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NICC Document

SIP-NNI Basic Voice Architecture

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C2 General

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Foreword

This NICC Document (ND) has been produced by NICC SIP TG.

1 Scope

The present document provides the architecture and requirements for interconnection of basic voice services between networks using a session based protocol. Behaviour of the NNI should be broadly in line with PSTN expectations and provide at least the minimum information which would be needed for interconnection between networks which meet UK regulatory conditions.

2 References

2.1 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For non-specific references, the latest edition of the referenced document (including any amendments) applies.

[2] ND1016 Requirements on Communications Providers in relation to Customer Line Identification display services and other related services
[3] ND1035 Basic Call SIP NNI Profile
[4] ND1633 Next Generation Networks; Element Naming Framework
[5] ND1636 NGN Interconnect: IP Address Allocation
[6] ND1704 End-to-End Network Performance Rules & Objectives for the Interconnection of NGNs
[7] ETSI Directives
[8] IETF STD0013 : Domain names - implementation and specification
[9] ND1643 Minimum Security Requirements for Interconnecting Communication Providers
[10] ITU-T Recommendation E.164 (02/2005) The international public telecommunication numbering plan
[11] ITU-T Recommendation G.811 Timing characteristics of primary reference clocks
[12] The National Telephony Numbering Plan as specified by Ofcom
[13] ND1628 Securing Data Flows with IPSec for NGN Interconnects
[14] ND1435 SIP-NNI Basic Voice Test Manual
[15] ND1653 Overload Control for SIP in UK Networks

2.2 Informative references

[i.1] ND1017 Interworking between Session Initiation Protocol (SIP) and UK ISDN User Part (UK ISUP)
[i.2] ND1007 ISDN User Part (ISUP)
[i.3] ND1027 UK BICC for use between PLMNs
[i.4] ND1033 NGA Telephony SIP User Profile
[i.5] RFC 3550 A Transport Protocol for Real-Time Applications

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:
Key Words: The key words “shall”, “shall not”, “must”, “must not”, “should”, “should not”, “may”, “need not”, “can” and “cannot” in this document are to be interpreted as defined in the ETSI Drafting Rules in [7]

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

BICC	Bearer Independent Call Control
CLI	Calling Line Identifier
CP	Communication Provider
DTMF	Dual Tone Multi-Frequency
IP	Internet Protocol
ISDN	Integrated Services Digital Network
ISUP	ISDN user part of C7 signalling
IUP	Interconnect User Part
NGA	Next Generation Access
NGA-T	Next Generation Access Telephony
NNI	Network-Network Interface
PLMN	Public Land Mobile Network
PSTN	Public Switched Telephone Network
SIP	Session Initiation Protocol
SIP-I	Session Initiation Protocol with encapsulated ISUP
SLA	Service Level Agreement
UK	United Kingdom of Great Britain and Northern Ireland

4 Overview and Requirements

4.1 General

This document provides the architecture and requirements for a Network-Network Interface providing session based services. The general requirements forming the basis of interconnect are:

- The interface shall support the set-up and clear down of basic calls
- Behaviour of the NNI should be broadly in line with PSTN expectations and shall provide at least the minimum information which would be needed for interconnection between networks which meet UK regulatory conditions.
- The NNI shall support a means of loop prevention
- Each CP shall be responsible for the generation of session progress tones and announcements appropriate to its role
- Early media shall be supported

Additional requirements of the architecture are listed in the following sub-clauses.

Support for additional capabilities described in annexes is optional. Where an additional capability is supported it shall comply with the requirements described in the appropriate annex.

4.2 Digit Sending

En-bloc sending shall be supported.

4.3 Number Formats

The following number formats shall be supported:

- E.164 numbers as specified in [10] for both CLI and Called Party Number
- UK specific numbers as specified in [12] for Called Party Number

4.4 Charging and Accounting

Signalling across the NNI shall provide sufficient information for each CP to separately establish the start and end of the media session. There is no requirement to carry any further specific charging information including P-Charging-Vector.

4.5 CLIP/CLIR

Compatibility with ND1016 [2] shall be supported

Signalling across the NNI shall provide sufficient information to maintain compatibility when interworking with ISUP networks

4.6 Media Capabilities

- The media path used shall comply with ND 1704 [6]
- Use of G.711 A-law codec shall be supported as a default for interoperability
- Packetisation times shall be established according to standard SIP procedures
- The NNI shall support codec negotiation at call establishment
- The NNI may support mid-call codec renegotiation
  NOTE: When supported, this requirement does not mandate transcoding to occur at any particular point in the network
- Out of band transport for DTMF may be supported and should be used where the negotiated codec is not capable of transmission of DTMF inband
- Out of band transport for FAX may be supported and should be used where the negotiated codec is not capable of transmission of FAX inband. As an alternative, mid call codec renegotiation may be used to establish a suitable media path for transmission of FAX inband.

4.7 Overload Control

Signalling of overload conditions across the NNI is not required and networks should take unilateral actions to protect against overload. Optional support for signalling of overload control is specified in Annex C. This includes an effective method of unilateral action to protect against SIP overload.

5 Functional Requirements

5.1 Functional Model

The functional model is shown in figure 1.

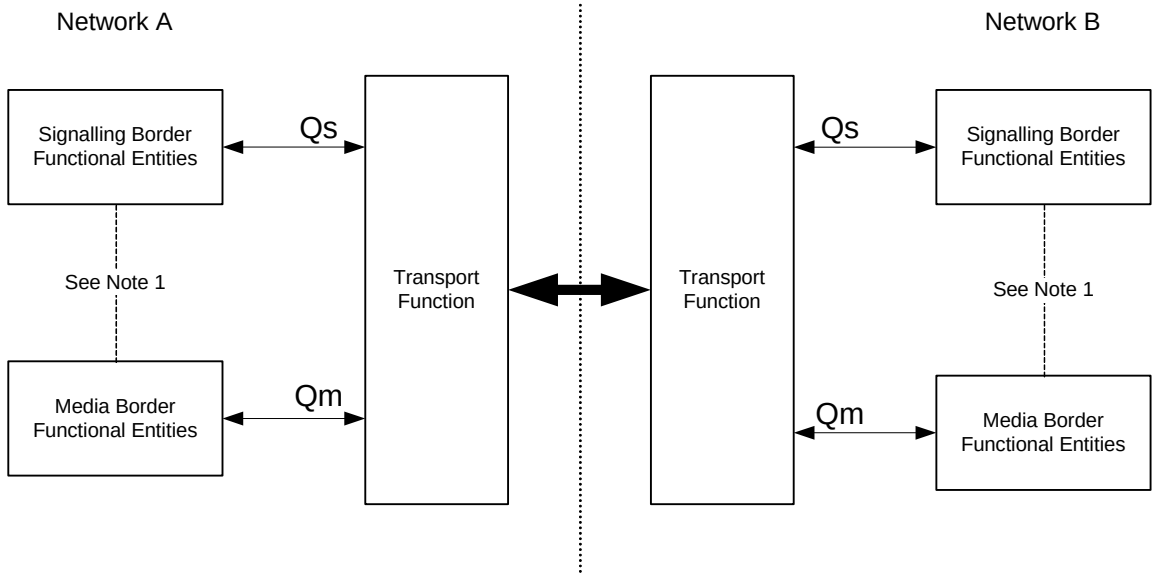

Figure 1 – SIP NNI Functional Model

Note 1: This line represents an interaction which may be direct or indirect. The information flows associated with this interaction are out of scope for this document.

The functional model is symmetrical about the point of interconnect.

5.2 Functional Entities

5.2.1 Signalling Functional Entities

The Signalling functional entities terminate the session/signalling flow. They may be realised using a call server, session controller or other device.

5.2.2 Bearer Functional Entities

The Bearer functional entities terminate the media flow. They may be realised using a media gateway, border controller or other device.

6 Interface Definitions

6.1 Signalling Interface (Qs)

6.1.1 Signalling Interconnect Use of the Transport Function

The signalling interface shall be carried over the IP capability of a transport function that may be reserved for signalling only, may be shared with media transport (Qm), or may be shared with other types of traffic.

Where VLANs are used, the traffic carried on one such VLAN shall not affect the capacity of other VLANs. Each VLAN may convey messages associated with one or more signalling associations. The dimensioning of each VLAN shall take account of the capacity required for peak load and loads encountered under fault conditions.

6.1.2 Signalling IP Addressing

An IP subnet shall be allocated, in accordance with ND1636 [5], for each signalling connection between the signalling border functions in each CP's network. Each device, IP interface, or other network element on the connection shall be allocated an agreed IP address from within this subnet. Each CP shall inform the other of the IP addresses to be used to communicate with each relevant signalling border function.

6.1.3 Bandwidth assigned for signalling

The bandwidth required for signalling should be determined by taking account of:

- the number of signalling paths carried
- the peak signalling rate of each of the signalling paths carried
- the failure modes and required resilience of the signalling capacity

6.1.4 Signalling Security

Signalling shall be protected from unauthorised access from inside or outside a communication provider’s network.

The signalling transport between networks should be secured by an IPSec tunnel in accordance with ND1628 [13].

6.1.5 Application Layer Protocol

The application signalling protocol should be SIP as profiled by any relevant NICC documents.

NOTE: At the time of publication the application signalling protocol for Qs defined in [3], meets the requirements of this architecture.

6.1.6 Signalling Transport Protocols

The signalling interface (Qs) may use UDP, TCP or SCTP.

6.1.7 Element Naming Scheme

This SIP URI naming scheme shall be used at the NNI for PSTN service but it should be noted that it is not intended for use at the UNI.

The SIP URI naming scheme should conform to ND1633 [4], using the format:

*<network internal part>***.***<local application ID>***.***<provider>***.***<NGN root domain>*

The NICC registered *<local application ID>* is "pstn" and should be used. However, ND1633 permits the use of other values as long as they contain numeric digits.

The *<network element identifier>* comprises *<network internal part>***.***<local application ID>*. The *<network element identifier>* shall identify the particular Signalling Border Functional Entity within a CP's network and is allocated by the owner of the registered *<provider>* (or equivalent) name. The owner of the registered *<network element identifier>* shall ensure that the *<network element identifier>* is unique to each Signalling Border Functional Entity within their network. The *<network element identifier>* may contain a series of labels, separated by dots.

Typical examples of SIP URI names that are fully compliant with ND1633 [4] are depicted in Table 6.1.7.a.

Table 6.1.7.a : Examples of preferred domain names based on this scheme

Network Internal Part	Local Application ID	Provider	NGN Root Domain	Consequent Domain Name
cs-23	pstn	exampletelco	uktel.org.uk	cs-23.pstn.example-telco.uktel.org.uk
	cs-23	exampletelco	uktel.org.uk	cs-23.example-telco.uktel.org.uk

Where a naming scheme other than that specified in ND1633 [4] is used, it shall be compliant with STD0013 [8] and shall comply with the permissible characters described in Section 4.2.1 and overall length described in Section 4.2.2 of ND1633 [4]. Typical examples of SIP URI names are depicted in Table 6.1.7.b.

Table 6.1.7.b : Examples of acceptable domain names

Network Element Identifier	Provider domain	Consequent Domain Name
cs-23	exampletelco.co.uk	cs-23.exampletelco.co.uk
cs-23	exampletelco.com	cs-23.exampletelco.com

6.1.8 SIP URI to IP Address Binding

The binding of SIP URI to IP address shall be passed as management information at the time of service establishment or as a result of any subsequent modifications.

6.2 Media Stream Interfaces (Qm)

6.2.1 Media Stream Definition and Announcement

The media stream shall be announced across the signalling interface (Qs) using the Session Description Protocol (SDP).

6.2.5 Media Stream Synchronisation

The basic voice SIP-NNI is not a reliable source for the provision of a clock synchronisation service.

In order to meet the required media slip rate for voice service types, each interconnecting network shall be synchronised to a clock source in accordance with ITU-T recommendation G.811 [11] by an independent means or shall be synchronised by an equivalent scheme.

6.2.6 Monitoring of IP Media Streams

The interface should carry RTCP packets between packetisation end points, which enable the following parameters to be monitored:-

- Delay
- Packet loss
- Jitter

This may be achieved using the Sender Reports described in the Real Time Control Protocol (RTCP) specified in IETF RFC 3550 [i.5].

6.2.7 Media Security

Authentication or encryption of the content of a media stream shall not be required.

7 Interworking Requirements

The service features described in clause 4 shall be interoperable with the same feature provided in the existing PSTN, PLMN and PSTN/PLMN-like networks. This is expected to require protocol interworking.

Note: To simplify the UK standards, it is expected that any interworking should be defined once, and may be achieved implicitly using concatenation of existing interworking specifications. Thus, if UK standards for interworking describe SIP to SIP-I and SIP-I to BICC, then interworking SIP to BICC should be considered as covered, and a separate interworking specification may not be required.

Signalling across the NNI shall interwork to at least:

- UK SIP-I [i.1];
- UK ISUP [i.2];
- UK BICC [i.3];
- NGA-T [i.4]

8 Management Requirements

8.1 Bandwidth Management

Each network shall ensure the traffic levels offered to the interconnect remain within the agreed SLA. Support of preconditions is not required.

8.2 Traffic Monitoring

It should be possible to determine where/when failures have occurred. RTCP should be supported and its usage is to be strongly recommended.

9 Test & Diagnostics Requirements

The requirements for SIP-NNI Basic Voice test and diagnostics shall be as specified in ND1435[14].

10 Security Requirements

The identity of the party being interconnected to should be verified. No security assumptions should be made about the other network i.e. they are considered insecure.

Either or both networks may hide their topology.

The requirements set in ND1643 [9] shall be complied with.

Annex <A> (normative): Emergency Calls

Support for this annex is optional and to be agreed bilaterally between connecting CPs.

Where Emergency Calling is supported it shall comply with the following requirements:

- Priority conveyance of emergency calls should be supported.
- The Interface specification shall support a mechanism to signal call priority, however its use is optional
- Use of the signalling mechanism for priority is optional

Annex <B> (informative): Call Diversion

Support for this annex is optional and to be agreed bilaterally between connecting CPs.

Where Call Diversion is supported it shall comply with the following requirements:

- The NNI shall support signalling of the identity of a diverting party
- The NNI shall support a means of loop prevention for diverted calls

Annex <C> (informative): Signalling of Overload Control

Support for this annex is optional and to be agreed bilaterally between connecting CPs.
Where signalling of overload control is supported it shall comply with the requirements set out in ND1653 [15].

History

Document history		
1.1.1	June 2013	Initial publication
1.2.1	November 2020	Second publication with new section 4.7 and Annex C; also addressing minor editorials
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