Objectives: After this experiment, we will be able to

1. learn how to subnet mask a network.
2. classify an IP address based on its 1st octet.
3. learn how does VLSM ~~work~~ and FLSM work.

Introduction: IP address has two versions IPv4 (32 bits) and IPv6 (128 bits) of which currently we are using IPv4. An IP address can be classified into two types. — ① Classful and ② Classless (subnetting). VLSM (Variable length Subnet mask) is a subnet ~~where~~ design strategy where all subnet masks can have varying sizes.

Theory:

Classful IPv4

	bits (32)	Range	Network bits	Representation
Class A	0.....	0-127	1st 8 bits	IP/8
Class B	10.....	128-191	1st 16 bits	IP/16
class C	110.....	192-223	1st 24 bits	IP/24
class D	1110....	224-239		
class E	1111....	240-255		

Class D is used for multicasting while class E is kept for reserved.

FLSM (Fixed length Subnet mask)

1. Say, we have a network IP address 192.168.1.0/24. We have 5 departments that need networks of sites 30, 20, 10, 5, 4. Now using subnet mask to determine the IP address for these 5 departments are shown below.

	IP address Range
CSE(30)	192.168.1.0 - 192.168.1.31/27
EEE(20)	192.168.1.32 - 192.168.1.63/27
ECE(10)	192.168.1.64 - 192.168.1.95/27
ME(5)	192.168.1.96 - 192.168.1.127/27
LE(4)	192.168.1.128 - 192.168.1.159/27

Here, for 5 departments only 3 bits needed to subnetting. Rest 5 bits (32-24-3) were used for host IP address.

Total 27 (24 fixed + 3 subnet section) bits are used for subnet mask. Subnet mask will be $\underbrace{11111111}_{255}.\underbrace{11111111}_{255}.\underbrace{11111111}_{255}.\underbrace{111\,00000}_{224}$

VLSM (Variable length Subnet mask)

Using VLSM for CSE(30), EEE(20), ECE(10), ME(11)

	IP address Range
CSE(30)	192.168.0.0 - 192.168.0.31/27
EEE(20)	192.168.0.32 - 192.168.0.63/27

But since ECE and ME needs IP address less than 16 so, only 4 bits are enough to represent these host address.

ECE(10)	192.168.0.64 - 192.168.0.79/28	1 bit from previous host section is added to subnet section
ME(11)	192.168.0.80 - 192.168.0.95/28	

Discussion: An IP address has three sections - network section and host section. Since some of the bits of IP address are fixed for classful IP address, class A has 50% of total IP, class B has 25% of total IP and class C has 12.5% total IP. An IP address and subnet mask can be used to find the base network address doing AND operation. In FLSM and VLSM 1st IP address represents the network address and last IP address represents the broadcasting address. So, these two IP address cannot be used for hosting.

Conclusion: Classful IP address often results to IP address being wasted. That's why FLSM and VLSM is used. Again FLSM also may lead to IP address wastage. But VLSM keeps the wastage to the minimum. During implementation of VLSM host address number must be considered first before the number of networks.

Reference:

1. Lab lecture (lecture delivered during LAB CSE 4106)

Objectives: We will be able to

1. learn how to use CISCO PACKET TRACER.
2. learn how to create network using Cisco Packet Tracer.
3. learn how does DHCP work.

Introduction: Cisco Packet Tracer is a network simulating tool. It is used to visualize how a network works. This software has various tools for creating a network (virtual) and simulate that.

Dynamic Host Configuration Protocol (DHCP) is a Client/Server protol that automatically provides an Internet Protocol (IP) host with its IP address and related configuration information such as the subnet mask and default gateway.

Theory: Cisco Packet Tracer has many features to use for creating and simulating a network. They are described below briefly.

1. Network devices
   - → Routers
   - → Switches
   - → Hubs
   - → wireless device
   - → security

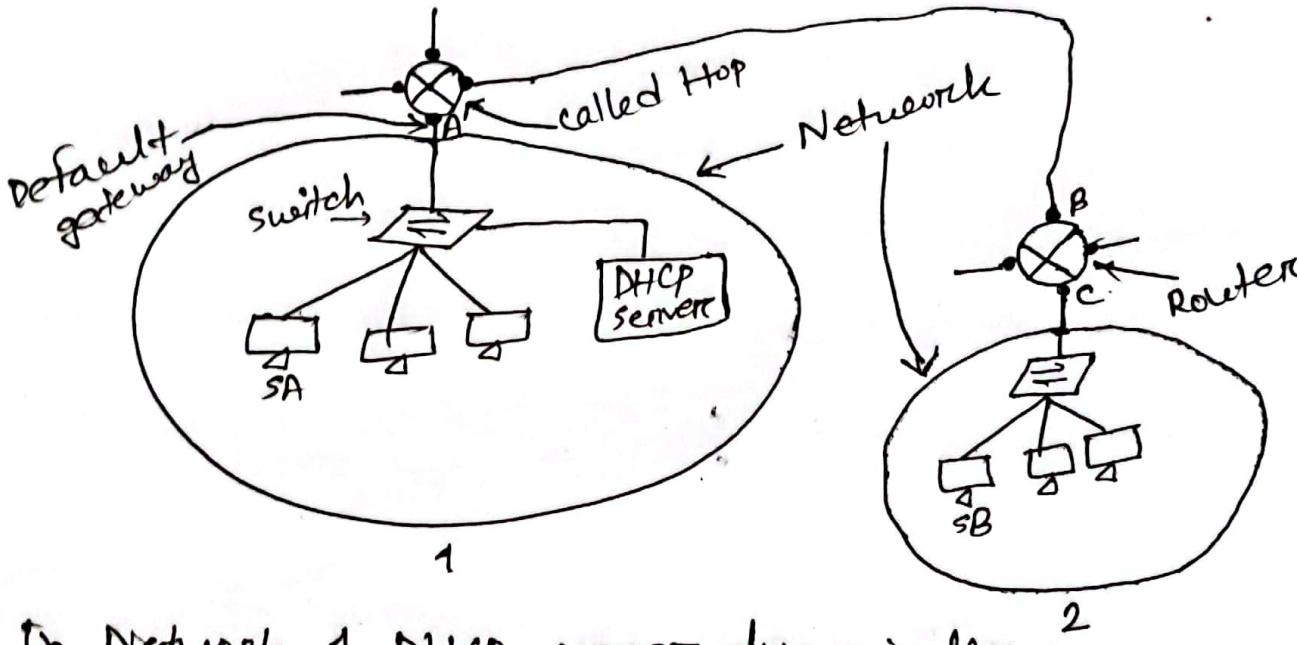
2. End devices
   - → end device (PC, laptop, server, tv, tablet, smart phone)
   - → home appliances (AC, battery, ceiling fan)
   - → smart city
   - → industrial

3. Components
   - → Boards
   - → Actuators
   - → Sensors

4. Connections
   - → console
   - → straight-through cable
   - → cross-over cable
   - → fiber
   - → coaxial

5. Miscellaneous

DHCP



Here, In Network 1 DHCP server dynamically assigns IP address to all the pc connected to the switch. In Network 2 all the PC have been assigned static IP address manually. If want to send msg from SA to SB, the msg flow direction will be as follows →

1. SA → switch
2. switch → default gateway (Router)
3. Router 1 → Router 2
4. Router 2 → switch
5. switch → SB

A and C are the default gateways for Router 1 and 2 respectively.

Discussion: In Cisco Packet Tracer we generally use Router 2911, Switch 2960. Router has 3 ethernet ports, PC has 1 ethernet port and switch has more ethernet port than any network device. In Cisco Packet Tracer, we can also use simulation to see how the msg transmits from one end-device to another device.

Conclusion: It is easy to use Cisco Packet Tracer to virtually create a network before physically implementing it and simulate it. That way, creating a complex would be less troubling. DHCP server minimizes errors caused by manual IP configuration.

References:

1. www.netacad.com/courses/packet-tracer
2. learn.microsoft.com/en-us/windows-server/networking/technologies/dhcp/dhcp-top
3. Cisco Packet Tracer (Software)
4. Lab lecture (lecture delivered in LAB CSE4106)