

Trabalho Mininet

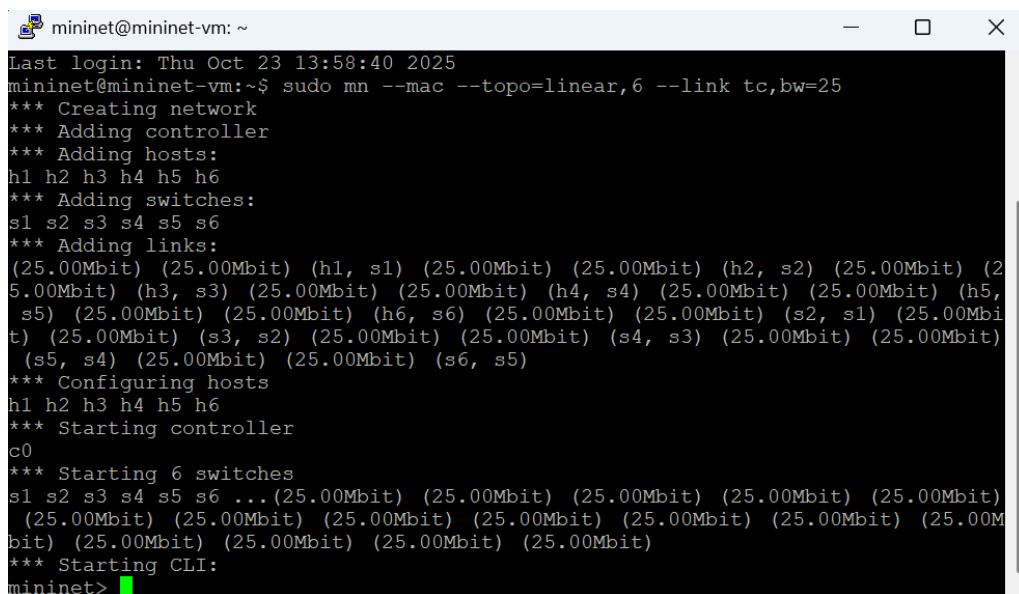
Introdução

Este trabalho apresenta o desenvolvimento de uma topologia linear utilizando o emulador de redes Mininet. O objetivo é compreender, de forma prática, a criação de uma rede composta por seis switches interconectados, configurando largura de banda, endereçamento e executando testes de comunicação e desempenho entre os nós adquiridos durante as aulas de Conceitos e Tecnologias para Dispositivos Conectados.

Topologia

Uma topologia de rede linear com 6 switch, considerando o endereço MAC padronizado e larguras de banda bw de 25Mbps.

Comando utilizado: `sudo mn --mac --topo=linear,6 --link tc,bw=25`

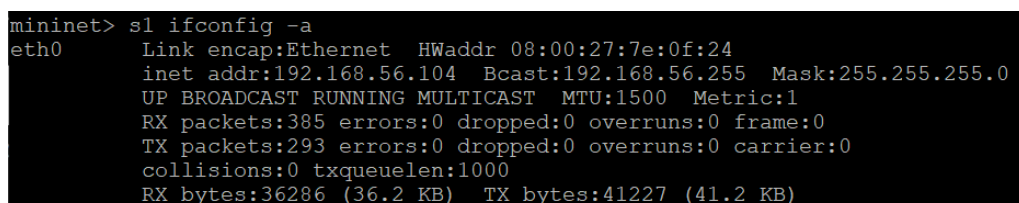


```
mininet@mininet-vm: ~
Last login: Thu Oct 23 13:58:40 2025
mininet@mininet-vm:~$ sudo mn --mac --topo=linear,6 --link tc,bw=25
*** Creating network
*** Adding controller
*** Adding hosts:
h1 h2 h3 h4 h5 h6
*** Adding switches:
s1 s2 s3 s4 s5 s6
*** Adding links:
(25.00Mbit) (25.00Mbit) (h1, s1) (25.00Mbit) (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
s1 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) (25.00M
bit) (25.00Mbit) (25.00Mbit) (25.00Mbit) (25.00Mbit) (25.00Mbit)
*** Starting CLI:
mininet>
```

Informações da topologia

Configurações:

Switch 1:



```
mininet> s1 ifconfig -a
eth0      Link encap:Ethernet  HWaddr 08:00:27:7e:0f:24
          inet addr:192.168.56.104  Bcast:192.168.56.255  Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:385 errors:0 dropped:0 overruns:0 frame:0
          TX packets:293 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:36286 (36.2 KB)  TX bytes:41227 (41.2 KB)
```

Host 1:

```
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)
```

Host 2:

```
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)
```

Host 3:

```
mininet> h3 ifconfig -a
h3-eth0  Link encap:Ethernet  HWaddr 00:00:00:00:00:03
         inet addr:10.0.0.3  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)
```

Host 4:

```
mininet> h4 ifconfig -a
h4-eth0  Link encap:Ethernet  HWaddr 00:00:00:00:00:04
         inet addr:10.0.0.4  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)
```

Host 5:

```
mininet> h5 ifconfig -a
h5-eth0  Link encap:Ethernet  HWaddr 00:00:00:00:00:05
         inet addr:10.0.0.5  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)
```

Host 6:

```
mininet> h6 ifconfig -a
h6-eth0    Link encap:Ethernet  HWaddr 00:00:00:00:00:06
           inet addr:10.0.0.6  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)
```

Dump da topologia (endereços IP):

```
mininet> dump
<Host h1: h1-eth0:10.0.0.1 pid=1742>
<Host h2: h2-eth0:10.0.0.2 pid=1744>
<Host h3: h3-eth0:10.0.0.3 pid=1746>
<Host h4: h4-eth0:10.0.0.4 pid=1748>
<Host h5: h5-eth0:10.0.0.5 pid=1750>
<Host h6: h6-eth0:10.0.0.6 pid=1752>
<OVSSwitch s1: lo:127.0.0.1,s1-eth1:None,s1-eth2:None pid=1757>
<OVSSwitch s2: lo:127.0.0.1,s2-eth1:None,s2-eth2:None,s2-eth3:None pid=1760>
<OVSSwitch s3: lo:127.0.0.1,s3-eth1:None,s3-eth2:None,s3-eth3:None pid=1763>
<OVSSwitch s4: lo:127.0.0.1,s4-eth1:None,s4-eth2:None,s4-eth3:None pid=1766>
<OVSSwitch s5: lo:127.0.0.1,s5-eth1:None,s5-eth2:None,s5-eth3:None pid=1769>
<OVSSwitch s6: lo:127.0.0.1,s6-eth1:None,s6-eth2:None pid=1772>
<Controller c0: 127.0.0.1:6653 pid=1735>
```

Net da topologia:

```
mininet> net
h1 h1-eth0:s1-eth1
h2 h2-eth0:s2-eth1
h3 h3-eth0:s3-eth1
h4 h4-eth0:s4-eth1
h5 h5-eth0:s5-eth1
h6 h6-eth0:s6-eth1
s1 lo: s1-eth1:h1-eth0 s1-eth2:s2-eth2
s2 lo: s2-eth1:h2-eth0 s2-eth2:s1-eth2 s2-eth3:s3-eth2
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 lo: s5-eth1:h5-eth0 s5-eth2:s4-eth3 s5-eth3:s6-eth2
s6 lo: s6-eth1:h6-eth0 s6-eth2:s5-eth3
c0
```

Nós da topologia:

```
mininet> nodes
available nodes are:
c0 h1 h2 h3 h4 h5 h6 s1 s2 s3 s4 s5 s6
```

Execução dos testes de ping

1 - pingall:

```
mininet> pingall
*** Ping: testing ping reachability
h1 -> 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)
```

2 – h3 ping -c 4 h5:

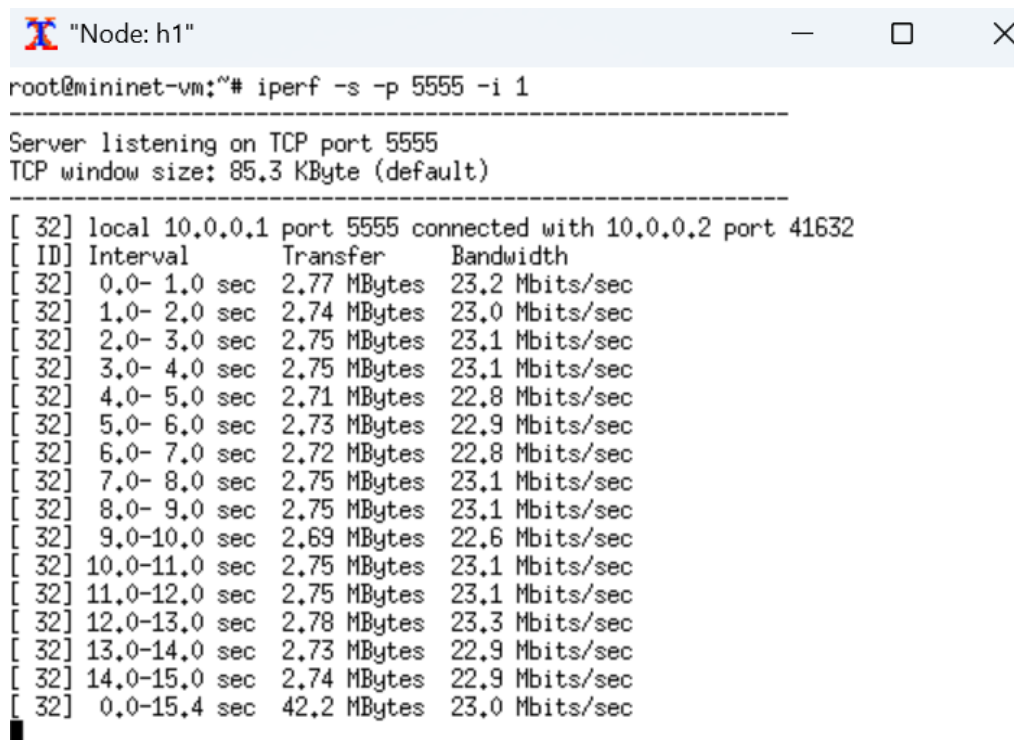
```
mininet> h3 ping -c 4 h5
PING 10.0.0.5 (10.0.0.5) 56(84) bytes of data.
64 bytes from 10.0.0.5: icmp_seq=1 ttl=64 time=1.76 ms
64 bytes from 10.0.0.5: icmp_seq=2 ttl=64 time=0.073 ms
64 bytes from 10.0.0.5: icmp_seq=3 ttl=64 time=0.140 ms
64 bytes from 10.0.0.5: icmp_seq=4 ttl=64 time=0.144 ms

--- 10.0.0.5 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3001ms
rtt min/avg/max/mdev = 0.073/0.529/1.762/0.712 ms
```

Execução dos testes de iperf:

Host 1 será um servidor e o host 2 um cliente:

Host 1:



```
root@mininet-vm:~# iperf -s -p 5555 -i 1

-----
Server listening on TCP port 5555
TCP window size: 85.3 KByte (default)
-----
[ 32] local 10.0.0.1 port 5555 connected with 10.0.0.2 port 41632
[ ID] Interval      Transfer    Bandwidth
[ 32] 0.0- 1.0 sec  2.77 MBytes 23.2 Mbits/sec
[ 32] 1.0- 2.0 sec  2.74 MBytes 23.0 Mbits/sec
[ 32] 2.0- 3.0 sec  2.75 MBytes 23.1 Mbits/sec
[ 32] 3.0- 4.0 sec  2.75 MBytes 23.1 Mbits/sec
[ 32] 4.0- 5.0 sec  2.71 MBytes 22.8 Mbits/sec
[ 32] 5.0- 6.0 sec  2.73 MBytes 22.9 Mbits/sec
[ 32] 6.0- 7.0 sec  2.72 MBytes 22.8 Mbits/sec
[ 32] 7.0- 8.0 sec  2.75 MBytes 23.1 Mbits/sec
[ 32] 8.0- 9.0 sec  2.75 MBytes 23.1 Mbits/sec
[ 32] 9.0-10.0 sec  2.69 MBytes 22.6 Mbits/sec
[ 32] 10.0-11.0 sec 2.75 MBytes 23.1 Mbits/sec
[ 32] 11.0-12.0 sec 2.75 MBytes 23.1 Mbits/sec
[ 32] 12.0-13.0 sec 2.78 MBytes 23.3 Mbits/sec
[ 32] 13.0-14.0 sec 2.73 MBytes 22.9 Mbits/sec
[ 32] 14.0-15.0 sec 2.74 MBytes 22.9 Mbits/sec
[ 32] 0.0-15.4 sec 42.2 MBytes 23.0 Mbits/sec
```

Host 2:



"Node: h2"



```
root@mininet-vm:~# 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)  
-----
```

```
[ 31] local 10.0.0.2 port 41632 connected with 10.0.0.1 port 5555  
[ ID] Interval      Transfer    Bandwidth  
[ 31] 0.0- 1.0 sec   3.88 MBytes 32.5 Mbits/sec  
[ 31] 1.0- 2.0 sec   2.62 MBytes 22.0 Mbits/sec  
[ 31] 2.0- 3.0 sec   3.00 MBytes 25.2 Mbits/sec  
[ 31] 3.0- 4.0 sec   2.62 MBytes 22.0 Mbits/sec  
[ 31] 4.0- 5.0 sec   2.62 MBytes 22.0 Mbits/sec  
[ 31] 5.0- 6.0 sec   2.62 MBytes 22.0 Mbits/sec  
[ 31] 6.0- 7.0 sec   3.00 MBytes 25.2 Mbits/sec  
[ 31] 7.0- 8.0 sec   2.62 MBytes 22.0 Mbits/sec  
[ 31] 8.0- 9.0 sec   2.62 MBytes 22.0 Mbits/sec  
[ 31] 9.0-10.0 sec   3.00 MBytes 25.2 Mbits/sec  
[ 31] 10.0-11.0 sec  2.62 MBytes 22.0 Mbits/sec  
[ 31] 11.0-12.0 sec  2.62 MBytes 22.0 Mbits/sec  
[ 31] 12.0-13.0 sec  3.00 MBytes 25.2 Mbits/sec  
[ 31] 13.0-14.0 sec  2.62 MBytes 22.0 Mbits/sec  
[ 31] 14.0-15.0 sec  2.62 MBytes 22.0 Mbits/sec  
[ 31] 0.0-15.1 sec  42.2 MBytes 23.5 Mbits/sec  
root@mininet-vm:~#
```