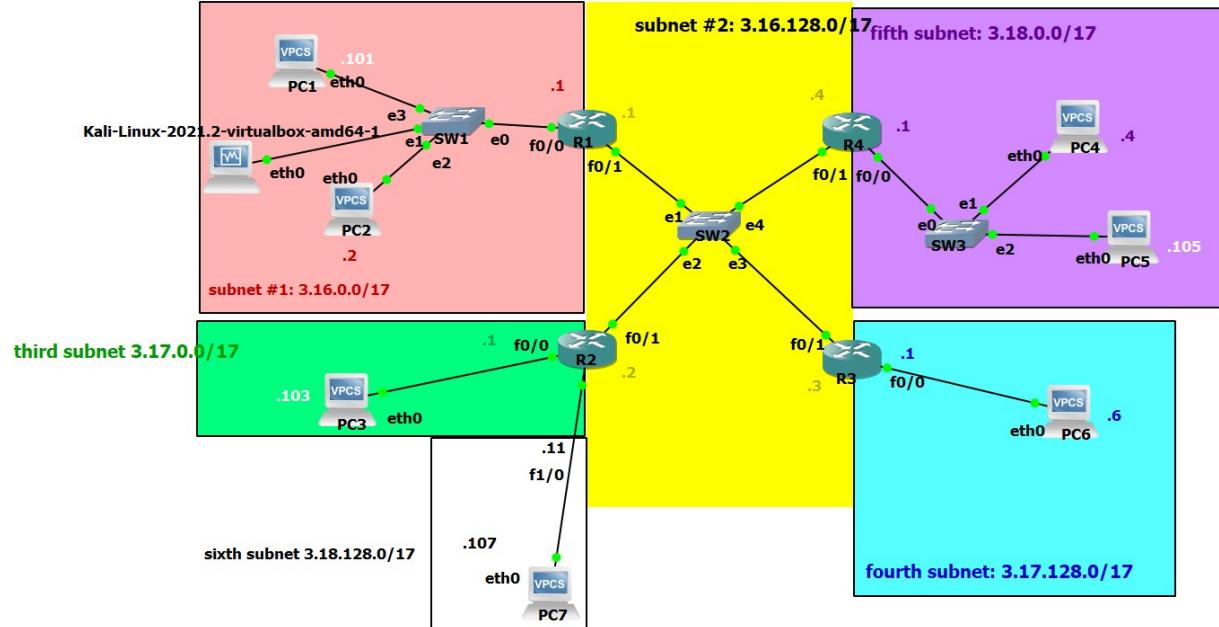


OSPF and RIP dynamic protocols

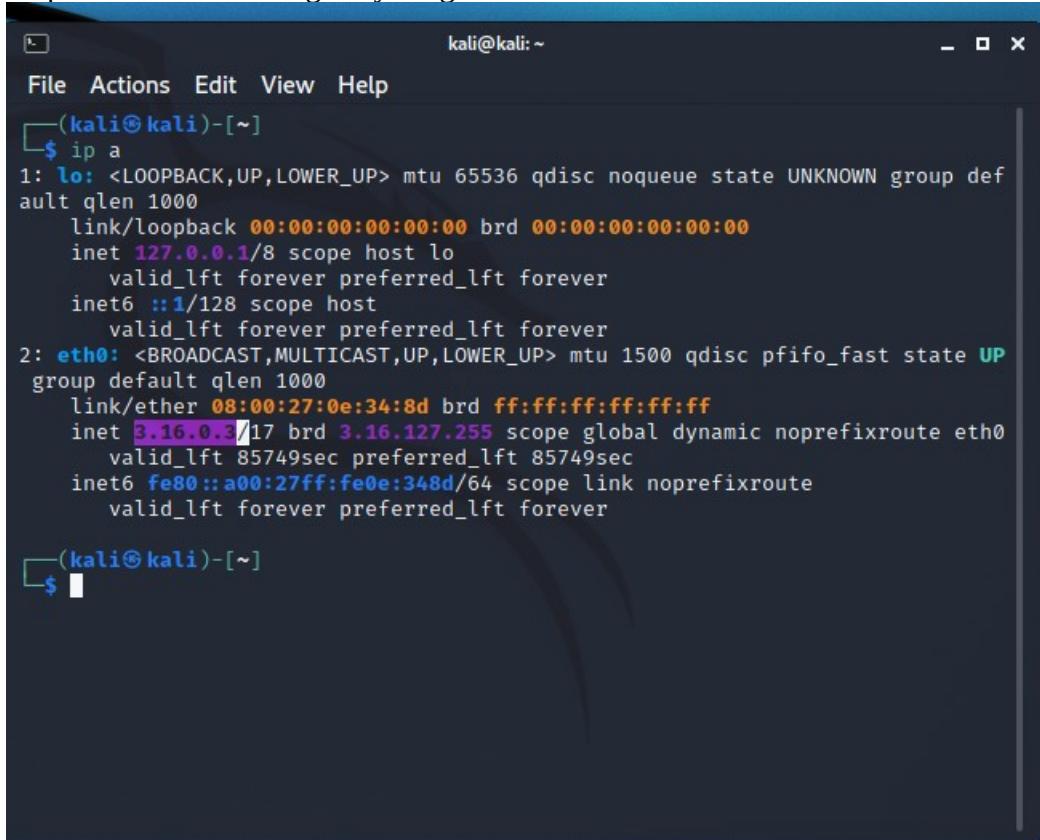
Network Layer Security Guide

may 05 2022



Kali

check for the ip if we need to change anything

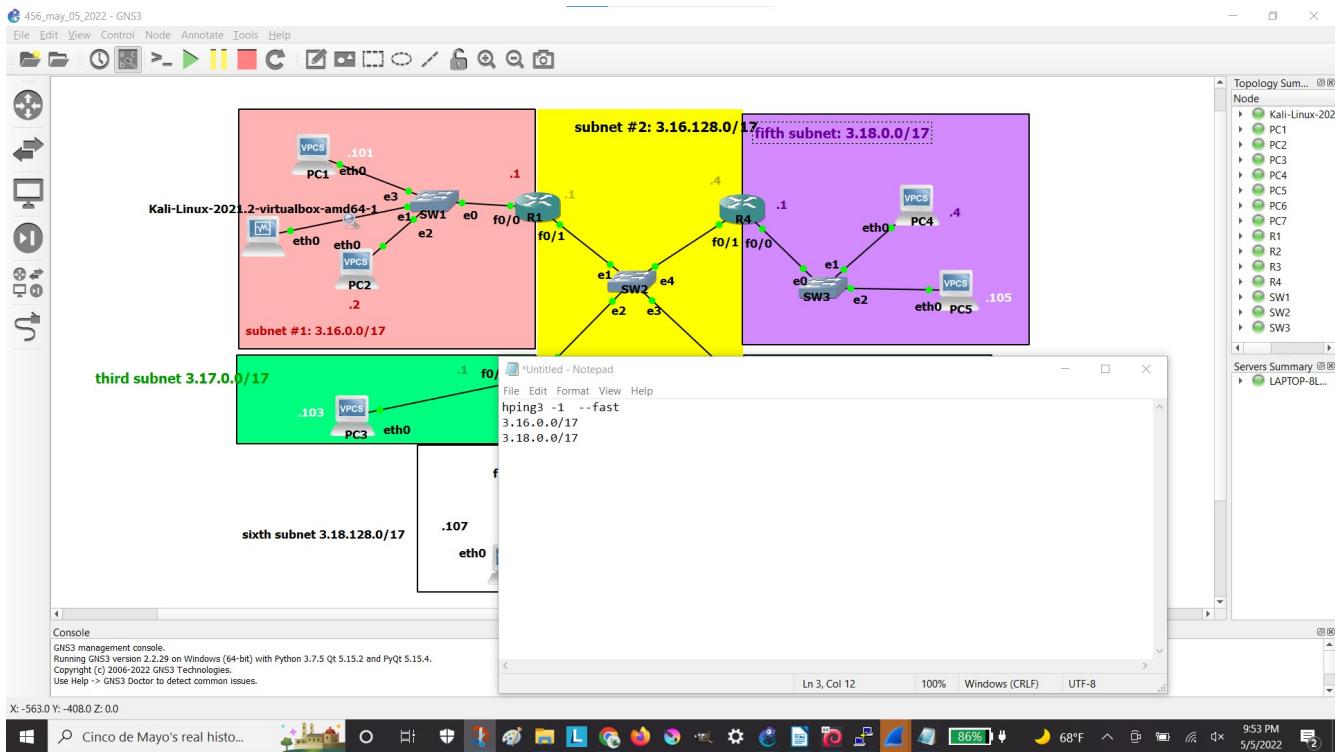


A terminal window titled "kali@kali: ~" showing the output of the "ip a" command. The window has a dark background with light-colored text. The "File" menu is visible at the top. The terminal shows two network interfaces: "lo" (loopback) and "eth0". The "lo" interface has an IP of 127.0.0.1/8. The "eth0" interface has an IP of 3.16.0.3/17 and a link layer address of 08:00:27:0e:34:8d.

```
kali@kali: ~
File Actions Edit View Help
[(kali㉿kali)-[~]
$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    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
    inet6 ::1/128 scope host
        valid_lft forever preferred_lft forever
2: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default qlen 1000
    link/ether 08:00:27:0e:34:8d brd ff:ff:ff:ff:ff:ff
    inet 3.16.0.3/17 brd 3.16.127.255 scope global dynamic noprefixroute eth0
        valid_lft 85749sec preferred_lft 85749sec
    inet6 fe80::a00:27ff:fe0e:348d/64 scope link noprefixroute
        valid_lft forever preferred_lft forever
[(kali㉿kali)-[~]
$ ]
```

next

Figure out who to ping



PC2 - PuTTY

```
VPCS is free software, distributed under the terms of the "BSD" licence.
Source code and license can be found at vpcs.sf.net.
For more information, please visit wiki.freecode.com.cn.

Press '?' to get help.
3.16.0.2/17

Executing the startup file

Checking for duplicate address...
PC1 : 3.16.0.2 255.255.128.0 gateway 3.16.0.1

PC2> sh ip

NAME      : PC2[1]
IP/MASK   : 3.16.0.2/17
GATEWAY   : 3.16.0.1
DNS       :
MAC       : 00:50:79:66:68:01
LPORT     : 20030
RHOST:PORT: 127.0.0.1:20031
MTU:      : 1500

PC2> P C Z
```

PC4 - PuTTY

```
VPCS is free software, distributed under the terms of the "BSD" licence.  
Source code and license can be found at vpcs.sf.net.  
For more information, please visit wiki.freecode.com.cn.  
  
Press '?' to get help.  
Executing the startup file 3.18.0.4/17  
  
Checking for duplicate address...  
PC1 : 3.18.0.4 255.255.128.0 gateway 3.18.0.1  
  
PC4> sh ip  
  
NAME : PC4[1]  
IP/MASK : 3.18.0.4/17  
GATEWAY : 3.18.0.1  
DNS :  
MAC : 00:50:79:66:68:03  
LPORT : 20034  
RHOST:PORT : 127.0.0.1:20035  
MTU: : 1500  
  
PC4> PC4
```

next
the commands:

The Network Layer: Denial-of-Service Attacks (DoS):
Network Layer Security.pdf Open with Google Docs @

- Ping utility sends ICMP echo request to a host, which in turn replies with an ICMP echo response.
- **Ping flood attack:** overwhelm the system with numerous pings.

Examples: Use Kali VM as the attacker's machine

```
(Kali) # hping3 -1 <target IP> --fast  
(Kali) # hping3 -1 <target IP> --faster  
(Kali) # hping3 -1 <target IP> --flood  
-1: Use ICMP  
--fast: Send 10 packets per second  
--faster: Send ~100 packets per second  
--flood: Send packets as quickly as possible
```

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```
hping3 -1 --fast
sudo hping3 -1 3.16.0.2 --fast
sudo hping3 -1 3.18.0.4 --fast
3.16.0.2/17
3.18.0.4/17
```

next

do the pinging

```
(kali㉿kali)-[~]
└─$ sudo hping3 -1 3.16.0.2 --fast
[sudo] password for kali:
HPING 3.16.0.2 (eth0 3.16.0.2): icmp mode set, 28 headers + 0 data bytes
len=46 ip=3.16.0.2 ttl=64 id=3112 icmp_seq=0 rtt=7.6 ms
len=46 ip=3.16.0.2 ttl=64 id=9006 icmp_seq=1 rtt=7.0 ms
len=46 ip=3.16.0.2 ttl=64 id=38461 icmp_seq=2 rtt=3.9 ms
len=46 ip=3.16.0.2 ttl=64 id=64366 icmp_seq=3 rtt=11.8 ms
len=46 ip=3.16.0.2 ttl=64 id=34302 icmp_seq=4 rtt=6.7 ms
len=46 ip=3.16.0.2 ttl=64 id=60292 icmp_seq=5 rtt=5.7 ms
len=46 ip=3.16.0.2 ttl=64 id=38427 icmp_seq=6 rtt=10.5 ms
len=46 ip=3.16.0.2 ttl=64 id=65042 icmp_seq=7 rtt=7.6 ms
len=46 ip=3.16.0.2 ttl=64 id=32796 icmp_seq=8 rtt=10.4 ms
len=46 ip=3.16.0.2 ttl=64 id=58895 icmp_seq=9 rtt=23.7 ms
len=46 ip=3.16.0.2 ttl=64 id=37662 icmp_seq=10 rtt=7.6 ms
len=46 ip=3.16.0.2 ttl=64 id=56416 icmp_seq=11 rtt=19.6 ms
len=46 ip=3.16.0.2 ttl=64 id=29102 icmp_seq=12 rtt=7.9 ms
len=46 ip=3.16.0.2 ttl=64 id=13601 icmp_seq=13 rtt=26.5 ms
len=46 ip=3.16.0.2 ttl=64 id=13236 icmp_seq=14 rtt=26.2 ms
len=46 ip=3.16.0.2 ttl=64 id=45430 icmp_seq=15 rtt=7.5 ms
len=46 ip=3.16.0.2 ttl=64 id=10399 icmp_seq=16 rtt=8.7 ms
```

```
(kali㉿kali)-[~]
└─$ sudo hping3 -1 3.18.0.4 --fast
HPING 3.18.0.4 (eth0 3.18.0.4): icmp mode set, 28 headers + 0 data bytes
len=46 ip=3.18.0.4 ttl=62 id=59492 icmp_seq=2 rtt=38.8 ms
len=46 ip=3.18.0.4 ttl=62 id=55734 icmp_seq=3 rtt=36.6 ms
len=46 ip=3.18.0.4 ttl=62 id=48226 icmp_seq=4 rtt=43.4 ms
len=46 ip=3.18.0.4 ttl=62 id=27232 icmp_seq=5 rtt=36.7 ms
len=46 ip=3.18.0.4 ttl=62 id=62895 icmp_seq=6 rtt=39.8 ms
len=46 ip=3.18.0.4 ttl=62 id=6341 icmp_seq=7 rtt=41.3 ms
len=46 ip=3.18.0.4 ttl=62 id=46201 icmp_seq=8 rtt=35.8 ms
len=46 ip=3.18.0.4 ttl=62 id=49583 icmp_seq=9 rtt=38.2 ms
len=46 ip=3.18.0.4 ttl=62 id=46037 icmp_seq=10 rtt=43.7 ms
len=46 ip=3.18.0.4 ttl=62 id=34443 icmp_seq=11 rtt=57.8 ms
len=46 ip=3.18.0.4 ttl=62 id=3183 icmp_seq=12 rtt=62.6 ms
len=46 ip=3.18.0.4 ttl=62 id=39088 icmp_seq=13 rtt=56.9 ms
len=46 ip=3.18.0.4 ttl=62 id=63199 icmp_seq=14 rtt=58.7 ms
len=46 ip=3.18.0.4 ttl=62 id=43709 icmp_seq=15 rtt=40.7 ms
len=46 ip=3.18.0.4 ttl=62 id=9045 icmp_seq=16 rtt=37.0 ms
len=46 ip=3.18.0.4 ttl=62 id=17798 icmp_seq=17 rtt=36.7 ms
len=46 ip=3.18.0.4 ttl=62 id=46640 icmp_seq=18 rtt=39.9 ms
len=46 ip=3.18.0.4 ttl=62 id=5335 icmp_seq=19 rtt=51.3 ms
len=46 ip=3.18.0.4 ttl=62 id=10124 icmp_seq=20 rtt=35.2 ms
len=46 ip=3.18.0.4 ttl=62 id=23867 icmp_seq=21 rtt=57.2 ms
len=46 ip=3.18.0.4 ttl=62 id=35255 icmp_seq=22 rtt=49.9 ms
```

next

look at the wireshark:

The Wireshark interface displays a list of network captures. The first two rows show a ping request from 3.16.0.3 to 3.16.0.2 and its reply from 3.16.0.2 to 3.16.0.3. Subsequent rows show a series of ICMP echo requests and replies between 3.16.0.3 and 3.16.0.2, with various TTL values (14, 15, 16, 17, 19, 20, 21, 22, 23, 25) and sequence numbers. A detailed analysis pane for the first ICMP request shows fields such as Version (4), Header Length (20 bytes), Differentiated Services Field (0x00), Total Length (28), Identification (0xc28), Flags (0x00), Fragment Offset (0), Time to Live (64), Protocol (ICMP), Header Checksum (0x6895), Source Address (3.16.0.3), and Destination Address (3.16.0.2). Below this, the Internet Control Message Protocol section is expanded, showing Type (8 - Echo (ping) request), Code (0), Checksum (0x43fb), Identifier (BE) (46084), Identifier (LE) (1204), Sequence Number (BE) (0), Sequence Number (LE) (0), and Response frame (15). The bottom of the interface shows the byte and ASCII representations of the selected packet.

2 0.000000	3.16.0.2	3.16.0.3	ICMP	60 Echo (ping) reply	id=0x7404, seq=0/0, ttl=64 (request in 1)
3 0.102708	3.16.0.3	3.16.0.2	ICMP	60 Echo (ping) request	id=0x7404, seq=256/1, ttl=64 (reply in 4)
4 0.103458	3.16.0.2	3.16.0.3	ICMP	60 Echo (ping) reply	id=0x7404, seq=256/1, ttl=64 (request in 3)
5 0.203260	3.16.0.3	3.16.0.2	ICMP	60 Echo (ping) request	id=0x7404, seq=512/2, ttl=64 (reply in 6)
6 0.203984	3.16.0.2	3.16.0.3	ICMP	60 Echo (ping) reply	id=0x7404, seq=512/2, ttl=64 (request in 5)
7 0.303779	3.16.0.3	3.16.0.2	ICMP	60 Echo (ping) request	id=0x7404, seq=768/3, ttl=64 (reply in 8)
8 0.304512	3.16.0.2	3.16.0.3	ICMP	60 Echo (ping) reply	id=0x7404, seq=768/3, ttl=64 (request in 7)
9 0.404330	3.16.0.3	3.16.0.2	ICMP	60 Echo (ping) request	id=0x7404, seq=1024/4, ttl=64 (reply in 10)
10 0.405042	3.16.0.2	3.16.0.3	ICMP	60 Echo (ping) reply	id=0x7404, seq=1024/4, ttl=64 (request in 9)
11 0.504817	3.16.0.3	3.16.0.2	ICMP	60 Echo (ping) request	id=0x7404, seq=1280/5, ttl=64 (reply in 12)
12 0.505570	3.16.0.2	3.16.0.3	ICMP	60 Echo (ping) reply	id=0x7404, seq=1280/5, ttl=64 (request in 11)
13 0.605119	3.16.0.3	3.16.0.2	ICMP	60 Echo (ping) request	id=0x7404, seq=1536/6, ttl=64 (reply in 14)
14 0.606095	3.16.0.2	3.16.0.3	ICMP	60 Echo (ping) reply	id=0x7404, seq=1536/6, ttl=64 (request in 13)
15 0.705465	3.16.0.3	3.16.0.2	ICMP	60 Echo (ping) request	id=0x7404, seq=1792/7, ttl=64 (reply in 16)
16 0.706157	3.16.0.2	3.16.0.3	ICMP	60 Echo (ping) reply	id=0x7404, seq=1792/7, ttl=64 (request in 15)

> Frame 2: 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface -, id 0
 > Ethernet II, Src: Private_66:68:01 (00:50:79:66:68:01), Dst: PcsCompu_0e:34:8d (08:00:27:0e:34:8d)
 ✓ Internet Protocol Version 4, Src: 3.16.0.2, Dst: 3.16.0.3
 0100 = Version: 4
 0101 = Header Length: 20 bytes (5)
 > Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
 Total Length: 28
 Identification: 0xd31 (40241)
 > Flags: 0x00
 Fragment Offset: 0
 Time to Live: 64
 Protocol: ICMP (1)
 Header Checksum: 0xd78b [validation disabled]
 [Header checksum status: Unverified]
 Source Address: 3.16.0.2
 Destination Address: 3.16.0.3

2 0.000000	3.16.0.2	3.16.0.3	ICMP	60 Echo (ping) reply	id=0x7404, seq=0/0, ttl=64 (request in 1)
3 0.102708	3.16.0.3	3.16.0.2	ICMP	60 Echo (ping) request	id=0x7404, seq=256/1, ttl=64 (reply in 4)
4 0.103458	3.16.0.2	3.16.0.3	ICMP	60 Echo (ping) reply	id=0x7404, seq=256/1, ttl=64 (request in 3)
5 0.203260	3.16.0.3	3.16.0.2	ICMP	60 Echo (ping) request	id=0x7404, seq=512/2, ttl=64 (reply in 6)
6 0.203984	3.16.0.2	3.16.0.3	ICMP	60 Echo (ping) reply	id=0x7404, seq=512/2, ttl=64 (request in 5)
7 0.303779	3.16.0.3	3.16.0.2	ICMP	60 Echo (ping) request	id=0x7404, seq=768/3, ttl=64 (reply in 8)
8 0.304512	3.16.0.2	3.16.0.3	ICMP	60 Echo (ping) reply	id=0x7404, seq=768/3, ttl=64 (request in 7)
9 0.404330	3.16.0.3	3.16.0.2	ICMP	60 Echo (ping) request	id=0x7404, seq=1024/4, ttl=64 (reply in 10)
10 0.405042	3.16.0.2	3.16.0.3	ICMP	60 Echo (ping) reply	id=0x7404, seq=1024/4, ttl=64 (request in 9)
11 0.504817	3.16.0.3	3.16.0.2	ICMP	60 Echo (ping) request	id=0x7404, seq=1280/5, ttl=64 (reply in 12)
12 0.505570	3.16.0.2	3.16.0.3	ICMP	60 Echo (ping) reply	id=0x7404, seq=1280/5, ttl=64 (request in 11)
13 0.605119	3.16.0.3	3.16.0.2	ICMP	60 Echo (ping) request	id=0x7404, seq=1536/6, ttl=64 (reply in 14)
14 0.606095	3.16.0.2	3.16.0.3	ICMP	60 Echo (ping) reply	id=0x7404, seq=1536/6, ttl=64 (request in 13)
15 0.705465	3.16.0.3	3.16.0.2	ICMP	60 Echo (ping) request	id=0x7404, seq=1792/7, ttl=64 (reply in 16)
16 0.706157	3.16.0.2	3.16.0.3	ICMP	60 Echo (ping) reply	id=0x7404, seq=1792/7, ttl=64 (request in 15)

> Frame 2: 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface -, id 0
 > Ethernet II, Src: Private_66:68:01 (00:50:79:66:68:01), Dst: PcsCompu_0e:34:8d (08:00:27:0e:34:8d)
 ✓ Internet Protocol Version 4, Src: 3.16.0.2, Dst: 3.16.0.3
 ✓ Internet Control Message Protocol
 Type: 0 (Echo (ping) reply)
 Code: 0
 Checksum: 0xbfb [correct]
 [Checksum Status: Good]
 Identifier (BE): 29700 (0x7404)
 Identifier (LE): 1140 (0x0474)
 Sequence Number (BE): 0 (0x0000)
 Sequence Number (LE): 0 (0x0000)
 [Request frame: 1]
 [Response time: 0.000 ms]

```
(kali㉿kali)-[~]
└─$ sudo hping3 -1 3.18.0.4 --fast
HPING 3.18.0.4 (eth0 3.18.0.4): icmp mode set, 28 headers + 0 data bytes
len=46 ip=3.18.0.4 ttl=62 id=42804 icmp_seq=2 rtt=45.6 ms
len=46 ip=3.18.0.4 ttl=62 id=21995 icmp_seq=3 rtt=47.8 ms
len=46 ip=3.18.0.4 ttl=62 id=20909 icmp_seq=4 rtt=49.2 ms
len=46 ip=3.18.0.4 ttl=62 id=45179 icmp_seq=5 rtt=47.6 ms
len=46 ip=3.18.0.4 ttl=62 id=58710 icmp_seq=6 rtt=43.7 ms
len=46 ip=3.18.0.4 ttl=62 id=9310 icmp_seq=7 rtt=38.9 ms
len=46 ip=3.18.0.4 ttl=62 id=20310 icmp_seq=8 rtt=48.8 ms
len=46 ip=3.18.0.4 ttl=62 id=17498 icmp_seq=9 rtt=41.0 ms
len=46 ip=3.18.0.4 ttl=62 id=18541 icmp_seq=10 rtt=34.8 ms
len=46 ip=3.18.0.4 ttl=62 id=60559 icmp_seq=11 rtt=46.9 ms
len=46 ip=3.18.0.4 ttl=62 id=51718 icmp_seq=12 rtt=38.2 ms
len=46 ip=3.18.0.4 ttl=62 id=19484 icmp_seq=13 rtt=45.0 ms
len=46 ip=3.18.0.4 ttl=62 id=42534 icmp_seq=14 rtt=48.8 ms
len=46 ip=3.18.0.4 ttl=62 id=19881 icmp_seq=15 rtt=36.0 ms
len=46 ip=3.18.0.4 ttl=62 id=31932 icmp_seq=16 rtt=51.5 ms
len=46 ip=3.18.0.4 ttl=62 id=14521 icmp_seq=17 rtt=43.8 ms
len=46 ip=3.18.0.4 ttl=62 id=29465 icmp_seq=18 rtt=39.4 ms
len=46 ip=3.18.0.4 ttl=62 id=34948 icmp_seq=19 rtt=45.8 ms
len=46 ip=3.18.0.4 ttl=62 id=39619 icmp_seq=20 rtt=42.1 ms
len=46 ip=3.18.0.4 ttl=62 id=14209 icmp_seq=21 rtt=45.7 ms
len=46 ip=3.18.0.4 ttl=62 id=17467 icmp_seq=22 rtt=40.0 ms
len=46 ip=3.18.0.4 ttl=62 id=23939 icmp_seq=23 rtt=47.9 ms
len=46 ip=3.18.0.4 ttl=62 id=11268 icmp_seq=24 rtt=43.0 ms
len=46 ip=3.18.0.4 ttl=62 id=7980 icmp_seq=25 rtt=38.2 ms
len=46 ip=3.18.0.4 ttl=62 id=35633 icmp_seq=26 rtt=50.1 ms
len=46 ip=3.18.0.4 ttl=62 id=52265 icmp_seq=27 rtt=38.1 ms
len=46 ip=3.18.0.4 ttl=62 id=33774 icmp_seq=28 rtt=45.0 ms
len=46 ip=3.18.0.4 ttl=62 id=27231 icmp_seq=29 rtt=45.6 ms
len=46 ip=3.18.0.4 ttl=62 id=38498 icmp_seq=30 rtt=52.4 ms
len=46 ip=3.18.0.4 ttl=62 id=24962 icmp_seq=31 rtt=47.9 ms
len=46 ip=3.18.0.4 ttl=62 id=14887 icmp_seq=32 rtt=36.2 ms
len=46 ip=3.18.0.4 ttl=62 id=15767 icmp_seq=33 rtt=47.2 ms
len=46 ip=3.18.0.4 ttl=62 id=46957 icmp_seq=34 rtt=41.5 ms
len=46 ip=3.18.0.4 ttl=62 id=35796 icmp_seq=35 rtt=1050.6 ms
^C
--- 3.18.0.4 hping statistic ---
36 packets transmitted, 34 packets received, 6% packet loss
```

→	5 0,202254	3.16.0.3	3.18.0.4	ICMP	60 Echo (ping) request id=0x8504, seq=512/2, ttl=64 (reply in 6)
←	6 0,243061	3.18.0.4	3.16.0.3	ICMP	42 Echo (ping) reply id=0x8504, seq=512/2, ttl=62 (request in 5)

5 0.202254	3.16.0.3	3.18.0.4	ICMP	60 Echo (ping) request	id=0x8504, seq=512/2, ttl=64 (reply in 6)
6 0.243061	3.18.0.4	3.16.0.3	ICMP	42 Echo (ping) reply	id=0x8504, seq=512/2, ttl=62 (request in 5)
7 0.303577	3.16.0.3	3.18.0.4	ICMP	60 Echo (ping) request	id=0x8504, seq=768/3, ttl=64 (reply in 8)
8 0.339685	3.18.0.4	3.16.0.3	ICMP	42 Echo (ping) reply	id=0x8504, seq=768/3, ttl=62 (request in 7)
9 0.406774	3.16.0.3	3.18.0.4	ICMP	60 Echo (ping) request	id=0x8504, seq=1024/4, ttl=64 (reply in 10)
10 0.446901	3.18.0.4	3.16.0.3	ICMP	42 Echo (ping) reply	id=0x8504, seq=1024/4, ttl=62 (request in 9)
11 0.508284	3.16.0.3	3.18.0.4	ICMP	60 Echo (ping) request	id=0x8504, seq=1280/5, ttl=64 (reply in 12)
12 0.543650	3.18.0.4	3.16.0.3	ICMP	42 Echo (ping) reply	id=0x8504, seq=1280/5, ttl=62 (request in 11)
13 0.608051	3.16.0.3	3.18.0.4	ICMP	60 Echo (ping) request	id=0x8504, seq=1536/6, ttl=64 (reply in 14)
14 0.649836	3.18.0.4	3.16.0.3	ICMP	42 Echo (ping) reply	id=0x8504, seq=1536/6, ttl=62 (request in 13)
15 0.708406	3.16.0.3	3.18.0.4	ICMP	60 Echo (ping) request	id=0x8504, seq=1792/7, ttl=64 (reply in 16)
16 0.746177	3.18.0.4	3.16.0.3	ICMP	42 Echo (ping) reply	id=0x8504, seq=1792/7, ttl=62 (request in 15)

```
> Frame 5: 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface -, id 0
> Ethernet II, Src: PcsCompu_0e:34:8d (08:00:27:0e:34:8d), Dst: c2:01:22:16:00:00 (c2:01:22:16:00:00)
> Internet Protocol Version 4, Src: 3.16.0.3, Dst: 3.18.0.4
    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
> Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
    Total Length: 28
    Identification: 0xa734 (42804)
    Flags: 0x00
    Fragment Offset: 0
    Time to Live: 64
    Protocol: ICMP (1)
    Header Checksum: 0xcd84 [validation disabled]
    [Header checksum status: Unverified]
    Source Address: 3.16.0.3
    Destination Address: 3.18.0.4
```

5 0.202254	3.16.0.3	3.18.0.4	ICMP	60 Echo (ping) request	id=0x8504, seq=512/2, ttl=64 (reply in 6)
6 0.243061	3.18.0.4	3.16.0.3	ICMP	42 Echo (ping) reply	id=0x8504, seq=512/2, ttl=62 (request in 5)
7 0.303577	3.16.0.3	3.18.0.4	ICMP	60 Echo (ping) request	id=0x8504, seq=768/3, ttl=64 (reply in 8)
8 0.339685	3.18.0.4	3.16.0.3	ICMP	42 Echo (ping) reply	id=0x8504, seq=768/3, ttl=62 (request in 7)
9 0.406774	3.16.0.3	3.18.0.4	ICMP	60 Echo (ping) request	id=0x8504, seq=1024/4, ttl=64 (reply in 10)
10 0.446901	3.18.0.4	3.16.0.3	ICMP	42 Echo (ping) reply	id=0x8504, seq=1024/4, ttl=62 (request in 9)
11 0.508284	3.16.0.3	3.18.0.4	ICMP	60 Echo (ping) request	id=0x8504, seq=1280/5, ttl=64 (reply in 12)
12 0.543650	3.18.0.4	3.16.0.3	ICMP	42 Echo (ping) reply	id=0x8504, seq=1280/5, ttl=62 (request in 11)
13 0.608051	3.16.0.3	3.18.0.4	ICMP	60 Echo (ping) request	id=0x8504, seq=1536/6, ttl=64 (reply in 14)
14 0.649836	3.18.0.4	3.16.0.3	ICMP	42 Echo (ping) reply	id=0x8504, seq=1536/6, ttl=62 (request in 13)
15 0.708406	3.16.0.3	3.18.0.4	ICMP	60 Echo (ping) request	id=0x8504, seq=1792/7, ttl=64 (reply in 16)
16 0.746177	3.18.0.4	3.16.0.3	ICMP	42 Echo (ping) reply	id=0x8504, seq=1792/7, ttl=62 (request in 15)

```
> Frame 5: 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface -, id 0
> Ethernet II, Src: PcsCompu_0e:34:8d (08:00:27:0e:34:8d), Dst: c2:01:22:16:00:00 (c2:01:22:16:00:00)
> Internet Protocol Version 4, Src: 3.16.0.3, Dst: 3.18.0.4
> Internet Control Message Protocol
    Type: 8 (Echo (ping) request)
    Code: 0
    Checksum: 0x70fb [correct]
    [Checksum Status: Good]
    Identifier (BE): 34052 (0x8504)
    Identifier (LE): 1157 (0x0485)
    Sequence Number (BE): 512 (0x0200)
    Sequence Number (LE): 2 (0x0002)
    [Response frame: 6]
```

6	0.243061	3.18.0.4	3.16.0.3	ICMP	42 Echo (ping) reply	id=0x8504, seq=512/2, ttl=62 (request in 5)
7	0.303577	3.16.0.3	3.18.0.4	ICMP	60 Echo (ping) request	id=0x8504, seq=768/3, ttl=64 (reply in 8)
8	0.339685	3.18.0.4	3.16.0.3	ICMP	42 Echo (ping) reply	id=0x8504, seq=768/3, ttl=62 (request in 7)
9	0.406774	3.16.0.3	3.18.0.4	ICMP	60 Echo (ping) request	id=0x8504, seq=1024/4, ttl=64 (reply in 10)
10	0.446901	3.18.0.4	3.16.0.3	ICMP	42 Echo (ping) reply	id=0x8504, seq=1024/4, ttl=62 (request in 9)
11	0.508284	3.16.0.3	3.18.0.4	ICMP	60 Echo (ping) request	id=0x8504, seq=1280/5, ttl=64 (reply in 12)
12	0.543650	3.18.0.4	3.16.0.3	ICMP	42 Echo (ping) reply	id=0x8504, seq=1280/5, ttl=62 (request in 11)
13	0.608051	3.16.0.3	3.18.0.4	ICMP	60 Echo (ping) request	id=0x8504, seq=1536/6, ttl=64 (reply in 14)
14	0.649836	3.18.0.4	3.16.0.3	ICMP	42 Echo (ping) reply	id=0x8504, seq=1536/6, ttl=62 (request in 13)
15	0.708406	3.16.0.3	3.18.0.4	ICMP	60 Echo (ping) request	id=0x8504, seq=1792/7, ttl=64 (reply in 16)
16	0.746427	3.19.0.1	3.16.0.2	ICMP	42 Echo (ping) reply	id=0x8504, seq=1792/7, ttl=62 (request in 15)

```
> Frame 6: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) on interface -, id 0
> Ethernet II, Src: c2:01:22:16:00:00 (c2:01:22:16:00:00), Dst: PcsCompu_0e:34:8d (08:00:27:0e:34:8d)
> Internet Protocol Version 4, Src: 3.18.0.4, Dst: 3.16.0.3
    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
> Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
    Total Length: 28
    Identification: 0xa734 (42804)
    Flags: 0x00
    Fragment Offset: 0
    Time to Live: 62
    Protocol: ICMP (1)
    Header Checksum: 0xcf84 [validation disabled]
    [Header checksum status: Unverified]
    Source Address: 3.18.0.4
    Destination Address: 3.16.0.3
```

6	0.243061	3.18.0.4	3.16.0.3	ICMP	42 Echo (ping) reply	id=0x8504, seq=512/2, ttl=62 (request in 5)
7	0.303577	3.16.0.3	3.18.0.4	ICMP	60 Echo (ping) request	id=0x8504, seq=768/3, ttl=64 (reply in 8)
8	0.339685	3.18.0.4	3.16.0.3	ICMP	42 Echo (ping) reply	id=0x8504, seq=768/3, ttl=62 (request in 7)
9	0.406774	3.16.0.3	3.18.0.4	ICMP	60 Echo (ping) request	id=0x8504, seq=1024/4, ttl=64 (reply in 10)
10	0.446901	3.18.0.4	3.16.0.3	ICMP	42 Echo (ping) reply	id=0x8504, seq=1024/4, ttl=62 (request in 9)
11	0.508284	3.16.0.3	3.18.0.4	ICMP	60 Echo (ping) request	id=0x8504, seq=1280/5, ttl=64 (reply in 12)
12	0.543650	3.18.0.4	3.16.0.3	ICMP	42 Echo (ping) reply	id=0x8504, seq=1280/5, ttl=62 (request in 11)
13	0.608051	3.16.0.3	3.18.0.4	ICMP	60 Echo (ping) request	id=0x8504, seq=1536/6, ttl=64 (reply in 14)
14	0.649836	3.18.0.4	3.16.0.3	ICMP	42 Echo (ping) reply	id=0x8504, seq=1536/6, ttl=62 (request in 13)
15	0.708406	3.16.0.3	3.18.0.4	ICMP	60 Echo (ping) request	id=0x8504, seq=1792/7, ttl=64 (reply in 16)
16	0.746427	3.19.0.1	3.16.0.2	ICMP	42 Echo (ping) reply	id=0x8504, seq=1792/7, ttl=62 (request in 15)

```
> Frame 6: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) on interface -, id 0
> Ethernet II, Src: c2:01:22:16:00:00 (c2:01:22:16:00:00), Dst: PcsCompu_0e:34:8d (08:00:27:0e:34:8d)
> Internet Protocol Version 4, Src: 3.18.0.4, Dst: 3.16.0.3
> Internet Control Message Protocol
    Type: 0 (Echo (ping) reply)
    Code: 0
    Checksum: 0x78fb [correct]
    [Checksum Status: Good]
    Identifier (BE): 34052 (0x8504)
    Identifier (LE): 1157 (0x0485)
    Sequence Number (BE): 512 (0x0200)
    Sequence Number (LE): 2 (0x0002)
    [Request frame: 5]
    [Response time: 40.807 ms]
```

next

Version (4 bits) – Internet Protocol version 4 (IPv4)

Header Length (4 bits) – Length of entire IP header between 20 to 60 bytes

Type of Service (8 bits) – This is used for QoS (Quality of Service); E.g., audio, voice

Total Length (16 bits) – Length of entire IP Packet; This includes IP header and Data (IP Payload).

Identification – If IP packet is fragmented during the transmission, all the fragments contain same identification number to identify original IP packet they belong.

Flags – As required by the network resources, if IP Packet is too large to handle, these ‘flags’ tells if they can be fragmented or not. In this 3-bit flag, the MSB is always set to ‘0’.

Fragment Offset – This offset tells the exact position of the fragment in the original IP Packet.

The Network Layer: Format of IPv4 Packet

Time to Live – To avoid looping in the network, every packet is sent with some TTL value set, which tells the network how many routers (hops) this packet can cross. At each hop, its value is decremented by one and when the value reaches zero, the packet is discarded.

Protocol – This tells the Network layer at the destination host to which next level protocol such packet belongs. *For example*, protocol number of ICMP is 1, TCP is 6 and UDP is 17.

Header Checksum – This field is used to keep checksum value of entire header which is then used to check if the packet is received error-free.

Source Address – The 32-bit address of the Sender (or source) of the packet.

Destination Address – The 32-bit address of the Receiver (or destination) of the packet.

Options – This optional field is used if the value of IHL is greater than 5. These options may contain values for options such as Security, Record Route, Time Stamp, etc.

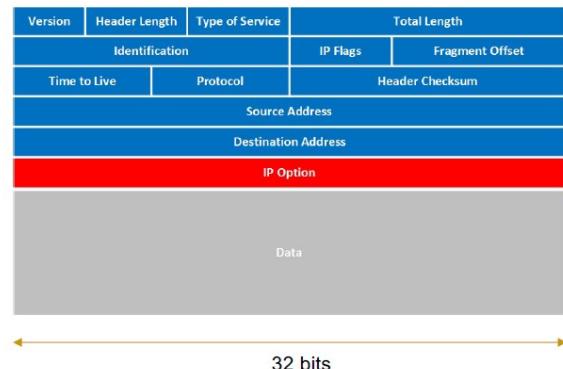


Image source: <https://networklessons.com/cisco/ccna-routing-switching-icnd1-100-105/ipv4-packet-header>

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The Network Layer: Format of IPv4 Packet

IPv4 Packet Example: Wireshark

```
Internet Protocol Version 4, src: 192.168.82.147 (192.168.82.147), dst: 192.243.232.2 (192.243.232.2)
  Version: 4
  Header Length: 20 bytes
  Differentiated Services Field: 0x00 (DSCP 0x00: Default; ECN: 0x00: Not-ECT (Not ECN-Capable Transport))
    0000 00.. = differentiated Services Codepoint: Default (0x00)
    .... ..00 = Explicit Congestion Notification: Not-ECT (Not ECN-Capable Transport) (0x00)
  Total Length: 1155
  Identification: 0x69de (27102)
  Flags: 0x02 (Don't Fragment)
    0... .... = Reserved bit: Not set
    .1.. .... = Don't fragment: Set
    ..0. .... = More fragments: Not set
  Fragment offset: 0
  Time to live: 128
  Protocol: TCP (6)
  Header checksum: 0xd064 [validation disabled]
    [Good: False]
    [Bad: False]
  Source: 192.168.82.147 (192.168.82.147)
  Destination: 192.243.232.2 (192.243.232.2)
    [Source GeoIP: Unknown]
    [Destination GeoIP: Unknown]
  Transmission Control Protocol, Src Port: 57487 (57487), Dst Port: 80 (80), Seq: 1102, Ack: 883, Len: 1115
```

Image source: <https://networklessons.com/cisco/ccna-routing-switching-icnd1-100-105/ipv4-packet-header>

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ICMP packets may carry the following messages:

- **Echo request:** Asks the destination machine to acknowledge the receipt of the packet
- **Echo response:** Acknowledges the receipt of a packet in reply to an echo request
- **Time exceeded:** error notification that the packet has expired (i.e., TTL is zero)
- **Destination unreachable:** Error notification that the packet could not be delivered

```
sudo hping3 -1 3.16.0.2 --fast
```

```
> Frame 76: 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface -, id 0
> Ethernet II, Src: PcsCompu_0e:34:8d (08:00:27:0e:34:8d), Dst: Private_66:68:01 (00:50:79:66:68:01)
< Internet Protocol Version 4, Src: 3.16.0.3, Dst: 3.16.0.2
    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
    < Internet Protocol Version 4, Src: 3.16.0.3, Dst: 3.16.0.2
        0x00 (DSCP: CS0, ECN: Not-ECT)
        0000 00.. = Differentiated Services Codepoint: Default (0)
        .... ..00 = Explicit Congestion Notification: Not ECN-Capable Transport (0)
        Total Length: 28
        Identification: 0xb9d5 (47573)
    < Flags: 0x00
        0.... .... = Reserved bit: Not set
        .0.... .... = Don't fragment: Not set
        ..0.... .... = More fragments: Not set
        Fragment Offset: 0
        Time to Live: 64
        Protocol: ICMP (1)
        Header checksum: 0xbae7 [validation disabled]
        [Header checksum status: Unverified]
        Source Address: 3.16.0.3
        Destination Address: 3.16.0.2
```

76 34.749199	3.16.0.3	3.16.0.2	ICMP	60 Echo (ping) request	id=0xf804, seq=0/0, ttl=64 (reply in 77)
77 34.749199	3.16.0.2	3.16.0.3	ICMP	60 Echo (ping) reply	id=0xf804, seq=0/0, ttl=64 (request in 76)
78 34.848985	3.16.0.3	3.16.0.2	ICMP	60 Echo (ping) request	id=0xf804, seq=256/1, ttl=64 (reply in 79)
79 34.849727	3.16.0.2	3.16.0.3	ICMP	60 Echo (ping) reply	id=0xf804, seq=256/1, ttl=64 (request in 78)
80 34.949560	3.16.0.3	3.16.0.2	ICMP	60 Echo (ping) request	id=0xf804, seq=512/2, ttl=64 (reply in 81)
81 34.950290	3.16.0.2	3.16.0.3	ICMP	60 Echo (ping) reply	id=0xf804, seq=512/2, ttl=64 (request in 80)
82 34.950291	3.16.0.2	3.16.0.2	ICMP	60 Echo (ping) request	id=0xf804, seq=768/2, ttl=64 (reply in 82)
<					
> Frame 76: 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface -, id 0					
> Ethernet II, Src: PcsCompu_0e:34:8d (08:00:27:0e:34:8d), Dst: Private_66:68:01 (00:50:79:66:68:01)					
> Internet Protocol Version 4, Src: 3.16.0.3, Dst: 3.16.0.2					
< Internet Control Message Protocol					
Type: 8 (Echo (ping) request)					
Code: 0					
Checksum: 0xffff [correct]					
[Checksum Status: Good]					
Identifier (BE): 63492 (0xf804)					
Identifier (LE): 1272 (0x04f8)					
Sequence Number (BE): 0 (0x0000)					
Sequence Number (LE): 0 (0x0000)					
[Response frame: 77]					
<					
> Frame 77: 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface -, id 0					
> Ethernet II, Src: Private_66:68:01 (00:50:79:66:68:01), Dst: PcsCompu_0e:34:8d (08:00:27:0e:34:8d)					
< Internet Protocol Version 4, Src: 3.16.0.2, Dst: 3.16.0.3					
0100 = Version: 4					
.... 0101 = Header Length: 20 bytes (5)					
< Differentiated Services Field					
0x00 (DSCP: CS0, ECN: Not-ECT)					
0000 00.. = Differentiated Services Codepoint: Default (0)					
.... ..00 = Explicit Congestion Notification: Not ECN-Capable Transport (0)					
Total Length: 28					
Identification: 0xb9d5 (47573)					
< Flags: 0x00					
0... = Reserved bit: Not set					
.0... = Don't fragment: Not set					
..0.... = More fragments: Not set					
Fragment Offset: 0					
Time to Live: 64					
Protocol: ICMP (1)					
Header Checksum: 0xbae7 [validation disabled]					
[Header checksum status: Unverified]					
Source Address: 3.16.0.2					
Destination Address: 3.16.0.3					
<					
> Frame 77: 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface -, id 0					
> Ethernet II, Src: Private_66:68:01 (00:50:79:66:68:01), Dst: PcsCompu_0e:34:8d (08:00:27:0e:34:8d)					
< Internet Protocol Version 4, Src: 3.16.0.2, Dst: 3.16.0.3					
< Internet Control Message Protocol					
Type: 0 (Echo (ping) reply)					
Code: 0					
Checksum: 0x07fb [correct]					
[Checksum Status: Good]					
Identifier (BE): 63492 (0xf804)					
Identifier (LE): 1272 (0x04f8)					
Sequence Number (BE): 0 (0x0000)					
Sequence Number (LE): 0 (0x0000)					
[Request frame: 76]					
[Response time: 0.000 ms]					
<					

sudo hping3 -1 3.18.0.4 --fast

> 104 5.035725	3.16.0.3	3.18.0.4	ICMP	60 Echo (ping) request	id=0x9d05, seq=12800/50, ttl=64 (reply in 105)
105 5.079833	3.18.0.4	3.16.0.3	ICMP	42 Echo (ping) reply	id=0x9d05, seq=12800/50, ttl=62 (request in 104)
106 5.136393	3.16.0.3	3.18.0.4	ICMP	60 Echo (ping) request	id=0x9d05, seq=13056/51, ttl=64 (reply in 107)
107 5.176452	3.18.0.4	3.16.0.3	ICMP	42 Echo (ping) reply	id=0x9d05, seq=13056/51, ttl=62 (request in 106)
108 5.236737	3.16.0.3	3.18.0.4	ICMP	60 Echo (ping) request	id=0x9d05, seq=13312/52, ttl=64 (reply in 109)
109 5.273078	3.18.0.4	3.16.0.3	ICMP	42 Echo (ping) reply	id=0x9d05, seq=13312/52, ttl=62 (request in 108)
110 5.337298	3.16.0.3	3.18.0.4	ICMP	60 Echo (ping) request	id=0x9d05, seq=13568/53, ttl=64 (reply in 111)
111 5.200447	3.18.0.4	3.16.0.3	ICMP	42 Echo (ping) reply	id=0x9d05, seq=13568/53, ttl=62 (request in 110)
<					
> Frame 104: 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface -, id 0					
> Ethernet II, Src: PcsCompu_0e:34:8d (08:00:27:0e:34:8d), Dst: c2:01:22:16:00:00 (c2:01:22:16:00:00)					
< Internet Protocol Version 4, Src: 3.16.0.3, Dst: 3.18.0.4					
0100 = Version: 4					
.... 0101 = Header Length: 20 bytes (5)					
> Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)					
Total Length: 28					
Identification: 0x390c (14604)					
Flags: 0x00					
0... = Reserved bit: Not set					
..0... = Don't fragment: Not set					
..0. = More fragments: Not set					
Fragment Offset: 0					
Time to Live: 64					
Protocol: ICMP (1)					
Header Checksum: 0x3bad [validation disabled]					
[Header checksum status: Unverified]					
Source Address: 3.16.0.3					
Destination Address: 3.18.0.4					

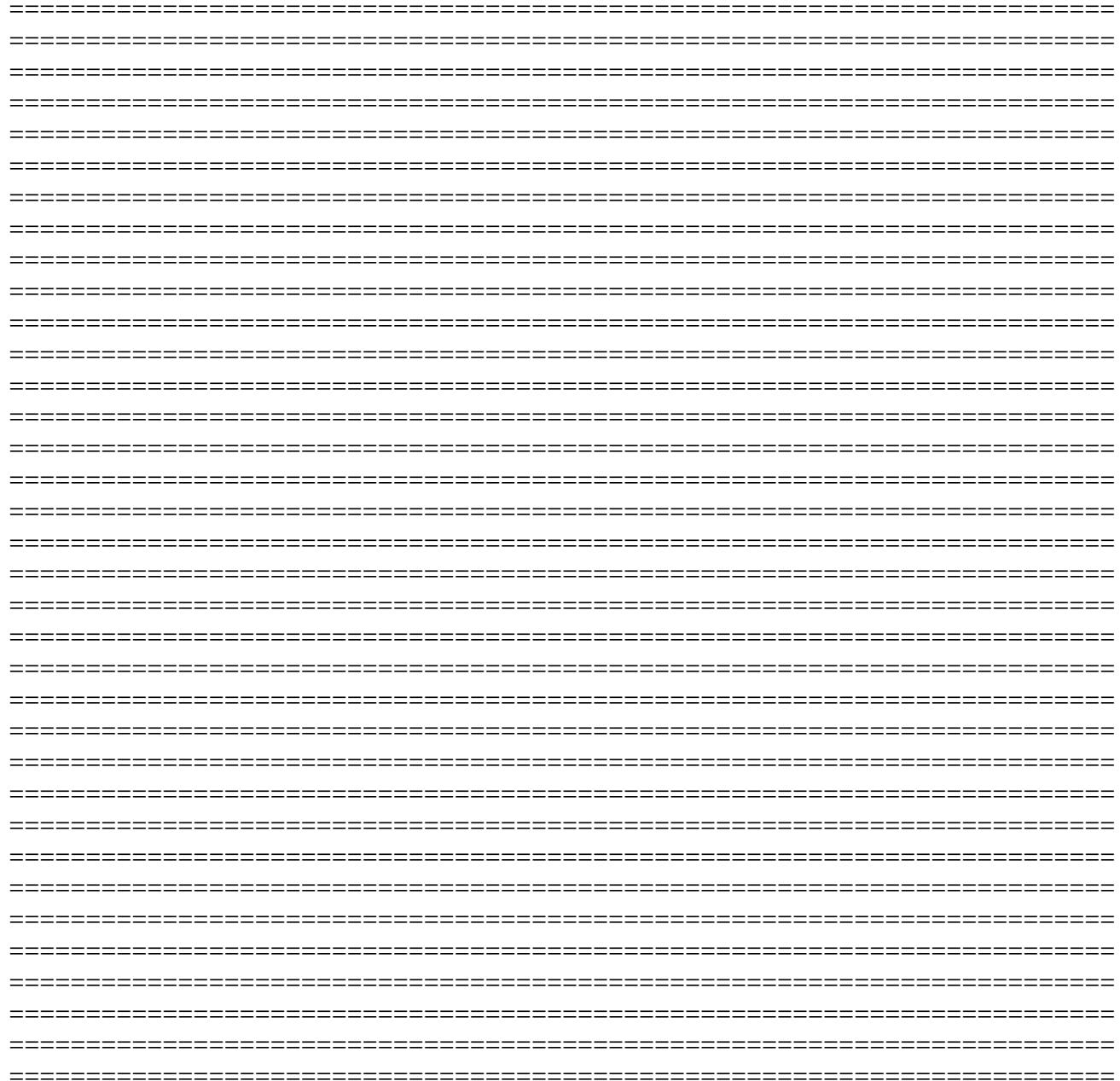
> 104 5.035725	3.16.0.3	3.18.0.4	ICMP	60 Echo (ping) request	id=0x9d05, seq=12800/50, ttl=64 (reply in 105)
105 5.079833	3.18.0.4	3.16.0.3	ICMP	42 Echo (ping) reply	id=0x9d05, seq=12800/50, ttl=62 (request in 104)
106 5.136393	3.16.0.3	3.18.0.4	ICMP	60 Echo (ping) request	id=0x9d05, seq=13056/51, ttl=64 (reply in 107)
107 5.176452	3.18.0.4	3.16.0.3	ICMP	42 Echo (ping) reply	id=0x9d05, seq=13056/51, ttl=62 (request in 106)
108 5.236737	3.16.0.3	3.18.0.4	ICMP	60 Echo (ping) request	id=0x9d05, seq=13312/52, ttl=64 (reply in 109)
109 5.273078	3.18.0.4	3.16.0.3	ICMP	42 Echo (ping) reply	id=0x9d05, seq=13312/52, ttl=62 (request in 108)
110 5.337298	3.16.0.3	3.18.0.4	ICMP	60 Echo (ping) request	id=0x9d05, seq=13568/53, ttl=64 (reply in 111)
111 5.200447	3.18.0.4	3.16.0.3	ICMP	42 Echo (ping) reply	id=0x9d05, seq=13568/53, ttl=62 (request in 110)
<					
> Frame 104: 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface -, id 0					
> Ethernet II, Src: PcsCompu_0e:34:8d (08:00:27:0e:34:8d), Dst: c2:01:22:16:00:00 (c2:01:22:16:00:00)					
< Internet Protocol Version 4, Src: 3.16.0.3, Dst: 3.18.0.4					
< Internet Control Message Protocol					
Type: 8 (Echo (ping) request)					
Code: 0					
Checksum: 0x28fa [correct]					
[Checksum Status: Good]					
Identifier (BE): 40197 (0x9d05)					
Identifier (LE): 1437 (0x059d)					
Sequence Number (BE): 12800 (0x3200)					
Sequence Number (LE): 50 (0x0032)					
[Response frame: 105]					

105 5.079833	3.18.0.4	3.16.0.3	ICMP	42 Echo (ping) reply	id=0x9d05, seq=12800/50, ttl=62 (request in 104)
106 5.136393	3.16.0.3	3.18.0.4	ICMP	60 Echo (ping) request	id=0x9d05, seq=13056/51, ttl=64 (reply in 107)
107 5.176452	3.18.0.4	3.16.0.3	ICMP	42 Echo (ping) reply	id=0x9d05, seq=13056/51, ttl=62 (request in 106)
108 5.236737	3.16.0.3	3.18.0.4	ICMP	60 Echo (ping) request	id=0x9d05, seq=13312/52, ttl=64 (reply in 109)
109 5.273078	3.18.0.4	3.16.0.3	ICMP	42 Echo (ping) reply	id=0x9d05, seq=13312/52, ttl=62 (request in 108)
110 5.337298	3.16.0.3	3.18.0.4	ICMP	60 Echo (ping) request	id=0x9d05, seq=13568/53, ttl=64 (reply in 111)
111 5.200447	3.18.0.4	3.16.0.3	ICMP	42 Echo (ping) reply	id=0x9d05, seq=13568/53, ttl=62 (request in 110)
<					
> Frame 105: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) on interface -, id 0					
> Ethernet II, Src: c2:01:22:16:00:00 (c2:01:22:16:00:00), Dst: PcsCompu_0e:34:8d (08:00:27:0e:34:8d)					
< Internet Protocol Version 4, Src: 3.18.0.4, Dst: 3.16.0.3					
0100 = Version: 4					
.... 0101 = Header Length: 20 bytes (5)					
> Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)					
0000 00.. = Differentiated Services Codepoint: Default (0)					
.... ..00 = Explicit Congestion Notification: Not ECN-Capable Transport (0)					
Total Length: 28					
Identification: 0x390c (14604)					
Flags: 0x00					
0... = Reserved bit: Not set					
..0... = Don't fragment: Not set					
..0. = More fragments: Not set					
Fragment Offset: 0					
Time to Live: 62					
Protocol: ICMP (1)					
Header Checksum: 0x3dad [validation disabled]					
[Header checksum status: Unverified]					
Source Address: 3.18.0.4					
Destination Address: 3.16.0.3					

105	5.079833	3.18.0.4	3.16.0.3	ICMP	42 Echo (ping) reply	id=0xd05, seq=12800/50, ttl=62 (request in 104)
106	5.136393	3.16.0.3	3.18.0.4	ICMP	60 Echo (ping) request	id=0xd05, seq=13056/51, ttl=64 (reply in 107)
107	5.176452	3.18.0.4	3.16.0.3	ICMP	42 Echo (ping) reply	id=0xd05, seq=13056/51, ttl=62 (request in 106)
108	5.236737	3.16.0.3	3.18.0.4	ICMP	60 Echo (ping) request	id=0xd05, seq=13312/52, ttl=64 (reply in 109)
109	5.273078	3.18.0.4	3.16.0.3	ICMP	42 Echo (ping) reply	id=0xd05, seq=13312/52, ttl=62 (request in 108)
110	5.337298	3.16.0.3	3.18.0.4	ICMP	60 Echo (ping) request	id=0xd05, seq=13568/53, ttl=64 (reply in 111)
111	5.390447	3.18.0.4	3.16.0.3	ICMP	42 Echo (ping) reply	id=0xd05, seq=13568/53, ttl=62 (request in 110)

> Frame 105: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) on interface -, id 0
 > Ethernet II, Src: c2:01:22:16:00:00 (c2:01:22:16:00:00), Dst: PcsCompu_0e:34:8d (08:00:27:0e:34:8d)
 > Internet Protocol Version 4, Src: 3.18.0.4, Dst: 3.16.0.3
 ▾ Internet Control Message Protocol
 Type: 0 (Echo (ping) reply)
 Code: 0
 Checksum: 0x30fa [correct]
 [Checksum Status: Good]
 Identifier (BE): 40197 (0xd05)
 Identifier (LE): 1437 (0x59d)
 Sequence Number (BE): 12800 (0x3200)
 Sequence Number (LE): 50 (0x0032)
 [Request frame: 104]
 [Response time: 44.108 ms]

next



```

55K bytes of NVRAM.
Installed image archive

% Crashinfo may not be recovered at flash:crashinfo
% This file system device reports an error

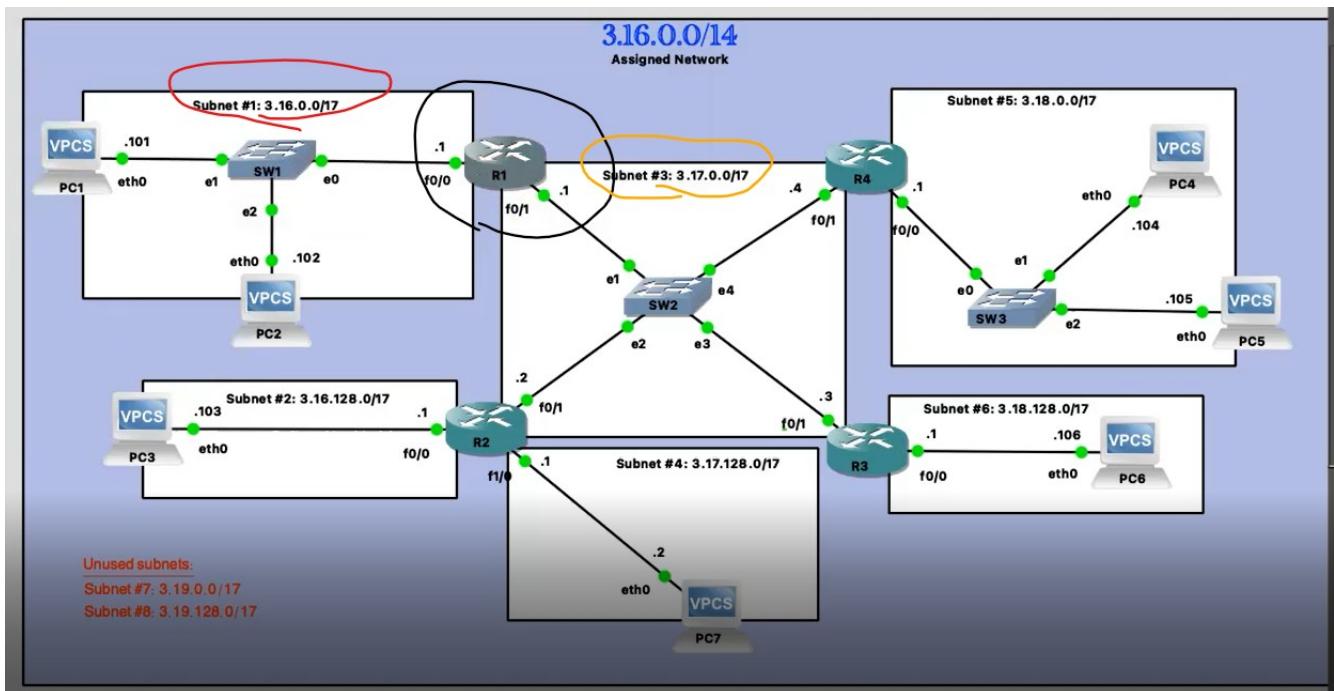
```

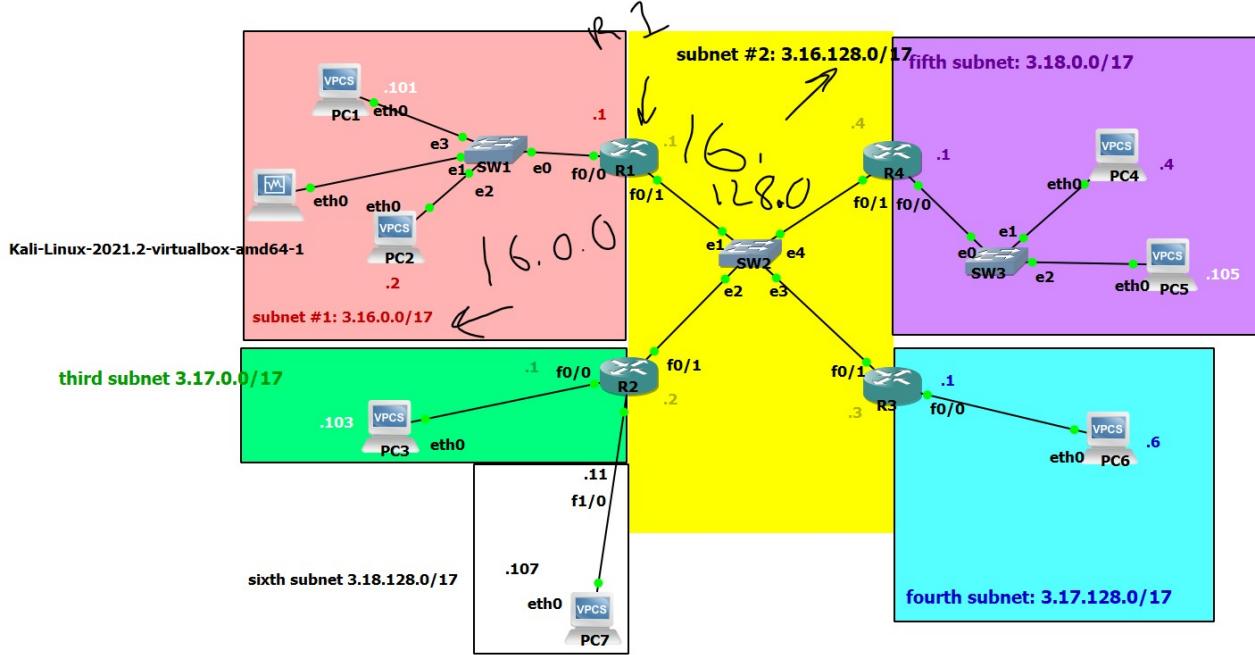
Press RETURN to get started!

```

R1#
R1# conf t
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#router rip
R1(config-router)#version 2
R1(config-router)#network 3.16.0.0
R1(config-router)#network 3.17.0.0
R1(config-router)#exit
R1(config)#router ospf 1
R1(config-router)#router-id 1.1.1.1
R1(config-router)#network 0.0.0.0 255.255.255.255 area 0
R1(config-router)#

```





```

conf t
router rip
version 2
network 3.16.0.0
network 3.16.128.0
exit
router ospf 1
router-id 1.1.1.1
network 0.0.0.0 255.255.255.255 area 0

```

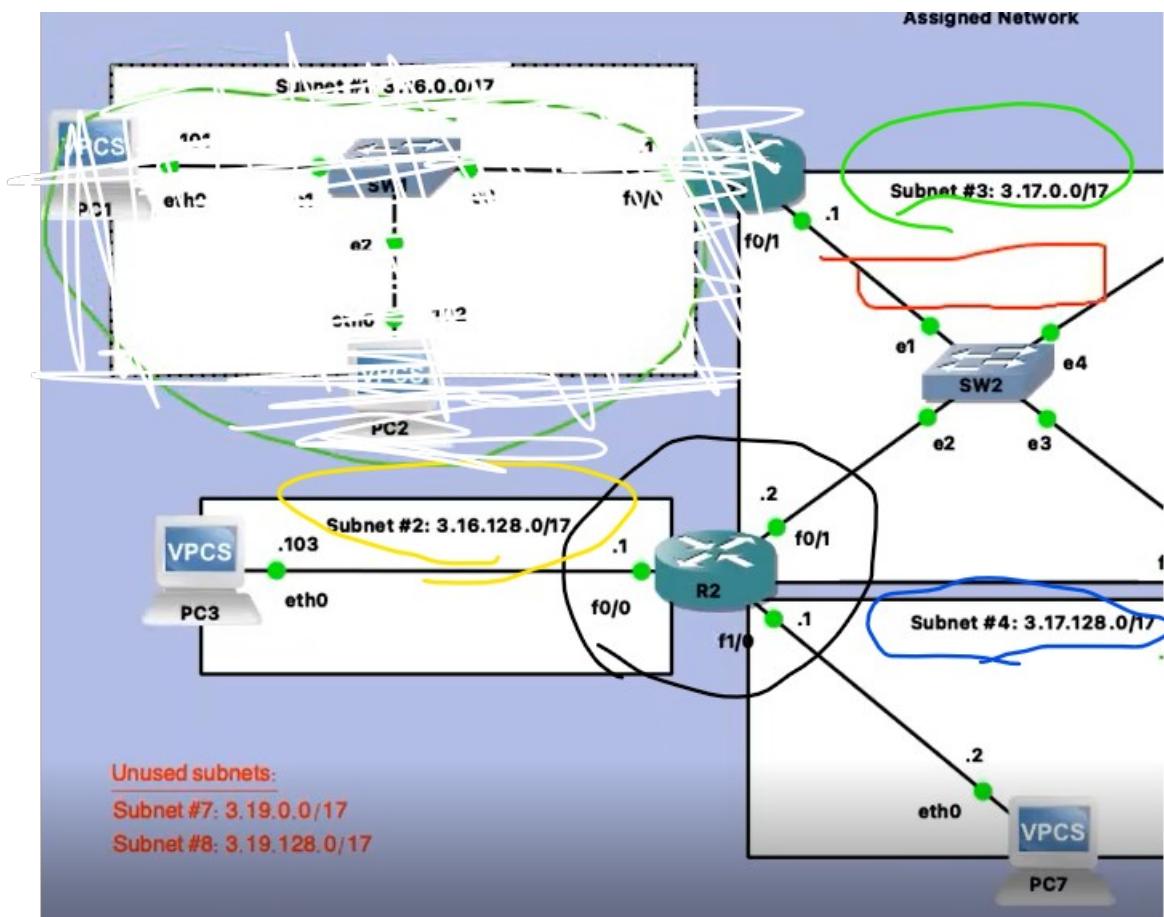
```

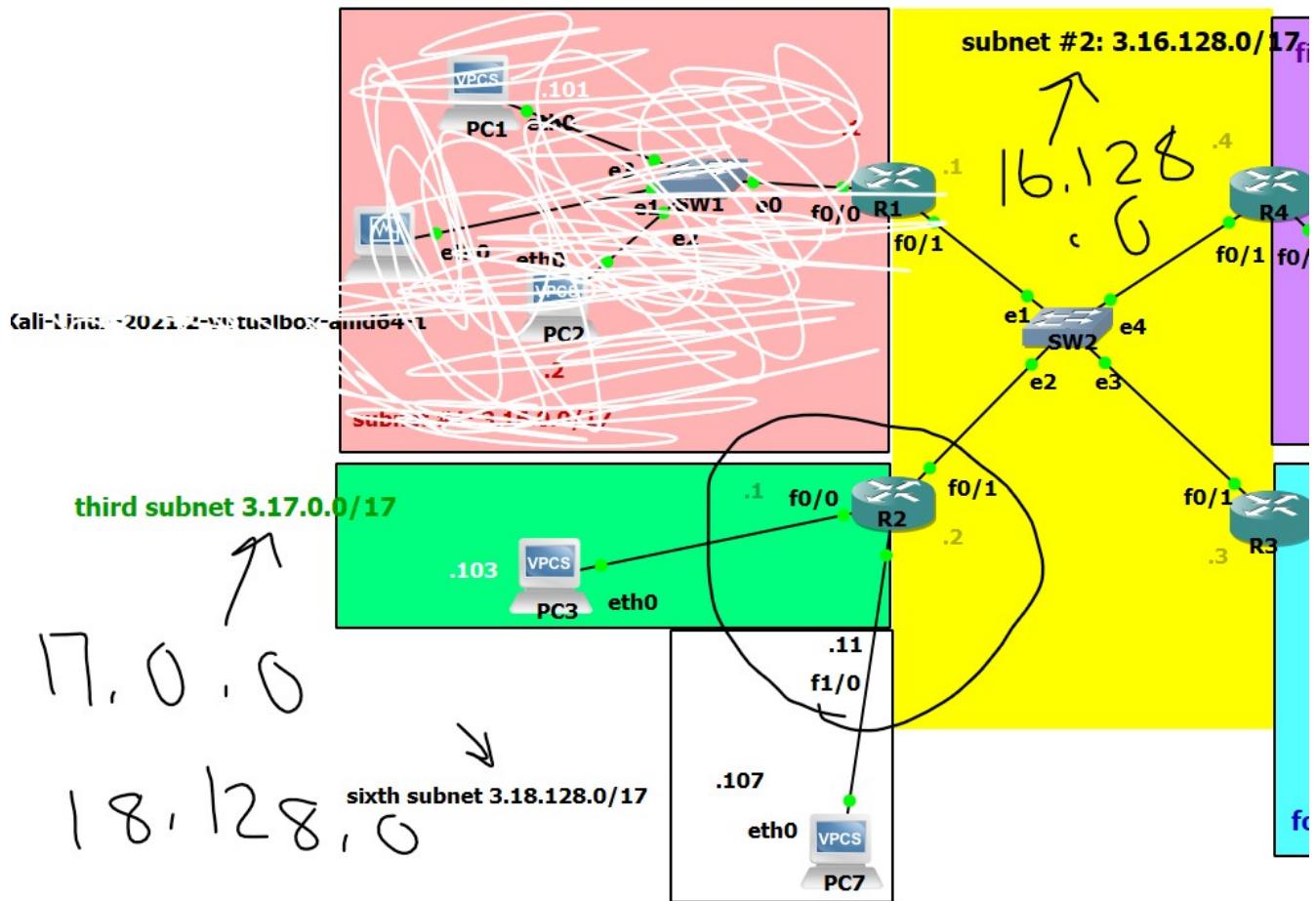
R1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#router rip
R1(config-router)#version 2
R1(config-router)#network 3.16.0.0
R1(config-router)#network 3.16.128.0
R1(config-router)#exit
R1(config)#router ospf 1
R1(config-router)#router-id 1.1.1.1
R1(config-router)#network 0.0.0.0 255.255.255.255 area 0
R1(config-router)#

```

next

```
R2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R2(config)#router rip
R2(config-router)#version 2
R2(config-router)#network 3.16.128.0
R2(config-router)#network 3.17.0.0
R2(config-router)#network 3.17.128.0
R2(config-router)#[ ]
```





```

conf t
router rip
version 2
network 3.17.0.0
network 3.16.128.0
network 3.18.128.0
do wr

```

```

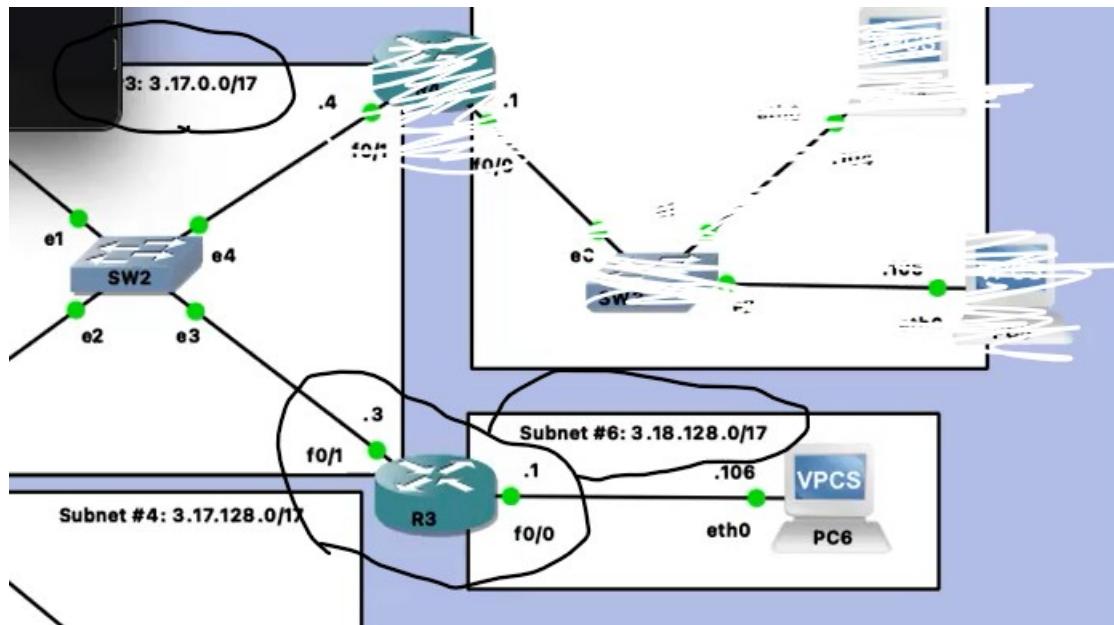
R2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R2(config)#router rip
R2(config-router)#version 2
R2(config-router)#network 3.17.0.0
R2(config-router)#network 3.16.128.0
R2(config-router)#network 3.18.128.0
R2(config-router)#do wr
Building configuration...
[OK]
R2(config-router)#

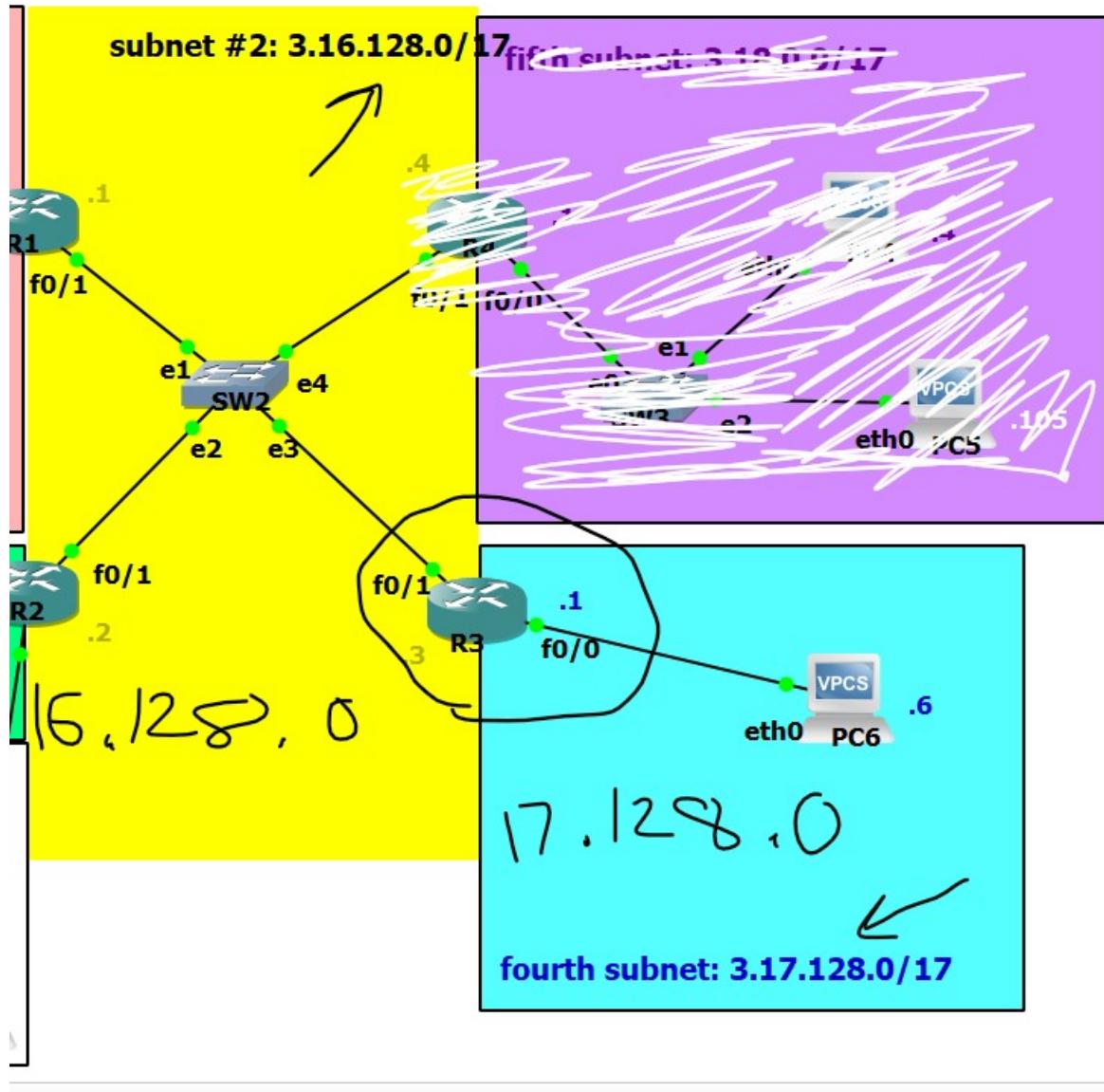
```

next

```
R3(config)#router rip
R3(config-router)#version ?
<1-2> rip version 1 or 2

R3(config-router)#version 2
R3(config-router)#network 3.17.0.0
R3(config-router)#network 3.18.128.0
R3(config-router)#[
```





```

conf t
router rip
version 2
network 3.16.128.0
network 3.17.128.0
do wr

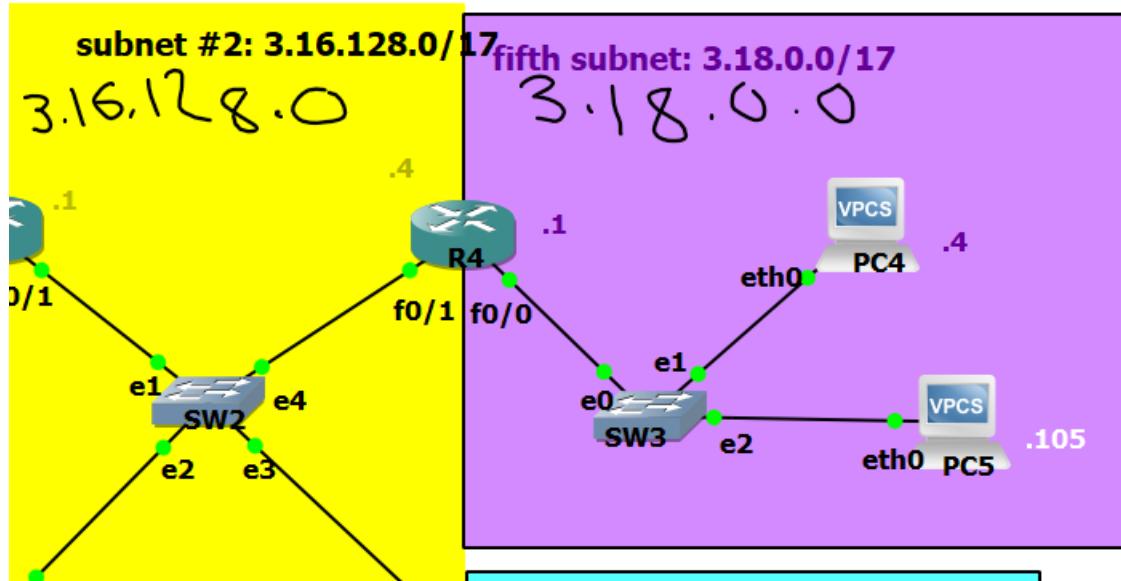
```

```

R3#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R3(config)#router rip
R3(config-router)#version 2
R3(config-router)#network 3.16.128.0
R3(config-router)#network 3.17.128.0
R3(config-router)#do wr
Building configuration...
[OK]

```

next



```

conf t
router rip
version 2
network 3.16.128.0
network 3.18.0.0
do wr

```

```
R4#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R4(config)#router rip
R4(config-router)#version 2
R4(config-router)#network 3.16.128.0
R4(config-router)#network 3.18.0.0
R4(config-router)#do wr
Building configuration...
[OK]
```

next

```
R1(config)#do sh ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2
      i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
      ia - IS-IS inter area, * - candidate default, U - per-user static route
      o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

      3.0.0.0/17 is subnetted, 6 subnets
S        3.18.0.0 [1/0] via 3.16.128.4
S        3.17.0.0 [1/0] via 3.16.128.2
C        3.16.0.0 is directly connected, FastEthernet0/0
S        3.18.128.0 [1/0] via 3.16.128.2
S        3.17.128.0 [1/0] via 3.16.128.3
C        3.16.128.0 is directly connected, FastEthernet0/1
```

```
R2(config)#do sh ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2
      i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
      ia - IS-IS inter area, * - candidate default, U - per-user static route
      o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

      3.0.0.0/17 is subnetted, 6 subnets
S        3.18.0.0 [1/0] via 3.16.128.4
C        3.17.0.0 is directly connected, FastEthernet0/0
S        3.16.0.0 [1/0] via 3.16.128.1
C        3.18.128.0 is directly connected, FastEthernet1/0
S        3.17.128.0 [1/0] via 3.16.128.3
C        3.16.128.0 is directly connected, FastEthernet0/1
```

```
R3(config)#do sh ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2
      i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
      ia - IS-IS inter area, * - candidate default, U - per-user static route
      o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

  3.0.0.0/17 is subnetted, 6 subnets
S    3.18.0.0 [1/0] via 3.16.128.4
S    3.17.0.0 [1/0] via 3.16.128.2
S    3.16.0.0 [1/0] via 3.16.128.1
S    3.18.128.0 [1/0] via 3.16.128.2
C    3.17.128.0 is directly connected, FastEthernet0/0
C    3.16.128.0 is directly connected, FastEthernet0/1
```

```
R4(config)#do sh ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2
      i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
      ia - IS-IS inter area, * - candidate default, U - per-user static route
      o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

  3.0.0.0/17 is subnetted, 6 subnets
C    3.18.0.0 is directly connected, FastEthernet0/0
S    3.17.0.0 [1/0] via 3.16.128.2
S    3.16.0.0 [1/0] via 3.16.128.1
S    3.18.128.0 [1/0] via 3.16.128.2
S    3.17.128.0 [1/0] via 3.16.128.3
C    3.16.128.0 is directly connected, FastEthernet0/1
```

timestamp around 39:44

R1#route show

```
% Invalid input detected at '^' marker.
```

R1#sh ip route

Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 - OSPF external type 2
i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
ia - IS-IS inter area, * - candidate default, U - per-user static route
o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

3.0.0.0/17 is subnetted, 6 subnets

S 3.18.0.0 [1/0] via 3.16.128.4

S 3.17.0.0 [1/0] via 3.16.128.2

C 3.16.0.0 is directly connected, FastEthernet0/0

S 3.18.128.0 [1/0] via 3.16.128.2

S 3.17.128.0 [1/0] via 3.16.128.3

C 3.16.128.0 is directly connected, FastEthernet0/1

for [1/0] I administrative j.S karile

R1#

next

Terminal Shell Edit View Window Help

hernan - R1 - telnet localhost 15002 - 78x29

```
S 3.18.0.0 [1/0] via 3.17.0.4
C 3.17.0.0 is directly connected, FastEthernet0/1
C 3.16.0.0 is directly connected, FastEthernet0/0
S 3.18.128.0 [1/0] via 3.17.0.3
S 3.17.128.0 [1/0] via 3.17.0.2
S 3.16.128.0 [1/0] via 3.17.0.2
R1(config-router)#do sh ip cef
Prefix Next Hop Interface
0.0.0.0/0 drop Null0 (default route handler entry)
0.0.0.0/32 receive
3.16.0.0/17 attached FastEthernet0/0
3.16.0.0/32 receive
3.16.0.1/32 receive
3.16.127.255/32 receive
3.16.128.0/17 3.17.0.2 FastEthernet0/1
3.17.0.0/17 attached FastEthernet0/1
3.17.0.0/32 receive
3.17.0.1/32 receive
3.17.0.2/32 3.17.0.2 FastEthernet0/1
3.17.0.3/32 3.17.0.3 FastEthernet0/1
3.17.0.4/32 3.17.0.4 FastEthernet0/1
3.17.127.255/32 receive
3.17.128.0/17 3.17.0.2 FastEthernet0/1
3.18.0.0/17 3.17.0.4 FastEthernet0/1
3.18.128.0/17 3.17.0.3 drop
224.0.0.0/24 receive
224.0.0.0/24 receive
255.255.255.255/32 receive
R1(config-router)#do sh ip [
```

CPSC456-May-5-2022

0:51:19 10 30 18/23 13:36

```
R1#sh ip cef
Prefix          Next Hop           Interface
0.0.0.0/0       drop              Null0 (default route handler entry)
0.0.0.0/32      receive
3.16.0.0/17     attached
3.16.0.0/32     receive
3.16.0.1/32     receive
3.16.0.3/32     3.16.0.3        FastEthernet0/0
3.16.127.255/32 receive
3.16.128.0/17   attached
3.16.128.0/32   receive
3.16.128.1/32   receive
3.16.128.2/32   3.16.128.2      FastEthernet0/1
3.16.128.3/32   3.16.128.3      FastEthernet0/1
3.16.128.4/32   3.16.128.4      FastEthernet0/1
3.16.255.255/32 receive
3.17.0.0/17     3.16.128.2      FastEthernet0/1
3.17.128.0/17   3.16.128.3      FastEthernet0/1
3.18.0.0/17     3.16.128.4      FastEthernet0/1
3.18.128.0/17   3.16.128.2      FastEthernet0/1
224.0.0.0/4     drop
224.0.0.0/24     receive
255.255.255.255/32 receive
R1#
```

show the ip's routes and hop information

cef = CEF (is an acronym)

cisco express forwarding

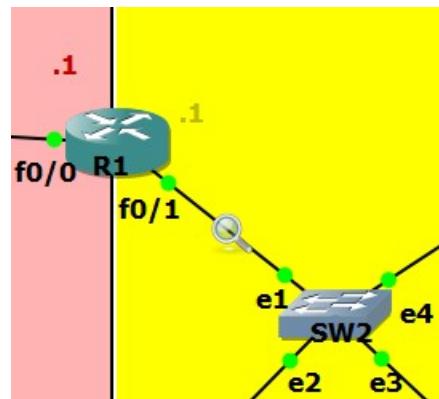
next

```
R1#sh ip protocol
Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 1.1.1.1
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    0.0.0.0 255.255.255.255 area 0
  Reference bandwidth unit is 100 mbps
  Routing Information Sources:
    Gateway          Distance      Last Update
    1.1.1.1           110          00:22:45
  Distance: (default is 110)

  Routing Protocol is "rip"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Sending updates every 30 seconds, next due in 15 seconds
  Invalid after 180 seconds, hold down 180, flushed after 240
  Redistributing: rip
  Default version control: send version 2, receive version 2
    Interface          Send   Recv Triggered RIP  Key-chain
    FastEthernet0/0      2       2
--More--
```

```
Routing Protocol is "rip"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Sending updates every 30 seconds, next due in 15 seconds
  Invalid after 180 seconds, hold down 180, flushed after 240
  Redistributing: rip
  Default version control: send version 2, receive version 2
    Interface          Send   Recv Triggered RIP  Key-chain
    FastEthernet0/0      2       2
    FastEthernet0/1      2       2
  Automatic network summarization is in effect
  Maximum path: 4
  Routing for Networks:
    3.0.0.0
  Routing Information Sources:
    Gateway          Distance      Last Update
    3.16.128.3        120          00:00:28
    3.16.128.2        120          00:00:21
    3.16.128.4        120          00:00:24
  Distance: (default is 120)
```

sh ip protocol



Capturing from - [R1 FastEthernet0/1 to SW2 Ethernet1]

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	3.16.128.1	224.0.0.5	OSPF	90	Hello Packet
2	3.032180	c2:01:22:16:00:01	c2:01:22:16:00:01	LOOP	60	Reply
3	4.451081	3.16.128.1	224.0.0.9	RIPv2	66	Response
4	7.901288	3.16.128.3	224.0.0.9	RIPv2	66	Response
5	10.051364	3.16.128.1	224.0.0.5	OSPF	90	Hello Packet
6	13.020403	c2:01:22:16:00:01	c2:01:22:16:00:01	LOOP	60	Reply
7	13.163862	3.16.128.2	224.0.0.9	RIPv2	86	Response
8	16.275379	3.16.128.4	224.0.0.9	RIPv2	66	Response
9	20.008626	3.16.128.1	224.0.0.5	OSPF	90	Hello Packet
10	23.002343	c2:01:22:16:00:01	c2:01:22:16:00:01	LOOP	60	Reply

next

1	0.000000	3.16.128.1	224.0.0.5	OSPF	90 Hello Packet
2	3.032180	c2:01:22:16:00:01	c2:01:22:16:00:01	LOOP	60 Reply
3	4.451081	3.16.128.1	224.0.0.9	RIPv2	66 Response
4	7.901288	3.16.128.3	224.0.0.9	RIPv2	66 Response
5	10.051364	3.16.128.1	224.0.0.5	OSPF	90 Hello Packet
6	13.020403	c2:01:22:16:00:01	c2:01:22:16:00:01	LOOP	60 Reply
7	13.163862	3.16.128.2	224.0.0.9	RIPv2	86 Response
8	16.275379	3.16.128.4	224.0.0.9	RIPv2	66 Response
9	20.008626	3.16.128.1	224.0.0.5	OSPF	90 Hello Packet
10	23.002343	c2:01:22:16:00:01	c2:01:22:16:00:01	LOOP	60 Reply
11	30.021933	3.16.128.1	224.0.0.5	OSPF	90 Hello Packet
12	31.021211	3.16.128.1	224.0.0.9	RIPv2	66 Response

Frame 1: 90 bytes on wire (720 bits), 90 bytes captured (720 bits) on interface -, id 0

Interface id: 0 (-)

Interface name: -

Encapsulation type: Ethernet (1)

Arrival Time: May 17, 2022 18:29:11.932444000 Pacific Daylight Time

[Time shift for this packet: 0.000000000 seconds]

Epoch Time: 1652837351.932444000 seconds

[Time delta from previous captured frame: 0.000000000 seconds]

[Time delta from previous displayed frame: 0.000000000 seconds]

[Time since reference or first frame: 0.000000000 seconds]

Frame Number: 1

Frame Length: 90 bytes (720 bits)

Capture Length: 90 bytes (720 bits)

[Frame is marked: False]

[Frame is ignored: False]

[Protocols in frame: eth:ethertype:ip:ospf]

[Coloring Rule Name: Routing]

[Coloring Rule String: hsrp || eigrp || ospf || bgp || cdp || vrrp || carp || gvrp || igmp || ismp]

OSPF

12.21.021211	3.16.128.1	224.0.0.0	RIPv2	66 Response
> Frame 1: 90 bytes on wire (720 bits), 90 bytes captured (720 bits) on interface -, id 0				
Ethernet II, Src: c2:01:22:16:00:01 (c2:01:22:16:00:01), Dst: IPv4mcast_05 (01:00:5e:00:00:05)				
Destination: IPv4mcast_05 (01:00:5e:00:00:05)				
Address: IPv4mcast_05 (01:00:5e:00:00:05)				
.... .0. = LG bit: Globally unique address (factory default)				
.... .1. = IG bit: Group address (multicast/broadcast)				
Source: c2:01:22:16:00:01 (c2:01:22:16:00:01)				
Address: c2:01:22:16:00:01 (c2:01:22:16:00:01)				
.... .1. = LG bit: Locally administered address (this is NOT the factory default)				
.... .0. = IG bit: Individual address (unicast)				
Type: IPv4 (0x0800)				
> Internet Protocol Version 4, Src: 3.16.128.1, Dst: 224.0.0.5				
> Open Shortest Path First				

OSPF

```

> Frame 1: 90 bytes on wire (720 bits), 90 bytes captured (720 bits) on interface -, id 0
> Ethernet II, Src: c2:01:22:16:00:01 (c2:01:22:16:00:01), Dst: IPv4mcast_05 (01:00:5e:00:00:05)
  Internet Protocol Version 4, Src: 3.16.128.1, Dst: 224.0.0.5
    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
    Differentiated Services Field: 0xc0 (DSCP: CS6, ECN: Not-ECT)
      1100 00.. = Differentiated Services Codepoint: Class Selector 6 (48)
      .... ..00 = Explicit Congestion Notification: Not ECN-Capable Transport (0)
    Total Length: 76
    Identification: 0x01b9 (441)
    Flags: 0x00
      0... .... = Reserved bit: Not set
      .0... .... = Don't fragment: Not set
      ..0. .... = More fragments: Not set
    Fragment Offset: 0
    Time to Live: 1
    Protocol: OSPF IGP (89)
    Header Checksum: 0x53ca [validation disabled]
    [Header checksum status: Unverified]
    Source Address: 3.16.128.1
    Destination Address: 224.0.0.5
  Open Shortest Path First

```

OSPF

```
0000 01 00 5e 00 00 05 c2 01 22 16 00 01 08 00 45 c0 ...^..... "....E.
```

12.21.0217.11	3.16.128.1	224.0.0.5	ROUTER	66 Response
<				
> Frame 1: 90 bytes on wire (720 bits), 90 bytes captured (720 bits) on interface -, id 0				
> Ethernet II, Src: c2:01:22:16:00:01 (c2:01:22:16:00:01), Dst: IPv4mcast_05 (01:00:5e:00:00:05)				
> Internet Protocol Version 4, Src: 3.16.128.1, Dst: 224.0.0.5				
Open Shortest Path First				
> OSPF Header				
> OSPF Hello Packet				
> OSPF LLS Data Block				

OSPF

```
> Frame 1: 90 bytes on wire (720 bits), 90 bytes
> Ethernet II, Src: c2:01:22:16:00:01 (c2:01:22:16:00:01)
> Internet Protocol Version 4, Src: 3.16.128.1,
< Open Shortest Path First
  < OSPF Header
    Version: 2
    Message Type: Hello Packet (1)
    Packet Length: 44
    Source OSPF Router: 1.1.1.1
    Area ID: 0.0.0.0 (Backbone)
    Checksum: 0xe68b [correct]
    Auth Type: Null (0)
    Auth Data (none): 0000000000000000
  > OSPF Hello Packet
  > OSPF LLS Data Block
```

```
12.21.82.1.11 2.16.128.1 224.0.0.0 RTOV
<
> Frame 1: 90 bytes on wire (720 bits), 90 bytes captured (720 bits)
> Ethernet II, Src: c2:01:22:16:00:01 (c2:01:22:16:00:01), Dst: IPv4mcast (224.0.0.0)
> Internet Protocol Version 4, Src: 3.16.128.1, Dst: 224.0.0.5
< Open Shortest Path First
  > OSPF Header
    < OSPF Hello Packet
      Network Mask: 255.255.128.0
      Hello Interval [sec]: 10
      < Options: 0x12, (L) LLS Data block, (E) External Routing
        0.... .... = DN: Not set
        .0... .... = O: Not set
        ..0. .... = (DC) Demand Circuits: Not supported
        ...1 .... = (L) LLS Data block: Present
        .... 0... = (N) NSSA: Not supported
        .... .0.. = (MC) Multicast: Not capable
        .... ..1. = (E) External Routing: Capable
        .... ...0 = (MT) Multi-Topology Routing: No
      Router Priority: 1
      Router Dead Interval [sec]: 40
      Designated Router: 3.16.128.1
      Backup Designated Router: 0.0.0.0
    > OSPF LLS Data Block
```

```

> Frame 1: 90 bytes on wire (720 bits), 90 bytes captured (720 bits) on interface -, id 0
> Ethernet II, Src: c2:01:22:16:00:01 (c2:01:22:16:00:01), Dst: IPv4mcast_05 (01:00:5e:00:00:05)
> Internet Protocol Version 4, Src: 3.16.128.1, Dst: 224.0.0.5
  ▼ Open Shortest Path First
    > OSPF Header
    > OSPF Hello Packet
    ▼ OSPF LLS Data Block
      Checksum: 0xffff6
      LLS Data Length: 12 bytes
      ▼ Extended options TLV
        TLV Type: 1
        TLV Length: 4
        ▼ Options: 0x00000001, (LR) LSDB Resynchronization
          .... .... .... .... .... ..0. = (RS) Restart Signal: Not set
          .... .... .... .... .... ..1 = (LR) LSDB Resynchronization: Set

```

Frame Number	Source IP	Destination IP	Protocol	Description
3 4.451081	3.16.128.1	224.0.0.9	RIPv2	66 Response
4 7.901288	3.16.128.3	224.0.0.9	RIPv2	66 Response
5 10.051364	3.16.128.1	224.0.0.5	OSPF	90 Hello Packet
6 13.020403	c2:01:22:16:00:01	c2:01:22:16:00:01	LOOP	60 Reply
7 13.163862	3.16.128.2	224.0.0.9	RIPv2	86 Response
8 16.275379	3.16.128.4	224.0.0.9	RIPv2	66 Response
9 20.008626	3.16.128.1	224.0.0.5	OSPF	90 Hello Packet
10 23.002343	c2:01:22:16:00:01	c2:01:22:16:00:01	LOOP	60 Reply
11 30.021933	3.16.128.1	224.0.0.5	OSPF	90 Hello Packet
12 34.021711	3.16.128.1	224.0.0.0	RIPv2	66 Response

Frame 3: 66 bytes on wire (528 bits), 66 bytes captured (528 bits) on interface -, id 0

- Interface id: 0 (-)
- Interface name: -
- Encapsulation type: Ethernet (1)
- Arrival Time: May 17, 2022 18:29:16.383525000 Pacific Daylight Time
- [Time shift for this packet: 0.000000000 seconds]
- Epoch Time: 1652837356.383525000 seconds
- [Time delta from previous captured frame: 1.418901000 seconds]
- [Time delta from previous displayed frame: 1.418901000 seconds]
- [Time since reference or first frame: 4.451081000 seconds]
- Frame Number: 3
- Frame Length: 66 bytes (528 bits)
- Capture Length: 66 bytes (528 bits)
- [Frame is marked: False]
- [Frame is ignored: False]
- [Protocols in frame: eth:etherype:ip:udp:rip]
- [Coloring Rule Name: TTL low or unexpected]
- [Coloring Rule String: (! ip.dst == 224.0.0.0/4 && ip.ttl < 5 && ! ipm && ! ospf) || (ip.dst == 224.0.0.0/24 && ip.dst != 224.0.0.251 && ip.ttl != 1 && !(vrrp || carp))]

Ethernet II, Src: c2:01:22:16:00:01 (c2:01:22:16:00:01), Dst: IPv4mcast_09 (01:00:5e:00:00:09)

Internet Protocol Version 4, Src: 3.16.128.1, Dst: 224.0.0.9

User Datagram Protocol, Src Port: 520, Dst Port: 520

Routing Information Protocol

RIPv2

Frame 3: 66 bytes on wire (528 bits), 66 bytes captured (528 bits) on interface -, id 0

Ethernet II, Src: c2:01:22:16:00:01 (c2:01:22:16:00:01), Dst: IPv4mcast_09 (01:00:5e:00:00:09)

- Destination: IPv4mcast_09 (01:00:5e:00:00:09)
- Address: IPv4mcast_09 (01:00:5e:00:00:09)
-0. = LG bit: Globally unique address (factory default)
-1. = IG bit: Group address (multicast/broadcast)
- Source: c2:01:22:16:00:01 (c2:01:22:16:00:01)
- Address: c2:01:22:16:00:01 (c2:01:22:16:00:01)
-1. = LG bit: Locally administered address (this is NOT the factory default)
-0. = IG bit: Individual address (unicast)
- Type: IPv4 (0x0800)

Internet Protocol Version 4, Src: 3.16.128.1, Dst: 224.0.0.9

User Datagram Protocol, Src Port: 520, Dst Port: 520

Routing Information Protocol

RIPv2

```
Internet Protocol Version 4, Src: 3.16.128.1, Dst: 224.0.0.9
    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
    Differentiated Services Field: 0xc0 (DSCP: CS6, ECN: Not-ECT)
        1100 00.. = Differentiated Services Codepoint: Class Selector 6 (48)
        .... ..00 = Explicit Congestion Notification: Not ECN-Capable Transport (0)
    Total Length: 52
    Identification: 0x0000 (0)
    Flags: 0x00
        0... .... = Reserved bit: Not set
        .0... .... = Don't fragment: Not set
        ..0. .... = More fragments: Not set
    Fragment Offset: 0
    Time to Live: 2
        [Expert Info (Note/Sequence): "Time To Live" != 1 for a packet sent to the Local Network Control Block (see RFC 3171)]
            ["Time To Live" != 1 for a packet sent to the Local Network Control Block (see RFC 3171)]
            [Severity level: Note]
            [Group: Sequence]
    Protocol: UDP (17)
    Header Checksum: 0x54df [validation disabled]
    [Header checksum status: Unverified]
    Source Address: 3.16.128.1
    Destination Address: 224.0.0.9
```

RIPv2

```
Frame 3: 66 bytes on wire (528 bits), 66 bytes captured (528 bits) on interface -, id 0
Ethernet II, Src: c2:01:22:16:00:01 (c2:01:22:16:00:01), Dst: IPv4mcast_09 (01:00:5e:00:00:09)
Internet Protocol Version 4, Src: 3.16.128.1, Dst: 224.0.0.9
User Datagram Protocol, Src Port: 520, Dst Port: 520
    Source Port: 520
    Destination Port: 520
    Length: 32
    Checksum: 0x136e [unverified]
    [Checksum Status: Unverified]
    [Stream index: 0]
    [Timestamps]
        [Time since first frame: 0.000000000 seconds]
        [Time since previous frame: 0.000000000 seconds]
    UDP payload (24 bytes)
Routing Information Protocol
```

RIPv2

```
> Frame 3: 66 bytes on wire (528 bits), 66 b
> Ethernet II, Src: c2:01:22:16:00:01 (c2:01
> Internet Protocol Version 4, Src: 3.16.128
> User Datagram Protocol, Src Port: 520, Dst
▽ Routing Information Protocol
    Command: Response (2)
    Version: RIPv2 (2)
    ▽ IP Address: 3.16.0.0, Metric: 1
        Address Family: IP (2)
        Route Tag: 0
        IP Address: 3.16.0.0
        Netmask: 255.255.128.0
        Next Hop: 0.0.0.0
        Metric: 1
```

RIPv2