



THE MILLENNIUM UNIVERSITY

Knowledge shall make you Free

Hospital Network Design & Implementation Using CPT

Supervised By

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Submitted By

Mohammad Sheikh Sadi

Batch: 31st ID: 118CSE0002

Department of CSE



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**A report submitted in partial fulfillment of the
requirements of the Bachelor of Science**

Supervisor Approval

The project title is “**Hospital Network Design & Implementation Using CPT**”, submitted by Mohammad Sheikh Sadi, ID No: 118CSE0002, Batch: 31st to the department of CSE. The

Millennium University has been accepted as satisfactory for the partial fulfillments of the requirements for the degree of B.Sc. in Computer Science & Engineering and approved as to its style and contents.

Dr. Md. Zahedul Hassan

Head of the Department of CSE & ICT

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Declaration

The project title is “**Hospital Network Design & Implementation Using CPT**” has been composed by me & all the works presented here are original and my own. I have declared that this work has not been submitted anywhere for any academic degree.

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Abstract

We are living in the age of technology. This technology has brought everything to our fingertips, and its main medium is the Internet or networking. For the purposes of this research, the “**Hospital Network Design & Implementation**” discipline of Information Systems will structure the overall methodology and framework for results. By leveraging the design science framework, this study will dissect and analyze various parts of a hospital’s network, to uncover substandard practices and problematic weaknesses that commonly result in an overall decrease in the quality of healthcare provided to patients, and negatively affect business operations of hospitals and healthcare facilities. In this network topology the nodes (i.e., computers, Printer switches, routers or other devices) are connected to a local area network (LAN) and network via links (twisted pair copper wire cable or optical fiber cable) which is enough for a smart hospital system. We have used Cisco Packet Tracer for designing the network topology. Here I use Star topology for networking. It’s a general design which can be implemented at any higher level to manage network system for any hospital or health care organization’s network.

Acknowledgment

In completing this graduation project, I have been fortunate to have help, support and encouragement from many people. I would like to take this opportunity to sincerely thank all of those who have helped make this thesis possible. I would like to acknowledge them for their cooperation. First, I would like to thank The Almighty Allah. Then I would like to send special thanks to my advisor Dr. Md. Zahedul Hassan (Head of Dept.- The Millennium University) who contributed to my intellectual development through coursework and assistantship, mentoring that guided me through this entire process. Also to mention our course coordinator and other teachers who are responsible for encouraging us to do a quality project as well as keeping busy with our project work to ensure a timely finish. I am extremely grateful for my loving family who has shown more support throughout my entire life than I could have ever wished for. My family has contributed immeasurably to shaping me as an individual as well as a professional; without their influence and encouragement, I would not be the person I am today. I anticipate my thesis can help both network professionals and prospective students alike, and it would be a corner stone in today's matrix support model.

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Introduction

The internet, sometimes simply called the net. The Internet is an increasingly important part of everyday life for people around the world. A worldwide system of interconnected computer networks and electronic devices that communicate with each other using an established set of protocols is called internet.



With an ever-growing need for healthcare and healthcare facilities, large hospitals and their subsidized branch facilities are demanding more stable and reliable sources for network solutions. The field of Information Technology and Network Infrastructure Management has become crucial components within the healthcare industry. Today, many hospitals, clinics, and outpatient care providers are taking full advantage of the benefits that modern technological advances have to offer.

Literature Survey

This research paper is related to a project that uses networking in hospitals and has examined various recommendation and technique for using the hospital network's private addressing schemes. We switched quickly between the LANs and ensured a secure WLAN network and clinical effectiveness is a core dimension of quality in hospital services.

This study will dissect and analyze different part of the network of a hospital, uncovering substandard practices and problematic weakness that commonly result in a general decline in the quality of healthcare provided to patients, and adversely affecting hospital and healthcare facilities business operations. I design a plan which helps in.

NETWORK REQUIREMENTS

The Proposal is to design a state of the art network for a hospital or health care organization. The hospital consists of various departments. All departments have desktop Computer, Network Printer and webcam. There is a data flow between the devices within the system. Our network requirements include network devices like routers, switches, server.

Objective

The primary objective of this research paper is to provide state of the art networking facilities for the IP-based medial devices, doctors, nurses, visitors and working staff of the hospital. Given the points to throw light on the subject matter:

- Providing remote medical consultancy or to supervise the surgery/operation from remote location.
- Uninterrupted high speed internet connectivity.
- Provide better medical facilities to the patients.
- Organized health records for future use.
- Uninterrupted communication between different departments of the hospital.
- Reducing the workload at nurse station, account department, reception desk.
- Keeping the research work of the doctors and medical records of patients secure.

HOSPITAL SEGMENTS

- 1** IT Department
- 2** Clinical Area
- 3** ICU
- 4** OT
- 5** General Ward
- 6** Privat Ward
- 7** Entrance Reception
- 8** Lobby and Parking

FEATURES AND SERVICES

- DNS
- Subnetting
- HTTPS
- FTP
- WIFI

DEFINITIONS

- DNS

The Domain Name System is a hierarchical and decentralized naming system for computers, services, or other resources connected to the Internet or a private network.

- 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.

- HTTPS

Hypertext Transfer Protocol Secure is an extension of the Hypertext Transfer Protocol. It is used for secure communication over a computer network and is widely used on the Internet. Hypertext Transfer Protocol Secure is an extension of the Hypertext Transfer Protocol. It is used for secure communication over a computer network and is widely used on the Internet.

- FTP

The File Transfer Protocol is a standard network protocol used for the transfer of computer files between a client and server on a computer network.

- WIFI

Wi-Fi is the name of a wireless networking technology that uses radio waves to provide wireless high-speed Internet and network connections.

COST OF NETWORK

- **Cisco Switch**

\$138 Each

\$1242 Cost of 9 Switch

- **Cisco Router**

\$235 Each

\$235 Cost of 1 Router

- **Cisco Server**

\$50 Each

\$150 Cost of 3 Server

- **Computer Cost**

\$208 Each

\$3744 Cost of 18 Computer

- **Printer Cost**

\$100 Each

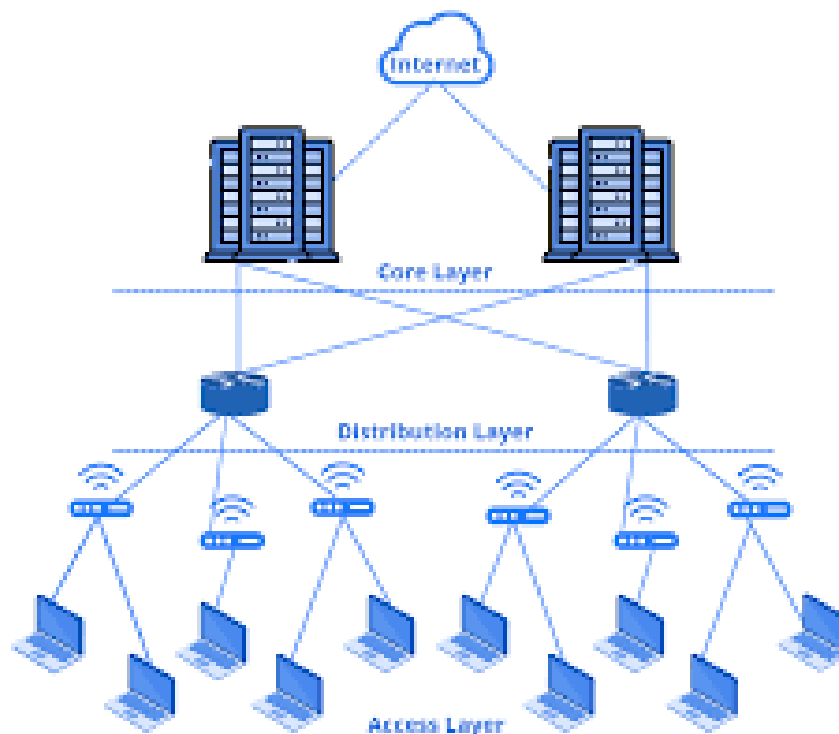
\$700 Cost of 7 Printer

Total Cost = \$6071

Model Structure

The hierarchical is also known as the progressive inter-networking model. This model improves the construction of a structure which is dependable, versatile, and more affordable various leveled internetwork in light of the fact that instead of concentrating on packet construction, it centers around the three functional area or layer, of a system:

Core Layer: This Layer is viewed as the foundation of the system and incorporates the top-of-the-line switches and rapid links or cables, for example, fiber cable. In core layer packets are neither manipulated nor does it route traffic at LAN level. The core layer is solely in charge of quick and dependable transportation of data over a network. The main aim of this layer is to reduce the latency rate while delivering a packet.

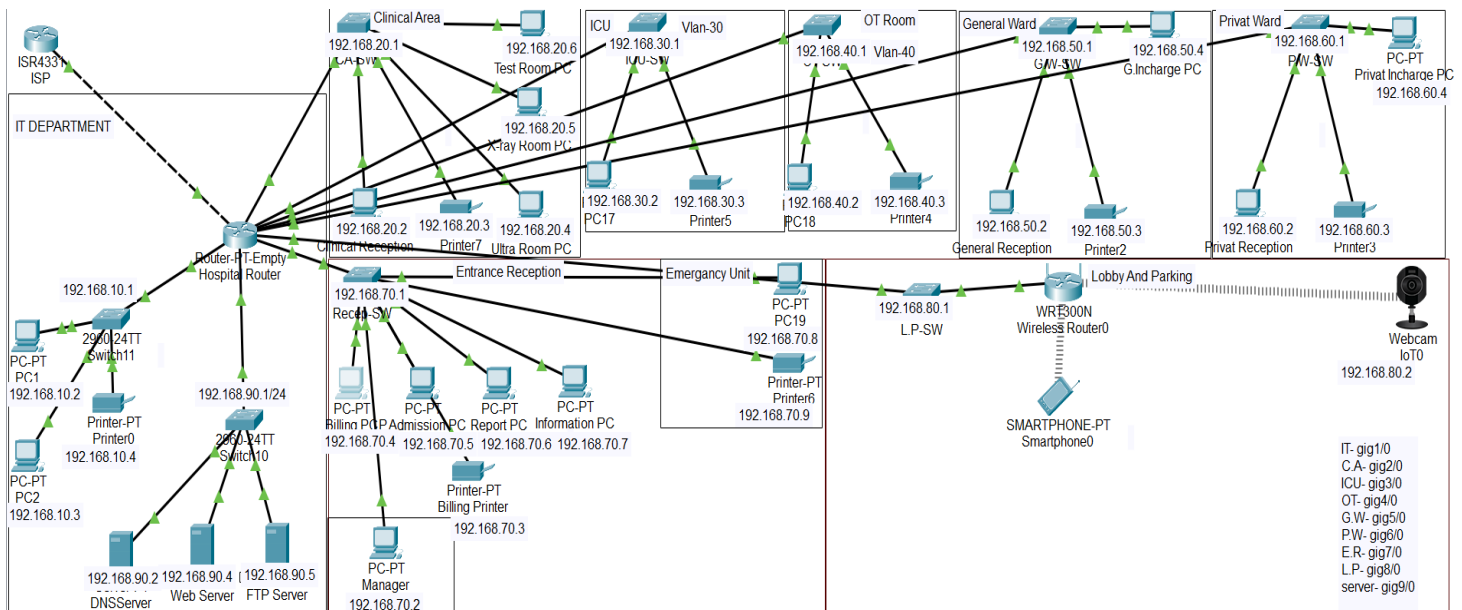


Distribution Layer: The distribution layer is in charge of directing the packet. It additionally gives protocol-based network connectivity. It is at

this layer where you start to apply authority over network transmissions, incorporating what comes in and what leaves the network. This layer incorporates LAN-based routers and layer 3 switches. This layer guarantees that data packets are legitimately directed among subnets and VLANs in your endeavor. This layer is likewise called the work-group layer.

Access Layer: The access layer contains gadgets that permit work group and client to utilize the role played by the core and distribution layer. In the access layer, you can extend or contract network areas utilizing a repeater, standard switch or a hub. This layer is additionally called the work area or desktop layer since it centers around associating end users, for example, computer system to the network. This layer guarantees that data bundles are conveyed to end client PCs.

NETWORK DIAGRAM



Model Analysis

ISP: A network is of little of no use without internet. For the project as big as this consisting almost 50 end user accessing internet at the same time so we need a high speed internet service provider. We cannot compromise on the internet speed.

Router: in our network we have routers at one levels, one at the core level and the distribution layer. We need to handle the bandwidth of 100mbps for now. To handle this bandwidth we are choosing cisco The single-port Cisco Gigabit Ethernet Network Module (part number PT-ROUTER-NM-1CGE) provides Gigabit Ethernet copper connectivity for access routers. The module is supported by the Cisco 2691, Cisco 3660, Cisco 3725, and Cisco 3745 series routers. This network module has one gigabit interface converter (GBIC) slot to carry any standard copper or optical Cisco GBIC. Cisco 4351 can smoothly give throughput of 200mbps.

Switch: in a network, a switch is a port that broadcasts to every end device or Ethernet-based device connected to it. Here in our model we used hubs to connect switches of different sector. The reason behind doing is to increase the reliability. We can easily figure out the fault if any sector is not receiving internet connection. Here we use 2960 IOS15 model switch for each department.

Server: server is a central system used for storing and managing data entire network. Here in our network we have installed three dedicate server i.e FTP server, DNS Server, HTTP /web server.

Warless Router: wireless router are basically devices which allow wireless devices to connect with either the help of Wi-Fi. We are using 2 Wap to provide maximum internet connectivity to wireless medical devices, smart phones, smart mobile tablets, laptop etc.

Cable: last but also the very important part is cabling the entire network. Without connecting one component of a network with other it is pretty much useless. Here in our model we had used unshielded twisted pair (UTP) cable to connect network to router, router to switch, switch to server, switch to end devices. We chose UTP cable because of its interference cancelling capabilities. To be very particular we used cat-6 grade cables because of its maximum transmission speed of 1000mbps/100meters. There is not much cost difference between cat-5e and cat-6 grade cable. So it is a vice choice to choose cat-6 cable for our network.

IP Assing & CONFIGURATION

The diagram is properly commented. We have divided the diagram into 8 segments as named above. Hospital Segments representing different departments of hospital. Following are the running configuration of routers and switches related to different segments of hospital respectively:

IT Department IP Address
192.168.10.1
Clinical Area IP Address
192.168.20.1
ICU Room IP Address
192.168.30.1
OT Room IP Address
192.168.40.1
General Ward IP Address
192.168.50.1

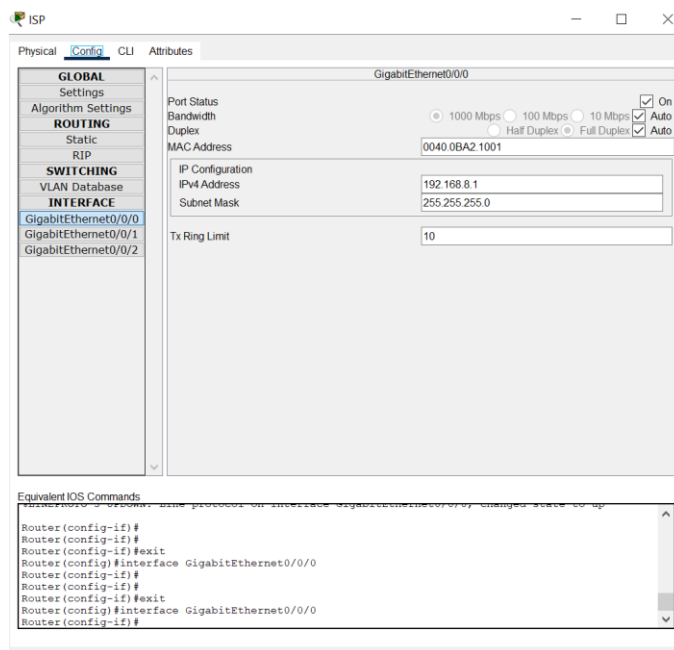
Privat Ward IP Address
192.168.60.1
Entrance IP Address
192.168.70.1
Lobby & Parking IP Address
192.168.80.1
Server IP Address
4.2.2.1

Network Implementation & Configuration

ISP To Router: A fiber optic line connect to our router from ISP. Then Configure it this way-

ISP Router Config:

Click on ISP Router, click on “CLI” then config this command way:



```
Router>enable
```

```
Router#
```

```
Router#configure terminal
```

Enter configuration commands, one per line. End with CNTL/Z.

```
Router(config)#interface GigabitEthernet0/0/0
```

```
Router(config-if)#no ip address
```

```
Router(config-if)#ip address 192.168.8.1 255.255.255.0
```

```
Router(config-if)#ip address 192.168.8.1 255.255.255.0
```

```
Router(config-if)#no shutdown
```

```
Router(config-if)#
```

```
%LINK-5-CHANGED: Interface GigabitEthernet0/0/0, changed state to up
```

```
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0/0,  
changed state to up
```

Hospital Router config for ISP: Here we changed the hospital router name as ukhospital by this command:

```
Router>enable
```

```
Router#
```

```
Router#configure terminal
```

```
Router#hostname ukhospital
```

```
ukhospital(config)#
```

```
ukhospital(config-if)#no shutdown
```

Port Gig0/0

Click on Hospital Router, click on “CLI” then config by this command way:

```
ukhospital>enable
```

```
ukhospital#configure terminal
```

```
ukhospital(config)#interface GigabitEthernet0/0
```

```
ukhospital(config-if)#ip address 192.168.9.1 255.255.255.0
```

```
ukhospital(config-if)#ip address 192.168.9.1 255.255.255.0
```

```
ukhospital(config-if)#no shutdown
```

```
ukhospital(config-if)#
```

```
%LINK-5-CHANGED: Interface GigabitEthernet0/0, changed state to up
```

Then config other port for the segment wise that ip address assigning

Port Gig1/0

Click on Hospital Router, click on “CLI” then config by this command way:

```
ukhospital>enable
```

```
ukhospital#configure terminal
```

```
ukhospital(config)#interface GigabitEthernet1/0
```

```
ukhospital(config-if)#ip address 192.168.10.1 255.255.255.0
```

```
ukhospital(config-if)#ip address 192.168.10.1 255.255.255.0
```

```
ukhospital(config-if)#no shutdown
```

```
ukhospital(config-if)#
```

```
%LINK-5-CHANGED: Interface GigabitEthernet1/0, changed state to up
```

Port Gig2/0

Click on Hospital Router, click on “CLI” then config by this command way:

```
ukhospital>enable
```

```
ukhospital#configure terminal
```

```
ukhospital(config)#interface GigabitEthernet2/0
```

```
ukhospital(config-if)#ip address 192.168.20.1 255.255.255.0
```

```
ukhospital(config-if)#ip address 192.168.20.1 255.255.255.0
```

```
ukhospital(config-if)#no shutdown
```

```
ukhospital(config-if)#
```

```
%LINK-5-CHANGED: Interface GigabitEthernet2/0, changed state to up
```

Port Gig3/0

Click on Hospital Router, click on “CLI” then config by this command way:

```
ukhospital>enable
```

```
ukhospital#configure terminal
```

```
ukhospital(config)#interface GigabitEthernet3/0
```

```
ukhospital(config-if)#ip address 192.168.30.1 255.255.255.0
```

```
ukhospital(config-if)#ip address 192.168.30.1 255.255.255.0
```

```
ukhospital(config-if)#no shutdown
```

```
ukhospital(config-if)#
```

```
%LINK-5-CHANGED: Interface GigabitEthernet3/0, changed state to up
```

Port Gig4/0

Click on Hospital Router, click on “CLI” then config by this command way:

```
ukhospital>enable
```

```
ukhospital#configure terminal
```

```
ukhospital(config)#interface GigabitEthernet4/0
```

```
ukhospital(config-if)#ip address 192.168.40.1 255.255.255.0
```

```
ukhospital(config-if)#ip address 192.168.40.1 255.255.255.0
```

```
ukhospital(config-if)#no shutdown
```

```
ukhospital(config-if)#
```

```
%LINK-5-CHANGED: Interface GigabitEthernet4/0, changed state to up
```

Port Gig5/0

Click on Hospital Router, click on “CLI” then config by this command way:

```
ukhospital>enable
```

```
ukhospital#configure terminal
```

```
ukhospital(config)#interface GigabitEthernet5/0
```

```
ukhospital(config-if)#ip address 192.168.50.1 255.255.255.0
```

```
ukhospital(config-if)#ip address 192.168.50.1 255.255.255.0
```

```
ukhospital(config-if)#no shutdown
```

```
ukhospital(config-if)#
```

```
%LINK-5-CHANGED: Interface GigabitEthernet5/0, changed state to up
```

Port Gig6/0

Click on Hospital Router, click on “CLI” then config by this command way:

```
ukhospital>enable
```

```
ukhospital#configure terminal
```

```
ukhospital(config)#interface GigabitEthernet6/0
```

```
ukhospital(config-if)#ip address 192.168.60.1 255.255.255.0
```

```
ukhospital(config-if)#ip address 192.168.60.1 255.255.255.0
```

```
ukhospital(config-if)#no shutdown
```

```
ukhospital(config-if)#
```

```
%LINK-5-CHANGED: Interface GigabitEthernet6/0, changed state to up
```

Port Gig7/0

Click on Hospital Router, click on “CLI” then config by this command way:

```
ukhospital>enable
```

```
ukhospital#configure terminal
```

```
ukhospital(config)#interface GigabitEthernet7/0
```

```
ukhospital(config-if)#ip address 192.168.70.1 255.255.255.0
```

```
ukhospital(config-if)#ip address 192.168.70.1 255.255.255.0
```

```
ukhospital(config-if)#no shutdown
```

```
ukhospital(config-if)#
```

```
%LINK-5-CHANGED: Interface GigabitEthernet7/0, changed state to up
```

Port Gig8/0

Click on Hospital Router, click on “CLI” then config by this command way:

```
ukhospital>enable
```

```
ukhospital#configure terminal
```

```
ukhospital(config)#interface GigabitEthernet8/0
ukhospital(config-if)#ip address 192.168.80.1 255.255.255.0
ukhospital(config-if)#ip address 192.168.80.1 255.255.255.0
ukhospital(config-if)#no shutdown
ukhospital(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet8/0, changed state to up
```

Port Gig9/0

Click on Hospital Router, click on “CLI” then config by this command way:

```
ukhospital>enable
ukhospital#configure terminal
ukhospital(config)#interface GigabitEthernet9/0
ukhospital(config-if)#ip address 192.168.90.1 255.255.255.0
ukhospital(config-if)#ip address 192.168.90.1 255.255.255.0
ukhospital(config-if)#no shutdown
ukhospital(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet9/0, changed state to up
```

Routing:

For transfer any data or packet we need routing all IP address by static routing by this command:

```
ukhospital>enable
ukhospital#configure terminal
ukhospital(config)#ip route 192.167.10.0 255.255.255.0 192.168.9.0
ukhospital(config)#ip route 192.167.20.0 255.255.255.0 192.168.9.0
ukhospital(config)#ip route 192.167.30.0 255.255.255.0 192.168.9.0
ukhospital(config)#ip route 192.167.40.0 255.255.255.0 192.168.9.0
ukhospital(config)#ip route 192.167.50.0 255.255.255.0 192.168.9.0
ukhospital(config)#ip route 192.167.60.0 255.255.255.0 192.168.9.0
```

```
ukhospital(config)#ip route 192.167.70.0 255.255.255.0 192.168.9.0
ukhospital(config)#ip route 192.167.80.0 255.255.255.0 192.168.9.0
ukhospital(config)#ip route 192.167.90.0 255.255.255.0 192.168.9.0
ukhospital(config-if)#no shutdown
ukhospital(config-if)#
```

and all IP address are routing with router to department wise IP Address.

SERVER SETUP

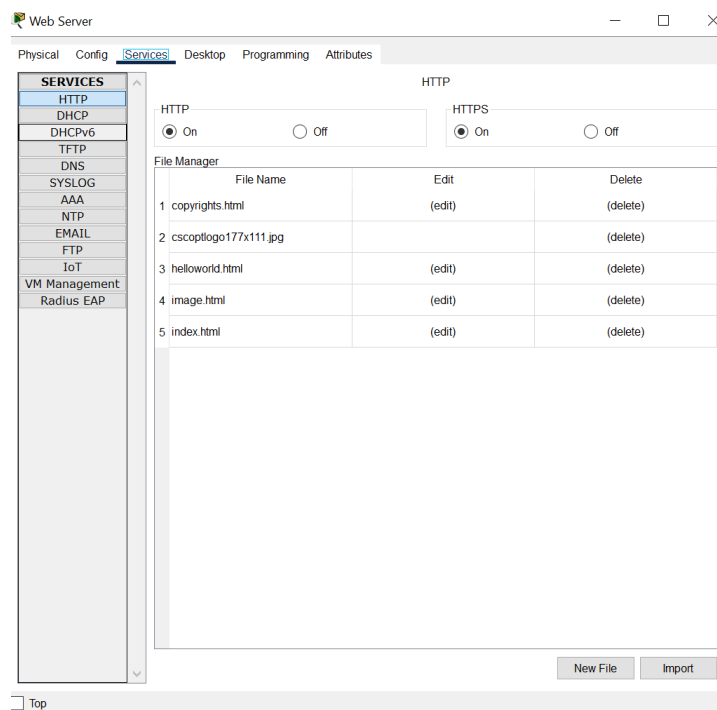
We need 3 server DNS,HTTP,FTP

DNS: Click Server, go to desktop assing ip address,subnet mask, default gateway, DNS address.

Then go services and click DNS, enable DNS service on and add name and IP address.

HTTP/Web Server: Click Server, go to desktop assing ip address,subnet mask, default gateway, DNS address.

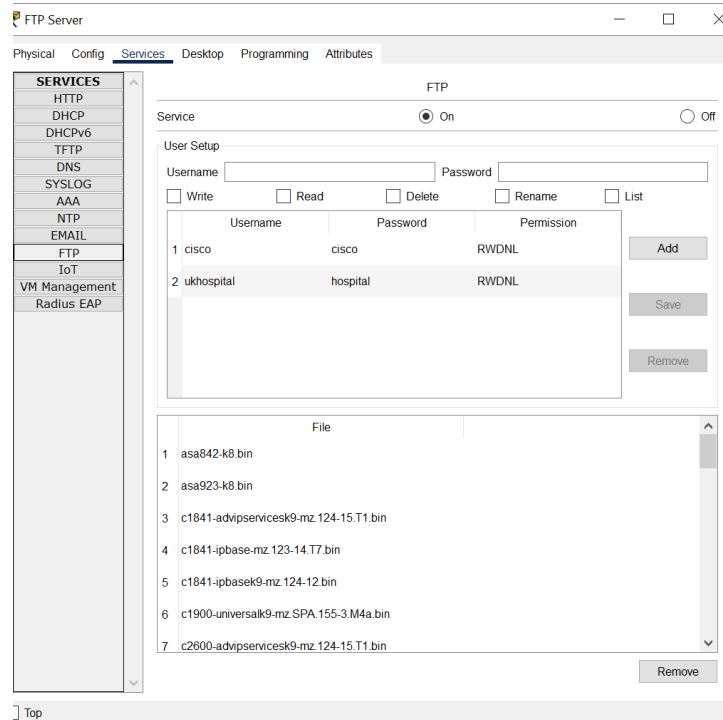
Then go services and click HTTP, on HTTP, edit in index.html (if you customise website).



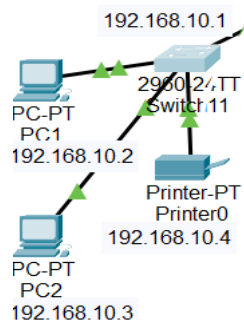
FTP Server: Click Server, go to desktop assigning ip address, subnet mask, default gateway, DNS address.

Then go services and click FTP. Such as it a storage so it need security so creat a new username and password and give access as user. Here I access all permissio read,write,edit,rename,list. You can also see file that are storage by user.

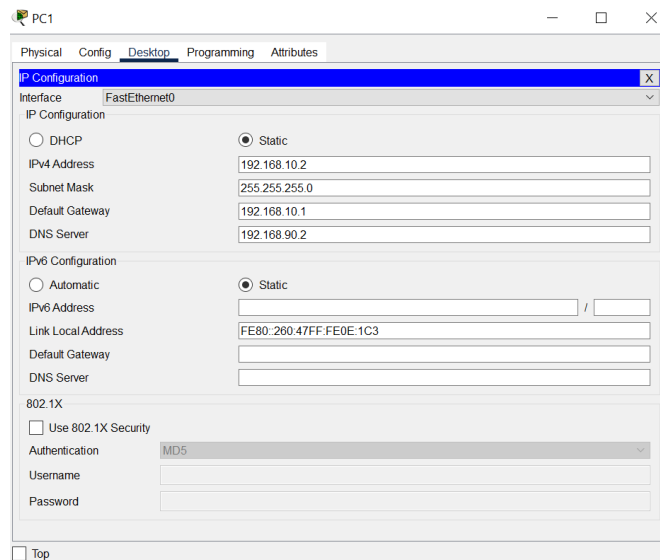
S



Hospital router Configuration complete then setup hospital segment wise end user pc or devices and per segment one switch. Connect end user pc, network printer and other end user device by copper straight cable.



End user IP assigning: click end user or pc, go to desktop, click ip configuration, then assigning ip address, subnet mask, default gateway and subnet mask.



this same way configure all pc or end user devices.

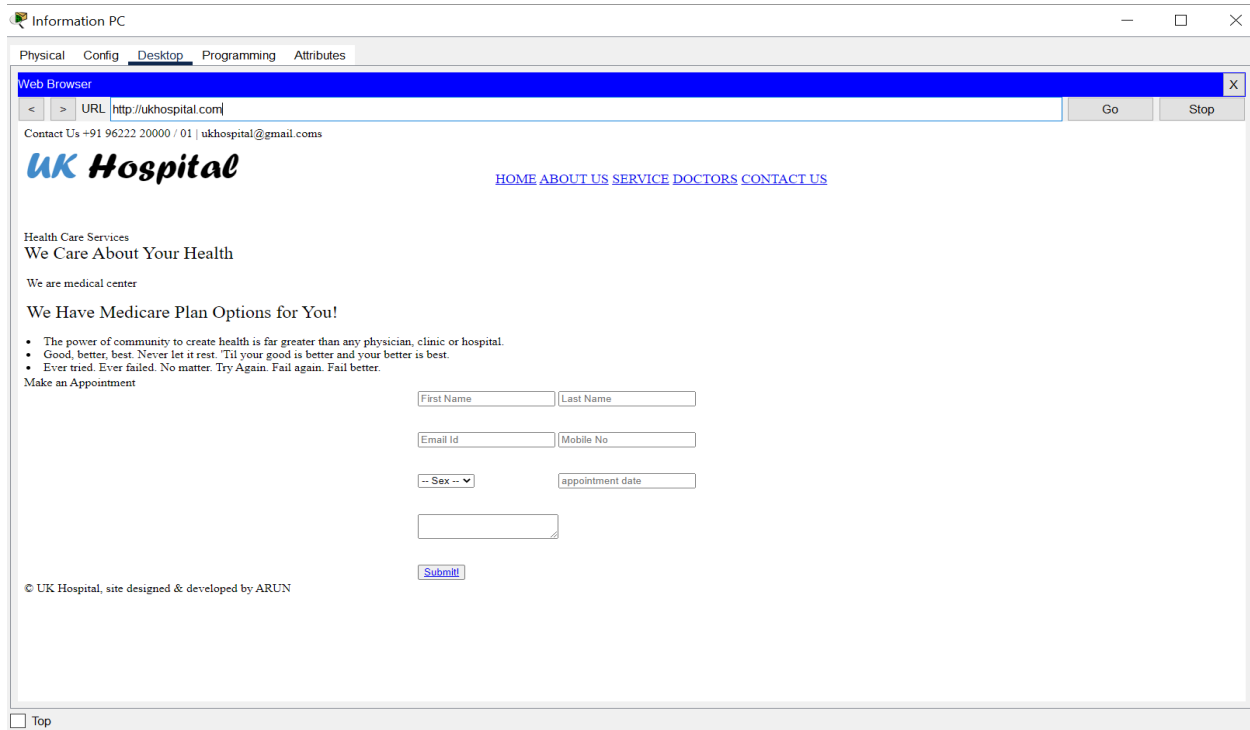
Result of Network implementation

Packet or data transfer one pc/user to other pc/user in different department


Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	Privat Recep...	Billing PC	ICMP		0.000	N	0	(edit)	(delete)
	Successful	Privat Recep...	Billing PC	ICMP		0.000	N	1	(edit)	(delete)

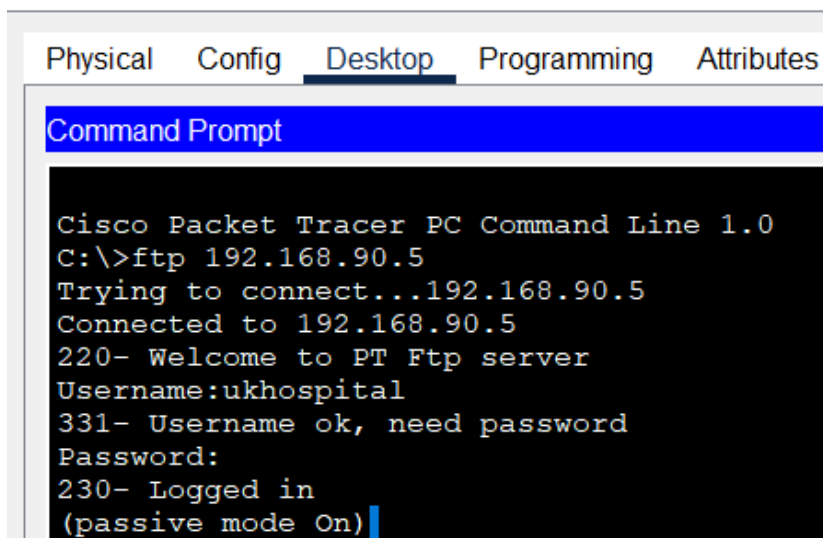
Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	Privat Recep...	Billing Printer	ICMP		0.000	N	0	(edit)	(delete)

Web browsing by name which set up at DNS Server and which raw file store in HTTP or Web server

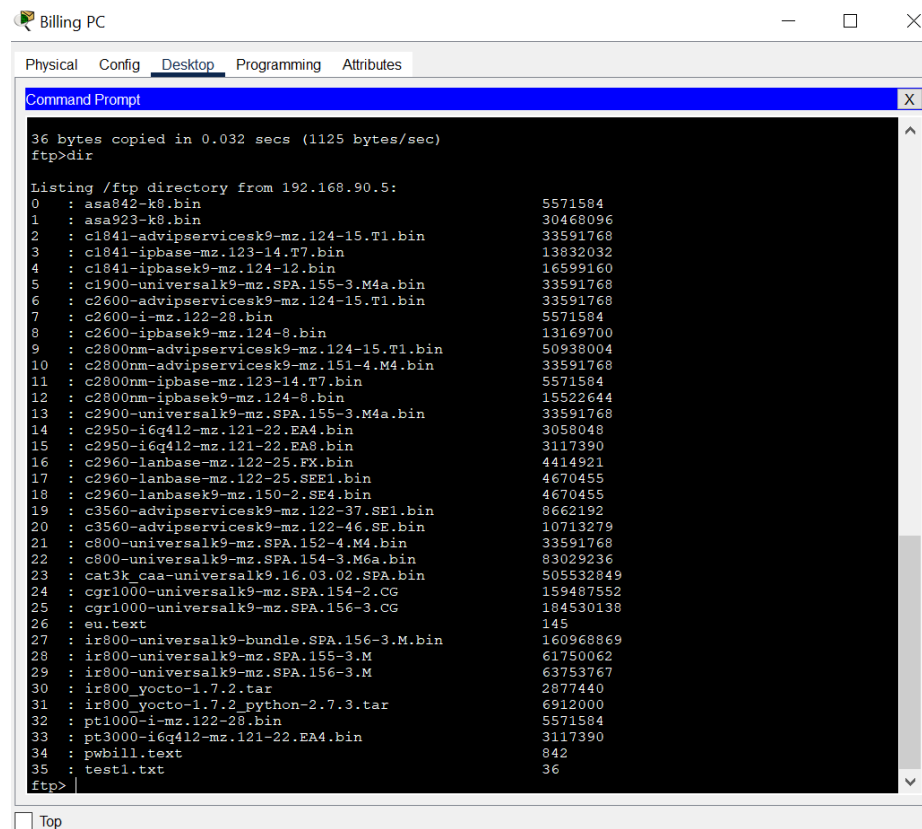


File Transfer protocol (FTP) storage from any pc to FTP by this way and command: Click any pc, go to desktop, click text editor, write any text, save this[test1.txt]. Then go to desktop mode back and click command prompt. Then follow this command line:

 Billing PC



to show that file saved in ftp write command again



```
36 bytes copied in 0.032 secs (1125 bytes/sec)
ftp>dir

Listing /ftp directory from 192.168.90.5:
0 : asa842-k8.bin 5571584
1 : asa923-k8.bin 30468096
2 : c1841-advipservicesk9-mz.124-15.T1.bin 33591768
3 : c1841-ipbase-mz.123-14.T7.bin 13832032
4 : c1841-ipbasek9-mz.124-12.bin 16599160
5 : c1900-universalk9-mz.SPA.155-3.M4a.bin 33591768
6 : c2600-advipservicesk9-mz.124-15.T1.bin 33591768
7 : c2600-i-mz.122-28.bin 5571584
8 : c2600-ipbasek9-mz.124-8.bin 13169700
9 : c2800nm-advipservicesk9-mz.124-15.T1.bin 50938004
10 : c2800nm-advipservicesk9-mz.151-4.M4.bin 33591768
11 : c2800nm-ipbase-mz.123-14.T7.bin 5571584
12 : c2800nm-ipbasek9-mz.124-8.bin 15522644
13 : c2900-universalk9-mz.SPA.155-3.M4a.bin 33591768
14 : c2950-i6q412-mz.121-22.EA4.bin 3058048
15 : c2950-i6q412-mz.121-22.EA8.bin 3117390
16 : c2960-lanbase-mz.122-25.FX.bin 4414921
17 : c2960-lanbase-mz.122-25.SEE1.bin 4670455
18 : c2960-lanbasek9-mz.150-2.SE4.bin 4670455
19 : c3560-advipservicesk9-mz.122-37.SE1.bin 8662192
20 : c3560-advipservicesk9-mz.122-46.SE.bin 10713279
21 : c800-universalk9-mz.SPA.152-4.M4.bin 33591768
22 : c800-universalk9-mz.SPA.154-3.M6a.bin 83029236
23 : cat3k_caa-universalk9.16.03.02.SPA.bin 505532849
24 : cgr1000-universalk9-mz.SPA.154-2.CG 159487552
25 : cgr1000-universalk9-mz.SPA.156-3.CG 184530138
26 : eu.text 145
27 : ir800-universalk9-bundle.SPA.156-3.M.bin 160968869
28 : ir800-universalk9-mz.SPA.155-3.M 61750062
29 : ir800-universalk9-mz.SPA.156-3.M 63753767
30 : ir800_yocto-1.7.2.tar 2877440
31 : ir800_yocto-1.7.2.python-2.7.3.tar 6912000
32 : pt1000-i-mz.122-28.bin 5571584
33 : pt3000-i6q412-mz.121-22.EA4.bin 3117390
34 : pwbill.text 842
35 : test1.txt 36
ftp>
```

To download any file follow this:

```
ftp> get pwbill.text

Reading file pwbill.text from 192.168.90.5:
File transfer in progress...

[Transfer complete - 842 bytes]

842 bytes copied in 0.036 secs (23388 bytes/sec)
ftp>
```

To save any file in FTP server follow this:

```
(passive mode on)
ftp>put test1.txt

Writing file test1.txt to 192.168.90.5:
File transfer in progress...

[Transfer complete - 36 bytes]
```

CONCLUSION

This report describes how we have designed network topology of hospital (Health care Management System). With VLSM for Subnetting, segmented the diagram into 8 segments. This topology can also be implemented on higher level of hospitals.

With the growth of information technology in every sector and explosion of medical IOT devices, the design of a network of any hospital has become very essential factor. The hospitals need to have a reliable, secure and scalable network design in order to keep the patients information, doctor's research work safe, convenient communication between various departments, etc. as well as keep it ready for any new IOT medical equipment that may be introduced in the future. The hierarchical model of networking best suits our needs along with providing additional features like easy maintenance, high security, simplified troubleshooting and effective performance.