

# C115

# Trabalho de Mininet

## (Aprendizado)

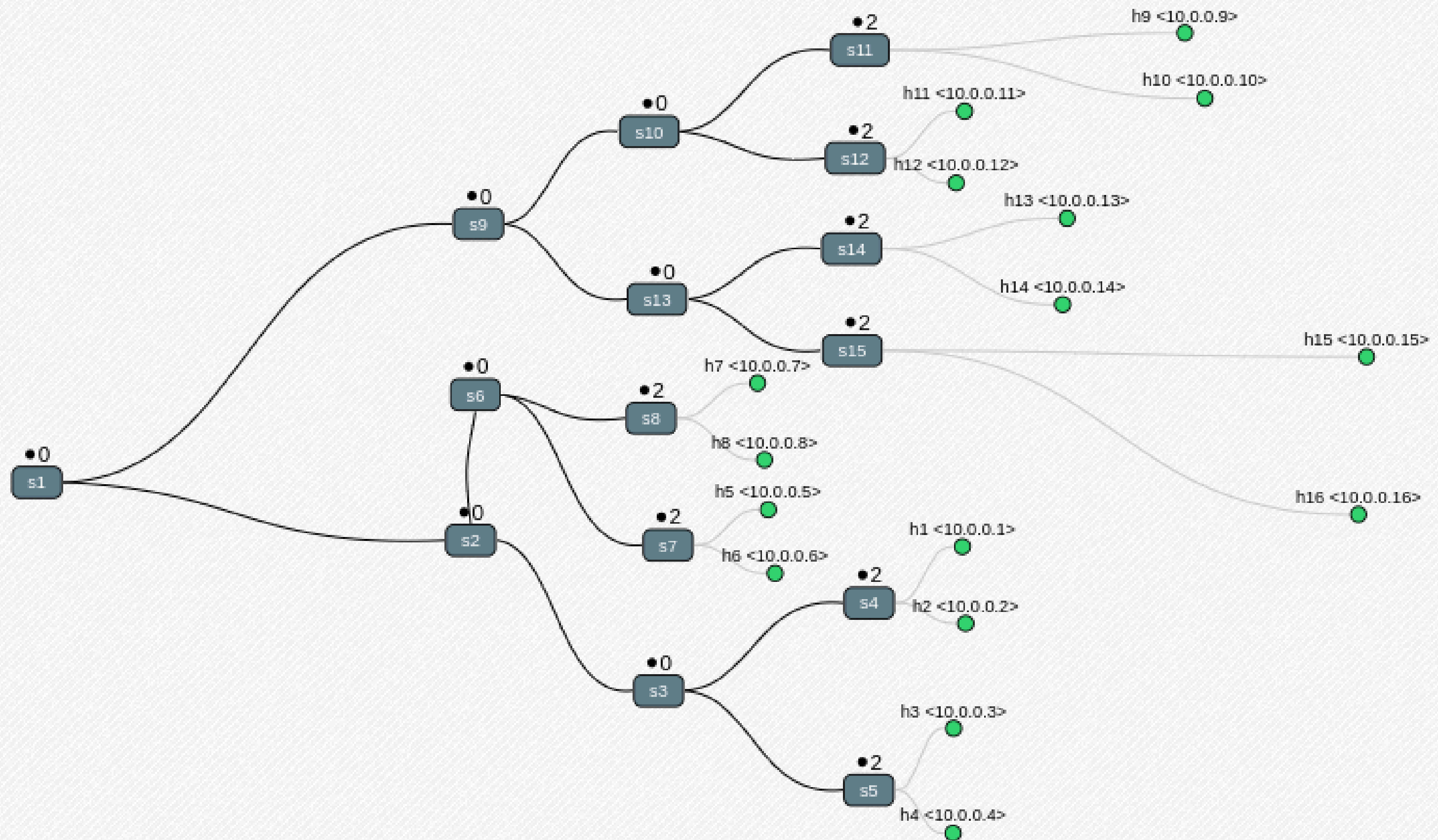
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# Criando a topologia

**MAC padronizado | bandwidth = 35Mbps | controlador mininet**

The image shows a terminal window titled "mininet@mininet-vm: ~" with a subtitle "mininet@mininet-vm: ~ 190x42". The terminal displays the execution of a Mininet script. The command entered is "sudo -E mn --topo=tree,depth=4,fanout=2 --mac --link tc,bw=25". The output shows the network creation process: "Creating network", "Adding controller", "Adding hosts" (listing h1 through h16), "Adding switches" (listing s1 through s15), and "Adding links" (listing 25 links between switches and hosts). The network is then configured: "Configuring hosts", "Starting controller", and "Starting 15 switches". The terminal ends with "mininet>". The background of the terminal window is red. The desktop environment is visible at the bottom, showing various application icons.



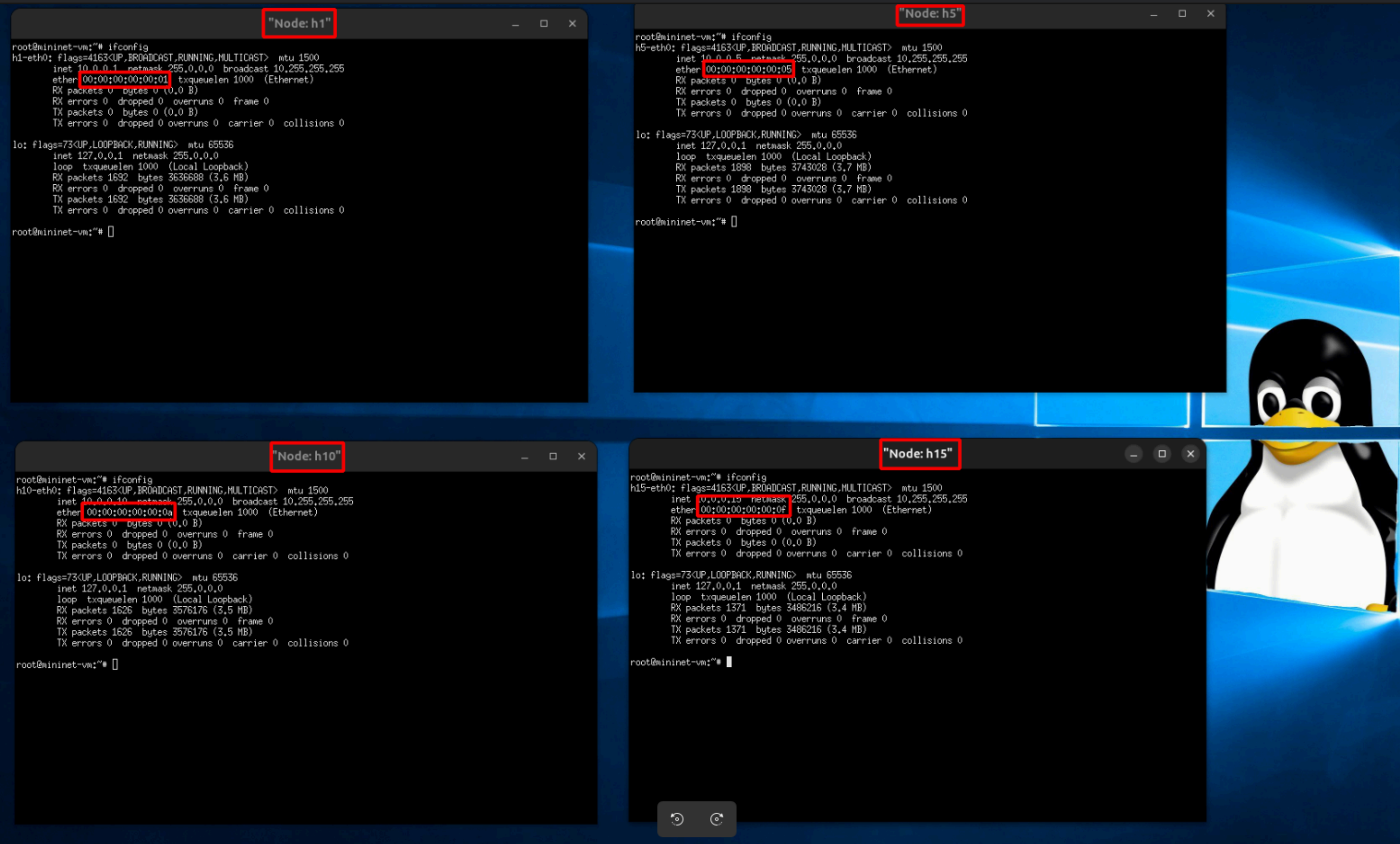
[Link: Mininet Topology Visualizer](#)

# Endereços IP

```
mininet> dump
<Host h1: h1-eth0:10.0.0.1 pid=3413>
<Host h2: h2-eth0:10.0.0.2 pid=3415>
<Host h3: h3-eth0:10.0.0.3 pid=3417>
<Host h4: h4-eth0:10.0.0.4 pid=3419>
<Host h5: h5-eth0:10.0.0.5 pid=3421>
<Host h6: h6-eth0:10.0.0.6 pid=3423>
<Host h7: h7-eth0:10.0.0.7 pid=3425>
<Host h8: h8-eth0:10.0.0.8 pid=3427>
<Host h9: h9-eth0:10.0.0.9 pid=3429>
<Host h10: h10-eth0:10.0.0.10 pid=3431>
<Host h11: h11-eth0:10.0.0.11 pid=3433>
<Host h12: h12-eth0:10.0.0.12 pid=3435>
<Host h13: h13-eth0:10.0.0.13 pid=3437>
<Host h14: h14-eth0:10.0.0.14 pid=3439>
<Host h15: h15-eth0:10.0.0.15 pid=3441>
<Host h16: h16-eth0:10.0.0.16 pid=3443>
<OVSSwitch s1: lo:127.0.0.1,s1-eth1:None,s1-eth2:None pid=3448>
<OVSSwitch s2: lo:127.0.0.1,s2-eth1:None,s2-eth2:None,s2-eth3:None pid=3451>
<OVSSwitch s3: lo:127.0.0.1,s3-eth1:None,s3-eth2:None,s3-eth3:None pid=3454>
<OVSSwitch s4: lo:127.0.0.1,s4-eth1:None,s4-eth2:None,s4-eth3:None pid=3457>
<OVSSwitch s5: lo:127.0.0.1,s5-eth1:None,s5-eth2:None,s5-eth3:None pid=3460>
<OVSSwitch s6: lo:127.0.0.1,s6-eth1:None,s6-eth2:None,s6-eth3:None pid=3463>
<OVSSwitch s7: lo:127.0.0.1,s7-eth1:None,s7-eth2:None,s7-eth3:None pid=3466>
<OVSSwitch s8: lo:127.0.0.1,s8-eth1:None,s8-eth2:None,s8-eth3:None pid=3469>
<OVSSwitch s9: lo:127.0.0.1,s9-eth1:None,s9-eth2:None,s9-eth3:None pid=3472>
<OVSSwitch s10: lo:127.0.0.1,s10-eth1:None,s10-eth2:None,s10-eth3:None pid=3475>
<OVSSwitch s11: lo:127.0.0.1,s11-eth1:None,s11-eth2:None,s11-eth3:None pid=3478>
<OVSSwitch s12: lo:127.0.0.1,s12-eth1:None,s12-eth2:None,s12-eth3:None pid=3481>
<OVSSwitch s13: lo:127.0.0.1,s13-eth1:None,s13-eth2:None,s13-eth3:None pid=3484>
<OVSSwitch s14: lo:127.0.0.1,s14-eth1:None,s14-eth2:None,s14-eth3:None pid=3487>
<OVSSwitch s15: lo:127.0.0.1,s15-eth1:None,s15-eth2:None,s15-eth3:None pid=3490>
<Controller c0: 127.0.0.1:6653 pid=3406>
mininet>
```



# Endereços MAC (hosts)



The image displays four terminal windows, each showing the output of the `ifconfig` command for a specific node. The MAC addresses are highlighted with red boxes:

- Node: h1**: `ether 00:00:00:00:00:01`
- Node: h5**: `ether 00:00:00:00:00:05`
- Node: h10**: `ether 00:00:00:00:00:0a`
- Node: h15**: `ether 00:00:00:00:00:0f`

Each terminal window also shows the configuration for the loopback interface `lo` and the Ethernet interface `h1-eth0` (or `h5-eth0`, `h10-eth0`, `h15-eth0`). The background of the terminal windows features a blue gradient with a penguin character in the bottom right corner.

# Endereços MAC (switch)

```
"Node: s1" (root)
RX packets 27795 bytes 31825212 (31.8 MB)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 27795 bytes 31825212 (31.8 MB)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

s1-eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
ether 8a:4a:ed:c1:45:0c txqueuelen 1000 (Ethernet)
RX packets 0 bytes 0 (0.0 B)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 0 bytes 0 (0.0 B)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

s1-eth2: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
ether 16:00:5b:74:70:9a txqueuelen 1000 (Ethernet)
RX packets 0 bytes 0 (0.0 B)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 0 bytes 0 (0.0 B)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

s10-eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
ether d6:c9:d4:c0:91:c0 txqueuelen 1000 (Ethernet)
RX packets 0 bytes 0 (0.0 B)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 0 bytes 0 (0.0 B)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

s10-eth2: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
ether b6:d1:f8:d6:e3:ea txqueuelen 1000 (Ethernet)
RX packets 0 bytes 0 (0.0 B)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 0 bytes 0 (0.0 B)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

"Node: s5" (root)
s4-eth3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
ether 6e:67:78:0c:c3:59 txqueuelen 1000 (Ethernet)
RX packets 0 bytes 0 (0.0 B)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 0 bytes 0 (0.0 B)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

s5-eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
ether 06:91:4b:1f:f1:e1 txqueuelen 1000 (Ethernet)
RX packets 0 bytes 0 (0.0 B)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 0 bytes 0 (0.0 B)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

s5-eth2: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
ether 72:79:c6:29:10:21 txqueuelen 1000 (Ethernet)
RX packets 0 bytes 0 (0.0 B)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 0 bytes 0 (0.0 B)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

s5-eth3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
ether 7a:b7:2c:91:3e:e3 txqueuelen 1000 (Ethernet)
RX packets 0 bytes 0 (0.0 B)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 0 bytes 0 (0.0 B)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

s6-eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
ether e6:47:df:08:b7:48 txqueuelen 1000 (Ethernet)
RX packets 0 bytes 0 (0.0 B)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 0 bytes 0 (0.0 B)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

"Node: s10" (root)
s1-eth2: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
ether 16:00:5b:74:70:9a txqueuelen 1000 (Ethernet)
RX packets 0 bytes 0 (0.0 B)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 0 bytes 0 (0.0 B)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

s10-eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
ether d6:c9:d4:c0:91:c0 txqueuelen 1000 (Ethernet)
RX packets 0 bytes 0 (0.0 B)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 0 bytes 0 (0.0 B)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

s10-eth2: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
ether b6:d1:f8:d6:e3:ea txqueuelen 1000 (Ethernet)
RX packets 0 bytes 0 (0.0 B)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 0 bytes 0 (0.0 B)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

s10-eth3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
ether c2:3b:c4:82:17:31 txqueuelen 1000 (Ethernet)
RX packets 0 bytes 0 (0.0 B)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 0 bytes 0 (0.0 B)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

s11-eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
ether 8a:9b:f3:92:24:5f txqueuelen 1000 (Ethernet)
RX packets 0 bytes 0 (0.0 B)
RX errors 0 dropped 0 overruns 0 frame 0

"Node: s15" (root)
ether 7e:06:5a:fd:61:51 txqueuelen 1000 (Ethernet)
RX packets 0 bytes 0 (0.0 B)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 0 bytes 0 (0.0 B)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

s15-eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
ether 5a:33:63:49:90:0e txqueuelen 1000 (Ethernet)
RX packets 0 bytes 0 (0.0 B)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 0 bytes 0 (0.0 B)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

s15-eth2: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
ether 5a:f2:ca:f7:30:1a txqueuelen 1000 (Ethernet)
RX packets 0 bytes 0 (0.0 B)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 0 bytes 0 (0.0 B)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

s15-eth3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
ether 1a:43:71:7b:d7:d3 txqueuelen 1000 (Ethernet)
RX packets 0 bytes 0 (0.0 B)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 0 bytes 0 (0.0 B)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

s2-eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
ether 22:96:b2:7f:e7:db txqueuelen 1000 (Ethernet)
RX packets 0 bytes 0 (0.0 B)
RX errors 0 dropped 0 overruns 0 frame 0
```

# Pings

```
mininet> pingall
*** Ping: testing ping reachability
h1 -> h2 h3 h4 h5 h6 h7 h8 h9 h10 h11 h12 h13 h14 h15 h16
h2 -> h1 h3 h4 h5 h6 h7 h8 h9 h10 h11 h12 h13 h14 h15 h16
h3 -> h1 h2 h4 h5 h6 h7 h8 h9 h10 h11 h12 h13 h14 h15 h16
h4 -> h1 h2 h3 h5 h6 h7 h8 h9 h10 h11 h12 h13 h14 h15 h16
h5 -> h1 h2 h3 h4 h6 h7 h8 h9 h10 h11 h12 h13 h14 h15 h16
h6 -> h1 h2 h3 h4 h5 h7 h8 h9 h10 h11 h12 h13 h14 h15 h16
h7 -> h1 h2 h3 h4 h5 h6 h8 h9 h10 h11 h12 h13 h14 h15 h16
h8 -> h1 h2 h3 h4 h5 h6 h7 h9 h10 h11 h12 h13 h14 h15 h16
h9 -> h1 h2 h3 h4 h5 h6 h7 h8 h10 h11 h12 h13 h14 h15 h16
h10 -> h1 h2 h3 h4 h5 h6 h7 h8 h9 h11 h12 h13 h14 h15 h16
h11 -> h1 h2 h3 h4 h5 h6 h7 h8 h9 h10 h12 h13 h14 h15 h16
h12 -> h1 h2 h3 h4 h5 h6 h7 h8 h9 h10 h11 h13 h14 h15 h16
h13 -> h1 h2 h3 h4 h5 h6 h7 h8 h9 h10 h11 h12 h14 h15 h16
h14 -> h1 h2 h3 h4 h5 h6 h7 h8 h9 h10 h11 h12 h13 h15 h16
h15 -> h1 h2 h3 h4 h5 h6 h7 h8 h9 h10 h11 h12 h13 h14 h16
h16 -> h1 h2 h3 h4 h5 h6 h7 h8 h9 h10 h11 h12 h13 h14 h15
*** Results: 0% dropped (240/240 received)
```

Especificando que o host 1 na porta 5555 vai ser um servidor TCP e o host 2 um cliente e executando testes de iperf, considerando um relatório por segundo com teste de 10 segundos. Fazendo os testes para a largura de banda de **25 Mbps**

```
root@mininet-vm:~# iperf -s -p 5555
-----
Server listening on TCP port 5555
TCP window size: 85,3 KByte (default)
-----
[ 6] local 10.0.0.1 port 5555 connected with 10.0.0.2 port 46444
[ ID] Interval      Transfer    Bandwidth
[ 6] 0.0-10.1 sec  28,8 MBytes  23,9 Mbits/sec
[ ]

root@mininet-vm:~# iperf -c 10.0.0.1 -p 5555 -t 10 -i 1
-----
Client connecting to 10.0.0.1, TCP port 5555
TCP window size: 187 KByte (default)
-----
[ 5] local 10.0.0.2 port 46444 connected with 10.0.0.1 port 5555
[ ID] Interval      Transfer    Bandwidth
[ 5] 0.0- 1.0 sec  3,12 MBytes  26,2 Mbits/sec
[ 5] 1.0- 2.0 sec  2,75 MBytes  23,1 Mbits/sec
[ 5] 2.0- 3.0 sec  2,88 MBytes  24,1 Mbits/sec
[ 5] 3.0- 4.0 sec  2,88 MBytes  24,1 Mbits/sec
[ 5] 4.0- 5.0 sec  2,88 MBytes  24,1 Mbits/sec
[ 5] 5.0- 6.0 sec  2,88 MBytes  24,1 Mbits/sec
[ 5] 6.0- 7.0 sec  2,88 MBytes  24,1 Mbits/sec
[ 5] 7.0- 8.0 sec  2,88 MBytes  24,1 Mbits/sec
[ 5] 8.0- 9.0 sec  2,75 MBytes  23,1 Mbits/sec
[ 5] 9.0-10.0 sec  2,88 MBytes  24,1 Mbits/sec
[ 5] 0.0-10.0 sec  28,8 MBytes  24,0 Mbits/sec
root@mininet-vm:~#
```



**Obrigado!**