# VoLTE – RCS Roaming and Interconnection Guidelines

## Version 1.0

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# 1 Introduction

## Purpose

Next generation multimedia services such as VoLTE and RCS using IMS have long been endorsed by the GSMA community. However, deployment of such services has been slow due to the challenges posed by the various implementation options and the diverse changing industry needs, specifically the impact on Roaming and Interworking scenarios.

Various documents have been written and continue to be tweaked by 3GPP and the GSMA. The purpose of this document is not to replace or restate the information mentioned in those documents, but to provide guidance on various implementation options and recommendations associated with VoLTE-RCS Roaming & Interconnection. GSMA specifications PRDs IR.92 [1], IR.94 [2], IR.65 [3], IR 88 [4], IR.90 [5], and RCC.07 [6] serve as the basis for broader requirements on the subject matter.

## Scope

This document defines guidelines for IMS service roaming in an Inter-Service Provider environment, and targets existing IMS service deployments. It aims to complement interworking procedures specified in GSMA PRDs RCC.54 [7] and IR.90 [5]. As such, it elaborates on roaming aspects of the service interchange, taking into consideration interconnection guidelines defined in GSMA PRD RCC.54 [7] and reference to the Interworking Form for IMS Based Services, published as Annex B of GSMA PRD IR.90 [5].

## Definition of Terms

| Term | Description |
|---|---|
| AF | Application Function |
| APN | Access Point Name |
| AS | Application Server |
| CDMA | Code Division Multiple Access |
| CDR | Charging Detail Record |
| CPM | Converged IP Messaging |
| CS | Circuit Switched |
| DSCP | Differentiated Services Code Point |
| DM | Device Management |
| DNS | Domain Name System |
| ENUM | E.164 Number Mapping |
| EPC | Evolved Packet Core |
| EPS | Evolved Packet System |
| E-UTRAN | Evolved Universal Terrestrial Radio Access Network |
| GBR | Guaranteed Bit Rate |
| GRX | GPRS Roaming eXchange |

| Term | Description |
|---|---|
| GSM | Global System for Mobile Communications |
| GTP | GPRS Tunnel Protocol |
| HPMN | Home Public Mobile Network |
| HSS | Home Subscriber Server |
| HTTP(S) | HyperText Transfer Protocol / HyperText Transfer Protocol Secure |
| IBCF | Interconnection Border Control Function |
| II-NNI | IMS-IMS Network-Network Interface |
| IM | Instant Messaging |
| IMS | Internet Protocol Multimedia Subsystem |
| IP | Internet Protocol |
| IP-CAN | IP Connectivity Access Network |
| IPX | Internet Protocol Packet eXchange |
| IR | International Roaming |
| LBO | Local Breakout |
| LI | Lawful Interception |
| LNP | Local Number Portability |
| LTE | Long Term Evolution |
| MME | Mobility Management Entity |
| MMS | Multimedia Message Service |
| MMTel | MultiMedia Telephony |
| MNO | Mobile Network Operator |
| MSRP | Message Session Relay Protocol |
| NNI | Network-Network Interface |
| OCS | Online Charging System |
| OMA | Open Mobile Alliance |
| PCC | Policy and Charging Control |
| PCRF | Policy and Charging Rules Function |
| PCEF | Policy and Charging Enforcement Function |
| P-CSCF | Proxy Call Session Control Function |
| PDN | Packet Data Network |
| P-GW | Packet Data Network Gateway |
| PLMN | Public Land Mobile Network |
| PRD | Permanent Reference Document |
| PS | Packet Switched |
| PSAP | Public Safety Answering Point |
| QCI | QoS Class Identifier |
| QoS | Quality of Service |

| Term | Description |
|---|---|
| RCS | Rich Communications Services |
| RTCP | RTP Control Protocol |
| RTP | Real-time Transport Protocol |
| SCC | Service Centralization and Continuity |
| SDP | Session Description Protocol |
| S-GW | Signalling Gateway |
| SIMPLE | Session Initiation Protocol for Instant Messaging and Presence Leveraging Extensions |
| SIP | Session Initiation Protocol |
| SLA | Service Level Agreement |
| SMS | Short Message Service |
| SMS-MO | Mobile Originated SMS |
| SMS-MT | Mobile Terminated SMS |
| SMSoIP | SMS over IP |
| SR-VCC | Single Radio Voice Call Continuity |
| TADS | Terminating Access Domain Selection |
| TAP | Transfer Account Record |
| TCP | Transmission Control Protocol |
| TrGW | Transition Gateway |
| TRF | Transit and Roaming Function |
| UDP | User Datagram Protocol |
| UE | User Equipment |
| UNI | User Network Interface |
| ViLTE | (conversational) Video over LTE |
| VoLTE | Voice over Long Term Evolution |
| VPMN | Visited Public Mobile Network |
| XCAP | XML Configuration Access Protocol |
| XML | Extensible Markup Language |

## Document Cross-References

| Ref | Doc Number | Title |
|---|---|---|
| [1] | GSMA PRD IR.92 | IMS Profile for Voice and SMS, Version 8.0, 22 April 2014 |
| [2] | GSMA PRD IR.94 | IMS Profile for Conversational Video Service, Version 7.0, 16 April 2014 |
| [3] | GSMA PRD IR.65 | IMS Roaming & Interworking Guidelines, Version 14.0, 28 April 2014 |
| [4] | GSMA PRD IR.88 | LTE and EPC Roaming Guidelines, Version 11.0, 20 January 2014 |
| [5] | GSMA PRD IR.90 | RCS Interworking Guidelines, Version 8.0, 20 March 2014 |
| [6] | GSMA PRD RCC.07 | Rich Communication Suite 5.1 Advanced Communications Services and Client Specification, Version 4.0, 28 November 2013 |

| Ref | Doc Number | Title |
|---|---|---|
| [7] | GSMA PRD RCC.54 | RCS Interconnection Guidelines, Version 1.0, 30 January 2014 |
| [8] | GSMA PRD IR.34 | Inter-Service Provider IP Backbone Guidelines, Version 9.1, 13 May 2013 |
| [9] | GSMA PRD IR.64 | IMS Service Centralization and Continuity Guidelines, Version 8.0, 28 November 2013 |
| [10] | GSMA PRD IR.25 | VoLTE Roaming Testing V1.0, 27 January 2014 |
| [11] | GSMA PRD AA.80 | Agreement for IP Packet eXchange (IPX) Services, V4.1, 27 July 2011 |
| [12] | GSMA PRD IR.38 | LTE and EPC Roaming Testing, Version 1.0, 03 April 2014 |
| [13] | GSMA PRD TD.41 | Testing the Transferred Account Procedure (TAP), Version 4.4, 19 March 2014. |
| [14] | GSMA PRD TD.50 | TAP Test Cases (TTC) for VoLTE Roaming Testing, Version 1.0, 06 May 2014. |
| [15] | GSMA PRD TD.51 | TAP Test Cases (TTC) for LTE and EPC Roaming Testing, Version 1.0, 15 May 2014. |
| [16] | GSMA PRD IR.36 | Adaptive Multirate Wide Band, Version 2.0, 21 February 2013 |
| [17] | GSMA PRD IR.67 | DNS/ENUM Guidelines for Service Providers & GRX/IPX Providers, Version 6,0, 1 December 2011 |
| [18] | GSMA PRD IR.23 | Organisation of GSM International Roaming Tests, Version 6.0 |
| [19] | GSMA PRD IR.35 | End–to–End Functional Capability Test Specification for Inter-PMN GPRS Roaming, Version 5 |
| [20] | 3GPP TS 29.165 | Inter-IMS Network to Network Interface (NNI) |
| [21] | 3GPP TS 23.228 | IP Multimedia Subsystem (IMS); Stage 2 |
| [22] | 3GPP TS 24.229 | IP multimedia call control protocol based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP) |
| [23] | 3GPP TS 26.114 | IP Multimedia Subsystem (IMS); Multimedia Telephony; Media handling and interaction |
| [24] | 3GPP TS 23.203 | Technical Specification Group Services and System Aspects; Policy and charging control architecture |
| [25] | 3GPP TS 33.106 | Technical Specification Group Services and System Aspects; 3G security; Lawful Interception requirements |
| [26] | 3GPP TS 33.107 | Technical Specification Group Services and System Aspects; 3G Security; Lawful interception architecture and functions |
| [27] | 3GPP TS 33.108 | Technical Specification Group Services and System Aspects; 3G Security; Handover interface for Lawful Interception |
| [28] | 3GPP TS 32.251 | Technical Specification Telecommunication management; Charging management; Packet Switched (PS) domain charging |
| [29] | 3GPP TS 32.299 | Technical Specification Telecommunication management; Charging management; Diameter charging applications |
| [30] | OMA DM | OMA Device Management Protocol, Approved Version 1.2.1 – 17 Jun 2008 |
| [31] | IETF RFC 3261 | SIP: Session Initiation Protocol |
| [32] | ATIS-0700005 | Lawfully Authorized Electronic Surveillance (LAES) for 3GPP IMS-based VoIP and other Multimedia Services |

| Ref | Doc Number | Title |
|---|---|---|
| [33] | ATIS-1000678 | Lawfully Authorized Electronic Surveillance (LAES) for Voice over Packet Technologies in Wireline Telecommunications Networks, Version 2 |

# 2 Reference Architecture

This section provides the reference architecture and introduces the components. Only a high level description is provided as the idea is not to replicate what other documents already provide.

## Overview

The reference architecture of VoLTE-RCS including roaming and interworking is depicted in the following figure. The architecture and procedures used for IMS-based services are based on 3GPP specifications such as TS 23.228 [21] and TS 24.229 [22].

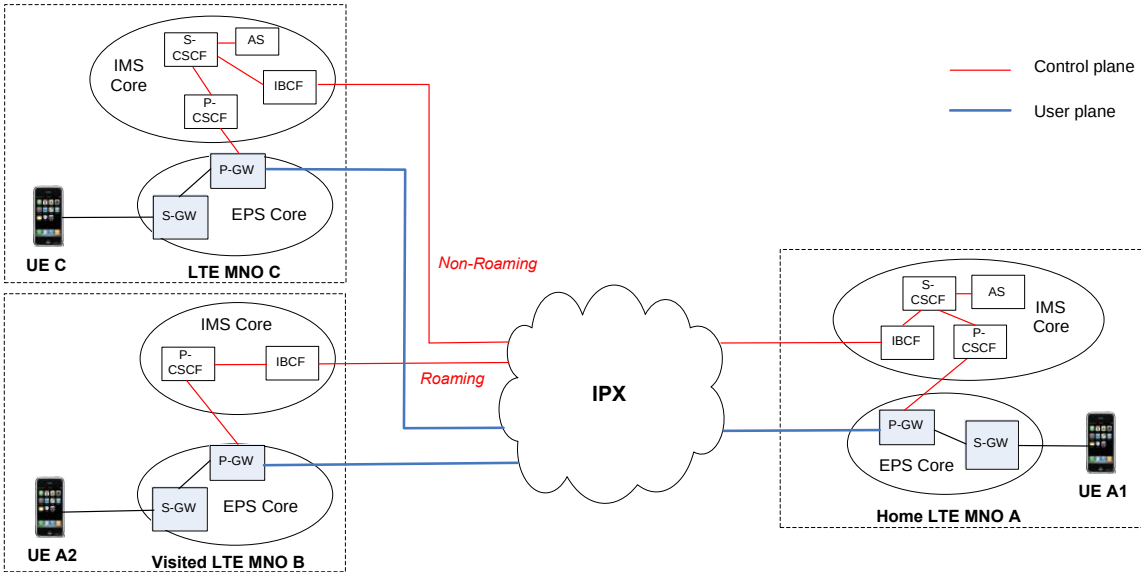


**Figure 1: Reference Architecture**

The reference architecture is based on the following assumptions:

a) IPX is used for both interworking and roaming as described in GSMA PRD IR.34 [8]
b) VoLTE, ViLTE and SMSoIP Interworking and Roaming is specified in GSMA PRD IR.65 [3]
c) VoLTE, ViLTE, SMSoIP and RCS Interworking is described in GSMA PRDs RCC.54 [7] and IR.90 [5]
d) The configuration of Supplementary Services in VoLTE and RCS is based on HTTP(S) and OMA DM procedures as defined in GSMA PRDs IR.92 [1] and RCC.07 [6]
e) Roaming and interconnection needs for protocols used in RCS specified in section 2.8 of GSMA PRD RCC.07 [6], are addressed in section 2.4 of GSMA PRD RCC.54 [7]

**Note 1:** The user plane of RCS services is home routed as indicated in section 2.3 of GSMA PRD IR.65 [3], and following routing architecture recommendations defined in GSMA PRD IR.88 [4].

a) Due to security concerns, all AS(s) configuration servers are not accessible via public Internet.

## IMS Roaming Architecture Options

### Local Breakout Architecture

Section 5.2.2 in GSMA PRD IR.88 [4] describes the LTE roaming architecture using the local breakout (LBO) option in the visited network where the user's IMS traffic is broken out from the Visited PGW across the Inter-IMS NNI to the IMS functions in the Home Network. See Section 2.2.1.1 for the description of Inter-IMS interworking support for LBO Roaming.

**Note 1**: If a VoLTE Roaming agreement is in place between the HPMN and VPMN, ViLTE and the RCS 5.1 services using the IMS APN in the UE (see Section 4.3.1 in GSMA PRD IR.92 [1], Section 4.1 in GSMA PRD IR.94 [2] and Section 2.9.1.3 in GSMA PRD RCC.07 [6]) will be configured by the Home Network to use the LBO option.

The Diameter based Gy interface shown in Figure 2 (based on but extending Figure 7.3-1 in GSMA PRD IR.88 [4]) provides the HPMN with the ability to monitor data usage of the roaming user and to disallow traffic in the visited P-GW when a subscribed usage threshold is reached (while still allowing traffic for VoLTE and SMSoIP).

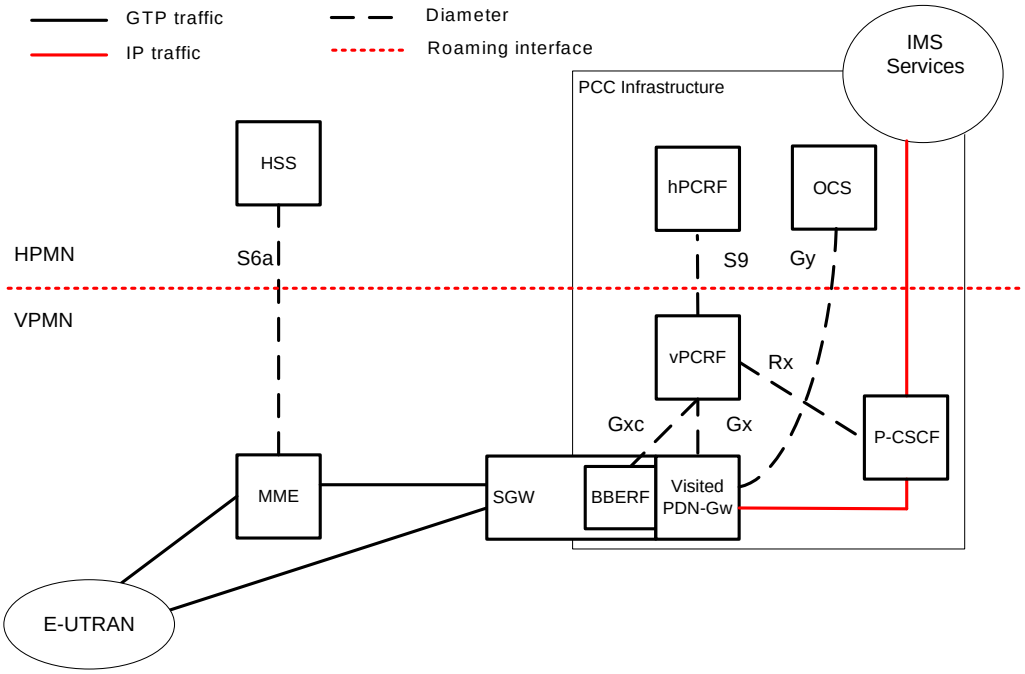


**Figure 2: IMS LBO Roaming Architecture**

### IMS LBO Routed Roaming Interworking

Section 2.4 in GSMA PRD IR.65 [3] describes the high level IMS Voice Roaming architecture for VPMN routing shown in Figure 3 below (referencing Figure 2.4 in GSMA PRD IR.65 [3]) and for HPMN routing shown in Figure 4 below (referencing Figure 5 in GSMA PRD IR.65 [3]).

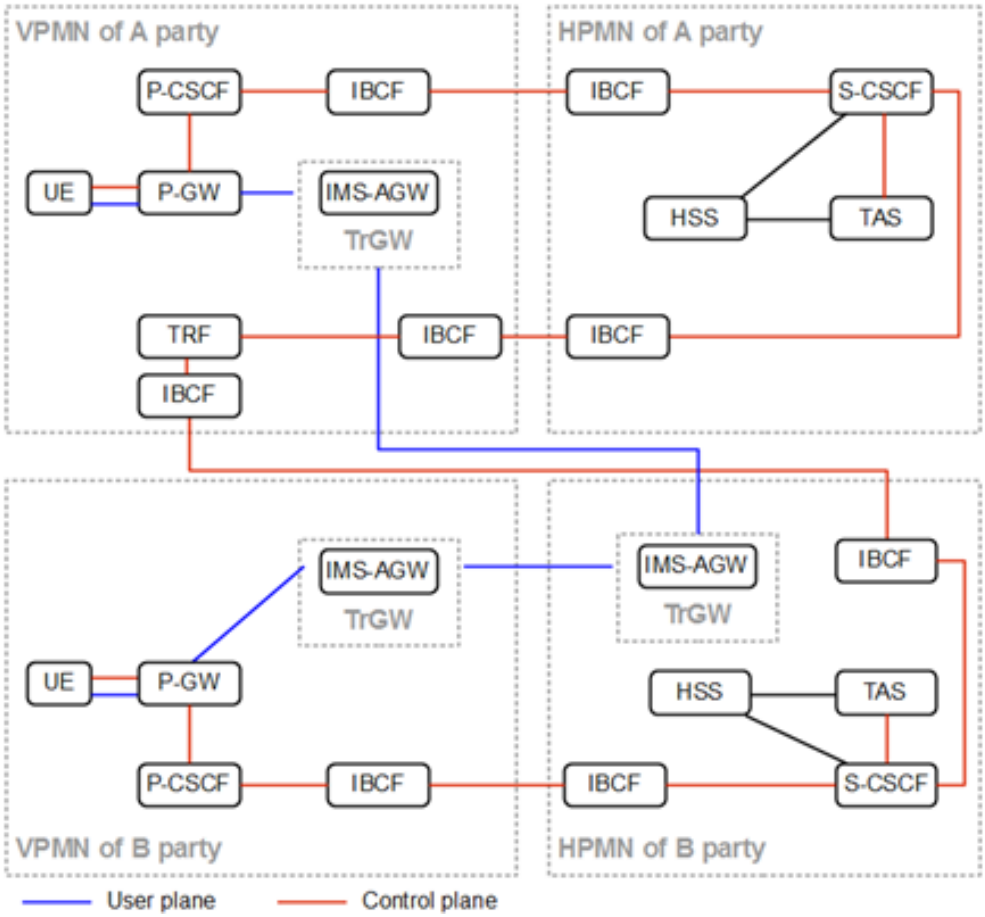


**Figure 3: IMS LBO Routed Roaming Interworking – VPMN Routing**

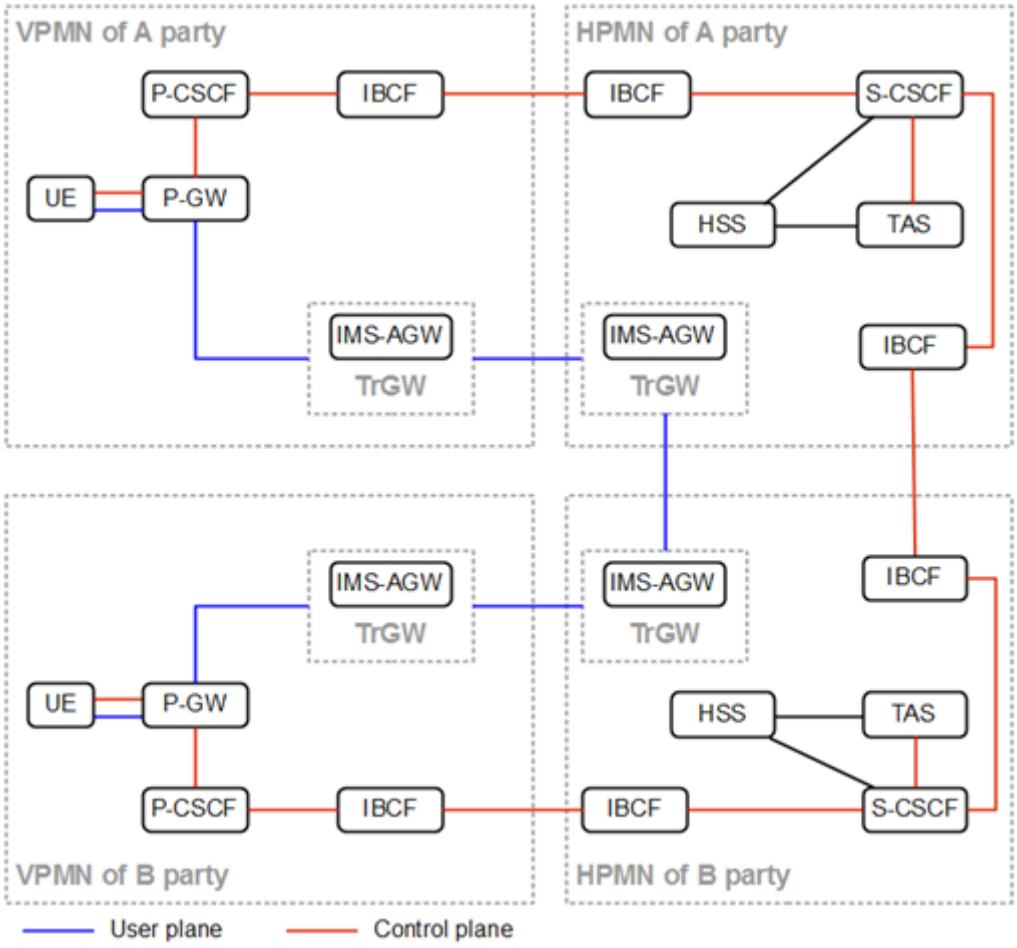


**Figure 4: IMS LBO Routed Roaming Interworking – HPMN Routing**

## Home Routed Architecture

### Using Dynamic Policy and Charging Control (PCC) support

Section 7.1 - (1) in GSMA PRD IR.88 [4] specifies the Home Routed Roaming architecture with PCC infrastructure implemented in the HPMN, and (2) describes the PCC functionality in the HPMN where for example:

- ViLTE calling where the PCRF in HPMN requests the setup of a QCI=1 bearer and in addition either a setup of a QCI-2 GBR bearer or of a non-GBR QCI bearer in the P-GW in HPMN (per GSMA PRD IR.94 [2]). Bearer management support required in the VPMN EPC and E-UTRAN is described in Sections 7.1.1 and 7.1.2 of GSMA PRD IR.88 [4].
- “Anti Bill Shock” where the PCRF or the OCS can ask the P-GW in the HPMN to terminate the PDN connection once a threshold is reached per HPMN policy.

Figure 5 below based on but extending Figure 7.1-1 in GSMA PRD IR.88 [4] shows the architecture diagram for this option.

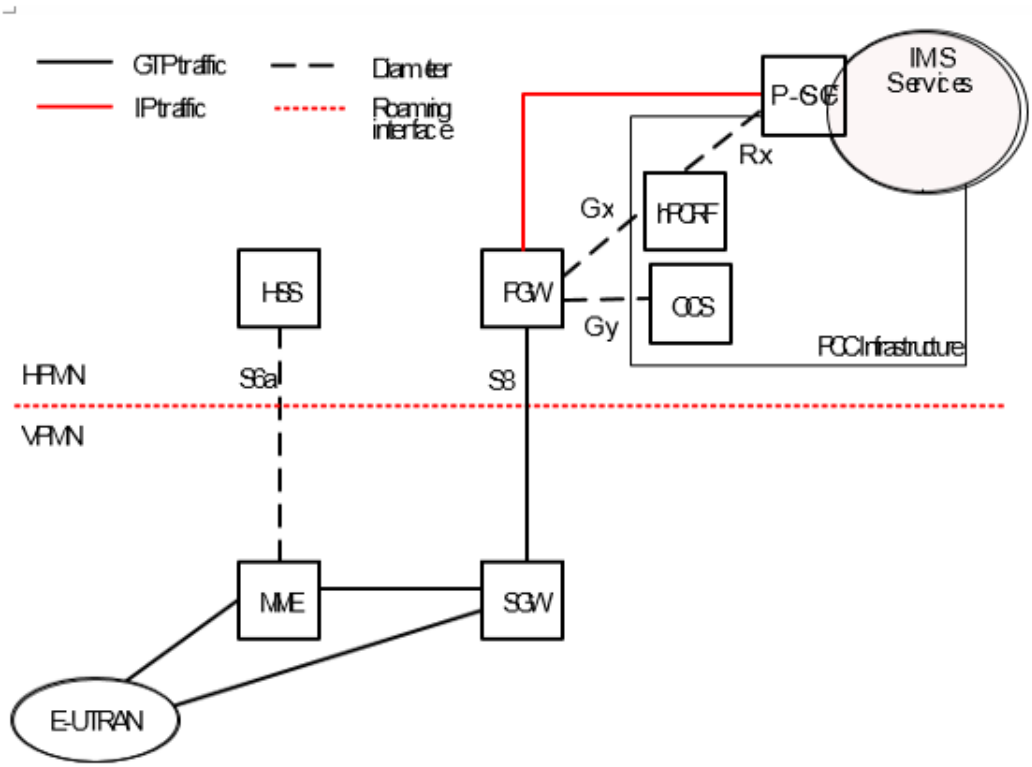


**Figure 5: IMS Home Routed Roaming Architecture**

### IMS Home Routed Roaming Interworking

The roaming scenario in Figure 5 below shows how the HPMN, based on service, commercial and/or regulatory obligations can enforce home routing of the traffic.

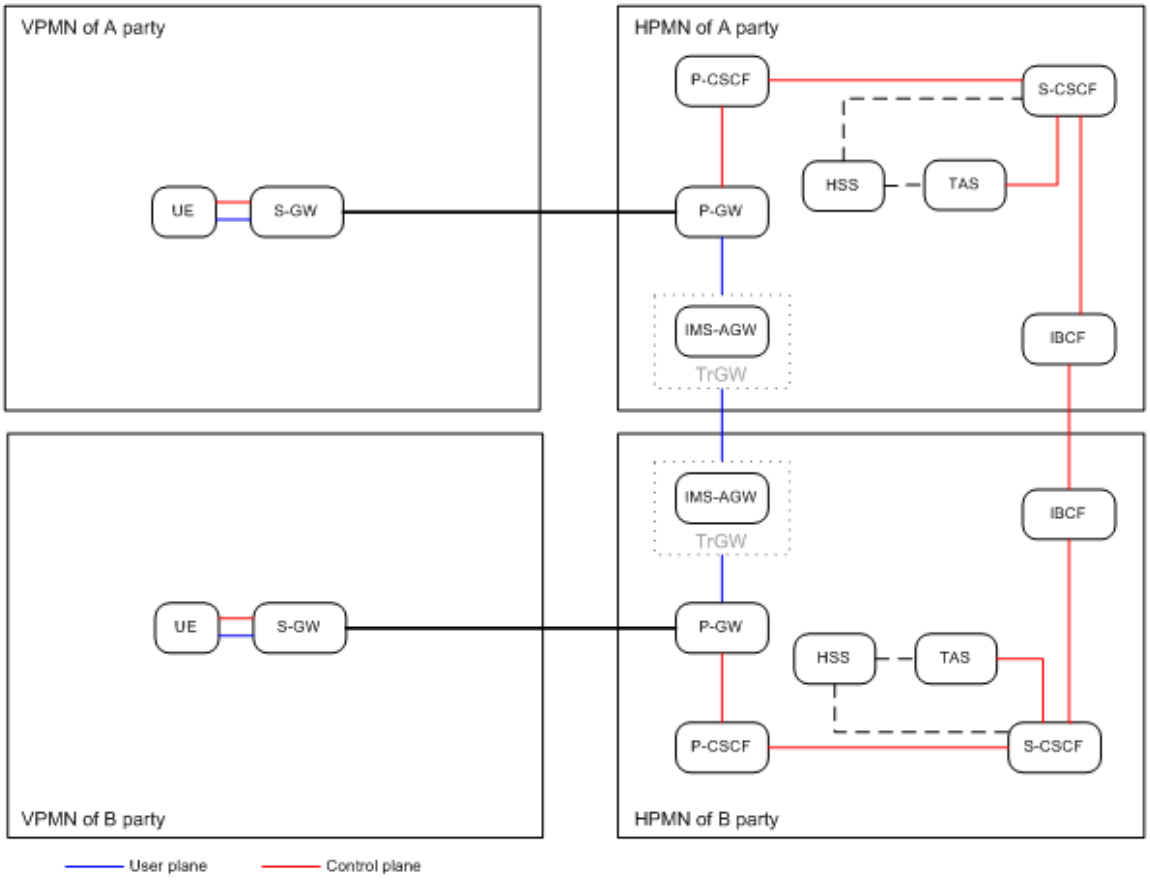


**Figure 6: IMS Home Routed Roaming Interworking**

### Using Static QoS support

Section 6A.1 in GSMA PRD IR.88 [4] describes the functionality needed for Home Routed LTE Roaming using static QoS support.

## Recommendation

LBO Roaming Architecture as described in Section 2.2.1 is recommended if IMS (VoLTE) Roaming is agreed between HPMN and VPMN.

Home Routed Architecture as described in Section 2.2.2 is left as an option if LTE Data Roaming is agreed between HPMN and VPMN (with enforcement of QoS as described in section 7.1.3 of GSMA PRD IR.88 [4]).

**Note 1**: The roaming architecture for handling Emergency Services is done independently of the above architecture choices because of the nature of the Emergency service requirements. This is described in section 4.5. Emergency Services must be provided to normal attached UEs and, depending on local regulations, these services can be extended to UEs in limited service state (e.g. UICC-less, no

subscription). However, the basic IMS architecture can be leveraged with Emergency Services' functionalities (e.g. E-CSCF and location support functions).

# 3 Technical Requirements and Recommendations

## Roaming Interfaces

## S8 Interface

### Procedures

Section 3.2.1 in GSMA PRD IR.88 [4] provides a general description of P-GW and S-GW selection procedures for the S8 Interface.

### HPMN Roaming Scenario

Section 3.2.1.3.1 in GSMA PRD IR.88 [4] describes P-GW Selection with Home routed traffic (GTP based S8).

## S6a Interface

Section 3.1.3 in GSMA PRD IR.88 [4] applies.

## S9 Interface

Section 3.1.3 in GSMA PRD IR.88 [4] applies.

If the service requires dynamic policy and charging control from the HPMN, Section 3.3.1 in GSMA PRD IR.88 [4] recommends the use of the S9 interface.

**Note 1:** VPMN and HPMN can exchange dynamic PCC rules over S9.

**Note 2:** VPMN and HPMN can exchange pre-configured PCC rules over S9; e.g. PCC rules are provisioned directly to the VPMN PCEF but activated by the Home PCRF.

**Note 3:** If S9 is not deployed, the Rating Groups and Service Identifiers used over Gy are coordinated between HPMN and VPMN (see Section 2.2.1). The assignment of Rating Groups and Service Identifiers is done as part of the PCC rules provisioned in the PCEF of the Visited PGW. The Visited PCRF will use locally configured policies according to the roaming agreement with the HPMN as input for PPC rule generation (see note 2 in 3GPP TS 23.203 [24] Section 6.2.1.3.1).

## IP Interworking

## Overview

Sections 2, 3, 5 and 6 in GSMA PRD RCC.54 [7] provide guidelines for interconnection between Service Providers for the purposes of interchanging VoLTE, ViLTE and RCS traffic originating from and terminating to the respective Service Providers' network.

**Note 1:** Specific guidance on IP Interworking aspects such as, IP Addressing, Security, Media Routing, etc. is not in scope.

### Interworking Form for IMS Services

Section 3.8 in GSMA PRD RCC.54 [7] specifies the use of the Interworking Form in Annex B of [IR.90] to document the mutually agreed NNI parameters between Service Providers.

### Inter-PLMN IP Backbone

#### IP Addressing Recommendation

Section 3.4.2 in GSMA PRD RCC.54 [7] allows use of IPv4, IPv6, or both for Service Provider Interconnections.

Use of IPv6 is recommended to facilitate IMS interworking across North America IMS deployments.

### IPX Interconnection

### Overview

Section 4 in GSMA PRD RCC.54 [7] provides the applicable portions of GSMA PRD IR.34 [8] that are used to provide guidelines on how Service Providers interconnect via an Inter-Service Provider IP Backbone (IPX) network.

**Note 1:** Specific guidance for IPX Providers is not provided in the current version of GSMA PRD RCC.54 [7].

## 4 Other Technical Requirements and Recommendations

### Addressing and Routing

Sections 3.6 and 5.5 in GSMA PRD RCC.54 [7], and section 6 in GSMA PRD IR.65 [3] specify addressing and routing guidelines for IMS based services and refers to GSMA PRD IR.67 [17] for guidelines on the use of DNS and ENUM. Section 6.4.3 of GSMA PRD IR.65 [3] specifies two methods for addressing across the NNI:

- Utilise address information (destination domain) in the Request-URI,
- Utilise address information (destination domain) in the topmost entry in the Route header.

If one or more Route headers are present, these will take precedence over the Request–URI.

### QoS Support

### Overview

Section 6A.1 in GSMA PRD IR.88 [4] specifies functionality needed in the VPMN and in the HPMN to support QoS for LTE roaming. QoS support is required for setting up the default

bearer when a roaming UE registers with the VPMN. According to GSMA PRD IR.88 [4] QoS support is subject to the roaming agreement between operators, and to be enforced by the VPMN.

### Options

In order to comply with agreed QoS policies the VPMN verifies the subscription information associated with the roamer against the supported QoS parameter values defined in the roaming agreement with the HPMN. If the roamer's subscription information is outside of the agreed parameter values, the VPMN would apply the QoS parameters specified in the roaming agreement for the set up of a PDN connection requested by the roamer, rather than using the parameters specified in the roamer subscription. In such cases, the HPMN will accept the QoS parameter values provided by the VPMN.

### Recommendations

Both VPMN and HPMN have to agree on the support of QoS policies defined in their roaming agreement as specified in GSMA PRD IR.88 [4].

## Policy and Charging Support

### Overview

Section 7 of GSMA PRD IR.88 [4] specifies technical requirements for dynamic policy and charging control for both Local Break Out (LBO) and Home Routed (HR) roaming scenarios defined in section 2 of this document. In the LBO roaming scenario described in Figure 2 in this document, the PCC elements are shared between the HPMN and the VPMN. For the HR roaming scenario described in Figure 2.4, the PCC elements are implemented in the HPMN, as the HPMN provides policy and charging control services that the VPMN will use to enforce QoS per roaming agreement.

PCC rules also identify the service data flow and specify applicable parameters for charging control based on subscription data and operator policies processed by the PCRF. The PCEF collects charging information per user per IP-CAN bearer and reports usage information to the charging functions.

> **Note 1**: The offline charging mechanism it is not considered in this document as it does not capture real-time charging information of the service rendered.

### Options

According to 3GPP TS 23.203 [24] QoS authorization information may be dynamically provisioned in PCC functional elements or pre-configured PCC rules can be statically provisioned in those PCC elements.

In case PCC rules are dynamically provisioned, authorized QoS information is provided for the setup of the requested bearer resources. If PCC rules are pre-configured, the authorized QoS information is effective as soon as these are activated.

Regardless if the PCC rules are dynamically provided or pre-configured, the PCRF needs to ensure that the PCC rules are within the limitations given by the subscription and operator policies. In an LBO roaming scenario in Figure 2 the roaming partners may implement the

S9 interface as described in section 3.1.3 of this document. However, according to GSMA PRD IR.88 [4], the S9 interface may not be required when the PCRF in the VPMN is configured with static policy rules for roaming subscribers. In the same roaming scenario the VPMN is service aware and the PCEF captures charging information in real-time and concurrently with resource usage of the service rendered. The use of the Gy interface between the OCS in the HPMN and the PCEF in the VPMN allows online credit control for service data flow based charging as indicated in GSMA PRD IR.88 [4].

### Recommendations

Both VPMN and HPMN have to agree on the exchange authorized QoS information either applying dynamic or pre-configured PCC rules for the synchronization of policy control functions in the respective networks, and as specified in GSMA PRD IR.88 [4].

### Security

Section 6.1 in GSMA PRD IR.88 [4] and section 4.3 in GSMA PRD IR.65 [3] indicate certain requirements and procedures that Service Providers should take into account to guarantee a proper level of operational security.

### Emergency Services

Emergency services are supported by the serving network (which is the visited network when roaming or the home network when not roaming). A P-GW within the serving network is selected based on a specific emergency APN and which is not the IMS APN (refer to GSMA PRD IR.88 [4] section 6.4). This provides for the following basic functionalities:

- Identifying the emergency session and setup of emergency bearers
- Routing the emergency session request to the appropriate PSAP
- Support of UE location determination with the location accuracy required (per regulatory requirements)
- Support of PSAP call back.

Emergency Services are described in the corresponding sections of the IMS based services for roaming and interconnection.

**Note 1:** Additional technical requirements associated with emerging IMS based services, such as RCS are to be considered in the future.

### Lawful Interception

### Overview

Lawful interception (LI) requirements for 3GPP IMS-based VoIP and other 3GPP IMS-based multimedia services are specified in 3GPP TS 33.106 [25].

### Options

The lawful interception capabilities are specified in 3GPP standards TS 33.107 [26] and TS 33.108 [27].

**Note 1**: The CS domain functionality as referring to CSFB is not in the scope of this document.

### Recommendations

Refer to 3GPP TS 33.106 [25] for global requirements for LI and Annex A for specific regional requirements for LI.

# 5 VoLTE Roaming and Interconnection

## Connectivity

### Overview

While sections 3 and 4 in GSMA PRD IR.92 [1] describe the UNI functionality needed to support Voice over LTE (VoLTE), section 5.1 of GSMA PRD IR.65 [3] focuses on NNI aspects, and the transport of IP based voice end-to-end between clients enabled by the IMS core systems of each Service Provider.

GSMA PRD IR.65 [3] summarizes voice routing scenarios for VoLTE Roaming based on II-NNI standards specified in 3GPP TS 29.165 [20], i.e., Home (HPMN) Routing and VPMN Routing.

For more information on roaming models for VoLTE see GSMA PRD IR.88 [4] also partially reflected in section 2.2 of this document.

### Recommendations

Depending on an inter-PLMN roaming agreement or SLA being in place, routing of media for VoLTE should follow VPMN Routing considerations. Otherwise, Home Routing will be applied.

## Codec Interworking

### Overview

GSMA PRD RCC.54 [7] Section 7.3.2.1 recommends that AMR, AMR wideband and G.711 mu-law speech codecs will be supported across the NNI. Moreover, it states that Service Providers will mutually agree as to the specific codec mode sets to be required and to be optionally supported across the NNI, and indicate this information in the “IP Voice Call codec” field of the IR.90 Interworking Form.

3GPP TS 26.114 [23] Table 6.3 on the handling of the AMR-NB and AMR-WB SDP parameters in the SDP offer/answer states that the preferred mode-set for AMR-NB is {12.2, 7.4, 5.9, 4.75} and for AMR-WB it is {12.65, 8.85 and 6.60} unless the MTSI client in terminal is configured with a preferred mode set.

### Recommendations

GSMA PRD IR.36 [16] recommends WB-Set 0 as the recommended configuration for voice transmission in all 3GPP mobile networks (that is 2G, 3G and Voice over LTE (VoLTE). Refer to 3GPP TS 26.114 [23] for complementing NB mode-set recommendations.

- The codec mode set Config-NB-Code=1 (3GPP TS 26.103 [16]) {AMR-NB12.2, AMR-NB7.4, AMR-NB5.9 and AMR-NB4.75} should be used unless the session-setup negotiation determines that other codec modes shall be used.
- The codec mode set Config-WB-Code=0 (3GPP TS 26.103 [16]) {AMR-WB12.65, AMR-WB8.85 and AMR-WB6.60} should be used unless the session-setup negotiation determines that other codec modes shall be used.

### IPX Interconnection

Refer to section 3.3 of this document.

### Addressing and Routing

Refer to section 4.1 of this document.

## QoS Support

### Overview

Section 4.3.2 in GSMA PRD IR.92 [1] describes the bearer considerations for Voice calls in E-UTRAN.

### Recommendations

Refer to GSMA PRD IR.92 [1] and section 4.2 in this document.

## Policy and Charging Support

### Overview

Section 7 of GSMA PRD IR.88 [4] specifies technical requirements for dynamic policy and charging control for both LBO and Home Routed roaming scenarios.

### Recommendations

Refer to GSMA PRD IR.88 [4] and section 4.3 in this document.

### Security

Refer to section 4.4 of this document.

## Emergency Services

### Overview

Section 5.2 in GSMA PRD IR.92 [1] identifies specific requirements for the support of Emergency Services in IMS based services such as for VoLTE service.

### Recommendations

Refer to GSMA PRD IR.92 [1] and section 4.5 in this document.

### Supplementary Services

### Overview

Support for VoLTE supplementary services is described in section 2.3 of GSMA PRD IR.92 [1]. The configuration of these services is described in section 2.3.2 of GSMA PRD IR.92 [1].

### Configuration Options for Supplementary Services

Ut Reference Point: GSMA PRD IR.92 [1] section 2.3.2 requires the use of XCAP over Ut reference point for configuration of supplementary services

**Note 1**: 3GPP TS 24.238 [21] defines SIP based user configuration that supports dialing Star/Pound (*/#) codes to configure supplementary services as is done in the NA legacy voice network. The network should support a Request-URI where the “user” parameter is set to “dialstring” as described in 3GPP TS 24.229 [22].

### Recommendations

GSMA PRD IR.92 [1] requires the use of Ut interface for management of MMTEL supplementary services.

# 6 ViLTE Roaming and Interconnection

### Connectivity

### Overview

GSMA PRD IR.94 [2] specifies features for the video service over LTE that are required on top of the features defined in GSMA PRD IR.92 [1] for VoLTE and SMSoIP. Section 3 in GSMA PRD IR.94 [2] identifies video media requirements while endorsing voice media requirements specified in GSMA PRD IR.92 [1].

### Recommendations

Refer to GSMA PRDs IR.94 [2] and IR.65 [3].

### IPX Interconnection

Refer to section 3.3 of this document.

### Addressing and Routing

Refer to section 4.1 of this document.

### QoS Support

#### 6.1.1 Overview

Section 4.2.1 in GSMA PRD IR.94 [2] describes the bearer considerations for Video calls in E-UTRAN.

### Options

Section 4.2.1 in GSMA PRD IR.94 [2] allows for use of the following options:

a) Video bearer using GBR (QCI 2)
b) Video bearer using non-GBR

### Recommendations

GSMA PRD IR.94 [2] recommends the use of QCI 2 or a non-GBR bearer. Based on mutual agreement between two mobile network operators, a non-GBR QCI may be used for video bearer.

**Note 1**: QCI 7 or other non-GBR QCIs as defined in 3GPP TS 23.203 [24] may be used as a non-GBR bearer for video

### Policy and Charging Support

### Overview

Section 7 of GSMA PRD IR.88 [4] specifies technical requirements for dynamic policy and charging control for both LBO and Home Routed roaming scenarios.

### Recommendations

Refer to GSMA PRD IR.88 [4] and section 4.3 of this document.

### Security

Refer to section 4.4 of this document.

### Emergency Services

### Overview

Annex B in GSMA PRD IR.94 [2] refers to GSMA PRD IR.92 [1] for specific requirements for the support of IMS emergency services and how video capability may be applied.

### Recommendations

Refer to GSMA PRDs IR.94 [2], IR.92 [1] and section 4.5 in this document

## 7 SMS over IP Roaming and Interconnection

### Connectivity

### Overview

Section 2.5 in GSMA PRD IR.92 [1] describes the UNI functionality needed to support SMS over IP (SMSoIP).

**Note 1**: SMS is one of the CS services that is expected to work as it does today.

**Note 2:** MMS is out of scope for this section of the document.

**Note 3**: Other GSMA PRDs refer to SMSoIP functionality using different terminology; e.g., it is referred to as SMS over IMS in GSMA PRD IR.25 [10].

If a VPMN supports LTE data services but does not provide an IMS service to visiting subscribers, then the VPMN must support SMS over SGs as described in GSMA PRD IR.88 [4] Sections 2.3.1 and 5.1.

## Options

**Note 1:** GSMA PRDs IR.65 [3] and IR.88 [4] currently have no specification on SMSoIP interworking in both the roaming and non-roaming aspects.

Section 2.4 in GSMA PRD IR.25 [10] describes the test SMS-MO and SMS-MT scenarios needed to support SMS over IP (SMSoIP) roaming.

**Note 2:** Information on testing details for SMSoIP interworking pending in Section 2.4.1 in GSMA PRD IR.25 [10].

### SMSoIP Roaming – SMS-MO Scenario

Section 2.4.2.1 in GSMA PRD IR.25 [10] describes the SMS-MO over IMS while roaming. This is shown in Figure 6 below (referencing Figure 2 in GSMA PRD IR.25 [10]).

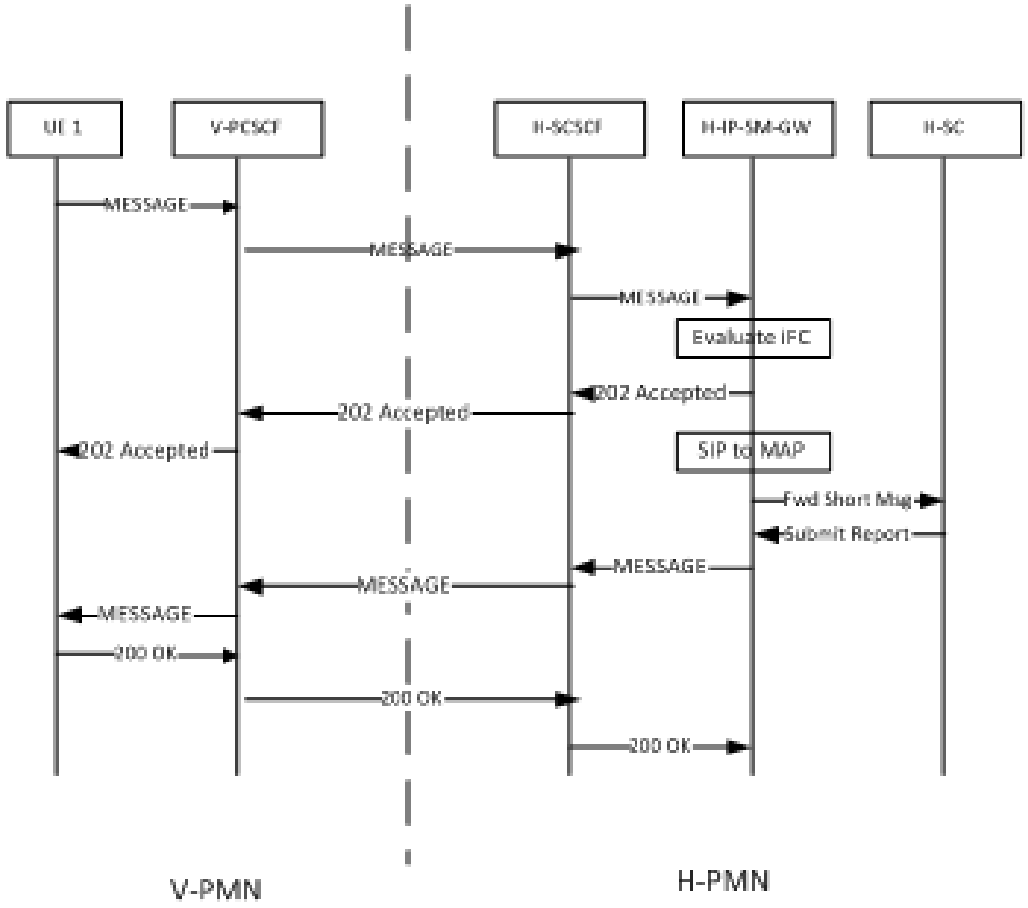


**Figure 7: SMS-MO over IMS Roaming Message Call Flow**

**SMSoIP Roaming – SMS-MT Scenario**

Section 2.4.2.2 in GSMA PRD IR.25 [10] describes the SMS-MT over IMS while roaming. This is shown in Figure 7 below (referencing Figure 3 in GSMA PRD IR.25 [10]).

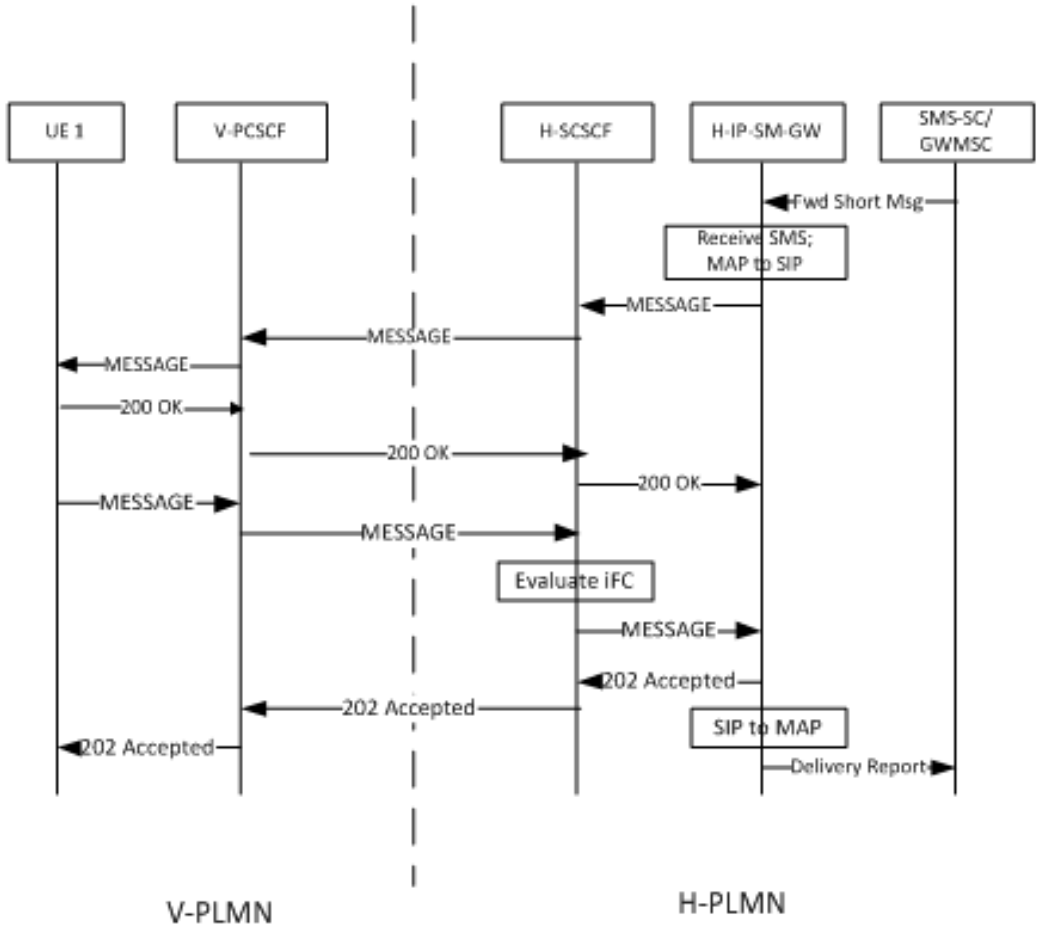


**Figure 8: SMS-MT over IMS Roaming Message Call Flow**

## Recommendations

SMSoIP interworking considering both the roaming and non-roaming aspects is recommended, although not currently specified in GSMA PRDs IR.65 [3] and IR.88 [4].

## IPX Interconnection

Refer to section 3.3 of this document.

## Addressing and Routing

Refer to section 4.1 of this document.

## QoS Support

Not applicable.

## Policy and Charging Support

Not applicable.

### Security

Refer to section 4.4 of this document.

### Emergency Services

Refer to section 4.5 of this document.

# 8 RCS Roaming and Interconnection

### Connectivity

### Overview

GSMA PRD RCC.54 [7] specifies guidelines for interconnection between Service Providers for the purpose of interchanging RCS traffic as determined by the mutual agreement between Service Providers captured in the Interworking Form for IMS based services in Annex B of GSMA PRD IR.90 [5].

### Options

Interworking aspects of RCS are identified in GSMA PRD IR.90 [5].

### Recommendations

Refer to GSMA PRDs RCC.54 [7], IR.90 [5] and IR.65 [3].

### IPX Interconnection

Refer to section 3.3 of this document.

### Addressing and Routing

Refer to section 4.1 of this document.

### QoS Support

### Overview

GSMA PRD RCC.54 [7] provides some guidance for QoS support in Section 4.6, but does not specify the assignment of QCI within a Service Provider's network as out of scope for RCS Interconnection. However, according to section 2.9.1.3 in GSMA PRD RCC.07 [6] if a device is in VoLTE mode, either QCI 8 or 9 may assigned for MSRP traffic.

### Recommendations

Refer to GSMA PRDs RCC.54 [7] and RCC.07 [6].

### Policy and Charging Support

### Overview

As RCS traffic is home routed the policy and charging control requirements specified in Section 7 of GSMA PRD IR.88 [4] are applicable.

### Recommendations

Refer to GSMA PRD IR.88 [4] and section 4.3 of this document.

### Security

Refer to section 4.4 of this document.

### Emergency Services

### Overview

Section 2.16 in GSMA PRD RCC.07 [6] specifies requirements for the support IMS Multimedia Emergency Services, further indicating that only the 1-to-1 Chat feature supports the applicable procedures.

### Recommendations

Refer to GSMA PRD RCC.07 [6] and section 4.5 of this document.

## 9 IMS Centralization Services (SrVCC/TADS/SCC AS)

Refer to GSMA PRD IR.64 [9].

## 10 Trials and Testing – Lessons learned

Operational issues identified during the trials that the mobile community needs to be aware of.

### Testing Framework

### Roaming Testing

Annex A in GSMA PRD IR.88 [4] provides references to GSMA PRDs IR.23 [18] and IR.35 [19] for LTE data roaming test cases.

**Note 1**: GSMA PRD IR.88 [4] currently does not include a reference to GSMA PRD IR.38 [12].

LTE and EPC Roaming testing is described in GSMA PRD IR.38 [12]. The objective, as stated in Section 1.2, is to confirm the capability of LTE data/CS Fallback/SMS over SGs services which users will receive when roaming. The test procedures, which are restricted to top-level capability testing, are described in Section 2.

**Note 2**: Section 1.1 in GSMA PRD IR.38 [12] listed the following as out of scope of the PRD:

- Definition of operation and maintenance procedures (see GSMA PRD IR.23 []
- Testing of VoLTE and SMSoIP (see GSMA PRD IR.25 [10]).
- Testing of TAP, billing applications and any inter-PLMN financial statement; (see GSMA PRD TD.41 [13])

VoLTE and SMSoIP roaming testing is described in GSMA PRD IR.25 [10].

**Note 3:** GSMA PRD IR.25 [10] does not include ViLTE and RCS 5.1 roaming test cases.

GSMA PRD TD.50 [14] specifies the TAP Test Cases for VoLTE service testing in accordance to the TAP Testing Procedures in GSMA PRD TD.41 [13].

GSMA PRD TD.51 [15] specifies the TAP Test Cases for LTE and EPC service testing in accordance to the TAP Testing Procedures in GSMA PRD TD.41 [13].

### Inter-IMS NNI Testing

VoLTE, ViLTE and RCS 5.1 NNI tests cases are described in GSMA PRD RCC.51 [15].

**Note 1**: GSMA PRD RCC.51 [15] does not include SMSoIP NNI test cases.

# Annex A Specific service requirements in certain regions

## A.1 Lawful Interception

Lawful interception (LI) capabilities specified in this section are applicable for service implementations in the United States. LI requirements in other regions also supporting 3GPP standards TS 33.106 [25], TS 33.107 [26], and TS 33.108 [27] should be considered in the Annex in the future.

ATIS-0700005 [32] specifies the LI capabilities for 3GPP IMS-based VoIP and other 3GPP IMS-based multimedia services and applicable for service implementations in the United States. This ATIS Standard was published in 2007, and the second version is currently in development by the ATIS WTSC-LI Subcommittee.

**Note 1**: ATIS-0700005 [32] covers requirements for IMS-based VoIP, which includes VoLTE. This ATIS Standard identifies specific United States requirements for LI.

ATIS-0700005 [32] is provided for the purposes of a “safe harbour” as specified in Section 107 of the Communication Assistance for Law Enforcement Act (CALEA).

ATIS-0700005 [32] defines an interface between a Telecommunications Service Provider and a Law Enforcement Agency for the reporting of lawfully authorized electronic surveillance (LAES) for 3GPP IMS-based VoIP and 3GPP IMS-based multimedia services.

The main purpose of ATIS-0700005 [32] is to provide capabilities for support of LAES for VoIP. In addition, the scope also includes other IMS-based multimedia services because the media type may change in mid-session (e.g., audio to video, video to audio). This ATIS Standard provides for the mapping of SIP messages to ATIS-1000678 [33] LAES messages. These LAES messages represent events in the processing of the VoIP call, and must take place from the beginning of a session because of the potential for a change in the VoIP call in the middle of the session.

# Annex B Document Management

## B.1 Document History

| Version | Date | Brief Description of Change | Approval Authority | Editor / Company |
|---|---|---|---|---|
| 0.1 | 31/03/2015 | First version submitted for approval | GSMA PSMC | Narayanan Haran United States Cellular Corporation |

## B.2 Other Information

| Type | Description |
|---|---|
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It is our intention to provide a quality product for your use. If you find any errors or omissions, please contact us with your comments. You may notify us at prd@gsma.com

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