

## **NGN; MTP3 over IP Interconnect between PLMNs using M2PA Protocol**

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## Foreword

This NICC Document (ND) has been produced by NICC Application protocols Working Group.

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## Introduction

The present document forms a part of a series of specifications defining the use of IP Transport between Next Generation PLMNs. The present specification contains the functionality of ND1005 and "IETF Standards Track RFC4165, Signalling System 7 (SS7) Message Transfer Part 2 (MTP2) - User Peer-to-Peer Adaptation Layer (M2PA)".

The use of SCTP based IP interconnect may be a requirement due to a number of reasons such as (a) the deployment of SIP based NGN interconnect and (b) due to the sheer volume of SS7 signalling traffic. CPs may also use SCTP links to carry existing SCCP (e.g., roaming and SMS) traffic by utilising the IP infrastructure that the CP deploys for the NGN SIP based interconnection or for any other reasons.

In addition, the CPs may also use the BICC or ISUP interconnect as an alternative option for SIP based interconnects. This specification may also be beneficial for all such SS7 over IP interconnect requirements.

Although a number of manufactures extended the M3UA protocol for supporting Peer-to-Peer communication between Signalling Gateways of the Public Networks, the IETF M2PA protocol is the standardised protocol that supports Peer-to-Peer communication between Signalling Gateways (and hence provides interoperability in a multi vendor environment).

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# 1 Scope

The present document specifies the use of MTP layer 3 signalling carrying a multiplicity of User Parts conveyed over an IP interconnect using M2PA protocol to, from or between Next Generation PLMNs. This document forms part of a series of specifications defining the use of IP transport for SS7 Signalling Transport Service between PLMNs.

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## 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
- [2] RFC4165: Signalling System 7 (SS7) Message Transfer Part 2 (MTP2) - User Peer-to-Peer Adaptation Layer (M2PA), IETF Standards Track
- [3] ND1028: UK Interconnect use of SCTP
- [4] ND1107: UK Interconnect use of SCCP & MTP
- [5] ND1005: C7 Interconnect Message Transfer Part (MTP)
- [7] ND1640: Architecture for SS7 Signalling Transport Service between PLMNs
- [8] ND1001: Use of SS7 point codes for network interconnect in the UK
- [9] Q.703: Specifications of Signalling System No. 7 Message transfer part - Signalling Link, ITU-T Recommendation
- [10] Q.704: "Specifications of Signalling System No. 7 Message transfer part - Signalling Network Functions and Messages", ITU-T Recommendation
- [11] Q.707: Specifications of Signalling System No. 7 - Testing and Maintenance, ITU-T Recommendation
- [12] Q.752: Specifications of Signalling System No. 7 - Operations Maintenance and Administration Part (OMAP), ITU-T Recommendation

### 2.2 Informative references

- [i.1] Q.700: Specifications of Signalling System No. 7 - Introduction, ITU-T Recommendation
- [i.2] Q.701: Specifications of Signalling System No. 7 Message transfer part - Functional Description, ITU-T Recommendation

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# 3 Definitions, symbols and abbreviations

## 3.1 Definitions

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

**Signalling link:** A MTP link corresponds to an SCTP association as defined in RFC4165 [2].

**SCTP multi-homing:** The SCTP association may consist of multiple paths with a recovery procedure using SCTP multi-homing that detects a failure of a network path and changes over to another path of the same SCTP association as defined in ND1028 [3].

## 3.2 Symbols

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

§ Clause Number

## 3.3 Abbreviations

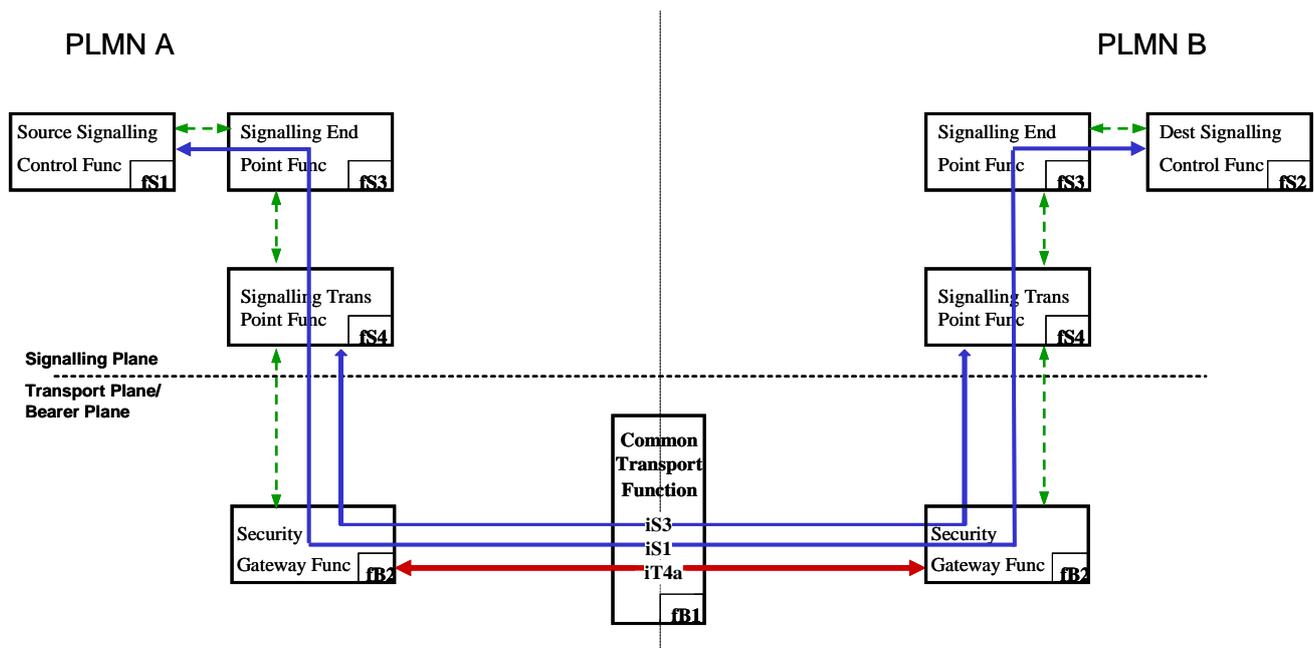
For the purposes of the present document, the following abbreviations apply:

BICC	Bearer Independent Call Control
CP	Communications Provider
ETSI	European Telecommunications Standards Institute
ITU-T	International Telecommunications Union – Telecommunications Standardisation Sector
IETF	Internet Engineering Task Force
IP	Internet Protocol
ISC	Interconnect Standards Committee (replaced by TSG WP)
ISDN	Integrated Services Digital Network
IPSP	IP Signalling Point
ISUP	Integrated Services User Part
ITU-T	International Telecommunications Union - Telecommunications Standardization Sector
MTP	Message Transfer Part of ITU-T Signalling System Number 7
MTP2	MTP Layer 2 protocol (Signalling Link)
MTP3	MTP Layer 3 Protocol (Signalling Network)
M2PA	Message Transfer Part User Peer-to Peer Adaptation Layer
NGN	Next Generation Network
NICC	Network Interoperability Consultative Committee
NTP	Network Termination Point
PNO-IG	Public Network Operators' – Interest Group (replaced by TSG)
PNO-ISC	Public Network Operators' – Interconnect Standards Committee (replaced by TSG)
PSTN	Public Switched Telephone Network
PLMN	Public Land Mobile Network
QoS	Quality of Service
RFC	Request for Comments
SCTP	Stream Control Transmission Protocol
SCCP	Signalling Connection Control Part
SEP	Signalling End Point
SS7	Signalling System Number 7
SSCOP	Service Specific Connection Oriented Protocol
SMS	Short Message Service
SPAN	Services and Protocols for Advanced Networks
SGW	Signalling Gateway
TFC	Transfer controlled message
TDM	Time Division Multiplexing

TSG Technical Steering Group  
UK United Kingdom of Great Britain and Northern Ireland

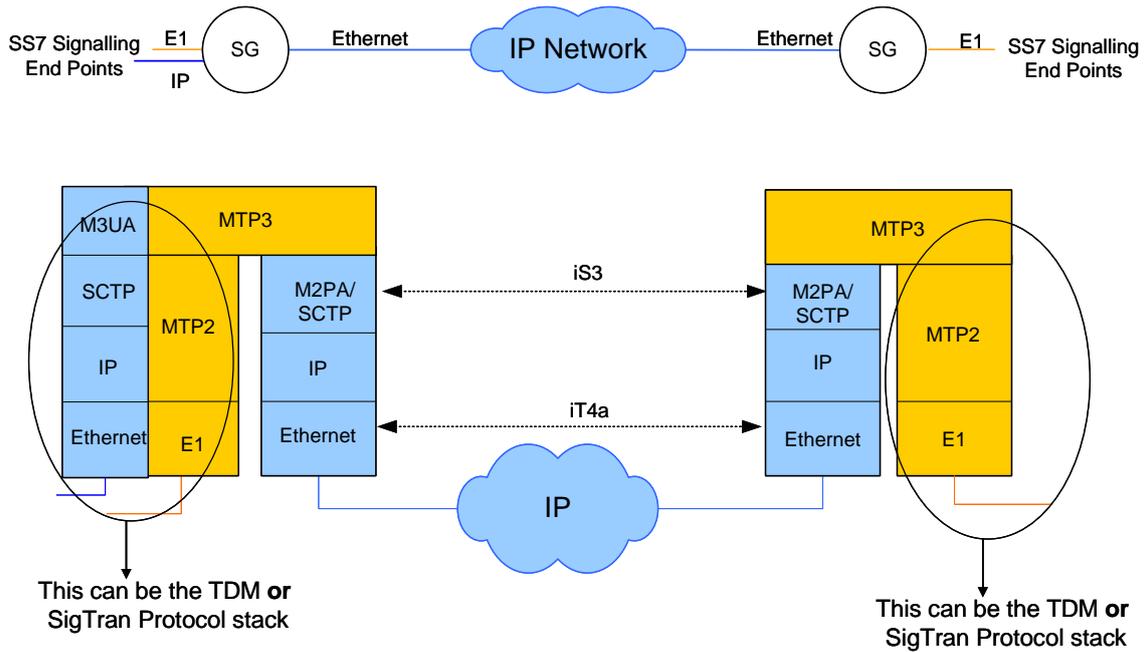
## 4 Functional Architecture

BICC and other MTP3 user protocols can be carried over the packet based interconnect between PLMNs in accordance with the architecture defined in ND1640 "Architecture for SS7 Signalling Transport Service between PLMNs"(see figure 1). The present ND is specified to meet the service and architectural requirements described in ND1640 [7], however this doesn't preclude the protocol specification to be used by other service architectures defined by NICC in the future.



**Figure 1: Quasi-associated signalling – (ND1640 [7])**

This architecture supports the peer-to-peer communication between Signalling transfer functions of the Public Networks using UK M2PA layer protocol, which supports the bearer related and non-bearer related protocol over the iS3 interface carried by IP/Ethernet (iT4a) links. An example protocol stack is shown in Figure 2 for informative reasons.



**Figure 2: An Example Protocol stack of the M2PA Signalling Transfer Point**

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## 5 Use of MTP

The present clause supersedes the requirements for STP interworking given in ND1005 [5] Clause 3. The style used is taken from the same so that comparison is made easy for the reader.

### 5.1 Treatment of Spare Bits and Additional Fields in Level 3 received Messages.

Reference Q.700; Q.701, §6; Q.704, §15; RFC4165, §2.3

Spare bits not coded to zero, and/or additional fields, received in an otherwise recognisable valid message, **SHALL NOT** affect the processing of that message. No attempt **SHALL** be made to interpret or process such spare bits or additional fields. This does not apply to spare values of defined fields, nor remove the requirement that spare bits **SHALL** be coded to zero.

### 5.2 Point Code Allocation

Reference Q.701, §3.2.1; RFC4165, §2.3

UK Point Code numbering scheme applies as described in ND1101 [8].

### 5.3 Time-out Values

Reference Q.704, §16.8; Q.707, §5.5

The time-outs **SHALL** be set to values in the ranges specified in the references above.

### 5.4 Signalling Network Management

References Q.704, §1.3, §3.1.3, §3.4.3, §3.5.3, §4, 7, §13.4, §13.5, §13.9

Transfer Restricted and Signalling Route Set Congestion Test procedures **SHALL NOT** be used. The TFR and SRSCT messages, if received, **SHALL** be treated as unrecognised messages. If a message is received for an unavailable destination (including when the destination is not in the routing tables), then the TFP sending procedures **SHALL** be invoked. The footnote against Q.704 §13.2.2 iii) **SHALL NOT** apply.

### 5.5 Routing of Messages

Reference Q.704, §2.3

If the configuration of the interconnect interfaces are such as to make circular routing of messages possible under route failure conditions, then a means of overcoming this problem **SHALL** be agreed between the interconnecting CPs.

### 5.6 Load Sharing Among Linksets

Reference Q.704, §2.3.2

At any signalling point, or signalling transfer point, all messages for any given destination point code, **SHALL** be carried by the same link set. The ability to share traffic for a given destination

point code over a number of link sets in a route set is not mandatory, and **SHALL NOT** be used between interconnecting CPs, unless by specific agreement between the CPs concerned.

## 5.7 The Number of Links in a Linkset

Reference Q.704, §2.3; RFC4165§ 4.1.2

A link set **SHALL** contain sufficient number of links to carry planned traffic subject to a minimum of 1 and a maximum of 16.

## 5.8 Load Sharing within a Linkset

Reference Q.704, §2.3.2

The choice of a link within a link set on which a message may normally be transmitted **SHALL** depend on the value of the Signalling Link Selection (SLS) field, the number of links in the link set, and the load sharing algorithm employed. Exceptionally it **SHALL** be possible to direct certain messages to particular links. The traffic **SHALL** be distributed evenly across the links in a linkset (i.e., across associations in the set of associations between two signalling points). Any suitable algorithm that produces an even distribution of SLS field values, to available Signalling Links (SLCs), may be employed. The difference in the number of SLS values allocated to any two available SLCs in a given linkset, **SHALL NOT** be greater than one.

## 5.9 Signalling Route Availability

Reference Q.704, §3.4

A signalling route **SHALL** also be considered unavailable if locally detected failures mean that signalling traffic to or towards the concerned destination cannot be transmitted over the concerned link set. Similarly a signalling route **SHALL** become available only when the signalling point becomes aware that all causes, locally or remotely detected, of its being unavailable have been removed. Transfer Restricted state **SHALL NOT** be used.

## 5.10 Signalling Network Congestion

Reference Q.704, §11.2.3, §11.2.4, §11.2.5; RFC4165, §5.5, §5.6

The national option of multiple link congestion states without message priority **SHALL** be used. The national procedure with the congestion priorities (Q.704 §13.7) and that of the International Network (Q.704 §13.6) **SHALL NOT** be used.

It is required to indicate 3 levels of congestion in the Transfer Controlled Message. In order to make the procedure compatible with earlier procedures, the coding 00 of the spare bits in the TFC **SHALL** not be used in transmitted TFC messages, and, if coding 00 is marked in a received TFC message, it **SHALL** be interpreted as indicating congestion at Level 2. Hence, the TFC spare bits **SHALL** be coded as follows;

**Table 1 Coding of Congestion Levels**

00	Not Used. If received, read as Congestion Level 2
01	Congestion Level 1
10	Congestion Level 2
11	Congestion Level 3

The option of congestion priorities **SHALL NOT** be used. ND1107 [4] gives additional guidance on setting congestion levels.

NOTE: The method of determining the congestion level is implementation dependent.

## 5.11 Signalling Link Unavailability

Reference Q.704, §4.3, §4.4; RFC4165 §4.1.7, §4.2.3

The load sharing requirement in 5.8 **SHALL** apply not only to normal operation, but also under conditions when M2PA link changeover and change back procedures have to be invoked.

## 5.12 Signalling Point Restart

Reference Q.704, §9

Interconnecting CPs **SHALL** determine the requirements for SP restart. Note that the Blue Book SP Restart procedure is inadequate and **SHALL NOT** be referenced. The requirement **SHALL** be either, that based on the Red Book National Option of §12.4.2.b) (text repeated below), or that in § 9 of ITU-T Recommendation Q.704 (1996).

*“A SRST message is sent from a signalling point ..... When a previously unavailable link set, directly connecting the signalling point with a signalling transfer point (STP), becomes available. In this case SRST messages sent to the STP refer to all destinations which in the absence of failures are accessible via the STP. Implementation of this item is a national option.”*

Refer also to ND1107 [4] “UK Interconnect use of MTP & SCCP”, which provides additional guidance on SP restart selection

## 5.13 Management Inhibiting

Reference Q.704, §10

Management Inhibition **SHALL NOT** be mandatory over the interface, but **MAY** be supported subject to agreement between the CPs concerned.

## 5.14 Link Management Procedures

Reference Q.704, §12; RFC4165 §4

The basic set of link management procedures as described in Q.704, §12.2, including link set emergency restart (§12.2.4.2.), **SHALL** be provided. The required M2PA modifications to those procedures are defined in RFC4165 §4.

## 5.15 Initial Testing of Signalling Links on Activation and Restoration

Reference Q.704, §12.2; Q.707, §2.2

On activation and restoration, if the initial alignment procedure is successful, a Signalling Link Test (SLT) procedure **SHALL** be carried out on the signalling link, over which traffic is to be conveyed.

The test which **SHALL** be made in accordance with Q.707, may be initiated automatically or manually. This **MUST** be successful before signalling traffic is allowed onto the link. If the procedure is not successful, then, in addition to a management system being informed, either processor outage **SHOULD** be set on the link concerned (i.e. Status Processor Outage message **SHOULD** be transmitted), or alternatively the link **SHALL** be marked as out of service and Link Status Out of Service message sent. This is to prevent the distant end from using the link, even if its own link test procedure is successful, and thus to avoid the possibility of a one way signalling relation. Whichever condition is set, it **SHALL** only be removed on instruction from management. The periodic generation of Signalling Link Test messages **SHALL NOT** be used. However, if a request for SLT is received, the normal response **SHALL** be given.

## 5.16 Automatic Allocation of Signalling Data Links

Reference Q.704, §12.6

The MTP **SHALL NOT** support Automatic Allocation of Signalling Data Links.

## 5.17 Service Indicator Octet

Reference Q.704, §14.2; ND1107, §6.2.1

The network indicator (sub-service bits as defined in section 14.2.2 of Q.704) **SHALL** be set to '10' (bits D and C of the sub-service) indicating "National Network". The allocation of service indicator bits (DCBA) for national signalling network Interconnect use **SHALL** be set according to Table 6.6 of ND1107 [4] with the additional service indicator bits as defined in Table 2.

**Table 2: Allocation of Service Indicator Octet**

Bits D C B A	Allocation
1101	UK Bearer Independent Call Control (BICC)

## 5.18 Signalling Network Management Messages

Reference Q.704, §15

The UPU message User Part Identity codes of §15.17.4 Q.704 apply only to the International Signalling Network. For the UK National Interconnect Signalling Network, the user part identity and the unavailability cause values needs to be set according to Table 6.7 of ND1107 [4], with additional service indicator bits as defined in Table 3. The network indicator **SHALL** be set to '10' (bits D and C of the sub-service) indicating "National Network".

**Table 3 Service Indicator Code in UPU Allocation**

Bits D C B A	Allocation
1101	UK Bearer Independent Call Control (BICC)

Where the UPU message "affected PC" field and Routing Label OPC differ, the message **SHALL** be discarded and a report made to management.

The following messages **SHALL NOT** be sent;

Transfer Restricted (§15.9)

Signalling-route-set-test (restricted) (Part of §15.10)

Signalling-route-set-congestion-test (§15.16)

Any of the above messages, if received, **SHALL** be treated as unrecognised messages.

## 5.19 Monitoring and Measurements

Reference Q.752

Requirements for Monitoring and Measurements **SHALL** be based on Q.752 [12], but details will be documented by the Network CP concerned.

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## 6. Use of M2PA

### 6.1 Endorsement Notice

The Layer 2 signalling link **SHALL** use Signalling System 7 (SS7) Message Transfer Part 2 (MTP2) – User Peer-to-Peer Adaptation Layer (M2PA). Therefore RFC4165 [2] is hereby endorsed subject to the changes listed in the present clause.

### 6.2 Changes to RFC4165

#### 6.2.1 Conventions

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. Any functionality outlined in RFC4165 as ‘**SHOULD**’ and ‘**MUST**’ is to be considered as mandatory (**SHALL**). Any behaviour outlined as ‘**SHOULD NOT**’ and ‘**MUST NOT**’ is to be read as ‘**SHALL NOT**’.

#### 6.2.2 References

Throughout RFC4165 [2] References to “SCTP” are to be interpreted as SCTP as described in ND1028 [3].

#### 6.2.3 Interpretation of User Data Field of RFC4165

The use of the PRI bits in the first octet of the Data field in section 2.3 of RFC4165 [2] does not apply within the scope of the present document. The whole first octet of the data field **SHALL** be set to spare, i.e. 0.

#### 6.2.4 Link Alignment

The proving period **SHALL NOT** be omitted as described in section 4.1.3 of RFC4165 [2].

NOTE: The link proving period (timer T4) **SHOULD** be calculated according to the SCTP parameters and the link bandwidth/delay characteristics, so that it **SHOULD** be equal to the duration of the SCTP slow start procedure.

### 6.3 Additional Guidance (Informative)

If the SCTP parameter values in ND1028 [3] are used then the M2PA T7 timer should be set to a value at the upper end of the range specified in Q.703 [9] for 64kbit/s links such that T7 will not normally mature before SCTP detects the association failure.

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## 7. Use of SCTP

### 7.1 Citation of SCTP

In order to avoid confusion the version of SCTP to be used **SHALL** be cited as “SCTP in accordance with ND1028 [3].

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## History

<b>Document history</b>		
V1.2.1	March 2011	NICC TSG approved for Issue