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Technical Specification

Telecommunications and Internet Converged Services and Protocols for Advanced Networking (TISPAN); IMS-based PSTN/ISDN Emulation Subsystem; Functional architecture

Reference
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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN).

1 Scope

The present document describes an IMS-based functional architecture for the PSTN/ISDN Emulation Subsystem (PES) of the ETSI TISPAN NGN overall architecture. The IMS-based PSTN/ISDN Emulation Subsystem described herein supports the emulation of PSTN services for analog terminals connected to the TISPAN NGN, through residential gateways or access gateways.

The present document provides a framework for an IMS-based functional architecture and is considered to be a preliminary version. In addition, in order to fulfill the requirements of different operators and national regulatory requirements, this archirecture will need to be enhanced.

See annex A for a list of potential open areas.

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 and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

[1] ETSI ES 282 001: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); NGN Functional Architecture Release 1".

[2] ETSI ES 282 007: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); IP Multimedia Subsystem (IMS) Functional architecture".

[3] ETSI TS 182 006: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); IP Multimedia Subsystem (IMS); Stage 2 description".

[4] ETSI TS 123 218: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); IP Multimedia (IM) session handling; IM Call Model; Stage 2; (3GPP TS 23.218)".

[5] ETSI ES 283 003: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Endorsement of "IP Multimedia Call Control Protocol based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP) Stage 3 (Release 6)" for NGN Release 1".

[6] ETSI TS 183 043: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); IMS-based PSTN/ISDN Emulation; Stage 3 specification".

[7] ETSI TS 183 021: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); NGN Release 1; Endorsement of 3GPP TS 29.162 Interworking between IM CN Sub-system and IP networks".

[8] ETSI ES 282 010: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Charging".

[9] ETSI ES 201 915-1: "Open Service Access (OSA); Application Programming Interface (API); Part 1: Overview (Parlay 3)".

[10] IETF RFC 3136 (June 2001): "The SPIRITS architecture".

[11] ETSI ETS 300 738: "Human Factors (HF); Minimum Man-Machine Interface (MMI) to public network based supplementary services".

[12] ITU-T Recommendation H.248: "Gateway control protocol".

[13] ETSI EN 300 659 (all parts): "Access and Terminals (AT); Analogue access to the Public Switched Telephone Network (PSTN); Subscriber line protocol over the local loop for display (and related) services".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

Access Gateway (AG): a gateway that interworks a significant number of analogue lines to a packet network and is located at the operator's premises

Media Gateway (MG): See ITU-T Recommendation H.248 [12].

NOTE: In the present document, Media Gateway refers both to Access Gateways and to Residential Gateways

Media Gateway Controller (MGC): see ITU-T Recommendation H.248 [12].

Residential Gateway (RG): a gateway that interworks a small number of analogue lines. A residential gateway typically contains one or two analogue lines and is located at the customer premises

Voice over IP Gateway: SIP-based gateway that connects legacy terminals to the NGN. When connecting analog lines, the Voice over IP Gateway includes at least an analog telephone adaptor (ATA).

NOTE: A Voice over IP Gateways (VGW) plays the role of an IMS UE with regards to the P-CSCF.

3.2 Abbreviations

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

AF	Application Function
AG	Access Gateway
AGCF	Access Gateway Control Function
AS	Application Server
ASF	Application Server Function
A-MGF	Access Media Gateway Function
ATA	Analogue Terminal Adaptor
BCSM	Basic Call State Model
BGF	Border Gateway Function
CCBS	Call Completion on Busy Subscriber
CSCF	Call Session Control Function
GW	GateWay
HSS	Home Subscriber Server
IBCF	Interconnection Border Control Function
I-CSCF	Interrogating-Call Session Control Function
IMS	IP Multimdia Subsystem
IM-SSF	IP Multimedia-Service Switching Function
ISDN	Integrated Services Digital Network
IWF	InterWorking Function
MG	Media Gateway
MGC	Media Gateway Controller
MGCF	Media Gateway Control Function
MGF	Media Gateway Function
MRFC	Multimedia Resource Function Controller

MRFP	Multimedia Resource Function Processor
NASS	Network Attachment Subsystem
NGN	Next Generation Network
OSA	Open Service Access
P-CSCF	Proxy-Call Session Control Function
PES	PSTN/ISDN Emulation Subsystem
RACS	Resource and Admission Control Subsystem
RG	Residential Gateway
R-MGF	Residential-MGF
SCIM	Service Capability Interaction Manager
S-CSCF	Serving-Call Session Control Function
SIGTRAN	SIGnalling TRANsport
SLF	Subscription Locator Function
SS7	Signalling System n°7
TDM	Time Division Multiplexing
VGW	Voice over IP Gateway
VoIP	Voice over IP

4 Overview

4.1 PSTN/ISDN Emulation subsystem environment

Figure 1 shows the PSTN/ISDN Emulation Subsystem and its relationships with other TISPAN NGN subsystem.

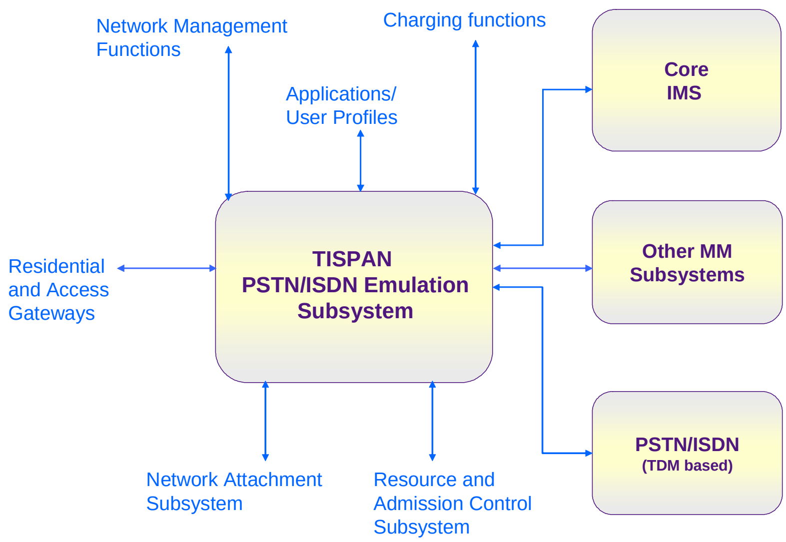

Figure 1: PSTN/ISDN Emulation Subsystem and its environment

4.2 Signalling configurations

Figure 2 illustrates the signalling configurations supported by the PSTN/ISDN Emulation Subsystem (PES) described in the present document.

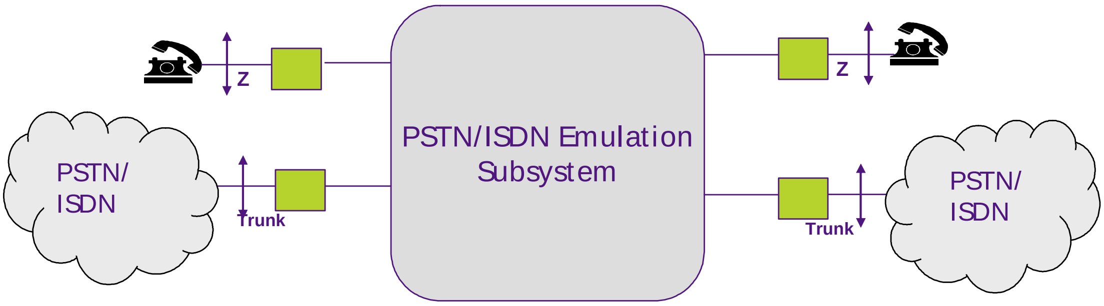

Figure 2: Signalling Configurations

Legacy terminals and/or legacy access nodes are connected to residential gateways or access gateways using standard interfaces. The protocol running on interfaces between these gateways and the PES is either H.248 (P1 reference point) or SIP (Gm reference point), depending on the type of gateway: media gateway (MG) or call control aware SIP-based voice over IP gateway (VGW), respectively. PSTN/ISDN islands may also be connected via trunking media gateway, controlled using the Mn reference point. Transit network functionality is supported as provided by the IMS ES 282 007 [2].

Support of ISDN access types by the IMS-based PES described in the present document is outside the scope of TISPAN NGN Release 1.

4.3 Constraints on services

The range of services that can be emulated in TISPAN NGN Release 1 is constrained by the functional architecture and the IMS SIP profile defined in ES 283 003 [5] on the Mw and ISC reference points, and of the Gm reference points in case of VGW.

5 Functional architecture

5.1 Overview

The functional architecturedescribed in this Technical Specification is one of the possible architectural options for structuring the the TISPAN PSTN/ISDN Emulation Subsystem (PES) identified in the TISPAN NGN overall architecture ES 282 001 [1]. This functional architecture uses the same architecture as the IMSdefined in ES 282 007 [2] with extensions defined in the present document. Figure 3 provides an overview of the functional entities that make up this architecture and shows their relationships to the other components of the NGN architecture.

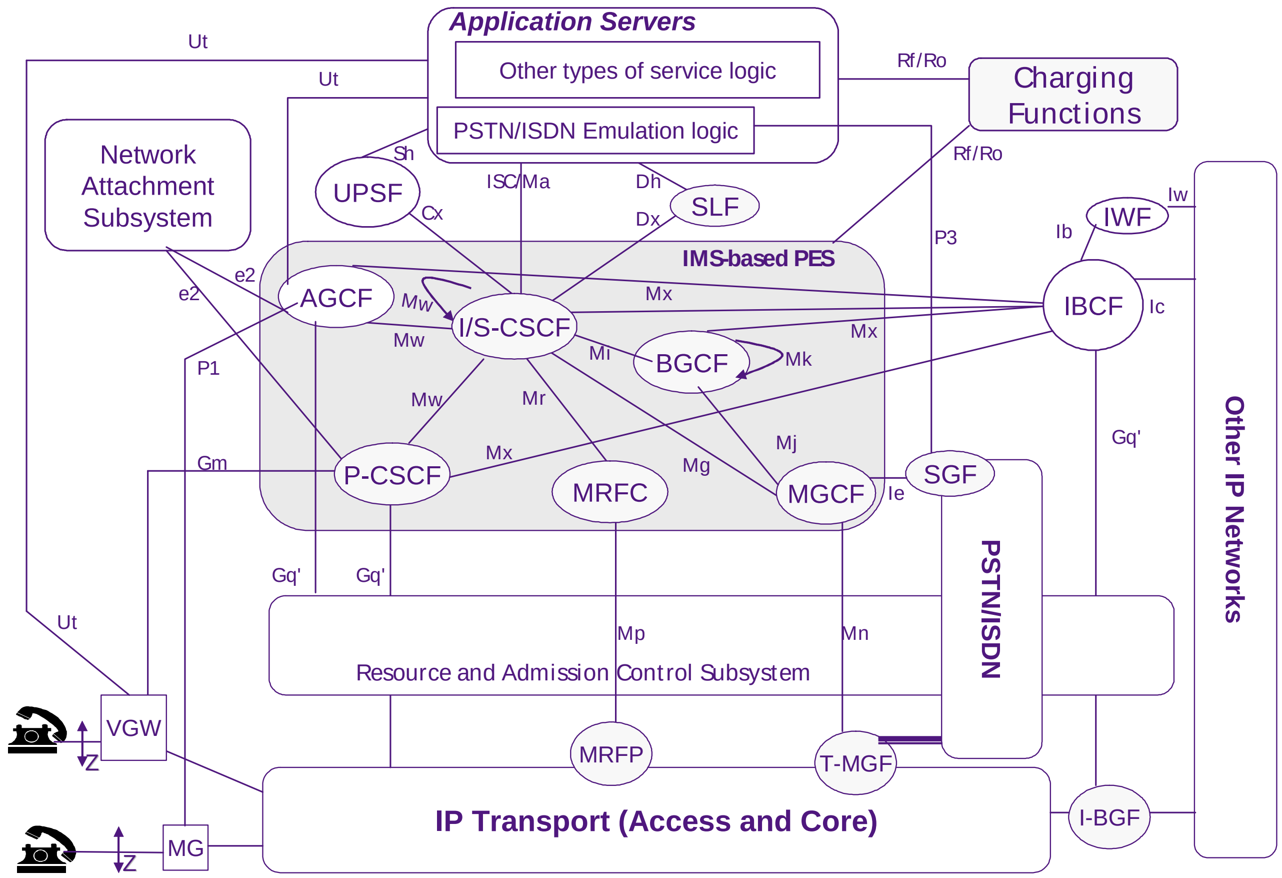

Figure 3: PSTN/ISDN Emulation Subsystem - Functional Architecture

Most of the functional entities inside the PSTN/ISDN Emulation Subsystem are identical or derived from their IMS counterpart 282 007 [2], with the noticeable exception of an Access Gateway Control Function (AGCF) that has the responsibility of controlling residential and access media gateways. For the other functional entities, any differences are noted in the following section.

A physical entity can house functional entities supporting both PES and IMS, that can be supported by a common addressing scheme.

5.2 Overview of Functional entities of the PES

5.2.1 Access Gateway Control Function (AGCF)

This functional entity is the first point of contact for residential and access media gateways. This entity is specific to the PSTN/ISDN emulation subsystem. It performs the following functions:

- Act as an MGC for controlling media gateways functions (R-MGF and A-MGF) located in residential and access gateways.
- Interact with the resource and admission control subsystem (RACS).
- Interact with the network attachment subsystem (NASS) to retrieve line profile information.
- Perform signalling interworking between SIP and analog signalling via the P1 reference point.
- Act as a SIP User Agent with regard to IMS SIP functional entities.
- Perform functions normally assigned to a P-CSCF on behalf of legacy terminals connected behind the media gateways (such as managing SIP registration procedures, generating asserted identities, and creating charging identifiers).

The AGCF appears as a P-CSCF to the other CSCFs. The SIP signalling capabilities available to the AGCF are limited to those available at the Mw reference point (e.g. flash-hook events are not explicitly reported to application servers but trigger appropriate SIP signalling procedures if required).

Moreover, the AGCF shall provide basic feature logic for:

- delivering the appropriate dialtone pattern;
- processing mid-call events, as described in clause 12.

NOTE 1: A solution based on AGCF shall be able to provide similar response time (e.g dial tone, ring tone) as today in the PSTN networks.

In case of AGCF failure, stable calls shall be preserved.

Further details on the AGCF structure and behaviour are provided in section 12.

NOTE 2: If desired, a network operator could choose to deploy an MGC that controls a set of media gateways following most of the AGCF call processing rules defined in the present document, and supports the Gm interface into an IMS or PES network via a P-CSCF, but this entity would fill the role of "Gateway (VGW)" depicted in figure 3 and would not be part of the trusted IMS core.

5.2.2 Multimedia Resource Function Controller (MRFC)

The behaviour of the MRFC is identical in the PSTN/ISDN Emulation Subsystem and in the IMS subsystem ES 282 007 [2].

5.2.3 Media Gateway Control Function (MGCF)

The role of the MGCF is identical in the PSTN/ISDN Emulation Subsystem and in the IMS subsystem ES 282 007 [2]. Signalling procedures for interworking with ISUP signalling are slightly different due to the presence of encapsulated ISUP information inside the PES and the need to ensure full ISDN transparency in case of ISDN calls transiting through the PES.

5.2.4 Proxy Call Session Control Function (P-CSCF)

The behaviour of the P-CSCF is identical in the PSTN/ISDN Emulation Subsystem and in the IMS subsystem ES 282 007 [2]. However, the P-CSCF is not used in configurations where an AGCF is required to control residential or access media gateways. In such cases, all functions normally provided by the P-CSCF will be provided directly by the AGCF.

5.2.5 Service Call Session Control Function (S-CSCF)

The behaviour of the S-CSCF is identical in the PSTN/ISDN Emulation Subsystem and in the IMS subsystem ES 282 007 [2].

5.2.6 Interrogating Call Session Control Function (I-CSCF)

The behaviour of the I-CSCF is identical in the PSTN/ISDN Emulation Subsystem and in the IMS subsystem ES 282 007 [2].

5.2.7 Breakout Gateway Control Function (BGCF)

The behaviour of the BGCF is identical in the PSTN/ISDN Emulation Subsystem and in the IMS subsystem ES 282 007 [2].

5.3 Internal Reference Points

5.3.1 Reference Point MGCF - CSCF (Mg Reference Point)

The Mg reference point allows the MGCF to forward incoming session signalling (from the PSTN) to the CSCF for the purpose of interworking with PSTN networks..

The protocol used for the Mg reference point is SIP. SIP messages may contain encapsulated ISUP information.

The role of this reference point is identical in the PES and IMS subsystems.

Details are described in TS 182 006 [3].

5.3.2 Reference Point CSCF - MRFC (Mr Reference Point)

The Mr reference point allows the S-CSCF to relay signalling messages between an application server function and an MRFC.

The protocol used for the Mr reference point is SIP.

The role of this reference point is identical in the PES and IMS subsystems ES 282 007 [2].

Details are described in TS 182 006 [3].

5.3.3 Reference Point CSCF - CSCF and AGCF - CSCF (Mw Reference Point)

The Mw reference point allows the communication and forwarding of signalling messaging between CSCFs and between an AGCF and a CSCF, e.g. during registration and session control.

The protocol used for the Mw reference point is SIP. SIP messages exchanged over the Mw reference point may contain encapsulated ISUP information, except between the AGCF and a CSCF.

The role of this reference point is identical in the PES and IMS subsystems ES 282 007 [2].

Details are described in TS 182 006 [3].

When two CSCF are located in different networks, signalling information for the Mw reference point crosses the IBCF.

5.3.4 Reference Point CSCF - BGCF (Mi reference point)

This reference point allows the Serving CSCF to forward the session signalling to the Breakout Gateway Control Function for the purpose of interworking to the PSTN networks.

The protocol used for the Mi reference point is SIP. SIP messages exchanged over the Mi reference point may containencapsulated ISUP information.

The role of this reference point is identical in the PES and IMS subsystems ES 282 007 [2].

Details are described in TS 182 006 [3].

5.3.5 Reference Point BGCF - MGCF (Mj reference point)

This reference point allows the Breakout Gateway Control Function to forward the session signalling to the Media Gateway Control Function (and vice-versa) for the purpose of interworking to the PSTN networks. This reference point may also be used by an MGCF to forward session signalling to the BGCF in case of transit scenarios, if the MGCF supports transit routeing.The protocol for the Mj reference point is SIP, possibly with encapsulated ISUP information.

The role of this reference point is identical in the PES and IMS subsystems ES 282 007 [2].

Details are described in TS 182 006 [3].

5.3.6 Reference Point BGCF - BGCF (Mk reference point)

This reference point allows the Breakout Gateway Control Function to forward the session signalling to another Breakout Gateway Control Function.

The Mk reference point is SIP, possibly with encapsulated ISUP information.

The role of this reference point is identical in the PES and IMS subsystems.

Details are described in TS 182 006 [3].

5.3.7 Reference Point AGCF, CSCF or BGCF - IBCF (Mx Reference Point)

The Mx reference point allows the communication and forwarding of signalling messages between an AGCF, CSCF or a BGCF and an IBCF.

NOTE: The protocol used for the Mx reference point is SIP.

The role of this reference point is identical in the PES and IMS subsystems.

SIP messages exchanged over the Mw reference point may contain encapsulated ISUP information, except between the AGCF and the IBCF.

Details are described in TS 182 006 [3].

6 Service Architecture

6.1 Overview

The service architecture for the PES and the IMS subsystems is the same. The generic behaviour of a application server functions is identical with respect to the PSTN/ISDN Emulation Subsystem and the TISPAN IMS. However, depending on the type of services to be emulated, certain application servers may need to understand and terminate the ISUP protocol encapsulated in SIP.

Three types of Application Server Functions (ASF) can be accessed by the IMS-based PES, through the ISC or Ma reference point (see figure 4).

- SIP Application Servers (SIP AS).
- The IM-SSF Application Server.
- The OSA SCS Application Server.

A SIP Application Server may contain "Service Capability Interaction Manager" (SCIM) functionality and other application servers. The SCIM functionality is an application which performs the role of interaction management. The internal structure of the application server is outside the standards.

The purpose of the IM SSF is to enable access to IN service logic programs hosted in legacy SCPs. The IM-SSF functionality encompasses the emulation of the IN Call Model (BCSM) on top of SIP signalling, IN triggering and feature management mechanisms, emulation of the IN Service Switching Finite State Machine and interworking with INAP.

NOTE 1: The role of the IM-SSF is identical in the PSTN/ISDN Emulation Subsystem and in the IMS subsystem ES 282 007 [2]. Basic behaviour is also identical. However, in the PES case, mapping procedures may take into account ISUP information encapsulated in SIP messages.

NOTE 2: The IM SSF is intended to enable access from the PES to IN service logic programs hosted in legacy SCPs. Access to PES services (i.e. hosted in SIP-based Application Servers) from legacy SSPs in the PSTN/ISDN is outside the scope of the present document. Appropriate gateway functions (e.g. SPIRITS gateway as defined in RFC 3136 [10]) have to be implemented in the PSTN/ISDN network for supporting such scenarios.The purpose of the OSA Service Capability Server is to provide access to OSA applications, according to the OSA/Parlay framework ES 201 915-1 [9].

Further details can be found in TS 182 006 [3].

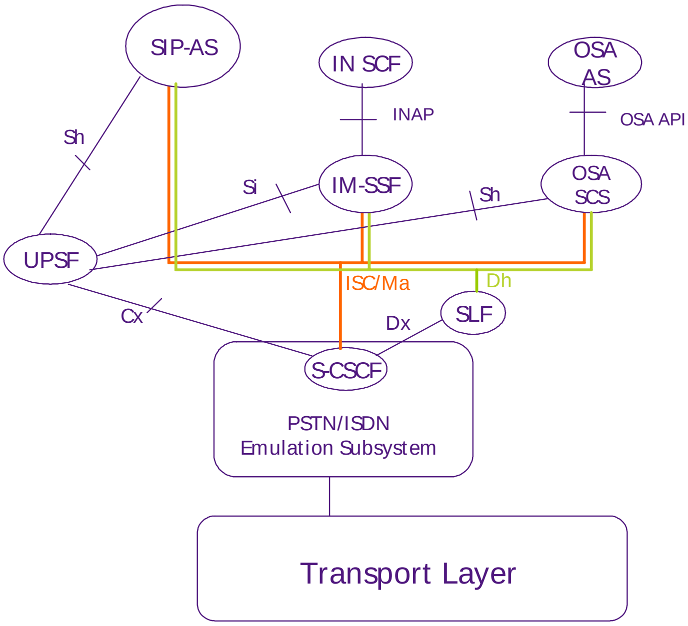

Figure 4: Value Added Services architecture

The Service-CSCF to AS interface is used to forward SIP requests, based on filter criteria associated with the originating or destinating user.

The Interrogating-CSCF to AS interface is used to forward SIP requests destined to a Public Service Identity hosted by the AS directly to that AS.

6.2 Reference points

6.2.1 Reference Point S-CSCF - ASF (ISC Reference Point)

The role of the ISC reference point is identical with respect to the PSTN/ISDN Emulation Subsystem and the IMS subsystem.

6.2.2 Reference Point UPSF - SIP AS or OSA SCS (Sh Reference Point)

The role of the Sh reference point with respect to the PSTN/ISDN Emulation Subsystem and the IMS subsystem is identical.

6.2.3 Reference Point UPSF - IM SSF (Si Reference Point)

The role of the Si reference point with respect to the PSTN/ISDN Emulation Subsystem and the IMS subsystem is identical.

6.2.4 Reference Point ASF- SLF (Dh Reference Point)

The role of the Dh reference point with respect to the PSTN/ISDN Emulation Subsystem and the IMS subsystem is identical.

6.2.5 Reference Point ASF - UE and ASF-AGCF (Ut Reference Point)

The role of the Ut reference point with respect to the PSTN/ISDN Emulation Subsystem and the IMS subsystem is identical.

The Ut reference point enables a voice over IP gateway (VGW) acting as a UE to manage information related to the services provided to the legacy equipment it connects.

The Ut reference point enables the AGCF to manage information related to the services provided to the legacy equipment connected to the media gateways it controls.

The Ut reference point applies to SIP Application Servers only.

Details are described in ES 282 007 [2].

6.2.6 Reference Point I-CSCF - AS (Ma Reference Point)

The role of the Ma reference point with respect to the PSTN/ISDN Emulation Subsystem and the IMS subsystem is identical.

This interface between Interrogating-CSCF and the Application Servers (i.e. SIP Application Server, OSA Service Capability Server, or CAMEL IM-SSF) is used to forward SIP requests destined to a Public Service Identity hosted by an Application Server directly to the Application Server.

Details are described in TS 182 006 [3].

7 External interfaces

7.1 Interfaces with entities in the transfer plane

Transfer plane entities are defined in ES 282 001 [1].

7.1.1 Reference Point MGCF - T-MGF (Mn Reference Point)

The role of this reference point with respect to the PSTN/ISDN Emulation Subsystem and the IMS subsystem is identical.

7.1.2 Reference Point MGCF - SGF (Ie Reference Point)

The Ie reference point enables the MGCF to exchange SS7 signalling information over IP with the SGF, according to the SIGTRAN architecture.

7.1.3 Reference Point AS - SGF (P3 Reference Point)

The PES uses the SGF primarily in support of the MGCF signalling to the PSTN, as does the IMS subsystem. In addition, some Application Servers involved in supporting PES users may use the SGF to support non call related signalling interactions with the PSTN (e.g. TCAP-based messages for CCBS).

7.1.4 Reference Point MRFC - MRFP (Mp Reference Point)

The role of this reference point with respect to the PSTN/ISDN Emulation Subsystem and the IMS subsystem is identical.

7.2 Interface with the UE

Conventional SIP UEs do not exist in PES. In PES, the User Equipment comprises one or more analogue terminals and the gateway to which they are connected via the Z reference point. This gateway may be a media gateway or a SIP-based Voice over IP Gateways (VGW). A SIP-based Voice over IP Gateways (VGW) plays the role of a UE with regards to the P-CSCF.

SIP-based VoIP gateways (VGW) interact with the PES via the Gm and Ut reference points. The protocol used for the Gm reference point is SIP. Details are described in ES 282 007 [2].

The role of this reference point is identical in the PES and IMS subsystems.

Media Gateways connecting legacy terminals interact with the PES via the P1 reference point.

7.3 Interfaces with the user profile

The SLF and UPSF entities are defined in ES 282 001 [1].

The behaviour of the UPSF and SLF in relation to the PSTN/ISDN Emulation Subsystem is identical to its behaviour in relation to the IMS subsystem ES 282 007 [2].

7.3.1 Interface with the SLF (Dx Reference Point)

The role of this reference point with respect to the PSTN/ISDN Emulation Subsystem and the IMS subsystem are identical.

7.3.2 Interface with the UPSF (Cx Reference Point)

The role of this reference point with respect to the PSTN/ISDN Emulation Subsystem and the IMS subsystem are identical.

7.4 Interfaces with Charging Functions

The following functional entities in the PES may act as charging trigger points:

- AS;
- BGCF;
- (I-/P-/S-) CSCF;
- MGCF;
- MRFC;
- AGCF.

For off-line charging the Rf interface is used. For on-line charging the Ro interface is used. Details are described in TS 182 010 [8].

NOTE: The IBCF to which the PES is connected may also act as a charging trigger point.

8 Interconnection with other networks

8.1 Interfaces with the PSTN/ISDN

Interconnection at the signalling level is provided via the SGF.

Interconnection at the media level is provided by the trunk interfaces at the T-MGF.

8.2 Interfaces with other external IP-based Subsystems

Interconnection with other IP-based subsystems (including other PSTN/ISDN Emulation subsystems) is performed via the IBCF at the signalling level.

In case of incoming sessions from other IP networks, the IBCF determines the next hop in IP routing depending on received signalling information, based on configuration data and/or data base look up. The next hop may be an I-CSCF, a BGCF or another IBCF.

Interconnection between PSTN/ISDN emulation subsystems occurs either between two home domains (e.g. session originating and terminating domain) or between a visited domain and a home domain (i.e. support of roaming capabilities).

Based on signalling information received from the PES and local policy rules, the IBCF decides on a per session basis whether the RACS should be involved in the interconnection.

NOTE: Depending on the operator policies, the decision as to whether or not media level interconnection is required (i.e. an I-BGF shall be inserted in the media path) for a particular session may be taken by the RACS, based on the "resource reservation service class" information received from the IBCF. The RACS shall also choose the appropriate interconnect link for media traffic based on the information received from the IBCF.

Figure 5 illustrates the case where no I-BGF is inserted. Figure 6 illustrates the case where an I-BGF is inserted by the visited network. All other interconnect scenarios identified in ES 282 007 [2] annex B are also applicable to the PES.

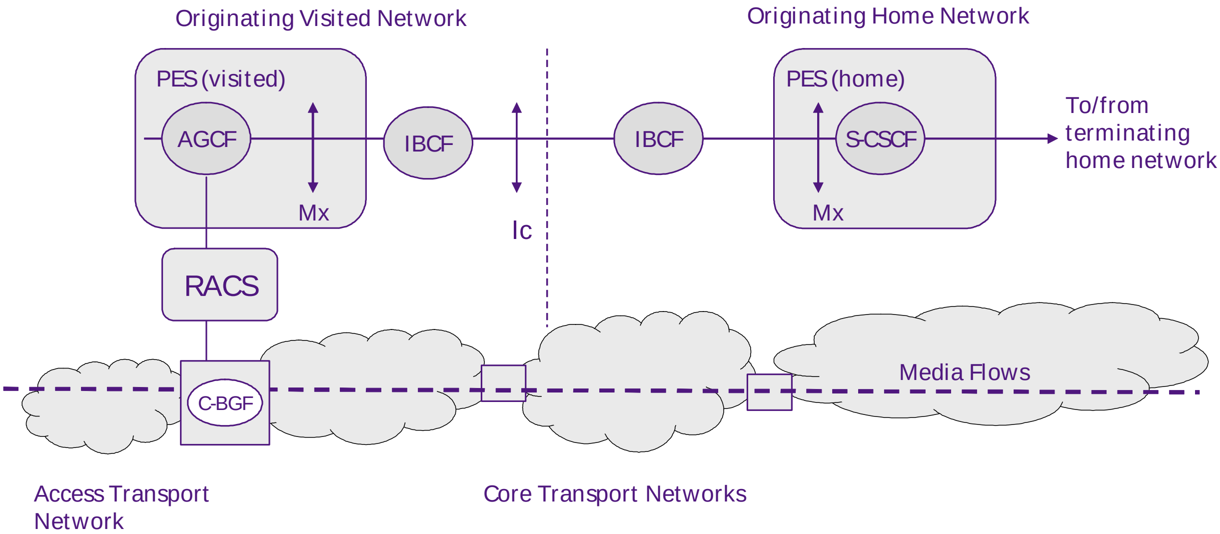

Figure 5: PES interconnect scenario without I-BGF

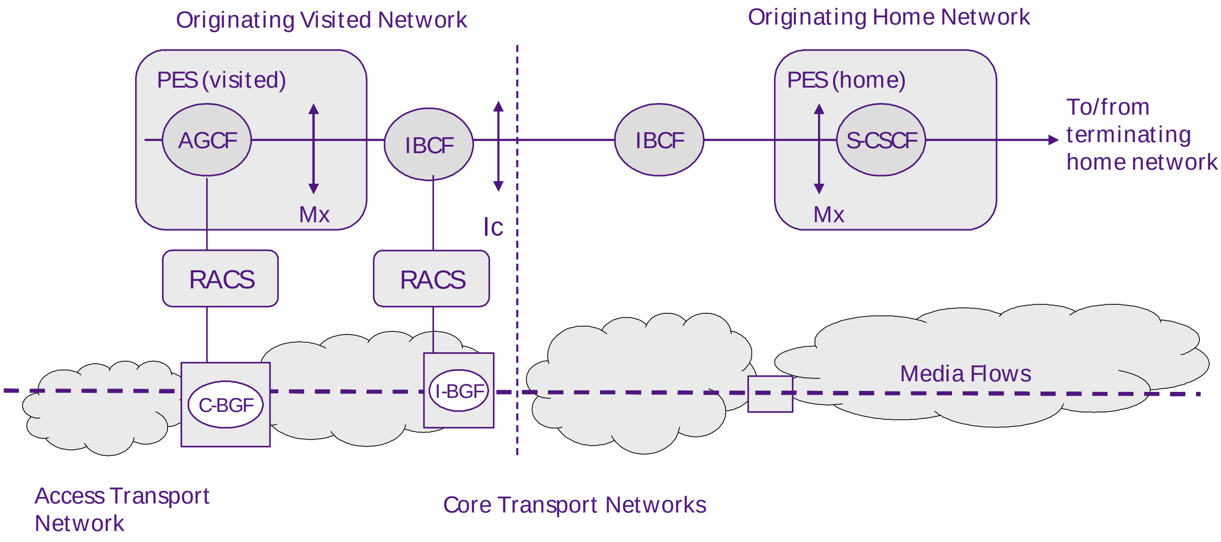

Figure 6: PES interconnect scenario with I-BGF

NOTE: As a network operator's option, an I-CSCF with encryption-based topology hiding capabilities (THIG) may also be inserted in the PES before the IBCF. This is not represented on figures 5 and 6.

9 Interfaces with the Network Attachment Subsystem (NASS)

The e2 reference point supports information transfer between the P-CSCF or the AGCF and the Network Attachment Subsystem.

The role of this reference point with respect to the PSTN/ISDN Emulation Subsystem and the IMS subsystem is identical.

NOTE: Interaction with the NASS is not be required in case the AGCF controls access gateways only.

10 Interface with the Resource and Admission Control Subsystem (RACS)

The Gq' reference point enables the P-CSCF or the AGCF to interact with the resource control subsystem for the following purposes:

- authorization of QoS resources;
- resource reservation;
- gate control (including NAPT binding information relay).

With regard to the RACS architecture; the P-CSCF and the AGCF play the role of an Application Function (AF).

The role of this reference point with respect to the PSTN/ISDN Emulation Subsystem and the IMS subsystem is identical.

NOTE: Interaction with the NASS may not be required in case the AGCF controls access gateways only and dedicated transport resources are used to support PES traffic.

In case of network interconnection, interactions with the resource control subsystem may also take place at the edge of the PES, at the IBCF level for the following purposes:

- gate control (including NAPT binding information relay).

With regard to the RACS architecture; the IBCF plays the role of an Application Function (AF).

Details are described in TS 182 021 [7].

11 Mode of operation

11.1 General Principles

Emulating PSTN/ISDN services using the IMS-based PES architecture described in the present document assumes that the logic of the service to be emulated resides in one or more application servers rather than in the AGCF or in gateways.

Emulating most PSTN supplementary services requires that at least one Application Server be inserted in the SIP signalling path.

For certain call configurations, this requires that encapsulated ISUP information be sent/received by some of these application servers (TS 183 043 [6]).

The logic embedded in the AGCF is either interworking logic (e.g. the AGCF has to know how to convert the information contained in an incoming SIP INVITE into a presentation message of the protocol for display services over analog lines as defined in EN 300 659 [13]) or service independent feature logic (e.g.; on receipt of an off-hook or flash-hook event from a media gateway, the AGCF shall autonomously request the media gateway to play a dial tone).

Although some application servers may be dedicated to the provision of PES-specific services, the PES architecture does not restrict the type of applications that a PES-user can access (see figure 7).

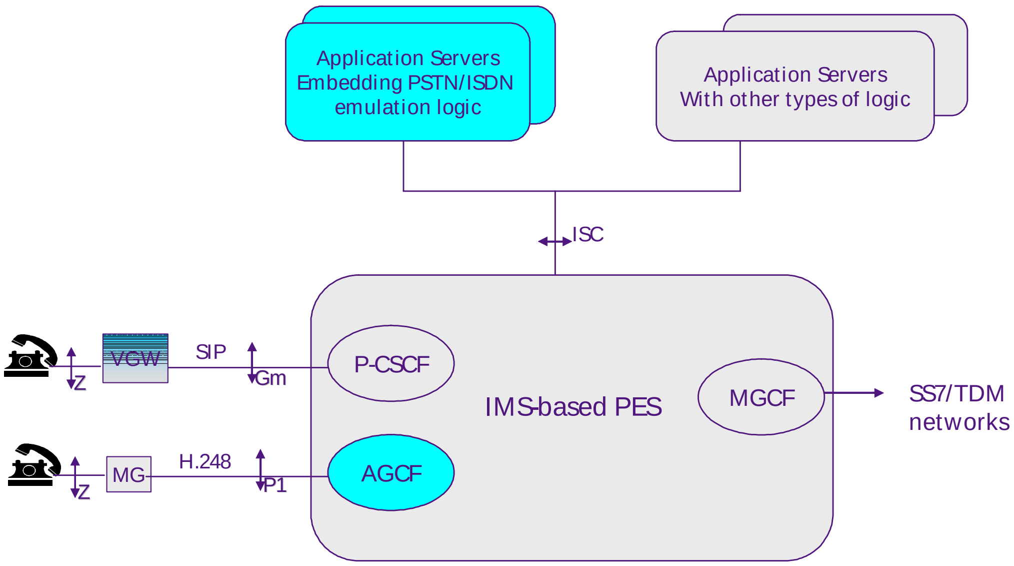

Figure 7: Service Access via the PES

11.2 Service Provisioning

11.2.1 Provisioning in the UPSF

The service profile of PES users is stored in the UPSF as for any other type of user. Appropriate filter criteria are set to ensure that PES-enabled Application Servers are involved in the processing of calls from/to PES-users. Setting these criteria does not require any specific service point trigger beyond those used in relation to the IMS subsystem ES 282 007 [2].

11.2.2 Provisioning in the AGCF

The following IMS parameters are assumed to be available in a local data base of the AGCF:

- private user identities;
- public user identities; and
- home network domain names.

The allocation of private and public user identities is left to each operator to decide. Two approaches are identified:

- One private user identity is assigned to a group of lines/subscribers.
- One private user identity is associated with each line connected to the media gateways controlled by the AGCF.

Each private user identity is associated with one home network domain name.

The association between a line (represented by a termination identifier on a media gateway) and one or more public user identities is provisioned in the AGCF.

The public and private user identities must be known by both the AGCF and the UPSF. It is up to the network operators to ensure that the AGCF and UPSF have consistent information.

The following information may also be provisioned on a per-line basis or on a per media gateway basis:

- A default dial-tone.
- A default digit-map.

The AGCF needs to be made aware of dial tone changes in case some specific supplementary services are activated. For that purpose it subscribes to the appropriate SIP events.

11.3 Registration

Registration and deregistration procedures are initiated by SIP-based gateways (VGW) on behalf of each line or group of lines it serves. The rest of the procedures are identical in the PES and IMS subsystems.

Registration and deregistration procedures are initiated by the AGCF on behalf of each line or group of lines connected to the media gateways it controls, based on the information contained in service change messages received from those media gateways and local configuration information. The rest of the procedures are identical in the PES and IMS subsystems.

A group of lines is represented by a set of public user identities sharing the same private user identiy and the home domain. One of the public user identities is explicitly registered. Other public user identities are implicitly registered.

The list of implicitly registered identities is returned by the UPSF to the AGCF. It should be noted that creating large registration groups may lead to excessively long signalling messages.If the list of registered identities returned by the UPSF does not match the list of public user identities associated with the private user identity, the AGCF should take appropriate management actions outside the scope of the present document.

11.4 Service code commands

Users of analog terminals usually manage supplementary services using service code commands using the syntax defined in ETS 300 738 [11], clause 6.1.1.

The AGCF has the necessary logic to determine whether a special dial tone needs to be delivered after the service prefix.

12 AGCF behaviour

12.1 AGCF components

The AGCF can be decomposed into three logical components:

- The Media Gateway Controller.
- The Feature Manager.
- The IMS Agent.

Figure 8 provides an overview of the AGCF logical structure.

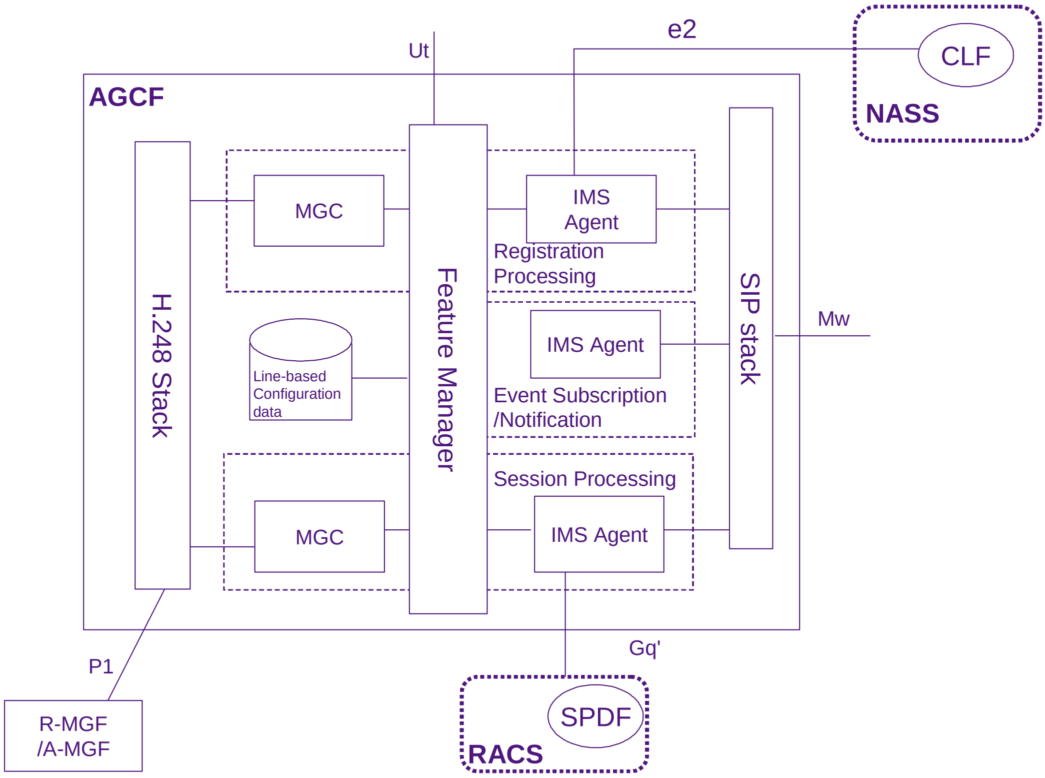

Figure 8: AGCF internal structure

12.2 Media Gateway Controller

The Media Gateway Controller component performs the following functions:

- keep track of the media gateway state (e.g. registration/deregistration);
- keep track of the line state (e.g. idle, active, parked, out of service, etc.);
- control the connection configuration (media flows topology and directionality) in media gateways;
- control the connection of tones and announcements in media gateways;
- receive line events and DTMF digits from media gateways;
- request media gateways to monitor line events and DTMF digits;
- perform basic digit analysis sufficient determine end of dialling to detect emergency calls (see note);
- provide line signals to media gateways;
- download "Digit Maps" to media gateways;
- controls media mapping and transcoding;
- controls signal processing features such as echo cancellation in media gateways.

NOTE: The full digit analysis procedure required for normal call routing purposes is perfomed by the S-CSCF and Application Servers.

12.3 Feature Manager

The Feature Manager is the functional block in AGCF that provides the coordination between the IMS core and the Media Gateways. For that, it holds a call and connection model that associate lines to call states and IMS dialogs.

Figure 8 shows a call and connection configuration where an analogue line is connected to two parties, each of these relationships being associated with a call state and a SIP dialogue.

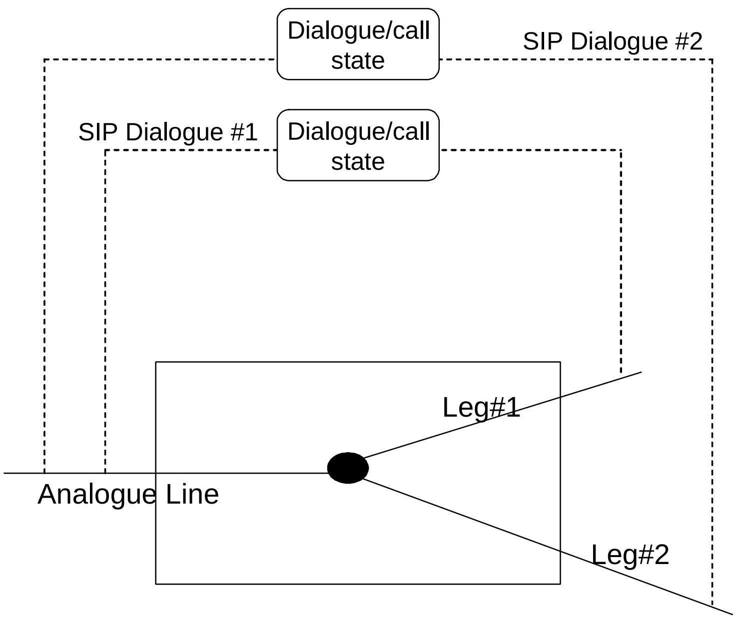

Figure 8: AGCF Call and Connection model

The feature manager component performs the following functions:

- Perform mediation of signalling events between Media gateways and S-CSCF in accordance with the connection model of AGCF.
- Request the registration of lines to the IMS core. Two possible mechanisms are be supported:
    - registration/deregistration of individual endpoints or registration/deregistration of the group of lines.
- Interacts with Application Servers to retrieve the current dial tone from the subscriber profile.
- Invokes basic features logic for processing mid call events, based on the call state and connection configuration. User input leading to mid call events may take various forms (e.g. register-recall, register-recall followed by one or more digits, one or more digits, etc.) depending on the network policies.

Signalling procedures in support of the above processing logic is outside the scope of this technical specification but shall be compatible with the constraints of the P1 and Mw reference points.

- Perform the mapping between alert information received from SIP signalling and ring patterns.
- Subscribe to the state of the lines behind media gateways in order to be informed when an individual line is deregistered (e.g. due to operational action a line may be no longer active).
- Manage the subscription for event report request from AS. The notification is delivered to the right AS.

12.4 IMS Agent

The IMS agent encompasses the functionality of an IMS UE and P-CSCF. It communicates with other IMS entities using the SIP profile described in ES 283 003 [5].

The following functionality is implemented in the IMS agent:

- Send/receive messages to/from the IMS entities. The received messages are sent to the Feature Manager that is responsible for processing them in accordance with the actual connection model of the line.
- Communicate with an I-CSCF in order to address the right S-CSCF. The identity of I-CSCF can be derived from DNS query.
- Interact with the Resource and Admission Control Subsystems (RACS).
- Interfaces with the Network Attachment Subsystem (NASS) in order to retrieve information related to the IP-connectivity access session (e.g. physical location of the user equipment), when the media gateway is located in the customer premises (i.e. residential media gateway).

The IMS agent is considered a trusted network element and therefore, security is equivalent to other IMS network elements.

13 Physical scenarios

Various physical scenarios can be derived from the functional architecture described in the previous clauses. How this functional architecture maps to physical devices and how many of the functional interfaces remain visible in a network implementation is outside the scope of standardisation. Possible implementations range from obvious scenarios with a one to one mapping between functional entities and physical entities, to physical architectures mimicking the hierarchical architecture of legacy networks (i.e. local and transit levels), based on only two types of physical nodes: call servers and media gateways.

Annex A (informative): Areas of discussion and potential open items

So far, areas of discussion and potencial open items include at least the following:

- Registration through the AGCF:
  - Clarification on whether individual lines (users) may belong to different service providers.
  - Clarification on grouping of lines to send a single registration for a collection of public user Ids.
- Service logic split between AGCF and Application Servers:
  - Clarification whether Flash-hook processing should be stage 3 issue.
- Overlap sending
- Interworking between AGCF and AS:
  - Clarification on whether Mw and ISC are open interfaces (i.e. can operator combine AGCF and AS from different vendors).
  - Clarify what parts of encapsulated ISUP are needed. Alternative solutions to it.
  - Usage of Ut reference point.
- Alignment with 3GPP:
  - Clarify whether signalling from AGCF is similar as signalling from P-CSCF E.g. How AS can distinquish between emulation and simulation service logic?
  - Implicit registration is used differently as in 3GPP (LS is sent to 3GPP to ask guidance).
  - Clarify the usage of encapsulated ISUP information.
  - It is open what to do if the list of registered identities returned by the UPSF does not match the list of public user identities associated with the private user identity. If AGCF uses those identities, the UPSF sees them as not registered and doesn't route terminating sessions to them.

History

Document history		
V1.1.1	April 2006	Publication