

MININET

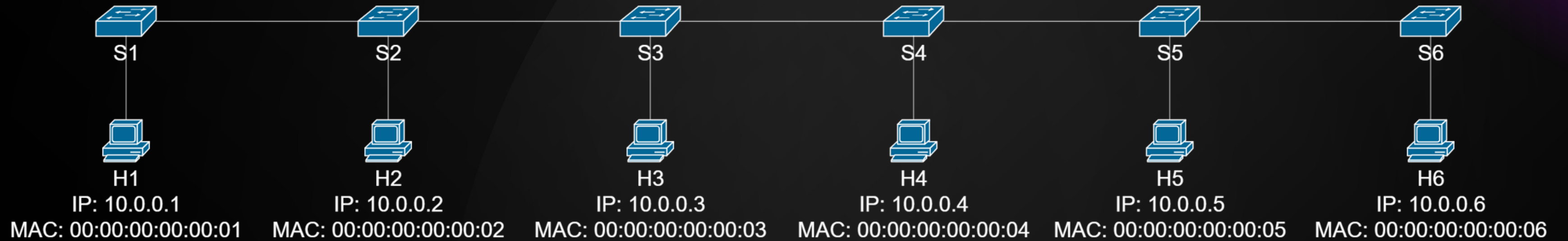
TRABALHO FINAL

Hélio Abreu Marques Rocha -1763
João Henrique Silva Delfino - 1662
Pedro Henrique de Souza - 1721

Exercício 1

Topologia

Topologia linear (6 switches e 6 hosts)



Execução e Testes



Criando a Topologia

```
joao@joao-Aspire-E5-573: ~  
joao@joao-Aspire-E5-573:~$ sudo mn --controller=default --mac --link tc,bw=5,delay=1ms --topo=linear,6  
*** Creating network  
* Adding controller  
* Google Chrome ts:  
h1 h2 h3 h4 h5 h6  
*** Adding switches:  
s1 s2 s3 s4 s5 s6  
*** Adding links:  
(5.00Mbit 1ms delay) (5.00Mbit 1ms delay) (h1, s1) (5.00Mbit 1ms delay) (5.00Mbit 1ms delay) (h2, s2) (5.00Mbit 1ms delay) (5.00Mbit 1ms delay)  
(h3, s3) (5.00Mbit 1ms delay) (5.00Mbit 1ms delay) (h4, s4) (5.00Mbit 1ms delay) (5.00Mbit 1ms delay) (h5, s5) (5.00Mbit 1ms delay) (5.00Mbit  
1ms delay) (h6, s6) (5.00Mbit 1ms delay) (5.00Mbit 1ms delay) (s2, s1) (5.00Mbit 1ms delay) (5.00Mbit 1ms delay) (s3, s2) (5.00Mbit 1ms dela  
y) (5.00Mbit 1ms delay) (s4, s3) (5.00Mbit 1ms delay) (5.00Mbit 1ms delay) (s5, s4) (5.00Mbit 1ms delay) (5.00Mbit 1ms delay) (s6, s5)  
*** Configuring hosts  
h1 h2 h3 h4 h5 h6  
*** Starting controller  
c0  
*** Starting 6 switches  
s1 s2 s3 s4 s5 s6 ... (5.00Mbit 1ms delay) (5.00Mbit 1ms delay) (5.00Mbit 1ms delay) (5.00Mbit 1ms delay) (5.00Mbit 1ms delay) (5.00Mbit 1ms de  
lay) (5.00Mbit 1ms delay) (5.00Mbit 1ms delay) (5.00Mbit 1ms delay) (5.00Mbit 1ms delay) (5.00Mbit 1ms delay) (5.00Mbit 1ms delay) (5.00Mbit 1  
ms delay) (5.00Mbit 1ms delay) (5.00Mbit 1ms delay) (5.00Mbit 1ms delay)
```

Informações das interfaces

IPs

```
mininet> dump
<Host h1: h1-eth0:10.0.0.1 pid=1106309>
<Host h2: h2-eth0:10.0.0.2 pid=1106311>
<Host h3: h3-eth0:10.0.0.3 pid=1106313>
<Host h4: h4-eth0:10.0.0.4 pid=1106315>
<Host h5: h5-eth0:10.0.0.5 pid=1106317>
<Host h6: h6-eth0:10.0.0.6 pid=1106319>
<OVSSwitch s1: lo:127.0.0.1,s1-eth1:None,s1-eth2:None pid=1106324>
<OVSSwitch s2: lo:127.0.0.1,s2-eth1:None,s2-eth2:None,s2-eth3:None pid=1106327>
<OVSSwitch s3: lo:127.0.0.1,s3-eth1:None,s3-eth2:None,s3-eth3:None pid=1106330>
<OVSSwitch s4: lo:127.0.0.1,s4-eth1:None,s4-eth2:None,s4-eth3:None pid=1106333>
<OVSSwitch s5: lo:127.0.0.1,s5-eth1:None,s5-eth2:None,s5-eth3:None pid=1106336>
<OVSSwitch s6: lo:127.0.0.1,s6-eth1:None,s6-eth2:None pid=1106339>
<Controller c0: 127.0.0.1:6653 pid=1106302>
```

MACs

```
mininet> py h1.MAC()
00:00:00:00:00:01
mininet> py h2.MAC()
00:00:00:00:00:02
mininet> py h3.MAC()
00:00:00:00:00:03
mininet> py h4.MAC()
00:00:00:00:00:04
mininet> py h5.MAC()
00:00:00:00:00:05
mininet> py h6.MAC()
00:00:00:00:00:06
```

Informações das interfaces

```
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
```


Testes de ping

1

```
mininet> pingallfull
*** Ping: testing ping reachability
h1 -> h2 h3 h4 h5 h6
h2 -> h1 h3 h4 h5 h6
h3 -> h1 h2 h4 h5 h6
h4 -> h1 h2 h3 h5 h6
h5 -> h1 h2 h3 h4 h6
h6 -> h1 h2 h3 h4 h5
*** Results:
h1->h2: 1/1, rtt min/avg/max/mdev 17.207/17.207/17.207/0.000 ms
h1->h3: 1/1, rtt min/avg/max/mdev 25.531/25.531/25.531/0.000 ms
h1->h4: 1/1, rtt min/avg/max/mdev 30.587/30.587/30.587/0.000 ms
h1->h5: 1/1, rtt min/avg/max/mdev 36.888/36.888/36.888/0.000 ms
h1->h6: 1/1, rtt min/avg/max/mdev 43.559/43.559/43.559/0.000 ms
h2->h1: 1/1, rtt min/avg/max/mdev 8.883/8.883/8.883/0.000 ms
h2->h3: 1/1, rtt min/avg/max/mdev 18.689/18.689/18.689/0.000 ms
h2->h4: 1/1, rtt min/avg/max/mdev 23.978/23.978/23.978/0.000 ms
h2->h5: 1/1, rtt min/avg/max/mdev 31.129/31.129/31.129/0.000 ms
h2->h6: 1/1, rtt min/avg/max/mdev 36.162/36.162/36.162/0.000 ms
h3->h1: 1/1, rtt min/avg/max/mdev 11.906/11.906/11.906/0.000 ms
h3->h2: 1/1, rtt min/avg/max/mdev 10.565/10.565/10.565/0.000 ms
h3->h4: 1/1, rtt min/avg/max/mdev 17.720/17.720/17.720/0.000 ms
h3->h5: 1/1, rtt min/avg/max/mdev 23.218/23.218/23.218/0.000 ms
h3->h6: 1/1, rtt min/avg/max/mdev 30.927/30.927/30.927/0.000 ms
h4->h1: 1/1, rtt min/avg/max/mdev 16.643/16.643/16.643/0.000 ms
h4->h2: 1/1, rtt min/avg/max/mdev 16.149/16.149/16.149/0.000 ms
h4->h3: 1/1, rtt min/avg/max/mdev 16.108/16.108/16.108/0.000 ms
h4->h5: 1/1, rtt min/avg/max/mdev 24.740/24.740/24.740/0.000 ms
h4->h6: 1/1, rtt min/avg/max/mdev 24.148/24.148/24.148/0.000 ms
h5->h1: 1/1, rtt min/avg/max/mdev 21.480/21.480/21.480/0.000 ms
h5->h2: 1/1, rtt min/avg/max/mdev 17.912/17.912/17.912/0.000 ms
h5->h3: 1/1, rtt min/avg/max/mdev 11.287/11.287/11.287/0.000 ms
h5->h4: 1/1, rtt min/avg/max/mdev 9.913/9.913/9.913/0.000 ms
h5->h6: 1/1, rtt min/avg/max/mdev 17.352/17.352/17.352/0.000 ms
h6->h1: 1/1, rtt min/avg/max/mdev 25.188/25.188/25.188/0.000 ms
h6->h2: 1/1, rtt min/avg/max/mdev 19.509/19.509/19.509/0.000 ms
h6->h3: 1/1, rtt min/avg/max/mdev 15.230/15.230/15.230/0.000 ms
h6->h4: 1/1, rtt min/avg/max/mdev 12.177/12.177/12.177/0.000 ms
h6->h5: 1/1, rtt min/avg/max/mdev 8.497/8.497/8.497/0.000 ms
```

```
root@joao-Aspire-E5-573:/home/joao# tcpdump -XX -n -i h1-eth0
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on h1-eth0, link-type EN10MB (Ethernet), capture size 262144 bytes
20:45:18.650824 IP 10.0.0.1 > 10.0.0.2: ICMP echo request, id 60908, seq 1, length 64
    0x0000: 0000 0000 0002 0000 0000 0001 0800 4500 .....E.
    0x0010: 0054 c5f8 4000 4001 60ae 0a00 0001 0a00 .T...@.....
    0x0020: 0002 0800 c3af edec 0001 0e40 4065 0000 .....@e..
    0x0030: 0000 2fea 0900 0000 0000 1011 1213 1415 ..5\.....
    0x0040: 1617 1819 1a1b 1c1d 1e1f 2021 2223 2425 .....!""$%
    0x0050: 2627 2829 2a2b 2c2d 2e2f 3031 3233 3435 &'()*+,-./012345
    0x0060: 3637 .....67
20:45:18.658604 IP 10.0.0.2 > 10.0.0.1: ICMP echo reply, id 60908, seq 1, length 64
    0x0000: 0000 0000 0001 0000 0000 0002 0800 4500 .....E.
    0x0010: 0054 555c 0000 4001 113b 0a00 0002 0a00 .TU...@.....
    0x0020: 0001 0000 cbaf edec 0001 0e40 4065 0000 .....@e..
    0x0030: 0000 2fea 0900 0000 0000 1011 1213 1415 ..5\.....
    0x0040: 1617 1819 1a1b 1c1d 1e1f 2021 2223 2425 .....!""$%
    0x0050: 2627 2829 2a2b 2c2d 2e2f 3031 3233 3435 &'()*+,-./012345
    0x0060: 3637 .....67
20:45:18.663240 IP 10.0.0.1 > 10.0.0.3: ICMP echo request, id 60909, seq 1, length 64
    0x0000: 0000 0000 0003 0000 0000 0001 0800 4500 .....E.
    0x0010: 0054 d6c4 4000 4001 4fe1 0a00 0001 0a00 .T...@.....
    0x0020: 0003 0800 2e7e eded 0001 0e40 4065 0000 .....@e..
    0x0030: 0000 c41a 0a00 0000 0000 1011 1213 1415 .....
    0x0040: 1617 1819 1a1b 1c1d 1e1f 2021 2223 2425 .....!""$%
    0x0050: 2627 2829 2a2b 2c2d 2e2f 3031 3233 3435 &'()*+,-./012345
    0x0060: 3637 .....67
20:45:18.674776 IP 10.0.0.3 > 10.0.0.1: ICMP echo reply, id 60909, seq 1, length 64
    0x0000: 0000 0000 0001 0000 0000 0003 0800 4500 .....E.
    0x0010: 0054 a7d1 0000 4001 bed4 0a00 0003 0a00 .T....@.....
    0x0020: 0001 0000 367e eded 0001 0e40 4065 0000 ....6".....@e..
    0x0030: 0000 c41a 0a00 0000 0000 1011 1213 1415 .....
    0x0040: 1617 1819 1a1b 1c1d 1e1f 2021 2223 2425 .....!""$%
    0x0050: 2627 2829 2a2b 2c2d 2e2f 3031 3233 3435 &'()*+,-./012345
    0x0060: 3637 .....67
20:45:18.680023 IP 10.0.0.1 > 10.0.0.4: ICMP echo request, id 60910, seq 1, length 64
    0x0000: 0000 0000 0004 0000 0000 0001 0800 4500 .....E.
    0x0010: 0054 2c8d 4000 4001 fa17 0a00 0001 0a00 .T...@.....
    0x0020: 0004 0800 bd3b edee 0001 0e40 4065 0000 .....@e..
    0x0030: 0000 355c 0a00 0000 0000 1011 1213 1415 ..5\.....
    0x0040: 1617 1819 1a1b 1c1d 1e1f 2021 2223 2425 .....!""$%
    0x0050: 2627 2829 2a2b 2c2d 2e2f 3031 3233 3435 &'()*+,-./012345
    0x0060: 3637 .....67
20:45:18.695748 IP 10.0.0.4 > 10.0.0.1: ICMP echo reply, id 60910, seq 1, length 64
    0x0000: 0000 0000 0001 0000 0000 0004 0800 4500 .....E.
    0x0010: 0054 4c99 0000 4001 1a0c 0a00 0004 0a00 .TL...@.....
    0x0020: 0001 0000 c53b edee 0001 0e40 4065 0000 .....@e..
```

2

```
20:45:18.695748 IP 10.0.0.4 > 10.0.0.1: ICMP echo reply, id 60910, seq 1, length 64
    0x0000: 0000 0000 0001 0000 0000 0004 0800 4500 .....E.
    0x0010: 0054 4c99 0000 4001 1a0c 0a00 0004 0a00 .TL...@.....
    0x0020: 0001 0000 c53b edee 0001 0e40 4065 0000 .....@e..
    0x0030: 0000 355c 0a00 0000 0000 1011 1213 1415 ..5\.....
    0x0040: 1617 1819 1a1b 1c1d 1e1f 2021 2223 2425 .....!""$%
    0x0050: 2627 2829 2a2b 2c2d 2e2f 3031 3233 3435 &'()*+,-./012345
    0x0060: 3637 .....67
20:45:18.700360 IP 10.0.0.1 > 10.0.0.5: ICMP echo request, id 60911, seq 1, length 64
    0x0000: 0000 0000 0005 0000 0000 0001 0800 4500 .....E.
    0x0010: 0054 85dd 4000 4001 a0c6 0a00 0001 0a00 .T...@.....
    0x0020: 0005 0800 45eb edef 0001 0e40 4065 0000 ....E.....@e..
    0x0030: 0000 acab 0a00 0000 0000 1011 1213 1415 .....
    0x0040: 1617 1819 1a1b 1c1d 1e1f 2021 2223 2425 .....!""$%
    0x0050: 2627 2829 2a2b 2c2d 2e2f 3031 3233 3435 &'()*+,-./012345
    0x0060: 3637 .....67
20:45:18.718526 IP 10.0.0.5 > 10.0.0.1: ICMP echo reply, id 60911, seq 1, length 64
    0x0000: 0000 0000 0001 0000 0000 0005 0800 4500 .....E.
    0x0010: 0054 f0b0 0000 4001 75f3 0a00 0005 0a00 .T....@.....
    0x0020: 0001 0000 4deb edef 0001 0e40 4065 0000 ....M.....@e..
    0x0030: 0000 acab 0a00 0000 0000 1011 1213 1415 .....
    0x0040: 1617 1819 1a1b 1c1d 1e1f 2021 2223 2425 .....!""$%
    0x0050: 2627 2829 2a2b 2c2d 2e2f 3031 3233 3435 &'()*+,-./012345
    0x0060: 3637 .....67
20:45:18.723430 IP 10.0.0.1 > 10.0.0.6: ICMP echo request, id 60912, seq 1, length 64
    0x0000: 0000 0000 0006 0000 0000 0001 0800 4500 .....E.
    0x0010: 0054 4892 4000 4001 de10 0a00 0001 0a00 .TH.@.....
    0x0020: 0006 0800 2b90 edf0 0001 0e40 4065 0000 .....+.....@e..
    0x0030: 0000 c605 0b00 0000 0000 1011 1213 1415 .....
    0x0040: 1617 1819 1a1b 1c1d 1e1f 2021 2223 2425 .....!""$%
    0x0050: 2627 2829 2a2b 2c2d 2e2f 3031 3233 3435 &'()*+,-./012345
    0x0060: 3637 .....67
20:45:18.745544 IP 10.0.0.6 > 10.0.0.1: ICMP echo reply, id 60912, seq 1, length 64
    0x0000: 0000 0000 0001 0000 0000 0006 0800 4500 .....E.
    0x0010: 0054 2f08 0000 4001 379b 0a00 0006 0a00 .T/...@.....
    0x0020: 0001 0000 3390 edf0 0001 0e40 4065 0000 .....3.....@e..
    0x0030: 0000 c605 0b00 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
20:45:18.752416 IP 10.0.0.2 > 10.0.0.1: ICMP echo request, id 60913, seq 1, length 64
    0x0000: 0000 0000 0001 0000 0000 0002 0800 4500 .....E.
    0x0010: 0054 5579 4000 4001 d12d 0a00 0002 0a00 .TUy@.....
    0x0020: 0001 0800 8829 edf1 0001 0e40 4065 0000 .....).@e..
```


3

Testes de ping

```

20:45:18.752416 IP 10.0.0.2 > 10.0.0.1: ICMP echo request, id 60913, seq 1, length 64
    0x0000: 0000 0000 0001 0000 0000 0002 0800 4500 .....E.
    0x0010: 0054 5579 4000 4001 d12d 0a00 0002 0a00 .TUy@.@.-.....
    0x0020: 0001 0800 8829 edf1 0001 0e40 4065 0000 .....@e..
    0x0030: 0000 696b 0b00 0000 0000 1011 1213 1415 ..ik.....
    0x0040: 1617 1819 1a1b 1c1d 1e1f 2021 2223 2425 .....!#$%
    0x0050: 2627 2829 2a2b 2c2d 2e2f 3031 3233 3435 &'()*+,-./012345
    0x0060: 3637 67
20:45:18.753480 IP 10.0.0.1 > 10.0.0.2: ICMP echo reply, id 60913, seq 1, length 64
    0x0000: 0000 0000 0002 0000 0000 0001 0800 4500 .....E.
    0x0010: 0054 c506 0000 4001 a0a0 0a00 0001 0a00 .T....@.....
    0x0020: 0002 0000 9029 edf1 0001 0e40 4065 0000 .....@e..
    0x0030: 0000 696b 0b00 0000 0000 1011 1213 1415 ..ik.....
    0x0040: 1617 1819 1a1b 1c1d 1e1f 2021 2223 2425 .....!#$%
    0x0050: 2627 2829 2a2b 2c2d 2e2f 3031 3233 3435 &'()*+,-./012345
    0x0060: 3637 67
20:45:18.841410 IP 10.0.0.3 > 10.0.0.1: ICMP echo request, id 60918, seq 1, length 64
    0x0000: 0000 0000 0001 0000 0000 0003 0800 4500 .....E.
    0x0010: 0054 a7df 4000 4001 7ec6 0a00 0003 0a00 .T..@.@.~.....
    0x0020: 0001 0800 d6d5 edf6 0001 0e40 4065 0000 .....@e..
    0x0030: 0000 19ba 0c00 0000 0000 1011 1213 1415 .....
    0x0040: 1617 1819 1a1b 1c1d 1e1f 2021 2223 2425 .....!#$%
    0x0050: 2627 2829 2a2b 2c2d 2e2f 3031 3233 3435 &'()*+,-./012345
    0x0060: 3637 67
20:45:18.842512 IP 10.0.0.1 > 10.0.0.3: ICMP echo reply, id 60918, seq 1, length 64
    0x0000: 0000 0000 0003 0000 0000 0001 0800 4500 .....E.
    0x0010: 0054 d6db 0000 4001 8fca 0a00 0001 0a00 .T....@.....
    0x0020: 0003 0000 ded5 edf6 0001 0e40 4065 0000 .....@e..
    0x0030: 0000 19ba 0c00 0000 0000 1011 1213 1415 .....
    0x0040: 1617 1819 1a1b 1c1d 1e1f 2021 2223 2425 .....!#$%
    0x0050: 2627 2829 2a2b 2c2d 2e2f 3031 3233 3435 &'()*+,-./012345
    0x0060: 3637 67
20:45:18.919913 IP 10.0.0.4 > 10.0.0.1: ICMP echo request, id 60923, seq 1, length 64
    0x0000: 0000 0000 0001 0000 0000 0004 0800 4500 .....E.
    0x0010: 0054 4cc8 4000 4001 d9dc 0a00 0004 0a00 .TL.@.@.....
    0x0020: 0001 0800 ff9e edfb 0001 0e40 4065 0000 .....@e..
    0x0030: 0000 efef 0d00 0000 0000 1011 1213 1415 .....
    0x0040: 1617 1819 1a1b 1c1d 1e1f 2021 2223 2425 .....!#$%
    0x0050: 2627 2829 2a2b 2c2d 2e2f 3031 3233 3435 &'()*+,-./012345
    0x0060: 3637 67
20:45:18.921146 IP 10.0.0.1 > 10.0.0.4: ICMP echo reply, id 60923, seq 1, length 64
    0x0000: 0000 0000 0004 0000 0000 0001 0800 4500 .....E.
    0x0010: 0054 2cad 0000 4001 39f8 0a00 0001 0a00 .T....@.9.....
    0x0020: 0004 0000 079f edfb 0001 0e40 4065 0000 .....@e..
    0x0030: 0000 efef 0d00 0000 0000 1011 1213 1415 .....
    0x0040: 1617 1819 1a1b 1c1d 1e1f 2021 2223 2425 .....!#$%
    0x0050: 2627 2829 2a2b 2c2d 2e2f 3031 3233 3435 &'()*+,-./012345
    0x0060: 3637 67

```

4

```

20:45:18.921146 IP 10.0.0.1 > 10.0.0.4: ICMP echo reply, id 60923, seq 1, length 64
    0x0000: 0000 0000 0004 0000 0000 0001 0800 4500 .....E.
    0x0010: 0054 2cad 0000 4001 39f8 0a00 0001 0a00 .T....@.9.....
    0x0020: 0004 0000 079f edfb 0001 0e40 4065 0000 .....@e..
    0x0030: 0000 efef 0d00 0000 0000 1011 1213 1415 .....
    0x0040: 1617 1819 1a1b 1c1d 1e1f 2021 2223 2425 .....!#$%
    0x0050: 2627 2829 2a2b 2c2d 2e2f 3031 3233 3435 &'()*+,-./012345
    0x0060: 3637 67
20:45:19.000025 IP 10.0.0.5 > 10.0.0.1: ICMP echo request, id 60928, seq 1, length 64
    0x0000: 0000 0000 0001 0000 0000 0005 0800 4500 .....E.
    0x0010: 0054 f0f5 4000 4001 35ae 0a00 0005 0a00 .T..@.@.5.....
    0x0020: 0001 0800 136b ee00 0001 0e40 4065 0000 .....k.....@e..
    0x0030: 0000 da1a 0f00 0000 0000 1011 1213 1415 .....
    0x0040: 1617 1819 1a1b 1c1d 1e1f 2021 2223 2425 .....!#$%
    0x0050: 2627 2829 2a2b 2c2d 2e2f 3031 3233 3435 &'()*+,-./012345
    0x0060: 3637 67
20:45:19.001627 IP 10.0.0.1 > 10.0.0.5: ICMP echo reply, id 60928, seq 1, length 64
    0x0000: 0000 0000 0005 0000 0000 0001 0800 4500 .....E.
    0x0010: 0054 85f0 0000 4001 e0b3 0a00 0001 0a00 .T....@.....
    0x0020: 0005 0000 1b6b ee00 0001 0e40 4065 0000 .....k.....@e..
    0x0030: 0000 da1a 0f00 0000 0000 1011 1213 1415 .....
    0x0040: 1617 1819 1a1b 1c1d 1e1f 2021 2223 2425 .....!#$%
    0x0050: 2627 2829 2a2b 2c2d 2e2f 3031 3233 3435 &'()*+,-./012345
    0x0060: 3637 67
20:45:19.085129 IP 10.0.0.6 > 10.0.0.1: ICMP echo request, id 60933, seq 1, length 64
    0x0000: 0000 0000 0001 0000 0000 0006 0800 4500 .....E.
    0x0010: 0054 2f1e 4000 4001 f784 0a00 0006 0a00 .T/.@.@.....
    0x0020: 0001 0800 805d ee05 0001 0f40 4065 0000 .....].....@e..
    0x0030: 0000 7a23 0100 0000 0000 1011 1213 1415 ..z#.....
    0x0040: 1617 1819 1a1b 1c1d 1e1f 2021 2223 2425 .....!#$%
    0x0050: 2627 2829 2a2b 2c2d 2e2f 3031 3233 3435 &'()*+,-./012345
    0x0060: 3637 67
20:45:19.086333 IP 10.0.0.1 > 10.0.0.6: ICMP echo reply, id 60933, seq 1, length 64
    0x0000: 0000 0000 0006 0000 0000 0001 0800 4500 .....E.
    0x0010: 0054 48c7 0000 4001 1ddc 0a00 0001 0a00 .TH...@.....
    0x0020: 0006 0000 885d ee05 0001 0f40 4065 0000 .....].....@e..
    0x0030: 0000 7a23 0100 0000 0000 1011 1213 1415 ..z#.....
    0x0040: 1617 1819 1a1b 1c1d 1e1f 2021 2223 2425 .....!#$%
    0x0050: 2627 2829 2a2b 2c2d 2e2f 3031 3233 3435 &'()*+,-./012345
    0x0060: 3637 67

```

Testes de taxa



Recriando a Topologia

```
joao@joao-Aspire-E5-573:~$ sudo mn --controller=default --mac --link tc,bw=25,delay=1ms --topo=linear,6
*** Creating network
*** Adding controller
*** Adding hosts:
h1 h2 h3 h4 h5 h6
*** Adding switches:
s1 s2 s3 s4 s5 s6
*** Adding links:
(25.00Mbit 1ms delay) (25.00Mbit 1ms delay) (h1, s1) (25.00Mbit 1ms delay) (25.00Mbit 1ms delay) (h2, s2) (25.00Mbit 1ms delay) (25.00Mbit 1ms delay) (h3, s3) (
25.00Mbit 1ms delay) (25.00Mbit 1ms delay) (h4, s4) (25.00Mbit 1ms delay) (25.00Mbit 1ms delay) (h5, s5) (25.00Mbit 1ms delay) (25.00Mbit 1ms delay) (h6, s6) (2
5.00Mbit 1ms delay) (25.00Mbit 1ms delay) (s2, s1) (25.00Mbit 1ms delay) (25.00Mbit 1ms delay) (s3, s2) (25.00Mbit 1ms delay) (25.00Mbit 1ms delay) (s4, s3) (25
.00Mbit 1ms delay) (25.00Mbit 1ms delay) (s5, s4) (25.00Mbit 1ms delay) (25.00Mbit 1ms delay) (s6, s5)
*** Configuring hosts
h1 h2 h3 h4 h5 h6
*** Starting controller
c0
*** Starting 6 switches
s1 s2 s3 s4 s5 s6 ... (25.00Mbit 1ms delay) (25.00Mbit 1ms delay) (25.00Mbit 1ms delay) (25.00Mbit 1ms delay) (25.00Mbit 1ms delay) (25.00Mbit 1ms delay) (25.00M
bit 1ms delay) (25.00Mbit 1ms delay) (25.00Mbit 1ms delay) (25.00Mbit 1ms delay) (25.00Mbit 1ms delay) (25.00Mbit 1ms delay) (25.00Mbit 1ms delay) (25.00Mbit 1m
s delay) (25.00Mbit 1ms delay) (25.00Mbit 1ms delay)
```

A topologia foi criada com banda de 25Mbps para permitir a realização dos testes com todas as bandas

Teste de taxa - 2Mbps

Servidor

Cliente

"Node: h1"

```
root@joao-Aspire-E5-573:/home/joao# 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 38014  
[ ID] Interval      Transfer    Bandwidth  
[ 32] 0.0- 1.0 sec   277 KBytes  2.27 Mbits/sec  
[ 32] 1.0- 2.0 sec   252 KBytes  2.06 Mbits/sec  
[ 32] 2.0- 3.0 sec   256 KBytes  2.10 Mbits/sec  
[ 32] 3.0- 4.0 sec   256 KBytes  2.10 Mbits/sec  
[ 32] 4.0- 5.0 sec   256 KBytes  2.10 Mbits/sec  
[ 32] 5.0- 6.0 sec   256 KBytes  2.10 Mbits/sec  
[ 32] 6.0- 7.0 sec   260 KBytes  2.13 Mbits/sec  
[ 32] 7.0- 8.0 sec   256 KBytes  2.10 Mbits/sec  
[ 32] 8.0- 9.0 sec   256 KBytes  2.10 Mbits/sec  
[ 32] 9.0-10.0 sec   256 KBytes  2.10 Mbits/sec  
[ 32] 10.0-11.0 sec   256 KBytes  2.10 Mbits/sec  
[ 32] 11.0-12.0 sec   256 KBytes  2.10 Mbits/sec  
[ 32] 12.0-13.0 sec   249 KBytes  2.04 Mbits/sec  
[ 32] 13.0-14.0 sec   263 KBytes  2.16 Mbits/sec  
[ 32] 14.0-15.0 sec   256 KBytes  2.10 Mbits/sec  
[ 32] 0.0-15.0 sec   3.88 MBytes  2.16 Mbits/sec
```

"Node: h2"

```
root@joao-Aspire-E5-573:/home/joao# iperf -c 10.0.0.1 -p 5555 -t 15 -i 1 -b 2M
```

```
-----  
Client connecting to 10.0.0.1, TCP port 5555  
TCP window size: 128 KByte (default)  
-----
```

```
[ 31] local 10.0.0.2 port 38014 connected with 10.0.0.1 port 5555  
[ ID] Interval      Transfer    Bandwidth  
[ 31] 0.0- 1.0 sec   384 KBytes  3.15 Mbits/sec  
[ 31] 1.0- 2.0 sec   256 KBytes  2.10 Mbits/sec  
[ 31] 2.0- 3.0 sec   256 KBytes  2.10 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   256 KBytes  2.10 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   256 KBytes  2.10 Mbits/sec  
[ 31] 0.0-15.0 sec   3.88 MBytes  2.17 Mbits/sec
```


Teste de taxa - 10Mbps

Servidor

Cliente

"Node: h1"

```
root@joao-Aspire-E5-573:/home/joao# 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 59664  
[ ID] Interval      Transfer    Bandwidth  
[ 32] 0.0- 1.0 sec  1.26 MBytes 10.6 Mbits/sec  
[ 32] 1.0- 2.0 sec  1.25 MBytes 10.5 Mbits/sec  
[ 32] 2.0- 3.0 sec  1.25 MBytes 10.5 Mbits/sec  
[ 32] 3.0- 4.0 sec  1.25 MBytes 10.5 Mbits/sec  
[ 32] 4.0- 5.0 sec  1.25 MBytes 10.5 Mbits/sec  
[ 32] 5.0- 6.0 sec  1.25 MBytes 10.5 Mbits/sec  
[ 32] 6.0- 7.0 sec  1.25 MBytes 10.5 Mbits/sec  
[ 32] 7.0- 8.0 sec  1.25 MBytes 10.5 Mbits/sec  
[ 32] 8.0- 9.0 sec  1.25 MBytes 10.5 Mbits/sec  
[ 32] 9.0-10.0 sec  1.25 MBytes 10.5 Mbits/sec  
[ 32] 10.0-11.0 sec 1.25 MBytes 10.5 Mbits/sec  
[ 32] 11.0-12.0 sec 1.25 MBytes 10.5 Mbits/sec  
[ 32] 12.0-13.0 sec 1.25 MBytes 10.5 Mbits/sec  
[ 32] 13.0-14.0 sec 1.25 MBytes 10.5 Mbits/sec  
[ 32] 14.0-15.0 sec 1.25 MBytes 10.5 Mbits/sec  
[ 32] 0.0-15.0 sec 18.9 MBytes 10.5 Mbits/sec
```

"Node: h2"

```
root@joao-Aspire-E5-573:/home/joao# iperf -c 10.0.0.1 -p 5555 -t 15 -i 1 -b 10M
```

```
-----  
Client connecting to 10.0.0.1, TCP port 5555  
TCP window size: 136 KByte (default)  
-----
```

```
[ 31] local 10.0.0.2 port 59664 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  1.25 MBytes 10.5 Mbits/sec  
[ 31] 2.0- 3.0 sec  1.25 MBytes 10.5 Mbits/sec  
[ 31] 3.0- 4.0 sec  1.25 MBytes 10.5 Mbits/sec  
[ 31] 4.0- 5.0 sec  1.25 MBytes 10.5 Mbits/sec  
[ 31] 5.0- 6.0 sec  1.25 MBytes 10.5 Mbits/sec  
[ 31] 6.0- 7.0 sec  1.25 MBytes 10.5 Mbits/sec  
[ 31] 7.0- 8.0 sec  1.25 MBytes 10.5 Mbits/sec  
[ 31] 8.0- 9.0 sec  1.25 MBytes 10.5 Mbits/sec  
[ 31] 9.0-10.0 sec  1.25 MBytes 10.5 Mbits/sec  
[ 31] 10.0-11.0 sec 1.25 MBytes 10.5 Mbits/sec  
[ 31] 11.0-12.0 sec 1.25 MBytes 10.5 Mbits/sec  
[ 31] 12.0-13.0 sec 1.25 MBytes 10.5 Mbits/sec  
[ 31] 13.0-14.0 sec 1.25 MBytes 10.5 Mbits/sec  
[ 31] 14.0-15.0 sec 1.25 MBytes 10.5 Mbits/sec  
[ 31] 0.0-15.0 sec 18.9 MBytes 10.6 Mbits/sec
```

Teste de taxa - 15Mbps

Servidor

Cliente

"Node: h1"	"Node: h2"
root@joao-Aspire-E5-573:/home/joao# iperf -s -p 5555 -i 1	root@joao-Aspire-E5-573:/home/joao# iperf -c 10.0.0.1 -p 5555 -t 15 -i 1 -b 15M
-----	-----
Server listening on TCP port 5555	Client connecting to 10.0.0.1, TCP port 5555
TCP window size: 85.3 KByte (default)	TCP window size: 85.3 KByte (default)
-----	-----
[32] local 10.0.0.1 port 5555 connected with 10.0.0.2 port 54390	[31] local 10.0.0.2 port 54390 connected with 10.0.0.1 port 5555
[ID] Interval Transfer Bandwidth	[ID] Interval Transfer Bandwidth
[32] 0.0- 1.0 sec 1.89 MBytes 15.9 Mbits/sec	[31] 0.0- 1.0 sec 2.00 MBytes 16.8 Mbits/sec
[32] 1.0- 2.0 sec 1.88 MBytes 15.7 Mbits/sec	[31] 1.0- 2.0 sec 1.88 MBytes 15.7 Mbits/sec
[32] 2.0- 3.0 sec 1.88 MBytes 15.7 Mbits/sec	[31] 2.0- 3.0 sec 1.88 MBytes 15.7 Mbits/sec
[32] 3.0- 4.0 sec 1.88 MBytes 15.7 Mbits/sec	[31] 3.0- 4.0 sec 1.88 MBytes 15.7 Mbits/sec
[32] 4.0- 5.0 sec 1.88 MBytes 15.7 Mbits/sec	[31] 4.0- 5.0 sec 1.88 MBytes 15.7 Mbits/sec
[32] 5.0- 6.0 sec 1.88 MBytes 15.7 Mbits/sec	[31] 5.0- 6.0 sec 1.88 MBytes 15.7 Mbits/sec
[32] 6.0- 7.0 sec 1.88 MBytes 15.7 Mbits/sec	[31] 6.0- 7.0 sec 1.88 MBytes 15.7 Mbits/sec
[32] 7.0- 8.0 sec 1.88 MBytes 15.7 Mbits/sec	[31] 7.0- 8.0 sec 1.88 MBytes 15.7 Mbits/sec
[32] 8.0- 9.0 sec 1.88 MBytes 15.7 Mbits/sec	[31] 8.0- 9.0 sec 1.88 MBytes 15.7 Mbits/sec
[32] 9.0-10.0 sec 1.88 MBytes 15.7 Mbits/sec	[31] 9.0-10.0 sec 1.88 MBytes 15.7 Mbits/sec
[32] 10.0-11.0 sec 1.88 MBytes 15.7 Mbits/sec	[31] 10.0-11.0 sec 1.88 MBytes 15.7 Mbits/sec
[32] 11.0-12.0 sec 1.88 MBytes 15.7 Mbits/sec	[31] 11.0-12.0 sec 1.88 MBytes 15.7 Mbits/sec
[32] 12.0-13.0 sec 1.88 MBytes 15.7 Mbits/sec	[31] 12.0-13.0 sec 1.88 MBytes 15.7 Mbits/sec
[32] 13.0-14.0 sec 1.88 MBytes 15.7 Mbits/sec	[31] 13.0-14.0 sec 1.88 MBytes 15.7 Mbits/sec
[32] 14.0-15.0 sec 1.88 MBytes 15.7 Mbits/sec	[31] 14.0-15.0 sec 1.88 MBytes 15.7 Mbits/sec
[32] 0.0-15.0 sec 28.2 MBytes 15.8 Mbits/sec	[31] 0.0-15.0 sec 28.2 MBytes 15.8 Mbits/sec

Teste de taxa - 20Mbps

Servidor

Cliente

"Node: h1"

```
root@joao-Aspire-E5-573:/home/joao# 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 37844  
[ ID] Interval      Transfer    Bandwidth  
[ 32] 0.0- 1.0 sec  2.51 MBytes 21.0 Mbits/sec  
[ 32] 1.0- 2.0 sec  2.50 MBytes 21.0 Mbits/sec  
[ 32] 2.0- 3.0 sec  2.50 MBytes 21.0 Mbits/sec  
[ 32] 3.0- 4.0 sec  2.50 MBytes 21.0 Mbits/sec  
[ 32] 4.0- 5.0 sec  2.50 MBytes 21.0 Mbits/sec  
[ 32] 5.0- 6.0 sec  2.50 MBytes 21.0 Mbits/sec  
[ 32] 6.0- 7.0 sec  2.50 MBytes 21.0 Mbits/sec  
[ 32] 7.0- 8.0 sec  2.50 MBytes 21.0 Mbits/sec  
[ 32] 8.0- 9.0 sec  2.50 MBytes 21.0 Mbits/sec  
[ 32] 9.0-10.0 sec  2.50 MBytes 21.0 Mbits/sec  
[ 32] 10.0-11.0 sec 2.50 MBytes 21.0 Mbits/sec  
[ 32] 11.0-12.0 sec 2.50 MBytes 21.0 Mbits/sec  
[ 32] 12.0-13.0 sec 2.50 MBytes 21.0 Mbits/sec  
[ 32] 13.0-14.0 sec 2.50 MBytes 21.0 Mbits/sec  
[ 32] 14.0-15.0 sec 2.50 MBytes 21.0 Mbits/sec  
[ 32] 0.0-15.0 sec 37.6 MBytes 21.0 Mbits/sec
```

"Node: h2"

```
root@joao-Aspire-E5-573:/home/joao# iperf -c 10.0.0.1 -p 5555 -t 15 -i 1 -b 20M
```

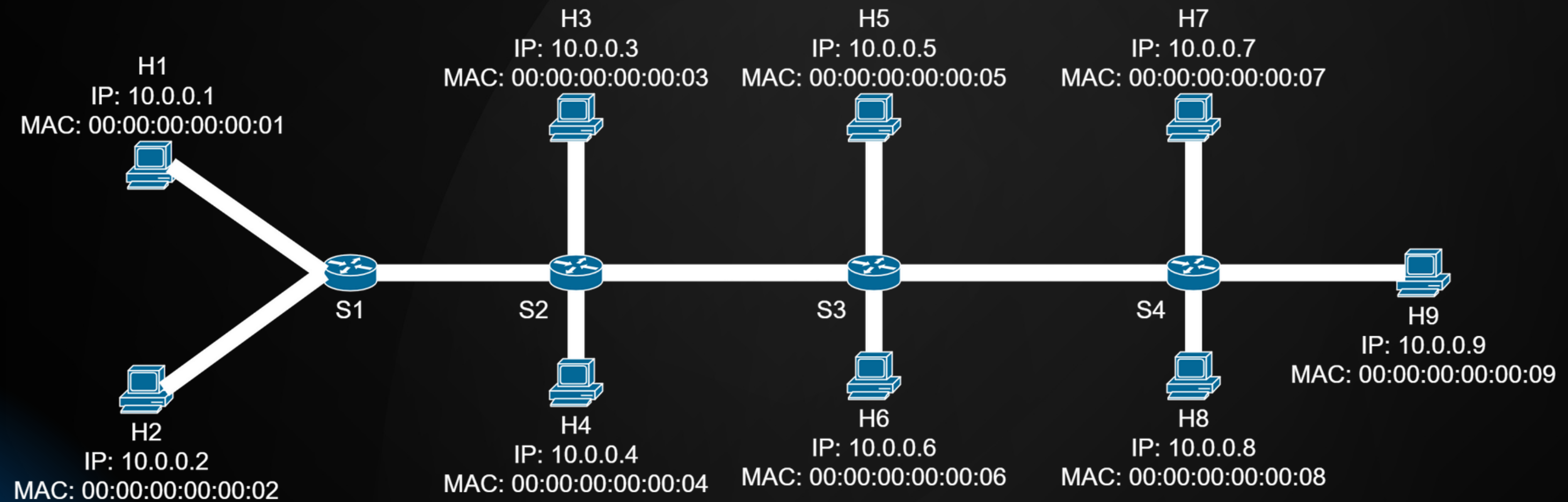
```
-----  
Client connecting to 10.0.0.1, TCP port 5555  
TCP window size: 153 KByte (default)  
-----
```

```
[ 31] local 10.0.0.2 port 37844 connected with 10.0.0.1 port 5555  
[ ID] Interval      Transfer    Bandwidth  
[ 31] 0.0- 1.0 sec  2.62 MBytes 22.0 Mbits/sec  
[ 31] 1.0- 2.0 sec  2.50 MBytes 21.0 Mbits/sec  
[ 31] 2.0- 3.0 sec  2.50 MBytes 21.0 Mbits/sec  
[ 31] 3.0- 4.0 sec  2.50 MBytes 21.0 Mbits/sec  
[ 31] 4.0- 5.0 sec  2.50 MBytes 21.0 Mbits/sec  
[ 31] 5.0- 6.0 sec  2.50 MBytes 21.0 Mbits/sec  
[ 31] 6.0- 7.0 sec  2.50 MBytes 21.0 Mbits/sec  
[ 31] 7.0- 8.0 sec  2.50 MBytes 21.0 Mbits/sec  
[ 31] 8.0- 9.0 sec  2.50 MBytes 21.0 Mbits/sec  
[ 31] 9.0-10.0 sec  2.50 MBytes 21.0 Mbits/sec  
[ 31] 10.0-11.0 sec 2.50 MBytes 21.0 Mbits/sec  
[ 31] 11.0-12.0 sec 2.50 MBytes 21.0 Mbits/sec  
[ 31] 12.0-13.0 sec 2.50 MBytes 21.0 Mbits/sec  
[ 31] 13.0-14.0 sec 2.50 MBytes 21.0 Mbits/sec  
[ 31] 14.0-15.0 sec 2.50 MBytes 21.0 Mbits/sec  
[ 31] 0.0-15.0 sec 37.6 MBytes 21.0 Mbits/sec
```

Exercício 2

Topologia

Topologia customizada



Execução e Testes



Getting interfaces information

```
h1 h1-eth0:s1-eth1
h2 h2-eth0:s1-eth2
h3 h3-eth0:s2-eth2
h4 h4-eth0:s2-eth3
h5 h5-eth0:s3-eth2
h6 h6-eth0:s3-eth3
h7 h7-eth0:s4-eth2
h8 h8-eth0:s4-eth3
h9 h9-eth0:s4-eth4
s1 lo: s1-eth1:h1-eth0 s1-eth2:h2-eth0 s1-eth3:s2-eth1
s2 lo: s2-eth1:s1-eth3 s2-eth2:h3-eth0 s2-eth3:h4-eth0 s2-eth4:s3-eth1
s3 lo: s3-eth1:s2-eth4 s3-eth2:h5-eth0 s3-eth3:h6-eth0 s3-eth4:s4-eth1
s4 lo: s4-eth1:s3-eth4 s4-eth2:h7-eth0 s4-eth3:h8-eth0 s4-eth4:h9-eth0
```

Getting IP address for all hosts interfaces

```
<Host h1: h1-eth0:10.0.0.1 pid=42077>
<Host h2: h2-eth0:10.0.0.2 pid=42079>
<Host h3: h3-eth0:10.0.0.3 pid=42081>
<Host h4: h4-eth0:10.0.0.4 pid=42083>
<Host h5: h5-eth0:10.0.0.5 pid=42085>
<Host h6: h6-eth0:10.0.0.6 pid=42087>
<Host h7: h7-eth0:10.0.0.7 pid=42089>
<Host h8: h8-eth0:10.0.0.8 pid=42091>
<Host h9: h9-eth0:10.0.0.9 pid=42093>
<OVSSwitch s1: lo:127.0.0.1,s1-eth1:None,s1-eth2:None,s1-eth3:None pid=42098>
<OVSSwitch s2: lo:127.0.0.1,s2-eth1:None,s2-eth2:None,s2-eth3:None,s2-eth4:None pid=42101>
<OVSSwitch s3: lo:127.0.0.1,s3-eth1:None,s3-eth2:None,s3-eth3:None,s3-eth4:None pid=42104>
<OVSSwitch s4: lo:127.0.0.1,s4-eth1:None,s4-eth2:None,s4-eth3:None,s4-eth4:None pid=42107>
```



Getting MAC Address for all hosts interfaces

00:00:00:00:00:01

00:00:00:00:00:02

00:00:00:00:00:03

00:00:00:00:00:04


00:00:00:00:00:05

00:00:00:00:00:06

00:00:00:00:00:07

00:00:00:00:00:08

00:00:00:00:00:09



Configuring switches to work normally

*** 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:

```
h1->h2: 1/1, rtt min/avg/max/mdev 0.376/0.376/0.376/0.000 ms
h1->h3: 1/1, rtt min/avg/max/mdev 1.037/1.037/1.037/0.000 ms
h1->h4: 1/1, rtt min/avg/max/mdev 2.318/2.318/2.318/0.000 ms
h1->h5: 1/1, rtt min/avg/max/mdev 0.782/0.782/0.782/0.000 ms
h1->h6: 1/1, rtt min/avg/max/mdev 0.796/0.796/0.796/0.000 ms
h1->h7: 1/1, rtt min/avg/max/mdev 1.259/1.259/1.259/0.000 ms
h1->h8: 1/1, rtt min/avg/max/mdev 1.076/1.076/1.076/0.000 ms
h1->h9: 1/1, rtt min/avg/max/mdev 0.887/0.887/0.887/0.000 ms
h2->h1: 1/1, rtt min/avg/max/mdev 0.065/0.065/0.065/0.000 ms
h2->h3: 1/1, rtt min/avg/max/mdev 0.540/0.540/0.540/0.000 ms
h2->h4: 1/1, rtt min/avg/max/mdev 1.225/1.225/1.225/0.000 ms
h2->h5: 1/1, rtt min/avg/max/mdev 0.837/0.837/0.837/0.000 ms
h2->h6: 1/1, rtt min/avg/max/mdev 0.805/0.805/0.805/0.000 ms
h2->h7: 1/1, rtt min/avg/max/mdev 0.834/0.834/0.834/0.000 ms
h2->h8: 1/1, rtt min/avg/max/mdev 0.857/0.857/0.857/0.000 ms
h2->h9: 1/1, rtt min/avg/max/mdev 1.185/1.185/1.185/0.000 ms
h3->h1: 1/1, rtt min/avg/max/mdev 0.306/0.306/0.306/0.000 ms
h3->h2: 1/1, rtt min/avg/max/mdev 0.088/0.088/0.088/0.000 ms
h3->h4: 1/1, rtt min/avg/max/mdev 0.547/0.547/0.547/0.000 ms
h3->h5: 1/1, rtt min/avg/max/mdev 0.943/0.943/0.943/0.000 ms
h3->h6: 1/1, rtt min/avg/max/mdev 0.593/0.593/0.593/0.000 ms
h3->h7: 1/1, rtt min/avg/max/mdev 0.773/0.773/0.773/0.000 ms
h3->h8: 1/1, rtt min/avg/max/mdev 0.705/0.705/0.705/0.000 ms
h3->h9: 1/1, rtt min/avg/max/mdev 0.759/0.759/0.759/0.000 ms
```

```
h4->h1: 1/1, rtt min/avg/max/mdev 0.062/0.062/0.062/0.000 ms
h4->h2: 1/1, rtt min/avg/max/mdev 0.058/0.058/0.058/0.000 ms
h4->h3: 1/1, rtt min/avg/max/mdev 0.074/0.074/0.074/0.000 ms
h4->h5: 1/1, rtt min/avg/max/mdev 0.875/0.875/0.875/0.000 ms
h4->h6: 1/1, rtt min/avg/max/mdev 0.757/0.757/0.757/0.000 ms
h4->h7: 1/1, rtt min/avg/max/mdev 0.753/0.753/0.753/0.000 ms
h4->h8: 1/1, rtt min/avg/max/mdev 0.913/0.913/0.913/0.000 ms
h4->h9: 1/1, rtt min/avg/max/mdev 1.210/1.210/1.210/0.000 ms
h5->h1: 1/1, rtt min/avg/max/mdev 0.125/0.125/0.125/0.000 ms
h5->h2: 1/1, rtt min/avg/max/mdev 0.070/0.070/0.070/0.000 ms
h5->h3: 1/1, rtt min/avg/max/mdev 0.143/0.143/0.143/0.000 ms
h5->h4: 1/1, rtt min/avg/max/mdev 0.067/0.067/0.067/0.000 ms
h5->h6: 1/1, rtt min/avg/max/mdev 0.693/0.693/0.693/0.000 ms
h5->h7: 1/1, rtt min/avg/max/mdev 1.060/1.060/1.060/0.000 ms
h5->h8: 1/1, rtt min/avg/max/mdev 0.582/0.582/0.582/0.000 ms
h5->h9: 1/1, rtt min/avg/max/mdev 0.795/0.795/0.795/0.000 ms
h6->h1: 1/1, rtt min/avg/max/mdev 0.120/0.120/0.120/0.000 ms
h6->h2: 1/1, rtt min/avg/max/mdev 0.061/0.061/0.061/0.000 ms
h6->h3: 1/1, rtt min/avg/max/mdev 0.060/0.060/0.060/0.000 ms
h6->h4: 1/1, rtt min/avg/max/mdev 0.070/0.070/0.070/0.000 ms
h6->h5: 1/1, rtt min/avg/max/mdev 0.068/0.068/0.068/0.000 ms
h6->h7: 1/1, rtt min/avg/max/mdev 0.982/0.982/0.982/0.000 ms
h6->h8: 1/1, rtt min/avg/max/mdev 0.581/0.581/0.581/0.000 ms
h6->h9: 1/1, rtt min/avg/max/mdev 0.525/0.525/0.525/0.000 ms
h7->h1: 1/1, rtt min/avg/max/mdev 0.068/0.068/0.068/0.000 ms
h7->h2: 1/1, rtt min/avg/max/mdev 0.155/0.155/0.155/0.000 ms
h7->h3: 1/1, rtt min/avg/max/mdev 0.087/0.087/0.087/0.000 ms
h7->h4: 1/1, rtt min/avg/max/mdev 0.070/0.070/0.070/0.000 ms
h7->h5: 1/1, rtt min/avg/max/mdev 0.073/0.073/0.073/0.000 ms
h7->h6: 1/1, rtt min/avg/max/mdev 0.113/0.113/0.113/0.000 ms
h7->h8: 1/1, rtt min/avg/max/mdev 0.808/0.808/0.808/0.000 ms
h7->h9: 1/1, rtt min/avg/max/mdev 0.599/0.599/0.599/0.000 ms
h8->h1: 1/1, rtt min/avg/max/mdev 0.087/0.087/0.087/0.000 ms
h8->h2: 1/1, rtt min/avg/max/mdev 0.105/0.105/0.105/0.000 ms
h8->h3: 1/1, rtt min/avg/max/mdev 0.296/0.296/0.296/0.000 ms
h8->h4: 1/1, rtt min/avg/max/mdev 0.068/0.068/0.068/0.000 ms
h8->h5: 1/1, rtt min/avg/max/mdev 0.073/0.073/0.073/0.000 ms
h8->h6: 1/1, rtt min/avg/max/mdev 0.055/0.055/0.055/0.000 ms
h8->h7: 1/1, rtt min/avg/max/mdev 0.068/0.068/0.068/0.000 ms
h8->h9: 1/1, rtt min/avg/max/mdev 0.522/0.522/0.522/0.000 ms
```

```
h9->h1: 1/1, rtt min/avg/max/mdev 0.118/0.118/0.118/0.000 ms
h9->h2: 1/1, rtt min/avg/max/mdev 0.077/0.077/0.077/0.000 ms
h9->h3: 1/1, rtt min/avg/max/mdev 0.080/0.080/0.080/0.000 ms
h9->h4: 1/1, rtt min/avg/max/mdev 0.059/0.059/0.059/0.000 ms
h9->h5: 1/1, rtt min/avg/max/mdev 0.072/0.072/0.072/0.000 ms
h9->h6: 1/1, rtt min/avg/max/mdev 0.064/0.064/0.064/0.000 ms
h9->h7: 1/1, rtt min/avg/max/mdev 0.061/0.061/0.061/0.000 ms
h9->h8: 1/1, rtt min/avg/max/mdev 0.070/0.070/0.070/0.000 ms
```

Configuring ARP

Adding rules for flow control

```
h1 -> h2 h4
```

```
h2 -> h1 h4
```

```
h4 -> h1 h2
```

```
*** Results: 0% dropped (6/6 received)
```

Link do GitHub



helio-rocha - Overview

helio-rocha has 7 repositories available. Follow their code on GitHub.

 GitHub



Joaohsd - Overview

Computer Engineering student at INATEL (2020.1). Coding readable and complete codes or trying to do that. - Joaohsd

 GitHub



pedrohdsouza - Overview

pedrohdsouza has 10 repositories available. Follow their code on GitHub.

 GitHub