SGW shall be defined in accordance with 3GPP TS 23.002 [10].

6.1.2.2 Media Gateway Control Function (MGCF)

This is the component within the IM CN subsystem, which controls the MGW, and also performs SIP to BICC or SIP to ISUP call related signalling mapping.

The functionality defined within MGCF shall be defined in accordance with 3GPP TS 23.002 [10].

6.1.2.3 Media Gateway Function (MGW)

This is the component within the IM CN subsystem which provides the interface between the PS domain and the CS domain, and it shall support the functions as defined in accordance with 3GPP TS 23.002 [10].

6.2 Control Plane Interworking Model

Within the IM CN subsystem, the 3GPP profile of SIP shall be used to originate and terminate IM sessions to and from the UE.

External legacy CS networks shall use BICC or ISUP to originate and terminate voice calls to and from the IM CN subsystem.

Therefore, in order to provide the required interworking to enable inter network session control, the control plane protocols shall be mapped together within the IM CN subsystem. This function is performed within the MGCF (see subclause 6.1.2).

6.3 User Plane Interworking Model

Within the IM CN subsystem, IPv6, and framing protocols such as RTP, is used to transport media packets to and from the UE.

External legacy CS networks use circuit switched bearer channels (i.e. 64kbits PCM) to carry encoded voice frames, to and from the IM CN subsystem.

Therefore, in order to provide the required interworking to enable media data exchange, the user plane protocols shall be translated within the IM CN subsystem. This function is performed within the MGW (see subclause 6.1.2).

7 Control Plane Interworking

Signalling from CS networks to or from IM CN SS networks, where the associated supported signalling protocols are SS7 and IP respectively, requires a level of interworking between the nodes across the Control Plane, i.e. the SS7 signalling function, SGW, MGCF and SIP signalling function. This interworking is required in order to provide a seamless support of a user part, i.e. SIP and BICC or SIP and ISUP.

The transport of SS7 signalling protocol messages of any protocol layer that is identified by MTP level 3, in SS7 terms, as a user part (MTP3-user) shall be accomplished in accordance with the protocol architecture defined in the following subclauses. For the present document these protocol layers includes, but is not limited to, Bearer Independent Call Control (BICC) and ISDN User Part (ISUP).

7.2 Interworking between CS networks supporting ISUP and the IM CN subsystem supporting SIP

The control plane between CS networks supporting ISUP and the IM CN subsystem supporting SIP, where the underlying network is SS7 and IP respectively is as shown in figure 2.

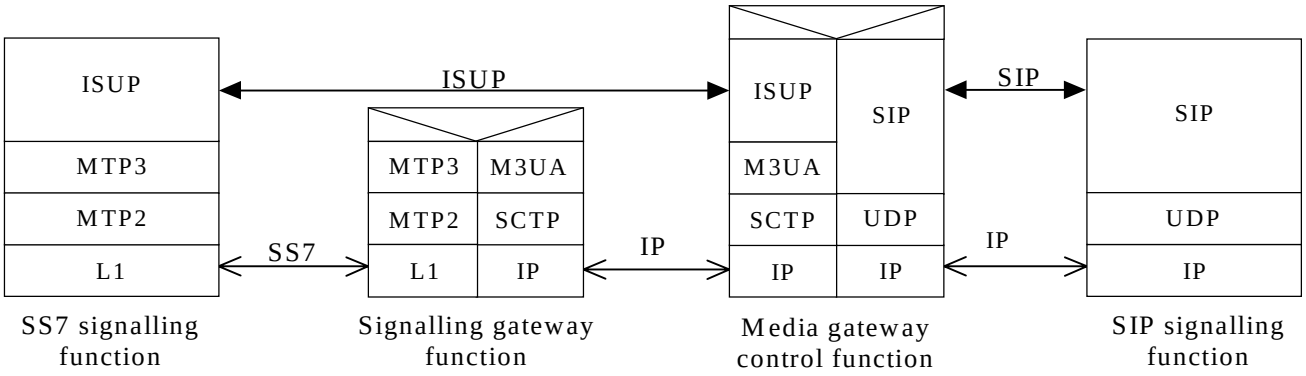

Figure 2: Control Plane interworking between CS networks supporting ISUP and the IM CN subsystem supporting SIP

7.2.1 Services performed by network entities in the control plane

7.2.1.1 Services performed by the SS7 signalling function

The SS7 signalling function provides the capabilities to deliver or receive SS7 MTP3-User information (e.g. ISUP or BICC) across the SS7 signalling network. The functional interface of the MTP, the MTP User parts and the signalling network are as detailed in ITU-T Q.701 to Q.709 [3].

7.2.1.2 Services of the SGW

The SGW shall perform the functions as described in 3GPP TS 23.002 [10].

In order to support the seamless operation of the MTP3-User part information between networks incorporating SS7 and IP, the SGW shall support the services of MTP as well as the services of the M3UA (see IETF M3UA [20]) and SCTP (see RFC 2960 [18]).

7.2.1.3 Services of the MGCF

The session handling and session control of the MGCF shall be as detailed in 3GPP TS 24.229 [9].

The MGCF shall provide the interaction, through the use of its interworking function, between the SS7 MTP3-User part information, e.g. ISUP, and SIP. It shall also provide the interaction between the mechanism used to transport the SS7 MTP3-User part information and SIP, i.e. the interaction between M3UA and SCTP and UDP (see RFC 768 [17]).

The MGCF interworking function shall also provide the translation between the SS7 MTP3-User part information and SIP, where the mapping of SIP to ISUP and BICC shall be detailed in accordance with ITU-T Q.1912.SIP [5].

7.2.1.4 Services of the SIP signalling function

The SIP signalling function provides the capabilities to deliver or receive multimedia session information across the IM CN subsystem signalling system. It is a logical entity that may reside in the CSCF, MGCF and other IM CN subsystem entities

7.2.2 Signalling interactions between network entities in the control plane

7.2.2.1 Signalling between the SS7 signalling function and MGCF

The SGW shall enable the signalling interaction between the SS7 signalling function and the MGCF.

7.2.2.1.1 Signalling from MGCF to SS7 signalling function

For signalling from the MGCF to the SS7 signalling function, the SGW shall terminate the SCTP and M3UA protocol layers and deliver the MTP3-User protocol messages, e.g. ISUP messages, towards the SS7 signalling function. The SGW transmits and receives SS7 Message Signalling Units (MSUs) to and from the SS7 signalling function over standard SS7 network interfaces, using MTP to provide reliable transport of the messages.

7.2.2.1.2 Signalling from SS7 signalling function to MGCF

For signalling from the SS7 signalling function to the MGCF, the SGW shall terminate SS7 MTP2 and MTP3 protocol layers and deliver MTP3-User part information messages, e.g. ISUP, towards the MGCF. In order to direct messages received from the SS7 MTP3 network to the appropriate IP destination, e.g. MGCF, the SGW shall perform a message distribution function using the information received from the MTP3-User message. Message distribution at the SGW shall be performed in accordance with IETF M3UA [7].

7.2.2.1.3 Services offered by SCTP and M3UA

The SGW internal protocol mapping and transportation between BICC or ISUP messages and IP encapsulated BICC or ISUP messages respectively is supported by the services of the M3UA adaptation layer and the underlying SCTP layer. The SGW shall allow for the transfer of MTP3-User signalling messages, e.g. BICC or ISUP, to and from an MGCF, where the peer MTP3-User protocol exists.

7.2.2.1.3.1 Services offer by SCTP

SCTP offers the ability to reliably transfer the SCTP User applications, e.g. M3UA, between the SCTP User application peers. The initialization procedure used for an association between two SCTP end-to-end peers, and the initialization to the SCTP User applications shall detailed in accordance with RCF 2960 [18].

7.2.2.1.3.2 Services offered by M3UA

When an association between two SCTP peers has been established, the use of M3UA shall provide the transport of MTP-TRANSFER primitives (see ITU-T Q.701 to Q.709 [3]) to its upper layer to the MTP3-User, e.g. ISUP.

7.2.2.2 Signalling between the MGCF and SIP signalling function

Signalling between the SIP signalling function and the MGCF shall use the services of IP, UDP and SIP. The use of a SIP URL shall enable the identification of the IP address of the IM CN subsystem entity, e.g. the MGCF and SIP signalling function.

Additionally, the SIP URL shall identify the SIP version, the method of transport (described as UDP in the present document) and SIP port number (see RFC 2543 [19]).

The naming and addressing concepts between the MGCF and SIP signalling function shall be detailed in accordance with 3GPP TS 23.228 [12]. The issues of general IP address management are discussed in 3GPP TS 23.221 [28].

7.3 Interworking between CS networks supporting BICC and the IM CN subsystem supporting SIP

The control plane between CS networks supporting BICC and the IM CN subsystem supporting SIP, where the underlying network is SS7 and IP respectively is as shown in figure 3.

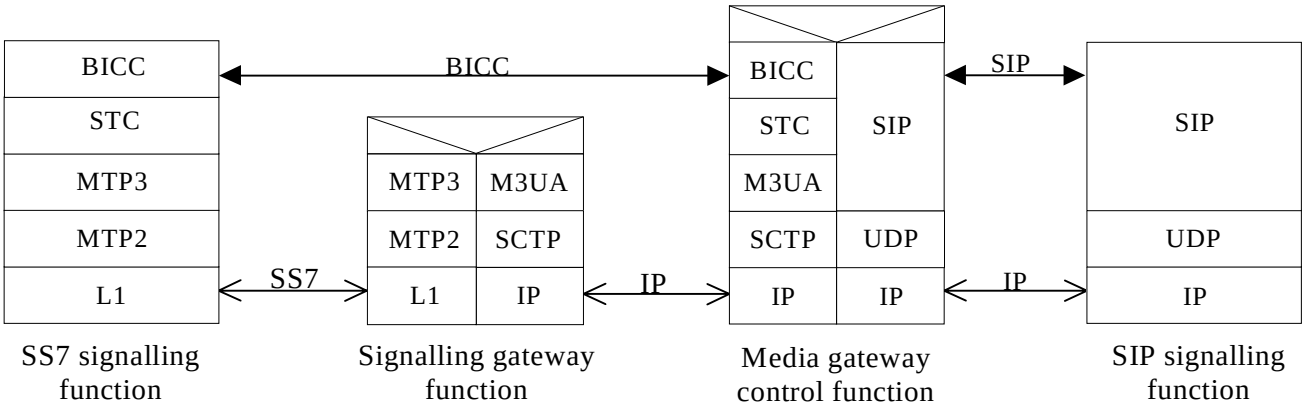

Figure 3: Control Plane interworking between CS networks supporting BICC and the IM CN subsystem supporting SIP

7.3.1 Services performed by network entities in the control plane

Services offered by the network entities in the control plane are as detailed in subclause 7.2.1.

7.3.2 Signalling interactions between network entities in the control plane

7.3.2.1 Signalling between the SS7 signalling function and MGCF

See subclause 7.2.2.1

7.3.2.1.1 Signalling from MGCF to SS7 signalling function

See subclause 7.2.2.1.1

7.3.2.1.2 Signalling from SS7 signalling function to MGCF

See subclause 7.2.2.1.2.

7.3.2.1.3 Services offered by STC, SCTP and M3UA

7.3.2.1.3.1 Services offer by SCTP

See subclase 7.2.2.1.3.1

7.3.2.1.3.2 Services offered by M3UA

See subclase 7.2.2.1.3.2

7.3.2.1.3.3 Services offered by STC

STC shall provide the services for the transparent transfer of STC user information, e.g. BICC, between STC users, i.e. the SS7 signalling function and the MGCF (see 3GPP TS 29.205 [14]).

STC shall perform the functions of Segmentation and reassembly, i.e. segments STC user data into segments that can be transported over the narrow-band MTP, data transfer service availability reporting and congestion reporting to the STC user and User part availability control.

7.3.2.2 Signalling between the MGCF and SIP signalling function

See subclase 7.3.2.2

8 User Plane Interworking

8.1 Overview

The IM CN subsystem shall support the AMR codec as the native codec for basic voice services. From the support of the AMR codec the, it is possible for the IM CN subsystem to interwork with other networks which support this codec (either as its native codec or through the use of transcoding in the other party's network).

It shall also be possible for the IM CN subsystem to interwork with the CS networks (e.g. PSTN, ISDN or a CS domain of a PLMN) by supporting AMR to G.711 transcoding (see ITU G.711 [1]) in the MGW, however it should be noted that it may be possible for the MGW to perform transcoding between AMR and other codec types supported by CS networks. Furthermore to allow interworking between users of the IM CN subsystem and IP multimedia fixed terminals and other codecs, interworking or additional transcoding capabilities may (this is implementation dependent) be supported by the MGW.

Figure 4 details the user plane protocol stack used to provide UMTS AMR to G.711 user plane interworking. The AMR coded voice packets use the IP service provided by the PS domain (via the Gi interface) to communicate with the UE.

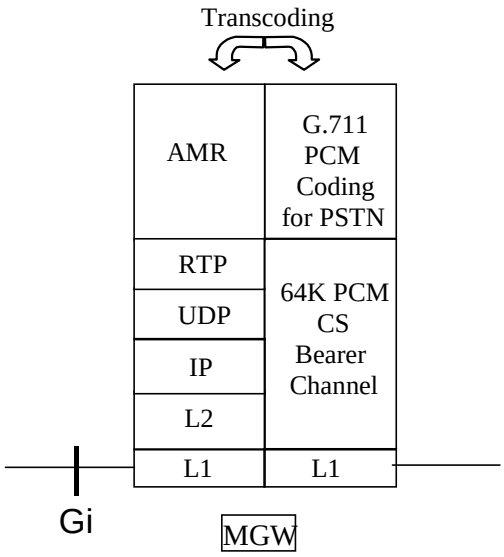

Figure 4: IM CN subsystem to CS Network User Plane MGW Protocol Stack used to support UMTS AMR to G.711 transcoding.

9 MGCF – MGW Interaction

9.1 Overview

The MGCF shall control the functions of the MGW, which are used to provide the connection between media streams of an IP based transport network and bearer channels from a CS network.

The MGCF shall interact with the MGW across the Mc reference point. It shall terminate the signalling across the Mc interface towards the MGW and the MGW shall terminate the signalling from the MGCF. The signalling interface across the Mc reference point shall be defined in accordance with ITU-T H.248 [2] and shall conform to 3GPP specific extensions as detailed in 3GPP TS 29.232 [15].

Bearer Control Protocol (IPBCP) shall be applicable between the MGCF and MGW is FFS

The use of existing H.248 3GPP specific packages are FFS

Annex A (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**
26/2/01		29.abc		0.0.0	Version 0.0.0 Presented to CN3 #16 - Sophia Antipolis - Initial Proposal		
17/5/01		29.163		0.1.0	Tdocs N3-010185, N3-010199, N3-010201 and N3-010210 agreed at CN3#17 - Rio Grande, Puerto Rico		
11/07/01		29.163		0.2.0	Tdocs N3-010312, N3-010315 agreed at CN#18 – Dresden, Germany		
19/09/01		29.163		0.3.0	Tdocs N3-010462, N3-010427 agreed at CN#19 – Brighton, UK		
30/11/01		29.163		1.0.0	Tdoc N3-010605 agreed at CN#20 – Cancun, Mexico		

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Cancun, Mexico. 26th - 30th November 2001.

Introduction

The attached version 1.0.0 of 3GPP TS 29.163 incorporates the agreements which were made during the CN3 #20 meeting in Cancun, Mexico.