LAB: Assignment 4

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Objective: Understand the concept of subnetting and configure a VPC in GNS3

1. Significance of classful addressing (Class- A, B, C, D and E in IP-addressing)

The first addressing system to be implemented as part of the Internet Protocol was Classful Addressing.Class A, Class B, Class C, Class D, and Class E are the five varieties of Classful addresses. In IPv4, this classification is known as Classful addressing or IP address classes.

- The first three classes, Class A, B, and C, are used for "public addressing", in which communication is always one-to-one between source and destination. It implies that when data is transmitted from a source, it will only be sent to a single network host.
- The reserved categories include Class D and Class E, with Class D being utilized for multicast and Class E being saved for future usage exclusively.
- In IPv4, the Network ID is the first part of Class A, B, and C, while the Host ID is the remaining second portion.
- The Host ID always indicates the number of hosts or nodes in a certain network, whereas the Network ID always identifies the network in a specific place.
- In Class A, B, and C, the address space is split into a certain number of IP address blocks. It also specifies the maximum number of hosts in a network.

2. Discussion on subnetting and subnet mask

Subnetting is the strategy used to partition a single physical network into more than one smaller logical sub-networks (subnets). An IP address includes a network segment and a host segment. Subnets are designed by accepting bits from the IP address's host part and using these bits to assign a number of smaller sub-networks inside the original network. Subnetting allows an organization to add sub-networks without the need to acquire a new network number via the Internet service provider (ISP). Subnetting helps to reduce the network traffic and conceals network complexity. Subnetting is essential when a single network number has to be allocated over numerous segments of a local area network (LAN).

A **subnet mask** is a 32 bits address used to distinguish between a network address and a host address in IP address. A subnet mask identifies which part of an IP address is the network address and the host address. They are not shown inside the data packets traversing the Internet. They carry the destination IP address, which a router will match with a subnet.

3. Example for Self-Practice:

We have a big single network having IP Address 200.1.2.0. We want to do subnetting and divide this network into 4 subnets.

Identify following:

a. IP Address of the subnets

b. Total number of IP Addresses in each subnet

c. Total number of hosts that can be configured in each subnet
d. Range of IP Addresses in each subnet

a. If we want to divide the network into 4 subnets, we need to use a subnet mask that will allocate 2 bits for the subnet portion of the address. The subnet mask for this will be 255.255.255.192. The 4 subnets will have the following IP addresses:

- Subnet 1: 200.1.2.0
- Subnet 2: 200.1.2.64
- Subnet 3: 200.1.2.128
- Subnet 4: 200.1.2.192

b. With a subnet mask of 255.255.255.192, each subnet will have 64 IP addresses. This is because the last 2 bits of the address are used for the subnet portion, which gives us 2^2 = 4 possible subnets, and the remaining 6 bits are used for host addresses, which gives us 2^6 - 2 = 62 possible host addresses per subnet (minus 2 for the network and broadcast addresses).

c. As mentioned above, each subnet can have a maximum of 62 hosts. This is because the first and last IP addresses in each subnet are reserved for the network and broadcast addresses, respectively.

d. The range of IP addresses in each subnet is as follows:

- Subnet 1: 200.1.2.0 to 200.1.2.63
- Subnet 2: 200.1.2.64 to 200.1.2.127
- Subnet 3: 200.1.2.128 to 200.1.2.191
- Subnet 4: 200.1.2.192 to 200.1.2.255

4. Discuss the GNS simulation environment.

The GNS simulation environment, or Global Network Simulator, is a discrete-event simulator designed to model and analyze large-scale communication networks. It is a flexible and modular platform that allows researchers to simulate a variety of network types and protocols, and to evaluate their performance under different scenarios.

The GNS simulator uses a high-level programming language to define network topologies, traffic patterns, and protocol specifications. It provides a range of built-in models for different network components, such as routers, switches, and hosts, and allows users to customize these models or create their own.

One of the key features of GNS is its ability to scale up to very large network sizes, making it useful for simulating global-scale networks and evaluating the performance of routing protocols and other networking technologies. It also includes advanced visualization tools for analyzing simulation results and exploring network behavior.

GNS is widely used in academic research and industry for studying various networking topics, such as network security, wireless communication, and the Internet of Things (IoT).

5. Consider the following information Table:

VPCS	PC1	PC2
IP Address	192.168.1.1	192.168.1.2
Subnet Mask	255.255.255.0	255.255.255.0
Default Gateway	192.168.1.100	192.168.1.100
DNS Server	192.168.1.100	192.168.1.100

Creating Topology

• In the GNS3 console, drag an Ethernet Switch in the work view area. • Drag two VPCS machines in the work view area.
• Connect PC1 to port 1 of Ethernet switch and connect PC2 to port 2 ofEthernet switch.
• Right-click on PC1 and then select Start to start it. Similarly, start PC2 also. • The following figure shows how to add VPCS in GNS3

Syntax to configure IP address on VPCS in GNS3

Once you have created the preceding topology in GNS3, the next task is configuring IP addresses and other TCP/IP settings on VPCS machines. In order to configure IP addresses on VPCS in GNS3, you need to perform the following steps:

1. Select and right-click PC1 and select Console to open its console. The CLIprompt window will be displayed.
2. In the CLI prompt window, use the following syntax to configure TCP/IPsettings on the VPCS.

   ip <IP Address> </Subnet Mask> <Default Gateway>

3. Next, use the following syntax to configure DNS server IP address.ip dns <DNS server IP address>
4. If you want to obtain TCP/IP setting on VPCS machine using the DHCP server, use the following syntax to obtain the TCP/IP settings from the DHCP server.

   ip dhcp

5. Once you have configured appropriate IP addresses on a VPCS machine, usethe following command to view the TCP/IP settings.

   show ip

Configure TCP/IP settings on VPCS PC1

1. First, execute the following command on PC1 to configure 192.168.1.1/24 IPaddress and 192.168.1.100 as the default gateway.

   PC1>ip 192.168.1.1 /24 192.168.1.100

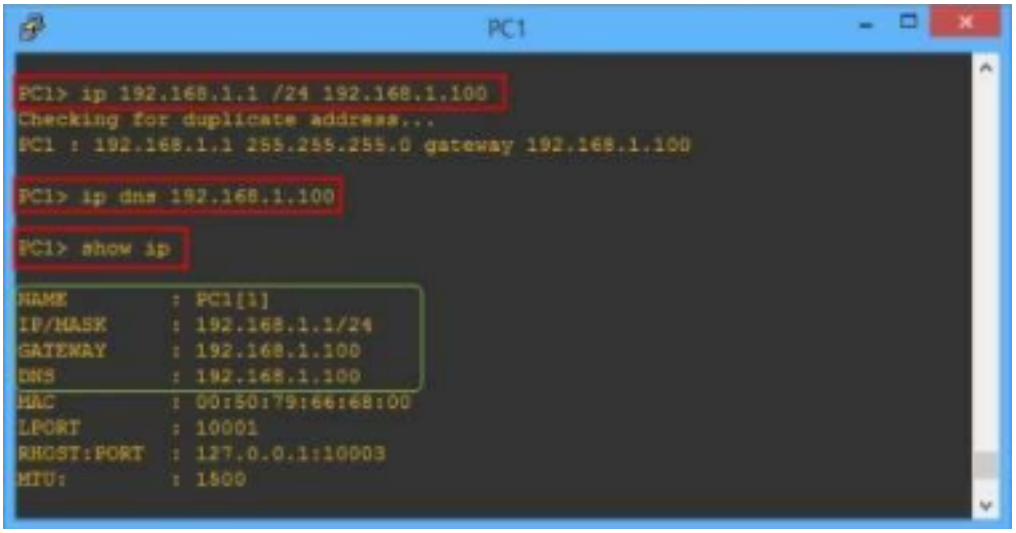
2. Next, execute the following command to configure 192.168.1.100 as DNSserver IP address.

PC1>ip dns 192.168.1.100

3. Next, execute the following command to view the TCP/IP settings on VPCSPC1.

   PC1>show ip

4. The following figure shows the TCP/IP configuration of VPCS PC1.



Configure TCP/IP settings on VPCS PC2

1. Execute the following command on PC2 to configure 192.168.1.1/24 IPaddress and 192.168.1.100 as the default gateway.
   PC2>ip 192.168.1.2 /24 192.168.1.100

2. Next, execute the following command to configure 192.168.1.100 as DNSserver IP address.

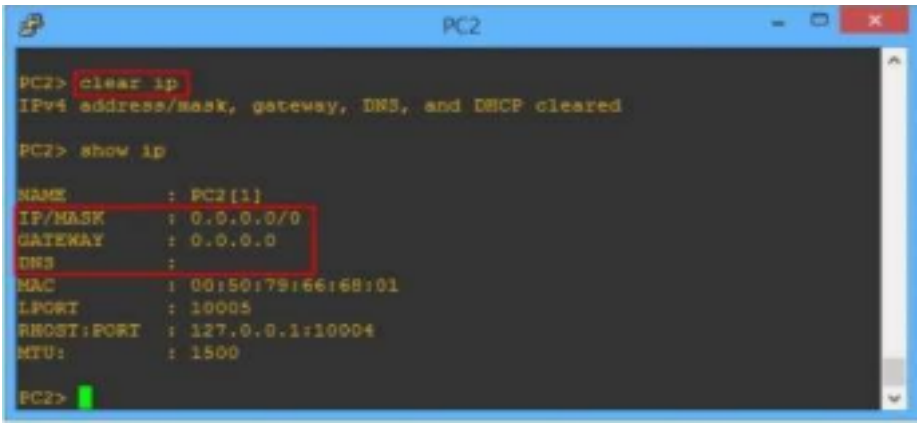
   PC2>ip dns 192.168.1.100

3. Next, execute the following command to view the TCP/IP settings on VPCSPC2.
   PC2>show ip

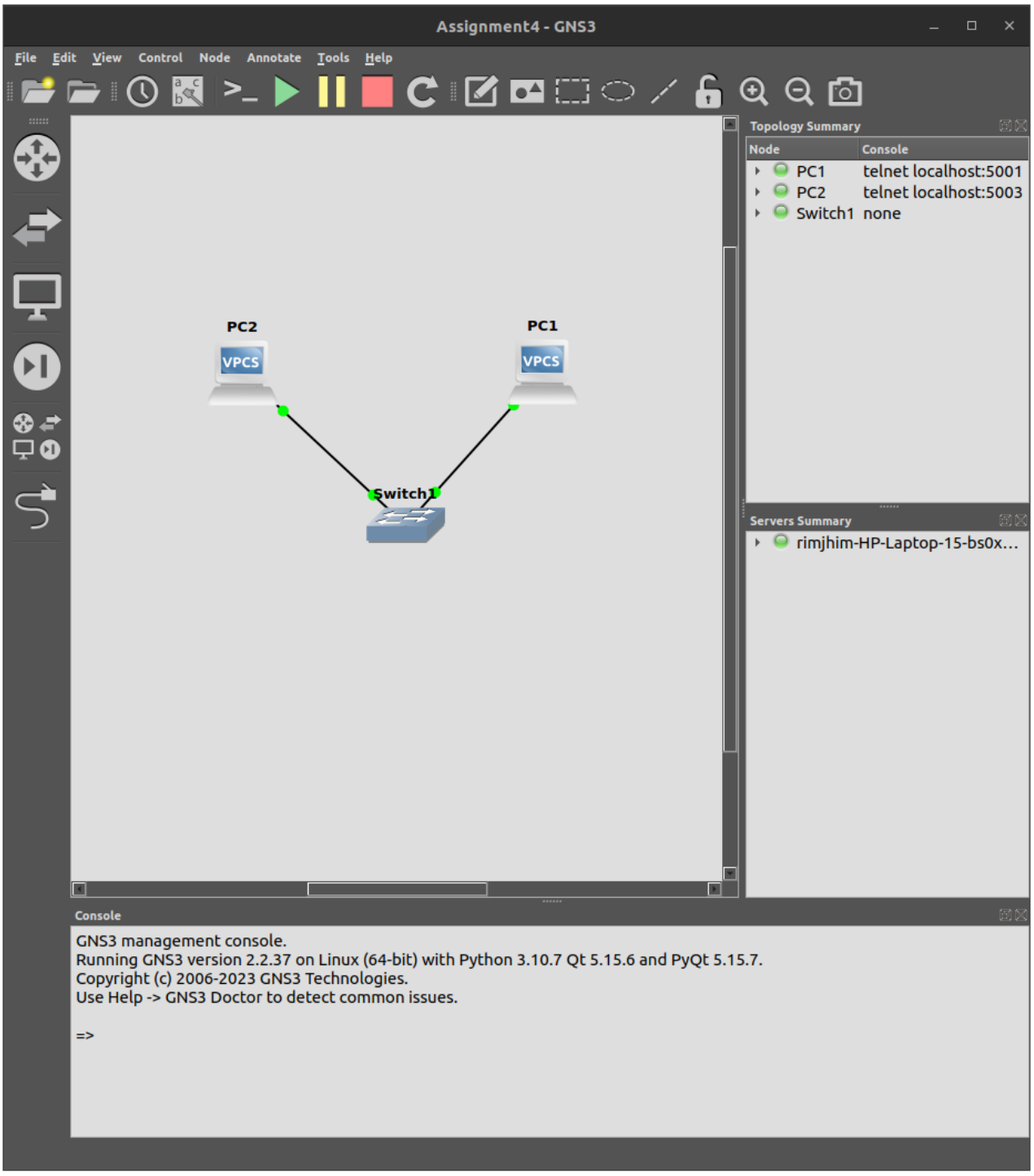
4. Then Test the connectivity to PC1
   PC2> ping 192.168.1.1
5. The following figure shows the TCP/IP configuration of VPCS PC2

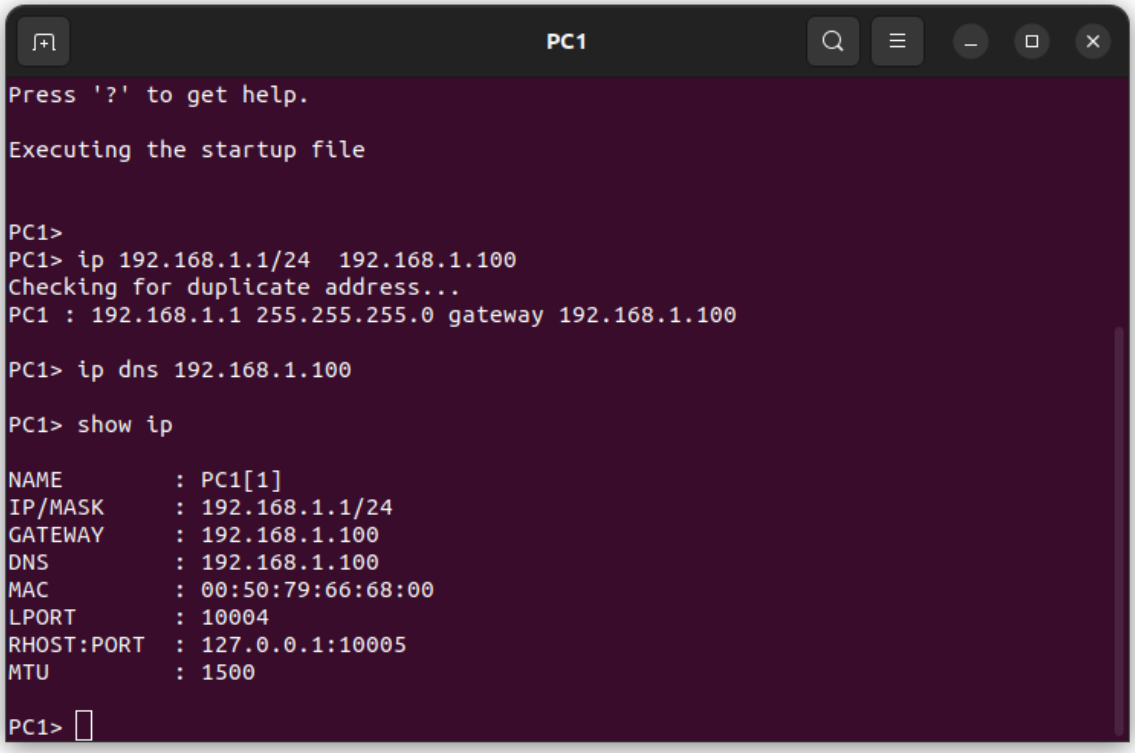
6. If you have misconfigured the TCP/IP settings or want to remove the TCP/IPsetting on a VPCS machine, use the following command.

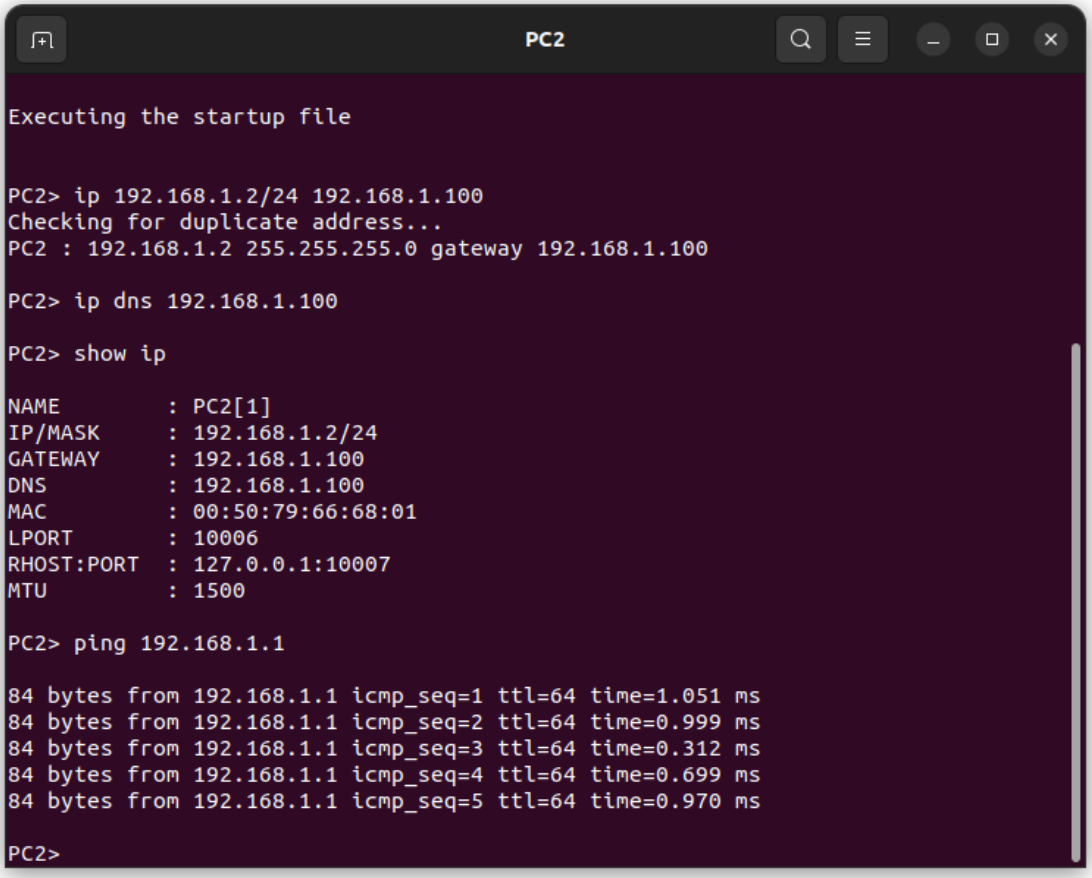
PC>clear ip



Soln:


Assignment4 - GNS3
File Edit View Control Node Annotate Tools Help
Topology Summary
Node Console
PC1 telnet localhost:5001
PC2 telnet localhost:5003
Switch1 none
Servers Summary
rimjhim-HP-Laptop-15-bs0x...
PC2
VPCS
PC1
VPCS
Switch1
Console
GNS3 management console.
Running GNS3 version 2.2.37 on Linux (64-bit) with Python 3.10.7 Qt 5.15.6 and PyQt 5.15.7.
Copyright (c) 2006-2023 GNS3 Technologies.
Use Help -> GNS3 Doctor to detect common issues.
=>


PC1
Press '?' to get help.
Executing the startup file
PC1>
PC1> ip 192.168.1.1/24 192.168.1.100
Checking for duplicate address...
PC1 : 192.168.1.1 255.255.255.0 gateway 192.168.1.100
PC1> ip dns 192.168.1.100
PC1> show ip
NAME   : PC1[1]
IP/MASK   : 192.168.1.1/24
GATEWAY   : 192.168.1.100
DNS   : 192.168.1.100
MAC   : 00:50:79:66:68:00
LPORT   : 10004
RHOST:PORT : 127.0.0.1:10005
MTU   : 1500
PC1>


PC2
Executing the startup file
PC2> ip 192.168.1.2/24 192.168.1.100
Checking for duplicate address...
PC2 : 192.168.1.2 255.255.255.0 gateway 192.168.1.100
PC2> ip dns 192.168.1.100
PC2> show ip
NAME   : PC2[1]
IP/MASK   : 192.168.1.2/24
GATEWAY   : 192.168.1.100
DNS   : 192.168.1.100
MAC   : 00:50:79:66:68:01
LPORT   : 10006
RHOST:PORT : 127.0.0.1:10007
MTU   : 1500
PC2> ping 192.168.1.1
84 bytes from 192.168.1.1 icmp_seq=1 ttl=64 time=1.051 ms
84 bytes from 192.168.1.1 icmp_seq=2 ttl=64 time=0.999 ms
84 bytes from 192.168.1.1 icmp_seq=3 ttl=64 time=0.312 ms
84 bytes from 192.168.1.1 icmp_seq=4 ttl=64 time=0.699 ms
84 bytes from 192.168.1.1 icmp_seq=5 ttl=64 time=0.970 ms
PC2>