

UK Interconnect use of SCTP

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Foreword

This NICC Document (ND) has been produced by NICC Applications Protocols Working Group.

Introduction

This document shall define the Stream Control Transmission Protocol (SCTP) requirements for UK interconnect use of IP. It is primarily intended for use in Orange release and beyond but may be used for Green and Purple release.

Note: In this first issue of this document there is no intention to change the technical requirements between Orange, Green and Purple release, however the latest RFCs will be mandated and as a consequence there may be, as yet unidentified, backward compatibility issues.

The information is intended for use by designers of signalling applications that require use of signalling transport protocols, as well as for use by network operators needing to engineer signalling transport networks and to configure signalling applications for UK national network interconnect.

This document will be revised as necessary and in accordance with the NICC workplan to include information appropriate to enhancements to the relevant signalling protocols.

1 Scope

This document specifies the requirements of the Stream Control Transmission Protocol (SCTP) for the transport of applications' signalling messages across a UK national interconnect between UK Public networks.

This SCTP specification is appropriate to interconnect within the UK network for end node to end node configuration.

The present document specifies the SCTP requirements for UK interconnect when used as a transport for the following protocols and adaptation layers:

- SIP
- SIP-I
- M3UA
- M2PA

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] RFC4960 Stream Control Transmission Protocol
- [3] ETSI TS 102 144 Services and Protocols for Advanced Networks (SPAN); MTP/SCCP/SSCOP and SIGTRAN (Message of SS7 over IP); Stream Control Transmission Protocol (SCTP)
- [4] ND1613 NGN Interconnect: Transport Service Layer Management
- [5] ND1029 UK Interconnect use of M3UA
- [6] ND1026 NGN; MTP3 over IP Interconnect between PLMNs using M2PA Protocol
- [7] ND1017 Interworking between Session Initiation Protocol (SIP) and UK ISDN User Part (UK ISUP)
- [8] ND1019 IP Multimedia Call Control based on Session Initiated Protocol (SIP) and Session Description Protocol (SDP) for UK Interconnect
- [9] RFC5062 Security Attacks Found Against the Stream Control Transmission Protocol (SCTP) and Current Countermeasures
- [10] ND1628 Securing DATA flows with IPsec for NGN interconnects
- [11] ITU-T Q.706 Signalling System No.7, Message Transfer Part, Signalling Performance
- [12] ITU-T Q.716 Signalling System No.7, Signalling Connection Control Part (SCCP performance)
- [13] ITU-T Q.766 Performance objectives in the integrated services digital network application

2.2 Informative references

- [i.1] RFC3436 Transport Layer Security over Stream Control Transmission Protocol
- [i.2] ETSI TS 102 141 Services and Protocols for Advanced Networks (SPAN); MTP/SCCP/SSCOP and SIGTRAN; M2UA
- [i.3] ETSI TS 102 142 Services and Protocols for Advanced Networks (SPAN); MTP/SCCP/SSCOP and SIGTRAN; M3UA
- [i.4] ETSI TS 102 143 Services and Protocols for Advanced Networks (SPAN); MTP/SCCP/SSCOP and SIGTRAN; SUA
- [i.5] ND1612 Generic IP Connectivity for PSTN/ISDN Services between Next Generation Networks
- [i.6] ND1620 NGN; Voice Line Control Service; Interconnect Architecture
- [i.7] RFC4168 The Stream Control Transmission Protocol (SCTP) as a Transport for the Session Initiation Protocol (SIP)

3 Definitions, symbols 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.

Any functionality outlined in RFC4960 [2] 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**'.

Not Required: The ETSI specifications TS 102 144 [3] use the term '**NOT REQUIRED**'. For UK Interconnect use this term is defined as follows:

It is not necessary for either the underlying functionality or signalling procedures associated with the service/feature to be supported by the implementation concerned for that implementation to qualify as conformant to the specification.

Note 1: Interconnected or communicating implementations that provide support of the service/feature/message/parameter identified will not be considered as non-conformant to the specification.

Note 2: Implementations shall not rely on '**NOT REQUIRED**' features being disabled (or enabled).

Note 3: The normal compatibility rules shall apply to the messages, parameters and codepoints needed to support the feature/service.

3.2 Symbols

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

N/A

3.3 Abbreviations

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

AP	Application
BICC	Bearer Independent Call Control
CP	Communications Provider
DATA	Payload Data (SCTP chunk)
ECN	Explicit Congestion Notification
ETSI	European Telecommunications Standards Institute
IANA	Internet Assigned Numbers Authority
IETF	Internet Engineering Task Force
INIT	Initiation (SCTP chunk)
INIT-ACK	Initiation Acknowledgement (SCTP chunk)
IP	Internet Protocol
IPsec	IP Security protocol
IPv4	Internet Protocol Version 4
IPv6	Internet Protocol Version 6
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
M2PA	MTP2 User Peer-to-Peer Adaptation Layer
M3UA	MTP3 User Adaptation Layer
MTP	Message Transfer Part of ITU-T Signalling System Number 7
MTP2	MTP Level 2 protocol (Signalling Link)
MTP3	MTP Level 3 Protocol (Signalling Network)
MTU	Maximum Transmission Unit
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
RTO	Retransmission Time-out
SACK	Selective Acknowledgement (SCTP chunk)
SCTP	Stream Control Transmission Protocol
SCCP	Signalling Connection Control Part
SDP	Session Description Protocol
SEP	Signalling End Point
SIP	Session Initiation Protocol
SIP-I	Session Initiation Protocol with encapsulated ISUP
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
TCP	Transmission Control Protocol
TDM	Time Division Multiplexing
TFC	Transfer controlled message
TLS	Transport Layer Security
TP	Transport
TSG	Technical Steering Group
UK	United Kingdom of Great Britain and Northern Ireland
VLC	Voice Line Control
WP	Working Party

Not all abbreviations will be used in this document.

4 Use of SCTP (normative):

4.1 Endorsement Notice

RFC4960 [2] is hereby endorsed subject to the exceptions in the present clause and applicable application annex.

4.2 Exceptions to RFC4960 [2]

RFC4960 Clause	Title	Change
1.5.3	User Data Fragmentation	<p>Insert the following paragraphs at the end of clause:</p> <p>“If the supported user data size (see clause 3) would result in DATA chunks larger than allowed by clause 6, the sending SCTP end-point SHALL support fragmentation of user data.</p> <p>However, if this is not the case the support of user data fragmentation on the sending side is NOT REQUIRED. This is the case for TS 102 141 [i.2] and TS 102 142 [i.3] when not used in combination with RFC 3436 [i.1].</p> <p>The reception of fragmented user data SHALL be supported.”</p>
3.	SCTP Packet Format	<p>Insert the following paragraphs at the end of clause:</p> <p>“An SCTP end-point SHALL support the sending and reception of user data with the maximum size defined by the upper layer.</p> <p>An SCTP end-point is NOT REQUIRED to support the handling of larger user data sizes. If transport layer security is used the user data size which has to be supported is 18,437, see RFC 3436 [i.1] for more information.”</p>
3.3.2.1	Optional/Variable-Length Parameters in INIT	<p>Insert the following paragraphs at the end of clause:</p> <p>“An SCTP end-point SHALL support IPv4 address parameters, MAY support IPv6 address parameters and SHALL NOT support the hostname address parameter. The sender of an INIT-chunk SHALL include the Supported Address parameter indicating the support of IPv4 and optionally IPv6. Support for Hostname addresses SHALL NOT be indicated. If a hostname address parameter is included in an INIT or INIT-ACK chunk, the receiver SHALL reply with an ABORT chunk using the error cause ‘Un-resolvable Address’.</p> <p>Single-homed SCTP end-points SHALL NOT include an address parameter in INIT and INIT-ACK chunks.”</p>
5.1.1	Handle Stream Parameters	<p>The minimum incoming and outgoing streams required is application dependant and is contained within the appropriate annex of this document.</p> <p>Insert the following paragraphs at the end of clause:</p> <p>“The number of streams to be supported at start up time by the association SHALL be the minimum requested (INIT chunk) and offered (INIT-ACK chunk) by the two endpoints.</p> <p>The number of outbound and inbound streams SHALL be the same in both directions. The method of allocating calls to streams is implementation dependant.</p> <p>If the peer endpoint supports only 1 incoming stream, or outgoing stream the endpoint SHALL abort the association and MAY report the failure to initialise the association to layer management. No restriction is placed on the maximum number of streams to be supported by an endpoint, within the constraints of RFC 4960 [2].“</p>

RFC4960 Clause	Title	Change
6.	User Data Transfer	<p>Insert the following paragraphs at the end of clause:</p> <p>“IP-packets containing SCTP packets SHALL NOT be larger than the Path MTU.</p> <p>An SCTP end-point SHALL use INIT and INIT-ACK chunks such that the resulting IP-packet is not larger than the Path MTU. This limits the number of paths used by SCTP associations. DATA chunks SHALL NOT exceed a size that would result in IP-packets larger than the path MTU. The size of HEARTBEAT chunks SHALL be equivalent to the size of DATA chunks.”</p>
6.4	Multi-Homed SCTP Endpoints	<p>Support for multi-homed SCTP endpoints is application dependant and is contained within the appropriate annex of this document.</p> <p>Insert the following paragraphs at the end of clause:</p> <p>“The chosen number of IP addresses for a given association SHOULD be a number that is supported by the implementations at each end of that association.</p> <p>A node SHOULD make use of multiple IP addresses if known for multi-homing. Whether this is done within the SCTP or is initiated by the SCTP’s user is implementation dependent.</p> <p>If association initialization to an IP destination address is unsuccessful, and alternative destination IP addresses are known, the sending node SHALL reattempt initialization by the sending the INIT chunk to the alternative IP address.”</p>
6.6	Ordered and Unordered Delivery	<p>Support for unordered delivery at the sending SCTP endpoint is application dependant and is contained within the appropriate annex of this document.</p> <p>Insert the following paragraphs at the end of clause:</p> <p>“The receiving SCTP end-point SHALL support the reception of DATA chunks marked for unordered delivery and ordered delivery.</p> <p>Note: TS 102 141 [i.2], TS 102 142 [i.3] and TS 102 143 [i.4] do not make use of unordered delivery and RFC 3436 [i.1] does not support it.”</p>
6.10	Bundling	<p>Insert the following paragraphs at the end of clause:</p> <p>“An SCTP end-point SHALL allow disabling of that DATA-chunk bundling which introduces additional delay.</p> <p>This SHALL NOT affect bundling which introduces no additional delays.”</p>
7.3	Path MTU Discovery	<p>Replace the clause with the following paragraph:</p> <p>“Path MTU discovery is NOT REQUIRED.</p> <p>The endpoint SHALL allow the MTU size for each path to be manually configured, within the range specified in Table 1.”</p>
8.3	Path Heartbeat	<p>Insert the following paragraph at the end of clause:</p> <p>“SCTP end-points SHALL support the heartbeat mechanism and the sending of HEARTBEAT chunks on idle paths SHALL be enabled by default.”</p>

RFC4960 Clause	Title	Change
15.	Suggested SCTP Protocol Parameter Values	<p>The default SCTP parameters defined in RFC 4960 [2] are intended to allow SCTP to co-exist seamlessly with TCP in the Internet. These values are considered to be unsuitable to meet the performance requirements of SS7 user parts and VLC applications (defined in ND1612 [i.5] and ND1620 [i.6]), especially during failure, congestion and packet loss situations. Hence they are not suitable for UK interconnect purposes.</p> <p>Replace the clause with the following paragraphs including Table 1:</p> <p>“For optimal performance appropriate values within the configurable range, defined in Table 1, SHALL be agreed by interconnecting parties; if such agreement can not be reached then the default values in Table 1 SHALL be used.</p> <p>Note: The application MAY require different defaults, in that case, please refer to the appropriate annex.”</p>

RFC4960 Clause	Title	Change		
Table 1: SCTP parameter values				
Parameter	Minimum value	Maximum value	Default value	Granularity
RTO.Min	10 ms	5 s	40 ms	10 ms
RTO.Max	200 ms	120 s	200 ms	10 ms
RTO.Initial	RTO.Min	RTO.Max	100 ms	10 ms
RTO.Alpha	1/8	1/8	1/8	
RTO.Beta	1/4	1/4	1/4	
Valid.Cookie.Life	5 s	120 s	60 s	1 s
HB.Interval	1 s	300 s	3 s	1 s
SACK period	0 ms	500 ms	0 ms (note 1)	10 ms
SACK frequency	1	5	1 (note 2)	1
MTU size (per path)	508 bytes	65535 bytes	1438 bytes (note 3)	1 byte
Max.Init.Retransmits			8	1
Association.Max.Retrans	6	10	10 (note 4)	1
Path.Max.Retrans	3	8	8 per destination address	1
Max.Burst			4 (note 5)	1
HB.Max.Burst			1 (note 5)	1
<p>Note 1: The SACK period defines the maximum delay for generating an acknowledgement after receipt of a packet containing a DATA chunk (i.e. artificial delay SHALL NOT be added).</p> <p>Note 2: The SACK frequency defines how often a SACK is generated for every <i>n</i> packets received containing one or more DATA chunks within the SACK period.</p> <p>Note 3: This is the maximum size of each packet in any transmission, including the IP header and payload, specified in octets. It is the value to be used for the Path MTU referred to in RFC4960 [2]. The value ensures that should the packet later be encapsulated using IPsec using the encryption and authentication options specified in ND1613 [4], then the resultant packet size would be less than or equal to 1500 octets and would therefore not require IP fragmentation when carried over Ethernet.</p> <p>Note 4: The Association.Max.Retrans default value SHALL be greater than the Path.Max.Retrans default value.</p> <p>Note 5: Max.Burst and HB.Max.Burst is NOT REQUIRED.</p>				
Appendix A	Explicit Congestion Notification	Replace the clause with the following sentence: "The support of ECN is NOT REQUIRED ."		

End of Clause 4

Annex A (normative): SCTP requirements for SIP

A.1 Exceptions to RFC4960 [2]

These requirements are in addition to clause 4 of this document and are only applicable to SIP, as defined by ND1019 [8].

RFC4960 Clause	Title	Change
5.1.1	Handle Stream Parameters	<p>Insert the following paragraphs at the end of clause:</p> <p>“A minimum of 16 outgoing and 16 incoming streams SHALL be supported.</p> <p>The receiving SCTP endpoint SHALL support the reception of data packets on stream 0. There are no management specific messages allocated to stream 0 for this application, therefore, the CP MAY choose to use stream 0 for outbound data packets.”</p>
6.4	Multi-Homed SCTP Endpoints	<p>Insert the following paragraph at the end of clause:</p> <p>“For the UK the choice of single or dual-homed associations is dependant upon the resilience requirements and the product being supported e.g. PSTN/ISDN IP Interconnect or VLC.”</p>
6.6	Ordered and Unordered Delivery	<p>Insert the following paragraph at the end of clause:</p> <p>“Support for unordered delivery at the sending SCTP end-point SHALL be the default action. Where the application requires an ordered delivery service the application specification MAY overrule this requirement.”</p>
14.4	Payload Protocol Identifiers	<p>Insert the following paragraph at the end of clause:</p> <p>“There is no standardised SCTP Payload Protocol Identifier for SIP registered with IANA. The value 0 SHALL be used.</p> <p>Note: This is in agreement with RFC 4168 [i.7].”</p>

End of Annex A

Annex B (normative): SCTP requirements for SIP-I

B.1 Exceptions to RFC4960 [2]

These requirements are in addition to clause 4 of this document and are only applicable to SIP-I, as defined by ND1017 [7].

RFC4960 Clause	Title	Change
5.1.1	Handle Stream Parameters	<p>Insert the following paragraphs at the end of clause:</p> <p>"A minimum of 16 outgoing and 16 incoming streams SHALL be supported.</p> <p>The receiving SCTP endpoint SHALL support the reception of data packets on stream 0. There are no management specific messages allocated to stream 0 for this application, therefore, the CP MAY choose to use stream 0 for outbound data packets."</p>
6.4	Multi-Homed SCTP Endpoints	<p>Insert the following paragraph at the end of clause:</p> <p>"For the UK the choice of single or dual-homed associations is dependant upon the resilience requirements and the product being supported e.g. PSTN/ISDN IP Interconnect or VLC."</p>
6.6	Ordered and Unordered Delivery	<p>Insert the following paragraph at the end of clause:</p> <p>"Support for ordered delivery at the sending SCTP end-point SHALL be the default action."</p>
14.4	Payload Protocol Identifiers	<p>Insert the following paragraph at the end of clause:</p> <p>"There is no standardised SCTP Payload Protocol Identifier for SIP-I registered with IANA. The value 0 SHALL be used.</p> <p>Note: This is in agreement with RFC 4168 [i.7]."</p>

End of Annex B

Annex C (normative): SCTP requirements for M3UA

C.1 Exceptions to RFC4960 [2]

These requirements are in addition to clause 4 of this document and are only applicable to M3UA, as defined by ND1029 [5].

RFC4960 Clause	Title	Change
5.1.1	Handle Stream Parameters	Insert the following paragraph at the end of clause: "A minimum of 2 incoming and 2 outgoing streams SHALL be supported."
6.4	Multi-Homed SCTP Endpoints	Insert the following paragraph at the end of clause: "An SCTP end-point SHALL support 2 or more paths towards its peer. "
6.6	Ordered and Unordered Delivery	Insert the following paragraph at the end of clause: "Support for unordered delivery at the sending SCTP-end-point is NOT REQUIRED . "

End of Annex C

Annex D (normative): SCTP requirements for M2PA

D.1 Exceptions to RFC4960 [2]

These requirements are in addition to clause 4 of this document and are only applicable to M2PA, as defined by ND1026 [6].

RFC4960 Clause	Title	Change												
5.1.1	Handle Stream Parameters	Insert the following paragraph at the end of clause: "A minimum of 2 incoming and 2 outgoing streams SHALL be supported."												
6.4	Multi-Homed SCTP Endpoints	Insert the following paragraph at the end of clause: "An SCTP end-point SHALL support 2 or more paths towards its peer."												
6.6	Ordered and Unordered Delivery	Insert the following paragraph at the end of clause: "Support for unordered delivery at the sending SCTP-end-point is NOT REQUIRED. "												
15.	Suggested SCTP Protocol Parameter Values	<p>Replace the default parameter values in Table 1, in the present document, with the default values shown below:</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="2" style="text-align: center;">SCTP parameter defaults</th> </tr> <tr> <th style="text-align: center;">Parameter</th> <th style="text-align: center;">Default value</th> </tr> </thead> <tbody> <tr> <td>RTO.Min</td> <td style="text-align: center;">100 ms</td> </tr> <tr> <td>RTO.Max</td> <td style="text-align: center;">200 ms</td> </tr> <tr> <td>Association.Max.Retrans</td> <td style="text-align: center;">8</td> </tr> <tr> <td>Path.Max.Retrans</td> <td style="text-align: center;">4 per destination address</td> </tr> </tbody> </table>	SCTP parameter defaults		Parameter	Default value	RTO.Min	100 ms	RTO.Max	200 ms	Association.Max.Retrans	8	Path.Max.Retrans	4 per destination address
SCTP parameter defaults														
Parameter	Default value													
RTO.Min	100 ms													
RTO.Max	200 ms													
Association.Max.Retrans	8													
Path.Max.Retrans	4 per destination address													

End of Annex D

Annex E (informative): SCTP general requirements

E.1 Consequences of choosing either IPv4 or IPv6 address types

The 'INIT' and 'INIT-ACK' chunk sizes are large enough to accommodate multiple IP addresses, however they do have a finite size, so if the number of IP addresses configured is large, then it is important to check that they do not exceed the chunk size. IPv6 addresses, being larger than IPv4 addresses, will reach the limit sooner.

E.2 Guidelines on IP Security Choices

The security considerations listed in RFC4960 [2] and RFC5062 [9] **SHOULD** be taken into account for UK interconnect.

The security for the underlying IP network will be provided by all of the following techniques:

- Physical access control
- IPsec - see ND1628 [10]

The standardisation of security measures is outside the scope of this document.

E.3 Guidelines on IP Address Assignment

Only selected combinations of IP addresses and Port identities **SHOULD** be allowed.

E.4 Performance Requirements

Performance requirements are outside the scope of this document. However, for SCTP Adaptation Layer protocols the network implementation should take into account the performance requirements as outlined in Q.706 [11], Q.716 [12] and Q.766 [13].

End of Annex E

History

Document history		
V1.1.1	March 2011	NICC/TSG approved version

End of Document