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Assignment No: 2.Using a Network Simulator (e.g. packet tracer) Configure
Sub-netting of a given network ,Super-netting of a given networks.

ASSIGNEMENT NAME : Using Packet tracer configure Subnetting & Supernetting of given network

Theory

Q.1) what is Subnetting?

Subnetting is a process of dividing large network into the smaller networks based on layer 3 IP address. Every computer on network has an IP address that represents its location on network. Two version of IP addresses are available IPv4 and IPv6. In this article we will perform Subnetting on IPv4.

IPv4

IP addresses are displayed in dotted decimal notation, and appear as four numbers separated by dots. Each number of an IP address is made from eight individual bits known as octet. Each octet can create number value from 0 to 255. An IP address would be 32 bits long in binary divided into the two components, network component and host component. Network component is used to identify the network that the packet is intend for, and host component is used to identify the individual host on network.

IP addresses are broken into the two components:
Network component: - Defines network segment of device.
Host component: - Defines the specific device on a particular network segment
IP Classes in decimal notation

Class A addresses range from 1-126
Class B addresses range from 128-191

Class C addresses range from 192-223

Class D addresses range from 224-239

Class E addresses range from 240-254

- 0 [Zero] is reserved and represents all IP addresses.
- 127 is a reserved address and is used for testing, like a loop back on an interface.
- 255 is a reserved address and is used for broadcasting purposes.

This assignment is the second part of our article “Network Addressing Explained with Subnetting and VLSM”. You can read other parts of this article here.

Basic of Network Addressing

Subnet mask

Subnet mask is a 32 bits long address used to distinguish between network address and host address in IP address. Subnet mask is always used with IP address. Subnet mask has only one purpose, to identify which part of an IP address is network address and which part is host address.

For example how will we figure out network partition and host partition from IP address 192.168.1.10? Here we need subnet mask to get details about network address and host address.

- In decimal notation subnet mask value 1 to 255 represent network address and value 0 [Zero] represent host address.
- In binary notation subnet mask **ON** bit [1] represent network address while **OFF** bit [0] represent host address.

In decimal notation

```
IP address      192.168.1.10

Subnet mask     255.255.255.0
```

Network address is **192.168.1** and host address is **10**.

In binary notation

```
IP address 11000000.10101000.00000001.00001010

Subnet mask 11111111.11111111.11111111.00000000
```

Network address is 11000000.10101000.00000001 and host address is 00001010

IP Class	Default Subnet	Network bits	Host bits	Total hosts	Valid hosts
A	255.0.0.0	First 8 bits	Last 24 bits	16, 777, 216	16, 777, 214

B	255.255.0.0	First 16 bits	Last 16 bits	65,536	65,534
C	255.255.255.0	First 24 bits	Last 8 bits	256	254

Network ID

First address of subnet is called network ID. This address is used to identify one segment or broadcast domain from all the other segments in the network.

Block Size

Block size is the size of subnet including network address, hosts addresses and broadcast address.

Broadcast ID

There are two types of broadcast, direct broadcast and full broadcast.

Direct broadcast or local broadcast is the last address of subnet and can be hear by all hosts in subnet.

Full broadcast is the last address of IP classes and can be hear by all IP hosts in network. Full broadcast address is 255.255.255.255

The main difference between direct broadcast and full broadcast is that routers will not propagate local broadcasts between segments, but they will propagate directed broadcasts.

Host Addresses

All address between the network address and the directed broadcast address is called host address for the subnet. You can assign host addresses to any IP devices such as PCs, servers, routers, and switches.

Subnetting

Subnetting is a process of breaking large network in small networks known as subnets. Subnetting happens when we extend default boundary of subnet mask. Basically we borrow host bits to create networks. Let's take a example

Being a network administrator you are asked to create two networks, each will host 30 systems.

Single class C IP range can fulfill this requirement, still you have to purchase 2 class C IP range, one for each network. Single class C range provides 256 total addresses and we need only 30 addresses, this will waste 226 addresses. These unused addresses would make additional route advertisements slowing down the network.

With subnetting you only need to purchase single range of class C. You can configure router to take first 26 bits instead of default 24 bits as network bits. In this case we would extend default boundary of subnet mask and borrow 2 host bits to create networks. By taking two bits from the host range and counting them as network bits, we can create two new subnets, and assign hosts them. As long as the two new network bits match in the address, they belong to the same network. You can change either of the two bits, and you would be in a new subnet.

Class C Subnetting

Default subnet mask of class C is 255.255.255.0. CIDR notation of class C is /24, which means 24 bits from IP address are already consumed by network portion and we have 8 host bits to work with. We cannot skip network bit, when we turned them on. Subnetting moves from left to right. So Class C subnet masks can only be the following:

CIDR	Decimal	Binary
/25	128	10000000
/26	192	11000000
/27	224	11100000
/28	240	11110000
/29	248	11111000
/30	252	11111100

As we have already discussed earlier in this article that we have to have at least 2 host bits for assigning IP addresses to hosts, that means we can't use /31 and /32 for subnetting.

Subnets	Subnet 1	Subnet 2
Network ID	0	128
First host	1	129
Last host	126	254
Broadcast ID	127	255

/26

CIDR /26 has subnet mask 255.255.255.192 and 192 is 11000000 in binary. We used two host bits in network address.

N = 2
H = 6
Total subnets (2^N) :- $2^2 = 4$
Block size (256 - subnet mask) :- 256 - 192 = 64
Valid subnets (Count blocks from 0) :- 0,64,128,192
Total hosts (2^H) :- $2^6 = 64$
Valid hosts per subnet (Total host - 2) :- 64 - 2 = 62

CIDR 26 255.255.255.0/26

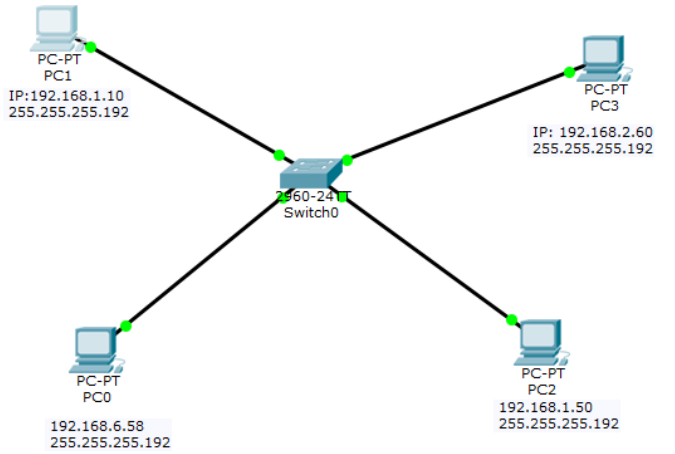


Fig. a Class C Network with CIDR 26

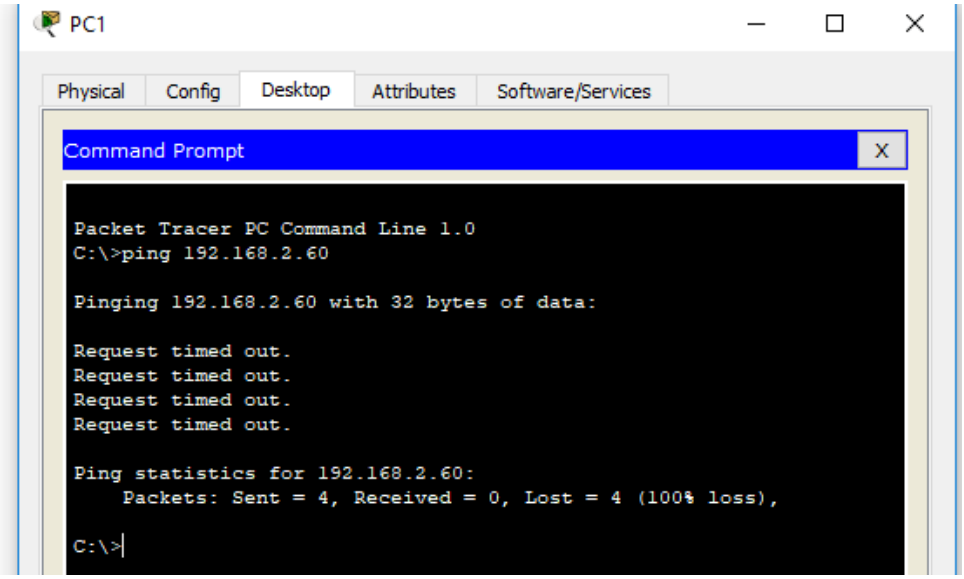


Fig. N/W Connectivity between 192.168.2.60 from 192.168.1.10

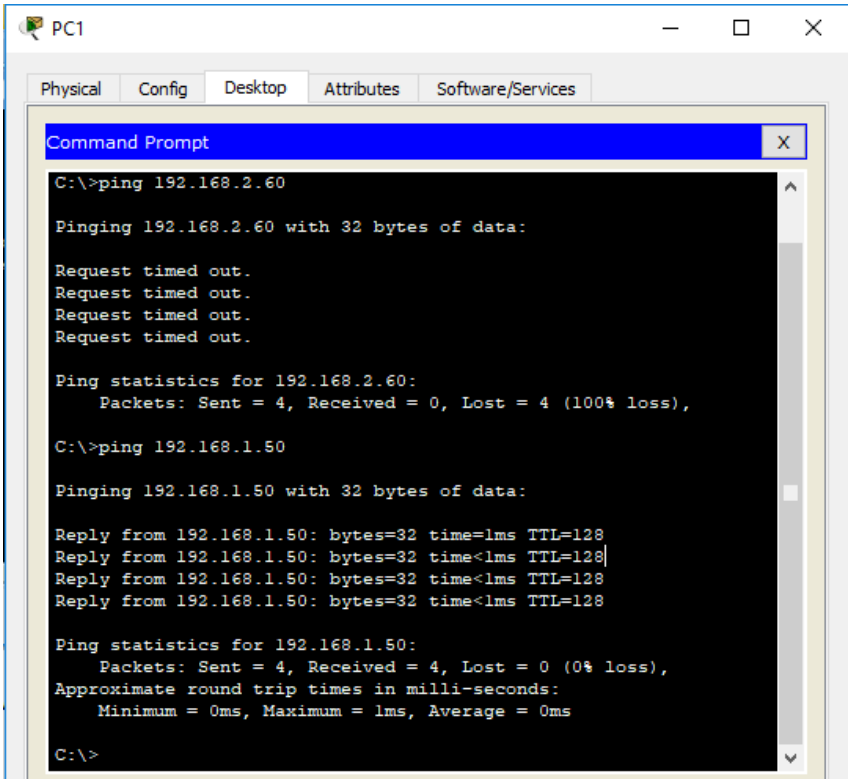


Fig. Connectivity for 192.168.1.10 to 192.168.1.50

Subnets	**Subnet 1**	**Subnet 2**	**Subnet 3**	**Subnet 4**
Network ID	0	64	128	192
First host	1	65	129	193
Last host	62	126	190	254
Broadcast ID	63	127	191	255

Supernetting

Definition: A supernet is created by combining several Internet Protocol (IP) networks or subnets into one network with a single classless Interdomain routing (CIDR) prefix. ... The procedure used to create a supernet is commonly called supernetting, route aggregation or route summarization.

Consider C Class Subnets

192.168.0.0|24

192.168.0.1|24

192.168.0.2|24

-Every C Class subnet contains 254 host addresses.

-Combining this subnet to form a one single supernet

We have, for summarizing the sub-network convert it into binary

N/W in Decimal	**N/W in Binary**
192.168.0.0|24	11000000.10101000.00000000.00000000
192.168.0.1|24	11000000.10101000.00000001.00000000
192.168.0.2|24	11000000.10101000.00000010.00000000
	8 + 8 + 6 + 0 = 22

Change in last two bits i.e 10 so 24-2=22

N/W must be in sequence

Host can be calculated 32-22=10 (32 is total bits in IP address – new obtain CIDR)

2^{10}=1024 Valid Host

New N/W Form

192.168.1.0|22

255.255.255.0|22

Binary Conversion:

11111111.11111111.11111100.00000000|22

2 bits goes to host

255.255.252.0 New Subnet Mask

IP Address:

Sr. No.	End User Devices	N/W Devices	IP Address	Subnet Mask
1	PC0	SWITCH 0	192.168.1.2	255.255.255.252
	PC1		192.168.1.3	
	PC2		192.168.1.4	
2	PC3	HUB 0	192.168.1.5	255.255.255.252
	PC4		192.168.1.6	
	PC5		192.168.1.7	
3	PC6	SWITCH 1	192.168.1.8	255.255.255.252

	PC7		192.168.1.9	
	PC8		192.168.1.10	
4	PC9	HUB 1	192.168.1.11	255.255.255.252
	PC10		192.168.1.12	
	PC11		192.168.1.13	

No of Hub: 2

No of Switch: 2

Subnet Mask: 255.255.252.0

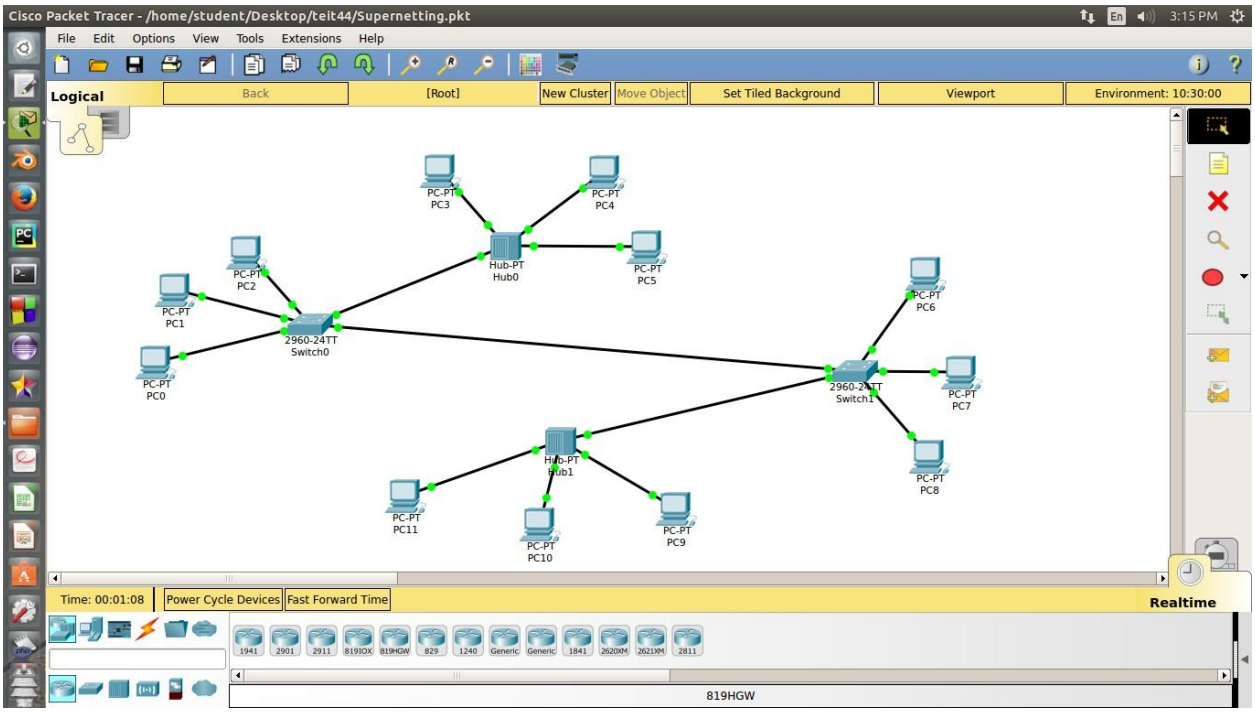


Fig. Network Topology for Supernetting

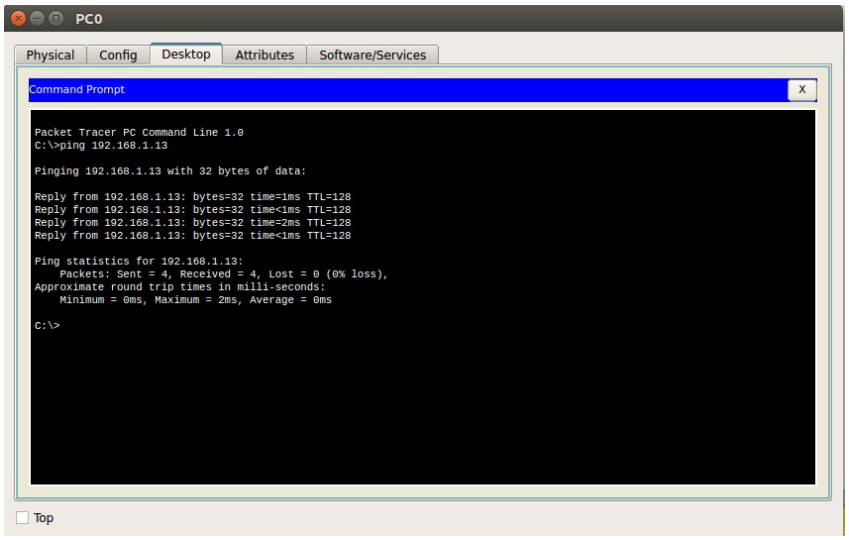
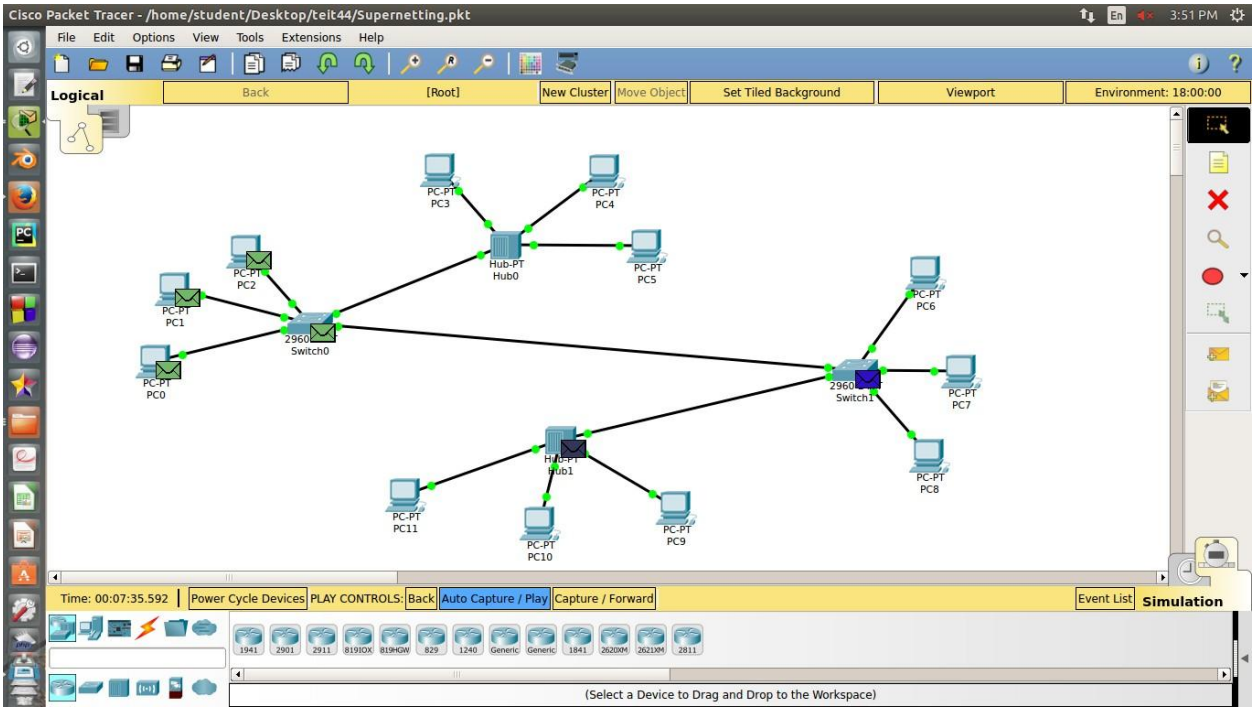


Fig. Checking connection between Different n/w



PacketTransferringfromPC-01toPC-11