48730-32548, Cyber Security Week-6

Understanding TCP/IP based Attacks Continued

Lab Environment Setup

You need to follow the Lab-4 (Week 5) virtual environment setup to perform the remaining tasks related to TCP/IP based attacks.

Netwox/Netwag

We need tools to send out network packets of different types and with different contents. We can use Netwag to do that. However, the GUI interface of Netwag makes it difficult for us to automate our process. Therefore, we strongly suggest that you use its command-line version, the Netwox command, which is the underlying command invoked by Netwag.

Netwox consists of a suite of tools, each having a specific number. You can run the command as following (the parameters depend on which tool you are using). For some of the tools, you have to run it with the root privilege:

➢ **netwox <number> [parameters ...]**

If you are not sure how to set the parameters, you can look at the manual by issuing "**netwox <number> --help**". You can also learn the parameter settings by running Netwag for each command you execute from the graphic interface, Netwag actually invokes a corresponding Netwox command, and it displays the parameter settings. Therefore, you can simply copy and paste the displayed command.

Wireshark Tool.

You also need a good network-traffic sniffer tool for this lab. Although Netwox comes with a sniffer, you will find that another tool called Wireshark is a much better sniffer tool.

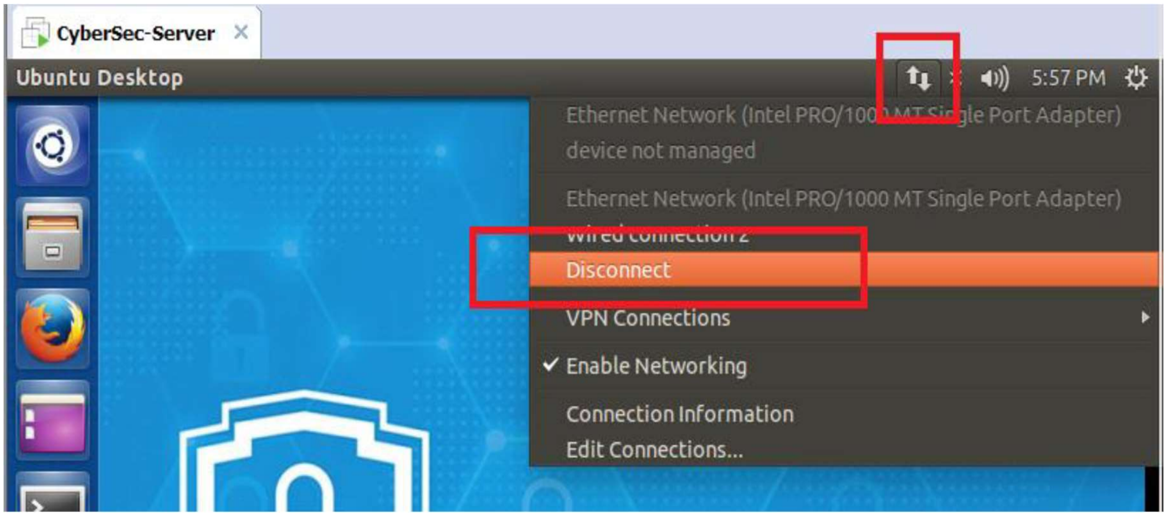
Both Netwox and Wireshark can be downloaded. If you are using our pre-built virtual machine, both tools are already installed. To sniff all the network traffic, both tools need to be run with root privilege.

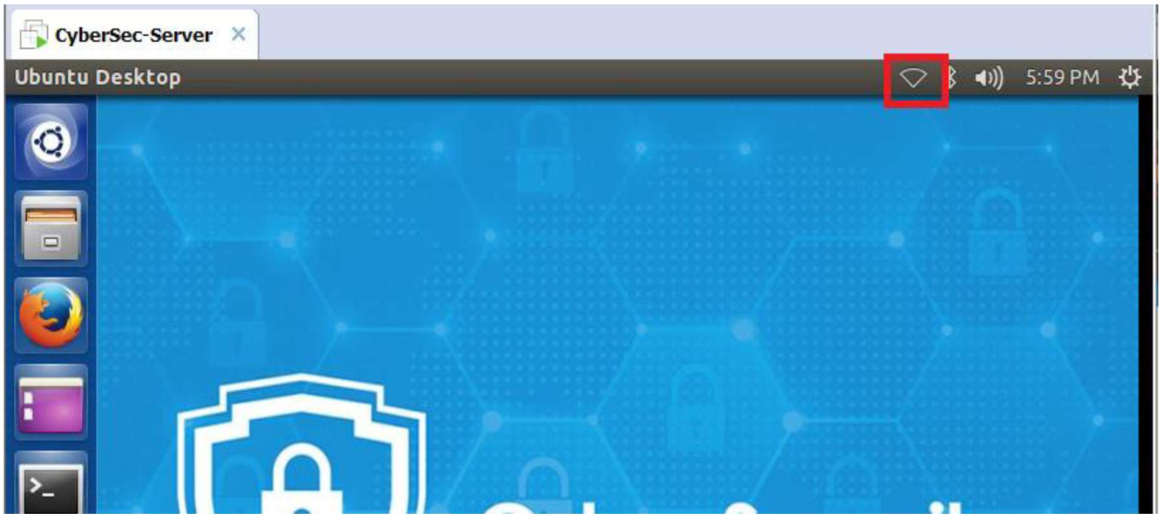
Lab Tasks

In this lab, you need to conduct attacks on the TCP/IP protocols. You can use the Netwag, Wireshark, Tshark tools in the attacks. All the attacks are performed on Linux operating systems. However, you can also conduct the same attack on the other operating system and compare the observations after lab classes. You are supposed to use all the above three different tolls for the experiments.

To simplify the "guess" of TCP sequence numbers and source port numbers, we assume that attacks are on the same physical network as the victims (Think of where such attacks may happen?). Therefore, you can use sniffer tools to get that information. The following is the list of attacks that need to be implemented and studied in this lab.

Before starting the task, disconnect the internet from the Server VM.





Task 4: TCP RST Attacks on Telnet and SSH Connections

The TCP RST Attack can terminate an established TCP connection between two victims. For example, if there is an established telnet connection (TCP) between two users A and B, attackers can spoof a RST packet from A to B, breaking this existing connection. To succeed in this attack, attackers need to correctly construct the TCP RST packet.

In this task, you need to launch a TCP RST attack to break an existing telnet connection between A and B. After that, try the same attack on an SSH connection.

In this task, we use **Netwag Tool 78** to conduct the attack, and **wireshark** tool to capture the packets.

Steps:

1. Open Wireshark on Client VM by entering “sudo wireshark” in the terminal.
2. Establish a telnet connection with Client from the Server. Enter “telnet <IP address>” and fill the username and password of the Client to establish a telnet connection. **(Screenshot required)**
3. Go to Attacker VM, run **Netwag** using the terminal. (sudo netwag)
4. Select **Tool 78: Reset every TCP packet**.
5. Select the **interface** and the “**spoofip: IP spoof initialization type**”. **(Screenshot required)**
6. Click “**Run It**”.
7. Go to Server, generate some data by typing something in terminal where a telnet connection with Client is established. **(Screenshot Required)**

For performing the same attack on SSH connection, establish an SSH connection with Client from the Server by entering “ssh username@IPaddress” instead of a telnet connection. Similar screenshots are required for TCP RST attack on SSH connection.

Task 5: ICMP Blind Connection-Reset and Source-Quench Attacks

(i) ICMP Blind Connection-Reset

ICMP messages can also be used achieve the connection-resetting attack. To do this, attackers send an ICMP error message that indicates a “hard error” to either of the two endpoints of a TCP connection. The connection can be immediately torn down as RFC 1122 states that a host should abort the corresponding connection when receiving such an ICMP error message. RFC 1122 defines “hard errors” as ICMP error messages of type 3 (Destination Unreachable) with code 2 (protocol unreachable), 3 (port unreachable), or 4 (fragmentation needed and DF bit set).

Use the **Netwag Tool 82** to conduct the attack, and then use **wireshark** tool to capture the packets.

Steps:

1. Open Wireshark on Client VM by entering “sudo wireshark” in the terminal. Set icmp as filter.
2. Ping Server from the Client.
3. Check the Wireshark capture. **(Screenshot Required)**
4. Go to Attacker VM, run **Netwag** using the terminal.
5. Select **Tool 82: Sniff and send ICMP4/ICMP6 destination unreachable**.
6. Select the **interface** and “**spoofip: IP spoof initialization type**”, input the **ICMP code (2)** and **source IP address**. **(Screenshot Required)**
7. Click “Run It”.
8. Check the Wireshark capture. **(Screenshot required)**

(ii) Source-Quench Attacks

The ICMP source quench message is used by the congested routers to tell the TCP senders to slow down. Attackers can forge such messages to conduct the denial of services attacks on TCP senders.

In this task, you need to launch the ICMP blind connect-reset attacks and the ICMP source quench attacks. You need to be noted that some systems may reasonably ignore this type of ICMP errors in certain TCP state.

Use the **Netwag Tool 85** to conduct the attack, and then use **wireshark** tool to capture the packets.

Steps:

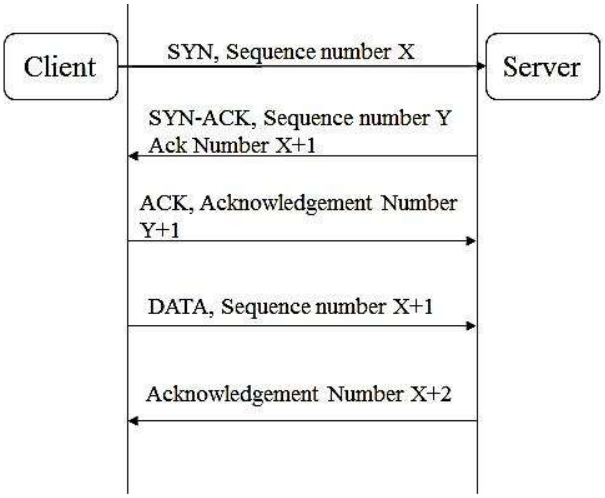
1. Open Wireshark on Client VM by entering “sudo wireshark” in the terminal. Set icmp as filter.
2. Ping Server from the Client.
3. Check the Wireshark capture. **(Screenshot Required)**
4. Go to Attacker VM, run **Netwag** using the terminal.
5. Select **Tool 85: Sniff and send ICMP4 source quench**.
6. Select the **interface** and “**spoofip: IP spoof initialization type**”, and input the **source IP address**. **(Screenshot Required)**
7. Click “Run It”.
8. Check the Wireshark capture. **(Screenshot required)**

Task 6: TCP Session Hijacking

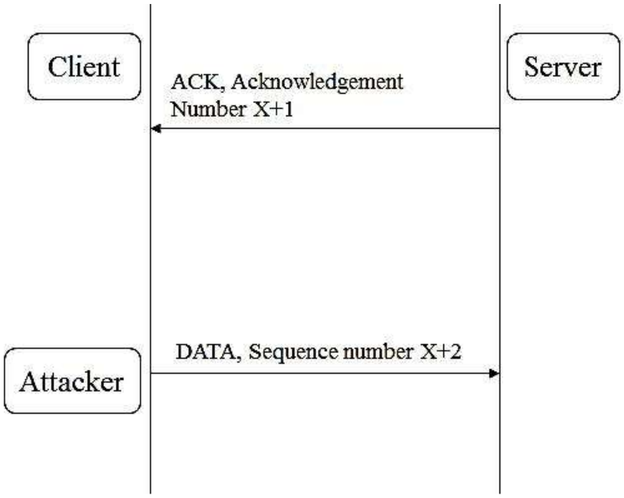
The objective of the TCP Session Hijacking attack is to hijack an existing TCP connection (session) between two victims by injecting malicious contents into this session. If this connection is a telnet session, attackers can inject malicious commands into this session, causing the victims to execute the malicious commands. You can use telnet in this task. You can also assume that the attackers and the victims are on the same LAN. Following figure illustrates the attack.

Note: If you use Wireshark to observe the network traffic, you should be aware that when Wireshark displays the TCP sequence number, by default, it displays the relative sequence number, which equals to the actual sequence number minus the initial sequence number. If you want to see the actual sequence number in a packet, you need to right click the TCP section of the Wireshark output, and select "Protocol Preference". In the popup window, uncheck the "Relative Sequence Number and Window Scaling" option.

Use the **Netwag Tool 36** to conduct the attack, and then use **wireshark** tool to capture the packets.


Client
Server
SYN, Sequence number X
SYN-ACK, Sequence number Y
Ack Number X+1
ACK, Acknowledgement Number
Y+1
DATA, Sequence number X+1
Acknowledgement Number X+2

Normal TCP 3 way handshake and sending data between client and server



Attacker Hijack the TCP session and send data "z" to server on behalf of client

Steps:

1. Open Wireshark on Client VM by entering "sudo wireshark" in the terminal. Set telnet as filter.
2. Establish a telnet connection with Client from the Server. Enter "telnet <IP address>" and fill the username and password of the Client to establish a telnet connection. **(Screenshot required)**
3. Generate some data by typing something in terminal where a telnet connection with Client is established.
4. Go to Wireshark on Client, look for last telnet packet sent from Server to the Client. **(Screenshot required)**
5. Ensure that "Relative sequence numbers" is disabled. (Check the Protocol Preferences)
6. Look into the details of TCP and telnet for last telnet packet sent from Server to the Client. **(Screenshot Required)**
7. Convert **'mkdir hello' + return key** to hexadecimal. (https://www.browserling.com/tools/text-to-hex)
8. Go to Attacker VM, run **Netwag** using the terminal.
9. Select **Tool 36: Spoof EthernetIp4Tcp packet**.

10. Provide the following information:

Device	Select **Eth0**
Ethernet Src	From the wireshark output
Ethernet Dst	From the wireshark output
IP4 ttl	**64**
IP4 Src	**10.0.2.6**
IP4 Dst	**10.0.2.8**
TCP Src	From the wireshark output
TCP Dst	From the wireshark output
TCP Seqnum	From the wireshark output
TCP Acknum	From the wireshark output: TCP Acknum + size of the data '/177'
TCP urg	**Tick**
TCP ack	**Tick**
TCP psh	**Tick**
TCP window	From the wireshark output
mixed data	Hex for 'mkdir hello' + return key : **6d 6b 64 69 72 20 68 65 6c 6c 6f 0a**

(Screenshot required)

11. Click "Run It".
12. Go back to Wireshark on Client, look for the last telnet packet sent from Server to Client before TCP Retransmission. (**Screenshot Required**)
13. Look into the details of Telnet for that packet. (**Screenshot Required**)
14. Check the home directory of Client.