Technical Specification Group Services and System Aspects **_TSGS#25(04)0530_**
Meeting #25, Palm Springs, USA

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**Source:** **TSG SA WG2**
**Title:** **CRs on 23.981 (Interworking aspects and migration scenarios for IPv4 based IMS implementation)**
**Agenda Item:** **7.2.3**

The following Change Request has been approved by TSG SA WG2 and is requested to be approved by TSG SA plenary #25.

| S2 doc # | Title | Spec | CR # | cat | Version in | Rel | WI | S2 meeting | Clauses affected |
|---|---|---|---|---|---|---|---|---|---|
| S2-042683 | IPv4 access to multimedia services and Mb reference point | 23.981 | 001 | F | 6.0.0 | 6 | IPv4IMS | S2 #41 | 2, 3.2, 3.3, 5.1, 5.3.7.3 (new section), 5.4.3.3 (new section) |
| S2-042890 | Creating a Rel-5 version of TR 23.981 | 23.981 | 002r1 | B | 6.0.0 | 5 | IPv4IMS | S2 #41 | 2, 3.1, 3.2, 3.3, 5.1, 5.2.1, 5.2.4.2, 5.3.1, 5.3.4.3, 5.3.6, 5.3.7.2, 5.3.7.3 (new), 5.4.3.3(new) |
| S2-042889 | Corrections to scenario ñ IPv4 visited and IPv6 home | 23.981 | 003r1 | F | 6.0.0 | 6 | IPv4IMS | S2 #41 | 5.3.4.3 |

**3GPP TSG-SA2 Meeting #41** **Tdoc ⌘S2-042683**
**Montreal, Canada, 16 ñ 20 August 2004**

CR-Form-v7

# CHANGE REQUEST

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| ⌘ | **23.981** | **CR** | **001** | ⌘**rev** | **-** | ⌘ | Current version: | **6.0.0** ⌘ |

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ***Proposed change affects:*** | UICC apps⌘ | | ME | X | Radio Access Network | | Core Network X |

| | | | |
|---|---|---|---|
| ***Title:*** | ⌘ IPv4 access to multimedia services and Mb reference point | | |
| ***Source:*** | ⌘ SA2 (Vodafone UK, Siemens) | | |
| ***Work item code:*** | ⌘ IPv4IMS | ***Date:*** ⌘ | 27/07/2004 |
| ***Category:*** | ⌘ **F** | ***Release:*** ⌘ | Rel-6 |
| | *Use <u>one</u> of the following categories:*<br>***F*** *(correction)*<br>***A*** *(corresponds to a correction in an earlier release)*<br>***B*** *(addition of feature),*<br>***C*** *(functional modification of feature)*<br>***D*** *(editorial modification)*<br>Detailed explanations of the above categories can be found in 3GPP TR 21.900. | *Use <u>one</u> of the following releases:*<br>*2 (GSM Phase 2)*<br>*R96 (Release 1996)*<br>*R97 (Release 1997)*<br>*R98 (Release 1998)*<br>*R99 (Release 1999)*<br>*Rel-4 (Release 4)*<br>*Rel-5 (Release 5)*<br>*Rel-6 (Release 6)* | |

| | |
|---|---|
| ***Reason for change:*** | ⌘ In TS 23.002 and 23.228, the Mb reference point is defined to access IPv6 network services. Within the scope TR 23.981, IPv4 is supported by the UE to access IMS services. Therefore for an UE accessing IMS services using IPv4 may not be able to "use" the Mb reference point in the sense of TR 23.002. |
| ***Summary of change:*** | ⌘ Clarify that IPv4 based IMS implementations also use IPv4 at the Mb reference point. Add new section to introduce IPv4 or dual stack support on Mb reference point and also on entities providing network services e.g. MRFP, MGW. |
| ***Consequences if not approved:*** | ⌘ Inconsistencies between TS 23.002 and TR 23.981. |

| | | | | | |
|---|---|---|---|---|---|
| ***Clauses affected:*** | ⌘ 2, 3.2, 3.3, 5.1, 5.3.7.3 (new section), 5.4.3.3 (new section) | | | | |
| | | **Y** | **N** | | |
| ***Other specs affected:*** | ⌘ | | X | Other core specifications | ⌘ |
| | | | X | Test specifications | |
| | | | X | O&M Specifications | |
| ***Other comments:*** | ⌘ | | | | |

## How to create CRs using this form:

Comprehensive information and tips about how to create CRs can be found at http://www.3gpp.org/specs/CR.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

******** FIRST MODIFIED SECTION *********

# 2 References

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.


[1] 3GPP TR 41.001: "GSM Release specifications".

[2] 3GPP TS 21.905: "Vocabulary for 3GPP Specifications".

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

[4] 3GPP TS 23.228: "IP Multimedia (IM) Subsystem - Stage 2".

[5] 3GPP TS 23.141: "Presence Service; Architecture and Functional Description".

[6] 3GPP TS 23.060: "General Packet Radio Service (GPRS); Service description; Stage 2".

[7] 3GPP TS 33.203: "3G security; Access security for IP-based services".

[7a] 3GPP TS 23.002: "Network Architecture".

[8] draft-ietf-ngtrans-isatap-21.txt (April 2004): "Intra-Site Automatic Tunnel Addressing Protocol (ISATAP)", work in progress.

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

[9] 3GPP TS 24.008: "Mobile radio interface Layer 3 specification; Core network protocols; Stage 3".

[10] RFC 2373: "IP Version 6 Addressing Architecture".

[11] OMA Device Management 1.1.2.

[12] OMA Client Provisioning 1.1.


# 3 Definitions, symbols and abbreviations

## 3.1 Definitions

For the purposes of the present document, the terms and definitions given in TS 21.905[2] and the following apply.

**Dual stack IM CN subsystem:** For the purpose of this technical report, a dual stack IM CN subsystem is an IM CN subsystem implementation in which all network entities support IPv4 and IPv6 for IMS communication. It is an IM CN subsystem implementation that supports both IPv6 as per 3GPP release 5 or later standards, and an IPv4 IM CN subsystem.

**IPv4 based IM CN subsystem implementation, IPv4 IM CN subsystem**: For the purpose of this technical report, an IPv4 based IM CN subsystem implementation (or short: IPv4 IM CN subsystem) means an IM CN subsystem implementation, which is based on 3GPP Release 5 or later standards, but uses IPv4 rather than IPv6.

**IPv4 based UE implementation, IPv4 UE**: For the purpose of this technical report, an IPv4 based UE implementation (or short: IPv4 UE) means a UE implementation, which is based on 3GPP Release 5 or later IMS standards, but uses IPv4 rather than IPv6 to access an IM CN subsystem.

**IPv6 based IM CN subsystem implementation, IPv6 IM CN subsystem**: For the purpose of this technical report, an IPv6 based IM CN subsystem implementation (or short: IPv6 IM CN subsystem) means the IM CN subsystem implementation according to 3GPP Release 5 or later standards that uses IPv6.

**IPv6 UE**: For the purpose of this technical report, an IPv6 UE means a UE implementation, which is based on 3GPP Release 5 or later IMS standards and uses only IPv6 to access IM CN subsystem even though the IP stack in the UE as such may be a dual IPv4 and IPv6 stack.

**IMS dual stack UE**: For the purpose of this technical report, an IMS dual stack UE means a UE implementation, which is based on 3GPP Release 5 or later IMS standards, but in addition to IPv6 can use IPv4 to access an IPv4 IM CN subsystem.

## 3.2 Symbols

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

| | |
|---|---|
| Gi | Reference point between GPRS and a packet data network. |
| Gm | Reference Point between a UE and a P-CSCF. |
| Gn | Interface between two GSNs within the same PLMN. |
| Mb | Reference point to network services. |

## 3.3 Abbreviations

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

| | |
|---|---|
| ALG | Application Level Gateway |
| CN | Core Network |
| CSCF | Call/Session Control Function |
| DHCP | Dynamic Host Configuration Protocol |
| DNS | Domain Name System |
| GGSN | Gateway GPRS Support Node |
| GPRS | General Packet Radio Service |
| GSN | GPRS Support Note |
| I-CSCF | Interrogating CSCF |
| IM | IP Multimedia |
| IMS | IP Multimedia Subsystem |
| IM-MGW | IP Multimedia ñ Media GateWay |
| IP | Internet Protocol |
| IPSec | IP Security protocol |
| MRFP | Multimedia Resource Function Processor |
| NAT | Network Address Translation |
| NA(P)T-PT | Network Address (Port-Multiplexing) Translation-Protocol Translation |
| OMA | Open Mobile Alliance |
| OTA | Over the Air Activation |
| PCO | Protocol Configuration Options |
| P-CSCF | Proxy-CSCF |
| PDP | Packet Data Protocol |
| QoS | Quality of Service |
| S-CSCF | Serving-CSCF |
| SGSN | Serving GPRS Support Node |
| SIP | Session Initiation Protocol |
| SMS | Short Message Service |
| TrGW | Transition Gateway |
| UE | User Equipment |

****** Next Modified Section *********

# 5.1 General

In order to provide support of early deployment of IPv4 IM CN subsystem, the implications on the terminals, GPRS system, the IM CN subsystem must be considered in the context of the functions provided by IPv6 IMS CN subsystem developed in 3GPP Rel 5 and onwards.

In addition, migration towards an IPv6 IM CN subsystem and co-existence of both IPv4 and IPv6 IM CN subsystem and thus interworking among these systems must also be considered using already available mechanism that may/will be used for early deployment scenarios. An IPv4 based IM CN subsystem implementation may need to support interworking with an IPv6 based 3GPP IM CN subsystem.

The 3GPP scope of early IMS implementations using IPv4 shall be primarily focused on considerations regarding the UE-network interface.

For IPv4 based IMS implementations the Mb reference point needs to provide access to IPv4 network services in addition to or instead of IPv6 network services. The relationship to Gi and other aspects of the Mb reference point, as defined in TS 23.002 [7a ], remain unchanged.

The following procedures shall be checked for possible impacts regarding the usage of IPv4:

- P-CSCF discovery; It is important to select one single P-CSCF discovery for early IPv4 IMS deployments to make interoperability easier.
- Access security (authentication and integrity protection);
- SIP Compression;
- Service Based Local Policy.

Aside from the P-CSCF address passed as part of the P-CSCF discovery, there are various other IMS entity addresses that are included in the IMS signalling methods. Addresses may be contained in route headers and may be passed in other headers such as to identify the appropriate on-line or off-line charging entities. It is necessary to verify that both IPv4 and IPv6 addresses can be supported. This is necessary to assure that both can be accommodated during the interim as a network evolves from one version to the other such that a flash cut is not required.

****** Next Modified Sections *********

## 5.3.7 IP Version Interworking for Services

### 5.3.7.1 Application Servers

Any interworking solution needs to consider the support for Application Servers. Application Servers may be dual stack or support only IPv6 or only IPv4.

### 5.3.7.2 Interworking support in dual stack IM CN subsystem

A dual stack IM CN subsystem and dual stack application servers may provide the necessary support for interworking between IP versions.

In particular, some IMS based services do not involve any media component but are based on SIP signalling only. Important examples are immediate messaging as described in subclause 5.16.1 of 3GPP TS 23.228 [4] and Presence as described in 3GPP TS 23.141 [5]. In such cases SIP signalling does not contain any IP addresses which would require a SIP-ALG. The dual stack IM CN subsystem can provide the necessary interworking: each entity forwards the SIP message using the appropriate IP version. Thus the service can be provided without any additional NAT in the network. This allows e.g. immediate messaging between an IPv4 UE and an IPv6 UE or allows a watcher with an IPv6 UE to subscribe to the presence information of a presentity publishing from a IPv4 UE, or vice versa. This is illustrated in figures 5-12 and 5-13 below.

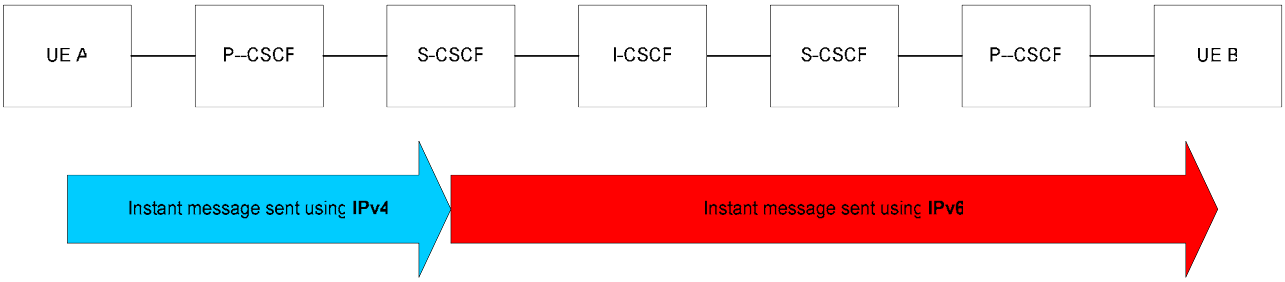


**Figure 5-12: Example with dual stack IM CN subsystem and Immediate Messaging**

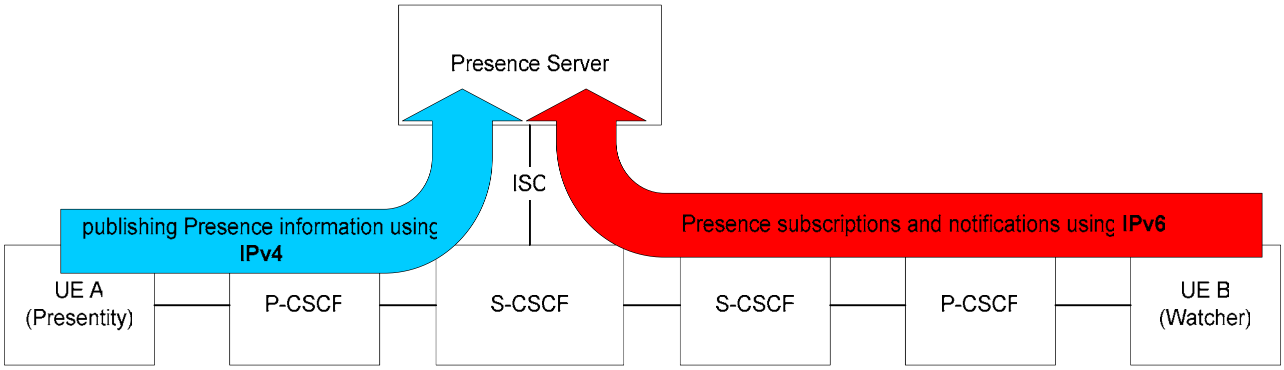


**Figure 5-13: Example with dual stack IM CN subsystem and Presence Server**

Note: In this scenario, if Presence information contains an IP address, then the IP address is not translated but provided as is to the watcher.

### 5.3.7.3 Access to network services

Access to IMS network services provided for example by MRFP or IM-MGW is done via the Mb reference point, see TS 23.002 [7a]. In the interest of interworking, the entities providing network services may support IPv6 only, IPv4 only or may be dual-stack. Accordingly, the Mb reference point should allow IPv4 access to network services.

## 5.4 Migration Scenarios

### 5.4.1 IPv4 UE and IPv6 IM CN subsystem

Due to migration, there may be cases where some IMS users still connect to the IMS using their IPv4 UE although the IM CN subsystem has evolved from IPv4 to IPv6.

In this case, the P-CSCF needs to support IPv4 towards the UE. An intermediary node between the UE and the P-CSCF would otherwise jeopardise the security association between the UE and P-CSCF. If the S-CSCF already evolved to IPv6, a NAT between P-CSCF and S-CSCF could provide the possibility for IPv4 UEs to register at an IPv6 S-CSCF with an IPv6 IP address.

While the detailed impact of this mechanism has not been studied within the TR, it is understood that it might have negative impact on security mechanisms, charging correlation and other services or capabilities that make use of the IP address. In line with the overall recommendation to avoid NATs, it is thus recommended to provide the dual stack capability in all IM CN subsystem nodes instead. Also, a NAT in such a scenario would not work on a per session basis, but would need to convert address information on a permanent basis.

The early deployment of IMS dual stack UEs facilitates the migration from IPv4 to IPv6, as it avoids the issue mentioned in this subclause.

### 5.4.2 A partially migrated IPv4 to IPv6 IM CN subsystem

While the final objective is a full scale IPv6 IMS, a combination of IPv4 and IPv6 IM CN subsystem elements may coexist temporarily in the same network due to migration from IPv4 to IPv6. It is for further study how to ensure inter-working in this case.

One approach would be to logically divide the network in two parts during the migration period and temporarily deploy NATs between the two parts using the interworking mechanisms described in subclause 5.3.

Another approach would be to deploy dual stack capable IMS networks already from the initial phase, which would avoid the issues described in this section.

In general, it can be seen that dual-stack IMS core network deployments make the migration to a full scale IPv6 IMS considerably easier.

### 5.4.3 Migration Aspects for Services

#### 5.4.3.1 Application Servers

Any migration solution needs to consider the support for Application Servers.

#### 5.4.3.2 Migration support in dual stack IM CN subsystem

An IPv4 IM CN subsystem (including application servers), which evolves to a dual stack IM CN subsystem, may provide the necessary support for both IPv4 UEs and IPv6 UEs. The considerations in subclause 5.3.7.2 apply also to this scenario.

#### 5.4.3.3 Access to network services

Any migration solution needs to consider the support in entities providing network services, such as MRFP and IM-MGW.

### 5.4.4 Example migration paths

Based on the considerations in this TR, the following could be example migration paths.

Operator A deploys an IPv4 based IM CN subsystem for the support of a few early server based IMS services. Operator(B) deploys a dual stack IM CN subsystem already for the earliest IMS services. In the initial phase, majority of the UEs available are IPv4 UEs, which support this limited set of services using IMS. In addition there may also be IMS dual stack UEs available. Later IMS dual stack UEs become more widely available and in addition support peer-to-peer services like voice. Gradually, operators A and B start to deploy more services over IMS. At some point the IM CN subsystem of operator A is migrated to a dual stack IM CN subsystem; the system can still support the early IPv4 UEs and the IMS dual stack UEs and in addition it is now possible to support IPv6 UEs. Finally the operators discontinue the support for IPv4 UEs and migrate to pure IPv6 IM CN subsystems.

********* END OF CHANGES **************

**3GPP TSG-SA WG2 Meeting #41**
**Montreal,Canada, 16-20 August 2004**

***Tdoc ⌘S2-042890***

*CR-Form-v7*

# CHANGE REQUEST

| ⌘ | 23.981 | CR | 002 | ⌘ rev | 1 | ⌘ | Current version: | 6.0.0 | ⌘ |
|---|---|---|---|---|---|---|---|---|---|

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

***Proposed change affects:*** UICC apps⌘ [ ] ME [X] Radio Access Network [ ] Core Network [X]

| | | | |
|---|---|---|---|
| ***Title:*** | ⌘ Creating a Rel-5 version of TR 23.981 | | |
| ***Source:*** | ⌘ SA2 (Siemens) | | |
| ***Work item code:*** | ⌘ IPv4IMS | ***Date:*** | ⌘ 19/08/2004 |
| ***Category:*** | ⌘ **B** | ***Release:*** | ⌘ Rel-5 |
| | *Use one of the following categories:*<br>***F*** *(correction)*<br>***A*** *(corresponds to a correction in an earlier release)*<br>***B*** *(addition of feature),*<br>***C*** *(functional modification of feature)*<br>***D*** *(editorial modification)*<br>Detailed explanations of the above categories can be found in 3GPP TR 21.900. | | *Use one of the following releases:*<br>*2 (GSM Phase 2)*<br>*R96 (Release 1996)*<br>*R97 (Release 1997)*<br>*R98 (Release 1998)*<br>*R99 (Release 1999)*<br>*Rel-4 (Release 4)*<br>*Rel-5 (Release 5)*<br>*Rel-6 (Release 6)* |

| | |
|---|---|
| ***Reason for change:*** | ⌘ SA#24 tasked SA WG2 to create a Rel-5 version of TR 23.981, removing any Rel-6 only content from the Rel-6 TR. This CR fulfills this request. It turned out however, that parts of the Rel-6 interworking architecture from TS 23.228 are essential for TR 23.981 as a whole. Thus it is proposed to include the architecture to the Release 5 version of TR 23.981 (which is informative in nature).<br>Also, Crs have been approved against the Rel-6 version at SA2#41, so these changes should also become part of the Rel-5 version. |
| ***Summary of change:*** | ⌘ - Add the Interworking architecture from 23.228 Rel-6 to TR 23.981 in Rel-5;<br>- Remove references to Rel-6 specification of Presence and Immediate Messaging;<br>- Remove Reference to work in progress in IETF (ISATAP);<br>- Replace Rel-6 terminology (IP-CAN bearer) by Rel-5 terminology (PDP context).<br>- Incorporate changes from CR#1 and CR#3rev1. |
| ***Consequences if not approved:*** | ⌘ SA decision would not be fulfilled. |

| | | | | |
|---|---|---|---|---|
| ***Clauses affected:*** | ⌘ 2, 3.1, 3.2, 3.3, 5.1, 5.2.1, 5.2.4.2, 5.3.1, 5.3.4.3, 5.3.6, 5.3.7.2, 5.3.7.3 (new), 5.4.3.3(new) | | | |
| | **Y** | **N** | | |
| ***Other specs affected:*** ⌘ | | X | Other core specifications | ⌘ |
| | | X | Test specifications | |
| | | X | O&M Specifications | |

| | |
|---|---|
| ***Other comments:*** | ⌘ |

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# 2 References

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[1] 3GPP TR 41.001: "GSM Release specifications".

[2] 3GPP TS 21.905: "Vocabulary for 3GPP Specifications".

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

[4] 3GPP TS 23.228: "IP Multimedia (IM) Subsystem - Stage 2".

[5] ~~3GPP TS 23.141: "Presence Service; Architecture and Functional Description".~~[void]

[6] 3GPP TS 23.060: "General Packet Radio Service (GPRS); Service description; Stage 2".

[7] 3GPP TS 33.203: "3G security; Access security for IP-based services".

[7a] 3GPP TS 23.002: "Network Architecture".

[8] [~~draft-ietf-ngtrans-isatap-21.txt (April 2004): "Intra-Site Automatic Tunnel Addressing Protocol (ISATAP)", work in progress.~~

~~Editor's note: The above document cannot be formally referenced until it is published as an RFC.~~void]

[9] 3GPP TS 24.008: "Mobile radio interface Layer 3 specification; Core network protocols; Stage 3".

[10] RFC 2373: "IP Version 6 Addressing Architecture".

[11] OMA Device Management 1.1.2.

[12] OMA Client Provisioning 1.1.

[13] RFC 2766: ìNetwork Address Translation-Protocol Translation (NAT-PT)î

[14] RFC 2663: ìIP Network Address Translator (NAT) Terminology and Considerationsî


# 3 Definitions, symbols and abbreviations

## 3.1 Definitions

For the purposes of the present document, the terms and definitions given in TS 21.905[2] and the following apply.

**Dual stack IM CN subsystem:** For the purpose of this technical report, a dual stack IM CN subsystem is an IM CN subsystem implementation in which all network entities support IPv4 and IPv6 for IMS communication. It is an IM CN subsystem implementation that supports both IPv6 as per 3GPP release 5 or later standards, and an IPv4 IM CN subsystem.

**IPv4 based IM CN subsystem implementation, IPv4 IM CN subsystem**: For the purpose of this technical report, an IPv4 based IM CN subsystem implementation (or short: IPv4 IM CN subsystem) means an IM CN subsystem implementation, which is based on 3GPP Release 5 or later standards, but uses IPv4 rather than IPv6.

**IPv4 based UE implementation, IPv4 UE**: For the purpose of this technical report, an IPv4 based UE implementation (or short: IPv4 UE) means a UE implementation, which is based on 3GPP Release 5 or later IMS standards, but uses IPv4 rather than IPv6 to access an IM CN subsystem.

**IPv6 based IM CN subsystem implementation, IPv6 IM CN subsystem**: For the purpose of this technical report, an IPv6 based IM CN subsystem implementation (or short: IPv6 IM CN subsystem) means the IM CN subsystem implementation according to 3GPP Release 5 or later standards that uses IPv6.

**IPv6 UE**: For the purpose of this technical report, an IPv6 UE means a UE implementation, which is based on 3GPP Release 5 or later IMS standards and uses only IPv6 to access IM CN subsystem even though the IP stack in the UE as such may be a dual IPv4 and IPv6 stack.

**IMS dual stack UE**: For the purpose of this technical report, an IMS dual stack UE means a UE implementation, which is based on 3GPP Release 5 or later IMS standards, but in addition to IPv6 can use IPv4 to access an IPv4 IM CN subsystem.

**NAT-PT/NAPT-PT:** NAT-PT uses a pool of globally unique IPv4 addresses for assignment to IPv6 nodes on a dynamic basis as sessions are initiated across the IP version boundaries. NAT-PT binds addresses in IPv6 network with addresses in IPv4 network and vice versa to provide transparent routing between the two IP domain without requiring any changes to end points, like the UE. NAT-PT needs to track the sessions it supports and mandates that inbound and outbound data for a specific session traverse the same NAT-PT router.

NAPT-PT provides additional translation of transport identifier (e.g., TCP and UDP port numbers, ICMP query identifiers). This allows the transport identifiers of a number of IPv6 hosts to be multiplexed into the transport identifiers of a single assigned IPv4 address. See Reference [13] for more details.

**ALG:** Application Level Gateway (ALG) is an application specific functional entity that allows an IPv6 node to communicate with an IPv4 node and vice versa when certain applications carry network addresses in the payloads like SIP/SDP. NA(P)T-PT is application unaware whereas ALGs are application specific translation entities that allow a host running an application to communicate transparently with another host running the same application but in a different IP version. See Reference [14] for more details.

For IMS, an **IMS ALG** provides the necessary application function for SIP/SDP protocols in order to communicate between IPv6 and IPv4 SIP applications.

## 3.2 Symbols

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

| | |
|---|---|
| Gi | Reference point between GPRS and a packet data network. |
| Gm | Reference Point between a UE and a P-CSCF. |
| Gn | Interface between two GSNs within the same PLMN. |
| Ix | Reference Point between IMS ALG and NA(P)T-PT |
| Mb | Reference point to network services. |
| Mx | Reference Point between a CSCF and IMS ALG |

## 3.3 Abbreviations

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

| | |
|---|---|
| ALG | Application Level Gateway |
| CN | Core Network |
| CSCF | Call/Session Control Function |
| DHCP | Dynamic Host Configuration Protocol |
| DNS | Domain Name System |
| GGSN | Gateway GPRS Support Node |
| GPRS | General Packet Radio Service |
| GSN | GPRS Support Note |
| I-CSCF | Interrogating CSCF |
| IM | IP Multimedia |
| IMS | IP Multimedia Subsystem |
| IM-MGW | IP Multimedia ñ Media GateWay |
| IP | Internet Protocol |

| | |
|---|---|
| IPSec | IP Security protocol |
| MRFP | Multimedia Resource Function Processor |
| NAT | Network Address Translation |
| NA(P)T-PT | Network Address (Port-Multiplexing) Translation-Protocol Translation |
| OMA | Open Mobile Alliance |
| OTA | Over the Air Activation |
| PCO | Protocol Configuration Options |
| P-CSCF | Proxy-CSCF |
| PDP | Packet Data Protocol |
| QoS | Quality of Service |
| S-CSCF | Serving-CSCF |
| SGSN | Serving GPRS Support Node |
| SIP | Session Initiation Protocol |
| SMS | Short Message Service |
| TrGW | Transition Gateway |
| UE | User Equipment |

*** next set of changes ***

## 5.1 General

In order to provide support of early deployment of IPv4 IM CN subsystem, the implications on the terminals, GPRS system, the IM CN subsystem must be considered in the context of the functions provided by IPv6 IMS CN subsystem developed in 3GPP Rel 5 and onwards.

In addition, migration towards an IPv6 IM CN subsystem and co-existence of both IPv4 and IPv6 IM CN subsystem and thus interworking among these systems must also be considered using already available mechanism that may/will be used for early deployment scenarios. An IPv4 based IM CN subsystem implementation may need to support interworking with an IPv6 based 3GPP IM CN subsystem.

The 3GPP scope of early IMS implementations using IPv4 shall be primarily focused on considerations regarding the UE-network interface.

For IPv4 based IMS implementations the Mb reference point needs to provide access to IPv4 network services in addition to or instead of IPv6 network services. The relationship to Gi and other aspects of the Mb reference point, as defined in TS 23.002 [7a ], remain unchanged.

The following procedures shall be checked for possible impacts regarding the usage of IPv4:

- P-CSCF discovery; It is important to select one single P-CSCF discovery for early IPv4 IMS deployments to make interoperability easier.
- Access security (authentication and integrity protection);
- SIP Compression;
- Service Based Local Policy.

Aside from the P-CSCF address passed as part of the P-CSCF discovery, there are various other IMS entity addresses that are included in the IMS signalling methods. Addresses may be contained in route headers and may be passed in other headers such as to identify the appropriate on-line or off-line charging entities. It is necessary to verify that both IPv4 and IPv6 addresses can be supported. This is necessary to assure that both can be accommodated during the interim as a network evolves from one version to the other such that a flash cut is not required.

## 5.2 UE access to IM CN subsystem

### 5.2.1 Obtaining IP address and P-CSCF discovery

Prior to communication with the IM CN subsystem, the UE:

a) establishes a ~~connection with the IP-CAN~~PDP context;

b) obtains an IP address using either the standard IETF protocols (e.g., DHCP) or a protocol that is particular to the IP-CAN technology that the UE is utilising;

c) acquires a P-CSCF address.

The existing P-CSCF discovery mechanism are either IPv6 specific or use Release 5 or later GPRS. For an IPv4 based IMS implementation, operators may need other mechanisms not currently defined as possible options in 3GPP IMS.

The following mechanisms need to be evaluated for P-CSCF discovery in IPv4:

a) the address of the P-CSCF can be requested by the UE and returned by the GGSN at PDP context establishment time. An IPv4 UE would need to obtain an IPv4 address as part of this exchange.

   If the PDP context established is of PDP type IPv4, then the GGSN may provide an IPv4 P-CSCF address. This does not preclude scenarios, where the GGSN returns an IPv6 P-CSCF address at IPv4 PDP context establishment, e.g. for the support of tunnelling (see subclause 5.3.4.3), or both IPv4 and IPv6 P-CSCF addresses. If the PDP type is IPv4 then it is recommended that the GGSN always return both IP versions, if it is capable, using the existing capabilities to send multiple P-CSCF addresses within the PCO IE.

   According to TS 24.008 [9], the P-CSCF address in the PCO field is an IPv6 address. Thus there are at least two possible approaches: The first approach would be to avoid any changes to or deviations from TS 24.008 [9] and use the existing methods to transfer an IPv4 address as an IPv6 address ("IPv6 address with embedded IPv4 address", as defined in RFC 2373 [10]).

~~Editor's Note: The use of an "IPv4-compatible" IPv6 address versus an "IPv4-mapped address" is for further study .~~

   The second approach would set the PCO field length to 4 and put the IP address in the content field. This would be a straightforward generalization of the specified method.

   In a migration period with a dual stack network, it may be useful for an operator to provide a common P-CSCF discovery mechanism for both the early IPv4 only UEs and the IPv6 Rel-5 (or later) UEs. In that case, the first approach using embedded addresses is recommended, as it does not require any changes to or deviations from TS 24.008.

b) based on DHCP. Currently the specifications limit this to the IPv6 methods for DHCP. In order for this method to be used by an IPv4 UE, it needs to be identified how IPv4 DHCP is used to obtain the P-CSCF address. A solution that provides access independence would be that an IPv4 P-CSCF and IPv4 UE support configuration of the appropriate P-CSCF information via DHCPv4. In this solution, use of DHCP provides the UE with the fully qualified domain name of a P-CSCF and the address of a Domain Name Server (DNS) that is capable of resolving the P-CSCF name. When using DHCP/DNS procedure for P-CSCF discovery with IPv4 GPRS-access, the GGSN acts as DHCP Relay agent relaying DHCP messages between UE and the DHCP server. This is necessary to allow the UE to properly interoperate with the GGSN. This solution however requires that a UE supporting early IPv4 implementations would support DHCPv4.

c) other mechanisms, such as SMS, OTA, OMA device management or other configuration schemes are already in use today by deployed UEs. Some of the provisioning mechanisms in use are vendor specific (such as pre-configuration mechanisms), but it is assumed that most of the early-deployed IPv4 UEs will support OMA specified provisioning mechanisms such as OMA Client Provisioning [12] and OMA Device Management (DM) [11]. It is recommended that provisioning parameters for IPv4 P-CSCF discovery be defined for OMA standardised provisioning mechanisms such as OMA DM [11].

The provisioning mechanism in c) does not require any support from the GPRS infrastructure and is thus expected to be used in early implementations from the beginning. The mechanism in a) may facilitate migration to one of the P-CSCF discovery mechanisms specified in TS 23.228. It is assumed that a UE, which has a pre-configured P-CSCF address, would try to connect to the pre-configured P-CSCF before using any other P-CSCF discovery mechanism.

| *** next set of changes *** |
|---|

### 5.2.4.2 Implications of not supporting IPv6 in SGSN

An inter-SGSN RAU may be rejected when using a PDP context with PDP type IPv6 due to the new SGSN does not support PDP type IPv6, or the new SGSN may accept the RAU but would then de-activate the PDP contexts it cannot support. If the behaviour above is followed and there are SGSNs in the roamed to PLMN that do not support PDP type IPv6, UEs accessing IMS from that PLMN may after a while end-up using PDP contexts of PDP type IPv4. That is, the communication towards IMS would be interrupted and the UE would have to re-register in IMS using an IPv4 address.

The UE would have to de-register from IMS and deactivate related PDP contexts before accessing IMS using a PDP context of PDP type IPv6 again, see subclause 5.2.2.1 for an IMS dual-stack UE behaviour.

The move to PDP contexts of type IPv4 would be avoided if all SGSNs support PDP type IPv6.

The IMS communication interruption and re-registration with an IPv4 address in IMS could be avoided if the UE uses a tunnelling mechanism like ISATAP [8]. However, as the UE is not on its own aware of IPv6 support in SGSNs, it is not possible for the UE to make a decision when to use and when not to use tunnelling.

# 5.3 Interworking scenarios

## 5.3.1 Interworking architecture and NATs

### 5.3.1.1 Interworking architecture

#### 5.3.1.1.1 General

This subclause TS 23.228 [4],5.3.1.1 clause 5.38, defines an architecture for interworking between an IPv6 based 3GPP IM CN subsystem and IPv4 SIP networks. It uses the concept of IMS-ALG and NATs (TrGWs), based on the general concept of ALGs and NA(P)T/NA(P)-PT: The IMS ALG is the necessary application level gateway, which is aware of SIP/SDP protocols, and the TrGW is a NA(P)T-PT, which provides the translation function.. An IPv4 based IM CN subsystem is a particular example for an IPv4 SIP network, and thus the interworking architecture may be applied. These mechanisms defined in 23.228 [4] are also applicable when an IPv4 IM CN subsystem migrates to IPv6, and needs to interwork with other IPv4 IM CN subsystems or IPv4 SIP networks.

The IP version interworking should not adversely affect IMS sessions that do not require IP version interworking. One possible architecture scenario can be based on the principle defined in 3GPP TS 23.221[3] using gateways.

Figure 5-x shows a high-level architecture diagram for one interworking model. In this case, the TrGW is a NA(P)T-PT providing the translation function.

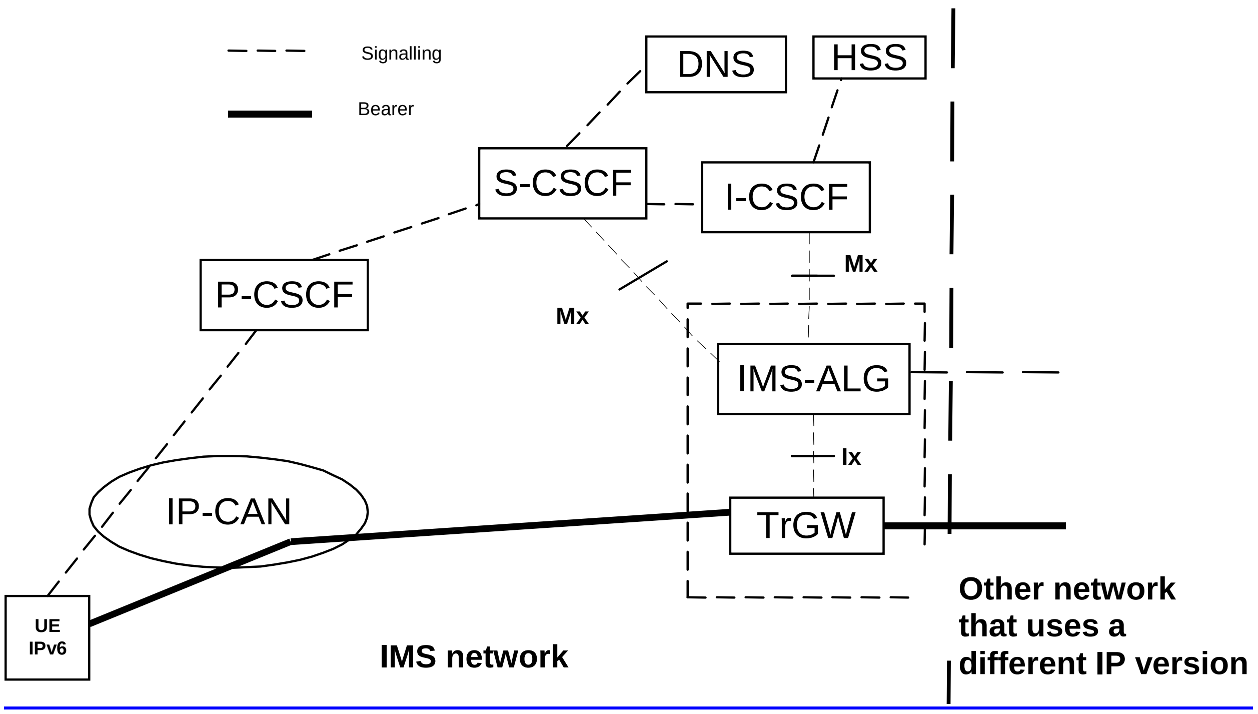


**Figure 5-x: General IP version interworking principle with TrGW**

The Mx reference point allows S-CSCF/I-CSCF to communicate with an IMS ALG function in order to provide interworking with networks that use a different IP version.

The Mx & Ix reference points are not specified within this release.

#### 5.3.1.1.2 Originating Session Flows towards IPv4 SIP network

The following example session flow shows a scenario where the S-CSCF is responsible for inserting the IMS-ALG in the session path. No I-CSCF node shown in this scenario, if configuration requires presence of an I-CSCF then it would have been collocated with the IMS-ALG.

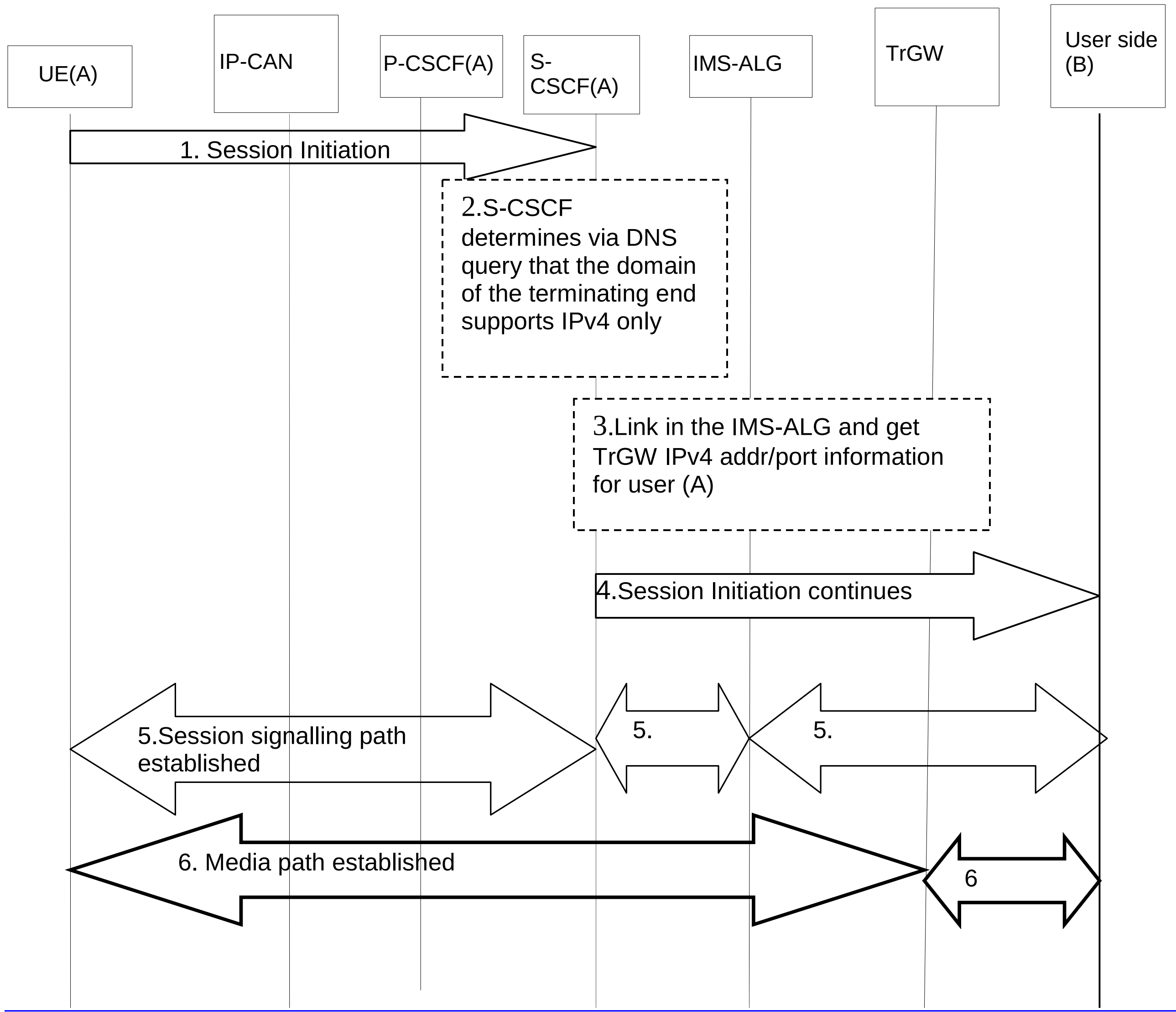


**Figure 5-y: Originating IMS session towards an IPv4 end point**

1. UE (A) initiates an IMS session towards User B, via the session path for IMS and the session is analysed at the S-CSCF of UE (A).
2. S-CSCF for user A determines via DNS (or other mechanism) that the User Bís domain cannot be communicated via IPv6 but can be via IPv4.
3. S-CSCF then acquires the necessary resources (via IMS ALG and TrGW) such as the IPv4 address and ports on behalf of user A so that User A can communicate with user B transparently.
4. The S-CSCF/IMS-ALG continues IMS signalling towards User B network where User Aís IPv6 address/port information is replaced by IPv4 information.
5. When User (B) responds to the session initiation requests, the IMS-ALG will replace the IPv4 address/port information of User (B) with its own IPv6 information for signalling and with TrGW IPv6 information for the media path as the contact information of User (B) and forward the request to S-CSCF of UE (A). Session signalling path is then established between the UE and the S-CSCF, the S-CSCF and the IMS-ALG, the IMS-ALG and the external network for User B.
6. The media path is established between the UE (A) and the TrGW, via the IP-CAN, and then between the TrGW and user B.

At session release, the IP address/Port information will be released for reuse by other sessions.

#### 5.3.1.1.3 Terminating Session Flows from IPv4 SIP network

The following session flow shows an example of a terminating session from an IPv4 SIP client towards and IPv6 IMS client. In order for the IPv6 IMS client to be reachable by the IPv4 network, it is assumed that the IPv4 network discovers (via mechanism such as DNS query) the IMS-ALG as the entry point to the IPv6 IMS network.

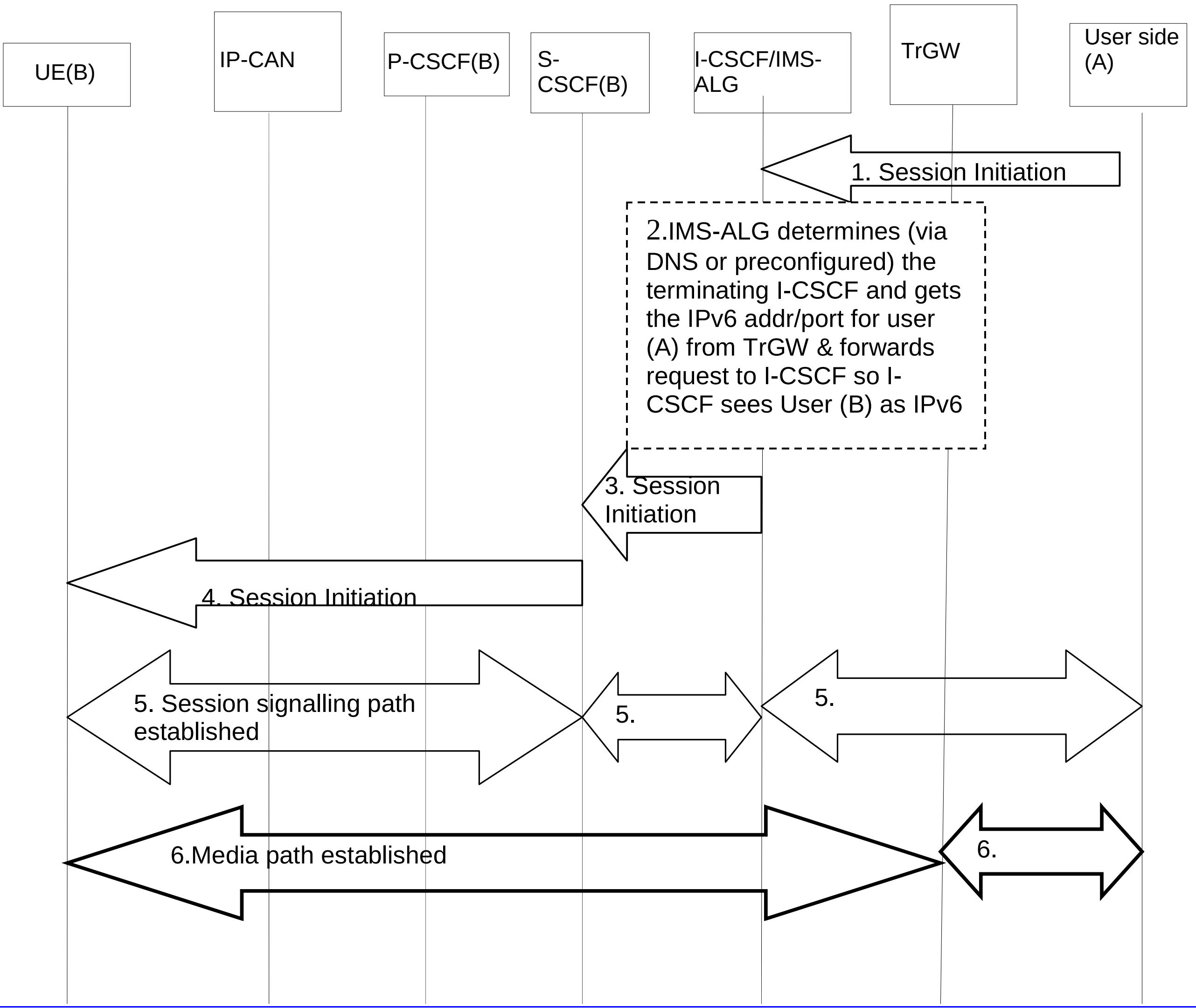


**Figure 5-z: Terminating IPv4 SIP session towards an IPv6 IMS user**

1. In the IMS-ALG, a terminating session is received. IMS-ALG determines either via DNS query or via preconfiguration the appropriate I-CSCF for the user (B) in the IMS network.

2. IMS-ALG also communicates with TrGW to get the mapping of IPv6 address and ports on behalf of user (A) and replaces the User (A) information in the incoming SIP message and forwards the message towards S-CSCF. From S-CSCF point of view, it continues setting up the IMS session like any other IMS sessions.

3. The incoming session arrives in the S-CSCF for the user (B).

4. Session set up continues as usual in the IMS domain towards user (B).

5. When UE (B) responds to the session initiation requests, the IMS-ALG will replace the IPv6 address/port information of User (B) with its own IPv4 information for signalling and with TrGW IPv4 information for the media path as contact information of UE (B) and forward the request towards the network of User (A). Session signalling path is established between User (B) and S-CSCF, S-CSCF and I-CSCF/IMS-ALG and IMS-ALG and the external User (A)ís network.

6. Media path is established between UE (B) and the TrGW, via the IP-CAN, and then between the TrGW and User (A).

At session release, the IP address/Port information will be released for reuse by other sessions.

*** next set of changes ***

#### 5.3.4.3 Roaming ñ IPv4 visited network, IPv6 IMS home network

The UE and the SGSN are in the IPv4 visited network. The GGSN, P-CSCF, I-CSCF and S-CSCF are in the IPv6 home network. The IMS home network is IPv6 only. The UE may be ~~IPv4~~ IPv6 only or may be IMS dual stack UE. Subclause 5.2.2.1 applies to the dual stack UE accessing the visited and home network.

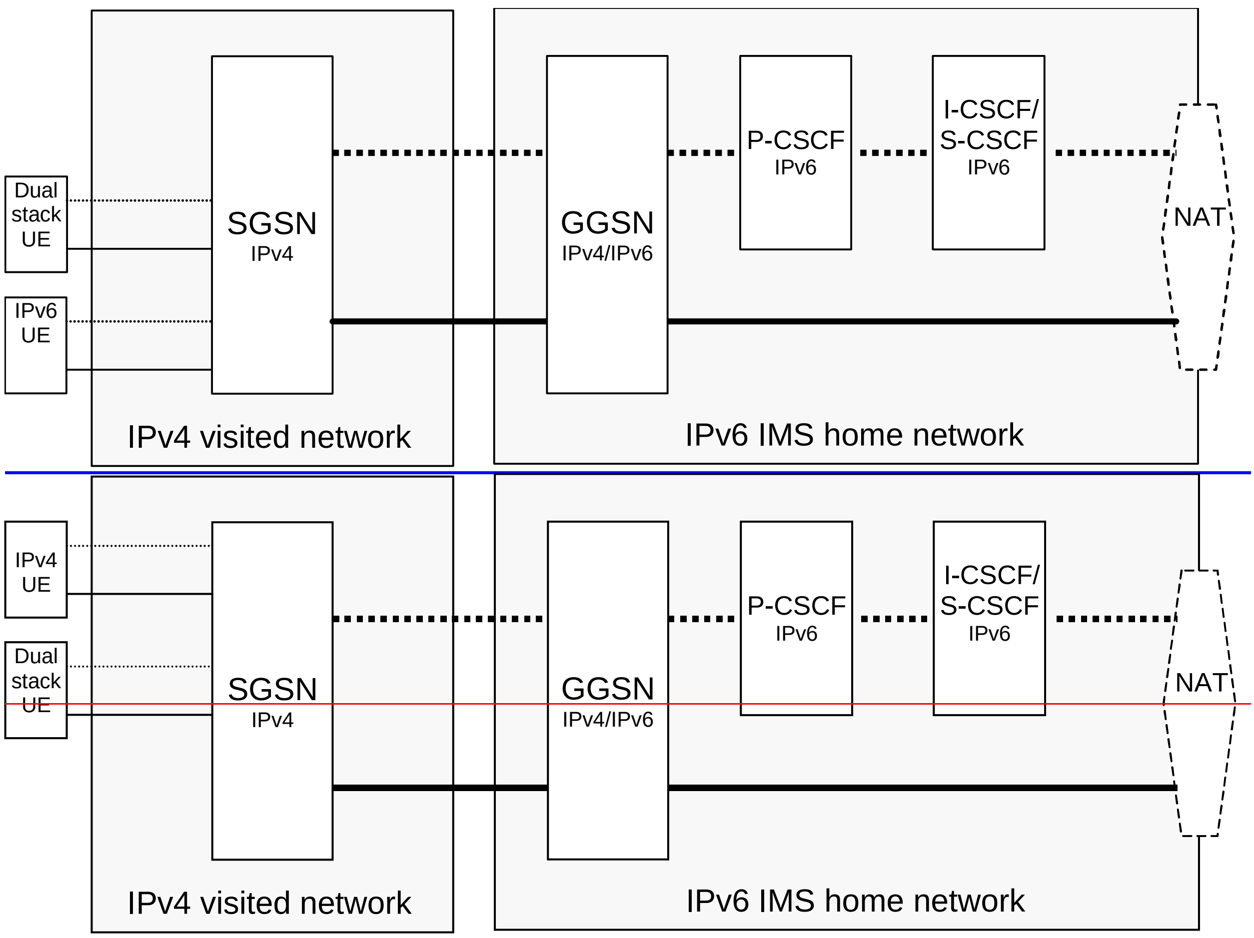


**Figure 5-7: GPRS roaming ñ IPv4 visited network, IPv6 home network**

In this scenario the requirement from subclause 4.2 is not met.

This is an attractive IMS deployment scenario for operators as it does not rely on the support of any explicit IMS functionality in the visited network; however problems arise through the lack of IPv6 PDP context support in the visited network. As such, operators should wherever possible seek agreements with their roaming partners for the support of IPv6 contexts where IMS roaming is to be supported (this should be the long term objective).

In the event that an IPv6 context is not available in the visited network, the only alternatives for the operator deploying an IPv6 only IM CN subsystem is are (a) to employ a dual stack IMS and establish an IPv4 IMS session or (b) to use a tunneling method between the UE and home network in order to acquire an IPv6 address. When the UE is IPv6 only, it is assumed that the UE does not have the capability to use a tunneling method between the UE and the home network to acquire an IPv6 address.

Tunneling of IPv6 packets over IPv4 from the UE to the IMS CN subsystem is a technically feasible, but there are various issues that would need to be addressed. There would be the need for an IPv4-IPv6 gateway acting as the tunnel end-point responsible for packing/unpacking the IPv6 packets. The UE would need to discover and address it. Also, the UE would need the ability to tunnel the packets. Further work would be needed on how the UE would address this entity, however existing ongoing IETF work (e.g. ISATAP [6]) could be used. This implementation would require additional functionality in the UE compared to the minimum IPv6 functionality as stated in 3GPP TS 23.221 [3] and an additional ISATAP router functionality in the network. Header compression using e.g. RFC 2507 is able to compress both the IPv4 and the IPv6 header. The SBLP mechanisms at the Go interface could not be used between an IPv4 GGSN and an IPv6 P-CSCF, i.e. this solution is not possible if SBLP over Go is required. This is therefore not a particularly attractive solution.

Similar considerations like in subclause 5.2.2.1 apply: one approach is that the UE would initially attempt to establish an IPv6 context to its home GGSN and, if this fails, establish an IPv4 context and tunnel an IPv6 IMS session over IPv4.

It can be concluded that network operators, who introduce 3GPP IMS using IPv6, have a strong interest that their GPRS roaming partners provide support for PDP contexts of PDP type IPv6.

*** next set of changes ***

### 5.3.6 Summary of issues arising from the scenarios

The following issues arise from the scenarios presented in subclauses 5.3.3, 5.3.4 and 5.3.5 above:

1. Address translation between private and public IPv4 address spaces for both signalling and bearer path;

   See considerations in subclause 5.3.1.2.

2. Address translation and protocol translation between IPv4 and IPv6 for both signalling and bearer path;

   As per the considerations under point 1) above, NAT- and ALG-based address and protocol translations shall be avoided whenever possible. The need for address and protocol translation between IPv4 and IPv6 is expected to be limited for the following two cases:

   - An IPv4 IM CN subsystem interconnecting with IPv6 IMS networks;
   - External non-3GPP IPv4 SIP networks interconnecting with IPv6 IMS networks;

     TS 23.228 [4] specifies the architecture as described in subclause 5.3.1.1

   Additionally, some scenarios (as per subclause 5.3.5) might need IP version interworking between the P-CSCF and the S-CSCF. However, it is desired to avoid IP version interworking between P-CSCF and S-CSCF. See subclause 5.3.5.2 for details.

3. Address translation and protocol translation for the bearer path;

4. IP version used on the connection between IM CN subsystems, both in roaming and interworking scenarios;

   It is recommended for IMS networks to apply an IP version for interconnecting to other networks that minimizes the need for IP address and/or protocol translation. This can be achieved if vast majority of operators migrate towards using IPv6 as early as possible to avoid the need for address (and protocol) translation.

Note: Early IMS deployments using public IPv4 addressing for their network elements and UEs can interconnect with each other without address translation.

5. IP version used by a dual-stack UE to access the IM CN subsystem in case of IMS roaming;

   See subclause 5.2.2.1.

6. Use of IMS in the home network through GPRS roaming in a network, which does not support IPv6 PDP contexts.

   It is recommended for GPRS networks offering IMS access capabilities to offer support for IPv6 PDP Contexts (i.e. upgrading the SGSNs to support IPv6 type of PDP context).

   Alternatively, roaming UEs using IPv6 to connect to their home IMS network would need to use some IPv6-in-IPv4 tunnelling mechanism in the UE (see, e.g. ~~ISATAP [8], see~~ subclause 5.3.4.3). However, such tunnelling solutions would not work well with QoS differentiation mechanisms (e.g. Service Based Local Policy) of the core network.

Note: Issue 6 is not directly related to IPv4 based IMS implementations.

*** next set of changes ***

#### 5.3.7.2 Interworking support in dual stack IM CN subsystem

A dual stack IM CN subsystem and dual stack application servers may provide the necessary support for interworking between IP versions.

In particular, some IMS based services do not involve any media component but are based on SIP signalling only. ~~Important e~~Examples are immediate messaging ~~as described in subclause 5.16.1 of 3GPP TS 23.228 [4]~~ and Presence ~~as described in 3GPP TS 23.141 [5]~~. In such cases SIP signalling does not contain any IP addresses which would require a

SIP-ALG. The dual stack IM CN subsystem can provide the necessary interworking: each entity forwards the SIP message using the appropriate IP version. Thus the service can be provided without any additional NAT in the network. This allows e.g. immediate messaging between an IPv4 UE and an IPv6 UE or allows a watcher with an IPv6 UE to subscribe to the presence information of a presentity publishing from a IPv4 UE, or vice versa. This is illustrated in figures 5-12 and 5-13 below.

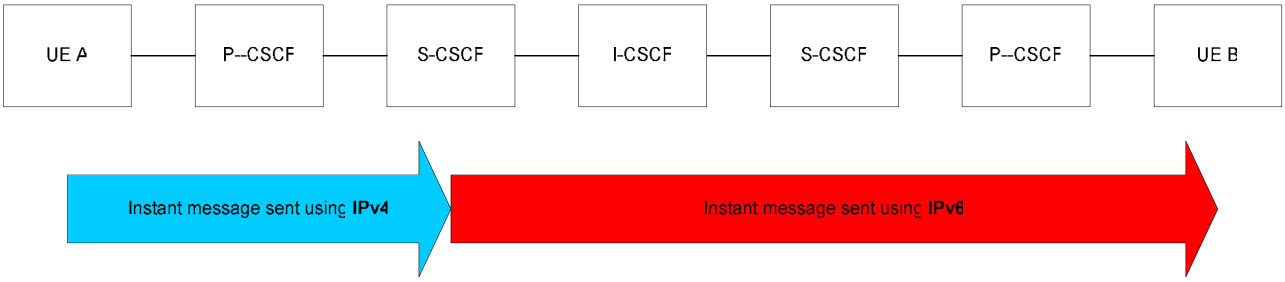


**Figure 5-12: Example with dual stack IM CN subsystem and Immediate Messaging**

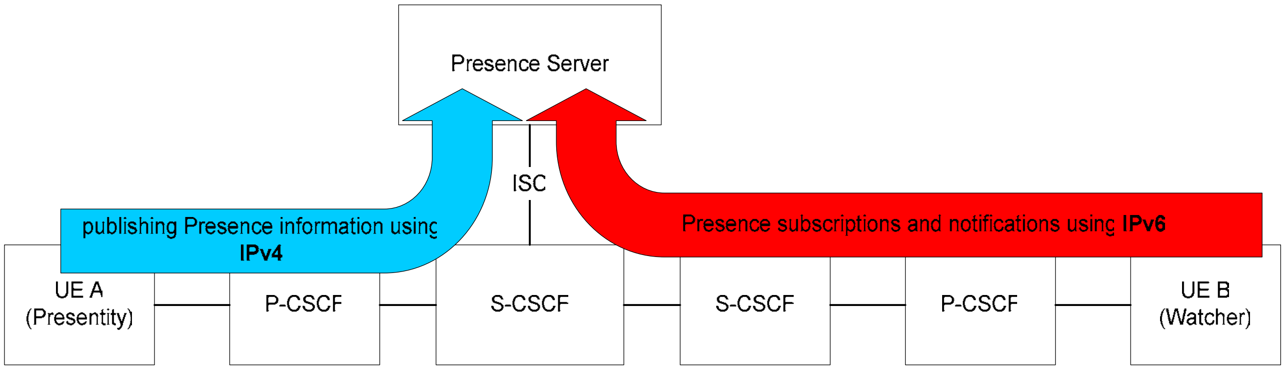


**Figure 5-13: Example with dual stack IM CN subsystem and Presence Server**

Note: In this scenario, if Presence information contains an IP address, then the IP address is not translated but provided as is to the watcher.

### 5.3.7.3 Access to network services

Access to IMS network services provided for example by MRFP or IM-MGW is done via the Mb reference point, see TS 23.002 [7a]. In the interest of interworking, the entities providing network services may support IPv6 only, IPv4 only or may be dual-stack. Accordingly, the Mb reference point should allow IPv4 access to network services.

# 5.4 Migration Scenarios

## 5.4.1 IPv4 UE and IPv6 IM CN subsystem

Due to migration, there may be cases where some IMS users still connect to the IMS using their IPv4 UE although the IM CN subsystem has evolved from IPv4 to IPv6.

In this case, the P-CSCF needs to support IPv4 towards the UE. An intermediary node between the UE and the P-CSCF would otherwise jeopardise the security association between the UE and P-CSCF. If the S-CSCF already evolved to IPv6, a NAT between P-CSCF and S-CSCF could provide the possibility for IPv4 UEs to register at an IPv6 S-CSCF with an IPv6 IP address.

While the detailed impact of this mechanism has not been studied within the TR, it is understood that it might have negative impact on security mechanisms, charging correlation and other services or capabilities that make use of the IP address. In line with the overall recommendation to avoid NATs, it is thus recommended to provide the dual stack capability in all IM CN subsystem nodes instead. Also, a NAT in such a scenario would not work on a per session basis, but would need to convert address information on a permanent basis.

The early deployment of IMS dual stack UEs facilitates the migration from IPv4 to IPv6, as it avoids the issue mentioned in this subclause.

### 5.4.2 A partially migrated IPv4 to IPv6 IM CN subsystem

While the final objective is a full scale IPv6 IMS, a combination of IPv4 and IPv6 IM CN subsystem elements may coexist temporarily in the same network due to migration from IPv4 to IPv6. It is for further study how to ensure inter-working in this case.

One approach would be to logically divide the network in two parts during the migration period and temporarily deploy NATs between the two parts using the interworking mechanisms described in subclause 5.3.

Another approach would be to deploy dual stack capable IMS networks already from the initial phase, which would avoid the issues described in this section.

In general, it can be seen that dual-stack IMS core network deployments make the migration to a full scale IPv6 IMS considerably easier.

### 5.4.3 Migration Aspects for Services

#### 5.4.3.1 Application Servers

Any migration solution needs to consider the support for Application Servers.

#### 5.4.3.2 Migration support in dual stack IM CN subsystem

An IPv4 IM CN subsystem (including application servers), which evolves to a dual stack IM CN subsystem, may provide the necessary support for both IPv4 UEs and IPv6 UEs. The considerations in subclause 5.3.7.2 apply also to this scenario.

#### 5.4.3.3 Access to network services

Any migration solution needs to consider the support in entities providing network services, such as MRFP and IM-MGW.

### 5.4.4 Example migration paths

Based on the considerations in this TR, the following could be example migration paths.

Operator A deploys an IPv4 based IM CN subsystem for the support of a few early server based IMS services. Operator(B) deploys a dual stack IM CN subsystem already for the earliest IMS services. In the initial phase, majority of the UEs available are IPv4 UEs, which support this limited set of services using IMS. In addition there may also be IMS dual stack UEs available. Later IMS dual stack UEs become more widely available and in addition support peer-to-peer services like voice. Gradually, operators A and B start to deploy more services over IMS. At some point the IM CN subsystem of operator A is migrated to a dual stack IM CN subsystem; the system can still support the early IPv4 UEs and the IMS dual stack UEs and in addition it is now possible to support IPv6 UEs. Finally the operators discontinue the support for IPv4 UEs and migrate to pure IPv6 IM CN subsystems.

********* END OF CHANGES **************

**3GPP TSG-SA2 Meeting #41** **Tdoc S2-042889**
**Montreal, Canada, 16-20 August 2004**

*CR-Form-v7.1*

# CHANGE REQUEST

| | | | | | |
|---|---|---|---|---|---|
| ⌘ **23.981** | **CR** **003** | ⌘ **rev** **1** ⌘ | Current version: | **6.0.0** | ⌘ |

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

***Proposed change affects:*** UICC apps⌘ [ ] ME [ ] Radio Access Network [ ] Core Network [X]

| | |
|---|---|
| ***Title:*** | ⌘ Corrections to scenario ñ IPv4 visited and IPv6 home |
| ***Source:*** | ⌘ SA2 (Ericsson) |
| ***Work item code:*** | ⌘ IPv4IMS |
| ***Date:*** | ⌘ 19/08/2004 |
| ***Category:*** | ⌘ **F** |
| ***Release:*** | ⌘ Rel-6 |

*Use one of the following categories:*
***F*** *(correction)*
***A*** *(corresponds to a correction in an earlier release)*
***B*** *(addition of feature),*
***C*** *(functional modification of feature)*
***D*** *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

*Use one of the following releases:*
*Ph2 (GSM Phase 2)*
*R96 (Release 1996)*
*R97 (Release 1997)*
*R98 (Release 1998)*
*R99 (Release 1999)*
*Rel-4 (Release 4)*
*Rel-5 (Release 5)*
*Rel-6 (Release 6)*
*Rel-7 (Release 7)*

| | |
|---|---|
| ***Reason for change:*** ⌘ | The sentence (in subclause 5.3.4.3) "This is therefore not a particularly attractive solution." was removed by the agreed document S2-042174, but the change was not implemented in version 1.2.0 and consequently not in version 6.0.0 either.<br><br>The scenario in subclause 5.3.4.3 is ìRoaming ñ IPv4 visited network, IPv6 IMS home networkî. In the figure an IPv4 UE is used, which should not be applicable as the home network IMS is IPv6 only. |
| ***Summary of change:*** ⌘ | The sentence "This is therefore not a particularly attractive solution." is removed from subclause 5.3.4.3.<br><br>The IPv4 only UE is removed from the scenario description and replaced by an IPv6 UE. |
| ***Consequences if not approved:*** ⌘ | The scenario describes a not applicable deployment |

| | | | | |
|---|---|---|---|---|
| ***Clauses affected:*** ⌘ | 5.3.4.3 | | | |
| | **Y** | **N** | | |
| ***Other specs affected:*** ⌘ | | X | Other core specifications | ⌘ |
| | | X | Test specifications | |
| | | X | O&M Specifications | |
| ***Other comments:*** ⌘ | | | | |

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Comprehensive information and tips about how to create CRs can be found at http://www.3gpp.org/specs/CR.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

### 5.3.4.3 Roaming ñ IPv4 visited network, IPv6 IMS home network

The UE and the SGSN are in the IPv4 visited network. The GGSN, P-CSCF, I-CSCF and S-CSCF are in the IPv6 home network. The IMS home network is IPv6 only. The UE may be IPv64 only or may be IMS dual stack UE. Subclause 5.2.2.1 applies to the dual stack UE accessing the visited and home network.

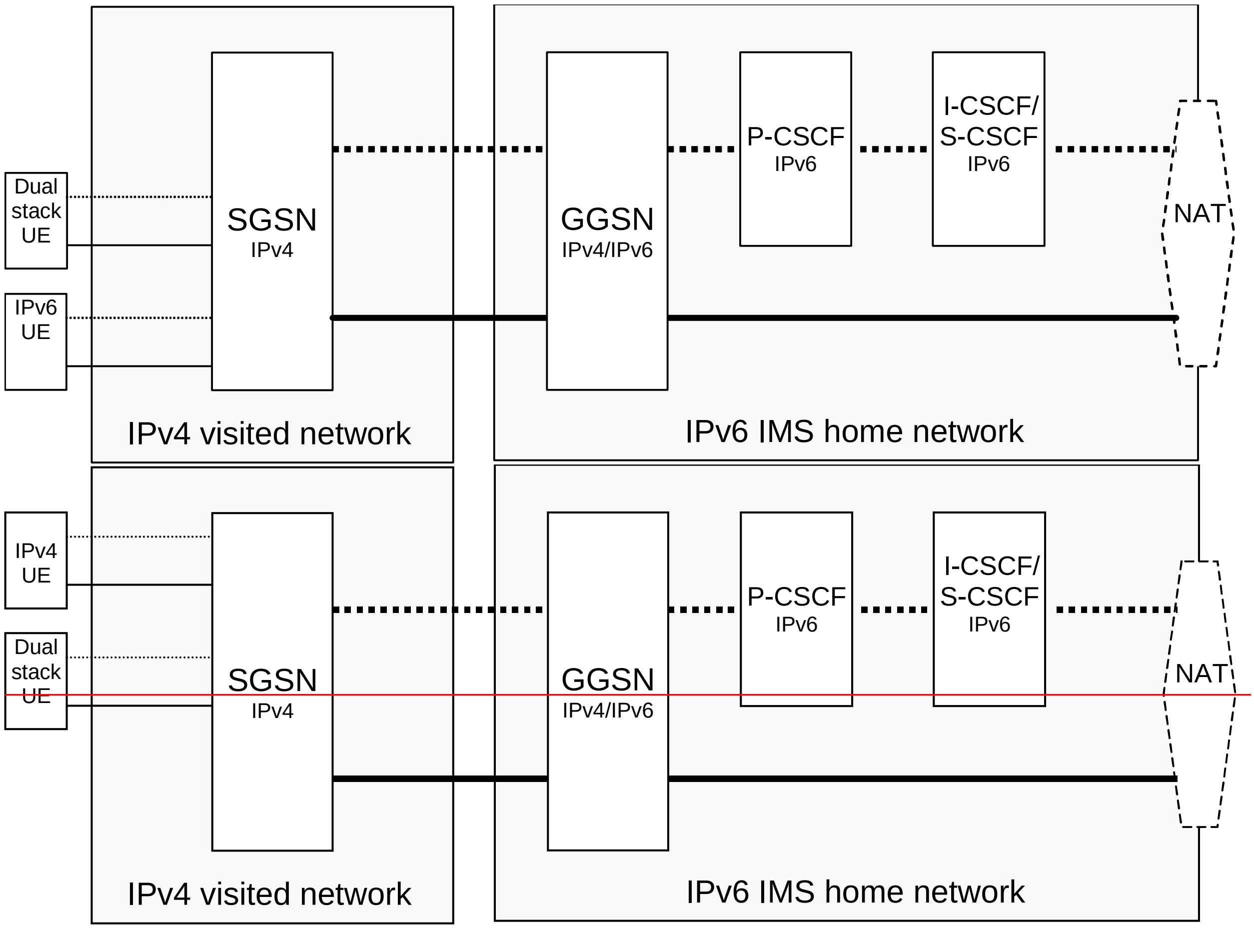


**Figure 5-7: GPRS roaming ñ IPv4 visited network, IPv6 home network**

In this scenario the requirement from subclause 4.2 is not met.

This is an attractive IMS deployment scenario for operators as it does not rely on the support of any explicit IMS functionality in the visited network; however problems arise through the lack of IPv6 PDP context support in the visited network. As such, operators should wherever possible seek agreements with their roaming partners for the support of IPv6 contexts where IMS roaming is to be supported (this should be the long term objective).

In the event that an IPv6 context is not available in the visited network, the only alternatives for the operator deploying an IPv6 only IM CN subsystem is ~~are (a) to employ a dual stack IMS and establish an IPv4 IMS session or (b)~~ to use a tunneling method between the UE and home network in order to acquire an IPv6 address. When the UE is IPv6 only, it is assumed that the UE does not have the capability to use a tunneling method between the UE and the home network to acquire an IPv6 address.

Tunneling of IPv6 packets over IPv4 from the UE to the IMS CN subsystem is a technically feasible, but there are various issues that would need to be addressed. There would be the need for an IPv4-IPv6 gateway acting as the tunnel end-point responsible for packing/unpacking the IPv6 packets. The UE would need to discover and address it. Also, the UE would need the ability to tunnel the packets. Further work would be needed on how the UE would address this entity, however existing IETF work (e.g. ISATAP [6]) could be used. This implementation would require additional functionality in the UE compared to the minimum IPv6 functionality as stated in 3GPP TS 23.221 [3] and an additional ISATAP router functionality in the network. Header compression using e.g. RFC 2507 is able to compress both the IPv4 and the IPv6 header. The SBLP mechanisms at the Go interface could not be used between an IPv4 GGSN and an IPv6 P-CSCF, i.e. this solution is not possible if SBLP over Go is required. ~~This is therefore not a particularly attractive solution.~~

Similar considerations like in subclause 5.2.2.1 apply: one approach is that the UE would initially attempt to establish an IPv6 context to its home GGSN and, if this fails, establish an IPv4 context and tunnel an IPv6 IMS session over IPv4.

It can be concluded that network operators, who introduce 3GPP IMS using IPv6, have a strong interest that their GPRS roaming partners provide support for PDP contexts of PDP type IPv6.