Lab 4: **Lab Assignment: Network Simulation Using MATLAB**

Objective:

1. Simulate a simple computer network using MATLAB.
2. Analyze network performance metrics such as throughput, delay, and packet loss.
3. Visualize data transmission over the network.

Tasks:

1. Design a Simple Network Topology

Simulate a network with:

- **1 Router**
- **2 Hosts (H1 and H2)**
- **A communication link between H1 ↔ Router ↔ H2**

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2. Key Parameters

- **Bandwidth (B):** 10 Mbps
- **Packet size:** 1 KB
- **Propagation delay (Tp):** 10 ms
- **Simulation duration:** 10 seconds
- **Traffic generation:** Poisson process for packet arrival

1. **Shows all Metrics Output:**

- **Throughput:** How much data is transmitted per second.
- **Average Delay:** The average time a packet takes to travel from source to destination.
- **Packet Loss Rate:** Percentage of dropped packets due to queue overflow.

2. **Shows all Graphs:**

- **Packet Arrivals:** Visualize when packets arrive at the router.
- **Packet Transmissions:** Show transmission times of packets.
- **Cumulative Packets Sent:** Display the total number of packets sent over time.

3. **Assignment Questions:**
   3.1. How does increasing the packet arrival rate (λ) affect throughput and delay?
   3.2. What happens to the packet loss rate when the queue size is reduced to 5?
   3.3. Modify the bandwidth to 100 Mbps. How does it impact the performance metrics?

Part 2:

Scenario: Multiple Links

The new network setup includes:

- **1 Router (R1)** with multiple links.
- **2 Hosts (H1 and H2)** connected to the router via separate links.
- A shared bandwidth and queue at the router to simulate contention.

Each link has its own propagation delay and bandwidth. The router handles packets from both hosts and forwards them according to their arrival time.

- Host 1 uses **Link 1** with bandwidth `B1` and propagation delay `Tp1`.

- Host 2 uses **Link 2** with bandwidth `B2` and propagation delay `Tp2`.

Assignment Questions:

1. **Do same for multi-links. Shows all Metrics Output. Shows all Graphs.**
2. **Do for private ip and public ip and do comparative analysis.**