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NICC Document

BICC/IP Connectivity for PLMN Services between NGNs

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Foreword

This NICC Document (ND) has been produced by NICC

Introduction

This specification forms part of the Next Generation Network, Multi-Service Interconnect (MSI) Release Structure and ought to be read in conjunction with the associated releases of the standard ‘Multi-Service Interconnect of UK Next Generation Networks’

1 Scope

This specification defines the connectivity of PLMN services between UK NGNs using BICC/IP technology. It is intended to support all relevant PLMN bearer services, teleservices and supplementary services.

This specification defines the service architecture and how it is supported by the MSI Common Transport Specification [2] that supports logical network layer point-to-point connectivity with dedicated bandwidth as the transport between communications providers (CPs). This document does not cover the facilities to support a transport function that utilises an IP routed, multi-point, interconnect network. However, it is not intended to preclude the deployment of such a layer 3 routed interconnect between CPs.

2 References

For the particular version of a document applicable to this release see ND1610 [1].

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.

[1] ND1610 Next Generation Networks, Release Definition

[1] ND1611 "Multi-Service Interconnect Common Transport for UK NGNs".

[2] ND1613 "Management of NGN Interconnect: Transport Service Layer"

[4] ND1628 "Security"

[5] ND1633 "Next Generation Networks; Element Naming Framework"

[6] ND 1636 "NGN Interconnect – IP Address Allocation"

[7] ND 1640 "Architecture for SS7 Signalling Transport Service between Next Generation PLMNs"

[8] Void

[9] ND1012 "Interconnect Stream Control Transmission Protocol (SCTP) and Adaptation Layers"

[10] Void

[11] ND1701 "Recommended Standard for the UK National Transmission Plan for Public Networks"

[12] ND1704 "End-to-End Network Performance Rules & Objectives for the Interconnection of NGNs"

[13] ETSI TS 123 205(V 4.11.0) "Universal Mobile Telecommunications System (UMTS); Bearer-independent circuit-switched core network;Stage 2"

[14] ETSI TS 123 153(V 4.14.0) "Universal Mobile Telecommunications System (UMTS); Out of band transcoder control; Stage 2"

[15] ETSI TS 129 415(V 4.4.0) "Universal Mobile Telecommunications System (UMTS); Core Network Nb Interface User Plane Protocols"

[16] ETSI TS 128 062(V 4.6.0) "Universal Mobile Telecommunications System (UMTS); Inband Tandem Free Operation (TFO) of speech codecs; Service description; Stage 3"

[17] Void

[18] RFC 768 Aug 1980 "User Datagram Protocol"
[19] RFC 2474 Dec 1998 "Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers"
[20] RFC 3550 July 2003 "RTP: A Transport Protocol for Real-Time Applications"
[21] RFC 3551 July 2003 "RTP Profile for Audio and Video Conferences with Minimal Control"
[22] RFC 4556 July 2006 "SDP: Session Description Protocol"
[23] IEEE STD 802.1q: "Virtual Bridged Local Area Networks"

2.2 Informative references

[24] IETF RFC 792: "Internet Control Message Protocol"
[25] ITU-T Q.1970 "BICC IP Bearer Control Protocol (IPBCP)"

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the [following] terms and definitions apply:

Next Generation PLMNs: The term refers to PLMNs that have separated control and bearer planes built upon an IP infrastructure.
VLAN: Where used in this document the term VLAN refers to an Ethernet Static VLAN

3.2 Abbreviations

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

BICC	Bearer Independent Control Protocol
CP	Communications Provider
DSCP	Differentiated Service Code Point
ETSI	European Telecommunication Standards Institute
IETF	Internet Engineering Task Force
IP	Internet Protocol
IPBCP	IP Bearer Control Protocol
IuFP	Iu Framing Protocol
ISDN	Integrated Services Digital Network
ISUP	ISDN User Part
ITU-T	International Telecommunication Union – Telecoms
MSI	Multi-Service Interconnect
NGN	Next Generation Network
PLMN	Public Land Mobile Network
RTP	Real-time Transport Protocol
SCTP	Stream Control Transmission Protocol
SDP	Session Description Protocol
TFO	Tandem Free Operation
TrFO	Transcoding Free Operation
UDP	User Datagram Protocol
VLAN	Virtual Local Area Network

4 PLMN service level functional architecture

The PLMN Functional Architecture defines the interconnect interfaces between two UK Next Generation PLMN Networks with relationship to the NGN's internal logical network functions.

4.1 Conventions used in the Architecture Figures

The convention used in labelling the functional architecture is as follows:-

- All logical functions and interfaces are labelled with an alpha/numeric identifier.
- All logical functions' identifiers begin with the letter 'f'.
- All interconnect interfaces' identifiers begin with the letter 'i'.
- The second letter of an identifier (function or interface) indicates if it is associated with the Control plane(C) or the Bearer plane (B). 'T' denotes functions or interfaces associated with the MSI Common Transport Specification [2] and 'S' denotes functions or interfaces associated with the signalling transport service specification [7]. E.g. iC5 is control plane interface number 5.
- All functions and interfaces that have their own separate technical definition are labelled with a number unique to the identifier type. E.g. fC1 and iC1 are different defined entities as are iB1 and iB2.
- Multiple instances of separate functions or interfaces that have the same definitions have the same identifier root but are differentiated by appending an alpha letter to the root identifier, e.g. Interfaces with the same root identifier and number and a different suffix letter such as iB1a, iB1b, etc indicate separate instances of the same interface type and definition.
- Green lines between functions indicate logical internal relationships within the NGN which are not defined.
- Red lines indicate interconnect interfaces for the common transport capabilities in the bearer plane.
- Blue lines indicate service level interfaces that sit on top of the associated underlying common transport capabilities.

4.2 Interconnect Architecture Definition

The PLMN Functional Architecture defines logical network functions and interconnect interfaces between two mobile Next Generation Networks, PLMN A and PLMN B. It shows the static relationships between functions and the interconnect interfaces between mobile NGNs. The functional architecture is divided into control and bearer planes and defines the properties of the functions and interfaces (see Figure 1). Note that the functional architecture is capable of being realised within a mobile NGN in a number of ways and that no physical implementation is implied.

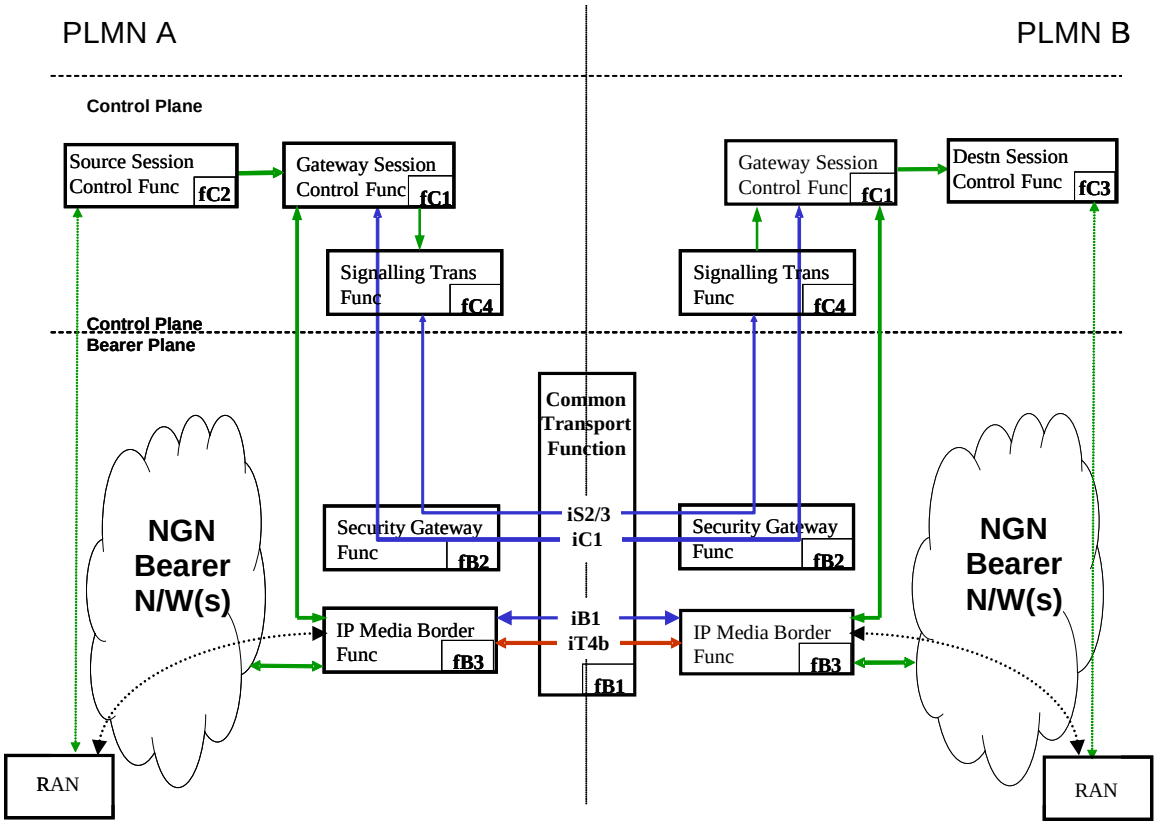

FIGURE 1: FUNCTIONAL ARCHITECTURE FOR PLMN GENERIC CONNECTIVITY

4.3 Functional Component Description

4.3.1 Control Plane Functions

4.3.1.1 Source Session Control Function (fC2)/ Destination Session Control Function (fC3)

Both components **shall** provide the MSC functionalities as defined in ETSI TS 123.205. The Source Session Control Function controls the originating terminal that is setting up a session, whilst the Destination Session Control Function controls the end terminal receiving a session set-up. Both of them route signals to the Gateway Session Control Function within its own network when they determine the routeing requires to be passed through an interconnect point.

4.3.1.2 Gateway Session Control Function (fC1)

The Gateway Session Control Function **shall** provide GMSC functionalities as defined in ETSI TS 123.205. It provides the co-ordination intelligence for controlling the other functional elements associated with the interconnection.

The Gateway Session Control Function:

a) **shall** interact with other session control functions within its own network in order to manage session egress or ingress for the interconnection point it controls. i.e. Source and Destination Session Control Functions (fC2 & fC3).

b) **shall** ensure that the media type and characteristics that are requested in the signalling are compatible with the service as defined in the media stream definition and announcement section (see section 5.4.3). Session requests that do not have compliant media parameters **shall** be rejected in line with section 5.4.1.3.

c) **shall**, during session establishment, determine that there is the required bandwidth for the bearer session as requested in the signalling.

d) **shall** control the use of the Media Border Function (fB3) when present. See section 5.3.2.3.

e) **shall** prevent unconstrained circular routeing by supporting the hop counter procedure as defined in the associated protocol specification.

f) **should** produce call detail records which **may** contain any of the following:-
   i. Call time and date.
   ii. Call duration.
   iii. Source and destination IP addresses between the IP Media Border Function (fB3) and the termination inside the NGN as well as the IP address between the IP Media Border Functions of the peer networks (fB3-fB3) for fault analysis between CPs.

4.3.1.3 Signalling Transport Function (fC4)

The service defined in this specification uses the signalling transport capabilities (iS2/iS3) of the signalling transport service specification as defined in ND 1640 [7]. The Signalling Transport Function is equivalent to the fS3 functional component defined in ND 1640 [7] where associated signalling transport architecture is chosen or the aggregation of the fS3 and fS4 components where quasi-associated signalling transport architecture is chosen.

4.3.2 Bearer Plane Functions

4.3.2.1 Transport Function (fB1)

This service uses the IP capabilities (iT4) of the common transport specification as defined in ND1611 [2] and in accordance with clause 7 of the present document.

4.3.2.2 Security Gateway Function (fB2)

This service uses the security gateway function component as defined in ND 1640 [7] and in accordance with clause 9 of the present document.

5.3.2.3 Media Border Function (fB3)

The IP Media Border Function **shall** provide the Media Gateway functionalities as defined in ETSI TS 123.205. It provides policing of media traffic between networks carried via transport interface iT4b.

The Media Border Function:

a) **should** allow the connection of RTP streams, within its own network (with associated IP address space and UDP port numbers) and the RTP streams at the interconnect, with different or overlapping IP address spaces and sets of UDP port numbers.

b) **should** provide an IP security enforcement point between the NGN and the interconnection space applying policies that only allow IP address and port numbers from agreed sources into the network operator's NGN

c) **shall** detect the loss and reestablishment of communications with its peer Media Border Function and **shall** support monitoring requests from its peer (See section 9.2).

4.4 Interface Definitions

4.4.1 Signalling Control Interface (iC1)

4.4.1.1 Application Layer Protocol

The application signalling protocol for iC1 **shall** be the UK Bearer Independent Control Protocol (BICC) as defined in the associated protocol specification.

4.4.1.2 Signalling Interconnect Use of the Signalling Transport Service (iS2/iS3)

The delivery of application layer protocol uses the signalling transport service as defined in ND 1640 [7] which specifies signalling interfaces carried over the IP capability of the common transport function. The iC1 interface defined in this document is a particular instance of the iS1 interface in ND 1640. It **shall** use the iS2 or iS3 capabilities as defined in ND1640 dependent upon the signalling network architecture chosen.

4.4.1.3 Unsupported Media Types

If the media type and characteristics that are requested in the signalling are not compatible with the PLMN service as defined in the media stream definition and announcement section (see section 5.4.4) the call setup request **shall** be rejected with a BICC cause value 79, 'Service or option not implemented, unspecified'.

4.4.1.4 Overload Control

CPs **shall** have restriction capabilities over traffic towards interconnected PLMNs to prevent overloading peer networks.

Note: Traffic overloads can be dynamically controlled, if supported at both ends, using the UK Automatic Congestion Control mechanism defined in the associated protocol specification.

4.4.1.5 Transcoding Free Operation (TrFO)

The TrFO capability as defined in ETSI TS 123.153 [14] **shall** be supported.

4.4.1.6 Dual-Tone Multi-Frequency (DTMF)

DTMF signals **shall** be transported out-of-band using the mechanism defined in the associated protocol specification.

4.4.2 Media Stream Transport Interfaces

4.4.2.1 Media Stream use of the Common Transport Capability (iT4b)

The media stream interface **shall** be carried over the IP capability of the transport function (iT4b) on a trail of fixed bandwidth reserved for media streams only.

4.4.3 Media Stream Definition and Announcement (iB1)

The iB1 interface **shall** behave as the Nb interface defined in ETSI TS 123.205[13]. The media stream **shall** be announced across the signalling interface (iC1) using the ITU-T Recommendation Q.1970 "BICC IP Bearer Control Protocol (IPBCP)" as modified by the associated protocol specification and the Session Description Protocol (SDP) [22]

The coding types supported by the NGN for PLMN service **shall** be:

- G.711 A-law 20ms
- 64kbs Transparent or Clearmode
- WB-AMR 20ms

NOTE: High-definition voice service is enabled between two mobile NGNs for WB mobile terminals

The media stream transport **shall** use the User Datagram Protocol (UDP) described in IETF RFC 768 [18], the Iu Framing Protocol (IuFP) described in ETSI TS 129.415 [15]**,** and the Real-Time Transport Protocol (RTP) described in IETF RFC 3550 [20].

The RTP payload type (PT) header field identifies the RTP payload format, and the mapping of payload type codes to payload formats **may** be static or dynamic (static means that the same code is bound to a particular format for all calls, whereas dynamic means that the code associated with a particular payload format may change from call to call). The number range 96-127 **shall** be reserved for dynamic assignment of payload type numbers in accordance with RFC 3551 [21].

The media stream **shall** only support symmetric RTP (i.e. originating and terminating media flows use the same IP address and port number).

4.4.3.1 Tandem Free Operation (TFO)

The in-band TFO negotiation mechanism as defined in ETSI TS 128.062 [16] **shall** be supported across the iB1 interface.

4.4.3.2 Packet Loss

Refer to "ND 1704: End-to-End Network Performance Rules & Objectives for the Interconnection of NGNs" [12] for information on packet loss.

4.4.3.3 Delay and Packet Delay Variation

Refer to "ND 1704: End-to-End Network Performance Rules & Objectives for the Interconnection of NGNs" [12] for information on delay and packet delay variation, except this document assumes

that a maximum of four CP networks will be involved in any call between interconnected Next Generation PLMNs in the UK, and the default packetisation time is 20ms.

Note: A maxium of four CP networks will be involved in a normal call is a prelimary assumption and needs to be further studied. It is only valid on the basis that the UK CDB is implemented for call routing.

4.4.3.4 Echo control

Refer to " ND 1704: End-to-End Network Performance Rules & Objectives for the Interconnection of NGNs" [12] for information on echo control.

4.4.3.5 Media Stream Synchronisation

The multi service interconnect is not a reliable source for the provision of a clock synchronisation service.

In order to meet the required media slip rate for PLMN service types, each interconnecting network **shall** be synchronised to a clock source in accordance with ITU-T recommendation G.811 by an independent means. Further guidance is available in Recommended Standard for the UK National Transmission Plan, NICC.[11].

5 Packet / Frame Marking

In order to introduce new and as yet undefined services to the MSI without changing this service, IP packet marking (DSCP) [18] or Ethernet frame marking [23] are not used. Media and signalling rely on being carried in independent VLANs, each with its own shaped and policed bandwidth, as a service provided by the Common Transport Function [2]. Therefore, these packet marking fields **should** be ignored**.**

6 IP Addressing

6.1 Version of Internet Protocol

This is defined in ND 1636 [6]

6.2 IP Address Ranges

This is defined in ND 1636 [6]

6.3 Network Address Translation

This is defined in ND 1636 [6]

6.4 Signalling IP Address Allocation

Refer to ND 1640 [7] for rules on signalling IP address allocation.

6.5 Media Stream IP Address Allocation

An IP subnet **shall** be allocated for each media trail connection (VLAN) between the media border functions in each CP's network. Each media border function **shall** be allocated a specific IP address within this subnet.

7 RESILIENCE

7.1 Definitions of Terms in this Section

A Signalling Link is a signalling connection between two signalling transport functions. A Media Route is managed bandwidth between paired, peer Media Border Functions.

7.2 IP Connectivity Failure Detection

Signalling plane IP connectivity **shall** be monitored as per specified in ND 1640 [7]
Media plane IP connectivity **should** be monitered by the Media Border Function. If the IP connection between Media Border Functions has failed then the Gateway Session Control Function **shall** be notified so that it **shall not** establish new sessions across that interconnect until the connection is re-established.

7.3 Signalling Resilience

Signalling plane resilience **shall** be provided by the signalling transport service as defined in ND 1640 [7].

7.4 Media Path Resilience

Media Routes may have resilience provided at the common transport function layer. The media stream for all sessions / calls in progress might be lost in the event of a Media Route failure that is not protected by common transport function layer mechanisms.

Resilience **should** be provided at the application layer via alternative routeing mechanisms within an originating NGN’s session control functions. In this case, when a session is being established, if the Gateway Session Control Function detects that a particular interconnecting Media Route is unavailable, through Media Route failure, it **should** select an alternative Media Border Function on a different Media Route if such exists, or notify the Source Session Control Function to direct the session setup to a Gateway Session Control Function that controls an alternative Media Route.

8 Security

8.1 Signalling Security

Signalling security **shall** be provided by the security gateway function as defined in ND 1640 [7].

8.2 Media Security

Authentication or encryption of the content of a media stream **shall not** be required between the Media Border Functions (fB3) on an interconnect.

History

Document history		
V1.1.1	2010	CA Approved for Publication