SCTP

Stream Control Transmission Protocol (SCTP) is a message oriented, reliable transport protocol with direct support for multi homing that runs on top of Internet Protocol (IPv4/IPv6).

Like TCP, SCTP provides reliable, connection-oriented data delivery with congestion control, path MTU discovery and message fragmentation. Unlike TCP, SCTP also provides:

1. Message framing
2. Multi-streaming
3. Multi-homing
4. Security and authentication
5. Ordered and unordered message delivery.

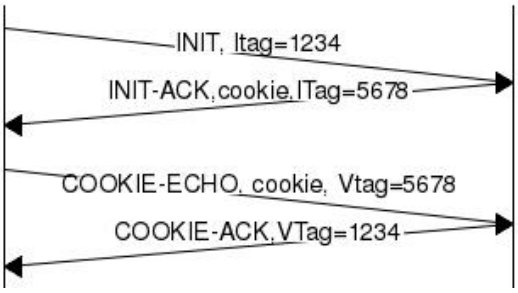
An increasing number of recent applications have found TCP too limiting. The limitations that users have wished to bypass include the following:

- The head-of-line blocking offered by TCP causes unnecessary delay as it provides strict order of transmission delivery of data. (Solved using Multi-Streaming)
- TCP treats data as a continuous stream of bytes without inherent message boundaries which requires extra overhead and additional processing. (Solved using Message Framing)
- TCP is relatively vulnerable to denial-of-service attacks, such as SYN attacks. (Solved using Security and Authentication Feature)

CONNECTION ESTABLISHMENT

The SCTP protocol was designed shortly after the first Denial of Service attacks against the three-way handshake used by TCP. These attacks have heavily influenced the connection establishment mechanism chosen for SCTP. An SCTP connection is established by using a four-way handshake.

The SCTP connection establishment uses several chunks to specify the values of some parameters that are exchanged. The SCTP four-way handshake uses four segments as shown in the figure below.

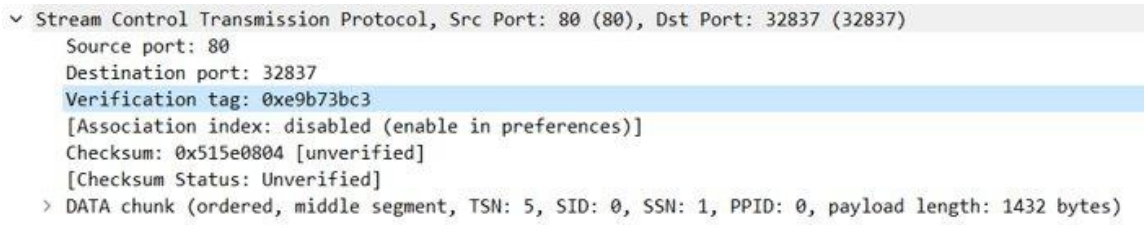


VERIFICATION TAG

- SCTP uses the Verification Tag to uniquely identify and correlate the endpoints of an association during its Four-Way Handshake.

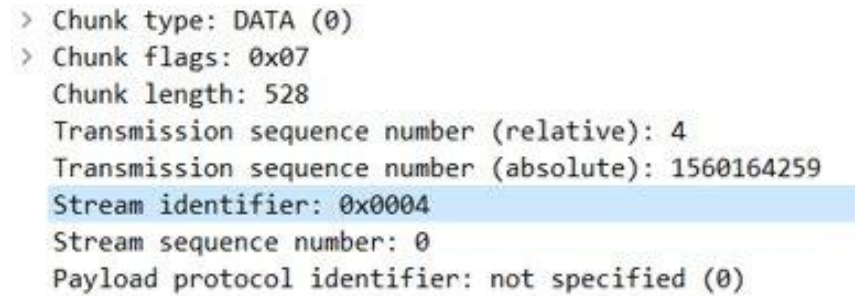
- It prevents resource exhaustion attacks such as SYN Flooding that attempt to overwhelm the system with large number of illegitimate connection attempts.

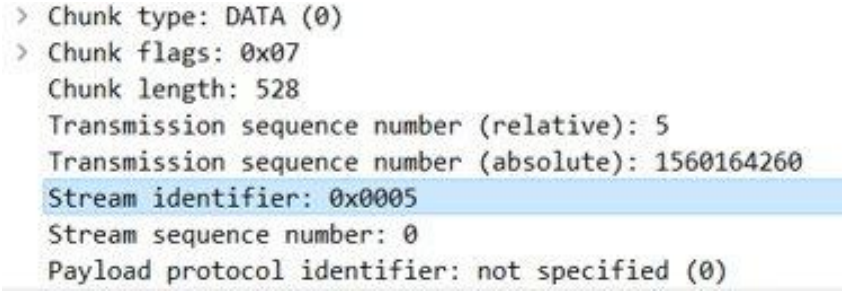
- It prevents blind attacks, where an adversary attempts to inject packets into an established association without knowledge of the current association's state reducing the risk of unauthorized access.



MULTI-STREAMING

- Multi-streaming in SCTP enables transmission of multiple streams of data concurrently which leads to increased parallelism and improved throughput.
- It helps mitigate the HOL blocking problem that can occur in protocols like HTTP/1.1, where the transmission of a large resource can be delayed by the transmission of a smaller resource in the same connection.





MULTI-HOMING

- Multi homing is the ability of an SCTP association to support multiple IP paths to its peer endpoint.
- In the event of network failures, such as a link going down, SCTP can dynamically switch to an alternate path, ensuring continuous communication.
- It enables load-balancing by distributing traffic among available paths and optimizing resource utilization.