



Network Design and Implementation Project for White Rock Hotel

**A dissertation submitted for the Higher
National Diploma in Network
Engineering**

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PROJECT REPORT

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DECLARATION

The thesis is my original work and has not been submitted previously for a degree at this or any other university/institute.

To the best of my knowledge, it does not contain any material published or written by another person, except as acknowledged in the text.

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This is to certify that this project is based on the work of under my supervision. The report has been prepared according to the format stipulated and is of an acceptable standard.

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ACKNOWLEDGEMENT

I would like to take this opportunity to extend my sincere appreciation to all those who played a crucial role in the design and successful execution of this project, and who generously shared their insightful suggestions that greatly contributed to our achievements. With the guidance and support of our esteemed course director **Mr. Indunil Daluwatte**, we were able to complete this assignment while acquiring knowledge that will undoubtedly benefit our future careers.

Our journey through this project allowed us to gather invaluable experience in various disciplines, as we conducted meticulous research at each stage of its development. These thorough examinations and research endeavors served as the building blocks for subsequent studies, enriching our knowledge and understanding. It is incumbent upon us to express profound gratitude to all those who contributed to this magnificent accomplishment.

The completion of this project, coupled with the knowledge and experience gained, is a testament to the collective efforts and support provided by a diverse group of individuals. We humbly acknowledge the assistance of each person who played a part in enabling us to achieve our goals and reach this significant milestone.

ABSTRACT

The objective of this network engineering project is to design and implement an efficient, reliable, and secure network infrastructure that optimizes the utilization of shared resources, ensuring high productivity, improving the guest experience, and facilitating seamless business operations. The project encompasses a comprehensive range of design and execution techniques necessary to achieve these goals, alongside a meticulous analysis of the outcomes. The project was developed using a bottom-up approach, wherein individual client requirements were carefully investigated and evaluated prior to the development of the overall network structure.

Based on these specific requirements, Collapsed Core Networking architecture was selected as the framework for deploying the company's networking tools and equipment. Key components of the project include Wireless Network Enhancement (implementing state-of-the-art Wireless Fidelity technologies to ensure optimum coverage throughout the premises and Quality of Service to prioritize traffic), Network Security (security of the data and network infrastructure from cyber threats achieved by implementing advanced security measures such as firewalls, intrusion detection systems, and encryption protocols), Bandwidth Management (bandwidth allocation effectively ensures high-demand application use does not compromise network performance), Monitoring (network monitoring tools help to assess the performance of the network and ensure minimal response time to issues), and Scalability (designing the network to accommodate future expansions without the need for major overhauls).

Implementation of the proposed network design will be tested prior to the phased rollout plan to minimize disruptions to hotel operations. Performance will be continuously monitored, and adjustments will be made as necessary to ensure optimal network performance.

Following the successful installation, the hotel will have a cutting-edge network infrastructure that not only meets the expectations of modern guests but also enhances the hotel's reputation and competitiveness in the hospitality industry. Moreover, the project will contribute to improved guest satisfaction, loyalty, and positive reviews, ultimately resulting in increased revenue for the hotel. It also underscores the importance of staying at the forefront of network engineering to meet the evolving demands of the hospitality industry.

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01. INTRODUCTION

1.1 ABOUT ORGANIZATION NETWORK

This network Mainly includes DMZ Server, layer 3 switches, layer 2 switches, access points, and firewalls. And this network connects 2 Internet Service Providers. All students, lecturers, and staff members can access the Internet. In the network, there are 10 VLANs. In the server room, there is one server rack with full functions. And all devices, all non-used ports stay as shutdown ports. This network required 15,584Mbps as Total Bandwidth.

In this network, all main network devices are Cisco-manufactured and other network devices are branded and quality manufactured.

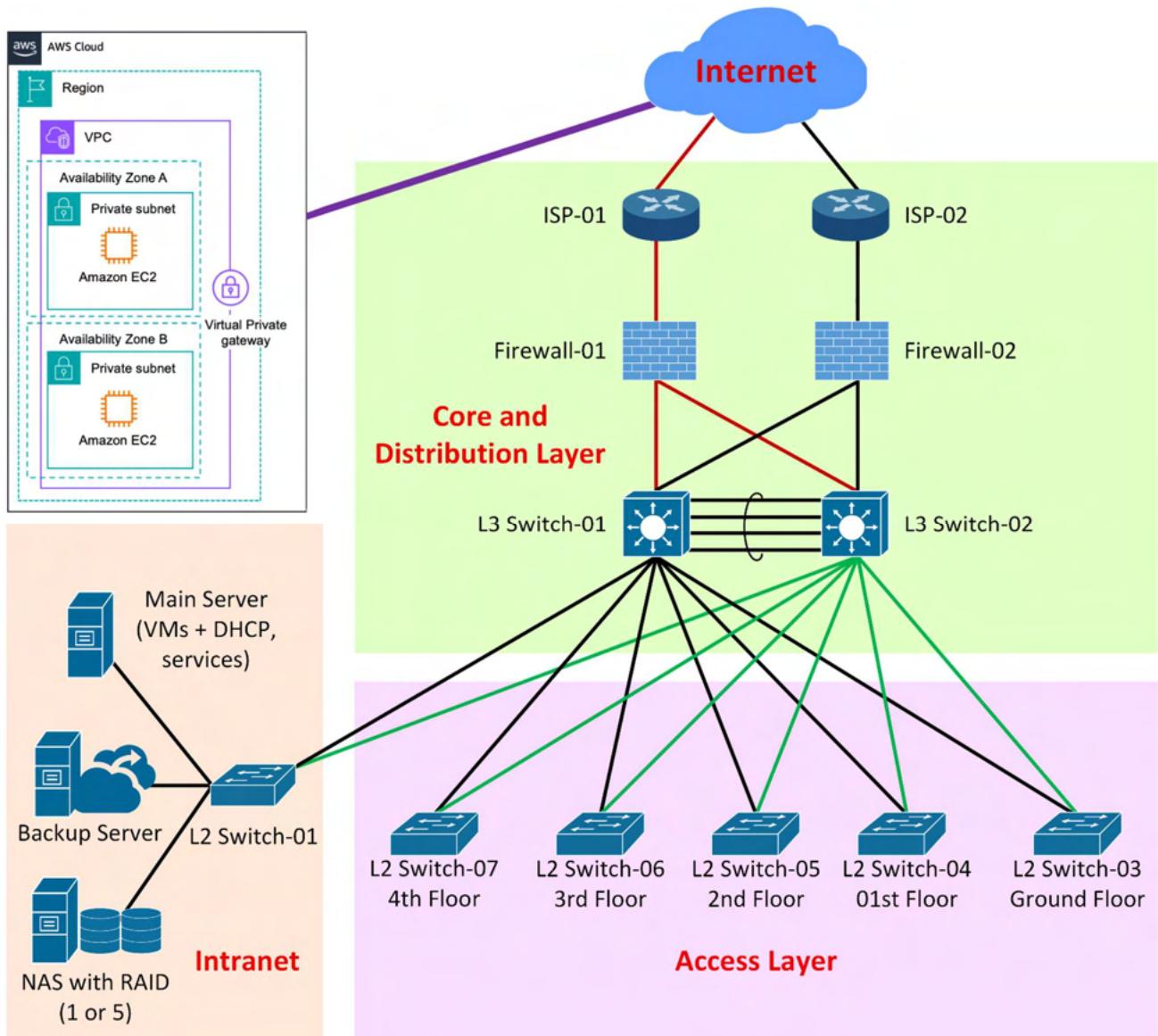
This network has floor-wise layer 2 switches. and every floor has CCTV and Wireless access points.

Every system, sections, and components should have the condition without any errors. This is the main policy for the network system. For that, it is important to have a network management system. When interconnecting the internal and external environment a large role should be played in facing malware and various network attacks to crash. For that, we can use firewalls or proxies going up. It is common to use an access point to maintain connections.

As well as worldwide IoT (internet of things) use of computer systems. By using this we can people, processes, data and things are all intelligently connected. Things are physical devices and objects connected to the internet and each other for intelligent decision-making.

02. NETWORK INFRASTRUCTURE & DESIGN

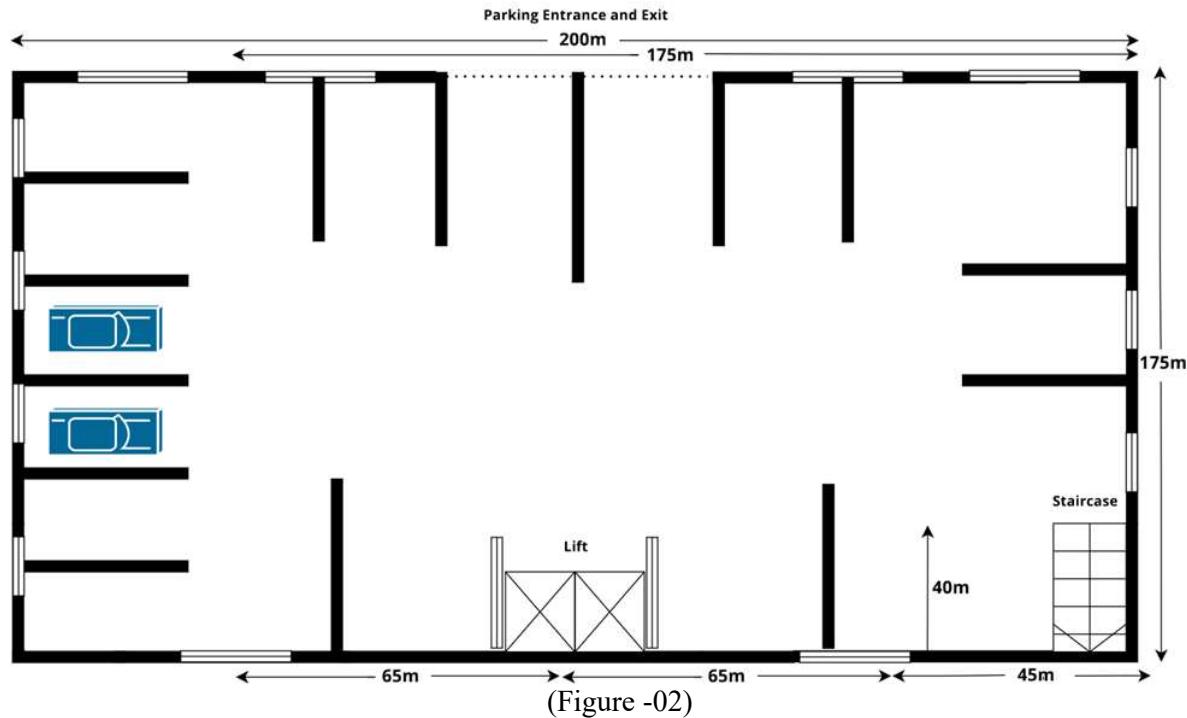
2.1 NETWORK DIAGRAM



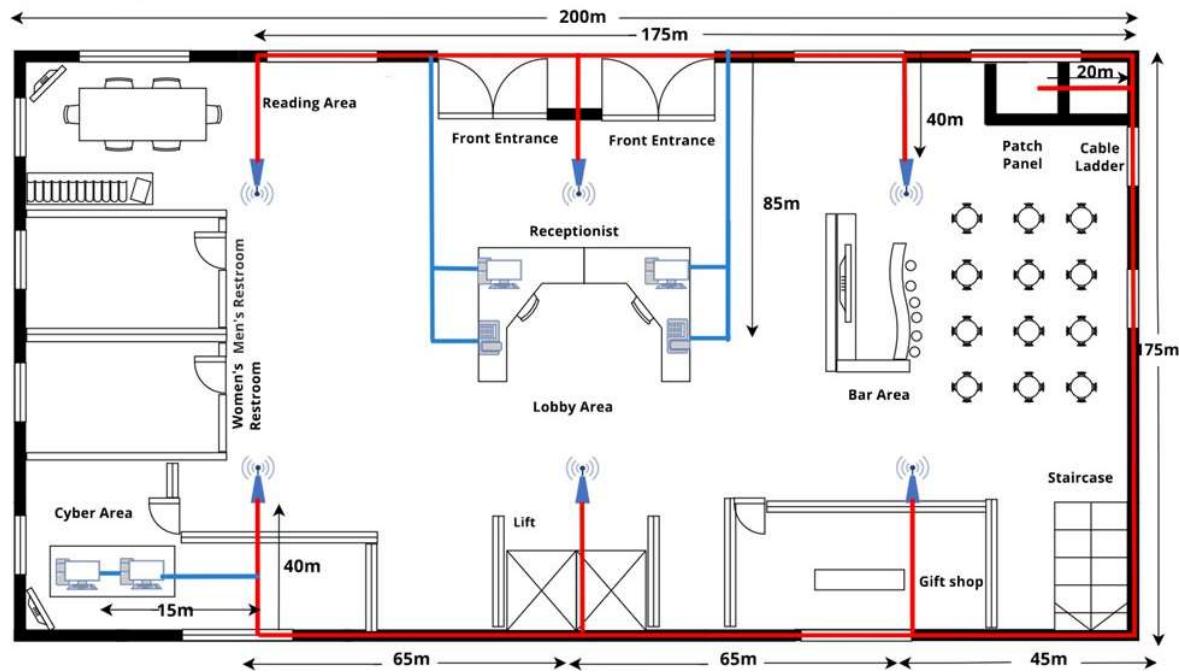
(Figure -01)

2.2 FLOOR & WIRING DIAGRAM

Ground Floor

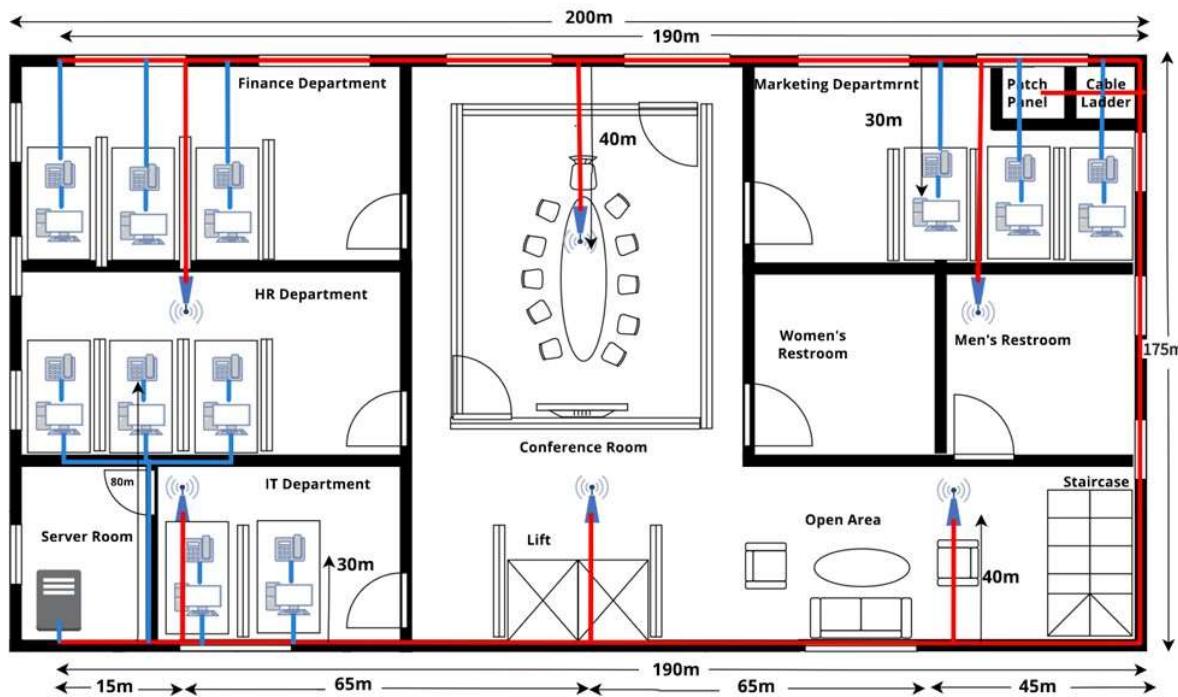


First Floor



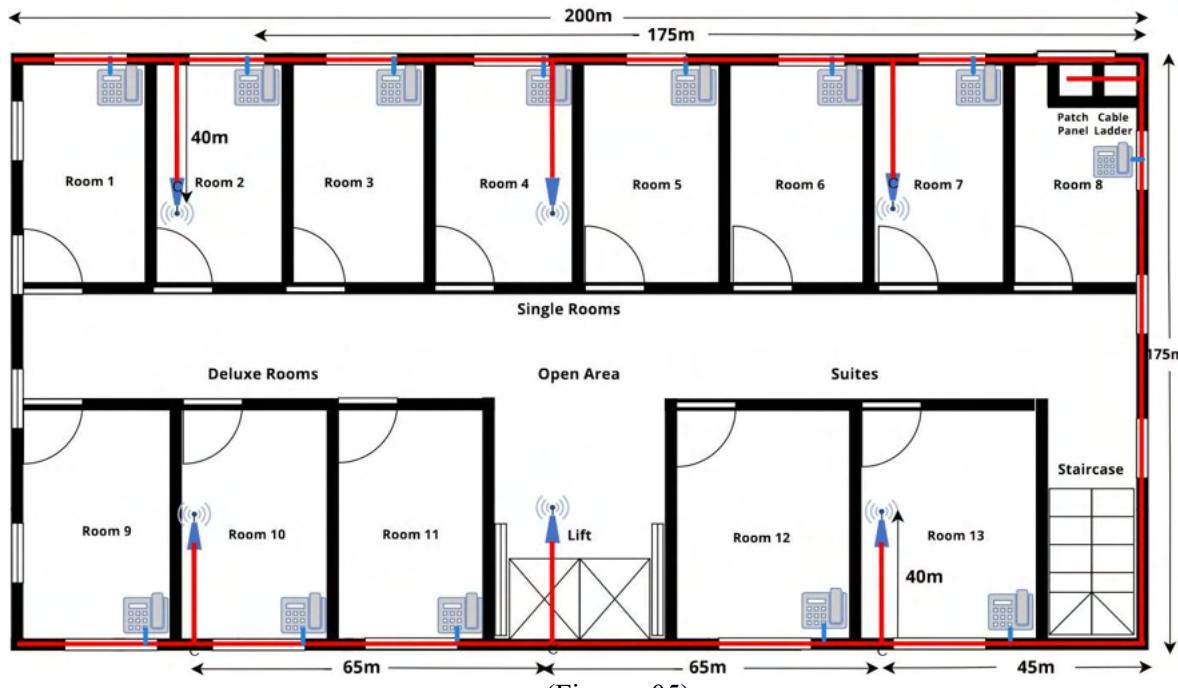
(Figure -03)

Second Floor



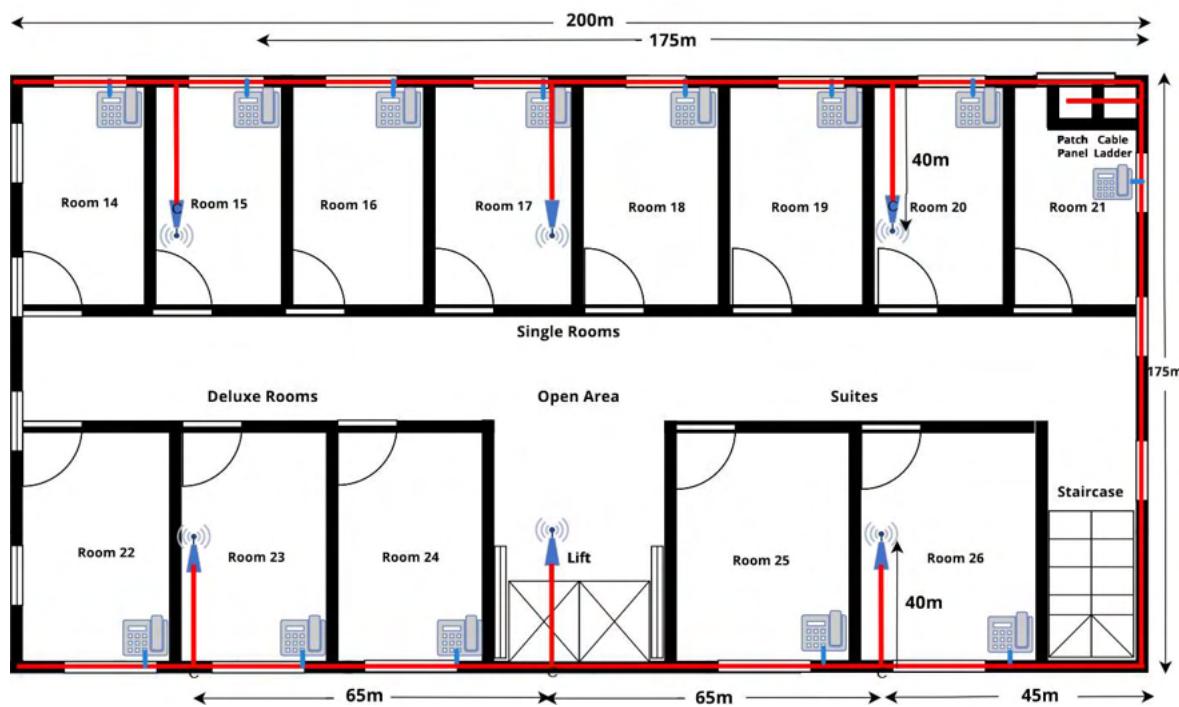
(Figure -04)

Third Floor



(Figure -05)

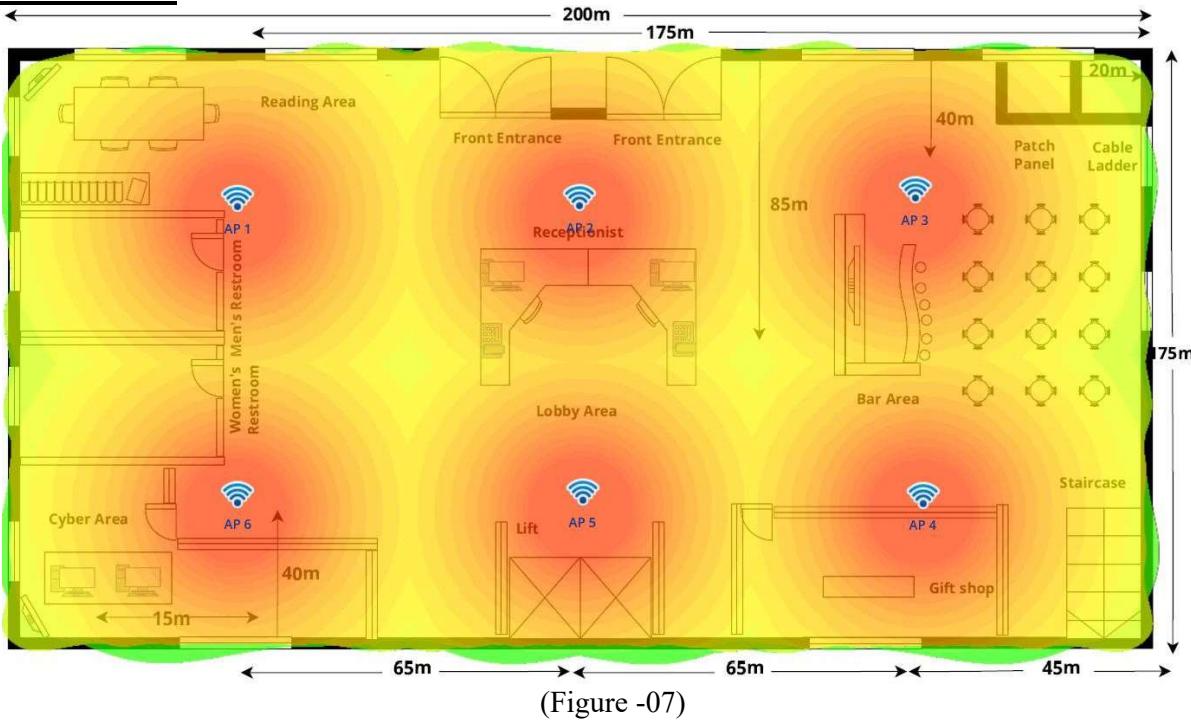
Fourth Floor



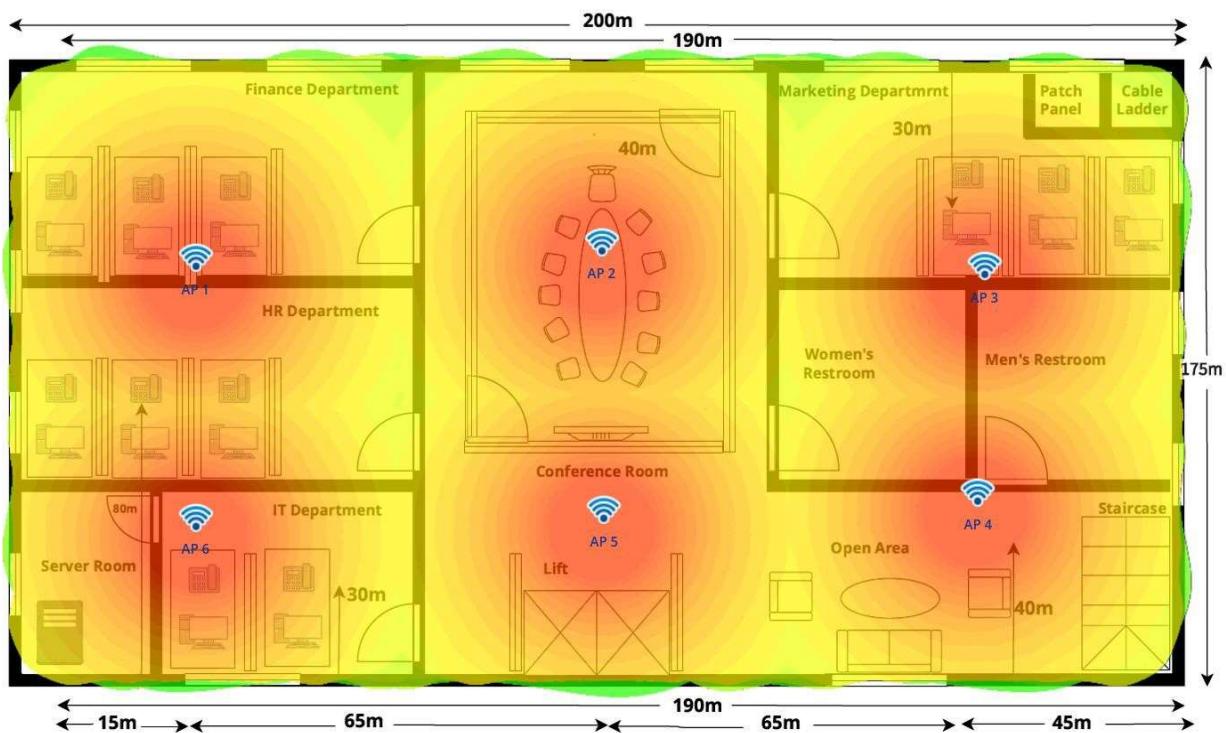
(Figure -06)

2.3 WIFI HEAT MAPS

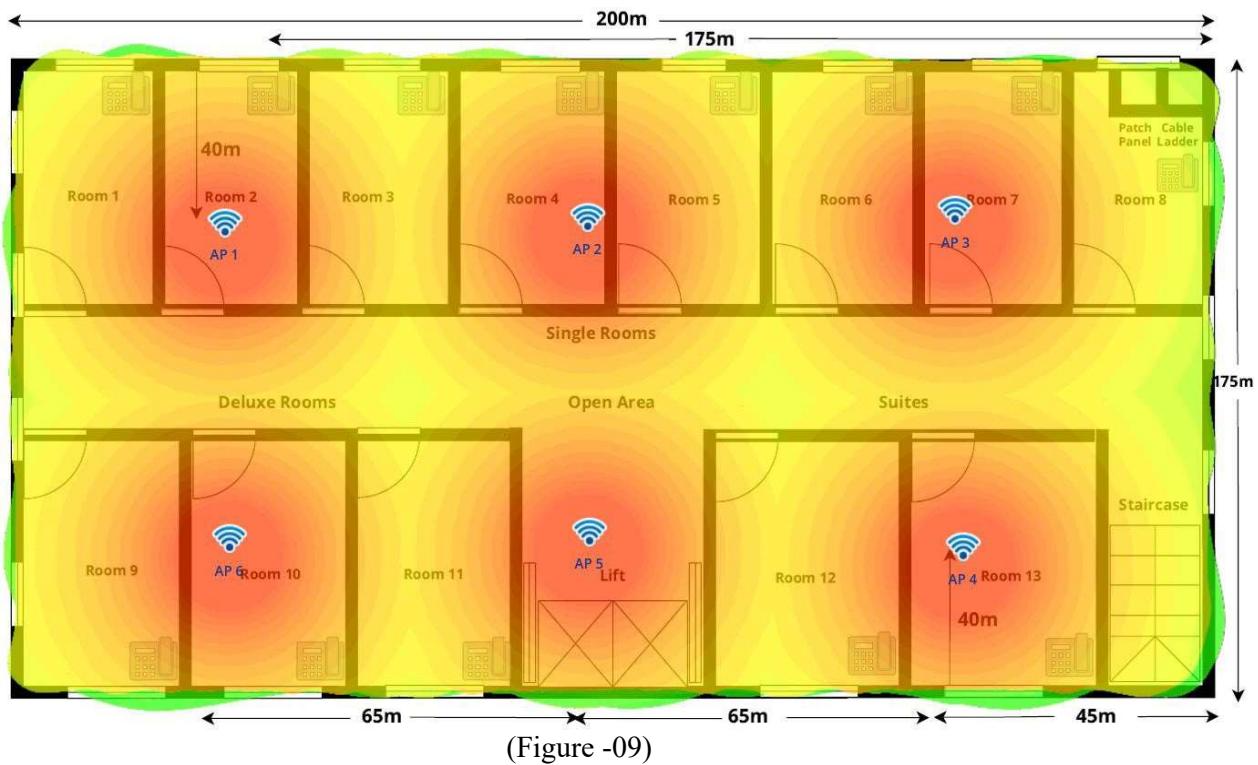
Ground Floor



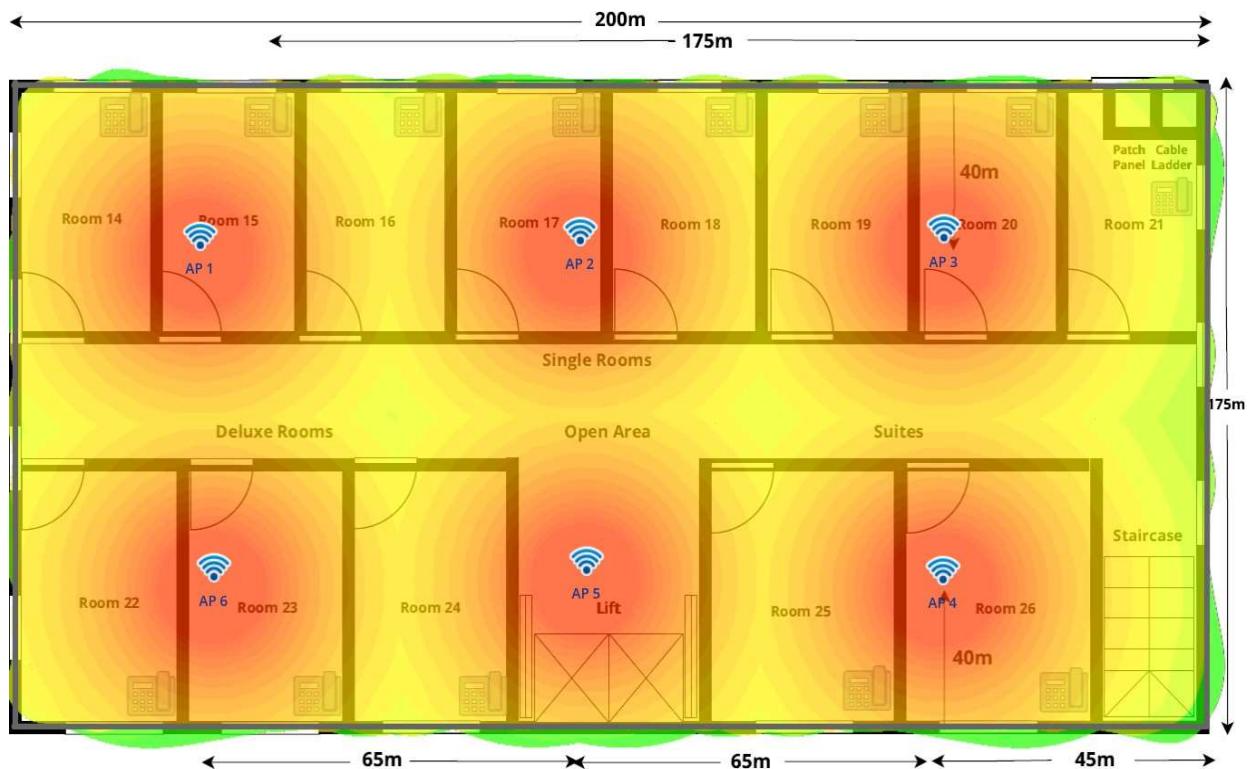
First Floor



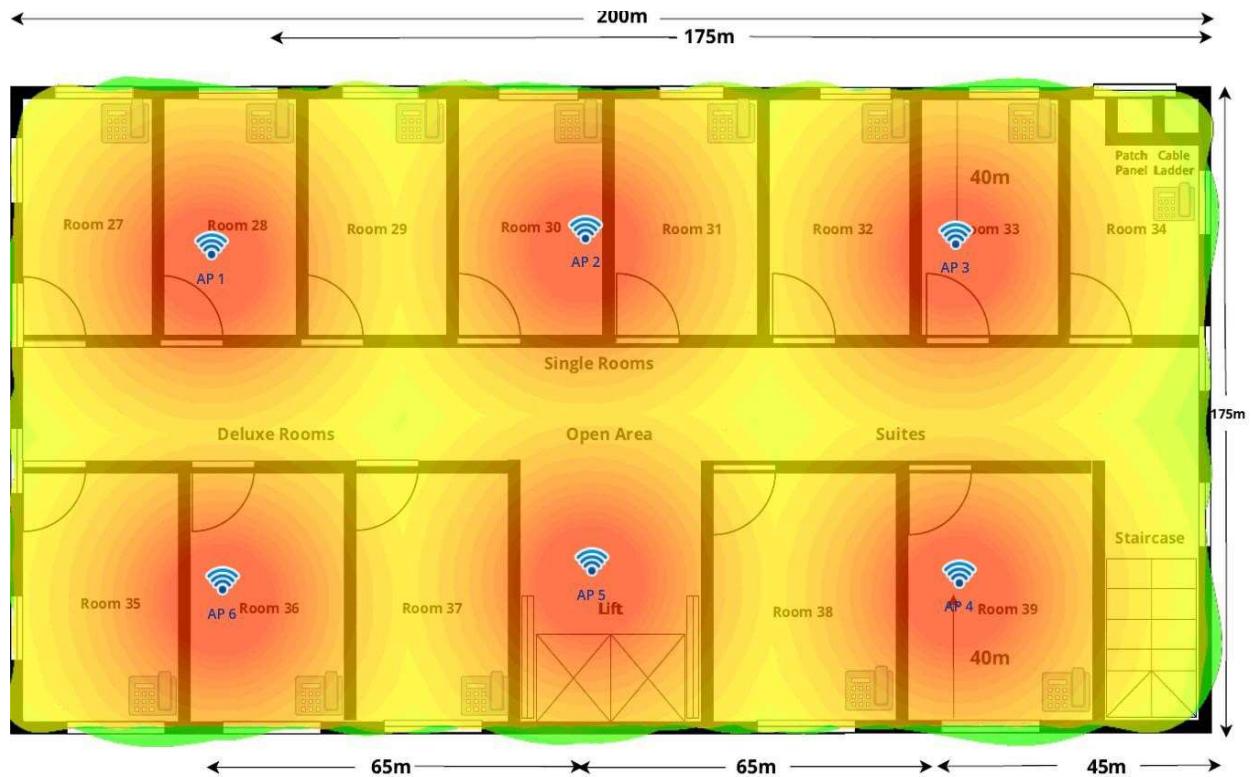
Second Floor



Third Floor



Fourth Floor



(Figure -11)

2.4 VLAN AND IP TABLE

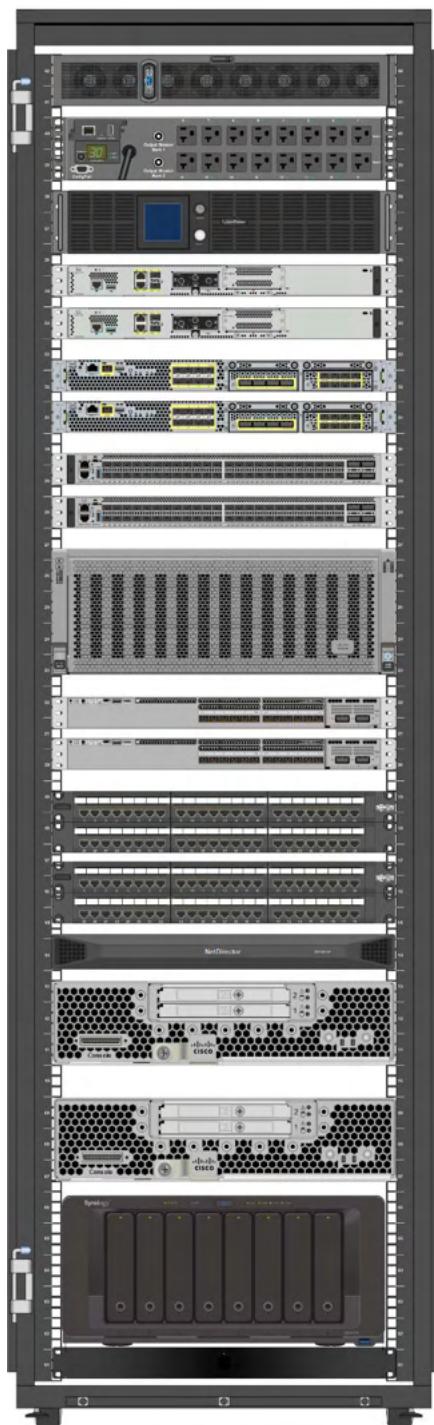
- ❖ 172.16.0.0/21 is Class B address.
- ❖ The network 172.16.0.0/21 has 1712 hosts.
- ❖ 10.10.10.0/24 only for Layer 3 devices and the firewall (also firewall do the routing part in here)
- ❖ Those subnets need 1563 hosts.

Name	Vlan No	Hosts Needed	Hosts Available	Unused Hosts	Network Address	Slash	Subnet Mask	Usable Range	Broadcast	Wildcard
Wireless AP users	10	1000	1022	22	172.16.0.0	/22	255.255.252.0	172.16.0.1 - 172.16.3.254	172.16.3.255	0.0.3.255
Workers	20	250	254	4	172.16.4.0	/24	255.255.255.0	172.16.4.1 - 172.16.4.254	172.16.4.255	0.0.0.255
Rest area	30	200	254	54	172.16.5.0	/24	255.255.255.0	172.16.5.1 - 172.16.5.254	172.16.5.255	0.0.0.255
IP Phones	40	40	62	22	172.16.6.128	/26	255.255.255.192	172.16.6.129 - 172.16.6.190	172.16.6.191	0.0.0.63
Office Management	50	36	62	26	172.16.6.192	/26	255.255.255.192	172.16.6.193 - 172.16.6.254	172.16.6.255	0.0.0.63
Top management	60	15	30	15	172.16.7.0	/27	255.255.255.224	172.16.7.1 - 172.16.7.30	172.16.7.31	0.0.0.31
IP Cameras (CCTV)	70	10	14	4	172.16.7.32	/28	255.255.255.240	172.16.7.33 - 172.16.7.46	172.16.7.47	0.0.0.15
Conference	80	10	14	4	172.16.7.48	/28	255.255.255.240	172.16.7.49 - 172.16.7.62	172.16.7.63	0.0.0.15
IT Department	90	10	14	4	172.16.7.64	/28	255.255.255.240	172.16.7.65 - 172.16.7.78	172.16.7.79	0.0.0.15
Native	99									
Network Devices		6	6	0	10.10.10.0	/24	255.255.255.0	10.10.10.1 - 10.10.10.30	10.10.10.31	0.0.0.255

(Table -01)

2.5 SERVER RACK & FLOOR CABINETS

Server Rack



(Figure -12)

Floor Cabinets

Ground Floor

4 U Rack

Cooling Fans



Power Distribution Units

1U- UPS

1U- 9400 Series Switch 24 Ports Line Card

1U- 9400 Supervisor Engine Module

1U- 9400 Series Switch 48 Ports Line Card

1st Floor

10 U Rack

Cooling Fans



Power Distribution Units

1U- UPS

1U- 9400 Series Switch 24 Ports Line Card

1U- 9400 Supervisor Engine Modules

1U- 9400 Series Switch 48 Ports Line Cards

2nd Floor

10 U Rack

Cooling Fans



Power Distribution Units

1U- UPS

1U- 9400 Series Switch 24 Ports Line Card

1U- 9400 Supervisor Engine Modules

1U- 9400 Series Switch 48 Ports Line Cards

3rd Floor

7 U Rack

Cooling Fans



Power Distribution Units

1U- UPS

1U- 9400 Series Switch 24 Ports Line Card

1U- 9400 Supervisor Engine Modules

1U- 9400 Series Switch 48 Ports Line Cards

4th Floor

4 U Rack

Cooling Fans



Power Distribution Units

1U- UPS

1U- 9400 Series Switch 24 Ports Line Card

1U- 9400 Supervisor Engine Module

1U- 9400 Series Switch 48 Ports Line Card

(Figure -13)

2.6 PORT MAPPING TABLE

Firewall - Primary

Firewall -01			
Interface	Connect to	Connecting Ports	Port Mode
Ethernet 1/1	Core Layer L3 Switch -01	ASIC0/Core1/49	40G or 100G native port
Ethernet 1/2	Core Layer L3 Switch -02	ASIC0/Core1/50	40G or 100G native port
Ethernet 1/3	Edge Router (ISP) -01	GigabitEthernet 0/0/3	-
Ethernet 1/4	DMZ L2 Switch -02	HundredGigE1/1/1	Uplink port
Ethernet 1/5	Shutdown ports		
Ethernet 1/6			
Ethernet 1/7			
Ethernet 1/8			

(Table -02)

Firewall - Backup

Firewall -02			
Interface	Connect to	Connecting Ports	Port Mode
Ethernet 1/1	Core Layer L3 Switch -01	ASIC0/Core1/50	40G or 100G native port
Ethernet 1/2	Core Layer L3 Switch -02	ASIC0/Core1/49	40G or 100G native port
Ethernet 1/3	Edge Router (ISP) -02	GigabitEthernet 0/0/3	-
Ethernet 1/4		HundredGigE1/1/2	Uplink port
Ethernet 1/5	Shutdown ports		
Ethernet 1/6			
Ethernet 1/7			
Ethernet 1/8			

(Table -03)

Core Layer L3 Switch - Primary

Core Layer L3 Switch -01			
Interface	Connect to	Connecting Ports	Port Mode
ASIC0/Core1/49	Firewall -01	Ethernet 1/1	SFP+ Ethernet
ASIC0/Core1/50	Firewall -02	Ethernet 1/1	SFP+ Ethernet
ASIC0/Core0/51	Intranet L2 Switch -01	HundredGigE1/1/1	Trunk port
GigabitEthernet0/0/1	Core Layer L3 Switch -02	GigabitEthernet0/0/1	EtherChannel 11/Trunk
GigabitEthernet0/0/2	Core Layer L3 Switch -02	GigabitEthernet0/0/2	EtherChannel 11/Trunk
GigabitEthernet0/0/3	Core Layer L3 Switch -02	GigabitEthernet0/0/3	EtherChannel 11/Trunk
GigabitEthernet0/0/4	Core Layer L3 Switch -02	GigabitEthernet0/0/4	EtherChannel 11/Trunk
GigabitEthernet0/0/5	AL L2 Switch -03 (Ground Floor)	GigabitEthernet0/0/1	EtherChannel 1/Trunk
GigabitEthernet0/0/6	AL L2 Switch -03 (Ground Floor)	GigabitEthernet0/0/2	EtherChannel 1/Trunk
GigabitEthernet0/0/7	AL L2 Switch -03 (Ground Floor)	GigabitEthernet0/0/3	EtherChannel 1/Trunk
GigabitEthernet0/0/8	AL L2 Switch -03 (Ground Floor)	GigabitEthernet0/0/4	EtherChannel 1/Trunk
GigabitEthernet0/0/9	AL L2 Switch -04 (First Floor)	GigabitEthernet0/0/1	EtherChannel 3/Trunk
GigabitEthernet0/0/10	AL L2 Switch -04 (First Floor)	GigabitEthernet0/0/2	EtherChannel 3/Trunk
GigabitEthernet0/0/11	AL L2 Switch -04 (First Floor)	GigabitEthernet0/0/3	EtherChannel 3/Trunk
GigabitEthernet0/0/12	AL L2 Switch -04 (First Floor)	GigabitEthernet0/0/4	EtherChannel 3/Trunk
GigabitEthernet0/0/13	AL L2 Switch -05 (Second Floor)	GigabitEthernet0/0/1	EtherChannel 5/Trunk
GigabitEthernet0/0/14	AL L2 Switch -05 (Second Floor)	GigabitEthernet0/0/2	EtherChannel 5/Trunk
GigabitEthernet0/0/15	AL L2 Switch -05 (Second Floor)	GigabitEthernet0/0/3	EtherChannel 5/Trunk
GigabitEthernet0/0/16	AL L2 Switch -05 (Second Floor)	GigabitEthernet0/0/4	EtherChannel 5/Trunk
GigabitEthernet0/0/17	AL L2 Switch -06 (Third Floor)	GigabitEthernet0/0/1	EtherChannel 7/Trunk
GigabitEthernet0/0/18	AL L2 Switch -06 (Third Floor)	GigabitEthernet0/0/2	EtherChannel 7/Trunk
GigabitEthernet0/0/19	AL L2 Switch -06 (Third Floor)	GigabitEthernet0/0/3	EtherChannel 7/Trunk
GigabitEthernet0/0/20	AL L2 Switch -06 (Third Floor)	GigabitEthernet0/0/4	EtherChannel 7/Trunk
GigabitEthernet0/0/21	AL L2 Switch -07 (Fourth Floor)	GigabitEthernet0/0/1	EtherChannel 9/Trunk
GigabitEthernet0/0/22	AL L2 Switch -07 (Fourth Floor)	GigabitEthernet0/0/2	EtherChannel 9/Trunk
GigabitEthernet0/0/23	AL L2 Switch -07 (Fourth Floor)	GigabitEthernet0/0/3	EtherChannel 9/Trunk
GigabitEthernet0/0/24	AL L2 Switch -07 (Fourth Floor)	GigabitEthernet0/0/4	EtherChannel 9/Trunk
ASIC0/Core0/52	Shutdown port		
GigabitEthernet0/0/25 - GigabitEthernet0/0/48	Shutdown ports		

(Table -04)

Core Layer L3 Switch - Backup

Core Layer L3 Switch -02			
Interface	Connect to	Connecting Ports	Port Mode
ASIC0/Core1/49	Firewall -02	Ethernet 1/2	SFP+ Ethernet
ASIC0/Core1/50	Firewall -01	Ethernet 1/2	SFP+ Ethernet
ASIC0/Core0/51	Intranet L2 Switch -01	HundredGigE1/1/2	Trunk port
GigabitEthernet0/0/1	Core Layer L3 Switch -01	GigabitEthernet0/0/1	EtherChannel 11/Trunk
GigabitEthernet0/0/2	Core Layer L3 Switch -01	GigabitEthernet0/0/2	EtherChannel 11/Trunk
GigabitEthernet0/0/3	Core Layer L3 Switch -01	GigabitEthernet0/0/3	EtherChannel 11/Trunk
GigabitEthernet0/0/4	Core Layer L3 Switch -01	GigabitEthernet0/0/4	EtherChannel 11/Trunk
GigabitEthernet0/0/5	AL L2 Switch -03 (Ground Floor)	GigabitEthernet0/0/5	EtherChannel 2/Trunk
GigabitEthernet0/0/6	AL L2 Switch -03 (Ground Floor)	GigabitEthernet0/0/6	EtherChannel 2/Trunk
GigabitEthernet0/0/7	AL L2 Switch -03 (Ground Floor)	GigabitEthernet0/0/7	EtherChannel 2/Trunk
GigabitEthernet0/0/8	AL L2 Switch -03 (Ground Floor)	GigabitEthernet0/0/8	EtherChannel 2/Trunk
GigabitEthernet0/0/9	AL L2 Switch -04 (First Floor)	GigabitEthernet0/0/5	EtherChannel 4/Trunk
GigabitEthernet0/0/10	AL L2 Switch -04 (First Floor)	GigabitEthernet0/0/6	EtherChannel 4/Trunk
GigabitEthernet0/0/11	AL L2 Switch -04 (First Floor)	GigabitEthernet0/0/7	EtherChannel 4/Trunk
GigabitEthernet0/0/12	AL L2 Switch -04 (First Floor)	GigabitEthernet0/0/8	EtherChannel 4/Trunk
GigabitEthernet0/0/13	AL L2 Switch -05 (Second Floor)	GigabitEthernet0/0/5	EtherChannel 6/Trunk
GigabitEthernet0/0/14	AL L2 Switch -05 (Second Floor)	GigabitEthernet0/0/6	EtherChannel 6/Trunk
GigabitEthernet0/0/15	AL L2 Switch -05 (Second Floor)	GigabitEthernet0/0/7	EtherChannel 6/Trunk
GigabitEthernet0/0/16	AL L2 Switch -05 (Second Floor)	GigabitEthernet0/0/8	EtherChannel 6/Trunk
GigabitEthernet0/0/17	AL L2 Switch -06 (Third Floor)	GigabitEthernet0/0/5	EtherChannel 8/Trunk
GigabitEthernet0/0/18	AL L2 Switch -06 (Third Floor)	GigabitEthernet0/0/6	EtherChannel 8/Trunk
GigabitEthernet0/0/19	AL L2 Switch -06 (Third Floor)	GigabitEthernet0/0/7	EtherChannel 8/Trunk
GigabitEthernet0/0/20	AL L2 Switch -06 (Third Floor)	GigabitEthernet0/0/8	EtherChannel 8/Trunk
GigabitEthernet0/0/21	AL L2 Switch -07 (Fourth Floor)	GigabitEthernet0/0/5	EtherChannel 10/Trunk
GigabitEthernet0/0/22	AL L2 Switch -07 (Fourth Floor)	GigabitEthernet0/0/6	EtherChannel 10/Trunk
GigabitEthernet0/0/23	AL L2 Switch -07 (Fourth Floor)	GigabitEthernet0/0/7	EtherChannel 10/Trunk
GigabitEthernet0/0/24	AL L2 Switch -07 (Fourth Floor)	GigabitEthernet0/0/8	EtherChannel 10/Trunk
ASIC0/Core0/52	Shutdown port		
GigabitEthernet0/0/25 - GigabitEthernet0/0/48	Shutdown ports		

(Table -05)

Intranet L2 Switch -01 (IT Management)

Intranet L2 Switch -01			
Interface	Connect to	Connecting Ports	Port Mode
HundredGigE1/1/1	Core Layer L3 Switch -01	ASIC0/Core0/51	Trunk port
HundredGigE1/1/2	Core Layer L3 Switch -02	ASIC0/Core0/51	Trunk port
TwentyFiveGigE1/1/1	Main Server-ESXI-01	GigabitEthernet0/1	Access port/Internet
TwentyFiveGigE1/1/2	Backup Server-ESXI-02	GigabitEthernet0/1	Access port/Internet
TwentyFiveGigE1/1/3	NAS-STORAGE	GigabitEthernet0/1	Access port/Internet
TwentyFiveGigE1/1/4	ADMIN-PC	GigabitEthernet0/1	Access port/Internet
TwentyFiveGigE1/1/5 - TwentyFiveGigE1/1/12	Shutdown ports		

(Table -06)

DMZ L2 Switch -02

DMZ L2 Switch -02			
Interface	Connect to	Connecting Ports	Port Mode
HundredGigE1/1/1	Firewall -01	Ethernet 1/4	SFP+ Ethernet
HundredGigE1/1/2	Firewall -02	Ethernet 1/4	SFP+ Ethernet
TwentyFiveGigE1/1/1	WEB Server	GigabitEthernet0/1	Access port/Internet
TwentyFiveGigE1/1/2 - TwentyFiveGigE1/1/12	Shutdown ports		

(Table -07)

Access Layer L2 Switch -03 (Ground Floor)

Access Layer L2 Switch -03 (Ground Floor)				
LCs	Interface	Connect to	Connecting Ports	Port Mode
LC - 01	GigabitEthernet0/0/1	Core Layer L3 Switch -01	GigabitEthernet0/0/5	EtherChannel 1/Trunk
	GigabitEthernet0/0/2	Core Layer L3 Switch -01	GigabitEthernet0/0/6	EtherChannel 1/Trunk
	GigabitEthernet0/0/3	Core Layer L3 Switch -01	GigabitEthernet0/0/7	EtherChannel 1/Trunk
	GigabitEthernet0/0/4	Core Layer L3 Switch -01	GigabitEthernet0/0/8	EtherChannel 1/Trunk
	GigabitEthernet0/0/5	Core Layer L3 Switch -02	GigabitEthernet0/0/5	EtherChannel 2/Trunk
	GigabitEthernet0/0/6	Core Layer L3 Switch -02	GigabitEthernet0/0/6	EtherChannel 2/Trunk
	GigabitEthernet0/0/7	Core Layer L3 Switch -02	GigabitEthernet0/0/7	EtherChannel 2/Trunk
	GigabitEthernet0/0/8	Core Layer L3 Switch -02	GigabitEthernet0/0/8	EtherChannel 2/Trunk
	GigabitEthernet0/0/9	Access Points -01	FastEthernet	Uplink port
	GigabitEthernet0/0/10	Access Points -02	FastEthernet	Uplink port
	GigabitEthernet0/0/11	Access Points -03	FastEthernet	Uplink port
	GigabitEthernet0/0/12	Access Points -04	FastEthernet	Uplink port
	GigabitEthernet0/0/15	IP Phone -01	FastEthernet	Access port/Voice
	GigabitEthernet0/0/16	IP Phone -02	FastEthernet	Access port/Voice
	GigabitEthernet0/0/21	PC -01	GigabitEthernet0/1	Access port/Internet
	GigabitEthernet0/0/22	PC -02	GigabitEthernet0/1	Access port/Internet
	GigabitEthernet0/0/23	PC -03	GigabitEthernet0/1	Access port/Internet
	GigabitEthernet0/0/48	IP Camera -01	FastEthernet	Access port/Video
	GigabitEthernet0/0/13 - /14 -/17 -/18 -/19 -/20 GigabitEthernet0/0/24 - GigabitEthernet0/0/47	Shutdown ports		

(Table -08)

❖ LCs - Line Cards

Access Layer L2 Switch -04 (First Floor)

Access Layer L2 Switch -04 (First Floor)				
LCs	Interface	Connect to	Connecting Ports	Port Mode
LC - 01	GigabitEthernet0/0/1	Core Layer L3 Switch -01	GigabitEthernet0/0/9	EtherChannel 3/Trunk
	GigabitEthernet0/0/2	Core Layer L3 Switch -01	GigabitEthernet0/0/10	EtherChannel 3/Trunk
	GigabitEthernet0/0/3	Core Layer L3 Switch -01	GigabitEthernet0/0/11	EtherChannel 3/Trunk
	GigabitEthernet0/0/4	Core Layer L3 Switch -01	GigabitEthernet0/0/12	EtherChannel 3/Trunk
	GigabitEthernet0/0/5	Core Layer L3 Switch -02	GigabitEthernet0/0/9	EtherChannel 4/Trunk
	GigabitEthernet0/0/6	Core Layer L3 Switch -02	GigabitEthernet0/0/10	EtherChannel 4/Trunk
	GigabitEthernet0/0/7	Core Layer L3 Switch -02	GigabitEthernet0/0/11	EtherChannel 4/Trunk
	GigabitEthernet0/0/8	Core Layer L3 Switch -02	GigabitEthernet0/0/12	EtherChannel 4/Trunk
	GigabitEthernet0/0/9	Access Points -05	FastEthernet	Uplink port
	GigabitEthernet0/0/10	Access Points -06	FastEthernet	Uplink port
	GigabitEthernet0/0/11	Access Points -07	FastEthernet	Uplink port
	GigabitEthernet0/0/12	Access Points -08	FastEthernet	Uplink port
	GigabitEthernet0/0/13	Access Points -09	FastEthernet	Uplink port
	GigabitEthernet0/0/14	Access Points -10	FastEthernet	Uplink port
	GigabitEthernet0/0/16	IP Phone -01	FastEthernet	Access port/Voice
	GigabitEthernet0/0/17	IP Phone -02	FastEthernet	Access port/Voice
	GigabitEthernet0/0/18	IP Phone -03	FastEthernet	Access port/Voice
	GigabitEthernet0/0/19	IP Phone -04	FastEthernet	Access port/Voice
	GigabitEthernet0/0/20	IP Phone -05	FastEthernet	Access port/Voice
LC - 02	GigabitEthernet0/0/26-GigabitEthernet0/0/48	PC -01 to PC -22	GigabitEthernet0/1	Access port/Internet
	GigabitEthernet0/0/15	Shutdown port		
LC - 03	GigabitEthernet0/0/21-GigabitEthernet0/0/25	Shutdown ports		
	GigabitEthernet0/0/1-GigabitEthernet0/0/48	PC -23 to PC -70	GigabitEthernet0/1	Access port/Internet
LC - 04	GigabitEthernet0/0/1-GigabitEthernet0/0/48	PC -71 to PC -118	GigabitEthernet0/1	Access port/Internet
LC - 05	GigabitEthernet0/0/1-GigabitEthernet0/0/39	PC -119 to PC -166	GigabitEthernet0/1	Access port/Internet
	GigabitEthernet0/0/48	IP Camera -02	FastEthernet	Access port/Video
	GigabitEthernet0/0/40-GigabitEthernet0/0/47	Shutdown ports		

(Table -09)

Access Layer L2 Switch -05 (Second Floor)

Access Layer L2 Switch -05 (Second Floor)				
LCs	Interface	Connect to	Connecting Ports	Port Mode
LC - 01	GigabitEthernet0/0/1	Core Layer L3 Switch -01	GigabitEthernet0/0/13	EtherChannel 5/Trunk
	GigabitEthernet0/0/2	Core Layer L3 Switch -01	GigabitEthernet0/0/14	EtherChannel 5/Trunk
	GigabitEthernet0/0/3	Core Layer L3 Switch -01	GigabitEthernet0/0/15	EtherChannel 5/Trunk
	GigabitEthernet0/0/4	Core Layer L3 Switch -01	GigabitEthernet0/0/16	EtherChannel 5/Trunk
	GigabitEthernet0/0/5	Core Layer L3 Switch -02	GigabitEthernet0/0/13	EtherChannel 6/Trunk
	GigabitEthernet0/0/6	Core Layer L3 Switch -02	GigabitEthernet0/0/14	EtherChannel 6/Trunk
	GigabitEthernet0/0/7	Core Layer L3 Switch -02	GigabitEthernet0/0/15	EtherChannel 6/Trunk
	GigabitEthernet0/0/8	Core Layer L3 Switch -02	GigabitEthernet0/0/16	EtherChannel 6/Trunk
	GigabitEthernet0/0/9	Access Points -11	FastEthernet	Uplink port
	GigabitEthernet0/0/10	Access Points -12	FastEthernet	Uplink port
	GigabitEthernet0/0/11	Access Points -13	FastEthernet	Uplink port
	GigabitEthernet0/0/12	Access Points -14	FastEthernet	Uplink port
	GigabitEthernet0/0/13	Access Points -15	FastEthernet	Uplink port
	GigabitEthernet0/0/14	Access Points -16	FastEthernet	Uplink port
	GigabitEthernet0/0/16	IP Phone -01	FastEthernet	Access port/Voice
	GigabitEthernet0/0/17	IP Phone -02	FastEthernet	Access port/Voice
	GigabitEthernet0/0/18	IP Phone -03	FastEthernet	Access port/Voice
	GigabitEthernet0/0/19	IP Phone -04	FastEthernet	Access port/Voice
	GigabitEthernet0/0/20	IP Phone -05	FastEthernet	Access port/Voice
LC - 02	GigabitEthernet0/0/26-GigabitEthernet0/0/48	PC -01 to PC -22	GigabitEthernet0/1	Access port/Internet
	GigabitEthernet0/0/15	Shutdown port		
LC - 03	GigabitEthernet0/0/21-GigabitEthernet0/0/25	Shutdown ports		
	GigabitEthernet0/0/1-GigabitEthernet0/0/48	PC -23 to PC -70	GigabitEthernet0/1	Access port/Internet
LC - 04	GigabitEthernet0/0/1-GigabitEthernet0/0/48	PC -71 to PC -118	GigabitEthernet0/1	Access port/Internet
	GigabitEthernet0/0/1-GigabitEthernet0/0/48	PC -119 to PC -166	GigabitEthernet0/1	Access port/Internet
LC - 05	GigabitEthernet0/0/1-GigabitEthernet0/0/48	PC -167 to PC -214	GigabitEthernet0/1	Access port/Internet
	GigabitEthernet0/0/1-GigabitEthernet0/0/41	PC -215 to PC -255	GigabitEthernet0/1	Access port/Internet
	GigabitEthernet0/0/48	IP Camera -03	FastEthernet	Access port/Video
LC - 06	GigabitEthernet0/0/42-GigabitEthernet0/0/47	Shutdown ports		

(Table -10)

Access Layer L2 Switch -06 (Third Floor)

Access Layer L2 Switch -06 (Third Floor)				
LCs	Interface	Connect to	Connecting Ports	Port Mode
LC -01	GigabitEthernet0/0/1	Core Layer L3 Switch -01	GigabitEthernet0/0/17	EtherChannel 7/Trunk
	GigabitEthernet0/0/2	Core Layer L3 Switch -01	GigabitEthernet0/0/18	EtherChannel 7/Trunk
	GigabitEthernet0/0/3	Core Layer L3 Switch -01	GigabitEthernet0/0/19	EtherChannel 7/Trunk
	GigabitEthernet0/0/4	Core Layer L3 Switch -01	GigabitEthernet0/0/20	EtherChannel 7/Trunk
	GigabitEthernet0/0/5	Core Layer L3 Switch -02	GigabitEthernet0/0/17	EtherChannel 8/Trunk
	GigabitEthernet0/0/6	Core Layer L3 Switch -02	GigabitEthernet0/0/18	EtherChannel 8/Trunk
	GigabitEthernet0/0/7	Core Layer L3 Switch -02	GigabitEthernet0/0/19	EtherChannel 8/Trunk
	GigabitEthernet0/0/8	Core Layer L3 Switch -02	GigabitEthernet0/0/20	EtherChannel 8/Trunk
	GigabitEthernet0/0/9	Access Points -17	FastEthernet	Uplink port
	GigabitEthernet0/0/10	Access Points -18	FastEthernet	Uplink port
	GigabitEthernet0/0/11	Access Points -19	FastEthernet	Uplink port
	GigabitEthernet0/0/12	Access Points -20	FastEthernet	Uplink port
	GigabitEthernet0/0/14-GigabitEthernet0/0/35	IP Phone -1 to IP Phone -22	FastEthernet	Access port/Voice
LC -02	GigabitEthernet0/0/40-GigabitEthernet0/0/48	PC -01 to PC -09	GigabitEthernet0/1	Access port/Internet
	GigabitEthernet0/0/13	Shutdown port		
	GigabitEthernet0/0/36-GigabitEthernet0/0/39	Shutdown ports		
	GigabitEthernet0/0/1-GigabitEthernet0/0/13	PC -10 to PC -22	GigabitEthernet0/1	Access port/Internet
	GigabitEthernet0/0/48	IP Camera -04	FastEthernet	Access port/Video
	GigabitEthernet0/0/14-GigabitEthernet0/0/47	Shutdown ports		

(Table -11)

Access Layer L2 Switch -07 (Fourth Floor)

Access Layer L2 Switch -07 (Fourth Floor)				
LCs	Interface	Connect to	Connecting Ports	Port Mode
LC - 01	GigabitEthernet0/0/1	Core Layer L3 Switch -01	GigabitEthernet0/0/21	EtherChannel 9/Trunk
	GigabitEthernet0/0/2	Core Layer L3 Switch -01	GigabitEthernet0/0/22	EtherChannel 9/Trunk
	GigabitEthernet0/0/3	Core Layer L3 Switch -01	GigabitEthernet0/0/23	EtherChannel 9/Trunk
	GigabitEthernet0/0/4	Core Layer L3 Switch -01	GigabitEthernet0/0/24	EtherChannel 9/Trunk
	GigabitEthernet0/0/5	Core Layer L3 Switch -02	GigabitEthernet0/0/21	EtherChannel 10/Trunk
	GigabitEthernet0/0/6	Core Layer L3 Switch -02	GigabitEthernet0/0/22	EtherChannel 10/Trunk
	GigabitEthernet0/0/7	Core Layer L3 Switch -02	GigabitEthernet0/0/23	EtherChannel 10/Trunk
	GigabitEthernet0/0/8	Core Layer L3 Switch -02	GigabitEthernet0/0/24	EtherChannel 10/Trunk
	GigabitEthernet0/0/9	Access Points -21	FastEthernet	Uplink port
	GigabitEthernet0/0/10	Access Points -22	FastEthernet	Uplink port
	GigabitEthernet0/0/11	Access Points -23	FastEthernet	Uplink port
	GigabitEthernet0/0/12	Access Points -24	FastEthernet	Uplink port
	GigabitEthernet0/0/13	Access Points -25	FastEthernet	Uplink port
	GigabitEthernet0/0/15	IP Phone -01	FastEthernet	Access port/Voice
	GigabitEthernet0/0/16	IP Phone -02	FastEthernet	Access port/Voice
	GigabitEthernet0/0/17	IP Phone -03	FastEthernet	Access port/Voice
	GigabitEthernet0/0/20-GigabitEthernet0/0/41	PC -01 to PC -22	GigabitEthernet0/1	Access port/Internet
	GigabitEthernet0/0/45-GigabitEthernet0/0/48	IP Camera -01 to IP Camera -04	FastEthernet	Access port/Video
	GigabitEthernet0/0/14	Shutdown port		
	GigabitEthernet0/0/18-GigabitEthernet0/0/19-GigabitEthernet0/0/42-GigabitEthernet0/0/44	Shutdown ports		

(Table -12)

03. PROJECT ANALYSIS

3.1 BANDWIDTH CALCULATION

Bandwidth Calculation Table

User Categories	No of Users	Allocated Bandwidth for 1 user (Mbps)	Required Bandwidth
Wireless AP users	1000	1 Mbps	1000 Mbps
Workers	250	32 Mbps	8000 Mbps
Rest Area	200	16 Mbps	3200 Mbps
IP Phones	40	5 Mbps	200 Mbps
Office Management	36	64 Mbps	2304 Mbps
Top management	15	4 Mbps	60 Mbps
IP Cameras (CCTV)	10	2 Mbps	20 Mbps
Conference	6	64 Mbps	384 Mbps
IT Department	6	64 Mbps	384 Mbps
Web Server	1	32 Mbps	32 Mbps
Required Total Bandwidth			15,584Mbps

(Table -13)

- ❖ The campus required **Total Bandwidth is 15,584Mbps.**
- ❖ That means the campus Needs 1.948GB per second.
- ❖ And the campus Needs approximately **1683.072TB for one month** with a daily working time of 8 hours.
- ❖ The campus contains 1 DMZ Server, 507 wired PCs, 37 IP Phones, 8 IP Cameras, and 25 Wireless Access Points with 1000 wireless users.
- ❖ According to this bandwidth, this network needs **Rs. 150,000.00 /= leased line from ISP Sri Lanka Telecom PLC** as a main leased line.
- ❖ **And Rs. 140,000.00 /= backup leased line from ISP Dialog Axiata PLC.**

04. FINANCIAL COST & BUDGET CALCULATION

4.1 BUDGET CALCULATION

Budget Calculation Table

Item Name	Model Number	Units	Price	
			For 1 Unit	For All Units
Access Points	Cisco C9120AX	25	\$2,165.00	\$54,125.00
Main Server Rack	Cisco R42610	1	\$4,389.00	\$4,389.00
Servers	Cisco UCS S3260	2	\$27,499.57	\$54,999.14
	NAS storage Servers	1	\$6,030.45	\$6,030.45
ISP Routers	Cisco 8200-1N-4T	2	\$5,322.98	\$10,645.96
Firewall	Cisco Firepower 4145	2	\$294,244.00	\$588,488.00
Layer 3 Switches	Cisco C9500 25G-48Y4C	2	\$28,638.00	\$57,276.00
Layer 2 Switches	Cisco C9300X-12Y-A	2	\$7,071.00	\$14,142.00
	Cisco C9400 Series 10U	2	\$59,125.00	\$118,250.00
	Cisco C9400 Series 7U	1	\$44,218.00	\$44,218.00
	Cisco C9400 Series 4U	2	\$31,166.00	\$62,332.00
Rackmount Monitor	NetDirector-B020U0819IP	1	\$2,647.20	\$2,647.20
Patch Panel 48-port	TRENDnet-TC-P48C6(v2.0R)	2	\$82.49	\$164.98
Power Supply	Tripp.Lite-PDUMH30NET	1	\$1,102.00	\$1,102.00
UPS	Cyberpower-OR1500LCDRTXL2U	1	\$714.95	\$714.95
	Cyberpower-OR500LCDRM1U	5	\$219.95	\$1,099.75
IP Phones	Cisco IP Phone-CP-8861-K9	37	\$829.00	\$30,673.00
IP Cameras	Cisco CIVS-IPC-8400	8	\$1,763.99	\$14,111.92
Network Cables CAT6-EXCEL	UTP-Cable 100-071-1000M-Dca	13	\$353.42	\$4,594.46
	Patch Cable CO-C6PL-UTP-Grn-0.5M	600	\$0.56	\$336.00
	Patch Cable CO-C6PL-UTP-Pink-1.5M	50	\$1.05	\$52.50
RJ45 wall Plates	Excel 6C-100-671	100	\$1.12	\$112.00
	Excel Office -100-271	50	\$1.20	\$60.00
RJ45 wall Socket	Excel Cat6 UTP -100-300	650	\$2.01	\$1,306.50
RJ45 Pinout	Excel Cat6A FTP-100-140	650	\$1.01	\$656.50
PoE+ Extender	1 Port-Cat6-100M NPOE-EXT-1G30	50	\$108.92	\$5,446.00
Network Leased line	From Sri Lanka Telecom PLC	1	\$410.00	\$410.00
	From Dialog Axiata PLC	1	\$383.00	\$383.00
	Total Price			\$1,106,265.88

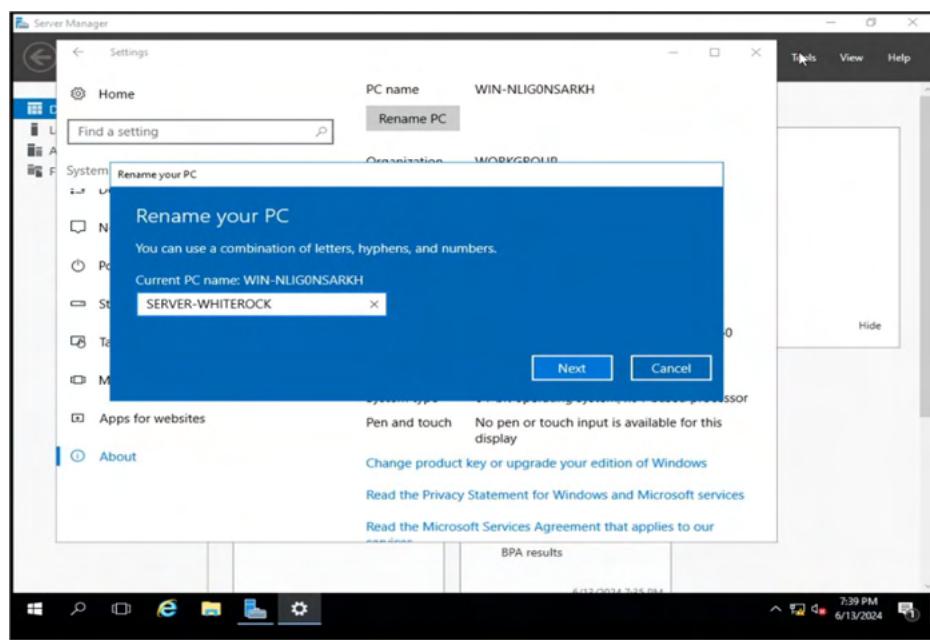
(Table-14)

05. IMPLEMENTATION

5.1 SERVER IMPLEMENTATION

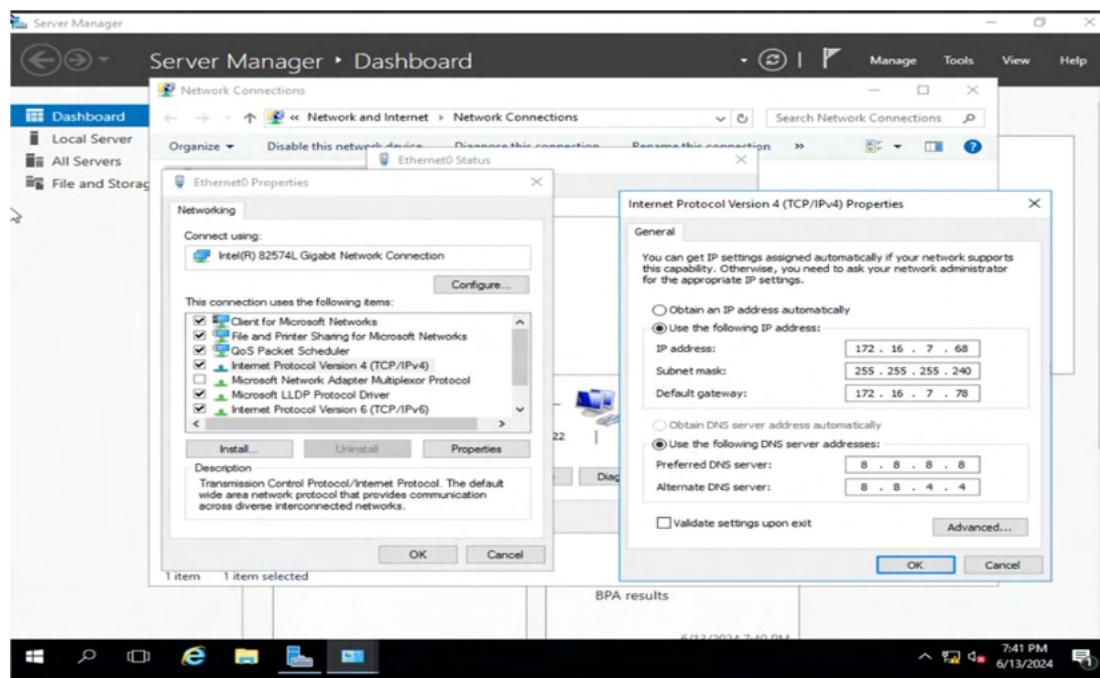
5.1.1 Initial configuration

Server Rename



(Figure -14)

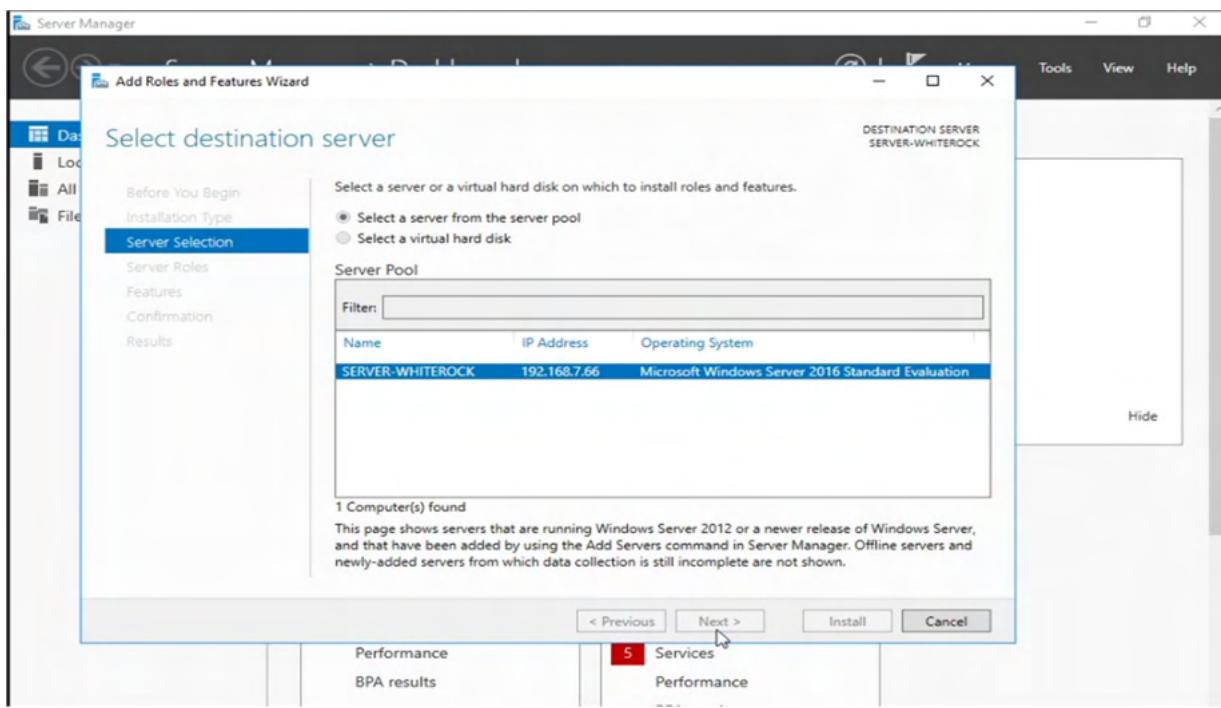
IPv4 Configuration



(Figure -15)

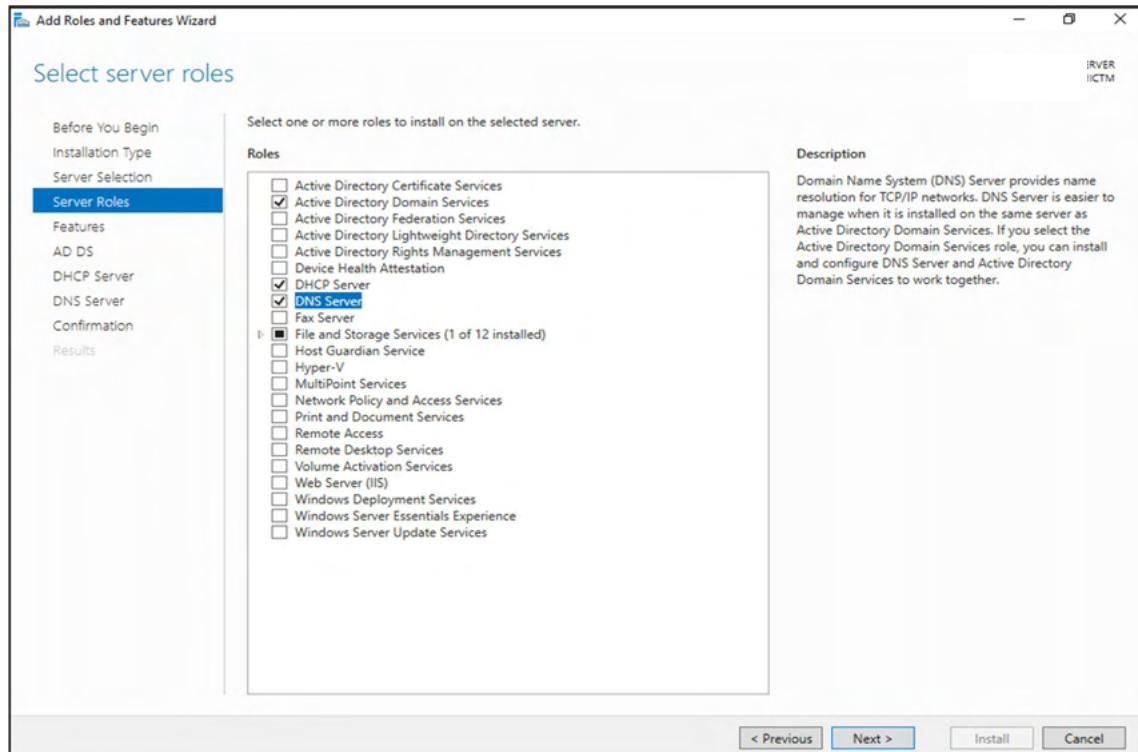
5.1.2 Add Role and Features

Add Role and Features



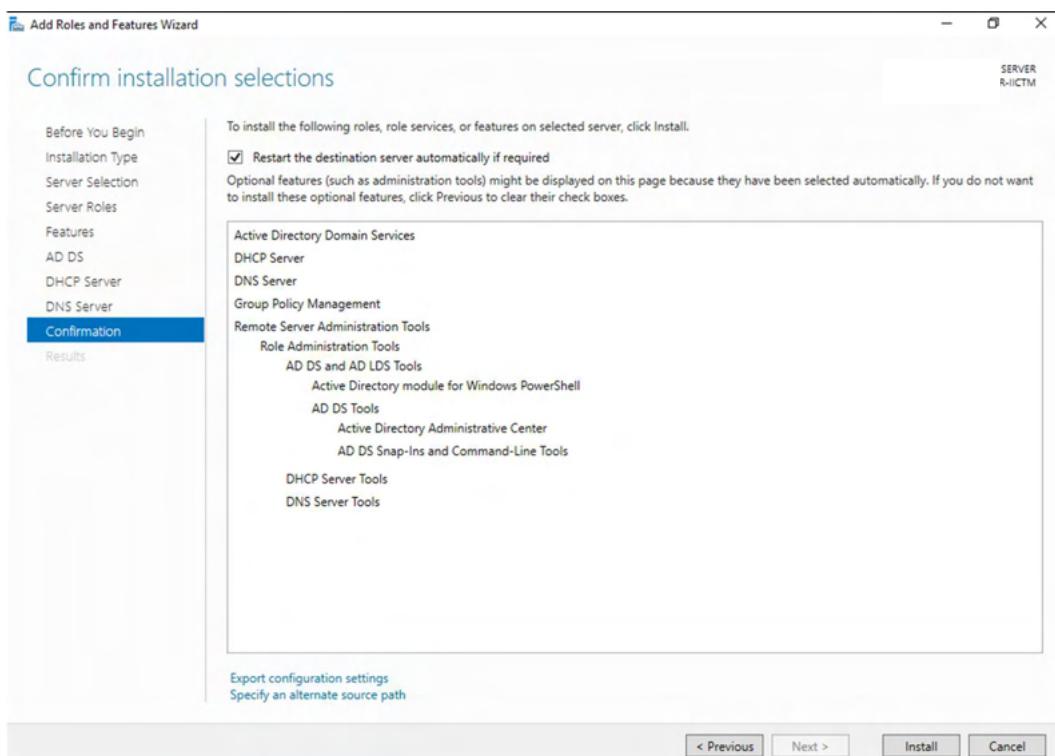
(Figure -16)

Select the Services



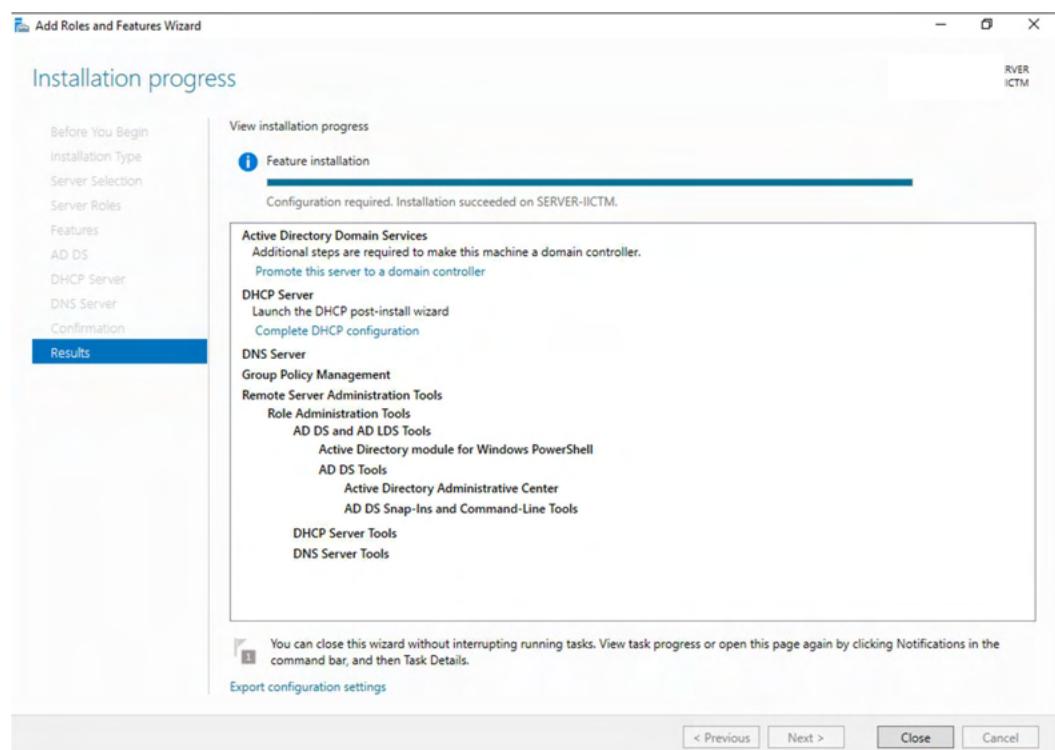
(Figure -17)

Confirm installation selections



(Figure -18)

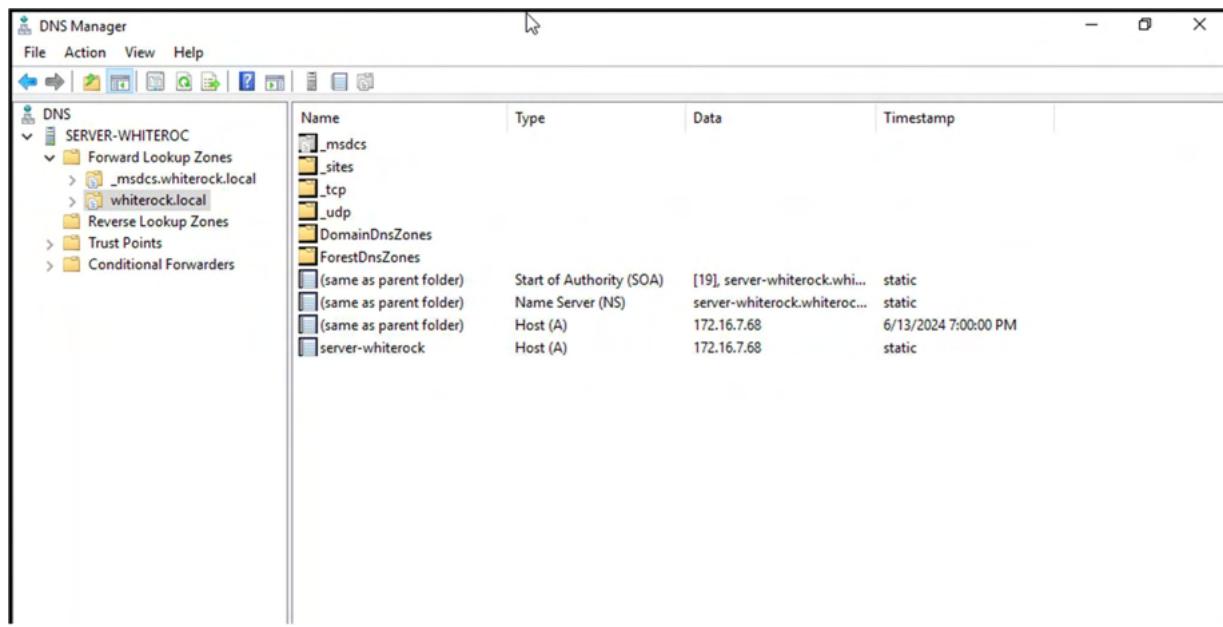
Installation Succeeded & Restart the Server



(Figure -19)

5.1.3 DNS

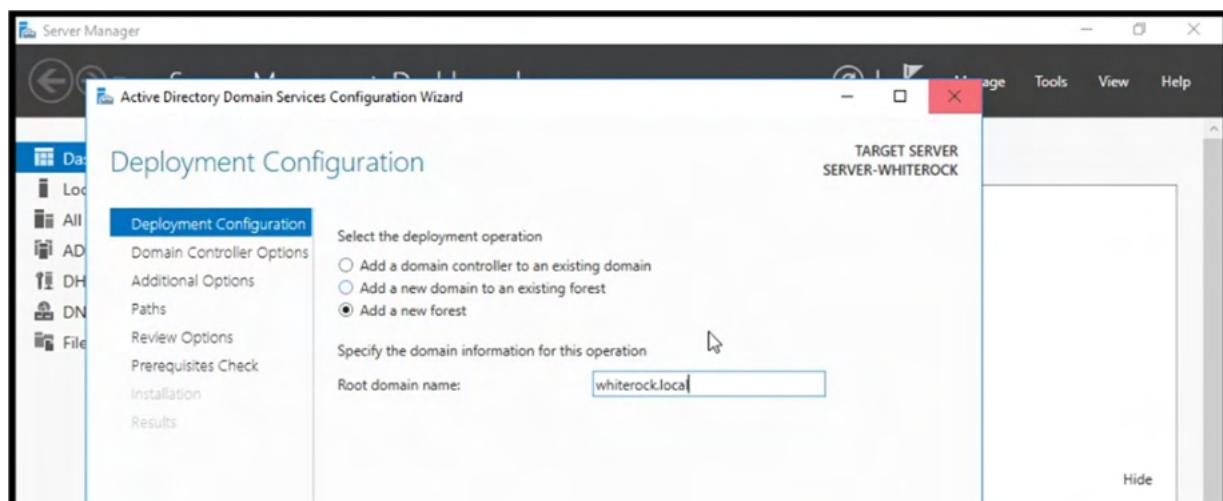
Select DNS Service



(Figure -20)

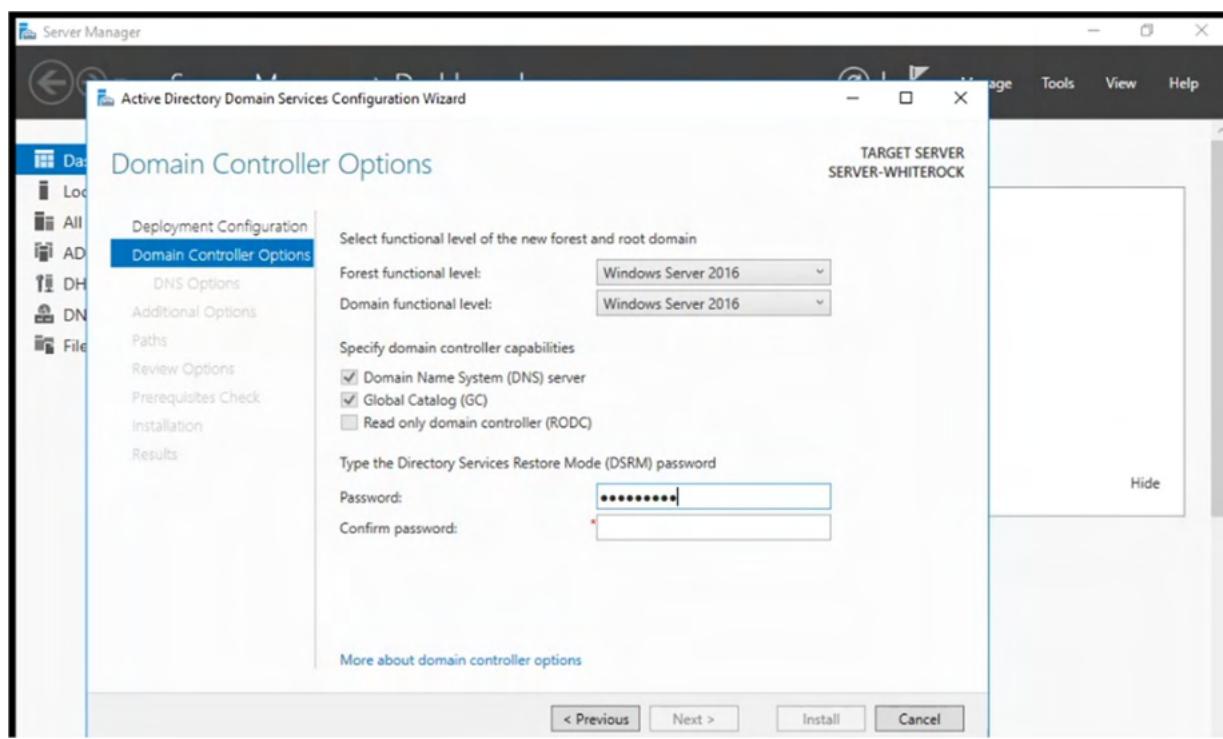
5.1.4 Active Directory

Add a New Forest



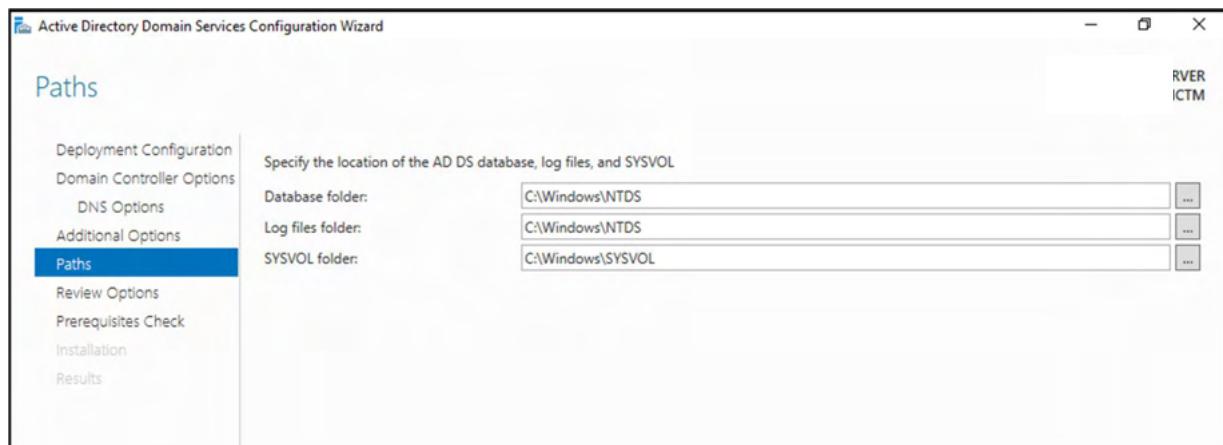
(Figure -21)

Select Forest & Domain Levels



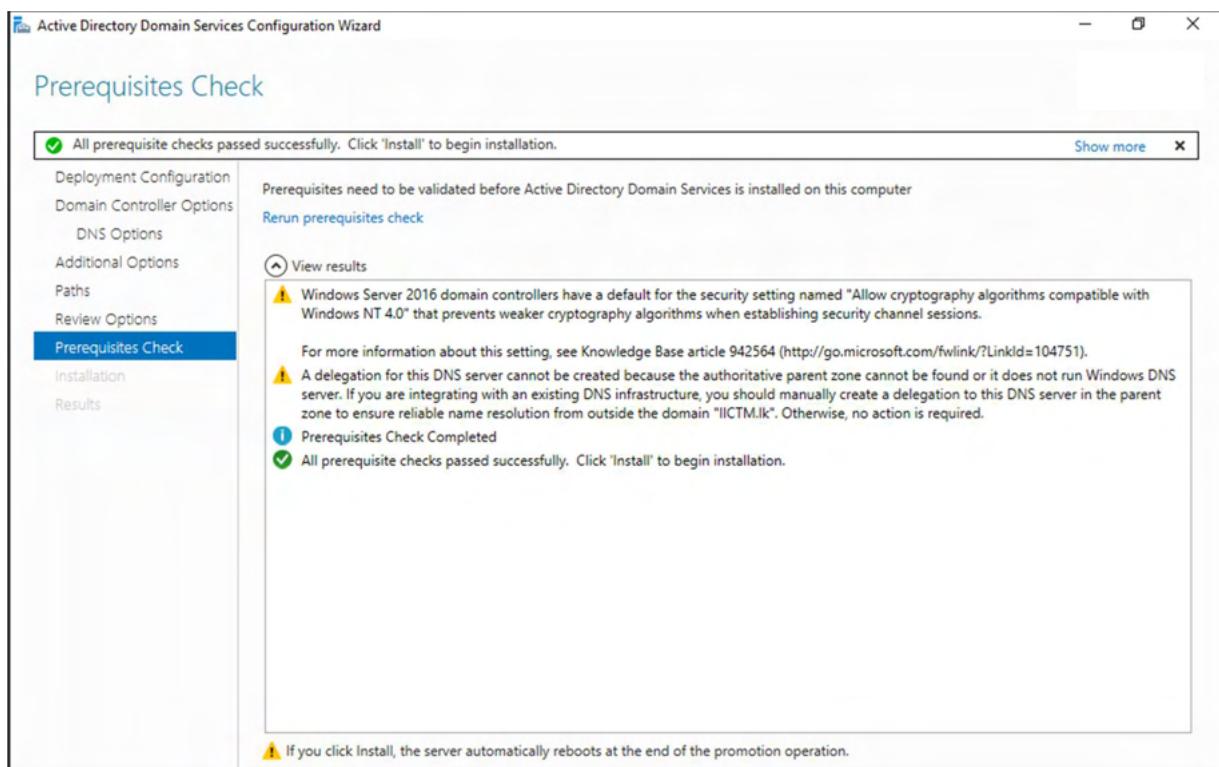
(Figure -22)

Select AD DS Path



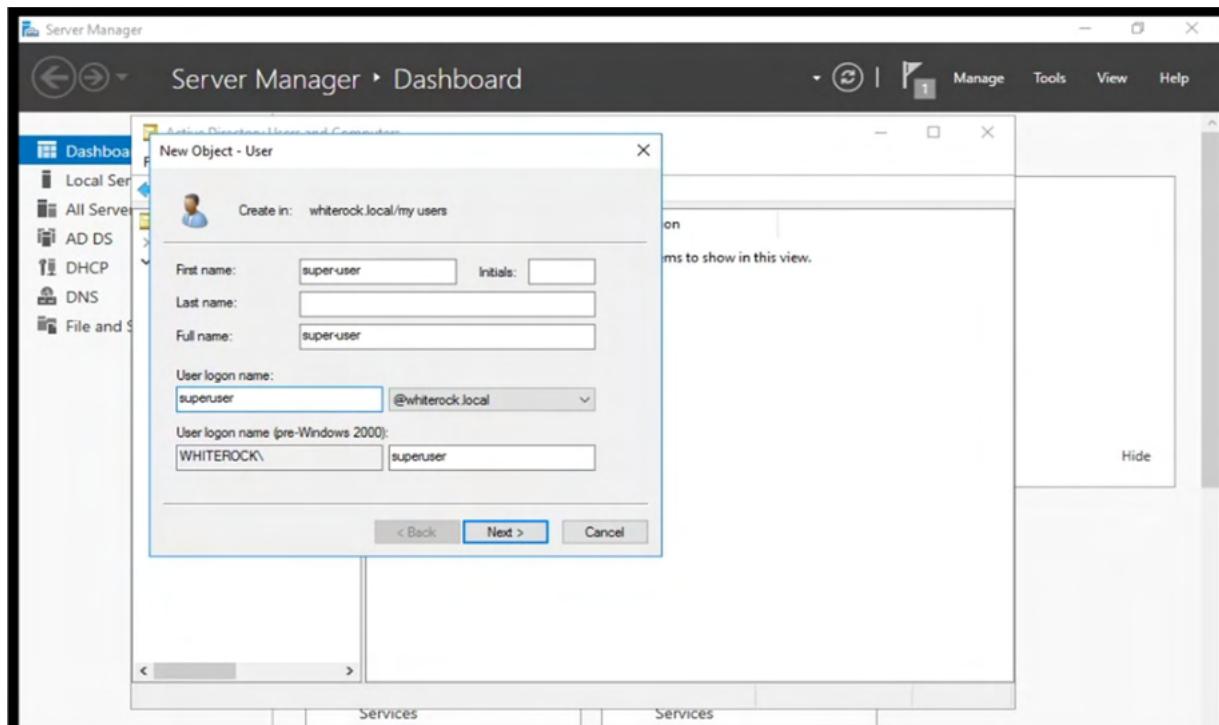
(Figure -23)

AD Prerequisites Check



(Figure -24)

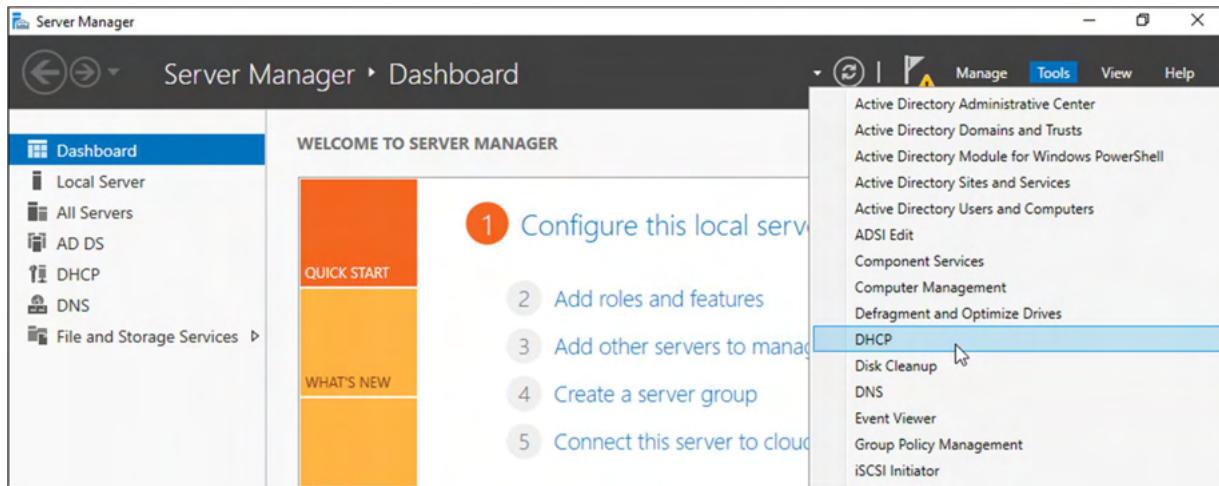
Create Client Login profile



(Figure -25)

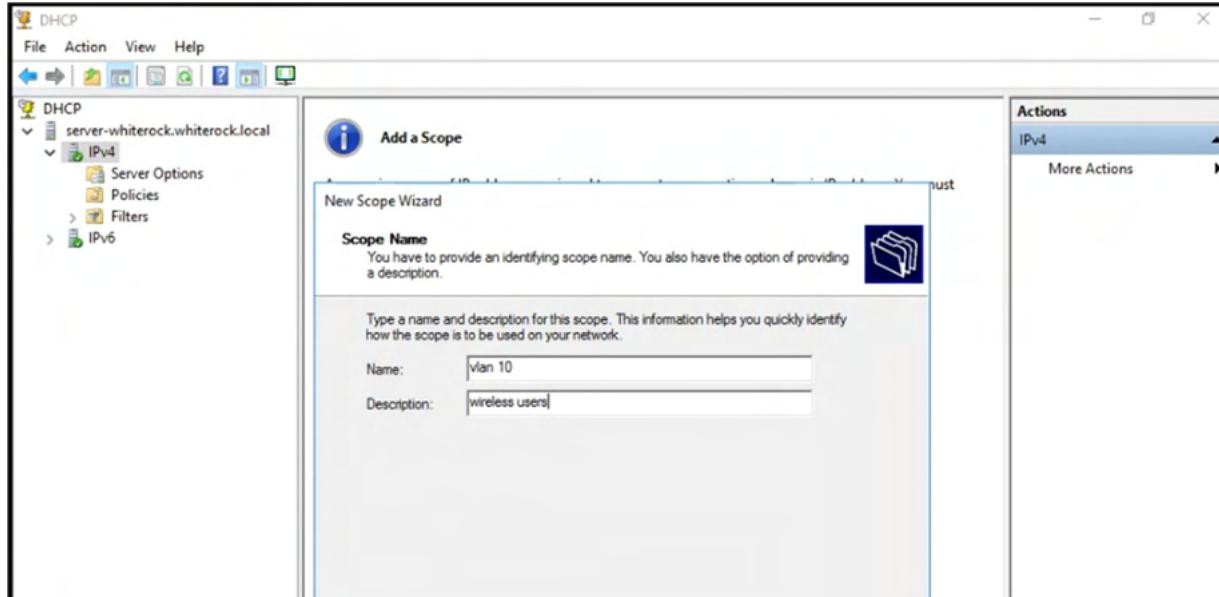
5.1.5 DHCP

Select DHCP Service



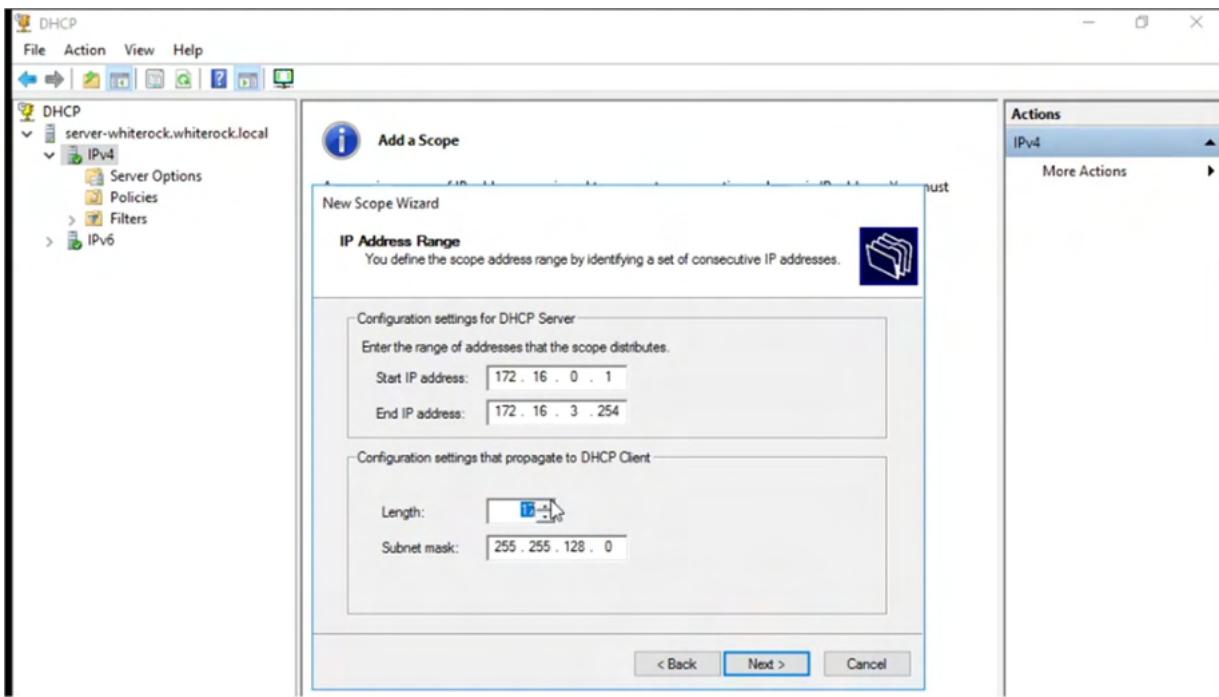
(Figure -26)

Add New Scope



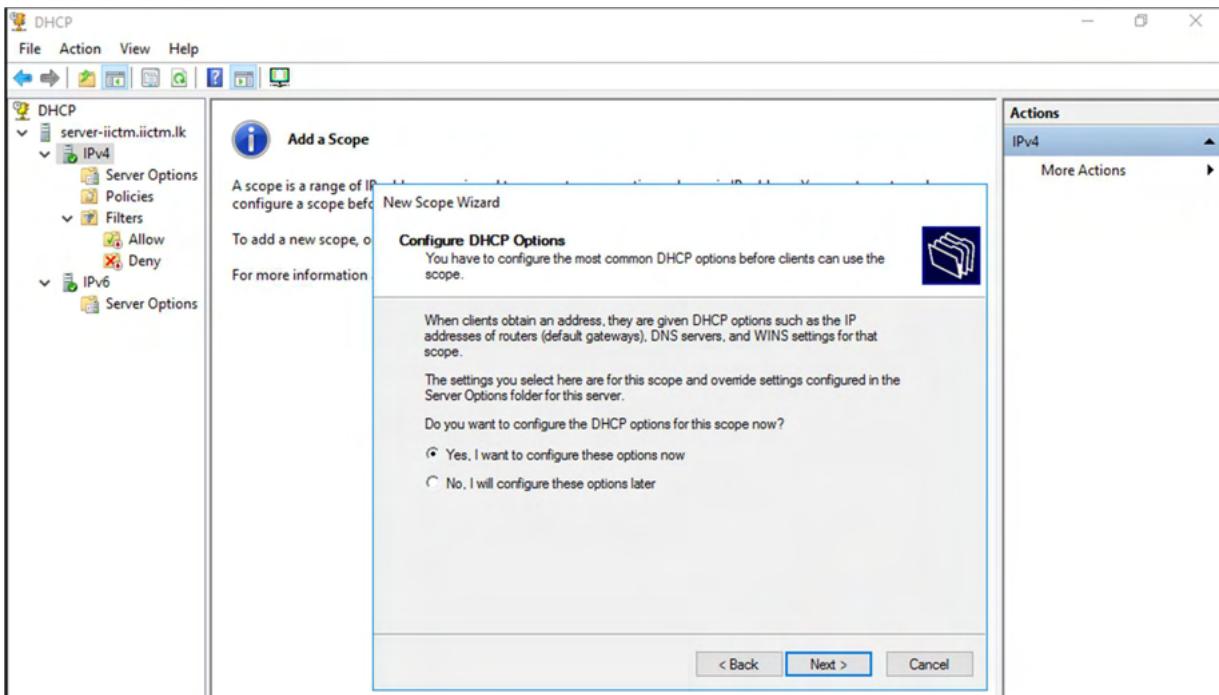
(Figure -27)

IP Address Range



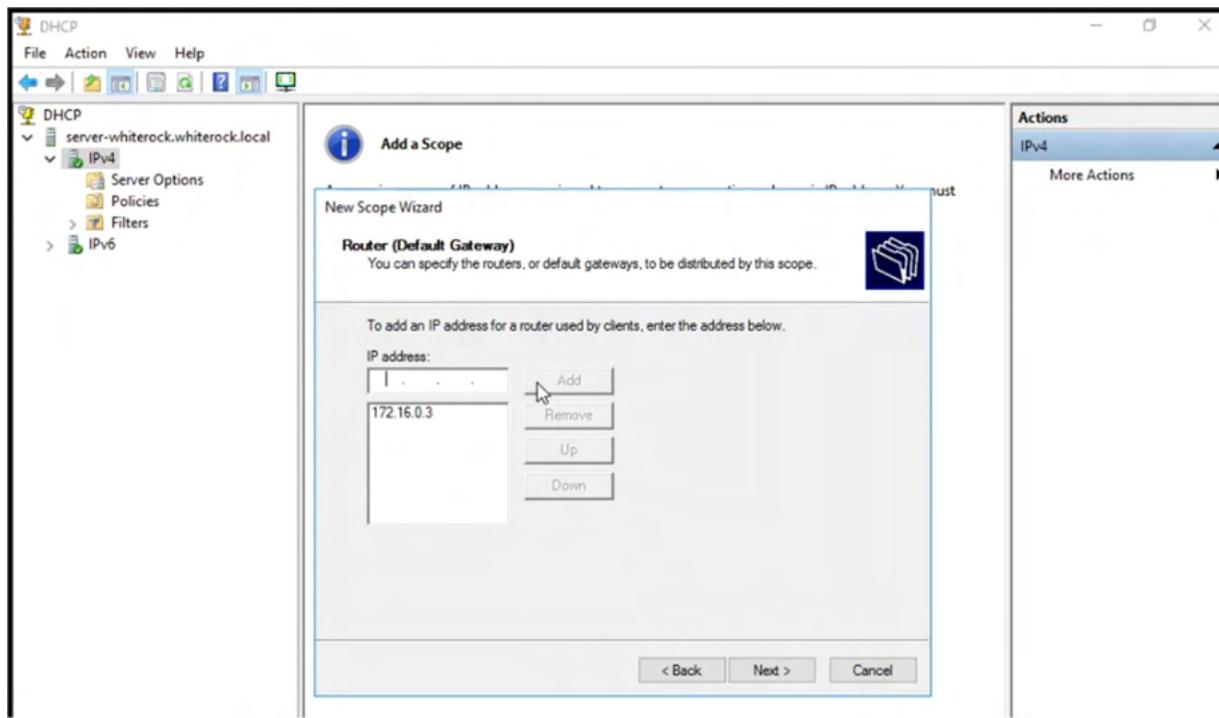
(Figure -28)

Configure DHCP Options



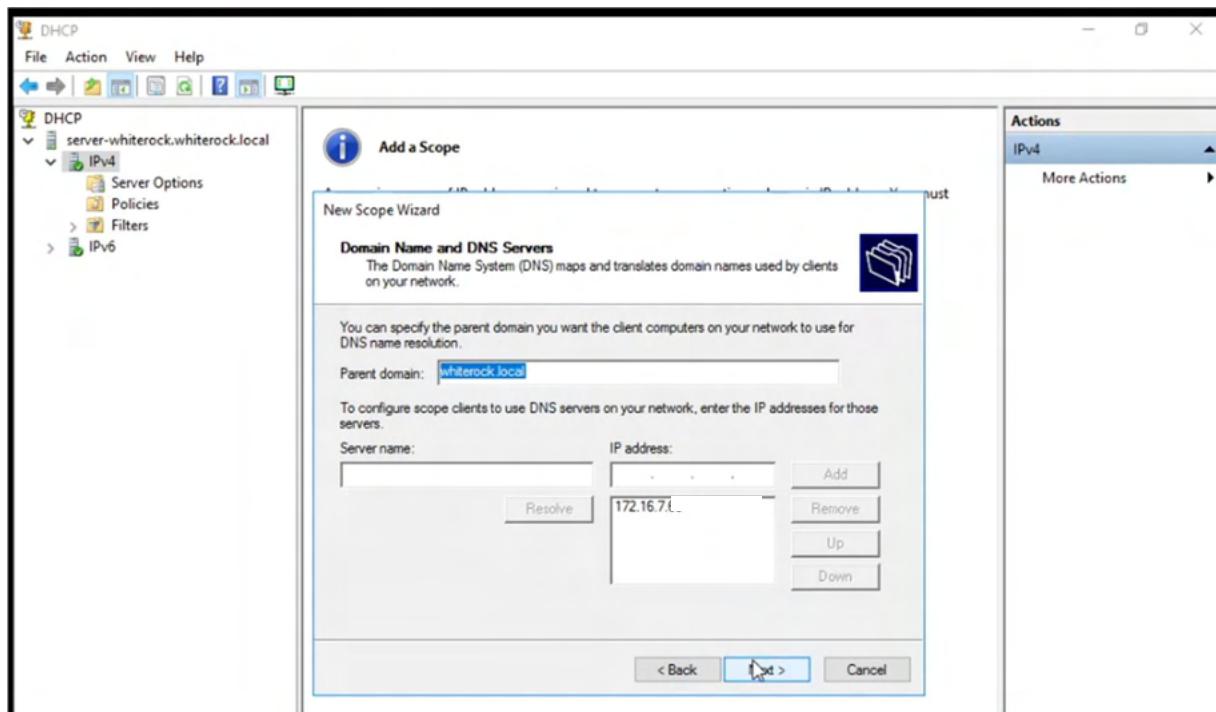
(Figure -29)

Default Gateway



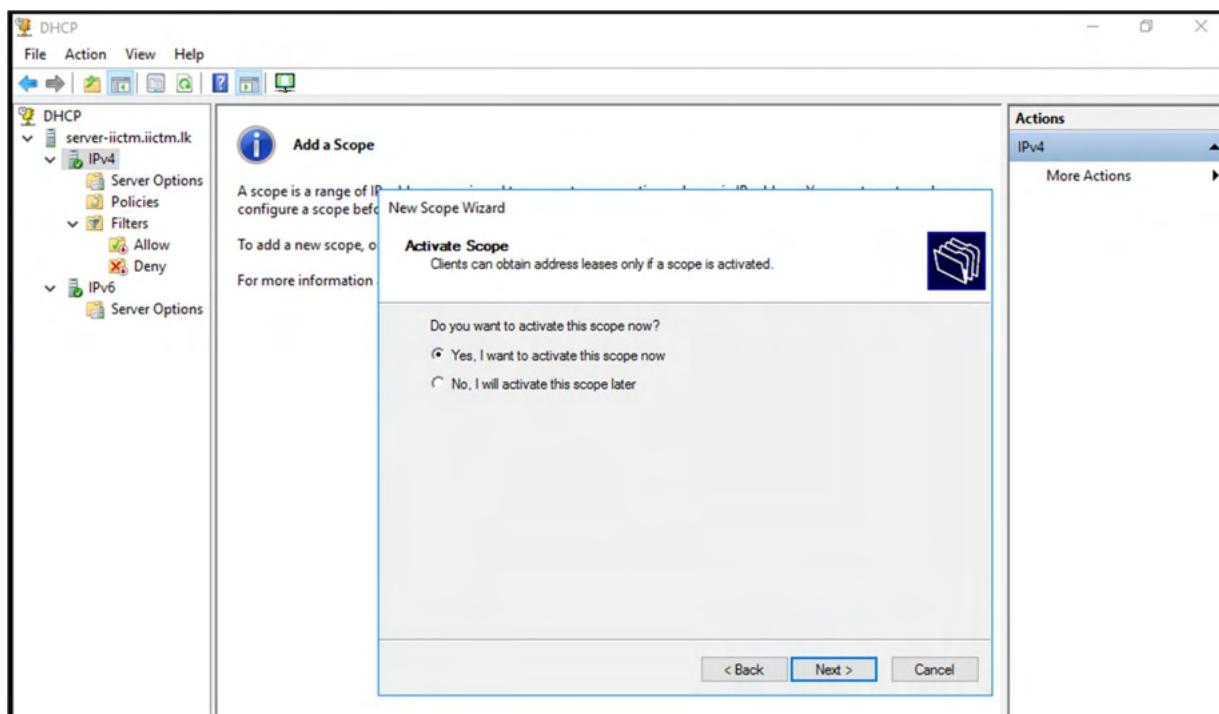
(Figure -30)

Add DNS IP



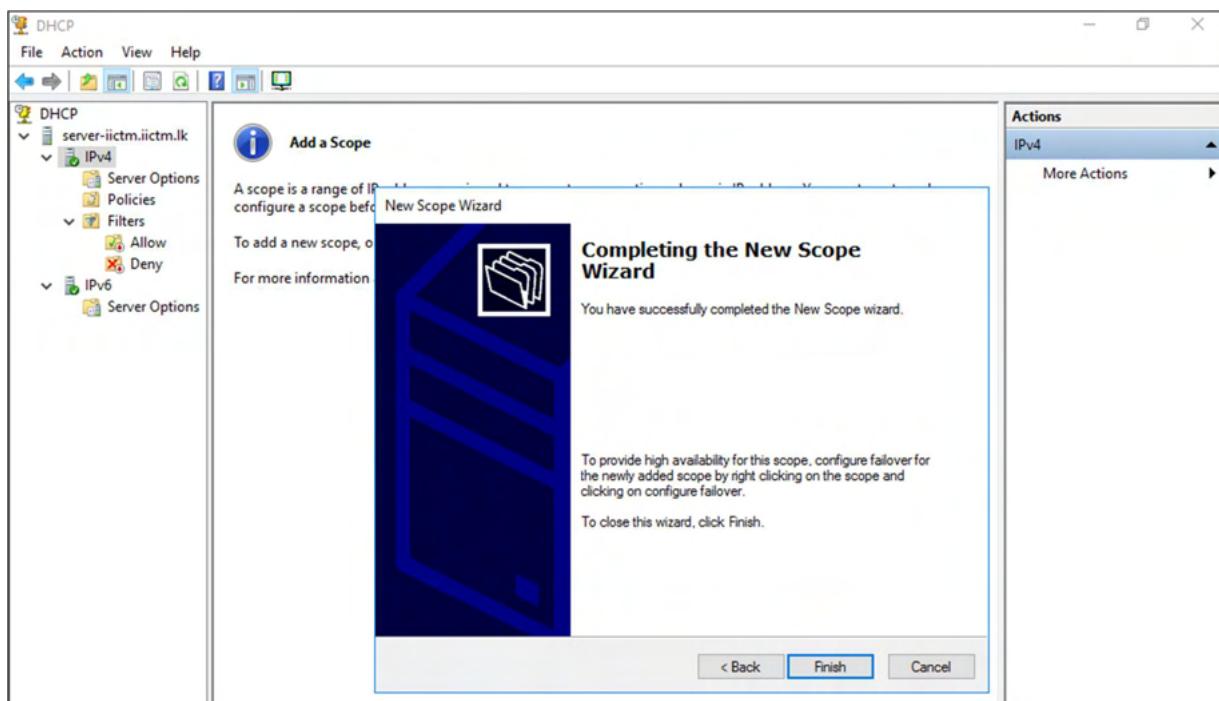
(Figure -31)

Active Scope



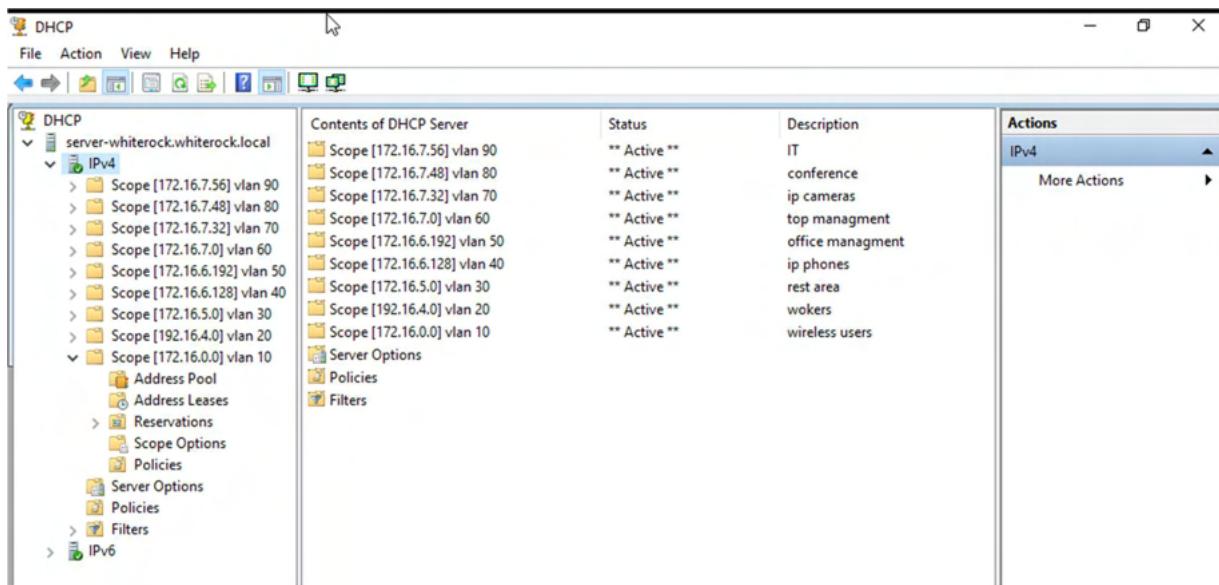
(Figure -32)

Save The Scope



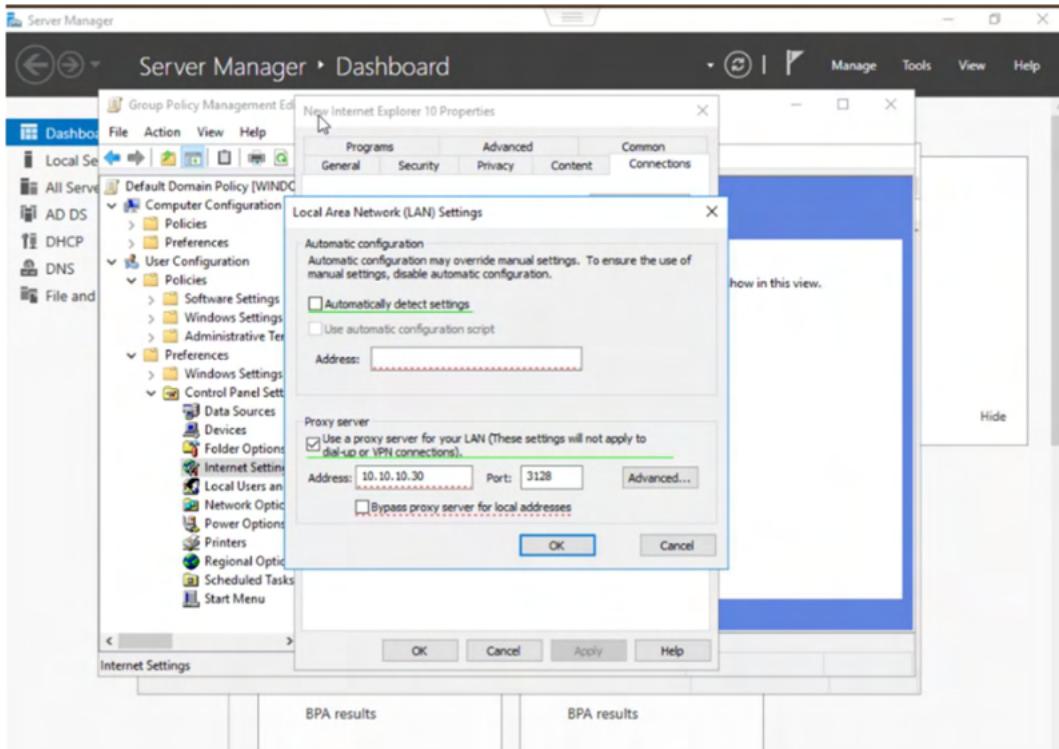
(Figure -33)

All Configured DHCP Scopes



(Figure -34)

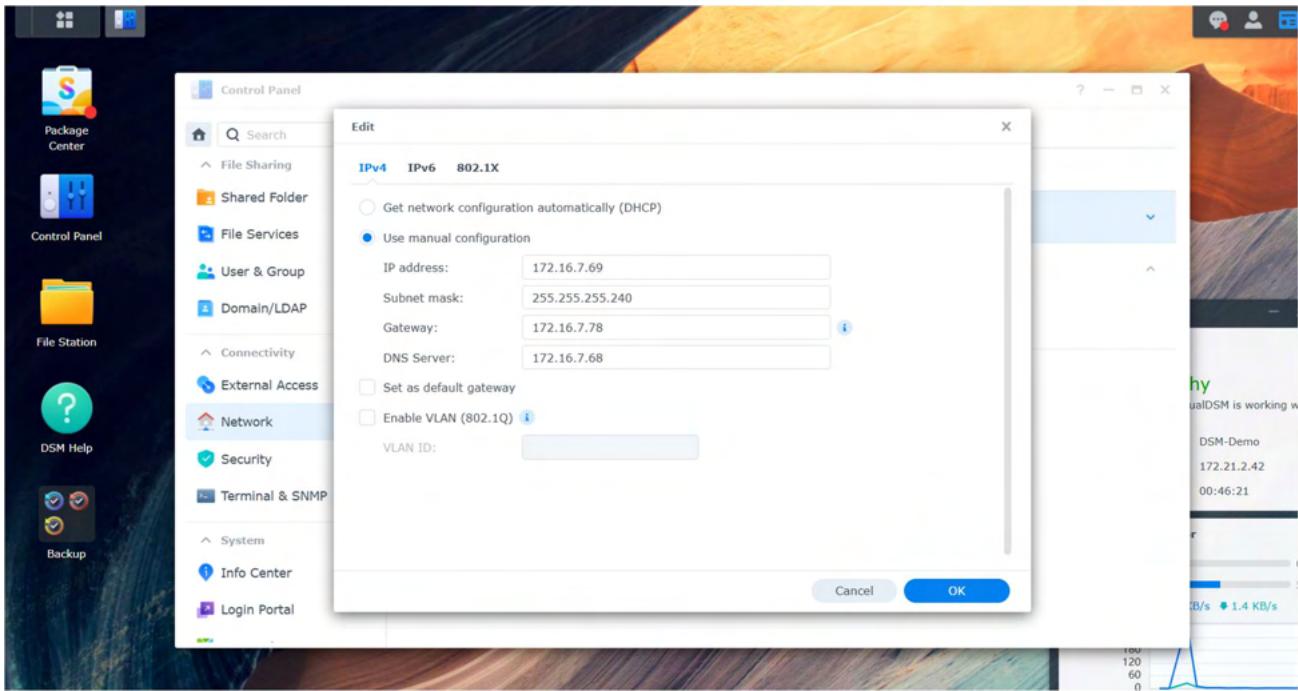
5.1.6 Add group polices into LAN hosts



(Figure -35)

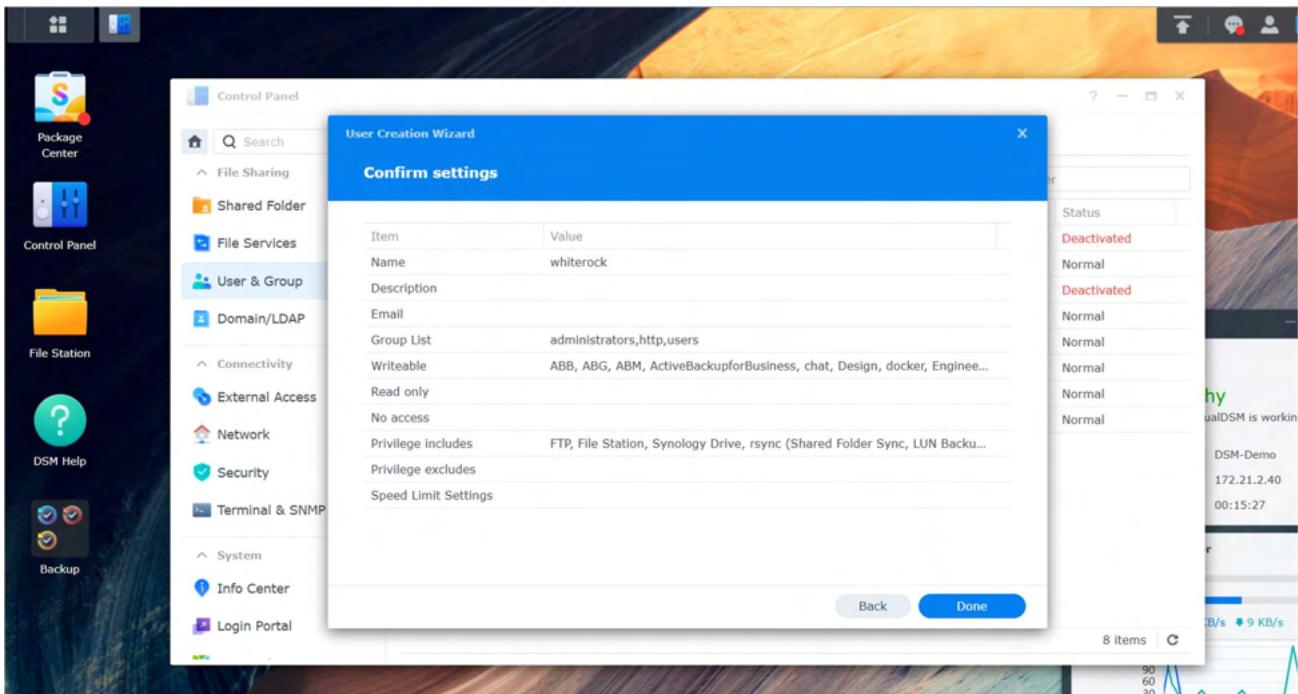
5.2 NAS STORAGE IMPLEMENTATION

Add ip address



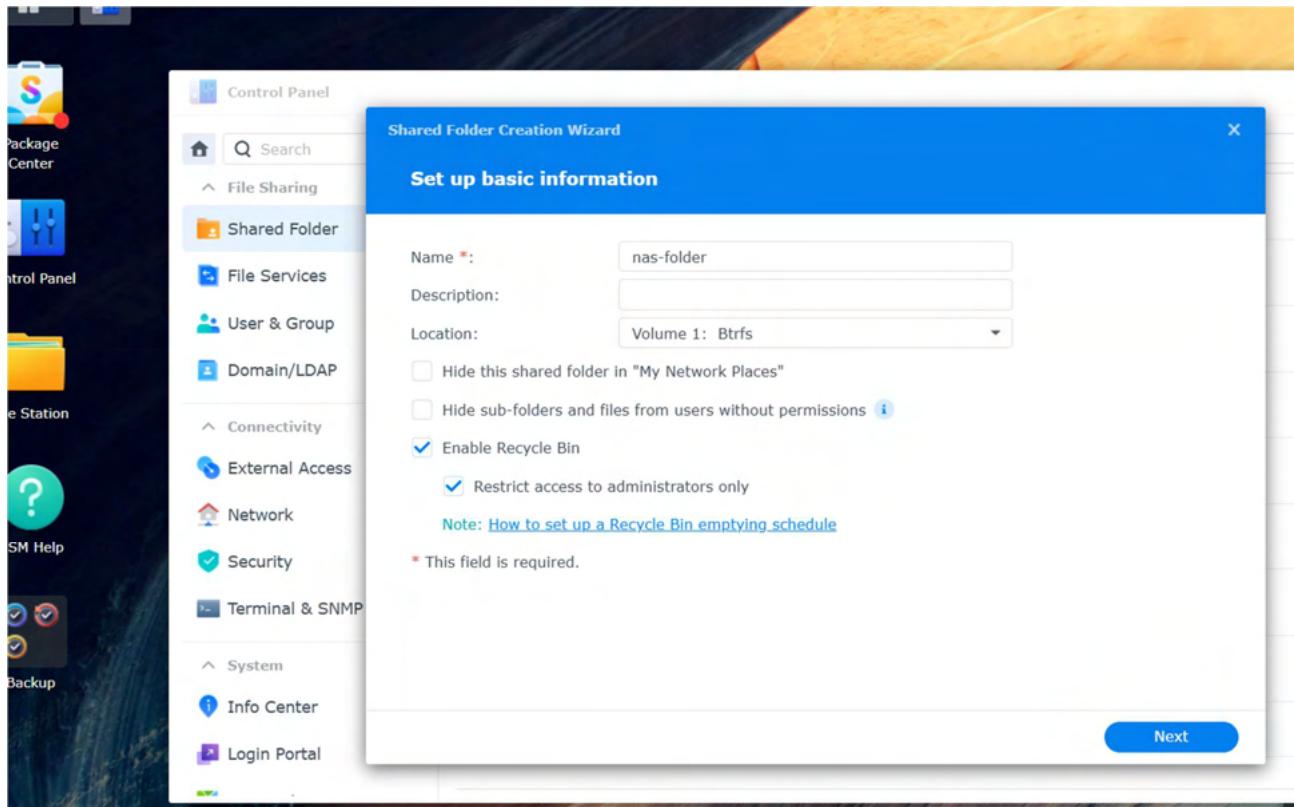
(Figure -36)

Create Login User Account



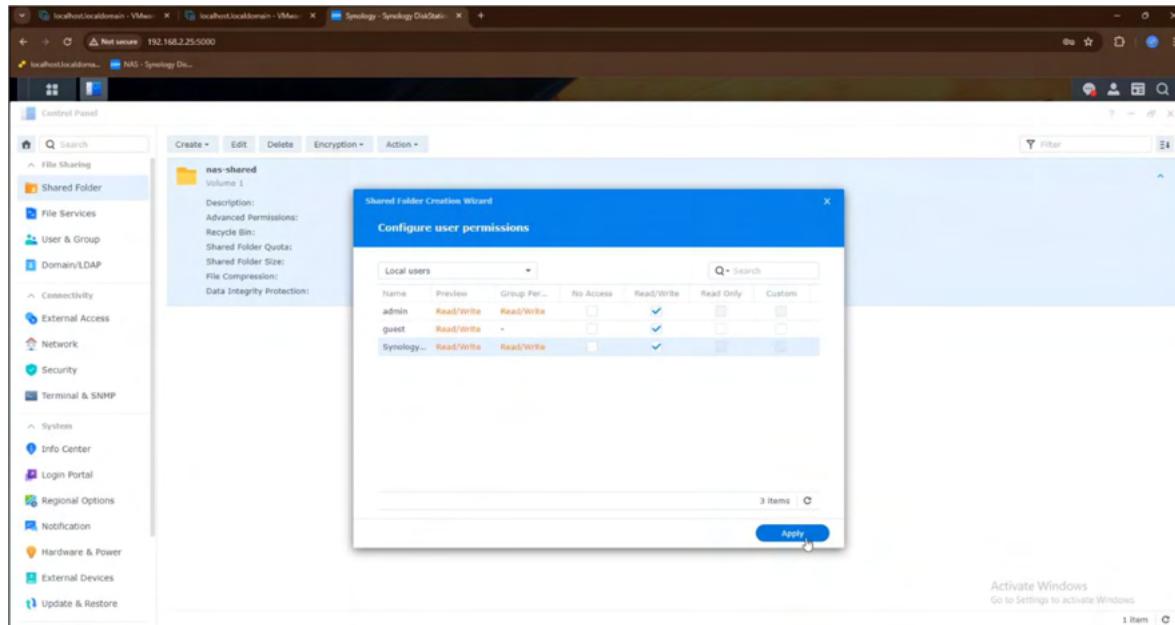
(Figure -37)

Create Shared Folder



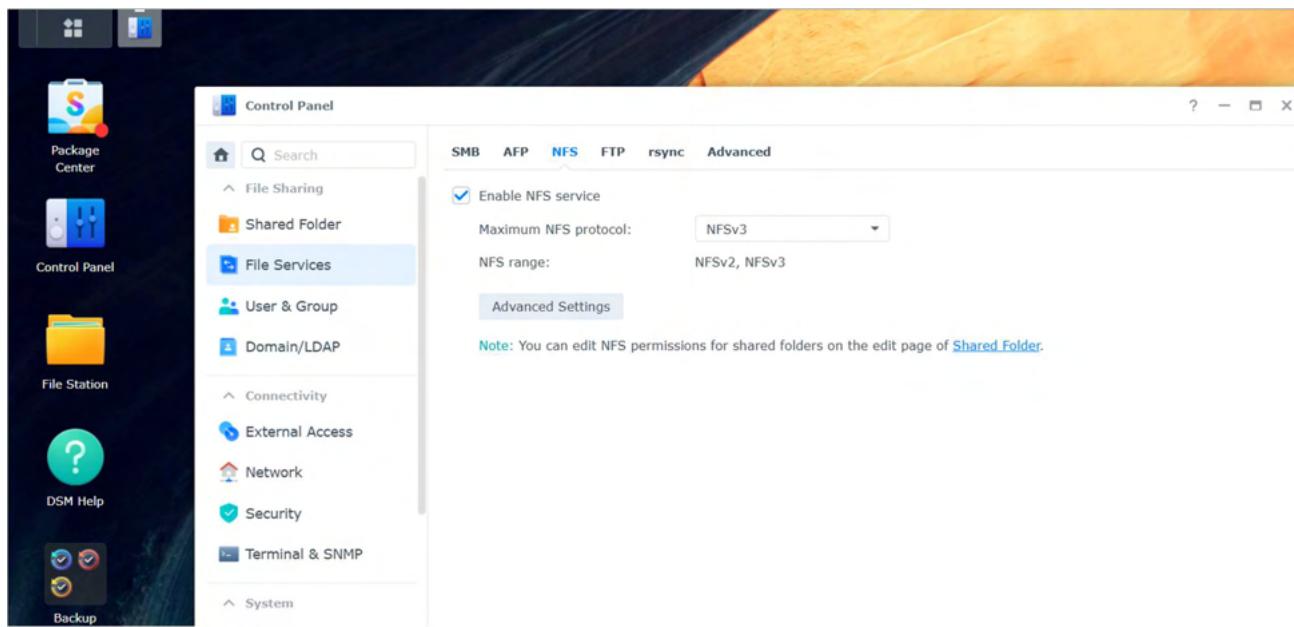
(Figure -38)

Give Permission To Shared Folder



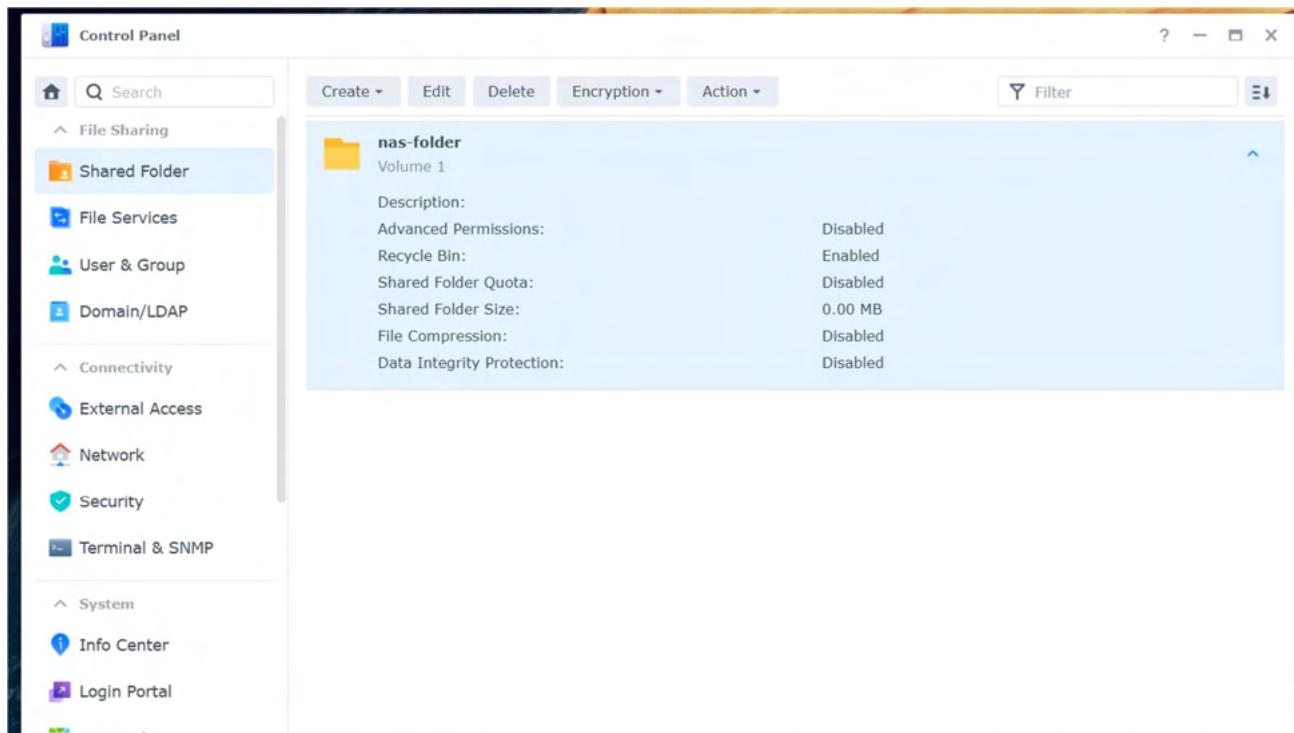
(Figure -39)

Enable NFS To NAS-Shared Folder



(Figure -40)

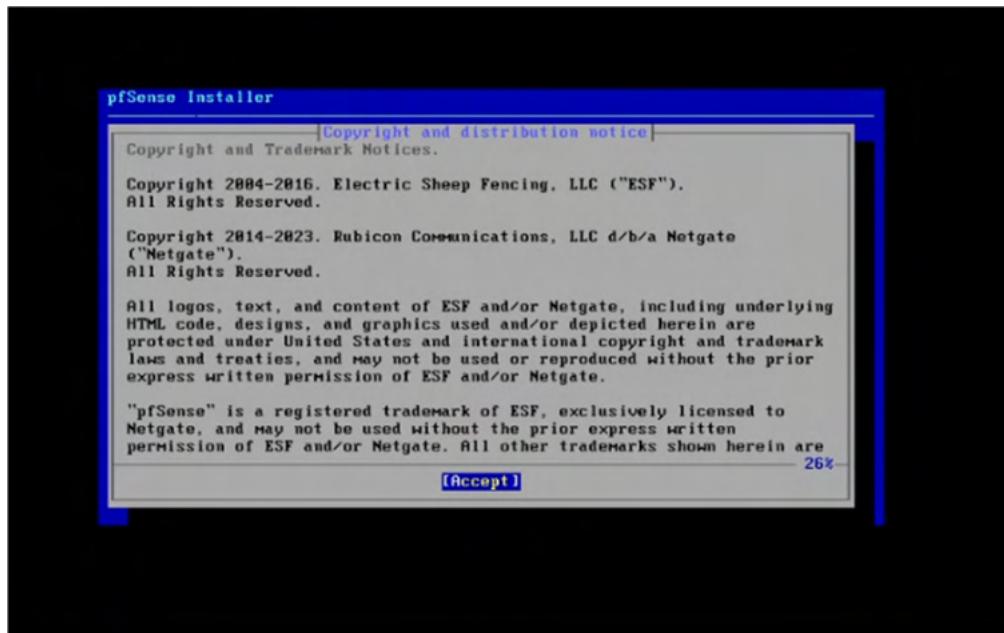
Shared Folder



(Figure -41)

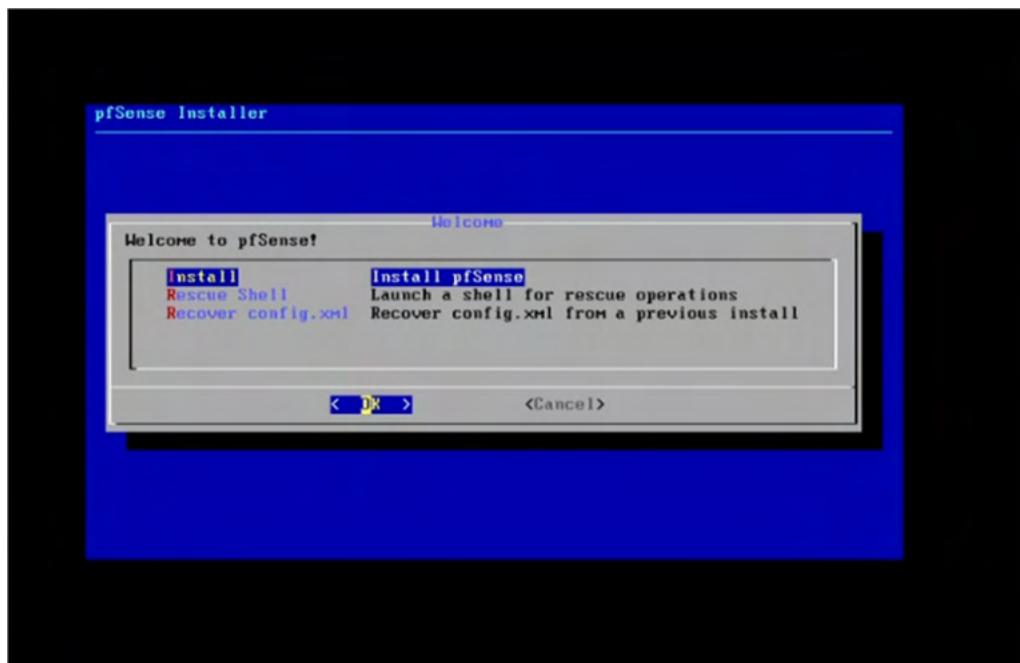
5.3. FIREWALL CONFIGURATION

PFSENSE Installer



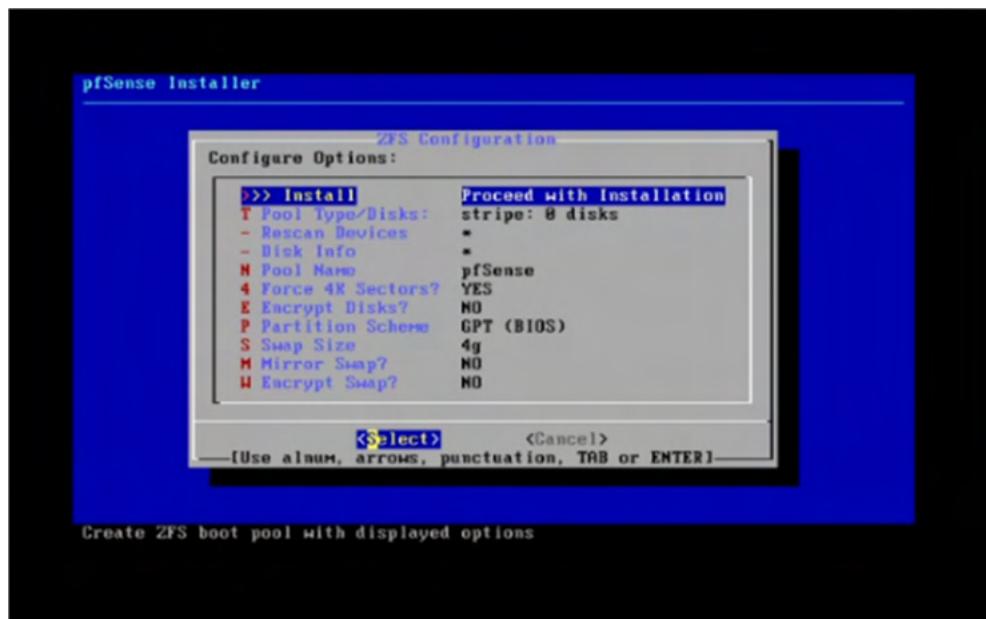
(Figure -42)

Select Install Pfsense And Click Ok

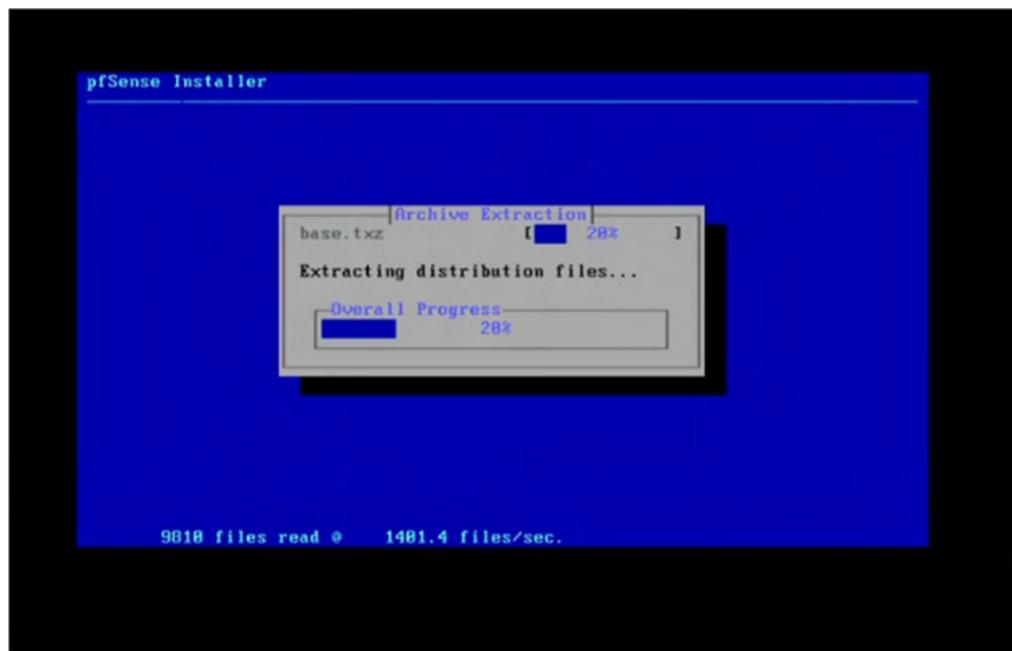


(Figure -43)

Select Continue With Default Options And Click Select

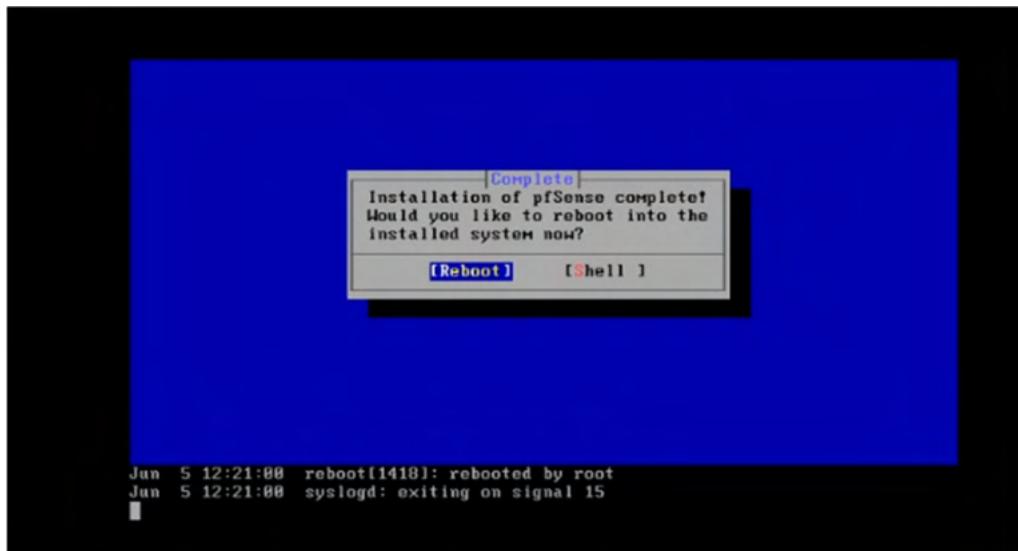


(Figure -44)



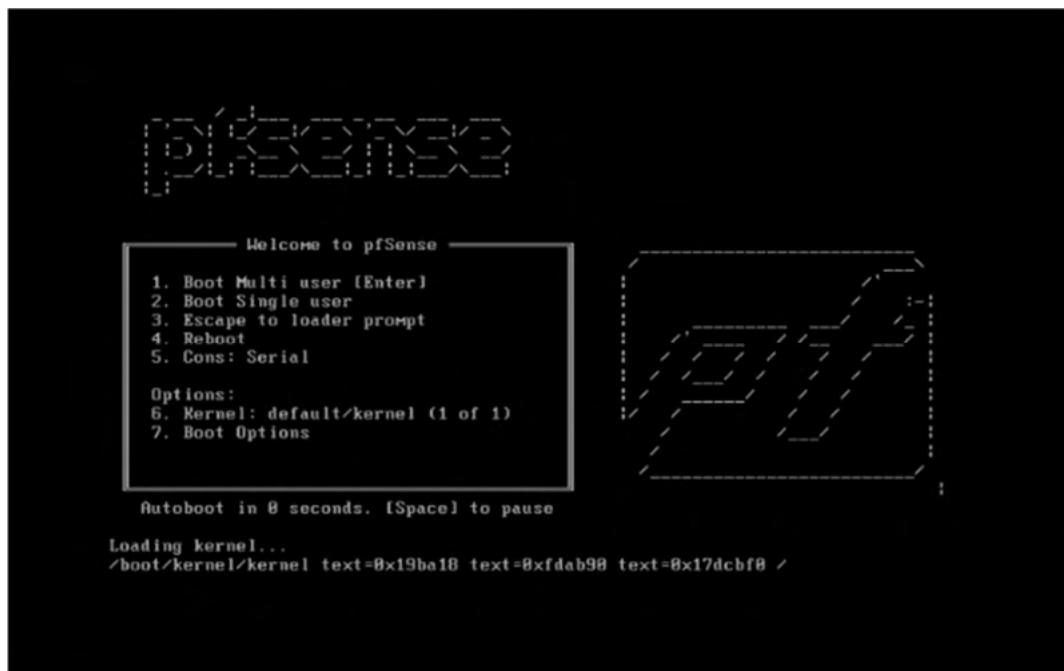
(Figure -45)

After Installation Of Pfsense Is Complete We Must Reboot The Pfsense.



(Figure -46)

Welcome Page On Pfsense Shell



(Figure -47)

Set IP Address ,Subnet-Mask And Default Gateway

```

Enter an option: 2
Available interfaces:
1 - WAN (em0 - dhcp, dhcp6)
2 - LAN (em1 - static)

Enter the number of the interface you wish to configure: 2
Configure IPv4 address LAN interface via DHCP? (y/n) n
Enter the new LAN IPv4 address. Press <ENTER> for none:
> 10.10.10.38

Subnet Masks are entered as bit counts (as in CIDR notation) in pfSense.
e.g. 255.255.255.0 = 24
      255.255.0.0   = 16
      255.0.0.0     = 8

Enter the new LAN IPv4 subnet bit count (1 to 32):
> 24

For a WAN, enter the new LAN IPv4 upstream gateway address.
For a LAN, press <ENTER> for none:
> █

```

(Figure -48)

Ips Applied Interface- Shell Options

```

8) Shell

Enter an option:

FreeBSD/amd64 (pfSense.home.arpa) (ttyv0)
VMware Virtual Machine - Netgate Device ID: 9fd3538ac35e12b7cf71
*** Welcome to pfSense 2.7.2-RELEASE (amd64) on pfSense ***
WAN (wan)      -> em0      -> v4/DHCP4: 192.168.151.153/24
LAN (lan)      -> em1      -> v4: 10.10.10.38/24

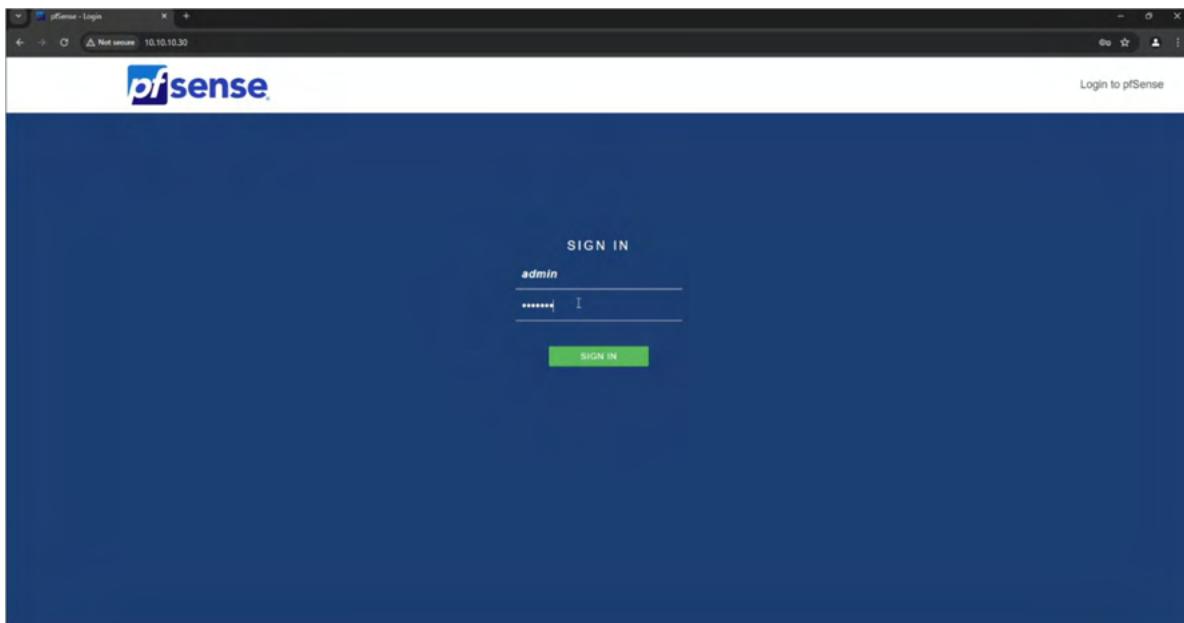
 0) Logout (SSH only)          9) pfTop
 1) Assign Interfaces          10) Filter Logs
 2) Set interface(s) IP address 11) Restart webConfigurator
 3) Reset webConfigurator password 12) PHP shell + pfSense tools
 4) Reset to factory defaults 13) Update from console
 5) Reboot system              14) Enable Secure Shell (sshd)
 6) Halt system                15) Restore recent configuration
 7) Ping host                  16) Restart PHP-FPM
 8) Shell

Enter an option: █

```

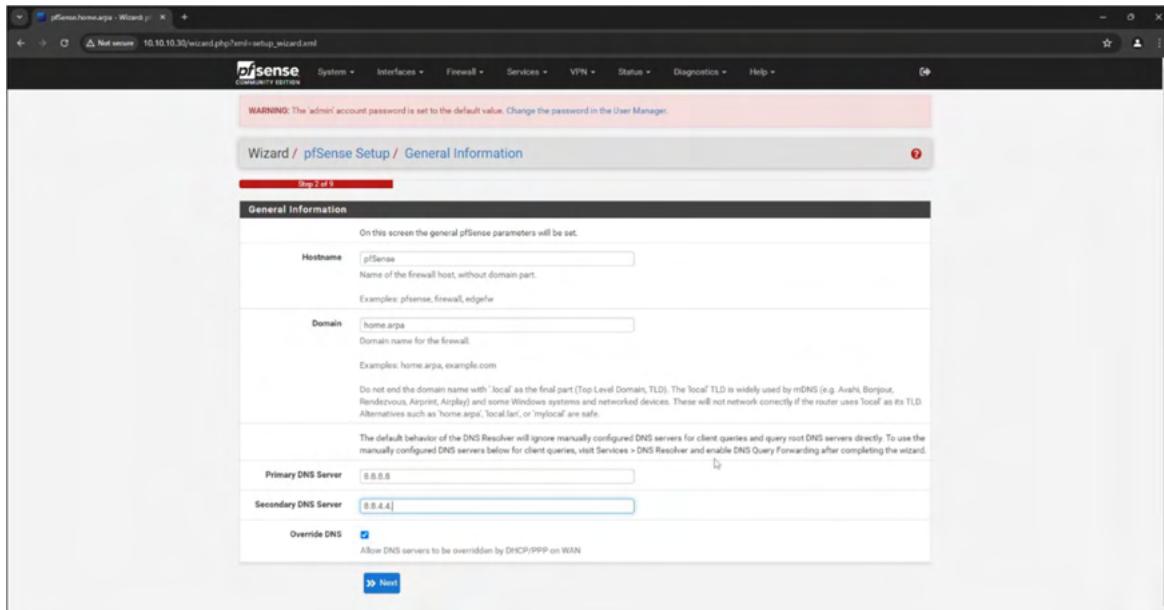
(Figure -49)

Log Into GUI Interface Using Username (Admin) And Password (pfSense)



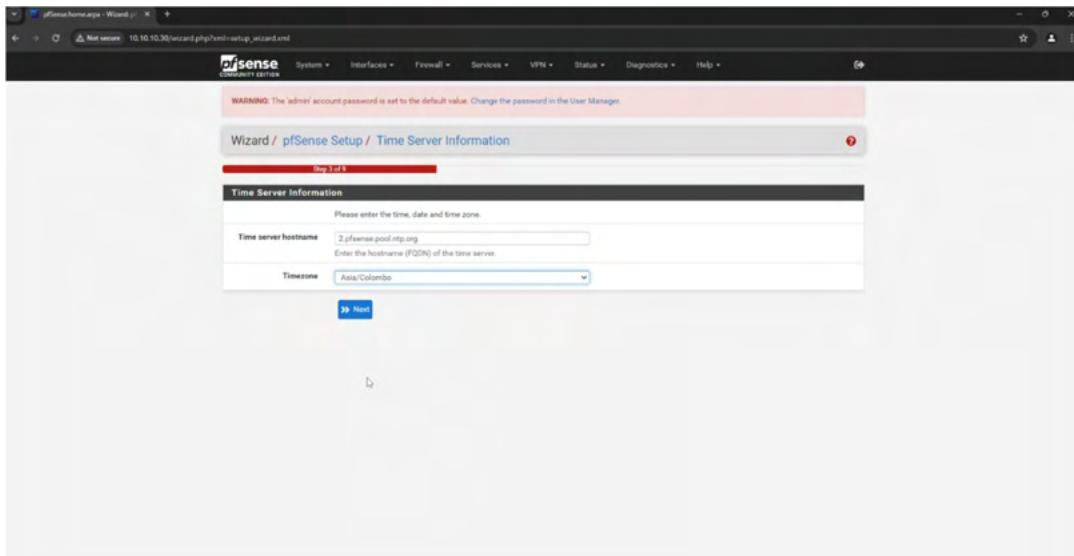
(Figure -50)

Add DNS And Time Zone



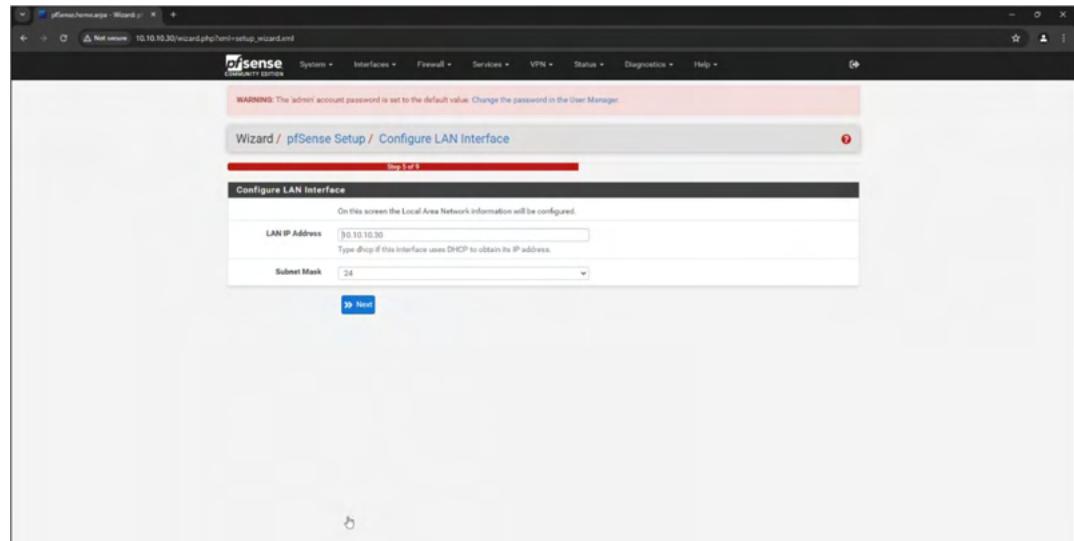
(Figure -51)

Add Time Zone



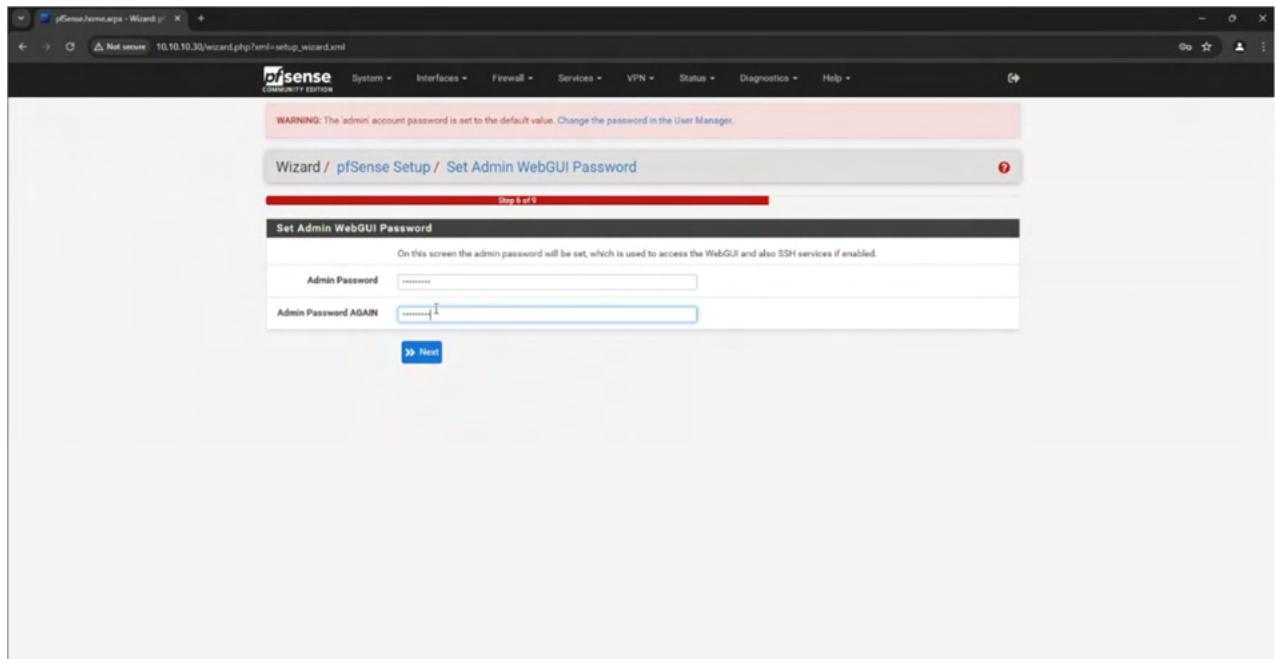
(Figure -52)

Check Ip For The LAN Interface



(Figure -53)

Change Default Password Into Strong Password



(Figure -54)

Pfsense Dashboard

(Figure -55)

Add Pfsense LAN Firewall Rules

The screenshot shows the Pfsense Firewall / Rules / LAN interface. A message at the top states: "The changes have been applied successfully. The firewall rules are now reloading in the background. Monitor the filter reload progress." Below this, there are tabs for Floating, WAN, and LAN, with LAN selected. A table lists various firewall rules:

States	Protocol	Source	Port	Destination	Port	Gateway	Queue	Schedule	Description	Actions
<input checked="" type="checkbox"/>	1/978 KB	*	*	LAN Address	80	*	*		Anti-Lockout Rule	
<input type="checkbox"/>	<input checked="" type="checkbox"/> 0/0 B	IPv4+6	*	*	*	*	*	none		
<input type="checkbox"/>	<input checked="" type="checkbox"/> 0/0 B	IPv4+6 ICMP	*	*	*	*	*	none		
<input type="checkbox"/>	<input checked="" type="checkbox"/> 0/0 B	IPv4+6 TCP/UDP	*	*	*	53 (DNS)	*	none		
<input type="checkbox"/>	<input checked="" type="checkbox"/> 0/16 KB	IPv4	*	LAN subnets	*	*	*	none	Default allow LAN to any rule	
<input type="checkbox"/>	<input checked="" type="checkbox"/> 0/0 B	IPv6	*	LAN subnets	*	*	*	none	Default allow LAN IPv6 to any rule	
<input type="checkbox"/>	<input checked="" type="checkbox"/> 0/0 B	IPv4+6 TCP	*	*	*	80 (HTTP)	*	none		
<input type="checkbox"/>	<input checked="" type="checkbox"/> 0/0 B	IPv4+6 TCP	*	*	*	443 (HTTPS)	*	none		

At the bottom, there are buttons for Add, Delete, Move, Copy, Save, and Separator.

(Figure -56)

Add Static Route For LAN.

The screenshot shows the Pfsense System / Routing / Gateways interface. A message at the top states: "The changes have been applied successfully." Below this, there are tabs for Gateways, Static Routes, and Gateway Groups, with Gateways selected. A table lists gateways:

Name	Default	Interface	Gateway	Monitor IP	Description	Actions
<input checked="" type="checkbox"/> WAN_DHCP		WAN	192.168.8.1	192.168.8.1	Interface WAN_DHCP Gateway	
<input checked="" type="checkbox"/> WAN_DHCP6		WAN			Interface WAN_DHCP6 Gateway	
<input type="checkbox"/> Route_1		LAN	10.10.10.1	10.10.10.1		
<input type="checkbox"/> Route_2		LAN	10.10.10.2	10.10.10.2		

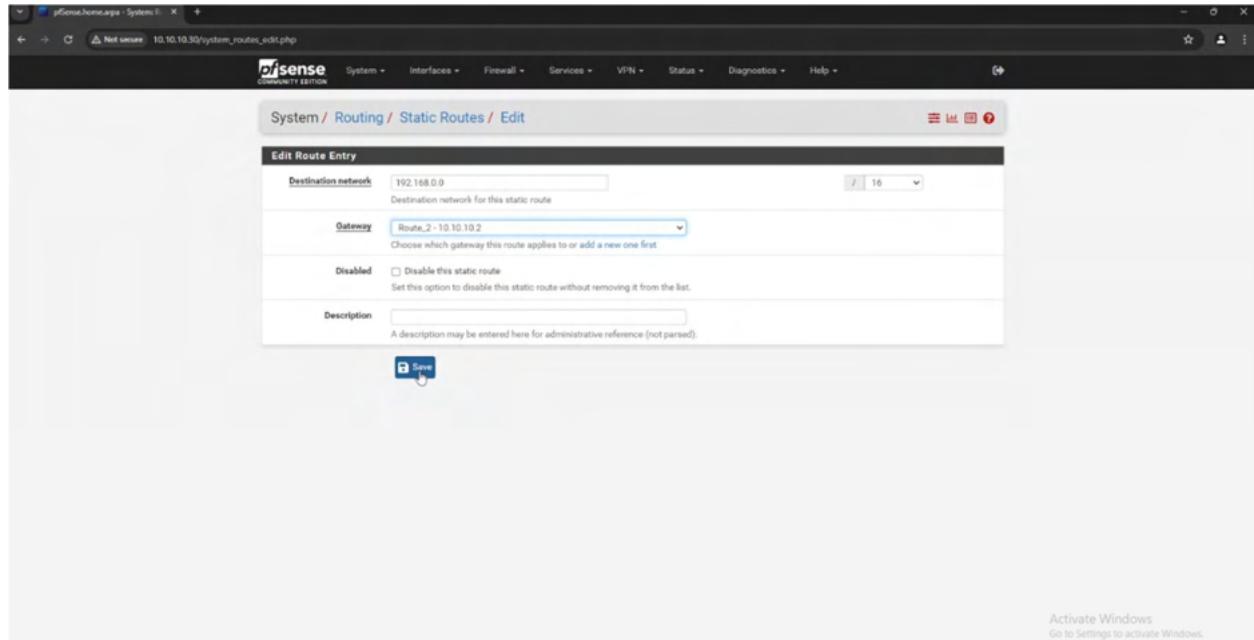
Below the table, there is a section for Default gateway:

- Default gateway IPv4: Automatic (dropdown menu)
- Default gateway IPv6: Automatic (dropdown menu)

Buttons at the bottom include Save and Add.

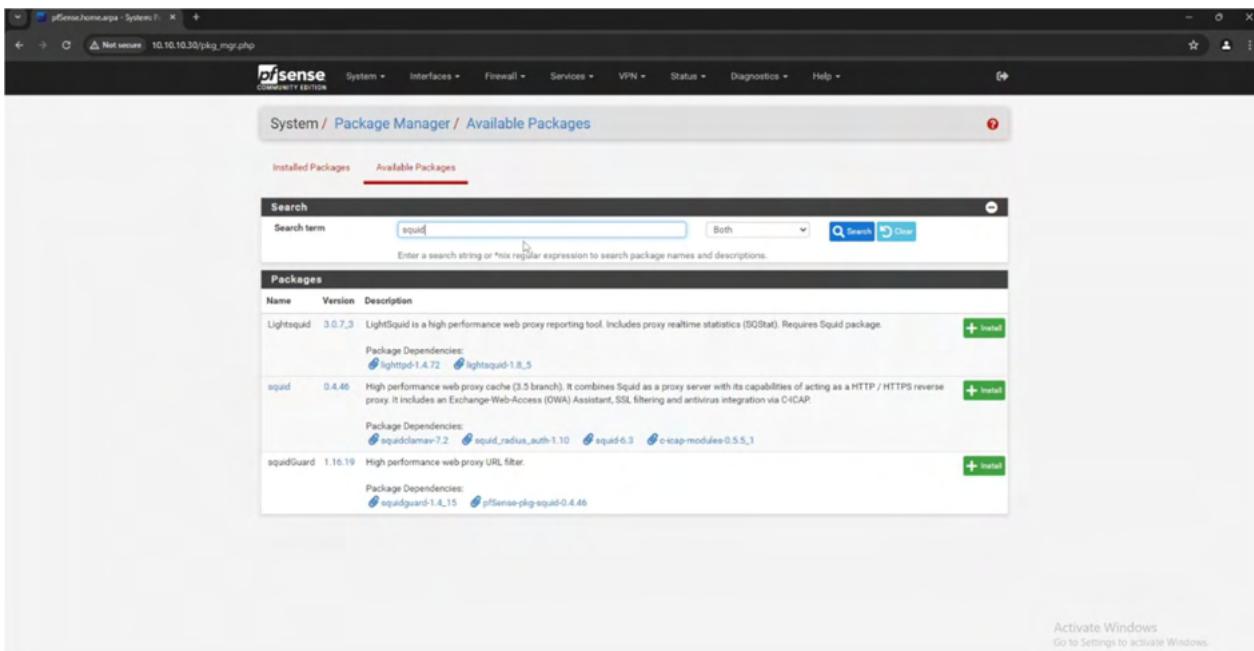
(Figure -57)

Add LAN Network IP



(Figure -58)

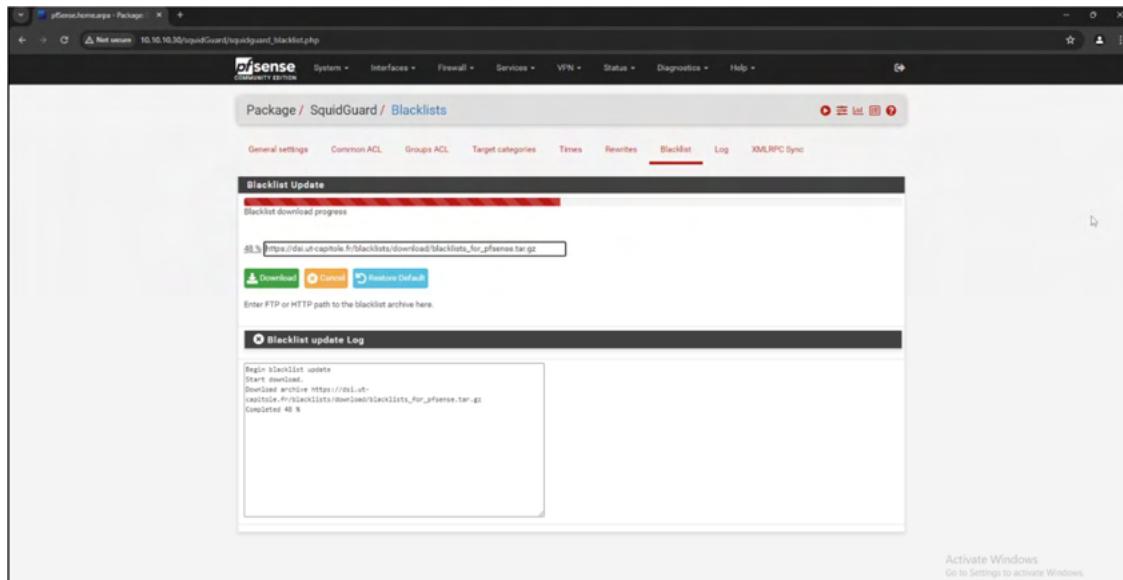
Installation Of Squid, Squid Guard and Light Squid



(Figure -59)

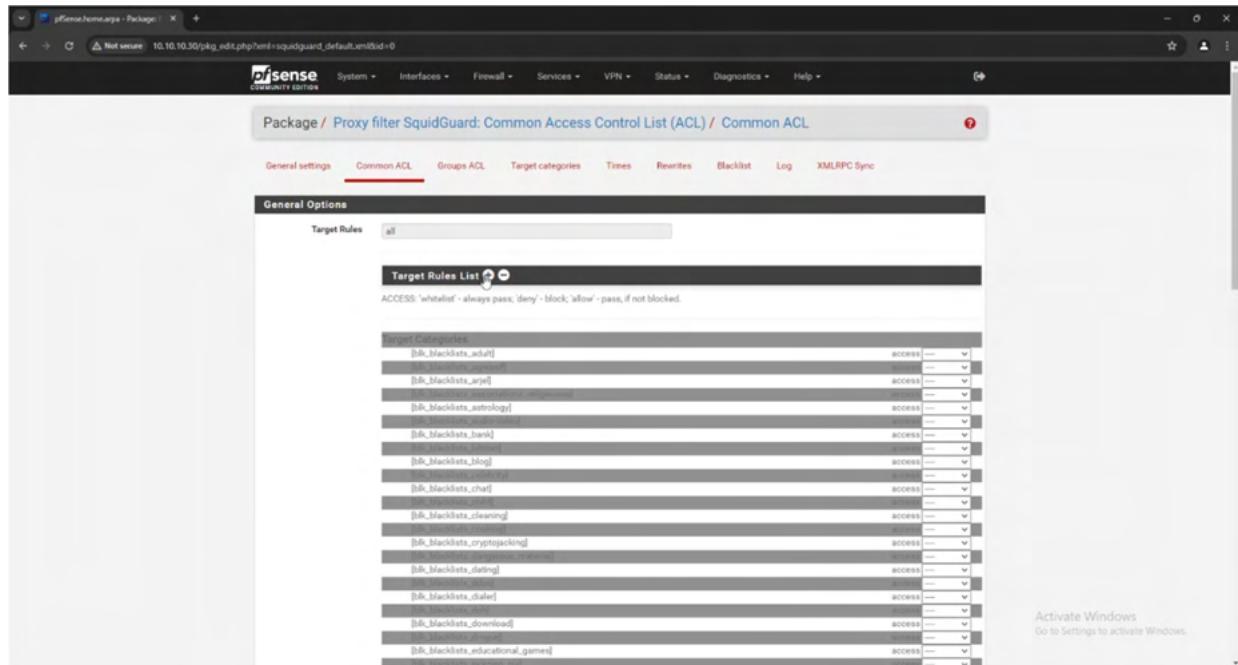
5.4 PROXY ACLS

Install Shallalist



(Figure -60)

Add Blacklist- (Shallalist)



(Figure -61)

Add Interfaces Into Proxy Service

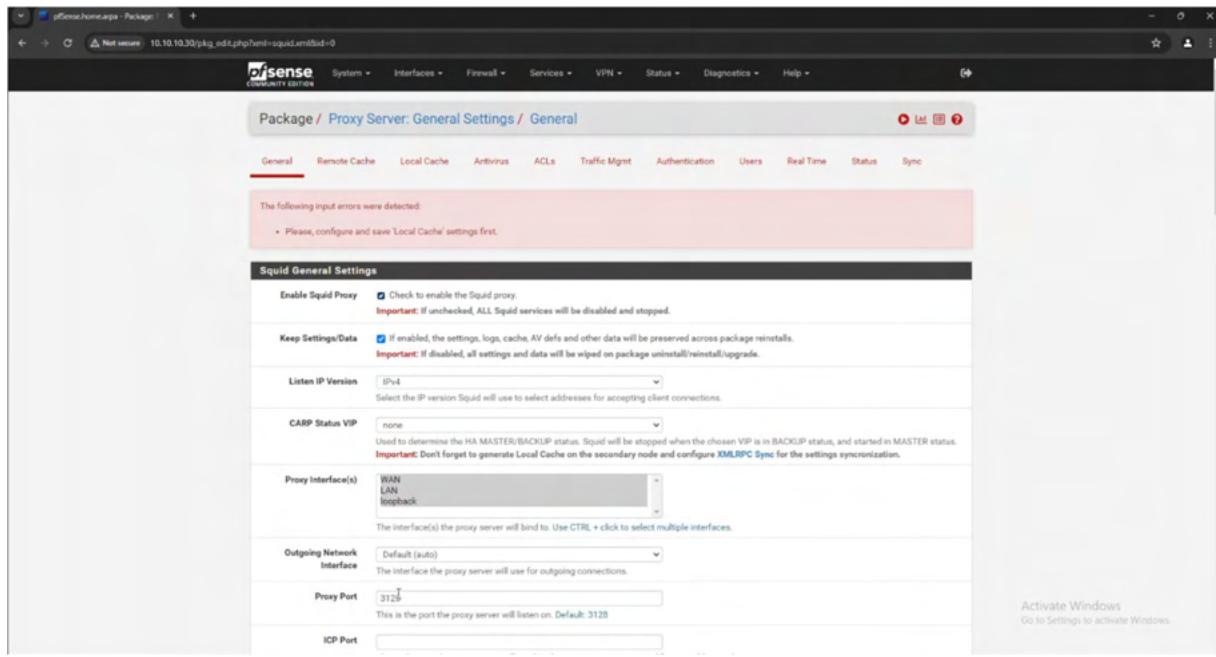
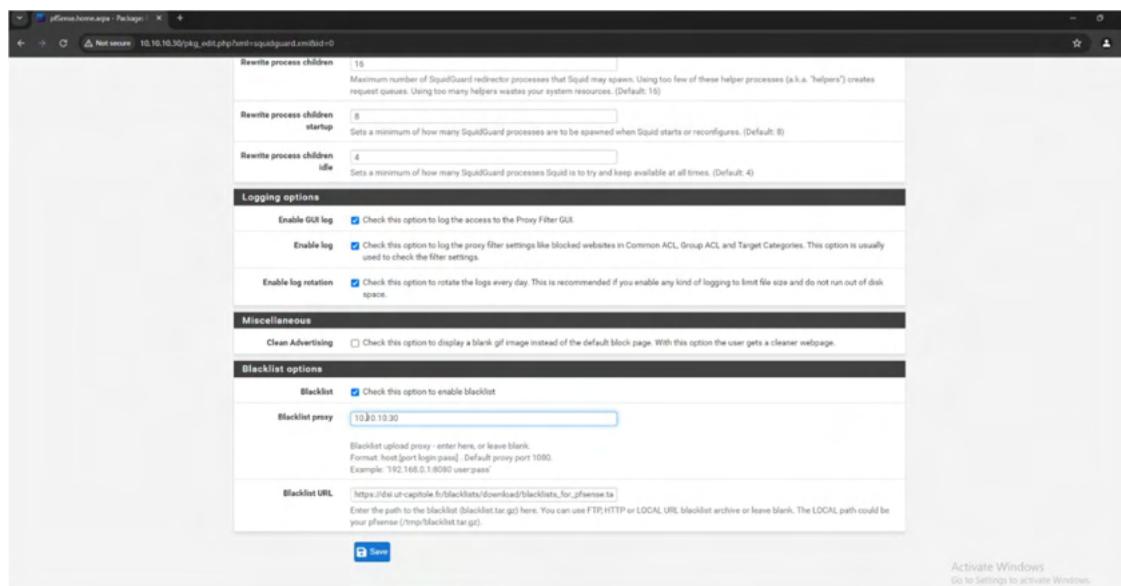


Figure – Configure Proxy Server



Add LAN Network Into Proxy Service

The screenshot shows the pfSense web interface with the URL 10.10.10.30/pkg_edit.php?xml=squid_nac.xml&id=0. The main menu includes System, Interfaces, Firewall, Services, VPN, Status, Diagnostics, Help, and pfSense COMMUNITY EDITION. The current page is 'Package / Proxy Server: Access Control / ACLs'. A red warning box at the top says: 'WARNING: The 'admin' account password is set to the default value. Change the password in the User Manager.' Below it, the 'Squid Access Control Lists' section has tabs for General, Remote Cache, Local Cache, Antivirus, **ACLs**, Traffic Mgmt, Authentication, Users, Real Time, Status, and Sync. The 'Allowed Subnets' tab is selected, showing the entry '172.16.0.0/16'. A note below says: 'Enter subnets that are allowed to use the proxy in CIDR format. All the other subnets won't be able to use the proxy. Put each entry on a separate line. When 'Allow Users on Interface' is checked on 'General' tab, there is no need to add the 'Proxy Interface(s)' subnet(s) to this list.'

(Figure -64)

Add Websites To Block List

The screenshot shows the pfSense web interface with the URL 10.10.10.30/pkg_edit.php?xml=squid_nac.xml&id=0. The main menu includes System, Interfaces, Firewall, Services, VPN, Status, Diagnostics, Help, and pfSense COMMUNITY EDITION. The current page is 'Package / Proxy Server: Access Control / ACLs'. The 'Block List' section has tabs for Whitelist, Blacklist, Block User Agents, and Block MIME Types (Reply Only). The 'Blacklist' tab is selected, showing entries for 'Facebook.com' and 'youtube.com'. A note below says: 'Destination domains that will be blocked for the users that are allowed to use the proxy. Put each entry on a separate line. You can also use regular expressions.' Other sections include 'Whitelist' (empty), 'Block User Agents' (empty), and 'Block MIME Types (Reply Only)' (empty).

(Figure -65)

5.5 VIRTUALIZATION

ESXI-MAIN (Add Ip Into The ESXI)



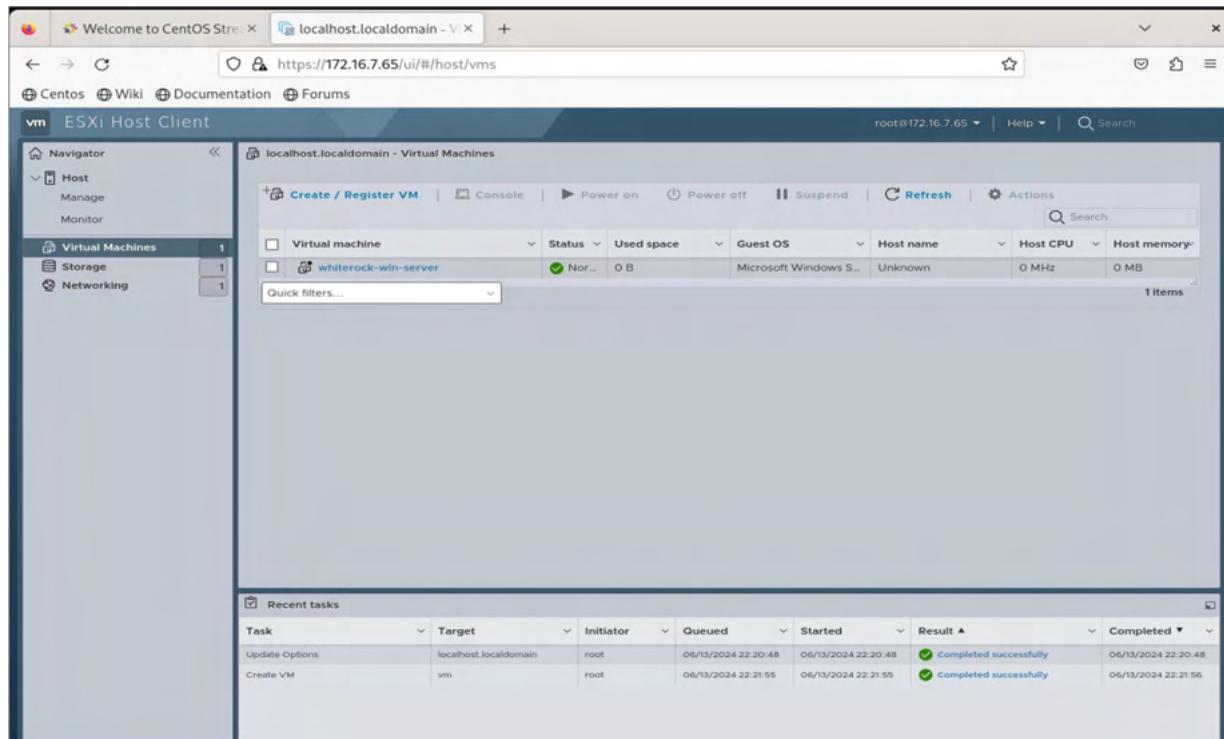
(Figure -66)

ESXI-BACKUP (add ip into the ESXI)



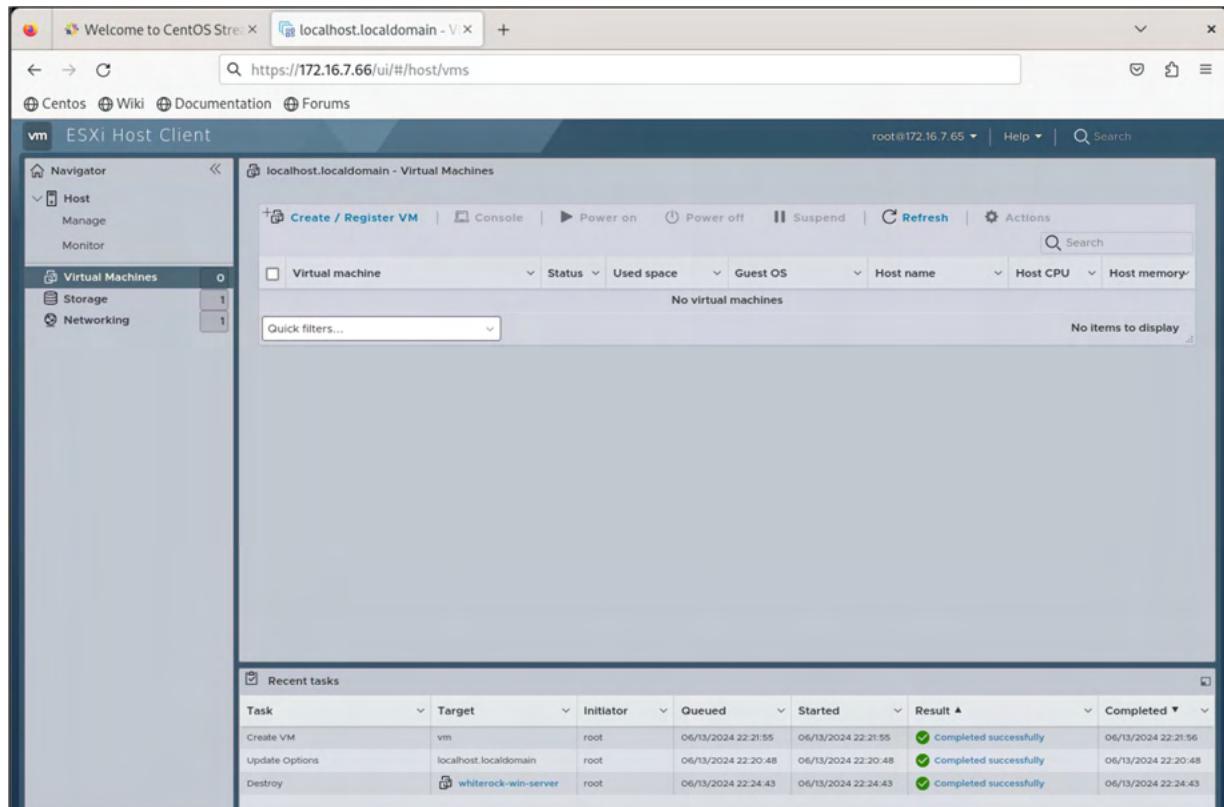
(Figure -67)

Login into MAIN ESXI



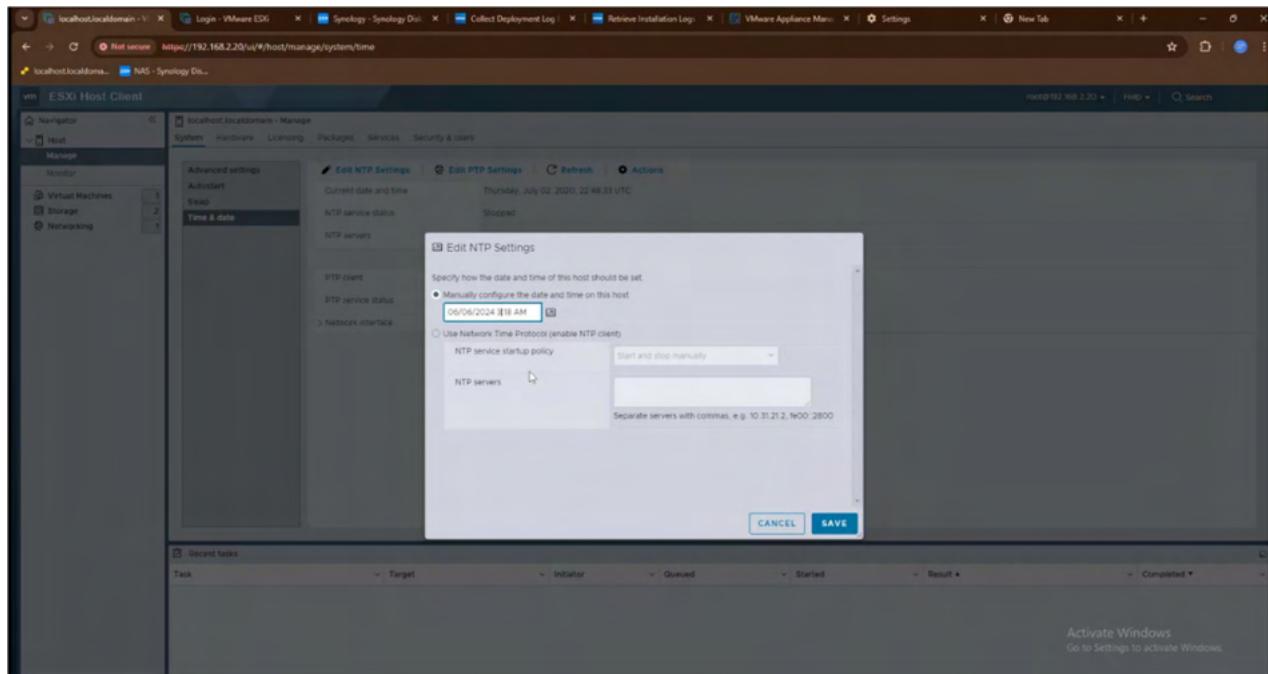
(Figure -68)

Login into BACKUP ESXI



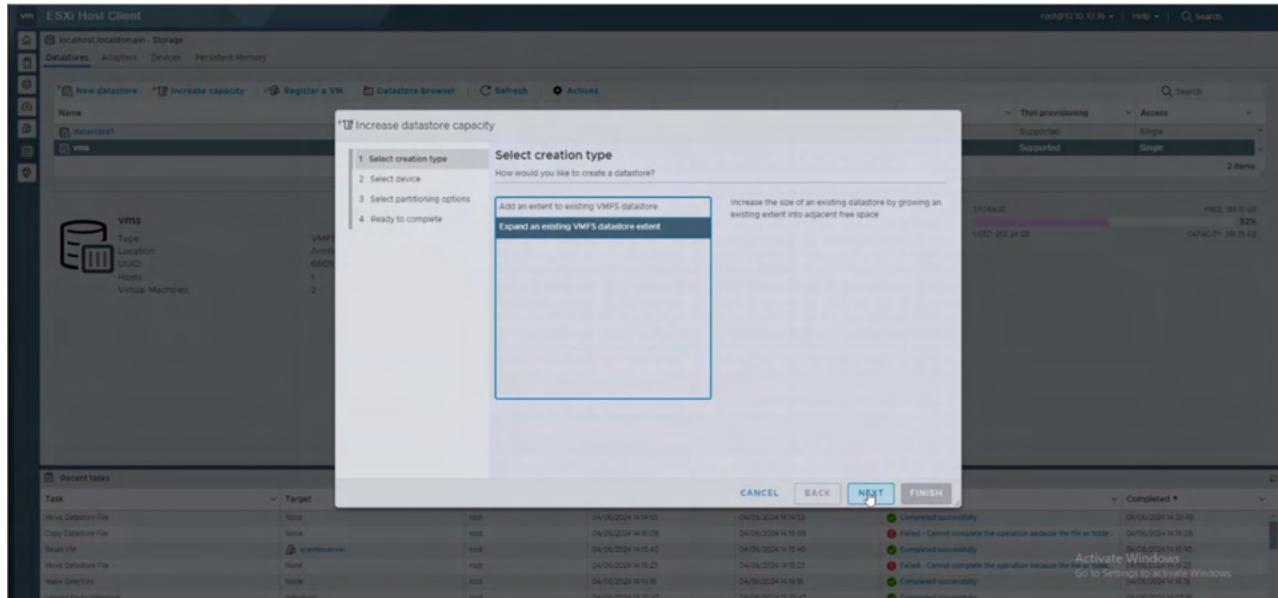
(Figure -69)

Change Correct Time Zones into Sri Lanka



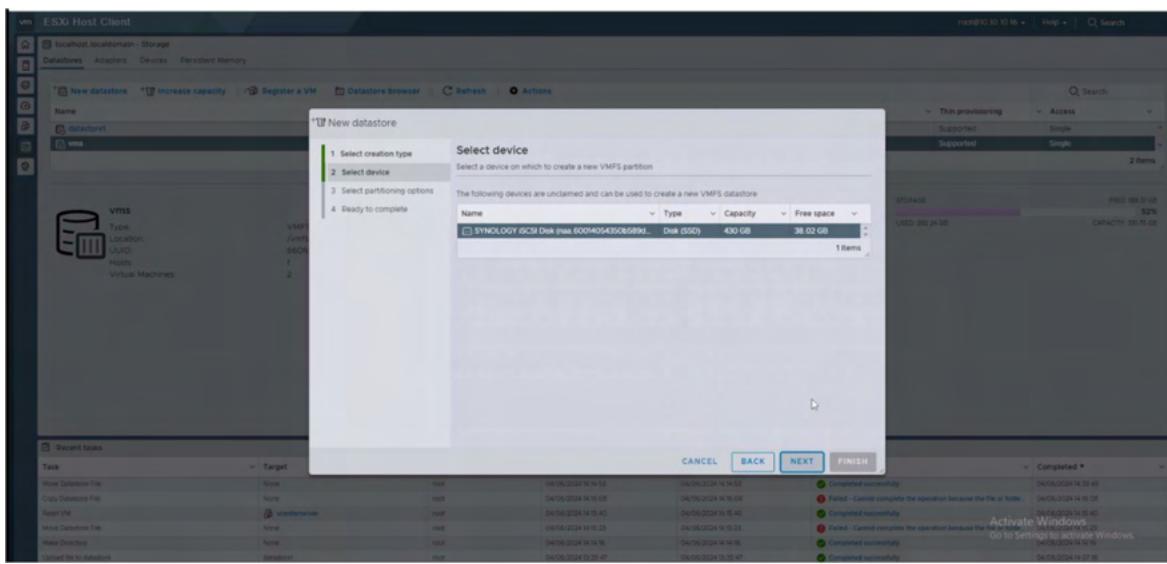
(Figure -70)

Add NAS Shared Directory Into ESXI MAIN And Backup



(Figure -71)

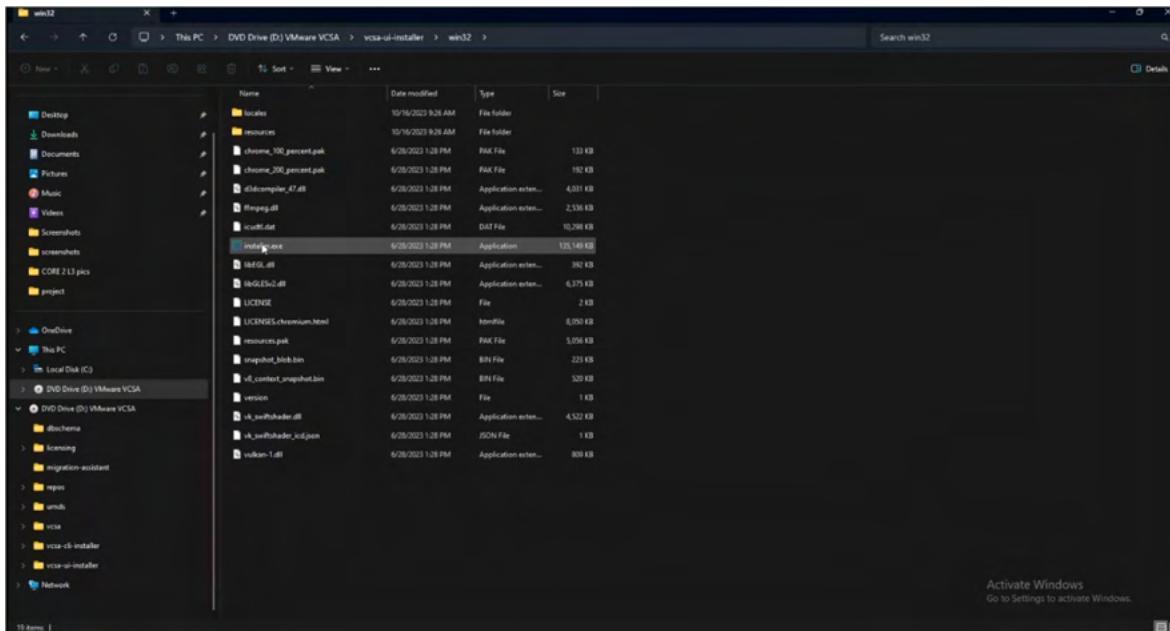
Select NAS



(Figure -72)

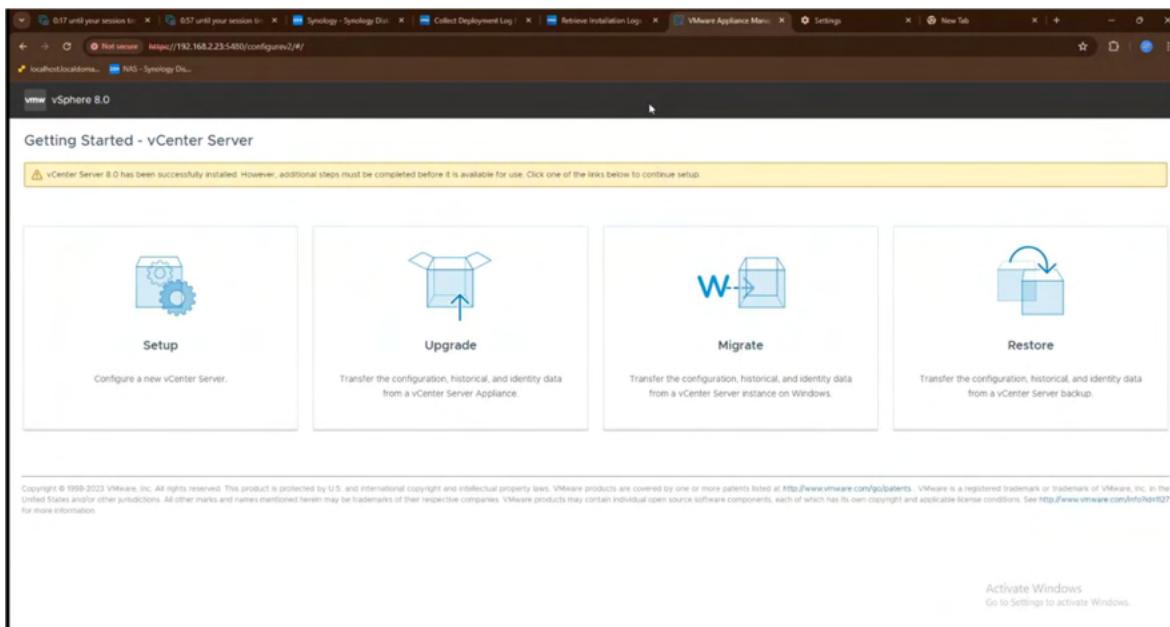
INSTALL V-CENTER

Mount (VMware-VCSA-all-8.0.2-23319993.iso)



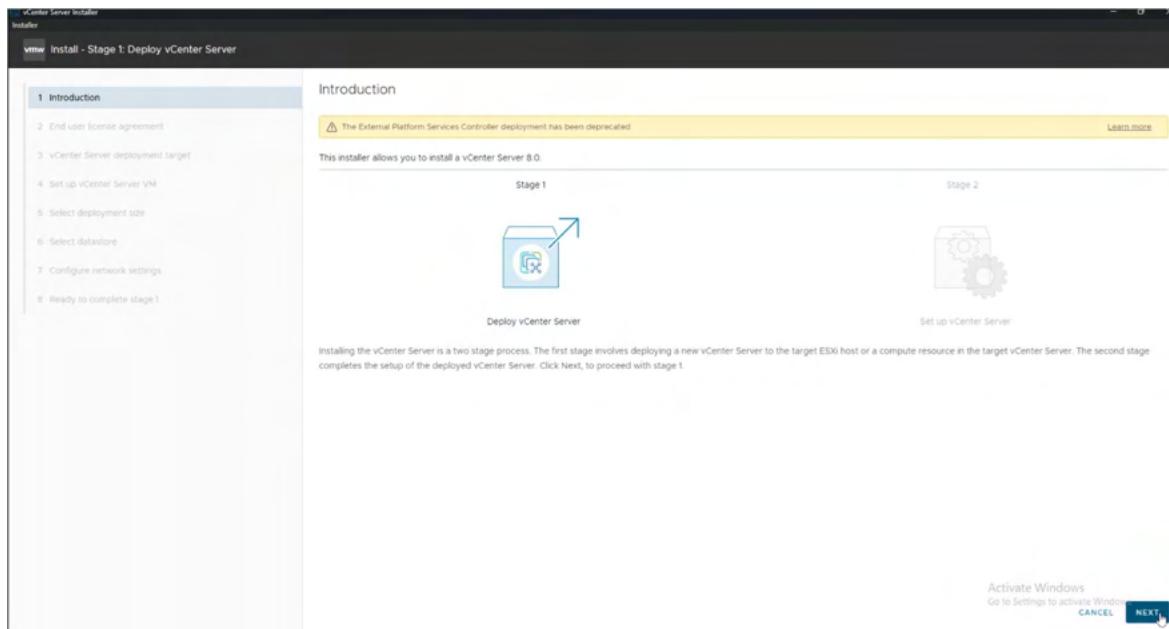
(Figure -73)

Install V-Center Using Windows GUI EXE



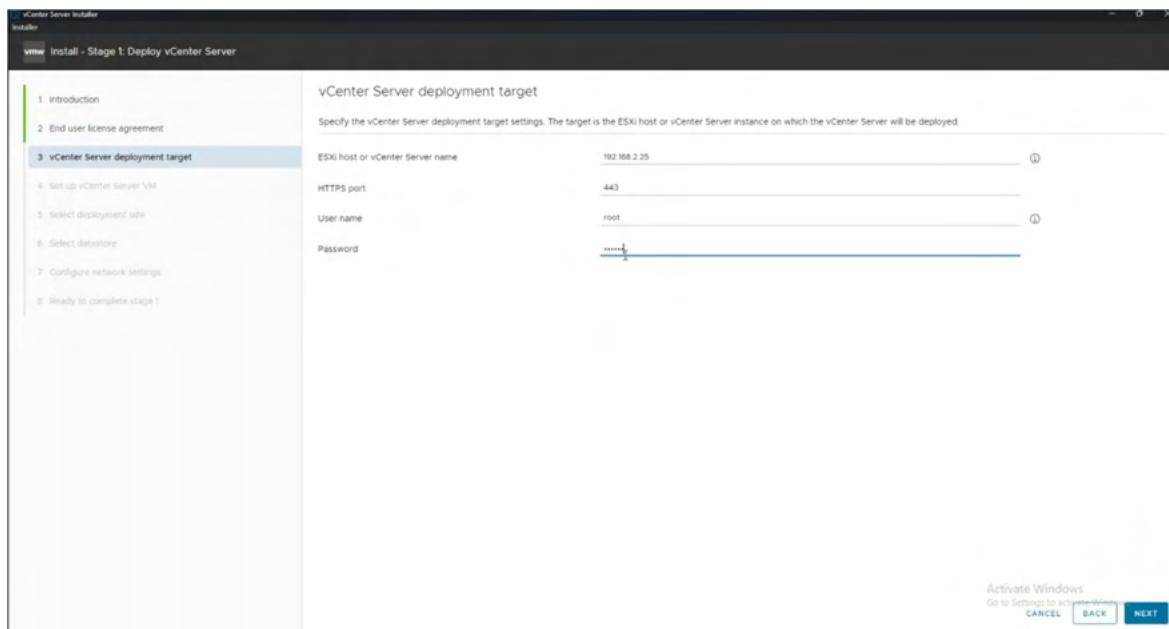
(Figure -74)

Stage -01 Installation



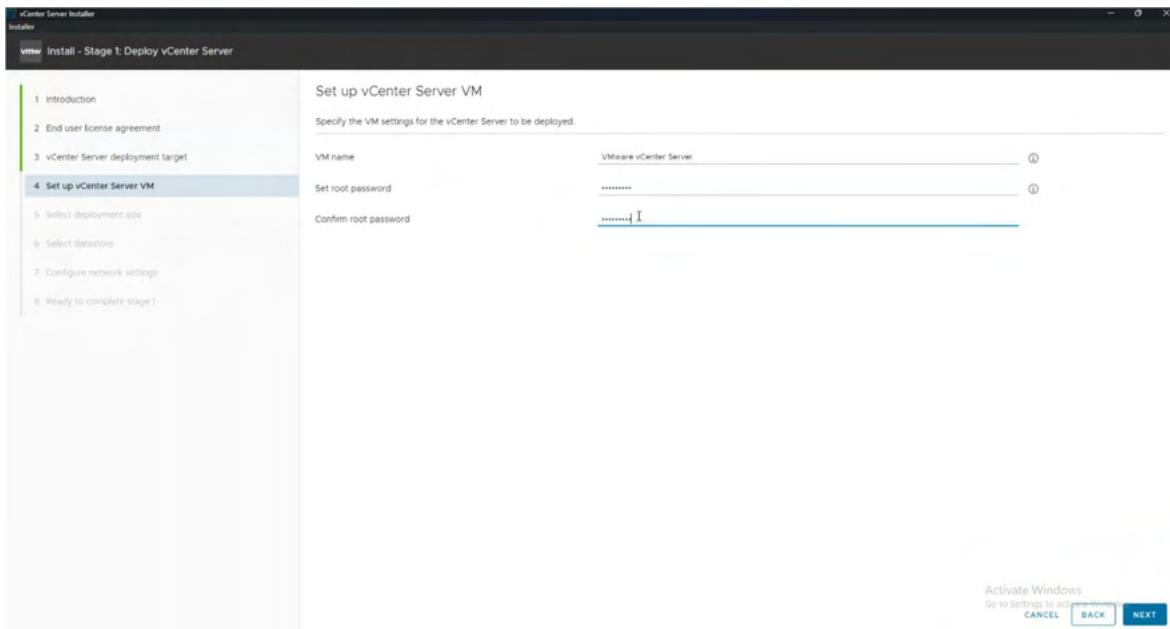
(Figure -75)

Vcenter Server Deployment Target



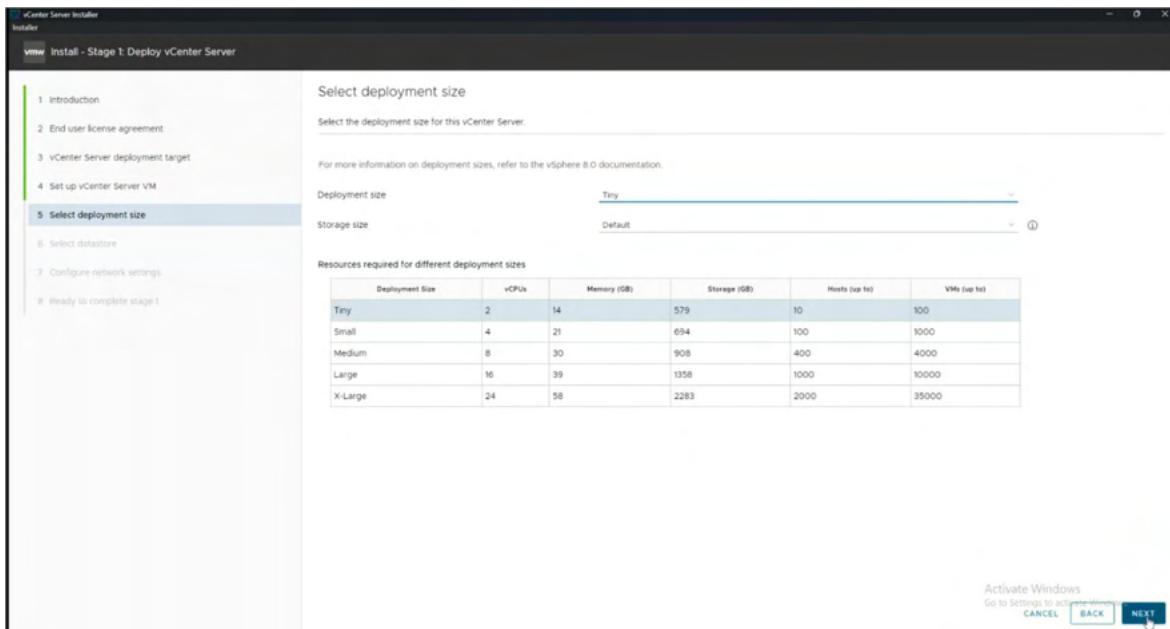
(Figure -76)

Set Root Password for V-center



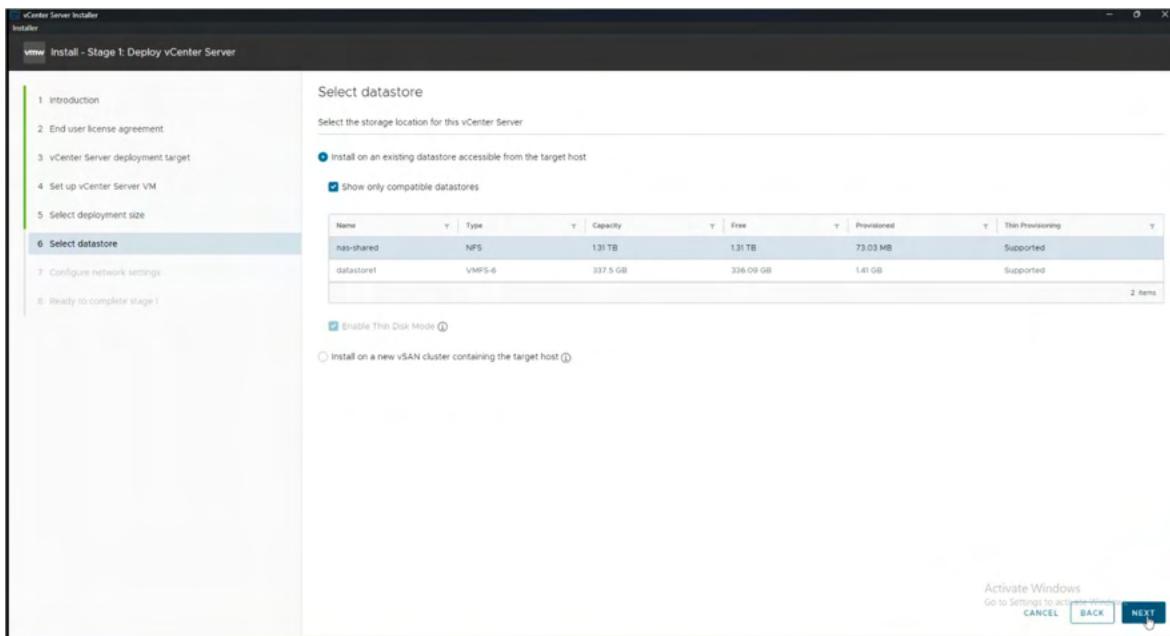
(Figure -77)

Select Deployment Size



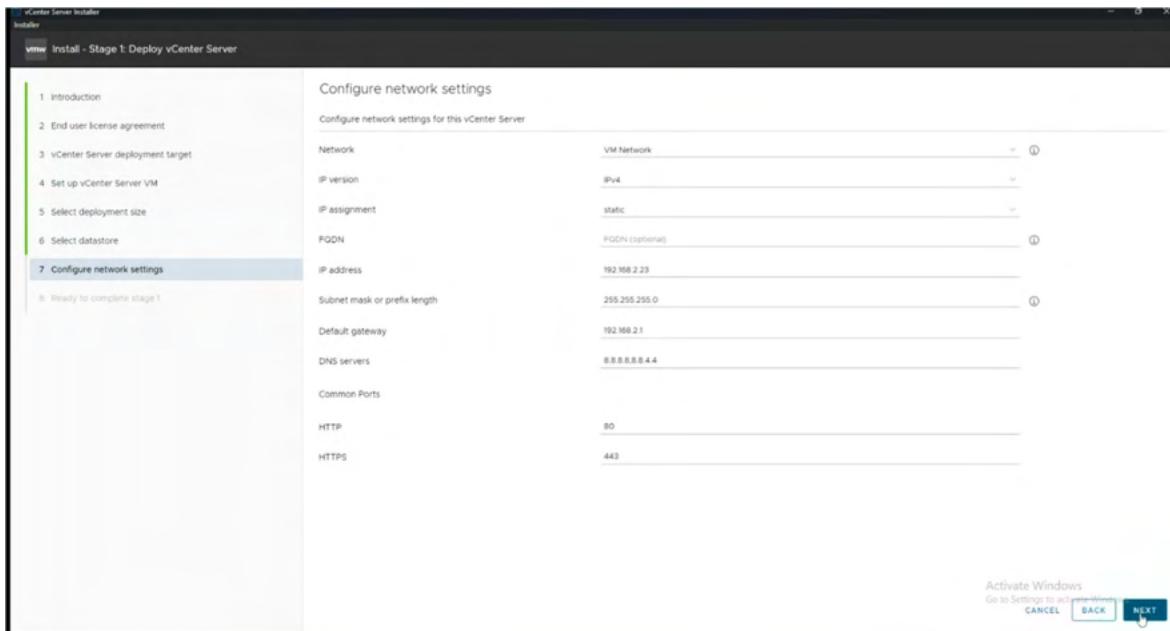
(Figure -78)

Select Datastore(NAS) & Enable Thin Disk Mode



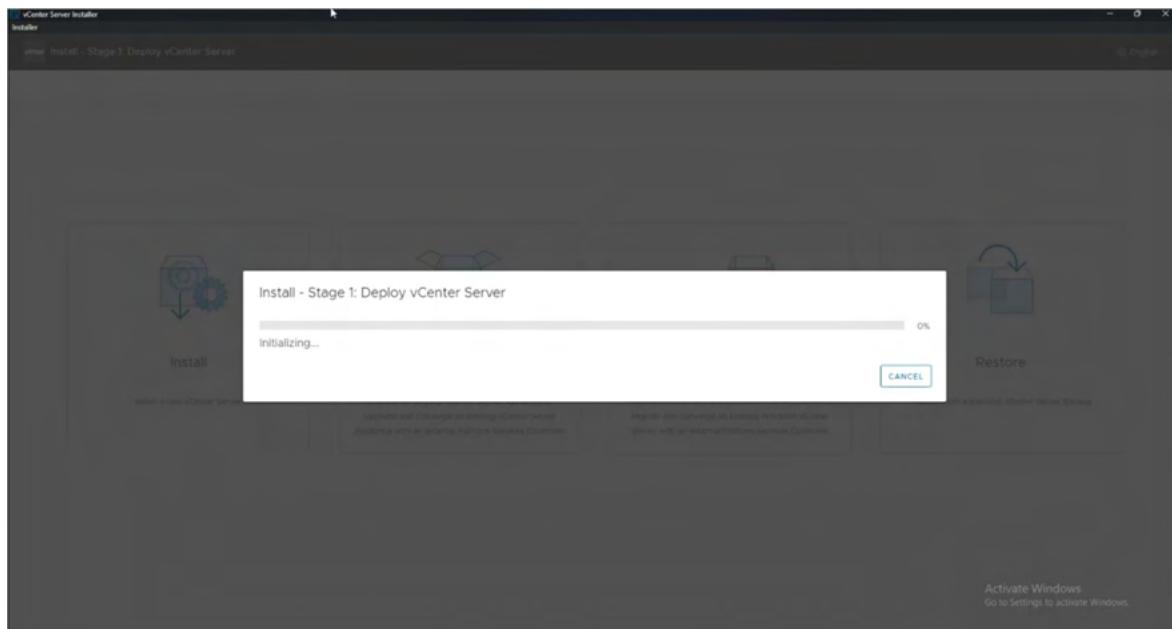
(Figure -79)

Configure Network Settings For V-Center



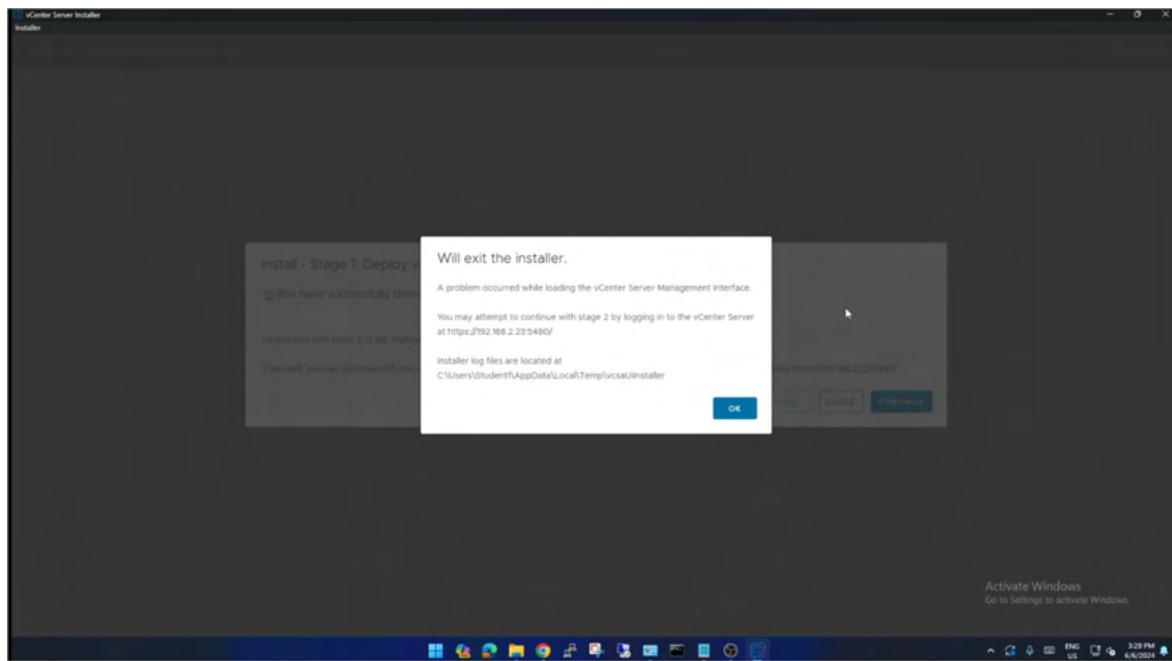
(Figure -80)

Start Installation Stage -01



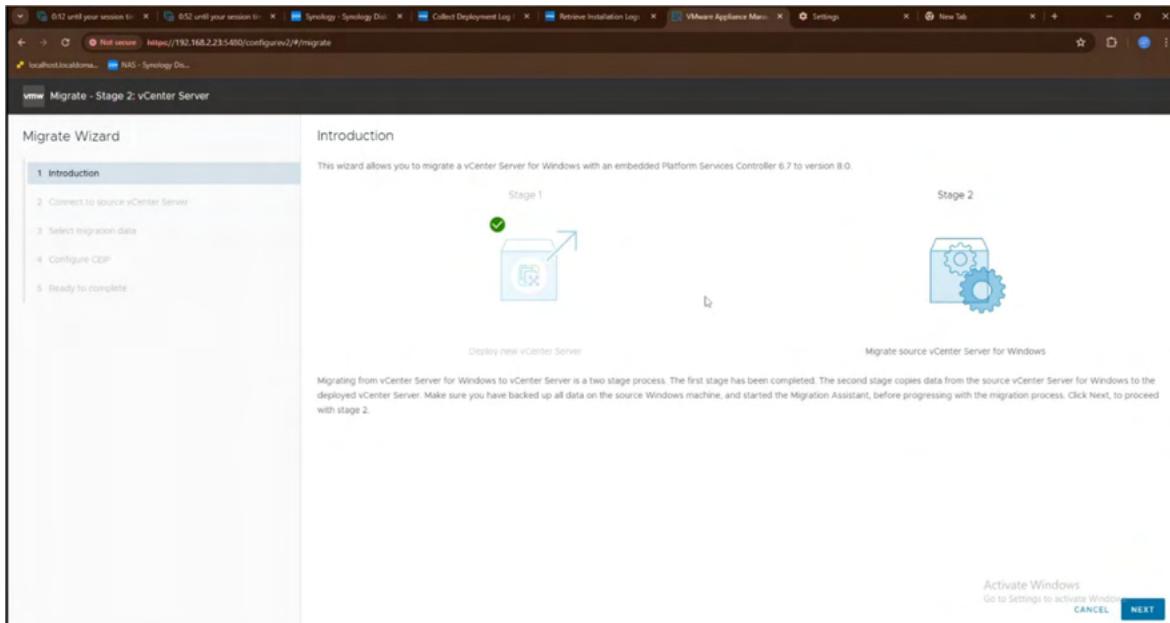
(Figure -81)

V-Center Installation Stage 01 Complete Show Message



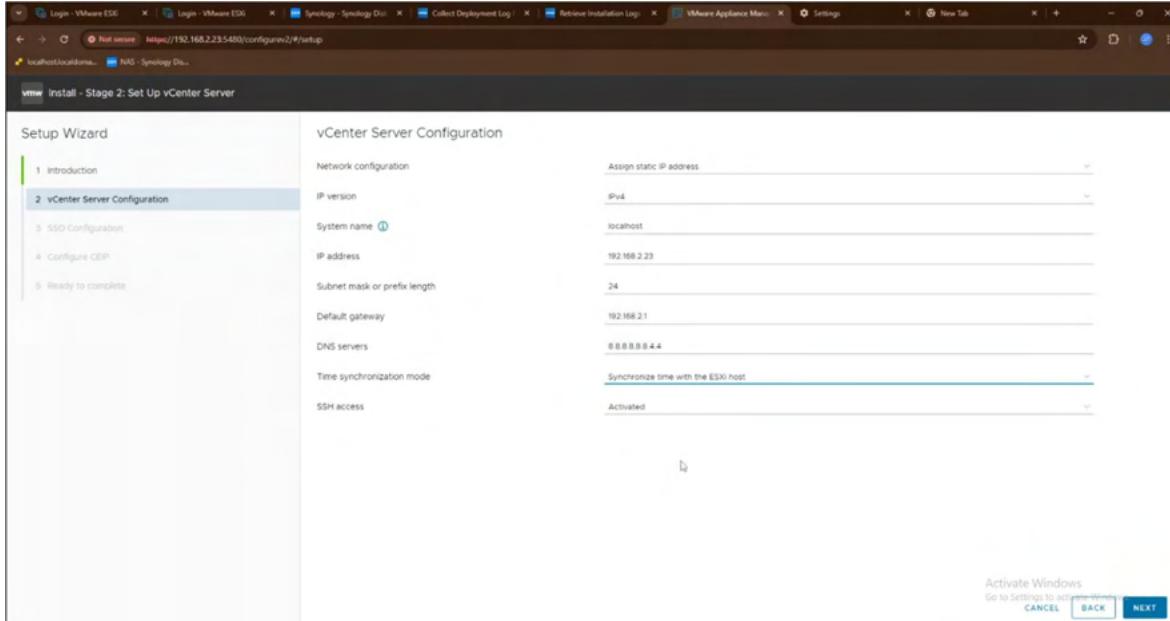
(Figure -82)

Stage -02 Installation



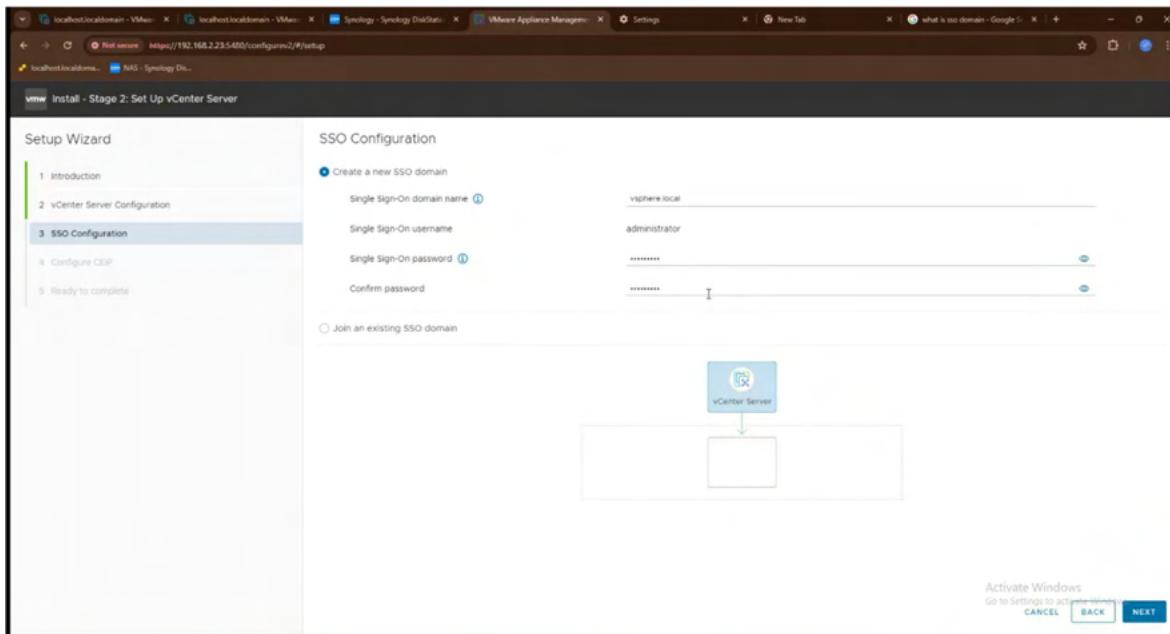
(Figure -83)

V-center Server Configuration



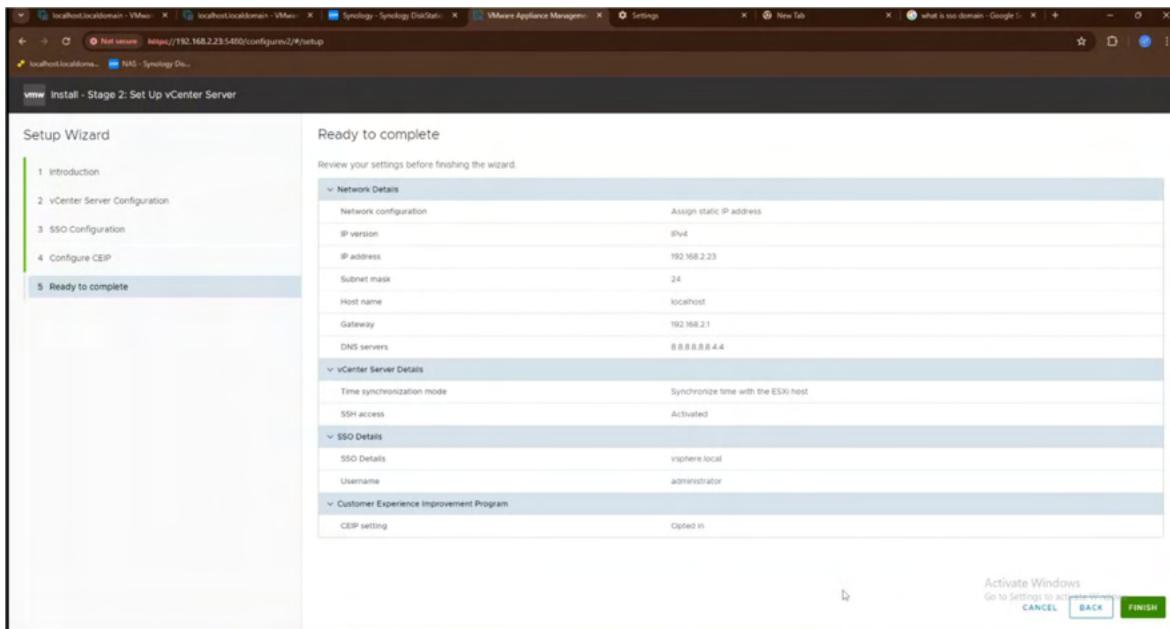
(Figure -84)

SSO Configurations



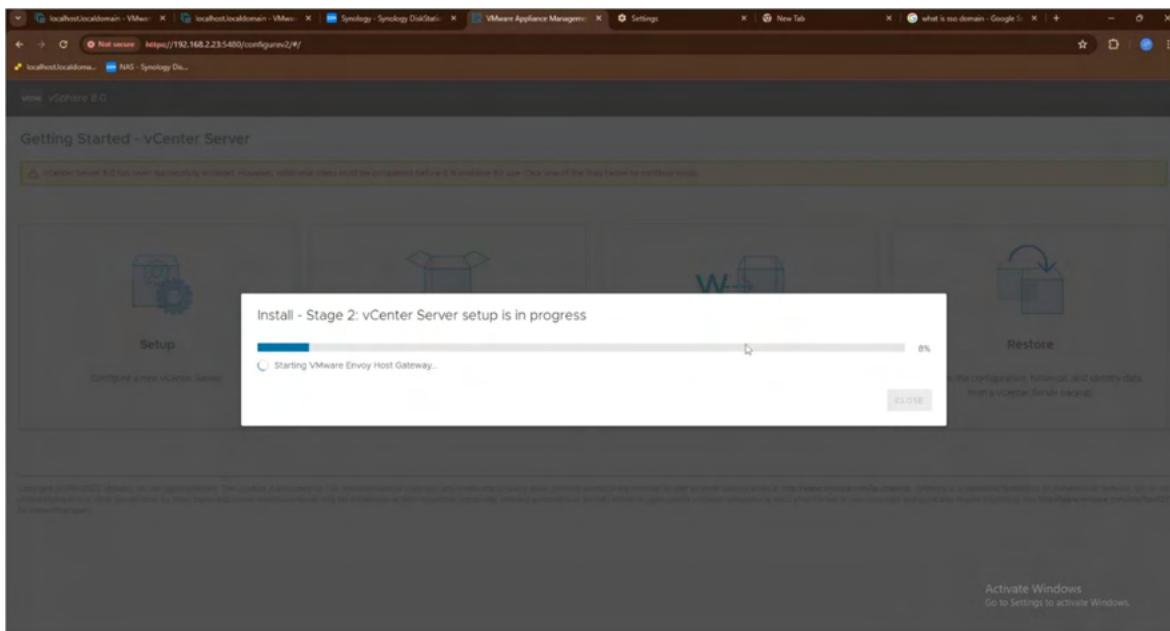
(Figure -85)

Stage 2 Installation Start-Up Confirmation Messages



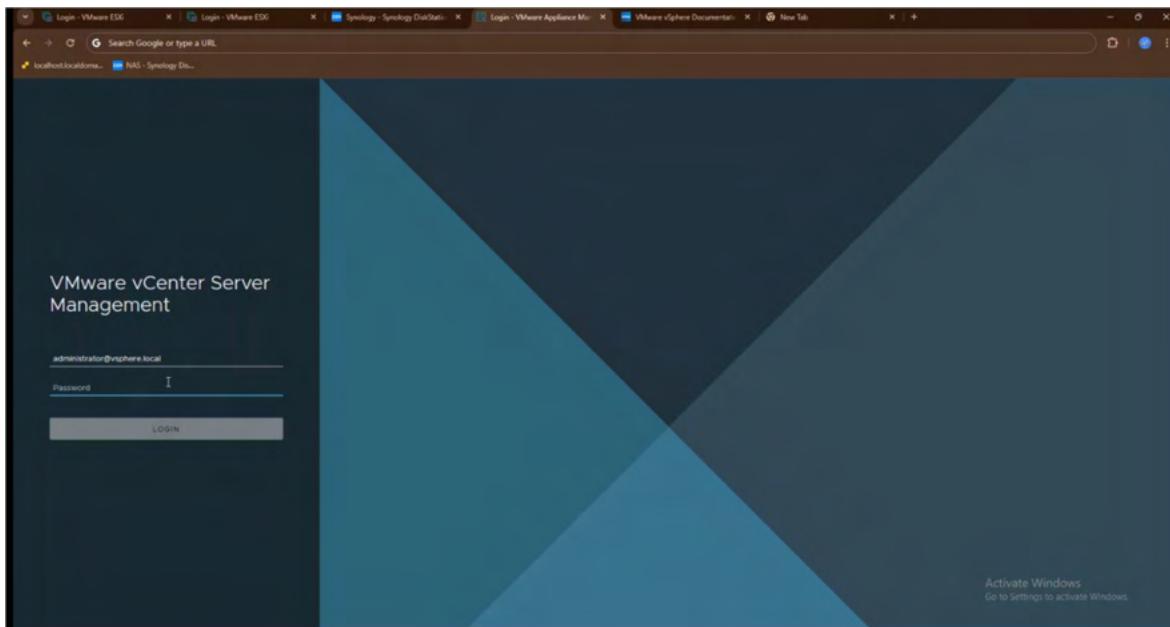
(Figure -86)

Start Installation Stage -02



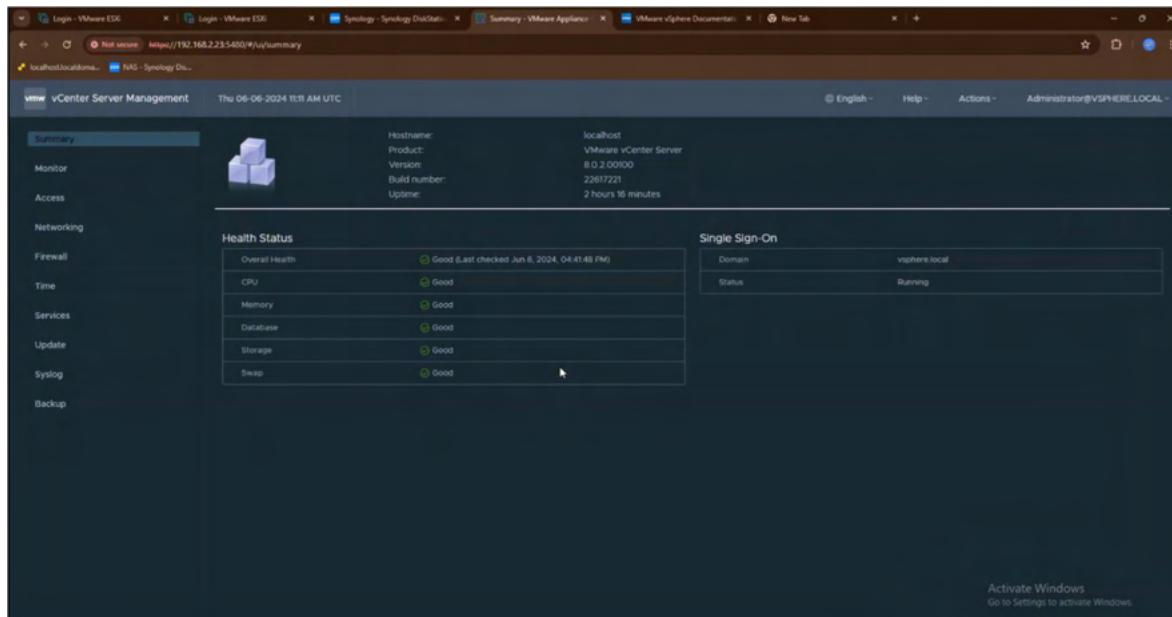
(Figure -87)

V-center Server Management Login Console



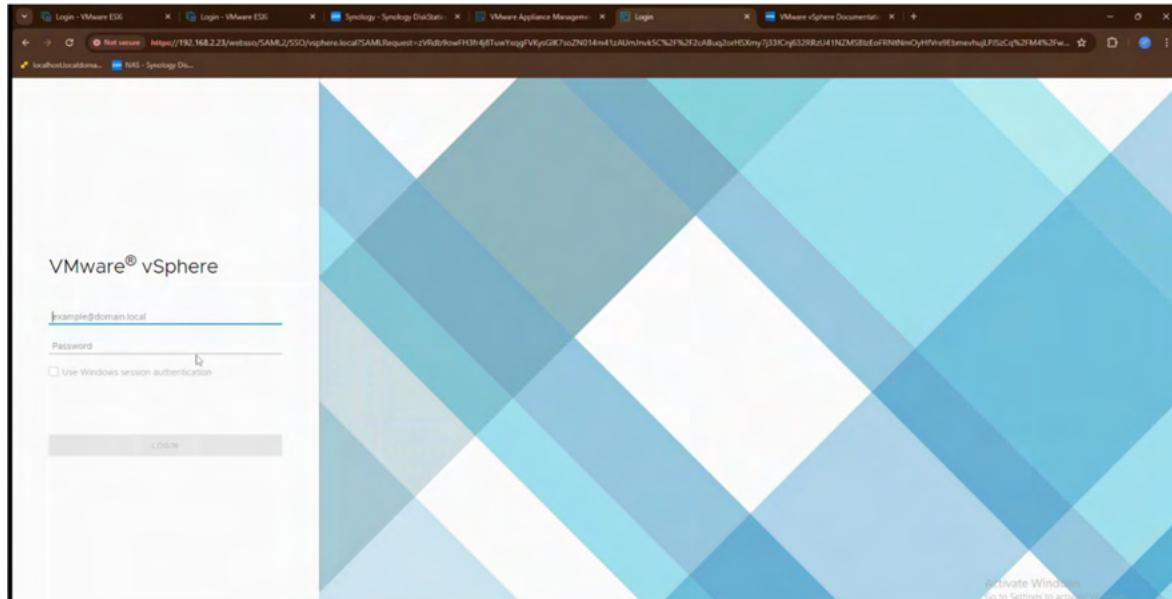
(Figure -88)

V-center Server Management Login Console-Dashboard



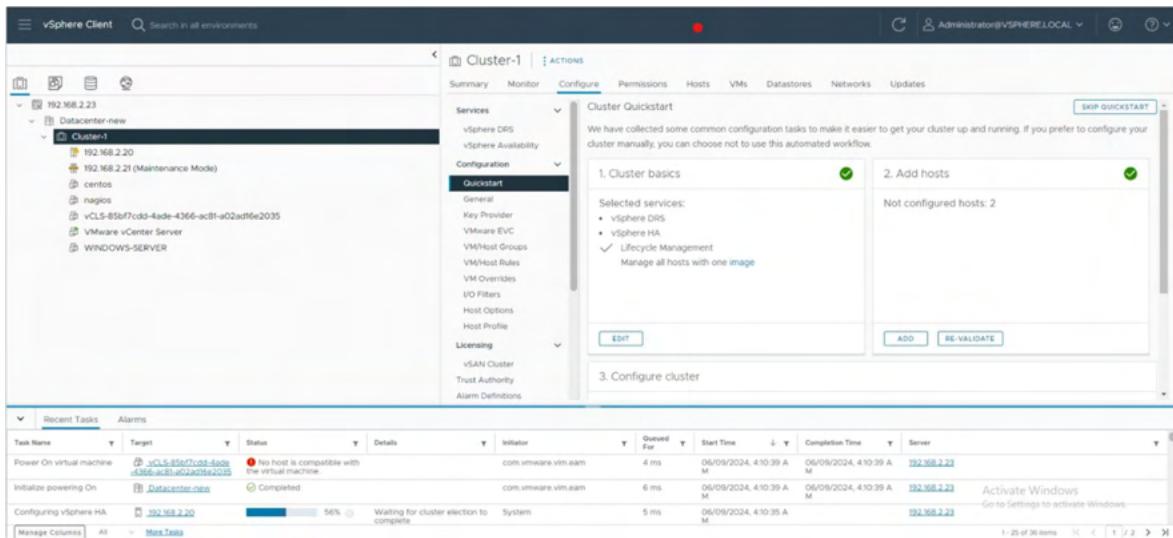
(Figure -89)

Vsphere Server Login



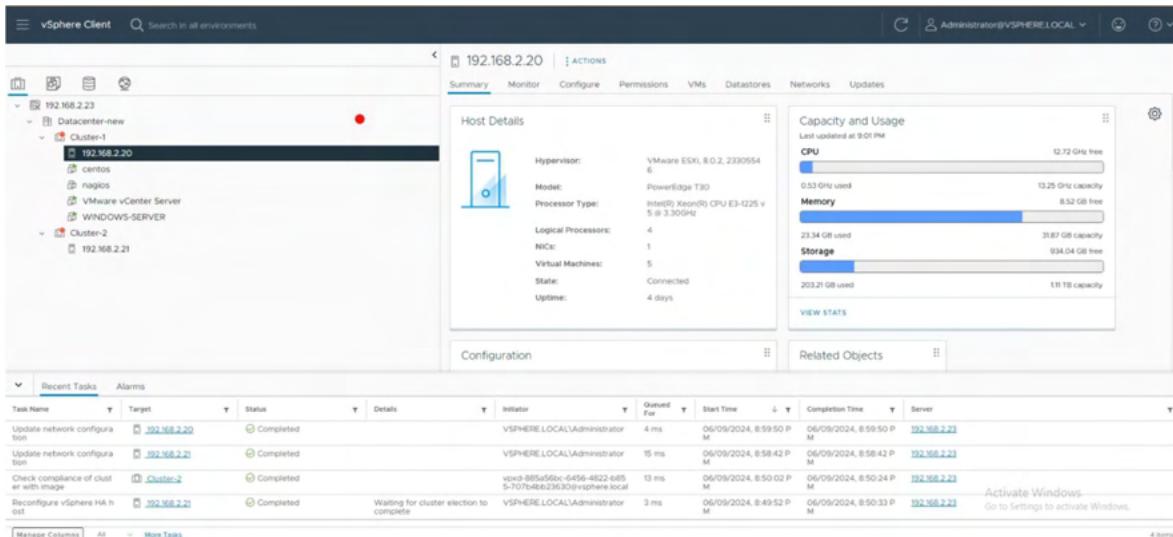
(Figure -90)

Create & Name the New Cluster



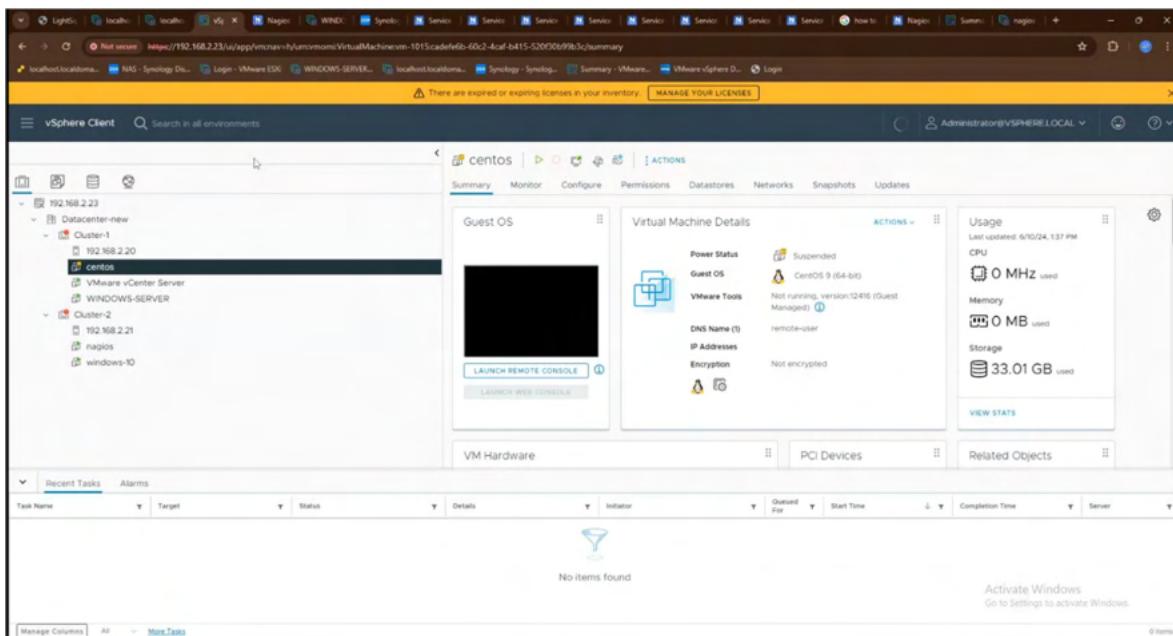
(Figure -91)

Add New & Existing Hosts To Cluster



(Figure -92)

Manage VMs using V-center

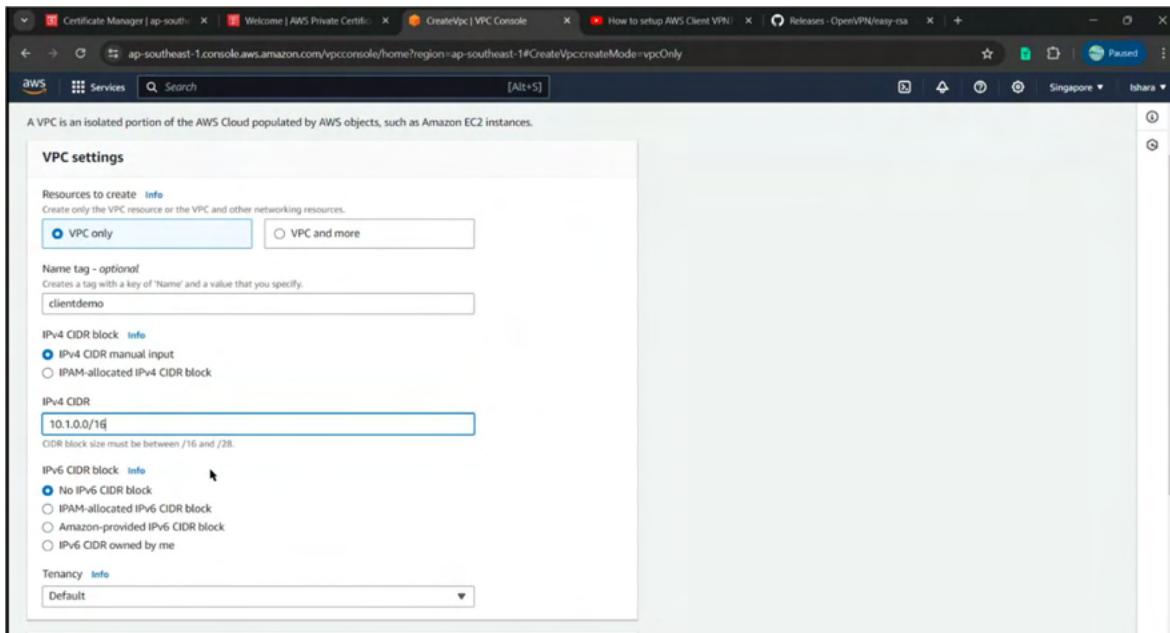


(Figure -93)

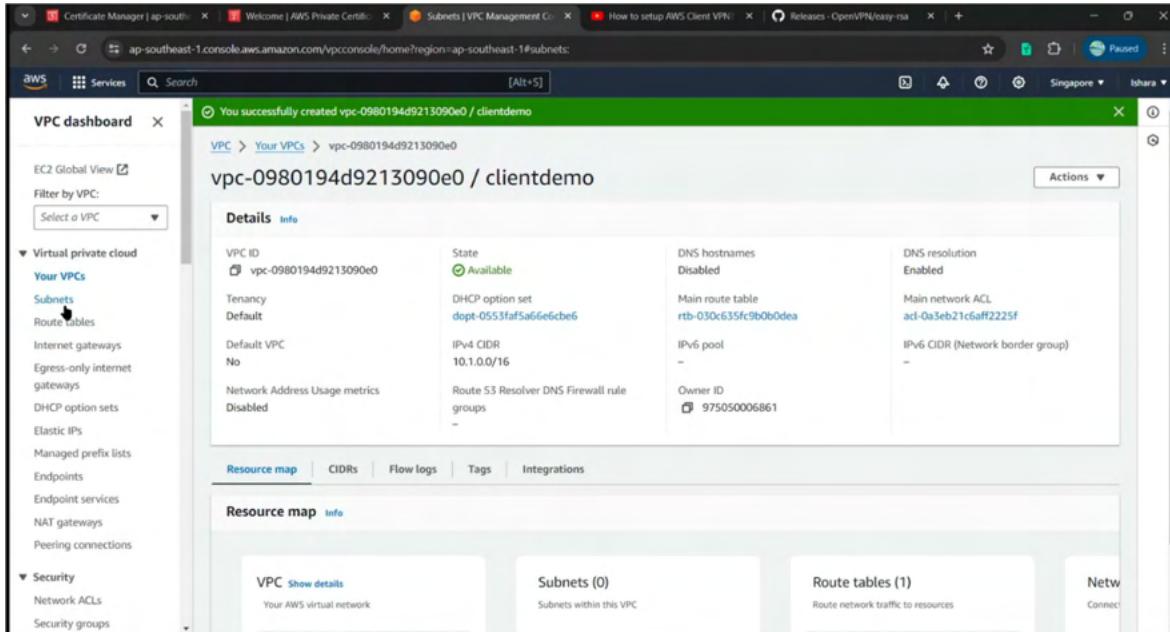
5.6 VPN CONFIGURATION

AWS Cloud and VPN Configurations

Create VPC

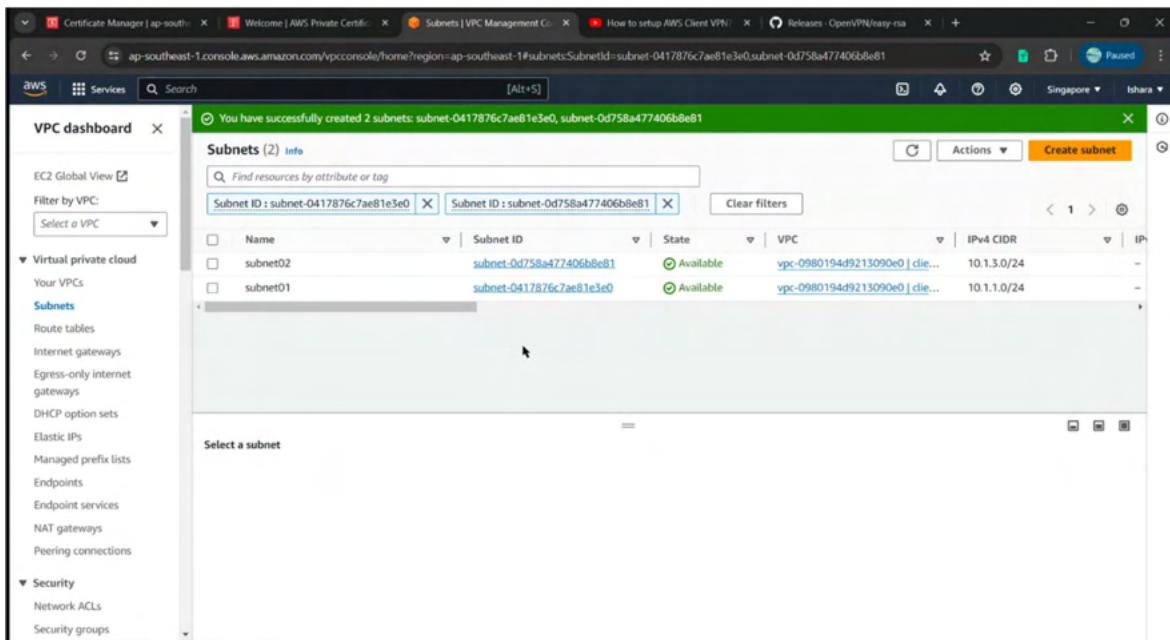


(Figure -94)



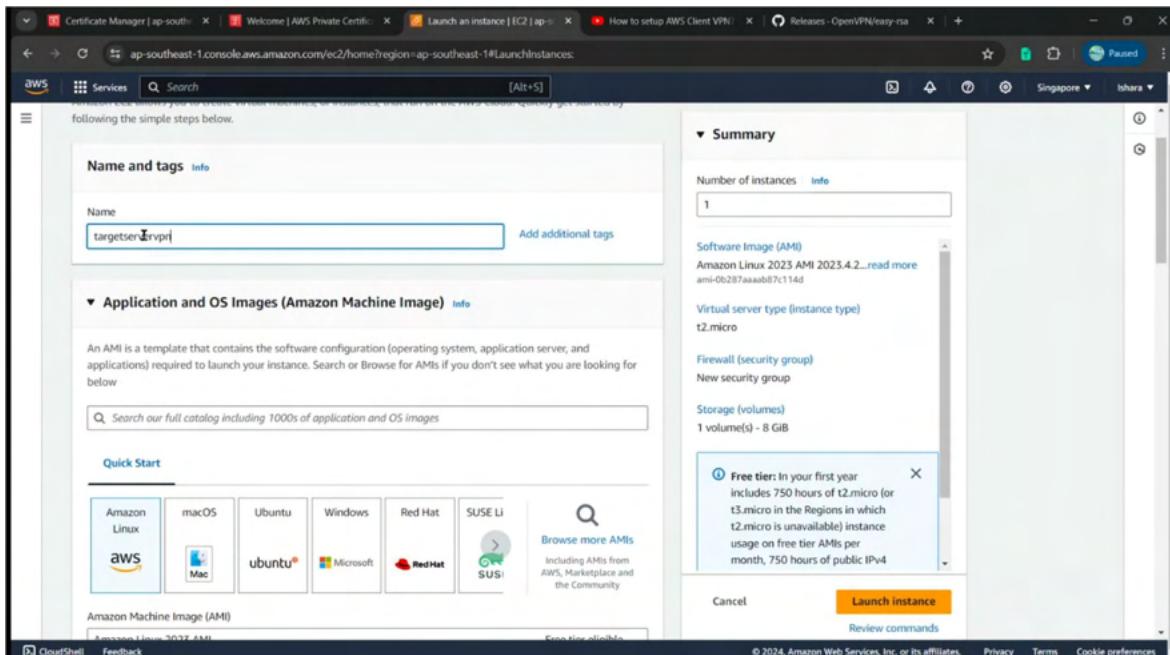
(Figure -95)

Create Subnets



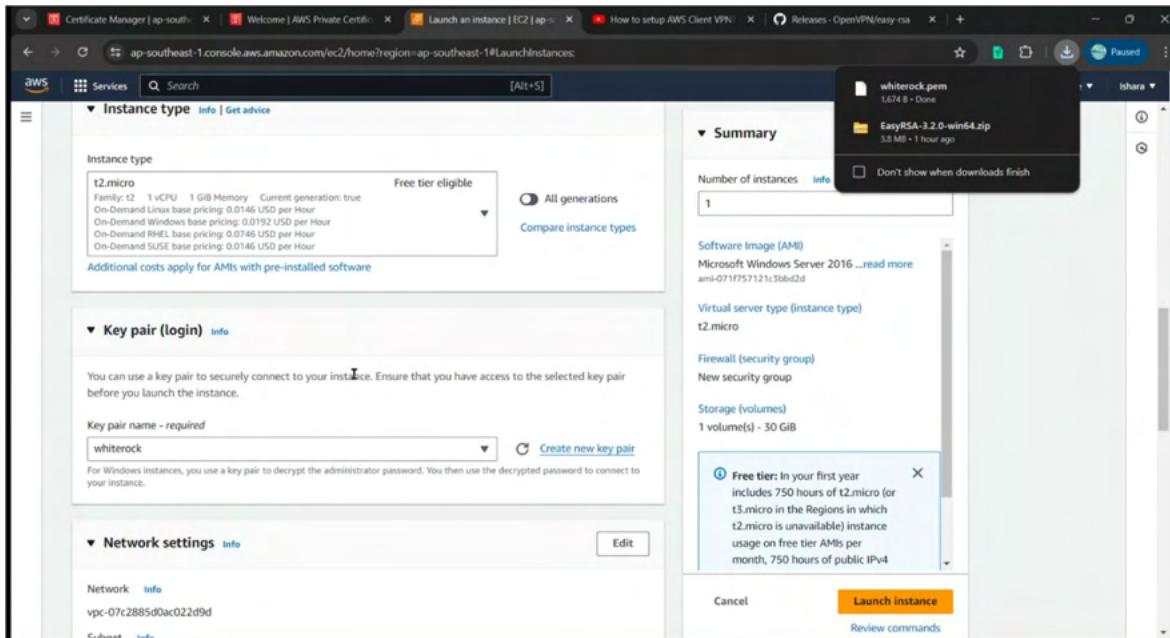
(Figure -96)

Create EC2 Instance



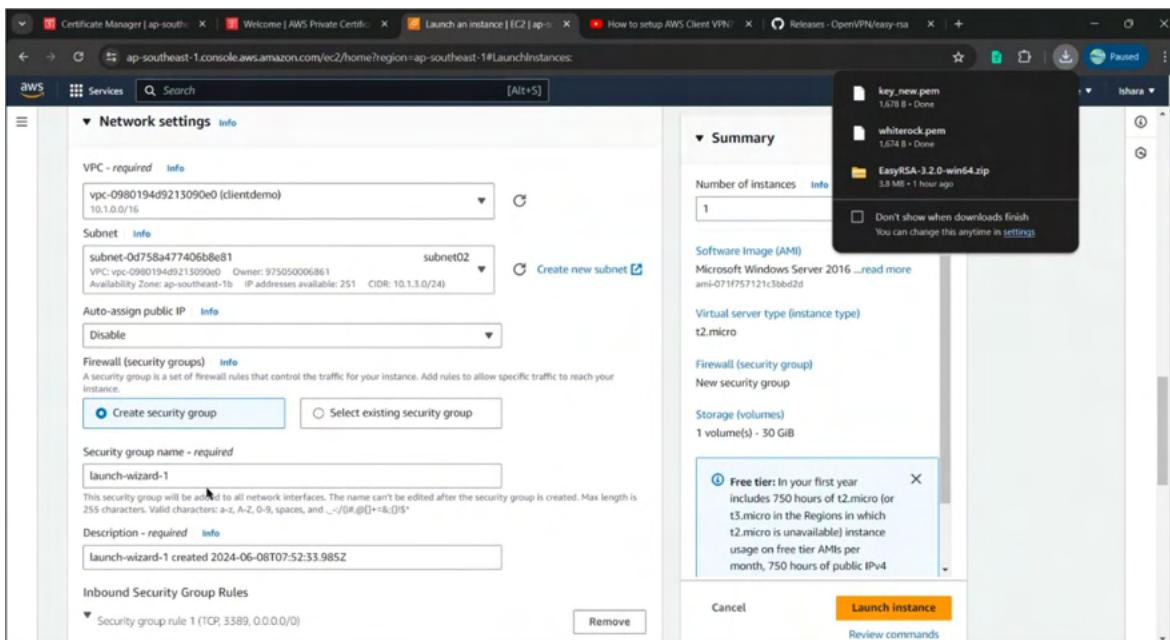
(Figure -97)

Create & Add Key Pair



(Figure -98)

Configure Network Settings



(Figure -99)

Make Own Public Key and Private Key

Download And Extract Easyrsa into A Directory



(Figure -100)

Create Certificate Authority

(Figure -101)

Create Server Certificate and Key

(Figure -102)

Create Client Certificate and Key

(Figure -103)

Create A Directory and Copy All Certificates, Keys

```
C:\EasyRSA-3.2.0>mkdir C:\vpncert
C:\EasyRSA-3.2.0>copy pki\ca.crt C:\vpncert
1 file(s) copied.

C:\EasyRSA-3.2.0>copy pki\issued\server.crt C:\vpncert
1 file(s) copied.

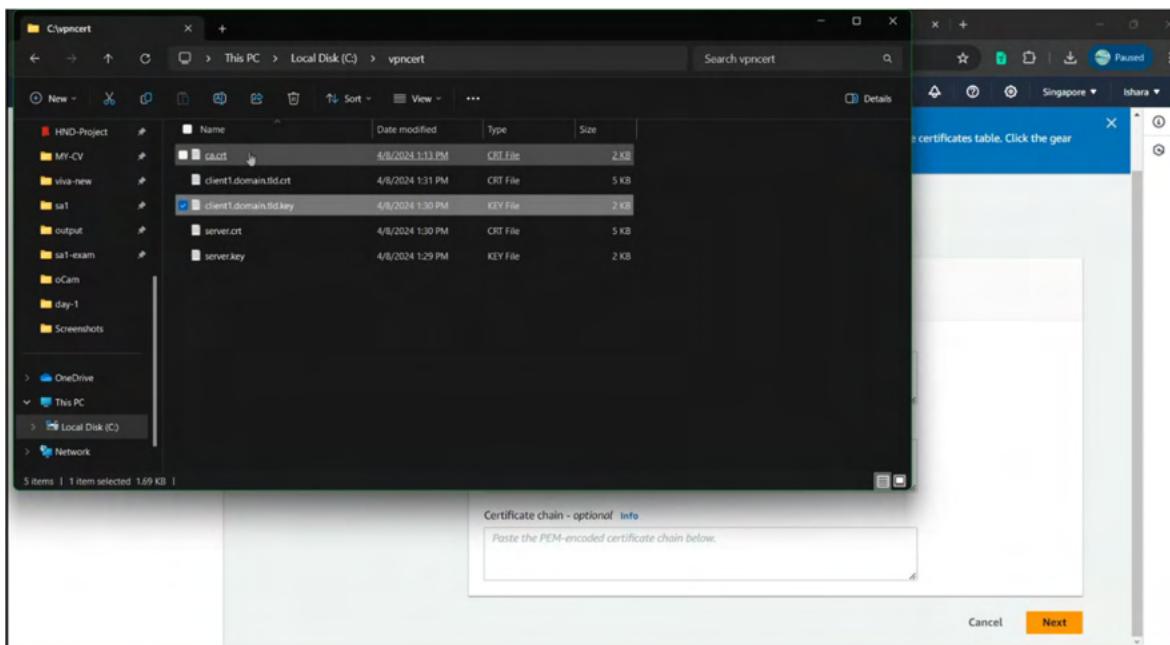
C:\EasyRSA-3.2.0>copy pki\issued\client1.domain.tld.crt C:\vpncert
1 file(s) copied.

C:\EasyRSA-3.2.0>copy pki\private\client1.domain.tld.key C:\vpncert
1 file(s) copied.

C:\EasyRSA-3.2.0>copy pki\private\client1.domain.tld.key C:\vpncert
1 file(s) copied.
```

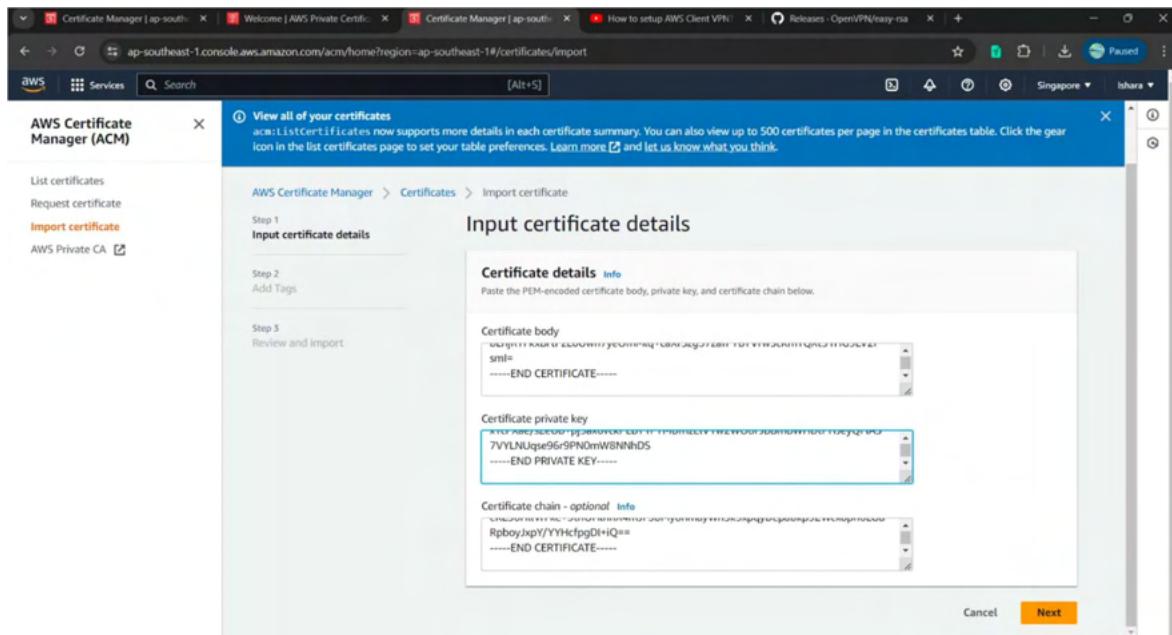
(Figure -104)

Created Certificates and Keys



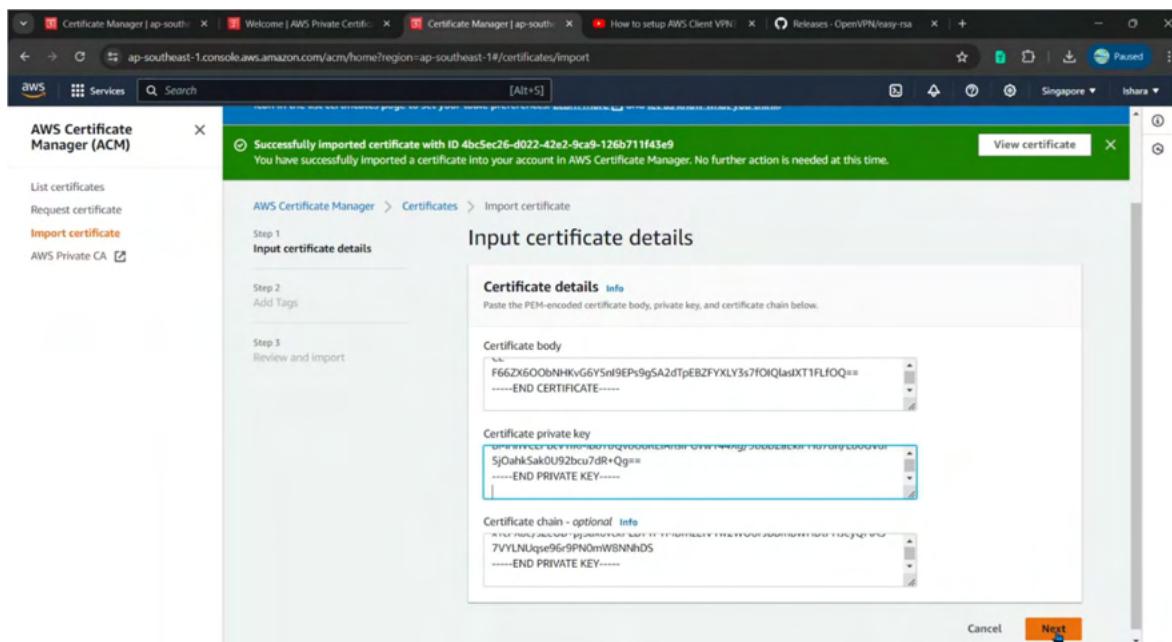
(Figure -105)

Import Server Certificates To AWS



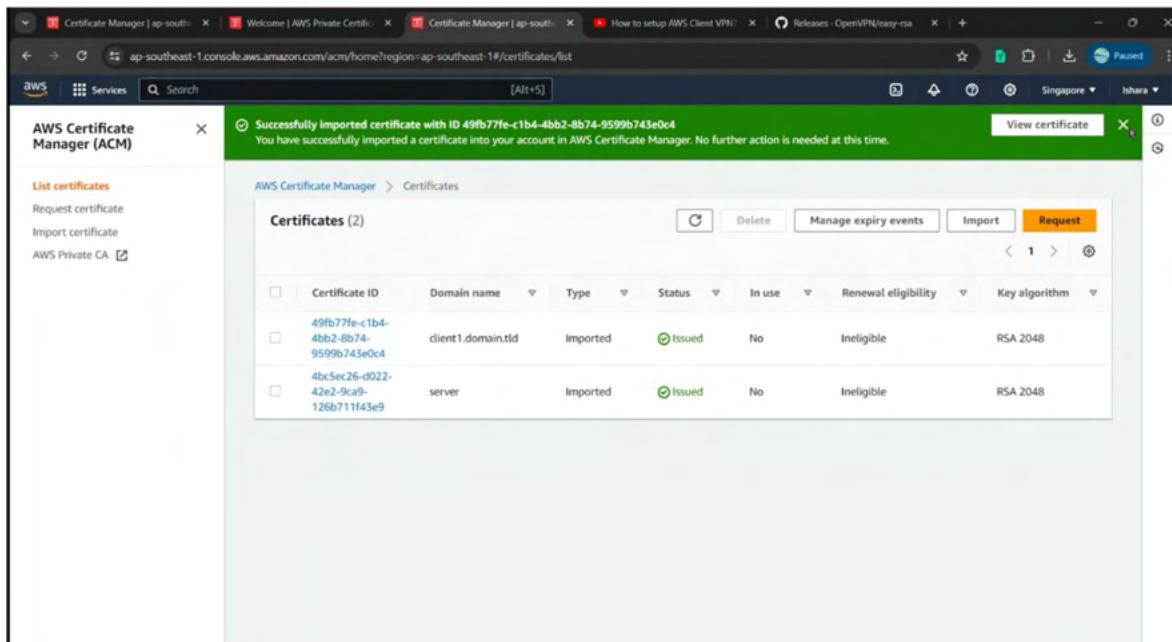
(Figure -106)

Import Client Certificates To AWS



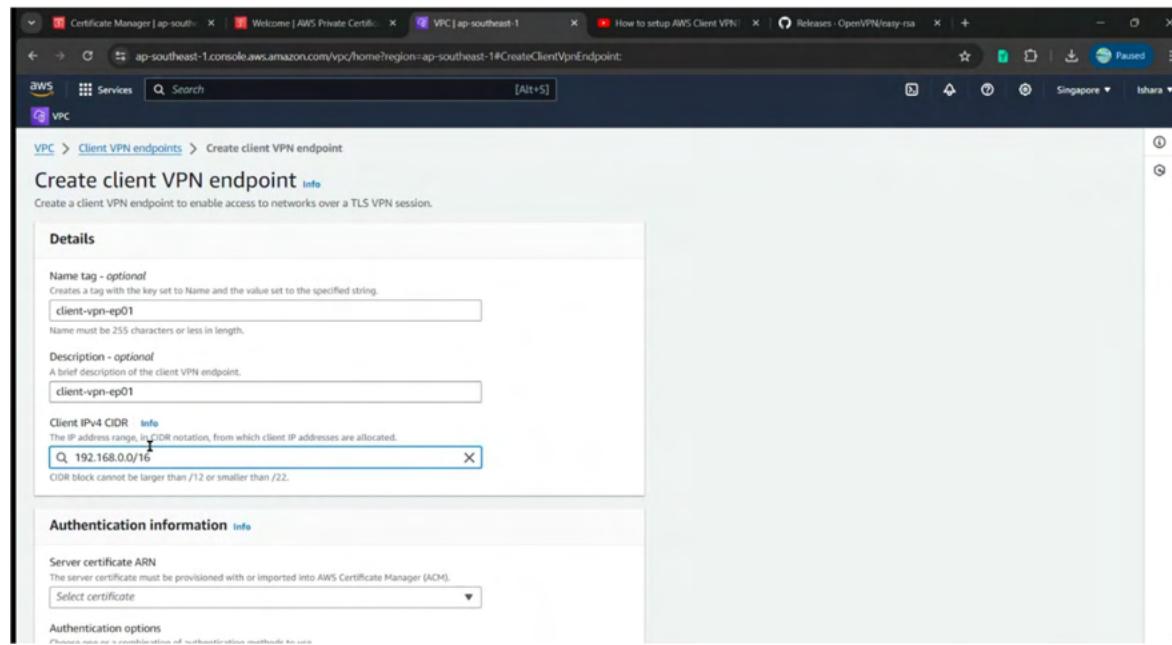
(Figure -107)

imported Server & client certificates



(Figure -108)

Create Client VPN Endpoint



(Figure -109)

Created Client VPN Endpoint

The screenshot shows the AWS VPC Client VPN endpoints dashboard. A success message at the top states: "You successfully created cvpn-endpoint-0ac014338150ab0d1 / client-vpn-ep01." Below this, a table lists the newly created endpoint:

Name	Client VPN endpoint ID	State	Client CIDR
client-vpn-ep01	cvpn-endpoint-0ac014338150ab0d1	Pending-associate	192.168.0.0/16

On the left sidebar, under the "VPC" section, the "Client VPN endpoints" option is selected. The bottom of the page displays a message: "0 client VPN endpoints selected".

(Figure -110)

Associate Target Network

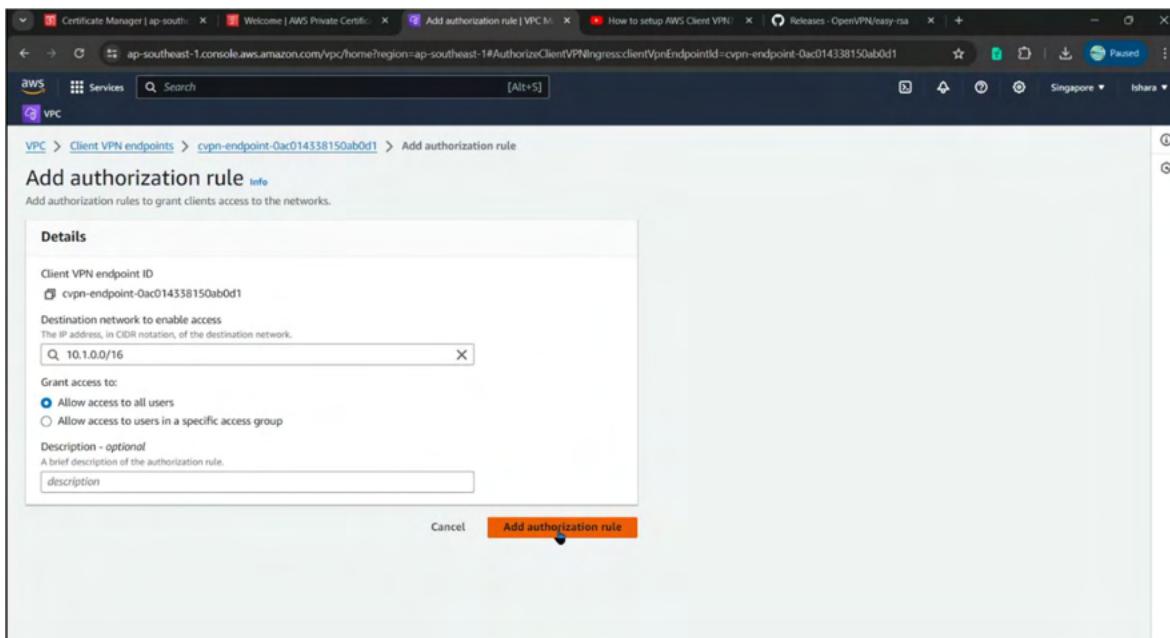
The screenshot shows the "Associate target network" dialog for the cvpn-endpoint-0ac014338150ab0d1 endpoint. The "Details" section includes:

- Client VPN endpoint ID: cvpn-endpoint-0ac014338150ab0d1
- VPC: vpc-0980194d9213090e0 (clientdemo)
- Choose a subnet to associate: subnet-0417876c7ae81e3e0 (subnet01)

At the bottom right of the dialog is a prominent orange "Associate target network" button.

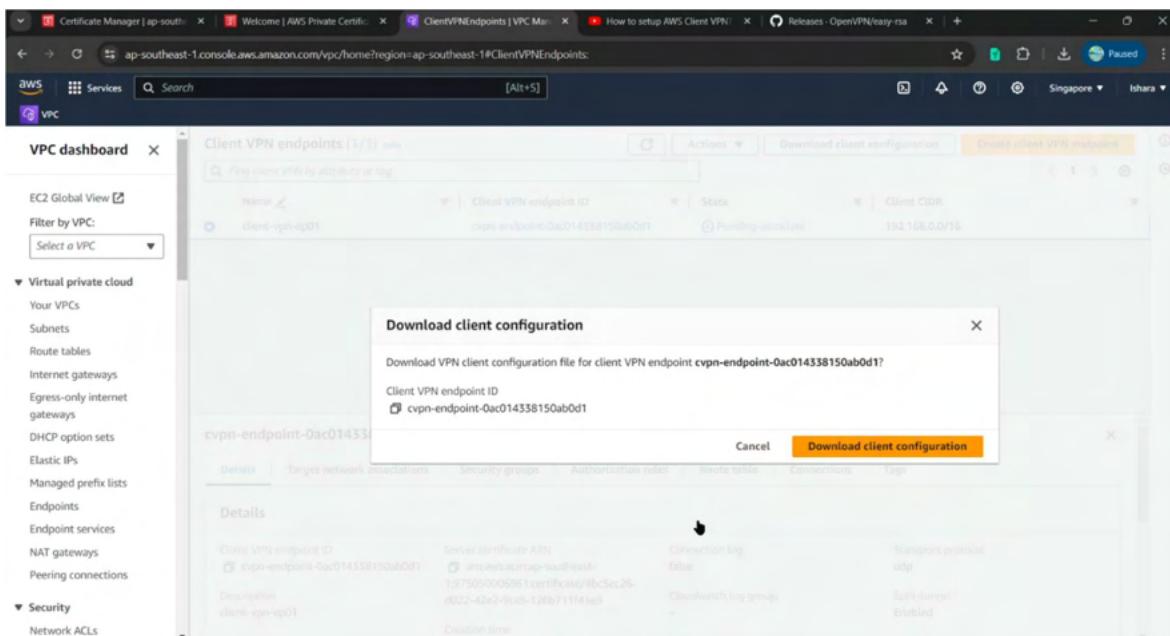
(Figure -111)

Associate Authorization Rule



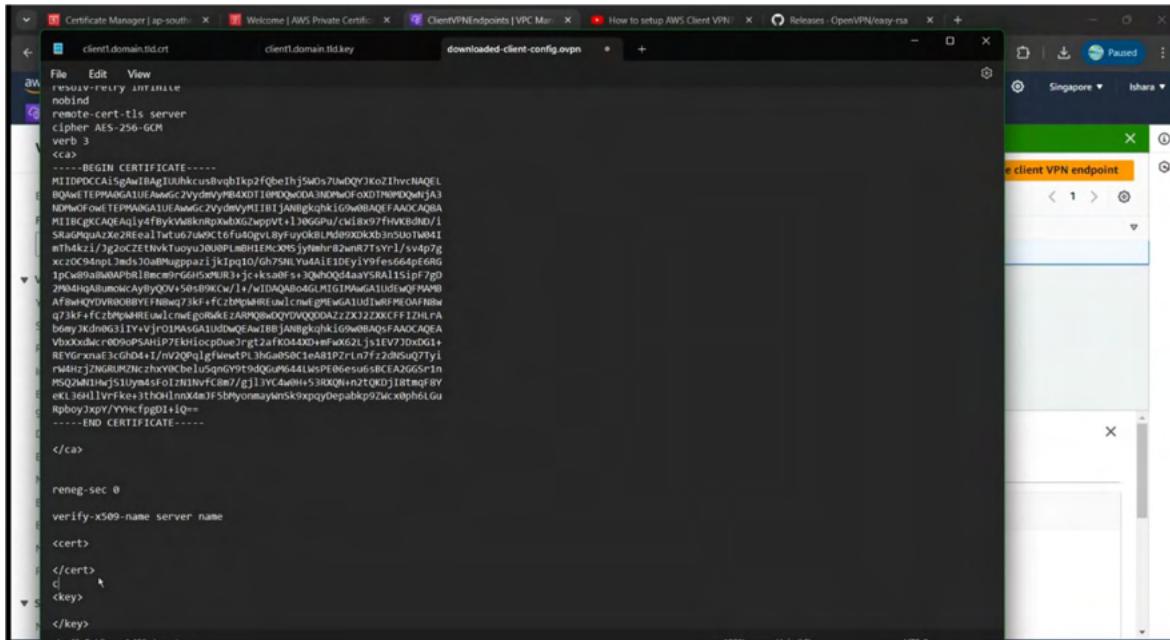
(Figure -112)

Download Client Configurations



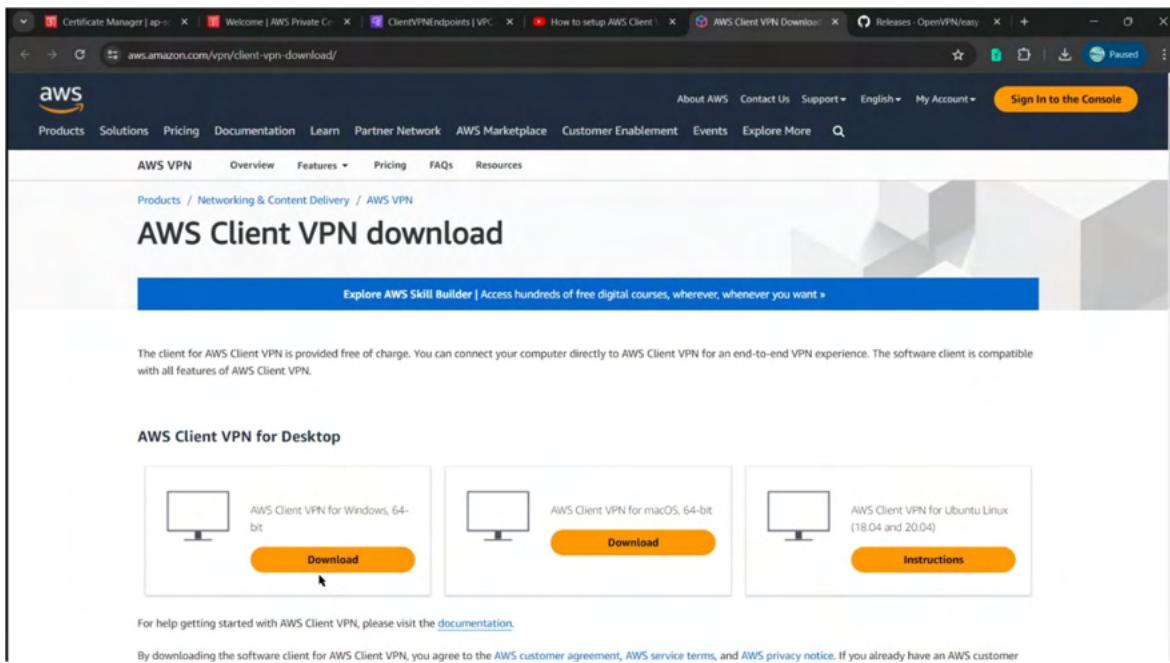
(Figure -113)

Edit Client Configurations with Certificate And Key



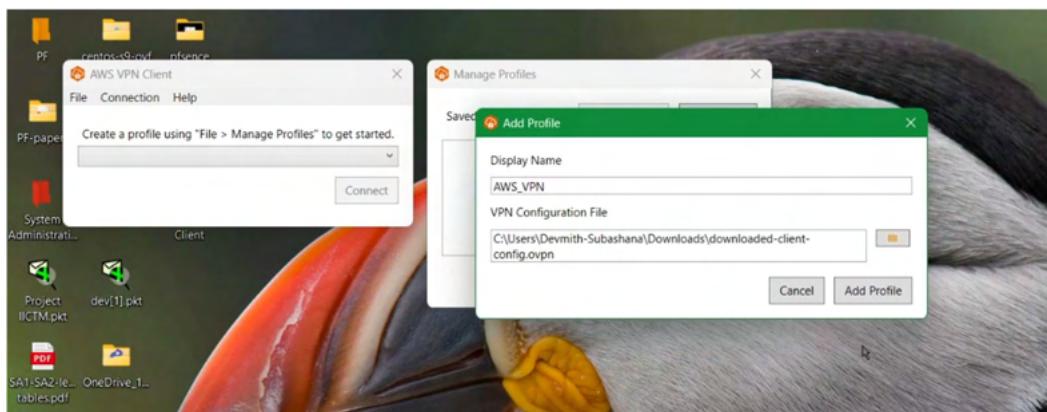
(Figure -114)

Download & Install AWS Client VPN



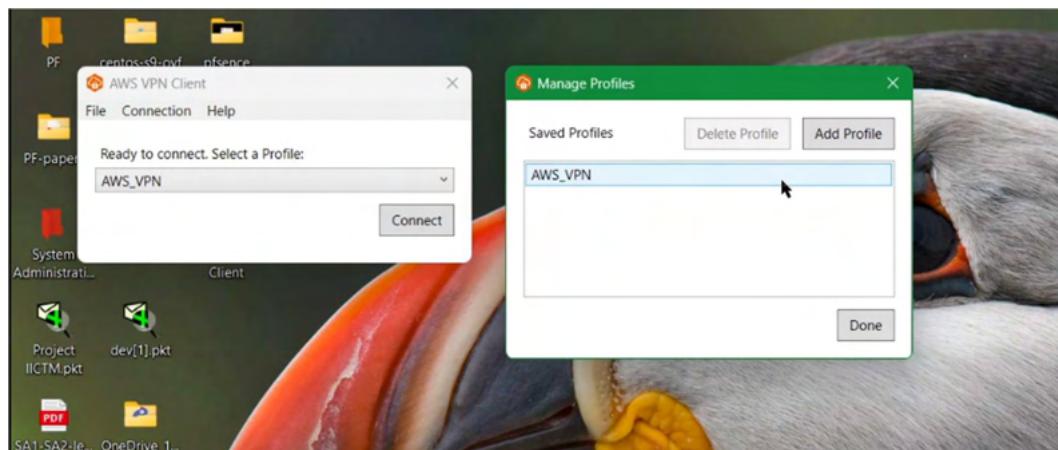
(Figure -115)

Add Profile on VPN CLIENT



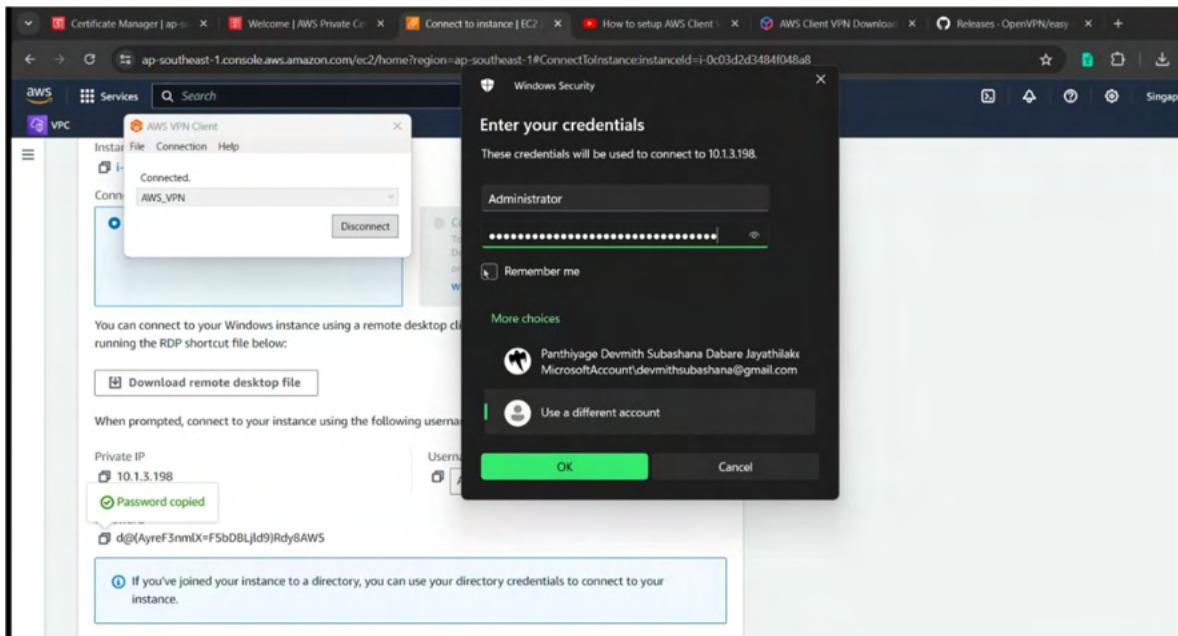
(Figure -116)

Connect To Profile



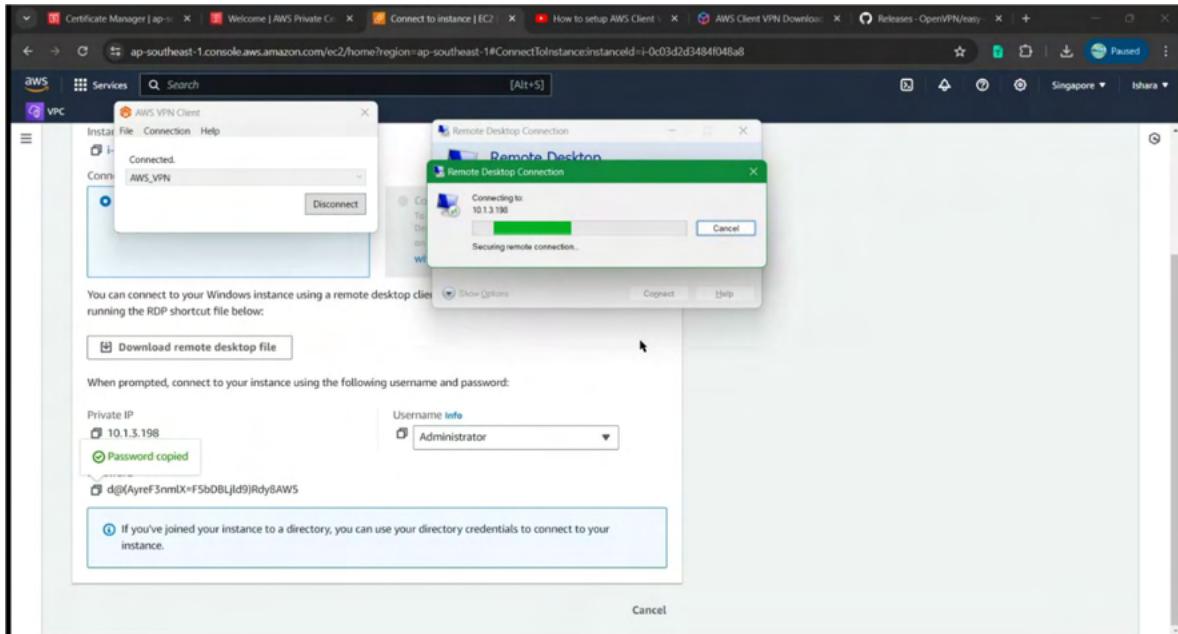
(Figure -117)

Enter Username and Password Provide On AWS



(Figure -118)

Initialize VPN Connection to Instance Using RDC



(Figure -119)

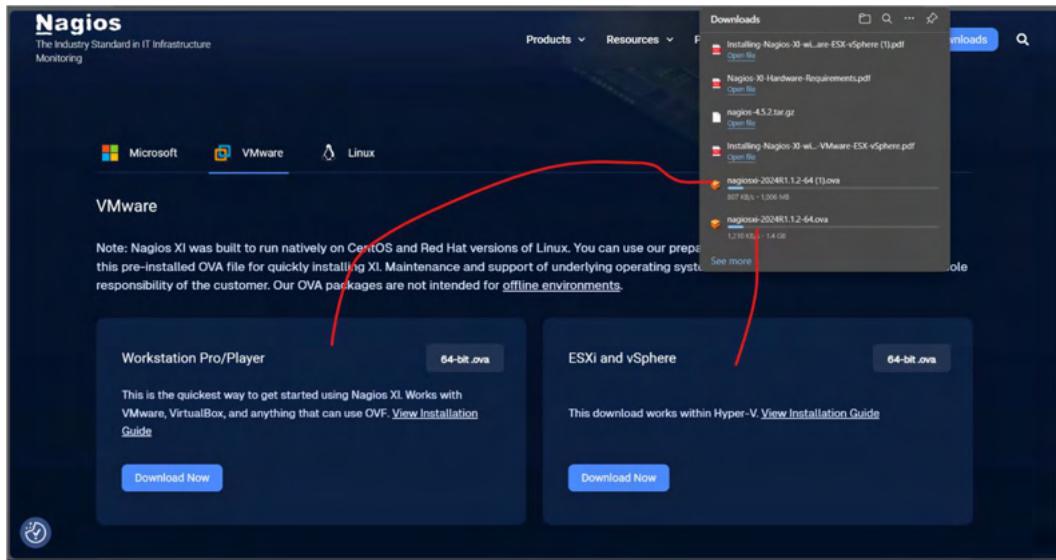
Connected AWS Instance Through VPN



(Figure -120)

5.7 NETWORK MONITORING

Download Nagios



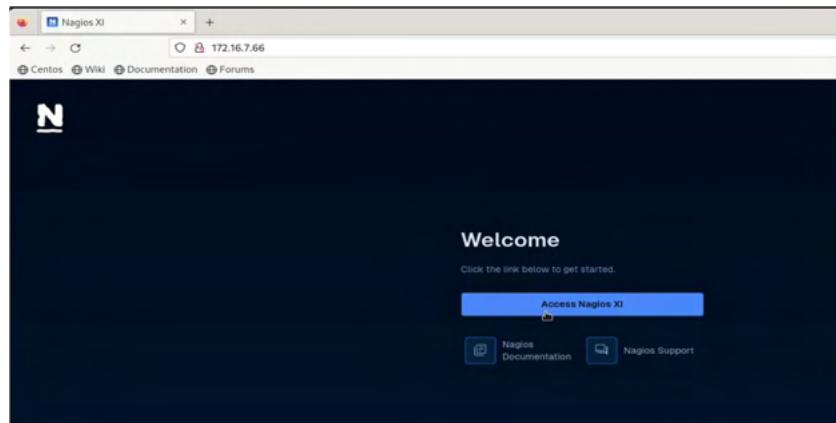
(Figure -121)

Installed Nagios



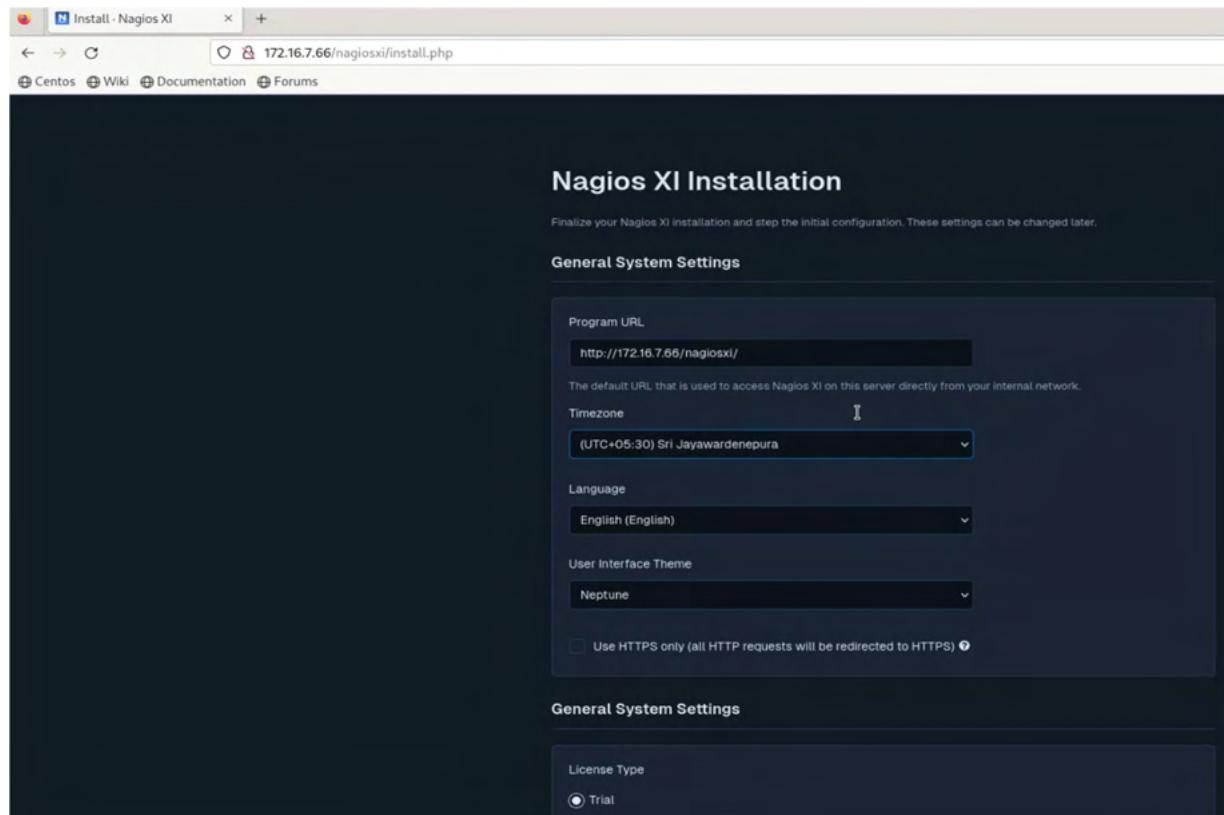
(Figure -122)

Login Into the Nagios Using IP



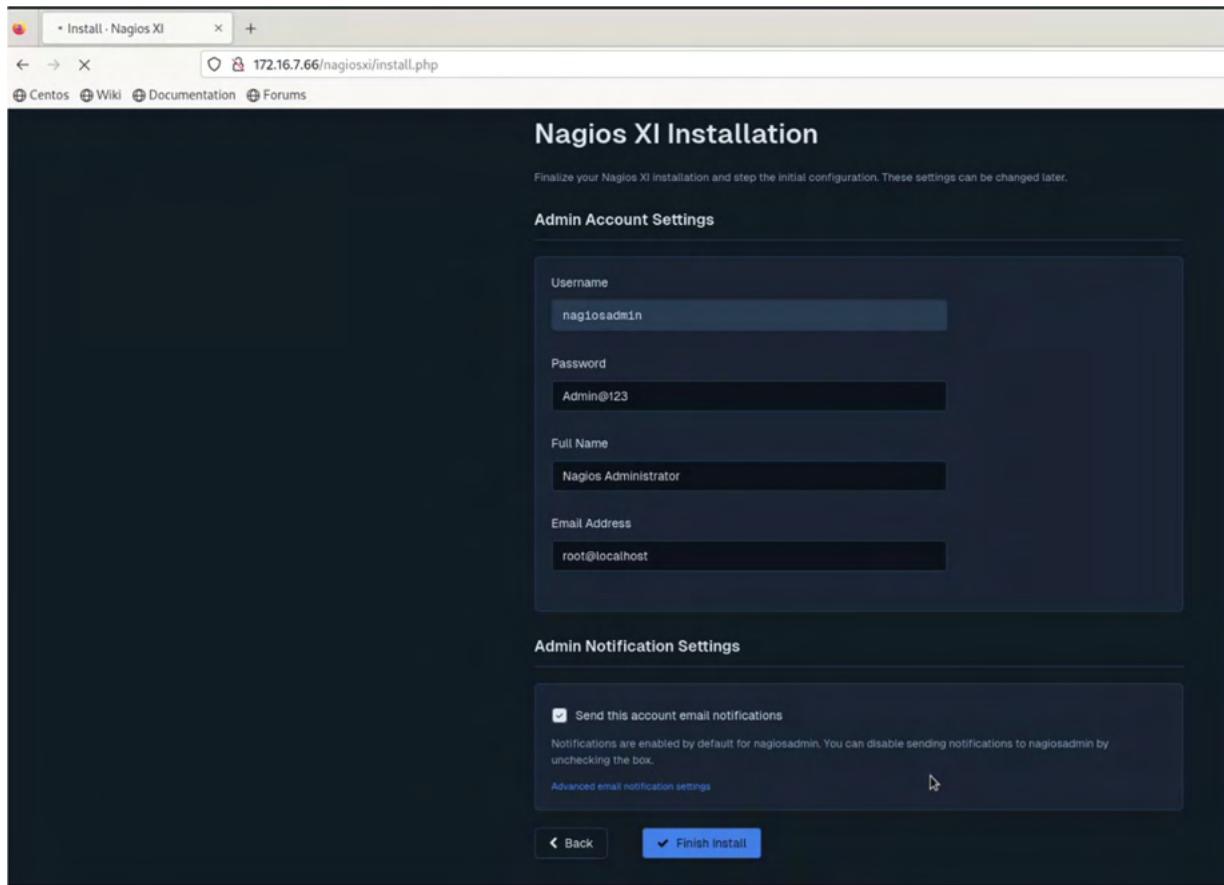
(Figure -123)

Set Time, Language and Theme



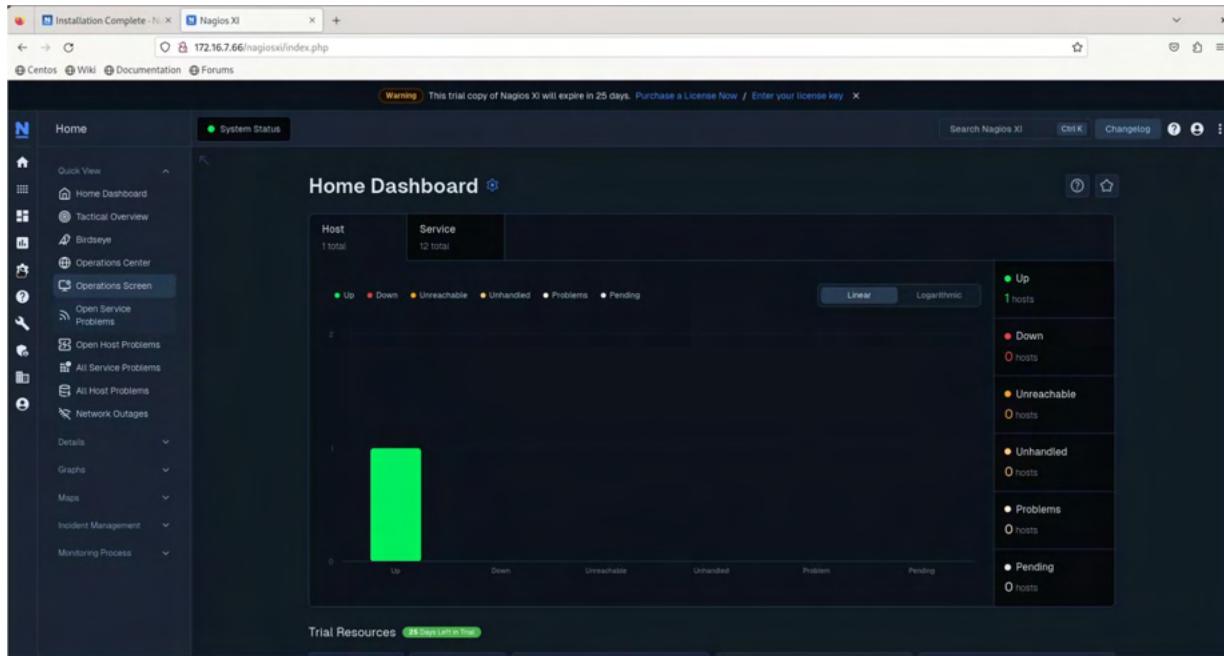
(Figure -124)

Set GUI Interface Username and Password



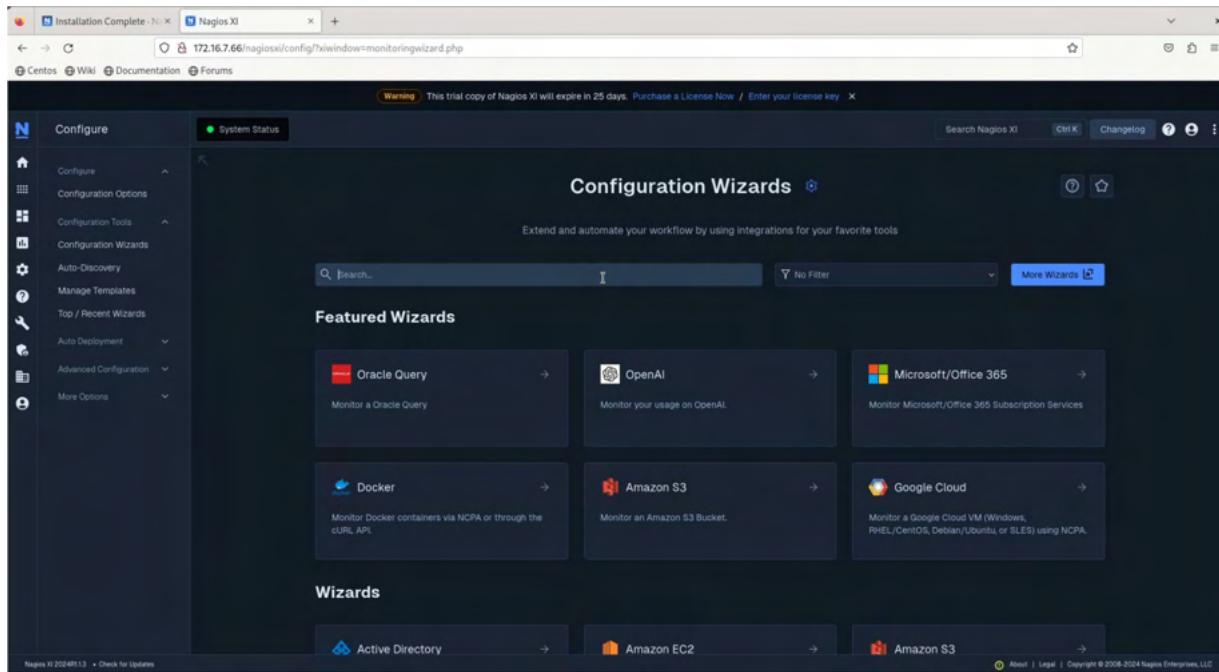
(Figure -125)

Nagios Dashboard



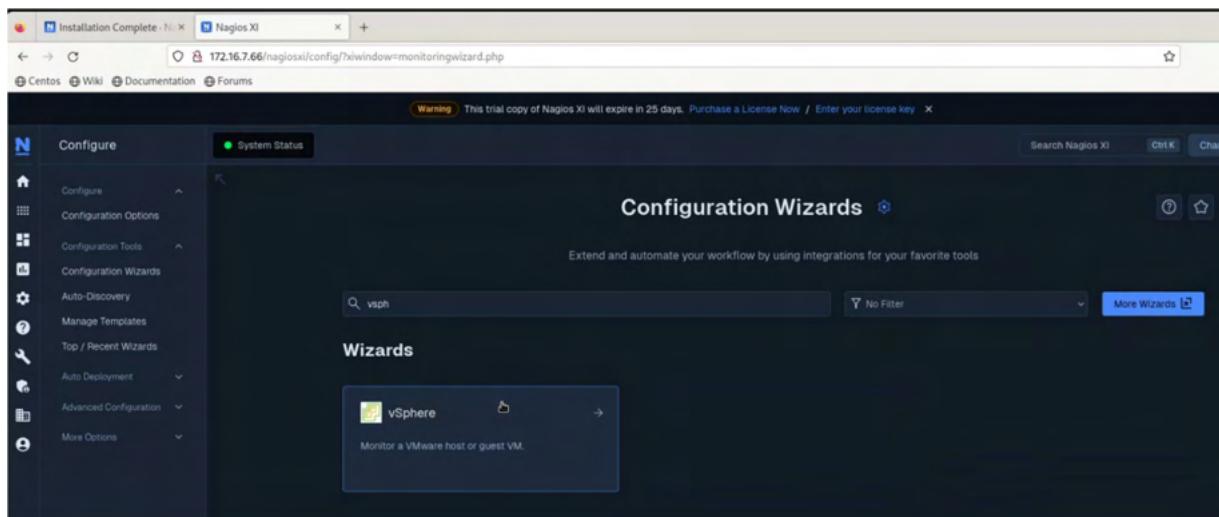
(Figure -126)

Add Monitoring Wizard



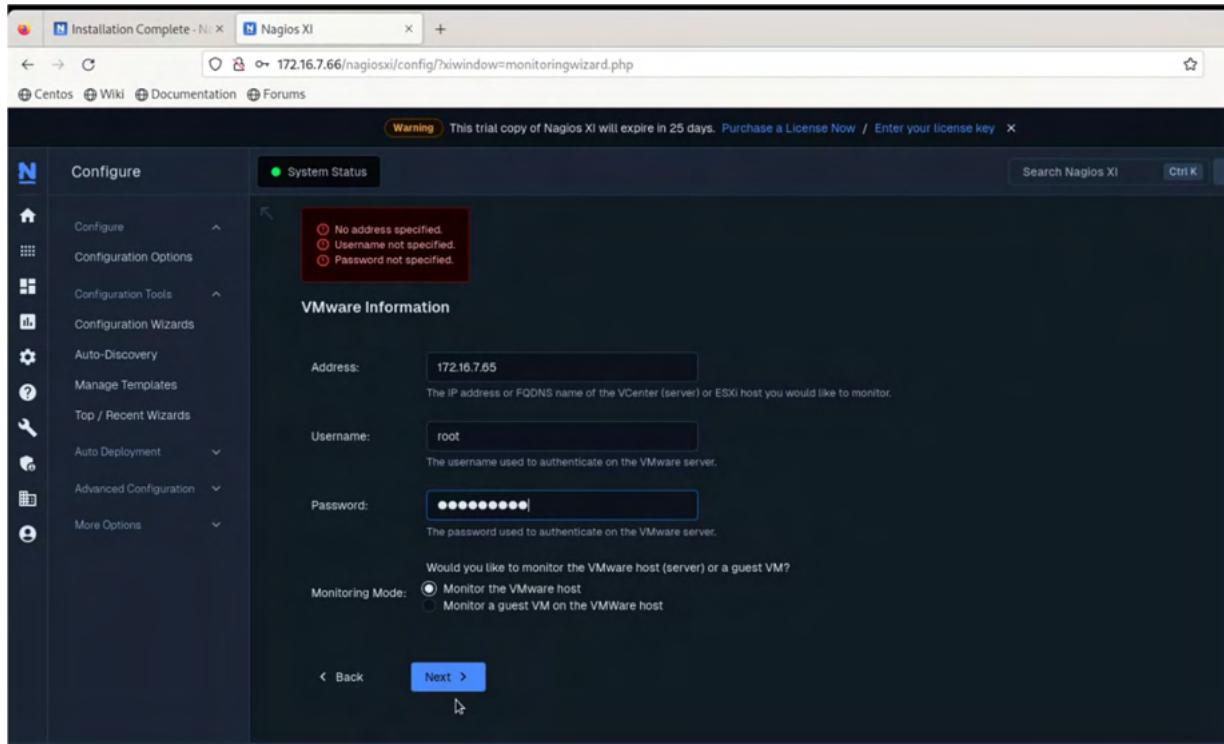
(Figure -127)

Add Monitoring Wizard For ESXI



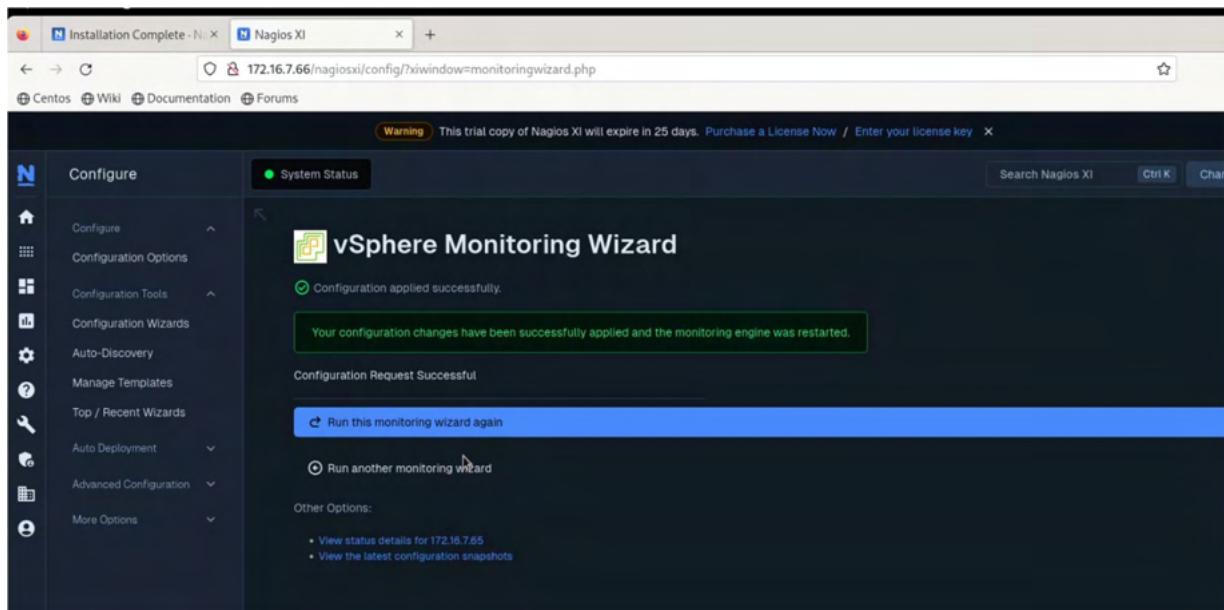
(Figure -128)

Add ESXI IP and login credentials



(Figure -129)

Completed Wizard For ESXI



(Figure -130)

5.8 NETWORK DEVICES IMPLEMENTATION

5.8.1 Core Layer L3 switches configuration

Core Layer L3 Primary switch configuration

Basic Configurations- Primary

```

Switch>enable
Switch#config terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#hostname Primary
Primary(config)#enable secret cisco
Primary(config)#line console 0
Primary(config-line)#password cisco
Primary(config-line)#login
Primary(config-line)#exit
Primary(config)#service password-encryption
Primary(config)#ip ssh version 2
Please create RSA keys (of at least 768 bits size) to enable SSH v2.
Primary(config)#ip domain-name iictm.lk
Primary(config)#crypto key generate rsa general-keys modulus 1024
The name for the keys will be: Primary.iictm.lk
Primary(config)#
Primary(config)#line vty 0 15
Primary(config-line)#password cisco
Primary(config-line)#transport input telnet
Primary(config-line)#login local
Primary(config-line)#exit
Primary(config)#username Admin password cisco
Primary(config)#banner motd #Unauthorized access is prohibited#
Primary(config)#no ip domain lookup
Primary(config)#ip routing
Primary(config)#exit
Primary#write
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]

```

(Figure -131)

Create vlan Configurations- Primary

```

primary(config)#vlan 10
primary(config-vlan)#name wireless_users
primary(config-vlan)#vlan 20
primary(config-vlan)#name Wokers
primary(config-vlan)#vlan 30
primary(config-vlan)#name Rest_area
primary(config-vlan)#vlan 40
primary(config-vlan)#name IP_phones
primary(config-vlan)#vlan 50
primary(config-vlan)#name Office_Managment
primary(config-vlan)#vlan 60
primary(config-vlan)#name Top_management
primary(config-vlan)#vlan 70
primary(config-vlan)#name IP_Cameras
primary(config-vlan)#vlan 80
primary(config-vlan)#name Conference
primary(config-vlan)#vlan 90
primary(config-vlan)#name IT_Department
primary(config-vlan)#vlan 99
primary(config-vlan)#name native
primary(config-vlan)#exit
primary(config)#

```

(Figure -132)

VLAN interface creating & HSRP Configurations- Primary

```

Primary(config)#
Primary(config)#int vlan 10
Primary(config-if)#ip address 172.16.0.1 255.255.252.0
Primary(config-if)#standby 1 ip 172.16.0.3
Primary(config-if)#standby 1 priority 255
Primary(config-if)#standby 1 preempt
Primary(config-if)#ip helper-address 172.16.7.60
Primary(config-if)#exit
Primary(config)#
Primary(config)#int vlan 20
Primary(config-if)#ip address 172.16.4.1 255.255.255.0
Primary(config-if)#standby 1 ip 172.16.4.3
Primary(config-if)#standby 1 priority 255
Primary(config-if)#standby 1 preempt
Primary(config-if)#ip helper-address 172.16.7.60
Primary(config-if)#exit
Primary(config)#
Primary(config)#int vlan 30
Primary(config-if)#ip address 172.16.5.1 255.255.255.0
Primary(config-if)#standby 1 ip 172.16.5.3
Primary(config-if)#standby 1 priority 255
Primary(config-if)#standby 1 preempt
Primary(config-if)#ip helper-address 172.16.7.60
Primary(config-if)#exit
Primary(config)#
Primary(config)#int vlan 40
Primary(config-if)#ip address 172.16.6.129 255.255.255.192
Primary(config-if)#standby 1 ip 172.16.6.131
Primary(config-if)#standby 1 priority 255
Primary(config-if)#standby 1 preempt
Primary(config-if)#ip helper-address 172.16.7.60
Primary(config-if)#exit
Primary(config)#
Primary(config)#int vlan 50
Primary(config-if)#ip address 172.16.6.193 255.255.255.192
Primary(config-if)#standby 1 ip 172.16.6.195
Primary(config-if)#standby 1 priority 255
Primary(config-if)#standby 1 preempt
Primary(config-if)#ip helper-address 172.16.7.60
Primary(config-if)#exit
Primary(config)#
Primary(config)#int vlan 60
Primary(config-if)#ip address 172.16.7.1 255.255.255.224
Primary(config-if)#standby 1 ip 172.16.7.3
Primary(config-if)#standby 1 priority 255
Primary(config-if)#standby 1 preempt
Primary(config-if)#ip helper-address 172.16.7.60
Primary(config-if)#exit
Primary(config)#
Primary(config)#int vlan 70
Primary(config-if)#ip address 172.16.7.33 255.255.255.240
Primary(config-if)#standby 1 ip 172.16.7.35
Primary(config-if)#standby 1 priority 255
Primary(config-if)#standby 1 preempt
Primary(config-if)#ip helper-address 172.16.7.60
Primary(config-if)#exit
Primary(config)#
Primary(config)#int vlan 80
Primary(config-if)#ip address 172.16.7.49 255.255.255.248
Primary(config-if)#standby 1 ip 172.16.7.51
Primary(config-if)#standby 1 priority 255
Primary(config-if)#standby 1 preempt
Primary(config-if)#ip helper-address 172.16.7.60
Primary(config-if)#exit
Primary(config)#
Primary(config)#int vlan 90
Primary(config-if)#ip address 172.16.7.57 255.255.255.248
Primary(config-if)#standby 1 ip 172.16.7.59
Primary(config-if)#standby 1 priority 255
Primary(config-if)#standby 1 preempt
Primary(config-if)#ip helper-address 172.16.7.60
Primary(config-if)#exit
Primary(config)#
Primary(config)#int vlan 99
Primary(config-if)#description native
Primary(config-if)#no shutdown
Primary(config-if)#exit

```

(Figure -133)

Rapid PVST configuration with VLAN root primary- Primary

```
Primary(config)#spanning-tree vlan 10,20,30,40,50,60,70,80,90,99 root primary
Primary(config)#

```

(Figure -134)

Etherchannel and trunking- Primary

```
Primary(config)#
Primary(config)#interface range gigabitEthernet 1/0/1-2
Primary(config-if-range)#channel-group 1 mode on
Primary(config-if-range)#switchport mode trunk
Primary(config-if-range)#no shutdown
Primary(config-if-range)#
Creating a port-channel interface Port-channel 1

```

(Figure -135)

Interface configuration for access layer- Primary

```
Primary(config-if-range)#
Primary(config-if-range)#exit
Primary(config)#
Primary(config)#interface gigabitEthernet 1/0/3
Primary(config-if)#switchport mode trunk

Primary(config-if)#
Primary(config-if)#interface gigabitEthernet 1/0/5
Primary(config-if)#switchport mode trunk

Primary(config-if)#
Primary(config-if)#interface gigabitEthernet 1/0/6
Primary(config-if)#switchport mode trunk

Primary(config-if)#
Primary(config-if)#interface gigabitEthernet 1/0/7
Primary(config-if)#switchport mode trunk

Primary(config-if)#
Primary(config-if)#interface gigabitEthernet 1/0/8
Primary(config-if)#switchport mode trunk

Primary(config-if)#
Primary(config-if)#interface gigabitEthernet 1/0/9
Primary(config-if)#switchport mode trunk

Primary(config-if)#interface gigabitEthernet 1/0/24
Primary(config-if)#no switchport
Primary(config-if)#ip address 100.100.100.10 255.255.255.0
Primary(config-if)#standby 0 ip 100.100.100.30
Primary(config-if)#standby priority 255
Primary(config-if)#standby preempt
Primary(config-if)#exit
Primary(config)#

```

(Figure -136)

VTP Configuration- Primary

```
Primary(config)#vtp mode s
Primary(config)#vtp mode server
Device mode already VTP SERVER.
Primary(config)#vtp
Primary(config)#vtp d
Primary(config)#vtp domain ?
    WORD  The ascii name for the VTP administrative domain.
Primary(config)#vtp domain
Primary(config)#vtp domain iictm.local
Changing VTP domain name from NULL to iictm.local
Primary(config)#vtp pa
Primary(config)#vtp password iictm@pass
Setting device VLAN database password to iictm@pass
Primary(config)#

```

(Figure -137)

Loopback Configuration- Primary

```
Primary(config)#interface loopback 1

Primary(config-if)#
%LINK-5-CHANGED: Interface Loopback1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Loopback1, changed state to up

Primary(config-if)#ip address 172.0.0.1 255.255.255.0
Primary(config-if)#no shut
Primary(config-if)#exit

```

(Figure -138)

IP Route- Primary

```
Primary(config)#
Primary(config)#ip route 0.0.0.0 0.0.0.0 100.100.100.100

```

(Figure -139)

Configurations save Command- Primary

```
Primary#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
Primary#

```

(Figure -140)

Core Layer L3 Backup switch configuration

Basic Configurations- Backup

```

Switch>enable
Switch#config terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#hostname Backup
Backup(config)#enable secret cisco
Backup(config)#line console 0
Backup(config-line)#password cisco
Backup(config-line)#login
Backup(config-line)#exit
Backup(config)#service password-encryption
Backup(config)#ip ssh version 2
Please create RSA keys (of at least 768 bits size) to enable SSH v2.
Backup(config)#ip domain-name iictm.lk
Backup(config)#crypto key generate rsa general-keys modulus 1024
The name for the keys will be: Backup.iictm.lk
Backup(config)#
Backup(config)#line vty 0 15
Backup(config-line)#password cisco
Backup(config-line)#transport input telnet
Backup(config-line)#login local
Backup(config-line)#exit
Backup(config)#username Admin password cisco
Backup(config)#banner motd #Unauthorized access is prohibited#
Backup(config)#no ip domain lookup
Backup(config)#ip routing
Backup(config)#exit
Backup#write
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]

```

(Figure -141)

vlan Configurations- Backup

```

Backup(config)#vlan 10
Backup(config-vlan)#name wireless_users
Backup(config-vlan)#vlan 20
Backup(config-vlan)#name Wokers
Backup(config-vlan)#vlan 30
Backup(config-vlan)#name Rest_area
Backup(config-vlan)#vlan 40
Backup(config-vlan)#name IP_phones
Backup(config-vlan)#vlan 50
Backup(config-vlan)#name Office_Managment
Backup(config-vlan)#vlan 60
Backup(config-vlan)#name Top_management
Backup(config-vlan)#vlan 70
Backup(config-vlan)#name IP_Cameras
Backup(config-vlan)#vlan 80
Backup(config-vlan)#name Conference
Backup(config-vlan)#vlan 90
Backup(config-vlan)#name IT_Department
Backup(config-vlan)#vlan 99
Backup(config-vlan)#name native
Backup(config-vlan)#exit
Backup(config)#

```

(Figure -142)

VLAN interface creating & HSRP Configurations-Backup

```

Backup(config)#
Backup(config)#int vlan 10
Backup(config-if)#ip address 172.16.0.2 255.255.252.0
Backup(config-if)#standby 1 ip 172.16.0.3
Backup(config-if)#standby 1 priority 254
Backup(config-if)#standby 1 preempt
Backup(config-if)#ip helper-address 172.16.7.60
Backup(config-if)#exit
Backup(config)#
Backup(config)#int vlan 20
Backup(config-if)#ip address 172.16.4.2 255.255.255.0
Backup(config-if)#standby 1 ip 172.16.4.3
Backup(config-if)#standby 1 priority 254
Backup(config-if)#standby 1 preempt
Backup(config-if)#ip helper-address 172.16.7.60
Backup(config-if)#exit
Backup(config)#
Backup(config)#int vlan 30
Backup(config-if)#ip address 172.16.5.2 255.255.255.0
Backup(config-if)#standby 1 ip 172.16.5.3
Backup(config-if)#standby 1 priority 254
Backup(config-if)#standby 1 preempt
Backup(config-if)#ip helper-address 172.16.7.60
Backup(config-if)#exit
Backup(config)#
Backup(config)#int vlan 40
Backup(config-if)#ip address 172.16.6.130 255.255.255.192
Backup(config-if)#standby 1 ip 172.16.6.131
Backup(config-if)#standby 1 priority 254
Backup(config-if)#standby 1 preempt
Backup(config-if)#ip helper-address 172.16.7.60
Backup(config-if)#exit
Backup(config)#
Backup(config)#int vlan 50
Backup(config-if)#ip address 172.16.6.194 255.255.255.192
Backup(config-if)#standby 1 ip 172.16.6.195
Backup(config-if)#standby 1 priority 254
Backup(config-if)#standby 1 preempt
Backup(config-if)#ip helper-address 172.16.7.60
Backup(config-if)#exit
Backup(config)#
Backup(config)#int vlan 60
Backup(config-if)#ip address 172.16.7.2 255.255.255.224
Backup(config-if)#standby 1 ip 172.16.7.3
Backup(config-if)#standby 1 priority 254
Backup(config-if)#standby 1 preempt
Backup(config-if)#ip helper-address 172.16.7.60
Backup(config-if)#exit
Backup(config)#
Backup(config)#int vlan 70
Backup(config-if)#ip address 172.16.7.34 255.255.255.240
Backup(config-if)#standby 1 ip 172.16.7.35
Backup(config-if)#standby 1 priority 254
Backup(config-if)#standby 1 preempt
Backup(config-if)#ip helper-address 172.16.7.60
Backup(config-if)#exit
Backup(config)#
Backup(config)#int vlan 80
Backup(config-if)#ip address 172.16.7.50 255.255.255.248
Backup(config-if)#standby 1 ip 172.16.7.51
Backup(config-if)#standby 1 priority 254
Backup(config-if)#standby 1 preempt
Backup(config-if)#ip helper-address 172.16.7.60
Backup(config-if)#exit
Backup(config)#
Backup(config)#int vlan 90
Backup(config-if)#ip address 172.16.7.58 255.255.255.248
Backup(config-if)#standby 1 ip 172.16.7.59
Backup(config-if)#standby 1 priority 254
Backup(config-if)#standby 1 preempt
Backup(config-if)#ip helper-address 172.16.7.60
Backup(config-if)#exit
Backup(config)#
Backup(config)#int vlan 99
Backup(config-if)#description native
Backup(config-if)#no shutdown
Backup(config-if)#exit

```

(Figure -143)

Rapid PVST configuration with VLAN root secondary-Backup

```
Backup(config)#
Backup(config)#spanning-tree vlan 10,20,30,40,50,60,99 root secondary
Backup(config)#

```

(Figure -144)

Etherchannel and trunking-Backup

```
Backup(config)#interface range gigabitEthernet 1/0/1-2
Backup(config-if-range)#channel-group 1 mode on
Backup(config-if-range)#switchport mode trunk
Backup(config-if-range)#no shutdown
Backup(config-if-range)#exit
Backup(config)#
Creating a port-channel interface Port-channel 1

```

(Figure -145)

Interface configuration for access layer-Backup

```
Backup(config)#
Backup(config)#interface gigabitEthernet 1/0/3
Backup(config-if)#switchport mode trunk

Backup(config-if)#
Backup(config-if)#interface gigabitEthernet 1/0/5
Backup(config-if)#switchport mode trunk

Backup(config-if)#
Backup(config-if)#interface gigabitEthernet 1/0/6
Backup(config-if)#switchport mode trunk

Backup(config-if)#
Backup(config-if)#interface gigabitEthernet 1/0/7
Backup(config-if)#switchport mode trunk

Backup(config-if)#
Backup(config-if)#interface gigabitEthernet 1/0/8
Backup(config-if)#switchport mode trunk

Backup(config-if)#
Backup(config-if)#interface gigabitEthernet 1/0/9
Backup(config-if)#switchport mode trunk

Backup(config-if)#interface gigabitEthernet 1/0/24
Backup(config-if)#no switchport
Backup(config-if)#ip address 100.100.100.20 255.255.255.0
Backup(config-if)#standby 0 ip 100.100.100.30
Backup(config-if)#standby priority 254
Backup(config-if)#standby preempt
Backup(config-if)#exit
Backup(config)#

```

(Figure -146)

VTP Configuration-Backup

```
Backup(config)#vtp mode client
Setting device to VTP CLIENT mode.
Backup(config)#vtp domain iictm.local
Domain name already set to iictm.local.
Backup(config)#vtp password iictm@pass
Setting device VLAN database password to iictm@pass
Backup(config)#

```

(Figure -147)

Loopback Configuration-Backup

```
Backup(config)#interface loopback 1
Backup(config-if)#
%LINK-5-CHANGED: Interface Loopback1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Loopback1, changed state to up
Backup(config-if)#ip address 172.0.0.2 255.255.255.0
Backup(config-if)#no shut
Backup(config-if)#exit
Backup(config)#

```

(Figure -148)

IP Route-Backup

```
Backup(config)#
Backup(config)#ip route 0.0.0.0 0.0.0.0 100.100.100.100
Backup(config)#

```

(Figure -149)

Configurations save Command-Backup

```
Backup#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
Backup#

```

(Figure -150)

5.8.2 Access Layer L2 switches configuration

Ground floor, First floor, Second floor, Third floor and Fourth floor switches configuration

All are same.

Basic Configurations - L2 switches

```

Switch>enable
Switch#config terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#hostname FLOOR-NO
FLOOR-NO(config)#enable secret cisco
FLOOR-NO(config)#line console 0
FLOOR-NO(config-line)#password cisco
FLOOR-NO(config-line)#login
FLOOR-NO(config-line)#exit
FLOOR-NO(config)#service password-encryption
FLOOR-NO(config)#ip ssh version 2
Please create RSA keys (of at least 768 bits size) to enable SSH v2.
FLOOR-NO(config)#ip domain-name iictm.lk
FLOOR-NO(config)#crypto key generate rsa general-keys modulus 1024
The name for the keys will be: FLOOR-NO.iictm.lk
FLOOR-NO(config)#line vty 0 15
FLOOR-NO(config-line)#password cisco
FLOOR-NO(config-line)#transport input telnet
FLOOR-NO(config-line)#login local
FLOOR-NO(config-line)#exit
FLOOR-NO(config)#username Admin password cisco
FLOOR-NO(config)#banner motd #Unauthorized access is prohibited#
FLOOR-NO(config)#no ip domain lookup
FLOOR-NO(config)#exit
FLOOR-NO#write
Building configuration...
[OK]

```

(Figure -151)

Create vlan Configurations - L2 switches

```

primary(config)#vlan 10
primary(config-vlan)#name wireless_users
primary(config-vlan)#vlan 20
primary(config-vlan)#name Wokers
primary(config-vlan)#vlan 30
primary(config-vlan)#name Rest_area
primary(config-vlan)#vlan 40
primary(config-vlan)#name IP_phones
primary(config-vlan)#vlan 50
primary(config-vlan)#name Office_Managment
primary(config-vlan)#vlan 60
primary(config-vlan)#name Top_management
primary(config-vlan)#vlan 70
primary(config-vlan)#name IP_Cameras
primary(config-vlan)#vlan 80
primary(config-vlan)#name Conference
primary(config-vlan)#vlan 90
primary(config-vlan)#name IT_Department
primary(config-vlan)#vlan 99
primary(config-vlan)#name native
primary(config-vlan)#exit
primary(config)#

```

(Figure -152)

Port Trunking & Access - L2 switches

```
FLOOR-NO(config)#
FLOOR-NO(config)#int range f0/23-24
FLOOR-NO(config-if-range)#switchport mode trunk
FLOOR-NO(config-if-range)#exit
FLOOR-NO(config)#
FLOOR-NO(config)#int f0/1
FLOOR-NO(config-if)#switchport mode access
FLOOR-NO(config-if)#switchport access vlan 10
FLOOR-NO(config-if)#exit
FLOOR-NO(config)#
FLOOR-NO(config)#int f0/2
FLOOR-NO(config-if)#switchport mode access
FLOOR-NO(config-if)#switchport access vlan 20
FLOOR-NO(config-if)#exit
FLOOR-NO(config)#
FLOOR-NO(config)#int f0/3
FLOOR-NO(config-if)#switchport mode access
FLOOR-NO(config-if)#switchport access vlan 30
FLOOR-NO(config-if)#exit
FLOOR-NO(config)#
FLOOR-NO(config)#int f0/4
FLOOR-NO(config-if)#switchport mode access
FLOOR-NO(config-if)#switchport access vlan 40
FLOOR-NO(config-if)#exit
FLOOR-NO(config)#
FLOOR-NO(config)#int f0/5
FLOOR-NO(config-if)#switchport mode access
FLOOR-NO(config-if)#switchport access vlan 50
FLOOR-NO(config-if)#exit
FLOOR-NO(config)#
FLOOR-NO(config)#int f0/6
FLOOR-NO(config-if)#switchport mode access
FLOOR-NO(config-if)#switchport access vlan 60
FLOOR-NO(config-if)#exit
FLOOR-NO(config)#
FLOOR-NO(config)#int f0/7
FLOOR-NO(config-if)#switchport mode access
FLOOR-NO(config-if)#switchport access vlan 70
FLOOR-NO(config-if)#exit
FLOOR-NO(config)#
FLOOR-NO(config)#int f0/8
FLOOR-NO(config-if)#switchport mode access
FLOOR-NO(config-if)#switchport access vlan 80
FLOOR-NO(config-if)#exit
FLOOR-NO(config)#
FLOOR-NO(config)#int f0/9
FLOOR-NO(config-if)#switchport mode access
FLOOR-NO(config-if)#switchport access vlan 90
FLOOR-NO(config-if)#exit
FLOOR-NO(config)#
FLOOR-NO(config)#exit
```

(Figure -153)

VTP Configuration - L2 switches

```
FLOOR-NO(config)#vtp mode client
Setting device to VTP CLIENT mode.
FLOOR-NO(config)#vtp domain iictm.local
Changing VTP domain name from NULL to iictm.local
FLOOR-NO(config)#vtp password iictm@pass
Setting device VLAN database password to iictm@pass
FLOOR-NO(config)#

```

(Figure -154)

Configurations save Command - L2 switches

```
FLOOR-NO#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
```

(Figure -155)

5.8.3 Management switch configuration

Basic Configurations - Management switch

```

Switch>
Switch>enable
Switch#config terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#hostname Managment-Switch
Managment-Switch(config)#enable secret cisco
Managment-Switch(config)#line console 0
Managment-Switch(config-line)#password cisco
Managment-Switch(config-line)#login
Managment-Switch(config-line)#exit
Managment-Switch(config)#line vty 0 15
Managment-Switch(config-line)#password cisco
Managment-Switch(config-line)#service password-encryption
Managment-Switch(config)#banner motd #Unauthorized access is prohibited#
Managment-Switch(config)#no ip domain lookup
Managment-Switch(config)#exit
Managment-Switch#write
Building configuration...
[OK]

```

(Figure-156)

Port configuration - Management switch

```

Managment-Switch#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Managment-Switch(config)#interface fastEthernet 0/2
Managment-Switch(config-if)#no shut
Managment-Switch(config-if)#interface fastEthernet 0/23
Managment-Switch(config-if)#no shut
Managment-Switch(config-if)#interface fastEthernet 0/24
Managment-Switch(config-if)#no shut

```

(Figure -157)

Configurations save Command - Management switch

```

Managment-Switch(config-if-range)#do cop r st
Destination filename [startup-config]?
Building configuration...
[OK]

```

(Figure -158)

5.8.4 Server switch configuration

Basic Configurations - Server switch

```

Switch>
Switch>enable
Switch#config terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#hostname SERVER-SWITCH
SERVER-SWITCH(config)#enable secret cisco
SERVER-SWITCH(config)#line console 0
SERVER-SWITCH(config-line)#password cisco
SERVER-SWITCH(config-line)#login
SERVER-SWITCH(config-line)#exit
SERVER-SWITCH(config)#service password-encryption
SERVER-SWITCH(config)#ip ssh version 2
Please create RSA keys (of at least 768 bits size) to enable SSH v2.
SERVER-SWITCH(config)#ip domain-name iictm.lk
SERVER-SWITCH(config)#crypto key generate rsa general-keys modulus 1024
The name for the keys will be: SERVER-SWITCH.iictm.lk

SERVER-SWITCH(config)#
SERVER-SWITCH(config)#line vty 0 15
SERVER-SWITCH(config-line)#password cisco
SERVER-SWITCH(config-line)#transport input telnet
SERVER-SWITCH(config-line)#login local
SERVER-SWITCH(config-line)#exit
SERVER-SWITCH(config)#username Admin password cisco
SERVER-SWITCH(config)#banner motd #Unauthorized access is prohibited#
SERVER-SWITCH(config)#no ip domain lookup
SERVER-SWITCH(config)#exit
SERVER-SWITCH#write
Building configuration...
[OK]

```

(Figure -159)

Create vlan Configurations - Server switch

```

primary(config)#vlan 10
primary(config-vlan)#name wireless_users
primary(config-vlan)#vlan 20
primary(config-vlan)#name Wokers
primary(config-vlan)#vlan 30
primary(config-vlan)#name Rest_area
primary(config-vlan)#vlan 40
primary(config-vlan)#name IP_phones
primary(config-vlan)#vlan 50
primary(config-vlan)#name Office_Managment
primary(config-vlan)#vlan 60
primary(config-vlan)#name Top_management
primary(config-vlan)#vlan 70
primary(config-vlan)#name IP_Cameras
primary(config-vlan)#vlan 80
primary(config-vlan)#name Conference
primary(config-vlan)#vlan 90
primary(config-vlan)#name IT_Department
primary(config-vlan)#vlan 99
primary(config-vlan)#name native
primary(config-vlan)#exit
primary(config)#

```

(Figure -160)

Port Trunking & Access - Server switch

```
SERVER-SWITCH(config)#int range f0/23-24
SERVER-SWITCH(config-if-range)#switchport mode trunk
SERVER-SWITCH(config-if-range)#exit
SERVER-SWITCH(config)#
SERVER-SWITCH(config)#int g0/1
SERVER-SWITCH(config-if)#switchport mode access
SERVER-SWITCH(config-if)#switchport access vlan 90
SERVER-SWITCH(config-if)#exit
```

(Figure -161)

VTP Configuration - Server switch

```
SERVER-SWITCH(config)#vtp mode client
Setting device to VTP CLIENT mode.
SERVER-SWITCH(config)#vtp domain iictm.local
Domain name already set to iictm.local.
SERVER-SWITCH(config)#vtp password iictm@pass
Setting device VLAN database password to iictm@pass
SERVER-SWITCH(config)#+
```

(Figure -162)

Configurations save Command - Server switch

```
SERVER-SWITCH#copy running-config st
SERVER-SWITCH#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
```

(Figure -163)

06. RESULT AND EVOLUTION

6.1 Implementation Verification on switches

6.1.1 Core Layer L3 Primary switch Configuration Verification

IP Configuration Verification- Primary

```
Primary#show ip interface brief
Interface          IP-Address      OK? Method Status       Protocol
Port-channel1      unassigned     YES unset up           up
GigabitEthernet1/0/1 unassigned     YES unset up           up
GigabitEthernet1/0/2 unassigned     YES unset up           up
GigabitEthernet1/0/3 unassigned     YES unset up           up
GigabitEthernet1/0/4 unassigned     YES unset administratively down down
GigabitEthernet1/0/5 unassigned     YES unset up           up
GigabitEthernet1/0/6 unassigned     YES unset up           up
GigabitEthernet1/0/7 unassigned     YES unset up           up
GigabitEthernet1/0/8 unassigned     YES unset up           up
GigabitEthernet1/0/9 unassigned     YES unset up           up
GigabitEthernet1/0/10 unassigned    YES unset administratively down down
GigabitEthernet1/0/11 unassigned    YES unset administratively down down
GigabitEthernet1/0/12 unassigned    YES unset administratively down down
GigabitEthernet1/0/13 unassigned    YES unset administratively down down
GigabitEthernet1/0/14 unassigned    YES unset administratively down down
GigabitEthernet1/0/15 unassigned    YES unset administratively down down
GigabitEthernet1/0/16 unassigned    YES unset administratively down down
GigabitEthernet1/0/17 unassigned    YES unset administratively down down
GigabitEthernet1/0/18 unassigned    YES unset administratively down down
GigabitEthernet1/0/19 unassigned    YES unset administratively down down
GigabitEthernet1/0/20 unassigned    YES unset administratively down down
GigabitEthernet1/0/21 unassigned    YES unset administratively down down
GigabitEthernet1/0/22 unassigned    YES unset administratively down down
GigabitEthernet1/0/23 unassigned    YES unset administratively down down
GigabitEthernet1/0/24 100.100.100.10 YES manual up           up
GigabitEthernet1/1/1 unassigned     YES unset administratively down down
GigabitEthernet1/1/2 unassigned     YES unset administratively down down
GigabitEthernet1/1/3 unassigned     YES unset administratively down down
GigabitEthernet1/1/4 unassigned     YES unset administratively down down
Vlan1              unassigned     YES unset administratively down down
Vlan10             172.16.0.1    YES manual up           up
Vlan20             172.16.4.1    YES manual up           up
Vlan30             172.16.5.1    YES manual up           up
Vlan40             172.16.6.129   YES manual up           up
Vlan50             172.16.6.193   YES manual up           up
Vlan60             172.16.7.1    YES manual up           up
Vlan70             172.16.7.33   YES manual up           up
Vlan80             172.16.7.49   YES manual up           up
Vlan90             172.16.7.57   YES manual up           up
Vlan99             unassigned     YES unset up           up
Primary#
```

(Figure -164)

VLAN Configuration Verification - Primary

```
Primary#show vlan brief
VLAN Name          Status    Ports
--- -----
1    default        active    Fa0/1, Fa0/2, Fa0/3, Fa0/4
                           Fa0/5, Fa0/6, Fa0/7, Fa0/8
                           Fa0/9, Fa0/10, Fa0/11, Fa0/12
                           Fa0/13, Fa0/14, Fa0/15, Fa0/16
                           Fa0/17, Fa0/18, Fa0/19, Fa0/20
                           Fa0/21, Fa0/22, Fa0/23, Fa0/24
                           Gig0/1, Gig0/2
10   wireless_users active
20   Wokers         active
30   Rest_area      active
40   IP_phones      active
50   Office_Managment active
60   Top_management active
70   IP_Cameras     active
80   Conference      active
90   IT_Department   active
99   native          active
1002 fddi-default  active
1003 token-ring-default active
1004 fddinet-default active
1005 trnet-default  active
Primary# |
```

(Figure -165)

IP Route Configuration Verification - Primary

```

Primary#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route

Gateway of last resort is 100.100.100.100 to network 0.0.0.0

  100.0.0.0/24 is subnetted, 1 subnets
C    100.100.100.0 is directly connected, GigabitEthernet1/0/24
  172.16.0.0/16 is variably subnetted, 9 subnets, 6 masks
C      172.16.0.0/22 is directly connected, Vlan10
C      172.16.4.0/24 is directly connected, Vlan20
C      172.16.5.0/24 is directly connected, Vlan30
C      172.16.6.128/26 is directly connected, Vlan40
C      172.16.6.192/26 is directly connected, Vlan50
C      172.16.7.0/27 is directly connected, Vlan60
C      172.16.7.32/28 is directly connected, Vlan70
C      172.16.7.48/29 is directly connected, Vlan80
C      172.16.7.56/29 is directly connected, Vlan90
S*   0.0.0.0/0 [1/0] via 100.100.100.100

Primary#

```

(Figure -166)

VTP Configuration Verification - Primary

```

Primary#show vtp status
VTP Version capable      : 1 to 2
VTP version running      : 1
VTP Domain Name          :
VTP Pruning Mode         : Disabled
VTP Traps Generation     : Disabled
Device ID                 : 0003.E4D0.1D00
Configuration last modified by 0.0.0.0 at 3-1-93 00:05:35
Local updater ID is 172.16.0.1 on interface V110 (lowest numbered VLAN interface found)

Feature VLAN :
-----
VTP Operating Mode       : Server
Maximum VLANs supported locally : 1005
Number of existing VLANs   : 15
Configuration Revision    : 20
MD5 digest               : 0xB0 0xC 0xDB 0x07 0xA0 0x4E 0xD1 0x44
                           0xF6 0x83 0xE 0xD3 0xA0 0x47 0x4F 0x04
Primary#

```

(Figure -167)

HSRP Configuration Verification - Primary

```

Primary#show standby brief
P indicates configured to preempt.
|
Interface  Grp  Pri P State Active      Standby           Virtual IP
Gig1/0/24   0    255 P Active local      100.100.100.20  100.100.100.30
V110        1    255 P Active local      172.16.0.2      172.16.0.3
V120        1    255 P Active local      172.16.4.2      172.16.4.3
V130        1    255 P Active local      172.16.5.2      172.16.5.3
V140        1    255 P Active local      172.16.6.130    172.16.6.131
V150        1    255 P Active local      172.16.6.194    172.16.6.195
V160        1    255 P Active local      172.16.7.2      172.16.7.3
V170        1    255 P Active local      172.16.7.34    172.16.7.35
V180        1    255 P Active local      172.16.7.50    172.16.7.51
V190        1    255 P Active local      172.16.7.58    172.16.7.59
Primary#

```

(Figure -168)

Etherchannel Summary Configuration Verification - Primary

```

Primary#show etherchannel summary
Flags: D - down      P - in port-channel
       I - stand-alone S - suspended
       H - Hot-standby (LACP only)
       R - Layer3      S - Layer2
       U - in use       f - failed to allocate aggregator
       u - unsuitable for bundling
       w - waiting to be aggregated
       d - default port

Number of channel-groups in use: 1
Number of aggregators: 1

Group Port-channel Protocol Ports
-----+-----+-----+
1      Po1(SU)          -      Gig1/0/1(P) Gig1/0/2(P)
Primary#

```

(Figure -169)

Trunking Configuration Verification - Primary

```

Primary#show interfaces trunk
Port      Mode        Encapsulation  Status      Native vlan
Gig1/0/3  on          802.1q         trunking   1
Gig1/0/5  on          802.1q         trunking   1
Gig1/0/6  on          802.1q         trunking   1
Gig1/0/7  on          802.1q         trunking   1
Gig1/0/8  on          802.1q         trunking   1
Gig1/0/9  on          802.1q         trunking   1

Port      Vlans allowed on trunk
Gig1/0/3  1-1005
Gig1/0/5  1-1005
Gig1/0/6  1-1005
Gig1/0/7  1-1005
Gig1/0/8  1-1005
Gig1/0/9  1-1005

Port      Vlans allowed and active in management domain
Gig1/0/3  1,10,20,30,40,50,60,70,80,90,99
Gig1/0/5  1,10,20,30,40,50,60,70,80,90,99
Gig1/0/6  1,10,20,30,40,50,60,70,80,90,99
Gig1/0/7  1,10,20,30,40,50,60,70,80,90,99
Gig1/0/8  1,10,20,30,40,50,60,70,80,90,99
Gig1/0/9  1,10,20,30,40,50,60,70,80,90,99

Port      Vlans in spanning tree forwarding state and not pruned
Gig1/0/3  1,10,20,30,40,50,60,70,80,90,99
Gig1/0/5  1,10,20,30,40,50,60,70,80,90,99
Gig1/0/6  1,10,20,30,40,50,60,70,80,90,99
Gig1/0/7  1,10,20,30,40,50,60,70,80,90,99
Gig1/0/8  1,10,20,30,40,50,60,70,80,90,99
Gig1/0/9  1,10,20,30,40,50,60,70,80,90,99

Primary#

```

(Figure -170)

Spanning-tree Configuration Verification-VLAN 01,10,20 - Primary

```

Primary#show spanning-tree
VLAN0001
  Spanning tree enabled protocol ieee
  Root ID  Priority    24586
            Address   0002.1749.EB4C
            Cost       6
            Port       39(Port-channel1)
            Hello Time 2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID Priority    32769  (priority 32768 sys-id-ext 1)
            Address   0002.1749.EB4C
            Hello Time 2 sec  Max Age 20 sec  Forward Delay 15 sec
            Aging Time 20

  Interface      Role Sts Cost      Prio.Nbr Type
  -----  -----
  Gi1/0/8        Desg FWD 19      128.8    P2p
  Gi1/0/9        Desg FWD 19      128.9    P2p
  Gi1/0/3        Desg FWD 19      128.3    P2p
  Gi1/0/5        Desg FWD 19      128.5    P2p
  Gi1/0/6        Desg FWD 19      128.6    P2p
  Gi1/0/7        Desg FWD 19      128.7    P2p
  Po1           Root BKN*3      128.39   Shr *TYPE_Inc

VLAN0010
  Spanning tree enabled protocol ieee
  Root ID  Priority    24586
            Address   0002.1749.EB4C
            This bridge is the root
            Hello Time 2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID Priority    24586  (priority 24576 sys-id-ext 10)
            Address   0002.1749.EB4C
            Hello Time 2 sec  Max Age 20 sec  Forward Delay 15 sec
            Aging Time 20

  Interface      Role Sts Cost      Prio.Nbr Type
  -----  -----
  Gi1/0/8        Desg FWD 19      128.8    P2p
  Gi1/0/9        Desg FWD 19      128.9    P2p
  Gi1/0/3        Desg FWD 19      128.3    P2p
  Gi1/0/5        Desg FWD 19      128.5    P2p
  Gi1/0/6        Desg FWD 19      128.6    P2p
  Gi1/0/7        Desg FWD 19      128.7    P2p
  Po1           Desg FWD 3       128.39   Shr

VLAN0020
  Spanning tree enabled protocol ieee
  Root ID  Priority    24596
            Address   0002.1749.EB4C
            This bridge is the root
            Hello Time 2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID Priority    24596  (priority 24576 sys-id-ext 20)
            Address   0002.1749.EB4C
            Hello Time 2 sec  Max Age 20 sec  Forward Delay 15 sec
            Aging Time 20

  Interface      Role Sts Cost      Prio.Nbr Type
  -----  -----
  Gi1/0/8        Desg FWD 19      128.8    P2p
  Gi1/0/9        Desg FWD 19      128.9    P2p
  Gi1/0/3        Desg FWD 19      128.3    P2p
  Gi1/0/5        Desg FWD 19      128.5    P2p
  Gi1/0/6        Desg FWD 19      128.6    P2p
  Gi1/0/7        Desg FWD 19      128.7    P2p
  Po1           Desg FWD 3       128.39   Shr

```

(Figure -171)

Spanning-tree Configuration Verification-VLAN 30,40,50 - Primary

```
VLAN0030
  Spanning tree enabled protocol ieee
  Root ID  Priority    24606
            Address     0002.1749.EB4C
            This bridge is the root
            Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID Priority    24606 (priority 24576 sys-id-ext 30)
            Address     0002.1749.EB4C
            Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
            Aging Time   20

  Interface      Role Sts Cost      Prio.Nbr Type
  -----  -----
  Gi1/0/8        Desg FWD 19       128.8    P2p
  Gi1/0/9        Desg FWD 19       128.9    P2p
  Gi1/0/3        Desg FWD 19       128.3    P2p
  Gi1/0/5        Desg FWD 19       128.5    P2p
  Gi1/0/6        Desg FWD 19       128.6    P2p
  Gi1/0/7        Desg FWD 19       128.7    P2p
  Po1           Desg FWD 3        128.39   Shr

VLAN0040
  Spanning tree enabled protocol ieee
  Root ID  Priority    24616
            Address     0002.1749.EB4C
            This bridge is the root
            Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID Priority    24616 (priority 24576 sys-id-ext 40)
            Address     0002.1749.EB4C
            Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
            Aging Time   20

  Interface      Role Sts Cost      Prio.Nbr Type
  -----  -----
  Gi1/0/8        Desg FWD 19       128.8    P2p
  Gi1/0/9        Desg FWD 19       128.9    P2p
  Gi1/0/3        Desg FWD 19       128.3    P2p
  Gi1/0/5        Desg FWD 19       128.5    P2p
  Gi1/0/6        Desg FWD 19       128.6    P2p
  Gi1/0/7        Desg FWD 19       128.7    P2p
  Po1           Desg FWD 3        128.39   Shr

VLAN0050
  Spanning tree enabled protocol ieee
  Root ID  Priority    24626
            Address     0002.1749.EB4C
            This bridge is the root
            Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID Priority    24626 (priority 24576 sys-id-ext 50)
            Address     0002.1749.EB4C
            Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
            Aging Time   20

  Interface      Role Sts Cost      Prio.Nbr Type
  -----  -----
  Gi1/0/8        Desg FWD 19       128.8    P2p
  Gi1/0/9        Desg FWD 19       128.9    P2p
  Gi1/0/3        Desg FWD 19       128.3    P2p
  Gi1/0/5        Desg FWD 19       128.5    P2p
  Gi1/0/6        Desg FWD 19       128.6    P2p
  Gi1/0/7        Desg FWD 19       128.7    P2p
  Po1           Desg FWD 3        128.39   Shr
```

(Figure -172)

Spanning-tree Configuration Verification-VLAN 60,70,80 - Primary

```
VLAN0060
  Spanning tree enabled protocol ieee
  Root ID  Priority  24636
            Address  0002.1749.EB4C
            This bridge is the root
            Hello Time 2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID Priority  24636 (priority 24576 sys-id-ext 60)
            Address  0002.1749.EB4C
            Hello Time 2 sec  Max Age 20 sec  Forward Delay 15 sec
            Aging Time 20

  Interface      Role Sts Cost      Prio.Nbr Type
-----  -----
Gi1/0/8        Desg FWD 19      128.8    P2p
Gi1/0/9        Desg FWD 19      128.9    P2p
Gi1/0/3        Desg FWD 19      128.3    P2p
Gi1/0/5        Desg FWD 19      128.5    P2p
Gi1/0/6        Desg FWD 19      128.6    P2p
Gi1/0/7        Desg FWD 19      128.7    P2p
Po1           Desg FWD 3       128.39   Shr

VLAN0070
  Spanning tree enabled protocol ieee
  Root ID  Priority  24646
            Address  0002.1749.EB4C
            This bridge is the root
            Hello Time 2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID Priority  24646 (priority 24576 sys-id-ext 70)
            Address  0002.1749.EB4C
            Hello Time 2 sec  Max Age 20 sec  Forward Delay 15 sec
            Aging Time 20

  Interface      Role Sts Cost      Prio.Nbr Type
-----  -----
Gi1/0/8        Desg FWD 19      128.8    P2p
Gi1/0/9        Desg FWD 19      128.9    P2p
Gi1/0/3        Desg FWD 19      128.3    P2p
Gi1/0/5        Desg FWD 19      128.5    P2p
Gi1/0/6        Desg FWD 19      128.6    P2p
Gi1/0/7        Desg FWD 19      128.7    P2p
Po1           Desg FWD 3       128.39   Shr

VLAN0080
  Spanning tree enabled protocol ieee
  Root ID  Priority  24656
            Address  0002.1749.EB4C
            This bridge is the root
            Hello Time 2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID Priority  24656 (priority 24576 sys-id-ext 80)
            Address  0002.1749.EB4C
            Hello Time 2 sec  Max Age 20 sec  Forward Delay 15 sec
            Aging Time 20

  Interface      Role Sts Cost      Prio.Nbr Type
-----  -----
Gi1/0/8        Desg FWD 19      128.8    P2p
Gi1/0/9        Desg FWD 19      128.9    P2p
Gi1/0/3        Desg FWD 19      128.3    P2p
Gi1/0/5        Desg FWD 19      128.5    P2p
Gi1/0/6        Desg FWD 19      128.6    P2p
Gi1/0/7        Desg FWD 19      128.7    P2p
Po1           Desg FWD 3       128.39   Shr
```

(Figure -173)

Spanning-tree Configuration Verification-VLAN 90,99 - Primary

```
VLAN090
  Spanning tree enabled protocol ieee
  Root ID  Priority    24666
            Address   0002.1749.EB4C
            This bridge is the root
            Hello Time 2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID Priority    24666 (priority 24576 sys-id-ext 90)
            Address   0002.1749.EB4C
            Hello Time 2 sec  Max Age 20 sec  Forward Delay 15 sec
            Aging Time 20

  Interface      Role Sts Cost      Prio.Nbr Type
  -----  -----
  Gi1/0/8        Desg FWD 19       128.8    P2p
  Gi1/0/9        Desg FWD 19       128.9    P2p
  Gi1/0/3        Desg FWD 19       128.3    P2p
  Gi1/0/5        Desg FWD 19       128.5    P2p
  Gi1/0/6        Desg FWD 19       128.6    P2p
  Gi1/0/7        Desg FWD 19       128.7    P2p
  Po1           Desg FWD 3        128.39   Shr

VLAN099
  Spanning tree enabled protocol ieee
  Root ID  Priority    24675
            Address   0002.1749.EB4C
            This bridge is the root
            Hello Time 2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID Priority    24675 (priority 24576 sys-id-ext 99)
            Address   0002.1749.EB4C
            Hello Time 2 sec  Max Age 20 sec  Forward Delay 15 sec
            Aging Time 20

  Interface      Role Sts Cost      Prio.Nbr Type
  -----  -----
  Gi1/0/8        Desg FWD 19       128.8    P2p
  Gi1/0/9        Desg FWD 19       128.9    P2p
  Gi1/0/3        Desg FWD 19       128.3    P2p
  Gi1/0/5        Desg FWD 19       128.5    P2p
  Gi1/0/6        Desg FWD 19       128.6    P2p
  Gi1/0/7        Desg FWD 19       128.7    P2p
  Po1           Desg FWD 3        128.39   Shr
```

(Figure -174)

6.1.2 Core Layer L3 Backup switch Configuration Verification

IP Configuration Verification - Backup

```
Backup#show ip interface brief
Interface          IP-Address      OK? Method Status       Protocol
Port-channel1     unassigned      YES unset up           up
GigabitEthernet1/0/1 unassigned      YES unset up           up
GigabitEthernet1/0/2 unassigned      YES unset up           up
GigabitEthernet1/0/3 unassigned      YES unset up           up
GigabitEthernet1/0/4 unassigned      YES unset administratively down down
GigabitEthernet1/0/5 unassigned      YES unset up           up
GigabitEthernet1/0/6 unassigned      YES unset up           up
GigabitEthernet1/0/7 unassigned      YES unset up           up
GigabitEthernet1/0/8 unassigned      YES unset up           up
GigabitEthernet1/0/9 unassigned      YES unset up           up
GigabitEthernet1/0/10 unassigned     YES unset administratively down down
GigabitEthernet1/0/11 unassigned     YES unset administratively down down
GigabitEthernet1/0/12 unassigned     YES unset administratively down down
GigabitEthernet1/0/13 unassigned     YES unset administratively down down
GigabitEthernet1/0/14 unassigned     YES unset administratively down down
GigabitEthernet1/0/15 unassigned     YES unset administratively down down
GigabitEthernet1/0/16 unassigned     YES unset administratively down down
GigabitEthernet1/0/17 unassigned     YES unset administratively down down
GigabitEthernet1/0/18 unassigned     YES unset administratively down down
GigabitEthernet1/0/19 unassigned     YES unset administratively down down
GigabitEthernet1/0/20 unassigned     YES unset administratively down down
GigabitEthernet1/0/21 unassigned     YES unset administratively down down
GigabitEthernet1/0/22 unassigned     YES unset administratively down down
GigabitEthernet1/0/23 unassigned     YES unset administratively down down
GigabitEthernet1/0/24 100.100.100.20 YES manual up           up
GigabitEthernet1/1/1 unassigned      YES unset administratively down down
GigabitEthernet1/1/2 unassigned      YES unset administratively down down
GigabitEthernet1/1/3 unassigned      YES unset administratively down down
GigabitEthernet1/1/4 unassigned      YES unset administratively down down
Vlan1              unassigned      YES unset administratively down down
Vlan10             172.16.0.2      YES manual up           up
Vlan20             172.16.4.2      YES manual up           up
Vlan30             172.16.5.2      YES manual up           up
Vlan40             172.16.6.130    YES manual up           up
Vlan50             172.16.6.194    YES manual up           up
Vlan60             172.16.7.2      YES manual up           up
Vlan70             172.16.7.34     YES manual up           up
Vlan80             172.16.7.50     YES manual up           up
Vlan90             172.16.7.58     YES manual up           up
Vlan99             unassigned      YES unset up           up
Backup#
```

(Figure -175)

VLAN Configuration Verification – Backup

```
Backup#show vlan brief
VLAN Name                Status      Ports
--- -----
1   default               active     Fa0/1, Fa0/2, Fa0/3, Fa0/4
                           Fa0/5, Fa0/6, Fa0/7, Fa0/8
                           Fa0/9, Fa0/10, Fa0/11, Fa0/12
                           Fa0/13, Fa0/14, Fa0/15, Fa0/16
                           Fa0/17, Fa0/18, Fa0/19, Fa0/20
                           Fa0/21, Fa0/22, Fa0/23, Fa0/24
                           Gig0/1, Gig0/2
10  wireless_users        active
20  Wokers                active
30  Rest_area              active
40  IP_phones              active
50  Office_Managment       active
60  Top_management         active
70  IP_Cameras             active
80  Conference              active
90  IT_Department          active
99  native                 active
1002 fddi-default          active
1003 token-ring-default    active
1004 fddinet-default        active
1005 trnet-default          active
```

(Figure -176)

IP Route Configuration Verification – Backup

```

Backup#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route

Gateway of last resort is 100.100.100.100 to network 0.0.0.0

  100.0.0.0/24 is subnetted, 1 subnets
C    100.100.100.0 is directly connected, GigabitEthernet1/0/24
  172.16.0.0/16 is variably subnetted, 9 subnets, 6 masks
C      172.16.0.0/22 is directly connected, Vlan10
C      172.16.4.0/24 is directly connected, Vlan20
C      172.16.5.0/24 is directly connected, Vlan30
C      172.16.6.128/26 is directly connected, Vlan40
C      172.16.6.192/26 is directly connected, Vlan50
C      172.16.7.0/27 is directly connected, Vlan60
C      172.16.7.32/28 is directly connected, Vlan70
C      172.16.7.48/29 is directly connected, Vlan80
C      172.16.7.56/29 is directly connected, Vlan90
S*   0.0.0.0/0 [1/0] via 100.100.100.100

Backup#

```

(Figure -177)

VTP Configuration Verification – Backup

```

Backup#show vtp status
VTP Version capable      : 1 to 2
VTP version running      : 1
VTP Domain Name          :
VTP Pruning Mode         : Disabled
VTP Traps Generation     : Disabled
Device ID                 : 0002.1725.C600
Configuration last modified by 0.0.0.0 at 3-1-93 00:10:02
Local updater ID is 172.16.0.2 on interface Vl10 (lowest numbered VLAN interface found)

Feature VLAN :
-----
VTP Operating Mode       : Server
Maximum VLANs supported locally : 1005
Number of existing VLANs   : 15
Configuration Revision    : 20
MD5 digest                : 0x81 0x7A 0xEE 0x2B 0xAE 0x6F 0xA9 0x07
                             0x44 0x33 0xB0 0xD5 0x4F 0xC8 0xBF 0x03
Backup#

```

(Figure -178)

HSRP Configuration Verification – Backup

```

Backup#show standby brief
                  P indicates configured to preempt.
                  |
Interface  Grp  Pri  P State   Active      Standby      Virtual IP
Gig1/0/24   0    254  P Standby  100.100.100.10 local       100.100.100.30
Vl10        1    254  P Standby  172.16.0.1   local       172.16.0.3
Vl20        1    254  P Standby  172.16.4.1   local       172.16.4.3
Vl30        1    254  P Standby  172.16.5.1   local       172.16.5.3
Vl40        1    254  P Standby  172.16.6.129  local       172.16.6.131
Vl50        1    254  P Standby  172.16.6.193  local       172.16.6.195
Vl60        1    254  P Standby  172.16.7.1   local       172.16.7.3
Vl70        1    254  P Standby  172.16.7.33  local       172.16.7.35
Vl80        1    254  P Standby  172.16.7.49   local      172.16.7.51
Vl90        1    254  P Standby  172.16.7.57   local      172.16.7.59
Backup#

```

(Figure -179)

Etherchannel Summary Configuration Verification – Backup

```

Backup#show etherchannel summary
Flags: D - down      P - in port-channel
       I - stand-alone S - suspended
       H - Hot-standby (LACP only)
       R - Layer3      S - Layer2
       U - in use      f - failed to allocate aggregator
       u - unsuitable for bundling
       w - waiting to be aggregated
       d - default port

Number of channel-groups in use: 1
Number of aggregators: 1

Group  Port-channel  Protocol    Ports
-----+-----+-----+
1      Po1(SU)        -          Gig1/0/1(P) Gig1/0/2(P)
Backup#

```

(Figure -180)

Trunking Configuration Verification – Backup

```

Backup#show interfaces trunk
Port      Mode      Encapsulation  Status      Native vlan
Gig1/0/3  on       802.1q        trunking   1
Gig1/0/5  on       802.1q        trunking   1
Gig1/0/6  on       802.1q        trunking   1
Gig1/0/7  on       802.1q        trunking   1
Gig1/0/8  on       802.1q        trunking   1
Gig1/0/9  on       802.1q        trunking   1

Port      Vlans allowed on trunk
Gig1/0/3  1-1005
Gig1/0/5  1-1005
Gig1/0/6  1-1005
Gig1/0/7  1-1005
Gig1/0/8  1-1005
Gig1/0/9  1-1005

Port      Vlans allowed and active in management domain
Gig1/0/3  1,10,20,30,40,50,60,70,80,90,99
Gig1/0/5  1,10,20,30,40,50,60,70,80,90,99
Gig1/0/6  1,10,20,30,40,50,60,70,80,90,99
Gig1/0/7  1,10,20,30,40,50,60,70,80,90,99
Gig1/0/8  1,10,20,30,40,50,60,70,80,90,99
Gig1/0/9  1,10,20,30,40,50,60,70,80,90,99

Port      Vlans in spanning tree forwarding state and not pruned
Gig1/0/3  1,10,20,30,40,50,60,70,80,90,99
Gig1/0/5  1
Gig1/0/6  1
Gig1/0/7  1
Gig1/0/8  1
Gig1/0/9  1

Backup#

```

(Figure -181)

Spanning-tree Configuration Verification-VLAN 01,10,20 – Backup

```

Backup#show spanning-tree
VLAN001
  Spanning tree enabled protocol ieee
  Root ID  Priority    24586
            Address     0002.1749.EB4C
            Cost         3
            Port        39(Port-channel1)
            Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID Priority    32769  (priority 32768 sys-id-ext 1)
            Address     0006.2AAA.E166
            Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
            Aging Time   20

  Interface      Role Sts Cost      Prio.Nbr Type
  -----  -----
  Po1          Root FWD 3       128.39  Shr
  Gi1/0/6       Desg FWD 19    128.6   P2p
  Gi1/0/1       Desg FWD 4       128.1   P2p
  Gi1/0/2       Desg FWD 4       128.2   P2p
  Gi1/0/3       Desg FWD 19    128.3   P2p
  Gi1/0/5       Desg FWD 19    128.5   P2p
  Gi1/0/8       Desg FWD 19    128.8   P2p
  Gi1/0/9       Desg FWD 19    128.9   P2p
  Gi1/0/7       Desg FWD 19    128.7   P2p

VLAN0010
  Spanning tree enabled protocol ieee
  Root ID  Priority    24586
            Address     0002.1749.EB4C
            Cost         38
            Port        3(GigabitEthernet1/0/3)
            Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID Priority    28682  (priority 28672 sys-id-ext 10)
            Address     0006.2AAA.E166
            Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
            Aging Time   20

  Interface      Role Sts Cost      Prio.Nbr Type
  -----  -----
  Gi1/0/6       Altn BLK 19    128.6   P2p
  Gi1/0/3       Root FWD 19    128.3   P2p
  Gi1/0/5       Altn BLK 19    128.5   P2p
  Gi1/0/8       Altn BLK 19    128.8   P2p
  Gi1/0/9       Altn BLK 19    128.9   P2p
  Gi1/0/7       Altn BLK 19    128.7   P2p

VLAN0020
  Spanning tree enabled protocol ieee
  Root ID  Priority    24596
            Address     0002.1749.EB4C
            Cost         38
            Port        3(GigabitEthernet1/0/3)
            Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID Priority    28692  (priority 28672 sys-id-ext 20)
            Address     0006.2AAA.E166
            Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
            Aging Time   20

  Interface      Role Sts Cost      Prio.Nbr Type
  -----  -----
  Gi1/0/6       Altn BLK 19    128.6   P2p
  Gi1/0/3       Root FWD 19    128.3   P2p
  Gi1/0/5       Altn BLK 19    128.5   P2p
  Gi1/0/8       Altn BLK 19    128.8   P2p
  Gi1/0/9       Altn BLK 19    128.9   P2p
  Gi1/0/7       Altn BLK 19    128.7   P2p

```

(Figure -182)

Spanning-tree Configuration Verification-VLAN 30,40,50 – Backup

```
VLAN0030
  Spanning tree enabled protocol ieee
  Root ID  Priority    24606
            Address   0002.1749.EB4C
            Cost        38
            Port       3(GigabitEthernet1/0/3)
            Hello Time 2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID Priority    28702  (priority 28672 sys-id-ext 30)
            Address   0006.2AAA.E166
            Hello Time 2 sec  Max Age 20 sec  Forward Delay 15 sec
            Aging Time 20

  Interface      Role Sts Cost      Prio.Nbr Type
  -----  -----
  Gi1/0/6        Altn BLK 19      128.6    P2p
  Gi1/0/3        Root FWD 19      128.3    P2p
  Gi1/0/5        Altn BLK 19      128.5    P2p
  Gi1/0/8        Altn BLK 19      128.8    P2p
  Gi1/0/9        Altn BLK 19      128.9    P2p
  Gi1/0/7        Altn BLK 19      128.7    P2p

VLAN0040
  Spanning tree enabled protocol ieee
  Root ID  Priority    24616
            Address   0002.1749.EB4C
            Cost        38
            Port       3(GigabitEthernet1/0/3)
            Hello Time 2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID Priority    28712  (priority 28672 sys-id-ext 40)
            Address   0006.2AAA.E166
            Hello Time 2 sec  Max Age 20 sec  Forward Delay 15 sec
            Aging Time 20

  Interface      Role Sts Cost      Prio.Nbr Type
  -----  -----
  Gi1/0/6        Altn BLK 19      128.6    P2p
  Gi1/0/3        Root FWD 19      128.3    P2p
  Gi1/0/5        Altn BLK 19      128.5    P2p
  Gi1/0/8        Altn BLK 19      128.8    P2p
  Gi1/0/9        Altn BLK 19      128.9    P2p
  Gi1/0/7        Altn BLK 19      128.7    P2p

VLAN0050
  Spanning tree enabled protocol ieee
  Root ID  Priority    24626
            Address   0002.1749.EB4C
            Cost        38
            Port       3(GigabitEthernet1/0/3)
            Hello Time 2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID Priority    28722  (priority 28672 sys-id-ext 50)
            Address   0006.2AAA.E166
            Hello Time 2 sec  Max Age 20 sec  Forward Delay 15 sec
            Aging Time 20

  Interface      Role Sts Cost      Prio.Nbr Type
  -----  -----
  Gi1/0/6        Altn BLK 19      128.6    P2p
  Gi1/0/3        Root FWD 19      128.3    P2p
  Gi1/0/5        Altn BLK 19      128.5    P2p
  Gi1/0/8        Altn BLK 19      128.8    P2p
  Gi1/0/9        Altn BLK 19      128.9    P2p
  Gi1/0/7        Altn BLK 19      128.7    P2p
```

(Figure -183)

Spanning-tree Configuration Verification-VLAN 60,70,80 – Backup

```
VLAN0060
  Spanning tree enabled protocol ieee
  Root ID  Priority    24636
            Address     0002.1749.EB4C
            Cost        38
            Port        3(GigabitEthernet1/0/3)
            Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID Priority    28732  (priority 28672 sys-id-ext 60)
            Address     0006.2AAA.E166
            Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec
            Aging Time  20

  Interface      Role Sts Cost      Prio.Nbr Type
  -----  -----
  Gi1/0/6        Altn BLK 19      128.6    P2p
  Gi1/0/3        Root FWD 19      128.3    P2p
  Gi1/0/5        Altn BLK 19      128.5    P2p
  Gi1/0/8        Altn BLK 19      128.8    P2p
  Gi1/0/9        Altn BLK 19      128.9    P2p
  Gi1/0/7        Altn BLK 19      128.7    P2p

VLAN0070
  Spanning tree enabled protocol ieee
  Root ID  Priority    24646
            Address     0002.1749.EB4C
            Cost        38
            Port        3(GigabitEthernet1/0/3)
            Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID Priority    32838  (priority 32768 sys-id-ext 70)
            Address     0006.2AAA.E166
            Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec
            Aging Time  20

  Interface      Role Sts Cost      Prio.Nbr Type
  -----  -----
  Gi1/0/6        Altn BLK 19      128.6    P2p
  Gi1/0/3        Root FWD 19      128.3    P2p
  Gi1/0/5        Altn BLK 19      128.5    P2p
  Gi1/0/8        Altn BLK 19      128.8    P2p
  Gi1/0/9        Altn BLK 19      128.9    P2p
  Gi1/0/7        Altn BLK 19      128.7    P2p

VLAN0080
  Spanning tree enabled protocol ieee
  Root ID  Priority    24656
            Address     0002.1749.EB4C
            Cost        38
            Port        3(GigabitEthernet1/0/3)
            Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID Priority    32848  (priority 32768 sys-id-ext 80)
            Address     0006.2AAA.E166
            Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec
            Aging Time  20

  Interface      Role Sts Cost      Prio.Nbr Type
  -----  -----
  Gi1/0/6        Altn BLK 19      128.6    P2p
  Gi1/0/3        Root FWD 19      128.3    P2p
  Gi1/0/5        Altn BLK 19      128.5    P2p
  Gi1/0/8        Altn BLK 19      128.8    P2p
  Gi1/0/9        Altn BLK 19      128.9    P2p
  Gi1/0/7        Altn BLK 19      128.7    P2p
```

(Figure -184)

Spanning-tree Configuration Verification-VLAN 90,99 – Backup

```
VLAN0090
  Spanning tree enabled protocol ieee
  Root ID  Priority    24666
            Address     0002.1749.EB4C
            Cost         38
            Port        3(GigabitEthernet1/0/3)
            Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID Priority    32858  (priority 32768 sys-id-ext 90)
            Address     0006.2AAA.E166
            Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
            Aging Time   20

  Interface      Role Sts Cost      Prio.Nbr Type
  -----  -----
  Gi1/0/6        Desg LSN 19      128.6    P2p
  Gi1/0/3        Root FWD 19      128.3    P2p
  Gi1/0/5        Desg LSN 19      128.5    P2p
  Gi1/0/8        Desg LSN 19      128.8    P2p
  Gi1/0/9        Desg LSN 19      128.9    P2p
  Gi1/0/7        Desg LSN 19      128.7    P2p

VLAN0099
  Spanning tree enabled protocol ieee
  Root ID  Priority    24675
            Address     0002.1749.EB4C
            Cost         38
            Port        3(GigabitEthernet1/0/3)
            Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID Priority    28771  (priority 28672 sys-id-ext 99)
            Address     0006.2AAA.E166
            Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
            Aging Time   20

  Interface      Role Sts Cost      Prio.Nbr Type
  -----  -----
  Gi1/0/6        Altn BLK 19      128.6    P2p
  Gi1/0/3        Root FWD 19      128.3    P2p
  Gi1/0/5        Altn BLK 19      128.5    P2p
  Gi1/0/8        Altn BLK 19      128.8    P2p
  Gi1/0/9        Altn BLK 19      128.9    P2p
  Gi1/0/7        Altn BLK 19      128.7    P2p

Backup#
```

(Figure -185)

6.1.3 Access Layer L2 switches Verification

Ground floor, First floor, Second floor, Third floor and Fourth floor switches configuration and Verification All are same.

VLAN Configuration Verification - L2 switches

```
FLOOR-NO#show interfaces trunk
Port      Mode      Encapsulation  Status      Native vlan
Fa0/23    on        802.1q         trunking    1
Fa0/24    on        802.1q         trunking    1

Port      Vlans allowed on trunk
Fa0/23   1-1005
Fa0/24   1-1005

Port      Vlans allowed and active in management domain
Fa0/23   1,10,20,30,40,50,60,70,80,90,99
Fa0/24   1,10,20,30,40,50,60,70,80,90,99

Port      Vlans in spanning tree forwarding state and not pruned
Fa0/23   10,20,30,40,50,60,70,80,90,99
Fa0/24   1

FLOOR-NO#
```

(Figure -186)

Trunking Configuration Verification - L2 switches

```
Primary#show vlan brief
VLAN Name          Status    Ports
----- -----
1    default        active    Fa0/1, Fa0/2, Fa0/3, Fa0/4
                           Fa0/5, Fa0/6, Fa0/7, Fa0/8
                           Fa0/9, Fa0/10, Fa0/11, Fa0/12
                           Fa0/13, Fa0/14, Fa0/15, Fa0/16
                           Fa0/17, Fa0/18, Fa0/19, Fa0/20
                           Fa0/21, Fa0/22, Fa0/23, Fa0/24
                           Gig0/1, Gig0/2
10   wireless_users  active
20   Wokers          active
30   Rest_area        active
40   IP_phones        active
50   Office_Managment active
60   Top_management   active
70   IP_Cameras       active
80   Conference        active
90   IT_Department    active
99   native           active
1002 fddi-default    active
1003 token-ring-default active
1004 fddinet-default  active
1005 trnet-default    active
Primary# |
```

(Figure -187)

IP Configuration Verification- L2 switches

Interface	IP-Address	OK?	Method	Status	Protocol
FastEthernet0/1	unassigned	YES	manual	up	up
FastEthernet0/2	unassigned	YES	manual	up	up
FastEthernet0/3	unassigned	YES	manual	down	down
FastEthernet0/4	unassigned	YES	manual	down	down
FastEthernet0/5	unassigned	YES	manual	down	down
FastEthernet0/6	unassigned	YES	manual	down	down
FastEthernet0/7	unassigned	YES	manual	down	down
FastEthernet0/8	unassigned	YES	manual	down	down
FastEthernet0/9	unassigned	YES	manual	down	down
FastEthernet0/10	unassigned	YES	manual	administratively down	down
FastEthernet0/11	unassigned	YES	manual	administratively down	down
FastEthernet0/12	unassigned	YES	manual	administratively down	down
FastEthernet0/13	unassigned	YES	manual	administratively down	down
FastEthernet0/14	unassigned	YES	manual	administratively down	down
FastEthernet0/15	unassigned	YES	manual	administratively down	down
FastEthernet0/16	unassigned	YES	manual	administratively down	down
FastEthernet0/17	unassigned	YES	manual	administratively down	down
FastEthernet0/18	unassigned	YES	manual	administratively down	down
FastEthernet0/19	unassigned	YES	manual	administratively down	down
FastEthernet0/20	unassigned	YES	manual	administratively down	down
FastEthernet0/21	unassigned	YES	manual	administratively down	down
FastEthernet0/22	unassigned	YES	manual	administratively down	down
FastEthernet0/23	unassigned	YES	manual	up	up
FastEthernet0/24	unassigned	YES	manual	up	up
GigabitEthernet0/1	unassigned	YES	manual	administratively down	down
GigabitEthernet0/2	unassigned	YES	manual	administratively down	down
Vlan1	unassigned	YES	manual	administratively down	down

(Figure -188)

6.1.4 Management switch Verification

IP Configuration Verification - Management switch

Interface	IP-Address	OK?	Method	Status	Protocol
FastEthernet0/1	unassigned	YES	manual	administratively down	down
FastEthernet0/2	unassigned	YES	manual	up	up
FastEthernet0/3	unassigned	YES	manual	administratively down	down
FastEthernet0/4	unassigned	YES	manual	administratively down	down
FastEthernet0/5	unassigned	YES	manual	administratively down	down
FastEthernet0/6	unassigned	YES	manual	administratively down	down
FastEthernet0/7	unassigned	YES	manual	administratively down	down
FastEthernet0/8	unassigned	YES	manual	administratively down	down
FastEthernet0/9	unassigned	YES	manual	administratively down	down
FastEthernet0/10	unassigned	YES	manual	administratively down	down
FastEthernet0/11	unassigned	YES	manual	administratively down	down
FastEthernet0/12	unassigned	YES	manual	administratively down	down
FastEthernet0/13	unassigned	YES	manual	administratively down	down
FastEthernet0/14	unassigned	YES	manual	administratively down	down
FastEthernet0/15	unassigned	YES	manual	administratively down	down
FastEthernet0/16	unassigned	YES	manual	administratively down	down
FastEthernet0/17	unassigned	YES	manual	administratively down	down
FastEthernet0/18	unassigned	YES	manual	administratively down	down
FastEthernet0/19	unassigned	YES	manual	administratively down	down
FastEthernet0/20	unassigned	YES	manual	administratively down	down
FastEthernet0/21	unassigned	YES	manual	administratively down	down
FastEthernet0/22	unassigned	YES	manual	administratively down	down
FastEthernet0/23	unassigned	YES	manual	up	up
FastEthernet0/24	unassigned	YES	manual	up	up
GigabitEthernet0/1	unassigned	YES	manual	administratively down	down
GigabitEthernet0/2	unassigned	YES	manual	administratively down	down
Vlan1	unassigned	YES	manual	administratively down	down

(Figure -189)

6.1.5 Server switch Verification

IP Configuration Verification - Server switch

```
SERVER-SWITCH#show ip interface brief
Interface          IP-Address      OK? Method Status           Protocol
FastEthernet0/1    unassigned     YES manual administratively down down
FastEthernet0/2    unassigned     YES manual administratively down down
FastEthernet0/3    unassigned     YES manual administratively down down
FastEthernet0/4    unassigned     YES manual administratively down down
FastEthernet0/5    unassigned     YES manual administratively down down
FastEthernet0/6    unassigned     YES manual administratively down down
FastEthernet0/7    unassigned     YES manual administratively down down
FastEthernet0/8    unassigned     YES manual administratively down down
FastEthernet0/9    unassigned     YES manual administratively down down
FastEthernet0/10   unassigned     YES manual administratively down down
FastEthernet0/11   unassigned     YES manual administratively down down
FastEthernet0/12   unassigned     YES manual administratively down down
FastEthernet0/13   unassigned     YES manual administratively down down
FastEthernet0/14   unassigned     YES manual administratively down down
FastEthernet0/15   unassigned     YES manual administratively down down
FastEthernet0/16   unassigned     YES manual administratively down down
FastEthernet0/17   unassigned     YES manual administratively down down
FastEthernet0/18   unassigned     YES manual administratively down down
FastEthernet0/19   unassigned     YES manual administratively down down
FastEthernet0/20   unassigned     YES manual administratively down down
FastEthernet0/21   unassigned     YES manual administratively down down
FastEthernet0/22   unassigned     YES manual administratively down down
FastEthernet0/23   unassigned     YES manual up           up
FastEthernet0/24   unassigned     YES manual up           up
GigabitEthernet0/1 unassigned     YES manual up           up
GigabitEthernet0/2 unassigned     YES manual administratively down down
Vlan1             unassigned     YES manual administratively down down
SERVER-SWITCH#
```

(Figure -190)

6.1.6 Firewall-Proxy Server Implementation Verification

Proxy-Report and Users Web Logs Verification

Squid User Access Report

Screenshot 1: Squid user access report (Jun 2024)

Date	Group	Users	Overview	Bytes	Average	Hit %	
10 Jun 2024	HR	5	1	1.5 G	300.4 M	0.00%	
09 Jun 2024	HR	1	1	97.3 M	97.3 M	0.00%	
08 Jun 2024	HR	3	2	1.1 G	362.1 M	0.00%	
Total/Average:			3	2	2.6 G	253.3 M	0.00%

Screenshot 2: Squid user access report (10 Jun 2024)

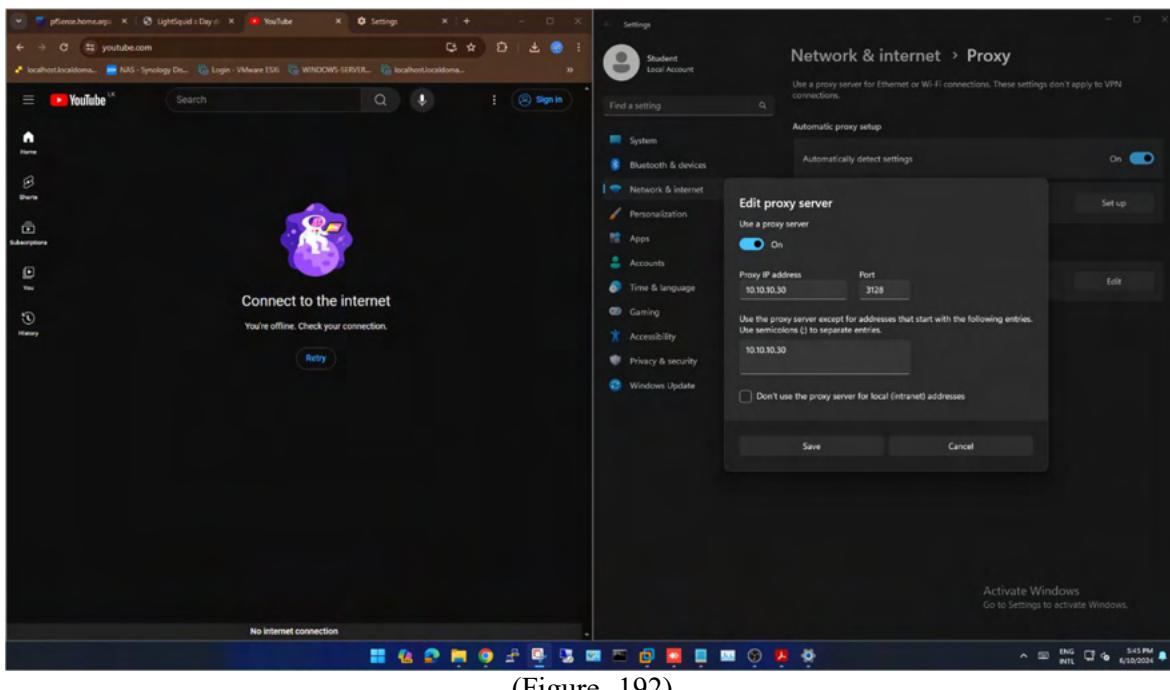
#	Time	User	Real Name	Connect	Bytes	%	Group
1	192.168.1.6	?	12:152	1.3 G	89.2%	2	
2	192.168.2.6	?	11:30	146.1 M	9.7%	2	
3	192.168.1.5	?	6:55	14.8 M	0.9%	2	
4	192.168.2.5	?	3:7	878.519	0.0%	2	
5	localhost	?	3	11.865	0.0%	2	

Screenshot 3: Squid user access report (10 Jun 2024) - Big Files

Total	Accessed site	Connect	Bytes	Cumulative	%
1	12.tlu.dl.delivery.mp.microsoft.com	10 534	1.0 G	1.0 G	78.3%
2	msedge.tlu.dl.delivery.mp.microsoft.com		2 165.8 M	1.2 G	12.3%
3	15.tlu.dl.delivery.mp.microsoft.com		80 32.5 M	1.2 G	2.4%
4	msedge.b.tlu.dl.delivery.mp.microsoft.com		244 20.1 M	1.2 G	1.5%
5	3.tlu.dl.delivery.mp.microsoft.com		66 13.8 M	1.2 G	1.0%
6	au.download.windowsupdate.com		109 12.4 M	1.2 G	0.9%
7	4.tlu.dl.delivery.mp.microsoft.com		21 11.1 M	1.2 G	0.8%
8	11.tlu.dl.delivery.mp.microsoft.com		87 6.5 M	1.2 G	0.4%
9	data-edge.smartscreen.microsoft.com:443		17 4.6 M	1.2 G	0.3%
10	tu.dl.delivery.mp.microsoft.com:443		12 3.7 M	1.2 G	0.2%
11	bing.com:443		30 3.7 M	1.2 G	0.2%
12	www.bing.com:443		66 2.9 M	1.2 G	0.2%
13	www.google.com:443		7 1.8 M	1.2 G	0.1%
14	ebayimg.com:443		5 1.5 M	1.2 G	0.1%
15	res.cdn.office.net:443		25 1.1 M	1.2 G	0.0%
16	www.gstatic.com:443		3 1.0 M	1.2 G	0.0%
17	v10.events.data.microsoft.com:443		187 931.752	1.2 G	0.0%
18	cp601.prod.do.dsp.mp.microsoft.com:443		103 715.529	1.2 G	0.0%
19	ntp.msn.com:443		6 543.244	1.2 G	0.0%
20	th.bing.com:443		34 495.709	1.2 G	0.0%
21	www.ebay.com:443		1 435.010	1.2 G	0.0%
22	assets.msn.com:443		19 386.244	1.2 G	0.0%
23	tsfe.trafficshaping.dsp.mp.microsoft.com:443		30 380.363	1.2 G	0.0%
24	assets.gstatic.com:443		4 330.620	1.2 G	0.0%
25	support.nagios.com:443		7 330.337	1.2 G	0.0%
26	geover.prod.do.dsp.mp.microsoft.com:443		45 286.896	1.2 G	0.0%
27	api.msn.com:443		12 268.403	1.2 G	0.0%
28	dl.delivery.mp.microsoft.com		102 221.561	1.2 G	0.0%
29	licensing.mp.microsoft.com:443		10 120.490	1.2 G	0.0%
30	config.edge.skyape.com:443		7 110.632	1.2 G	0.0%
31	fonts.gstatic.com:443		5 109.413	1.2 G	0.0%
32	fe3cr.delivery.mp.microsoft.com:443		21 85.755	1.2 G	0.0%
33	securepubads.g.doubleclick.net:443		2 84.317	1.2 G	0.0%
34	kv601.prod.do.dsp.mp.microsoft.com:443		11 83.147	1.2 G	0.0%
35	p.clarity.ms:443		14 83.042	1.2 G	0.0%
36	www.googletagmanager.com:443		1 79.637	1.2 G	0.0%
37	browser.events.data.msn.com:443		14 73.902	1.2 G	0.0%
38	oneclient.sfx.ms:443		1 72.695	1.2 G	0.0%

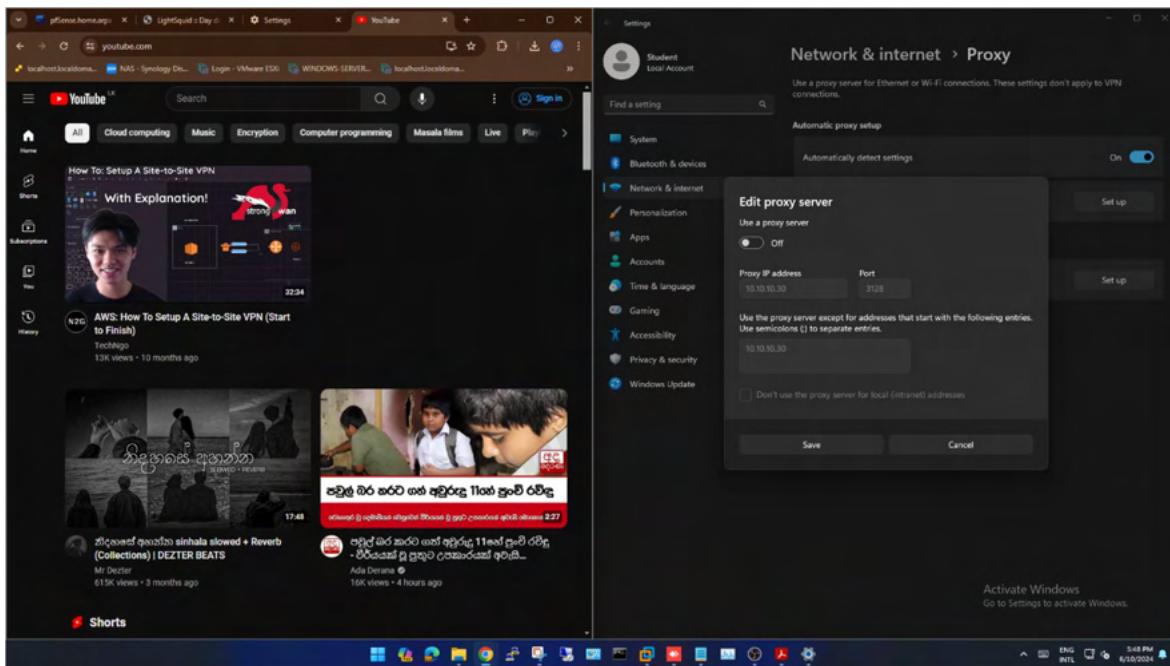
(Figure -191)

Firewall Proxy Service and Backlist Verification-when service ON



(Figure -192)

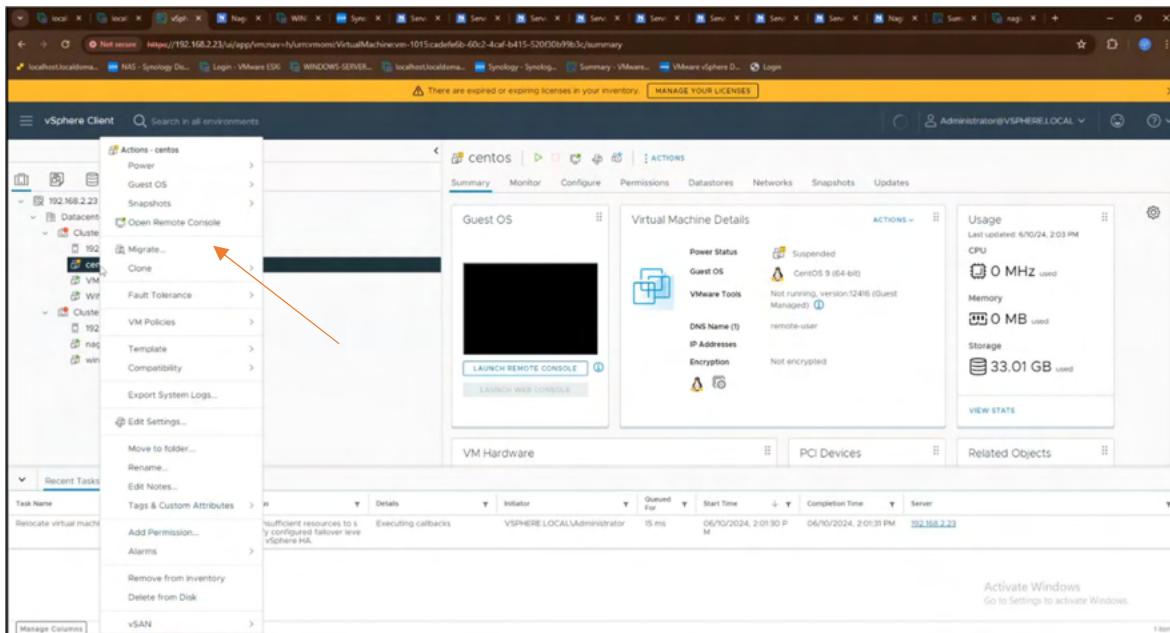
Firewall Proxy Service and Backlist Verification-when service OFF



(Figure -193)

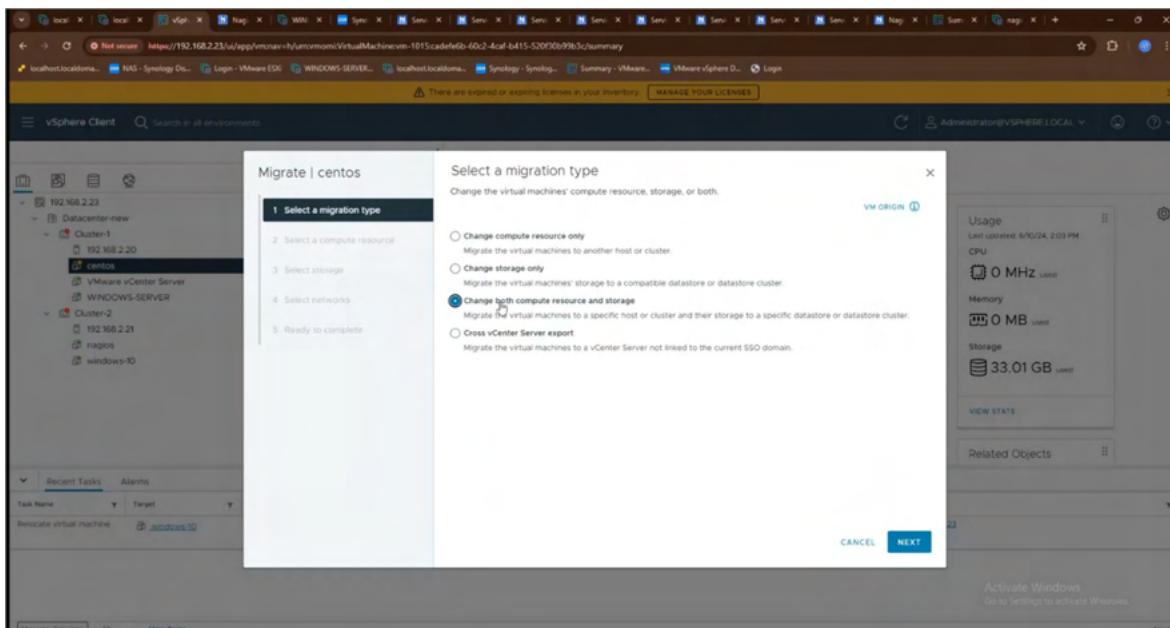
6.1.7 Offline Migration Implementation Verification

Select machine



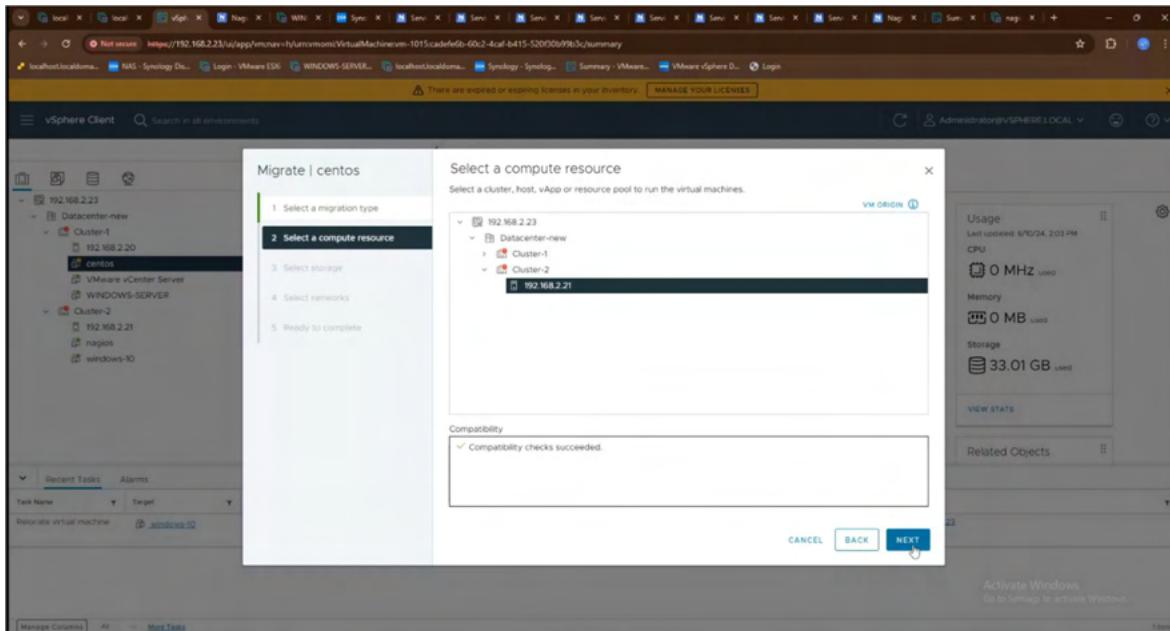
(Figure -194)

Select Migration Type



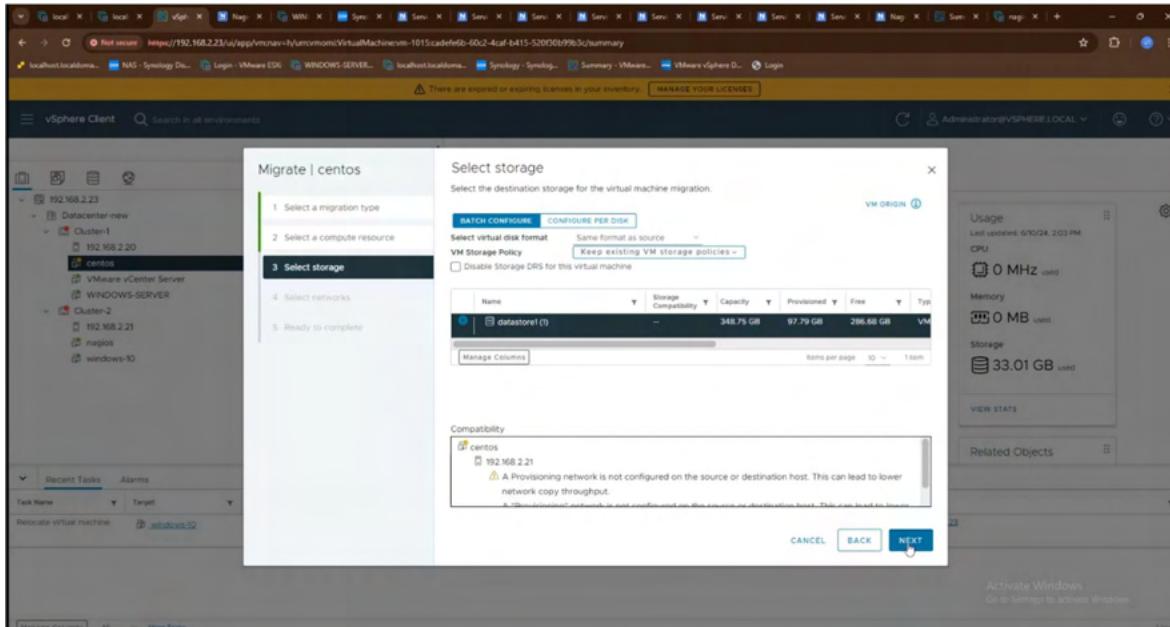
(Figure -195)

Select Migration Destination



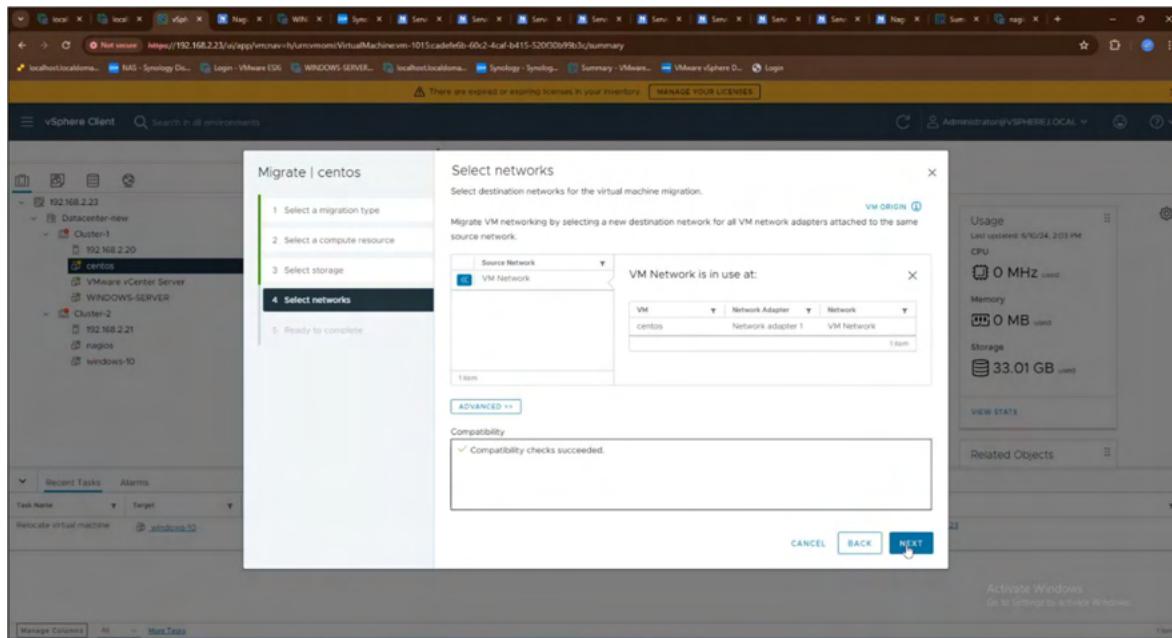
(Figure -196)

Select Migration Destination-storage



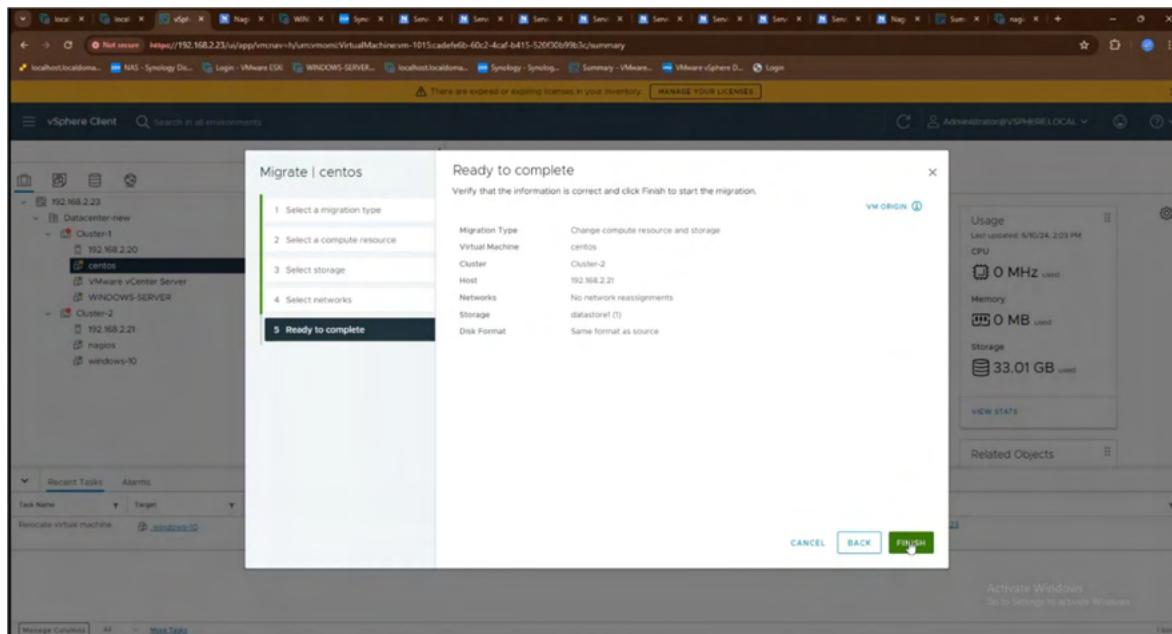
(Figure -197)

Select Migration Destination-network



(Figure -198)

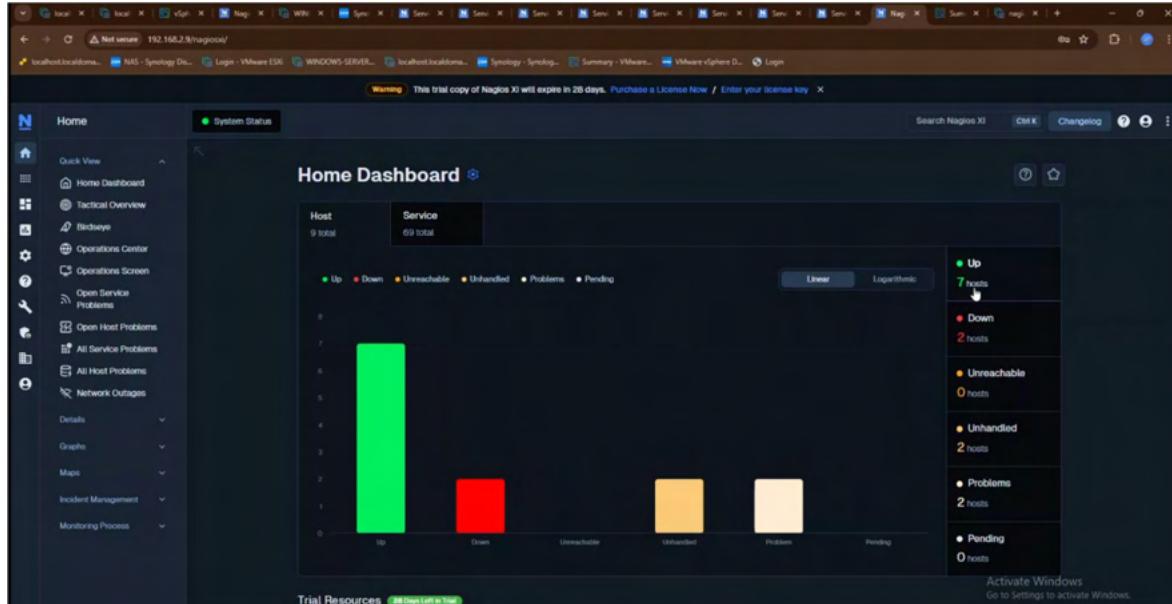
Migration Confirmation



(Figure -199)

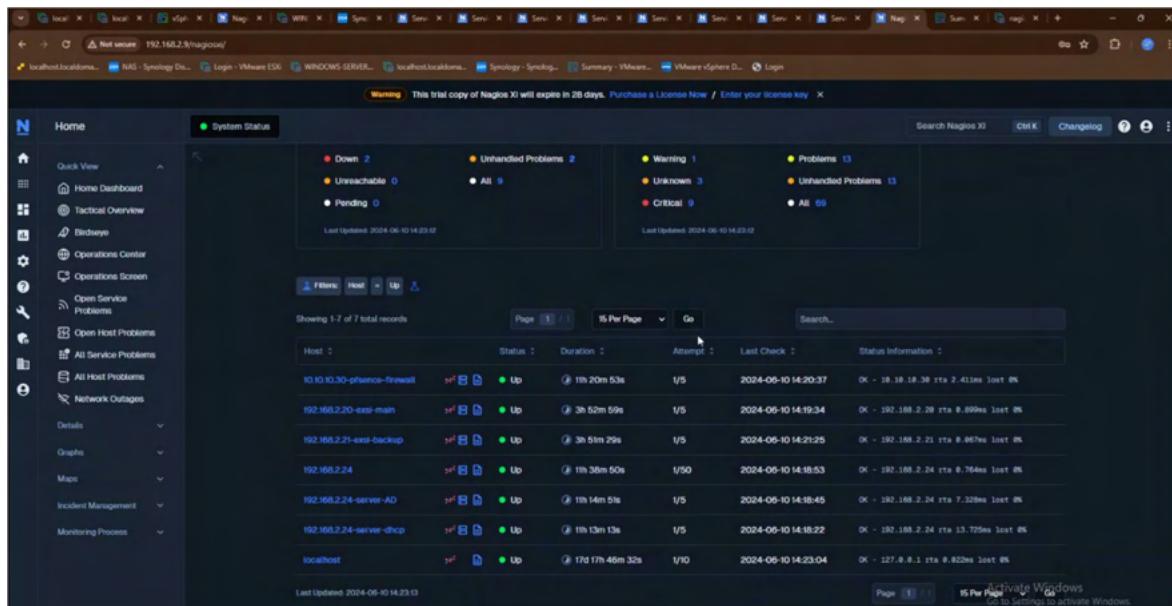
6.1.8 Nagios Monitoring Implementation Verification

Main dashboard



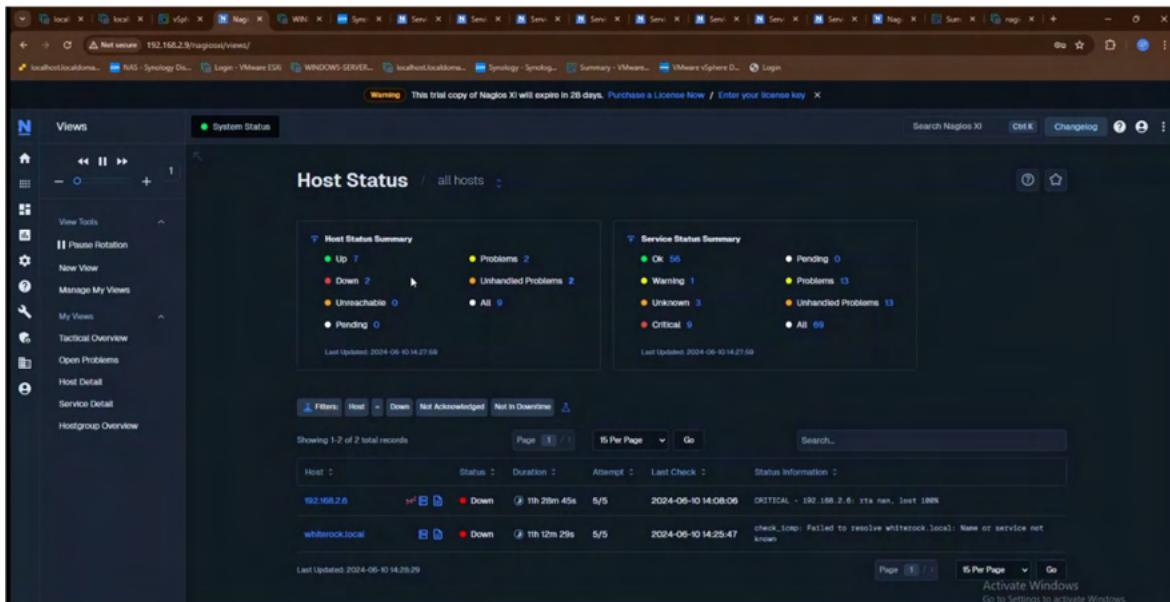
(Figure -200)

Live Monitoring All Added Interfaces



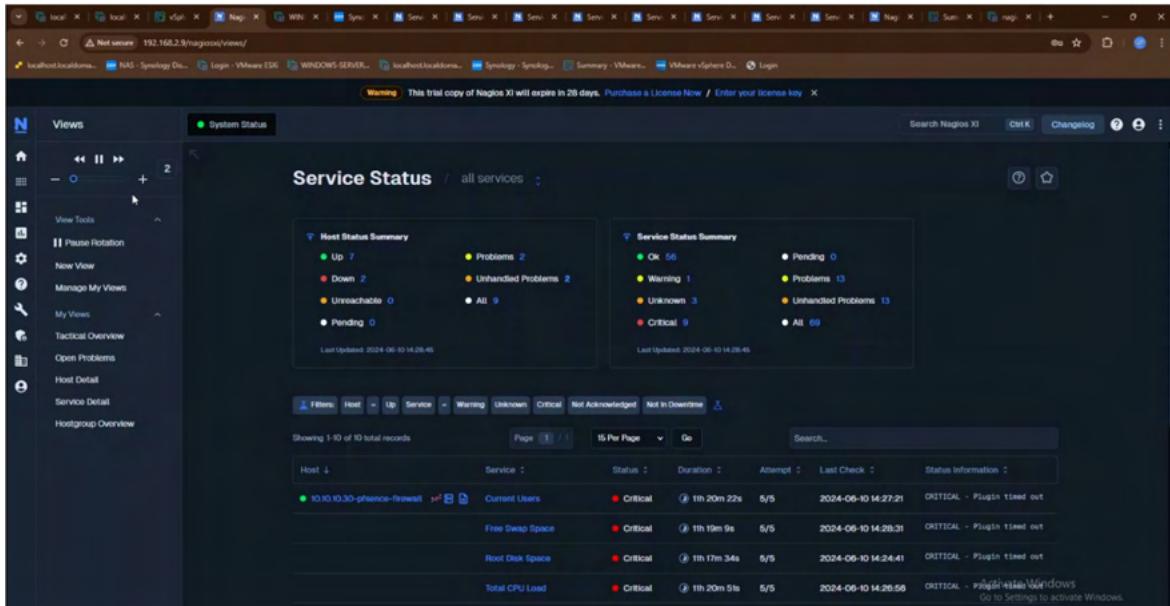
(Figure -201)

Notify 2 Down Ports



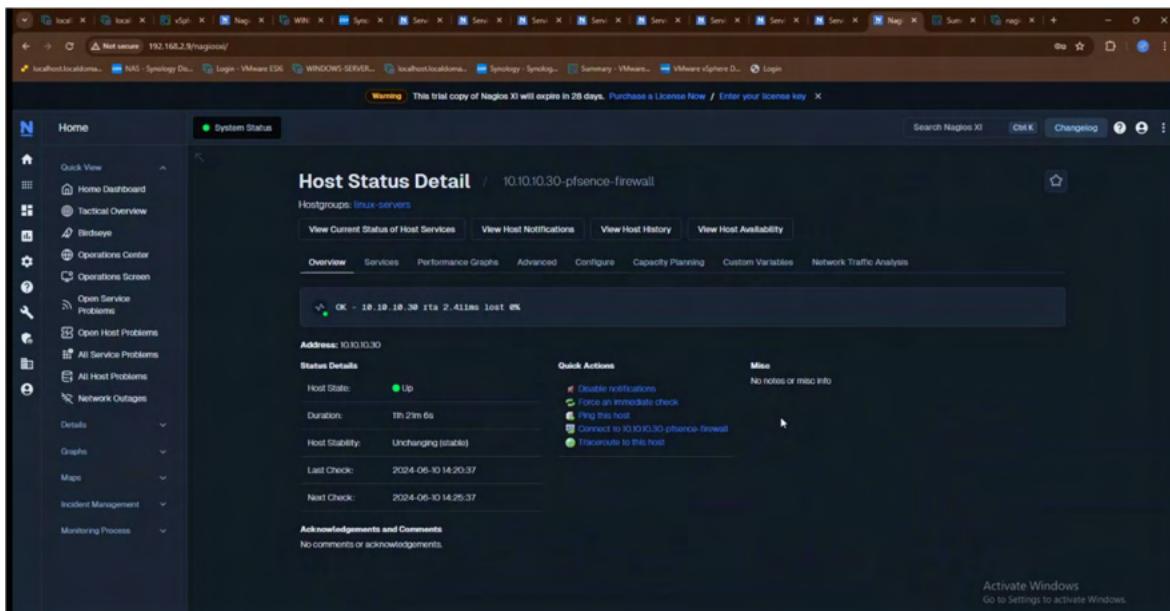
(Figure -202)

Nagios Service Status



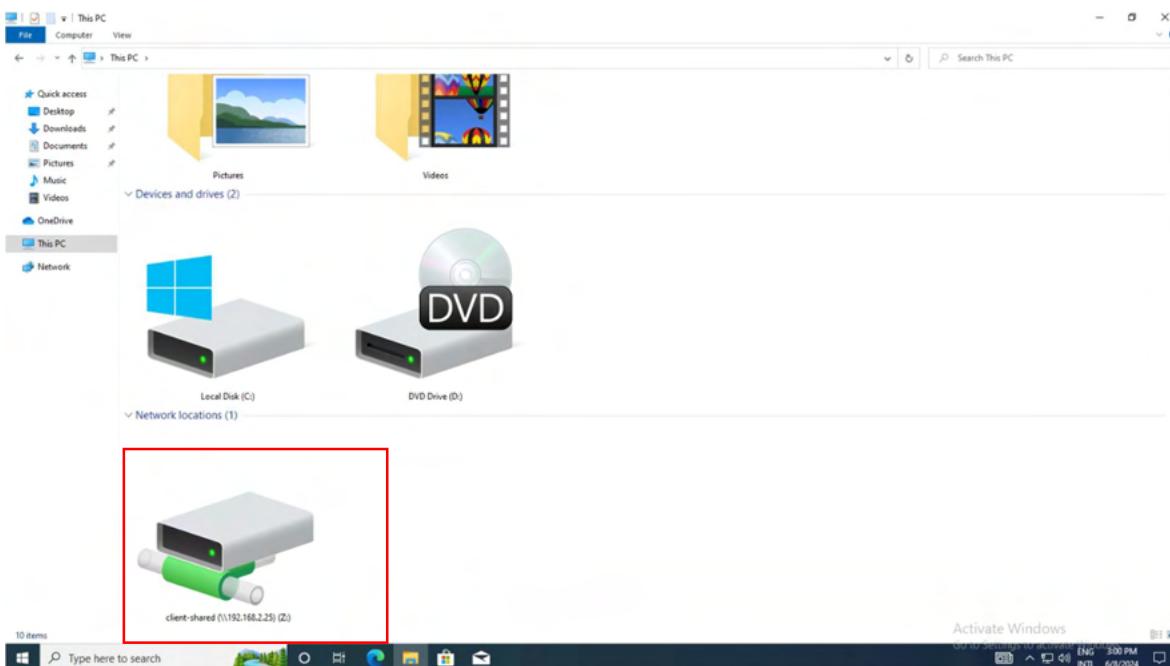
(Figure -203)

Pfsense Firewall Monitoring Details



(Figure -204)

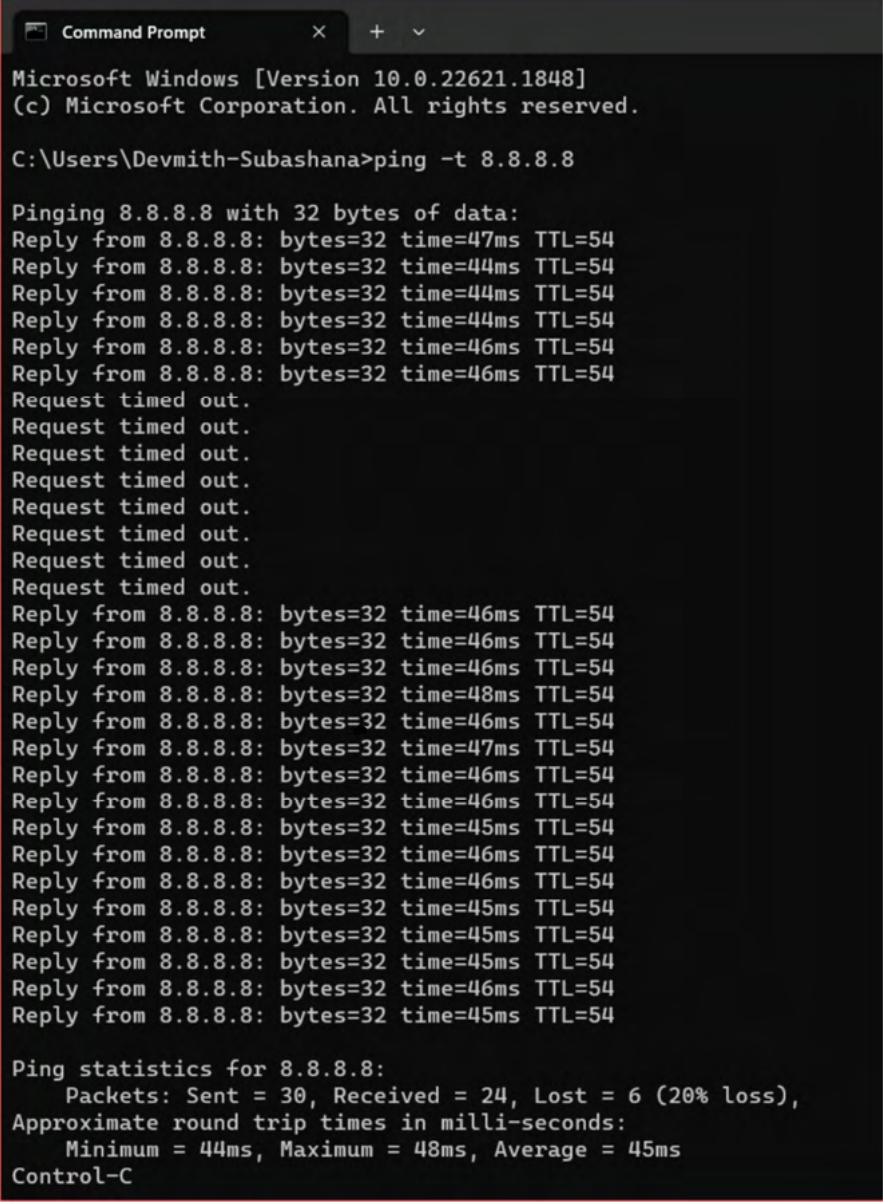
6.1.9 Attached Shared Folder On Client PC Implementation Verification



(Figure -205)

6.1.10 Internet Connectivity Confirmation

clients Reach The Google DNS Server



The screenshot shows a Microsoft Windows Command Prompt window with the title "Command Prompt". The window displays the output of a "ping" command to the IP address 8.8.8.8. The output shows multiple replies from the Google DNS server, with most replies having a TTL of 54 and times ranging from 44ms to 48ms. There are also several "Request timed out." messages. The ping statistics at the end show a 20% loss of packets.

```
Microsoft Windows [Version 10.0.22621.1848]
(c) Microsoft Corporation. All rights reserved.

C:\Users\Devmith-Subashana>ping -t 8.8.8.8

Pinging 8.8.8.8 with 32 bytes of data:
Reply from 8.8.8.8: bytes=32 time=47ms TTL=54
Reply from 8.8.8.8: bytes=32 time=44ms TTL=54
Reply from 8.8.8.8: bytes=32 time=44ms TTL=54
Reply from 8.8.8.8: bytes=32 time=44ms TTL=54
Reply from 8.8.8.8: bytes=32 time=46ms TTL=54
Reply from 8.8.8.8: bytes=32 time=46ms TTL=54
Request timed out.
Reply from 8.8.8.8: bytes=32 time=46ms TTL=54
Reply from 8.8.8.8: bytes=32 time=46ms TTL=54
Reply from 8.8.8.8: bytes=32 time=46ms TTL=54
Reply from 8.8.8.8: bytes=32 time=48ms TTL=54
Reply from 8.8.8.8: bytes=32 time=46ms TTL=54
Reply from 8.8.8.8: bytes=32 time=47ms TTL=54
Reply from 8.8.8.8: bytes=32 time=46ms TTL=54
Reply from 8.8.8.8: bytes=32 time=46ms TTL=54
Reply from 8.8.8.8: bytes=32 time=46ms TTL=54
Reply from 8.8.8.8: bytes=32 time=45ms TTL=54
Reply from 8.8.8.8: bytes=32 time=46ms TTL=54
Reply from 8.8.8.8: bytes=32 time=46ms TTL=54
Reply from 8.8.8.8: bytes=32 time=45ms TTL=54
Reply from 8.8.8.8: bytes=32 time=45ms TTL=54
Reply from 8.8.8.8: bytes=32 time=45ms TTL=54
Reply from 8.8.8.8: bytes=32 time=46ms TTL=54
Reply from 8.8.8.8: bytes=32 time=45ms TTL=54

Ping statistics for 8.8.8.8:
    Packets: Sent = 30, Received = 24, Lost = 6 (20% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 44ms, Maximum = 48ms, Average = 45ms
Control-C
```

(Figure -206)

07. Conclusion

The network design presented in this report offers a comprehensive and efficient solution for enhancing the connectivity and communication infrastructure of the university.

Through careful analysis and consideration of the institution's requirements, we have developed a strong network architecture that supports the current needs and allows for future scalability. The design incorporates a hierarchical network model, utilizing core, distribution, and access layers to optimize performance, security, and manageability. By implementing redundant links, load balancing mechanisms, and backup systems, we have addressed potential points of failure 100 and ensured high availability for critical services. Additionally, the design incorporates provisions for wireless connectivity across the campus, allowing seamless access to network resources for both staff and students. Rich wireless coverage, coupled with access controls and quality of service mechanisms, ensures a reliable and optimized user experience.

The deployment plan presented in this report outlines the necessary steps, timelines, and resource requirements for implementing the proposed network design. It also considers factors such as budgetary constraints and potential disruptions to minimize any negative impacts during the implementation phase. Overall, the network design outlined in this report aspires to provide the university with a modern, scalable, and secure network infrastructure that fosters collaboration, innovation, and efficient communication among students, faculty, and staff. By embracing this design, the university can enhance its technological capabilities and support its mission of delivering high-quality education in the digital generation.

The Floor Plans of the University consists of 5 floors which are, Ground floor, First floor, Second floor, Third floor and Fourth floor There are WAPs, CCTVs, switches, PCs, IP phones, printers, Projectors, and other technology on every floor. Each level is 3.6 meters tall, with a total space of around 7,500 square meters. Since the budget is constrained, the customer has asked that Cat 6 cables be used for the wiring. The Red, Yellow, Green, Blue, and Pink LINES on each floor represent the cable structure. All The servers are reachable at the third floor in the server room, along with other network management devices. Due to various departments, the number of host devices and speed of the internet connectivity may change.

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09. DEVICES SELECTION AND FEATURES

9.1 Access Points

Cisco Catalyst 9120AX Series



(Figure -207)

The Cisco Catalyst 9120AX Series Access Points are the next generation of enterprise access points.

They are resilient, secure, and intelligent.

Trust Anchor capabilities include:

- Image signing
- Secure Boot
- Cisco Trust Anchor module

Features and benefits

- Wi-Fi 6 (802.11ax)
- Cisco RF ASIC
- Uplink/downlink OFDMA
- MU-MIMO technology
- Target wake time
- Intelligent Capture
- Flexible Radio Assignment
- Dual 5-GHz radio support
- Smart antenna connector
- Cisco Embedded Wireless Controller

9.2 Server Rack

Cisco R42610 Rack



(Figure -208)

Cisco® R Series Racks are an ideal solution for mission-critical environments that require the highest levels of reliability, structural integrity, and security. The series' modern design delivers exceptional power, cooling, and cable management features as well as the strength and stability required in today's rack enclosures, offering peace of mind for the most important infrastructure elements. The Cisco R Series Racks are certified for use with the Cisco Unified Computing System™ and selected Nexus products, allowing Cisco to offer a complete infrastructure solution, including computing, networking, rack, power, and services.

Features and Benefits

- Tested with Cisco UCS
- Front & rear doors
- Split side panels
- Top panel
- PDU mounting
- Equipment mounting capacity 42RU

9.3 Servers

Cisco UCS B200 M6 Blade Server



(Figure -209)

The Cisco UCS B200 M6 Blade Server delivers performance, flexibility, and optimization for deployments in data centers, in the cloud, and at remote sites.

Features and benefits

The Cisco UCS B200 M6 provides these main features:

- Up to two 3rd Gen Intel Xeon Scalable processors with up to 40 cores per CPU
- 32 DIMM slots for industry-standard DDR4 memory at speeds up to 3200 MHz, with up to 8 TB of total memory when using 512-GB DIMMs. Up to 16 DIMM slots ready for Intel Optane DC PMem to accommodate up to 12 TB of Intel Optane DC persistent memory
- Modular LAN on Motherboard (mLOM) card with Cisco UCS Virtual Interface Card (VIC) 1440, a 2-port, 40-gigabit Ethernet (GE), Fiber Channel over Ethernet (FCoE)—capable mLOM mezzanine adapter
- Optional rear mezzanine VIC with two 40-Gbps unified I/O ports or two sets of 4 x 10-Gbps unified I/O ports, delivering 80 Gbps to the server; adapts to either 10- or 40-Gbps fabric connections
- Two optional, hot-pluggable, Solid-State Drives (SSDs), or Non-Volatile Memory Express (NVMe) 2.5-inch drives with a choice of enterprise-class Redundant Array of Independent Disks (RAIDs) or pass-through controllers or 4 M.2 SATA drives for flexible boot and local storage capabilities
- Support for one rear storage mezzanine card

Cisco UCS S3260 Storage Server



(Figure -210)

The Cisco UCS® S3260 Storage Server (Figure 1) is a modular, high-density, high-availability, dual-node storage- optimized server well suited for service providers, enterprises, and industry-specific environments.

Features and Benefits

- Dual 2-socket server nodes based on 2nd Gen Intel Xeon Scalable processors with up to 48 cores per server node
- Up to 1.5 TB of DDR4 memory per M5 server node and up to 1 TB of Intel Optane™ DC Persistent Memory
- Support for high-performance Nonvolatile Memory Express (NVMe) and flash memory
- Massive 1,080-TB data storage capacity that easily scales to petabytes with Cisco UCS Manager software
- Policy-based storage management framework for zero-touch capacity on demand
- Dual-port 40-Gbps system I/O controllers with a Cisco UCS Virtual Interface Card 1300 platform
- embedded chip or PCIe-based system I/O controller for Quad Port 10/25G Cisco VIC 1455 or Dual Port 40/100G Cisco VIC 1495 or 3rd party PCIe adapters
- Unified I/O for Ethernet or Fibre Channel to existing NAS or SAN storage environments
- Support for Cisco bidirectional transceivers, with 40-Gbps connectivity over existing 10-Gbps cabling infrastructure.

9.4 Edge Routers

Cisco Catalyst C8200-1N-4T edge router



(Figure -211)

The Cisco Catalyst 8200 Series Edge Platforms are 5G-ready cloud edge platforms designed for Secure Access Service Edge (SASE), multilayer security, and cloud-native agility to accelerate your journey to cloud.

Features and Benefits

- ❖ Multicore processors
 - C8200-1N-4T uses an Intel® x86 CPU with 8 GB DRAM memory default
- ❖ Embedded IPsec VPN hardware acceleration
 - C8200-1N-4T enables up to 1 Gbps IPsec traffic
- ❖ Integrated Gigabit Ethernet ports
 - Provides four built-in Ethernet WAN ports
 - Two Ethernet ports are Small Form-Factor Pluggable (SFP) and two are RJ45 ports, enabling fiber as well as copper connectivity
- ❖ DRAM
 - C8200-1N-4T ships with 8 GB DRAM
- ❖ Flash memory support
 - Both models have an integrated onboard 8-GB flash which is not upgradable. M.2 storage provides flash upgrade options
- ❖ Power supply
 - Both models use an internal, fixed AC power supply
 - Power over Ethernet (PoE) is available as an option
 - PoE ports added in the Network Interface Module (NIM) slot will require an additional external PoE power supply.

9.5 Firewall Devices

PFSENSE



(Figure -212)

The Cisco Firepower 4100 Series is a family of seven threat-focused NGFW security platforms. Their throughput range addresses data center and internet edge use cases.

Features and Benefits

- Firewall -80G
- NGFW -53G
- ISP -55G
- Interfaces -8 x SFP+ on chassis
- Optional Interfaces -2 x NM's: 1/10/40G, FTW
- Throughput: FW + AVC (1024B) -53 Gbps
- Throughput: FW + AVC + IPS (1024B) -53 Gbps
- Maximum concurrent sessions, with AVC -30 million
- Maximum new connections per second, with AVC-365K
- TLS (Hardware Decryption) -10 Gbps
- Throughput: NGIPS (1024B) -55 Gbps
- IPsec VPN Throughput (1024B TCP w/Fastpath) -24 Gbps
- Maximum VPN Peers -20,000
- Multi-Instance Capable -Yes
- Centralized management -Centralized configuration, logging, monitoring, and reporting are performed by the Management Center or alternatively in the cloud with Cisco Defense Orchestrator.

9.6 Layer 3 Switches

Catalyst 9500-48Y4C 25G high-performance switches



(Figure -213)

The Catalyst 9500 Series, including the new Catalyst 9500X models, continues to shape the future with continued innovation that helps you reimagine connections, reinforce security and redefine the experience for your hybrid workforce big and small.

Features and Benefits

- The Cisco Unified Access Data Plane (UADP) Application-Specific Integrated Circuit (ASIC) ready for next-generation technologies with its programmable pipeline, micro engine capabilities, and template-based, configurable allocation of Layer 2 and Layer 3 forwarding, Access Control Lists (ACLs), and Quality-of-Service (QoS) entries
- Up to 6.4 Tbps switching capacity with up to 2 Bpps of forwarding performance
- Up to 36 MB of unified buffer per ASIC
- Intel 2.4-GHz x86 CPU with up to 120 GB of USB 3.0 or up to 960 GB of SATA SSD storage for container-based application hosting
- Up to 48 nonblocking 25 Gigabit Ethernet SFP28 ports
- Scalable routing (IPv4, IPv6, and multicast) tables and Layer 2 tables
- Up to 256,000 routing entries (IPv4/IPv6) for high-end campus core and aggregation deployments
- Up to 512,000 Flexible NetFlow (FNF) entries in hardware
- IPv6 support in hardware, providing wire-rate forwarding for IPv6 networks
- Dual-stack IPv4/IPv6 and dynamic hardware forwarding table allocations, for ease of IPv4-to-IPv6 migration
- Hardware support for Application Hosting (e.g. with Cisco ThousandEyes Enterprise Agent).

9.7 Layer 2 Switches

Cisco Catalyst 9300X-12Y-A Switch



(Figure -214)

Cisco Catalyst 9300 Series switches are Cisco's lead stackable enterprise access switching platform and as part of the Catalyst 9000 family, are built to transform your network to handle a hybrid world where the workplace is anywhere, endpoints could be anything, and applications are hosted all over the place. The Catalyst 9300 Series, including the new Catalyst 9300X models, continues to shape the future with continued innovation that helps you reimagine connections, reinforce security and redefine the experience for your hybrid workforce big and small.

Features and Benefits

- ❖ Highest wireless scale for Wi-Fi 6 and 802.11ac Wave 2 access points supported on a single switch with select models
- ❖ Catalyst 9300 and Catalyst 9300L/LM models are based on the Cisco UADP 2.0 Application-Specific Integrated Circuit (ASIC) with programmable pipeline and micro-engine capabilities, along with template-based, configurable allocation of Layer 2 and Layer 3 forwarding, Access Control Lists (ACLs), and Quality of Service (QoS) entries
- ❖ Catalyst 9300X models are based on UADP 2.0sec ASIC which adds line rate support for Crypto, including 100G hardware-based IPsec
- ❖ x86 CPU complex with 8-GB memory, and 16 GB of flash and external USB 3.0 SSD pluggable storage slot (delivering up to 240GB of storage with an option SSD drive) to host containers. C9300X models support 16GB of memory
- ❖ USB 2.0 slot to load system images and set configurations
- ❖ Up to 1 TBps of local stackable switching bandwidth with Catalyst 9300X models
- ❖ Deeper buffer and higher scale model options for rich multi-media content delivery applications.

Cisco Catalyst 9400 Series Switch



(Figure -215)

Cisco® Catalyst® 9400 Series switches are Cisco's lead modular enterprise access switching platform and as part of the Catalyst 9000 family, are built to transform your network to handle a hybrid world where the workplace is anywhere, endpoints could be anything, and applications are hosted all over the place.

Cisco Catalyst 9400 Series chassis

The Cisco Catalyst 9400 Series offers three chassis options and a wide range of line card options. It provides a common architecture that can scale up to 400 ports. Cisco StackWise Virtual technology doubles this port density by virtually stacking two Catalyst 9400 modular switches in a single logical switch.

Supervisor configuration

The Catalyst 9400 Series offers an industry-leading supervisor engine built for secure networks, IoT applications, next generation mobility and cloud adoption. Supervisor Engine-2 options (Sup-2, Sup 2XL) and Supervisor Engine-1 options (Sup-1, Sup-1XL, Sup-1XL-Y) are built with the latest Unified Access Data Plane ASIC future-proofed for next generation technologies with its programmable pipeline, microengine capabilities and template-based configurable allocation of Layer 2, Layer 3, forwarding, Access Control Lists (ACLs) and QoS entries.

Line card options

The Catalyst 9400 Series offers the ability to mix and match a range of line cards to support numerous LAN access, server connectivity, Small and Medium-Sized Business (SMB) or branch-office deployments. The Cisco Catalyst 9400 Series supports the line cards listed in Table 4 by part number.

Power supply

There are three modes of operation supported by Cisco Catalyst 9400 power supplies. In all the modes the power supplies can be of type whether AC or DC.

- Redundant N + N mode
- Redundant N + 1 mode
- Combined mode

Fan trays

Each Cisco Catalyst 9400 Series uses dual serviceable fan trays for cooling. Cisco Catalyst 9400 switches can optionally be accessed from the rear for flexible cable management. The chassis is enterprise closet-optimized with side-to-side airflow.

Features and Benefits

- The Cisco Unified Access Data Plane (UADP) 3.0sec ASIC on C9400X-SUP-2XL, C9400X-SUP-2 and Cisco Unified Access Data Plane (UADP) 2.0 ASIC on C9400-SUP-1/1XL/1XL-Y is ready for next-generation technologies with its programmable pipeline, microengine capabilities, and template based configurable allocation of Layer 2, Layer 3, forwarding, Access Control List (ACL), and Quality of Service (QoS) entries
- Intel 2.4-GHz x86 with up to 960 GB of SATA SSD local storage for container-based application hosting
- Up to 4 non-blocking 100/40 Gigabit Ethernet uplinks and up to 4 non-blocking 25/10 Gigabit Ethernet uplinks on Supervisor-2/2XL
- Up to 2 non-blocking 25 Gigabit Ethernet uplinks on Supervisor-1XL-Y
- Up to 2 non-blocking 40 Gigabit Ethernet uplinks (Quad Small Form-Factor Pluggable [QSFP]) and up to 8 non-blocking 10 Gigabit Ethernet uplinks (SFP+) on Supervisor-1/1XL/1XL-Y.

9.8 Rackmount Monitor (KVM Switch)

NetDirector 8-Port B020-U08-19-IP



(Figure -216)

Control up to 8 computers from anywhere in the world with a single KVM switch with integrated console and IP remote access. This KVM switch is a smart solution for secure server control that saves rack space and money.

Features and Benefits

- Saves Space and Money
- IP Remote Access for Fewer Trips to the Server Room
- Simplifies IT Tasks
- Large 19" LCD
- Advanced Security Features
- Expandability and Long-Lasting Reliability

9.9 Patch Panel

TC-P48C6 Patch Panel



(Figure -217)

Prepare yourself for Copper Gigabit Ethernet with TRENDnet's Cat. 6 RJ-45 UTP Patch Panels. These patch panels are certified for 250Mhz Category 6, which are perfect for Copper Gigabit Ethernet connections

Features and Benefits

- Cat6 patch panels deliver a steady 250Mhz connection to copper Gigabit switches
- Ideal solution for Ethernet, Fast Ethernet and Gigabit applications
- Meets ANSI/EIA/TIA 568-B.2-1 and ISO/IEC 11801 Standards
- New version 110D IDC type terminal blocks (use 110 or Krone type tool)
- Color-coded labeling for T568A and T568B wiring schemes
- 1000Base-T Copper Gigabit Ethernet ready
- Compatible with Cat. 3, 4, 5, 5e, and 6 cabling
- Works perfectly with TC-PDT Punch Down Tool
- UL E157358 listed

9.10 Power Supply

PDUMH30NET Power Supply



(Figure -218)

2.9kW switched PDU distributes, monitors and manages single-phase power in an IT environment. Built-in Java-free network interface helps you remotely monitor load levels to prevent overloads that cause downtime. The PDUMH30NET 2.9kW Single-Phase Switched PDU provides advanced network control and remote power monitoring with the ability to turn on, turn off, reboot or lock out power to each outlet. By reducing the frequency of on-site visits, these advanced remote capabilities can save you money and reduce downtime

Features and Benefits

- 2.9kW 120V single-phase 2U rack-mount switched PDU
- 16 controllable NEMA 5-15/20R outlets in 2 load banks
- Pre-installed WEBCARDLX with latest version of PADM20 for IP-based Auto Probe feature
- Digital ammeter for on-site load monitoring in real time
- NEMA L5-30P input with 10-ft. (3.05 m) AC power cord.

9.11 UPS

OR1500LCDRTXL2U SMART APP LCD UPS



(Figure -219)

Cost-effective feature-rich power protection for networking, servers and telecommunications equipment. The CyberPower Smart App Intelligent LCD OR1500LCDRTXL2U uninterruptible power supply (UPS) is designed to protect office servers, corporate and departmental networks, and network-based appliances such as internetworking hardware, telecom equipment and high-end workstations. Its automatic voltage regulation (AVR) technology delivers a consistent and clean AC power, protecting connected equipment and preventing costly business interruptions. This UPS system is ENERGY STAR® qualified with patented Greenpower UPS™ Bypass circuitry to save on energy costs by reducing energy consumption and heat buildup.

Features and Benefits

- 1500VA / 1125W
- Line Interactive Topology
- Full AVR Buck/Boost
- GreenPower UPS™
- 2U Rack Mount/Tower Convertible
- Multifunction Rotatable LCD
- SNMP/HTTP Remote Management
- 8 Outlets / USB, Serial, and EPO Ports

OR500LCDRM1U SMART APP LCD UPS



(Figure -220)

A rackmount UPS with line interactive topology, the CyberPower Smart App LCD OR500LCDRM1U provides battery backup (using simulated sine wave output) and surge protection for department servers, workgroup servers, workstations, network devices, and telecom installations without active PFC power supplies. The OR500LCDRM1U uses Automatic Voltage Regulation (AVR) to correct minor power fluctuations without switching to battery power, which extends battery life. AVR is essential in areas where power fluctuations occur frequently.

Features and Benefits

- Capacity: 500 VA / 300 W
- Topology: Line Interactive
- Waveform: Simulated Sine Wave
- Output: 120 VAC ± 10%
- Plug type & cord: NEMA 5-15P, 10 ft. cord
- Outlet types: 6 × NEMA 5-15R
- Communication: USB, Relay, SNMP

9.12 IP Phones

Cisco IP Phone 8861



(Figure -221)

The Cisco® IP Phone 8861 is a business-class collaboration endpoint that combines high-fidelity, reliable, secure, and scalable voice over IP communications with Cisco Intelligent Proximity for telephony integration for personal mobile devices to support small to large enterprise businesses.

Features and Benefits

- The Cisco IP Phone 8861 offers a 5-in. high-resolution (800 x 480) widescreen VGA backlit color display. Localized language support, including right-to-left on-screen text, meets the needs of global users.
- The phone offers a built-in Gigabit Ethernet switch for both network connection and your PC connection.
- The phone also supports campuses with 802.11a/b/g/n/ac WLAN enabled.
- Support for Cisco EnergyWise™ technology makes the Cisco IP Phone 8861 more energy-efficient and ecofriendly; the phone is qualified by the Energy Star organization.
- An optional wall-mount kit is orderable as a spare part for customers seeking this capability.
- Up to three optional IP Phone 8800 Key Expansion Modules can be supported for 108 additional line/feature keys.
- Charcoal and white color options.

9.13 IP Cameras

Cisco Video Surveillance 8400 IP Camera



(Figure -222)

The Cisco® Video Surveillance 8400 IP Camera is an outdoor, high-definition, full-functioned video endpoint with an integrated infrared illuminator and industry-leading image quality and processing power.

Features and Benefits

- True high-definition video: The camera streams crisp and clear 2560 x 1920 (5 megapixel) video at 30fps while maintaining low network bandwidth.
- Motorized focus and zoom: The lens on the 8400 IP Camera allow the focus and zoom to be controlled remotely, greatly simplifying installations and field of view adjustments.
- Integrated infrared illuminator: The infrared illuminator can light an area up to 30 meters away. SMART IR feature allows camera to automatically adjust IR projection based on subject distance.
- Outdoor-ready: An IP67 and IK10-rated enclosure and an included mounting bracket allow for outdoor mounting straight out of the box.
- Quad streaming: The camera can stream H.265, H.264, and MJPEG video simultaneously. Each video stream can be configured with individual resolution, quality, and frame-rate settings.
- Day/night operation: The camera provides true day/night functionality and includes an infrared filter that automatically switches to night mode in low-light scenes. This function can be set to manual, automatic, or scheduled control.

9.14 Network Cables

Excel Solid Cat6 Cable U/UTP LSOH CPR Euroclass Dca



(Figure -223)

Excel solid Cat6 ethernet cable U/UTP LSOH CPR Euroclass Dca manufactured and tested to the TIA/EIA 568-B.2-1, EN50173-1 and ISO/ IEC 11801 Cat 6 specifications, 1000m Reel. Each cable consists of 8 color coded solid copper conductors twisted together to form four pairs. These are then formed around a central X-shaped polyethylene Centre with the whole cable produced in a LSOH sheath.

Excel Category 6 Unscreened LSOH cables are manufactured and tested to the TIA/EIA 568-B.2-1, EN50173-1 and ISO/ IEC 11801 Category 6 specifications. Each cable consists of 8 colour coded polyethylene insulated conductors. These are twisted together to form 4 pairs with varying lay lengths. These pairs are then formed around a central ‘X’ shaped polyethylene filler, which assists in maintaining and enhancing the cable performance. The print legend on the cable now includes information regarding the DOP number, Test and Classification of the cable for traceability.

Features and Benefits

- EC Verified
- Choice of Color
- LSOH outer sheath
- Euroclass Dca-s2-d2-a1
- Cat6 Solid Copper Cable
- U/UTP No Overall Screening
- No Conductor Screening
- Reaction-to-fire class according to EN 13501-6: Dca
- Smoke development class according to EN 13501-6: s2

9.15 RJ45

Excel 100-671Wall Plates



(Figure -224)

A new range of single and double gang faceplates and associated blanks, specifically designed for the mounting of the Excel range of 6c voice and data modules.

Features and Benefits

- Number of units: 4
- Flush-mounted installation: yes
- Suitable for floor box: yes
- Material: Thermoplastic
- Color: White
- Ral-number (akin): 9016
- Available in single/double gang
- For use with 6c data or voice modules
- Bevelled design
- Screen printing option available

Excel 100-300 Wall Sockets



(Figure -225)

Excel Category 6 RJ45 modules comply with the EIA TIA Standard for Category 6. Each shuttered module is supplied with a slide label field and space above, this is allowed for use of self-adhesive or further labelling if required. Termination can be made using Krone tooling, a cable tie base is positioned to the side of the IDC blocks to relieve cable stress.

Features and Benefits

- Fits 27mm back box when used with beveled faceplate
- Built-in slide label system
- Choice of colors
- LSA Style Termination Blocks
- Surface mounted: Yes (faceplate required)
- Flush-mounted installation: Yes (faceplate required)
- Floor box/sub-floor mounted: Yes (faceplate required)
- Type of fastening: Engage (snap)
- Type of connector: RJ45 8(8)
- Category: 6

Excel 100-140 RJ45 Plug



(Figure -226)

Screened Field Termination RJ45 Plug offers easy, toolless termination, and it complies fully with ISO/IEC 11801, Category 6A and ANSI/TIA-568-C.2 standards. It offers a fully shielded die-cast zinc alloy, nickel plated body and gold-plated phosphor bronze contact pins. Suitable for cable diameters between 6 and 8mm, strain relief is provided by the compression nut on the back of the connector. IDC termination accepts wire gauges from 23 to 26AWG.

Features and Benefits

- Model: Plug
- Type of connector: RJ45 8(8)
- Shielded: yes
- Category: 6A (IEC)
- Connection type: Crimp
- Requires termination tool: no
- Fully screened Category 6A
- Die-cast zinc alloy construction
- Toolless - easy termination
- Supports 10 Gigabit Ethernet
- Independently verified
- Can be re-terminated numerous times

9.16 Ethernet POE Extender

1-Port Gigabit Ethernet PoE+ Extender - NPOE-EXT-1G30



(Figure -227)

Extends a 10/100/1000 Mbps network connection between a powered source device and a PoE/PoE+ device up to 328 ft.

Gigabit Extender Lets You Cascade Your Existing PoE/PoE+ Connection up to 500 Meters. This single-port connector allows you to extend the connection between your powered source device, such as a PoE (Power over Ethernet) switch, and a remote PoE device an extra 328 feet (100 meters). In addition, by cascading as many as four NPOE-EXT-1G30 extenders, you can extend that connection as far as 1,640 feet (500 meters) total. Just connect the extender between two sections of Cat5e/6/6a cable up to 328 feet each.

Features and Benefits

- Saves money by delivering 30W of power + data up to 328 ft. through existing cabling
- Cascade up to 4 extenders to extend PoE connection up to 1,640 ft. total
- Extends power + data to any PoE or PoE+ device installed where no AC outlet is available
- Supports Gigabit Ethernet data transfer speeds up to 1000 Mbps (1 Gbps)
- Quick and easy plug-and-play installation with no configuration necessary

