Lab 4.5.2.4 - Using Wireshark to Observe the TCP 3-Way Handshake

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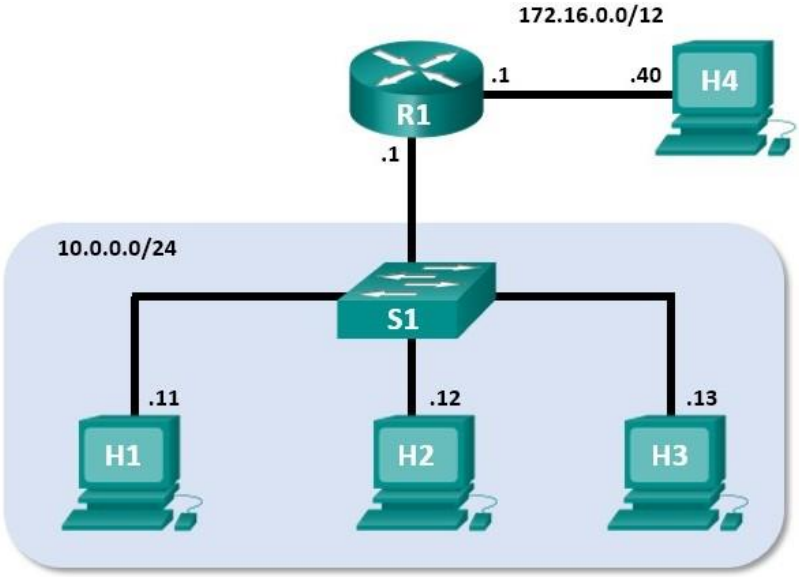
Mininet Topology



Objectives

Part 1: Prepare the Hosts to Capture the Traffic

Part 2: Analyze the Packets using Wireshark

Part 3: View the Packets using tcpdump

Background / Scenario

In this lab, you will use Wireshark to capture and examine packets generated between the PC browser using the HyperText Transfer Protocol (HTTP) and a web server, such as www.google.com. When an application, such as HTTP or File Transfer Protocol (FTP) first starts on a host, TCP uses the three-way handshake to establish a reliable TCP session between the two hosts. For example, when a PC uses a web browser to surf the Internet, a three-way handshake is initiated, and a session is established between the PC host and web server. A PC can have multiple, simultaneous, active TCP sessions with various web sites.

Part 1: Prepare the Hosts to Capture the Traffic

a. Start the **CyberOps** VM. Log in with username `analyst` and the password `cyberops`

b. Open a terminal and start **Mininet**.

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

c. Start host **H1** and **H4** in *Mininet*.

```
***      Starting
CLI:     mininet>
xterm H1 mininet>
xterm H4
```

d. Start the web server on H4.

```
[root@secOps analyst]#
/home/analyst/lab.support.files/scripts/reg_server_start.sh
```

e. Start the web browser on **Node: H1**. This will take a few moments.

```
[root@secOps analyst]# firefox &
```

f. After the *Firefox* window opens, start a **tcpdump** session in the terminal **Node: H1** and send the output to a file called **capture.pcap**. With the **-v** option, you can watch the progress. This capture will stop after capturing 50 packets, as it is configured with the option **-c 50**.

```
[root@secOps analyst]# tcpdump -i H1-eth0 -v -c 50 -w
/home/analyst/capture.pcap
```

g. After the *tcpdump* starts, quickly navigate to **172.16.0.40** in the **Firefox** web browser.

Part 2: Analyze the Packets using Wireshark

Step 1: Apply a filter to the saved capture.

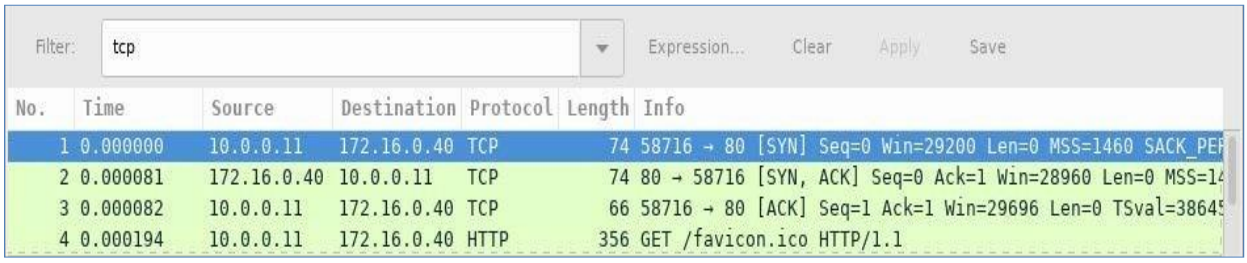
a. Press **Enter** to see the prompt. Start **Wireshark** on **Node: H1**. Click **OK** when prompted by the warning regarding running *Wireshark* as superuser.

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

b. In *Wireshark*, click **File** > **Open**. Select the saved **capture.pcap** file located at

/home/analyst/capture.pcap.

c. Apply a **tcp** filter to the capture. In this example, the first 3 frames are the traffic in interest.

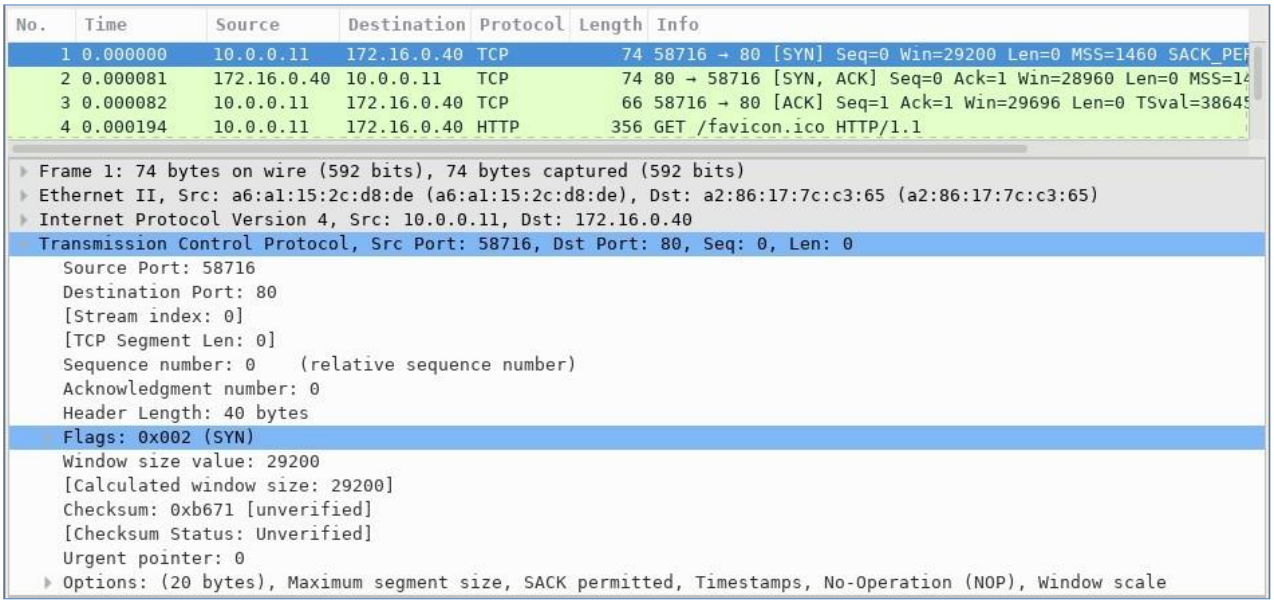


Step 2: Examine the information within packets including IP addresses, TCP port numbers, and TCP control flags.

a. In this example, *frame 1* is the start of the three-way handshake between the *PC* and the server on *H4*. In the packet list pane (top section of the main window), select the first packet, if necessary.

b. Click the **arrow** to the left of the *Transmission Control Protocol* in the packet details pane to expand the window and examine the *TCP* information. Locate the source and destination port information. Resize the panes if necessary.

c. Click the **arrow** to the left of the *Flags*. A value of 1 means that flag is set. Locate the flag that is set in this packet.



What is the *TCP* source port number? 56420

How would you classify the source port? Dynamic or Private

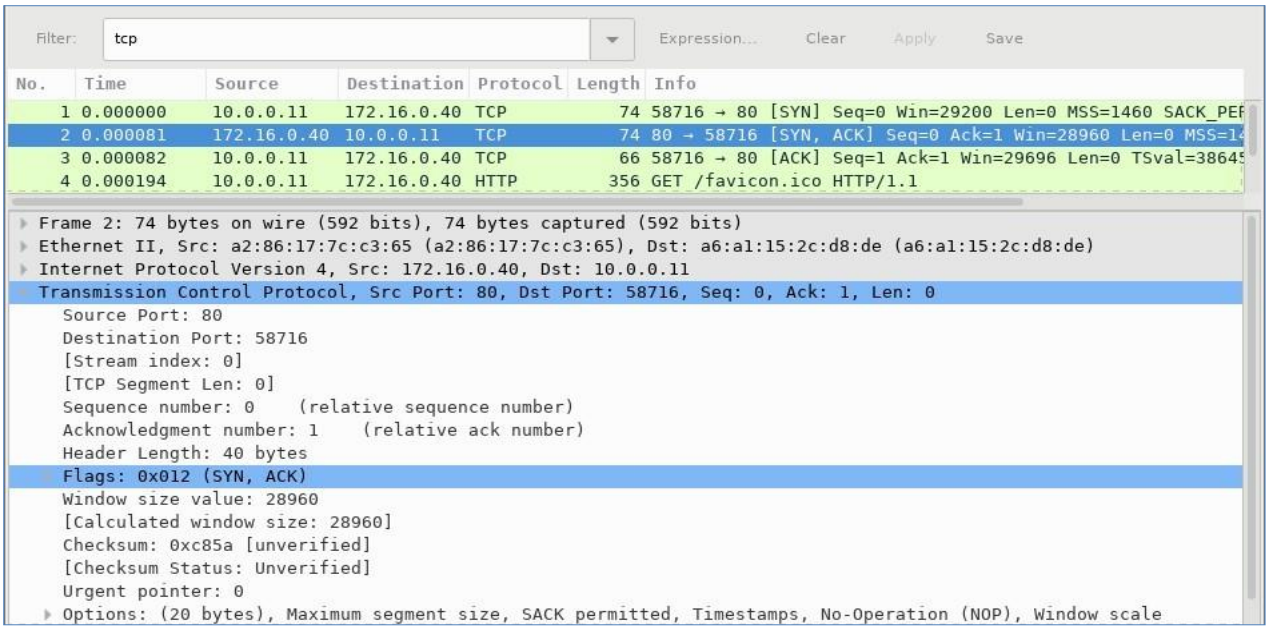
What is the *TCP* destination port number? 80

How would you classify the destination port? Registered, web protocol or http.

Which flag (or flags) is set? SYN

What is the relative sequence number set to? 0

d. Select the next packet in the three-way handshake. In this example, this is *frame 2*. This is the web server replying to the initial request to start a session.



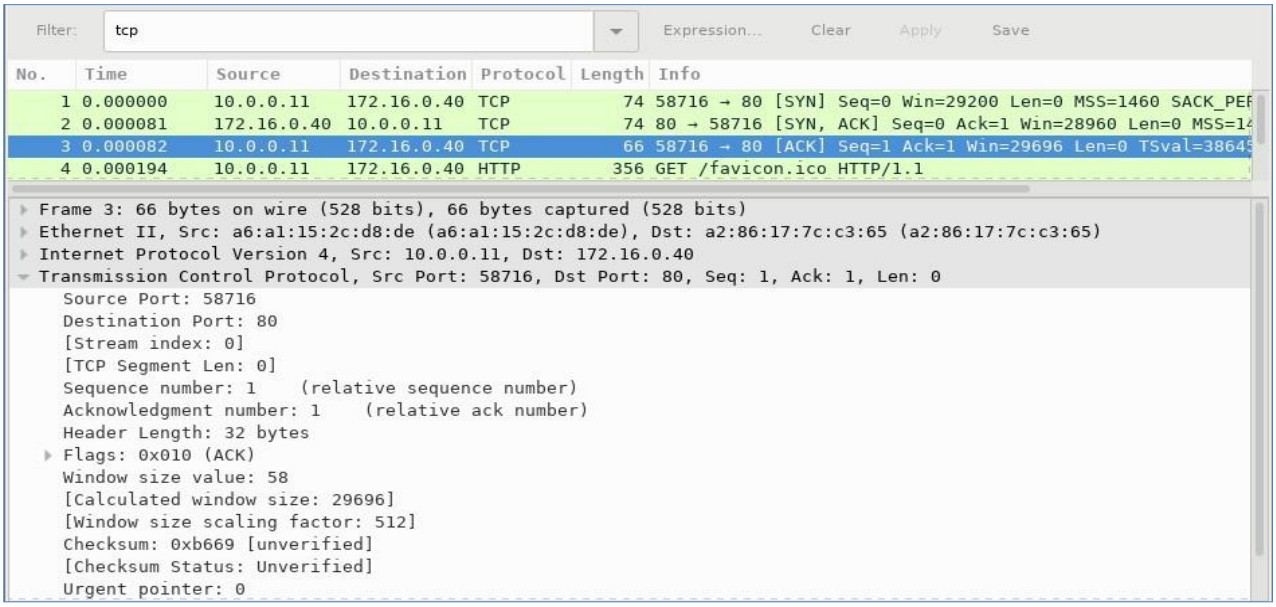
What are the values of the source and destination ports? Source port is 80 and destination port is 56420.

Which flags are set? ACK, SYN

What are the relative sequence and acknowledgment numbers set to?

Relative sequence 0 and acknowledge is 1

e. Finally, select the third packet in the three-way handshake.



Examine the third and final packet of the handshake.

Which flag (or flags) is set? ACK

The relative sequence and acknowledgment numbers are set to 1 as a starting point. The TCP connection is established and communication between the source computer and the web server can begin.

Part 3: View the packets using tcpdump

You can also view the *pcap* file and filter for the desired information.

a. Open a new terminal window for the *CyberOps* VM and enter `man tcpdump`. **Note**: You may need to press **Enter** to see the prompt.

Using the manual pages available with the Linux operating system, you read or search through the manual pages for options for selecting the desired information from the pcap file.

```
[analyst@secOps ~]# man tcpdump
TCPDUMP(1)                  General Commands Manual                 TCPDUMP(1)
NAME
       tcpdump - dump traffic on a network


SYNOPSIS
       tcpdump [ -AbdDefhHIJKlLnNOpqStuUvxX# ] [ -B buffer_size ]
               [ -c count ]
               [ -C file_size ] [ -G rotate_seconds ] [ -F file ]
               [ -i interface ] [ -j tstamp_type ] [ -m module ] [ -M secret ]
               [ --number ] [ -Q in|out|inout ]
               [ -r file ] [ -V file ] [ -s snaplen ] [ -T type ] [ -w file ]
               [ -W filecount ]
               [ -E spi@ipaddr algo:secret,...  ]
               [ -y datalinktype ] [ -z postrotate-command ] [ -Z user ]
               [ --time-stamp-precision=tstamp_precision ]
               [ --immediate-mode ] [ --version ]
               [ expression ]
<some output omitted>
```

To search through the man pages, you can use / (searching forward) or ? (searching backward) to find specific terms, and **n** to forward to the next match and **q** to quit. For example, search for the information on the switch -r, type **/-r**. Type **n** to move to the next match. What does the switch **-r** do?

Option -r it allows to read the Packet from saved file and also by using -w tcpdump helps to write pcap files in wireshark.

b. In the same terminal, open the capture file using the following command to view the first 3 TCP packets captured:

```
[analyst@secOps ~]# tcpdump -r /home/analyst/capture.pcap tcp -c 3
reading from file capture.pcap, link-type EN10MB (Ethernet)
13:58:30.647462 IP 10.0.0.11.58716 > 172.16.0.40.http: Flags [S], seq
2432755549, win 29200, options [mss 1460,sackOK,TS val 3864513189 ecr
0,nop,wscale 9], length 0
13:58:30.647543 IP 172.16.0.40.http > 10.0.0.11.58716: Flags [S.], seq
1766419191, ack 2432755550, win 28960, options [mss 1460,sackOK,TS val
50557410 ecr 3864513189,nop,wscale 9], length 0
13:58:30.647544 IP 10.0.0.11.58716 > 172.16.0.40.http: Flags [.], ack 1, win
58, options [nop,nop,TS val 3864513189 ecr 50557410], length 0
```

To view the 3-way handshake, you may need to increase the number of lines after the **-c** option.

c. Navigate to the terminal used to start **Mininet**. Terminate the *Mininet* by entering `quit` in the main *CyberOps* VM terminal window.

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

*** Stopping 2 terms
*** Stopping 5 links
.....
*** Stopping 1 switches
s1
*** Stopping 5 hosts
H1 H2 H3 H4 R1
*** Done
[analyst@secOps ~]$
```

d. After quitting *Mininet*, enter **sudo mn -c** to clean up the processes started by *Mininet*. Enter the password `cyberops` when prompted.

```
[analyst@secOps scripts]$ sudo mn -c
[sudo] password for analyst:
```

Reflection

1. There are hundreds of filters available in Wireshark. A large network could have numerous filters and many different types of traffic. List three filters that might be useful to a network administrator.

   Filter using Protocols, IP addresses and specific ports.

2. What other ways could Wireshark be used in a production network?

   Wireshark is a network protocol. It is used for troubleshooting networks errors, testing network performance and monitoring signals.