



INTERNATIONAL SCHOOL OF MANAGEMENT AND TECHNOLOGY

FACULTY OF COMPUTING

ASSIGNMENT COVER SHEET

This form is to be completed by students submitting assignments of level 4 and level 5. Students are required to complete all sections and attach to your assignment.

STUDENT DETAILS	
STUDENT NAME	Krishna Prasad Bajgai
STUDENT ID	

UNIT AND ASSIGNMENT DETAILS			
UNIT TITLE	Networking		
UNIT NUMBER			
ASSIGNMENT TITLE	Cutting Edge IT Solution Network System		
ISSUE DATE	15/05/2023	DUE DATE	21/07/2023
ASSESSOR NAME	Elu Chhetri Panday		
ESTIMATED WORD LENGTH			

DECLARATION AND ACKNOWLEDGEMENT

When submitting assignments, each student must sign a declaration confirming that the work is their own.

Plagiarism and Collusion

Plagiarism: to use or pass off as one's own, the writings or ideas of another without acknowledging or crediting the source from which the ideas are taken.

Collusion: submitting an assignment, project or report completed by another person and passing it off as one's.

In accordance with the Academic Integrity and Plagiarism Policy:

1. I declare that:

- a) this assignment is entirely my own work, except where I have included fully-documented references to the work of others,
- b) the material contained in this assignment has not previously been submitted for any other subject at the University or any other educational institution, except as otherwise permitted,
- c) no part of this assignment or product has been submitted by me in another (previous or current) assessment, except where appropriately referenced, and with prior permission from the Lecturer / Tutor / Unit Coordinator for this unit.

2. I acknowledge that:

- a) if required to do so, I will provide an electronic copy of this assignment to the assessor;
- b) the assessor of this assignment may, for the purpose of assessing this assignment:
 - I. reproduce this assignment and provide a copy to another member of academic staff;
 - II. communicate a copy of this assignment to a plagiarism checking service such as Plagiarism Check (which may then retain a copy of this assignment on its database for the purpose of future plagiarism checking).

I am aware of and understand that any breaches to the Academic Code of Conduct will be investigated and sanctioned in accordance with the College Policy.			
SIGNATURE	Krishna	DATE	21/07/2023

PREFACE

Computer networks are crucial for allowing resource utilization, data exchange, and communication in today's networked environment. This introduction will discuss the advantages of computer networks and how crucial they are to contemporary businesses.

We'll also examine how networks might centralize management to better meet the varied needs of enterprises. As a result, they will operate more effectively. As it becomes more and more obvious, computer networks have taken on a crucial role in modern business, enabling smooth communication and enabling supporting sectors to flourish in a networked environment.

Join us on this journey as we explore the various benefits of computer networks and discover how they affect the performance of contemporary businesses.

Table of Contents

Introduction	7
Objective	7
Scope.....	7
The benefits and Constraints of different network types and standards	7
Introduction	7
Network types of Organization.....	8
1. Physical Network.....	8
a) LAN (Local Area Network).....	9
b) MAN (Metropolitan Area Network).....	10
c) WAN (Wide Area Network)	11
2. Logical Network	12
a) Peer to Peer Network.....	13
b) Client-Server Networking.....	14
c) Cloud Computing.....	15
 Overview:.....	16
TRANSMISSION MEDIUM	17
a) Wired Network	17
b. Wireless Network	18
c. Hybrid Network.....	18
Overview	19
Network Standard.....	19
a. OSI Model.....	22
b. TCP/IP Model.....	24
c. IEEE Standards.....	25

Overview	27
Network Topology.....	28
a. Bus Topology	28
b. Star Topology	29
c. Tree Topology	30
d. Ring Topology.....	30
e. Mesh Topology.....	31
f. Hybrid Topology.....	32
Communication and Bandwidth.....	33
Impact of Network Topology on Communication and Bandwidth	33
Overview	33
Network Protocol	34
Overview	34
Networking Devices	35
1. Router	35
2. Switch.....	35
3. Hub.....	36
4. Wireless Access Point (WAP).....	36
5. Network Firewall	36
6. Workstation (PC)	36
Workstation hardware dependence and the relevant networking software	36
Server Operating System.....	37
Client Operating System	37
Overview	37
Client Computer Configuration.....	38

Server Computer Configuration.....	39
The network system physical diagram.....	40
Logical Design of the network:.....	40
IP Sheet:.....	40
Device Requirements.....	41
Overview	41
Implementation of network system based on a prepared design.....	41
Implementation of Telnet and Firewalls for security.....	49
Analyzing test results against expected results and Documentation	51
Specifying Admin and User roles using Virtual Machine Ware.....	57
Design a maintenance schedule to support the networked system.....	88
Evaluating and testing the design to meet the requirements analyzing user feedback	89
Network Systems potential enhancements	91
Servers.....	92
Overview	96
Evaluating critical reflection and justifying valid conclusions.....	96
References	98

Introduction

In Kathmandu, Cutting Edge IT Solution is a well-known provider of IT services. With the latest technological tools and software, a new branch is opening in Butwal to better serve the general people. I now hold the position of IT officer at Cutting-Edge IT Solutions' newest location in Butwal. I'll be responsible of planning, creating, implementing, and improving the network infrastructure for the company in my new position. Discussions of IP addresses, server architectures, network services, network elements, and security precautions are included. By carrying out these duties, I hope to assist Cutting-Edge IT Solution in expanding and succeeding as it pursues its expansion goals.

Objective

Investigating networking theories, creating gorgeous networks, effectively installing networked systems, and troubleshooting them are the objectives of working with the newest division of Cutting-Edge IT Solutions.

Scope

Cutting-Edge IT Solutions' main goal is to create a high-performing network design that guarantees data isolation, security, and top performance.

The benefits and Constraints of different network types and standards

Introduction

The primary objective of this task is to examine various network protocols and kinds, as well as their advantages and disadvantages. It includes all interconnected hardware needed for data transmission, such as computers, servers, peripherals, and network equipment. Peer-to-peer, client-server, cloud, cluster, centralization, and virtualization network types are investigated. Network models and standards like IEEE and 802.x, TCP/IP, and OSI are also described for assuring compatibility and comprehending network protocols. There includes discussion of the unique characteristics of each network type and standard, as well as its benefits and drawbacks.

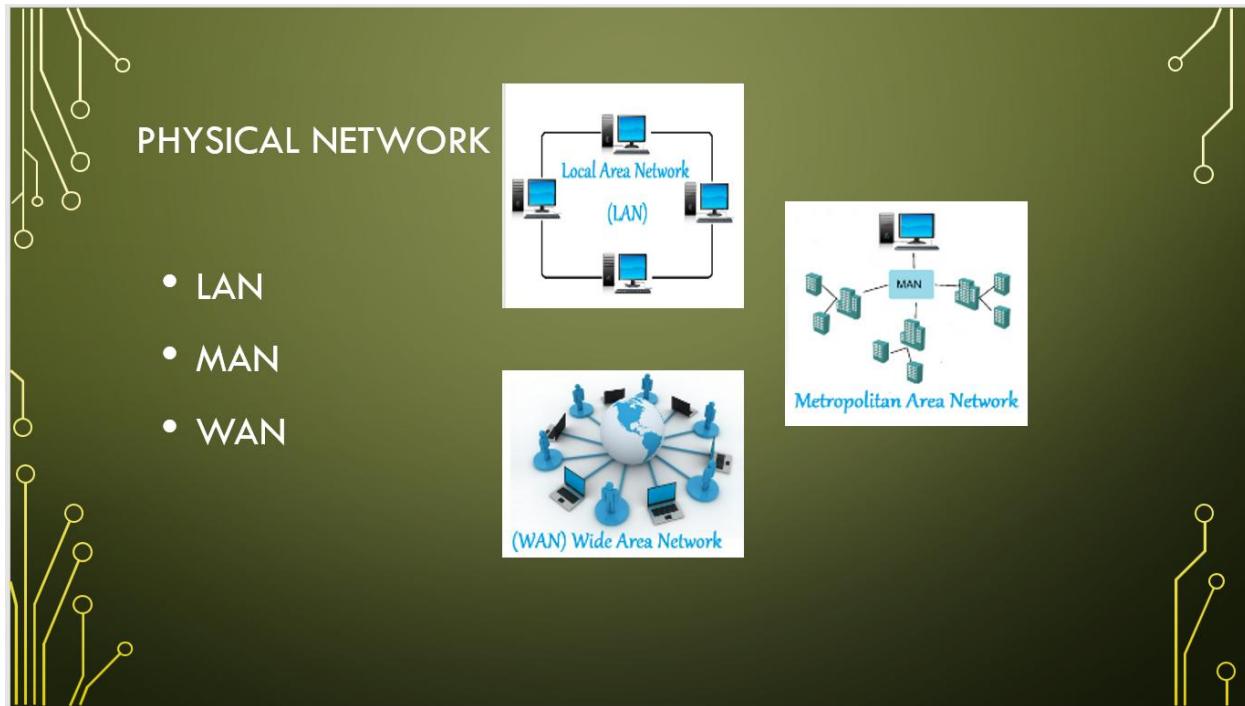
Network types of Organization

Physical networks and logical networks are the two sorts.



Physical Networks and Its Types

The cables, computer adapters, and other networking components that connect the hardware components of the network make up the physical network. Persons can be categorized into three groups based on their size:



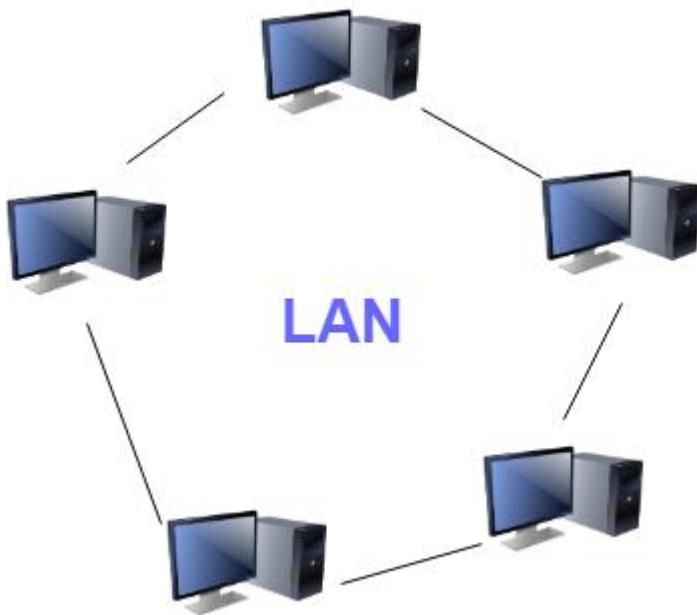
Local Area Network (LAN)

In a small area, such as a home, office, lab, or commercial facility, a local area network (LAN) is a group of linked computers and associated peripherals.

Sharing resources like files, printers, games, and other applications is extremely advantageous while using this network.

A person's home or place of employment's PCs and printers are connected via the most basic LAN network arrangement. LAN is a well-known example of a communication channel.

This network consists of less than 5000 networked devices dispersed across many buildings.



Advantages of LAN:

- All network users' data may be kept on a single hard drive on the server computer, and messages and data may be transferred effortlessly across networked workstations.
- Since it is convenient to retain data in one location, data security is enhanced.

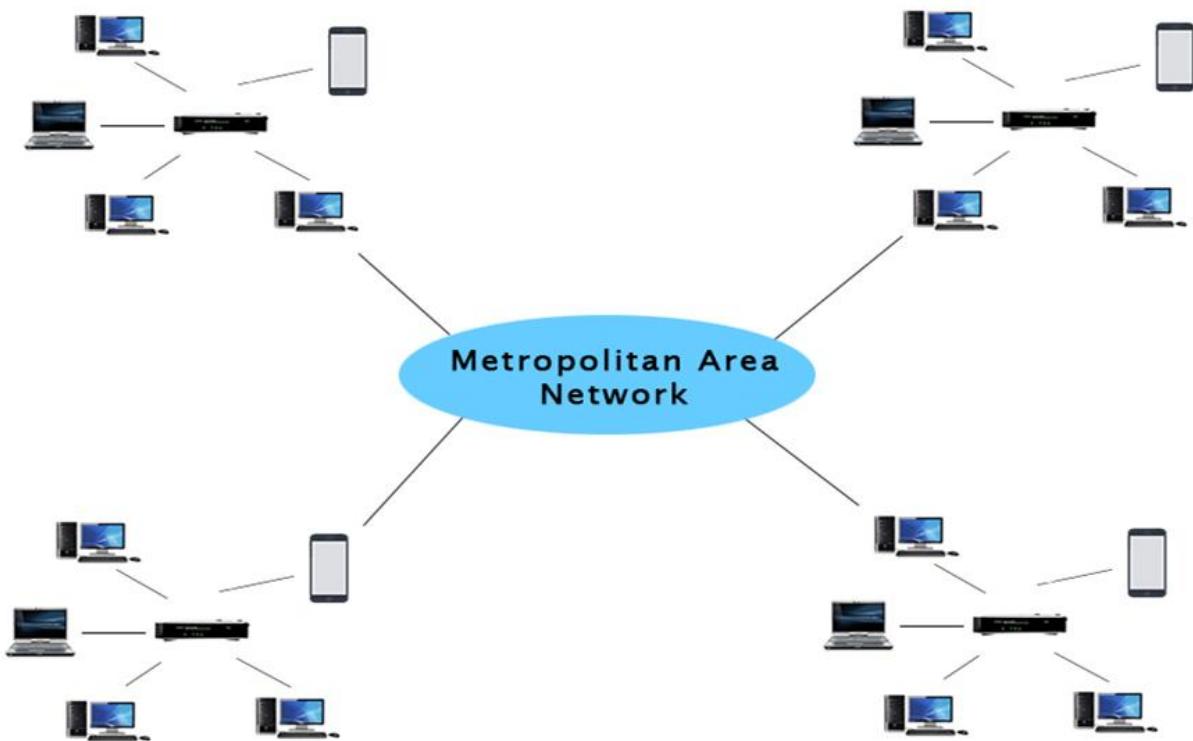
Disadvantages of LAN:

- Malware assaults are possible.
- Although LANs will save money since they share computer resources, the initial cost of installing them is fairly significant.
- Because every LAN user's personal data files are accessible to the LAN administrator, there is little privacy provided.
- If a LAN administrator is unable to safeguard a centralized data repository, unauthorized users may have access to an organization's most important data.
- Local Area Networks need ongoing LAN management due to problems with software configuration and hardware breakdowns.

(Guru99, 2023)

Metropolitan Area Network (MAN)

A "metropolitan area network" (MAN) is a type of computer network that services an entire city, a college campus, or a small area. MANs have a wider geographic reach than LANs, which are limited to a single structure or location. This type of network can have a range of a few miles to tens of miles, depending on how it is configured.



Advantages of MAN:

- It provides speedy communication using high-speed carriers, including fiber optic connections.

- The dual bus in the MAN network enables simultaneous data transfer in both directions.
- It provides strong support for an expansive size network and greater access to WANs.
- The entirety or certain neighborhoods of a city are frequently included in MAN networks.

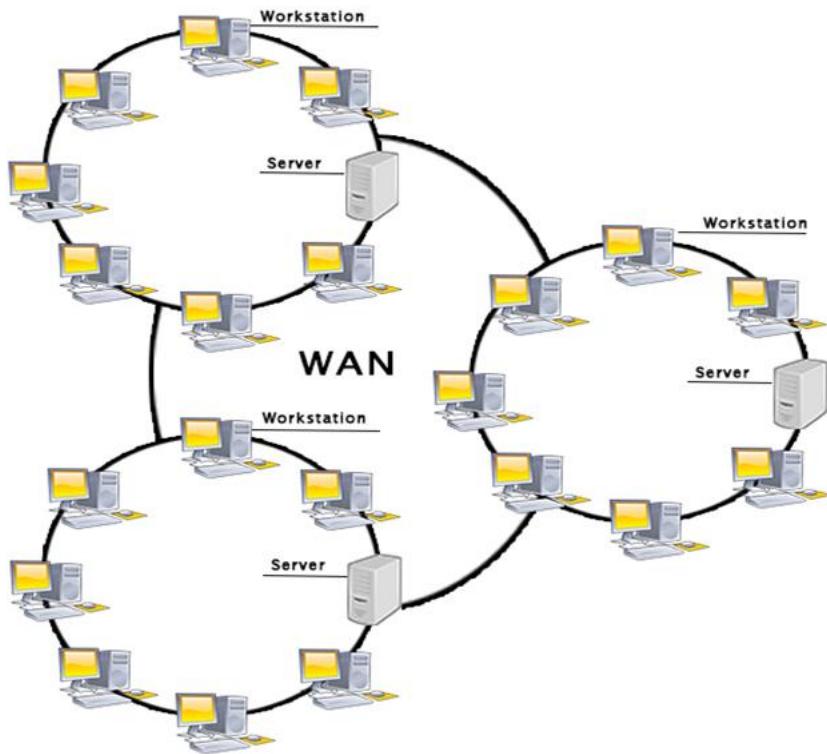
Disadvantages of MAN:

- Additional cable is needed to construct a MAN connection from one place to another.
- It's challenging to secure a MAN network system against hackers.

(Guru99, 2023)

Wide Area Network (WAN)

A significant computer network that covers a sizable geographic area is known as the WAN (Wide region Network). A local area network (LAN) that links to other LANs through phone lines and radio waves is known as a wide area network (WAN) infrastructure. The majority of companies and groups are affected.



(WAN) Wide Area Network

Advantages of WAN:

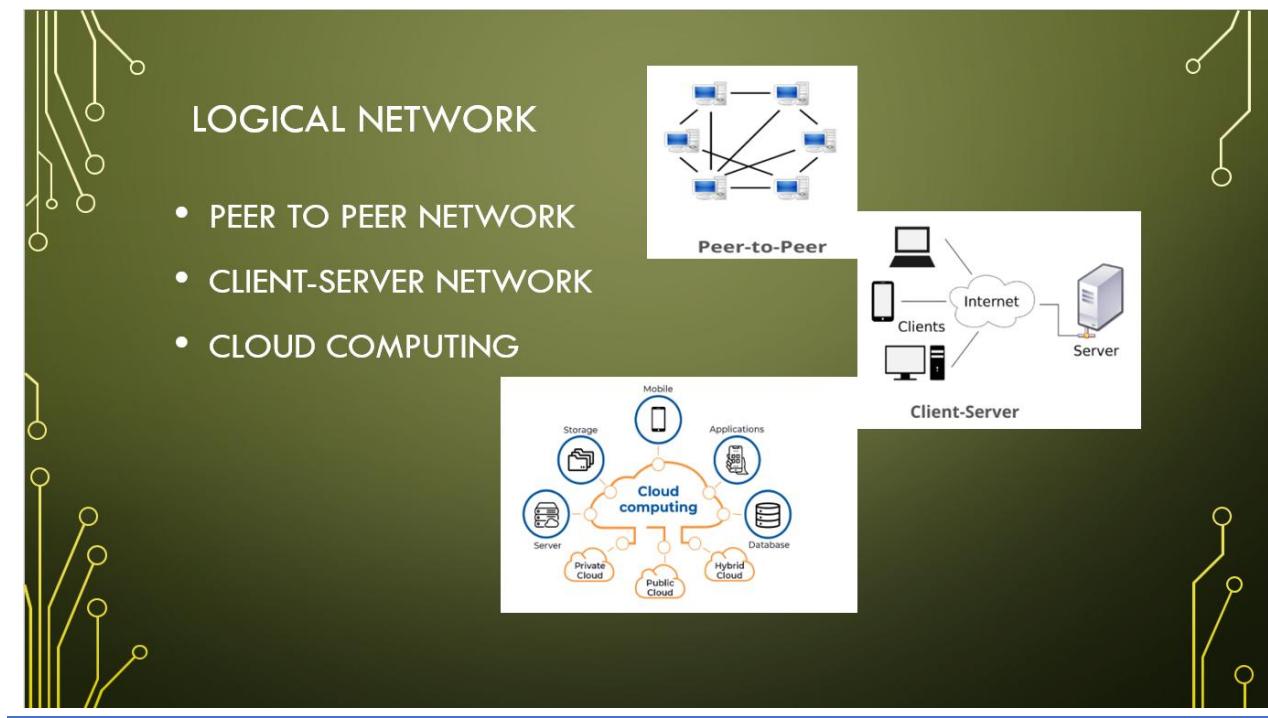
- The WAN enables access to a wider geographic region. As a result, remote offices may simply communicate with one another.
- Consists of electronic gadgets such as cell phones, laptops, tablets, computers, video game consoles, and other gadgets.
- Client devices' built-in radio transmitters and receivers are how WLAN connections operate.

Disadvantages of WAN:

- The initial expenses and maintenance requirements for the WAN network are rather high.
- Network administrators and certified technicians are in demand.
- In comparison to other kinds of computer networks, it doesn't offer as much protection.

(Guru99, 2023)

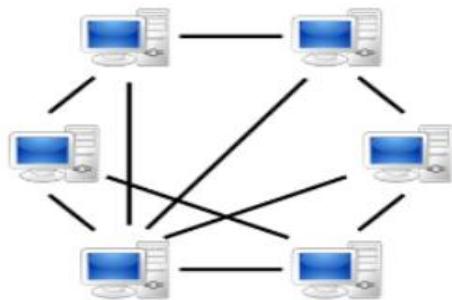
Logical Network and Its Types



Peer to Peer Network

A peer-to-peer (P2P) network facilitates direct resource and information exchange without the need for a centralized server since each member (or "peer") may act as both a client and a server. P2P networks are decentralized, which means that they are not managed or supported by a single body. In a P2P network, each peer is equal and has the ability to connect to any other peer. Among other things, peers can swap files, data, and computing power. P2P networks are often used for file sharing because they allow users to receive data directly from other users rather than via a central server.

(Tutorialspoint.com, 2023)



Peer-to-Peer

Advantages of peer-to-peer network:

- Operating systems for networks are not required.
- Since users may select which files to share, there is no need for professional personnel like network specialists.
- Why If one PC malfunctions, the network won't sustain any more harm. Simply said, it means that some files won't be accessible to others anymore.

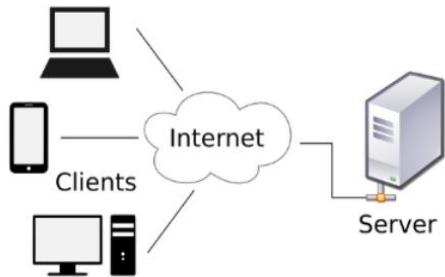
(for, 2023)

Disadvantages of peer-to-peer network:

- Since several users may be using the same system, the user experience may be delayed.
 - Other than the permissions, there is little to no security. On a regular basis, users forget to log in to their computers.
- (for, 2023)

Client-Server Networking

To access resources and services in a client-server network, users connect to a dedicated host over a LAN or WAN connection. WAN connections can also be created via the Internet. One alternative is to use a daemon or dedicated server to track client requests. A network connection is created as soon as a client request is received and maintained until it is fulfilled.



Client-Server

(Zenarmor.com, 2023)

Advantages of Client-server network:

- Every file is stored in its own place.
- Central management is used for network peripherals.
- Central management oversees network security and backups.
- Users could have access to centralized data that is shared.

(for, 2023)

Disadvantages of Client-server network:

- It is required to use a specialized network operating system.
- The cost of purchasing the server is high.
- Professional personnel, such a network manager, are required.
- There might be several disruptions if a network component fails.

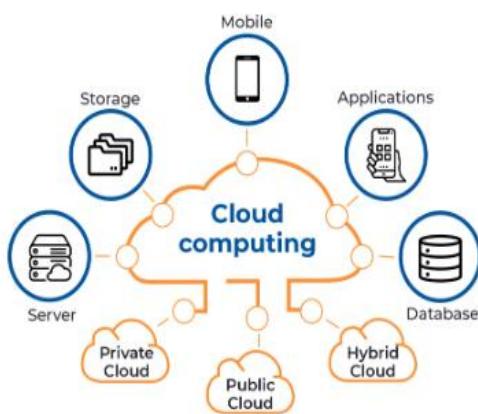
(for, 2023)

Cloud Computing

The use of data and computer resources through the internet for data storage and retrieval is known as cloud computing. Nothing remains on your computer. This phrase describes the on-demand accessibility of computer services including servers, databases, networking, and data storage. Cloud computing should make it simpler for users to access data centers. Data from far-off servers can also be accessed by users.

Examples of cloud computing services include Google Cloud, Azure, and AWS.

(Guru99, 2023)



Advantages of Cloud computing:

- Enhanced effectiveness
- Requires less upkeep
- Regular software upgrades
- Backup and recovery

- Scalability and effectiveness
- Increased ability to store
- strengthening data security

(Guru99, 2023)

Disadvantages of Cloud computing:

- The underlying cloud infrastructure's restrictions being eased
- take precautions against security concerns like those related to data privacy and online abuse.
- The challenge of interacting with current systems
- Unexpected expenses and costs

(Google Cloud, 2023)

Overview:

Because of its centralized control, scalability, performance, data security, resource utilization, and data permanence and availability, client-server networking has been employed by me for logical networks. Cloud computing must take into account issues with internet connectivity, privacy, cost, and data security, whereas peer-to-peer networking problems with centralized management, scalability, and security. Due to these benefits, client-server networking is the ideal choice for companies whose network architecture places a high emphasis on control and performance.

Because our new branch is located within the building, a smaller area where LANs are permitted, I have used LAN as a physical network to connect PCs through MAN and WAN. We are all aware of how important MANs and WANs are for connecting larger geographic regions and allowing communication between several locations. However, due to the inadequate network connection at our new branch in Butwal, LAN is used to satisfy the demands of applications that require high-speed data transmission, security, affordability, scalability, and performance.

TRANSMISSION MEDIUM

Whether it is through people or pieces of equipment, information may be transmitted from a source to a destination through a transmission channel. The three main types of transmission medium are as follows. Here are a few examples:



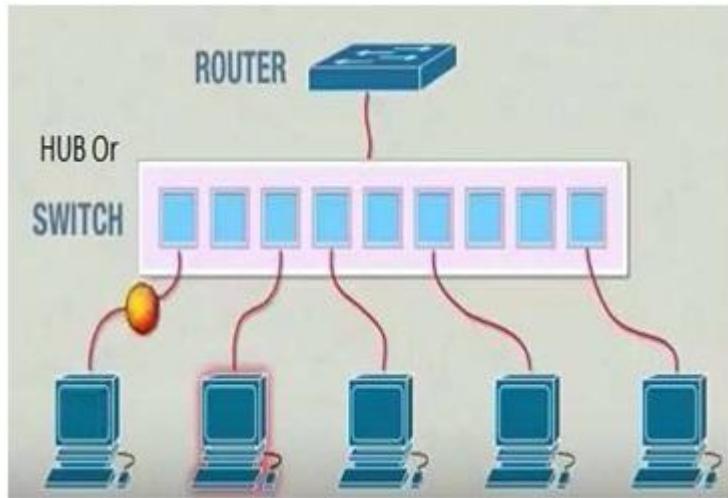
Wired Network

A wired network is composed of connections that go via different system parts.

In wired communication, cables such as copper wires, fiber optic cable, flexible cables, and twisted pair are utilized.

A wired network uses its transport medium to carry a wide variety of electrical messages.

(Rfwireless-world.com, 2023)

**Benefits:**

- The network's higher data rate enables information to be transmitted quickly.
- The setup process is simple.
- Cables offer more bandwidth.
- It offers higher dependability and service quality (QoS).

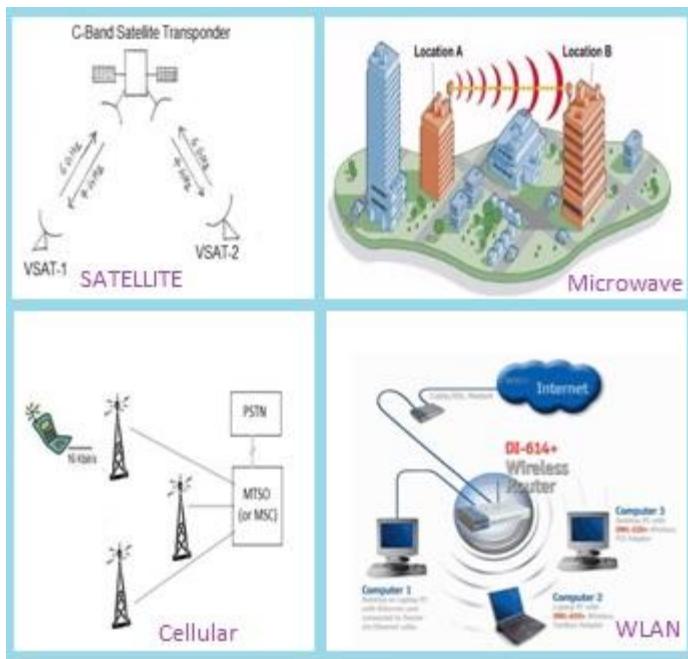
Constraints:

- While in use, a linked connection restricts mobility.
- Installation takes longer.
- When compared to their wireless equivalents, technological items provide a greater risk of injury.

(Rfwireless-world.com, 2023)

b. Wireless Network

The transmitter, receiver, and other parts of the wireless system communicate wirelessly to form a wireless network. This system does not require optical, twisted pair, or any other sort of cable. Numerous electromagnetic (EM) wave modulation techniques are used to convey data between the transmitter and receiver.



Advantages of wireless network:

- Wireless networks are simple to set up and keep up.
- The price is quite low since there are so many mobile user devices from various manufacturers available.
- Using wireless networks like Wi-Fi, Bluetooth, and others makes file transfers easier.

Disadvantages of wireless network:

- Compared to wired networks, wireless networks usually offer slower speeds.
- Compared to conventional wired networks, wireless networks are thought to be less secure.
- In wireless networks, jitter and protracted connection setup times may reduce service quality.

Hybrid network

In order to provide a well-rounded solution for connectivity and communication between systems and devices, hybrid networks integrate wired and wireless technologies.

Advantages of hybrid network

- It offers users and devices flexibility.
- It guaranteed a smooth expansion.
- It provides redundancy.
- It expanded the reach of networks.
- Cost efficiency is maximized.

Disadvantages of hybrid network

- It made network administration more difficult.
- It need strict security measures.
- It has an impact on network efficiency.
- It entails larger upfront fees.

Businesses decide on the network type depending on their unique needs. For reliable and quick communication, offices choose wired networks. In mobile environments, such as residences or places with Wi-Fi, wireless networks are frequently utilized. Larger businesses or academic institutions frequently use hybrid networks, which blend wired and wireless connections to satisfy a variety of purposes.

Overview

The network's selected transmission method is hybrid networks. Hybrid networks, which include wired and wireless communication channels, may be advantageous for businesses. Redundancy, adaptability, mobility, cost optimization, coverage, and flexibility are a few of these advantages. This is one of the primary reasons in favor of the use of hybrid networks. Due to these benefits, it is the best choice for businesses looking to develop a reliable, flexible, and long-lasting network design.

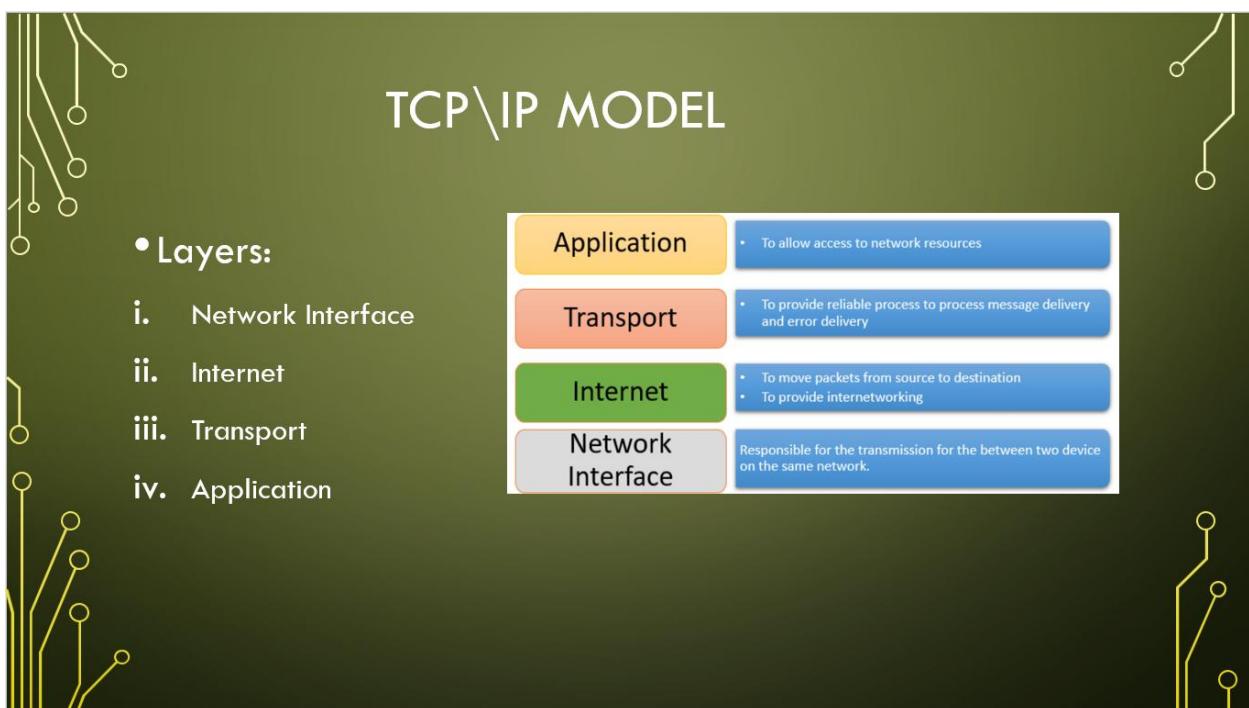
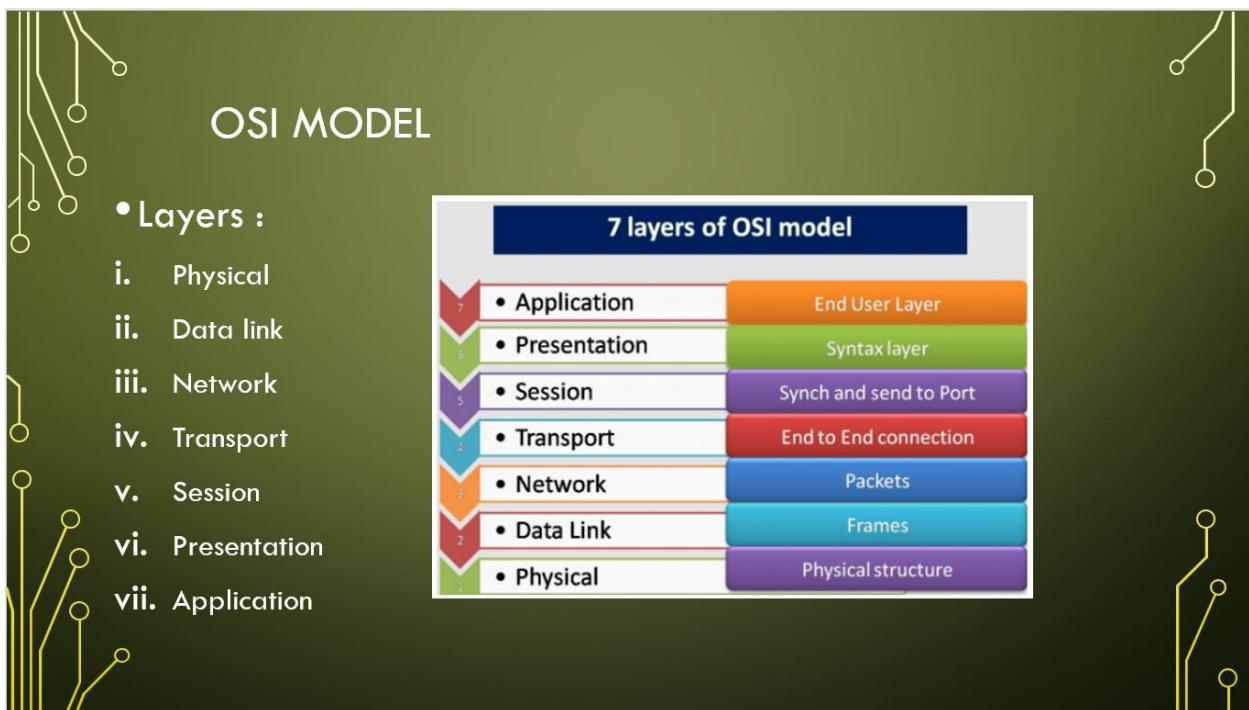
Network Standard

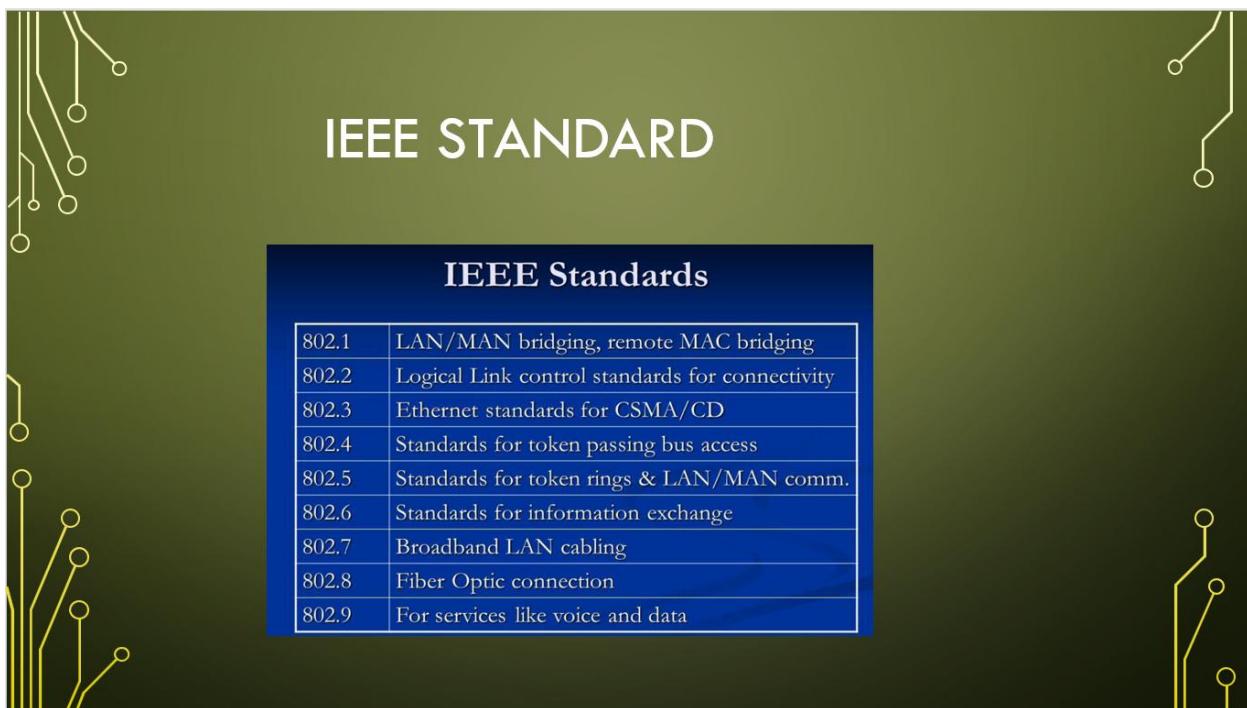
Networking standards provide the data transmission procedures required for networking systems and methodologies to function together. Standards aid in the creation and upkeep of free markets

by enabling various vendors to compete on the quality of their goods while keeping compatible with goods that are already on the market.

(Tutorialspoint.com, 2020)





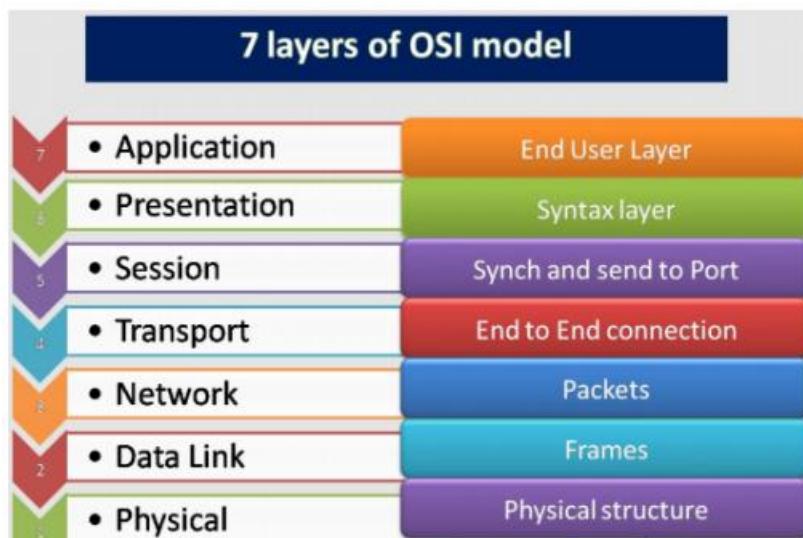


OSI Model

The seven levels at which computer systems can communicate with one another via a network are defined by the Open Systems Interconnection (OSI) paradigm.

All important computer and telecommunications sectors recognized it as the first all-encompassing architecture for network communications at the beginning of the 1980s.

The contemporary Internet was founded using the more efficient TCP/IP architecture rather than OSI. The OSI 7-layer model is still widely used in spite of this since it is useful for designing and visualizing networks as well as finding and resolving networking problems.



7. Application Layer

End-user applications like web browsers and email clients function at the application layer. It offers protocols that enable data transmission and reception between computer programmes and the delivery of useful information to users.

The Hypertext Transfer Protocol (HTTP), File Transfer Protocol (FTP), Post Office Protocol (POP), Simple Mail Transfer Protocol (SMTP), and Domain Name System (DNS) are a few examples of application layer protocols.

6. Presentation Layer

For the application layer, data is prepared at the presentation layer.. It specifies how data should be compressed, encrypted, and sent between two devices in order for it to be safely received at the other end. All data transmitted by the application layer is first processed by the presentation layer before being transferred via the session layer.

5. Session Layer

The primary goal of the session layer is to manage communication sessions—including how they should be formed, maintained, and terminated—between programmes. The transport layer, which includes TCP in the TCP/IP paradigm, is principally in charge of handling data transmission. The transport layer also creates checkpoints for data resumption and guarantees trustworthy end-to-end data delivery.

4. Transport Layer

The transport layer at the other end divides the data sent at the session layer into "segments".

It is in charge of putting the segments back together at the other end to deliver information that the session layer may use.

Error control, which assesses if data was wrongly received and, if not, requests it again, and flow control, which delivers data at a rate that matches the connection speed of the receiving device, are the two duties that fall within the purview of the transport layer.

3. Network Layer

The network layer is crucial to computer networks because it performs two key functions. Data is initially split up into teeny-tiny pieces known as network packets, which are then reassembled at their destination. It also uses different packet routing techniques to discover the quickest path for data to travel via the physical network. The network layer uses network addresses, usually Internet Protocol (IP) addresses, to identify and route messages to the correct target nodes. Devices on networks may interact effectively and effortlessly thanks to this critical layer.

2. Data Link Layer

The data link layer is responsible for managing connections between directly connected devices in a network. It converts packets into frames before transmitting them. It manages data flow and ensures flawless device communication using MAC addresses.

1. Physical Layer

The wired or wireless connections that physically connect network nodes are under the control of the physical layer.

In addition to establishing the connection between the devices—whether it be a wired or wireless connection—it also controls bit rate regulation and the transmission of raw data, which consists just of a stream of 0s and 1s.

(Learning Center, 2023)

Advantages of OSI Model:

- The OSI model's protocols are concealed, making it easy to add new ones and change existing ones.
- The OSI model is a truly global concept that equipment and device makers may easily adopt.
- Both connection-oriented and connectionless services are supported by this architecture.

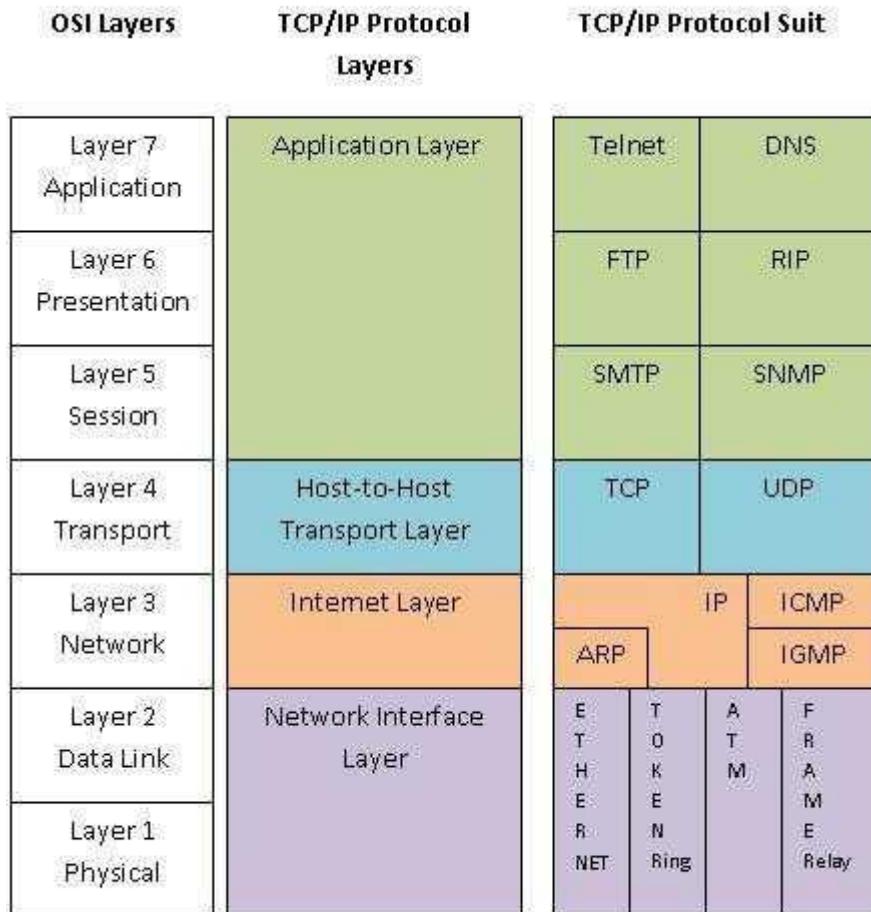
Disadvantages of OSI Model:

- The OSI paradigm states that not every application requires data integrity.
- The OSI paradigm is not used in all computer-based communications applications.
- Due to the complexity of the concept, the earliest implementations were time-consuming and difficult.

(Rfwireless-world.com, 2023)

TCP/IP Model

According to RFC793, TCP is a reliable, network-centric protocol. It makes use of a header that safeguards appropriate byte-stream communication and stores the relevant data.



www.rfwireless-world.com

Advantages of TCP/IP:

- It has a scalable design and is an open protocol that is industry standard.

- It makes use of systems for flow control, error control, and congestion control.
- TCP packets are given special treatment by routers once they have been read.
- When used on a modem or LAN, TCP offers comparatively greater throughput.

Disadvantages of TCP/IP:

- It requires more setup and upkeep than NetBEUI or IPX/SPX.
- On networks with little to moderate traffic, it could be slower than IPX/SPX and NetBEUI.
- Centralized TCP/IP domain assignment necessitates both time and money for registration.
- Block boundaries are not utilized by TCP. Creators must come up with their own.

(Rfwireless-world.com, 2023)

IEEE Standards

IEEE 802 networking standards define the requirements for the physical and data-link layers for technologies like Ethernet and WLAN.

IEEE Standards

802.1	LAN/MAN bridging, remote MAC bridging
802.2	Logical Link control standards for connectivity
802.3	Ethernet standards for CSMA/CD
802.4	Standards for token passing bus access
802.5	Standards for token rings & LAN/MAN comm.
802.6	Standards for information exchange
802.7	Broadband LAN cabling
802.8	Fiber Optic connection
802.9	For services like voice and data

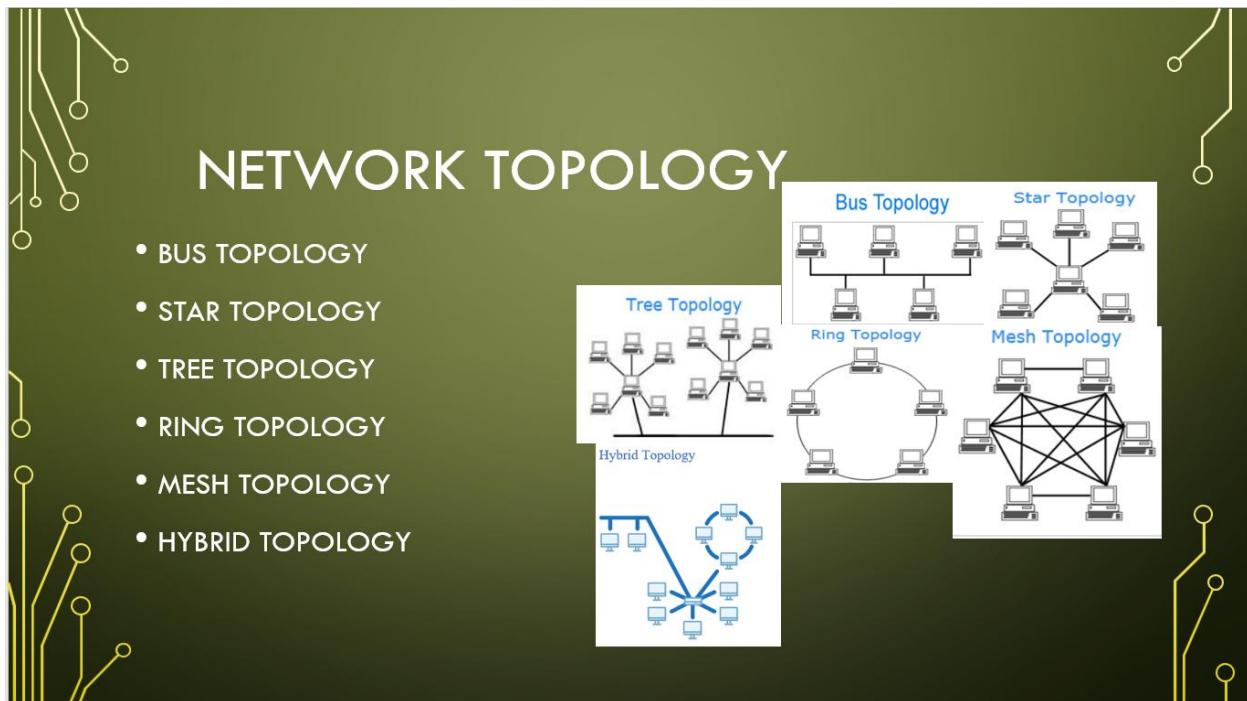
A variety of IEEE standards serve various goals and scopes. Here are a few other instances:

IEEE 802.10	It is used in interoperable LAN/MAN security.
IEEE 802.11	It is used in wireless LAN, MAC, and Physical layer specifications.
IEEE 802.12	It is used in the demand-priority access method, in the physical layer, and in repeater specifications.
IEEE 802.13	It is not used.
IEEE 802.14	It is used in cable modems (not used now).
IEEE 802.15	It is used in WPAN (Wireless Personal Area Network).
IEEE 802.16	It is used in Wireless MAN (Wireless Metropolitan Area Network).
IEEE 802.17	It is used in RPR access (Resilient Packet Ring).

Overview

The networking protocol I've decided to utilize in this case is TCP/IP since it's simple to use, compatible with the Internet, widely used, constantly evolving, and has a wealth of real-world experience. Even though TCP/IP is more well-known and appreciated due to its practical applicability, the OSI model provides a solid theoretical framework for comprehending network protocols.

Network Topology



Slide9- Network Topology and its types

In computer networks, a topology represents the logical data flow inside the network as well as the physical connections between nodes. A topology essentially describes how devices are connected to one another and communicate.

The two fundamental topologies utilized in computer networks are those of logic and material.

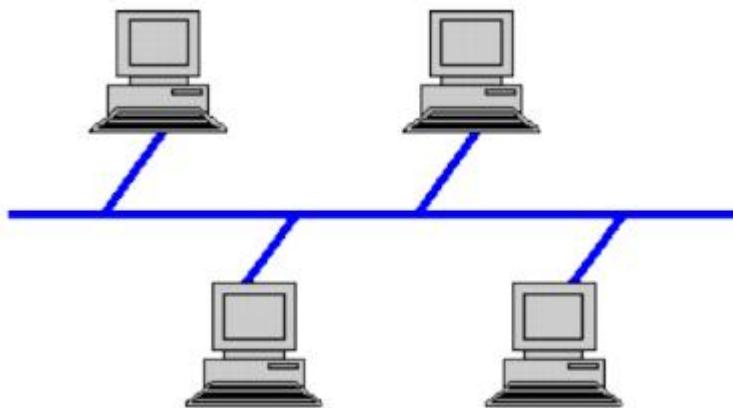
In computer networks, there are fundamentally six main categories of physical structure. Its types are as follows:

- ❖ Ring Topology
- ❖ Bus Topology
- ❖ Mesh Topology

- ❖ Star Topology
- ❖ Tree Topology
- ❖ Hybrid Topology

Bus Topology

A basic network architecture known as a bus topology uses a single bus or channel for communication.



Advantages of Bus Topology:

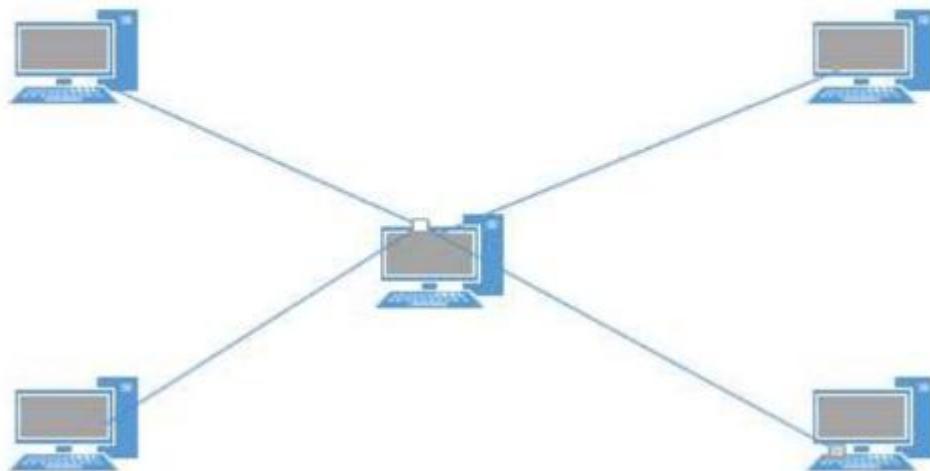
- Convenience of setup and use.
- The other nodes won't be affected if one of them fails.
- There is less wiring required.
- Low-cost and simple to use.

Disadvantages of Bus Topology:

- The network will also malfunction if the bus does.
- Due to the bus' small length, only a few nodes may connect to it.
- Communications are broadcast to every node, posing further threats to and difficulties with security.
- The bus, the only means of transportation, is congested.

Star Topology

In a star architecture, each node in a computer network is connected to the hub at the centre.



Advantages of Star Topology:

- Centralized administration.
- Less expensive.
- Problems that are easily fixed.
- If one node fails, it won't affect the other nodes.

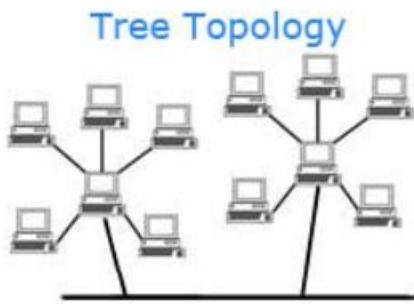
Disadvantages of Star Topology:

- If the main device breaks down, the network will be destroyed.
- The input-output port capacity of a central device limits the number of devices that may be connected to the network.

Tree Topology

A computer network with a tree structure's primary bus wire links all nodes, either directly or indirectly.

Tree topologies are produced by combining bus and star topologies.



Advantages of Tree Topology:

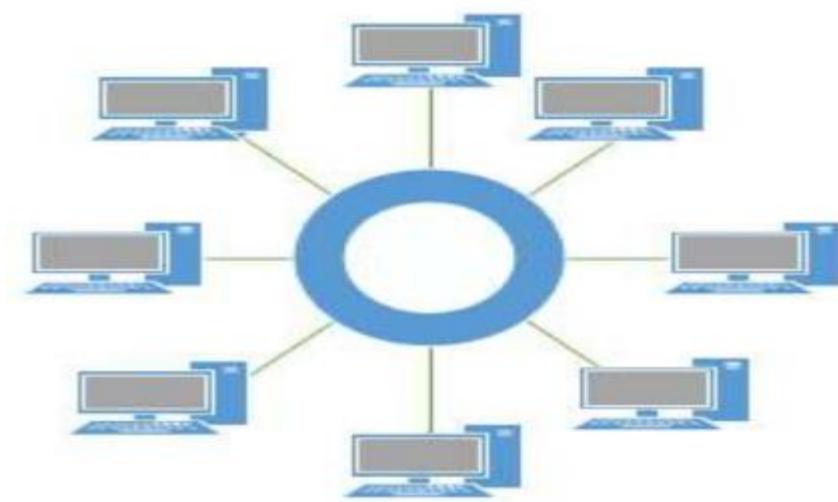
- Abundant network coverage.
- Inspection of each tier simplifies fault detection.
- Minimal to none loss of data.
- There are several direct and indirect connections between nodes.

Disadvantages of Tree Topology:

- The cost of hardware and cabling is high.
- It is challenging to operate a sizable network using a tree architecture.
- It calls for a lot of upkeep.
- The network will be destroyed if the primary bus fails.

Ring Topology

A ring topology is created when two computers are connected.



Advantages of Ring Topology:

- It is easy to install.
- Reduced Cabling Offers Advantages.
- Reduces the chance of a data collision moving in one direction.
- Easier to fix (the damaged node cannot pass the token).

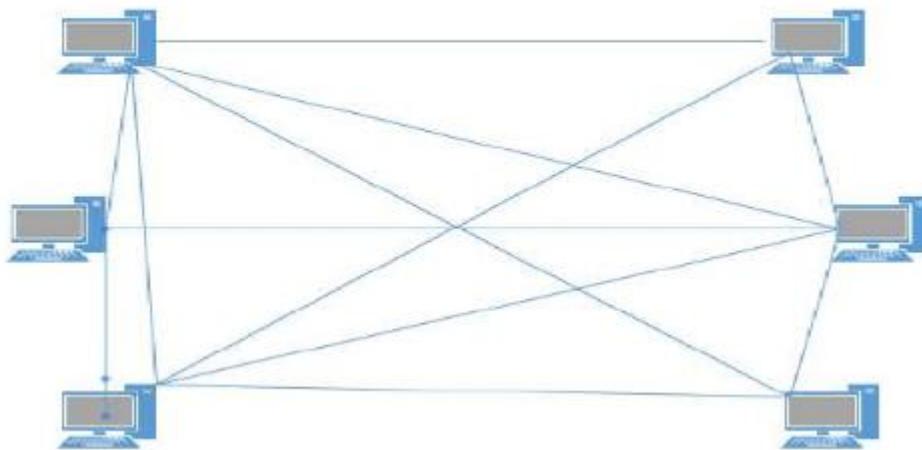
Disadvantages of Ring Topology:

- The network will be destroyed if one node fails.
- Slow data transfer speeds since each message must travel via many rings.

- Difficult to reassemble (we must destroy the ring).

Mesh Topology

A sort of computer network design known as mesh topology connects nodes.



Advantages of Mesh Topology:

- Direct communication is made possible through specialized connections.
- High failure tolerance owing to the distinct routes used by each node.
- Secrecy and anonymity are kept thanks to a special communication pathway.
- The network includes backup nodes in case a node fails.

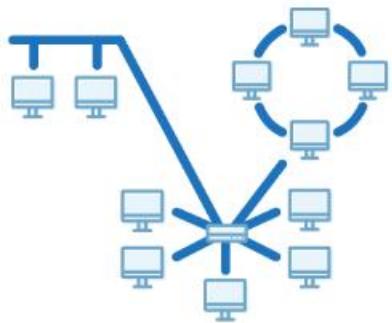
Disadvantages of Mesh Topology:

- The requirement for very high cabling.
- It is not possible to complete in an inexpensive manner.
- The network installation requires a lot of room.
- Installation and upkeep are rather challenging.

Hybrid Topology

In computer architecture, a hybrid topology incorporates two or more topologies. Actually, those are the ones that are used the most.

Hybrid Topology



Advantages of Hybrid Topology:

- It has the ability to control several nodes.
- It provides us with the flexibility to adjust the network as needed to meet our demands.
- Extremely reliable (the network as a whole keeps running even if one node fails).

Disadvantages of Hybrid Topology:

- A complex pattern.
- Expensive to implement.
- A Multi-Station Access Unit (MSAL) is necessary.

The many topology types used in computer networks are the main subject of this.

(Afteracademy.com, 2020)

Communication and Bandwidth

Communication is the act of passing ideas, thoughts, or messages from one item or person to another.

The term "bandwidth" describes the amount of data that may be sent through an internet connection in a certain amount of time.

Impact of Network Topology on Communication and Bandwidth

Design decisions have a big impact on a network's reliability, scalability, bandwidth distribution, and communication effectiveness. They control data flow and node connections, which has an impact on latency, scalability, and bandwidth accessibility. By cutting down on hops and distance, communication is improved and latency is reduced. Scalable topologies are capable of controlling growth and increasing traffic. Other topologies employ shared communication channels, which result in congestion and reduced capacity, while some topologies use dedicated connections for better bandwidth allocation. Shorter, straighter pathways in topologies reduce latency and enhance real-time communication.

Overview

Due to its many advantages, mesh topology is a smart choice for the network architecture of the new branch in Butwal. Mesh topology is a great option for guaranteeing dependable connectivity, effective data transmission, and secure operations because of its inherent redundancy, stability, scalability, flexibility, fault isolation, performance, and security. Mesh architecture increases the branch's overall resilience by offering many channels for data flow, decreasing the risk of downtime in the event of a connection failure. Its adaptability allows for the easy addition of additional devices and the potential expansion of the network without significantly compromising performance. The ability of mesh architecture to isolate faults enhances network stability by confining issues to specific areas and preventing widespread outages. Furthermore, the ability of the network to manage data traffic across a range of pathways enhances throughput and lowers latency, both of which are crucial for effective operations. Furthermore, the mesh topology's improved security, which incorporates data encryption and dynamic routing, protects private data and guards against unauthorised access to the network. With these significant advantages in mind, mesh topology installation in the new branch in Butwal ensures that the firm

will have a dependable and efficient network infrastructure that can meet the branch's changing needs while ensuring safe and successful operations.

Network Protocol

- POP3 is a well-liked protocol for receiving incoming email.
- SMTP is used to manage outgoing emails, ensuring their distribution and delivery.
- FTP enables the transfer of various types of data, including documents and multimedia files, between computers.
- Safe computer-to-computer communication is ensured through HTTPS.
- TCP is a solid option for secure data packet transport across IP networks.
- The primary network layer for packet routing across networks is the IP protocol.

Two types of IP protocols:

1. IPv4 (Internet Protocol version 4) is the most widely used version, employing 32-bit addresses represented as four sets of decimal numbers separated by periods (e.g., 192.168.0.1). However, the availability of IPv4 addresses has become limited due to the Internet's rapid growth. To address this issue, IPv6 (Internet Protocol version 6) was introduced.
2. IPv6 uses 128-bit addresses represented as eight groups of hexadecimal numbers separated by colons (e.g., 2001:0db8:85a3:0000:0000:8a2e:0370:7334). With its larger address space, IPv6 can accommodate a significantly greater number of devices and offers additional features such as enhanced security and auto-configuration.

Overview

The OSI model and the TCP/IP model, which employ different protocols at different levels, are two networking concepts that are essential for effective communication between sender and receiver. The communication is negatively impacted when these protocols don't function as intended.

Networking Devices

Router

The router is an essential component of network gear for transferring data packets across networks, such as the Internet and Local Area Networks (LANs). As a gateway, it makes it easier to connect to other networks and to communicate with other networks' connected devices.



Switch

Switches are essential elements of a local area network because they connect network devices and offer effective communication. They provide error-free data transfer between connected devices by using MAC addresses to route data packets to the proper devices inside the network. In contrast, routers at the network layer link several networks together by rerouting traffic in accordance with IP addresses.



Hub

Devices are connected via hubs, but they lack the intelligence to effectively direct data. They broadcast data to everyone, which causes congestion and subpar performance. For more effective network administration, switches are favored.

Wireless Access Point (WAP)

A hub cannot route data packets despite connecting several networked devices because it lacks intelligence. Every device that is linked transmits and receives data, thereby affecting network speed.

Network Firewall

All incoming and outgoing network traffic is monitored and controlled by this security tool in line with specified security requirements.

Workstation (PC)

Workstations are robust computer platforms made for lone users.

Workstation hardware dependence and the relevant networking software

The connections between a workstation's physical components and the network software that runs on them have an impact on the workstation's performance and capabilities. Hardware components including the CPU, graphics card, and storage capacity all influence processing speed, graphics capability, and storage capacity.

Networking software is necessary to ensure seamless connectivity and communication between workstations and other systems or networks. It makes it simpler for individuals to successfully interact, move data, and share resources. The equipment setup for the new facility in Butwal will include computers, servers, router switches, and cables, all of which have undergone meticulous examination.

Server Operating System

An operating system that is specifically made to be installed and used on a server computer is known as a server operating system (OS).

It is a sophisticated operating system that has the skills and features needed in client-server topologies or other sorts of corporate computer settings.

(Techopedia, 2014)

Client Operating System

The desktop or mobile operating system is referred to as the "client operating system".

(Easy Tech Junkie, 2023)

Overview

By selecting Windows for the new location, you can be confident that your business will gain from using a tried-and-true, adaptable, and user-friendly operating system that promotes productive operations, easy software integration, and efficient operations.

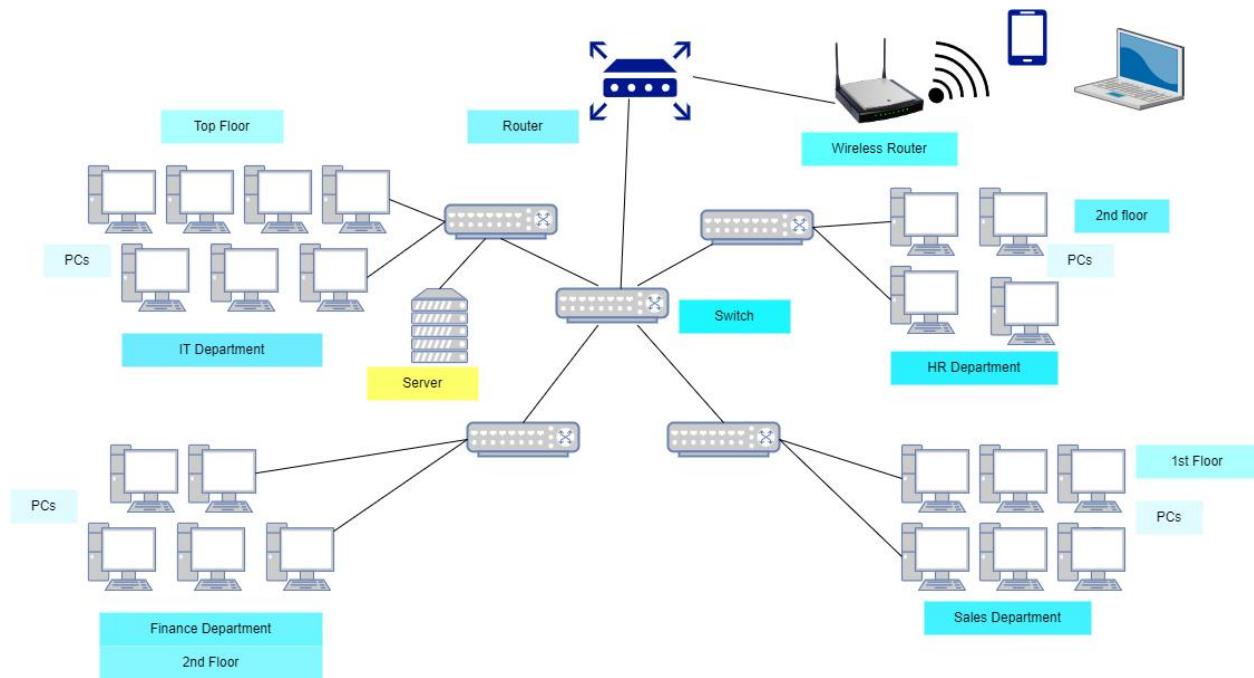
Client Computer Configuration

Hardware/Software	Dependency
OS-Window 8 and higher	With OS, we are unable to access a GUI and use desktop or computer functions.
RAM-8GB	RAM is required for increased data efficiency and quick processing. More and more RAM users install, the faster and more efficient the computer will be.
Graphics-4GB	using graphics is crucial for faster multimedia file transmission. more the graphics card users choose, the better and smoother the computer will be.
Processor-i7 and higher	i7 processors excellent at multitasking and processor-intensive workloads, and the greater the processor configuration, the better the performance will be, as we have lots of task to do without delaying a couple of seconds.
SSD- 1TB	File transfers are quicker, and the device will run smoothly.
HDD-2TB	we will add 2 TB of HDD to increase the storage capacity, as we required lots of storage to store the sensitive file of the bank as well as customers.
Connectivity 1x USB3.0	To connect the external devices such as mouse, keyboard and otherwith USB in faster rate.
CAT 6 ethernet cable and RJ 45	To enable LAN configuration and transmit the data at a high speed and also provide the greatest bandwidth. A NIC card and Ethernet port are required for LAN and Internet use.
Firewall-Cisco ASA5515-X and ASA 5585-X Firepower	To secure the network from viruses and malware, a firewall is necessary.

Server Computer Configuration

Hardware/Software	Dependency
OS- windows Server2012R2, 2016, 2019	With OS, we are unable to access a GUI and use desktop or computer functions.
RAM-64 GB	RAM is required for increased data efficiency and quick processing. More and more RAM users install, the faster and more efficient the computer will be.
Graphics-16 GB	using graphics is crucial for faster multimedia file transmission. more the graphics card users choose, the better and smoother the computer will be.
Processor-i7 and more	i7 processors excellent at multitasking and processor-intensive workloads, and the greater the processor configuration, the better the performance will be, as we have lots of task to do without delaying a couple of seconds.
HDD-100TB	File transfers are quicker, and the device will run smoothly.
Connectivity1xUSB3.0	we will add 2 TB of HDD to increase the storage capacity, as we required lots of storage to store the sensitive file of the bank as well as customers.
CAT 6 ethernet cable and RJ 45	To connect the external devices such as mouse, keyboard and otherwith USB in faster rate.
Firewall-Cisco ASA 5515-X and ASA 5585-X Fire POWER	To enable LAN configuration and transmit the data at a high speed and also provide the greatest bandwidth. A NIC card and Ethernet port are required for LAN and Internet use.

The network system physical diagram



Logical Design of the network:

IP Sheet:

Department	Network IP	Usable IP	Broadcast IP	Subnet Mask
IT	193.167.9.0	193.167.9.1-193.167.9.14	193.167.9.15	255.255.255.240
Finance	193.167.9.16	193.167.9.17-193.167.9.22	193.167.9.23	255.255.255.248
HR	193.167.9.24	193.167.9.25- 193.167.9.30	193.167.9.31	255.255.255.248
Sales	193.167.9.32	193.167.9.33- 193.167.9.46	193.167.9.47	255.255.255.240
Routers	193.167.9.48	193.167.9.49- 193.167.9.50	193.167.9.51	255.255.255.252

We got ip address by host method.

Device Requirements

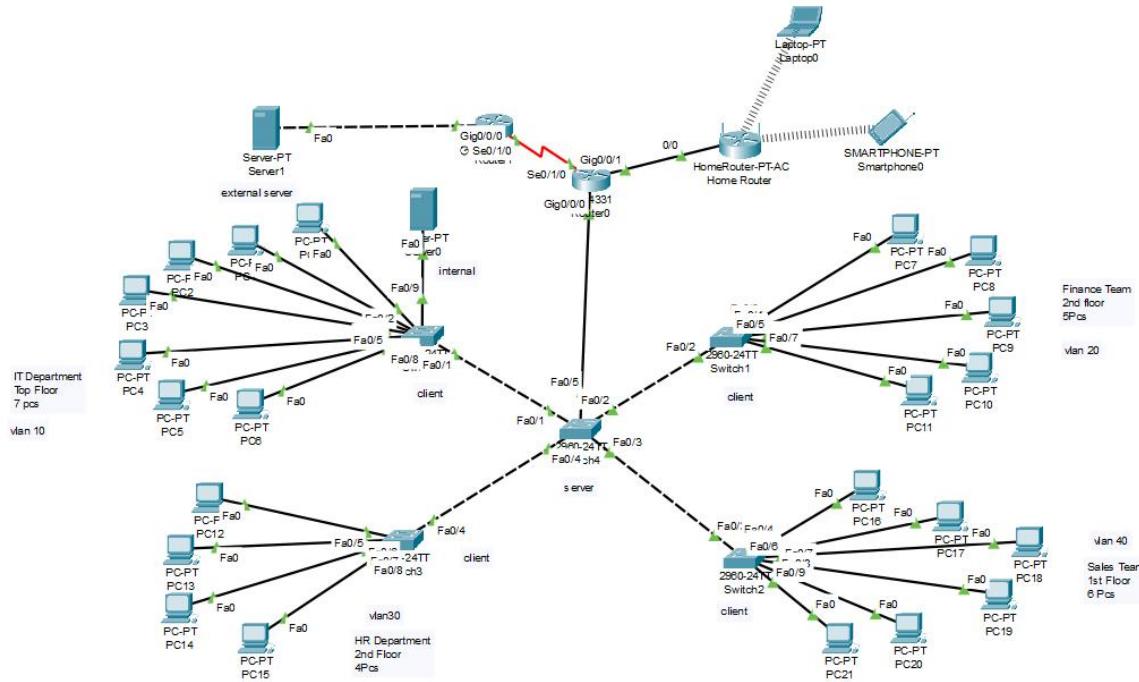
Serial Number	Device Name	No. of Device	Cost (Rs.)
1.	PC	25	$25 * 40000 = 1000000$
2.	Routers	2	$2 * 550000 = 1100000$
3.	Switch	5	$5 * 230000 = 1150000$
4.	Servers	2	$2 * 150000 = 300000$
5.	Wireless Router	1	$1 * 4000 = 4000$

Overview

When constructing the Cisco network for Cutting-Edge IT Solutions' new branch in Butwal, I carefully considered the best, most secure technology available while staying within the budgetary constraints. The network infrastructure may be confident that it will operate with the highest level of security and efficiency thanks to these reliable devices.

Implementation of network system based on a prepared design

Structured design



- **VTP**

```

Switch>en
Switch#config t
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#vtp mode client
Setting device to VTP CLIENT mode.
Switch(config)#vtp domain Cuttingedge
Domain name already set to Cuttingedge.
Switch(config)#vtp password 1999
Setting device VLAN database password to 1999
Switch(config)#vlan 10
VTP VLAN configuration not allowed when device is in CLIENT mode.
Switch(config)#int range fa0/2-8
Switch(config-if-range)#sw mo access
Switch(config-if-range)#sw access vlan 10
Switch(config-if-range)#exit
Switch(config)#

```

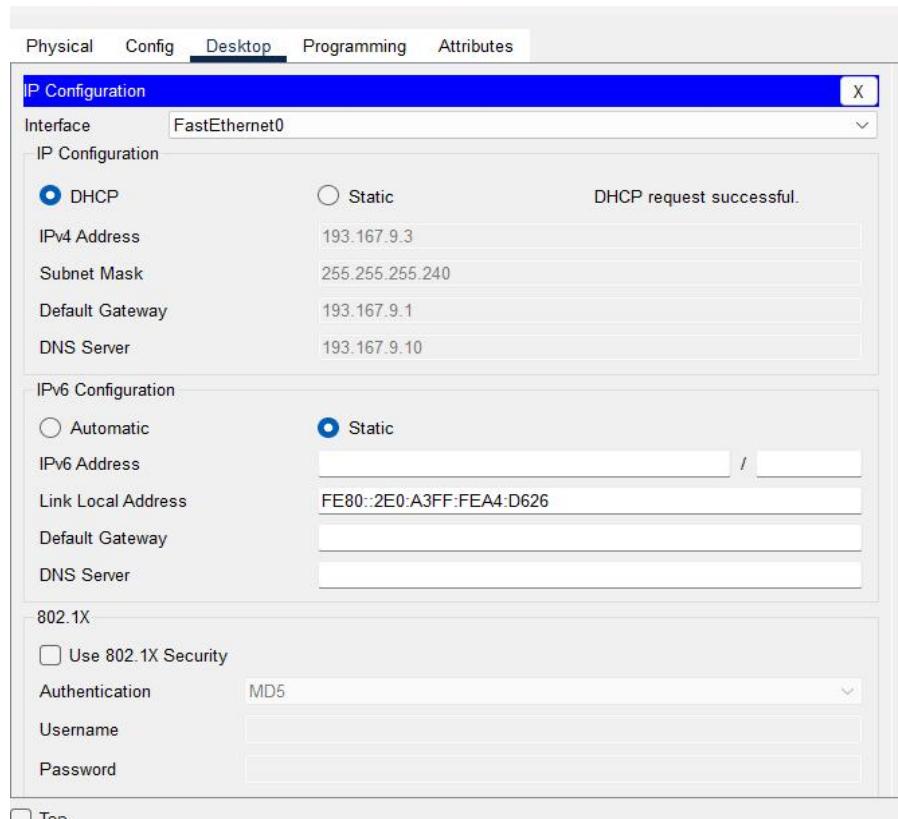
- **VLAN**

```

Switch(config)#vlan 10
Switch(config-vlan)#name IT
Switch(config-vlan)#exit
Switch(config)#vlan 20
Switch(config-vlan)#name finance
Switch(config-vlan)#exit
Switch(config)#vlan 30
Switch(config-vlan)#name HR
Switch(config-vlan)#exit
Switch(config)#vlan 40
Switch(config-vlan)#name Sales
Switch(config-vlan)#

```

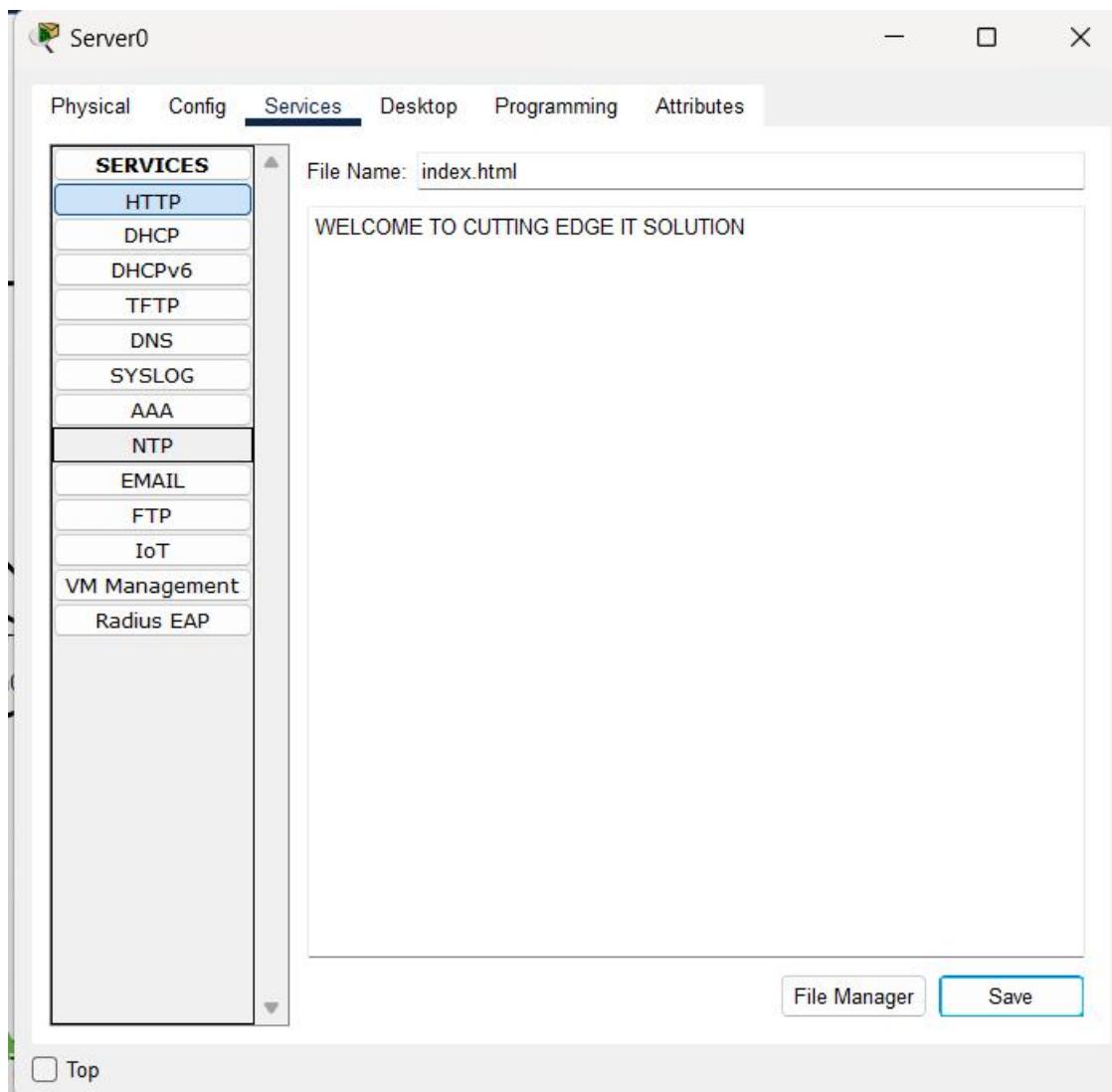
- **DHCP**



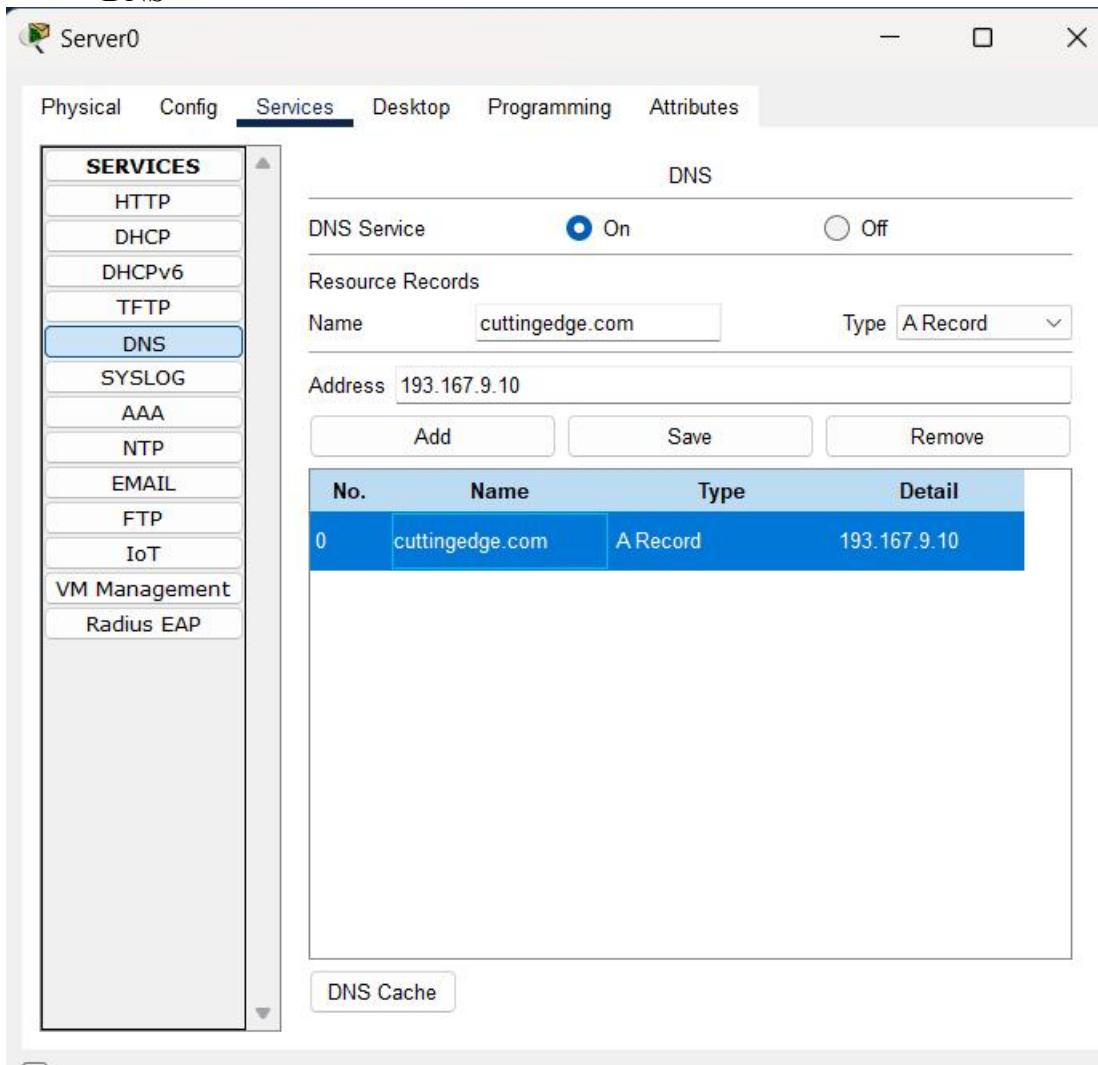
- **HTTP**

In this instance, index.html was produced automatically by Cisco and altered to say "WELCOME TO CUTTING EDGE IT SOLUTION".

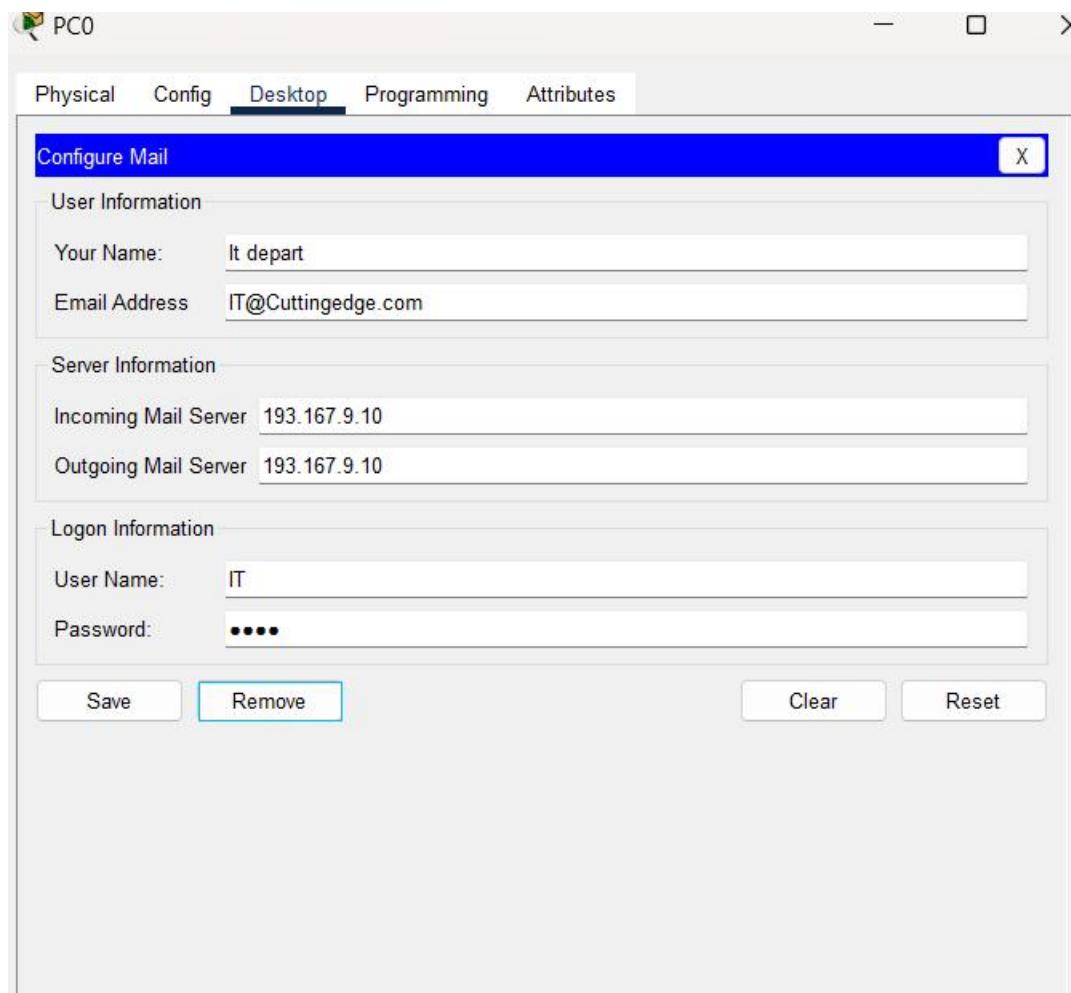
```
<html>
<center><font size='+2' color='blue'>Cisco Packet Tracer</font></center>
<hr>Welcome to Cisco Packet Tracer. Opening doors to new opportunities. Mind Wide Open.
<p>Quick Links:
<br><a href='helloworld.html'>A small page</a>
<br><a href='copyrights.html'>Copyrights</a>
<br><a href='image.html'>Image page</a>
<br><a href='cscptlogo177x111.jpg'>Image</a>
</html>
```



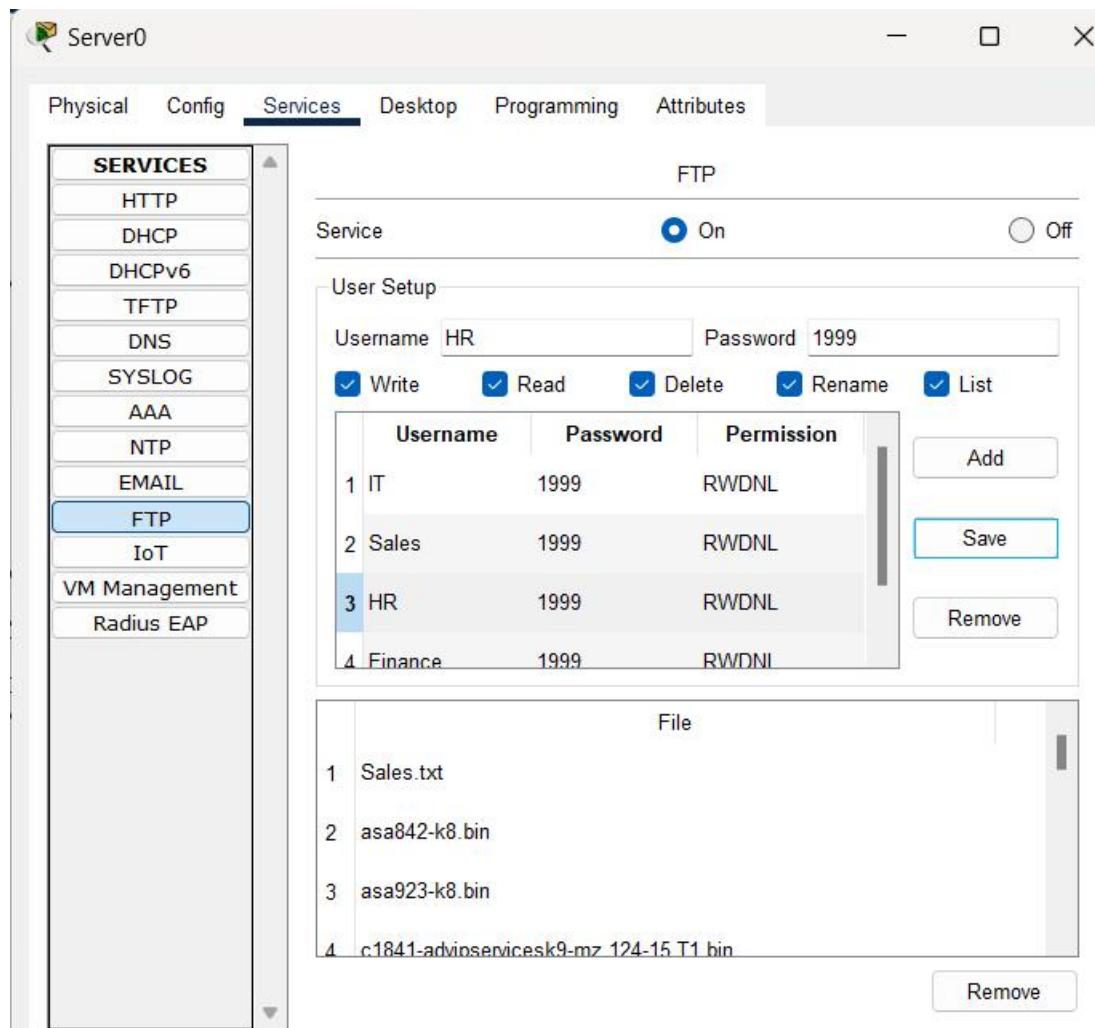
- DNS



- EMAIL



- **FTP**



- ROUTING

```

Router(config)#router eigrp 10
Router(config-router)#do sh ip route
Codes: L - local, C - connected, S - static, 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

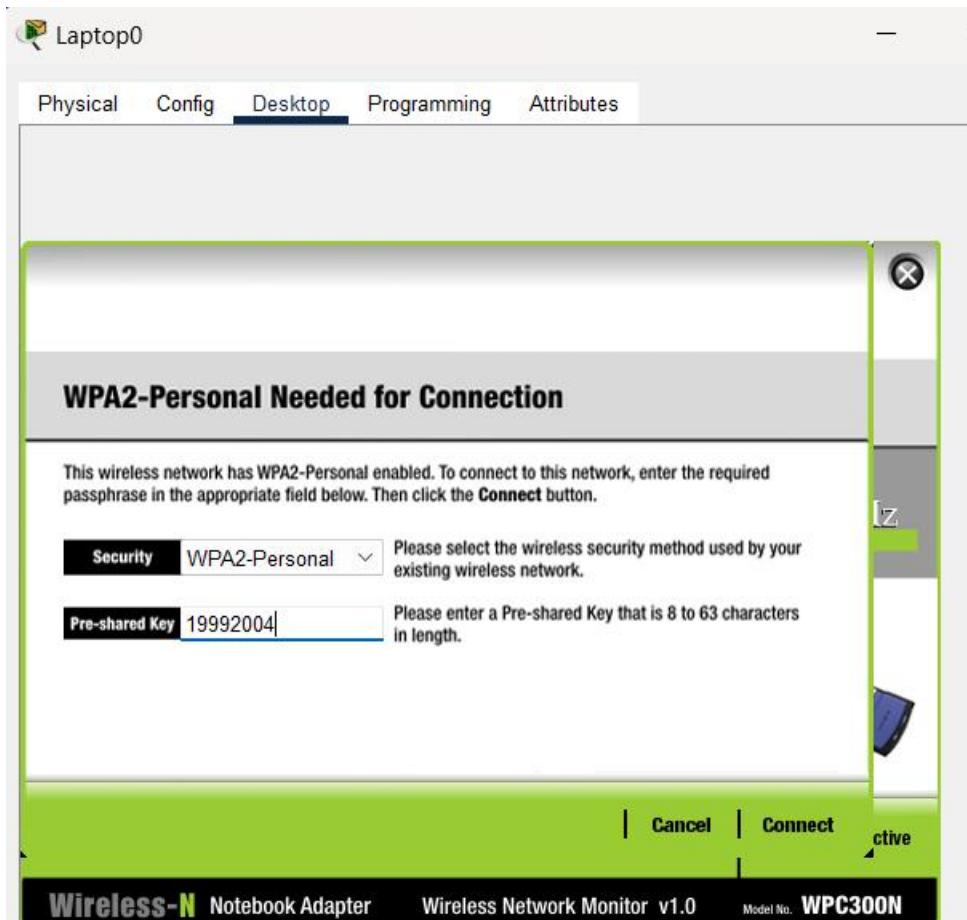
Gateway of last resort is not set

      22.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C        22.0.0.0/8 is directly connected, GigabitEthernet0/0/0
L        22.0.0.1/32 is directly connected, GigabitEthernet0/0/0
      193.167.9.0/24 is variably subnetted, 2 subnets, 2 masks
C        193.167.9.48/30 is directly connected, Serial0/1/0
L        193.167.9.50/32 is directly connected, Serial0/1/0

Router(config-router)#network 22.0.0.0
Router(config-router)#network 193.167.9.48
Router(config-router)#exit
Router(config)#

```

- Wireless Connection in Laptop



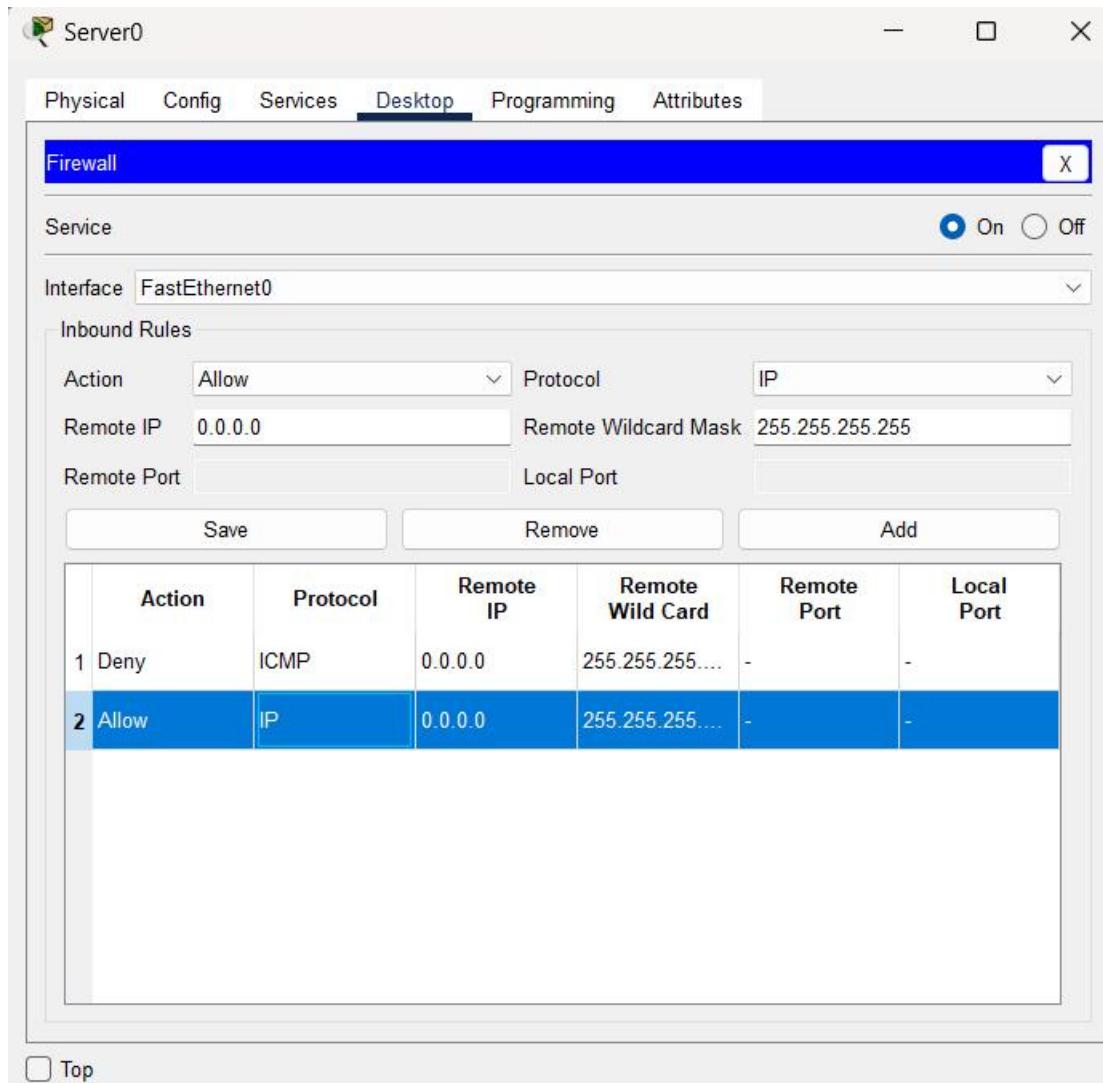
Implementation of Telnet and Firewalls for security

1. TELNET

```
Router>en
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#line vty 0 4
Router(config-line)#password 1999
Router(config-line)#login
Router(config-line)#enable secret 1999
Router(config)#

```

2. FIREWALLS

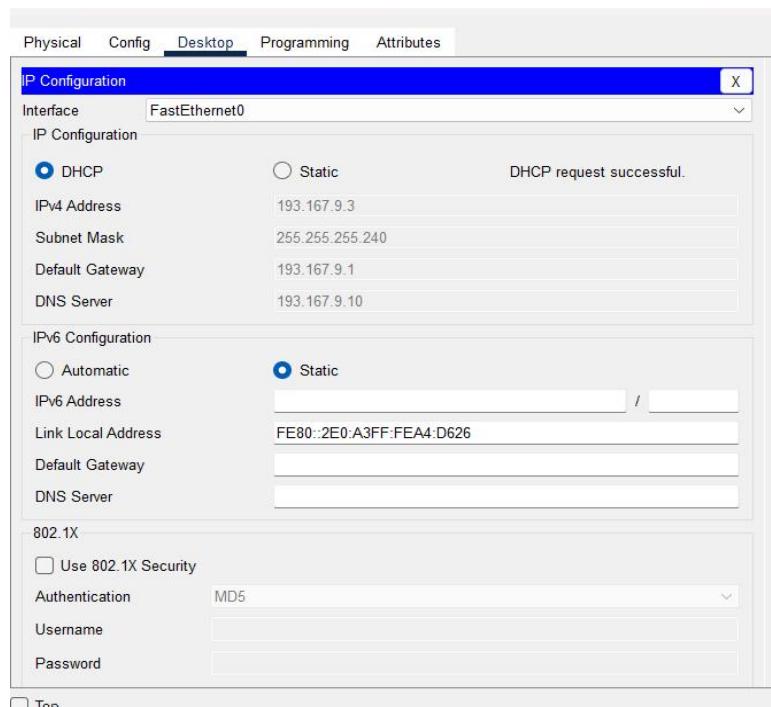


Analyzing test results against expected results and Documentation

We will evaluate the efficiency of our Cisco packet tracing and look for any problems in this part.

S. No	Date	What was tested	Expected result	Actual result	Remark
1.	01-07-2023	DHCP testing	Client computer will automatically get IPv4 address.	Client computer successfully get IPv4 address.	DHCP server automatically assign an IP address to a computer from a defined range of numbers configured for a given network.

Result:



S. No	Date	What was tested	Expected result	Actual result	Remark
2.	01-07-2023	Routing	5 Ip address to be affected and come in Eigrp form written “D” at the front.	5 Ip address affected and come in Eigrp form written “D” at the front of their IP address.	Routing is successfully executed in all routers.

Here, D is Eigrp successed IP.

Output

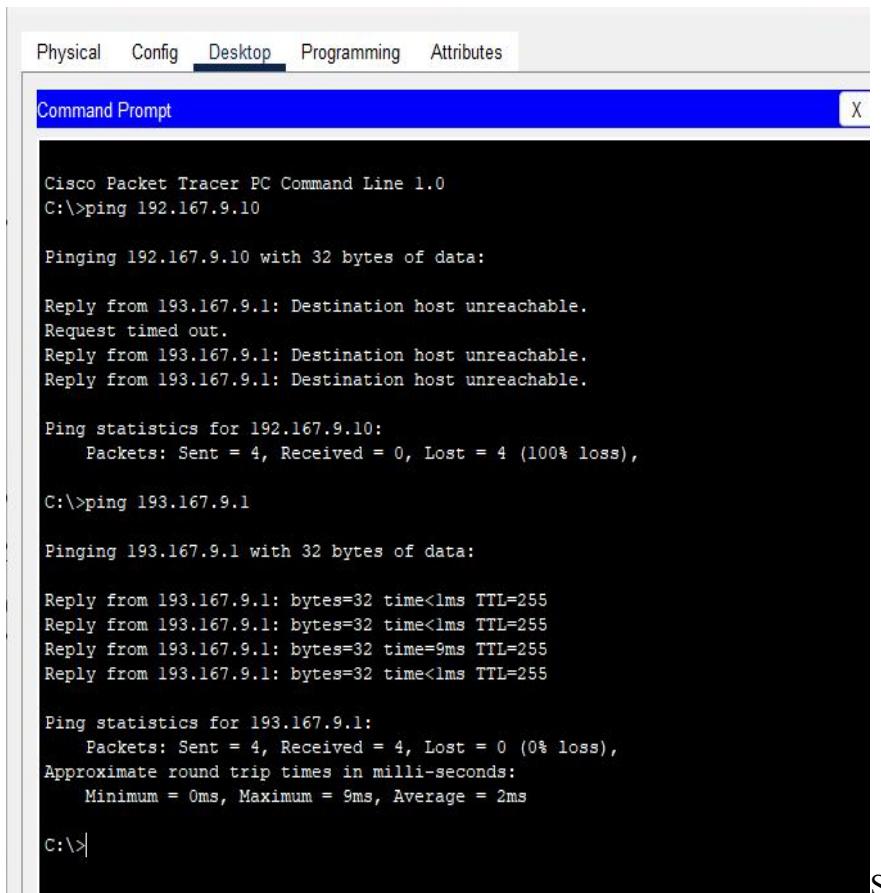
```

22.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C   22.0.0.0/8 is directly connected, GigabitEthernet0/0/0
L   22.0.0.1/32 is directly connected, GigabitEthernet0/0/0
193.167.9.0/24 is variably subnetted, 7 subnets, 5 masks
D     193.167.9.0/24 is a summary, 00:00:12, Null0
D     193.167.9.0/28 [90/2172416] via 193.167.9.49, 00:00:12, Serial0/1/0
D     193.167.9.16/29 [90/2172416] via 193.167.9.49, 00:00:12, Serial0/1/0
D     193.167.9.24/29 [90/2172416] via 193.167.9.49, 00:00:12, Serial0/1/0
D     193.167.9.32/28 [90/2172416] via 193.167.9.49, 00:00:12, Serial0/1/0
C     193.167.9.48/30 is directly connected, Serial0/1/0
L     193.167.9.50/32 is directly connected, Serial0/1/0

```

S. No	Date	What was tested	Expected result	Actual result	Remark
3.	01-07-2023	Firewall	ICMP will be lost and IP will be Ping.	ICMP lost the ping and IP received and pinged.	IP was successfully pinged.

Result:



The screenshot shows a command-line interface for Cisco Packet Tracer. The tabs at the top are Physical, Config, Desktop, Programming, and Attributes. The Desktop tab is selected. The window title is "Command Prompt". The command entered is "ping 192.167.9.10". The output shows four failed pings to 192.167.9.10 due to destination host unreachable. Then, a ping to 193.167.9.1 is performed, which succeeds with four packets sent, four received, and zero loss. Approximate round trip times are shown as 0ms minimum, 9ms maximum, and 2ms average. The prompt "C:\>" is visible at the bottom.

```

Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.167.9.10

Pinging 192.167.9.10 with 32 bytes of data:
Reply from 193.167.9.1: Destination host unreachable.
Request timed out.
Reply from 193.167.9.1: Destination host unreachable.
Reply from 193.167.9.1: Destination host unreachable.

Ping statistics for 192.167.9.10:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
C:\>ping 193.167.9.1

Pinging 193.167.9.1 with 32 bytes of data:

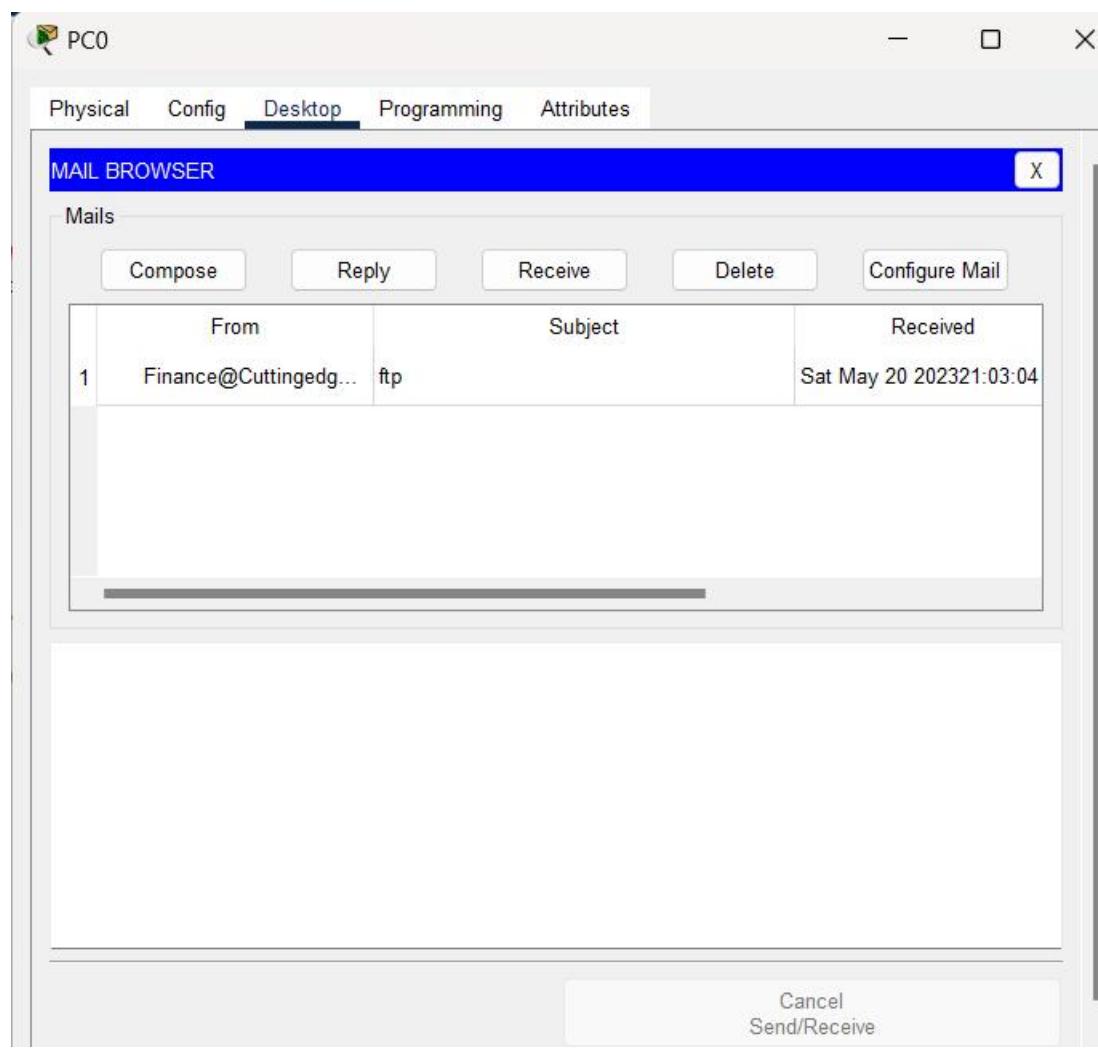
Reply from 193.167.9.1: bytes=32 time<1ms TTL=255
Reply from 193.167.9.1: bytes=32 time<1ms TTL=255
Reply from 193.167.9.1: bytes=32 time=9ms TTL=255
Reply from 193.167.9.1: bytes=32 time<1ms TTL=255

Ping statistics for 193.167.9.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 9ms, Average = 2ms
C:\>

```

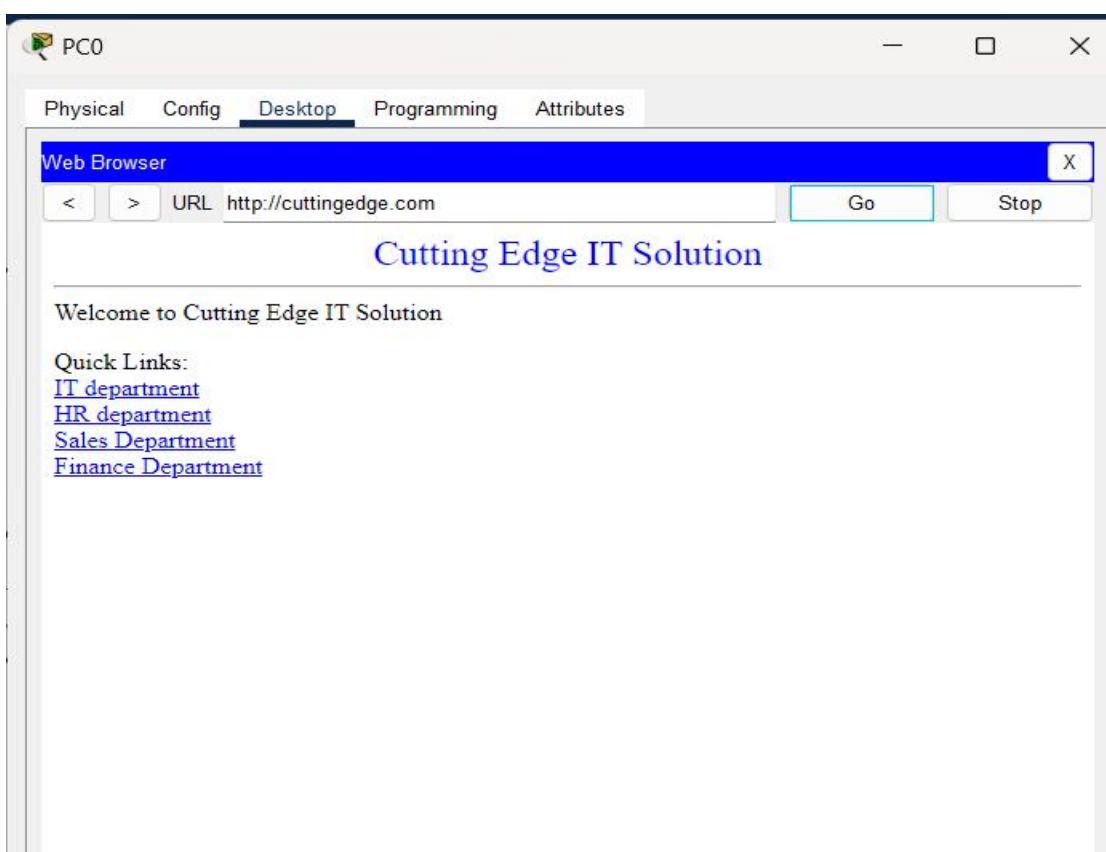
S. No	Date	What was tested	Expected result	Actual result	Remark
4.	20-05-2023	Email	Email will be received.	Email was received in respected email address.	Email was successfully received.

Result:



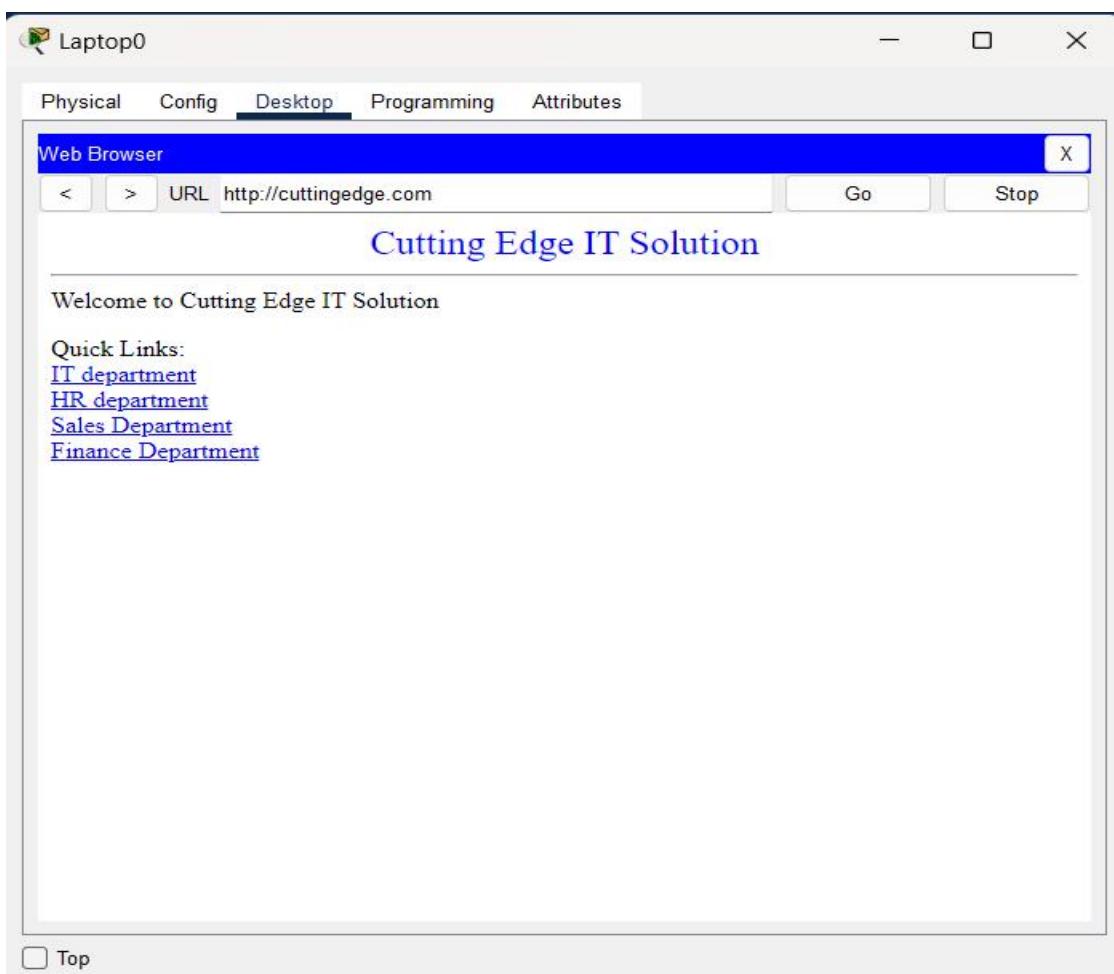
S. No	Date	What was tested	Expected result	Actual result	Remark
5.	01-07-2023	HTTP And DNS	HTTP edited text will be appeared in screen.	HTTP edited text appeared in the screen.	HTTP and DNS was successful.

Result:



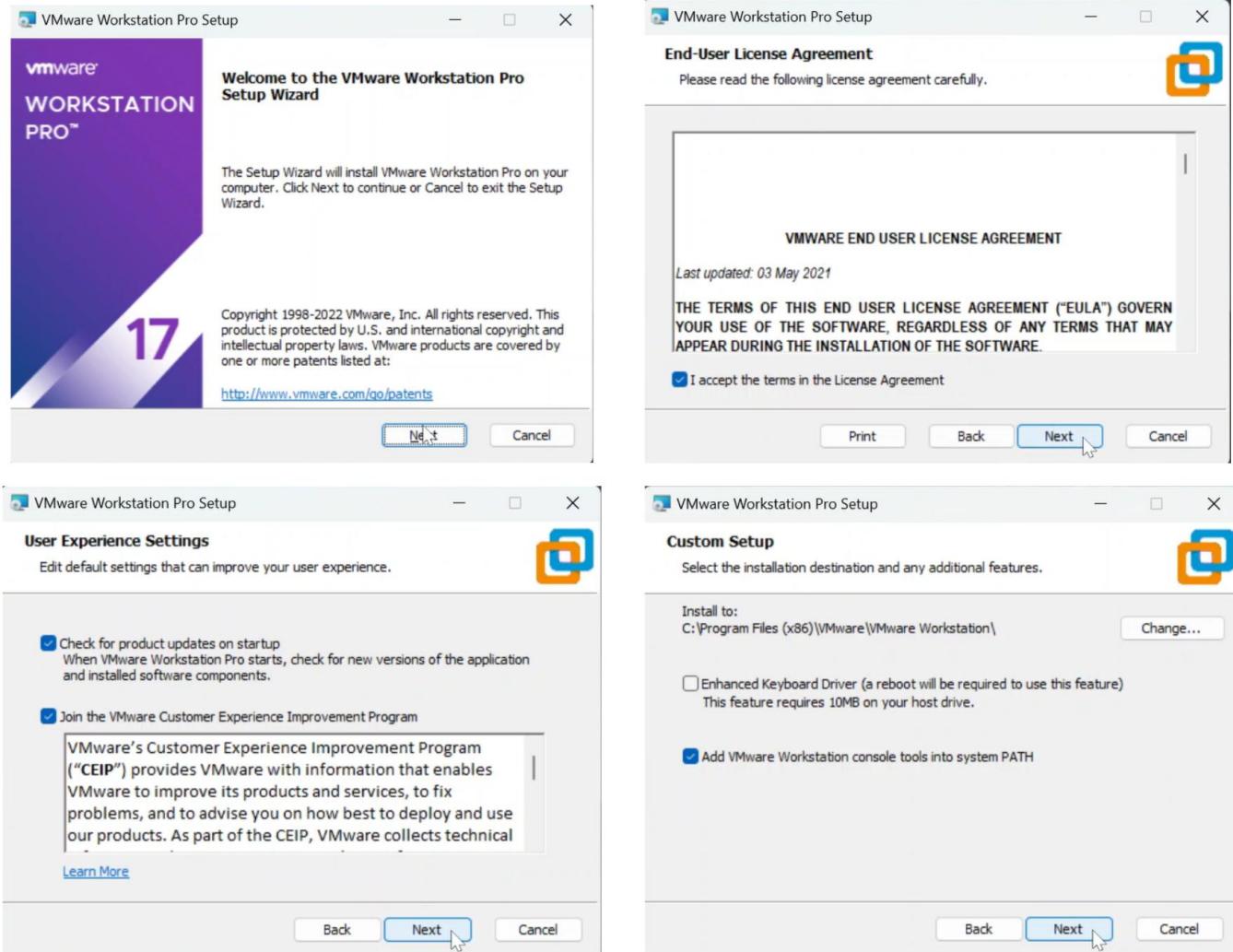
S. No	Date	What was tested	Expected result	Actual result	Remark
6.	01-07-2023	Wireless connection	HTTP edited text will be shown while web browsing.	HTTP edited text shown while web browsing.	Wireless connection was successful.

Result:



Specifying Admin and User roles using Virtual Machine Ware

Steps to follow:



1. Download VMWare and run the .exe file and starts Installing the VMware Workstation Pro

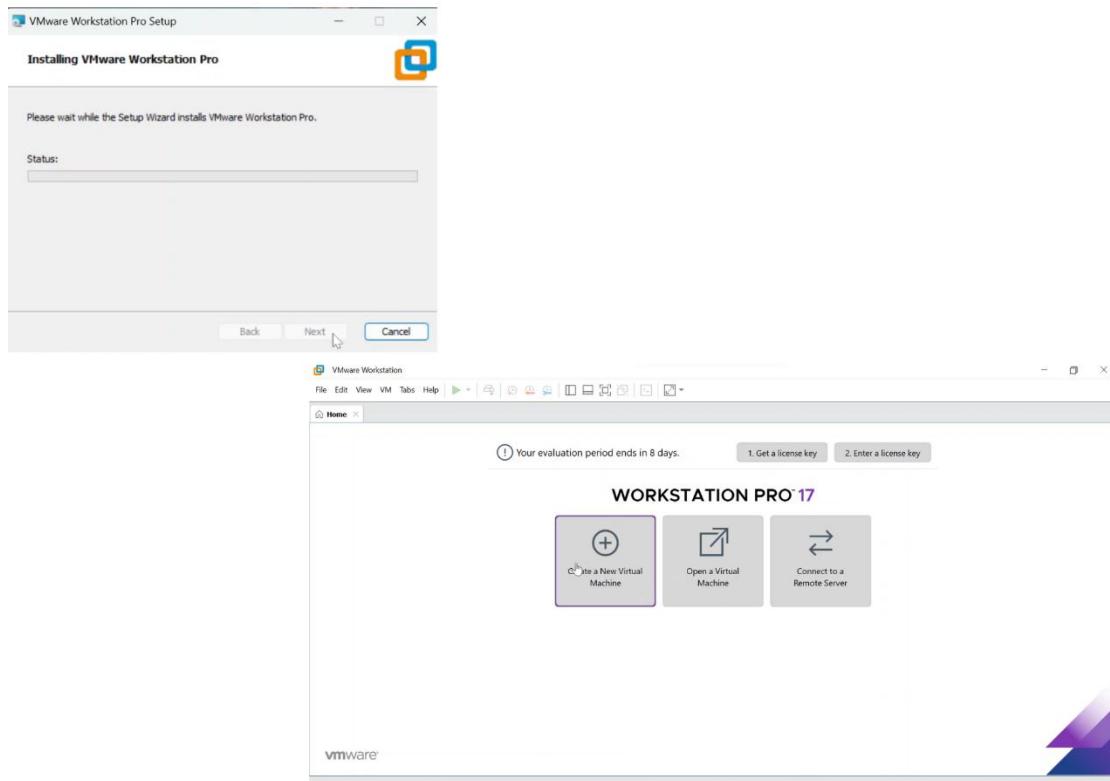
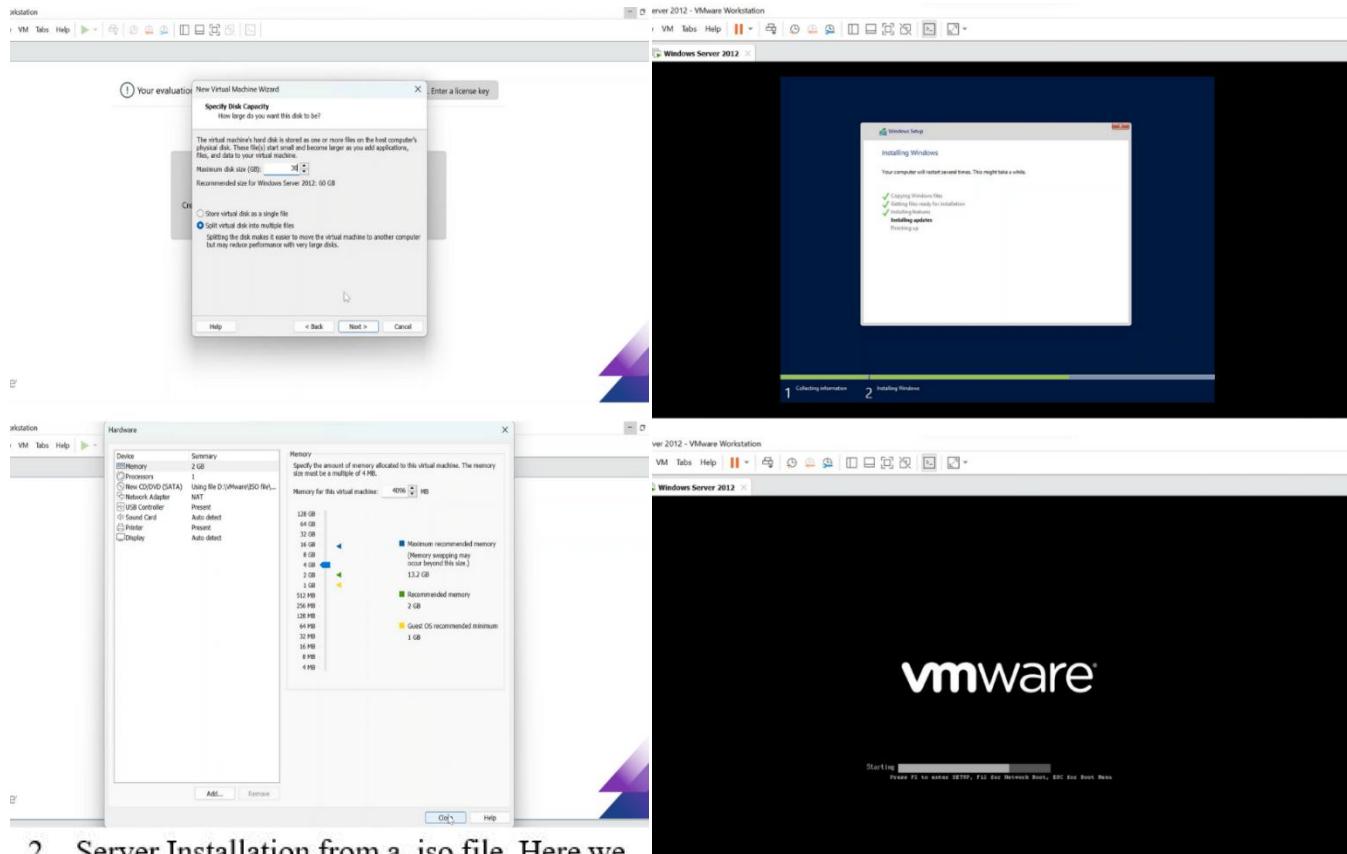


Fig 1: VMWare Installation steps



2. Server Installation from a .iso file. Here we will create a new virtual machine and follow the below steps:
RAM is 4 GB

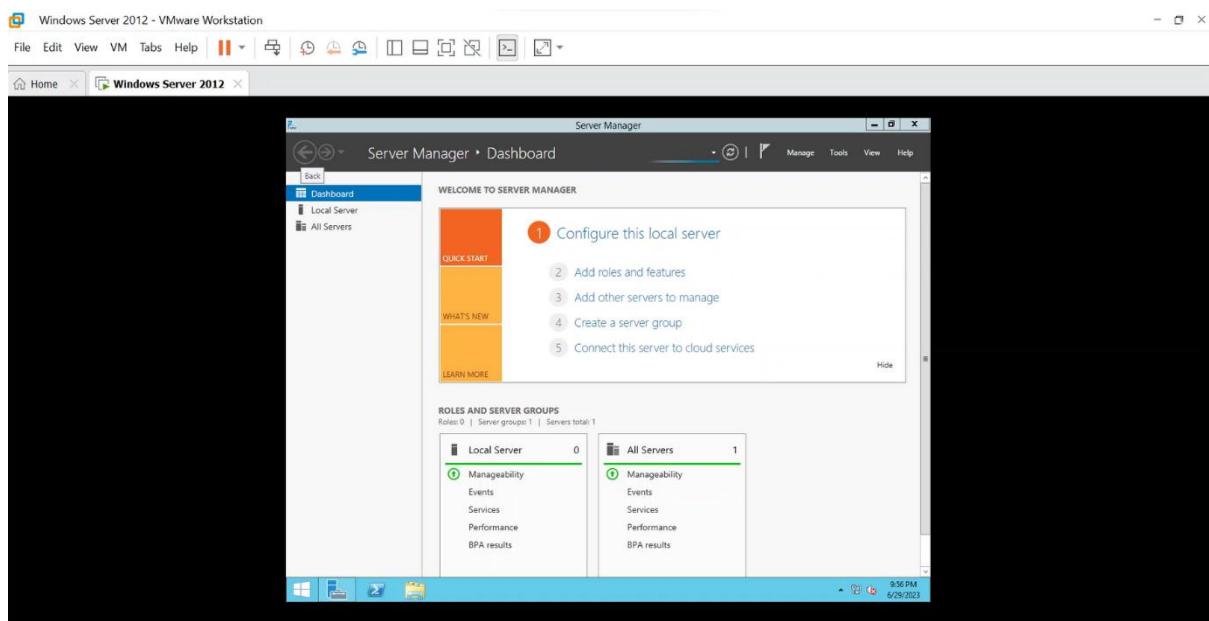


Fig 2 – Server Installation process

3. Client Installation from .iso file. We are installing windows 10. Go to new virtual machine and follow the below steps

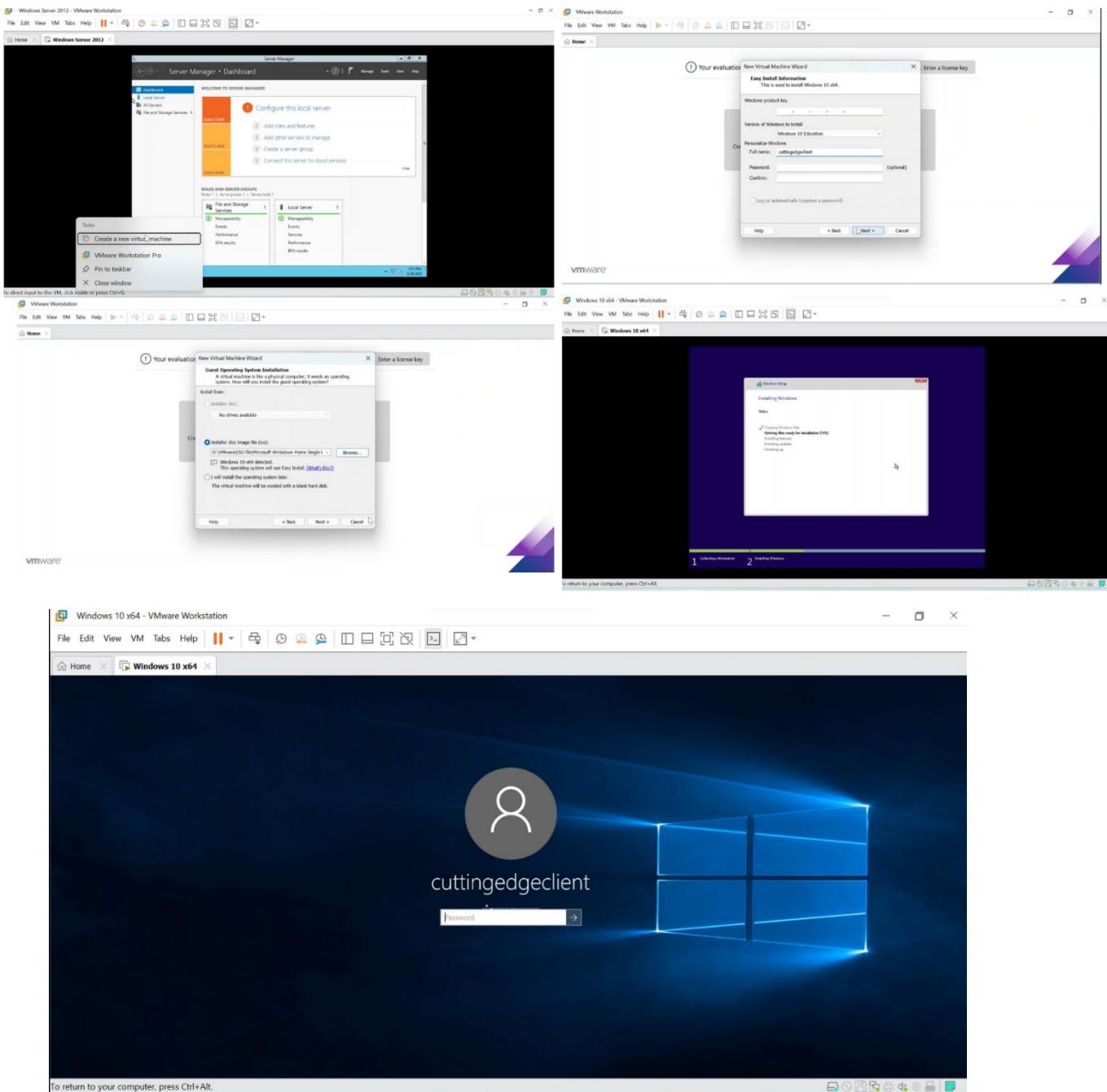
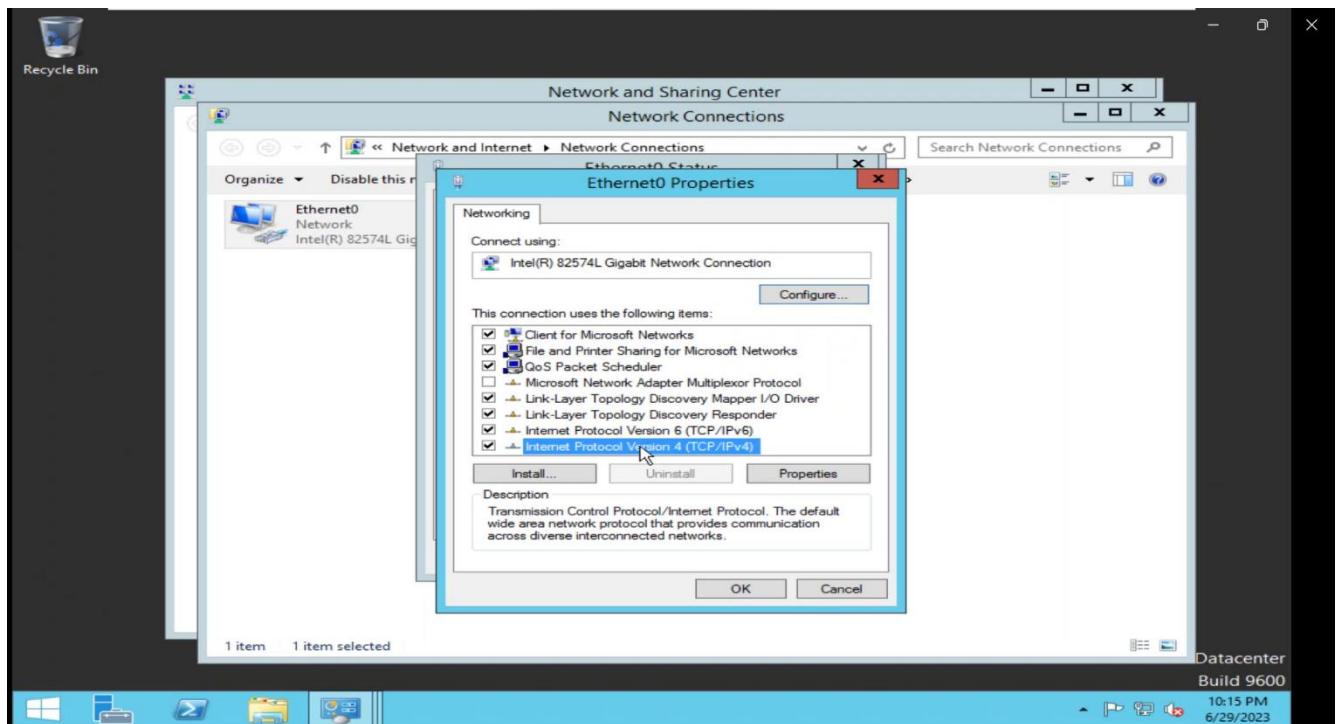


Fig 3 – Windows Installation process

4. In server you need to do three things –

- i. Change IP address – Go to Network and setting, change adapter and select Ethernet and right click. Ethernet status dialog box appears and from there select properties. In the properties you will find IPV4 click it and select properties. Change IP to 172.168.10.10, Subnet mask 255.255.255.240 and Default Gateway to 172.168.10.1
- ii. Turn off Fire walls and – Go to network and setting, windows firewalls, select advance and turn off domain, private and public firewall status.
- iii. Change Administrative password – Sign out of cutting edge and change administration password dialog box appears. Change new password ‘Server@123’



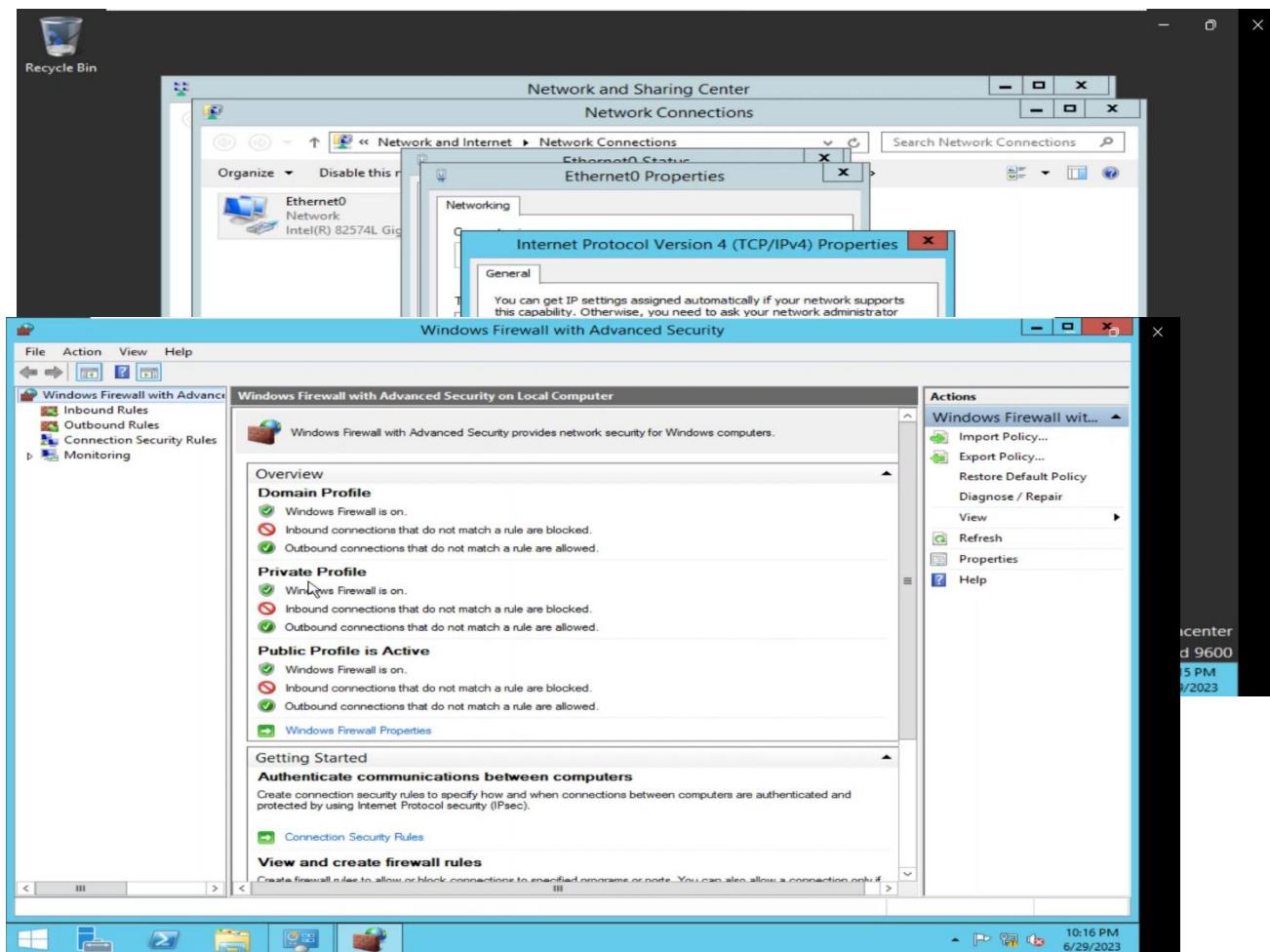


Fig 4 – Providing IP address

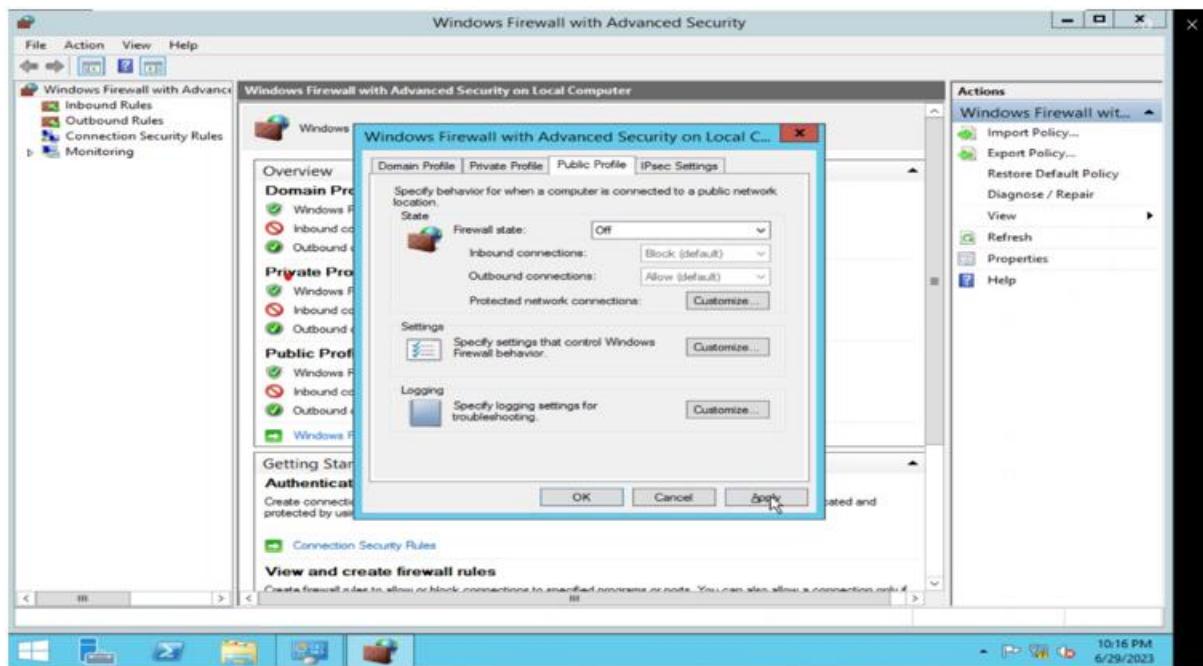


Fig 5 – Turning off firewalls

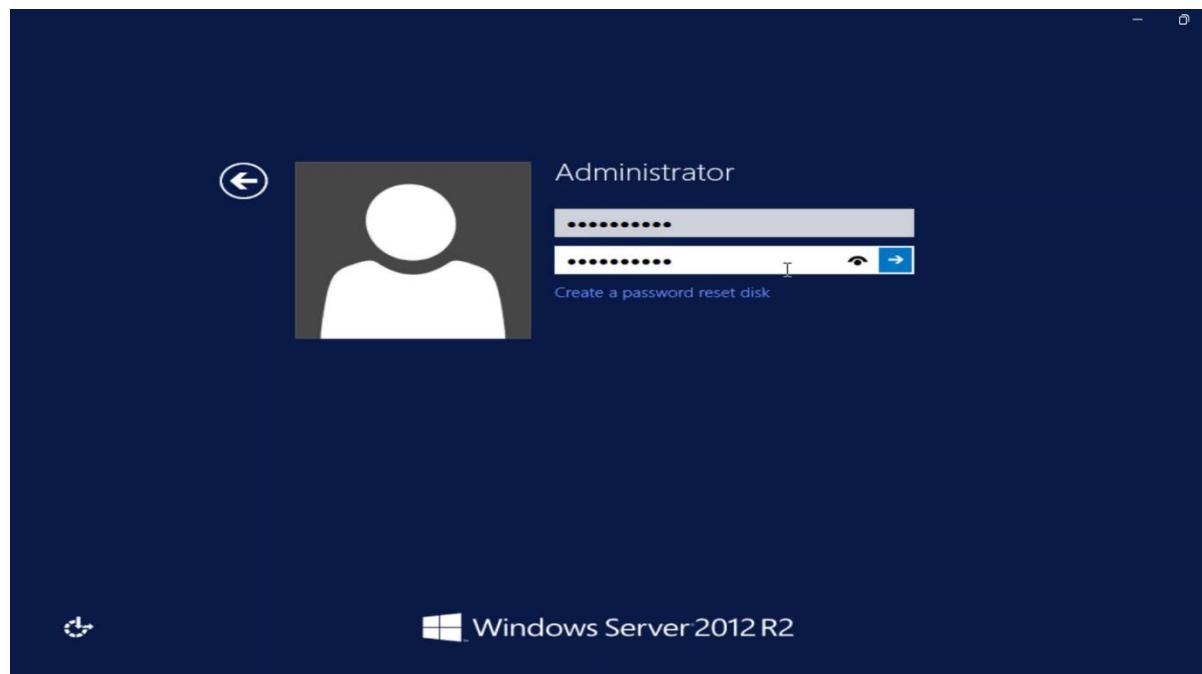


Fig 6 – Administrator password change

5. Now we need to add Active Directory. Open server manager and click on local server and go to manage menu and select add roles and features

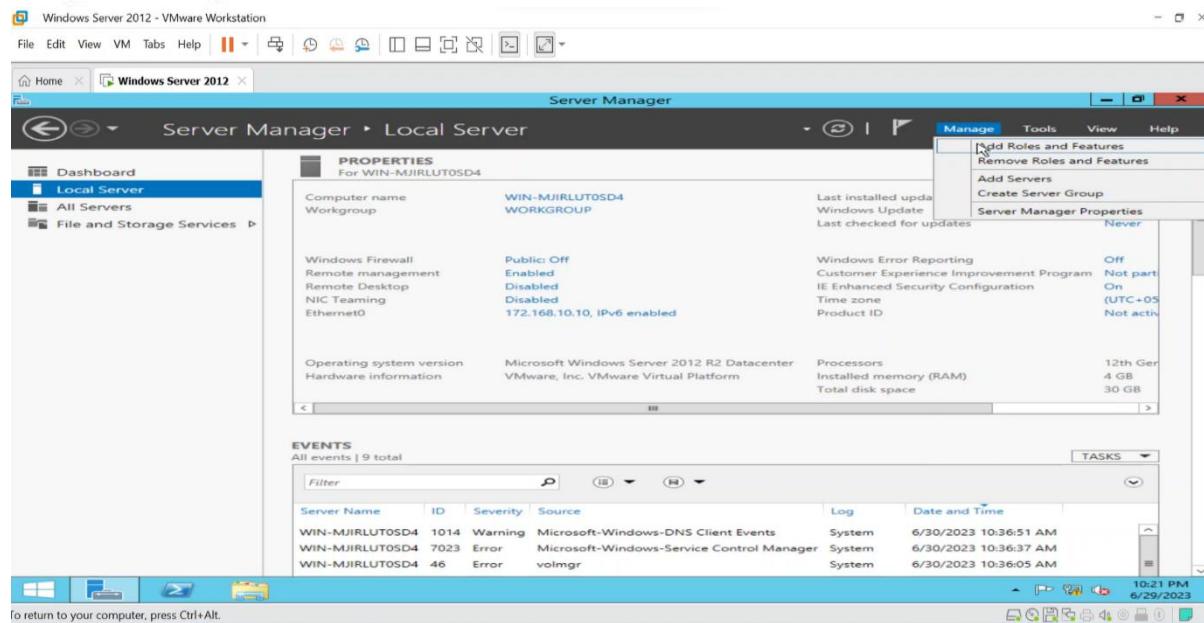


Fig 7: Active Directory Installation

6. Click next and next and select active directory service from the add roles windows

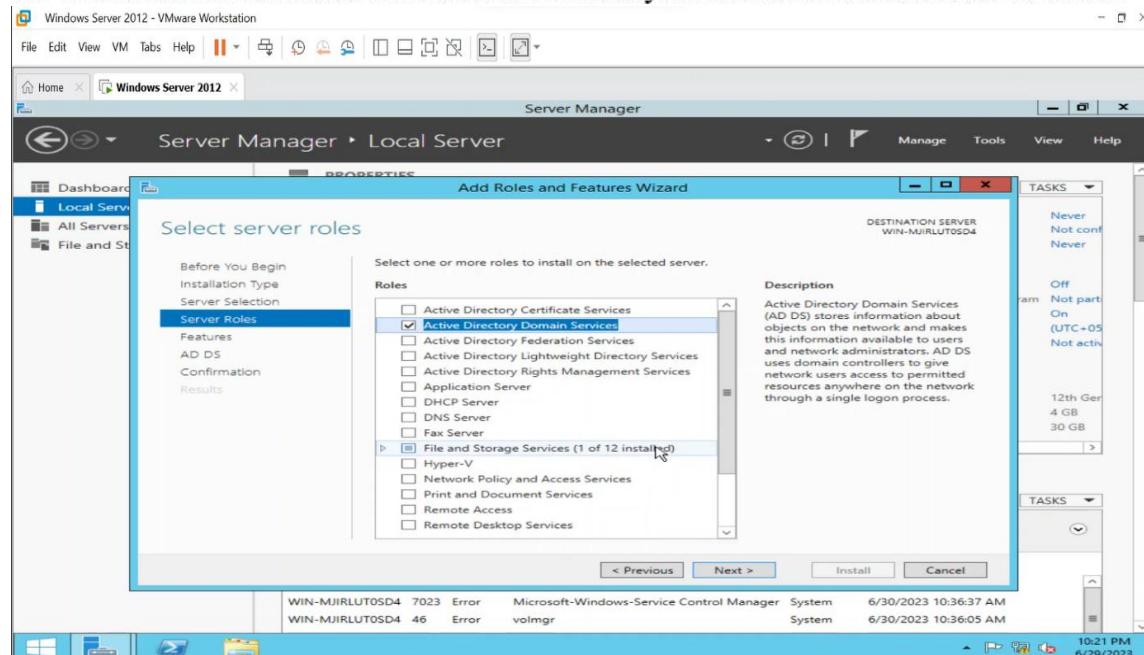


Fig 8: Active Directory Installation cont.

7. Select restart option and press install

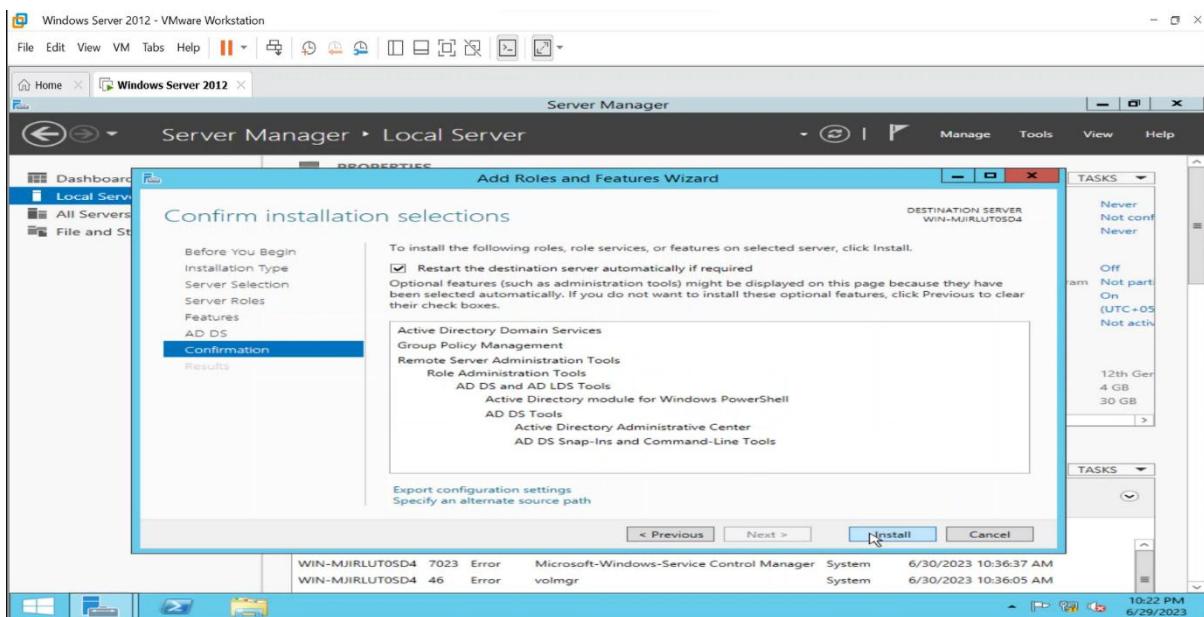


Fig 9: Active Directory Installation cont.

8. After the installation of AD click on promote this server to Domain Controller

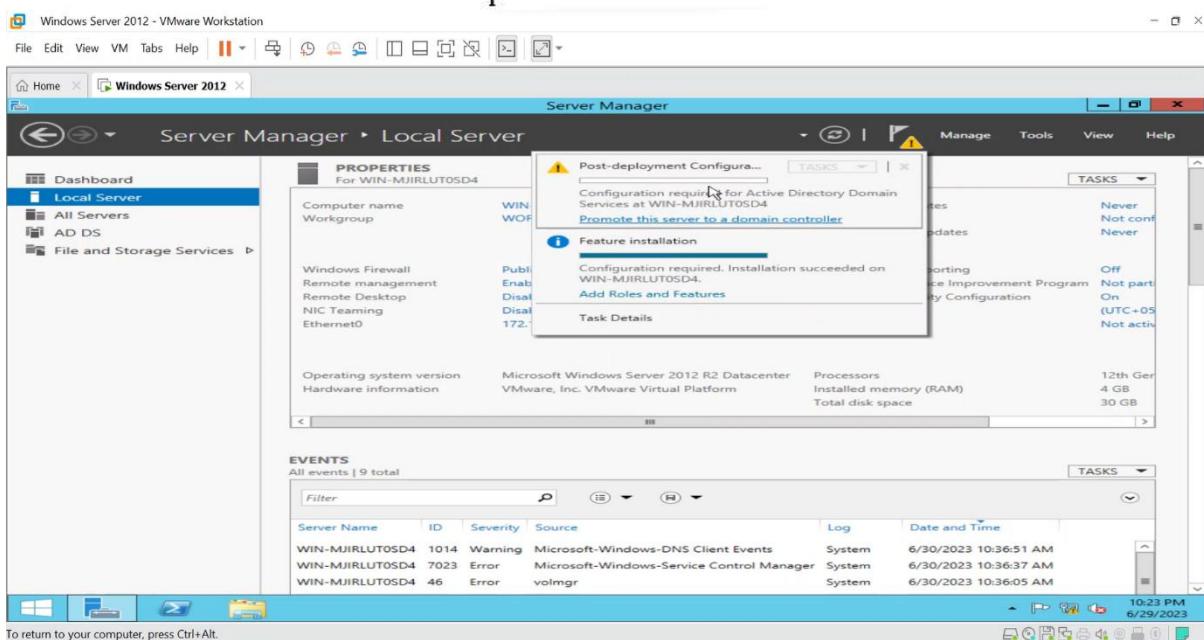


Fig 10: Promoting the server to Domain Controller

9. Select add a new forest from deployment configuration windows and write domain name as cuttingedge.com

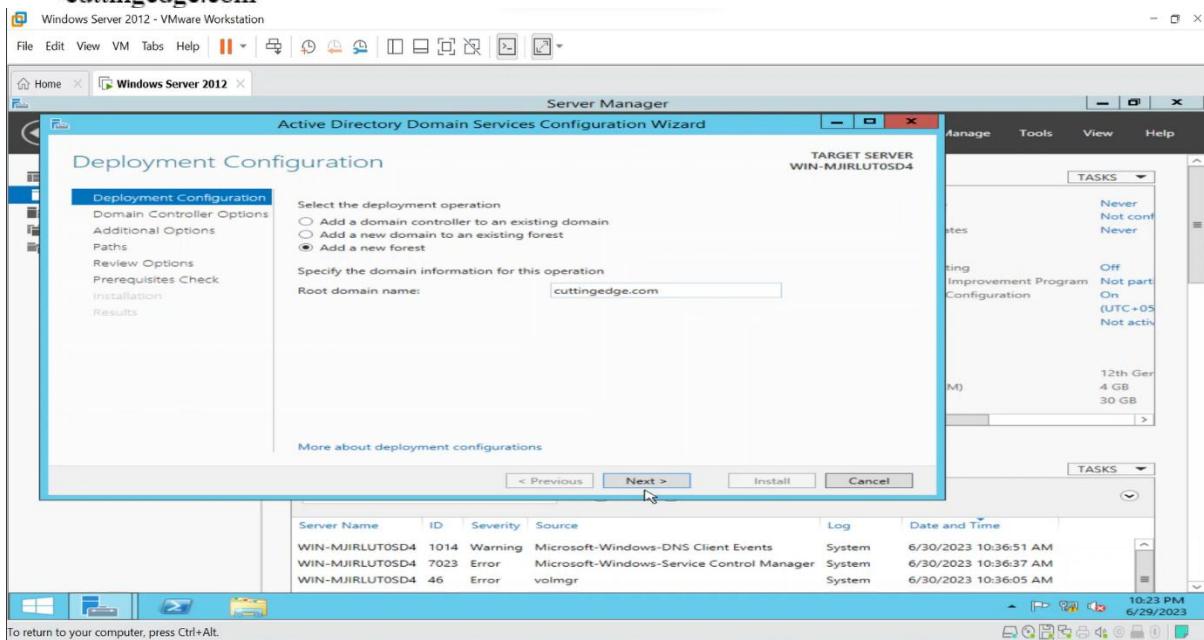


Fig 11: Providing Domain name

10. Provide password and confirm password

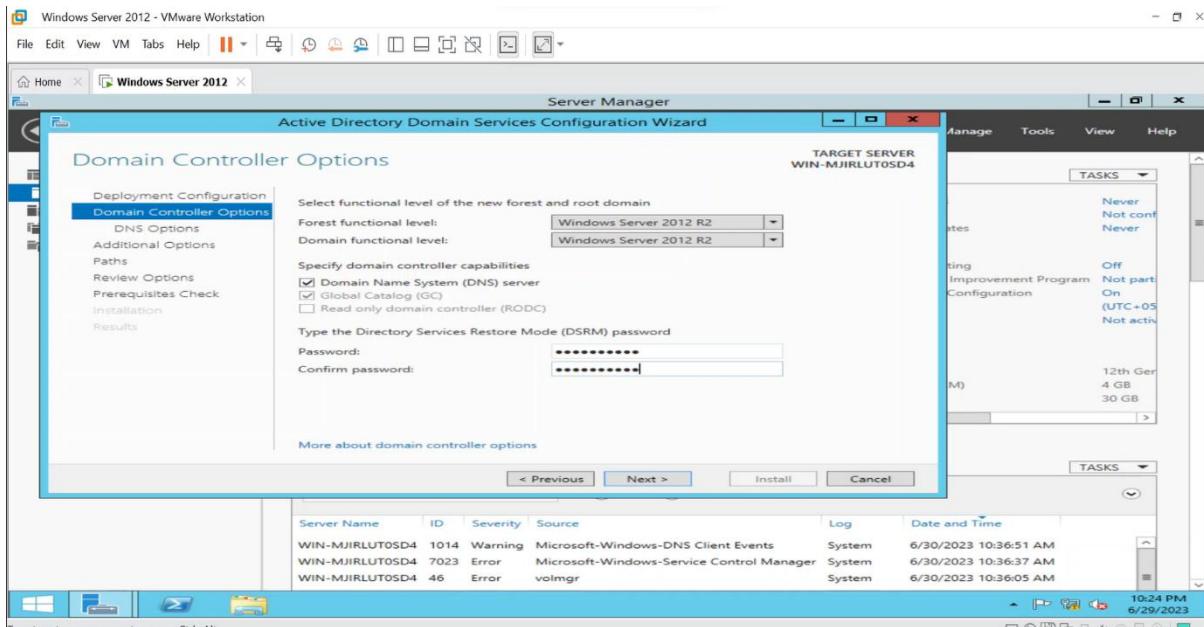


Fig 12: Providing Password

11. Click the next, again click on next to check NetBIOS name (it will come automatically in capital letters) click next

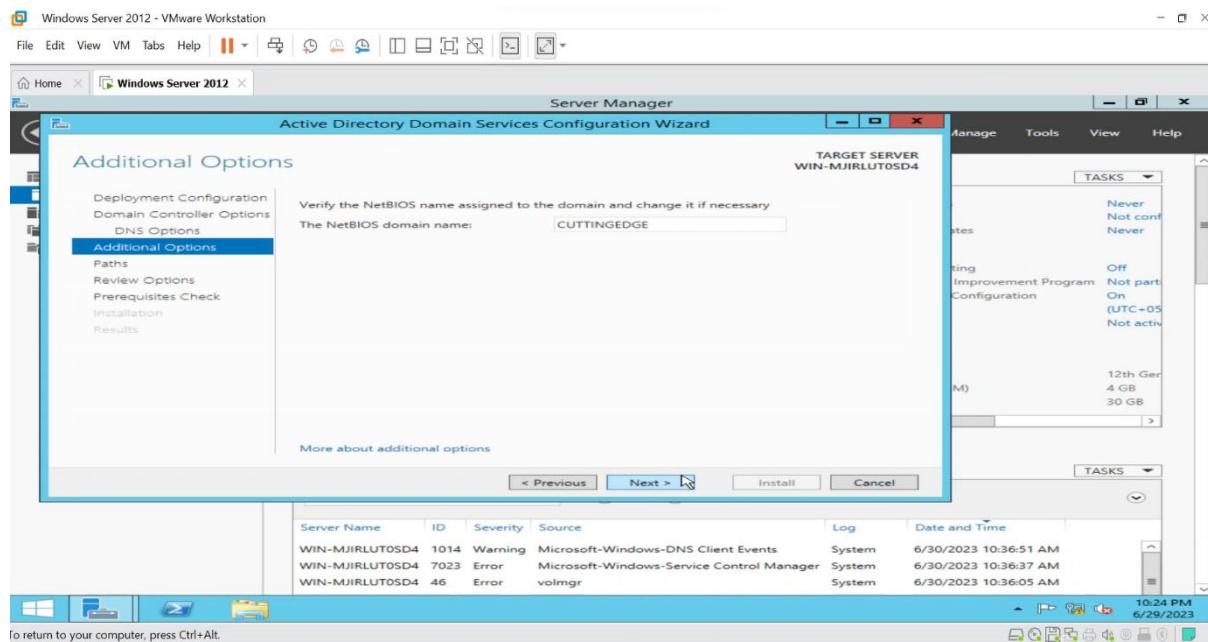
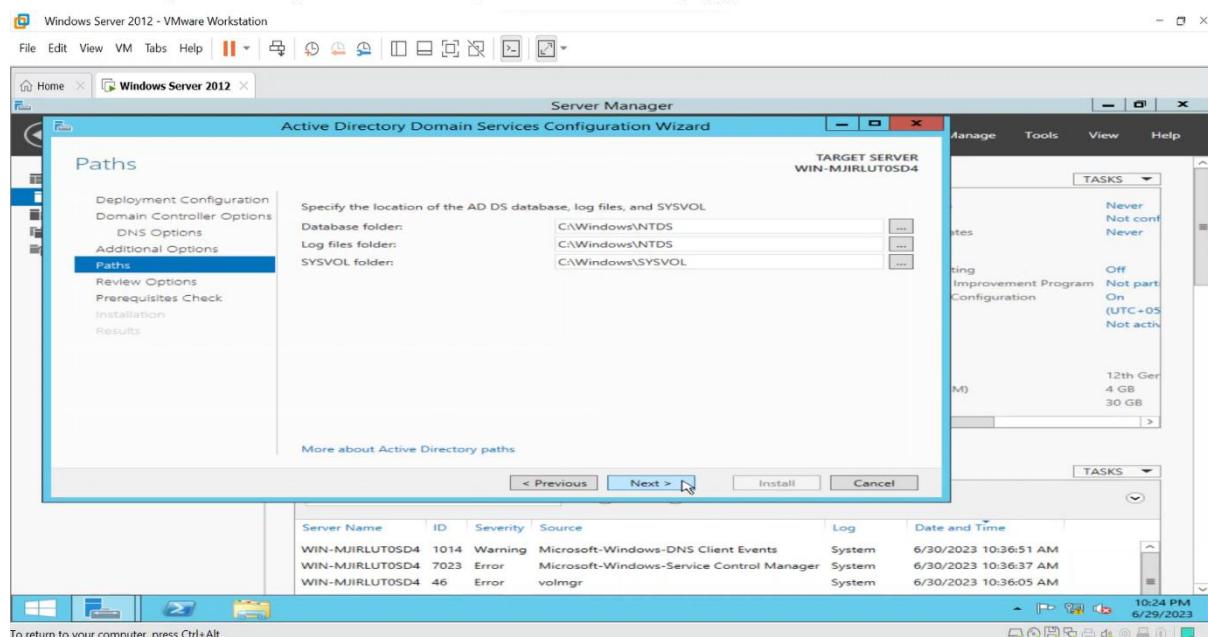
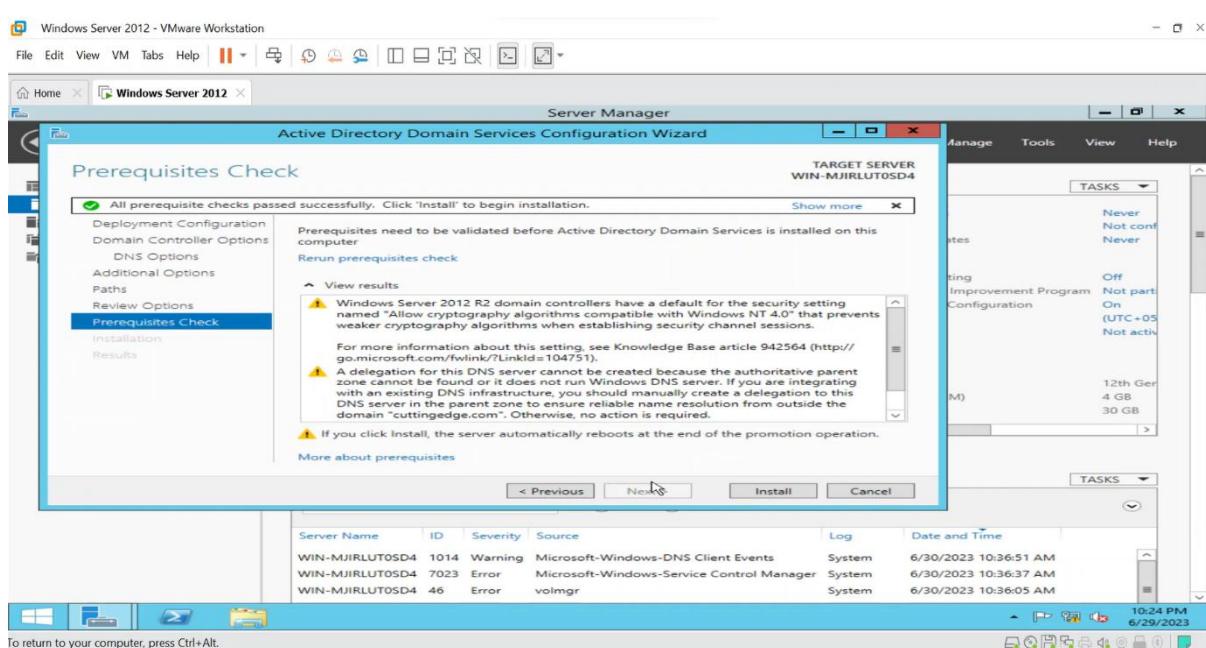
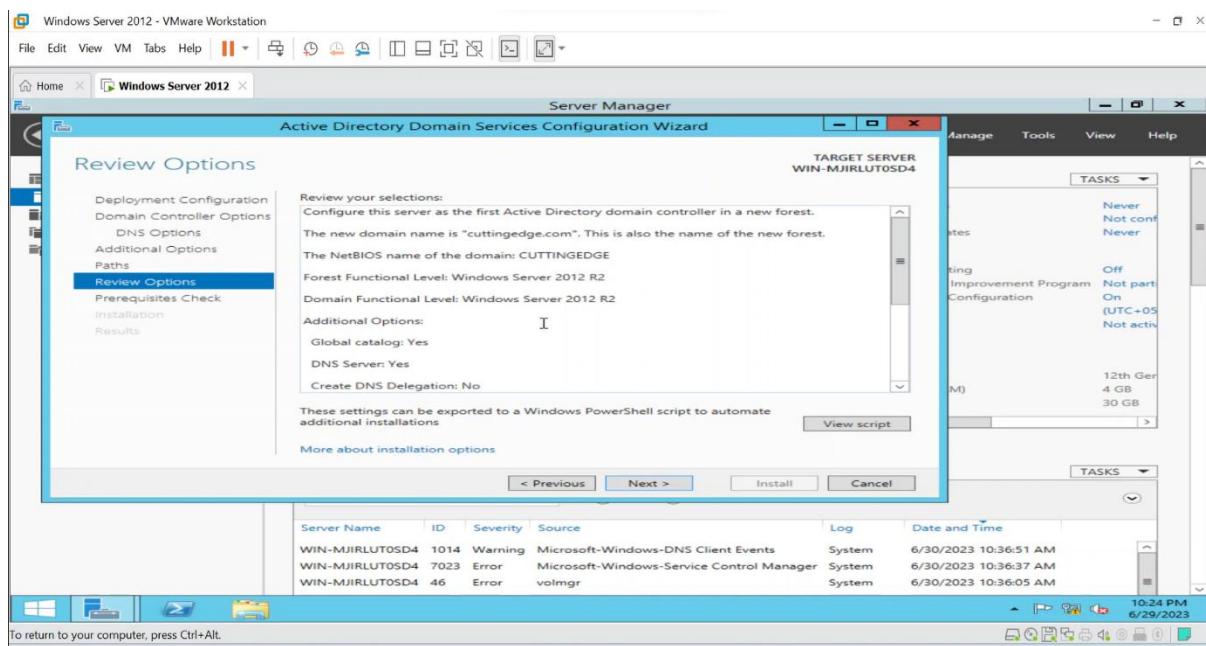


Fig 13: NetBIOS domain name

12. For Path, Review option and Prerequisites check simply press next and install





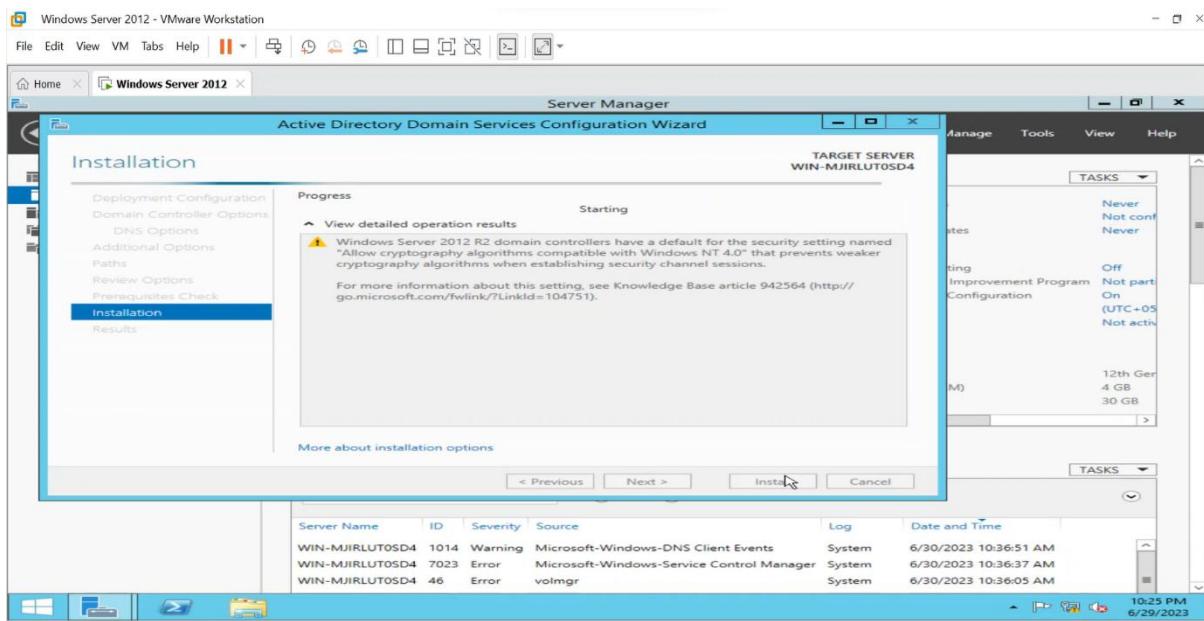


Fig 14 – Checking Path, Review option and Prerequisites and installing

13. In client you need to –

- Change IP address – Go to Network and setting, change adapter and select Ethernet and right click. Ethernet status dialog box appears and from there select properties. In the properties you will find IPV4 click it and select properties. Change IP to 172.168.10.2, Subnet mask 255.255.255.240, Default Gateway to 172.168.10.1 and Preferred DNS as 172.168.10.10

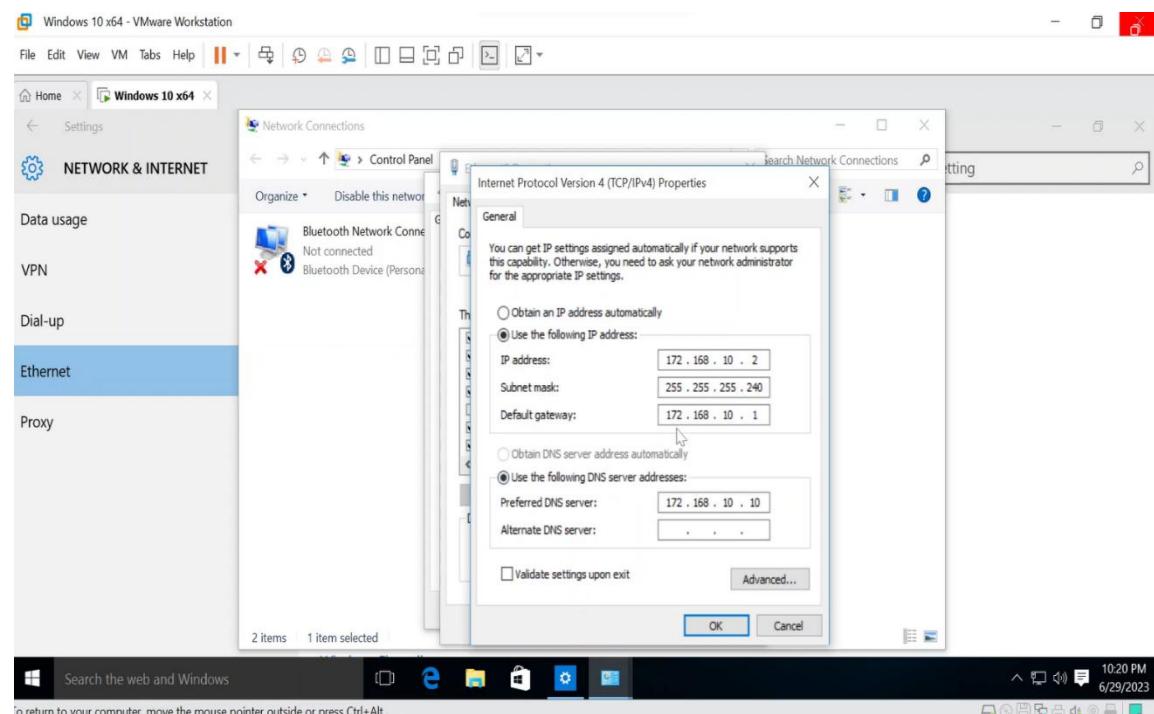


Fig 15– Client IP address update

14. In client side try to ping the server IP address to check whether connection is established or not

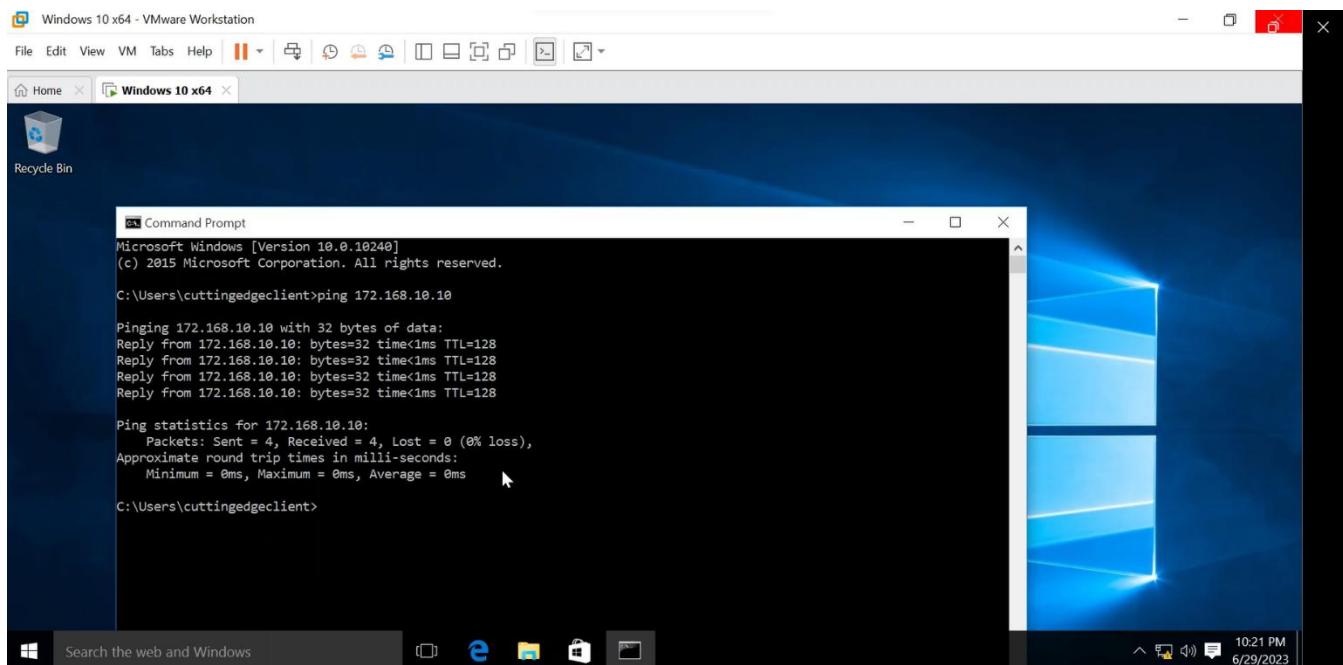


Fig 16 – Successfully Pinged to server

15. Ping cuttingedge.com

Windows 10 x64 - VMware Workstation

File Edit View VM Tabs Help

Home Windows 10 x64

Command Prompt

```
C:\Users\cuttingedgeclient>ping 172.168.10.10

Pinging 172.168.10.10 with 32 bytes of data:
Reply from 172.168.10.10: bytes=32 time<1ms TTL=128

Ping statistics for 172.168.10.10:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\Users\cuttingedgeclient>ping cuttingedge.com

Ping request could not find host cuttingedge.com. Please check the name and try again.

C:\Users\cuttingedgeclient>ping cuttingedge.com

Pinging cuttingedge.com [172.168.10.10] with 32 bytes of data:
Reply from 172.168.10.10: bytes=32 time<1ms TTL=128

Ping statistics for 172.168.10.10:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

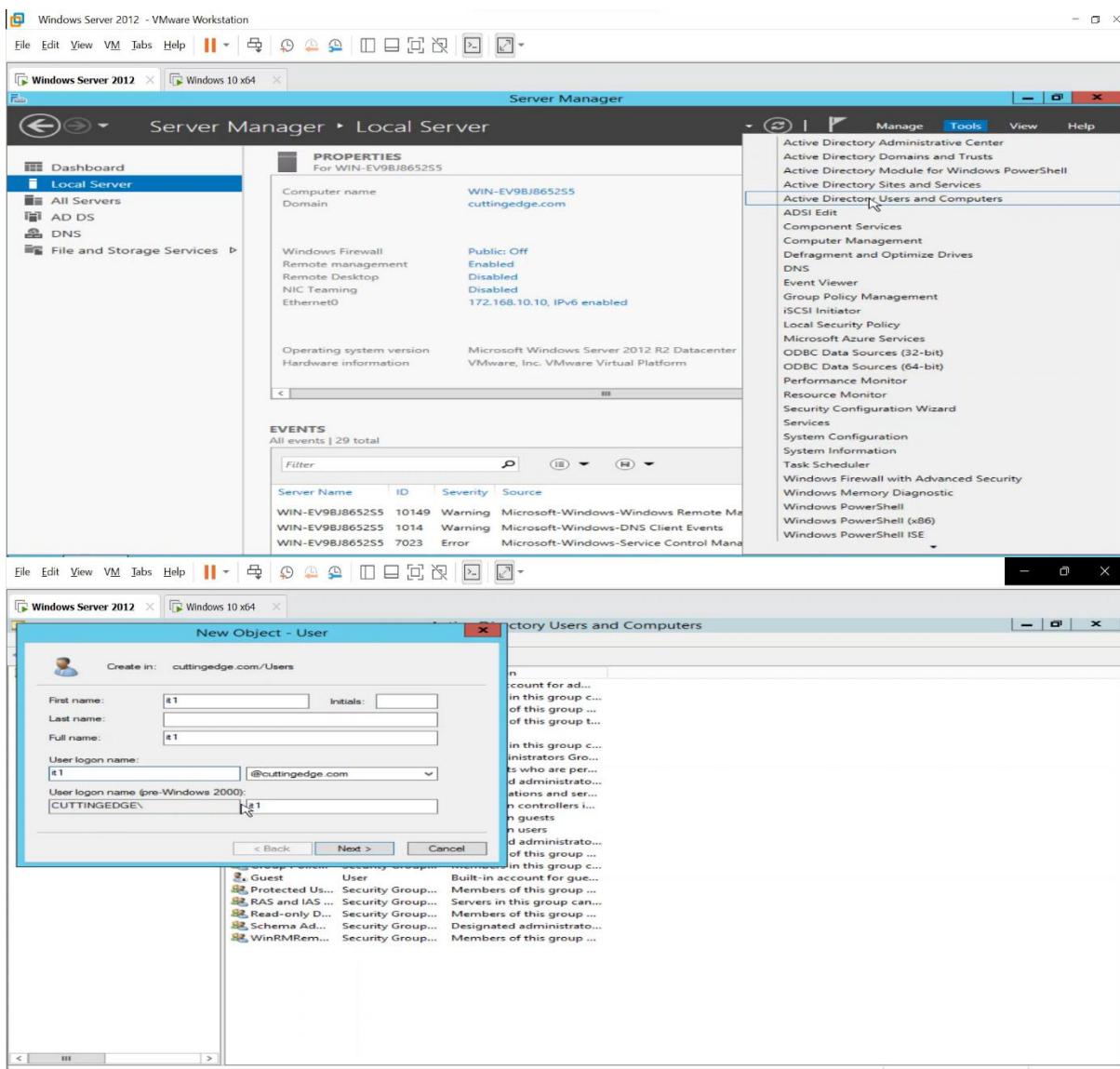
C:\Users\cuttingedgeclient>
```

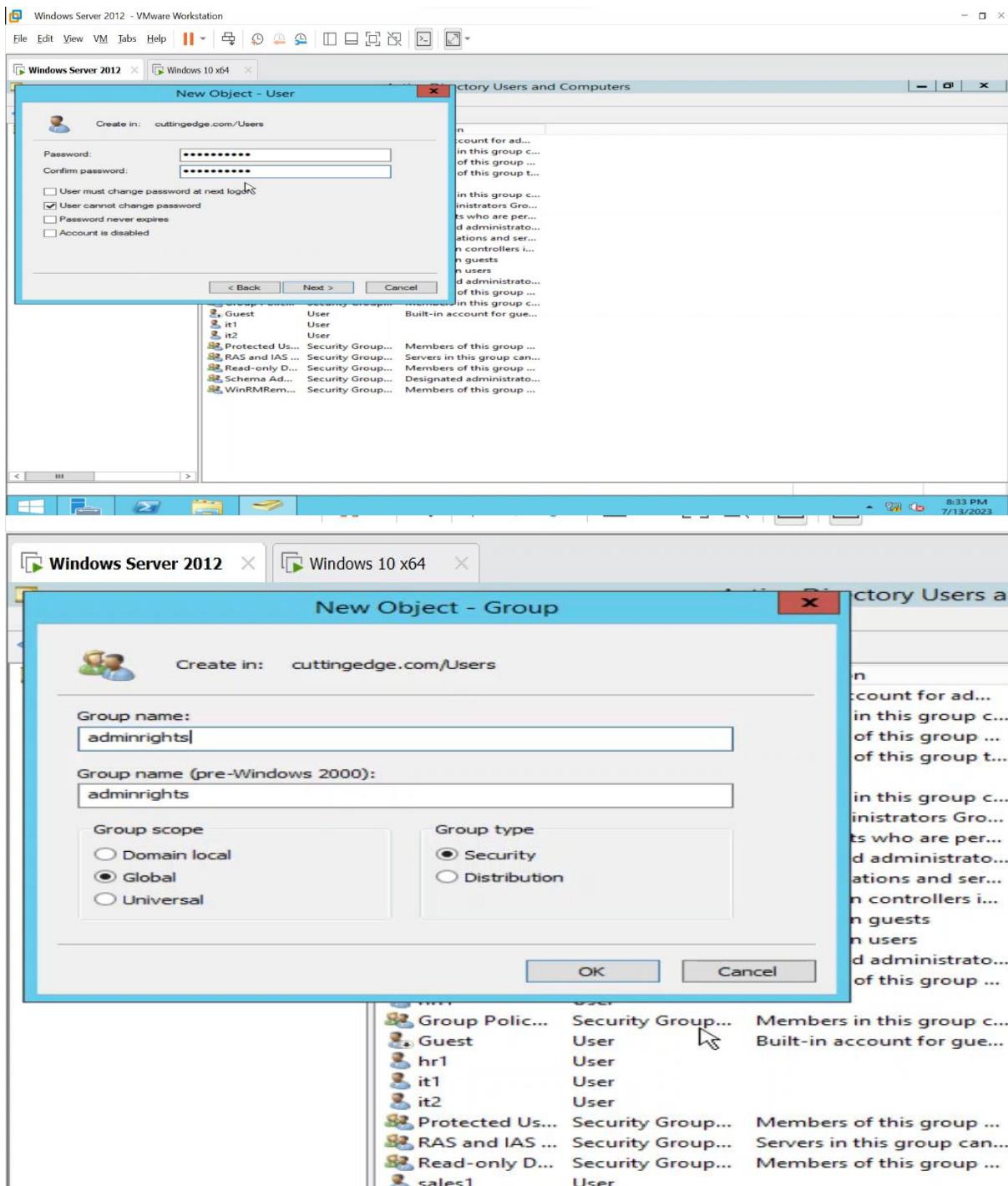
Fig 17 – Pinging domain name in client

16. Go to tools – Active Directory users and computers, Select user folder. Right click and create users – I have created it1, it2, hr1, sales1 and fin1 for demo. Group as adminrights and readrights.

While creating user we need to provide password to user which we will be using for accessing the user from client operating system.

Inside adminrights group I have added it1 and it2 as users and Inside readrights I have added hr1, sales1 and fin1.





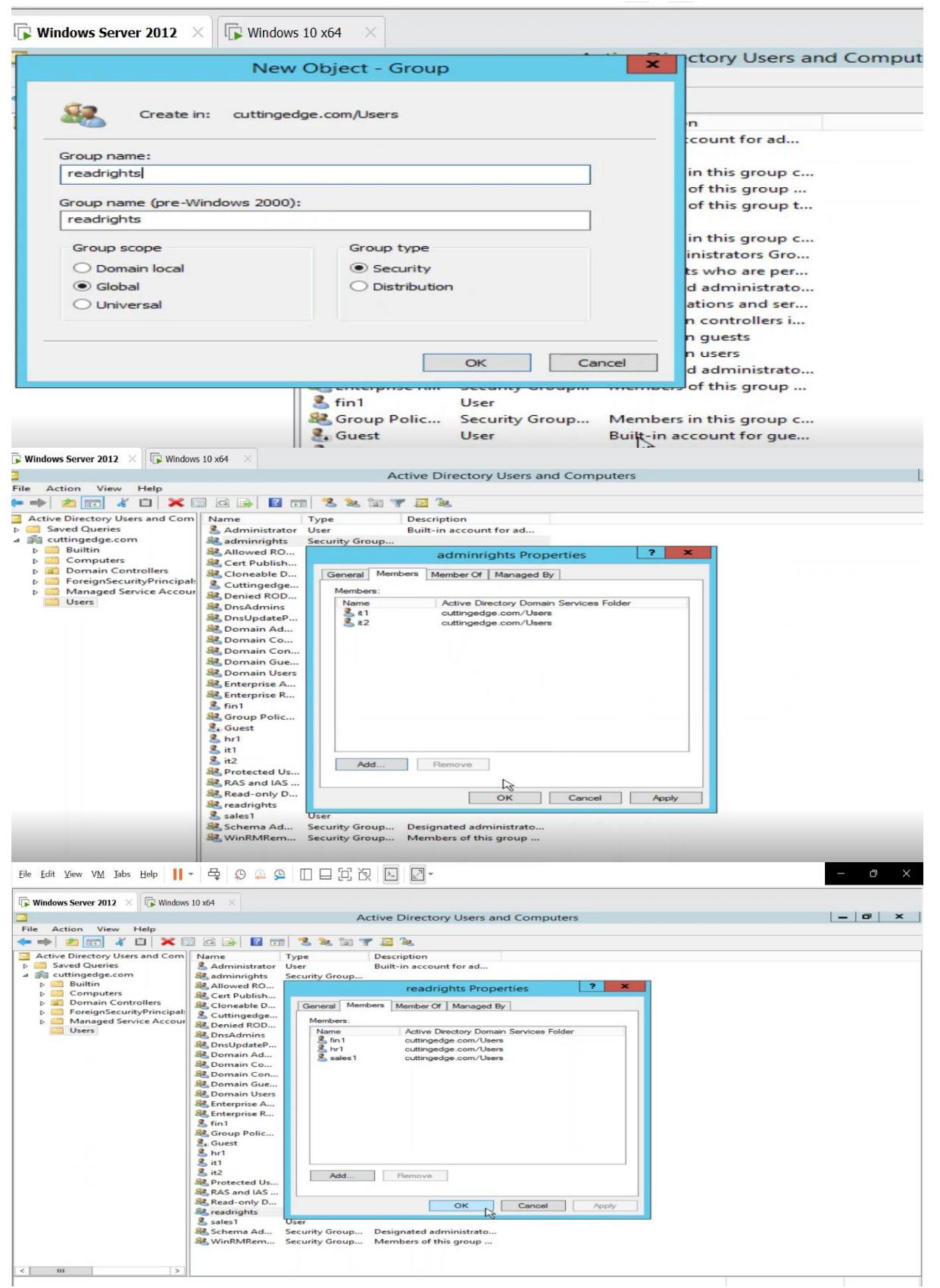
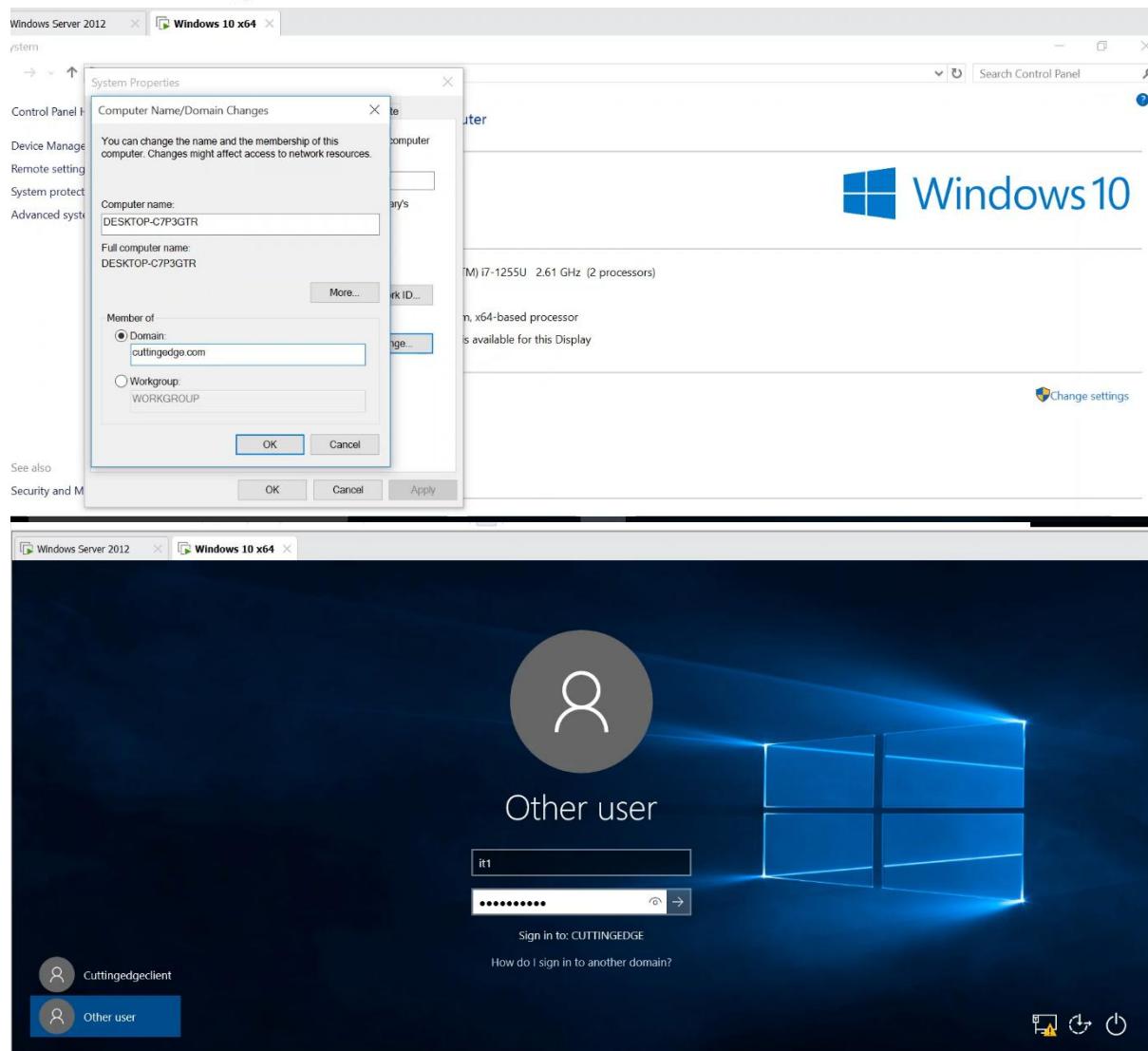


Fig 18– Creating users and group

17. Go to client and change the domain name from This PC to “cuttingedge.com”. We get prompt to shut down the client. While logging in provide the user’s name and password which we have created. Once logged in start run command and provide <\\172.168.10.10> (Server ip). We are able to open server successfully and now we can transfer the files and folder there and it shall be updated to server and other users.



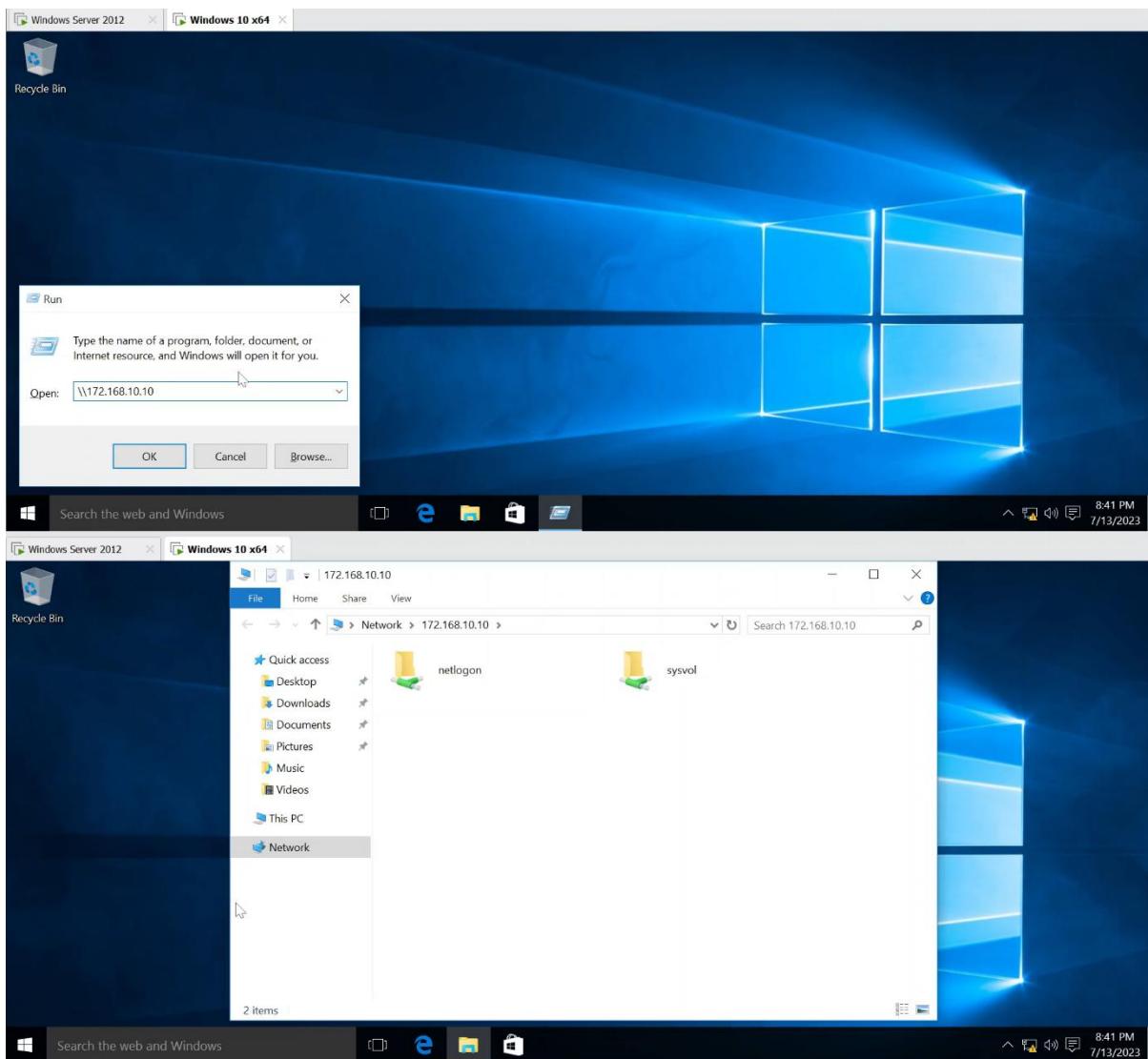


Fig 19– Changing domain name of client to establish a connection between serve and client

18. Now we need to add Web Server (IIS) for access website. Open server manager and click on local server and go to manage menu and select add roles and features. Select Webserver (IIS) and enter next. Select the feature you want to provide and install it. Here we need to select FTP

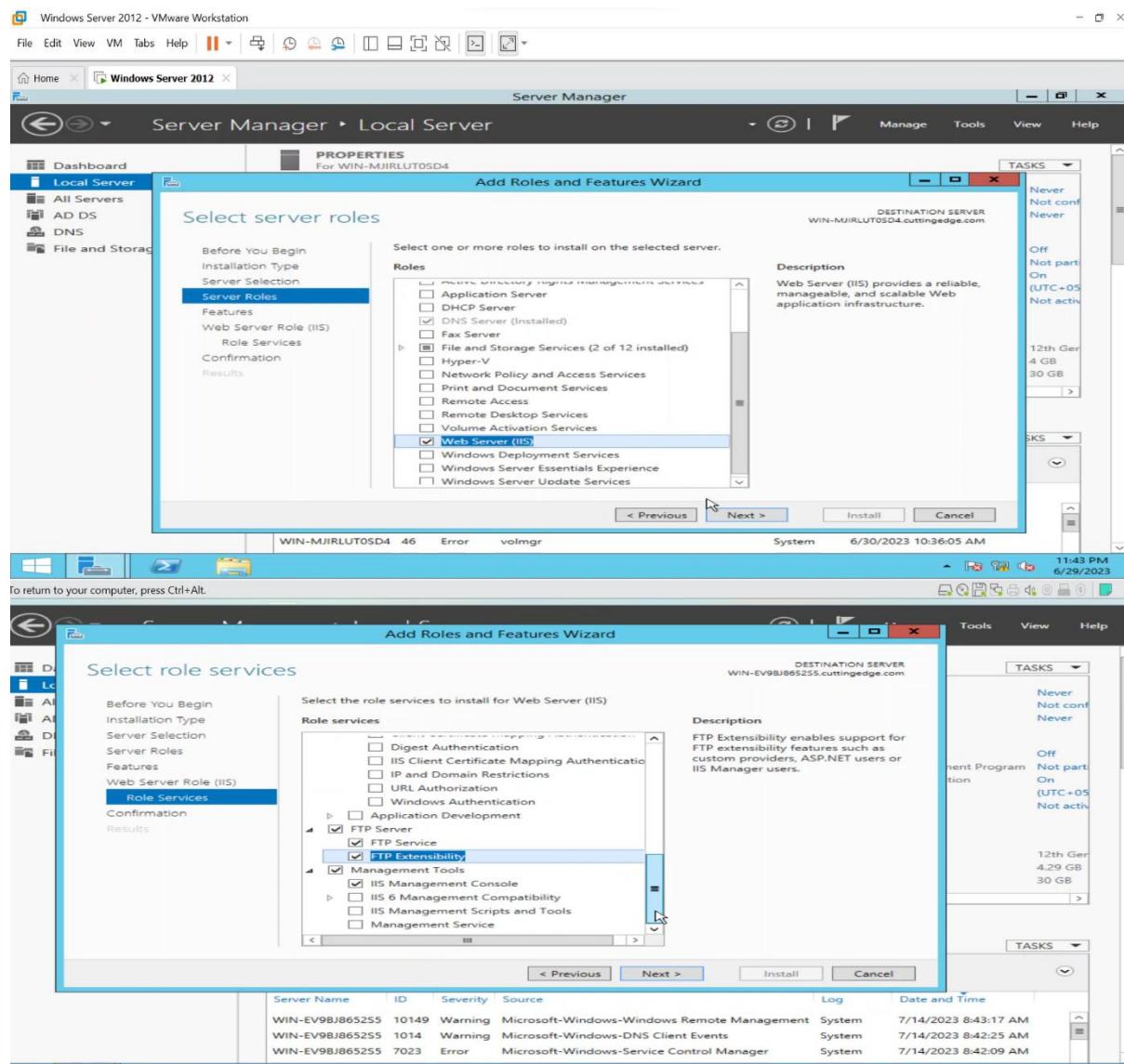


Fig20: Installing web server (IIS) with FTP features

19. Go to tools and select IIS Manager from the list. Internet Information Service Manager dialog box opens. Go to sites and right click and add a new website with all the details.

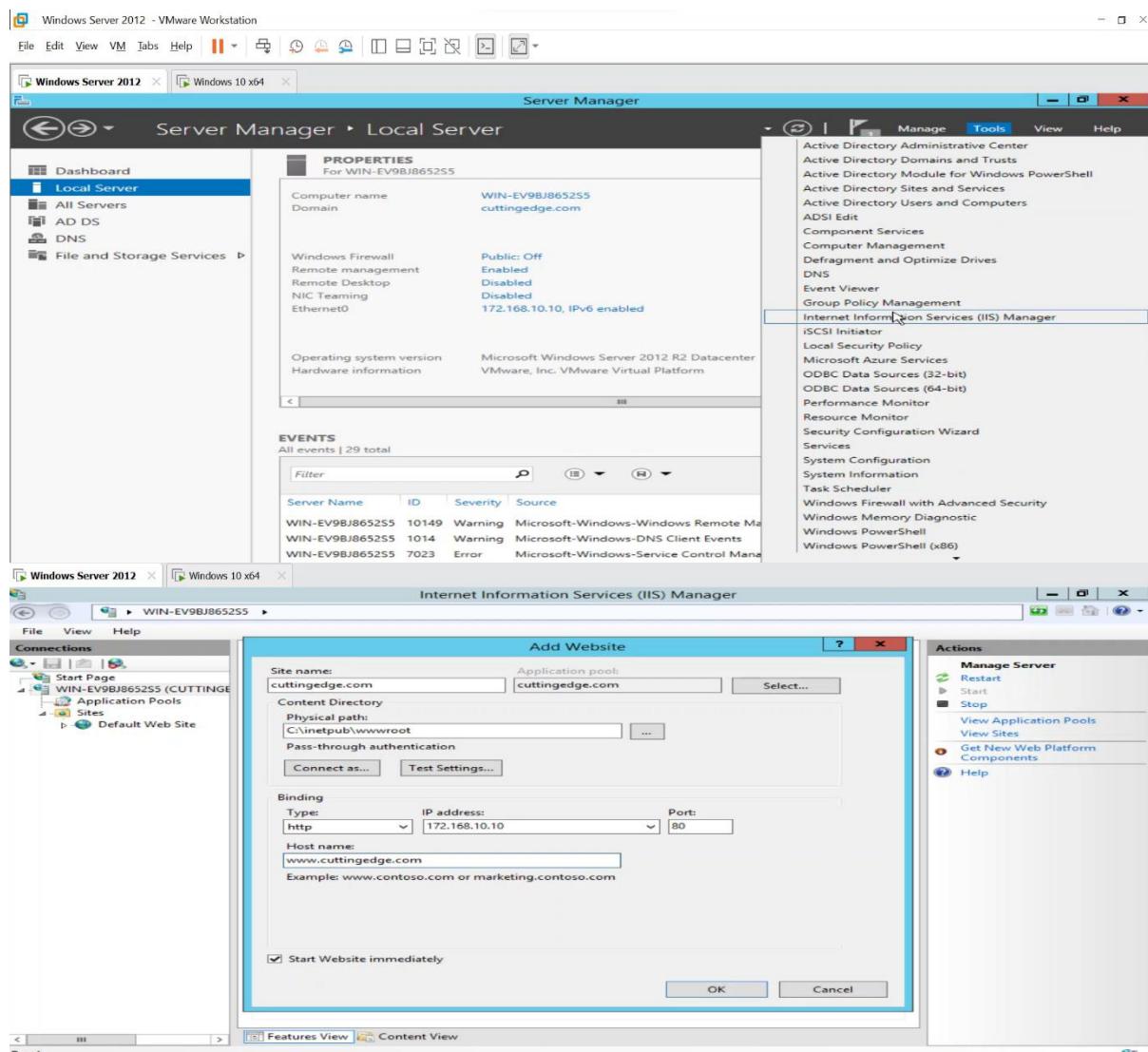


Fig 21– Adding cuttingedge.com website

20. Go to it1 user client and open web browser and write the cutting.com domain name. It should open the page

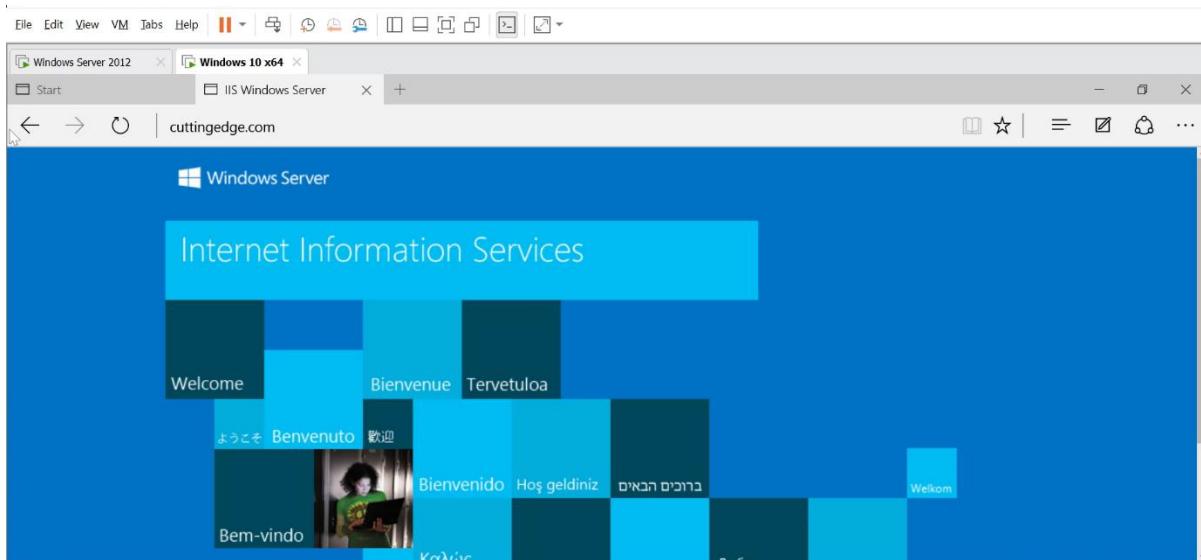
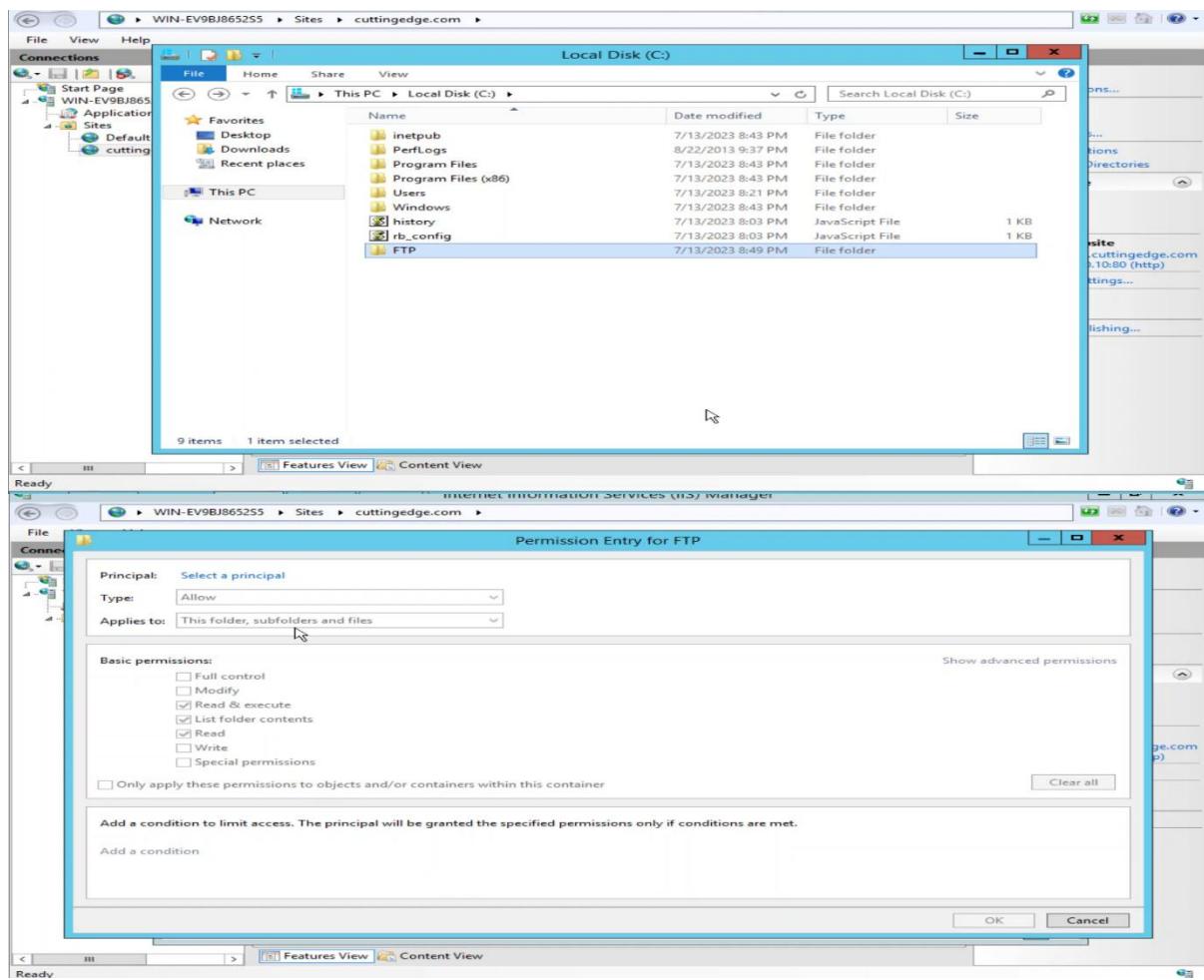


Fig 22– cuttingedge.com website successfully open in user browsers

21. Create an FTP folder in C drive and right click on it. Right click on folder go to security and select advance. Select disable inheritance permission. Remove the users group users. Click on add select principle and add group (adminrights and readrights) for permission. Provide full permission to adminrights group and read only rights to readrights group.



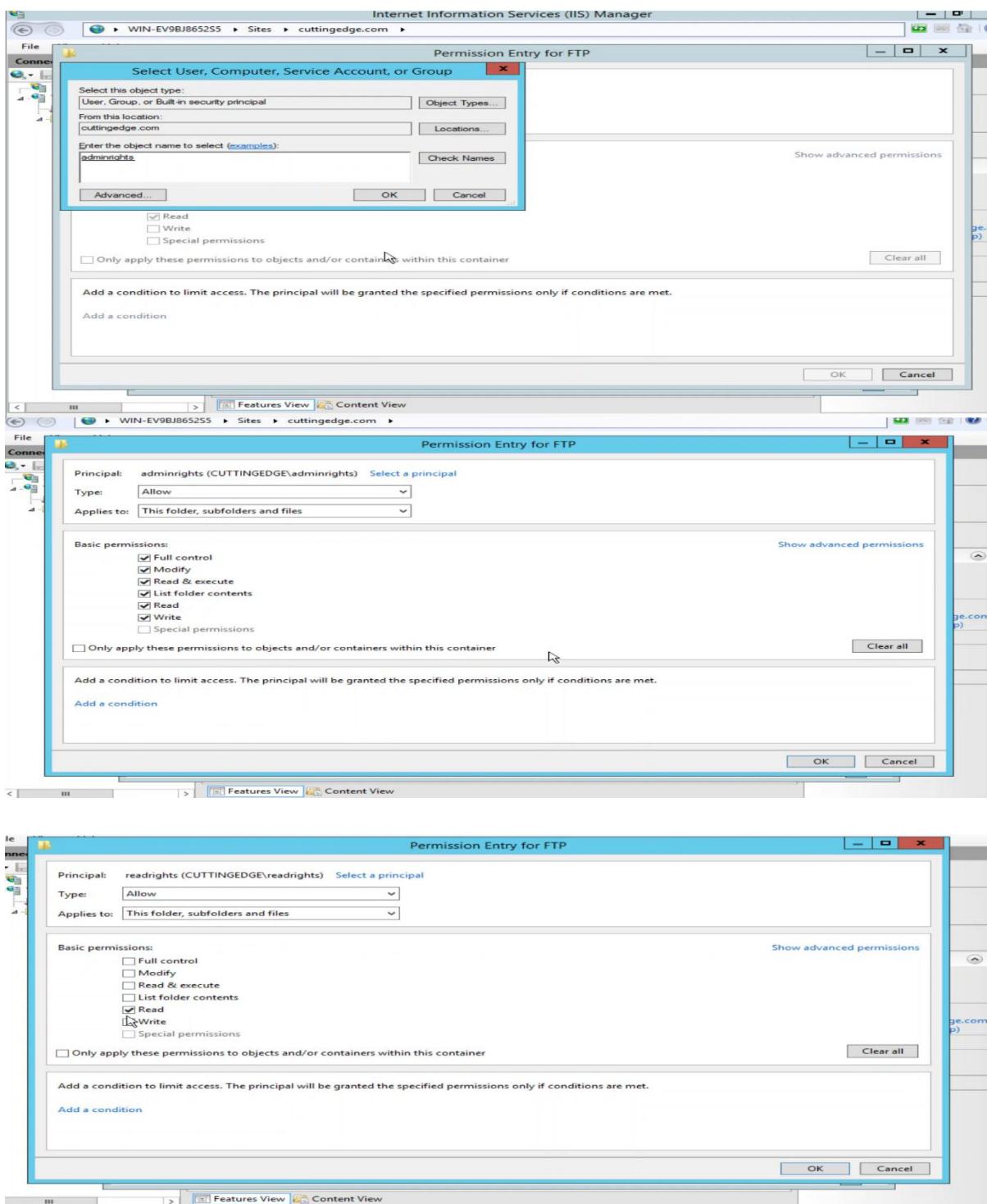


Fig 23 – Providing rights to group in FTP folder

22. Go to IIS manager and right click on site and add an ftp server. Provide ftp server name and provide path of folder which we have created i.e., c:\FTP. Bind the ftp with ip and select no ssl certificate. Select basic and select specified roles and group in allow access to. Add adminrights group name and read write permission

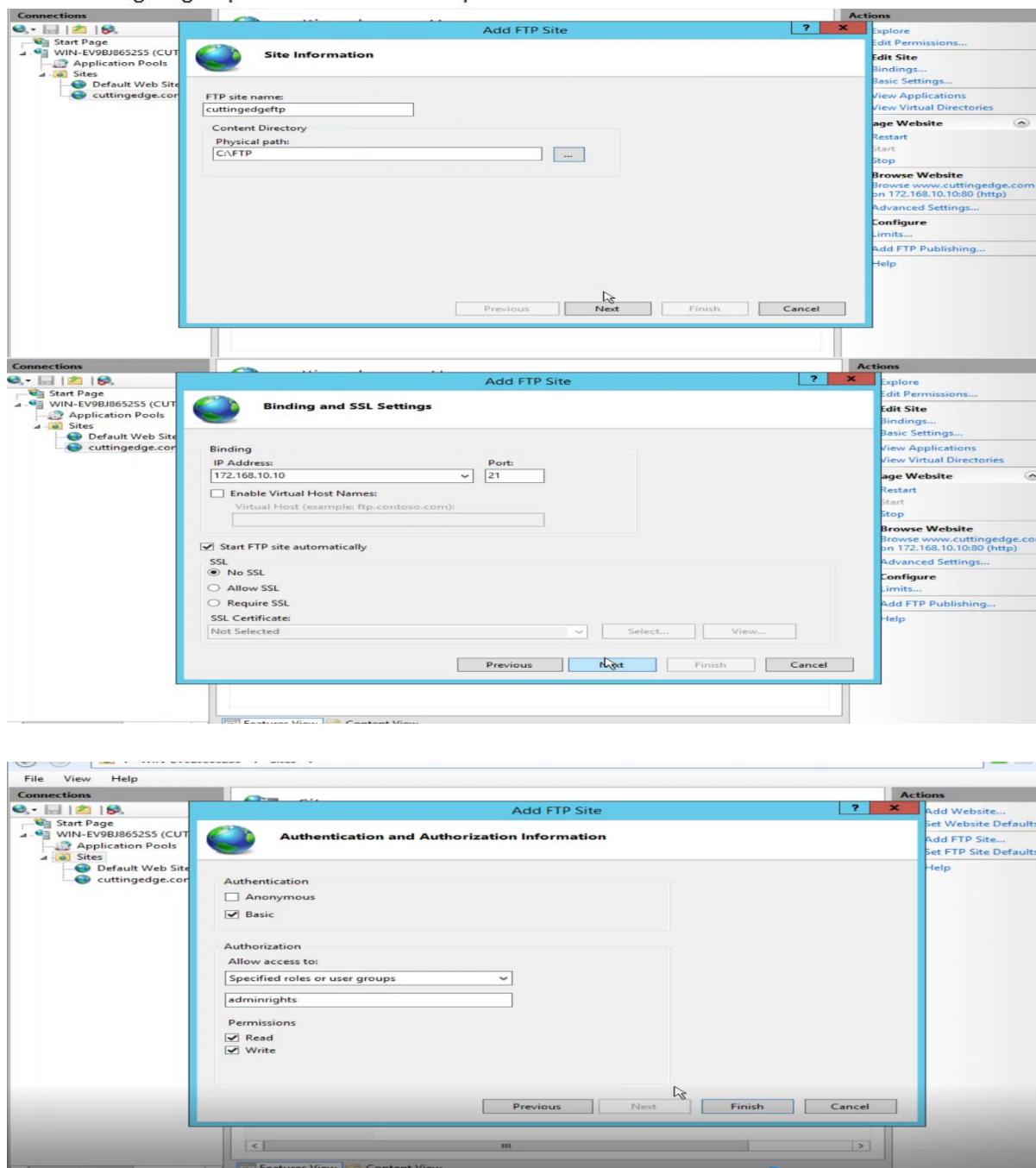


Fig 24 – Creating FTP server and providing rights to access the FTP folder

23. Go to client machine open explorer and type <ftp://serveripaddress>

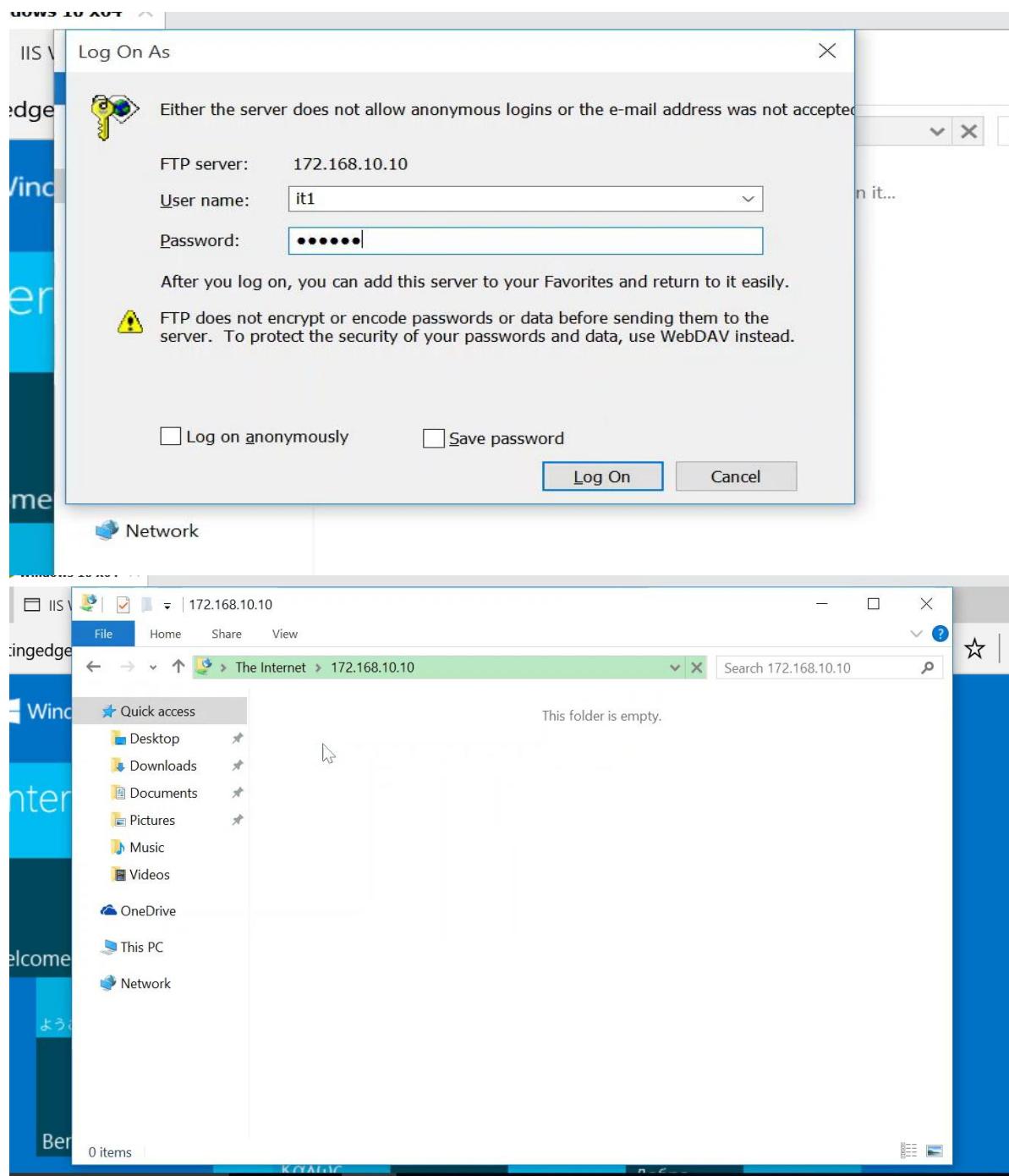


Fig 25– FTP folder accessing from user it1

24. Go to C and create a folder with FTPreadonly and right click on it on the file sharing provide read only to hr1, sales1 and finance and provide read and write feature to it1 and it2.

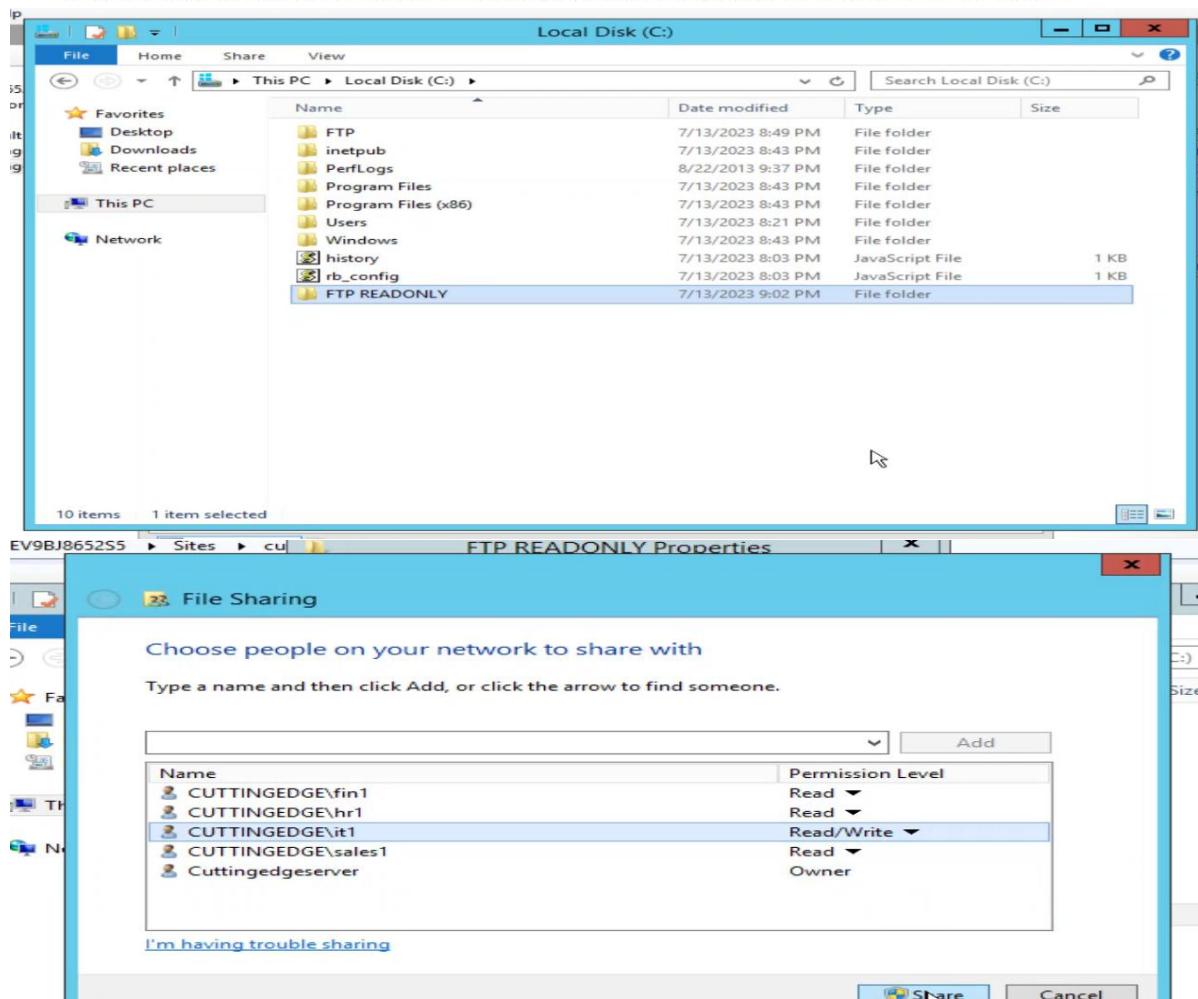


Fig 26 - Providing R access to hr1, fin1 and sales1 and R/W access to it1 and it2

25. Go to client machine. Since it1 is already open type <\\172.168.10.10> in run. Server is access and the folder with the name ftpreadonly we can see the. Open it and create a folder as ITUserfolder and log out form the system Instead of it1 and it2, use hr1, fin1 or sales1 to log in again. Again type <\\172.168.10.10> in run and inside ftpreadonly try to create another folder you will get a message like “Permission Denied”

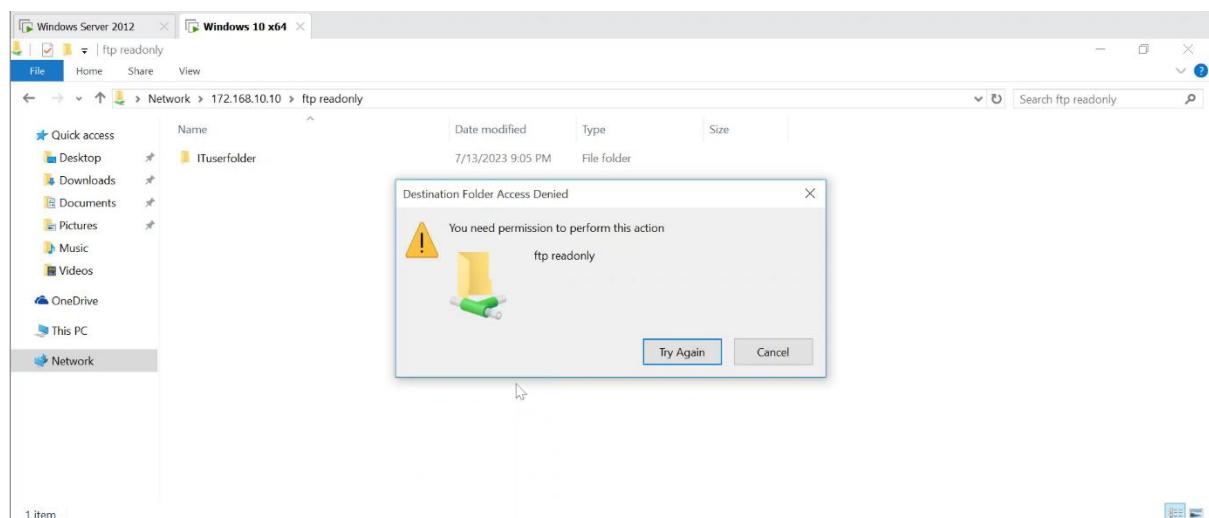
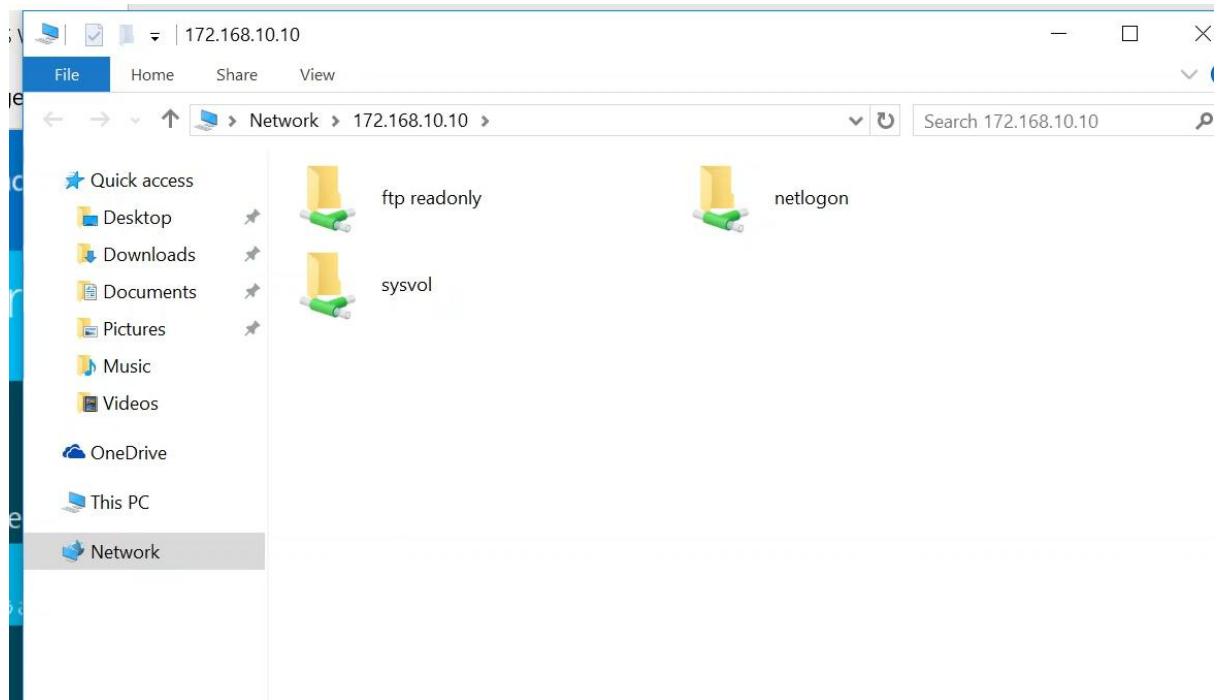


Fig 27– Checking admin and other user rights
in ftreadonly

Design a maintenance schedule to support the networked system

S.N.	Consideration	Time Interval
1	Backup and Recovery	Daily
2	Reliable Network Security	Weekly or Monthly
3	Software Maintenance	Monthly
4	Hardware Component Maintenance	Monthly

Gantt chart:

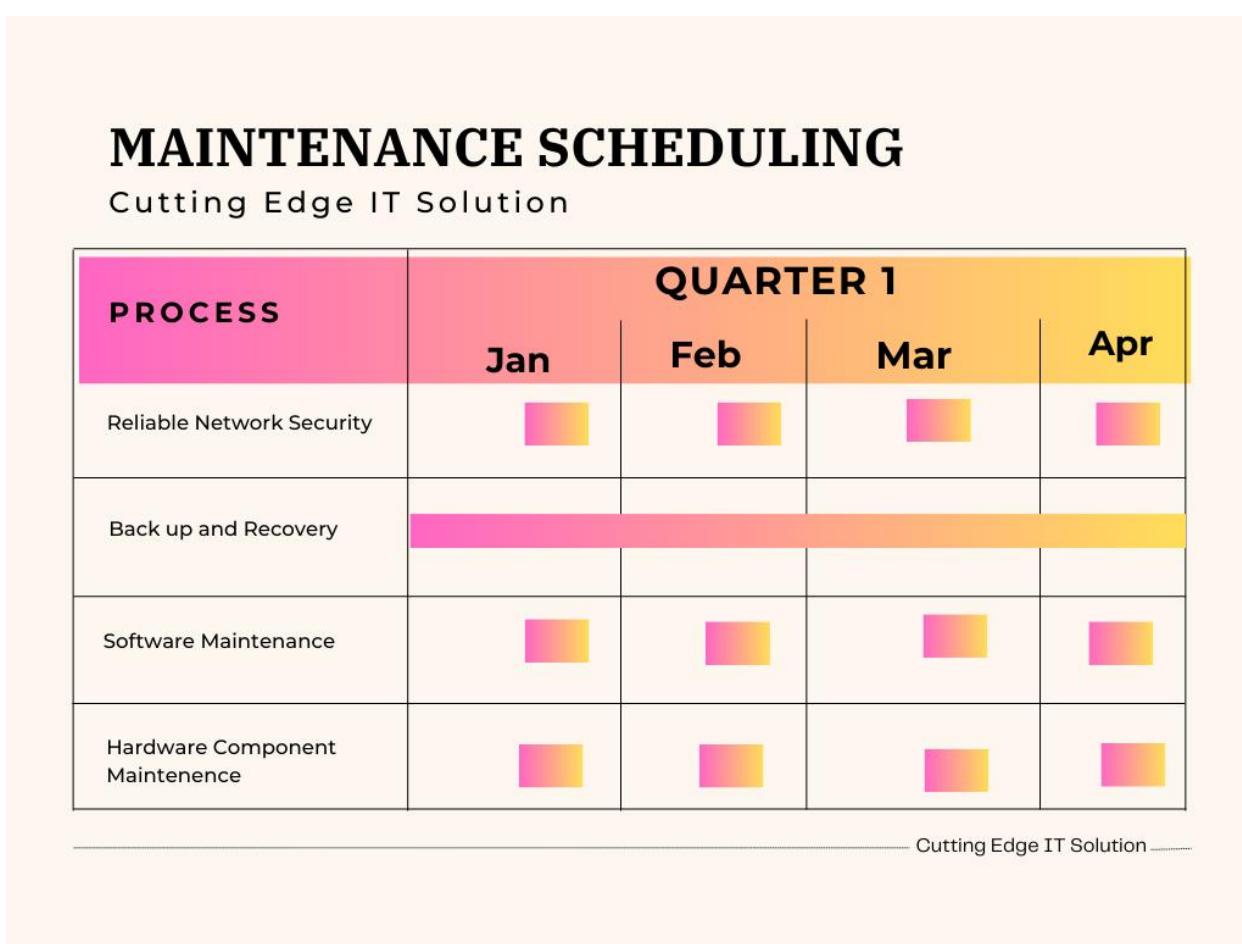


Fig: Gant chart for maintenance

Evaluating and testing the design to meet the requirements analyzing user feedback

Independent Feedback			
Project Title: CUTTING-EDGE IT SOLUTIONS			
Project Description (in brief):			
<p>I have created a network design using Cisco Packet Tracer for the recently opened branch of Cutting-Edge IT Solution in Butwal. The network is divided into four departments: IT, HR, Finance, and Sales, each with its own set of responsibilities. To facilitate various functions like email, web browsing, FTP, and wireless communication, I have integrated a DNS server into the network. The IT department comprises 7 computers, which provide infrastructure support for all departments. The Finance department has 5 computers to handle and see about finance status of the branch, HR has 4 computers, and Sales has 6 computers, specially utilized for managing sales data and storing information at the Butwal branch.</p>			
Important Features of the Design	1) User friendly and effective.	2) This project is run on every platform because Cisco Systems are used	3) This project contains well managed design, security, organized ip, interdepartmental contacts and data transfer facilities etc.
	4) All the information in the table can be automatically retrieved from database.	5) Duplicate user cannot be added.	6) It allows login for only the valid users having correct user name and password. And the admin has different authentication than a user.
	7) It provides remote management to handle the troubleshooting	8) This design automatic transfer and manage the data from outside as well as inside.	
Checklists	YES	NO	Comment
Have identified the whole server (DHCP, DNS, SMTP SERVER, FTP SERVER)	✓		The whole server has been identified.

Have system requirements been defined and are they clear?	✓	System requirements have been defined and they are clear.
Have Front End and Back End of the system has been designed?	✓	The front end and back end of the system has been designed.
Has the system been implemented in align with the proper design?	✓	The system has been implemented in align with the proper design.
Have been critically tested and reviewed the system or not?	✓	The system has been critically tested and reviewed.
Does the system solve the problem of the client? And design the security?	✓	The system solves the problem of the client and it is secured.
Does the system fulfill the requirements of the clients? And arrange the ip as per client requirements?	✓	The system fulfills the client requirements and have arranged the ip as per client requirements.
Have implement routing and switching?	✓	Routing and switching have been implemented in the system.
Significance of the Project	1) The design has well defined and manage ip and hardware systems 2) The information can be transferring any time within network as well as outside of local network. 3) All the information in the table can be automatically retrieved from database.	

	<p>4) Duplicate user cannot be added for mail server or hardware security is also there for protect unauthorized access of router, switch and servers.</p> <p>5) It allows login for only the valid users having correct user name and password. And the admin has different authentication than a user.</p> <p>6) It supports remote management using telnet.</p> <p>7) It also supports vlan and intervlan communication with other branches securely.</p>
--	--

Network Systems potential enhancements

a. Hardware's

- Increase RAM from 8GB to 16GB to enhance performance and memory handling.
- To accommodate growing file storage demands, increase storage to 2TB.
- Consider upgrading to the most recent Cisco routers and switches, such the Cisco ISR 4000 Series and Cisco Catalyst 9000 Series, for cutting-edge features and performance improvements.

b. Software

- Improving multitasking and accelerating processing by equipping client workstations with i9 CPUs.
- Installing the most recent version of the server operating system, such as Windows Server 2012, to take advantage of improved security, functionality, and feature updates.

c. Security

- Setting up a VPN solution to secure **remote access and data transfer**.
- Building a proxy server to improve traffic filtering, monitoring, and security.
- Using Network Address Translation (NAT), which enhances security, to conceal internal IP addresses.
- Implementing port security methods to restrict access to network ports and permit only permitted devices to pass.

Servers

A server is a piece of equipment that allows other networked devices access to certain resources, services, or operations. Physical servers and logical servers are the two main categories of servers.

A physical server is a standalone computer that runs server software. Physical servers in network configurations offer dedicated performance, security, and management.

There are various types of physical servers, including:

1. Tower Server:

A tower server is a freestanding, upright computer intended to function as a server.

(Techopedia, 2017)



Fig: Tower Server

2. Rack Server:

A rack server, also known as a rack mount server or rack mount computer, is a specific kind of computer designed to fit inside a standard rectangular server rack. These server racks are frequently seen in data centres, server rooms, and other IT environments where several servers and networking equipment are housed together.



Fig: Rack Server

3. Blade Server:

Blade servers are vital for modern data centers and businesses because to their compact size, shared architecture, virtualization support, scalability, and redundancy. It saves space, energy, and resources while simultaneously providing the flexibility and dependability needed to meet expanding digital demands.

(Techopedia, 2011)



Logical servers are created as virtual objects within physical servers or server clusters. The following logical server types are commonly used in networks:

a. File Server

File servers are important computer network hubs that handle and store data files for user access and collaboration. They are significant in modern enterprises because of their centralized control, which ensures excellent data management and sharing.

b. Mail Server

Because they handle both incoming and outgoing protocols, mail servers are critical for network email communication. They provide stable and efficient email transmission, which ensures constant communication and connectivity.

c. Database Server

The database server is essential for database administration and data-driven decision making. Its seamless hardware and software integration enables enterprises to achieve technical excellence and data-driven innovation through optimal data management, security, and accessibility.

d. Print Server

In order to handle printing jobs in a network that may involve several printers, print servers are connected to computer networks.

e. Application Server

The installed program's business and functional logic is utilized to run an application server and provide access to users and/or other apps.

Tower Server	Rack server	Blade server
Integrated desktop computers that take up more space.	Installed in standard racks, providing a balanced use of space.	Are compact and contain modular circuit boards with CPU, memory, and network controls.
Provide scalability, customization, high-cost performance.	Typically, 1U, 4U, 6U or 10U in height and have limited internal space for expansion slots.	Save space and offer hot-swappable deployment, ideal for data clustering.
Have wide-ranging applications and are suitable for handling multi-user requests and providing various services.	Offers simplified cabling and ease of deployment, reducing failures and providing cost-effectiveness.	Can be easily maintained and monitored through single interface, with simplified cabling.
Offer flexibility in upgrades and scalability, and their heat dissipation is relatively easier compared to rack or blade.	Commonly used in larger data centers for space-saving and efficient management, but proper cooling is essential.	Cooling is crucial due to the high heat generated by blade servers.
A cost-effective solution with substantial computing power and high efficiency.	More affordable smaller deployments provide benefits in terms of management and energy efficiency.	The initial expenses for capital, deployment, and configuration may come with a substantial cost.

It costs Rs.150000.	It costs Rs.400000.	It cost Rs. 1000000/piece.
---------------------	---------------------	----------------------------

Overview

Because of the restricted space at the newly built Butwal branch, we employed tower servers. Because of their self-contained architecture and simple configuration, they require less extra hardware and are therefore more cost-effective. The agility and scalability of tower servers

match the needs of our growing company, allowing us to add and remove servers as needed. This option ensures that our network configuration is both efficient and adaptable.

Evaluating critical reflection and justifying valid conclusions

The network of the newest branch of Cutting-Edge IT Solutions was well planned. For the new branch in Butwal, I chose a mesh topology to emphasize the significance of redundancy, dependability, scalability, flexibility, fault isolation, performance, security, and adaptability to changing conditions.

This configuration is ideal for secure operations, dependable connectivity, and rapid data transfer. POP3, SMTP, FTPS, HTTPS, TCP, and IP protocols were used to meet the requirements for communication and data transmission.

TCP/IP was chosen over OSI because of its simplicity, scalability, and extensive real-world use. It is critical to monitor security, scalability, and performance. Regular administrator training promotes good network administration. Client-server networking enables centralised management, scalability, and data security. We increased security by implementing a firewall and utilising VTP and VLAN for a secure internal connection. The ability to grant appropriate access privileges improves document management. Our network is ready to satisfy current and future demands.

As the CIO of a cutting-edge IT solution, I have carefully considered the network topology, protocols, and deployment techniques that will best suit the demands of the business. The network design exhibits a thorough understanding of network basics and enables efficient communication, secure data transmission, and scalability. Cutting-Edge IT Solutions may increase network performance and ensure that it remains effective in meeting the firm's changing expectations by employing practices such as constant monitoring, staying up to date, and providing training.

References:

- Guru99. (2023). *Types of Computer Network: What is LAN, MAN and WAN*. [online] Available at: <https://www.guru99.com/types-of-computer-network.html> [Accessed 20 Jul. 2023].
- Tutorialspoint.com. (2023). *Peer to Peer Networks*. [online] Available at: <https://www.tutorialspoint.com/peer-to-peer-networks> [Accessed 20 Jul. 2023].
- for (2023). *Computer Science learning for school students*. [online] Teach-ict.com. Available at: https://www.teach-ict.com/gcse_new/networks/peer_peer/minicweb/pg5.htm [Accessed 20 Jul. 2023].
- Zenarmor.com. (2023). *What is Client-Server Networking? Definition, Advantages, and Disadvantages - zenarmor.com*. [online] Available at: <https://www.zenarmor.com/docs/network-basics/what-is-client-server-network> [Accessed 20 Jul. 2023].
- Guru99. (2023). *What is Cloud Computing? Definition, Explain with Examples*. [online] Available at: <https://www.guru99.com/what-is-cloud-computing-with-example.html#1> [Accessed 20 Jul. 2023].
- Google Cloud. (2023). *Advantages Of Cloud Computing | Google Cloud*. [online] Available at: <https://cloud.google.com/learn/advantages-of-cloud-computing> [Accessed 20 Jul. 2023].
- Rfwireless-world.com. (2023). *Advantages of wired network | disadvantages of wired network*. [online] Available at: <https://www.rfwireless-world.com/Terminology/Advantages-and-Disadvantages-of-wired-network.html> [Accessed 20 Jul. 2023].
- Tutorialspoint.com. (2020). *Network Standardization*. [online] Available at: <https://www.tutorialspoint.com/Network-Standardization#> [Accessed 20 Jul. 2023].

Learning Center. (2023). *What is OSI Model | 7 Layers Explained* | Imperva. [online] Available at: <https://www.imperva.com/learn/application-security/osi-model/> [Accessed 20 Jul. 2023].

Rfwireless-world.com. (2023). *Advantages of OSI Model | disadvantages of OSI Model*. [online] Available at: <https://www.rfwireless-world.com/Terminology/Advantages-and-Disadvantages-of-OSI-model.html> [Accessed 20 Jul. 2023].

Rfwireless-world.com. (2023). *Advantages of TCP-IP | disadvantages of TCP-IP*. [online] Available at: <https://www.rfwireless-world.com/Terminology/Advantages-and-Disadvantages-of-TCP-IP.html> [Accessed 20 Jul. 2023].

Afteracademy.com. (2020). *What is network topology and types of network topology?* [online] Available at: <https://afteracademy.com/blog/what-is-network-topology-and-types-of-network-topology/> [Accessed 20 Jul. 2023].

Techopedia. (2014). *Server Operating System*. [online] Available at: <https://www.techopedia.com/definition/30145/server-operating-system-server-os> [Accessed 20 Jul. 2023].

Easy Tech Junkie. (2023). *What is a Client Operating System?* [online] Available at: <https://www.easytechjunkie.com/what-is-a-client-operating-system.htm> [Accessed 20 Jul. 2023].

Techopedia. (2011). *Blade Server*. [online] Available at: <https://www.techopedia.com/definition/2283/blade-server> [Accessed 20 Jul. 2023].

Techopedia. (2017). *Tower Server*. [online] Available at: <https://www.techopedia.com/definition/15318/tower-server> [Accessed 20 Jul. 2023].