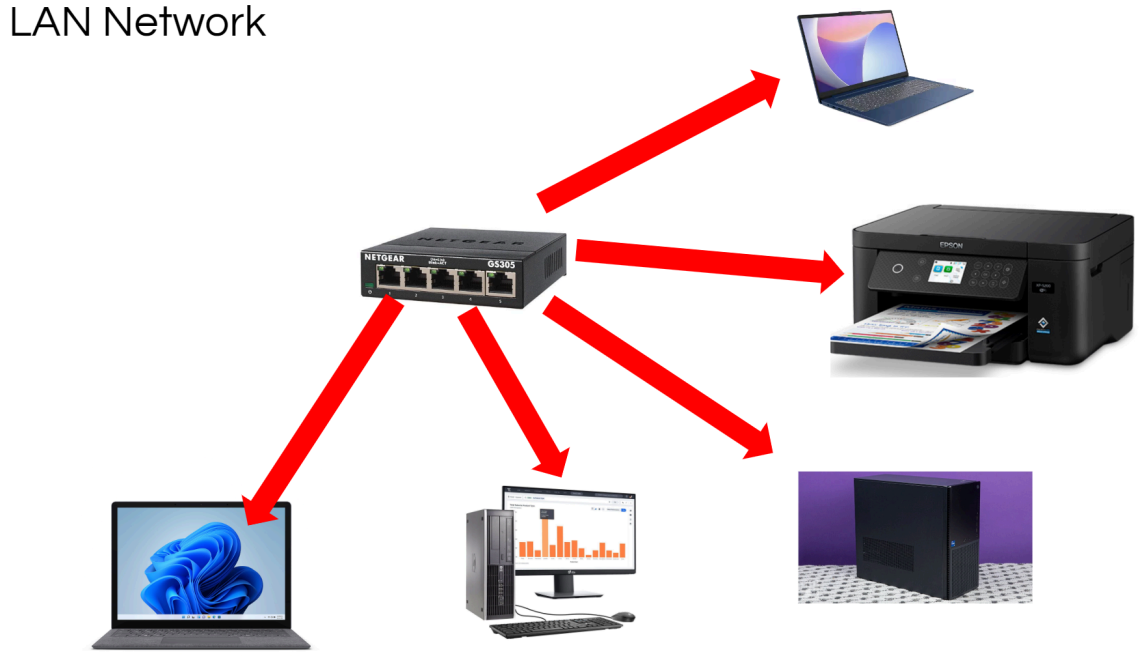
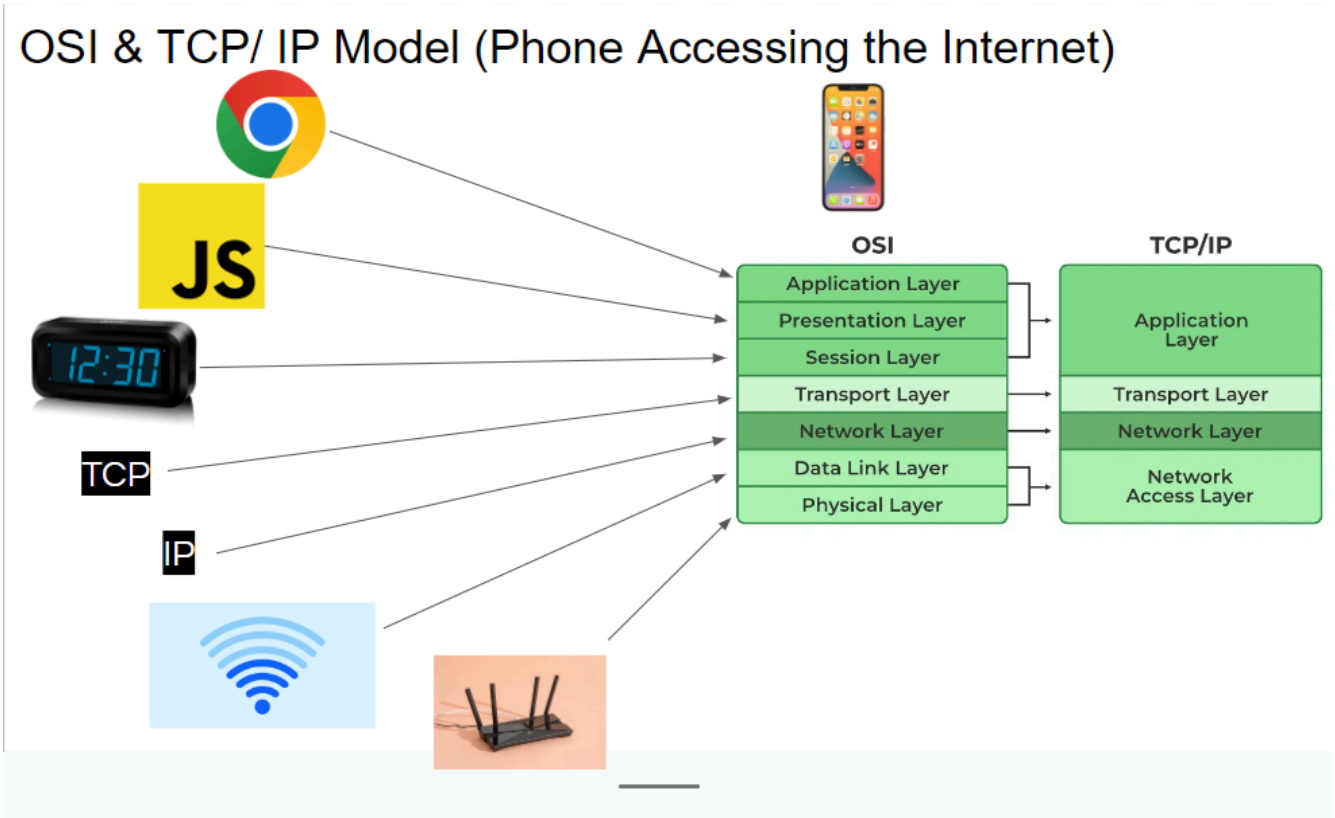
Network Topology



How This Topology Supports Network Management -
In this topology, a managed switch is being used to manage all of the devices contained within the LAN network. Managed switches are commonly used to enable centralized configuration, monitoring, and device management. An admin of this network is able to remotely control devices, send files, and distribute commands to the devices connected to this network. This network allows traffic monitoring, which enables secure communication within devices through early detection and troubleshooting.

Network Protocols and Architectures



Subnetting

Network Address: 172.25.144.0/21
Host Count: 50
Subnet Mask: /21 = 255.255.248.0
New Subnet Mask: /26 = 255.255.255.192
Subnet Range: 172.25.146.192 - 172.25.146.255
Network Address: 172.25.146.192
Broadcast Address: 172.25.146.255

Implement Network Security Fundamentals

Firewall Rule
Goal: Using Next-Generation Firewall, completely block access to X across this network.
Action: Deny
Protocol: Any
Source IP: 192.168.1.0/24 (Random IP)
Source Port: Any

Destination IP: 199.16.156.0/22
Destination Port: 80 or 443

IDS Configuration
Traffic Type: TCP
Source Port: 104.244.46.0/24
Destination Port: 104.244.46.0/24
Action: Creates an alert when traffic is detected on the X IP range
Message: “X Access Detected” is logged

IPS Configuration
Traffic Type: TCP
Source Port: 104.244.46.0/24
Destination Port: 104.244.46.0/24
Action: Blocks packets, preventing connection

Detected Event Example

IDS Example:
Twitter Access Detected - Source: 192.168.1.100 Destination: 8.25.194.20 Port: 443

IPS Example
Twitter Traffic Blocked - Source: 192.168.1.100 Destination: 8.25.194.20 Port: 443

Access Control Measures

ACL Configuration

Device: Proxy Server
Protocol: HTTPS
Requirement: Filter traffic based on website/app certificate validation status

1) Enable SSL Certificate inspection/validation on the proxy server
2) Allow website with valid certificates
3) Deny websites with expired, untrusted, or unknown certificates

Access Control Model

Discretionary Access Control (DAC)

Access Control to Information: Through company ownership
Flexibility for Accessing Information: High
Access Complexity: Very Complex
Support for Multilevel Database System: No
System: Unix Based Systems

Steps

- For both Windows and Unix systems
- Restrict users from disabling SSL validation in their browsers
- Enforce SSL/TLS validation to prevent certificate warning from being ignored
- Create group policy for all machines

User Access Level

Employees

- Employees are limited to website with valid SSL/TLS Certificates
- Attempts to access untrusted websites are automatically blocked
- Employees log in through Single Sign-On using Google Workspace
- SSO Enforces strict certificate validation for accessing services and websites
- Access to resources are managed centrally
- All SSO login attempts are logged in a central location

Admins

- Admins are granted access to all websites
- Admins are allowed to bypass standard web filtering rules
- Must provide justification however
- Access to dangerous websites are automatically logged and reviewed
- Admin access is constantly monitored
- All activity are logged for maintaining accountability
- Admins authenticate via a different SSO System than employees
- Admins are required to use multiple types of MFA
- Some options include (Biometrics, Pins, Devices, Notifications)

Secure Wireless Networks

WPA 3 Configuration

Network SSID: Billyboy
Passphrase: S3cure@Net!2024
Firmware: Pfsense Firewall
Authentication Protocol: WPA3
Encryption Method: AES-GCMP/ AES - CCMP

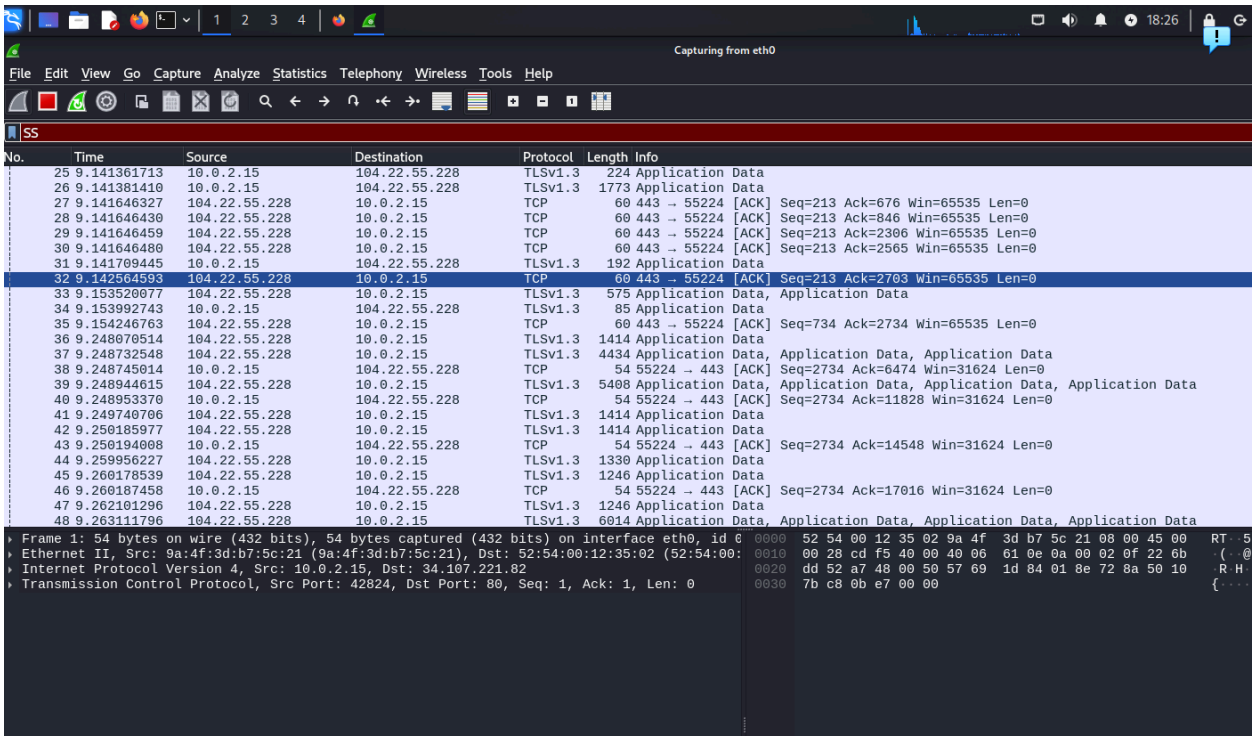
Disable WPA2 to ensure WPA 3 works properly on the router

Wireless Intrusion Prevention System (WIPS) Configuration

- Set monitoring policies
- Block rogue access points
- Create a whitelist of authorized MAC addressed in a given network
- Detect and block attacks
- Enable detection for DoS attacks
- Set email alerts for unauthorized access attempts
- Keep logs in a centralized location

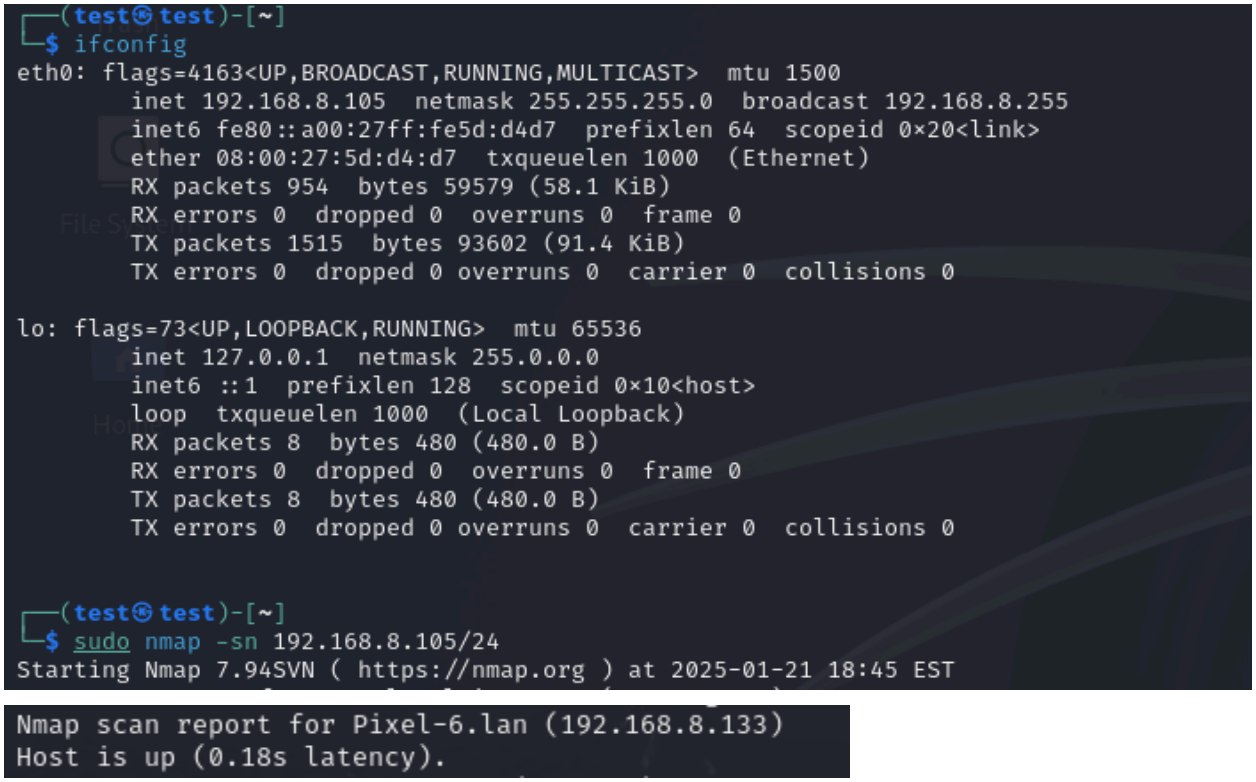
Utilize Network Security Tools

Wireshark Capture



Vulnerability Scanner Report

Network Penetration Testing Tool



Monitor and Respond to Network Security Events

Logs

Firewall log Snippet

[2025-01-22 10:30:12] SRC=192.168.1.105 DST=192.168.1.10 PROTO=TCP DPT=22 ACTION=ACCEPT
[2025-01-22 10:30:15] SRC=192.168.1.105 DST=192.168.1.10 PROTO=TCP DPT=22 ACTION=ACCEPT
[2025-01-22 10:31:01] SRC=192.168.1.105 DST=192.168.1.10 PROTO=TCP DPT=22 ACTION=BLOCK

IDS Alert Log

[2025-01-22 10:34:45] ALERT: Potential Brute Force Attack
SRC_IP: 192.168.1.105
DST_IP: 192.168.1.10
PORT: 22
COUNT: 15 attempts in 2 minutes

Authentication Attempts

Jan 22 10:30:12 server sshd[1234]: Failed password for invalid user admin from 192.168.1.105 port 54123 ssh2

Jan 22 10:30:15 server sshd[1234]: Failed password for invalid user root from 192.168.1.105 port 54124 ssh2
Jan 22 10:30:17 server sshd[1235]: Failed password for invalid user test from 192.168.1.105 port 54125 ssh2

1.) Initial Detection
The IDS flagged a brute force attack targeting SSH on a critical server. The firewall log confirmed repeated connection attempts from 192.168.1.105.

2.) Immediate Actions
- Blocked the attacking IP address using the firewall:
  iptables -A INPUT -s 192.168.1.105 -j DROP
- Disabled password-based SSH authentication on the server and enabled key-based authentication
  echo "PasswordAuthentication no" >> /etc/ssh/sshd_config
  systemctl restart sshd

3.) Investigation
- Reviewed logs to confirm no successful login occurred.
- Checked the server for any unauthorized changes or processes (none were found).
- Conducted a vulnerability scan to ensure the server was up to date.

4.) Remediation
- Updated SSH configurations to use a non-standard port and enabled two-factor authentication.
- Conducted a network-wide scan to identify other suspicious activities (none detected).

5.) Preventative Measures

- Deployed fail2ban to dynamically block IPs after multiple failed login attempts.
- Reviewed and hardened firewall rules for SSH traffic