LAB 5> Computer Network Design using HUB in GNS3

210905272

1. Design network configuration shown in Figure 5.29 for all parts. Connect all four VMs to a single Ethernet segment via a single hub as shown in Figure 5.29. Configure the IP addresses for the PCs as shown in Table 6.1.

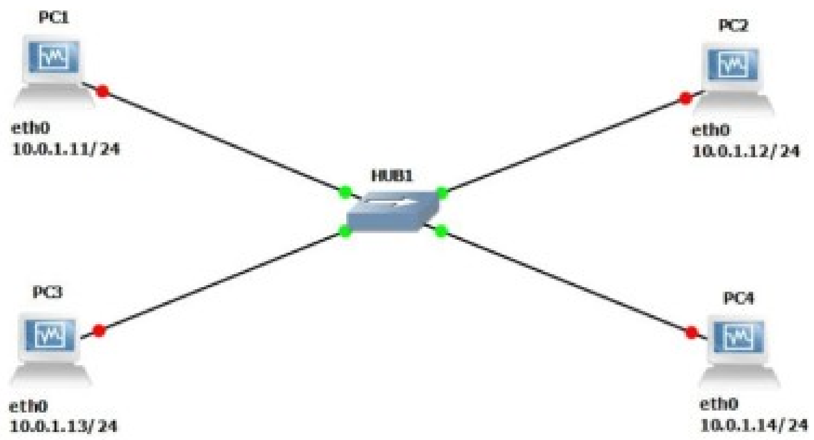


Figure 5.29: Network Design

VMS	IP Addresses of Ethernet Interface eth0
PC1	10.0.1.11 / 24
PC2	10.0.1.12 / 24
PC3	10.0.1.13 / 24
PC4	10.0.1.14 / 24

a. On PC1, view the ARP cache with show arp

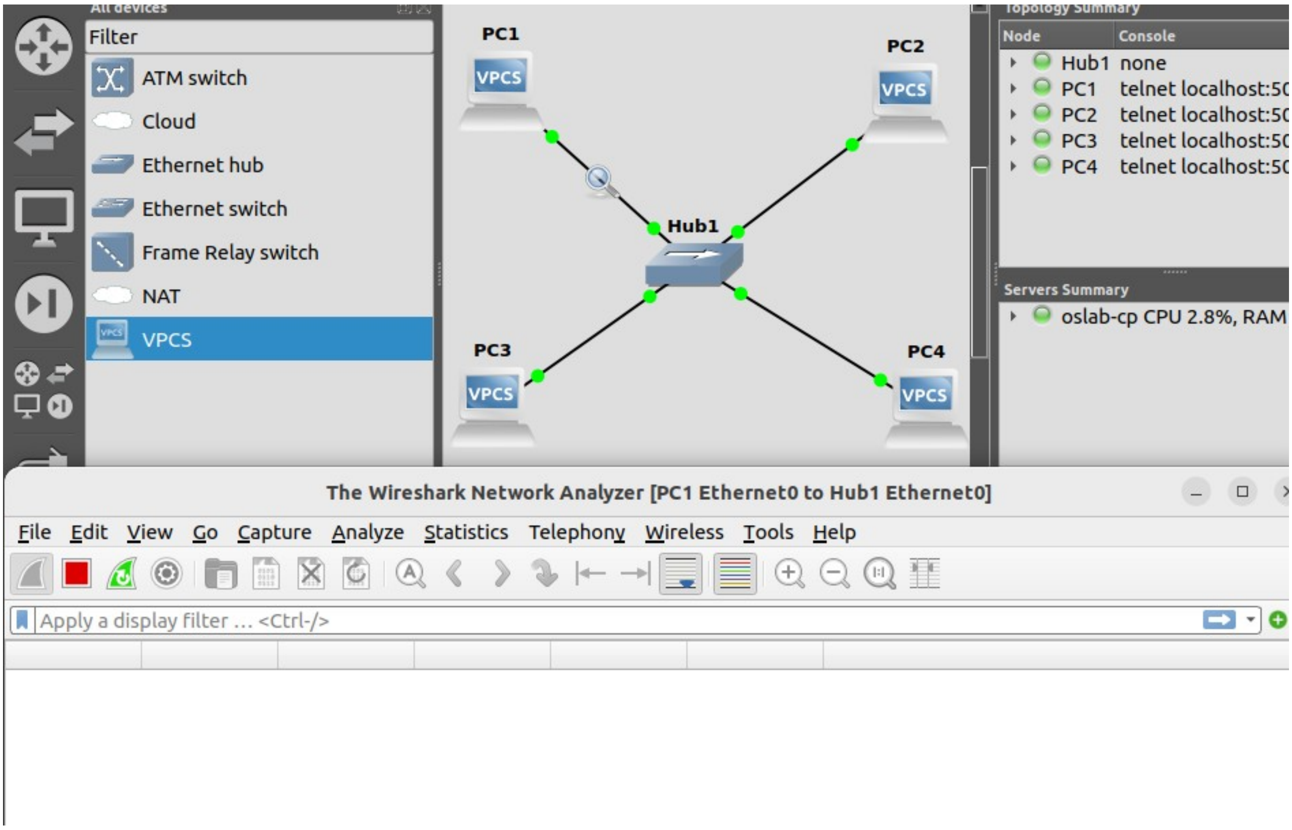
The Address Resolution Protocol cache has no entries since no broadcast message has been sent out.

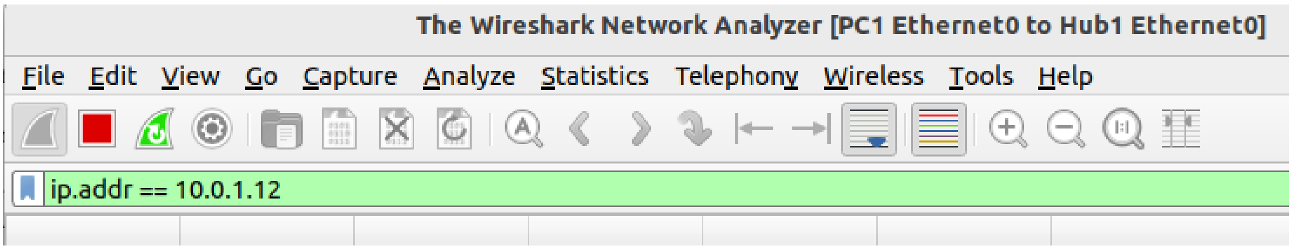
```
PC1> show arp

arp table is empty
```

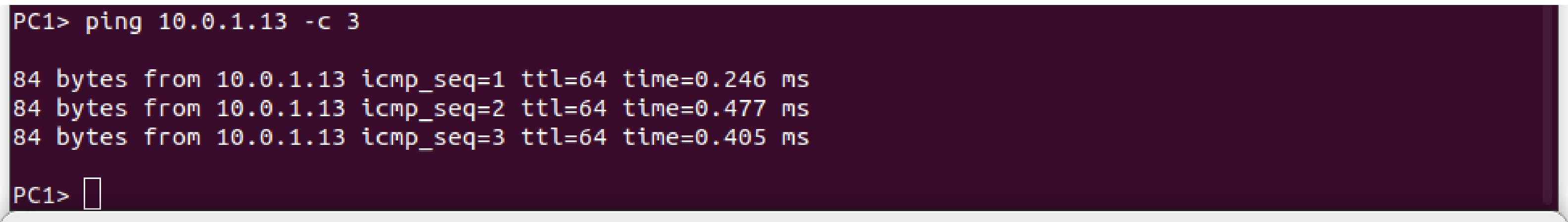
b. Start Wireshark on PC1-Hub1 link with a capture filter set to the IP address of PC2.

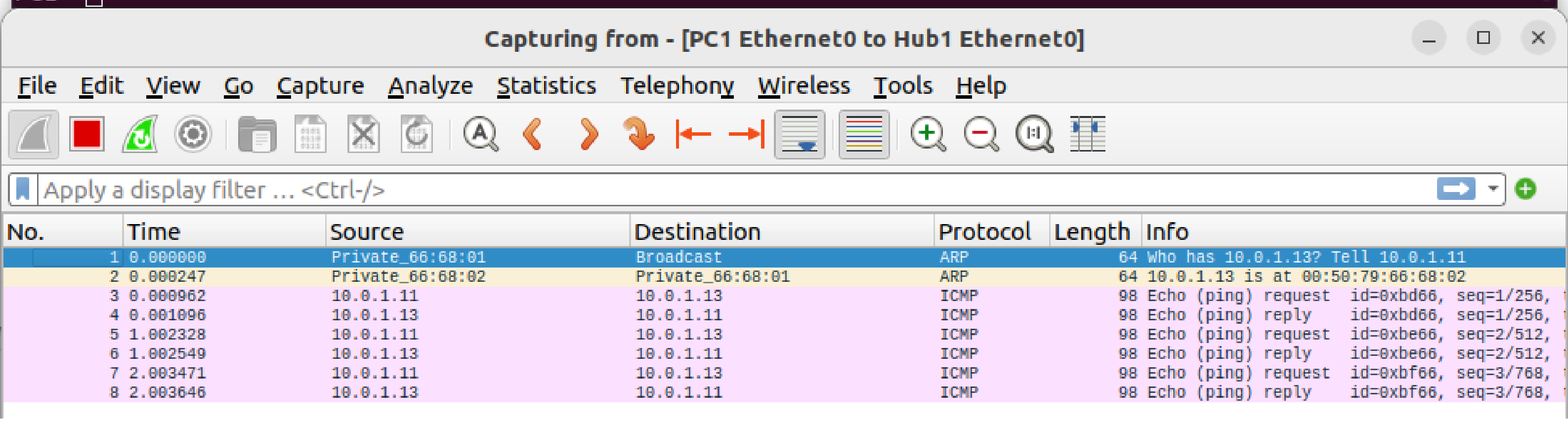
Initially empty





c. Issue a ping command from PC1 to PC2





ping 10.0.1.13 -c 3
sends 3 packets from pc1(10.0.1.11) to pc3(10.0.1.13)

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	Private_66:68:01	Broadcast	ARP	64	Who has 10.0.1.13? Tell 10.0.1.11
2	0.000247	Private_66:68:02	Private_66:68:01	ARP	64	10.0.1.13 is at 00:50:79:66:68:02
3	0.000062	10.0.1.11	10.0.1.13	ICMP	98	Echo (ping) request id=0xbd66, seq=1/256

Wireshark · Packet 2 · -

```
▸ Frame 2: 64 bytes on wire (512 bits), 64 bytes captured (512 bits) on interface -, id 0
▾ Ethernet II, Src: Private_66:68:02 (00:50:79:66:68:02), Dst: Private_66:68:01 (00:50:79:66:68:01)
  ▸ Destination: Private_66:68:01 (00:50:79:66:68:01)
  ▸ Source: Private_66:68:02 (00:50:79:66:68:02)
    Type: ARP (0x0806)
    Padding: 000000000000000000000000000000000000
    Frame check sequence: 0x00000000 [unverified]
    [FCS Status: Unverified]
▾ Address Resolution Protocol (reply)
    Hardware type: Ethernet (1)
    Protocol type: IPv4 (0x0800)
    Hardware size: 6
    Protocol size: 4
    Opcode: reply (2)
    Sender MAC address: Private_66:68:02 (00:50:79:66:68:02)
    Sender IP address: 10.0.1.13
    Target MAC address: Private_66:68:01 (00:50:79:66:68:01)
    Target IP address: 10.0.1.11
```

DST: 00:50:79:66:68:02
SRC: 00:50:79:66:68:01
Destination: Private_66:68:01 (00:50:79:66:68:01)
Source: Private_66:68:02 (00:50:79:66:68:02)
Type: ARP (0x0806)

d. View the ARP cache again with the command arp -a.

```
PC1> show arp

00:50:79:66:68:02  10.0.1.13 expires in 88 seconds
```

e. Save the results of Wireshark.

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	Private_66:68:01	Broadcast	ARP	64	Who has 10.0.1.13? Tell 10.0.1.11
2	0.000263	Private_66:68:02	Private_66:68:01	ARP	64	10.0.1.13 is at 00:50:79:66:68:02
3	0.001022	10.0.1.11	10.0.1.13	ICMP	98	Echo (ping) request id=0x6e6b, seq=1/256, ttl=64 (reply in 4)
4	0.001111	10.0.1.13	10.0.1.11	ICMP	98	Echo (ping) reply id=0x6e6b, seq=1/256, ttl=64 (request in 3)
5	1.002255	10.0.1.11	10.0.1.13	ICMP	98	Echo (ping) request id=0x6f6b, seq=2/512, ttl=64 (reply in 6)
6	1.002564	10.0.1.13	10.0.1.11	ICMP	98	Echo (ping) reply id=0x6f6b, seq=2/512, ttl=64 (request in 5)
7	2.003478	10.0.1.11	10.0.1.13	ICMP	98	Echo (ping) request id=0x706b, seq=3/768, ttl=64 (reply in 8)
8	2.003675	10.0.1.13	10.0.1.11	ICMP	98	Echo (ping) reply id=0x706b, seq=3/768, ttl=64 (request in 7)

2. To observe the effects of having more than one host with the same (duplicate) IP address in a network.

```
PC1> ip 10.0.1.11/24
Checking for duplicate address...
PC1 : 10.0.1.11 255.255.255.0

PC1>
```

```
PC4> ip 10.0.1.11/24
Checking for duplicate address...
10.0.1.11 is being used by MAC 00:50:79:66:68:01
Address not changed

PC4>
```

Two PC on the same network cannot have the same address. Addresses are unique.

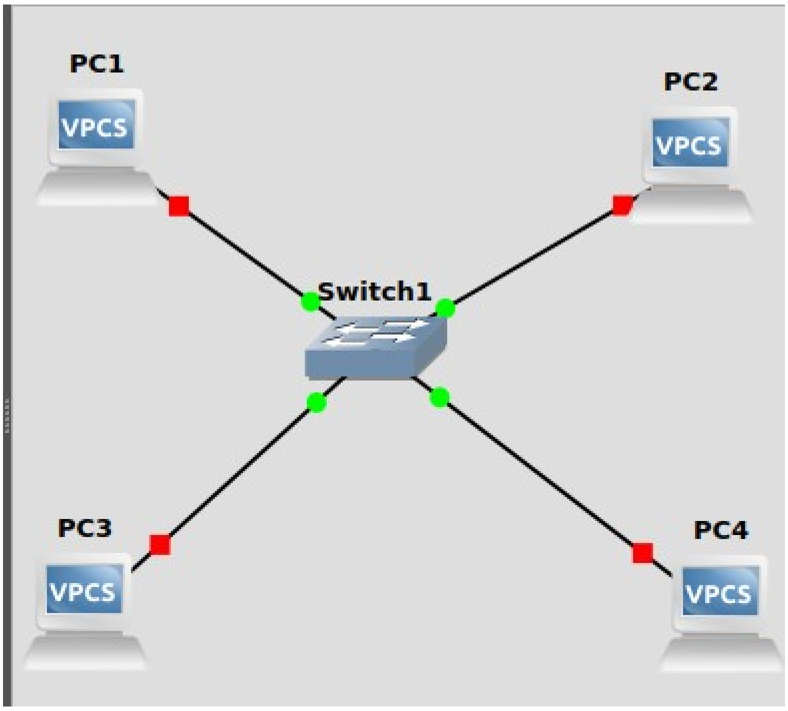
a. Delete all entries in the ARP cache on all Pcs.
reset ARP
ARP entries reset themselves in 2 minutes
b. Run Wireshark on PC3-Hub1 link and capture the network traffic to and from the duplicate IP
address 10.0.1.11.
c. From PC3, issue a ping command to the duplicate IP address, 10.0.1.11, by typing
PC3% ping 10.0.1.11 –c 5
d. Stop Wireshark, save all ARP packets and screenshot the ARP cache of PC3 using arp –a command: PC3% arp – a
e. When you are done with the exercise, reset the IP address of PC4 to its original value as given
in Table 6.1.

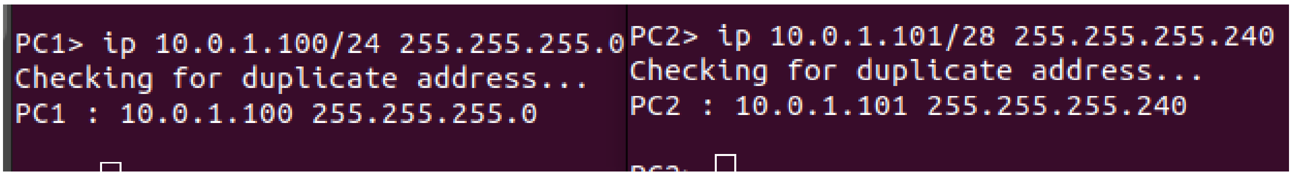
3. To test the effects of changing the netmask of a network configuration.

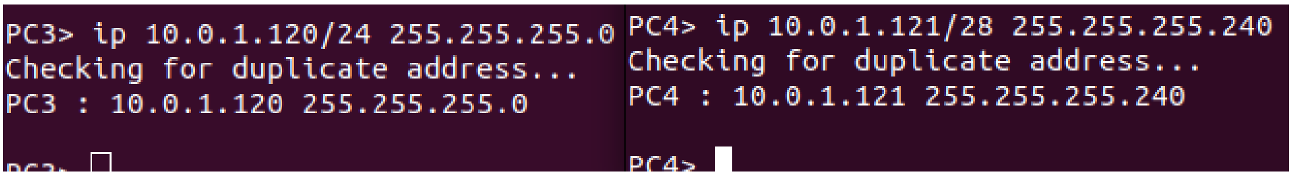
a. Design the configuration as Exercise 1 and replace the hub with a switch, two hosts (PC2 and PC4) have been assigned different network prefixes.

Setup the interfaces of the hosts as follows:

VPCS	IP Address of eth0	Network Mask
PC1	10.0.1.100 / 24	255.255.255.0
PC2	10.0.1.101 / 28	255.255.255.240
PC3	10.0.1.120 / 24	255.255.255.0
PC4	10.0.1.121 / 28	255.255.255.240



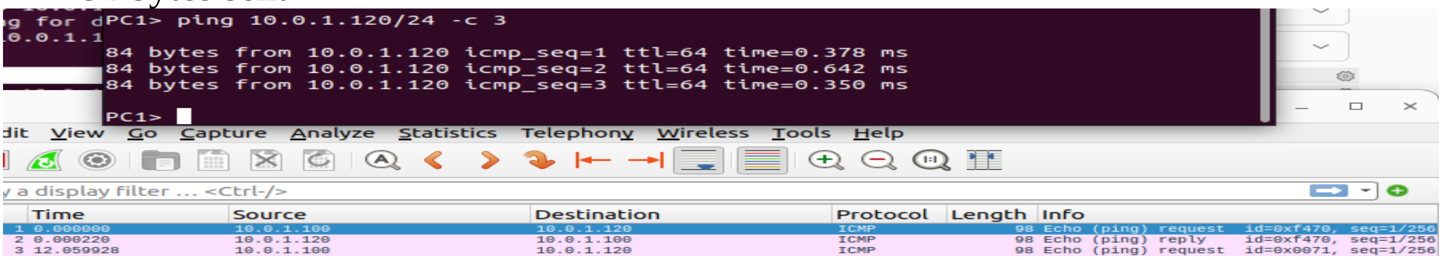




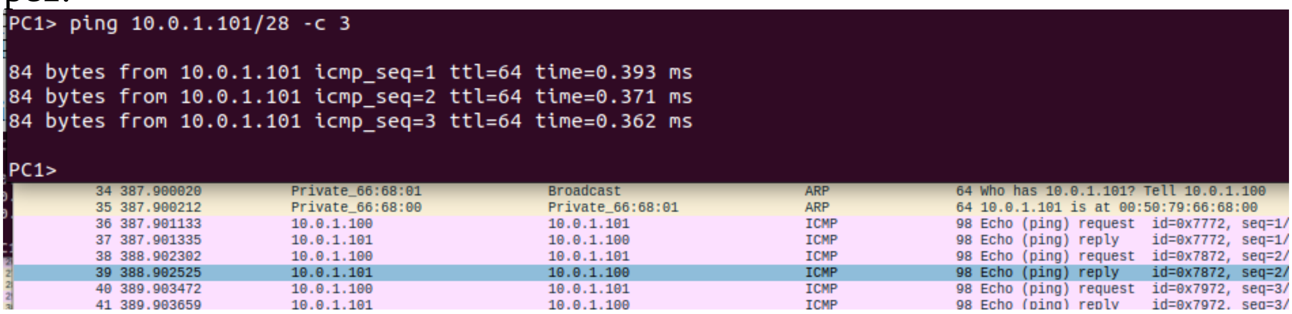
.

b. Run Wireshark on PC1-Hub1 link and capture the packets for the following scenarios
i. From PC1 ping PC3.

ping 10.0.1.120/24 -c 1
84 bytes sent



ii. From PC1 ping PC2.
ping 10.0.1.101/28 -c 3
SPECIAL CASE: should not ping since networkmasks are different. In binary the masked bits are the same. First 4 bits match in net Id of pc2 and host id of pc1.



iii. From PC1 ping PC4. PC1 cannot reach PC2 since they have different network prefixes.

ping 10.0.1.121/28 -c 3
Different network prefixes. Different subnets mask value

```
PC1> ping 10.0.1.121/28 -c 3

10.0.1.121 icmp_seq=1 timeout
10.0.1.121 icmp_seq=2 timeout
10.0.1.121 icmp_seq=3 timeout

PC1>
```

```
26 224.818445   10.0.1.100          10.0.1.121   ICMP   98 Echo (ping) request  id=0xd471, seq=3/768
27 224.819569   Private_66:68:03    Broadcast    ARP    64 Who has 255.255.255.240? Tell 10.0.1.121
28 225.820211   Private_66:68:03    Broadcast    ARP    64 Who has 255.255.255.240? Tell 10.0.1.121
29 226.820791   10.0.1.121          10.0.1.100   ICMP   98 Echo (ping) reply    id=0xd271, seq=2/512
30 226.820841   Private_66:68:03    Broadcast    ARP    64 Who has 255.255.255.240? Tell 10.0.1.121
31 227.820929   Private_66:68:03    Broadcast    ARP    64 Who has 255.255.255.240? Tell 10.0.1.121
32 228.821795   Private_66:68:03    Broadcast    ARP    64 Who has 255.255.255.240? Tell 10.0.1.121
33 229.822338   10.0.1.121          10.0.1.100   ICMP   98 Echo (ping) reply    id=0xd471, seq=3/768
```

iv. From PC4 ping PC1.

```
PC4> ping 10.0.1.100/24 -c 3

host (255.255.255.240) not reachable

PC4>
```

v. From PC2 ping PC4.

Ping packets sent from pc2 to pc4 but cannot be captured using current setup of wireshark since it is capturing for pc1 to switch and it is not involved

vi. From PC2 ping PC3.

Ping packets sent from pc2 to pc3 but cannot be captured using current setup of wireshark since it is capturing for pc1 to switch and it is not involved

c. Save the Wireshark output to a text file (using the "Packet Summary" option from "Print") , and save the output of the ping commands. Note that not all of the above scenarios are successful. Save all the output including any error messages.

d. When you are done with the exercise, reset the interfaces to their original values as given Table 6.1. (Note that /24 corresponds to network mask 255.255.255.0. and /28 to network mask 255.255.255.240).

PC1> ip 10.0.1.11/24
PC2> ip 10.0.1.12/24
PC3> ip 10.0.1.13/24
PC4> ip 10.0.1.14/24