### 15.Download iperf in laptop/phone and make sure they are in same network. Try different iperf commands with tcp, udp, birectional, reverse, multicast, parallel options and analyze the bandwidth and rate of transmission, delay, jitter etc.

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**1. TCP vs UDP in iPerf**

TCP (Transmission Control Protocol)

* Reliable: Ensures all data is received correctly.
* Connection-Oriented: Requires a handshake before data transfer.
* Used for: File transfers, web browsing, and email.
* Performance Metric: Measures throughput (Mbps/Gbps).

UDP (User Datagram Protocol)

* Unreliable but fast: Does not guarantee delivery.
* Connectionless: No handshake, data is sent continuously.
* Used for: Streaming, VoIP, gaming, and real-time applications.
* Performance Metric: Measures packet loss, jitter, and latency.

**2. iPerf Test Modes**

Basic Bandwidth Test

* Server: Listens for incoming connections.
* Client: Sends data to test bandwidth capacity.
* Example: A client sends data to a server, and iPerf calculates the available network speed.

Bidirectional Testing

* Measures network performance in both directions simultaneously.
* Useful for full-duplex networks where sending and receiving occur at the same time.

Reverse Mode

* Normal iPerf tests send data from client to server.
* In reverse mode, data flows from server to client.
* Helps in testing download speeds instead of uploads.

Parallel Streams

* Simulates multiple concurrent connections.
* Useful for checking server load handling and congestion.

Multicast Testing

* Sends UDP traffic to a multicast group address.
* Used in video streaming, IPTV, and conference calls.

**3. Key Network Performance Metrics in iPerf**

Bandwidth:

* The maximum data transfer rate over a network.
* Measured in Megabits per second (Mbps) or Gigabits per second (Gbps).

Latency (Delay):

* The time taken for a packet to travel from sender to receiver.
* Measured in milliseconds (ms).
* Higher latency leads to slow network response.

Packet Loss:

* The percentage of dropped packets during transmission.
* Should be close to 0% for a stable network.
* Higher packet loss leads to poor quality in VoIP and video streaming.

**4. Real-World Application of iPerf**

* Checking network speed between two devices.
* Troubleshooting slow internet or LAN speeds.
* Testing the impact of firewalls, routers, and switches.
* Optimizing network performance for cloud and data centers.