



# MASTER SWORD

## PUBLISHING



# Enterprise Infrastructure

Computer Security & Network Technology:  
Capstone Project Presentation

Jayce Mangum · Professor Linda Epps · Lake Washington Institute of Technology · Spring 2026



# Executive Summary

- Designed and implemented a small-scale enterprise environment.
- Deployed Windows Server, Linux, macOS, and security testing systems
- Developed Python automation solutions for Linux-based system configurations and user management
- Implemented security controls, incident response plan, and AWS-based security awareness training system

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**MASTER SWORD**  
— ♦ P U B L I S H I N G ♦ —



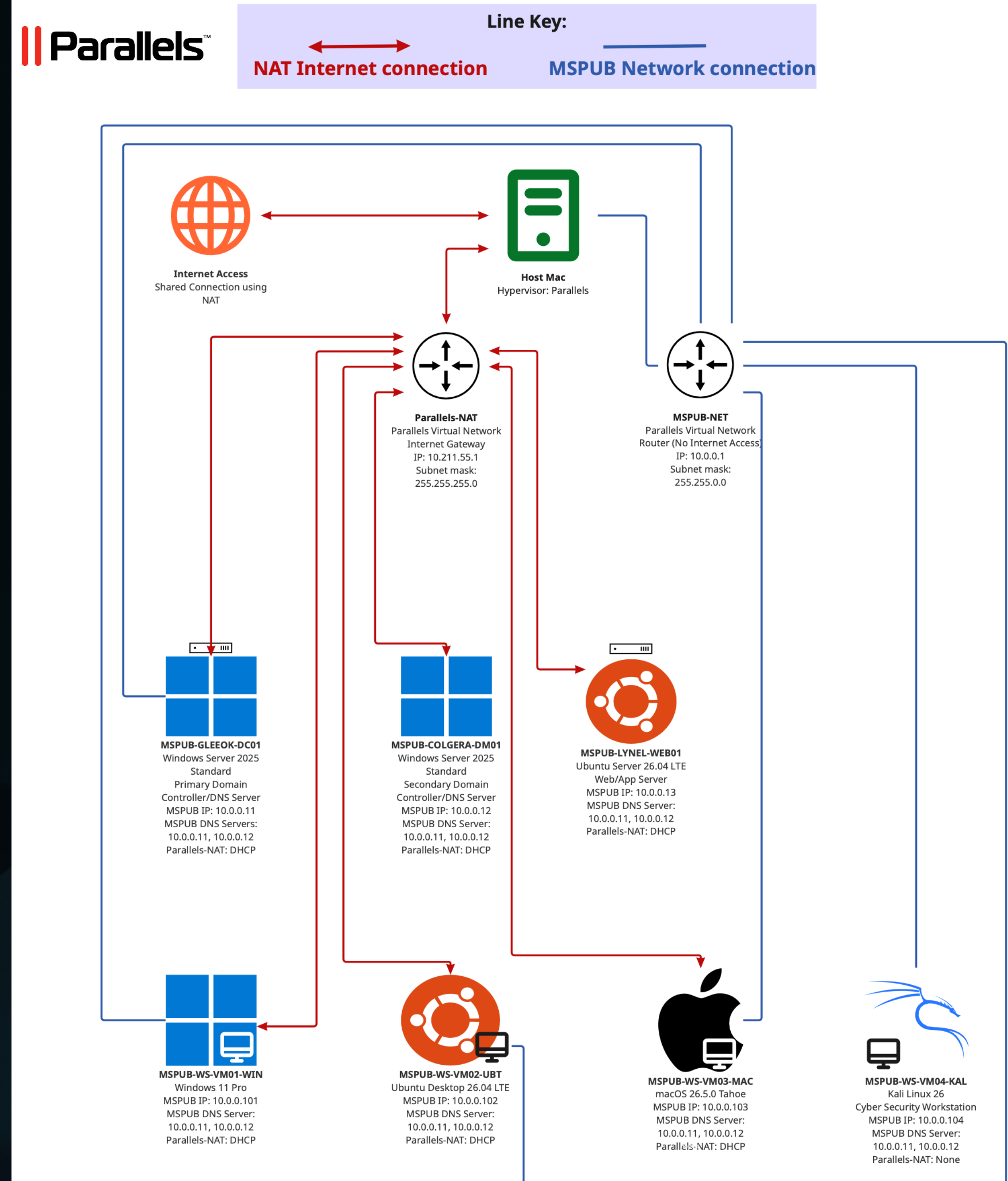


# Project Overview

## MSPUB Environment

- Home Lab
  - 7 Virtual Machines
  - Virtual Networking
- Networking
  - Physical Equipment
- Python Automation Scripts
- Security Implementations
- AWS Cloud Environment

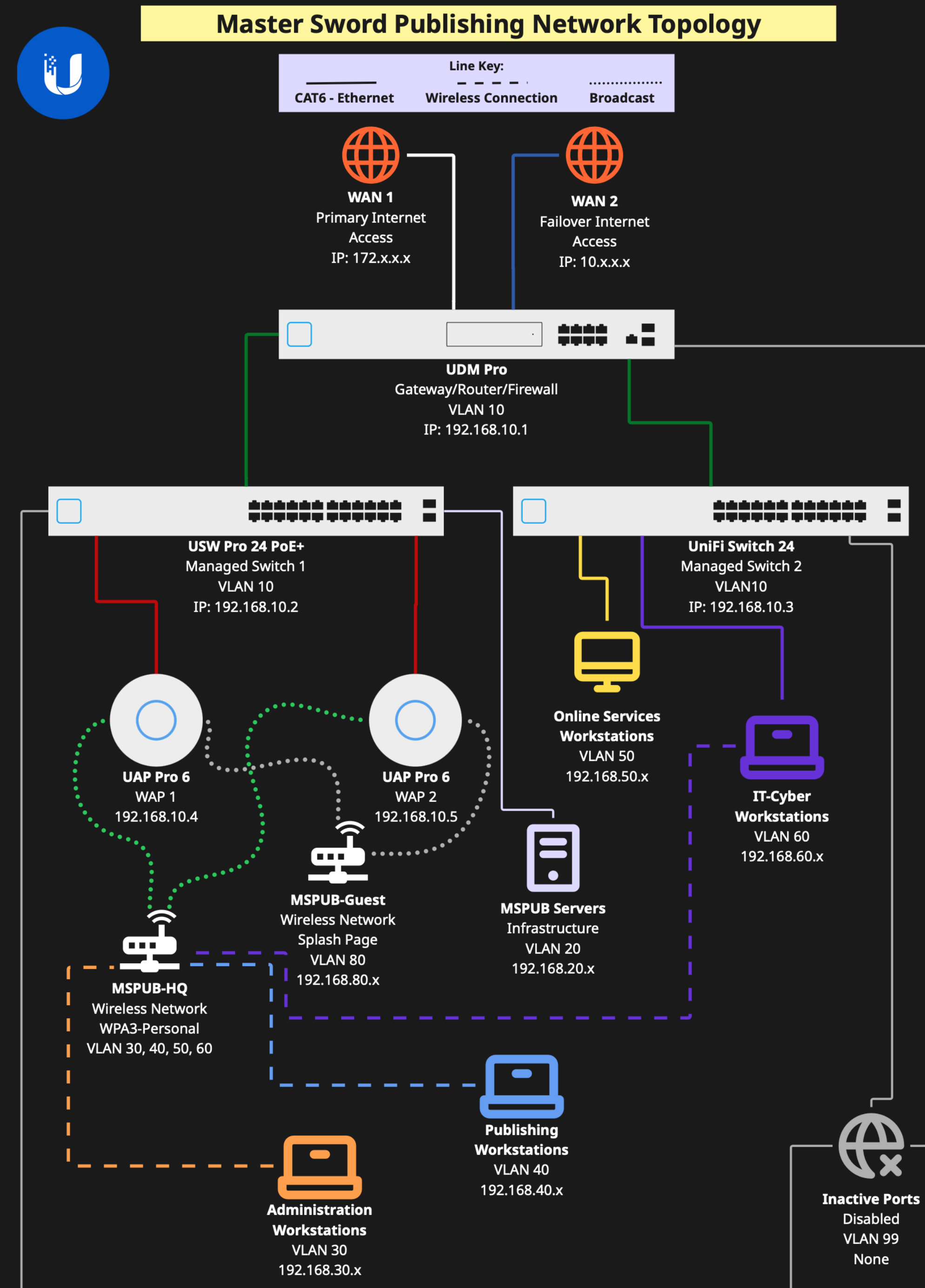
## Master Sword Publishing Virtual Home Lab Topology





# Physical Network Design & Topology

- UniFi Dream Machine Pro
  - Gateway/Router/Firewall
- UniFi Switch Pro 24 PoE+
  - Managed Switch w/ Power Over Ethernet support
- UniFi Switch 24
  - Managed Switch
- UniFi Access Point Pro 6
  - 2 Wireless Access Points





# VLAN Segmentation

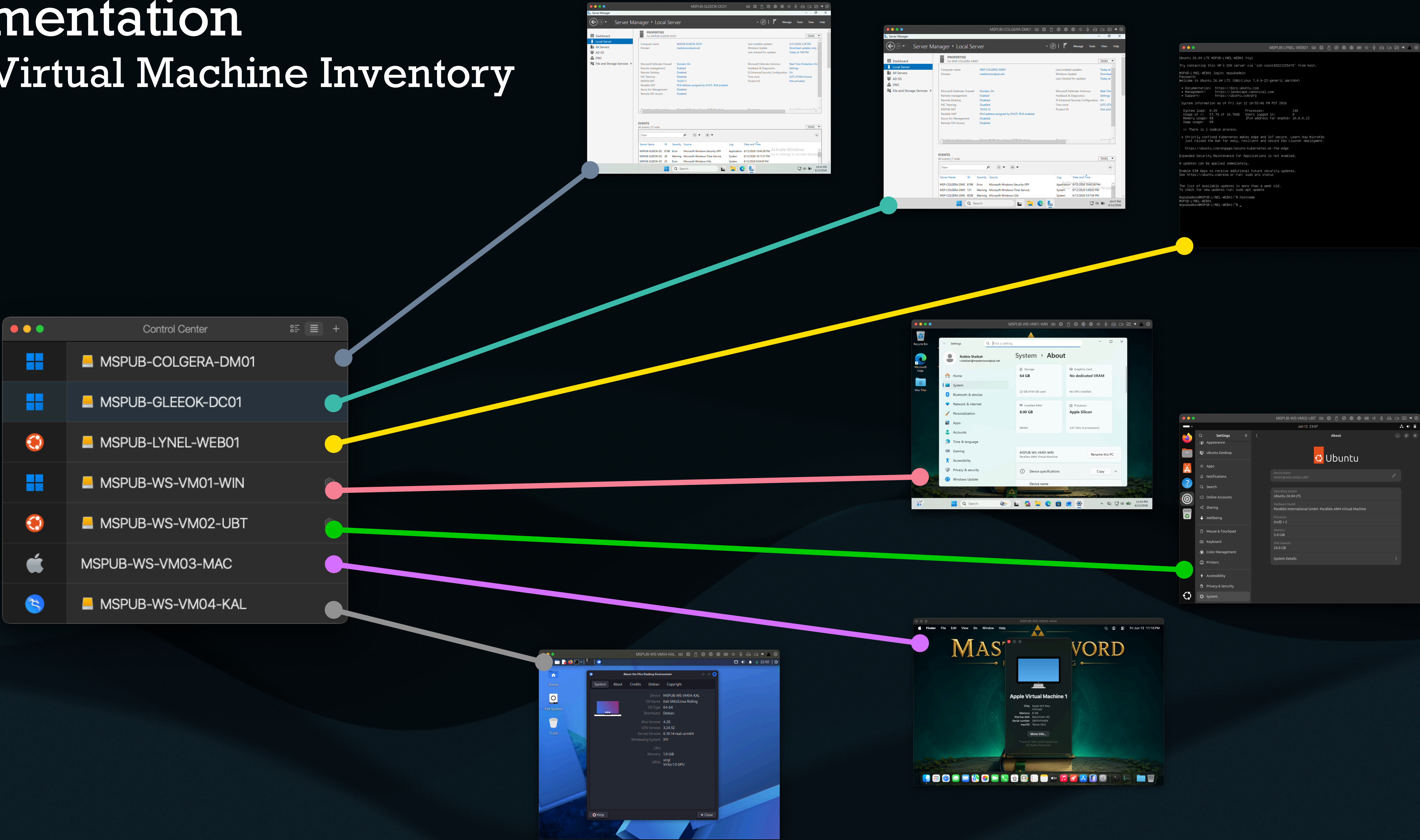
## & IP Addressing

| Purpose                  | Infrastructure              | Servers                     | Administration              | Publishing                 | Online Services             | IT-Cyber                     | Guest Network              | Blackhole (Disabled Ports) |
|--------------------------|-----------------------------|-----------------------------|-----------------------------|----------------------------|-----------------------------|------------------------------|----------------------------|----------------------------|
| VLAN ID                  | 10                          | 20                          | 30                          | 40                         | 50                          | 60                           | 80                         | 255                        |
| Minimum Host Requirement | 5                           | 3                           | 2                           | 4                          | 1                           | 4                            | 254                        | 0                          |
| CIDR                     | 192.168.10.0/29             | 192.168.20.0/29             | 192.168.30.0/29             | 192.168.40.0/29            | 192.168.50.0/30             | 192.168.60.0/28              | 192.168.80.0/24            | No DHCP                    |
| Gateway                  | 192.168.10.1                | 192.168.20.1                | 192.168.30.1                | 192.168.40.1               | 192.168.50.1                | 192.168.60.1                 | 192.168.80.1               | None                       |
| Mask                     | 255.255.255.248             | 255.255.255.248             | 255.255.255.248             | 255.255.255.248            | 255.255.255.252             | 255.255.255.240              | 255.255.255.0              | N/A                        |
| IP Address Range         | 192.168.10.2 - 192.168.10.6 | 192.168.20.2 - 192.168.20.6 | 192.168.30.2 - 192.168.30.6 | 192.168.40.2- 192.168.40.6 | 192.168.50.2 - 192.168.50.2 | 192.168.60.2 - 192.168.60.14 | 192.168.80.2 - 192.168.254 | N/A                        |
| Broadcast                | 192.168.10.7                | 192.168.20.7                | 192.168.20.7                | 192.168.40.7               | 192.168.50.3                | 192.168.60.15                | 192.168.80.255             | None                       |
| Usable Hosts             | 6                           | 6                           | 6                           | 6                          | 2                           | 10                           | 254                        | 0                          |



# Infrastructure Implementation

## MSPUB Virtual Machine Inventory





# MSPUB Virtual Network Configuration

MSPUB AD Domain

| FQDN               | NetBIOS | IP Address                                   | Router/Gateway | Subnet Mask | DNS Servers            |
|--------------------|---------|----------------------------------------------|----------------|-------------|------------------------|
| masterswordpub.net | MSPUB   | 10.0.0.11 (Primary)<br>10.0.0.12 (Secondary) | 10.0.0.1       | 255.255.0.0 | 10.0.0.11<br>10.0.0.12 |

Virtual Machine Network Settings

| Hostname           | IP Address | Router/Gateway | Subnet Mask | DNS                    |
|--------------------|------------|----------------|-------------|------------------------|
| MSPUB-WS-VM01-WIN  | 10.0.0.101 | 10.0.0.1       | 255.255.0.0 | 10.0.0.11<br>10.0.0.12 |
| MSPUB-WS-VM02-UBT  | 10.0.0.102 | 10.0.0.1       | 255.255.0.0 | 10.0.0.11<br>10.0.0.12 |
| MSPUB-WS-VM03-MAC  | 10.0.0.103 | 10.0.0.1       | 255.255.0.0 | 10.0.0.11<br>10.0.0.12 |
| MSPUB-WS-VM04-KAL  | 10.0.0.104 | 10.0.0.1       | 255.255.0.0 | 10.0.0.11<br>10.0.0.12 |
| MSPUB-COLGERA-DM01 | 10.0.0.12  | 10.0.0.1       | 255.255.0.0 | 10.0.0.11<br>10.0.0.12 |
| MSPUB-LYNEL-WEB01  | 10.0.0.13  | 10.0.0.1       | 255.255.0.0 | 10.0.0.11<br>10.0.0.12 |



# Linux Automation

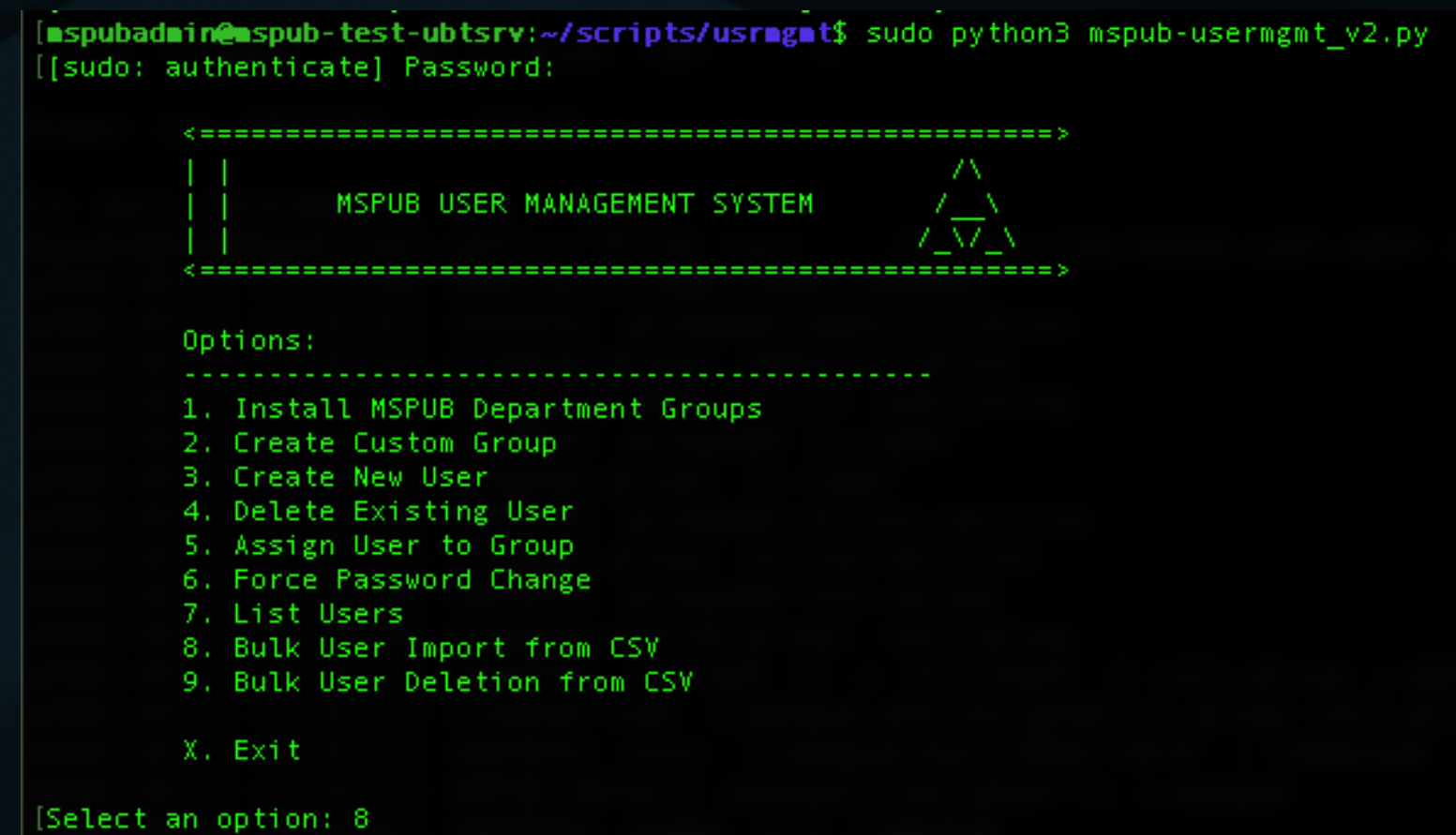
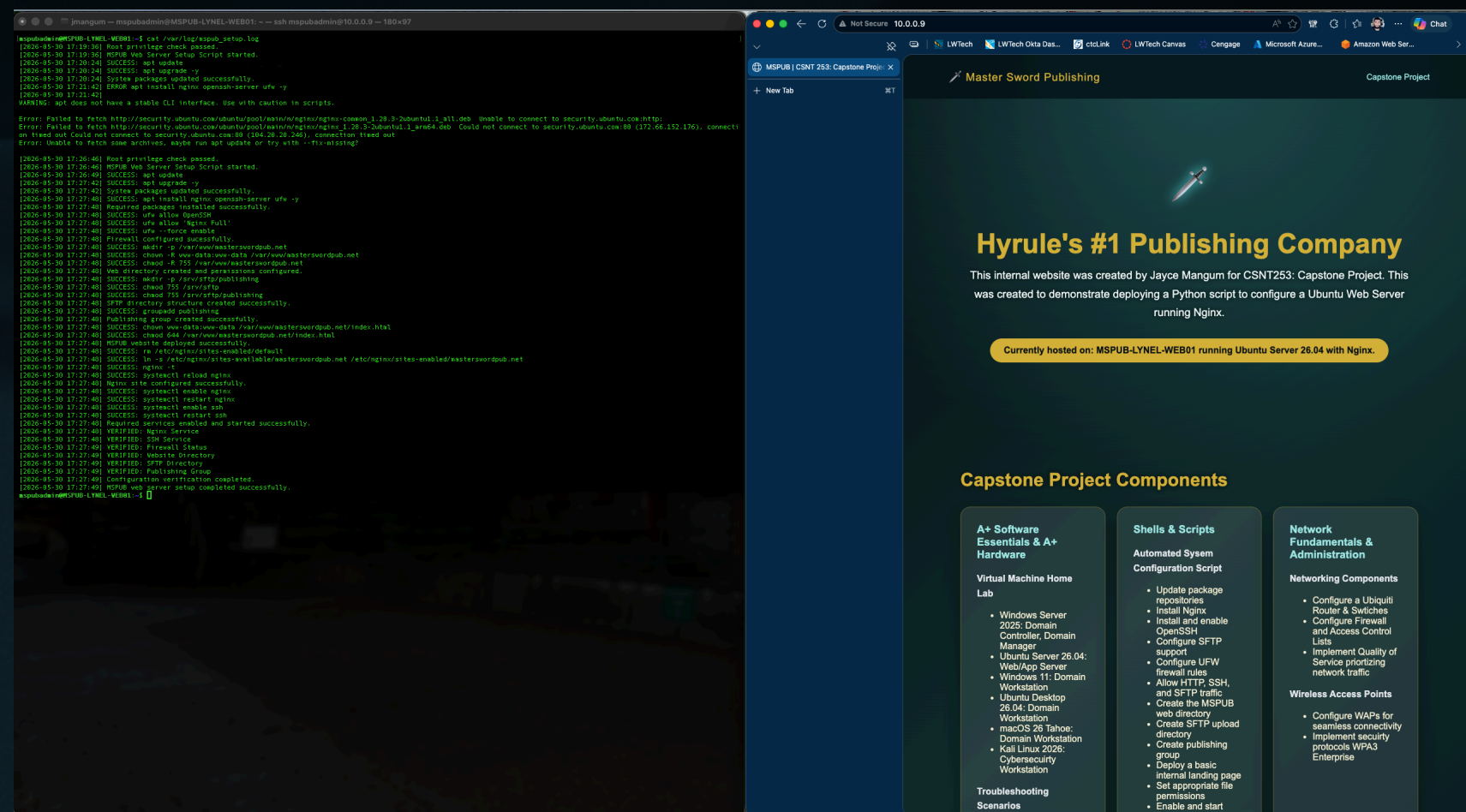
## Python Scripts

### Webserver System Configuration Script

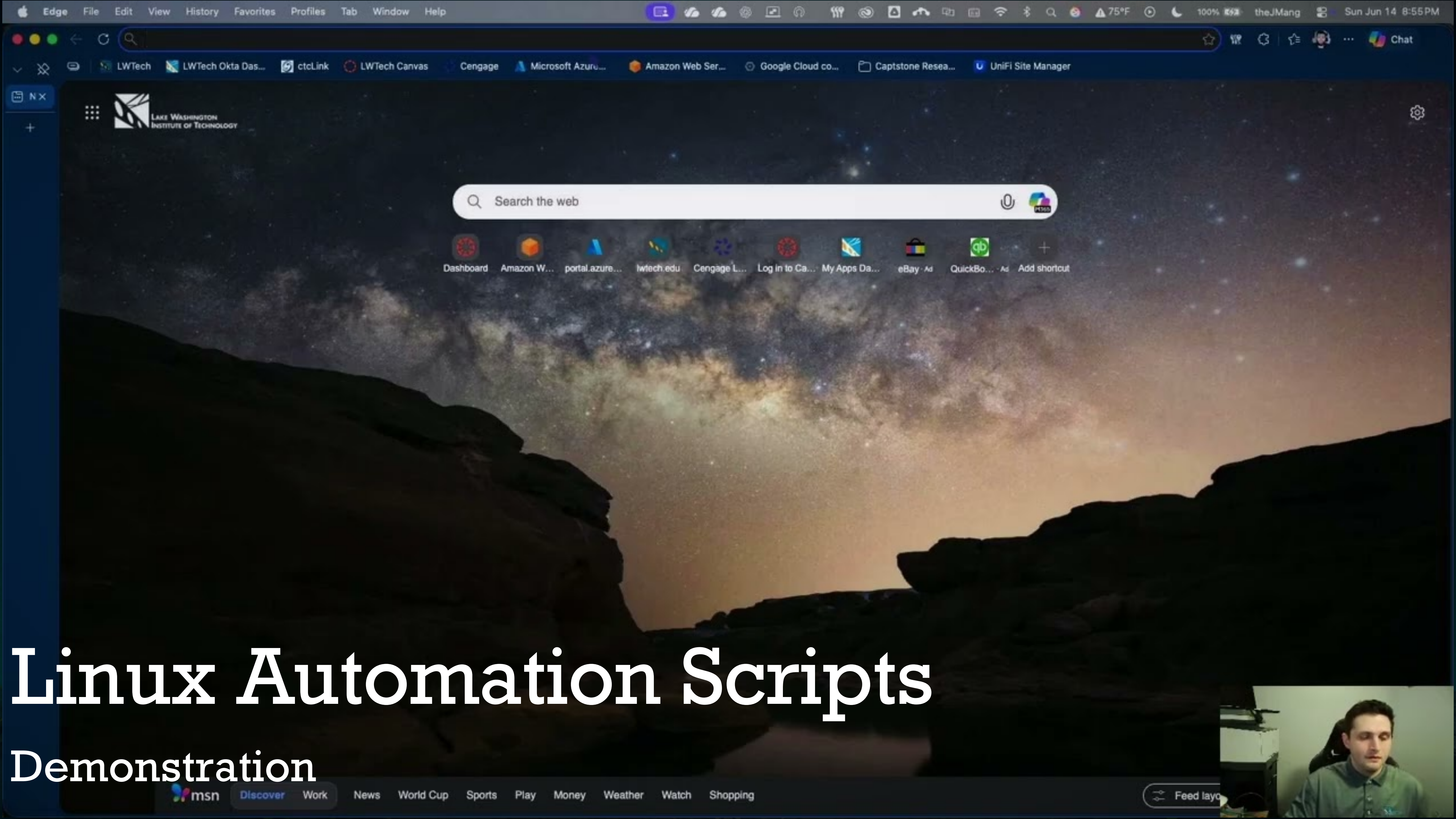
- Nginx Installation & Configuration
- SFTP Installation & Configuration
- UFW Configuration
- Logging

### User Management Script

- User creation/deletion
- Group Management
- CSV Imports
- Logging







# Linux Automation Scripts

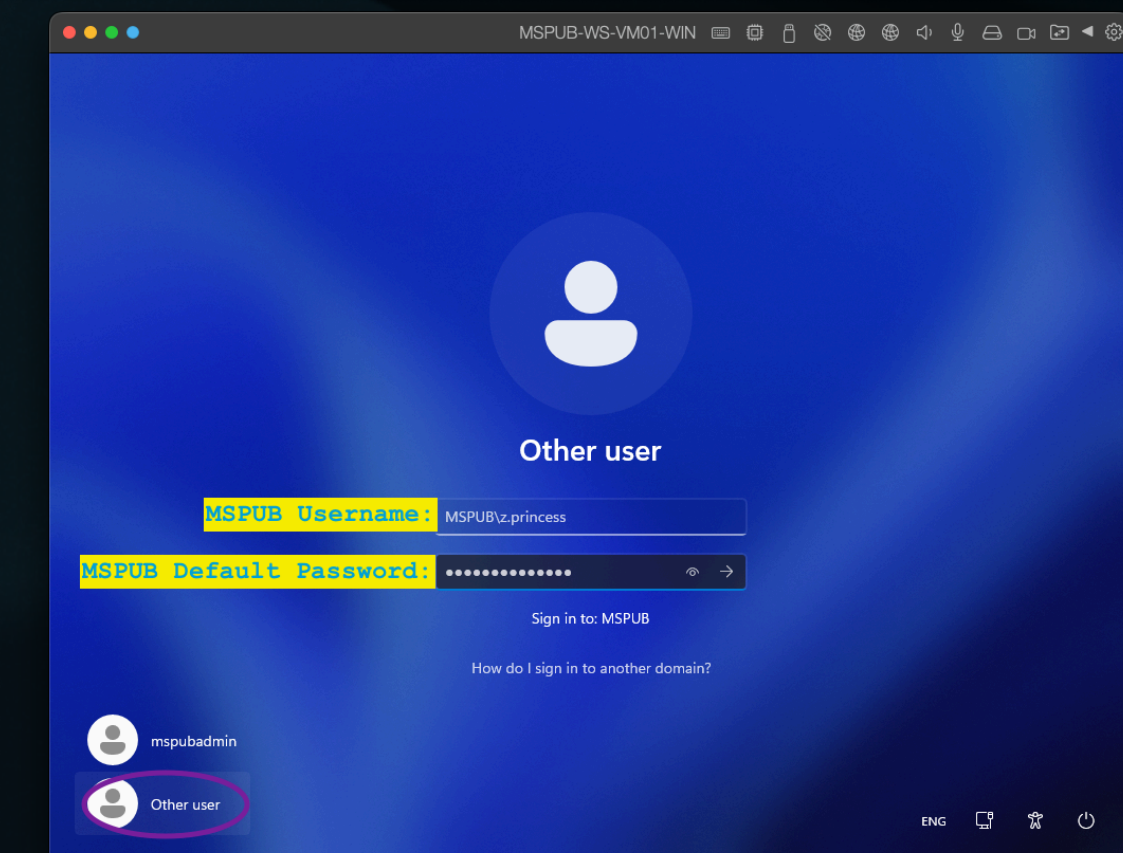
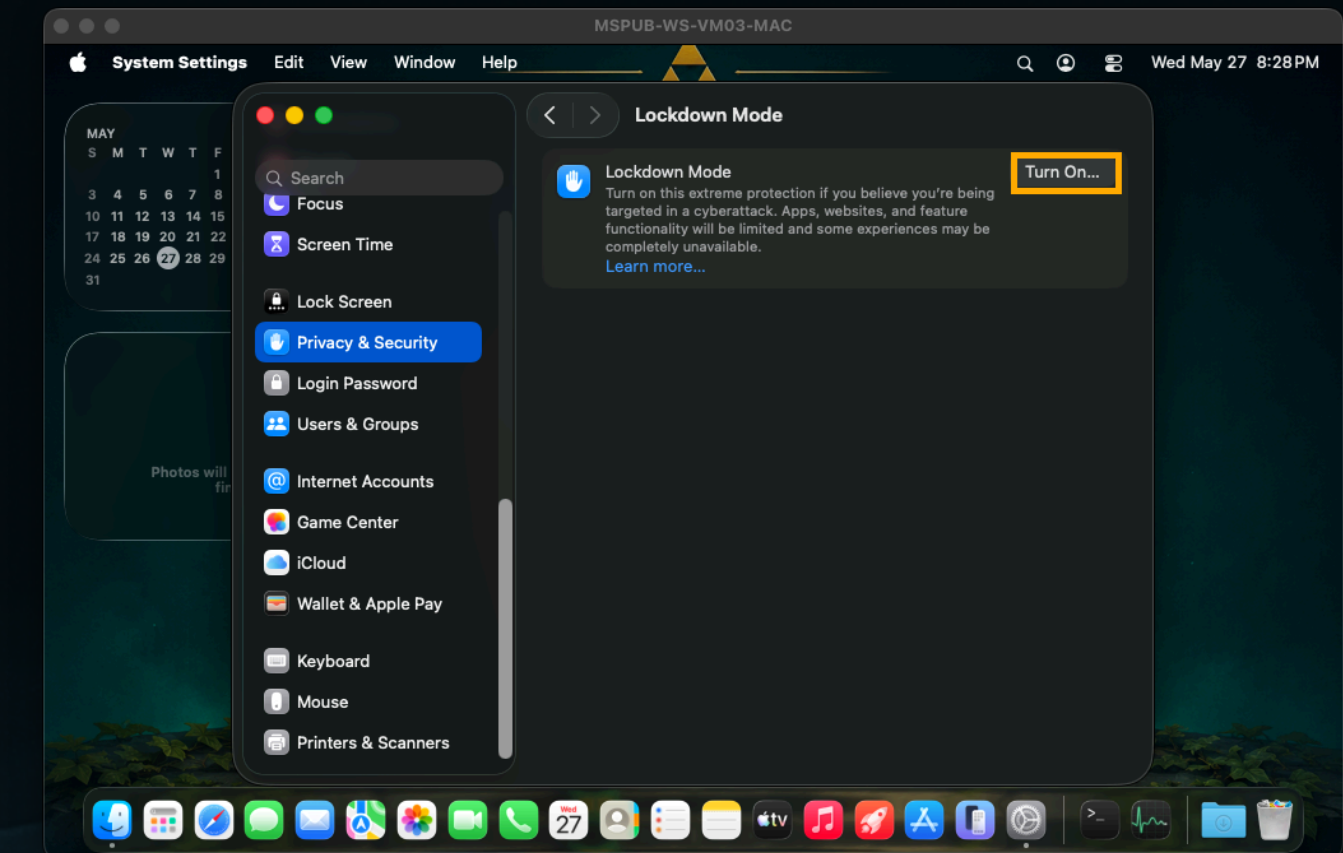
## Demonstration



# Security

## Implementations

- Windows Defender
- macOS Security Settings
- Ubuntu Firewall/Security configuration
- Active Directory authentication
- Security Awareness Training Campaign
- Incident Response Plan

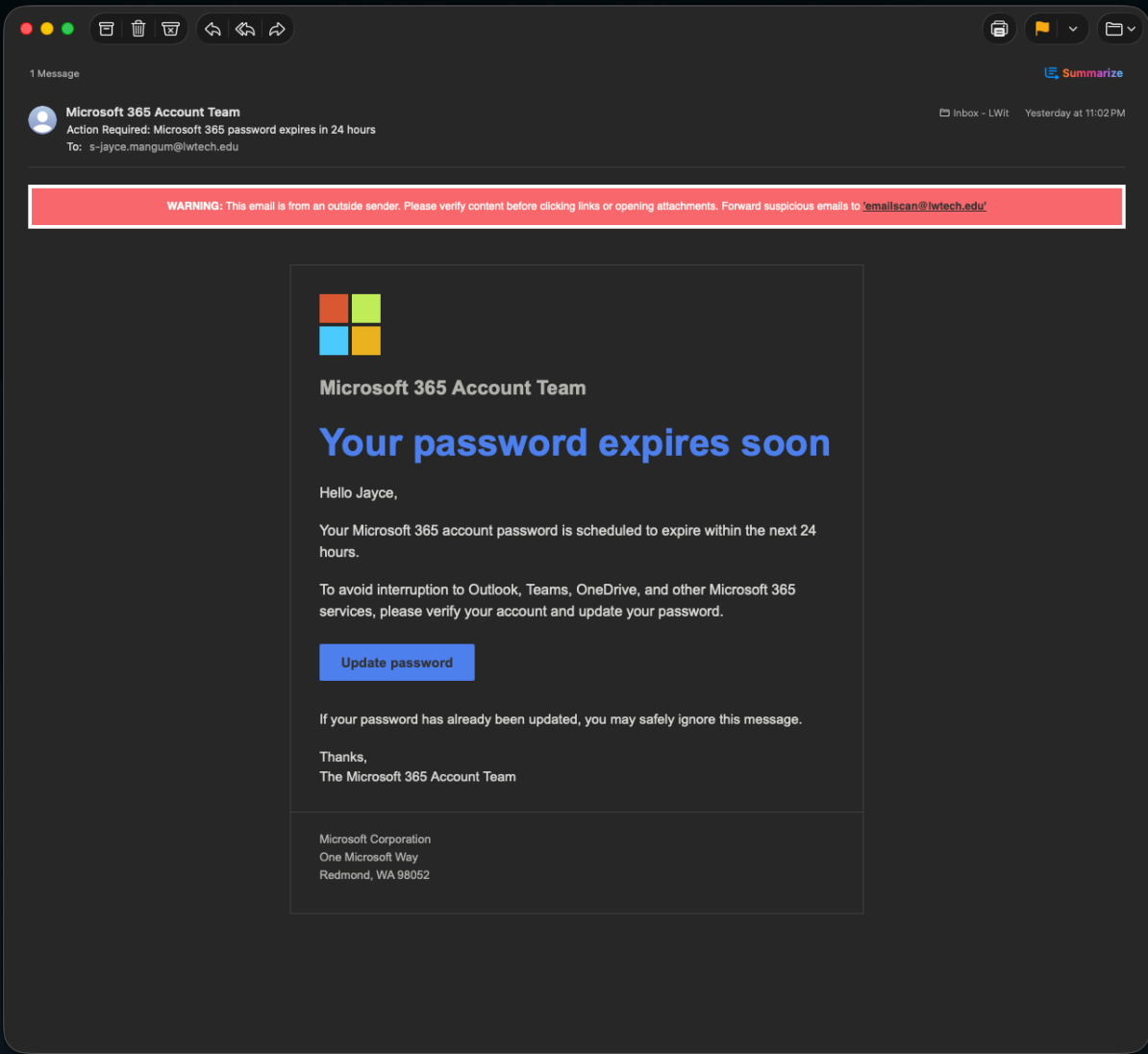




# Security Awareness Training (SAT) & Incident Response

## Security Awareness Training Simulation

- Phishing campaign
- Credential harvesting simulation
- Immediate user training



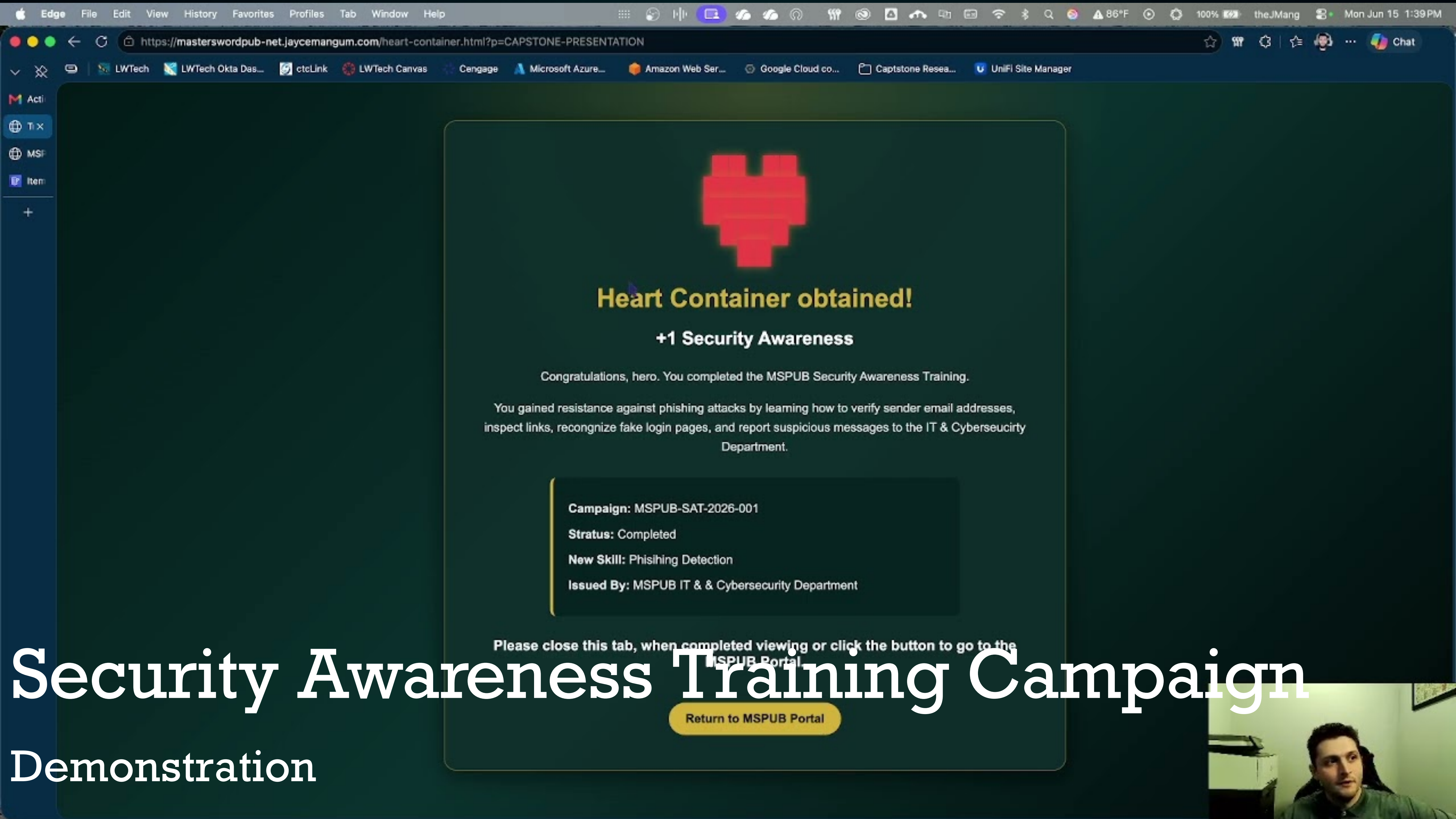
## Incident Response Plan (IRP)

- ISO 27001 alignment
- Detection
- Containment
- Recovery

## Severity Matrix

| Severity Level | Color Code | Business Impact  | Example                                 |
|----------------|------------|------------------|-----------------------------------------|
| Low            | Yellow     | Minimal          | Spam email or blocked phishing attempts |
| Medium         | Orange     | Limited          | Suspicious activity affecting one user  |
| High           | Red        | Significant      | Confirmed account compromise            |
| Critical       | Dark Red   | Severe           | Widespread compromise or ransomware     |
| Resolved       | Green      | Normal Operation | Systems have been restored              |



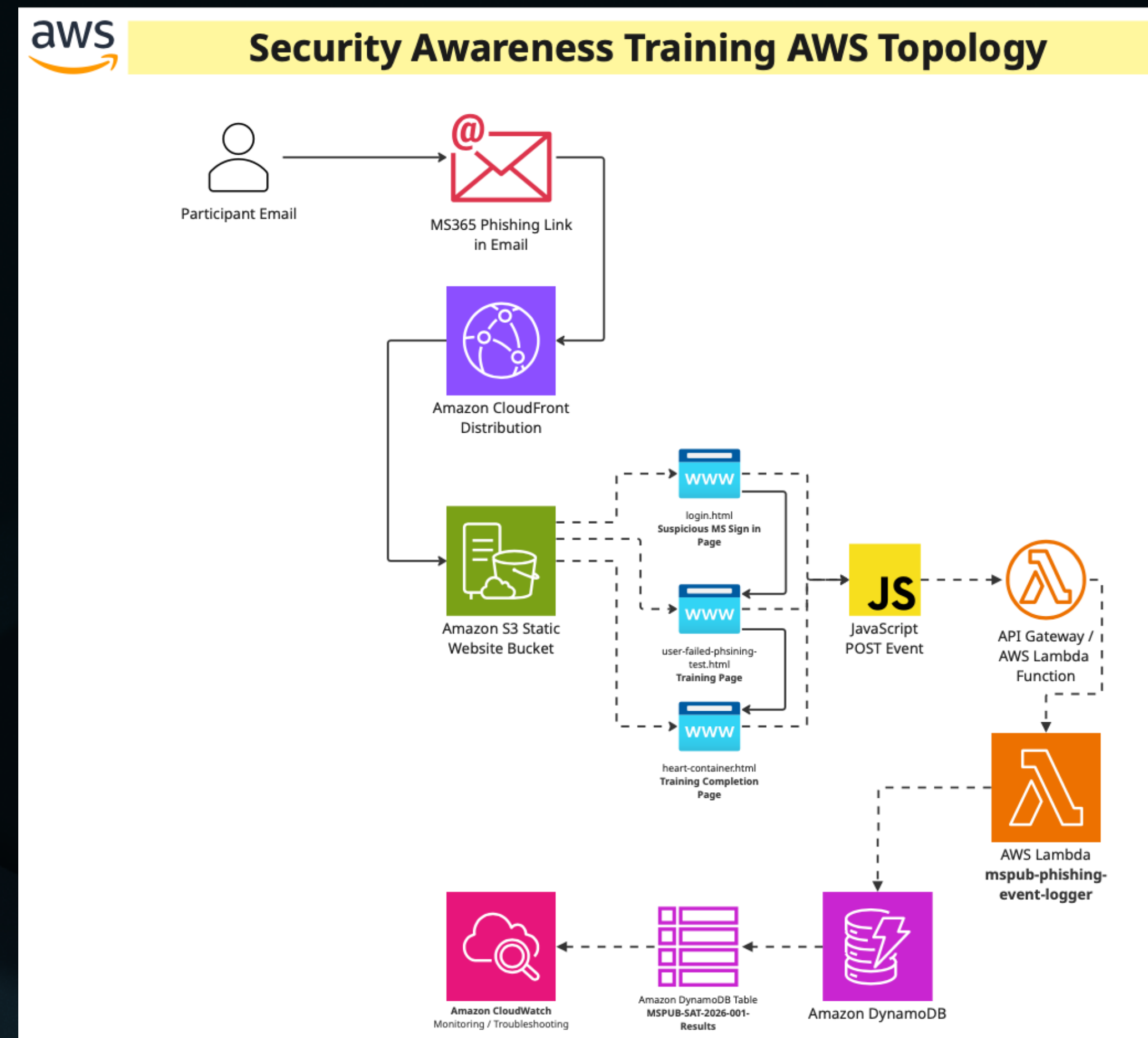


# Security Awareness Training Campaign Demonstration



# MSPUB SAT Simulation

## AWS Workflow Topology





# MSPUB SAT Simulation

## Results

- Who received the emails?
  - 5 Students
  - Professor Epps
  - 5 Friends
- Participant ID assignment
- 5/11 participants opened and entered credentials

| Scenario                                                    | Severity Level |
|-------------------------------------------------------------|----------------|
| User reports email without clicking                         | Low            |
| User opens email but takes no action                        | Low            |
| User clicks phishing link only                              | Medium         |
| User reaches login page but enters nothing                  | Medium         |
| User enters credentials into phishing page                  | High           |
| Multiple users enter credentials                            | High           |
| Evidence of account compromise after credential entry       | High           |
| Multiple compromised accounts affecting business operations | Critical       |
| Malware/ransomware delivered through phishing campaign      | Critical       |

*\*\*Note: If you did not receive the message, it was discovered that LWTech’s Email Filters may have blocked it, moved it to junk, and deleted the message entirely.*



# MSPUB SAT Simulation

## Results Tracker

Statistics

| Metric             | Count | Percentage |
|--------------------|-------|------------|
| Emails Sent        | 11    | 100.00%    |
| Links Clicked      | 5     | 41.67%     |
| Login Attempts     | 5     | 41.67%     |
| Training Viewed    | 5     | 41.67%     |
| Training Completed | 4     | 33.33%     |
| Did Not Respond    | 6     | 50.00%     |

Participant Tracker

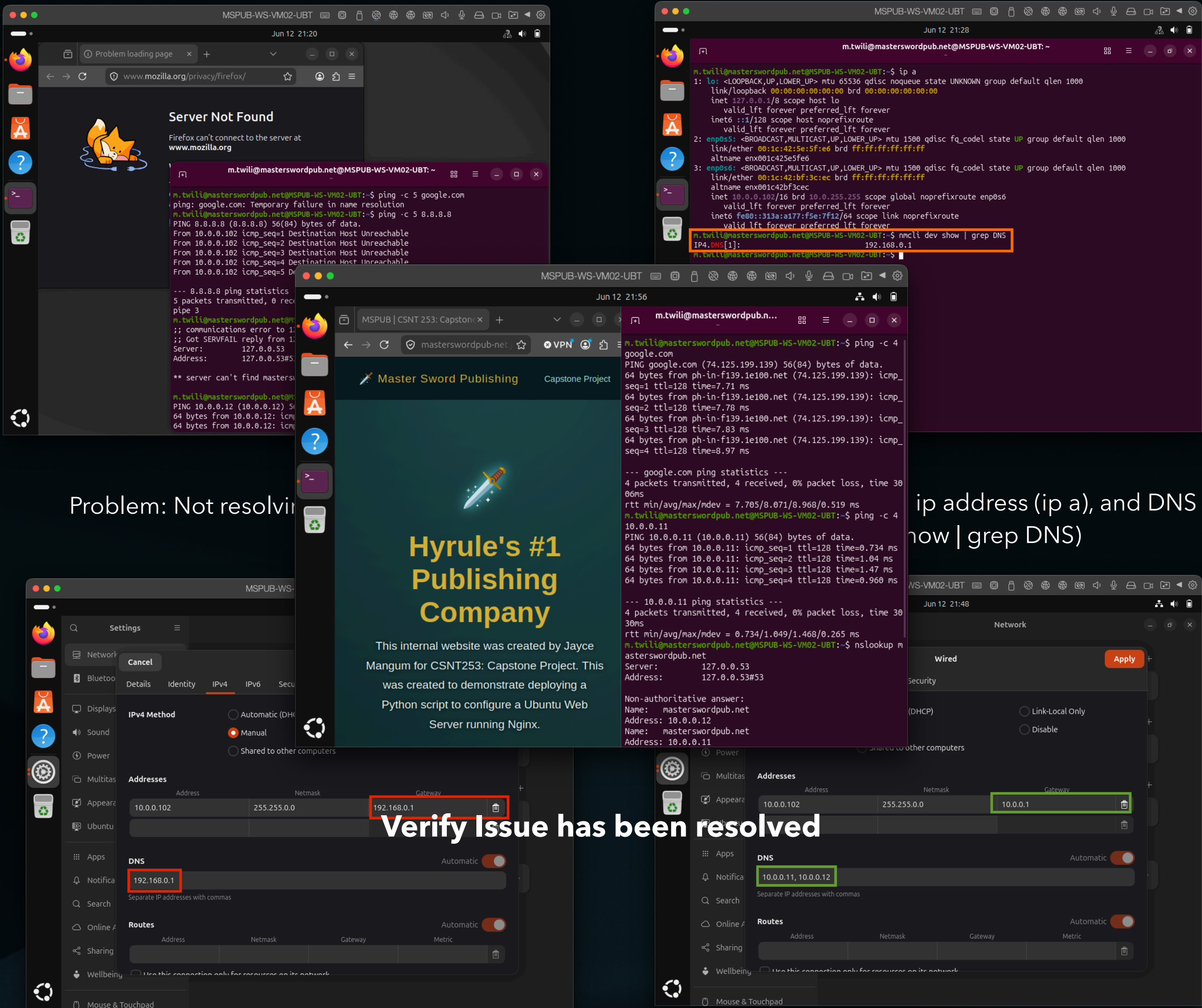
| Participant ID | Person      | Custom Email Button Link ID                                           | Email Sent | Email Sent Date | Initial Link Clicked | Login Attempt Clicked | Training Viewed | Training Completed | Notes                                                                                                                                             |
|----------------|-------------|-----------------------------------------------------------------------|------------|-----------------|----------------------|-----------------------|-----------------|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| participant00  | Link H.     | https://masterswordpub-net.jaycemangum.com/login.html?p=participant00 | YES        | 6/6/26 7:06 PM  | YES                  | YES                   | YES             | YES                | This account was used for documentation purposes to demonstrate the work flow of this phishing campaign. (Does not count towards statistics)      |
| participant01  | Linda E.    | https://masterswordpub-net.jaycemangum.com/login.html?p=participant01 | YES        | 6/6/26 10:25 AM | NO                   | NO                    | NO              | NO                 | College's email filter system appears to have tried verifying the email link. Participant has either ignored the email, or didn't click the link. |
| participant02  | Bob H.      | https://masterswordpub-net.jaycemangum.com/login.html?p=participant02 | NO         | N/A             | N/A                  | N/A                   | N/A             | N/A                | Email not sent, was not selected by the random wheel of names.                                                                                    |
| participant03  | Brent B.    | https://masterswordpub-net.jaycemangum.com/login.html?p=participant03 | NO         | N/A             | N/A                  | N/A                   | N/A             | N/A                | Email not sent, was not selected by the random wheel of names.                                                                                    |
| participant04  | Alyx B.     | https://masterswordpub-net.jaycemangum.com/login.html?p=participant04 | NO         | N/A             | N/A                  | N/A                   | N/A             | N/A                | Email not sent, was not selected by the random wheel of names.                                                                                    |
| participant05  | Mihail B.   | https://masterswordpub-net.jaycemangum.com/login.html?p=participant05 | YES        | 6/6/26 10:15 AM | NO                   | NO                    | NO              | NO                 | College's email filter system appears to have tried verifying the email link. Participant has either ignored the email, or didn't click the link. |
| participant06  | Joshua B.   | https://masterswordpub-net.jaycemangum.com/login.html?p=participant06 | NO         | N/A             | N/A                  | N/A                   | N/A             | N/A                | Email not sent, was not selected by the random wheel of names.                                                                                    |
| participant07  | Tim C.      | https://masterswordpub-net.jaycemangum.com/login.html?p=participant07 | NO         | N/A             | N/A                  | N/A                   | N/A             | N/A                | Email not sent, was not selected by the random wheel of names.                                                                                    |
| participant08  | Keith C.    | https://masterswordpub-net.jaycemangum.com/login.html?p=participant08 | NO         | N/A             | N/A                  | N/A                   | N/A             | N/A                | Email not sent, was not selected by the random wheel of names.                                                                                    |
| participant09  | Iftu I.     | https://masterswordpub-net.jaycemangum.com/login.html?p=participant09 | YES        | 6/6/26 10:17 AM | NO                   | NO                    | NO              | NO                 | College's email filter system appears to have tried verifying the email link. Participant has either ignored the email, or didn't click the link. |
| participant10  | Mateen K.   | https://masterswordpub-net.jaycemangum.com/login.html?p=participant10 | NO         | N/A             | N/A                  | N/A                   | N/A             | N/A                | Email not sent, was not selected by the random wheel of names.                                                                                    |
| participant11  | Akshatha K. | https://masterswordpub-net.jaycemangum.com/login.html?p=participant11 | NO         | N/A             | N/A                  | N/A                   | N/A             | N/A                | Email not sent, was not selected by the random wheel of names.                                                                                    |
| participant12  | Brandon M.  | https://masterswordpub-net.jaycemangum.com/login.html?p=participant12 | NO         | N/A             | N/A                  | N/A                   | N/A             | N/A                | Email not sent, was not selected by the random wheel of names.                                                                                    |
| participant13  | Maksim M.   | https://masterswordpub-net.jaycemangum.com/login.html?p=participant13 | YES        | 6/6/26 10:18 AM | NO                   | NO                    | NO              | NO                 | College's email filter system appears to have tried verifying the email link. Participant has either ignored the email, or didn't click the link. |
| participant14  | Dylan R.    | https://masterswordpub-net.jaycemangum.com/login.html?p=participant14 | NO         | N/A             | N/A                  | N/A                   | N/A             | N/A                | Email not sent, was not selected by the random wheel of names.                                                                                    |
| participant15  | Zach S.     | https://masterswordpub-net.jaycemangum.com/login.html?p=participant15 | NO         | N/A             | N/A                  | N/A                   | N/A             | N/A                | Email not sent, was not selected by the random wheel of names.                                                                                    |
| participant16  | Hutton S.   | https://masterswordpub-net.jaycemangum.com/login.html?p=participant16 | NO         | N/A             | N/A                  | N/A                   | N/A             | N/A                | Email not sent, was not selected by the random wheel of names.                                                                                    |
| participant17  | Mamadou S.  | https://masterswordpub-net.jaycemangum.com/login.html?p=participant17 | YES        | 6/6/26 10:20 AM | NO                   | NO                    | NO              | NO                 | College's email filter system appears to have tried verifying the email link. Participant has either ignored the email, or didn't click the link. |
| participant18  | Caden T.    | https://masterswordpub-net.jaycemangum.com/login.html?p=participant18 | YES        | 6/6/26 10:21 AM | NO                   | NO                    | NO              | NO                 | College's email filter system appears to have tried verifying the email link. Participant has either ignored the email, or didn't click the link. |
| participant19  | Gilbert W.  | https://masterswordpub-net.jaycemangum.com/login.html?p=participant19 | NO         | N/A             | N/A                  | N/A                   | N/A             | N/A                | Email not sent, was not selected by the random wheel of names.                                                                                    |
| participant37  | Taylor M.   | https://masterswordpub-net.jaycemangum.com/login.html?p=participant20 | YES        | 6/6/26 10:09 AM | YES                  | YES                   | YES             | YES                | Opened link twice, then filled out the form, and proceeded through the exercise.                                                                  |
| participant38  | Kali T.     | https://masterswordpub-net.jaycemangum.com/login.html?p=participant21 | YES        | 6/6/26 9:30 AM  | YES                  | YES                   | YES             | NO                 | Ignored email or didn't click the link in the email.                                                                                              |
| participant39  | David M.    | https://masterswordpub-net.jaycemangum.com/login.html?p=participant22 | YES        | 6/6/26 9:26 AM  | YES                  | YES                   | YES             | YES                | Opened link twice, then filled out the form, and proceeded through the exercise.                                                                  |
| participant40  | Anna J.     | https://masterswordpub-net.jaycemangum.com/login.html?p=participant23 | YES        | 6/6/26 9:55 AM  | YES                  | YES                   | YES             | YES                |                                                                                                                                                   |
| participant41  | Mason H.    | https://masterswordpub-net.jaycemangum.com/login.html?p=participant24 | YES        | 6/6/26 9:38 AM  | YES                  | YES                   | YES             | YES                |                                                                                                                                                   |
| participant42  | Stacey M.   | https://masterswordpub-net.jaycemangum.com/login.html?p=participant25 | NO         | N/A             | N/A                  | N/A                   | N/A             | N/A                | Email not sent, was not selected by the random wheel of names.                                                                                    |
| participant43  | Corey M.    | https://masterswordpub-net.jaycemangum.com/login.html?p=participant26 | NO         | N/A             | N/A                  | N/A                   | N/A             | N/A                | Email not sent, was not selected by the random wheel of names.                                                                                    |
| participant44  | Kyrah B.    | https://masterswordpub-net.jaycemangum.com/login.html?p=participant27 | NO         | N/A             | N/A                  | N/A                   | N/A             | N/A                | Email not sent, was not selected by the random wheel of names.                                                                                    |
| participant45  | Tristan B.  | https://masterswordpub-net.jaycemangum.com/login.html?p=participant28 | NO         | N/A             | N/A                  | N/A                   | N/A             | N/A                | Email not sent, was not selected by the random wheel of names.                                                                                    |



# Troubleshooting Scenario

## DNS Misconfiguration

- Problem:
  - User unable to access internal services/web pages
- Investigation:
  - Name resolution request fails
  - Pinging internal resources fails
  - Check DNS Settings
- Resolution:
  - Fix DNS settings to correct name servers



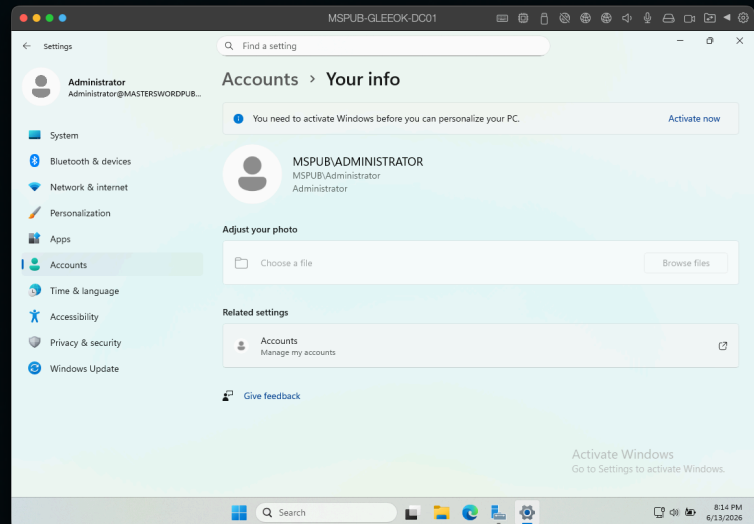
Investigation: Network Settings: Gateway/DNS are misconfigured

Resolution: Configure the gateway and DNS to the correct settings

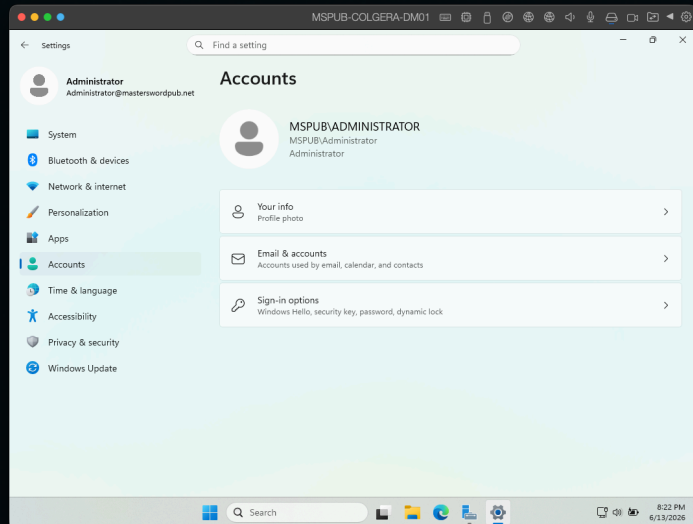


# Testing & Validation

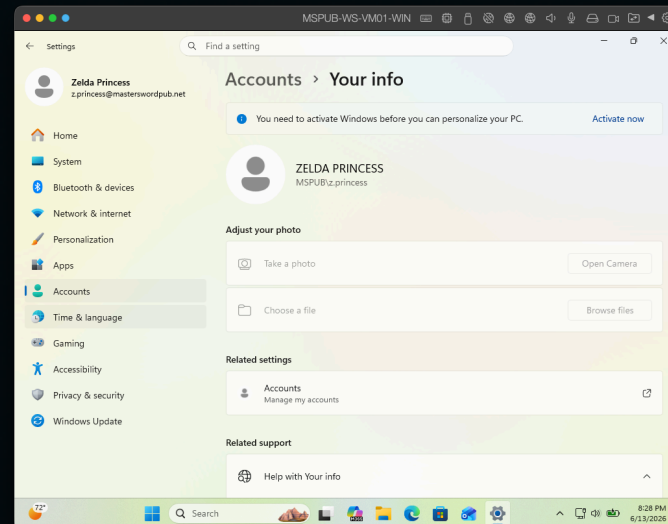
## Active Directory authentication



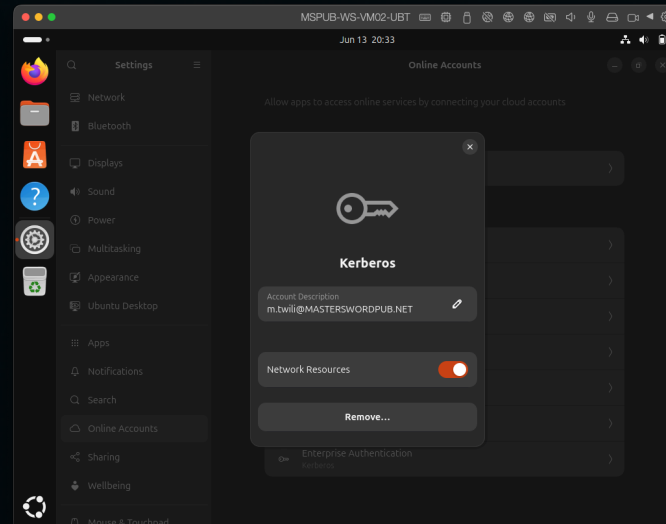
MSPUB-GLLEOK-DC01



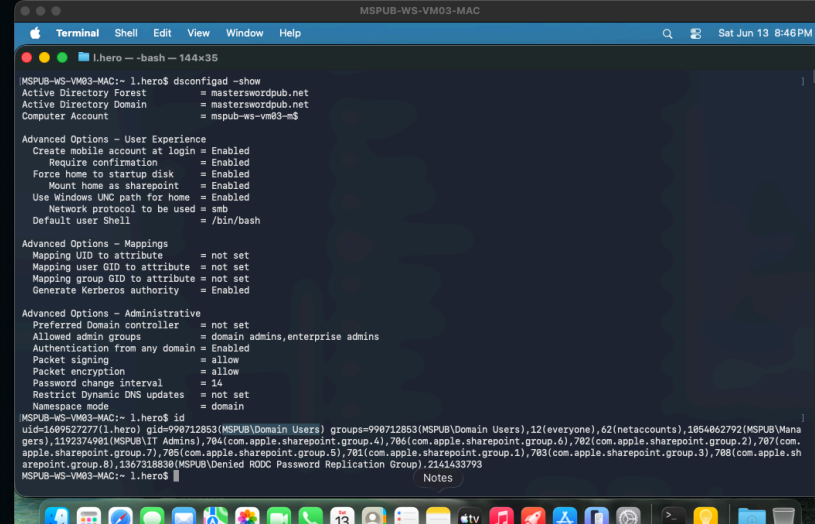
MSPUB-COLGERA-DM01



MSPUB-WS-VM01-WIN



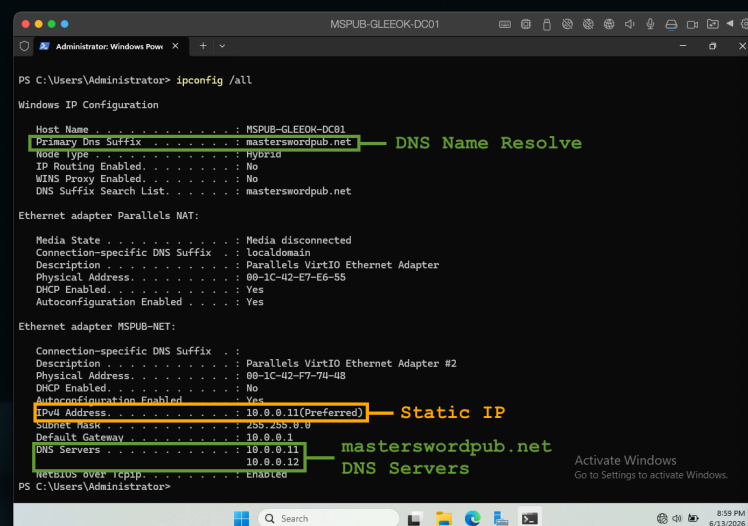
MSPUB-WS-VM02-UBT



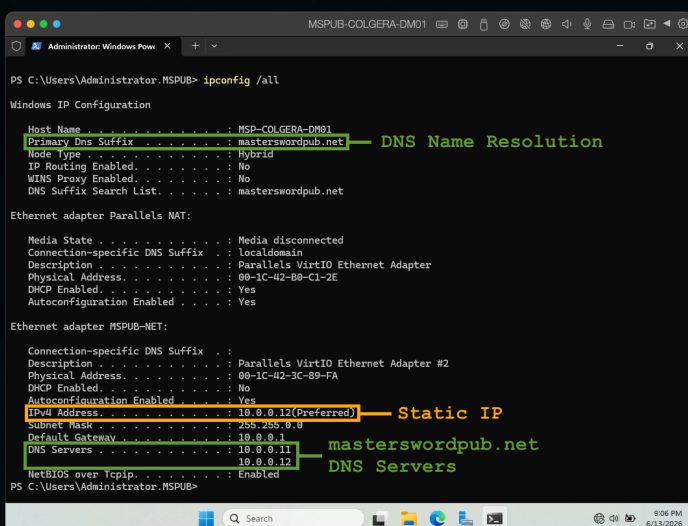
\*\*Note: MSPUB-LYNEL-  
WEB01 & MSPUB-WS-  
VM04-KAL were not  
added to the  
masteswordpub.net  
domain

MSPUB-WS-VM03-MAC

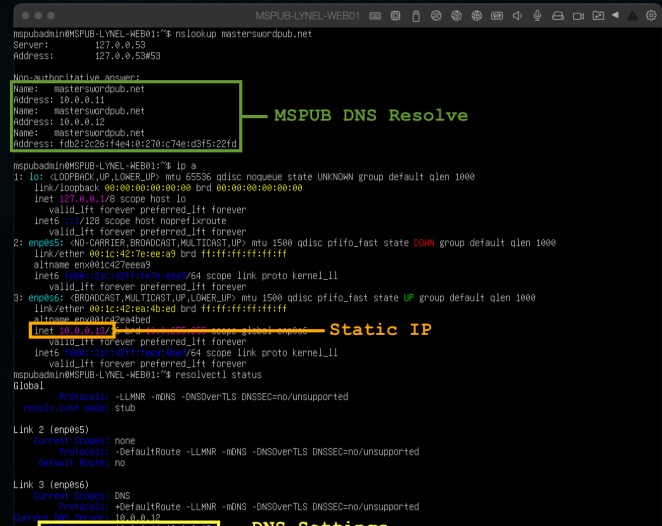
## DSN Name Resolution & IP Address Assignment



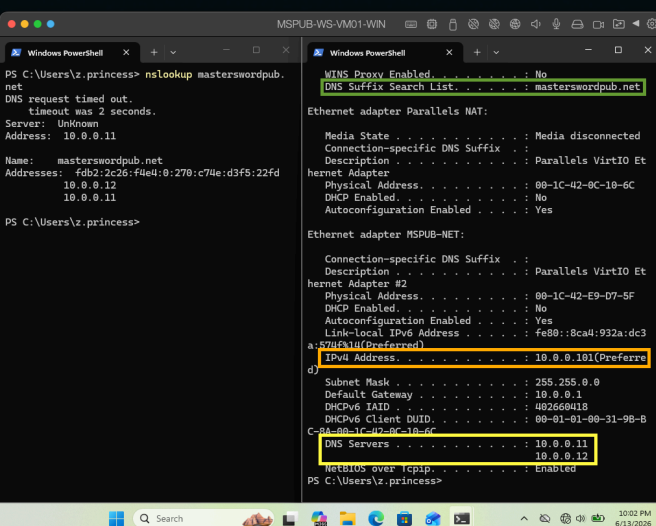
MSPUB-GLLEOK-DC01



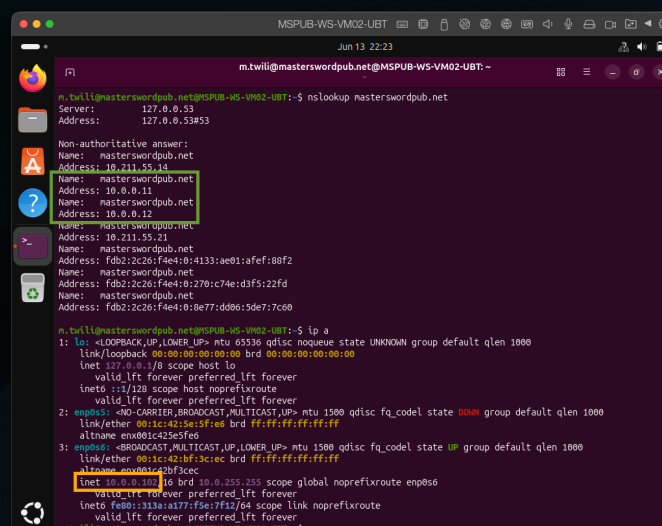
MSPUB-COLGERA-DM01



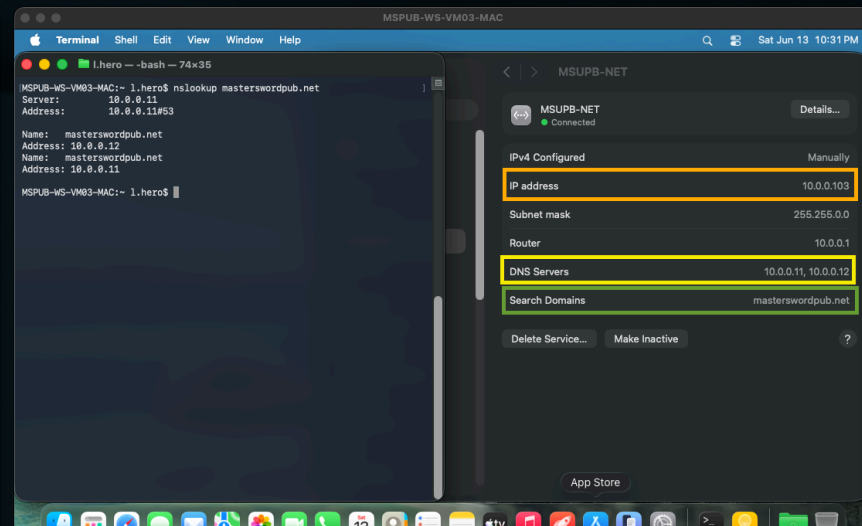
MSPUB-LYNEL-WEB01



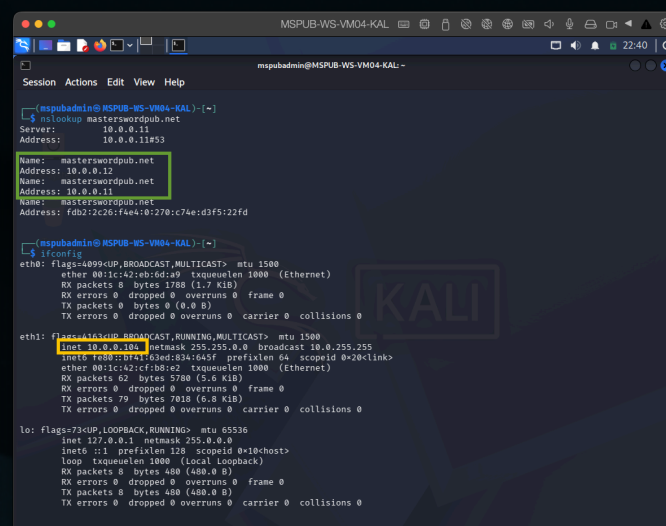
MSPUB-WS-VM01-WIN



MSPUB-WS-VM02-UBT



MSPUB-WS-VM03-MAC



MSPUB-WS-VM04-KAL



# Testing & Validation

## User Management Script

```
mspubadmin@MSPUB-LYNEL-WEB01:~/scripts/usragat$ sudo python3 ./mspub-usermgmt_v2.py

[jmangum@DINRAAL UserCreationMenu % ssh mspubadmin@10.0.0.13
[mspubadmin@10.0.0.13's password:
Welcome to Ubuntu 26.04 LTS (GNU/Linux 7.0.0-22-generic aarch64)

 * Documentation:  https://docs.ubuntu.com
 * Management:    https://landscape.canonical.com
 * Support:        https://ubuntu.com/pro

System information as of Sat Jun 13 11:17:53 PM PDT 2026

System load:  0.0          Processes:    144
Usage of /:   37.7% of 10.70GB Users logged in:  0
Memory usage: 11%          IPv4 address for enp0s6: 10.0.0.13
Swap usage:   0%

=> There is 1 zombie process.

 * Strictly confined Kubernetes makes edge and IoT secure. Learn how MicroK8s
just raised the bar for easy, resilient and secure K8s cluster deployment.

https://ubuntu.com/engage/secure-kubernetes-at-the-edge

Expanded Security Maintenance for Applications is not enabled.

0 updates can be applied immediately.

Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status

The list of available updates is more than a week old.
To check for new updates run: sudo apt update

Last login: Sat Jun 13 22:53:17 2026 from 10.0.0.2
mspubadmin@MSPUB-LYNEL-WEB01:~$
```

User Management Script was ran while using SSH from host

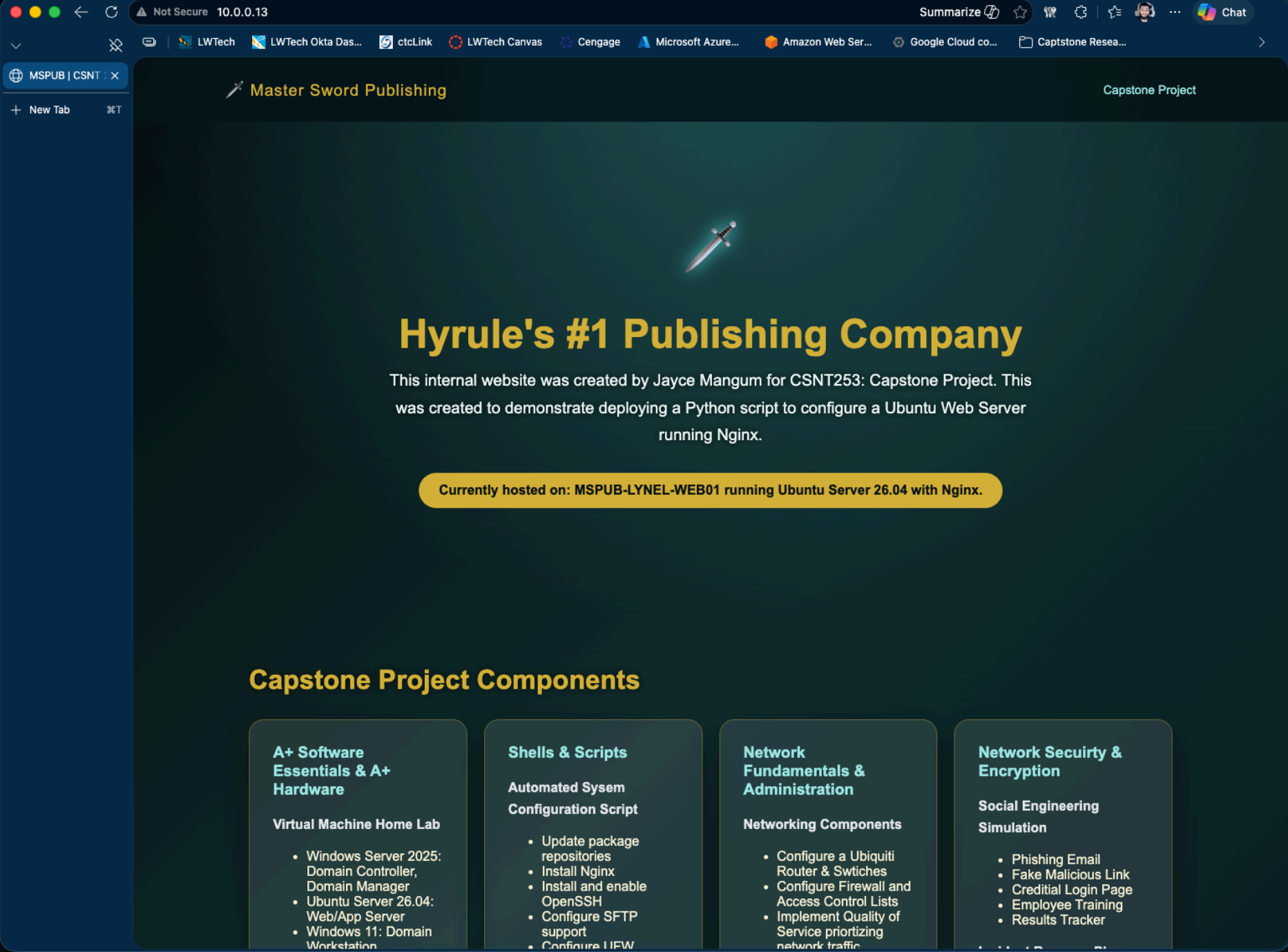
Batch User Import

to VM

Logs in /var/log/mspub\_user\_mgmt.log

## Webserver System Configuration Script

```
mspubadmin@MSPUB-LYNEL-WEB01:~$ cd ./scripts/websrvconf
mspubadmin@MSPUB-LYNEL-WEB01:~/scripts/websrvconf$ ls -l
total 16
-rwx----- 1 mspubadmin mspubadmin 6159 Jun 13 23:44 mspub-webserver-setup_v3.py
-rwx----- 1 mspubadmin mspubadmin 6248 Jun 14 00:22 mspub_index.html
```



```
[2026-06-14 00:36:20] SUCCESS: ln -s /etc/nginx/sites-available/masterswordpub.net /etc/nginx/sites-enabled/masterswordpub.net
[2026-06-14 00:36:20] SUCCESS: nginx -t
[2026-06-14 00:36:20] SUCCESS: systemctl reload nginx
[2026-06-14 00:36:20] Nginx site configured successfully.
[2026-06-14 00:36:20] SUCCESS: systemctl enable nginx
```

MSPUB Webpage loads when going to VM IP address on host

machine or other VM on the network

Logs in /var/log/mspub\_setup.log



# Risk Analysis

| Risk               | Mitigation         |
|--------------------|--------------------|
| Credential Theft   | MFA/User Training  |
| Malware            | Hardening/Patching |
| Network compromise | Segmentation       |
| Human Error        | Documentation      |



# Lessons Learned

- Troubleshooting complex systems often requires patience and systematic testing.
- Active Directory deployments are heavily dependent on properly configured DNS services.
- Automation can save a significant amount of time when managing users and system configurations.
- Cloud platforms provide powerful tools for monitoring, logging, and security awareness initiatives.
- Thorough documentation became one of the most valuable tools throughout this project.



# Future Improvements

- Multi Factor Authentication (MFA)
- Security Information and Event Management (SIEM)
- Centralized logging
- Expanded SAT campaigns
- Storage Solutions



# Conclusion

- Networking
- Automation
- Security
- Documentation
- Cloud

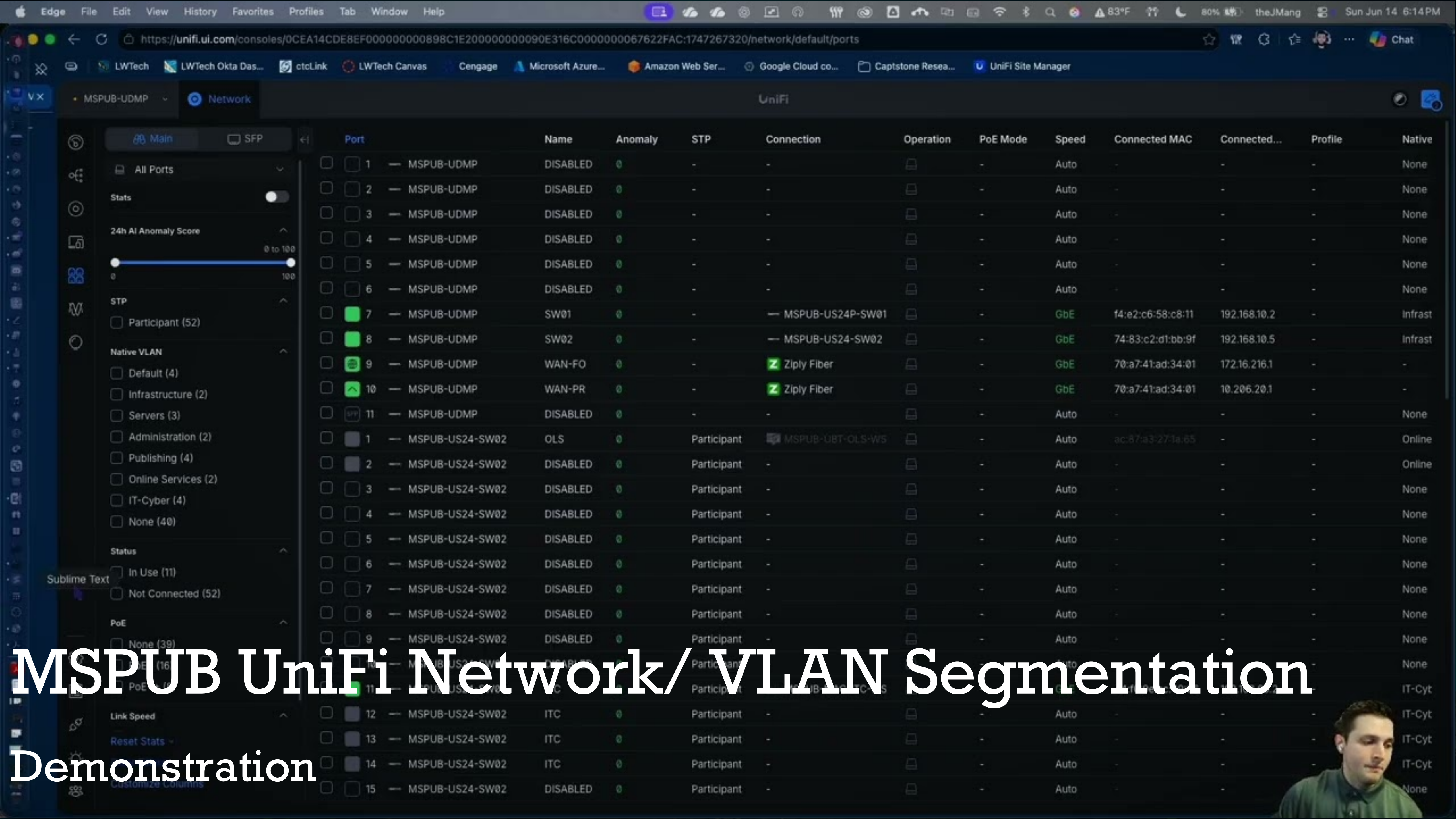


# Questions & Answers



# Appendices/Backup Slides

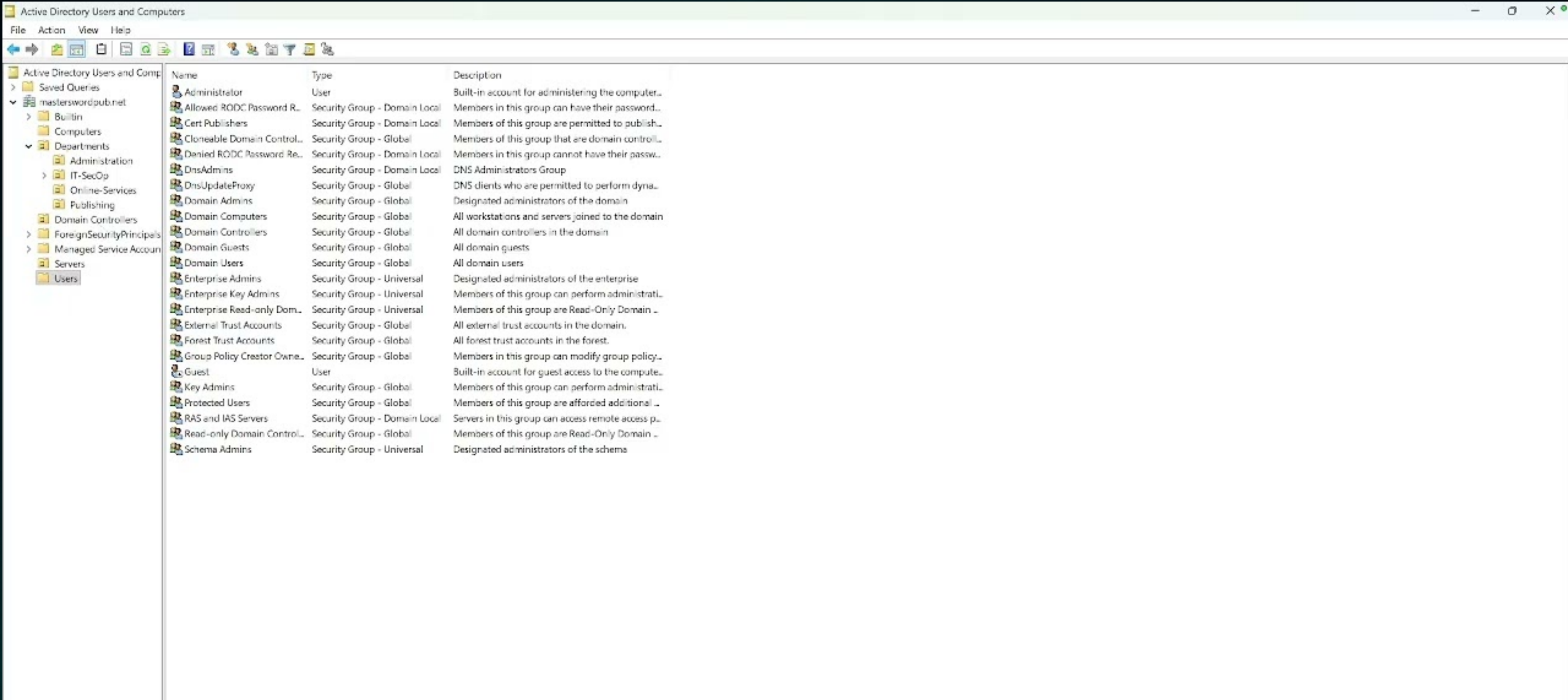




# MSPUB UniFi Network/VLAN Segmentation Demonstration

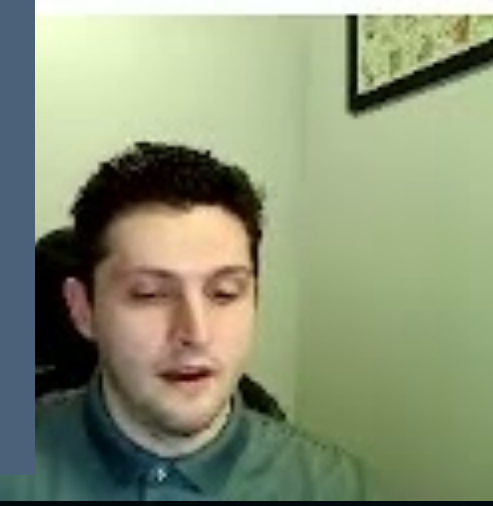






# MSPUB Active Directory Overview

## Demonstration







Search

Wallpaper

Notifications

Sound

Focus

Screen Time

Lock Screen

Privacy & Security

Login Passwords

Users & Groups

Internet Accounts

Game Center

iCloud

Wallet & Apple Pay

Users & Groups

MSPUB Administrator  
Admin

Guest User  
Off

Add Group

Add User...

Off

Edit...

?

Network Servers

No Servers

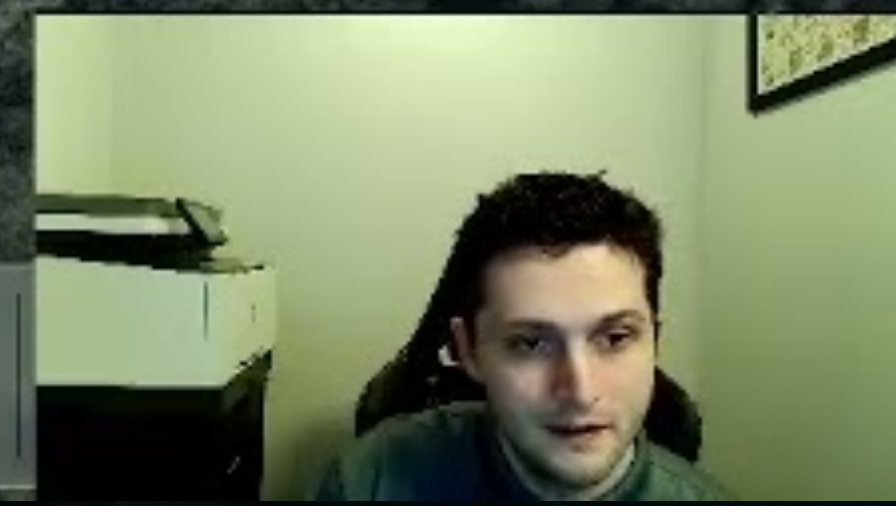
+ -

Open Directory Utility...

Done

# macOS Active Directory Bind

## Demonstration

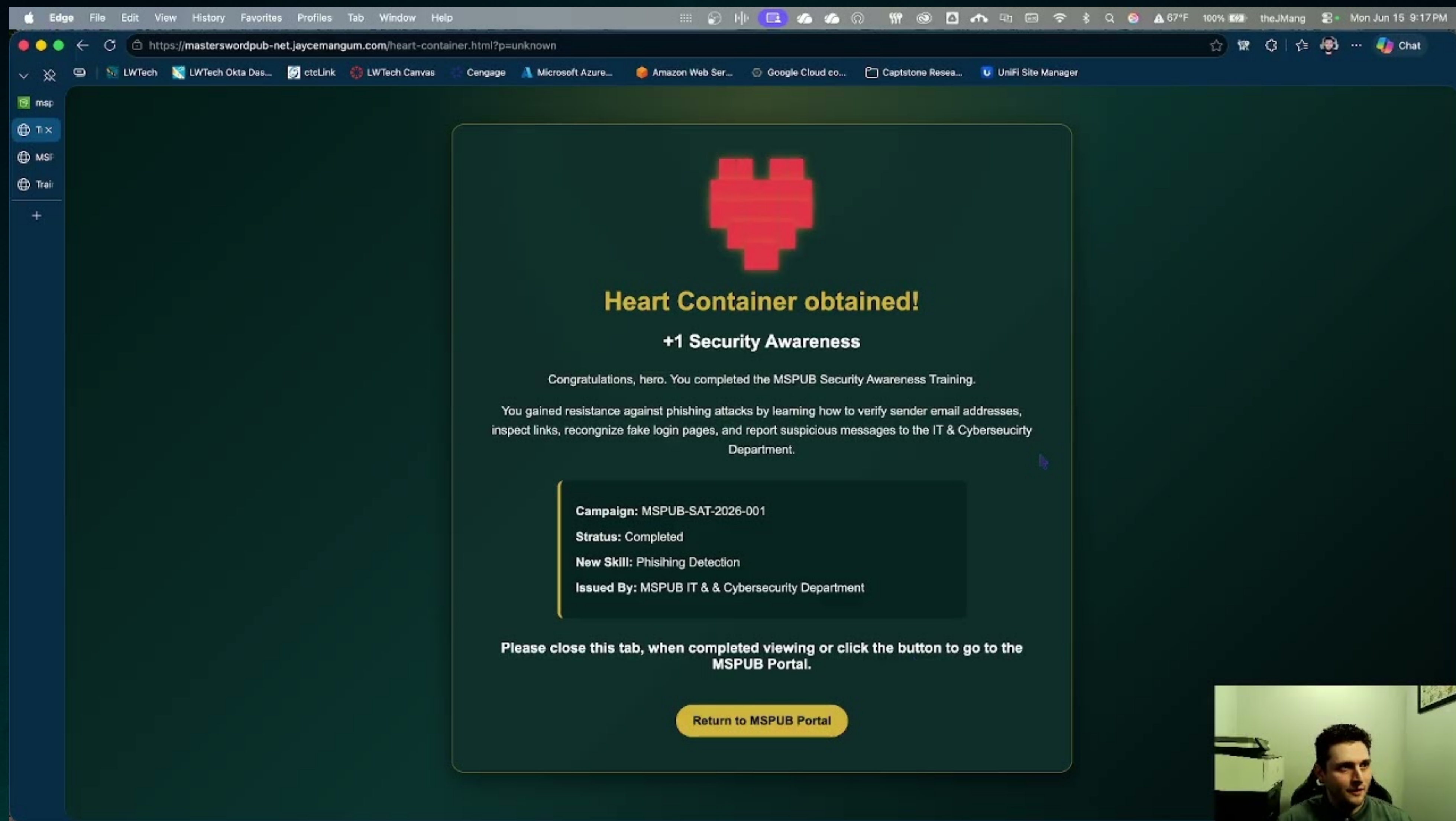




# Windows Demonstration







# SAT Campaign AWS Resources Overview

## Demonstration