TRABALHO MININET CONCEITOS INICIAIS

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Criação de uma Tree com profundidade (depth=4) e ramificação (fanout=2).

```
sudo mn --topo tree, depth=4,fanout=2 --mac --link tc, bw=25
```

```
mininet@mininet-vm:~$ sudo mn --topo tree,depth=4,fanout=2 --mac --link tc,bw=25
*** Creating network
*** Adding controller
*** Adding hosts:
h1 h2 h3 h4 h5 h6 h7 h8 h9 h10 h11 h12 h13 h14 h15 h16
*** Adding switches:
s1 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13 s14 s15
*** Adding links:
(25.00Mbit) (25.00Mbit) (s1, s2) (25.00Mbit) (25.00Mbit) (s1, s9) (25.00Mbit) (25.00Mbit) (s2, s3) (25.00Mbit) (25.00
Mbit) (s2, s6) (25.00Mbit) (25.00Mbit) (s3, s4) (25.00Mbit) (25.00Mbit) (s3, s5) (25.00Mbit) (25.00Mbit) (s4, h1) (25
.00Mbit) (25.00Mbit) (s4, h2) (25.00Mbit) (25.00Mbit) (s5, h3) (25.00Mbit) (25.00Mbit) (s5, h4) (25.00Mbit) (25.00Mbi
t) (s6, s7) (25.00Mbit) (25.00Mbit) (s6, s8) (25.00Mbit) (25.00Mbit) (s7, h5) (25.00Mbit) (25.00Mbit) (s7, h6) (25.00
Mbit) (25.00Mbit) (s8, h7) (25.00Mbit) (25.00Mbit) (s8, h8) (25.00Mbit) (25.00Mbit) (s9, s10) (25.00Mbit) (25.00Mbit)
 (s9, s13) (25.00Mbit) (25.00Mbit) (s10, s11) (25.00Mbit) (25.00Mbit) (s10, s12) (25.00Mbit) (25.00Mbit) (s11, h9) (2
5.00Mbit) (25.00Mbit) (s11, h10) (25.00Mbit) (25.00Mbit) (s12, h11) (25.00Mbit) (25.00Mbit) (s12, h12) (25.00Mbit) (2
5.00Mbit) (s13, s14) (25.00Mbit) (25.00Mbit) (s13, s15) (25.00Mbit) (25.00Mbit) (s14, h13) (25.00Mbit) (25.00Mbit) (s
14, h14) (25.00Mbit) (25.00Mbit) (s15, h15) (25.00Mbit) (25.00Mbit) (s15, h16)
*** Configuring hosts
h1 h2 h3 h4 h5 h6 h7 h8 h9 h10 h11 h12 h13 h14 h15 h16
*** Starting controller
c0
*** Starting 15 switches
s1 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13 s14 s15 ...(25.00Mbit) (25.00Mbit) (25.00Mbit) (25.00Mbit) (25.00Mbit) (25
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*** Starting CLI:
```

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Inspecionar informações das interfaces, endereços MAC, IP e portas

net show

```
mininet> net show
h1 h1-eth0:s4-eth1
h2 h2-eth0:s4-eth2
h3 h3-eth0:s5-eth1
h4 h4-eth0:s5-eth2
h5 h5-eth0:s7-eth1
h6 h6-eth0:s7-eth2
h7 h7-eth0:s8-eth1
h8 h8-eth0:s8-eth2
h9 h9-eth0:s11-eth1
h10 h10-eth0:s11-eth2
h11 h11-eth0:s12-eth1
h12 h12-eth0:s12-eth2
h13 h13-eth0:s14-eth1
h14 h14-eth0:s14-eth2
h15 h15-eth0:s15-eth1
h16 h16-eth0:s15-eth2
s1 lo:  s1-eth1:s2-eth3 s1-eth2:s9-eth3
s2 lo:  s2-eth1:s3-eth3 s2-eth2:s6-eth3 s2-eth3:s1-eth1
s3 lo:  s3-eth1:s4-eth3 s3-eth2:s5-eth3 s3-eth3:s2-eth1
s4 lo:  s4-eth1:h1-eth0 s4-eth2:h2-eth0 s4-eth3:s3-eth1
s5 lo:  s5-eth1:h3-eth0 s5-eth2:h4-eth0 s5-eth3:s3-eth2
s6 lo:  s6-eth1:s7-eth3 s6-eth2:s8-eth3 s6-eth3:s2-eth2
s7 lo:  s7-eth1:h5-eth0 s7-eth2:h6-eth0 s7-eth3:s6-eth1
s8 lo:  s8-eth1:h7-eth0 s8-eth2:h8-eth0 s8-eth3:s6-eth2
s9 lo:  s9-eth1:s10-eth3 s9-eth2:s13-eth3 s9-eth3:s1-eth2
s10 lo:  s10-eth1:s11-eth3 s10-eth2:s12-eth3 s10-eth3:s9-eth1
s11 lo:  s11-eth1:h9-eth0 s11-eth2:h10-eth0 s11-eth3:s10-eth1
s12 lo:  s12-eth1:h11-eth0 s12-eth2:h12-eth0 s12-eth3:s10-eth2
s13 lo:  s13-eth1:s14-eth3 s13-eth2:s15-eth3 s13-eth3:s9-eth2
s14 lo:  s14-eth1:h13-eth0 s14-eth2:h14-eth0 s14-eth3:s13-eth1
s15 lo:  s15-eth1:h15-eth0 s15-eth2:h16-eth0 s15-eth3:s13-eth2
c0
```

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Para verificar os endereços MAC dos hosts

<host> ifconfig

```
mininet> h1 ifconfig
h1-eth0   Link encap:Ethernet   HWaddr 00:00:00:00:00:01
          inet addr:10.0.0.1  Bcast:10.255.255.255  Mask:255.0.0.0
          UP BROADCAST RUNNING MULTICAST   MTU:1500   Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)   TX bytes:0 (0.0 B)

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

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Para verificar os endereços MAC dos hosts

<host> ifconfig

```
mininet> h2 ifconfig
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)
```

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Para verificar os endereços IP dos hosts

<host1> ip addr show

```
mininet> h1 ip addr show
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
       valid_lft forever preferred_lft forever
2: h1-eth0@if256: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc htb state UP group default qlen 1000
    link/ether 00:00:00:00:00:01 brd ff:ff:ff:ff:ff:ff link-netnsid 0
    inet 10.0.0.1/8 brd 10.255.255.255 scope global h1-eth0
       valid_lft forever preferred_lft forever
```

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Para verificar os endereços IP dos hosts

<host2> ip addr show

```
mininet> h2 ip addr show
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
2: h2-eth0@if257: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc htb state UP group default qlen 1000
    link/ether 00:00:00:00:00:02 brd ff:ff:ff:ff:ff:ff link-netnsid 0
    inet 10.0.0.2/8 brd 10.255.255.255 scope global h2-eth0
        valid_lft forever preferred_lft forever
```

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Testes de ping entre os diferentes nós

<host1> ping –c 5 <host2>

```
mininet> h1 ping -c 5 h2
PING 10.0.0.2 (10.0.0.2) 56(84) bytes of data.
64 bytes from 10.0.0.2: icmp_seq=1 ttl=64 time=7.41 ms
64 bytes from 10.0.0.2: icmp_seq=2 ttl=64 time=0.191 ms
64 bytes from 10.0.0.2: icmp_seq=3 ttl=64 time=0.033 ms
64 bytes from 10.0.0.2: icmp_seq=4 ttl=64 time=0.033 ms
64 bytes from 10.0.0.2: icmp_seq=5 ttl=64 time=0.030 ms

--- 10.0.0.2 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4001ms
rtt min/avg/max/mdev = 0.030/1.540/7.413/2.937 ms
```

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Testes de ping entre os diferentes nós

<host1> ping –c 5 <host3>

```
mininet> h1 ping -c 5 h3
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=10.8 ms
64 bytes from 10.0.0.3: icmp_seq=2 ttl=64 time=0.279 ms
64 bytes from 10.0.0.3: icmp_seq=3 ttl=64 time=0.036 ms
64 bytes from 10.0.0.3: icmp_seq=4 ttl=64 time=0.039 ms
64 bytes from 10.0.0.3: icmp_seq=5 ttl=64 time=0.035 ms

--- 10.0.0.3 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4000ms
rtt min/avg/max/mdev = 0.035/2.247/10.848/4.301 ms
```

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Configurar o servidor e cliente TCP com iperf

iperf –s –p 5555 –i 1

```
root@mininet-vm:~# iperf -s -p 5555 -i 1
------------------------------------------------------------
Server listening on TCP port 5555
TCP window size: 85.3 KByte (default)
------------------------------------------------------------
[ 70] local 10.0.0.1 port 5555 connected with 10.0.0.2 port 44024
[ ID] Interval       Transfer     Bandwidth
[ 70]  0.0- 1.0 sec  2.70 MBytes  22.6 Mbits/sec
[ 70]  1.0- 2.0 sec  2.72 MBytes  22.8 Mbits/sec
[ 70]  2.0- 3.0 sec  2.69 MBytes  22.5 Mbits/sec
[ 70]  3.0- 4.0 sec  2.68 MBytes  22.5 Mbits/sec
[ 70]  4.0- 5.0 sec  2.71 MBytes  22.7 Mbits/sec
[ 70]  5.0- 6.0 sec  2.72 MBytes  22.8 Mbits/sec
[ 70]  6.0- 7.0 sec  2.68 MBytes  22.5 Mbits/sec
[ 70]  7.0- 8.0 sec  2.68 MBytes  22.5 Mbits/sec
[ 70]  8.0- 9.0 sec  2.73 MBytes  22.9 Mbits/sec
[ 70]  9.0-10.0 sec  2.73 MBytes  22.9 Mbits/sec
[ 70]  0.0-10.1 sec  27.4 MBytes  22.7 Mbits/sec
```

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Configurar o servidor e cliente TCP com iperf

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