الف)

توپولوژی در فایل پایتون ضمیمه شده بیاده سازی شده است.

ب)

```
root@mininet-vm;/home/mininet/lab03# ip link

1: lo: <L00PBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN mode DEFAULT
group default qlen 1000
    link/loopback 00:00:00:00:00 brd 00:00:00:00:00
2: h4-eth0@if20; <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue state
UP mode DEFAULT group default qlen 1000
    link/ether 82:bb;33:68:c6:69 brd ff;ff;ff;ff;ff;ff link-netnsid 0
3: h4-eth1@if20; <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue state
UP mode DEFAULT group default qlen 1000
    link/ether d2:f2:65:d0:42:c2 brd ff;ff;ff;ff;ff link-netnsid 0
4: h4-eth2@if24: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue state
UP mode DEFAULT group default qlen 1000
    link/ether f6:5e:01:d0:c4:04 brd ff;ff;ff;ff;ff link-netnsid 0
root@mininet-vm;/home/mininet/lab03#
```

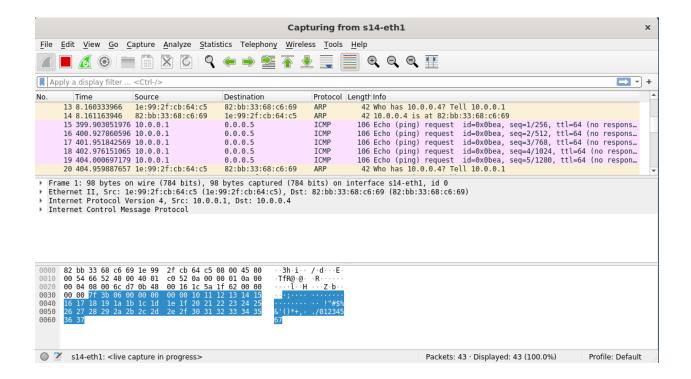
```
UP mode DEFAULT group default qlen 1000
link/ether f6:5e:01:d0:c4:04 brd ff:ff:ff:ff:ff:ff link-netnsid 0
root@mininet-wm;/home/mininet/lab03# ifconfig
h4-eth0: flags=4163KUP,BROADCAST,RUNNING,MULTICAST> mtu 1500
inet 10.0.0.4 netmask 255.0.0.0 broadcast 10.255.255,255
ether 82:bb:33:68:c6:69 txqueuelen 1000 (Ethernet)
RX packets 101 bytes 9394 (9.3 KB)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 101 bytes 9394 (9.3 KB)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

h4-eth1: flags=4163KUP,BROADCAST,RUNNING,MULTICAST> mtu 1500
ether d2:f2:65:d0:42:c2 txqueuelen 1000 (Ethernet)
RX packets 0 bytes 0 (0.0 B)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 0 bytes 0 (0.0 B)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

h4-eth2: flags=4163KUP,BROADCAST,RUNNING,MULTICAST> mtu 1500
ether f6:5e:01:d0:c4:04 txqueuelen 1000 (Ethernet)
RX packets 1 bytes 42 (42.0 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 frame 0
TX packets 0 bytes 0 (0.0 B)
TX errors 0 dropped 0 overruns 0 frame 0
TX packets 0 bytes 0 (0.0 B)
TX 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
```

```
h1 x

root@mininet-vm:/home/mininet/lab03# ping 10.0.0.4 -c5
PINS 10.0.0.4 (10.0.0.4) 56(84) bytes of data.
64 bytes from 10.0.0.4: icmp_seq=1 ttl=64 time=0.063 ms
64 bytes from 10.0.0.4: icmp_seq=2 ttl=64 time=0.044 ms
64 bytes from 10.0.0.4: icmp_seq=2 ttl=64 time=0.043 ms
64 bytes from 10.0.0.4: icmp_seq=4 ttl=64 time=0.042 ms
64 bytes from 10.0.0.4: icmp_seq=5 ttl=64 time=0.058 ms
--- 10.0.0.4 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4080ms
rtt min/avg/max/mdev = 0.042/0.050/0.063/0.008 ms
root@mininet-vm:/home/mininet/lab03#
```



سوال اول: همانطور که در اسکرین شات بالا مشهود است جدول ARP هاست h1 شامل آدرس MAC هاست h4 نیست و قبل از درخواست ping با درخواست ARP به پیدا کردن آدرس MAC مدنظر میپردازد. هاست h4 در جواب arp اعلام میکند که pi مد نظر را دارد . سپس درخواست پینگ صورت میگیرد

جدول arp برای هاست h1 قبل از پینگ به صورت زیر است

```
h1 x

root@mininet-vm:/home/mininet/lab03# arp -a

root@mininet-vm:/home/mininet/lab03#
```

بعد از انجام پینگ مقادیر لازم در جدول قرار میگیرند.

```
root@mininet-vm:/home/mininet/lab03# arp -a
root@mininet-vm:/home/mininet/lab03# ping 10,0.0.4 -c5
PING 10,0.0.4 (10,0.0.4) 56(84) bytes of data.
64 bytes from 10,0.0.4: icmp_seq=1 ttl=64 time=5.57 ms
64 bytes from 10,0.0.4: icmp_seq=2 ttl=64 time=0.374 ms
64 bytes from 10,0.0.4: icmp_seq=3 ttl=64 time=0.047 ms
64 bytes from 10,0.0.4: icmp_seq=4 ttl=64 time=0.060 ms
64 bytes from 10,0.0.4: icmp_seq=5 ttl=64 time=0.041 ms
--- 10,0.0.4 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4059ms
rtt min/avg/max/mdev = 0,041/1,218/5,571/2,179 ms
root@mininet-vm:/home/mininet/lab03# arp -a
? (10,0.0.4) at b6:3e:9aic4:cf:fa [ether] on h1-eth0
root@mininet-vm:/home/mininet/lab03#
```

h1

×

root@mininet-vm:/home/mininet/lab03# ip addr del 10.0.0.1 dev h1-eth0 Warning: Executing wildcard deletion to stay compatible with old scripts. Explicitly specify the prefix length (10.0.0.1/32) to avoid this warnin 9.

This special behaviour is likely to disappear in further releases,

root@mininet-vm:/home/mininet/lab03# ip addr add 10.10.14.1/24 dev h1-eth0 Command "10.10.14.1/24" is unknown, try "ip address help".
root@mininet-vm:/home/mininet/lab03# ip addr add 10.10.14.1/24 dev h1-eth0 root@mininet-vm:/home/mininet/lab03#

h2

×

root@mininet-vm:/home/mininet/lab03# ip addr del 10.0.0.2 dev h2-eth0 Warning: Executing wildcard deletion to stay compatible with old scripts. Explicitly specify the prefix length (10.0.0.2/32) to avoid this warnin

9. This special behaviour is likely to disappear in further releases,

fix your scripts!
root@mininet-vm:/home/mininet/lab03# ip addr add 10.10.24.2/24 dev h2-eth0
root@mininet-vm:/home/mininet/lab03#

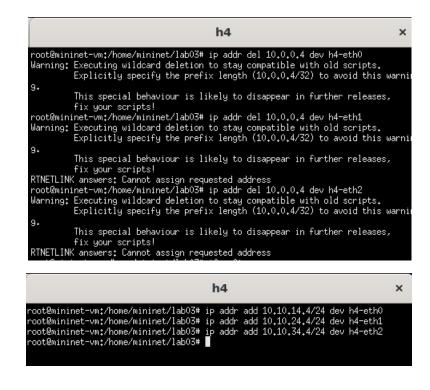
h3

×

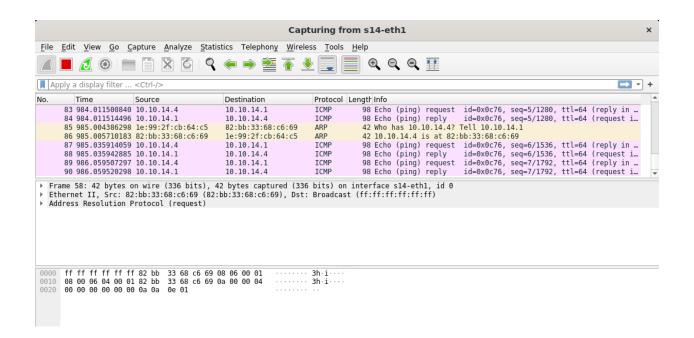
root@mininet-vm:/home/mininet/lab03# ip addr del 10.0.0.3 dev h3-eth0 Warning: Executing wildcard deletion to stay compatible with old scripts. Explicitly specify the prefix length (10.0.0.3/32) to avoid this warnin

9. This special behaviour is likely to disappear in further releases,

rost@mininet-vm;/home/mininet/lab03# root@mininet-vm;/home/mininet/lab03# root@mininet-vm;/home/mininet/lab03# | |



سوال دوم: همانطور که در wireshark مشاهده میشود بسته های arp رد بدل شده است



سوال سوم: خير ممكن نيست چرا gateway تعريف نشده است

```
root@mininet-vm:/home/mininet/lab03# ping 10.10.24.4
ping: connect: Network is unreachable
root@mininet-vm:/home/mininet/lab03# ping 10.10.34.4
ping: connect: Network is unreachable
root@mininet-vm:/home/mininet/lab03#
```

```
h1 ×

root@mininet-vm:/home/mininet/lab03# ip route
10.10.14.0/24 dev h1-eth0 proto kernel scope link src 10.10.14.1
root@mininet-vm:/home/mininet/lab03#
```

سوال چهارم: فقط همان شبکه lan که در آن قرار داریم دیده میشود.

```
root@mininet-vm:/home/mininet/lab03# ip route
10.10.14.0/24 dev h1-eth0 proto kernel scope link src 10.10.14.1
root@mininet-vm:/home/mininet/lab03# ip route add default via 10.10.14.4
root@mininet-vm:/home/mininet/lab03# ip route
default via 10.10.14.4 dev h1-eth0
10.10.14.0/24 dev h1-eth0 proto kernel scope link src 10.10.14.1
root@mininet-vm:/home/mininet/lab03#
```

سوال بنجم:

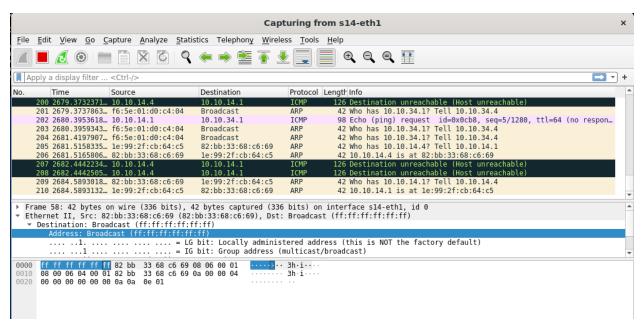
بله ping انجام میشود در تصویر زیر دیده میشود

```
h1 x

root@mininet-vm:/home/mininet/lab03# ping 10.10.34.4

PING 10.10.34.4 (10.10.34.4) 56(84) bytes of data.
64 bytes from 10.10.34.4: icmp_seq=1 ttl=64 time=1.08 ms
64 bytes from 10.10.34.4: icmp_seq=2 ttl=64 time=0.781 ms
64 bytes from 10.10.34.4: icmp_seq=3 ttl=64 time=0.166 ms
^C
--- 10.10.34.4 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2013ms
rtt min/avg/max/mdev = 0.166/0.675/1.080/0.380 ms
root@mininet-vm:/home/mininet/lab03#
```

امکان پینگ زدن به h3 همچنان ممکن نیست



```
h4 ×

root@mininet-vm:/home/mininet/lab03# echo 1 > /proc/sys/net/ipv4/ip_forward root@mininet-vm:/home/mininet/lab03#
```

همچنان نمیتوان در خواست بینگ به h3 داد.

(هاست h3 مشكلي داشت نتونستم حلش كنم ولي h2 مشكلي نداشت از اينجا به بعد با h2 رفتم)

سوال ششم:

برای حل این مشکل در h2 نیز gateway را مشخص میکنیم

حال میتوان از روی h1 به h2 پینگ زد

```
hl x

root@mininet-vm:/home/mininet/lab03# ping 10.10.24.2 -c5

PING 10.10.24.2 (10.10.24.2) 56(84) bytes of data.
64 bytes from 10.10.24.2: icmp_seq=1 ttl=63 time=3.56 ms
64 bytes from 10.10.24.2: icmp_seq=2 ttl=63 time=0.972 ms
64 bytes from 10.10.24.2: icmp_seq=3 ttl=63 time=0.389 ms
64 bytes from 10.10.24.2: icmp_seq=4 ttl=63 time=0.047 ms
64 bytes from 10.10.24.2: icmp_seq=5 ttl=63 time=0.070 ms
--- 10.10.24.2 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4058ms
rtt min/avg/max/mdev = 0.047/1.006/3.555/1.317 ms
root@mininet-vm:/home/mininet/lab03#
```

سوال هفتم:

به دلیل همان مشکل بالا کلا امکان پینگ گرفتن به و از h3 ممکن نبود ولی پینگ بین h2 و h1 ممکن بود که در بالا آمده است. همان طور که مشاهده میکنیم اولین دستور پر میشوند.