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### RESEARCH ARTICLE

# MULTIHOMING AND MULTISTREAM PROTOCOL IN COMPUTER NETWORKS

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#### *Abstract*

*SCTP (stream control transmission protocol) is a reliable message oriented transport layer protocol. It is an IETF standard developed by the Transport Area Working Group (TSVWG). SCTP has been standardized by the IETF(Internet Engineering Task Force) in series of RFCs ,as a reliable transport protocol to transport SS7(Signaling System 7) signaling messages for internet applications such as ISDN over IP, telephony sinagaling , media gateway control, IP telephony[5]. SCTP is similar to TCP in many services. They are both unicast connection-oriented reliable protocols, provide in-sequence packet delivery and congestion control. SCTP preserves message boundaries and at the same time detects lost data, and out of order data. It uses 32 bit checksum as opposed to a 16 bit checksum of TCP. Although TCP has traditionally been used, we argue that SCTP provides better services than TCP in terms of reliability and performance. Due to its attractive features such as multi-streaming and multi-homing. SCTP has received much popularity, in terms of both research and development [6, 7]. SCTP provides multi-homing in that endpoints can use multiple IP addresses for the connection. SCTP may be more resistant to Man in the Middle (MITM) and Denial of Service (DoS). Multi-stream does not refer to multiple streams in the TCP sense but rather each stream represents a sequence of messages within a single association. These may be long or short messages which include flags for control of segmentation and reassembly.*

**Keywords-** *SCTP, Multi-homing, Multi-stream*

#### **Introduction**

Stream Control Transmission Protocol (SCTP) [2] is a reliable, message oriented transport protocol that provides new services and features for IP communication. Before SCTP, TCP is used for reliable communication [1] as UDP is a unreliable protocol [4]. TCP is a stream oriented protocol. TCP has several deficiencies such as:

1) TCP strict byte-order delivery gives rise to head-of-line (HOL) blocking in some applications.

- 2) TCP is stream-oriented instead of message oriented.
- 3) TCP does not support multi-homing, that is, if there is a loss at any point, the whole data stream gets blocked .It cannot be tolerated if we are sending real time data such as audio or video
- 4) TCP is vulnerable to blind Denial of Service (DoS) attacks by SYN segments.

To overcome the above limitations of TCP for transport of signaling messages, a new transport protocol, Stream Control Transmission Protocol (SCTP), are used. SCTP provides several new features that are not available in TCP. The two most important of these are: 1) Multi-homing

2) Multi-stream service

Other additional benefits of SCTP are:

- 1) Allow half-closed connections.
- 2) Preservation of message boundaries.
- 3) Protect against SYN flooding attacks.
- 4) Selective acknowledgements.
- 5) Unordered data delivery.

**COMPARISON OF FEATURES**

Many of the features found in TCP and UDP can also be found in SCTP. By looking at Table 1, you can easily see the benefits of SCTP over TCP and UDP. SCTP, like TCP, provides a connection oriented, full duplex, reliable communication path. Many of the standard features you will find in TCP (congestion control, flow control, etc.) can also be found in SCTP. However, unlike TCP, SCTP provides a transport of messages, not just bytes. In this section we will go through the unique and strikingly different features found in SCTP (Multihoming and multistream).

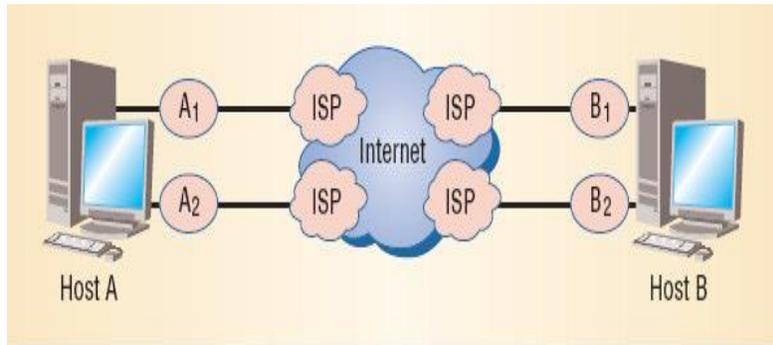
Services/Features	SCTP	UDP	TCP
Message-Oriented	yes	no	yes
Byte-Oriented	no	no	yes
Connection-Oriented	yes	No	yes
Reliable data transfer	Yes	no	yes
Partially-Reliable data transfer	optional	no	no
Ordered data delivery	yes	no	yes
Unordered delivery	yes	yes	no
Multistreaming	Yes	no	no
Multihoming	yes	no	No
Flow control	yes	no	yes
Congestion Control	yes	No	yes
ECN Capable	yes	no	yes
Selective Acknowledgments	yes	no	optional
Application PDU fragmentation	yes	no	Yes
Application PDU bundling	yes	no	yes
Path MTU discovery	yes	no	yes
SYN flooding attack prevention	yes	n/a	no
Allows half-closed state	no	n/a	yes
Time wait state	no	n/a	yes
Reach-ability	yes	no	optional
CRC based checksum	yes	no	no
Authentication	optional	no	optional
Pseudo-header for checks	no	yes	yes

**Table 1**

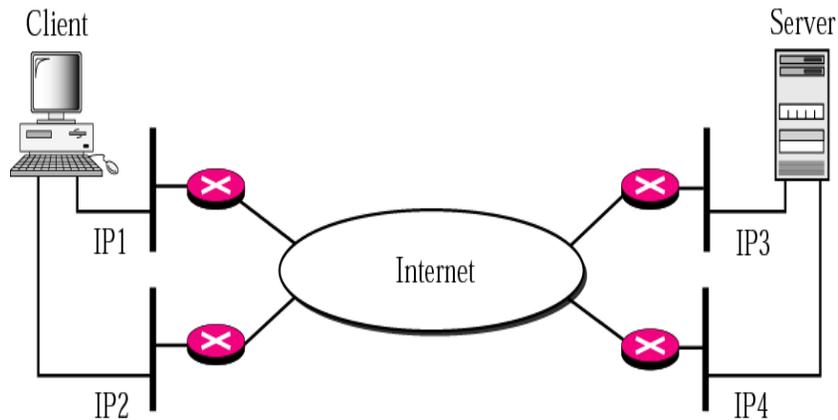
**Multihoming**

Multihoming is simply defined as having connection to the Internet through more than one Internet Service Provider (ISP).A TCP connection has involves one source and one destination IP address. This means that even if the sender and receiver is a multihomed (connected to more than one physical address with multiple IP addresses), only one IP addresses per end can be utilized during the connection .An SCTP on the other hand supports multihoming service. Multihoming allows two endpoints to set up an association with multiple IP addresses for each endpoint (In SCTP, *association* is the name for the communication relationship between endpoints). Therefore, sending and receiver can define multiple IP addresses. If one path fails, another interface can be used for data delivery without interpretation. Multihoming allows an

association between two endpoints span across multiple IP addresses or network interface cards. Multihoming is a desired functionality because it provides fault tolerance and guarantees a reliable connectivity for users. So many users, all around the world, are interested to use and benefit from this functionality. This built-in support for multihomed endpoints can utilize redundancy in the network, and allow high-availability applications perform switch over's during link failure situations without interrupting data transfer. Multi-homing is an essential property of SCTP is its support of multi-homed nodes, i.e. nodes which can be reached under several IP addresses. If we allow SCTP nodes to support more than one IP address, during network failure data can be rerouted to alternative destination IP addresses. This makes the nodes more tolerant against physical network failures and other problems of that type. Multi-homing enables systems that have multiple interfaces, for redundancy, to use one over the other without having to wait.



**Fig 1: Multihomed end hosts**



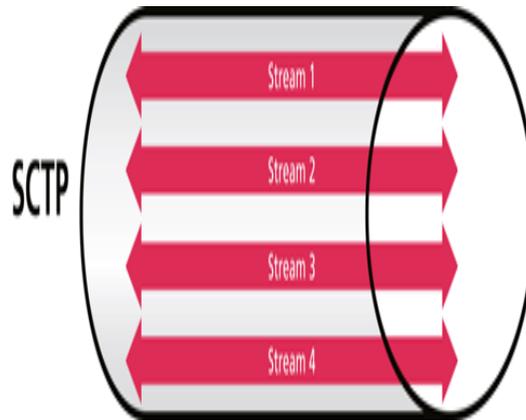
**Fig 2: Multihoming**

In the above scenario [Fig 2] the client and server is connected to network with two different IP addresses for each. Therefore the client and server make an association using four different IP addresses. But at a time only single association is used if there is a block in selected association then it can switch to another association. Therefore, SCTP does not allow local sharing between associations (paths).

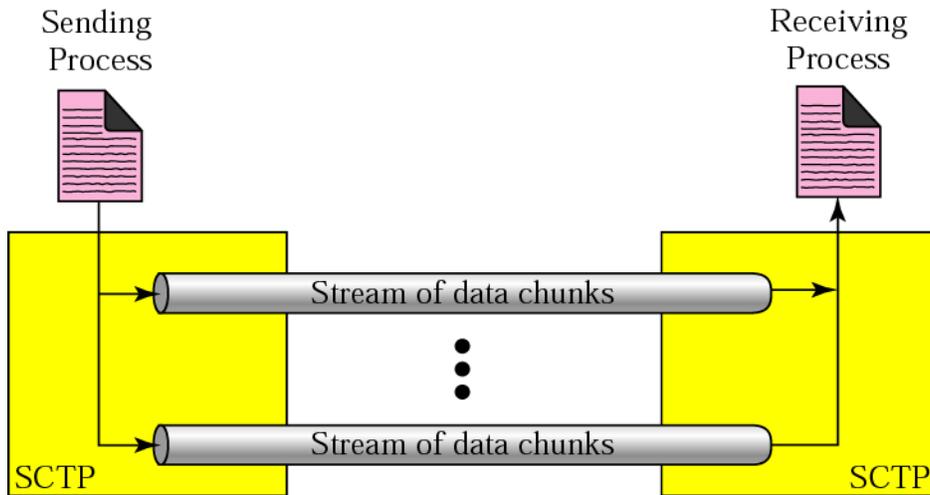
**Multistream**

Using TCP, only one single data stream is allowed per connection. All of the information must be passed through that one stream. In TCP single path is used for both transmissions, acknowledgement and retransmission of frames i.e. it is a stream oriented protocol. The main disadvantage of this approach is that if there is a loss at any point the whole data stream gets blocked. It cannot be tolerated if we are sending real time data such as audio or video. SCTP allows multistream service in each connection, which is called association. Multistreaming refers to the capability of SCTP to transmit several independent streams of data in parallel. SCTP allows multiple simultaneous data streams within a connection or association. Each message sent to a data stream can have a different final destination, but each must maintain message boundaries. If one of the streams gets blocked, the other stream can deliver the data. In TCP if a packet is

lost, the connection effectively grinds to a halt while it waits for the retransmission to be sent [3] . This phenomenon where packets are blocked by a previous packet in which has been lost is known as Head-of-Line blocking (HOL). TCP's strict byte-order delivery gives rise to head-of-line (HOL) blocking in some applications. Multistreaming is used to alleviate the head-of-line (HOL) blocking effect. The benefit in having multiple independent data streams is that only the stream that is affected would be blocked; the other streams would continue to send data. An SCTP association is equivalent to a TCP connection. They both represent an end-to-end relationship between two transmitting nodes. In TCP multistreaming involves multiple opening TCP connections through which stream of data is sent, but this method is not efficient because it involves larger portion of available channel bandwidth .On the other hand, multistreaming in SCTP involves a single association where all streams reside.



**Fig 3: Multi-streaming (SCTP Association)**



**Fig. 4: Multi-streaming**

**CONCLUSION**

This paper describes the multihoming and multistream property of Stream Control Transmission Protocol (SCTP). The Stream Control Transmission Protocol (SCTP) is as a reliable transport protocol which is used to overcome a number of limitations of TCP such as head of line (HOL) blocking. In general, SCTP can be used any place TCP can be used and gives the application greater flexibility. SCTP has received much has received much attention from the research community.

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