ACN Mid Term Project

Network Design

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BIT 1st Year 2nd Semester

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Chapter 1: Introduction

1. Overview

Lama Tech Company is a well-known IT company in Kathmandu valley. It mainly focuses on building software and digital marketing. Company is known for its expert digital marketing employee who have grown multiple business into large scale. It is the era of technology, companies are shifting from traditional marketing to digital marketing. Marketing plays an important role in building any business so choosing a right company for marketing can help you lift your business to next level.

As a IT company, it is very important to have a reliable, scalable and secured network. So, Lama Tech Company has assigned us to build the network for them to continue building brands. The company has more than 2000 staffs with 3 buildings. It also require access control and routing between various departments. The company requires a reliable and efficient network to support their daily operation. The designed network should also be scalable as the company grows.

The network designed for this company should have optimized routing, enhanced performance and improved security. Proper network subnetting using VLSM is needed for the company, there should also be proper vlans for each department. Vlan will be help to reduce the broadcast domain of the network and enhance the performance. We should also configure Inter-vlan routing for communication between various department in the company. It will also avoid the need to reach router to traffic flow between various network. This will reduce the overhead from the router and communication will be a lot faster. We are also assigned to configure NAT, so that the company's end device can send traffic to public ip address and access the internet. We will be using PAT in this project. We should also block some network from communicating with other network to provide more security. We will configure standard Access Control List (ACL) in our case.

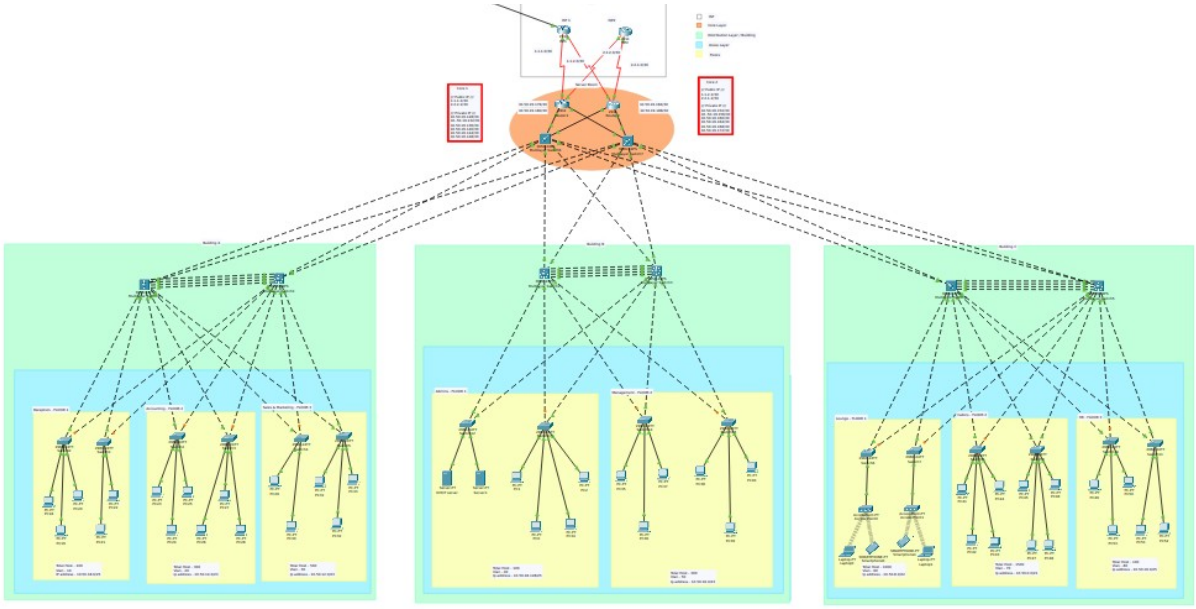
Chapter 2: Network Design Proposal

2.1 Topology

As the company currently incorporates flat network technology but it does not meet the company's wishes, we should change the technique to a 3-tier design and at different levels. Topology are the visual map of how network are connected. A 3-tier topology is a network topology in which network is divided into 3 major segments

- Core layer
- Distribution layer
- Access layer

This topology divides the function according to its name. Since, the company is growing, we need to think of future and should provide space for scaling. This network topology is very secured and can be scaled up easily to accommodate the needs in future.



- Core layer is presented in orange in color, distribution layer in green, access layer in blue and each vlans in yellow.

- The company has more than 2000 employee and requires around 4000 has, so it requires huge network. (Company network :10.50.0.0/20)

Core layer:

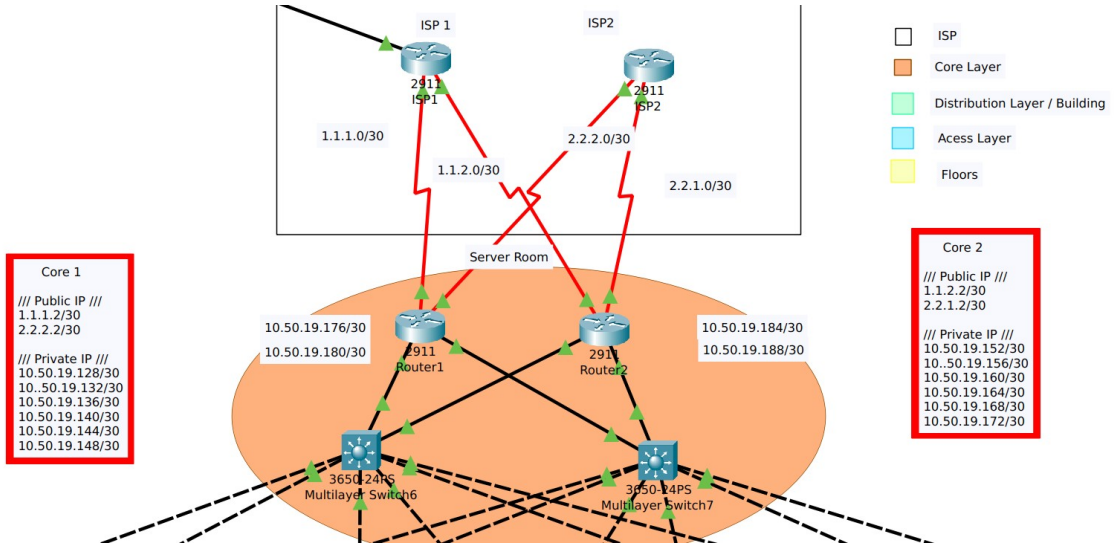


Fig 1

Distribution layer:

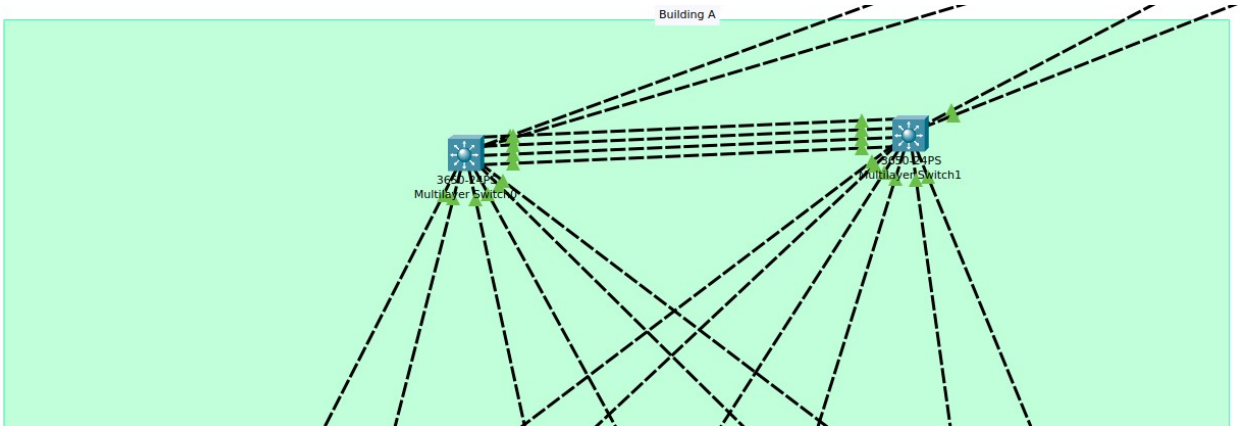


Fig 2

Access Layer:

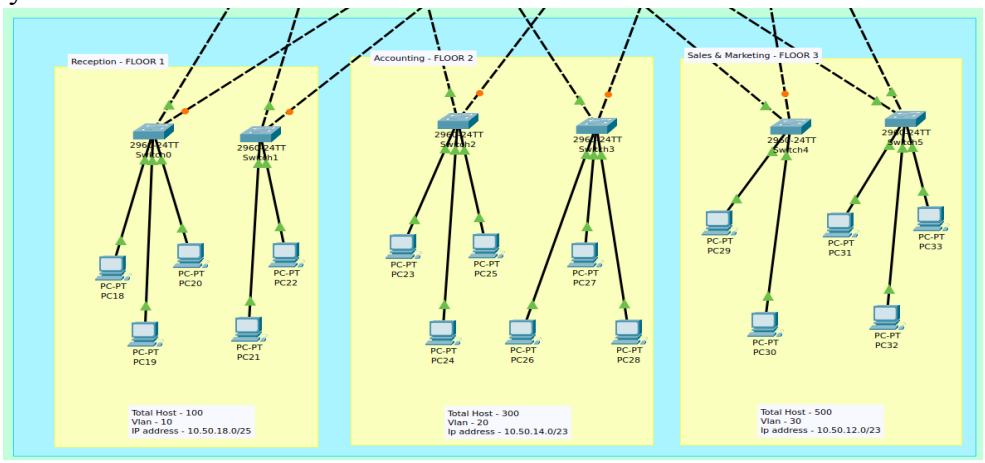


Fig 3

2.2 VLAN:

VLANs are used to create a logical broadcast domain of a larger LAN segment. It is used to improve network performance and provide more security to the network. It decrease the broadcast domain of a network. We can configure separate policies for each vlans. Traffics of one vlan cannot enter another vlan unless inter-vlan is configured. I have created different vlan for each department in this project. This will increase the performance of network, since the broadcast domain is small.

2.3 Inter-VLAN:

Inter-Vlan is a process of forwarding traffic from one vlan to another. Vlan doesn't allow traffic to get outside of its domain so, to forward the traffic from one vlan to another, we need to configure inter-vlan separately. We will be using inter-vlan in layer 3 switch using SVI(Switch Virtual Interface) in this project for communicating between different departments in different vlans.

2.4 IP addressing:

As we know, IPv4 address are limited and is declining as the technology grows. So, we need to utilize the address and avoid wasting. We will be using private ip address for our company and will use VLSM to subnet our network. We can convert private ip into public using NAT later to allow traffic to travel over the network. It will minimize the number of ip wastage. We will be using 10.50.0.0/20 ip address in our company.

2.5 Routing:

Routing is the process of forwarding traffic from one network to another. Routers are used to select the best path, determine cost and maintain a routing table for forwarding traffic between different network. We will be configuring OSPF(Open Shortest Path First) routing protocol in this project. This is a dynamic routing protocol which will select the best path by itself and forward the traffic from the default gateway. It is based on link state routing algorithm. It calculates the cost of the path to select the best path for forwarding traffic. It is easy to configure and is also more efficient than other routing protocol.

2.6 WAN Connectivity:

WAN(Wide Area Network) is a network that covers large geographical area. It interconnect LANs from different geographical area. It is important for a company to select the best carrier connection for better experience. We will be using 2 different ISPs: ClassicTech and Vianet. We have used dual-carrier WAN connection from both our ISP to avoid any one point failure. We have negotiated with the ISP to use both connection for load balancing. We have also used Port address translation for communication from internal network to the internet.

2.7 EtherChannel:

EtherChannel is a port link aggregation technology. It allows to groups multiple physical link to act as a single logical link for fault tolerance and load balancing. We have used etherchannel concept in layer 3 switch in distribution layer. It helps to increase the speed of switch-switch communication.

2.8 ACL:

Access Control List (ACL) is a security concept used for packet filtering. It is used to filter traffic based on packet header. When the packet reaches the router it perform extra operation to filter those packets to determine if they can be forwarded. We have used standard acl in our network which blocks the building C's packet to enter building A or vice versa.

Chapter 3. Network Implementation and Configuration

The company has 2 different ISP in use with different Ip address. Company uses 2 public ip address for each ISP to avoid one point failure system and improve reliability of the network. Public IP addresses are used for communication on the Internet. We will use 10.50.0.0/20, the private IP address. We will configure VLANs for different departments in our company. We will create a subnet to minimize wastage of IP addresses. Here are all the IP address used:

3.0 IP Subnetting & Configuration

Public IP address:

- IP address from ISP 1:
  - 1.1.1.0 / 30
  - 1.1.2.0 /30
- IP address from ISP 2:
  - 2.2.1.0 / 30
  - 2.2.2.0 / 30

Private IP address: (10.50.0.0 / 20)

- Cabin – 1,500 required
  - 10.50.0.0 / 21 – 2,048 total hosts
    - Network address – 10.50.0.0
    - Broadcast address – 10.50.7.255
    - Subnet Mask – 255.255.240.0
- Lounge – 1,000 required
  - 10.50.8.0 / 22 – 1,048 total hosts
    - Network Address – 10.50.8.0
    - Broadcast Address – 10.50.11.255
    - Subnet Mask – 255.255.248.0
- Sales & Marketing – 500 required
  - 10.50.12.0 / 23 – 512 total hosts
    - Network address – 10.50.12.0
    - Broadcast address – 10.50.13.255
    - Subnet mask – 255.255.252.0
- Accounting – 300 required
  - 10.50.14.0 / 23 – 512 total hosts
    - Network address – 10.50.14.0
    - Broadcast address – 10.50.15.255
    - Subnet mask – 255.255.252.0

- Management – 300 required
  - 10.50.16.0 / 23 – 512 total hosts
    - Network address – 10.50.16.0
    - Broadcast address – 10.50.17.255
    - Subnet mask – 255.255.252.0

- Reception – 100 required
  - 10.50.18.0 / 25 – 128 total hosts
    - Network address – 10.50.18.0
    - Broadcast address – 10.50.18.127
    - Subnet mask – 255.255.255.128

- Admin – 100 required
  - 10.50.18.128 / 25 – 128 total hosts
    - Network address – 10.50.18.128
    - Broadcast address – 10.50.18.255
    - Subnet mask – 255.255.255.128

- Human Resource – 100 required
  - 10.50.19.0 / 25 – 128 total hosts
    - Network address – 10.50.19.0
    - Broadcast address -10.50.19.127
    - Subnet mask – 255.255.255.128

- Core layer switches
  - Core1 switch
    - 10.50.19.128 /30 – GigabitEthernet 1/0/1
    - 10..50.19.132 /30 – GigabitEthernet 1/0/2
    - 10.50.19.136 /30 – GigabitEthernet 1/0/3
    - 10.50.19.140 /30 – GigabitEthernet 1/0/4
    - 10.50.19.144 /30 – GigabitEthernet 1/0/5
    - 10.50.19.148 /30 – GigabitEthernet 1/0/6

- Core2 switch
  - 10.50.19.152 /30 – GigabitEthernet 1/0/1
  - 10..50.19.156 /30 – GigabitEthernet 1/0/2
  - 10.50.19.160 /30 – GigabitEthernet 1/0/3
  - 10.50.19.164 /30 – GigabitEthernet 1/0/4
  - 10.50.19.168 /30 – GigabitEthernet 1/0/5
  - 10.50.19.172 /30 – GigabitEthernet 1/0/6

- Core layer Router
  - Core1 router
    - 10.50.19.176 /30 - GigabitEthernet 0/0
    - 10.50.19.180 /30 - GigabitEthernet 0/1
  - Core2 router
    - 10.50.19.184 /30 - GigabitEthernet 0/0
    - 10.50.19.188 /30 - GigabitEthernet 0/1

3.1 Basic Switch and Router Configuration

Core Router 1 :

```
Router> en
Router# configure terminal
Router(config)# hostname Core_Router1
Core_Router1(config)#line console 0
Core_Router1(config-line)#password aayush123
Core_Router1(config-line)#login
Core_Router1(config-line)#exit
Core_Router1(config)#enable secret 123aayush
Core_Router1(config)#service password-encryption
Core_Router1(config)#banner motd # This is a core Router #
Core_Router1(config)#end
Core_Router1#write
```

Core Router 2 :

```
Router> en
Router# configure terminal
Router(config)# hostname Core_Router2
Core_Router2(config)#line console 0
Core_Router2(config-line)#password aayush123
Core_Router2(config-line)#login
Core_Router2(config-line)#exit
Core_Router2(config)#enable secret 123aayush
Core_Router2(config)#service password-encryption
Core_Router2(config)#banner motd # This is a core Router #
Core_Router2(config)#end
Core_Router2#write
```

Core Switch 1:

```
Switch> en
Switch# configure terminal
Switch(config)#hostname Core_Switch1
Core_Switch1(config)#line console 0
Core_Switch1(config-line)#password aayush123
Core_Switch1(config-line)#login
Core_Switch1(config-line)#exit
Core_Switch1(config)#enable secret 123aayush
Core_Switch1(config)#service password-encryption
Core_Switch1(config)#banner motd # This is a Core Switch. #
Core_Switch1(config)#end
Core_Switch1#write
```

Core Switch 2 :

```
Switch> en
Switch# configure terminal
Switch(config)#hostname Core_Switch2
Core_Switch2(config)#line console 0
Core_Switch2(config-line)#password aayush123
Core_Switch2(config-line)#login
Core_Switch2(config-line)#exit
Core_Switch2(config)#enable secret 123aayush
Core_Switch2(config)#service password-encryption
Core_Switch2(config)#banner motd # This is a Core Switch. #
Core_Switch2(config)#end
Core_Switch2#write
```

Building A: (Distribution layer switches)

Building A Switch 1 :

```
Switch>en
Switch#configure terminal
Switch(config)#hostname BuildingA_Switch1
BuildingA_Switch1(config)#line console 0
BuildingA_Switch1(config-line)#password aayush123
BuildingA_Switch1(config-line)#login
BuildingA_Switch1(config-line)#exit
BuildingA_Switch1(config)#enable secret 123aayush
BuildingA_Switch1(config)#service password-encryption
BuildingA_Switch1(config)#banner motd # This is a Distribution layer switch of Building A #
BuildingA_Switch1(config)#end
```

Building A Switch 2 :

```
Switch>en
Switch#configure terminal
Switch(config)#hostname BuildingA_Switch2
BuildingA_Switch2(config)#line console 0
BuildingA_Switch2(config-line)#password aayush123
BuildingA_Switch2(config-line)#login
BuildingA_Switch2(config-line)#exit
BuildingA_Switch2(config)#enable secret 123aayush
BuildingA_Switch2(config)#service password-encryption
BuildingA_Switch2(config)#banner motd # This is a Distribution layer switch of Building A #
BuildingA_Switch2(config)#end
```

Building B: (Distribution layer switches)

Building B Switch 1 :

```
Switch>en
Switch#configure terminal
Switch(config)#hostname BuildingB_Switch1
BuildingB_Switch1(config)#line console 0
BuildingB_Switch1(config-line)#password aayush123
BuildingB_Switch1(config-line)#login
BuildingB_Switch1(config-line)#exit
BuildingB_Switch1(config)#enable secret 123aayush
BuildingB_Switch1(config)#service password-encryption
BuildingB_Switch1(config)#banner motd # This is a Distribution layer switch of Building B #
BuildingB_Switch1(config)#end
BuildingB_Switch1#write
```

Building B Switch 2 :

```
Switch>en
Switch#configure terminal
Switch(config)#hostname BuildingB_Switch2
BuildingB_Switch2(config)#line console 0
BuildingB_Switch2(config-line)#password aayush123
BuildingB_Switch2(config-line)#login
BuildingB_Switch2(config-line)#exit
BuildingB_Switch2(config)#enable secret 123aayush
BuildingB_Switch2(config)#service password-encryption
BuildingB_Switch2(config)#banner motd # This is a Distribution layer switch of Building B #
BuildingB_Switch2(config)#end
BuildingB_Switch2#write
```

Building C : (Distribution layer switches)

Building C Switch 1:

```
Switch>en
Switch#configure terminal
Switch(config)#hostname BuildingC_Switch1
BuildingC_Switch1(config)#line console 0
BuildingC_Switch1(config-line)#password aayush123
BuildingC_Switch1(config-line)#login
BuildingC_Switch1(config-line)#exit
BuildingC_Switch1(config)#enable secret 123aayush
BuildingC_Switch1(config)#service password-encryption
BuildingC_Switch1(config)#banner motd # This is a Distribution layer switch of Building C #
BuildingC_Switch1(config)#end
BuildingC_Switch1#write
```

Building C Switch 2:

```
Switch>en
Switch#configure terminal
Switch(config)#hostname BuildingC_Switch2
BuildingC_Switch2(config)#line console 0
BuildingC_Switch2(config-line)#password aayush123
BuildingC_Switch2(config-line)#login
BuildingC_Switch2(config-line)#exit
BuildingC_Switch2(config)#enable secret 123aayush
BuildingC_Switch2(config)#service password-encryption
BuildingC_Switch2(config)#banner motd # This is a Distribution layer switch of Building C #
BuildingC_Switch2(config)#end
BuildingC_Switch2#write
```

3.2 VLAN & Inter-Vlan Configuration

Building A Switch 1 & Building A Switch 2:

```
BuildingA_Switch1 > enable
BuildingA_Switch1# configure terminal
BuildingA_Switch1(config) # vlan 10
BuildingA_Switch1(config-vlan) # name Reception
BuildingA_Switch1(config-vlan) # interface vlan 10
BuildingA_Switch1(config-vlan) # description Reception vlan: 10
BuildingA_Switch1(config-vlan) # ip address 10.50.18.0 255.255.255.128
BuildingA_Switch1(config-vlan) # exit
BuildingA_Switch1(config) # vlan 20
BuildingA_Switch1(config-vlan) # name Accounting
BuildingA_Switch1(config-vlan) # interface vlan 20
BuildingA_Switch1(config-vlan) # description Accounting vlan: 20
BuildingA_Switch1(config-vlan) # ip address 10.50.14.0 255.255.254.0
BuildingA_Switch1(config-vlan) # exit
BuildingA_Switch1(config) # vlan 30
BuildingA_Switch1(config-vlan) # name Sales
BuildingA_Switch1(config-vlan) # interface vlan 30
BuildingA_Switch1(config-vlan) # description Sales & Marketing vlan: 30
BuildingA_Switch1(config-vlan) # ip address 10.50.12.0 255.255.254.0
BuildingA_Switch1(config-vlan) # exit
BuildingA_Switch1(config) # interface range gig1/0/3-8
BuildingA_Switch1(config-if-range) # switchport mode trunk
BuildingA_Switch1(config) # exit
BuildingA_Switch1 # write
```

**** We will repeat this same code in BuildingA_Switch2**

Reception Switch 1 and Switch 2 :

```
Reception_1 > enable
Reception_1 # configure terminal
Reception_1(config) # vlan 10
Reception_1(config-vlan) # name Reception
Reception_1(config-vlan) # exit
Reception_1(config) # interface range fa0/1-2
Reception_1(config-if-range) # switchport mode trunk
Reception_1(config-if-range) # exit
Reception_1(config) # interface range fa0/3-24
Reception_1(config-if-range) # switchport mode access
Reception_1(config-if-range) # switchport access vlan 10
Reception_1(config-if-range) # end
Reception_1 # write
```

**** We will repeat this same code in Reception_2 switch**

Accounting Switch 1 & Switch 2 :

```
Accounting_1 > enable
Accounting_1 # configure terminal
Accounting_1(config) # vlan 20
Accounting_1(config-vlan) # name Accounting
Accounting_1(config-vlan) # exit
Accounting_1(config) # interface range fa0/1-2
Accounting_1(config-if-range) # switchport mode trunk
Accounting_1(config-if-range) # exit
Accounting_1(config) # interface range fa0/3-24
Accounting_1(config-if-range) # switchport mode access
Accounting_1(config-if-range) # switchport access vlan 20
Accounting_1(config-if-range) # end
Accounting_1 # write
```

**** We will repeat this same code in Accounting_2 switch**

Sales & Marketing Switch 1 & Switch 2 :

```
Sales_1 > enable
Sales_1 # configure terminal
Sales_1(config) # vlan 30
Sales_1(config-vlan) # name Sales
Sales_1(config-vlan) # exit
Sales_1(config) # interface range fa0/1-2
Sales_1(config-if-range) # switchport mode trunk
Sales_1(config-if-range) # exit
Sales_1(config) # interface range fa0/3-24
Sales_1(config-if-range) # switchport mode access
Sales_1(config-if-range) # switchport access vlan 30
Sales_1(config-if-range) # end
Sales_1 # write
```

**** We will repeat this same code in Sales_2 switch**

Building B Switch 1 & Switch 2 :

```
BuildingB_Switch1 > enable
BuildingB_Switch1# configure terminal
BuildingB_Switch1(config) # vlan 30
BuildingB_Switch1(config-vlan) # name Admin
BuildingB_Switch1(config-vlan) # interface vlan 30
BuildingB_Switch1(config-vlan) # description Admin vlan: 30
BuildingB_Switch1(config-vlan) # ip address 10.50.18.128 255.255.255.128
BuildingB_Switch1(config-vlan) # exit
BuildingB_Switch1(config) # vlan 40
BuildingB_Switch1(config-vlan) # name Management
BuildingB_Switch1(config-vlan) # interface vlan 40
BuildingB_Switch1(config-vlan) # description Management vlan: 40
BuildingB_Switch1(config-vlan) # ip address 10.50.16.0 255.255.254.0
BuildingB_Switch1(config-vlan) # exit
BuildingB_Switch1(config) # interface range gig1/0/3-6
BuildingB_Switch1(config-if-range) # switchport mode trunk
BuildingB_Switch1(config) # exit
BuildingB_Switch1 # write
```

**** We will repeat this same code in BuildingB_Switch2**

Admin Switch 1 & Switch 2 :

```
Admin_1 > enable
Admin_1 # configure terminal
Admin_1(config) # vlan 40
Admin_1(config-vlan) # name Admin
Admin_1(config-vlan) # exit
Admin_1(config) # interface range fa0/1-2
Admin_1(config-if-range) # switchport mode trunk
Admin_1(config-if-range) # exit
Admin_1(config) # interface range fa0/3-24
Admin_1(config-if-range) # switchport mode access
Admin_1(config-if-range) # switchport access vlan 40
Admin_1(config-if-range) # end
Admin_1 # write
```

**** We will repeat this same code in Admin_2**

Management Switch 1 & Switch 2 :

```
Management_1 > enable
Management_1 # configure terminal
Management_1(config) # vlan 50
Management_1(config-vlan) # name Management
Management_1(config-vlan) # exit
Management_1(config) # interface range fa0/1-2
Management_1(config-if-range) # switchport mode trunk
Management_1(config-if-range) # exit
Management_1(config) # interface range fa0/3-24
Management_1(config-if-range) # switchport mode access
Management_1(config-if-range) # switchport access vlan 50
Management_1(config-if-range) # end
Management_1 # write
```

**** We will repeat this same code in Management_2**

Building C Switch 1 & Switch 2

```
BuildingC_Switch1 > enable
BuildingC_Switch1# configure terminal
BuildingC_Switch1(config) # vlan 60
BuildingC_Switch1(config-vlan) # name Lounge
BuildingC_Switch1(config-vlan) # interface vlan 60
BuildingC_Switch1(config-vlan) # description Lounge vlan: 60
BuildingC_Switch1(config-vlan) # ip address 10.50.8.0 255.255.252.0
BuildingC_Switch1(config-vlan) # exit
BuildingC_Switch1(config) # vlan 70
BuildingC_Switch1(config-vlan) # name Cabins
BuildingC_Switch1(config-vlan) # interface vlan 70
BuildingC_Switch1(config-vlan) # description Employee Cabins vlan: 70
BuildingC_Switch1(config-vlan) # ip address 10.50.14.0 255.255.248.0
BuildingC_Switch1(config-vlan) # exit
BuildingC_Switch1(config) # vlan 80
BuildingC_Switch1(config-vlan) # name HR
BuildingC_Switch1(config-vlan) # interface vlan 80
BuildingC_Switch1(config-vlan) # description HR's vlan: 30
BuildingC_Switch1(config-vlan) # ip address 10.50.19.0 255.255.255.128
BuildingC_Switch1(config-vlan) # exit
BuildingC_Switch1(config) # interface range gig1/0/3-8
BuildingC_Switch1(config-if-range) # switchport mode trunk
BuildingC_Switch1(config) # exit
BuildingC_Switch1 # write
```

**** We will repeat this same code in BuildingC_Switch2**

Lounge Switch 1 & Switch 2 :

```
Lounge_1 > enable
Lounge_1 # configure terminal
Lounge_1(config) # vlan 60
Lounge_1(config-vlan) # name Lounge
Lounge_1(config-vlan) # exit
Lounge_1(config) # interface range fa0/1-2
Lounge_1(config-if-range) # switchport mode trunk
Lounge_1(config-if-range) # exit
Lounge_1(config) # interface range fa0/3-24
Lounge_1(config-if-range) # switchport mode access
Lounge_1(config-if-range) # switchport access vlan 60
Lounge_1(config-if-range) # end
Lounge_1 # write
```

**** We will repeat this same code in Lounge_2**

Cabin Switch 1 & Switch 2 :

```
Cabin_1 > enable
Cabin_1 # configure terminal
Cabin_1(config) # vlan 70
Cabin_1(config-vlan) # name Cabin
Cabin_1(config-vlan) # exit
Cabin_1(config) # interface range fa0/1-2
Cabin_1(config-if-range) # switchport mode trunk
Cabin_1(config-if-range) # exit
Cabin_1(config) # interface range fa0/3-24
Cabin_1(config-if-range) # switchport mode access
Cabin_1(config-if-range) # switchport access vlan 70
Cabin_1(config-if-range) # end
Cabin_1 # write
```

**** We will repeat this same code in Cabin_2**

HR Switch 1 & Switch 2 :

```
HR_1 > enable
HR_1 # configure terminal
HR_1(config) # vlan 80
HR_1(config-vlan) # name HR
HR_1(config-vlan) # exit
HR_1(config) # interface range fa0/1-2
HR_1(config-if-range) # switchport mode trunk
HR_1(config-if-range) # exit
HR_1(config) # interface range fa0/3-24
HR_1(config-if-range) # switchport mode access
HR_1(config-if-range) # switchport access vlan 80
HR_1(config-if-range) # end
HR_1 # write
```

**** We will repeat this same code in HR_2**

3.3 OSPF Routing Configuration

Core Router 1 :

```
Core_Router1 > enable
Core_Router1 # configure terminal
Core_Router1 (config) # router ospf 60
Core_Router1 (config-router) # network 1.1.1.0 0.0.0.252 area 0
Core_Router1 (config-router) # network 2.2.2.0 0.0.0.252 area 0
Core_Router1 (config-router) # network 10.50.19.176 0.0.0.252 area 0
Core_Router1 (config-router) # network 10.50.19.180 0.0.0.252 area 0
Core_Router1 (config-router) # end
Core_Router1 # write
```

Core Router 2 :

```
Core_Router2 > enable
Core_Router2 # configure terminal
Core_Router2 (config) # router ospf 60
Core_Router2 (config-router) # network 1.1.2.0 0.0.0.252 area 0
Core_Router2 (config-router) # network 2.2.1.0 0.0.0.252 area 0
Core_Router2 (config-router) # network 10.50.19.184 0.0.0.252 area 0
Core_Router2 (config-router) # network 10.50.19.188 0.0.0.252 area 0
Core_Router2 (config-router) # end
Core_Router2 # write
```

Core Switch 1 :

```
Core_Switch1 > enable
Core_Switch1 # configure terminal
Core_Switch1 (config) # ip routing
Core_Switch1 (config) #interface range gig1/0/1-8
Core_Switch1 (config-if-range) # no switchport
Core_Switch1 (config-if-range) # exit
Core_Switch1 (config) # router ospf 60
Core_Switch1 (config-router) # network 10.50.18.0 0.0.0.127 area 0
Core_Switch1 (config-router) # network 10.50.14.0 0.0.1.255 area 0
Core_Switch1 (config-router) # network 10.50.12.0 0.0.1.255 area 0
Core_Switch1 (config-router) # network 10.50.18.128 0.0.0.127 area 0
Core_Switch1 (config-router) # network 10.50.16.0 0.0.1.255 area 0
Core_Switch1 (config-router) # network 10.50.8.0 0.0.3.255 area 0
Core_Switch1 (config-router) # network 10.50.0.0 0.0.7.255 area 0
Core_Switch1 (config-router) # network 10.50.19.0 0.0.0.128 area 0
Core_Switch1 (config-router) # network 10.50.19.176 0.0.0.252 area 0
Core_Switch1 (config-router) # network 10.50.19.188 0.0.0.252 area 0
Core_Switch1 (config-router) # end
Core_Switch1 # write
```

Core Switch 2 :

```
Core_Switch2 > enable
Core_Switch2 # configure terminal
Core_Switch2 (config) # ip routing
Core_Switch2 (config) #interface range gig1/0/1-8
Core_Switch2 (config-if-range) # no switchport
Core_Switch2 (config-if-range) # exit
Core_Switch2 (config) # router ospf 60
Core_Switch2 (config-router) # network 10.50.18.0 0.0.0.127 area 0
Core_Switch2 (config-router) # network 10.50.14.0 0.0.1.255 area 0
Core_Switch2 (config-router) # network 10.50.12.0 0.0.1.255 area 0
Core_Switch2 (config-router) # network 10.50.18.128 0.0.0.127 area 0
Core_Switch2 (config-router) # network 10.50.16.0 0.0.1.255 area 0
Core_Switch2 (config-router) # network 10.50.8.0 0.0.3.255 area 0
Core_Switch2 (config-router) # network 10.50.0.0 0.0.7.255 area 0
Core_Switch2 (config-router) # network 10.50.19.0 0.0.0.128 area 0
Core_Switch2 (config-router) # network 10.50.19.184 0.0.0.252 area 0
Core_Switch2 (config-router) # network 10.50.19.180 0.0.0.252 area 0
Core_Switch2 (config-router) # end
Core_Switch2 # write
```

3.4 NAT(PAT) Configuration

Core Router 1 :

```
Core_Router1 > enable
Core_Router1 # configure terminal
Core_Router1 (config) # ip nat inside source list 1 interface se0/0/0 overload
Core_Router1 (config) # ip nat inside source list 1 interface se0/0/0 overload
Core_Router1 (config) # access-list 1 permit 10.50.18.0 0.0.0.127
Core_Router1 (config) # access-list 1 permit 10.50.14.0 0.0.1.255
Core_Router1 (config) # access-list 1 permit 10.50.12.0 0.0.1.255
Core_Router1 (config) # access-list 1 permit 10.50.18.128 0.0.0.127
Core_Router1 (config) # access-list 1 permit 10.50.16.0 0.0.1.255
Core_Router1 (config) # access-list 1 permit 10.50.8.0 0.0.3.255
Core_Router1 (config) # access-list 1 permit 10.50.0.0 0.0.7.255
Core_Router1 (config) # access-list 1 permit 10.50.19.0 0.0.0.127
Core_Router1 (config) # exit
Core_Router1# write
```

Core Router 2 :

```
Core_Router2 > enable
Core_Router2 # configure terminal
Core_Router2 (config) # ip nat inside source list 1 interface se0/0/0 overload
Core_Router2 (config) # ip nat inside source list 1 interface se0/0/0 overload
Core_Router2 (config) # access-list 1 permit 10.50.18.0 0.0.0.127
Core_Router2 (config) # access-list 1 permit 10.50.14.0 0.0.1.255
Core_Router2 (config) # access-list 1 permit 10.50.12.0 0.0.1.255
Core_Router2 (config) # access-list 1 permit 10.50.18.128 0.0.0.127
Core_Router2 (config) # access-list 1 permit 10.50.16.0 0.0.1.255
Core_Router2 (config) # access-list 1 permit 10.50.8.0 0.0.3.255
Core_Router2 (config) # access-list 1 permit 10.50.0.0 0.0.7.255
Core_Router2 (config) # access-list 1 permit 10.50.19.0 0.0.0.127
Core_Router2 (config) # exit
Core_Router2# write
```

3.5 EtherChannel Configuration

Distribution Layer Switches :

Building A Switch 1 :

```
BuildingA_Switch1 > enable
BuildingA_Switch1 # configure terminal
BuildingA_Switch1 (config) # interface range gig1/0/9-12
BuildingA_Switch1 (config-if-range) # channel-group 1 mode active
BuildingA_Switch1 (config-if-range) # exit
BuildingA_Switch1 (config) # interface port-channel 1
BuildingA_Switch1 (config-if) # switchport mode trunk
BuildingA_Switch1 (config-if) # switchport trunk allowed vlan 10,20,30
BuildingA_Switch1 (config-if) # end
BuildingA_Switch1 # write
```

Building A Switch 2 :

```
BuildingA_Switch2 > enable
BuildingA_Switch2 # configure terminal
BuildingA_Switch2 (config) # interface range gig1/0/9-12
BuildingA_Switch2 (config-if-range) # channel-group 1 mode passive
BuildingA_Switch2 (config-if-range) # exit
BuildingA_Switch2 (config) # interface port-channel 1
BuildingA_Switch2 (config-if) # switchport mode trunk
BuildingA_Switch2 (config-if) # switchport trunk allowed vlan 10,20,30
BuildingA_Switch2 (config-if) # end
BuildingA_Switch2 # write
```

Building B Switch 1 :

```
BuildingB_Switch1 > enable
BuildingB_Switch1 # configure terminal
BuildingB_Switch1 (config) # interface range gig1/0/9-12
BuildingB_Switch1 (config-if-range) # channel-group 1 mode active
BuildingB_Switch1 (config-if-range) # exit
BuildingB_Switch1 (config) # interface port-channel 1
BuildingB_Switch1 (config-if) # switchport mode trunk
BuildingB_Switch1 (config-if) # switchport trunk allowed vlan 40,50
BuildingB_Switch1 (config-if) # end
BuildingB_Switch1 # write
```

Building B Switch 2 :

```
BuildingB_Switch2 > enable
BuildingB_Switch2 # configure terminal
BuildingB_Switch2 (config) # interface range gig1/0/9-12
BuildingB_Switch2 (config-if-range) # channel-group 1 mode passive
BuildingB_Switch2 (config-if-range) # exit
BuildingB_Switch2 (config) # interface port-channel 1
BuildingB_Switch2 (config-if) # switchport mode trunk
BuildingB_Switch2 (config-if) # switchport trunk allowed vlan 40,50
BuildingB_Switch2 (config-if) # end
BuildingB_Switch2 # write
```

Building C Switch 1 :

```
BuildingC_Switch1 > enable
BuildingC_Switch1 # configure terminal
BuildingC_Switch1 (config) # interface range gig1/0/9-12
BuildingC_Switch1 (config-if-range) # channel-group 1 mode active
BuildingC_Switch1 (config-if-range) # exit
BuildingC_Switch1 (config) # interface port-channel 1
BuildingC_Switch1 (config-if) # switchport mode trunk
BuildingC_Switch1 (config-if) # switchport trunk allowed vlan 60,70,80
BuildingC_Switch1 (config-if) # end
BuildingC_Switch1 # write
```

Building C Switch 2 :

```
BuildingC_Switch2 > enable
BuildingC_Switch2 # configure terminal
BuildingC_Switch2 (config) # interface range gig1/0/9-12
BuildingC_Switch2 (config-if-range) # channel-group 1 mode passive
BuildingC_Switch2 (config-if-range) # exit
BuildingC_Switch2 (config) # interface port-channel 1
BuildingC_Switch2 (config-if) # switchport mode trunk
BuildingC_Switch2 (config-if) # switchport trunk allowed vlan 60,70,80
BuildingC_Switch2 (config-if) # end
BuildingC_Switch2 # write
```

3.6 Access Control List (ACL) Configuration

Building A Switch 1 & Switch 2 :

```
BuildingA_Switch1 > enable
BuildingA_Switch1# configure terminal
BuildingA_Switch1(config) # ip access-list standard Accounting_ACL
BuildingA_Switch1(config-std-nacl)# deny 10.50.18.0 0.0.0.127
BuildingA_Switch1(config-std-nacl)# deny 10.50.12.0 0.0.1.255
BuildingA_Switch1(config-std-nacl)# deny 10.50.16.0 0.0.1.255
BuildingA_Switch1(config-std-nacl)# deny 10.50.8.0 0.0.3.255
BuildingA_Switch1(config-std-nacl)# deny 10.50.0.0 0.0.7.255
BuildingA_Switch1(config-std-nacl)# deny 10.50.19.0 0.0.0.127
BuildingA_Switch1(config-std-nacl)# permit any
BuildingA_Switch1(config-std-nacl)# exit
BuildingA_Switch1(config) # interface range gig1/0/1-2
BuildingA_Switch1(config-if-range) # ip access-group Accounting_ACL out
BuildingA_Switch1(config-if-range) # exit
BuildingA_Switch1(config) # do write
BuildingA_Switch1(config) # exit
BuildingA_Switch1# write
```

Building B Switch 1 & Switch 2 :

```
BuildingB_Switch1 > enable
BuildingB_Switch1# configure terminal
BuildingB_Switch1(config) # ip access-list standard Only_Allow_Admin
BuildingB_Switch1(config-std-nacl)# deny 10.50.14.0 0.0.0.127
BuildingB_Switch1(config-std-nacl)#permit any
BuildingB_Switch1(config-std-nacl)# exit
BuildingB_Switch1(config) # interface range gig1/0/5-6
BuildingB_Switch1(config-if-range) # ip access-group Only_Allow_Admin out
BuildingB_Switch1(config-if-range) # exit
BuildingB_Switch1(config) # do write
BuildingB_Switch1(config) # exit
BuildingB_Switch1# write
```

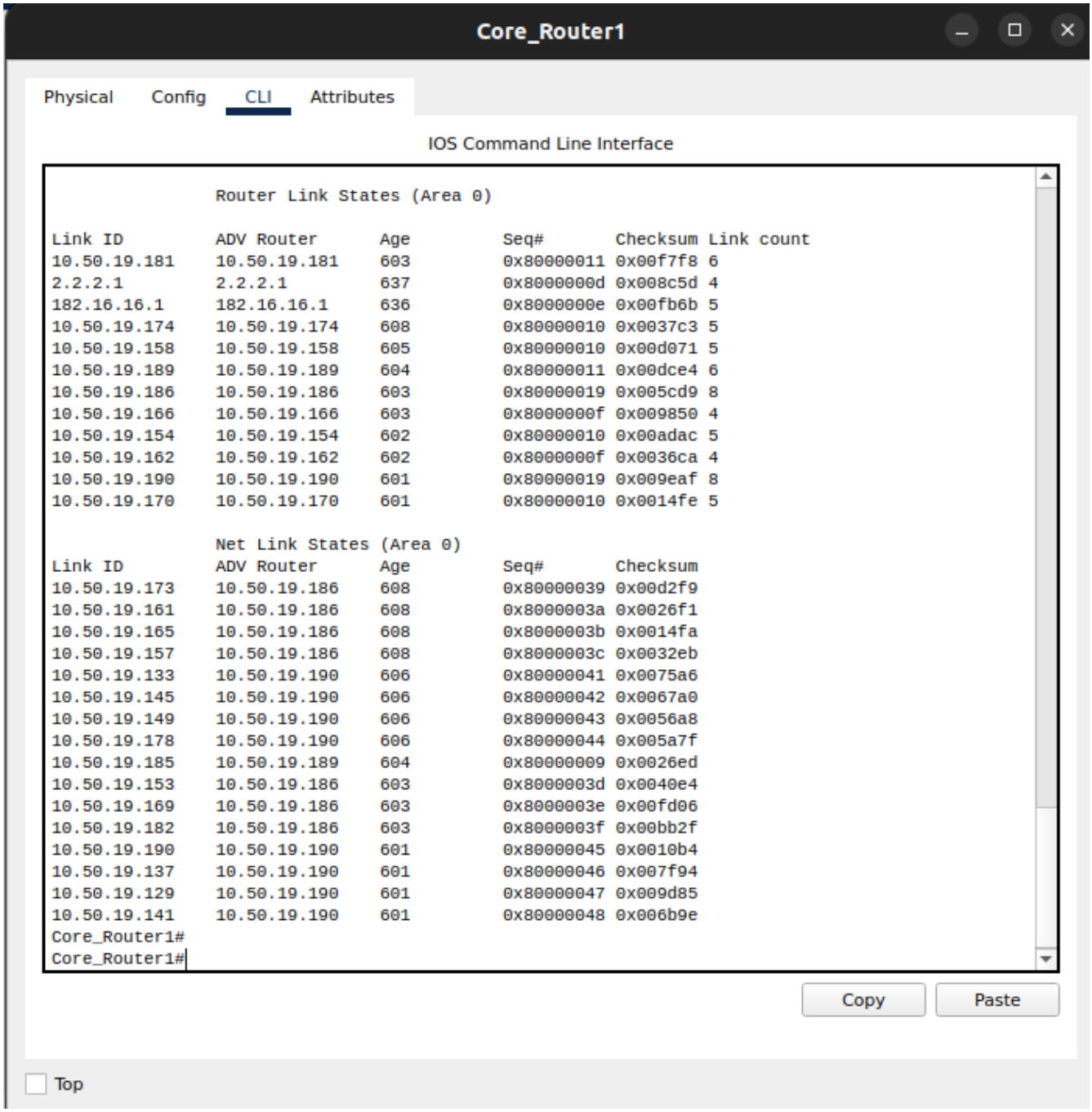
Building C Switch 1 & Switch 2 :

```
BuildingC_Switch1 > enable
BuildingC_Switch1# configure terminal
BuildingC_Switch1(config) # ip access-list standard Block_Accounting
BuildingC_Switch1(config-std-nacl)# deny 10.50.14.0 0.0.0.127
BuildingC_Switch1(config-std-nacl)#permit any
BuildingC_Switch1(config-std-nacl)# exit
BuildingC_Switch1(config) # interface range gig1/0/1-2
BuildingC_Switch1(config-if-range) # ip access-group Block_Accounting out
BuildingC_Switch1(config-if-range) # exit
BuildingC_Switch1(config) # do write
BuildingC_Switch1(config) # exit
BuildingC_Switch1# write
```

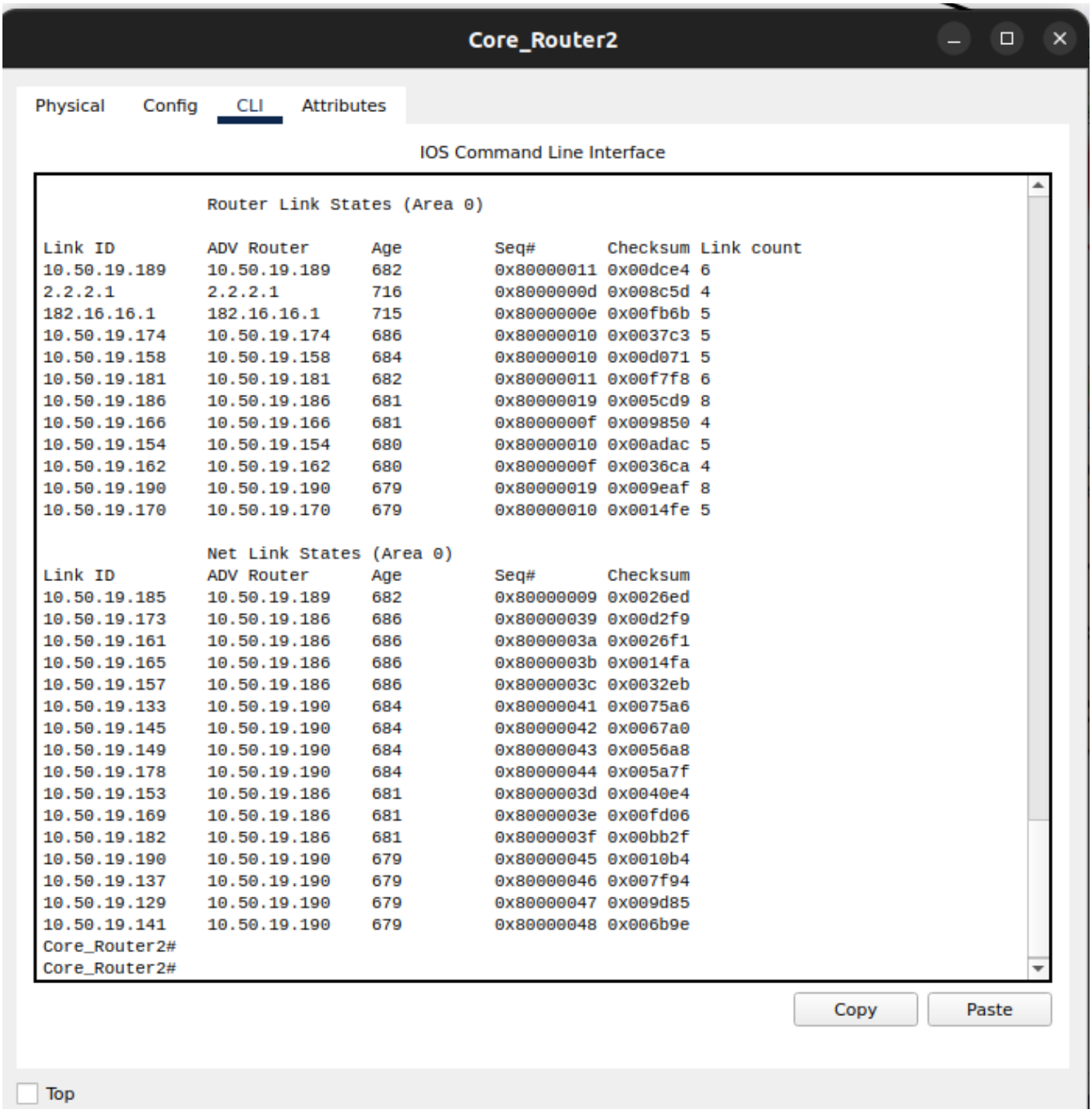
4. Network Troubleshooting and Optimization

4.1 OSPF

Core Router 1:

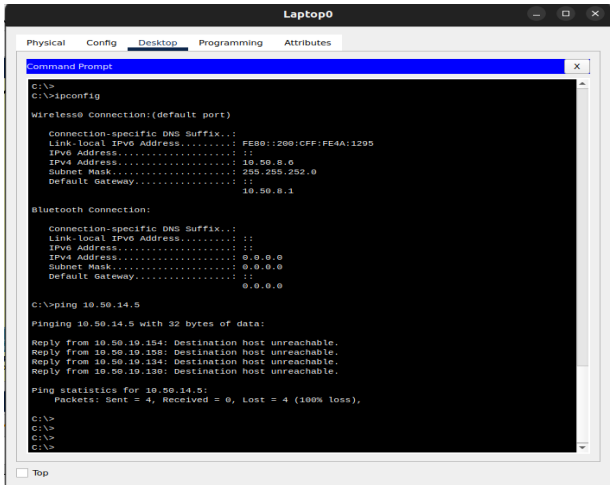


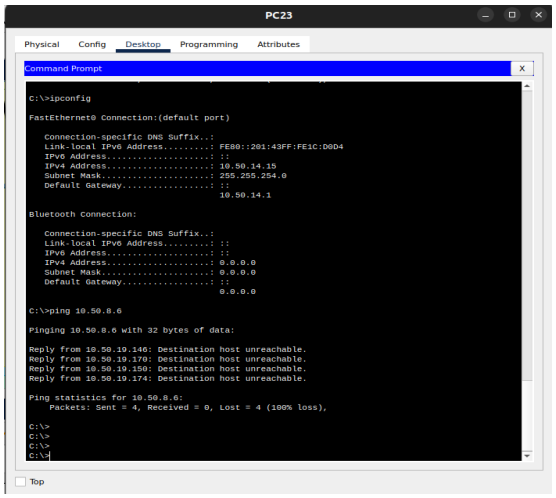
Core Router 2 :



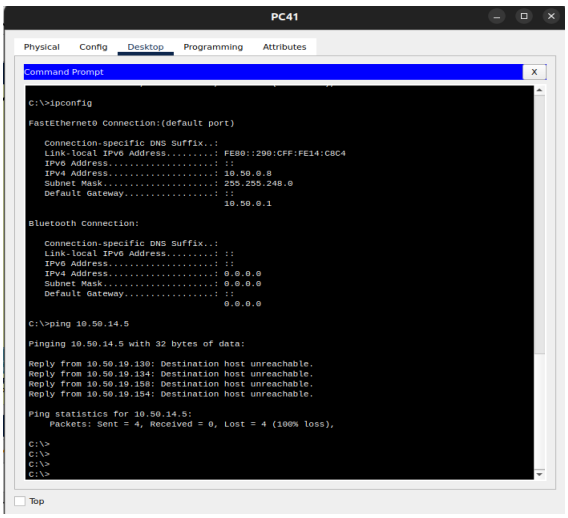
4.2 ACL

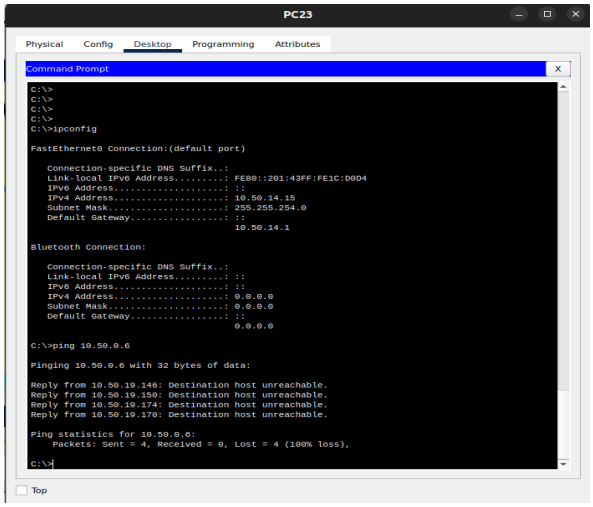
From Cabin to Accounting & Vice Versa :



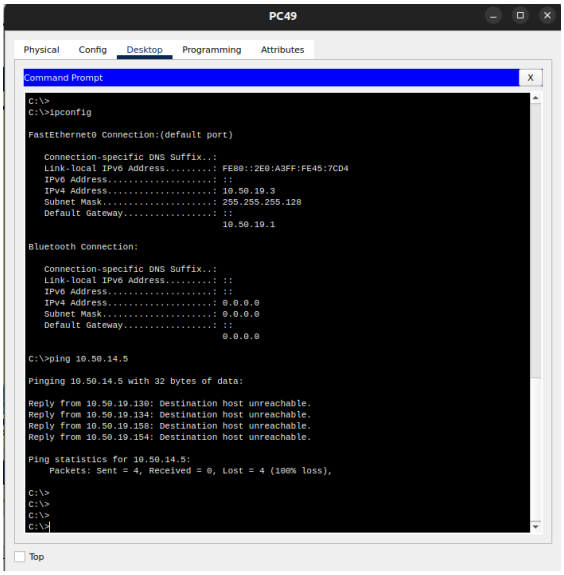


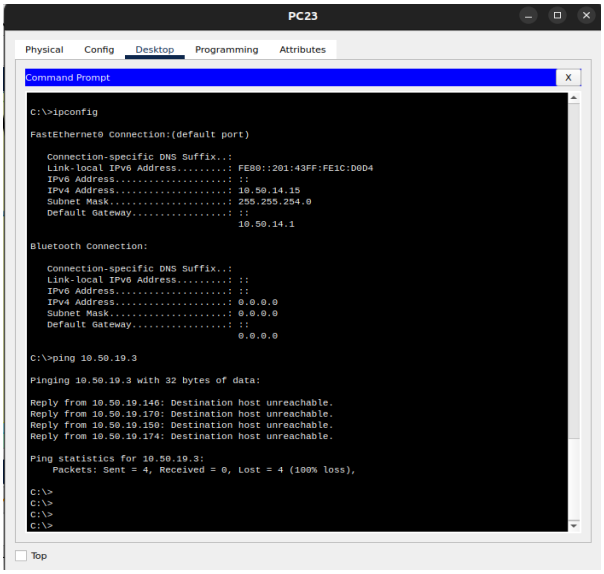
From Lounge to Accounting & Vice Versa :





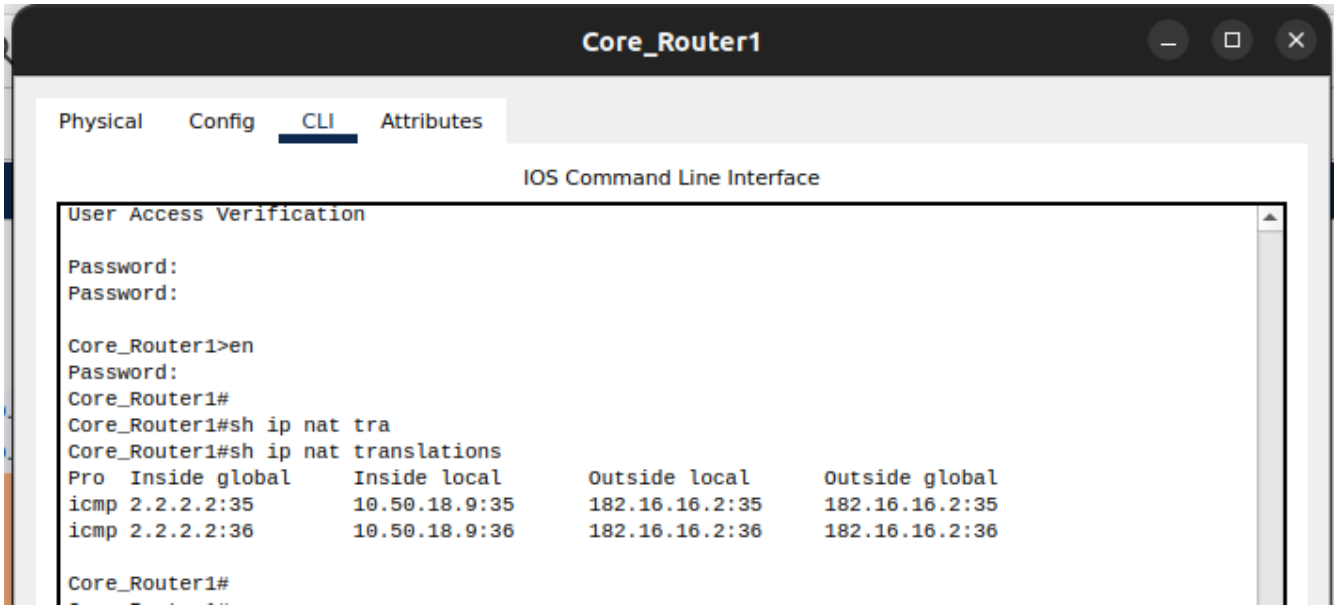
From HR to Accounting & Vice Versa :



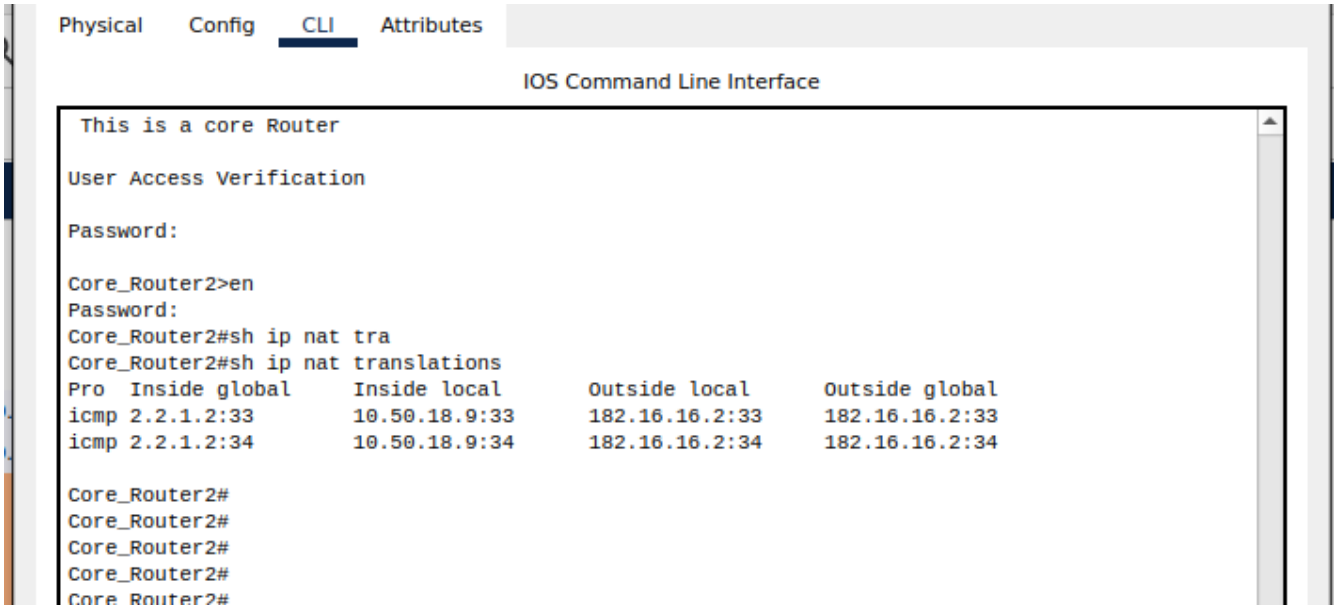


4.3 NAT

Core Router 1 :



Core Router 2 :



Conclusion

In conclusion, we have successfully created a network for Lama Tech Company. We have fulfilled all their basic requirement. We created a network of 10.50.0.0 / 20. We utilized the network by dividing the network using VLSM. We made sub networks for each department and created vlan for each department. Since, the network is designed using 3 tier network architecture, we tried using layer 3 switches instead of routers to lower the price.

In this network, each department belongs to its separate vlan which decreases the broadcast domain in the network. We have also configured inter-vlan for communication between various vlan, if necessary. It is very difficult for IT admin to configure ip address in each device statically, so we have configured a dhcp server in Admin department. It will dynamically assign ip address to any new device. We have also configured acl for better security. In this way, we have fulfilled the need of company and increased the efficiency of the system. This network also avoids any single point failure for more reliability. Overall, we can say that the system will be able to handle traffic for few decades as the company grows into large scale company.

Reference

Network Representation and Topologies – Introduction to Networks [online] Available at: https://contenthub.netacad.com/itn-dl/1.3.1 [Accessed 8th September 2023]

Overview of VLAN- Switching, Routing and Wireless Essential [online] Available at https://contenthub.netacad.com/srwe-dl/3.1.1 [Accessed 8th September 2023]

Inter-Vlan Routing- Switching, Routing and Wireless Essential [online] Available at https://contenthub.netacad.com/srwe-dl/4.1.1 [Accessed 8th September 2023]

Introduction to OSPF - Enterprise Networking, Security, and Automation [online] Available at https://contenthub.netacad.com/ensa-dl/1.1.1 [Accessed 8th September 2023]

WAN Concept - Enterprise Networking, Security, and Automation [online] Available at https://contenthub.netacad.com/ensa-dl/7.1.1 [Accessed 9th September 2023]

NAT and its Configuration - Enterprise Networking, Security, and Automation [online] Available at https://contenthub.netacad.com/ensa-dl/6.1.1 [Accessed 9th September 2023]

ACL Concepts - Enterprise Networking, Security, and Automation [online] Available at https://contenthub.netacad.com/ensa-dl/4.1.1 [Accessed 9th September 2023]

EtherChannel and Link aggregation - Switching, Routing, and Wireless Essentials [online] Available at https://contenthub.netacad.com/srwe-dl/6.1.1 [Accessed 10th September 2023]