# Lab 4.1.2.0 – Introduction to Wireshark

**This lab has been updated for use on NETLAB+.**
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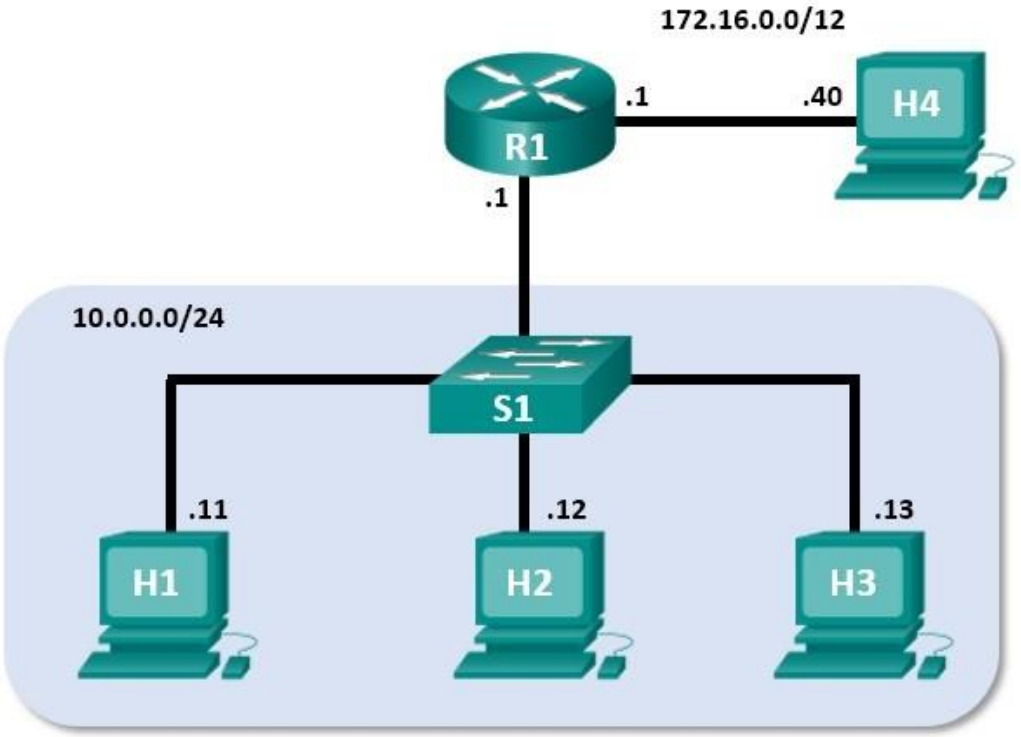
## Mininet Topology




## Objectives

**Part 1: Install and Verify the Mininet Topology**

**Part 2: Capture and Analyze ICMP Data in Wireshark**

## Background / Scenario

The *CyberOps* VM includes a *Python* script that, when you run it, will set up and configure the devices shown in the figure above. You will then have access to four hosts, a switch, and a router inside your one VM. This will allow you to simulate a variety of network protocols and services without having to configure a physical network of devices. For example, in this lab you will use the **ping** command between two hosts in the *Mininet Topology* and capture those pings with Wireshark.

Wireshark is a software protocol analyzer, or "packet sniffer" application, used for network troubleshooting, analysis, software and protocol development, and education. As data streams travel over the network, the sniffer "captures" each protocol data unit (PDU) and can decode and analyze its content according to the appropriate RFC or other specifications.

Wireshark is a useful tool for anyone working with networks for data analysis and troubleshooting. You will use Wireshark to capture ICMP data packets.

# Part 1: Install and Verify the Mininet Topology

In this part, you will use a *Python* script to set up the *Mininet Topology* inside the *CyberOps* VM. You will then record the IP and MAC addresses for **H1** and **H2**.

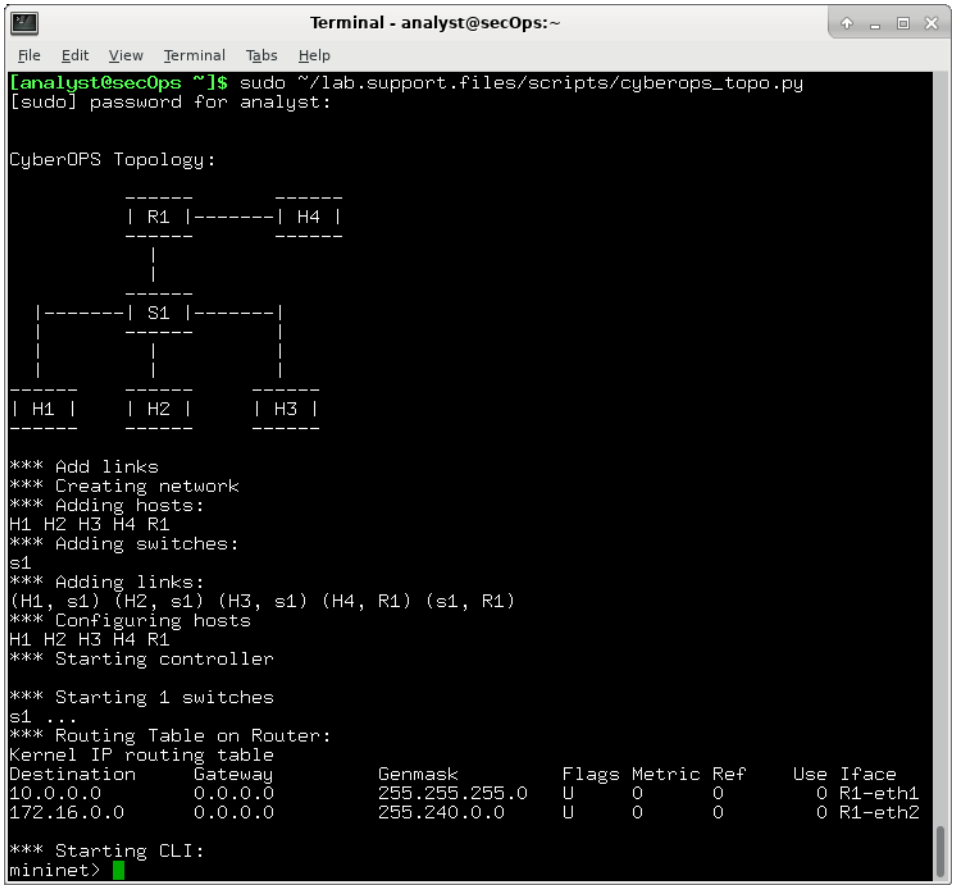
## Step 1: Verify your PC's interface addresses.

Launch the **CyberOps Workstation** VM. Log on to the **CyberOps Workstation** VM as the `analyst`, using the password `cyberops` and open a **terminal** window.

## Step 2: Run the Python script to install the Mininet Topology.

At the command prompt, start **mininet** and enter the following command. When prompted, enter `cyberops` as the password.

```
[analyst@secOps ~]$ sudo ~/lab.support.files/scripts/cyberops_topo.py
[sudo] password for analyst:
```



## Step 3: Record IP and MAC addresses for H1 and H2.

a. At the *mininet* prompt, start terminal windows on hosts **H1** and **H2**. This will open separate windows for these hosts. Each host will have its own separate configuration for the network including unique IP and MAC addresses.

```
*** Starting CLI:
mininet> xterm H1
mininet> xterm H2
```

b. At the prompt on **Node: H1**, enter `ifconfig` to verify the IPv4 address and record the MAC address. Do the same for **Node: H2**. The IPv4 address and MAC address are highlighted below for reference.

```
[root@secOps analyst]# ifconfig
H1-eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.0.0.11  netmask 255.255.255.0  broadcast 10.0.0.255
        inet6 fe80::2c69:4dff:febb:a219  prefixlen 64  scopeid 0x20<link>
        ether 26:3a:45:65:75:23  txqueuelen 1000  (Ethernet)
        RX packets 152  bytes 13036 (12.7 KiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 107  bytes 9658 (9.4 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

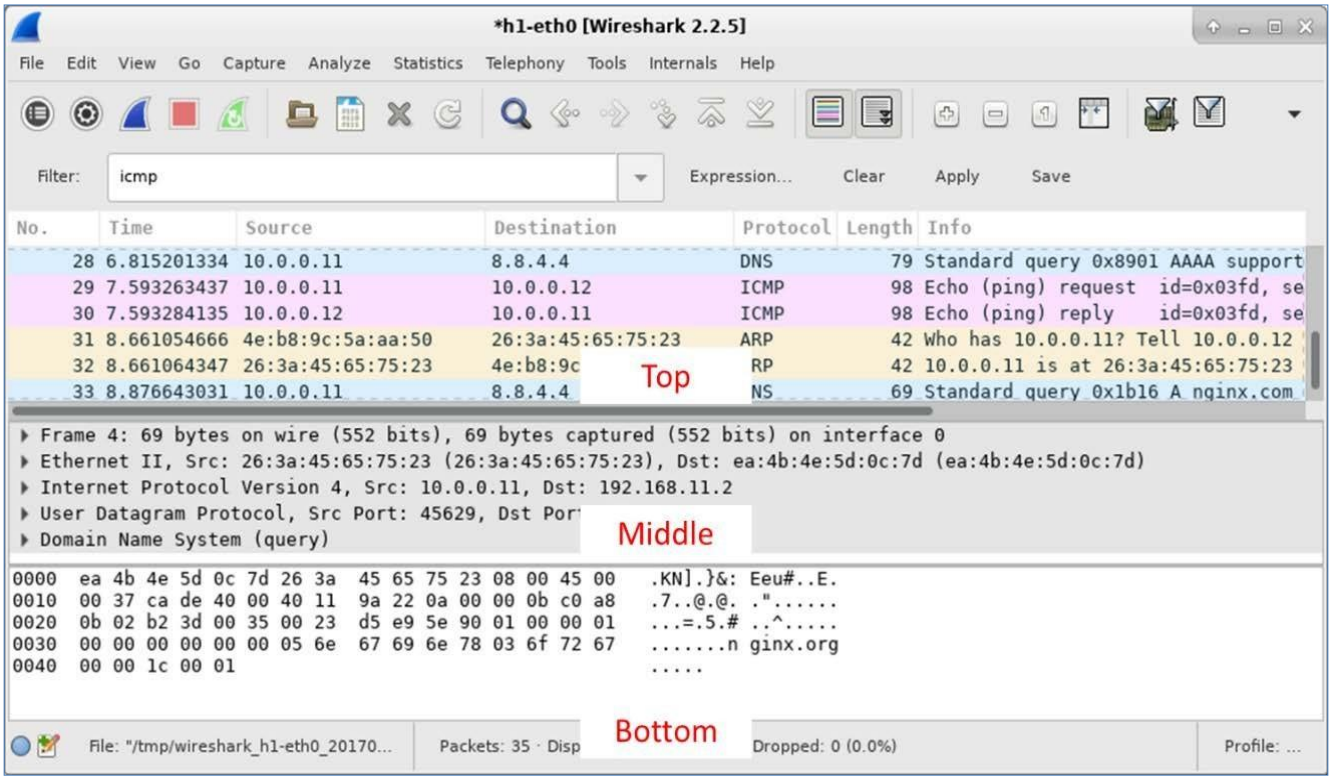
| Host-interface | IP Address | MAC Address |
|---|---|---|
| H1-eth0 | 10.0.0.11 | ca:4c:74:76:cc:6c |
| H2-eth0 | 10.0.0.12 | 2a:ab:b7:f5:ee:98 |

# Part 2: Capture and Analyze ICMP Data in Wireshark

In this part, you will ping between two hosts in the *Mininet* and capture *ICMP* requests and replies in *Wireshark*. You will also look inside the captured *PDUs* for specific information. This analysis should help to clarify how packet headers are used to transport data to the destination.

## Step 1: Examine the captured data on the same LAN.

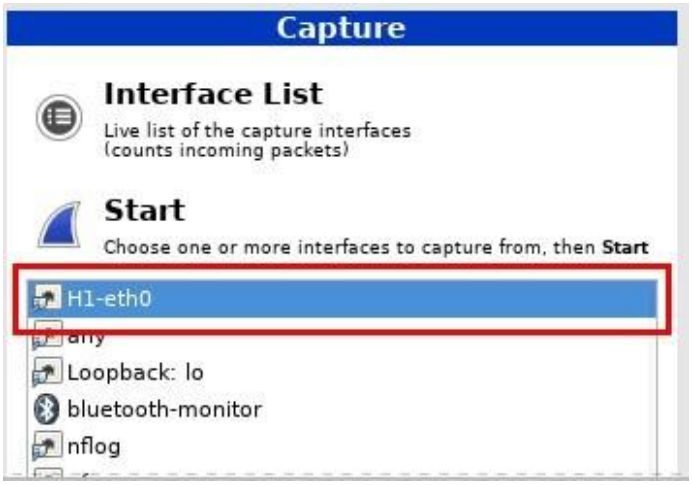
In this step, you will examine the data that was generated by the ping requests of your team member's PC. Wireshark data is displayed in three sections: 1) The top section displays the list of PDU frames captured with a summary of the IP packet information listed, 2) the middle section lists *PDU* information for the frame selected in the top part of the screen and separates a captured *PDU* frame by its protocol layers, and 3) the bottom section displays the raw data of each layer. The raw data is displayed in both hexadecimal and decimal form.




a. On **Node: H1**, enter **wireshark-gtk &** to start **Wireshark** (The pop-up warning is not important for this lab.). Click **OK** to continue.

```
[root@secOps]# wireshark-gtk &
[1] 1552
[root@secOps ~]#
** (wireshark-gtk:1552): WARNING **: Couldn't connect to accessibility bus: Failed to connect to socket /tmp/dbus-f0dFz9baYA: Connection refused
Gtk-Message: GtkDialog mapped without a transient parent. This is discouraged.
```

b. In the *Wireshark* window, under the *Capture* heading, select the **H1-eth0** interface. Click **Start** to capture the data traffic.




c. On **Node: H1**, press the **Enter** key, if necessary, to get a prompt. Then type **ping -c 5 10.0.0.12** to ping H2 five times. The command option **-c** specifies the count or number of pings. The **5** specifies that five pings should be sent. The pings will all be successful.

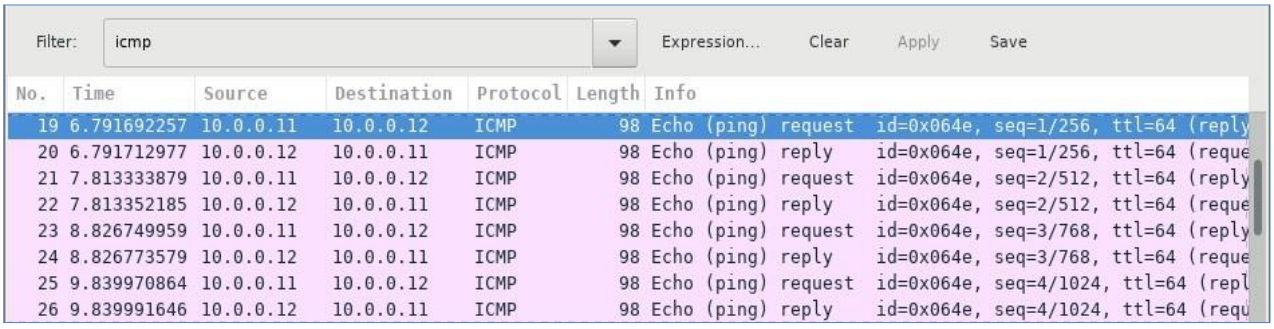
```
[root@secOps analyst]# ping -c 5 10.0.0.12
```

d. Navigate to the **Wireshark** window, click **Stop** to stop the packet capture.

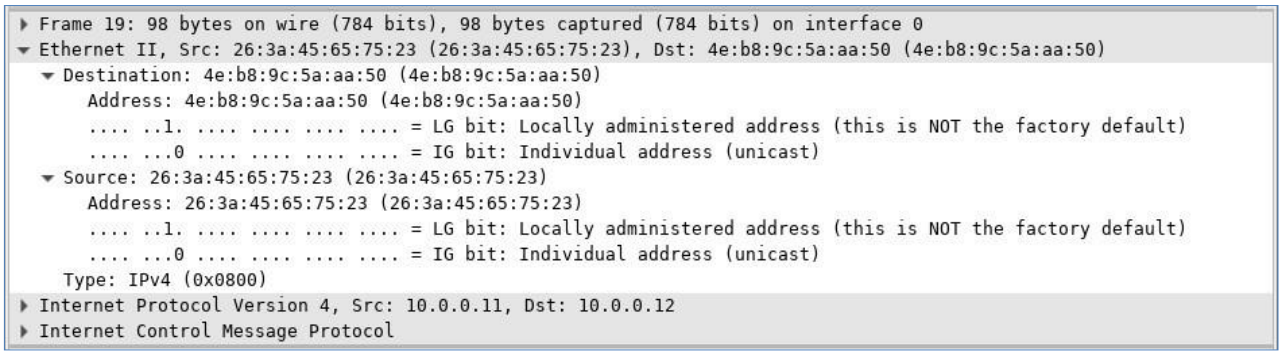
e. A filter can be applied to display only the interested traffic.

Type `icmp` in the **Filter** field and click **Apply**.

f. If necessary, click the first **ICMP request** PDU frames in the top section of *Wireshark*. Notice that the *Source* column has *H1's* IP address, and the *Destination* column has *H2's* IP address.



g. With this PDU frame still selected in the top section, navigate to the middle section. Click the arrow to the left of the Ethernet II row to view the Destination and Source MAC addresses.
**Note**: You may need to resize the bottom portion of the Wireshark window.




Does the *Source MAC* address match H1's interface? Yes

Does the *Destination MAC* address in Wireshark match H2's MAC address? Yes

**Note**: In the preceding example of a captured *ICMP* request, *ICMP* data is encapsulated inside an *IPv4* packet *PDU* (*IPv4 header*) which is then encapsulated in an *Ethernet II frame PDU* (*Ethernet II header*) for transmission on the LAN.

## Step 2: Examine the captured data on the remote LAN.

You will ping remote hosts (hosts not on the LAN) and examine the generated data from those pings. You will then determine what is different about this data from the data examined in Part 1.

a. At the *mininet* prompt, start terminal windows on hosts H4 and R1.

```
mininet> xterm H4
mininet>    xterm
R1
```

b. At the prompt on **Node: H4**, enter `ifconfig` to verify the *IPv4* address and record the MAC address. Do the same for the **Node: R1**.

```
[root@secOps analyst]# ifconfig
```

| Host-interface | IP Address | MAC Address |
|---|---|---|
| H4-eth0 | 172.16.0.40 | aa:8e:c9:9e:c0:29 |
| R1-eth1 | 10.0.0.1 | 0a:d5:dd:bc:5b:b0 |
| R1-eth2 | 172:16:0.1 | de:b8:77:08:d4:0d |

c. Start a new *Wireshark* capture on *H1* by selecting **Capture > Start**. You can also click the **Start** button or type **Ctrl-E** Click **Continue without Saving** to start a new capture.

d. *H4* is a simulated remote server. Ping **H4** from **H1**. The ping should be successful.

```
[root@secOps analyst]# ping -c 5 172.16.0.40
```

e. Review the captured data in **Wireshark**. Examine the **IP** and **MAC** addresses that you pinged. Notice that the MAC address is for the R1-eth1 interface. List the destination IP and MAC addresses.

IP: 172.16.0.40 MAC: 0a:d5:dd:bc:5b:b0

f. In the main *CyberOps* VM command prompt, enter `quit` to stop *Mininet*.

```
mininet> quit
*** Stopping 0 controllers

*** Stopping 4 terms
*** Stopping 5 links
.....
*** Stopping 1
switches s1
*** Stopping 5 hosts
H1 H2 H3 H4 R1
*** Done
```

g. To clean up all the processes that were used by Mininet, enter the **sudo mn -c** command at the prompt.

```
analyst@secOps ~]$ sudo mn -c
[sudo] password for analyst:
*** Removing excess controllers/ofprotocols/ofdatapaths/pings/noxes
killall controller ofprotocol ofdatapath ping nox_core lt-nox_core ovs-openflowd ovs-controller udpbwtest mnexec ivs 2> /dev/null
killall -9 controller ofprotocol ofdatapath ping nox_core lt-nox_core ovs-openflowd ovs-controller udpbwtest mnexec ivs 2> /dev/null
pkill -9 -f "sudo mnexec"
*** Removing junk from /tmp
rm -f /tmp/vconn* /tmp/vlogs* /tmp/*.out /tmp/*.log
*** Removing old X11 tunnels
*** Removing excess kernel datapaths
ps ax | egrep -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.
```