Lab-03-A

Aim: To create Sub-LAN Networks

Objective: Connect 3 PCs to a switch and configure 2 PCs in one sub-LAN and the remaining PC in a different sub-LAN.

Theory of Sub-LAN Networks:

A Sub-LAN (Sub Local Area Network) is a smaller segment within a larger Local Area Network (LAN). It is created by dividing a LAN into multiple smaller networks or subnets. Each sub-LAN or subnet functions as an independent network, with its own range of IP addresses. Devices within the same sub-LAN can communicate directly with each other, while communication between different sub-LANs often requires routing.

A subnet is used to divide a large network into a number of smaller, linked networks, which helps to minimize traffic. Subnets reduce the need for traffic to use unnecessary routes, which speeds up the network. By removing the need for extra routers, subnetting makes network traffic simpler. This makes sure the data being transmitted can get to its destination as fast as possible, eliminating or avoiding any potential diversions that may slow it down.

To do in the Lab:

- Assign IP addresses to each PC, grouping 2 PCs in one subnet and the 3rd PC in a different subnet.
- Test connectivity within the PCs of same subnet.
- Test connectivity within the PCs of two different subnets.

Exercise-1:

Explain the steps to configure static IP addresses for PCs in different sub-LANs.

Exercise-2:

Perform a ping test between PCs in the same sub-LAN and between PCs in different sub-LANs. Document the results and explain the significance.

Expected Output :

- The two PCs within the same subnet must be connected and communicate with each other, while two PCs from two different subnets should fail to communicate with each other.

Sample Questions:

Q-1) Explain the differences between a LAN and a sub-LAN. Why would you use sub-LANs within a LAN?

Q-2) Explain the role of subnet masks in dividing networks. How does the subnet mask in this experiment determine which PCs are in the same or different sub-LANs?

Q-3) Given the configuration above, if PC3 needed to communicate with PC1 and PC2, what additional network configuration would be necessary?

Q-4) What challenges might you face if you were to add more devices to each sub-LAN?

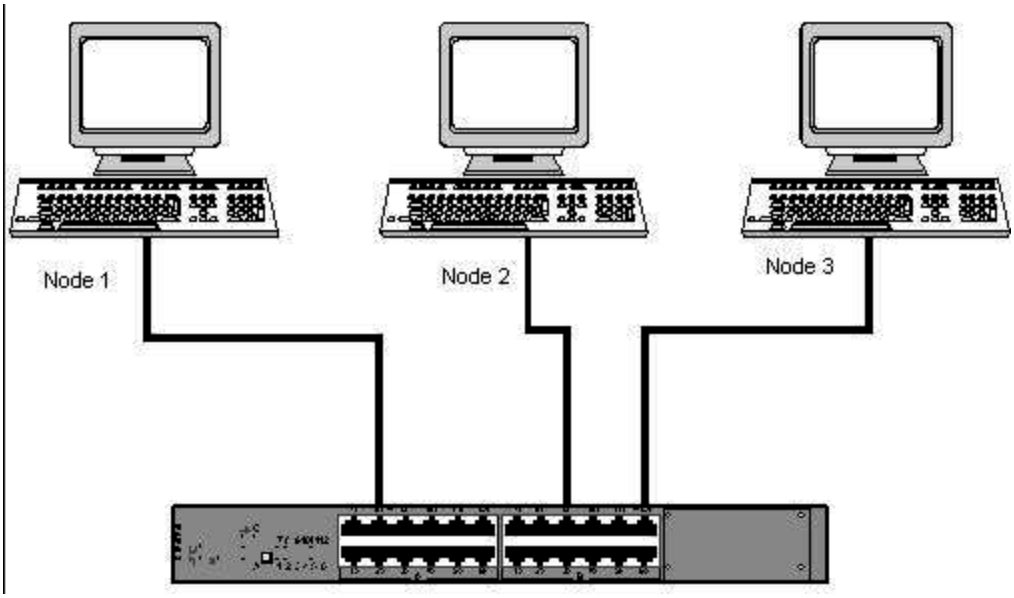
References:

- **https://www.javatpoint.com/subnetting-in-computer-networks#:~:text=A%20subnet%20is%20a%20smaller,which%20helps%20to%20minimize%20traffic.**
- **https://www.geeksforgeeks.org/introduction-to-subnetting/**

Lab-03-B

Aim: To set up and configure DHCP

Resources: Linux OS, 3 PC's, Hub



DHCP Theory

IP addresses assignment

Static Address Assignment - Static IP address is assigned to the machines either during installation of the Operating Systems or later using Network Configuration tools. In case of post-installation configuration, either netconfig or ifconfig or /sbin/setup can be the possible candidates. The problem with this method is that, there is a greater probability of duplication.

Dynamic Address Assignment - DHCP enables the clients in the network to get their IP addresses as well as information about the network parameters assigned by the DHCP server on the network. In case of DHCP, the dynamic address is given when the client boots once its configured for DHCP. This means that, every time the IP address of the machine may not be the same. DHCP assigns the IP address to the client from its pool of addresses.

The Dynamic Host Configuration Protocol (DHCP) provides configuration parameters to Internet hosts. DHCP consists of two components: a protocol for delivering host-specific configuration parameters from a DHCP server to a host and a mechanism for allocation of network addresses to hosts.

DHCP is built on a client-server model, where designated DHCP server hosts allocate network addresses and deliver configuration parameters to dynamically configured hosts.

DHCP supports three mechanisms for IP address allocation.

Automatic allocation - DHCP assigns a permanent IP address to a client.

Dynamic allocation - DHCP assigns an IP address to a client for a limited period of time (or until the client explicitly relinquishes the address).

Manual allocation – A client's IP address is assigned by the network administrator, and DHCP is used simply to convey the assigned address to the client. A particular network will use one or more of these mechanisms, depending on the policies of the network administrator.

Dynamic allocation is the only one of the three mechanisms that allows automatic reuse of an address that is no longer needed by the client to which it was assigned. Thus, dynamic allocation is particularly useful for assigning an address to a client that will be connected to the network only temporarily or for sharing a limited pool of IP addresses among a group of clients that do not need permanent IP addresses. Dynamic allocation may also be a good choice for assigning an IP address to a new client being permanently connected to a network where IP addresses are sufficiently scarce that it is important to reclaim them when old clients are retired. Manual allocation allows DHCP to be used to eliminate the error-prone process of manually configuring hosts with IP addresses in environments where (for whatever reasons) it is desirable to manage IP address assignment outside of the DHCP mechanisms.

DHCP defines mechanisms through which clients can be assigned a network address for a finite lease, allowing for serial reassignment of network addresses to different clients. Also, DHCP provides the mechanism for a client to acquire all of the IP configuration parameters that it needs in order to operate.

To do in the Lab:

Server Side:

- Install the isc-dhcp-server package, which provides the DHCP server functionality needed to assign IP addresses to devices on your network.
- Configure the DHCP Server, i.e define the network settings for your DHCP server.
- Start the DHCP Server Service, so that it can begin assigning IP addresses to clients on the specified subnet.
- Check the IP(which is assigned dynamically).

Client Side:

- Configure the network settings file of your system, and set up the 'enp2s0' network interface to use DHCP to obtain an IP address automatically. (check by 'ip a' for the interface name of your system)
- Restart Network manager and systemd-networkd services to apply the changes.
- Verify the address obtained from DHCP server.

Exercise-1:

Try configuring the dhcpd by adding the configuration options in /etc/dhcpd.conf. Check the assignment of the addresses with 1 server and 2 clients connected through a hub. Check out whether the combinations of above options and result are consistent.

Expected Output :

- Steps followed in setting up a DHCP.
- Name of the file(s) you have modified (if any).
- Note the modification(s) (if any) done to the file(s).
- The necessary tests that you performed to check if the DHCP works.

Sample Questions:

Q1.What is the difference between static IP address and dynamic IP address.?

Q2.What do you mean by lease time of dynamically assigned IP address? How its value isgoverned?

Q3.How can one bind an IP address to a MAC address?

References:

- **https://tldp.org/HOWTO/DHCP/**
- **http://www.astahost.com/info.php/howto-setup-dhcp-server-linux_t2602.html**