

College Computer Network Design

by

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List of Abbreviations

| | |
|---------------|-------------------------------------|
| DNS | Domain Name System |
| DHCP | Dynamic Host Configuration Protocol |
| E-Mail | Electronic-Mail |
| IoT | Internet of things |
| FTP | File Transfer Protocol |
| TCP | Transmission Control Protocol |
| IP | Internet Protocol |
| CPT | Cisco Packet Tracer |

Chapter 1

Introduction

The Increasing demand of high-performance network has challenged network researchers to design network architectures capable of delivering a high quality of service to end users. The network infrastructure design becomes critical part for every college and IT organization. As every college needs a network design as per their respective department so they can have a control over every department by dividing the college Network Architecture design into respective department wise which is required for a proper control on the camera to have a proper visual of each department which helps in the safety of staffs and student of college. The college department wise network has to be made secure as well so that essential data like students and teacher's personal information does not fall into wrong hand or the result of students doesn't get tampered.

In general, we need to design a network topology that is easy to understand, easy to manage, easy to troubleshoot and is adaptable to change in future according to the new department. This network design offered concentrates on the positions of each element in the department network and how these components and capability can solve these issues of security concerns of college.

Chapter 2

Component Details

Switch

Switches are networking devices operating at layer 2 or a data link layer of the OSI model. They connect devices in a network and use packet switching to send, receive or forward data packets or data frames over the network.

A switch has many ports, to which computers are plugged in. When a data frame arrives at any port of a network switch, it examines the destination address, performs necessary checks and sends the frame to the corresponding device(s). It supports unicast, multicast as well as broadcast communications.



Fig. 2.1 Switch

Router

A router is a device that connects two or more packet-switched networks or subnetworks. It serves two primary functions: managing traffic between these networks by forwarding data packets to their intended IP addresses, and allowing multiple devices to use the same Internet connection.

There are several types of routers, but most routers pass data between LANs (local area networks) and WANs (wide area networks). A LAN is a group of connected devices restricted to a specific geographic area. A LAN usually requires a single router.



Fig. 2.2 Router

Server

A server is a software or hardware device that accepts and responds to requests made over a network. The device that makes the request, and receives a response from the server, is called a client. On the Internet, the term "server" commonly refers to the computer system that receives requests for a web files and sends those files to the client.

Servers manage network resources. For example, a user may set up a server to control access to a network, send/receive e-mail, manage print jobs, or host a website. They are also proficient at performing intense calculations. Some servers are committed to a specific task, often referred to as dedicated. However, many servers today are shared servers that take on the responsibility of e-mail, DNS, FTP, and even multiple websites in the case of a web server.



Fig. 2.3 Server

Access Point

A Access Point is a device that enables wireless network packet forwarding and routing, and serves as an access point in a local area network. It works much like a wired router but replaces wires with wireless radio signals to communicate within and to external network environments. It can function as a switch and as an Internet router and wireless router.



Fig. 2.4 Access Point

Desktop Computer (PC)

PCs are multipurpose computer suited for individual end users, as opposed to high-performance computers that are typically reserved for IT specialists for carrying out tasks such as managing servers. PCs typically run on commercial Operating Systems (OS), commercial software applications, and freeware and open source software.



Fig. 2.5 Desktop

Laptop

Laptop computers, also known as notebooks, are portable computers that you can take with you and use in different environments. They include a screen, keyboard, and a trackpad or trackball, which serves as the mouse. Because laptops are meant to be used on the go, they have a battery which allows them to operate without being plugged into a power outlet. Laptops also include a power adapter that allows them to use power from an outlet and recharges the battery.



Fig. 2.6 Laptop

Air Conditioner (AC)

A Air conditioning (often referred to as AC, A/C or air con) is a system used to cool down the temperature in an inside space by removing the existing heat and moisture from the room. The air conditioner quickly converts gas into a liquid and back again using chemicals that remove the warm air from inside your home. It then gets disposed of outside. In simple terms, an air conditioning system controls the temperature, humidity and air quality in indoor spaces.



Fig. 2.7 Air conditioner

Webcam

A webcam is a camera that connects to a computer. It captures either still pictures or motion video, and with the aid of software, can transmit its video on the Internet in real-time. Today, most webcams are either embedded in the top edge of a laptop computer display or connected to the computer USB port.



Fig. 2.8 webcam

Home Gateway

Home gateway is a single component of networking hardware system applied in the field of telecommunication for the interaction of devices that enable the data flow from one discrete network to others. It act as routers or switches that are capable of interacting with multiple networks and can work on seven layers of the OSI model. The default gateway is referred to as the computer program

configures to do that task. It serves interoperability between networks and connected components like signal translators, fault isolators, protocol translators, rate converters and impedance matchers.



Fig. 2.9 Home gateway

Cables

The most 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) cables to connect network to router, routers to switch, switch to servers, switch to end devices. We chose UTP cables because of its interference cancelling capabilities. To be very particular we used cat-6 grade cables because of its maximum transmission speed of 1000mbps/100 meters. There is not much cost difference between cat-5e and cat-6 grade cable. So, it is a good choice to choose cat-6 cable for our network.



Fig. 2.10 Cables

Chapter 3

Methodology for Network Design

Network Design Architecture:

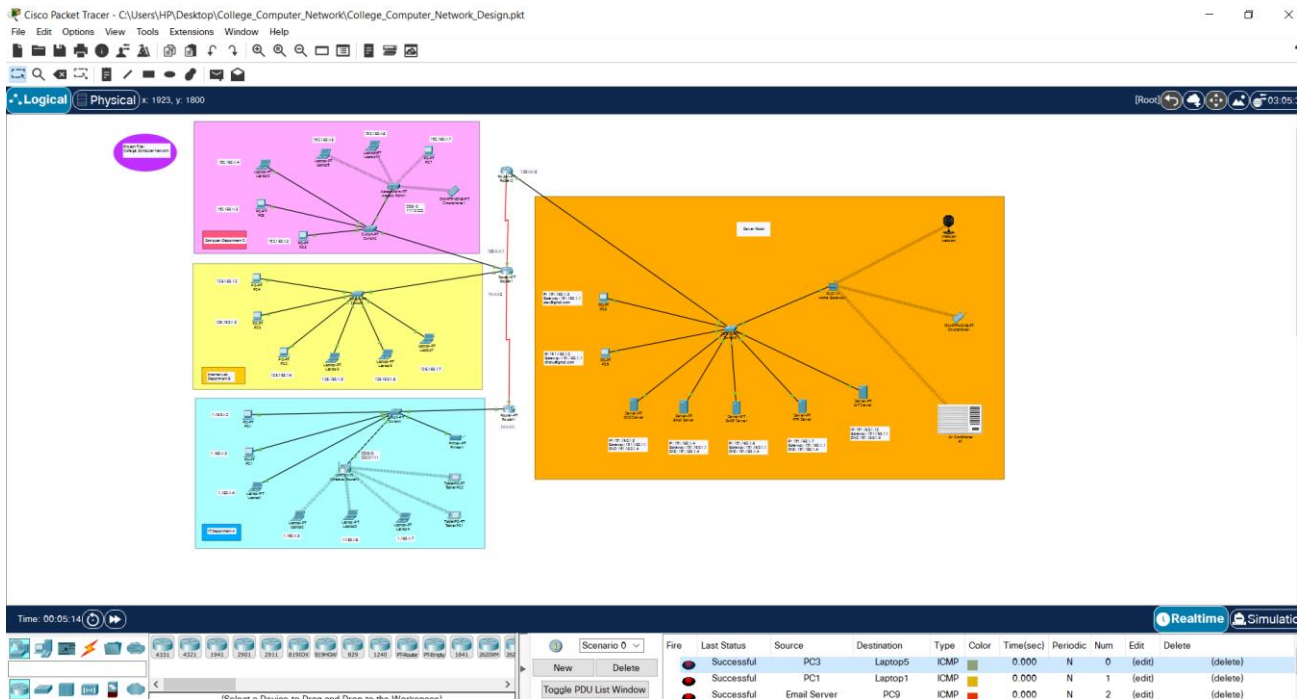


Fig. No. 4.1: Network Design Architecture

This is the network design of our College Computer Network Design. We have divided our network into 4 different departments i.e. Main server room, IT department, Computer department and Internet lab.

We have used different server for each service i.e., DHCP, DNS, IoT, Email and FTP.

We have used four switches one for each department and two switch is connected to an one router and another switches is connected to another routers.

We use IoT components web cam and Air Conditioner, it is controlled remotely by smartphone.

Also, we have assigned Default Gateway for each room. Each PC is assigned with its unique IP address.

Explanation of each Service

DNS

The Domain Name System (DNS) is the phonebook of the Internet. Humans access information online through domain names, like nytimes.com or espn.com. Web browsers interact through Internet Protocol (IP) addresses. DNS translates domain names to IP addresses so browsers can load Internet resources.

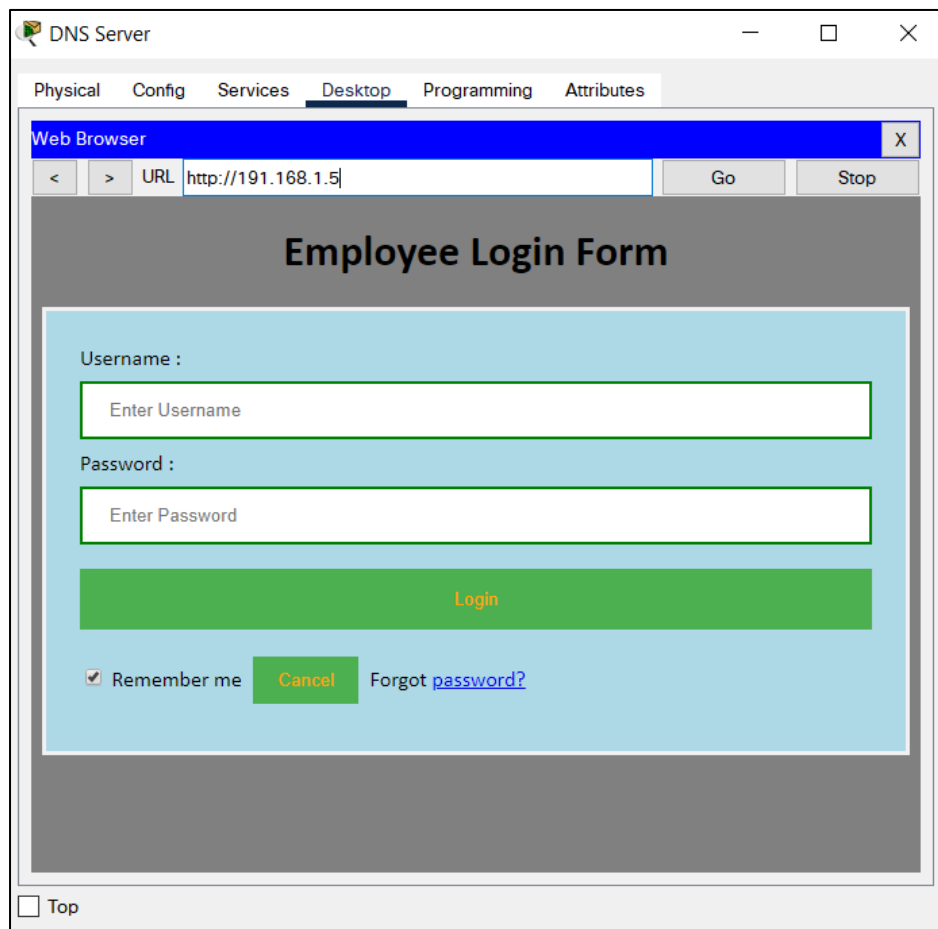


Fig. No. 4.2 DNS

DHCP

A DHCP Server is a network server that automatically provides and assigns IP addresses, default gateways and other network parameters to client devices. It relies on the standard protocol known as Dynamic Host Configuration Protocol or DHCP to respond to broadcast queries by clients.

A DHCP server automatically sends the required network parameters for clients to properly

communicate on the network. Without it, the network administrator has to manually set up every client that joins the network, which can be cumbersome, especially in large networks. DHCP servers usually assign each client with a unique dynamic IP address, which changes when the client's lease for that IP address has expired.

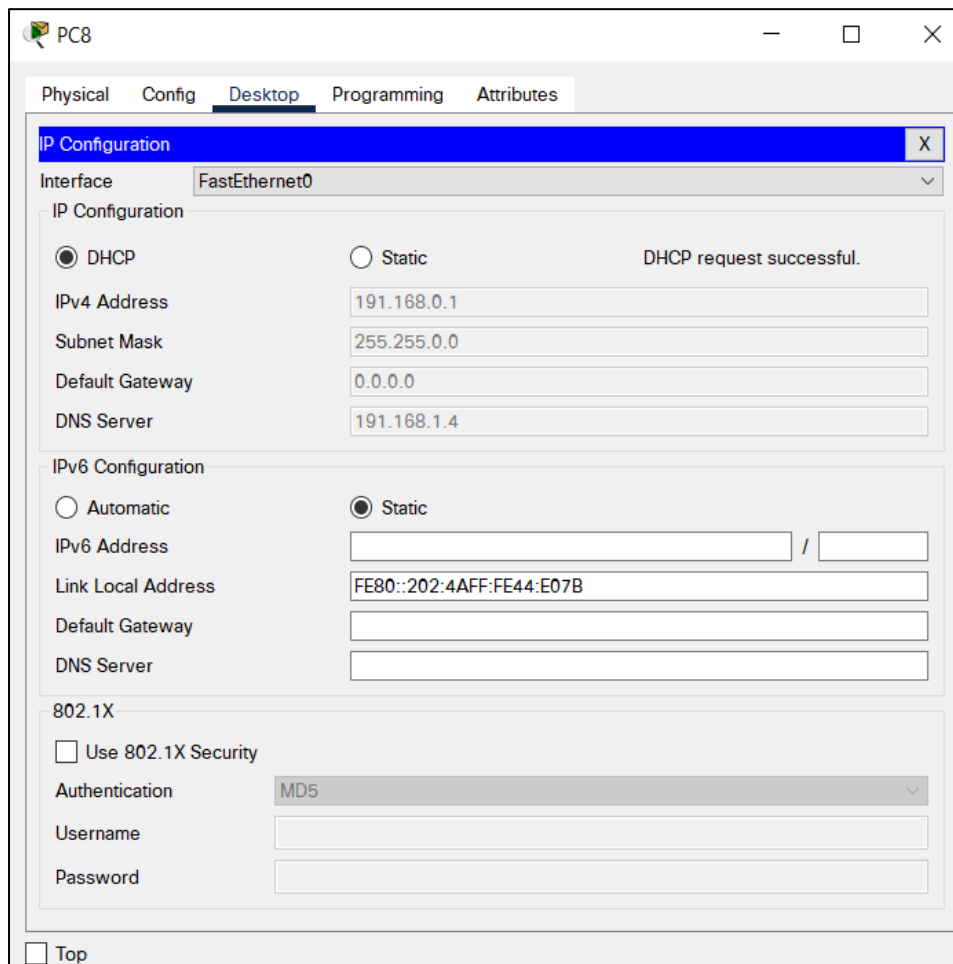


Fig. No. 4.3 DHCP

Email

A mail server (or email server) is a computer system that sends and receives email. In many cases, web servers and mail servers are combined in a single machine. However, large ISPs and public email services (such as Gmail and Hotmail) may use dedicated hardware for sending and receiving email. Email is a very efficient way to stay in touch with customers and visitors to your website. Your Web Hosting Hub account allows you to create an unlimited number of email addresses. Instead of paying for a stamp and putting a message in an envelope, the message is typed on your computer and sent digitally through the Internet. This makes keeping in contact much faster as emails are often received almost instantly after they are sent. To send an email, all you need is an email address, a program used

to write the email, and an internet connection.

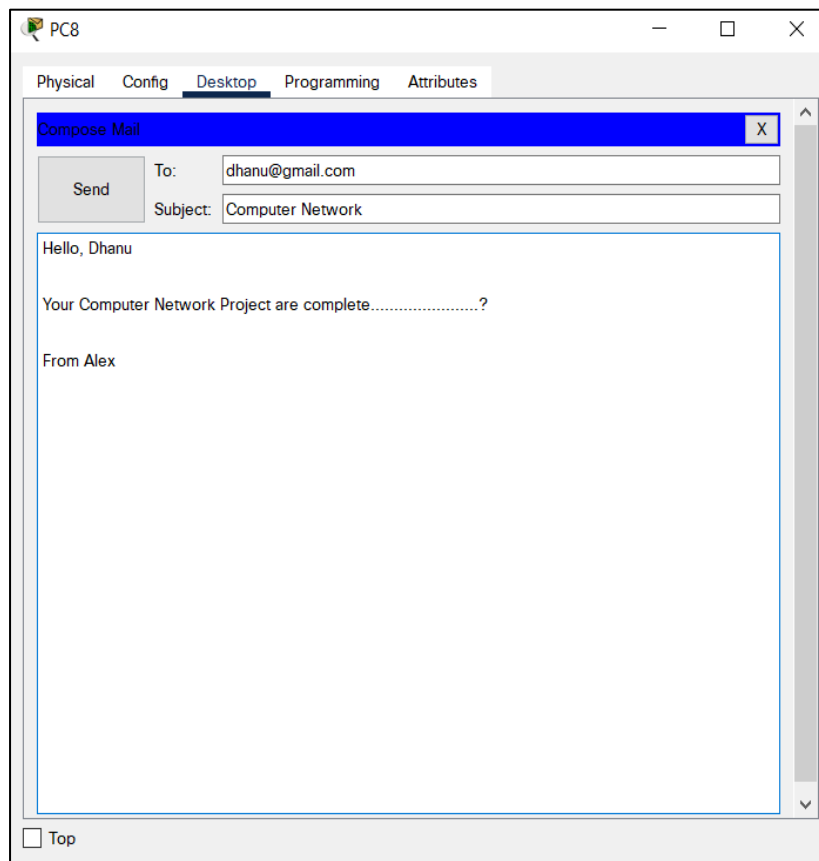


Fig. No. 4.4 E-Mail Send

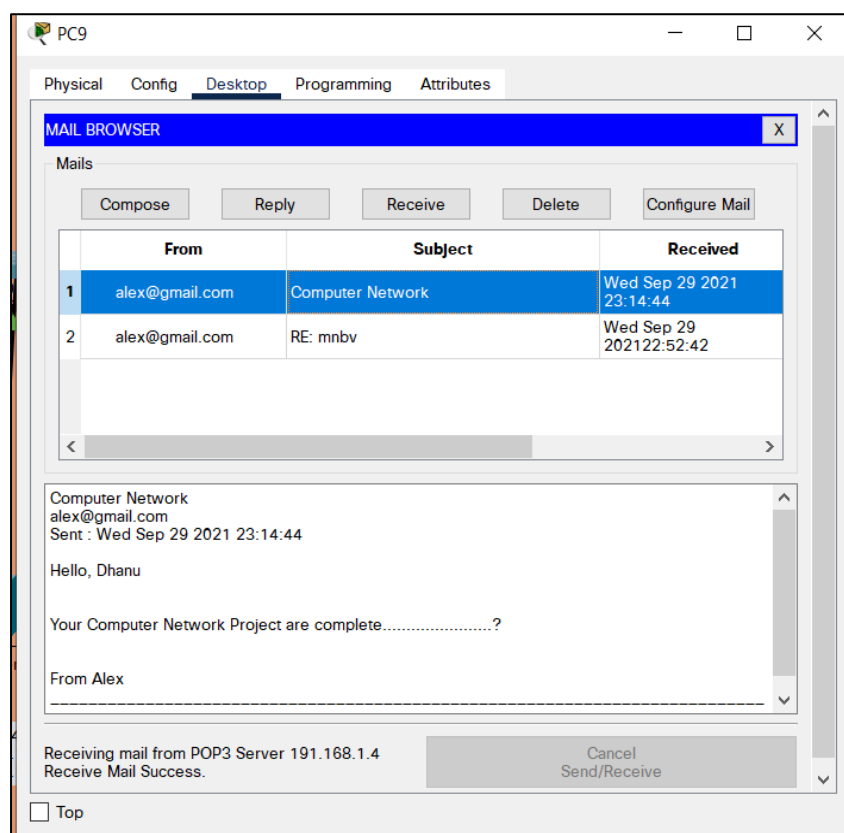


Fig. No. 4.5 E-Mail Receive

IoT

Internet of things or internet of everything refer to the idea of thing (object), that are readable, recognizable, locatable, addressable through information sensing devices (sensor) and controllable via internet.

Things are physical objects with unique identifiers that are able to transfer data over the network. Examples of physical objects include vehicles, smart phones, home appliances, toys, cameras, medical instruments and industrial systems, animals, people, buildings, etc.

Internet of Things is a new revolutionary and advanced technology where any object becomes smart object, and where they can communicate information about themselves without human intervention. The Internet of Things is expected to make a huge change in our lives; it will help us to perform our tasks and duties in a better way.

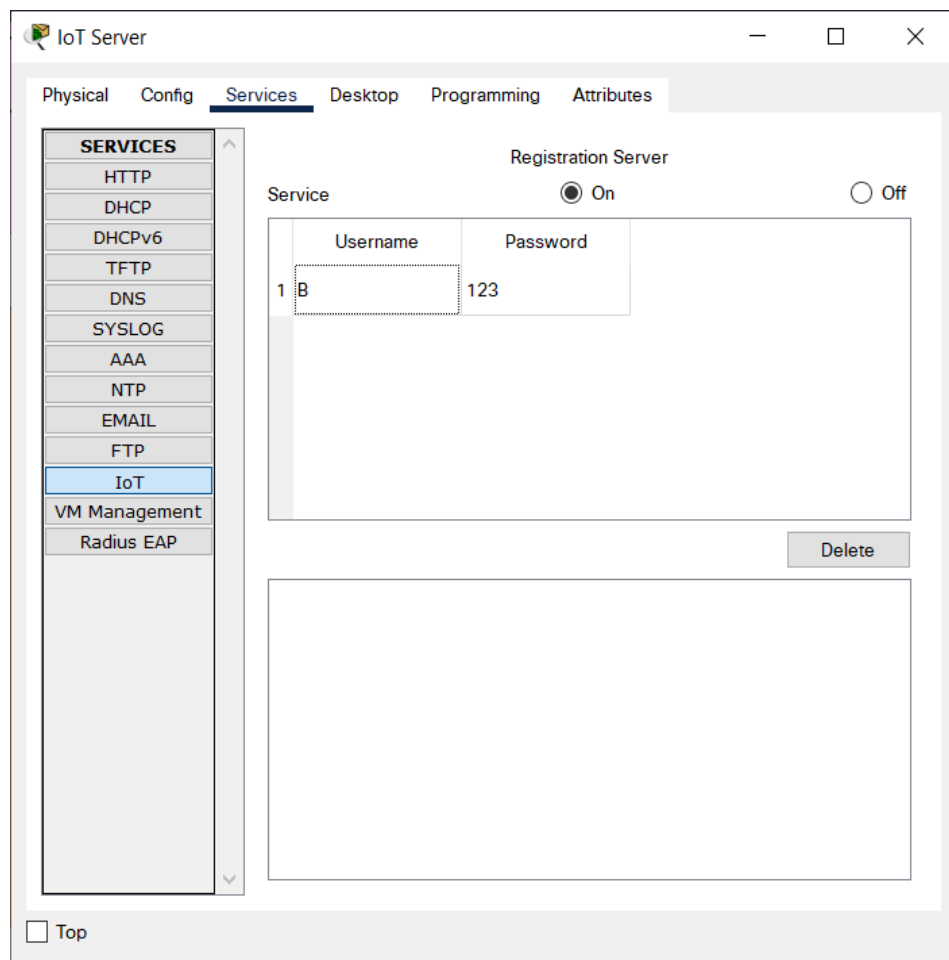


Fig. No. 4.6 IoT 1

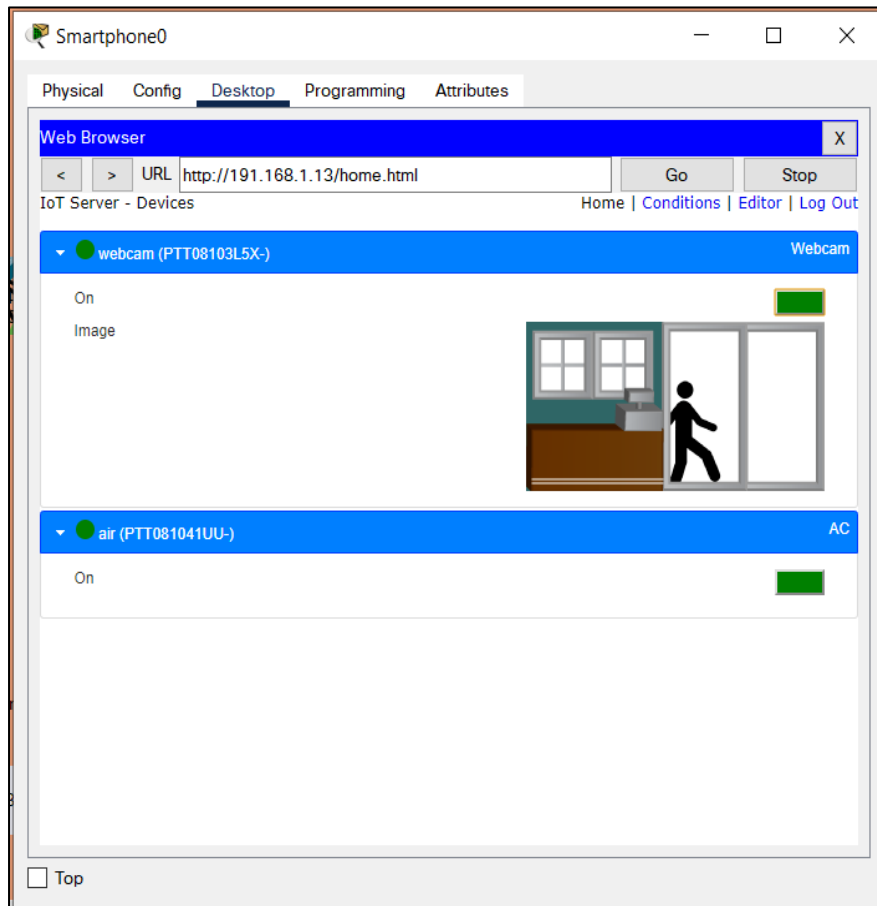


Fig. No. 4.7 IoT 2

FTP

FTP (File Transfer Protocol) is a network protocol for transmitting files between computers over Transmission Control Protocol/Internet Protocol (TCP/IP) connections. Within the TCP/IP suite, FTP is considered an application layer protocol.

In an FTP transaction, the end user's computer is typically called the local host. The second computer involved in FTP is a remote host, which is usually a server. Both computers need to be connected via a network and configured properly to transfer files via FTP. Servers must be set up to run FTP services, and the client must have FTP software installed to access these services.

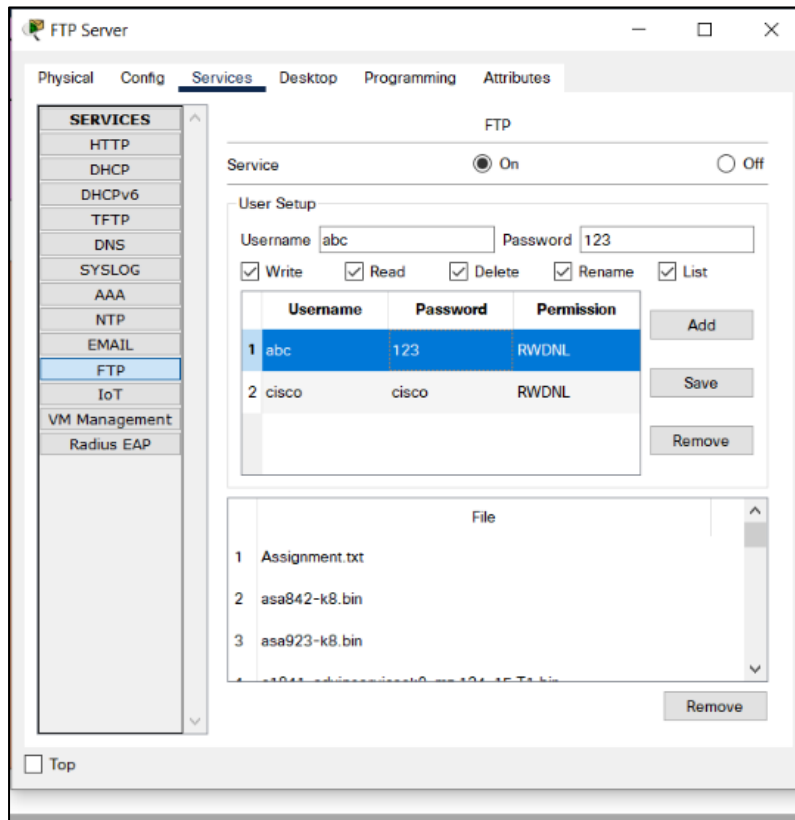


Fig. No. 4.8 FTP 1

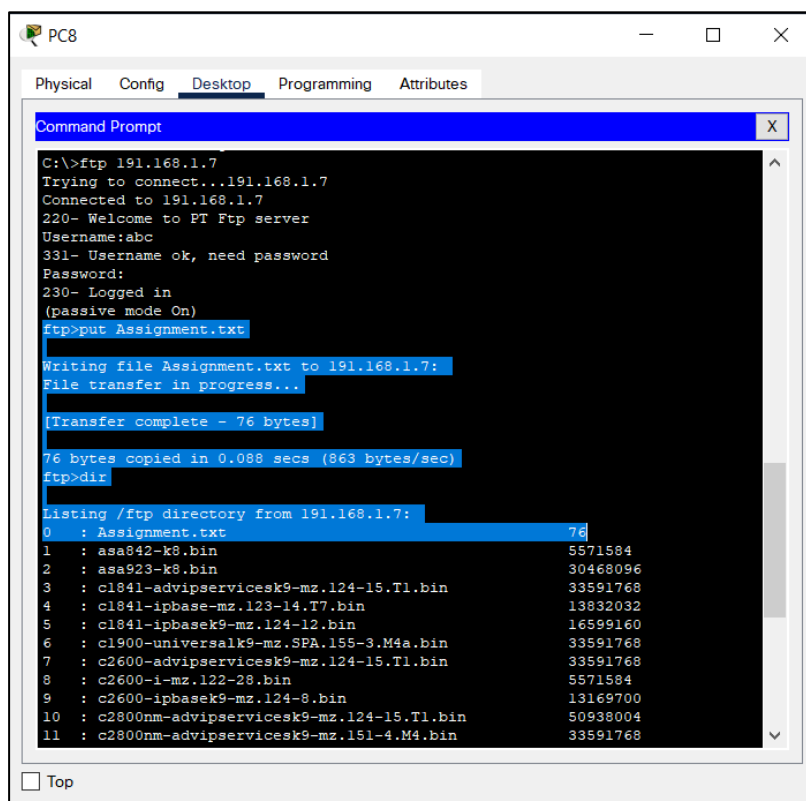


Fig. No. 4.9 FTP 2

Chapter 4

Conclusion

In this report, we present design and deployment of an college computer network. The proposed system network is to update the existing network and also enhance its capabilities and increase the flexibility of the network which will eventually provide good security.

Thus, we have studied all the components like routers, switches, etc. and services like DNS, DHCP, IoT, Email, FTP, etc. and successfully designed a College Computer Network using Cisco Packet Tracer.

References

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- 2. <https://youtu.be/q-UUbPk6fYo>**
- 3. <https://youtu.be/MPTrbFzIn0Y>**
- 4. <https://github.com/topics/packet-tracer>**