

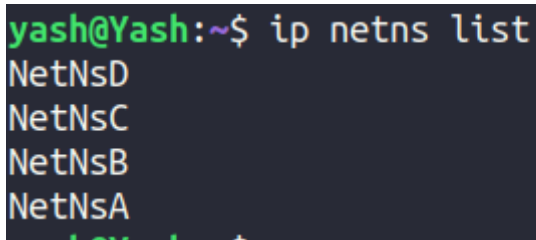
# CS 549: Performance Analysis of Computer Networks

## Lab Assignment 3

Submitted By : Yash Gupta , B21147

---

Creating four namespaces , NetNsA ...NetNsB



```
yash@Yash:~$ ip netns list
NetNsD
NetNsC
NetNsB
NetNsA
```

Different IP Addresses have been assigned to each interface on each namespace.

*NetNsA - 172.16.17.1*

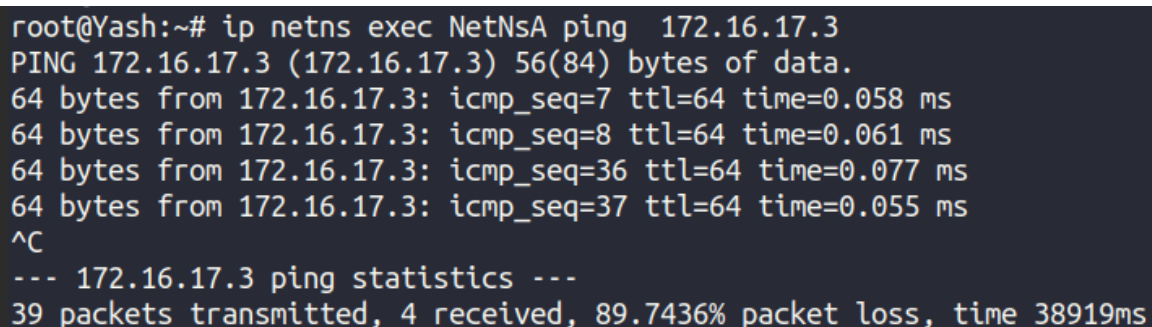
*NetNsB - 172.16.17.2*

*NetNsC - 172.16.17.3*

*NetNsD - 172.16.17.4*

**(a) Run ping between NetNsA and NetNsB.** Observe the traffic using Wireshark.

**Observations** :- Initially I gave the IP addresses in the same range as my host machine i.e. 172.16.17.x / 24. The packets loss was around 90 % ( see the attached screenshot below ).



```
root@Yash:~# ip netns exec NetNsA ping 172.16.17.3
PING 172.16.17.3 (172.16.17.3) 56(84) bytes of data.
64 bytes from 172.16.17.3: icmp_seq=7 ttl=64 time=0.058 ms
64 bytes from 172.16.17.3: icmp_seq=8 ttl=64 time=0.061 ms
64 bytes from 172.16.17.3: icmp_seq=36 ttl=64 time=0.077 ms
64 bytes from 172.16.17.3: icmp_seq=37 ttl=64 time=0.055 ms
^C
--- 172.16.17.3 ping statistics ---
39 packets transmitted, 4 received, 89.7436% packet loss, time 38919ms
```

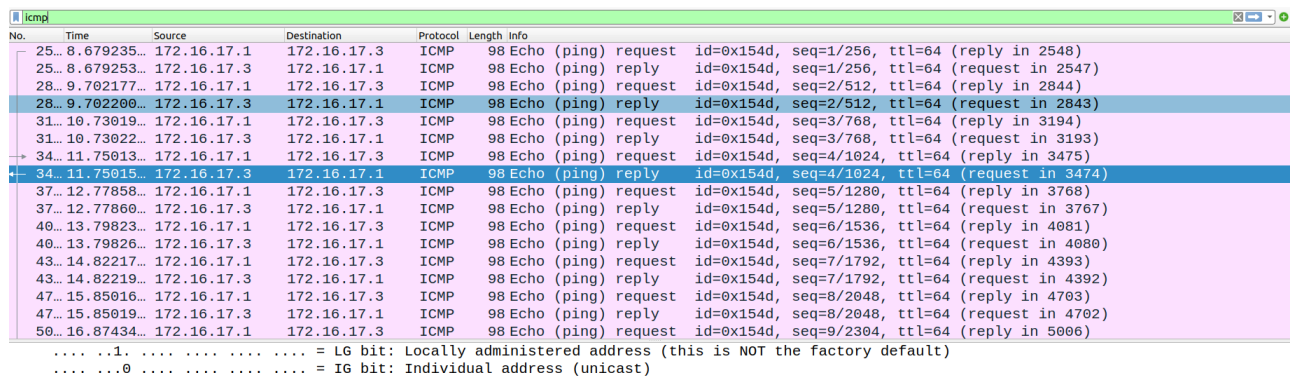
Later on when I changed the ip range to 192.0.2.x/24 for every namespace interface – the packets loss was 0 %.  
( attached screenshot below )

```

root@Yash:~# ip netns exec NetNsA ping 192.0.2.2
PING 192.0.2.2 (192.0.2.2) 56(84) bytes of data.
64 bytes from 192.0.2.2: icmp_seq=1 ttl=64 time=0.081 ms
64 bytes from 192.0.2.2: icmp_seq=2 ttl=64 time=0.059 ms
64 bytes from 192.0.2.2: icmp_seq=3 ttl=64 time=0.056 ms
64 bytes from 192.0.2.2: icmp_seq=4 ttl=64 time=0.120 ms
64 bytes from 192.0.2.2: icmp_seq=5 ttl=64 time=0.049 ms
64 bytes from 192.0.2.2: icmp_seq=6 ttl=64 time=0.049 ms
64 bytes from 192.0.2.2: icmp_seq=7 ttl=64 time=0.051 ms
64 bytes from 192.0.2.2: icmp_seq=8 ttl=64 time=0.056 ms
64 bytes from 192.0.2.2: icmp_seq=9 ttl=64 time=0.041 ms
64 bytes from 192.0.2.2: icmp_seq=10 ttl=64 time=0.049 ms
64 bytes from 192.0.2.2: icmp_seq=11 ttl=64 time=0.053 ms
64 bytes from 192.0.2.2: icmp_seq=12 ttl=64 time=0.045 ms
64 bytes from 192.0.2.2: icmp_seq=13 ttl=64 time=0.073 ms
^C
--- 192.0.2.2 ping statistics ---
13 packets transmitted, 13 received, 0% packet loss, time 12272ms
rtt min/avg/max/mdev = 0.041/0.060/0.120/0.020 ms
root@Yash:~#

```

The network traffic visualized on wireshark is also attached :



No.	Time	Source	Destination	Protocol	Length	Info
25...	8.679235...	172.16.17.1	172.16.17.3	ICMP	98	Echo (ping) request id=0x154d, seq=1/256, ttl=64 (reply in 2548)
25...	8.679253...	172.16.17.3	172.16.17.1	ICMP	98	Echo (ping) reply id=0x154d, seq=1/256, ttl=64 (request in 2547)
28...	9.702177...	172.16.17.1	172.16.17.3	ICMP	98	Echo (ping) request id=0x154d, seq=2/512, ttl=64 (reply in 2844)
28...	9.702200...	172.16.17.3	172.16.17.1	ICMP	98	Echo (ping) reply id=0x154d, seq=2/512, ttl=64 (request in 2843)
31...	10.73019...	172.16.17.1	172.16.17.3	ICMP	98	Echo (ping) request id=0x154d, seq=3/768, ttl=64 (reply in 3194)
31...	10.73022...	172.16.17.3	172.16.17.1	ICMP	98	Echo (ping) reply id=0x154d, seq=3/768, ttl=64 (request in 3193)
34...	11.75013...	172.16.17.1	172.16.17.3	ICMP	98	Echo (ping) request id=0x154d, seq=4/1024, ttl=64 (reply in 3475)
34...	11.75015...	172.16.17.3	172.16.17.1	ICMP	98	Echo (ping) reply id=0x154d, seq=4/1024, ttl=64 (request in 3474)
37...	12.77858...	172.16.17.1	172.16.17.3	ICMP	98	Echo (ping) request id=0x154d, seq=5/1280, ttl=64 (reply in 3768)
37...	12.77860...	172.16.17.3	172.16.17.1	ICMP	98	Echo (ping) reply id=0x154d, seq=5/1280, ttl=64 (request in 3767)
40...	13.79823...	172.16.17.1	172.16.17.3	ICMP	98	Echo (ping) request id=0x154d, seq=6/1536, ttl=64 (reply in 4081)
40...	13.79826...	172.16.17.3	172.16.17.1	ICMP	98	Echo (ping) reply id=0x154d, seq=6/1536, ttl=64 (request in 4080)
43...	14.82217...	172.16.17.1	172.16.17.3	ICMP	98	Echo (ping) request id=0x154d, seq=7/1792, ttl=64 (reply in 4393)
43...	14.82219...	172.16.17.3	172.16.17.1	ICMP	98	Echo (ping) reply id=0x154d, seq=7/1792, ttl=64 (request in 4392)
47...	15.85016...	172.16.17.1	172.16.17.3	ICMP	98	Echo (ping) request id=0x154d, seq=8/2048, ttl=64 (reply in 4703)
47...	15.85019...	172.16.17.3	172.16.17.1	ICMP	98	Echo (ping) reply id=0x154d, seq=8/2048, ttl=64 (request in 4702)
50...	16.87434...	172.16.17.1	172.16.17.3	ICMP	98	Echo (ping) request id=0x154d, seq=9/2304, ttl=64 (reply in 5006)

...1... = LG bit: Locally administered address (this is NOT the factory default)  
...0... = IG bit: Individual address (unicast)

Every request and response is captured in wireshark for applied *ICMP* filter.

(b) Adding queue discipline with 20 % loss

There are 3 possibilities based on where we are adding the policy of 20% loss

1. On the sender side
2. on the receiver side
3. On both sides

Conisdering the first option as most appropriate in accordance with the real world sceneario , where packets loss occurs because of congestion in the network, Applying queuing disipline to sender side ( interface macvlanA in namespace NetNsA).

```

root@Yash:~# sudo ip netns exec NetNsA tc qdisc add dev macvlanA root netem loss 20%
root@Yash:~#
root@Yash:~# sudo ip netns exec NetNsA tc qdisc show dev macvlanA
qdisc netem 8001: root refcnt 2 limit 1000 loss 20%

```

Now pinging 192.0.2.2 from this interface

```

root@Yash:~# grc ip netns exec NetNsA ping 192.0.2.2
PING 192.0.2.2 (192.0.2.2) 56(84) bytes of data.
64 bytes from 192.0.2.2: icmp_seq=1 ttl=64 time=0.037 ms
64 bytes from 192.0.2.2: icmp_seq=2 ttl=64 time=0.034 ms
64 bytes from 192.0.2.2: icmp_seq=3 ttl=64 time=0.039 ms
64 bytes from 192.0.2.2: icmp_seq=4 ttl=64 time=0.051 ms
64 bytes from 192.0.2.2: icmp_seq=5 ttl=64 time=0.037 ms
64 bytes from 192.0.2.2: icmp_seq=6 ttl=64 time=0.042 ms
64 bytes from 192.0.2.2: icmp_seq=7 ttl=64 time=0.066 ms
64 bytes from 192.0.2.2: icmp_seq=10 ttl=64 time=0.045 ms
64 bytes from 192.0.2.2: icmp_seq=12 ttl=64 time=0.062 ms
64 bytes from 192.0.2.2: icmp_seq=13 ttl=64 time=0.048 ms
64 bytes from 192.0.2.2: icmp_seq=14 ttl=64 time=0.044 ms
^C
--- 192.0.2.2 ping statistics ---
14 packets transmitted, 11 received, 21.4286% packet loss, time 13299ms
rtt min/avg/max/mdev = 0.034/0.045/0.066/0.009 ms

```

packets with seq no - 8 , 9 , 11 are lost. ( loss fraction = 3 / 14 = 0.21 )

23...	11.00720...	192.0.2.1	192.0.2.2	ICMP	98 Echo (ping) request	id=0x0f60, seq=6/1536, ttl=64 (reply in 2332)
23...	11.00722...	192.0.2.2	192.0.2.1	ICMP	98 Echo (ping) reply	id=0x0f60, seq=6/1536, ttl=64 (request in 2331)
25...	12.03126...	192.0.2.1	192.0.2.2	ICMP	98 Echo (ping) request	id=0x0f60, seq=7/1792, ttl=64 (reply in 2517)
25...	12.03128...	192.0.2.2	192.0.2.1	ICMP	98 Echo (ping) reply	id=0x0f60, seq=7/1792, ttl=64 (request in 2516)
30...	15.10320...	192.0.2.1	192.0.2.2	ICMP	98 Echo (ping) request	id=0x0f60, seq=10/2560, ttl=64 (reply in 3054)
30...	15.10322...	192.0.2.2	192.0.2.1	ICMP	98 Echo (ping) reply	id=0x0f60, seq=10/2560, ttl=64 (request in 3053)
34...	17.15125...	192.0.2.1	192.0.2.2	ICMP	98 Echo (ping) request	id=0x0f60, seq=12/3072, ttl=64 (reply in 3427)

This is also captured in wireshark.  
As packets with sequence number 8 , 9 , 11 are not captured by wireshark.

Hence the applied fixed loss of 20% in queuing discipline of sender is perfectly reflected in the experiment results.

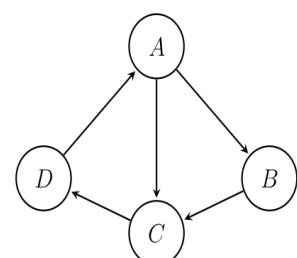
```

... seq=6/1536, ttl
... seq=7/1792, ttl
... seq=7/1792, ttl
... seq=10/2560, tt
... seq=10/2560, tt
... seq=12/3072, tt

```

## Part -2

From the requirements of the downstream tasks, it is very clear that :



1. For each outgoing link from every node , there has to be a interface corresponding to it.
2. There should be atleast 1 receiving interface for each node. ( I am making only 1 )

Based on this , The interfaces corresponing to each namespace with their IP addresses are:

```
root@Yash:~# ip netns exec NetNsA ifconfig AB 192.0.2.1/24
root@Yash:~# ip netns exec NetNsA ifconfig AC 192.0.2.2/24
root@Yash:~# ip netns exec NetNsA ifconfig Ai 192.0.2.3/24
root@Yash:~#
root@Yash:~# ip netns exec NetNsB ifconfig BC 192.0.2.4/24
root@Yash:~# ip netns exec NetNsB ifconfig Bi 192.0.2.5/24
root@Yash:~#
root@Yash:~# ip netns exec NetNsC ifconfig CD 192.0.2.6/24
root@Yash:~# ip netns exec NetNsC ifconfig ci 192.0.2.7/24
root@Yash:~#
root@Yash:~# ip netns exec NetNsD ifconfig DA 192.0.2.8/24
root@Yash:~# ip netns exec NetNsD ifconfig Di 192.0.2.9/24
root@Yash:~#
```

Here AB is the interface corresponding to Namespace of node A and outgoing link to B.

Similary Ai , Bi , etc are the interfaces for all the incoming links to the node.

-----

I am facing some logical errors hence can't proceed further. I thought that creating different interfaces for each link will help to deactivate a particular link by just making 100 % loss on corresponding interface. But doing so is blocking whole namespace/ node.

**Hence submitting the partial assignment for now.**