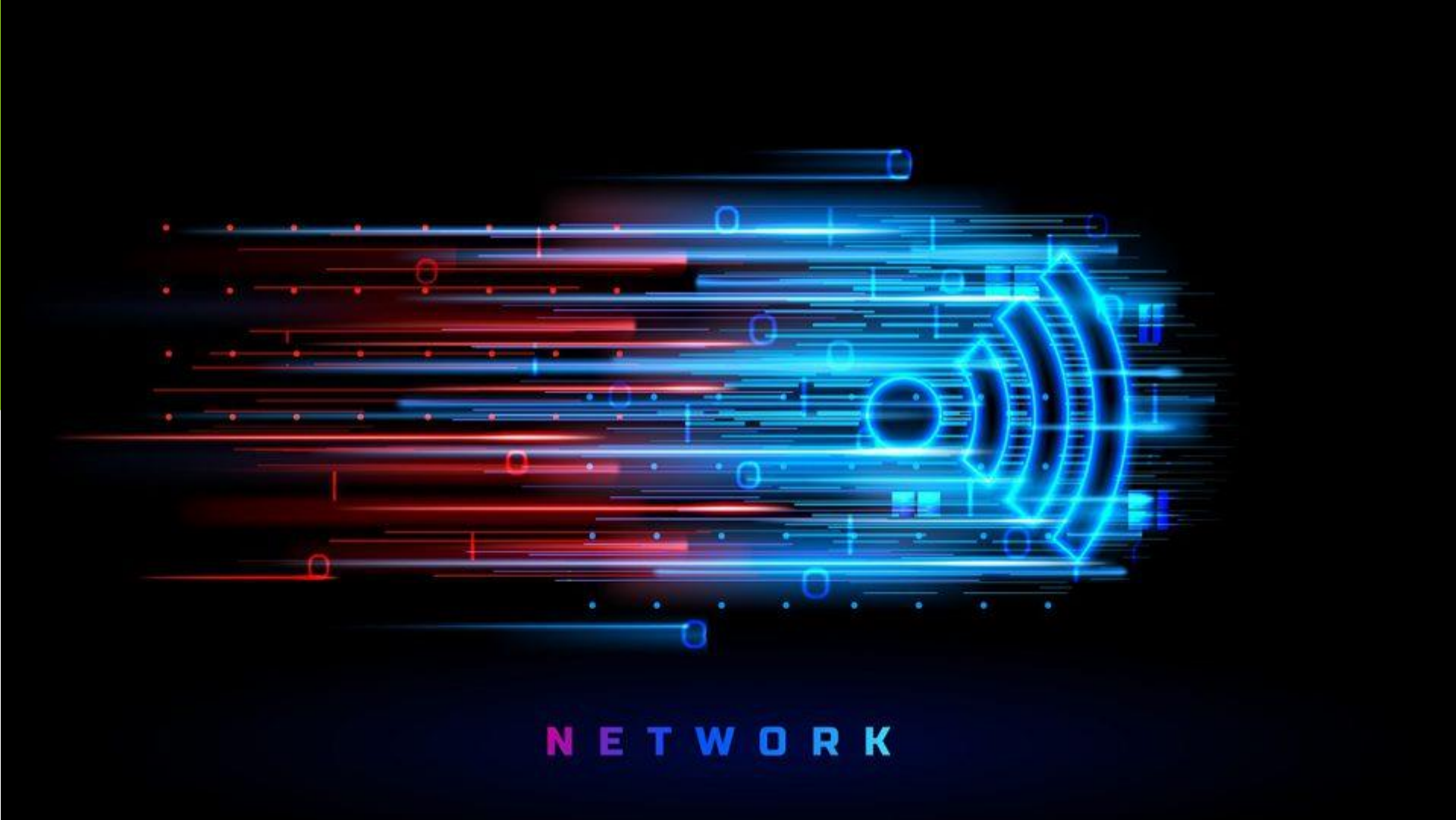
NETWORK

Network performance

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Network performance

Network performance

- Performance of a network related to the measure of service quality of a network as perceived by the user. There are different ways to measure the performance of a network, depending upon the nature and design of the network.

Network performance

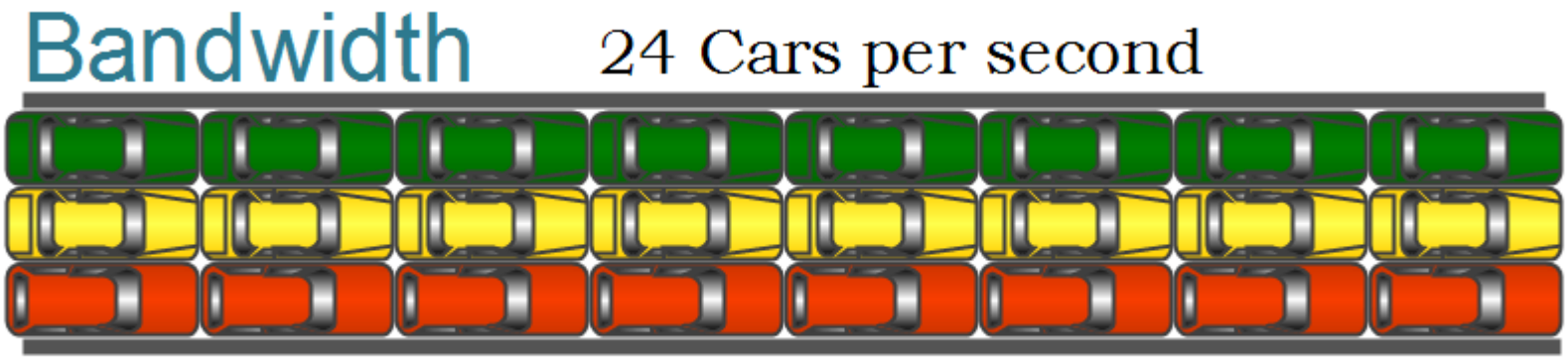
- **The characteristics that measure the performance of a network are**
  - Bandwidth
  - Throughput
  - Latency (Delay)

Bandwidth vs throughput

❑ **Let us consider:** A highway which has a capacity of moving, say, **200 vehicle** at a time. But at a random time someone notices only, say, **150 vehicles** moving through it due to some congestion on the road. As a result, the capacity is likely to be 200 vehicles per unit time and the throughput is 150 vehicles at a time.

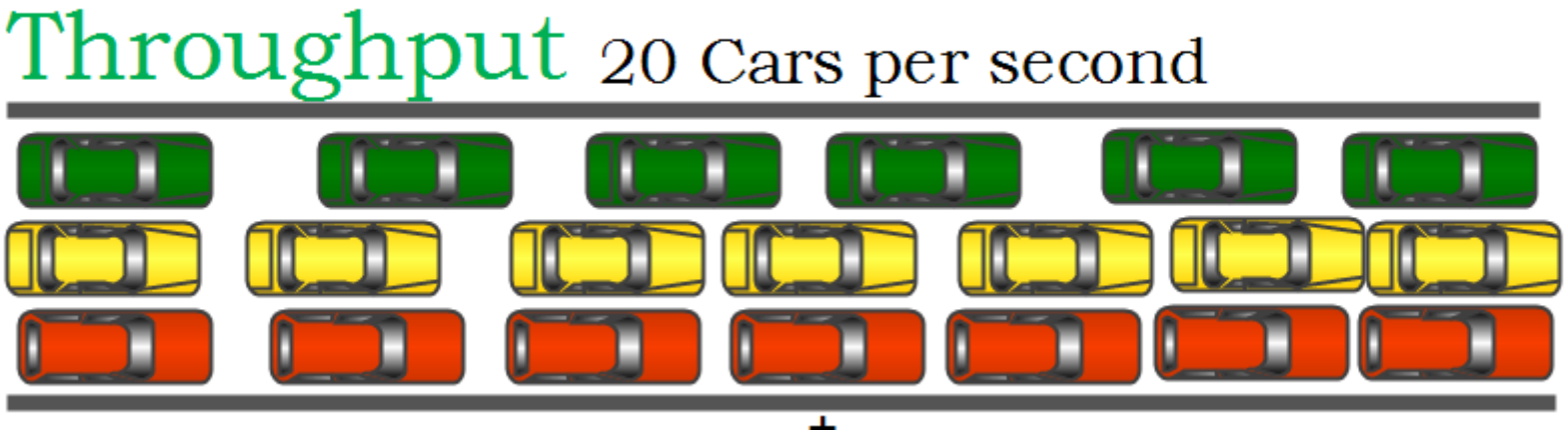
BANDWIDTH

- Bandwidth describes the information-carrying capacity of a medium



Throughput

- throughput describes the actual use of that capacity.



Measuring throughput and bandwidth

- The following table lists the common bits rate of digital signals used in computer networks.

Bits Rate	Description
1bps	1 bit per second
1Kbps	1000 bits per second
1Mbps	1,000,000 bits per second
1Gbps	1,000,000,000 bits per second
1Tbps	1,000,000,000,000 bits per second

Let’s take one more example.

File size: **46 megabits**

Ethernet overhead (the total of extra information which each data packet conta ins such as header and trailer): **10 megabits.**

The total amount of data to be transferred:

56 megabits (46 megabits + 10 megabits)

Bandwidth (Maximum data transfer speed): **56 Mbps**

Amount of data lost due to errors and acknowledgments: **28 Mbps**

Throughput: **56 Mbps - 28 Mbps = 28 Mbps**

The time it takes to transfer the entire file: **56 megabits/28 Mbps = 2 second s**

Let’s take one more example.

Example:

Input: A network with bandwidth of 10 Mbps can pass only an average of 12,

000 frames per minute where each frame carries an average of 10, 000 bits.

What will be the throughput for this network?

Output: We can calculate the throughput as

Throughput = (12, 000 x 10, 000) / 60 = 2 Mbps

Latency

- Latency is the delay between a user's action and a web application's response to that action,
- In simpler terms: latency may be defined as the time required to successfully send a packet across a network.

Latency is generally measured in milliseconds (ms)

Latency

- There are four main components that affect network latency, including:

Latency = Propagation Time + Transmission Time + Queuing Time + Processing Delay

Propagation Time

- **Propagation Time:** It is the time required for a bit to travel from the source to the destination.
- Propagation time can be calculated as the ratio between the link length (distance) and the propagation speed over the communicating medium. For example, for an electric signal, propagation time is the time taken for the signal to travel through a wire.

Propagation time = Distance / Propagation speed

Propagation Time

Example:

Input: What will be the propagation time when the distance between two points is 12, 000 km?

Assuming the propagation speed to be 2.4 * 10^8 m/s in cable.

Output: We can calculate the propagation time as-

Propagation time = (12000 * 10000) / (2.4 * 10^8) = 50 ms

Transmission Time

- the amount of time from the beginning until the end of a message transmission.
- In the case of a digital message, it is the time from the first bit until the last bit of a message has left the transmitting node.

Transmission Time

- transmission time in seconds can be obtained from the packet size in bit and the bit rate in bit/s as:
- transmission time = Packet size / Bit rate(bandwidth)

Example: Assuming 100 Mbit/s Ethernet, and the maximum packet size of 1526 bytes,

Maximum packet transmission time = 1526×8 bit / (100 × 106 bit/s) ≈ 122 µs

Example

- Example:
- Input:What will be the propagation time and the transmission time for a 2.5-kbyte message when the bandwidth of the network is 1 Gbps? Assuming the distance between sender and receiver is 12, 000 km and speed of light is 2.4 * 10^8 m/s.

Output: We can calculate the propagation and transmission time as-

- Propagation time = (12000 * 10000) / (2.4 * 10^8) = 50 ms
- Transmission time = (2560 * 8) / 10^9 = 0.020 ms

Queuing Time

- Queuing time is a time based on how long the packet has to sit around in the router.

Processing time

- Processing time :time required to process packet at router or destination host to remove header ,Perform error detection and correction procedure.

Check the network latency

- you can check the network latency of your internet connection with any website

by passing its web address or IP address in the command prompt on a Windows or Mac.

Here is an example of the command prompt on Windows:

C:\Users\username>ping www.google.com

Pinging www.google.com [172.217.19.4] with 32 bytes of data:

Reply from 172.217.19.4: bytes=32 time=47ms TTL=52

Reply from 172.217.19.4: bytes=32 time=45ms TTL=52

Reply from 172.217.19.4: bytes=32 time=47ms TTL=52

Reply from 172.217.19.4: bytes=32 time=43ms TTL=52

Ping statistics for 172.217.19.4:

Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),

Approximate round trip times in milli-seconds:

Minimum = 43ms, Maximum = 47ms, **Average = 45ms**

Check the network latency

Here you can see the result of pinging www.google.com. The statistics show that the average time it takes for a roundtrip between the given PC and Google’s network is 45ms.

Task

- Write a program that computes Bandwidth, Throughput, Latency of the network (your Router)