

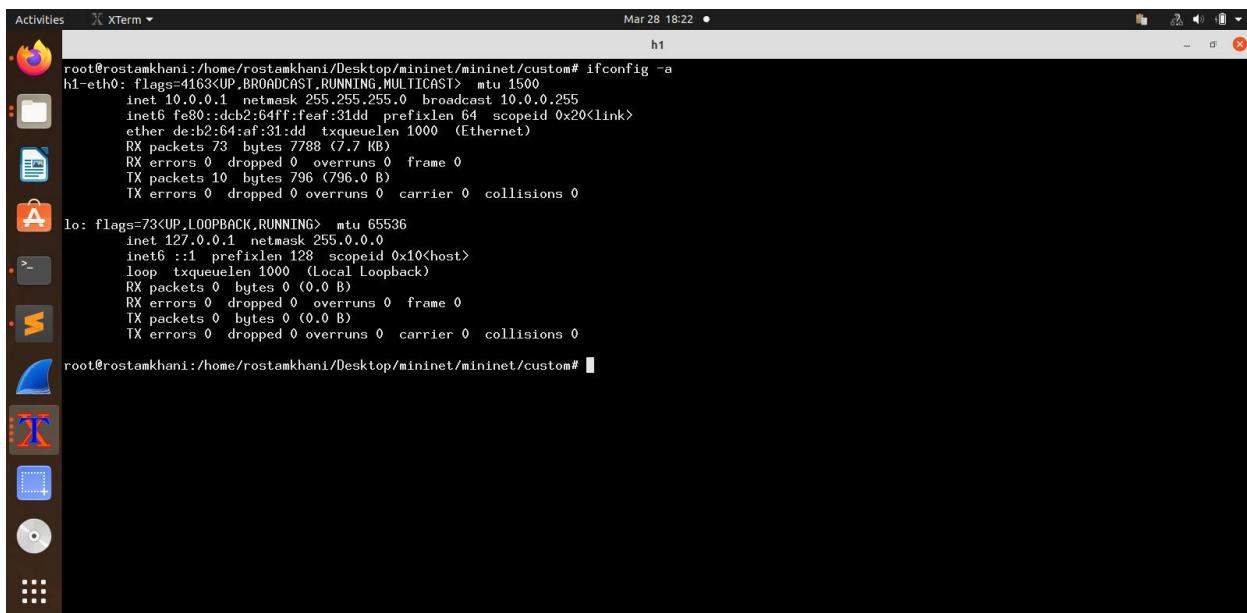
# گزارش آزمایش 3

محمد مصطفی رستم خانی - 97521306

آرمین غلامپور - 97521414

\$ sudo python topo1.py

(الف)



```
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# ifconfig -a
h1-eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
        inet 10.0.0.1 netmask 255.255.255.0 broadcast 10.0.0.255
                inet6 fe80::dcba:64ff:feaf:31dd prefixlen 64 scopeid 0x20<link>
                    ether de:b2:64:af:31:dd txqueuelen 1000 (Ethernet)
                    RX packets 73 bytes 7788 (7.7 KB)
                    RX errors 0 dropped 0 overruns 0 frame 0
                    TX packets 10 bytes 796 (796.0 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
                inet6 ::1 prefixlen 128 scopeid 0x10<host>
                    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
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom#
```

Activities XTerm Mar 28 18:22 ● h2

```
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# ifconfig -a
h2:eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 10.0.0.2 netmask 255.255.255.254 broadcast 10.255.255.254
        inet6 fe80::4c63:ecff:febi:362 prefixlen 64 scopeid 0x20<link>
            ether 4e:63:ec:b1:93:62 txqueuelen 1000 (Ethernet)
                RX packets 72 bytes 7698 (7.6 KB)
                RX errors 0 dropped 0 overruns 0 frame 0
                TX packets 10 bytes 796 (796.0 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
        inet6 ::1 prefixlen 128 scopeid 0x10<host>
            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
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom#
```

Activities XTerm Mar 28 18:23 ● h3

```
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# ifconfig -a
h3:eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 10.0.0.3 netmask 255.255.255.0 broadcast 10.0.0.255
        inet6 fe80::ecb3:74ff:fe3b:ba1a prefixlen 64 scopeid 0x20<link>
            ether ee:b3:74:3b:ba:1a txqueuelen 1000 (Ethernet)
                RX packets 73 bytes 7784 (7.7 KB)
                RX errors 0 dropped 0 overruns 0 frame 0
                TX packets 10 bytes 796 (796.0 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
        inet6 ::1 prefixlen 128 scopeid 0x10<host>
            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
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom#
```

```

Activities X XTerm Mar 28 18:23 • h4
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# ifconfig -a
h4-eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
        inet 10.0.1.4 brd 255.255.255.0 broadcast 10.0.1.255
          inet6 fe80::f4e7:8eff:fe9e:8792 brd fe80::f4e7:8eff:fe9e:8792 prefixlen 64 scopeid 0x20<link>
            ether f8:e7:8e:9e:87:92 txqueuelen 1000 (Ethernet)
              RX packets 73 bytes 7784 (7.7 KB)
              RX errors 0 dropped 0 overruns 0 frame 0
              TX packets 10 bytes 796 (796.0 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 brd 255.0.0.0
          inet6 ::1 brd :: prefixlen 128 scopeid 0x10<host>
            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
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# ■

```

سوال 1: ماشین h2 دارای پیکر بندی اشتباه است. زیرا دارای subnet mask اشتباه است. برای رفع آن از دستورات زیر استفاده می کنیم:

- # ip addr flush dev h2-eth0
- # ip addr add 10.0.0.2/24 dev h2-eth0

```

Activities X XTerm Mar 28 18:28 • h2
      TX packets 10 bytes 796 (796.0 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 brd 255.0.0.0
        inet6 ::1 brd :: prefixlen 128 scopeid 0x10<host>
          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
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# ipaddrflush def h2-eth0
ipaddrflush: command not found
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# ip addr flush dev h2-eth0
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# ip addr add 10.0.0.2/24 dev h2-eth0
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# ifconfig
h2-eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
        inet 10.0.0.2 brd 255.255.255.0 broadcast 0.0.0
          ether 4e:63:ec:b1:03:62 txqueuelen 1000 (Ethernet)
            RX packets 86 bytes 8826 (8.8 KB)
            RX errors 0 dropped 0 overruns 0 frame 0
            TX packets 14 bytes 1116 (1.1 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 brd 255.0.0.0
          inet6 ::1 brd :: prefixlen 128 scopeid 0x10<host>
            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
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# ■

```

```

Activities XTerm Mar 28 18:33 •
h2
TX packets 10 bytes 796 (796.0 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
inet6 ::1 prefixlen 128 scopeid 0x10<host>
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

root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# ipaddrflush def h2-eth0
ipaddrflush: command not found
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# ip addr flush dev h2-eth0
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# ip addr add 10.0.0.2/24 dev h2-eth0
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# ifconfig
h2-eth0: flags=4163<UP,BROADCAST,MULTICAST> mtu 1500
inet 10.0.0.2 netmask 255.255.255.0 broadcast 0.0.0.0
ether 4e:63:ec:b1:03:b2 txqueuelen 1000 (Ethernet)
RX packets 86 bytes 8826 (8.8 KB)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 14 bytes 1116 (1.1 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
inet6 ::1 prefixlen 128 scopeid 0x10<host>
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

root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom#

```

با استفاده از دستورات زیر، سوییچ های s12 , s34 را به hub تبدیل می کنیم:

- mininet> sh ovs-ofctl add-flow s12 action=flood
- mininet> sh ovs-ofctl add-flow s34 action=flood

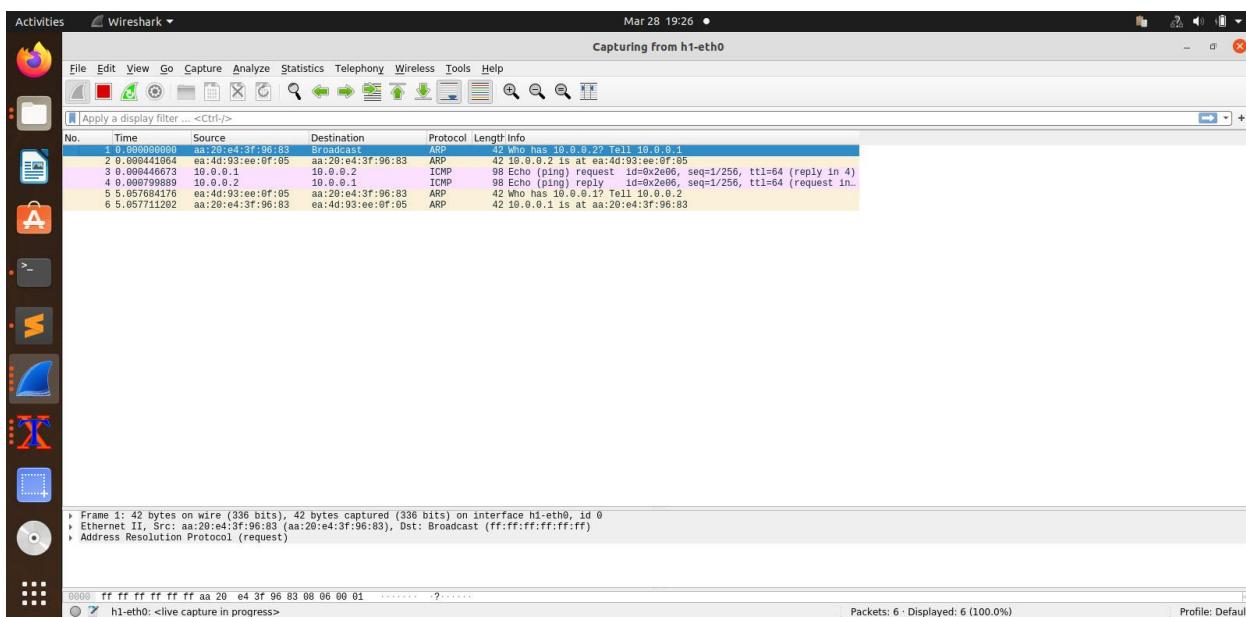
```

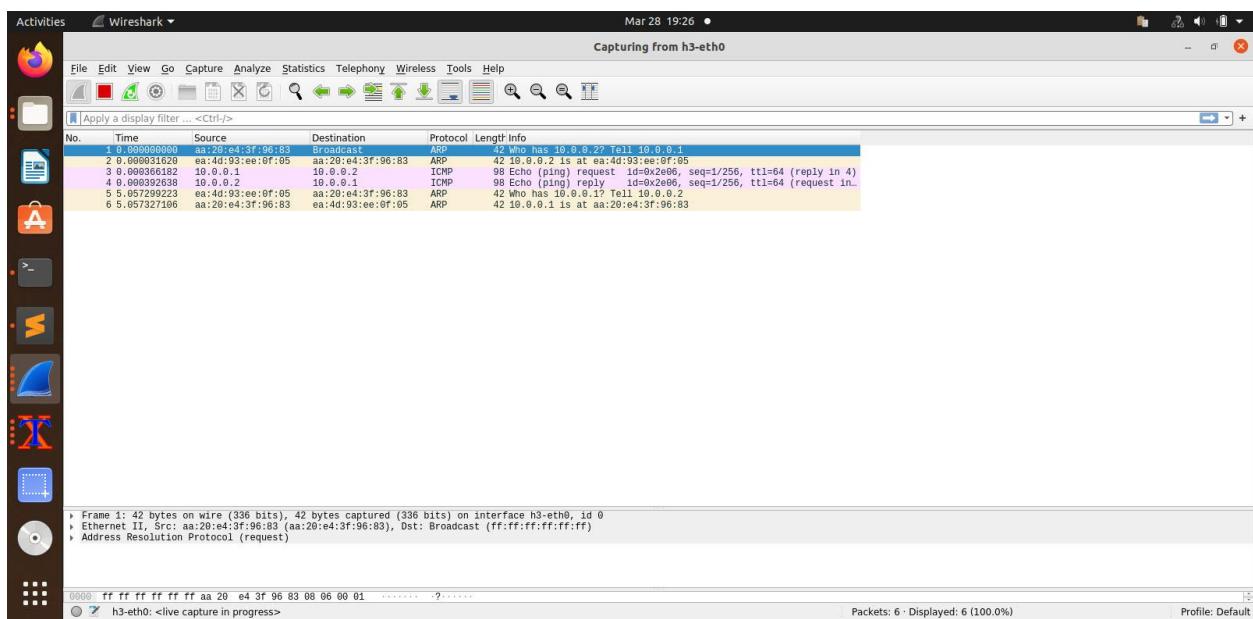
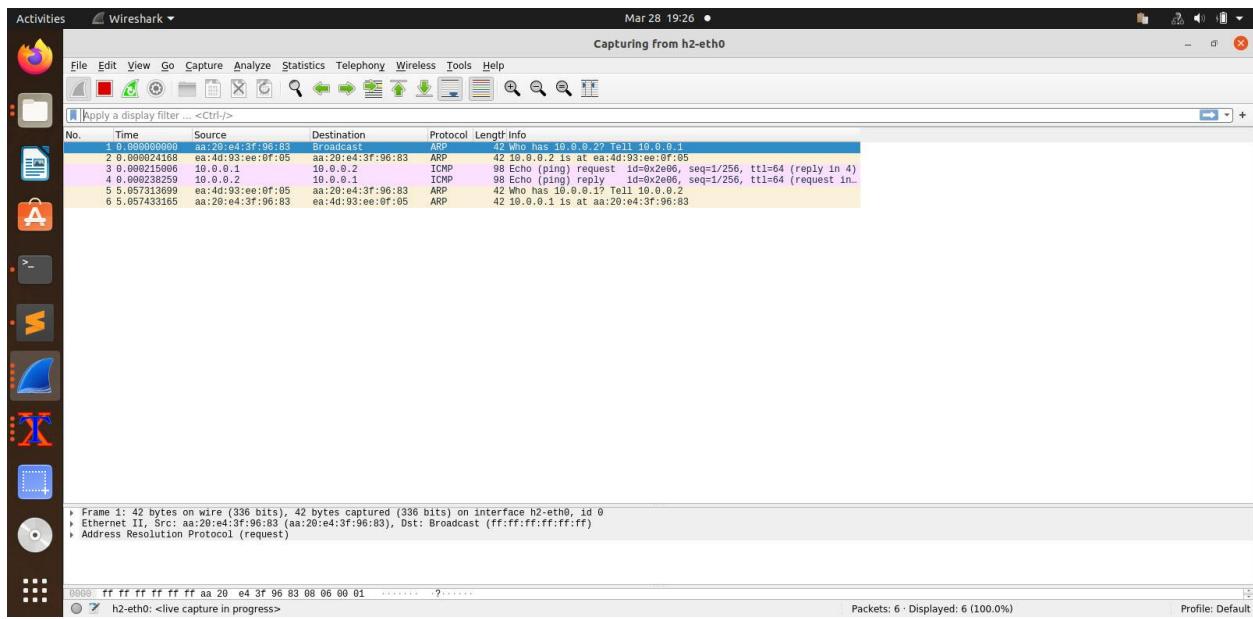
rostamkhani@rostamkhani:~/Desktop/mininet/mininet/custom$ sudo python3 topo1.py
[sudo] password for rostamkhani:
*** Adding controller
*** Adding hosts
*** Adding switches
*** Creating links
*** Starting network
*** Configuring hosts
h1 h2 h3 h4
*** Starting controller
c0
*** Starting 2 switches
s12 s34 ...
*** Starting xterm on hosts
*** Running the command line interface
*** Starting CLI:
mininet> sh ovs-ofctl add-flow s12 action=flood
mininet> sh ovs-ofctl add-flow s34 action=flood
mininet>

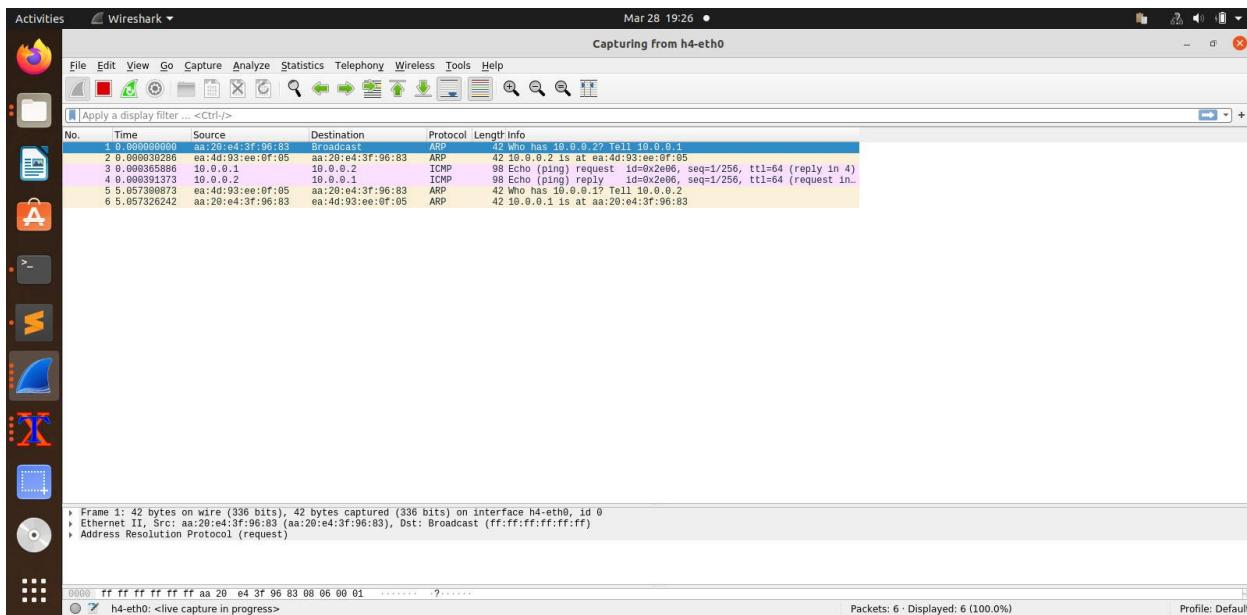
```

سپس از h1، ماشین 2 را پینگ می کنیم.

```
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# sudo wireshark
QStandardPaths: XDG_RUNTIME_DIR not set, defaulting to '/tmp/runtime-root'
^Z
[1]+  Stopped                  sudo wireshark
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# bg
[1]+  sudo wireshark &
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# ping 10.0.0.2 -c 1
PING 10.0.0.2 (10.0.0.2) 56(64) bytes of data.
64 bytes from 10.0.0.2: icmp_seq=1 ttl=64 time=0.508 ms
--- 10.0.0.2 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 0.508/0.508/0.508/0.000 ms
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom#
```







سوال 2: همانطور که در بالا مشاهده می کنیم، تفاوتی در ترافیک دریافت شده در چهار ماشین وجود ندارد. زیرا 12 هاب هستند و پیام را فقط broadcast می کنند. پس همه ماشین ها همه پیام ها را دریافت می کنند. (ARP request-ARP reply-ICMP request-ICMP reply).

(ب)

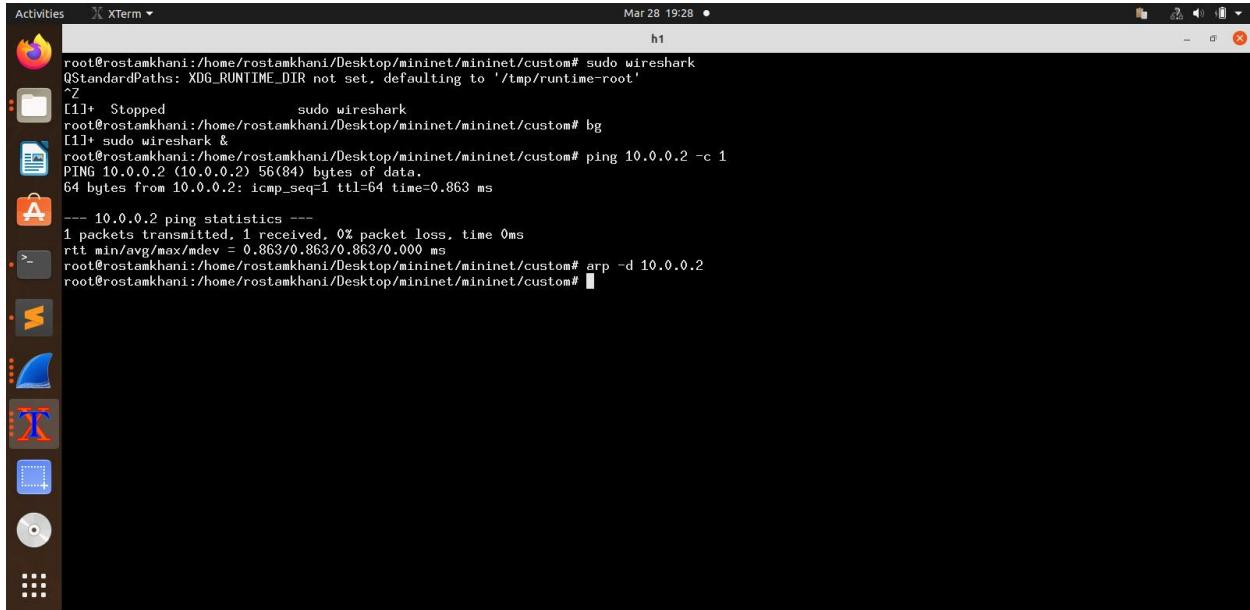
ابتدا با استفاده از دستور زیر، s12 را به سوییج تبدیل می کنیم:

• mininet> sh ovs-ofctl add-flow s12 action=normal

```
Activities Terminal Mar 28 19:09 •
root@rostan-khan:~/Desktop/mininet/mininet/custom
root@rostan-khan:~/Desktop/mininet/mininet/custom$ rm -f /tmp/vconn* /tmp/vlogs* /tmp/*.*out /tmp/*.*log
root@rostan-khan:~/Desktop/mininet/mininet/custom$ *** Removing old X11 tunnels
root@rostan-khan:~/Desktop/mininet/mininet/custom$ *** Removing excess kernel datapaths
root@rostan-khan:~/Desktop/mininet/mininet/custom$ ps ax | grep -o 'dp[0-9]:' | sed 's/dp/nl:/'
*** Removing OVS datapaths
ovs-vsctl --timeout=1 list-br
ovs-vsctl --timeout=1 list-br
*** Removing all links of the pattern foo-ethX
ip link show | egrep -o '([-_-[:alnum:]]+)-eth[[:digit:]]+'
ip link show
*** Killing stale mininet node processes
pkill -9 -f mininet
*** Shutting down stale tunnels
pkill -9 -f Tunnel-Ethernet
pkill -9 -f .ssh/mn
rm -f /.ssh/mn/*
*** Cleanup complete.
root@rostan-khan:~/Desktop/mininet/mininet/custom$ sudo python3 topo1.py
*** Adding controller
*** Adding hosts
*** Adding switches
*** Creating links
*** Starting network
*** Configuring hosts
h1 h2 h3 h4
*** Starting controller
c0
*** Starting 2 switches
s12 s34 ...
*** Starting xterm on hosts
*** Running the command line interface
*** Starting CLI:
mininet> sh ovs-ofctl add-flow s12 action=flood
mininet> sh ovs-ofctl add-flow s34 action=flood
mininet> sh ovs-ofctl add-flow s12 action=normal
mininet>
```

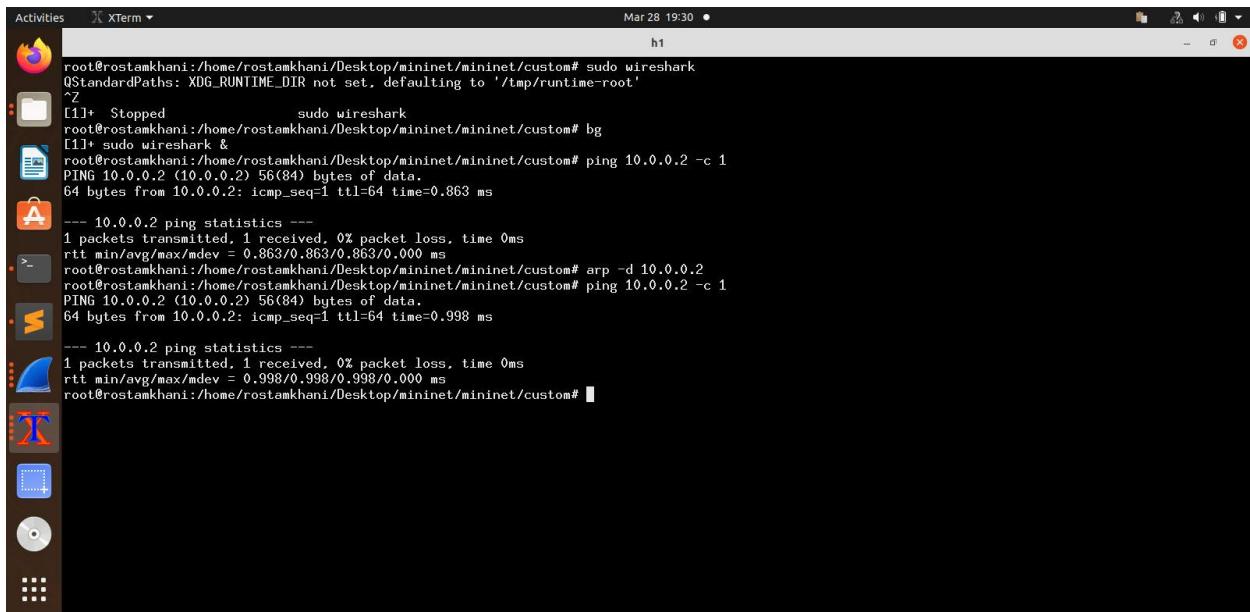
سپس محتوای کش ARP روی h1 را پاک می کنیم:

```
# arp -d 10.0.0.2
```



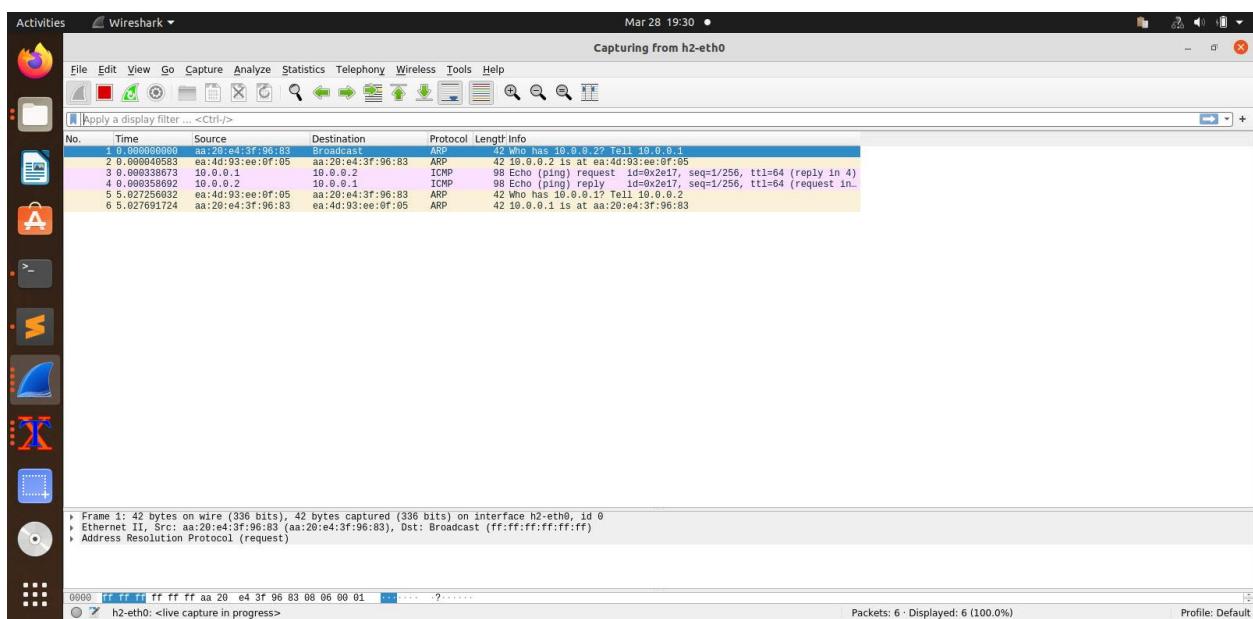
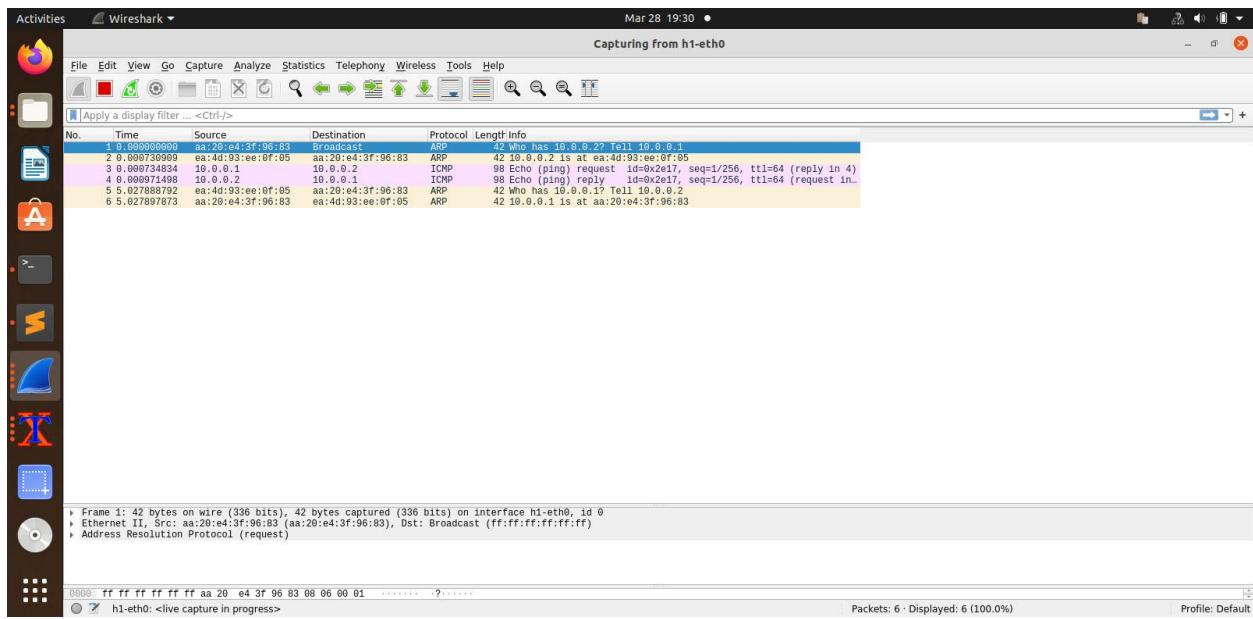
```
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# sudo wireshark
QStandardPaths: XDG_RUNTIME_DIR not set, defaulting to '/tmp/runtime-root'
^Z
[1]+  Stopped      sudo wireshark
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# bg
[1]+  sudo wireshark &
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# ping 10.0.0.2 -c 1
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=0.863 ms
--- 10.0.0.2 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 0.863/0.863/0.863/0.000 ms
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# arp -d 10.0.0.2
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom#
```

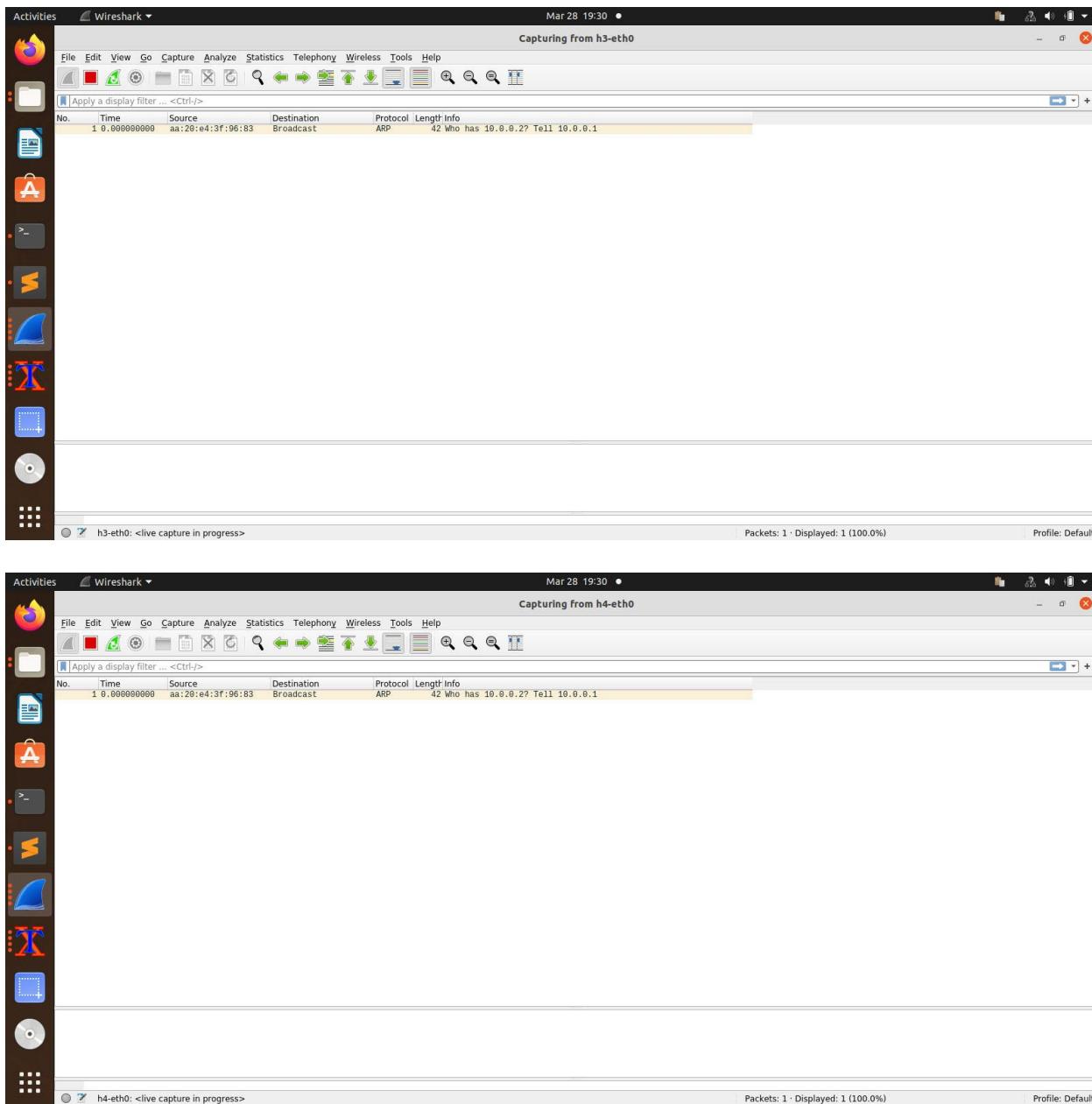
سپس ping میکنیم:



```
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# sudo wireshark
QStandardPaths: XDG_RUNTIME_DIR not set, defaulting to '/tmp/runtime-root'
^Z
[1]+  Stopped      sudo wireshark
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# bg
[1]+  sudo wireshark &
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# ping 10.0.0.2 -c 1
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=0.863 ms
--- 10.0.0.2 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 0.863/0.863/0.863/0.000 ms
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# arp -d 10.0.0.2
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# ping 10.0.0.2 -c 1
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=0.998 ms
--- 10.0.0.2 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 0.998/0.998/0.998/0.000 ms
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom#
```

سوال 3: h1 و h2 همه پیام ها را دریافت کرده اند. h3 و h4 تنها پیام های ARP request را دریافت کرده اند. زیرا s12 پیام های arp (reply) ماشین 3 را می فرستد و آن هم h2 و h3 را دریافت کرده اند. زیرا s12 فقط بین h1 و h2 منتقل می شود.





#### سوال 4:

در حالتی که دو هاب داشتیم همه پیام ها broad cast می شدند. ولی در این حالت پیام های ICMP request و ARP reply و ICMP reply در همه شبکه پخش نمی شوند.

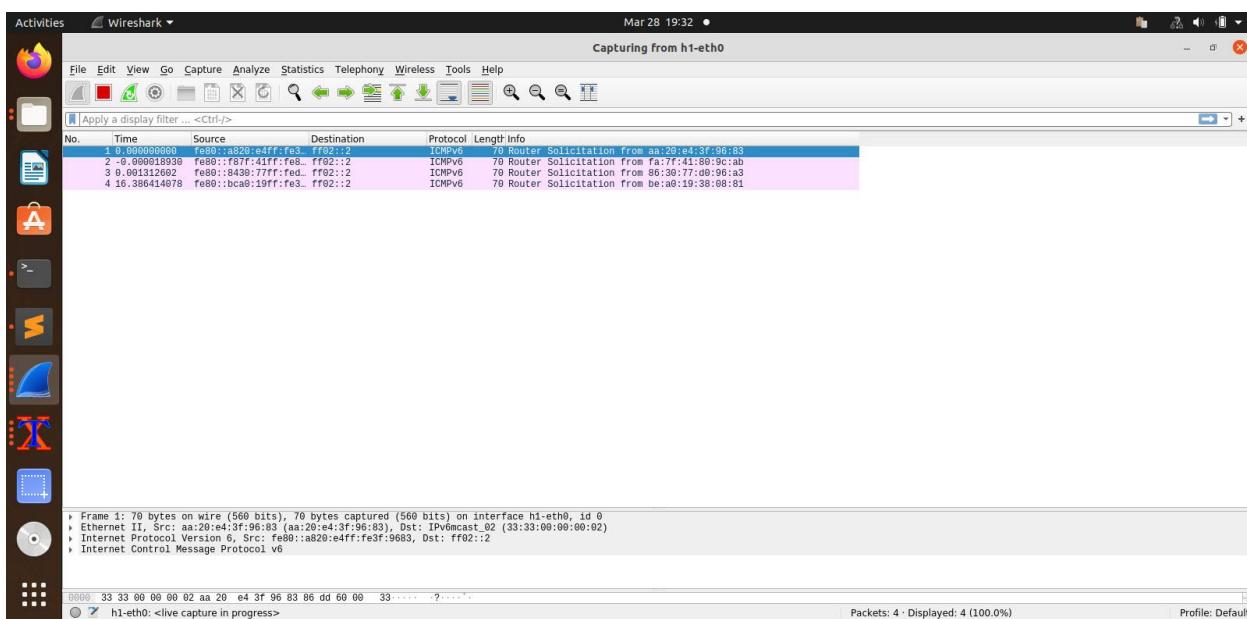
سوال 5: h1 و h3 همه بسته ها را میگیرند و h2 فقط بسته های arp request را میگیرد.

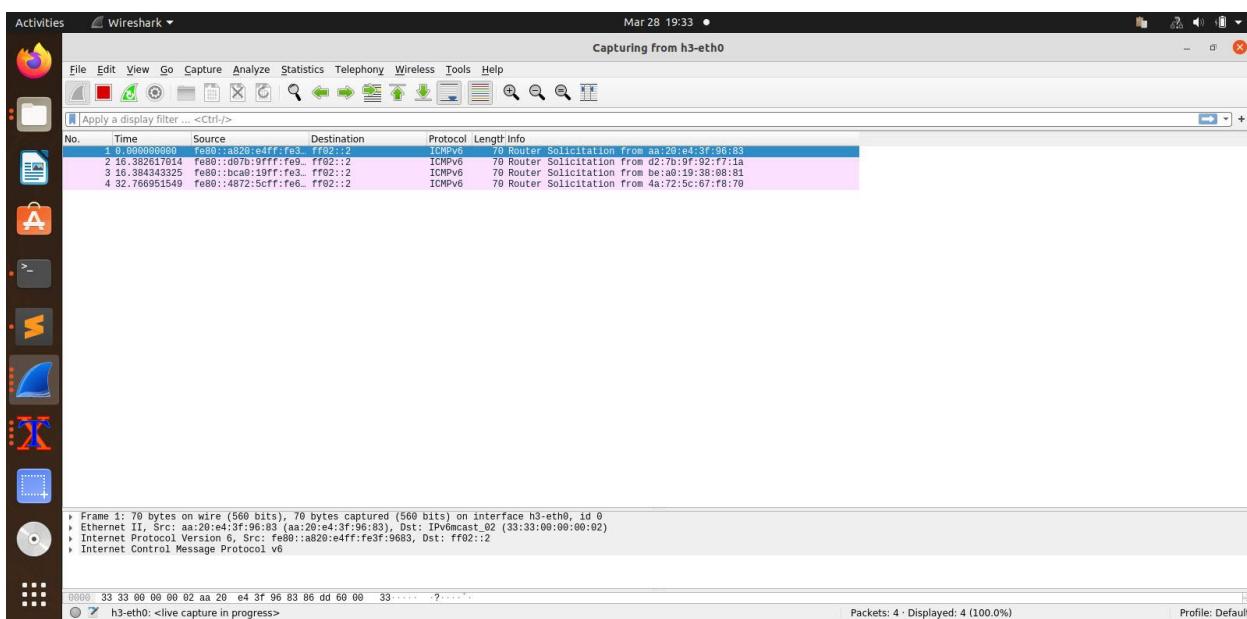
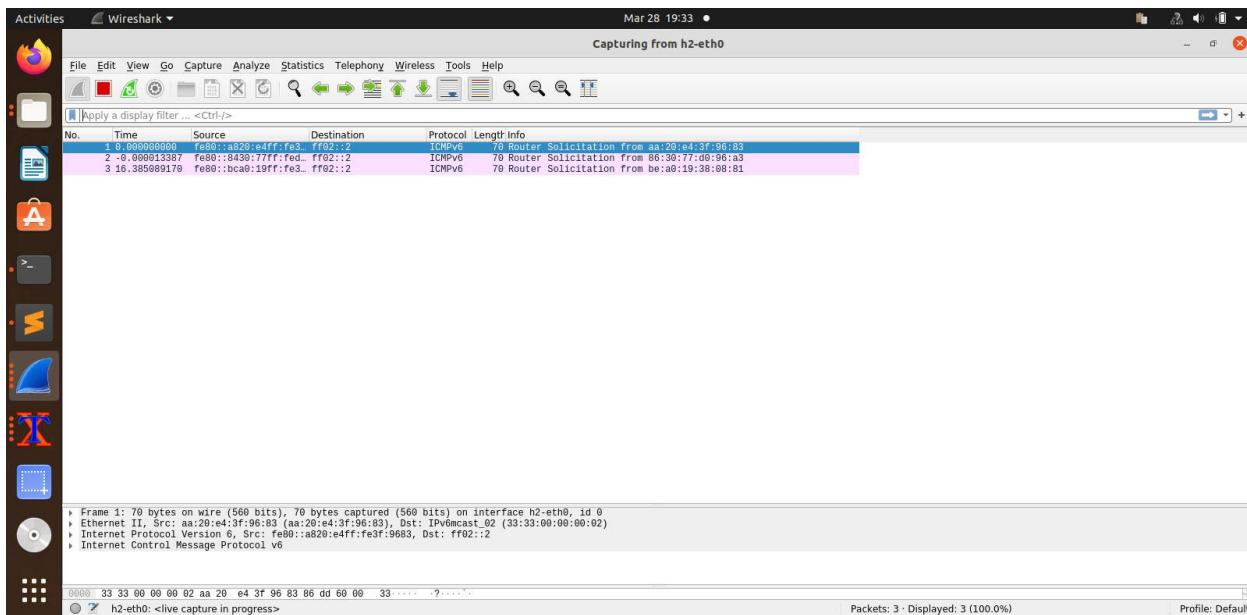
Activities XTerm Mar 28 19:32 • h1

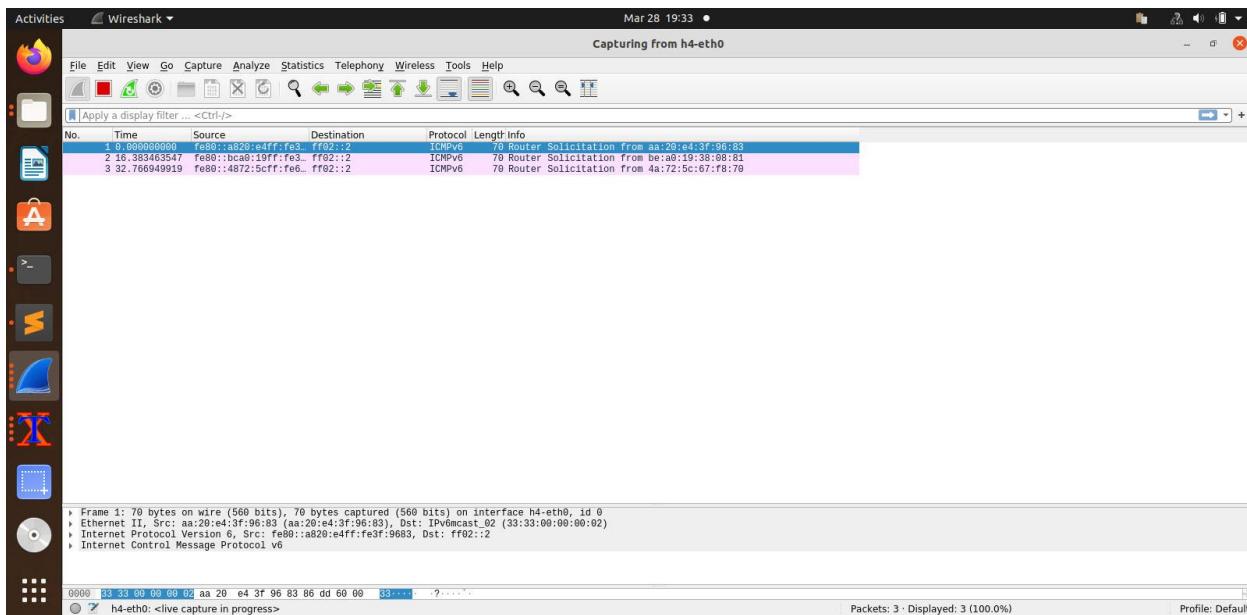
```
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# sudo wireshark
QStandardPaths: XDG_RUNTIME_DIR not set, defaulting to '/tmp/runtime-root'
^Z
[1]+  Stopped                  sudo wireshark
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# bg
[1]+  sudo wireshark &
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# ping 10.0.0.2 -c 1
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=0.863 ms

--- 10.0.0.2 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 0.863/0.863/0.863/0.000 ms
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# arp -d 10.0.0.2
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# ping 10.0.0.2 -c 1
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=0.998 ms

--- 10.0.0.2 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 0.998/0.998/0.998/0.000 ms
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# ping 10.0.1.4 -c 1
ping: connect: Network is unreachable
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom#
```



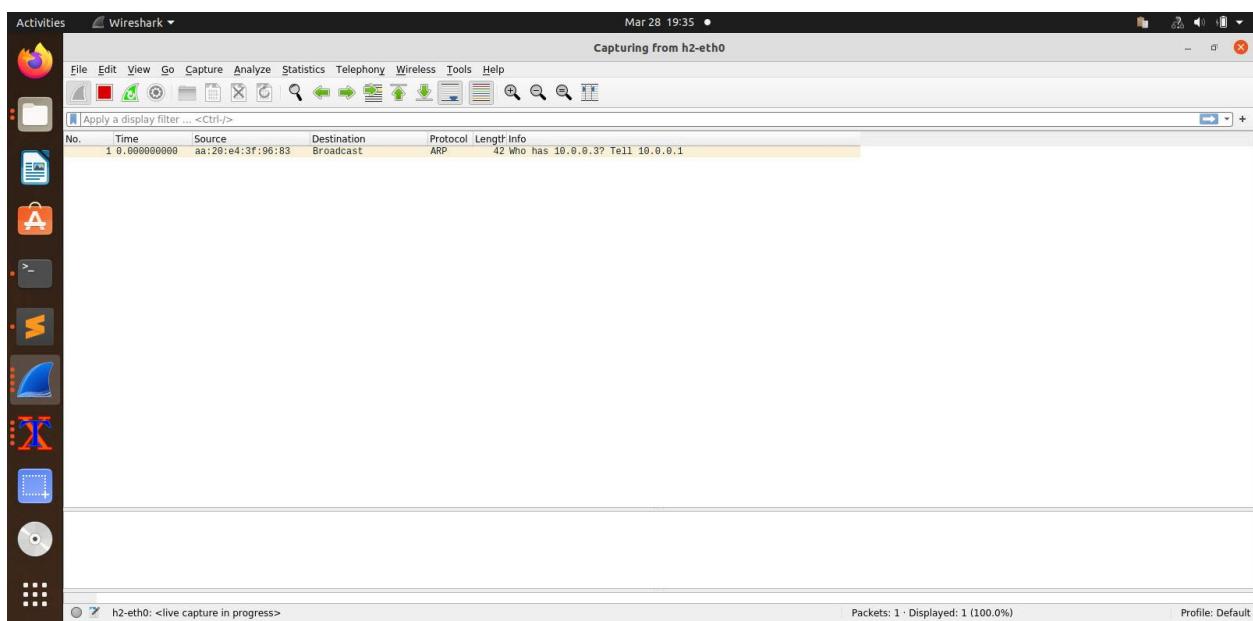
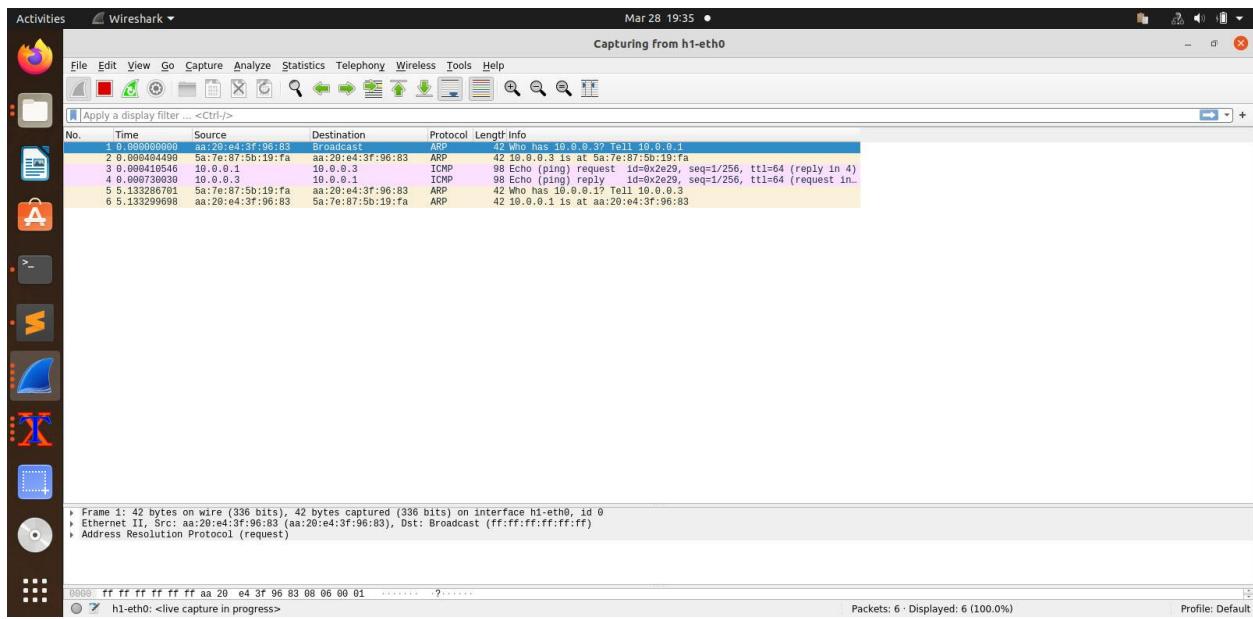


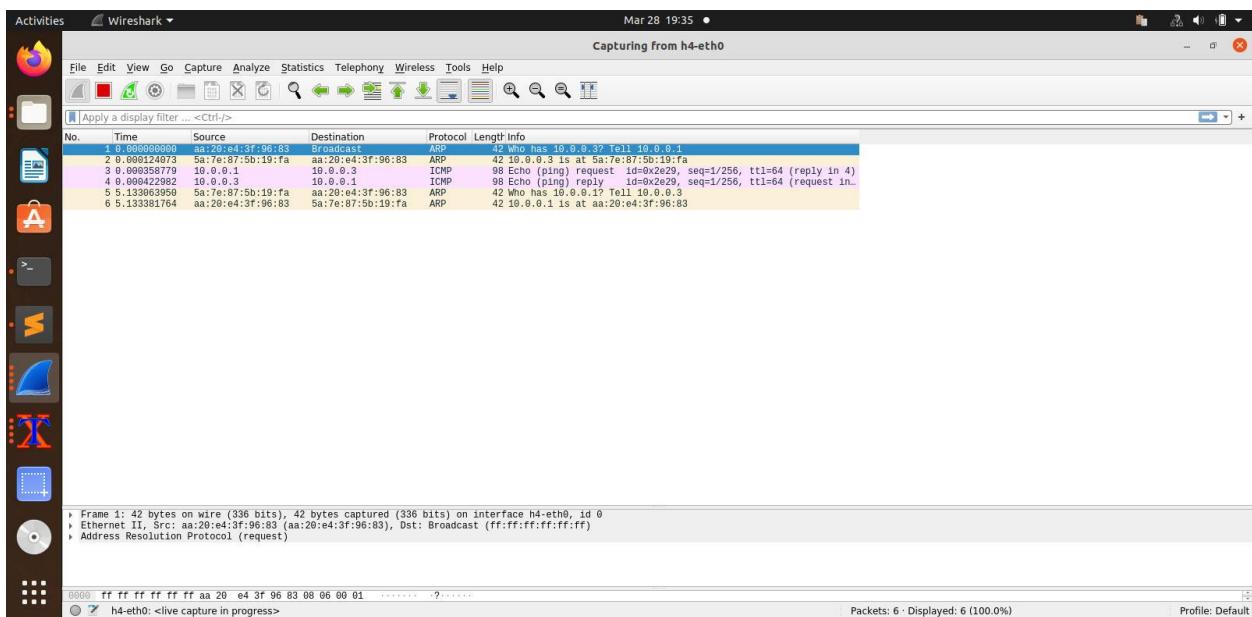
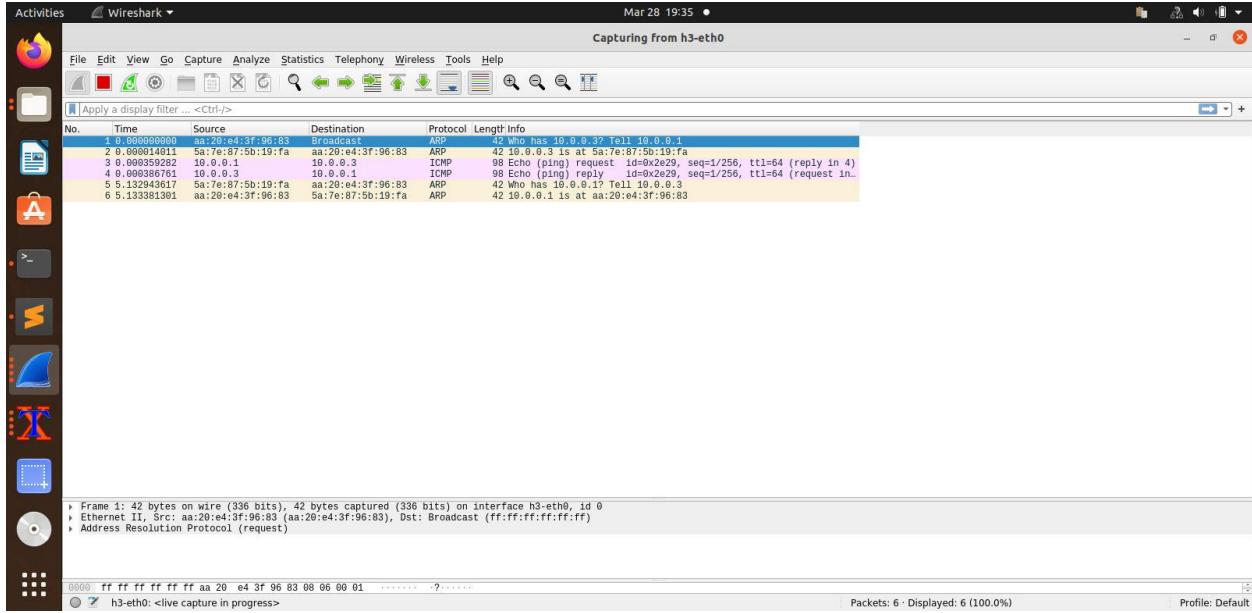


سوال 6: h1 و h4 همه بسته ها را میگیرند و h2 فقط بسته های arp request را میگیرد.

```

Activities XTerm Mar 28 19:35 •
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# sudo wireshark
QStandardPaths: XDG_RUNTIME_DIR not set. defaulting to '/tmp/runtime-root'
^Z
[1]+ Stopped sudo wireshark
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# bg
[1]+ sudo wireshark &
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# ping 10.0.0.2 -c 1
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=0.863 ms
--- 10.0.0.2 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 0.863/0.863/0.863/0.000 ms
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# arp -d 10.0.0.2
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# ping 10.0.0.2 -c 1
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=0.998 ms
--- 10.0.0.2 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 0.998/0.998/0.998/0.000 ms
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# ping 10.0.1.4 -c 1
ping: connect: Network is unreachable
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# ping 10.0.0.3 -c 1
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=0.756 ms
--- 10.0.0.3 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 0.756/0.756/0.756/0.000 ms
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom#
```





(c)

```

root@rostanikhani:~/Desktop/mininet/mininet/custom$ ovs-vsctl --timeout=1 list-br
*** Removing all links of the pattern foo-ethX
ip link show | egrep -o '([-_.:alnum:]+-eth[[:digit:]]+)'
ip link show
*** Killing stale mininet node processes
pkill -9 -f mininet:
*** Shutting down stale tunnels
pkill -9 -f Tunnel=ethernet
pkill -9 -f .ssh/mn
rm -f ~/.ssh/mn/*
*** Cleanup complete.
root@rostanikhani:~/Desktop/mininet/mininet/custom$ sudo python3 topo2.py
*** Adding controller
*** Adding hosts
*** Adding router
*** Adding switch
*** Creating links
*** Starting network
*** Configuring hosts
h1 h2 h3 r1
*** Starting controller
c0
*** Starting 1 switches
s12 ...
*** Configuring hosts
*** Starting xterm on hosts
*** Running the command line interface
*** Starting CLI:
mininet> pingall
*** Ping: testing ping reachability
h1 -> h2 X r1
h2 -> h1 X r1
h3 -> X X r1
r1 -> h1 h2 h3
*** Results: 33% dropped (8/24 received)
mininet>

```

سوال8: همانطور که مشاهده می شود، 33 درصد از بسته ها drop شده اند.

سوال9: همانطور که مشاهده می شود، h1 و h2 نمی توانند با h3 ارتباط برقرار کنند.

سوال10: همانطور که مشاهده می شود subnet mask=255.255.255.0 است.

```

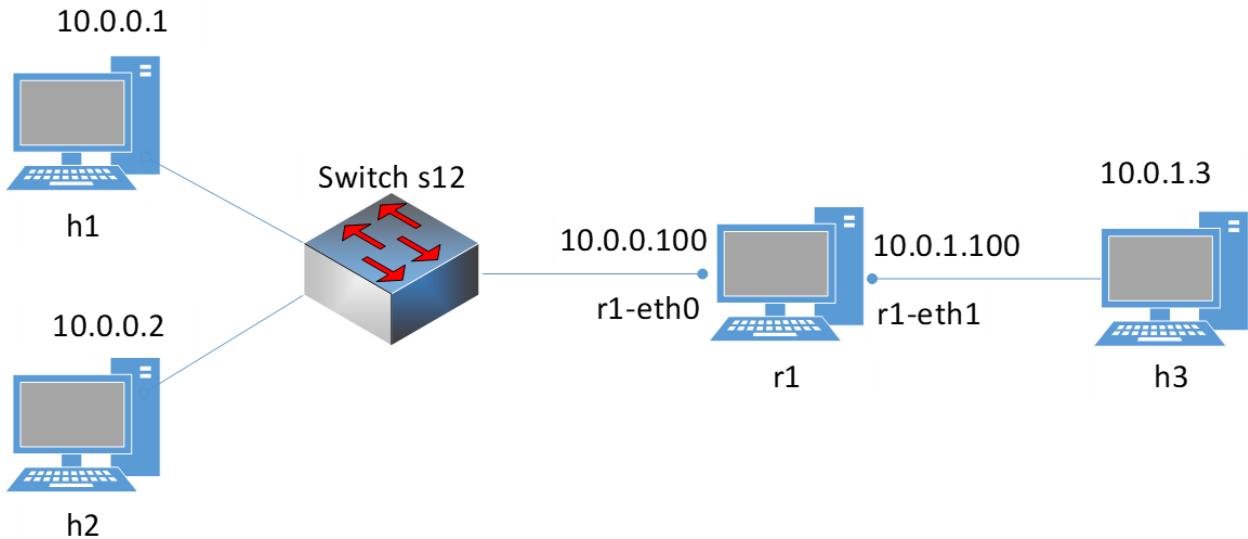
File Edit Selection Find View Goto Tools Project Preferences Help
topo1.py topo2.py
~/Desktop/mininet/mininet/custom/topo2.py - Sublime Text (UNREGISTERED)

4
5 "Importing Libraries"
6 from mininet.net import Mininet
7 from mininet.node import Controller
8 from mininet.cli import CLI
9 from mininet.log import setLogLevel, info
10
11 "Function definition: This is called from the main function"
12 def firstNetwork():
13
14     "Create an empty network and add nodes to it."
15     net = Mininet()
16
17     info( '*** Adding controller\n' )
18     net.addController( 'c0' )
19
20     info( '*** Adding hosts\n' )
21     h1 = net.addHost( 'h1', ip='10.0.0.1/24' )
22     h2 = net.addHost( 'h2', ip='10.0.0.2/24' )
23     h3 = net.addHost( 'h3', ip='10.0.0.3/24' )
24
25     info( '*** Adding router \n' )
26     r1 = net.addHost( 'r1', ip='10.0.0.100/24' )
27
28     info( '*** Adding switch \n' )
29     s12 = net.addSwitch( 's12' )
30
31     info( '*** Creating links\n' )
32     net.addLink( h1, s12 )
33     net.addLink( h2, s12 )

Line 1, Column 1
master (5) Tab Size: 4 Python

```

سوال11: دو اینترفیس ۲۱ دارای ip های 10.0.0.100 و 10.0.1.100 هستند.



سوال 12: اشتباهات موجود در پیکره بندی و راه های رفع آنها عبارتند از:

```

Activities Sublime Text
File Edit Selection Find View Goto Tools Project Preferences Help
~/Desktop/mininet/mininet/custom/topo2.py - Sublime Text (UNREGISTERED)
Mar 28 19:45 •
topo1.py topo2.py
22     h2 = net.addHost( 'h2', ip='10.0.0.2/24' )
23     h3 = net.addHost( 'h3', ip='10.0.1.3/24' )
24
25     info( '*** Adding router\n' )
26     r1 = net.addHost( 'r1', ip='10.0.0.100/24' )
27
28     info( '*** Adding switch\n' )
29     s12 = net.addSwitch( 's12' )
30
31     info( '*** Creating links\n' )
32     net.addLink( h1, s12 )
33     net.addLink( h2, s12 )
34     net.addLink( s12, r1, intfName2='r1-eth0' )
35     net.addLink( r1, h3, intfName1='r1-eth1' )
36
37     info( '*** Starting network\n' )
38     net.start()
39     "This is used to run commands on the hosts"
40
41     info( '*** Configuring hosts\n' )
42     r1.cmd('ifconfig r1-eth1 10.0.1.100 netmask 255.255.255.0')
43     r1.cmd('echo 1 > /proc/sys/net/ipv4/ip_forward')
44
45     h1.cmd('ip route add default via 10.0.0.100')
46     h2.cmd('ip route add default via 10.0.0.101')
47     h3.cmd('ip route add default via 10.0.1.100')
48
49     info( '*** Starting xterm on hosts\n' )
50     h1.cmd('xterm -xrm \'XTerm.vt100.allowTitleOps: false\' -T h1 &')
51     h2.cmd('xterm -xrm \'XTerm.vt100.allowTitleOps: false\' -T h2 &')
52     h3.cmd('xterm -xrm \'XTerm.vt100.allowTitleOps: false\' -T h3 &')

```

•# echo 1 > /proc/sys/net/ipv4/ip\_forward

Activities Sublime Text • Mar 28 19:49 •

~/Desktop/mininet/mininet/custom/topo2.py - Sublime Text (UNREGISTERED)

File Edit Selection Find View Goto Tools Project Preferences Help

topo1.py topo2.py

```
31     info( '*** Creating links\n' )
32     net.addLink( h1, s12 )
33     net.addLink( h2, s12 )
34     net.addLink( s12, r1, intfName2='r1-eth0' )
35     net.addLink( r1, h3, intfName1='r1-eth1' )
36
37     info( '*** Starting network\n' )
38     net.start()
39     "This is used to run commands on the hosts"
40
41     info( '*** Configuring hosts\n' )
42     r1.cmd('ifconfig r1-eth1 10.0.1.100 netmask 255.255.255.0')
43     r1.cmd('echo 1 > /proc/sys/net/ipv4/ip_forward')
44     h1.cmd('ip route add default via 10.0.0.100')
45     h2.cmd('ip route add default via 10.0.0.101')
46     h3.cmd('ip route add default via 10.0.1.100')
47
48     info( '*** Starting xterm on hosts\n' )
49     h1.cmd('xterm -xrm \'XTerm.vt100.allowTitleOps: false\' -T h1 &')
50     h2.cmd('xterm -xrm \'XTerm.vt100.allowTitleOps: false\' -T h2 &')
51     h3.cmd('xterm -xrm \'XTerm.vt100.allowTitleOps: false\' -T h3 &')
52     r1.cmd('xterm -xrm \'XTerm.vt100.allowTitleOps: false\' -T r1 &')
53
54     info( '*** Running the command line interface\n' )
55     CLI( net )
56
57     info( '*** Closing the terminals on the hosts\n' )
58     h1.cmd("killall xterm")
59     h2.cmd("killall xterm")
60     h3.cmd("killall xterm")
```

Line 41, Column 36

P master (5) Tab Size: 4 Python

Activities Terminal • Mar 28 19:50 •

rostankhani@rostankhani: ~/Desktop/mininet/mininet/custom

```
File ovs-vsctl --timeout=1 list-br
*** Removing all links of the pattern foo-ethX
ip link show | egrep -o '([_.[:alnum:]]+-eth[[:digit:]]+)'
31 ip link show
32 *** Killing stale mininet node processes
33 pkill -9 -f mininet:
34 *** Shutting down stale tunnels
35 pkill -9 -f Tunnel=Ethernet
36 pkill -9 -f .ssh/mn
36 rm -f ~/.ssh/mn/*
37 *** Cleanup complete.
38 rostankhani@rostankhani: ~/Desktop/mininet/mininet/custom$ sudo python3 topo2.py
39 *** Adding controller
40 *** Adding hosts
41 *** Adding router
42 *** Adding switch
43 *** Creating links
44 *** Starting network
45 *** Configuring hosts
46 h1 h2 h3 r1
46 *** Starting controller
47 c0
48 *** Starting i switches
49 s12 ...
50 *** Configuring hosts
51 *** Starting xterm on hosts
52 *** Running the command line interface
53 *** Starting CLI:
53 mininet> pingall
54 *** Ping: testing ping reachability
55 h1 -> h2 h3 r1
56 h2 -> h1 X r1
57 h3 -> h1 X r1
58 r1 -> h1 h2 h3
59 *** Results: 16% dropped (10/62 received)
60 mininet>
```

Line 41, Column 30

P master (5) Tab Size: 4 Python

همانطور که مشاهده می شود تعداد کمتری از بسته ها drop شدند. (16 درصد)

Activities XTerm Mar 28 19:56 • h1

```
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# ping 10.0.1.3 -c 1
PING 10.0.1.3 (10.0.1.3) 56(84) bytes of data.
64 bytes from 10.0.1.3: icmp_seq=1 ttl=63 time=28.5 ms

--- 10.0.1.3 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 28.458/28.458/28.458/0.000 ms
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom#
```

Activities Wireshark Mar 28 19:57 •

Capturing from r1-eth0 and r1-eth1

No.	Time	Source	Destination	Protocol	Length	Info
1	Mar 28 19:56:59.000	b8:35:b2:d6:12:a5	b8:35:b2:d6:12:a5	ARP	42	0.0.1.3 is at 0e:a4:c7:3c:46:fd
2	Mar 28 19:56:59.032	0e:a4:c7:3c:46:fd	10.0.1.3	ICMP	88	Echo (ping) request id=0x3452, seq=1/256, ttl=63 (reply in 4)
3	Mar 28 19:56:59.189	10.0.0.1	10.0.1.3	ICMP	88	Echo (ping) reply id=0x3452, seq=1/256, ttl=64 (request in 1)
4	Mar 28 19:56:59.287	10.0.0.1	10.0.0.1	ICMP	88	Echo (ping) reply id=0x3452, seq=1/256, ttl=64 (request in 1)
5	Mar 28 19:56:59.320	b8:35:b2:d6:12:a5	Broadcast	ARP	42	Who has 10.0.0.1? Tell 10.0.0.1
6	Mar 28 19:56:59.347	0e:a4:c7:3c:46:fd	10.0.0.1	ARP	42	Who has 10.0.0.1? Tell 10.0.0.1
7	Mar 28 19:56:59.349	10.0.0.1	10.0.0.1	ICMP	88	Echo (ping) request id=0x3452, seq=1/256, ttl=64 (reply in 8)
8	Mar 28 19:56:59.351	10.0.0.1	10.0.0.1	ICMP	88	Echo (ping) reply id=0x3452, seq=1/256, ttl=63 (request in 1)
9	Mar 28 19:56:59.352	10.0.0.1	10.0.0.1	ICMP	88	Echo (ping) request id=0x3452, seq=1/256, ttl=64 (reply in 8)
10	Mar 28 19:56:59.353	10.0.0.1	10.0.0.1	ICMP	88	Echo (ping) reply id=0x3452, seq=1/256, ttl=64 (request in 1)
11	Mar 28 19:56:59.354	10.0.0.1	10.0.0.1	ICMP	88	Echo (ping) request id=0x3452, seq=1/256, ttl=64 (reply in 8)
12	Mar 28 19:56:59.355	10.0.0.1	10.0.0.1	ICMP	88	Echo (ping) reply id=0x3452, seq=1/256, ttl=64 (request in 1)

Frame 1: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) on interface r1-eth1, id 1  
 Ethernet II Src: Rostamkhani (b8:35:b2:d6:12:a5) Dst: Broadcast (ff:ff:ff:ff:ff:ff)  
 Address Resolution Protocol (request)

0000: ff ff ff ff ff ff a2 35 b2 d9 12 a5 08 06 00 01 ..... 5 .....  
 r1-eth0 and r1-eth1: <live capture in progress>

Packets: 12 · Displayed: 12 (100.0%) Profile: Default

مشکل دیگر و راه رفع آن:

Activities XTerm Mar 28 20:06 • h1

```
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# ping 10.0.1.3 -c 1
PING 10.0.1.3 (10.0.1.3) 56(84) bytes of data.
64 bytes from 10.0.1.3: icmp_seq=1 ttl=63 time=28.5 ms

--- 10.0.1.3 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 28.458/28.458/28.458/0.000 ms
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# ip route
default via 10.0.0.100 dev h1-eth0
10.0.0.0/24 dev h1-eth0 proto kernel scope link src 10.0.0.1
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom#
```

Activities XTerm Mar 28 20:06 • h2

```
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# ip route
default via 10.0.0.101 dev h2-eth0
10.0.0.0/24 dev h2-eth0 proto kernel scope link src 10.0.0.2
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom#
```

Activities XTerm Mar 28 20:06 • h3

```
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# ip route
default via 10.0.1.100 dev h3-eth0
10.0.1.0/24 dev h3-eth0 proto kernel scope link src 10.0.1.3
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom#
```

Activities XTerm Mar 28 20:13 • h2

```
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# ip route
default via 10.0.0.101 dev h2-eth0
10.0.0.0/24 dev h2-eth0 proto kernel scope link src 10.0.0.2
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# ip route del default via 10.0.0.101
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# ip route add default via 10.0.0.100
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom#
```

```

root@rostamkhani:~/Desktop/mininet/mininet/custom Mar 28 20:14
root@rostamkhani:~/Desktop/mininet/mininet/custom ovs-vsctl --timeout=1 list-br
default*** Removing all links of the pattern foo-ethX
10.0.ip link show | egrep -o '([-.[:alnum:]]+-eth[[:digit:]]+)'
root@rostamkhani:~/Desktop/mininet/mininet/custom ip link show
root@rostamkhani:~/Desktop/mininet/mininet/custom pkill -9 -f mininet:
    *** Shutting down stale tunnels
    pkill -9 -f Tunnel=ethernet
    pkill -9 -f .ssh/mn
    rm -f ~/.ssh/mn/*
    *** Cleanup complete.
root@rostamkhani:~/Desktop/mininet/mininet/custom$ sudo python3 topo2.py
    *** Adding controller
    *** Adding hosts
    *** Adding router
    *** Adding switch
    *** Creating links
    *** Starting network
    *** Configuring hosts
h1 h2 h3 r1
    *** Starting controller
c0
    *** Starting 1 switches
s12 ...
    *** Configuring hosts
    *** Starting xterm on hosts
    *** Running the command line interface
    *** Starting CLI:
mininet> pingall
    *** Ping: testing ping reachability
h1 -> h2 h3 r1
h2 -> h1 h3 r1
h3 -> h1 h2 r1
r1 -> h1 h2 h3
    *** Results: 0% dropped (12/12 received)
mininet>

```

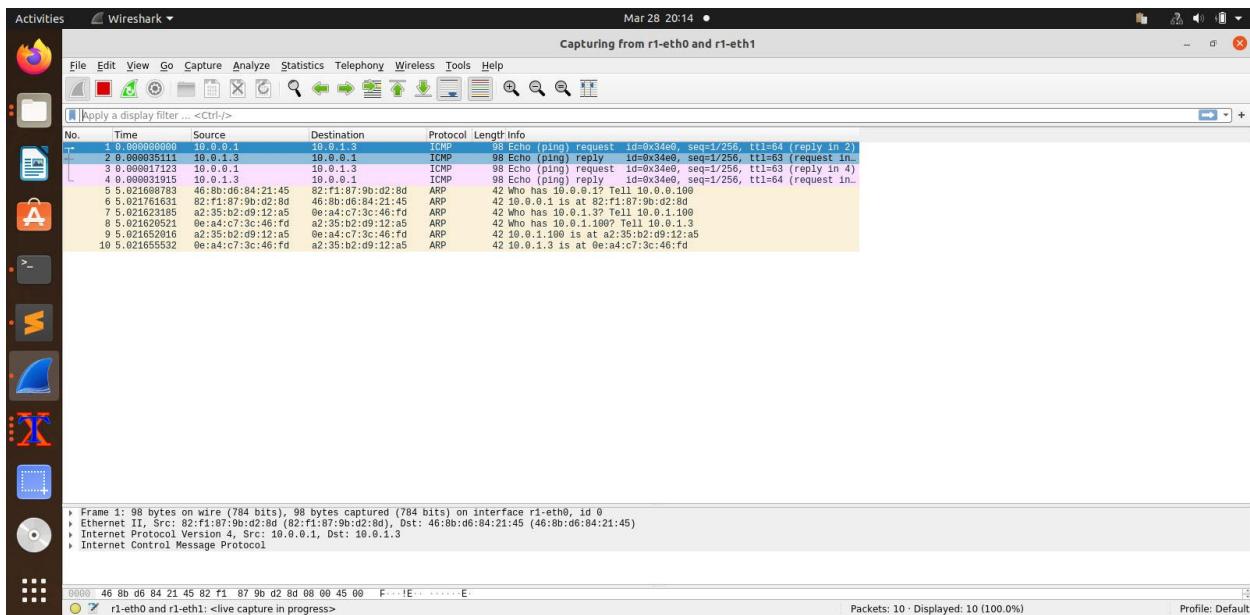
حال مشاهده می کنیم که بسته ای drop نشد.(0 درصد)

سوال 13: در دو مرحله پیکره بندی را اصلاح کردیم:

مرحله اول: 16 درصد

مرحله دوم: 0 درصد

سوال 14: destination mac address و source mac address را تغییر میدهند.



سوال 15: هدف از این تغییر، مسیر یابی و arp request بعدی و نیز مخفی کردن subnet از دنیای بیرون از subnet است.

Changing the assigned MAC address may allow the user to bypass access control lists on servers or routers, either hiding a computer on a network or allowing it to impersonate another network device.

(۵)

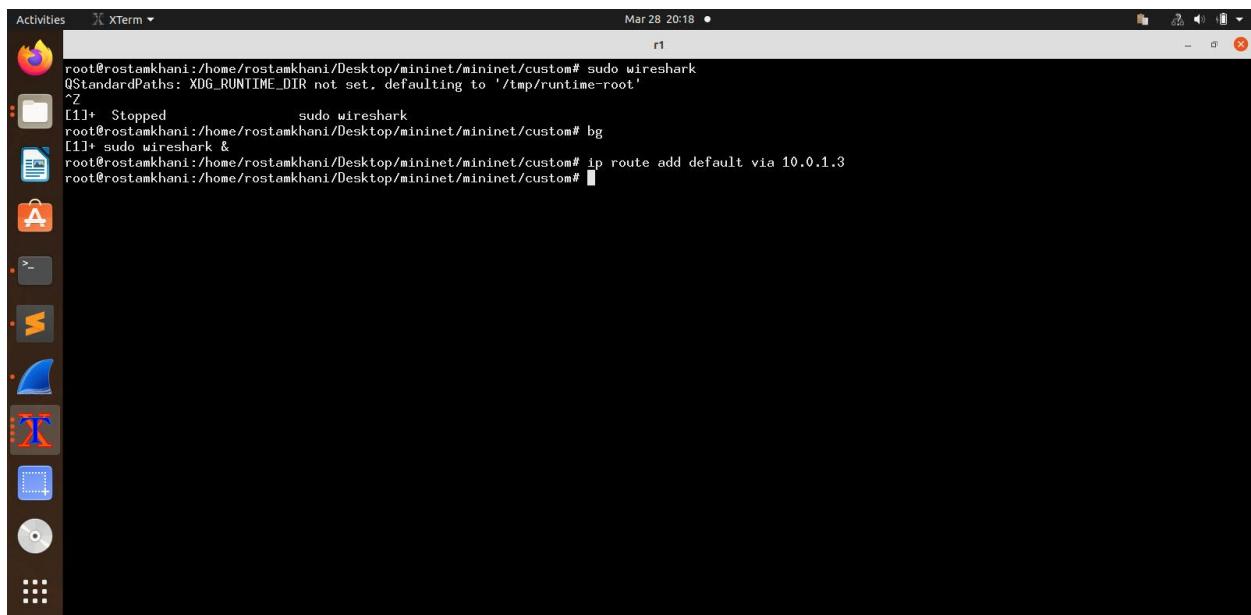
سوال 16:

•For h3:

```
# echo 1 > /proc/sys/net/ipv4/ip_forward  
# ip route del default via 10.0.1.100
```

•For r1:

```
# ip route add default via 10.0.1.3
```



```
Activities XTerm Mar 28 20:18 r1  
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# sudo wireshark  
QStandardPaths: XDG_RUNTIME_DIR not set, defaulting to '/tmp/runtime-root'  
^Z  
[1]+ Stopped sudo wireshark  
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# bg  
[1]+ sudo wireshark &  
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# ip route add default via 10.0.1.3  
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom#
```

سوال 17: وقتی که h1 برای h3 یک request بفرستد برای بازگشت reply باید default gateway داشته باشیم که در مرحله قبل آن را پاک کردیم. پس باید برای h3 یک default gateway تعریف کنیم.

Activities XTerm Mar 28 20:34 • h1

```
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# ping 10.0.1.3 -c 1
PING 10.0.1.3 (10.0.1.3) 56(84) bytes of data.
--- 10.0.1.3 ping statistics ---
1 packets transmitted, 0 received, 100% packet loss, time 0ms
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom#
```

Activities Wireshark Mar 28 20:34 • Capturing from h3-eth0

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Apply a display filter... <Ctrl-J>

No.	Time	Source	Destination	Protocol	Length	Info
1	Mar 28 20:34:00.000000000	a2:35:b2:d9:12:a5	0e:a4:c7:3c:46:fd	Ethernet II	64	ARP Who has 10.0.1.3? Tell 10.0.1.108
2	Mar 28 20:34:00.000066000	a2:35:b2:d9:12:a5	0e:a4:c7:3c:46:fd	ARP	42	10.0.1.3 is at 0e:a4:c7:3c:46:fd
3	Mar 28 20:34:00.000092000	0e:a4:c7:3c:46:fd	a2:35:b2:d9:12:a5	ARP	42	10.0.1.3 is at 0e:a4:c7:3c:46:fd

Frame 1: 88 bytes on wire (704 bits), 88 bytes captured (704 bits) on interface h3-eth0, id 0  
Ethernet II, Src: a2:35:b2:d9:12:a5 (a2:35:b2:d9:12:a5), Dst: 0e:a4:c7:3c:46:fd (0e:a4:c7:3c:46:fd)  
Internet Protocol Version 4, Src: 10.0.0.1, Dst: 10.0.1.3  
Internet Control Message Protocol

0000 0e a4 c7 3c 46 fd a2 35 b2 d9 12 a5 00 00 45 00 ...F 5 .....E:  
h3-eth0: <live capture in progress>

Packets: 3 • Displayed: 3 (100.0%) Profile: Default

Activities Wireshark • Mar 28 20:35 •

Capturing from r1-eth0

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Apply a display filter ... <Ctrl-/>

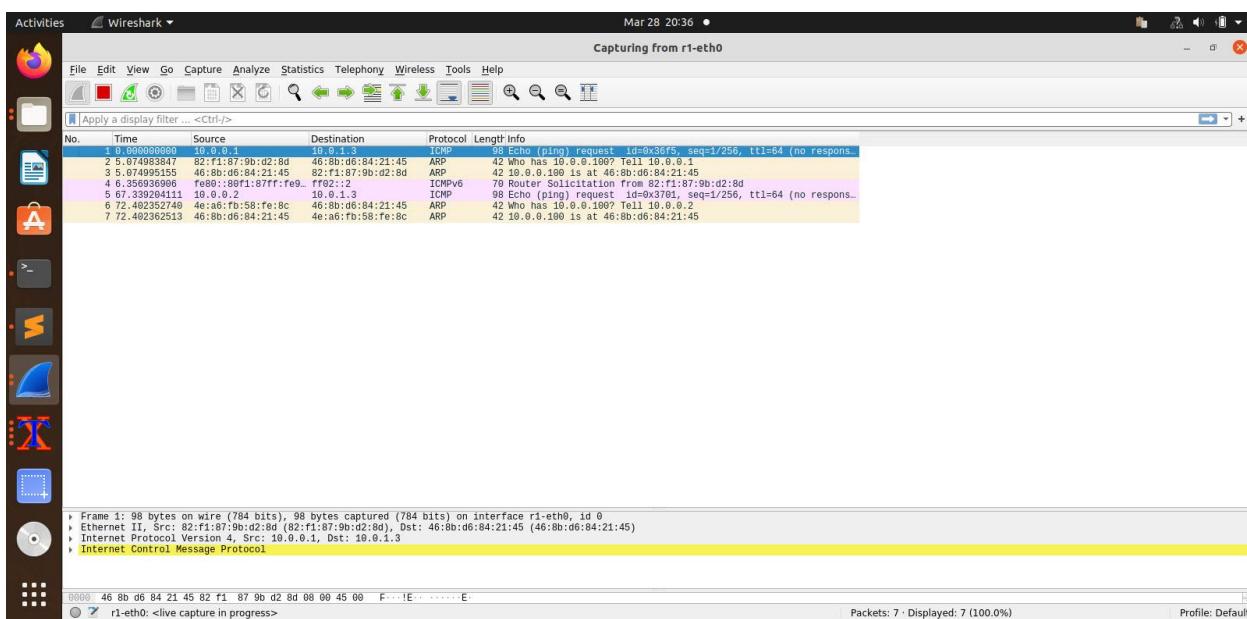
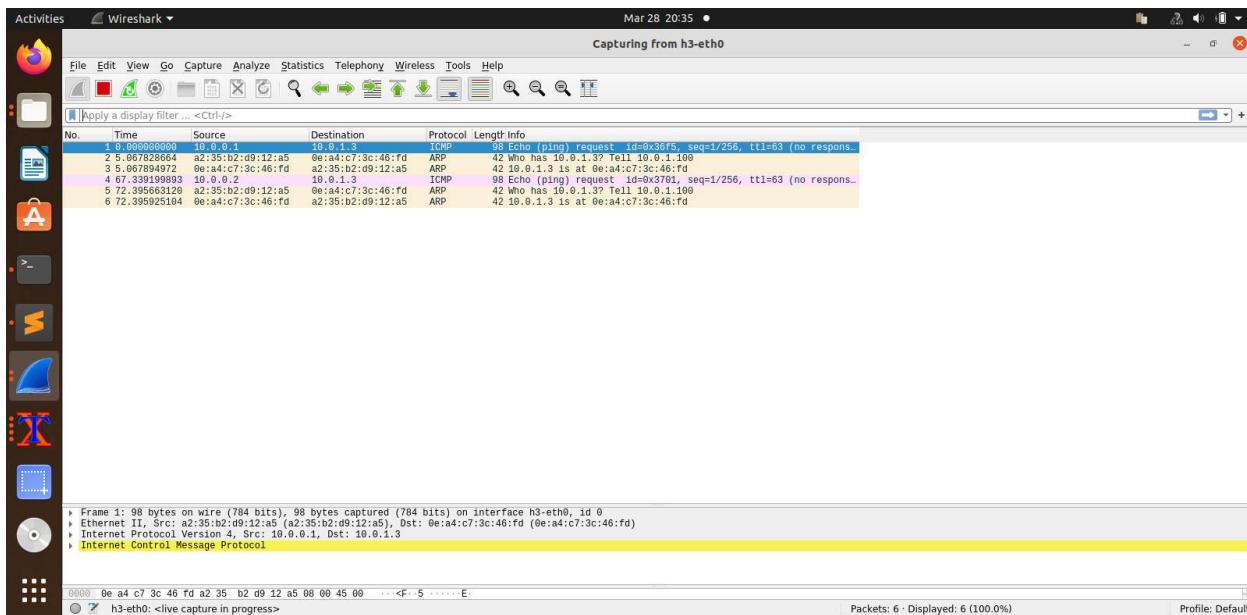
No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	10.0.0.1	10.0.0.199	ICMP	64	Echo (ping) request id=0x36f5 seq=1/256, ttl=64 (no response)
2	0.074995155	46:8b:d6:84:21:45	46:8b:d6:84:21:45	ARP	42	46:8b:d6:84:21:45 is at 46:8b:d6:84:21:45
3	0.074995155	46:8b:d6:84:21:45	82:f1:87:9b:d2:8d	ARP	42	10.0.0.199 is at 46:8b:d6:84:21:45
4	0.356936986	fe80::80f1:87ff:fe92:2	fe80::80f1:87ff:fe92:2	ICMPv6	76	Router Solicitation from 82:f1:87:9b:d2:8d

r1-eth0: <live capture in progress> Packets: 4 · Displayed: 4 (100.0%) Profile: Default

Activities XTerm • Mar 28 20:35 •

h2

```
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# ping 10.0.1.3 -c 1
PING 10.0.1.3 (10.0.1.3) 56(84) bytes of data.
--- 10.0.1.3 ping statistics ---
1 packets transmitted, 0 received, 100% packet loss. time 0ms
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom#
```



سؤال: 18

```
# ip route add 10.0.0.0/24 via 10.0.1.100
```

Activities XTerm Mar 28 20:37 • h3

```
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# echo 1 > /proc/sys/net/ipv4/ip_forward
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# ip route del default via 10.0.1.100
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# sudo wireshark
QStandardPaths: XDG_RUNTIME_DIR not set, defaulting to '/tmp/runtime-root'
^Z
[1]+  Stopped                  sudo wireshark
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# bg
[1]+ sudo wireshark &
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# sudo wireshark
QStandardPaths: XDG_RUNTIME_DIR not set, defaulting to '/tmp/runtime-root'
^C
[2]+  Stopped                  sudo wireshark
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# bg
[2]+ sudo wireshark &
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# ^C
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# sudo wireshark
QStandardPaths: XDG_RUNTIME_DIR not set, defaulting to '/tmp/runtime-root'
^Z
[3]+  Stopped                  sudo wireshark
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# bg
[3]+ sudo wireshark &
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# ^C
[2]- Done                      sudo wireshark
[3]+ Done                      sudo wireshark
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# sudo wireshark
QStandardPaths: XDG_RUNTIME_DIR not set, defaulting to '/tmp/runtime-root'
^Z
[1]+  Stopped                  sudo wireshark
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# bg
[1]+ sudo wireshark &
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# ip route
10.0.1.0/24 dev h3-eth0 proto kernel scope link src 10.0.1.3
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# ip route add 10.0.0.0/24 via 10.0.1.100
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom#
```

Activities XTerm Mar 28 20:38 • h1

```
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom# ping 10.0.1.3 -c 1
PING 10.0.1.3 (10.0.1.3) 56(84) bytes of data.
64 bytes from 10.0.1.3: icmp_seq=1 ttl=63 time=19.9 ms

--- 10.0.1.3 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 19.934/19.934/19.934/0.000 ms
root@rostamkhani:/home/rostamkhani/Desktop/mininet/mininet/custom#
```

