TCP (Transmission Control Protocol) and UDP (User Datagram Protocol) are both transport layer protocols in the OSI model, responsible for enabling communication between devices over a network. However, they serve different purposes and have distinct characteristics.  
  
1. TCP (Transmission Control Protocol)  
  
Connection-Oriented: TCP establishes a connection before data can be sent. It ensures reliable communication between devices.  
  
Reliability: TCP guarantees that data is delivered accurately and in the correct order. If data is lost or corrupted, TCP will retransmit it.  
  
Flow Control: TCP uses flow control mechanisms to ensure that the sender does not overwhelm the receiver with too much data at once.  
  
Error Checking: It checks for errors in the data transmission and ensures that data is received correctly.  
  
Use Cases: TCP is used when reliability is critical, such as in applications like:  
  
Web browsing (HTTP/HTTPS)  
  
Email (SMTP, IMAP)  
  
File transfer (FTP)  
  
Remote login (SSH)  
  
  
Key Features:  
  
Three-Way Handshake: TCP initiates a connection with a three-step process: SYN, SYN-ACK, ACK.  
  
Flow and Congestion Control: TCP ensures that data flow is controlled and manages network congestion.  
  
Ordered Data Delivery: Ensures that data packets are received in the correct order.  
  
  
  
2. UDP (User Datagram Protocol)  
  
Connectionless: UDP does not establish a connection before sending data, making it faster but less reliable.  
  
No Reliability: UDP does not guarantee that data will be delivered, nor does it check for errors or retransmit lost data.  
  
No Flow Control: UDP does not manage data flow between sender and receiver.  
  
No Error Correction: If a packet is lost or corrupted, it is up to the application layer to handle it.  
  
Use Cases: UDP is used in situations where speed is more important than reliability, such as:  
  
Streaming media (audio/video)  
  
Online gaming  
  
VoIP (Voice over IP)  
  
DNS (Domain Name System)  
  
Real-time communication systems  
  
  
Key Features:  
  
No Handshake: Data is sent without the establishment of a connection, which allows for faster transmission.  
  
Unreliable Delivery: No guarantee that packets will reach their destination.  
  
Lower Overhead: Due to the lack of error checking and connection establishment, UDP has lower overhead compared to TCP.  
  
  
  
Comparison of TCP and UDP:  
  
In summary, TCP is used when reliability and ordered delivery are critical, while UDP is chosen when speed is more important than guaranteed delivery, and the application can tolerate some data loss.  
  
  
  
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