INTERNSHIP ON NETWORK SECURITY: AN APPROACH FOR ROUTING SECURITY

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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DHAKA, BANGLADESH

DECEMBER 2022

APPROVAL

This Internship titled **"Internship on Network Security: an approach for Routing Security"** submitted by Md. Al-Amin, ID No: 201-15-13688 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 19-01-2023.

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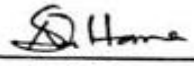

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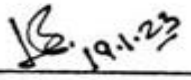

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DECLARATION

I hereby declare that this project has been done by me under the supervision of **Sharmin Akter, Senior Lecturer, Department of CSE** Daffodil International University and co-supervision of **Tahmina Sultana Priya, Lecturer, Department of CSE** Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for the award of any degree or diploma.

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ACKNOWLEDGEMENT

I begin by giving God the highest praise and gratitude for His wonderful blessings, which enabled me to successfully finish the final year internship.

I sincerely appreciate **Sharmin Akter**, Senior Lecturer, and **Tahmina Sultana Priya**, Lecturer, CSE Department, Daffodil International University, Dhaka, and express my sincere gratitude. She has extensive knowledge and a strong desire to do this project for my supervisor. This endeavor was made possible by her never-ending patience, academic guidance, constant encouragement, frequent and energetic supervision, and constructive criticism, invaluable advice, reading many subpar drafts, and fixing them at all stages.

I would like to offer our sincere gratitude to **Professor Dr. Touhid Bhuiyan**, Professor and Head Department of CSE, as well as to the other faculty members and employees of the CSE department of Daffodil International University, for their kind assistance in finishing our project.

Thank you to everyone who participated in this discussion while taking classes at Daffodil International University.

I must respectfully conclude by thanking our parents for their unwavering support as well as our patients.

ABSTRACT

I have done my internship at an IIG company. The company name was Windstream Communication LTD. The internship was for six months. In this internship, I had a trainer named Mr. Anirban Datta. In my six months internship, I learned a lot of things from him.

In these six months, I learned about the core knowledge I need to be a routing security professional and also attained so much knowledge with the help of detailed reports and live sessions.

During the whole month, I got the support and guidance I needed from the respective mentor (Mr. Anirban) irrespective of the time.

Before this internship, I don't have much knowledge about routing protocols and routing security. I learned about some routing protocols (static routing, OSPF routing, default routing, BGP, etc), VLAN configuration, and some routing securities as well.

I have used some virtual tools like Cisco Packet Tracer and GNS3 for learning routing protocols and routing securities. I also practiced on some real routers such as Cisco Routers.

I practiced all the above-mentioned tools and also try to learn about routing security and routing protocols.

The overall experience for these six months was full of knowledge and new experience with several tools and live sessions.

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CHAPTER 1

Introduction

1.1 Introduction of Internship

Internships are an essential tool for promoting practical work experience. Internships are a fantastic way to develop experience, practical skills, and career preparation. We can learn about ourselves and see ourselves from many angles by doing an internship in a genuine workplace. It aids in the development and regulation of our attitudes and behavior when interacting with various types of people and circumstances.

I choose my internship at Routing Security because it gives me a great convenience to apply my theory and knowledge in a real working environment. I got a chance to do my internship in an IIG company. The company name was Windstream Communication LTD. I joined the company for my internship on 6th June 2022. Mr. Anirban Datta was my trainer during my internship.

I learned theory at university, but through my internship, I learned how to interact with the real world. Internships help me recognize my weaknesses and strengths. The reason I chose the internship was to prepare me for a more demanding working environment and situation. Work-life is very difficult as it requires hard work, dedication, and the ability to recover. Something I need to prepare and train for.

1.2 Motivation

At Daffodil International University, I am currently studying Bachelor of Engineering Science in Computer Science. I recognize the value of hands-on experience, which is rich in understanding textbooks and solving real-world problems.

I want to be a cyber-security expert. And I really like this networking course. During my internship, I appreciated having conversations with people to better understand their requirements and offer them high-quality services. My strengths are in my capacity to read and comprehend difficulties and to complete tasks promptly and beautifully. I have also witnessed the job and responsibilities of a waiter. I believe that my work will help me to be more successful in life.

During my university life, I took network-related courses like (data transmission, communication engineering, computer network security, etc.). My interest in troubleshooting and networking stems from solving basic system problems by searching the internet.

1.3 Internship Objectives

The major objectives of this report are to meet the CSE program's standards and to demonstrate the knowledge and information gained throughout the internship period with the organization.

- Practical application of what I have learned through my academic studies at Daffodil International University.
- The internship will give me confidence and it will enhance my practical skills.
- The internship will teach me how to work in a real environment and how to face challenges in a work environment.
- The internship will enhance my public relations by dealing with various employees and supervisors.
- During my internship in an organization, network design and maintenance troubleshooting and network-related tasks impacted this situation.
- It will help me to find a good job because of my excellence during the internship period.

1.4 Introduction to the Company

One of the biggest private IIG operators in Bangladesh is Windstream Communication Limited. It was established in 2012. WCL collected the IIG license through a public auction by the Bangladesh Telecommunications Regulatory Board. They are connected with multiple CDNs and IXs in different geographic regions. It is one of Bangladesh's biggest private-sector IIG operators. The upstreams of Windstream Communication Limited for IPv4 are TATA COMMUNICATIONS (AMERICA) INC, NTT America, Inc., Voxility LLP, Bangladesh Submarine Cable Company Limited (BSCCL), Bharti Airtel Ltd, Hurricane Electric LLC. And the upstreams of Windstream Communication Limited for IPv6 are Core-Backbone GmbH, TATA COMMUNICATIONS (AMERICA) INC, NTT America, Inc., Voxility LLP, Bangladesh Submarine Cable Company Limited (BSCCL), Bharti Airtel Ltd, Hurricane Electric LLC.

1.5 Report Layout

In my internship report, there I have given a description of the work that I have learned and it has been working continuously for 6 months.

1st Chapter: In the 1st chapter, I made an effort to describe the beginning of my internship, the motivation behind it, its goal, and the introduction of the company where I had the opportunity to complete it.

2nd Chapter: In the 2nd chapter, I've discussed the company introduction, the firm's products and market situation, the target markets of WCL, Windstream Company Limited's SWOT analysis, and the organizational structure of the company where I finished my internship.

3rd Chapter: In the 3rd chapter, I made an effort to convey how I worked and what I did while I was an intern. I made an effort to describe the work done there, provided some instances, and included some of the work's figures.

4th Chapter: In the 4th chapter, I make an effort to write on competencies and smart planning.

5th Chapter: In the 5th chapter, Writing the Conclusion and Future Career was my attempt.

CHAPTER 2

Internship at Windstream Communication Limited

2.1 Introduction

Windstream Communication Limited is a Bangladeshi technology company. It was established in 2012 as a limited liability company. WCL's head office is in Ramna, Dhaka and its registered office is in Kaliakaia, Dhaka. It is a top supplier of cutting-edge network communications and technology solutions for individuals, startups, and large corporations. Bundled services from Windstream include broadband, telephony, security options, and digital television for customers. WCL's AS number is 139009. Its communications services include local and nationwide broadband, Multi-Protocol Label Switching (MPLS), International Private Leased Circuit (IPLC), IP Bandwidth for International Call centers, Private line (including special access), and other ancillary services. Windstream Communication Ltd. is formed to address the growing need for a reliable International Internet Gateway (IIG) and provide IP Transit services to a large number of ISPs, BWAs, and other ANS operators in Bangladesh.

Fig-1: Logo of WCL

2.2 Product and Market Situation

Products:

- **IP Transit:** Networks can connect to the rest of the Internet via BGP using the IP Transit service. With IP Transit, one network offers access to the full Internet routing table in exchange for a fee, in contrast to peering, where AS networks only share their customer routes. IP Transit services are often billed monthly in advance or based on consumption.

Fig-2: IP Transit

- **Multi-Protocol Label Switching (MPLS):** The networking technology known as Multiprotocol Label Switching, or MPLS, employs "labels" rather than network addresses to identify the shortest path for traffic in order to handle forwarding over private wide area networks. MPLS can be used when dependability and speed are essential.

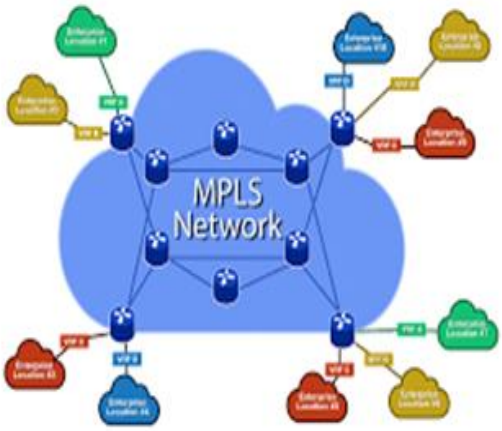

Fig-3: MPLS

- **International Private Leased Circuit (IPLC):** A point-to-point private line known as an international private leased circuit (IPLC) is used by a business to connect between offices that are spread out throughout the globe. Internet access, data interchange, video conferencing, and other forms of communication can all be done with an IPLC. An IPLC offers a private connection for conducting digital communications across sites for a global organization.

Fig-4: IPLC

- **VoIP Services:** VoIP phone system, we can make calls over our Internet connection rather than our traditional landline or cell phone network. Over a broadband connection, a VoIP system transforms analog speech signals into digital signals. Calls are connected to other telephone networks via VoIP servers.

Fig-5: VoIP

- **IIG Bandwidth:** A telecommunications service known as an international internet gateway service is used to route international incoming and outgoing Internet-based data traffic through an international internet gateway that is connected to an existing submarine cable or satellite earth station. One of the biggest international internet gateway (IIG) service providers in Bangladesh is WCL, which connects to the global internet via BSCCL (SMW4, SMW5), Tata Communications, Bharti Airtel, and Singapore Telecommunications.

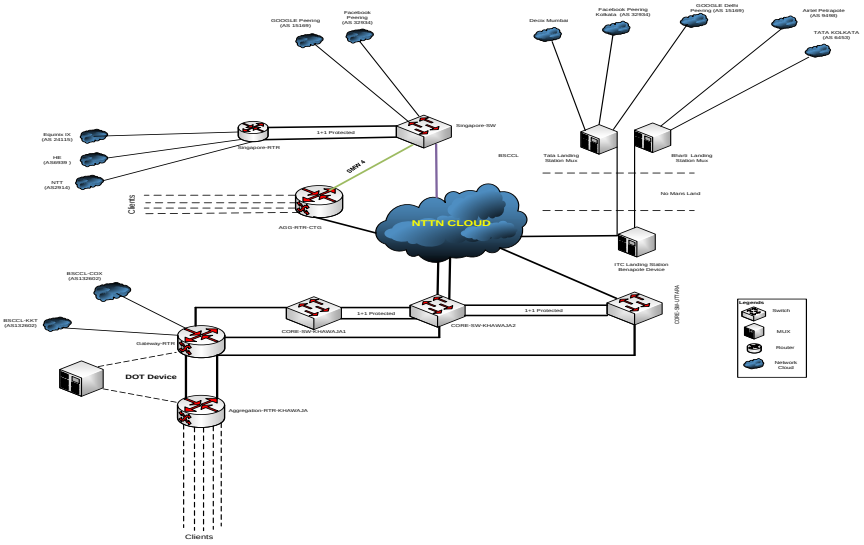

Fig-6: IIG Bandwidth

Market Situation:

The BTRC reports that IIG offices are required to be established at the district levels by December 2021 and that Upazila and Union levels would shortly see an expansion of services. Internet users in the nation are now more frequently using live and streaming services for gaming, entertainment, and shopping, and this trend is only projected to continue in the future. Broadband internet usage will consequently rise as a result. Broadband internet usage may increase if payment channels are made simpler and more accessible.

2.3 Target Group

- Internet Service Provider (ISP),
- Government Organizations,
- Digital Cable TV Operator,
- Mobile Network Operator

2.4 SWOT Analysis

Strength

The primary areas of Windstream's business where it excels provide it a competitive edge in the market. Intangible assets like financial standing, seasoned staff, product originality, and brand equity are crucial elements of brand power. The SWOT analysis of Windstream revealed the following strengths.

1. A strong network with full service.

2. A comprehensive offer for its customers.

3. Strong research and development to provide new products.

Weakness

Brand vulnerabilities are certain areas where a company might make improvements to boost its position. A particular weakness is a quality that your business lacks or that your rivals excel at. The following list outlines his SWOT analysis's shortcomings for Windstream.

1. Centralized geographic presence.
2. Operational inefficiencies leading to revenue pressure.
3. Reduced liquidity impacting operations

Opportunities

Any brand can get better, which might increase sales. A brand may have opportunities for geographic expansion, product improvements, better communication, etc. The following are the opportunities identified by Windstream's SWOT analysis:

1. Strategic growth projects to expand geographic and market reach
2. Development of Communications Services in Different Markets
3. There is a high demand for internet broadband.

Threats

Elemental threats to the company could hurt it. Threatening elements include escalating rivalry, shifting legal requirements, and substitute products and services. He found the following threats for Windstream in his SWOT analysis:

1. Service is subject to rapid technological change
2. Intense competition causes price pressure
3. Relatively low returns from underlying markets

2.5 Organizational Structure

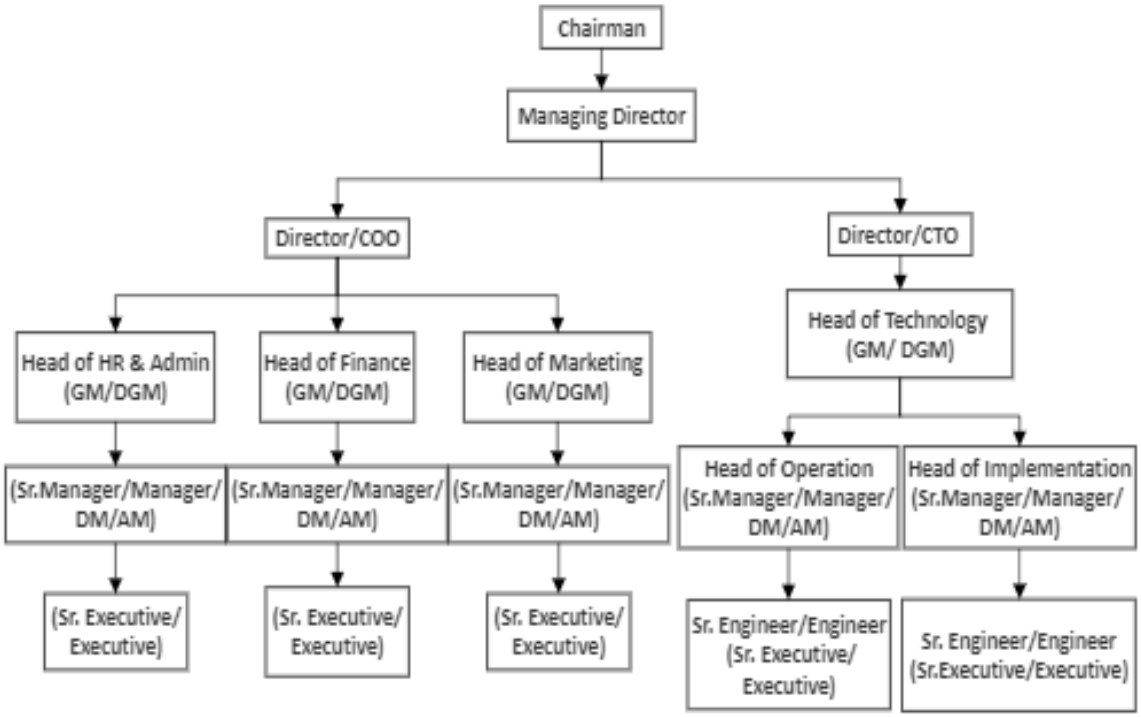

Fig-7: Organizational Structure of WCL

CHAPTER 3

Tasks, Projects and Activities

3.1 Daily Task and Activities

I have finished my internship at Windstream Communication Limited under their Network Operation Center (NOC). They treated me like their employee. My intern time was 8.00 AM to 4.00 PM from Saturday to Thursday. I started my internship on 06 June 2022 to 02 December.

- I learned about Routing security and discussed it every day with my trainer.
- Review our last-day activities again if I make a mistake here then try to solve it with our trainer or my classmate.
- Perfectly I want to try learning our daily class module base teaching.
- Create our course-related documentary.
- Communication via mail and over the phone with clients.
- Using monitoring tools (Cacti Graphs, PRTG, Smoke Ping, etc).
- Checking clients' status (if they are down or not).
- Checking the client down (event) or upstream down.

3.2 Events and Activities

There were lot of events, but i get an opportunity to attend only one event. The event name was "Nou ICT Mela 2022". It was arranged by IT Polly. It was IT Polly's 5th Nou ICT Mela. The fair was held on Tuesday, September 27, 2022, with more than 2,700 technology participants. There were a total of 10 stalls at the event, including IT Palli's own stall, gold sponsors Maxhub, and Windstream with 8 more stalls. Also, their several seminars were organized. BTRC Chairman (Senior Secretary) Shyam Sundar Shikder was present as the Chief Guest.

3.3 Project Task and Activities

IP Address

What is IP Address?

A device's IP address, which is a unique address, can be used to identify it on the internet or within a local network. The principles controlling the organization of data transmitted through a local or wide-area network are referred to as "Internet Protocol," or IP.

A series of integers, each separated by a period, make up an IP address. IP addresses are represented by four numbers; 192.168.2.37 is an example of one such address. Each number in the set has a range from 0 to 255. The full IP addressing range is therefore from 0.0.0.0 to 255.255.255.255.

Type of Internet Protocol (IP) Address: Type of IP addresses are given below:

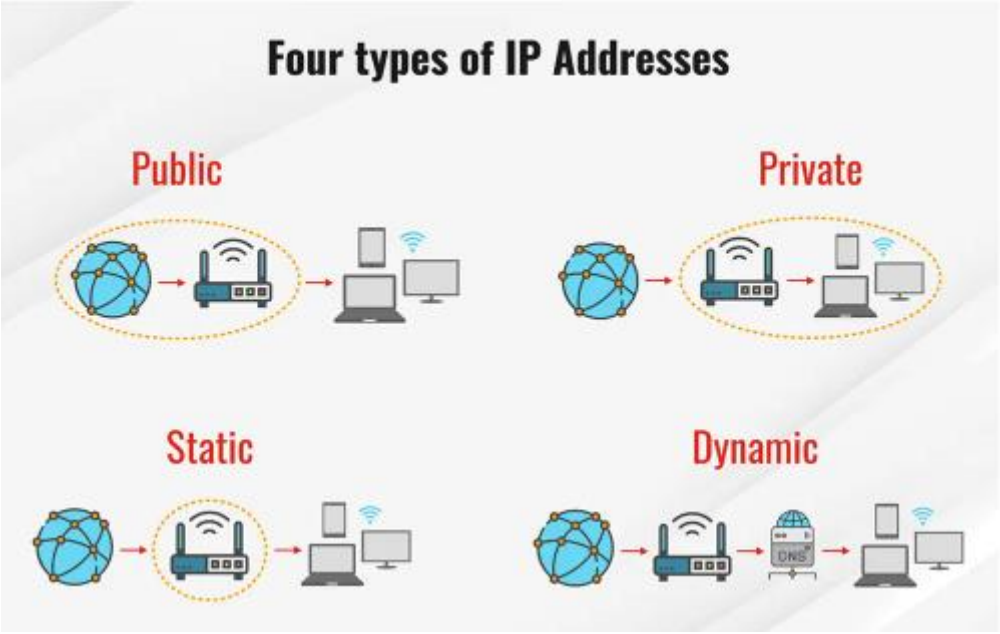

Fig-8: Type of IP Addresses

Subnet Mask

What is Subnet Mask?

A 32-bit integer known as a subnet mask is created by setting the network bits to all 1 and the host bits to all 0. This is how the subnet mask separates the IP address into the network address and host address.

The "255" address is always associated with a broadcast address, while the "0" address is always connected to a network address. Since neither can be allocated to hosts because they are both reserved for these particular applications.

Most networks use the Internet Protocol, which consists of the IP address, subnet mask, and gateway or router, as the underlying structure to allow device communication.

How does Subnet Mask works?

Sub-netting is essential for building fast and efficient computer networks. As organizations throughout the world expand, efficient network structure and management are critical for huge corporations looking to expand digitally.

When traffic has efficient pathways to traverse the network, complex networks become resilient. Without proper data channels, all network traffic would arbitrarily flow over all potential routes, resulting in traffic congestion and bottlenecks that would reduce network performance.

Subnets allow network traffic to flow through a small number of routers, requiring data packets to travel a lesser distance by taking mini-routes to reach their destination within a larger network.

Routing Protocol

What is Routing Protocols?

A routing protocol is a set of predefined rules that routers use to interact with sources and destinations. Instead of sending information from the source to the destination, it simply updates the routing table with the information. Thanks to router protocols, we can describe how routers communicate with each other. This allows the network to choose a route between any two of its nodes on the computer network.

Type of Routing Protocol: Types of routing protocol are given below:

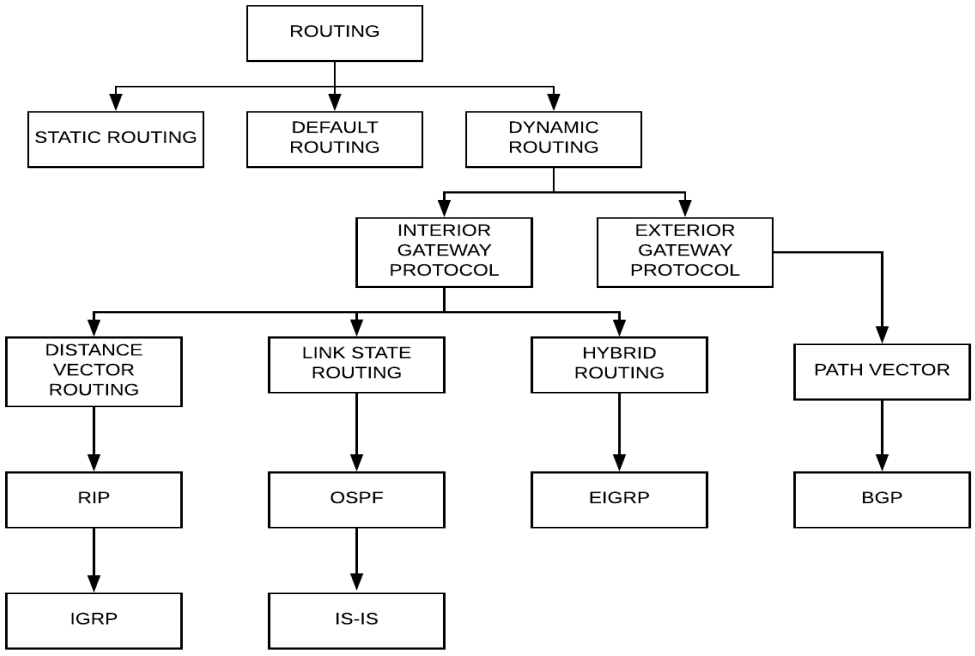

Fig-9: Type of Routing Protocol

Static Routing Configuration Work-01

Static routing: Network routing methods include static routing. It is not a routing protocol; rather, it is a network route that has been manually configured and chosen, typically by the network administrator. It is utilized when it is predicted that neither the network settings nor the surrounding environment will change.

Only a few circumstances make static routing the best option. The rigidity of static routing results in network deterioration, latency, and congestion because there is no adjustment made when the principal route is unavailable.

Static routing makes routing decisions based on established paths from the routing database, which can only be manually modified by administrators. When there are limited possibilities for choosing a route or when there is just one feasible approach, static routes are frequently employed.

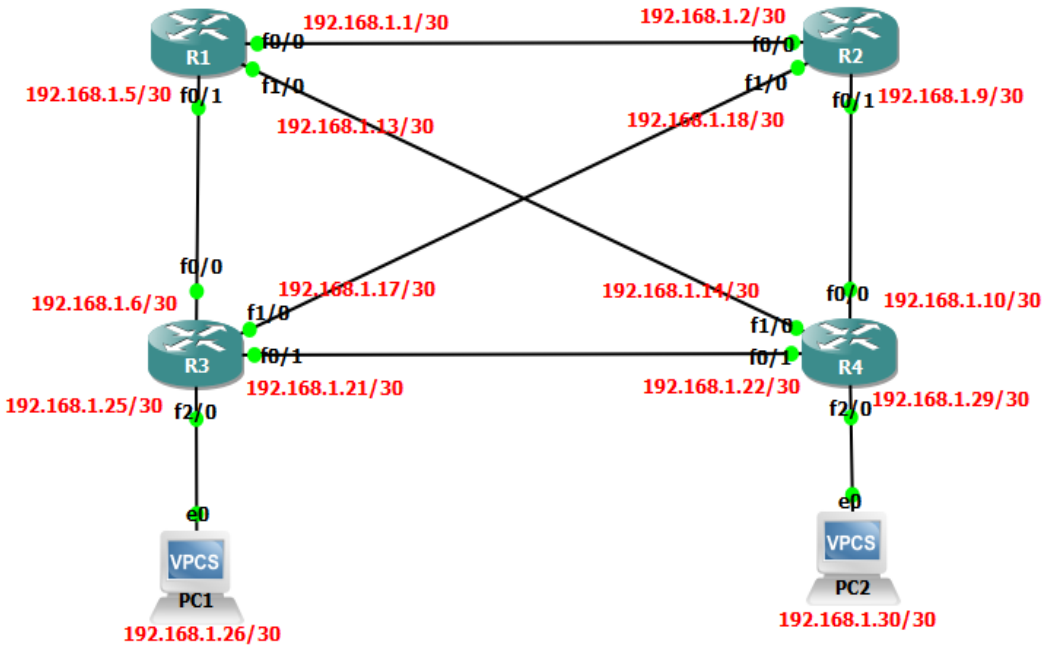

Fig-10: Static Route

```
interface FastEthernet0/0
 description R1 to R2
 ip address 192.168.1.1 255.255.255.252
 duplex auto
 speed auto
interface FastEthernet0/1
 description R1 to R3
 ip address 192.168.1.5 255.255.255.252
 duplex auto
 speed auto
interface FastEthernet1/0
 description R1 to R4
 ip address 192.168.1.13 255.255.255.252
 duplex auto
 speed auto
!
ip forward-protocol nd
ip route 192.168.1.8 255.255.255.252 192.168.1.2
ip route 192.168.1.24 255.255.255.252 192.168.1.6
ip route 192.168.1.28 255.255.255.252 192.168.1.14
!
```

Fig-11: Router-1 Static Configuration

```
interface FastEthernet0/0
 description R2 to R1
 ip address 192.168.1.2 255.255.255.252
 duplex auto
 speed auto
interface FastEthernet0/1
 description R2 to R4
 ip address 192.168.1.9 255.255.255.252
 duplex auto
 speed auto
interface FastEthernet1/0
 description R2 to R3
 ip address 192.168.1.18 255.255.255.252
 duplex auto
 speed auto
ip forward-protocol nd
ip route 192.168.1.4 255.255.255.252 192.168.1.1
ip route 192.168.1.24 255.255.255.252 192.168.1.1
ip route 192.168.1.28 255.255.255.252 192.168.1.10
!
```

Fig-12: Router-2 Static Configuration

```
interface FastEthernet0/0
 description R3 to R1
 ip address 192.168.1.6 255.255.255.252
 duplex auto
 speed auto
interface FastEthernet0/1
 description R3 to R4
 ip address 192.168.1.21 255.255.255.252
 duplex auto
 speed auto
interface FastEthernet1/0
 description R3 to R2
 ip address 192.168.1.17 255.255.255.252
 duplex auto
 speed auto
!
interface FastEthernet2/0
 description R3 to PC-1
 ip address 192.168.1.25 255.255.255.252
 duplex auto
 speed auto
!
ip forward-protocol nd
ip route 192.168.1.0 255.255.255.252 192.168.1.5
ip route 192.168.1.28 255.255.255.252 192.168.1.5
```

Fig-13: Router-3 Static Configuration

```
interface FastEthernet0/0
 description R4 to R2
 ip address 192.168.1.10 255.255.255.252
 duplex auto
 speed auto
interface FastEthernet0/1
 description R4 to R3
 ip address 192.168.1.22 255.255.255.252
 duplex auto
 speed auto
interface FastEthernet1/0
 description R4 to R1
 ip address 192.168.1.14 255.255.255.252
 duplex auto
 speed auto
!
interface FastEthernet2/0
 description R4 to PC-2
 ip address 192.168.1.29 255.255.255.252
 duplex auto
ip forward-protocol nd
ip route 192.168.1.0 255.255.255.252 192.168.1.13
ip route 192.168.1.4 255.255.255.252 192.168.1.21
ip route 192.168.1.24 255.255.255.252 192.168.1.21
!
```

Fig-14: Router-4 Static Configuration

OSPF Configuration Work-02

OSPF: A routing protocol for IP networks is called OSPF. It belongs to the class of IGPs and employs an LSR algorithm while functioning within a single AS.

Using link status information gathered from accessible routers, OSPF creates a topology map of the network. The Internet Layer sees the topology as a routing table for packet routing according to destination IP addresses. OSPF supports both IPv4 and IPv6 networks, as well as the CIDR addressing architecture.

OSPF is used by many large enterprise networks. IS-IS is typically used by large service provider networks more often than other LSR-based protocols.

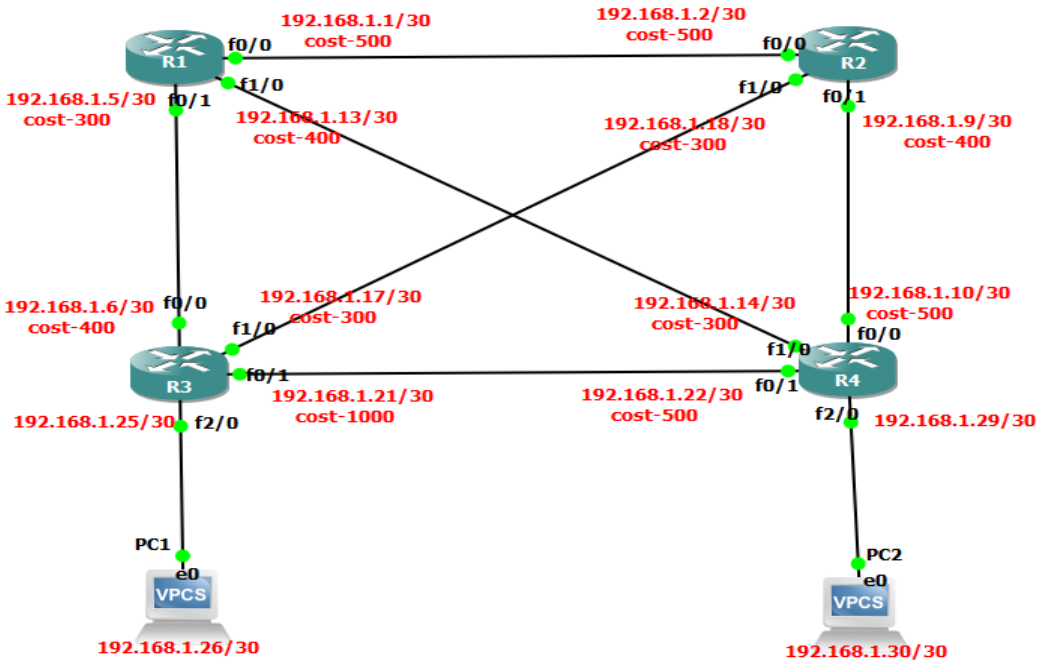

Fig-15: OSPF

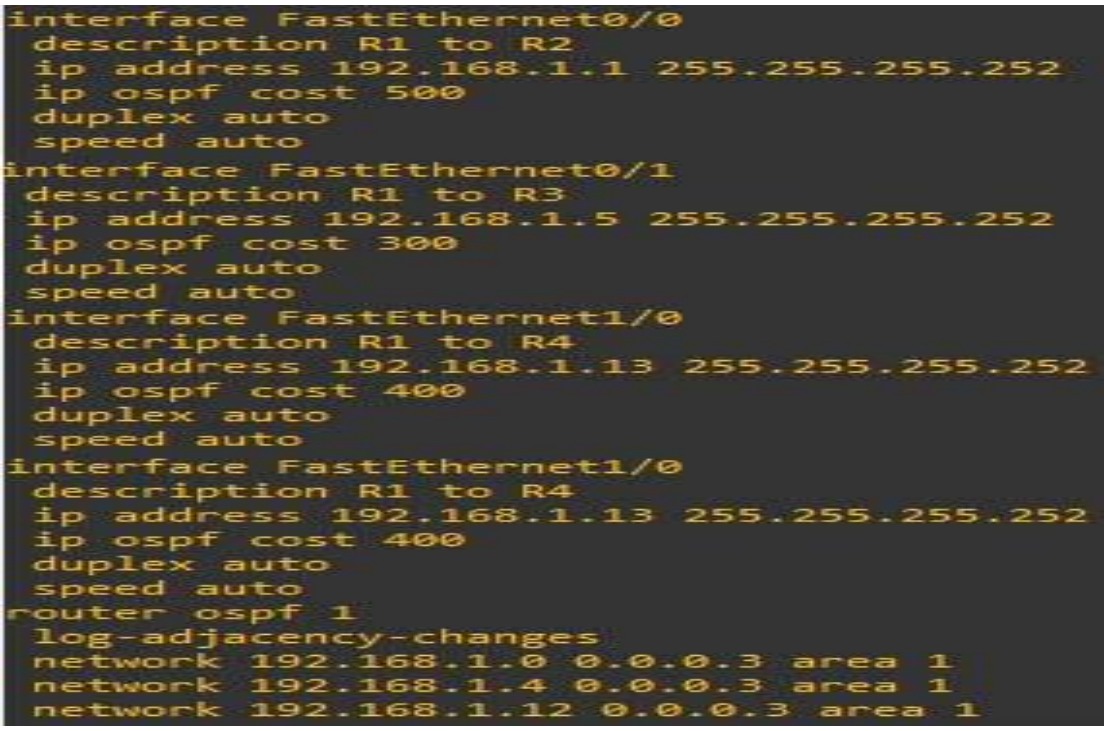

Fig-16: Router-1 OSPF Configuration

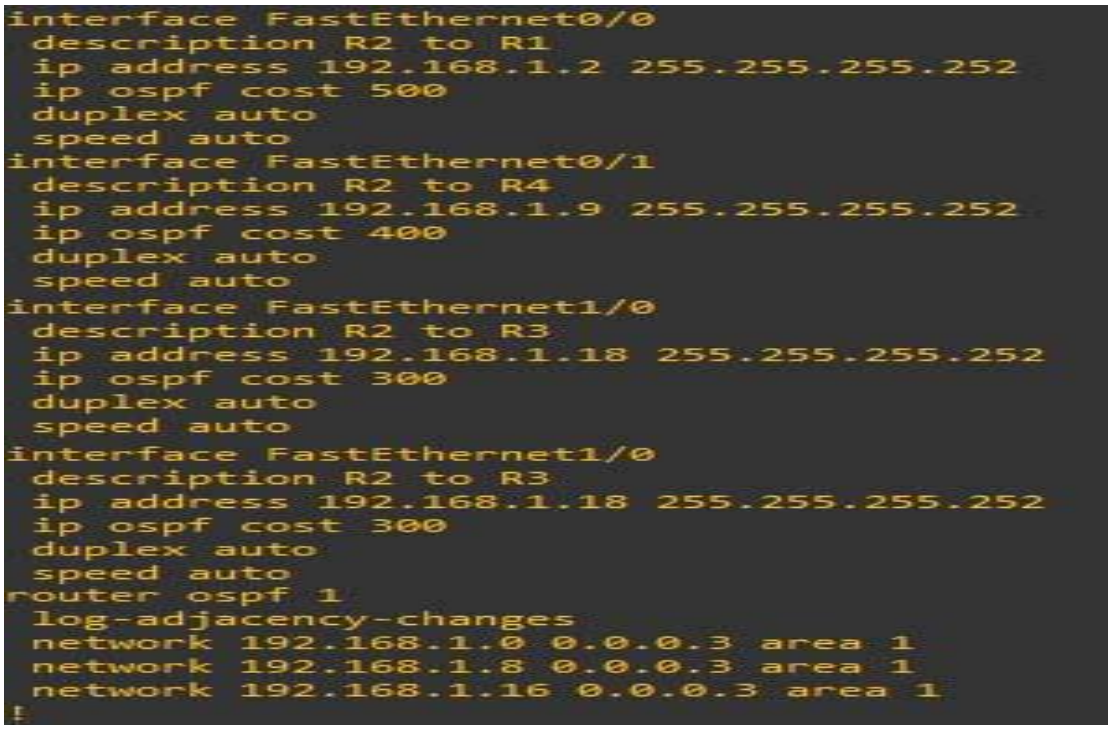

Fig-17: Router-2 OSPF Configuration

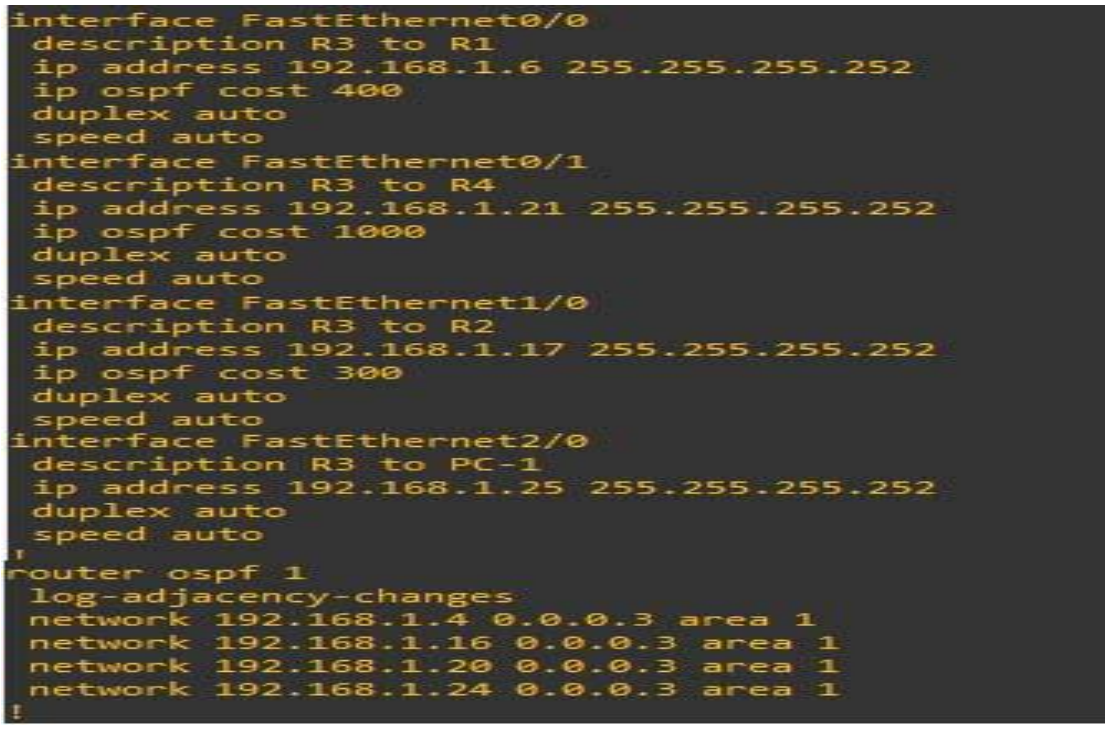

Fig-18: Router-3 OSPF Configuration

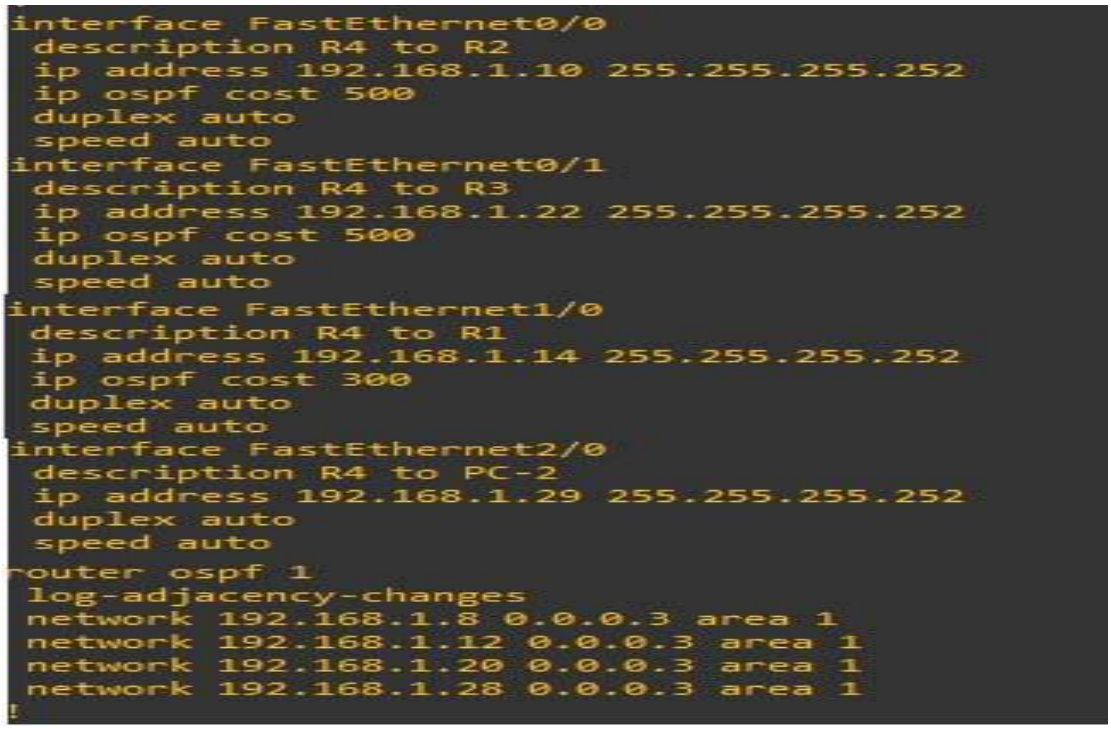

Fig-19: Router-4 OSPF Configuration

Default Route Configuration Work-03

Default Route: The router uses the default route to forward an incoming packet when the routing database does not include other options. Routers make traffic forwarding decisions by using the routing table. The two elements of a routing table entry are the remote network and the local interface connected to it.

When a packet arrives on one of the router's interfaces, the router reads the destination network address and finds that network address in the routing table.

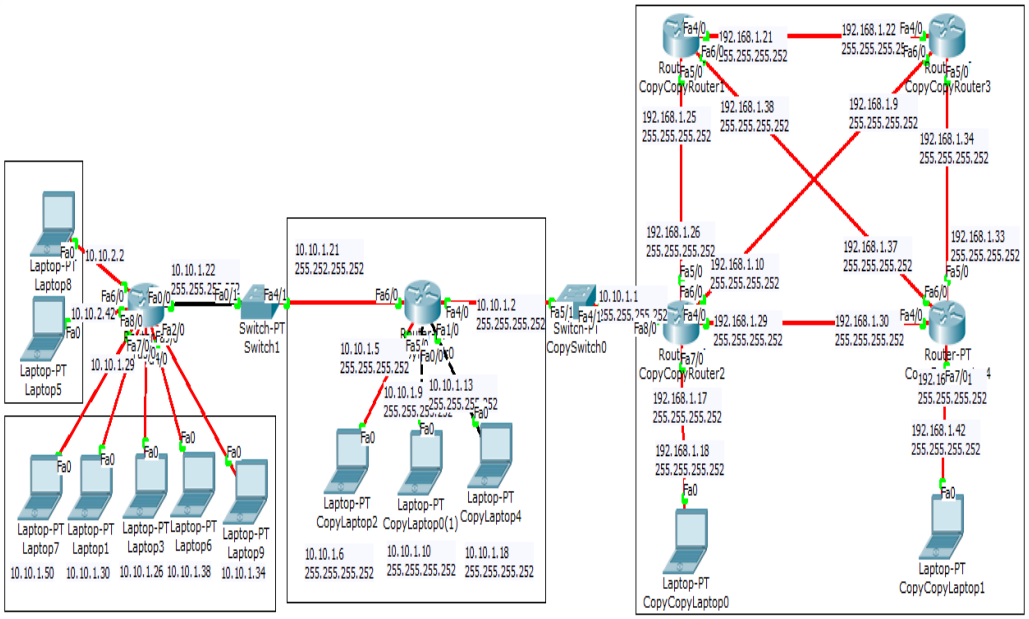

Fig-20: Default Routing

```
interface FastEthernet0/0
 ip address 10.10.1.9 255.255.255.252
 duplex auto
 speed auto
!
interface FastEthernet1/0
 ip address 10.10.1.17 255.255.255.252
 duplex auto
 speed auto
!
interface FastEthernet4/0
 ip address 10.10.1.2 255.255.255.252
!
interface FastEthernet5/0
 ip address 10.10.1.5 255.255.255.252
!
interface FastEthernet6/0
 ip address 10.10.1.21 255.255.255.252
!
ip classless
ip route 0.0.0.0 0.0.0.0 10.10.1.22
ip route 0.0.0.0 0.0.0.0 10.10.1.1
ip route 192.168.1.16 255.255.255.252 10.10.1.1
ip route 192.168.1.40 255.255.255.252 10.10.1.1
!
```

Fig-21: Default Client Router Configuration

```
interface FastEthernet0/0
 ip address 10.10.1.22 255.255.255.252
 duplex auto
 speed auto
interface FastEthernet2/0
 ip address 10.10.1.33 255.255.255.252
!
interface FastEthernet4/0
 ip address 10.10.1.25 255.255.255.252
!
interface FastEthernet5/0
 ip address 10.10.1.29 255.255.255.252
!
interface FastEthernet6/0
 ip address 10.10.2.1 255.255.255.252
!
interface FastEthernet7/0
 ip address 10.10.1.49 255.255.255.252
!
interface FastEthernet8/0
 ip address 10.10.2.41 255.255.255.252
!
interface FastEthernet9/0
 ip address 10.10.1.37 255.255.255.252
!
ip classless
ip route 0.0.0.0 0.0.0.0 10.10.1.21
!
```

Fig-22: Default Sub-Client Router Configuration

Router Username and Password:

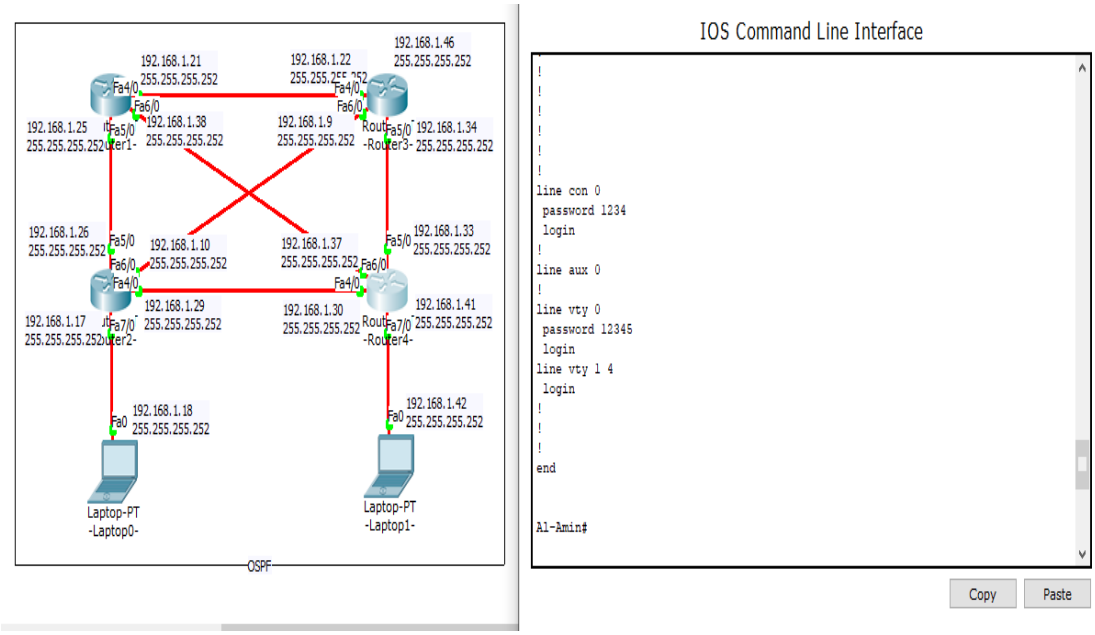

Fig-23: Router Username and Password

Remote Login (Telnet):

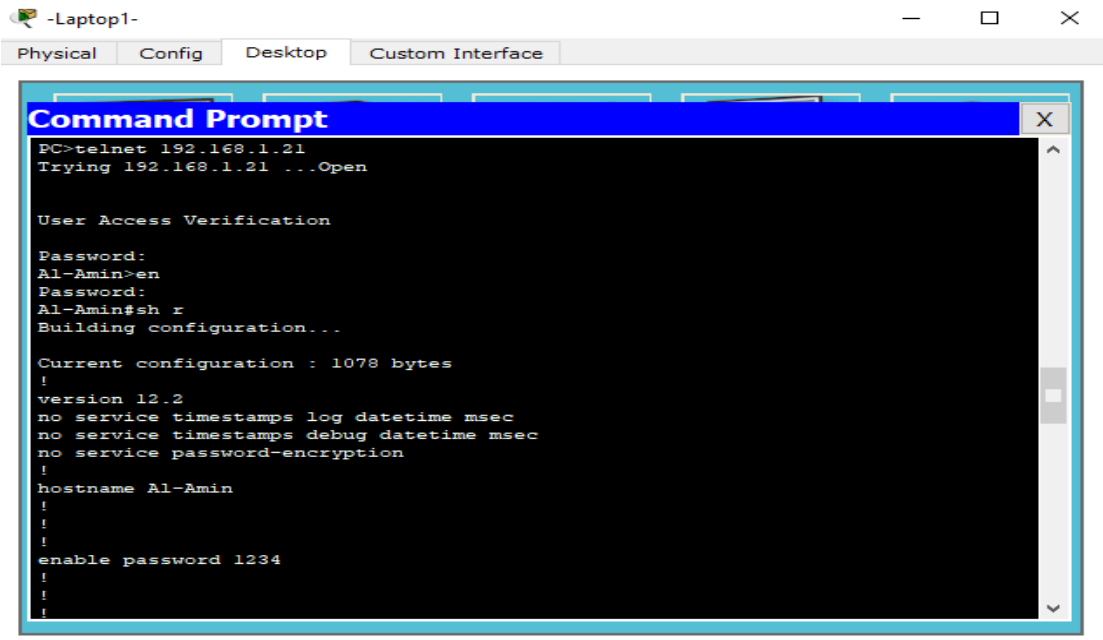

Fig-24: Remote Login Configuration

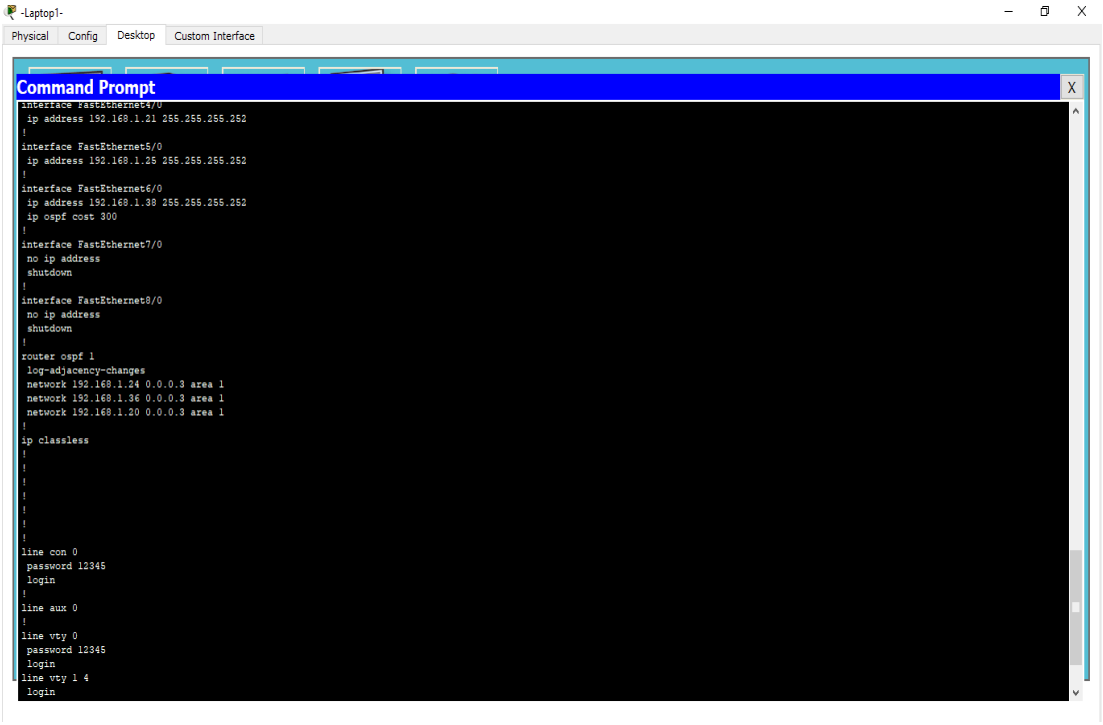

Fig-25: Remote Login (Telnet)

Remote Login (SSH):

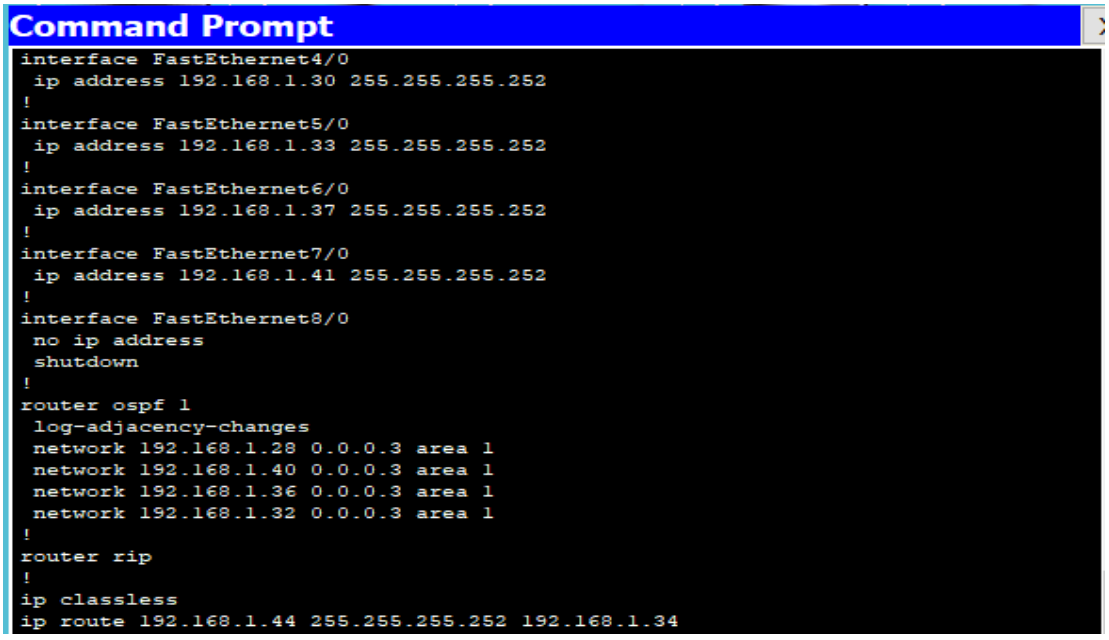

Fig-26: Remote Login (SSH) Configuration-1

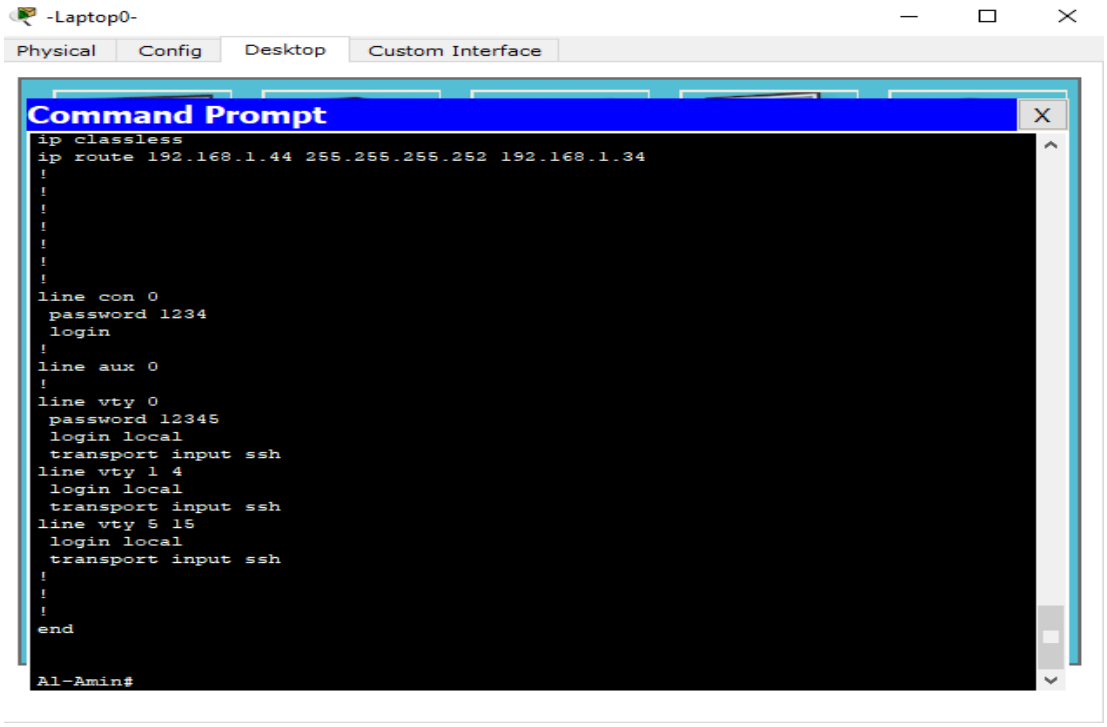

Fig-27: Remote Login (SSH) Configuration-2

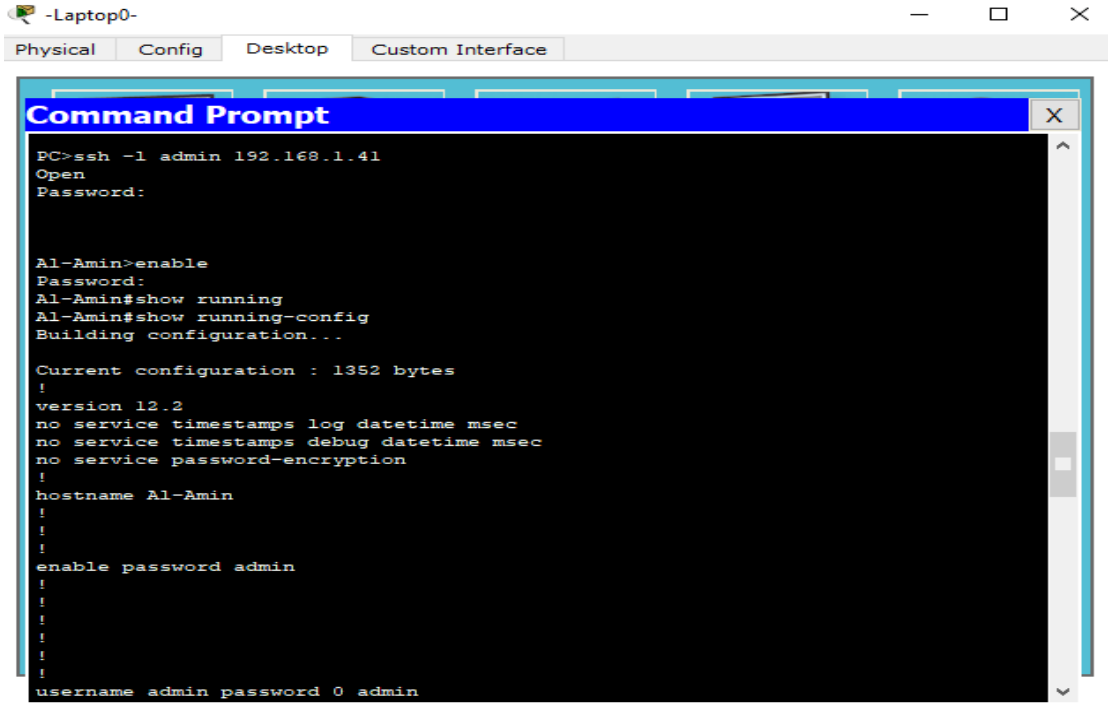

Fig-28: Remote Login (SSH)

VLAN Configuration Work-4

VLAN: The term "virtual local area network" (VLAN) refers to a virtualized link that connects numerous network nodes and devices from different LANs to form a single logical network. These days, enterprises with complex networking infrastructures must use virtual local area networks. To improve security and scalability and minimize latency, organizations need solutions that enable network partitioning. LANs are used to connect a collection of devices, including PCs and printers, to a server through cables, whereas VLANs allow several LANs and their associated devices to communicate via wireless internet.

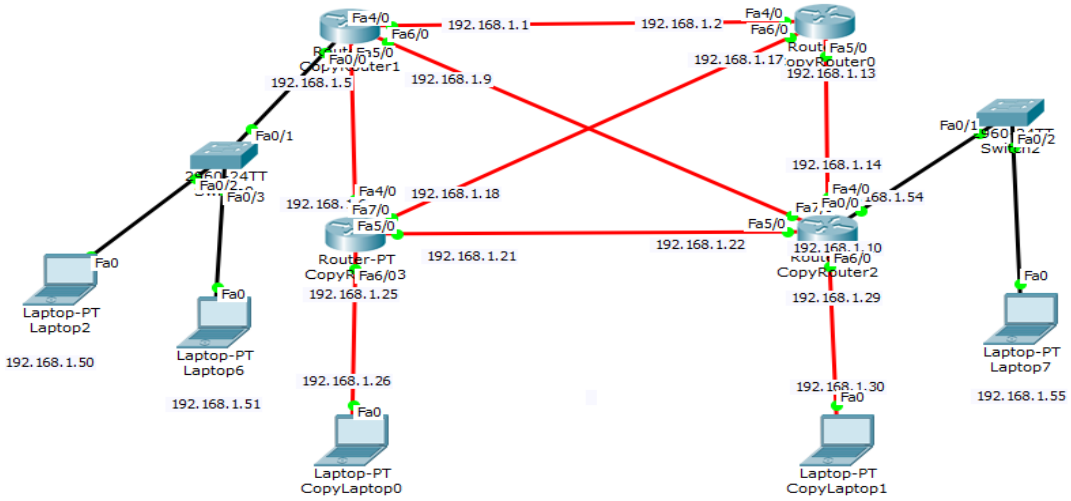

Fig-29: VLAN

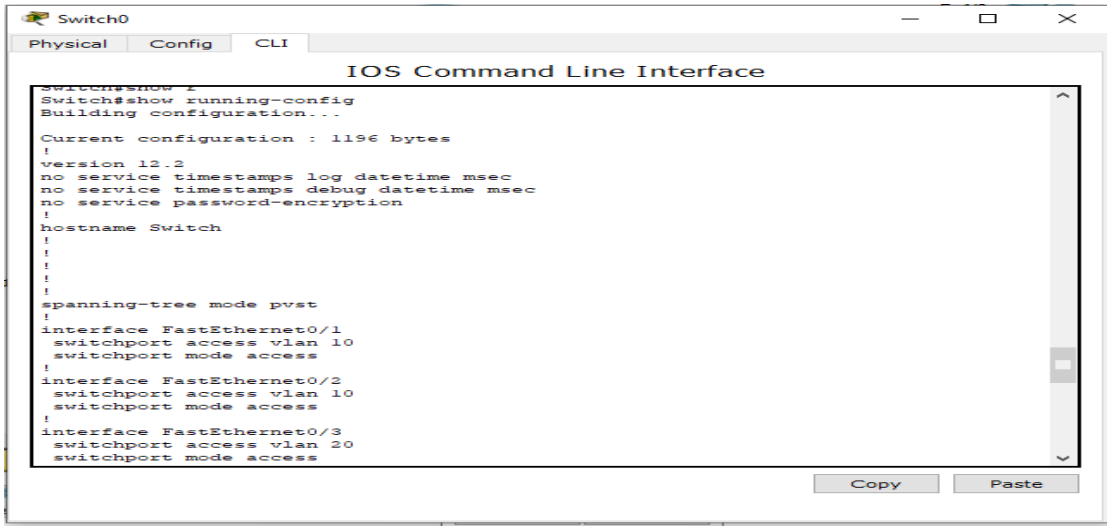

Fig-30: VLAN Configuration

RIR

An entity known as a regional Internet registry (RIR) is in charge of registering and allocating Internet number resources like IP addresses and autonomous system (AS) numbers within some areas of the globe. The numerous RIRs are parts of the Internet Number Registry System (INRS), which was situated on October 24, 2003. They are a part of the largest Number Resource Organization (NRO). As the system of regional Internet registries developed, management duties were divided among five different registries. The Five RIRs include:

ARIN: In charge of managing Internet names and addresses for North America and Canada.

RIPE NCC: In charge of managing Internet names and addresses for Central Asia, the Middle East, and Europe.

APNIC: APNIC is in responsible for managing Internet addresses and domains in Asia and the Pacific and was established in Tokyo, Japan.

LACNIC: LAPNIC is in charge of managing Internet names and addresses for Latin America and the Caribbean.

AFRINIC: In charge of managing Internet names and addresses for the African continent.

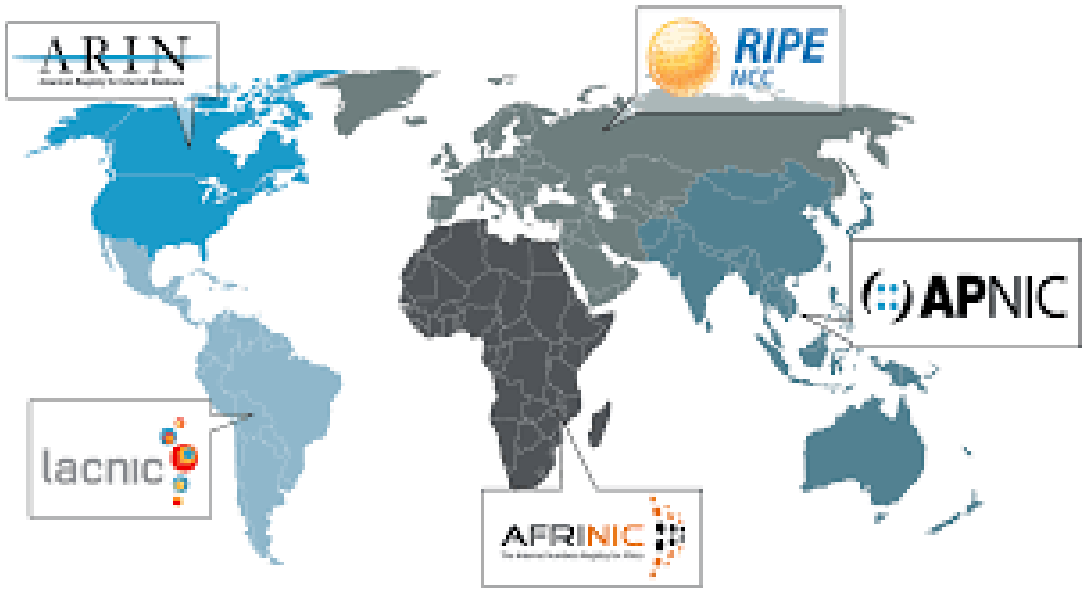

Fig-31: RIR

EBGP

What is EBGP?

The External Border Gateway Protocol (EBGP) is an extension of the Border Gateway Protocol (BGP) that allows communication between different Autonomous Systems (AS). EBGP provides network connectivity between autonomous systems and autonomous systems of BGP implementations. It is the underlying protocol that underpins Internet or AS connections around the world.

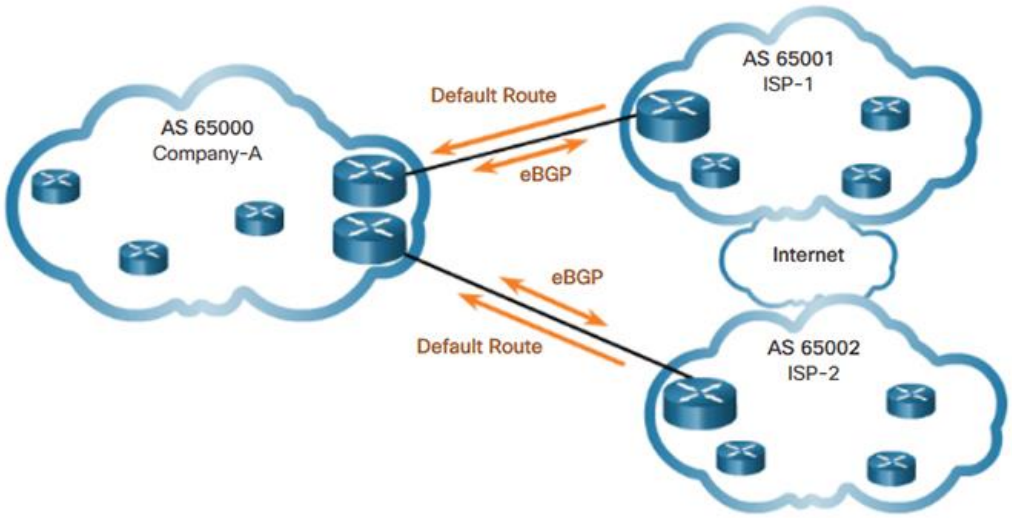

Fig-32: EBGP

Why EBGP Used For?

EBGP is commonly used to connect networks for various enterprises or the worldwide Internet. These entities could be ISPs, universities, or huge enterprises with extensive network infrastructure. Each AS must implement BGP for internal communications in order for EBGP to function.

EBGP is used and implemented at the edge or border router, which connects two or more autonomous systems. It collaborates with the Internal Border Gateway Protocol (IBGP) to move data from the external Internet/AS to the internal Internet/AS and vice versa.

IBGP

What is IBGP?

Internal Border Gateway Protocol is the official name for this protocol (IBGP). It uses within an autonomous system. For prefix learning, all devices within the same autonomous system must form either a full of mesh topology or a confederation with route reflectors. It uses to connect two BGP routers within the same autonomous system. The administrative distance is set to 200 by default. An IBGP route learned from an IBGP peer cannot be published to other IBGP peers, but can be advertised to an EBGP peer. Attributes such as local settings provide to IBGP peers. The next hop does not change when a route advertises to an IBGP peer.

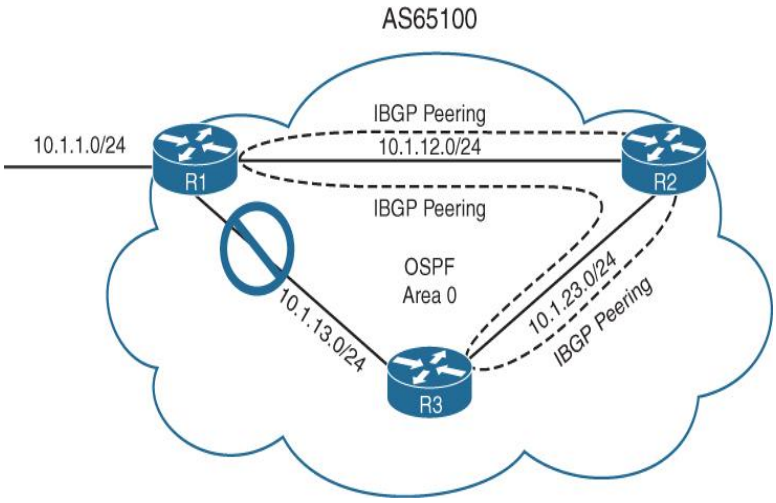

Fig-33: IBGP

BGP Configuration Work-5

BGP: BGP resembles the Internet's postal service in certain ways. When a letter puts into a mailbox, the postal service examines it to determine a quick and effective way to deliver it to the recipient. Similarly, when someone sends data over the Internet, BGP is responsible for examining all potential routes that the data might take and choosing the best route, usually involving switching between autonomous systems. The Internet operates on the BGP protocol, which allows data routing. BGP is a protocol that allows fast and efficient communication when a user in Singapore uses her server of origin in Argentina to load her website.

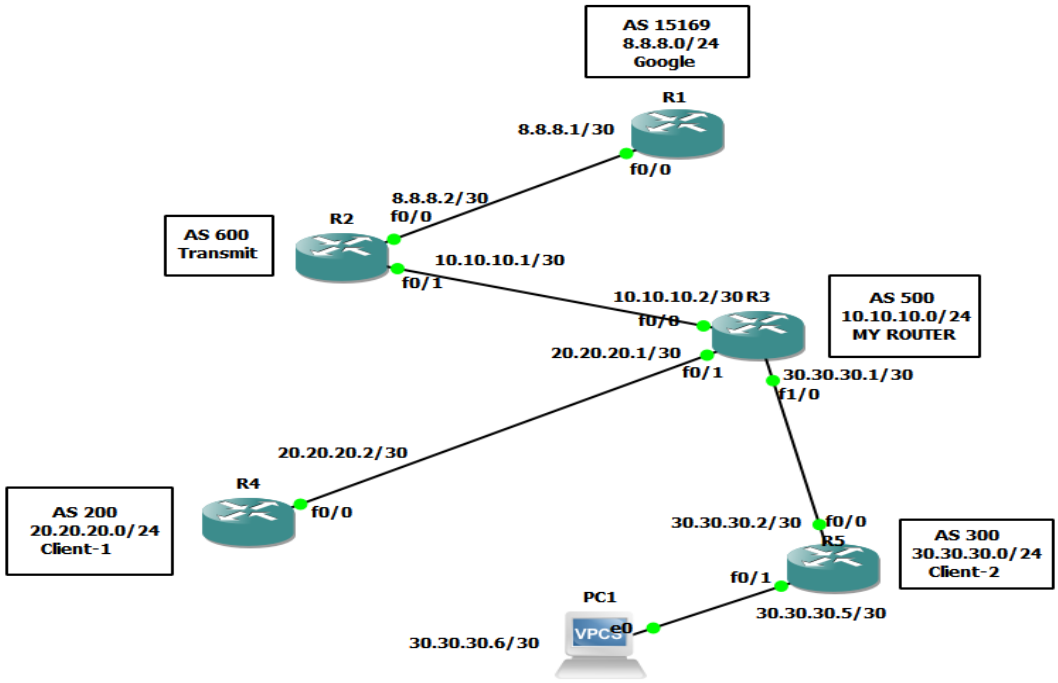

Fig-34: BGP Configuration

```
R1#show running-config | section bgp
router bgp 15169
 no synchronization
 bgp log-neighbor-changes
 network 8.8.8.0 mask 255.255.255.0
 neighbor 8.8.8.2 remote-as 600
 no auto-summary
R1#show ip route
     21.0.0.0/24 is subnetted, 1 subnets
B       21.21.21.0 [20/0] via 8.8.8.2, 00:02:38
     20.0.0.0/24 is subnetted, 1 subnets
B       20.20.20.0 [20/0] via 8.8.8.2, 00:02:38
     8.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       8.8.8.0/30 is directly connected, FastEthernet0/0
S       8.8.8.0/24 is directly connected, Null0
     10.0.0.0/24 is subnetted, 1 subnets
B       10.10.10.0 [20/0] via 8.8.8.2, 00:02:38
     30.0.0.0/24 is subnetted, 1 subnets
B       30.30.30.0 [20/0] via 8.8.8.2, 00:02:39
R1#show ip bgp
BGP table version is 10, local router ID is 8.8.8.1
   Network          Next Hop            Metric LocPrf Weight Path
*> 8.8.8.0/24       0.0.0.0                  0         32768 i
*> 10.10.10.0/24    8.8.8.2                                0 600 500 i
*> 20.20.20.0/24    8.8.8.2                                0 600 500 200 i
*> 21.21.21.0/24    8.8.8.2                                0 600 500 200 i
*> 30.30.30.0/24    8.8.8.2                                0 600 500 300 i
R1#show ip bgp summary
BGP router identifier 8.8.8.1, local AS number 15169
Neighbor        V    AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
8.8.8.2         4   600      17      11       10    0    0 00:07:14        4
R1#traceroute 20.20.20.2
Tracing the route to 20.20.20.2
  1 8.8.8.2 20 msec 20 msec 16 msec
  2 10.10.10.2 [AS 500] 32 msec 28 msec 36 msec
  3 20.20.20.2 [AS 200] 48 msec 36 msec 44 msec
R1#traceroute 30.30.30.2
Tracing the route to 30.30.30.2
  1 8.8.8.2 12 msec 8 msec 12 msec
  2 10.10.10.2 [AS 500] 24 msec 24 msec 32 msec
  3 30.30.30.2 [AS 300] 44 msec 40 msec 36 msec
```

Fig-35: Router-1 BGP Configuration

```
R2#show ip bgp
BGP table version is 10, local router ID is 21.21.21.1
   Network          Next Hop            Metric LocPrf Weight Path
*> 8.8.8.0/24       8.8.8.1                  0             0 15169 i
*> 10.10.10.0/24    10.10.10.2               0             0 500 i
*> 20.20.20.0/24    10.10.10.2                             0 500 200 i
*> 21.21.21.0/24    10.10.10.2                             0 500 200 i
*> 30.30.30.0/24    10.10.10.2                             0 500 300 i
R2#traceroute 20.20.20.2
Tracing the route to 20.20.20.2
  1 10.10.10.2 [AS 500] 8 msec 16 msec 16 msec
  2 20.20.20.2 [AS 200] 20 msec 40 msec 20 msec
R2#traceroute 30.30.30.6
Tracing the route to 30.30.30.6
  1 10.10.10.2 [AS 500] 20 msec 24 msec 8 msec
  2 30.30.30.2 [AS 300] 28 msec 20 msec 40 msec
  3  *
    30.30.30.6 [AS 300] 32 msec 68 msec
R2#show running-config | section bgp
router bgp 600
 no synchronization
 bgp log-neighbor-changes
 neighbor 8.8.8.1 remote-as 15169
 neighbor 10.10.10.2 remote-as 500
 neighbor 21.21.21.2 remote-as 200
R2#show ip route
     21.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       21.21.21.0/30 is directly connected, FastEthernet1/0
B       21.21.21.0/24 [20/0] via 10.10.10.2, 00:08:06
     20.0.0.0/24 is subnetted, 1 subnets
B       20.20.20.0 [20/0] via 10.10.10.2, 00:08:06
     8.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       8.8.8.0/30 is directly connected, FastEthernet0/0
B       8.8.8.0/24 [20/0] via 8.8.8.1, 00:11:26
```

Fig-36: Router-2 BGP Configuration

```
R3#show running-config | section bgp
router bgp 500
 no synchronization
 bgp log-neighbor-changes
 network 10.10.10.0 mask 255.255.255.0
 network 20.20.20.0 mask 255.255.255.0
 network 30.30.30.0 mask 255.255.255.0
 neighbor 10.10.10.1 remote-as 600
 neighbor 20.20.20.2 remote-as 200
 neighbor 30.30.30.2 remote-as 300
 no auto-summary
R3#show ip route
     21.0.0.0/24 is subnetted, 1 subnets
B       21.21.21.0 [20/0] via 20.20.20.2, 00:10:45
     20.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       20.20.20.0/30 is directly connected, FastEthernet0/1
B       20.20.20.0/24 [20/0] via 20.20.20.2, 00:10:45
     8.0.0.0/24 is subnetted, 1 subnets
B       8.8.8.0 [20/0] via 10.10.10.1, 00:10:45
     10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       10.10.10.0/30 is directly connected, FastEthernet0/0
S       10.10.10.0/24 is directly connected, Null0
     30.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       30.30.30.0/30 is directly connected, FastEthernet1/0
B       30.30.30.0/24 [20/0] via 30.30.30.2, 00:10:46
R3#show ip bgp
   Network          Next Hop            Metric LocPrf Weight Pat
*> 8.8.8.0/24       10.10.10.1                             0 600
*> 10.10.10.0/24    0.0.0.0                  0         32768 i
*> 20.20.20.0/24    20.20.20.2               0             0 200
*> 21.21.21.0/24    20.20.20.2               0             0 200
*> 30.30.30.0/24    30.30.30.2               0             0 300
R3#traceroute 8.8.8.1
Tracing the route to 8.8.8.1
  1 10.10.10.1 28 msec 24 msec 16 msec
  2 8.8.8.1 [AS 15169] 44 msec 40 msec 40 msec
R3#traceroute 30.30.30.6
Tracing the route to 30.30.30.6
  1 30.30.30.2 [AS 300] 24 msec 8 msec 8 msec
  2 30.30.30.6 [AS 300] 28 msec 24 msec 20 msec
```

Fig-37: Router-3 BGP Configuration

```
R4#show running-config | section bgp
router bgp 200
 bgp log-neighbor-changes
 neighbor 20.20.20.1 remote-as 500
 neighbor 21.21.21.1 remote-as 600
 !
 address-family ipv4
  neighbor 20.20.20.1 activate
  neighbor 20.20.20.1 route-map R3-OUT out
  neighbor 21.21.21.1 activate
  no auto-summary
  no synchronization
  network 20.20.20.0 mask 255.255.255.0
  network 21.21.21.0 mask 255.255.255.0
 exit-address-family
R4#show ip route
     21.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       21.21.21.0/30 is directly connected, FastEthernet0/1
S       21.21.21.0/24 is directly connected, Null0
     20.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       20.20.20.0/30 is directly connected, FastEthernet0/0
S       20.20.20.0/24 is directly connected, Null0
     8.0.0.0/24 is subnetted, 1 subnets
B       8.8.8.0 [20/0] via 20.20.20.1, 00:12:49
     10.0.0.0/24 is subnetted, 1 subnets
B       10.10.10.0 [20/0] via 20.20.20.1, 00:12:50
     30.0.0.0/24 is subnetted, 1 subnets
B       30.30.30.0 [20/0] via 20.20.20.1, 00:12:50
R4#show ip bgp
BGP table version is 12, local router ID is 21.21.21.2
   Network          Next Hop            Metric LocPrf Weight Path
*> 8.8.8.0/24       20.20.20.1                             0 500 600 15169 i
*> 10.10.10.0/24    20.20.20.1               0             0 500 i
*> 20.20.20.0/24    0.0.0.0                  0         32768 i
*> 21.21.21.0/24    0.0.0.0                  0         32768 i
*> 30.30.30.0/24    20.20.20.1                             0 500 300 i
R4#show ip bgp summary
BGP router identifier 21.21.21.2, local AS number 200
Neighbor        V    AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
20.20.20.1      4   500      30      25       12    0    0 00:13:30        3
21.21.21.1      4   600       0       0        0    0    0 never    Active
R4#traceroute 8.8.8.1
Tracing the route to 8.8.8.1
  1 20.20.20.1 20 msec 28 msec 24 msec
  2 10.10.10.1 [AS 500] 28 msec 36 msec 40 msec
  3 8.8.8.1 [AS 15169] 72 msec 56 msec 72 msec
```

Fig-38: Router-4 BGP Configuration

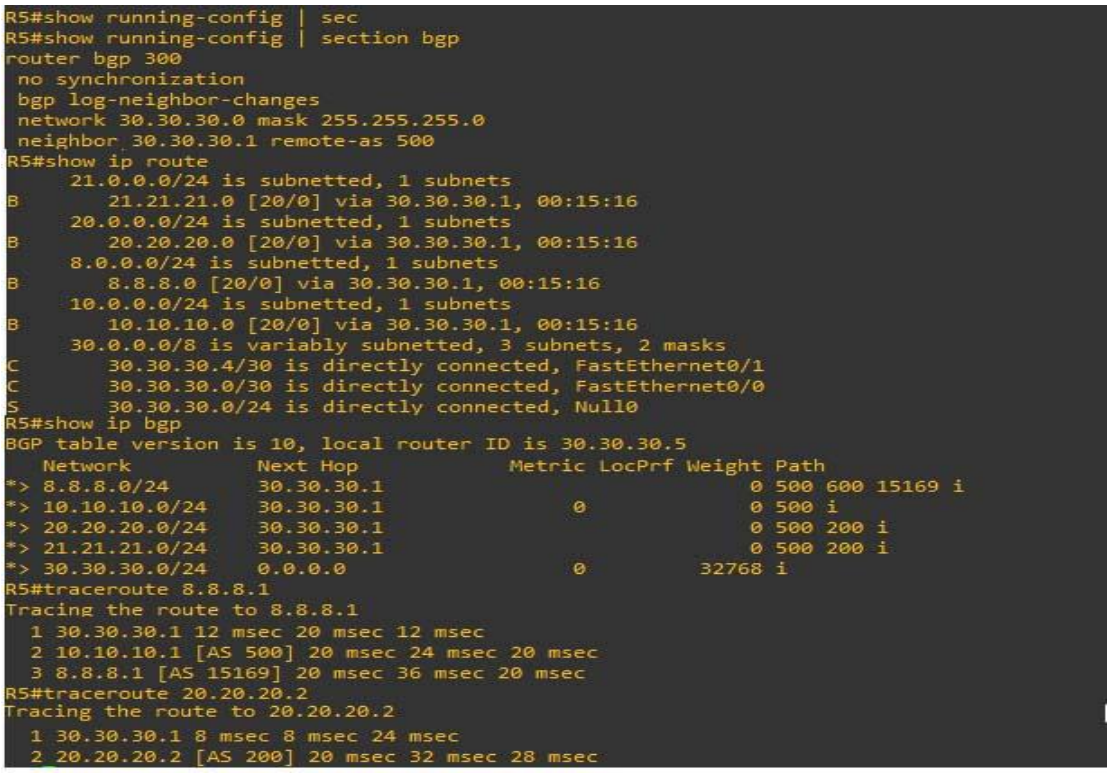

Fig-39: Router-5 BGP Configuration

BGP Route Leaking Work-6

Route Leaking: It is a BGP Route leaking "the spread of routing notifications outside their intended audience. It is when an Autonomous System (AS) announces a learned BGP route to another AS in violation of the recipient's, sender's, or one of the preceding AS's intended policies."

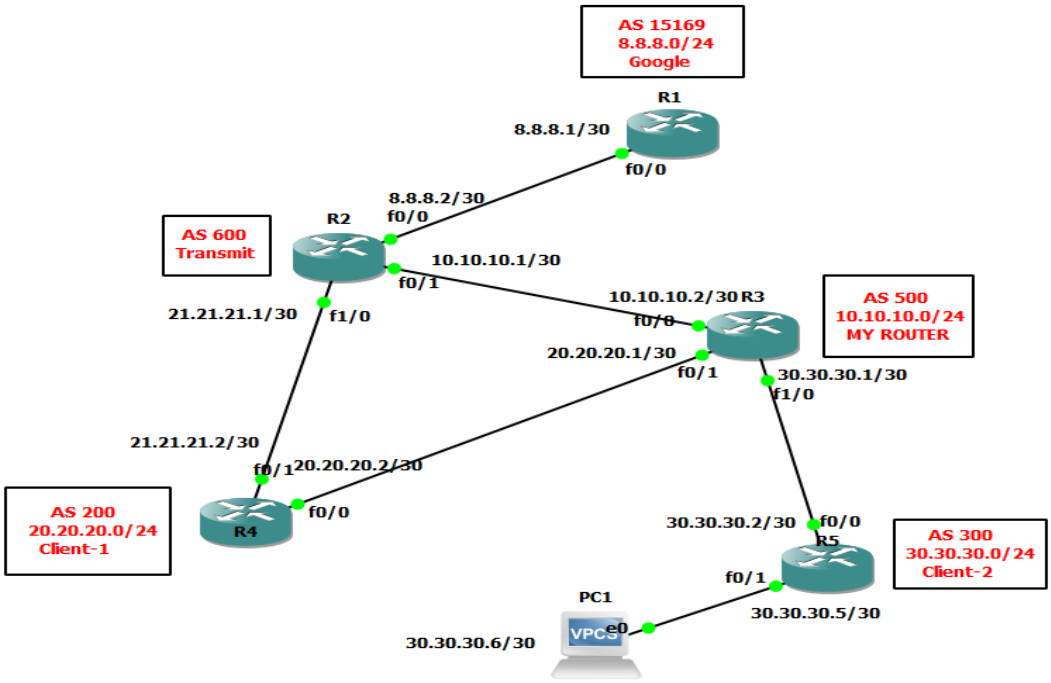

Fig-40: Route Leaking

```
 running-config | section bgp
bgp 500
chronization
g-neighbor-changes
k 10.10.10.0 mask 255.255.255.0
k 20.20.20.0 mask 255.255.255.0
k 30.30.30.0 mask 255.255.255.0
or 10.10.10.1 remote-as 600
or 20.20.20.2 remote-as 200
or 30.30.30.2 remote-as 300
o-summary
 ip bgp
le version is 6, local router ID is 30.30.30.1
   Network          Next Hop            Metric LocPrf Weight Path
*> 8.8.8.0/24       20.20.20.2                300         0 200 600 15169 i
*                   10.10.10.1                            0 600 15169 i
*> 10.10.10.0/24    0.0.0.0                  0          32768 i
*  20.20.20.0/24    10.10.10.1                            0 600 200 i
*>                  20.20.20.2               0    300      0 200 i
*  21.21.21.0/24    10.10.10.1                            0 600 200 i
*>                  20.20.20.2               0    300      0 200 i
*> 30.30.30.0/24    30.30.30.2               0             0 300 i
R3#show ip route
     21.0.0.0/24 is subnetted, 1 subnets
B       21.21.21.0 [20/0] via 20.20.20.2, 00:04:21
     20.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       20.20.20.0/30 is directly connected, FastEthernet0/1
B       20.20.20.0/24 [20/0] via 20.20.20.2, 00:04:21
     8.0.0.0/24 is subnetted, 1 subnets
B       8.8.8.0 [20/0] via 20.20.20.2, 00:04:21
     10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       10.10.10.0/30 is directly connected, FastEthernet0/0
S       10.10.10.0/24 is directly connected, Null0
     30.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       30.30.30.0/30 is directly connected, FastEthernet1/0
B       30.30.30.0/24 [20/0] via 30.30.30.2, 00:04:22
R3#traceroute 8.8.8.1
Tracing the route to 8.8.8.1
  1 20.20.20.2 [AS 200] 28 msec 20 msec 4 msec
  2 21.21.21.1 [AS 200] 28 msec 32 msec 28 msec
  3 8.8.8.1 [AS 15169] 24 msec 36 msec 60 msec
R5#traceroute 8.8.8.1
Tracing the route to 8.8.8.1
1 30.30.30.1 12 msec 12 msec 12 msec
2 20.20.20.2 [AS 200] 24 msec 40 msec 40 msec
3 21.21.21.1 [AS 200] 44 msec 56 msec 36 msec
4 8.8.8.1 [AS 15169] 80 msec 52 msec 80 msec
```

Fig-41: Route Leaking Problem

```
router bgp 500
 no synchronization
 bgp log-neighbor-changes
 network 10.10.10.0 mask 255.255.255.0
 network 20.20.20.0 mask 255.255.255.0
 network 30.30.30.0 mask 255.255.255.0
 neighbor 10.10.10.1 remote-as 600
 neighbor 10.10.10.1 route-map R2-IN in
 neighbor 20.20.20.2 remote-as 200
 neighbor 30.30.30.2 remote-as 300
 no auto-summary
!
ip forward-protocol nd
ip route 10.10.10.0 255.255.255.0 Null0
ip prefix-list R2-IN seq 5 permit 8.8.8.0/24
no cdp log mismatch duplex
route-map R2-IN permit 10
 match ip address prefix-list R2-IN in
 set local-preference 1000
R3#show ip bgp
BGP table version is 6, local router ID is 30.30.30.1
   Network          Next Hop            Metric LocPrf Weight Path
*  8.8.8.0/24       20.20.20.2                            0 200 600 15169 i
*>                  10.10.10.1                1000        0 600 15169 i
*> 10.10.10.0/24    0.0.0.0                  0          32768 i
*> 20.20.20.0/24    10.10.10.1                1000        0 600 200 i
*                   20.20.20.2               0            0 200 i
*> 21.21.21.0/24    10.10.10.1                1000        0 600 200 i
*                   20.20.20.2               0            0 200 i
*> 30.30.30.0/24    30.30.30.2               0            0 300 i
R3#show ip route
     21.0.0.0/24 is subnetted, 1 subnets
B       21.21.21.0 [20/0] via 10.10.10.1, 00:00:55
     20.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       20.20.20.0/30 is directly connected, FastEthernet0/1
B       20.20.20.0/24 [20/0] via 10.10.10.1, 00:00:55
     8.0.0.0/24 is subnetted, 1 subnets
B       8.8.8.0 [20/0] via 10.10.10.1, 00:00:55
     10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       10.10.10.0/30 is directly connected, FastEthernet0/0
S       10.10.10.0/24 is directly connected, Null0
     30.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       30.30.30.0/30 is directly connected, FastEthernet1/0
B       30.30.30.0/24 [20/0] via 30.30.30.2, 00:00:56
R5#traceroute 8.8.8.1
Tracing the route to 8.8.8.1
  1 30.30.30.1 12 msec 16 msec 12 msec
  2 10.10.10.1 [AS 500] 20 msec 40 msec 24 msec
  3 8.8.8.1 [AS 15169] 64 msec 32 msec 36 msec
R3#traceroute 8.8.8.1
Tracing the route to 8.8.8.1
  1 10.10.10.1 12 msec 20 msec 12 msec
  2 8.8.8.1 [AS 15169] 24 msec 32 msec 16 msec
```

Fig-42: Route Leaking Problem Solve

CHAPTER-4

Competencies and Smart Plan

4.1 Competencies Earned

To encourage participants to enhance their skills in a range of IT system support activities so that they are prepared entry-level professionals upon the conclusion of the internship. Regardless of the kind, scope, or complexity of the system I manage during my internship, this level of framework identifies ways to strengthen your skills. Develop our growth potential and direction to hone our three essential management abilities for managing internships: technical expertise, performance, and personal conduct and attitude. The Manager Competency Development Internship also how to create a corporate skills development framework that businesses can use for ongoing employee evaluation and development.

4.2 Smart Plan

SMART means a set of goals and objectives, namely the 5 aspects of the goals are: Specified, Measurable, Available, Compliant, and timeframe. The idea is that all internship policies must adhere to the SMART standard in order to work. Therefore, when planning for internship…

- **Specific:** The aim has a target in a specific region is meant to build a system or address a particular need.
- **Measurable:** The objective must be countable at the very minimum to permit the system to make measurable progress.
- **Attainable:** The goal must be realistic and must be an attainable resource in the system.
- **Retain ability:** The aim must be consistent with other company objectives that will be deemed relevant in addition to being practical and reachable inside the system.
- **Time-bound:** The system is set up with a stated end date for the aim.

4.3 Reflections

Criticize that although the light portfolio content will be more personalized than other assignments, you should use the same level of critical analysis as you do in any essay or test. Make sure you write down all the stages of your work, from the planning stages to the completion. You need to include extensive information for technical problem analysis. The results of the analysis also suggest future improvements. To obtain the highest marks Your Thinking Report should include a detailed analysis of learning outcomes Part of this should include a few well-thought-out suggestions for developing similar activities in the future.

CHAPTER-5

Conclusion and Future Career

5.1 Discussion and Conclusion

The goal of the internship I was given to complete is to develop a system that will allow network security to be automated. It will greatly simplify the task of informing different clients and users.

There is a substantial workforce of networking security engineers in Bangladesh's IT sector across the border. It has a highly promising future in Bangladesh shortly, but it needs a lot of opportunity if the specialized software can be done correctly and completely.

5.2 Scope for Further Career

Even though my internship is completed according to actual requirements, there are a few things we can add or improve on, if time allows. The implementation of the IT Support system should be reviewed. We can look to other Networking for a better idea of how we can use a more efficient and cost-effective system. There are a few opportunities waiting for me and it will help us improve my career. The marketplace is ideal for a network engineer in the IT sector. So I want to build my career in the Networking IT sector.

Appendix

BGP- Boarder Gateway Protocol

VLAN- Virtual Local Area Network

LAN- Local Area Network

SSH-- Secure Shell

OSPF-- Open Shortest Path First

LSR-- Label Switching Router

IGP-- Interior Gateway Protocol

CIDR-- Classless Inter-Domain Routing

IPv4-- Internet Protocol Version 4

IPv6-- Internet Protocol Version 6

EBGP-- External Boarder Gateway Protocol

IBGP-- Internal Boarder Gateway Protocol

IP-- Internet Protocol

PRTG-- Paessler Router Traffic Grapher

SNMP-- Simple Network Management Protocol

MRTG-- Multi Router Traffic Grapher

NOC-- Network Operation Center

ISP-- Internet Service Provider

TV-- Television

BTRC-- Bangladesh Telecommunication Regulatory Commission

IIG-- International Internet Gateway

WCL-- Windstream Communication Limited

BSCCL-- Bangladesh Submarine Cable Company Limited

VoIP-- Voice over Internet Protocol

IPLC-- International Private Leased Circuit

MPLC-- Motion Picture Licensing Corporation

IT—Information Technology

CDN-- Content Delivery Network

IX-- Internet Exchange

CSE-- Computer Science Engineering

LTD-- Limited

AS-- Autonomous System

IP-- Internet Protocol

RIR-- Regional Internet Registry

APNIC-- Asia-Pacific Network Information Centre

AFRINIC-- African Network Information Center

ARIN-- American Registry for Internet Numbers

LACNIC-- Latin America and Caribbean Network Information Centre

RIPENCC-- Réseaux IP Européens Network Coordination Centre

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