MINI-PROJECT TITLE
Small IT Company Network

B. E. Information Technology

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DECLARATION

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We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in this submission.

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CERTIFICATE

This Network Design Lab Mini-project {Title} by {Students Names} is complete in all respects and was successfully demonstrated on {Final external presentation date}.

Name : ----------

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(External examiner)

Name : ----------

Signature :----------

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Date:

Place:

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Chapter 1

Introduction

An enterprise network consists of physical and virtual networks and protocols that serve the dual purpose of connecting all users and systems on a local area network (LAN) to applications in the data center and cloud as well as facilitating access to network data and analytics.

Enterprise networking provides fast and reliable connectivity for end users as well as applications. Applications are increasingly more distributed in the modern network and simplified networking and security across wired and wireless infrastructure is a business imperative. Network administrators require enterprise networking solutions that provide a single pane of glass across data centers and clouds, and network automation frameworks that simplify day 1 and day 2 network operations.

Enterprise networking relies on high-speed switching and routing devices that mediate data transfers between desktop computers, servers, applications, and services.
A modern enterprise network consists of a common networking and security platform that provides a variety of networking services such as switching, routing, load balancing, firewalling, wifi, and service mesh for modern applications. This converged enterprise networking approach helps eliminate operational silos and facilitates end-to-end network automation.

The project aims to build enterprise network design for small IT i.e. (Information Technology) company. The IT company contains various departments such as Finance , Human Resource , Accounts , Marketing , Customer Care , Admin etc.The proposed network consists of various departments of the company which are connected to each other via network and internetworking devices such as routers , switches , Gateways and Servers.

The network will be scalable in terms of network speed , bandwidth and On-demand network services required for the departments and company network architecture or infrastructure. The company will choose the best data centers which helps to scale cost effectively. The challenge is how to scale infrastructure on-demand to stay ahead of demand while maximizing financial efficiency.

Chapter 2

Network Block Diagram

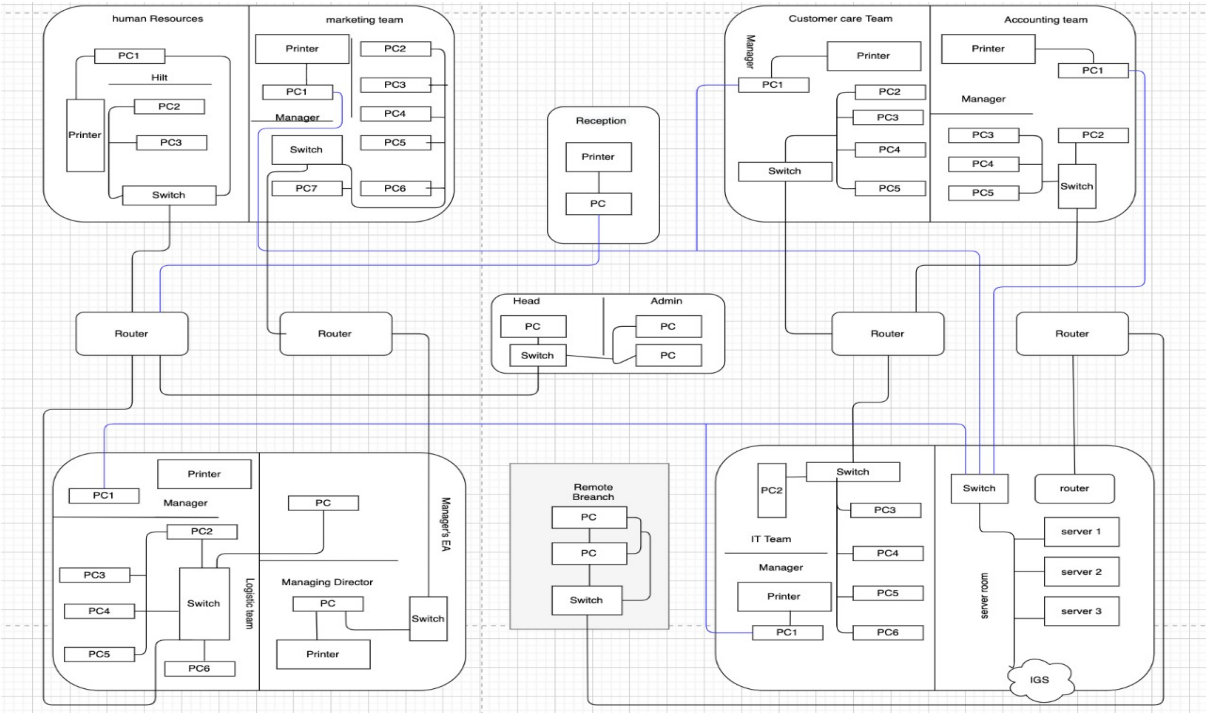

Fig.no. 1 Network Block Diagram For IT Company Network

The above diagram shows networking between the various departments of the company. The departments are connected to each other through internetworking devices.This is the network architecture or block diagram for an IT company. The architecture consists of Human Resource, Marketing ,Admin head ,Customercare and Receptionist. The department holds the required number of PCs and printers for their operation. These are connected via networking devices such as routers,switches and servers. There is a server room where servers are connected which gives web,email,and ftp services to the departments. The remote branch is also connected to the company. This branch contains old records of the company.

Chapter 3

List of Network Devices

Table no.1 Description of network devices

Sr. No	Network Devices	No.of Components
1	Router	5
2	Switch	10
3	Personal Computer	40
4	Printer	9
5	Cables	3
6.	Modem	1
7.	Server	3

Chapter 4

Bill of Materials

Table no.2 Bill of Materials

Sr. No	Device Name	Quantity	Model Name	Cisco Cost (Rs.)	Non Cisco Cost (Rs.)
1.	Router	5	Cisco RV160 VPN Router | Gigabit Ethernet (GbE) Wired Ports	10,000*5=50,000	---
2.	Switch	10	Cisco SF95D-08-IN 8-Port 10/100 Desktop Switch	1,350*10= 13,500	---
3.	Personal Computer	40	Dell Inspiron 3880 10th Gen Intel Core i3 Desktop	---	37,000*50 =14,80,000
4.	Printer	9	HP Deskjet Ink Advantage 2335 Colour Printer, Scanner and Copier	---	5,700*5=51,300
5.	Cables	3	AmazonBasics RJ45 Cat-6 Ethernet Patch/LAN Cable -3Feet (0.9Meters),Black	---	250*3=750
6.	Modem	1	D-Link DIR-841 - AC1200 MU-MIMO Wi-Fi Gigabit Router with Fast Ethernet LAN Ports	---	2,599*1= 2,599
8.	Server	3	Dell PowerEdge T440 Server, Intel Xeon 4210R (2nd Gen, 10 Core) Processor with 2 x 32GB RAM & 3 x 1.2TB 10K RPM SAS Hard Disk, 3 Years Warranty by Dell.	---	285,900*3 = 8,57,700
Total Cost :					**24,55,849**

Chapter 5

Network Configuration Details

1. DHCP:

DHCP stands for “Dynamic Host Configuration Protocol” is a network protocol used on IP networks where a DHCP server automatically assigns IP address and other network properties to hosts on the network. In this project we have implemented DHCP for 2 departments which are Accounts and IT team in a company.
Two pools of ip addresses have been added from which the router assigns an IP to each new host.

1. 192.168.10.0/24 - DHCP pool Range: 192.168.10.11 - 192.168.10.15
2. 172.168.10.0/24 - DHCP pool Range: 172.168.10.11- 172.168.10.13

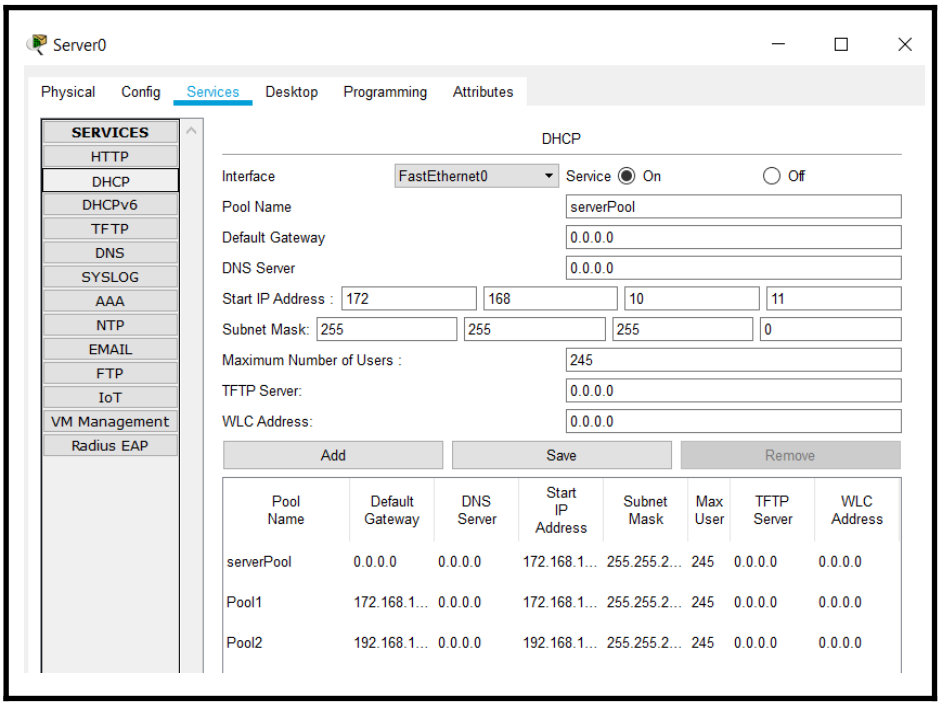

Fig.no. 2. DHCP server configuration

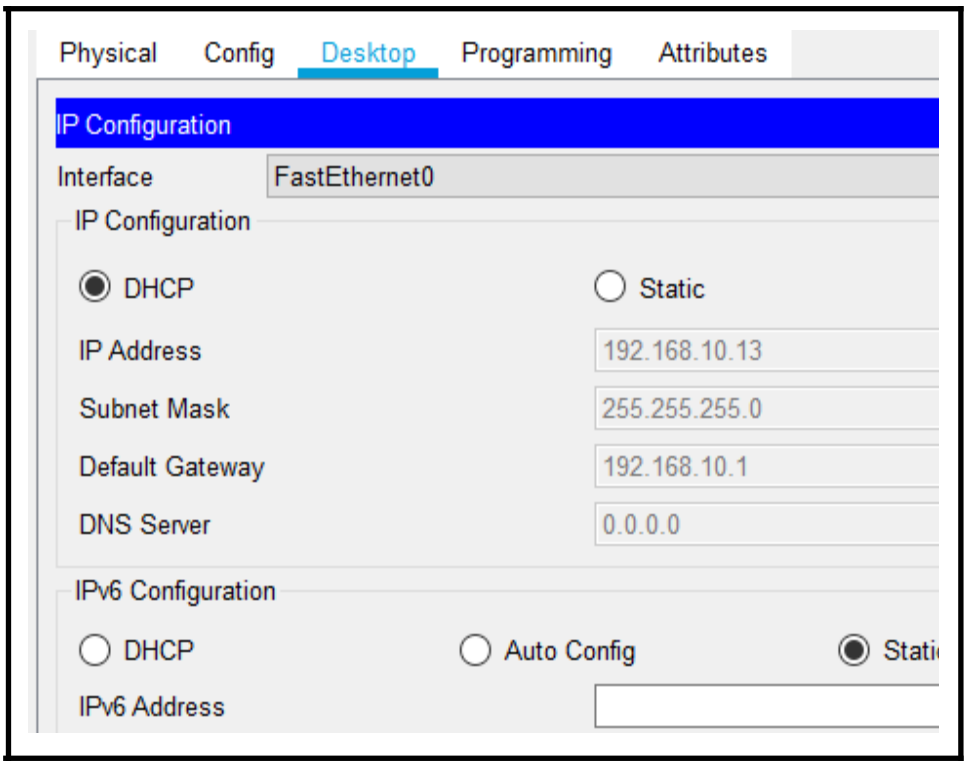

Fig.no. 3. IP address assigned by DHCP

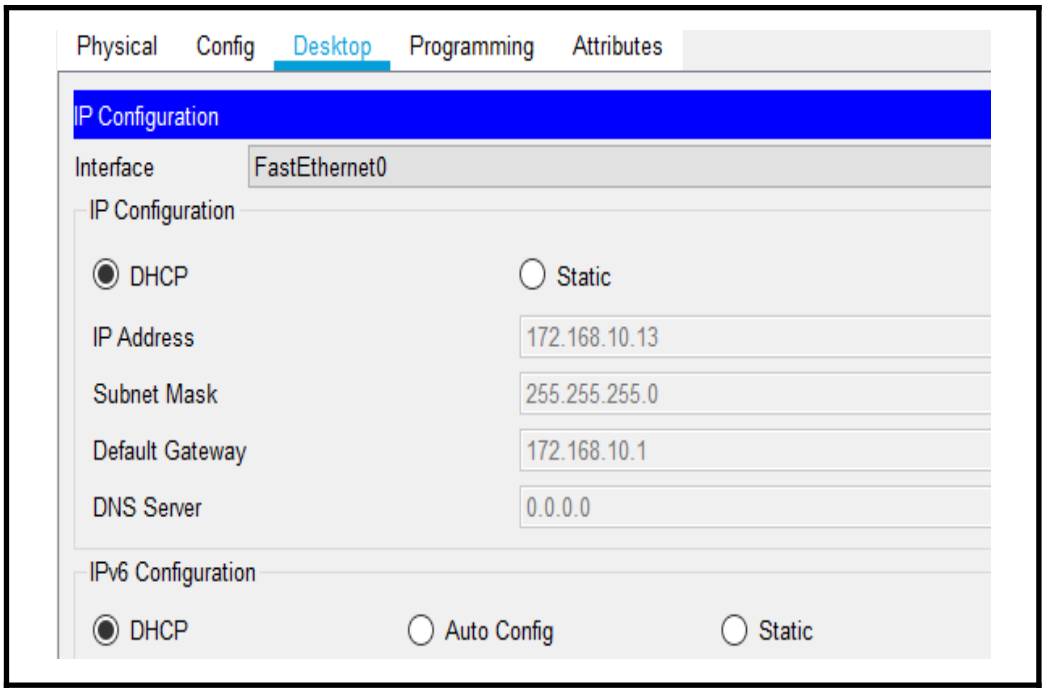

Fig.no. 4. IP address assigned by DHCP

2. Vlan:

VLAN is a custom network which is created from one or more local area networks. It enables a group of devices available in multiple networks to be combined into one logical network. The result becomes a virtual LAN that is administered like a physical LAN. The full form of VLAN is defined as Virtual Local Area Network.
VLAN in networking is a virtual extension of LAN. A LAN is a group of computer and peripheral devices which are connected in a limited area such as school, laboratory, home, and office building. It is a widely useful network for sharing resources like files, printers, games, and other applications.In this project , the vlan database contains the vlan numbers which are set for departments of the company.

IP address of departments :
128.168.0.0/16 :vlan number 10
192.168.1.32/27 :vlan number20

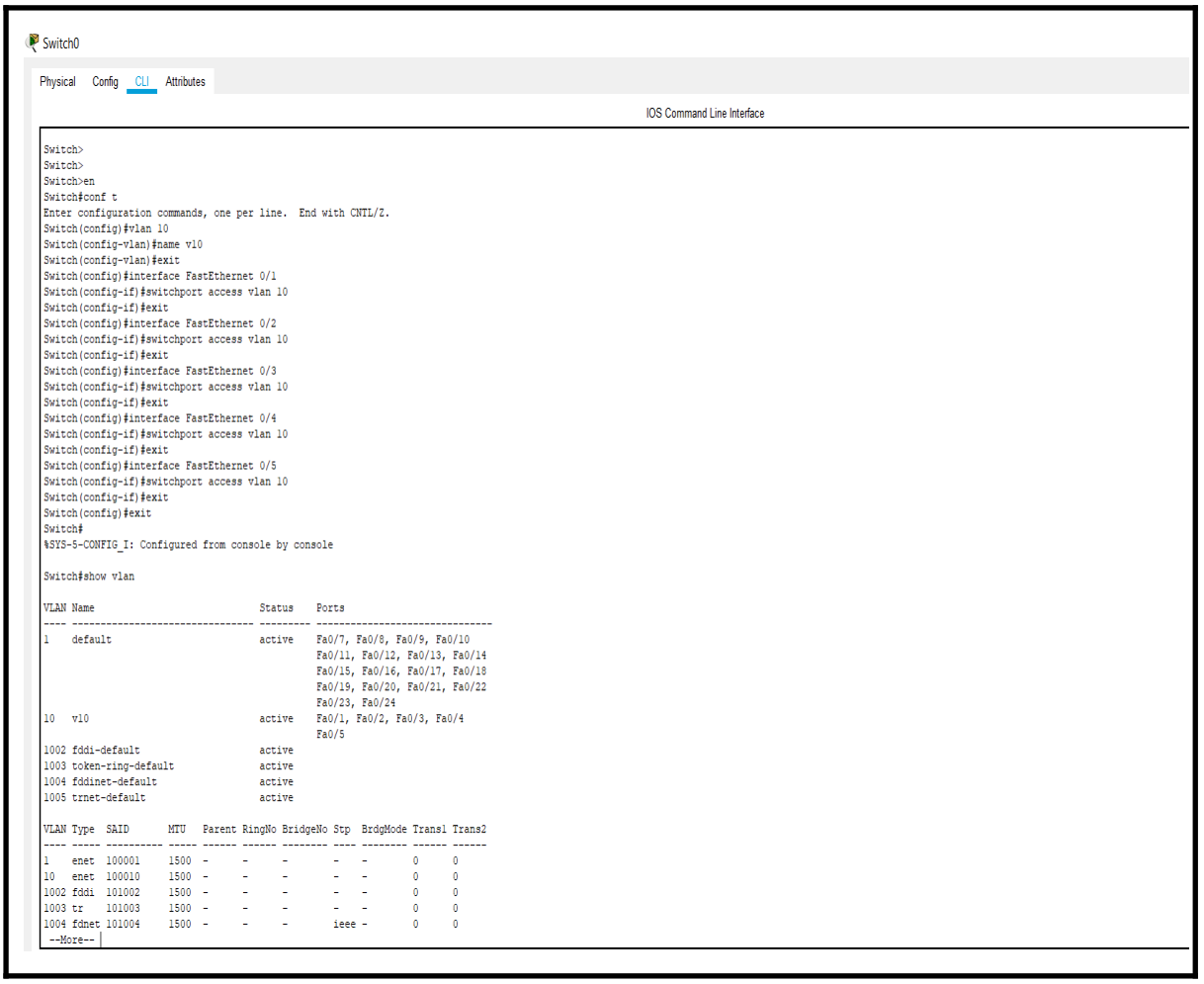

Fig.no. 5 VLAN configuration on switch for HR department

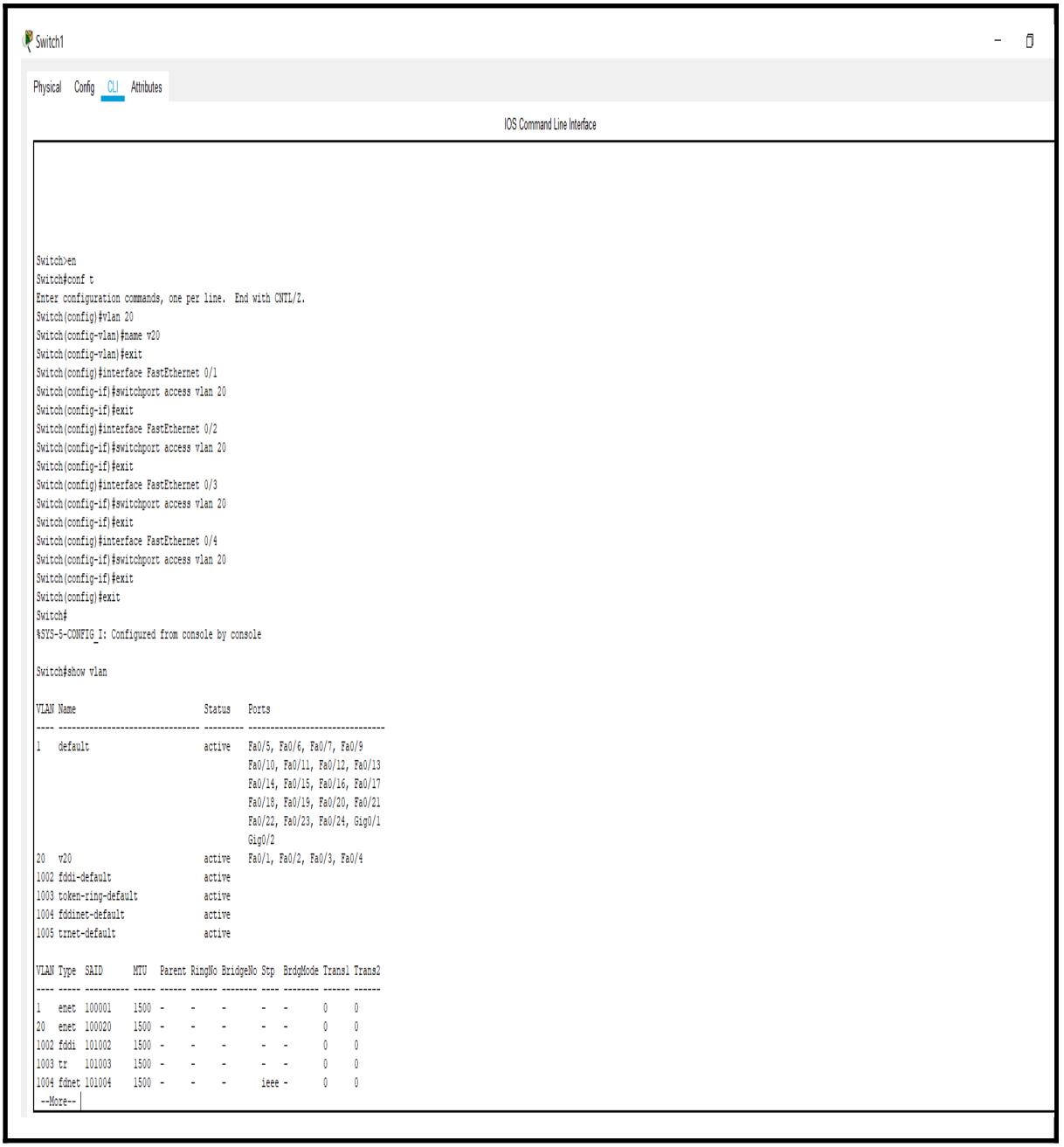

Fig.no. 6 VLAN configuration on switch for operations department

3. Subnetting:

A subnetwork or subnet is a logical subdivision of an IP network. The practice of dividing a network into two or more networks is called subnetting.
Subnetting is the process of partitioning a network into two or more networks based on utilization.The networks 192.168.1.0/27 and 192.168.2.0/27 are assigned to the company for subnetting.
It is subnetted as follows:

1. 192.168.1.0/27- 192.168.1.30/27- Marketing department
2. 192.168.1.32/27-192.168.1.63/27 - Operations department
3. 192.168.1.64/27-192.168.1.94/27- Customer Care department
4. 192.168.2.0/27- 192.168.2.30/27- Finance department
5. 192.168.2.32/27-192.168.2.63/27 - Reception department
6. 192.168.2.64/27-192.168.2.94/27- Admin department

Broadcast Address : 255.255.255.224

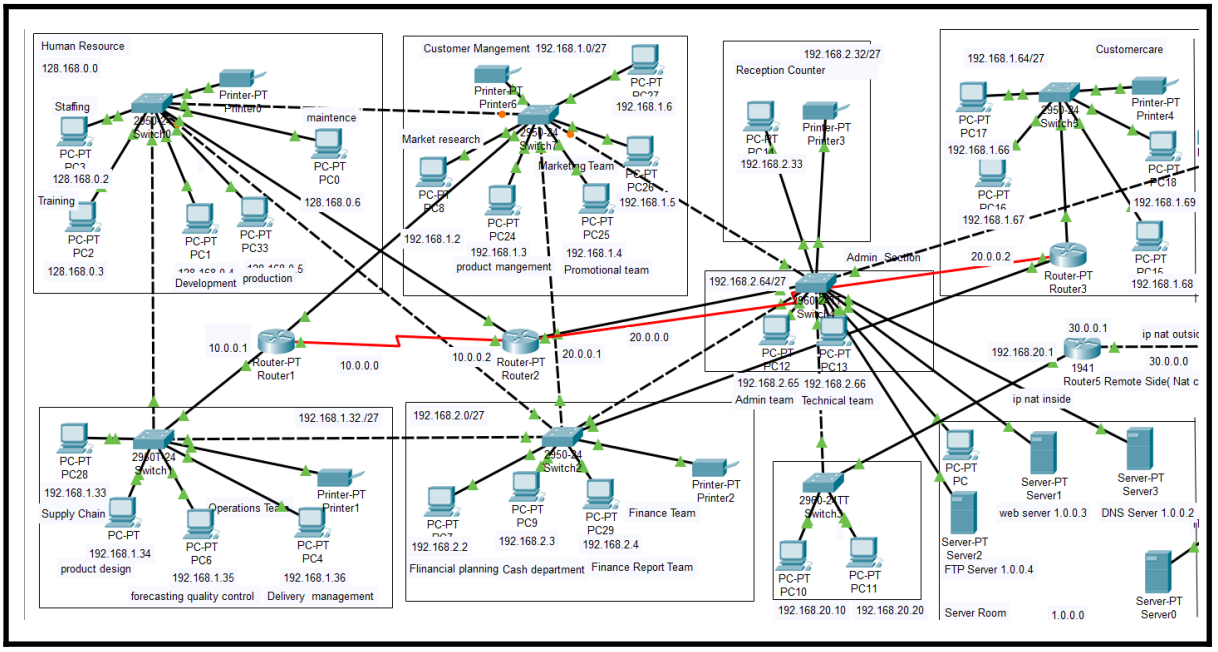

Fig.no. 7 Subnetting in departments

4. NAT (Network Address Translation):

NAT stands for network address translation. It's a way to map multiple local private addresses to a public one before transferring the information

Company implemented a Static Network Address Translation (NAT) which allows the user to configure one-to-one translations of the inside local addresses to the outside global addresses. It allows both IP addresses and port number translations from the inside to the outside traffic and the outside to the inside traffic.

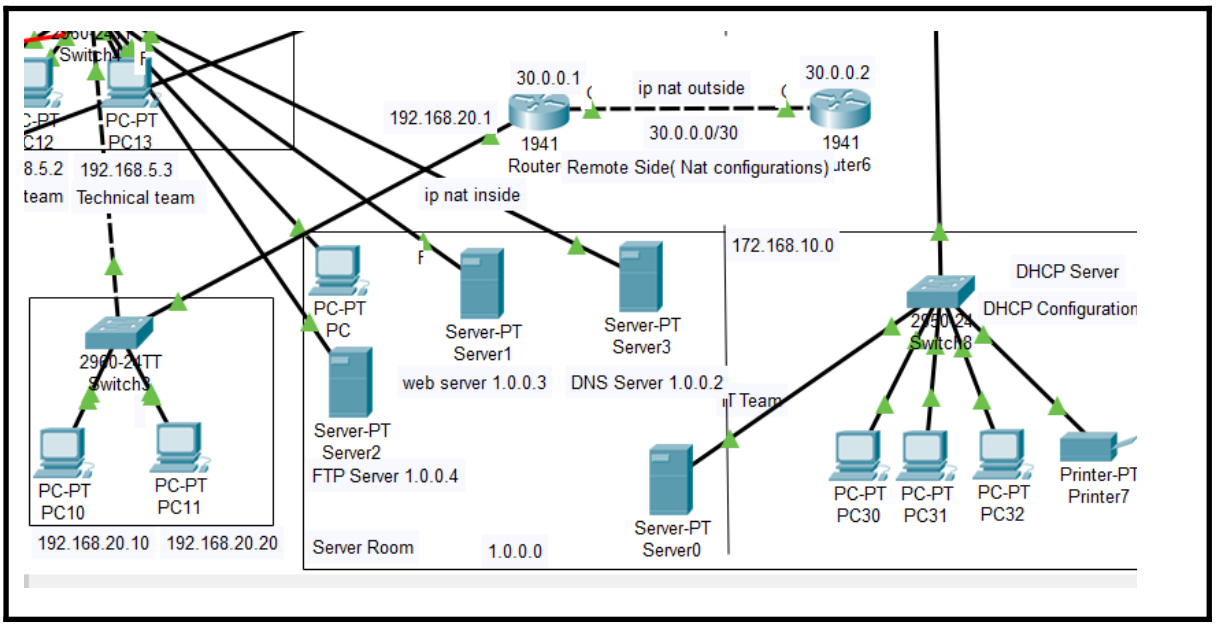

Fig.no. 7 NAT configurations

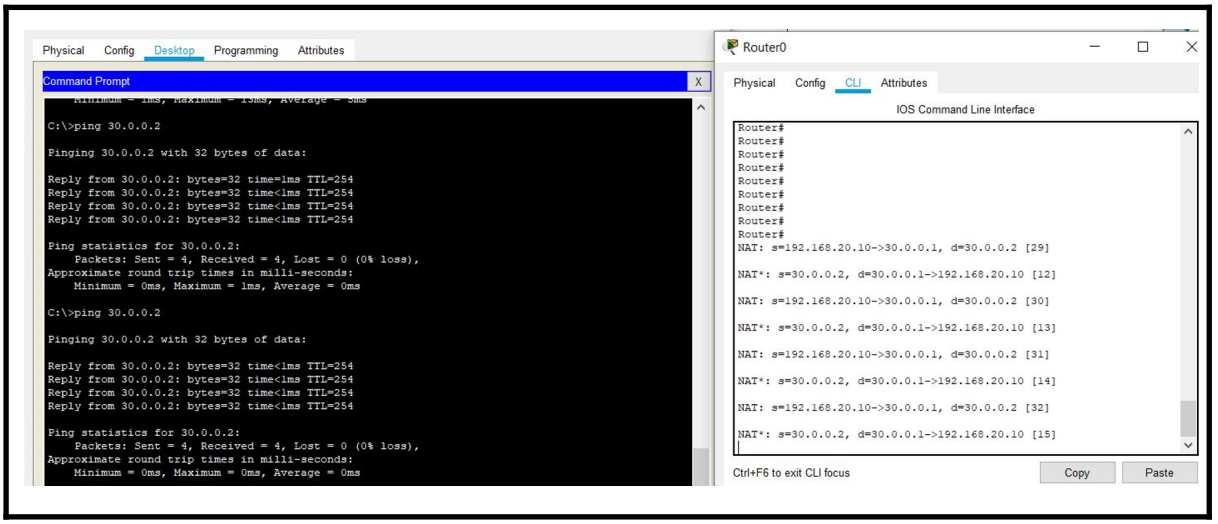

Fig.no. 8 Accessing NAT configurations

5.RIP(v2):

The Routing Information Protocol is one of the oldest distance-vector routing protocols which employs the hop count as a routing metric. RIP prevents routing loops by implementing a limit on the number of hops allowed in a path from source to destinationThe Routing Information Protocol (RIP) is one of a family of IP Routing protocols, and is an Interior Gateway Protocol (IGP) designed to distribute routing information within an Autonomous System (AS).

RIP Version 2(v2) is configured on all routers as a routing protocol. All routers contain the network addresses of next hop for packet routing.

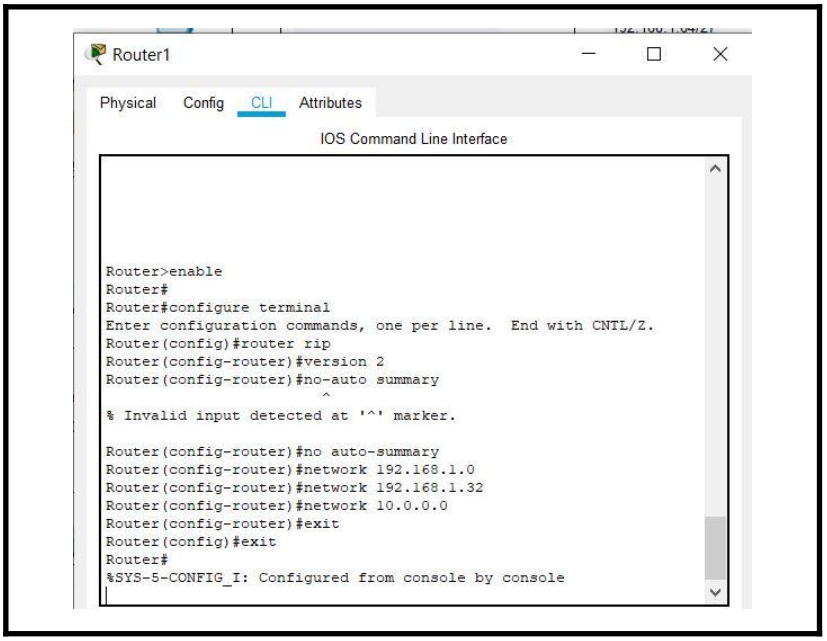

Fig.no. 9 RIP protocol

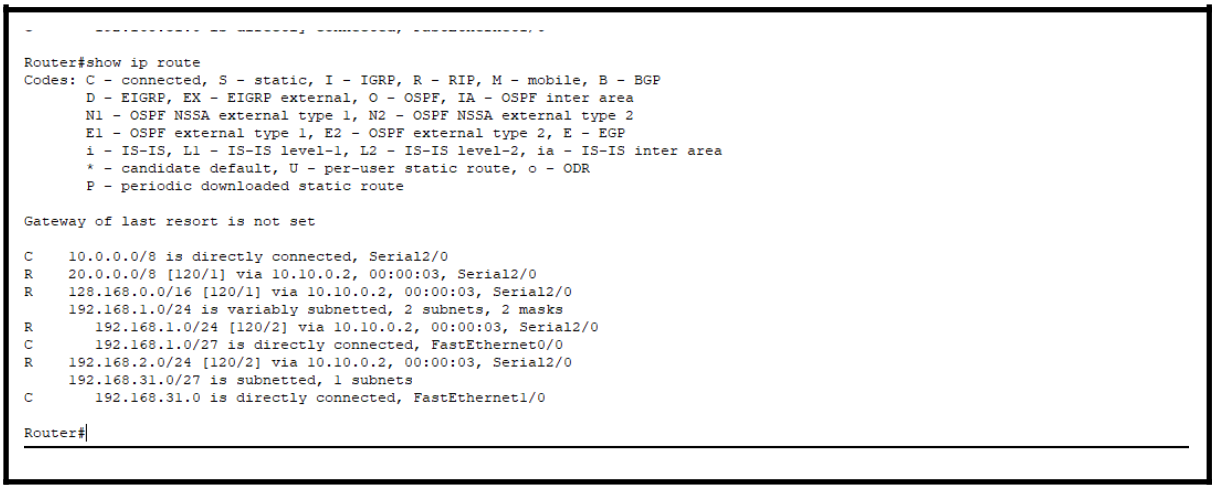

Fig.no. 10 Routing table of router

6.Network Management Protocol(SNMP):

- Simple Network Management Protocol is an Internet Standard protocol for collecting and organizing information about managed devices on IP networks and for modifying that information to change device behavior.
- SNMP Runtime Components:

1. **SNMP-managed devices and resources**—These are the devices and network elements on which an agent runs.
2. **SNMP agent—**This software runs on the hardware or service being monitored by SNMP, collecting data on various metrics like CPU usage, bandwidth usage or disk space. As queried by the SNMP manager, the agent finds and sends this information back to SNMP management systems.

3. SNMP manager—(also referred to as SNMP server) This component functions as a centralized management station running an SNMP management application on many different operating system environments. It actively requests agents send SNMP updates at regular intervals.

4. Management information base (MIB)—This data structure is a text file (with a .mib file extension) that describes all data objects used by a particular device that can be queried or controlled using SNMP including access control. Inside the MIB there are many different managed objects which can be identified by Object Identifiers. An Object Identifier (OID) is a MIB identifier that is used to delineate between devices within the MIB. OIDs are uniquely generated as numeric identifiers used for access to MIB objects.

```
Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface GigabitEthernet0/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface GigabitEthernet0/1
Router(config-if)#
Router(config-if)#exit
Router(config)#interface GigabitEthernet0/0
Router(config-if)#exit
Router(config)#
Router(config)#
Router(config)#shut down
               ^
% Invalid input detected at '^' marker.

Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#
Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#snmp-server community ?
  WORD  SNMP community string
Router(config)#snmp-server community read ?
  ro  Read-only access with this community string
  rw  Read-write access with this community string
  <cr>
Router(config)#snmp-server community read ro
%SNMP-5-WARMSTART: SNMP agent on host Router is undergoing a warm start
Router(config)#snmp-server community write rw
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#
```

Fig.no. 11 SNMP configuration

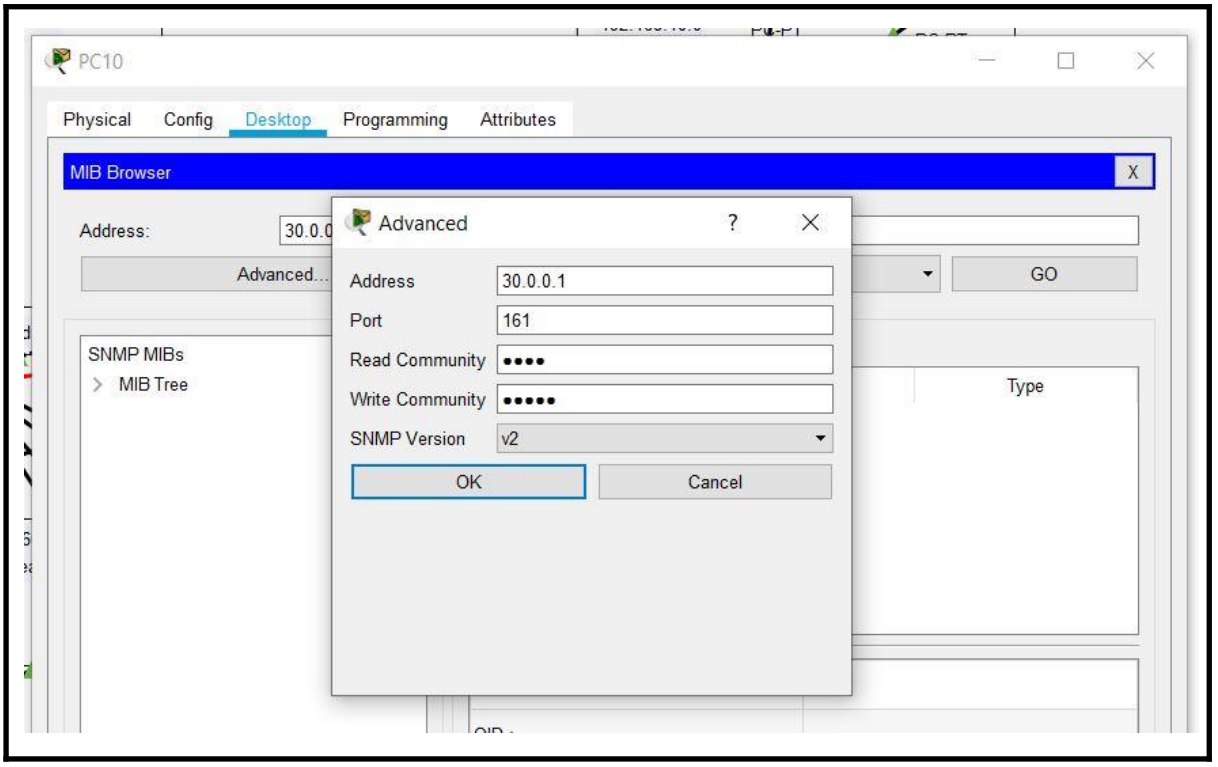

Fig.no. 12 MIB Browser with advanced option

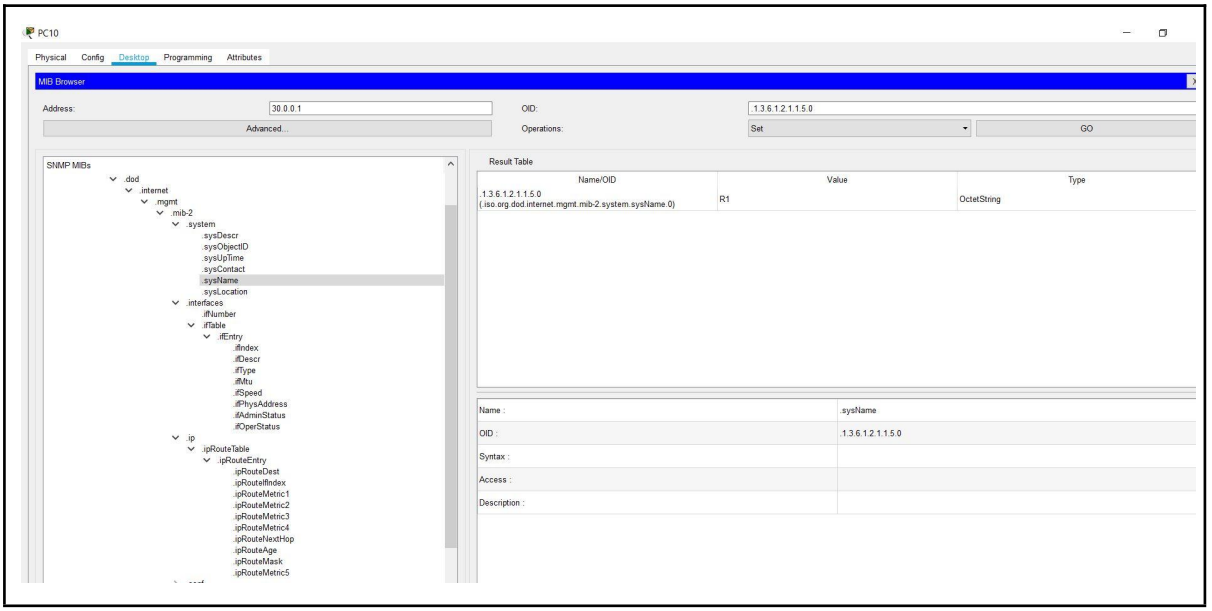

Fig.no. 13 MIB Browser with advanced option

7. Network Design:

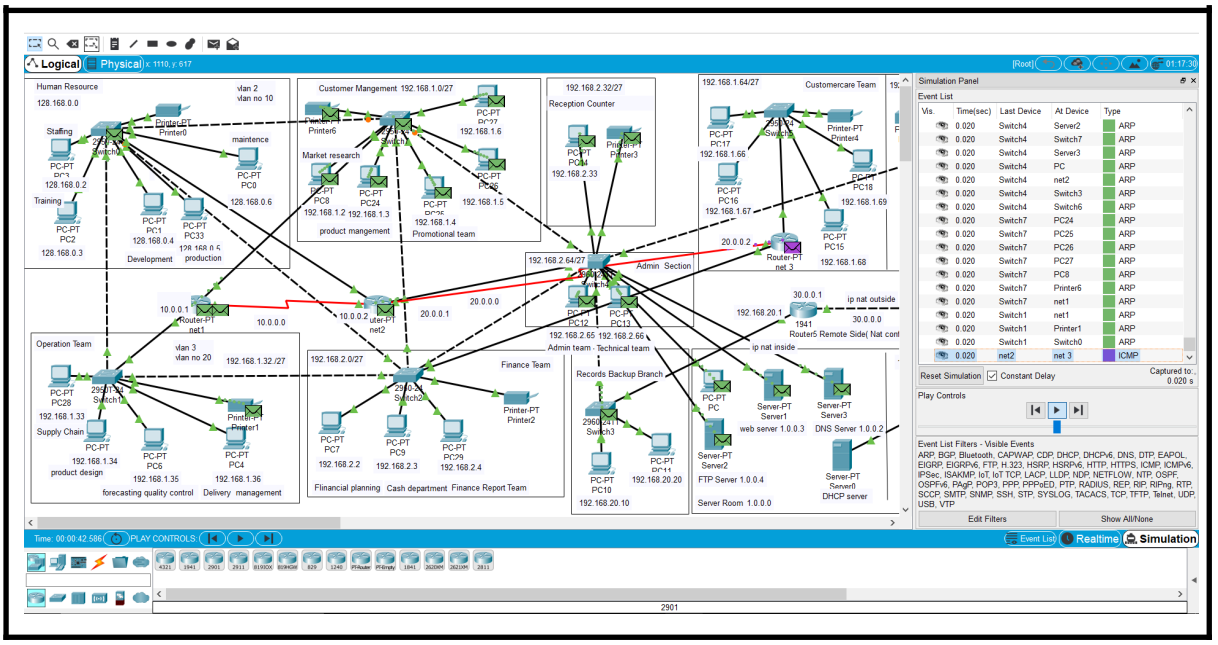

Fig.no. 14 Network Design for Small IT Company Network

8. Testing DNS Service:

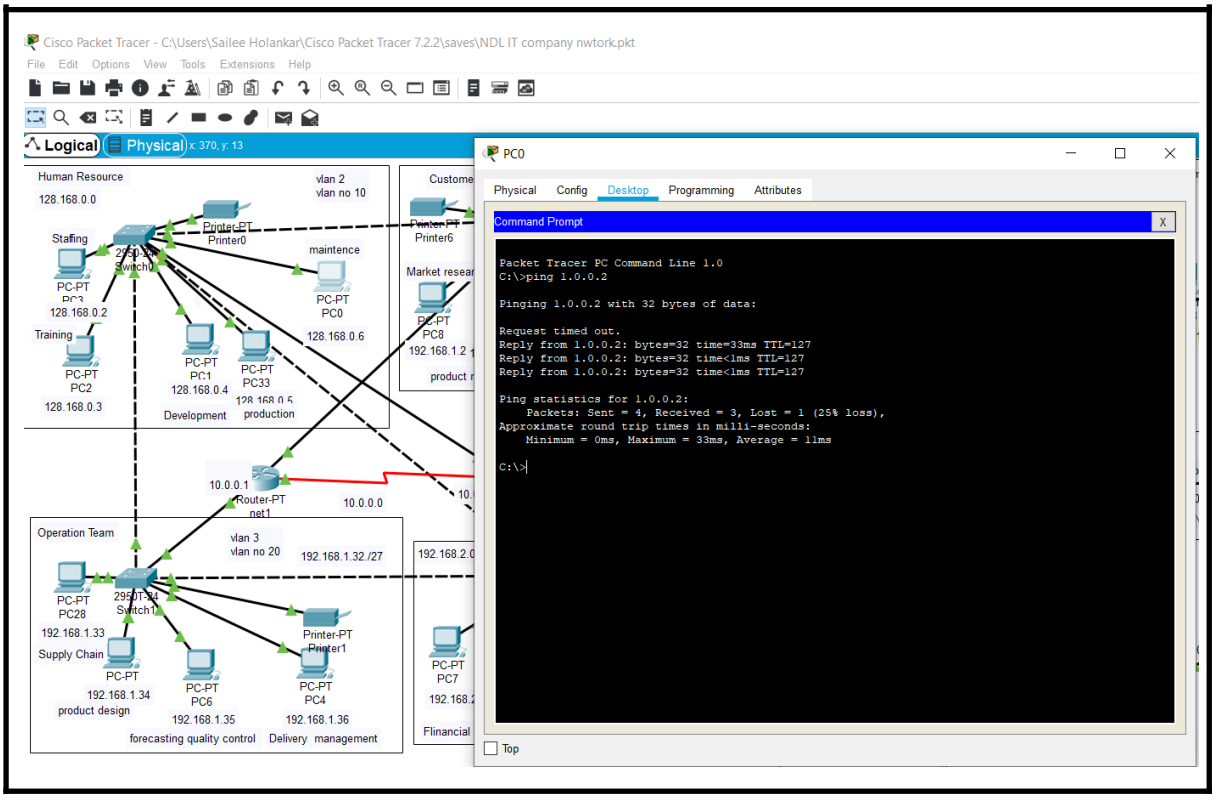

Fig.no. 15 Testing DNS service on computer

9. Testing Web Service:

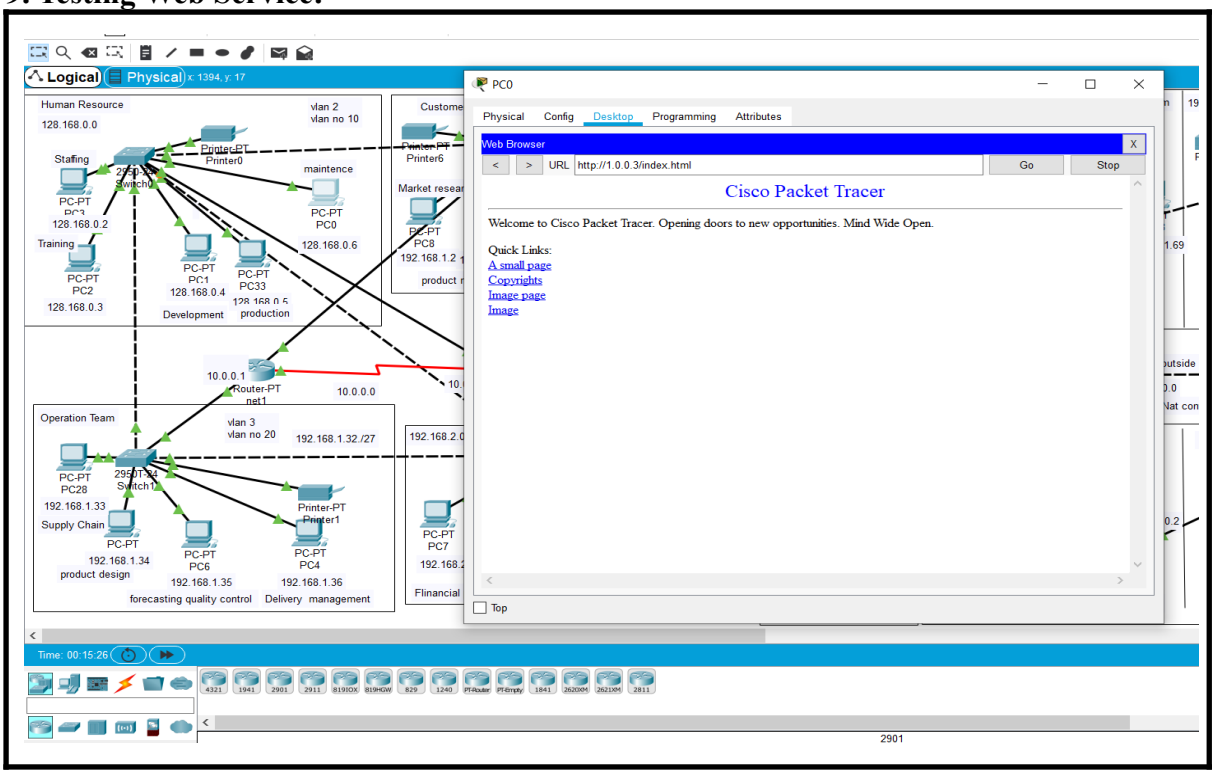

Fig.no. 16 Testing web or HTTP service on computer

10. Testing FTP Service:

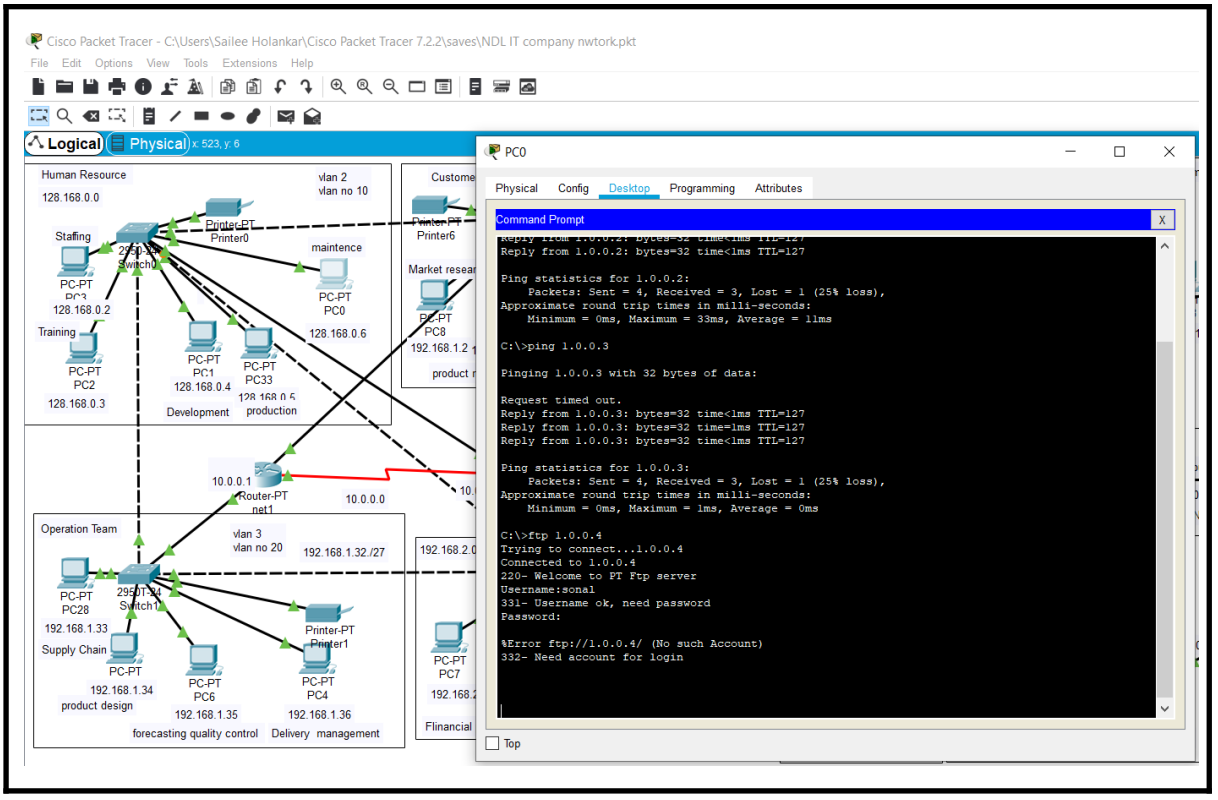

Fig.no. 17 Testing FTP service on computer

Chapter 6

Conclusion

The aim of the project is to design a network for a small IT company which consists of sub-different departments. The company can provide on demand services , network access and higher bandwidth to the other departments.Company implemented DHCP configuration for the two departments which are Accounts and IT team. These departments consist of subunits which can access the department network.The company divided large networks into small networks by subnetting for four departments for efficient network utilization.Company implemented VLAN configuration in the departments.VLANs address issues such as scalability, security, and network management. Network architects set up VLANs to provide network segmentation.A unique IP (Internet Protocol)address is given to each computer of the department network . Every network address is assigned to the router by RIP(Routing Information Protocol) using version 2 (v2).Company also connected to the remote branch. This remote branch contains old records of the company.The connection is provided by connecting the central router to their remote branch. NAT is applied on that remote branch. The SNMP(Simple Network Management Protocol) tool is used to monitor all departments of the company.

Chapter 7

References

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