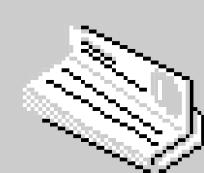
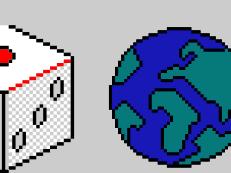
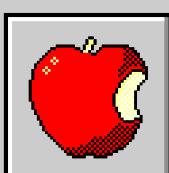
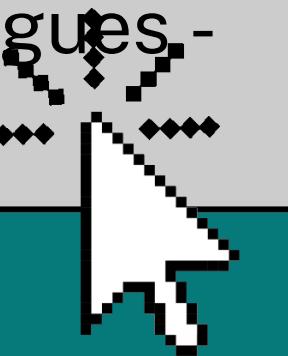


# Trabalho Final

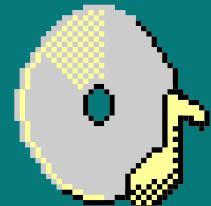
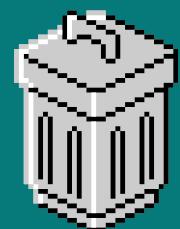
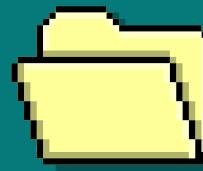
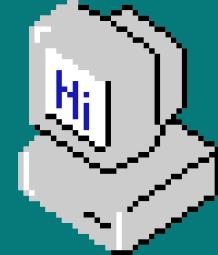
## Mininet



Igor Luiz Rodrigues -  
GEC - 1523



11:11PM



# Abrindo o mininet e logando



```
UBUNTU_MININET [Executando] - Oracle VM VirtualBox
Arquivo Máquina Visualizar Entrada Dispositivos Ajuda

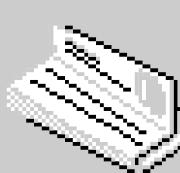
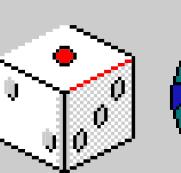
Ubuntu 20.04.1 LTS mininet-vm tty1

mininet vm login:
Password:
Welcome to Ubuntu 20.04.1 LTS (GNU/Linux 5.4.0-42-generic x86_64)

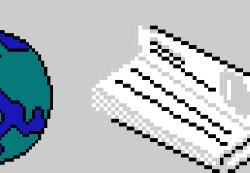
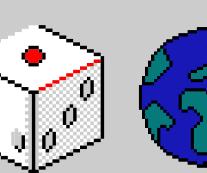
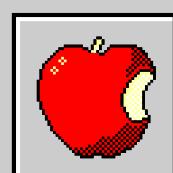
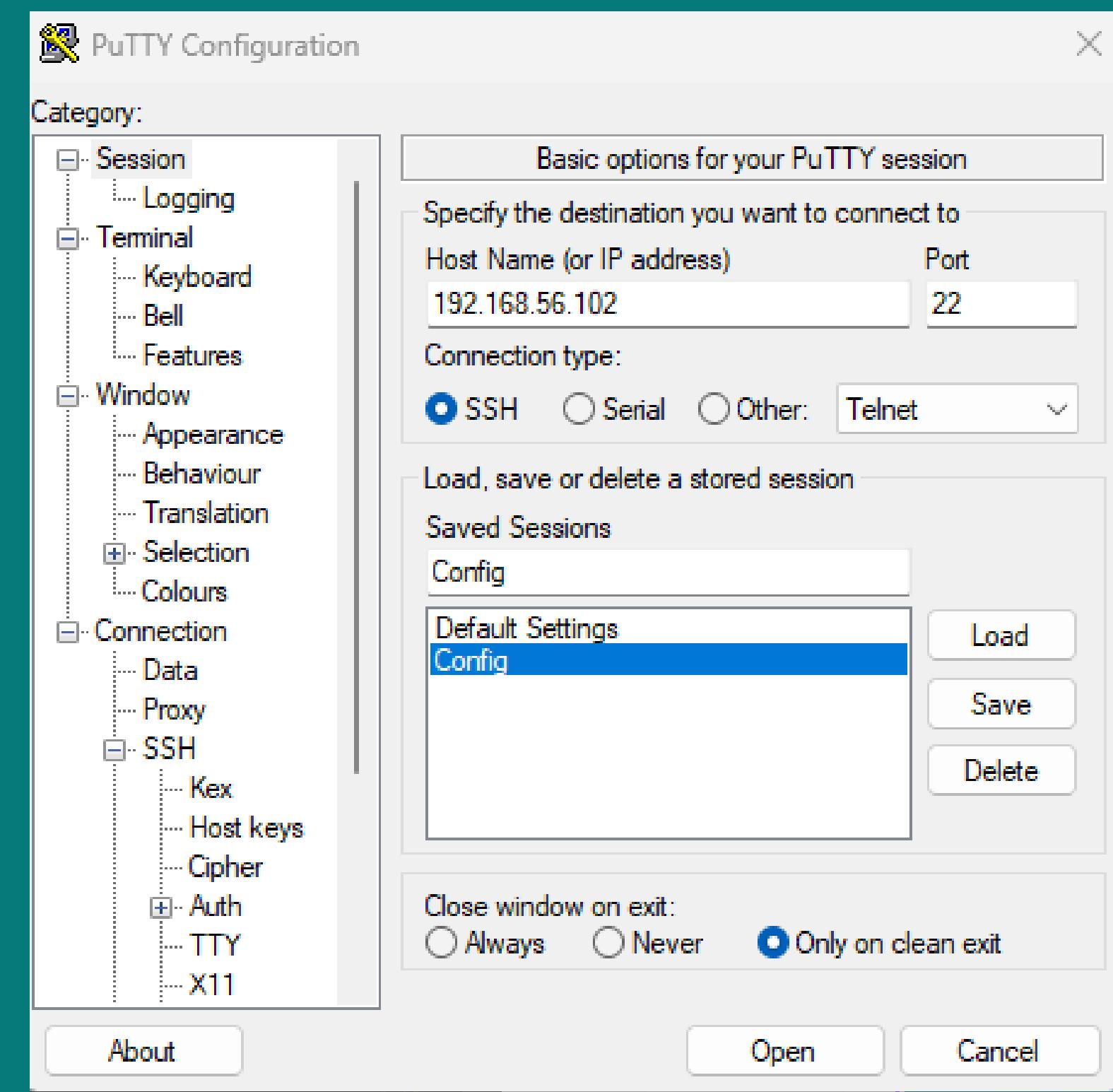
 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

Last login: Sun Oct 15 17:31:23 PDT 2023 from 192.168.56.1 on pts/32
mininet@mininet-vm:~$ _
```

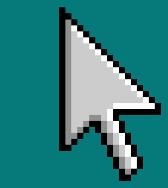
Right Control



# Abrindo o putty e configurando

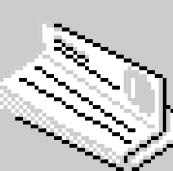
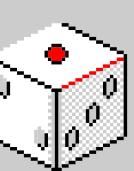
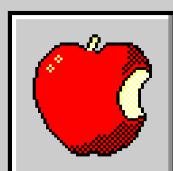


# Configurando a topologia da Tree



Tree possuindo topologia linear com 6 hosts, o endereço Mac padronizado, a largura de banda de 5Mbps e controlador do Mininet.

```
mininet@mininet-vm:~$ sudo mn --topo=linear,6 --link tc,bw=5 --mac
*** Creating network
*** Adding controller
*** Adding hosts:
h1 h2 h3 h4 h5 h6
*** Adding switches:
s1 s2 s3 s4 s5 s6
*** Adding links:
(h1, s1) (5.00Mbit) (h2, s2) (5.00Mbit) (h3, s3) (5.00Mbit)
(s4, h4) (5.00Mbit) (h5, s5) (5.00Mbit) (h6, s6) (5.00Mbit)
(s1, h1) (5.00Mbit) (s2, h2) (5.00Mbit) (s3, h3) (5.00Mbit)
(s4, h4) (5.00Mbit) (s5, h5) (5.00Mbit) (s6, h6) (5.00Mbit)
*** Configuring hosts
h1 h2 h3 h4 h5 h6
*** Starting controller
c0
*** Starting 6 switches
s1 s2 s3 s4 s5 s6 ... (5.00Mbit) (5.00Mbit) (5.00Mbit) (5.00Mbit) (5.00Mbit)
(5.00Mbit) (5.00Mbit) (5.00Mbit) (5.00Mbit) (5.00Mbit) (5.00Mbit) (5.00Mbit)
*** Starting CLI:
mininet>
```

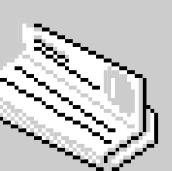
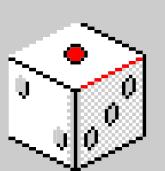
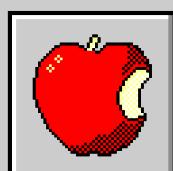


# Inspecionando as Informações da Interface

Nós: mostrando os nós da rede, através do comando “nodes”

Enlaces: mostrando os enlaces da rede, através do comando “net”

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

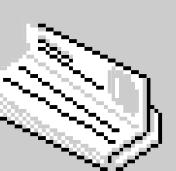
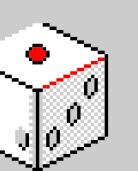


# Inspecionando as Informações da Interface



## Endereços lógicos: verificando os endereços lógicos dos dispositivos da rede através do comando "dump"

```
mininet> dump
<Host h1: h1-eth0:10.0.0.1 pid=1140>
<Host h2: h2-eth0:10.0.0.2 pid=1144>
<Host h3: h3-eth0:10.0.0.3 pid=1146>
<Host h4: h4-eth0:10.0.0.4 pid=1148>
<Host h5: h5-eth0:10.0.0.5 pid=1150>
<Host h6: h6-eth0:10.0.0.6 pid=1152>
<OVSSwitch s1: lo:127.0.0.1,s1-eth1:None,s1-eth2:None pid=1157>
<OVSSwitch s2: lo:127.0.0.1,s2-eth1:None,s2-eth2:None,s2-eth3:None pid=1160>
<OVSSwitch s3: lo:127.0.0.1,s3-eth1:None,s3-eth2:None,s3-eth3:None pid=1163>
<OVSSwitch s4: lo:127.0.0.1,s4-eth1:None,s4-eth2:None,s4-eth3:None pid=1166>
<OVSSwitch s5: lo:127.0.0.1,s5-eth1:None,s5-eth2:None,s5-eth3:None pid=1169>
<OVSSwitch s6: lo:127.0.0.1,s6-eth1:None,s6-eth2:None pid=1172>
<Controller c0: 127.0.0.1:6653 pid=1132>
mininet>
```



# Inspecionando as Informações da Interface

## Dados do Host: mostrando os dados do host h1 e h2

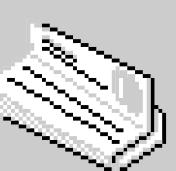
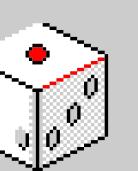
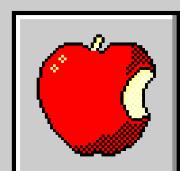
```
mininet> h1 ifconfig -a
h1-eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
      inet 10.0.0.1 netmask 255.0.0.0 broadcast 10.255.255.255
        ether 00:00:00:00:00:01 txqueuelen 1000 (Ethernet)
          RX packets 0 bytes 0 (0.0 B)
          RX errors 0 dropped 0 overruns 0 frame 0
          TX packets 0 bytes 0 (0.0 B)
          TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
      inet 127.0.0.1 netmask 255.0.0.0
        loop txqueuelen 1000 (Local Loopback)
          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

mininet> h2 ifconfig -a
h2-eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
      inet 10.0.0.2 netmask 255.0.0.0 broadcast 10.255.255.255
        ether 00:00:00:00:00:02 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

lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
      inet 127.0.0.1 netmask 255.0.0.0
        loop txqueuelen 1000 (Local Loopback)
          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

mininet>
```



# Inspecionando as Informações da Interface

## Dados do Host: mostrando os dados do host h3 e h4

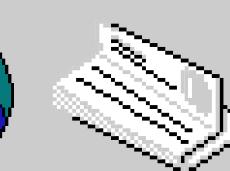
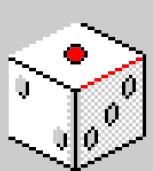
```
mininet> h3 ifconfig -a
h3-eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
        inet 10.0.0.3 netmask 255.0.0.0 broadcast 10.255.255.255
          ether 00:00:00:00:00:03 txqueuelen 1000 (Ethernet)
            RX packets 0 bytes 0 (0.0 B)
            RX errors 0 dropped 0 overruns 0 frame 0
            TX packets 0 bytes 0 (0.0 B)
            TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

        lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
          inet 127.0.0.1 netmask 255.0.0.0
            loop txqueuelen 1000 (Local Loopback)
            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

mininet> h4 ifconfig -a
h4-eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
        inet 10.0.0.4 netmask 255.0.0.0 broadcast 10.255.255.255
          ether 00:00:00:00:00:04 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

        lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
          inet 127.0.0.1 netmask 255.0.0.0
            loop txqueuelen 1000 (Local Loopback)
            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

mininet>
```



# Inspecionando as Informações da Interface



## Dados do Host: mostrando os dados do host h5 e h6

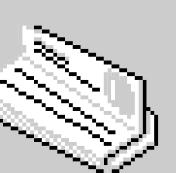
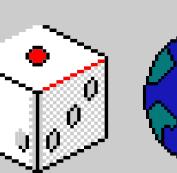
```
mininet> h5 ifconfig -a
h5-eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
        inet 10.0.0.5 netmask 255.0.0.0 broadcast 10.255.255.255
          ether 00:00:00:00:05 txqueuelen 1000 (Ethernet)
            RX packets 0 bytes 0 (0.0 B)
            RX errors 0 dropped 0 overruns 0 frame 0
            TX packets 0 bytes 0 (0.0 B)
            TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
        inet 127.0.0.1 netmask 255.0.0.0
        loop txqueuelen 1000 (Local Loopback)
          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

mininet> h6 ifconfig -a
h6-eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
        inet 10.0.0.6 netmask 255.0.0.0 broadcast 10.255.255.255
          ether 00:00:00:00:06 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

lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
        inet 127.0.0.1 netmask 255.0.0.0
        loop txqueuelen 1000 (Local Loopback)
          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

mininet> _
```



# Inspecionando as Informações da Interface

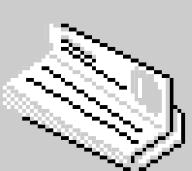
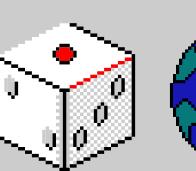
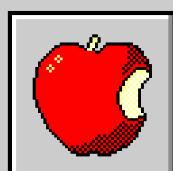
## Dados do Switch: mostrando os dados do switch s1

```
mininet@mininet-vm: ~
mininet> s1 ifconfig -a
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
        inet 10.0.2.15 netmask 255.255.255.0 broadcast 10.0.2.255
          ether 08:00:27:19:91:e0 txqueuelen 1000 (Ethernet)
            RX packets 482 bytes 54313 (54.3 KB)
            RX errors 0 dropped 0 overruns 0 frame 0
            TX packets 489 bytes 43419 (43.4 KB)
            TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
        inet 192.168.56.102 netmask 255.255.255.0 broadcast 192.168.56.255
          ether 08:00:27:d5:41:10 txqueuelen 1000 (Ethernet)
            RX packets 486 bytes 46524 (46.5 KB)
            RX errors 0 dropped 0 overruns 0 frame 0
            TX packets 298 bytes 39985 (39.9 KB)
            TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
        inet 127.0.0.1 netmask 255.0.0.0
          loop txqueuelen 1000 (Local Loopback)
            RX packets 18394 bytes 1037856 (1.0 MB)
            RX errors 0 dropped 0 overruns 0 frame 0
            TX packets 18394 bytes 1037856 (1.0 MB)
            TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

ovs-system: flags=4098<BROADCAST,MULTICAST> mtu 1500
        ether 62:a6:f9:cb:7a:9d 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
```



# Inspecionando as informações da Interface

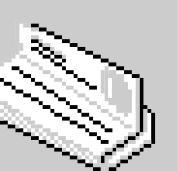
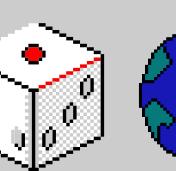
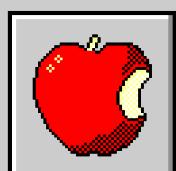
## Dados do Switch: mostrando os dados do switch s2

```
mininet@mininet-vm: ~
mininet> s2 ifconfig -a
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
        inet 10.0.2.15 netmask 255.255.255.0 broadcast 10.0.2.255
                ether 08:00:27:19:91:e0 txqueuelen 1000 (Ethernet)
                RX packets 489 bytes 54883 (54.8 KB)
                RX errors 0 dropped 0 overruns 0 frame 0
                TX packets 496 bytes 43989 (43.9 KB)
                TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
        inet 192.168.56.102 netmask 255.255.255.0 broadcast 192.168.56.255
                ether 08:00:27:d5:41:10 txqueuelen 1000 (Ethernet)
                RX packets 538 bytes 52154 (52.1 KB)
                RX errors 0 dropped 0 overruns 0 frame 0
                TX packets 342 bytes 53703 (53.7 KB)
                TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
        inet 127.0.0.1 netmask 255.0.0.0
        loop txqueuelen 1000 (Local Loopback)
        RX packets 18940 bytes 1069128 (1.0 MB)
        RX errors 0 dropped 0 overruns 0 frame 0
        TX packets 18940 bytes 1069128 (1.0 MB)
        TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

ovs-system: flags=4098<BROADCAST,MULTICAST> mtu 1500
        ether 62:a6:f9:cb:7a:9d 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
```



# Inspecionando as Informações da Interface

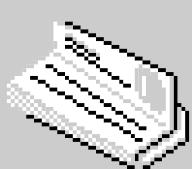
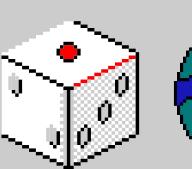
## Dados do Switch: mostrando os dados do switch s3

```
mininet@mininet-vm: ~
mininet> s3 ifconfig -a
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
        inet 10.0.2.15 netmask 255.255.255.0 broadcast 10.0.2.255
        ether 08:00:27:19:91:e0 txqueuelen 1000 (Ethernet)
        RX packets 492 bytes 55123 (55.1 KB)
        RX errors 0 dropped 0 overruns 0 frame 0
        TX packets 499 bytes 44229 (44.2 KB)
        TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
        inet 192.168.56.102 netmask 255.255.255.0 broadcast 192.168.56.255
        ether 08:00:27:d5:41:10 txqueuelen 1000 (Ethernet)
        RX packets 579 bytes 56420 (56.4 KB)
        RX errors 0 dropped 0 overruns 0 frame 0
        TX packets 378 bytes 66549 (66.5 KB)
        TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
        inet 127.0.0.1 netmask 255.0.0.0
        loop txqueuelen 1000 (Local Loopback)
        RX packets 19174 bytes 1082544 (1.0 MB)
        RX errors 0 dropped 0 overruns 0 frame 0
        TX packets 19174 bytes 1082544 (1.0 MB)
        TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

ovs-system: flags=4098<BROADCAST,MULTICAST> mtu 1500
        ether 62:a6:f9:cb:7a:9d 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
```



# Inspecionando as Informações da Interface

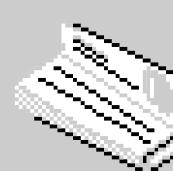
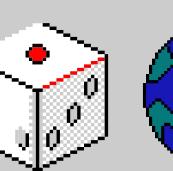
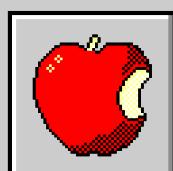
## Dados do Switch: mostrando os dados do switch s4

```
mininet@mininet-vm: ~
mininet> s4 ifconfig -a
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
        inet 10.0.2.15 netmask 255.255.255.0 broadcast 10.0.2.255
          ether 08:00:27:19:91:e0 txqueuelen 1000 (Ethernet)
            RX packets 532 bytes 58333 (58.3 KB)
            RX errors 0 dropped 0 overruns 0 frame 0
            TX packets 539 bytes 47439 (47.4 KB)
            TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
        inet 192.168.56.102 netmask 255.255.255.0 broadcast 192.168.56.255
          ether 08:00:27:d5:41:10 txqueuelen 1000 (Ethernet)
            RX packets 653 bytes 68553 (68.5 KB)
            RX errors 0 dropped 0 overruns 0 frame 0
            TX packets 429 bytes 82999 (82.9 KB)
            TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
        inet 127.0.0.1 netmask 255.0.0.0
        loop txqueuelen 1000 (Local Loopback)
          RX packets 21982 bytes 1243536 (1.2 MB)
          RX errors 0 dropped 0 overruns 0 frame 0
          TX packets 21982 bytes 1243536 (1.2 MB)
          TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

ovs-system: flags=4098<BROADCAST,MULTICAST> mtu 1500
        ether 62:a6:f9:cb:7a:9d 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
```



# Inspecionando as Informações da Interface

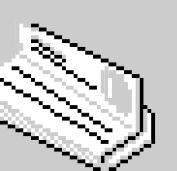
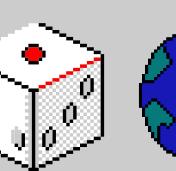
## Dados do Switch: mostrando os dados do switch s5

```
mininet@mininet-vm: ~
mininet> s5 ifconfig -a
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
        inet 10.0.2.15 netmask 255.255.255.0 broadcast 10.0.2.255
          ether 08:00:27:19:91:e0 txqueuelen 1000 (Ethernet)
            RX packets 535 bytes 58573 (58.5 KB)
            RX errors 0 dropped 0 overruns 0 frame 0
            TX packets 542 bytes 47679 (47.6 KB)
            TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
        inet 192.168.56.102 netmask 255.255.255.0 broadcast 192.168.56.255
          ether 08:00:27:d5:41:10 txqueuelen 1000 (Ethernet)
            RX packets 686 bytes 71719 (71.7 KB)
            RX errors 0 dropped 0 overruns 0 frame 0
            TX packets 456 bytes 94607 (94.6 KB)
            TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
        inet 127.0.0.1 netmask 255.0.0.0
        loop txqueuelen 1000 (Local Loopback)
            RX packets 22162 bytes 1253856 (1.2 MB)
            RX errors 0 dropped 0 overruns 0 frame 0
            TX packets 22162 bytes 1253856 (1.2 MB)
            TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

ovs-system: flags=4098<BROADCAST,MULTICAST> mtu 1500
        ether 62:a6:f9:cb:7a:9d 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
```



# Inspecionando as Informações da Interface

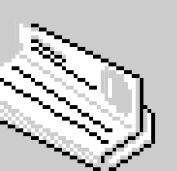
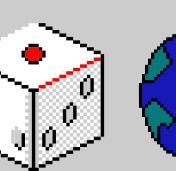
## Dados do Switch: mostrando os dados do switch s6

```
mininet@mininet-vm: ~
mininet> s6 ifconfig -a
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
        inet 10.0.2.15 netmask 255.255.255.0 broadcast 10.0.2.255
          ether 08:00:27:19:91:e0 txqueuelen 1000 (Ethernet)
            RX packets 541 bytes 59083 (59.0 KB)
            RX errors 0 dropped 0 overruns 0 frame 0
            TX packets 548 bytes 48189 (48.1 KB)
            TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
        inet 192.168.56.102 netmask 255.255.255.0 broadcast 192.168.56.255
          ether 08:00:27:d5:41:10 txqueuelen 1000 (Ethernet)
            RX packets 724 bytes 77462 (77.4 KB)
            RX errors 0 dropped 0 overruns 0 frame 0
            TX packets 488 bytes 107585 (107.5 KB)
            TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
    inet 127.0.0.1 netmask 255.0.0.0
      loop txqueuelen 1000 (Local Loopback)
        RX packets 22594 bytes 1278624 (1.2 MB)
        RX errors 0 dropped 0 overruns 0 frame 0
        TX packets 22594 bytes 1278624 (1.2 MB)
        TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

ovs-system: flags=4098<BROADCAST,MULTICAST> mtu 1500
        ether 62:a6:f9:cb:7a:9d 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
```



# Inspecionando as informações da interface

## Outras informações dos switches

```
mininet@mininet-vm: ~

s1: flags=4098<Broadcast,Multicast> mtu 1500
    ether 82:a4:da:ed:27:40 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: flags=4098<Broadcast,Multicast> mtu 1500
    ether 06:88:4b:64:7c:4d 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

s3: flags=4098<Broadcast,Multicast> mtu 1500
    ether 56:2b:17:aa:8a:41 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

s4: flags=4098<Broadcast,Multicast> mtu 1500
    ether c2:5f:69:61:6d:47 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: flags=4098<Broadcast,Multicast> mtu 1500
    ether 0a:a8:9a:03:3e:45 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: flags=4098<Broadcast,Multicast> mtu 1500
    ether 8a:c9:18:91:f0:4f 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
```

```
mininet@mininet-vm: ~

s1-eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    ether 82:e6:57:4a:20:50 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

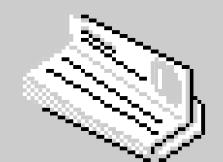
s1-eth2: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    ether 02:29:c4:b1:29:89 txqueuelen 1000 (Ethernet)
    RX packets 0 bytes 0 (0.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 0 bytes 0 (0.0 B)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

s2-eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    ether e2:9e:13:2f:e8:38 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-eth2: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    ether aa:5b:21:0c:30:47 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-eth3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    ether 9e:e8:81:fb:80:8c 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

s3-eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    ether 32:c1:8f:db:de:00 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
```



# Inspecionando as Informações da Interface

## Outras informações dos switches

```
mininet@mininet-vm: ~
s3-eth2: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
          ether c6:85:7a:42:78:26 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

s3-eth3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
          ether 4a:24:2d:91:9d:07 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

s4-eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
          ether 76:la:a8:31:33:04 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

s4-eth2: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
          ether ee:87:46:45:4d:03 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

s4-eth3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
          ether 2e:45:72:c8:4e:7b 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 d6:92:e7:d9:c5:4a 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
```

```
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

s4-eth3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
          ether 2e:45:72:c8:4e:7b 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

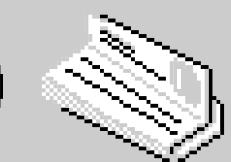
s5-eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
          ether d6:92:e7:d9:c5:4a txqueuelen 1000 (Ethernet)
          RX packets 0 bytes 0 (0.0 B)
          RX errors 0 dropped 0 overruns 0 frame 0
          TX packets 0 bytes 0 (0.0 B)
          TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

s5-eth2: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
          ether la:3f:c2:7c:3d:2d 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

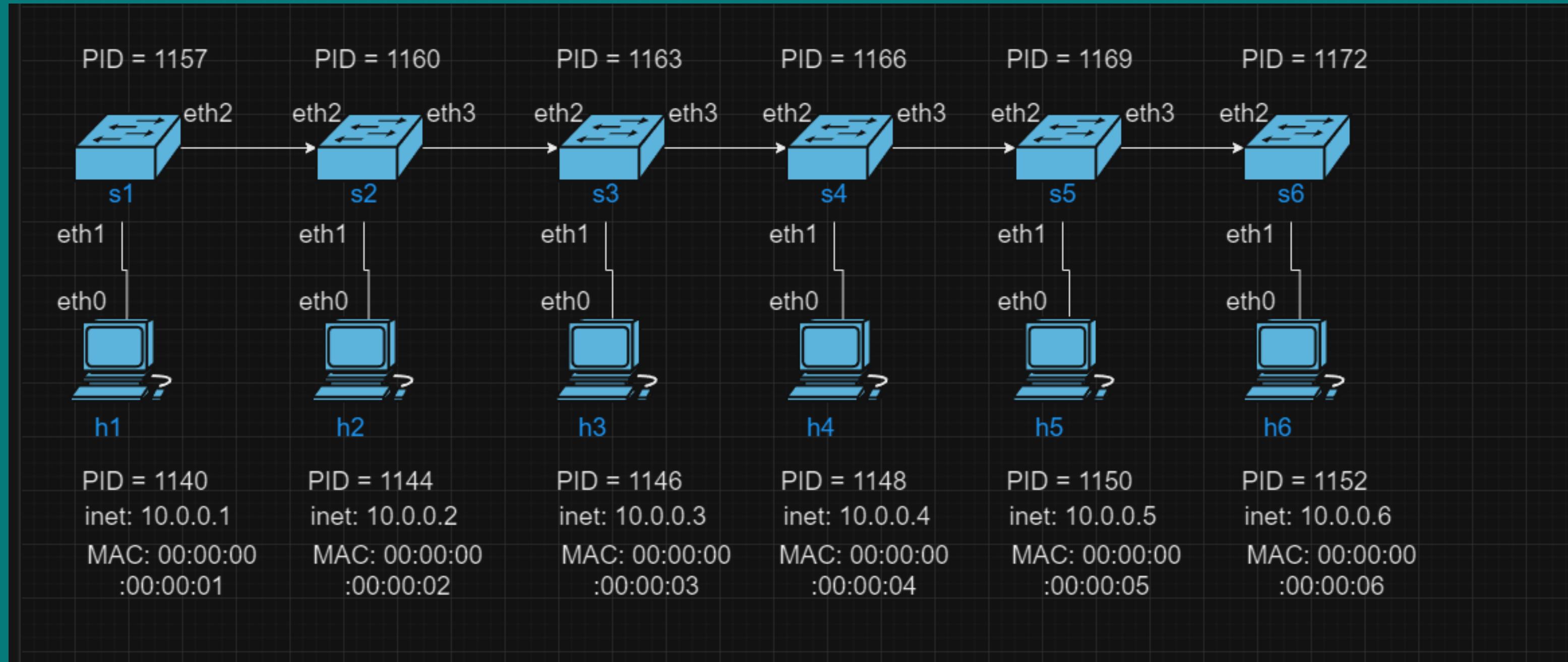
s5-eth3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
          ether 62:2b:f5:1c:ee:df txqueuelen 1000 (Ethernet)
          RX packets 0 bytes 0 (0.0 B)
          RX errors 0 dropped 0 overruns 0 frame 0
          TX packets 0 bytes 0 (0.0 B)
          TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

s6-eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
          ether c6:33:c1:fa:db:c5 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

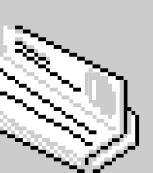
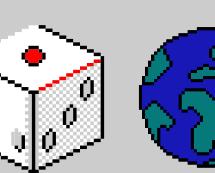
s6-eth2: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
          ether 9a:90:d0:73:f4:a2 txqueuelen 1000 (Ethernet)
          RX packets 0 bytes 0 (0.0 B)
          RX errors 0 dropped 0 overruns 0 frame 0
          TX packets 0 bytes 0 (0.0 B)
          TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```



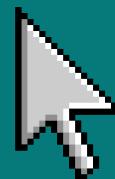
# Criando a Topologia da Rede



<https://drive.google.com/file/d/1EU2xQKcM7t9k5VnEUXXLkD9blb4pXKv-/view?usp=sharing>



# Testes das Redes



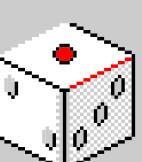
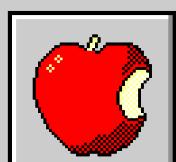
## De h1 para h3:

X "Node: h1"

```
root@mininet-vm:~# ping 10.0.0.3
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=7.99 ms
64 bytes from 10.0.0.3: icmp_seq=2 ttl=64 time=0.780 ms
64 bytes from 10.0.0.3: icmp_seq=3 ttl=64 time=0.047 ms
64 bytes from 10.0.0.3: icmp_seq=4 ttl=64 time=0.050 ms
^C
--- 10.0.0.3 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3002ms
rtt min/avg/max/mdev = 0.047/2.217/7.994/3.348 ms
root@mininet-vm:~#
```

X "Node: h3"

```
root@mininet-vm:~# tcpdump -XX -n -i h3-eth0
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on h3-eth0, link-type EN10MB (Ethernet), capture size 262144 bytes
15:48:17.094621 ARP, Request who-has 10.0.0.3 tell 10.0.0.1, length 28
 0x0000: ffff ffff 0000 0000 0001 0806 0001 .....
 0x0010: 0800 0604 0001 0000 0000 0001 0a00 0001 .....
 0x0020: 0000 0000 0000 0a00 0002 .....
15:48:17.094634 ARP, Reply 10.0.0.3 is-at 00:00:00:00:00:03, length 28
 0x0000: 0000 0000 0001 0000 0002 0806 0001 .....
 0x0010: 0800 0604 0002 0000 0000 0002 0a00 0002 .....
 0x0020: 0000 0000 0001 0a00 0001 .....
15:48:17.098261 IP 10.0.0.1 > 10.0.0.3: ICMP echo request, id 4612, seq 1, length 64
 0x0000: 0000 0000 0002 0000 0000 0001 0800 4500 ....E.
 0x0010: 0054 420c 4000 4001 e49a 0a00 0001 0a00 .TB.Q.Q.....
 0x0020: 0002 0800 918a 1204 0001 31c9 2965 0000 ....1.e..
 0x0030: 0000 396f 0100 0000 0000 1011 1213 1415 ..9o.....
 0x0040: 1617 1819 1a1b 1c1d 1e1f 2021 2223 2425 ....!#$%
 0x0050: 2627 2829 2a2b 2c2d 2e2f 3031 3233 3435 &'()*,-./012345
 0x0060: 3637 67
15:48:17.098276 IP 10.0.0.3 > 10.0.0.1: ICMP echo reply, id 4612, seq 1, length 64
 0x0000: 0000 0000 0001 0000 0002 0800 4500 ....E.
 0x0010: 0054 246a 0000 4001 423d 0a00 0002 0a00 .T$..Q.B=....
 0x0020: 0001 0000 998a 1204 0001 31c9 2965 0000 ....1.e..
 0x0030: 0000 396f 0100 0000 0000 1011 1213 1415 ..9o.....
 0x0040: 1617 1819 1a1b 1c1d 1e1f 2021 2223 2425 ....!#$%
 0x0050: 2627 2829 2a2b 2c2d 2e2f 3031 3233 3435 &'()*,-./012345
 0x0060: 3637 67
15:48:18.096140 IP 10.0.0.1 > 10.0.0.3: ICMP echo request, id 4612, seq 2, length 64
 0x0000: 0000 0000 0002 0000 0000 0001 0800 4500 ....E.
 0x0010: 0054 42aa 4000 4001 e3fc 0a00 0001 0a00 .TB.Q.Q.....
 0x0020: 0002 0800 da81 1204 0002 32c9 2965 0000 ....2.e..
 0x0030: 0000 ef76 0100 0000 0000 1011 1213 1415 ...v.....
 0x0040: 1617 1819 1a1b 1c1d 1e1f 2021 2223 2425 ....!#$%
 0x0050: 2627 2829 2a2b 2c2d 2e2f 3031 3233 3435 &'()*,-./012345
 0x0060: 3637 67
15:48:18.096153 IP 10.0.0.3 > 10.0.0.1: ICMP echo reply, id 4612, seq 2, length 64
 0x0000: 0000 0000 0001 0000 0000 0002 0800 4500 ....E.
 0x0010: 0054 248c 0000 4001 421b 0a00 0002 0a00 .T$..Q.B.....
 0x0020: 0001 0000 e281 1204 0002 32c9 2965 0000 ....2.e..
```



# Testes das Redes

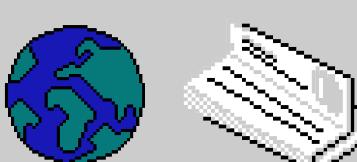
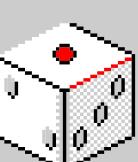
## De h2 para h4:

X "Node: h2"

```
root@mininet-vm:~# ping 10.0.0.4
PING 10.0.0.4 (10.0.0.4) 56(84) bytes of data.
64 bytes from 10.0.0.4: icmp_seq=1 ttl=64 time=5.58 ms
64 bytes from 10.0.0.4: icmp_seq=2 ttl=64 time=0.760 ms
64 bytes from 10.0.0.4: icmp_seq=3 ttl=64 time=0.049 ms
64 bytes from 10.0.0.4: icmp_seq=4 ttl=64 time=0.047 ms
64 bytes from 10.0.0.4: icmp_seq=5 ttl=64 time=0.064 ms
64 bytes from 10.0.0.4: icmp_seq=6 ttl=64 time=0.050 ms
64 bytes from 10.0.0.4: icmp_seq=7 ttl=64 time=0.055 ms
^C
--- 10.0.0.4 ping statistics ---
7 packets transmitted, 7 received, 0% packet loss, time 6004ms
rtt min/avg/max/mdev = 0.047/0.943/5.582/1.909 ms
root@mininet-vm:~#
```

X "Node: h4"

```
root@mininet-vm:~# tcpdump -XX -n -i h4-eth0
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on h4-eth0, link-type EN10MB (Ethernet), capture size 262144 bytes
15:52:01.134200 ARP, Request who-has 10.0.0.4 tell 10.0.0.2, length 28
  0x0000: ffff ffff ffff 0000 0000 0003 0806 0001 .....
  0x0010: 0800 0604 0001 0000 0000 0003 0a00 0003 .....
  0x0020: 0000 0000 0000 0a00 0004 .....
15:52:01.134213 ARP, Reply 10.0.0.4 is-at 00:00:00:00:00:04, length 28
  0x0000: 0000 0000 0003 0000 0000 0004 0806 0001 .....
  0x0010: 0800 0604 0002 0000 0000 0004 0a00 0004 .....
  0x0020: 0000 0000 0003 0a00 0003 .....
15:52:01.136633 IP 10.0.0.2 > 10.0.0.4: ICMP echo request, id 4652, seq 1, length 64
  0x0000: 0000 0000 0004 0000 0000 0003 0800 4500 ....E.
  0x0010: 0054 509d 4000 4001 d605 0a00 0003 0a00 .TP.@@.....
  0x0020: 0004 0800 fec4 122c 0001 11ca 2965 0000 .....e..
  0x0030: 0000 eb05 0200 0000 0000 1011 1213 1415 .....
  0x0040: 1617 1819 1a1b 1c1d 1e1f 2021 2223 2425 ....!#$%
  0x0050: 2627 2829 2a2b 2c2d 2e2f 3031 3233 3435 &'()*+,-./012345
  0x0060: 3637 67
15:52:01.136648 IP 10.0.0.4 > 10.0.0.2: ICMP echo reply, id 4652, seq 1, length 64
  0x0000: 0000 0000 0003 0000 0000 0004 0800 4500 ....E.
  0x0010: 0054 48f2 0000 4001 1db1 0a00 0004 0a00 .TH...@.....
  0x0020: 0003 0000 06cb 122c 0001 11ca 2965 0000 .....e..
  0x0030: 0000 eb05 0200 0000 0000 1011 1213 1415 .....
  0x0040: 1617 1819 1a1b 1c1d 1e1f 2021 2223 2425 ....!#$%
  0x0050: 2627 2829 2a2b 2c2d 2e2f 3031 3233 3435 &'()*+,-./012345
  0x0060: 3637 67
15:52:02.135116 IP 10.0.0.2 > 10.0.0.4: ICMP echo request, id 4652, seq 2, length 64
  0x0000: 0000 0000 0004 0000 0000 0003 0800 4500 ....E.
  0x0010: 0054 516a 4000 4001 d538 0a00 0003 0a00 .TQj@.0..8.....
  0x0020: 0004 0800 b7c0 122c 0002 12ca 2965 0000 .....e..
  0x0030: 0000 310f 0200 0000 0000 1011 1213 1415 ..1.....
  0x0040: 1617 1819 1a1b 1c1d 1e1f 2021 2223 2425 ....!#$%
  0x0050: 2627 2829 2a2b 2c2d 2e2f 3031 3233 3435 &'()*+,-./012345
  0x0060: 3637 67
15:52:02.135130 IP 10.0.0.4 > 10.0.0.2: ICMP echo reply, id 4652, seq 2, length 64
  0x0000: 0000 0000 0003 0000 0000 0004 0800 4500 ....E.
  0x0010: 0054 4965 0000 4001 1d3e 0a00 0004 0a00 .Tie..@..>.....
  0x0020: 0003 0000 bfc0 122c 0002 12ca 2965 0000 .....e..
```



# Testes das Redes

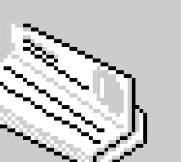
## De h5 para h6:

X "Node: h5"

```
root@mininet-vm:~# ping 10.0.0.6
PING 10.0.0.6 (10.0.0.6) 56(84) bytes of data.
64 bytes from 10.0.0.6: icmp_seq=1 ttl=64 time=8.59 ms
64 bytes from 10.0.0.6: icmp_seq=2 ttl=64 time=0.730 ms
64 bytes from 10.0.0.6: icmp_seq=3 ttl=64 time=0.055 ms
64 bytes from 10.0.0.6: icmp_seq=4 ttl=64 time=0.049 ms
64 bytes from 10.0.0.6: icmp_seq=5 ttl=64 time=0.093 ms
64 bytes from 10.0.0.6: icmp_seq=6 ttl=64 time=0.046 ms
^C
--- 10.0.0.6 ping statistics ---
6 packets transmitted, 6 received, 0% packet loss, time 5001ms
rtt min/avg/max/mdev = 0.046/1.595/8.597/3.140 ms
root@mininet-vm:~#
```

X "Node: h6"

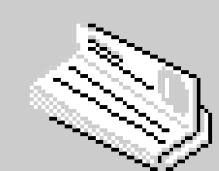
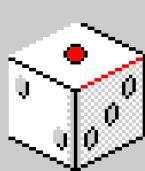
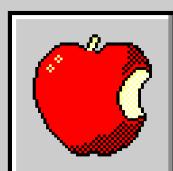
```
root@mininet-vm:~# tcpdump -XX -n -i h6-eth0
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on h6-eth0, link-type EN10MB (Ethernet), capture size 262144 bytes
15:54:16.819500 ARP, Request who-has 10.0.0.6 tell 10.0.0.5, length 28
 0x0000: ffff ffff 0000 0000 0005 0806 0001 .....
 0x0010: 0800 0604 0001 0000 0000 0005 0a00 0005 .....
 0x0020: 0000 0000 0000 0a00 0006 .....
15:54:16.819509 ARP, Reply 10.0.0.6 is-at 00:00:00:00:00:06, length 28
 0x0000: 0000 0000 0005 0000 0000 0806 0001 .....
 0x0010: 0800 0604 0002 0000 0000 0006 0a00 0006 .....
 0x0020: 0000 0000 0005 0a00 0005 .....
15:54:16.825013 IP 10.0.0.5 > 10.0.0.6: ICMP echo request, id 4691, seq 1, length 64
 0x0000: 0000 0000 0006 0000 0000 0005 0800 4500 ....E.
 0x0010: 0054 a7b6 4000 4001 7ee8 0a00 0005 0a00 .T..@.~.....
 0x0020: 0006 0800 ff2a 1253 0001 98ca 2965 0000 ....*.S....)e..
 0x0030: 0000 597e 0c00 0000 0000 1011 1213 1415 ..Y".....
 0x0040: 1617 1819 1a1b 1c1d 1e1f 2021 2223 2425 ....!#$%
 0x0050: 2627 2829 2a2b 2c2d 2e2f 3031 3233 3435 &'()*+,-./012345
 0x0060: 3637 67
15:54:16.825034 IP 10.0.0.6 > 10.0.0.5: ICMP echo reply, id 4691, seq 1, length 64
 0x0000: 0000 0000 0005 0000 0000 0006 0800 4500 ....E.
 0x0010: 0054 ede4 0000 4001 78ba 0a00 0006 0a00 .T..@.x.....
 0x0020: 0005 0000 072b 1253 0001 98ca 2965 0000 ....+.S....)e..
 0x0030: 0000 597e 0c00 0000 0000 1011 1213 1415 ..Y".....
 0x0040: 1617 1819 1a1b 1c1d 1e1f 2021 2223 2425 ....!#$%
 0x0050: 2627 2829 2a2b 2c2d 2e2f 3031 3233 3435 &'()*+,-./012345
 0x0060: 3637 67
15:54:17.820968 IP 10.0.0.5 > 10.0.0.6: ICMP echo request, id 4691, seq 2, length 64
 0x0000: 0000 0000 0006 0000 0000 0005 0800 4500 ....E.
 0x0010: 0054 a891 4000 4001 7e0d 0a00 0005 0a00 .T..@.~.....
 0x0020: 0006 0800 0522 1253 0002 99ca 2965 0000 ....".S....)e..
 0x0030: 0000 5286 0c00 0000 0000 1011 1213 1415 ..R.....
 0x0040: 1617 1819 1a1b 1c1d 1e1f 2021 2223 2425 ....!#$%
 0x0050: 2627 2829 2a2b 2c2d 2e2f 3031 3233 3435 &'()*+,-./012345
 0x0060: 3637 67
15:54:17.820980 IP 10.0.0.6 > 10.0.0.5: ICMP echo reply, id 4691, seq 2, length 64
 0x0000: 0000 0000 0005 0000 0000 0006 0800 4500 ....E.
 0x0010: 0054 eeb3 0000 4001 77eb 0a00 0006 0a00 .T..@.w.....
 0x0020: 0005 0000 0d22 1253 0002 99ca 2965 0000 ....".S....)e..
```



# Teste Para Largura BW = 2



```
mininet@mininet-vm: ~
mininet@mininet-vm:~$ sudo mn --topo=linear,6 --link tc,bw=2 --mac
*** Creating network
*** Adding controller
*** Adding hosts:
h1 h2 h3 h4 h5 h6
*** Adding switches:
s1 s2 s3 s4 s5 s6
*** Adding links:
(h1, s1) (2.00Mbit) (s1, h2) (2.00Mbit) (h2, s2) (2.00Mbit) (s2, h3) (2.00Mbit) (h3, s3) (2.00Mbit) (s3, h4) (2.00Mbit) (h4, s4) (2.00Mbit) (s4, h5) (2.00Mbit) (h5, s5) (2.00Mbit) (s5, h6) (2.00Mbit) (h6, s6) (2.00Mbit)
*** Configuring hosts
h1 h2 h3 h4 h5 h6
*** Starting controller
c0
*** Starting 6 switches
s1 s2 s3 s4 s5 s6 ... (2.00Mbit) (2.00Mbit)
*** Starting CLI:
mininet>
```

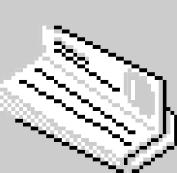
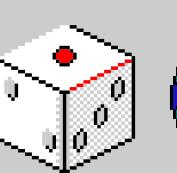


# Teste Para Largura BW = 2

Configurando o host 1 na porta 5555 como servidor tcp e o host 2 como um cliente. E fazendo testes iperf com ambos.

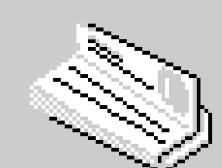
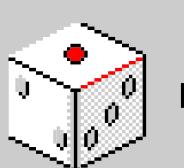
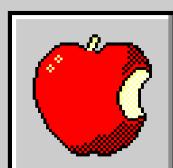
```
X "Node: h1"
root@mininet-vm:~# iperf -s -p 5555 -i 1
-----
Server listening on TCP port 5555
TCP window size: 85.3 KByte (default)
[ 32] local 10.0.0.1 port 5555 connected with 10.0.0.2 port 53720
[ ID] Interval Transfer Bandwidth
[ 32] 0.0- 1.0 sec 238 KBytes 1.95 Mbits/sec
[ 32] 1.0- 2.0 sec 233 KBytes 1.91 Mbits/sec
[ 32] 2.0- 3.0 sec 232 KBytes 1.90 Mbits/sec
[ 32] 3.0- 4.0 sec 235 KBytes 1.92 Mbits/sec
[ 32] 4.0- 5.0 sec 233 KBytes 1.91 Mbits/sec
[ 32] 5.0- 6.0 sec 232 KBytes 1.90 Mbits/sec
[ 32] 6.0- 7.0 sec 235 KBytes 1.92 Mbits/sec
[ 32] 7.0- 8.0 sec 233 KBytes 1.91 Mbits/sec
[ 32] 8.0- 9.0 sec 235 KBytes 1.92 Mbits/sec
[ 32] 9.0-10.0 sec 232 KBytes 1.90 Mbits/sec
[ 32] 10.0-11.0 sec 233 KBytes 1.91 Mbits/sec
[ 32] 11.0-12.0 sec 235 KBytes 1.92 Mbits/sec
[ 32] 12.0-13.0 sec 232 KBytes 1.90 Mbits/sec
[ 32] 13.0-14.0 sec 233 KBytes 1.91 Mbits/sec
[ 32] 14.0-15.0 sec 235 KBytes 1.92 Mbits/sec
[ 32] 15.0-16.0 sec 232 KBytes 1.90 Mbits/sec
[ 32] 0.0-16.4 sec 3.75 MBytes 1.91 Mbits/sec
-----
```

```
X "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 53720 connected with 10.0.0.1 port 5555
[ ID] Interval Transfer Bandwidth
[ 31] 0.0- 1.0 sec 512 KBytes 4.19 Mbits/sec
[ 31] 1.0- 2.0 sec 256 KBytes 2.10 Mbits/sec
[ 31] 2.0- 3.0 sec 128 KBytes 1.05 Mbits/sec
[ 31] 3.0- 4.0 sec 256 KBytes 2.10 Mbits/sec
[ 31] 4.0- 5.0 sec 256 KBytes 2.10 Mbits/sec
[ 31] 5.0- 6.0 sec 256 KBytes 2.10 Mbits/sec
[ 31] 6.0- 7.0 sec 256 KBytes 2.10 Mbits/sec
[ 31] 7.0- 8.0 sec 256 KBytes 2.10 Mbits/sec
[ 31] 8.0- 9.0 sec 128 KBytes 1.05 Mbits/sec
[ 31] 9.0-10.0 sec 256 KBytes 2.10 Mbits/sec
[ 31] 10.0-11.0 sec 256 KBytes 2.10 Mbits/sec
[ 31] 11.0-12.0 sec 256 KBytes 2.10 Mbits/sec
[ 31] 12.0-13.0 sec 256 KBytes 2.10 Mbits/sec
[ 31] 13.0-14.0 sec 256 KBytes 2.10 Mbits/sec
[ 31] 14.0-15.0 sec 128 KBytes 1.05 Mbits/sec
[ 31] 0.0-15.6 sec 3.75 MBytes 2.02 Mbits/sec
-----
```



# Teste Para Largura Bw = 10

```
mininet@mininet-vm: ~
mininet@mininet-vm:~$ sudo mn --topo=linear,6 --link tc,bw=10 --mac
*** Creating network
*** Adding controller
*** Adding hosts:
h1 h2 h3 h4 h5 h6
*** Adding switches:
s1 s2 s3 s4 s5 s6
*** Adding links:
(10.00Mbit) (10.00Mbit) (h1, s1) (10.00Mbit) (h2, s2) (10.00Mbit) (1
0.00Mbit) (h3, s3) (10.00Mbit) (h4, s4) (10.00Mbit) (10.00Mbit) (h5,
s5) (10.00Mbit) (h6, s6) (10.00Mbit) (10.00Mbit) (s2, s1) (10.00Mbi
t) (10.00Mbit) (s3, s2) (10.00Mbit) (10.00Mbit) (s4, s3) (10.00Mbit) (10.00Mbit)
(s5, s4) (10.00Mbit) (10.00Mbit) (s6, s5)
*** Configuring hosts
h1 h2 h3 h4 h5 h6
*** Starting controller
c0
*** Starting 6 switches
s1 s2 s3 s4 s5 s6 ... (10.00Mbit) (10.00Mbit) (10.00Mbit) (10.00Mbit)
(10.00Mbit) (10.00Mbit) (10.00Mbit) (10.00Mbit) (10.00Mbit) (10.00M
bit) (10.00Mbit) (10.00Mbit) (10.00Mbit) (10.00Mbit)
*** Starting CLI:
mininet>
```

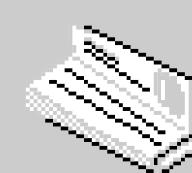
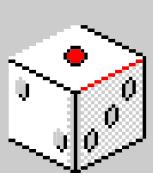


# Teste Para Largura BW = 10

Configurando o host 1 na porta 5555 como servidor tcp e o host 2 como um cliente. E fazendo testes iperf com ambos.

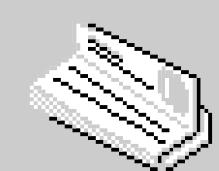
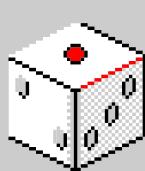
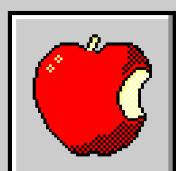
```
X "Node: h1"
root@mininet-vm:~# iperf -s -p 5555 -i 1
-----
Server listening on TCP port 5555
TCP window size: 85.3 KByte (default)
[ 32] local 10.0.0.1 port 5555 connected with 10.0.0.2 port 53744
[ ID] Interval Transfer Bandwidth
[ 32] 0.0- 1.0 sec 1.14 MBytes 9.59 Mbits/sec
[ 32] 1.0- 2.0 sec 1.14 MBytes 9.58 Mbits/sec
[ 32] 2.0- 3.0 sec 1.14 MBytes 9.55 Mbits/sec
[ 32] 3.0- 4.0 sec 1.14 MBytes 9.56 Mbits/sec
[ 32] 4.0- 5.0 sec 1.14 MBytes 9.56 Mbits/sec
[ 32] 5.0- 6.0 sec 1.14 MBytes 9.56 Mbits/sec
[ 32] 6.0- 7.0 sec 1.14 MBytes 9.56 Mbits/sec
[ 32] 7.0- 8.0 sec 1.14 MBytes 9.56 Mbits/sec
[ 32] 8.0- 9.0 sec 1.14 MBytes 9.59 Mbits/sec
[ 32] 9.0-10.0 sec 1.14 MBytes 9.53 Mbits/sec
[ 32] 10.0-11.0 sec 1.14 MBytes 9.58 Mbits/sec
[ 32] 11.0-12.0 sec 1.14 MBytes 9.56 Mbits/sec
[ 32] 12.0-13.0 sec 1.14 MBytes 9.56 Mbits/sec
[ 32] 13.0-14.0 sec 1.14 MBytes 9.57 Mbits/sec
[ 32] 14.0-15.0 sec 1.14 MBytes 9.58 Mbits/sec
[ 32] 0.0-15.3 sec 17.4 MBytes 9.56 Mbits/sec
[ ]
```

```
X "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 53744 connected with 10.0.0.1 port 5555
[ ID] Interval Transfer Bandwidth
[ 31] 0.0- 1.0 sec 1.38 MBytes 11.5 Mbits/sec
[ 31] 1.0- 2.0 sec 1.12 MBytes 9.44 Mbits/sec
[ 31] 2.0- 3.0 sec 1.12 MBytes 9.44 Mbits/sec
[ 31] 3.0- 4.0 sec 1.12 MBytes 9.44 Mbits/sec
[ 31] 4.0- 5.0 sec 1.12 MBytes 9.44 Mbits/sec
[ 31] 5.0- 6.0 sec 1.12 MBytes 9.44 Mbits/sec
[ 31] 6.0- 7.0 sec 1.25 MBytes 10.5 Mbits/sec
[ 31] 7.0- 8.0 sec 1.12 MBytes 9.44 Mbits/sec
[ 31] 8.0- 9.0 sec 1.00 MBytes 8.39 Mbits/sec
[ 31] 9.0-10.0 sec 1.25 MBytes 10.5 Mbits/sec
[ 31] 10.0-11.0 sec 1.12 MBytes 9.44 Mbits/sec
[ 31] 11.0-12.0 sec 1.12 MBytes 9.44 Mbits/sec
[ 31] 12.0-13.0 sec 1.12 MBytes 9.44 Mbits/sec
[ 31] 13.0-14.0 sec 1.12 MBytes 9.44 Mbits/sec
[ 31] 14.0-15.0 sec 1.12 MBytes 9.44 Mbits/sec
[ 31] 0.0-15.1 sec 17.4 MBytes 9.65 Mbits/sec
[ ]
```



# Teste Para Largura BW = 15

```
mininet@mininet-vm: ~
mininet@mininet-vm:~$ sudo mn --topo=linear,6 --link tc,bw=15 --mac
*** Creating network
*** Adding controller
*** Adding hosts:
h1 h2 h3 h4 h5 h6
*** Adding switches:
s1 s2 s3 s4 s5 s6
*** Adding links:
(15.00Mbit) (15.00Mbit) (h1, s1) (15.00Mbit) (h2, s2) (15.00Mbit) (1
5.00Mbit) (h3, s3) (15.00Mbit) (15.00Mbit) (h4, s4) (15.00Mbit) (15.00Mbit) (h5,
s5) (15.00Mbit) (h6, s6) (15.00Mbit) (15.00Mbit) (s2, s1) (15.00Mbi
t) (15.00Mbit) (s3, s2) (15.00Mbit) (15.00Mbit) (s4, s3) (15.00Mbit) (15.00Mbit)
(s5, s4) (15.00Mbit) (15.00Mbit) (s6, s5)
*** Configuring hosts
h1 h2 h3 h4 h5 h6
*** Starting controller
c0
*** Starting 6 switches
s1 s2 s3 s4 s5 s6 ... (15.00Mbit) (15.00Mbit) (15.00Mbit) (15.00Mbit)
(15.00Mbit) (15.00Mbit) (15.00Mbit) (15.00Mbit) (15.00Mbit) (15.00Mbit)
(15.00Mbit) (15.00Mbit) (15.00Mbit) (15.00Mbit)
*** Starting CLI:
mininet>
```



# Teste Para Largura BW = 15

Configurando o host 1 na porta 5555 como servidor tcp e o host 2 como um cliente. E fazendo testes iperf com ambos.

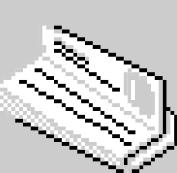
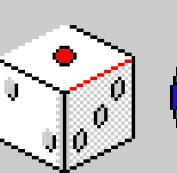
```
X "Node: h1"
root@mininet-vm:~# iperf -s -p 5555 -i 1
-----
Server listening on TCP port 5555
TCP window size: 85.3 KByte (default)

[ 32] local 10.0.0.1 port 5555 connected with 10.0.0.2 port 53768
[ ID] Interval Transfer Bandwidth
[ 32] 0.0- 1.0 sec 1.71 MBytes 14.4 Mbits/sec
[ 32] 1.0- 2.0 sec 1.70 MBytes 14.2 Mbits/sec
[ 32] 2.0- 3.0 sec 1.70 MBytes 14.2 Mbits/sec
[ 32] 3.0- 4.0 sec 1.70 MBytes 14.3 Mbits/sec
[ 32] 4.0- 5.0 sec 1.69 MBytes 14.2 Mbits/sec
[ 32] 5.0- 6.0 sec 1.70 MBytes 14.2 Mbits/sec
[ 32] 6.0- 7.0 sec 1.70 MBytes 14.3 Mbits/sec
[ 32] 7.0- 8.0 sec 1.69 MBytes 14.2 Mbits/sec
[ 32] 8.0- 9.0 sec 1.69 MBytes 14.2 Mbits/sec
[ 32] 9.0-10.0 sec 1.70 MBytes 14.3 Mbits/sec
[ 32] 10.0-11.0 sec 1.69 MBytes 14.2 Mbits/sec
[ 32] 11.0-12.0 sec 1.70 MBytes 14.3 Mbits/sec
[ 32] 12.0-13.0 sec 1.70 MBytes 14.2 Mbits/sec
[ 32] 13.0-14.0 sec 1.70 MBytes 14.2 Mbits/sec
[ 32] 14.0-15.0 sec 1.70 MBytes 14.2 Mbits/sec
[ 32] 0.0-15.2 sec 25.9 MBytes 14.2 Mbits/sec
[ ] 
```

```
X "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)

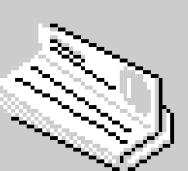
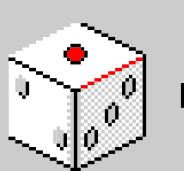
[ 31] local 10.0.0.2 port 53768 connected with 10.0.0.1 port 5555
[ ID] Interval Transfer Bandwidth
[ 31] 0.0- 1.0 sec 2.00 MBytes 16.8 Mbits/sec
[ 31] 1.0- 2.0 sec 1.62 MBytes 13.6 Mbits/sec
[ 31] 2.0- 3.0 sec 1.75 MBytes 14.7 Mbits/sec
[ 31] 3.0- 4.0 sec 1.62 MBytes 13.6 Mbits/sec
[ 31] 4.0- 5.0 sec 1.75 MBytes 14.7 Mbits/sec
[ 31] 5.0- 6.0 sec 1.75 MBytes 14.7 Mbits/sec
[ 31] 6.0- 7.0 sec 1.62 MBytes 13.6 Mbits/sec
[ 31] 7.0- 8.0 sec 1.75 MBytes 14.7 Mbits/sec
[ 31] 8.0- 9.0 sec 1.62 MBytes 13.6 Mbits/sec
[ 31] 9.0-10.0 sec 1.75 MBytes 14.7 Mbits/sec
[ 31] 10.0-11.0 sec 1.62 MBytes 13.6 Mbits/sec
[ 31] 11.0-12.0 sec 1.75 MBytes 14.7 Mbits/sec
[ 31] 12.0-13.0 sec 1.75 MBytes 14.7 Mbits/sec
[ 31] 13.0-14.0 sec 1.62 MBytes 13.6 Mbits/sec
[ 31] 14.0-15.0 sec 1.75 MBytes 14.7 Mbits/sec
[ 31] 0.0-15.2 sec 25.9 MBytes 14.3 Mbits/sec
[ ] 
```

root@mininet-vm:~# █



# Teste Para Largura Bw = 20

```
mininet@mininet-vm: ~  
  
mininet@mininet-vm:~$ sudo mn --topo=linear,6 --link tc,bw=20 --mac  
*** Creating network  
*** Adding controller  
*** Adding hosts:  
h1 h2 h3 h4 h5 h6  
*** Adding switches:  
s1 s2 s3 s4 s5 s6  
*** Adding links:  
(20.00Mbit) (20.00Mbit) (h1, s1) (20.00Mbit) (20.00Mbit) (h2, s2) (20.00Mbit) (2  
0.00Mbit) (h3, s3) (20.00Mbit) (20.00Mbit) (h4, s4) (20.00Mbit) (20.00Mbit) (h5,  
s5) (20.00Mbit) (20.00Mbit) (h6, s6) (20.00Mbit) (20.00Mbit) (s2, s1) (20.00Mbi  
t) (20.00Mbit) (s3, s2) (20.00Mbit) (s4, s3) (20.00Mbit) (20.00Mbit)  
(s5, s4) (20.00Mbit) (20.00Mbit) (s6, s5)  
*** Configuring hosts  
h1 h2 h3 h4 h5 h6  
*** Starting controller  
c0  
*** Starting 6 switches  
s1 s2 s3 s4 s5 s6 ... (20.00Mbit) (20.00Mbit) (20.00Mbit) (20.00Mbit)  
(20.00Mbit) (20.00Mbit) (20.00Mbit) (20.00Mbit) (20.00Mbit) (20.00M  
bit) (20.00Mbit) (20.00Mbit) (20.00Mbit)  
*** Starting CLI:  
mininet> 
```



# Teste Para Laroufa Blj = 20

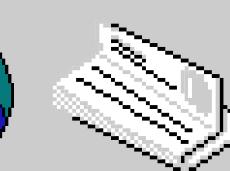
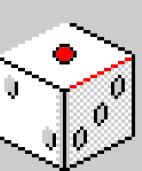
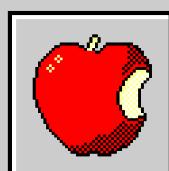
**Configurando o host 1 na porta 5555 como servidor tcp e o host 2 como um cliente. E fazendo testes iperf com ambos durante 15 segundos.**

```
X "Node: h1"
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 53792
[ ID] Interval Transfer Bandwidth
[ 32] 0.0- 1.0 sec 2.25 MBytes 18.8 Mbits/sec
[ 32] 1.0- 2.0 sec 2.21 MBytes 18.6 Mbits/sec
[ 32] 2.0- 3.0 sec 2.21 MBytes 18.5 Mbits/sec
[ 32] 3.0- 4.0 sec 2.22 MBytes 18.6 Mbits/sec
[ 32] 4.0- 5.0 sec 2.22 MBytes 18.6 Mbits/sec
[ 32] 5.0- 6.0 sec 2.23 MBytes 18.7 Mbits/sec
[ 32] 6.0- 7.0 sec 2.22 MBytes 18.7 Mbits/sec
[ 32] 7.0- 8.0 sec 2.21 MBytes 18.6 Mbits/sec
[ 32] 8.0- 9.0 sec 2.22 MBytes 18.6 Mbits/sec
[ 32] 9.0-10.0 sec 2.22 MBytes 18.6 Mbits/sec
[ 32] 10.0-11.0 sec 2.22 MBytes 18.6 Mbits/sec
[ 32] 11.0-12.0 sec 2.21 MBytes 18.6 Mbits/sec
[ 32] 12.0-13.0 sec 2.22 MBytes 18.6 Mbits/sec
[ 32] 13.0-14.0 sec 2.22 MBytes 18.6 Mbits/sec
[ 32] 14.0-15.0 sec 2.22 MBytes 18.6 Mbits/sec
[ 32] 0.0-15.2 sec 33.6 MBytes 18.6 Mbits/sec

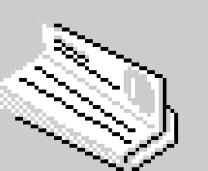
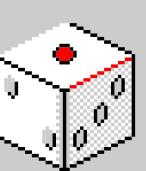
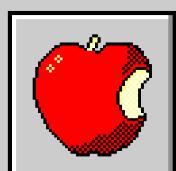
X "Node: h2"
root@mininet-vm:~# iperf -c 10.0.0.1 -p 5555 -i 1 -t 15
-----
Client connecting to 10.0.0.1, TCP port 5555
TCP window size: 85.3 KByte (default)

[ 31] local 10.0.0.2 port 53792 connected with 10.0.0.1 port 5555
[ ID] Interval Transfer Bandwidth
[ 31] 0.0- 1.0 sec 2.38 MBytes 19.9 Mbits/sec
[ 31] 1.0- 2.0 sec 2.25 MBytes 18.9 Mbits/sec
[ 31] 2.0- 3.0 sec 2.25 MBytes 18.9 Mbits/sec
[ 31] 3.0- 4.0 sec 2.12 MBytes 17.8 Mbits/sec
[ 31] 4.0- 5.0 sec 2.25 MBytes 18.9 Mbits/sec
[ 31] 5.0- 6.0 sec 2.25 MBytes 18.9 Mbits/sec
[ 31] 6.0- 7.0 sec 2.25 MBytes 18.9 Mbits/sec
[ 31] 7.0- 8.0 sec 2.25 MBytes 18.9 Mbits/sec
[ 31] 8.0- 9.0 sec 2.12 MBytes 17.8 Mbits/sec
[ 31] 9.0-10.0 sec 2.25 MBytes 18.9 Mbits/sec
[ 31] 10.0-11.0 sec 2.25 MBytes 18.9 Mbits/sec
[ 31] 11.0-12.0 sec 2.25 MBytes 18.9 Mbits/sec
[ 31] 12.0-13.0 sec 2.25 MBytes 18.9 Mbits/sec
[ 31] 13.0-14.0 sec 2.12 MBytes 17.8 Mbits/sec
[ 31] 14.0-15.0 sec 2.25 MBytes 18.9 Mbits/sec
[ 31] 0.0-15.1 sec 33.6 MBytes 18.7 Mbits/sec
```



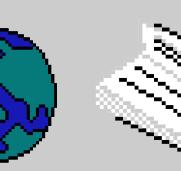
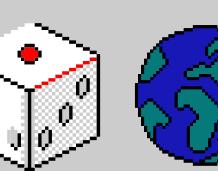
# Topologia da Rede no Python

```
mininet_topo.py X
mininet_topo.py > ...
1  from mininet.topo import Topo
2
3  class MyTopo(Topo):
4
5      def __init__(self):
6          Topo.__init__(self)
7
8          h1 = self.addHost('h1')
9          h2 = self.addHost('h2')
10         h3 = self.addHost('h3')
11         h4 = self.addHost('h4')
12         h5 = self.addHost('h5')
13         h6 = self.addHost('h6')
14         h7 = self.addHost('h7')
15         h8 = self.addHost('h8')
16         h9 = self.addHost('h9')
17         s1 = self.addSwitch('s1')
18         s2 = self.addSwitch('s2')
19         s3 = self.addSwitch('s3')
20         s4 = self.addSwitch('s4')
21
22         self.addLink(h1, s1)
23         self.addLink(h2, s1)
24         self.addLink(h3, s2)
25         self.addLink(h4, s2)
26         self.addLink(h5, s3)
27         self.addLink(h6, s3)
28         self.addLink(h7, s4)
29         self.addLink(h8, s4)
30         self.addLink(h9, s4)
31         self.addLink(s1, s2)
32         self.addLink(s2, s3)
33         self.addLink(s3, s4)
34
35         print("Topology Created Successfully")
36
37     topos = {'mytopo': (lambda: MyTopo())}
```



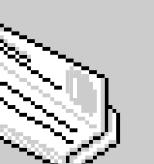
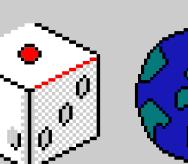
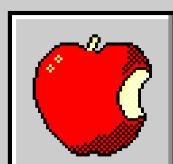
# Criando a Topologia pelo Código

```
mininet@mininet-vm:~$ sudo mn --custom Downloads/mininet_topo.py --topo mytopo --controller=none --mac  
*** Creating network  
*** Adding controller  
*** Adding hosts:  
h1 h2 h3 h4 h5 h6 h7 h8 h9  
*** Adding switches:  
s1 s2 s3 s4  
*** Adding links:  
(h1, s1) (h2, s1) (h3, s2) (h4, s2) (h5, s3) (h6, s3) (h7, s4) (h8, s4) (h9, s4) (s1, s2) (s2, s3)  
(s3, s4)  
*** Configuring hosts  
h1 h2 h3 h4 h5 h6 h7 h8 h9  
*** Starting controller  
  
*** Starting 4 switches  
s1 s2 s3 s4 ...  
*** Starting CLI:  
mininet> █
```



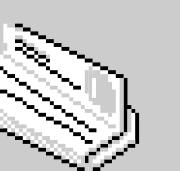
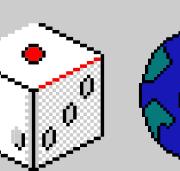
# Inspecionando as Informações da Interface

```
mininet> nodes
available nodes are:
h1 h2 h3 h4 h5 h6 h7 h8 h9 s1 s2 s3 s4
mininet> net
h1 h1-eth0:s1-eth1
h2 h2-eth0:s1-eth2
h3 h3-eth0:s2-eth1
h4 h4-eth0:s2-eth2
h5 h5-eth0:s3-eth1
h6 h6-eth0:s3-eth2
h7 h7-eth0:s4-eth1
h8 h8-eth0:s4-eth2
h9 h9-eth0:s4-eth3
s1 lo:  s1-eth1:h1-eth0  s1-eth2:h2-eth0  s1-eth3:s2-eth3
s2 lo:  s2-eth1:h3-eth0  s2-eth2:h4-eth0  s2-eth3:s1-eth3  s2-eth4:s3-eth3
s3 lo:  s3-eth1:h5-eth0  s3-eth2:h6-eth0  s3-eth3:s2-eth4  s3-eth4:s4-eth4
s4 lo:  s4-eth1:h7-eth0  s4-eth2:h8-eth0  s4-eth3:h9-eth0  s4-eth4:s3-eth4
```



# Inspecionando as Informações da Interface

```
mininet> dump
<Host h1: h1-eth0:10.0.0.1 pid=4621>
<Host h2: h2-eth0:10.0.0.2 pid=4624>
<Host h3: h3-eth0:10.0.0.3 pid=4627>
<Host h4: h4-eth0:10.0.0.4 pid=4630>
<Host h5: h5-eth0:10.0.0.5 pid=4633>
<Host h6: h6-eth0:10.0.0.6 pid=4636>
<Host h7: h7-eth0:10.0.0.7 pid=4639>
<Host h8: h8-eth0:10.0.0.8 pid=4642>
<Host h9: h9-eth0:10.0.0.9 pid=4645>
<OVSSwitch s1: lo:127.0.0.1,s1-eth1:None,s1-eth2:None,s1-eth3:None pid=4651>
<OVSSwitch s2: lo:127.0.0.1,s2-eth1:None,s2-eth2:None,s2-eth3:None,s2-eth4:None pid=4654>
<OVSSwitch s3: lo:127.0.0.1,s3-eth1:None,s3-eth2:None,s3-eth3:None,s3-eth4:None pid=4657>
<OVSSwitch s4: lo:127.0.0.1,s4-eth1:None,s4-eth2:None,s4-eth3:None,s4-eth4:None pid=4660>
mininet>
```



# Informações de h1 e h2

```
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)
```

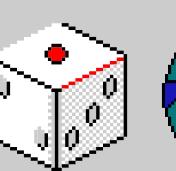
```
lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
                  UP LOOPBACK RUNNING  MTU:65536  Metric:1
                  RX packets:48641  errors:0  dropped:0  overruns:0  frame:0
                  TX packets:48641  errors:0  dropped:0  overruns:0  carrier:0
                  collisions:0  txqueuelen:1
                  RX bytes:5001116 (5.0 MB)  TX bytes:5001116 (5.0 MB)
```

```
mininet>
```

```
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)
```

```
mininet>
```



# Informações de h3 e h4

```
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)
```

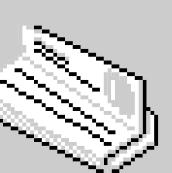
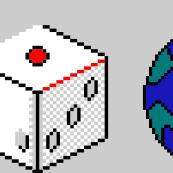
```
lo         Link encap:Local Loopback
            inet addr:127.0.0.1 Mask:255.0.0.0
                    UP LOOPBACK RUNNING MTU:65536 Metric:1
                    RX packets:0 errors:0 dropped:0 overruns:0 frame:0
                    TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
                    collisions:0 txqueuelen:1
                    RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)
```

```
mininet> █
```

```
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)
```

```
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)
```

```
mininet> █
```



# Informações de h5 e h6

```
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)
```

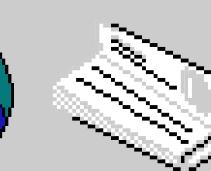
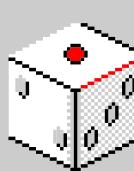
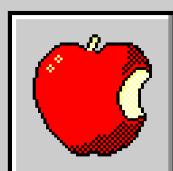
```
lo        Link encap:Local Loopback
            inet addr:127.0.0.1 Mask:255.0.0.0
                    UP LOOPBACK RUNNING MTU:65536 Metric:1
                    RX packets:0 errors:0 dropped:0 overruns:0 frame:0
                    TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
                    collisions:0 txqueuelen:1
                    RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)
```

```
mininet>
```

```
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)
```

```
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)
```

```
mininet>
```



# Informações de h7 e h8

```
mininet> h7 ifconfig -a
h7-eth0    Link encap:Ethernet HWaddr 00:00:00:00:00:07
            inet addr:10.0.0.7 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)

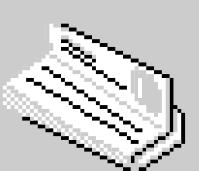
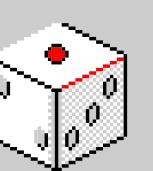
lo         Link encap:Local Loopback
            inet addr:127.0.0.1 Mask:255.0.0.0
            UP LOOPBACK RUNNING MTU:65536 Metric:1
            RX packets:0 errors:0 dropped:0 overruns:0 frame:0
            TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
            collisions:0 txqueuelen:1
            RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)

mininet> █
```

```
mininet> h8 ifconfig -a
h8-eth0    Link encap:Ethernet HWaddr 00:00:00:00:00:08
            inet addr:10.0.0.8 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)

mininet> █
```



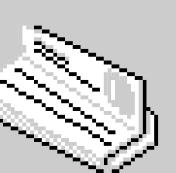
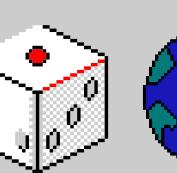
# Informações de h9



```
mininet> h9 ifconfig -a
h9-eth0    Link encap:Ethernet HWaddr 00:00:00:00:00:09
            inet addr:10.0.0.9 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)

mininet>
```



# Informações de s1 e s2

```
mininet> s1 ifconfig -a
eth0      Link encap:Ethernet HWaddr 08:00:27:e1:40:59
          inet addr:10.0.2.15 Bcast:10.0.2.255 Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
          RX packets:78986 errors:0 dropped:0 overruns:0 frame:0
          TX packets:13879 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:105408040 (105.4 MB) TX bytes:2057495 (2.0 MB)

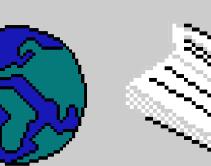
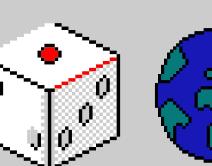
eth1      Link encap:Ethernet HWaddr 08:00:27:3f:f7:b0
          inet addr:192.168.56.101 Bcast:192.168.56.255 Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
          RX packets:1215438 errors:0 dropped:0 overruns:0 frame:0
          TX packets:7727551 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:112190534 (112.1 MB) TX bytes:20382633178 (20.3 GB)

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:893601 errors:0 dropped:0 overruns:0 frame:0
          TX packets:893601 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1
          RX bytes:10524919003 (10.5 GB) TX bytes:10524919003 (10.5 GB)
```

```
mininet> s2 ifconfig -a
eth0      Link encap:Ethernet HWaddr 08:00:27:e1:40:59
          inet addr:10.0.2.15 Bcast:10.0.2.255 Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
          RX packets:78988 errors:0 dropped:0 overruns:0 frame:0
          TX packets:13881 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:105408190 (105.4 MB) TX bytes:2057645 (2.0 MB)

eth1      Link encap:Ethernet HWaddr 08:00:27:3f:f7:b0
          inet addr:192.168.56.101 Bcast:192.168.56.255 Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
          RX packets:1226800 errors:0 dropped:0 overruns:0 frame:0
          TX packets:7749493 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:113778158 (113.7 MB) TX bytes:20415537356 (20.4 GB)

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:913976 errors:0 dropped:0 overruns:0 frame:0
          TX packets:913976 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1
          RX bytes:10542991351 (10.5 GB) TX bytes:10542991351 (10.5 GB)
```



# Informações de s3 e s4

```
mininet> s3 ifconfig -a
eth0      Link encap:Ethernet  HWaddr 08:00:27:e1:40:59
          inet addr:10.0.2.15  Bcast:10.0.2.255  Mask:255.255.255.0
                  UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
                  RX packets:78989 errors:0 dropped:0 overruns:0 frame:0
                  TX packets:13882 errors:0 dropped:0 overruns:0 carrier:0
                  collisions:0 txqueuelen:1000
                  RX bytes:105408280 (105.4 MB)  TX bytes:2057735 (2.0 MB)

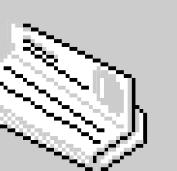
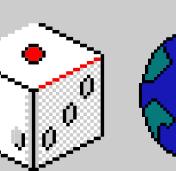
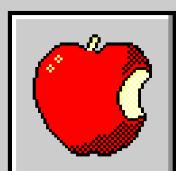
eth1      Link encap:Ethernet  HWaddr 08:00:27:3f:f7:b0
          inet addr:192.168.56.101  Bcast:192.168.56.255  Mask:255.255.255.0
                  UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
                  RX packets:1228661 errors:0 dropped:0 overruns:0 frame:0
                  TX packets:7751376 errors:0 dropped:0 overruns:0 carrier:0
                  collisions:0 txqueuelen:1000
                  RX bytes:114056952 (114.0 MB)  TX bytes:20415787394 (20.4 GB)

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:917661 errors:0 dropped:0 overruns:0 frame:0
                  TX packets:917661 errors:0 dropped:0 overruns:0 carrier:0
                  collisions:0 txqueuelen:1
                  RX bytes:10543270163 (10.5 GB)  TX bytes:10543270163 (10.5 GB)
```

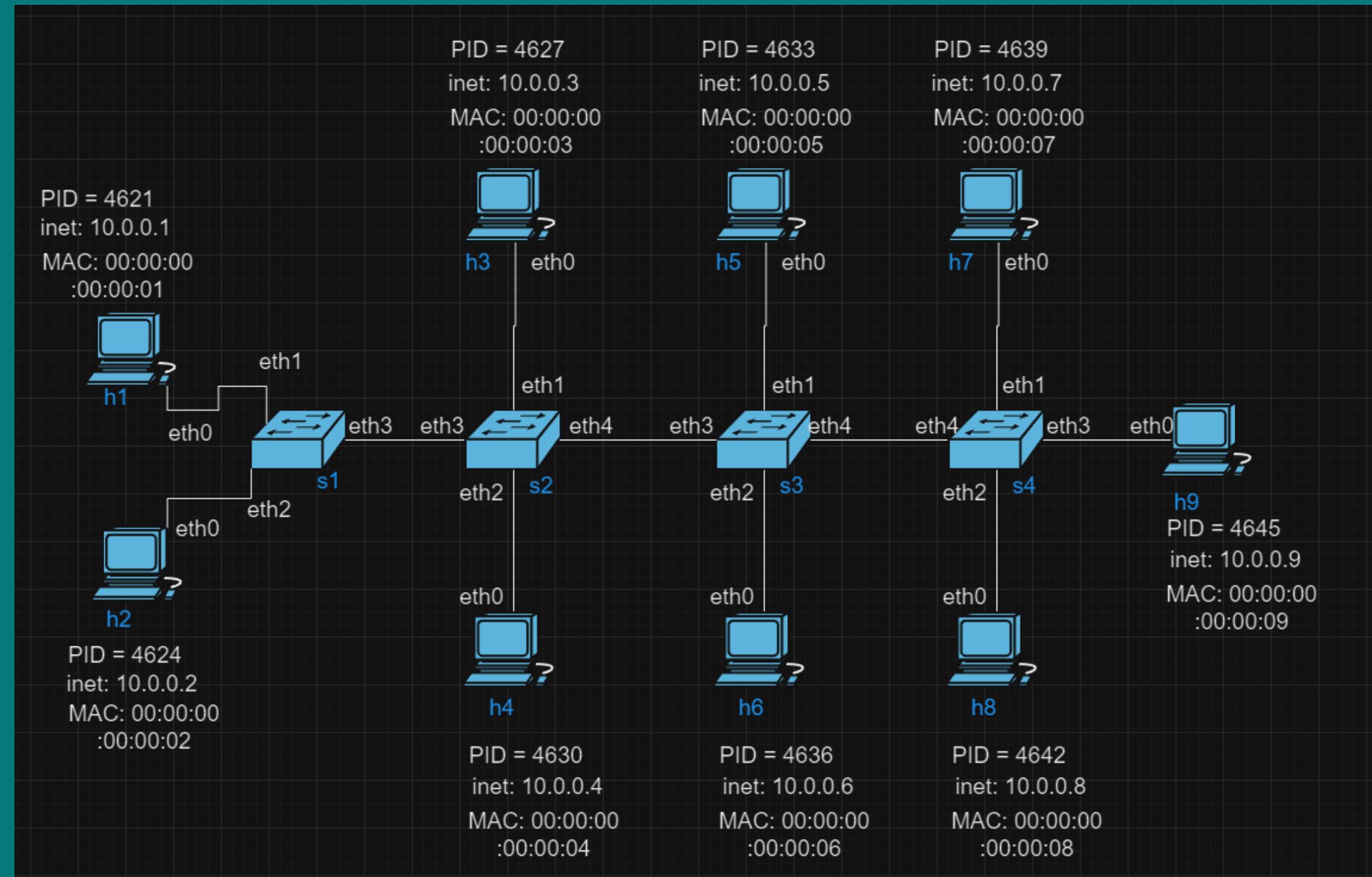
```
mininet> s4 ifconfig -a
eth0      Link encap:Ethernet  HWaddr 08:00:27:e1:40:59
          inet addr:10.0.2.15  Bcast:10.0.2.255  Mask:255.255.255.0
                  UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
                  RX packets:78991 errors:0 dropped:0 overruns:0 frame:0
                  TX packets:13884 errors:0 dropped:0 overruns:0 carrier:0
                  collisions:0 txqueuelen:1000
                  RX bytes:105408430 (105.4 MB)  TX bytes:2057885 (2.0 MB)

eth1      Link encap:Ethernet  HWaddr 08:00:27:3f:f7:b0
          inet addr:192.168.56.101  Bcast:192.168.56.255  Mask:255.255.255.0
                  UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
                  RX packets:1230184 errors:0 dropped:0 overruns:0 frame:0
                  TX packets:7752913 errors:0 dropped:0 overruns:0 carrier:0
                  collisions:0 txqueuelen:1000
                  RX bytes:114284822 (114.2 MB)  TX bytes:20416004644 (20.4 GB)

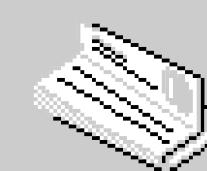
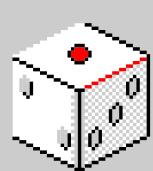
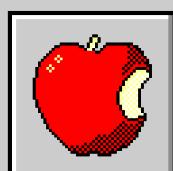
lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
                  UP LOOPBACK RUNNING  MTU:65536  Metric:1
                  RX packets:920660 errors:0 dropped:0 overruns:0 frame:0
                  TX packets:920660 errors:0 dropped:0 overruns:0 carrier:0
                  collisions:0 txqueuelen:1
                  RX bytes:10543503223 (10.5 GB)  TX bytes:10543503223 (10.5 GB)
```



# Topologia da Rede



[https://drive.google.com/file/d/18epOsj27dLWziRvQtmNlaQE8BDRvo8\\_-/view?usp=sharing](https://drive.google.com/file/d/18epOsj27dLWziRvQtmNlaQE8BDRvo8_-/view?usp=sharing)



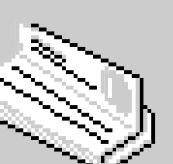
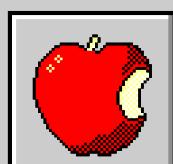
# Configurando os Switches e Pingando



X "Node: h1"

```
root@mininet-vm:~# sudo ovs-ofctl add-flow s1 action=normal
root@mininet-vm:~# sudo ovs-ofctl add-flow s2 action=normal
root@mininet-vm:~# sudo ovs-ofctl add-flow s3 action=normal
root@mininet-vm:~# sudo ovs-ofctl add-flow s4 action=normal
root@mininet-vm:~# █
```

```
mininet> pingall
*** Ping: testing ping reachability
h1 -> h2 h3 h4 h5 h6 h7 h8 h9
h2 -> h1 h3 h4 h5 h6 h7 h8 h9
h3 -> h1 h2 h4 h5 h6 h7 h8 h9
h4 -> h1 h2 h3 h5 h6 h7 h8 h9
h5 -> h1 h2 h3 h4 h6 h7 h8 h9
h6 -> h1 h2 h3 h4 h5 h7 h8 h9
h7 -> h1 h2 h3 h4 h5 h6 h8 h9
h8 -> h1 h2 h3 h4 h5 h6 h7 h9
h9 -> h1 h2 h3 h4 h5 h6 h7 h8
*** Results: 0% dropped (72/72 received)
mininet> █
```



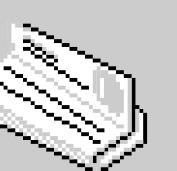
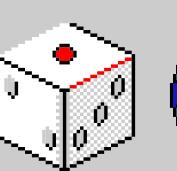
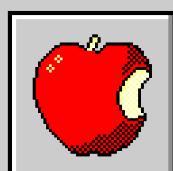
# Configurando os Switches e Pingando

X "Node: h1"

```
root@mininet-vm:~# ping 10.0.0.3
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=0.224 ms
64 bytes from 10.0.0.3: icmp_seq=2 ttl=64 time=0.046 ms
64 bytes from 10.0.0.3: icmp_seq=3 ttl=64 time=0.040 ms
64 bytes from 10.0.0.3: icmp_seq=4 ttl=64 time=0.035 ms
64 bytes from 10.0.0.3: icmp_seq=5 ttl=64 time=0.040 ms
64 bytes from 10.0.0.3: icmp_seq=6 ttl=64 time=0.035 ms
^C
--- 10.0.0.3 ping statistics ---
6 packets transmitted, 6 received, 0% packet loss, time 4999ms
rtt min/avg/max/mdev = 0.035/0.070/0.224/0.068 ms
root@mininet-vm:~#
```

X "Node: h1"

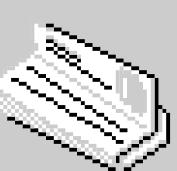
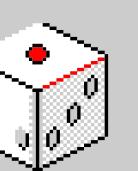
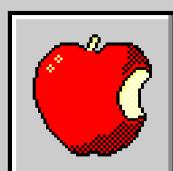
```
root@mininet-vm:~# ping 10.0.0.9
PING 10.0.0.9 (10.0.0.9) 56(84) bytes of data.
64 bytes from 10.0.0.9: icmp_seq=1 ttl=64 time=0.351 ms
64 bytes from 10.0.0.9: icmp_seq=2 ttl=64 time=0.044 ms
64 bytes from 10.0.0.9: icmp_seq=3 ttl=64 time=0.050 ms
64 bytes from 10.0.0.9: icmp_seq=4 ttl=64 time=0.049 ms
64 bytes from 10.0.0.9: icmp_seq=5 ttl=64 time=0.044 ms
64 bytes from 10.0.0.9: icmp_seq=6 ttl=64 time=0.044 ms
^C
--- 10.0.0.9 ping statistics ---
6 packets transmitted, 6 received, 0% packet loss, time 4998ms
rtt min/avg/max/mdev = 0.044/0.097/0.351/0.113 ms
root@mininet-vm:~#
```



# Excluindo as Regras Criadas Anteriormente

X "Node: h1"

```
root@mininet-vm:~# sudo ovs-ofctl del-flows s1
root@mininet-vm:~# sudo ovs-ofctl del-flows s2
root@mininet-vm:~# sudo ovs-ofctl del-flows s3
root@mininet-vm:~# sudo ovs-ofctl del-flows s4
root@mininet-vm:~# █
```

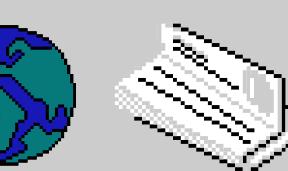
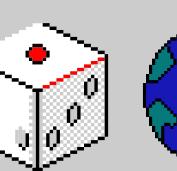
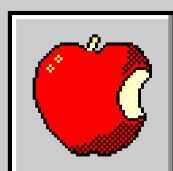


# Criando Regras Baseando no Endereço MAC

Host h1 com os hosts: h2,h3,h4 e h5

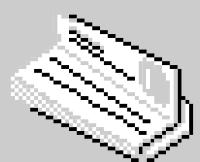
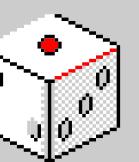
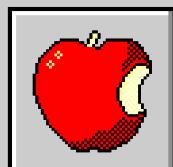
```
X "Node: h1"

root@mininet-vm:~# sudo ovs-ofctl add-flow s1 dl_type=0x806,nw_proto=1,action=flood
root@mininet-vm:~# sudo ovs-ofctl add-flow s1 dl_src=00:00:00:00:00:01,dl_dst=00:00:00:00:00:02,actions=output:2
root@mininet-vm:~# sudo ovs-ofctl add-flow s1 dl_src=00:00:00:00:00:02,dl_dst=00:00:00:00:00:01,actions=output:1
root@mininet-vm:~#
root@mininet-vm:~# sudo ovs-ofctl add-flow s1 dl_src=00:00:00:00:00:01,dl_dst=00:00:00:00:00:03,actions=output:3
root@mininet-vm:~# sudo ovs-ofctl add-flow s2 dl_src=00:00:00:00:00:01,dl_dst=00:00:00:00:00:03,actions=output:1
root@mininet-vm:~# sudo ovs-ofctl add-flow s2 dl_src=00:00:00:00:00:03,dl_dst=00:00:00:00:00:01,actions=output:3
root@mininet-vm:~# sudo ovs-ofctl add-flow s1 dl_src=00:00:00:00:00:03,dl_dst=00:00:00:00:00:01,actions=output:1
root@mininet-vm:~#
root@mininet-vm:~# sudo ovs-ofctl add-flow s1 dl_src=00:00:00:00:00:01,dl_dst=00:00:00:00:00:04,actions=output:3
root@mininet-vm:~# sudo ovs-ofctl add-flow s2 dl_src=00:00:00:00:00:01,dl_dst=00:00:00:00:00:04,actions=output:2
root@mininet-vm:~# sudo ovs-ofctl add-flow s2 dl_src=00:00:00:00:00:04,dl_dst=00:00:00:00:00:01,actions=output:3
root@mininet-vm:~# sudo ovs-ofctl add-flow s1 dl_src=00:00:00:00:00:04,dl_dst=00:00:00:00:00:01,actions=output:1
root@mininet-vm:~#
root@mininet-vm:~# sudo ovs-ofctl add-flow s1 dl_src=00:00:00:00:00:01,dl_dst=00:00:00:00:00:05,actions=output:3
root@mininet-vm:~# sudo ovs-ofctl add-flow s2 dl_src=00:00:00:00:00:01,dl_dst=00:00:00:00:00:05,actions=output:4
root@mininet-vm:~# sudo ovs-ofctl add-flow s3 dl_src=00:00:00:00:00:01,dl_dst=00:00:00:00:00:05,actions=output:1
root@mininet-vm:~# sudo ovs-ofctl add-flow s3 dl_src=00:00:00:00:00:05,dl_dst=00:00:00:00:00:01,actions=output:3
root@mininet-vm:~# sudo ovs-ofctl add-flow s2 dl_src=00:00:00:00:00:05,dl_dst=00:00:00:00:00:01,actions=output:3
root@mininet-vm:~# sudo ovs-ofctl add-flow s1 dl_src=00:00:00:00:00:05,dl_dst=00:00:00:00:00:01,actions=output:1
root@mininet-vm:~#
```



# Criando Regras Baseando no Endereço MAC

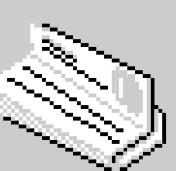
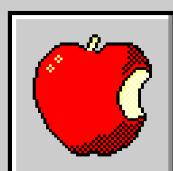
# Host h4 com os hosts: h5,h6,h7,h8 e h9



# Criando Regras Baseando no Endereço MAC

## Host h6 com os hosts: h7,h8 e h9

```
root@mininet-vm:~#  
root@mininet-vm:~# sudo ovs-ofctl add-flow s3 dl_src=00:00:00:00:00:06,dl_dst=00:00:00:00:00:07,actions=output:4  
root@mininet-vm:~# sudo ovs-ofctl add-flow s4 dl_src=00:00:00:00:06,dl_dst=00:00:00:00:00:07,actions=output:1  
root@mininet-vm:~# sudo ovs-ofctl add-flow s4 dl_src=00:00:00:00:07,dl_dst=00:00:00:00:00:06,actions=output:4  
root@mininet-vm:~# sudo ovs-ofctl add-flow s3 dl_src=00:00:00:00:07,dl_dst=00:00:00:00:00:06,actions=output:2  
root@mininet-vm:~#  
root@mininet-vm:~# sudo ovs-ofctl add-flow s3 dl_src=00:00:00:00:06,dl_dst=00:00:00:00:00:08,actions=output:4  
root@mininet-vm:~# sudo ovs-ofctl add-flow s4 dl_src=00:00:00:00:06,dl_dst=00:00:00:00:00:08,actions=output:2  
root@mininet-vm:~# sudo ovs-ofctl add-flow s4 dl_src=00:00:00:00:08,dl_dst=00:00:00:00:00:06,actions=output:4  
root@mininet-vm:~# sudo ovs-ofctl add-flow s3 dl_src=00:00:00:00:08,dl_dst=00:00:00:00:00:06,actions=output:2  
root@mininet-vm:~#  
root@mininet-vm:~# sudo ovs-ofctl add-flow s3 dl_src=00:00:00:00:06,dl_dst=00:00:00:00:00:09,actions=output:4  
root@mininet-vm:~# sudo ovs-ofctl add-flow s4 dl_src=00:00:00:00:06,dl_dst=00:00:00:00:00:09,actions=output:3  
root@mininet-vm:~# sudo ovs-ofctl add-flow s4 dl_src=00:00:00:00:09,dl_dst=00:00:00:00:00:06,actions=output:4  
root@mininet-vm:~# sudo ovs-ofctl add-flow s3 dl_src=00:00:00:00:09,dl_dst=00:00:00:00:00:06,actions=output:2  
root@mininet-vm:~# █
```



# Mostrando os Testes Para as Regras

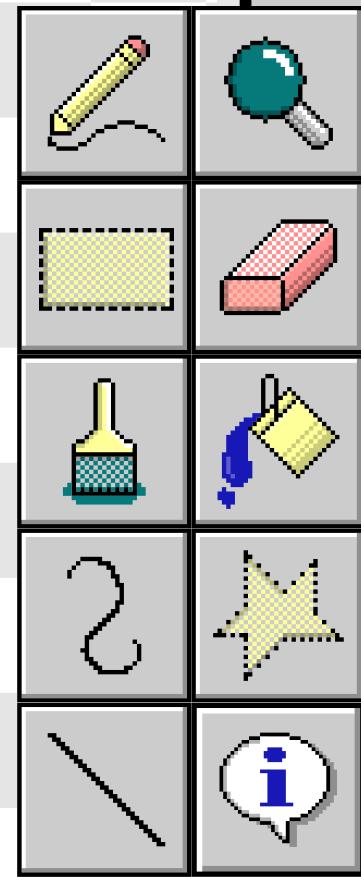
```
mininet> h1 ping h5
PING 10.0.0.5 (10.0.0.5) 56(84) bytes of data.
64 bytes from 10.0.0.5: icmp_seq=1 ttl=64 time=1.66 ms
64 bytes from 10.0.0.5: icmp_seq=2 ttl=64 time=0.030 ms
^C
--- 10.0.0.5 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1001ms
rtt min/avg/max/mdev = 0.030/0.845/1.661/0.816 ms
mininet>
```

```
mininet> h4 ping h6
PING 10.0.0.6 (10.0.0.6) 56(84) bytes of data.
64 bytes from 10.0.0.6: icmp_seq=1 ttl=64 time=1.88 ms
64 bytes from 10.0.0.6: icmp_seq=2 ttl=64 time=0.063 ms
^C
--- 10.0.0.6 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1003ms
rtt min/avg/max/mdev = 0.063/0.975/1.888/0.913 ms
mininet>
```

```
mininet> h6 ping h9
PING 10.0.0.3 (10.0.0.9) 56(84) bytes of data.
64 bytes from 10.0.0.9: icmp_seq=1 ttl=64 time=0.304 ms
64 bytes from 10.0.0.9: icmp_seq=2 ttl=64 time=0.045 ms
^C
--- 10.0.0.9 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 999ms
rtt min/avg/max/mdev = 0.045/0.174/0.304/0.130 ms
mininet>
```





FIM!

