



```
wifi@wifi-virtualbox: ~/redes-computadores-2022-2/aula02
wifi@wifi-virtualbox: ~/redes-computadores-2022-2/aula02 80x24
64 bytes from 203.0.113.1: icmp_seq=3 ttl=58 time=0.226 ms
^C
--- 203.0.113.1 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2045ms
rtt min/avg/max/mdev = 0.218/0.412/0.794/0.269 ms
mininet-wifi> h1a ping h1c
PING 198.51.100.1 (198.51.100.1) 56(84) bytes of data.
64 bytes from 198.51.100.1: icmp_seq=1 ttl=58 time=0.505 ms
64 bytes from 198.51.100.1: icmp_seq=2 ttl=58 time=0.250 ms
64 bytes from 198.51.100.1: icmp_seq=3 ttl=58 time=0.309 ms
^C
--- 198.51.100.1 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2076ms
rtt min/avg/max/mdev = 0.250/0.354/0.505/0.109 ms
mininet-wifi> h1a ping h1d
PING 192.168.10.1 (192.168.10.1) 56(84) bytes of data.
64 bytes from 192.168.10.1: icmp_seq=1 ttl=58 time=0.533 ms
64 bytes from 192.168.10.1: icmp_seq=2 ttl=58 time=0.237 ms
64 bytes from 192.168.10.1: icmp_seq=3 ttl=58 time=0.236 ms
^C
--- 192.168.10.1 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2032ms
rtt min/avg/max/mdev = 0.236/0.335/0.533/0.139 ms
mininet-wifi>
```

H1A ping H1D

```
wifi@wifi-virtualbox: ~/redes-computadores-2022-2/aula02
wifi@wifi-virtualbox: ~/redes-computadores-2022-2/aula02 80x24
^C
--- 198.51.100.1 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2076ms
rtt min/avg/max/mdev = 0.250/0.354/0.505/0.109 ms
mininet-wifi> h1a ping h1d
PING 192.168.10.1 (192.168.10.1) 56(84) bytes of data.
64 bytes from 192.168.10.1: icmp_seq=1 ttl=58 time=0.533 ms
64 bytes from 192.168.10.1: icmp_seq=2 ttl=58 time=0.237 ms
64 bytes from 192.168.10.1: icmp_seq=3 ttl=58 time=0.236 ms
^C
--- 192.168.10.1 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2032ms
rtt min/avg/max/mdev = 0.236/0.335/0.533/0.139 ms
mininet-wifi> h1b ping h1a
PING 192.0.2.1 (192.0.2.1) 56(84) bytes of data.
64 bytes from 192.0.2.1: icmp_seq=1 ttl=58 time=0.414 ms
64 bytes from 192.0.2.1: icmp_seq=2 ttl=58 time=0.228 ms
64 bytes from 192.0.2.1: icmp_seq=3 ttl=58 time=0.225 ms
64 bytes from 192.0.2.1: icmp_seq=4 ttl=58 time=0.225 ms
^C
--- 192.0.2.1 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3064ms
rtt min/avg/max/mdev = 0.225/0.273/0.414/0.081 ms
mininet-wifi>
```

H1B ping H1A

```
wifi@wifi-virtualbox: ~/redes-computadores-2022-2/aula02
wifi@wifi-virtualbox: ~/redes-computadores-2022-2/aula02 80x24
--- 192.168.10.1 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2032ms
rtt min/avg/max/mdev = 0.236/0.335/0.533/0.139 ms
mininet-wifi> h1b ping h1a
PING 192.0.2.1 (192.0.2.1) 56(84) bytes of data.
64 bytes from 192.0.2.1: icmp_seq=1 ttl=58 time=0.414 ms
64 bytes from 192.0.2.1: icmp_seq=2 ttl=58 time=0.228 ms
64 bytes from 192.0.2.1: icmp_seq=3 ttl=58 time=0.225 ms
64 bytes from 192.0.2.1: icmp_seq=4 ttl=58 time=0.225 ms
^C
--- 192.0.2.1 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3064ms
rtt min/avg/max/mdev = 0.225/0.273/0.414/0.081 ms
mininet-wifi> h1b ping h1c
PING 198.51.100.1 (198.51.100.1) 56(84) bytes of data.
64 bytes from 198.51.100.1: icmp_seq=1 ttl=59 time=0.379 ms
64 bytes from 198.51.100.1: icmp_seq=2 ttl=59 time=0.202 ms
64 bytes from 198.51.100.1: icmp_seq=3 ttl=59 time=0.136 ms
64 bytes from 198.51.100.1: icmp_seq=4 ttl=59 time=0.214 ms
^C
--- 198.51.100.1 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3063ms
rtt min/avg/max/mdev = 0.136/0.232/0.379/0.089 ms
mininet-wifi>
```

## H1B ping H1C

```
wifi@wifi-virtualbox: ~/redes-computadores-2022-2/aula02
wifi@wifi-virtualbox: ~/redes-computadores-2022-2/aula02 80x24
--- 192.0.2.1 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3064ms
rtt min/avg/max/mdev = 0.225/0.273/0.414/0.081 ms
mininet-wifi> h1b ping h1c
PING 198.51.100.1 (198.51.100.1) 56(84) bytes of data.
64 bytes from 198.51.100.1: icmp_seq=1 ttl=59 time=0.379 ms
64 bytes from 198.51.100.1: icmp_seq=2 ttl=59 time=0.202 ms
64 bytes from 198.51.100.1: icmp_seq=3 ttl=59 time=0.136 ms
64 bytes from 198.51.100.1: icmp_seq=4 ttl=59 time=0.214 ms
^C
--- 198.51.100.1 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3063ms
rtt min/avg/max/mdev = 0.136/0.232/0.379/0.089 ms
mininet-wifi> h1c ping h1a
PING 192.0.2.1 (192.0.2.1) 56(84) bytes of data.
64 bytes from 192.0.2.1: icmp_seq=1 ttl=58 time=0.405 ms
64 bytes from 192.0.2.1: icmp_seq=2 ttl=58 time=0.237 ms
64 bytes from 192.0.2.1: icmp_seq=3 ttl=58 time=0.237 ms
64 bytes from 192.0.2.1: icmp_seq=4 ttl=58 time=0.237 ms
^C
--- 192.0.2.1 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3051ms
rtt min/avg/max/mdev = 0.237/0.279/0.405/0.072 ms
mininet-wifi>
```

## H1C ping H1A



```
*** Starting CLI:
mininet-wifi> roteador2 ip route
10.10.100.0/30 dev roteador2-eth0 proto kernel scope link src 10.10.100.2
10.10.100.4/30 dev roteador2-eth1 proto kernel scope link src 10.10.100.5
192.0.2.0/24 via 10.10.100.1 dev roteador2-eth0
192.168.10.0/24 via 10.10.100.6 dev roteador2-eth1
198.51.100.0/24 via 10.10.100.6 dev roteador2-eth1
203.0.113.0/24 via 10.10.100.6 dev roteador2-eth1
mininet-wifi> roteador3 ip route
10.10.100.8/30 dev roteador3-eth1 proto kernel scope link src 10.10.100.9
10.10.100.12/30 dev roteador3-eth0 proto kernel scope link src 10.10.100.14
192.0.2.0/24 via 10.10.100.13 dev roteador3-eth0
192.168.10.0/24 via 10.10.100.10 dev roteador3-eth1
198.51.100.0/24 via 10.10.100.10 dev roteador3-eth1
203.0.113.0/24 via 10.10.100.10 dev roteador3-eth1
mininet-wifi> roteador4 ip route
10.10.100.4/30 dev roteador4-eth0 proto kernel scope link src 10.10.100.6
10.10.100.8/30 dev roteador4-eth1 proto kernel scope link src 10.10.100.10
10.10.100.16/30 dev roteador4-eth2 proto kernel scope link src 10.10.100.17
192.0.2.0/24 via 10.10.100.5 dev roteador4-eth0
192.168.10.0/24 via 10.10.100.18 dev roteador4-eth2
198.51.100.0/24 via 10.10.100.18 dev roteador4-eth2
203.0.113.0/24 via 10.10.100.18 dev roteador4-eth2
mininet-wifi>
```

Roteador 2, 3, 4 ip route

```
mininet-wifi> roteador5 ip route
10.10.100.16/30 dev roteador5-eth0 proto kernel scope link src 10.10.100.18
10.10.200.0/30 dev roteador5-eth2 proto kernel scope link src 10.10.200.1
10.10.200.4/30 dev roteador5-eth1 proto kernel scope link src 10.10.200.5
192.0.2.0/24 via 10.10.100.17 dev roteador5-eth0
192.168.10.0/24 via 10.10.200.2 dev roteador5-eth2
198.51.100.0/24 via 10.10.200.2 dev roteador5-eth2
203.0.113.0/24 via 10.10.200.6 dev roteador5-eth1
mininet-wifi> roteador6 ip route
10.10.200.4/30 dev roteador6-eth0 proto kernel scope link src 10.10.200.6
10.10.201.0/30 dev roteador6-eth1 proto kernel scope link src 10.10.201.1
10.10.202.8/30 dev roteador6-eth2 proto kernel scope link src 10.10.202.9
192.0.2.0/24 via 10.10.200.5 dev roteador6-eth0
192.168.10.0/24 via 10.10.202.10 dev roteador6-eth2
198.51.100.0/24 via 10.10.202.10 dev roteador6-eth2
203.0.113.0/24 via 10.10.201.2 dev roteador6-eth1
mininet-wifi> roteador7 ip route
10.10.200.8/30 dev roteador7-eth2 proto kernel scope link src 10.10.200.9
192.0.2.0/24 via 10.10.200.10 dev roteador7-eth2
192.168.10.0/24 dev roteador7-eth1 proto kernel scope link src 192.168.10.254
198.51.100.0/24 dev roteador7-eth0 proto kernel scope link src 198.51.100.254
203.0.113.0/24 via 10.10.200.10 dev roteador7-eth2
mininet-wifi>
```

Roteador 5,6,7 ip route

The screenshot shows a terminal window titled 'wif@wif-virtualbox: ~/redes-computadores-2022-2/aula02'. The user is in the 'mininet-wifi' directory. They execute the command 'roteador8 ip route', which displays the following output:

```
10.10.200.0/30 dev roteador8-eth0 proto kernel scope link src 10.10.200.2
10.10.200.8/30 dev roteador8-eth1 proto kernel scope link src 10.10.200.10
10.10.202.4/30 dev roteador8-eth3 proto kernel scope link src 10.10.202.5
10.10.206.0/30 dev roteador8-eth2 proto kernel scope link src 10.10.206.1
192.0.2.0/24 via 10.10.200.1 dev roteador8-eth0
192.168.10.0/24 via 10.10.200.9 dev roteador8-eth1
198.51.100.0/24 via 10.10.200.9 dev roteador8-eth1
203.0.113.0/24 via 10.10.202.6 dev roteador8-eth3
```

Next, they execute 'roteador9 ip route', showing:

```
10.10.201.8/30 dev roteador9-eth2 proto kernel scope link src 10.10.201.9
10.10.202.4/30 dev roteador9-eth1 proto kernel scope link src 10.10.202.6
10.10.202.8/30 dev roteador9-eth0 proto kernel scope link src 10.10.202.10
192.0.2.0/24 via 10.10.202.9 dev roteador9-eth0
192.168.10.0/24 via 10.10.202.5 dev roteador9-eth1
198.51.100.0/24 via 10.10.202.5 dev roteador9-eth1
203.0.113.0/24 via 10.10.202.9 dev roteador9-eth0
```

Finally, they execute 'roteador10 ip route', showing:

```
10.10.201.4/30 dev roteador10-eth2 proto kernel scope link src 10.10.201.5
10.10.201.8/30 dev roteador10-eth1 proto kernel scope link src 10.10.201.10
10.10.206.0/30 dev roteador10-eth0 proto kernel scope link src 10.10.206.2
192.0.2.0/24 via 10.10.201.9 dev roteador10-eth1
192.168.10.0/24 via 10.10.206.1 dev roteador10-eth0
198.51.100.0/24 via 10.10.206.1 dev roteador10-eth0
203.0.113.0/24 via 10.10.201.6 dev roteador10-eth2
```

The terminal window also shows a file explorer on the left with a tree view of the project files and a status bar at the bottom indicating the current file is 'aula02'.

Roteador 8,9,10 ip route

```
mininet-wifi> roteador11 ip route
10.10.201.0/30 dev roteador11-eth1 proto kernel scope link src 10.10.201.2
10.10.201.4/30 dev roteador11-eth2 proto kernel scope link src 10.10.201.6
192.0.2.0/24 via 10.10.201.1 dev roteador11-eth1
192.168.10.0/24 via 10.10.201.5 dev roteador11-eth2
198.51.100.0/24 via 10.10.201.5 dev roteador11-eth2
203.0.113.0/24 dev roteador11-eth0 proto kernel scope link src 203.0.113.254
mininet-wifi>
```

Roteador11 ip route



```
wifi@wifi-virtualbox: ~/redes-computadores-2022-2/aula02
wifi@wifi-virtualbox: ~/redes-computadores-2022-2/aula02 80x26
203.0.113.0/24 dev roteador11-eth0 proto kernel scope link src 203.0.113.254
mininet-wifi> h1a ping h2a
PING 192.0.2.2 (192.0.2.2) 56(84) bytes of data.
64 bytes from 192.0.2.2: icmp_seq=1 ttl=64 time=0.512 ms
64 bytes from 192.0.2.2: icmp_seq=2 ttl=64 time=0.104 ms
^C
--- 192.0.2.2 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1034ms
rtt min/avg/max/mdev = 0.104/0.308/0.512/0.204 ms
mininet-wifi> h1b ping h2b
PING 203.0.113.2 (203.0.113.2) 56(84) bytes of data.
64 bytes from 203.0.113.2: icmp_seq=1 ttl=64 time=0.246 ms
64 bytes from 203.0.113.2: icmp_seq=2 ttl=64 time=0.109 ms
^C
--- 203.0.113.2 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1019ms
rtt min/avg/max/mdev = 0.109/0.177/0.246/0.068 ms
mininet-wifi> h1c ping h2c
PING 198.51.100.2 (198.51.100.2) 56(84) bytes of data.
64 bytes from 198.51.100.2: icmp_seq=1 ttl=64 time=0.190 ms
64 bytes from 198.51.100.2: icmp_seq=2 ttl=64 time=0.104 ms
^C
--- 198.51.100.2 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1024ms
rtt min/avg/max/mdev = 0.104/0.147/0.190/0.043 ms
mininet-wifi> 
```

```
mininet-wifi> h1d ping h2d
PING 192.168.10.2 (192.168.10.2) 56(84) bytes of data.
64 bytes from 192.168.10.2: icmp_seq=1 ttl=64 time=0.240 ms
64 bytes from 192.168.10.2: icmp_seq=2 ttl=64 time=0.115 ms
64 bytes from 192.168.10.2: icmp_seq=3 ttl=64 time=0.105 ms
^C
--- 192.168.10.2 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2050ms
rtt min/avg/max/mdev = 0.105/0.153/0.240/0.061 ms
mininet-wifi> 
```

Conexões entre os Hosts

Codigo:

```
#!/usr/bin/python
#!/usr/bin/python
from mininet.log import setLogLevel, info
from mn_wifi.cli import CLI
from mn_wifi.net import Mininet_wifi
```

```
def topology(remote_controller):
    "Create a network."
    net = Mininet_wifi()

    info("**** Adding stations/hosts\n")
```

```
h1a = net.addHost("h1a", ip="192.0.2.1/24")
h2a = net.addHost("h2a", ip="192.0.2.2/24")
h1b = net.addHost("h1b", ip="203.0.113.1/24")
h2b = net.addHost("h2b", ip="203.0.113.2/24")
h1c = net.addHost("h1c", ip="198.51.100.1/24")
h2c = net.addHost("h2c", ip="198.51.100.2/24")
h1d = net.addHost("h1d", ip="192.168.10.1/24")
h2d = net.addHost("h2d", ip="192.168.10.2/24")
```

```
roteador1 = net.addHost("roteador1")
roteador2 = net.addHost("roteador2")
roteador3 = net.addHost("roteador3")
roteador4 = net.addHost("roteador4")
roteador5 = net.addHost("roteador5")
roteador6 = net.addHost("roteador6")
roteador7 = net.addHost("roteador7")
roteador8 = net.addHost("roteador8")
roteador9 = net.addHost("roteador9")
roteador10 = net.addHost("roteador10")
roteador11 = net.addHost("roteador11")
```

```
info("**** Adding P4Switches (core)\n")
```

```
switch1 = net.addSwitch("switch1")
switch2 = net.addSwitch("switch2")
switch3 = net.addSwitch("switch3")
switch4 = net.addSwitch("switch4")
```

```
info("**** Creating links\n")
```

```
info("**** Switch Roteador 1\n")
net.addLink(h1a, switch1, bw=1000)
net.addLink(h2a, switch1, bw=1000)
```

```
info("**** Switch Roteador 2\n")
net.addLink(h1b, switch2, bw=1000)
net.addLink(h2b, switch2, bw=1000)
```

```
info("**** Switch Roteador 3\n")
net.addLink(h1c, switch3, bw=1000)
net.addLink(h2c, switch3, bw=1000)
```

```
info("**** Switch Roteador 4\n")
net.addLink(h1d, switch4, bw=1000)
net.addLink(h2d, switch4, bw=1000)
```

```
net.addLink(roteador1, switch1, bw=1000) #r1 eth0
net.addLink(roteador11, switch2, bw=1000) #r11 eth0
net.addLink(roteador7, switch3, bw=1000) #r7 eth0
net.addLink(roteador7, switch4, bw=1000) #r7 eth1
```



```
net.addLink(roteador1, roteador2, bw=1000) #r1 eth1 e r2 eth0
net.addLink(roteador1, roteador3, bw=1000) #r1 eth2 e r3 eth0
net.addLink(roteador2, roteador4, bw=1000) #r2 eth1 e r4 eth0
net.addLink(roteador3, roteador4, bw=1000) #r3 eth1 e r4 eth1
net.addLink(roteador5, roteador4, bw=1000) #r5 eth0 e r4 eth2
net.addLink(roteador5, roteador6, bw=1000) #r5 eth1 e r6 eth0
net.addLink(roteador5, roteador8, bw=1000) #r5 eth2 e r8 eth0
net.addLink(roteador6, roteador11, bw=1000) #r6 eth1 e r11 eth1
net.addLink(roteador6, roteador9, bw=1000) #r6 eth2 e r9 eth0
net.addLink(roteador7, roteador8, bw=1000) #r7 eth2 e r8 eth1
net.addLink(roteador8, roteador10, bw=1000) #r8 eth2 e r10 eth0
net.addLink(roteador8, roteador9, bw=1000) #r8 eth3 e r9 eth1
net.addLink(roteador9, roteador10, bw=1000) #r9 eth2 e r10 eth1
net.addLink(roteador10, roteador11, bw=1000) #r10 eth2 e r11 eth2
```

```
info("*** Starting network\n")
net.start()
net.staticArp()
```

```
info("*** Applying switches configurations\n")
```

```
switch1.cmd(
'ovs-ofctl add-flow {} "actions=output:NORMAL"'.format(switch1.name))
switch2.cmd(
'ovs-ofctl add-flow {} "actions=output:NORMAL"'.format(switch2.name))
switch3.cmd(
'ovs-ofctl add-flow {} "actions=output:NORMAL"'.format(switch3.name))
switch4.cmd(
'ovs-ofctl add-flow {} "actions=output:NORMAL"'.format(switch4.name))
```

```
info("*** Applying hosts and routers configurations\n")
```

```
roteador1.cmd("ifconfig roteador1-eth0 192.0.2.254/24")
roteador1.cmd("ifconfig roteador1-eth1 10.10.100.1/30")
roteador1.cmd("ifconfig roteador1-eth2 10.10.100.13/30")
```

```
roteador2.cmd("ifconfig roteador2-eth0 10.10.100.2/30")
roteador2.cmd("ifconfig roteador2-eth1 10.10.100.5/30")
```

```
roteador3.cmd("ifconfig roteador3-eth0 10.10.100.14/30")
roteador3.cmd("ifconfig roteador3-eth1 10.10.100.9/30")
```

```
roteador4.cmd("ifconfig roteador4-eth0 10.10.100.6/30")
roteador4.cmd("ifconfig roteador4-eth1 10.10.100.10/30")
roteador4.cmd("ifconfig roteador4-eth2 10.10.100.17/30")
```

```
roteador5.cmd("ifconfig roteador5-eth0 10.10.100.18/30")
roteador5.cmd("ifconfig roteador5-eth1 10.10.200.5/30")
roteador5.cmd("ifconfig roteador5-eth2 10.10.200.1/30")
```

```
roteador6.cmd("ifconfig roteador6-eth0 10.10.200.6/30")
roteador6.cmd("ifconfig roteador6-eth1 10.10.201.1/30")
roteador6.cmd("ifconfig roteador6-eth2 10.10.202.9/30")
```

```
roteador7.cmd("ifconfig roteador7-eth0 198.51.100.254/24")
roteador7.cmd("ifconfig roteador7-eth1 192.168.10.254/24")
roteador7.cmd("ifconfig roteador7-eth2 10.10.200.9/30")
```

```
roteador8.cmd("ifconfig roteador8-eth0 10.10.200.2/30")
roteador8.cmd("ifconfig roteador8-eth1 10.10.200.10/30")
roteador8.cmd("ifconfig roteador8-eth2 10.10.206.1/30")
roteador8.cmd("ifconfig roteador8-eth3 10.10.202.5/30")
```

```
roteador9.cmd("ifconfig roteador9-eth0 10.10.202.10/30")
roteador9.cmd("ifconfig roteador9-eth1 10.10.202.6/30")
roteador9.cmd("ifconfig roteador9-eth2 10.10.201.9/30")
```

```
roteador10.cmd("ifconfig roteador10-eth0 10.10.206.2/30")
roteador10.cmd("ifconfig roteador10-eth1 10.10.201.10/30")
roteador10.cmd("ifconfig roteador10-eth2 10.10.201.5/30")
```

```
roteador11.cmd("ifconfig roteador11-eth0 203.0.113.254/24")
roteador11.cmd("ifconfig roteador11-eth1 10.10.201.2/30")
roteador11.cmd("ifconfig roteador11-eth2 10.10.201.6/30")
```

```
h1a.cmd("ip route add default via 192.0.2.254")
h2a.cmd("ip route add default via 192.0.2.254")
h1b.cmd("ip route add default via 203.0.113.254")
h2b.cmd("ip route add default via 203.0.113.254")
h1c.cmd("ip route add default via 198.51.100.254")
h2c.cmd("ip route add default via 198.51.100.254")
h1d.cmd("ip route add default via 192.168.10.254")
h2d.cmd("ip route add default via 192.168.10.254")
```

```
roteador1.cmd("ip route add 203.0.113.0/24 via 10.10.100.2")
roteador1.cmd("ip route add 198.51.100.0/24 via 10.10.100.14")
roteador1.cmd("ip route add 192.168.10.0/24 via 10.10.100.14")
```

```
roteador2.cmd("ip route add 192.0.2.0/24 via 10.10.100.1")
roteador2.cmd("ip route add 203.0.113.0/24 via 10.10.100.6")
roteador2.cmd("ip route add 198.51.100.0/24 via 10.10.100.6")
roteador2.cmd("ip route add 192.168.10.0/24 via 10.10.100.6")
```

```
roteador3.cmd("ip route add 192.0.2.0/24 via 10.10.100.13")
roteador3.cmd("ip route add 203.0.113.0/24 via 10.10.100.10")
roteador3.cmd("ip route add 198.51.100.0/24 via 10.10.100.10")
roteador3.cmd("ip route add 192.168.10.0/24 via 10.10.100.10")
```

```
roteador4.cmd("ip route add 192.0.2.0/24 via 10.10.100.5")
roteador4.cmd("ip route add 203.0.113.0/24 via 10.10.100.18")
roteador4.cmd("ip route add 198.51.100.0/24 via 10.10.100.18")
roteador4.cmd("ip route add 192.168.10.0/24 via 10.10.100.18")
```

```
roteador5.cmd("ip route add 192.0.2.0/24 via 10.10.100.17")
roteador5.cmd("ip route add 203.0.113.0/24 via 10.10.200.6")
roteador5.cmd("ip route add 198.51.100.0/24 via 10.10.200.2")
roteador5.cmd("ip route add 192.168.10.0/24 via 10.10.200.2")
```

```
roteador6.cmd("ip route add 192.0.2.0/24 via 10.10.200.5")
roteador6.cmd("ip route add 203.0.113.0/24 via 10.10.201.2")
roteador6.cmd("ip route add 198.51.100.0/24 via 10.10.202.10")
roteador6.cmd("ip route add 192.168.10.0/24 via 10.10.202.10")
```

```
roteador7.cmd("ip route add 192.0.2.0/24 via 10.10.200.10")
roteador7.cmd("ip route add 203.0.113.0/24 via 10.10.200.10")
```

```
roteador8.cmd("ip route add 192.0.2.0/24 via 10.10.200.1")
roteador8.cmd("ip route add 203.0.113.0/24 via 10.10.202.6")
roteador8.cmd("ip route add 198.51.100.0/24 via 10.10.200.9")
roteador8.cmd("ip route add 192.168.10.0/24 via 10.10.200.9")
```

```
roteador9.cmd("ip route add 192.0.2.0/24 via 10.10.202.9")
roteador9.cmd("ip route add 203.0.113.0/24 via 10.10.202.9")
roteador9.cmd("ip route add 198.51.100.0/24 via 10.10.202.5")
roteador9.cmd("ip route add 192.168.10.0/24 via 10.10.202.5")
```

```
roteador10.cmd("ip route add 192.0.2.0/24 via 10.10.201.9")
roteador10.cmd("ip route add 203.0.113.0/24 via 10.10.201.6")
roteador10.cmd("ip route add 198.51.100.0/24 via 10.10.206.1")
roteador10.cmd("ip route add 192.168.10.0/24 via 10.10.206.1")
```

```
roteador11.cmd("ip route add 192.0.2.0/24 via 10.10.201.1")
roteador11.cmd("ip route add 198.51.100.0/24 via 10.10.201.5")
roteador11.cmd("ip route add 192.168.10.0/24 via 10.10.201.5")
```

```
info("*** Running CLI\n")
CLI(net)
```

```
info("*** Stopping network\n")  
net.stop()
```

```
if __name__ == "__main__":  
    setLogLevel("info")  
    remote_controller = False  
    topology(remote_controller)
```