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<u>Lab 4 Report</u>

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1) Summarize what you learned in a few paragraphs. (20 points)

Prior to this lab, we had never used GENI before. While executing the exercises for this lab, we learned that GENI is an extremely useful tool for running tests on a sample network, way before it is deployed. After we got the control interface IP address through iperf, it was extremely interesting to see how the Web Server statistics, and the apache server status for the IP address looked like. It allowed us to look at the connections that were made, and how much data was being sent. When we had to refresh the statistics over and over again, we learnt that the statistics kept changing as the amount of documents requested by the client changed.

We also learned that by using 'ping' and 'traceroute', we were able to understand which IP addresses were able to connect to the client and the web, and which IP addresses failed to do so. It was really interesting to witness what connections could be made by the interfaces, while being able to see what packets were being sent. Overall, it was a really helpful lab to understand the importance of using private keys, and the importance of network security in such cases.

5 a.) Log in to the server node following the steps in step 4. Get the control interface IP address by typing ifconfig. This IP address should be accessible from the internet. In a web browser, type the IP address found from ifconfig. (20 points)

- **IP address found from ifconfig:**

```
samner1@server:~$ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.171.20.103  netmask 255.255.255.192  broadcast 192.171.2
0.127
        inet6 fe80::62:33ff:fe88:8e7a  prefixlen 64  scopeid 0x20<link>
        ether 02:62:33:88:8e:7a  txqueuelen 1000  (Ethernet)
        RX packets 125369  bytes 59414559 (59.4 MB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 116523  bytes 19650919 (19.6 MB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.10.10.1  netmask 255.255.255.0  broadcast 10.10.10.255
        inet6 fe80::62:f8ff:fe43:282c  prefixlen 64  scopeid 0x20<link>
        ether 02:62:f8:43:28:2c  txqueuelen 1000  (Ethernet)
        RX packets 23350667  bytes 13620810499 (13.6 GB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 27640874  bytes 57243074093 (57.2 GB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 0  bytes 0 (0.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 0  bytes 0 (0.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

- **IP Address in web browser:**
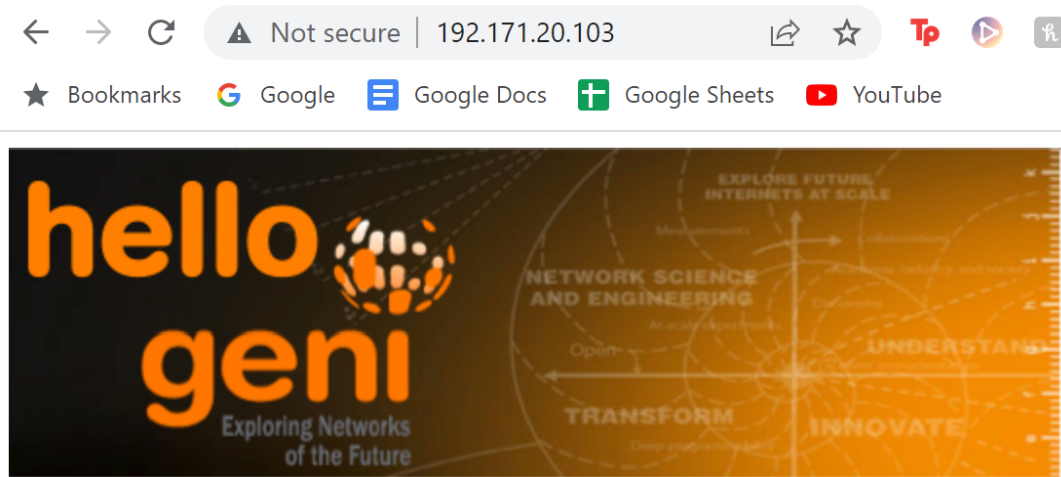
[Web Server Statistics](#)

[Logs from the iperf Sever](#)

5 b.) Click the Web Server Statistics link to look at statistics. Refresh the page a couple of times to see how the statistics change as the client requests documents. Make sure you include a screenshot in your report. (20 points)

- **Original:**

Apache Server Status for 192.171.20.103 (via 192.171.20.103)

Server Version: Apache/2.4.29 (Ubuntu)
Server MPM: event
Server Built: 2023-01-31T14:01:53

Current Time: Wednesday, 01-Mar-2023 08:20:13 CST
Restart Time: Tuesday, 28-Feb-2023 11:33:37 CST
Parent Server Config. Generation: 1
Parent Server MPM Generation: 0
Server uptime: 20 hours 46 minutes 36 seconds
Server load: 0.00 0.01 0.00
Total accesses: 100095 - Total Traffic: 47.9 GB
CPU Usage: u63.82 s390.49 cu0 cs0 - .607% CPU load
1.34 requests/sec - 0.7 MB/second - 501.5 kB/request
1 requests currently being processed, 74 idle workers

Slot	PID	Stopping	Connections		Threads		Async connections		
			total	accepting	busy	idle	writing	keep-alive	closing
0	3544	no	0	yes	0	25	0	0	0
1	3545	no	0	yes	1	24	0	0	0
2	7523	no	0	yes	0	25	0	0	0
Sum	3		0	0		1	74	0	0	0

- **After 4 refreshes**

Current Time: Wednesday, 01-Mar-2023 08:23:42 CST
Restart Time: Tuesday, 28-Feb-2023 11:33:37 CST
Parent Server Config. Generation: 1
Parent Server MPM Generation: 0
Server uptime: 20 hours 50 minutes 5 seconds
Server load: 0.03 0.01 0.00
Total accesses: 100100 - Total Traffic: 47.9 GB
CPU Usage: u63.83 s390.5 cu0 cs0 - .606% CPU load
1.33 requests/sec - 0.7 MB/second - 501.5 kB/request
1 requests currently being processed, 74 idle workers

Slot	PID	Stopping	Connections		Threads		Async connections		
			total	accepting	busy	idle	writing	keep-alive	closing
0	3544	no	0	yes	0	25	0	0	0
1	3545	no	0	yes	0	25	0	0	0
2	7523	no	1	yes	1	24	0	1	0
Sum	3	0	1		1	74	0	1	0

```
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```

5 c.) Click the Logs from the iperf Server link to see the statistics from the iperf transfers. Take a screenshot of what you observe. (10 points)

```
------------------------------------------------------------
Server listening on TCP port 5001
TCP window size:  128 KByte (default)
------------------------------------------------------------
[  4] local 10.10.10.1 port 5001 connected with 10.10.10.2 port 37494
[ ID] Interval       Transfer     Bandwidth
[  4]  0.0-10.0 sec   114 MBytes  95.4 Mbits/sec
[  5] local 10.10.10.1 port 5001 connected with 10.10.10.2 port 37668
[  5]  0.0-10.0 sec  2.83 KBytes  2.32 Kbits/sec
[  4]  0.0-10.2 sec   116 MBytes  95.4 Mbits/sec
[SUM]  0.0-10.2 sec   116 MBytes  95.4 Mbits/sec
[  5] 10.0-20.0 sec   112 MBytes  94.1 Mbits/sec
[  4] local 10.10.10.1 port 5001 connected with 10.10.10.2 port 37670
[  4]  0.0-10.0 sec  5.66 KBytes  4.63 Kbits/sec
[  4] 10.0-20.0 sec  0.00 Bytes   0.00 bits/sec
[  6] local 10.10.10.1 port 5001 connected with 10.10.10.2 port 37672
[  6]  0.0-10.0 sec  5.66 KBytes  4.63 Kbits/sec
[  6] 10.0-20.0 sec  0.00 Bytes   0.00 bits/sec
[  5]  0.0-20.4 sec   116 MBytes  47.4 Mbits/sec
[  4] 20.0-30.0 sec  57.3 MBytes  48.0 Mbits/sec
[  6] 20.0-30.0 sec  53.2 MBytes  44.6 Mbits/sec
[  5] local 10.10.10.1 port 5001 connected with 10.10.10.2 port 37674
[  5]  0.0-10.0 sec  8.48 KBytes  6.95 Kbits/sec
[  5] 10.0-20.0 sec  0.00 Bytes   0.00 bits/sec
[  5] 20.0-30.0 sec  0.00 Bytes   0.00 bits/sec
[  4]  0.0-30.4 sec  58.9 MBytes  16.3 Mbits/sec
[SUM]  0.0-30.4 sec   174 MBytes  48.2 Mbits/sec
[  4] local 10.10.10.1 port 5001 connected with 10.10.10.2 port 37678
[  4]  0.0-10.0 sec  52.3 KBytes  42.9 Kbits/sec
[  4] 10.0-20.0 sec  0.00 Bytes   0.00 bits/sec
[  4] 20.0-30.0 sec  0.00 Bytes   0.00 bits/sec
[  7] local 10.10.10.1 port 5001 connected with 10.10.10.2 port 37676
[  7]  0.0-10.0 sec  2.83 KBytes  2.32 Kbits/sec
[  7] 10.0-20.0 sec  0.00 Bytes   0.00 bits/sec
[  7] 20.0-30.0 sec  0.00 Bytes   0.00 bits/sec
[  6]  0.0-30.6 sec  55.6 MBytes  15.2 Mbits/sec
[  5] 30.0-40.0 sec  37.5 MBytes  31.5 Mbits/sec
[  4] 30.0-40.0 sec  34.8 MBytes  29.2 Mbits/sec
[  7] 30.0-40.0 sec  37.4 MBytes  31.4 Mbits/sec
[  4]  0.0-40.4 sec  36.2 MBytes  7.52 Mbits/sec
[  7]  0.0-40.4 sec  39.2 MBytes  8.14 Mbits/sec
[  5]  0.0-40.5 sec  39.4 MBytes  8.17 Mbits/sec
[  4] local 10.10.10.1 port 5001 connected with 10.10.10.2 port 37682
[  4]  0.0-10.0 sec  14.1 KBytes  11.6 Kbits/sec
[  4] 10.0-20.0 sec  0.00 Bytes   0.00 bits/sec
[  4] 20.0-30.0 sec  0.00 Bytes   0.00 bits/sec
[  4] 30.0-40.0 sec  0.00 Bytes   0.00 bits/sec
[  6] local 10.10.10.1 port 5001 connected with 10.10.10.2 port 37680
[  6]  0.0-10.0 sec  8.48 KBytes  6.95 Kbits/sec
[  6] 10.0-20.0 sec  0.00 Bytes   0.00 bits/sec
[  6] 20.0-30.0 sec  0.00 Bytes   0.00 bits/sec
[  6] 30.0-40.0 sec  0.00 Bytes   0.00 bits/sec
[  8] local 10.10.10.1 port 5001 connected with 10.10.10.2 port 37686
[  8]  0.0-10.0 sec  14.1 KBytes  11.6 Kbits/sec
```

5 e.) This task shouldn't take more than 30 seconds. Change the number after -P and watch how the performance is affected while you change the number of parallel TCP connections. Make sure you include a screenshot in your report. (10 points)

- **Original**

```
samneri@client:~$ iperf -c server -P 2
------------------------------------------------------------
Client connecting to server, TCP port 5001
TCP window size: 85.0 KByte (default)
------------------------------------------------------------
[  4] local 10.10.10.2 port 49790 connected with 10.10.10.1 port 5001
[  3] local 10.10.10.2 port 49788 connected with 10.10.10.1 port 5001
[ ID] Interval       Transfer     Bandwidth
[  3]  0.0-10.0 sec  59.2 MBytes  49.6 Mbits/sec
[  4]  0.0-10.0 sec  56.1 MBytes  46.9 Mbits/sec
[SUM]  0.0-10.0 sec   115 MBytes  96.5 Mbits/sec
```

- **Change number to 10**

```
------------------------------------------------------------
Client connecting to server, TCP port 5001
TCP window size: 85.0 KByte (default)
------------------------------------------------------------
[  4] local 10.10.10.2 port 49794 connected with 10.10.10.1 port 5001
[  8] local 10.10.10.2 port 49802 connected with 10.10.10.1 port 5001
[  5] local 10.10.10.2 port 49796 connected with 10.10.10.1 port 5001
[ 10] local 10.10.10.2 port 49806 connected with 10.10.10.1 port 5001
[  6] local 10.10.10.2 port 49798 connected with 10.10.10.1 port 5001
[ 11] local 10.10.10.2 port 49808 connected with 10.10.10.1 port 5001
[  7] local 10.10.10.2 port 49800 connected with 10.10.10.1 port 5001
[  9] local 10.10.10.2 port 49804 connected with 10.10.10.1 port 5001
[  3] local 10.10.10.2 port 49792 connected with 10.10.10.1 port 5001
[ 12] local 10.10.10.2 port 49810 connected with 10.10.10.1 port 5001
```

2 f.) For each of the three interfaces for the server in part a:

```
kumra@server:~$ ping 171.67.92.155
PING 171.67.92.155 (171.67.92.155) 56(84) bytes of data.
64 bytes from 171.67.92.155: icmp_seq=1 ttl=64 time=0.045 ms
64 bytes from 171.67.92.155: icmp_seq=2 ttl=64 time=0.043 ms
64 bytes from 171.67.92.155: icmp_seq=3 ttl=64 time=0.042 ms
64 bytes from 171.67.92.155: icmp_seq=4 ttl=64 time=0.052 ms
64 bytes from 171.67.92.155: icmp_seq=5 ttl=64 time=0.053 ms
64 bytes from 171.67.92.155: icmp_seq=6 ttl=64 time=0.042 ms
64 bytes from 171.67.92.155: icmp_seq=7 ttl=64 time=0.044 ms
64 bytes from 171.67.92.155: icmp_seq=8 ttl=64 time=0.042 ms
64 bytes from 171.67.92.155: icmp_seq=9 ttl=64 time=0.056 ms
64 bytes from 171.67.92.155: icmp_seq=10 ttl=64 time=0.044 ms
64 bytes from 171.67.92.155: icmp_seq=11 ttl=64 time=0.042 ms
^C
--- 171.67.92.155 ping statistics ---
11 packets transmitted, 11 received, 0% packet loss, time 10224ms
rtt min/avg/max/mdev = 0.042/0.045/0.056/0.010 ms
kumra@server:~$ ping 10.10.10.1
PING 10.10.10.1 (10.10.10.1) 56(84) bytes of data.
64 bytes from 10.10.10.1: icmp_seq=1 ttl=64 time=0.061 ms
64 bytes from 10.10.10.1: icmp_seq=2 ttl=64 time=0.042 ms
64 bytes from 10.10.10.1: icmp_seq=3 ttl=64 time=0.042 ms
64 bytes from 10.10.10.1: icmp_seq=4 ttl=64 time=0.042 ms
64 bytes from 10.10.10.1: icmp_seq=5 ttl=64 time=0.055 ms
64 bytes from 10.10.10.1: icmp_seq=6 ttl=64 time=0.046 ms
64 bytes from 10.10.10.1: icmp_seq=7 ttl=64 time=0.043 ms
64 bytes from 10.10.10.1: icmp_seq=8 ttl=64 time=0.043 ms
64 bytes from 10.10.10.1: icmp_seq=9 ttl=64 time=0.037 ms
64 bytes from 10.10.10.1: icmp_seq=10 ttl=64 time=0.102 ms
^C
--- 10.10.10.1 ping statistics ---
10 packets transmitted, 10 received, 0% packet loss, time 9194ms
rtt min/avg/max/mdev = 0.037/0.051/0.102/0.019 ms
```

a) **Eth0:**
   i) This interface can access the client
   ii) This interface can access the world wide web
   iii) This interface is what connects to the web. This is why I am able to go to the actual site just by using the IP address 171.67.92.155 on the web browser. When using iperf, this interface, and this address is also what the client connects to.

b) Eth1:

    i)   This interface can access the client

    ii)   This interface cannot access the web

    iii)   The reason this interface cannot connect to the web is because it has a private network IP address. Hence, it can only connect to the devices that are within the same network. The reason it was able to connect to the client, is because the client and server in this case were on the same network.

c) Lo:

    i)   This interface cannot access the client

    ii)   This interface cannot access the web

    iii)   This interface has a loopback address which is specific to each and every computer. Here, the client cannot connect to the server loopback address, because it is impossible to access a loopback address of a different device. That is why, it was not able to access the client and was not able to access the web.