INSTITUTE FOR ADVANCED COMPUTING
AND
SOFTWARE DEVELOPMENT
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DOCUMENTATION ON

"DEFENSE IN DEPTH"

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SUBMITTED BY

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ABSTRACT

"Defense in Depth" is a comprehensive security strategy that employs a multi-layered approach to safeguard an organization's assets and information. This project focuses on implementing a robust defense framework that integrates technological, procedural, and human-centric measures. The strategy encompasses network security, physical security, and personnel training, creating a resilient shield against potential threats. Through the deployment of advanced cybersecurity tools, encryption technologies, and intrusion detection systems, the project aims to fortify the organization's digital infrastructure. Additionally, emphasis is placed on establishing stringent access controls, periodic security audits, and incident response plans to ensure a proactive defense posture. The project recognizes the dynamic nature of security threats and incorporates continuous monitoring and threat intelligence to adapt and evolve the defense mechanisms. Collaborative efforts with external security experts and agencies contribute to a holistic approach, ensuring a unified front against cyber threats. Through simulation exercises and training programs, the project endeavors to enhance the organization's overall security awareness and preparedness. Ultimately, "Defense in Depth" seeks to create a resilient and adaptive security environment, safeguarding critical assets and information against an evolving threat landscape.

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1. INTRODUCTION

In today's digital landscape, cybersecurity threats are constantly evolving, making it imperative for organizations to adopt robust defensive measures to protect their assets and data. The "Defense in Depth" approach offers a comprehensive strategy for bolstering cybersecurity defenses by implementing multiple layers of security controls.

At the forefront of this strategy is the Perimeter Security Layer, where technologies like Snort, an intrusion detection system, help detect and prevent external threats from breaching the network. Moving inward, Network Security focuses on safeguarding the internal network using tools like iptables and sshguard to enforce strict access controls and detect suspicious activities.
Endpoint Security strengthens defenses by securing individual devices with technologies like Honeypots and Haproxy, while Data Security ensures the confidentiality and integrity of sensitive information by encrypting data stored in internal databases.

Identity and Access Management restricts access to critical resources, limiting administrative privileges to a single sudo user. Security Monitoring and Incident Response tools like tcpdump enable real-time detection and response to security incidents, while Application Security protects web-based services with HTTPS encryption on public networks.

Together, these layers form a comprehensive defense-in-depth strategy, providing organizations with the resilience and agility needed to defend against the ever-evolving threat landscape.

1.1 PROBLEM STATEMENT

In most organizations, the assumption of a security perimeter with trusted objects “inside” and untrusted objects “outside” no longer holds. Malicious insiders, compromised accounts, and zero-day vulnerabilities can quickly place malicious actors inside your network and at close range to critical infrastructure.

Defense in depth (DiD) is a security strategy that helps organizations deal with this situation. The strategy assumes that attackers will, or already have, penetrated different layers of the organization’s defenses. Multiple layers of security are needed to detect attackers at every stage of their attack cycle.

1.2 ADVANTAGES

- **Enhanced Security**: Defense in depth provides multiple layers of defense mechanisms, making it harder for attackers to penetrate the system.
- **Redundancy**: By having multiple layers, if one layer fails, there are other layers in place to protect the system.
- **Flexibility:** It allows organizations to tailor security measures according to their specific needs and requirements.
- **Resilience:** Defense in depth increases the system's ability to withstand and recover from attacks or security breaches.
- **Compliance:** It helps organizations meet regulatory requirements by demonstrating robust security measures at various levels.

2. LITERATURE SURVEY

The "Defense in Depth" project aims to create a robust cybersecurity framework that provides comprehensive protection against a wide range of cyber threats. By adopting a layered defense strategy, the project seeks to enhance the security posture of organizations and minimize the risk of data breaches and cyber attacks.

Perimeter Security Layer (Snort): The project focuses on implementing Snort, an open-source intrusion detection system (IDS), at the perimeter to monitor and analyze network traffic. Snort's rule-based detection mechanism helps identify and block malicious activities, safeguarding the organization's network perimeter from external threats.

Network Security (Internal Network): Beyond the perimeter, the project emphasizes strengthening internal network security measures to protect against insider threats and unauthorized access. This involves deploying firewalls, segmenting networks, and enforcing access controls to prevent unauthorized access to sensitive information and resources.

Endpoint Security (iptables, sshguard, Honeypot, Haproxy): Endpoint security is vital for protecting individual devices from cyber threats. The project incorporates iptables for host-based firewall protection, sshguard to mitigate brute-force attacks on SSH connections, and honeypots to lure and trap attackers. Additionally, Haproxy helps balance and secure traffic between servers, ensuring high availability and protection against DDoS attacks.

Data Security (Encrypted Database): Data security measures focus on encrypting sensitive information stored in databases to prevent unauthorized access and data breaches. By encrypting data at rest and in transit, the project aims to safeguard confidential information even if attackers manage to penetrate other layers of defense.

Identity and Access Management (Sudo User): Limiting administrative privileges to a single sudo user helps reduce the attack surface and minimize the risk of privilege escalation attacks. By enforcing strong authentication mechanisms and least privilege principles, the project ensures that only authorized users have access to critical resources.

Security Monitoring and Incident Response (tcpdump): The project emphasizes proactive security monitoring using tcpdump to capture and analyze network traffic for suspicious activities.

Application Security (Https - Public Network): Securing web applications is critical to protecting against various cyber threats such as cross-site scripting (XSS), SQL injection, and data breaches. Implementing HTTPS (Hypertext Transfer Protocol Secure) ensures secure communication between web servers and clients by encrypting data transmission over the internet

3. SURVEY OF TECHNOLOGY

In deploying the "Defense in Depth" strategy, a thorough survey of technology solutions is essential to address various cybersecurity aspects effectively. Beginning with perimeter security, Snort emerges as a preferred choice for its rule-based intrusion detection capabilities and strong community support. For internal network security, the use of VLANs, ACLs, and VPNs enhances segmentation and restricts unauthorized access. Endpoint security is bolstered by leveraging iptables for firewall management, sshguard for dynamic SSH blocking, and Honeypots for deceptive defense. Haproxy is selected for load balancing and reverse proxy functions, ensuring robust protection.

Data security is fortified by implementing AES encryption for databases, safeguarding sensitive information from unauthorized access. Identity and access management practices include designating a single user as a sudo user, minimizing administrative privileges and reducing potential attack vectors. Security monitoring and incident response capabilities are enhanced with tcpdump for real-time packet analysis, facilitating rapid threat detection and mitigation.

Application security is prioritized with the adoption of HTTPS for secure web communication, mitigating risks associated with data interception and manipulation. Secure file transfer protocols such as SFTP are employed to ensure encrypted transmission of files, maintaining data confidentiality and integrity. DNS security is ensured with BIND9, known for its robustness and support for DNSSEC, providing authentication and integrity verification for DNS responses.

Additionally, password security measures involve implementing Bcrypt for secure password storage, mitigating risks associated with password-based attacks. Through this comprehensive survey and adoption of appropriate technologies, organizations can establish a multi-layered defense strategy, safeguarding against diverse cyber threats effectively.

4.REQUIREMENT & ANALYSIS

Requirements:

Hardware requirements :

Operating system :- Debian 12 & Windows 10
RAM : 16 GB
SSD: 256GB
Virtual Box(VB)

5. METHODOLOGY

Methodology for implementing the "Defense in Depth" approach involves a systematic process to address various aspects of cybersecurity.

Requirement Analysis: Begin by analyzing the organization's security requirements and identifying potential vulnerabilities and risks.
Perimeter Security Layer (Snort): Deploy Snort at the network perimeter to analyze incoming and outgoing traffic for signs of malicious activity.
Network Security (Internal Network): Implement network segmentation, access control lists (ACLs), and virtual private networks (VPNs) to secure communication within the internal network.
Endpoint Security (iptables, sshguard, Honeypot, Haproxy): Configure iptables as a firewall utility to manage network traffic rules. Install sshguard to monitor SSH login attempts and block suspicious IP addresses dynamically. Deploy Honeypots to divert attackers from critical systems. Use Haproxy as a reverse proxy for enhanced security and performance.

Data Security (Encrypted Database): Encrypt databases containing sensitive information using encryption algorithms like AES to protect data confidentiality.

Identity and Access Management (Sudo User): Limit access to critical systems by granting sudo privileges to authorized users only.

Security Monitoring and Incident Response (tcpdump): Install tcpdump for real-time network traffic analysis and packet capture to monitor network activity and detect anomalies.

Application Security (HTTPS): Secure web applications using HTTPS to encrypt data transmitted between web browsers and servers.

Secure File Transfer (SFTP): Implement SFTP for secure file transfer between systems, ensuring data confidentiality during transit.

DNS Security (BIND9): Deploy BIND9 DNS server with DNSSEC to authenticate DNS responses and prevent DNS spoofing attacks.

Password Security (Bcrypt): Use Bcrypt for secure password storage, generating salted hash values to protect user passwords from brute-force attacks.

Integration and Testing: Integrate all security components into the organization's infrastructure and conduct thorough testing to ensure proper functionality and effectiveness.

Training and Awareness: Provide training to employees on security best practices and raise awareness about potential cyber threats and how to mitigate them.

Regular Updates and Maintenance: Implement a process for regular updates and maintenance of security systems and protocols to address emerging threats and vulnerabilities.

By following this methodology, organizations can establish a robust defense in depth strategy to protect against a wide range of cyber threats and ensure the security of their critical assets and data.

Snort: Snort works by analyzing network traffic in real-time to detect and alert on suspicious activity based on predefined rules.
iptables: iptables operates as a firewall by filtering and manipulating network packets to control incoming and outgoing traffic.
sshguard: sshguard protects against brute-force attacks by monitoring SSH authentication attempts and dynamically blocking malicious IP addresses.
Honeypot: Honeypots simulate vulnerable systems to lure attackers, allowing security professionals to monitor and analyze their tactics and techniques.
Haproxy: Haproxy functions as a load balancer and reverse proxy, distributing incoming traffic across multiple servers and providing high availability and performance.
AES encryption: AES encryption secures data by encrypting it with a symmetric key cipher, ensuring confidentiality and integrity during storage and transmission.
sudo user: Designating a single sudo user restricts administrative privileges to one account, reducing the attack surface and enhancing access control.
tcpdump: tcpdump captures and analyzes network packets in real-time, providing valuable insights for network troubleshooting, security monitoring, and forensics.
HTTPS: HTTPS encrypts web communication using SSL/TLS protocols, protecting sensitive information from eavesdropping and tampering.
SFTP: SFTP enables secure file transfer over SSH, encrypting data during transmission to prevent interception and unauthorized access.
BIND9: BIND9 serves as a DNS server, translating domain names into IP addresses and facilitating secure and reliable domain name resolution.
Bcrypt: Bcrypt hashes and salts passwords, making them resistant to brute-force attacks and enhancing password security in authentication systems.

Working:-

sshguard -

```
sudo apt install sshguard
sudo systemctl start sshguard
sudo systemctl enable sshguard
sudo nano /etc/sshguard/sshguard.conf
sudo systemctl restart sshguard
sudo nano /etc/sshguard/sshguard.conf
sudo systemctl restart sshguard
```

configuration file -

```
#### REQUIRED CONFIGURATION ####
# Full path to backend executable (required, no default)
BACKEND="/usr/lib/x86_64-linux-gnu/sshg-fw-nft-sets"

# Shell command that provides logs on standard output. (optional, no default)
# Example 1: ssh and sendmail from systemd journal:
LOGREADER="LANG=C /bin/journalctl -afb -p info -n1 -o cat SYSLOG_FACILITY=4 SYSLOG_FACILITY=10"

#### OPTIONS ####
# Block attackers when their cumulative attack score exceeds THRESHOLD.
# Most attacks have a score of 10. (optional, default 30)
THRESHOLD=30
BLOCK_DURATION=600
UNBLOCK_THRESHOLD=50
MAX_ATTEMPTS_PER_IP=3
LOG_LEVEL=ERROR
SYSLOG_ENABLE=yes
FIREWALL_BACKEND=iptables
# Block attackers for initially BLOCK_TIME seconds after exceeding THRESHOLD.
# Subsequent blocks increase by a factor of 1.5. (optional, default 120)
BLOCK_TIME=120

# Remember potential attackers for up to DETECTION_TIME seconds before
# resetting their score. (optional, default 1800)
DETECTION_TIME=1800
```

cmd -

```
sudo systemctl status sshguard
```

DNS (*BIND9*):

```
;
; BIND reverse data file for local loopback interface
;
$TTL    604800
@       IN      SOA     ns.shuharilabs.local. admin.shuharilabs.local. (
                              1         ; Serial
                         604800         ; Refresh
                          86400         ; Retry
                        2419200         ; Expire
                         604800 )       ; Negative Cache TTL
;
@       IN      NS      ns.shuharilabs.local.
1.0.0   IN      PTR     localhost.
127     IN  PTR     ns.shuharilabs.local.
16      IN  PTR     ser1.shuharilabs.local.
41      IN  PTR     ser1.shuharilabs.local.
```

HAPROXY:

```
global
        log /dev/log    local0
        log /dev/log    local1 notice
        chroot /var/lib/haproxy
        stats socket /run/haproxy/admin.sock mode 660 level admin
        stats timeout 30s
        user haproxy
        group haproxy
        daemon

        # Default SSL material locations
        ca-base /etc/ssl/certs
        crt-base /etc/ssl/private

        # See: https://ssl-config.mozilla.org/#server=haproxy&server-version=2.0.3&config=intermediate
        ssl-default-bind-ciphers ECDHE-ECDSA-AES128-GCM-SHA256:ECDHE-RSA-AES128-GCM-SHA256:ECDHE-ECDSA-AES256-GCM-SHA384:ECDHE-RSA-AES256-GCM-SHA384:ECDHE-ECDSA-CHACHA20-POLY1305:ECDHE-RSA-CHACHA20-POLY1305:DHE-RSA-AES128-GCM-SHA256:DHE-RSA-AES256-GCM-SHA384
        ssl-default-bind-ciphersuites TLS_AES_128_GCM_SHA256:TLS_AES_256_GCM_SHA384:TLS_CHACHA20_POLY1305_SHA256
        ssl-default-bind-options ssl-min-ver TLSv1.2 no-tls-tickets

defaults
        log     global
        mode    http
```

```
        option  httplog
        option  dontlognull
        timeout connect 5000
        timeout client  50000
        timeout server  50000
        errorfile 400 /etc/haproxy/errors/400.http
        errorfile 403 /etc/haproxy/errors/403.http
        errorfile 408 /etc/haproxy/errors/408.http
        errorfile 500 /etc/haproxy/errors/500.http
        errorfile 502 /etc/haproxy/errors/502.http
        errorfile 503 /etc/haproxy/errors/503.http
        errorfile 504 /etc/haproxy/errors/504.http

frontend http_front
        bind *:80
#       bind *:443
        default_backend http_back

backend http_back
        balance roundrobin
        server server1 192.168.64.41:80 check
        server server2 192.168.64.16:80 check
```

Honey-pot

```
sudo update-alternatives --install /usr/bin/python3 python3 /usr/local/bin/python3.8 1
 sudo apt install git python3-virtualenv libssl-dev libffi-dev build-essential libpython3-dev
python3-minimal authbind virtualenv
git clone https://github.com/cowrie/cowrie.git cowrie

 wget https://www.python.org/ftp/python/3.11.3/Python-3.11.7.tgz
unzip Python-3.11.2.tar.xz
    sudo unzip Python-3.11.2.tar.xz
    sudo tar -xf Python-3.11.2.tar.xz
    ls
   cd Python-3.11.2
    ls
    ./configure --enable-optimizations
    sudo make altinstall
   sudo update-alternatives --install /usr/bin/python3 python3 /usr/local/bin/python3.11 1
 sudo update-alternatives --install /usr/bin/python3 python3 /usr/local/bin/python3.11 1
sudo apt install python3-virtualenv
  801  sudo pip install virtualenv==15.1.0
virtualenv venv
source venv/bin/activate
```

```
    pip install --upgrade pip
    pip install --upgrade -r requirements.txt
cp etc/cowrie.cfg.dist etc/cowrie.cfg
    nano etc/cowrie.cfg
    nano etc/userdb.txt
    bin/cowrie status
    bin/cowrie start
    bin/cowrie status
         top
   sudo tail -f var/log/cowrie/cowrie.log
```

change ssh port number 22 to 222 (any) [cmd login - ssh -p 222 ser1@192.168.56.117]
set cowrie port number 22

iptables

sudo iptables -A INPUT -p tcp --dport 80 -m state --state NEW -m recent --set
sudo iptables -A INPUT -p tcp --dport 80 -m state --state NEW -m recent --update --seconds 60 --hitcount 10 -j DROP

sudo iptables -A INPUT -p tcp --dport 443 -m state --state NEW -m recent --set --name HTTPS
sudo iptables -A INPUT -p tcp --dport 443 -m state --state NEW -m recent --update --seconds 60 --hitcount 3 --name HTTPS -j DROP

whitelisting
sudo iptables -A INPUT -s trusted_ip_address -j ACCEPT

blacklisting
sudo iptables -A INPUT -s malicious_ip_address -j DROP

alert tcp any any -> $HOME_NET 80 (msg:"Possible HTTP Flood Detected"; flow:stateless; threshold:type limit, track by_src, count 10, seconds 60; sid:1000001;)

HTTPS CERTIFICATE USING OPENSSL:

ROOTCA -

sudo apt install vsftpd openssl net-tools tree -y
path /home/shuhari

mkdir ca

cd ca
mkdir -p certs crl newcerts private subca/csr subca/certs
touch index.txt
touch index.txt.attr
echo 1000 > serial
echo 1000 > crlnumber

import rootca.cnf file and change path dir = /home/shuhari/ca

KEY GENERATION -

openssl genrsa -aes256 -out private/ca.key.pem 4096
chmod 400 private/ca.key.pem
CERTIFICATE -

openssl req -config rootca.cnf -key private/ca.key.pem -new -x509 -days 7200 -sha256 -extensions v3_ca -out certs/ca.cert.pem

SUBCA -
sudo apt install vsftpd openssl net-tools tree -y
mkdir subca
cd subca
mkdir certs csr crl newcerts private
touch index.txt
touch index.txt.attr
echo 1000 > serial
echo 1000 > crlnumber
import subca.cnf file change path dir = /home/shuhari/subca
SUBCA KEY -
openssl genrsa -aes256 -out private/subca.key.pem 4096
chmod 400 private/subca.key.pem

SUBCA CSR -
openssl req -config subca.cnf -key private/subca.key.pem -new -sha256 -out csr/subca.csr.pem

scp csr/subca.cnf 192.168.80.4:/home/shuhari/subca/csr

Open ROOT
ROOTCA SIGN ON SUBCA -

openssl ca -config rootca.cnf -extensions v3_intermediate_ca -days 3650 -notext -md sha256 -in subca/csr/subca.csr.pem -out subca/cert/subca.cert.pem

openssl -x509 -noout -text -in subca/cert/subca.cert.pem

compare sha256

sha256sum newcerts/index.txt subca/cert/subca.cert.pem

scp subca/cert/subca.cert.pem 192.168.80.3:/home/shuhari/certs

WEB CERTIFICATE -
sudo apt install vsftpd bind9 apache2 tree openssl net-tools -y
SETUP DNS
import subca.cnf file
mkdir /home/shuhari/certs
mkdir /home/shuhari/ser1
cd certs
KEY GENERATION -
openssl genrsa -aes256 -out www.shuhari.local.key.pem 2048
chmod 400 www.shuhari.local.key.pem

CSR -
openssl req -config subca.cnf -key www.shuhari.local.key.pem -new -sha256 -out www.shuhari.local.csr.pem

scp www.shuhari.local.csr.pem 192.168.80.3:/home/shuhari/csr

open subca
SUBCA SIGN ON WWW -
openssl ca -config subca.cnf -extensions server_cert -days 365 -notext -md sha256 -in csr/www.shuhari.local.csr.pem -out certs/www.shuhari.local.cert.pem

NOW COLLECT ALL CERTIFICATES OF ROOTCA SUBCA AND WWW
scp certs/* 192.168.80.5:/home/shuhari/ser1

FROM ROOTCA
scp certs/ca.cert.pem 192.168.80.5:/home/shuhari/ser1
go to WWWW

cd ser1

cat www.shuhari.local.cert.pem subca.cert.pem ca.cert.pem > www.bundle.cert

mkdir /etc/apache2/ssl
sudo a2enmod ssl
sudo a2ensite default-ssl

sudo cp www.bundle.cert /etc/apache2/ssl
sudo cp ../certs/www.shuhari.local.key.pem /etc/apache2/ssl

sudo nano /etc/apache2/sites-available/default-ssl

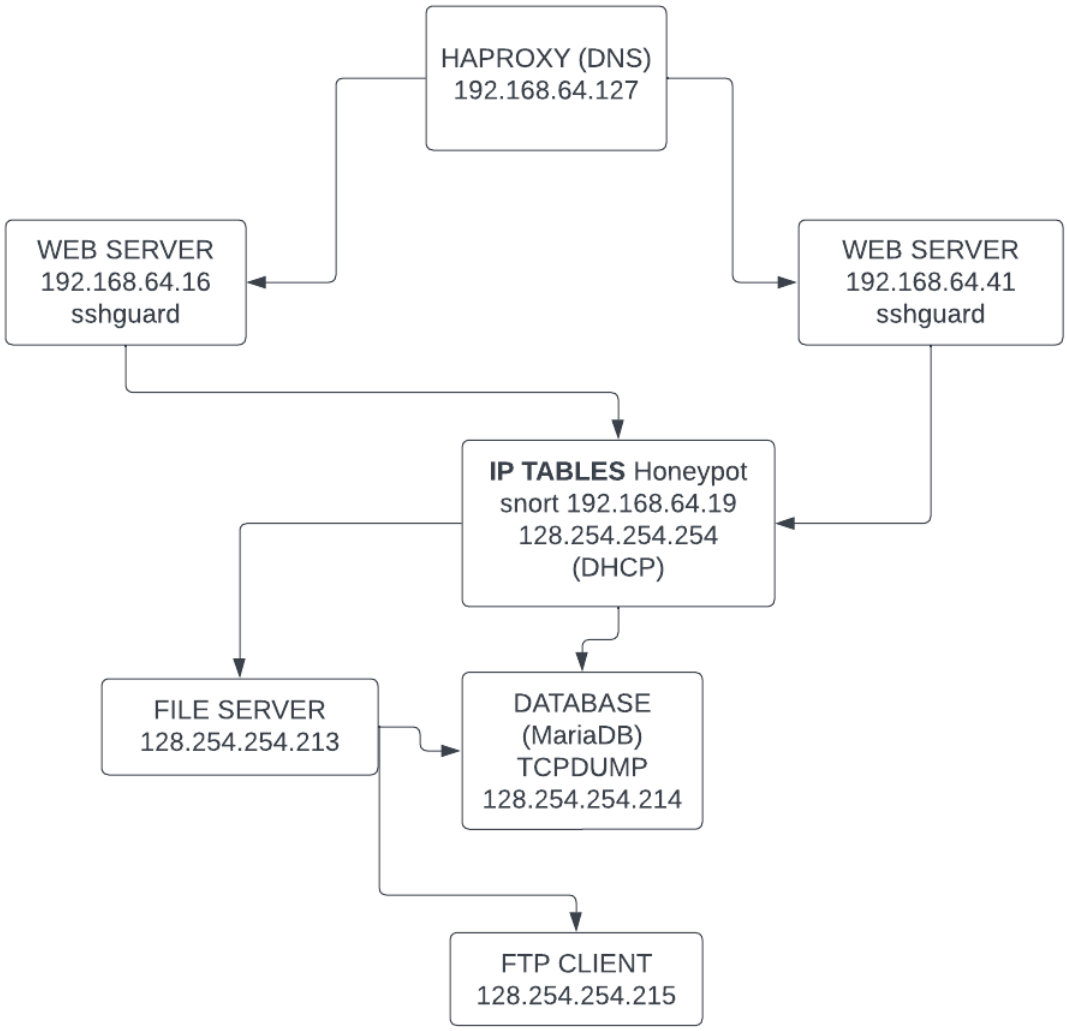
5.1 PROPOSED SYSTEM

Defense in depth helps you ensure that you are protecting your systems as effectively as possible. It forces you to account for security even when your various tools and solutions have been compromised. No security tool or measure is perfect so you need to account for potential failures. By building in layers of security, you can reduce the chance of a single point of failure occurring in your systems.

The digital world has revolutionized how we live, work and play. However, it's a digital world that is constantly open to attack, and because there are so many potential attackers, we need to ensure we have the right security in place to prevent systems and networks being compromised. Unfortunately, there is no single method that can successfully protect against every single type of attack. This is where a defense in depth architecture comes into play.

6.SYSTEM DESIGN

6.1 FLOW CHART



7. IMPLEMENTATION

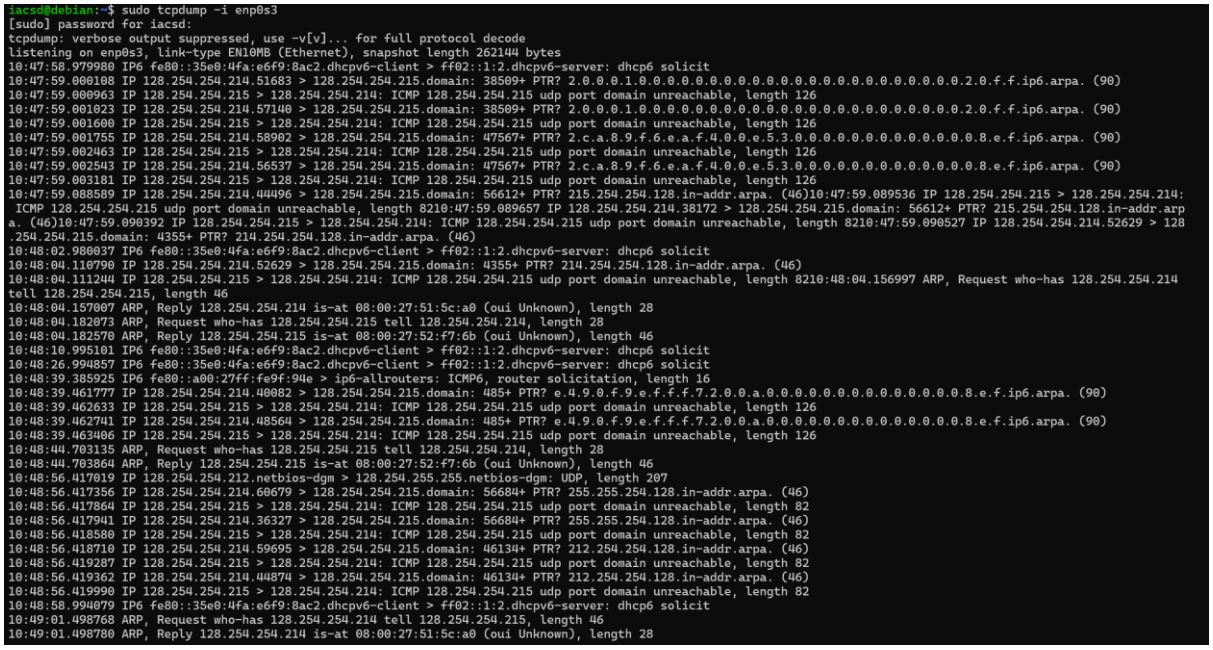
INTERNAL NETWORK

```
iacsd@debian:~$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
       valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host noprefixroute
       valid_lft forever preferred_lft forever
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 08:00:27:51:5c:a0 brd ff:ff:ff:ff:ff:ff
    inet 128.254.254.214/16 brd 128.254.255.255 scope global dynamic enp0s3
       valid_lft 427sec preferred_lft 427sec
    inet6 fe80::a00:27ff:fe51:5ca0/64 scope link
       valid_lft forever preferred_lft forever
3: enp0s8: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 08:00:27:73:04:2d brd ff:ff:ff:ff:ff:ff
    inet 192.168.56.112/24 brd 192.168.56.255 scope global dynamic enp0s8
       valid_lft 442sec preferred_lft 442sec
    inet6 fe80::a00:27ff:fe73:42d/64 scope link
       valid_lft forever preferred_lft forever
iacsd@debian:~$
```

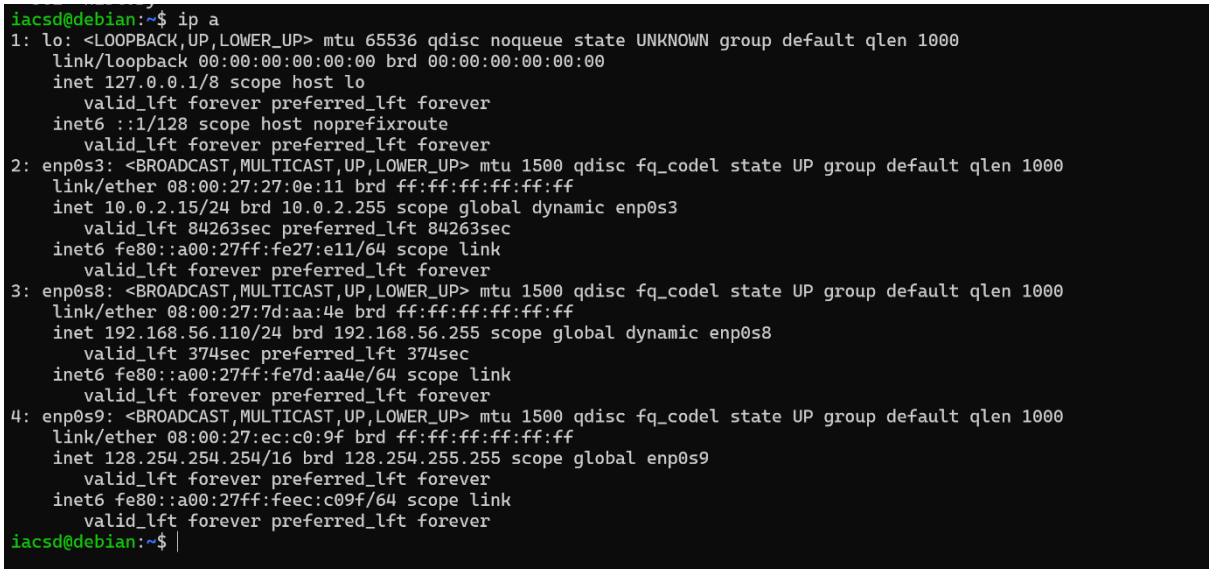
MARIADB PASSWORD ENCRYPTION -

```
MariaDB [pr]> select * from data;
+----+----------+--------------------------------------------------------------+
| id | username | password                                                     |
+----+----------+--------------------------------------------------------------+
|  1 |          |                                                              |
|  2 | user1    | pass@123                                                     |
|  3 |          |                                                              |
|  4 |          |                                                              |
|  5 |          |                                                              |
|  6 | hello    | hello                                                        |
|  7 | hello    | $2y$10$WLvYmOt2XFi.oajbocpM2OtJ0Bvk8HqgYvf7P5gtIUToVWe2zX79e |
|  8 | exam     | $2y$10$ogS7Z1FDX7kK6KdEOMD0UuTYuXlCxTv/w3GCcjR/cGIVOhu0BqI82 |
|  9 | Ditiss   | $2y$10$/NJgWdYC2SwwOi8jDo1NAOl5NUT/bcg92zpa8o2JYX0ucKoDADT1i |
| 10 | iacsd    | $2y$10$eZzyTsbwAGDdEYEU7xDMYepNEZAm6JzqgTSDaUbZU1ZnYpxtKdwCC |
| 11 | Pune     | $2y$10$4cqbML0sfcWpWW8sW8RDYOr5T8Je14CkrYr4dZM.kqDc4wKk1DBIm |
| 12 | India    | $2y$10$fNh4bZ4gh9o61Kseu7aAluzHi3WrrY7mSmzzQWi3AuUHcwGcJuzO6 |
| 13 | sushma   | $2y$10$kFYVbSL3yo3AhotZAZXs7eA/mlcUeH5ML0yI8BP.QB8KlqNonW/fC |
| 14 | pratik   | $2y$10$7AWf0VSBYmGzo8h/tfCSiOYAbguk6zg47L5Kl2bk/SswssjqMcNMu |
| 15 | q        | $2y$10$IpoROkIxEBD3ET/u/qz5BedygbBvIqCbNVZtoQ56G4cJEoLdpO18O |
+----+----------+--------------------------------------------------------------+
15 rows in set (0.000 sec)

MariaDB [pr]>
```

TCPDUMP



IPTABLES

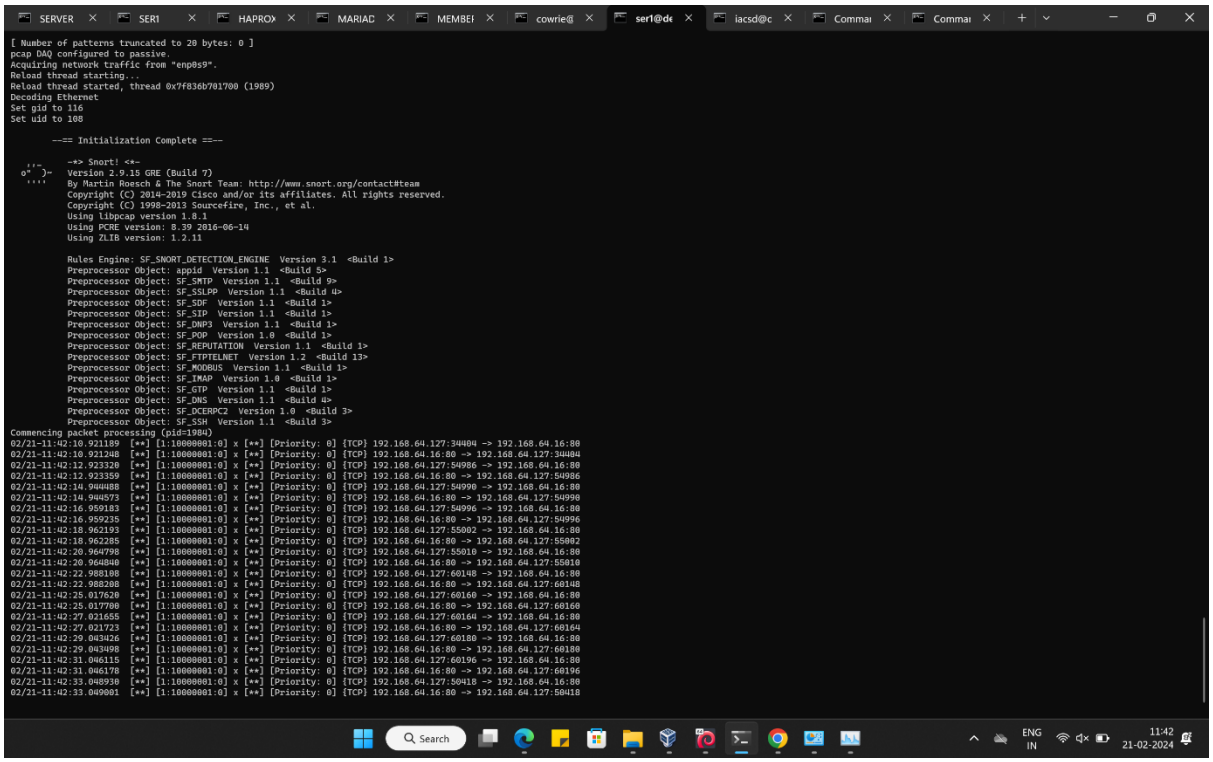


```
iacsd@debian:~$ sudo iptables -L
Chain INPUT (policy ACCEPT)
target     prot opt source               destination

Chain FORWARD (policy ACCEPT)
target     prot opt source               destination
ACCEPT     all  --  anywhere             anywhere
ACCEPT     all  --  anywhere             anywhere             state RELATED,ESTABLISHED

Chain OUTPUT (policy ACCEPT)
target     prot opt source               destination
iacsd@debian:~$ sudo iptables -t nat -L
Chain PREROUTING (policy ACCEPT)
target     prot opt source               destination

Chain INPUT (policy ACCEPT)
target     prot opt source               destination

Chain OUTPUT (policy ACCEPT)
target     prot opt source               destination

Chain POSTROUTING (policy ACCEPT)
target     prot opt source               destination
MASQUERADE  all  --  anywhere             anywhere
iacsd@debian:~$
```

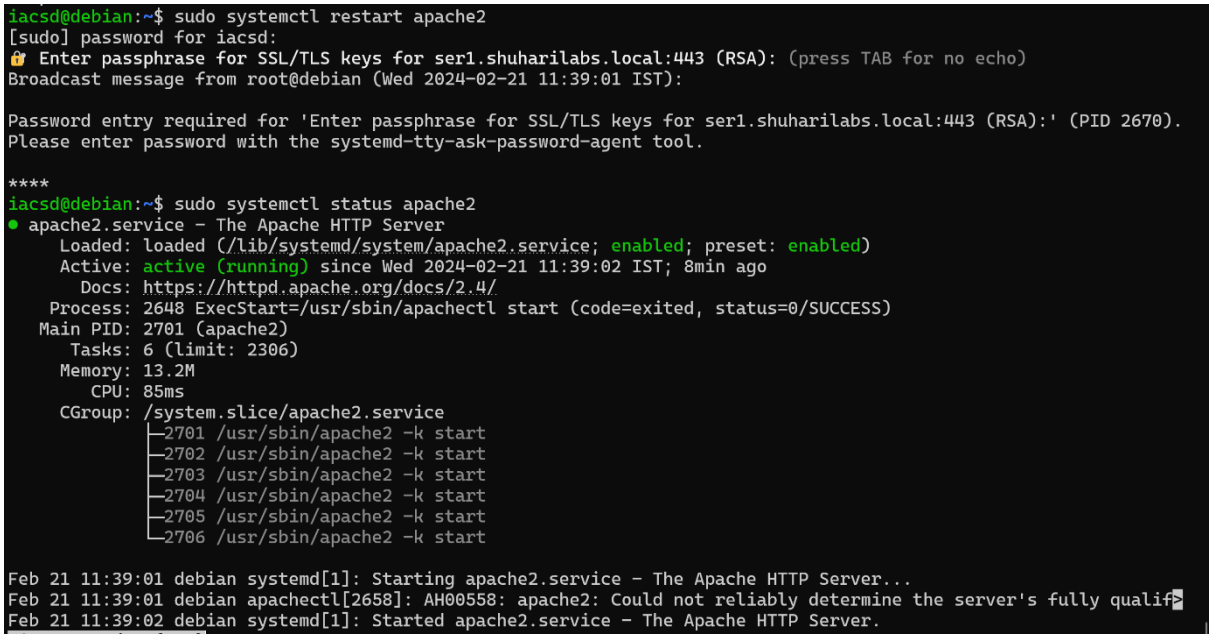
HONEYPOT

```
(venv) cowrie@debian:~/cowrie$ sudo tail -f var/log/cowrie/cowrie.log
[sudo] password for cowrie:
2024-02-21T11:17:14.189778Z [HoneyPotSSHTransport,2,192.168.64.97] CMD: cd /etc/
2024-02-21T11:17:14.190241Z [HoneyPotSSHTransport,2,192.168.64.97] Command found: cd /etc/
2024-02-21T11:20:08.852877Z [-] Timeout reached in HoneyPotSSHTransport
2024-02-21T11:20:08.853430Z [twisted.conch.ssh.session#info] exitCode: 1
2024-02-21T11:20:08.853562Z [cowrie.ssh.connection.CowrieSSHConnection#debug] sending request b'exit-status'
2024-02-21T11:20:08.853903Z [-] Closing TTY Log: var/lib/cowrie/tty/fd9f902f09a7aa75111bbcdfe2b19648ad19bbe0fe91e9e9417900b9f107a81f after 180 seconds
2024-02-21T11:20:08.854079Z [cowrie.ssh.connection.CowrieSSHConnection#info] sending close 0
2024-02-21T11:20:08.854437Z [HoneyPotSSHTransport,2,192.168.64.97] avatar root logging out
2024-02-21T11:20:08.854593Z [cowrie.ssh.transport.HoneyPotSSHTransport#info] connection lost
2024-02-21T11:20:08.854735Z [HoneyPotSSHTransport,2,192.168.64.97] Connection lost after 182 seconds
2024-02-21T11:41:04.567579Z [cowrie.ssh.factory.CowrieSSHFactory] New connection: 192.168.64.97:4910 (192.168.64.16:22) [session: 0ef24d5eac48]
2024-02-21T11:41:04.569448Z [HoneyPotSSHTransport,3,192.168.64.97] Remote SSH version: SSH-2.0-OpenSSH_for_Windows_8.6
2024-02-21T11:41:04.570274Z [HoneyPotSSHTransport,3,192.168.64.97] SSH client hassh fingerprint: ae8bd7dd09970555aa4c6ed22adbbf56
2024-02-21T11:41:04.571130Z [cowrie.ssh.transport.HoneyPotSSHTransport#debug] kex alg=b'curve25519-sha256' key alg=b'ssh-ed25519'
2024-02-21T11:41:04.571189Z [cowrie.ssh.transport.HoneyPotSSHTransport#debug] outgoing: b'aes128-ctr' b'hmac-sha2-256' b'none'
2024-02-21T11:41:04.571303Z [cowrie.ssh.transport.HoneyPotSSHTransport#debug] incoming: b'aes128-ctr' b'hmac-sha2-256' b'none'
2024-02-21T11:41:04.576791Z [cowrie.ssh.transport.HoneyPotSSHTransport#debug] NEW KEYS
2024-02-21T11:41:04.577461Z [cowrie.ssh.transport.HoneyPotSSHTransport#debug] starting service b'ssh-userauth'
2024-02-21T11:41:04.578527Z [cowrie.ssh.userauth.HoneyPotSSHUserAuthServer#debug] b'ser1' trying auth b'none'
2024-02-21T11:41:05.961461Z [cowrie.ssh.userauth.HoneyPotSSHUserAuthServer#debug] b'ser1' trying auth b'password'2024-02-21T11:41:05.961966Z [HoneyPotSSHTra
nsport,3,192.168.64.97] login attempt [b'ser1'/b''] failed
2024-02-21T11:41:06.963830Z [cowrie.ssh.userauth.HoneyPotSSHUserAuthServer#debug] b'ser1' failed auth b'password'2024-02-21T11:41:06.964092Z [cowrie.ssh.use
rauth.HoneyPotSSHUserAuthServer#debug] unauthorized login: ()
2024-02-21T11:41:08.587181Z [cowrie.ssh.transport.HoneyPotSSHTransport#info] connection lost
2024-02-21T11:41:08.587483Z [HoneyPotSSHTransport,3,192.168.64.97] Connection lost after 4 seconds
2024-02-21T11:41:13.450270Z [cowrie.ssh.factory.CowrieSSHFactory] New connection: 192.168.64.97:4911 (192.168.64.16:22) [session: 55327f8a12a9]
2024-02-21T11:41:13.452442Z [HoneyPotSSHTransport,4,192.168.64.97] Remote SSH version: SSH-2.0-OpenSSH_for_Windows_8.6
2024-02-21T11:41:13.453118Z [HoneyPotSSHTransport,4,192.168.64.97] SSH client hassh fingerprint: ae8bd7dd09970555aa4c6ed22adbbf56
2024-02-21T11:41:13.454092Z [cowrie.ssh.transport.HoneyPotSSHTransport#debug] kex alg=b'curve25519-sha256' key alg=b'ssh-ed25519'
2024-02-21T11:41:13.454164Z [cowrie.ssh.transport.HoneyPotSSHTransport#debug] outgoing: b'aes128-ctr' b'hmac-sha2-256' b'none'
2024-02-21T11:41:13.454224Z [cowrie.ssh.transport.HoneyPotSSHTransport#debug] incoming: b'aes128-ctr' b'hmac-sha2-256' b'none'
2024-02-21T11:41:13.460118Z [cowrie.ssh.transport.HoneyPotSSHTransport#debug] NEW KEYS
2024-02-21T11:41:13.460807Z [cowrie.ssh.transport.HoneyPotSSHTransport#debug] starting service b'ssh-userauth'
2024-02-21T11:41:13.461712Z [cowrie.ssh.userauth.HoneyPotSSHUserAuthServer#debug] b'root' trying auth b'none'
2024-02-21T11:41:14.016587Z [cowrie.ssh.userauth.HoneyPotSSHUserAuthServer#debug] b'root' trying auth b'password'2024-02-21T11:41:14.016918Z [HoneyPotSSHTra
nsport,4,192.168.64.97] login attempt [b'root'/b's'] succeeded
2024-02-21T11:41:14.017415Z [HoneyPotSSHTransport,4,192.168.64.97] Initialized emulated server as architecture: linux-x64-lsb
2024-02-21T11:41:14.017753Z [cowrie.ssh.userauth.HoneyPotSSHUserAuthServer#debug] b'root' authenticated with b'password'
2024-02-21T11:41:14.018043Z [cowrie.ssh.transport.HoneyPotSSHTransport#debug] starting service b'ssh-connection'
2024-02-21T11:41:14.021616Z [cowrie.ssh.connection.CowrieSSHConnection#debug] got channel b'session' request
2024-02-21T11:41:14.021823Z [cowrie.ssh.session.HoneyPotSSHSession#info] channel open
```

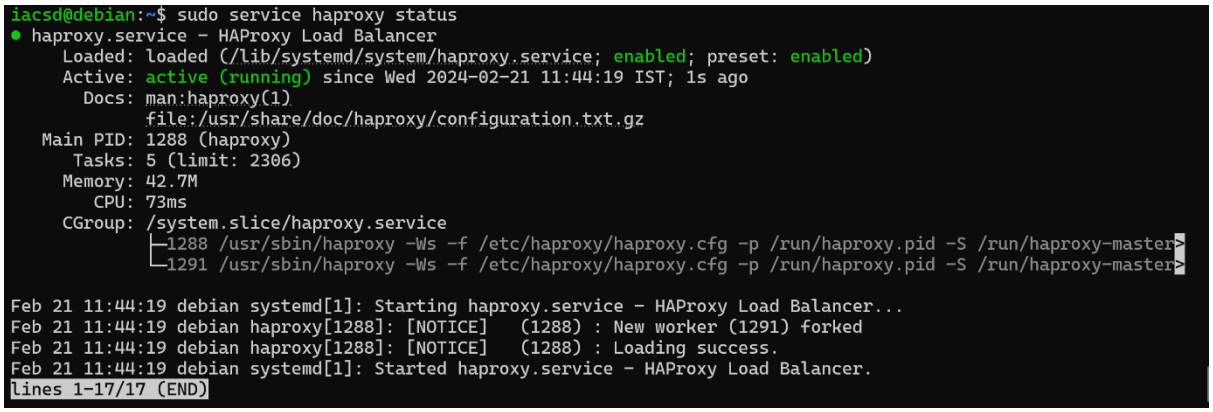
SNORT



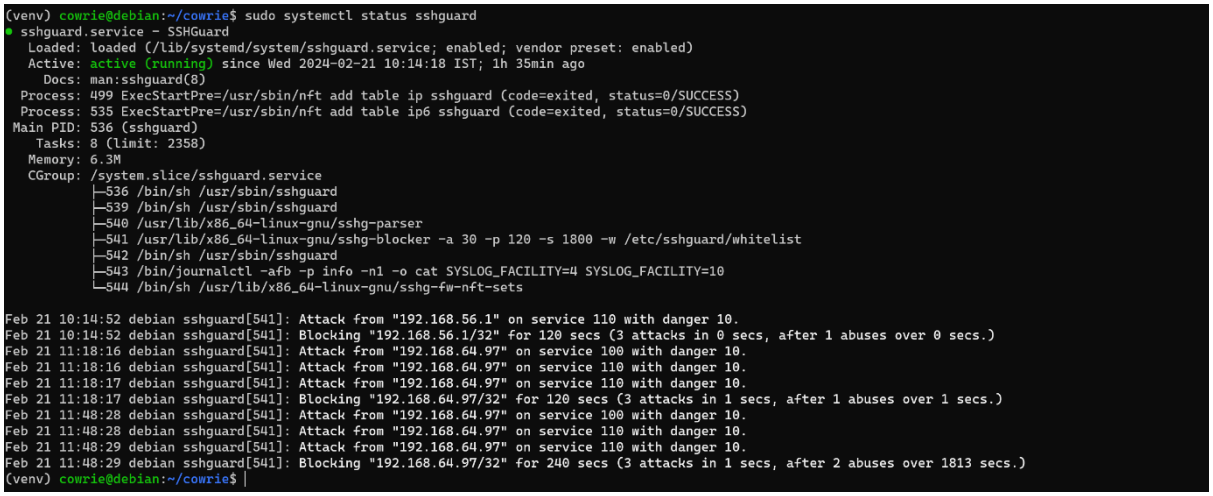
APACHE2 – HTTPS



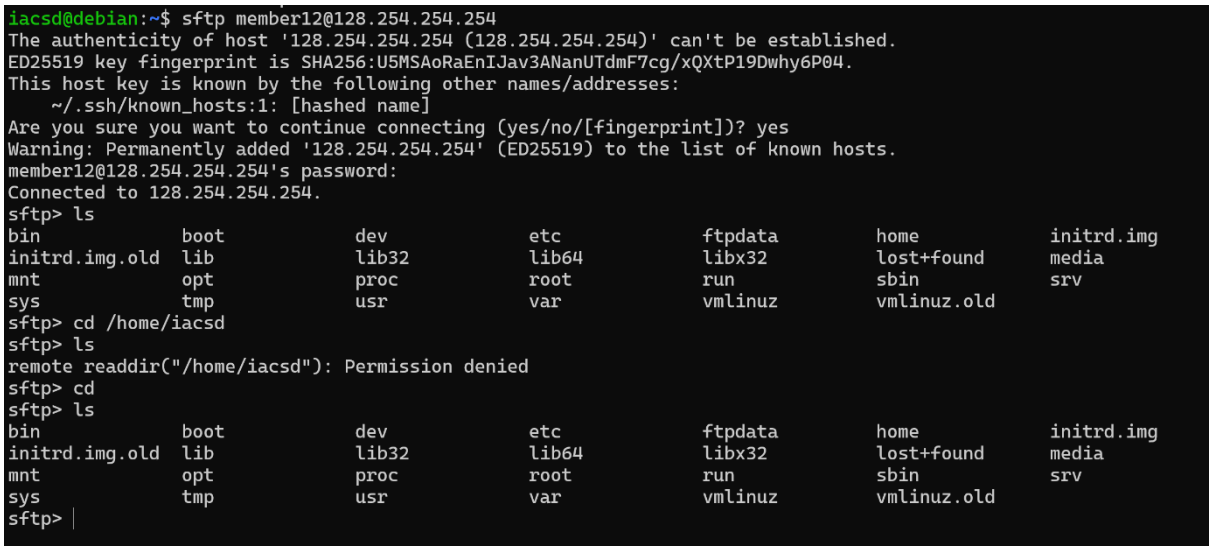
HAPROXY



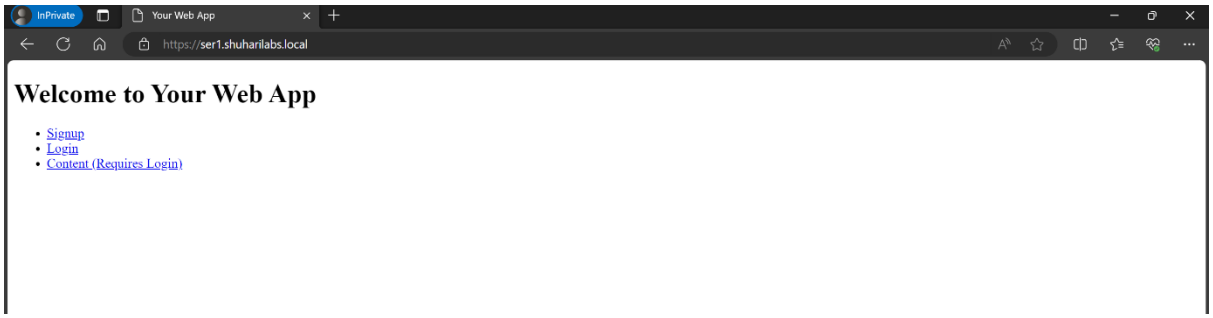
SSHGUARD

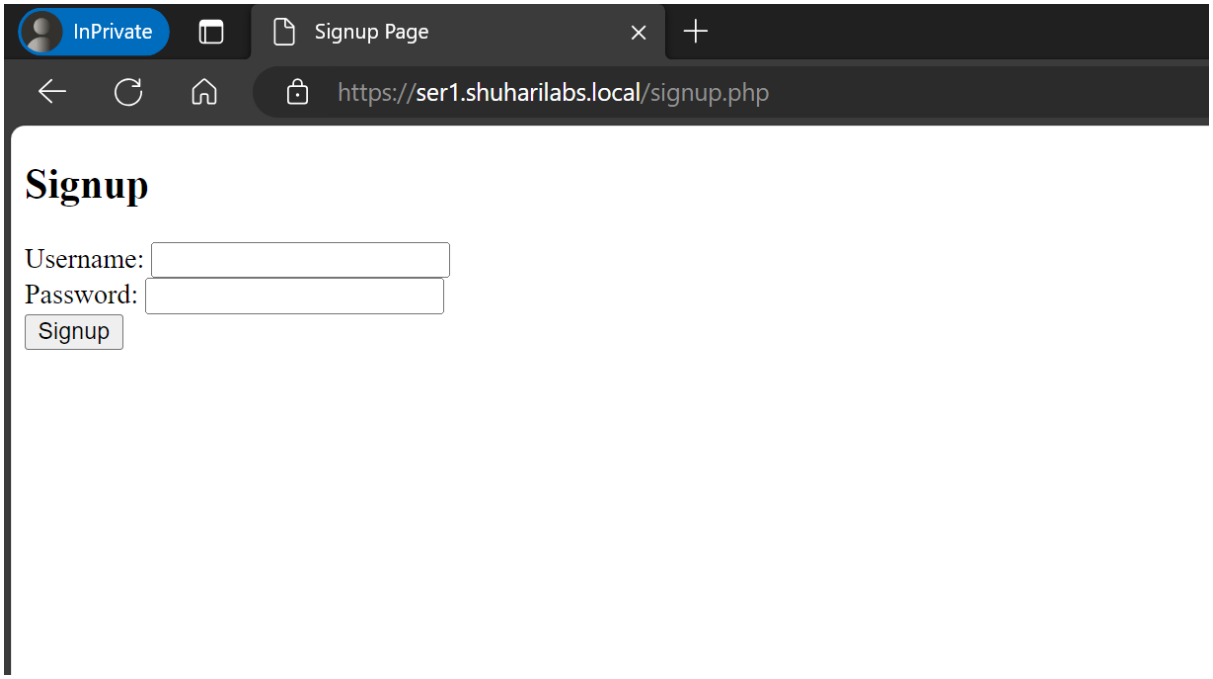


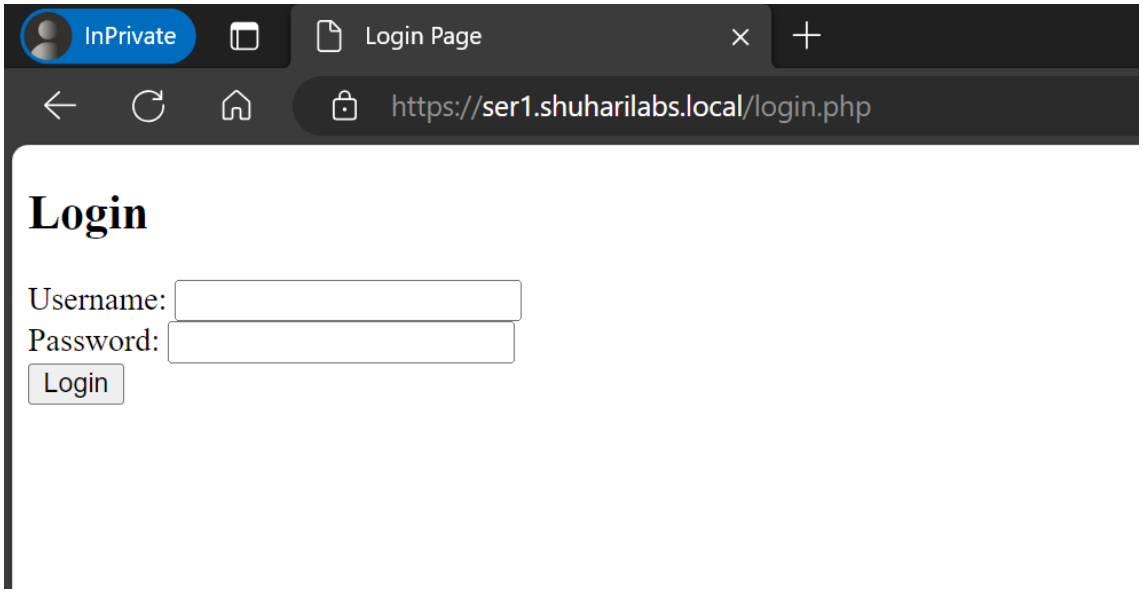
SFTP



WEBPAGES


InPrivate
Your Web App
https://ser1.shuharilabs.local
Welcome to Your Web App
Signup
Login
Content (Requires Login)


InPrivate
Signup Page
https://ser1.shuharilabs.local/signup.php
Signup
Username:
Password:
Signup




```
 GNU nano 3.2                          /var/www/html/login_process.php

<?php
session_start();

if ($_SERVER["REQUEST_METHOD"] == "POST") {
    // Database connection parameters
    $servername = "128.254.254.214";
    $username = "iacsd";
    $password = "iacsd";
    $dbname = "pr";

    // Create connection
    $conn = new mysqli($servername, $username, $password, $dbname);

    // Check connection
    if ($conn->connect_error) {
        die("Connection failed: " . $conn->connect_error);
    }

    // Retrieve values from the login form
    $username = $_POST['username'];
    $enteredPassword = $_POST['password'];

    // Perform a secure query using prepared statements
    $sql = "SELECT id, username, password FROM data WHERE username = ?";
    $stmt = $conn->prepare($sql);
    $stmt->bind_param("s", $username);
    $stmt->execute();
```

```php
<?php
if ($_SERVER["REQUEST_METHOD"] == "POST") {
    // Database connection parameters
    $servername = "128.254.254.214";
    $username = "iacsd";
    $password = "iacsd";
    $dbname = "pr";

    // Create connection
    $conn = new mysqli($servername, $username, $password, $dbname);

    // Check connection
    if ($conn->connect_error) {
        die("Connection failed: " . $conn->connect_error);
    }

    // Retrieve values from the signup form
    $username = $_POST['username'];
    $password = password_hash($_POST['password'], PASSWORD_BCRYPT);

    // Perform a secure query using prepared statements
    $sql = "INSERT INTO data (username, password) VALUES (?, ?)";
    $stmt = $conn->prepare($sql);
    $stmt->bind_param("ss", $username, $password);

    if ($stmt->execute()) {
        echo "Signup successful!";
```

8. FUTURE SCOPE

The future scope for the project "Defense in Depth" encompasses several key areas aimed at enhancing the overall cybersecurity posture. Firstly, the integration of machine learning algorithms can significantly improve threat detection capabilities by identifying patterns and anomalies in network traffic and user behavior. This proactive approach allows for quicker identification and mitigation of potential security threats. Additionally, automated incident response mechanisms can be implemented to swiftly respond to security incidents, reducing manual intervention and response time. Enhanced user authentication methods, such as multi-factor authentication and biometric authentication, can further strengthen identity and access management, ensuring secure user authentication processes. Integration with cloud security solutions will extend the project's security measures to protect data and applications hosted in the cloud, addressing the evolving threat landscape in cloud environments. Continuous security monitoring tools and techniques will enable real-time detection and mitigation of security
vulnerabilities and threats

9. CONCLUSION

In conclusion, the "Defense in Depth" project offers a comprehensive approach to cybersecurity, addressing various layers of defense to safeguard critical assets and mitigate security risks effectively.

By implementing robust perimeter security measures like Snort and leveraging internal network security protocols, such as iptables and Haproxy, the project ensures protection against external and internal threats. Endpoint security solutions like sshguard and Honeypot bolster the defense posture by monitoring and detecting suspicious activities on end-user devices. Furthermore, data security measures, including database encryption and user access management, safeguard sensitive information from unauthorized access and data breaches.

The integration of security monitoring tools like tcpdump enables real-time threat detection and incident response, enhancing overall security posture. Additionally, application security enhancements like HTTPS encryption ensure secure communication over public networks.

Looking ahead, the project's future scope encompasses advancements in machine learning, automation, and cloud security to address emerging threats and compliance requirements effectively.

With a focus on continuous improvement and adaptation to evolving cybersecurity challenges, the "Defense in Depth" project remains committed to ensuring a resilient and robust security framework for organizations in today's dynamic threat landscape.

10.REFERENCES

- https://www.haproxy.com/documentation/haproxy-configuration-tutorials/ssl-tls/
- https://sshguard.net/docs.html
- https://www.snort.org/documents
- https://mariadb.com/kb/en/documentation/