

---

**INTERNATIONAL INTERCONNECTION FORUM**  
**FOR SERVICES OVER IP**  
**(i3 FORUM)**

([www.i3forum.org](http://www.i3forum.org))

**Source:**

**Working Group “Technology”**

**i3 forum keyword: Voice, IMS, Interoperability, OBC**

<p><b>Calling Line Identification (CLI) management</b> <b>(Release 1.0) June 2019</b></p>
---

This document provides the i3 forum’s perspective on the interoperability issues related to the international interconnection of multiservice IMS-based platforms focusing on voice and video services originated from fixed as well as mobile networks. The scope covers both the interoperability between a Service Provider and Int. Carrier and between two Int. Carriers. It does not intend to duplicate other existing specifications or documents on the same issue, but to complement these documents with the perspective of the International Carrier members of i3 forum.



---

## Table of Contents

1.	Scope and objective of the document .....	4
2.	Symbols and Acronyms.....	5
3.	References.....	6
4.	CLI management.....	7
5.	Addressing schemes.....	7
6.	CLI privacy .....	8
7.	CLI presentation.....	9
8.	VoIP to TDM interworking considerations .....	9
9.	P-Asserted-ID URI considerations .....	10
10.	CLI management in case of diverted calls.....	10

## **1. Scope and objective of the document**

Over the last few years Calling Line Identification (CLI) has become relevant also for wholesale inter-operator billing due to the fact that Origin Based Charging (OBC) principle has been adopted in some regions, mainly in Europe. This means that CLI affects wholesale call termination rate among operators. It is therefore important to correctly identify valid CLI so that proper rating and billing is applied between interconnected operators.

This document provides technical guidelines on CLI management so that CLI information is consistent in the end-to-end call path.

## 2. Symbols and Acronyms

3GPP	3rd Generation Partnership Project
BSS	Business Support System
CLI	Calling Line Identification
ENUM	E.164 NUmber Mapping
ETSI	European Telecommunications Standards Institute
FNO	Fixed Network Operator
GSM	Global System for Mobile Communications
HPLMN	Home Public Land Mobile Network
HPMN	Home Public Mobile Network
IETF	Internet Engineering Task Force
IMS	IP Multimedia Subsystem
IPX	IP eXchange
IPX P	IPX Provider
ISUP	ISDN User Part
ITU	International Telecommunications Union
MNO	Mobile Network Operator
NNI	Network to Network Interface
OBC	Origin Based Charging
PSTN	Public Switched Telephone Network
RCS	Rich Communication Suite
RFC	Request For Comments
SIP	Session Initiation Protocol
SIP-URI	SIP protocol URI
SS7	Signalling System 7
TDM	Time Division Multiplexing
Tel-URI	Telephone URI
URI	Uniform Resource Identifier
ViLTE	Video over LTE
VoIMS	Voice over IMS
VoIP	Voice over IP
VoLTE	Voice over LTE

### 3. References

- [1] IETF, "RFC 3966; The tel URI for Telephone Numbers".
- [2] ITU-T, "E.164; The international public telecommunication numbering plan".
- [3] IETF, "RFC 3986; Uniform Resource Identifier (URI): Generic Syntax".
- [4] GSMA, "IR.67; DNS and ENUM Guidelines for Service Providers and GRX and IPX Providers".
- [5] IETF, "RFC 3325; Private Extensions to the Session Initiation Protocol (SIP) for Asserted Identity within Trusted Networks".
- [6] ITU-T, "Q.1912.5 (01/2018); Interworking between session initiation protocol (SIP) and bearer independent call control protocol or ISDN user part".
- [7] IETF, "RFC 5806; Diversion Indication in SIP".
- [8] IETF, "RFC 4244; An Extension to the Session Initiation Protocol (SIP) for Request History Information".
- [9] IETF, "RFC 3261; SIP: Session Initiation Protocol".
- [10] i3forum, "Common functionalities and capabilities of an IPX platform, Release 2, May 2014".
- [11] i3forum, "Interconnection & Roaming IMS Signaling Profile, Release 3 (May 2016)".
- [12] i3forum, "Technical Interconnection Model for International Voice Services, Release 6, (May 2014)".
- [13] i3forum, "IMS-Based Services: Network-Network Interface Definition, Release 1.1," September 2018.
- [14] i3forum, "IMS-Based Services: Technical and Commercial Analysis of International Interconnection and Roaming Services, Release 3.0," September 2018.
- [15] i3forum, "IMS-Based Services: Service Interoperability, Release 1.1," September 2018.

## 4. CLI management

For the management of session-based communication services the Calling Line Identification (CLI) is a key requirement for roaming, charging and operational practices. It is the intention of the CLI to transmit a caller's telephone number to the called party's telephone equipment when the call is being set up. Whether this service can be successfully presented to the callee depends on the service capabilities of the involved operators. If this service is supported in an international IMS environment, it is mandatory that international IPX Providers (see Figure 1) will pass on the CLI unaltered.

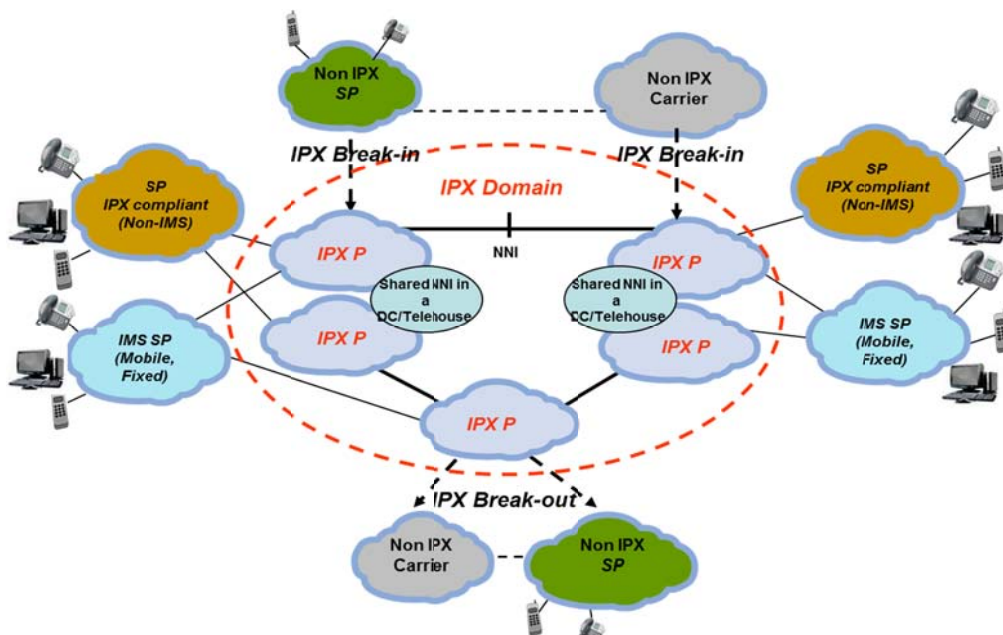


Figure 1 – Session-based services reference model

IPX Providers, under normal operational conditions, are not expected to check CLI validity. An IPX Provider cannot guarantee that:

- the CLI will be transmitted by the originating Service Provider;
- the CLI received from the originating Service Provider is a valid value, i.e. a value of a CLI owned or ported to Service Provider, and indeed, is the correct CLI for the calling party;
- the CLI forwarded to an interconnecting IPX Provider will be delivered to the terminating user, or delivered without any error being introduced beyond the interconnecting IPX Provider;

Call should never be rejected with “no-CLI”, instead, a surcharge if possible can be applied by the terminating party.

## 5. Addressing schemes

As services migrate away from a circuit switched environment to IP, the user identification number starts to differentiate from the PSTN numbering scheme. This process generates opportunities as well as challenges to manage. The opportunities lie with the fact that more granular domains can be created, each with no limitation on the services it can cover. The challenges come from the impact on existing network platforms and related OSS/BSS chain and how to implement this transition phase.

Two basic addressing schemes can be identified:

Tel URI according to RFC3966 [1] which endorses the traditional ITU-T E.164 [2] addressing scheme;

SIP URI according to RFC3986 [3] which links the user identification with his network domain, (sip:+14085551212@domain.com;user=phone). It is recommended to use parameter user = phone since it guaranties that user part of SIP URI is a phone number. For mobile networks IR.67 [4] further specifies the user identification string as: sip:+14085551212@ims.mnc<MNC>.mcc<MCC>.3gppnetwork.org;user=phone

## 6. CLI privacy

As a communications provider, International Carriers have privileged access to CLI. The three privacy markings in SIP used to satisfy data protection requirements are:

- a. **Available** – where the CLI can be used for display purposes;

The recommended SIP message in this case will have the below format:

```
From: <sip: +447584123456@domain; user=phone>
P-Asserted-Identity: <sip: + 447584123456@domain; user=phone>
Or
From: <sip: +447584123456@domain; user=phone>
P-Asserted-Identity: <sip: + 447584123456@domain; user=phone>
Privacy: none
```

- b. **Withheld** – where the caller has exercised the possibility of preventing the display of CLI information, therefore the CLI is present but classified restricted;

The recommended SIP message in this case will have the below format:

```
From: <sip: + 447584123456@domain; user=phone>
P-Asserted-Identity: <sip: + 447584123456@domain; user=phone>
Privacy: id; user
Or alternatively the following format is permitted:
From: <sip: anonymous@anonymous.invalid>
P-Asserted-Identity: <sip: + 447584123456@domain; user=phone>
Privacy: id
```

- c. **Unavailable** – where, at any point in the end-to-end conveyance of a communication, it is not possible:

- o to offer End-User privacy choices and ensure that they are respected
- o to display the caller's CLI information that is prevented by Communications Providers in order to preserve the anonymity of a caller's Network Number when a Presentation Number is available.

The recommended SIP message in this case will have the below format:

```
From: <unavailable@anonymous.invalid>
P-Asserted-Identity: <sip: @domain; user=phone>
Privacy: id
```

In TDM networks CLIP and CLIR have been standardized with the following meanings: CLIP will represent the CLI is available to be displayed; CLIR will represent the caller ID was restricted from display.



## 7. CLI presentation

IPX Providers can ensure that a CLI received is always passed on unmodified across their own domain except in the case to change CLI from national format to international format. A CLI in SIP would normally be in the format specified in section 5, so no change of format would be necessary. IPX Providers can also have specific agreements with other interconnecting IPX Providers in order to guarantee CLI transparency.

The same principles apply in case of adoption of SIP-URI addressing format (see section 5).

In recent years Origin Based Charging principle has been adopted by wholesale industry in some regions. It follows that correctness of CLI affects also charging between operators and lack of clear definition for valid CLI may lead to disputes between them.

In this regards, a valid CLI is defined as:

- It is transferred through P-Asserted Identity SIP header, according to RFC 3325 [5]
- It is one which complies with the format set out in the ITU-T numbering plan E.164 [2], meaning that “+” and “Country Code” have to be included in CLI and no national significant numbers are considered as valid CLI
- It has been designated as available for use in the Numbering Plan of the country it belongs to
- Should P-Asserted Identity SIP header be unavailable or not compliant to ITU-T numbering plan E.164, From SIP header can be used to determine CLI only for presentation purposes but not for Origin Based Charging

The recommendation for the SIP presentation rule is the following:

If PAI is present and it is a valid E.164 number, this could be used for presentation by end network; IPX provider handing over traffic to an end network could agree to meet interworking requirements of the end network.

Calls without a CLI, with invalid CLI, with manipulated CLI could be invoiced at the highest rate by the terminating carrier.

## 8. VoIP to TDM interworking considerations

Reference ITU recommendation for VoIP-TDM interworking is ITU-T Q.1912.5 [6]. This recommendation provides guidelines on SIP to BICC/ISUP interworking and viceversa. In particular, it specifies how incoming SIP signalling has to be mapped to ISUP. For this interworking scenario, there can be two cases affecting CLI definition:

1. The call signalling has a well formed P-Asserted-ID (PAI) header. In this case the ITU recommendation states that SIP PAI header has to be mapped to the ISUP Calling Party Number
2. The call signalling has no well-formed P-Asserted-ID (PAI) header. In this case ITU recommendation leaves room for interpretation since it states that it is a network option to either include a network provided E.164 number or omit the Address Signals of Calling Party Number.

As far as scenario 2 is concerned, recommendation is to omit Address Signals of Calling Party Number regardless of From header content. The rationale behind this recommendation is that for Origin Based Charging P-Asserted-ID is the only SIP header transferring valid CLI information.

## 9. P-Asserted-ID URI considerations

P-asserted-ID header may contain either Tel URI or SIP URI. For CLI identification purposes multiple P-Asserted-ID headers should not be used unless there is a P-asserted-ID containing Tel URI and/or a P-asserted-ID containing SIP URI and user=phone. In this case both type of URIs must contain the same phone number. If none of the above exist and contain a valid E.164 number, CLI will not be considered valid.

## 10. CLI management in case of diverted calls

In case of a diverted call, headers involved in CLI identification are either Diversion header or History info in SIP domain, Redirecting Number in the ISUP domain.

Since Origin Based Charging has been adopted, CLI identification has a meaning not only for presentation but also for applying different rates according to the origin of the call.

In a diverted call, that is A number calling B number with a diversion service to C number, looking into the B to C leg, these are the headers that identify each origin related number:

- A number: From and P-Asserted-ID [5] header (SIP), Calling Party Number (ISUP)
- B number: top most Diversion [7] or History-Info [8] header (SIP), Redirecting Number (ISUP)

So considering the B to C leg an operator needs to decide which is the correct CLI for presentation and for Origin Based Charging purposes.

Recommendation for presentation is to use A number, following the same rules previously described in this document.

Recommendation for Origin Based Charging is to use B number, since in case receiving a diverted call B number represents the actual incoming path.

The impact of this recommendation on Origin Based Charging varies depending of the combination of A and B numbers and the final destination of the call.