Lab 4.4.2.8 – Using Wireshark to Examine Ethernet Frames

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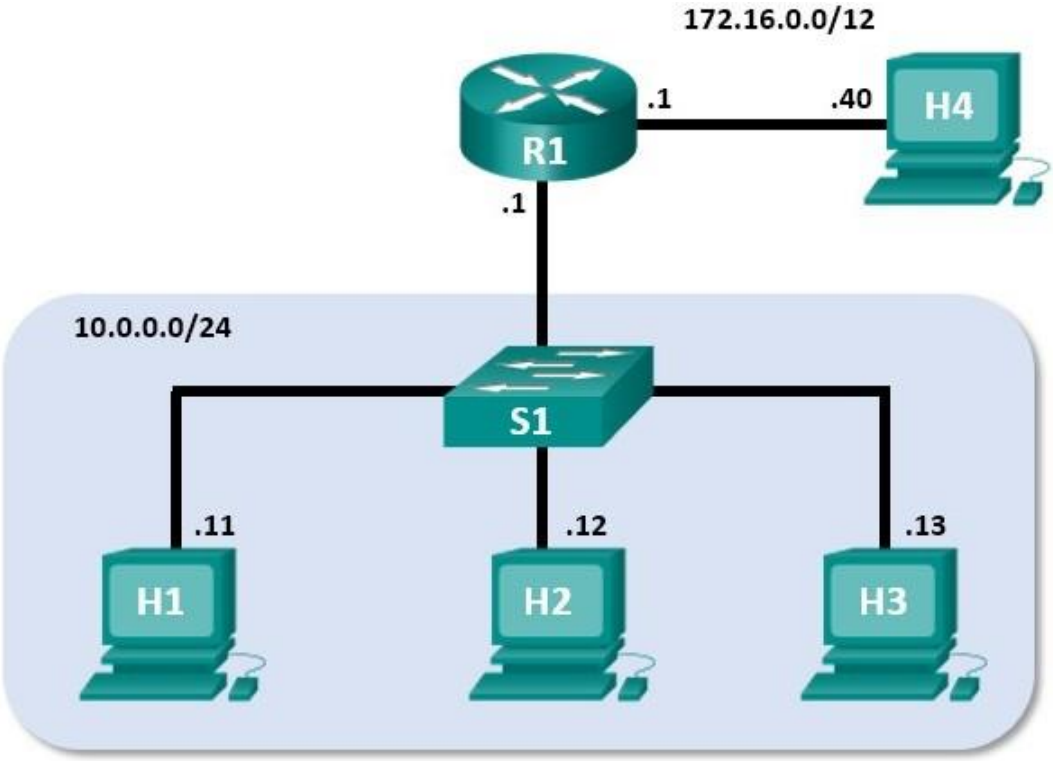
Mininet Topology



Objectives

Part 1: Examine the Header Fields in an Ethernet II Frame

Part 2: Use Wireshark to Capture and Analyze Ethernet Frames

Background / Scenario

When upper layer protocols communicate with each other, data flows down the *Open Systems Interconnection* (*OSI*) layers and is encapsulated into a *Layer 2* frame. The frame composition is dependent on the media access type. For example, if the upper layer protocols are *TCP* and *IP* and the media access is *Ethernet*, then the *Layer 2* frame encapsulation will be *Ethernet II*. This is typical for a LAN environment.

When learning about *Layer 2* concepts, it is helpful to analyze frame header information. In the first part of this lab, you will review the fields contained in an *Ethernet II* frame. In *Part 2*, you will use *Wireshark* to capture and analyze *Ethernet II* frame header fields for local and remote traffic.

Part 1: Examine the Header Fields in an Ethernet II Frame

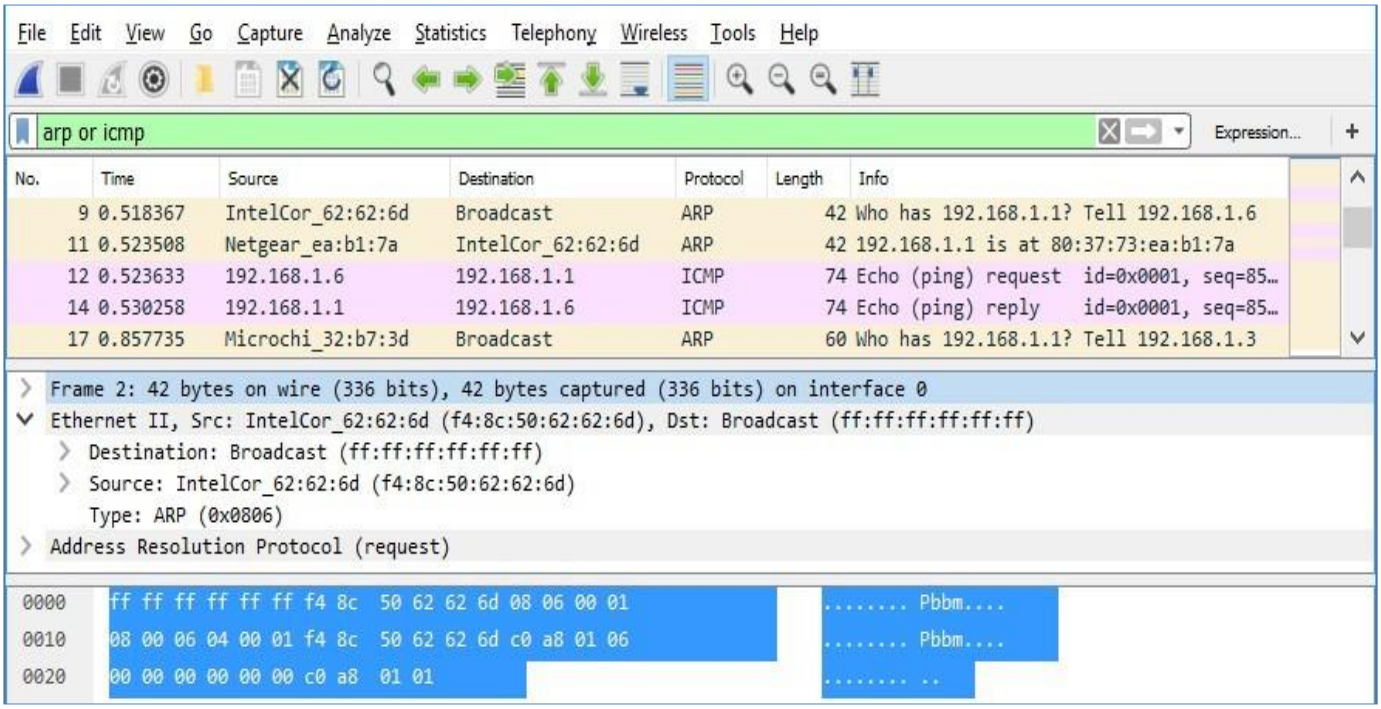
In *Part 1*, you will examine the header fields and content in an *Ethernet II Frame* provided to you. A *Wireshark* capture will be used to examine the contents in those fields.

Step 1: Review the Ethernet II header field descriptions and lengths.

Preamble	Destination Address	Source Address	Frame Type	Data	FCS
8 Bytes	6 Bytes	6 Bytes	2 Bytes	46 – 1500 Bytes	4 Bytes

Step 2: Examine Ethernet frames in a Wireshark capture.

The *Wireshark* capture below shows the packets generated by a ping being issued from a PC host to its default gateway. A filter has been applied to Wireshark to view the *ARP* and *ICMP* protocols only. The session begins with an *ARP* query for the MAC address of the gateway router, followed by four ping requests and replies.



Step 3: Examine the Ethernet II header contents of an ARP request.

The following table takes the first frame in the *Wireshark* capture and displays the data in the Ethernet II header fields.

Field	Value	Description
Preamble	Not shown in capture	This field contains synchronizing bits, processed by the NIC hardware.
Destination Address	Broadcast (ff:ff:ff:ff:ff:ff)	Layer 2 addresses for the frame. Each address is 48 bits long, or 6 octets, expressed as 12 hexadecimal digits, `0-9,A-F`. A common format is `12:34:56:78:9A:BC`. The first six hex numbers indicate the manufacturer of the network interface card (NIC), the last six hex numbers are the serial number of the NIC. The destination address may be a broadcast, which contains all ones, or a unicast. The source address is always unicast.
Source Address	IntelCor_62:62:6d (f4:8c:50:62:62:6d)	
Frame Type	0x0806	For Ethernet II frames, this field contains a hexadecimal value that is used to indicate the type of upper-layer protocol in the data field. There are numerous upper-layer protocols supported by Ethernet II. Two common frame types are: Value Description `0x0800` IPv4 Protocol `0x0806` Address resolution protocol (ARP)
Data	ARP	Contains the encapsulated upper-level protocol. The data field is between 46 – 1,500 bytes.
FCS	Not shown in capture	Frame Check Sequence, used by the NIC to identify errors during transmission. The value is computed by the sending machine, encompassing frame addresses, type, and data field. It is verified by the receiver.

What is significant about the contents of the destination address field?

The destination address is a major element of the packer header, and it identifies the recipient of the packet. In network routers to identify the packet in the network to determine packet reached destination then network routers use destination address field.

Why does the PC send out a broadcast *ARP* prior to sending the first ping request?

To determine the MAC address of the destination device of the same network before building the frame header it ping request.

What is the MAC address of the source in the first frame? MAC address of the source f4:8c:50:62:62:6d

What is the *Vendor ID* (*OUI*) of the Source's NIC? IntelCor_62:62:6d (f4:8c:50:62:62:6d)

What portion of the MAC address is the *OUI*? First 3 octets of MAC indicate the Organizationally Unique identifier **f4:8c:50**

What is the Source's NIC serial number? Source NIC serial number is 62:62:6d

Part 2: Use Wireshark to Capture and Analyze Ethernet Frames

In *Part 2*, you will use *Wireshark* to capture local and remote Ethernet frames. You will then examine the information that is contained in the frame header fields.

Step 1: Examine the network configuration of H3.

a. Start and log into your **CyberOps Workstation** using the following credentials:
Username: `analyst` Password: `cyberops`

b. Open a **terminal** to start **mininet** and enter the following command at the prompt. When prompted, enter `cyberops` as the password.

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

c. At the *mininet* prompt, start terminal windows on host **H3**.

```
*** Starting CLI:
mininet> xterm H3
```

d. At the prompt on **Node: H3**, enter `ifconfig` to verify the *IPv4* address and record the MAC address.

Host-interface	IP Address	MAC Address
H3-eth0	10.0.0.13	d6:cb:e4:ee:96:d8

e. At the prompt on **Node: H3**, enter `netstat -r` to display the default gateway information.

```
[root@secOps ~]# netstat -r
Kernel IP routing table
Destination     Gateway         Genmask         Flags   MSS Window  irtt Iface
default         10.0.0.1        0.0.0.0         UG        0 0          0 H3-
eth0
10.0.0.0        0.0.0.0         255.255.255.0   U         0 0          0 H3-eth0
```

f. What is the IP address of the default gateway for the host H3? 10.0.0.1

Step 2: Start capturing traffic on H3-eth0.

a. In the terminal window for **Node: H3**, enter `arp -n` to display the content of the *ARP* cache.

```
[root@secOps analyst]# arp -n
```

b. If there is any existing *ARP* information in the cache, clear it by enter the following command: **arp -d *IP- address***. Repeat until all the cached information has been cleared.

```
[root@secOps analyst]# arp -n
Address                  HWtype  HWaddress           Flags Mask            Iface
10.0.0.1                 ether   5a:d0:1d:01:9f:be   C                     H3-eth0

[root@secOps analyst]# arp -d 10.0.0.1
Address                  HWtype  HWaddress           Flags Mask            Iface
10.0.0.1                         (incomplete)        C                     H3-eth0
```

c. In the terminal window for **Node: H3**, open **Wireshark** and start a packet capture for *H3-eth0* interface. Click **OK** to continue past the dialog window.

```
[root@secOps analyst]# wireshark-gtk &
```

Step 3: Ping H1 from H3.

a. From the **terminal** on **H3**, press the **Enter** key to bring the prompt back and ping the default gateway and stop after send 5 echo request packets.

```
[root@secOps analyst]# ping -c 5 10.0.0.1
```

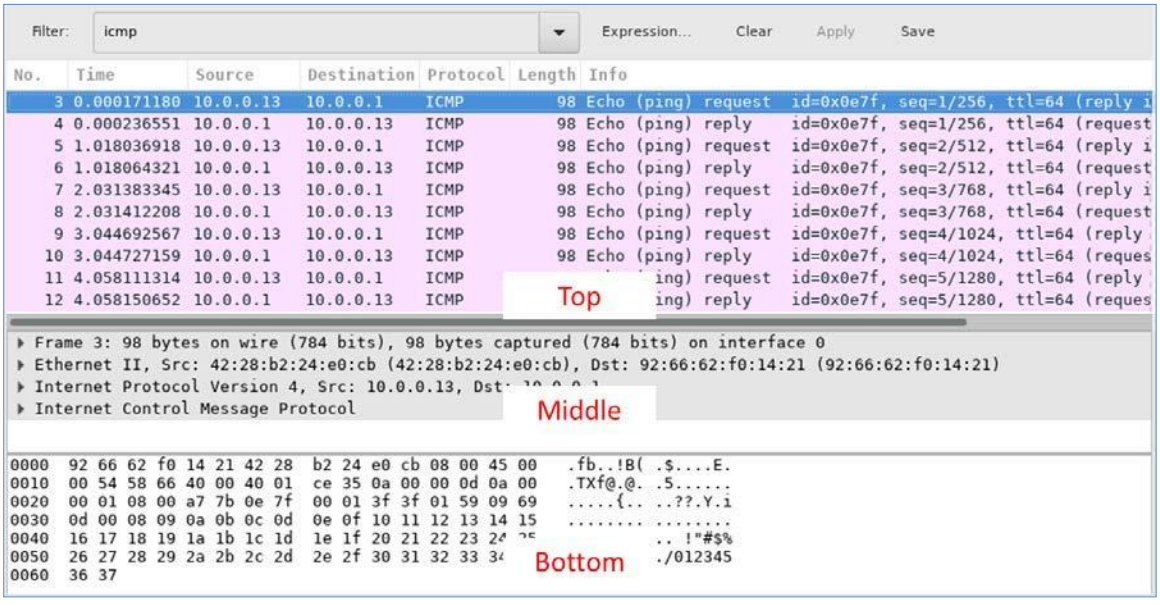
b. After the ping is completed, **stop** the *Wireshark* capture.

Step 4: Filter Wireshark to display only ICMP traffic.

Apply the **icmp** filter to the captured traffic so only *ICMP* traffic is shown in the results.

Step 5: Examine the first Echo (ping) request in Wireshark.

The *Wireshark* main window is divided into three sections: the *Packet List* pane (top), the *Packet Details* pane (middle), and the *Packet Bytes* pane (bottom). If you selected the correct interface for packet capturing in *Step 3*, Wireshark should display the ICMP information in the *Packet List* pane of Wireshark, similar to the following example. Resize the panes accordingly.



a. In the *Packet List* pane (top section), click the first frame listed. You should see **Echo (ping) request** under the **Info** heading. This should highlight the line blue.

b. Examine the first line in the *Packet Details* pane (middle section). This line displays the length of the frame; 98 bytes in this example.

c. The second line in the *Packet Details* pane shows that it is an *Ethernet II* frame. The source and destination MAC addresses are also displayed.

What is the MAC address of the PC's NIC? d6:cb:e4:ee:96:d8

What is the default gateway's MAC address? 8a:20:c5:0a:94:9a

d. You can click the arrow at the beginning of the second line to obtain more information about the *Ethernet II* frame.

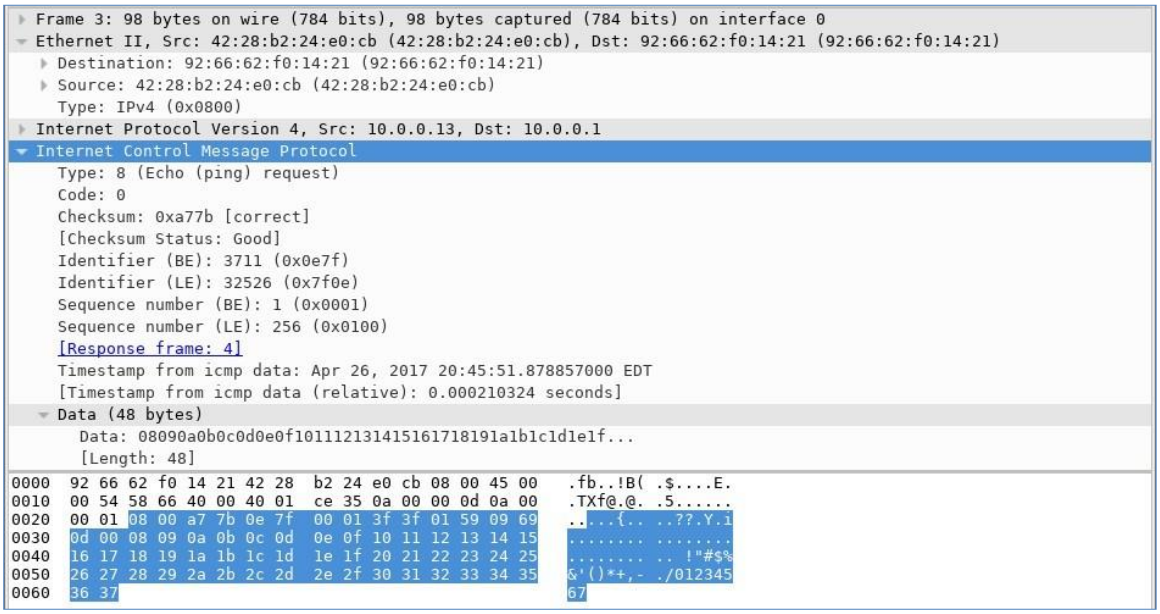
What type of frame is displayed? 0x0800

e. The last two lines displayed in the middle section provide information about the data field of the frame. Notice that the data contains the source and destination *IPv4* address information.

What is the source IP address? 10.0.0.13

What is the destination IP address? 10.0.0.1

f. You can click any line in the middle section to highlight that part of the frame (hex and ASCII) in the *Packet Bytes* pane (bottom section). Click the **Internet Control Message Protocol** line in the middle section and examine what is highlighted in the *Packet Bytes* pane.



g. Click the next frame in the top section and examine an *Echo* reply frame. Notice that the source and destination MAC addresses have reversed, because this frame was sent from the default gateway router as a reply to the first ping.

What device and MAC address is displayed as the destination address?

Host H3: d6:cb:e4:ee:96:d8

Step 6: Start a new capture in Wireshark.

a. Click the **Start Capture** icon to start a new *Wireshark* capture. You will receive a popup window asking if you would like to save the previous captured packets to a file before starting a new capture. Click **Continue without Saving**.

b. In the terminal window of **Node: H3**, press the **Enter** key to bring back the prompt and send 5 echo request packets to **172.16.0.40**

c. Stop capturing packets when the pings are completed.

Step 7: Examine the new data in the packet list pane of Wireshark.

In the first echo (ping) request frame, what are the source and destination MAC addresses?

Source: d6:cb:e4:ee:96:d8

Destination: 8a:20:c5:0a:94:9a

What are the source and destination IP addresses contained in the data field of the frame?

Source: 10.0.0.13

Destination: 172.16.0.40

Compare these addresses to the addresses you received in *Step 5*. The only address that changed is thedestination IP address. Why has the destination IP address changed, while the destination MAC addressremained the same?

It uses the destination MAC address as the default gateway.

Reflection

Wireshark does not display the preamble field of a frame header. What does the preamble contain?

It is in physical layer header it is taken off by the NIC before passing into operating system. Where the preamble consists of 7 bytes with 6 octets by the notating of alternating 0's and 1's.