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SERIES Y: GLOBAL INFORMATION INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS AND NEXT-GENERATION NETWORKS

Next Generation Networks – Generalized mobility

Fixed mobile convergence with a common IMS session control domain

Recommendation ITU-T Y.2808

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Recommendation ITU-T Y.2808

Fixed mobile convergence with a common IMS session control domain

Summary

Recommendation ITU-T Y.2808 describes principles, service and network capabilities, and architectures for IP multimedia subsystem (IMS) based fixed-mobile convergence (FMC).

Source

Recommendation ITU-T Y.2808 was approved on 29 June 2009 by ITU-T Study Group 13 (2009-2012) under Recommendation ITU-T A.8 procedures.

Keywords

Convergence, fixed, fixed-mobile convergence (FMC), IP multimedia subsystem (IMS), international mobile telecommunication (IMT), mobile.

FOREWORD

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Fixed mobile convergence with a common IMS session control domain

1 Scope

This Recommendation describes the principles, service and network capabilities, and architectures for IP multimedia subsystem (IMS) based fixed-mobile convergence (FMC).

This Recommendation describes a network architecture that uses IMS to provide the same set of services to user terminals, regardless of whether they use fixed or mobile access network technologies, and ensures 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 [ITU-T Y.2021] for IMS related entities, and [ITU-T Y.2012] for non-IMS related entities functionality. This Recommendation details IMS FMC specific architectural entities requirements which are generically defined in [ITU-T Y.2012] and [ITU-T Y.2021].

Although this Recommendation is focused on future IMS-based networks, some legacy fixed network requirements are also addressed.

2 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.

[ITU-T Q.1707] Recommendation ITU-T Q.1707/Y.2804 (2008), *Generic framework of mobility management for next generation networks.*

[ITU-T Q.1741.5] Recommendation ITU-T Q.1741.5 (2008), *IMT-2000 references to Release 7 of GSM-evolved UMTS core network.*

[ITU-T Q.1742.5] Recommendation ITU-T Q.1742.5 (2006), *IMT-2000 references (approved as of 31 December 2005) to ANSI-41 evolved core network with cdma2000 access network.*

[ITU-T Q.1761] Recommendation ITU-T Q.1761 (2004), *Principles and requirements for convergence of fixed and existing IMT-2000 systems.*

[ITU-T Q.1762] Recommendation ITU-T Q.1762/Y.2802 (2007), *Fixed-mobile convergence general requirements.*

[ITU-T Y.2012] Recommendation ITU-T Y.2012 (2006), *Functional requirements and architecture of the NGN release 1.*

[ITU-T Y.2014] Recommendation ITU-T Y.2014 (2008), *Network attachment control functions in next generation networks.*

[ITU-T Y.2021] Recommendation ITU-T Y.2021 (2006), *IMS for Next Generation Networks.*

[ITU-T Y.2031] Recommendation ITU-T Y.2031 (2006), *PSTN/ISDN emulation architecture.*

[ITU-T Y.2262] Recommendation ITU-T Y.2262 (2006), *PSTN/ISDN emulation and simulation.*

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 convergence [ITU-T Q.1761]: Coordinated evolution of formerly discrete networks towards uniformity in support of services and applications.

3.1.2 discrete mobility [ITU-T Q.1761]: See "Nomadism".

3.1.3 discrete terminal mobility [ITU-T Q.1761]: Ability to have discrete mobility using the same terminal.

3.1.4 fixed mobile convergence [ITU-T Q.1762]: In a given network configuration, the capabilities that provide services and application to the end user defined in Recommendation ITU-T Y.2091 regardless of the fixed or mobile access technologies being used and independent of the user's location. In the NGN environment (ITU-T Y.2011), it means to provide NGN services to end users regardless of the fixed or mobile access technologies being used.

3.1.5 handover [b-ITU-T Q.1706]: The ability to provide services with some impact on their service level agreements to a moving object during and after movement.

3.1.6 home network [b-ITU-T Q.1706]: 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.

3.1.7 mobility [ITU-T Q.1761]: 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.

3.1.8 mobility management [b-ITU-T Q.1706]: The set of functions used to provide mobility. These functions include authentication, authorization, location updating, paging, download of user information and more.

3.1.9 nomadism [ITU-T Q.1761]: 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 the 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.

3.1.10 personal mobility [ITU-T Q.1761]: 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.

3.1.11 roaming [b-ITU-T 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.

3.1.12 seamless handover [b-ITU-T Q.1706]: It is a special case of mobility with service continuity since it preserves the ability to provide services without any impact on their service level agreements to a moving object during and after movement.

3.1.13 seamless service [b-ITU-T Q.1706]: A service that is implemented such that it will ensure that users will not experience any service disruptions while changing the point of attachment.

3.1.14 service continuity [b-ITU-T Q.1706]: The ability for a moving object to maintain ongoing service over including current states, such as user's network environment and session for a service.

3.1.15 terminal mobility [b-ITU-T Q.1706]: This is the mobility for those scenarios where the same terminal equipment is moving or is used at different locations. It includes 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.

3.1.16 visited network [b-ITU-T Y.2091]: The network that is local to the customer in a roaming configuration.

3.2 Terms defined in this Recommendation

None.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

2G	Second Generation
3G	Third Generation
AAA	Authentication, Authorization and Accounting
AC	Authentication Centre
AGW	Access Gateway
AKA	Authentication and Key Agreement
AN	Access Network
B2BUA	Back to Back User Agent
BRAS	Broadband Remote Access Server
CAMEL	Customized Applications for Mobile network Enhanced Logic
CAN	Connectivity Access Network
CAVE	Cellular Authentication and Voice Encryption
CMIP	Client MIP
CN	Core Network
CS	Circuit Switched
CSI	Combining CS and IMS services
CSRN	CS domain Routing Number
DSL	Digital Subscriber Line
DSLAM	Digital Subscriber Line Access Multiplexer
EPC	Evolved Packet Core
EPS	Evolved Packet System

FMC	Fixed Mobile Convergence
GERAN	GSM Edge Radio Access Network
GGSN	Gateway GPRS Supporting Node
GMSC	Gateway MSC
GPRS	General Packet Radio Service
GPS	Global Positioning System
GSM	Global System (for) Mobile (communications)
GTP	GPRS Tunnelling Protocol
HSS	Home Subscriber Server
ICS	IMS Centralized Services
IMS	IP Multimedia Subsystem
IMT-2000	International Mobile Telecommunications – 2000
IP	Internet Protocol
ISDN	Integrated Services Digital Network
ISIM	IMS Subscriber Identity Module
ISUP	ISDN User Part
IWF	Inter-Working Function
LAN	Local Area Network
MGCF	Media Gateway Control Function
MIH	Media Independent Handover
MIIS	MIH Information Server
MIP	Mobile IP
MME	Mobility Management Entity
MMSC	MultiMedia Service Continuity
MSC	Mobile Switching Centre
MT	Mobile Terminal
NACF	Network Attachment Control Function
NASS	Network Attachment Sub-System
NAT	Network Address Translation
NIS	Network Information Server
P-CSCF	Proxy-Call Session Control Function
PCRF	Policy and Charging Resource Function
PDA	Personal Digital Assistant
PDN	Packet Data Network
PES	PSTN/ISDN Emulation Subsystem
PLMN	Public Land Mobile Network
PMIP	Proxy MIP

PS	Packet Switched
PSDN	Packet Switched Data Network
PSTN	Public Switched Telephone Network
QoS	Quality of Service
RACF	Radio Access Control Function
RAN	Radio Access Network
RNC	Radio Network Controller
S-CSCF	Serving-Call Session Control Function
SCP	Service Control Point
SGW	Serving Gateway
SIM	Subscriber Identity Module
SMS	Short Message Service
UE	User Equipment
UICC	Universal Integrated Circuit Card
UMA	Unlicensed Mobile Access
UMTS	Universal Mobile Telecommunications System
UPE	User Plane Entity
UTRAN	UMTS Radio Access Network
VCC	Voice Call Continuity
VHE	Virtual Home Environment
VMSC	Visited MSC
VSC	Voice Service Continuity
WLAN	Wireless LAN

5 Conventions

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

6 IMS based FMC architecture

The long-term goal for fixed mobile convergence (FMC) is to provide users with seamless services across fixed and mobile environments. It does not matter from the user's perspective with which architecture this seamless service experience is achieved. This is however very relevant from a network operator's perspective because it impacts the architecture requirements for providing such services.

Principles and requirements for convergence of fixed and existing IMT-2000 systems described in [ITU-T Q.1761] address 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. In addition, fixed-mobile convergence general requirements provided in [ITU-T Q.1762] address the high-level requirements leading to the development of recommendations and implementation guidelines for the realization of fixed mobile convergence (FMC).

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.

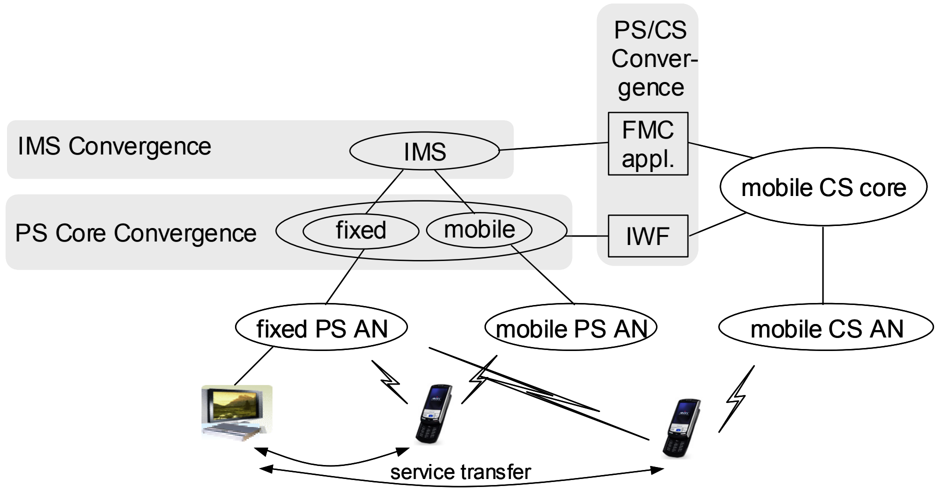

Figure 1 – High-level IMS based FMC architecture

The 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 access in order 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 studied in this Recommendation.

The alternative for service level handover is transport level handover through the use of a suitable mobility management protocol. This type of handover requires a common packet switched core where the authorization of network attachment and the quality of service (QoS) context of the attachment can be transferred from one access to another. Packet switched (PS) core convergence to enable transport level handover 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 circuit switched (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), as illustrated in Figure 1. The convergence functions are drawn between the two networks to illustrate their bridging nature. These functions will, however, be contained within the IMS network, as the intent of the architecture is to reuse existing CS interfaces.

Note that IMS-based public switched telephone network (PSTN)/integrated services digital network (ISDN) emulation architecture [ITU-T Y.2031] could also be considered as an IMS-based FMC architecture, since the converged IMS may provide circuit-switched emulated services to mobile as well as PSTN/ISDN terminals. This FMC scenario is detailed in [ITU-T Y.2262] and is outside of the scope of this Recommendation.

7 NGN domain model and convergence levels

7.1 IMS-based NGN reference model

Figure 2 depicts an abstracted IMS-based NGN reference model for both fixed and mobile network environments. This model, derived from the NGN framework architecture [ITU-T Y.2012], is used in this Recommendation to describe the different levels of convergence that can be achieved.

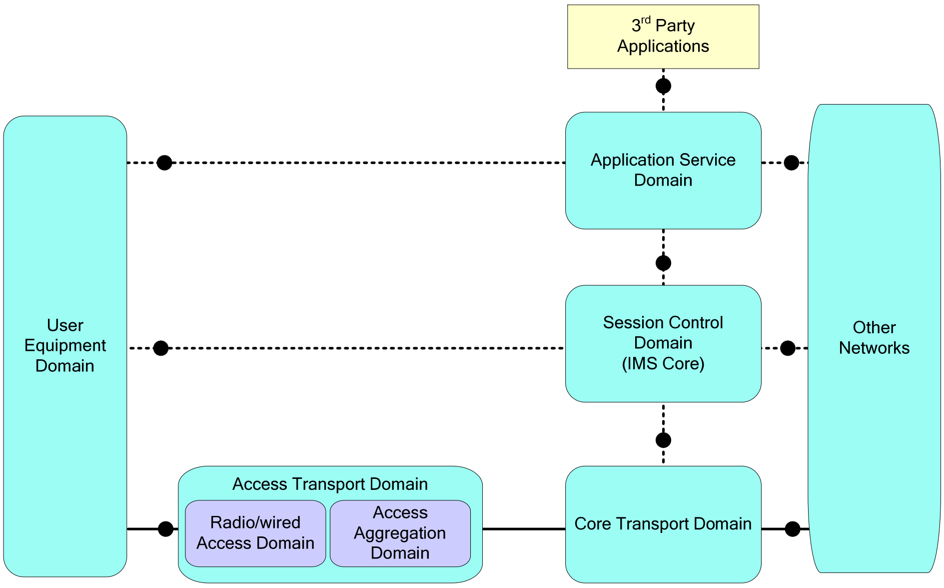

Figure 2 – IMS based NGN reference model

The access transport domain provides the connectivity between the user equipment domain and the core transport domain. Within the access transport domain, the physical access media dependent radio/wired access domain (e.g., digital subscriber line access multiplexer (DSLAM), 3G base stations and radio network controller (RNC), wireless local area network (WLAN) access points, etc.) is distinguished from the access aggregation domain that aggregates the traffics from multiple radio/wired access domain instances to the core transport domain. General packet radio service (GPRS), part of the 3GPP IP connectivity access network, is an example of an access aggregation domain, and so is the network that connects DSLAM to a broadband remote access server (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., Mobile IP (MIP) home agents). The core transport domain interconnects with access transport domains within the same network and the core transport domains of other networks and supports media processing functions as necessary. Network attachment and 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 an 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 (UE) and between UEs and other networks is provided by the session control domain, which also contains functions supporting presence and location services. The session control domain interfaces with the core transport domain to convey transport resource requests and network address translation (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, the application service domain contains functionality that supports so-called application services such as messaging and information services that may be built on top of session control services.

7.2 Principles of IMS-based service convergence

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 documentation can be found in [ITU-T Q.1741.5].

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

– Access to the same IMS-based services from different terminals using different public identities (these may be implemented as a single physical terminal with different public identities);
– 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 UMTS radio access network (UTRAN) and WLAN/Bluetooth handset or personal digital assistant (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 architecture is required to support sharing of access and core transport domain facilities by multiple service platform providers.

7.3 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 four possible points of convergence at different network levels (domains). Note that the access transport 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 left-second diagram of Figure 3. 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. This point of convergence is of interest to service providers wishing to provide multimedia session continuity to their subscribers, independently from the underlying transport networks.

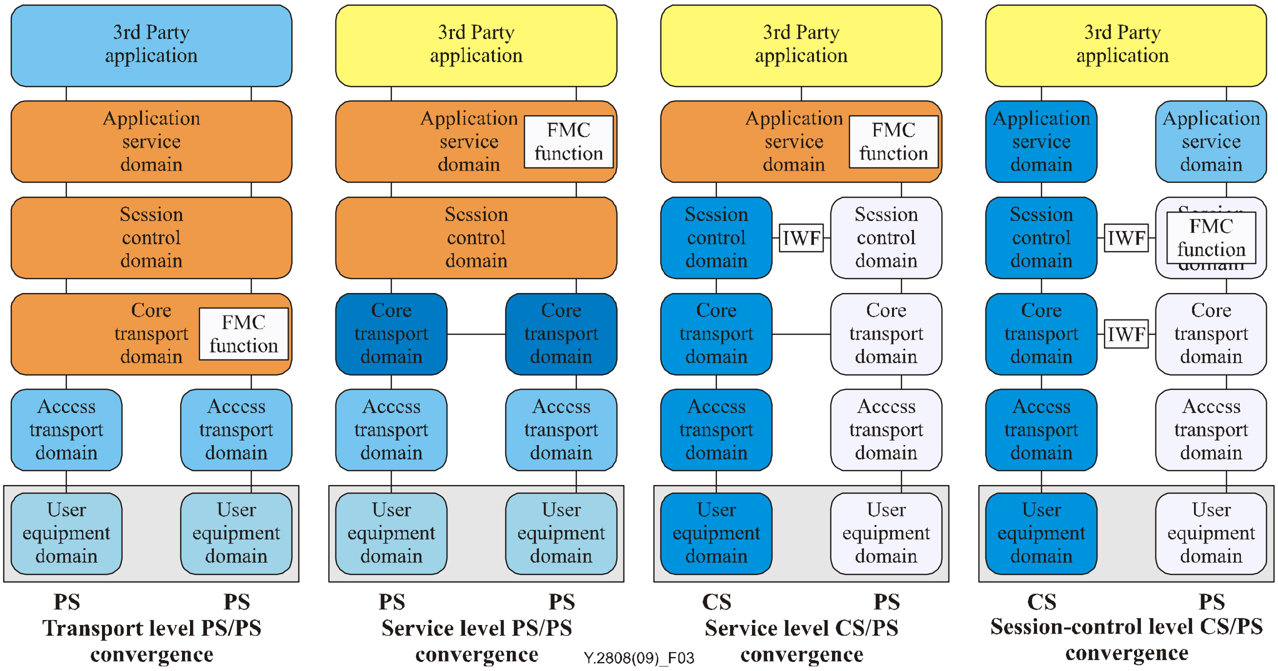

Figure 3 – Convergence point and FMC function

The alternative architecture to support service continuity to multi-mode terminals makes use of FMC functions provided in a common core transport domain. This is shown on the left hand side of Figure 3. This form of convergence is of interest to 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 the one originally committed in 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, then the session domain is recommended to be informed, since 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 [ITU-T Q.1707].

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

Transport and service-level PS/PS 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 may take time, and it is therefore imperative to have the ability to provide service continuity for voice calls between the PS fixed access domains and the CS mobile access domains. The architecture to enable this capability is shown on the left-third diagram of Figure 3, "Service level PS/CS convergence". Inter-working between CS and PS domains is provided by signalling gateway functions and media gateway functions. These functions are not specific to FMC, because they are also required anyway for terminals in 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 of special interest to service providers who operate in both CS-based mobile networks and PS-based fixed networks.

The alternative architecture to support CS and PS convergence makes use of a FMC function in a session control domain (e.g., the IMS domain). This is shown on the right hand side of Figure 3. This point of convergence is of special interest to service providers who operate in both CS-based mobile networks and PS-based fixed networks. In this scenario, the PS session control domain (e.g., the IMS domain) provides the FMC function. The CS domain needs to coordinate and provide an appropriate routing function in which CS calls may also be controlled by the PS session control domain. This routing function in the CS domain may be provided through the service control point (SCP) and the mobile switching centre (MSC).

A combination of all four types of convergence, as illustrated in Figure 3, may also be applied to allow for roaming between CS and PS domains, or to combine handover and service transfer capabilities

8 IMS-based FMC capabilities

8.1 Service-level convergence and service continuity

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

There are at least 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, these technologies 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, as important is the fact that each service has its own specific parameters, for instance the video quality and frame rate of real-time video transmission requires adjustment to fit into a given bandwidth. Service-level convergence takes these aspects into consideration.

8.1.1 Service continuity

Service continuity can be classified into the following two major categories:

– MMSC: multimedia service continuity;

– VSC: voice service continuity.

Multimedia services consist of a partial or full combination of data services, voice services, and video services. Service continuity of multimedia services includes service continuity of these respective services and the required synchronization between them.

Voice service continuity provides seamless voice services to subscribers across different network boundaries.

In service continuity, there are three major scenarios to be addressed:

– service continuity on the same user device;
– service continuity on different multimedia user terminals;
– service continuity on different telephony (voice only) terminals.

These scenarios are described in the following clauses.

8.1.1.1 Service continuity on the same user device

Figure 4 illustrates the scenario where service continuity is provided on the same user device. The possible types of service continuity achievable in this scenario are outlined in Table 1.

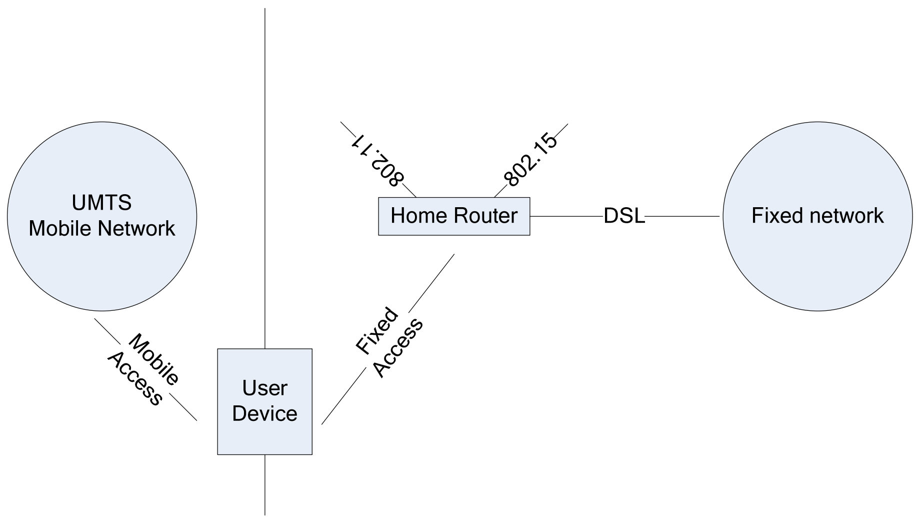

Figure 4 – Service continuity on the same terminal

Table 1 identifies which types of service continuity (i.e., MMSC and/or VSC) are achievable, depending on different access networks and control technologies.

Table 1 – Service continuity on the same user device

Access network/ Control technologies	WLAN/IMS	WLAN/UMA
UMTS/IMS – PS	MMSC/VSC	MMSC/VSC
UMTS/IMS – CSI	MMSC/VSC	MMSC/VSC
UMTS/PLMN – CS	VSC	VSC

8.1.1.2 Service continuity between different multimedia user terminals

Service continuity between different multimedia user terminals allows to:

– Obtain better in-house coverage without special dual mode terminals;
– conserve mobile bandwidth by using fixed broadband technology whenever possible;
– enjoy services provided by powerful multimedia terminals with higher bandwidth fixed access.

This FMC scenario is illustrated in Figure 5, with possible service continuity situations outlined in Table 2.

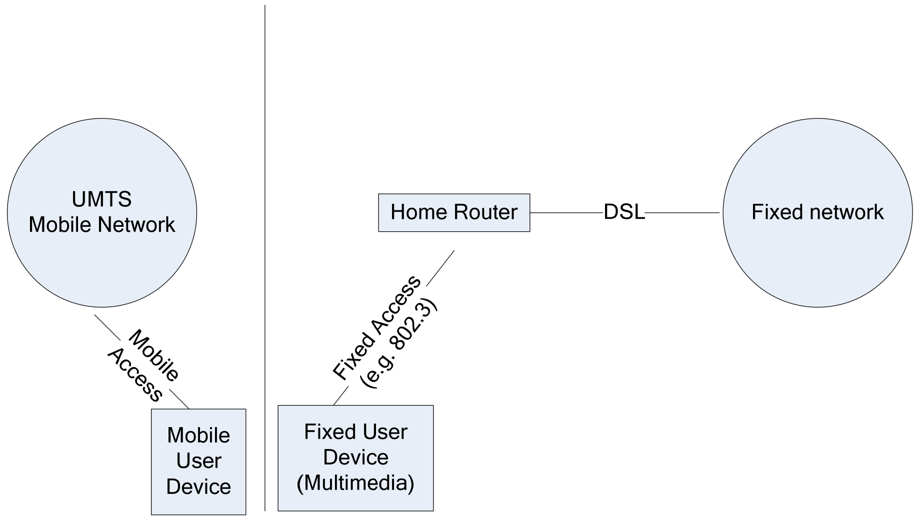

Figure 5 – Service continuity between different multimedia terminals

Table 2 identifies which types of service continuity (i.e., MMSC and/or VSC) are achievable, depending on different access networks and control technologies.

Table 2 – Service continuity between different multimedia terminals

Access network/ Control technologies	Fixed packet access/IMS
UMTS/IMS – PS	MMSC/VSC
UMTS/IMS – CSI	MMSC/VSC
UMTS/PLMN – CS	VSC

8.1.1.3 Service continuity between telephony terminals

The rationale for this case is similar to that of the multimedia terminal case. The key aspect is that although the special dual-mode terminal is not being used, this type of service continuity also offers the same benefits of mobile bandwidth conservation, better voice quality and better signal coverage whenever fixed access is available. Figure 6 outlines the corresponding configuration.

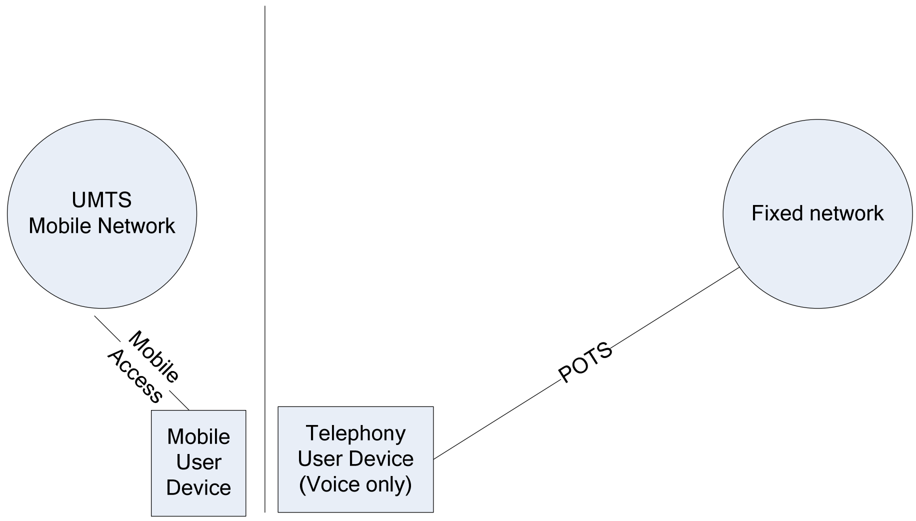

Figure 6 – Service continuity between telephony terminals

Table 3 identifies the types of service continuity (i.e., VSC in this case) that are achievable, depending on different access networks and control technologies.

Table 3 – Service continuity between telephony terminals

Access network/ Control technologies	PSTN interface/ PES@ IMS	PSTN interface/ PSTN
UMTS/IMS	VSC	N/A
UMTS/IMS – CSI	VSC	N/A
UMTS/PLMN – CS	VSC	N/A

8.1.2 Constraints of service level convergence

The service level cannot perform transport level tasks, namely controlling and monitoring radio signal strength, attachment and detachment to network access points, and IP address configuration. To guarantee independence from access transport technologies, the service level must rely on either the UE to provide information on the transport level conditions through signalling at the service level, i.e., session initialization protocol (SIP) signalling in the IMS context, or on an information service which 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 [b-IEEE 802.21] 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 providing a better match for the preferred service profile.

Appendix II provides further information on 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 to 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 signalling cannot take advantage of service level handover control.

8.2 Session-control level convergence and convergence services

The objective of session-control level convergence is to provide a common session-control level for multi-access networks (i.e., packet switched networks and CS mobile networks). Based on the session-control level convergence, service providers can provide end users with convergence services or FMC services regardless of the subscriber's points of attachment to the network.

There are two scenarios which are related to the session-control level convergence:

In Figure 7, FMC services are provided between IMS controlled packet switched networks (e.g., WLAN and GPRS). In this scenario convergence services may be employed by terminals accessing the packet switched network controlled by the common session control domain.

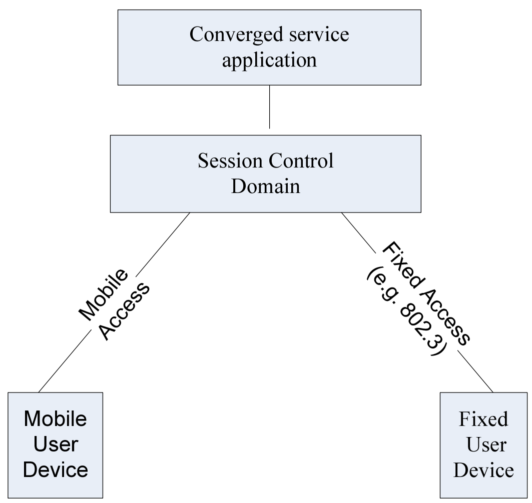

Figure 7 – FMC between IMS controlled packet switched networks

In Figure 8, FMC services are provided between an IMS controlled packet switched network and CS mobile networks (e.g., WLAN and 3G CS network). In this scenario, mobile terminals and fixed terminals are controlled through a different session control domain. To provide convergence services, the CS mobile network (i.e., universal mobile telecommunication system (UMTS) CS mobile network) shall support the appropriate routing function, making the CS session also controllable at the PS session control domain; i.e., by IMS. The routing function in the CS domain may be provided through the SCP and MSC, or through the 3GPP defined ICS function. Inter-working between CS and PS domains is provided by signalling and media gateways.

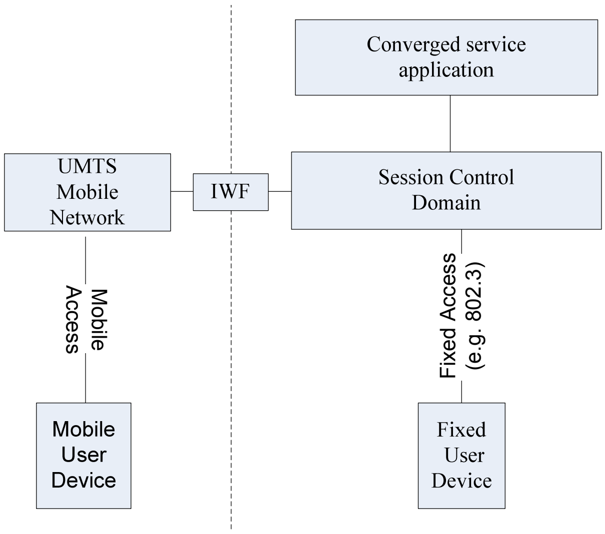

Figure 8 – FMC between an IMS controlled packet switched network and CS mobile networks

8.3 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 services.

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 [b-3GPP TS 33.203] 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 the FMC terminal implements the ISIM functionality, to provide the same user identity information and the same level of security, regardless of 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 universal integrated circuit card (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 an IPSec-based IMS security mechanism should be supported in an FMC network. The mechanism to do so is described in [b-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.

CDMA-2000 terminals which do not have ISIM card may be supported in an FMC network by using the mechanism described in [b-3GPP2 S.S0127] and referred to as cellular authentication and voice encryption (CAVE) based IMS security.

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 [b-ETSI TS 187 003] for this purpose are applicable:

- SIP HTTP digest authentication as specified in [b-IETF RFC 2617]

  This method is fully standardized by [b-IETF 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 are not standardized.

- 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 sub-system (NASS) (the NASS equivalent in ITU-T is called network attachment control function (NACF) [ITU-T Y.2014]). 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 NACF 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 proxy – call session control function (P-CSCF) of the IMS, the P-CSCF queries the NACF 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 serving-call session control function (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 gateway GPRS supporting node (GGSN), HSS and the IMS network entities reside 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.

8.4 Public services capabilities

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

9 Service level convergence architecture and FMC functions

9.1 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 network information server (NIS). MIH information server (MIIS) [b-IEEE 802.21] is an example of NIS.

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

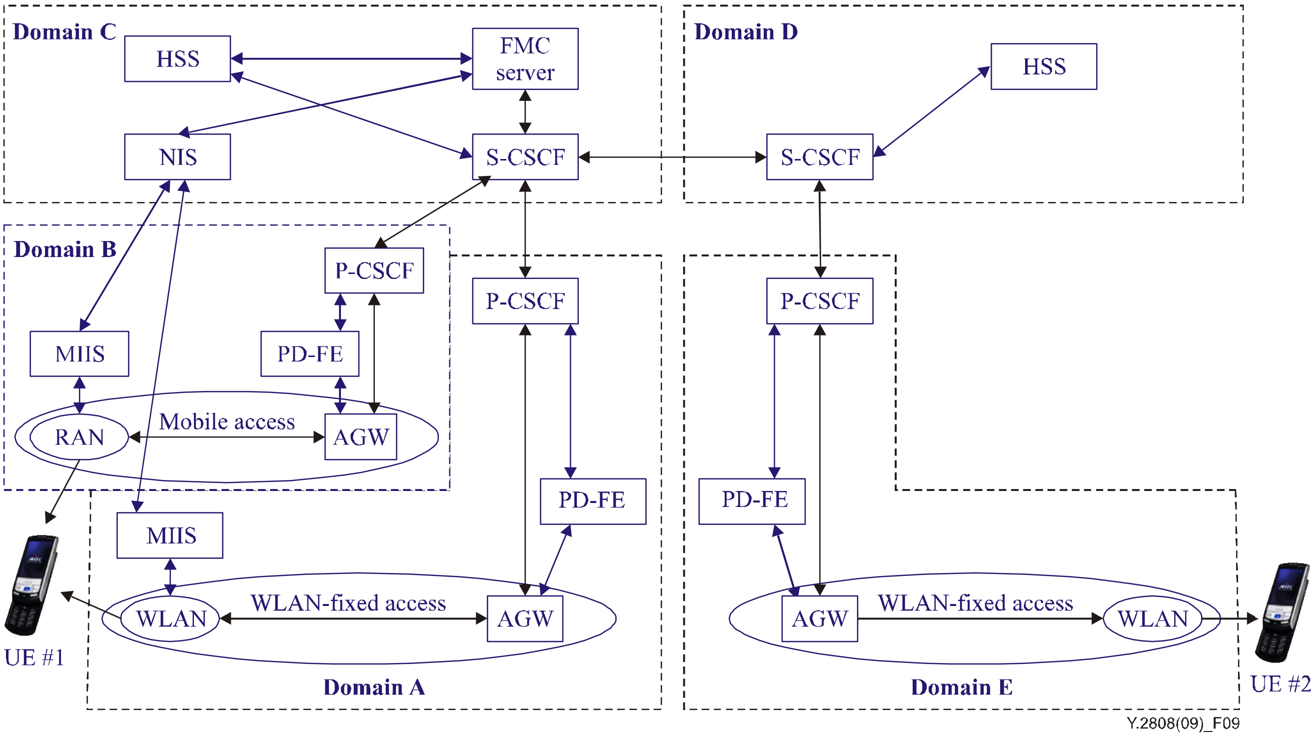

Figure 9 – PS-PS service level convergence architecture

Figure 9 shows the general case of 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, Figure 9 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 users' 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, and
- executes the handover using third party call control.

The NIS collects information about available access networks and capacity and may also provide cost information. It is depicted in a hierarchical arrangement where the NIS in the IMS home domain of the user can collect access network information from other NIS in visited domains. Each NIS 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:

- Is required to support multiple registrations from the same UE (same Private Identity).
- Is required to 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 global positioning system (GPS).
- Is required to be able to transmit and receive data on both interfaces simultaneously.
- Is recommended to 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 9 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 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 be a fixed or a mobile operator or both.

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

In cases where 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.

9.2 Architecture and FMC functions for PS-CS service continuity

Voice call 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. 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 [b-3GPP TS 23.206] is depicted in Figure 10.

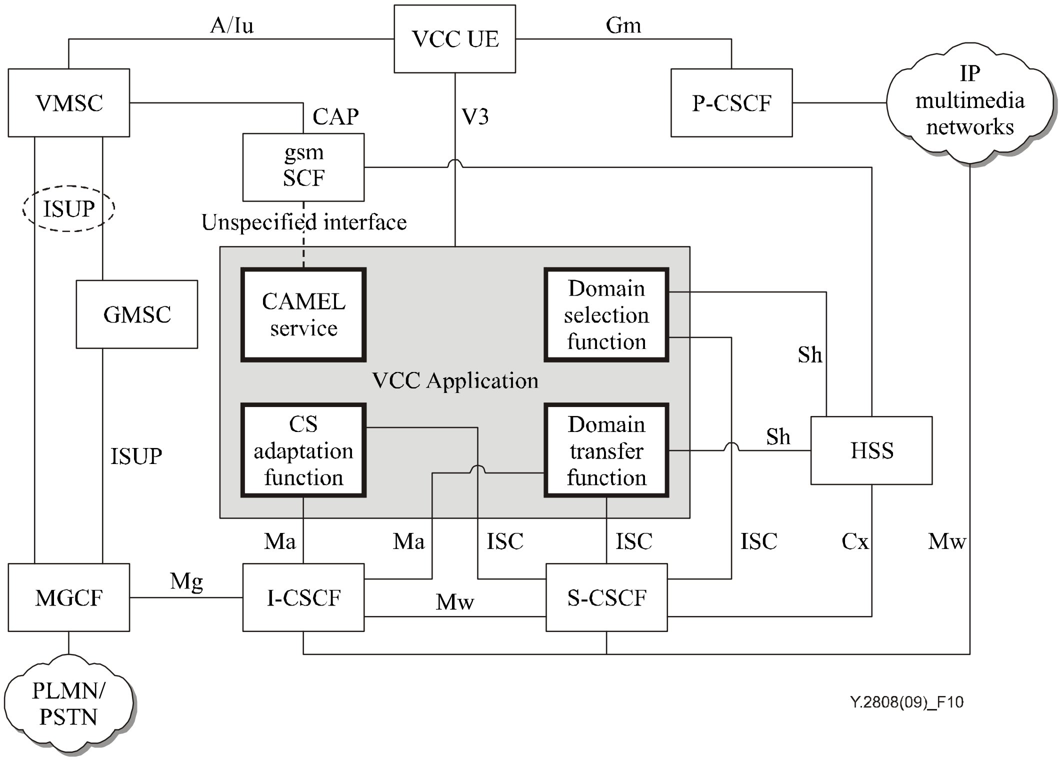

Figure 10 – VCC reference architecture

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 the IMS and CS domains in order to carry out 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, customized applications for mobile network enhanced logic (CAMEL) service triggering is used at the VMSC towards the gsmSCF function. The VCC AS returns routing information to the visited MSC (VMSC), which is used by the VMSC to route the call towards a media gateway control function (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 gateway MSC (GMSC) or the use of a local number portability database are also possible. Possible options are documented in [b-3GPP TS 23.206].

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 [b-3GPP TS 23.206], and illustrated in Figure 10, has its limitations. When domain transfer takes place, because the call is not implemented in both domains, certain calls, such as calls involved in conference or multi-party services, may be interrupted. Domain transfer may not be supported for voice sessions with mid-call services before the anchoring takes place. Alternative approaches, such as IMS centralized services (ICS) [b-3GPP TR 23.892] can be applied to address these limitations.

Appendix I

Architecture of the current converged network

(This appendix does not form an integral part of this Recommendation)

This appendix provides information on the architectural aspects of existing fixed and mobile networks. The architecture of current networks is analysed to highlight the architectural aspects and interfaces that are relevant to IMS-based FMC in this Recommendation.

I.1 3GPP architecture

An overview of the 3GPP mobile network architecture can be found in [b-3GPP TR 23.882] and is reproduced in Figure I.1. Figure I.1 represents the 3GPP Release 6 architecture, with the exception of the PCRF that is a Release 7 component that replaces the 3GPP Release 6 PDF.

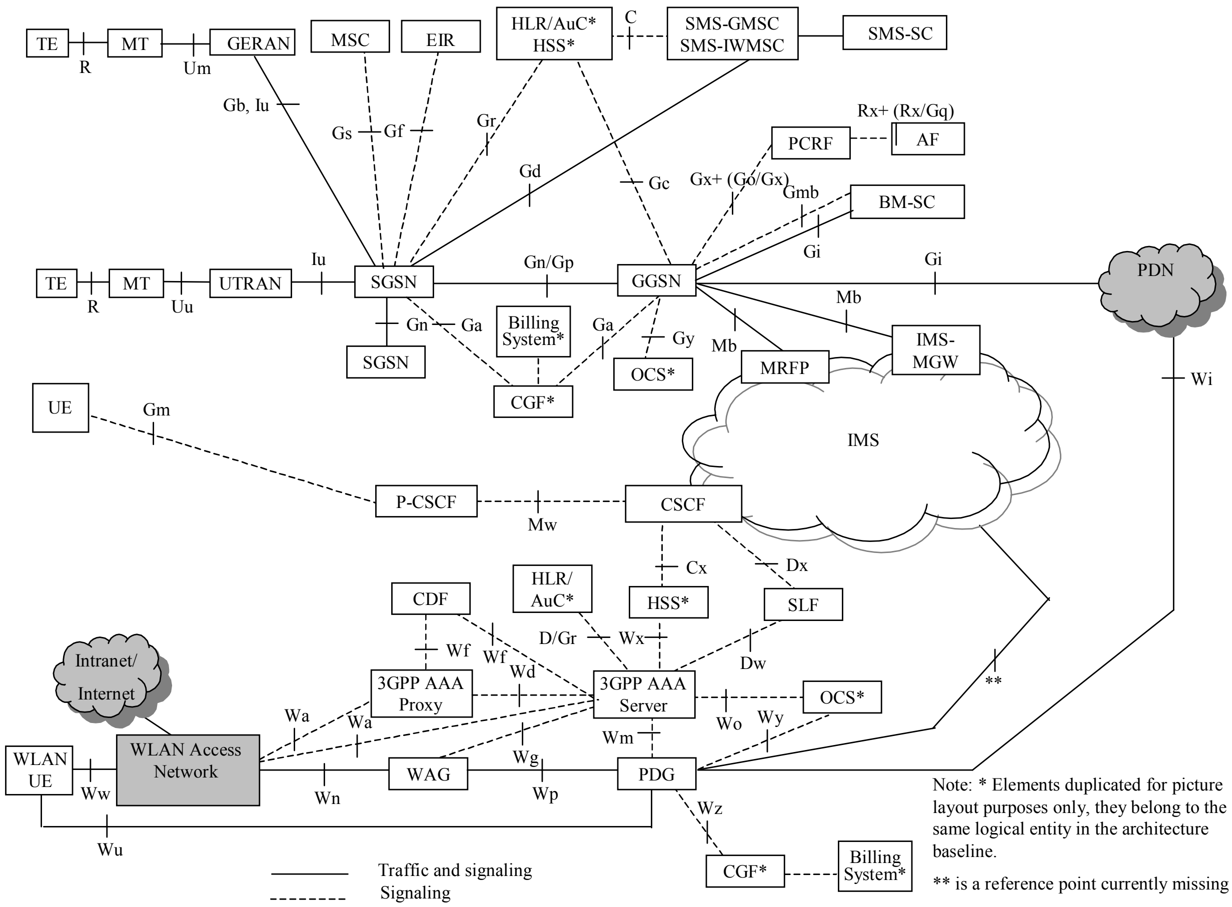

Figure I.1 – Logical baseline architecture for 3GPP

Figure I.1 depicts the three different types of accesses that have been defined by 3GPP: GERAN, UTRAN and I-WLAN. GSM edge radio access network (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 I.1). 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 radio access network (RAN) perspective. From an FMC perspective, GPRS appears to be a 3GPP specific access aggregation network, including intra-access mobility management functions. In Figure I.2 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.

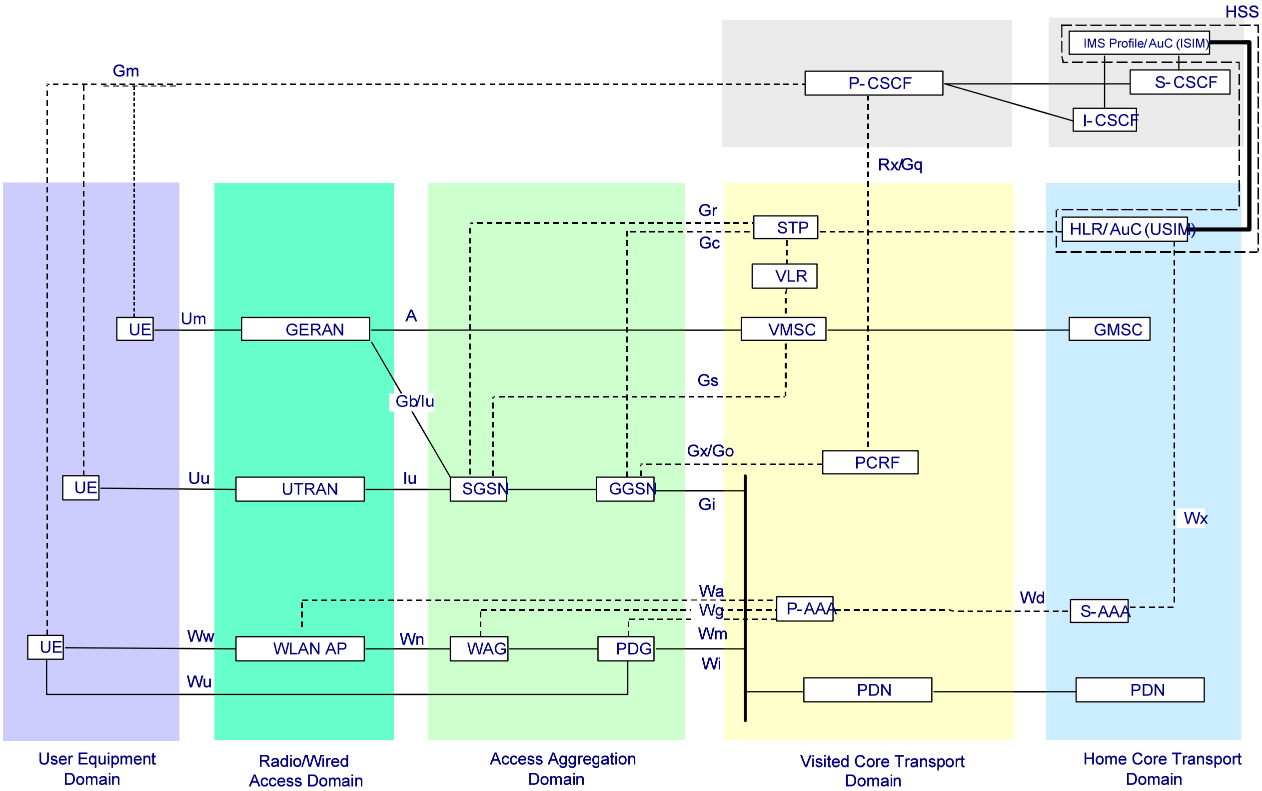

Figure I.2 – Mapping of 3GPP architecture to IMS-based FMC reference model

As described in clause 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 I.2 is that the 3GPP 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.

I.2 3GPP2 architecture

The 3GPP2 network architecture is very similar to the 3GPP network architecture. In fact 3GPP2 has adopted the 3GPP IMS standards since 2006. Figure I.3 illustrates the MMD network architecture defined by [b-3GPP2 X.S0013].

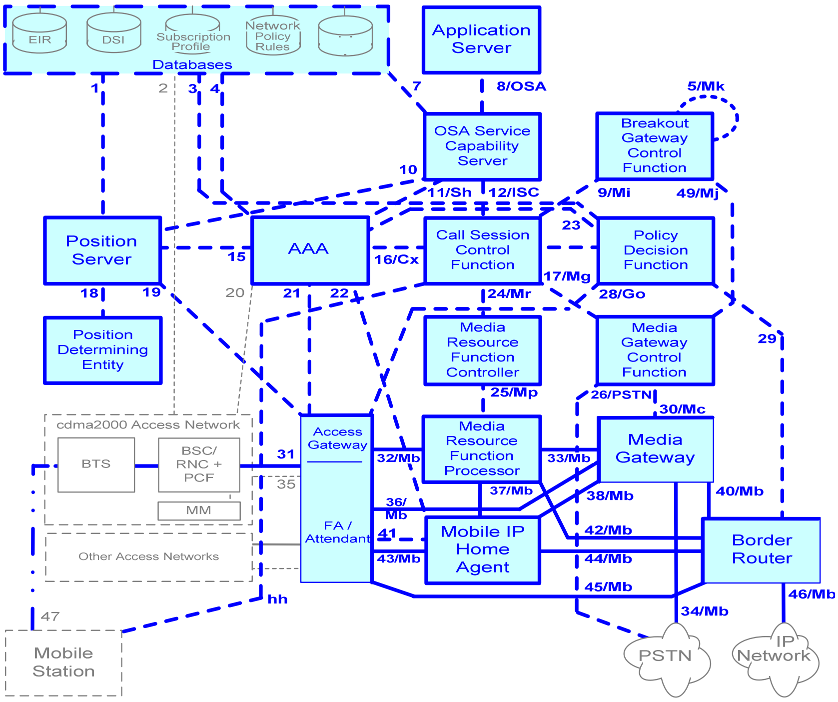

Figure I.3 – MMD network architecture model

The mapping of 3GPP2 network on FMC domains is illustrated in Figure I.4. For comparison, only the relevant components are included.

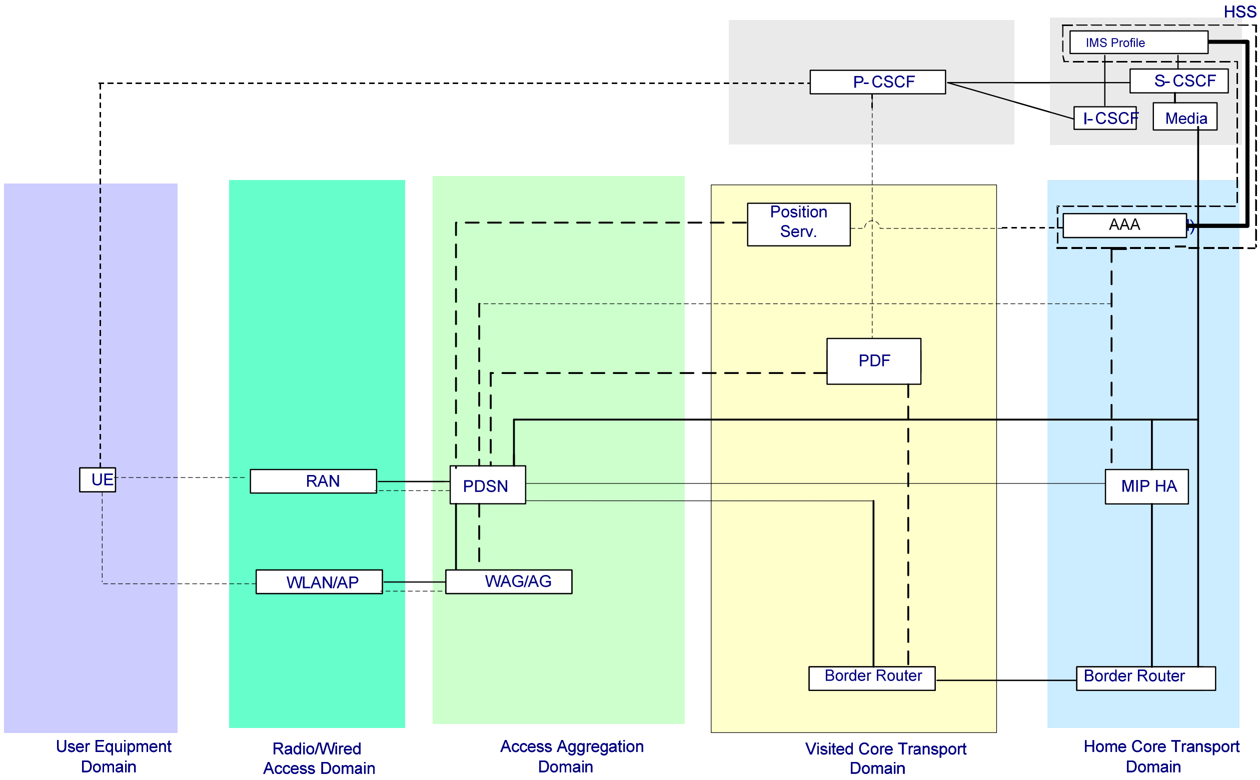

Figure I.4 – Mapping of 3GPP2 architecture (with home routed traffic) to IMS-based FMC reference model

I.3 3GPP evolved packet system

The architectural evolution of 3GPP mobile networks is referred to as the evolved packet system (EPS), 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 of the 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. Figure I.5 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 [b-3GPP TS 23.401] is an evolution of the current GPRS tunnelling protocol (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 [b-3GPP TS 23.401] is reproduced in Figure I.5.

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 Figure I.5, 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/user plane entity (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.

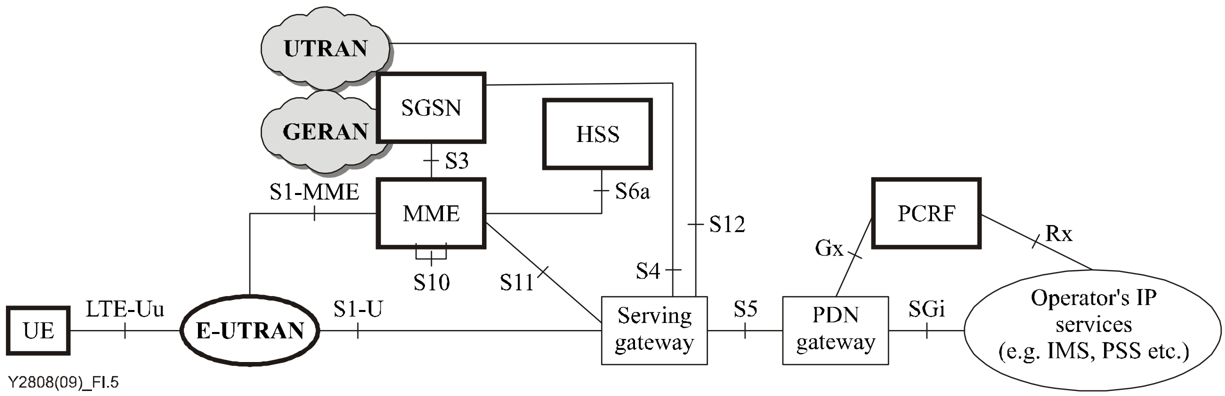

Figure I.5 – Non-roaming architecture for 3GPP accesses

The mapping of the GTP based EPS architecture is similar to that of the 3GPP Release 7 architecture shown in Figure I.1, with the PDN GW replacing the GGSN as the access network termination point.

The second variant of the EPS architecture, documented in [b-3GPP TS 23.402], provides a 'global' mobility anchor for network (Proxy MIP (PMIP), client MIPv4 (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 [b-3GPP 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 I.6 shows an instantiation of the [b-3GPP 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 I.6 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 [b-3GPP 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.

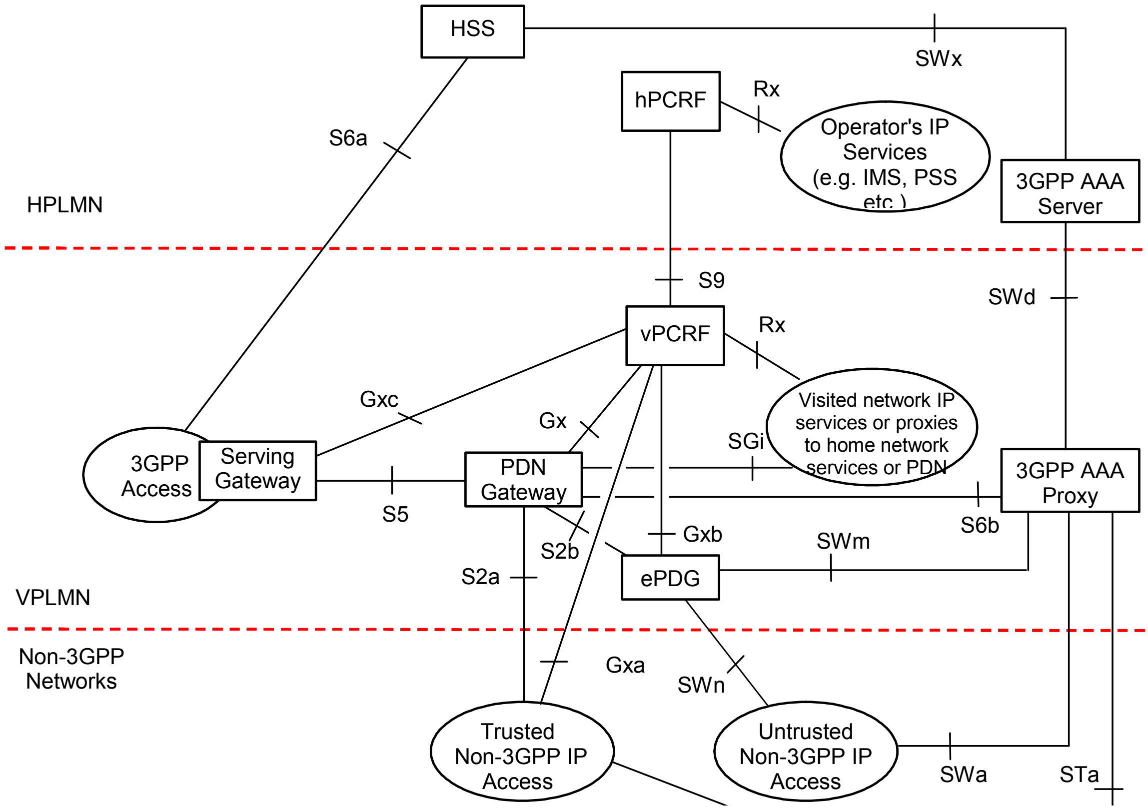

Figure I.6 – Roaming architecture for EPS using S5, S2a, S2b – Local breakout

With the [b-3GPP 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 I.6. The mapping of the [b-3GPP TS 23.402] architecture of Figure I.6 on the FMC domains is shown in Figure I.7. 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 I.6, the P-CSCF may also be located in the home network.

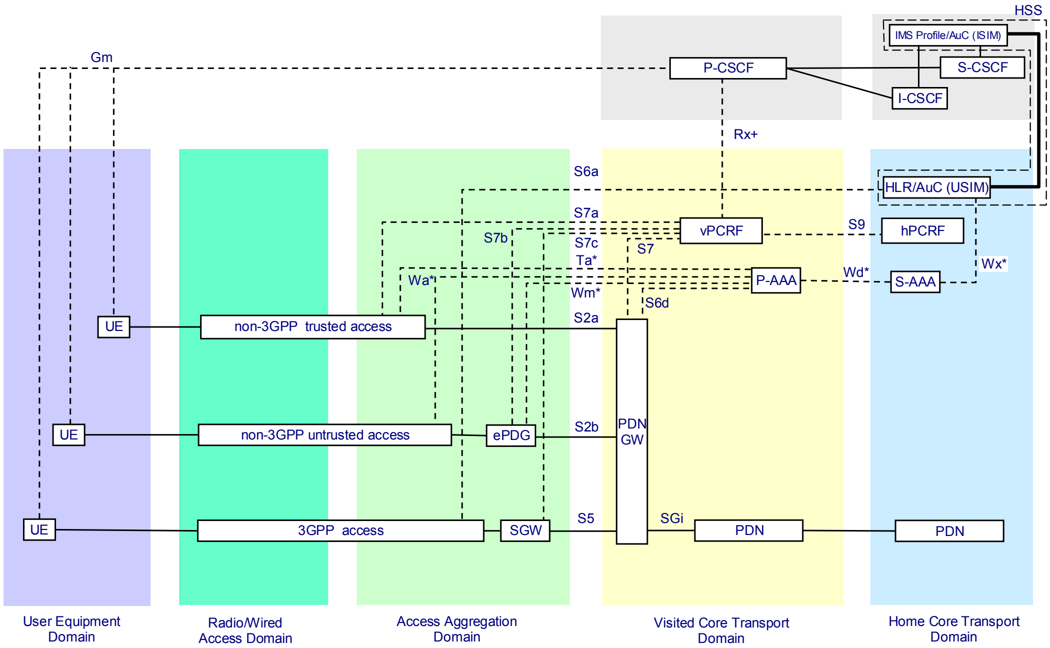

Figure I.7 – Mapping of local break-out architecture to IMS-based FMC reference model

I.4 VCC architecture

The mapping of 3GPP VCC architecture to IMS-based FMC reference model is illustrated in Figure I.8.

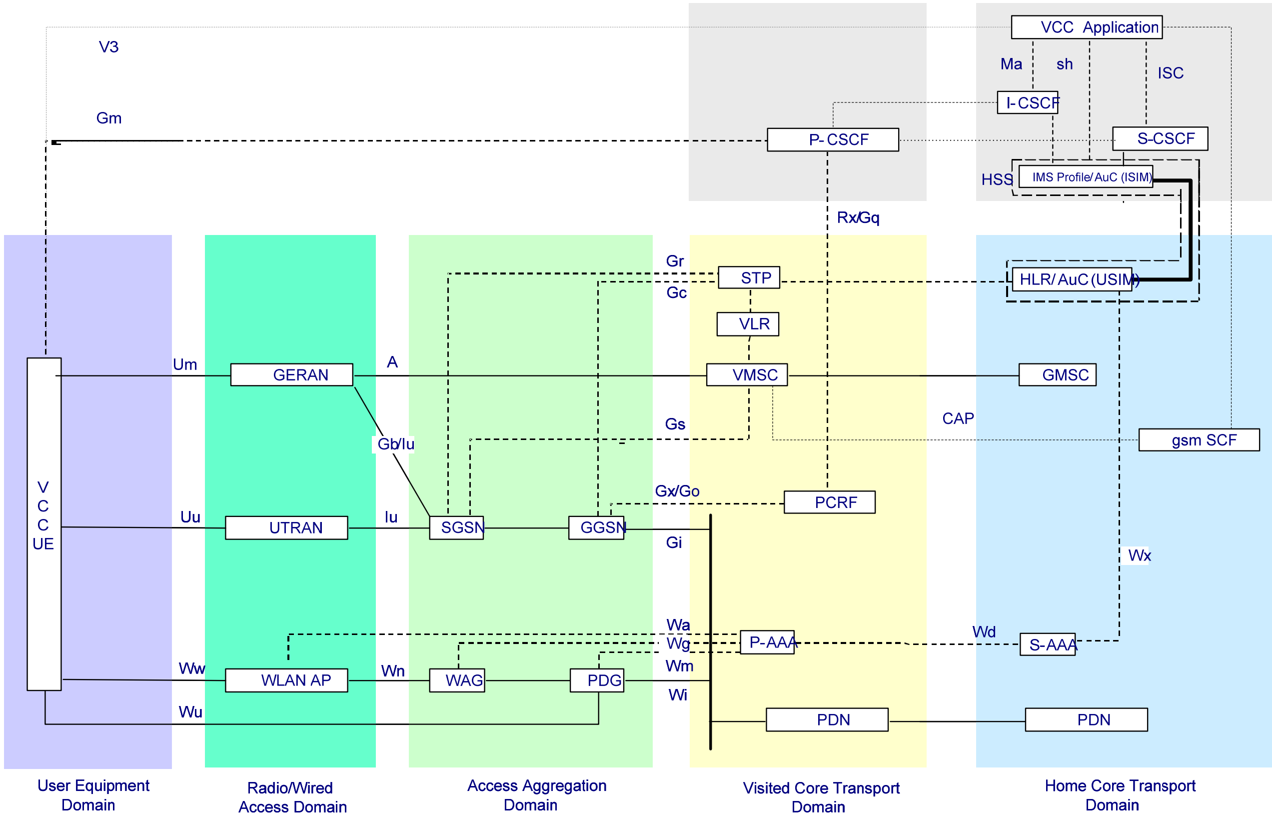

Figure I.8 – Mapping of 3GPP VCC architecture to IMS-based FMC reference model

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 gsmSCF appear to be the VCC architecture specific elements.

Appendix II

Transport level convergence

(This appendix does not form an integral part of this Recommendation)

The principles of transport level convergence are outlined in clause 7. 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 II.1.

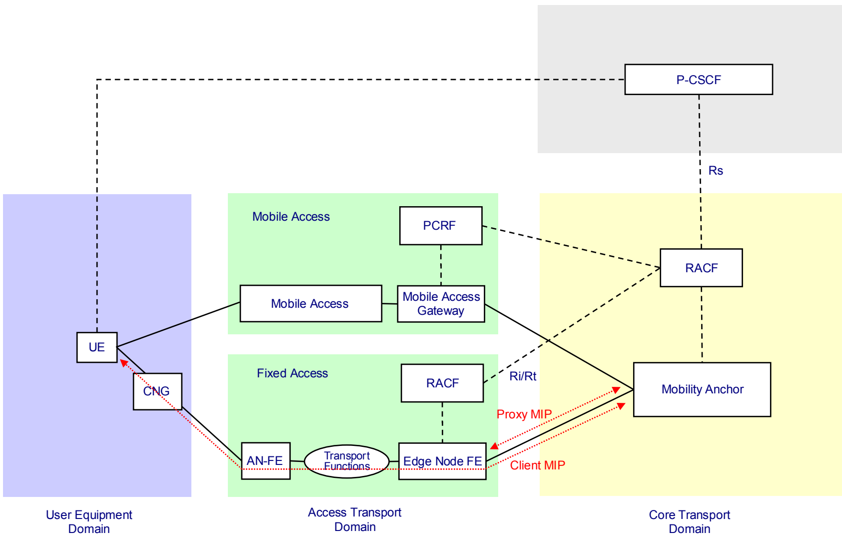

Figure II.1 – Transport level convergence interfaces

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.

Bibliography

[b-ITU-T Q.1706] Recommendation ITU-T Q.1706/Y.2801 (2006), *Mobility management requirements for NGN*.

[b-ITU-T Q-Sup.47] ITU-T Q-series Recommendations – Supplement 47 (2004), *Emergency services for IMT-2000 networks – Requirements for harmonization and convergence*.

[b-ITU-T Q-Sup.52] ITU-T Q-series Recommendations – Supplement 52 (2003), *NNI mobility management requirements for systems beyond IMT-2000*.

[b-ITU-T Y.2091] Recommendation ITU-T Y.2091 (2008), *Terms and definitions for Next Generation Networks*.

[b-3GPP TR 23.882] 3rd Generation Partnership Project TR 23.882 (2008), 3*GPP system architecture evolution (SAE): Report on technical options and conclusions*.

[b-3GPP TR 23.892] 3rd Generation Partnership Project TR 23.892 (2008), 3*GPP IP Multimedia Subsystem (IMS) centralized services*.

[b-3GPP TR 33.978] 3rd Generation Partnership Project TR 33.978 (2008), *Security aspects of early IP Multimedia Subsystem (IMS)*.

[b-3GPP TS 23.206] 3rd Generation Partnership Project TS 23.206 (2007), *Voice Call Continuity (VCC) between Circuit Switched (CS) and IP Multimedia Subsystem (IMS); Stage 2*.

[b-3GPP TS 23.401] 3rd Generation Partnership Project TS 23.401 (2009), *General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access*.

[b-3GPP TS 23.402] 3rd Generation Partnership Project TS 23.402 (2009), *Architecture Enhancements for non-3GPP accesses (Release 8)*.

[b-3GPP TS 33.203] 3rd Generation Partnership Project TS 33.203 (2009), 3*G security; Access security for IP-based services*.

[b-3GPP2 S.S0127] 3rd Generation Partnership Project 2 S.S0127-0 (2008), *CAVE Based IMS Security*.

[b-3GPP2 X.S0013] 3rd Generation Partnership Project 2 X.S0013 (2005), *All-IP Core Network Multimedia Domain; Overview*.

[b-ETSI TS 187 003] ETSI TS 187 003 (2009), *NGN Security; Security Architecture*.

[b-IEEE 802.21] IEEE 802.21-2008, *IEEE Standard for Local and Metropolitan Area Networks Media Independent Handover Services*.

[b-IETF RFC 2617] IETF RFC 2617 (1999), *HTTP Authentication: Basic and Digest Access Authentication*.

[b-IETF RFC 3261] IETF RFC 3261 (2002), *SIP: Session Initiation Protocol*.

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