

NG.137 IPX Requirements
Version 3.0
02 October 2026

Security Classification: Non-Confidential

Access to and distribution of this document is restricted to the persons permitted by the security classification. This document is subject to copyright protection. This document is to be used only for the purposes for which it has been supplied and information contained in it must not be disclosed or in any other way made available, in whole or in part, to persons other than those permitted under the security classification without the prior written approval of the Association.

Copyright Notice

Copyright © 2026 GSM Association

Disclaimer

The GSMA makes no representation, warranty or undertaking (express or implied) with respect to and does not accept any responsibility for, and hereby disclaims liability for the accuracy or completeness or timeliness of the information contained in this document. The information contained in this document may be subject to change without prior notice.

Compliance Notice

The information contain herein is in full compliance with the GSMA Antitrust Compliance Policy.

This Permanent Reference Document has been developed and is maintained by GSMA in accordance with the provisions set out in GSMA AA.34 - Policy and Procedures for Official Documents.

Table of Contents

1 Introduction 4
1.1 Overview 4
1.2 Scope 5
1.3 Definitions & Abbreviations 5
1.4 References 5
1.5 Conventions 6
2 IPX Overview 6
2.1 IPI Framework and the IPX Domain 6
2.2 The IPX Network 7
2.3 IPX Models 8
2.3.1 IPX Transport 9
2.3.2 IPX Service Transit 9
2.3.3 IP Service Hub 10
2.4 IPX Transport Network 10
2.4.1 IPX VLAN 10
3 IPX Services 12
3.1 User data roaming (GRX) 12
3.2 SIGTRAN (Transit of SCCP traffic over IP) 13
3.3 IPX Voice Service 13
3.4 DNS 13
3.5 MMS and SMS Hubbing 14
3.6 Wi-Fi Roaming 14
3.7 Diameter Signalling 14
3.8 VOLTE (IMS) Interworking and RCS in Hub or Transit Mode 15
3.9 VoLTE/IMS/RCS Interconnection ENUM 16
3.10 VoLTE roaming 16
3.11 HTTP/2 Signalling 17
4 Obligations 17
4.1 Compliance with GSMA recommendation 17
4.2 Cascade Billing 17
4.3 Cascading of responsibilities 18
4.4 Peering Principle 18
4.5 Transparency 18
4.6 Traceability 19
4.7 Inter-IPX Provider Interconnection obligation/Full interconnection model 19
4.8 One stop shopping 19
4.9 Transport and Service Layer 19
4.10 MNOs options 20
4.11 No more than two IPX Providers 20
4.12 Enabling indirect connectivity 20
4.13 Additional Supporting Functionalities 20
Annex A Connectivity Option: “IPX Transport” 21

A.1 Definition of connectivity option “IPX Transport” (transport only, i.e. without service awareness): 21
A.2 Commercial Requirements 21
A.3 IPX Transport Charging and Payment 21
A.4 Technical Requirements 21
A.5 Operational and Maintenance Requirements and IPX Transport SLA 21
Annex B CONNECTIVITY OPTION “IPX SERVICE TRANSIT” 22
B.1 Definition of Connectivity Option “IPX Service Transit” 22
B.2 Commercial requirements 22
B.2.1 IPX Service Transit 22
B.2.2 Responsibility of the IPX Provider 22
B.2.3 Responsibility of the Service Provider 22
B.3 IPX Service Transit Charging and Payments 23
B.3.1 General 23
B.3.2 Settlement for IPX Service Transit: 23
B.4 Technical Requirements 24
B.5 Operational and Maintenance Requirements and IPX Service Transit SLA 24
Annex C CONNECTIVITY OPTION “IPX SERVICE HUB” 25
C.1 Definition of Connectivity Option: IPX Service Hub 25
C.2 Commercial Requirements 25
C.2.1 IPX Service Hub 25
C.2.2 Responsibility of the IPX Provider 25
C.2.3 Responsibility of the Service Provider 25
C.2.4 Cascading of Payments 26
C.2.5 Charges, Payment and Settlement 26
C.2.6 Opt-in or opt-out 26
C.2.7 Technical requirements 26
C.2.8 Operational and Maintenance Requirements and IPX Service Hub SLA 26
Annex D Document Management 27
D.1 Document History 27
D.2 Other Information 27

1 Introduction

1.1 Overview

The IP packet eXchange (IPX) is a global, private, secure, IP network which supports end-to-end quality of service and the principle of cascading interconnect payments (when applicable). In order to provide these features, the IPX can be service aware, unlike the Internet and the GPRS Roaming eXchange (GRX) network. GRX is now considered an IPX service which is offered on an IPX Network. As the mobile technology evolves toward an all IP core, the IPX network is required to support many new services and not only at the transport level.

Several new requirements including Quality of Service (QoS), service awareness, SIGTRAN, DIAMETER, and cascaded responsibilities have been added to what has now become a framework, meaning a base transport network with a set of defined services and their specific requirements.

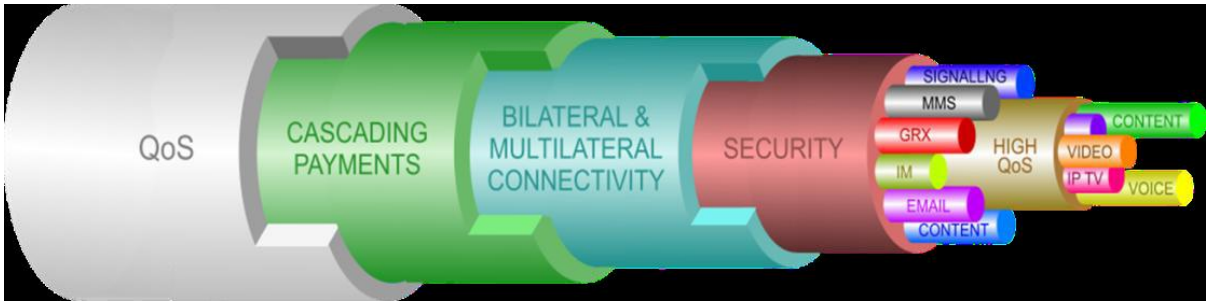

Figure 1: IPX: Schematic representation.

The IPX network is built on the key principles of openness, quality of service, cascading payments and efficiency.

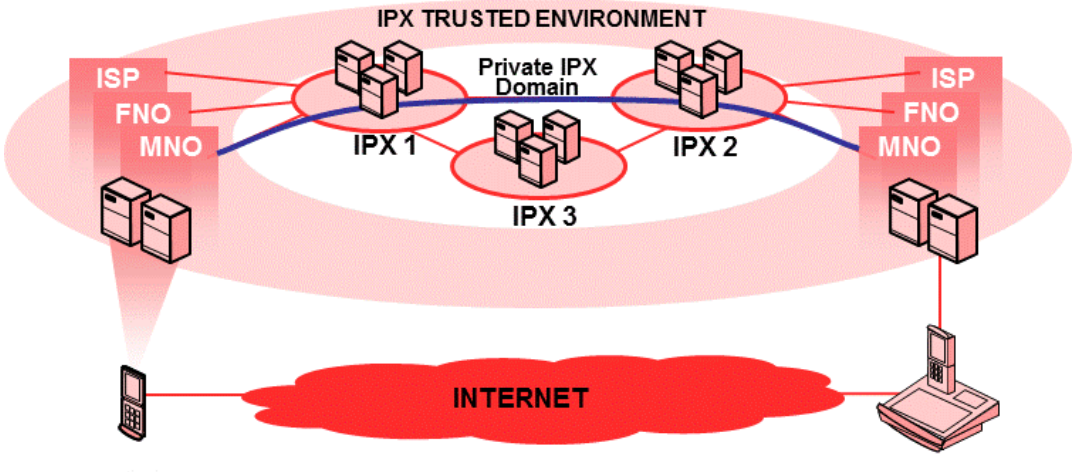

Figure 2 The IPX network

For guidelines for IPX Provider networks please refer to GSMA PRDs IR.34.

1.2 Scope

The initial objective of this document is to present an overview of the services and supporting documents that constitute the IPX. As a general rule, the information in this document shall be aligned with the information in the supporting documents.

The document will provide an overview and references about the IPX transport aspects and the additional IPX services.

The second objective of this PRD relates to the:

- Requirements for peering between IPX Providers
- Requirements related to cascade responsibility
- Commercial obligations of IPX Providers

This document describes the requirements and responsibilities of the IPX Provider as it relates to the Connectivity Options described below and in Annex A primarily from a data perspective. Inherent in the services provided by an IPX is signalling.

1.3 Definitions & Abbreviations

Definitions & Abbreviations used in this PRD and not detailed below as can be found in GSMA PRD WA.03.

The document will use the terms Service Provider and IPX Provider. A Service Provider can be a Mobile Network Operator (MNO), a Fixed Operator or an Application Service Provider (ASP).
An IPX Provider is defined as an entity offering an IP network transport that provides end-to-end QoS and application/protocol proxies that provide service awareness to manage IP based application service exchanges. In addition to the IP transport network, IPX also supports cascading responsibility.

1.4 References

Ref	Doc Number	Title
[1]	IR. 77	Inter-Operator IP Backbone Security Requirements for Service Providers and Inter-operator IP backbone Providers
[2]	IR.34	Guidelines for IPX Provider networks
[3]	IR.67	DNS and ENUM Guidelines for Service Providers and GRX and IPX Providers
[4]	WA.03	Definitions & Abbreviations
[5]	RFC2119	“Key words for use in RFCs to Indicate Requirement Levels”, S. Bradner, March 1997. Available at http://www.ietf.org/rfc/rfc2119.txt
[6]	AA.80	Agreement for IP Packet eXchange (IPX) Services
[7]	IN.01	Interworking Service Level Agreement
[8]	BA.51	Roaming Service Level Agreement Guidelines
[9]	NG.105	ENUM Guidelines for Service Providers and IPX Providers

Ref	Doc Number	Title
[10]	IR.88	LTE and EPC Roaming Guidelines
[11]	FS.09	Diameter Interconnect Security
[12]	FS.52	Global Title Leasing Code of Conduct
[13]	NG.113	5G SA Roaming guidelines
[14]	IR.80	Technical Architecture Alternatives for Open Connectivity Roaming Hubbing Model
[15]	IR.33	GPRS Roaming Guidelines
[16]	IR.72	SIGTRAN basic principles
[17]	IR.22	SCCP Signalling Aspects for Roaming
[18]	IR.52	IR.52 MMS Interworking Guidelines
[19]	IR.53	MMS Inter-working Tests
[20]	IR.75	OPEN Connectivity SMS Hubbing Architecture
[21]	IR.61	IR.61 Wi-Fi Roaming Guidelines
[22]	IR.65	IR.65 IMS Roaming, Interconnection and Interworking Guidelines
[23]	WA.14	IPX requirements
[24]	RFC3588	Diameter Base Protocol
[25]	3GPP TS 23.203	Policy and charging control architecture
[26]	3GPP TS 29.272	Evolved Packet System (EPS); Mobility Management Entity (MME) and Serving GPRS Support Node (SGSN) related interfaces based on Diameter protocol.

1.5 Conventions

The key words “must”, “must not”, “required”, “shall”, “shall not”, “should”, “should not”, “recommended”, “may”, and “optional” in this document are to be interpreted as described in RFC2119 [5].

2 IPX Overview

2.1 IPI Framework and the IPX Domain

The GPRS Roaming Exchange (GRX) was created as a platform for enabling mobile data roaming.

GRX networks evolved from purely the exchange of 2.5G and 3G packet switched roaming services to additionally facilitate inter-working of MMS.

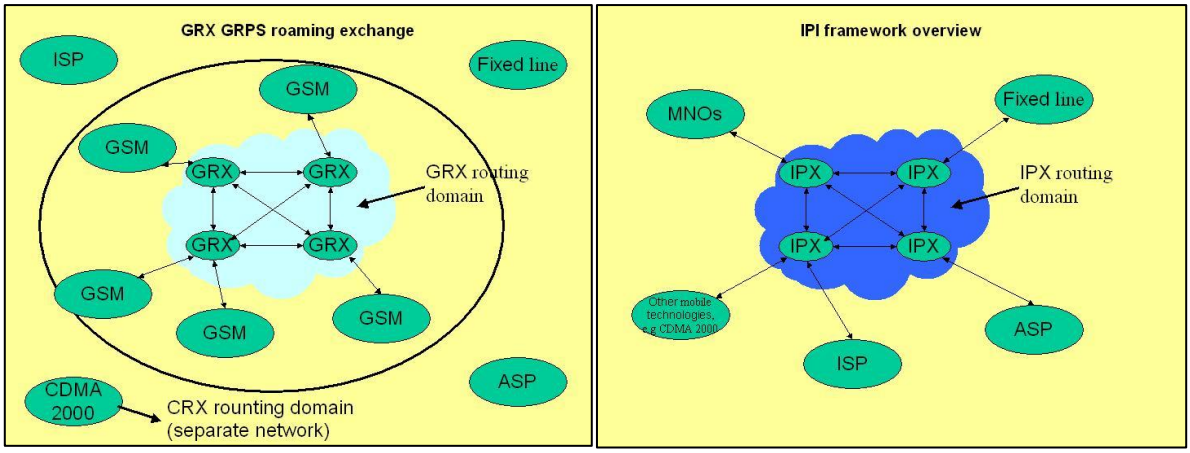

Figure 3: The Evolution of the GRX Model to the IPI Framework

The IP Inter-working (IPI) Framework extends the GRX model significantly (see above diagram). It opens this managed network approach to provide a managed IP network environment that includes traffic from both fixed and mobile networks (both GSM and non-GSM networks). It can also provide interconnection to parties such as ISPs, ASPs, Content Providers, etc. Such parties connected to the IPX are referred to as Service Providers.

To meet the demands of IP-based services, the IPI Framework introduced interworking with other Service Providers (e.g. Fixed Operators, CDMA Operators) on a broad range of IP based services while maintaining its core IPI principles.

The IPX Providers allow for interconnection at the service layer whereby individual services can be connected with specific quality and accounting as required per service, allowing Interworking between Service Providers.

The IPI delivers a secure, reliable and controlled network environment in which IPX Providers enable roaming and Interworking services between the end-users, subscribing to the services offered by relevant Service Providers (e.g. Mobile Network Operators). IPX Providers can also play a more active role, providing commercial intermediary transaction services for Mobile Network Operators and other Service Providers participating in the IPI Framework.

The template agreement for IPX Services outlining the terms and conditions between an IPX Provider and Service Provider can be found in GSMA PRD AA.80.

2.2 The IPX Network

IPX consists of an IP network transport that provides end-to-end QoS and application/protocol proxies that provide service awareness to manage IP based application service exchanges. In addition to the IP transport network, IPX also supports cascading responsibility. To summarize, the key components are:

- IP network Transport
- Service awareness gateways, also described as IPX Proxies in supporting documentation.
- Cascading responsibility/support for billing and SLAs.

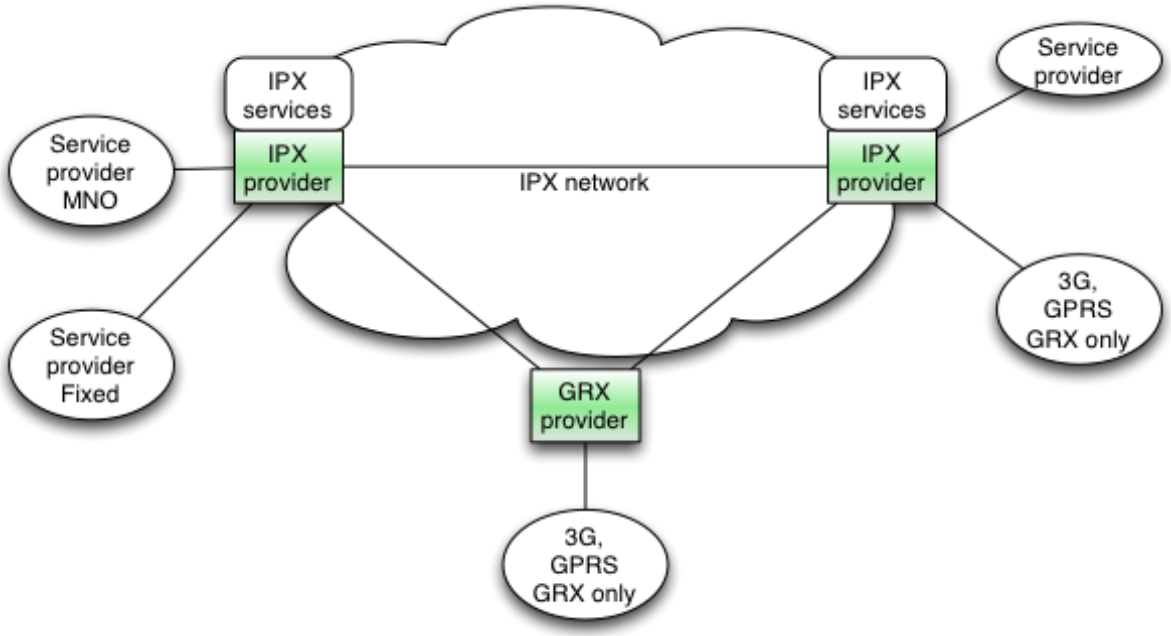

Figure 4 IPX network high level description

2.3 IPX Models

The IPI Framework plays an important role in defining the IP Packet Exchange (IPX) Domain. This managed network provides interconnection between different Service Providers - i.e. mobile and fixed operators, other service providers such as ISPs, ASPs and later possibly Content Providers and other stakeholders in a scalable and secure way, with special focus on guaranteed QoS.

Within the IPX Domain, IPX Providers manage the exchange of traffic and associated basic control information. IPX Providers must offer both technical and commercial interconnect capability via a single agreement with the Service Provider.

The IPI Framework is designed to support the delivery of services in a clearly defined, pre-agreed and guaranteed manner. These must be supported by strict and consistent associated level of security and QoS. Accounting within this managed environment will refer to both the service layer as well as the transport layer.

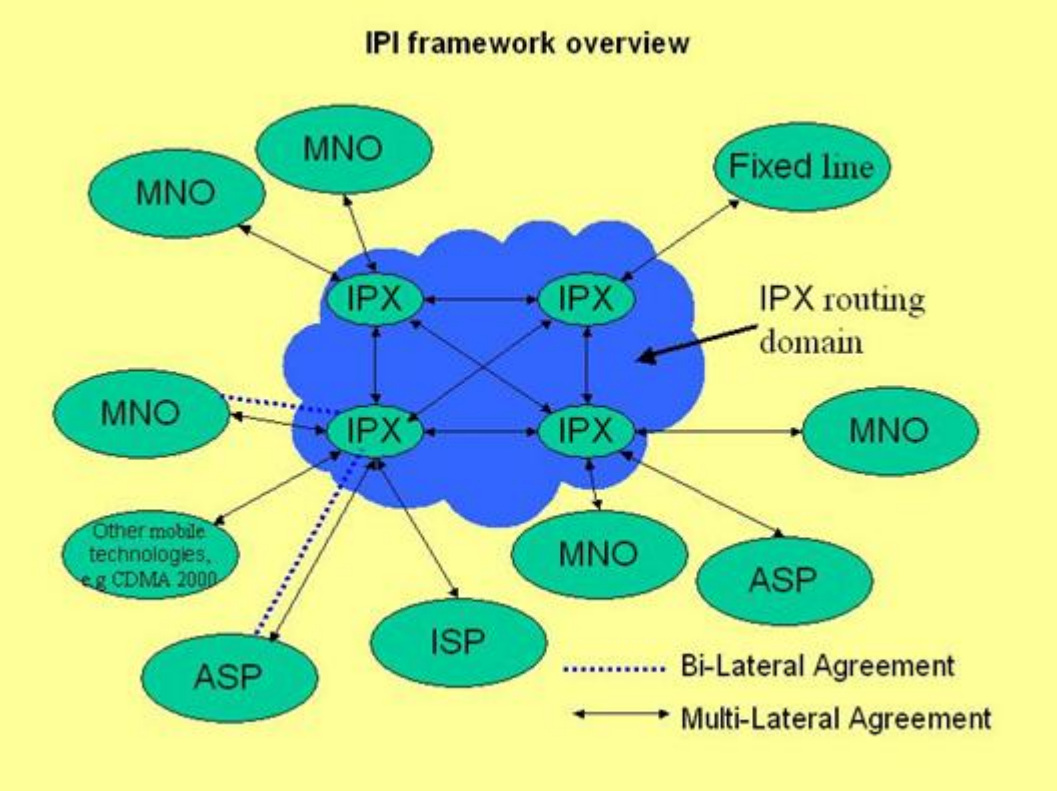

Figure 5: IPI Framework business entities

The IPI Framework is open to all relevant business entities within the IP value chain. The fig.5 above shows possible interconnection between the main business entities within the IPI Framework. While relevant for all Service Providers utilizing IPX providers, the remaining body of this PRD will focus on the relationship between the IPX Provider and MNO.

The IPX Domain supports 3 interconnection models which are outlined below.

1. Transport only (see annex A for details)
2. Bilateral service transit (see annex B for details)
3. Multilateral service hub (see annex C for details)

2.3.1 IPX Transport

IPX Transport is a bilateral agreement between two MNOs using the IPX transport layer with guaranteed end-to-end QoS.

As with the GRX, this connectivity option is not service aware and it can be used to transport any protocol between the two MNOs (provided compliance with security requirements is maintained).

The Transport option charging can, for instance, be based on data volumes or capacity since it is service unaware. Cascade billing is not possible under this model as service awareness is not available.

2.3.2 IPX Service Transit

IPX Service Transit is a bilateral agreement between two MNOs using IPX Proxy functions and the IPX transport layer with guaranteed end-to-end QoS.

The MNO uses the IPX facilities such as proxies for voice or signalling while maintaining a direct commercial relationship with the other MNO.

This Connectivity Option provides the opportunity to include service-based interconnect charging instead of, or in addition to, the transport charging through cascaded billing.

2.3.3 IP Service Hub

IP Service Hub is a Connectivity Option providing multilateral interconnect with guaranteed end-to-end QoS and including service-based interconnect charging.

Hubbing/multilateral connectivity is where traffic is routed from one MNO to many destinations or interworking partners via a single agreement with the IPX Provider.

The hub functionality is provided by an IPX Proxy.

IPX Service Transit and IPX Service Hub are the same from an IP and service connectivity perspective and are better defined as business operating models. References regarding the hub model can be found in the GSMA PRD IR.80.

2.4 IPX Transport Network

The IPX transport network refers to all the elements in the IPX network that provide IP routing, segregation of traffic between the services, security and Quality of Service.

Typically, Service Providers are connected to each other using the IPX network. Each Service Provider is interconnected to an IPX Provider. The IPX Providers are connected via the peering interface at the peering points or via private interconnects. It is also possible for Service Providers to have direct bilateral IP interconnects. Service Providers and IPX Providers can also be interconnected directly at the peering point.

Details about IPX Transport network requirements can be found in the GSMA PRDs IR.34 and IR.77

2.4.1 IPX VLAN

As described in section 2.3.1, services on IPX are separated logically. The logical separation can be, or not, only visible by the IPX Providers (see IR.34.) At the peering points, the services are grouped in Virtual Local Area Networks (VLANs). See 6:

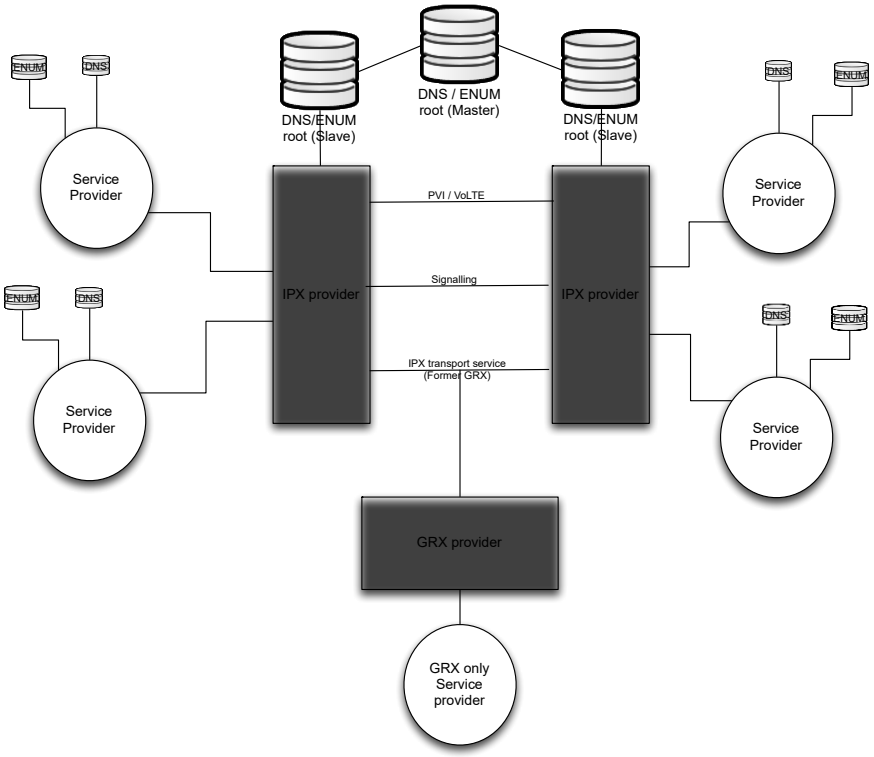

Figure 6 VLAN separation schema

The separation of VLAN is necessary to ensure better isolation between services on IPX which provides improved security, better bandwidth management and improved quality.

When an IPX Provider elects not to offer a particular service then the Provider does not have to peer on the related VLAN. Refer to IR.34 for details on service separation at the peering point.

3 IPX Services

The table below is a summary of the defined IPX services

Services	PRD	Description
User Data Roaming (GRX)	IR.33 (GPRS), IR.88 (4G), NG.113 (5G)	Gp (for GPRS), S8 (for 4G) and N9 (for 5G) interfaces
SIGTRAN Signalling	IR.72	Transport of the signalling protocols over IP for 3G
DNS service on IPX	IR.67	Guidelines for DNS on IPX and GRX.
MMS, SMS Hubbing	IR.75, IR.52, AA80	SMS hubbing over IP and MMS
VoIPX (PVI)	IR.83, AA.80	Packet voice interconnect, VoIMS NNI
WIFI roaming	IR.61	WIFI roaming guidelines
Diameter transport	IR.88	Diameter interfaces for LTE and EPC roaming, S6a, S6d, S9, Gy, Gx interfaces
IMS Roaming	IR.65, IR.58 IR.92 for VoLTE and IMS SMS IR.94 for ViLTE NG.114 for Voice, Video and Messaging over NR	For VoLTE, support of S8HR as per IR.65 For Voice, Video and Messaging over NR, support of N9HR as per NG.113 and IR.65
IMS Interconnect	IR.65 IR.95 for II-NNI	Inter IMS NNI (II-NNI), Ici/Izi interfaces with IBCF or Mb/Mw interface without IBCF
RCS Interconnect	IR.90	IMS NNI, plus interworking functions as described in IR.90
RCS Roaming	IR.65, IR.90	
Intercarrier ENUM	NG.105	
HTTPs Signalling	NG.113	5G SA roaming signalling between SEPP

Table 1: IPX Services

The remainder of Section 3 describes the IPX services listed in Table 1 above in more detail and gives references to the GSMA documentation about those services.

3.1 User data roaming (GRX)

The GRX service legacy provides connectivity for the GTP traffic between mobile network operators. GRX also makes use of the Domain Name System (DNS) service for Access Point Name (APN) resolution. Details about the user data roaming guidelines and the associated roaming architecture can be found in the GSMA PRD IR.33 (GPRS), IR.88 (4G) and NG.113 (5G).

Generally, the GRX network is used as a service unaware transport network with full IP connectivity between service providers.

Details about the network requirements for GRX can be found in the GSMA PRD IR.34.

3.2 SIGTRAN (Transit of SCCP traffic over IP)

The Mobile Application Protocol was traditionally carried by SS7 over TDM links. In recent years SIGnaling TRANsport (SIGTRAN: that is SS7 over IP) has been adopted by many service providers and International Gateway Providers (IGPs). While not being exclusively an IPX service, SIGTRAN can be carried over the IPX network. Guidelines about SIGTRAN can be found in GSMA PRD IR.72. Information about SCCP and roaming in GSM can be found in the GSMA PRD IR.22.

3.3 IPX Voice Service

IPX may support IP voice telephony services, Voice over IPX (VoIPX).

There are essentially two types of VoIP to be considered in IPX:

- Voice originating on a circuit bearer (for example, GSM voice) and then encapsulated in Real-time Transport Protocol (RTP) / User Datagram Protocol (UDP)/IP protocols. Here, the signalling likely to be used is Session Initiation Protocol with encapsulated ISUP (SIP-I). This is termed 3GPP Release 4 voice.
- Voice originating on a packet bearer (for example, 3GPP Session Initiation Protocol (SIP) or IP Multimedia Subsystem (IMS) voice). Again, the media will be carried as RTP/UDP/IP, but the standardized signalling for voice is 3GPP-SIP or SIP-I.

The IPX voice service can be supported in Transit or using the Hub connectivity option.

The following PRDs provide the guidelines for IPX voice; IMS voice profile and roaming guidelines:

- IR.83 SIP-I Interworking
- AA.80 Packet Voice Interconnection Service Schedule to AA.80

3.4 DNS

The Domain Name System has several functions in IPX:

Name service for the traditional data roaming service (GPRS, 3G, LTE, 5G) used for the resolution of the Access Point Names to determine the address of the home Gateway (GGSN, PGW, SMF/UPF).

MMS routing.

The DNS service, according to IR.34 has to be supported by IPX providers on the IPX VLANS where applicable.

GSMA PRD IR.67 covers the guidelines for the implementation of DNS in the IPX network.

DNS shall not be confused with carrier ENUM. Although they share the same PRD GSMA PRD IR.67, and the same protocol, they do not provide or support the same services.

3.5 MMS and SMS Hubbing

MMS transport between mobile network operators uses IPX transport. MMS interworking guidelines can be found in the GSMA PRD IR.52 and MMS interworking tests can be found in the GSMA PRD IR.53.

SMS Hubbing is normally based on SS7/ Mobile Application Part (MAP) transport. It is however possible to use IPX and the Short Message Peer-to-Peer (SMPP) protocol for SMS delivery between SMS Hubs and SMS Hub customers. The guidelines for SMS Hubs can be found in the GSMA PRD IR.75.

Note: Providers offering only those services are not defined as IPX providers but as “Service Providers” as per IPX definitions.

3.6 Wi-Fi Roaming

Wi-Fi roaming, more specifically the use of Extensible Authentication Protocol Method for GSM Subscriber Identity Module (EAP-SIM) for authentication on Wi-Fi hotspots is done using the IPX network. Participating hotspot providers forward the authentication parameters to a gateway to the IPX network. The authentication requests are then forwarded onto the MNO. The guidelines for Wi-Fi roaming can be found in the GSMA PRD IR.61.

Wi-Fi roaming can use IPX services, for example. IPX transport to send the necessary information.

Note**:** Providers offering only those services are not defined as IPX providers but as “Service Providers” as per IPX definitions.

3.7 Diameter Signalling

The Diameter Signalling interfaces have been introduced with LTE has a replacement to the SS7 based interfaces used in 2G, 3G.

An IPX Provider offering Service Transit or Service Hub connectivity options is expected to provide Diameter Relay and routing services for Diameter

The guidelines for Diameter transport in the context of LTE roaming can be found in the GSMA PRD IR.88.

More details about the Diameter protocol can be found in IETF RFC3588. Table 1 provides the complete list of Diameter interfaces and Table 2 below lists the most common diameter interfaces used between service providers on IPX.

Nodes	Interface ID	Protocol
MME – HSS	S6a	Diameter Base Protocol (IETF RFC 3588 [3]) and 3GPP TS 29.272 [8])
PCRF-PCRF	S9	3GPP TS 23.203

Table 2 : Diameter Protocols

3.8 VOLTE (IMS) Interworking and RCS in Hub or Transit Mode

IMS and Rich Communication Suite (RCS) include many services that can be carried in Hub or Transit mode. IMS in Transit or Hub mode can support the transfer of presence information, video, file transfer, etc. A provider working in Transit or Hub mode must also be able to support SIP domain routing and E.164 Number Mapping (ENUM).

The use of a Hub for those services is the better option for Service Providers who do not wish to manage multiple bilateral relationships for the enablement of those services across multiple mobile network operators.

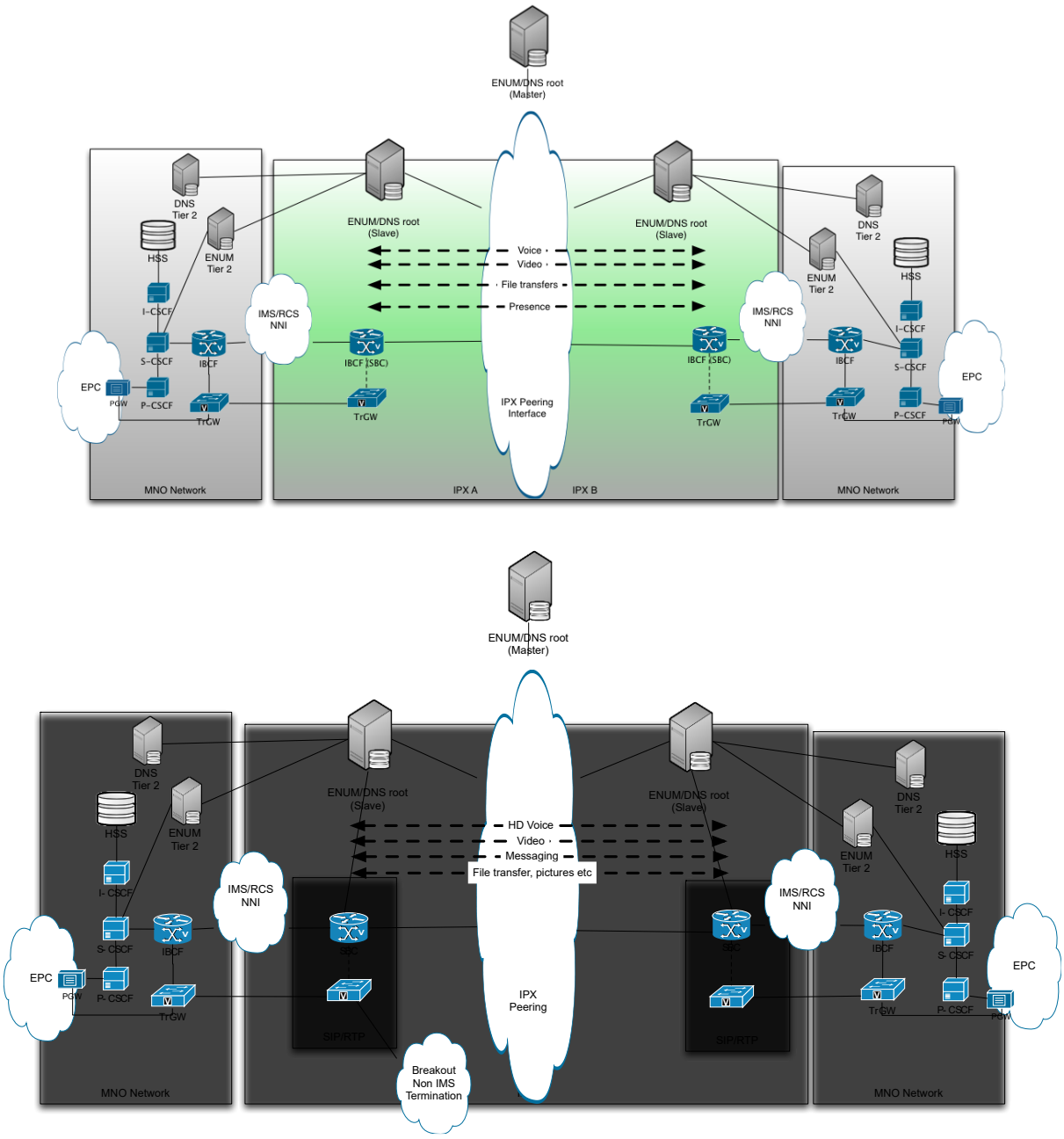

Figure 7 VOLTE (IMS) interworking in transit or hub mode reference architecture

Below is the list of the current GSMA PRDs describing IMS services:

- IR.58 IMS Profile for Voice over HSPA
- IR.65 IMS Roaming and Interworking Guidelines
- IR.90 RCS interworking guidelines
- IR.92 IMS Profile for Voice and SMS
- IR.94 IMS Profile for Conversational Video Service
- IR.95 SIP-SDP Inter-IMS NNI Profile (New PRD)

3.9 VoLTE/IMS/RCS Interconnection ENUM

ENUM (E.164 Number translation service) is a service based on the Domain Name System protocol and hierarchy that allows the mapping of E.164 numbers into SIP domains, and hosts services and protocols. In the referenced hierarchy for ENUM (see GSMA PRD IR.67), T0 is the root database for the World, T1 is the national level database and T2 is the service provider level database.

ENUM is a critical component for interworking between IMS operators. ENUM allows one network to determine if the destination of an IMS communication is IMS capable and accordingly select the proper NNI to ensure that “richer” communication services are available to the end users. A service provider wishing to launch an IMS/VoLTE service within its own domain but also considering VoLTE interworking with other IMS capable networks is strongly encouraged to create its own ENUM Tier 2 directory and open it to the IPX community. Alternatively, ENUM T2 service can be offered by the IPX provider on behalf of the service provider as well as ENUM T1 services where this is not available.

IPX uses carrier ENUM instead of public ENUM. See GSMA PRD NG.105.

The GSMA PRD NG.105 provides the guidelines for the implementation of DNS/ENUM in the IPX network

3.10 VoLTE roaming

VoLTE roaming is supported in S8HR architectures endorsed by the GSMA.

S8 Home routed: the data and media planes are routed to the home network over the S8 interface and the IPX. The S8HR architecture is described in GSMA PRD IR.65 section 2.3.

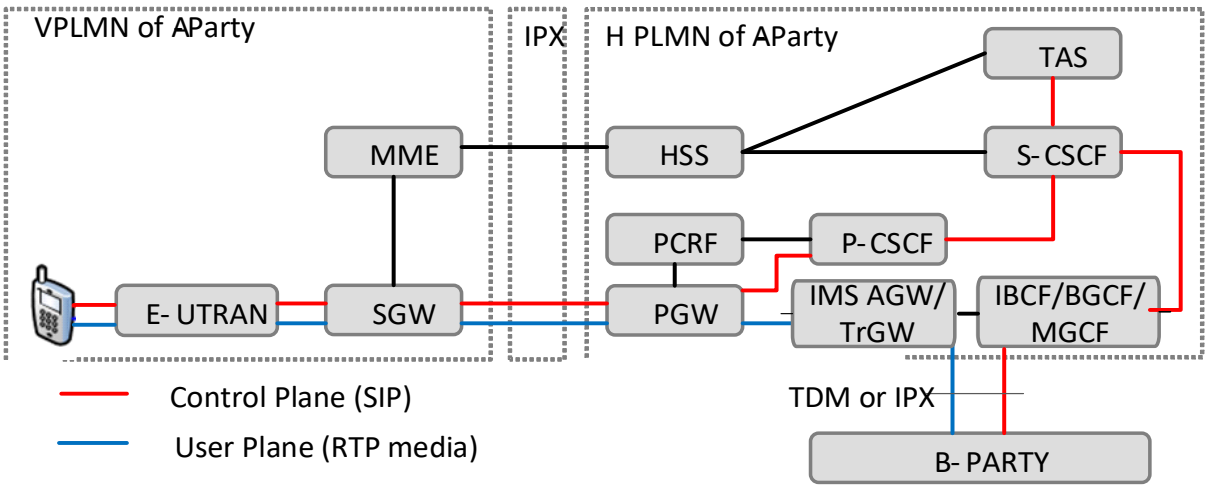

Figure 8 S8HR VoLTE Roaming Architecture

3.11 HTTP/2 Signalling

The HTTP/2 Signalling interfaces have been introduced with 5G has a replacement to the Diameter based interfaces used in 4G.

HTTP/2 signalling transport all 5G SA roaming signalling, using N32 interface between SEPPs.

4 Obligations

All IPX providers and MNOs must follow all requirements as defined in this PRD and in GSMA PRD IR.34.

4.1 Compliance with GSMA recommendation

The IPI framework defines a set of interconnection services for roaming and interworking between Service Providers. The fundamentals of a successful, efficient and seamless interworking rely on the adoption of common standards across the entire chain between the Service Providers. IPX Providers take up a central position with the delivery of a set of connectivity services used by multiple MNOs, playing a key role and in the adoption of common standards and best practices. IPX Providers must commit to be in full compliance with GSMA recommendations and guidelines for IPX Provider networks defined in IR.34 and this PRD.

IPX Providers must be in full compliance of GSMA PRD FS.52 in relation to Global Title Leasing.

4.2 Cascade Billing

Where cascade billing is offered as a service by the IPX provider, the MNO acting as the termination network must be compensated for delivering services to the end user. For example, international voice interconnect where the terminating network needs to be paid MTR charges (Mobile Termination Rate), as per the traditional interconnect model. Any exchange of payments between two IPX providers for MTR must only be related to a cascade payment as in the above example or as a contractual penalty in case of non-

compliance to an SLA (this must also be part of a cascade), or any charges as agreed upon bilaterally between the IPX providers. For the avoidance of doubt, no mark-ups are permitted for cascading payments between the IPX providers.

4.3 Cascading of responsibilities

Cascading of responsibilities means that an IPX Provider must be held responsible for the actions of the next IPX Provider (when transport/transit of traffic will need to pass through more than one IPX Provider from the originating network to the terminating network) to support end-to-end SLA and for security and anti-fraud measures. This is documented in IN.01 as it relates to end-to-end SLAs.

Conditions regarding KPIs and SLA will apply in the **inter-IPX Providers' relationship (IPX Interconnection)** as part of the bilateral agreement between each IPX Provider.

The IPXs should interconnect to one another (peering) and offer a single ubiquitous service to MNOs regardless of the geographic location of the destinations/Interworking partners and in compliance to the IPI principles.

Such inter-IPX Providers' relationship shall be implemented in accordance with the content of the bi-lateral agreements between the IPX Providers and the MNOs. The commitments agreed between the IPX Providers must enable IPX Providers to offer IPX services end-to-end and in the framework of the commitments given to the MNOs.

End-to-end responsibilities must extend from the border gateway of the originating MNO up to the border gateway of the terminating MNO (local loop connections are included in the concept in the end-to-end path). To enable and support full end-to-end services, all parties in the chain must be responsible for their requirements. These requirements are outlined in GSMA PRD IR.34.

4.4 Peering Principle

IPX is an interconnection service where the IPX Providers must interconnect or peer between each other, to complement their own reach of OnNet customers and deliver a full coverage toward the rest of the MNOs.

The individual cost for the establishment, or for any upgrade of the physical connectivity between the IPX Providers, must be borne by each individual IPX, as per the bilateral agreement between the IPX providers. This does not imply free peering, but does require commercially reasonable arrangements.

Different peering principles might apply and coexist on the peering agreement depending on the scope of service and interconnection models (IPX Transport, IPX Transit and IPX hubs) covered by the peering agreement.

4.5 Transparency

The IPX Provider must transport and handle the traffic end-to-end in a transparent way as per the bilateral agreement between the IPX Providers, while supporting the requirements of the MNO. The routing used by the IPX Providers must be made transparent to the MNOs (either online or principally agreed commercially, as defined GSMA PRD IR.34). If multiple routes are used, all the routes must be specified. For example, IPX 1 connects to MNO B

through either IPX 2 or IPX 3 to support the service it provides to MNO A. As part of this transparency principle, IPX 1 must publish the below two routes to MNO A:

IPX1->IPX 2-> MNO B

&

IPX1->IPX 3-> MNO B

4.6 Traceability

It is expected that traffic over the IPX is fully traceable end-to-end. Deviation from end-to-end requirements, determining any other authorised/non-authorised use, compliance with certification criteria etc. must be possible to track.

4.7 Inter-IPX Provider Interconnection obligation/Full interconnection model

The IPX provider must implement, without any hindrance or barriers (commercial, technical or otherwise), the necessary interconnection with any required IPX Provider which has a primary established traffic transmission towards the destinations/Interworking partners requested by the MNO.

Full interconnection among the IPX Providers is mandated between all the IPX Providers, in particular to avoid trombone of traffic through peering interconnection established in another region, as per the bilateral agreement between IPX Providers. This will also support the establishment of SLAs for critical services. It is recommended for IPX providers to follow an open peering principle, and in no way aim to impede or prevent regional peering connection by raising technical or commercial barriers.

Interconnection between IPX Providers must adhere to the principles and binding guidelines established by this PRD and other applicable GSMA PRDs to support the corresponding agreement between the IPX Providers and the MNO. Each IPX provider must make their standard inter-IPX peering agreement available to other IPX providers to set up peering, as outlined in GSMA PRD IR.34.

4.8 One stop shopping

The contractual framework underpinning the IPX Domain is based on technical and commercial connectivity model, whereby MNOs only need to sign one agreement with the IPX Provider in order to get connection to a range of services and a large number of MNOs – provided that such parties adhere to the IPX rules and requirements. This creates a secure, accessible and efficient model, which stimulates competition throughout the value chain.

4.9 Transport and Service Layer

The IPX provider can offer both a transport layer and/or a service layer, the latter enabling a Service Transit or a Hubbing Service.

The IPX Provider is expected to offer as a minimum the transport layer (as a necessary base for all IPX Providers' interaction) on top of which it can provide the service layer (where specific requirements will apply on an end-user service-by-service assumption).

4.10 MNOs options

An MNO can choose, for a specific selection of services, i.e. to use the IPX Domain for transport ONLY (where a bilateral arrangement has been made directly with another MNO) while the MNO continues using the IPX Domain on the Service Layer for other services.

4.11 No more than two IPX Providers

No more than two IPX Providers must be involved in the end-to-end delivery. For clarity, this rule does not apply in SS7 signalling where multiple hops were allowed historically before IPX was introduced and SS7 was part of the voice network.

4.12 Enabling indirect connectivity

Any MNO or IPX Provider acting as a gateway between the IPX Domain and the outside world (i.e. enabling other parties not directly connected to the IPX Domain, to send and receive traffic to and from the IPX Domain), must assume full responsibility with regard to all obligations as set out in this document and other relevant GSMA PRDs. This means that everything outside the “IPX domain”, interacting with the IPX-domain, must be compliant with the IPI framework as well as bilateral agreements between individual IPX Providers.

The security requirements outlined in GSMA PRD IR.77 are mandatory for IPX Providers. The IPX network shall meet the requirements as defined.

4.13 Additional Supporting Functionalities

Beyond the interconnection models described in this PRD, there are a number of value added services offered by IPX Providers to MNOs that are beyond the scope of this document (For example ENUM, Number Portability). These example value added services are described in GSMA PRD IR.67 and NG.105.

Annex A Connectivity Option: “IPX Transport”

A.1 Definition of connectivity option “IPX Transport” (transport only, i.e. without service awareness):

The ‘IPX Transport’ connectivity option enables a bilateral connection between the Service Provider and one other Participating Service Provider utilising the IPX Transport Layer, but without service awareness. This includes providing guaranteed QoS only if the participating Service Provider is connected (a) directly to the IPX Provider or (b) to any other third Party IPX Provider who has separately agreed on guaranteeing QoS with the IPX Provider.

“IPX Transport” technically is specified in IR.34.

A.2 Commercial Requirements

The scope of the IPX Transport connectivity option is considered applicable only between the IPX Provider and the Service Provider and is to implement the IPX connection between the Service Provider and a Participating Service Provider. Any other circumstance with regard to the bilateral connection is outside the scope of their direct Agreement and shall be subject to a separate agreement between the Service Provider and the Participating Service Provider.

The IPX Provider agrees to convey traffic exchanged between the Service Provider and the respective other Participating Service Provider, either directly or via a Third Party IPX Provider for delivery to the Service Provider or the Participating Service Provider’s respective networks.

A.3 IPX Transport Charging and Payment

IPX Transport Charging and Payment shall be settled in accordance with AA.80 Financial Annex.

In the event that Third Party IPX Providers are involved, the remuneration to such Third Party IPX Providers for the traffic handling shall be paid by the IPX Provider, who may then charge the Service Provider with these costs in addition to its own service charges, based on bilateral agreement.

A.4 Technical Requirements

IPX Transport technical requirements shall be defined in accordance with GSMA PRD IR.34, IR.77 and GSMA PRD IR.67 and GSMA PRD NG.105.

A.5 Operational and Maintenance Requirements and IPX Transport SLA

Operational and Maintenance requirements and IPX Transport are stated in GSMA PRD BA.51 and GSMA PRD IN.01.

Annex B CONNECTIVITY OPTION "IPX SERVICE TRANSIT"

B.1 Definition of Connectivity Option "IPX Service Transit"

The IPX Provider's service transit is a bilateral connection based on Service Awareness.

The 'IPX Service Transit' Connectivity Option enables a bilateral connection between the Service Provider and one other Participating Service Provider utilising the IPX Transport layer and the IPX Service layer provided by the IPX Provider with guaranteed QoS end-to-end and service awareness.

Several bilateral agreements (i.e. SPA-IPXP, SPB–IPXP, SPA–SPB in the simple case of two Service Provider being connected by one IPX Provider)" enable inter alia cascading of service aware payments; the two Service Provider negotiating and agreeing the termination fee, the IPXP taking the role of a clearing house.

IPX Service Transit and IPX Service Hub are technically the same (utilizing the same infrastructure: IPX service and transport layer), but contractually very different. IPX Service Transit is managed through many inter-related, bilateral agreements whereas the IPX Service Hub is managed through a single hub agreement between SP and IPX Providers and many bilateral agreements among IPX Providers.

B.2 Commercial requirements

B.2.1 IPX Service Transit

The scope of the IPX Service Transit connectivity option is applicable only between the IPX Provider and two Service Providers.

B.2.2 Responsibility of the IPX Provider

IPX Provider agrees to convey the traffic exchanged between the Service Provider and the Participating Service Provider (with whom the Service Provider also deploys the IPX Provider's IPX Service Transit), either directly or via a Third Party IPX for delivery to the Service Provider or the Participating Service Provider's respective networks .

B.2.3 Responsibility of the Service Provider

The Service Provider agrees to convey the traffic received from the IPX Provider to the Service Provider's network, whereas (for the avoidance of doubt) such traffic may be:

Data received by the IPX Provider directly from the respective Participating Service Provider (with whom the Service Provider also deploys the IPX Provider's IPX Service Transit); or

Data received by the IPX Provider from the Participating Service Provider (with whom the Service Provider deploys the IPX Provider's IPX Service Transit) via a Third Party IPX Provider.

B.3 IPX Service Transit Charging and Payments

B.3.1 General

IPX Service Transit Charging and Payment information shall be stated within the AA.80 Financial Annex.

B.3.1.1 Charging Components

The charging components applicable to the IPX Provider's IPX Service Transit with regard to any specific Service are defined in the AA.80 Financial Annex.

The charging components for IPX Service Transit consist of

- the IPX Service Transit Charge, i.e. the remuneration of the IPX Provider for the IPX Service Transit and
- the Termination Charges (a) quoted by the Service Provider and (b) agreed directly between Service Provider and the Participating Service Provider.

The Service Providers shall pay the same IPX Service Transit Charge, whether a Third Party IPX Provider is involved or not.

The Termination Charges for each applicable Service shall be

- agreed directly between the Service Provider and the Participating Service Provider in a separate agreement and brought to the attention of the IPX Provider.

In the event that Third Party IPX Providers are involved, the remuneration to such Third Party IPX Providers for the traffic handling shall be dealt with by the IPX Provider who considers this activity in its pricing.

B.3.2 Settlement for IPX Service Transit:

The Service Provider, the IPX Provider(s), and the Participating Service Provider jointly have to agree the method of settlement. Two options are possible for IPX Service Transit.

B.3.2.1 Direct Settlement of termination rates

The Service Provider and the Participating Service Provider(s) (with whom the Service Provider deploys the IPX Provider's IPX Service Transit) shall perform the settlement of the applicable Termination Charges for the corresponding Service.

The IPX Provider may invoice the Service Provider for the IPX Service Transit Charges and the Service Provider shall pay the IPX Provider, as bilaterally agreed.

The IPX Service Transit Charges applicable for a respective Service are defined in the AA.80 Financial Annex.

B.3.2.2 Cascaded Settlement of termination rates

The IPX Provider may invoice the Service Provider for the IPX Service Transit Charges and the Service Provider shall pay the IPX Provider, as bilaterally agreed.

Service Providers shall pay the same IPX Service Hub Transit charge, whether or not a Third Party IPX Provider is used.

The IPX Service Transit Charges applicable for a respective Service are defined in the GSMA PRD AA.80 Financial Annex.

The Service Provider shall specify its Termination rate to the IPX Provider by Service in the GSMA PRD AA.80 Financial Annex.

The IPX Provider shall ensure transparency on the Participating Service Providers' Termination rates. Transparency in this context means a clear split, at an invoice level, between the Elected Participating Service Providers' Termination rates and other Service charging components.

B.4 Technical Requirements

IPX Service Transit technical requirements shall be defined in accordance with GSMA PRD GSMA PRDs IR.34, IR.67, NG.105 and IR.77 and the GSMA PRD AA.80 Technical Annex.

B.5 Operational and Maintenance Requirements and IPX Service Transit SLA

Both Parties will adhere to the GSMA PRDs IR.34, IR.67, NG.105, IN.01 and IR.77.

Annex C CONNECTIVITY OPTION “IPX SERVICE HUB”

C.1 Definition of Connectivity Option: IPX Service Hub

The IPX Provider’s hub functionality ("IPX Hub”) is a multilateral connection based on Service Awareness.

Traffic is exchanged between the Service Provider and multiple Participating Service Providers through the IPX Hub, which facilitates the service through a single agreement and connection between the Service Provider and the IPX Provider. The single agreement and connection enable inter alia cascading of quality of service responsibilities and of payments.

C.2 Commercial Requirements

C.2.1 IPX Service Hub

The IPX Provider operates the IPX Hub enabling traffic exchange and Service Interworking between Participating Service Providers. Upon the terms and subject to the conditions set out in their Agreement, the Parties wish to establish terms and conditions for the IPX Service Hub.

C.2.2 Responsibility of the IPX Provider

The IPX Provider shall supply the IPX Hub to the Service Provider whereby the IPX Hub conveys traffic received from the Service Provider to the Elected Participating Service Providers’ Systems run by each Elected Participating Service Provider either directly or via another IPX Hub for delivery to a Participating Service Provider; vice versa the IPX Provider shall also convey traffic from the Elected Participating Service Providers to the Service Provider for termination to the Service Provider.

The IPX Provider shall procure and provide to the Service Provider, the necessary Termination Services from, and in respect of each Elected Participating Service Provider from which the Service Provider has elected to receive traffic by means of the IPX Hub in order to enable Service interworking.

The IPX Provider provides to the Service Provider the IPX Hub, the Service Level Agreement and Test Plan and Operational Procedures.

C.2.3 Responsibility of the Service Provider

The Service Provider agrees to provide its Termination Service for traffic sent via the IPX Provider to the Service Provider according to their Agreement which may include:

Data received by the IPX Provider directly from a respective Participating Service Provider (with whom the Service Provider deploys the IPX Provider’s IPX Service Hub) i.e. Elected Participating Service Provider; and

Data received by the IPX Provider from a Participating Service Provider (with whom the Service Provider deploys the IPX Provider’s IPX Service Hub) i.e. Elected Participating Service Provider, via a Third Party IPX Provider.

The Service Provider shall use the IPX Hub in accordance with their Agreement.

C.2.4 Cascading of Payments

The Service Provider shall specify its Termination rate to the IPX Provider by Service within the AA.80 Financial Annex.

The IPX Provider shall ensure transparency on the Participating Service Providers' Termination rates. Transparency in this context means a clear split, at an invoice level, between the Elected Participating Service Providers' Termination rates and other Service charging components.

Service Providers shall pay the same IPX Service Hub Transit charge, whether or not a Third Party IPX Provider is used.

C.2.5 Charges, Payment and Settlement

IPX Service Hub Charging and Payment shall be settled in accordance with any applicable clauses referring to this concept in their Agreement.

IPX Service Transit Charging and Payment shall be made in accordance with the AA.80 Financial Annex .

Charging components: The Charging Components applicable to the IPX Providers for the IPX Service Hub with regards to any specific Service are defined in GSMA PRD AA.80 Financial Annex .

The Charging component applied by the Service Provider to the IPX Provider for the Termination Service is detailed in the GSMA PRD AA.80 Financial Annex.

In the event that Third Party IPX Providers are involved, the remuneration to such Third Party IPX Providers for the traffic handling, shall be paid by the IPX Provider who may charge the Service Provider this cost in addition to the service charges in the invoice.

C.2.6 Opt-in or opt-out

Whether opt-in or opt-out applies may need to be subject to trial on a Service-by-Service basis, i.e. in reference to which particular Service is being implemented through the IPX Hub, and therefore it will be stated and defined in the GSMA PRD AA.80 Technical Annex .

C.2.7 Technical requirements

Technical requirements shall be defined in accordance with PRDs IR.34, IR.67, NG.105 and IR.77.

C.2.8 Operational and Maintenance Requirements and IPX Service Hub SLA

Both Parties will adhere to the GSMA PRDs IR.34, IR.67, NG.105, IN.01 and IR.77.

Annex D Document Management

D.1 Document History

Version	Date	Brief Description of Change	Approval Authority	Editor / Company
1.0	31 October 2019	New PRD WA.14	WAS eVote	Kathleen Leach (Sprint)
1.1	12 February 2020	Add signalling service language and references	WAS eVote	Kathleen Leach (Sprint)
1.0		PRD transferred to NG. New Reference is NG.135	NG	Javier Sendin (GSMA)
1.1	17 April 2023	Add CR 1002 and 1003	NG	Kathleen Leach (T-Mobile US)
1.2	26 January 2024	Add Compliance to GT Leasing CoC	ISAG	Kathleen Leach (T-Mobile US)
2.0	July 2024	Add CR 1005 to include AA.51	ISAG	Kathleen Leach (T-Mobile US)
3.0	02 Oct 2026	NRG29_001 CR.1005 inclusion of VoNR Roaming (N9HR)	ISAG	Marc Balon (Orange)

D.2 Other Information

Type	Description
Document Owner	NG
Editor / Company	Marc Balon, Orange

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

Your comments or suggestions & questions are always welcome.