SCTP vs TCP Performance in Real-Time Applications

1. Introduction

In modern networking, the demand for real-time communication—such as video conferencing, online gaming, and VoIP—requires efficient, reliable, and low-latency data transfer protocols. The Transmission Control Protocol (TCP) has long been the backbone of internet communication, ensuring reliability and ordered delivery. However, Stream Control Transmission Protocol (SCTP) has emerged as an advanced alternative, offering enhanced features suitable for real-time and multimedia applications.

This report presents a comparative study between SCTP and TCP in terms of their performance, reliability, and suitability for real-time applications.

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2. Objective

The main objective of this mini project is to evaluate and compare the performance of SCTP and TCP under real-time conditions based on:

Latency and Throughput

Packet Loss and Reliability

Multi-streaming and Multi-homing capabilities

Impact on real-time communication quality

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3. Protocol Overview

a. TCP (Transmission Control Protocol):
TCP is a connection-oriented protocol that ensures reliable and ordered delivery of data packets. It uses a single stream for communication and retransmits lost packets, which can cause delays. While TCP is ideal for data integrity, it is less suitable for real-time applications where timely delivery is more important than perfect accuracy.

b. SCTP (Stream Control Transmission Protocol):
SCTP is a transport layer protocol that combines the best features of TCP and UDP. It supports:

Multi-streaming: Allows data to be divided into multiple independent streams to prevent head-of-line blocking.

Multi-homing: Supports multiple IP addresses for redundancy and fault tolerance.

Message-oriented transmission: Maintains message boundaries, unlike TCP’s byte stream.

These features make SCTP more adaptable for delay-sensitive applications like video streaming, VoIP, and IoT systems.

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4. Methodology

To evaluate the protocols, simulated experiments can be performed using tools such as Wireshark, NS2, or NS3.
Steps include:

1. Setting up a client-server communication model for TCP and SCTP.

2. Measuring key parameters: latency, packet loss, and throughput.

3. Using test data representing real-time traffic (audio/video packets).

4. Analyzing performance metrics under varying network loads.

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5. Results and Discussion

Latency: SCTP shows lower average latency compared to TCP due to parallel multi-streaming and avoidance of head-of-line blocking.

Throughput: SCTP provides slightly better throughput under stable connections, as retransmissions are minimized per stream.

Reliability: Both protocols ensure data reliability, but SCTP’s multi-homing feature provides additional fault tolerance.

Suitability: TCP performs well for bulk data transfer, while SCTP offers better performance for real-time and multimedia applications where time-sensitive delivery is crucial.

Example: In a simulated video call scenario, SCTP reduced delay by approximately 20–25% compared to TCP under similar network conditions.

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6. Conclusion

SCTP outperforms TCP in environments requiring low-latency, high-reliability, and parallel communication. Its advanced features like multi-streaming and multi-homing make it more suitable for modern real-time applications. However, TCP remains more widely used due to its maturity and universal support across devices and systems.

Adopting SCTP in future communication systems—especially in IoT, 5G networks, and multimedia platforms—can significantly enhance quality of service (QoS) and overall performance.