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Presentation of Specification to TSG or WG

Presentation to:	**TSG CN Plenary Meeting #25**
Document for presentation:	**TS 29.162, Version 1.1.1**
Presented for:	**Information**

Abstract of document:

The TS defines the interworking between IM CN Subsystem and IP networks.

Changes since last presentation to Meeting #:

A Release 5 version has been presented to the plenary before. A number of issues have been clarified regarding the interworking between 3GPP profile of SIP defined in 3GPP TS 24.229 and an IETF compliant SIP network. In addition, IP version interworking between IM CN Subsystem and an IP v4 network has been added.

Outstanding Issues:

- Refinement of IPv4/v6 interworking. by Dec 04

Contentious Issues:

-

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Technical Specification

3rd Generation Partnership Project; Technical Specification Group Core Network; Interworking between the IM CN subsystem and IP networks (Release 6)

Keywords

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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 IM CN subsystem interworks with the external IP networks through the Mb reference point.

This document details the interworking between the IM CN subsystem and external IP networks for IM service support. It addresses the issues of control plane interworking, user plane interworking and IP version interworking.

The document specifies the control plane interworking between a standard SIP as specified in RFC 3261 [2] and the 3GPP profile as specified in 3GPP TS 24.229 [1].

The IP version Interworking, between IP version 4 RFC 791 [9] and IP version 6 RFC 1883 [10] detailed in terms of the processes and protocol mappings required in order to support both mobile originated and terminated calls.

Other areas addressed encompass mapping of bearer capabilities and QoS information.

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. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document.*

[1] 3GPP TS 24.229: "Internet Protocol (IP) multimedia call control protocol based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP); Stage 3".

[2] IETF RFC 3261: "SIP: Session Initiation Protocol".

[3] 3GPP TS 23.221: "Architectural requirements".

[4] 3GPP TS 29.061: "Interworking between the Public Land Mobile Network (PLMN) supporting packet based services and Packet Data Networks (PDN)".

[5] 3GPP TS 23.002: "Network architecture".

[6] 3GPP TS 26.235: "Packet switched conversational multimedia applications; Default codecs".

[7] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[8] 3GPP TS 23.228: "IP Multimedia Subsystem (IMS); Stage 2".

[9] IETF RFC 791: "Internet Protocol".

[10] IETF RFC 1883: "Internet Protocol, Version 6 (IPv6) Specification".

[11] IETF RFC 2766: "Network Address Translation - Protocol Translation (NAT-PT)".

[12] IETF RFC 2663: "IP Network Address Translator (NAT) Terminology and Considerations".

[13] 3GPP TR 29.962: "Signalling interworking between the 3GPP profile of the Session Initiation Protocol (SIP) and non-3GPP SIP usage".

[14] ITU-T Recommendation H.263: "Video coding for low bit rate communication".

[15] ITU-T Recommendation G.723.1: "Dual rate speech coder for multimedia communications transmitting at 5.3 and 6.3 kbit/s".

[16] ITU-T Recommendation G.729: "Coding of speech at 8 kbit/s using conjugate-structure algebraic-code-excited linear-prediction (CS-ACELP)".

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

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 [7] and the following apply:

IM CN subsystem: (IP Multimedia CN subsystem) comprises of all CN elements for the provision of IP multimedia applications over IP multimedia sessions

IP multimedia session: set of multimedia senders and receivers and the data streams flowing from senders to receivers IP multimedia sessions are supported by the IP multimedia CN Subsystem and are enabled by IP connectivity bearers (e.g. GPRS as a bearer). A user may invoke concurrent IP multimedia sessions.

3.2 Symbols

Void.

3.3 Abbreviations

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

CSCF	Call Session Control Function
GTP	GPRS Tunnelling Protocol
IETF STD	Internet Engineering Task Force STandarD
IM	IP Multimedia
IMS	IP Multimedia Subsystem
IMS-ALG	IMS - Application Level Gateway
IP	Internet Protocol
IPv4	IP version 4
IPv6	IP version 6
LAN	Local Area Network
MEGACO	MEdia GAteway COntrol
MRFC	Multimedia Resource Function Controller
MRFP	Multimedia Resource Function Processor
NA (P) T-PT	Network Address (Port-Multiplexing) Translation-Protocol Translation
PDN	Packet Data Network
QoS	Quality of Service
S-CSCF	Serving-CSCF
SIP UA	SIP User Agent
SIP	Session Initiation Protocol
TrGW	Translation GateWay
UE	User Equipment
WAN	Wide Area Network

4 General

4.1 General interworking overview

The IM CN Subsystem shall interwork with SIP RFC 3261 [2] based IP Multimedia networks. These IP Multimedia networks include:

- SIP User Agents (UAs);
- SIP Servers.

As such, the IM CN Subsystem has to be able to interwork to all of these above functional entities in the IP multimedia network, as there is a possibility that they all may be involved in an IM session. The general interworking model is shown in figure 1. The SIP based Multimedia networks may use IP version 4 RFC 791 [9] or IP version 6 RFC 1883 [10].

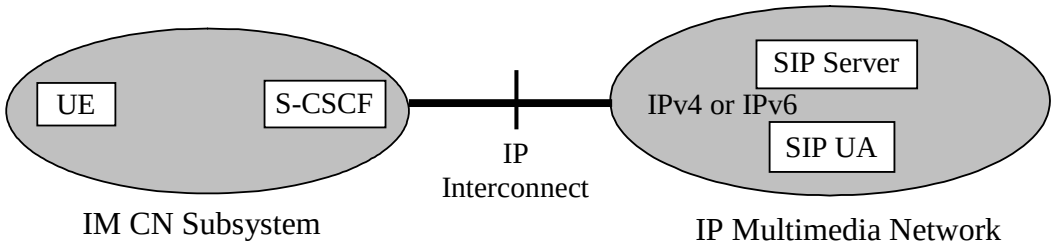


Figure 1: Interworking Model for IM CN Subsystem to IP Multimedia Network

The UE shall use the CSCF in order to communicate with the external IP multimedia network entities.

It shall be possible for the CSCF to communicate with SIP UAs directly.

It shall be possible for the CSCF to communicate with SIP Servers directly, which in turn can then communicate with SIP UAs.

To provide the IP version interworking the functions of an IMS-ALG and a TrGW may be used. The IMS-ALG and the TrGW may be implemented as a part of other physical entities in the IMS.

NOTE: Other methods to provide IP version interworking are for further study.

4.2 Interworking scenarios

3GPP specifications design the IM CN subsystem elements and interfaces to exclusively support IPv6.
3GPP TS 23.221 [3] details the interoperability scenarios that an UE may experience when interworking with an external PDN. All of these IP transport layer interworking scenarios can apply to the application layer interworking scenarios detailed in clause 4.2.1.

4.2.1 UE with 3GPP SIP profile capability connecting to an external SIP device

The procedures used by an UE with 3GPP SIP profile to connect to an external SIP device are analysed in 3GPP TR 29.962 [13] are specified in 3 GPP TS 24.229 [1].

5 Network characteristics

5.1 Key characteristics of IP Multimedia Networks

The Internet is a conglomeration of networks utilising a common set of protocols. IP protocols are defined in the relevant IETF RFCs. The networks topologies may be based on LANs (e.g. Ethernet), Point-to-Point leased lines, PSTN, ISDN, X.25 or WANs using switched technology (e.g. SMDS, ATM).

IP multimedia networks provide the ability for users to invoke IP multimedia applications in order to send and receive (where applicable) voice and data communications. One protocol used to manage IP multimedia sessions is the Session Initiation Protocol (SIP) (RFC 3261 [2]).

5.2 Key characteristics of UMTS IM CN Subsystem

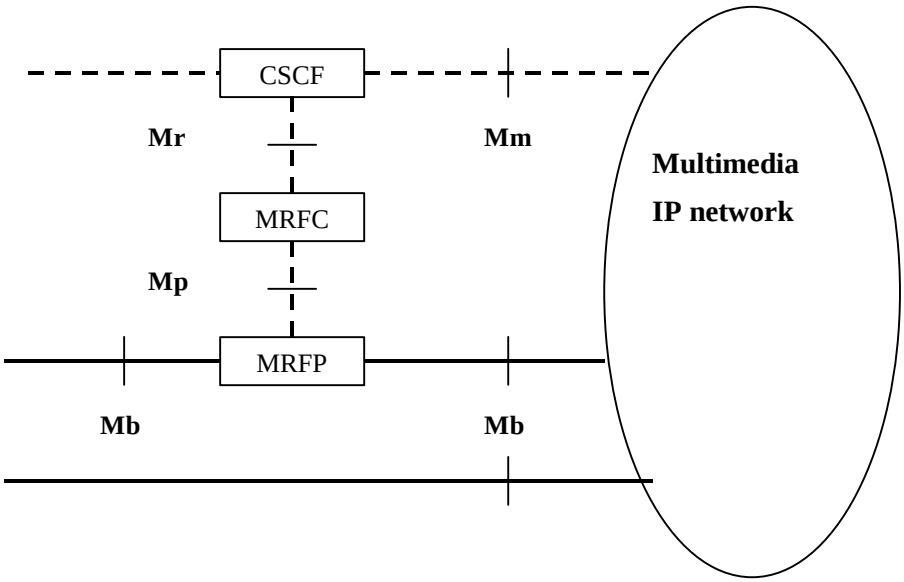
The UMTS IM CN subsystem uses the SIP protocol to manage IP multimedia sessions, and uses IP as the transport mechanism for both SIP session signalling and media transport.

The UMTS IM CN subsystem shall support interworking with existing fixed and mobile voice and IP data networks, including PSTN, ISDN, Mobile and Internet.

6 Interworking with IP networks

6.1 Interworking Reference Model for control plane interworking and user plane interworking

Figure 2 details the reference architecture required to support interworking between the IM CN subsystem and IP networks for IM services.



NOTE: Multimedia IP networks may be connected via the Mb interface to various network entities, such as an UE (via an GTP Tunnel reaching to the GGSN), an MRFP, or an application server.

Figure 2: IM CN Subsystem to IP network interworking ref. architecture

Protocol for Mm: The single call control protocol applied to the Mm interface between CSCF and external IP networks will be RFC 3261 [2]. SIP extension packages mandated by 3GPP are possibly not supported.

Protocol for Mb: This interface defined in 3GPP TS 23.002 [5] and is IP based. Further information is provided in 3GPP TS 29.061 [4] and 3GPP TS 26.235 [6].

Protocol for Mr: This interface is detailed in 3GPP TS 24.229 [1]. The protocol is not specified within this release of the specification.

Protocol for Mp: This interface is defined in 3GPP TS 23.002 [5]. The protocol is not specified within this release of the specification.

6.1.1 Interworking Functional Entities

6.1.1.1 S-CSCF

This entity provides the control plane functionality between SIP with 3GPP TS 24.229 [1] and RFC 3261 [2].

6.1.1.2 MRFP

This entity may be used to provide used plane transcoding within the IM CN subsystem.

6.1.1.3 MRFC

This entity controls the MRFP via the Mp interface.

6.2 Control plane interworking model

6.2.1 IM CN Subsystem originated calls

Sessions, which originate in the IM CN subsystem, shall be required; to interwork to standard SIP RFC 3261 [2] based IP Multimedia network domains at the control plane level within the UMTS IM Subsystem domain.

- For sessions terminating in SIP based IP networks, then control plane interworking shall be supported via the Mm reference interface (S-CSCF to external IP multimedia networks).

6.2.2 IM CN Subsystem terminated calls

Calls, which terminate in the IM CN Subsystem, shall be required to interwork to standard SIP RFC 3261 [2] based IP Multimedia network domains at the control plane level within the UMTS IM Subsystem domain.

- For calls originating in SIP based IP networks, then control plane interworking shall be supported via the Mm reference interface (S-CSCF to external IP multimedia networks).

6.3 User plane interworking model

The Mb interface is used to provide the user plane within the IM CN subsystem and towards external IP Multimedia network domains.

A MRFP may be inserted in the user plane. The MRFP provides support for bearer related services such as multi-party sessions, announcements to a user or transcoding.

6.4 IP version interworking model

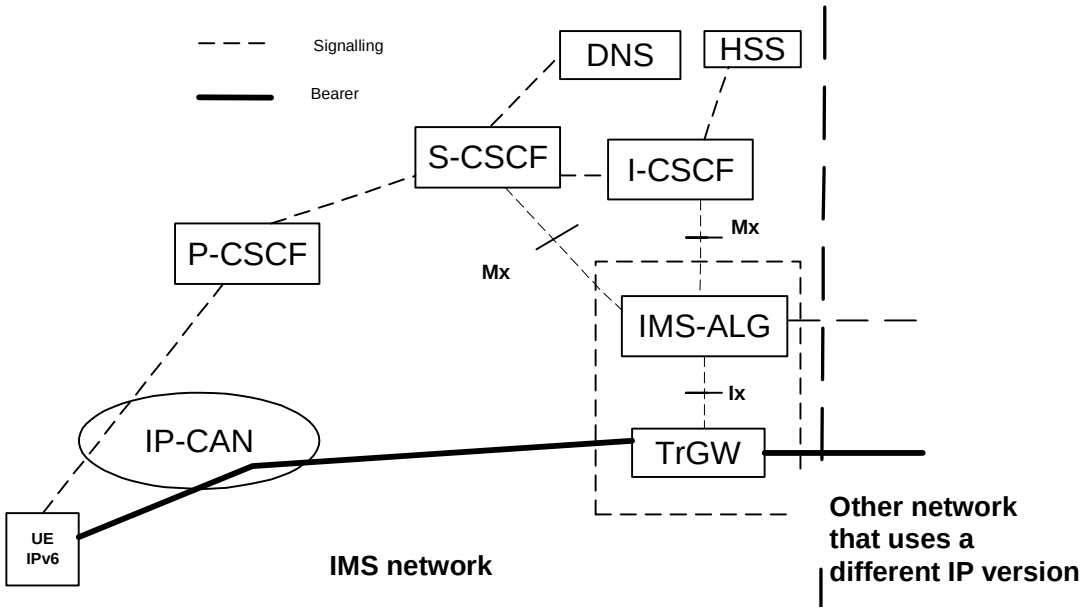


Figure 3: Model for IP version interworking

Figure 3 details the reference architecture required to support interworking between the IMS and IP SIP networks supporting IP version 4.

Mx reference point: The Mx reference point is not specified within this release of the specification.

Ix reference point: The Ix reference point is not specified within this release of the specification.

6.4.1 Interworking functional entities

6.4.1.1 IMS-ALG

It is an application specific functional entity that allows an IPv6 node to communicate with an IPv4 node and vice versa when certain applications carry network addresses in the payloads like SIP/SDP. For IMS, an IMS ALG provides the necessary application function for SIP/SDP protocols in order to communicate between IPv6 and IPv4 SIP applications.

6.4.1.2 TrGW

TrGW is a NAT-PT/NAPT-PT and uses a pool of globally unique IPv4 addresses for assignment to IPv6 nodes on a dynamic basis as sessions are initiated across the IP version boundaries. NAT-PT binds addresses in IPv6 network with addresses in IPv4 network and vice versa to provide transparent routing between the two IP domain without requiring any changes to end points. NAPT-PT provides additional translation of transport identifier (TCP and UDP port numbers). More detailed information on the NAT-PT/NAPT-PT is given in RFC 2766 [11] and RFC 2663 [12].

7 Control plane interworking

7.1 SIP with 3GPP Profile to Standard SIP Interworking

3GPP TS 24.229 [1] defines the procedures on a 3GPP-IMS UE to be able to connect to a standard SIP terminal.

8 User Plane Interworking

8.1 Overview

The present specification addresses user plane interworking between codec types used for either speech or video. Codecs used for conversational services in the PS domain are as defined in 3GPP TS 26.235 [6]. Codecs of particular interest are described in annex A

8.2 Transparent User Plane

The user plane may be transported through the IM CN subsystem without being processed by any IM CN subsystem entity.

8.3 Non Transparent User Plane

The MRFP may provide transcoding of the user plane if a codec mismatch occurs.

9 IP Version Interworking at the IMS-ALG/TrGW

9.1 Control plane interworking

9.1.1 Originating Session Set-up to IPv4 SIP network

9.1.1.1 Receipt of the first SDP offer

At the receipt of the first SDP offer the IMS-ALG:

- Provides to the TrWG the IPv6 address(es) and port number(s) as received in the c-line(s) and m-line(s) in the SDP.
- Requests the TrGW to bind corresponding IPv4 address(es) from its pool and port number(s) to the received IPv6 address(es) and port number(s) to enable the routing of user plane traffic through the TrGW.

When the IMS-ALG has received the requested information from the TrGW the IMS-ALG shall include the IPv4 addresses and port send a new offer to the IPv4 network. The IMS-ALG shall create a SIP message in accordance with the rules of a Back-to-Back User agent as described in TS 24.229 [1] with the following clarification:

- The IPv4 address(es) and port number(s) shall replace the IPv6 address(es) and port number(s) in the SDP.
- The IMS-ALG shall create a Record-Route header containing its own SIP URI.

9.1.1.2 Receipt of the first SDP answer

At the receipt of the first SDP answer from the IPv4 network the IMS-ALG:

- Provides to the TrGW the IPv4 address(es) and port number(s) as received in the c-line(s) and m-line(s) in the SDP.
- Requests the TrGW to bind the corresponding IPv6 address(es) and port number(s) to the received IPv4 address(es) and port number(s) to enable the routing of user plane traffic through the TrGW.

When the IMS-ALG has received the requested information, the IMS-ALG shall send an SDP answer to the IPv6 network. The IMS-ALG shall create the SIP message in accordance with the rules of a Back-to-Back User agent as described in 3GPP TS 24.229 [1] with the following clarification:

- The IPv6 address(es) and port number(s) shall replace the received IPv4 address(es) and port number(s) in the SDP.

9.1.2 Terminating Session set-up from IPv4 SIP network

9.1.2.1 Receipt of an SDP offer

At the receipt of the first SDP offer the IMS-ALG:

- Provides to the TrGW the IPv4 address(es) and port number(s) as received in the c-lin(es) and m-lin(es) in the SDP.

- Requests the TrGW to bind the corresponding IPv6 address(es) and port number(s) to the received IPv4 address(es) and port number(s) to enable the routing of user plane traffic through the TrGW.

When the IMS-ALG has received the requested information from the TrGW the IMS-ALG shall send an SDP offer to the IPv6 network. The IMS-ALG shall create a SIP message in accordance with the rules of a Back-to-Back User agent as described in 3GPP TS 24.229 [1] with the following clarification:

- The IPv6 address(es) and port number(s) shall replace the received IPv4 address(es) and port number(s) in the SDP.

- The IMS-ALG shall create a Record-Route header containing its own SIP URI if the SIP message is a request.

9.1.2.2 Receipt of SDP answer

At the receipt of a SDP answer from the IPv6 network the IMS-ALG:

- Provides to the TrGW the IPv6 address(es) and port number(s) as received in the c-line(s) and m-line(s) in the SDP.

- Requests the TrGW to bind the corresponding IPv4 address(es) and port number(s) with the received IPv6 address(es) and port number(s) to enable the routing of user plane traffic through the TrGW.

When the IMS-ALG has received the requested information, the IMS-ALG shall send a SDP answer to the IPv4 network. The IMS-ALG shall create the SIP message in accordance with the rules of a Back-to-Back User agent as described in 3GPP TS 24.229 [1] with the following clarification:

- The IPv4 address(es) and port number(s) shall replace the received IPv6 address(es) and port number(s) in the SDP.

9.1.3 Change of connection information

After the dialog is established it is possible for both ends of the session to change the connection data for the session. When the IMS-ALG/TrGW receives a SDP offer/answer where port number(s) or IP address(es) is included. There are four different possibilities:

1) IP address(es) or/and port number(s) have been added. In this case additional binding(s) shall be provided;

2) IP address(es) or/and port number(s) have been deleted. In this case binding(s) shall be made free;

3) IP address(es) and port number(s) have been reassigned of the users. In this case the binding(s) shall reflect the reassignment;

4) No change has been made to the IP address(es) and port number(s). In this case no change shall be made to the existing binding(s).

9.1.4 Release of the session

At the receipt of BYE, CANCEL request or non 200 final responses the IMS-ALG shall release the session and request the TrGW to release the bindings established for the session.

9.2 User plane transport

The TrGW shall use the established bindings described above to transport the messages between the IPv6 network and IPv4 network in the following way.

At the receipt of a payload message the TrGW shall:

- Replace the received IPv4 address(es) and port number(s) in the payload message with the corresponding IPv6 address(es) and port number(s).
- Replace the received IPv6 address(es) and port number(s) in the payload message with the corresponding IPv4 address(es) and port number(s).

Annex A (informative): Codecs used for Conversational Services

Codecs used for Conversational Services For codecs for conversational services in the PS domain are defined according to 3GPP TS 26.235 [6]. These include:

- Narrowband speech: The support of the AMR codec is mandated.
- For wideband speech: The support of the AMR-WB codec is mandated
- For video: The support of the H.263 profile 0 level 10 v1 is mandated, and the support of MPEG4 visual sp @ level 0 and ITU-T Recommendation H.263 [14] profile 3 level 10 are optional.

In non-3GPP SIP networks there are no mandatory codecs. However, the following codecs are of interest:

- Narrowband speech: ITU-T Recommendations G.723.1 [15], G.729 [16] and G.711 [17]are known to be commonly deployed.
- Video codecs: ITU-T Recommendation H.263 [14] and MPEG4 are expected to be used.

Annex B (informative): Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
2001-02					Version 0.0.0 Presented to CN3 #16 - Sophia Antipolis - Initial Proposal - TS 29.162 number allocated by MCC		0.0.0
2001-05					Tdocs N3-010226 and N3-010200 agreed at CN3#17 - Rio Grande, Puerto Rico		0.1.0
2001-10					Tdoc N3-010331 agreed at CN3#18 - Dresden, Germany	0.1.0	0.2.0
2001-10					Revised TS based on decision within CN3#19 to reduce the scope of Work Item - as proposed in Tdoc N3-010425. Clean version based on changes agreed in N3-010479 at Cn3#19 -Brighton, UK.	0.2.0	0.3.0
2001-11					Added informative Annex A about interworking between IPv4 and IPv6, as agreed in Cn3#20 Cancun.	0.3.0	0.4.0
2002-01					Included N3-020094, N3-020104, and tidied editors notes.	0.4.0	0.5.0
2002-02					Editorial changes agreed in CN3#21, Sophia Antipolis.	0.5.0	0.6.0
2002-02					DAB, MCC some minor editorials	0.6.0	0.6.1
2002-03					Presented as v1.0.0 to TSG#15 for information	0.6.1	1.0.0
2002-08					Editorial changes agreed in CN3#33, Sophia	1.0.0	1.1.0
2002-09					Editorial corrections made to ensure alignment with 3GPP drafting rules	1.1.0	1.1.1

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