

Week 1 Summary – Server + Capstone Project

During Week 1 of the Server + Capstone project, the following key tasks were successfully accomplished:

1. **Proxmox Bootable USB Creation**

- A USB drive was flashed with Proxmox VE 6.4-1 ISO using Rufus.
- Configured with appropriate partition scheme (MBR/GPT) and file system (FAT32).
- Ensured Proxmox compatibility by selecting DD mode.

2. **BIOS Configuration and Boot Setup**

- Accessed BIOS on the server and adjusted the boot sequence to prioritize the USB device for installation.

3. **RAID Configuration**

- Accessed RAID controller utility and deleted existing virtual disks.
- Created and initialized a new RAID 6 array using available drives.

4. **Proxmox Installation and Network Bridge Setup**

- Installed Proxmox VE 6.4-1 on the server using the RAID virtual disk.
- Configured the Proxmox web interface with a static IP (10.10.10.151) and created bridge `vmbr0` for external connectivity.

5. **Secure Jump Box Deployment**

- Created `vmbr1` for an isolated subnet (172.16.0.0/24).
- Deployed a hardened Ubuntu Jump Box with SSH enabled and root login disabled.
- Configured firewall rules using `ufw` to restrict SSH access to trusted networks.

6. **Routing and NAT Configuration**

- Enabled IP forwarding and implemented NAT/PAT rules using `iptables`.
- Configured port forwarding to allow secure external access to internal machines via the Jump Box.

7. **Persistent Firewall Rules**

- Installed `iptables-persistent` to ensure firewall rules survive reboots.

8. **Internal Subnet Setup for Lab VMs**

- Created `vmbr2` for internal VM communication (192.168.0.0/24).
- Assigned static IPs to internal VMs (Windows Server, Windows 11, Ubuntu Desktop).
- Configured the Proxmox host as the gateway and Windows Server as the DNS server.

9. ****Static Routing for Internal Connectivity****

- Added static routes on both Windows and Linux internal VMs to enable bidirectional communication with the Jump Box.

This setup lays the foundation for a multi-subnet virtual lab environment hosted on Proxmox, supporting future Windows and Linux deployments with segmentation, NAT, and secure access controls.

Week 2 Summary – Server + Capstone Project

In Week 2 of the Server + Capstone project, services were deployed across multiple virtual machines to simulate a functioning enterprise network. The configuration involved both Windows and Linux servers, as well as client endpoints.

****VM Overview and Roles:****

- ****WINServer19 (192.168.0.2)**** – Windows Server 2019: DHCP, DNS, IIS, SQL Express
- ****LinuxServer (192.168.0.3)**** – Ubuntu 24.04: NGINX, MariaDB, NTP, Syslog
- ****Win10 (192.168.0.4)**** – Windows 10 Client Endpoint
- ****UbuntuPC (192.168.0.5)**** – Ubuntu 24.04.1 Client Endpoint

****Phase 1: Windows Service Deployment****

1. **DNS Setup**

- Installed the DNS Server role and created a primary forward lookup zone ('team.a.local').
- Added an A record for `winserver.team.a.local` pointing to 192.168.0.2.
- Verified DNS resolution using `nslookup`.

2. **DHCP Configuration**

- Installed the DHCP Server role and created a new scope named 'CapstoneScope' with the following parameters:

- IP Range: 192.168.0.4–192.168.0.20
- Gateway: 192.168.0.1
- DNS: 192.168.0.2
- Activated the scope and tested DHCP assignment on Win10 and Ubuntu clients.

3. **IIS & Web Page Deployment**

- Enabled IIS via Server Manager.
- Customized the default `index.html` page to display a welcome message.
- Verified web page availability at `http://192.168.0.2`.

****Phase 2: Linux Service Deployment****

1. **NGINX Web Server**

- Installed and configured NGINX to serve a basic HTML page with a welcome message.
- Verified web access from other VMs at `http://192.168.0.3`.

2. **MariaDB Installation and Configuration**

- Installed MariaDB and set up a database `capstone_db`.
- Created a user `capuser` with full privileges.
- Successfully tested access to the database.

3. **NTP Configuration**

- Installed and verified NTP synchronization using `ntpq -p`.

4. **Syslog Setup**

- Installed and enabled `rsyslog`.
- Tested logging by sending a custom message and confirming it appeared in `/var/log/syslog`.

****Phase 3: Monitoring and Network Testing****

- Performed ping tests between Windows and Linux machines to confirm full connectivity.
- Successfully resolved hostnames using DNS from both client systems.

This week focused on building the core services and basic monitoring necessary for internal network operation and client-server interaction, laying the groundwork for advanced security, automation, and domain functionality in upcoming phases.

Week 3 Summary – Server + Capstone Project

In Week 3 of the Server + Capstone project, the focus shifted to physical network integration and switch configuration to support secure and segmented infrastructure deployment.

****Phase 1: Proxmox Network Expansion****

- Created a new bridge interface `vmbr3` on the Proxmox host.
- Assigned it to a second NIC (e.g., `ens02`).
- Set a static IP address of `192.168.10.2` to place Proxmox on the new 192.168.10.0/24 subnet (Team A).

****Phase 2: Switch Configuration****

- Configured a physical network switch with the following:
 - Hostname: `teamA`
 - Enable secret password set for privileged access.
 - Assigned IP address: `192.168.10.10` (Team A switch IP).
 - Saved configuration using `write memory` & `copy run start`
 - Verified active ports (e.g., `fa0/1`, `fa0/24`) using `show ip interface brief`.

****Phase 3: SSH Remote Access Configuration****

- Set the switch's domain name to `lab.local`.
- Generated an RSA key pair (1024 bits).
- Created a local user account: `teamA`.
- Configured VTY lines for:
 - SSH-only access.
 - Local login using the created user account.
- Successfully tested SSH connectivity from the Proxmox host (`192.168.10.2`) to the TeamA switch, Classroom Switch and Classroom Router.

****Phase 4: Internet and Gateway Connectivity****

- From the Proxmox host, verified connectivity to the default gateway at `192.168.10.1`.
- Confirmed that the Proxmox system had a functioning network route and Layer 3 connection.

****Summary Table****

- **VLAN:** 1
- **Subnet:** 192.168.10.0/24
- **IPs:**
 - Proxmox: 192.168.10.2
 - Switch: 192.168.10.10
- **SSH Status:**
 - SSH Enabled: Yes
 - RSA Key Size: 1024 bits
 - SSH Username: `teama`
 - SSH Tested From: 192.168.10.2

****Reflection****

- **Most Challenging Step:** Resetting the switch due to potential loss of prior configuration and needing console access.
- **SSH Benefits:** SSH enables secure, encrypted remote access, improving administrative efficiency and reducing the need for physical access to network hardware.

This phase integrated virtual infrastructure with physical Layer 2/3 networking components, improving operational realism and expanding the network's security and manageability.

Capstone project – Week 1:

Date: 7-08-25

Team: A

Team Members & Roles:

- Windows Specialist: Santos Bonilla, Everardo Cantu
-  Linux Specialist: Jose Leon Jr.
-  Networking Specialist: Jesus Ortiz
-  Team Lead: Robert Roberts

Objective

Physically inspect and assemble the server, install Proxmox, create foundational VMs, and produce a network diagram reflecting a small-school IT environment.

Phase 1: Hardware Inspection & Proxmox Installation

Step 1: Examine Server Hardware

Task: Open the server and record the hardware details or find information in server manual.

Component	Expected Requirement	Actual Spec	Notes
CPU Cores	≥ 4 Virtualizable cores	16 Processors (2 sockets 8 cores)	Xeon E5520 @2.27 GHz
Virtualization Support	Intel VT-x / AMD-V	VT-x	
RAM	≥ 16 GB	64 GB	
Storage	≥ 200 GB (local)	1.818 TB	RAID-6
NICs	≥ 2 (1 for mgmt, 1 for VMs)	2 1GB	

Step 2: Install Proxmox VE

Task: Flash USB using Rufus and install Proxmox.

- Rufus ISO used:** Rufus 4.7
- Selected scheme:** Bios/GPT/UEFI? GPT
- File system:** FAT-32
- Installation issues or notes:**

When attempting to configure the server, we failed to select the correct slot on the KVM switch so the screen wouldn't load because it wanted detecting an input. This caused us to take server apart and troubleshoot/verify I/O connections, when it was not needed.

Phase 2: VM Provisioning & Network Bridge

Step 3: Bridge Configuration

(Networking Specialist)

- **Bridge name:** vmbr0
- **Static IP given to Proxmox host:** 10.10.10.151
- **Ping test to internet (e.g., 8.8.8.8):** 7.5ms

Step 4: Create Base VMs

VM Name	OS & Version	Static IP	Assigned Role	Responsible
WindowsServer01	Windows Server 2019	192.168.0.2	DNS/DHCP initial build	Windows Spec
LinuxServer01	Ubuntu/Debian Ubuntu 6.4.1	192.168.0.5	NGINX/NTP/Syslog starter	 Linux Spec

- **Ping response Windows → Linux:** 1 ms
- **Ping response Linux → Windows:** UNKNWN ms .85ms

Step 5: Documentation and reporting

• Team Lead

- Populate the **IT Asset Tracking Spreadsheet** with host + VM info
- Export a snapshot to include in the Week 1 Report

Network Diagram Requirement

Task: Create a diagram representing your small-school network: Proxmox host, vmbr0, and two VMs.

Options:

- Cisco Packet Tracer (recommended for exposure to network simulation)
- Paper sketch (photo acceptable)
- Draw.io or Visio alternative (free tools)

Week 1 Report (Submit as PDF/Word)

Include the following:

1. **Proxmox Host Screenshot** — Dashboard showing both VMs
2. **Network Diagram** — From Phase 3
3. **Asset Tracking Snapshot** — Top entries from your spreadsheet
4. **Short Reflection** (2–3 sentences per question):
 - Were your hardware specs adequate for virtualization?
 1. Yes the Dell PowerEdge had adequate hardware specs to deploy our services.
 - What installation or network issues did your team encounter?
 1. Unknown syntax during JumpBox installation cause issues when configuring the vNIC as well as unknown syntax caused delays in deploying the Jump Box SSH services.

- Is your environment ready to begin service setups next week?
 1. Yes, our virtualized environment is established VIA a Type 1 hypervisor deployed on a Dell PowerEdge R420 Server. 3 Virtual Bridges establish our segmented network:
 1. **vmbr0**: External bridge for LAN access Web UI availability
 2. **vmbr1**: Isolated bridge for Jump Box (172.16.0.0/24)
 3. **vmbr2**: Internal bridge for VM traffic (192.168.0.0/24)
 2. Deployed all necessary VMs for our Netowrk:
 1. WinServer2019
 2. Ubuntu Server
 3. Win10 client
 4. Win11 client
 5. Ubuntu client
 3. All routing (NAT/PAT) , Firewall, and SSH configurations have been Established.

Next steps is to Configure Roles and features on both servers.

The screenshot shows the Proxmox Virtual Environment 6.4-4 web interface. The left sidebar is titled "Datacenter" and contains a search bar and several management sections: Summary, Cluster, Ceph, Options, Storage, Backup, Replication, Permissions, Users, API Tokens, Groups, Pools, Roles, Authentication, HA, ACME, Firewall, Metric Server, and Support. The main content area displays a table of resources under "Datacenter".

Type	Description	Disk usage...	Memory us...	CPU usage	Uptime	Host CPU ...	Host Mem...
node	teamam	44.6 %	21.5 %	6.1% of 16 ...	00:51:59	-	-
qemu	100 (LinuxServer)	93.1 %	0.5% of 2 ...	00:24:53	0.1% of 16...	4.4 %	
qemu	101 (JumpBox)	18.6 %	0.2% of 2 ...	00:24:59	0.0% of 16...	0.6 %	
qemu	102 (WINServer19)	45.3 %	9.2% of 4 ...	00:44:59	2.3% of 16...	2.9 %	
qemu	200 (UbuntuPC)	-	-	-	-	-	-
qemu	201 (win10)	79.2 %	23.9% of 4 ...	00:17:13	6.0% of 16...	5.0 %	
qemu	202 (WIN11)	-	-	-	-	-	-
storage	local (teamam)	44.6 %	-	-	-	-	-
storage	local-lvm (teamam)	3.4 %	-	-	-	-	-

At the bottom, there is a "Tasks" section showing recent activity:

Start Time	End Time	Node	User name	Description	Status
Jul 11 10:53:22		teamam	root@pam	VM/CT 201 - Console	
Jul 11 10:39:32		teamam	root@pam	VM/CT 201 - Console	
Jul 11 10:38:11		teamam	root@pam	VM/CT 102 - Console	
Jul 11 10:11:59		teamam	root@pam	VM/CT 102 - Console	
Jul 11 10:45:36	Jul 11 10:49:57	teamam	root@pam	VM/CT 201 - Console	OK

Capstone Network Topology Overview

1. Proxmox Host

- **Role:** Hypervisor for all VMs
- **IP Address:** 10.10.10.151
- **Bridges:**
 - vmbr0: Default LAN / Internal network (10.10.10.0/24)
 - vmbr1: Isolated subnet for Jump Box (172.16.0.0/24)
 - vmbr2: Isolated subnet for VM's (192.168.0.0/24)

2. Jump Box

- **OS:** Ubuntu Server
- **IP Address:** 172.16.0.2
- **Bridge:** vmbr1
- **Purpose:** Gateway access to internal systems
- **Access Control:** ufw firewall allows only trusted IPs (e.g., 192.168.0.0/24 & 10.10.10.0/24)
- **Routing:** Enabled on Proxmox host to allow traffic between subnets

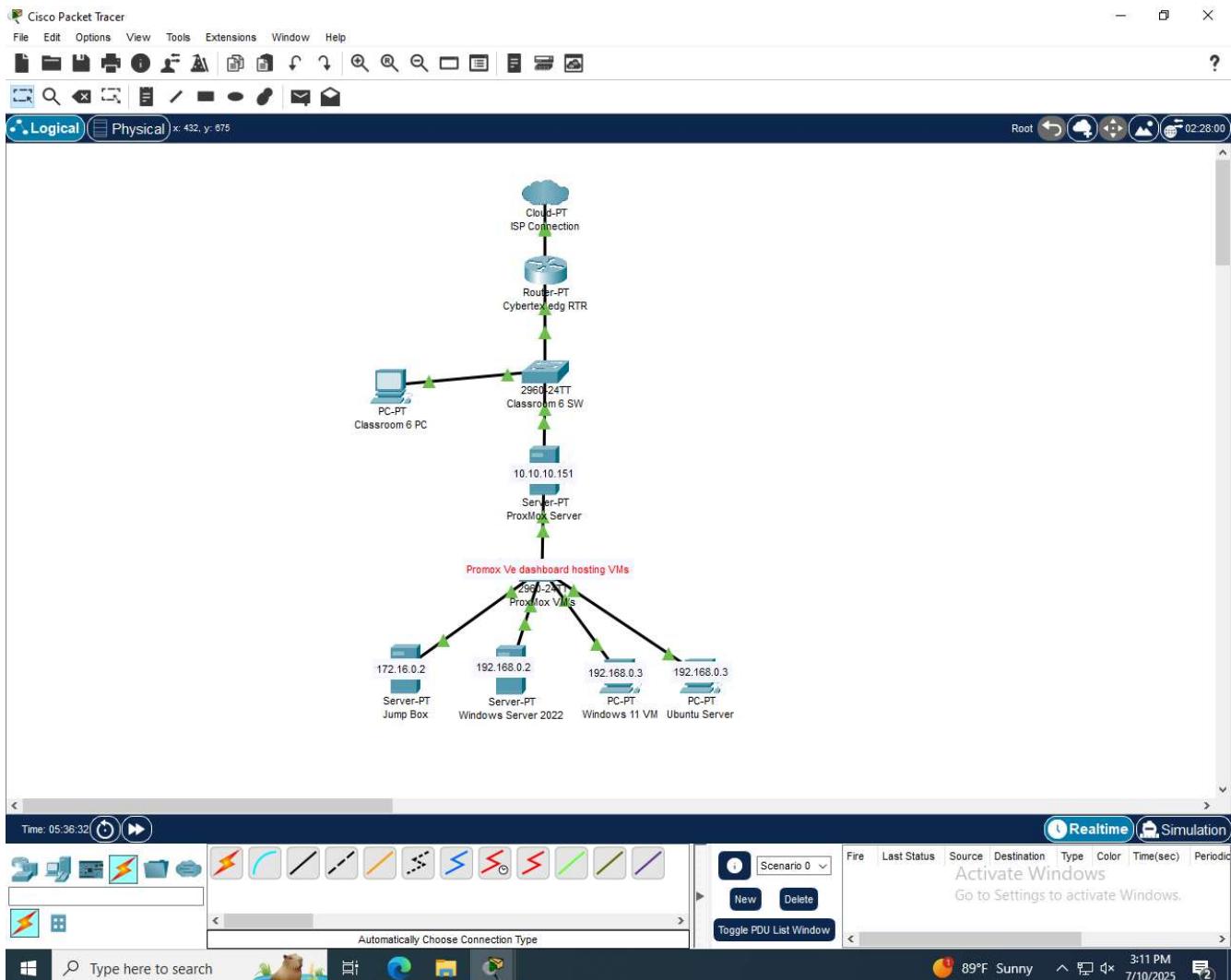
3. Internal VMs (connected to vmbr0)

VM Name	OS	IP Address	Role
WINServer19	Windows Server 2019	192.168.0.2	DHCP, DNS, IIS, SQL Express
WIN11	Windows 11	192.168.0.3	Client endpoint
Win10	Windows 10	192.168.0. X 4	Client endpoint
LinuxServer	Ubuntu 24.04 Server	192.168.0.5	NGINX, MongoDB, Syslog
UbuntuPC	Ubuntu 24.04.1	192.168.0.6	Client endpoint

These VMs will be accessible only **via the Jump Box**, assuming SSH or RDP/Remote access is tunneled through it.

Routing & Security

- **Proxmox Host** handles NAT and IP forwarding between 172.16.0.0/24 and 192.168.0.0/24
- **Firewall Rules:**
 - Jump Box accepts SSH from school subnet (10.10.10.0/24)
 - Internal VMs accept SSH from Jump Box (172.16.0.0/24)



ITS 7 – Week 2: Lab

Date: July 18, 2025

Team: Team A

Team Members & Roles:

- ❑ Windows Specialist: Santos Bonilla & Everardo Cantu
- ❑ Linux Specialist: Jose Leon
- ❑ Networking Specialist: Jesus Ortiz
- ❑ Team Lead: Robert Roberts & Everardo Cantu

❑ Objective

Confirm internal network is working via NAT bridge (192.168.0.0/24) and Jump Box, then deploy core services: Windows DNS/DHCP/IIS and Linux NGINX/databases. Ensure both **internal connectivity** and **internet access** with NAT are operational. Continue documenting configurations.

❑ Phase 0: Verify Internal Network & NAT

❑ Networking Specialist Task

1. Ping Tests via NAT Bridge (vmbr1):

- Proxmox host → Jump Box: 0.411 ms
- Jump Box → Windows VM: 0.728 ms
- Jump Box → Linux VM: 0.778ms

2. Internet Connectivity (via VM NAT):

- From Windows VM: ping 8.8.8.8 → 8 ms
- From Linux VM: curl https://ifconfig.me → returned IP:
104.0.139.84teama@linuxserver

3. Gateway & DNS Verification

VM	Gateway	VM IP	DNS Server	Working? (Y/N)
Windows VM	192.168.0.1	192.168.0.2	8.8.8.8/ 192.168.0.2	Y
Linux VM	192.168.0.1	192.168.0.3	8.8.8.8/ 192.168.0.2	Y

❑ Phase 1: Windows Service Deployment

❑ Windows Specialist Task

1. DNS & DHCP Setup

- Zone Name: teama.dns
- A Record: Hostname: winserver.teama.dns → IP: 192.168.0.2
- DHCP Scope: From 192.168.0.4 to 192.168.0.50 ; Gateway: 192.168.0.1

2. IIS Installation

- Deploy “Welcome” page accessible at: http://192.168.0.2

□ Phase 2: Linux Service Deployment

□ Linux Specialist Task

1. NGINX Setup:

- Created sample page in /var/www/html/
- Accessible at: http://192.168.0.3/

2. Database Installation

- MariaDB: Created DB & user: capstone_db & capuser
- Test output via CLI: "Welcome to the MariaDB monitor. Commands end with ; or \g."

□ Phase 3: Network-Based Testing

□ Networking Specialist Task

- Ping Windows → Linux: 1 ms
- Ping Linux → Windows: 0.752 ms
- DNS Lookup (Linux terminal): nslookup winserver.teama.dns → IP: 192.168.0.2
- Confirm Windows VM gets DHCP IP: Win10 and Ubuntu PC's got DHCP IP: 192.168.0.4 & 192.168.0.5 respectively

□ Week 2 Report (PDF/Word)

1. Cover Page – Week, Team, Roles

2. NAT Bridge + Connectivity Proof

- Ping & internet test results

3. Screenshots:

- DNS zone + A record
- DHCP scope/leases
- IIS page in browser
- NGINX page in browser
- DB CLI with query results

4. Test Summary Table

5. Reflection :

Which NAT or connectivity tests were tricky?

- NAT configurations were straight forward and had no issues. Setting up SSH in the jumpbox was tricky due to how the server uses ssh with the virtual bridge. Extra firewall rules needed to be added in the jumpbox to include its own network for ssh to work

Which core service setup took the longest or was hardest?

- DNS would not resolve even though all necessary steps were completed.
- 3 issues identified
 - o Reverse lookup zone was set up incorrectly, pointing to the Windows server hostname instead of the DNS Server hostname.

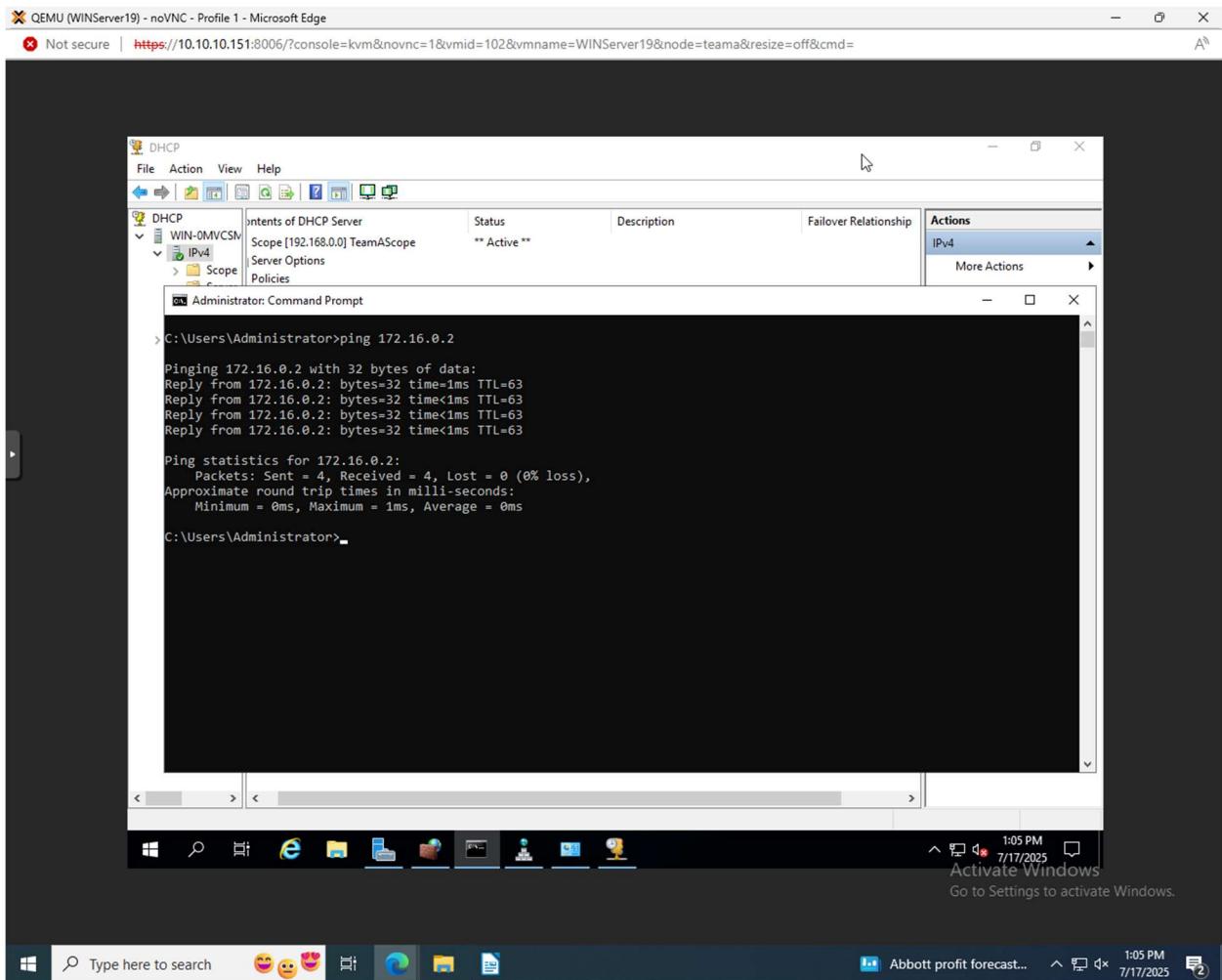
Once fixed DNS query's resolved incorrectly

- o Nslookup was trying to resolve IPv6 instead of IPv4, once Ipv6 was disabled, DNS query's resolved correctly but to wrong DNS server.
- o Ip settings were set with 8.8.8.8 as primary DNS and 192.168.0.2 as secondary. DNS query's would resolve but gave an error that winserver.teama.dns was a non existent domain. Once 192.168.0.2 was set as primary DNS, query's resolved correctly.

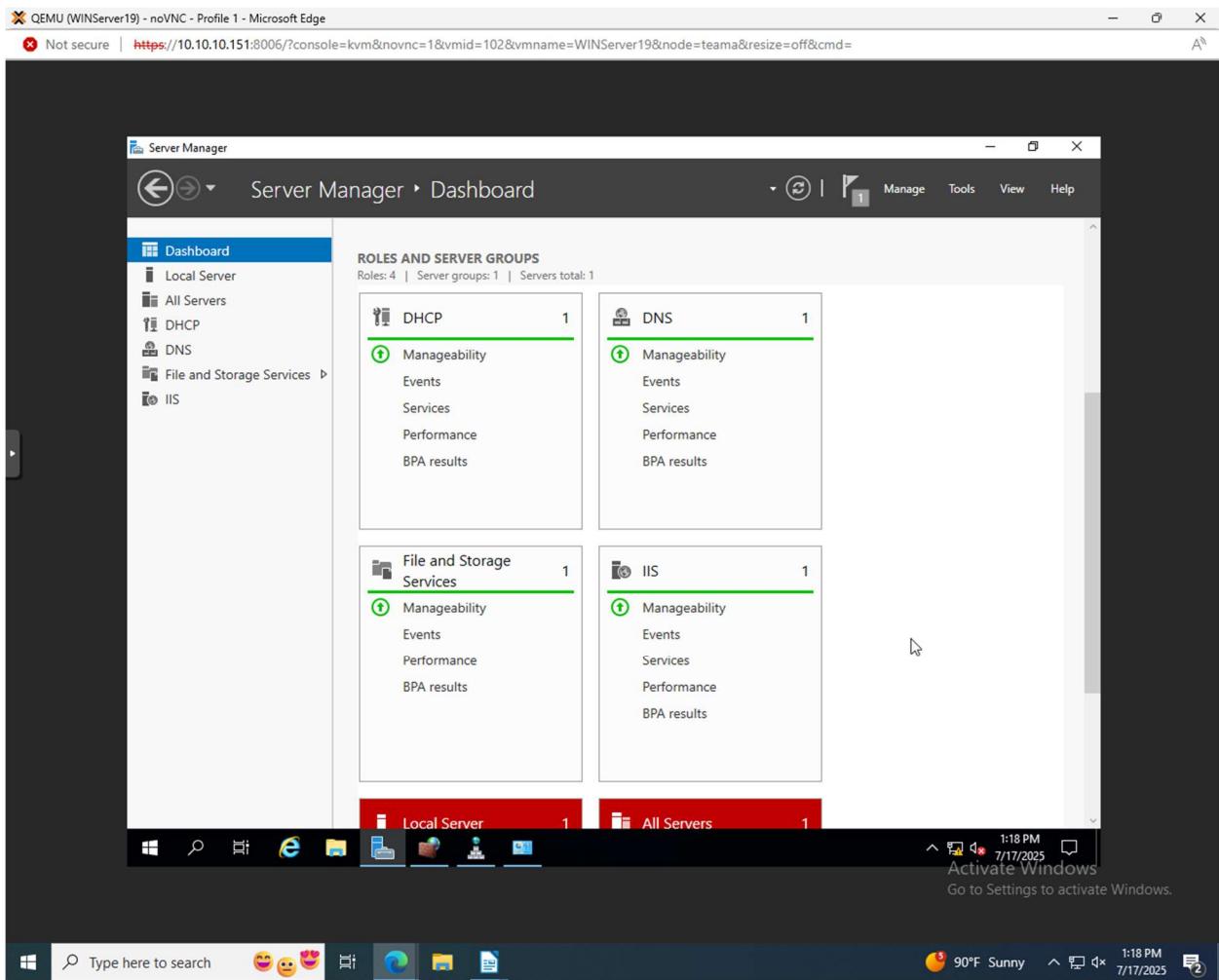
Any network or NAT-related issues that need resolution?

- No Network or NAT issue need resolution.

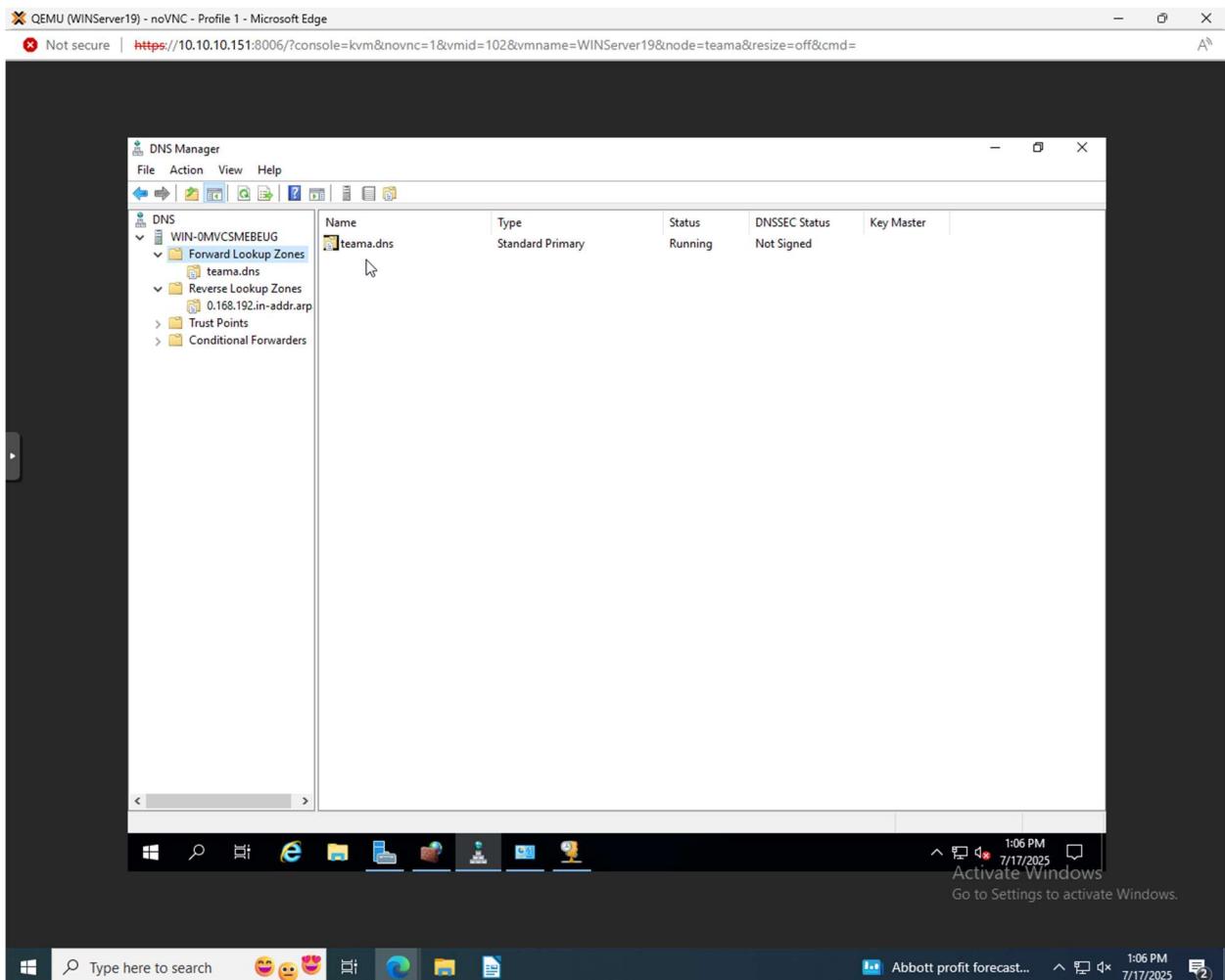
2.a) NAT Bridge + Connectivity Proof



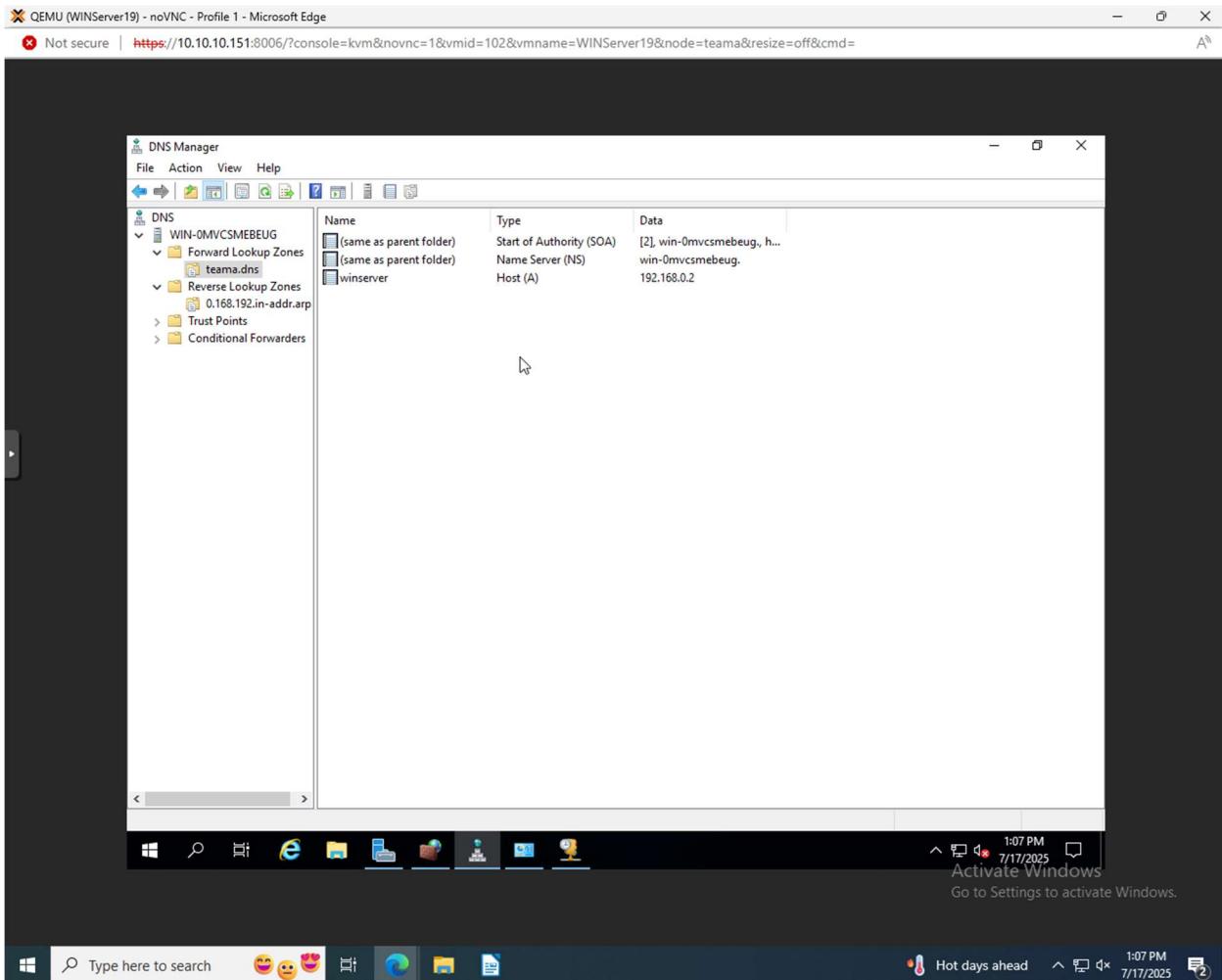
3.a) Server Dashboard with features installed



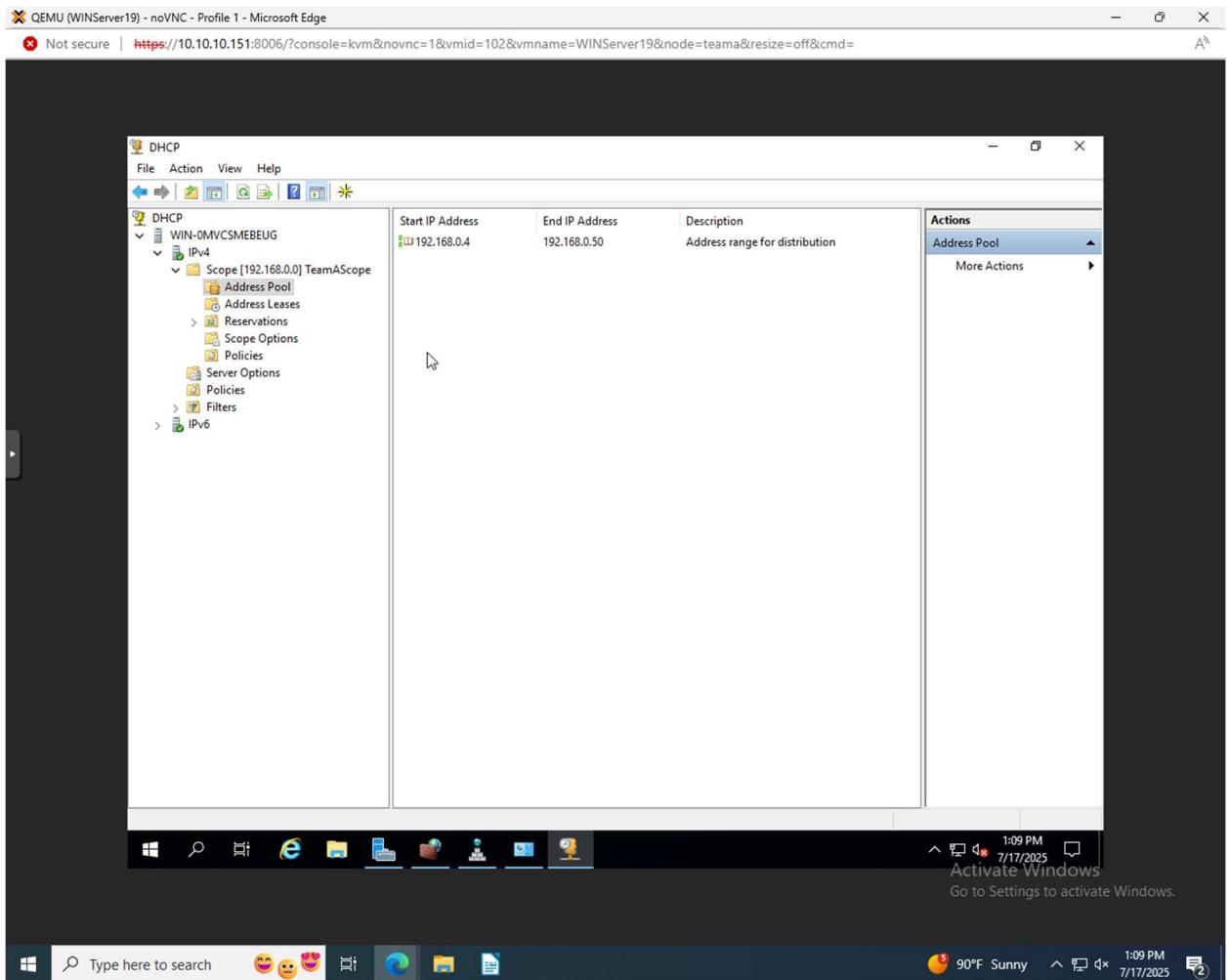
3.b) DNS zone



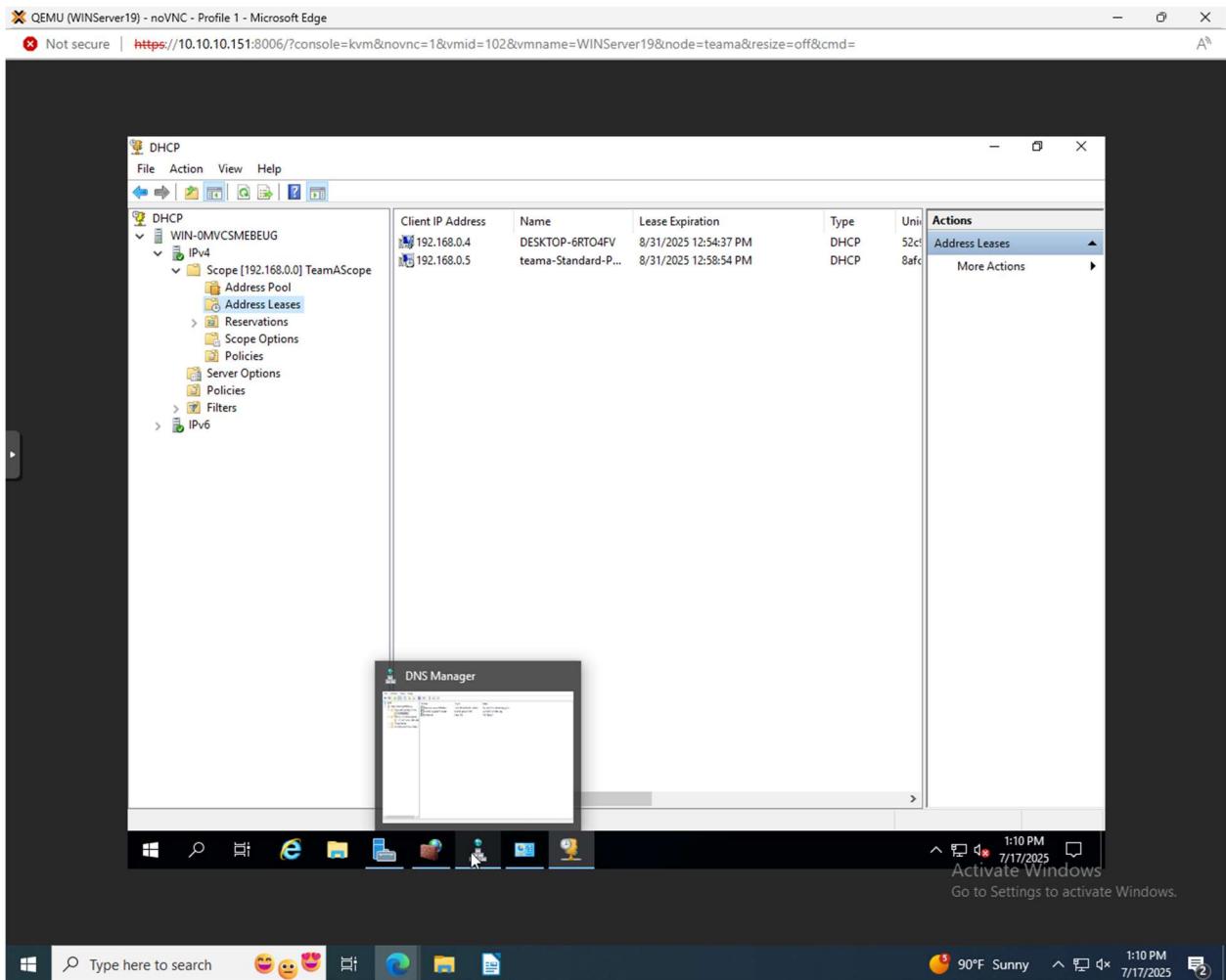
3.c) DNS A Record



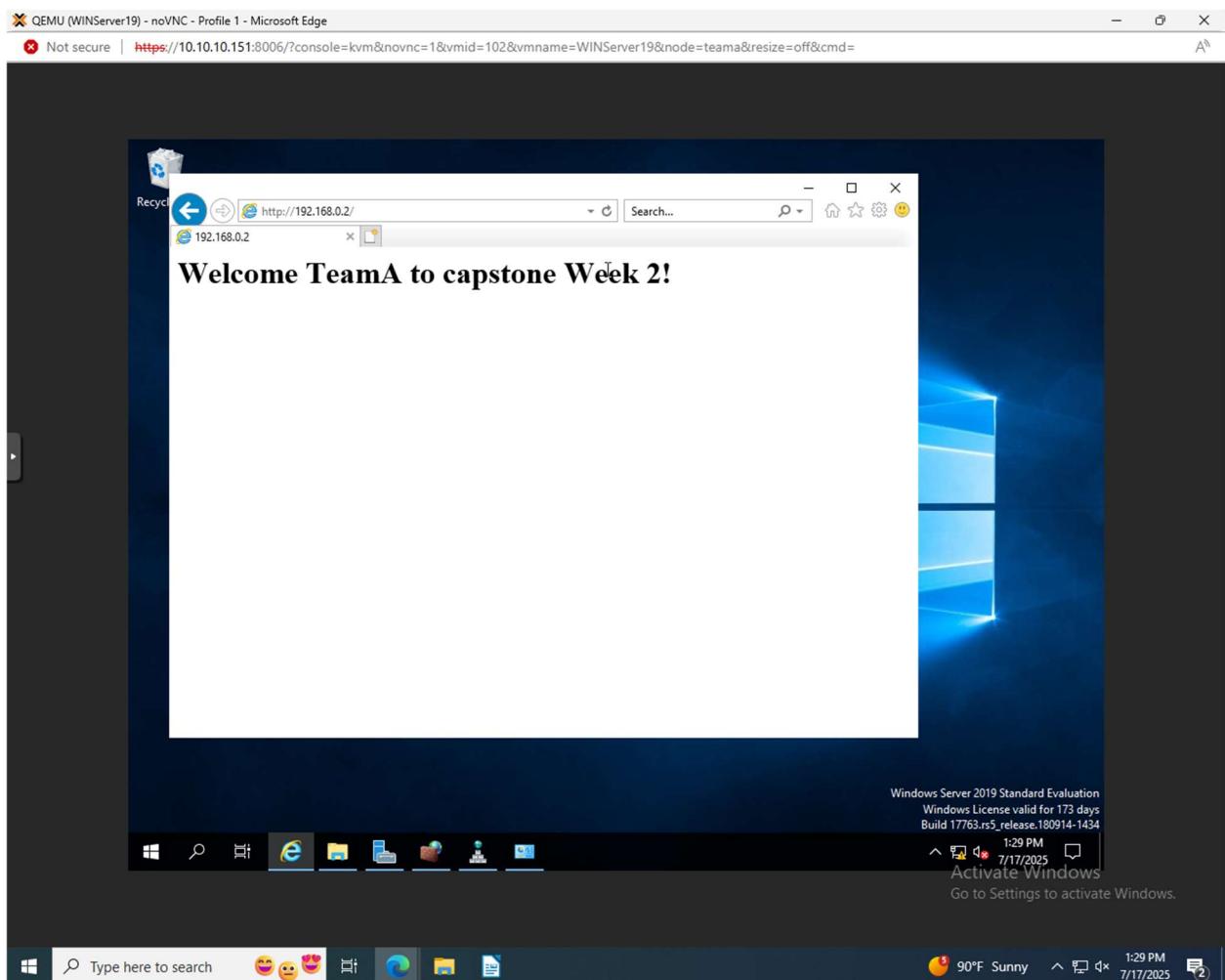
3.d) DHCP SCOPE



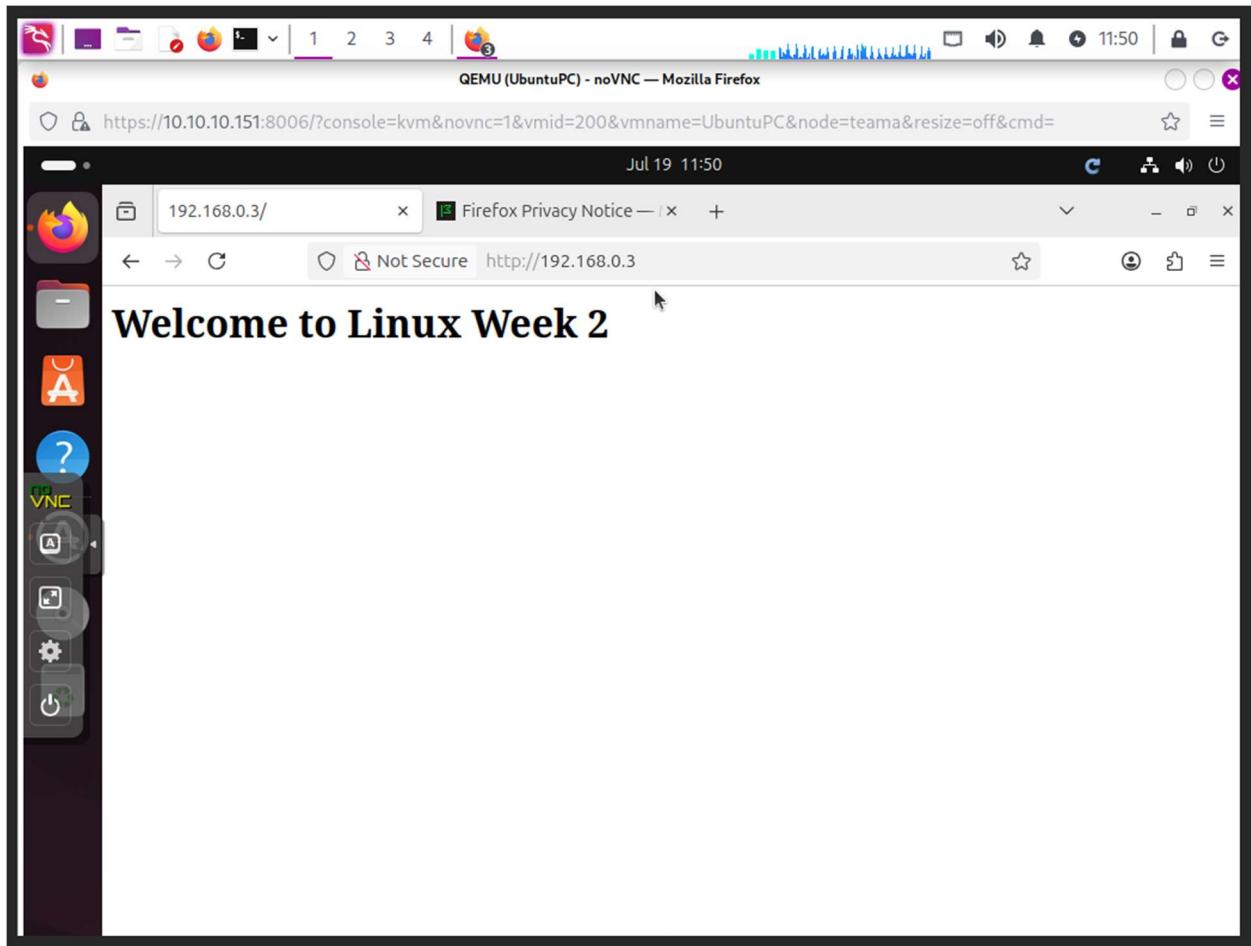
3.e) DHCP LEASE



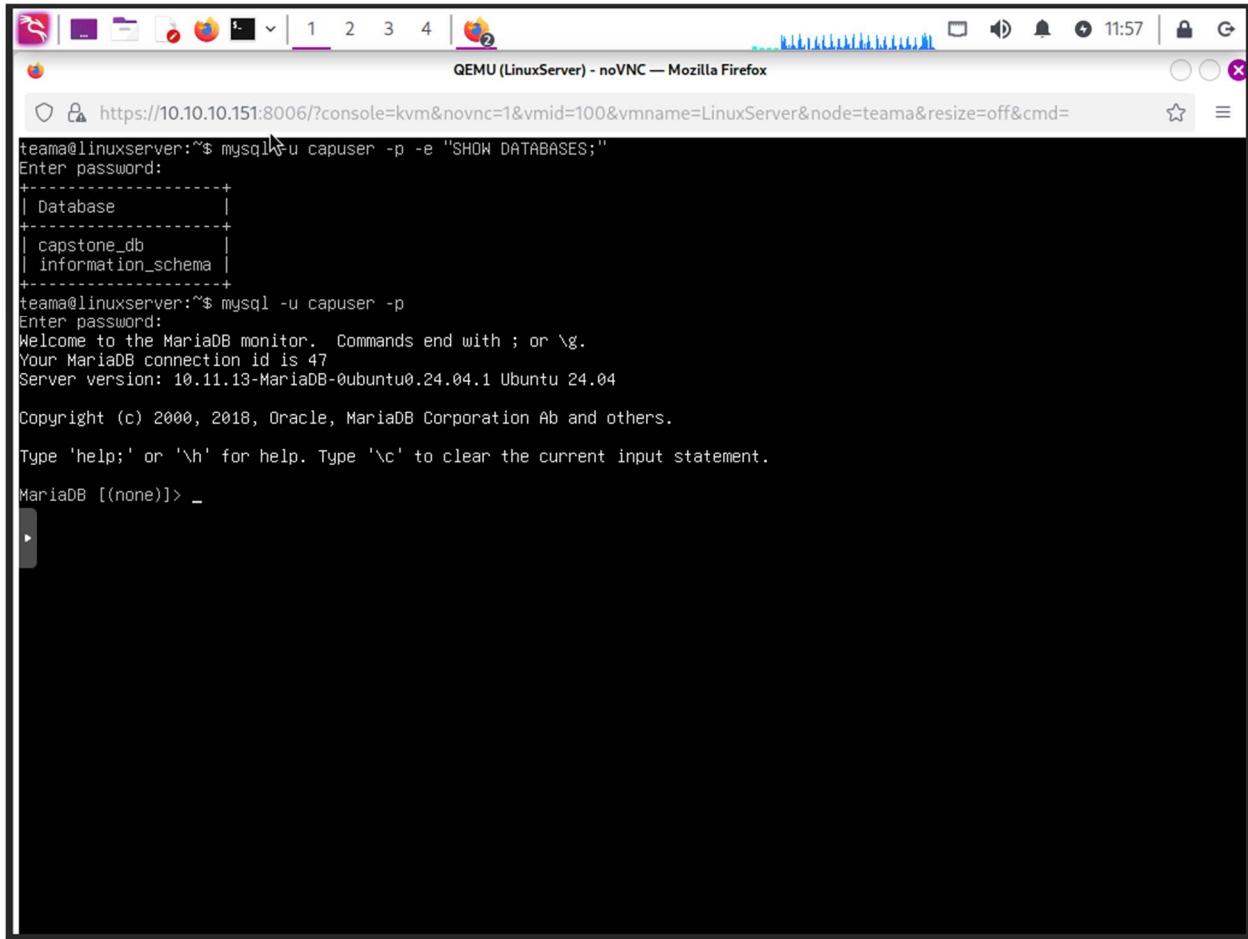
3.f) IIS Webpage



3.g) NGINX Page in browser



3.H) DB CLI query results



team@linuxserver:~\$ mysql -u capuser -p -e "SHOW DATABASES;"
Enter password:
+-----+
| Database |
+-----+
| capstone_db |
| information_schema |
+-----+
team@linuxserver:~\$ mysql -u capuser -p
Enter password:
Welcome to the MariaDB monitor. Commands end with ; or \g.
Your MariaDB connection id is 47
Server version: 10.11.13-MariaDB-0ubuntu0.24.04.1 Ubuntu 24.04
Copyright (c) 2000, 2018, Oracle, MariaDB Corporation Ab and others.
Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.
MariaDB [(none)]> _

ITS 7 – Week 3: Lab – Network Integration G Proxmox Connectivity

Date: 25JUL25

Team: Team A

Team Members G Roles:

- Windows Specialist: Santos Bonilla, Everardo Cantu
 -  Linux Specialist: Jose Leon
 -  Networking Specialist: Jesus Ortiz
 -  Team Lead: Robert Robets
-

Objective

Establish connectivity between the switch and router, configure VLANs on the switch, and enable SSH for secure remote management. Each team's Proxmox host must function within a secondary network: 192.168.10.0/24.

F Pre-Phase: Configure vmbr3 on Proxmox Host

1. Create a new Proxmox bridge interface vmbr3 and assign it to your second NIC (e.g., ens02).
 2. Set a static IP address: 192.168.10.X
 - Use your team number: Team A = 2, B = 3, C = 4, etc.
-

F Phase 0: Basic Switch G Router Setup

Networking Specialist Task

1. On the switch:
 - Set the hostname
 - Configure the enable secret password
 - Assign IP address: 192.168.10.X
 - Based on your team (A = 10, B = 11, C = 12, etc.)
 - Save configuration using write memory

Test and Document:

- Switch Hostname: teama
 - Active Ports (output of show ip interface brief): fa 0/1, fa 0/24
-

F Phase 1: Enable SSH on the Switch

Networking Specialist Task

1. Set domain name (e.g., lab.local)
2. Generate RSA key pair (minimum 1024 bits)
3. Create a local user with a password
4. Configure VTY lines to:
 - Use local login
 - Accept SSH only (no telnet)

Test SSH Access:

- From your Proxmox host (using vmbr3), SSH into the switch using its IP

Document:

- SSH Enabled (Y/N): Y
 - RSA Key Size: 1024 bits
 - SSH Username: teama
 - SSH Tested From Proxmox IP: 192.168.10.2
-

F Phase 2: Connectivity and Internet Testing

Networking Specialist Task

1. From your Proxmox host:
 - Ping your default gateway: 192.168.10.1

Document:

- Proxmox IP: 192.168.10.2
 - Gateway Reachable: Yes
-

Week 3 Report Requirements

Submit a single document including:

1. **Cover Page** – Team info and roles
2. **Summary Table** – VLANs, subnets, IPs, and SSH status
 - **VLAN** - 1
 - **Subnet** – 192.168.10.0/24
 - **IP's** – 192.168.10.2 (PX) 192.168.10.10 (Switch)
3. **Screenshots** of:
 - VLAN configuration on the switch
 - SSH login to the switch
4. **Updated Network Diagram** showing Layer 2 C 3 connections, VLAN/subnet mapping for the 192.168.10.0/24 network
5. **Reflection Questions:**
 - What was the most challenging configuration step?
 - The most challenging configuration step was resetting the switch.
 - How did SSH improve your ability to manage the network?
 - SSH allows the team to manage the network remotely.

Team Lead Responsibilities

- Ensure all screenshots and configurations are collected from each team member
- Update the asset tracker with VLAN IDs and IP addresses
- Review the final report before submission

Instructor Initials: _____

X teama - Proxmox Console - Google Chrome

Not secure https://10.10.10.151:8006/?console=shell&xtermjs=1&vmid=0&vmname=&node=teama&cmd=

```
Last login: Fri Jul 25 09:45:46 CDT 2025 on pts/0
Linux teama 5.4.106-1-pve #1 SMP PVE 5.4.106-1 (Fri, 19 Mar 2021 11:08:47 +0100) x86_64

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
root@teama:~# ssh -c aes256-cbc teama@192.168.10.10
Password:

teama#sho run int vlan 1
Building configuration...

Current configuration : 63 bytes
!
interface Vlan1
 ip address 192.168.10.10 255.255.255.0
end

teama#
```

