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Universal Mobile Telecommunications System (UMTS);
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Service requirements for the Internet Protocol (IP)
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Stage 1
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Contents

Foreword

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

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1 Scope

This TS defines the service requirements from users' and operators' perspective for the support of IP multimedia applications through the IMS.

IP multimedia applications are supported by IP multimedia sessions in the IM CN Subsystem. IP multimedia sessions use IP connectivity bearers (e.g. GPRS as a bearer). Examples of IP multimedia applications include speech communication, real time multimedia applications, shared online whiteboards etc.

This TS, in general, does not standardise usage of IP multimedia applications, but instead identifies the requirements to enable their support.

In order to align IP multimedia applications wherever possible with non-3GPP IP applications, the general approach is to adopt non-3GPP IP based solutions.

The existing legacy tele- and supplementary services shall not be re-standardised as IP multimedia applications, and multimedia equivalent applications may be created with toolkits.

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*.

2.1 Normative references

[1] 3GPP TS 22.003: "CS Teleservices supported by a PLMN".

[2] Void

[3] Void

[4] Void

[5] 3GPP TS 22.101: "Service principles".

[6] Void

[7] 3GPP TS 22.146: "Multimedia Broadcast/Multicast Service; Stage 1"

[8] Void

[9] IETF RFC 3261: "SIP: Session Initiation Protocol"

[10] 3GPP TS 22.078: "Customised Applications for Mobile network Enhanced Logic (CAMEL); Service definition – Stage 1"

[11] 3GPP TS 22.057: "Mobile Execution Environment (MexE); Service description, Stage 1"

[12] 3GPP TS 22.038: "USIM/SIM Application Toolkit (USAT/SAT); Service description; Stage 1"

[13] Open Mobile Alliance (OMA): OMA-RD-Parlay_Service_Access-V1_0-20100427-A

[14] 3GPP TR 21.905: "Vocabulary for 3GPP specifications"

[15] IETF RFC 3966: "The tel URI for Telephone Numbers"

[16] 3GPP TS 22.240: "Stage 1 Service Requirement for the 3GPP Generic User Profile (GUP)"

[17] ETSI ETS 300 284: "Integrated Services Digital Network (ISDN); User-to-User Signalling (UUS) supplementary service; Service description"

[19] ETSI TS 102 424: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Requirements of the NGN network to support Emergency Communication from Citizen to Authority"

[20] 3GPP TS 22.173: "Multimedia Telephony Service and supplementary services"

[21] 3GPP TS 31.103: "Characteristics of the IP Multimedia Services Identity Module (ISIM) application".

[22] IETF RFC 5039: "The Session Initiation Protocol (SIP) and Spam" http://www.ietf.org/rfc/rfc5039.txt?number=5039

[23] IETF RFC 5631: "Session Initiation Protocol (SIP) Session Mobility" http://www.ietf.org/rfc/rfc5631.txt?number=5631

[24] 3GPP TS 23.228: "IP Multimedia Subsystem (IMS); Stage 2".

[25] 3GPP TS 22.081: "Line Identification supplementary services; Stage 1"

[26] ITU-T Recommendation E.164: "The international public telecommunication numbering plan".

[27] Void

[28] Open Mobile Alliance (OMA): OMA-AD-Push-V2.3-20111122-A.pdf

[29] IANA language (http://www.iana.org/assignments/language-subtag-registry/)

[30] Void

[31] Void

[32] IETF RFC 7478: "Web Real-Time Communication Use-cases and Requirements" https://tools.ietf.org/html/rfc7478

[33] 3GPP TS 22.519: "Business Communication Requirements"

2.2 Informative references

[18] GSMA PRD IR.34: "Inter-Service Provider IP Backbone Guidelines"

[33] ETSI TR 180 003: "TISPAN; Technical Report on NGN National IP Interconnection"

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [14] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [14].

Access independence: the ability for the subscribers to access their IP Multimedia services over any access network capable of providing IP-connectivity, e.g. via:

- 3GPP accesses (e.g. E-UTRAN, UTRAN, GERAN)
- Non 3GPP accesses with specified interworking (e.g. WLAN with 3GPP interworking, DOCSIS®, WiMAX™ and cdma2000® access)
- Other non 3GPP accesses that are not within the current scope of 3GPP (e.g. xDSL, PSTN, satellite, WLAN without 3GPP interworking)

Conference: An IP multimedia session with two or more participants. Each conference has a "conference focus". A conference can be uniquely identified by a user. Examples for a conference could be a Telepresence or a multimedia game, in which the conference focus is located in a game server.

Telepresence: A conference with interactive audio-visual communications experience between remote locations, where the users enjoy a strong sense of realism and presence between all participants by optimizing a variety of attributes such as audio and video quality, eye contact, body language, spatial audio, coordinated environments and natural image size.

Telepresence System: A set of functions, devices and network elements which are able to capture, deliver, manage and render multiple high quality interactive audio and video signals in a Telepresence conference. An appropriate number of devices (e.g. cameras, screens, loudspeakers, microphones, codecs) and environmental characteristics are used to establish Telepresence.

Conference Focus: The conference focus is an entity which has abilities to host conferences including their creation, maintenance, and manipulation of the media. A conference focus implements the conference policy (e.g. rules for talk burst control, assign priorities and participant's rights).

Domain Name Owner: The entity that is noted in the Internet (i.e. ICANN or one of its subsidiaries) as owning the Domain Name.

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

IMS Inter UE Transfer: Transfer at the IMS-level of all or some of the media components of an IMS session between UEs under the control of the same end-user while maintaining service continuity.

IMS Network-Independent Public User Identity (INIPUI): A Public User Identity in the form of a SIP URI where the Domain Name part is a Shared Domain Name.

IMS Network-Independent Public User Identity (INIPUI) User: An entity that is identified by an IMS Network-Independent Public User Identity.

IMS Network-Independent Public User Identity (INIPUI) Host: The entity that hosts and manages the INIPUIs.

IMS Network-Independent Public User Identity (INIPUI) Registry: An entity that provides mapping of IMS Network-Independent Public User Identities and IMS NNI-Routable Identifiers.

IMS Network-Independent Public User Identity (INIPUI) Operator: An IMS operator who provides IMS-based Services for a Shared Domain Name.

IP multimedia application: an application that handles one or more media types simultaneously such as speech, audio, video and data (e.g. chat text, shared whiteboard) in a synchronised way from the user's point of view. A multimedia application may involve multiple media streams of the same or different types multiple parties, multiple connections, and the addition or deletion of resources within a single IP multimedia session. A user may invoke concurrent IP multimedia applications in an IP multimedia session.

IP multimedia service: an IP multimedia service is the user experience provided by one or more IP multimedia applications.

IP multimedia session: an IP multimedia session is a 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.

Personal mobility: This is the mobility for those scenarios where the user changes the terminal used for network access at different locations. The ability of a user to access telecommunication services at any terminal on the basis of a personal identifier, and the capability of the network to provide those services delineated in the user's service profile.

Source: ITU-T NGN Focus Group.

NOTE: Personal mobility is sometimes referred to as User mobility. User mobility is defined as the user having the capability to be able to move to different physical locations and use a terminal. In today's world there are examples of this already implemented. For example a user can travel around the world and use the public fixed line telephone network to be able to receive either all of the services that they would receive from their home fixed line telephone, or a limited number of services. Primarily the minimum service is the ability to make a voice call. Likewise a user can connect to their email by making use of internet cafes

etc. The similarity of both cases is that the user is being provided with a terminal/device to gain access to there service. As for identification, the user has no unique identity in terms of the access network.

Shared Domain Name: The domain name in the IMS Network-Independent Public User Identity, and which is served by multiple IMS Operators.

Spoofed call: A call where caller identity creation, modification or removal in call signalling results in an unauthorized or illegal use of this identity in the call., This typically occurs where the caller intends to defraud the called user or otherwise illegally obscure the real caller identity.

Terminal Mobility: This is mobility for those scenarios where the same terminal equipment is moving or is used at different locations. The ability of a terminal to access telecommunication services from different locations or while in motion, and the capability of the network to identify and locate that terminal.

Source: ITU-T NGN Focus Group.

NOTE: Terminal Mobility is an extension of User Mobility, although it is possible to have Terminal Mobility without User Mobility. Terminal Mobility is defined as the terminal having the ability to be moved to different physical locations and provide the user access to their services by one or more different access methods.

Unsolicited Communication: Unsolicited Communication (UC) denotes bulk communication in IMS where the benefit is weighted in favour of the sender. In general the receiver(s) of UC do not wish to receive such communication. UC may comprise of, e.g., "SPam over IP Telephony (SPIT)" [22] or "SPam over IP Messaging (SPIM)".

Web Real-Time Communications (WebRTC): A set of browser extensions enabling web applications to define real-time services.

WebRTC IMS client: A WebRTC client that allows a user to access IMS services from a device that supports a WebRTC-capable browser.

Further definitions are given in 3GPP TR 21.905 [14].

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [14] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [14].

DOCSIS®	Data Over Cable Service Interface Specifications
INIPUI	IMS Network Independent Public User Identity
WebRTC	Web Real-Time Communications
WiMAX™	Worldwide Interoperability for Microwave Access

Note: WiMAX™ is a trademark of the WiMAX Forum
DOCSIS® is registered trademark of Cable Television Laboratories, Inc.
cdma2000® is a registered trademark of the Telecommunications Industry Association (TIA-USA)

4 Introduction

IP has opened up a whole range of communication applications, which may allow operators to develop totally new value added applications as well as to enhance their existing solutions. The open architecture and platforms supported by IP and operating systems may lead to applications and new opportunities that are more difficult to replicate using a standard switched centralised solution.

A complete solution for the support of IP multimedia applications (including voice communications) shall be available. The solution consists of UEs, GERAN or UTRAN radio access networks and GPRS evolved core network. One of the main objectives for 3GPP specifications is to ensure that the availability and behaviour of these IP applications when used via the 3GPP mobile access is at least as good as when used via other mobile access types.

5 High level requirements

Support for IP multimedia sessions shall be provided in a flexible manner to allow operators to differentiate their services in the market place as well customise them to meet specific user needs. This shall be provided by the use of service capabilities in both networks and terminals, including both Personal Mobility and Terminal Mobility, for the creation and support of IP multimedia applications.

The following high level requirements shall be supported for IP multimedia applications:

- Negotiable QoS for IP multimedia sessions both at the time of a session establishment as well as during the session by the operator and the user
- Negotiable QoS for individual media components in an IP multimedia session both at the time of establishing a media component as well as when the media component is active by the operator and the user
- End to end QoS for voice at least as good as that achieved by the circuit-switched wireless systems shall be enabled
- Support of roaming, negotiation between operators for QoS and for Service Capabilities is required. Such negotiation should be automated rather than manual, e.g., when another operator adds new service capabilities.
- Support of roaming and interconnection shall include the capability for media to be routed optimally between IMS operators, i.e. according to criteria set by the operators.
- Possibility for a network operator to implement IP Policy Control for IP multimedia applications.
- IP multimedia sessions shall be able to support a variety of different media types. A set of media types shall be identified to ensure interoperability (e.g. default codec selection and header compression).
- Within each IP multimedia session, one or more IP multimedia applications shall be supported. It shall be possible to support multiple IP multimedia applications to efficiently provide a coherent and consistent IP multimedia service experience. Such support involves identifying which applications are invoked per subscriber, understanding the appropriate order of the set of applications, and resolving application interactions during the session.
- The possibility for IP multimedia applications to be provided without a reduction in privacy, security, or authentication compared to corresponding packet switched and circuit switched services.
- IMS shall be capable to provide transcoding (at least for voice sessions) where needed when two UEs do not support a common codec.
- Interconnection between two IMS domains shall be supported.

Note: see also Section 10

- Roaming shall be supported enabling users to access IP multimedia services provisioned by the:
  - Home Environment
  - Serving Network
- The principle of access independence shall be supported. It is desirable that an operator should be able to offer services to their subscribers regardless of how they obtain an IP connection (e.g. E-UTRAN, UTRAN, GERAN, fixed lines, LAN, DOCSIS®, WiMAX™ and cdma2000® access).

Note: Access independence principle can only be ensured by 3GPP for the access technologies 3GPP has defined or has defined specific interworking.

- It shall be possible for the users to access IM CN via an IP connection (e.g. GPRS, fixed lines, LAN) with Network Address Translation (NAT) deployed.
- IM CN should provide support for the users to access IM CN through a Firewall (FW) with configuration restrictions (e.g. only HTTP allowed, port range limitation) deployed outside operators' domain.

- It shall be possible to support session-related internet applications that have been developed outside the 3GPP community.

- It shall be possible to limit the view of an operator's network topology to authorised entities.

- It shall be possible to support the multiple UEs associated with a single IMS service subscription. It shall be possible to share one Public User Identity between multiple UEs. It shall also be possible to identify the individual UEs with separate Public User Identities. IMS shall be able to route sessions towards the identified UE(s), e.g. based on UE capability, User preference and/or Network preferences.

- It shall be possible for a service to identify and interact with a specific UE even when multiple UEs share the same single Public User Identity. A UE shall be capable to identify and interact with a specific UE even when multiple UEs share the same single Public User Identity, except when the UE supports only limited capabilities and thus is unable to become engaged in a service that requires such functionality. Examples include a telemetry-only capable UE that only supports the capabilities for point-to-point communication.

- The IMS shall support a mechanism to provide configuration parameters and obtain operational status of the UE. This includes the ability to provide software upgrade, service configuration, and collect operational status. According to operator policies this information may be provided to applications.

- The IMS shall be capable to access user location information, whether the user is roaming or not. According to operator policies this information may be provided to applications.

- Where required (e.g. by regulation) the IMS shall provide the capability for the user to indicate to the network that a communication is malicious.

Note: see also MCID in [20].

- Where required (e.g. by regulation) the IMS shall provide the capability for the network, on behalf of the user, to reject incoming communications from users who have restricted the presentation of their originating identity.

Note: see also ACR in [20].

- The IMS shall support the capability of enabling early media for an IMS multimedia session. The capability for such early media shall be applied towards both calling and called user.

Note: Early media refers to media (e.g., audio and video) that is exchanged before a particular session is accepted by the called user.

- The IMS shall have mechanisms available to control overload that:

  1) automatically maximize effective throughput (i.e. admitted service requests/sec) at an overloaded resource.

  2) achieve this throughout the duration of an overload event, and irrespective of the overloaded resource's capacity or of the number of sources of overload;

  3) are configurable by the service provider so that, under processing overload, a high proportion of response times at overloaded resources are low enough so as not to cause customers to prematurely abandon service requests;

  4) should be possible to be applied within a service provider's IMS, and between different service providers' IMSs;

  5) should be possible to be applied within an IMS subsystem and between different IMS subsystems.

NOTE: As a general rule, an IMS's call, session and command processing resources can experience prolonged processing overload under the appropriate circumstances (e.g. partial, or full, server failure, high rates of incoming service requests). Consequently, it needs to be equipped with some form of overload detection and control (including expansive controls such as load balancing and resource replication), in order to keep response times just low enough under such processing overload to preclude customers abandoning their service requests prematurely.

6 Standardised service capability approach

IP multimedia applications shall, as a principle, not be standardised, allowing operator specific variations. It shall be possible to enable rapid service creation and deployment using service capabilities.

It is important that commercially available IP multimedia applications are supported. In general compatibility shall be with these IP multimedia applications instead of building 3GPP-specific solutions.

The following options shall be available in the 3GPP standards to enable service delivery:

- an architectural framework shall be created that enables maximum flexibility in the end user device and network servers, similar in concept to that used in the Internet.

  This framework shall enable an operator to efficiently deploy IP multimedia applications in a network-agnostic manner without having to wait for these applications or additional enabling technology, to be standardised in 3GPP.

- service capabilities (enhanced to control IP multimedia applications), which will allow IP multimedia applications to be deployed in a vendor independent manner

  CAMEL [10], MExE [11], SAT [12] and OSA [13], should be improved to support IP multimedia applications, e.g. additions to APIs, service capability features, service capability servers, user profile etc.

- the IM CN Subsystem user related data to be stored in a standardised format and to be managed and accessed using standardised mechanisms of the 3GPP Generic User Profile (GUP) [16].

- mechanisms which allow the network or the application to understand the limitations of the mobile and thereby take appropriate actions.

Note: There is a concern that with a large variety of toolkits to create applications, service interworking between terminals and networks may be compromised and needs to be addressed.

7 User service requirements

IP multimedia sessions provide the ability for users to invoke IP multimedia applications to send and receive (where applicable) voice and data communications, even when roaming. This includes interworking with existing voice and data networks for both fixed (e.g. PSTN, ISDN, internet etc.) and mobile users.

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

It shall be possible to have basic voice calls between IMS users and users in CS domain/PSTN-style networks. When an IM session originates or terminates in a CS telephony call, the experience of the CS telephony network user should not substantially differ from that of a call between two CS telephony network users in terms of aspects such as the delay to set-up communications and the total permissible delay in transporting speech between the end users. The IM CN subsystem does not necessarily have to support all services offered by the CS telephony network.

7.1 Identifying IP multimedia application subscriptions

There is no requirement to support standardised subscription mechanisms for IP multimedia applications.

IP multimedia applications may require to be provisioned and configured by users and operators. Since the source and variety of IP multimedia applications may not be standardised, the specific feature codes to provision, enable and configure IP multimedia applications may not be standardised either. .

Note: The standardised service capabilities, personalised Internet web pages and evolving IP mechanisms may be used to allow user (self) provisioning, configuration and enabling of IP multimedia applications.

7.2 Access to the IM CN subsystem

7.2.0 General

IMS, complying with the principle of access independence, supports IP multimedia applications via IP multimedia sessions over a multitude of IP Connectivity Access Networks. These include e.g. E-UTRAN, UTRAN, GERAN, fixed line, I-WLAN, DOCSIS®, WiMAX™, cdma2000®, and DVB-RCS2 access.

7.2.1 Access control

The IM CN subsystem shall be able to verify at any time that the user is entitled to use the resources of the IM CN subsystem.

7.2.2 IMS Registration and De-registration

In order to be able to access services from the IM CN Subsystem a UE shall register on the IM CN Subsystem.

- A UE that supports IMS shall be able to register on the IM CN Subsystem.
- A UE may support automated IMS registration, e.g. when gaining access to the PS domain.
- For fixed line, the IM CN subsystem shall support control of UE registration based on network information which is related to UE location (e.g. IP address, DSLAM information, etc). The registration control shall be based on subscription information which indicates whether registration control applies and to which location registrations are to be restricted.
- A UE that supports IMS shall be able to de-register from the IM CN Subsystem.
- The network operator shall be able to de-register a UE from the IM CN Subsystem.

7.3 Capability negotiation

The IMS shall provide the capability for IP multimedia applications (whether it is an application of a user or the network) to negotiate their capabilities to identify and select the available media components, QoS etc. of IP multimedia sessions. It shall be possible for the capability negotiation to take place on invocation, acceptance and during an IP multimedia session (e.g. following a change in UE capabilities, change in media types etc.). Capability negotiation may be initiated by the user, operator or an application on behalf of them.

In order to support the user's preferences for IP multimedia applications, the capability negotiation shall take into account the information in the user profile whenever applicable. This includes the capability to route the IP multimedia session to a specific UE, when multiple UEs share the same IMS service subscription. In the Telepresence case, this may also include the UE capability for handling media, e.g. UE profile (screen size, number of screens and cameras, etc.). The IMS shall provide the capability for IP multimedia applications to exchange information about negotiated media components so that a sending system, receiving system, or intermediate system can make decisions about transmitting, selecting, and rendering media streams (e.g., decide which video stream is to be displayed on the left screen or how audio stream is to be rendered on the loudspeaker to maintain the spatial effect if multiple media streams are exchanged).

7.4 Redirecting of IP Multimedia sessions

The IMS shall support the capability for the user, or the network on behalf of the user, to identify an alternative destination for an IP multimedia session or individual media of an IP multimedia session. Redirection to alternative destinations may be initiated by the sending party, receiving party or the network on their behalf. It shall be possible for redirection to be initiated at various stages of an IP Multimedia session. For example:

- Prior to the set up of an IP Multimedia session
- During the initial request for an IP Multimedia session
- During the establishment of an IP Multimedia session
- While the IP Multimedia session is ongoing

Redirection can be applied for all Multimedia sessions unconditionally or it can be caused by any of a set list of events or conditions. Typical causes could be:

- Identity of the caller
- Location or presence of the calling or called party
- If the called party is already in a session
- If the called party is unreachable or unavailable in some other way
- If the called party does not respond
- After a specified alerting interval
- User's preference on routing for specific IP Multimedia session based on the capabilities of multiple UEs sharing the same IMS service subscription.
- Time of day.

There are other causes that could be applied that do not require standardisation.

7.5 Invoking an IP multimedia session

7.5.0 General

The user shall be able to invoke one or more IP multimedia sessions. The user shall also be able to activate concurrent IP multimedia applications within each IP multimedia session.

7.5.1 Identification and addressing

Subscribers within the IMS shall be identifiable in originating and terminating sessions by means of one or multiple Public User Identities. The Public User Identity shall:

- be able to be assigned to more than one Private User Identity;
- be administered by the network operator and not be changeable by the user; and
- be globally reachable.

The Private User Identity shall be able to be assigned to more than one Public User Identity.

Both telecommunication numbering and Internet addressing schemes shall be supported as Public User Identities.

The Public User Identity shall utilise either the SIP URI scheme (as defined in IETF RFC 3261 [9]) or the Tel URI scheme (as defined in IETF RFC 3966 [15]).

Both SIP URIs and Tel URIs can be used to convey E.164 [26] numbers;

- The network operator shall be able to use in the Public User Identity either the same E.164 [26] number used for CS speech telephony (TS11 [1]) or a different E.164 number.

Both telecom and internet numbering and addressing schemes shall be supported as public identities. IP multimedia communication establishment (both originating and terminating) depending on originator shall be able to be based on E.164/TELURI (e.g. tel:+4412345678) [15]or SIP URI (sip:my.name@company.org) [9]. It shall be possible to assign several public identities for one subscription.

Whilst not required for routing between terminals within the IMS, it should be possible for the IMS network to:

- recognise and treat URIs, containing 'IM' or 'Pres' prefixes, received from other networks supporting such prefixes; and
- insert an 'IM', 'Pres' or 'mailto' prefix to an outgoing URI to enable routing to the correct addressee in external networks supporting such prefixes.

It shall be possible for the network operator to guarantee the authenticity of a Public User Identity presented for an incoming session to a user where the communication is wholly across trusted networks.

Note 4: This is equivalent to the calling line presentation services CLIP [25] in the telephony networks.

A terminating IMS entity may receive the original destination identity provided by the originating entity.

Note 5: This enables the address originally input by the subscriber to be available at the destination even when it has been translated e.g. from a free phone or premium rate service identifier.

7.5.2 Negotiation at IM session invocation

It shall be possible for the capability negotiation to take place at the time of the IP multimedia session invocation. Refer to clause 7.3 for further details on capability negotiation on IP multimedia session invocation.

A UE should support negotiation of the user's desired language(s) (as defined in IANA [29]) and modalities for spoken, signed and written languages.

The system should be able to negotiate the user's desired language(s) and modalities, per media stream and/or session, in order of preference.

A service provider shall be able to pass language and modality information between the endpoints. With respect to the language and modality information, there are no other service provider actions required.

7.5.3 Emergency communications

The requirements for Emergency communications are contained in [5] for PLMN specified by 3GPP and in [19] for NGN broadband accesses.

7.5.4 Information of a Called Party

A calling party (A) shall be able to request information regarding

- whether the called party (B) is a premium rate number or international number,
- the HPLMN of the called party (B).

Based on the information, the calling party (A) could exercise the option of either continuing or terminating the call.

The HPLMN of the calling party (A) shall be able to provide information to a calling party (A) regarding

- whether the called party (B) is a premium rate number or international number,
- the HPLMN of the called party (B). In case of INIPUI, the HPLMN of the calling party (A) shall be able to retrieve the information about the HPLMN of the called party (B).

Based on the information provided, the calling party (A) could exercise the option of either continuing or terminating the call.

7.5.5 IMS Network-Independent Public User Identities (INIPUI)

The following requirements apply for IMS Network-Independent Public User Identities:

- Multiple INIPUI Operators shall be able to associate SIP URIs of type "sip:user@domain" (also known as "alphanumeric SIP URIs") that share a single domain name.
- An INIPUI Operator shall be able to associate a SIP URI scheme for a domain name that has other URI schemes from different service providers.

Note 1: This allows customers who use an INIPUI Operator in one geographic region to use another INIPUI Operator in another region without affecting the domain name used (which may be part of a corporate branding), as well as choose a different service provider for different service offerings e.g. different IMS operator compared to their email provider.

Note 2: Provisioning of the INIPUI Registry for a particular Shared Domain Name is done by a single entity, the INIPUI Host. This ensures the uniqueness of the username, when assigned by different INIPUI operators, within a Shared Domain Name. The INIPUI Host also needs to ensure each INIPUI provisioned in the INIPUI Registry is authorised by the Domain Name Owner.

- The IMS shall support a mechanism for an INIPUI User to be globally reachable by any subscriber, regardless of whether the originating operator supports INIPUI. In addition, an IMS operator that is serving inbound roaming INIPUI Users shall not be required to support any additional configuration on top of what already exists.

- The IMS shall support the use of INIPUI as an IMS identity between the calling User and their INIPUI Operator.

- The use of INIPUI shall be transparent to the UE and therefore INIPUIs shall be usable by pre-Release 11 UEs, subject to the UE support of alphanumeric SIP URI.

- When the user enters the INIPUI of the called party, the UE shall display the INIPUI that was entered, subject to the UE display capability. In case of Terminating Identification Presentation (TIP), the INIPUI of the terminating party shall be displayed according to the requirements in TS 22.173 [20].

- The IMS shall support passing of an INIPUI of the originating user and the INIPUI shall be displayed as CLI to the called party, subject to the UE display capability.

- An originating operator shall be able to request an INIPUI address resolution to be performed by an intermediate network and to receive the result of the INIPUI address resolution from that intermediate network prior to routing the session.

- An intermediate network shall be able to service INIPUI address resolutions received from an originating operator by querying the INIPUI Registry. The intermediate network shall then be able to provide the resolved INIPUI address to the originating operator.

Note: The above two requirements allow the originating operator to decide how to route the session (e.g. itself or via an intermediate network).

- An entity accessing an INIPUI Registry to resolve an INIPUI shall provide the INIPUI Registry with the identity of the operator that is the source of the query in addition to its own identity. An entity accessing an INIPUI Registry for provisioning purposes shall provide the INIPUI Registry with its own identity.

The above may be subject to regulatory requirements.

7.5.6 Void

7.6 Handling of an incoming session (by the terminating entity)

7.6.1 Automatic re-routing

IMS shall provide the capability to handle communications rejected (e.g. due to unavailability of PSTN/ISDN resources) using re-routing.

7.6.2 Presentation of session originator identity

The IMS shall present the identity of the session originator (see 7.5.1). The network shall suppress the presentation of the identity when requested by the session originator.

Operator policies (e.g. requirements for support of emergency communications) may over-ride the user request for suppression.

The results of any spoofed call detection which is applied to the session originator identity by the terminating IMS, shall be presented to the user based on operator policies. This spoofed call detection results presentation may be independent of the suppression of session originator identity presentation.

7.6.3 Negotiation of an incoming session

Interaction with the user profile shall be supported, and additionally direct interaction with the user may be required. Refer to clause 7.3 for further details on capability negotiation on an incoming IP multimedia session.

7.6.4 Accepting or rejecting an incoming session

It shall be possible for the user to either accept, reject, ignore or re-direct an incoming IP multimedia session. Further, it shall also be possible for the user to accept only a subset of the offered media, not have any of the media offered to him at all etc.

7.6.5 Handling of an incoming session addressed to an unallocated identity

In case of an incoming session addressed to an identity administered by the operator but not allocated to a user or a service, the IMS shall be able to reject, re-route or trigger service logic to that incoming session.

7.6.6 Differentiated paging for voice over E-UTRAN termination attempts

More efficient radio resource usage can be achieved by using a more aggressive paging profile for voice over E-UTRAN services than for other services using the IMS signaling bearer, requiring a distinction to be made between voice over E-UTRAN and non-voice over E-UTRAN traffic.

As a network option, the IMS shall support a mechanism to enable a different paging policy for voice over E-UTRAN vs non-voice over E-UTRAN services in EPC access.

7.7 Handling of an ongoing session

7.7.1 User modification of media in an ongoing session

The user shall be able to negotiate the addition or deletion of media components of IP multimedia applications during an IP multimedia session. Refer to clause 7.3 for further details on capability negotiation during an IP multimedia session.

7.7.2 Suspending and resuming of an ongoing session

It shall be possible for the user to suspend an IP multimedia session, and resume that IP multimedia session at a later time.

7.7.3 Presentation of identity of connected-to party of a session

It shall be possible to present to the originator of a session the identity of the party to which she is connected (see 7.5.1).

However, the connected-to party shall be able to request that her identity is not revealed to the originator of the session.

Operator policies (e.g. requirements for support of emergency communications) may over-ride the user request for suppression.

7.8 Ending a session

The user shall be able to end an IP multimedia session at any time during the session. The network may end an IP multimedia session at any time during the session (e.g. in failure conditions).

7.9 Void

7.10 Handling of conferences

7.10.1 General

Conferences allow users participating in the conference to communicate with all other participants simultaneously. A conference has a "conference focus" that controls the conference.

Note: A user participating in the conference, depending on the conference policy, might be allowed to communicate with the focus e.g. to request invitation of another user into the conference.

7.10.2 User requirements

7.10.2.1 General

The following minimum user requirements for conferences exist:

- A user shall be able to request the creation of a conference.
- A user shall be able to request to join an existing conference.
- A user participating in the conference shall be able to request modification of the conference (e.g. add/remove media, manipulation of data streams, add/remove participants) depending on the conference policy.
- A user participating in the conference shall be able to request termination of the conference, depending on the conference policy.
- A user participating in the conference shall be able to receive information from the conference focus (e.g. participants in conference, participants joining or leaving the conference)
- A user participating in the conference shall be able to transfer the invited participants to other focus aware conference user(s) prior to leaving the conference if that user has invited participants to the conference.
- When a user attempts to join a conference the system shall be able to check that the user is authorized to attend.

7.10.2.2 Telepresence

In addition to the requirements in clause 7.10.2.1, the following apply for Telepresence:

- A user participating in a Telepresence session shall be able to indicate which source to receive from a list of sources (e.g. a user may want the media from camera x, or might want the source chosen by a Voice Activity Detection system). This may occur during session establishment, or at any time during the session.
- A user participating in a Telepresence session shall be able to choose the way received media is composed (e.g. a user may choose a specific camera from the far end, or may want the media to be shown as Picture in Picture).
- A user participating in a Telepresence session shall be able to communicate with others using different types of UEs in the same Telepresence session (e.g. mobile phone, laptop/pc, conference room with a different number of cameras and displays).
- A designated user participating in a Telepresence session shall be able to manage the Telepresence session (e.g. launch a session, manage floor control, etc).
- A user participating in a Telepresence session shall be able to engage in presenting (e.g. slide or media sharing) in real-time.
- A user shall be able to participate in a Telepresence session from a voice only device.
- A user participating in a Telepresence session shall be able to have the same experience whether the Telepresence session is in the same operator network or across networks belonging to different operators.
- A user on network operator A shall be able to participate in the Telepresence session initiated by a user on an enterprise network or a user on network operator B.
- A user on network operator A shall be able to initiate a Telepresence session with other participants from an enterprise network or network operator B.

7.10.3 Network-based Conference Focus

For the case where the "conference focus" is based in the network, the following requirements apply:

- The home network shall be able to provide the "conference focus".
- The visited network shall be able to provide the "conference focus", controlled by the home network, and subject to roaming agreements.

7.11 Handling of multicast services

Multicast services allow IMS users and service providers to send multimedia to a group of IMS users simultaneously in an unidirectional way of communication. The underlying network may be able to support mechanisms that optimize the delivery of multimedia to the individual members of that group (e.g. MBMS [7])

Note: an example for applicability of multicast services could be the IMS based "Push to talk over Cellular" service, that is being standardised by OMA.

- An IMS application located on an application server in the network shall be able to request that multimedia is sent to a group of IMS users, which are specified by this request.

- Depending on the capabilities of the underlying network IMS shall be able to use optimized mechanisms of the network (e.g. multicast capabilities such as MBMS [7]) for the delivery of multimedia to the group of IMS users.

7.12 Support for Local Numbers in the IMS

A number or short code originating from a UE may correspond to a local number based on HPLMN/VPLMN's numbering plan, a service number in the HPLMN/VPLMN, or a private numbering plan.

A number or short code may have a local context indicator (LCI) added to it. The value of an LCI helps the HPLMN to route the call and, if necessary, route the call to the country/VPLMN/private network of origin. The LCI may include:

- access specific information consist of e.g. country code plus network code, country code plus area code, or an identification of a private numbering plan;

- the home domain;

- an indication that UE does not support processing of the dialled string; or

- any other value entered by the user.

If the HPLMN cannot interpret the number or short code based on the included LCI, the HPLMN may apply policies to translate local numbers to globally routable identity and to route the call.

The HPLMN shall analyse the received number and route the call as follows:

- If the number or short code has an LCI, the HPLMN should interpret the short code to a globally routable URI or E.164 [26] number according to the value of the LCI, and then correctly route the call. If the HPLMN is unable to resolve or route the received number then an error message shall be returned to the originating UE.

7.13 User determined user busy

The network shall support the capability of a user to reject an incoming IMS session with an indication of "user busy". This indication may be used by the network as a trigger for certain services e.g. Call Forwarding on Busy. If the session rejection is propagated back to the originator, the "user busy" indication must be provided as the cause of the rejection.

The conditions for user determined "user busy" include:

- the session is offered to a single contact that rejects with a "user busy" indication; or

- the session is offered to multiple contacts with a single public identity, and one contact rejects with a "user busy" indication on behalf of the set of contacts; or

- the session is offered to multiple contacts; and

  - none of the contacts progress the session; and

  - one or more of the contacts rejects with a "user busy" indication.

Note: A contact is e.g. a terminal, a UE, or some other kind of equipment in the user premises.

7.14 IMS Inter-UE Transfer

The IMS shall be able to provide IMS Inter-UE Transfer between:

- different UEs connected via the same IP-CAN,
- different UEs connected via different 3GPP IP-CANs,
- different UEs connected via a 3GPP IP-CAN and a non-3GPP IP-CAN (e.g. fixed line connectivity),
- different UEs connected via different non-3GPP IP-CANs.

In addition the IMS shall be able to provide IMS Inter-UE Transfer from UEs connected via an IP-CAN to ICS entities that provide interworking with UEs in the CS Domain.

Note 1: In this case it might not be possible to retrieve the session after it has been transferred.

Note 2: When interworking with the UEs in the CS domain, the available IUT features are limited by the UE's capabilities.

The following requirements are applicable for IMS Inter-UE Transfer.

- The IMS shall support the capability to transfer/retrieve some or all of the media components to/from different IMS UEs belonging to the same or different user(s) while providing continuous service experience to these users. In order to provide continuous service experience to the user, the receiving IMS UE capabilities (e.g. display resolutions, codecs capabilities, and access network data rate, etc.) shall be taken into consideration and the transferred sessions adapted accordingly.
  - It shall be possible to provide continuous service experience when the session is transferred between IMS UEs of different capabilities.
- It shall be possible to transfer some or all media components to the target IMS UE(s) belonging to the same or different user(s) that are subscribed to the same operator. This can be initiated either directly from the controlling IMS UE or on request from the IMS UE where the media will be transferred.
- It shall be possible to replicate some or all media components to the target IMS UE(s) belonging to the same or different user(s) that are subscribed to the same operator. This can be initiated either directly from the controlling IMS UE or on request from the IMS UE where the media will be replicated.
- Replication / transfer of some or all media components to target IMS UE(s), belonging to the same or to different user(s) that are subscribed to the same operator, shall not be performed when the remote end (e.g. the source of the media) of the session restricts such operation.
- It shall be possible to transfer service control related to all media components to the target IMS UE that belongs to the same user and has subscription with the same operator. This can be initiated either directly from the controlling IMS UE or on request from the IMS UE where the control will be transferred.

Note 3: Transfer of service control and transfer / replication of media components are independent of each other. This means the above requirements include the case where certain media components are transferred / replicated to the target IMS UE(s) whilst the related service control remains in the source IMS UE or is transferred to the target IMS UE, and the case where service control is transferred to the target IMS UE whilst the controlled media components remain in the source IMS UE.

- Inter-UE Transfer shall be subject to operator policy.
- It shall be possible to discover information on ongoing IMS sessions on different IMS UEs belonging to the IUT e.g. available IMS sessions, media components, controller/controllee capability.

IMS shall support the capability to add /delete media components across different UEs belonging to the same or different user(s) that are subscribed to the same operator, while providing continuous service experience to these users.

An IMS user shall be able to control media components of an IMS session between different UEs as following:

- Add new media components to different UEs at session setup and session modification.

- Remove media components of an ongoing multimedia session from different UEs.

IMS shall support the capability to share control of media components among multiple UEs belonging to one or more users that are subscribed to the same operator. Shared control of media components may be exclusive (i.e. only one UE has the control at a time) or simultaneous (i.e. more than one UE has the control at the same time).

It shall be possible for the network to authorise shared control of media components among multiple IMS users.

It shall be possible for the IMS user controlling the session to allow one or more IMS users in the session to share control of media components.

Note 4: Inter-UE transfer use case as defined by IETF can be found in [23].

7.15 Prevention of Unsolicited Communication in IMS (PUCI)

7.15.1 High level requirements

IMS should provide means to identify and act on unsolicited communication.

Solutions for prevention against unsolicited communication shall not have negative impact on the services provided by IMS.

PUCI should provide means for cooperation between operator's networks.

IMS should provide means for a user to inform the network of an unsolicited communication.

7.15.2 Detection of Unsolicited Communication

Depending on Operator policies IMS should support capabilities that enable IMS to detect that an IMS session is unsolicited and classify as UC. These capabilities should apply to all IMS based services and apply to real-time (e.g. voice, video …) and to non-real-time (e.g. messaging …) IMS traffic.

IMS should support capabilities that enable a terminating party to report IMS sessions as UC.

The method of reporting UC may be dependent on the IMS service.

Reporting should be possible irrespective of whether an originating party has withheld its identity (e.g. by referring to the last call).

7.15.3 Prevention of Unsolicited Communication to the terminating party

Depending on Operator policies IMS should support capabilities to indicate to a terminating party that an IMS session has been classified UC.

Depending on Operator policies IMS should support capabilities to protect a terminating party from IMS sessions that have been classified UC.

7.15.4 Notification of UC to the originating party

Depending on Operator policies IMS should support capabilities that allow notifying an originiating party that a performed or attempted communication to the terminating party has been classified as UC.

7.15.5 Conveying information on UC to other networks

Depending on Operator policies IMS should support capabilities that enable the IMS of a network to convey information on detected UC in an IMS session to an other IMS on the path of that IMS session

7.16 Support for Push Notification Service in IMS

The IMS shall be able to support SIP based Push Notification Service as defined in [28].

8 Interworking requirements

8.1 General

The IMS shall support the capability for interoperability with the following:

- PLMN CS domain,
- PSTN/ISDN networks,
- Packet Cable network,
- Internet.
- Other non 3GPP networks providing IP Multimedia sessions.

The scope of this interoperability may result in a limited service capability.

8.2 Interworking with PLMN CS Domain

The IMS shall support conveyance of voice calls and multimedia services between IMS users and users in CS domain (within the limits set by the CS domain).

If more than one IMS party is involved in a communication with a PSTN party/parties, the communication between the IMS parties shall not be adversely impacted by the presence of a PSTN party.

Note: That this boundary may still be subject to regulatory requirements associated with communications with the PSTN including, but not limited to, lawful interception of voice calls and multimedia services, and number portability.

The boundary interworking shall be able to convey the information associated with the services listed below:

CLIP/CLIR;

Call Forwarding.

Also due to regulatory reasons the subscriber identity may be required to be conveyed via the IMS-CS/PSTN boundary to enable calling line identification services on both sides.

Support of:

Call barring,

Call waiting/hold,

MPTY,

on the boundary interface is for further study.

8.3 Interworking with PSTN/ISDN networks

8.3.0 General

Interworking between IMS and PSTN/ISDN networks shall be supported. PSTN/ISDN networks in this context refer to legacy PSTN/ISDN and TISPAN NGNs supporting PSTN/ISDN Emulation.

Note: TISPAN NGN supporting PSTN/ISDN Emulation provide to the end-user the same experience as a legacy PSTN/ISDN and from a interconnection perspective the TISPAN NGN behaves like an IMS network.

As a network option and depending on inter-operator policies, the IMS shall support transit of traffic between PSTN/ISDN networks.

8.3.1 Overlap Signalling

Support for overlap signalling in the IMS is an option limited to the interworking with PSTN/ISDN networks that use overlap signalling. Support of this option shall be based on inter-operator policies at the interconnection point. The IMS of operators not supporting overlap signalling shall not be affected.

In the absence of such inter-operator policies, networks interworking with IMS shall select appropriate signalling mechanisms to complete the call without any impact on IMS networks not supporting overlap signalling..

Note 1: PSTN/ISDN networks that convert overlap signalling to en-bloc, are considered to be networks that do not use overlap signalling.

In the cases where a PSTN/ISDN network, based on inter-operator policies, provides overlap signalling into the IMS, the following requirements shall be taken into account:

- For calls terminating in the IMS, conversion of overlap signalling to en-bloc shall take place within the IMS domain.
- Impact on the IMS shall be minimized.
- The service experience for the end-user shall be similar to the PSTN/ISDN.
- When the IMS network supports transit of traffic, transit of overlap signalling may be supported towards destination networks, if the policy permits overlap signalling towards those.

Note 2: Overlap signalling support should not be linked to E.164 [26] numbering schemes.

Note 3: Overlap signalling is not generated or terminated by an IMS UE it is only generated or terminated by devices within the PSTN/ISDN networks.

8.3.2 Subaddressing (SUB)

Where public telecommunication numbers are used, the IMS may support the Subaddress (SUB) service that allows the called (served) user to expand his addressing capacity beyond the one given by the public telecommunication number.

Note: Subaddressing is required for interoperability with existing users.

Subaddressing is required when at least one of the users services are provided from an ISDN.

The IMS may support the interoperability of Subaddressing with the PSTN/ISDN networks and vice versa.

8.3.3 User-to-User Signalling (UUS)

The IMS may support the User-to-User Signalling (UUS) service that enables a calling party to send and/or receive a limited amount of User-to-User-Information (UUI) to/from a called party in association with a communication.

Note: UUS is required for interoperability with existing users.

UUS is required when at least one of the users services are provided from an ISDN.

The IMS may support the interoperability of User-to-User Signalling services with the PSTN/ISDN networks and vice versa.

Only UUS service 1 with an implicit request is supported [17].

8.4 Void

8.5 Interworking with Packet Cable

The IMS shall support the capability for interoperability with Packet Cable networks. The scope of this interoperability may result in a limited service capability.

8.6 Interworking with Internet

The IMS shall support interworking with the Internet.

8.7 Voice Interworking with Enterprise IP-PBX

Voice interworking with Enterprise IP-PBX shall be handled as specified in TS 22.519 [33].

8.8 Interworking of Telepresence

Interworking between IMS-based Telepresence and other non-3GPP network provided Telepresence shall be supported (e.g. enterprise Telepresence).

A UE using CS voice shall be able to participate in a Telepresence session.

The interconnection between an operator and Enterprise should be via a QoS-enabled IP connection.

8.9 Void

9 IP Addressing

9.1 General

The Operator of an IMS infrastructure may base the implementation on IPv4 only, IPv6 only or both. The choice is an operator option.

The IMS may support UEs using IPv4 only, IPv6 only or both at an IP-based User-Network Interface. The choice is an operator option.

9.2 IP addressing for cdma2000 access to IMS

The IMS may support UEs using simultaneous multiple IP addresses.

10 Interconnection requirements

10.1 Introduction

IMS interconnect represents the interconnection of IMS functionality between 2 IMS networks over an underlying IP infrastructure.

A distinction can be made between:

- Direct IMS interconnect, and
- Indirect IMS interconnect.

Direct IMS interconnect is interconnection of IMS functionality between 2 IMS networks using a common IP interconnect network that is not SIP aware. In this case there is only one IMS-NNI (see Figure 10.1).

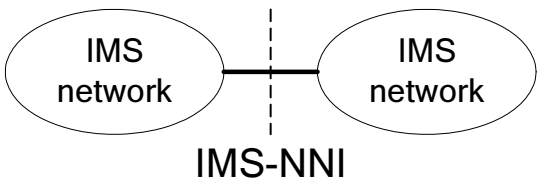

Figure 10.1 Basic IMS interconnect with single IMS-NNI

Indirect IMS interconnect is interconnection of IMS functionality between 2 IMS networks using a common IP interconnect network that is SIP aware. In this case there are two or more IMS-NNIs (see Figure 10.2). One or more of the intermediate networks may also be IMS networks providing "transit" functionality.

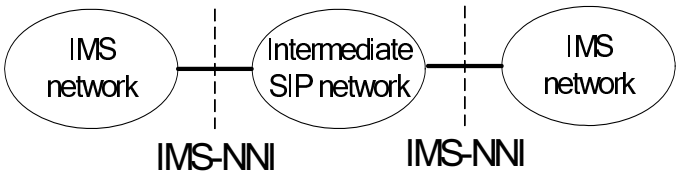

Figure 10.2 Indirect IMS interconnect with multiple IMS-NNIs

Note: An IMS NNI could also be applied between an IMS network and another SIP based network if that SIP based network conforms to IMS specifications on the interconnect interface.

An IMS network B delivers originating IMS services (e.g. least cost routing, service dependant routing, call barring, number translation, break-out) to a network A if the services are delivered for a session that arrives in the IMS network B over an IMS NNI from network A (Figure 10.3).

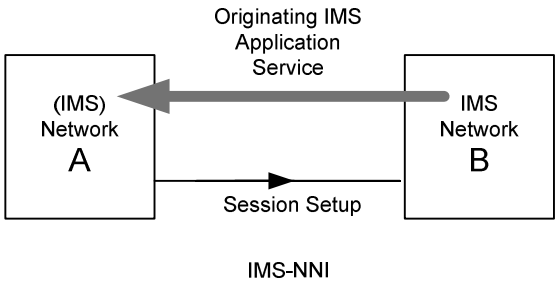

Figure 10.3: delivery of originating IMS application services across an IMS-NNI

An IMS network C delivers terminating IMS services (e.g. bulk rerouting, redundancy, profile based reachability, number translation) to a network D in case the services are delivered for a session that shall continue from the IMS network C over an IMS NNI to network D (Figure 10.4).

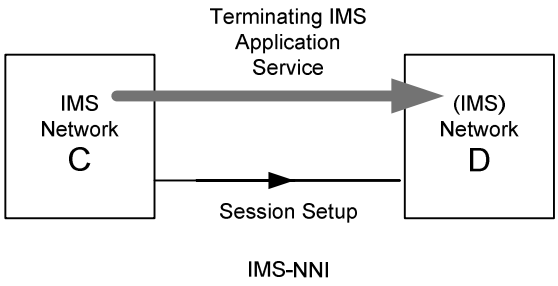

Figure 10.4: delivery of terminating IMS application services across an IMS-NNI

10.2 IP interconnect

The IP connection used for IMS IP interconnect shall be generic such that it can support all combinations of core network interconnection. E.g. the IP interconnection shall be shared between the IMS interconnection and the CS IP interconnection.

It shall be possible to handle the inter-connection of all services over this generic IP interface. The handling of security and charging shall also be generic for all IP inter-connect scenarios.

10.3 IMS network interconnect

The following requirements apply at the interconnection point (IMS NNI) between two different IMS networks or between an IMS network and a SIP based network that conforms to the IMS specification at the interconnect interface.

The IMS network and intermediate networks shall support the capability for service identification, when such information is available.

The IMS intermediate networks shall be able to apply operator defined policy at the interconnection point.

The IMS intermediate networks shall support the capability for control of the session resources when two different IMS networks are connected which have different IP addressing schemes.

The IMS network shall support both bilateral interconnection between two networks and multilateral interconnection (e.g. GSMA IPX [18]) provided by intermediate network(s).

The IMS network shall support both international interconnect and national interconnect (e.g. as specified in [33]).

The IMS network and intermediate networks shall support service aware interconnection.

Note 1: service awareness could be based on service identification, media parameters etc.

The IMS network and intermediate networks shall be able to support multiple peering points for the interconnection to another IMS network or intermediate network.

Note 2: selection of a peering point could be based on location, load balancing, or called party PUI, etc.

An IMS network shall be able to deliver IMS originating application services and terminating application services to other networks interconnected over the IMS NNI .

An IMS network shall be able to deliver IMS originating application services and/or terminating application services to users that are registered to another network.

The IMS network and intermediate networks shall support codec negotiation across one or multiple interconnects to minimise transcoding (and preferably eliminate it) to provide the highest quality service to the user.

If two UEs, belonging to two IMS networks, do not support a common codec for voice service session, the network and/or intermediate networks shall be capable to provide transcoding functionality at the interconnection point.

In case of interconnect between an IMS network and a SIP based network (e.g. SIP-I) the following requirements apply.

The IMS network and intermediate networks shall support the capability for service interoperability by means of service interworking requirements defined in clause 8.

In case of interconnection between two networks using the same non-IMS SIP Profile (e.g. SIP-I), the intermediate network shall transparently transport the non-IMS signalling information.

11 Support of WebRTC IMS Client access to IMS

11.1 Service description (informative)

Use cases and requirements for Web Real-Time Communication (WebRTC) are defined in [32]. The support of WebRTC IMS client access to IMS significantly expands the pool of clients able to access IMS.

The WebRTC IMS client access to IMS feature provides a means by which an IMS operator can offer IMS services to a user running a compatible WebRTC-enabled web application in their WebRTC-enabled browser. The user will access the application from a web page offered either directly by the IMS operator or by a third party.

The WebRTC IMS clients can access capabilities that may not be available in IMS, including use of WebRTC media capabilities without the need to convert to/from IMS protocols and end to end WebRTC security, subject to regulatory constraints. For example, in situations where data communications do not traverse the operator network, WebRTC

media travels end to end between two WebRTC IMS clients without any protocol conversion. The media may then not be subject to the same regulatory constraints as communications that do traverse the operator network. In such cases, end to end security may be provided on the data stream as an optional service enhancement.

11.2 Requirements

When accessing IMS services via WebRTC IMS client the IMS shall allow a user to access IMS services from an application offered either directly by the IMS operator or by a third party.

The IMS shall be able to support access to the following IMS services and capabilities for WebRTC IMS client access:

- multimedia telephony[20], excluding fax and CS data,

- early media, and

- network tones and announcements.

Note: IMS Multimedia Emergency Sessions [5] are not supported for WebRTC IMS Client access.

The IMS shall support online and offline charging for WebRTC IMS client access (including clients provided by the operator or a third party).

The available services and capabilities for WebRTC IMS clients accessing IMS shall be determined according to operator policy and user subscription settings in IMS.

Note: The available services and capabilities can be further limited by the provider of the WebRTC IMS client (e.g. operator or a third party), by the capabilities of the WebRTC IMS client (e.g. no video support), and/or by the IP access used to access the IMS network (e.g. IP access networks without QoS support).

The IMS shall support service origination and service termination with a WebRTC IMS Client. The IMS shall support media and protocol interworking and/or transcoding, when necessary.

3GPP system shall provide the appropriate QoS (based on operator policy and user subscription) for WebRTC IMS client traffic originating from an access network supporting QoS.

When accessing IMS services via a WebRTC IMS client, the IMS shall provide the equivalent levels of security and integrity as it provides when accessing IMS services in other ways.

The 3GPP UE shall make available for use by the WebRTC IMS client the codecs whose support is mandatory for the access technology being used to access IMS services.

The IMS shall authenticate the user that accesses IMS services using credentials provided by the operator or credentials provided by authorized third party (for web-identity based authentication) via a WebRTC IMS client and associate the user to one or more public identities (e.g. IMS Public User Identity or MSISDN).

Note: The authentication of the subscriber can be performed via the WebRTC IMS client or by a WebRTC server on behalf of a user.

When supporting WebRTC IMS client access, the IMS shall maintain compliance with regulatory requirements for IMS services.

When accessing IMS services via WebRTC IMS client, the IMS shall allow a subscriber to access call management.

For WebRTC IMS client to WebRTC IMS client communication, the IMS shall support traversal of media across NAT devices.

11.3 Protocol Conversion Minimization Requirements

The IMS shall provide a mechanism to support data communication between WebRTC IMS clients without requiring bearer level protocol conversions between WebRTC and IMS protocols.

The IMS shall be able to support data communication between WebRTC IMS clients using WebRTC end to end security mechanisms.

Note: Implementation of this capability is subject to operator policy and regulatory constraints.

Annex A (informative): Example IP multimedia application scenarios

The following example scenarios describe the personalised handling of individual media in multimedia applications (note that this list is neither complete nor exhaustive):-

1) The user is in a voice communication, and receives an incoming IP video communication. The user decides not to accept the communication, but diverts the incoming video to a messaging system. Further, the user is given an indication that there is a video message in his mail box

2) The user is in a voice communication, and receives an incoming video communication. The user decides to accept the communication but wishes to switch between the two communications.

3) The user is idle in a network and not involved in a communication. The user modifies his user profile to divert all voice communications other than those from high priority, pre-identified callers (e.g. his boss). In this scenario all emails and text messages continue to be received regardless of the sender.

4) On receiving a communication, the calling party's identity is displayed (if not restricted) and user shall be able to decide whether to accept the communication, or divert to a messaging system. The user shall be able to request media handling of the communication (e.g. media splitting to different destinations, media conversion).

5) The user is busy in a communication when receiving an incoming communication, but responds to the originating party that he will respond later. The user may request that the originating party's details (if not restricted) are stored with a reminder in user's profile.

6) Hi-fi sound (nuances, character of voice)
Person(s): Marketing Manager, Rita
Situation: She is at a launch party for some customers in London. In the break she listens to her messages and one from another customer in Tokyo gets her attention. He just wants her to call, but doesn't say if it is urgent or not.
Solution: Due to the excellent sound quality of the terminals involved and the messaging system, she picks up the faint irritation in his voice and decides to call him immediately. It was urgent and she could remedy the situation easily by emailing the information from her built in PDA storage. The customer was relieved as he was just going in to a very important meeting.
Benefit(s): Good sound quality gives more information to base judgements on, i.e. emulates real life meetings better.

7) Stereo sound (nuances, character of voice plus positions, sound-scapes)
Person(s): Purchase Officer, Gustavo
Situation: Participates in a conference to discuss purchase of a new kind of steel for the factory in Rio. As he is on the road he calls from his hotel room in Sydney. The conference is in the head office in Rio. The local department has invited the two final contenders to have them argue their cases. The two companies are positioned at the different ends of the table. One of the groups is presenting and mentions something about deliveries. A side remark is barely audible, "we can't deliver that quality and that quantity this year !" Who gave this remark?
Solution: The excellent sound quality together with the stereoscopic sound gives Gustavo the information he needed. It was the other group that gave the remark. The decision was made for him at that point. He gave the order to the presenting group right after they finished a very good presentation that told him everything he wanted to hear. The setup at the head office was done with two synchronized UEs at each end of the table.
Benefit(s): Stereoscopic sound gives even more information than just hi-fi sound to base judgements on, i.e. emulates real life meetings better.

8) Conference/chat with "private rooms"
Person(s): A project team at an IT company: Rick, Diana, Ted, Sven and Liu
They are based in different cities.
Situation: The project team has one of their weekly reporting meetings using their mobile communicators. In the middle of the meeting, Rick and Diana get lost in a lengthy arguing on some detailed design matters that bores the rest of the team. Ted, the moderator, finds that it is nevertheless necessary to give Rick and Diana some minutes to finish their discussion, so he decides to not interrupt them. At the same time Sven remembers that he need to remind Liu to send a report to him on the latest findings from her research work.
Solution: The team use a conference/chat service with the new facility "private rooms". This allows Sven to direct a few words in privacy to Liu. Sven activates easily this feature by the GUI of his communicator. Liu is

immediately notified by the GUI of her communicator that Sven is now talking privately with her (this is necessary to avoid embarrassing misunderstandings that could occur if Liu would answer Sven in the "common room" instead of in the new "private room" that Sven has created).
Since the voices of all conference members are synthetically mapped in a stereophonic projection, Liu is able to hear what Sven is saying, even though he speaks simultaneously with the other team members (the communicator will not automatically adjust the sound volume of the "common room", since it cannot know if Liu is more interested in Sven's comments or in continuing to listen to the other team members).
Benefit(s): This service emulates virtual presence in a conference room in the best possible way without adding more visionary technologies like holographic projections, etc. The synthetic stereophonic sound projection provides good possibilities for a conference member to discriminate unwanted voices even if the meeting situation is informal and spontaneous and everyone are talking at the same time. The flexible possibilities to create one or more "private rooms" make it easy to make private comments to selected colleagues. The easy-to-use and fast responding GUI makes the needed end-user effort to create a new "room" so low, that it feels natural to use the function even for exchanging just a few quick words.
Alternative use: Exchange the IT project team with a gang of teenagers that are planning what to do in the weekend. The service works perfectly well also in that scenario and provides the same benefits.
Additional features: Easy GUI controlled addition of new participants (can be initiated by any of the participants), including addressing, notification/invitation, etc. (cf. "outgoing call" in PSTN). GUI notification of new incoming session invitations (cf. "incoming call" in PSTN) and possibility to choose action as desired (incorporate the "calling party" in the existing conference session, creating a new separate session, rejecting the invitation, diverting it to a messaging system, etc.) Whiteboarding and/or application sharing.

9) Multiplayer mobile gaming with voice channel
Person(s): Joe (age 15), Blenda (age 14), Fredric (age 15) and all their "cyber friends" in the Shoot-n-Shout v.14.0 community
Situation: In the legendary multiplayer game Shoot-n-Shout v.14.0 the most popular game mode is a team competition. The idea is simply to shoot down the members of the concurring teams. There are always a lot of active game sessions in CyberSpace. At a web/WAP service operated by the game application provider, interested potential players can choose a game session and also find other gamers to form a team with. There is a text chat service where potential team-mates can learn to know each other.
Joe, Blenda and Fredric meet on the web/WAP chat and decide to form a team to take up the fight in one of the Shoot-n-Shout sessions. They are preparing a game strategy in advance through the text chat service, but when they have started the battle it takes too long time to type text, so they the will need another way to communicate with each other.
Solution: The game application provider makes use of a conference/chat service with "private rooms" in order to provide a multi-player voice service to the players of Shoot-n-Shout. When a game starts there is one "common room" where all players can talk (or rather shout) to each other and one "private room" for each team. Players in a team can also dynamically create more "private rooms" if they only like to talk to one (or a few) of their friends. (See the conference/chat scenario for details.)
The volume (and stereophonic position) of the players voices when they are using the "common room" is controlled so that it matches the virtual surroundings in the game environment. As an example, players that are behind a wall will only be heard as a vague whisper in the distance.
Benefit(s): A voice channel will enhance the gaming experience for several popular network games.

10) Application sharing with voice commentary
Person(s): Marketing Manager, Rita and Media expert, Jones
Situation: The launch of a new campaign for some customers in London. Last minute feedback is that one of the customers is expecting the latest gadget to be included, even if its only a prototype. Rita knows it’s not included in the presentation and she has no information with her.
Solution: Rita calls Jones, the media guru they employed for design of their important presentations. He has the information and some pictorials. He sends them over into Rita’s PowerPoint application and they edit the new slide together as they discuss the textual information to be included.
Benefit(s): The process is extremely interactive and the session takes only 5 minutes thanks to the broadband connection and the fact that they don’t need to Ping-Pong the pictures and the text back and forth. (Emphasize mobile or fixed access as required). The customer is happy and a Letter of Intent is signed.
Comments: By adding voice and pictures in an interactive session we achieve both effectiveness and interaction, two desired components.

11) Emergency location with voice conversation, navigation and picture transfer
Person(s): Ma Beth, her children and the pet dog Bobby
Situation: The family is out driving in the country side and they take a turn on the slippery country road a bit too fast. They slide down into the ditch. Bobby the dog in the back of the van gets a heavy box of books on top of his

left paw. It may be broken, and you can tell it certainly hurts from the loud yelps that come out in a rushed stream. The rest of the family is ok. They were all buckled up.
Solution: Ma Beth reaches for her communicator as soon as she has recovered from the initial shock. She calls 112 (911 or similar). The answer comes after 23 seconds and the operator immediately confirms the identity and the location of the van. Ma Beth is a bit taken aback by this quick information and has to think for awhile, then confirms the location as possibly correct. She then states the problem and she gets connected to a vet that asks a few pertinent questions. She can show a close up picture of the dog's left paw and the vet confirms a possible (95%) broken leg just above the paw. He gives a few quick instructions and sends her a map of the closest emergency animal hospital. The map shows her current position and soon displays the quickest way to get to the hospital. Well there, Bobby is taken care of and things are looking up. Even the kids are smiling now that the dog is calm and free from pains, and he looks so funny with his little cast.
Benefit(s): The initial call transfers emergency information to the operator automatically. This ensures minimum delay to correct action. The Communicator transfers the picture that gives enough information to make a very accurate and fast assessment of the situation. Then the map transfer and display on the terminal together with the current position gives clear information and directions for Ma Beth to drive and make the right turns at every corner. In her still half-shocked state she can drive to the hospital without hesitation about where to go. Very reassuring for all parties including the dog that gets fastest possible help.
Comments: The call is initially just a voice call but evolves with the best of positioning in emergency situations and navigational aid together with picture and graphics transfer.

12) The Real Virtual Theatre and Foyer Chat room – Fixed Network example
Person(s): Theatre going "cultural" group with one member (Bob) in a hospital bed.
Situation: The group is watching the play and are utterly fascinated by the first act. When they come out into the foyer in the break they remember Bob. They really want to share this first act with him since they know Shakespeare's Midsummer Night's Dream is his favorite.
Solution: Bob uses the theatre's online streaming service via the hospital network. (At only half the price of a theatre ticket!). The play displays in color and stereo surround sound on his bedside TV set. In the break his friends call him up from the theatre chat room. The chat room is equipped with 3D sound pick up and local display screens with streaming facilities. They set up the streaming from one of the screens to be synchronized with Bob's bedside equipment. Their voices are also mixed into the sound streams as they talk. Bob now gets both the playbacks from the first act and his friends' voices in 3D surround sound. Bob's voice is projected close to the screen as if he was standing leaning on the bench right there. His voice is very clear and full of emotions as he speaks to the various playbacks. Both parties can control the playbacks and watch their own selection in a second window on the screen.
Benefit(s): Bob can pick up every nuance in the lively discussion, including the whispered comments from Greta in the back. The group is almost feeling Bob's presence because of the emotional clarity and distinct position of his voice. As both parties have control and visibility of the streaming sessions, it is very effective and very interactive.
Comments: Experiential services are sought after. This one can be a bit exclusive because of the equipment requirements, but the uses are many.

13) Mobile synchronized MM container
Person(s): The married couple Bill and Christine and their daughter Linda
Situation: Bill is on a business travel to Spain. He calls his wife Christine every night using his MMM terminal. Often Christine is answering at home using her Screenphone, but this particular evening Christine has arranged a baby-sitter for their children so she could go to a restaurant with some friend. When Bill is calling, she is sitting on the commuter train on her way home. Bill often show some pictures during his calls (both live pictures showing the environment where he is at the moment and pictures that he has been taking during the day with his separate digital camera).
Today, their talk starts off as a common voice conversation. After a while Bill likes to show Christine the lovely sunset view that he can see from his hotel room, so he make some snapshots with the built-in camera of his terminal and sends them in real-time mode to Christine. Christine likes to show one of them to their little daughter Linda when she comes home.
Solution: With a quick gesture on the touchscreen of Christine's MMM terminal, she instantly moves the selected picture from the real-time session window to the "multimedia container" icon. All the contents of the "container" is automatically mirrored between the MMM terminal and her home server. In this way, Christine can easily pick up the picture from her Screenphone at home. If Linda is at sleep when Christine comes home, she can wait until tomorrow.
Benefit(s): The "multimedia container" can be used for every type of MM content that one likes to have available both at home and at another location. This "container paradigm" is very intuitive and stimulates the use of images, video clips etc. for a multitude of purposes. The "container" can be used both for transferring content from the MMM terminal to the home server (as in this scenario) and in the opposite direction.

Annex B (Informative): Business models use cases

The IMS supports agreements between the access network operator and the network operator providing IMS services (IMS operator).

The IMS shall be able to offer services to users that are attached to access networks owned by another operator.

The service offering may be restricted by the capabilities of the access network and the agreement between the access network operator and the IMS operator.

The IMS shall support at least the following operator's domain relationships:

a) Access network to IMS relationships

a.1) Access network and the IMS it connects to, belong to the same operator as shown in figure B.1.

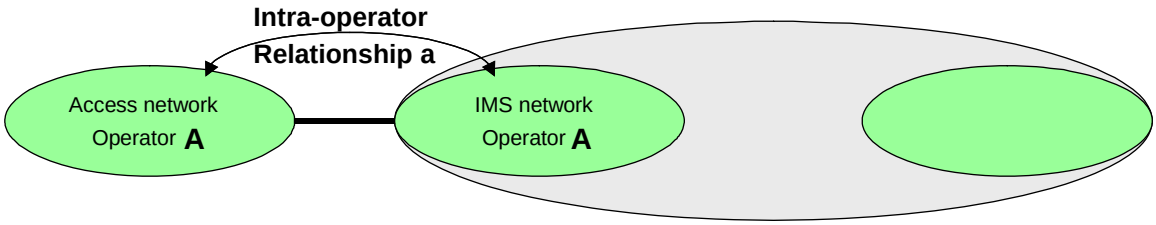

Figure B.1

a.2) Access network and the IMS it connects to, belong to different operators having an interconnection as shown in figure B.2.

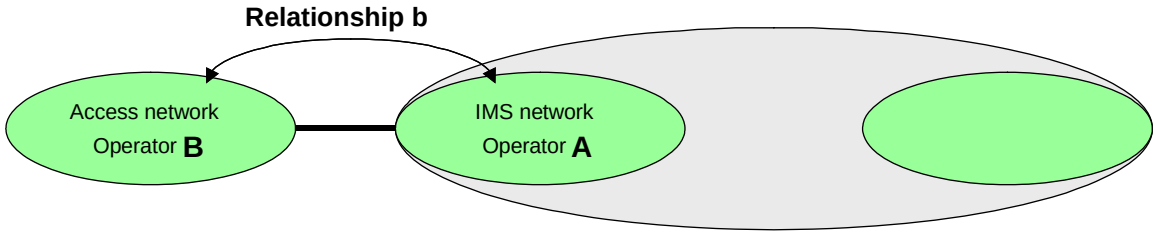

Figure B.2

b) IMS level relationships

b.1) The IMS (e.g. 3GPP or NGN) to which the access network connects and the Home IMS (e.g. NGN or 3GPP) which provides the IMS services belong to different operators as shown in figure B.3.

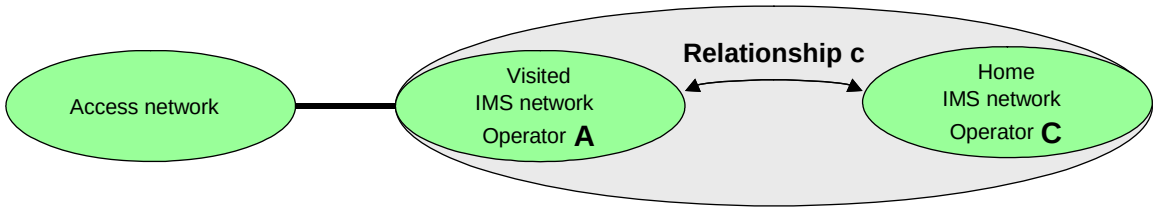

Figure B.3

b.2) The IMS (e.g. 3GPP or NGN) to which the access network connects and the Home IMS (e.g. NGN or 3GPP) which provides the IMS services are the same as shown in figure B.4.

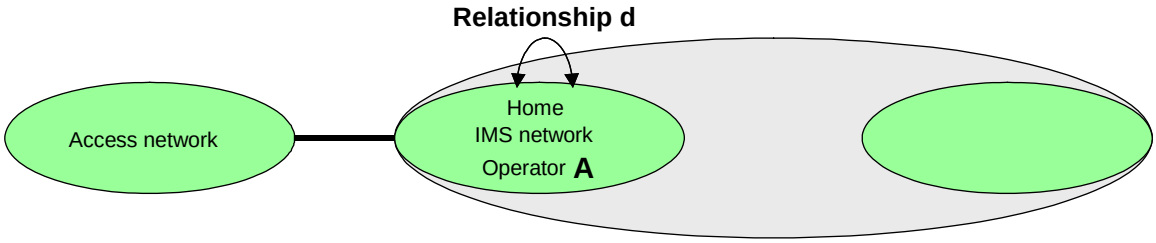

Figure B.4

b.3) The IMS (e.g. 3GPP or NGN) to which the access network connects and the Home IMS (e.g. NGN or 3GPP) which provides the IMS services belong to the same operator as shown in figure B.5.

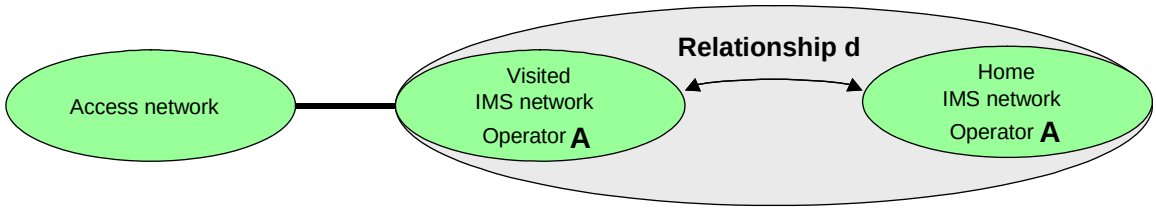

Figure B.5

An IMS operator shall be capable of connecting to other network operators via:

- an interconnect model where agreements are established between two operators;
- an interconnect model where intermediate network(s) can provide interconnect on behalf of multiple operators (and may be based on an agreement between the operators and their intermediate network provider).

A single IMS operator shall be able to choose to support either of the interconnect models, or both of the interconnect models simultaneously.

Annex C (Informative): Basic communication cases for IMS networks

A basic communication case can be described on a per IMS basis by stating the IMS entry point and an exit point for the communication as shown in figure C.1.

The following general types of entry/exit point can be identified:

- Access (for communication to from terminals);
- Interconnect to non-IMS network;
- Interconnect to other IMS;
- Internal network resource (e.g. a conference bridge for conferencing services).

As a general rule a network based on IMS shall support the following basic communication cases on a per network basis, as shown in Table C.1.

Table C.1

From (entry point)	To (exit point)			
	Access Network	**Interconnect to other IMS**	**Interconnect to non-IMS network**	**Internal Network Resource**
Access Network	Required	Required	Required	Required
Interconnect to other IMS	Required			Required
Interconnect to non-IMS network	Required		Required	Required
Internal Network Resource	Required			

It is not precluded that other, more complex communication cases may be provided by service level concatenation of basic communication cases, e.g. by means of call diversion services.

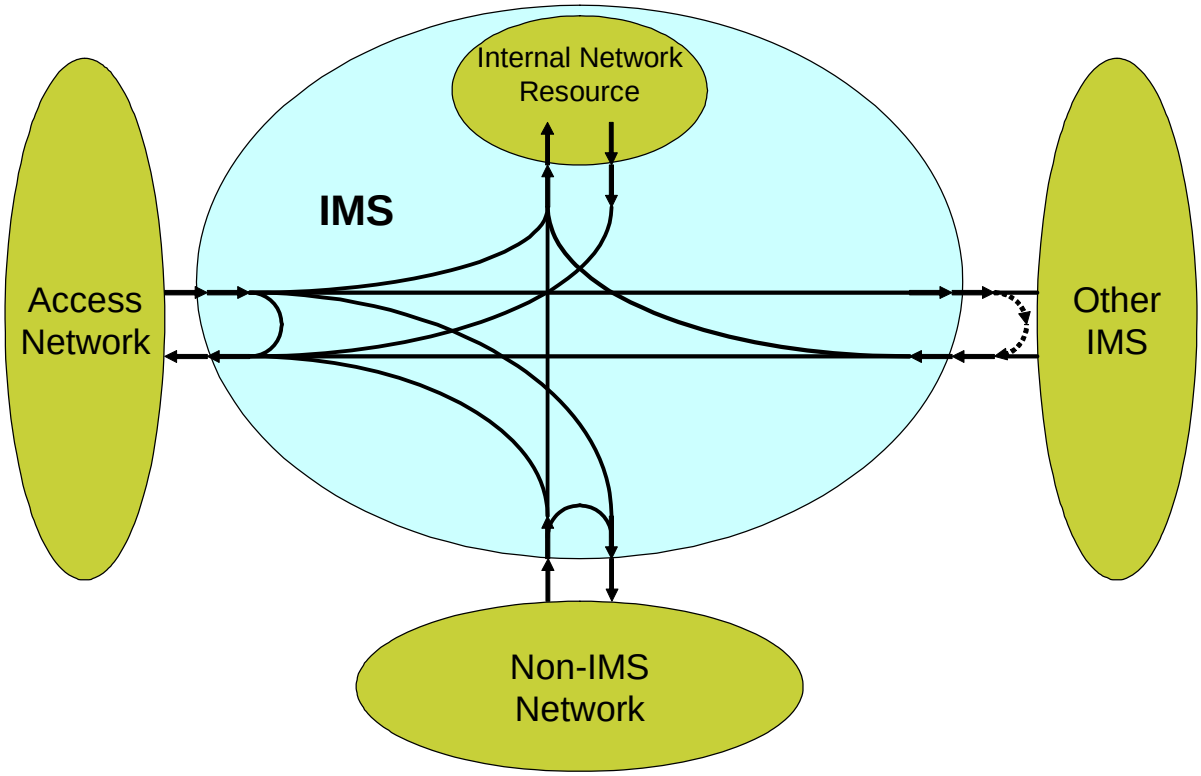

Figure C.1: Graphical representation of supported basic communication cases

Annex D (normative): Access to IMS via non-3GPP access

This annex defines additional specific requirements for access to IMS via non-3GPP access.

These requirements shall not apply to terminals having a 3GPP access.

For non-3GPP-only terminals with neither ISIM nor USIM, the IMC may be used to access the IMS via a non-3GPP access technology. However, if ISIM [21] is present it shall be used to access IMS or if ISIM is not present but USIM [24] is present, USIM shall be used to access IMS.

Annex E (informative): Example use cases for IMS Inter UE Transfer (i.e. transfer/replication/sharing)

Users of communication services will increasingly use different devices with different communication capabilities to meet their communication needs. Users may wish to initiate, transfer, manipulate, or otherwise maintain the simultaneous real time streaming of multimedia components (e.g. video, speech, audio) between multiple devices for a variety of reasons. For example, users may wish to control:

- the coordinated delivery of simultaneous multimedia streams to multiple devices owned by the same user (e.g. to take advantage of the different video and audio capabilities of the different devices: high definition television, surround sound stereo, home speaker phone, etc)
- shared multimedia content in real time across multiple devices owned by others (who may be in different locations)

This annex defines some of the use cases for IMS Inter UE Transfer (i.e. transfer/replication/sharing), examples of which are given below (note that this list is neither complete nor exhaustive):

1) Shared control of session across multiple IMS users

Jill calls Jane to share and discuss a video.

- Jane and Jill’s controls are synchronized so they share the seamless video experience. Both UEs are capable of shared control.

Either Jill or Jane can pause the shared video to provide comments. Either of them can resume the video when they are ready to do so.

- Jane and Jill need to be authorized by network after Jill allows Jane to share control.

2) Transfer of service control

Jane is having a multi-media call (audio/video stream) on her mobile with Jill while coming home. After arriving at home, Jane transfers the video stream and service control to another device that belongs to her (e.g. a PC that is IMS capable and on which she is logged in), but keeps the audio on her mobile to keep the conversation private from the other people in the room.

3) Media Replication

Jane is watching a video clip on her cell phone, which another family member (Jane’s Dad) starts to watch, so they are watching together and talking about it. Jane’s Dad wants to continue watching the video clip on another device (e.g. Jane's PC that is IMS capable and on which she is logged in), so he requests replication of the video component to Jane's PC.

4) Video replication

Steve, president of a wine-tasting club schedules a video documentary to start at an agreed time for all club members, so that they can watch it from their home and chat together about it while watching. In this case, all sessions are synchronized, and Steve is able to control the video playing: he can put the video on pause for all members in the same time.

Annex F (Informative): Void

Annex G (Informative): Example use cases for IMS-Based Telepresence

This annex provides a use case for IMS-Based Telepresence.

In the scenario below, a project team has one of their weekly reporting meetings using a Telepresence conference. Steven, John and Marc are in a meeting room in San Francisco. Fred and Liu are in another room in Paris. Ted is on the road and joins using his mobile phone. Bill is at home and joins using his PC. Both meeting rooms are equipped with multiple cameras and large display monitors. Three cameras and screens are arranged to provide a panoramic view of the room. Additional cameras and screens are used to share presentations among the participants.

Multiple video streams are shared along with additional information (e.g. spatial information, video resolution, and environmental), so that the user experience is as if they are in same location. Audio information (e.g. spatial information) is exchanged to facilitate the rendering of the audio in accordance with the rendering of the video. Users in the meeting enjoy a strong sense of realism and presence between all participants.

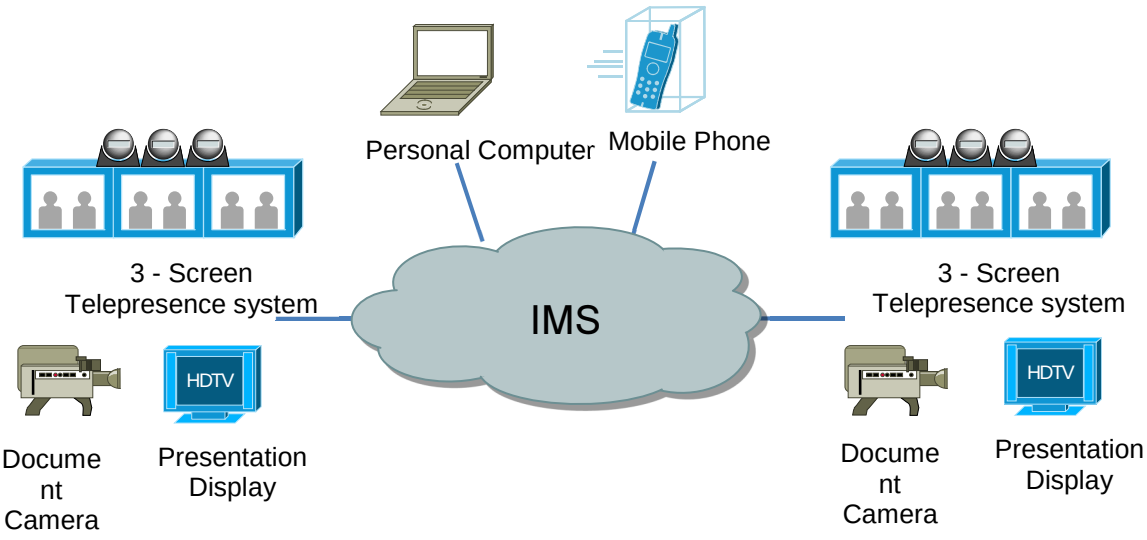

Figure G.1 – Telepresence

In the above scenario participants may be from different operator's networks, or from enterprise networks. In such cases, IMS-based Telepresence has interconnection with Telepresence in other networks.

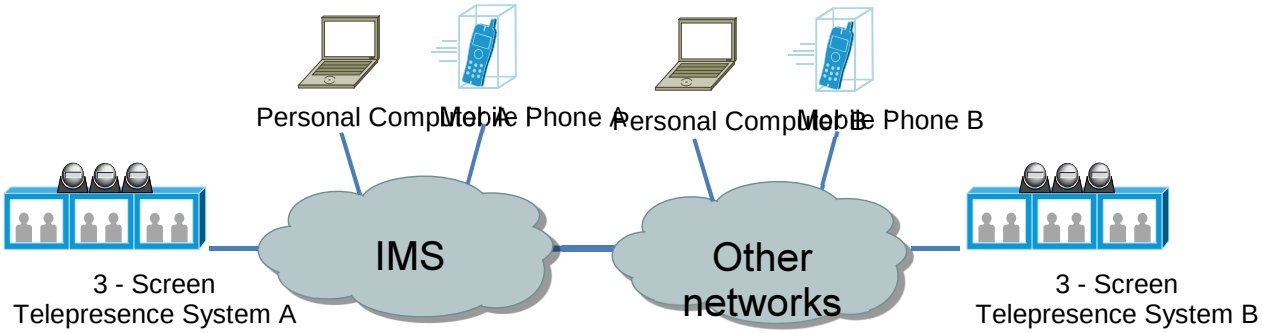

Figure G.2 – Interconnection of Telepresence

Annex H (Informative): Support of WebRTC client access to IMS

H.1 General

The following use cases have been provided to describe WebRTC client access to IMS.

1. WebRTC-based application supports broad IMS client capabilities
2. User gets his/her IMS service via third-party WebRTC-based application
3. User gets third-party IMS service via WebRTC-based application
4. Anonymous user gets IMS service via third-party WebRTC-based application
5. End to end WebRTC bearer support over IMS

H.2 WebRTC-based application supports broad IMS client capabilities

H.2.1 Description

Mary provides her credentials when accessing a WebRTC-based application provided by her IMS operator to access a broad range of IMS services (these credentials are provided by the operator). The application provides a user interface to the IMS user, Mary, to allow her to invoke her IMS services. Using the application, Mary is able to access the same broad range of capabilities available to a native IMS client, as appropriate to the available access technologies. In particular, Mary is able to originate and terminate calls using any of her IMS public user identities, and may access other rich communication services such as presence and instant messaging sessions. The instant messaging sessions may be integrated with other WebRTC media.

H.2.2 Pre-conditions

Mary has an IMS subscription and a WebRTC-capable browser on a device that supports an access technology with acceptable QoS (e.g., LTE).

Mary might have multiple credentials provided by the operator linked to her IMS subscription (e.g., user name and password).

Mary's IMS operator hosts a web site that provides a WebRTC-based portal to Mary's IMS services.

H.2.3 Service flows

Mary accesses her IMS operator’s web site from her browser, which executes an instance of the IMS portal client.

The IMS portal arranges to authenticate (based on the offered credentials) and register the IMS/WebRTC client with IMS and provides a user interface to Mary via the browser to access IMS services.

Mary can initiate or receive multimedia sessions, access presence information, participate in instant messaging sessions, and initiate any other service expected by a native IMS client.

H.2.4 Post-conditions

After invoking IMS services, the browser window remains available for Mary to initiate other services or to accept incoming sessions.

H.3 User gets their IMS service via third-party WebRTC-based application

H.3.1 Description

John clicks on a link to a third-party WebRTC-based application that offers access to his IMS services from his IMS operator. The third-party application provides a specialized application to John such as gaming, conferencing, or business services, where the application can benefit if the user has access to IMS services. John provides his IMS credentials in a secure manner to the IMS operator during the scenario before he is able to access his IMS services.

H.3.2 Pre-conditions

John has an IMS subscription and a WebRTC capable browser on a device that supports an access technology with acceptable QoS (e.g., LTE).

A third-party WebRTC-based application provides access to a WebRTC-based portal to the user's IMS.

The third party has a business relationship with the IMS operator that allows the third party to incorporate access to IMS services into the experience provided by the third-party application.

H.3.3 Service flows

John accesses the third-party web site from his browser, which executes the third-party WebRTC-based application along with the WebRTC IMS client functions needed for access to an IMS portal.

The IMS portal arranges to authenticate and register the IMS/WebRTC client with IMS and cooperates with the third-party server to provide a user interface to John via the browser to access his IMS services.

John has access to IMS services via the third-party WebRTC-based application.

H.3.4 Post-conditions

After invoking IMS services, the browser window remains available for John to initiate other services or to accept incoming sessions, if supported.

H.4 User gets third-party IMS service via WebRTC-based application

H.4.1 Description

Mary clicks on a link to a third-party WebRTC-based application that offers access to real time communications services facilitated by an IMS operator. The third-party WebRTC-based application provides enterprise-specific communication services to employee Mary. The third-party WebRTC-based application configures a block of IMS public user identities for use with an IMS operator on behalf of all the users of the web site (e.g., this block may be a domain or sub-domain). An individual user, Mary, logs into the third-party WebRTC-based application but does not have user specific credentials with the IMS operator. Mary receives some communications services directly from the third-party WebRTC-based application and other communications services directly from the IMS operator. For example, the third-party WebRTC-based application may facilitate RTC sessions directly between WebRTC clients, while IMS facilitates sessions with non-WebRTC endpoints.

H.4.2 Pre-conditions

Mary has a WebRTC capable browser on a device that supports an acceptable access technology.

A third-party WebRTC-based application provides access to a WebRTC-based portal to the IMS that has a block of IMS public user identities and subscriptions configured for use with an IMS operator. The WebRTC-based portal maintains the association between the users' credentials and its IMS public user identities.

The third party has a business relationship with the IMS operator that allows the third-party WebRTC-based application to incorporate access to IMS services into the experience provided by the third-party WebRTC-based application.

The third-party server supports all interworking with the IMS and assigns individual public user identities to the users of its web site so that they can receive IMS services.

H.4.3 Service flows

Mary accesses the third-party web site from her browser, which executes the third-party WebRTC-based application along with the WebRTC-based client functions needed for access to an IMS portal.

The third-party WebRTC-based application registers and authenticates Mary for access to the IMS services associated with an assigned public user identity from the public user identity block used by the third-party WebRTC-based portal to IMS.

The IMS portal cooperates with the third-party WebRTC-based application to provide a user interface to Mary via her browser to access IMS services.

Mary has access to IMS services via the WebRTC-based application.

H.4.4 Post-conditions

After invoking IMS services, the browser window remains available to initiate other services or to accept incoming sessions, if supported.

H.5 Anonymous user gets IMS service via third-party WebRTC-based application

H.5.1 Description

John clicks on a link to a third-party WebRTC-based application that offers access to real time communications services facilitated by an IMS operator. The third-party WebRTC-based application provides a specialized application to the user such as a customer services portal for a retail establishment. The third-party WebRTC-based application registers a public user identity with an IMS operator on behalf of all its users of. John does not log into the third-party WebRTC-based application and does not have user specific credentials with IMS. John is unknown (anonymous) to both the third-party WebRTC-based application and IMS. John receives very limited origination services from IMS, as allowed by the third-party WebRTC-based application. In particular, John is not reachable via any public user identity via this third-party WebRTC-based application. This capability might be used to allow a user to initiate a call to a customer representative but to no one else, or to join a conference, for example.

H.5.2 Pre-conditions

John has a WebRTC capable browser on a device that supports an acceptable access technology.

A third-party has a subscription with an IMS operator and provides a web site that provides access to a WebRTC-based portal to the IMS.

The third-party has a business relationship with the IMS operator that allows the third-party to incorporate access to IMS services into the features provided by the third-party WebRTC-based application.

The third-party WebRTC-based portal to the IMS maintains its registration with IMS and allows (potentially anonymous) users of its web site (e.g., John) to access IMS services using its (the third-party WebRTC-based portal to the IMS) identity so that they can receive IMS services.

H.5.3 Service flows

John accesses the third-party web site from his browser, which executes the third-party WebRTC-based application along with the WebRTC-based client functions needed for access to an IMS portal.

The third-party WebRTC-based application may not register or authenticate John, but instead treats him as an anonymous guest with limited privileges to access IMS services using the portal’s IMS identity.

The IMS portal cooperates with the third-party WebRTC-based application to provide a user interface to John via his browser to access IMS services.

John has access to limited IMS services via his browser user interface, e.g., John may not be reachable since no unique IMS public user identity is assigned to him, and there may be limitations on which other parties he can contact.

H.5.4 Post-conditions

After invoking IMS services, the browser window remains available for John to initiate other available IMS services.

H.6 End to end WebRTC bearer support over IMS

H.6.1 Description

Jane is doing her taxes using an online tool and encounters a complexity with which she would like some help. Her tax tool website includes a big red HELP button which connects her to a tax advisor associated with the tool. Associated with the HELP button is a link to a third-party WebRTC-based application that offers access to communications services facilitated by an IMS operator. The third-party WebRTC-based application provides a specialized application to the user such as a customer services portal for a tax advisor. In addition to being able to utilize IMS capabilities, the tax advisor has an agreement with their IMS operator to use a WebRTC based codec as its preferred audio codec and, as an enterprise service, to provide secure chat to communicate with WebRTC IMS client users. The IMS operator is able to convey the audio and chat session without bearer level protocol conversion which might interfere with quality and maintains the end to end security between Jane's device and third party WebRTC-based application. Figure H.1 illustrates the configuration allowing end to end communication between WebRTC IMS clients.

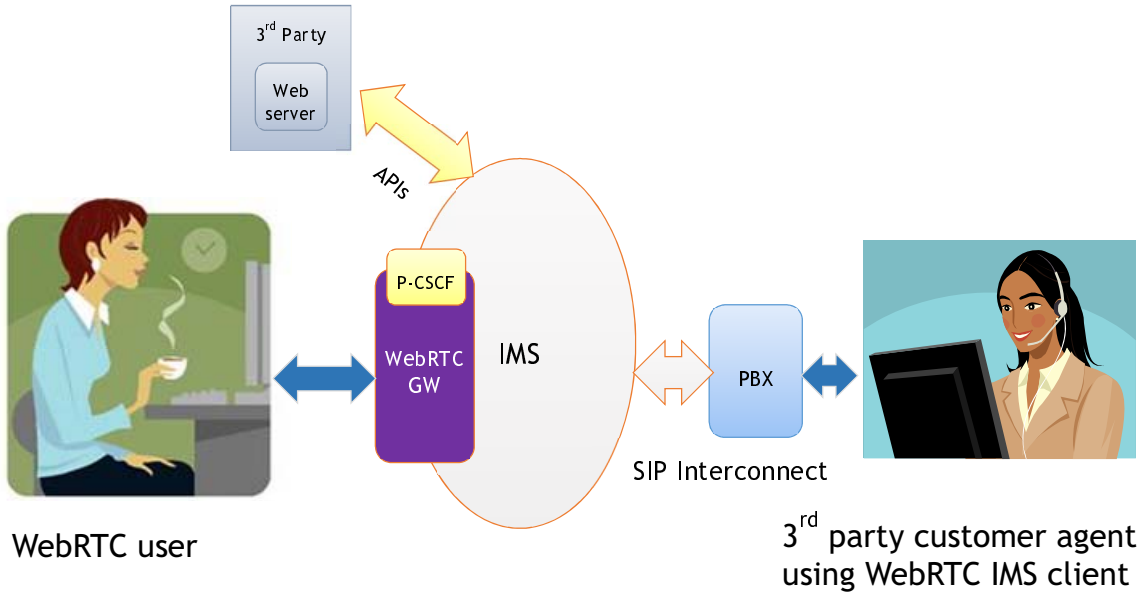

Figure H.6-1 End to end WebRTC IMS communication

H.6.2 Pre-conditions

Jane has a WebRTC capable browser on a device that supports a WebRTC codec and an end to end WebRTC security protocol.

Her tax advisor has a subscription with an IMS operator and provides a web site that provides access to a WebRTC-based portal to the IMS; the IMS does not support the WebRTC codec.

The tax advisor has a business relationship with the IMS operator that allows the tax advisor to incorporate access to specialized non-IMS capabilities (e.g., use of WebRTC codec, secure chat) into the features provided by the tax advisor's WebRTC-based application.

The tax advisor's web site provides customers the ability to select from various options (e.g., voice, chat, video, secure/unsecure channels) when they request online HELP.

The tax advisor has their WebRTC browser up and is registered with IMS and is able initiate services or to accept incoming sessions.

H.6.3 Service flows

Jane accesses the tax advisor web site from her browser by clicking on the HELP button, which executes the WebRTC-based application along with the WebRTC IMS client functions needed for access to IMS.

Jane engages in an unsecured chat session with her tax advisor to resolve a question on completing her tax forms. This chat session is hosted by IMS and does not provide end to end security.

While continuing the chat session, Jane opens an audio connection with her tax advisor as the discussion becomes more complex. Since both endpoints are WebRTC IMS clients supporting the same WebRTC codec, and the tax advisor's subscription allows it, the bearer path is conveyed without protocol conversion, allowing Jane and the tax advisor to experience very high quality audio.

While discussing the tax issue, Jane and her tax advisor decide it would be helpful to share figures, calculations, and personal tax information. To do this securely, they select a secure chat line that utilizes the WebRTC end to end security.

H.6.4 Post-conditions

Jane is satisfied with the quality and security of her exchange with her tax advisor.

Annex I (informative): Change history

Change history											
TSG SA#	SA Doc.	SA1 Doc	Spec	CR	Rev	Rel	Cat	Subject/Comment	Old	New	WI
SP-12	SP-010246	S1-010455	22.228	002		Rel-5	C	CR 22.228 - Capability of the IM CN Subsystem to present the identity of connected-to party	5.1.0	5.2.0	IMS-CCR-STAGE1
SP-12	SP-010246	S1-010453	22.228	003		Rel-5	C	CR to 22.228 on Redirection of IP Multimedia Sessions	5.1.0	5.2.0	IMS-CCR-STAGE1
SP-13	SP-010435	S1-010824	22.228	007		Rel-5	D	Interworking with internet	5.2.0	5.3.0	IMS
SP-13	SP-010435	S1-010825	22.228	008		Rel-5	C	Determination of terminal capability	5.2.0	5.3.0	IMS
SP-14	SP-010671	S1-011278	22.228	005	1	Rel-5	F	Defintion of Local Services	5.3.0	5.4.0	IMS
SP-15	SP-020058	S1-020507	22.228	010		Rel-5	B	CR 22.228 Rel. 5, IMS Addressing	5.4.0	5.5.0	IMS
SP-15	SP-020058	S1-020657	22.228	011		Rel-5	B	CR to 22.228 on ISIM	5.4.0	5.5.0	IMS
SP-15	SP-020045	S1-020457	22.228	012	-	Rel-5	F	Editorial CR to correct terms and references	5.4.0	5.5.0	CORRECT
SP-15	SP-020126		22.228	013		Rel-5	F	Correction of references to obsolete SIP RFC 2543 IETF specification	5.4.0	5.5.0	IMS-CCR
SP-16	SP-020258	S1-021162	22.228	016		Rel-6	D	Revised version of S1-020846CR to 22.228 v5.5.0 on Editorial for REL6	5.5.0	6.0.0	IMS
SP-17	SP-020562	S1-021771	22.228	017		Rel-6	B	CR to 22.228 Rel 6 on IMS interworking	6.0.0	6.1.0	IMS2
SP-19	SP-030028	S1-030182	22.228	018	-	Rel-6	B	GUP for IMS subscription management	6.1.0	6.2.0	GUP
SP-20	SP-030259	S1-030522	22.228	019		Rel-6	B	Multiple UEs in IMS service subscription	6.2.0	6.3.0	IMS
SP-20	SP-030259	S1-030523	22.228	020	-	Rel-6	B	Addition of requirements to IMS to enable conference-like services	6.2.0	6.3.0	IMS2
SP-21	SP-030465	S1-030906	22.228	021	-	Rel-6	F	Clarification on the meaning of Access Independence	6.3.0	6.4.0	IMS
SP-22	SP-030706	S1-031314	22.228	022	-	Rel-6	C	Multi terminal requirement--22.228	6.4.0	6.5.0	IMS
SP-24	SP-040293	S1-040517	22.228	023	-	Rel-6	F	Deletion of duplicated scenarios of Annex A	6.5.0	6.6.0	IMS
SP-24	SP-040292	S1-040538	22.228	024	-	Rel-6	F	Editorial Correction of R5 reference	6.5.0	6.6.0	IMS2
SP-25	SP-040511	S1-040717	22.228	025	-	Rel-7	B	Requirements for the handling of SIP URIs with Presence or IM prefixes	6.6.0	7.0.0	IMIMS2
SP-27	SP-050060	S1-050173	22.228	029	-	Rel-7	A	Tel-URI related reference update	7.0.0	7.1.0	IMS2
SP-27	SP-050059	S1-050253	22.228	030	-	Rel-7	A	Removal of Reference to TS 22.121	7.0.0	7.1.0	TEI7
SP-29	SP-050511	S1-050778	22.228	0033	-	Rel-7	A	Removal of Local Services	7.1.0	7.2.0	IMS2
SP-29	SP-050510	S1-050882	22.228	0034	-	Rel-7	B	CR to 22.228 for allowing IMS to use multicast capabilities of the network	7.1.0	7.2.0	MBMSE
SP-29	SP-050531	S1-050941	22.228	0035	-	Rel-7	B	CR to 22.228 on CS-IMS multimedia service interworking	7.1.0	7.2.0	MITe
SP-30	SP-050748	S1-051150	22.228	0035	-	Rel-7	B	Ability for a service to address a user on a unique UE in an IMS system when multiple UEs are registered with the same IMS Public User Identity	7.2.0	7.3.0	GRUU - 32116
SP-30	SP-050752	S1-051232	22.228	0036	-	Rel-7	B	Clarify multiple applications per service	7.2.0	7.3.0	ISB
SP-32	SP-060317	S1-060560	22.228	0039	-	Rel-7	F	Identification of communication services, AI30-06	7.3.0	7.4.0	ServID
SP-32	SP-060432	-	22.228	0041	2	Rel-7	F	Support of Local Numbers in the IMS	7.3.0	7.4.0	TEI7
SP-32	SP-060323	S1-060611	22.228	0040	-	Rel-8	B	Network requested IMS session initiation	7.3.0	8.0.0	TEI8
SP-33	SP-060463	S1-060855	22.228	0043	-	Rel-8	A	Support of local numbers in the IMS - clarification and corrections	8.0.0	8.1.0	IMS2

SP-37	SP-070657	S1-070991	22.228	0047	2	Rel-8	A	Identification of a specific UE when multiple UEs share a single Public User Identity	8.1.0	8.2.0	TEI8
SP-37	SP-070658	S1-071294b	22.228	0048		Rel-8	B	TISPAN Service and Capability requirements for Common IMS	8.1.0	8.2.0	TISCAP-R8
SP-38	SP-070844	S1-071683	22.228	0054	1	Rel-8	F	NAT support in Common IMS	8.2.0	8.3.0	CIMS8-TIS
SP-38	SP-070844	S1-071684	22.228	0056	1	Rel-8	D	Corrections to definition of "Access Independence"	8.2.0	8.3.0	CIMS8-TIS
SP-38	SP-070844	S1-071780	22.228	0060	1	Rel-8	F	Any IP version support	8.2.0	8.3.0	CIMS8-TIS
SP-38	SP-070844	S1-071866	22.228	0063	1	Rel-8	F	Corrections based on LS from TISPAN and Action from SA Plenary	8.2.0	8.3.0	CIMS8-TIS
SP-38	SP-070846	S1-071787	22.228	0049	1	Rel-8	B	User determined user busy	8.2.0	8.3.0	CIMS8-TIS
SP-38	SP-070862	S1-071924	22.228	0053	1	Rel-8	C	Optimal Media Routing Support for IMS Sessions	8.2.0	8.3.0	IPinterc
SP-38	SP-070862	S1-071926	22.228	0059	2	Rel-8	B	IMS Interconnection requirement	8.2.0	8.3.0	IPINTERC
SP-39	SP-080031	S1-080184	22.228	0062	4	Rel-8	F	Enhancements on access to the IMS	8.3.0	8.4.0	CIMS8-TIS
SP-39	SP-080031	S1-080167	22.228	0064	2	Rel-8	D	Removal of abbreviations and definitions already included in 21.905	8.3.0	8.4.0	CIMS8-TIS
SP-39	SP-080205	-	22.228	0066	3	Rel-8	F	Corrections to Interworking with PSTN/ISDN networks	8.3.0	8.4.0	CIMS8-TIS
SP-39	SP-080040	S1-080238	22.228	0067	1	Rel-8	B	Additional requirements for IMS interconnection	8.3.0	8.4.0	IPINTERC
SP-39	SP-080031	S1-080183	22.228	0068	-	Rel-8	C	Emergency communication for fixed NGN	8.3.0	8.4.0	CIMS8-TIS
SP-39	SP-080040	S1-080328	22.228	0069	1	Rel-8	B	Clarification of requirements for IMS interconnection	8.3.0	8.4.0	IPINTERC
SP-40	SP-080298	S1-080610	22.228	0070	2	Rel-8	B	Service Requirements for Common IMS	8.4.0	8.5.0	CIMS_3GPP2
SP-42	SP-080775	S1-083215	22.228	0048	1	Rel-8	F	Requirements for capability enabling early media	8.5.0	8.6.0	TEI8
SP-42	SP-080769	S1-083442	22.228	0075	1	Rel-8	B	IMS Credentials requirements	8.5.0	8.6.0	CIMS_3GPP2
SP-42	SP-080775	S1-084052	22.228	0077	-	Rel-8	F	Correction of wrong reference	8.5.0	8.6.0	TEI8
SP-42	SP-080780	S1-084416	22.228	0079	2	Rel-9	B	IMS IDT - Inter UE Transfer - Definitions	8.6.0	9.0.0	IDT
SP-42	SP-080780	S1-084215	22.228	0080	2	Rel-9	B	IMS IDT Inter UE Transfer Service Requirements	8.6.0	9.0.0	IMS_SCC-IDT
SP-42	SP-080782	S1-084406	22.228	0084	2	Rel-9	B	Service requirements for Prevention of Unsolicited Communication in IMS (PUCI)	8.6.0	9.0.0	PUCI
SP-43	SP-090084	S1-090185	22.228	0085	1	Rel-9	F	IMS IDT Inter UE Transfer Service Requirements	9.0.0	9.1.0	IMS_SCC-IDT
SP-43	SP-090084	S1-090341	22.228	0088	1	Rel-9	B	IUT between an IP CAN and 3GPP CS Domain	9.0.0	9.1.0	IMS_SCC_IDT
SP-43	SP-090086	S1-090340	22.228	0087	3	Rel-10	C	Requirements for a focus aware conference users before leaving the conference	9.1.0	10.0.0	TEI10
SP-45	SP-090652	S1-093373	22.228	0098	3	Rel-10	B	Use Cases for Transfer of Control	10.0.0	10.1.0	eIMS_SCC-IDT
SP-45	SP-090652	S1-093292	22.228	0099	3	Rel-10	B	Use Case for Shared Control of session across Multiple IMS users	10.0.0	10.1.0	eIMS_SCC-IDT
SP-45	SP-090652	S1-093375	22.228	0100	2	Rel-10	B	Use Case for Media Replication	10.0.0	10.1.0	eIMS_SCC-IDT
SP-45	SP-090652	S1-093378	22.228	0101	2	Rel-10	B	Clarification of session setup / modification requirements	10.0.0	10.1.0	eIMS_SCC-IDT
SP-45	SP-090652	S1-093475	22.228	0102	2	Rel-10	B	Shared Control of media flows across multiple UEs	10.0.0	10.1.0	eIMS_SCC-IDT
SP-45	SP-090652	S1-093379	22.228	0103	3	Rel-10	B	Transfer of Control / Media Replication requirements	10.0.0	10.1.0	eIMS_SCC-IDT
SP-45	SP-090652	S1-093291	22.228	0105	2	Rel-10	B	Use Case for video replication	10.0.0	10.1.0	eIMS_SCC- IDT
SP-45	SP-090660	S1-093284	22.228	0109	3	Rel-10	C	Add the feature of completing dialed number to global form	10.0.0	10.1.0	TEI10
SP-45	SP-090483	S1-093296	22.228	0113	3	Rel-10	B	Receiving the original destination identity	10.0.0	10.1.0	TEI10
SP-46	SP-090846	S1-094129	22.228	0122	-	Rel-10	B	Add support for the mailto scheme to IMS	10.1.0	10.2.0	TEI10

SP-46	SP-090846	S1-094481	22.228	0119	1	Rel-10	F	Announcement towards the terminating user	10.1.0	10.2.0	TEI10
SP-46	SP-090846	S1-094282	22.228	0121	2	Rel-10	B	IMS-Unallocated identity handling	10.1.0	10.2.0	TEI10
SP-46	SP-090846	S1-094280	22.228	0120	2	Rel-10	B	Request information of a called party	10.1.0	10.2.0	TEI10
SP-46	SP-090847	S1-094279	22.228	0116	3	Rel-10	F	Clarification to IUT service control requirement	10.1.0	10.2.0	IMS_SC_eIDT
SP-46	SP-090847	S1-094285	22.228	0124	2	Rel-10	F	Inclusion of an IETF reference for IUT	10.1.0	10.2.0	eIMS_SCC-IDT
SP-49	SP-100575	S1-102053	22.228	0131	-	Rel-10	A	Removal of references to 3GPP OSA	10.2.0	10.3.0	TEI10
SP-49	SP-100577	S1-102387	22.228	0127	1	Rel-10	F	Alignment of Transfer of Control requirements	10.2.0	10.3.0	IMS_SC_eIDT
SP-49	SP-100581	S1-102407	22.228	0132	2	Rel-11	B	IMS application services across IMS-NNI	10.2.0	11.0.0	IPXS
SP-50	SP-100803	S1-103009	22.228	0133	-	Rel-11	B	Conferencing Support in a VPLMN	11.0.0	11.1.0	OSCAR
SP-50	SP-100799	S1-103200	22.228	0135	2	Rel-11	B	Additions to IMS application services across IMS-NNI	11.0.0	11.1.0	IPXS
SP-50								Problem with figures 10.3 and 10.4 (introduced by CR0135r2 above) solved	11.1.0	11.1.1	IPXS
SP-51	SP-110164	S1-110074	22.228	0139	-	Rel-11	D	Editorial change to figure 10.3 and 10.4 Clause 10.1	11.1.1	11.2.0	IPXS
SP-51	SP-110172	S1-110428	22.228	0141	2	Rel-11	B	IUT Privacy considerations associated with remote end user and restricting copyrighted content.	11.1.1	11.2.0	TEI11
SP-52	SP-110375	S1-111390	22.228	0145	1	Rel-11	B	New annex for VINE reference model	11.2.0	11.3.0	VINE
SP-52	SP-110375	S1-111396	22.228	0144	4	Rel-11	B	Voice Interworking with Enterprise IP-PBX (VINE) Requirements	11.2.0	11.3.0	VINE
SP-52	SP-110376	S1-111354	22.228	0143	2	Rel-11	B	FW traversal support in Common IMS	11.2.0	11.3.0	TEI11
SP-52	SP-110379	S1-111346	22.228	0126	3	Rel-11	B	IMS Network-Independent Public User Identities	11.2.0	11.3.0	INIPUI
SP-53	SP-110581	S1-112192	22.228	0142	2	Rel-11	B	Information of called party for INIPUI	11.3.0	11.4.0	INPUI
SP-53	SP-110582	S1-112026	22.228	0149	-	Rel-11	F	Re-introduction of an approved high level requirement	11.3.0	11.4.0	TEI11
SP-53	SP-110632	S1-112373	22.228	0147	2	Rel-11	F	Clarification of UE for VINE	11.3.0	11.4.0	VINE
SP-54	SP-110814	S1-113322	22.228	0150	2	Rel-12	B	Use Case for IMS-Based Telepresence	11.4.0	12.0.0	IMS_TELEP
SP-54	SP-110814	S1-113324	22.228	0151	1	Rel-12	B	Requirements for IMS-Based Telepresence	11.4.0	12.0.0	IMS_TELEP
SP-54	SP-110814	S1-113318	22.228	0154	1	Rel-12	B	IMS-Based Telepresence Definition	11.4.0	12.0.0	IMS_TELEP
SP-54	SP-110816	S1-113325	22.228	0155	1	Rel-12	B	INIPUI Address Resolution	11.4.0	12.0.0	TEI12
SP-55	SP-120101	S1-120300	22.228	0156	3	Rel-12	B	Clarification of Telepresence Requirements	12.0.0	12.1.0	IMS_TELEP
SP-55	SP-120101	S1-120278	22.228	0157	1	Rel-12	B	Interoperability requirements for Telepresence	12.0.0	12.1.0	IMS_TELEP
SP-55	SP-120101	S1-120080	22.228	0158	-	Rel-12	B	Addition of interconnection diagram to the Telepresence use case	12.0.0	12.1.0	IMS_TELEP
SP-55	SP-120101	S1-120279	22.228	0159	1	Rel-12	B	Interworking requirements for Telepresence	12.0.0	12.1.0	IMS_TELEP
SP-55	SP-120106	S1-120139	22.228	0161	1	Rel-12	B	IMS interconnect requirements for national interconnect	12.0.0	12.1.0	IPXSNAT
SP-56	SP-120290	S1-121399	22.228	0162	1	Rel-12	F	Corrections and enhancements for Telepresence	12.1.0	12.2.0	IMS_TELEP
SP-56	SP-120290	S1-121407	22.228	0163	1	Rel-12	B	Addition of definition for Telepresence System	12.1.0	12.2.0	IMS_TELEP
SP-56	SP-120290	S1-121067	22.228	0164	-	Rel-12	B	Additional Interworking Requirement	12.1.0	12.2.0	IMS_TELEP
SP-56	SP-120290	S1-121404	22.228	0165	1	Rel-12	B	Additional Display Requirements	12.1.0	12.2.0	IMS_TELEP
SP-56	SP-120290	S1-121151	22.228	0167	-	Rel-12	B	Clarification of Telepresence Requirements	12.1.0	12.2.0	IMS_TELEP
SP-57	SP-120527	S1-122486	22.228	0168	3	Rel-12	B	IMS interconnect with non-IMS based networks	12.2.0	12.3.0	IPXSNAT

SP-57	SP-120527	S1-122355	22.228	0170	1	Rel-12	B	Adding TISPAN reference on national interconnect	12.2.0	12.3.0	IPXSNAT
SP-57	SP-120530	S1-122438	22.228	0171	1	Rel-12	B	IP-PBXs in static mode of operation	12.2.0	12.3.0	BusTI
SP-57	SP-120531	S1-122354	22.228	0169	1	Rel-12	B	Definition of DVB-RCS2 as an access network for IMS	12.2.0	12.3.0	IMSSat
SP-57	SP-120532	S1-122500	22.228	0172	2	Rel-12	B	IMS registration control based on location information	12.2.0	12.3.0	IMS_RegCon
SP-57	SP-120534	S1-122502	22.228	0174	3	Rel-12	D	IMS support for Push Notification Service	12.2.0	12.3.0	TEI12
SP-58	SP-120864	S1-124449	22.228	0180	1	Rel-12	A	Removal of operator initiated IMS registration	12.3.0	12.4.0	TEI8
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SP-64	SP-140230	S1-141532	22.228	0198	2	Rel-13	B	Support for end to end WebRTC bearer support over IMS	12.6.0	13.0.0	eWebRTCi
SP-64	SP-140236	S1-141575	22.228	0199	2	Rel-13	B	Use of differentiated paging for incoming voice over E-UTRAN services	12.6.0	13.0.0	voE-UTRAN_PPD
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SP-65	SP-140504	S1-143503	22.228	0206	1	Rel-13	B	NAT Traversal in WebRTC	13.0.0	13.1.0	eWebRTCi
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History

Document history		
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