



# Cybersecurity

## Module 11 Challenge Submission File

### Network Security Homework

Make a copy of this document to work in, and then fill out the solution for each prompt below. Save and submit this completed file as your Challenge deliverable.

#### Part 1: Review Questions

##### Security Control Types

The concept of defense in depth can be broken down into three security control types. Identify the security control type of each set of defense tactics.

1. Walls, bollards, fences, guard dogs, cameras, and lighting are what type of security control?

Physical security controls

2. Security awareness programs, BYOD policies, and ethical hiring practices are what type of security control?

Administrative security controls

3. Encryption, biometric fingerprint readers, firewalls, endpoint security, and intrusion detection systems are what type of security control?

Technical security controls

## Intrusion Detection and Attack Indicators

### 1. What's the difference between an IDS and an IPS?

The Intrusion Detection System (IDS) is designed to read and generate alerts by detecting attacks and unusual traffic while on the other hand Intrusion Prevention System (IPS) will block those detected attacks and unusual traffic.

### 2. What's the difference between an indicator of attack (IOA) and an indicator of compromise (IOC)?

An Indicator of Attack (IOA) will provide evidence and suggestion on an attempted attack or security breach towards a network or any operating system while the Indicator of Compromise will evidence a confirmed data breach or an attack that has already taken place.

## The Cyber Kill Chain

Name the seven stages of the cyber kill chain, and provide a brief example of each.

### 1. Stage 1:

**Reconnaissance:** The attacker will gather all the information or vulnerabilities like email address, password, name of the system owner, port information, etc. in order to begin a subtle yet a very effective attack.

### 2. Stage 2:

**Weaponization:** During this stage the attacker will develop an exploit to execute and may even construct a back door as backup in case their primary entry slot has been identified.

### 3. Stage 3:

**Delivery:** Here the attacker will begin sending their developed tool of attack for example any malicious link, attachments, trojan, etc. Here the

attacker may lean highly towards social engineering to make sure that at least their exploit receives some sort of response.

#### 4. Stage 4:

**Exploitation:** Upon successful delivery of the exploit tool, the attacker will begin exploiting the system within, for example, trying to get access to the configuration file or root.

#### 5. Stage 5:

**Installation:** The attacker will now begin installing the support threat actors and exploits to carry out the planned attack.

#### 6. Stage 6:

**Command and Control:** Taking assistance of the installed malwares and threat actors the attacker will slowly begin to gain the access of various tools and commands of the system. Here they may also start expanding their area of exploits within the systems using their tools.

#### 7. Stage 7:

**Actions on Objective:** In this stage the attacker will begin their final part of the attack which is stealing, manipulating and exploiting the data. This is deemed the most destructive step out of 7 as the damage cannot be controlled without any severe consequences.

*Reference: <https://www.crowdstrike.com/cybersecurity-101/cyber-kill-chain/>*

## Snort Rule Analysis

Use the provided Snort rules to answer the following questions:

### Snort Rule #1

```
alert tcp $EXTERNAL_NET any -> $HOME_NET 5800:5820 (msg:"ET SCAN Potential VNC Scan 5800-5820"; flags:S,12; threshold: type both, track by_src, count 5, seconds 60; reference:url,doc.emergingthreats.net/2002910; classtype:attempted-recon; sid:2002910; rev:5; metadata:created_at 2010_07_30, updated_at 2010_07_30;)
```

1. Break down the Snort rule header and explain what this rule does.

```
alert tcp $EXTERNAL_NET any -> $HOME_NET 5800:5820 (msg:"ET SCAN Potential VNC Scan 5800-5820"
```

**alert:** The alert has been generated upon a rule match

**tcp:** This will highlight the matched protocol, here it is highlighting "tcp"

**\$EXTERNAL\_NET:** As the name suggests, it will display the external hosts's range of an ip or network.

**any:** This will display the source port.

-> Direction for the flow of traffic

**\$HOME\_NET:** This is a variable which will indicate all range of ip which are protected.

**5800:5820:** Destination port range to match.

**msg:** ET SCAN Potential VNC Scan 5800-5820

2. What stage of the cyber kill chain does the alerted activity violate?

The alerted activity will likely violate the reconnaissance stage of the cyber kill chain.

3. What kind of attack is indicated?

Based on the generated alert, it is indicating a VNC (Virtual Network Computing) Scan attack.

## Snort Rule #2

```
alert tcp $EXTERNAL_NET $HTTP_PORTS -> $HOME_NET any (msg:"ET POLICY PE EXE
or DLL Windows file download HTTP"; flow:established,to_client;
flowbits:isnotset,ET.http.binary; flowbits:isnotset,ET.INFO.WindowsUpdate;
file_data; content:"MZ"; within:2; byte_jump:4,58,relative,little;
content:"PE|00 00|"; distance:-64; within:4; flowbits:set,ET.http.binary;
metadata: former_category POLICY;
reference:url,doc.emergingthreats.net/bin/view/Main/2018959;
classtype:policy-violation; sid:2018959; rev:4; metadata:created_at
2014_08_19, updated_at 2017_02_01;)
```

1. Break down the Sort rule header and explain what this rule does.

```
alert tcp $EXTERNAL_NET $HTTP_PORTS -> $HOME_NET any (msg:"ET POLICY PE EXE
or DLL Windows file download HTTP"
```

**alert:** The alert has been generated upon a rule match

**tcp:** This will highlight the matched protocol, here it is highlighting “tcp”

**\$EXTERNAL\_NET:** As the name suggests, it will display the external hosts’s range of an ip or network.

**\$HTTP\_PORTS:** Matched HTTP ports variable

-> Direction for the flow of traffic

**\$HOME\_NET:** This is a variable which will indicate all range of ip which are protected.

**any:** This will display the destination port.

**msg:** ET POLICY PE EXE or DLL Windows file download HTTP

2. What layer of the defense in depth model does the alerted activity violate?

The alerted activity will likely violate the delivery layer from the defense in depth model.

3. What kind of attack is indicated?

As per the alert which highlights Policy violation of PE(Portable Executable) or DLL Windows file download over HTTP, is indicating an attack to execute by downloading a malicious file on the victim's system.

### Snort Rule #3

Your turn! Write a Snort rule that alerts when traffic is detected inbound on port 4444 to the local network on any port. Be sure to include the `msg` in the rule option.

```
alert tcp $EXTERNAL_NET any -> $HOME_NET 4444 (msg: "Port 4444 detected incoming traffic"; sid:2010109)
```

## Part 2: "Drop Zone" Lab

Set up.

Log into the Azure `firewalld` machine using the following credentials:

- Username: `sysadmin`
- Password: `cybersecurity`

Uninstall UFW.

Before getting started, you should verify that you do not have any instances of UFW running. This will avoid conflicts with your `firewalld` service. This also ensures that `firewalld` will be your default firewall.

- Run the command that removes any running instance of UFW.

```
$ sudo apt remove ufw
```

## Enable and start firewalld.

By default, the firewalld service should be running. If not, then run the commands that enable and start firewalld upon boots and reboots.

```
$ sudo systemctl enable firewalld  
  
$ sudo systemctl start firewalld
```

**Note:** This will ensure that firewalld remains active after each reboot.

## Confirm that the service is running.

Run the command that checks whether the `firewalld` service is up and running.

```
$ sudo firewall-cmd --state
```

## List all firewall rules currently configured.

Next, list all currently configured firewall rules. This will give you a good idea of what's currently configured and save you time in the long run by ensuring that you don't duplicate work that's already done.

- Run the command that lists all currently configured firewall rules:

```
$ sudo firewall-cmd --list-all
```

- Take note of what zones and settings are configured. You may need to remove unneeded services and settings.

## List all supported service types that can be enabled.

- Run the command that lists all currently supported services to find out whether the service you need is available.

```
$ sudo firewall-cmd --get-services
```

- Notice that the `home` and `drop` zones are created by default.

## Zone views.

- Run the command that lists all currently configured zones.

```
$ sudo firewall-cmd --get-all-zones
```

- Notice that the `public` and `drop` zones are created by default. Therefore, you will need to create zones for `web`, `sales`, and `mail`.

## Create zones for `web`, `sales`, and `mail`.

- Run the commands that create `web`, `sales`, and `mail` zones.

```
$ sudo firewall-cmd --permanent --new-zone=web
```

```
$ sudo firewall-cmd --permanent --new-zone=sales
```

```
$ sudo firewall-cmd --permanent --new-zone=mail
```

## Set the zones to their designated interfaces.

- Run the commands that set your `eth` interfaces to your zones.

```
$ sudo firewall-cmd --zone=public --change-interface=eth0
```

```
$ sudo firewall-cmd --zone=web --change-interface=eth1
```

```
$ sudo firewall-cmd --zone=sales --change-interface=eth2
```

```
$ sudo firewall-cmd --zone=mail --change-interface=eth3
```



## Add services to the active zones.

- Run the commands that add services to the `public` zone, the `web` zone, the `sales` zone, and the `mail` zone.

- `public`:

```
$ sudo firewall-cmd --permanent --zone=public --add-service=http
$ sudo firewall-cmd --permanent --zone=public --add-service=https
$ sudo firewall-cmd --permanent --zone=public --add-service=pop3
$ sudo firewall-cmd --permanent --zone=public --add-service=smtp
```

- `web`:

```
$ sudo firewall-cmd --permanent --zone=web --add-service=http
```

- `sales`:

```
$ sudo firewall-cmd --permanent --zone=sales --add-service=https
```

- `mail`:

```
$ sudo firewall-cmd --permanent --zone=mail --add-service=pop3
$ sudo firewall-cmd --permanent --zone=mail --add-service=smtp
```

- What is the status of `http`, `https`, `smtp` and `pop3`?

The status of `http`, `https`, `smtp` and `pop3` indicates “yes”.

## Add your adversaries to the drop zone.

- Run the command that will add all current and any future blacklisted IPs to the `drop` zone.

```
$ sudo firewall-cmd --permanent --zone=drop --add-source =10.208.56.23
$ sudo firewall-cmd --permanent --zone=drop --add-source =135.95.103.76
$ sudo firewall-cmd --permanent --zone=drop --add-source =76.34.169.118
```

Make rules permanent, then reload them.

It's good practice to ensure that your firewalld installation remains nailed up and retains its services across reboots. This helps ensure that the network remains secure after unplanned outages such as power failures.

- Run the command that reloads the firewalld configurations and writes it to memory:

```
$ sudo firewall-cmd --reload
```

View active zones.

Now, provide truncated listings of all currently **active** zones. This is a good time to verify your zone settings.

- Run the command that displays all zone services.

```
$ sudo firewall-cmd --get-active-zones
```

Block an IP address.

- Use a rich-rule that blocks the IP address 138.138.0.3 on your public zone.

```
$ sudo firewall-cmd --zone=public --add-rich-rule='rule family="ipv4" source address="138.138.0.3" reject'
```

Block ping/ICMP requests.

Harden your network against ping scans by blocking icmp echo replies.

- Run the command that blocks pings and icmp requests in your public zone.

```
$ sudo firewall-cmd --zone=public --add-icmp-block=echo-reply  
--add-icmp-block=echo-request
```

### Rule check.

Now that you've set up your brand new firewalld installation, it's time to verify that all of the settings have taken effect.

- Run the command that lists all of the rule settings. Do one command at a time for each zone.

```
$ sudo firewall-cmd --zone=public --list-all  
  
$ sudo firewall-cmd --zone=web --list-all  
  
$ sudo firewall-cmd --zone=sales --list-all  
  
$ sudo firewall-cmd --zone=mail --list-all  
  
$ sudo firewall-cmd --zone=drop --list-all
```

- Are all of the rules in place? If not, then go back and make the necessary modifications before checking again.

Congratulations! You have successfully configured and deployed a fully comprehensive firewalld installation.

## Part 3: IDS, IPS, DiD and Firewalls

Now, you'll work on another lab. Before you start, complete the following review questions.

## IDS vs. IPS Systems

1. Name and define two ways an IDS connects to a network.

**Network tap:** These are physical hardware devices, which enables the network connectivity by maintaining an inbound and an outbound network flow at the same time.

**SPAN:** Span is also known as port mirroring, this will send an image of the all networks towards a physical port, where they can capture and analyze the packets.

*Reference: <https://git.bootcampcontent.com/University-of-Toronto/UTOR-VIRT-CYBER-PT-03-2023-U-LOLC/-/blob/main/Class-A/11-Network-Security/2/StudentGuide.md>*

2. Describe how an IPS connects to a network.

IPS physically connects inline with the flow of data. An IPS is typically placed in between the firewall and network switch.

*Reference: <https://git.bootcampcontent.com/University-of-Toronto/UTOR-VIRT-CYBER-PT-03-2023-U-LOLC/-/blob/main/Class-A/11-Network-Security/2/StudentGuide.md>*

3. What type of IDS compares patterns of traffic to predefined signatures and is unable to detect zero-day attacks?

Signature based IDS

4. What type of IDS is beneficial for detecting all suspicious traffic that deviates from the well-known baseline and is excellent at detecting when an attacker probes or sweeps a network?

Anomaly based IDS

## Defense in Depth

1. For each of the following scenarios, provide the layer of defense in depth that applies:

- a. A criminal hacker tailgates an employee through an exterior door into a secured facility, explaining that they forgot their badge at home.

Physical

- b. A zero-day goes undetected by antivirus software.

Application

- c. A criminal successfully gains access to HR's database.

Data

- d. A criminal hacker exploits a vulnerability within an operating system.

Host

- e. A hacktivist organization successfully performs a DDoS attack, taking down a government website.

Network

- f. Data is classified at the wrong classification level.

Policy, Procedures & Awareness

- g. A state-sponsored hacker group successfully firewalked an organization to produce a list of active services on an email server.

perimeter

2. Name one method of protecting data-at-rest from being readable on hard drive.

Hard drive encryption

3. Name one method of protecting data-in-transit.

VPN

4. What technology could provide law enforcement with the ability to track and recover a stolen laptop?

GPS Enabled Devices

5. How could you prevent an attacker from booting a stolen laptop using an external hard drive?

Firmware password

## Firewall Architectures and Methodologies

1. Which type of firewall verifies the three-way TCP handshake? TCP handshake checks are designed to ensure that session packets are from legitimate sources.

Circuit Level Gateways

2. Which type of firewall considers the connection as a whole? Meaning, instead of considering only individual packets, these firewalls consider whole streams of packets at one time.

Stateful Firewall

3. Which type of firewall intercepts all traffic prior to forwarding it to its final destination? In a sense, these firewalls act on behalf of the recipient by ensuring the traffic is safe prior to forwarding it.

## Application Firewall

4. Which type of firewall examines data within a packet as it progresses through a network interface by examining source and destination IP address, port number, and packet type—all without opening the packet to inspect its contents?

## Packet Filtering Firewalls

5. Which type of firewall filters solely based on source and destination MAC address?

## MAC Layer Firewalls

### Optional Additional Challenge Lab: “Green Eggs & SPAM”

In this activity, you will target spam, uncover its whereabouts, and attempt to discover the intent of the attacker.

- You will assume the role of a junior security administrator working for the Department of Technology for the State of California.
- As a junior administrator, your primary role is to perform the initial triage of alert data: the initial investigation and analysis followed by an escalation of high-priority alerts to senior incident handlers for further review.
- You will work as part of a Computer and Incident Response Team (CIRT), responsible for compiling **threat intelligence** as part of your incident report.

### Threat Intelligence Card

**Note:** Log in to the Security Onion VM, and use the following **indicator of attack** to complete this portion of the assignment.

Locate the indicator of attack in Sguil based off of the following:

- **Source IP/port:** 188.124.9.56:80
- **Destination address/port:** 192.168.3.35:1035
- **Event message:** ET TROJAN JS/Nemucod.M.gen downloading EXE payload

Answer the following questions:

1. What was the indicator of an attack? (*Hint: What do the details reveal?*)

[Enter answer here]

2. What was the adversarial motivation (purpose of the attack)?

[Enter answer here]

3. Describe observations and indicators that may be related to the perpetrators of the intrusion. Categorize your insights according to the appropriate stage of the cyber kill chain, as structured in the following table:

TTP	Example	Findings
<b>Reconnaissance</b>	How did the attacker locate the victim?	
<b>Weaponization</b>	What was downloaded?	
<b>Delivery</b>	How was it downloaded?	
<b>Exploitation</b>	What does the exploit do?	
<b>Installation</b>	How is the exploit installed?	
<b>Command &amp; Control (C2)</b>	How does the attacker gain control of the remote machine?	
<b>Actions on Objectives</b>	What does the software that the attacker sent do to complete its tasks?	

4. What are your recommended mitigation strategies?



[Enter answer here]

5. List your third-party references.

[Enter answer here]