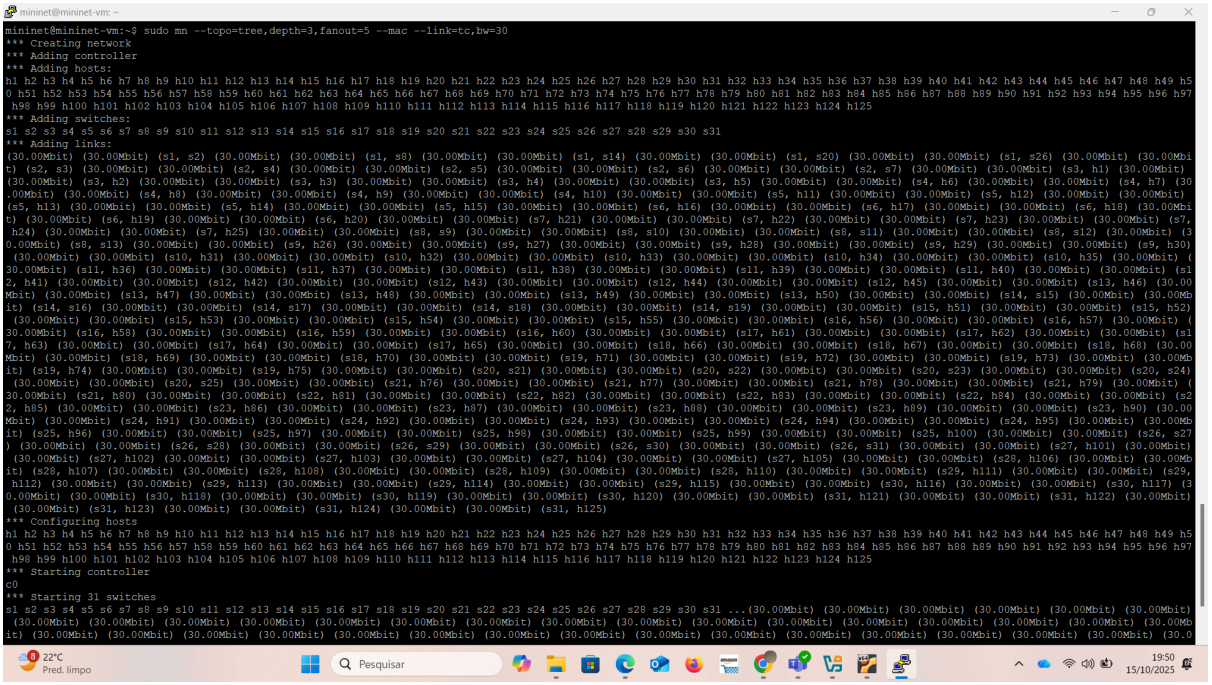
TRABALHO FINAL MININET

NOMES: Gabriel Lopes Silva - Pedro Tiso Vinhas Mesquita
MATRÍCULA: 2043 - 1932

Considere uma topologia árvore com profundidade três e ramificação cinco :

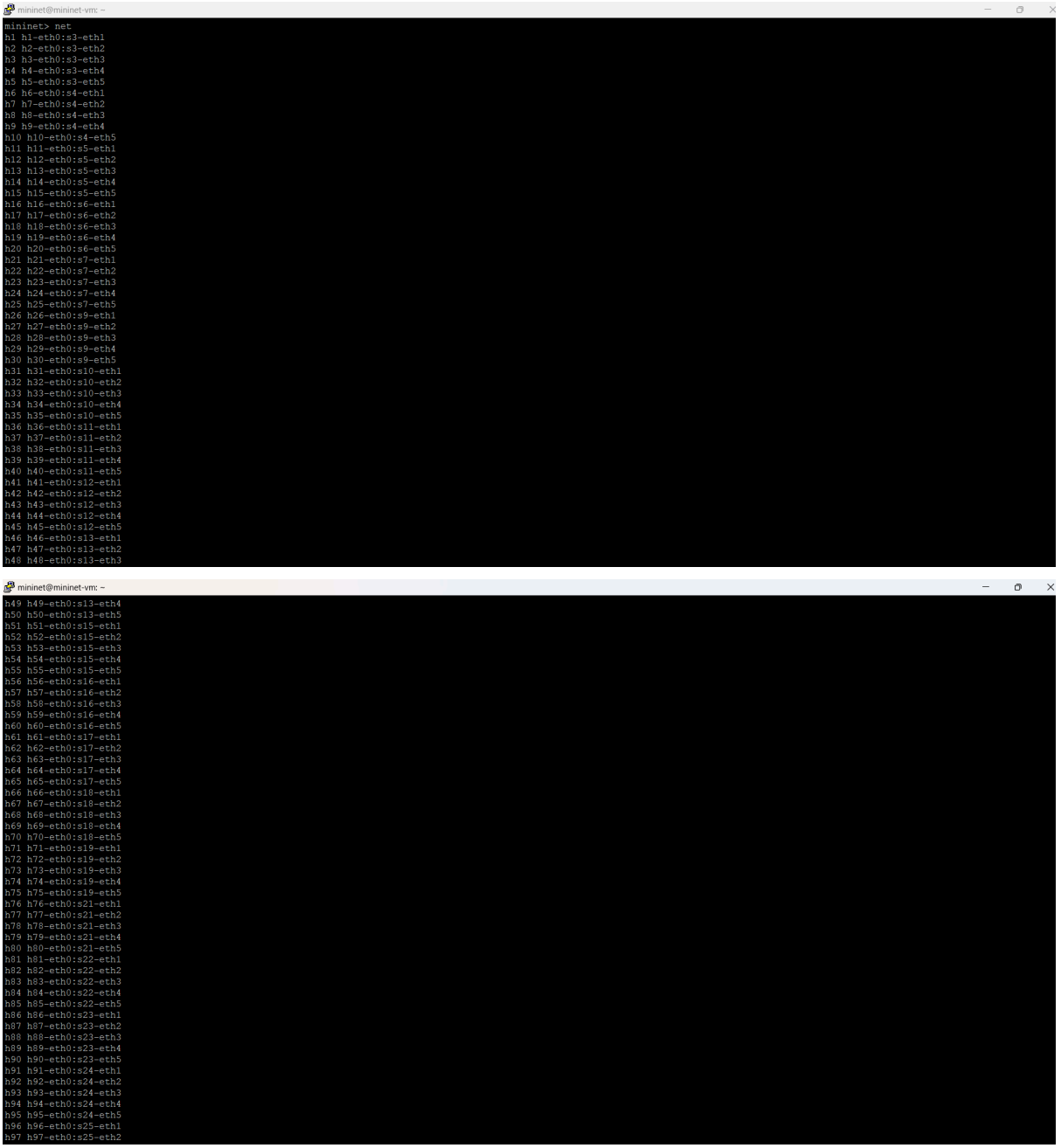
- Com uso de linha de comando padrão do Mininet, crie a topologia considerando o endereço MAC padronizado, larguras de banda bw de 30 Mbps e controlador do Mininet (não precisa especificar);

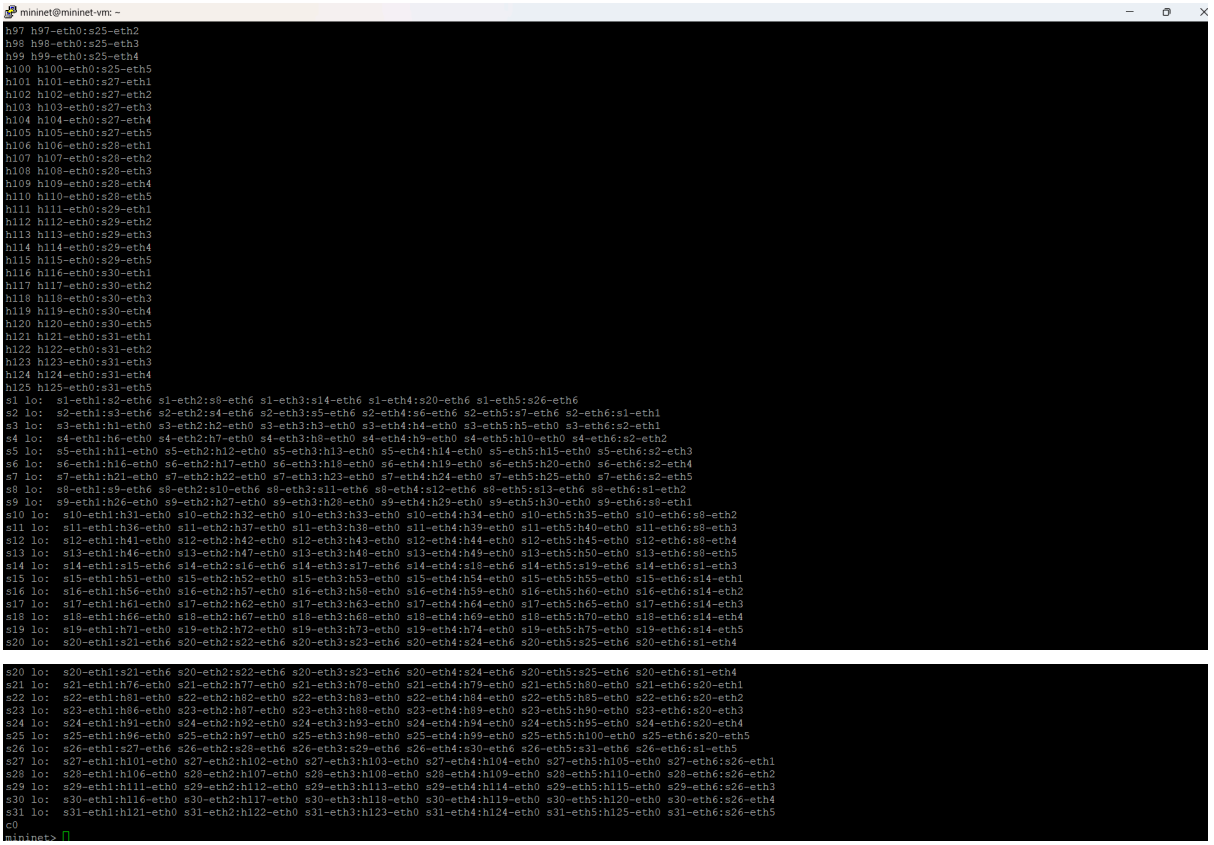
  Comando: sudo mn --topo=tree,depth=3,fanout=5 --mac --link=tc,bw=30
  PRINT:



Inspecione informações das interfaces, endereços MAC, IP e portas através de linhas de comando;

Comando: net
PRINT:




mininet@mininet-vm: ~
h97 h97-eth0:s25-eth2
h98 h98-eth0:s25-eth3
h99 h99-eth0:s25-eth4
h100 h100-eth0:s25-eth5
h101 h101-eth0:s27-eth1
h102 h102-eth0:s27-eth2
h103 h103-eth0:s27-eth3
h104 h104-eth0:s27-eth4
h105 h105-eth0:s27-eth5
h106 h106-eth0:s28-eth1
h107 h107-eth0:s28-eth2
h108 h108-eth0:s28-eth3
h109 h109-eth0:s28-eth4
h110 h110-eth0:s28-eth5
h111 h111-eth0:s29-eth1
h112 h112-eth0:s29-eth2
h113 h113-eth0:s29-eth3
h114 h114-eth0:s29-eth4
h115 h115-eth0:s29-eth5
h116 h116-eth0:s30-eth1
h117 h117-eth0:s30-eth2
h118 h118-eth0:s30-eth3
h119 h119-eth0:s30-eth4
h120 h120-eth0:s30-eth5
h121 h121-eth0:s31-eth1
h122 h122-eth0:s31-eth2
h123 h123-eth0:s31-eth3
h124 h124-eth0:s31-eth4
h125 h125-eth0:s31-eth5
s1 lo: s1-eth1:s2-eth6 s1-eth2:s8-eth6 s1-eth3:s14-eth6 s1-eth4:s20-eth6 s1-eth5:s26-eth6
s2 lo: s2-eth1:s3-eth6 s2-eth2:s4-eth6 s2-eth3:s5-eth6 s2-eth4:s6-eth6 s2-eth5:s7-eth6 s2-eth6:s1-eth1
s3 lo: s3-eth1:h1-eth0 s3-eth2:h2-eth0 s3-eth3:h3-eth0 s3-eth4:h4-eth0 s3-eth5:h5-eth0 s3-eth6:s2-eth1
s4 lo: s4-eth1:h6-eth0 s4-eth2:h7-eth0 s4-eth3:h8-eth0 s4-eth4:h9-eth0 s4-eth5:h10-eth0 s4-eth6:s2-eth2
s5 lo: s5-eth1:h11-eth0 s5-eth2:h12-eth0 s5-eth3:h13-eth0 s5-eth4:h14-eth0 s5-eth5:h15-eth0 s5-eth6:s2-eth3
s6 lo: s6-eth1:h16-eth0 s6-eth2:h17-eth0 s6-eth3:h18-eth0 s6-eth4:h19-eth0 s6-eth5:h20-eth0 s6-eth6:s2-eth4
s7 lo: s7-eth1:h21-eth0 s7-eth2:h22-eth0 s7-eth3:h23-eth0 s7-eth4:h24-eth0 s7-eth5:h25-eth0 s7-eth6:s2-eth5
s8 lo: s8-eth1:s9-eth6 s8-eth2:s10-eth6 s8-eth3:s11-eth6 s8-eth4:s12-eth6 s8-eth5:s13-eth6 s8-eth6:s1-eth2
s9 lo: s9-eth1:h26-eth0 s9-eth2:h27-eth0 s9-eth3:h28-eth0 s9-eth4:h29-eth0 s9-eth5:h30-eth0 s9-eth6:s8-eth1
s10 lo: s10-eth1:h31-eth0 s10-eth2:h32-eth0 s10-eth3:h33-eth0 s10-eth4:h34-eth0 s10-eth5:h35-eth0 s10-eth6:s8-eth2
s11 lo: s11-eth1:h36-eth0 s11-eth2:h37-eth0 s11-eth3:h38-eth0 s11-eth4:h39-eth0 s11-eth5:h40-eth0 s11-eth6:s8-eth3
s12 lo: s12-eth1:h41-eth0 s12-eth2:h42-eth0 s12-eth3:h43-eth0 s12-eth4:h44-eth0 s12-eth5:h45-eth0 s12-eth6:s8-eth4
s13 lo: s13-eth1:h46-eth0 s13-eth2:h47-eth0 s13-eth3:h48-eth0 s13-eth4:h49-eth0 s13-eth5:h50-eth0 s13-eth6:s8-eth5
s14 lo: s14-eth1:s15-eth6 s14-eth2:s16-eth6 s14-eth3:s17-eth6 s14-eth4:s18-eth6 s14-eth5:s19-eth6 s14-eth6:s1-eth3
s15 lo: s15-eth1:h51-eth0 s15-eth2:h52-eth0 s15-eth3:h53-eth0 s15-eth4:h54-eth0 s15-eth5:h55-eth0 s15-eth6:s14-eth1
s16 lo: s16-eth1:h56-eth0 s16-eth2:h57-eth0 s16-eth3:h58-eth0 s16-eth4:h59-eth0 s16-eth5:h60-eth0 s16-eth6:s14-eth2
s17 lo: s17-eth1:h61-eth0 s17-eth2:h62-eth0 s17-eth3:h63-eth0 s17-eth4:h64-eth0 s17-eth5:h65-eth0 s17-eth6:s14-eth3
s18 lo: s18-eth1:h66-eth0 s18-eth2:h67-eth0 s18-eth3:h68-eth0 s18-eth4:h69-eth0 s18-eth5:h70-eth0 s18-eth6:s14-eth4
s19 lo: s19-eth1:h71-eth0 s19-eth2:h72-eth0 s19-eth3:h73-eth0 s19-eth4:h74-eth0 s19-eth5:h75-eth0 s19-eth6:s14-eth5
s20 lo: s20-eth1:s21-eth6 s20-eth2:s22-eth6 s20-eth3:s23-eth6 s20-eth4:s24-eth6 s20-eth5:s25-eth6 s20-eth6:s1-eth4
s20 lo: s20-eth1:s21-eth6 s20-eth2:s22-eth6 s20-eth3:s23-eth6 s20-eth4:s24-eth6 s20-eth5:s25-eth6 s20-eth6:s1-eth4
s21 lo: s21-eth1:h76-eth0 s21-eth2:h77-eth0 s21-eth3:h78-eth0 s21-eth4:h79-eth0 s21-eth5:h80-eth0 s21-eth6:s20-eth1
s22 lo: s22-eth1:h81-eth0 s22-eth2:h82-eth0 s22-eth3:h83-eth0 s22-eth4:h84-eth0 s22-eth5:h85-eth0 s22-eth6:s20-eth2
s23 lo: s23-eth1:h86-eth0 s23-eth2:h87-eth0 s23-eth3:h88-eth0 s23-eth4:h89-eth0 s23-eth5:h90-eth0 s23-eth6:s20-eth3
s24 lo: s24-eth1:h91-eth0 s24-eth2:h92-eth0 s24-eth3:h93-eth0 s24-eth4:h94-eth0 s24-eth5:h95-eth0 s24-eth6:s20-eth4
s25 lo: s25-eth1:h96-eth0 s25-eth2:h97-eth0 s25-eth3:h98-eth0 s25-eth4:h99-eth0 s25-eth5:h100-eth0 s25-eth6:s20-eth5
s26 lo: s26-eth1:s27-eth6 s26-eth2:s28-eth6 s26-eth3:s29-eth6 s26-eth4:s30-eth6 s26-eth5:s31-eth6 s26-eth6:s1-eth5
s27 lo: s27-eth1:h101-eth0 s27-eth2:h102-eth0 s27-eth3:h103-eth0 s27-eth4:h104-eth0 s27-eth5:h105-eth0 s27-eth6:s26-eth1
s28 lo: s28-eth1:h106-eth0 s28-eth2:h107-eth0 s28-eth3:h108-eth0 s28-eth4:h109-eth0 s28-eth5:h110-eth0 s28-eth6:s26-eth2
s29 lo: s29-eth1:h111-eth0 s29-eth2:h112-eth0 s29-eth3:h113-eth0 s29-eth4:h114-eth0 s29-eth5:h115-eth0 s29-eth6:s26-eth3
s30 lo: s30-eth1:h116-eth0 s30-eth2:h117-eth0 s30-eth3:h118-eth0 s30-eth4:h119-eth0 s30-eth5:h120-eth0 s30-eth6:s26-eth4
s31 lo: s31-eth1:h121-eth0 s31-eth2:h122-eth0 s31-eth3:h123-eth0 s31-eth4:h124-eth0 s31-eth5:h125-eth0 s31-eth6:s26-eth5
c0
mininet>

Comando: dump
PRINT:

mininet@mininet-vm: ~

```
mininet> dump
<Host h1: h1-eth0:10.0.0.1 pid=13028>
<Host h2: h2-eth0:10.0.0.2 pid=13030>
<Host h3: h3-eth0:10.0.0.3 pid=13032>
<Host h4: h4-eth0:10.0.0.4 pid=13034>
<Host h5: h5-eth0:10.0.0.5 pid=13036>
<Host h6: h6-eth0:10.0.0.6 pid=13038>
<Host h7: h7-eth0:10.0.0.7 pid=13040>
<Host h8: h8-eth0:10.0.0.8 pid=13042>
<Host h9: h9-eth0:10.0.0.9 pid=13044>
<Host h10: h10-eth0:10.0.0.10 pid=13046>
<Host h11: h11-eth0:10.0.0.11 pid=13048>
<Host h12: h12-eth0:10.0.0.12 pid=13050>
<Host h13: h13-eth0:10.0.0.13 pid=13052>
<Host h14: h14-eth0:10.0.0.14 pid=13054>
<Host h15: h15-eth0:10.0.0.15 pid=13056>
<Host h16: h16-eth0:10.0.0.16 pid=13058>
<Host h17: h17-eth0:10.0.0.17 pid=13060>
<Host h18: h18-eth0:10.0.0.18 pid=13062>
<Host h19: h19-eth0:10.0.0.19 pid=13064>
<Host h20: h20-eth0:10.0.0.20 pid=13066>
<Host h21: h21-eth0:10.0.0.21 pid=13068>
<Host h22: h22-eth0:10.0.0.22 pid=13070>
<Host h23: h23-eth0:10.0.0.23 pid=13072>
<Host h24: h24-eth0:10.0.0.24 pid=13074>
<Host h25: h25-eth0:10.0.0.25 pid=13076>
<Host h26: h26-eth0:10.0.0.26 pid=13078>
<Host h27: h27-eth0:10.0.0.27 pid=13080>
<Host h28: h28-eth0:10.0.0.28 pid=13082>
<Host h29: h29-eth0:10.0.0.29 pid=13084>
<Host h30: h30-eth0:10.0.0.30 pid=13086>
<Host h31: h31-eth0:10.0.0.31 pid=13088>
<Host h32: h32-eth0:10.0.0.32 pid=13090>
<Host h33: h33-eth0:10.0.0.33 pid=13092>
<Host h34: h34-eth0:10.0.0.34 pid=13094>
<Host h35: h35-eth0:10.0.0.35 pid=13096>
<Host h36: h36-eth0:10.0.0.36 pid=13098>
<Host h37: h37-eth0:10.0.0.37 pid=13100>
<Host h38: h38-eth0:10.0.0.38 pid=13102>
<Host h39: h39-eth0:10.0.0.39 pid=13104>
<Host h40: h40-eth0:10.0.0.40 pid=13106>
<Host h41: h41-eth0:10.0.0.41 pid=13108>
<Host h42: h42-eth0:10.0.0.42 pid=13110>
<Host h43: h43-eth0:10.0.0.43 pid=13112>
<Host h44: h44-eth0:10.0.0.44 pid=13114>
<Host h45: h45-eth0:10.0.0.45 pid=13116>
<Host h46: h46-eth0:10.0.0.46 pid=13118>
<Host h47: h47-eth0:10.0.0.47 pid=13120>
<Host h48: h48-eth0:10.0.0.48 pid=13122>
<Host h49: h49-eth0:10.0.0.49 pid=13124>
<Host h50: h50-eth0:10.0.0.50 pid=13126>
<Host h51: h51-eth0:10.0.0.51 pid=13128>
<Host h52: h52-eth0:10.0.0.52 pid=13130>
<Host h53: h53-eth0:10.0.0.53 pid=13132>
<Host h54: h54-eth0:10.0.0.54 pid=13134>
<Host h55: h55-eth0:10.0.0.55 pid=13136>
<Host h56: h56-eth0:10.0.0.56 pid=13138>
<Host h57: h57-eth0:10.0.0.57 pid=13140>
<Host h58: h58-eth0:10.0.0.58 pid=13142>
<Host h59: h59-eth0:10.0.0.59 pid=13144>
<Host h60: h60-eth0:10.0.0.60 pid=13146>
<Host h61: h61-eth0:10.0.0.61 pid=13148>
```

```
<OVSSwitch s1: lo:127.0.0.1,s1-eth1:None,s1-eth2:None,s1-eth3:None,s1-eth4:None,s1-eth5:None pid=13281>
<OVSSwitch s2: lo:127.0.0.1,s2-eth1:None,s2-eth2:None,s2-eth3:None,s2-eth4:None,s2-eth5:None,s2-eth6:None pid=13284>
<OVSSwitch s3: lo:127.0.0.1,s3-eth1:None,s3-eth2:None,s3-eth3:None,s3-eth4:None,s3-eth5:None,s3-eth6:None pid=13287>
<OVSSwitch s4: lo:127.0.0.1,s4-eth1:None,s4-eth2:None,s4-eth3:None,s4-eth4:None,s4-eth5:None,s4-eth6:None pid=13290>
<OVSSwitch s5: lo:127.0.0.1,s5-eth1:None,s5-eth2:None,s5-eth3:None,s5-eth4:None,s5-eth5:None,s5-eth6:None pid=13293>
<OVSSwitch s6: lo:127.0.0.1,s6-eth1:None,s6-eth2:None,s6-eth3:None,s6-eth4:None,s6-eth5:None,s6-eth6:None pid=13296>
<OVSSwitch s7: lo:127.0.0.1,s7-eth1:None,s7-eth2:None,s7-eth3:None,s7-eth4:None,s7-eth5:None,s7-eth6:None pid=13299>
<OVSSwitch s8: lo:127.0.0.1,s8-eth1:None,s8-eth2:None,s8-eth3:None,s8-eth4:None,s8-eth5:None,s8-eth6:None pid=13302>
<OVSSwitch s9: lo:127.0.0.1,s9-eth1:None,s9-eth2:None,s9-eth3:None,s9-eth4:None,s9-eth5:None,s9-eth6:None pid=13305>
<OVSSwitch s10: lo:127.0.0.1,s10-eth1:None,s10-eth2:None,s10-eth3:None,s10-eth4:None,s10-eth5:None,s10-eth6:None pid=13308>
<OVSSwitch s11: lo:127.0.0.1,s11-eth1:None,s11-eth2:None,s11-eth3:None,s11-eth4:None,s11-eth5:None,s11-eth6:None pid=13311>
<OVSSwitch s12: lo:127.0.0.1,s12-eth1:None,s12-eth2:None,s12-eth3:None,s12-eth4:None,s12-eth5:None,s12-eth6:None pid=13314>
<OVSSwitch s13: lo:127.0.0.1,s13-eth1:None,s13-eth2:None,s13-eth3:None,s13-eth4:None,s13-eth5:None,s13-eth6:None pid=13317>
<OVSSwitch s14: lo:127.0.0.1,s14-eth1:None,s14-eth2:None,s14-eth3:None,s14-eth4:None,s14-eth5:None,s14-eth6:None pid=13320>
<OVSSwitch s15: lo:127.0.0.1,s15-eth1:None,s15-eth2:None,s15-eth3:None,s15-eth4:None,s15-eth5:None,s15-eth6:None pid=13323>
<OVSSwitch s16: lo:127.0.0.1,s16-eth1:None,s16-eth2:None,s16-eth3:None,s16-eth4:None,s16-eth5:None,s16-eth6:None pid=13326>
<OVSSwitch s17: lo:127.0.0.1,s17-eth1:None,s17-eth2:None,s17-eth3:None,s17-eth4:None,s17-eth5:None,s17-eth6:None pid=13329>
<OVSSwitch s18: lo:127.0.0.1,s18-eth1:None,s18-eth2:None,s18-eth3:None,s18-eth4:None,s18-eth5:None,s18-eth6:None pid=13332>
<OVSSwitch s19: lo:127.0.0.1,s19-eth1:None,s19-eth2:None,s19-eth3:None,s19-eth4:None,s19-eth5:None,s19-eth6:None pid=13335>
<OVSSwitch s20: lo:127.0.0.1,s20-eth1:None,s20-eth2:None,s20-eth3:None,s20-eth4:None,s20-eth5:None,s20-eth6:None pid=13338>
<OVSSwitch s21: lo:127.0.0.1,s21-eth1:None,s21-eth2:None,s21-eth3:None,s21-eth4:None,s21-eth5:None,s21-eth6:None pid=13341>
<OVSSwitch s22: lo:127.0.0.1,s22-eth1:None,s22-eth2:None,s22-eth3:None,s22-eth4:None,s22-eth5:None,s22-eth6:None pid=13344>
<OVSSwitch s23: lo:127.0.0.1,s23-eth1:None,s23-eth2:None,s23-eth3:None,s23-eth4:None,s23-eth5:None,s23-eth6:None pid=13347>
<OVSSwitch s24: lo:127.0.0.1,s24-eth1:None,s24-eth2:None,s24-eth3:None,s24-eth4:None,s24-eth5:None,s24-eth6:None pid=13350>
<OVSSwitch s25: lo:127.0.0.1,s25-eth1:None,s25-eth2:None,s25-eth3:None,s25-eth4:None,s25-eth5:None,s25-eth6:None pid=13353>
<OVSSwitch s26: lo:127.0.0.1,s26-eth1:None,s26-eth2:None,s26-eth3:None,s26-eth4:None,s26-eth5:None,s26-eth6:None pid=13356>
<OVSSwitch s27: lo:127.0.0.1,s27-eth1:None,s27-eth2:None,s27-eth3:None,s27-eth4:None,s27-eth5:None,s27-eth6:None pid=13359>
<OVSSwitch s28: lo:127.0.0.1,s28-eth1:None,s28-eth2:None,s28-eth3:None,s28-eth4:None,s28-eth5:None,s28-eth6:None pid=13362>
<OVSSwitch s29: lo:127.0.0.1,s29-eth1:None,s29-eth2:None,s29-eth3:None,s29-eth4:None,s29-eth5:None,s29-eth6:None pid=13365>
<OVSSwitch s30: lo:127.0.0.1,s30-eth1:None,s30-eth2:None,s30-eth3:None,s30-eth4:None,s30-eth5:None,s30-eth6:None pid=13368>
<OVSSwitch s31: lo:127.0.0.1,s31-eth1:None,s31-eth2:None,s31-eth3:None,s31-eth4:None,s31-eth5:None,s31-eth6:None pid=13371>
<Controller c0: 127.0.0.1:6653 pid=13021>
```

Comando: h1 ifconfig
PRINT:

```
mininet> h1 ifconfig
h1-eth0   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)

lo        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>
```

Comando: h2 ifconfig
PRINT:

```
mininet> h2 ifconfig
h2-eth0   Link encap:Ethernet  HWaddr 00:00:00:00:00:02
          inet addr:10.0.0.2  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)

lo        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>
```

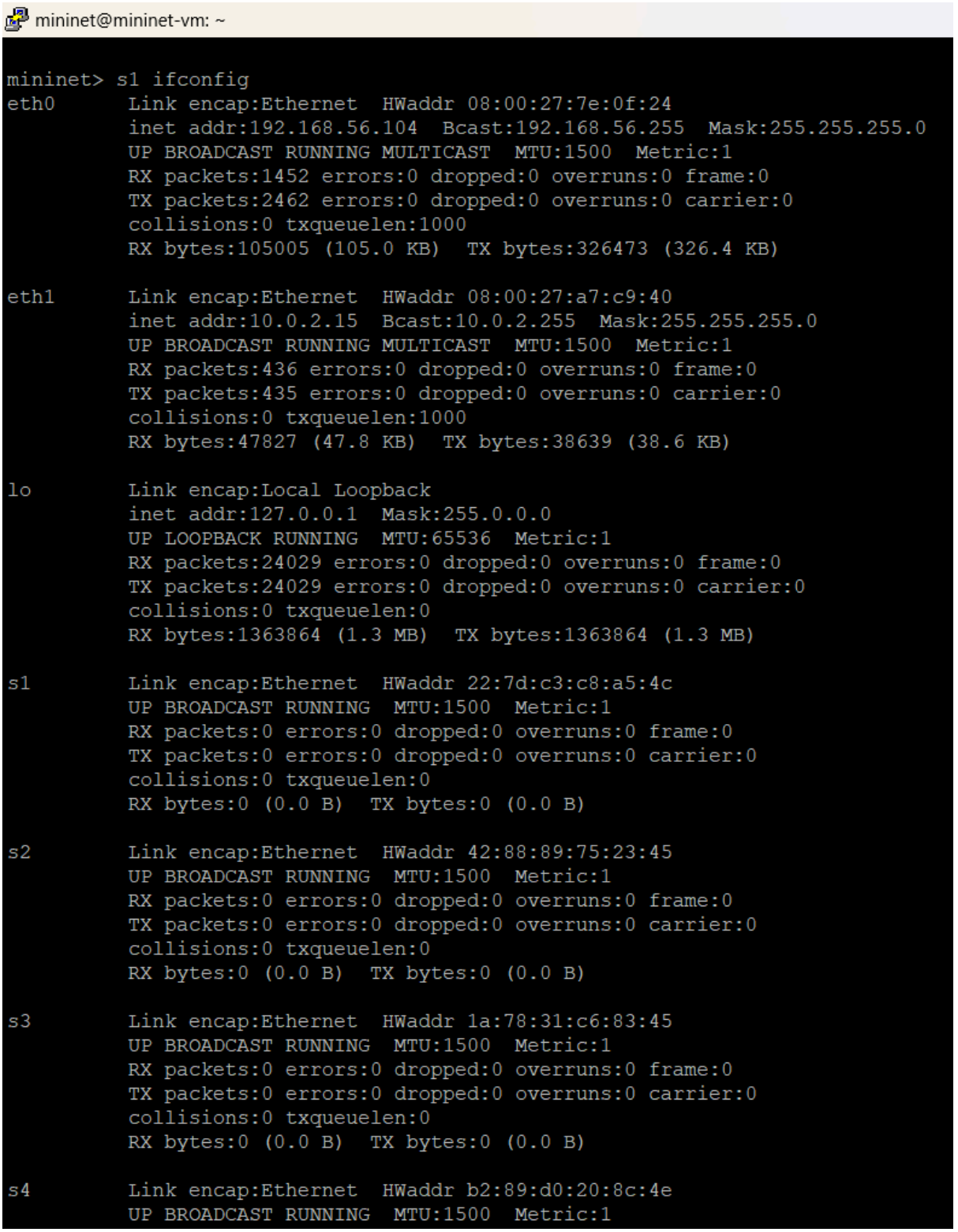
Comando: h124 ifconfig
PRINT:

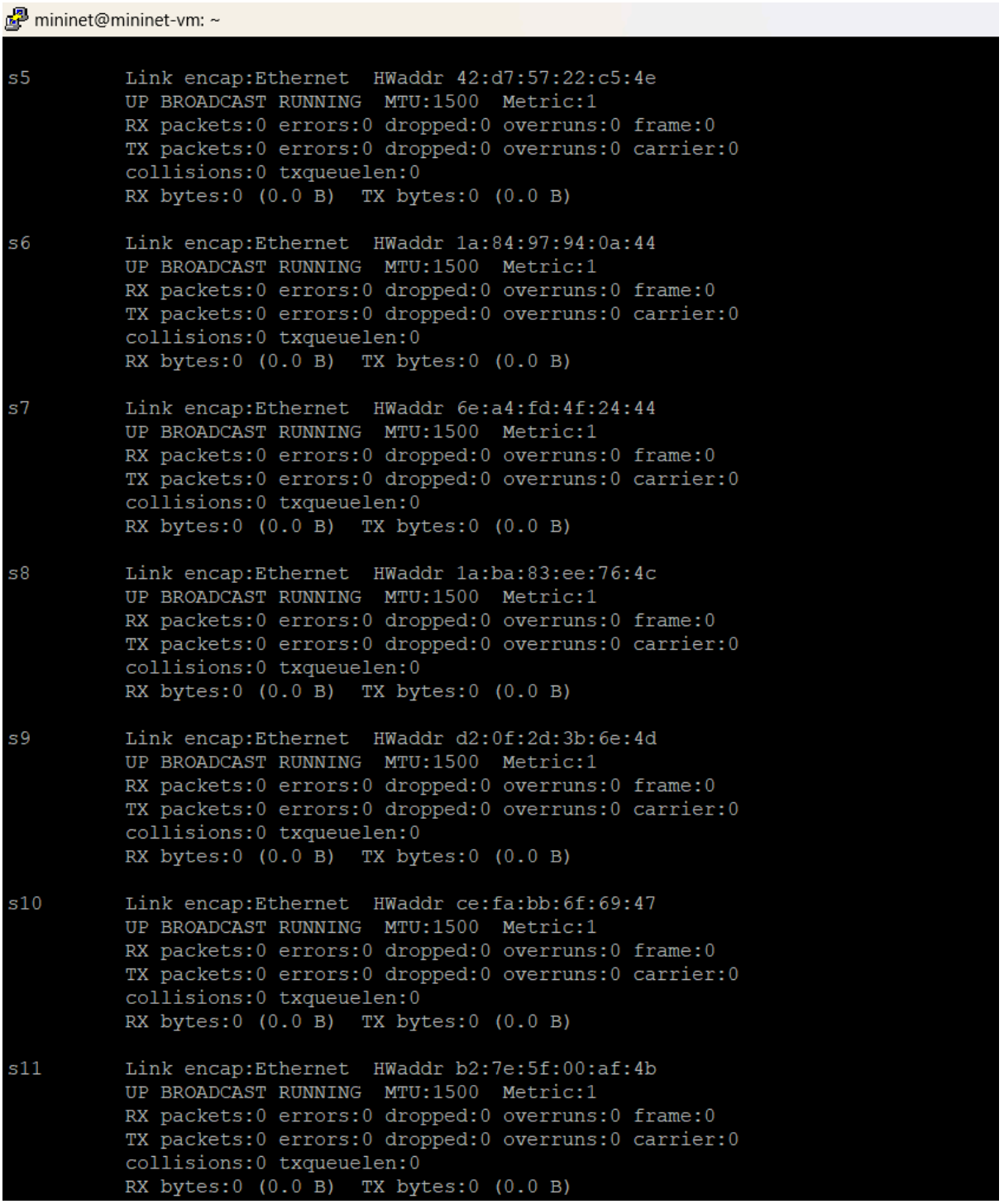
```
mininet> h124 ifconfig
h124-eth0 Link encap:Ethernet  HWaddr 00:00:00:00:00:7c
          inet addr:10.0.0.124  Bcast:10.255.255.255  Mask:255.0.0.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

lo        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>
```

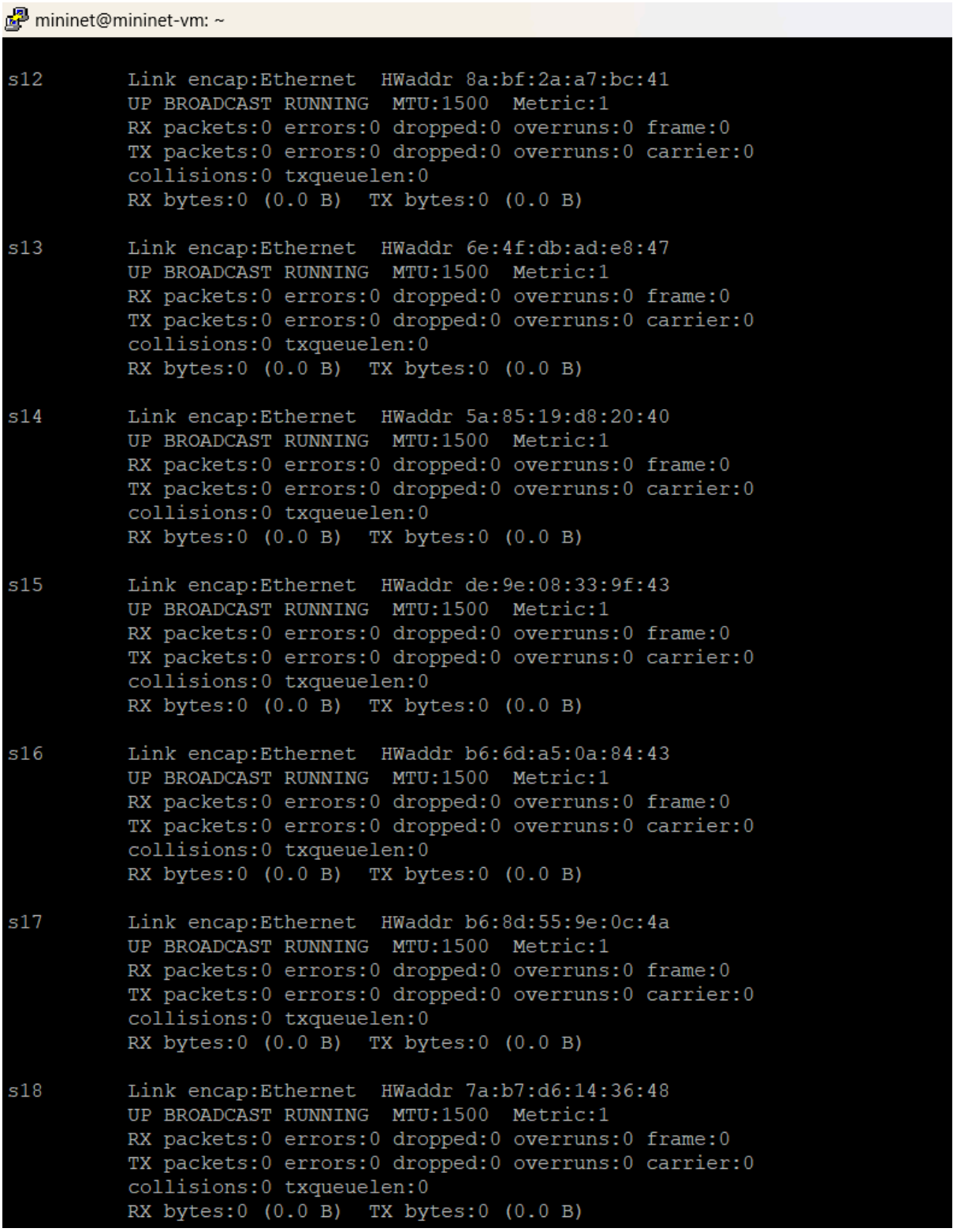
Comando: h15 ifconfig
PRINT:

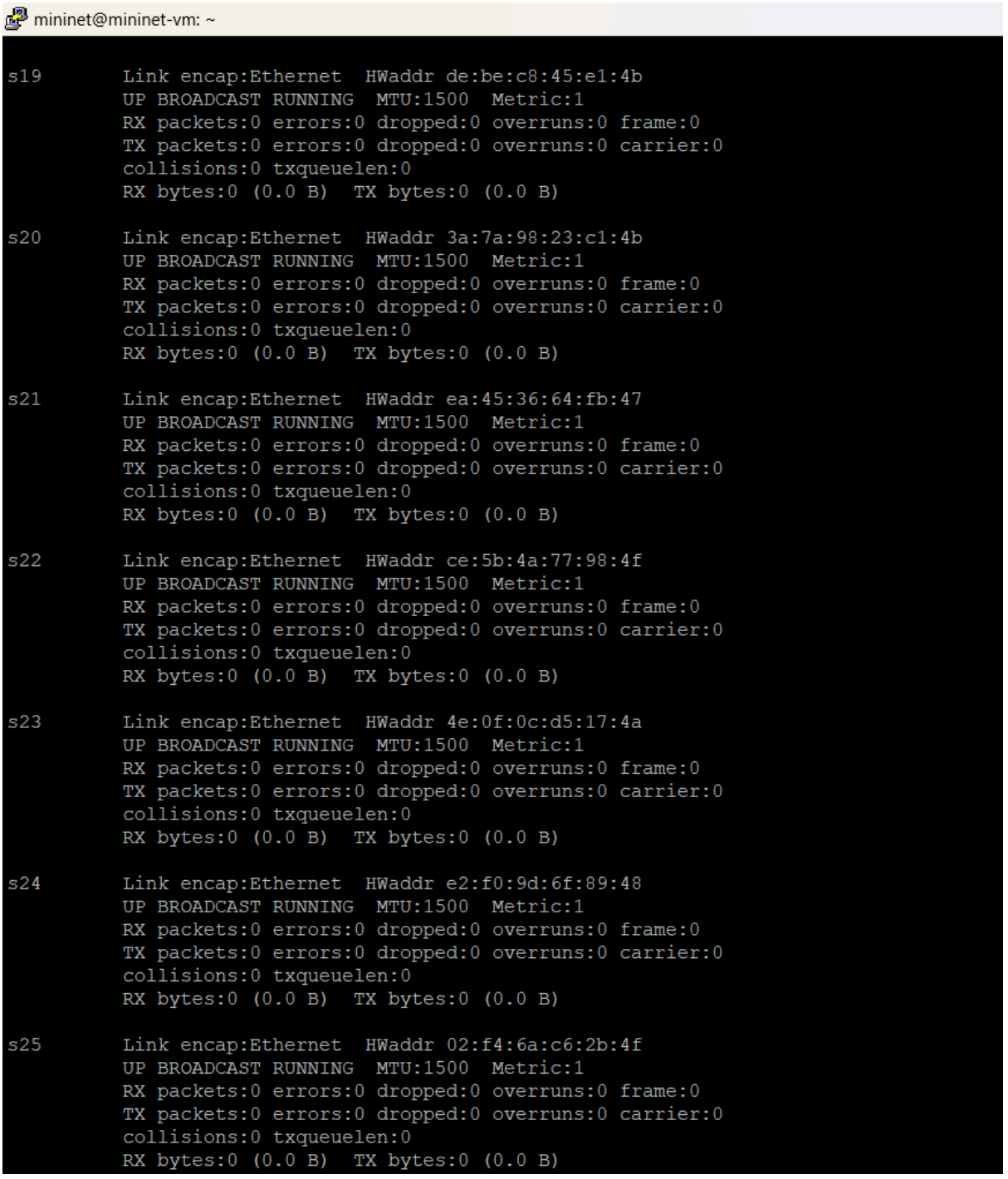
```
mininet> h125 ifconfig
h125-eth0 Link encap:Ethernet  HWaddr 00:00:00:00:00:7d
          inet addr:10.0.0.125  Bcast:10.255.255.255  Mask:255.0.0.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

lo        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>
```

Comando: s1 ifconfig
PRINT:
OBS: Devido a resposta ser muito grande, printei apenas algumas partes, porém com os comandos que descrevi, conseguimos visualizar todos os itens solicitados.




mininet@mininet-vm: ~
s5 Link encap:Ethernet HWaddr 42:d7:57:22:c5:4e
UP BROADCAST RUNNING 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:0
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)
s6 Link encap:Ethernet HWaddr 1a:84:97:94:0a:44
UP BROADCAST RUNNING 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:0
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)
s7 Link encap:Ethernet HWaddr 6e:a4:fd:4f:24:44
UP BROADCAST RUNNING 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:0
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)
s8 Link encap:Ethernet HWaddr 1a:ba:83:ee:76:4c
UP BROADCAST RUNNING 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:0
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)
s9 Link encap:Ethernet HWaddr d2:0f:2d:3b:6e:4d
UP BROADCAST RUNNING 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:0
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)
s10 Link encap:Ethernet HWaddr ce:fa:bb:6f:69:47
UP BROADCAST RUNNING 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:0
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)
s11 Link encap:Ethernet HWaddr b2:7e:5f:00:af:4b
UP BROADCAST RUNNING 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:0
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)

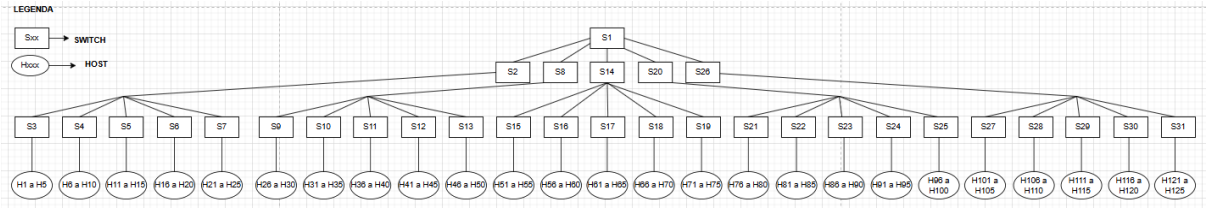

mininet@mininet-vm: ~
s12 Link encap:Ethernet HWaddr 8a:bf:2a:a7:bc:41
UP BROADCAST RUNNING MTU:1500 Metric:1
RX packets:0 errors:0 dropped:0 overruns:0 frame:0
TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:0
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)
s13 Link encap:Ethernet HWaddr 6e:4f:db:ad:e8:47
UP BROADCAST RUNNING 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:0
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)
s14 Link encap:Ethernet HWaddr 5a:85:19:d8:20:40
UP BROADCAST RUNNING 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:0
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)
s15 Link encap:Ethernet HWaddr de:9e:08:33:9f:43
UP BROADCAST RUNNING 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:0
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)
s16 Link encap:Ethernet HWaddr b6:6d:a5:0a:84:43
UP BROADCAST RUNNING 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:0
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)
s17 Link encap:Ethernet HWaddr b6:8d:55:9e:0c:4a
UP BROADCAST RUNNING 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:0
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)
s18 Link encap:Ethernet HWaddr 7a:b7:d6:14:36:48
UP BROADCAST RUNNING 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:0
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)


mininet@mininet-vm: ~
s19 Link encap:Ethernet HWaddr de:be:c8:45:e1:4b
UP BROADCAST RUNNING 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:0
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)
s20 Link encap:Ethernet HWaddr 3a:7a:98:23:c1:4b
UP BROADCAST RUNNING 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:0
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)
s21 Link encap:Ethernet HWaddr ea:45:36:64:fb:47
UP BROADCAST RUNNING 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:0
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)
s22 Link encap:Ethernet HWaddr ce:5b:4a:77:98:4f
UP BROADCAST RUNNING 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:0
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)
s23 Link encap:Ethernet HWaddr 4e:0f:0c:d5:17:4a
UP BROADCAST RUNNING 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:0
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)
s24 Link encap:Ethernet HWaddr e2:f0:9d:6f:89:48
UP BROADCAST RUNNING 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:0
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)
s25 Link encap:Ethernet HWaddr 02:f4:6a:c6:2b:4f
UP BROADCAST RUNNING 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:0
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)

```
mininet@mininet-vm: ~

s26       Link encap:Ethernet  HWaddr aa:3c:79:ec:01:48
          UP BROADCAST RUNNING  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:0
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

s27       Link encap:Ethernet  HWaddr 42:e7:eb:f5:20:43
          UP BROADCAST RUNNING  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:0
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

s28       Link encap:Ethernet  HWaddr 7a:d4:51:e1:0b:41
          UP BROADCAST RUNNING  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:0
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

s29       Link encap:Ethernet  HWaddr da:25:41:29:0b:4a
          UP BROADCAST RUNNING  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:0
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

s30       Link encap:Ethernet  HWaddr d2:4a:5a:c7:d2:48
          UP BROADCAST RUNNING  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:0
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

s31       Link encap:Ethernet  HWaddr 0a:66:12:da:3e:42
          UP BROADCAST RUNNING  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:0
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)
```

```
mininet@mininet-vm: ~

          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

s1-eth2   Link encap:Ethernet  HWaddr 0a:e0:c5:90:0d:cd
          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)

s1-eth3   Link encap:Ethernet  HWaddr 46:dd:69:98:6c:b7
          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)

s1-eth4   Link encap:Ethernet  HWaddr 66:f4:46:f8:44:8f
          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)

s1-eth5   Link encap:Ethernet  HWaddr 76:5d:9f:bf:6f:1a
          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)

s10-eth1  Link encap:Ethernet  HWaddr 4a:b8:35:56:e8:10
          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)

s10-eth2  Link encap:Ethernet  HWaddr 66:cd:86:8f:ef:6c
          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)

s10-eth3  Link encap:Ethernet  HWaddr 86:a4:64:83:f0:0e
          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
```

- Crie um desenho ilustrativo da topologia com todas as informações obtidas no item anterior;



HOSTs:

- ➢ Devido a grande quantidade de hosts, resumi os mesmos em blocos de 5 hosts que se conectam ao switch correspondente;
- ➢ IP: Os endereços IPs dos hosts são sequenciais, de forma que: h1 - 10.0.0.1 até h125 - 10.0.0.125;
- ➢ MAC: Na criação da topologia, padronizamos os endereços MAC de forma que os mesmos ficaram: h1 - 00:00:00:00:00:01 até 00:00:00:00:00:7d (alterando o final dos 125 hosts conforme a representação em hexadecimal);
- ➢ Cada host tem uma única interface para se conectar ao switch de base que está conectado. O padrão de identificação é hx-eth0 (x varia para cada host a partir de sua identificação. Ex: h1 - h1-eth0).

SWITCHs:

- ➢ Todos os 31 Switchs da topologia foram representados;
- ➢ O S1 possui 5 portas para conexão com os switchs intermediários. São identificadas por padrão com a sigla s1-eth1 até s1-eth5;
- ➢ Switchs intermediários(s2, s8, s14, s20 e s26) possuem 6 portas (1 porta para o switch pai e 5 para os seus filhos). Possuem um padrão de identificação indicado pela sigla sx-eth1 a sx-eth6 (x será a identificação de cada switch, no caso, 2, 8, 14, 20 e 26);
- ➢ Switchs base(mais inferiores) se conectam com a rede de hosts e seguem o mesmo padrão dito anteriormente.

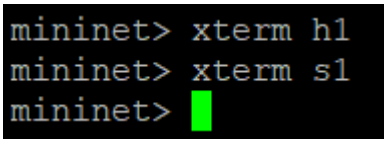
OBS: O print do desenho em maior qualidade está no gitHub

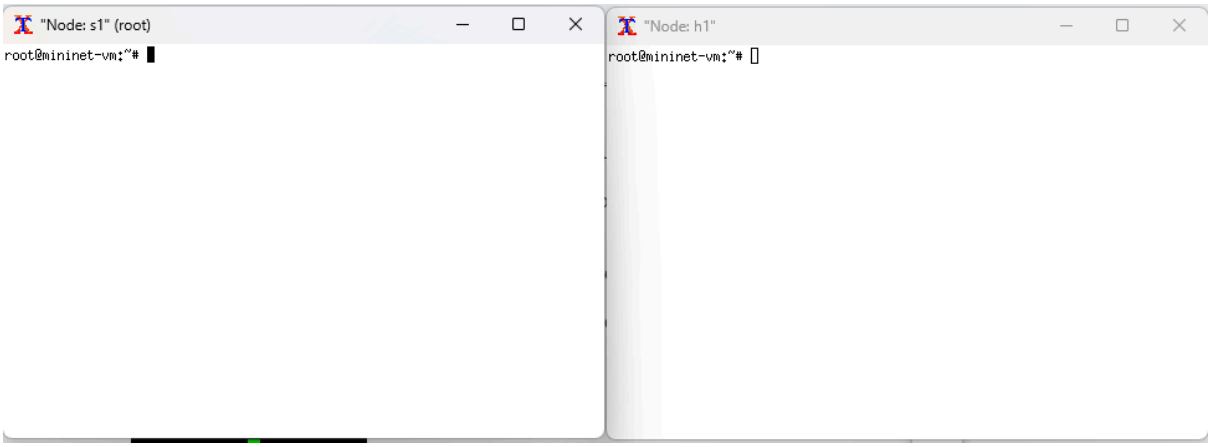
- Execute testes de ping entre os diferentes nós, mostre os pacotes chegando nos nós com uso do comando tcpdump.

  Comando: xterm s1 - Abrindo um terminal paralelo referente do switch 1 (“pai da topologia)

  xterm h1 - Abrindo o terminal do host 1 para executar o ping em outro host da topologia

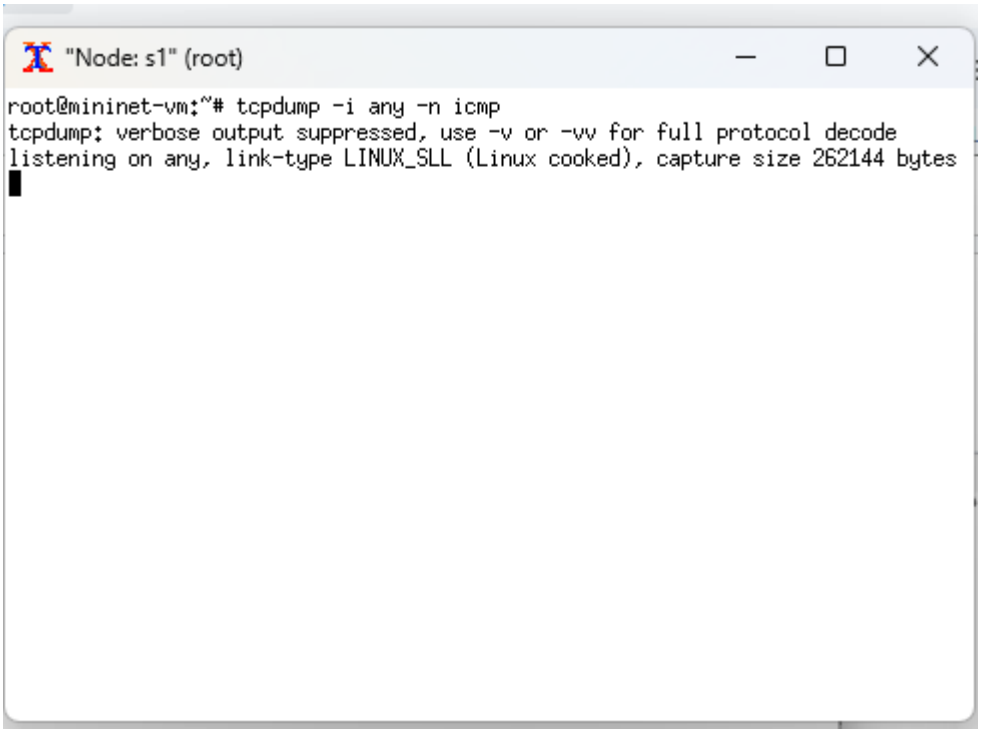
  PRINT:



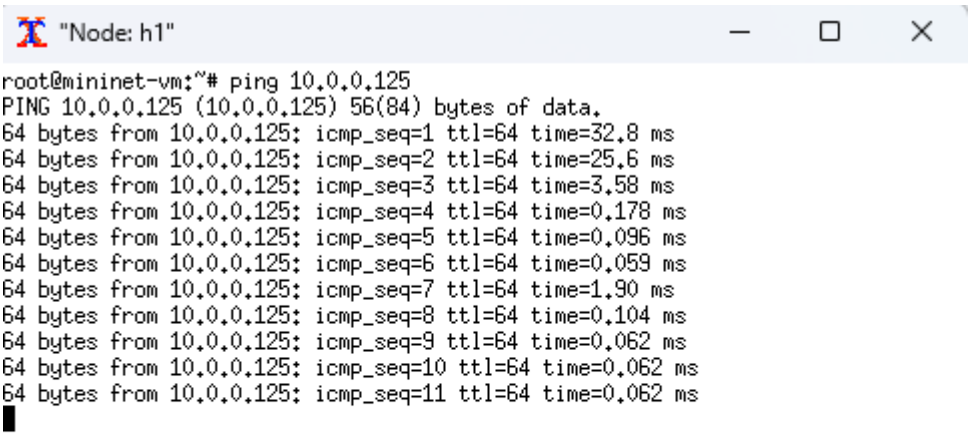


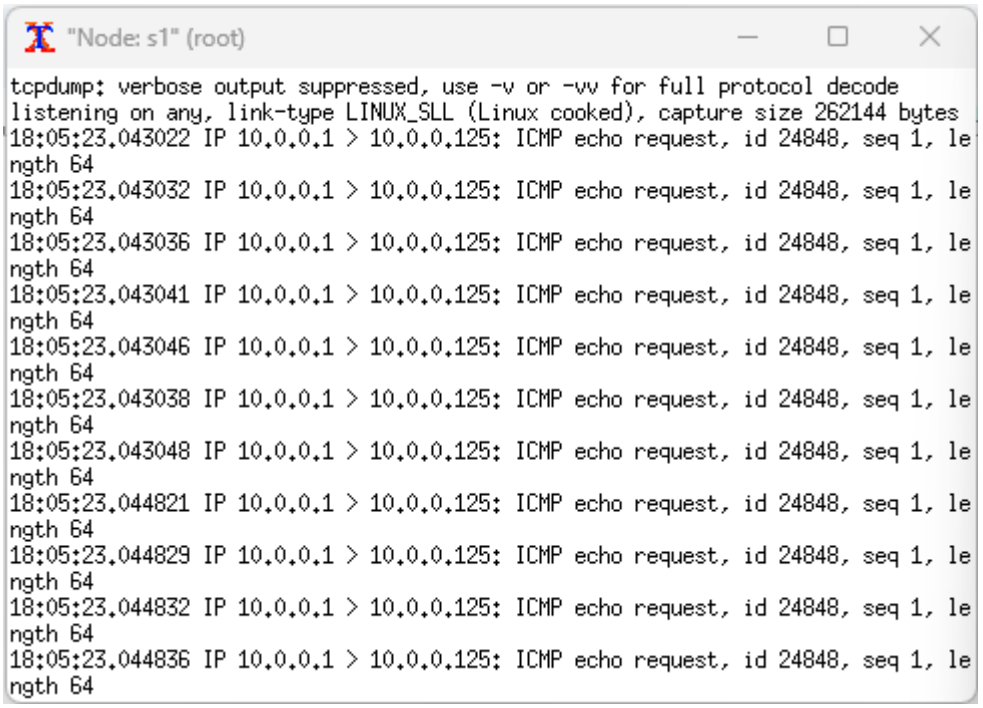
  Comando: tcpdump -i any -n icmp (Em S1)

  PRINT:

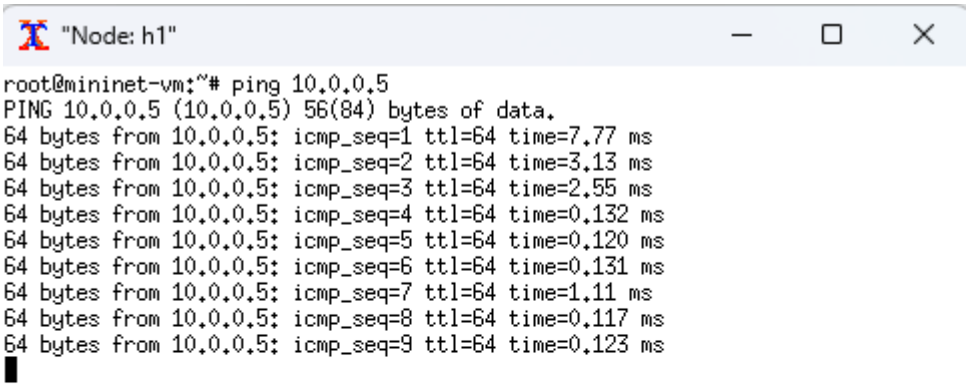


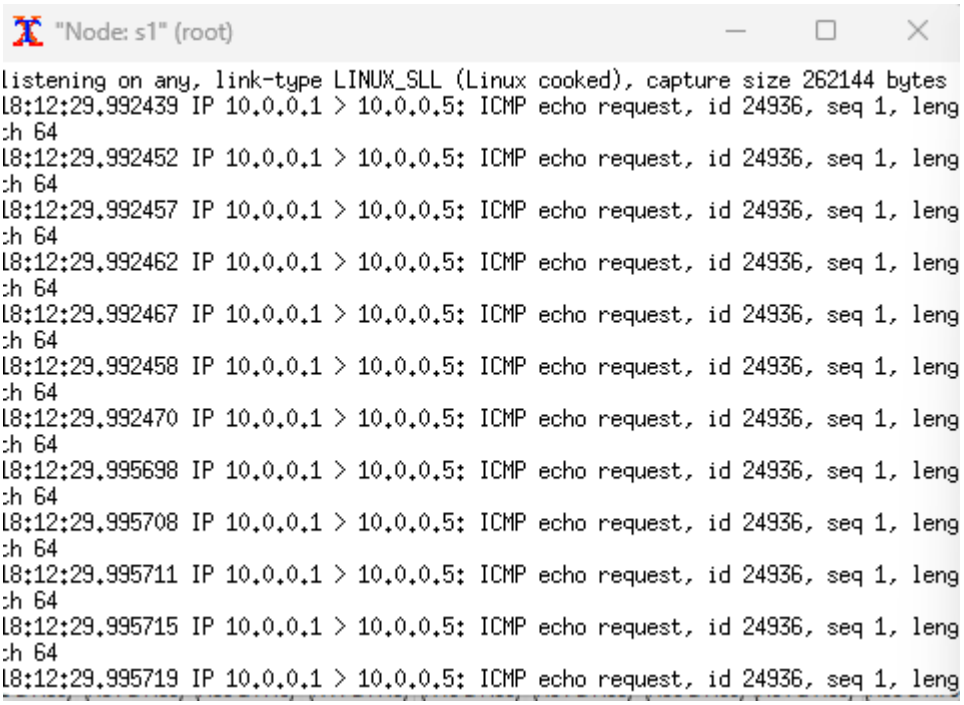
Comando: ping 10.0.0.125 (h1 ping h125)
PRINT:



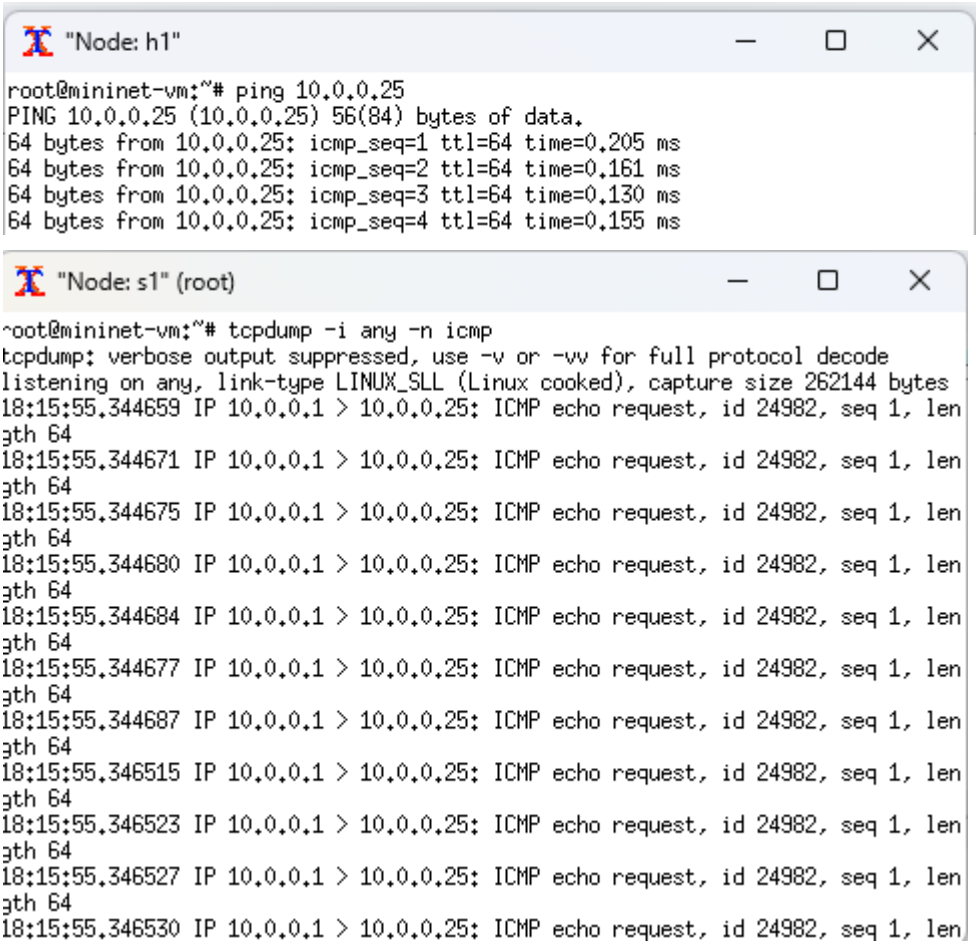


Comando: ping 10.0.0.5 (h1 ping h5)
PRINT:

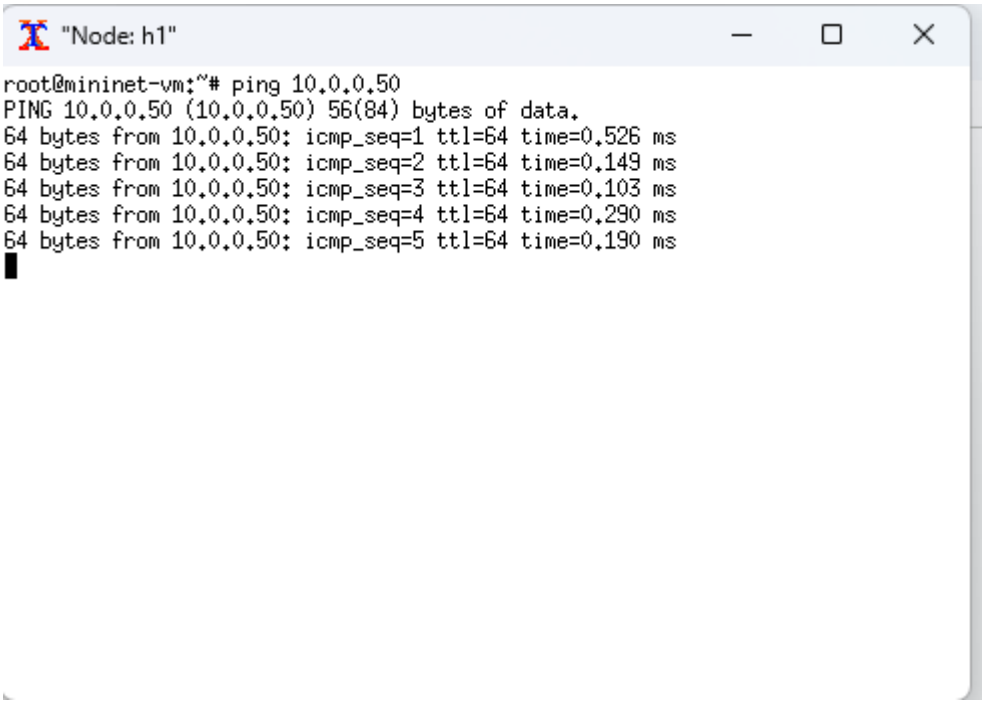

"Node: h1"
root@mininet-vm:~# ping 10.0.0.5
PING 10.0.0.5 (10.0.0.5) 56(84) bytes of data.
64 bytes from 10.0.0.5: icmp_seq=1 ttl=64 time=7.77 ms
64 bytes from 10.0.0.5: icmp_seq=2 ttl=64 time=3.13 ms
64 bytes from 10.0.0.5: icmp_seq=3 ttl=64 time=2.55 ms
64 bytes from 10.0.0.5: icmp_seq=4 ttl=64 time=0.132 ms
64 bytes from 10.0.0.5: icmp_seq=5 ttl=64 time=0.120 ms
64 bytes from 10.0.0.5: icmp_seq=6 ttl=64 time=0.131 ms
64 bytes from 10.0.0.5: icmp_seq=7 ttl=64 time=1.11 ms
64 bytes from 10.0.0.5: icmp_seq=8 ttl=64 time=0.117 ms
64 bytes from 10.0.0.5: icmp_seq=9 ttl=64 time=0.123 ms

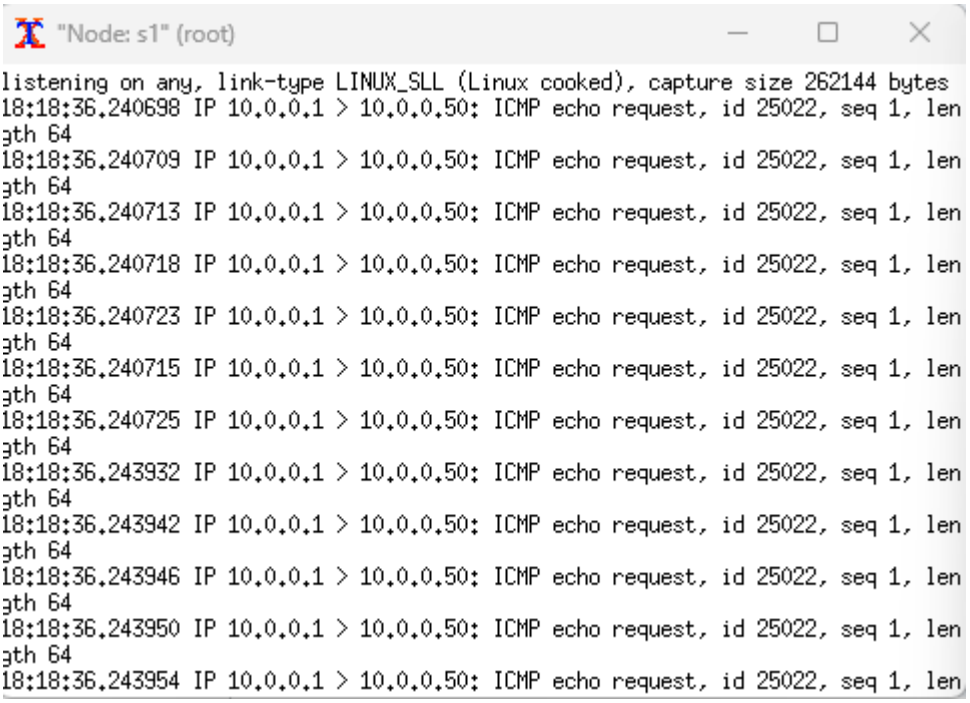

"Node: s1" (root)
listening on any, link-type LINUX_SLL (Linux cooked), capture size 262144 bytes
18:12:29.992439 IP 10.0.0.1 > 10.0.0.5: ICMP echo request, id 24936, seq 1, leng
:h 64
18:12:29.992452 IP 10.0.0.1 > 10.0.0.5: ICMP echo request, id 24936, seq 1, leng
:h 64
18:12:29.992457 IP 10.0.0.1 > 10.0.0.5: ICMP echo request, id 24936, seq 1, leng
:h 64
18:12:29.992462 IP 10.0.0.1 > 10.0.0.5: ICMP echo request, id 24936, seq 1, leng
:h 64
18:12:29.992467 IP 10.0.0.1 > 10.0.0.5: ICMP echo request, id 24936, seq 1, leng
:h 64
18:12:29.992458 IP 10.0.0.1 > 10.0.0.5: ICMP echo request, id 24936, seq 1, leng
:h 64
18:12:29.992470 IP 10.0.0.1 > 10.0.0.5: ICMP echo request, id 24936, seq 1, leng
:h 64
18:12:29.995698 IP 10.0.0.1 > 10.0.0.5: ICMP echo request, id 24936, seq 1, leng
:h 64
18:12:29.995708 IP 10.0.0.1 > 10.0.0.5: ICMP echo request, id 24936, seq 1, leng
:h 64
18:12:29.995711 IP 10.0.0.1 > 10.0.0.5: ICMP echo request, id 24936, seq 1, leng
:h 64
18:12:29.995715 IP 10.0.0.1 > 10.0.0.5: ICMP echo request, id 24936, seq 1, leng
:h 64
18:12:29.995719 IP 10.0.0.1 > 10.0.0.5: ICMP echo request, id 24936, seq 1, leng

Comando: ping 10.0.0.25 (h1 ping h25)
PRINT:

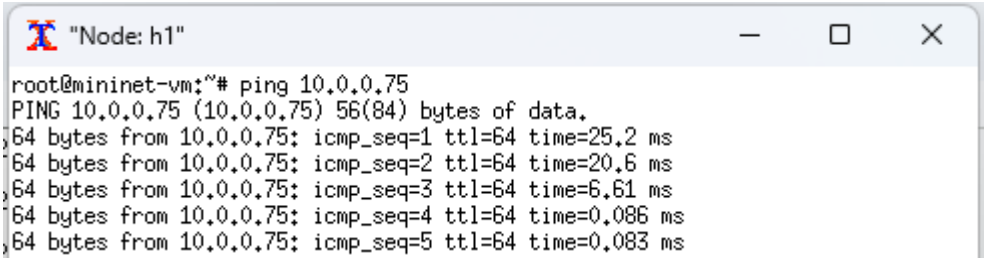


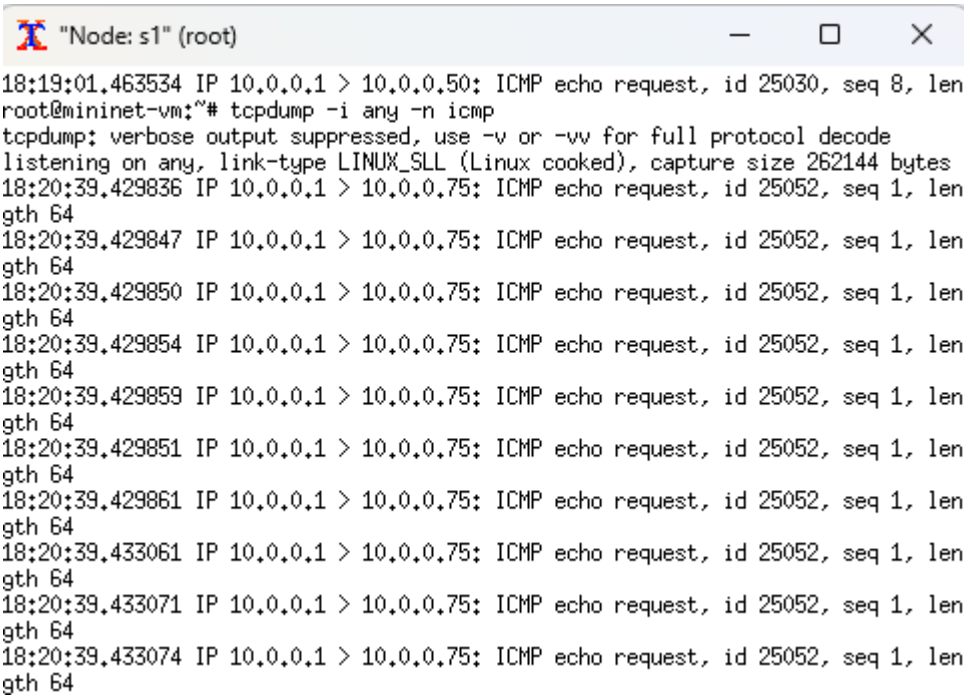
Comando: ping 10.0.0.50 (h1 ping h50)
PRINT:



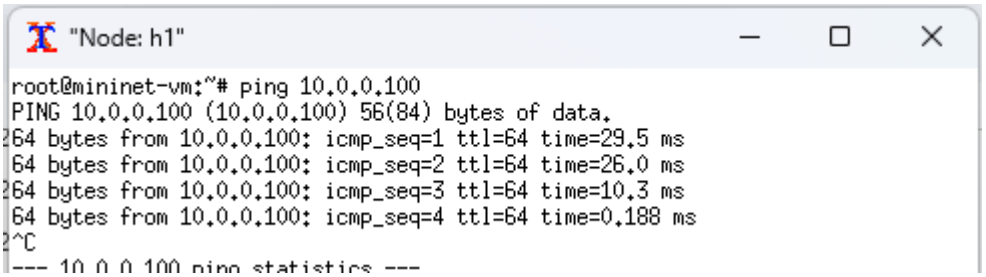


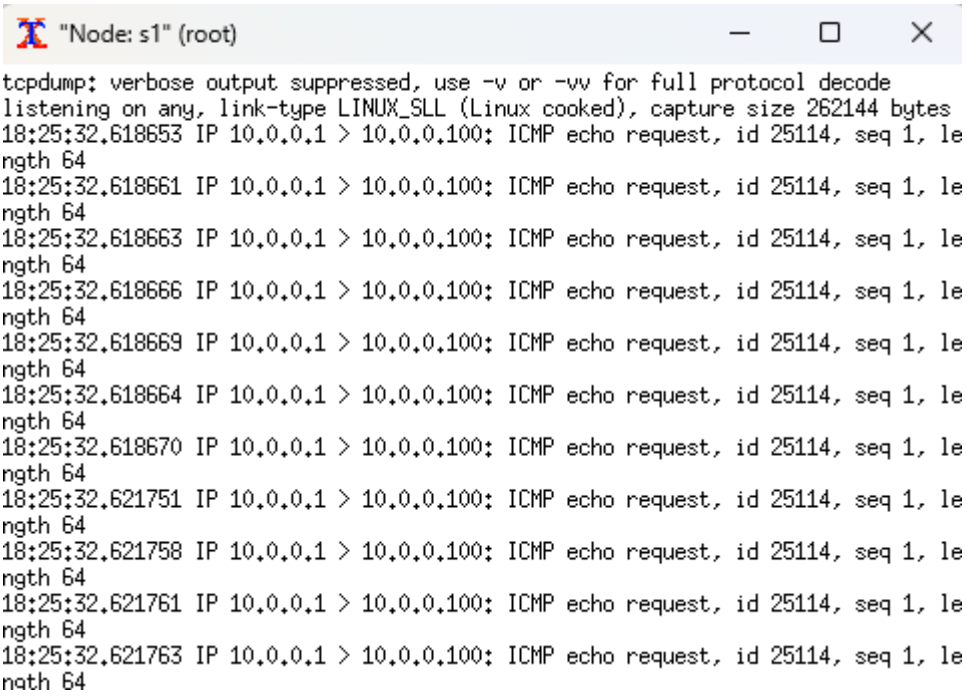
Comando: ping 10.0.0.75 (h1 ping h75)
PRINT:





Comando: ping 10.0.0.100 (h1 ping h100)
PRINT:

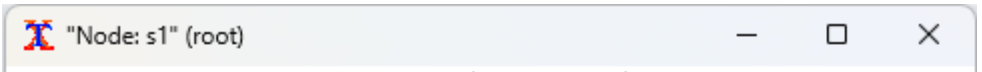




Comando: xterm h26 - Abrindo um host aleatório
PRINT:

Comando: ping 10.0.0.101 (h1 ping h101) - Ping aleatório
PRINT:


```
root@mininet-vm:~# ping 10.0.0.101
PING 10.0.0.101 (10.0.0.101) 56(84) bytes of data.
64 bytes from 10.0.0.101: icmp_seq=1 ttl=64 time=39.5 ms
64 bytes from 10.0.0.101: icmp_seq=2 ttl=64 time=2.94 ms
64 bytes from 10.0.0.101: icmp_seq=3 ttl=64 time=0.165 ms
64 bytes from 10.0.0.101: icmp_seq=4 ttl=64 time=0.180 ms
```

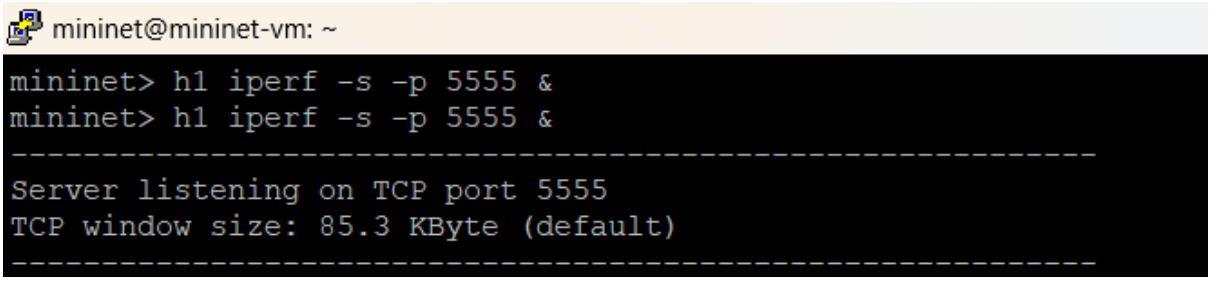



```
listening on any, link-type LINUX_SLL (Linux cooked), capture size 262144 bytes
18:28:19.117339 IP 10.0.0.26 > 10.0.0.101: ICMP echo request, id 25174, seq 1, l
ength 64
18:28:19.117343 IP 10.0.0.26 > 10.0.0.101: ICMP echo request, id 25174, seq 1, l
ength 64
18:28:19.120805 IP 10.0.0.26 > 10.0.0.101: ICMP echo request, id 25174, seq 1, l
ength 64
18:28:19.120811 IP 10.0.0.26 > 10.0.0.101: ICMP echo request, id 25174, seq 1, l
ength 64
18:28:19.124663 IP 10.0.0.26 > 10.0.0.101: ICMP echo request, id 25174, seq 1, l
ength 64
18:28:19.124666 IP 10.0.0.26 > 10.0.0.101: ICMP echo request, id 25174, seq 1, l
ength 64
18:28:19.127274 IP 10.0.0.26 > 10.0.0.101: ICMP echo request, id 25174, seq 1, l
ength 64
18:28:19.127278 IP 10.0.0.26 > 10.0.0.101: ICMP echo request, id 25174, seq 1, l
ength 64
18:28:19.128531 IP 10.0.0.26 > 10.0.0.101: ICMP echo request, id 25174, seq 1, l
ength 64
18:28:19.128547 IP 10.0.0.101 > 10.0.0.26: ICMP echo reply, id 25174, seq 1, len
gth 64
18:28:19.130333 IP 10.0.0.101 > 10.0.0.26: ICMP echo reply, id 25174, seq 1, len
gth 64
18:28:19.130336 IP 10.0.0.101 > 10.0.0.26: ICMP echo reply, id 25174, seq 1, len
```

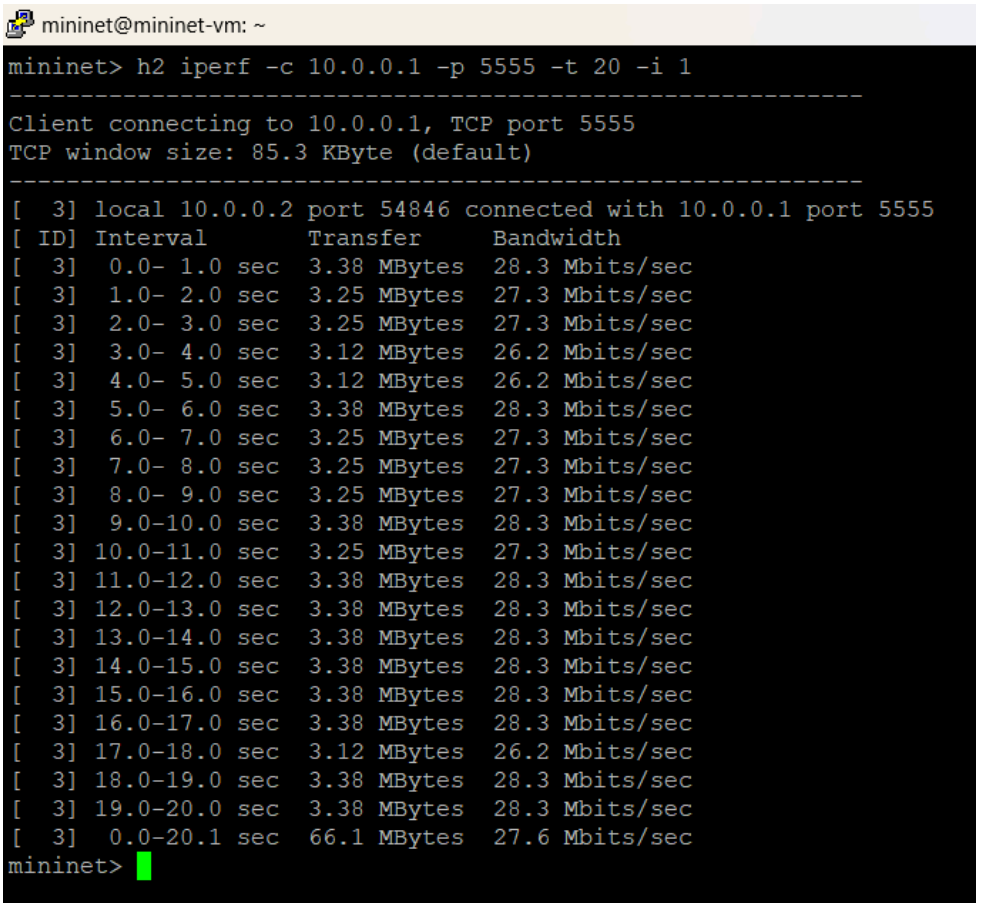
- Especifique que o host 1 na porta 5555 vai ser um servidor TCP e o host 2 um cliente e execute testes de iperf, considere um relatório por segundo com teste de 20 segundos. Faça os testes para larguras de banda bw de 30 e 40 Mbps (Necessário reconstruir a topologia para os outros valores).

  TESTE BW = 30Mbps

  Comando: h1 iperf -s -p 5555 & (rodando em segundo plano)
  PRINT:



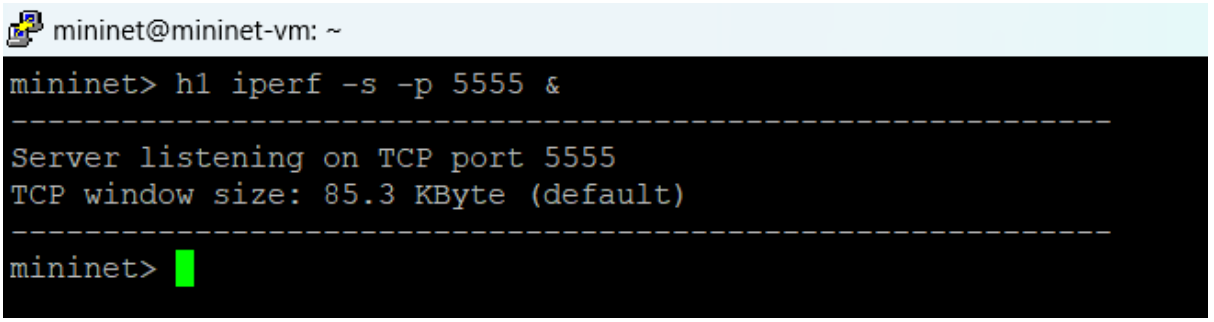
  Comando: h2 iperf -c 10.0.0.1 -p 5555 -t 20 -i 1
  PRINT:



TESTE BW = 40Mbps

Comando: sudo mn --topo=tree,depth=3,fanout=5 --mac --link=tc,bw=40 (nova topologia)

Comando: h1 iperf -s -p 5555 & (rodando em segundo plano)
PRINT:



Comando: h2 iperf -c 10.0.0.1 -p 5555 -t 20 -i 1
PRINT: