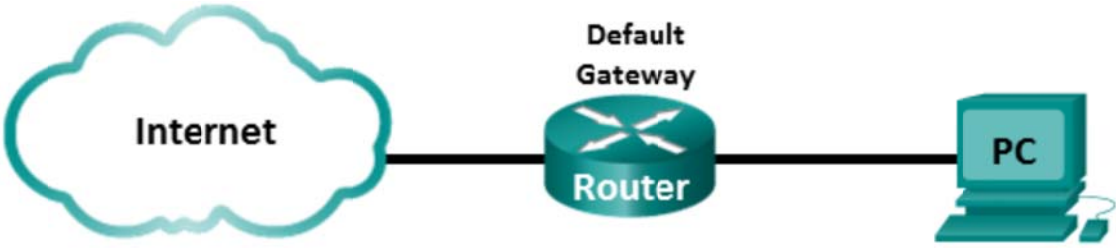
Lab – Using Wireshark to Examine Ethernet Frames (Instructor Version)

Instructor Note: Red font color or Gray highlights indicate text that appears in the instructor copy only.

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.

Instructor Note: This lab assumes that the student is using a PC with Internet access. It also assumes that Wireshark has been pre-installed on the PC. The screenshots in this lab were taken from Wireshark v1.8.3 for Windows 7 (64bit).

Required Resources

- 1 PC (Windows 7, Vista, or XP with Internet access with Wireshark installed)

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. 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 the network configuration of the PC.

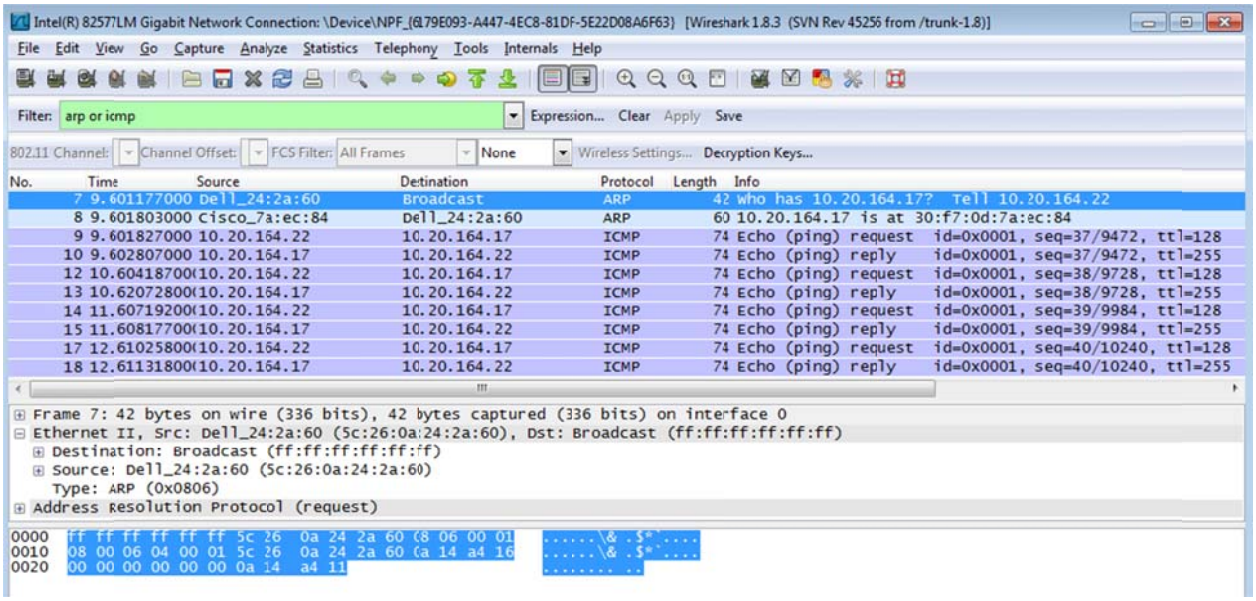
This PC host IP address is 10.20.164.22 and the default gateway has an IP address of 10.20.164.17.

```
Ethernet adapter Local Area Connection:

   Connection-specific DNS Suffix  . : cisco.com
   Link-local IPv6 Address . . . . . : fe80::b875:731b:3c7b:c0b1%10
   IPv4 Address. . . . . . . . . . . : 10.20.164.22
   Subnet Mask . . . . . . . . . . . : 255.255.255.240
   Default Gateway . . . . . . . . . : 10.20.164.17
```

Step 3: 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 4: 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	Dell_24:2a:60 (5c:26:0a:24:2a:60)	
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?

_____

_____

All hosts on the LAN will receive this broadcast frame. The host with the IP address of 10.20.164.17 (default gateway) will send a unicast reply to the source (PC host). This reply contains the MAC address of the NIC of the Default Gateway.

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

_____

_____

_____

Before the PC can send a ping request to a host, it needs to determine the destination MAC address before it can build the frame header for that ping request. The ARP broadcast is used to request the MAC address of the host with the IP address contained in the ARP.

What is the MAC address of the source in the first frame? _____ 5c:26:0a:24:2a:60

What is the Vendor ID (OUI) of the Source's NIC? _____ Dell

What portion of the MAC address is the OUI?

_____

The first 3 octets of the MAC address indicate the OUI.

What is the Source's NIC serial number? _____ 24:2a:60

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: Determine the IP address of the default gateway on your PC.

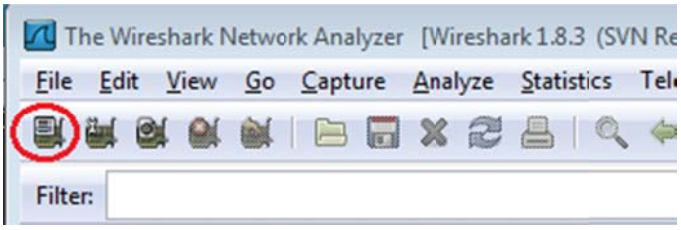
Open a command prompt window and issue the **ipconfig** command.

What is the IP Address of the PC Default Gateway? _____ Answers will vary

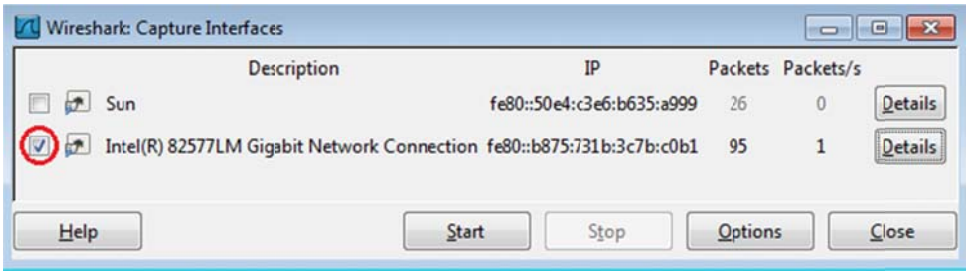
Step 2: Start capturing traffic on your PC's NIC.

a. Open Wireshark.

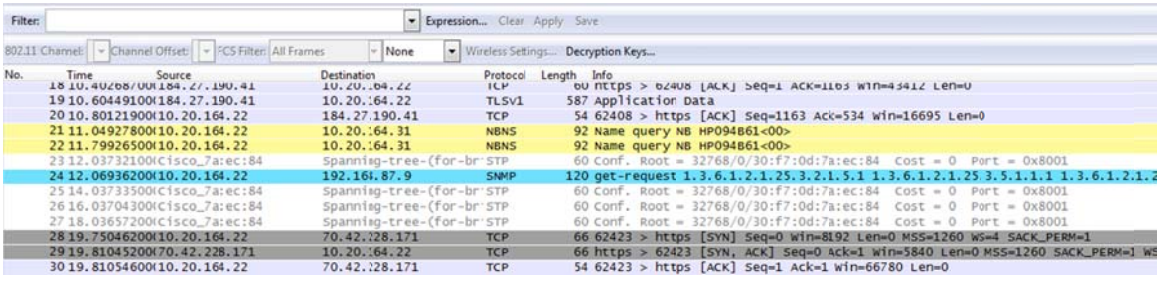
b. On the Wireshark Network Analyzer toolbar, click the **Interface List** icon.



c. On the Wireshark: Capture Interfaces window, select the interface to start traffic capturing by clicking the appropriate check box, and then click **Start**. If you are uncertain of what interface to check, click **Details** for more information about each interface listed.



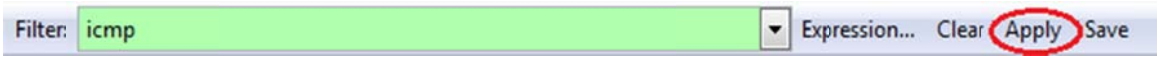
d. Observe the traffic that appears in the Packet List window.



Step 3: Filter Wireshark to display only ICMP traffic.

You can use the filter in Wireshark to block visibility of unwanted traffic. The filter does not block the capture of unwanted data; it only filters what to display on the screen. For now, only ICMP traffic is to be displayed.

In the Wireshark **Filter** box, type **icmp**. The box should turn green if you typed the filter correctly. If the box is green, click **Apply** to apply the filter.

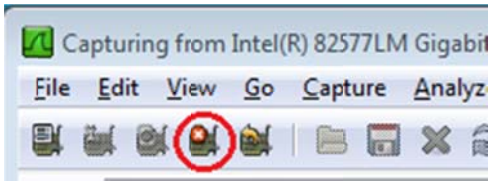


Step 4: From the command prompt window, ping the default gateway of your PC.

From the command window, ping the default gateway using the IP address that you recorded in Step 1.

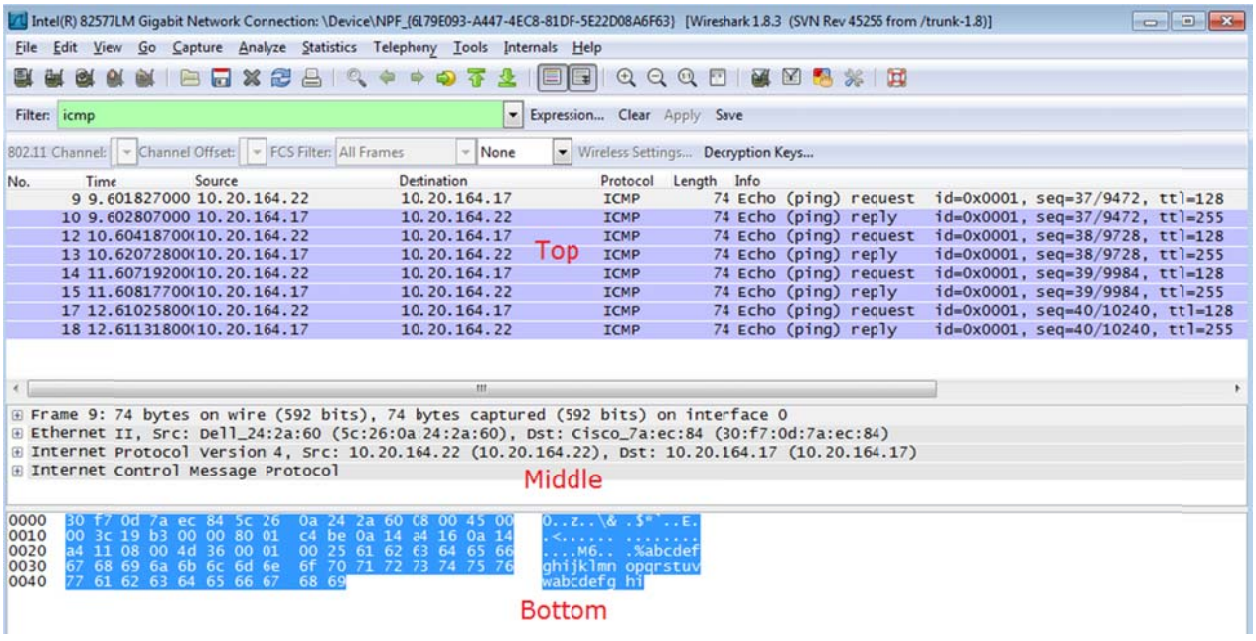
Step 5: Stop capturing traffic on the NIC.

Click the **Stop Capture** icon to stop capturing traffic.



Step 6: 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.



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; 74 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? _____ 5c:26:0a:24:2a:60 in example

What is the default gateway's MAC address? _____ 30:f7:0d:7a:ec:84 in example

d. You can click the plus (+) sign at the beginning of the second line to obtain more information about the Ethernet II frame. Notice that the plus sign changes to a minus (-) sign.

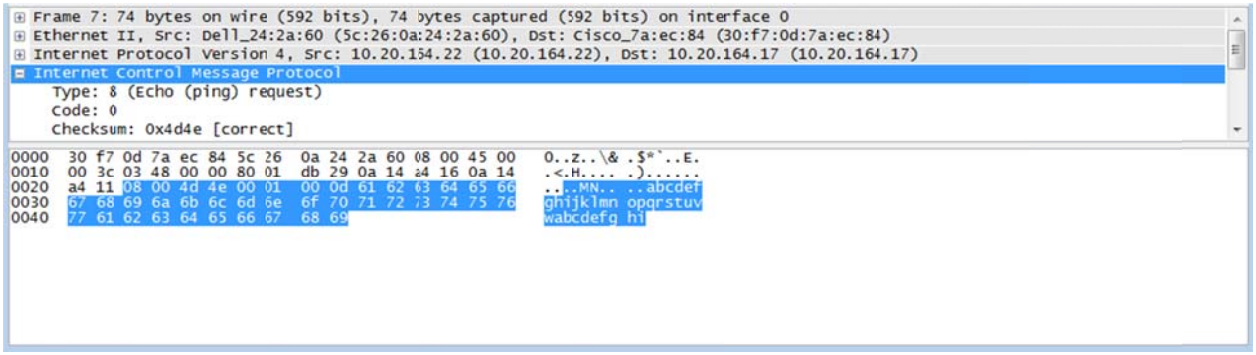
What type of frame is displayed? _____ 0x0800 or an IPv4 frame type.

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? _____ 10.20.164.22 in the example

What is the destination IP address? _____ 10.20.164.17 in the example

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.



What do the last two highlighted octets spell? _____ hi

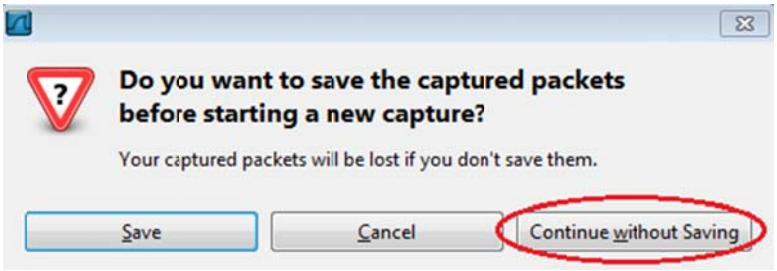
g. Click the next frame in the top section and examine an Echo reply frame. Notice that the source and destination MAC addresses have reversed, because this frame was sent from the default gateway router as a reply to the first ping.

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

_____ The host PC, 5c:26:0a:24:2a:60 in example.

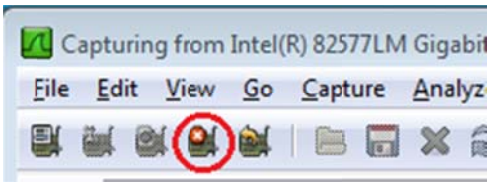
Step 7: Restart packet capture in Wireshark.

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**.



Step 8: In the command prompt window, ping www.cisco.com.

Step 9: Stop capturing packets.



Step 10: 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: _____ This should be the MAC address of the PC.

Destination: _____ This should be the MAC address of the Default Gateway.

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

Source: _____ This is still the IP address of the PC.

Destination: _____ This is the address of the server at www.cisco.com.

Compare these addresses to the addresses you received in Step 7. The only address that changed is the destination IP address. Why has the destination IP address changed, while the destination MAC address remained the same?

_____

_____

_____

_____

Layer 2 frames never leave the LAN. When a ping is issued to a remote host, the source will use the Default Gateway's MAC address for the frame destination. The Default Gateway receives the packet, strips the Layer 2 frame information from the packet and then creates a new frame header with the next hop's MAC address. This process continues from router to router until the packet reaches its destination IP address.

Reflection

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

_____

_____

The preamble field contains seven octets of alternating 1010 sequences, and one octet that signals the beginning of the frame, 10101011.