Trabalho Mininet: Topologia linear com 6 switchs

0) Preparar o ambiente

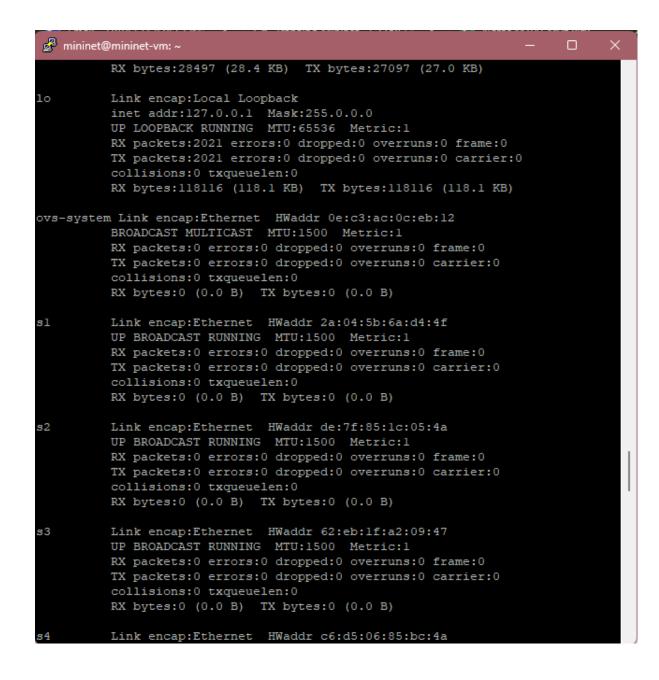
```
🞤 mininet@mininet-vm: ~
                                                                           mininet@mininet-vm:~$ sudo mn --topo=linear,6 --mac --link tc,bw=25
*** Creating network
*** Adding controller
*** Adding hosts:
h1 h2 h3 h4 h5 h6
*** Adding switches:
s1 s2 s3 s4 s5 s6
*** Adding links:
(25.00Mbit) (25.00Mbit) (h1, s1) (25.00Mbit) (25.00Mbit) (h2, s2) (25.00Mbit) (2
5.00Mbit) (h3, s3) (25.00Mbit) (25.00Mbit) (h4, s4) (25.00Mbit) (25.00Mbit) (h5,
s5) (25.00Mbit) (25.00Mbit) (h6, s6) (25.00Mbit) (25.00Mbit) (s2, s1) (25.00Mbi
t) (25.00Mbit) (s3, s2) (25.00Mbit) (25.00Mbit) (s4, s3) (25.00Mbit) (25.00Mbit)
(s5, s4) (25.00Mbit) (25.00Mbit) (s6, s5)
*** Configuring hosts
h1 h2 h3 h4 h5 h6
*** Starting controller
c0
*** Starting 6 switches
sl s2 s3 s4 s5 s6 ...(25.00Mbit) (25.00Mbit) (25.00Mbit) (25.00Mbit) (25.00Mbit)
(25.00Mbit) (25.00Mbit) (25.00Mbit) (25.00Mbit) (25.00Mbit) (25.00Mbit) (25.00Mbit)
bit) (25.00Mbit) (25.00Mbit) (25.00Mbit) (25.00Mbit)
*** Starting CLI:
mininet>
```

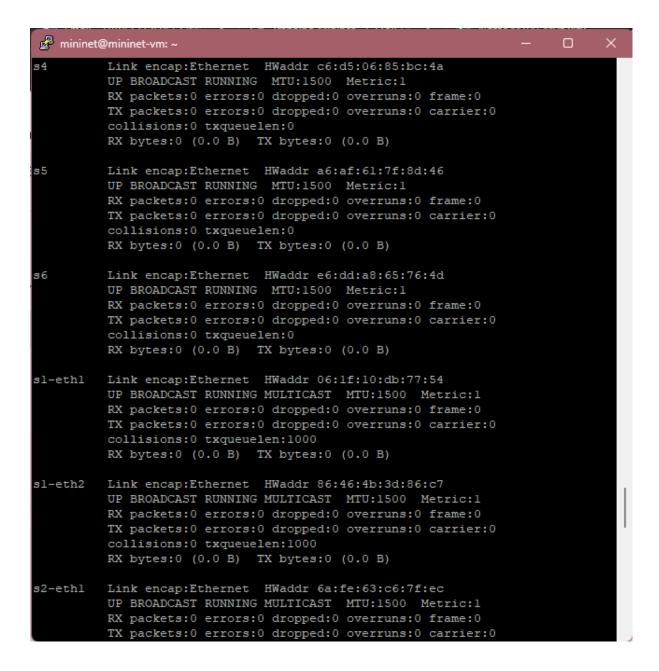
1) Criar a topologia linear com 6 switches, MAC padronizado e 25 Mbps

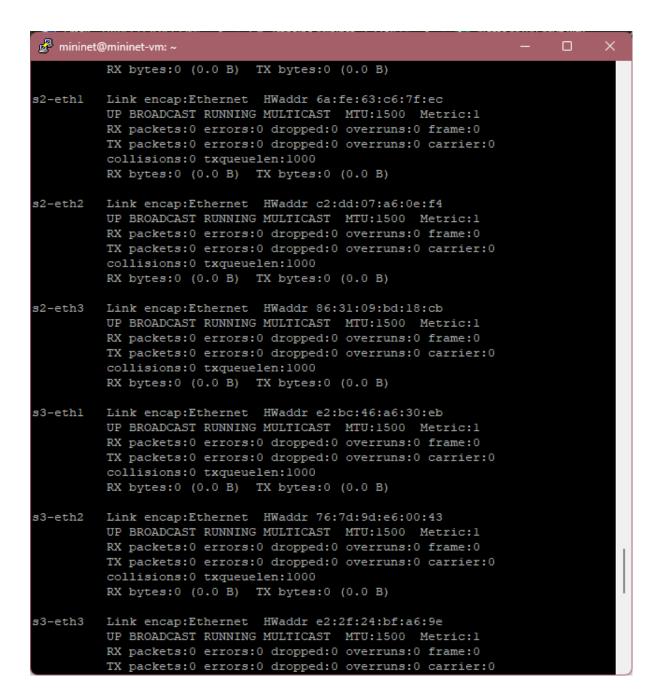
```
mininet@mininet-vm: ~
                                                                           mininet> nodes
available nodes are:
c0 hl h2 h3 h4 h5 h6 sl s2 s3 s4 s5 s6
mininet> net
hl hl-eth0:sl-ethl
h2 h2-eth0:s2-eth1
h3 h3-eth0:s3-eth1
h4 h4-eth0:s4-eth1
h5 h5-eth0:s5-eth1
h6 h6-eth0:s6-ethl
sl lo: sl-ethl:hl-eth0 sl-eth2:s2-eth2
       s2-eth1:h2-eth0 s2-eth2:s1-eth2 s2-eth3:s3-eth2
s2 lo:
s3 lo: s3-eth1:h3-eth0 s3-eth2:s2-eth3 s3-eth3:s4-eth2
s4 lo: s4-eth1:h4-eth0 s4-eth2:s3-eth3 s4-eth3:s5-eth2
       s5-eth1:h5-eth0 s5-eth2:s4-eth3 s5-eth3:s6-eth2
s6 lo: s6-ethl:h6-eth0 s6-eth2:s5-eth3
c0
mininet> dump
<Host h1: h1-eth0:10.0.0.1 pid=1987>
<Host h2: h2-eth0:10.0.0.2 pid=1989>
<Host h3: h3-eth0:10.0.0.3 pid=1991>
(Host h4: h4-eth0:10.0.0.4 pid=1993>
(Host h5: h5-eth0:10.0.0.5 pid=1995>
<Host h6: h6-eth0:10.0.0.6 pid=1997>
<OVSSwitch sl: lo:127.0.0.1,sl-ethl:None,sl-eth2:None pid=2002>
<OVSSwitch s2: 10:127.0.0.1,s2-eth1:None,s2-eth2:None,s2-eth3:None pid=2005>
<OVSSwitch s3: lo:127.0.0.1,s3-ethl:None,s3-eth2:None,s3-eth3:None pid=2008>
<OVSSwitch s4: lo:127.0.0.1,s4-ethl:None,s4-eth2:None,s4-eth3:None pid=2011>
<0VSSwitch s5: lo:127.0.0.1,s5-ethl:None,s5-eth2:None,s5-eth3:None pid=2014>
<OVSSwitch s6: lo:127.0.0.1,s6-eth1:None,s6-eth2:None pid=2017>
Controller c0: 127.0.0.1:6653 pid=1980>
mininet>
```

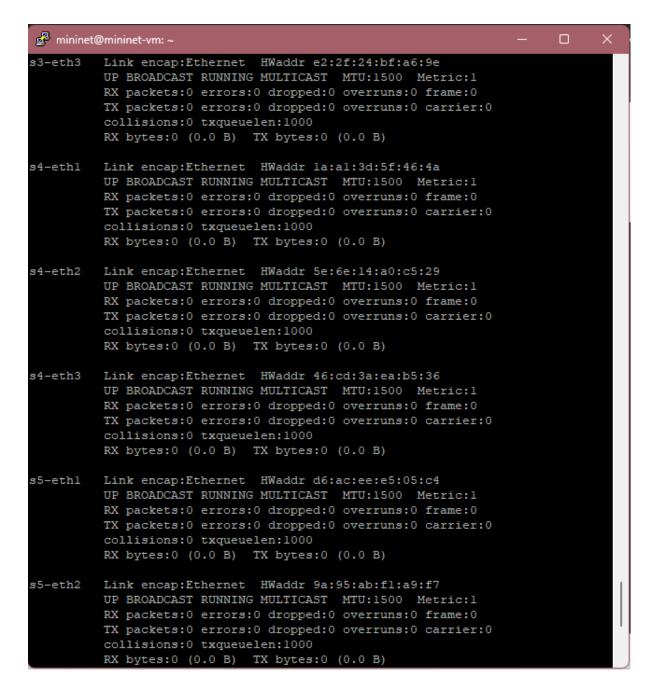
2) Inspecionar interfaces, MAC, IP e porta:

```
mininet@mininet-vm: -
                                                                     mininet> hl ifconfig -a
         Link encap:Ethernet HWaddr 00:00:00:00:00:01
          inet addr:10.0.0.1 Bcast:10.255.255.255 Mask:255.0.0.0
         UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
         RX packets:0 errors:0 dropped:0 overruns:0 frame:0
         TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
         collisions:0 txqueuelen:1000
         RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)
10
         Link encap:Local Loopback
         inet addr:127.0.0.1 Mask:255.0.0.0
         UP LOOPBACK RUNNING MTU:65536 Metric:1
         RX packets:0 errors:0 dropped:0 overruns:0 frame:0
         TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
         collisions:0 txqueuelen:0
         RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)
```









```
🧬 mininet@mininet-vm: ~
                                                                      collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)
         Link encap:Ethernet HWaddr 9a:95:ab:fl:a9:f7
s5-eth2
         UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
         RX packets:0 errors:0 dropped:0 overruns:0 frame:0
         TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
         RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)
         Link encap:Ethernet HWaddr da:4c:ce:el:7f:16
s5-eth3
         UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
         TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
         RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)
         Link encap:Ethernet HWaddr 52:a2:6f:08:f0:52
s6-ethl
         UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
         RX packets:0 errors:0 dropped:0 overruns:0 frame:0
         TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)
         Link encap:Ethernet HWaddr c2:7b:60:e2:f1:e4
s6-eth2
         UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
         TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)
mininet>
mininet@mininet-vm: ~
                                                                     mininet> sh ovs-ofctl show sl
OFPT FEATURES REPLY (xid=0x2): dpid:0000000000000001
n tables:254, n buffers:256
capabilities: FLOW STATS TABLE STATS PORT STATS QUEUE STATS ARP MATCH IP
actions: OUTPUT SET VLAN VID SET VLAN PCP STRIP VLAN SET DL SRC SET DL DST SET
NW SRC SET NW DST SET NW TOS SET TP SRC SET TP DST ENQUEUE
1(s1-eth1): addr:06:1f:10:db:77:54
    config:
    state:
    current:
               10GB-FD COPPER
    speed: 10000 Mbps now, 0 Mbps max
2(s1-eth2): addr:86:46:4b:3d:86:c7
    config:
    state:
               10GB-FD COPPER
    current:
    speed: 10000 Mbps now, 0 Mbps max
LOCAL(s1): addr:2a:04:5b:6a:d4:4f
    config:
    state:
    speed: 0 Mbps now, 0 Mbps max
OFPT_GET_CONFIG_REPLY (xid=0x4): frags=normal miss_send_len=0
```

mininet>

3) Testes de ping

```
mininet@mininet-vm: ~
                                                                       mininet> pingall
*** Ping: testing ping reachability
hl -> h2 h3 h4 h5 h6
h2 -> h1 h3 h4 h5 h6
h3 -> h1 h2 h4 h5 h6
h4 -> h1 h2 h3 h5 h6
h5 -> h1 h2 h3 h4 h6
h6 -> h1 h2 h3 h4 h5
*** Results: 0% dropped (30/30 received)
mininet> hl ping -c 5 h2
PING 10.0.0.2 (10.0.0.2) 56(84) bytes of data.
64 bytes from 10.0.0.2: icmp seq=1 tt1=64 time=0.255 ms
64 bytes from 10.0.0.2: icmp seq=2 ttl=64 time=0.072 ms
64 bytes from 10.0.0.2: icmp seq=3 ttl=64 time=0.055 ms
64 bytes from 10.0.0.2: icmp seq=4 ttl=64 time=0.058 ms
64 bytes from 10.0.0.2: icmp seq=5 ttl=64 time=0.060 ms
--- 10.0.0.2 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 3996ms
rtt min/avg/max/mdev = 0.055/0.100/0.255/0.077 ms
mininet> hl ping -c 5 h3
PING 10.0.0.3 (10.0.0.3) 56(84) bytes of data.
64 bytes from 10.0.0.3: icmp seq=1 ttl=64 time=0.316 ms
64 bytes from 10.0.0.3: icmp seq=2 ttl=64 time=0.058 ms
64 bytes from 10.0.0.3: icmp seq=3 ttl=64 time=0.059 ms
64 bytes from 10.0.0.3: icmp seq=4 ttl=64 time=0.067 ms
64 bytes from 10.0.0.3: icmp seq=5 ttl=64 time=0.089 ms
--- 10.0.0.3 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 3997ms
rtt min/avg/max/mdev = 0.058/0.117/0.316/0.100 ms
```

4) iperf TCP (h1 = servidor, h2 = cliente, porta 5555, 1 s por 15

```
mininet@mininet.vm:~

mininet> h1 iperf -s -p 5555 -i 1 & mininet> h2 iperf -c 10.0.0.1 -p 5555 -i 1 -t 15

Client connecting to 10.0.0.1, TCP port 5555

TCP window size: 85.3 kByte (default)

[ 3] local 10.0.0.2 port 44034 connected with 10.0.0.1 port 5555

[ ID] Interval Transfer Bandwidth

[ 3] 0.0- 1.0 sec 3.25 MBytes 27.3 Mbits/sec

[ 3] 1.0- 2.0 sec 2.75 MBytes 23.1 Mbits/sec

[ 3] 2.0- 3.0 sec 3.00 MBytes 25.2 Mbits/sec

[ 3] 3.0- 4.0 sec 2.88 MBytes 24.1 Mbits/sec

[ 3] 4.0- 5.0 sec 2.75 MBytes 23.1 Mbits/sec

[ 3] 5.0- 6.0 sec 3.00 MBytes 25.2 Mbits/sec

[ 3] 7.0- 8.0 sec 2.75 MBytes 23.1 Mbits/sec

[ 3] 8.0- 9.0 sec 2.75 MBytes 23.1 Mbits/sec

[ 3] 9.0-10.0 sec 3.00 MBytes 25.2 Mbits/sec

[ 3] 10.0-11.0 sec 2.75 MBytes 23.1 Mbits/sec

[ 3] 11.0-12.0 sec 2.88 MBytes 24.1 Mbits/sec

[ 3] 11.0-12.0 sec 2.75 MBytes 23.1 Mbits/sec

[ 3] 11.0-11.0 sec 2.75 MBytes 23.1 Mbits/sec

[ 3] 11.0-12.0 sec 2.88 MBytes 24.1 Mbits/sec

[ 3] 11.0-15.0 sec 2.75 MBytes 23.1 Mbits/sec

[ 3] 11.0-15.0 sec 43.2 MBytes 24.1 Mbits/sec

[ 3] 10.0-15.0 sec 43.2 MBytes 24.1 Mbits/sec
```

5) Encerrar e limpar

```
mininet@mininet-vm: ~
                                                                      mininet> exit
*** Stopping 1 controllers
c0
*** Stopping 11 links
*** Stopping 6 switches
sl s2 s3 s4 s5 s6
*** Stopping 6 hosts
h1 h2 h3 h4 h5 h6
*** Done
completed in 1571.141 seconds
mininet@mininet-vm:~$ sudo mn -c
*** Removing excess controllers/ofprotocols/ofdatapaths/pings/noxes
killall controller ofprotocol ofdatapath ping nox core lt-nox core ovs-openflo
wd ovs-controller udpbwtest mnexec ivs 2> /dev/null
killall -9 controller ofprotocol ofdatapath ping nox core lt-nox core ovs-open
flowd ovs-controller udpbwtest mnexec ivs 2> /dev/null
pkill -9 -f "sudo mnexec"
*** Removing junk from /tmp
rm -f /tmp/vconn* /tmp/vlogs* /tmp/*.out /tmp/*.log
*** Removing old X11 tunnels
*** Removing excess kernel datapaths
ps ax | egrep -o 'dp[0-9]+' | sed 's/dp/nl:/'
*** Removing OVS datapaths
ovs-vsctl --timeout=1 list-br
ovs-vsctl --timeout=l list-br
*** Removing all links of the pattern foo-ethX
ip link show | egrep -o '([-_.[:alnum:]]+-eth[[:digit:]]+)'
ip link show
```