Green University of Bangladesh

Department of Computer Science and Engineering (CSE)
Semester: (Fall, Year: 2022), B.Sc. in CSE (Day)

Designing an ISP(Internet Service Provider) Network to Provide Wired and Wireless Internet Connections.

Course Title: Wireless Networks Lab
Course Code: CSE 418
Section: D2

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Contents

Chapter 1

1 Introduction

1.1 Overview

An Internet service provider (ISP) is an organization that provides services for accessing, using, managing, or participating in the Internet. ISPs can be organized in various forms, such as commercial, community-owned, non-profit, or otherwise privately owned. Internet services typically provided by ISPs can include Internet access, Internet transit, domain name registration, web hosting, Usenet service, and colocation.

1.2 Motivation

We take the help of networks to facilitate our daily work and to communicate with each other. But in many cases, especially towards the village, we face various problems to connect to the network. Although various ISP companies are now working to connect the Internet to the wire, some problems still exist in rural areas. If a person wants to get internet connection then he has to bear the cost of service charge, cabler cost, home router purchase cost to get the connection in the initial stage apart from paying for the internet package. Also, sometimes it is too expensive for them to bear the entire cost of running a device. At present, SHADHIN WiFi is providing wireless internet services from district to village to solve this problem. We want to work with this existing service. In addition to wireless connection, we will also provide wire internet service. Our goal is to make the customer use the internet at a low cost. If the user wants, he can buy and use the internet pack according to his need from any access point in the range of his device. In this way, he does not have to provide any services other than internet package services.

1.3 Problem Definition

1.3.1 Problem Statement

The project faces issues related to wireless network connectivity. Users may experience intermittent or unreliable connections to the wireless access points, leading to disruptions in their internet services. Identifying the root cause of these connectivity issues and implementing effective solutions is crucial to ensure a seamless wireless experience for the users.

The current design may not adequately cater to future expansion and increasing user demands. As the ISP network grows, it is important to ensure scalability and accommodate additional subscribers without compromising the network's performance. Scaling up the network infrastructure while maintaining optimal performance poses a significant challenge that needs to be addressed.

1.3.2 Complex Engineering Problem

Name of the P Attributes	Explain how addressed this attribute
P1: Depth of knowledge required	This project aims to requires depth of knowledge in design and analysis i.e. Required of Knowledge of wireless networks.
P3: Depth of analysis required	This project requires depth of analysis i.e Get better results using minimum devices.
P7: Interdependence	The problem includes multiple device configuration and components that are interdependent i.e WLC (wireless controller) and Access Point.

1.4 Design Goals/Objectives

- To design and configure a MAN network.
- To control multiple access points through WLC.
- To setup DHCP, DNS, FTP servers
- To control IOT devices from different locations.
- To reduce IP waste.
- To create a Internet environment.

Chapter 2

2 Design/Development/Implementation of the Project

2.1 Project Details

This is an Internet service provider (ISP) network which is an organization that provides services for accessing, using, managing, or participating in the Internet. ISP can be organized in various forms, such as commercial, community-owned, non-profit, or otherwise privately owned. Internet services typically provided by ISP can include Internet access, Internet transit, domain name registration, web hosting and Usenet service.

2.2 Project View

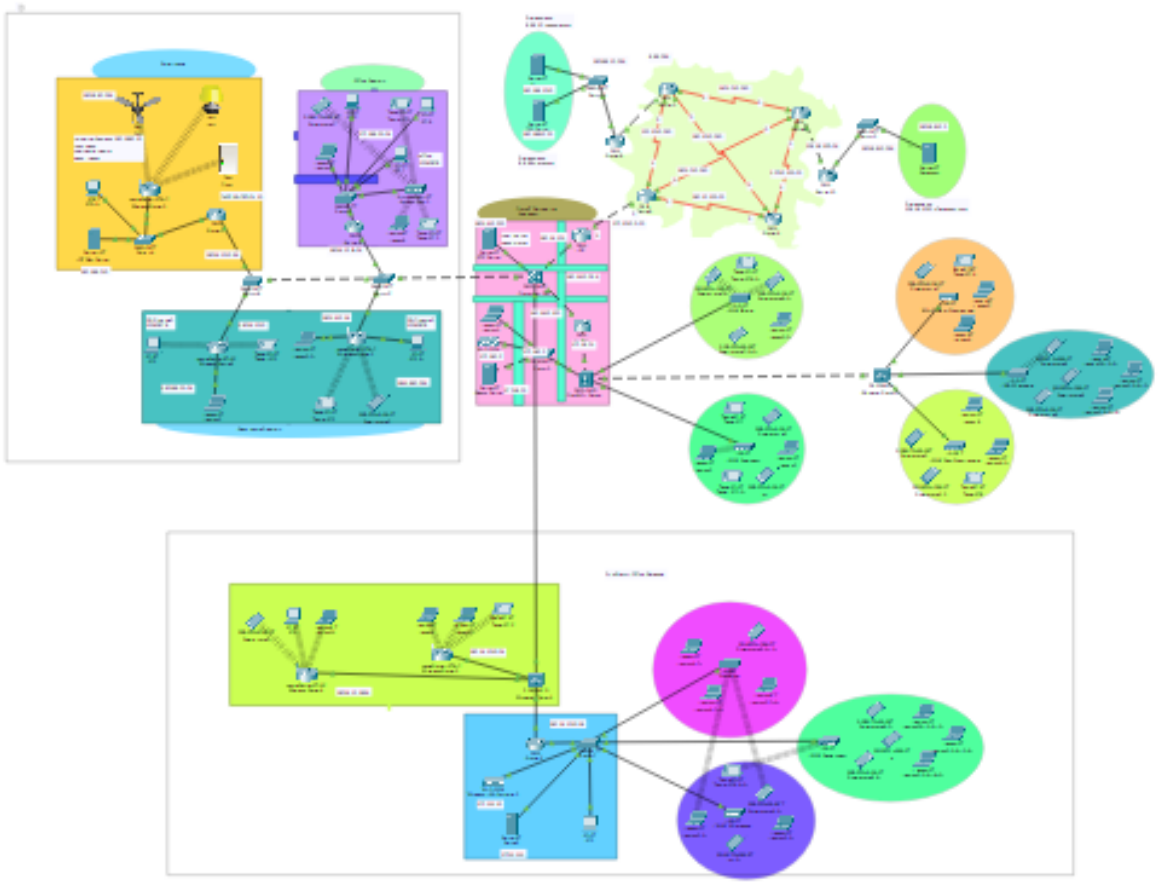

Fig 1 : Topology of ISP Network

IP assign: In this table, we've shown the useable IP addresses in our project.

Network	IP
Smart Home	192.168.0.0/24
Office	172.168.0.0/24
Home 1	193.168.0.0/24
Home 2	194.168.0.0/24
Google	192.168.12.10/24
Facebook	192.168.10.2/24
ISP Head Office	180.14.12.0/24
Wireless Network	172.16.0.2/16
ISP 2nd Branch	172.11.1.0/16
Google Server	192.168.12.10
Facebook Server	128.16.15.10
IOT Server	192.168.0.10
FTP Server	180.14.12.200
WLC	172.16.0.5
Radius Server	172.16.0.2
WLC 1	172.11.1.10
Radius Server 1	172.11.1.11

2.3 Implementation

2.3.1 Smart Home

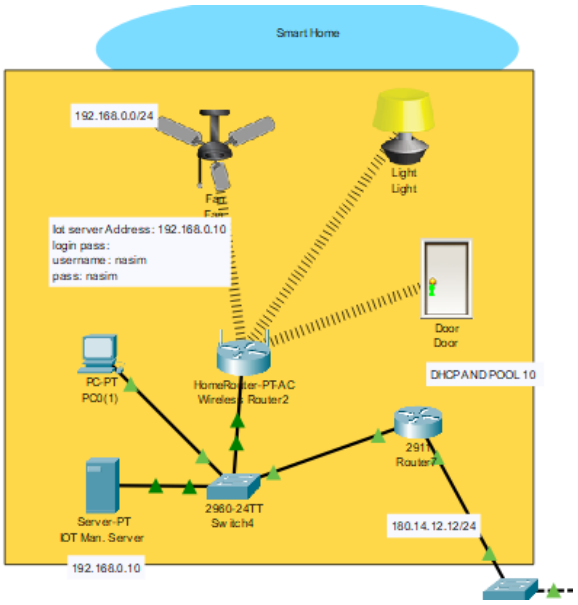

Fig 2 : Smart Home Topology

Here, we take IOT devices those are connected with home router that are getting IP from DHCP.

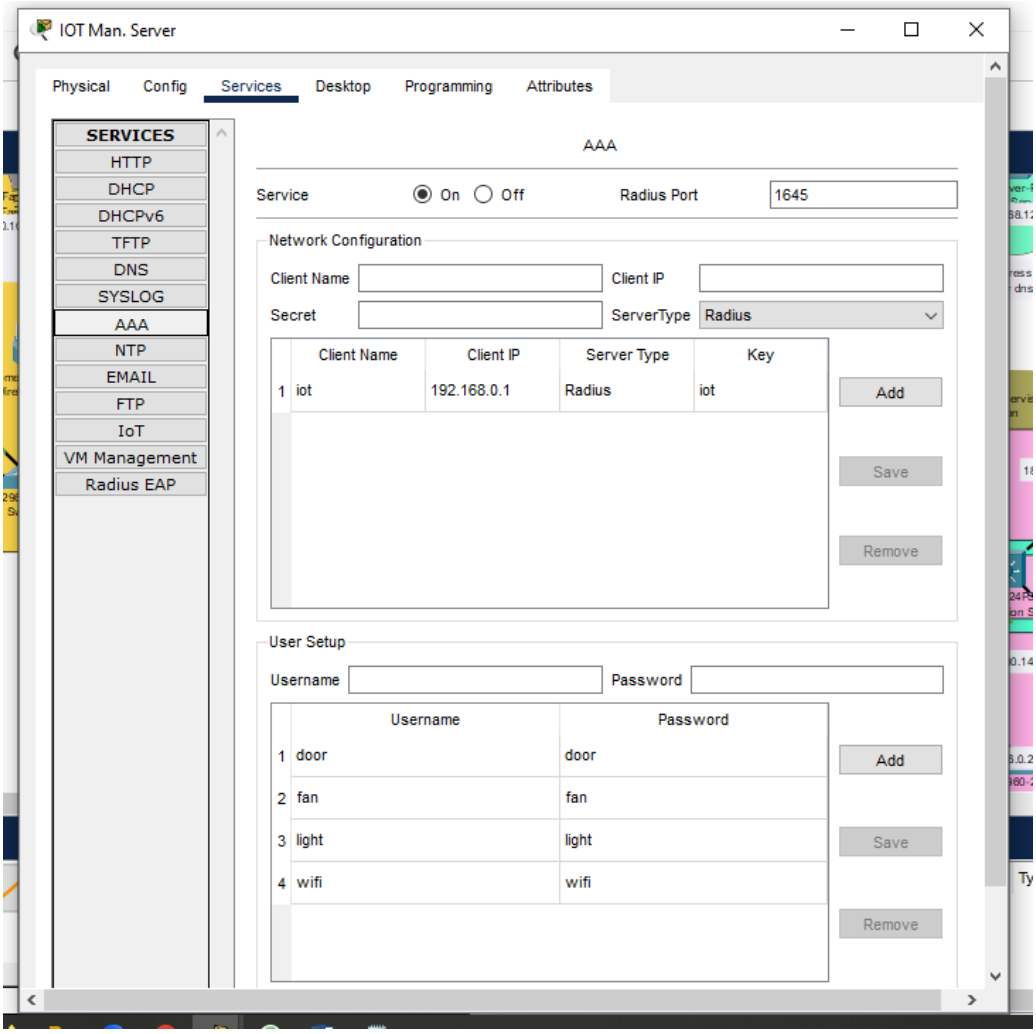

Fig 3 : IOT Server Configuration

We create radius server and IOT devices. That's why we created username password.

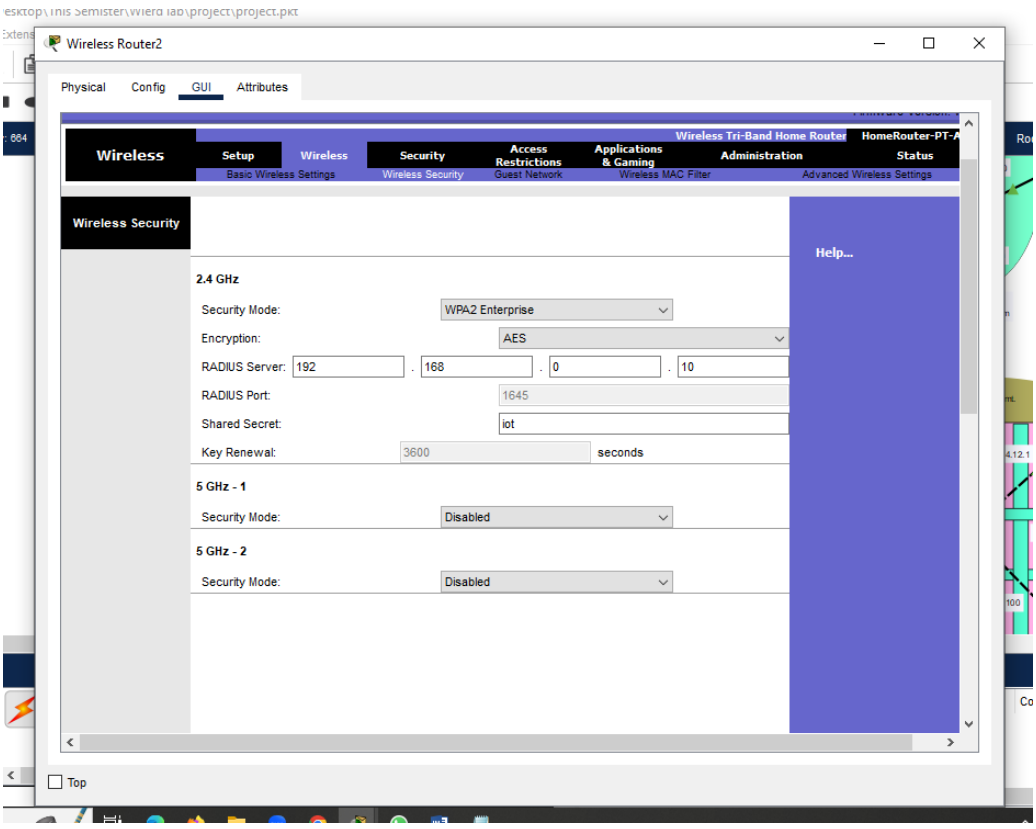

Fig 4: Wireless Router Configuration

In home router, we include a radius server IP.

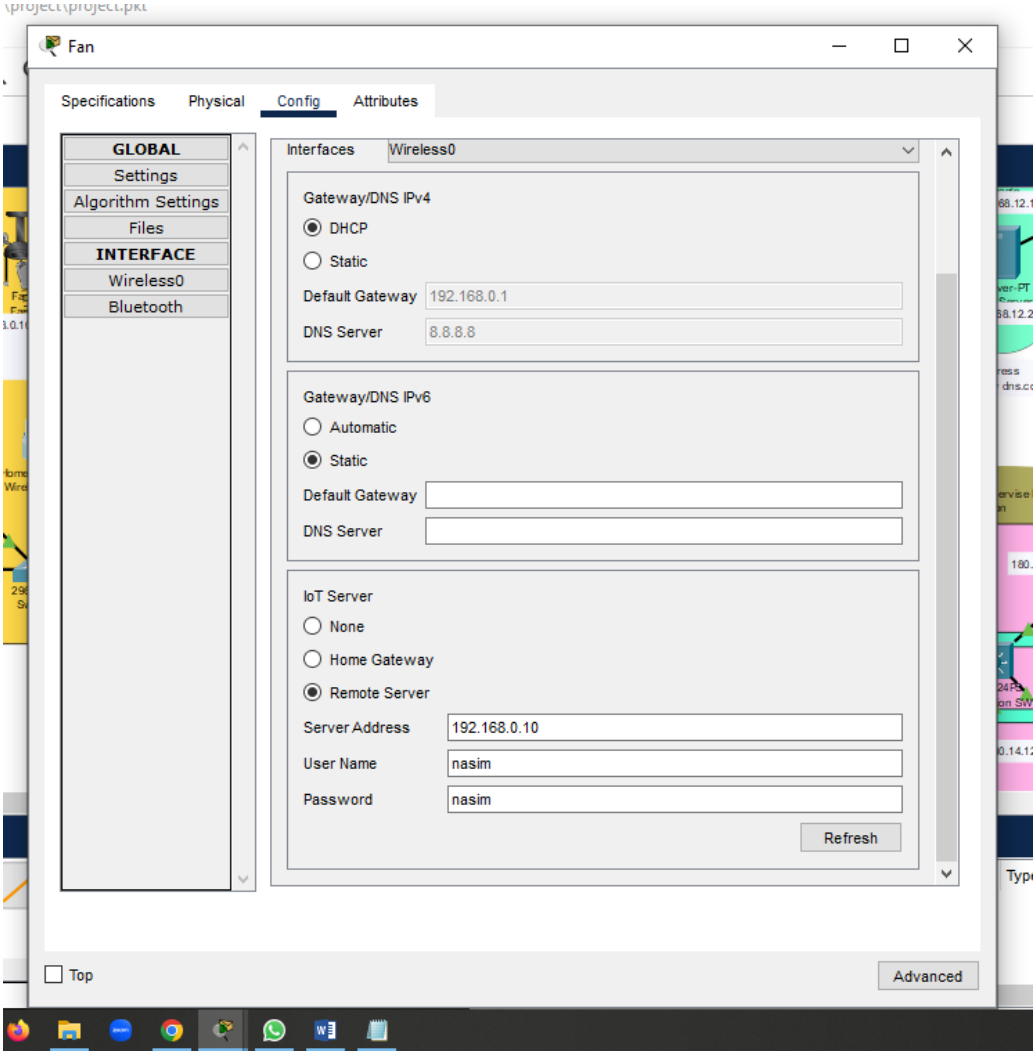

Fig 5: IoT Fan Configuaration

We attached remote server IP, username and password in IOT devices. Because, when we will turn on monitor then we can control it from anywhere.

2.3.2 Office Network

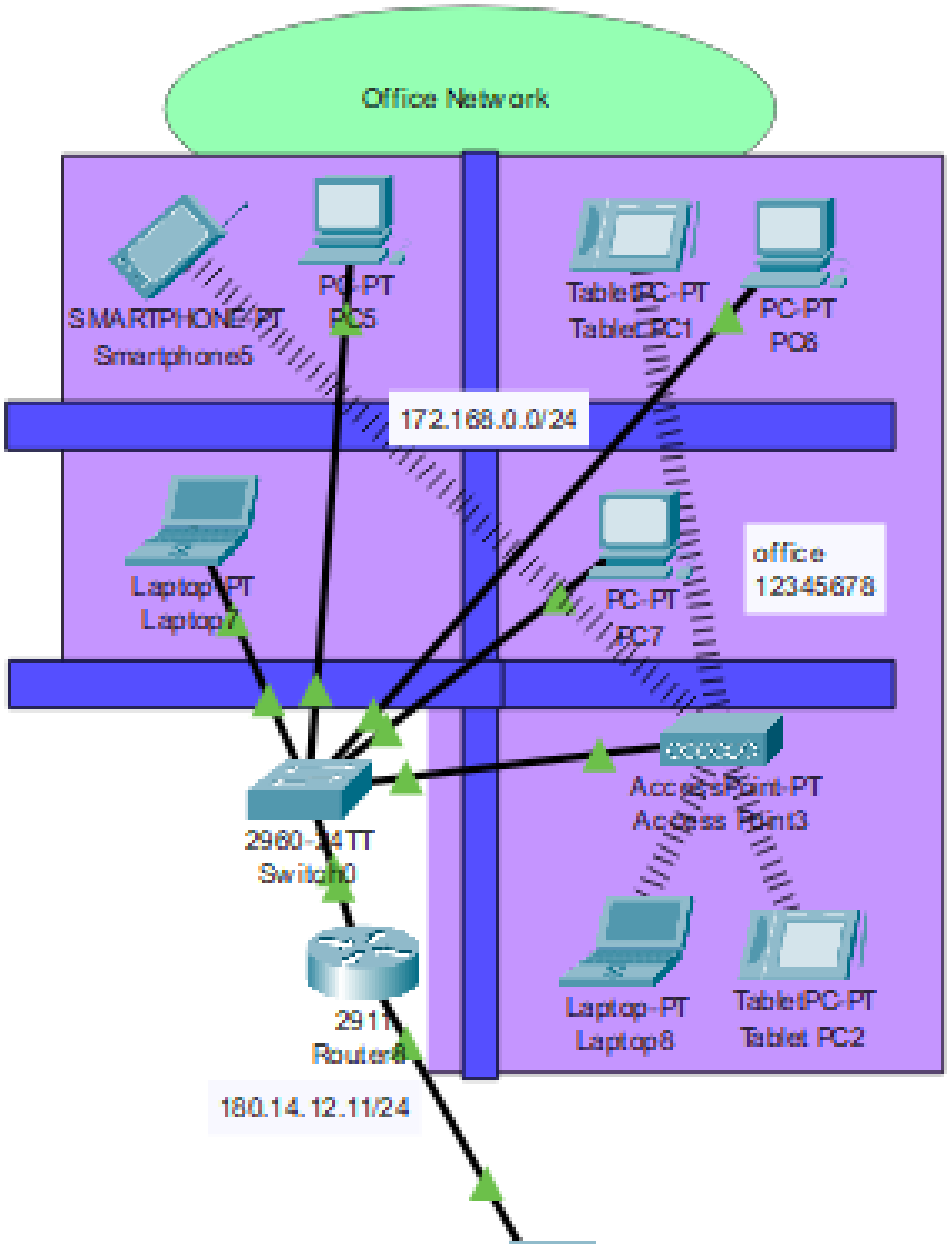

Fig 6: Office Network Topology

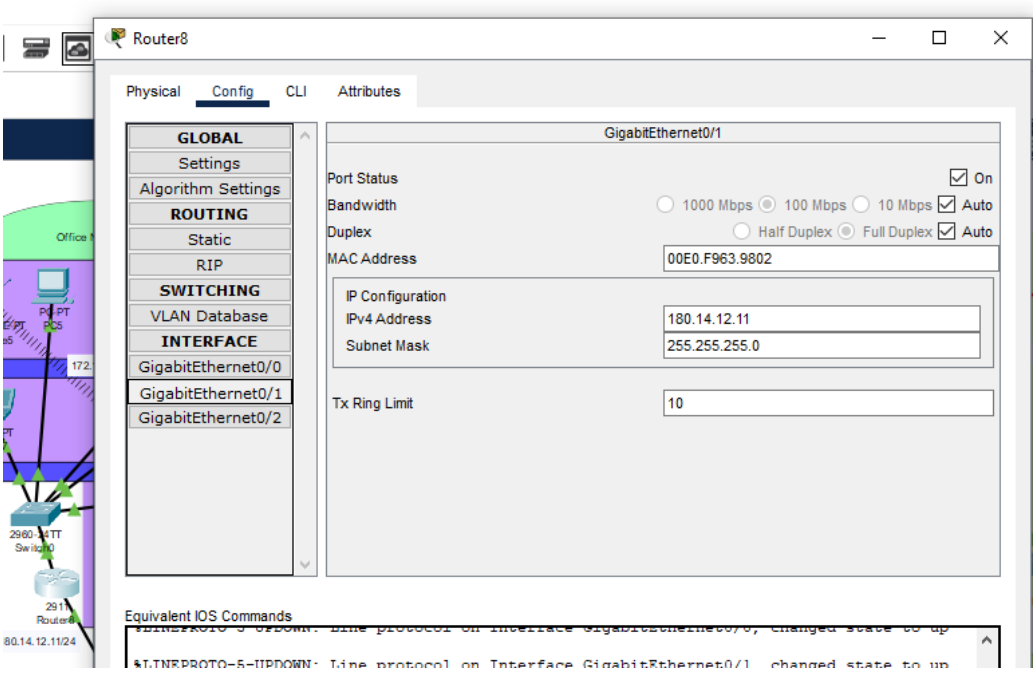

Fig 7: Router IP Configuration

We can access internet to connection build up from ISP.

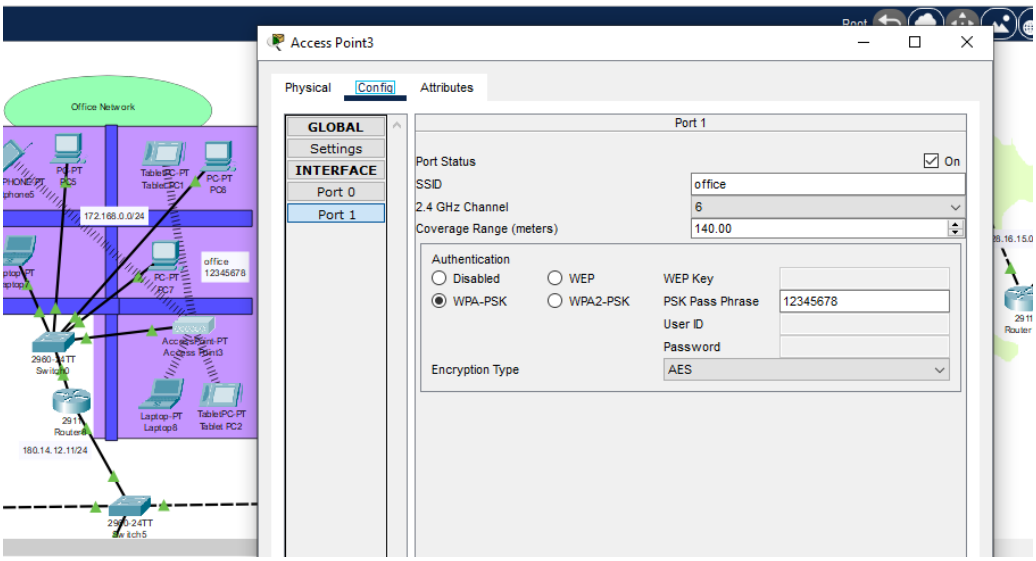

Fig 8: Access Point SSID Configuration

We configure access point to wireless connection .That's why devices can be connected easily.

2.3.3 Internet Environment

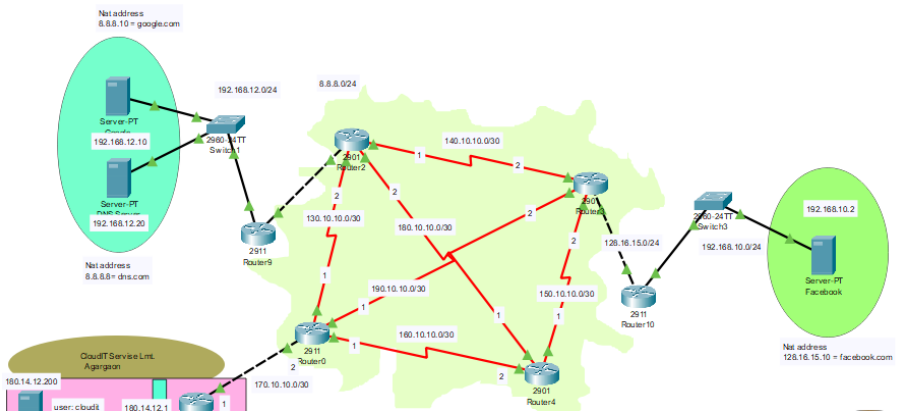

Fig 9: Internet Environment Topology

Basically, it is an internet area with is a logical collection of networks supported by gateways ,routers ,bridges host and various layers of protocol.It allows us to send messages share pictures download music and stream videos at a touch of a button.

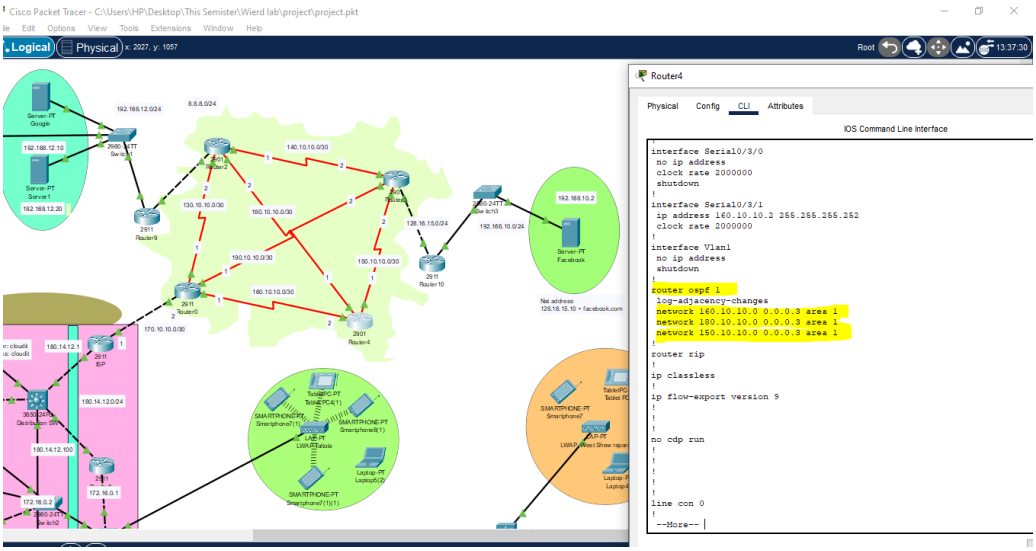

Fig 10: OSPS Configuration

OSPF: OSPF(Open Shortest Path First) [5] is an interior gateway protocol developed by the OSPF working group of the internet engineering task force here we use multiple routers to create internet environment there are connected by IP addresses we used OSPF as like routing protocol fare some network connected those we included in OSPF area 1.

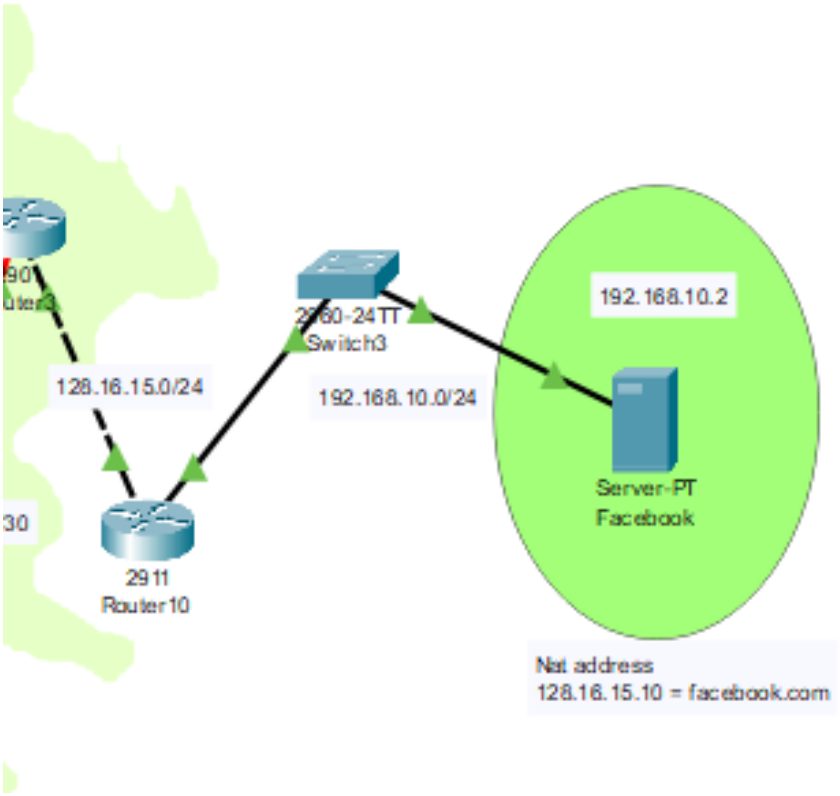

Fig 11: Facebook Server Topology

Here, we create a facebook server. When anyone search "'facebook.com" then they will get the ping. After that It will show an user interface.

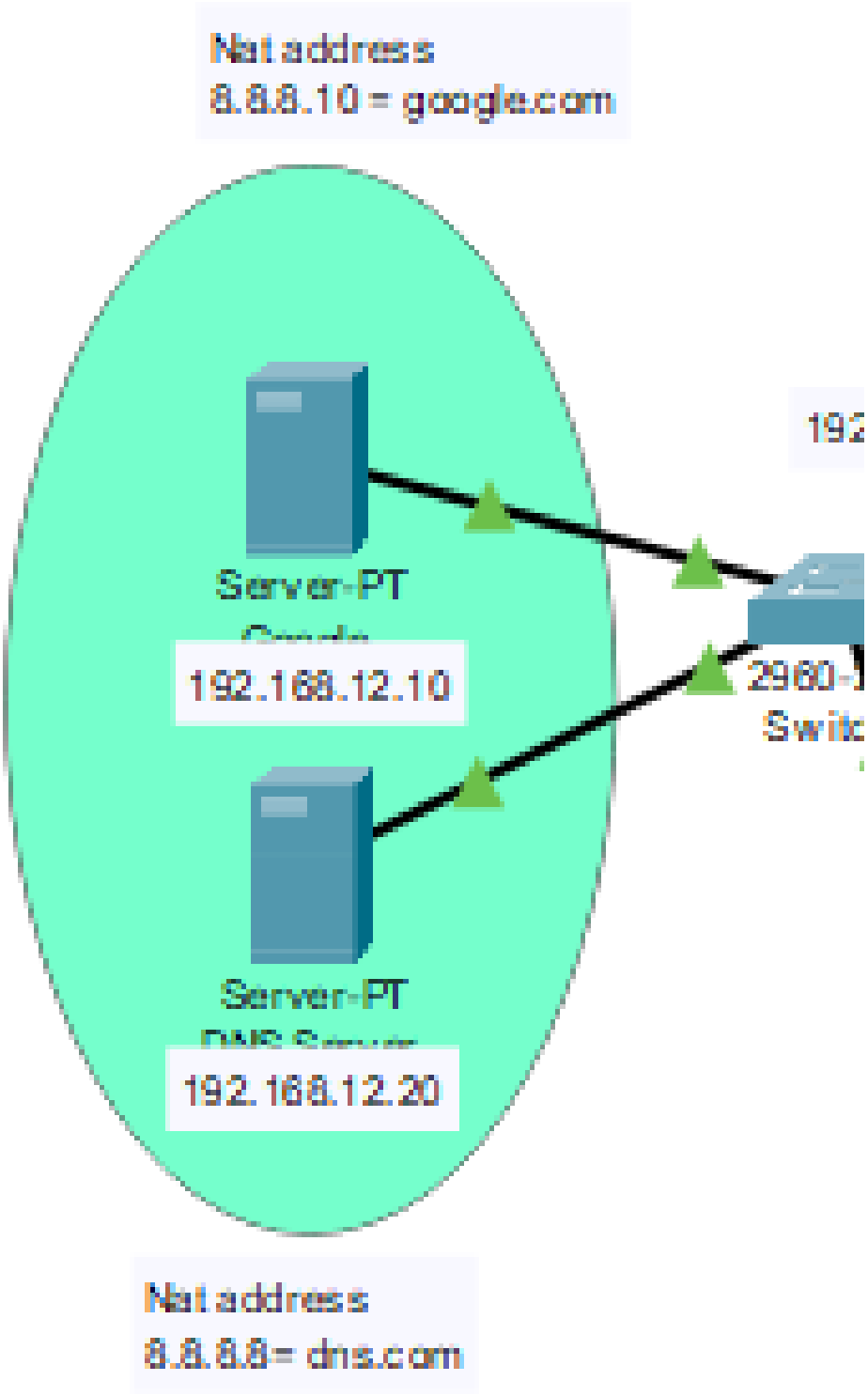

Fig 12: Google Server Topology

Here, we create a facebook server. When anyone search "'google.com" then they will get the ping. After that It will show an user interface.

DNS Server: The Domain Name System (DNS) is the phonebook of the Internet. When users type domain names such as 'google.com' or 'nytimes.com' into web browsers, DNS is responsible for finding the correct IP address for those sites.[3]

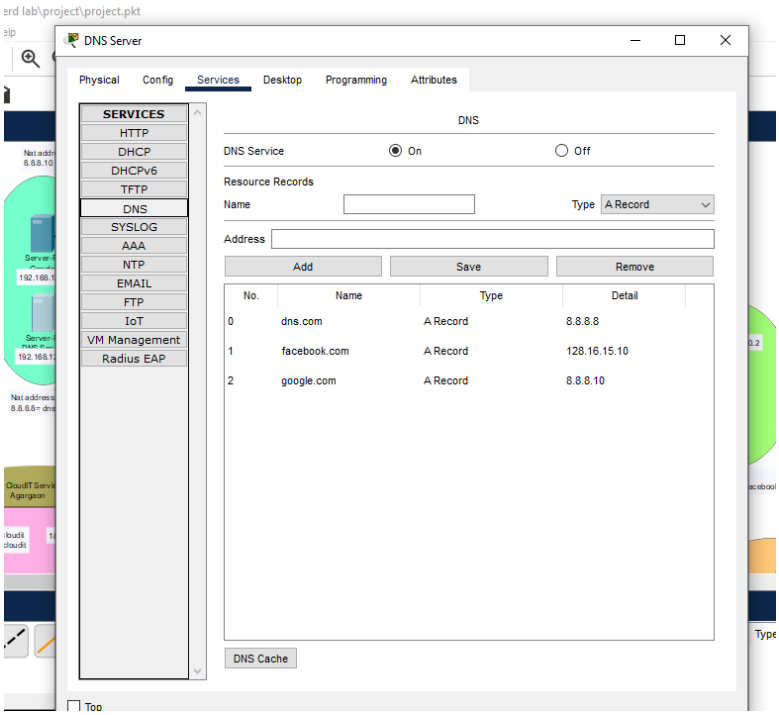

Fig 13: DNS Server Configuaration

We add determine name in Google and Facebook that's why we can search and can ping easily.

NAT Configuration : The use of Network Address Translation (NAT) has been wide spread for a number of years; this is because it is able to solve a number of problems with the same relatively simple configuration. At its most basic, NAT enables the ability to translate one set of addresses to another. This enables traffic coming from a specific host to appear as though it is coming from another and do it transparently. This article looks at some of the basic concepts that are used when configuring NAT and reviews the configuration steps required to get NAT working.[1]

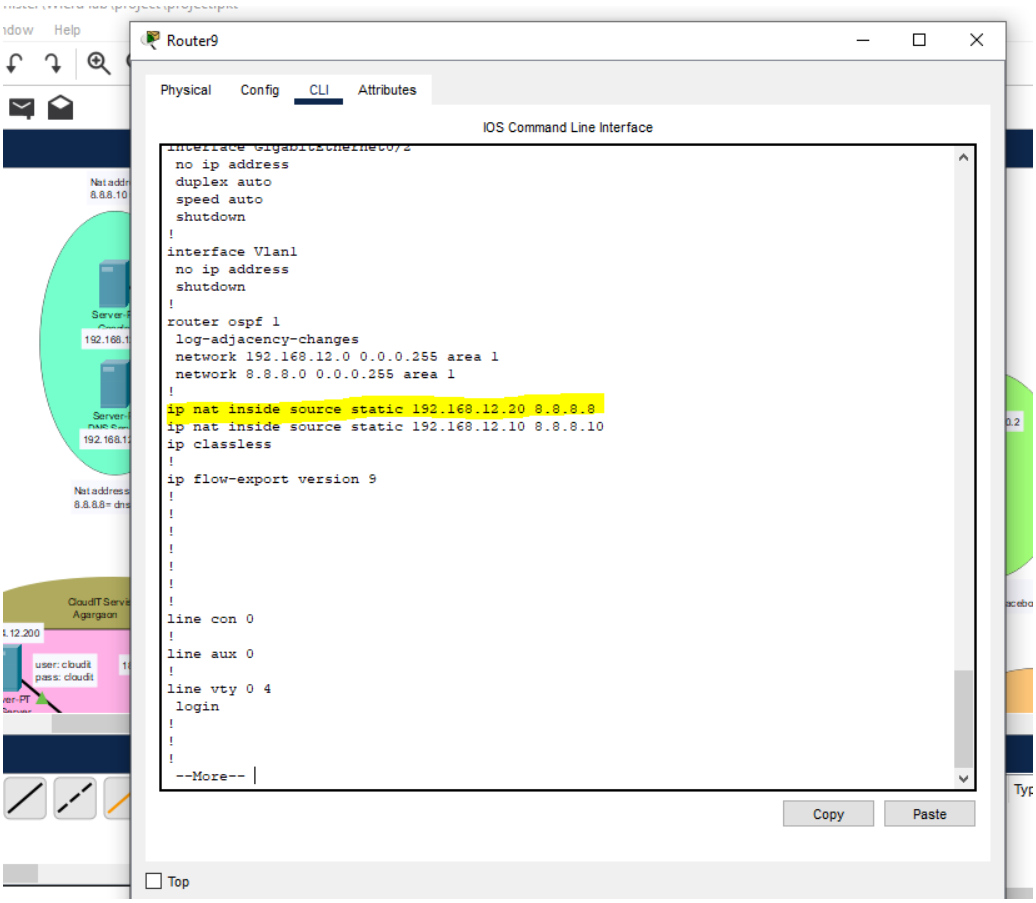

Fig 14: NAT Configuration Google IP

In Google's router we converted Google's private IP into public using static NAT.

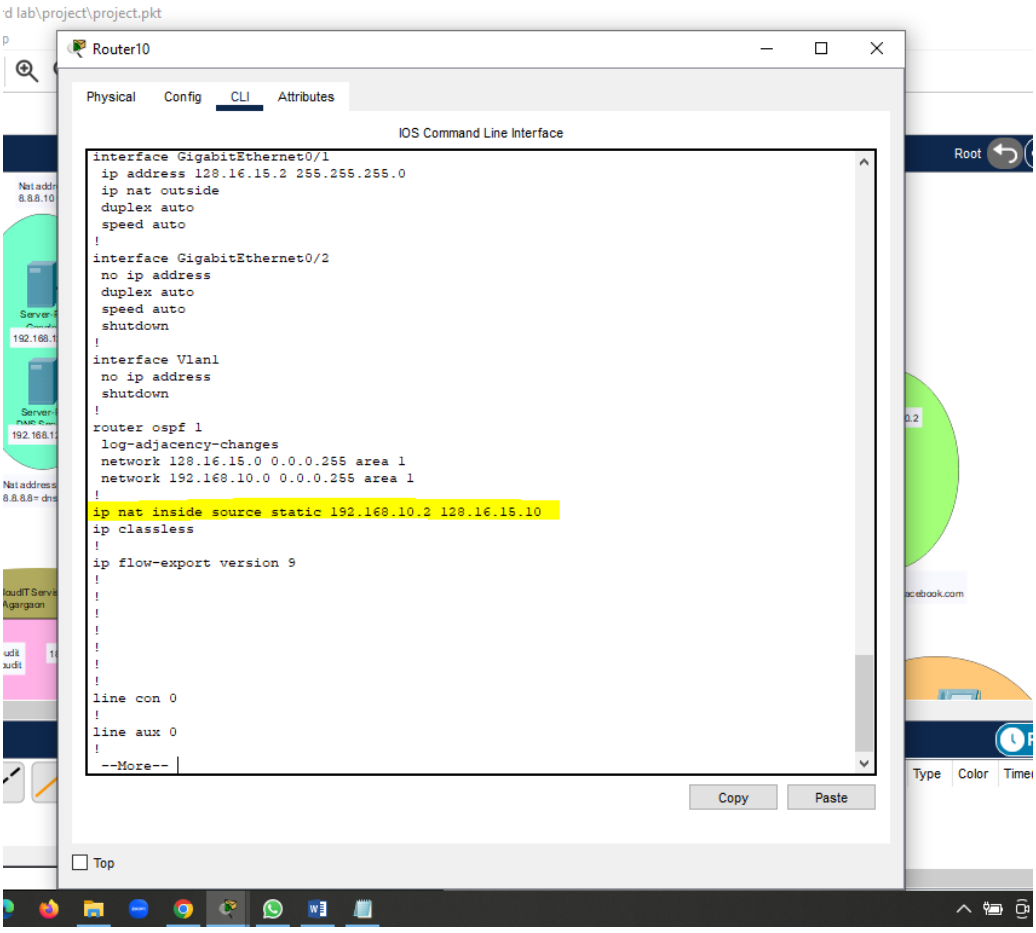

Fig 15: NAT Configuration Facebook IP

By using static net in Facebook router, we have converted Facebook private IP to public IP.

2.3.4 ISP Head Office

WLC : A wireless LAN controller (WLC) is a network device used to monitor and manage wireless access points in an organization. WLCs are connected to routers and allow devices from across the organization to connect to the router via access points. WLCs are generally used in combination with the Lightweight Access Point Protocol (LWAPP) to manage light-weight access points in bulk by the network administrator or network operations center.The wireless LAN controller is part of the Data Plane within the Cisco Wireless Model.[4]

FTP Server : An FTP server is computer software consisting of one or more programs that can execute commands given by remote client(s) such as receiving, sending, deleting files, creating or removing directories, etc. The software may run as a software component of a program, as a standalone program or even as one or more processes. An FTP server plays the role of a server in a client–server model using the FTP and/or the FTPS and/or the SFTP network protocol(s).

Radius Server : we will configure Radius Server and a Cisco Router for RADIUS Authentication, for the users connected to the router via Cisco switch.[2]

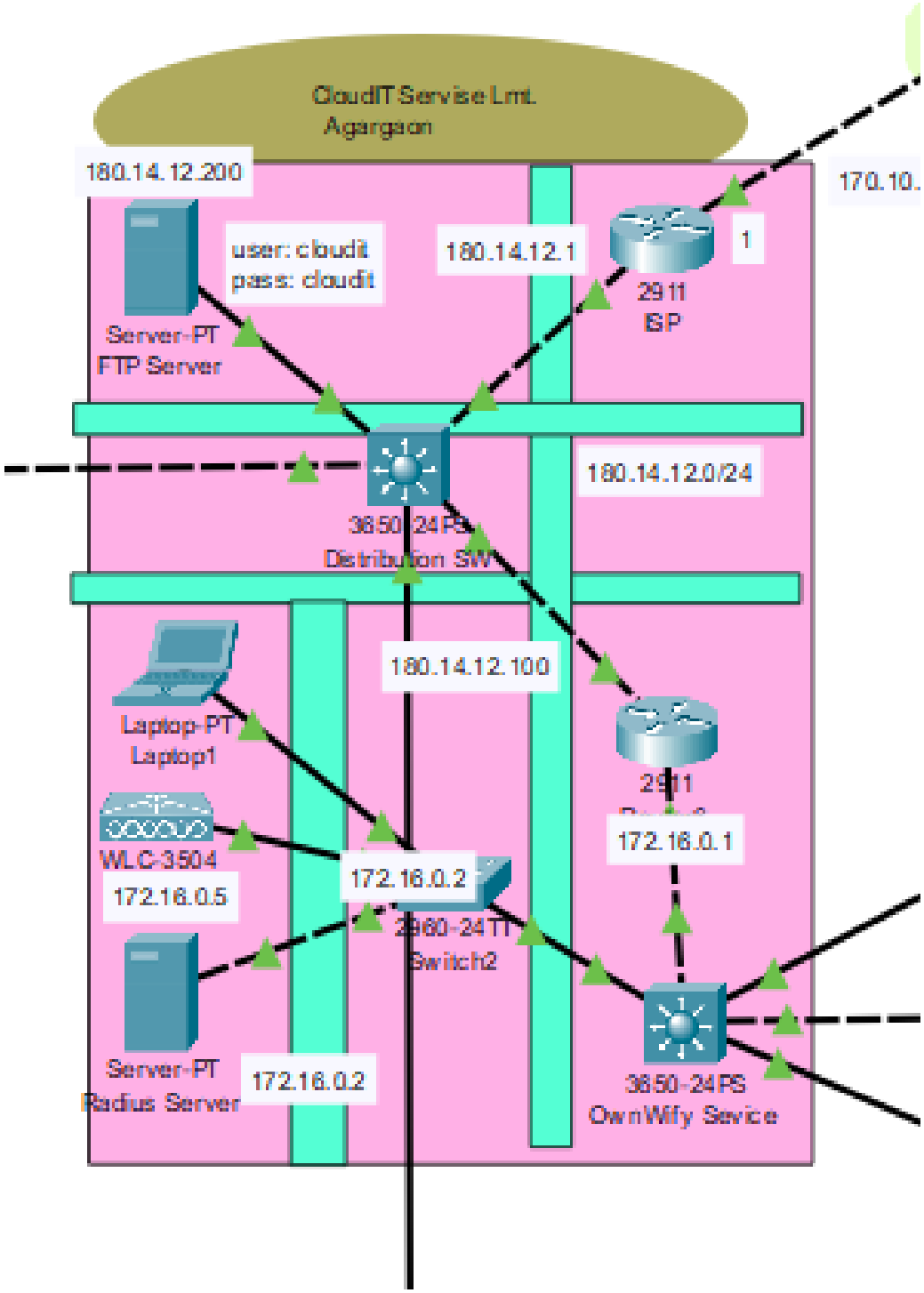

Fig 15: ISP Head Office Topology

2.3.5 Home Network

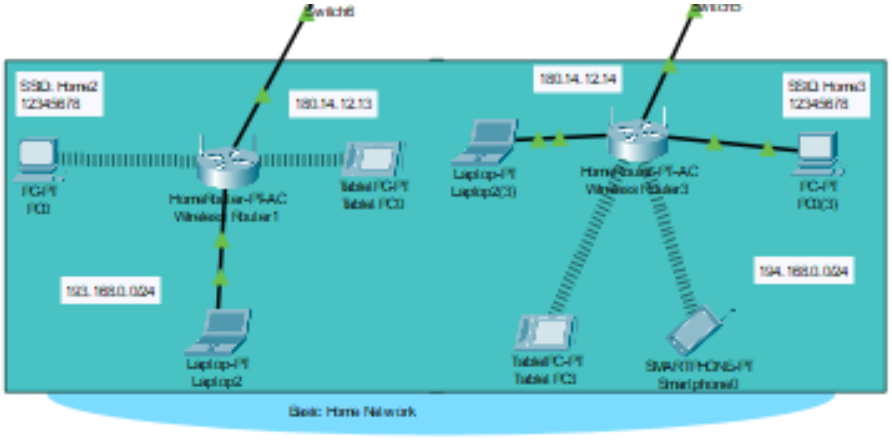

Fig 17: Home Network Topology

Here, the basic home is connected to the ISP.So that, the internet can be accessed through it. AND devices are connected through home router also.

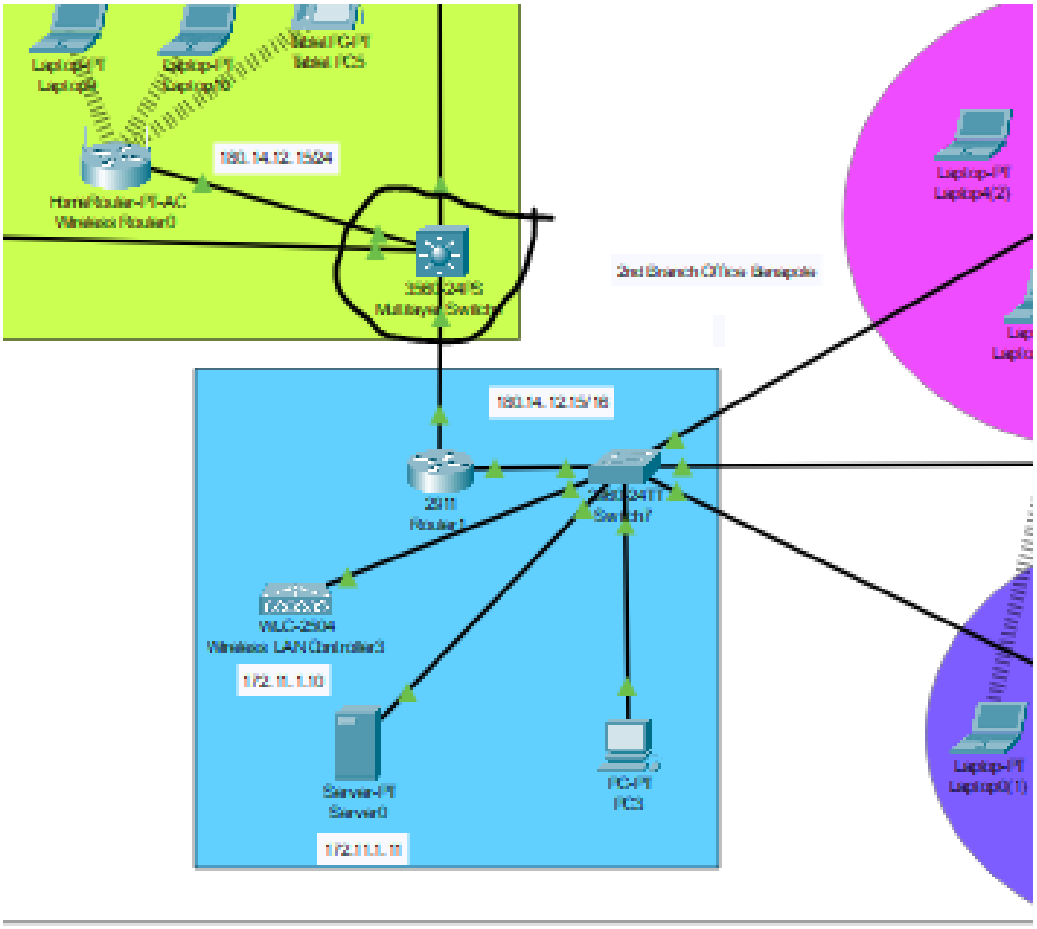

Fig 18: Branch Office Topology

WLC and Radius server configuration are making as like head office configuration.Here, users can access FTP server from head office.

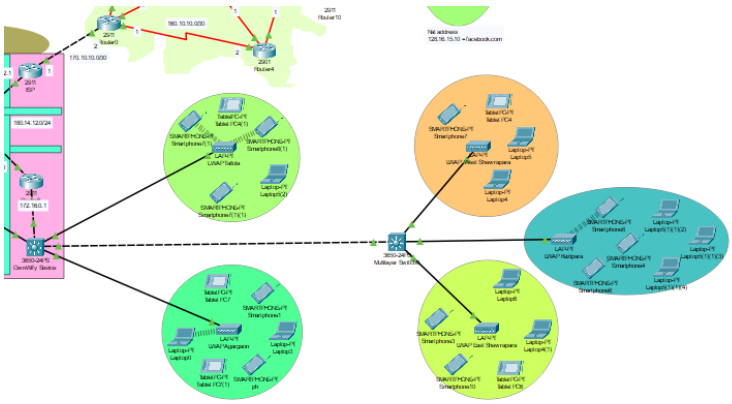

Fig 19: Wireless Network Topology

Wireless network is controlled by WLC. And access point controlled by WLC also. User can use the username and password to connect by access point.

2.3.6 WLC Configuration

Fig 20: WLC Configuration(login intreface)

Firstly, we take laptop to browse from 172.16.0.0/16 network.In WLC configuration, we search IP 172.16.0.5 .That's why It will show a login interface. Then we will log into the initial stage by user name and password.

In security option, we connect radius server with WLC. Then we include radius server ,IP address, radius server port number.

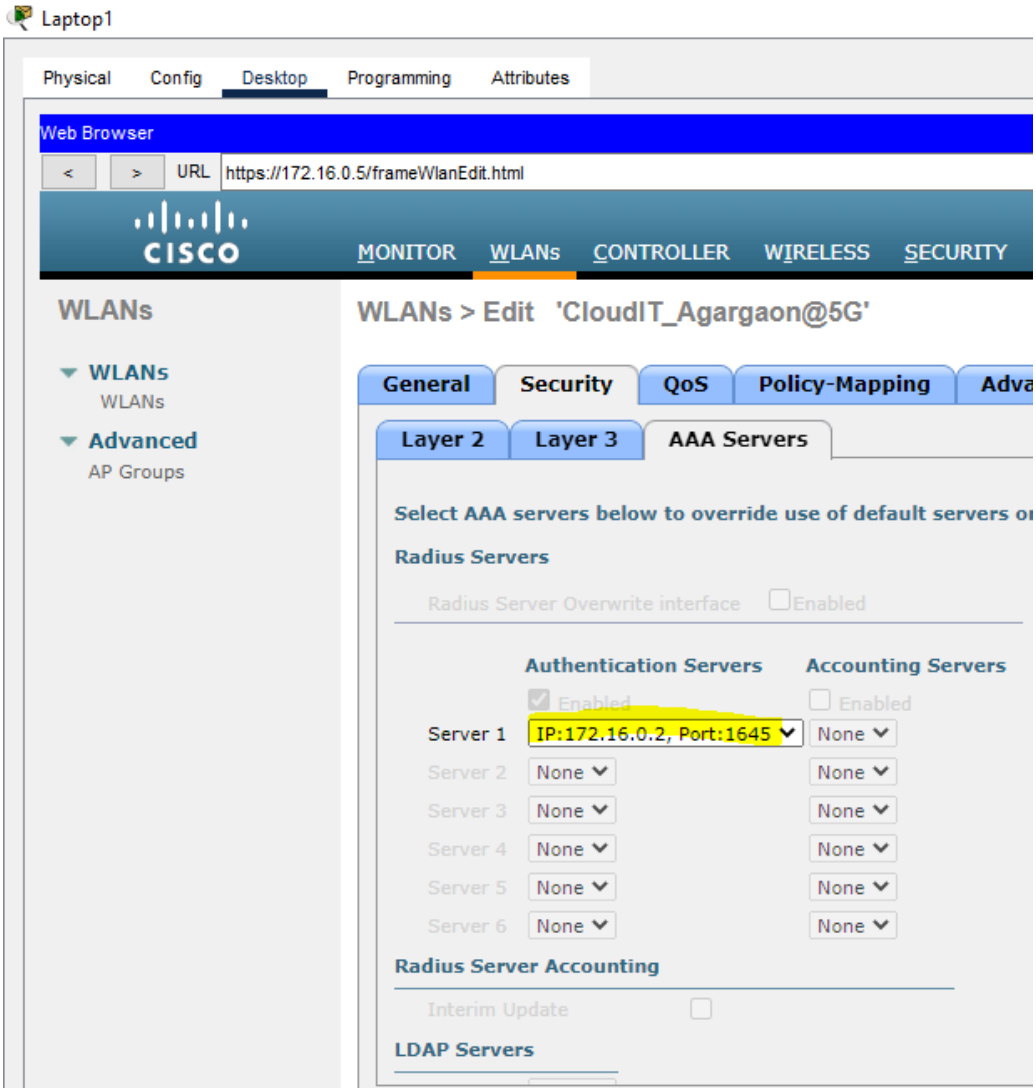

Fig 21: Wireless Section(add radius server)

In wireless section, all access point will show in 172.16.0.0/16 network.

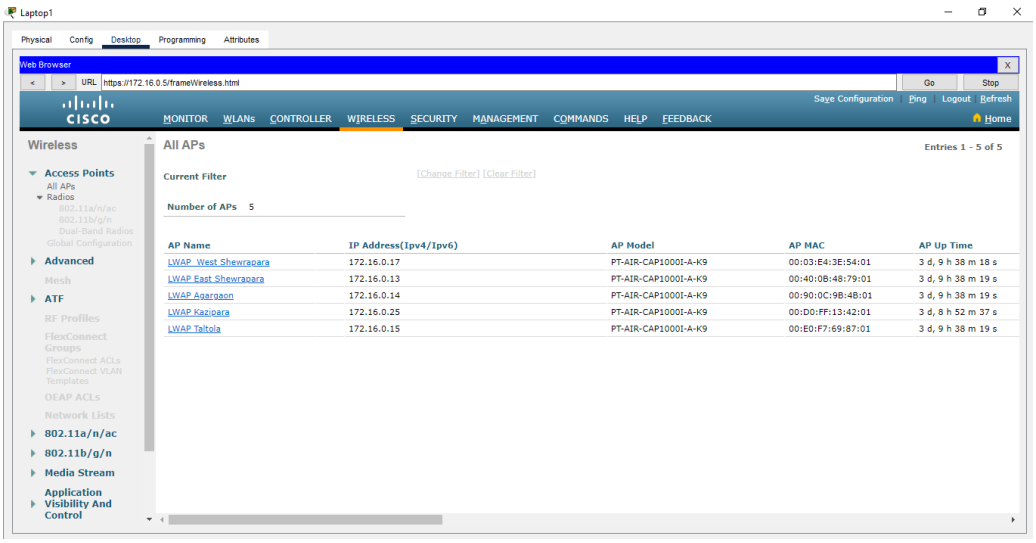

Fig 22: Lists of AP

When, we will click WLAN interface will open with SSID name we included .It should be right here then after that, we will select "WPA+wpa2" . In WPA2 policy, WPA2 Encryption and 802.IX will check mark.

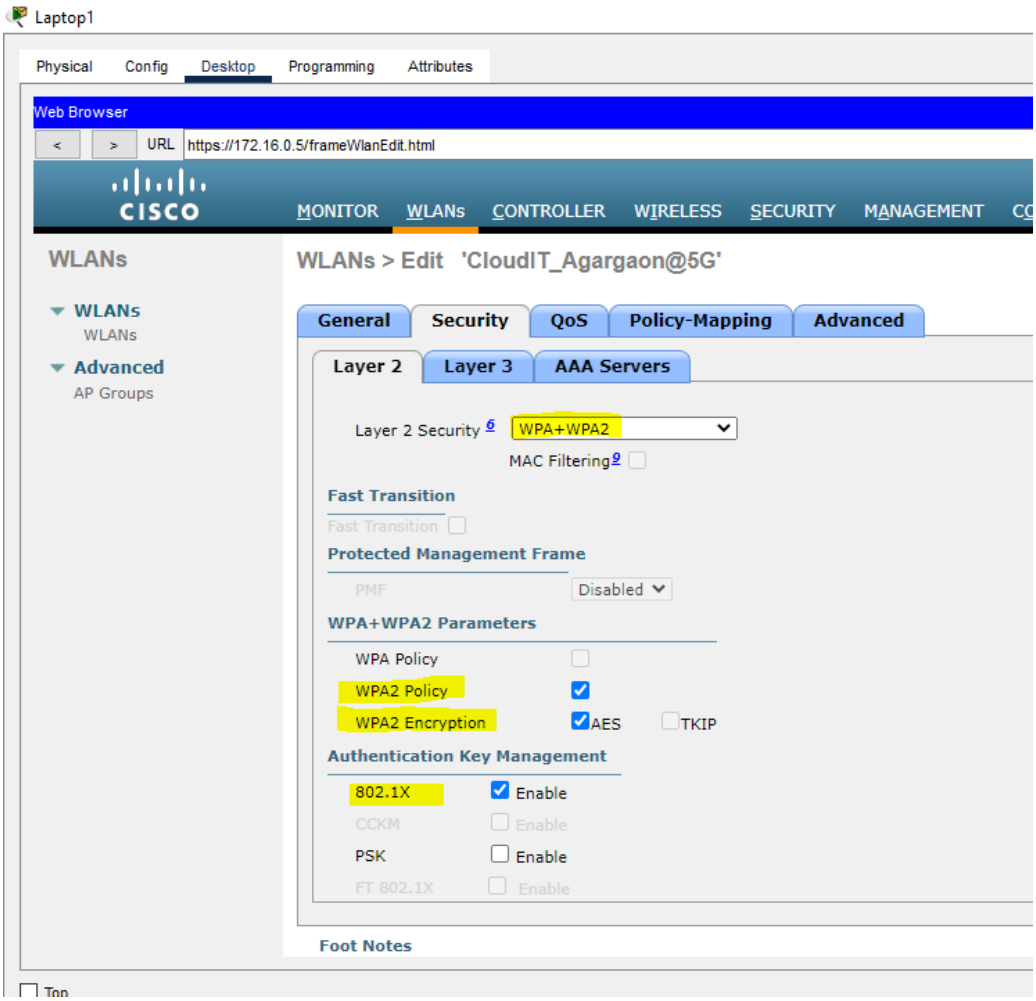

Fig 23: Set Policy

Then we will turn the advance option.It will create APs group then we will add SSID that we wanted firstly. This work will be like those group and SSID that we created.

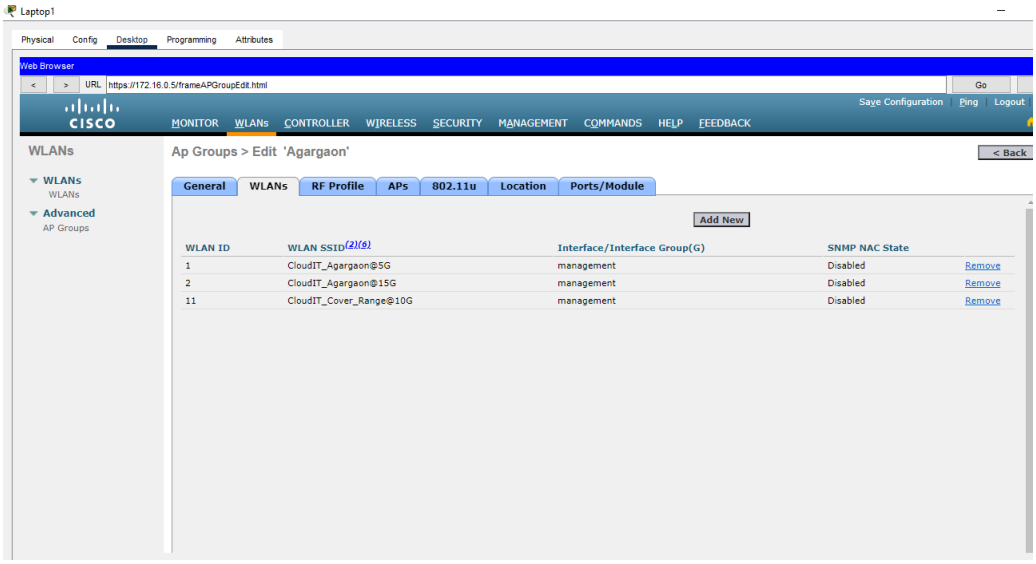

Fig 24: WLCs Section

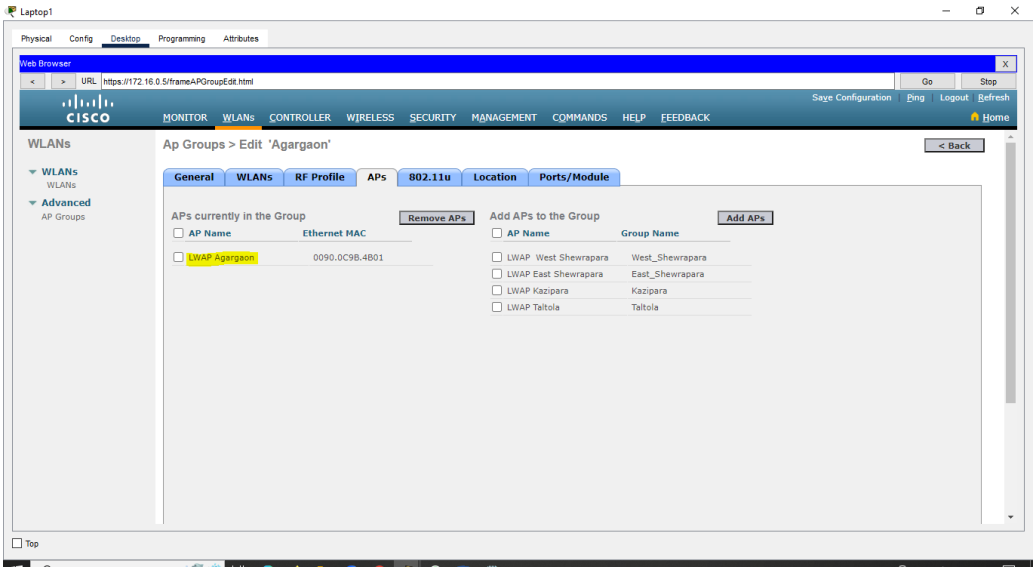

Fig 25: AP set group

We will go into APs option. After that, which SSID will show that will be selected.

2.3.7 FTP Server Configuration

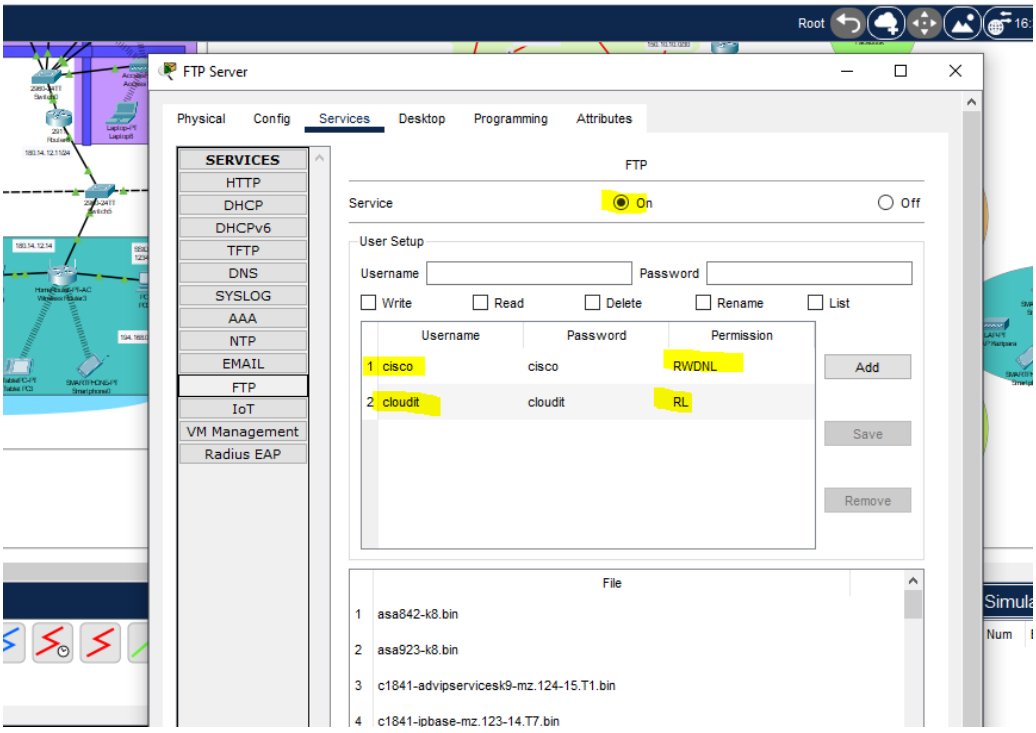

Fig 26: FTP Server Configuration

After completing server ATP configuration, we turn into services option then we will go to on button and click the check mark. Then for admin, we create username and password. Because, admin activities server with can perform all works after that we create username and password and the access here.

Chapter 3
Performance Evaluation

3 Simulation Environment/Simulation Procedure

After completing our implementation, We will check our project performance.

3.0.1 IOT Devices Access Different Places

Here, we will check our IOT Devices from another place's office networks.

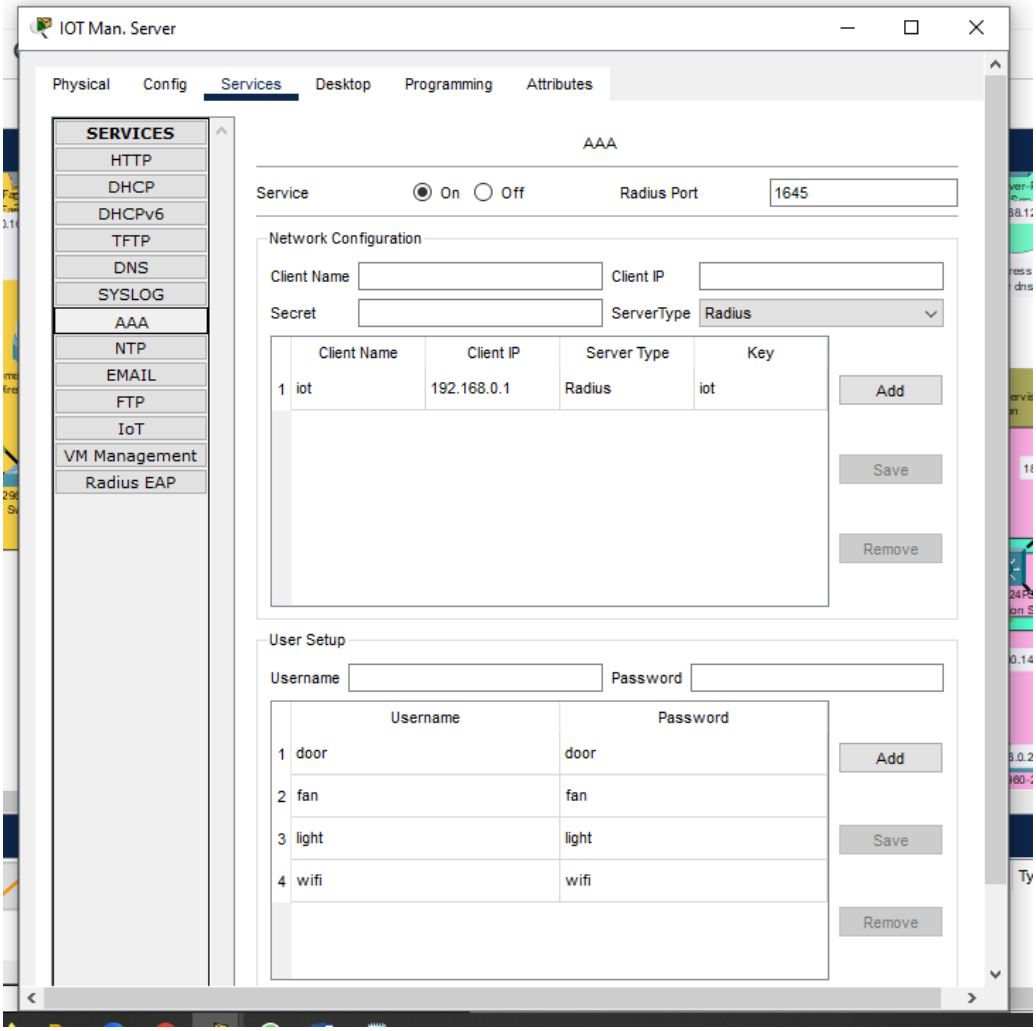

Fig 27: IOT Configuration

In this picture, IOT devices are controlled by the office network's access point. By using smartphone,we open IOT monitor interface. Then we open IOT server and include IP address. After that, we will log in by username and password.

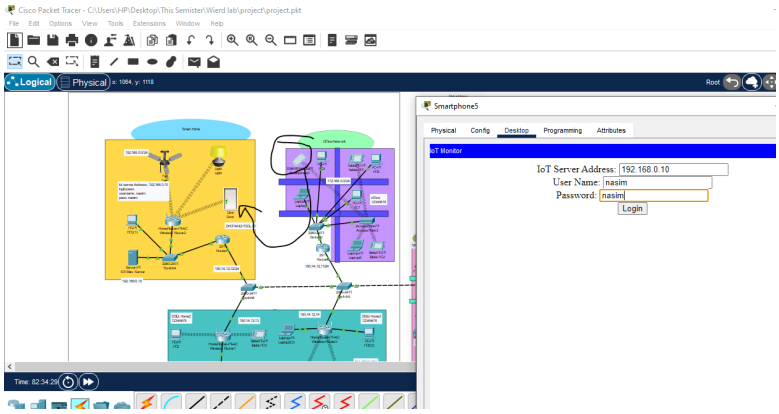

Fig 28: Smart Phone to IoT devices Access

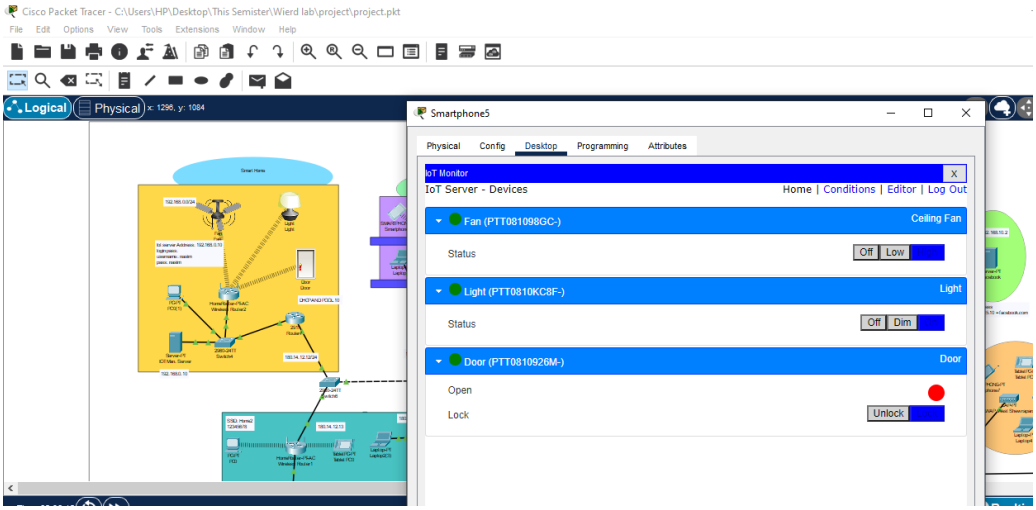

Fig 29: Smart Phone to IoT devices control

3.0.2 Access FTP Server from User End

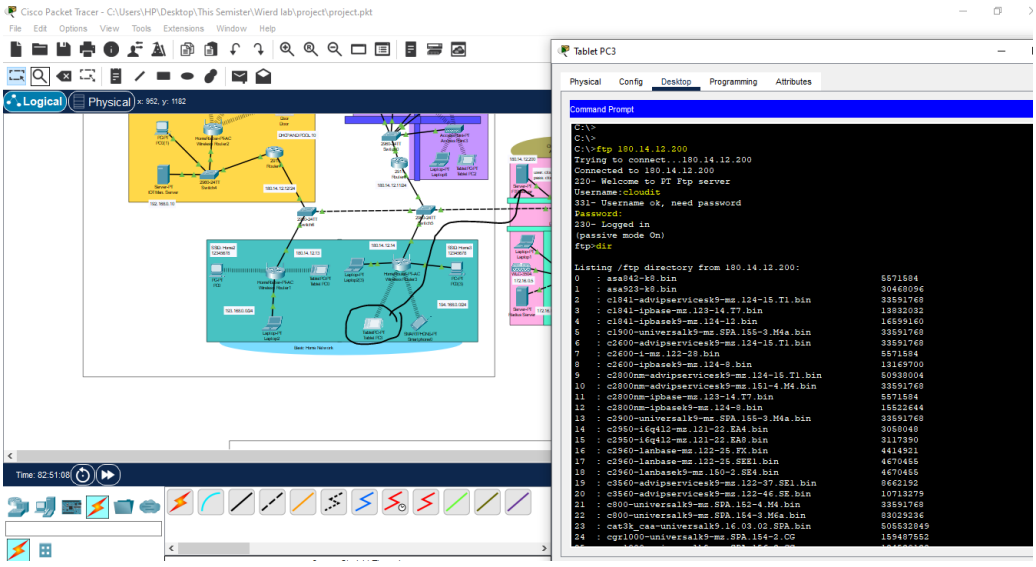

Fig 30: Access FTP Server from User End

To take access, FTP server will maintain commands. We will write "FTP 180.14.12.200" then turn inter. After that, we will access FTP by username and password. After completing this, it will be ready to read and download.

3.0.3 Ping Google and Facebook Server

By using ISP Network, we are now able to ping by commanding Google and Facebook server from user from wireless work.

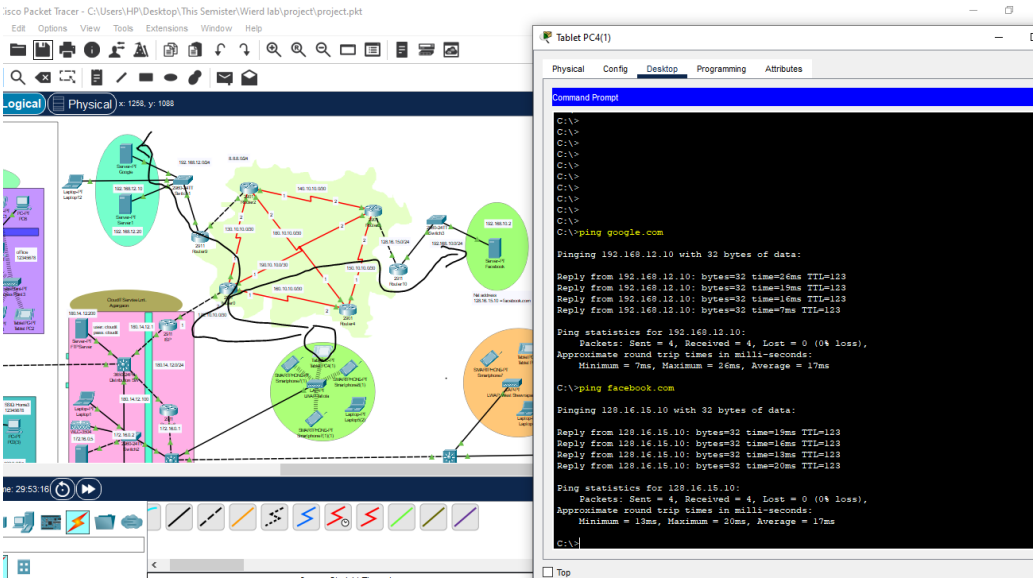

Fig 31: Ping Google and Facebook Server from user

By using ISP network, we can command Google and Facebook server to ping.

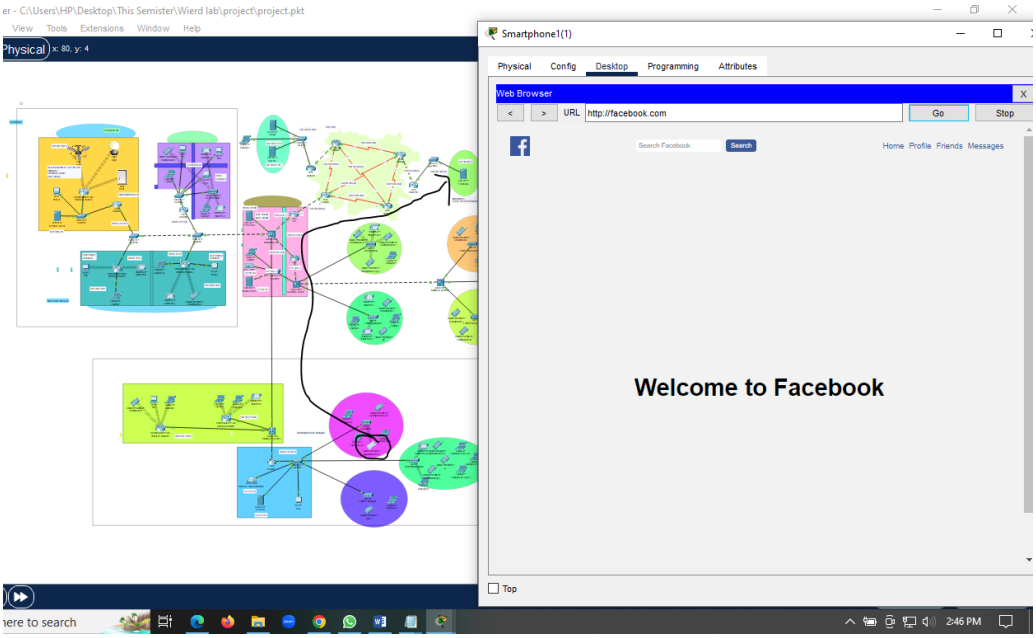

Fig 32: Ping Complete with Facebook

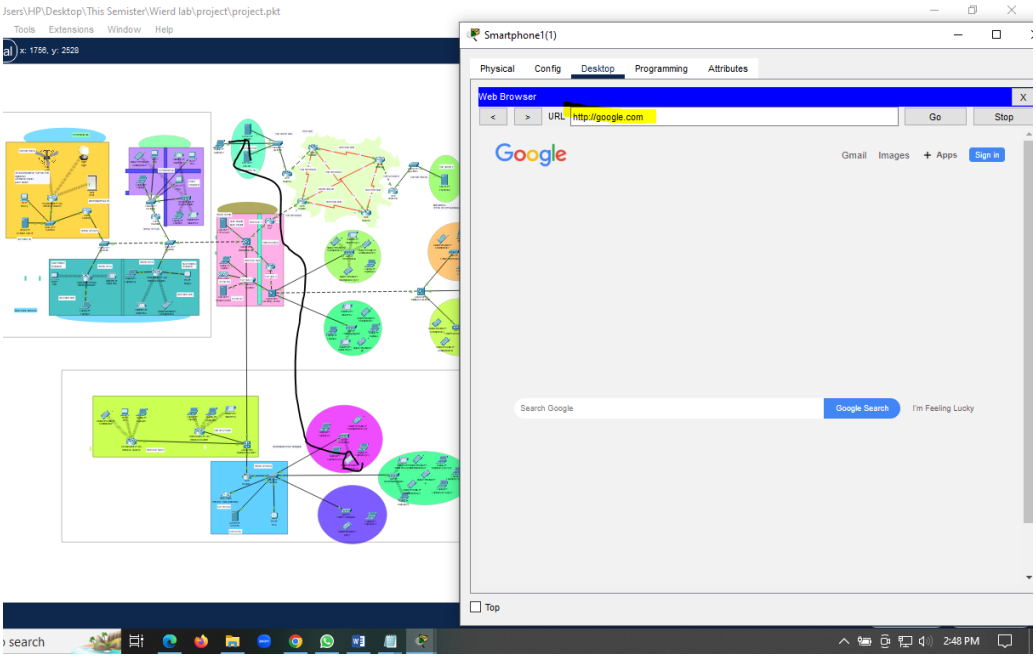

Fig 33: Ping Complete with Google

Here, we checked 2nd branch is connected by user's browser and we ping Google and Facebook server.

Chapter 4

4 Conclusion

4.1 Discussion

We have tried to make the solution according to our original problem where no useless features are used. All the features we used made problem solving even more powerful. After each feature is added its proper working is tested. We have tried to implement maximum learning outcomes in lab classes. Also to add many new functionalities which we have learned from various sources. We faced many problems to solve this project. Since many new things we have learned and implemented.

4.2 Limitations

Connectivity issues with wireless network devices: One limitation of the project is that sometimes the wireless network devices fail to connect to the access point. The cause of this issue could not be determined, which hinders the ability to troubleshoot and resolve the problem effectively.
Lack of MAC address filtering in Cisco Packet Tracer WLC: Another limitation is that the Cisco Packet Tracer Wireless LAN Controller (WLC) does not support filtering MAC addresses. In real devices, MAC address filtering is a common security measure to allow only authorized devices to connect to the network. However, due to the absence of this feature in Cisco Packet Tracer, users are able to connect multiple devices using the same password

4.3 Scope of Future Work

- In our project we are using NAT only in internet network rest of the network we use static, dynamic and PAT as per our requirement.
- We are using RIP routing in our project, we want our project to be bigger where we will use OSPF and BGP routing protocol in addition to Rip Routing.
- Creating separate VLANs on the network and configuring trunk ports to establish connections between them.
- Creating EtherChannels with switch-to-switch backup lines.

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