



Program: MSc Information Systems with Computing

Module: Networks and Systems Administration

Assignment: CA 1

Submitted to: Prof. Obinna Izima

Submitted by: Deep Shah (10557732)

TABLE OF CONTENTS

Acronyms	4
1. Introduction	4
1.1 Aim	5
1.2 Scope of this project	5
1.3 Approach for implementing this project	5
2. Background	5
2.1 Advantages of the System	6
2.2 Similar Hardware	6
3. Technologies	6
4. Technical Description	7
4.1 Switches	8
4.2 Server & Router	9
4.3 Machines	9
4.4 IOT(HomeGateway)	11
4.5 FTP	11
4.6 DNS	12
4.7 DHCP	13

4.8 HTTP	14
4.9 Cloud Networking	16
4.10 P2P Connections	17
5. Project Testing	17
5.1 Testing IOT	17
5.2 Testing FTP	19
5.3 Testing DHCP	21
5.4 Testing DNS	22
5.5 Testing HTTP	22
5.6 Testing P2P	23
6. Evaluation	25
7. References	25

TABLE OF FIGURES

Figure No 1. School Network	8
Figure No 2. Switch Connection	9
Figure No 3. PC's IP address example	10
Figure No 4. IoT Home Gateway	11
Figure No 5. FTP Server Services	12

Figure No 6. DNS Services	13
Figure No 7. DHCP Configuration for DHCP1 and DHCP2	14
Figure No8. HTTP Services	15
Figure No 9. Cloud Network	17
Figure No 10. Devices Connected on Smartphone	18
Figure No 11. IoT Testing	19
Figure No 12. FTP Testing	20/21
Figure No 13. DHCP Services	22
Figure No 14. HTTP Testing	23
Figure No 15. P2P Connection	24

Acronyms

IoT: Internet Of Things

DHCP: Dynamic Host Configuration Protocol

HTTP: Hypertext Transfer Protocol

DNS: Domain Name System

FTP: File Transfer Protocol

IP: Internet Protocol

LAN: Local Area Network

PC: Personal Computer

MAC: Media Access Control

P2P: Peer To Peer

1. INTRODUCTION

Computer networks enable communication for every business, entertainment, and research purpose. The internet, online search, email, audio and video sharing, online commerce, live-streaming, and social networks all exist because of computer networks..So basically networking is a form of telecommunication between different mediums like computers or smartphones.The best network which is known by almost everyone is the internet. If an information can be transferred successfully from one device to another then it is considered as networking. Switches,routers,gateways,modems,etc are utilized for networking.Thus networking plays an important role in today's world.

1.1 Aim

Implementation and design of Network and System is represented in this project.
Building and establishing a Network between various departments of a school while implementing System administration technologies that helps to communicate easily between all the departments along with deployment of IoT via HomeGateway which can be accessed and configured remotely.

The aim of this project is to create a network for an entire school that has three different departments and how they can ardently communicate at the same time with each other with One of the departments acting as main department.The project also centers on different networking layouts which helps in making the communication secured.

1.2 Scope of the project

By using various system architectures this project focused on construction and administration of a School network which can handle challenging tasks and other Computing technologies. The system technologies will be discussed in the Technologies section of the Project. Connection of IOT will also be a focus of implementation in this project

1.3 Approach for implementing this project

The project is made with the intention of letting three departments of school communicate and share information to each other with the help of networking technologies and Management Department being the head of all the departments. The approach was very disciplined and that was beneficial in implementing the different

technologies related to the project. This helped in functioning of the school become more easy, simple and time-saving.

2. Background

This project foundation is to build a network between three different departments of the school with the Management department being the head of all departments. It could be achieved using Cisco Packet Tracer. After the successful implementation of this network, it can help in improving the communication between the three departments. With the help of this project , all the three departments can be virtually connected to each other. Also , the implementation of IoT helps in controlling the devices used in school remotely via smartphone.

2.1 Advantages of the System

As it is already known that Cisco Packet Tracer is used for this project. Based on my understanding and researches done by me , I opted to make this project on Cisco Packet Tracer. The reason for choosing the Cisco Packet Tracer was that Users can easily create network topologies In Cisco Packet Tracer by just dragging and dropping routers,switches and all the other types of required network devices. Also, according to wikipedia Cisco claims that Packet Tracer is useful for network experimentation.

2.2 Similar Hardware

1. AWS: It provides access to on-demand digital courses like AWS Cloud Practitioner Essentials, Big Data Technical Fundamentals, Security Fundamentals, and Job Roles in the Cloud. You can also explore new training to learn about Machine Learning and Storage.
2. CloudShare: It helps software organizations grow revenue, increase efficiency and improve quality by making it easy to replicate complex on-premise IT environments in the cloud, with specialized solutions for training, sales enablement, and sandboxing for testing and support

3. Technologies

Following are the technologies which were useful for this project :

1. Cloud Computing : Cloud Computing helps in the connection of IoT. It acts as a third party which offers users to gain secured access to the servers or connected devices.
2. IoT : IoT acronyms for Internet of Things. IoT helps in automation of various appliances that are used. These are embedded with sensors. It can send and receive data.
3. DHCP : DHCP acronyms for Dynamic Host Configuration Protocol. With the help of DHCP IP(Internet Protocol) address, subnet mask, default gateway is automatically provided to IP host.
4. FTP : FTP acronyms for File Transfer Protocol. It is used for transmitting files from one host to the other. FTP can be used to upload or download files from the server.
5. DNS : DNS acronyms for Domain Name System. It helps in telling the name of the sites using its IP address. It is a secured and efficient process. In simple terms, DNS acts like a directory of names and IP addresses.
6. HTTP : HTTP acronyms for Hypertext Transfer Protocol. It helps in fetching the data from html files. It acts as a data exchange between the web and user. It is TCP/IP based communication protocol.

4. Technical Descriptions :

For implementing the project , we have made use of Cisco Packet Tracer. Using Cisco Packet Tracer we have connected the three departments of the school that is Management Department , Administration Department and Faculty Department. Management Department is the head of all the departments. We have also used various networking technologies as described in the above part. We have made use of 4 routers all performing different tasks. All the routers are connected to each other via cables. The router is connected to the switches of each department. The switch of each department is connected to the PC and servers. Only 1 server is connected directly to the router. There are total of 9 PC used in our project. Each PC is connected to the switch. Also, we have made use of 3 Servers. Two of them are DHCP servers and One server performs the tasks of DNS, FTP and HTTP. The reason for choosing three different servers was for the efficient working of servers. We did not want the servers to take much load and get crashed frequently. IoT is connected through cloud separately using Home Gateway which can be operated by a smartphone. It helps in controlling the devices in school premises remotely.

The Image below shows our Network

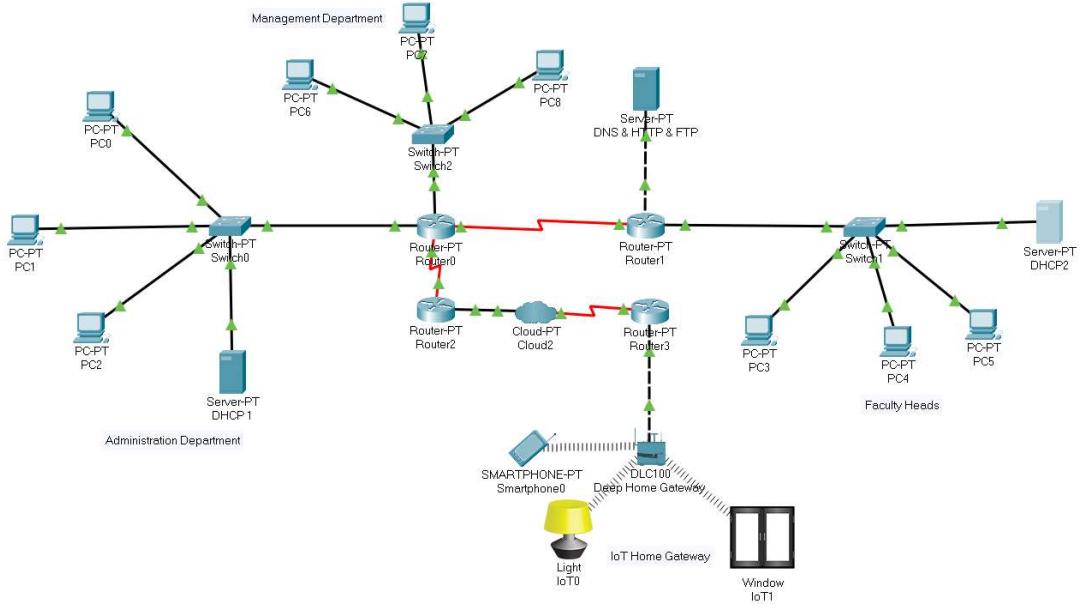


Fig 1. School Network

4.1 Switches

Switches are used for connecting multiple devices of the same network.

We have used a total of Three Switches for this network deployment, they are named as Switch 0, Switch 1 and Switch 2. Switch 0 connects the Administration Department with the router, Switch 1 connects the Faculty Department with the router and similarly Switch 2 connects the Management Department with the router.

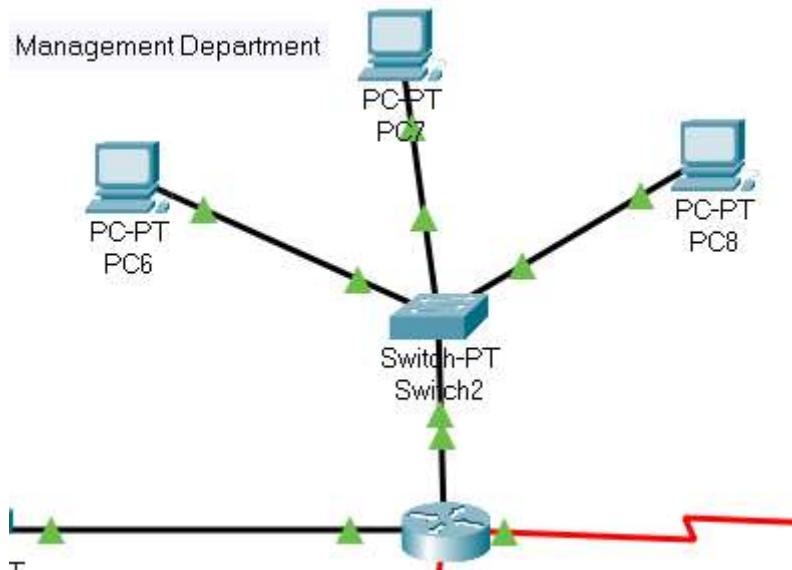


Fig 2. Switch connections

4.2 Server & Router :

Servers are used for transferring the data from one source to another with the help of Local Network. For the project , we have made use of 3 Servers for the ease of use as mentioned in the Technical description.

Routers acts as a medium to connect with other systems.Routers are used for forwarding the data from one source to another. Router reads the network address and forwards it to the respective address. Router ensures that the data is sent to the perfect address and is not misplaced or lost.

As mentioned earlier, we have made use of 4 routers. All routers are assigned differently with different servers or switches. The Four routers are named as Router0 , Router1 , Router2 and Router3.

Router0 is connected with switch0 and switch2 that connects the Administration Department and Management Department respectively. One end of Router0 is connected to Router1 and One end is connected to Router2.

Router 1 is connected to the DNS,HTTP and FTP server. Also the other end is connected with switch1 which connects the Faculty Department.It is also connected with Router0.

Router2 is connected with Router0 and also Cloud.

Router3 is connected with Cloud and IoT HomeGateway. Thus we can say that all these routers help in connecting our entire network.

In Fig.1 we can clearly see the connections of Servers and Routers.

4.3 Machines :

For this network structure, we have made use of 9 PC , Each department having 3 PC. These machines are used to send or receive data and messages from one system to another with the help of switches.

PC0,PC1,PC2 are assigned with the Administration Department.

PC3,PC4,PC5 are assigned with the Faculty Department.

PC6,PC7,PC8 are assigned with the Management Department. Each PC has its own unique IP address.

A Smartphone is also assigned with the HomeGateway for controlling the IOT devices
The image below shows the example of the PC's IP address.

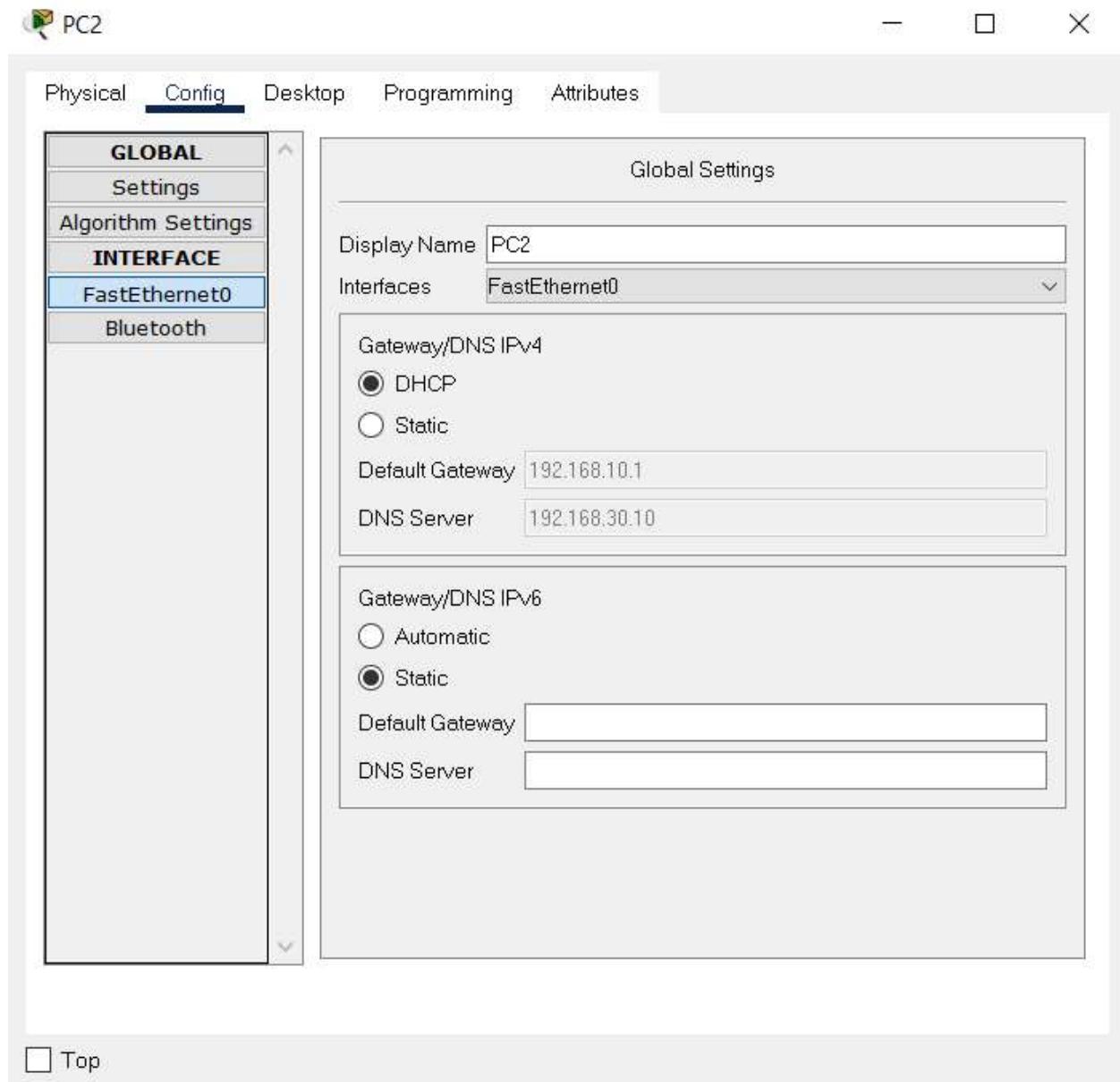


Fig 3. PC's IP address example

4.4 IOT(HomeGateway)

IoT refers to Internet Of Things. For the project we have connected the IoT devices via Home Gateway . This is connected with the router and that router is connected with the cloud. Thus we are connecting IoT to the School Network via cloud. With the help of this, user can access the devices remotely through a smartphone. In our Network Structure the HomeGateway is connected to Router3 and that is connected with cloud. Image below represents our IoT structure.

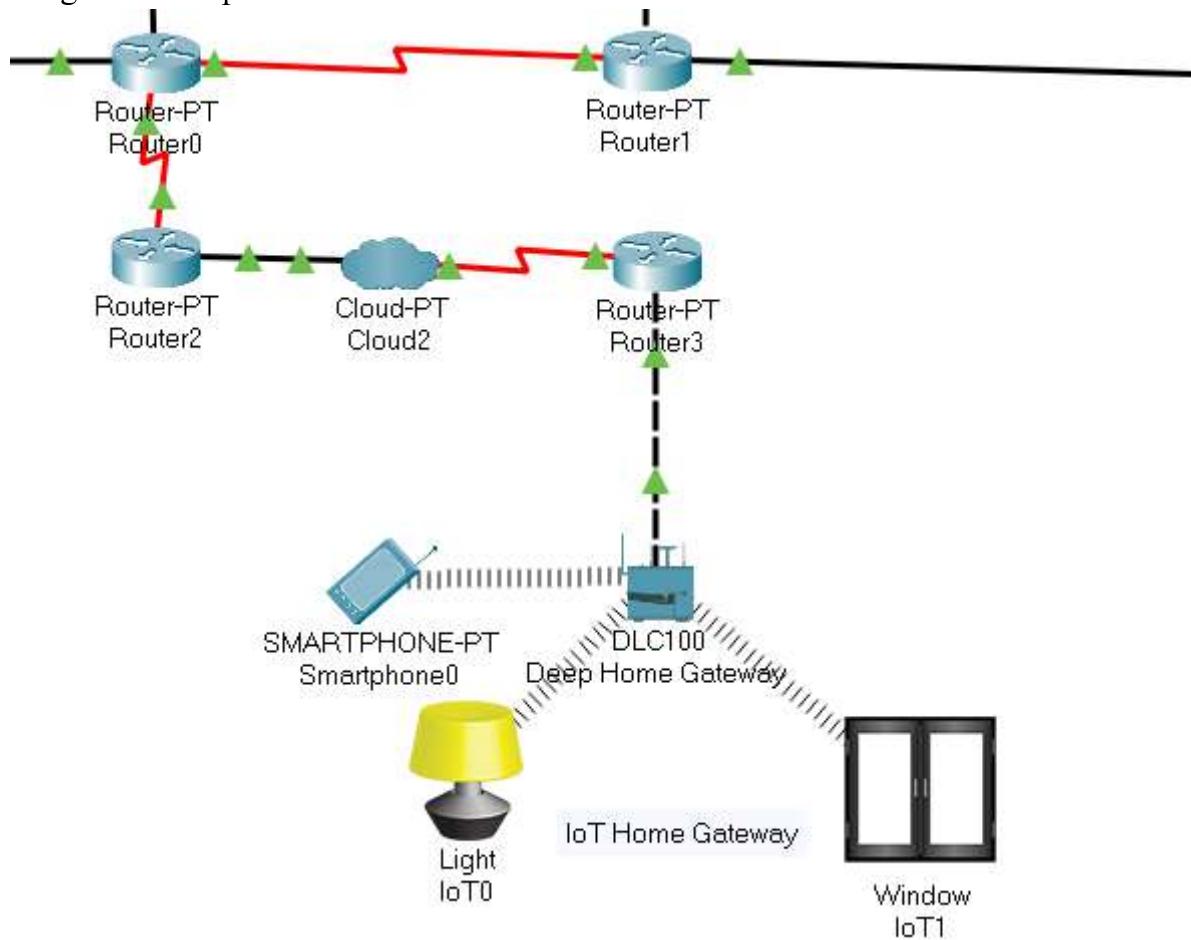


Fig 4. IoT Home Gateway

4.5 FTP :

FTP acronyms for File Transfer Protocol. We have used 1 server for FTP that is connected with Router1. This FTP server allows all the devices in the network to make changes in the data. To access the FTP , a user needs to enter the login credentials like user ID and password. If the credentials are proper, the user gets access to the server.FTP server is connected to the Router1 with the help of ethernet cable.

Below Image shows our FTP server services.

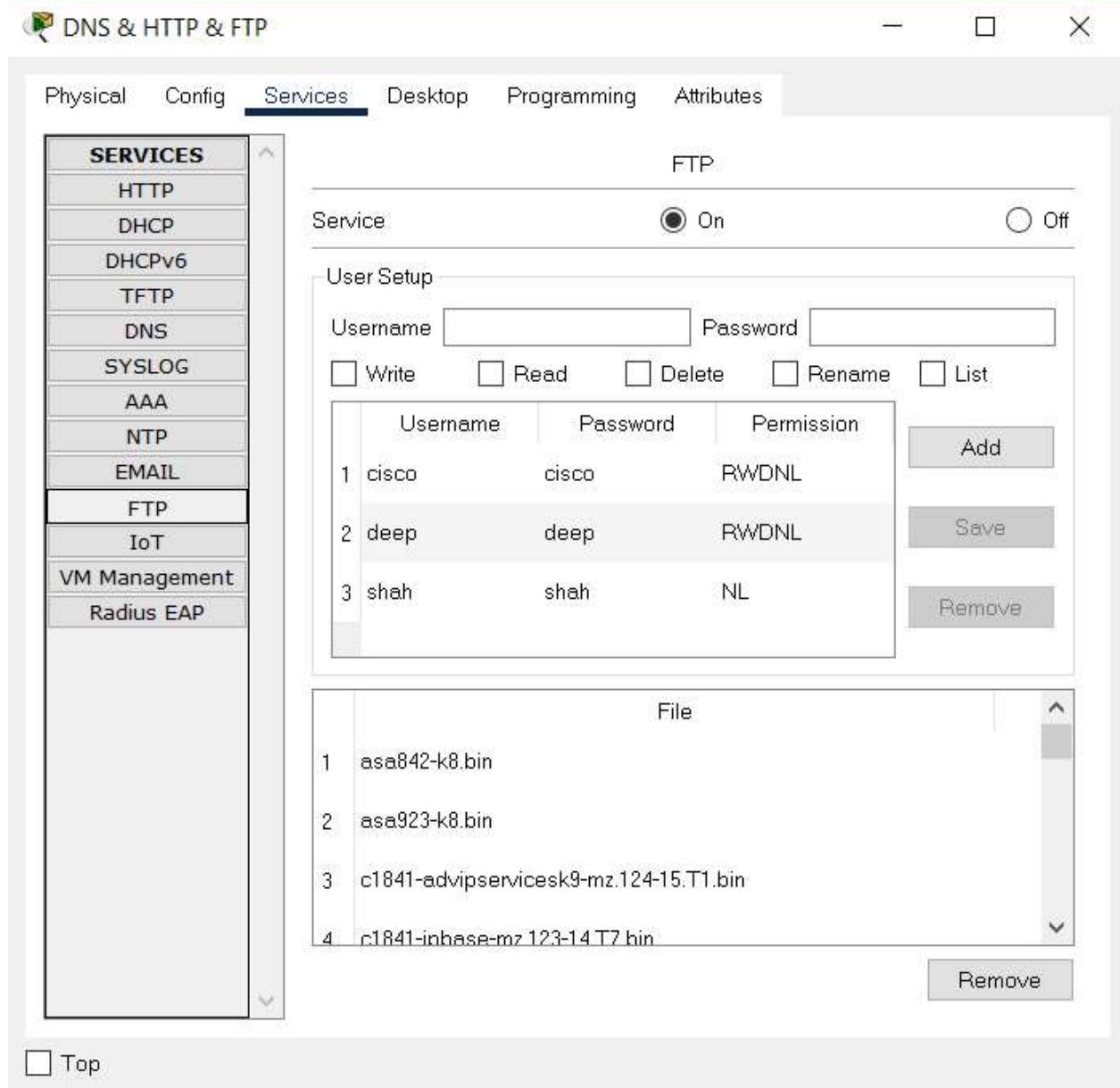


Fig 5. FTP Server Services

From the above image we can clearly see that different users are given different permissions.

4.6 DNS :

DNS acronyms for Domain Name System. In this Network structure we have made use of a DNS server and given the domain name as ‘mydemo.com’ with type ‘A Record’ and

address 192.168.30.10. The DNS server is connected to router1 with the help of ethernet cable.

The image below refers to our DNS server.

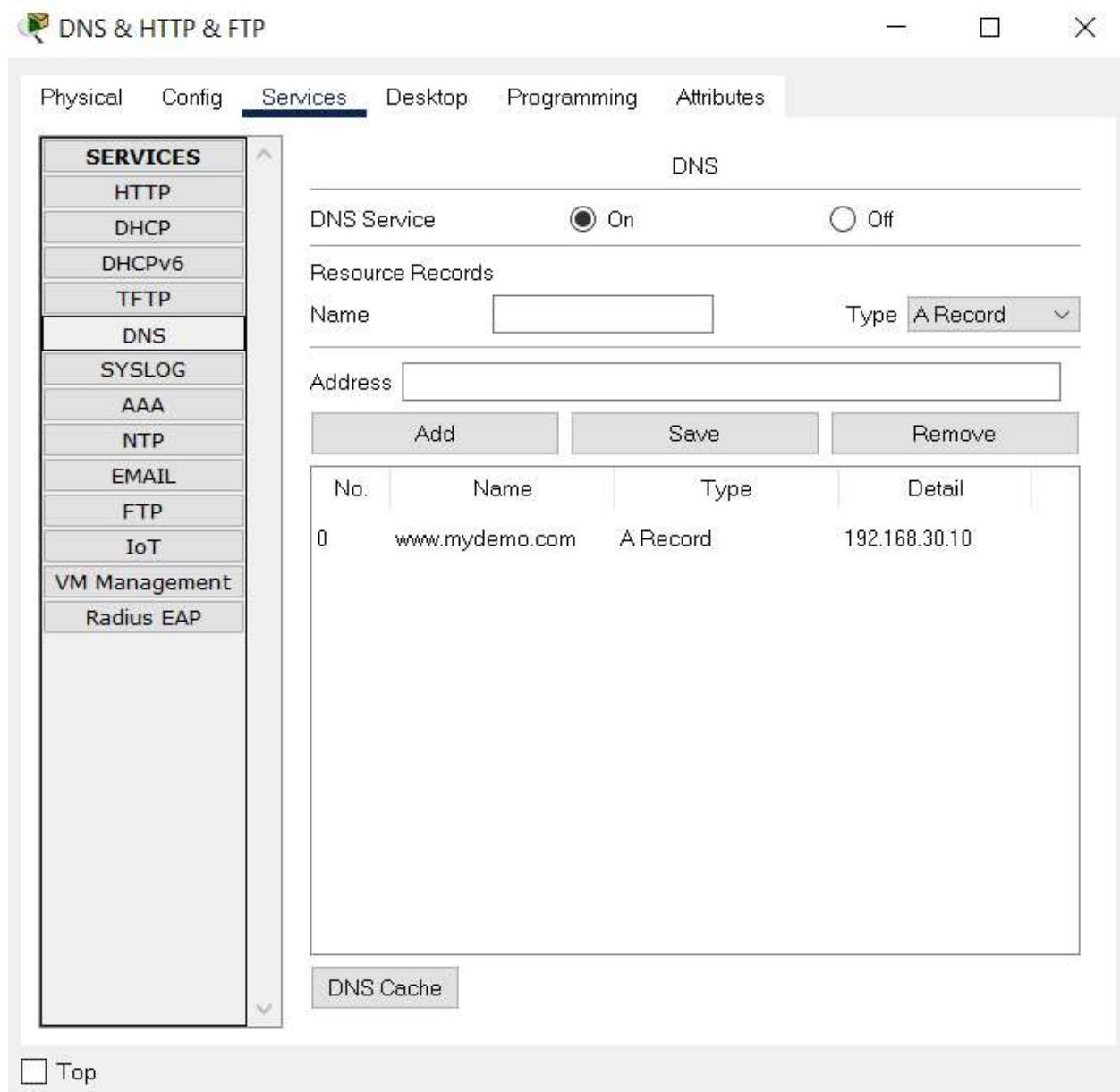


Fig 6. DNS Services

4.7 DHCP :

As discussed earlier, we have used 2 different DHCP servers for our Project. DHCP 1 is used for the Administration Department and DHCP 2 is used for the Faculty Department. These DHCP Servers automatically assigns the IP addresses to the connected machines. Thus making it easier to communicate with the system . DHCP

servers are connected to the router with the help of a switch. The Management Department does not have DHCP servers rather they are statically connected to the router. As seen in Fig 1. DHCP 1 Server is connected to switch0 and DHCP 2 server is connected to switch1. All these connections are done with the help of ethernet cables. In Fig 1 , we can see the connections of our DHCP servers with the switch.

We connect DHCP 1 and DHCP 2 servers with Pool Name ‘serverPool’. The IP addresses will be different.

Below image shows DHCP configuration.

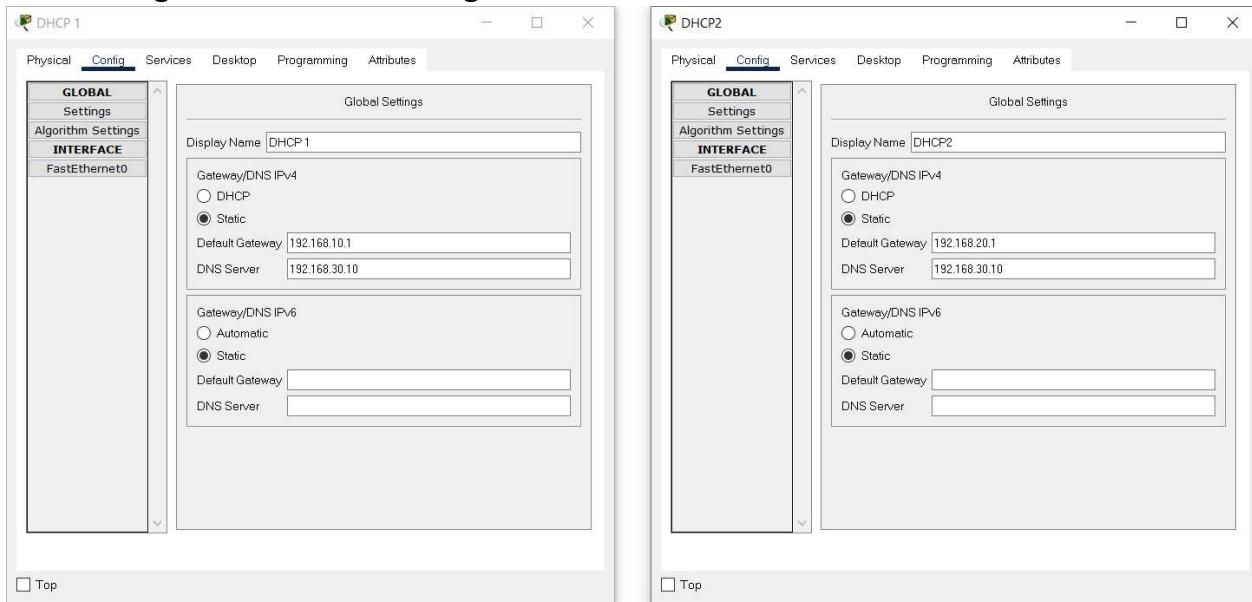


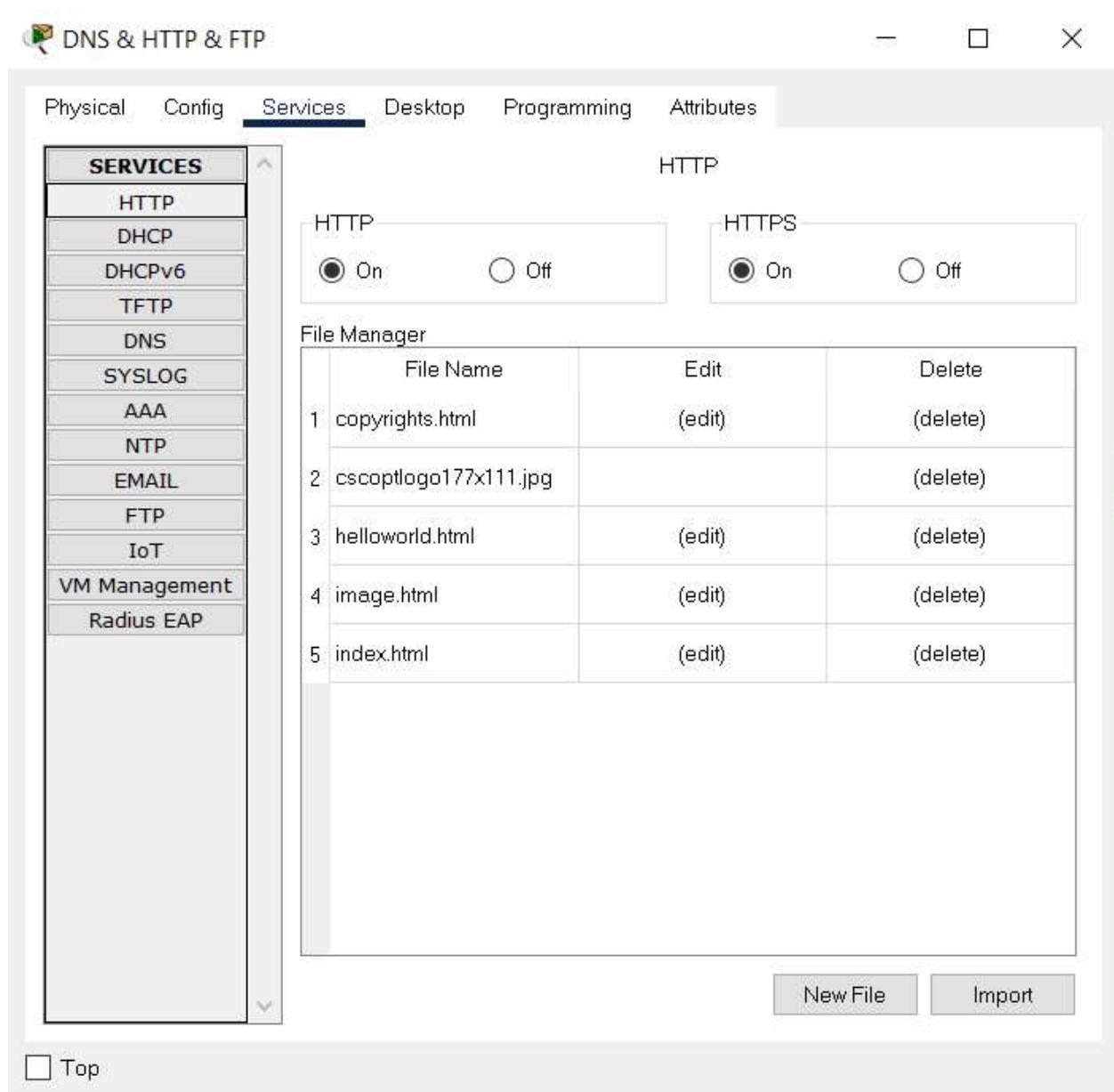
Fig 7 . DHCP Configuration for DHCP1 and DHCP2

4.8 HTTP :

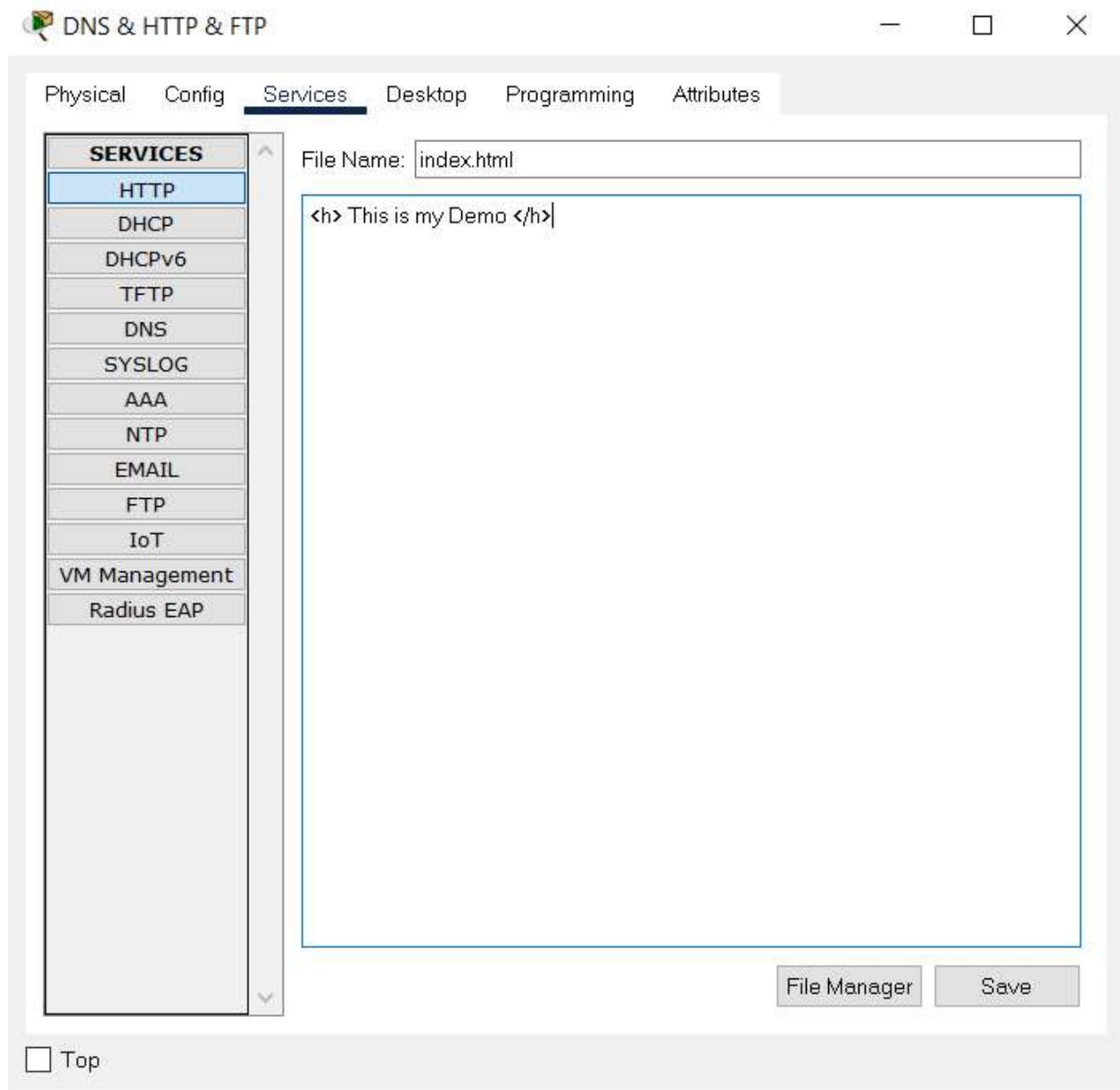
As described earlier , http is helps in reading the html file from the domain.

For our School Network , we have assigned http to a different server that is connected with Router1 with the help of ethernet cables. All the machines in our system can open this by entering the proper domain name.

Below image represents our HTTP Services.



(Fig 8. HTTP Services Examples)



(Fig 8. HTTP Services Examples)

4.9 Cloud Networking :

For this School Network , Cloud Networking helps us connect the IoT devices with the School Premises. This cloud acts as a third party and helps in operating with the help of Smartphones. This Cloud Network behaves like the connection between the Router2 and Router3.

The Image below represents our cloud network.

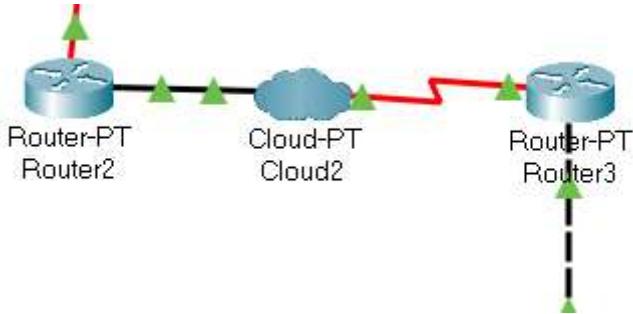


Fig 9. Cloud Network

4.10 P2P Connections :

One of the main objectives of this School Network is that all the machines should be able to communicate with each other. For this peer to peer connection is very important. P2P connections can be achieved by properly configuring all the machines, switches, servers and routers used to build the network.

5. Project Testing :

We made the entire School Network on Cisco Packet Tracer version 8.0 ; The use of Cisco Packet Tracer made the work a lot simpler and quicker. As mentioned in the introduction part , we tried to reach our Aim of the project by following necessary steps and doing the configuration part as required. Testing the entire project gave us successful results . Below are the details of the testing part.

5.1 Testing IOT

The IoT part was connected via router and cloud using Home Gateway. The aim of using IoT was to control the devices remotely through a smartphone. We were successful in doing that and thus now we can control the Lights and Windows with Smartphone. Below image represents our successful connection of IoT devices on smartphone.

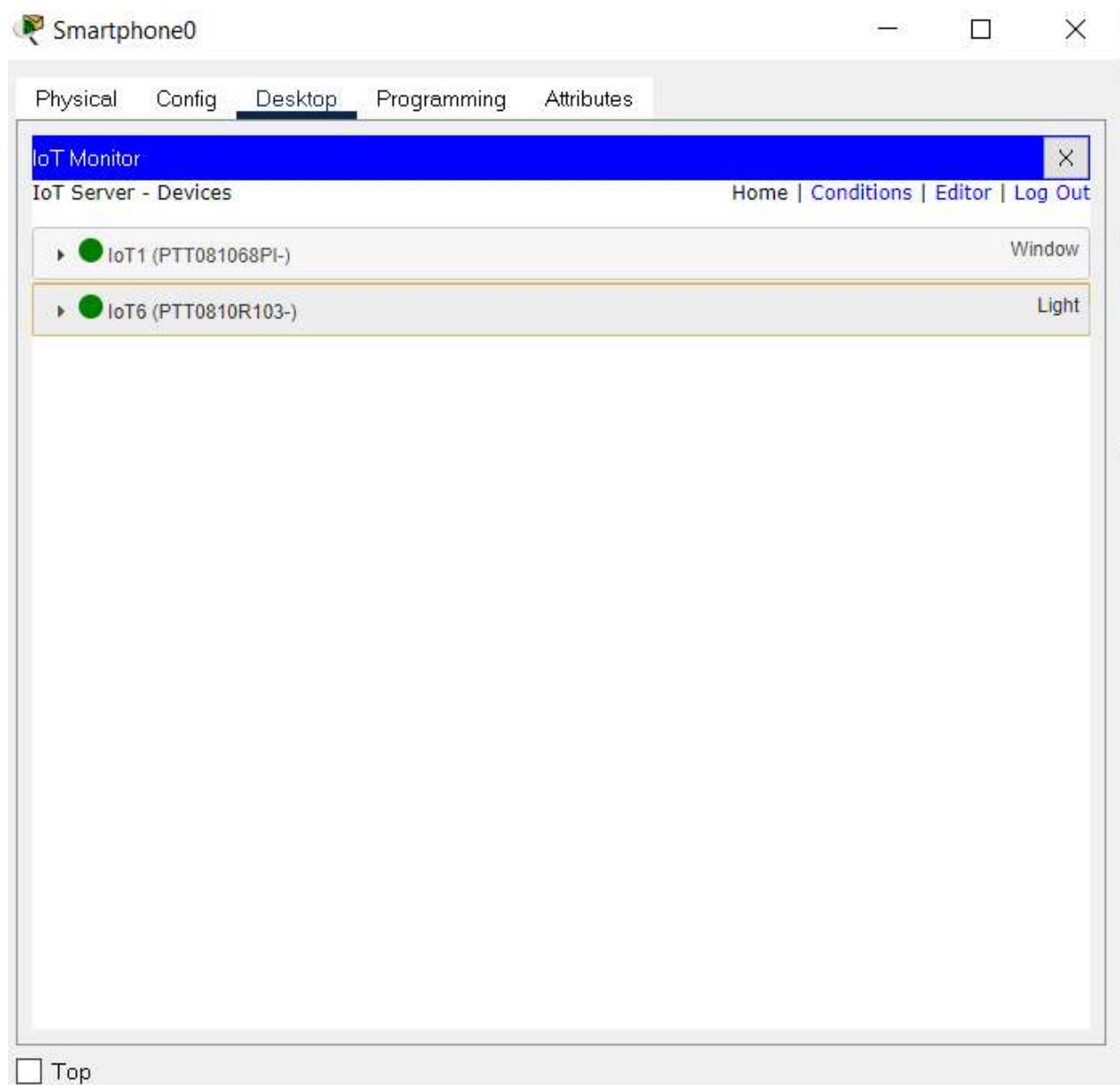


Fig 10. Devices Connected on Smartphone

We can see from the above image that 2 devices Window and Light can now be operated through a smartphone.

The image below represents that testing was successful

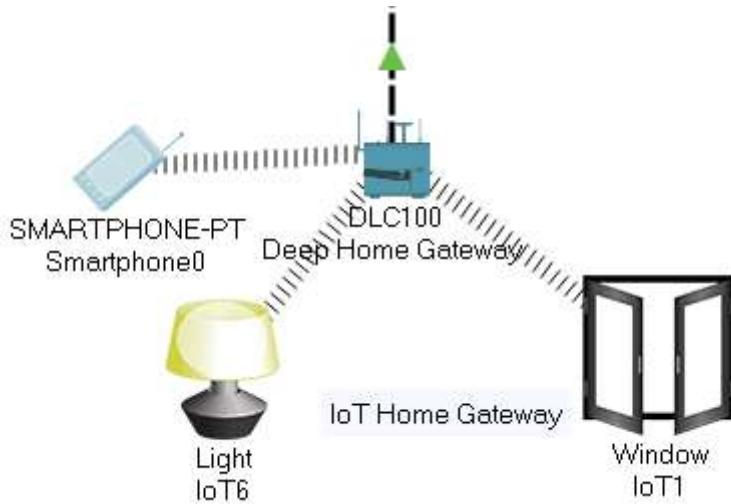


Fig 11. IoT Testing

From the above figure it is clearly visible that Light is ON now and the window is open. IoT is working successfully.

5.2 Testing FTP :

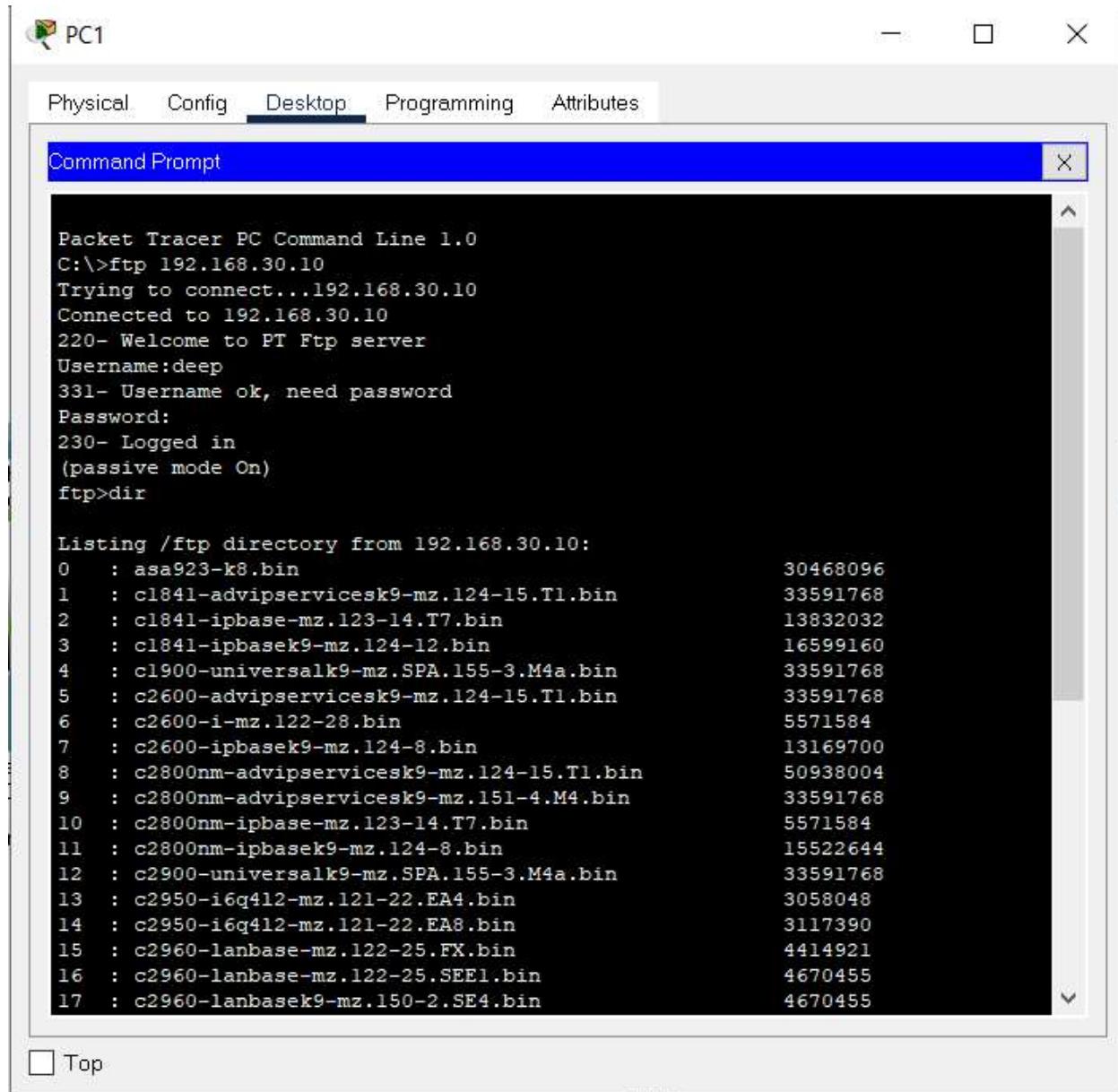
FTP implementation is necessary so as to perform different tasks from any of the machines in our system.

We configured the FTP servers and tried connecting it through other PC's. We were successful in performing the said task.

We tried opening the directory of ftp server . The server asked to enter login details. After the details were entered correctly , we could access the server.

We opened the directory and deleted the details associated with number 31 from the list. It was successfully implemented.

The Figure below represents successful implementation of FTP server.



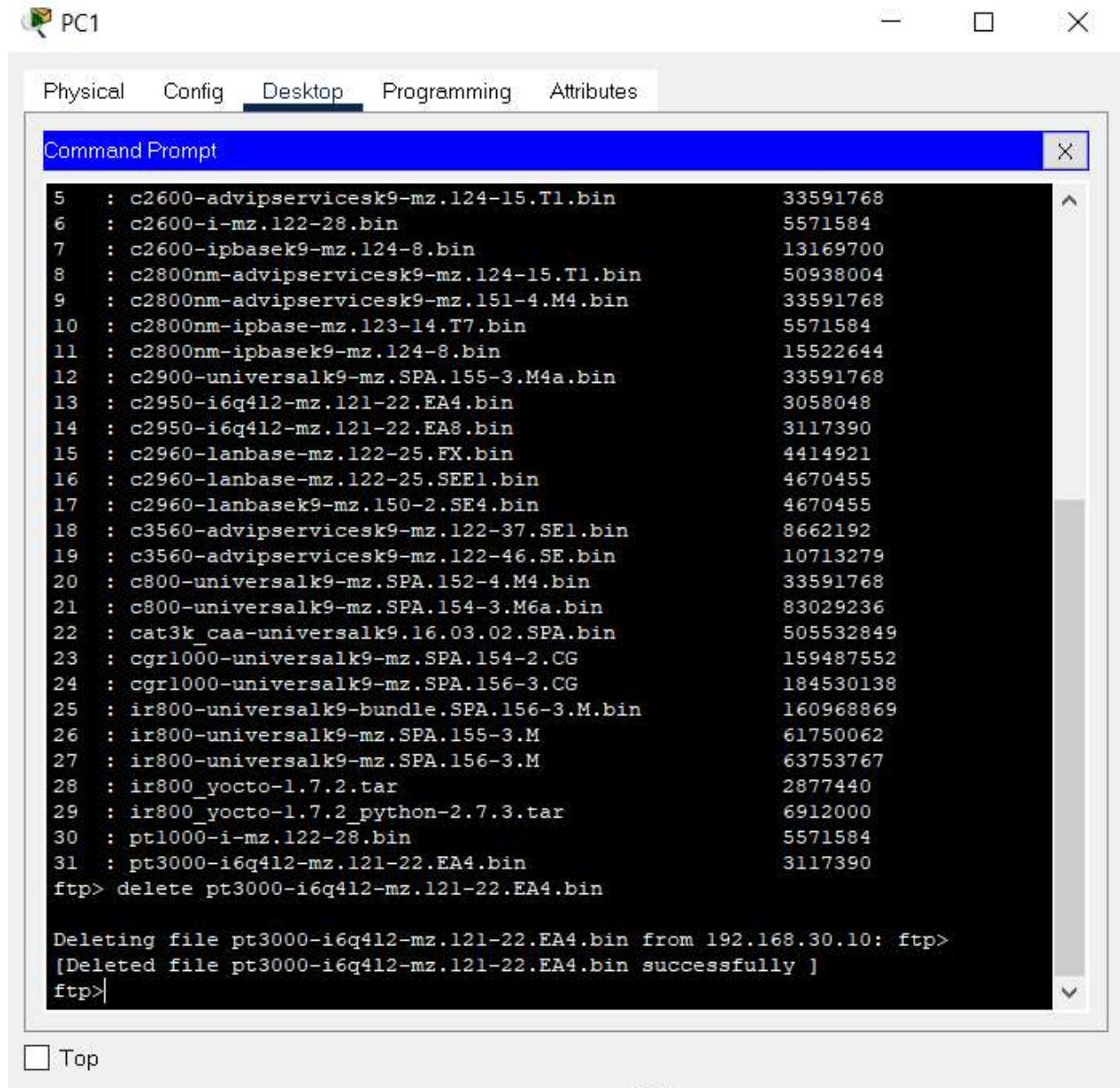


Fig 12. FTP Testing

From the above image we can clearly see that details of list no.31 is deleted successfully from the ftp server.

5.3 Testing DHCP :

The two DHCP servers in our Network is configured properly. This has also helped in assigning the IP addresses automatically.

Below images show the representation of our both the DHCP servers.

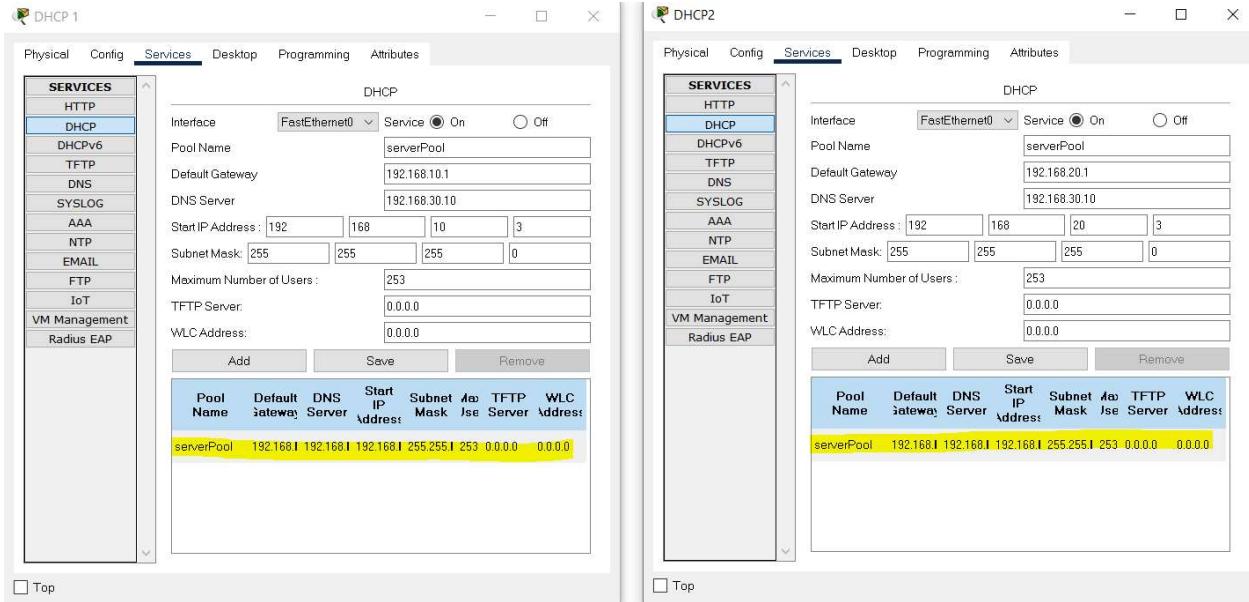


Fig 13. DHCP Servers

From the above image we can see that a Pool Name with ServerPool is created in both the DHCP servers.

Default Gateway for DHCP 1 is 192.168.10.1

Default gateway for DHCP 2 is 192.168.20.1

5.4 Testing DNS :

We had entered the domain name as mydemo.com; This was done properly with proper configuration. Other systems were successfully able to connect with the DNS server. The Default gateway of our DNS server is 192.168.20.1 ; It is connected through ethernet cables with router2.

DNS was tested successfully.

5.5 Testing HTTP :

We had created the http server and configured it systematically so that each machine can access the http server and can gain the data in it.

We entered the http address in one of the PCs and we could see the data in it.

Thus it was tested successfully and is working properly.

Below image refers to the successful implementation of HTTP.

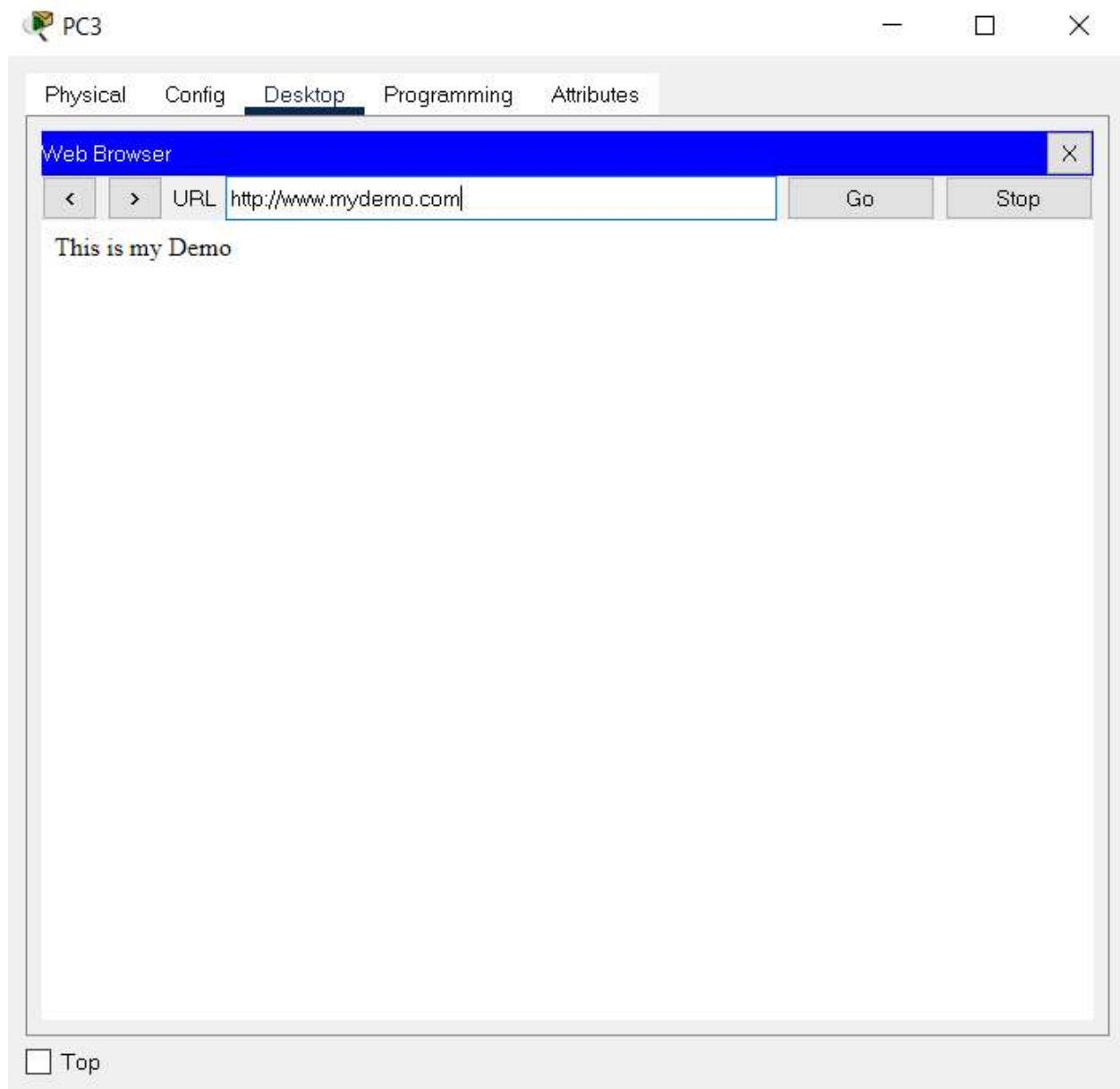


Fig 14. HTTP Testing

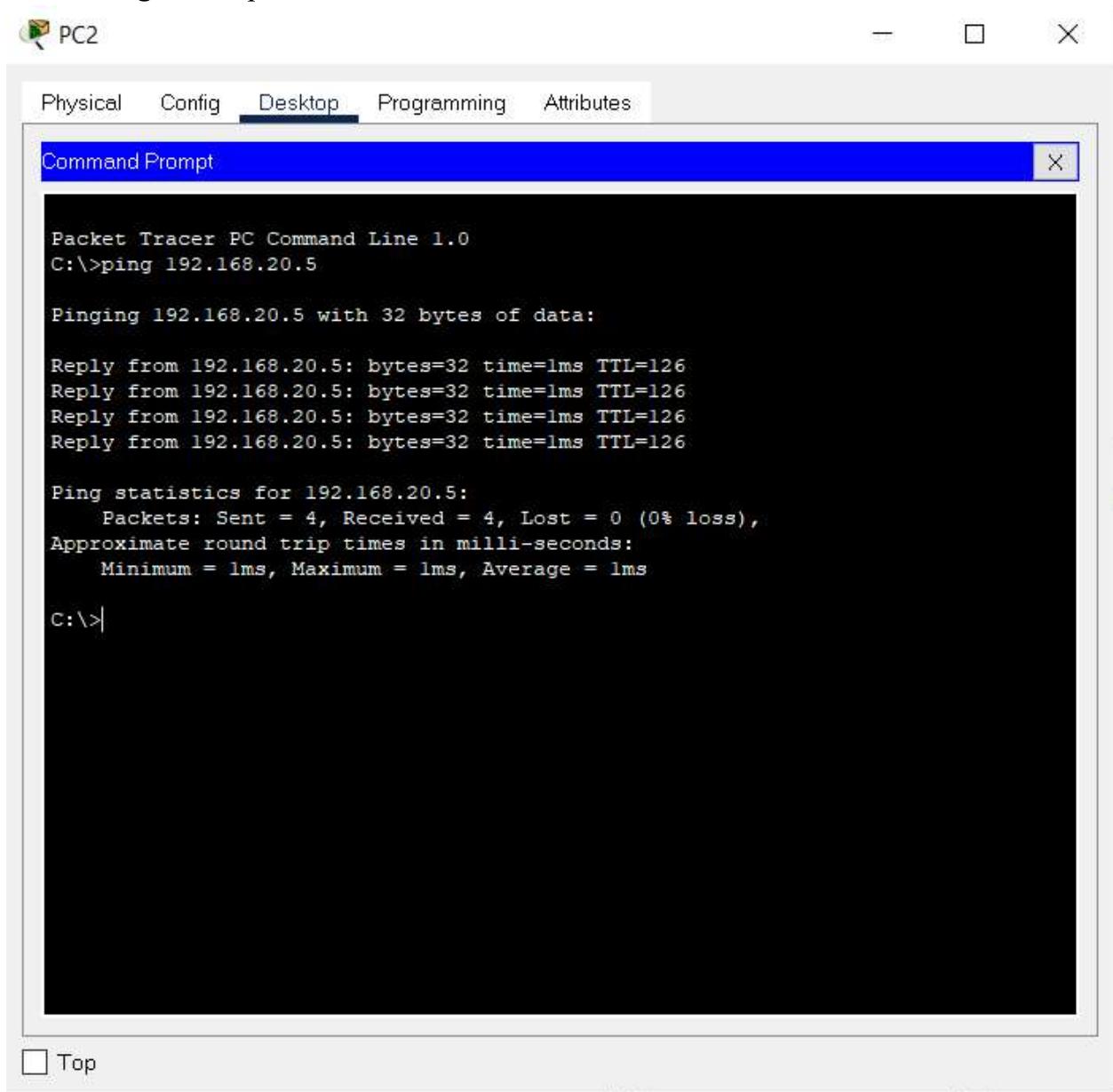
In the above image we can clearly see the details of HTTP Server.

5.6 Testing P2P :

One of the most important part of our project was the peer to peer connection, that means all the machines in the system should be able to communicate with each other without any difficulties. We were successful in achieving this goal.

All the machines in the system are able to communicate with each other.

Below image is the proof of our P2P connection.



The screenshot shows a Windows Command Prompt window titled "Command Prompt". The window is part of a software interface with tabs for "Physical", "Config", "Desktop" (which is selected), "Programming", and "Attributes". The command entered is "ping 192.168.20.5". The output shows four successful replies from the target IP address, each with 32 bytes and a TTL of 126. It also provides ping statistics: 4 packets sent, 4 received, 0 lost (0% loss), and approximate round trip times of 1ms minimum, maximum, and average.

```
Packet Tracer PC Command Line 1.0
C:\>ping 192.168.20.5

Pinging 192.168.20.5 with 32 bytes of data:

Reply from 192.168.20.5: bytes=32 time=1ms TTL=126

Ping statistics for 192.168.20.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 1ms, Average = 1ms

C:\>
```

Fig 15. P2P Connection

From the above image it is confirmed that we were able to successfully do the P2P connection, also the data was sent without any loss. We achieved 100% results.

6. Evaluation :

After critically examining the project plan and the architecture that has been deployed by the platform we see that the school network helps connect the various parts of the school in a very concise and efficient manner.

The shortcoming of the project generally relates to two areas. The first one is the user of four servers for our school network. This use of four servers takes a toll on the capital of the school and the second shortcoming relates to the networking structure. The network could have been deployed in a manner wherein it connects to more intricate parts of the department segregating the network in a more complex manner.

Furthermore the architecture proves to be a stronghold when it comes to file sharing and accessing web configurations in a school premise.

7. References:

IBM.Networking a complete guide(2021) Available at
<https://www.ibm.com/cloud/learn/networking-a-complete-guide>
(Accessed :09 Mar 2021)

G2.Cisco Packet Tracer Alternatives & Competitors(2020) Available at
<https://www.g2.com/products/cisco-packet-tracer/competitors/alternatives>
(Accessed :11 Mar 2021)

Gordon Davies(2019)Networking Fundamentals: Develop the networking skills required to pass the Microsoft MTA Networking Fundamentals Exam 98-366. 1st edn. Packt Publishing.