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Introduction

This document contains the output draft of Q.FMC-IMS resulting from discussions at the NGN-GSI meeting held in Geneva from 12 – 22 May, 2008.

Compared to the previous version a major restructuring of the draft is:

1) Update the session of definition;
2) Add the mapping of 3GPP VCC architecture to IMS based FMC reference model。

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Working Draft of Q.FMC-IMS:

Fixed mobile convergence with a common IMS session control domain

Summary

This Recommendation describes principles and requirements for IMS based convergence of fixed and mobile networks (“fixed-mobile convergence, (FMC)”). This convergence of fixed and mobile networks enables mobile users to roam outside the serving area of their mobile networks and still have access to the same set of services outside their network boundaries as they do within those boundaries, subject to the constraints of physical access and commercial agreements.

This Recommendation presents IMS-FMC architectures in relation to an NGN reference model and describes the application of convergence architectures defined by other standard bodies in the context of this model.

This Recommendation is focused on future IMS-based Networks, although some legacy fixed network requirements are also addressed.

Keywords

IMT-2000, IMS, FMC, convergence, fixed, mobile

1 Introduction

The evolution of individual core network technologies towards common Internet Protocol (IP) based solutions provides long term opportunities for the convergence of diverse network technologies and the convergence of fixed and mobile networks. The fixed-mobile convergence provides, in turn, opportunities for extending the reach and scope of services beyond what could be supported in the pre-converged environment.

Recommendation ITU-T Q.1761 “Principles and Requirements for Convergence of Fixed and Existing IMT-2000 Systems” addresses the opportunities in the near to medium term that may be enabled by providing capabilities to enable IMT-2000 roaming users to access their basic and enhanced services. Recommendation ITU-T Q.1762/Y.2802 “Fixed-mobile Convergence General Requirements” addresses the high-level requirements leading to the development of recommendations and implementation guidelines for the realization of Fixed Mobile Convergence (FMC).

The scope of this Recommendation is to identify the architecture, implementation principles, service and network capabilities of FMC offered by IMS-based networks.

2 Scope

This recommendation describes a network architecture that uses IMS to provide the same set of services to user terminals regardless of the use of fixed or mobile access network technologies, and to ensure service continuity when the point of attachment of the terminal changes between different access network technologies.

The architecture employs the functional entities groupings defined in Y.2021 for IMS related entities, and Y.2012 for non-IMS related entities functionality. This recommendation details IMS FMC specific architectural entities requirements which are generically defined in Y.2012 and Y.2021 (e.g. for application servers).

3 References

The following ITU-T Recommendations and other references contain provisions, which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published.

The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

3.1 Normative References

[1] ITU-T Recommendation Q.1701 (03/1999) Framework for IMT-2000 Networks

[2] ITU-T Recommendation Q.1702 (06/2002) Long-term vision of network aspects for systems beyond IMT-2000

[3] ITU-T Recommendation Q.1703 (xx/xx) Service and Network Capabilities Framework of Network Aspects for Systems Beyond IMT-2000

[4] ITU-T Recommendation Q.1711 (03/1999) Network functional model for IMT-2000

[5] ITU-T Recommendation Q.1741.1 (04/02) IMT-2000 references to release 1999 of GSM evolved UMTS network with UTRAN access network

[6] ITU-T Recommendation Q.1741.2 (12/02) IMT-2000 references to release 4 of GSM evolved UMTS core network with UTRAN access network.

[7] ITU-T Recommendation Q.1741.3 (08/03) IMT-2000 references to release 5 of GSM evolved UMTS core network with UTRAN access network.

[8] [ITU-T Recommendation Q.1741.4 (05/05) IMT 2000 References to Release 6 of GSM evolved UMTS Core Network]

[9] ITU-T Recommendation Q.1742.1 (12/02) IMT-2000 References to ANSI-41 evolved core network with cdma2000 Access Network

[10] ITU-T Recommendation Q.1742.2 (xx/xx) IMT-2000 References to ANSI-41 evolved core network with cdma2000 Access Network

[11] ITU-T Recommendation Q.1742.3 (06/03) IMT-2000 References to ANSI-41 evolved core network with cdma2000 Access Network

[12] ITU-T Recommendation Q.1742.4 (12/04) IMT-2000 References (approved as of 30 June 2004) to ANSI-41 evolved Core Network with cdma2000 Access Network

3.2 Informative References

[1] Supplement 47 to the ITU-T Q series Recommendations Emergency Services for IMT-2000 Networks – Requirements for Harmonization and Convergence

[2] Supplement 52 to the ITU-T Q series Recommendations Technical Report on NNI Mobility Management Requirements for Systems Beyond IMT-2000

[3] IEEE P802.21 D01.00 Media Independent Handover Services

[4] 3GPP2 X.S0013-000-A All-IP Core Network Multimedia Domain; Overview

[5] TS 23.401 GPRS enhancements for E-UTRAN access; (Release 8)

[6] TS 23.402 Architecture Enhancements for non-3GPP accesses (Release 8)

4 Definitions

~~*Editor's note: This section has not been updated since the September 2005 meeting. Definitions need to be aligned with those in Q.MMR. Contributions are invited*~~

Convergence	Coordinated evolution of formerly discrete networks towards uniformity in support of services and applications.
Emergency call	A call requesting emergency services. A caller is given a fast and easy means of giving information about an emergency situation to the appropriate emergency organization (e.g. fire department, police, and ambulance). Emergency calls will be routed to the emergency services in accordance with national regulations.

IEPS	Allows an authorized user to have access to the International Telephone Service while the service is restricted due to damage, congestion and/or other faults. The International Emergency Preference Scheme (IEPS) is needed when there is a crisis situation, which causes abnormal telecommunication requirements for governmental, military, civil authorities and other specially authorised users of public telecommunications networks.
Discrete Mobility	See Nomadism.
Discrete Terminal Mobility	Ability to have discrete mobility using the same terminal.
Fixed Mobile Convergence	Use of wired and wireless access technologies in conjunction with IMS-based [Core[1]] Networks.
Handover (Supplement 52 to Q Series)	The ability of a mobile user/terminal/network to change location while media streams are active.
Home Network [Q.1706] ~~(Supplement 52 to Q Series)~~	The network to which a mobile user is normally connected, or the service provider with which the mobile user is associated, and where the user's subscription information is managed.
Visited Network [Q.1706] ~~(Supplement 52 to Q Series)~~	The network outside a home network that provides service to a mobile user. This term is more business significant than geographically significant. ~~The network outside home network that provides service to a mobile user.~~
Mobility Management [Q.1706] ~~(Supplement 52 to Q Series)~~	The set of functions used to provide mobility. These functions include authentication, authorization, location updating, paging, download of user information and more. ~~The set of functions used to manage a mobile user accessing a local network other than that user's home network. These functions include communication with the home network for purposes of authentication, authorization, location updating and download of user information.~~
Network Mobility	The ability of a network, where a set of fixed or mobile nodes are

(Supplement 52 to Q Series)	networked each other, to changes, as a unit, its point of attachment to the corresponding network upon the network's movement itself.
Mobility	Ability to provide services irrespective of changes that may occur by user/terminal's activities. The user is able to change his network access point, as he moves, without interrupting his current service session, i.e., handovers are possible. In some situations, the handover may lead to a briefly suspended service session or it may require a change in the level of service provided as a consequence of the capabilities of the new access point to which the user has become connected through the handover process. Supplement 52 to Q Series - The ability for a user to access subscribed services while in motion, and the capability of the network to identify and locate the user's terminal.
Nomadism	Ability of the user to change his network access point after moving; when changing the network access point, the user's service session is completely stopped and then started again, i.e., there is no handover possible. It is assumed that normal usage pattern is that users shutdown their service session before moving to another access point or changing terminal. This is the mobility alluded to in the case of fixed mobile convergence.
Personal Mobility	Ability of a user to access telecommunication services at any terminal on the basis of a personal identifier, and the capability of the network to provide those services according to the user's service profile. Note: Personal mobility involves the network capability to locate the terminal associated with the user for the purposes of addressing, routing and charging of the user's calls.
Roaming [Q.1706]	The ability for a user to function in a serving network different from the home network. NOTE – This is the ability of the users to access services according to their user profile while moving outside of their subscribed home network, i.e., by using an access point of a visited network. This requires the ability of the user to get access to the visited network, the existence of an interface between home network and visited network, as well as a roaming agreement between the respective network operators. ~~Ability to provide service to a user through access from a network other than the network to which he has subscribed.~~ ~~Supplement 52 to Q Series - The ability of a mobile user to get connectivity from visited network." During roaming, a user is able to change network access points as he moves. However, his current service session is completely stopped at the old location and a new session is started at the new location, i.e., there is no handover.~~

Terminal Mobility	Ability of a terminal to access telecommunication services from different locations and while in motion, and the capability of the network to identify and locate that terminal Supplement 52 to Q Series - This is mobility for those scenarios where the same terminal equipment is moving or is used at different locations. The ability of a terminal to access telecommunication services from different locations and while in motion, and the capability of the network to identify and locate that terminal.
Seamless Handover (Supplement 52 to Q Series)	The process by which latency and data loss incurred during handover is within the range to be acceptable to the users, (e.g., below a certain limit) for real-time services.
Seamless Service (Supplement 52 to Q Series)	Seamless service will prevent users from experiencing any service disruptions while maintaining mobility.

5 Abbreviations

<Include all abbreviations used in this Recommendation>

2G	Second Generation
3G	Third Generation
AT	Access and Terminals
CN	Core Network
EFN	Evolved Fixed Network
EG	ETSI Guideline
ES	ETSI Standard
ETSI	European Telecommunications Standards Institute
FMC	Fixed Mobile Convergence
GSM	Global System (for) Mobile (Communications)
IMT-2000	International Mobile Telecommunications - 2000
IEPS	International Emergency Preference Scheme
IP	Internet Protocol
ISDN	Integrated Services Digital Network
ISP	Internet Service Provider
LAN	Local Area Network
PSDN	Packet Switched Data Network
PSTN	Public Switched Telephone Network
SMS	Short Message Service

UPT	Universal Personal Telecommunications
USO	Universal Service Obligation
VHE	Virtual Home Environment
WISP	Wireless ISP
WLAN	Wireless LAN
WLL	Wireless Local Loop

6 Conventions

There is no particular notation, style, presentation, or other conventions used within this Recommendation.

7 IMS based FMC architecture

The long-term goal for Fixed Mobile Convergence is to provide users with seamless services across fixed and mobile environments. It doesn't matter from the user's perspective with which architecture this seamless service experience is achieved. This is however very relevant from a network operator perspective, because it does impact the cost for providing such services.

The high level FMC architecture defined in this recommendation is depicted in figure 1. The architecture assumes a common IMS service platform for the delivery of services over fixed and mobile networks.

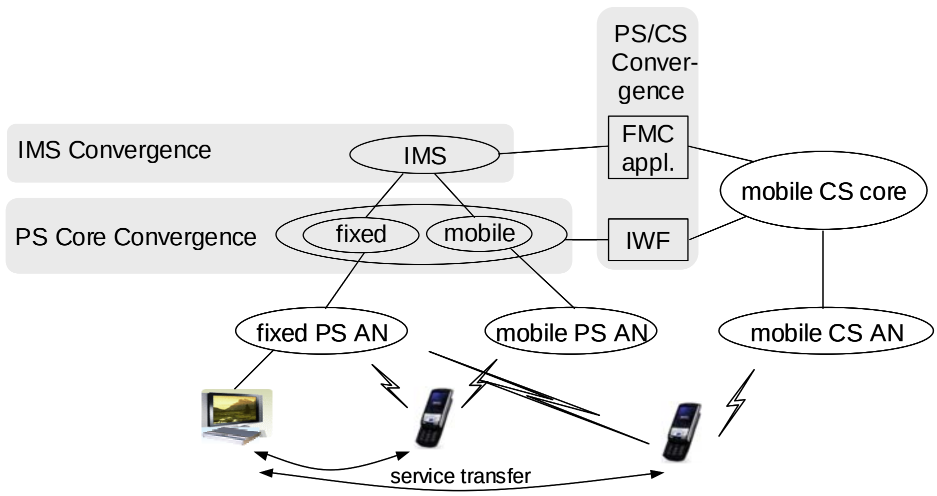

Figure 1 – IMS based FMC architecture

This converged IMS platform may be used to transfer services between terminals attached to different networks based on reachability, user preferences or at the user's explicit request. It may also be used to transfer services from one access to another to provide service continuity for multi-mode terminals that can attach to both fixed and mobile access points. IMS based service level transfer and handover is one of the architectures studied in this recommendation.

The alternative for service level handover is transport level handover through a suitable mobility management protocol. This type of handover requires a common packet switched core where the authorization of network attachment and the QoS context of the attachment can be transferred from one access to another. PS Core convergence to enable transport level handover is another architecture that is studied in this recommendation.

In view of the ubiquitous deployment of circuit switched mobile networks this recommendation also considers architectures to provide service continuity between an IMS controlled packet switched network and CS mobile networks. This type of architecture requires specific PS/CS convergence functions to bridge the IMS controlled network and the CS network. These are represented by a service level FMC Application and a transport level inter-working function (IWF) in figure 1. The convergence functions are drawn between the two networks to illustrate their bridging nature. They will however be contained within the IMS network as the intent of the architecture is to reuse existing CS interfaces.

Note that IMS based PSTN/ISDN emulation could also be considered as an IMS based FMC architecture, since the converged IMS may provide services to mobile as well as PSTN/ISDN terminals. This FMC scenario is detailed in Y.2262 and is outside of the scope of this recommendation.

8 NGN Domain model and convergence levels

8.1 NGN domain model

Figure 2 depicts network domains in both fixed and mobile networks in accordance to the NGN framework architecture (Y.2012) in order to describe different level of convergence that can be achieved. This serves as an abstracted NGN reference model from a service provider's perspective.

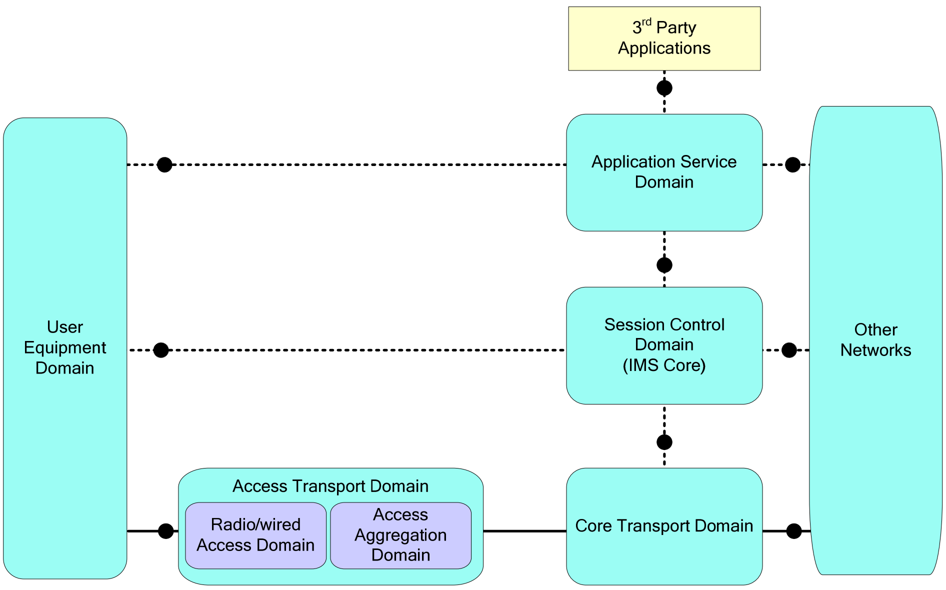

Figure 2 - IMS Based NGN Reference Model

The Access Transport Domain provides the connectivity between the User Equipment Domain and the Core Transport Domain. Within the Access Transport Domain we distinguish the physical access media dependent Radio/Wired Access Domain (e.g. DSLAMs, 3G Base Stations and RNCs, WLAN Access Points etc.) from the Access Aggregation Domain that aggregates the traffics from multiple Radio/Wired Access Domain instances to an edge node. GPRS, part of the 3GPP IP

Connectivity Access Network, is an example of an Access Aggregation Domain and so is the network that connects DSLAMs to a BRAS/IP Edge device. A mobile Access Aggregation Domain will contain mobility management functions.

The Core Transport Domain may also contain mobility functions in order to support mobility across different Access Domains (e.g. MIP Home Agents). The Core Transport Domain interconnects with Access Domains within the same network and the Core Transport Domains of other networks and supports media processing functions as necessary. Network attachment, resource and admission control functions are contained in both the Access and Core Transport Domains.

IP in the transport domains enables the bridging of diverse fixed and wireless technologies. However, interoperability of the various access technologies at the transport layer only is not sufficient to support global mobility in such heterogeneous environment. Common control layer mechanisms, such as identification and authentication mechanisms, access control and authorization function, IP address allocation and management, user environment management (VHE), user profile management and accessibility to user data are required to achieve true convergence across different access technologies and across different networks.

Session control of connectivity between User Equipments and between UEs and other networks is provided by the Session Control Domain that also contains functions supporting presence and location services. The Session Control Domain interfaces with the Core Transport Domain to convey transport resource requests and NAT binding information, if applicable. It may also interface with the Access Transport Domain, for instance to convey location information in case of a Wired Access Domain.

Finally there is the Application Service Domain containing functionality that supports so-called application services such as messaging and information services that may be built on top of session control services.

The starting point for FMC as described in this Recommendation is the use of common Application Service and Session Control for fixed and mobile users. The Session Control Domain is the core part of the 3GPP IP Multimedia System standard. References to the 3GPP IMS Release 7 documentation can be found in ITU-T Recommendation Q.1741.5.

IMS based service convergence enables a number of FMC service capabilities:

- access to the same IMS based services from different terminals with different public identities (these may be implemented as a single physical terminal with different public identity)
- access to the same services from different terminals using the same public user identity; this allows the user to decide which services are directed toward which terminal and in which order, whilst the calling party only needs to know one public identity.
- service continuity on a multi-mode terminal whilst moving between a home or enterprise fixed network environment and the mobile network (e.g. a dual-mode UTRAN and WLAN/Bluetooth handset or PDA that can connect either to a UTRAN base station or to a private WLAN/Bluetooth Access Point that is connected to a fixed broadband access).

In terms of the domain model, the IMS based FMC architecture is based on the following principles:

– the architecture is required to provide access to IMS based services from any type of user equipment with IMS compatible interfaces,

– the user equipment may be connected to any type of packet based Access Transport Domain with compatible interfaces that are able to convey the protocols between the user equipment and IMS transparently,

– Access Transport Domains may be connected to a multi-access Core Transport Domain, which implies that the interfaces between access and core may be access technology specific,

– the interfaces between the Core Transport Domain and the IMS service platform are technology independent and based on the required functionalities to support IMS-based services and capabilities; this does not preclude the use of other service platforms that support this interface,

– the interfaces shall support sharing of Access and Core Transport Domain facilities by multiple service platform providers.

8.2 Convergence levels

FMC functions can be viewed as functional elements that hide the difference between fixed and mobile access from the next higher level in the domain model and indirectly from the user. The location of the FMC functions determines the point/level at which the convergence takes place. The point of network convergence can be different among different network operators depending on the nature of the current networks (mobile network, fixed network, CS network, PS network etc.). Figure 3 illustrates three possible points of convergence at different network levels (domains). Please note, the Access Domains for fixed and mobile services are per definition different, although some common components may be shared between mobile and fixed networks. The same applies to Core Transport Domains for mobile and fixed networks.

Service level convergence is illustrated in the middle of figure 7. It may provide service continuity to multi-mode terminals if the terminals, the session and application domains have the suitable capabilities. It is essential for service level handover that the terminal supports simultaneous dual-radio interfaces and for the session domain to support multiple simultaneous registrations of the same private identity. In order to support service level handover for a multi-mode terminal, a FMC function is required in the application domain that can select between two session legs. I.e. a back-to-back User Agent is required. This point of convergence is most likely adopted by service providers that want to provide multi-media session continuity independently from the underlying transport networks.

Service level mobility management is described in general in draft Rec. MMF.

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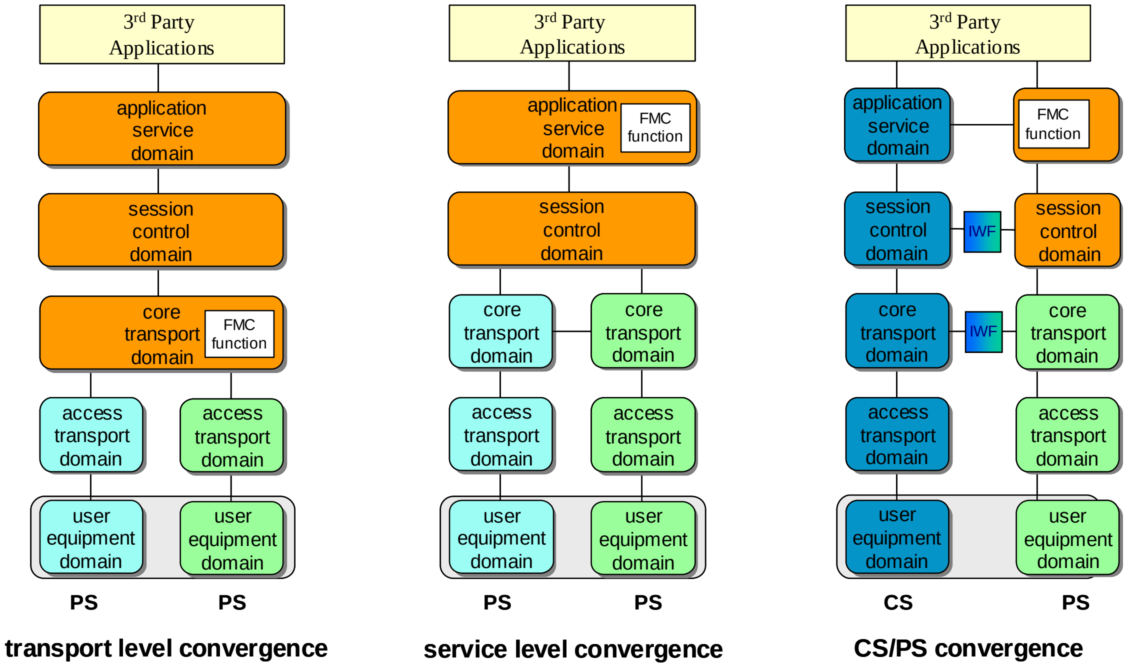

Figure 3- Convergence point and FMC function

Editor's Note: Contributions are invited to illustrate the session-control level convergence.

The alternative architecture to support service continuity to multi-mode terminals is by FMC functions in a common core transport domain. This is shown on the left hand side of figure 7. This point of convergence is most likely adopted by operators who own multi-access core transport networks. In this case, the FMC function in the core transport domain presides over the handover between access domains and the associated network attachment and QoS contexts. If the target access domain can provide the same QoS as the current serving access domain the session control domain does not have to be involved in the handover. If the QoS of the target network is lower than that originally committed to the session domain, then the session control domain needs to be involved in the handover decision. If the target network offers the possibility to increase the QoS of a session, than the session domain should be informed, because it may be desirable to upgrade the QoS of the end-to-end session depending on the capabilities of the access and the terminal at the other end. Transport level mobility management is described in draft Rec. MMF.

FMC functionality at the transport level may be combined with the FMC functionality at the service level. This would for instance be necessary to combine a transport level handover for a multi-mode terminal with the capability to transfer a service (e.g. video) from that terminal to a different terminal with a better display.

Transport and service level convergence assume that all services are carried over packet switched access and core transport domains. The transition of all mobile networks to packet based voice service will however take time, and it is therefore of interest to have the ability to provide service continuity for voice calls between PS fixed access domains and CS mobile access domains. The architecture to enable this capability is shown on the right hand side of figure 7. Interworking between CS and PS domains is provided by Signaling and Media Gateways. These functions are not specific for FMC, because they are required anyway for terminals on both networks to communicate with each other. The FMC specific function in the application domain is able to support two separate call legs, one in the CS domain and the other in the PS domain and select the appropriate domain based on user and/or operator preferences. This scenario is most likely adopted by service providers who operate both CS based mobile network and PS based fixed network.

A combination of all three types of convergence illustrated in figure 3 may be applied to also allow for roaming between CS and PS domains or to combine handover and service transfer capabilities with Enhanced VPN capabilities across CS and PS domains.

9 IMS based FMC capabilities

9.1 Service level convergence and service continuity

As the common objective for both end users and service providers is to achieve service convergence, i.e. seamless and boundaryless services. Service continuity requires that the services provided to a subscriber are not interrupted regardless the subscriber's points of attachment to the network. Service continuity across domains is provided by FMC functionality at the service level.

There are two main aspects that motivate the use of service level convergence:

- The user's demand to always benefit from the highest possible performance/cost ratio in any given network environment,
- The operator's desire to optimize the allocation of network resources, extend services to new network environments and diversify the service portfolio.

While transport level handover technologies (such as Mobile IP) can provide continuity of network attachment, they lack the ability to dynamically adapt the services to the network conditions. The reason is that service provisioning depends on a number of aspects that cannot be controlled at the transport level, such as user preferences and inter-operator service agreements. Also each service has its own specific parameters, for instance the video quality and frame rate of real-time video transmission may need to be adjusted to fit into a given bandwidth. Service level convergence is able to take these aspects into account.

9.1.1 Service continuity

The service continuity can be classified into the following three major categories:

a. MSC: Multi-media Service Continuity

b. VSC: Voice Service Continuity

c. RSC: Registration Service Continuity

Multi-media services consist of partial or full combination of Data services, voice services, and video services. The service continuation of multi-media services includes the service continuation of respective services and the required synchronization between them.

The Voice Service Continuity provides seamless voice services to subscribers across different network boundaries.

Registration Service Continuity provides transparent registration services across different terminal boundaries or across different network boundaries.

For service continuity, there are three major scenarios to be addressed

1. Service continuity on the same user device. The figure below illustrates this case, and the possible service continuity scenarios are outlined in the table below.

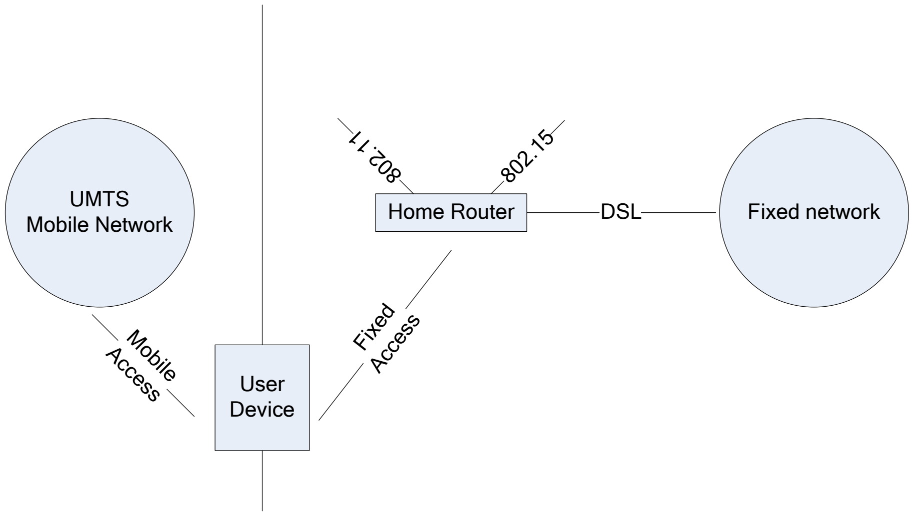

Figure 4- Service continuity on the same terminal

	Fixed	Wireless (802.11)	
Mobile	***Control Technology***	IMS	UMA
UMTS	IMS - PS	RSC/MSC	RSC/MSC
	IMS - (PS+CS) (CSI)	RSC/MSC	RSC/MSC
	PLMN - CS	VSC[2]	***N/A***[3]

Table 1 Service Continuity on the same user device

2. Service continuity on different multimedia user terminals. The rationale for this case are
    a. Obtain better in-house coverage without special dual mode terminals
    b. Conserve mobile bandwidth by using fixed broadband technology whenever possible
    c. Enjoy services provided by powerful multimedia terminals with higher bandwidth fixed access

    This FMC scenario can be illustrated in the following figure, with possible service continuity situations outlined in the companion table.

[2] This is the VCC discussed in 3GPP.

[3] IMS is not involved in supporting these services.

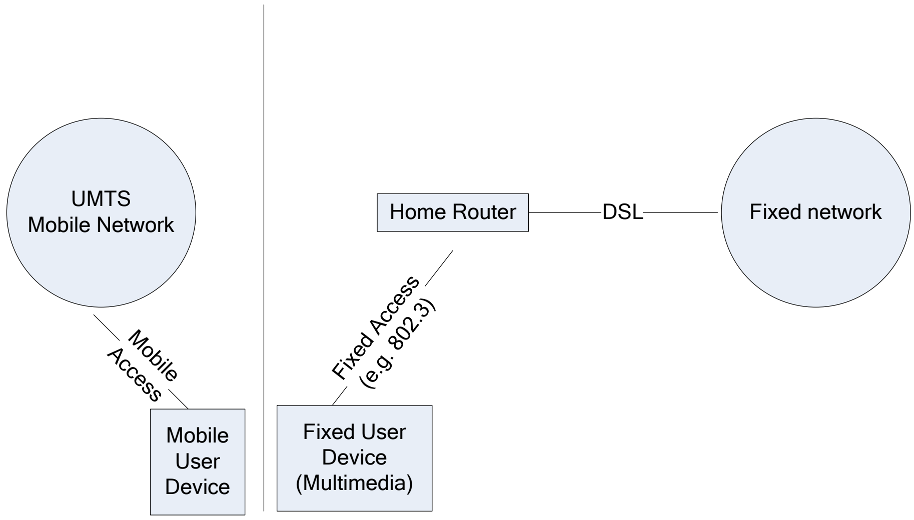

Figure 5- Service Continuity on different multimedia terminals

The service continuity capabilities are outlined below:

	Fixed Access	Fixed Packet Access
Mobile Access	***Control Technology***	IMS
UMTS	IMS-PS	MSC
	IMS- (PS+CS)(CSI)	MSC
	PLMN - CS	VSC

Table 2 Service Continuity on different multimedia terminals

3. Service continuity on different telephony (voice only) terminals. The rationale for this case is similar to that of the multimedia terminal case. The key aspects are not using the special dual-mode terminal while still getting the same benefits of bandwidth conservation for mobile, better voice quality and better signal coverage whenever fixed access is available. The following table outline the configuration

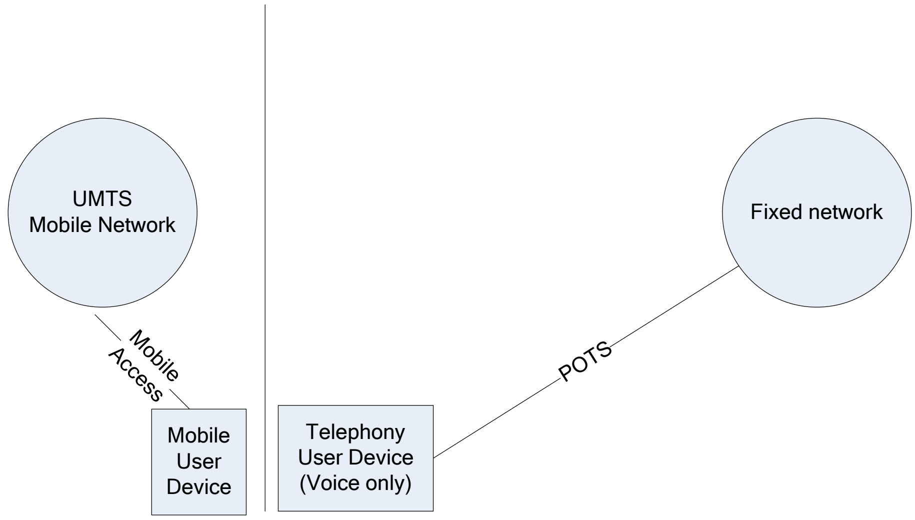

Figure 6- Service Continuity on different telephony terminals

The service continuity capabilities via various voice technologies on the fixed network part can be outlined in the table below:

	Fixed Access	PSTN I/F			
Mobile Access	***Control Technology***	PES@IMS	UMA-J	PSTN	PES@CS
UMTS	IMS	VSC	VSC	VSC	VSC
	IMS - (PS+CS) (CSI)	VSC	VSC	VSC	VSC
	PLMN - CS	***N/A***[1]	***N/A***[1]	N/A[1]	N/A[1]

Table 3 Service Continuity on different Telephony terminals

9.1.2 Constraints of service level convergence

The service level cannot perform transport level tasks like controlling and monitoring radio signal strength, attachment and detachment to network access points and IP address configuration. Therefore, to be independent of specific access transport technologies it must rely on either the User Equipment to provide information on the transport level conditions through signaling at the service level, i.e. SIP signaling in the IMS context or on an information service that collects such information from the access networks.

The former method requires the UE to frequently activate its radio interfaces, scan for potential access networks and perform radio measurements on these networks. If the scanning is performed infrequently it poses inherent delay in the handover operation, whilst frequent scanning will increase power consumption. To ease the burden on the UE to achieve access independent handover, the Media Independent Handover (MIH) architecture that has been elaborated in IEEE 802.21 [3] may be applied in conjunction with service level handover control. The MIH information service provides means to supply information on the wireless access networks and their available capacity and costs to the service level control function. Based on location information from the UE, the service level control function can then decide if there are any access networks in the vicinity of the UE that provide a better match for the preferred service profile.

Annex B provides further information on the transport domain convergence.

A basic assumption for fixed mobile service level convergence is that fixed and mobile network interfaces can be active simultaneously. This is obviously the case for service transfer from one terminal to another. In case of multimode terminals it is also possible for terminals that e.g. can operate both a WLAN radio to access a fixed WLAN Access Point as well as high-speed radio access to a mobile base station at the same time. This so-called Dual-Radio operation is however not always possible between high power mobile radios, e.g. between different 3GPP radios. Service level handover schemes that take advantage of Dual-Radio operation are therefore not generically applicable between mobile access networks and would need to be enhanced for Single-Radio operation.

An obvious limitation of IMS service level convergence is that it is per definition limited to IMS based services (services delivered via SIP User Agents that are IMS compliant). UEs that do not support IMS signaling cannot take advantage of service level handover control.

9.2 Security capabilities

Access to the IMS session control domain and the services that are built on top of it does require the authentication and registration of users of this domain. Exceptions exist for emergency.

Compared to stationary access in fixed networks, nomadic and wireless access in fixed networks and mobile access in mobile networks face an increased level of security threats. To counter these threats a security framework has been adopted in the mobile world (TS33.203) for IMS access, with the IMS Subscriber Identity Module (ISIM) as a key component. The ISIM contains both User Identity information as well as security mechanisms.

To facilitate FMC it is recommended that FMC terminal implements the ISIM functionality, to provide the same User Identity information and the same level of security, regardless whether the terminal is attached to a fixed or a mobile access. This recommendation does not prescribe how the ISIM functionality is implemented. This may be in the form of a UICC, but other forms of implementation (e.g. “soft” ISIM) are not precluded.

Although full support of ISIM functionality is the preferred solution from a security perspective for IMS access authentication, it is acknowledged that the smooth introduction of IMS will require interim solutions that can support legacy terminals without ISIM functionality. Such interim solutions should still provide an adequate level of protection against the most significant security threats that will exist in early FMC deployments. Use of devices that do support ISIM functionality when these become available at acceptable costs is recommended.

Legacy or early 3G mobile terminals that do not have ISIM and/or do not support IPSec based IMS security mechanism should be supported in an FMC network. The mechanism to do so is described in 3GPP TR 33.978 and is referred to as early IMS security. It relies on bearer level security at the GPRS level based on SIM or USIM. The IMS level signalling, and especially the IMS identities claimed by a user are checked securely against the GPRS level security context.

Legacy or early fixed SIP terminals that do not contain UICC and/or do not support IMS AKA should be supported in an FMC network if connected to a fixed access network. Two mechanisms that are described in ETSI TS 187 003 for this purpose are applicable:

- SIP HTTP digest authentication as specified in RFC 2617
  This method is fully standardised by RFC 3261 for SIP implementations. It does require the secure provisioning of a user specific password on the terminal. The security of this method highly depends on the strength of the chosen password and on the password provisioning method. Appropriate choices are an operator's responsibility and not standardised.
- NASS-IMS bundled authentication
  This method is similar to "early IMS security" in that it relies on bearer level security, which in the case of fixed networks is provided by the Network Attachment System. The network attachment in fixed networks is however not provided by SIM functionality, but relies on the implicit authentication of the fixed access line and/or the explicit authentication of a provisioned bearer level user identity and credentials.

  During network attachment, the NASS allocates an IP address to the terminal and stores the layer-2 and layer-3 identities in the NASS profile. When the terminal registers with the P-CSCF of the IMS, the P-CSCF queries the NASS to obtain the location information (the access line identity) of the terminal. The P-CSCF embeds the location information into the SIP message and forwards it towards the S-CSCF for verification. The S-CSCF verifies the received location information against the location information in the user profile. The user is authenticated for IMS access if the verification is successful.

Note that with early IMS security, the network authentication is provided by SIM functionality and also the GGSN, HSS and the IMS network entities resides in the home network, so there will be trusted binding between the SIP identity and the network identity. In case of fixed network NASS-IMS bundled authentication the IMS domain will need to have a trusted agreement on the fixed network authentication procedure and binding.

Editor's Note: Contributions are invited providing more detail on the following topics to further develop this section. Contributions addressing the various different scenarios for different access technologies would be particularly useful.

- Potential for use of swipe card
- Need to understand full functionality required in IMS-based networks as this may impact what and where information may need to be stored with respect to ISIM functionality
- Authorisation also important in addition to authentication, e.g. in application of toolkit, QoS, validation/accounting/billing for internet usage (e.g. mobile/fixed/business/home)
- DSLAM implementation e.g. in residential applications e.g. using software realisation of ISIM functionality in central office that authenticates physical line or number e.g. for billing
- Software ISIM functionality in central office
- Copper pair association
- Multiple ISIM functionality instantiations per line, perhaps associated with multiple PINs
- "Black phone" support, e.g using SIP user agent, decadic conversion, copper pair association, no mobility support in secure legacy systems
- new functions/features in IMS-based networks that are not available in legacy networks or equipment

- set limits to backward compatibility (“serve as served before”)
- currently authentication stops at subscriber level in legacy networks (not at user)
- encourage IMS-based networks to understand the difference between user and subscriber, and how to authenticate each, this is a key issue
- but still need to cope with acquisition and installation of new terminals and equipment
- work in addition to ISIM functionality is still needed
- terminals may not have ISIM card, other mechanisms are possible, ISIM card is not mandatory as an implementation method
- review 3GPP SA2 TLS as another potential security mechanism
- authentication in IMS-based networks should apply to all/any types of terminals that are connected (application-specific details for each access technology)
- need to address AAA issues
- need to address separation of user, terminal and subscriber identities
- many implicit fixed network issues have become unconsciously buried over time
- ISIM functionality is one existing technique in Mobile networks, use the same to facilitate development of IMS-based networks
- Emerging regulatory constraints in respect of blockage of stolen phones

Editor’s Note: Contributions are invited providing more detail on the above topics to further develop this section.

9.3 Public services capabilities

FMC is required to provide all the means to support public interest services required by regulations or laws of relevant national or regional administrations and international treaties. This includes requirements for

- Lawful Interception,
- Malicious Communication Identification,
- Unsolicited Bulk Telecommunications,
- Emergency Telecommunications,
- Location Information related to Emergency Telecommunication,
- User Identity Presentation and Privacy,
- Network or Service Provider Selection,
- Users with Disabilities,
- Number Portability and
- Service Unbundling.

Editor's Note: Contributions are invited providing more detail on the above topics to elaborate how IMS-FMC realize the functionalities.

10 Service Level Convergence Architecture and FMC Functions

10.1 Architecture and FMC functions for PS-PS service continuity

The functions that are involved in PS-PS service level convergence are shown in figure 7. Two new functions are introduced in the architecture: The FMC Application Server and the MIH Information Server (MIIS).

The FMC application server may support both service transfer between terminals as well as service level handover for multi-mode terminals. For ease of description the following only refers to the latter.

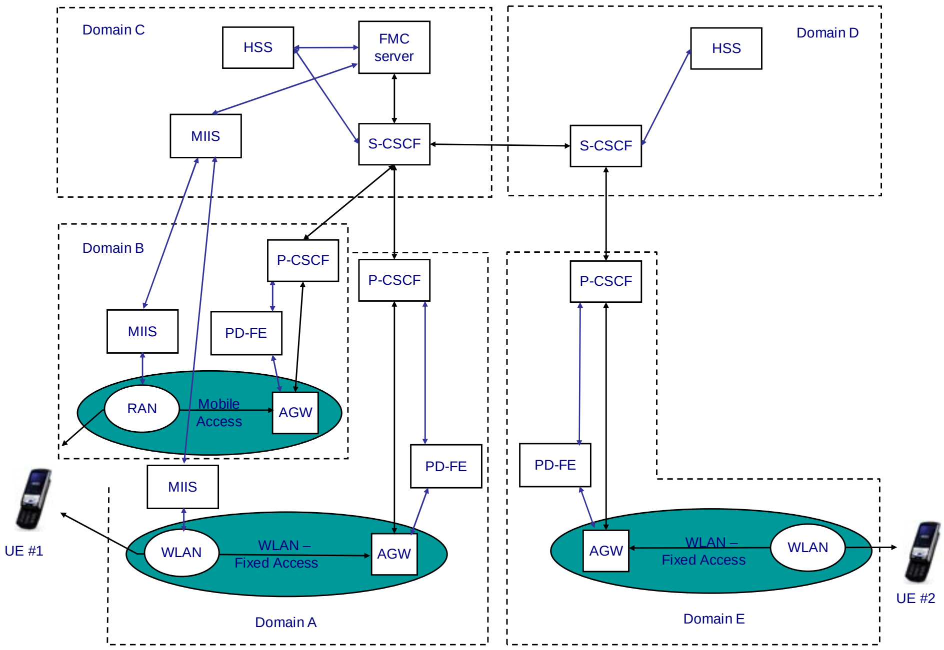

Figure 7 - PS – PS Service Level Convergence Architecture

The figure 7 shows the general case of a UE #1 (on the left hand side of the figure) that is within the radio coverage of both a Visited WLAN access network as well as a Visited Mobile access network, while the access network handover is controlled by an FMC application server in its Home Network. For simplicity the figure shows the scenario where only the originating terminal (UE #1) is a dual mode terminal under service level control. In this scenario the terminating UE #2 has broadband WLAN access, but the service session bandwidth is constrained by the lower bandwidth of the mobile Radio Access Network to which UE #1 is connected. UE #1 may have indicated a preference for a video call with UE #2, but will only get an audio call due to this constraint. When the FMC application server learns that UE #1 has moved to a location where it can be provided with broadband fixed access, it will initiate a handover. The scenario can be extended to the case where also the terminating UE is provided with service level control through an FMC application server in its home network. The originating FMC application server, by subscribing to network context information of the terminating UE from the terminating FMC application server, may then optimize the end-to-end session according to both user's service preferences.

The FMC application server performs the following functions:

- collects information from the HSS on the user's profile and the operator's policy and charging model,
- receives information from the UE on the user's preferences for a session, based on a user defined policy,
- receives information from the UE on the UE location e.g. in the P-Access-Network Info of SIP messages that convey information about the radio access technology and e.g. the radio cell identity
- obtains information from the MIIS (see below) in its domain on available access networks for the UE,
- applies operator policies to the information received and may initiate handover accordingly,
- executes the handover using third party call control.

The MIH Information server collects information about available access networks and capacity and may also provide cost information. It is depicted in a hierarchical arrangement where the MIIS in the IMS home domain of the User can collect access network information from other MISSs in visited domains. Each MISS may collect information from one of more types of access networks in its domain.

Other functions that need to be enhanced to support service level handover are:

S-CSCF:

- shall support multiple registrations from the same UE (same Private Identity)
- will forward SIP messages to the FMC application server according to standard IMS procedures

UE:

- already provides location information in the P-Access-Network-Info, but this may be enhanced with the most accurate location information that the UE has available e.g. geographic location information based on GPS .
- shall be able to transmit and receive data on both its interfaces simultaneously
- should be able to select and order data when it temporarily receives the same data on both its interfaces in order to support seamless operation

Figure 7 depicts five network domains. Each domain may belong to a different network operator. Domains A, B, C and E could however also be part of the same operator's network, in which case domain D is not applicable. Domain C belongs per definition to the Home Service Provider of the UE #1 on the left hand side of the figure to which the FMC handover service is provided. Both A and B may be Visited networks, or either one could be part of the Home Service Provider network. In other words the Home Service Provider may either be a fixed or a mobile operator or both.

As the handover procedure is based on SIP signaling between UE and the FMC server it can be supported by the regular roaming interfaces for IMS services.

In cases that service continuity is achieved by transport level mechanisms, e.g. through Mobile IP, and the mobile and fixed access provide equivalent QoS (bandwidth, delay, packet loss) the transport level handover can be transparent to the service level. In case the QoS of both accesses is substantially different, the service level needs to be involved in the handover decision process. Providing the service level with full control of the handover process as described above offers the advantage that the service that is provided to the user can continuously be optimized for the access network conditions.

10.2 Architecture and FMC functions for PS-CS service continuity

VCC is an IMS centric approach to provide service continuity for voice calls when a multi-mode WLAN-SIP/2G-3G-CS terminal changes its point of attachment. It’s considered being the key organic IMS application. VCC provides the capability to transfer the path of a voice call between a CS and a PS-IMS domain. It assumes that the UE is capable of supporting two separate call legs related to the same voice communication (one over the CS domain and the other via the IMS domain). VCC solution provides completely automatic connectivity from the end-user point of view. The most appropriate network domain (i.e. mobile CS domain or IMS domain) to serve the user is selected based on a combination of user and operator defined policies.

The VCC reference architecture defined in TS 23.206 by 3GPP is depicted in the figure below:

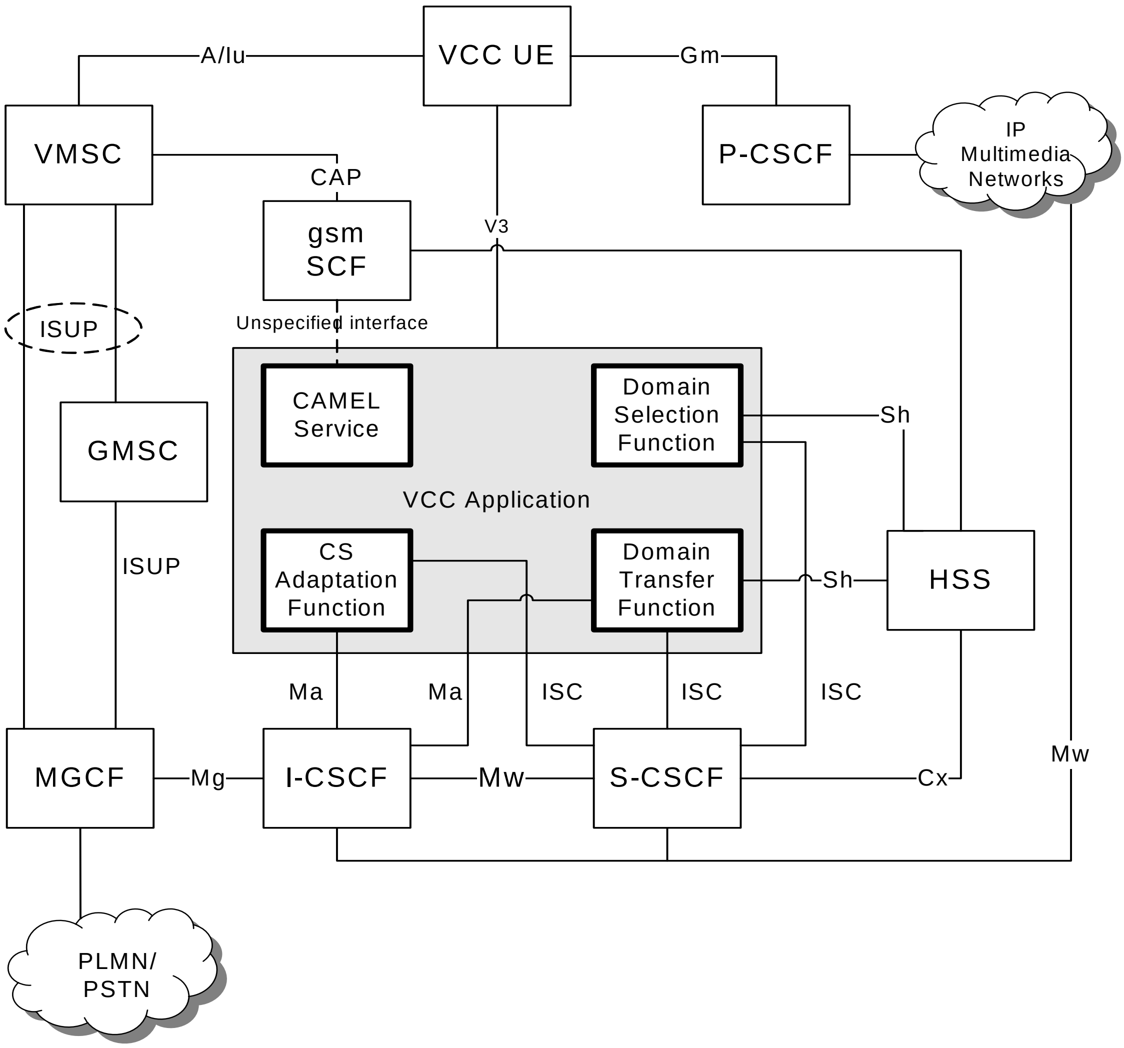

Figure 8 – TS23.206 VCC reference architecture

The VCC Application is implemented as an IMS application server. It controls the establishment of call legs required to transfer a call between a CS and PS domain. UEs have to register with both IMS and CS domains in order to realize the VCC functionalities. After IMS registration according to the regular IMS procedures information can be exchanged between the VCC UE and VCC Application (VCC AS).

For calls originating in the IMS domain initial Filter Criteria for the user result in the routing of the IMS originating sessions to the VCC-AS in the home IMS network, where the VCC AS uses 3rd party call control to initiate a call to the remote party on behalf of the user. For calls originating in the CS domain CAMEL service triggering is used at the VMSC towards the gsmSCF function. The VCC AS returns routing information to the VMSC, which is used by the VMSC to route the call towards an MGCF in the user's home IMS network. The VCC Application terminates the incoming leg towards the intended called party by acting as a Back to Back User Agent (B2BUA).

For terminated calls coming from the IMS domain the VCC AS is invoked. It selects the terminating network as part of the termination service logic for the user. If the call is to be terminated in the IMS domain, the VCC AS acts again as a B2BUA using 3rd party call control to establish a normal IMS session setup towards the terminating VCC UE. If the call is to be terminated to CS domain, the VCC AS determines the CS domain Routing Number (CSRN), optionally in collaboration with HSS. For calls coming from the CS domain it is necessary to anchor the call in the IMS domain. Since this is in the home domain, it is an operator decision how the anchoring is achieved. CAMEL triggering could be used, but other methods like dedicated trunk groups at the GMSC or the use of a local number portability database are also possible. Possible options are documented in TS 23.206.

The routing of terminating calls is depicted in the figure below.

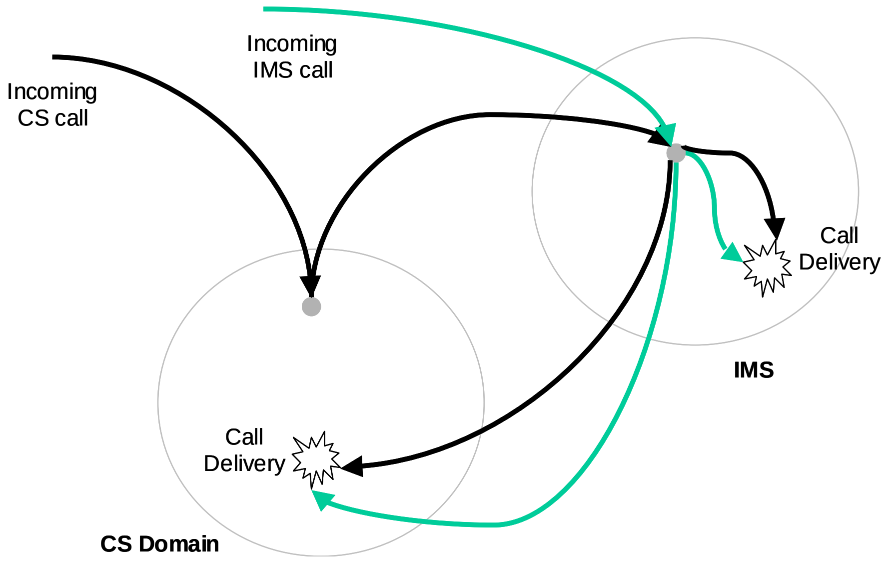

Figure 9 – VCC call termination

Domain transfer is initiated by the VCC UE based on the predefined conditions requiring transfer. For a transfer from a CS to a PS-IMS domain the UE sends an SIP INVITE to the VCC AS to initiate the transfer procedure. For a transfer from a PS-IMS to a CS domain the UE initiates a CS call towards the VCC AS. The VCC AS performs the transfer of IMS leg to CS using SIP Session Transfer.

The bearer path interruption due to the switchover is estimated to be in the 100 – 200 ms range.

The VCC architecture defined in TS23.206 (3GPP Rel. 7) and illustrated in figure 8 has its limitations. When domain transfer takes place, because of the call is not implemented in both domains, certain calls, such as calls that involved in the conference or multi-party services may be interrupted. Domain transfer may not be supported for voice sessions with mid call services before the anchoring being taken place. To address these limitations, alternative approaches, such as Centralized IMS Services (TR 23.892) are under study in 3GPP release 8.

Annex A - Architecture of the current converged network

The section provides information on the architectural aspects of existing fixed and mobile networks. The architecture of current networks is analyzed to highlight the architectural aspects and interfaces that are relevant to IMS based FMC in this recommendation.

A1. 3GPP Architecture

An overview of the 3GPP mobile network architecture can be found in TR 23.882 V1.0.0 and is reproduced below. The figure represents the 3GPP release 6 architecture with the exception of the PCRF that is a release 7 component that replaces the release 6 PDF.

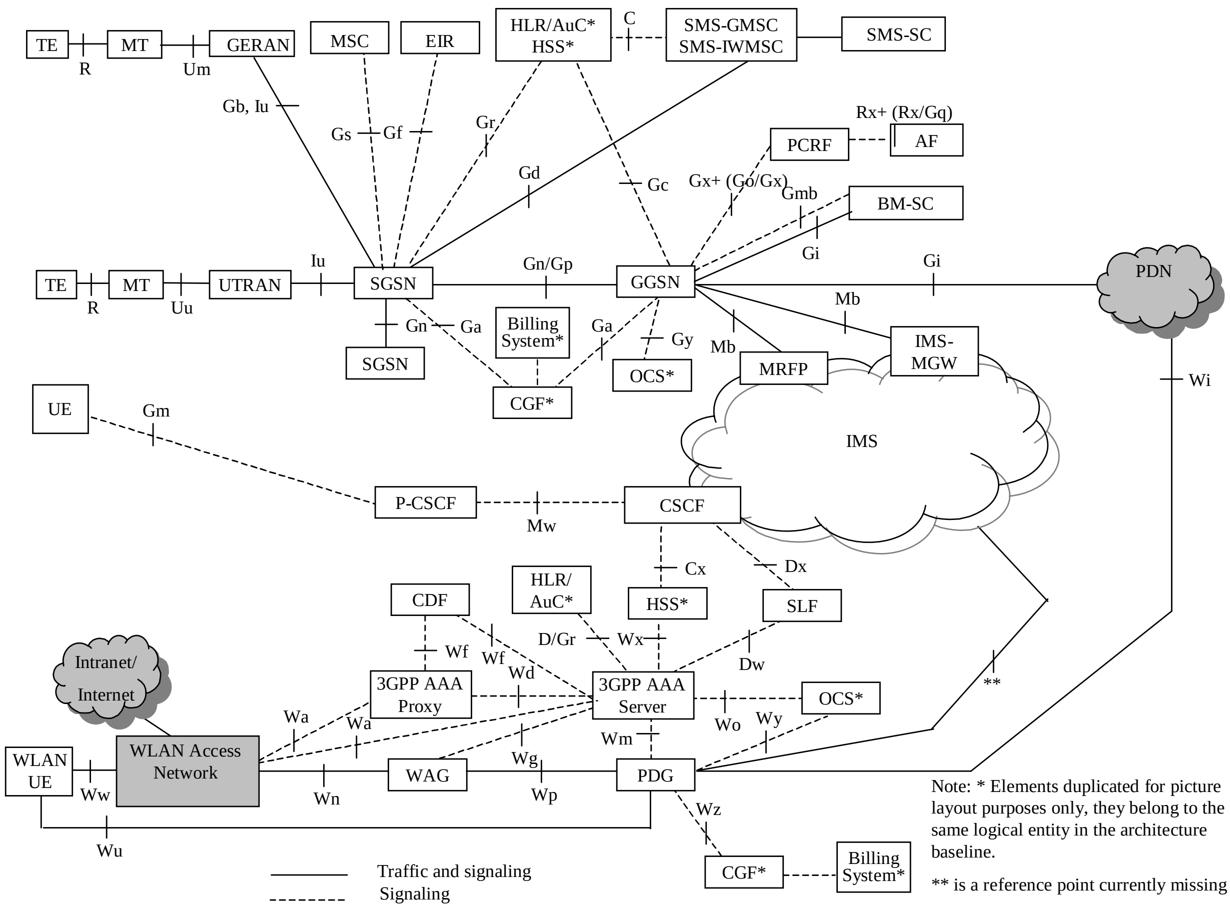

Figure A1 - TR 23.882 Logical baseline architecture for 3GPP

The figure depicts the three different types of accesses that have been defined by 3GPP: GERAN, UTRAN and I-WLAN. GERAN was originally designed to interface to a 2G core network through the A-interface for voice and the Gb-interface for data. Subsequently the Iu-interface has been introduced for GERAN, in order to allow GERAN to be connected to a 3G core network.

In 2G networks voice is carried over the circuit switched A-interface. In current 3G networks voice is pre-dominantly carried over the circuit switched Iu-cs interface, although the standards are in place to support voice and conversational services over the Iu-ps interface. Optimization of GERAN to also carry conversational services in packet mode is being studied.

3GPP has defined two types of WLAN access: 3GPP IP access and Direct IP Access. WLAN 3GPP IP access provides access to the 3GPP core network via an IPSec tunnel between WLAN UE and PDG (see figure above). Direct IP access provides access to an IP network directly from the WLAN without passing data through the 3GPP core. 3GPP core functions are however used for authentication and authorization of the access to the WLAN and the locally connected IP network (e.g. Internet).

A mapping of the 3GPP architecture to the FMC reference model is not straightforward, because many deployment scenarios exist in current networks. In 3GPP GPRS is considered to be part of the IP-CAN (IP Connectivity Access Network) from an IMS perspective as well as part of the 3GPP Core Network from a RAN perspective. From an FMC perspective GPRS appears to be a 3GPP specific access aggregation network, including intra-access mobility management functions. In the figure below we have depicted a mapping of the 3GPP entities on the FMC domain model with a split of the Core Domains in a Visited and a Home Domain. In practical deployments the access and visited domains are within a single operator domain

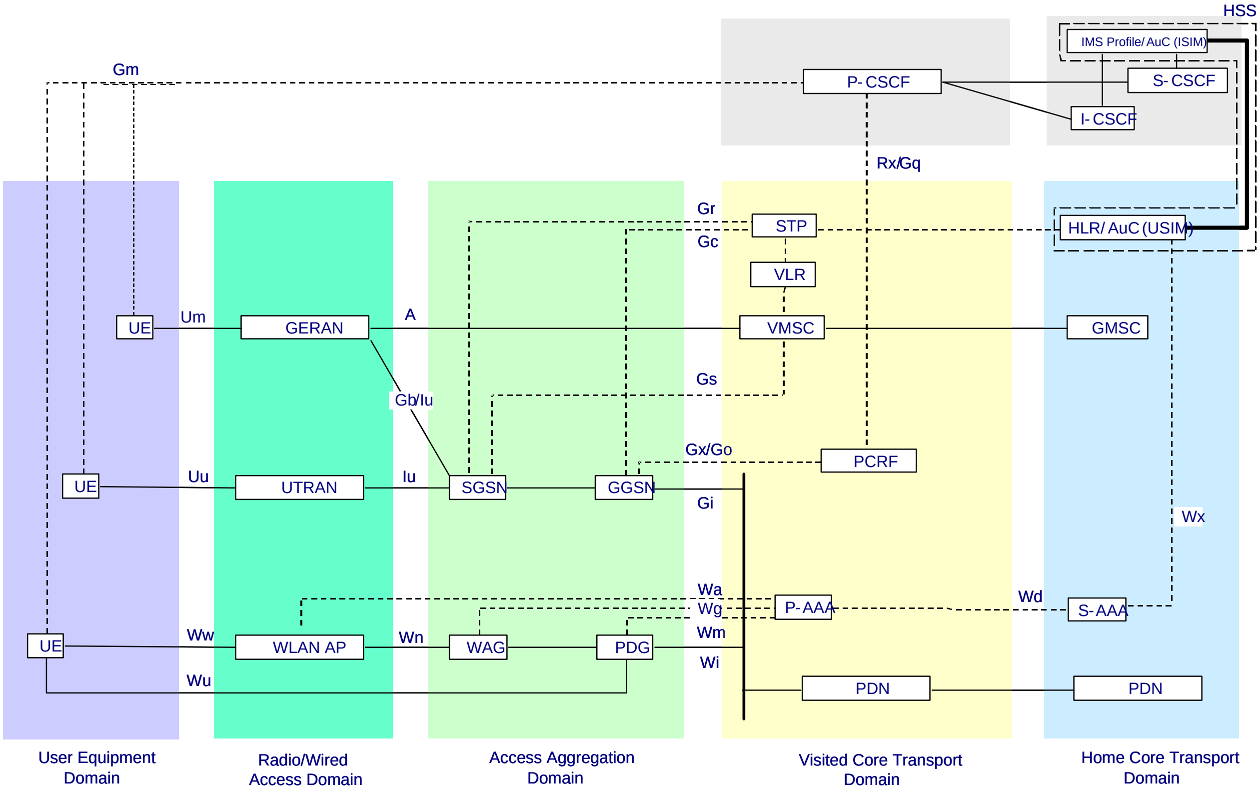

Figure A2 – Mapping of 3GPP architecture to IMS based FMC reference model

As described in section 9, the long term architecture for FMC is the NGN architecture, where the Core Transport Domains are access independent. The implication of the mapping depicted in figure 9 is that the 3GPPP PS domain components that are mapped on the FMC core transport domains are candidates to evolve to a common role for both 3GPP and non 3GPP accesses. This implies that the interfaces to the Session Control Domain will also be common. It should be an objective to define common interfaces to the access domain as well, but these will only be applicable for new access systems.

A2. 3GPP2 Architecture

3GPP2 network architecture is very similar to the 3GPP network architecture. In fact 3GPP2 has adopted the 3GPP IMS standards since 2006. The diagram below illustrates the MMD network architecture defined by 3GPP2:

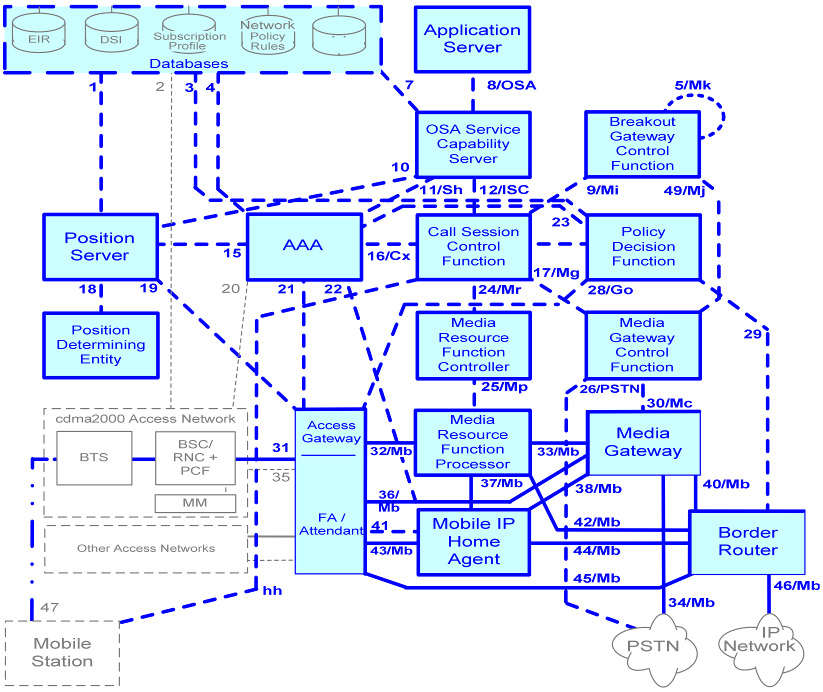

Figure A3 - 3GPP2 X.S0013-000-A MMD Network Architecture Model

The mapping of 3GPP2 network on FMC domains is illustrated below. For comparison, only the relevant components are included.

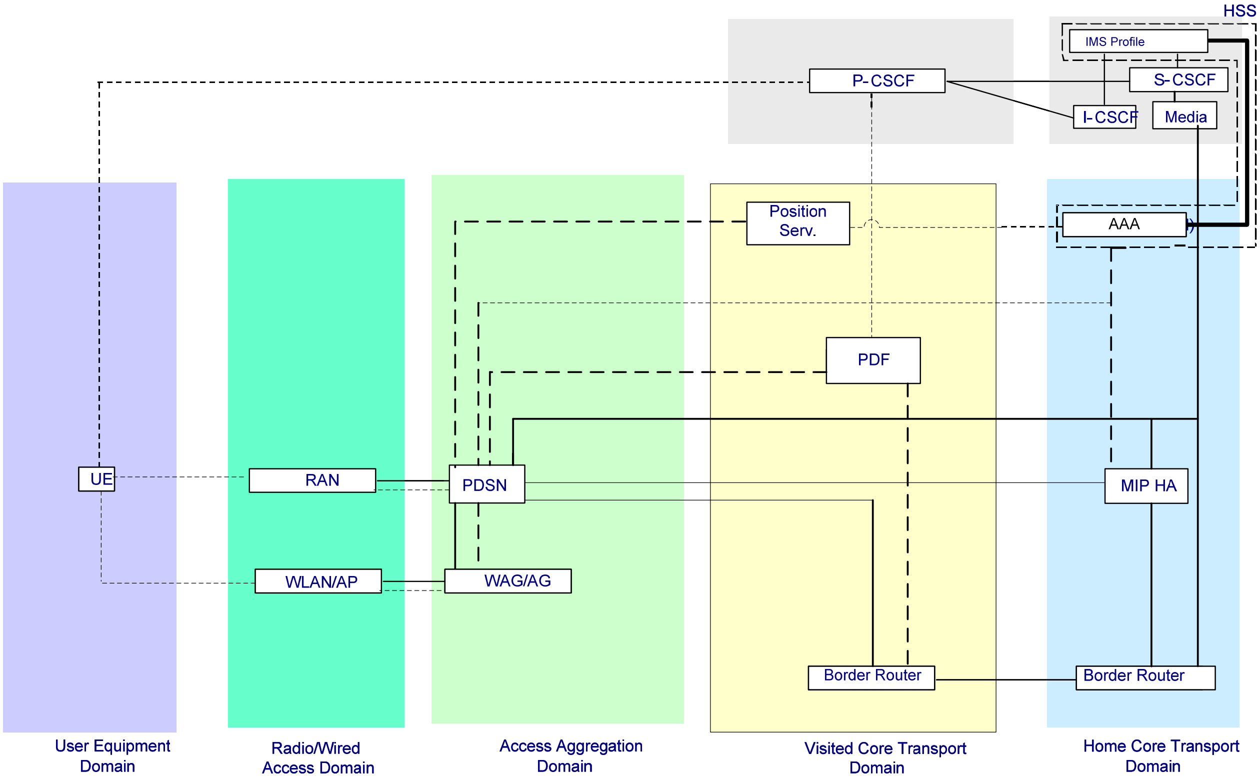

Figure A4 – Mapping of 3GPP2 architecture (with home routed traffic) to IMS based FMC reference model

A3. TISPAN network architecture

SIP-based IMS platform was originally developed for IP based 3GPP/2 networks. ITU-T and ETSI have selected the SIP-based IMS platform as the NGN platform for the convergence of telecommunication and internet.

The ETSI TISPAN architecture of the evolved fixed network is depicted in the figure below:

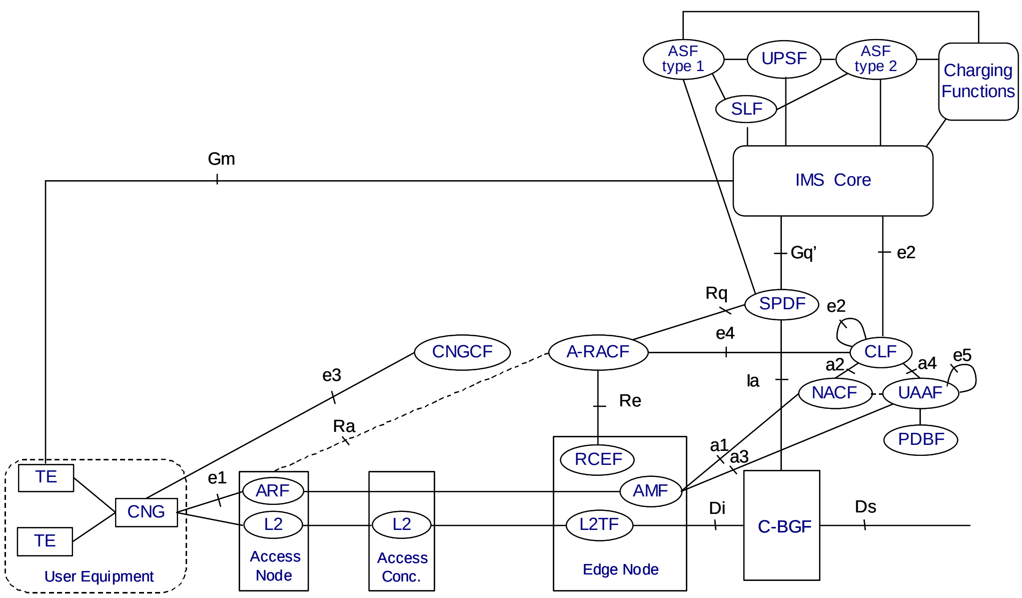

Figure 12 - TISPAN Functional Architecture

A possible mapping of the TISPAN functional architecture on the FMC domains is shown in the next figure. It should be noted that support of nomadicity and roaming for different deployment scenarios is further elaborated in TISPAN R2.

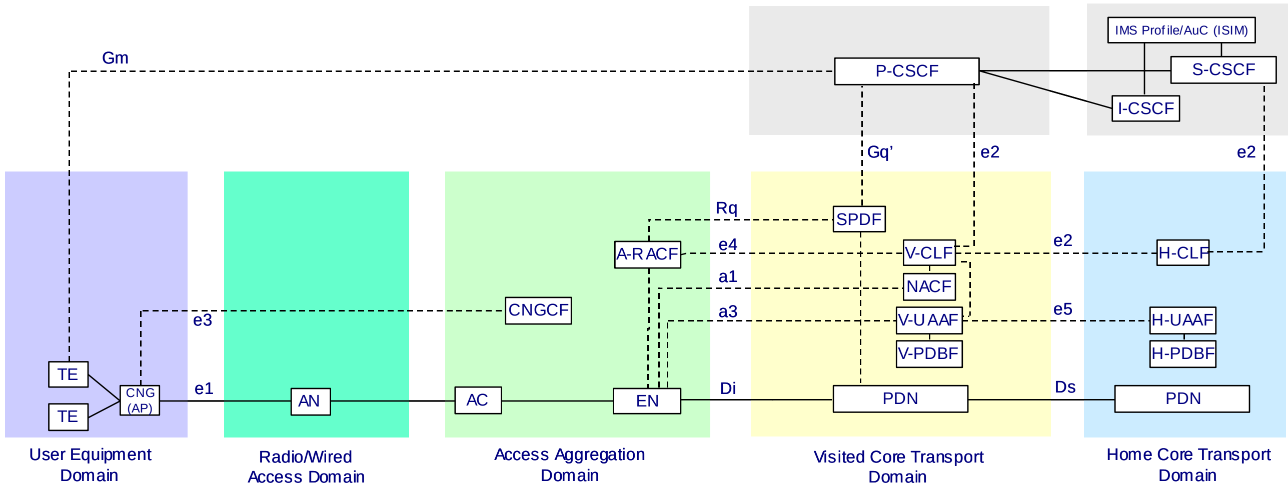

Figure A5 – Mapping of Functional Architecture to IMS based reference model

The functions that are relevant from an FMC common core perspective are in the Core Transport Domains. Compared with the 3GPP architecture the TISPAN architecture provides a more detailed functional decomposition, however it complicates the identification of common functions and interfaces.

Editor's note: Further study is needed to map the figures above on versions based on FRA components. FRA is currently lacking a roaming model.

A4. 3GPP Evolved Packet System

The architectural evolution of 3GPP mobile networks is referred to as the Evolved Packet System, consisting of an Evolved Packet Core (EPC) and an Evolved UTRAN radio access network. The EPC is designed to connect other 3GPP accesses also, as well as non-3GPP accesses, currently the subject of a feasibility study in 3GPP SA2. The objectives of the study 3GPP network evolution are not only to provide higher data rates and lower data and control plane latency, but also to provide service continuity between the I-WLAN and 3GPP PS domain and terminal mobility between different access networks in general, continuity within and between 3GPP access networks and between 3GPP and non-3GPP accesses. The figure 15 below shows the high level architecture for the evolved 3GPP system for the non-roaming case.

To satisfy the large variety of network environments of mobile network operators, the EPS architecture has two variants. The first one, documented in TS 23.401 is an evolution of the current GTP based architecture and retains the GTP model of 2G/3G mobile networks for network based intra 3GPP mobility. This model uses tunnelling over IP for mobility management and also to create QoS tunnels that are mapped 1:1 to radio bearers in the 3GPP radio access networks. Two levels of mobility are defined in the EPS. The global mobility anchor is called a Packet Data Network (PDN) Gateway and the network that connects a mobile network to the PDN GW can be considered as a virtual layer 2 access network. In case of roaming with home routed, the layer 2 network is extended to a PDN GW in the network of the home operator and can be considered as an access network from the perspective of the home operator.

Other functional entities in the EPS architecture are the Serving Gateway (SGW) that provides a local mobility anchor as well as the anchor point for intra 3GPP mobility. The Mobility Management Entity (MME) is a control plane node that supports mobility management and related functions such as idle mode tracking and paging and acts as a proxy for authentication and also for QoS signalling. The Policy and Charging Resource Function (PCRF) is responsible for dynamic policy control and supplies QoS policy information together with charging rules for aggregated IP flows to the PDN GW. The non-roaming architecture as depicted in TS 23.401 is reproduced in figure 15.

The significance of the 3GPP study for FMC is that it includes the connection of a non-3GPP IP access to the Evolved 3GPP Packet Core network, which may be a fixed access network. As is shown in the figure the non 3GPP access network will be connected to an Inter AS Anchor function, so that mobility between the fixed access and a 3GPP could in principle be supported, for instance using Mobile IP.

The evolved 3GPP architecture is mobile network centric in the sense that the 3GPP specific MME/UPE mobility function is depicted as part of the evolved packet core. In a roaming scenario the MME/UPE will be in the visited and the Inter AS Anchor in the home network. It is the latter network that can be mapped on the FMC core transport home domain, and hence the part of the architecture that may contain FMC functions to support FMC on the network layer.

A detailed analysis of the required FMC functions has to wait for a further functional decomposition of the roaming architecture.

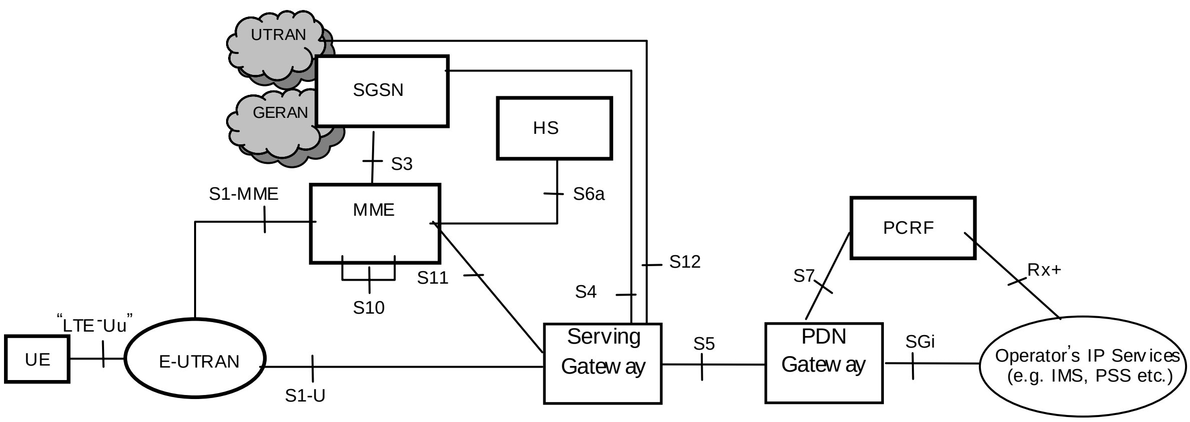

Figure A6 -– TS 23.401 R23.882 Logical high level Non-roaming architecture for the evolved system3GPP accesses

Editor's note: This figure is subject to change and should be replaced by the final version in the published TS.

The mapping of the GTP based EPS architecture is similar to that of the Release -7 architecture shown in figure 9 with the PDN GW replacing the GGSN as the access network termination point.

The second variant of the EPS architecture, documented in TS 23.402, provides a 'global' mobility anchor for both network (PMIP, CMIPv4 FA) as well as host based (DSMIPv6) mobility in the PDN GW. IETF based mobility management is supported towards non-3GPP accesses for compatibility with these accesses. The PDN GW can support mobility between 3GPP and non-3GPP accesses using either network or host based mobility. The 3GPP network interface to the PDN GW (S5) may be either GTP based according to TS 23.401, but may also use PMIP. In the latter case there are no per QoS tunnels on the S5 interface and the QoS signalling towards the Serving Gateway is directly from the PCRF, rather than via the PDN GW. Figure 16 shows an instantiation of the TS 23.402 architecture with 3GPP as well as non-3GPP accesses. Note the distinction between trusted and untrusted access. For untrusted access it is deemed necessary to run an IPSec tunnel between the UE and a gateway (ePDG) in the operator domain to provide sufficient security for the user. The architecture model in figure 16 shows the use of PMIP interfaces from the PDN GW to all accesses and local breakout (global mobility anchoring) of all traffic in the visited network. Many more deployment options of the TS 23 .402 architecture are possible depending on operator deployment and terminal capabilities, including the use of host based mobility (DSMIPv6) to achieve mobility between 3GPP and non-3GPP accesses.

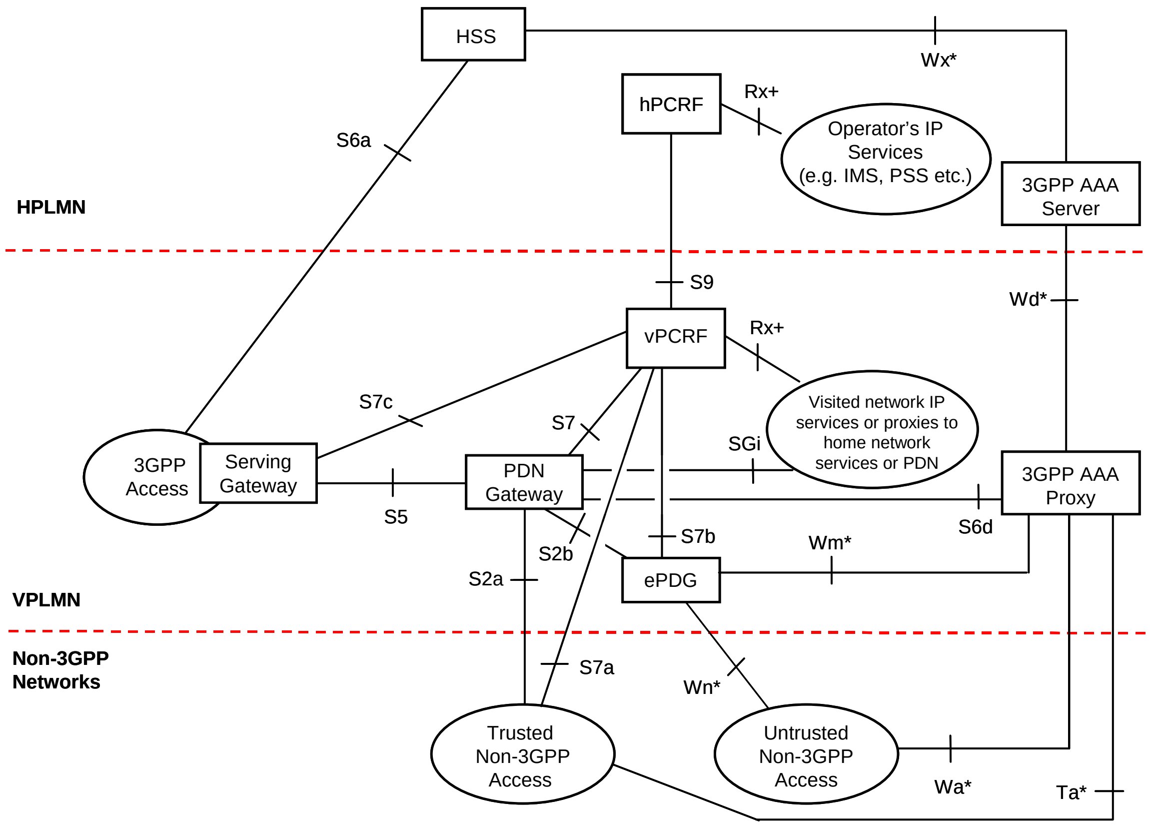

Figure A7 – TS 23.402 Roaming architecture for EPS using S5, S2a, S2b – Local Breakout

Editor's note: This figure is subject to change and should be replaced by the final version in the published TS.

With the TS 23.402 architecture there is no virtual layer 2 on the reference points towards the PDN GW and the access can be considered to be terminated in the SGW or in an equivalent functional entity in the non-3GPP access. The PDN GW may be located in the core network of the visited or home operator. The former case is depicted in figure 16. The mapping of the TS 23.402 architecture of figure 16 on the FMC domains is shown in figure 17 below. For simplicity we have only drawn the case where the IMS P-CSCF is located in the visited network, but as is shown in figure 16, the P-CSCF may also be located in the home network.

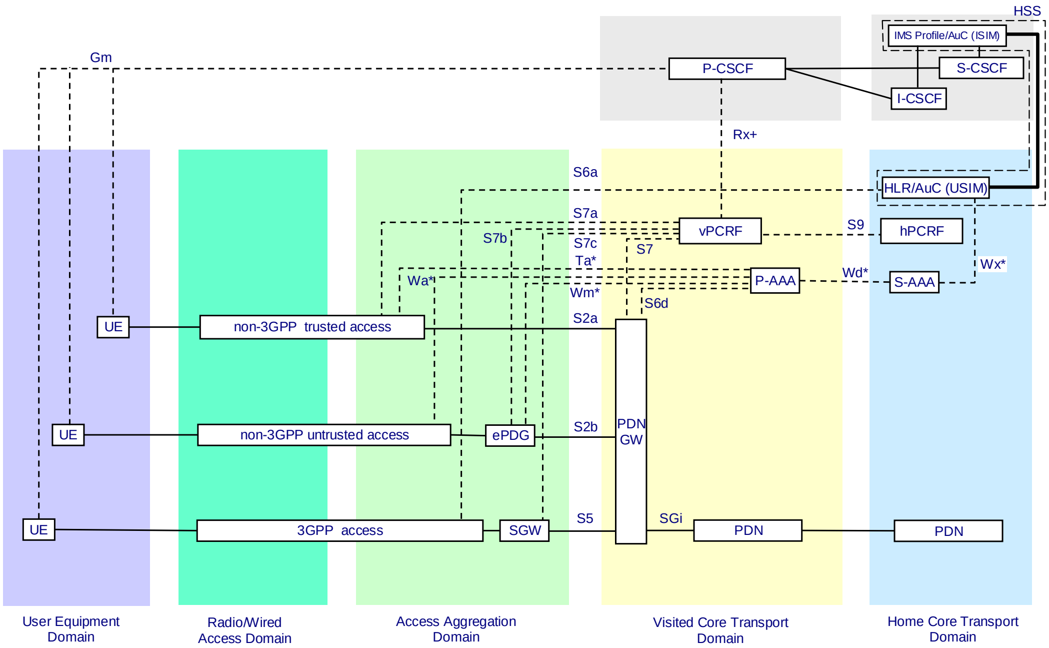

Figure A8 – Mapping of 3GPP TS 23.402 local break-out architecture to

IMS based FMC reference model

A5.VCC architecture

The mapping of 3GPP VCC architecture to IMS based FMC reference model is illustrated below.

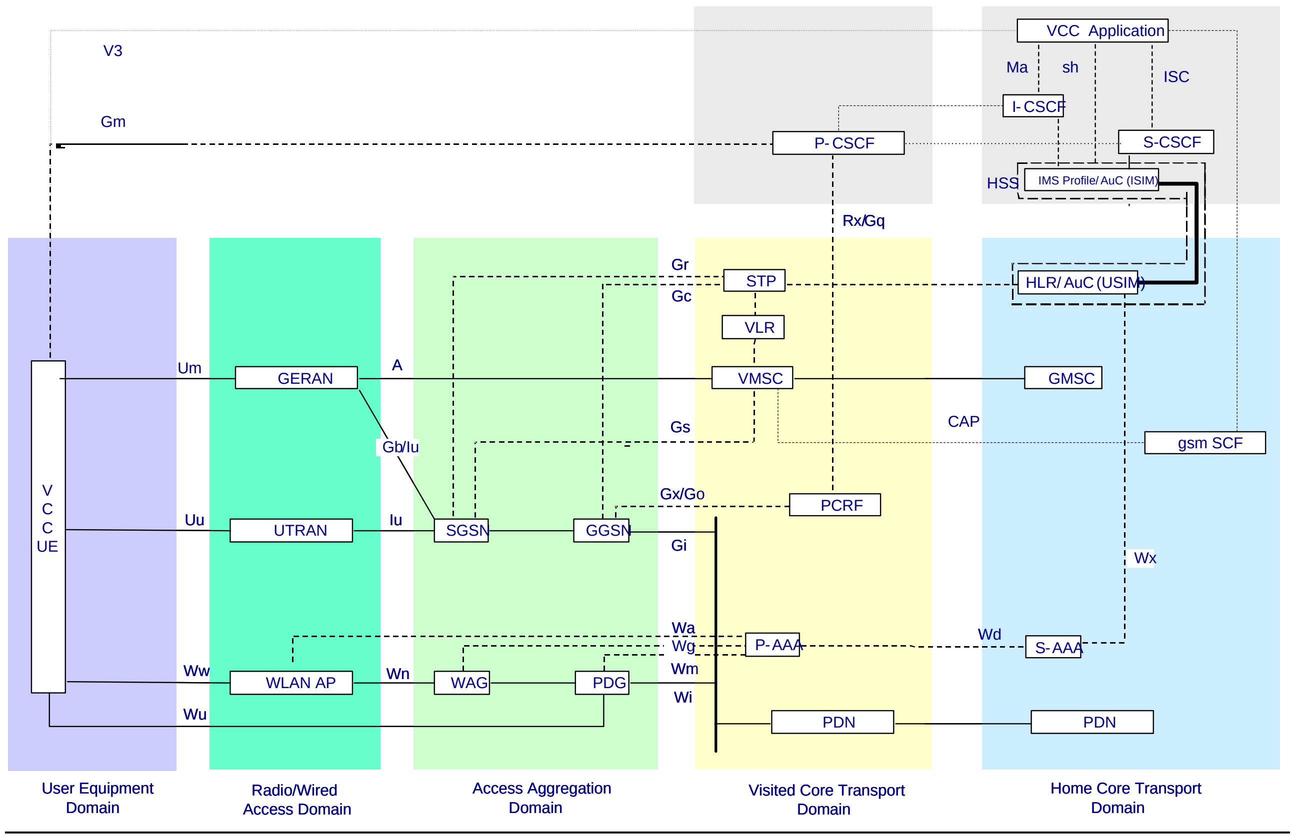

Figure A9 -<u>Mapping of 3GPP VCC architecture to IMS based FMC reference model</u>

<u>This mapping is very similar to the one of 3GPP architecture to IMS based FMC reference model. The difference is that from the PS-CS service continuity prospective VCC application, VCC UE and gsm SCF appear to be the VCC architecture specific elements.</u>

Editor's Note: Contributions are invited providing more detail on the above topics to further develop the above sections.

Annex B. Transport level convergence

B1. Overview

The principles of transport level convergence are outlined in chapter 8. It assumes that the transport stratum of the NGN provides for mobility between mobile and fixed accesses and that such mobility is transparent to the service stratum, other than through information provided through IMS signalling (e.g. provided in the P-Access Header). This implies that the IP contact address of the UE remains unchanged during mobility events, both from the perspective of the service stratum as well as for the corresponding UE. To provide service continuity for multimedia sessions the UE shall be able to attach simultaneously to a fixed and a mobile access, allowing for a make-before-break handover, but all user plane data will always be carried over the same access.

Transport level convergence and its inter-domain interfaces are illustrated in figure 9.x.1.

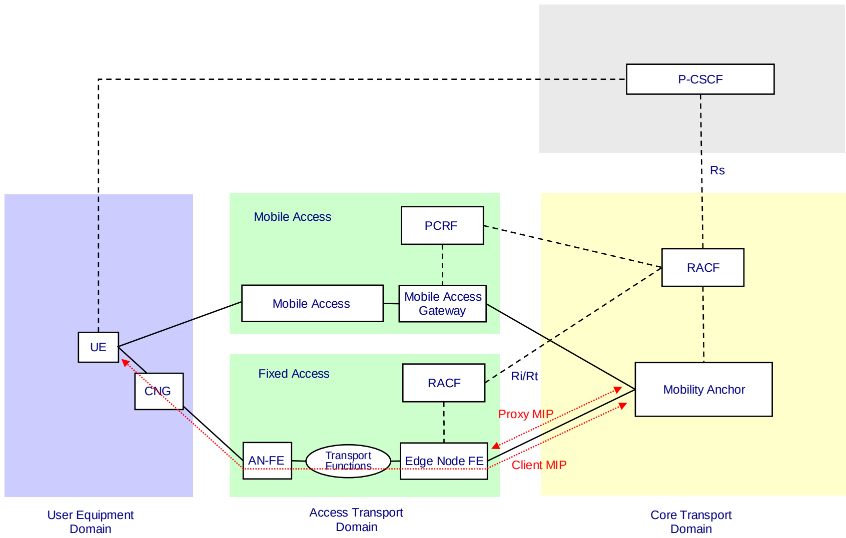

Figure B1 – Transport Level Convergence interfaces

The Core Transport Domain contains a mobility anchor and associated mobility control that routes data for a UE to the Access Domain to which the UE is attached. The Core Transport Domain provides a unified, i.e. access independent interface to the Session Control Domain for per session QoS control.

Editor's note: It is FFS if either Proxy MIP or Client MIP(e.g. DSMIPv6) or both are applicable for FMC (see also clause 9.2.x)

B2. Mobility control interfaces

[This clause will specify the mobility protocols on the Access to Core Transport Domain reference point that are applicable for transport level convergence with reference to the appropriate documents.]

Editor's note: The 3GPP Evolved Packet System (see annex …) supports a number of mobility options, at least three of which are potentially applicable to FMC:

- *Proxy MIP between the Edge Node in the Access Transport Domain and the mobility anchor in the Core Transport Domain with an IPSec tunnel between Edge Node and UE for transport level security*
- *Dual Stack MIPv6 between UE and the mobility anchor in the Core Transport Domain with an IPSec tunnel between Edge Node and UE for transport level security*
- *Dual Stack MIPv6 between UE and the mobility anchor in the Core Transport Domain without an IPSec tunnel between Edge Node and UE*

The first two are applicable both to public as well as private (customer network) WLAN access points. The last option could be used in combination with WLAN specific security mechanisms within a customer network.

It is FFS which of these –or other- protocols will be specified for FMC.

B3. Access Domain Resource and Admission control interfaces

[This clause will specify the protocol(s) for resource and admission control between the Access and the Core Transport Domains with reference to the appropriate documents.]

Editor's note: Mobile access networks are within the scope of Y.2111 (RACF), but a number of aspects that are specific to mobile access networks are not covered in Y.2111 and the associated Q.330x stage 3 recommendations as yet. We can distinguish two categories of resource and admission control issues with respect to Y.2111:

1. *related to the static configuration of QoS and gates when the UE attaches to the network or changes its point of attachment between a fixed and a mobile access*
2. *related to dynamic service level session control*

Open issues related to the static configuration include:

- *Need to allow for static, subscription based QoS in an FMC deployment without RACF (this mode of operation is supported by the 3GPP EPS through procedures that provide subscription based QoS parameters to transport functions via the AAA (i.e. NACF) infrastructure)*
- *Need to distinguish between the subscribed QoS of an individual UE (e.g. a mobile subscription) and the subscribed QoS of a fixed network access line that may support multiple UEs simultaneously through a customer network*
- *Mechanism to discover the appropriate and same PD-FE entity from the Access and Core Transport Domains on UE attachment*
- *Mechanism to support Access Domain Edge Node relocation*
- *Allocation of IPSec functionality (see 9.x.2 above) to access or core domain as the latter will hide individual flows from the Edge Node in the access domain*

Open issues related to dynamic session control include:

- *Need to support per session control on the fixed network WLAN radio access (would require the standardization of a mechanism to provide QoS parameters to the UE)*
- *Need to support session based QoS control and gating in the fixed network access domain, and and if so,*
- *Ability for the Edge Node and procedure to provide it with sufficient information to look into DSMIP tunnel*

B4. Session based QoS and NAT control interface

[This clause will specify the protocol(s) for session based QoS and NAT control on the reference point between the Core Transport Domain and the Session Control Domain with reference to the appropriate documents.]

Editor's note: The NGN Rs interface (Q.3301.1) provides for integrated QoS and NAT control, just like the equivalent TISPAN specification of Gq'. Embedded NAT control is however not supported by 3GPP IMT-2000 standards for the Rx interface, neither is it included in the 3GPP Policy and Charging Control interface to the mobility anchor in the Core Transport Domain. 3GPP standards allow for both an IMS Application Level Gateway approach to NAT control (with a dedicated control interface to an IMS Access Gateway) as *well as for the ICE and Outbound approach using STUN servers in the network. Discussions have recently started in the context of the Common IMS on the harmonization of Gq' and Rx+ for 3GPP Release 8.*

It is FFS which NAT traversal mechanisms and associated control interfaces will be specified for FMC.

B5. Network discovery and selection

[This clause will specify requirements and procedures for network discovery and selection on power-up of a UE and for handover between fixed and mobile access with reference to appropriate documents.]