| Stream Control Transmission Protocol (SCTP Session Setup, Release and IP Address Reconfiguration)  |   |                                     |                                       |   |  |  |  |
|--|---|-------------------------------------|---------------------------------------|---|--|--|--|
|  | SCTP Network  |                                     |                                       | EventStudio System Designer 2.5   |  |  |  |
| SCIP Endpoint A  |   | I P Endpoint B                      | ddroce D 2                            | 08-Mar-06 07·22 (Page 1)  |  |  |  |
| IP Address A   | IP Address B I  | I IP A                              | adress B 2                            |   |  |  |  |
| This sequence diagram was generated with EventStudio System Designer 2.5 (http://www.EventHelix.com/EventStudio).<br>The diagram is based on an Ethereal capture obtained from: http://wiki.ethereal.com/SampleCaptures.   |   |                                     |                                       |   |  |  |  |
| Stream Control Transmissic<br>SCTP belongs to the SIGTR<br>over IP.  | Stream Control Transmission Protocol (SCTP) is a relatively new transport layer in the IP Protocol Stack.<br>SCTP belongs to the SIGTRAN protocol family and has been used as the transport layer for carrying telecom signaling<br>over IP.  |                                     |                                       |   |  |  |  |
| SCTP provides a reliable tra<br>interface with no message b  | SCTP provides a reliable transport service that operates at message level (unlike TCP that provides a byte stream interface with no message boundaries).  |                                     |                                       |   |  |  |  |
| SCTP allows multiple messa<br>be sent in a single SCTP me  | age streams to be exchar<br>essage as chunks. Select  | nged on a single<br>ive acknowledge | SCTP connection.<br>ments are support | Data from multiple streams can<br>ted at individual chunk level.  |  |  |  |
| Recent additions to the SCT<br>be switched over from one<br>is moved before removing t   | Recent additions to the SCTP protocol allow dynamic configuration of the IP addresses. Similar to SS7, SCTP can be switched over from one link to another. SCTP supports a make-before-break changeover, i.e. the packet stream is moved before removing the link that needs to be taken out of service.                      |                                     |                                       |   |  |  |  |
| <ul> <li>In this sequence diagram we will be examining some of the features of SCTP.</li> <li>(1) SCTP Connection establishment.</li> <li>(2) SCTP data exchange and selective acknowledgement.</li> <li>(3) Addition of a new IP address to an SCTP connection.</li> <li>(4) Switching over to the new IP address.</li> <li>(5) Removing the old IP address.</li> <li>(6) SCTP connection release.</li> </ul>   |   |                                     |                                       |   |  |  |  |
| Sotting up the SCTP copped   | tion  |                                     |                                       |   |  |  |  |
| 1:INIT         Initiate tag:         Advertised receiver windo         Number of outb         Number of inbou         Initiate tag:         Advertised receiver windo         Number of inbou         Initiate tag:         Advertised receiver windo         Number of outb         Number of outb         Number of outb         Number of inbou         Initiate tag:         Advertised receiver windo         Number of outb         Number of outb         Number of inbou         Initiate tag:         Advertised receiver windo         Number of inbou         Initiate tag:         Parameter type: St         Parameter type: Forward         3:COOKIE_         Unpack the data and perform an i         with MAC         Initiate the SCTP conned | Chunk<br>0x71b81d1f,<br>w credit (a _rwnd): 109568,<br>ound streams: 65535,<br>2702200202<br>CK Chunk<br>0x48e63127,<br>w credit (a _rwnd): 109568,<br>ound streams: 10,<br>ound streams: 10,<br>4194126429,<br>ate cookie (0x0007),<br>2: ECN (0x8000),<br>d TSN supported (0xc000)<br>ECHO Chunk<br>ntegrity check<br>:tion |                                     |                                       | An association setup request is received in the closed<br>state. The server analyzes the received INIT chunk and<br>generates all the values needed at its side to enter an<br>established association, and generates a secure hash of<br>these values and a secret key (e.g. with the MD5 or<br>SHA-1 algorithms).<br>The secure hash values and a message authentication<br>code (MAC) are stored in a COOKIE parameter. This<br>information is sent by in the INIT-ACK message.<br>SCTP Endpoint B copies the COOKIE into the<br>COOKIE-ECHO message.<br>SCTP End Point A validates the COOKIE-ECHO by<br>checking it against the included MAC,<br>The COOKIE-ECHO validation had passed, so an SCTP |  |  |  |
| 4:COOKIE   | ACK Chunk   |                                     |                                       | instance is created.<br>SCTP Endpoint A replies with a COOKIE-ACK, indicating that the COOKIE-ECHO has been accepted.   |  |  |  |
| 5:DAT<br>TSN: 27<br>Stream Iden<br>Stream seque  | A Chunk<br>D2200202,<br>tifier: 0x0000,<br>ence number: 0   |                                     |                                       | Endpoint B sends stream data using the DATA chunk.<br>The Transport Sequence Number (TSN) is assigned to<br>the chunk. The acknowledgements sent from the receiver<br>to the sender are based on these sequence numbers.  |  |  |  |
| Addition of a new IP address   |   |                                     |                                       |   |  |  |  |
|  |   |                                     |                                       |   |  |  |  |

| Stream Control Transmission Protocol (SCTP Session Setup, Release and IP Address Reconfiguration)   |   |                |   |  |  |  |  |  |
|---|---|----------------|---|--|--|--|--|--|
| SCTD Endpoint A   |   |                | EventStudio System Designer 2.5   |  |  |  |  |  |
| IP Address A  | IP Address B 1  | IP Address B 2 | 08-Mar-06 07:22 (Page 2)  |  |  |  |  |  |
| 6:ASCONF Chun<br>Serial numbe<br>Parameter type: IP<br>IP Version 4 addre<br>Parameter type: Addre<br>Correlation<br>Parameter type: IP<br>IP Version 4 addre           | k [Add IP Address]<br>pr: 0xa1104d8a,<br>v4 address (0x0005),<br>ss: IP_Address (0x0005),<br>d: 0x0000000,<br>v4 address (0x0005),<br>ess: IP_Address_B_2                     |                | SCTP Endpoint B sends an Address configuration change<br>chunk (ASCONF) with an "Add IP Address" indication for<br>IP_Address_B_2.  |  |  |  |  |  |
| 7:SAC<br>Cumulative TSN<br>Advertised receiver windo<br>Number of gap ackno<br>Number of du   | K Chunk<br>ACK: 2702200202,<br>w credit (a _rvnd): 109542,<br>wledgement blocks : 0,<br>plicated TSNs: 0  |                | SCTP Endpoint A acknowledges the data by sending a Cumulative TSN ACK. SCTP supports a powerful selective acknowledgement interface. Gaps in received sequence numbers can be signaled efficiently. |  |  |  |  |  |
| 8:ASCONF<br>Serial numb   | _ACK Chunk<br>er: 0xa1104d8a ►  |                | The SCTP Endpoint A acknowledges the addip request.<br>The ack is sent within the Address Configuration Ack<br>(ASCONF_ACK) chunk.  |  |  |  |  |  |
| 9:DAT<br>TSN: 41<br>Stream Ider<br>Stream sequ  | A Chunk<br>94126429,<br>htifier: 0x0000,<br>ence number: 0  |                | A new IP address has been added but this has no impact<br>on the data communication.  |  |  |  |  |  |
| 10:SAC<br>Cumulative TSN<br>Advertised receiver windo<br>Number of gap ackno<br>Number of du  | CK Chunk<br>ACK: 4194126429,<br>w credit (a _rwnd): 108568,<br>wledgement blocks : 0,<br>plicated TSNs: 0   |                |   |  |  |  |  |  |
| 11:DA<br>TSN: 27<br>Stream Ider<br>Stream sequ  | TA Chunk<br>02200203,<br>ntifier: 0x0000,<br>ence number: 1   |                |   |  |  |  |  |  |
| 12:SACK Chur<br>SACk<br>Cumulative TSN<br>Advertised receiver windo<br>Number of gap ackno<br>Number of du<br>DATA<br>Chunk le<br>TSN: 41<br>Stream Ider<br>Stream sequ | IK + DATA Chunk<br>Chunk,<br>ACK: 2702200203,<br>w credit (a _rvnd): 109516,<br>plicated TSNs: 0,<br>Chunk,<br>ngth: 1016,<br>94126430,<br>ntifier: 0x0000,<br>ence number: 1 |                | A message containing the SACK and the DATA chunk.   |  |  |  |  |  |
| 13:DA<br>TSN: 41<br>Stream Ider<br>Stream sequ  | TA Chunk<br>94126431,<br>tifier: 0x0000,<br>ence number: 2  |                |   |  |  |  |  |  |
| 14:SAC<br>Cumulative TSN<br>Advertised receiver windo<br>Number of gap ackno<br>Number of du  | CK Chunk<br>ACK: 4194126431,<br>w credit (a _rvvnd): 107568,<br>owledgement blocks : 0,<br>plicated TSNs: 0   |                |   |  |  |  |  |  |
| 15:DA<br>TSN: 41<br>Stream Ider<br>Stream sequ  | TA Chunk<br>94126432,<br>htifier: 0x0000,<br>ence number: 3   |                |   |  |  |  |  |  |
| ■ 16:DA<br>TSN: 27<br>Stream Ider<br>Stream sequ  | TA Chunk<br>02200204,<br>httfier: 0x0000,<br>ence number: 2   |                |   |  |  |  |  |  |
| Set the primary address to  | the newly added IP addres   | S.             |   |  |  |  |  |  |
|   |   |                |   |  |  |  |  |  |



| Stream Control Transm   | Stream Control Transmission Protocol (SCTP Session Setup, Release and IP Address Reconfiguration)                                  |   |                                 |   |  |  |  |  |
|-------------------------|--|---|---------------------------------|---|--|--|--|--|
|                         | SCTP N   | Vetwork   | EventStudio System Designer 2.5 |   |  |  |  |  |
| SCTP Endpoint A         | SCTP Endpoint A SCTP Endpoint B  |   |                                 |   |  |  |  |  |
| IP Address A            | IP Add   | ress B 1 IP Ad  | dress B 2                       | 08-Mar-06 07:22 (Page 4)                                      |  |  |  |  |
|                         |  | A Chunk   |                                 | •   |  |  |  |  |
|                         | TSN: 2702200207,<br>Stream Identifier: 0x0000,<br>Stream sequence number: 5  |   | -                               |   |  |  |  |  |
|                         |  |   |                                 |   |  |  |  |  |
|                         | Stream Seque   |   |                                 |   |  |  |  |  |
|                         | 30:SAC   | K Chunk   |                                 |   |  |  |  |  |
| Antura                  | Cumulative TSN /   | CK: 2702200207,                                       |                                 |   |  |  |  |  |
| Adve                    | Number of gap ackno  | v credit (a _rwnd): 109516,<br>wledgement blocks : 0, |                                 |   |  |  |  |  |
|                         | Number of dup  | licated TSNs: 0                                       |                                 |   |  |  |  |  |
|                         | 21.047   | A Chunk   |                                 |   |  |  |  |  |
| ◀                       | 31.DA1   |   | _                               |   |  |  |  |  |
|                         | Stream Iden  | ifier: 0x0000,  |                                 |   |  |  |  |  |
|                         | Stream seque   | nce number: 6   |                                 |   |  |  |  |  |
|                         | 32·SAC   | K Chunk   |                                 |   |  |  |  |  |
| ◀                       | Cumulative TSN /   | CK: 4194126435.                                       | _                               |   |  |  |  |  |
| Adve                    | rtised receiver windo  | v credit (a _rwnd): 109568,                           |                                 |   |  |  |  |  |
|                         | Number of dup  | licated TSNs: 0                                       |                                 |   |  |  |  |  |
|                         | ·  |   |                                 |   |  |  |  |  |
|                         | 33:DAT   | A Chunk   |                                 |   |  |  |  |  |
|                         | TSN: 270<br>Stream Iden  | 2200209,<br>lifier: 0x0000                            |                                 |   |  |  |  |  |
|                         | Stream seque   | nce number: 7   |                                 |   |  |  |  |  |
|                         |  |   |                                 |   |  |  |  |  |
| Releasing the SCTP conn | ection.  | I   |                                 |   |  |  |  |  |
| 34 Shutdown Indication  |  |   |                                 | The SCTP higher layer decides to release the SCTP             |  |  |  |  |
|                         |  |   |                                 | connection.   |  |  |  |  |
|                         | 35:SHUTD   | DWN Chunk   |                                 | Shutdown Chunk is sent out for releasing the SCTP connection. |  |  |  |  |
|                         | Cumulative TSN   |   | ▶                               |   |  |  |  |  |
|                         |  |   |                                 |   |  |  |  |  |
|                         | 36:SACK Chur<br>Cumulative TSN ACK: 270<br>Advertised receiver window credit<br>Number of gap acknowledger<br>Number of duplicated |   | A new acknowle                  | A new acknowledgement is received after sending the           |  |  |  |  |
| Adve                    |  |   |                                 | Shuhuuvviv Illessaye.   |  |  |  |  |
|                         |  |   |                                 |   |  |  |  |  |
|                         |  |   |                                 |   |  |  |  |  |
|                         | 37:SHUTDOW   | N_ACK Chunk   |                                 | Endpoint B accepts the release of the SCTP connection.        |  |  |  |  |
| •                       | 38.SHUTD   |   |                                 | The SHUTDOWN message is resent to reflect the                 |  |  |  |  |
|                         | Cumulative TSN   |   |                                 | sequence number received in the acknowledgement.              |  |  |  |  |
|                         |  |   |                                 | ~   |  |  |  |  |
|                         | 39:SHUTDOWN_   | COMPLETE Chunk  |                                 | This message completes the release of the SCTP                |  |  |  |  |
|                         |  |   | -                               | connection.   |  |  |  |  |
|                         |  |   |                                 |   |  |  |  |  |
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|                         |  |   |                                 |   |  |  |  |  |
| 1                       |  | I   | 1                               |   |  |  |  |  |