Data Structures

Binary Trees and Binary Search Trees

Problem: Network Tree

One day you open TikTok only to discover that it has been banned in Pakistan. So you connect to a VPN and easily get access to TikTok. The next day your friend tells you that a new season of Squid Games has been released so you log in to Netflix and start streaming.

Let us see what is actually happening behind all these connections to different websites.

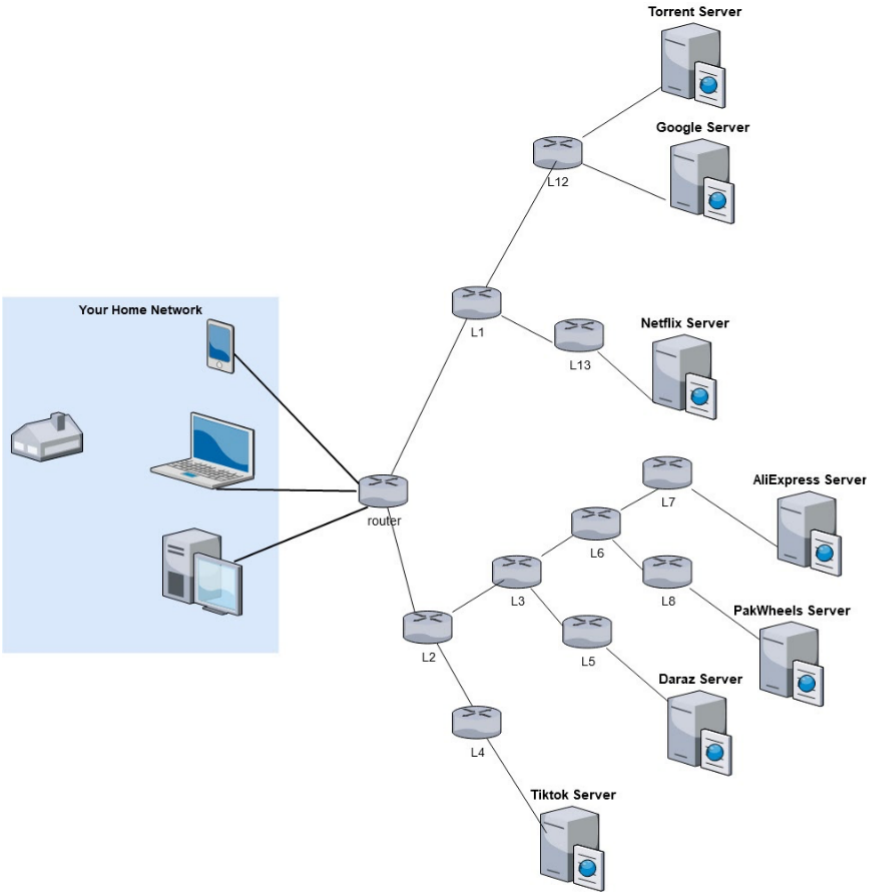
Your laptop is connected to the router at your home, which acts as a gateway from your network to the internet i.e. all the devices outside your network. Every device including the router has an IP Address that acts as the device's unique identity. The communication i.e. the data sent and received, between any two devices, takes place in packets. Every packet contains a source IP Address and destination IP Address this information tells the packet where to go and where to come back. All the devices are connected to each other using IP Addresses and this makes up the internet.

TASKS:

1. Create a Binary Search Tree of the network given in Figure. The insertion of different devices in the network tree will follow the principle of BST i.e. the left subtree should be lesser than the right subtree of every node. This decision can be made on the basis of the IP Addresses of each device. Think about which device should be the root of the tree?

2. Find and display the path the packet(generated from your laptop) will take to reach every server in the network.

Considering the network below has the IP Address given in the table, the communication between your laptop and the TikTok server takes place in the following manner.



Device	IP Address	Device	IP Address
Laptop	192.168.11.29	L8	172.150.12.08
Router	192.168.11.01	PakWheels Server	172.150.12.03
L2	172.132.11.01	L7	172.150.13.32
L4	172.129.11.03	AliExpress Server	172.150.13.40
TikTok Server	172.129.11.08	L1	192.176.11.01
L3	172.150.11.01	L13	192.170.11.08
L5	172.150.09.01	Netflix Server	192.170.11.03
Daraz Server	172.150.08.01	L12	192.180.11.10
L6	172.150.13.01	Torrent Server	192.180.11.13

Google Server	192.180.11.09	------	--------

- Your system wants to connect to TikTok server.
- The system generates a packet for communication. The source IP Address in packet is your laptop's IP Address and destination IP Address is your router's IP Address, it is because the first stop of packet is the router.
- Once the packet reaches the router the source Address changes to router's IP Address and destination Address changes to L2's IP Address. The packet is then forwarded to L2.
- Once the packet reaches the L2 the source Address changes to L2's IP Address and destination Address changes to L4's IP Address. The packet is then forwarded to L4.
- Once the packet reaches the L4 the source Address changes L4's IP Address and destination Address changes to TikTok server's IP Address, now the packet finally reaches the server.
- Similar communication takes place for other websites as well.