DEPLOYING "DUAL STACK" IN A CAMPUS NETWORK DIAGRAM

BY

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This Report Presented in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science in Computer Science and Engineering

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APPROVAL

This Project titled "**Deploying Dual Stack in a Campus Network Diagram**", submitted by **Md. Moshfequr Rahman Maruf, Maksudul Islam** and **Puja Das** to the Department of Computer Science and Engineering, Daffodil International University, has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on 3th June 2021.

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DECLARATION

We hereby declare that, this project has been done by us under the supervision of **Narayan Ranjan Chakraborty, Assistant Professor, Department of CSE** Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

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ABSTRACT

This report write on a networking based project named “Deploying Dual Stack in a campus network". Here we configure both IPv4 & IPv6 in a same campus network. Gradually we go ahead to IPv6 for some major limitation of IPv4. so we deploy “Dual stack” in a same network as both IPv4 and IPv6 accessing devices can use it. For deploying this project, we designed a campus network then we implement it in GNS3 and cisco packet tracer simulator, for configuring we use different IP address & routing protocol after that we test the whole network. The main limitation of our project is security issue. Now we can see day by day newly cybercrime will happen so it is major challenge for us to make more secure the campus network. Finally, this project will be helpful any kind of ISP, campus and corporate network. It is also can use as a proper guideline.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

In this current era internet plays a vital role for this reason internet accessing devices are increasing day by day and maximum devices use an IP address. For this rapid growth, IPv4 address are running out gradually for its limited IP. So we want to deploy "Dual Stack" (combination of IPv4 & IPv6) in a campus network. We are currently in IPv4 but IPv6 will be next generation protocol for internet communication because of its largest address, High security features and highly routing efficiency. As our project work with both IP address (IPv4 & IPv6) so it will more effective.

1.2 Motivation

IPv4 address are running out day by day for its small address space and we moving towards IPv6 gradually. IPv6 will be the next generation protocol for internet communication. So, we have to learn how IPv6 works in a network diagram besides IPv4. Since we have implement a "Dual Stack" network in our project so it will help us. This project also helpful for any ISP, IT Sectors, banking sector etc. to stabilize their network diagram.

1.3 Objectives

- Study in basic networking.
- Study in IPv4 & IPv6.
- Studying Dual Stack structure & its components.
- Diagram Design.
- Create Dual Stack diagram in GNS3 simulator.

- IP planning for the designed Dual Stack network.
- Suitable protocol chooses.
- Implement this network diagram.
- Testing the “Dual Stack” network.

1.4 Expected Outcome

After completing our project while all devices are linked up, they can share information easily each other. The system will more secure and data packet will be sent without any traffic. Since our project is Dual Stack, if IPv4 or IPv6 is disabled for any reason, it will act as a backup for the other. Another important outcome is the ISP & IT Sectors can be benefit from our project; they can use our project as a proper guideline.

1.5 Project Management and Finance

project management gives an overview about the project such as how we design, implement and outcome of the project whereas project finance gives funding or financial structure of project. For implementing our project, we need simulator where we design the campus network, as it is a software based project. After design we use different routing protocol and use commands for enable the network and as an output we will get an active campus network which allows both IPv4 and IPv6 address. We will implement a software based project. The simulator that we will use is available and we got them easily. So there will no need of funding or financial structure for the project.

1.6 Report Layout

Here will give a whole overview about our project report. In our project report there are six chapter these are Introduction, Background, Requirement Specification, Design

Specification, Implementation & testing, Conclusion with future scope. In chapter 1 we discuss about Introduction, here also five sub chapter. In introduction we give a brief about the project, in motivation we say why we do this, in objective we show exert what we do in our project, in expected outcome we will show what we can from the project. Chapter 2 was about background about the project. Here we discuss about background Related Works, Scope of The Problem and Challenges that we face. Chapter 3 is about Requirement Analysis. Here we discuss how we collect resources and design the network. Chapter 4 is about Design Specification which describes about whole front and back end design, also describe which requirement we need for implementing. Chapter 5 is Implementing and testing where we give how we implement the project and test result too. The final chapter is conclusion and Future scope where we give an overview about our work and which changes will be in future.

CHAPTER 2

BACKGROUND

2.1 Preliminaries

As web innovation begins to spread in the field, the Internet and our common life have become steadily involved. Thus, the "Dual stack" network is a very interactive and professional LAN. ISPs have chosen an IP address conversion method known as "Dual stack". With the "Dual stack" solution, every networking device, server, switch, router and firewall in the ISP network will be configured with IPv4 and IPv6 connectivity. Most importantly, "Dual stack" technology allows ISPs to process IPv4 and IPv6 data traffic simultaneously. If a IT Sector, ISP includes many professional branches, we can create multiple local area networks and also through wired connections and services this branches.

2.2 Related Works

We can see many projects around us which was implemented by IPv4 or Ipv6. These projects work with a single IP address. But we are deploying a Dual stack in a campus which supports both IP (IPv4 and ipv6). This type of project did not implement yet but there are many resources from where we can take a good knowledge about our projects Wikipedia, research paper, journal, how it works, which protocol being used etc.

The main concept about our project is to study IPv4 and IPv6 and using those implement our project by selecting a campus network.

Though we use IPv4 present now but in near future we must have switch to IPv6 as IPv4 uses 32 bit only and IP address accessing increased phenomenally.

Therefore, we choose this project which has scope to evolution in near future. when we discuss about this project. we face some question:

- Why choose "Dual stack" networks?

- What resources are available for the proposed system? Is the problem worth solving?
- What will happen after the project?
- what filled used it?

2.3 Competitive Analysis

we have a lot of websites, resources from where we can know about many features about IPv4 or IPv6. But question is, are they user friendly? If we think about in current situation for internet communication then our answer is yes, as we are currently in IPv4.But if we think about of near future for internet communication, better efficiency and security then IPv6 is suitable. So, we can say these features are applicable for only single implementation. Whereas our project "Dual stack" which was implement by both IPv4 and IPv6 addresses. This project is very user friendly because it allows both IP using devices in a same network without synchronization. Most important part is will idle for IT sectors as we moving towards IPv6.

2.4 Scope of the problem

Internet Protocol version 4 (IPv4) IP addresses are being used everywhere, but the biggest problem is the small IP addresses (only 32 bits) that are currently in use. To explore the solution, IPv6 IP addresses were invented but not yet widely applied. Therefore, we think it is a good opportunity to configure this network diagram to place a "Dual stack" combination of IPv4 and IPv6.

2.5 Challenges

There are many challenges to complete the project. The following are the challenges:

- Designing the network Diagram.
- Planning & implementing both IPv4 & IPv6 for this network diagram.
- IP assigning to all router interfaces perfectly.
- Troubleshooting of all configurations.

CHAPTER 3

REQUIREMENT SPECIFICATION

3.1 Business Process Modeling

We can use our project as business purpose. ISP can use our project idea to implement their network and they can provide service in house, office building, Banking sectors, Shopping mall through pppoe, static or DHCP service.

3.2 Requirement Collection and Analysis

We visited the server center under DOL (Daffodil Online Limited) to know the requirements of our project and talked to the IT controller and server controller of Daffodil Online Limited. We have learned about the configuration of real life switch and have configured it by studying. We have also seen and gained knowledge of all the devices, routers, cables, switch, printers, servers, computers to do our project.

3.2.1 IP Protocols

IPv4

Internet protocol version 4 is the fourth version of the Internet protocol. IPv4 32-bit address. 5 classes of IPv4 address.

- Class

N	H	H	H

A

- Class

N	N	H	H

B

- Class

N	N	N	H

C

- Class D (Multicasting).
- Class E (Reserved).

<u>Range of IPv4 Classes</u>

Class A – 1.0.0.0 – 126.255.255.255

Class B – 128.0.0.0 – 191.255.255.255

Class C – 192.0.0.0 – 223.255.255.255

I learned a gather knowledge of IPv4 Subnetting.

IPv6

Internet protocol version 6 is the six version of the Internet protocol. IPv4 128-bit address & Hexadecimal format. Every portion separate (:).

2001: ABCD: 0000: 0000: 1234: 0001: 0110: 000F

Three classes of IPv6 address.

- Unicast.
- Multicast.
- Anycast.

Unicast are three types.

- Global Unicast.

- Unique Local.
- Link Local.

Global Unicast: Any addresses that is started in 2000 & first 3 bits are constant like that 001 that's called Global Unicast.

For example: 2001: ABCD :: 1234 : 1 : 110: F

Unique Local: Any addresses that is started in FC00 & first 7 bits are constant like that that's called Unique Local.

For example: FC00 : 0 : 0 : 1 :: AAAA

link Local: Any addresses that is started in FE80 & first 10 bits are constant like that's called Unique Local.

For example: FC00 : 0 : 0 : 1 :: AAAA

I learned a gather knowledge of IPv6 Subnetting.

3.2.2 Switch Basic Configuration

The topics we cover:

- Hostname Setup.
- Console Password Setup.
- Enable Password Setup.
- Enable Secret Password Setup.
- Telnet Configuration.
- VLAN Configuration
- Port assign to single interface.

8. Port assign using "range" command.

To configure a switch, we have to know three basic modes. These modes also are the same for

Router. Total five modes are given below.

S/N Mode Explanation:

1. User Execution Switch>

2. Privilege Switch#

3. Global configuration Switch(config)#

4. Interface Switch(config-if)#

5. Sub-interface Switch(config-subif)#

**For a fresh switch we have to take access the switch using console.

Press RETURN to get started!

Switch>en

Switch>enable

Switch#conf

Switch#configure t

Switch#configure terminal

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

Switch(config)#

1. Hostname Setup:

Switch(config)#hostname Switch1

2. Console Password Setup:

Switch1(config)#line console 0

Switch1(config-line)#password cisco

Switch1(config-line)#login

Switch1(config-line)#exit

Switch1(config)#

Switch1#end

Translating "end"...domain server (255.255.255.255)

Switch1(config)#no ip domain-lookup

3. Enable Password Setup:

Switch1(config)#enable password 12345

4. Enable Secret Password Setup:

Switch1(config)#enable secret cisco123

**This password is recommended than ‘enable password’ because it is encrypted by default.

**To Encrypt system passwords we have to execute this command:

Switch1(config)#service password-encryption

**Actually telnet/vty is for remote access, so we must need to configure IP Address and

default-gateway. (Public/Real IP). But in layer 2 switch IP address cannot be configured in its

interfaces that’s why we have to configure IP address in its default vlan “Vlan 1” or by creating another vlan as per our requirement. Here we configured the IP address to the default vlan

Switch1(config)#interface vlan 1

Switch1(config-if)#ip address 192.168.10.10 255.255.255.0

Switch1(config-if)#no shutdown

Switch1(config-if)#exit

Switch1(config)#ip default-gateway 192.168.10.1**By default the telnet client of windows is disabled. So we have to enable the telnet client service.

3.3 Use Case Modeling & Description

Generally, use case model diagram used to show the relation between client and the system. By the basis of scenario, we will draw the use case usually to stablished the relationship and the audience can easily understand what we actually want to say. In a word a use case diagram points out the interaction between the system and the users and how many ways the action can be done by the actor. Simply we can say the use case is the work flow of the whole system.

Use case scenario

Basically in our project the user will sent packet easily inside the campus network using both IPv4 and IPv6 address. So here devices will act as client/actor. Inside the network there are different department, server. These department consists with router, switches,

devices. They will refer to Internet operator. Here also Internet service protocol attached they refers as Network Provider. So in our use case diagram we show how the actor influence with whole internal system.

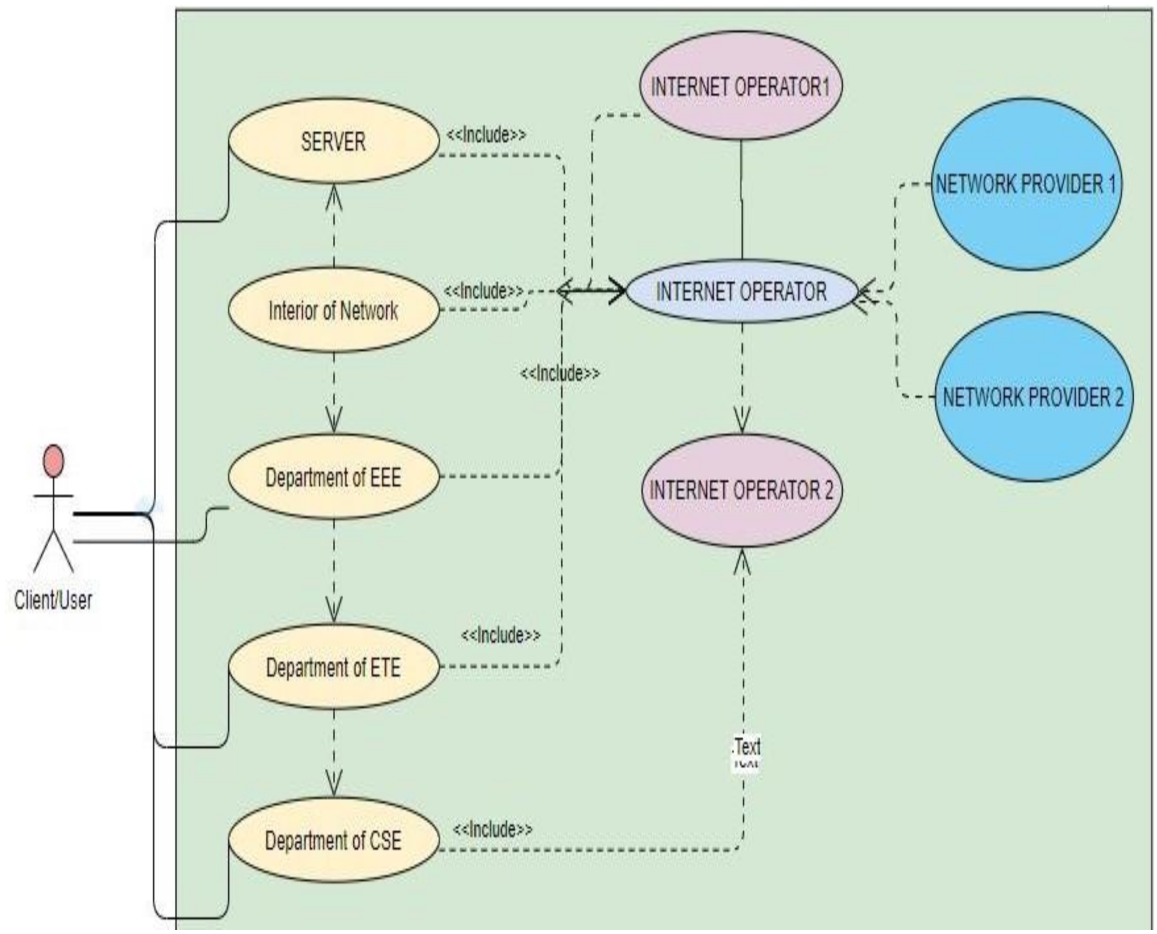


Figure 3.1: Use Case Modeling Diagram

The use case model diagram that we draw for the campus network will give below in Figure 3.1.

3.4 Design Requirement

For our project design, we can use Cisco Packet Tracer, Draw.Io and GNS3 Simulator. We build a prototype using their simulator. We want to download the personal websites of their simulators. Cisco Packet Tracer was powered by a Cisco where we can use and play all Cisco devices GNS3 simulator.

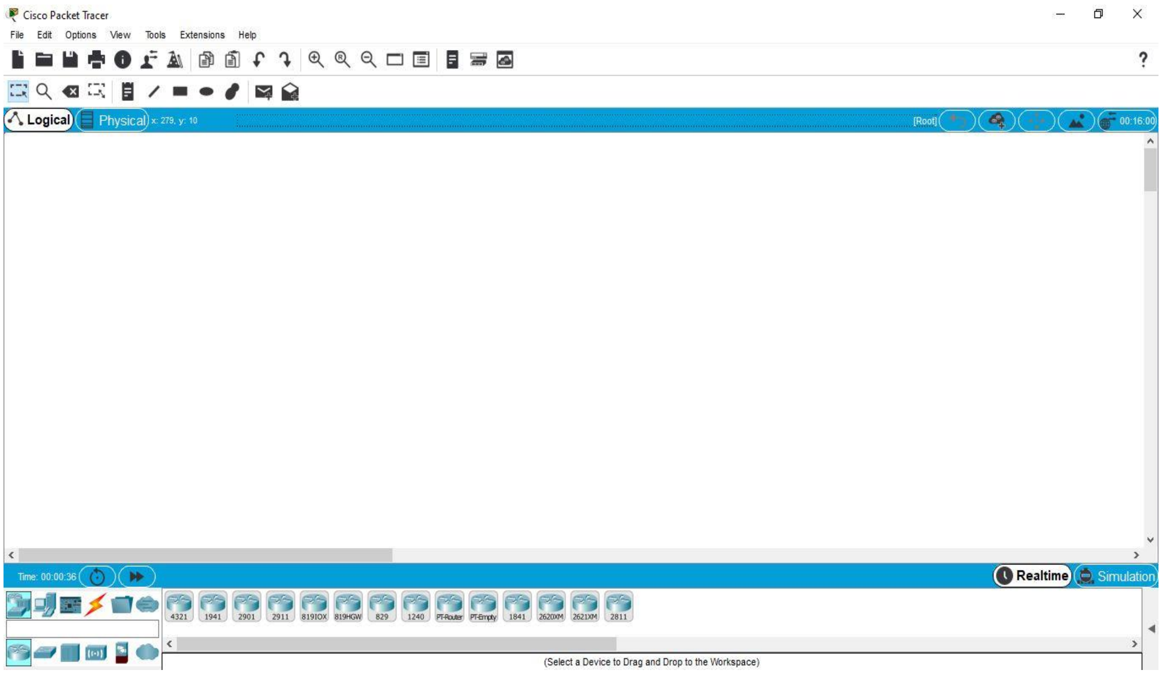


Figure 3.2: Cisco Packet Tracer Simulator

This figure 3.2, is the direction of Cisco Packet Tracer where we are going to build our network prototype.

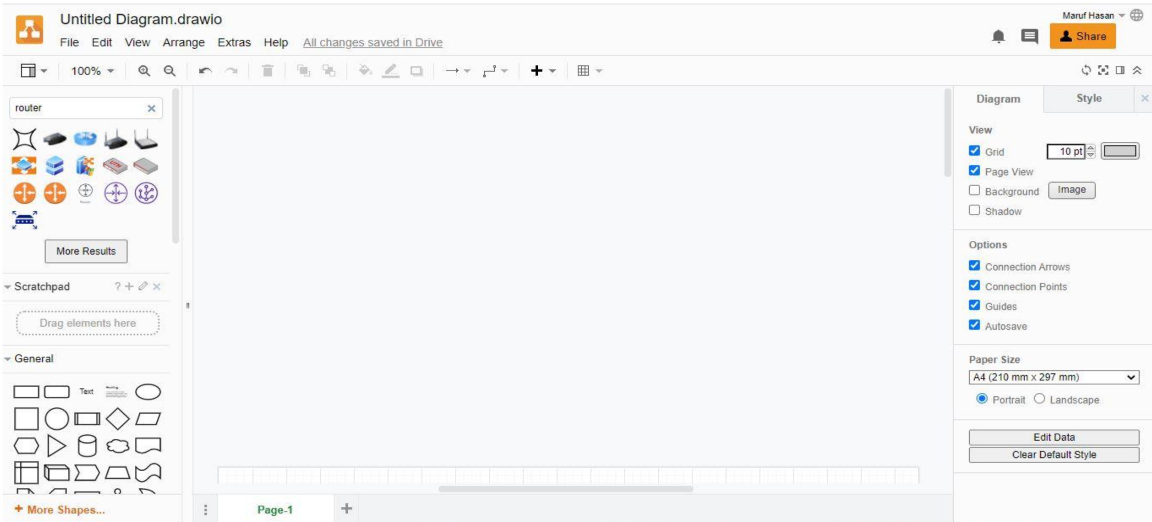


Figure 3.3: Draw.io Simulator

This figure 3.3 is the outlook of Draw.io simulator. We also make our network prototype besides cisco packet tracer & GNS3.

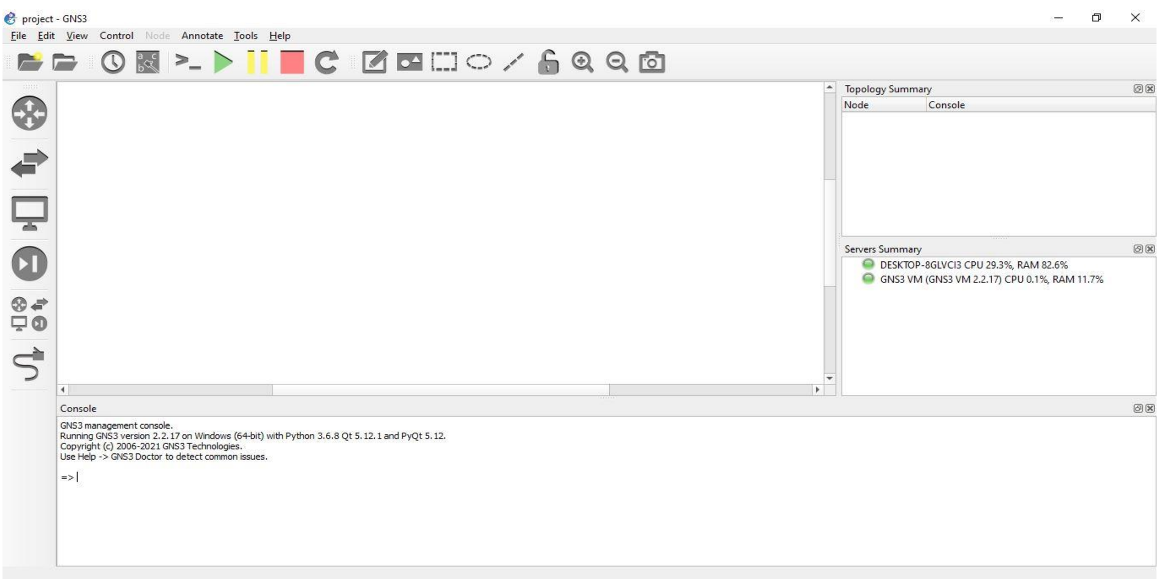


Figure 3.4: GNS3 Simulator

This figure 3.4, is of the GNS3 simulator method. We build our network prototypes in addition to the Cisco Packet Tracer.

CHAPTER 4

DESIGN SPECIFICATION

4.1 Front-end Design

The sketch diagram of our project that we draw.

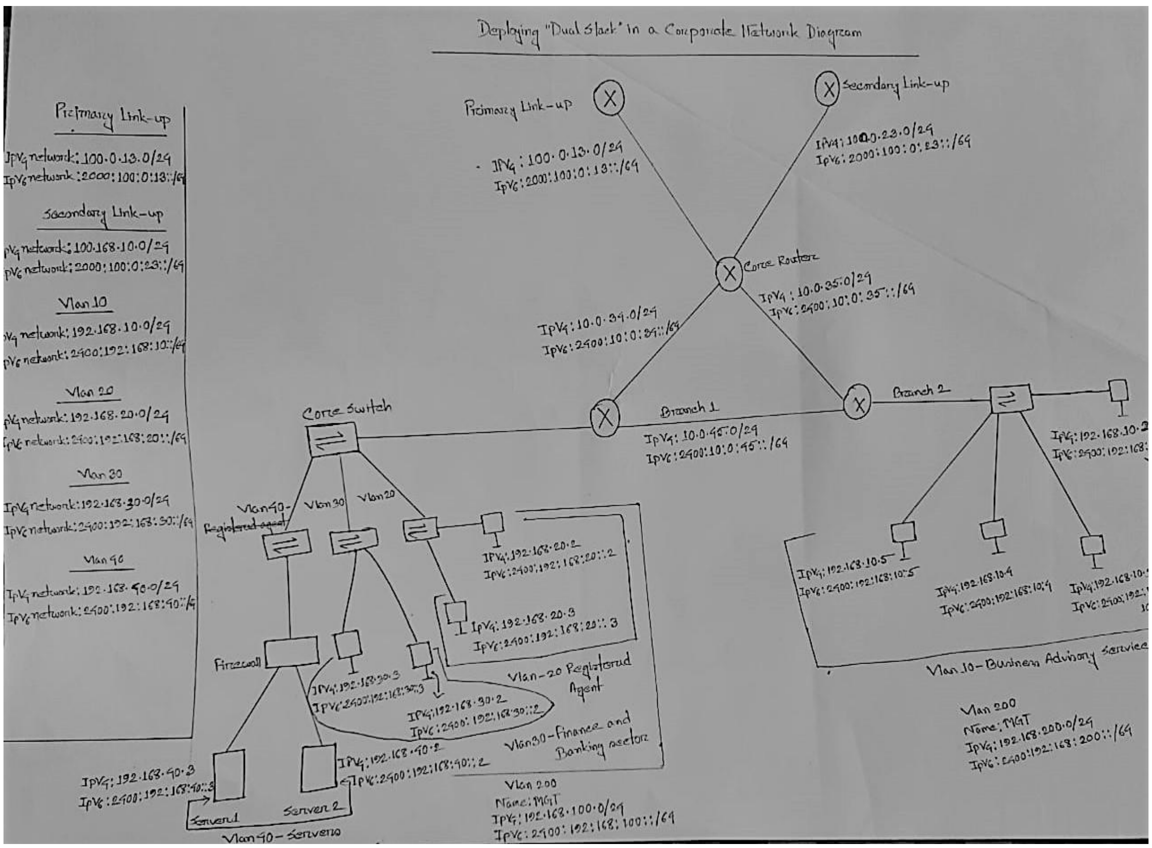


Figure 4.1: Sketch Diagram

This figure 4.1, is sketch design of our campus network. This is the complete design of our project where we are trying to show all the necessary elements with proper IPv4 and IPv6 address plan.

We use router, switch, server, pc, laptop & printer for designing the campus network. The appliances are shown below:

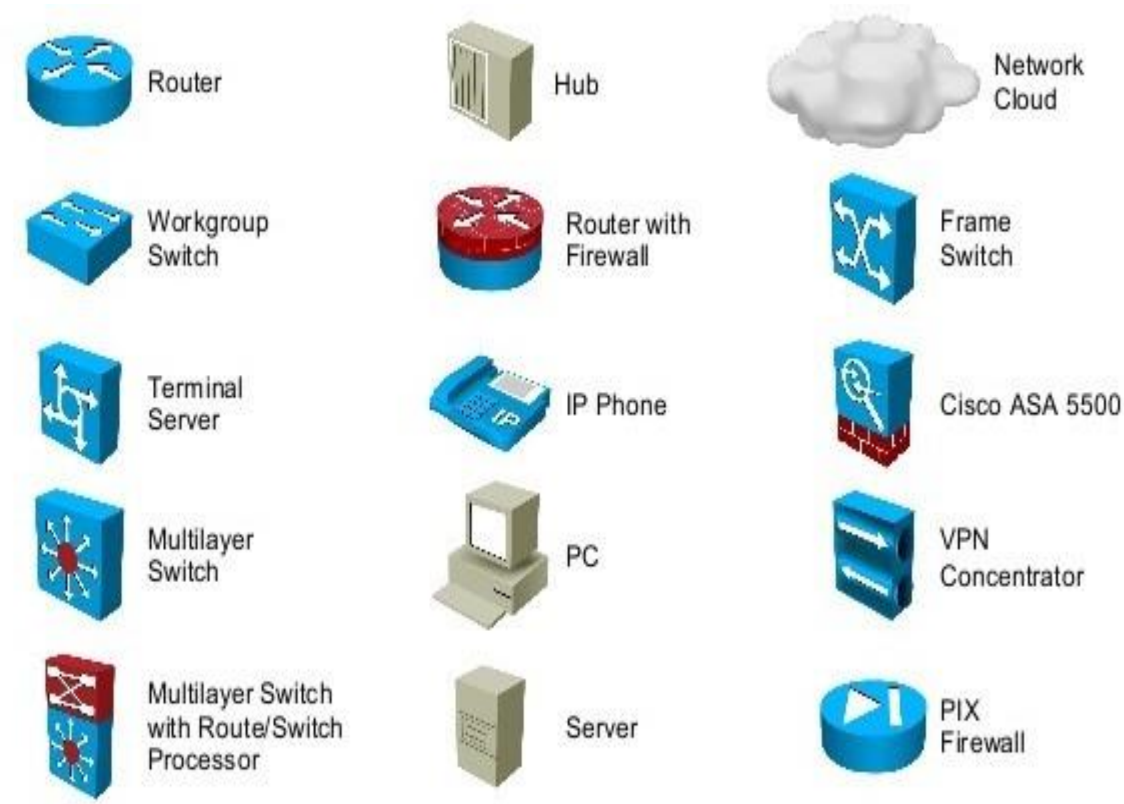


Figure 4.2: Instrument for design

This figure 4.2, is components of our project.

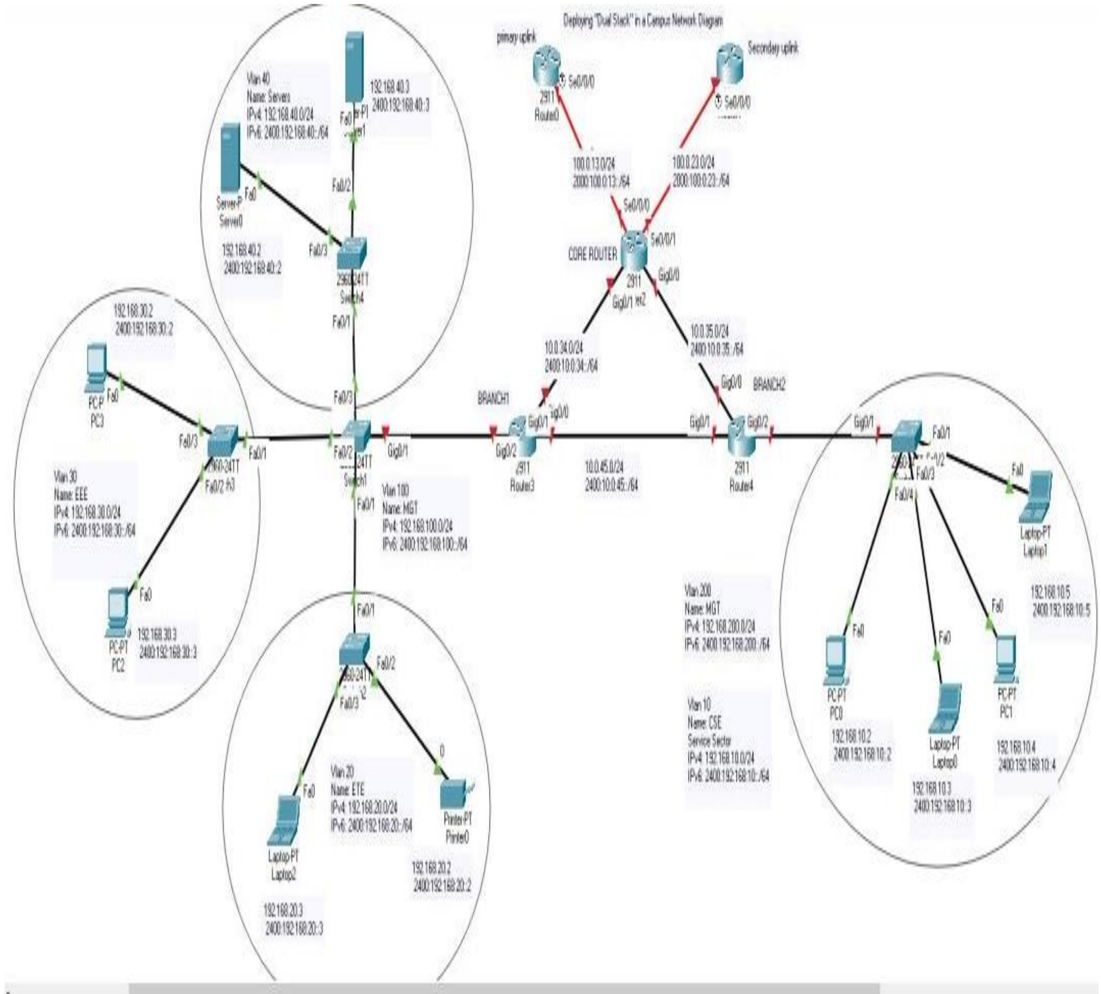


Figure 4.3: Campus Network that we Design in Packet Tracer

This figure 4.3, is complete design of our campus network that we designed at Cisco Packet Tracer Simulator using IPv4 and IPv6 addresses.

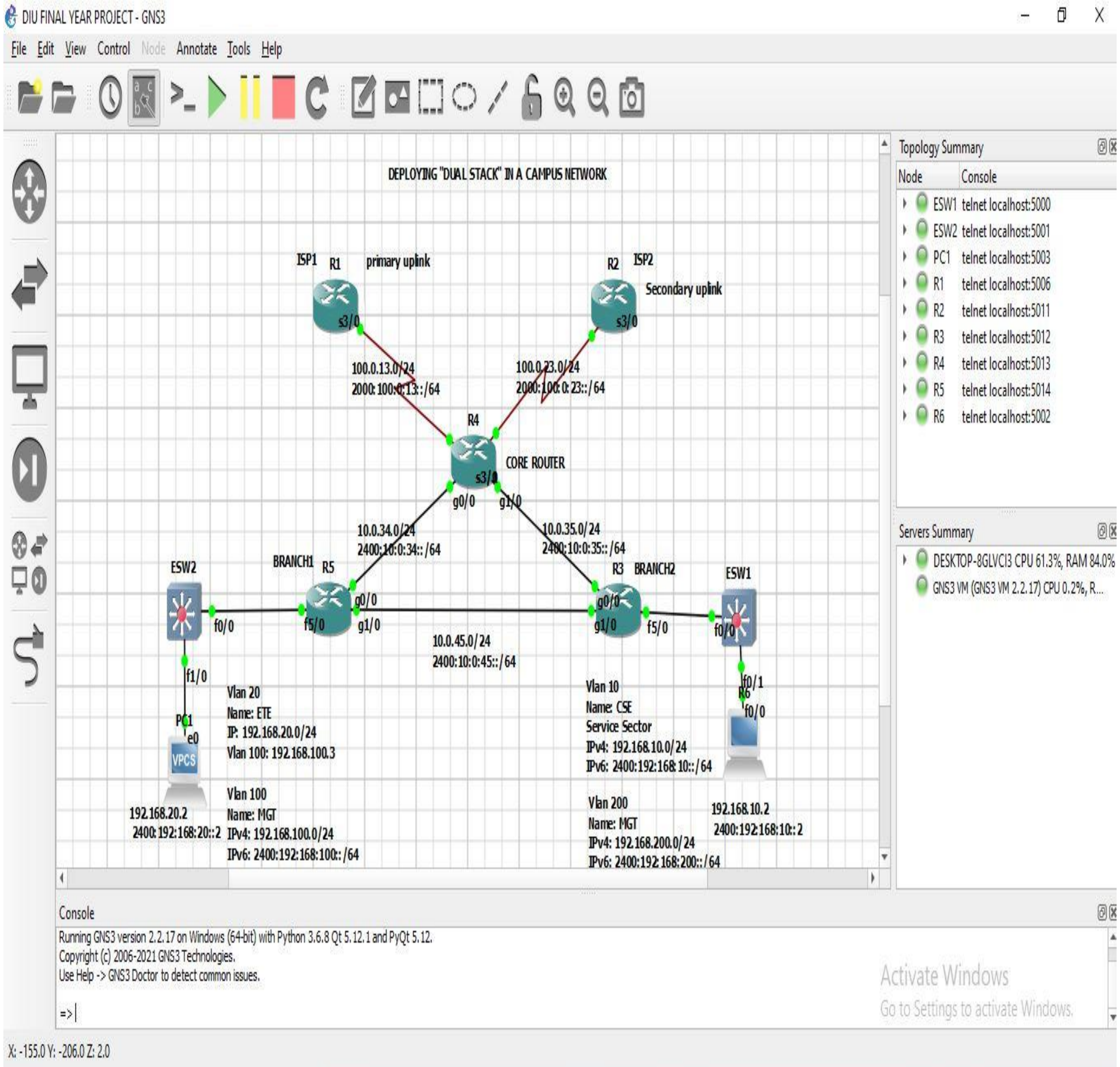


Figure 4.4: Network Design in GNS3

This figure 4.4 is complete design of our campus network that we designed in GNS3 Simulator using IPv4 and IPv6 addresses.

4.2 Back-end Design

Back-end design is the design where we will configure our protocol like as router, switch, PC, Printer in command. Next few figures will show the back-end design of different devices we use.

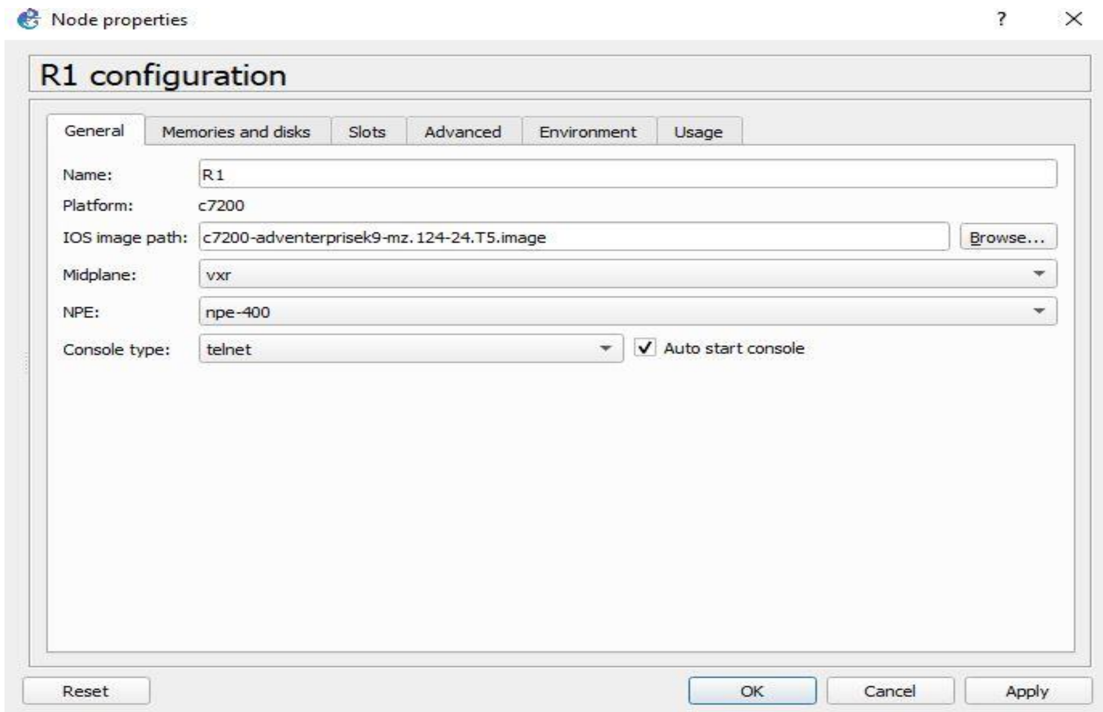


Figure 4.5: back-end design of a router

This figure 4.5 is the back-end design of a router.

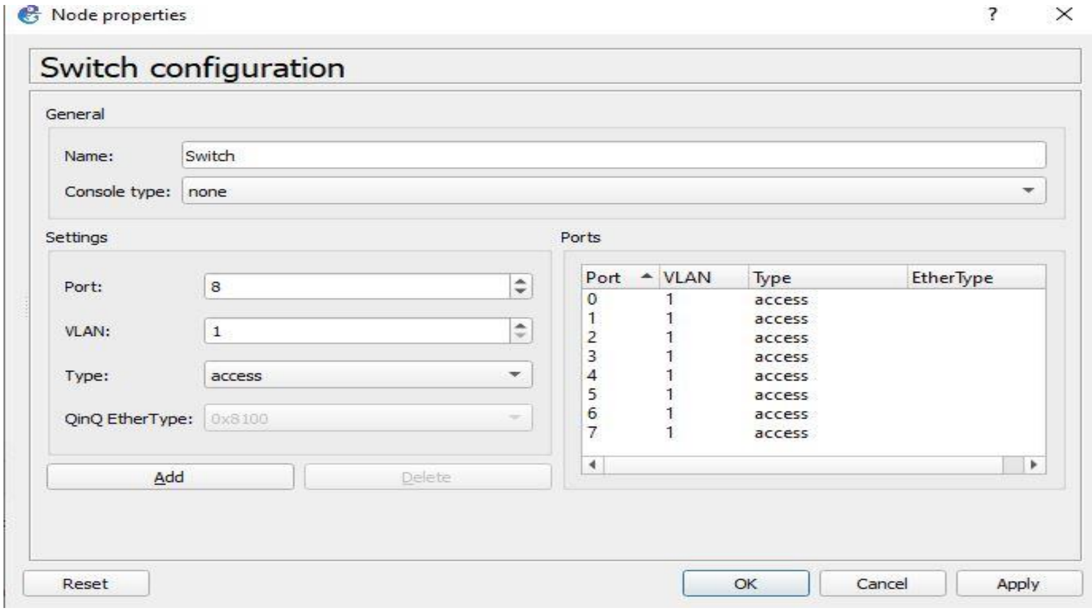


Figure 4.6: back-end design of a switch

This figure 4.6 is the back-end design of a switch.

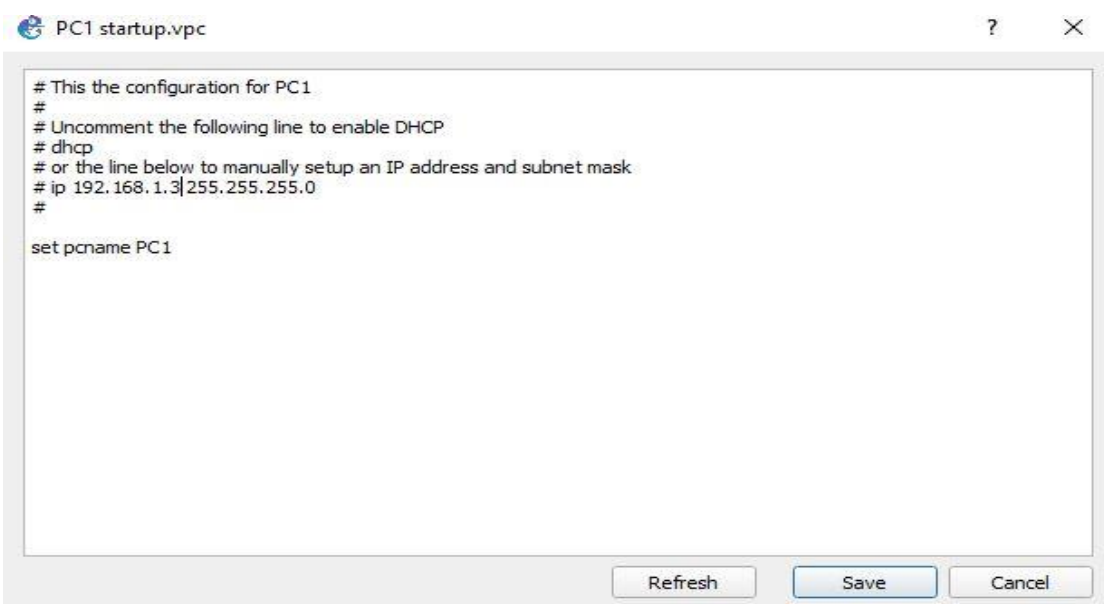


Figure 4.7: back-end design of a PC.

This figure 4.7 is the back-end design of a PC.

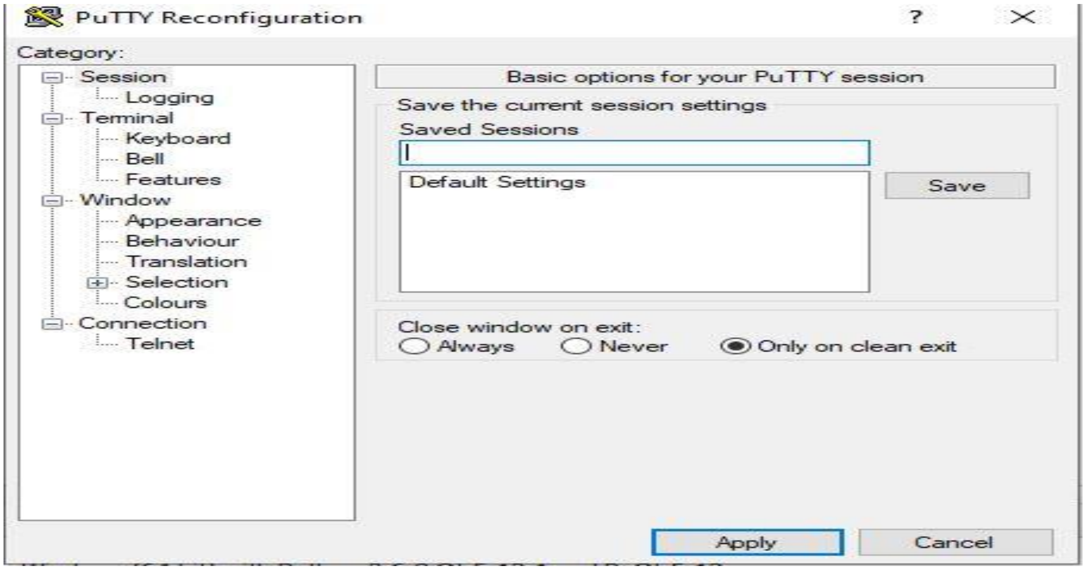


Figure 4.8: back-end design of a putty.

This figure 4.8 is the back-end design of a putty.

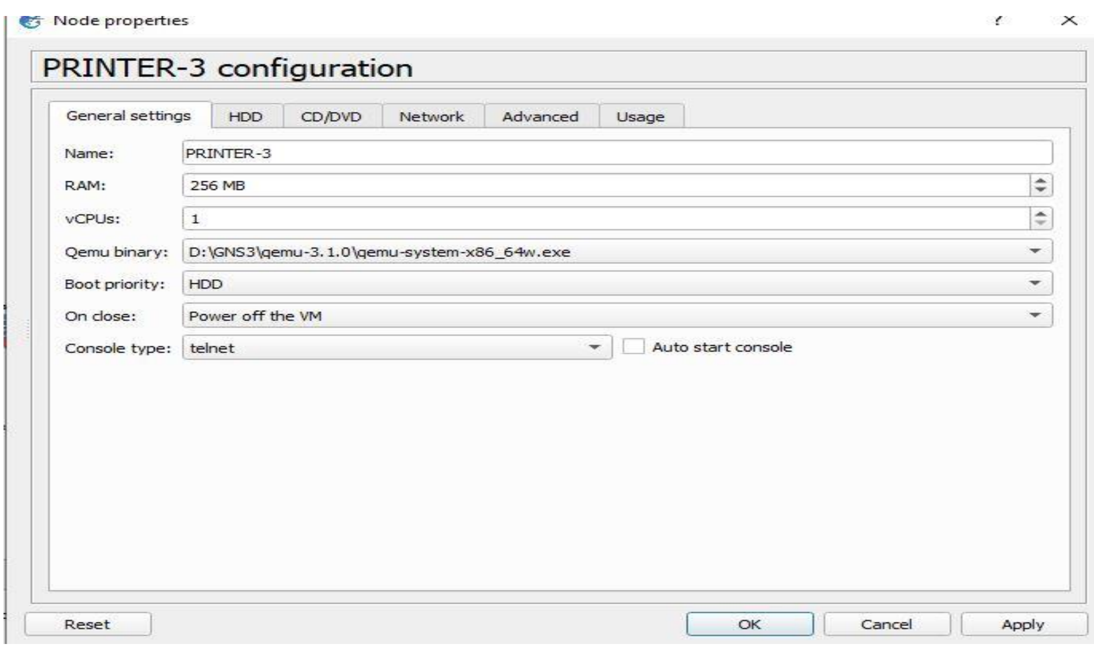


Figure 4.9: back-end design of a Printer

This figure 4.9 is the back-end design of a Printer.

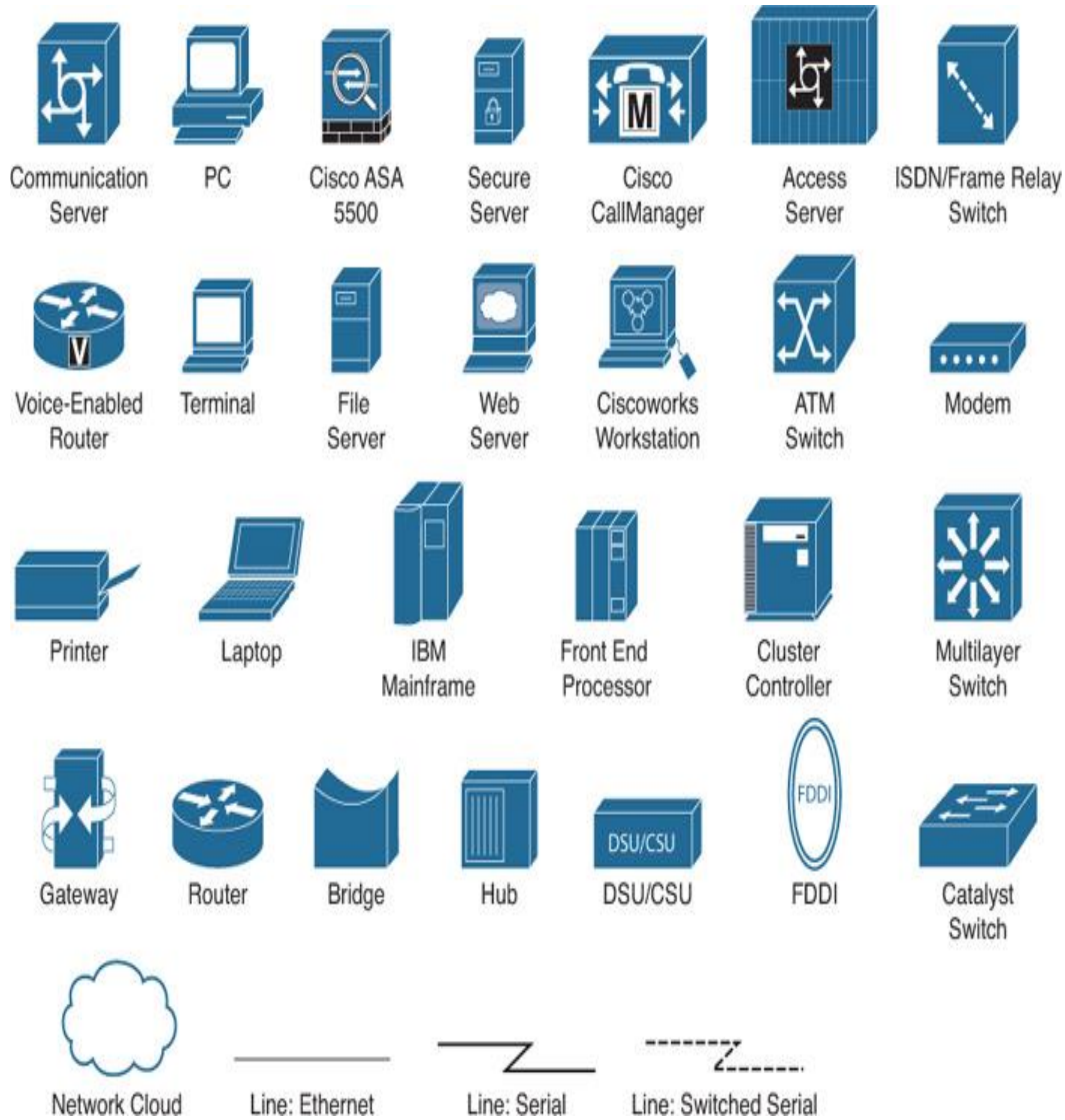


Figure 4.10: GNS3 Protocols

This figure4.10 shows that equipment that we use in GNS3 Simulator.

4.3 Interaction Design and User Experience (UX)

UX means user experience, we just implement our project but not launch it yet publicly. So we are sorry about it as we can't give any information about user experience.

4.4 Implementation Requirements

To implement the Campus Network, we use packet tracer and GNS3 simulator. We need network protocols for designing the campus network such as, router, switch, pc, laptop, printer and connecting wires. We also need routing protocol to enable the network. We will use Ospf routing, BGP routing, NAT, Vlan, Inter-Vlan. For implementing “Dual Stack” we have to give command in all protocol that we use.

CHAPTER 5

IMPLEMENTATION AND TESTING

5.1 Implementation of Front-end Design

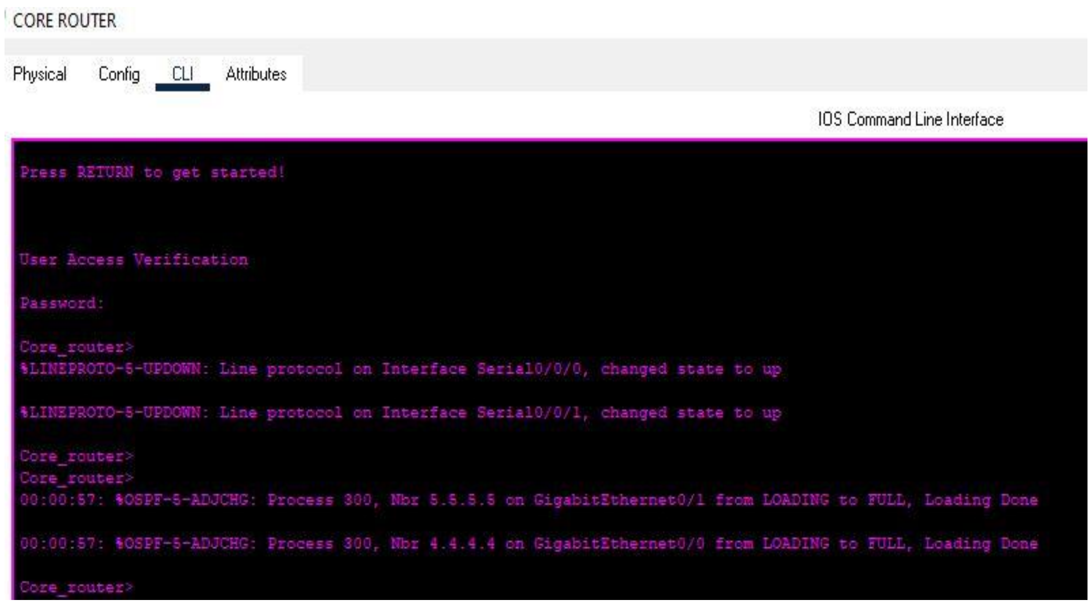


Figure 5.1: Enable password of all routers

In this figure5.1, we setup router enable password in GNS3 for its better security & we also configure hostname to identify specific router.

ISP_1 Router Configuration:

```
Router>enable
Router#configure terminal
Router(config)#hostname ISP_1

ISP_1(config)#interface se3/0
ISP_1(config-if)#ip address 100.0.13.1 255.255.255.0
ISP_1(config-if)#description "To_Core_Router"
ISP_1(config-if)#no shutdown
ISP_1(config-if)#exit
ISP_1(config)#do wr
Building configuration...
[OK]

ISP_1(config)#ipv6 unicast-routing
ISP_1(config)#interface se3/0
ISP_1(config-if)#ipv6 address 2000:100:0:13::1/64
ISP_1(config-if)#exit
ISP_1(config)#do wr
Building configuration...
[OK]

ISP_1(config)#router bgp 100
ISP_1(config-router)#bgp router-id 1.1.1.1
ISP_1(config-router)#neighbor 2000:100:0:13::3 remote-as 300

ISP_1(config-router)#address-family ipv6 unicast
ISP_1(config-router-af)#neighbor 2000:100:0:13::3 activate
ISP_1(config-router-af)#neighbor 2000:100:0:13::3 next-hop-self
ISP_1(config-router-af)#neighbor 2000:100:0:13::3 default-originate
ISP_1(config-router-af)#exit-address-family
ISP_1(config-router)#
ISP_1(config-router)#exit
ISP_1(config)#do wr
Building configuration...
[OK]
```

Figure 5.2: ISP_1 router configuration

Figure 5.2, ISP_1 is primary linkup of our project network diagram. In this figure, we want to show which command we used in backend of ISP_1 router in GNS3.

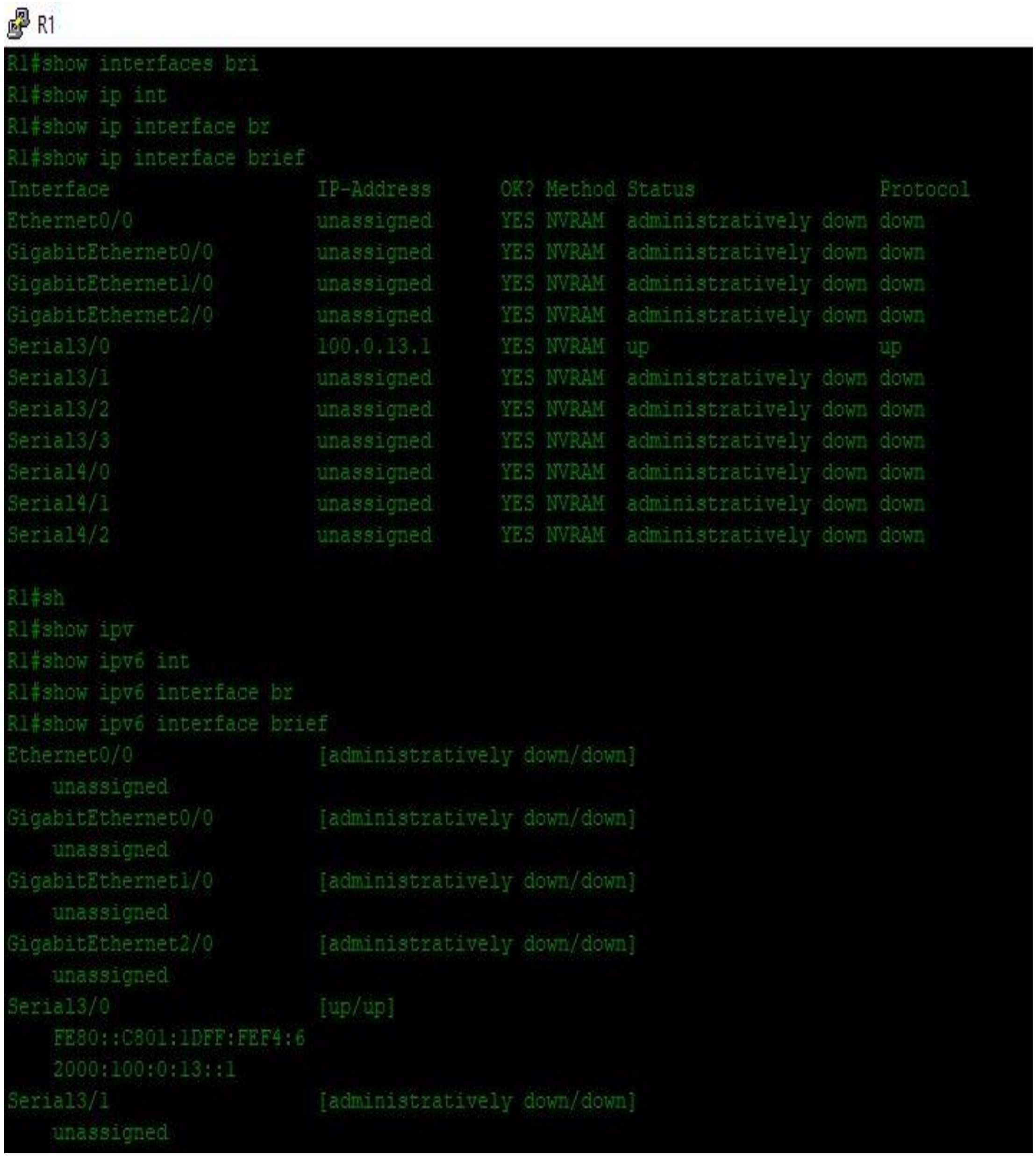


Figure 5.3: ISP_1 all Interface Linkup

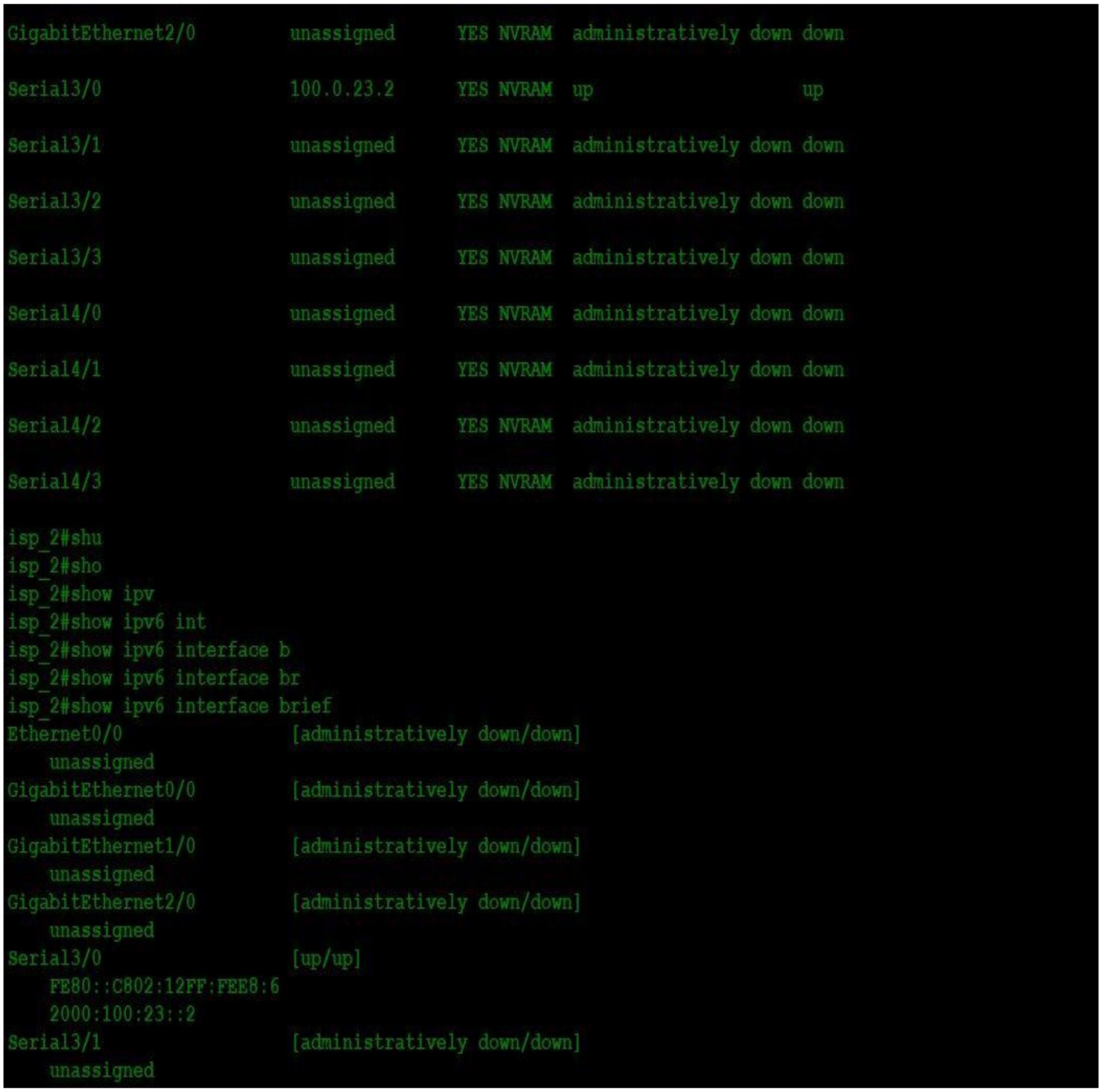
In this figure 5.3, we show that how primary link attach with core router using "ip interface brief" command for IPv4 & "ipv6 interface brief" command for IPv6 addresses in GNS3.

ISP_2 Router Configuration

```
ISP_2>enable
ISP_2#configure terminal
ISP_2(config)#hostname ISP_2

ISP_2(config)#interface se3/0
ISP_2(config-if)#description "To_Core_Router"
ISP_2(config-if)#ip address 100.0.23.2 255.255.255.0
ISP_2(config-if)#no shutdown
ISP_2(config-if)#exit

ISP_2(config)#do wr
Building configuration...
[OK]
ISP_2(config)#
ISP_2(config)#do ping 100.0.23.3

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 100.0.23.3, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/1/5 ms

ISP_2(config)#ipv6 unicast-routing
ISP_2(config)#interface se3/0
ISP_2(config-if)#ipv6 address 2000:100:0:23::2/64
ISP_2(config-if)#exit
ISP_2(config)#do wr
Building configuration...
[OK]
ISP_2(config)#

ISP_2(config)#router bgp 200
ISP_2(config-router)#bgp router-id 2.2.2.2
ISP_2(config-router)#neighbor 2000:100:0:23::3 remote-as 300

ISP_2(config-router)#address-family ipv6 unicast
ISP_2(config-router-af)#neighbor 2000:100:0:23::3 activate
ISP_2(config-router-af)#neighbor 2000:100:0:23::3 next-hop-self
ISP_2(config-router-af)#neighbor 2000:100:0:23::3 default-originate
ISP_2(config-router-af)#exit-address-family
ISP_2(config-router)#
ISP_2(config-router)#exit
ISP_2(config)#do wr
Building configuration...
[OK]
ISP_2(config)#exit
```

Figure 5.4: ISP_2 router configuration

Figure 5.4, ISP_2 is secondary linkup of our project network diagram. In this figure, we want to show which command we used in backend of ISP_2 router in GNS3.



```
GigabitEthernet2/0        unassigned      YES NVRAM  administratively down down

Serial3/0                 100.0.23.2      YES NVRAM  up                    up

Serial3/1                 unassigned      YES NVRAM  administratively down down

Serial3/2                 unassigned      YES NVRAM  administratively down down

Serial3/3                 unassigned      YES NVRAM  administratively down down

Serial4/0                 unassigned      YES NVRAM  administratively down down

Serial4/1                 unassigned      YES NVRAM  administratively down down

Serial4/2                 unassigned      YES NVRAM  administratively down down

Serial4/3                 unassigned      YES NVRAM  administratively down down

isp_2#shu
isp_2#sho
isp_2#show ipv
isp_2#show ipv6 int
isp_2#show ipv6 interface b
isp_2#show ipv6 interface br
isp_2#show ipv6 interface brief
Ethernet0/0               [administratively down/down]
    unassigned
GigabitEthernet0/0        [administratively down/down]
    unassigned
GigabitEthernet1/0        [administratively down/down]
    unassigned
GigabitEthernet2/0        [administratively down/down]
    unassigned
Serial3/0                 [up/up]
    FE80::C802:12FF:FEE8:6
    2000:100:23::2
Serial3/1                 [administratively down/down]
    unassigned
```

Figure 5.5: ISP_2 all Interface Linkup

In this figure 5.5, we show that how secondary link attach with core router using “ip interface brief” command for IPv4 & “ipv6 interface brief” command for IPv6 addresses in GNS3.

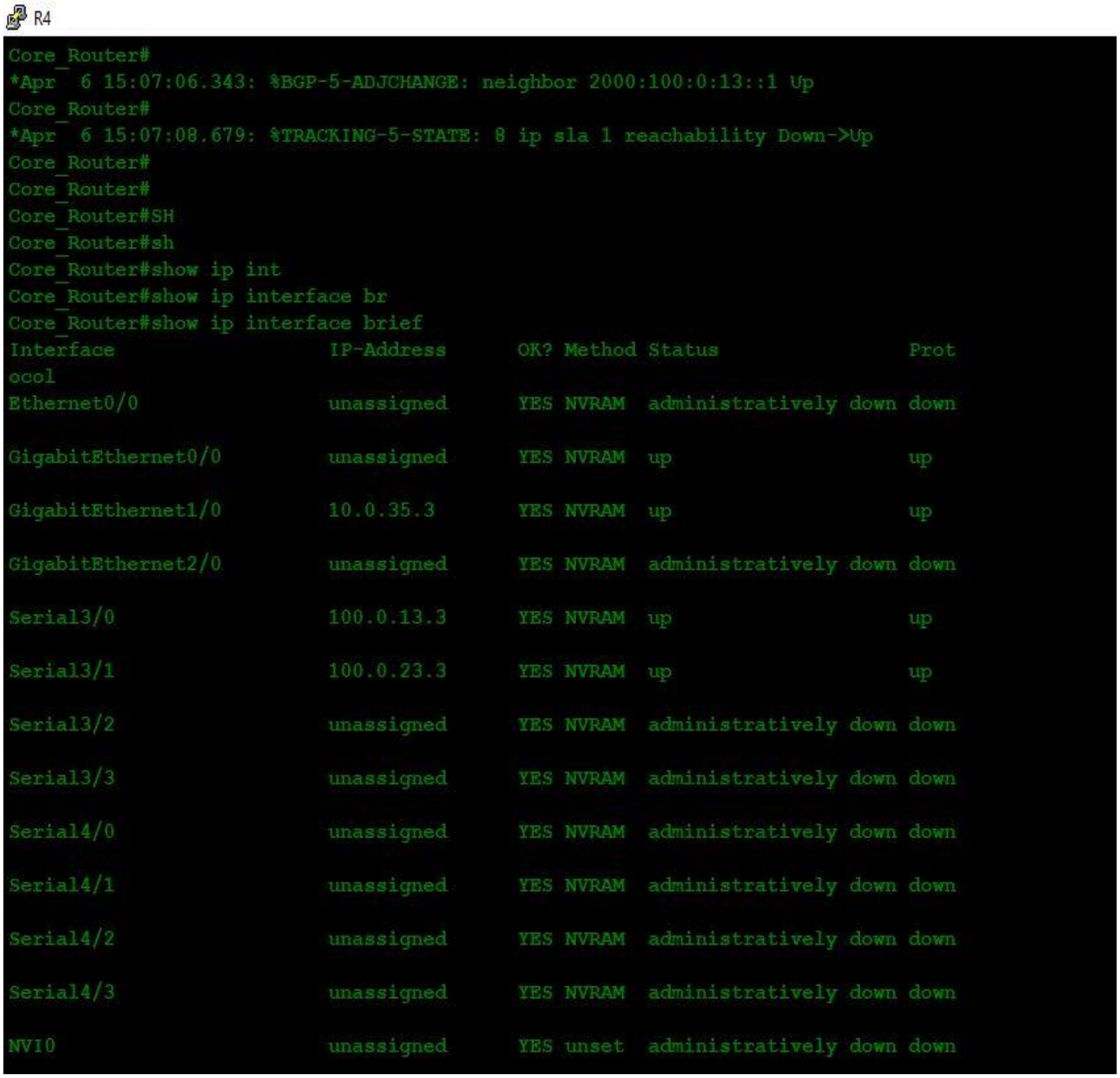
Core Router Configuration:

R4

```
!
router ospf 300
 router-id 3.3.3.3
 log-adjacency-changes
 network 10.0.34.0 0.0.0.255 area 0
 network 10.0.35.0 0.0.0.255 area 0
 default-information originate always
!
router bgp 300
 no synchronization
 bgp log-neighbor-changes
 neighbor 2000:10:0:23::2 remote-as 200
 neighbor 2000:100:0:13::1 remote-as 100
 neighbor 2000:100:0:13::1 description Primary_ISP
 neighbor 2000:100:0:23::2 remote-as 200
 neighbor 2000:100:0:23::2 description Secondary_ISP
 no auto-summary
 !
 address-family ipv6
  neighbor 2000:10:0:23::2 activate
  neighbor 2000:10:0:23::2 route-map PREPEND out
  neighbor 2000:100:0:13::1 activate
  neighbor 2000:100:0:13::1 next-hop-self
  neighbor 2000:100:0:13::1 route-map LOCALPREF in
  neighbor 2000:100:0:23::2 activate
  neighbor 2000:100:0:23::2 next-hop-self
  network 2400:10:0:34::/64
  network 2400:10:0:35::/64
  network 2400:10:0:45::/64
  network 2400:192:168:10::/64
  network 2400:192:168:20::/64
  network 2400:192:168:30::/64
  network 2400:192:168:40::/64
 exit-address-family
!
ip forward-protocol nd
ip route 0.0.0.0 0.0.0.0 100.0.13.1 track 8
ip route 0.0.0.0 0.0.0.0 100.0.23.2 10
no ip http server
no ip http secure-server
!
```

Figure 5.6: Core Router configuration

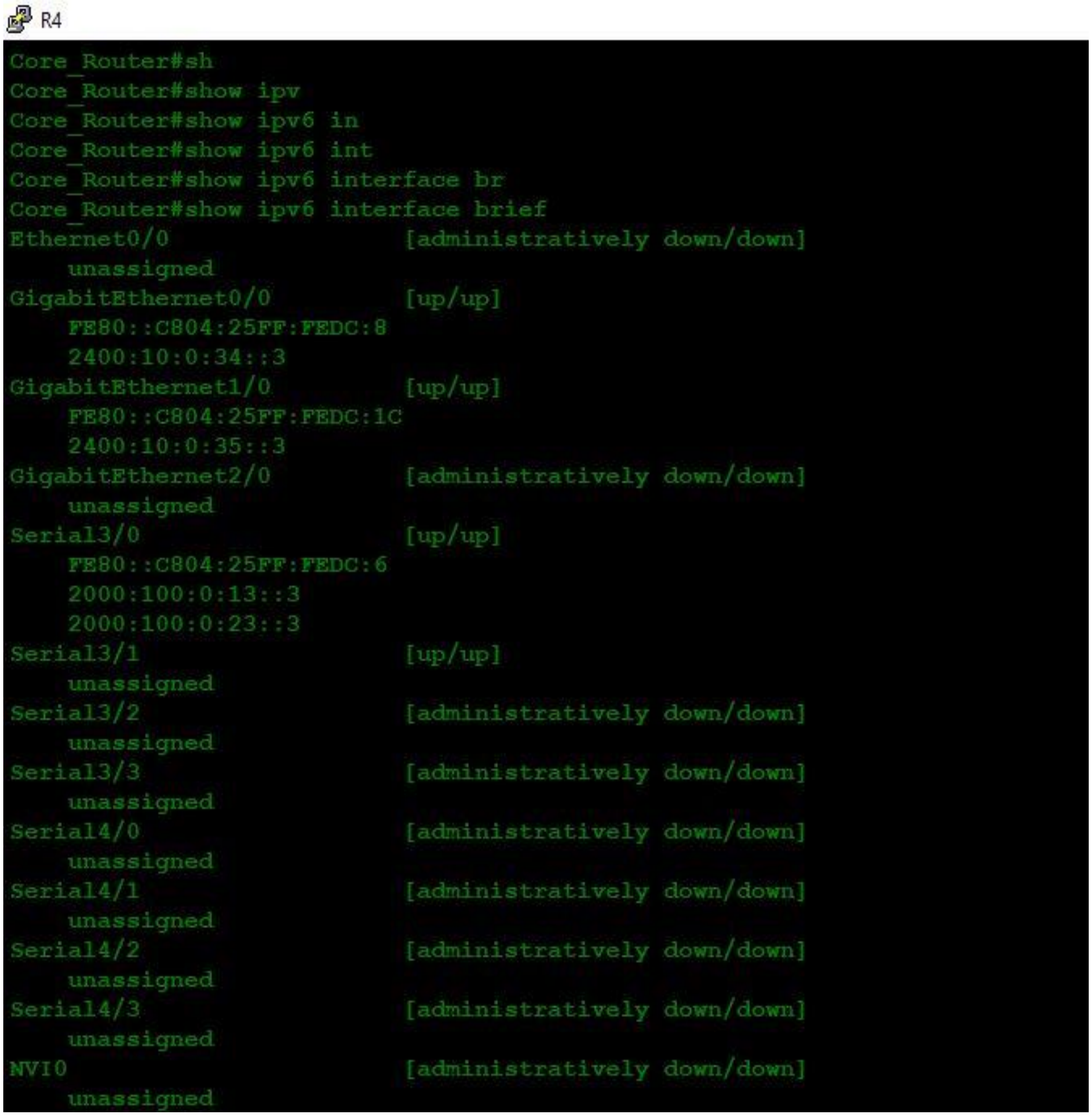
In this figure 5.6, we show the core router configuration which handle the whole protocols of our project. Branch_1 & Branch_2 are point to point connected this router and ISP_1, ISP_2 are connected outside with this router. Here we configure Ospf routing for reachability. We also configure NAT and BGP routing for getting access from ISP respectively IPv4 & IPv6.



```
R4
Core_Router#
*Apr  6 15:07:06.343: %BGP-5-ADJCHANGE: neighbor 2000:100:0:13::1 Up
Core_Router#
*Apr  6 15:07:08.679: %TRACKING-5-STATE: 8 ip sla 1 reachability Down->Up
Core_Router#
Core_Router#
Core_Router#SH
Core_Router#sh
Core_Router#show ip int
Core_Router#show ip interface br
Core_Router#show ip interface brief
Interface                  IP-Address      OK? Method Status                Prot
ocol
Ethernet0/0                unassigned      YES NVRAM  administratively down down

GigabitEthernet0/0         unassigned      YES NVRAM  up                    up

GigabitEthernet1/0         10.0.35.3       YES NVRAM  up                    up

GigabitEthernet2/0         unassigned      YES NVRAM  administratively down down

Serial3/0                  100.0.13.3      YES NVRAM  up                    up

Serial3/1                  100.0.23.3      YES NVRAM  up                    up

Serial3/2                  unassigned      YES NVRAM  administratively down down

Serial3/3                  unassigned      YES NVRAM  administratively down down

Serial4/0                  unassigned      YES NVRAM  administratively down down

Serial4/1                  unassigned      YES NVRAM  administratively down down

Serial4/2                  unassigned      YES NVRAM  administratively down down

Serial4/3                  unassigned      YES NVRAM  administratively down down

NVI0                       unassigned      YES unset  administratively down down
```

Figure 5.7: Core Router all Interface Linkup

Here figure 5.7 we show how all routers linked with core router using "ip interface brief" command for IPv4 in GNS3.

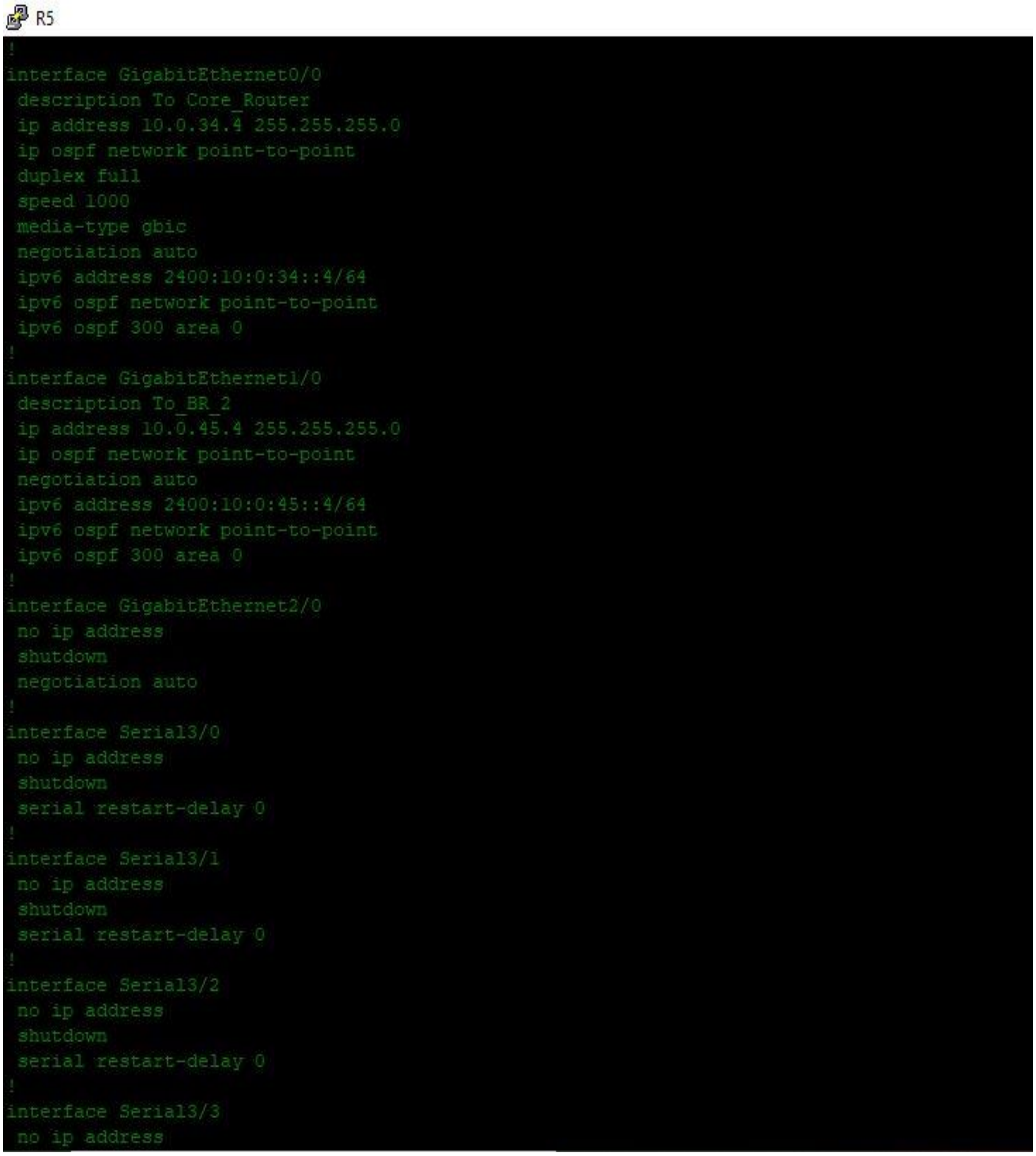


```
R4
Core_Router#sh
Core_Router#show ipv
Core_Router#show ipv6 in
Core_Router#show ipv6 int
Core_Router#show ipv6 interface br
Core_Router#show ipv6 interface brief
Ethernet0/0                [administratively down/down]
    unassigned
GigabitEthernet0/0         [up/up]
    FE80::C804:25FF:FEDC:8
    2400:10:0:34::3
GigabitEthernet1/0         [up/up]
    FE80::C804:25FF:FEDC:1C
    2400:10:0:35::3
GigabitEthernet2/0         [administratively down/down]
    unassigned
Serial3/0                  [up/up]
    FE80::C804:25FF:FEDC:6
    2000:100:0:13::3
    2000:100:0:23::3
Serial3/1                  [up/up]
    unassigned
Serial3/2                  [administratively down/down]
    unassigned
Serial3/3                  [administratively down/down]
    unassigned
Serial4/0                  [administratively down/down]
    unassigned
Serial4/1                  [administratively down/down]
    unassigned
Serial4/2                  [administratively down/down]
    unassigned
Serial4/3                  [administratively down/down]
    unassigned
NVI0                       [administratively down/down]
    unassigned
```

Figure 5.8: Core Router all Interface Linkup

Here figure 5.8, we show how all routers linked with core router using “ipv6 interface brief” command for IPv6 in GNS3.

BRANCH_1 Configuration



```
R5
!
interface GigabitEthernet0/0
 description To Core_Router
 ip address 10.0.34.4 255.255.255.0
 ip ospf network point-to-point
 duplex full
 speed 1000
 media-type gbic
 negotiation auto
 ipv6 address 2400:10:0:34::4/64
 ipv6 ospf network point-to-point
 ipv6 ospf 300 area 0
!
interface GigabitEthernet1/0
 description To_BR_2
 ip address 10.0.45.4 255.255.255.0
 ip ospf network point-to-point
 negotiation auto
 ipv6 address 2400:10:0:45::4/64
 ipv6 ospf network point-to-point
 ipv6 ospf 300 area 0
!
interface GigabitEthernet2/0
 no ip address
 shutdown
 negotiation auto
!
interface Serial3/0
 no ip address
 shutdown
 serial restart-delay 0
!
interface Serial3/1
 no ip address
 shutdown
 serial restart-delay 0
!
interface Serial3/2
 no ip address
 shutdown
 serial restart-delay 0
!
interface Serial3/3
 no ip address
```

Figure 5.9: Branch_1 Ospf Configuration

Figure 5.9 Branch_1 are point to point connected with core router, core switch & Branch_2 in the campus network diagram. Here, we configure Ospf routing.

R5

```
interface FastEthernet5/0.20
 description "Intervlan Routing For Vlan 20"
 encapsulation dot1Q 20
 ip address 192.168.20.1 255.255.255.0
 ipv6 address 2400:192:168:20::1/64
 ipv6 ospf 300 area 1
!
interface FastEthernet5/0.30
 description "Intervlan Routing For Vlan 30"
 encapsulation dot1Q 30
 ip address 192.168.30.1 255.255.255.0
 ipv6 address 2400:192:168:30::1/64
 ipv6 ospf 300 area 1
!
interface FastEthernet5/0.40
 description "Intervlan Routing For Vlan 40"
 encapsulation dot1Q 40
 ip address 192.168.40.1 255.255.255.0
 ipv6 address 2400:192:168:40::1/64
 ipv6 ospf 300 area 1
!
interface FastEthernet6/0
 no ip address
 shutdown
 duplex auto
 speed auto
!
interface FastEthernet6/1
 no ip address
 shutdown
 duplex auto
 speed auto
!
router ospf 300
 router-id 4.4.4.4
 log-adjacency-changes
 passive-interface default
 no passive-interface GigabitEthernet0/0
 no passive-interface GigabitEthernet1/0
 network 10.0.34.0 0.0.0.255 area 0
 network 10.0.45.0 0.0.0.255 area 0
 network 192.168.20.0 0.0.0.255 area 1
 network 192.168.30.0 0.0.0.255 area 1
 network 192.168.40.0 0.0.0.255 area 1
```

Figure 5.10: Branch_1 Inter-vlan configuration

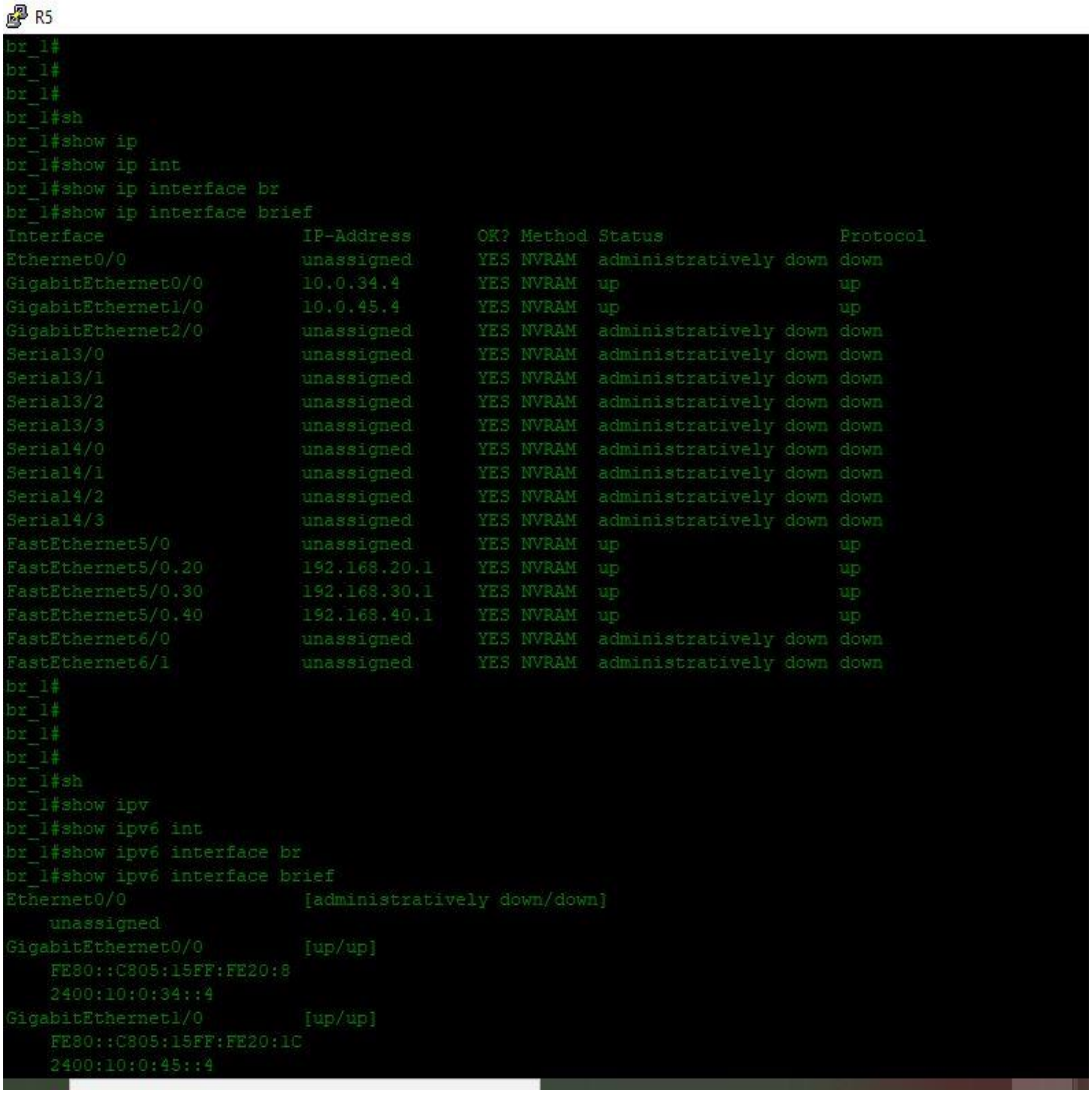
Figure 5.10, Branch_1 also Connected with the core switch. In our project diagram EEE, ETE department & Servers sector are connected with core switch. Here we configure Inter-Vlan (vlan20, vlan30, valn40) for getting access smoothly.

R5

```
br_1#show ipv6 interface br
br_1#show ipv6 interface brief
Ethernet0/0                [administratively down/down]
    unassigned
GigabitEthernet0/0         [up/up]
    FE80::C805:15FF:FE20:8
    2400:10:0:34::4
GigabitEthernet1/0         [up/up]
    FE80::C805:15FF:FE20:1C
    2400:10:0:45::4
GigabitEthernet2/0         [administratively down/down]
    unassigned
Serial3/0                  [administratively down/down]
    unassigned
Serial3/1                  [administratively down/down]
    unassigned
Serial3/2                  [administratively down/down]
    unassigned
Serial3/3                  [administratively down/down]
    unassigned
Serial4/0                  [administratively down/down]
    unassigned
Serial4/1                  [administratively down/down]
    unassigned
Serial4/2                  [administratively down/down]
    unassigned
Serial4/3                  [administratively down/down]
    unassigned
FastEthernet5/0            [up/up]
    unassigned
FastEthernet5/0.20         [up/up]
    FE80::C805:15FF:FE20:8C
    2400:192:168:20::1
FastEthernet5/0.30         [up/up]
    FE80::C805:15FF:FE20:8C
    2400:192:168:30::1
FastEthernet5/0.40         [up/up]
    FE80::C805:15FF:FE20:8C
    2400:192:168:40::1
FastEthernet6/0            [administratively down/down]
    unassigned
FastEthernet6/1            [administratively down/down]
    unassigned
br_1#
```

Figure 5.11: Branch_1 linkup Configuration

Here figure 5.11, we show how all link up with Branch_1 using “ipv6 interface brief” command for IPv6 in GNS3.



```
R5
br_1#
br_1#
br_1#
br_1#sh
br_1#show ip
br_1#show ip int
br_1#show ip interface br
br_1#show ip interface brief
Interface                  IP-Address      OK? Method Status                Protocol
Ethernet0/0                unassigned      YES NVRAM  administratively down down
GigabitEthernet0/0         10.0.34.4       YES NVRAM  up                    up
GigabitEthernet1/0         10.0.45.4       YES NVRAM  up                    up
GigabitEthernet2/0         unassigned      YES NVRAM  administratively down down
Serial3/0                  unassigned      YES NVRAM  administratively down down
Serial3/1                  unassigned      YES NVRAM  administratively down down
Serial3/2                  unassigned      YES NVRAM  administratively down down
Serial3/3                  unassigned      YES NVRAM  administratively down down
Serial4/0                  unassigned      YES NVRAM  administratively down down
Serial4/1                  unassigned      YES NVRAM  administratively down down
Serial4/2                  unassigned      YES NVRAM  administratively down down
Serial4/3                  unassigned      YES NVRAM  administratively down down
FastEthernet5/0            unassigned      YES NVRAM  up                    up
FastEthernet5/0.20         192.168.20.1    YES NVRAM  up                    up
FastEthernet5/0.30         192.168.30.1    YES NVRAM  up                    up
FastEthernet5/0.40         192.168.40.1    YES NVRAM  up                    up
FastEthernet6/0            unassigned      YES NVRAM  administratively down down
FastEthernet6/1            unassigned      YES NVRAM  administratively down down
br_1#
br_1#
br_1#
br_1#
br_1#sh
br_1#show ipv
br_1#show ipv6 int
br_1#show ipv6 interface br
br_1#show ipv6 interface brief
Ethernet0/0                [administratively down/down]
    unassigned
GigabitEthernet0/0         [up/up]
    FE80::C805:15FF:FE20:8
    2400:10:0:34::4
GigabitEthernet1/0         [up/up]
    FE80::C805:15FF:FE20:1C
    2400:10:0:45::4
```

Figure 5.12: Branch_1 linkup Configuration

Here figure 5.12, we show how all link up with Branch_1 using “ip interface brief” for IPv4 & “ipv6 interface brief” command for IPv6 in GNS3 simulator.

Branch_2 Configuration:

```
R3
BR_2#
BR_2#
BR_2#sh
BR_2#show ip int
BR_2#show ip interface br
BR_2#show ip interface brief
Interface                  IP-Address      OK? Method Status                Protocol
Ethernet0/0                unassigned      YES NVRAM  administratively down down
GigabitEthernet0/0         10.0.35.5       YES NVRAM  up                    up
GigabitEthernet1/0         10.0.45.5       YES NVRAM  up                    up
GigabitEthernet2/0         unassigned      YES NVRAM  administratively down down
Serial3/0                  unassigned      YES NVRAM  administratively down down
Serial3/1                  unassigned      YES NVRAM  administratively down down
Serial3/2                  unassigned      YES NVRAM  administratively down down
Serial3/3                  unassigned      YES NVRAM  administratively down down
Serial4/0                  unassigned      YES NVRAM  administratively down down
Serial4/1                  unassigned      YES NVRAM  administratively down down
Serial4/2                  unassigned      YES NVRAM  administratively down down
Serial4/3                  unassigned      YES NVRAM  administratively down down
FastEthernet5/0            unassigned      YES NVRAM  up                    up
FastEthernet5/0.10         192.168.10.1    YES NVRAM  up                    up
FastEthernet6/0            unassigned      YES NVRAM  administratively down down
FastEthernet6/1            unassigned      YES NVRAM  administratively down down
BR_2#
BR_2#sh
BR_2#show ipv
BR_2#show ipv6 int
BR_2#show ipv6 interface br
BR_2#show ipv6 interface brief
Ethernet0/0                [administratively down/down]
    unassigned
GigabitEthernet0/0         [up/up]
    FE80::C803:29FF:FE18:8
    2400:10:0:35::5
GigabitEthernet1/0         [up/up]
    FE80::C803:29FF:FE18:1C
    2400:10:0:45::5
GigabitEthernet2/0         [administratively down/down]
    unassigned
Serial3/0                  [administratively down/down]
    unassigned
Serial3/1                  [administratively down/down]
    unassigned
```

Figure 5.13: Branch_2 all Interface Linkup

Here figure 5.13, we show how all link up with Branch_1 using “ip interface brief” for IPv4 & “ipv6 interface brief” command for IPv6 in GNS3 simulator.

R3

```
!
interface GigabitEthernet0/0
 description To_Core_Router
 ip address 10.0.35.5 255.255.255.0
 ip ospf network point-to-point
 duplex full
 speed 1000
 media-type gbic
 negotiation auto
 ipv6 address 2400:10:0:35::5/64
 ipv6 ospf network point-to-point
!
interface GigabitEthernet1/0
 description To_BR_1
 ip address 10.0.45.5 255.255.255.0
 ip ospf network point-to-point
 negotiation auto
 ipv6 address 2400:10:0:45::5/64
 ipv6 ospf network point-to-point
!
interface GigabitEthernet2/0
 no ip address
 shutdown
 negotiation auto
```

Figure 5.14: Branch_2 OSPF Configuration

In figure 5.14, we configure Ospf routing & figure.

R3

```
interface FastEthernet5/0.10
 description "Intervlan Routing For Vlan 10"
 encapsulation dot1Q 10
 ip address 192.168.10.1 255.255.255.0
 ipv6 address 2400:192:168:10::1/64
 ipv6 ospf 300 area 0
!
interface FastEthernet6/0
 no ip address
 shutdown
 duplex auto
 speed auto
!
interface FastEthernet6/1
 no ip address
 shutdown
 duplex auto
 speed auto
!
router ospf 300
 router-id 5.5.5.5
 log-adjacency-changes
 passive-interface FastEthernet5/0
 network 10.0.35.0 0.0.0.255 area 0
 network 10.0.45.0 0.0.0.255 area 0
 network 192.168.10.0 0.0.0.255 area 0
```

Figure 5.15: Branch_2 Inter-Vlan Configuration

Figure 5.15, we configure Inter-vlan under vlan 10 for CSE department of this campus network. We use Inter-vlan as all devices can get access under CSE department.

Core Switch Configuration

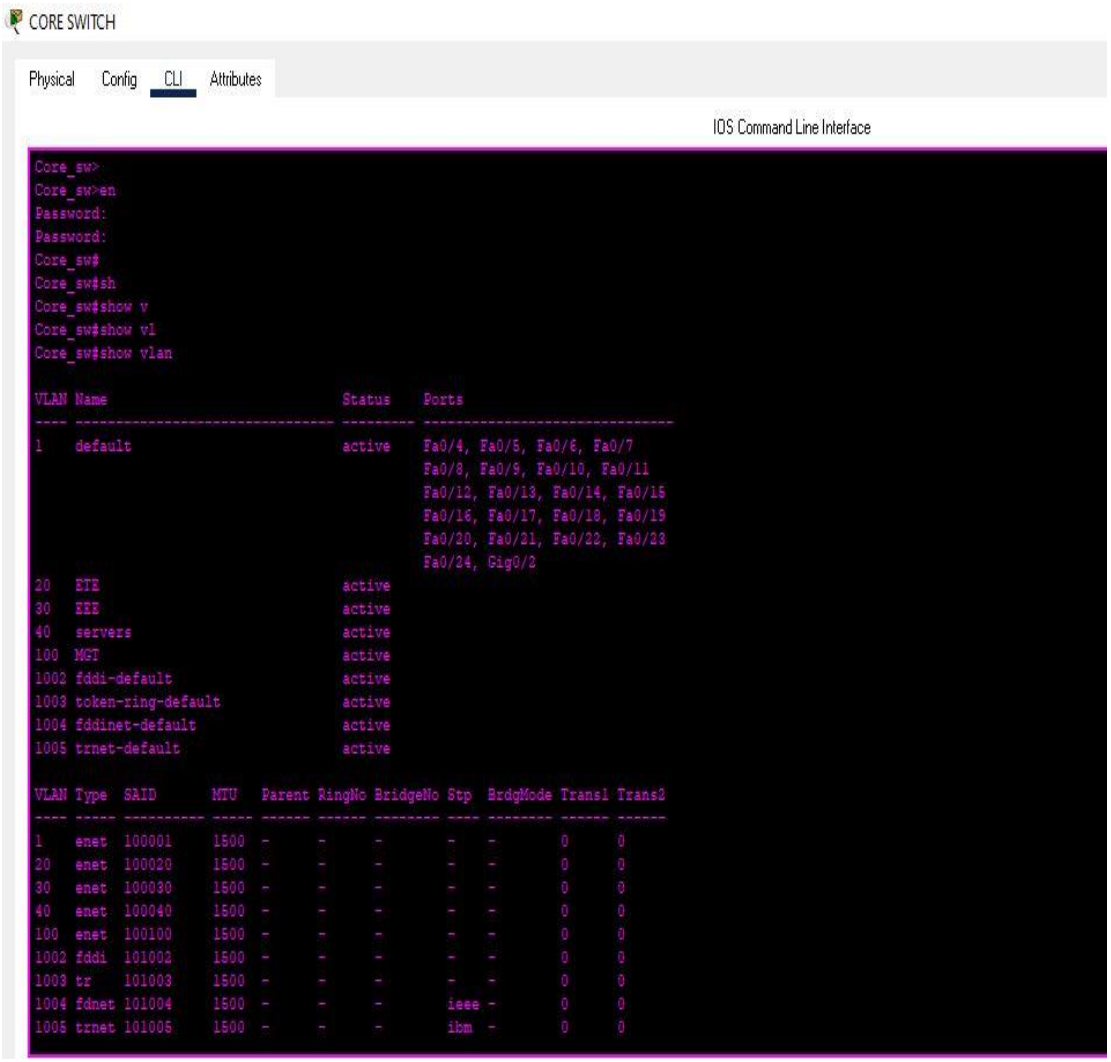


Figure 5.16: Core Switch Vlan Configuration

In figure 5.16 we show core switch where 3 Distribution switch are directly connected and configure vlan 20 for ETE department, vlan 30 for EEE department & vlan 40 for web server & file server. We use as all devices under the core switch can get access to each other. Here we use “show vlan interface” command to show all vlan that are connected with core switch.

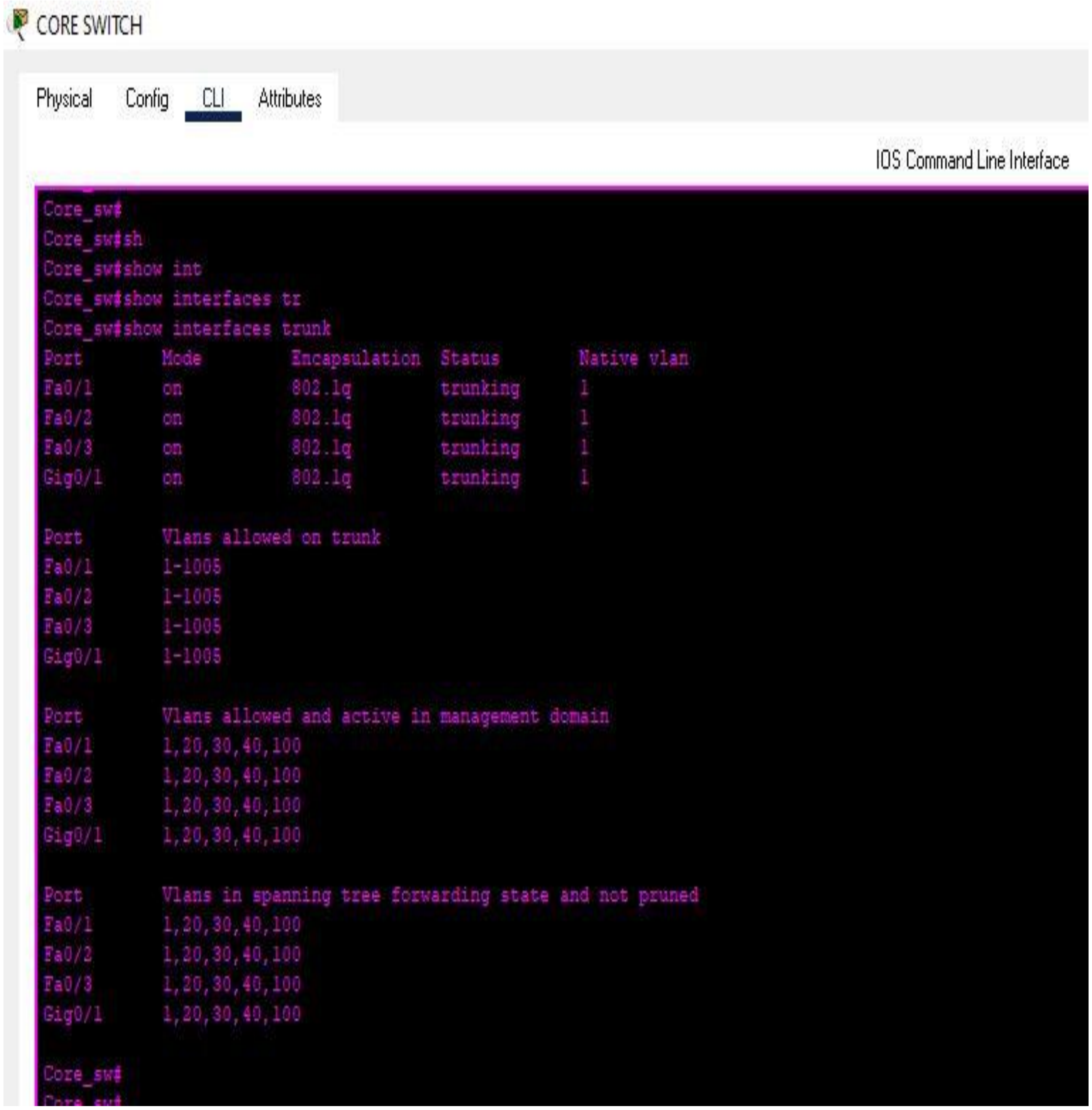


Figure 5.17: Core Switch Trunk Configuration

If we want to get access form router to switch, we must trunk configure. In figure 5.17 we use "show interface trunk" command to show all trunk port configuration.

Web Server Configuration

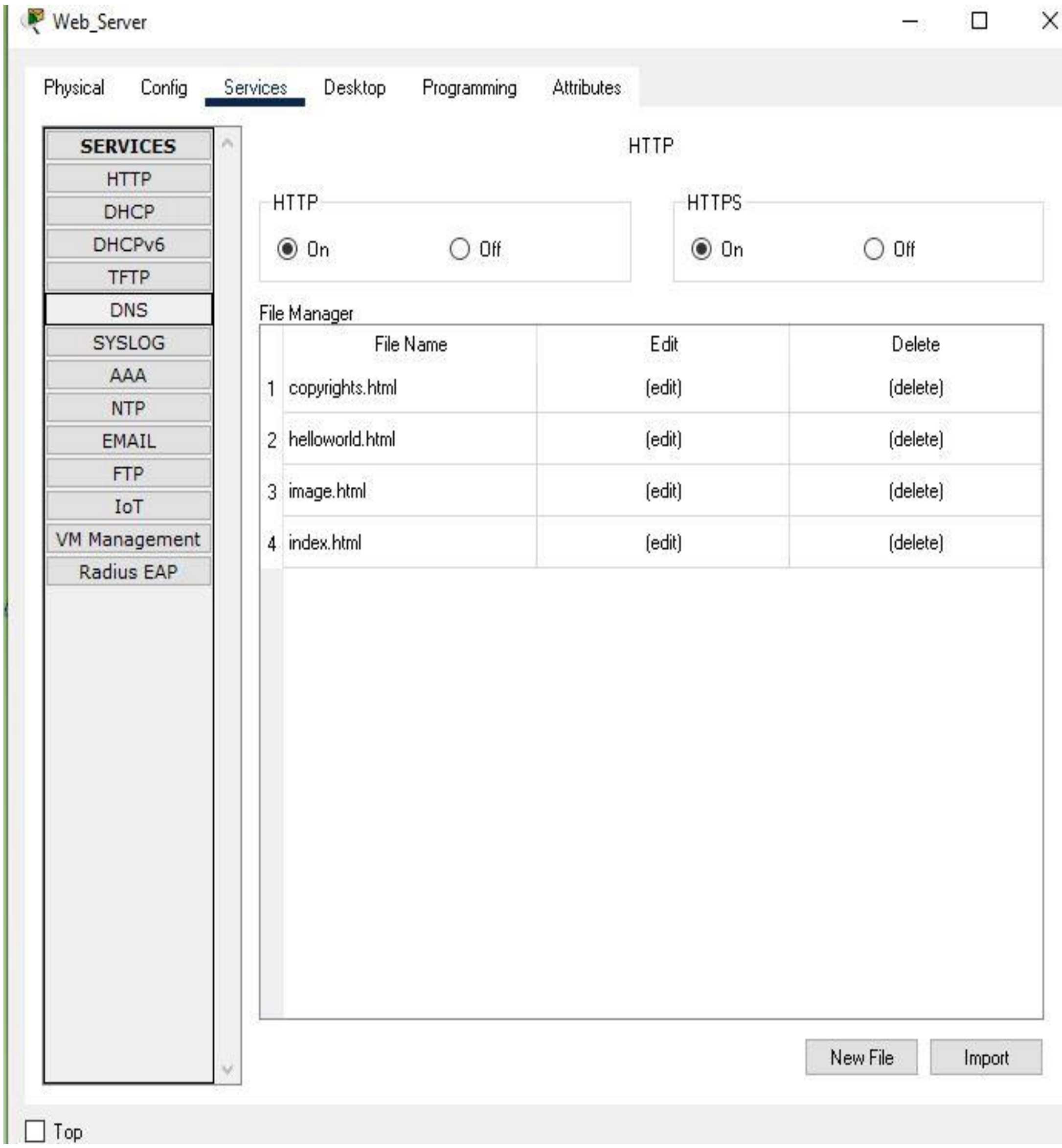


Figure 5.18: Web Server Setup Configuration

In figure 5.18, we show web server configuration.

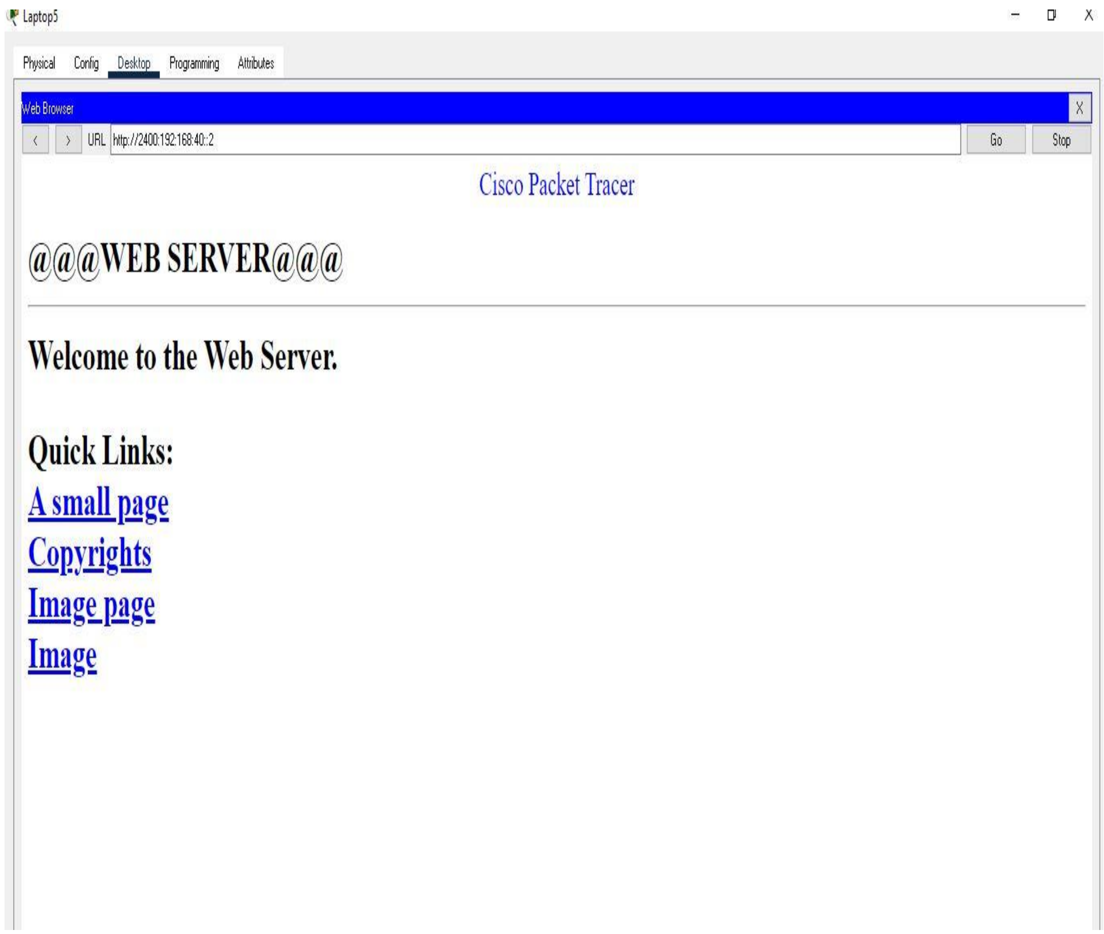


Figure 5.19: Web Server Configuration

In figure 5.19, we show web server configuration where we need http & https to turn in, where clients can edit or delete files when they need.

FTP Server Configuration

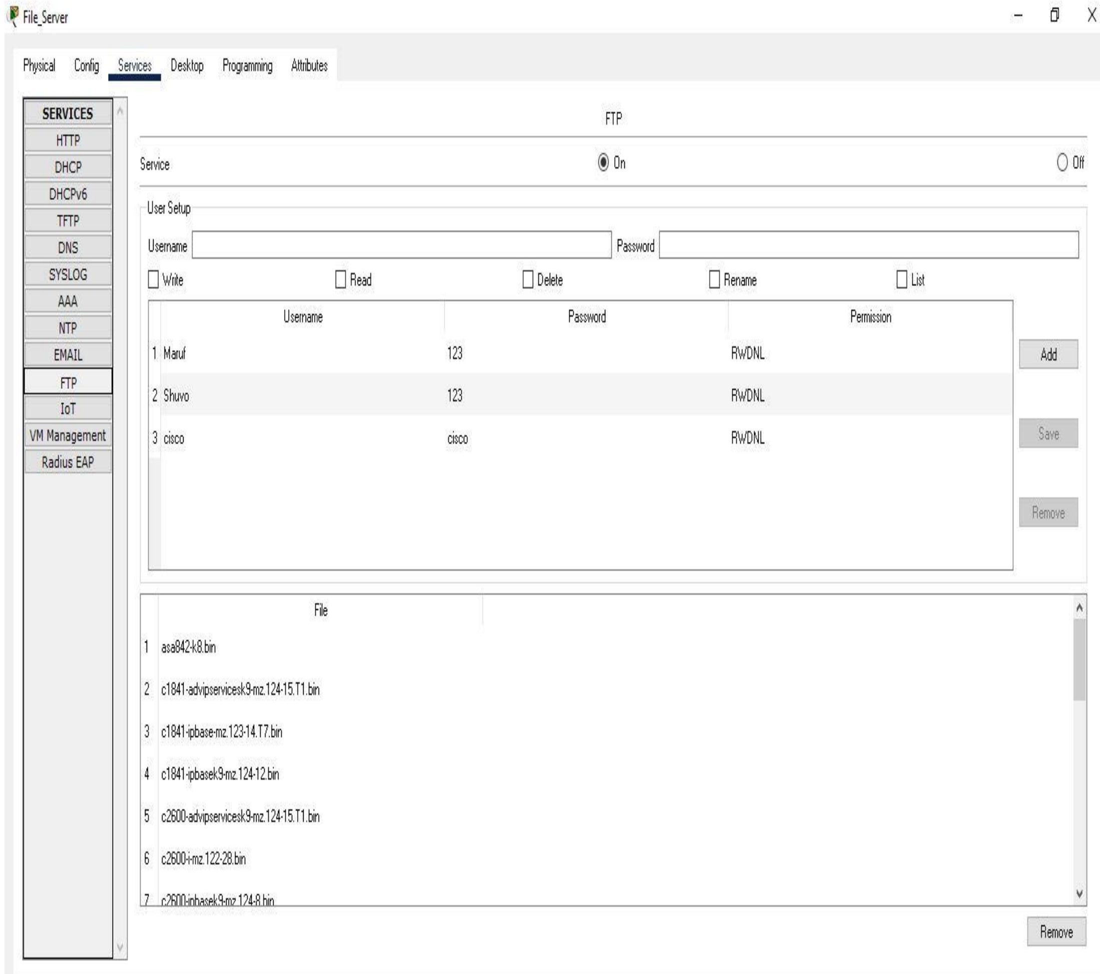


Figure 5.20: FTP Server setup Configuration

In figure 5.20, we configiure FTP server setup in our project.

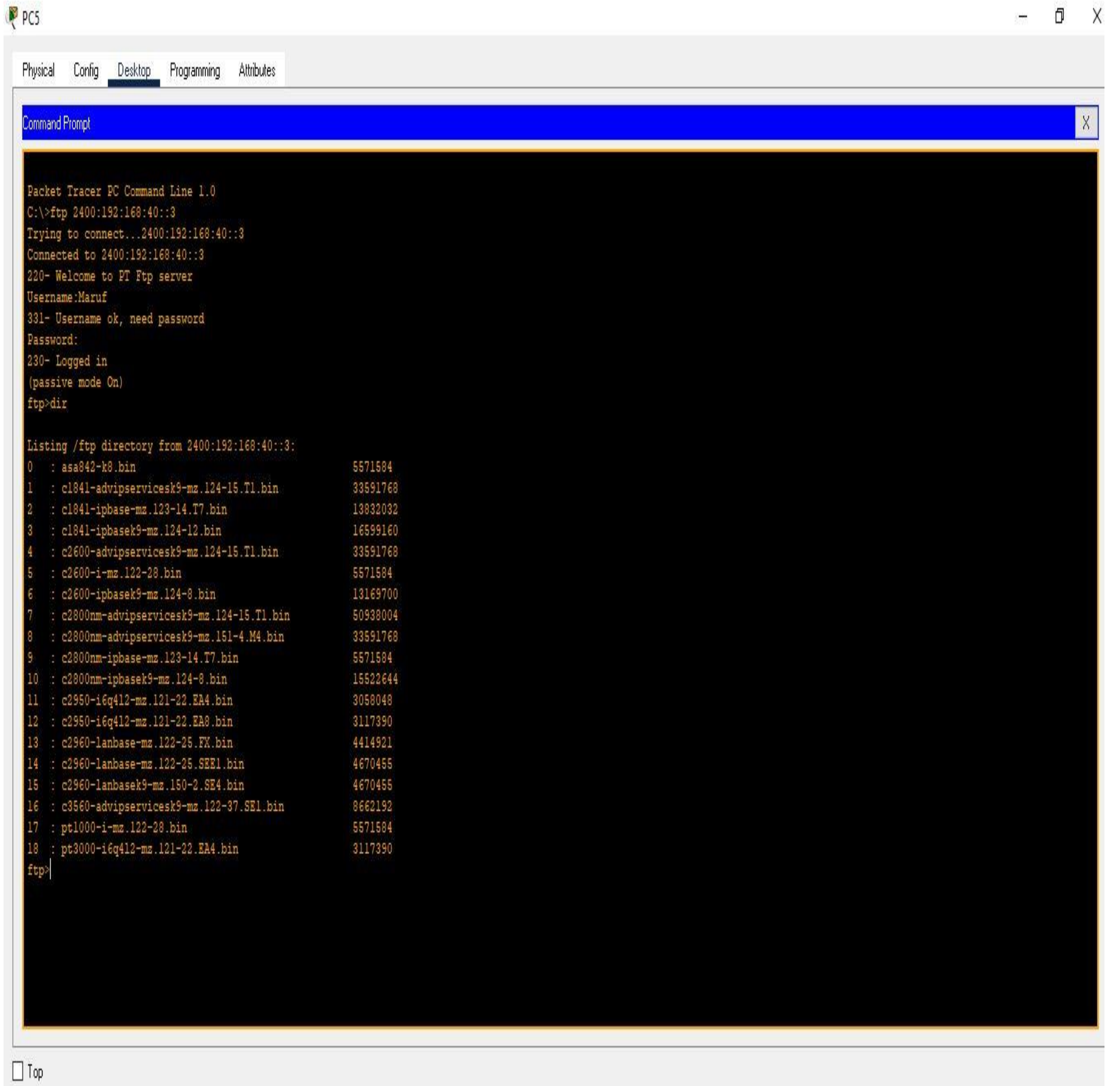


Figure 5.21: FTP Server Configuration

In figure 5.21, we configiure FTP server in our project. We create user name and password to secure our FTP server.we give access where the user can write, read, delete, rename, access or list the FTP files.

5.2 Testing Implementation

Testing Implementation also major part of every project. After Implementing whole campus network, we test all routers, switches & whole network protocols in this network. We check all access reachability whole network. we use ping test and tracert for testing.

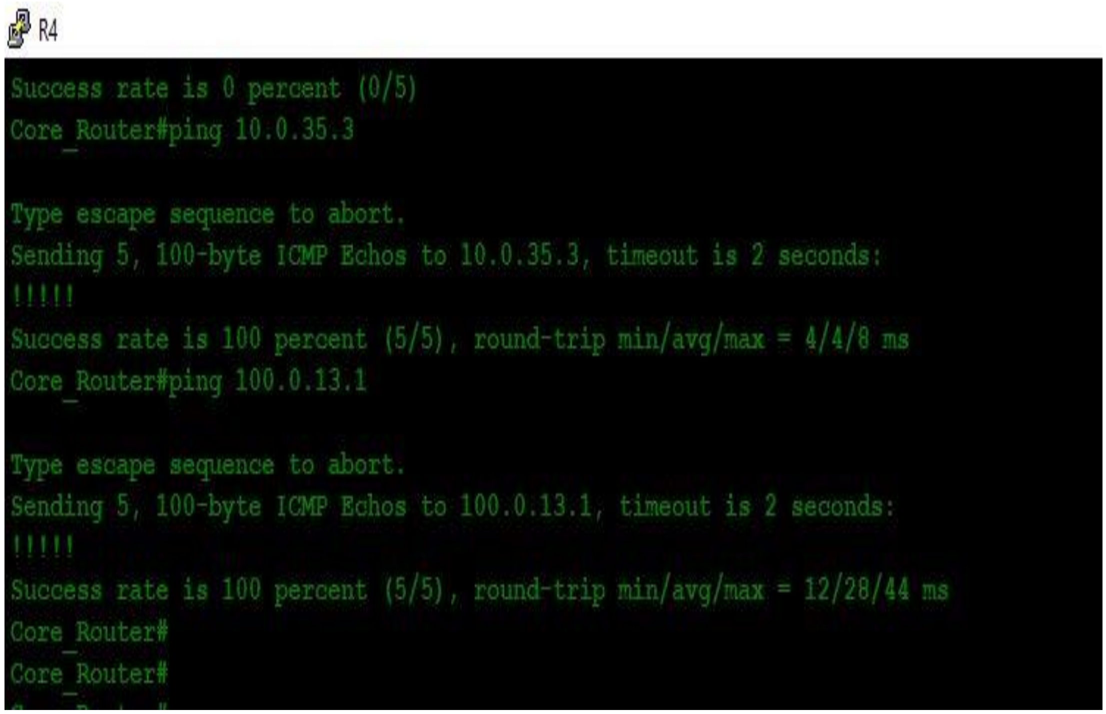


Figure 5.22: Ping test 1

In figure 5.22, we test ping of core router to check the access reachability ISP_1, Branch_1 & Branch_2 routers.

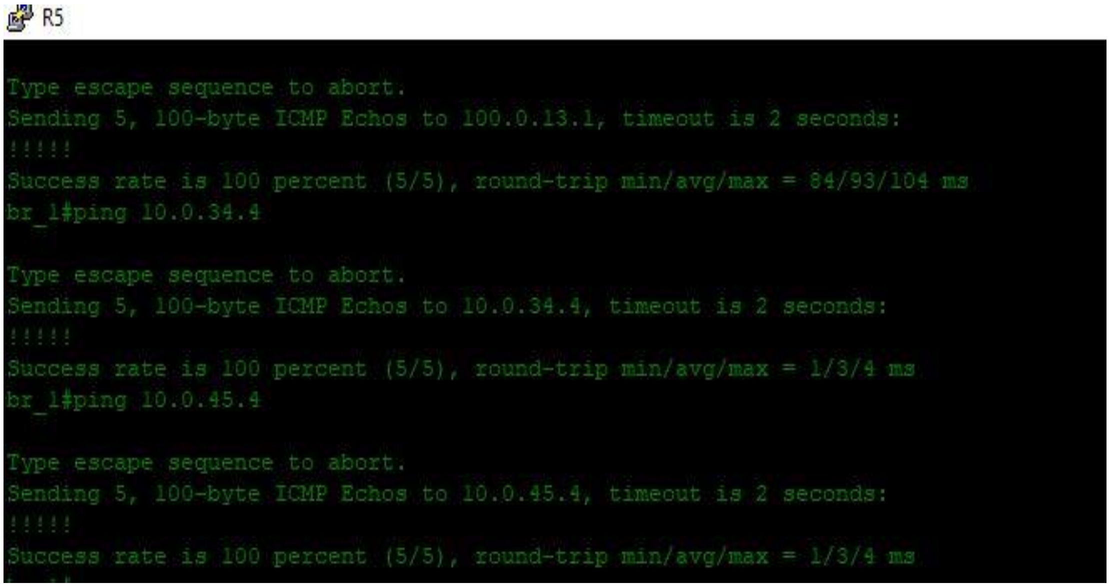


Figure 5.23: Ping test 2

In figure 5.23, we test ping of Branch_1 to check the access reachability ISP_1, & core routers.

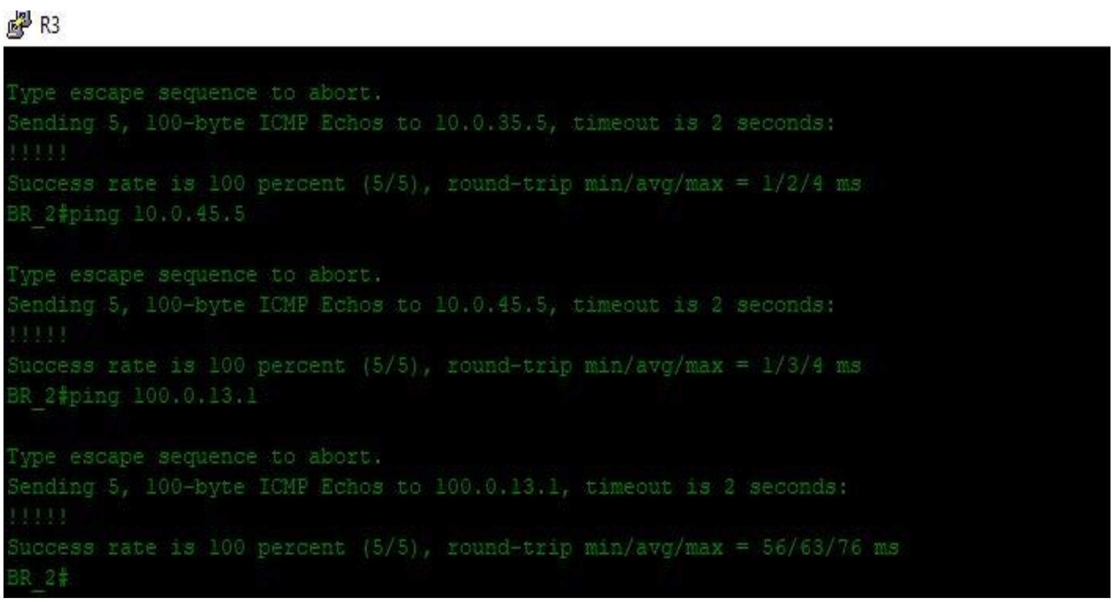


Figure 5.24: Ping test 3

This figure 5.24, shows ping test from branch_2 to other networks.

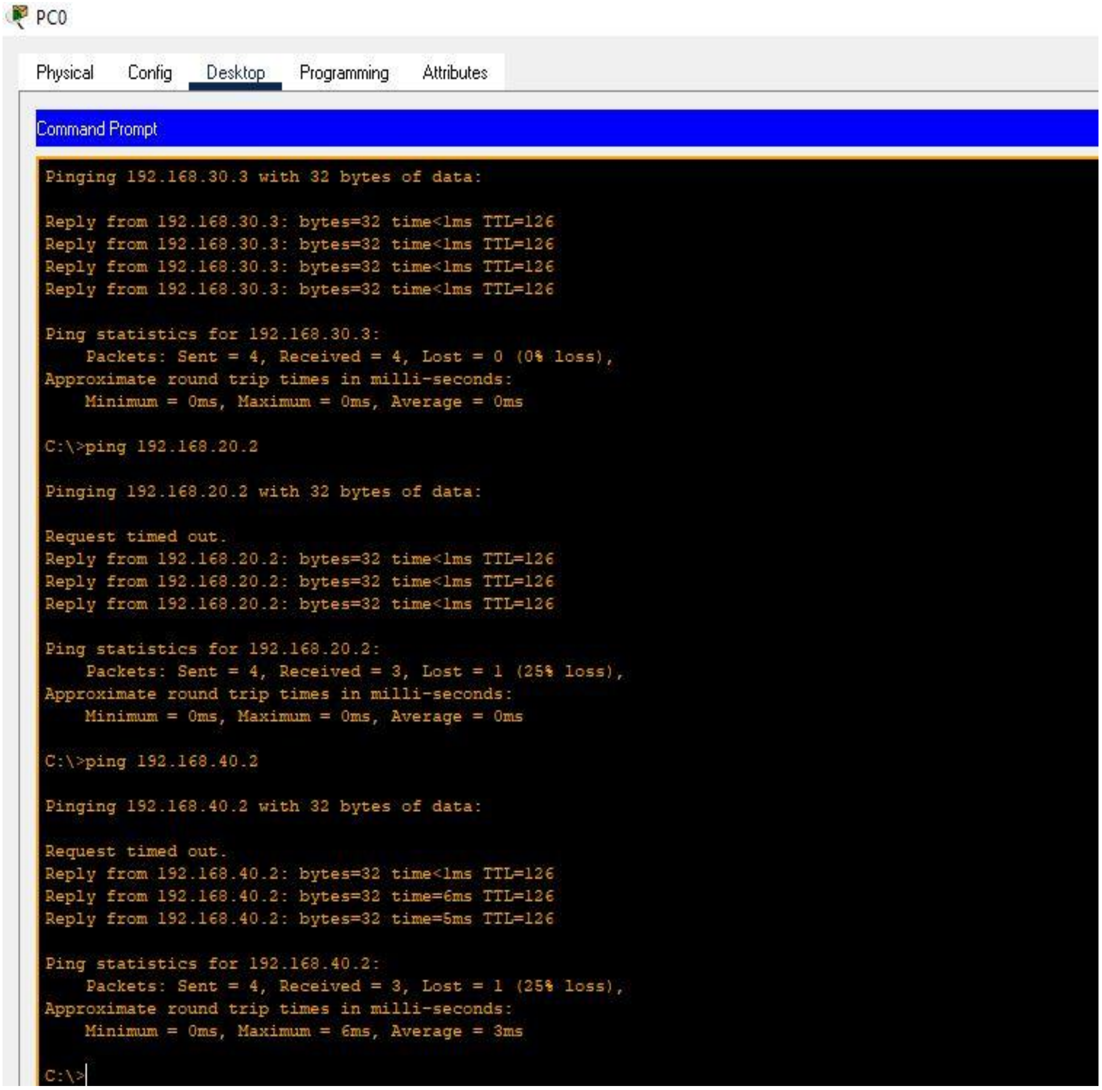


Figure 5.25: Ping test 4

This figure 5.25, shows ping test from CSE department host to other networks.

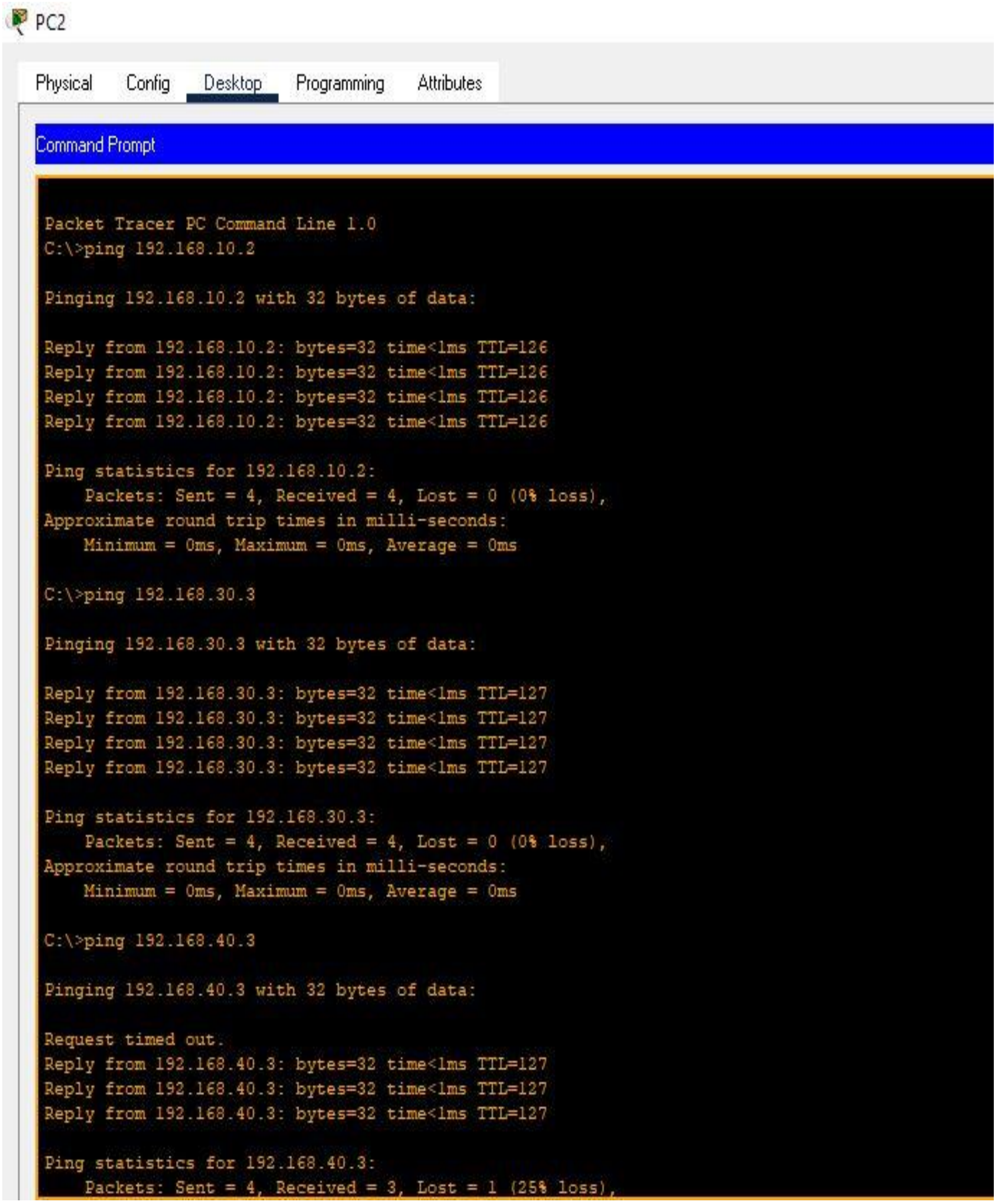


Figure 5.26: Ping test 5

This figure 5.26, shows ping test from ETE department host to other networks.

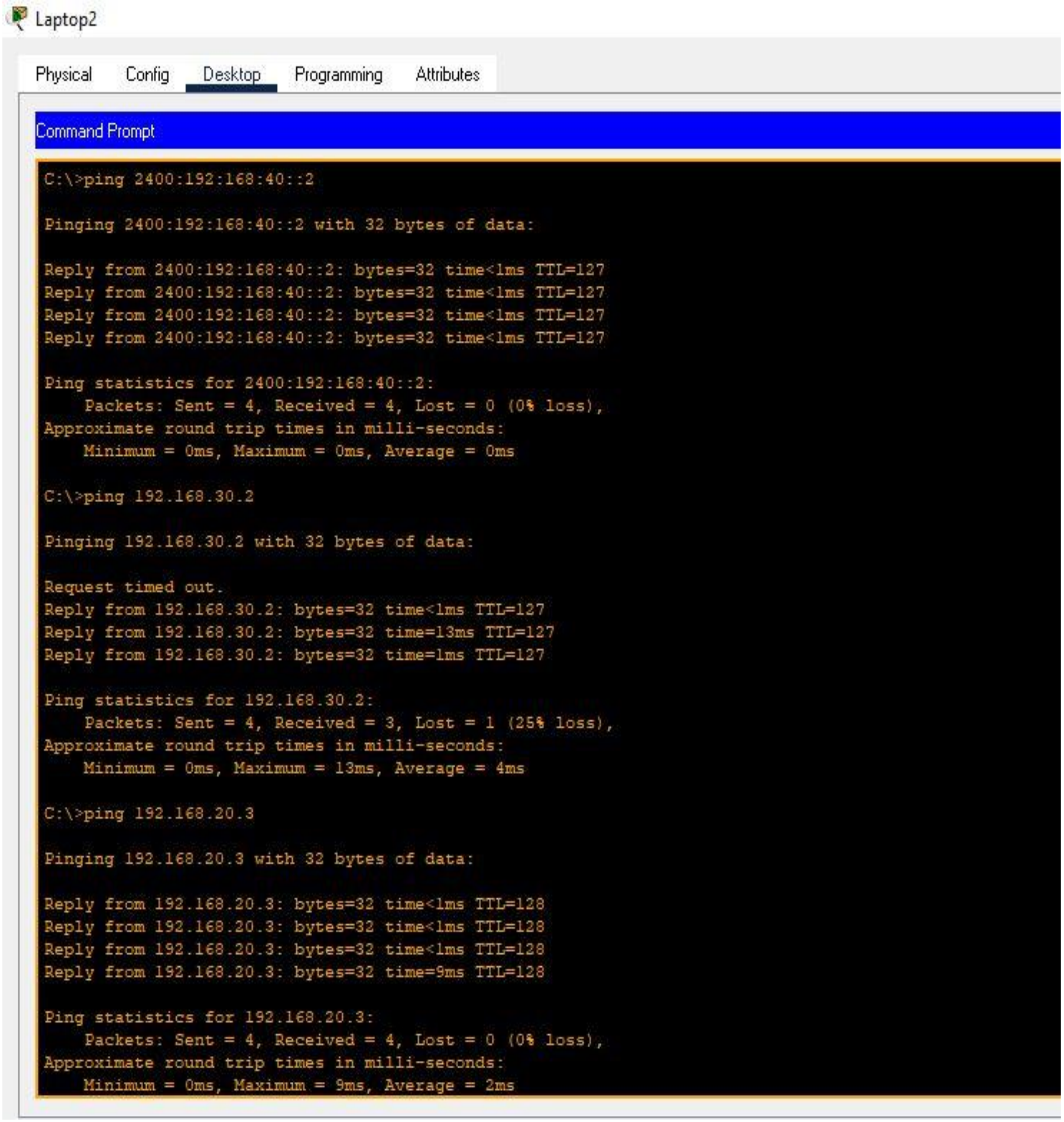


Figure 5.27: Ping test 6

This figure 5.27, shows ping test from CSE department host to other networks.

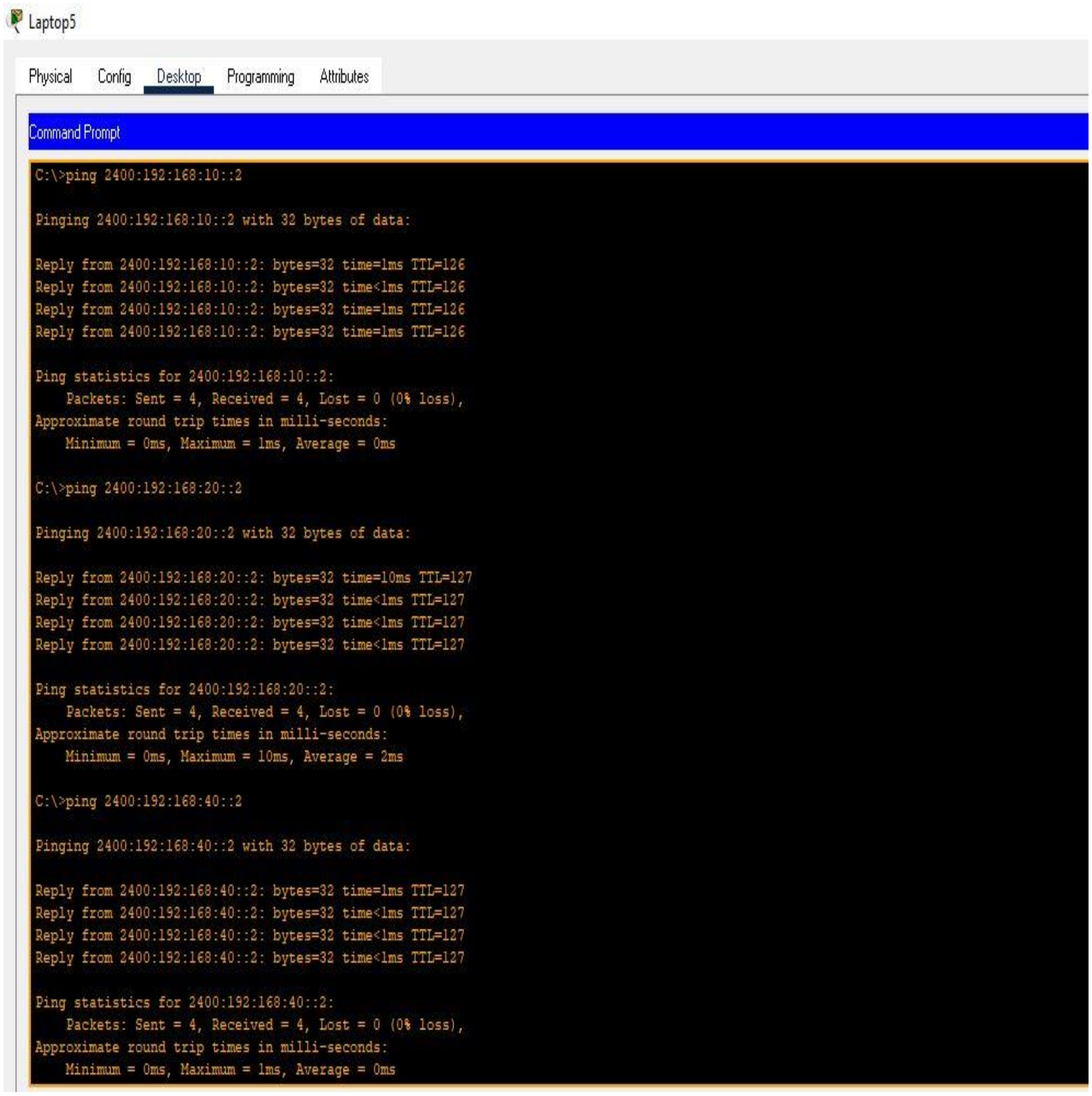


Figure 5.28: Ping test 7

This figure 5.28, shows ping test from EEE department host to other networks.

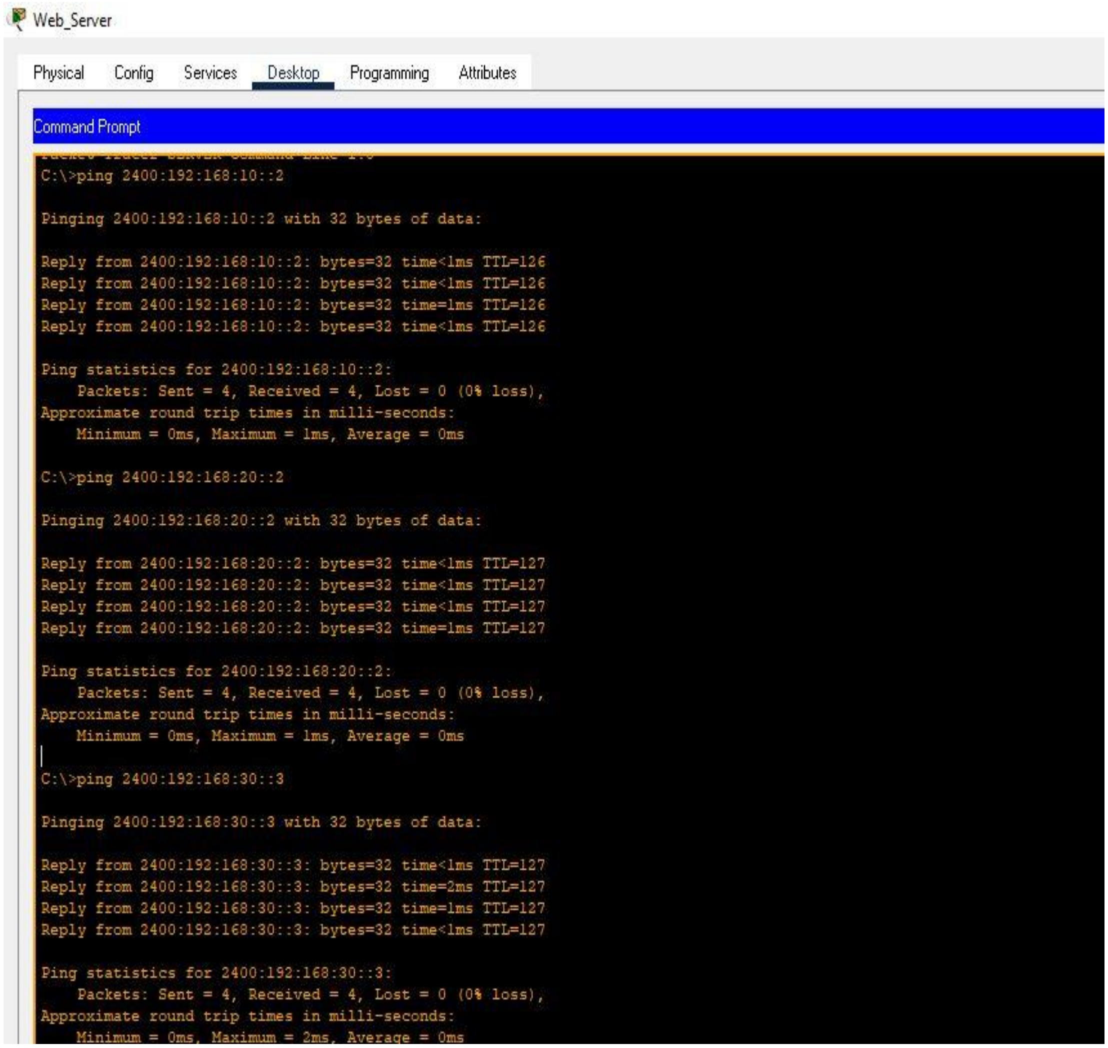


Figure 5.29: Ping test 8

This figure 5.29, shows ping test from web Server to access reachability check all department.

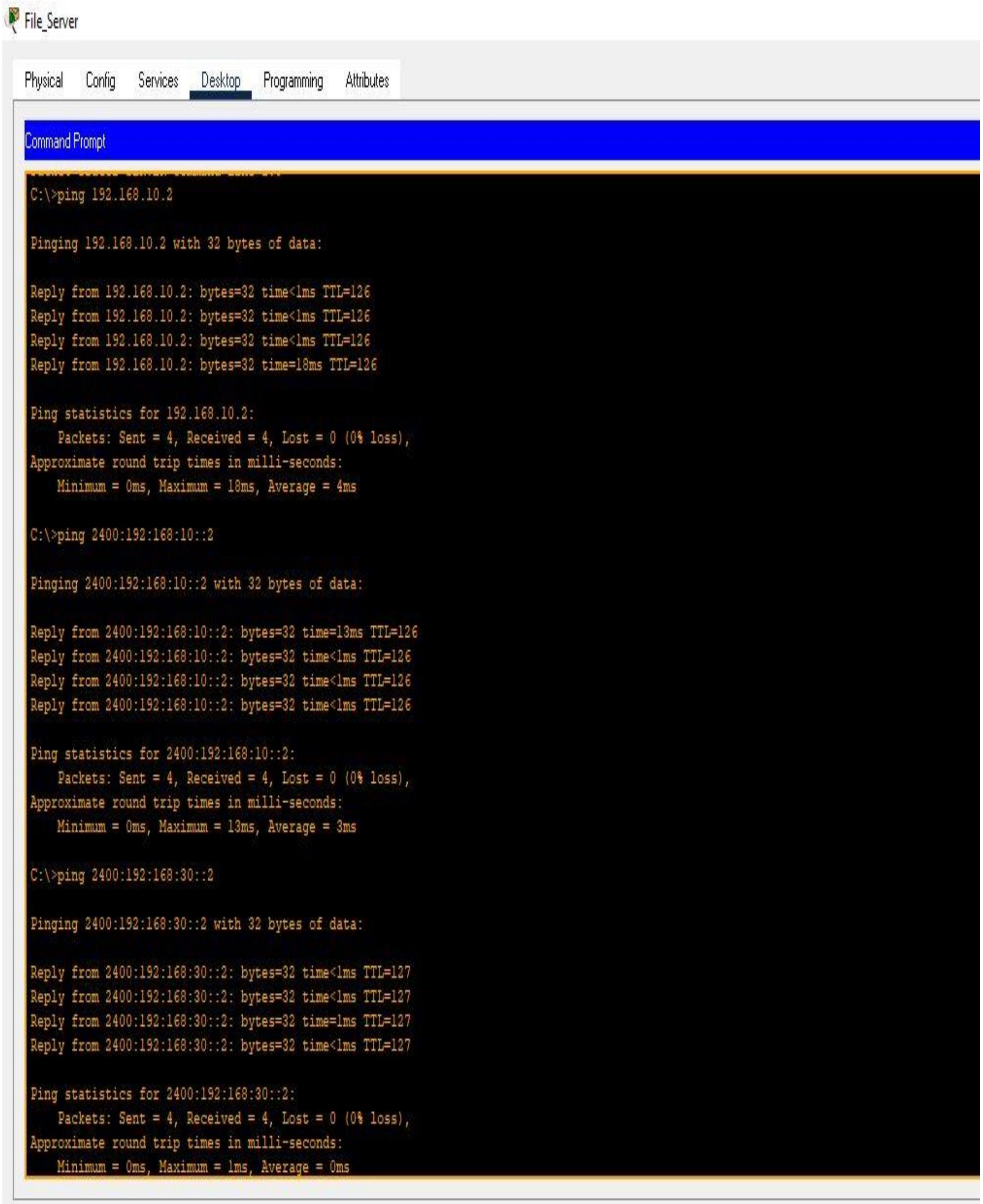


Figure 5.30: Ping test 9

This figure 5.30, shows ping test from web Server to access reachability check all department.

5.3 Test Results and Report

Test report should be created formally because from it we can get the proper result of daily use. For getting the test result we have to test our Dual Stack campus network and from the outcome of the network we can give the test result. Measuring the outcome, we test the hole campus network. The components that we use ping test. The ping test that we use will give bellow:

- ISP to core router
- core router to Branch Router
- router to Distribution Switch
- Router to Core Switch
- core-switch to distributed-switch
- router to inter vlan different department
- server to server
- Pc to Pc in same vlan
- Pc to Pc in different vlan
- Pc to whole network.

After ping test we can see the packets will easily send inside the whole network without traffing.we. we can easily access in different vlan, server, switch in the campus network. For these reasons we believe that our project will easily accepted by clients.

CHAPTER 6

IMPACT ON SOCIETY AND ENVIRONMENT

6.1 Impact on society

Before implementing any project, it very necessary to case analysis of the projects. Impact on society is one of the major key aspects of this analysis. Here mainly discuss about why the project is essential for the society, why we allow it, how it will use in society, was it virtues for us, is it harmful or dangerous for society etc.

we are deploying a Dual stack project. It will very helpful for society because people can use both IPv4 and IPv6 address in a same network. There will be no risk of sending data packet, without traffic they can use it. Though we have no UX but we are dedicated.

Hopefully it will play an important role to established a strong and stable network around our society. It will be blessing for us all, we and different IT sectors can use this network and they are major part of our society. This network is stable and safe for use so the user feels blessing as their data will secure. It will be great for our society. On the other hand, this is a software based project. Here main challenge is to keep secure the network from cyber-attack for society. Hopefully we will able to take the challenges.

6.2 Impact on Environment

It is very necessary to keep clean and safe our environment. while we made or implement any project, sometimes it will harmful or dangerous for our environment. There is some issue of pollution, security, natural resources damage, crime and so on but our project is software based implementation. So here will no risk for environment pollution, personal security and any kind damages of natural resources. Our project is blessing for environment.

we can easily browse the network, here we ensure more security, better routing efficiency for this reason the user may blessed.

As here low risk of cyber-attack so we believe this project will more effective to keep safe and quite the environment around us.

6.3 Ethical Aspects

It is very important part of every project. It is one kind of honesty and responsibility. It is very necessary to care about ethical aspects for developing any projects. we were honest to designing and implementing our project. We work for it as it will helpful for us and try to avoid all those things that are harmful people. We also try to protect the confidential and private data that will share through the network. We try to do all things by maintain all ethical aspects.

6.4 Sustainability plan

Firstly, we design the whole network diagram carefully then implement it by using different routing protocol and commands. After implementing we test the whole network and it work successfully. As we have no user experience of the network and for sustainability we have to launch the project. while we do that, the user able to use the network and can give feedback and if necessary, we have to add new features of the program. we have also target to convince the institution or ISP who use campus network around us so that they modify their network by using our project as guideline. After that the network will use more and we will able to detect bugs and can upgrade the network. This will help to increase the sustainability.

CHAPTER 7

CONCLUSION AND FUTURE SCOPE

7.1 Discussion and Conclusion

The journey is to develop our project is great experience. we develop a networking based project named “Deploying a Dual Stack in a campus network". To develop this project, we have to face many problems many challenges such as drawing the campus network diagram. We are familiar with ipv4 but ipv6 was new topic for us, so we have to lot of study about it. GNS3 was also new simulator for us, we face many some difficulties here. we also face challenge to select which ip protocol, routing protocol use. But we have a great team work thus we overcome all those challenges and successfully implement the project. we think our project will be more effective for IT sectors.

7.2 Scope for Further Development

Ipv4 running out gradually and IPv6 will be next generation protocol for internet communication. Though ipv6 is more secure but it is not wildly used. Thus it is new protocol so it has to faces many difficulties in future such as security issues, newly cyber-attack etc.

while ipv6 will use everywhere we will use some protocol to make our campus network more secure and stable. Those,

- will increase campus area.
- will add more protocol.
- will increase more security.

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PLAGIARISM

Test-1

ORIGINALITY REPORT

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