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
[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)
[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
[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]

<table>
<thead>
<tr>
<th>RFC4960 Clause</th>
<th>Title</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5.3</td>
<td>User Data Fragmentation</td>
<td>Insert the following paragraphs at the end of clause:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&quot;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 <strong>SHALL</strong> support fragmentation of user data.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>However, if this is not the case the support of user data fragmentation on the sending side is <strong>NOT REQUIRED</strong>. 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].</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The reception of fragmented user data <strong>SHALL</strong> be supported.&quot;</td>
</tr>
<tr>
<td>3.</td>
<td>SCTP Packet Format</td>
<td>Insert the following paragraphs at the end of clause:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&quot;An SCTP end-point <strong>SHALL</strong> support the sending and reception of user data with the maximum size defined by the upper layer.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>An SCTP end-point is <strong>NOT REQUIRED</strong> 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.&quot;</td>
</tr>
<tr>
<td>3.3.2.1</td>
<td>Optional/Variable-Length Parameters in INIT</td>
<td>Insert the following paragraphs at the end of clause:</td>
</tr>
</tbody>
</table>
|                |                                         | "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’.

**Single-homed SCTP end-points **SHALL NOT** include an address parameter in INIT and INIT-ACK chunks."                                                                                                                                                                                                 |
<p>| 5.1.1          | Handle Stream Parameters                | The minimum incoming and outgoing streams required is application dependant and is contained within the appropriate annex of this document.                                                                                                                                 |
|                |                                         | Insert the following paragraphs at the end of clause:                                                                                                                                                                                                                                                                             |
|                |                                         | &quot;The number of streams to be supported at start up time by the association <strong>SHALL</strong> be the minimum requested (INIT chunk) and offered (INIT-ACK chunk) by the two endpoints.                                                                                                                                                                         |
|                |                                         | The number of outbound and inbound streams <strong>SHALL</strong> be the same in both directions. The method of allocating calls to streams is implementation dependant.                                                                                                                                                                                                                      |
|                |                                         | If the peer endpoint supports only 1 incoming stream, or outgoing stream the endpoint <strong>SHALL</strong> abort the association and <strong>MAY</strong> 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].&quot;                                                                                   |</p>
<table>
<thead>
<tr>
<th>RFC4960 Clause</th>
<th>Title</th>
<th>Change</th>
</tr>
</thead>
</table>
| 6.            | User Data Transfer | Insert the following paragraphs at the end of clause:  
“IP-packets containing SCTP packets **SHALL NOT** be larger than the Path MTU.  
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.” |
| 6.4           | Multi-Homed SCTP Endpoints | Support for multi-homed SCTP endpoints is application dependant and is contained within the appropriate annex of this document.  
Insert the following paragraphs at the end of clause:  
“**SHOULD** be a number that is supported by the implementations at each end of that association.  
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.  
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.” |
| 6.6           | Ordered and Unordered Delivery | Support for unordered delivery at the sending SCTP endpoint is application dependant and is contained within the appropriate annex of this document.  
Insert the following paragraphs at the end of clause:  
**SHALL** support the reception of DATA chunks marked for unordered delivery and ordered delivery.  
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.” |
| 6.10          | Bundling | Insert the following paragraphs at the end of clause:  
“**SHALL** allow disabling of that DATA-chunk bundling which introduces additional delay.  
This **SHALL NOT** affect bundling which introduces no additional delays.” |
| 7.3           | Path MTU Discovery | Replace the clause with the following paragraph:  
“Path MTU discovery is **NOT REQUIRED.**  
The endpoint **SHALL** allow the MTU size for each path to be manually configured, within the range specified in Table 1.” |
| 8.3           | Path Heartbeat | Insert the following paragraph at the end of clause:  
“**SHALL** support the heartbeat mechanism and the sending of HEARTBEAT chunks on idle paths **SHALL** be enabled by default.” |
<table>
<thead>
<tr>
<th>RFC4960 Clause</th>
<th>Title</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>15.</td>
<td>Suggested SCTP Protocol Parameter Values</td>
<td>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. Replace the clause with the following paragraphs including Table 1: “For optimal performance appropriate values within the configurable range, defined in Table 1, <strong>SHALL</strong> be agreed by interconnecting parties; if such agreement cannot be reached then the default values in Table 1 <strong>SHALL</strong> be used. Note: The application <strong>MAY</strong> require different defaults, in that case, please refer to the appropriate annex.”</td>
</tr>
</tbody>
</table>

Note: The application **MAY** require different defaults, in that case, please refer to the appropriate annex.” |
Table 1: SCTP parameter values

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Minimum value</th>
<th>Maximum value</th>
<th>Default value</th>
<th>Granularity</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTO.Min</td>
<td>10 ms</td>
<td>5 s</td>
<td>40 ms</td>
<td>10 ms</td>
</tr>
<tr>
<td>RTO.Max</td>
<td>200 ms</td>
<td>120 s</td>
<td>200 ms</td>
<td>10 ms</td>
</tr>
<tr>
<td>RTO.Initial</td>
<td>RTO.Min</td>
<td>RTO.Max</td>
<td>100 ms</td>
<td>10 ms</td>
</tr>
<tr>
<td>RTO.Alpha</td>
<td>1/8</td>
<td>1/8</td>
<td>1/8</td>
<td></td>
</tr>
<tr>
<td>RTO.Beta</td>
<td>1/4</td>
<td>1/4</td>
<td>1/4</td>
<td></td>
</tr>
<tr>
<td>Valid.Cookie.Life</td>
<td>5 s</td>
<td>120 s</td>
<td>60 s</td>
<td>1 s</td>
</tr>
<tr>
<td>HB.Interval</td>
<td>1 s</td>
<td>300 s</td>
<td>3 s</td>
<td>1 s</td>
</tr>
<tr>
<td>SACK period</td>
<td>0 ms</td>
<td>500 ms</td>
<td>0 ms (note 1)</td>
<td>10 ms</td>
</tr>
<tr>
<td>SACK frequency</td>
<td>1</td>
<td>5</td>
<td>1 (note 2)</td>
<td>1</td>
</tr>
<tr>
<td>MTU size (per path)</td>
<td>508 bytes</td>
<td>65535 bytes</td>
<td>1438 bytes (note 3)</td>
<td>1 byte</td>
</tr>
<tr>
<td>Max.Init.Retransmits</td>
<td></td>
<td></td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>Association.Max.Retrans</td>
<td>6</td>
<td>10</td>
<td>10 (note 4)</td>
<td>1</td>
</tr>
<tr>
<td>Path.Max.Retrans</td>
<td>3</td>
<td>8</td>
<td>8 per destination address</td>
<td>1</td>
</tr>
<tr>
<td>Max.Burst</td>
<td></td>
<td></td>
<td>4 (note 5)</td>
<td>1</td>
</tr>
<tr>
<td>HB.Max.Burst</td>
<td></td>
<td></td>
<td>1 (note 5)</td>
<td>1</td>
</tr>
</tbody>
</table>

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).

Note 2: The SACK frequency defines how often a SACK is generated for every \( n \) packets received containing one or more DATA chunks within the SACK period.

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.


Note 5: Max.Burst and HB.Max.Burst is NOT REQUIRED.

Appendix A | Explicit Congestion Notification | Replace the clause with the following sentence:
|--------------|----------------------------------|---
|              | “The support of ECN is NOT REQUIRED.” |
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].

<table>
<thead>
<tr>
<th>RFC4960 Clause</th>
<th>Title</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1.1</td>
<td>Handle Stream Parameters</td>
<td>Insert the following paragraphs at the end of clause:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&quot;A minimum of 16 outgoing and 16 incoming streams <strong>SHALL</strong> be supported.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The receiving SCTP endpoint <strong>SHALL</strong> 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 <strong>MAY</strong> choose to use stream 0 for outbound data packets.&quot;</td>
</tr>
<tr>
<td>6.4</td>
<td>Multi-Homed SCTP Endpoints</td>
<td>Insert the following paragraph at the end of clause:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“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.”</td>
</tr>
<tr>
<td>6.6</td>
<td>Ordered and Unordered Delivery</td>
<td>Insert the following paragraph at the end of clause:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“Support for <strong>unordered</strong> delivery at the sending SCTP end-point <strong>SHALL</strong> be the default action. Where the application requires an ordered delivery service the application specification <strong>MAY</strong> overrule this requirement.”</td>
</tr>
<tr>
<td>14.4</td>
<td>Payload Protocol Identifiers</td>
<td>Insert the following paragraph at the end of clause:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“There is no standardised SCTP Payload Protocol Identifier for SIP registered with IANA. The value 0 <strong>SHALL</strong> be used.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Note:</strong> This is in agreement with RFC 4168 [7].</td>
</tr>
</tbody>
</table>

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].

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

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].

<table>
<thead>
<tr>
<th>RFC4960 Clause</th>
<th>Title</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1.1</td>
<td>Handle Stream Parameters</td>
<td>Insert the following paragraph at the end of clause:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&quot;A minimum of 2 incoming and 2 outgoing streams <strong>SHALL</strong> be supported.**</td>
</tr>
<tr>
<td>6.4</td>
<td>Multi-Homed SCTP Endpoints</td>
<td>Insert the following paragraph at the end of clause:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&quot;An SCTP end-point <strong>SHALL</strong> support 2 or more paths towards its peer. &quot;</td>
</tr>
<tr>
<td>6.6</td>
<td>Ordered and Unordered Delivery</td>
<td>Insert the following paragraph at the end of clause:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&quot;Support for unordered delivery at the sending SCTP-end-point is <strong>NOT</strong> REQUIRED. &quot;</td>
</tr>
</tbody>
</table>

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].

<table>
<thead>
<tr>
<th>RFC4960 Clause</th>
<th>Title</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1.1</td>
<td>Handle Stream Parameters</td>
<td>Insert the following paragraph at the end of clause: &quot;A minimum of 2 incoming and 2 outgoing streams SHALL be supported.&quot;</td>
</tr>
<tr>
<td>6.4</td>
<td>Multi-Homed SCTP Endpoints</td>
<td>Insert the following paragraph at the end of clause: &quot;An SCTP end-point SHALL support 2 or more paths towards its peer.&quot;</td>
</tr>
<tr>
<td>6.6</td>
<td>Ordered and Unordered Delivery</td>
<td>Insert the following paragraph at the end of clause: &quot;Support for unordered delivery at the sending SCTP-end-point is NOT REQUIRED.&quot;</td>
</tr>
<tr>
<td>15.</td>
<td>Suggested SCTP Protocol Parameter Values</td>
<td>Replace the default parameter values in Table 1, in the present document, with the default values shown below:</td>
</tr>
</tbody>
</table>

### SCTP parameter defaults

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Default value</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTO.Min</td>
<td>100 ms</td>
</tr>
<tr>
<td>RTO.Max</td>
<td>200 ms</td>
</tr>
<tr>
<td>Association.Max.Retrans</td>
<td>8</td>
</tr>
<tr>
<td>Path.Max.Retrans</td>
<td>4 per destination address</td>
</tr>
</tbody>
</table>
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 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

<table>
<thead>
<tr>
<th>Document history</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1.1.1</td>
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</tbody>
</table>

End of Document