

Trabalho de aprendizado ao Mininet

Etapa 1 → Criando a topologia: `sudo mn --topo=tree,depth=3,fanout=3 --mac --link tc,bw=35`

```
mininet@mininet-vm:~$ sudo mn --topo=tree,depth=3,fanout=3 --mac --link tc,bw=35
*** Creating network
*** Adding controller
*** Adding hosts:
h1 h2 h3 h4 h5 h6 h7 h8 h9 h10 h11 h12 h13 h14 h15 h16 h17 h18 h19 h20 h21 h22 h
23 h24 h25 h26 h27
*** Adding switches:
s1 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13
*** Adding links:
(35.00Mbit) (35.00Mbit) (s1, s2) (35.00Mbit) (35.00Mbit) (s1, s6) (35.00Mbit) (3
5.00Mbit) (s1, s10) (35.00Mbit) (35.00Mbit) (s2, s3) (35.00Mbit) (35.00Mbit) (s2
, s4) (35.00Mbit) (35.00Mbit) (s2, s5) (35.00Mbit) (35.00Mbit) (s3, h1) (35.00Mb
it) (35.00Mbit) (s3, h2) (35.00Mbit) (35.00Mbit) (s3, h3) (35.00Mbit) (35.00Mbit
) (s4, h4) (35.00Mbit) (35.00Mbit) (s4, h5) (35.00Mbit) (35.00Mbit) (s4, h6) (35
.00Mbit) (35.00Mbit) (s5, h7) (35.00Mbit) (35.00Mbit) (s5, h8) (35.00Mbit) (35.0
0Mbit) (s5, h9) (35.00Mbit) (35.00Mbit) (s6, s7) (35.00Mbit) (35.00Mbit) (s6, s8
) (35.00Mbit) (35.00Mbit) (s6, s9) (35.00Mbit) (35.00Mbit) (s7, h10) (35.00Mbit)
(35.00Mbit) (s7, h11) (35.00Mbit) (35.00Mbit) (s7, h12) (35.00Mbit) (35.00Mbit)
(s8, h13) (35.00Mbit) (35.00Mbit) (s8, h14) (35.00Mbit) (35.00Mbit) (s9, h15) (
35.00Mbit) (35.00Mbit) (s9, h16) (35.00Mbit) (35.00Mbit) (s9, h17) (35.00Mbit) (
35.00Mbit) (s9, h18) (35.00Mbit) (35.00Mbit) (s10, s11) (35.00Mbit) (35.00Mbit)
(s10, s12) (35.00Mbit) (35.00Mbit) (s10, s13) (35.00Mbit) (35.00Mbit) (s11, h19)
(35.00Mbit) (35.00Mbit) (s11, h20) (35.00Mbit) (35.00Mbit) (s11, h21) (35.00Mb
it) (35.00Mbit) (s12, h22) (35.00Mbit) (35.00Mbit) (s12, h23) (35.00Mbit) (35.00M
bit) (s12, h24) (35.00Mbit) (35.00Mbit) (s13, h25) (35.00Mbit) (35.00Mbit) (s13,
h26) (35.00Mbit) (35.00Mbit) (s13, h27)
*** Configuring hosts
h1 h2 h3 h4 h5 h6 h7 h8 h9 h10 h11 h12 h13 h14 h15 h16 h17 h18 h19 h20 h21 h22 h
23 h24 h25 h26 h27
*** Starting controller
c0
*** Starting 13 switches
s1 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13 ... (35.00Mbit) (35.00Mbit) (35.00Mbit
) (35.00Mbit) (35.00Mbit) (35.00Mbit) (35.00Mbit) (35.00Mbit) (35.00Mbit) (35.00
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5.00Mbit) (35.00Mbit) (35.00Mbit) (35.00Mbit) (35.00Mbit) (35.00Mbit) (35.00Mbit
) (35.00Mbit) (35.00Mbit) (35.00Mbit) (35.00Mbit) (35.00Mbit) (35.00Mbit) (35.00
Mbit) (35.00Mbit)
*** Starting CLI:
mininet>
```

Etapa 2 → Verificação do nós: nodes

```
mininet> nodes
available nodes are:
c0 h1 h10 h11 h12 h13 h14 h15 h16 h17 h18 h19 h2 h20 h21 h22 h23 h24 h25 h26 h27 h3 h4 h5 h6 h7 h8 h9 s1 s10 s11 s12 s13 s2 s3 s4 s5 s6 s7 s8 s9
mininet>
```

Etapa 3 → Verificação de MAC, IP: `h1 ifconfig -a` e `h2 ifconfig -a`

| h1 ifconfig -a | h2 ifconfig -a |
|--|--|
| <pre>mininet> h1 ifconfig -a 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:1 RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)</pre> | <pre>mininet> h2 ifconfig -a 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:1 RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)</pre> |

Etapa 4 → Verificação das portas: net

```
mininet> net
s1 s1-eth1:s2-eth4 s1-eth2:s6-eth4 s1-eth3:s10-eth4
s2 s2-eth1:s3-eth4 s2-eth2:s4-eth4 s2-eth3:s5-eth4 s2-eth4:s1-eth1
s3 s3-eth1:h1-eth0 s3-eth2:h5-eth0 s3-eth3:h3-eth0 s3-eth4:s2-eth1
s4 s4-eth1:h4-eth0 s4-eth2:h5-eth0 s4-eth3:h6-eth0 s4-eth4:s2-eth2
s5 s5-eth1:h7-eth0 s5-eth2:h8-eth0 s5-eth3:h9-eth0 s5-eth4:s2-eth3
s6 s6-eth1:s7-eth4 s6-eth2:h8-eth4 s6-eth3:s9-eth4 s6-eth4:s1-eth2
s7 s7-eth1:h10-eth0 s7-eth2:h11-eth0 s7-eth3:h12-eth0 s7-eth4:s6-eth1
s8 s8-eth1:h13-eth0 s8-eth2:h14-eth0 s8-eth3:h15-eth0 s8-eth4:s6-eth2
s9 s9-eth1:h16-eth0 s9-eth2:h17-eth0 s9-eth3:h18-eth0 s9-eth4:s6-eth3
s10 s10-eth1:s11-eth4 s10-eth2:s12-eth4 s10-eth3:s13-eth4 s10-eth4:s1-eth3
s11 s11-eth1:h19-eth0 s11-eth2:h20-eth0 s11-eth3:h21-eth0 s11-eth4:s10-eth1
s12 s12-eth1:h22-eth0 s12-eth2:h23-eth0 s12-eth3:h24-eth0 s12-eth4:s10-eth2
s13 s13-eth1:h25-eth0 s13-eth2:h26-eth0 s13-eth3:h27-eth0 s13-eth4:s10-eth3
```

Etapla 5 → Teste de ping para todos os nós: pingall

```
mininet> pingall
*** Ping: testing ping reachability
h1 -> h2 h3 h4 h5 h6 h7 h8 h9 h10 h11 h12 h13 h14 h15 h16 h17 h18 h19 h20 h21 h22 h23 h24 h25 h26 h27
h2 -> h1 h3 h4 h5 h6 h7 h8 h9 h10 h11 h12 h13 h14 h15 h16 h17 h18 h19 h20 h21 h22 h23 h24 h25 h26 h27
h3 -> h1 h2 h4 h5 h6 h7 h8 h9 h10 h11 h12 h13 h14 h15 h16 h17 h18 h19 h20 h21 h22 h23 h24 h25 h26 h27
h4 -> h1 h2 h3 h5 h6 h7 h8 h9 h10 h11 h12 h13 h14 h15 h16 h17 h18 h19 h20 h21 h22 h23 h24 h25 h26 h27
h5 -> h1 h2 h3 h4 h6 h7 h8 h9 h10 h11 h12 h13 h14 h15 h16 h17 h18 h19 h20 h21 h22 h23 h24 h25 h26 h27
h6 -> h1 h2 h3 h4 h5 h7 h8 h9 h10 h11 h12 h13 h14 h15 h16 h17 h18 h19 h20 h21 h22 h23 h24 h25 h26 h27
h7 -> h1 h2 h3 h4 h5 h6 h8 h9 h10 h11 h12 h13 h14 h15 h16 h17 h18 h19 h20 h21 h22 h23 h24 h25 h26 h27
h8 -> h1 h2 h3 h4 h5 h6 h7 h9 h10 h11 h12 h13 h14 h15 h16 h17 h18 h19 h20 h21 h22 h23 h24 h25 h26 h27
h9 -> h1 h2 h3 h4 h5 h6 h7 h8 h10 h11 h12 h13 h14 h15 h16 h17 h18 h19 h20 h21 h22 h23 h24 h25 h26 h27
h10 -> h1 h2 h3 h4 h5 h6 h7 h8 h9 h11 h12 h13 h14 h15 h16 h17 h18 h19 h20 h21 h22 h23 h24 h25 h26 h27
h11 -> h1 h2 h3 h4 h5 h6 h7 h8 h9 h10 h12 h13 h14 h15 h16 h17 h18 h19 h20 h21 h22 h23 h24 h25 h26 h27
h12 -> h1 h2 h3 h4 h5 h6 h7 h8 h9 h10 h11 h13 h14 h15 h16 h17 h18 h19 h20 h21 h22 h23 h24 h25 h26 h27
h13 -> h1 h2 h3 h4 h5 h6 h7 h8 h9 h10 h11 h12 h14 h15 h16 h17 h18 h19 h20 h21 h22 h23 h24 h25 h26 h27
h14 -> h1 h2 h3 h4 h5 h6 h7 h8 h9 h10 h11 h12 h13 h15 h16 h17 h18 h19 h20 h21 h22 h23 h24 h25 h26 h27
h15 -> h1 h2 h3 h4 h5 h6 h7 h8 h9 h10 h11 h12 h13 h14 h16 h17 h18 h19 h20 h21 h22 h23 h24 h25 h26 h27
h16 -> h1 h2 h3 h4 h5 h6 h7 h8 h9 h10 h11 h12 h13 h14 h15 h17 h18 h19 h20 h21 h22 h23 h24 h25 h26 h27
h17 -> h1 h2 h3 h4 h5 h6 h7 h8 h9 h10 h11 h12 h13 h14 h15 h16 h18 h19 h20 h21 h22 h23 h24 h25 h26 h27
h18 -> h1 h2 h3 h4 h5 h6 h7 h8 h9 h10 h11 h12 h13 h14 h15 h16 h17 h19 h20 h21 h22 h23 h24 h25 h26 h27
h19 -> h1 h2 h3 h4 h5 h6 h7 h8 h9 h10 h11 h12 h13 h14 h15 h16 h17 h18 h20 h21 h22 h23 h24 h25 h26 h27
h20 -> h1 h2 h3 h4 h5 h6 h7 h8 h9 h10 h11 h12 h13 h14 h15 h16 h17 h18 h19 h21 h22 h23 h24 h25 h26 h27
h21 -> h1 h2 h3 h4 h5 h6 h7 h8 h9 h10 h11 h12 h13 h14 h15 h16 h17 h18 h19 h20 h22 h23 h24 h25 h26 h27
h22 -> h1 h2 h3 h4 h5 h6 h7 h8 h9 h10 h11 h12 h13 h14 h15 h16 h17 h18 h19 h20 h21 h23 h24 h25 h26 h27
h23 -> h1 h2 h3 h4 h5 h6 h7 h8 h9 h10 h11 h12 h13 h14 h15 h16 h17 h18 h19 h20 h21 h22 h24 h25 h26 h27
h24 -> h1 h2 h3 h4 h5 h6 h7 h8 h9 h10 h11 h12 h13 h14 h15 h16 h17 h18 h19 h20 h21 h22 h23 h25 h26 h27
h25 -> h1 h2 h3 h4 h5 h6 h7 h8 h9 h10 h11 h12 h13 h14 h15 h16 h17 h18 h19 h20 h21 h22 h23 h24 h26 h27
h26 -> h1 h2 h3 h4 h5 h6 h7 h8 h9 h10 h11 h12 h13 h14 h15 h16 h17 h18 h19 h20 h21 h22 h23 h24 h25 h27
h27 -> h1 h2 h3 h4 h5 h6 h7 h8 h9 h10 h11 h12 h13 h14 h15 h16 h17 h18 h19 h20 h21 h22 h23 h24 h25 h26
*** Results: 0% dropped (702/702 received)
```

Etapla 6 → Configurando h1 como servidor: iperf -s -p 5555 -i 1

```
"Node: h1"
root@mininet-vm:~# iperf -s -p 5555 -i 1
-----
Server listening on TCP port 5555
TCP window size: 85.3 KByte (default)
-----
[ 88] local 10.0.0.1 port 5555 connected with 10.0.0.2 port 38150
[ ID] Interval      Transfer    Bandwidth
[ 88] 0.0- 1.0 sec  1.62 MBytes 13.6 Mbits/sec
[ 88] 1.0- 2.0 sec  1.64 MBytes 13.7 Mbits/sec
[ 88] 2.0- 3.0 sec  1.65 MBytes 13.9 Mbits/sec
[ 88] 3.0- 4.0 sec  1.62 MBytes 13.6 Mbits/sec
[ 88] 4.0- 5.0 sec  1.61 MBytes 13.5 Mbits/sec
[ 88] 5.0- 6.0 sec  1.64 MBytes 13.8 Mbits/sec
[ 88] 6.0- 7.0 sec  1.63 MBytes 13.7 Mbits/sec
[ 88] 7.0- 8.0 sec  1.63 MBytes 13.7 Mbits/sec
[ 88] 8.0- 9.0 sec  1.67 MBytes 14.0 Mbits/sec
[ 88] 9.0-10.0 sec  1.63 MBytes 13.7 Mbits/sec
[ 88] 0.0-10.2 sec 16.8 MBytes 13.7 Mbits/sec
^
```

Etapla 7 → Configurando h2 como cliente: iperf -c 10.0.0.1 -p 5555 -i -t 20

```
"Node: h2"
root@mininet-vm:~# iperf -c 10.0.0.1 -p 5555 -i -t 20
WARNING: interval too small, increasing from 0.00 to 0.5 seconds.
iperf: ignoring extra argument -- 20
-----
Client connecting to 10.0.0.1, TCP port 5555
TCP window size: 85.3 KByte (default)
-----
[ 87] local 10.0.0.2 port 38150 connected with 10.0.0.1 port 5555
[ ID] Interval      Transfer    Bandwidth
[ 87] 0.0- 0.5 sec  1.12 MBytes 18.9 Mbits/sec
[ 87] 0.5- 1.0 sec  768 KBytes 12.6 Mbits/sec
[ 87] 1.0- 1.5 sec  896 KBytes 14.7 Mbits/sec
[ 87] 1.5- 2.0 sec  768 KBytes 12.6 Mbits/sec
[ 87] 2.0- 2.5 sec  896 KBytes 14.7 Mbits/sec
[ 87] 2.5- 3.0 sec  896 KBytes 14.7 Mbits/sec
[ 87] 3.0- 3.5 sec  768 KBytes 12.6 Mbits/sec
[ 87] 3.5- 4.0 sec  896 KBytes 14.7 Mbits/sec
[ 87] 4.0- 4.5 sec  768 KBytes 12.6 Mbits/sec
[ 87] 4.5- 5.0 sec  896 KBytes 14.7 Mbits/sec
[ 87] 5.0- 5.5 sec  768 KBytes 12.6 Mbits/sec
[ 87] 5.5- 6.0 sec  768 KBytes 12.6 Mbits/sec
[ 87] 6.0- 6.5 sec  768 KBytes 12.6 Mbits/sec
[ 87] 6.5- 7.0 sec  896 KBytes 14.7 Mbits/sec
[ 87] 7.0- 7.5 sec  896 KBytes 14.7 Mbits/sec
[ 87] 7.5- 8.0 sec  768 KBytes 12.6 Mbits/sec
[ 87] 8.0- 8.5 sec  896 KBytes 14.7 Mbits/sec
[ 87] 8.5- 9.0 sec  768 KBytes 12.6 Mbits/sec
[ 87] 9.0- 9.5 sec  896 KBytes 14.7 Mbits/sec
[ 87] 9.5-10.0 sec  896 KBytes 14.7 Mbits/sec
[ 87] 0.0-10.1 sec 16.8 MBytes 13.9 Mbits/sec
root@mininet-vm:~#
```