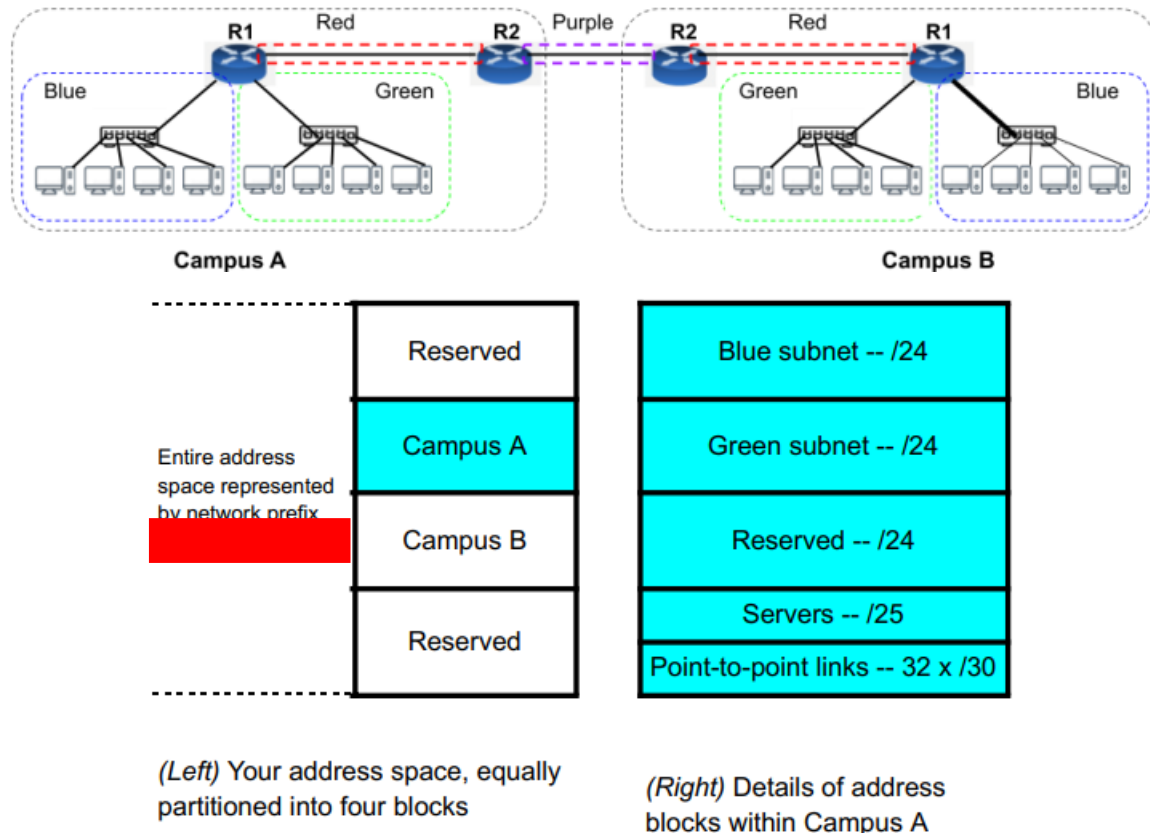


Simulate GNS3 network | GNS3- simulates routers, switches, and PCs

Student #- 2020- [REDACTED]

IP addressing plan for [REDACTED]

Address Space- 20.6.54.00/20



1.

*Address Space in Dotted Decimal- 00010100.00000110.00110110.00000000 (/20)

*00010100.00000110.0011xxxx.xxxxxxxx /20- first 20 bits are the netmask prefix / network address, the rest are don't cares

*Notes- 128, 64, 32, 16 | 8, 4, 2, 1

- /20- Network Prefix Length, means that the first 20bits of all IP addresses (32bits in IPv4) in the network must be similar
- To partition the address space by 4, we use the concept of Permutation and Binary. To represent 4 different groups, we need 2bits (00, 01, 10, and 11). This will result into 4 /22 blocks (used the 2bits after the 20th bit from the MSB).

Groups	Dotted Decimal	Subnet Address	Subnet Range
Reserved	00010100.00000110.001100xx.xxxxxxxx	20.6.48.0/22	20.6.48.0 – 20.6.51.255
Campus A	00010100.00000110.001101xx.xxxxxxxx	20.6.52.0/22	20.6.52.0 – 20.6.55.255
Campus B	00010100.00000110.001110xx.xxxxxxxx	20.6.56.0/22	20.6.56.0 – 20.6.59.255
Reserved	00010100.00000110.001111xx.xxxxxxxx	20.6.60.0/22	20.6.60.0 – 20.6.63.255

For Campus A

*Same utilization of Permutation and Binary concepts in subdivisions

Groups	Dotted Decimal	Subnet Address	Subnet Range
Blue Subnet	00010100.00000110.00110100.xxxxxxxx	20.6.52.00/24	20.6.52.00 - 20.6.52.255
Green Subnet	00010100.00000110.00110101.xxxxxxxx	20.6.53.00/24	20.6.53.00 – 20.6.53.255
Reserved	00010100.00000110.00110110.xxxxxxxx	20.6.54.00/24	20.6.54.00 – 20.6.54.255
Servers (/25)	00010100.00000110.00110111.0xxxxxxx	20.6.55.00/25	20.6.55.00 – 20.6.55.127
P2P Links (32 x /30)	00010100.00000110.00110111.100000xx	20.6.55.128/30	20.6.55.128 – 20.6.55.131
	00010100.00000110.00110111.100001xx	20.6.55.132/30	20.6.55.132 – 20.6.55.135
	00010100.00000110.00110111.100010xx	20.6.55.136/30	20.6.55.136 – 20.6.55.139
	00010100.00000110.00110111.100011xx	20.6.55.140/30	20.6.55.140 – 20.6.55.143
	00010100.00000110.00110111.100100xx	20.6.55.144/30	20.6.55.144 – 20.6.55.147
	00010100.00000110.00110111.100101xx	20.6.55.148/30	20.6.55.148 – 20.6.55.151
	00010100.00000110.00110111.100110xx	20.6.55.152/30	20.6.55.152 – 20.6.55.155
	00010100.00000110.00110111.100111xx	20.6.55.156/30	20.6.55.156 – 20.6.55.159
	00010100.00000110.00110111.101000xx	20.6.55.160/30	20.6.55.160 – 20.6.55.163
	00010100.00000110.00110111.101001xx	20.6.55.164/30	20.6.55.164 – 20.6.55.167
	00010100.00000110.00110111.101010xx	20.6.55.168/30	20.6.55.168 – 20.6.55.171
	00010100.00000110.00110111.101011xx	20.6.55.172/30	20.6.55.172 – 20.6.55.175
	00010100.00000110.00110111.101100xx	20.6.55.176/30	20.6.55.176 – 20.6.55.179
	00010100.00000110.00110111.101101xx	20.6.55.180/30	20.6.55.180 – 20.6.55.183
	00010100.00000110.00110111.101110xx	20.6.55.184/30	20.6.55.184 – 20.6.55.187
	00010100.00000110.00110111.101111xx	20.6.55.188/30	20.6.55.188 – 20.6.55.191
	00010100.00000110.00110111.110000xx	20.6.55.192/30	20.6.55.192 – 20.6.55.195
	00010100.00000110.00110111.110001xx	20.6.55.196/30	20.6.55.196 – 20.6.55.199
	00010100.00000110.00110111.110010xx	20.6.55.200/30	20.6.55.200 – 20.6.55.203
	00010100.00000110.00110111.110011xx	20.6.55.204/30	20.6.55.204 – 20.6.55.207
	00010100.00000110.00110111.110100xx	20.6.55.208/30	20.6.55.208 – 20.6.55.211
	00010100.00000110.00110111.110101xx	20.6.55.212/30	20.6.55.212 – 20.6.55.215
	00010100.00000110.00110111.110110xx	20.6.55.216/30	20.6.55.216 – 20.6.55.219
	00010100.00000110.00110111.110111xx	20.6.55.220/30	20.6.55.220 – 20.6.55.223
	00010100.00000110.00110111.111000xx	20.6.55.224/30	20.6.55.224 – 20.6.55.227
	00010100.00000110.00110111.111001xx	20.6.55.228/30	20.6.55.228 – 20.6.55.231

	00010100.00000110.00110111.111010xx	20.6.55.232/30	20.6.55.232 – 20.6.55.235
	00010100.00000110.00110111.111011xx	20.6.55.236/30	20.6.55.236 – 20.6.55.239
	00010100.00000110.00110111.111100xx	20.6.55.240/30	20.6.55.240 – 20.6.55.243
	00010100.00000110.00110111.111101xx	20.6.55.244/30	20.6.55.244 – 20.6.55.247
	00010100.00000110.00110111.111110xx	20.6.55.248/30	20.6.55.248 – 20.6.55.251
	00010100.00000110.00110111.111111xx	20.6.55.252/30	20.6.55.252 – 20.6.55.255

For Campus B

Groups	Dotted Decimal	Subnet Address	Subnet Range
Blue Subnet	00010100.00000110.00111000.xxxxxxxx	20.6.56.00/22	20.6.56.00 – 20.6.56.255
Green Subnet	00010100.00000110.00111001.xxxxxxxx	20.6.57.00/24	20.6.57.00 – 20.6.57.255
Reserved	00010100.00000110.00111010.xxxxxxxx	20.6.58.00/24	20.6.58.00 – 20.6.58.255
Servers (/25)	00010100.00000110.00111011.0xxxxxxx	20.6.59.00/25	20.6.59.00 – 20.6.59.127
P2P Links (32 x /30)	00010100.00000110.00111011.100000xx	20.6.59.128/30	20.6.59.128 – 20.6.59.131
	00010100.00000110.00111011.100001xx	20.6.59.132/30	20.6.59.132 – 20.6.59.135
	00010100.00000110.00111011.100010xx	20.6.59.136/30	20.6.59.136 – 20.6.59.139
	00010100.00000110.00111011.100011xx	20.6.59.140/30	20.6.59.140 – 20.6.59.143
	00010100.00000110.00111011.100100xx	20.6.59.144/30	20.6.59.144 – 20.6.59.147
	00010100.00000110.00111011.100101xx	20.6.59.148/30	20.6.59.148 – 20.6.59.151
	00010100.00000110.00111011.100110xx	20.6.59.152/30	20.6.59.152 – 20.6.59.155
	00010100.00000110.00111011.100111xx	20.6.59.156/30	20.6.59.156 – 20.6.59.159
	00010100.00000110.00111011.101000xx	20.6.59.160/30	20.6.59.160 – 20.6.59.163
	00010100.00000110.00111011.101001xx	20.6.59.164/30	20.6.59.164 – 20.6.59.167
	00010100.00000110.00111011.101010xx	20.6.59.168/30	20.6.59.168 – 20.6.59.171
	00010100.00000110.00111011.101011xx	20.6.59.172/30	20.6.59.172 – 20.6.59.175
	00010100.00000110.00111011.101100xx	20.6.59.176/30	20.6.59.176 – 20.6.59.179
	00010100.00000110.00111011.101101xx	20.6.59.180/30	20.6.59.180 – 20.6.59.183
	00010100.00000110.00111011.101110xx	20.6.59.184/30	20.6.59.184 – 20.6.59.187
	00010100.00000110.00111011.101111xx	20.6.59.188/30	20.6.59.188 – 20.6.59.191
	00010100.00000110.00111011.110000xx	20.6.59.192/30	20.6.59.192 – 20.6.59.195
	00010100.00000110.00111011.110001xx	20.6.59.196/30	20.6.59.196 – 20.6.59.199
	00010100.00000110.00111011.110010xx	20.6.59.200/30	20.6.59.200 – 20.6.59.203
	00010100.00000110.00111011.110011xx	20.6.59.204/30	20.6.59.204 – 20.6.59.207
	00010100.00000110.00111011.110100xx	20.6.59.208/30	20.6.59.208 – 20.6.59.211
	00010100.00000110.00111011.110101xx	20.6.59.212/30	20.6.59.212 – 20.6.59.215
	00010100.00000110.00111011.110110xx	20.6.59.216/30	20.6.59.216 – 20.6.59.219
	00010100.00000110.00111011.110111xx	20.6.59.220/30	20.6.59.220 – 20.6.59.223
	00010100.00000110.00111011.111000xx	20.6.59.224/30	20.6.59.224 – 20.6.59.227
	00010100.00000110.00111011.111001xx	20.6.59.228/30	20.6.59.228 – 20.6.59.231
	00010100.00000110.00111011.111010xx	20.6.59.232/30	20.6.59.232 – 20.6.59.235
	00010100.00000110.00111011.111011xx	20.6.59.236/30	20.6.59.236 – 20.6.59.239

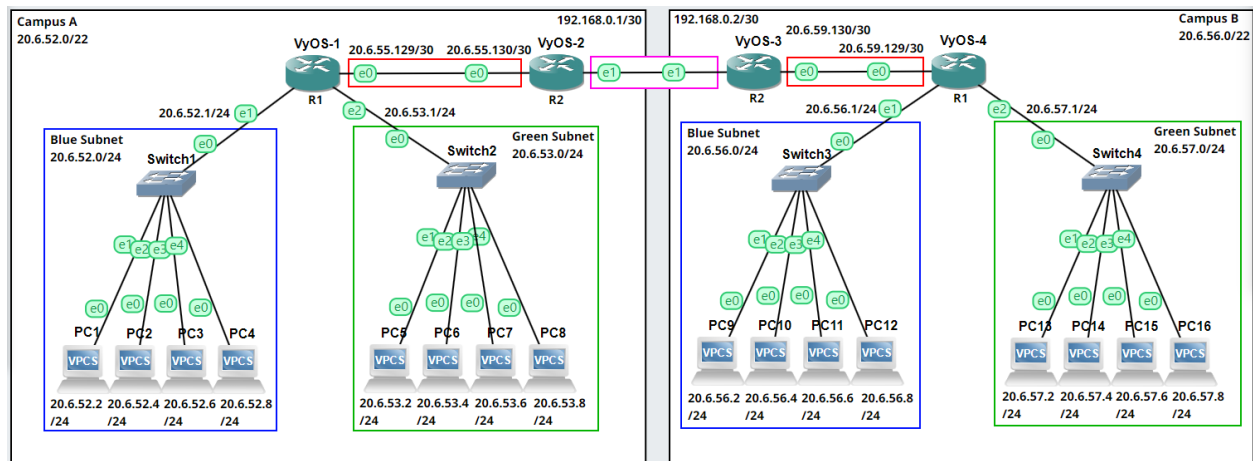
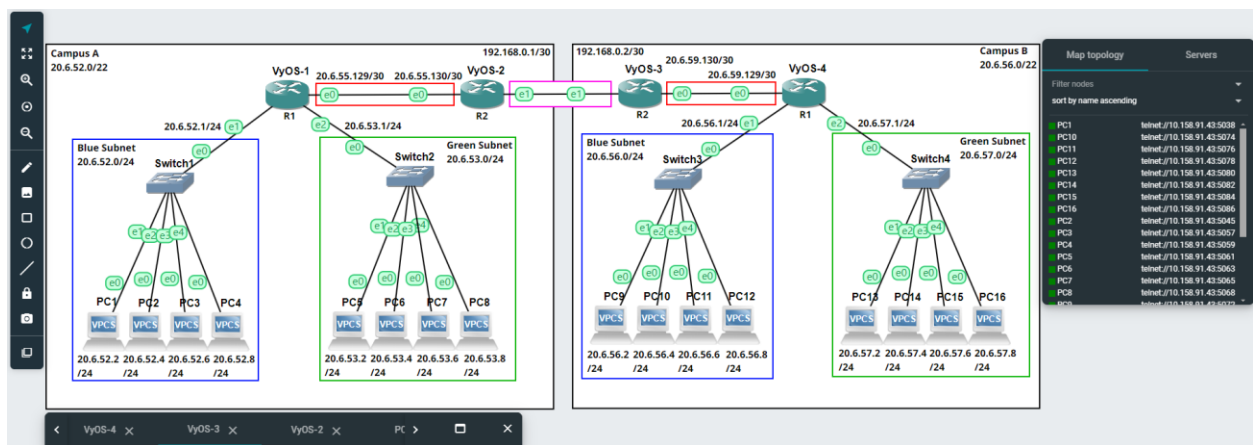
00010100.00000110.00111011.111100xx	20.6.59.240/30	20.6.59.240 – 20.6.59.243
00010100.00000110.00111011.111101xx	20.6.59.244/30	20.6.59.244 – 20.6.59.247
00010100.00000110.00111011.111110xx	20.6.59.248/30	20.6.59.248 – 20.6.59.251
00010100.00000110.00111011.111111xx	20.6.59.252/30	20.6.59.252 – 20.6.59.255

2.

*Start OpenVPN

*Credentials-

-
-



*The positions of Blue and Green Subnets are swapped on Campus B (but the links used are the same)

*Commands-

- ip <IP address>/<subnet>- for setting up a PC's IP address and subnet
- save
- show ip- for checking current PC's configurations

- Routers-
 - configure / conf
 - exit
 - set interfaces ethernet <eth#> address <IP address>/<subnet>-
 - delete / del interfaces ethernet <eth#> address <IP address>/<subnet>-
 - commit- lock changes (for temp file...)
 - save
 - show interfaces / int
- Tab- shows list of possible commands...
- Arrows up or down- command history...

For Campus A

*Blue Subnet

```

GNS3 console    PC1 X
Copyright (c) 2007-2015, Paul Meng (mirnshi@gmail.com)
All rights reserved.

VPCS is free software, distributed under the terms of the "BSD" licence.
Source code and license can be found at vpcs.sf.net.
For more information, please visit wiki.freecode.com.cn.

Press '?' to get help.

Executing the startup file

Checking for duplicate address...
PC1 : 10.0.0.10 255.255.255.0 gateway 10.0.0.1

PC1> ip 20.6.52.2/24
Checking for duplicate address...
PC1 : 20.6.52.2 255.255.255.0

PC1> save
Saving startup configuration to startup.vpc
. done

PC1> 
```

```
PC1> ip 20.6.52.2/24
Checking for duplicate address...
PC1 : 20.6.52.2 255.255.255.0

PC1> save
Saving startup configuration to startup.vpc
. done

PC1> show ip

NAME       : PC1[1]
IP/MASK    : 20.6.52.2/24
GATEWAY    : 0.0.0.0
DNS        :
MAC        : 00:50:79:66:68:06
LPORT     : 20046
RHOST:PORT : 127.0.0.1:20047
MTU        : 1500
```

```
PC3> ip 20.6.52.6/24
Checking for duplicate address...
PC3 : 20.6.52.6 255.255.255.0

PC3> save
Saving startup configuration to startup.vpc
. done

PC3> show ip

NAME       : PC3[1]
IP/MASK    : 20.6.52.6/24
GATEWAY    : 0.0.0.0
DNS        :
MAC        : 00:50:79:66:68:02
LPORT     : 20082
RHOST:PORT : 127.0.0.1:20083
MTU        : 1500
```

```
PC2> ip 20.6.52.4/24
Checking for duplicate address...
PC2 : 20.6.52.4 255.255.255.0

PC2> save
Saving startup configuration to startup.vpc
. done

PC2> show ip

NAME       : PC2[1]
IP/MASK    : 20.6.52.4/24
GATEWAY    : 0.0.0.0
DNS        :
MAC        : 00:50:79:66:68:07
LPORT     : 20048
RHOST:PORT : 127.0.0.1:20049
MTU        : 1500
```

```
PC4> ip 20.6.52.8/24
Checking for duplicate address...
PC4 : 20.6.52.8 255.255.255.0

PC4> save
Saving startup configuration to startup.vpc
. done

PC4> show ip

NAME       : PC4[1]
IP/MASK    : 20.6.52.8/24
GATEWAY    : 0.0.0.0
DNS        :
MAC        : 00:50:79:66:68:08
LPORT     : 20084
RHOST:PORT : 127.0.0.1:20085
MTU        : 1500
```

*Green Subnet

<pre>PC5> ip 20.6.53.2/24 Checking for duplicate address... PC5 : 20.6.53.2 255.255.255.0 PC5> save Saving startup configuration to startup.vpc . done PC5> show ip NAME : PC5[1] IP/MASK : 20.6.53.2/24 GATEWAY : 0.0.0.0 DNS : MAC : 00:50:79:66:68:01 LPORT : 20086 RHOST:PORT : 127.0.0.1:20087 MTU : 1500</pre>	<pre>PC6> ip 20.6.53.4/24 Checking for duplicate address... PC6 : 20.6.53.4 255.255.255.0 PC6> save Saving startup configuration to startup.vpc . done PC6> show ip NAME : PC6[1] IP/MASK : 20.6.53.4/24 GATEWAY : 0.0.0.0 DNS : MAC : 00:50:79:66:68:09 LPORT : 20088 RHOST:PORT : 127.0.0.1:20089 MTU : 1500</pre>
<pre>PC7> ip 20.6.53.6/24 Checking for duplicate address... PC7 : 20.6.53.6 255.255.255.0 PC7> save Saving startup configuration to startup.vpc . done PC7> show ip NAME : PC7[1] IP/MASK : 20.6.53.6/24 GATEWAY : 0.0.0.0 DNS : MAC : 00:50:79:66:68:00 LPORT : 20090 RHOST:PORT : 127.0.0.1:20091 MTU : 1500</pre>	<pre>PC8> ip 20.6.53.8/24 Checking for duplicate address... PC8 : 20.6.53.8 255.255.255.0 PC8> save Saving startup configuration to startup.vpc . done PC8> show ip NAME : PC8[1] IP/MASK : 20.6.53.8/24 GATEWAY : 0.0.0.0 DNS : MAC : 00:50:79:66:68:03 LPORT : 20092 RHOST:PORT : 127.0.0.1:20093 MTU : 1500</pre>

For Campus B

*Blue Subnet

<pre>PC9> ip 20.6.56.2/24 Checking for duplicate address... PC9 : 20.6.56.2 255.255.255.0 PC9> save Saving startup configuration to startup.vpc . done PC9> show ip NAME : PC9[1] IP/MASK : 20.6.56.2/24 GATEWAY : 0.0.0.0 DNS : MAC : 00:50:79:66:68:05 LPORT : 20094 RHOST:PORT : 127.0.0.1:20095 MTU : 1500</pre>	<pre>PC10> ip 20.6.56.4/24 Checking for duplicate address... PC10 : 20.6.56.4 255.255.255.0 PC10> save Saving startup configuration to startup.vpc . done PC10> show ip NAME : PC10[1] IP/MASK : 20.6.56.4/24 GATEWAY : 0.0.0.0 DNS : MAC : 00:50:79:66:68:04 LPORT : 20096 RHOST:PORT : 127.0.0.1:20097 MTU : 1500</pre>
<pre>PC11> ip 20.6.56.6/24 Checking for duplicate address... PC11 : 20.6.56.6 255.255.255.0 PC11> save Saving startup configuration to startup.vpc . done PC11> show ip NAME : PC11[1] IP/MASK : 20.6.56.6/24 GATEWAY : 0.0.0.0 DNS : MAC : 00:50:79:66:68:0a LPORT : 20098 RHOST:PORT : 127.0.0.1:20099 MTU : 1500</pre>	<pre>PC12> ip 20.6.56.8/24 Checking for duplicate address... PC12 : 20.6.56.8 255.255.255.0 PC12> save Saving startup configuration to startup.vpc . done PC12> show ip NAME : PC12[1] IP/MASK : 20.6.56.8/24 GATEWAY : 0.0.0.0 DNS : MAC : 00:50:79:66:68:0b LPORT : 20100 RHOST:PORT : 127.0.0.1:20101 MTU : 1500</pre>

*Green Subnet

```
PC13> ip 20.6.57.2/24
Checking for duplicate address...
PC13 : 20.6.57.2 255.255.255.0

PC13> save
Saving startup configuration to startup.vpc
. done

PC13> show ip
NAME       : PC13[1]
IP/MASK    : 20.6.57.2/24
GATEWAY    : 0.0.0.0
DNS        :
MAC        : 00:50:79:66:68:0c
LPORT     : 20102
RHOST:PORT : 127.0.0.1:20103
MTU        : 1500

PC15> ip 20.6.57.6/24
Checking for duplicate address...
PC15 : 20.6.57.6 255.255.255.0

PC15> save
Saving startup configuration to startup.vpc
. done

PC15> show ip
NAME       : PC15[1]
IP/MASK    : 20.6.57.6/24
GATEWAY    : 0.0.0.0
DNS        :
MAC        : 00:50:79:66:68:0e
LPORT     : 20106
RHOST:PORT : 127.0.0.1:20107
MTU        : 1500

PC14> ip 20.6.57.4/24
Checking for duplicate address...
PC14 : 20.6.57.4 255.255.255.0

PC14> save
Saving startup configuration to startup.vpc
. done

PC14> show ip
NAME       : PC14[1]
IP/MASK    : 20.6.57.4/24
GATEWAY    : 0.0.0.0
DNS        :
MAC        : 00:50:79:66:68:0d
LPORT     : 20104
RHOST:PORT : 127.0.0.1:20105
MTU        : 1500

PC16> ip 20.6.57.8/24
Checking for duplicate address...
PC16 : 20.6.57.8 255.255.255.0

PC16> save
Saving startup configuration to startup.vpc
. done

PC16> show ip
NAME       : PC16[1]
IP/MASK    : 20.6.57.8/24
GATEWAY    : 0.0.0.0
DNS        :
MAC        : 00:50:79:66:68:0f
LPORT     : 20108
RHOST:PORT : 127.0.0.1:20109
MTU        : 1500
```

```
[ 6.477403] systemd-journald[325]: Received client request to flush runtime
ournal.

Welcome to VyOS - vyos ttyS0

vyos login: vyos
Password:
Welcome to VyOS!

Check out project news at https://blog.vyos.io
and feel free to report bugs at https://phabricator.vyos.net

You can change this banner using "set system login banner post-login" command.

VyOS is a free software distribution that includes multiple components,
you can check individual component licenses under /usr/share/doc/*/copyright
vyos@vyos:~$ conf
WARNING: You are currently configuring a live-ISO environment, changes will not
persist until installed
[edit]
vyos@vyos# set interfaces ethernet eth0 address 20.6.55.129/30
[edit]
vyos@vyos# set interfaces ethernet eth1 address 20.6.52.1/24
[edit]
```

```

[edit]
vyos@vyos# set interfaces ethernet eth2 address 20.6.53.1/24
[edit]
vyos@vyos# commit
[edit]
vyos@vyos# sace

Invalid command: [sace]

[edit]
vyos@vyos# save
Saving configuration to '/config/config.boot'...
Done
[edit]

```

```

vyos@vyos# show interfaces
ethernet eth0 {
    address 20.6.55.129/30
    hw-id 0c:e3:35:10:00:00
}
ethernet eth1 {
    address 20.6.52.1/24
    hw-id 0c:e3:35:10:00:01
}
ethernet eth2 {
    address 20.6.53.1/24
    hw-id 0c:e3:35:10:00:02
}
ethernet eth3 {
    hw-id 0c:e3:35:10:00:03
}
loopback lo {
}
[edit]
vyos@vyos#

```

```

vyos@vyos# show interfaces
ethernet eth0 {
    address 20.6.59.129/30
    hw-id 0c:cd:33:ea:00:00
}
ethernet eth1 {
    address 20.6.56.1/24
    hw-id 0c:cd:33:ea:00:01
}
ethernet eth2 {
    address 20.6.57.1/24
    hw-id 0c:cd:33:ea:00:02
}
ethernet eth3 {
    hw-id 0c:cd:33:ea:00:03
}
loopback lo {
}
[edit]
vyos@vyos#

```

*Left- R1 on Campus A, Right- R2 on Campus B

- a. From a PC in the Blue subnet, is it possible to ping another PC w/in the same subnet? Why or why not?
- Yes. All PCs/hosts in the Blue subnet were configured such that they are within the same network (same network prefix, same bit sequence starting from the MSB up to the 24th bit [/24]), and there is 1 switch connecting all of them.

```

PC1> ping 20.6.52.4

84 bytes from 20.6.52.4 icmp_seq=1 ttl=64 time=0.453 ms
84 bytes from 20.6.52.4 icmp_seq=2 ttl=64 time=0.695 ms
84 bytes from 20.6.52.4 icmp_seq=3 ttl=64 time=0.722 ms
84 bytes from 20.6.52.4 icmp_seq=4 ttl=64 time=0.658 ms
84 bytes from 20.6.52.4 icmp_seq=5 ttl=64 time=0.621 ms

```

- b. From a PC in the Blue subnet, is it possible to ping R1's directly connected interface? Why or why not?
- Yes, the interface was set to have an address of 20.6.52.1/24 (same subnet, same network prefix, thus same local network), and they're all connected to 1 switch.

```
PC1> ping 20.6.52.1/24
84 bytes from 20.6.52.1 icmp_seq=1 ttl=64 time=0.559 ms
84 bytes from 20.6.52.1 icmp_seq=2 ttl=64 time=1.189 ms
84 bytes from 20.6.52.1 icmp_seq=3 ttl=64 time=2.455 ms
84 bytes from 20.6.52.1 icmp_seq=4 ttl=64 time=1.094 ms
84 bytes from 20.6.52.1 icmp_seq=5 ttl=64 time=1.080 ms
```

- c. From a PC in the Blue subnet, is it possible to ping a PC in the Green subnet? Why or why not?
- No. PCs from the Blue Subnet (i.e. from Campus A) and Green Subnet (i.e. from Campus A) have /24 subnets but they differ with respect to network prefix (i.e. first 24 bits from the MSB), thus they don't belong to the same local network. Although the interfaces (for Blue and Green Subnets) were already configured, the PCs have not been given default gateways yet, that are needed to communicate with hosts from other local networks.

```
PC1> ping 20.6.53.2
No gateway found
```

3.

*Commands-

- set protocols static route <dest IP address>/<subnet> next-hop <next hop router address>-static routing
- show protocols

*R1 on Campus A

```
vyos@vyos# set protocols static route 20.6.52.0/24 next-hop 20.6.52.1
[edit]
vyos@vyos# set protocols static route 20.6.53.0/24 next-hop 20.6.53.1
[edit]
vyos@vyos# show protocols
+static {
+  route 20.6.52.0/24 {
+    next-hop 20.6.52.1 {
+    }
+  }
+  route 20.6.53.0/24 {
+    next-hop 20.6.53.1 {
+    }
+  }
+}
[edit]
vyos@vyos# commit
[edit]
vyos@vyos# save
Saving configuration to '/config/config.boot'...
Done
[edit]
vyos@vyos#
```

*R1 on Campus B

```
vyos@vyos# set protocols static route 20.6.56.0/24 next-hop 20.6.56.1
[edit]
vyos@vyos# set protocols static route 20.6.57.0/24 next-hop 20.6.56.1
[edit]
vyos@vyos# commit
[edit]
vyos@vyos# save
Saving configuration to '/config/config.boot'...
Done
[edit]
vyos@vyos# show protocols
static {
    route 20.6.56.0/24 {
        next-hop 20.6.56.1 {
        }
    }
    route 20.6.57.0/24 {
        next-hop 20.6.56.1 {
        }
    }
}
[edit]
vyos@vyos#
```

*Fixed this into-

```
vyos@vyos# show protocols
static {
    route 20.6.56.0/24 {
        next-hop 20.6.56.1 {
        }
    }
    route 20.6.57.0/24 {
        next-hop 20.6.57.1 {
        }
    }
}
[edit]
```

- a. From a PC in the Blue subnet, is it possible to ping a PC in the Green subnet? Why or why not?
- No, not yet. What we did is we just set the router such that when the destination is to the Blue subnet, it routes the packets to the appropriate interface (i.e. 20.6.56.1), and vice versa. But we still don't set the default gateway for the PCs; if the gateway is not yet configured, it is not possible to communicate with PCs from another network.

```
PC1> ping 20.6.53.2
No gateway found
```

- b. Configure all the hosts (PCs) in the campus you are working on such that their default gateways are the R1 interfaces directly connected to the same subnet as the host. Is it now possible to ping a PC in the Green subnet from a host in the Blue subnet and vice versa? What

effect, if any, did the presence of a configured default gateway make? Explain your answer in detail.

- Yes, now that the appropriate default gateway (R1 interface) was given to all PCs, and there is a router configured accordingly (that can connect the 2 subnets), Blue-Green Subnet communications are now possible.

<pre>PC1> ip 20.6.52.2/24 20.6.52.1 Checking for duplicate address... PC1 : 20.6.52.2 255.255.255.0 gateway 20.6.52.1 PC1> save Saving startup configuration to startup.vpc . done PC1> show ip NAME : PC1[1] IP/MASK : 20.6.52.2/24 GATEWAY : 20.6.52.1 DNS : MAC : 00:50:79:66:68:08 LPORT : 20046 RHOST:PORT : 127.0.0.1:20047 MTU : 1500</pre>	<pre>PC2> ip 20.6.52.4/24 20.6.52.1 Checking for duplicate address... PC2 : 20.6.52.4 255.255.255.0 gateway 20.6.52.1 PC2> save Saving startup configuration to startup.vpc . done PC2> show ip NAME : PC2[1] IP/MASK : 20.6.52.4/24 GATEWAY : 20.6.52.1 DNS : MAC : 00:50:79:66:68:03 LPORT : 20048 RHOST:PORT : 127.0.0.1:20049 MTU : 1500</pre>
<pre>PC3> show ip NAME : PC3[1] IP/MASK : 20.6.52.6/24 GATEWAY : 20.6.52.1 DNS : MAC : 00:50:79:66:68:06 LPORT : 20082 RHOST:PORT : 127.0.0.1:20083 MTU : 1500</pre>	<pre>PC4> show ip NAME : PC4[1] IP/MASK : 20.6.52.8/24 GATEWAY : 20.6.52.1 DNS : MAC : 00:50:79:66:68:0f LPORT : 20084 RHOST:PORT : 127.0.0.1:20085 MTU : 1500</pre>
<pre>PC5> show ip NAME : PC5[1] IP/MASK : 20.6.53.2/24 GATEWAY : 20.6.53.1 DNS : MAC : 00:50:79:66:68:01 LPORT : 20086 RHOST:PORT : 127.0.0.1:20087 MTU : 1500</pre>	<pre>PC6> show ip NAME : PC6[1] IP/MASK : 20.6.53.4/24 GATEWAY : 20.6.53.1 DNS : MAC : 00:50:79:66:68:09 LPORT : 20088 RHOST:PORT : 127.0.0.1:20089 MTU : 1500</pre>
<pre>PC7> show ip NAME : PC7[1] IP/MASK : 20.6.53.6/24 GATEWAY : 20.6.53.1 DNS : MAC : 00:50:79:66:68:0b LPORT : 20090 RHOST:PORT : 127.0.0.1:20091 MTU : 1500</pre>	<pre>PC8> show ip NAME : PC8[1] IP/MASK : 20.6.53.8/24 GATEWAY : 20.6.53.1 DNS : MAC : 00:50:79:66:68:0a LPORT : 20092 RHOST:PORT : 127.0.0.1:20093 MTU : 1500</pre>

<pre>PC9> show ip NAME : PC9[1] IP/MASK : 20.6.56.2/24 GATEWAY : 20.6.56.1 DNS : MAC : 00:50:79:66:68:0e LPORT : 20094 RHOST:PORT : 127.0.0.1:20095 MTU : 1500</pre>	<pre>PC10> show ip NAME : PC10[1] IP/MASK : 20.6.56.4/24 GATEWAY : 20.6.56.1 DNS : MAC : 00:50:79:66:68:0c LPORT : 20096 RHOST:PORT : 127.0.0.1:20097 MTU : 1500</pre>
<pre>PC11> show ip NAME : PC11[1] IP/MASK : 20.6.56.6/24 GATEWAY : 20.6.56.1 DNS : MAC : 00:50:79:66:68:02 LPORT : 20098 RHOST:PORT : 127.0.0.1:20099 MTU : 1500</pre>	<pre>PC12> show ip NAME : PC12[1] IP/MASK : 20.6.56.8/24 GATEWAY : 20.6.56.1 DNS : MAC : 00:50:79:66:68:0d LPORT : 20100 RHOST:PORT : 127.0.0.1:20101 MTU : 1500</pre>
<pre>PC13> show ip NAME : PC13[1] IP/MASK : 20.6.57.2/24 GATEWAY : 20.6.57.1 DNS : MAC : 00:50:79:66:68:05 LPORT : 20102 RHOST:PORT : 127.0.0.1:20103 MTU : 1500</pre>	<pre>PC14> show ip NAME : PC14[1] IP/MASK : 20.6.57.4/24 GATEWAY : 20.6.57.1 DNS : MAC : 00:50:79:66:68:00 LPORT : 20104 RHOST:PORT : 127.0.0.1:20105 MTU : 1500</pre>
<pre>PC15> show ip NAME : PC15[1] IP/MASK : 20.6.57.6/24 GATEWAY : 20.6.57.1 DNS : MAC : 00:50:79:66:68:07 LPORT : 20106 RHOST:PORT : 127.0.0.1:20107 MTU : 1500</pre>	<pre>PC16> show ip NAME : PC16[1] IP/MASK : 20.6.57.8/24 GATEWAY : 20.6.57.1 DNS : MAC : 00:50:79:66:68:04 LPORT : 20108 RHOST:PORT : 127.0.0.1:20109 MTU : 1500</pre>

```
PC1> ping 20.6.53.2
84 bytes from 20.6.53.2 icmp_seq=1 ttl=63 time=3.220 ms
84 bytes from 20.6.53.2 icmp_seq=2 ttl=63 time=2.088 ms
84 bytes from 20.6.53.2 icmp_seq=3 ttl=63 time=2.612 ms
84 bytes from 20.6.53.2 icmp_seq=4 ttl=63 time=2.073 ms
84 bytes from 20.6.53.2 icmp_seq=5 ttl=63 time=5.093 ms
```

```
PC5> ping 20.6.52.2
84 bytes from 20.6.52.2 icmp_seq=1 ttl=63 time=3.896 ms
84 bytes from 20.6.52.2 icmp_seq=2 ttl=63 time=1.661 ms
84 bytes from 20.6.52.2 icmp_seq=3 ttl=63 time=2.178 ms
84 bytes from 20.6.52.2 icmp_seq=4 ttl=63 time=2.147 ms
84 bytes from 20.6.52.2 icmp_seq=5 ttl=63 time=2.184 ms
```

*Set interfaces

```
vyos@vyos:~$ conf
WARNING: You are currently configuring a live-ISO environment, changes will not
persist until installed
[edit]
vyos@vyos# set interfaces ethernet eth0 address 20.6.55.130/30
[edit]
vyos@vyos# set interfaces ethernet eth1 address 192.168.0.1/30
[edit]
vyos@vyos# commit
sav[edit]
vyos@vyos# save
Saving configuration to '/config/config.boot'...
Done
[edit]
```

```
vyos@vyos# show interfaces
ethernet eth0 {
    address 20.6.55.130/30
    hw-id 0c:94:f2:f3:00:00
}
ethernet eth1 {
    address 192.168.0.1/30
    hw-id 0c:94:f2:f3:00:01
}
ethernet eth2 {
    hw-id 0c:94:f2:f3:00:02
}
ethernet eth3 {
    hw-id 0c:94:f2:f3:00:03
}
loopback lo {
}
[edit]
```

```
vyos@vyos# show interfaces
ethernet eth0 {
    address 20.6.59.130/30
    hw-id 0c:bc:4b:d2:00:00
}
ethernet eth1 {
    address 192.168.0.2/30
    hw-id 0c:bc:4b:d2:00:01
}
ethernet eth2 {
    hw-id 0c:bc:4b:d2:00:02
}
ethernet eth3 {
    hw-id 0c:bc:4b:d2:00:03
}
loopback lo {
}
[edit]
```

*Left- R2 on Campus A, Right- R2 on Campus B

*Set static routes

*R2 on Campus A

```

vyos@vyos# set protocols static route 20.6.52.0/23 next-hop 20.6.55.129
[edit]
vyos@vyos# set protocols static route 20.6.56.0/22 next-hop 192.168.0.2
[edit]
vyos@vyos# commit
[edit]
vyos@vyos# save
Saving configuration to '/config/config.boot'...
Done
[edit]
vyos@vyos# show protocols
static {
    route 20.6.52.0/23 {
        next-hop 20.6.55.129 {
        }
    }
    route 20.6.56.0/22 {
        next-hop 192.168.0.2 {
        }
    }
}
[edit]

```

*R2 on Campus B

```

vyos@vyos# set protocols static route 20.6.56.0/23 next-hop 20.6.59.129
[edit]
vyos@vyos# set protocols static route 20.6.52.0/22 next-hop 192.168.0.1
[edit]
vyos@vyos# commit
[edit]
vyos@vyos# save
Saving configuration to '/config/config.boot'...
Done
[edit]
vyos@vyos# show protocols
static {
    route 20.6.52.0/22 {
        next-hop 192.168.0.1 {
        }
    }
    route 20.6.56.0/23 {
        next-hop 20.6.59.129 {
        }
    }
}
[edit]

```

- a. From a PC in 1 campus, is it possible to ping any PC in the other campus? Why or why not?
- No. What we configured for now is we set routes from R2 (on Campus A) to the Campus B network, as well as R2 (on Campus A) to R1 (on Campus A), and vice versa. So, let's say we try to ping a PC from Blue subnet from Campus B (i.e. PC1) using a PC from Blue subnet from Campus A (i.e. PC9). The packets from PC1 were transferred to the switch and it identifies that the destination is not within the local network so the switch transfers the packets to the gateway (R1 interface). Here, we get stuck as we still don't have a configuration for R1 when the packets' destination is not to either the Blue or Green subnets (i.e. on Campus A) *.


```
PC1> ping 20.6.56.2

*20.6.52.1 icmp_seq=1 ttl=64 time=2.135 ms (ICMP type:3, code:0, Destination net
work unreachable)
*20.6.52.1 icmp_seq=2 ttl=64 time=1.996 ms (ICMP type:3, code:0, Destination net
work unreachable)
*20.6.52.1 icmp_seq=3 ttl=64 time=1.402 ms (ICMP type:3, code:0, Destination net
work unreachable)
*20.6.52.1 icmp_seq=4 ttl=64 time=1.563 ms (ICMP type:3, code:0, Destination net
work unreachable)
20.6.56.2 icmp_seq=5 timeout
```

- b. Configure a default route in R1 that points to R2's directly reachable network interface. Can you now ping any PC w/in the other campus? What effect, if any, did the presence of a configured default gateway make? Explain your answer in detail.
- Yes. Now, we configured R1 to encompass all other destinations other than to either Blue or Green subnets (0.0.0.0/0). Let's continue from *. Here the destination is neither to Blue nor Green subnets, so we set the next hop to (i.e. 20.6.55.130), an interface of R2 (i.e. on Campus A). We already configured in R2 that when the destination is to the other Campus, it sends the packets to the other Campus' R2. R2 on (i.e. Campus B) identifies that the destination is to either the (i.e. Campus B's) Blue or Green subnets so it gives the packets to R1 (i.e. on Campus B). R1 have configurations to route to either Blue or Green subnets (i.e. Blue subnet).

<pre>vyos@vyos# show protocols static { route 0.0.0.0/0 { next-hop 20.6.55.130 { } } route 20.6.52.0/24 { next-hop 20.6.52.1 { } } route 20.6.53.0/24 { next-hop 20.6.53.1 { } } } [edit]</pre>	<pre>vyos@vyos# show protocols static { route 0.0.0.0/0 { next-hop 20.6.59.130 { } } route 20.6.56.0/24 { next-hop 20.6.56.1 { } } route 20.6.57.0/24 { next-hop 20.6.57.1 { } } } [edit]</pre>
---	---

*Left- R1 on Campus A, Right- R1 on Campus B

```
PC1> ping 20.6.56.2

84 bytes from 20.6.56.2 icmp_seq=1 ttl=60 time=10.770 ms
84 bytes from 20.6.56.2 icmp_seq=2 ttl=60 time=8.700 ms
84 bytes from 20.6.56.2 icmp_seq=3 ttl=60 time=7.214 ms
84 bytes from 20.6.56.2 icmp_seq=4 ttl=60 time=9.192 ms
84 bytes from 20.6.56.2 icmp_seq=5 ttl=60 time=8.406 ms

PC1> ping 20.6.57.8

84 bytes from 20.6.57.8 icmp_seq=1 ttl=60 time=18.346 ms
84 bytes from 20.6.57.8 icmp_seq=2 ttl=60 time=8.331 ms
84 bytes from 20.6.57.8 icmp_seq=3 ttl=60 time=6.269 ms
84 bytes from 20.6.57.8 icmp_seq=4 ttl=60 time=8.094 ms
84 bytes from 20.6.57.8 icmp_seq=5 ttl=60 time=7.271 ms
```

```
PC13> ping 20.6.52.2
84 bytes from 20.6.52.2 icmp_seq=1 ttl=60 time=7.224 ms
84 bytes from 20.6.52.2 icmp_seq=2 ttl=60 time=8.507 ms
84 bytes from 20.6.52.2 icmp_seq=3 ttl=60 time=6.517 ms
84 bytes from 20.6.52.2 icmp_seq=4 ttl=60 time=8.438 ms
84 bytes from 20.6.52.2 icmp_seq=5 ttl=60 time=8.815 ms

PC13> ping 20.6.53.8
84 bytes from 20.6.53.8 icmp_seq=1 ttl=60 time=9.324 ms
84 bytes from 20.6.53.8 icmp_seq=2 ttl=60 time=7.176 ms
84 bytes from 20.6.53.8 icmp_seq=3 ttl=60 time=8.252 ms
84 bytes from 20.6.53.8 icmp_seq=4 ttl=60 time=7.825 ms
84 bytes from 20.6.53.8 icmp_seq=5 ttl=60 time=7.226 ms
```

*Notes

- I was now able to ping other PCs/hosts from the other Campuses. Turns out the issue is like a “bug.” What I did is I just deleted VyOS 4 then just added a new one. I used the same interfaces and protocols.
- However, the issue where after refreshing / stopping the restarting the nodes, the interfaces and protocols suddenly disappear, has not been addressed yet in my case.