Redes de Computadores

3rd Phase

Connecting Multiple Networks

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Contents

1 Introduction

In this phase we will be mainly configuring devices present in a network with 3 routers and 3 LAN's. To do this we will take advantage of EVE-NG emulator running on a web browser and a telnet client.

The topology is already provided to us so we only need to configure and test the devices on the network.

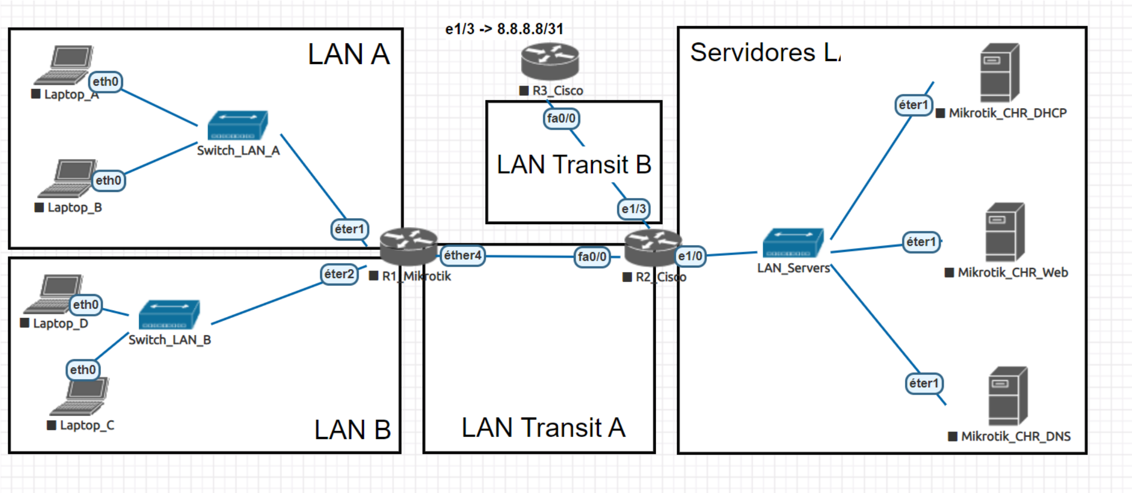


Figure 1: Network Topology

2 Gathering Information

2.1 Needed IP addresses

2.1.1 LAN A & LAN B

Using the formula present on the statement, we get that the number of clients connected to LAN A is 54 and 27 for LAN B. Knowing that in each LAN we need an IP address for the router interface, one for the Broadcast and one for the Network.

We can now conclude that we will need 3 IP addresses for each LAN plus the number of clients.

Results:
LAN A -> 57 IP addresses
LAN B -> 30 IP addresses

2.1.2 LAN Transit A & B

In each LAN Transit we will only need one IP address for each of the router interfaces, one for the broadcast and one for the Network.

Results:
LAN Transit A -> 4 IP addresses
LAN Transit B -> 4 IP addresses

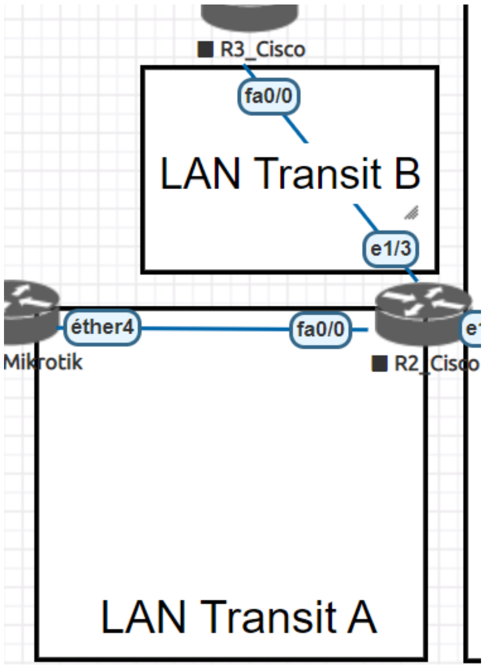


Figure 2: LAN Transit A and B Topology

2.1.3 LAN C

For LAN C we will have the largest remaining contiguous block of our address space, this will be calculated in 2.2.3.

Even though we only need four IP's for this LAN, one for each of the three servers and one for the routing interface.

2.2 Subnetting Networks

The range of addresses given to our group is 192.168.10.0/**24**, with this We now know that the entire network where the LAN's are included have a Subnet Mask of **24** 1's

(11111111.11111111.11111111.00000000), those octets converted into decimal represent the number 255.255.255.0

This Subnet Mask means that our Network is a **Class C** network and we can only use the last octet (byte) to Address IP's. . . so we have a total of 2 power to 8 (256) IP addresses that we can address to our Network. and every address will look like 192.168.10.x.

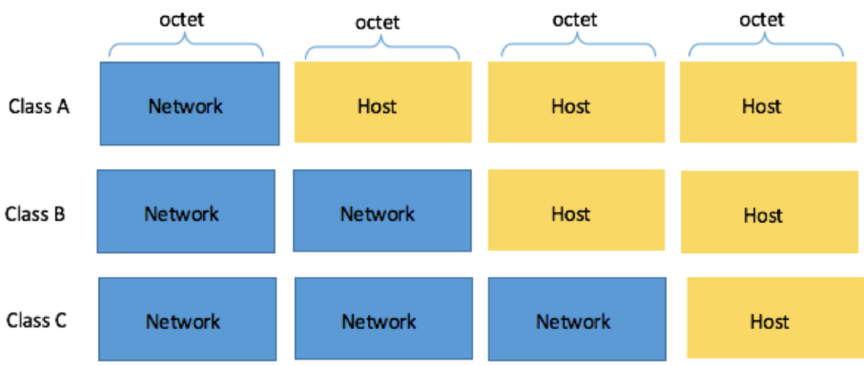


Figure 3: Network Classes and Octets division

This last octet is known as the **Host ID** (in a Class C Network case) and they are unique for each Host in a private network, the first three octets are known as **Host ID**, because they aren't mutable.

Important Note: You can Subnet a Network in other Smaller Networks.

Now that we understand IP ranges and Subnetting a bit better we can quickly understand that for each one of the LAN's we can subnet our network into something with 192.168.10.x/y format.

CIDR Block Size	Exponential Notation	Number of Addresses
/24	2^8	256
/23	2^9	512
/22	2^{10}	1024
/21	2^{11}	2048
/20	2^{12}	4096
/19	2^{13}	8192
/18	2^{14}	16384
/17	2^{15}	32768
/16	2^{16}	65536

Table 1: CDIR and Its Number Addresses

2.2.1 Subnetting LAN A

Number of IP Addresses Needed:
57

Number of IP Addresses Addressed:
$2^6 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 64$

Number of IP Addresses Wasted:
$64 - 57 = 7$

Number of IP Addresses Wasted:

Decimal	->	255.255.255.192
Binary	->	11111111.11111111.11111111.11000000
CIDR Notation	->	/26

2.2.2 Subnetting LAN B

Number of IP Addresses Needed:
4

Number of IP Addresses Addressed:
$2^2 = 2 \times 2 = 4$

Number of IP Addresses Wasted:
$4 - 4 = 0$

Number of IP Addresses Wasted:

Decimal	->	255.255.255.252
Binary	->	11111111.11111111.11111111.11111100
CIDR Notation	->	/30

2.2.3 Subnetting LAN C

To this LAN we will address the largest remaining contiguous block of our address space, to get to this value let's make some calculus with the Number of IP Addresses Addressed before.

1. **Calculate the number of the remaining IP Addresses**

   $(\textit{Starting Address Range}) - (\textit{Summation of all IP's addressed}) = 256 - 64 - 32 - 4 - 4 = 152$

2. **Translate the result to binary**

   10011000

3. **Look at the first 1 counting from left to right, everything on the right turn 0**

   10000000

4. **Everything on the left from this same 1 turn 1**

   10000000 (in this case is the same)

Now, this number is the last Octet of LAN C Subnet.

Number of IP Addresses Addressed:
$2^7 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 128$

Number of IP Addresses Wasted:
$128 - 4 = 124$

Number of IP Addresses Wasted:

Decimal	->	255.255.255.128
Binary	->	11111111.11111111.11111111.10000000
CIDR Notation	->	/25

2.3 Allocating the IP's to the Hosts

Before we start allocating the IP's in each Lan, we need to be aware of those rules:

1. We can never use the First IP of an address range, It's known as the Network Address and it represents the Network itself.
2. We can never use the Last IP of an address range, It's known as the Broadcast IP (broadcast is a way to send a message to every IP present in the Subnet, for example an **ARP Request**).
3. Usually the IP before the last one is used by the Routing Interface.

Now we can start addressing the IP's,

LAN A:

Network Address	->192.168.10.0
Laptop A	->192.168.10.1
Laptop B	->192.168.10.2
Ether 1	->192.168.10.62
Broadcast	->192.168.10.63

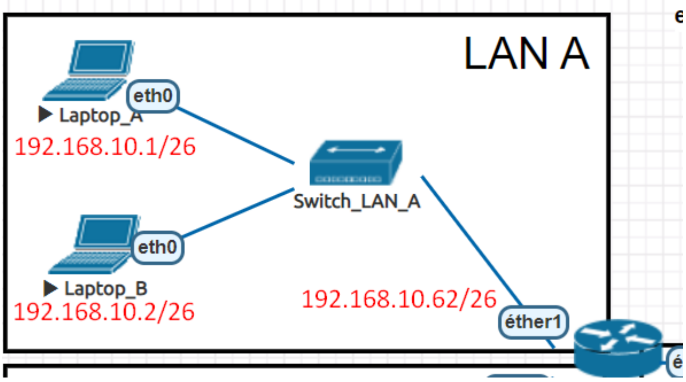


Figure 4: LAN A addressing

LAN B:

Network Address	->192.168.10.64
Laptop C	->192.168.10.65
Laptop D	->192.168.10.66
Ether 2	->192.168.10.94
Broadcast	->192.168.10.95

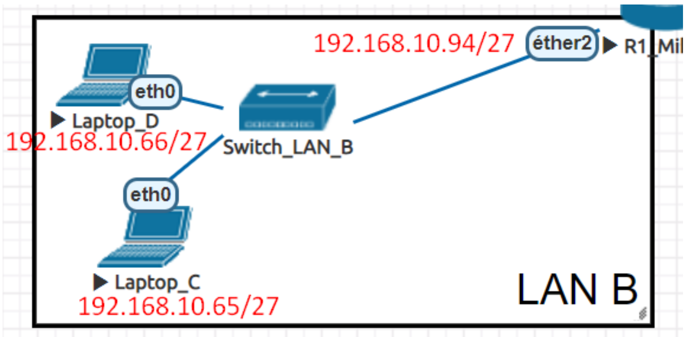


Figure 5: LAN B addressing

LAN Transit A:

Network Address	->192.168.10.96
R2_Cisco fa0/0	->192.168.10.98
R1_Mikrotik ether4	->192.168.10.97
Broadcast	->192.168.10.99

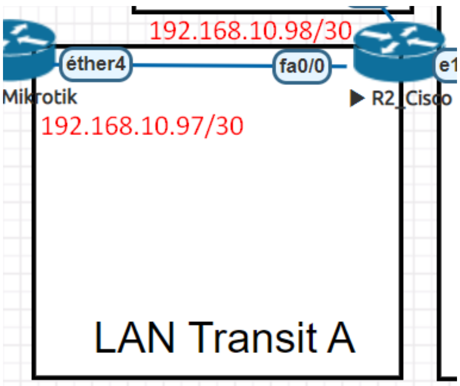


Figure 6: LAN Transit A addressing

LAN Transit B:

Network Address	->192.168.10.100
R2_Cisco fa0/0	->192.168.10.101
R1_Mikrotik ether4	->192.168.10.102
Broadcast	->192.168.10.103

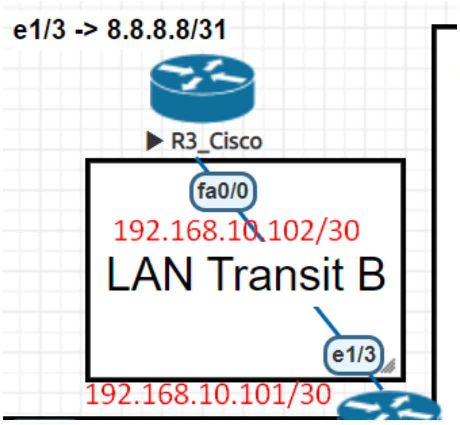


Figure 7: LAN Transport B addressing

LAN C:

Network Address	->192.168.10.128
Mikrotik_CHR_DCHP	->192.168.10.129
Mikrotik_CHR_WEB	->192.168.10.130
Mikrotik_CHR_DNS	->192.168.10.131
e1/0 (R2_Cisco)	->192.168.10.254
Broadcast	->192.168.10.255

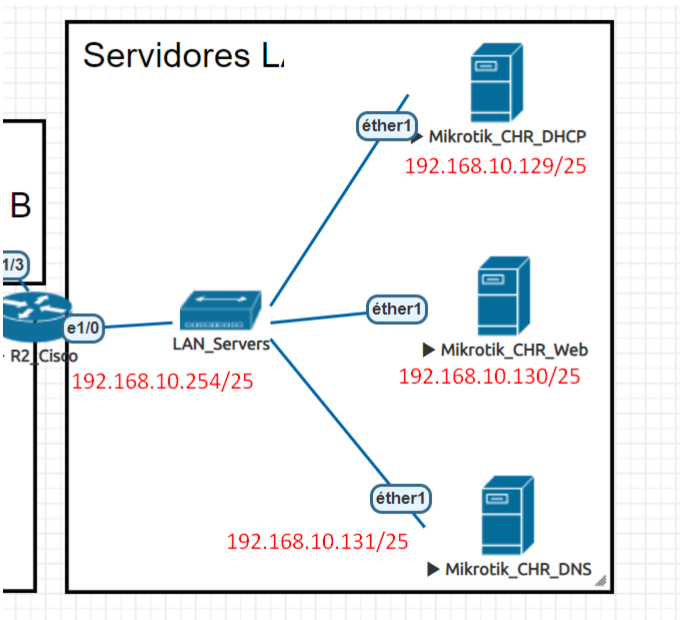


Figure 8: LAN C addressing

2.4 Gateways

When Looking for a host that's in another network, we use what's called a "Gateway". The Host doesn't find the destination so It sends the message somewhere.

Generally the Host gateway, in case it's a Laptop, is a Router Interface IP Address and the Router itself will have gateways, either It is another Router Interface or just sending it out to the internet to find the destination address out of the Private Network.

In Phase 2, we had the Gateways of every laptop in each LAN being the router interface IP address presented on this same LAN. In Phase 3 the rule is the same, but interfaces IP addresses changed.

Now we will define the gateways for Laptops A,B,C,D as well as services Mikrotik_CHR_DCP, Mikrotik_CHR_DNS, Mikrotik_CHR_WEB and R1_Mikrotik,R2_cisco and R3_cisco:

Laptop A/B	->	192.168.10.62 (R1 ether1)
Laptop C/D	->	192.168.10.94 (R1 ether2)
R1_Mikrotik	->	192.168.10.98 (R2 f0/0)
R2_Cisco	:	192.168.10.97 (R1_Mikrotik ether4)
		192.168.10.102 (R3_Cisco f0/0)
R3_Cisco	:	192.168.10.101 (R2_Cisco e1/3)

3 Configuring the Topology

3.1 Configuring LAN A

Let's start by configuring the Laptop A and B, we already know the IP and gateway for both, we just need to allocate It with telnet.

```
VPCS> ip 192.168.10.1/26 192.168.10.62
Checking for duplicate address...
PC1 : 192.168.10.1 255.255.255.192 gateway 192.168.10.62

VPCS> show

NAME   IP/MASK              GATEWAY
VPCS1  192.168.10.1/26      192.168.10.62
       fe80::250:79ff:fe66:6808/64
```

Figure 9: Addressing IP and gateway to Laptop_A

```
VPCS> ip 192.168.10.2/26 192.168.10.62
Checking for duplicate address...
PC1 : 192.168.10.2 255.255.255.192 gateway 192.168.10.62

VPCS> show

NAME   IP/MASK              GATEWAY
VPCS1  192.168.10.2/26      192.168.10.62
       fe80::250:79ff:fe66:6804/64
```

Figure 10: Addressing IP and gateway to Laptop_B

Now we will configure the ether1 and print the IP routing table on the R1_Mikrotik.

```
[admin@MikroTik] /ip address> add
address: 192.168.10.62/26
interface: ether1
[admin@MikroTik] /ip address> print
Flags: X - disabled, I - invalid, D - dynamic
 #   ADDRESS            NETWORK         INTERFACE
 0   192.168.10.62/26   192.168.10.0    ether1
[admin@MikroTik] /ip address>
```

Figure 11: Addressing ether1 in Mikrotik R1 configurations

3.2 Configuring LAN B

Let's start by configuring the Laptop C and D, we already know the IP and gateway for both, we just need to allocate It with telnet.

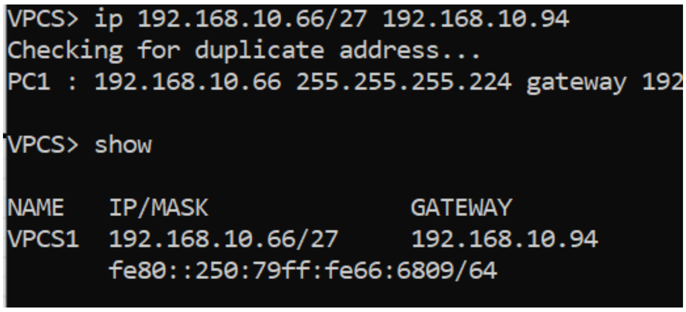


Figure 12: Addressing IP and gateway to Laptop_B

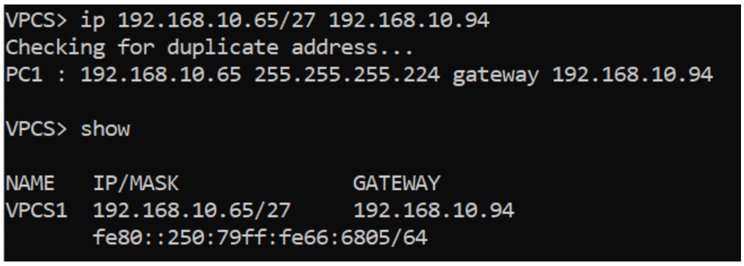


Figure 13: Addressing IP and gateway to Laptop_B

Now we will finally configure the ether2 and print the IP routing table on the R1_Mikrotik.

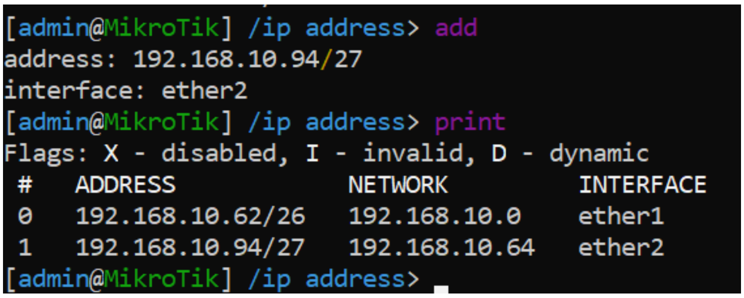


Figure 14: Addressing R1_Mikrotik ether2

3.3 Configuring LAN Transit A

We will now configure R1_Mikrotik ether4 and R2_Cisco f0/0.

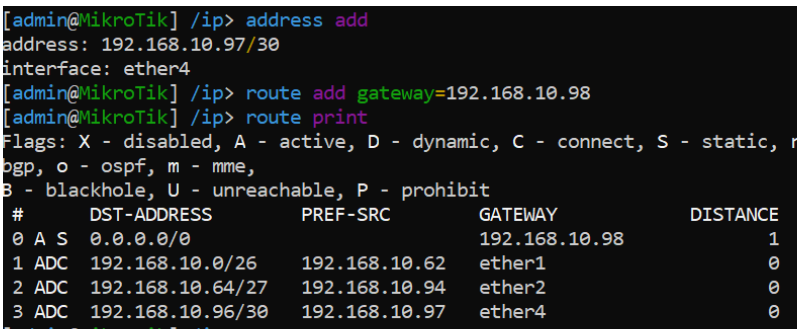


Figure 15: Addressing R1_Mikrotik ether4 and Gateway

```
Router>enable
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface f0/0
Router(config-if)#ip address 192.168.10.98 255.255.255.252
Router(config-if)#no shutdown
```

```
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#ip route 192.168.10.0 255.255.255.192 192.168.10.97
Router(config)#ip route 192.168.10.64 255.255.255.224 192.168.10.97
```

```
Gateway of last resort is not set

      192.168.10.0/24 is variably subnetted, 8 subnets, 5 masks
S        192.168.10.0/26 [1/0] via 192.168.10.97
S        192.168.10.64/27 [1/0] via 192.168.10.97
C        192.168.10.96/30 is directly connected, FastEthernet0/0
L        192.168.10.98/32 is directly connected, FastEthernet0/0
C        192.168.10.100/30 is directly connected, Ethernet1/3
L        192.168.10.101/32 is directly connected, Ethernet1/3
C        192.168.10.128/25 is directly connected, Ethernet1/0
L        192.168.10.254/32 is directly connected, Ethernet1/0
Router#write
Building configuration...
[OK]
```

Figure 16: Addressing R2_Cisco f0/0 and Gateways and showing ip route

3.4 Configuring LAN Transit B

In this LAN Transit we need to configure R2_Cisco e1/3 and R3_Cisco f0/0.

```
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface e1/3
Router(config-if)#ip address 192.168.10.101 255.255.255.252
Router(config-if)#no shutdown
Router(config-if)#
```

```
Router(config)#ip route 8.8.8.8 255.255.255.254 192.168.10.102
```

```
      8.0.0.0/31 is subnetted, 1 subnets
S        8.8.8.8 [1/0] via 192.168.10.102
      192.168.10.0/24 is variably subnetted, 8 subnets, 5 masks
S        192.168.10.0/26 [1/0] via 192.168.10.97
S        192.168.10.64/27 [1/0] via 192.168.10.97
C        192.168.10.96/30 is directly connected, FastEthernet0/0
L        192.168.10.98/32 is directly connected, FastEthernet0/0
C        192.168.10.100/30 is directly connected, Ethernet1/3
L        192.168.10.101/32 is directly connected, Ethernet1/3
C        192.168.10.128/25 is directly connected, Ethernet1/0
L        192.168.10.254/32 is directly connected, Ethernet1/0
```

Figure 17: Addressing R2_Cisco e1/3, gateways and showing IP route

```
Router(config)#interface e1/3
Router(config-if)#ip addres 8.8.8.8 255.255.255.254
Router(config-if)#no shutdown
Router(config-if)#end
Router#configg
*Jun  6 20:14:39.171: %SYS-5-CONFIG_I: Configured from console by
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface f0/0
Router(config-if)#ip address 192.168.10.102 255.255.255.252
Router(config-if)#no shutdown
```

```
Router(config)#ip route 192.168.10.64 255.255.255.224 192.168.10.101
Router(config)#ip route 192.168.10.0 255.255.255.192 192.168.10.101
Router(config)#ip route 192.168.10.128 255.255.255.128 192.168.10.101
```

```
S*    0.0.0.0/0 is directly connected, Ethernet1/3
      8.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C        8.8.8.8/31 is directly connected, Ethernet1/3
L        8.8.8.8/32 is directly connected, Ethernet1/3
      192.168.10.0/24 is variably subnetted, 5 subnets, 5 masks
S        192.168.10.0/26 [1/0] via 192.168.10.101
S        192.168.10.64/27 [1/0] via 192.168.10.101
C        192.168.10.100/30 is directly connected, FastEthernet0/0
L        192.168.10.102/32 is directly connected, FastEthernet0/0
S        192.168.10.128/25 [1/0] via 192.168.10.101
Router#
```

Figure 18: Addressing R3_Cisco f0/0, e1/3,gateways and showing IP route

3.5 Configuring LAN C

```
Router(config-if)#interface e1/0
Router(config-if)#ip address 192.168.10.254 255.255.255.128
Router(config-if)#no shutdown
Router(config-if)#^Z
Router#sh ip interface brief
*Jun  6 06:43:30.867: %SYS-5-CONFIG_I: Configured from console by console
Interface              IP-Address      OK? Method Status                Protocol
FastEthernet0/0        192.168.10.98   YES manual up                    up
Ethernet1/0            192.168.10.254  YES manual up                    up
```

Figure 19: Addressing R2_Cisco e1/0 and showing interface brief

```
[admin@MikroTik] /ip address> .. route add gateway=192.168.10.254
[admin@MikroTik] /ip address> add
address: 192.168.10.129/25
interface: ether1
[admin@MikroTik] /ip address> .. route print
Flags: X - disabled, A - active, D - dynamic, C - connect, S - static, r -
B - blackhole, U - unreachable, P - prohibit
 #      DST-ADDRESS        PREF-SRC        GATEWAY            DISTANCE
 0 A S  0.0.0.0/0                          192.168.10.254            1
 1 ADC  192.168.10.128/25  192.168.10.129  ether1                    0
[admin@MikroTik] /ip address>
```

Figure 20: Adressing Mikrotik_CHR_DCP ether1 and gateway

```
[admin@MikroTik] /ip>> address add
address: 192.168.10.130/25
interface: ether1
[admin@MikroTik] /ip>>
accounting  dhcp-client  dns       ipsec     pool   service   socks  traffic-flow
address     dhcp-relay   firewall  neighbor  proxy  settings  ssh    upnp
arp         dhcp-server  hotspot   packing   route  smb       tftp   export
[admin@MikroTik] /ip>> route add gateway=192.168.10.254
[admin@MikroTik] /ip>> route print
Flags: X - disabled, A - active, D - dynamic, C - connect, S - static, r - rip, b -
B - blackhole, U - unreachable, P - prohibit
 #      DST-ADDRESS        PREF-SRC        GATEWAY            DISTANCE
 0 A S  0.0.0.0/0                          192.168.10.254            1
 1 ADC  192.168.10.128/25  192.168.10.130  ether1                    0
[admin@MikroTik] /ip>> _
```

Figure 21: Adressing Mikrotik_CHR_web ether1 and gateway

```
[admin@MikroTik] /ip> ro add gateway=192.168.10.254
[admin@MikroTik] /ip> ad add
address: 192.168.10.131/25
interface: ether1
[admin@MikroTik] /ip> ro print
Flags: X - disabled, A - active, D - dynamic, C - connect, S - static, r -
B - blackhole, U - unreachable, P - prohibit
 #      DST-ADDRESS        PREF-SRC        GATEWAY            DISTANCE
 0 A S  0.0.0.0/0                          192.168.10.254            1
 1 ADC  192.168.10.128/25  192.168.10.131  ether1                    0
[admin@MikroTik] /ip> _
```

Figure 22: Adressing Mikrotik_CHR_DNS ether1 and gateway

4 Checking Connections

Let's check if everything alright by pinging from Laptop_A and Laptop_C, the 3 servers in LAN C, Router2 Interfaces, Router1 and 8.8.8.8.

As we saw in Phase 2 Report, the more hops a packet gets through the slower it gets to the destinations.

With that being said we can predict that pinging R2_Cisco interfaces from Laptop_A or Laptop_D will be slower than pinging R1_Mikrotik, because it's a 2 Hops path instead of only 1 Hop. Even slower than pinging R2_Cisco from this Laptops we will have the pings to R3_Cisco and LAN C Hosts, because in this case packets go through a 3 Hops path

4.1 Pinging from Laptop_A

As expected, with the path getting longer between the destination and the source of the ping, the answer time gets slower.

```
VPCS> ping 192.168.10.129

84 bytes from 192.168.10.129 icmp_seq=1 ttl=62 time=13.012 ms
84 bytes from 192.168.10.129 icmp_seq=2 ttl=62 time=20.195 ms
84 bytes from 192.168.10.129 icmp_seq=3 ttl=62 time=20.487 ms
84 bytes from 192.168.10.129 icmp_seq=4 ttl=62 time=20.124 ms
84 bytes from 192.168.10.129 icmp_seq=5 ttl=62 time=18.865 ms
```

```
VPCS> ping 192.168.10.130

84 bytes from 192.168.10.130 icmp_seq=1 ttl=62 time=15.996 ms
84 bytes from 192.168.10.130 icmp_seq=2 ttl=62 time=18.554 ms
84 bytes from 192.168.10.130 icmp_seq=3 ttl=62 time=19.696 ms
84 bytes from 192.168.10.130 icmp_seq=4 ttl=62 time=18.454 ms
84 bytes from 192.168.10.130 icmp_seq=5 ttl=62 time=12.327 ms
```

```
VPCS> ping 192.168.10.131

84 bytes from 192.168.10.131 icmp_seq=1 ttl=62 time=12.266 ms
84 bytes from 192.168.10.131 icmp_seq=2 ttl=62 time=20.130 ms
84 bytes from 192.168.10.131 icmp_seq=3 ttl=62 time=18.735 ms
84 bytes from 192.168.10.131 icmp_seq=4 ttl=62 time=17.212 ms
84 bytes from 192.168.10.131 icmp_seq=5 ttl=62 time=18.796 ms
```

Figure 23: Pinging 3 Servers on LAN C from Laptop_A

```
VPCS> ping 192.168.10.254

84 bytes from 192.168.10.254 icmp_seq=1 ttl=254 time=10.175 ms
84 bytes from 192.168.10.254 icmp_seq=2 ttl=254 time=6.400 ms
84 bytes from 192.168.10.254 icmp_seq=3 ttl=254 time=7.144 ms
84 bytes from 192.168.10.254 icmp_seq=4 ttl=254 time=8.457 ms
84 bytes from 192.168.10.254 icmp_seq=5 ttl=254 time=11.201 ms
```

```
VPCS> ping 192.168.10.98

84 bytes from 192.168.10.98 icmp_seq=1 ttl=254 time=14.844 ms
84 bytes from 192.168.10.98 icmp_seq=2 ttl=254 time=8.823 ms
84 bytes from 192.168.10.98 icmp_seq=3 ttl=254 time=16.261 ms
84 bytes from 192.168.10.98 icmp_seq=4 ttl=254 time=8.152 ms
84 bytes from 192.168.10.98 icmp_seq=5 ttl=254 time=11.886 ms
```

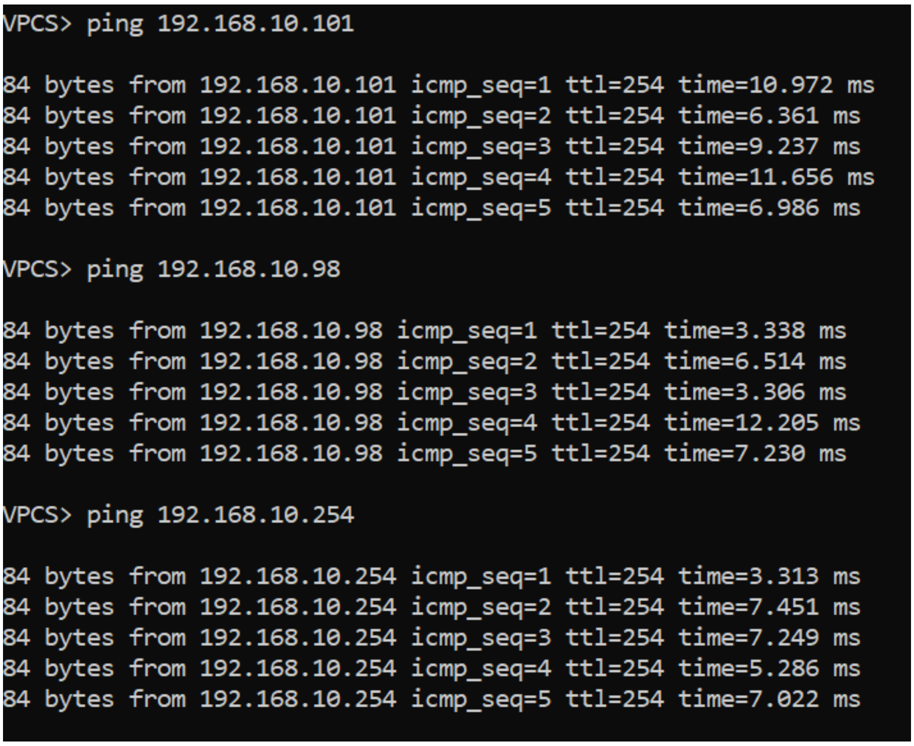
```
VPCS> ping 192.168.10.101

84 bytes from 192.168.10.101 icmp_seq=1 ttl=254 time=8.051 ms
84 bytes from 192.168.10.101 icmp_seq=2 ttl=254 time=11.285 ms
84 bytes from 192.168.10.101 icmp_seq=3 ttl=254 time=9.982 ms
84 bytes from 192.168.10.101 icmp_seq=4 ttl=254 time=7.730 ms
84 bytes from 192.168.10.101 icmp_seq=5 ttl=254 time=6.622 ms
```

Figure 24: Pinging R2_Interfaces from Laptop_A

```
VPCS> ping 8.8.8.8

84 bytes from 8.8.8.8 icmp_seq=1 ttl=253 time=29.377 ms
84 bytes from 8.8.8.8 icmp_seq=2 ttl=253 time=16.414 ms
84 bytes from 8.8.8.8 icmp_seq=3 ttl=253 time=17.171 ms
84 bytes from 8.8.8.8 icmp_seq=4 ttl=253 time=15.598 ms
84 bytes from 8.8.8.8 icmp_seq=5 ttl=253 time=17.477 ms
```

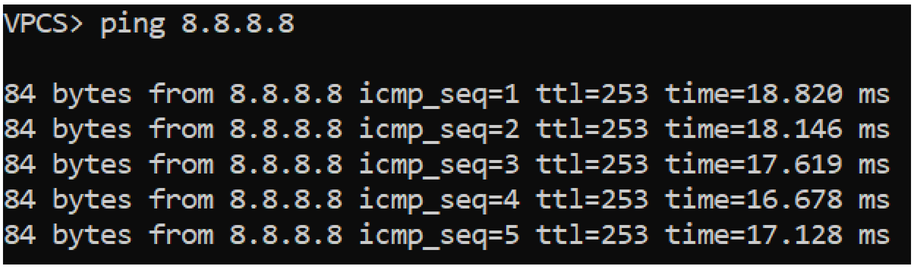
Figure 25: Pinging 8.8.8.8 from Laptop_A

4.2 Pinging from Laptop_D



```
VPCS> ping 192.168.10.101

84 bytes from 192.168.10.101 icmp_seq=1 ttl=254 time=10.972 ms
84 bytes from 192.168.10.101 icmp_seq=2 ttl=254 time=6.361 ms
84 bytes from 192.168.10.101 icmp_seq=3 ttl=254 time=9.237 ms
84 bytes from 192.168.10.101 icmp_seq=4 ttl=254 time=11.656 ms
84 bytes from 192.168.10.101 icmp_seq=5 ttl=254 time=6.986 ms

VPCS> ping 192.168.10.98

84 bytes from 192.168.10.98 icmp_seq=1 ttl=254 time=3.338 ms
84 bytes from 192.168.10.98 icmp_seq=2 ttl=254 time=6.514 ms
84 bytes from 192.168.10.98 icmp_seq=3 ttl=254 time=3.306 ms
84 bytes from 192.168.10.98 icmp_seq=4 ttl=254 time=12.205 ms
84 bytes from 192.168.10.98 icmp_seq=5 ttl=254 time=7.230 ms

VPCS> ping 192.168.10.254

84 bytes from 192.168.10.254 icmp_seq=1 ttl=254 time=3.313 ms
84 bytes from 192.168.10.254 icmp_seq=2 ttl=254 time=7.451 ms
84 bytes from 192.168.10.254 icmp_seq=3 ttl=254 time=7.249 ms
84 bytes from 192.168.10.254 icmp_seq=4 ttl=254 time=5.286 ms
84 bytes from 192.168.10.254 icmp_seq=5 ttl=254 time=7.022 ms
```

Figure 26: Pinging R2_Cisco interfaces from Laptop_D



```
VPCS> ping 8.8.8.8

84 bytes from 8.8.8.8 icmp_seq=1 ttl=253 time=18.820 ms
84 bytes from 8.8.8.8 icmp_seq=2 ttl=253 time=18.146 ms
84 bytes from 8.8.8.8 icmp_seq=3 ttl=253 time=17.619 ms
84 bytes from 8.8.8.8 icmp_seq=4 ttl=253 time=16.678 ms
84 bytes from 8.8.8.8 icmp_seq=5 ttl=253 time=17.128 ms
```

Figure 27: Pinging 8.8.8.8 from Laptop_D

```
VPCS> ping 192.168.10.129

84 bytes from 192.168.10.129 icmp_seq=1 ttl=62 time=14.619 ms
84 bytes from 192.168.10.129 icmp_seq=2 ttl=62 time=16.310 ms
84 bytes from 192.168.10.129 icmp_seq=3 ttl=62 time=16.503 ms
84 bytes from 192.168.10.129 icmp_seq=4 ttl=62 time=30.673 ms
84 bytes from 192.168.10.129 icmp_seq=5 ttl=62 time=16.525 ms

VPCS> ping 192.168.10.130

84 bytes from 192.168.10.130 icmp_seq=1 ttl=62 time=18.941 ms
84 bytes from 192.168.10.130 icmp_seq=2 ttl=62 time=16.798 ms
84 bytes from 192.168.10.130 icmp_seq=3 ttl=62 time=18.822 ms
84 bytes from 192.168.10.130 icmp_seq=4 ttl=62 time=19.523 ms
84 bytes from 192.168.10.130 icmp_seq=5 ttl=62 time=17.311 ms

VPCS> ping 192.168.10.131

84 bytes from 192.168.10.131 icmp_seq=1 ttl=62 time=20.606 ms
84 bytes from 192.168.10.131 icmp_seq=2 ttl=62 time=18.081 ms
84 bytes from 192.168.10.131 icmp_seq=3 ttl=62 time=16.790 ms
84 bytes from 192.168.10.131 icmp_seq=4 ttl=62 time=17.426 ms
84 bytes from 192.168.10.131 icmp_seq=5 ttl=62 time=16.399 ms
```

Figure 28: Pinging Servers in LAN C from Laptop_D

5 Final Configurations

```
VPCS> show

NAME   IP/MASK              GATEWAY                           GATEWAY
VPCS1  192.168.10.1/26      192.168.10.62
       fe80::250:79ff:fe66:6808/64
```

Figure 29: Laptop_A configuration

```
NAME   IP/MASK              GATEWAY
VPCS1  192.168.10.2/26      192.168.10.62
       fe80::250:79ff:fe66:6804/64
```

Figure 30: Laptop_B configuration

```
NAME   IP/MASK              GATEWAY
VPCS1  192.168.10.65/27     192.168.10.94
       fe80::250:79ff:fe66:6805/64
```

Figure 31: Laptop_C configuration

```
VPCS> show

NAME   IP/MASK              GATEWAY                           GATEWAY
VPCS1  192.168.10.66/27     192.168.10.94
       fe80::250:79ff:fe66:6809/64
```

Figure 32: Laptop_D configuration

```
[admin@MikroTik] > ip route print
Flags: X - disabled, A - active, D - dynamic, C - connect, S - static, r
B - blackhole, U - unreachable, P - prohibit
 #      DST-ADDRESS        PREF-SRC        GATEWAY            DISTANCE
 0 A S  0.0.0.0/0                          192.168.10.98             1
 1 ADC  192.168.10.0/26    192.168.10.62   ether1                    0
 2 ADC  192.168.10.64/27   192.168.10.94   ether2                    0
 3 ADC  192.168.10.96/30   192.168.10.97   ether4                    0
```

Figure 33: R1_Mikrotik IP Route

```
      8.0.0.0/31 is subnetted, 1 subnets
S        8.8.8.8 [1/0] via 192.168.10.102
      192.168.10.0/24 is variably subnetted, 8 subnets, 5 masks
S        192.168.10.0/26 [1/0] via 192.168.10.97
S        192.168.10.64/27 [1/0] via 192.168.10.97
C        192.168.10.96/30 is directly connected, FastEthernet0/0
L        192.168.10.98/32 is directly connected, FastEthernet0/0
C        192.168.10.100/30 is directly connected, Ethernet1/3
L        192.168.10.101/32 is directly connected, Ethernet1/3
C        192.168.10.128/25 is directly connected, Ethernet1/0
L        192.168.10.254/32 is directly connected, Ethernet1/0
Router>
```

Figure 34: R2_Cisco IP Route

```
S*    0.0.0.0/0 is directly connected, Ethernet1/3
      8.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C        8.8.8.8/31 is directly connected, Ethernet1/3
L        8.8.8.8/32 is directly connected, Ethernet1/3
      192.168.10.0/24 is variably subnetted, 5 subnets, 5 masks
S        192.168.10.0/26 [1/0] via 192.168.10.101
S        192.168.10.64/27 [1/0] via 192.168.10.101
C        192.168.10.100/30 is directly connected, FastEthernet0/
L        192.168.10.102/32 is directly connected, FastEthernet0/
S        192.168.10.128/25 [1/0] via 192.168.10.101
```

Figure 35: R3_Cisco IP Route

```
[admin@MikroTik] > ip route print
Flags: X - disabled, A - active, D - dynamic, C - connect, S - static, r -
B - blackhole, U - unreachable, P - prohibit
 #      DST-ADDRESS         PREF-SRC         GATEWAY            DISTANCE
 0 A S  0.0.0.0/0                            192.168.10.254            1
 1 ADC  192.168.10.128/25   192.168.10.129   ether1                    0
```

Figure 36: Mikrotik_CHR_DHCP IP Route

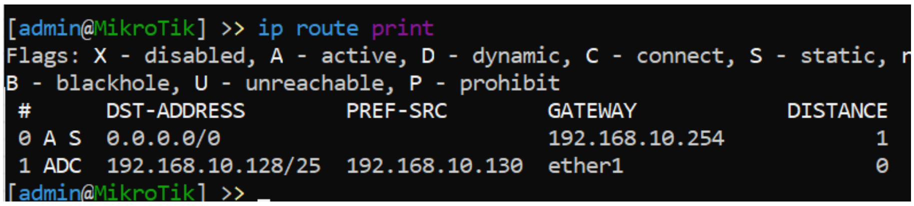


Figure 37: Mikrotik_CHR_WEB IP Route

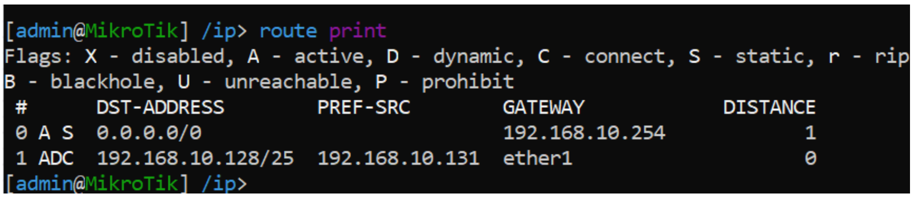


Figure 38: Mikrotik_CHR_DNS IP Route

6 Conclusion

With this project we were able to test our knowledge about configuring and connecting multiple networks, as well as understanding better gateways. Along this phase we learn a lot about Cisco Routers too and how to configure them.

Making a gateway static path and trace routing the packets when bug's happened were the most interesting part of this phase, being able to trace the packet hops between the network is an amazing way to understand how Packet flow works on a network.