

# **Firewall Evasion**

*Seed Lab*

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# Lab setup:

## Starting the container screenshot:

```
[12/02/25]seed@VM:~/.../AneeshLabSetup$ dcup
Creating network "net-10.8.0.0" with the default driver
Creating network "net-192.168.20.0" with the default driver
Building hostA
Step 1/5 : FROM handsonsecurity/seed-ubuntu:large
---> cecb04fbf1dd
Step 2/5 : ARG DEBIAN_FRONTEND=noninteractive
---> Running in f52b2cf66309
Removing intermediate container f52b2cf66309
---> a696ea0c3e94
Step 3/5 : RUN apt-get update      && apt-get -y install openssh-ser
ver      && rm -rf /var/lib/apt/lists/*
---> Running in 8c9a05660e03
Get:1 http://security.ubuntu.com/ubuntu focal-security InRelease [1
28 kB]
Get:2 http://security.ubuntu.com/ubuntu focal-security/universe amd
64 Packages [1308 kB]
Get:3 http://archive.ubuntu.com/ubuntu focal InRelease [265 kB]
Get:4 http://security.ubuntu.com/ubuntu focal-security/multiverse a
md64 Packages [33.1 kB]
Get:5 http://security.ubuntu.com/ubuntu focal-security/restricted a
md64 Packages [4801 kB]
Get:6 http://security.ubuntu.com/ubuntu focal-security/main amd64 P
ackages [4432 kB]
```

```
seed@VM: ~/.../AneeshLabSetup
Creating B2-192.168.20.6 ... done
Creating A1-10.8.0.5      ... done
Attaching to B-192.168.20.99, A2-10.8.0.6, A-10.8.0.99, router-fire
wall, B2-192.168.20.6, B1-192.168.20.5, A1-10.8.0.5
A-10.8.0.99 | * Starting internet superserver inetd          [
OK ]
A-10.8.0.99 | * Starting OpenBSD Secure Shell server sshd     [
OK ]
A2-10.8.0.6 | * Starting internet superserver inetd          [
OK ]
B-192.168.20.99 | * Starting internet superserver inetd      [
OK ]
B-192.168.20.99 | * Starting OpenBSD Secure Shell server sshd
[
OK ]
B2-192.168.20.6 | * Starting internet superserver inetd      [
OK ]
router-firewall | * Starting internet superserver inetd      [
OK ]
B1-192.168.20.5 | * Starting internet superserver inetd      [
OK ]
A1-10.8.0.5 | * Starting internet superserver inetd          [
OK ]
```

### Connecting to host A container screenshot:

```
seed@VM: ~/.../AneeshLabSetup
[12/02/25] seed@VM:~/.../AneeshLabSetup$ dockps
55deb1a03d86  A-10.8.0.99
3046faf5f3ac  A1-10.8.0.5
f92991273035  B2-192.168.20.6
51dd4aa58085  B1-192.168.20.5
f2ed2cb305c7  router-firewall
05427ce2f081  A2-10.8.0.6
da4c4ab36818  B-192.168.20.99
[12/02/25] seed@VM:~/.../AneeshLabSetup$ docksh ^C
[12/02/25] seed@VM:~/.../AneeshLabSetup$ docksh 55deb1a03d86
root@55deb1a03d86:/#
```

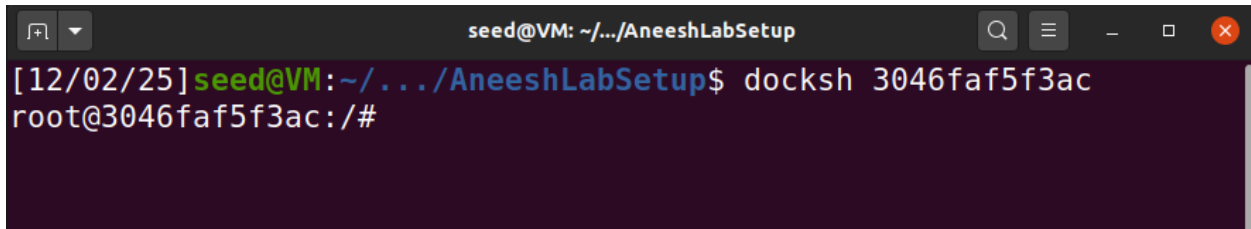
## Task 1:

### Command screenshot:

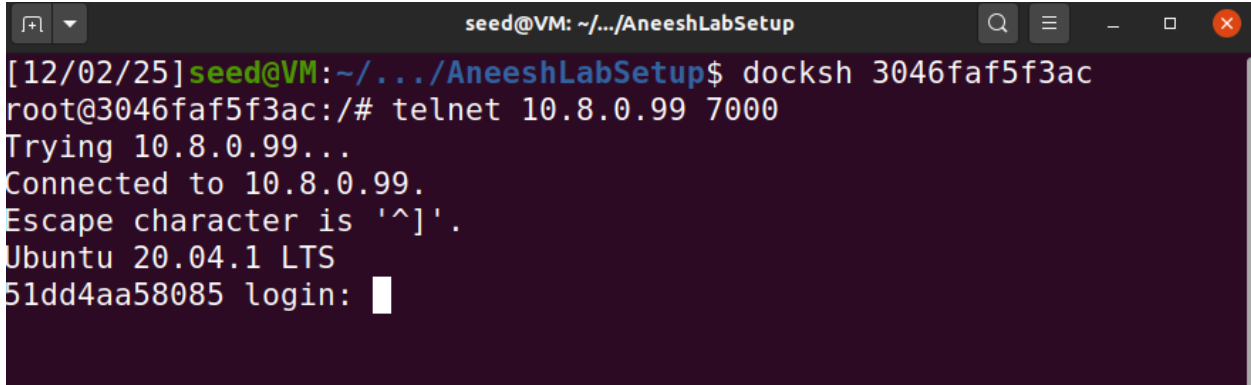
```
seed@VM: ~/.../AneeshLabSetup
51dd4aa58085  B1-192.168.20.5
f2ed2cb305c7  router-firewall
05427ce2f081  A2-10.8.0.6
da4c4ab36818  B-192.168.20.99
[12/02/25] seed@VM:~/.../AneeshLabSetup$ docksh ^C
[12/02/25] seed@VM:~/.../AneeshLabSetup$ docksh 55deb1a03d86
root@55deb1a03d86:/# ssh -4NT -L 10.8.0.99:7000:192.168.20.5:23 seed@192.168.20.99
```

**Explanation:** Any host A1 or A2, if they want to telnet to host B1, they have to telnet to hostA's address or port 7000. HostA will send the packets to HostB and any packets that HostB will receive from HostA or from port 7000 will be forwarded to 192.168.20.5 address which is for HostB1 in the internet network.

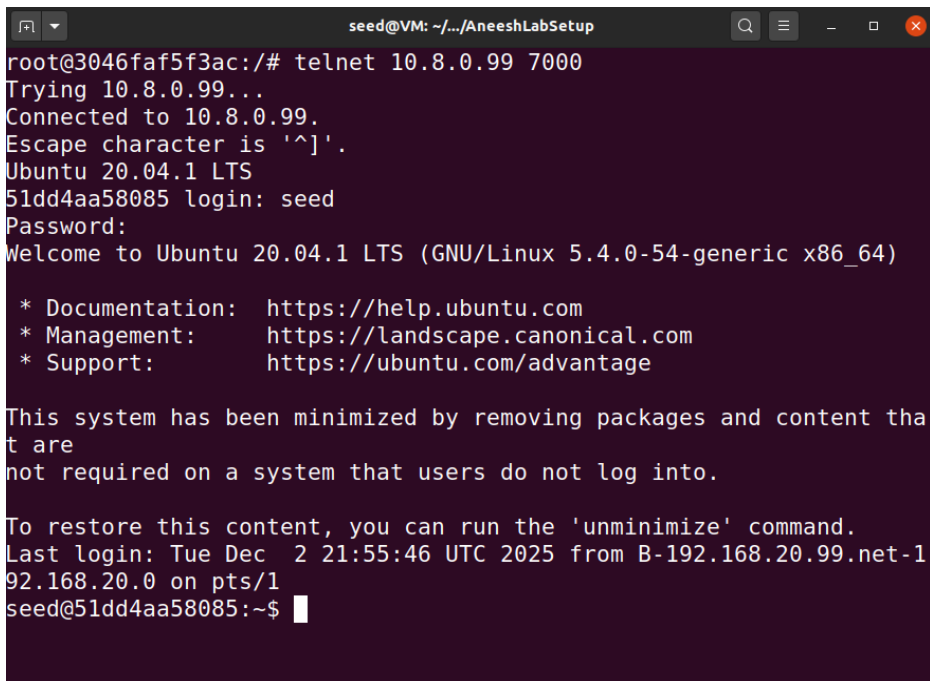
### Connecting to A1 Host container screenshot:

A terminal window titled 'seed@VM: ~/.../AneeshLabSetup' with search, menu, and window control icons. The command 'docksh 3046faf5f3ac' is entered, resulting in a prompt change from 'seed@VM' to 'root@3046faf5f3ac'.

### Telnet to Host A using port 7000 screenshot:

A terminal window titled 'seed@VM: ~/.../AneeshLabSetup' showing the execution of 'telnet 10.8.0.99 7000'. The output shows a successful connection to 10.8.0.99, displaying 'Ubuntu 20.04.1 LTS' and a login prompt '51dd4aa58085 login:'.

### Putting the credentials screenshot:

A terminal window titled 'seed@VM: ~/.../AneeshLabSetup' showing the continuation of the telnet session. The user 'seed' is logged in. The system is Ubuntu 20.04.1 LTS with kernel 5.4.0-54-generic. It displays documentation, management, and support links, followed by a message about system minimization and a last login timestamp.

**Explanation:** When I run telnet from A1 to 10.8.0.99:7000, the traffic is first sent to Host A, where SSH is listening on the forwarded port. SSH then encrypts this data and carries it inside its allowed TCP connection to Host B. Once it reaches B, SSH opens a separate internal Telnet connection to B1 (192.168.20.5:23) and delivers the traffic there. As a result, it appears to be connected directly to B1 even though the firewall would normally block this access.

## Q1) How many TCP connections are involved?

No.	Time	Source	Destination	Protocol
316	2025-12-02 17:2...	10.8.0.5	10.8.0.99	TCP
317	2025-12-02 17:2...	192.168.20.99	10.8.0.99	SSH
318	2025-12-02 17:2...	10.8.0.99	192.168.20.99	TCP
319	2025-12-02 17:2...	10.8.0.99	10.8.0.5	TCP
320	2025-12-02 17:2...	10.8.0.5	10.8.0.99	TCP
321	2025-12-02 17:2...	192.168.20.99	10.8.0.99	SSH
322	2025-12-02 17:2...	10.8.0.99	192.168.20.99	TCP
323	2025-12-02 17:2...	10.8.0.99	10.8.0.5	TCP
324	2025-12-02 17:2...	10.8.0.5	10.8.0.99	TCP

Source	Destination	Protocol	Length
192.168.20.99	192.168.20.5	TCP	66
192.168.20.5	192.168.20.99	TELNET	476
192.168.20.99	192.168.20.5	TCP	66
192.168.20.5	192.168.20.99	TELNET	153
192.168.20.99	192.168.20.5	TCP	66
192.168.20.5	192.168.20.99	TELNET	68
192.168.20.99	192.168.20.5	TCP	66
192.168.20.5	192.168.20.99	TELNET	87
192.168.20.99	192.168.20.5	TCP	66

**Ans)** There are three TCP connections involved in the static port-forwarding process. The first connection is between the external host and Host A on port 7000. The second connection is the encrypted SSH session from Host A to Host B on port 22. The third connection is the internal Telnet connection from Host B to Host B1 on port 23.

## Q2) Why can this tunnel successfully help users of the firewall rule?

**Ans)** The tunnel evades the firewall because all Telnet traffic is carried inside an allowed SSH connection. The firewall only sees encrypted SSH packets going to port 22, which it permits, so it never detects or blocks the Telnet data inside the tunnel. Once the SSH connection reaches Host B, the Telnet traffic is delivered internally to B1, bypassing the firewall's restriction on direct access to internal services.

## Task 2.1:

Connecting to Host B container Screenshot:

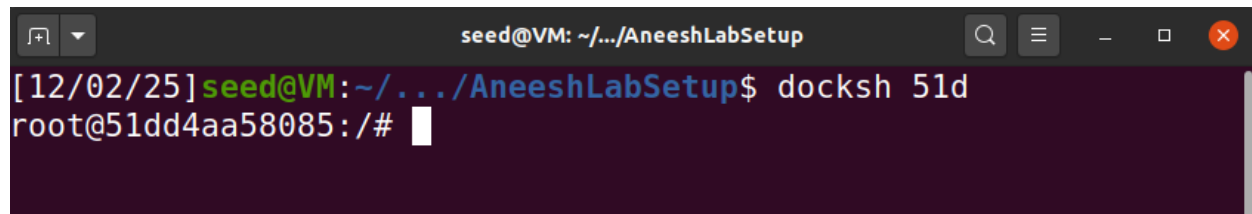
```
seed@VM: ~/.../AneeshLabSetup
[12/02/25] seed@VM:~/.../AneeshLabSetup$ dockps
55deb1a03d86  A-10.8.0.99
3046faf5f3ac  A1-10.8.0.5
f92991273035  B2-192.168.20.6
51dd4aa58085  B1-192.168.20.5
f2ed2cb305c7  router-firewall
05427ce2f081  A2-10.8.0.6
da4c4ab36818  B-192.168.20.99
[12/02/25] seed@VM:~/.../AneeshLabSetup$ docksh da4c4ab36818
root@da4c4ab36818:/#
```

Running the command in Host B container:

```
seed@VM: ~/.../AneeshLabSetup
f92991273035  B2-192.168.20.6
51dd4aa58085  B1-192.168.20.5
f2ed2cb305c7  router-firewall
05427ce2f081  A2-10.8.0.6
da4c4ab36818  B-192.168.20.99
[12/02/25] seed@VM:~/.../AneeshLabSetup$ docksh da4c4ab36818
root@da4c4ab36818:/# ssh -4NT -D 192.168.20.99:7200 seed@10.8.0.99
The authenticity of host '10.8.0.99 (10.8.0.99)' can't be established.
ECDSA key fingerprint is SHA256:aY3pVS+VtCKaoZ4j8Gh/Q80SwPRAhhisBUPZ7G+ZmDo.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '10.8.0.99' (ECDSA) to the list of known hosts.
seed@10.8.0.99's password:
```

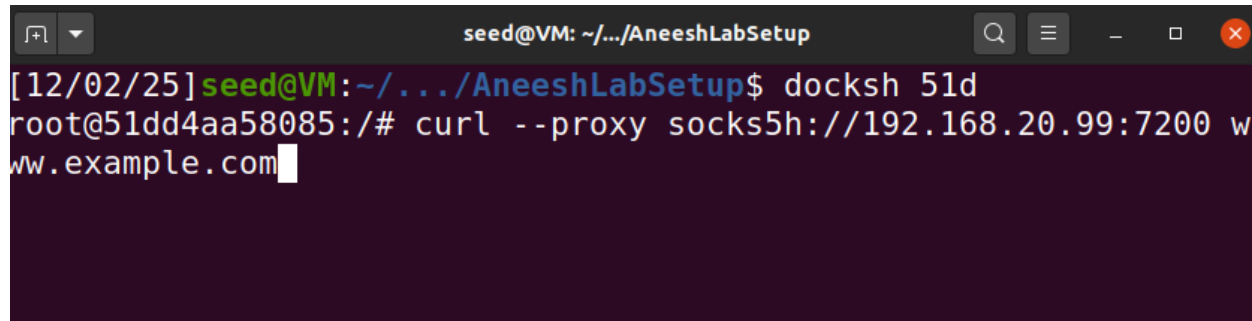
**Explanation:** we set up a dynamic port-forwarding tunnel from Host B to Host A. By using the -D option, B creates a SOCKS5 proxy that listens on port 7200 of its internal IP address (192.168.20.99). Any application on the internal network that sends traffic to this proxy will have its requests forwarded through the encrypted SSH tunnel to Host A (10.8.0.99), which then connects to the final destination on behalf of B. This allows internal hosts to reach blocked external websites by routing their traffic through A.

Connecting to Host B1 container screenshot:

A terminal window titled 'seed@VM: ~/.../AneeshLabSetup' with a search icon, menu icon, and window controls. The prompt is '[12/02/25] seed@VM: ~/.../AneeshLabSetup\$'. The command 'docksh 51d' has been entered, and the prompt has changed to 'root@51dd4aa58085: /#'.

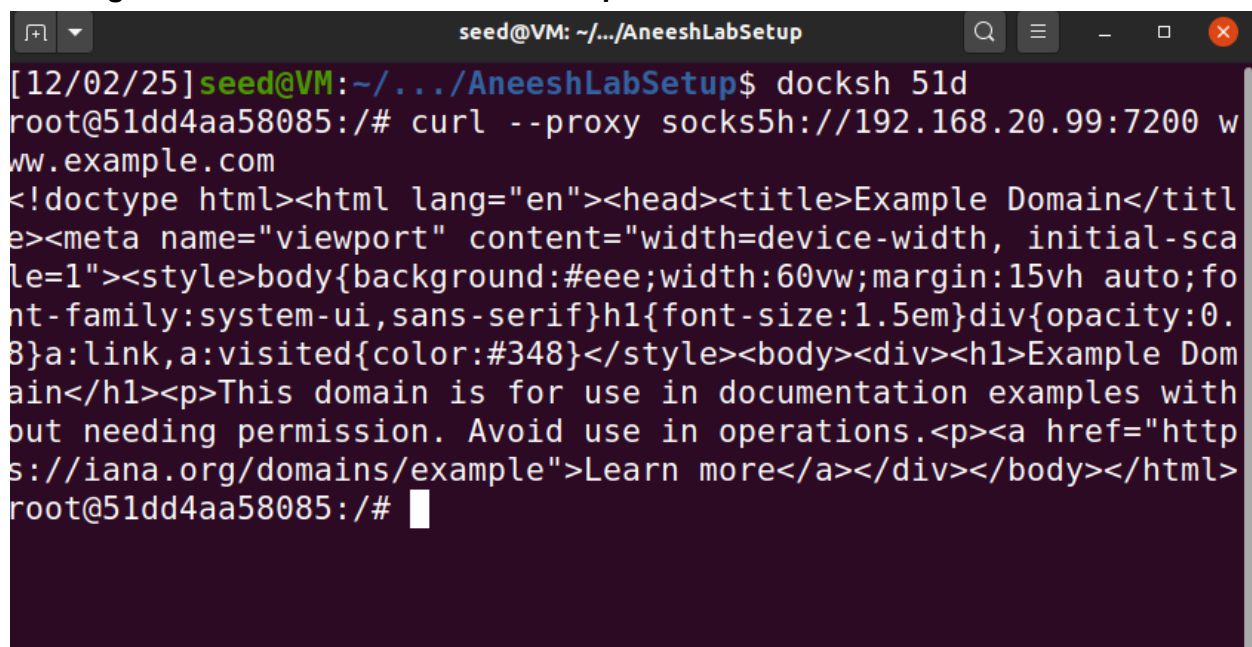
```
seed@VM: ~/.../AneeshLabSetup$ docksh 51d
root@51dd4aa58085: /#
```

Testing Dynamic port forwarding using curl command screenshot:

A terminal window titled 'seed@VM: ~/.../AneeshLabSetup' with a search icon, menu icon, and window controls. The prompt is '[12/02/25] seed@VM: ~/.../AneeshLabSetup\$'. The command 'docksh 51d' has been entered, and the prompt has changed to 'root@51dd4aa58085: /#'. The command 'curl --proxy socks5h://192.168.20.99:7200 www.example.com' has been entered, and the prompt is now 'www.example.com' followed by a cursor.

```
seed@VM: ~/.../AneeshLabSetup$ docksh 51d
root@51dd4aa58085: /# curl --proxy socks5h://192.168.20.99:7200 w
www.example.com
```

Running the command screenshot and output:

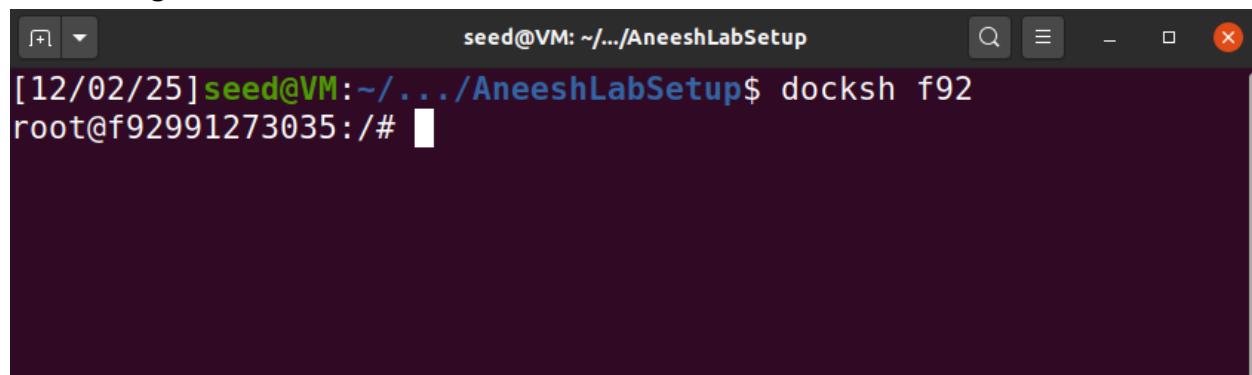
A terminal window titled 'seed@VM: ~/.../AneeshLabSetup' with a search icon, menu icon, and window controls. The prompt is '[12/02/25] seed@VM: ~/.../AneeshLabSetup\$'. The command 'docksh 51d' has been entered, and the prompt has changed to 'root@51dd4aa58085: /#'. The command 'curl --proxy socks5h://192.168.20.99:7200 www.example.com' has been entered, and the output is displayed as HTML code.

```
seed@VM: ~/.../AneeshLabSetup$ docksh 51d
root@51dd4aa58085: /# curl --proxy socks5h://192.168.20.99:7200 w
www.example.com
<!doctype html><html lang="en"><head><title>Example Domain</titl
e><meta name="viewport" content="width=device-width, initial-sca
le=1"><style>body{background:#eee;width:60vw;margin:15vh auto;fo
nt-family:system-ui,sans-serif}h1{font-size:1.5em}div{opacity:0.
8}a:link,a:visited{color:#348}</style><body><div><h1>Example Dom
ain</h1><p>This domain is for use in documentation examples with
out needing permission. Avoid use in operations.<p><a href="http
s://iana.org/domains/example">Learn more</a></div></body></html>
root@51dd4aa58085: /#
```

**Explanation:** As it can be seen from the screenshot above, receiving the HTML page from [www.example.com](http://www.example.com) confirms that the SOCKS5 proxy on Host B (listening at 192.188.20.99:7200) is functioning correctly. Although the firewall blocks direct access to [www.example.com](http://www.example.com) from the internal network, curl successfully retrieves the website because the request is routed through the SSH dynamic tunnel to Host A. Host A makes the actual external connection, and the response is delivered back through the encrypted SSH tunnel to B, allowing the blocked site to be accessed indirectly.

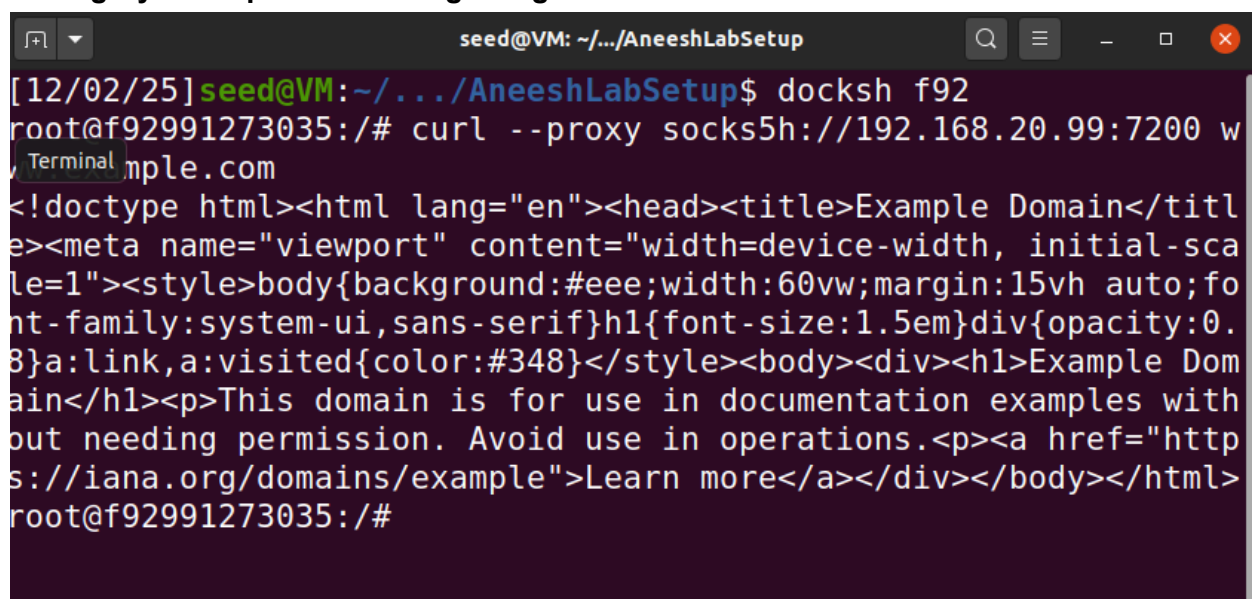


Connecting to Host B2 container screenshot:

A terminal window titled 'seed@VM: ~/.../AneeshLabSetup'. The prompt is '[12/02/25] seed@VM: ~/.../AneeshLabSetup\$'. The user enters 'docksh f92'. The prompt changes to 'root@f92991273035: /#'.

```
seed@VM: ~/.../AneeshLabSetup
[12/02/25] seed@VM: ~/.../AneeshLabSetup$ docksh f92
root@f92991273035: /#
```

Testing Dynamic port forwarding using curl command screenshot:

A terminal window titled 'seed@VM: ~/.../AneeshLabSetup'. The prompt is '[12/02/25] seed@VM: ~/.../AneeshLabSetup\$'. The user enters 'docksh f92'. The prompt changes to 'root@f92991273035: /#'. The user enters 'curl --proxy socks5h://192.168.20.99:7200 www.example.com'. The output is an HTML document for 'Example Domain'.

```
seed@VM: ~/.../AneeshLabSetup
[12/02/25] seed@VM: ~/.../AneeshLabSetup$ docksh f92
root@f92991273035: /# curl --proxy socks5h://192.168.20.99:7200 www
Example Domain
<!doctype html><html lang="en"><head><title>Example Domain</titl
e><meta name="viewport" content="width=device-width, initial-sca
le=1"><style>body{background:#eee;width:60vw;margin:15vh auto;fo
nt-family:system-ui,sans-serif}h1{font-size:1.5em}div{opacity:0.
8}a:link,a:visited{color:#348}</style><body><div><h1>Example Dom
ain</h1><p>This domain is for use in documentation examples with
out needing permission. Avoid use in operations.<p><a href="http
s://iana.org/domains/example">Learn more</a></div></body></html>
root@f92991273035: /#
```

**Explanation:** We did it again just to make sure its dynamic using Host B2 this time and again the same output which confirms it.

**Q1) Which computer establishes the actual connection with the intended web server?**

**Ans)** The actual connection to the web server is established by Host A (10.8.0.99). Host B only sends its traffic to the local SOCKS proxy, which forwards it through the encrypted SSH tunnel. Host A receives these forwarded requests and performs the real outbound TCP connection to the website, bypassing the firewall that blocks B's direct access.

**Q2) How does that computer know which server to connect to?**

**Ans)** Host A knows the target server because the SOCKS5 protocol includes the destination hostname and port inside the request sent from curl to the proxy. When B receives the request on its SOCKS port (7200), it embeds the server address ([www.example.com:80](http://www.example.com:80)) in the SOCKS5 handshake and forwards it through the SSH tunnel. Host A reads this information from the SOCKS5 header and uses it to initiate the correct external TCP connection.



## Task 2.2:

Connecting to the router firewall container screenshot:

```
seed@VM: ~/.../AneeshLabSetup
[12/02/25] seed@VM:~/.../AneeshLabSetup$ dockps
55deb1a03d86  A-10.8.0.99
3046faf5f3ac  A1-10.8.0.5
f92991273035  B2-192.168.20.6
51dd4aa58085  B1-192.168.20.5
f2ed2cb305c7  router-firewall
05427ce2f081  A2-10.8.0.6
da4c4ab36818  B-192.168.20.99
[12/02/25] seed@VM:~/.../AneeshLabSetup$ docksh f2e
root@f2ed2cb305c7:/#
```

Checking the iptables screenshot:

```
[12/02/25] seed@VM:~/.../AneeshLabSetup$ docksh f2e
root@f2ed2cb305c7:/# iptables -L FORWARD
Chain FORWARD (policy ACCEPT)
target     prot opt source                destination
ACCEPT     tcp  --  anywhere               anywhere             ct
state RELATED,ESTABLISHED
ACCEPT     tcp  --  anywhere               anywhere             tc
p dpt:ssh
DROP       tcp  --  anywhere               anywhere
DROP       all  --  anywhere               93.184.216.0/24
root@f2ed2cb305c7:/#
```

Appending new website IP address screenshot:

```
root@f2ed2cb305c7:/# iptables -A FORWARD -d 50.62.89.0/24 -j DROP
root@f2ed2cb305c7:/#
```

### Checking if it was appended screenshot:

```
root@f2ed2cb305c7:/# iptables -L FORWARD -n
Chain FORWARD (policy ACCEPT)
target     prot opt source                destination            ct
state RELATED,ESTABLISHED
ACCEPT     tcp  --  0.0.0.0/0              0.0.0.0/0              ct
ACCEPT     tcp  --  0.0.0.0/0              0.0.0.0/0              tc
p dpt:22
DROP       tcp  --  0.0.0.0/0              0.0.0.0/0
DROP       all  --  0.0.0.0/0              93.184.216.0/24
DROP       all  --  0.0.0.0/0              50.62.89.0/24
root@f2ed2cb305c7:/#
```

**Explanation:** As it can be seen from the screenshot above that it was successfully added.

### Connecting to Host B container and running dynamic proxy command again:

```
seed@VM: ~/.../AneeshLabSetup
[12/02/25] seed@VM:~/.../AneeshLabSetup$ dockps
55deb1a03d86  A-10.8.0.99
3046faf5f3ac  A1-10.8.0.5
f92991273035  B2-192.168.20.6
51dd4aa58085  B1-192.168.20.5
f2ed2cb305c7  router-firewall
05427ce2f081  A2-10.8.0.6
da4c4ab36818  B-192.168.20.99
[12/02/25] seed@VM:~/.../AneeshLabSetup$ docksh da4
root@da4c4ab36818:/# ssh -4NT -D 192.168.20.99:7200 seed@10.8.0.
99
seed@10.8.0.99's password:

```

### Setting the proxy manually in the browser screenshot:

Connection Settings

Configure Proxy Access to the Internet

☐ No proxy

☐ Auto-detect proxy settings for this network

☐ Use system proxy settings

☒ Manual proxy configuration

HTTP Proxy  Port

☐ Also use this proxy for FTP and HTTPS

HTTPS Proxy  Port

FTP Proxy  Port

SOCKS Host  Port

☐ SOCKS v4 ☒ SOCKS v5

☐ Automatic proxy configuration URL

Reload

No proxy for

Example: .mozilla.org, .net.nz, 192.168.1.0/24

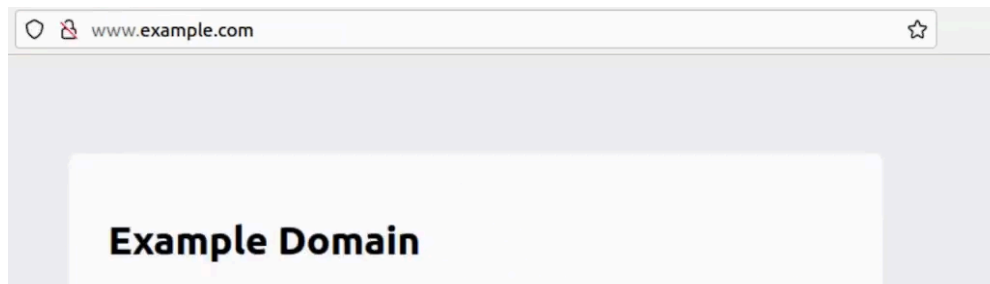
Connections to localhost, 127.0.0.1, and ::1 are never proxied.

☐ Do not prompt for authentication if password is saved

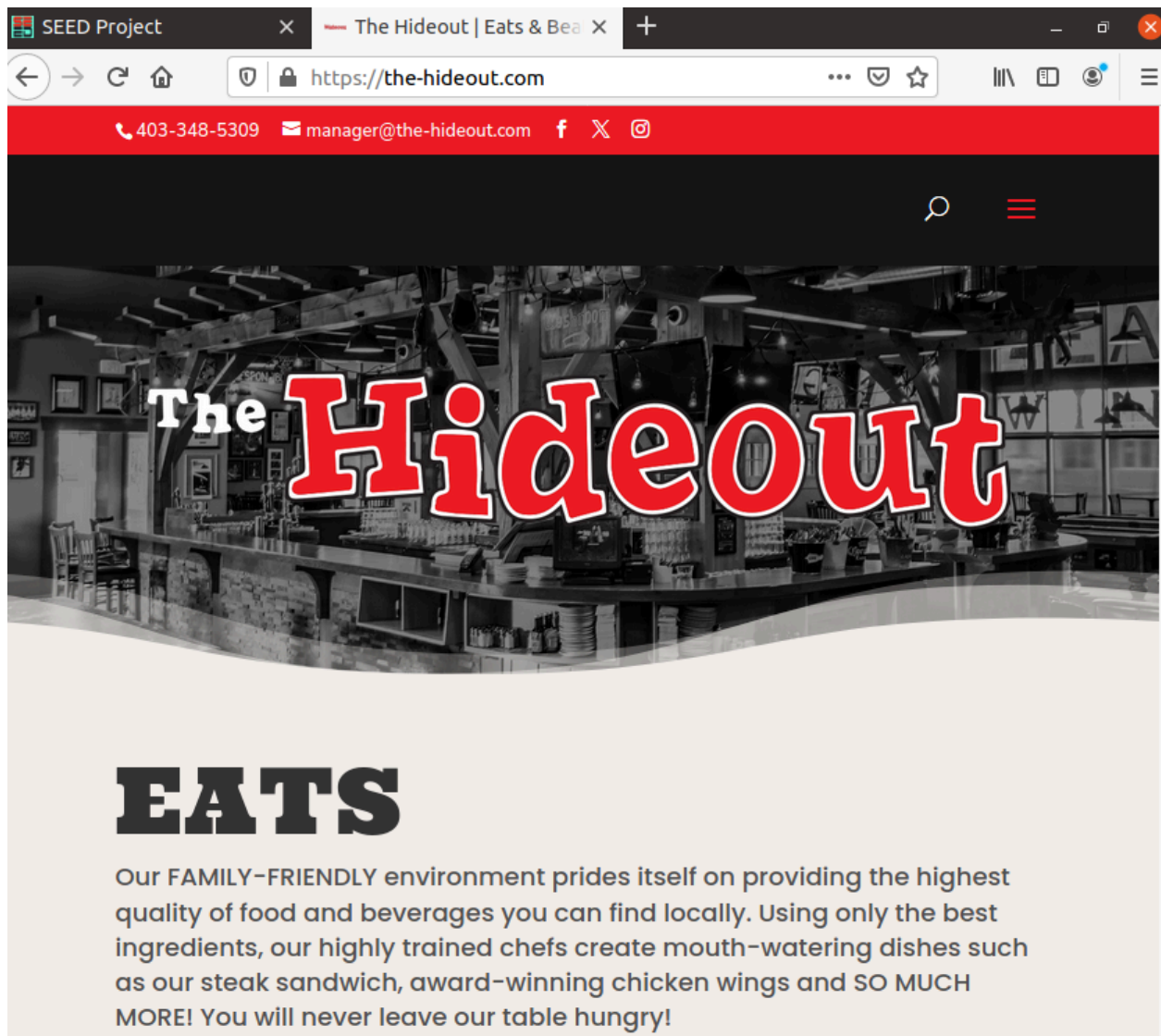
☐ Proxy DNS when using SOCKS v5

Help Cancel OK

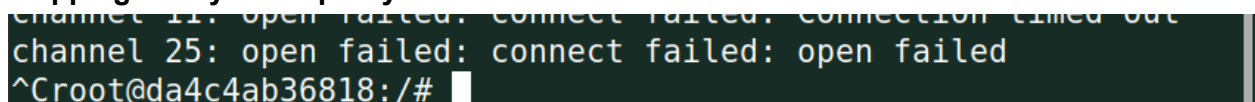
Checking example domain screenshot:



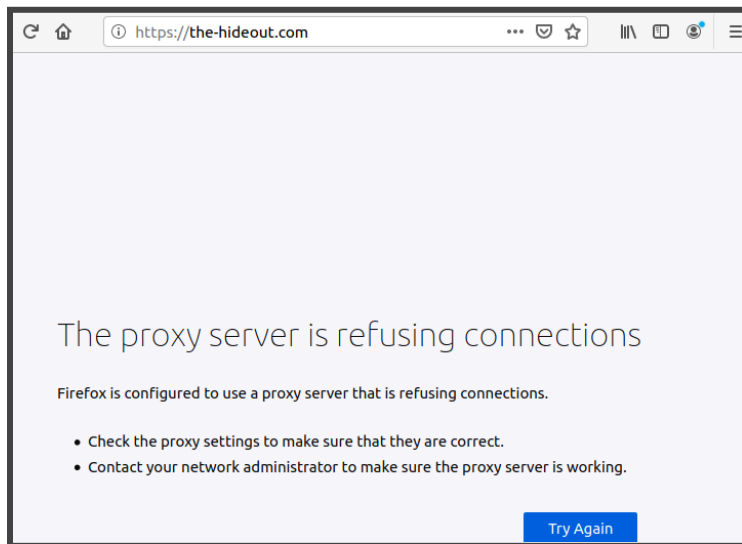
Checking the second website if its connected:



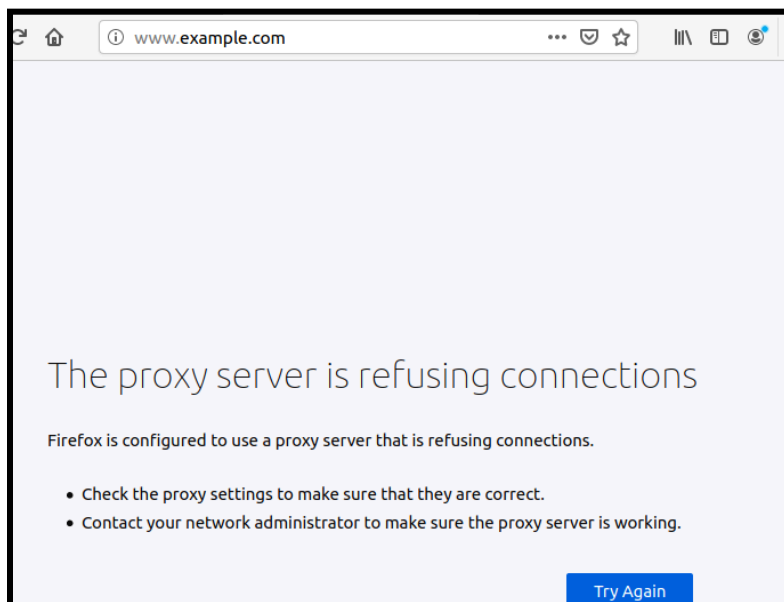
Stopping the dynamic proxy container screenshot:



**Refreshing the website to check if its connected to dynamic proxy server:**



**Checking our example website again:**



**Explanation:** While the dynamic port-forwarding tunnel was active, all browser traffic was routed through the SOCKS5 proxy running on Host B at 192.168.20.99:7200. Because the proxy forwarded requests through the SSH tunnel to host A, the browser was able to access the websites that were blocked by the firewall's rules, including the additional site blocked via the iptables rule. After stopping the proxy with CTRL+C, the SOCKS5 service on B immediately stopped listening on port 7200. The browser was still configured to use this proxy, so when it attempted to refresh the page, it had no functioning proxy to connect to. As a result, the browser displayed "proxy server is refusing connection." Without the proxy running, the traffic could no longer be forwarded through the SSH tunnel and instead followed the normal route, where the firewall correctly blocked both websites due to the configured filtering rules.

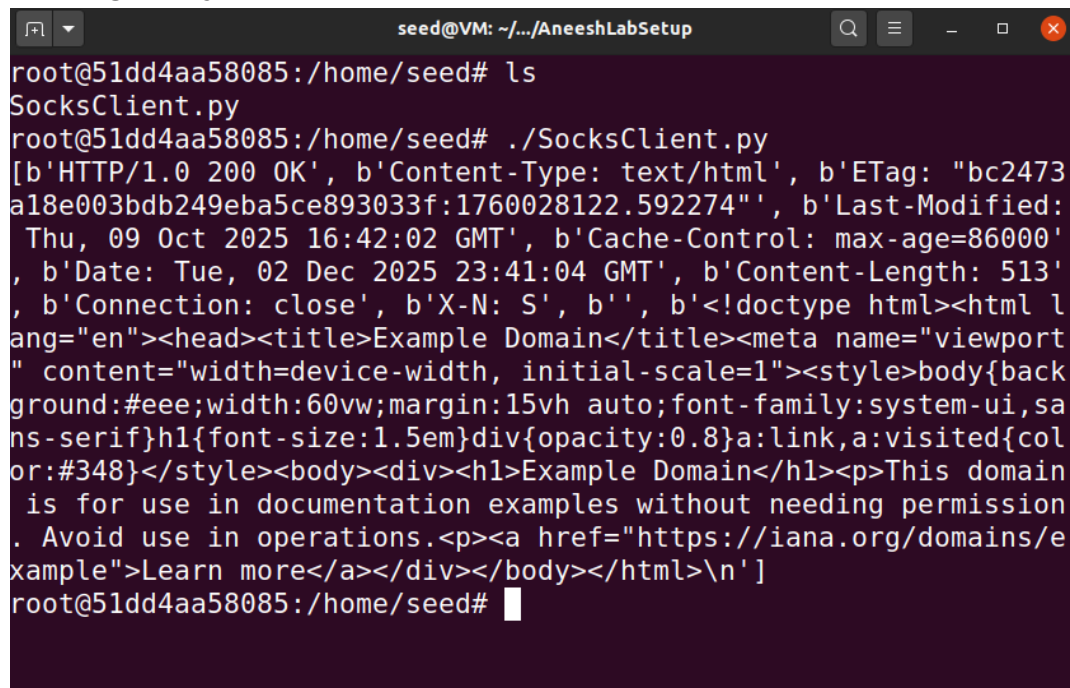
## Task 2.3:

Changing the port in [SocksClient.py](#) file screenshot:



```
1#!/bin/env python3
2
3import socks
4
5s = socks.socksocket()
6
7# Set the proxy
8s.set_proxy(socks.SOCKS5, "192.168.20.99", 7200)
9
10# Connect to final destination via the proxy
11hostname = "www.example.com"
12s.connect((hostname, 80))
13
14request = b"GET / HTTP/1.0\r\nHost: " +
    hostname.encode('utf-8') + b"\r\n\r\n"
15s.sendall(request)
16
17# Get the response
18response = s.recv(2048)
19while response:
20    print(response.split(b"\r\n"))
21    response = s.recv(2048)
```

Running the python script screenshot:



```
root@51dd4aa58085:/home/seed# ls
SocksClient.py
root@51dd4aa58085:/home/seed# ./SocksClient.py
[b'HTTP/1.0 200 OK', b'Content-Type: text/html', b'ETag: "bc2473a18e003bdb249eba5ce893033f:1760028122.592274"', b'Last-Modified: Thu, 09 Oct 2025 16:42:02 GMT', b'Cache-Control: max-age=86000', b'Date: Tue, 02 Dec 2025 23:41:04 GMT', b'Content-Length: 513', b'Connection: close', b'X-N: S', b'', b'<!doctype html><html lang="en"><head><title>Example Domain</title><meta name="viewport" content="width=device-width, initial-scale=1"><style>body{background:#eee;width:60vw;margin:15vh auto;font-family:system-ui,sans-serif}h1{font-size:1.5em}div{opacity:0.8}a:link,a:visited{color:#348}</style><body><div><h1>Example Domain</h1><p>This domain is for use in documentation examples without needing permission. Avoid use in operations.<p><a href="https://iana.org/domains/example">Learn more</a></div></body></html>\n']
root@51dd4aa58085:/home/seed#
```

Connecting to the Host B2 container screenshot:

```
seed@VM: ~/.../AneeshLabSetup
[12/02/25] seed@VM:~/.../AneeshLabSetup$ dockps
55deb1a03d86  A-10.8.0.99
3046faf5f3ac  A1-10.8.0.5
f92991273035  B2-192.168.20.6
51dd4aa58085  B1-192.168.20.5
f2ed2cb305c7  router-firewall
05427ce2f081  A2-10.8.0.6
da4c4ab36818  B-192.168.20.99
[12/02/25] seed@VM:~/.../AneeshLabSetup$ docksh f92
```

Python script code with different website screenshot:

```
GNU nano 4.8 Socks_Client.py
#!/bin/env python3

import socks

s = socks.socksocket()

# Set the proxy
s.set_proxy(socks.SOCKS5, "192.168.20.99", 7200)

# Connect to final destination via the proxy
hostname = "www.the-hideout.com"
s.connect((hostname, 80))

request = b"GET / HTTP/1.0\r\nHost: " + hostname.encode('utf-8')
s.sendall(request)

# Get the response
response = s.recv(2048)
while response:
    print(response.split(b"\r\n"))

[ Read 21 lines ]
^G Get Help ^O Write Out ^W Where Is ^K Cut Text ^J Justify
^X Exit ^R Read File ^\ Replace ^U Paste Tex ^T To Spell
```



### Running the python script screenshot:

```
seed@VM: ~/.../AneeshLabSetup
root@f92991273035:/home/seed# nano Socks_Client.py
root@f92991273035:/home/seed# ./Socks_Client.py
[b'HTTP/1.1 301 Moved Permanently', b'Date: Tue, 02 Dec 2025 23:
48:47 GMT', b'Content-Type: text/html; charset=iso-8859-1', b'Co
nnection: close', b'Server: cloudflare', b'Location: https://www
.the-hideout.com/', b'CF-Ray: 9a7eb7970cb144b0-YYZ', b'CF-Cache-
Status: HIT', b'Cache-Control: public, max-age=2678400', b'Expir
es: Fri, 02 Jan 2026 23:48:47 GMT', b'Strict-Transport-Security:
max-age=31536000; includeSubDomains', b'Vary: User-Agent, Accep
t-Encoding', b'content-security-policy: upgrade-insecure-request
s', b'x-backend: varnish_ssl', b'x-cache: cached', b'x-cache-hit
: HIT', b'x-cacheable: YES:Forced', b'x-cacheproxy-retries: 0/2'
, b'x-content-type-options: nosniff', b'x-php-version: 8.3', b'x
-xss-protection: 1; mode=block', b'Set-Cookie: __cf_bm=TfKxXs8MB
bChbTMJ4n73hIHdGF_GvdpYn4HFfT0R2Mg-1764719327-1.0.1.1-1.jAQh9FrK
AMWw9BXMopx7zqbtQ96GRyv4PjIRmnuLM2aAEy_ecxjBwDTUquwHJN_iA5Hk0Qtg
Nb08065tT.BMfJ4isv_mfFGVy.1ECyUFC; path=/; expires=Wed, 03-Dec-2
5 00:18:47 GMT; domain=.www.the-hideout.com; HttpOnly', b'alt-sv
c: h3=":443"; ma=86400', b'', b'<!DOCTYPE HTML PUBLIC "-//IETF//
DTD HTML 2.0//EN">\n<html><head>\n<title>301 Moved Permanently</
title>\n</head><body>\n<h1>Moved Permanently</h1>\n<p>The docume
nt has moved <a href="https://www.the-hideout.com/">here</a>.</p
>\n</body></html>\n']
root@f92991273035:/home/seed#
```

**Explanation:** Running the same python SOCKS5 client on Host B and Host B2 successfully retrieved the HTML content from both [www.example.com](http://www.example.com) and [www.the-hideout.com](http://www.the-hideout.com). Although these websites were blocked by the firewalls' rules, the script bypassed the restrictions by forwarding all traffic to the SOCKS5 proxy running on host B. The proxy sent the destination hostname and port through the encrypted SSH tunnel to host A, which established the actual external TCP connections. The web servers' responses were then returned through the tunnel to the internal hosts. This confirms that any internal container using the SOCKS proxy can reach blocked websites by routing its traffic through Host A instead of directly through the firewall.



## Task 3.1:

Starting container as a Host A screenshot:

```
seed@VM: ~/.../AneeshLabSetup
[12/02/25] seed@VM:~/.../AneeshLabSetup$ dockps
55deb1a03d86  A-10.8.0.99
3046faf5f3ac  A1-10.8.0.5
f92991273035  B2-192.168.20.6
51dd4aa58085  B1-192.168.20.5
f2ed2cb305c7  router-firewall
05427ce2f081  A2-10.8.0.6
da4c4ab36818  B-192.168.20.99
[12/02/25] seed@VM:~/.../AneeshLabSetup$ docksh 55d
root@55deb1a03d86:/#
```

Creating the VPN tunnel using SSH screenshot:

```
[12/02/25] seed@VM:~/.../AneeshLabSetup$ docksh 55d
root@55deb1a03d86:/# ssh -w 0:0 root@192.168.20.99 -o "PermitLocalCommand=yes" -o "LocalCommand= ip addr 192.168.53.88/24 dev tun0 && ip link set tun0 up" -o "RemoteCommand=ip addr 192.168.53.99/24 dev tun0 && ip link set tun0 up"
root@192.168.20.99's password:
```

Connecting to Host B1 for telnet command:

```
[12/02/25] seed@VM:~/.../AneeshLabSetup$ dockps
55deb1a03d86  A-10.8.0.99
3046faf5f3ac  A1-10.8.0.5
f92991273035  B2-192.168.20.6
51dd4aa58085  B1-192.168.20.5
f2ed2cb305c7  router-firewall
05427ce2f081  A2-10.8.0.6
da4c4ab36818  B-192.168.20.99
[12/02/25] seed@VM:~/.../AneeshLabSetup$ docksh 51dd
```

## Running the Telnet Command:

```
root@51dd4aa58085:/# telnet 10.8.0.99
Trying 10.8.0.99...
Connected to 10.8.0.99.
Escape character is '^]'.
Ubuntu 20.04.1 LTS
55debl1a03d86 login: seed
Password:
Welcome to Ubuntu 20.04.1 LTS (GNU/Linux 5.4.0-54-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:    https://landscape.canonical.com
 * Support:       https://ubuntu.com/advantage

This system has been minimized by removing packages and content
that are
not required on a system that users do not log into.

To restore this content, you can run the 'unminimize' command.
seed@55debl1a03d86:~$
```

## Checking the wireshark once the command was ran:

The image shows a Wireshark network traffic capture window titled "[SEED Labs] \*any". The interface includes a menu bar (File, Edit, View, Go, Capture, Analyze, Statistics, Telephony, Wireless, Tools, Help) and a toolbar with various icons. The packet list pane on the left shows a list of captured packets. The packet details pane on the right shows the selected packet (No. 20) and its details. The packet bytes pane at the bottom shows the raw data of the selected packet.

No.	Time	Source	Destination	Protocol	Length	Info
8	2025-12-02 20:1...	192.168.20.5	10.8.0.99	TCP	76	45322
9	2025-12-02 20:1...	192.168.20.5	10.8.0.99	TCP	76	[TCP D
10	2025-12-02 20:1...	192.168.20.5	10.8.0.99	TCP	76	[TCP D
11	2025-12-02 20:1...	192.168.20.5	10.8.0.99	TCP	76	[TCP D
12	2025-12-02 20:1...	10.8.0.99	192.168.20.5	TCP	76	23 → 4
13	2025-12-02 20:1...	10.8.0.99	192.168.20.5	TCP	76	[TCP D
14	2025-12-02 20:1...	10.8.0.99	192.168.20.5	TCP	76	[TCP D
15	2025-12-02 20:1...	10.8.0.99	192.168.20.5	TCP	76	[TCP D
16	2025-12-02 20:1...	192.168.20.5	10.8.0.99	TCP	68	45322
17	2025-12-02 20:1...	192.168.20.5	10.8.0.99	TCP	68	[TCP D
18	2025-12-02 20:1...	192.168.20.5	10.8.0.99	TCP	68	[TCP D
19	2025-12-02 20:1...	192.168.20.5	10.8.0.99	TCP	68	[TCP D
20	2025-12-02 20:1...	192.168.20.5	10.8.0.99	TELNET	92	Telnet
21	2025-12-02 20:1...	192.168.20.5	10.8.0.99	TCP	92	[TCP R
22	2025-12-02 20:1...	192.168.20.5	10.8.0.99	TCP	92	[TCP R
23	2025-12-02 20:1...	192.168.20.5	10.8.0.99	TCP	92	[TCP R
24	2025-12-02 20:1...	10.8.0.99	192.168.20.5	TCP	68	23 → 4
25	2025-12-02 20:1...	10.8.0.99	192.168.20.5	TCP	68	[TCP D
26	2025-12-02 20:1...	10.8.0.99	192.168.20.5	TCP	68	[TCP D
27	2025-12-02 20:1...	10.8.0.99	192.168.20.5	TCP	68	[TCP D
47	2025-12-02 20:1...	10.8.0.99	192.168.20.5	TELNET	80	Telnet
48	2025-12-02 20:1...	10.8.0.99	192.168.20.5	TCP	80	[TCP R
49	2025-12-02 20:1...	10.8.0.99	192.168.20.5	TCP	80	[TCP R
50	2025-12-02 20:1...	10.8.0.99	192.168.20.5	TCP	80	[TCP R
51	2025-12-02 20:1...	192.168.20.5	10.8.0.99	TCP	68	45322
52	2025-12-02 20:1...	192.168.20.5	10.8.0.99	TCP	68	[TCP D
53	2025-12-02 20:1...	192.168.20.5	10.8.0.99	TCP	68	[TCP D
54	2025-12-02 20:1...	192.168.20.5	10.8.0.99	TCP	68	[TCP D
55	2025-12-02 20:1...	10.8.0.99	192.168.20.5	TELNET	83	Telnet
56	2025-12-02 20:1...	192.168.20.5	10.8.0.99	TELNET	71	Telnet
57	2025-12-02 20:1...	192.168.20.5	10.8.0.99	TELNET	68	[TCP D

The packet details pane for packet 20 shows the following information:

- Frame 20: 92 bytes on wire (736 bits) captured (0.000000000 seconds) on interface eth0
- Ethernet II, Src: VirtualBox\_\_enp0s8, Dst: VirtualBox\_\_enp0s8
- TCP, Src Port: 45322, Dst Port: 23, Seq: 1000000000, Win: 0, Len: 0
- Telnet, Seq: 1000000000, Len: 0

The packet bytes pane shows the raw data of the selected packet:

```
0000  00 03 00 01 00 06 02 42  c0 a8 14 05 00 00 08 00  .....B .....
0010  45 10 00 4c af f0 40 00  40 06 ab 93 c0 a8 14 05  E..L..@. @.....
```

## Following the Telnet Protocol in wireshark screenshot:

The screenshot displays the Wireshark interface with a capture of a Telnet session. The packet list pane shows a series of TCP packets. Packet 20, which is a Telnet packet, is selected. A right-click context menu is open over packet 20, with the 'Follow' option highlighted. The packet details pane shows the raw data of the selected packet, which is a Telnet packet.

No.	Time	Source	Destination	Protocol	Length	Info
8	2025-12-02 20:1...	192.168.20.5	10.8.0.99	TCP	76	45322
9	2025-12-02 20:1...	192.168.20.5	10.8.0.99	TCP	76	[TCP 0
10	2025-12-02 20:1...	192.168.20.5	10.8.0.99	TCP	76	[TCP 0
11	2025-12-02 20:1...	192.168.20.5	10.8.0.99	TCP	76	[TCP 0
12	2025-12-02 20:1...	10.8.0.99	192.168.20.5	TCP	76	23 → 4
13	2025-12-02 20:1...	10.8.0.99	192.168.20.5	TCP	76	[TCP 0
14	2025-12-02 20:1...	10.8.0.99	192.168.20.5	TCP	76	[TCP 0
15	2025-12-02 20:1...	10.8.0.99	192.168.20.5	TCP	76	[TCP 0
16	2025-12-02 20:1...	192.168.20.5	10.8.0.99	TCP	68	45322
17	2025-12-02 20:1...	192.168.20.5	10.8.0.99	TCP	68	[TCP 0
18	2025-12-02 20:1...	192.168.20.5	10.8.0.99	TCP	68	[TCP 0
19	2025-12-02 20:1...	192.168.20.5	10.8.0.99	TCP	68	[TCP 0
20	2025-12-02 20:1...	192.168.20.5	10.8.0.99	TELNET	82	Telnet
21	2025-12-02 20:1...	192.168.20.5	10.8.0.99	TCP	68	[TCP 0
22	2025-12-02 20:1...	192.168.20.5	10.8.0.99	TCP	68	[TCP 0
23	2025-12-02 20:1...	192.168.20.5	10.8.0.99	TCP	68	[TCP 0
24	2025-12-02 20:1...	10.8.0.99	192.168.20.5	TCP	68	[TCP 0
25	2025-12-02 20:1...	10.8.0.99	192.168.20.5	TCP	68	[TCP 0
26	2025-12-02 20:1...	10.8.0.99	192.168.20.5	TCP	68	[TCP 0
27	2025-12-02 20:1...	10.8.0.99	192.168.20.5	TCP	68	[TCP 0
47	2025-12-02 20:1...	10.8.0.99	192.168.20.5	TCP	68	[TCP 0
48	2025-12-02 20:1...	10.8.0.99	192.168.20.5	TCP	68	[TCP 0
49	2025-12-02 20:1...	10.8.0.99	192.168.20.5	TCP	68	[TCP 0
50	2025-12-02 20:1...	10.8.0.99	192.168.20.5	TCP	68	[TCP 0
51	2025-12-02 20:1...	192.168.20.5	10.8.0.99	TCP	68	[TCP 0
52	2025-12-02 20:1...	192.168.20.5	10.8.0.99	TCP	68	[TCP 0
53	2025-12-02 20:1...	192.168.20.5	10.8.0.99	TCP	68	[TCP 0
54	2025-12-02 20:1...	192.168.20.5	10.8.0.99	TCP	68	[TCP 0
55	2025-12-02 20:1...	192.168.20.5	10.8.0.99	TCP	68	[TCP 0
56	2025-12-02 20:1...	192.168.20.5	10.8.0.99	TCP	68	[TCP 0

Context Menu Options:

- Mark/Unmark Packet (Ctrl+M)
- Ignore/Unignore Packet (Ctrl+D)
- Set/Unset Time Reference (Ctrl+T)
- Time Shift... (Ctrl+Shift+T)
- Packet Comment... (Ctrl+Alt+C)
- Edit Resolved Name
- Apply as Filter
- Prepare as Filter
- Conversation Filter
- Colorize Conversation
- SCTP
- Follow
- Copy
- Protocol Preferences
- Decode As...
- Show Packet in New Window

Packet Details (Raw Data):

```

0000  00 03 00 01 00
0010  45 10 00 4c af
0020  0a 08 00 63 b1
0030  80 18 01 f6 df
0040  41 5d 6a 06 ff fd 03 ff fb 18 ff fb 1f ff fb 20
0050  ff fb 21 ff fb 22 ff fb 27 ff fd 05
  
```

### Checking the TCP Stream screenshot:

A screenshot of the Wireshark 'Follow TCP Stream' window. The title bar reads 'Wireshark · Follow TCP Stream (tcp.stream eq 0) · any'. The main pane displays a reconstructed Telnet session. At the top, there are several lines of dots and special characters representing control sequences. Below these, the text '38400,38400....' is followed by a prompt '@'. Then, the text 'xterm.....Ubuntu 20.04.1 LTS' appears. This is followed by a login prompt '...55deb1a03d86 login: ddeeeess..' and a password prompt 'Password: dees'. After a line separator, a welcome message 'Welcome to Ubuntu 20.04.1 LTS (GNU/Linux 5.4.0-54-generic x86\_64)' is shown. Below this, three lines of system information are listed: '\* Documentation: https://help.ubuntu.com', '\* Management: https://landscape.canonical.com', and '\* Support: https://ubuntu.com/advantage'. A paragraph follows: 'This system has been minimized by removing packages and content that are not required on a system that users do not log into.' Another paragraph states: 'To restore this content, you can run the 'unminimize' command.' The session ends with the prompt 'seed@55deb1a03d86:~\$'. On the right side of the window, a partial view of the 'Info' pane is visible, showing packet details for TCP and Telnet.

**Explanation:** When the Telnet connection was initiated from Host B1 to external host A through the VPN tunnel, the firewall normally blocks this type of traffic, the VPN encapsulates all packets inside an encrypted SSH connection between A and B. Because of this, the firewall did not see any direct Telnet packets or SYN attempts. It only observed encrypted SSH packets flowing through the tunnel. This confirms that the Telnet session was successfully routed through the tun0 interfaces created by the SSH. When I opened Wireshark on the internal interface and located the Telnet packets before they were encrypted by the VPN. When I followed the TCP stream, Wireshark reconstructed the complete Telnet session. Even the username and password were visible in plaintext within the stream. This is because all data including credentials are sent as plaintext without encryption as Telnet doesn't provide that. Anyone with access to the network path could capture and read this information if the Telnet traffic is not protected by a tunnel.

## Task 3.2:

Connecting to Host B container screenshot:

```
seed@VM: ~/.../AneeshLabSetup
[12/02/25] seed@VM: ~/.../AneeshLabSetup$ dockps
55deb1a03d86  A-10.8.0.99
3046faf5f3ac  A1-10.8.0.5
f92991273035  B2-192.168.20.6
51dd4aa58085  B1-192.168.20.5
f2ed2cb305c7  router-firewall
05427ce2f081  A2-10.8.0.6
da4c4ab36818  B-192.168.20.99
[12/02/25] seed@VM: ~/.../AneeshLabSetup$ docksh da4
root@da4c4ab36818:/#
```

Running the SSH command screenshot on Host B:

```
seed@VM: ~/.../AneeshLabSetup
root@da4c4ab36818:/# ssh -w 0:0 root@10.8.0.99 -o "PermitLocalCo
mmand=yes" -o "LocalCommand= ip addr add 192.168.53.88/24 dev tu
n0 && ip link set tun0 up" -o "RemoteCommand= ip addr add 192.16
8.53.88/24 dev tun0 && ip link set tun0 up"
root@10.8.0.99's password:
```

Connecting to Host B2 container screenshot:

```
seed@VM: ~/.../AneeshLabSetup
[12/02/25] seed@VM: ~/.../AneeshLabSetup$ dockps
55deb1a03d86  A-10.8.0.99
3046faf5f3ac  A1-10.8.0.5
f92991273035  B2-192.168.20.6
51dd4aa58085  B1-192.168.20.5
f2ed2cb305c7  router-firewall
05427ce2f081  A2-10.8.0.6
da4c4ab36818  B-192.168.20.99
[12/02/25] seed@VM: ~/.../AneeshLabSetup$ f92

Command 'f92' not found, did you mean:

  command 'f95' from deb gfortran (4:9.3.0-1ubuntu2)
  command 'f95' from deb flang-7 (20190329-5)

Try: sudo apt install <deb name>
[12/02/25] seed@VM: ~/.../AneeshLabSetup$ docksh f92
root@f92991273035:/#
```

## Running the Telnet command on HostB container:

```
[12/02/25]seed@VM:~/.../AneeshLabSetup$ docksh f92
root@f92991273035:/# telnet 10.8.0.6
Trying 10.8.0.6...
Connected to 10.8.0.6.
Escape character is '^]'.
Ubuntu 20.04.1 LTS
05427ce2f081 login: seed
Password:
Welcome to Ubuntu 20.04.1 LTS (GNU/Linux 5.4.0-54-generic x86_64)

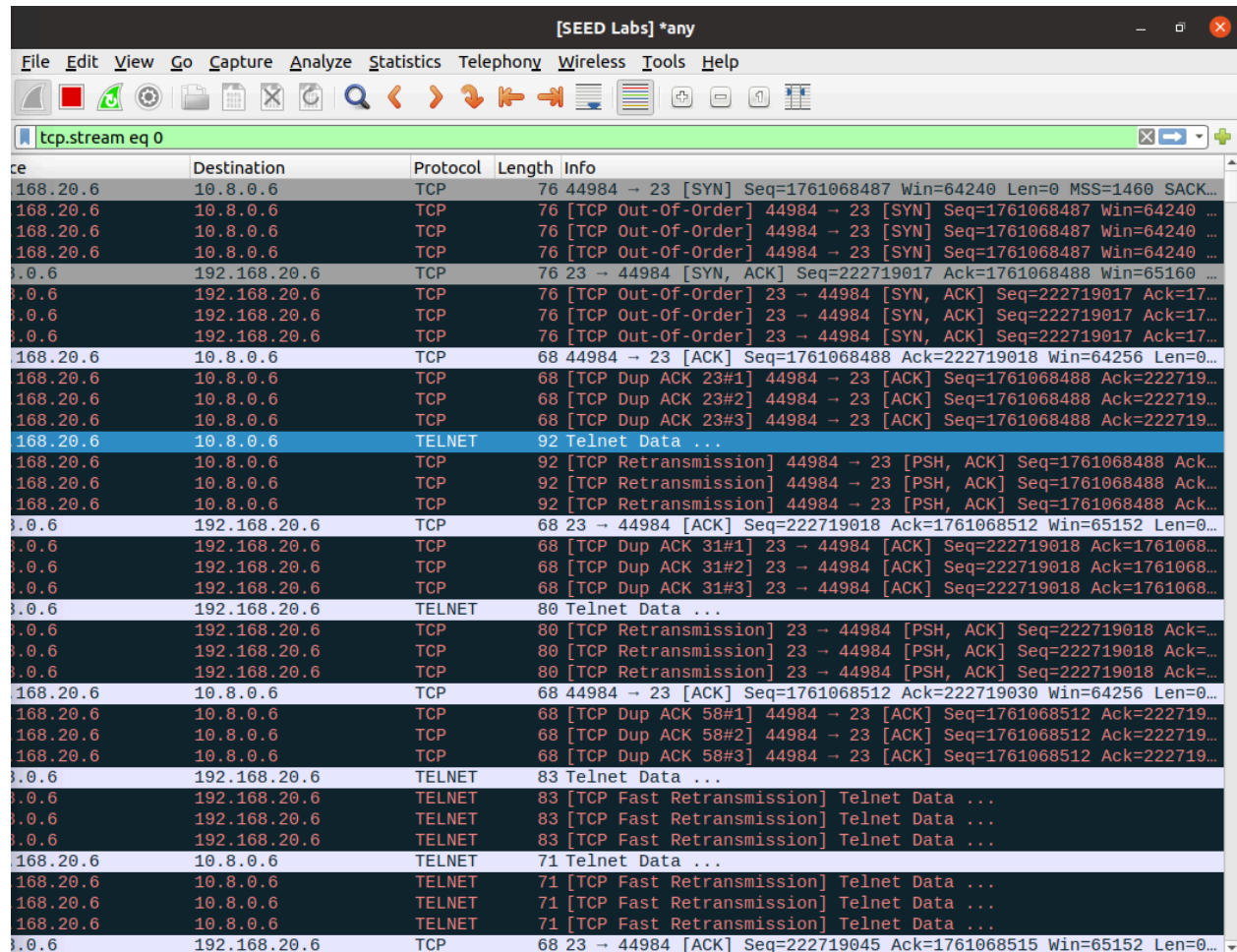
 * Documentation:  https://help.ubuntu.com
 * Management:    https://landscape.canonical.com
 * Support:       https://ubuntu.com/advantage

This system has been minimized by removing packages and content
that are
not required on a system that users do not log into.

To restore this content, you can run the 'unminimize' command.

The programs included with the Ubuntu system are free software;
```

## Wireshark screenshot after running the Telnet command:



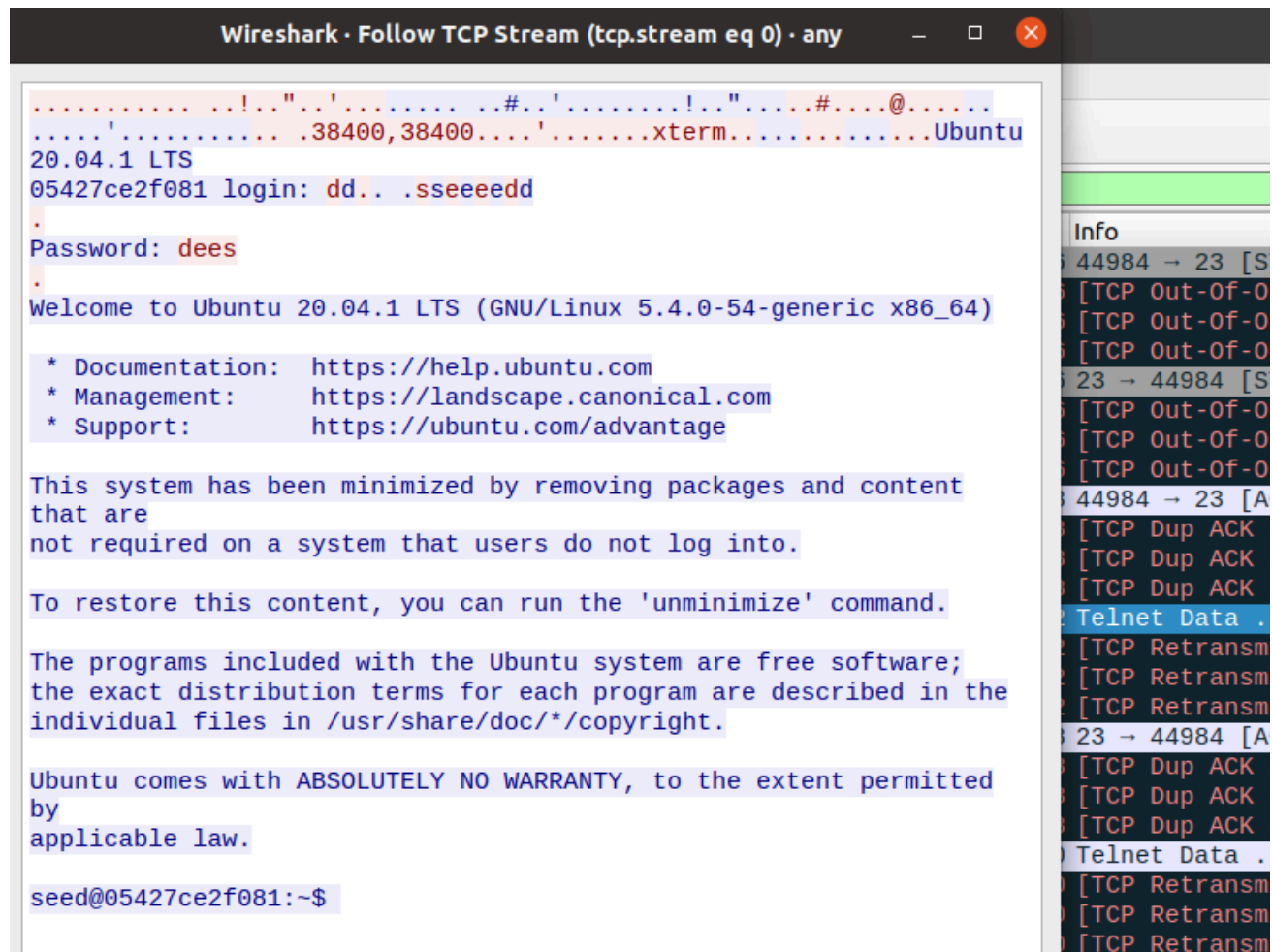
The screenshot shows a Wireshark capture of network traffic. The packet list on the left shows a sequence of packets. The packet details pane on the right shows the structure of a TELNET packet.

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	10.8.0.6	10.8.0.6	TCP	76	44984 → 23 [SYN] Seq=1761068487 Win=64240 Len=0 MSS=1460 SACK...
2	0.000000	10.8.0.6	10.8.0.6	TCP	76	[TCP Out-Of-Order] 44984 → 23 [SYN] Seq=1761068487 Win=64240 ...
3	0.000000	10.8.0.6	10.8.0.6	TCP	76	[TCP Out-Of-Order] 44984 → 23 [SYN] Seq=1761068487 Win=64240 ...
4	0.000000	10.8.0.6	10.8.0.6	TCP	76	[TCP Out-Of-Order] 44984 → 23 [SYN] Seq=1761068487 Win=64240 ...
5	0.000000	10.8.0.6	192.168.20.6	TCP	76	23 → 44984 [SYN, ACK] Seq=222719017 Ack=1761068488 Win=65160 ...
6	0.000000	10.8.0.6	192.168.20.6	TCP	76	[TCP Out-Of-Order] 23 → 44984 [SYN, ACK] Seq=222719017 Ack=17...
7	0.000000	10.8.0.6	192.168.20.6	TCP	76	[TCP Out-Of-Order] 23 → 44984 [SYN, ACK] Seq=222719017 Ack=17...
8	0.000000	10.8.0.6	192.168.20.6	TCP	76	[TCP Out-Of-Order] 23 → 44984 [SYN, ACK] Seq=222719017 Ack=17...
9	0.000000	10.8.0.6	10.8.0.6	TCP	68	44984 → 23 [ACK] Seq=1761068488 Ack=222719018 Win=64256 Len=0...
10	0.000000	10.8.0.6	10.8.0.6	TCP	68	[TCP Dup ACK 23#1] 44984 → 23 [ACK] Seq=1761068488 Ack=222719...
11	0.000000	10.8.0.6	10.8.0.6	TCP	68	[TCP Dup ACK 23#2] 44984 → 23 [ACK] Seq=1761068488 Ack=222719...
12	0.000000	10.8.0.6	10.8.0.6	TCP	68	[TCP Dup ACK 23#3] 44984 → 23 [ACK] Seq=1761068488 Ack=222719...
13	0.000000	10.8.0.6	10.8.0.6	TELNET	92	Telnet Data ...
14	0.000000	10.8.0.6	10.8.0.6	TCP	92	[TCP Retransmission] 44984 → 23 [PSH, ACK] Seq=1761068488 Ack...
15	0.000000	10.8.0.6	10.8.0.6	TCP	92	[TCP Retransmission] 44984 → 23 [PSH, ACK] Seq=1761068488 Ack...
16	0.000000	10.8.0.6	10.8.0.6	TCP	92	[TCP Retransmission] 44984 → 23 [PSH, ACK] Seq=1761068488 Ack...
17	0.000000	10.8.0.6	192.168.20.6	TCP	68	23 → 44984 [ACK] Seq=222719018 Ack=1761068512 Win=65152 Len=0...
18	0.000000	10.8.0.6	192.168.20.6	TCP	68	[TCP Dup ACK 31#1] 23 → 44984 [ACK] Seq=222719018 Ack=1761068...
19	0.000000	10.8.0.6	192.168.20.6	TCP	68	[TCP Dup ACK 31#2] 23 → 44984 [ACK] Seq=222719018 Ack=1761068...
20	0.000000	10.8.0.6	192.168.20.6	TCP	68	[TCP Dup ACK 31#3] 23 → 44984 [ACK] Seq=222719018 Ack=1761068...
21	0.000000	10.8.0.6	192.168.20.6	TELNET	80	Telnet Data ...
22	0.000000	10.8.0.6	192.168.20.6	TCP	80	[TCP Retransmission] 23 → 44984 [PSH, ACK] Seq=222719018 Ack=...
23	0.000000	10.8.0.6	192.168.20.6	TCP	80	[TCP Retransmission] 23 → 44984 [PSH, ACK] Seq=222719018 Ack=...
24	0.000000	10.8.0.6	192.168.20.6	TCP	80	[TCP Retransmission] 23 → 44984 [PSH, ACK] Seq=222719018 Ack=...
25	0.000000	10.8.0.6	10.8.0.6	TCP	68	44984 → 23 [ACK] Seq=1761068512 Ack=222719030 Win=64256 Len=0...
26	0.000000	10.8.0.6	10.8.0.6	TCP	68	[TCP Dup ACK 58#1] 44984 → 23 [ACK] Seq=1761068512 Ack=222719...
27	0.000000	10.8.0.6	10.8.0.6	TCP	68	[TCP Dup ACK 58#2] 44984 → 23 [ACK] Seq=1761068512 Ack=222719...
28	0.000000	10.8.0.6	10.8.0.6	TCP	68	[TCP Dup ACK 58#3] 44984 → 23 [ACK] Seq=1761068512 Ack=222719...
29	0.000000	10.8.0.6	192.168.20.6	TELNET	83	Telnet Data ...
30	0.000000	10.8.0.6	192.168.20.6	TELNET	83	[TCP Fast Retransmission] Telnet Data ...
31	0.000000	10.8.0.6	192.168.20.6	TELNET	83	[TCP Fast Retransmission] Telnet Data ...
32	0.000000	10.8.0.6	192.168.20.6	TELNET	83	[TCP Fast Retransmission] Telnet Data ...
33	0.000000	10.8.0.6	10.8.0.6	TELNET	71	Telnet Data ...
34	0.000000	10.8.0.6	10.8.0.6	TELNET	71	[TCP Fast Retransmission] Telnet Data ...
35	0.000000	10.8.0.6	10.8.0.6	TELNET	71	[TCP Fast Retransmission] Telnet Data ...
36	0.000000	10.8.0.6	10.8.0.6	TELNET	71	[TCP Fast Retransmission] Telnet Data ...
37	0.000000	10.8.0.6	192.168.20.6	TCP	68	23 → 44984 [ACK] Seq=222719045 Ack=1761068515 Win=65152 Len=0...



**Explanation:** In the screenshot above it can be seen that on Wireshark the internal interface shows the full TCP handshake and Telnet Data because this traffic is captured before entering the VPN tunnel. Once encapsulated the Telnet packets become encrypted inside SSH, so only the inner unencrypted traffic is visible on the internal side.

#### Checking TCP Stream of Telnet screenshot:



**Explanation:** The packets are not blocked by the firewall because all the traffic from B, B1 and B2 is routed through the VPN tunnel instead of going directly to the blocked websites. When the VPN is active, the internal hosts send their packets to tun0, where they are encapsulated and encrypted inside an SSH connection to A. The firewall only sees SSH traffic between B and A, which is allowed, and never sees the actual HTTP requests to the blocked IP ranges. It then makes the external web connection on behalf of the internal hosts, so the firewall's egress filters are completely bypassed.



## Task 4:

A SOCKS5 proxy forwards traffic on an application by application basis so only programs that are explicitly configured to use the proxy such as curl, browser or custom scripts will actually send their traffic through it. It does support tunneling for specific connections but does not protect all system traffic. The main advantages of SOCKS5 are that it is lightweight, easy to set up, and very effective for bypassing egress filters, but it does not encrypt any traffic at all beyond the SSH tunnel and also requires each application to have SOCKS support.

Whereas, A vpn creates a virtual network interface (tun0) that routes all system traffic through the tunnel automatically. Any program, even those without proxy support for example telnet can use the tunnel without modification. The pros of a VPNs are that it provides full network-level protection, hides all internal traffic from the firewall, and works transparently for every application. The cons are that they require more configuration and can introduce more overhead compared to SOCKS. For example in Task 3, when I created VPN tunneling every program on B, B1 and B2 automatically used the tunnel without any extra config.

Overall, I think SOCKS5 is useful when you only need to tunnel specific applications while the VPN is more powerful because it is transparent and protects all traffic without much setup.