# Lab 4: Overlay Network and VXLAN

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## VXLAN setup

On VM 1: In mininet, set the IPs for both hosts:

```
h1 ifconfig h1-eth0 10.0.0.1 netmask 255.0.0.0
h2 ifconfig h2-eth0 10.0.0.2 netmask 255.0.0.0
```

Open another terminal, set the switch IP:

```
sudo ifconfig s1 10.0.0.5/8 up
```

#### On VM 2:

In mininet, set the IPs for both hosts:

```
h3 ifconfig h3-eth0 10.0.0.3 netmask 255.0.0.0
h4 ifconfig h4-eth0 10.0.0.4 netmask 255.0.0.0
```

Open another terminal, set the switch IP:

```
sudo ifconfig s2 10.0.0.6/8 up
```

When we ping 10.0.0.6/10.0.0.3/10.0.0.4 from 10.0.0.5/10.0.0.1/10.0.0.2, it returns 'unreachable'.

On VM1:

```
sudo ovs-vsctl add-br br1
```

Assign the IP of ens34 to br1:

```
sudo ovs-vsctl add-port br1 ens34
sudo ifconfig br1 192.168.56.101/24 up
```

Add a new default route for br1:

sudo route add default gw 192.168.56.201

#### On VM2:

sudo ovs-vsctl add-br br1

## Assign the IP of ens34 to br1:

sudo ovs-vsctl add-port br1 ens34
sudo ifconfig br1 192.168.56.103/24 up

## Add a new default route for br1:

sudo route add default gw 192.168.56.201

## Now we create the VXLAN tunnel.

## On VM1:

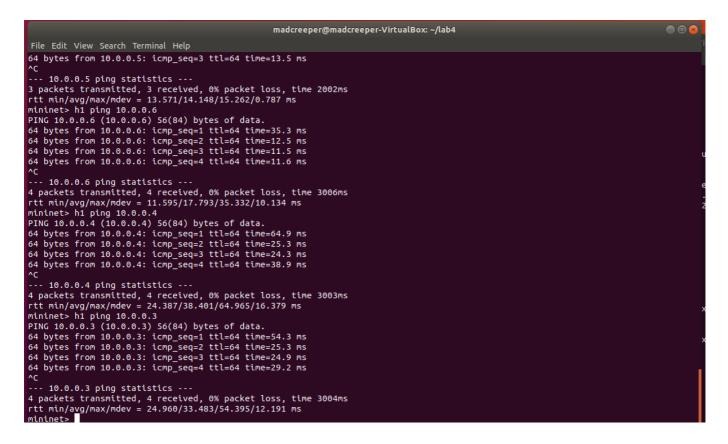
sudo ovs-vsctl add-port s1 vxlan1 -- set interface vxlan1 type=vxlan
options:remote\_ip=192.168.56.103

## On VM2:

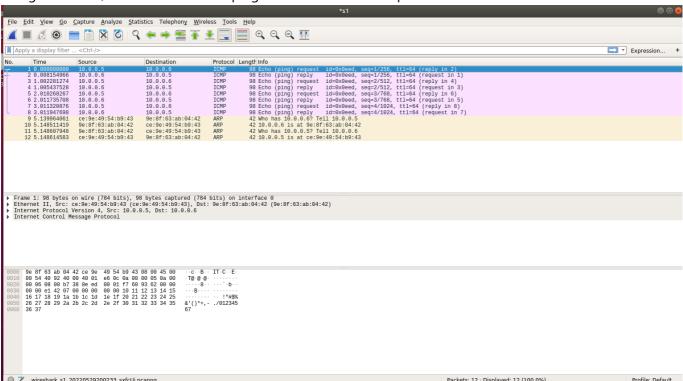
sudo ovs-vsctl add-port s2 vxlan1 -- set interface vxlan1 type=vxlan
options:remote\_ip=192.168.56.101

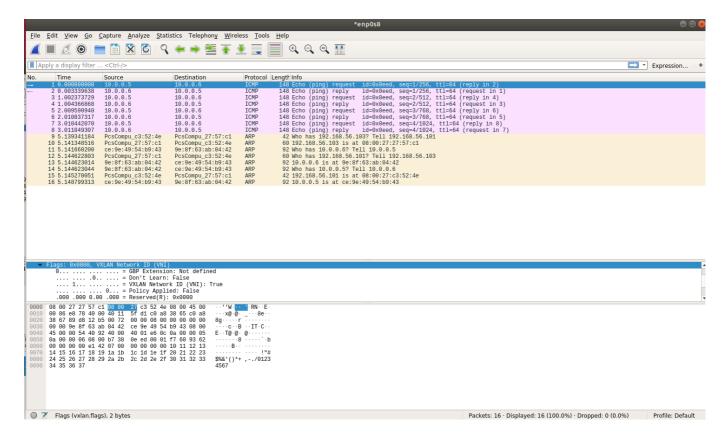
# **Testing**

After this we we can test ping and the network works.



Using Wireshark, we can see that the ping command uses these protocols below:





- ICMP: Mainly used by the ping command, namely ICMP echo request and reply.
- IPv4. The network layer protocol used in this lab.
- ARP. This is used to resolve the MAC address given an IP address. We can see in the screenshot that a
  host (s1) asks for the MAC address of 10.0.0.6 and gets a response.
- Ethernet: the data link layer protocol used by Mininet.

Before we use *iperf* to test the bandwidth, we need to change the MTU of the hosts:

```
mininet> h1 ifconfig h1-eth0 mtu 1450
mininet> h2 ifconfig h2-eth0 mtu 1450
^Cmininet> h4 ifconfig h4-eth0 mtu 1450
```

This is because VXLAN adds a 50 Byte header to a data link layer segment. In order for iperf to work on a standard mtu of 1500, we need to reduce the host ethernet interface mtu.

The bandwidth between s1 and s2 is an unlimited 1Gbps.

```
madcreeper@madcreeper-VirtualBox:~$ iperf3 -c 192.168.56.103 -p 5201
Connecting to host 192.168.56.103, port 5201
  4] local 192.168.56.101 port 45450 connected to 192.168.56.103 port 5201
  ID] Interval
                                   Bandwidth
                        Transfer
                                                    Retr Cwnd
  41
                        129 MBytes 1.08 Gbits/sec 394
       0.00-1.00
                  sec
                                                           249 KBytes
  41
       1.00-2.00
                         138 MBytes 1.16 Gbits/sec 351
                                                          235 KBytes
                  sec
                                    1.19 Gbits/sec 300
                                                           246 KBytes
                         141 MBytes
  41
       2.00-3.00
                   sec
                                    1.16 Gbits/sec 264
                                                           199 KBytes
  41
       3.00-4.00
                  sec
                         138 MBytes
                                                          252 KBytes
                  sec 141 MBytes 1.18 Gbits/sec 224
  4]
       4.00-5.00
                  sec 138 MBytes 1.16 Gbits/sec 224
                                                          249 KBytes
  4]
       5.00-6.00
                  sec 141 MBytes 1.18 Gbits/sec 289
                                                          238 KBytes
      6.00-7.00
                                    1.07 Gbits/sec 247
  4]
       7.00-8.00
                   sec
                       128 MBytes
                                                           184 KBytes
                         134 MBytes
                                    1.13 Gbits/sec 242
                                                           214 KBytes
  4]
       8.00-9.00
                   sec
  4]
                         134 MBytes 1.13 Gbits/sec 217
       9.00-10.00 sec
                                                           242 KBytes
  ID] Interval
                        Transfer
                                    Bandwidth
                                                    Retr
   41
       0.00-10.00 sec 1.33 GBytes 1.14 Gbits/sec 2752
                                                                    sender
   4]
       0.00-10.00 sec 1.33 GBytes 1.14 Gbits/sec
                                                                    receiver
iperf Done.
madcreeper@madcreeper-VirtualBox:~S
```

The bandwidth between h1/h2 and h3/h4 is limited by the 10Mbps links.

```
madcreeper@madcreeper-VirtualBox: ~/lab4
 File Edit View Search Terminal Help

4 packets transmitted, 4 received, 0% packet loss, time 3011ms
rtt min/avg/max/mdev = 0.693/3.443/8.176/2.905 ms
mininers h1 ifconfig h1-eth0 mtu 1450
mininers h2 ifconfig h2-eth0 mtu 1450
mininets s1 ifconfig s1-eth0 mtu 1450
SIOCSIFMTU: No such device
mininets h1 iperf3 -c 10.0.0.4 -p 5201
Connecting to host 10.0.0.4, port 5201
[4] local 10.0.0.1 port 47110 connected to 10.0.0.4 port 5201
[ID] Interval
Transfer Bandwidth Retr Cwnd
[4] 0.00-1.00 sec 1.48 MBytes 12.4 Mbits/sec 0 94.2
[4] 1.00-2.00 sec 1.29 MBytes 10.8 Mbits/sec 0 145
[4] 2.00-3.01 sec 1.29 MBytes 10.8 Mbits/sec 0 145
[4] 3.01-4.01 sec 1.29 MBytes 10.8 Mbits/sec 0 248
[4] 4.01-5.00 sec 1.29 MBytes 10.8 Mbits/sec 0 299
[4] 5.00-6.01 sec 1.23 MBytes 11.2 Mbits/sec 0 382
[4] 6.01-7.00 sec 1.23 MBytes 10.3 Mbits/sec 0 382
[4] 7.00-8.01 sec 1.29 MBytes 10.8 Mbits/sec 0 355
[4] 8.01-9.00 sec 1.29 MBytes 10.8 Mbits/sec 0 355
[4] 9.00-10.01 sec 1.29 MBytes 10.8 Mbits/sec 0 355
[4] 8.01-9.00 sec 1.29 MBytes 10.8 Mbits/sec 0 505
[4] 9.00-10.01 sec 1.29 MBytes 10.8 Mbits/sec 0 505
                                                                                                                                                                                                                                                                                                                                                                                                                                    5201
Cwnd
94.2 KBytes
145 KBytes
198 KBytes
248 KBytes
299 KBytes
352 KBytes
                                                                                                                                                                                                                                                                                                                                                                                                                                             404 KBytes
455 KBytes
505 KBytes
                                                      nterval Transfer Bandwidth
0.00-10.01 sec 13.1 MBytes 11.0 Mbits/sec
0.00-10.01 sec 10.5 MBytes 8.80 Mbits/sec
iperf Done.
mininet> h2 iperf3 -c 10.0.0.4 -p 5201

Connecting to host 10.0.0.4, port 5201

[ 4] local 10.0.0.2 port 51908 connected to 10.0.0.4 port 5201

[ 10] Interval Transfer Bandwidth Retr Cwnd

[ 4] 0.00-1.01 sec 1.72 MBytes 14.3 Mbits/sec 0 176

[ 4] 1.01-2.00 sec 1.35 MBytes 11.4 Mbits/sec 0 179

[ 4] 2.00-3.01 sec 1.29 MBytes 10.8 Mbits/sec 0 232

[ 4] 3.01-4.00 sec 1.17 MBytes 9.83 Mbits/sec 0 232

[ 4] 4.00-5.00 sec 1.29 MBytes 10.8 Mbits/sec 0 325

[ 4] 5.00-6.00 sec 1.35 MBytes 11.3 Mbits/sec 0 384

[ 4] 6.00-7.00 sec 1.41 MBytes 11.3 Mbits/sec 0 481

[ 4] 7.00-8.00 sec 1.35 MBytes 11.3 Mbits/sec 0 491

[ 4] 8.00-9.00 sec 1.23 MBytes 10.2 Mbits/sec 0 491

[ 4] 9.00-10.00 sec 1.23 MBytes 10.2 Mbits/sec 0 591
                                                                                                                                                                                                                                                                                                                                                                                                                                             126 KBytes
179 KBytes
232 KBytes
279 KBytes
                                                                                                                                                                                                                                                                                                                                                                                                                                               329 KBytes
384 KBytes
438 KBytes
                ID]
4]
4]
                                         Interval
                                                                                                                                                                                                                                                                            Bandwidth
                                                                                                                                                                                                                                                                                                                                                                                              Retr
                                                         0.00-10.00 sec 13.4 MBytes
0.00-10.00 sec 10.6 MBytes
         iperf Done.
mininet>
```

ping tells a similar story. Since each hop is 5ms except for between s1 and s2, the rtt is around 20-30 ms between h1/h2 and h3/h4, and < 1ms between s1 and s2.

```
mininet> h1 ping -c 4 10.0.0.4
PING 10.0.0.4 (10.0.0.4) 56(84) bytes of data.
64 bytes from 10.0.0.4: icmp_seq=1 ttl=64 time=25.1 ms
64 bytes from 10.0.0.4: icmp_seq=2 ttl=64 time=32.2 ms
64 bytes from 10.0.0.4: icmp_seq=3 ttl=64 time=25.4 ms
64 bytes from 10.0.0.4: icmp_seq=4 ttl=64 time=24.0 ms
--- 10.0.0.4 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3014ms
rtt min/avg/max/mdev = 24.062/26.732/32.280/3.247 ms
mininet> h2 ping -c 4 10.0.0.4
PING 10.0.0.4 (10.0.0.4) 56(84) bytes of data.
64 bytes from 10.0.0.4: icmp_seq=1 ttl=64 time=26.2 ms
64 bytes from 10.0.0.4: icmp seq=2 ttl=64 time=41.0 ms
64 bytes from 10.0.0.4: icmp_seq=3 ttl=64 time=28.2 ms
64 bytes from 10.0.0.4: icmp seq=4 ttl=64 time=29.2 ms
--- 10.0.0.4 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3007ms
rtt min/avg/max/mdev = 26.285/31.200/41.026/5.775 ms
mininet> s1 ping -c 4 10.0.0.4
PING 10.0.0.4 (10.0.0.4) 56(84) bytes of data.
64 bytes from 10.0.0.4: icmp seq=1 ttl=64 time=31.5 ms
64 bytes from 10.0.0.4: icmp seq=2 ttl=64 time=13.5 ms
64 bytes from 10.0.0.4: icmp_seq=3 ttl=64 time=11.2 ms
64 bytes from 10.0.0.4: icmp seq=4 ttl=64 time=12.9 ms
--- 10.0.0.4 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3008ms
rtt min/avg/max/mdev = 11.283/17.345/31.546/8.242 ms
mininet>
```

```
madcreeper@madcreeper-VirtualBox:~$ ping -c 4 192.168.56.103
PING 192.168.56.103 (192.168.56.103) 56(84) bytes of data.
64 bytes from 192.168.56.103: icmp_seq=1 ttl=64 time=1.57 ms
64 bytes from 192.168.56.103: icmp_seq=2 ttl=64 time=0.647 ms
64 bytes from 192.168.56.103: icmp_seq=3 ttl=64 time=0.624 ms
64 bytes from 192.168.56.103: icmp_seq=4 ttl=64 time=0.597 ms

--- 192.168.56.103 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3069ms
rtt min/avg/max/mdev = 0.597/0.860/1.573/0.412 ms
madcreeper@madcreeper-VirtualBox:~$
```