Lab 9 -- Routing

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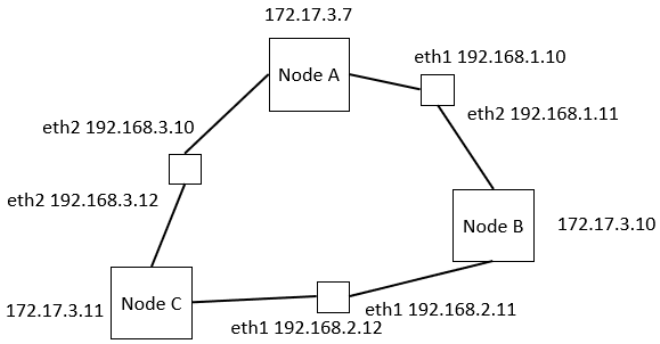
1 My topology



Node #1 (at Colorado InstaGENI):

Status	Client ID	Component ID	Expiration	Type	Hostname
Unknown	NodeA	pc3		default-vm	NodeA.routing.ch-geni-net.instageni.colorado.edu
Login	ssh tolik@pc3.instageni.colorado.edu -p 25610 ssh ziqi1756@pc3.instageni.colorado.edu -p 25610 ssh matta@pc3.instageni.colorado.edu -p 25610				
Interfaces		**MAC**		**Layer 3**	
VM:if0	pc3:lo0	0272d7498b6f		ipv4: 192.168.1.10	
VM:if1	pc3:lo0	029c0624abba		ipv4: 192.168.3.10	

Node #2 (at Colorado InstaGENI):

Status	Client ID	Component ID	Expiration	Type	Hostname
Unknown	NodeB	pc3		default-vm	NodeB.routing.ch-geni-net.instageni.colorado.edu
Login	ssh tolik@pc3.instageni.colorado.edu -p 25611 ssh ziqi1756@pc3.instageni.colorado.edu -p 25611 ssh matta@pc3.instageni.colorado.edu -p 25611				
Interfaces		**MAC**		**Layer 3**	
VM-0:if0	pc3:lo0	026e9c0b7770		ipv4: 192.168.1.11	
VM-0:if1	pc3:lo0	02790f8f14ab		ipv4: 192.168.2.11	

Node #3 (at Colorado InstaGENI):

Status	Client ID	Component ID	Expiration	Type	Hostname
Unknown	NodeC	pc3		default-vm	NodeC.routing.ch-geni-net.instageni.colorado.edu
Login	ssh tolik@pc3.instageni.colorado.edu -p 25612 ssh ziqi1756@pc3.instageni.colorado.edu -p 25612 ssh matta@pc3.instageni.colorado.edu -p 25612				
Interfaces		**MAC**		**Layer 3**	
VM-1:if0	pc3:lo0	024738d431e8		ipv4: 192.168.2.12	
VM-1:if1	pc3:lo0	02722e1358e0		ipv4: 192.168.3.12	

Link #1:

Client ID	Endpoint #0	Endpoint #1
link0	VM-0:if0	VM:if0

Link #2:

Client ID	Endpoint #0	Endpoint #1
link1	VM-0:if1	VM-1:if0

Link #3:

Client ID	Endpoint #0	Endpoint #1
link2	VM:if1	VM-1:if1

To add static route to a network in the routing table:

route add -net 192.168.1.0 netmask 255.255.255.0 gw 192.168.1.1 dev eth0

In above command:	
add	-Indicates that the route is added to routing table.
-net	-Indicates that desination is a network.
192.168.0.1	-Indicates IP address of destination network.
netmask	-Indicates the subnetmask of destination network.
gw 192.168.1.1	-Indicates the gateway of destination network.
dev eth0	-Indicates that the packets are routed via the interface eth0.

2 Questions:

1. **What happens when you traceroute from A to IP address 192.168.2.12 before you setup the static routes? Why?** Include the output of the traceroute in your writeup

```
ziqi1756@nodea:~$ traceroute 192.168.2.12
traceroute to 192.168.2.12 (192.168.2.12), 30 hops max, 60 byte packets
 1  NodeC-link1 (192.168.2.12)  1.218 ms  1.088 ms  0.989 ms
```

```
ziqi1756@nodea:~$ route -n
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
0.0.0.0         172.16.0.1      0.0.0.0         UG    1024   0        0 eth0
172.16.0.0      0.0.0.0         255.240.0.0     U     0      0        0 eth0
172.16.0.1      0.0.0.0         255.255.255.255 UH    1024   0        0 eth0
192.168.0.0     192.168.1.11    255.255.0.0     UG    0      0        0 eth1
192.168.1.0     0.0.0.0         255.255.255.0   U     0      0        0 eth1
192.168.2.12    192.168.3.12    255.255.255.252 UG    0      0        0 eth2
192.168.3.0     0.0.0.0         255.255.255.0   U     0      0        0 eth2
```

The routing table in Node A shows that if the destination is 192.168.12 then the next hop is 192.168.3.12 Using interface eth2 192.168.3.10. Thus, it takes only one hop to reach the destination.

2. **Setup the routing from A to 192.168.2.12 so that it goes through B. Was it enough to just modify the routing tables? What else did you need to change in order for the traffic to flow? Ensure that you have connectivity by running a ping from A to 192.168.2.12.** In your writeup include all the commands you ran and a screenshot of the routing configuration.

```
ziqi1756@nodea:~$ sudo route add -net 192.168.2.12 netmask 255.255.255.252 gw 192.168.1.11 dev eth1
ziqi1756@nodea:~$ route -n
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
0.0.0.0         172.16.0.1      0.0.0.0         UG    1024   0        0 eth0
172.16.0.0      0.0.0.0         255.240.0.0     U     0      0        0 eth0
172.16.0.1      0.0.0.0         255.255.255.255 UH    1024   0        0 eth0
192.168.0.0     192.168.1.11    255.255.0.0     UG    0      0        0 eth1
192.168.1.0     0.0.0.0         255.255.255.0   U     0      0        0 eth1
192.168.2.12    192.168.1.11    255.255.255.252 UG    0      0        0 eth1
192.168.2.12    192.168.3.12    255.255.255.252 UG    0      0        0 eth2
192.168.3.0     0.0.0.0         255.255.255.0   U     0      0        0 eth2
```

It was enough to just modify the routing tables.

3. **What happens when you traceroute from A to IP address 192.168.2.12 after you setup the static routes?** In your writeup include a screenshot of the traceroute output.

```
ziqi1756@nodea:~$ sudo route add -net 192.168.2.12 netmask 255.255.255.252 gw 192.168.1.11 dev eth1
ziqi1756@nodea:~$ route -n
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
0.0.0.0         172.16.0.1      0.0.0.0         UG    1024   0        0 eth0
172.16.0.0      0.0.0.0         255.240.0.0     U     0      0        0 eth0
172.16.0.1      0.0.0.0         255.255.255.255 UH    1024   0        0 eth0
192.168.0.0     192.168.1.11    255.255.0.0     UG    0      0        0 eth1
192.168.1.0     0.0.0.0         255.255.255.0   U     0      0        0 eth1
192.168.2.12    192.168.1.11    255.255.255.252 UG    0      0        0 eth1
192.168.2.12    192.168.3.12    255.255.255.252 UG    0      0        0 eth2
192.168.3.0     0.0.0.0         255.255.255.0   U     0      0        0 eth2
ziqi1756@nodea:~$ traceroute 192.168.2.12
traceroute to 192.168.2.12 (192.168.2.12), 30 hops max, 60 byte packets
 1  NodeB-link0 (192.168.1.11)  1.261 ms  1.162 ms  1.067 ms
 2  NodeC-link1 (192.168.2.12)  1.793 ms  1.716 ms  1.691 ms
ziqi1756@nodea:~$
```

It takes two hops to reach the destination.

Node B Routing Table

```
ziqi1756@nodeb:~$ route -n
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
0.0.0.0         172.16.0.1      0.0.0.0         UG    1024   0        0 eth0
172.16.0.0      0.0.0.0         255.240.0.0     U     0      0        0 eth0
172.16.0.1      0.0.0.0         255.255.255.255 UH    1024   0        0 eth0
192.168.0.0     192.168.2.12    255.255.0.0     UG    0      0        0 eth2
192.168.1.0     0.0.0.0         255.255.255.0   U     0      0        0 eth1
192.168.2.0     0.0.0.0         255.255.255.0   U     0      0        0 eth2
192.168.3.8     192.168.1.10    255.255.255.252 UG    0      0        0 eth1
```

Node C Routing Table

```
ziqi1756@nodec:~$ route -n
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
0.0.0.0         172.16.0.1      0.0.0.0         UG    1024   0        0 eth0
172.16.0.0      0.0.0.0         255.240.0.0     U     0      0        0 eth0
172.16.0.1      0.0.0.0         255.255.255.255 UH    1024   0        0 eth0
192.168.0.0     192.168.3.10    255.255.0.0     UG    0      0        0 eth2
192.168.1.11    192.168.2.11    255.255.255.255 UGH   0      0        0 eth1
192.168.2.0     0.0.0.0         255.255.255.0   U     0      0        0 eth1
192.168.3.0     0.0.0.0         255.255.255.0   U     0      0        0 eth2
```