May 2023 – Semester 2

BACHELOR OF COMPUTER SCIENCE (Hons)

ASSIGNMENT (WEIGHTAGE: 20%)

Module Name:	Operating System and Computer Networks
Module Code:	ITS 66304
Dead Line:	Tuesday, July 11, 2023
Presentation:	Week 11

Student declaration: we declare that –

1. We understand what is meant by plagiarism.
2. The implications of plagiarism have been explained to us by our lecturer.
3. The assignment is entirely our work, except where we have given fully documented references to the work of others.
4. The material contained in this assignment has not previously been submitted for assessment in any other formal course of study.

TITLE	REPORT & DESIGN A LAN FOR A COMPANY USING PACKET TRACER
COURSE TUTOR / LECTURER	MR. APURVA NEPAL

STUDENT NAME	UNIVERSITY ID	STUDENT ID
SUJAL RATNA TULADHAR	362 483	22013 230

ACKNOWLEDGEMENT

During the period of our project and completion of this report we have benefited from many peoples and would like to express our sincere thanks.

We would like to express my hearty gratitude to our respected lecturer Mr. Apurva Nepal as well as the project supervisor for invaluable suggestions and inspiring guidance for completing this study. Their cooperation, suggestions and keen interest in this study are over memorable. The vigorous efforts made us present this research work in this form. It is my good fortune to get very cooperative teacher.

During the work in progress, the support, helpfulness and constant encouragement kept me motivated in research work. This wonderful project for computer network. Which provided invaluable interest, guidance during the course of the work. We have not only learned but also got important suggestions regarding scientific writing and other related matters. I am very much grateful to our teachers.

We would like to thank and appreciate all the faculty members who have provided encouragement, suggestions and help to complete during the course of this project work. We would like to thank my colleagues who directly and indirectly helped me.

Finally, we would like to thank all those whose efforts made the preparation of this project possible, through contributions to topics, review, process, support of work, etc. Which also helped us in doing a lot of research and came to know about so many new things

TABLE OF CONTENT

PROBLEM QUESTION

You have been hired as a network engineer by a medium-sized company with 50 employees and 4 departments – sales and marketing, finance, hr management and operations. Your task is to design a basic network that ensures each department can communicate with each other while also keeping their data and information secure.

- To start, you would need to conduct an assessment of the company's current network infrastructure, including the number of devices and their locations, as well as the current network architecture. This will help you determine the most suitable design for the new network.

The company infrastructure detail is as follows:

The current network infrastructure of xyz company includes a single switch to which all devices are connected. This switch has 48 ports and is a layer 2 switch with no routing capabilities. The switch is not managed, meaning that there is no central control over the network traffic, and all devices are on the same broadcast domain, resulting in frequent broadcast storms and network congestion.

The switch is connected to a cable modem provided by the internet service provider, which connects to the internet. There is no router or firewall between the switch and the internet, leaving the network vulnerable to cyber-attacks and data breaches.

The devices connected to the switch include 50 desktop computers, 4 printers, and 2 servers. The computers run on different operating systems, including windows, macos, and linux. The printers are shared across the network, and employees can access them from any device. The servers are used for file storage and email services.

There are no wireless access points in the current network infrastructure, meaning that all devices are connected to the switch using ethernet cables.

- Next, you would need to choose the appropriate hardware and software to meet the company's requirements. For example, you may recommend the use of a network switch to connect all the devices within each department, and a router to connect the different departments. You may also suggest implementing a firewall to secure the network from external threats.

- To ensure secure communication between the departments, you may recommend creating separate VLANs for each department. You may also suggest implementing access control lists (acls) to restrict access to sensitive data and resources.

To make this scenario more realistic, you could use **cisco packet tracer**, a simulation tool that allows you to **design, configure, and troubleshoot network infrastructures**. Using packet tracer, you could create a virtual network with devices such as switches, routers, and firewalls, and simulate different scenarios to test the network's functionality and security.

As a final step, you would need to document the network design and provide instructions for its implementation, including the configuration of each device and any security measures that need to be taken. This would ensure that the network is properly implemented and can be easily maintained and updated in the future

1. PROBLEM ANALYSIS

1.1. Problem Identification with Appropriate Contextual Details

IDENTIFICATION	CONTEXTUAL DETAILS
Design a basic network design so each department can communicate	Hired as network engineer by medium sized company
All devices connected to single 48 port	Layer 2 switch with no routing capabilities,
Switch not managed	No central control over network traffic
Frequent broadcast storms, network congestion	All devices on same broadcast domain
Vulnerable to cyber-attack and data breach	Cable modem from ISP connect switch to internet no router or firewall in between to keep data and information secure
No wireless access point	All devices connected to switch by ethernet cable
4 department shared printer	80 employees 80 desktop pcs

Computer networks are extremely vital for working in our technological society. A majority of companies depend on the proper functioning of their networks for communications. The Local Area Network (LANs) is the most basic and important computer network to be owned and implemented also by individual companies and could be used for interconnection with Wide Area Networks (WANs). Resource sharing is probably equally as important where a LANs serves as the access vehicle for an intranet or internet.

In building a network infrastructure,

Communication between two or more different local area networks or between wide area networks is the most challenging job, so in this project, we have used the OSPF (Open Shortest Path First) protocol which has the characteristics to choose the shortest path which will evaluate the delay and improves the efficiency of the packet exchange. Furthermore,

We have used technologies such as DHCP to automate IP address to end devices, FTP to transfer files from one device to another, email services to communicate, DNS to decode domain names to IP addresses so that browsers can load internet resources

2. CHOICE OF DEVICES WITH EXPLAINATIONS

2.1. List Of Multiple Appropriate and Relevant Devices

ISP OUTSIDE/ DMZ SERVER

NETWORK DEVICES

TYPE	NAMES	QUANTITY	COST
ROUTERS	ISR4331	1	3000
SWITCHES	PT-EMPTY	1	350
SECURITY (ASA)	5506-X	1	1000
WAN EMULATOR	CLOUD PT EMPTY	1	5000
	MODEM DSL CABLE	2 1 1	 30 30

END DEVICES

END DEVICES	SERVER	2	2000

LANS/INTRANET

NETWORK DEVICES

ROUTERS	PT EMPTY	1	150
SWITCHES	MULTILAYER 3650-24PS	4	5000
WIRELESS DEVICES	HOME ROUTER	1	

END DEVICES

SERVER	2	2000
PC	80	1000
LAPTOP	6	1000
PRINTER	4	1500
TABLET	6	400
SMARTPHONE	6	250

CONNECTIONS ALL GIGABITS

CABLES	FROM	TO
COPPER STRAIGHT THROUGH	ROUTER	FIREWALL
	PC AND PRINTER	MULTILAYER SWITCH
COPPER CROSS OVER	FIREWALL	ROUTER
	ROUTER	ROUTER
FIBER	CLOUD	SWITCH
	SWITCH	SERVER
PHONE	CLOUD	DSL MODEM
SERIAL DCE DTE	ROUTER	ROUTER
COAXIAL	CLOUD	CABLE MODEM

2.2. CLEAR AND DETAILED EXPLANATION

Any company would require or need professional tools to help them with the design and maintenance of LANs. A simulation tool like Cisco Packet Tracer (CPT) is a multi-tasking network simulation software that can be used to perform and analyze various network activities such as implementation/chance of different topologies, subnetting, and analysis of various network configuration and troubleshooting commands and a way to predict the impact on the network of a hardware upgrade, an increase in traffic.

The study report describes how the tool can be used to develop a simulation model of the lans for the company and provides an insight into various concepts such as topology design, ip address configuration and how to send information in form of packet in a single network and the use of virtual local area networks (vlansss) to separate the traffic generated by the different departments. The simulation results and performance analyses showed that the design was successful.

2.2.1. MEETING TASK REQUIREMENTS

CHOOSE APPROPRIATE HARDWARE AND SOFTWARE	TO MEET COMPANY REQUIREMENTS
CONFIGURING SWITCHES	TO CONNECT ALL DEVICES WITHIN DEVICES
CONFIGURING ROUTERS	TO CONNECT DEPARTMENTS
INSTALLING ACCESS POINTS	TO PROVIDE WIRELESS CONNECTIVITY
IMPLEMENTING FIREWALLS	TO SECURE NETWORK FROM EXTERNAL THREATS
CREATING VLANSSS	ENSURE SECURE COMMUNICATION BETWEEN DEPARTMENTS
IMPLEMENTING ACCESS CONTROL LISTS	TO RESTRICT ACCESS TO SENSITIVE DATA AND RESOURCES
SIMULATE DIFFERENT SCENARIOS	TEST NETWORK FUNCTIONALITY AND SECURITY
ENSURE PROPER IMPLEMENTATION	EASY MAINTENANCE AND UPGRADABILITY

2.2.2. Advantages

- Improved performance

By reducing the amount of traffic, a given endpoint sees and processes.

Break up broadcast spaces, diminishing the number of other has from which any given gadget sees broadcasts

- Tighten security

Progress security by empowering the next degree of control over which gadgets have get to each other.

- Ease administration

To group endpoints moreover empowers chairmen to gather gadgets for authoritative, nontechnical purposes.

- Application filtering

many applications produce traffic signatures that can be recognized and filtered as required. Block specific parts but not the entire application.

2.2.3. Disadvantages

- Increased cost due to purchasing additional hardware: acquiring these gadgets will increment the generally fetched of the organize foundation.
- Increased complexity in network design and management: the usage of these gadgets will increment the complexity of arrange plan and administration. purchasing these devices will increase the overall cost of the network infrastructure

3. Design of Network with Cisco Packet Tracer

3.1. Complex network topology requirements

Topology

Network topology describes the interconnection, physical and logical appearance between arrangement of computers, cables and other components in a data communication and how it can be used for sharing resources from one node and sending it through the network to other nodes on a different network. The different types of network topologies used in our assignments are:

- Bus topology: a network topology that are connected to a single wire with terminals are each end. Here if the cable breaks the network cannot communicate.
- Star topology: a network topology in which all the hubs on the organize are associated through a central gadget switch. Each workstation has a cable that goes from the network card to switch device. One benefits of the star topology is that a break in the cable causes only the workstation to go down, not the entire network like bus topology.
- Wireless topology: topology where few cables are used to connect systems. The arrange is made up of transmitters that broadcast the bundles utilizing radio frequencies. The arrange contains uncommon transmitters called remote get to focus which amplify a radio circle within the shape of a bubble around the transmitter.
- Hybrid topology: some networks of today are implemented by having a combination of more than one topology: star and bus, star and ring, ring and bus or ring, bus and star.

Communication media

Network gadgets are associated together employing a medium, the medium can be cables which can either be coaxial cable or turned match cable or it can be by optic fiber cables, or the medium can be free space (discuss) by the utilize of radio waves.

- Coaxial cable: This cable is made up of two conductors. One of them is an inner insulated conductor surrounded by another conductor made of a metallic foil or woven wire. Coaxial cable is resistant to electromagnetic interference (EMI) because the inner conductor is shielded by the metallic outer conductor.
- Twisted pair cable: individual insulated copper strands are interwoven into a twisted pair cable. Two types of twisted pair cable include shielded and unshielded twisted pair where three types of cabling for UTP cable and they are: straight through cable, cross over cable and roll over cable. The straight through cable is utilized to put through either a host to a switch or center or to put through a router to a switch or center. The cross over cable can be utilized to put through a switch to switch, hub to a hub, host to host, hub to switch and a router direct to host.
- Optic fiber cable: an alternative to copper cabling, which sends light through an optic fiber. Utilizing light rather than power makes fiber optics resistant to EMI. They ordinarily have more prominent most extreme separate between organized gadgets and more noteworthy information carrying capacity.
- Wireless: clients pick up get to a wired arrange by communicating through radio waves with a remote get to point (ap). The access point is then hardwired to LANS.

3.1.1. Redundancy

To guarantee secure communication between the offices, making partitioned VLANSSs for each division is vital. The VLANSs will anticipate broadcast storms and arrange blockage, which can make strides arrange execution. Guarantee that there's no single point of disappointment within the arrange, which is able offer assistance in keeping up organize uptime.

3.1.2. Scalability

Ensure that the organize can develop as the company extends, which can offer assistance in assembly future organize necessities. Structures that are versatile may extend to handle extra client bunches, inaccessible destinations, and applications without influencing the level of benefit given to current clients.

3.1.3. Security

Get to control records (ACLs) will limit get to vanes delicate information and assets, guaranteeing that as it were authorized staff can get to the data. This will avoid information breaches and cyber-attacks, which can keep the company's information and data secure. Guarantee that the network is secured from outside dangers, which is able offer assistance in avoiding information breaches and cyber-attacks.

Security must be built into the arrange from the starting; it cannot be presented after the organize is wrapped up. To secure organize assets, it is fundamental to put security equipment, channels, and firewall highlights.

3.1.4. Efficiency

To ensure that the network performs optimally, which will help in increasing productivity and efficiency

Availability: a network that is built for availability provides constant, dependable performance, seven days a week, twenty-four hours a day. Also, the performance of the network should not be adversely affected by the breakdown of a single connection or piece of equipment.

Manageability: regardless of how excellent the initial network design, the network must be able to be managed and supported by the available network employees. An ineffective or inefficient network is one that is excessively complicated or challenging to manage.

3.2. Network devices configurations

3.2.1. IP addresses

IPv4

Address structures

i. Each number represents an 8-bit portion of the 32 bits and each of these four divisions are called an octet. instead of writing out individual bit value, it is written in dotted-decimal notation, for example 192.168.144.120.

ii. An IP address consist of two types of addresses: network and host address

iii. There are five classes of IP addresses classes of IP addresses

Class	Fix leading	Public range	Private range
A	0	0.0.0.0 to 127.255.255.255	10.0.0.0 to 10.255.255.255
B	10	128.0.0.0 to 191.255.255.255	172.16.0.0 to 172.31.255.255

C	110	192.0.0.0 to 223.255.255.255	192.168.0.0 to 192.168.255.255
D	1110	224.0.0.0 to 239.255.255.255	Multicast research
E	1111	240.0.0.0 to 254.255.255255	Reserved limited experimental

iv. IP addresses can be dynamically configured using DHCP or statically configured by manual input on the device

Subnetting

i. The process of stealing bits from the host part of an IP to divide the larger network into smaller sub-networks called subnets. Here, network subnet host fields are created.

ii. One IP address is always reserved to identify the subnet (network address) and another to identify the broadcast address within the subnet.

iii. Subnetting can be done by three methods

   a. Number of subnets needed from single IP block

   b. Number of host nodes per block

   c. Reverse engineering where subnet mask and IP address is given and host per subnet with number of subnets are to found

Subnet mask

i. Every host on the network must know which part of the host address will be used for subnet to work

ii. A 32-bit value that allows the recipient to distinguish the network from the host id portion of the IP address.

iii. Subnet mask for different classes of networks

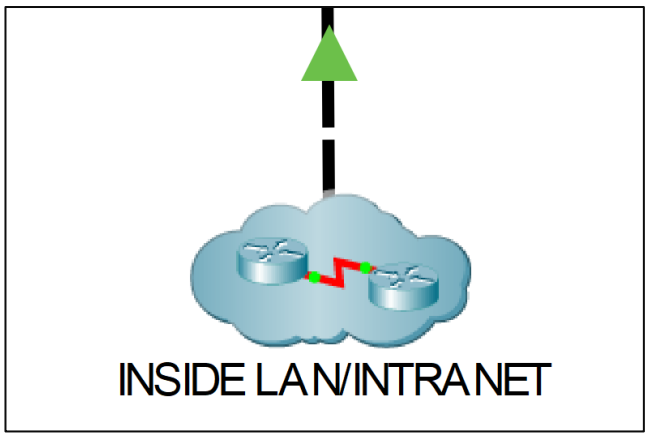
Class	Format	Default subnet mask	CIDR	Network	Hosts
A	N.H.H.H	255.0.0.0	/8	126	16,777,214
B	N.N.H.H	255.255.0.0	/16	16,382	65,534
C	N.N.N.H	255.255.255.0	/24	2,097,150	254

Special purpose reserved IP address

Address block /CIDR	Range	Scope purpose	Specified by
0.0.0.0/8	0.255.255.255	Software broadcast messages	RFC 1700
10.0.0.0/8	10.255.255.255	Private local communication	RFC 1918
100.64.0.0/10	100.127.255.255	Private service provider using carrier grade NAT	RFC 6598
127.0.0.0/8	127.255.255.255	Host loopback	RFC 990
169.254.0.0/16	169.254.255.255	Subnet link-local for 2 hosts with no IP address	RFC 3927
172.16.0.0/12	172.31.255.255	Private local communication	RFC 1918
192.0.0.0/24	192.0.0.255	Private IANA special purpose	RFC 1918
192.0.2.0/24	192.0.2.255	Documentation TEST-NET	RFC 5727
192.88.99.0/24	192.88.99.255	Internet 6to4 anycast relays	RFC 3068
192.168.0.0/16	192.168.255.255	Private local communication	RFC 1918
198.18.0.0/15	198.19.255.255	Private testing inter-network communication between subnets	RFC 2554
198.51.100.0/24	198.51.100.255	Documentation TEST-NET -2	RFC 5727
203.0.113.0/24	203.0.113.255	Documentation TEST-NET -3	RFC 5727
224.0.0.0/4	239.255.255.255	Internet multicast assignment	RFC 5771
233.252.0.0/24	233.252.255.255	Documentation MCAST-TEST-NET	RFC 5771
240.0.0.0/4	255.255.255.254	Reserved for future use	RFC 6890
255.255.255.255/32	255.255.255.255	Reserved limited broadcast destination address	RFC 6890

NETWORK IDENTIFICATION

Class:	C
First octet range:	192-233
IP type:	Private
Network host parts:	N.N.N.H
Total bits:	32
Network bits(n):	24
Host bits(h):	8



Before subnetting

Acquired network:	192.168.144.0/24
Binary IP address:	11000000.10101000.10010000.00000000
Hex IP address:	C0.A8.90.00
Subnet mask:	255.255.255.0
Binary IP address:	11111111.11111111.11111111.00000000
Hex IP address:	FF.FF.FF.00
CIDR:	/24
Total number of hosts:	$2^n = 256$ (0 to 255)
Number of usable hosts:	$2^n – 2 = 254$

All networks

IP address	Network address	Usable host range		Broadcast address	Subnet mask
		Start address	End address		
192.168.144.0/24	192.168.144.0	192.168.144.1	192.168.144.254	192.168.144.255	255.255.255.0

After subnet

Largest host in network:	24 (24 ports multilayer switch)
Minium host per network:	11000 (in binary)
Total bits in octet:	8
Minimum host bits (h):	5
Borrowed network bits (s):	3 (subnet bits)
Total sub-networks; 2^s	$2^3 = 8$
Total hosts; 2^h	$2^5 = 32$
Mask bits (network bit + borrowed):	24 + 3 = 27
New subnet bitmap:	110NNNNN.NNNNNNNN.NNNNNNNN.SSSHHHHH

New subnet IP addresses:

Short:	192.168.144.0 /27
CIDR notation:	/27
Subnet mask:	255.255.255.224
Binary subnet mask:	11111111.11111111.11111111.11100000
Hex subnet mask	FF.FF.FF.E0
Wildcard mask:	0.0.0.31
Usable hosts per network:	30

All 8 of the possible /27 networks for 192.168.144.0

Short notation	Network address	Usable host range		Broadcast address:	Usage
		Start address	End address		
192.168.144.0/27	192.168.144.0	192.168.144.1	192.168.144.30	192.168.144.31	S&M
192.168.144.32/27	192.168.144.32	192.168.144.33	192.168.144.62	192.168.144.63	F
192.168.144.64/27	192.168.144.64	192.168.144.65	192.168.144.94	192.168.144.95	O

192.168.144.96/27	192.168.144.96	192.168.144.97	192.168.144.126	192.168.144.127	HRM
192.168.144.128/27	192.168.144.128	192.168.144.129	192.168.144.158	192.168.144.159	Extra
192.168.144.160/27	192.168.144.160	192.168.144.161	192.168.144.190	192.168.144.191	Extra
192.168.144.192/27	192.168.144.192	192.168.144.193	192.168.144.222	192.168.144.223	Extra
192.168.144.224/27	192.168.144.224	192.168.144.225	192.168.144.254	192.168.144.255	Extra

Office end devices with multi-layer switch

Office	Pc – 20	Printer – 1	Default gateway	Cable
Sales and management	192.168.144.1-20	192.168.144.29	192.168.144.30	Copper straight
Finance	192.168.144.33-52	192.168.144.61	192.168.144.62	Copper straight
Operations	192.168.144.65-84	192.168.144.93	192.168.144.94	Copper straight
Human resource management	192.168.144.97-110	192.168.144.125	192.168.144.126	Copper straight
Servers	File – 192.168.144.249	Email – 192.168.144.250	192.168.144.254	Copper straight

Office switch with main office multi-layer switch

Office / room	Office MLS	Switch	Interface gateway	Cable	VLANSS
Sales and management	Gig1/0/1	Gig1/0/24	192.168.144.30	Copper crossover	10
Finance	Gig1/0/2	Gig1/0/24	192.168.144.62	Copper crossover	20
Operations	Gig1/0/3	Gig1/0/24	192.168.144.94	Copper crossover	30
Human resource management	Gig1/0/4	Gig1/0/24	192.168.144.126	Copper crossover	40
Server	Gig1/0/5	Gig0/1	192.168.144.250	Copper crossover	50

Server

Total number of hosts:	8
Number of usable hosts:	6
Subnet mask:	255.255.255.248

Wildcard mask:	0.0.0.7
Binary subnet mask:	11111111.11111111.11111111.11111000
IP class:	C
CIDR notation:	/29

Switch and server

Network address	**Usable host range**	**Broadcast address:**
192.168.144.248	192.168.144.249 - 192.168.144.254	192.168.144.255

Wireless

Short IP address:	192.168.120.0
Total number of hosts:	64
Number of usable hosts:	62
Subnet mask:	255.255.255.192
Wildcard mask:	0.0.0.63
Binary subnet mask:	11111111.11111111.11111111.11000000
IP class:	C
CIDR notation:	/26
IP type:	Private

All 4 of the possible /26 networks for 192.168.120.*

Network address	**Usable host range**	**Broadcast address:**	**Usages**
192.168.120.0	192.168.120.1 - 192.168.120.62	192.168.120.63	Sales and management
192.168.120.64	192.168.120.65 - 192.168.120.126	192.168.120.127	Operations
192.168.120.128	192.168.120.129 - 192.168.120.190	192.168.120.191	Finance
192.168.120.192	192.168.120.193 - 192.168.120.254	192.168.120.255	Human resource management

Main office router Firewall and ISP

Total number of hosts:	4
Number of usable hosts:	2
Subnet mask:	255.255.255.252
Wildcard mask:	0.0.0.3
Binary subnet mask:	11111111.11111111.11111111.11111100
IP class:	C
CIDR notation:	/30

Network address	Interface in	Main office router	Interface out	Firewall	Broadcast address
192.168.120.0	Gig0/0	192.168.120.2	Gig1/2	192.168.120.1	192.168.120.3

Network address	Interface out	Isp router	Interface in	Firewall	Broadcast address
10.10.10.0	Gig0/0	10.10.10.1	Gig1/1	10.10.10.2	10.10.10.3

DMZ

Total number of hosts:	16,777,214
Number of usable hosts:	16,777,214
Subnet mask:	255.0.0.0
Wildcard mask:	0. 255.255.255
Binary subnet mask:	11111111.00000000.00000000.00000000
IP class:	C
CIDR notation:	/8
IP type	Public

Network address	Interface out	Interface in	DMZ Switch and Firewall	Interface	Server	Broadcast address
8.0.0.0	Gig0/1 Gig1/3	Gig1/1 Gig2/1	Default gateway 8.8.8.1	Gig0	8.8.8.4 8.8.8.8	8.255.255.255

3.2.2. VLANs

Separate VLANSs will be created for each department, which will help in preventing broadcast storms and network congestion, improving network performance. Large business computer networks often set up VLANs to re-partition a network for improved traffic management.

Multi-switch VLANs send packets between multiple switches, making VLANs with segments in separate locations possible. Multi-switch VLANs can to prioritize activity utilizing the IEEE802.1p standard within the equipment layers and the RSVP standard within the internetwork layers.

a. Improved performance

By reducing the amount of traffic, a given endpoint sees and processes.

Break up broadcast spaces, diminishing the number of other has from which any given gadget sees broadcasts

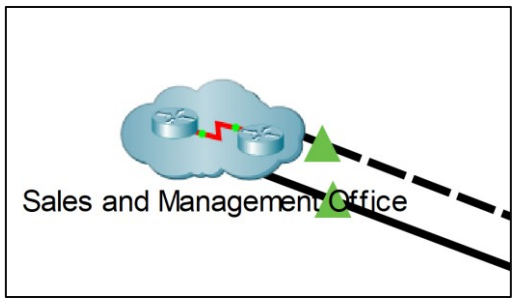
b. Tighten security

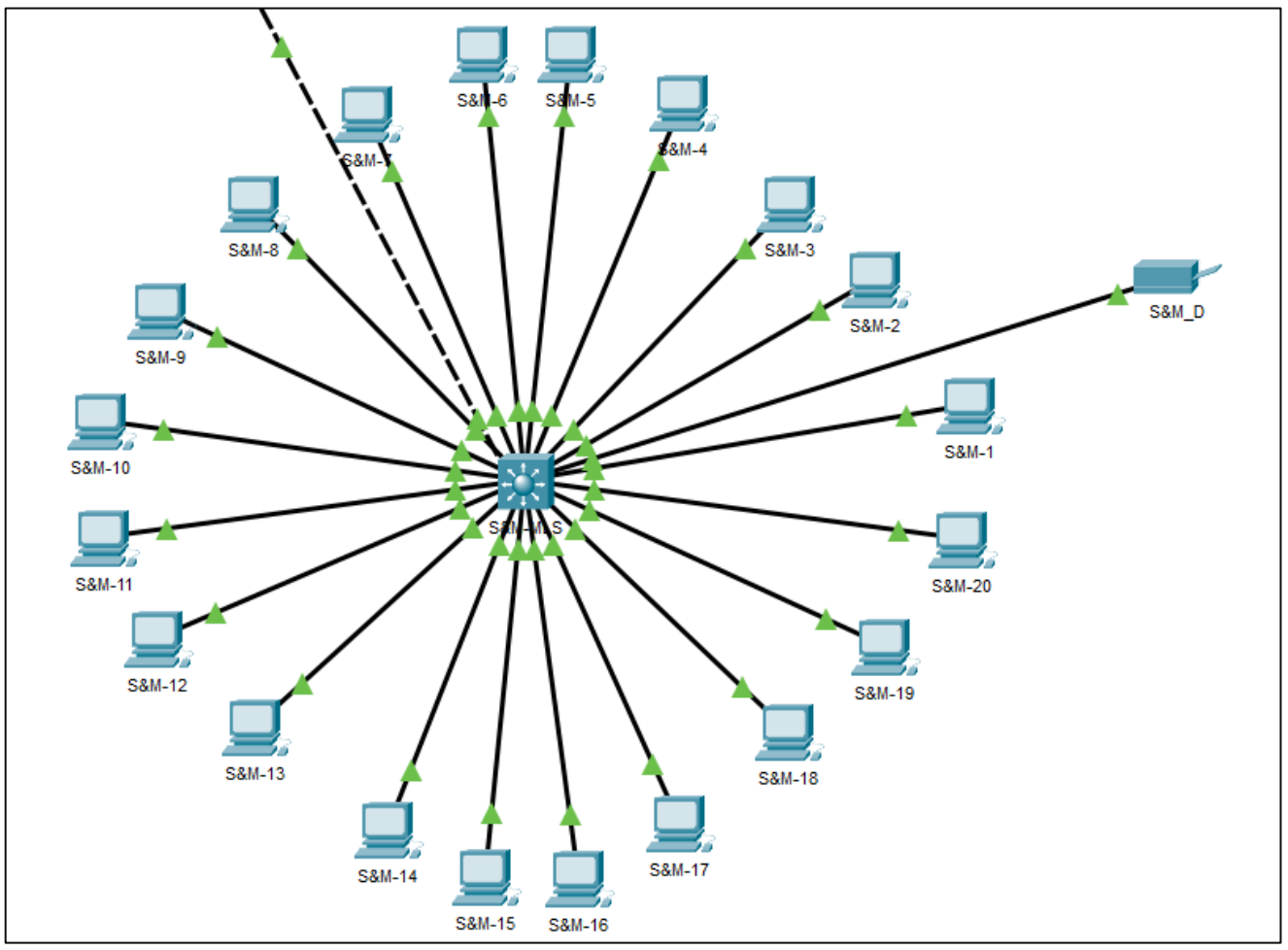
Progress security by empowering the next degree of control over which gadgets have get to each other.

c. Ease administration

To group endpoints moreover empowers chairmen to gather gadgets for authoritative, nontechnical purposes.

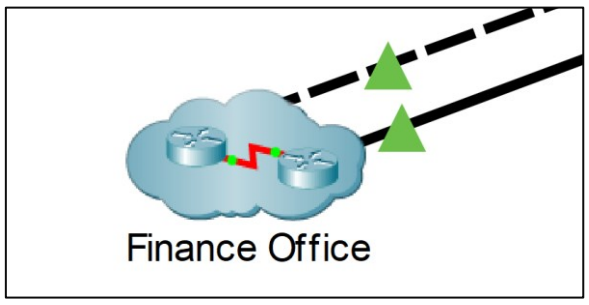
Sales and management

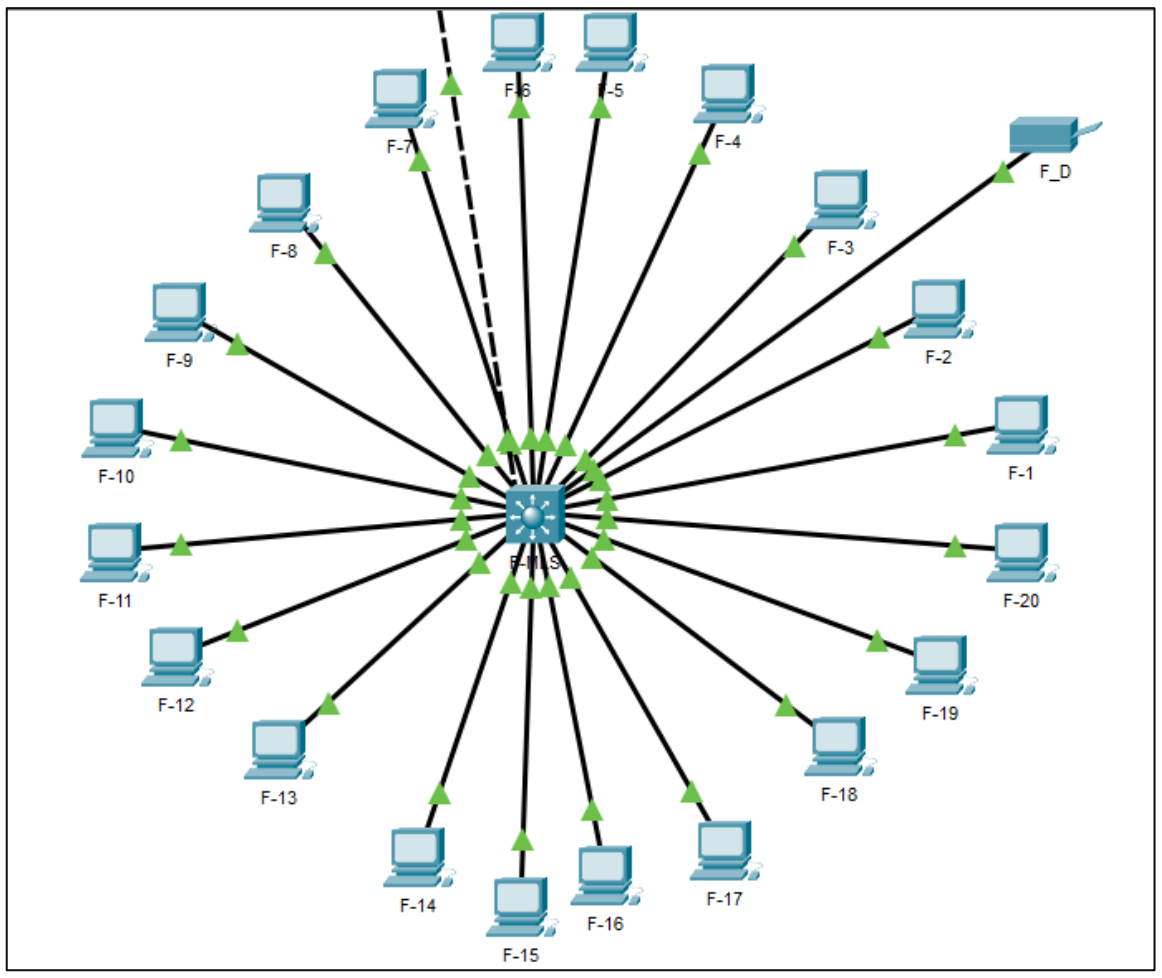





```
Device Name: S&M-MLS
Device Model: 3650-24PS
Hostname: S&M-MLS

Port                    Link   VLAN   IP Address        IPv6 Address                              MAC Address
GigabitEthernet1/0/1    Up     10     <not set>         <not set>                                 00E0.8FA7.DE01
GigabitEthernet1/0/2    Up     10     <not set>         <not set>                                 00E0.8FA7.DE02
GigabitEthernet1/0/3    Up     10     <not set>         <not set>                                 00E0.8FA7.DE03
GigabitEthernet1/0/4    Up     10     <not set>         <not set>                                 00E0.8FA7.DE04
GigabitEthernet1/0/5    Up     10     <not set>         <not set>                                 00E0.8FA7.DE05
GigabitEthernet1/0/6    Up     10     <not set>         <not set>                                 00E0.8FA7.DE06
GigabitEthernet1/0/7    Up     10     <not set>         <not set>                                 00E0.8FA7.DE07
GigabitEthernet1/0/8    Up     10     <not set>         <not set>                                 00E0.8FA7.DE08
GigabitEthernet1/0/9    Up     10     <not set>         <not set>                                 00E0.8FA7.DE09
GigabitEthernet1/0/10   Up     10     <not set>         <not set>                                 00E0.8FA7.DE0A
GigabitEthernet1/0/11   Up     10     <not set>         <not set>                                 00E0.8FA7.DE0B
GigabitEthernet1/0/12   Up     10     <not set>         <not set>                                 00E0.8FA7.DE0C
GigabitEthernet1/0/13   Up     10     <not set>         <not set>                                 00E0.8FA7.DE0D
GigabitEthernet1/0/14   Up     10     <not set>         <not set>                                 00E0.8FA7.DE0E
GigabitEthernet1/0/15   Up     10     <not set>         <not set>                                 00E0.8FA7.DE0F
GigabitEthernet1/0/16   Up     10     <not set>         <not set>                                 00E0.8FA7.DE10
GigabitEthernet1/0/17   Up     10     <not set>         <not set>                                 00E0.8FA7.DE11
GigabitEthernet1/0/18   Up     10     <not set>         <not set>                                 00E0.8FA7.DE12
GigabitEthernet1/0/19   Up     10     <not set>         <not set>                                 00E0.8FA7.DE13
GigabitEthernet1/0/20   Up     10     <not set>         <not set>                                 00E0.8FA7.DE14
GigabitEthernet1/0/21   Up     10     <not set>         <not set>                                 00E0.8FA7.DE15
GigabitEthernet1/0/22   Down   10     <not set>         <not set>                                 00E0.8FA7.DE16
GigabitEthernet1/0/23   Down   10     <not set>         <not set>                                 00E0.8FA7.DE17
GigabitEthernet1/0/24   Up     10     <not set>         <not set>                                 00E0.8FA7.DE18
GigabitEthernet1/1/1    Down   1      <not set>         <not set>                                 00D0.BA87.2B01
GigabitEthernet1/1/2    Down   1      <not set>         <not set>                                 00D0.BA87.2B02
GigabitEthernet1/1/3    Down   1      <not set>         <not set>                                 00D0.BA87.2B03
GigabitEthernet1/1/4    Down   1      <not set>         <not set>                                 00D0.BA87.2B04
Vlan1                   Down   1      <not set>         <not set>                                 00D0.FFD5.4DCB

Physical Location: Intercity > Home City > Corporate Office > Main Wiring Closet > Rack > S&M-MLS
```

Finance



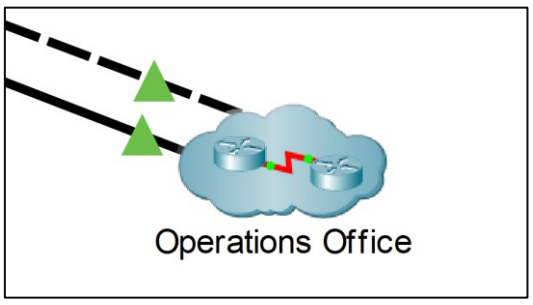


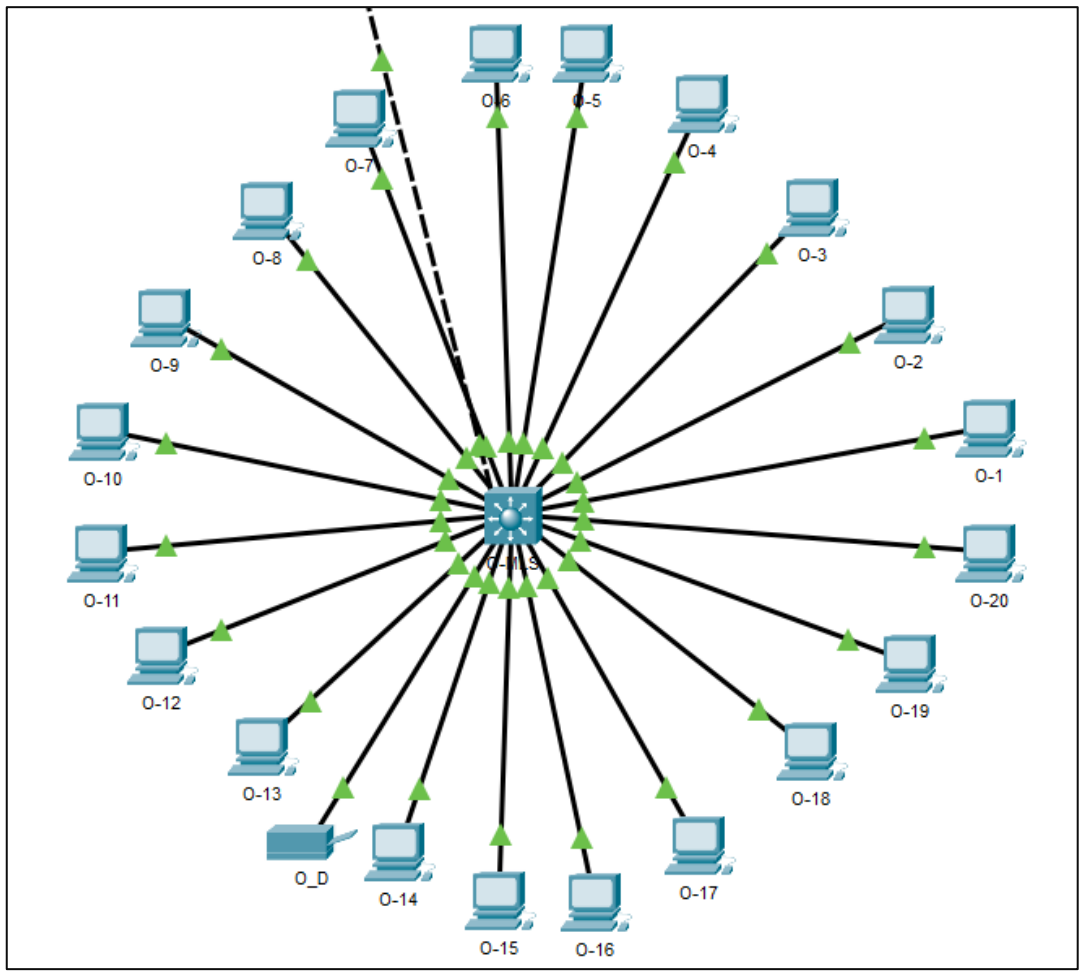
Device Name: F-MLS
Device Model: 3650-24PS
Hostname: F-MLS

Port	Link	VLAN	IP Address	IPv6 Address	MAC Address
GigabitEthernet1/0/1	Up	20	<not set>	<not set>	00E0.F7E1.0486
GigabitEthernet1/0/2	Up	20	<not set>	<not set>	0010.111A.4791
GigabitEthernet1/0/3	Up	20	<not set>	<not set>	0090.21B4.A712
GigabitEthernet1/0/4	Up	20	<not set>	<not set>	0002.17CA.5D0D
GigabitEthernet1/0/5	Up	20	<not set>	<not set>	0060.5CC1.E239
GigabitEthernet1/0/6	Up	20	<not set>	<not set>	000B.BE64.1902
GigabitEthernet1/0/7	Up	20	<not set>	<not set>	00D0.BA22.D438
GigabitEthernet1/0/8	Up	20	<not set>	<not set>	0002.4A1A.AEE1
GigabitEthernet1/0/9	Up	20	<not set>	<not set>	0004.9A2A.1C9C
GigabitEthernet1/0/10	Up	20	<not set>	<not set>	000C.CF08.4C0E
GigabitEthernet1/0/11	Up	20	<not set>	<not set>	00D0.BAA9.0CA5
GigabitEthernet1/0/12	Up	20	<not set>	<not set>	0002.1628.C76E
GigabitEthernet1/0/13	Up	20	<not set>	<not set>	00D0.FF02.105C
GigabitEthernet1/0/14	Up	20	<not set>	<not set>	0090.0C14.9E15
GigabitEthernet1/0/15	Up	20	<not set>	<not set>	0090.2108.A060
GigabitEthernet1/0/16	Up	20	<not set>	<not set>	000C.8586.C168
GigabitEthernet1/0/17	Up	20	<not set>	<not set>	000C.8512.3615
GigabitEthernet1/0/18	Up	20	<not set>	<not set>	0090.2B11.C558
GigabitEthernet1/0/19	Up	20	<not set>	<not set>	0009.7C2A.3DD7
GigabitEthernet1/0/20	Up	20	<not set>	<not set>	0060.701D.AE7A
GigabitEthernet1/0/21	Down	20	<not set>	<not set>	000D.BDAD.EEC4
GigabitEthernet1/0/22	Down	20	<not set>	<not set>	0003.E486.1C6D
GigabitEthernet1/0/23	Up	20	<not set>	<not set>	00D0.D314.8223
GigabitEthernet1/0/24	Up	20	<not set>	<not set>	0003.E421.CEA6
GigabitEthernet1/1/1	Down	1	<not set>	<not set>	0003.E4E5.1A37
GigabitEthernet1/1/2	Down	1	<not set>	<not set>	00D0.FF10.B36C
GigabitEthernet1/1/3	Down	1	<not set>	<not set>	0005.5EBC.9002
GigabitEthernet1/1/4	Down	1	<not set>	<not set>	00E0.A3E6.94B5
Vlan1	Down	1	<not set>	<not set>	0007.EC09.170A

Physical Location: Intercity > Home City > Corporate Office > Main Wiring Closet > Rack > F-MLS

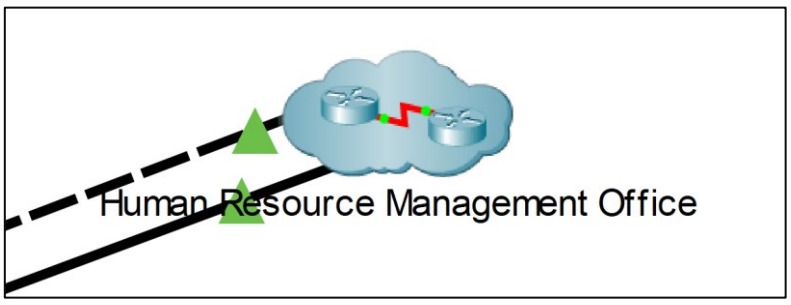
Operations

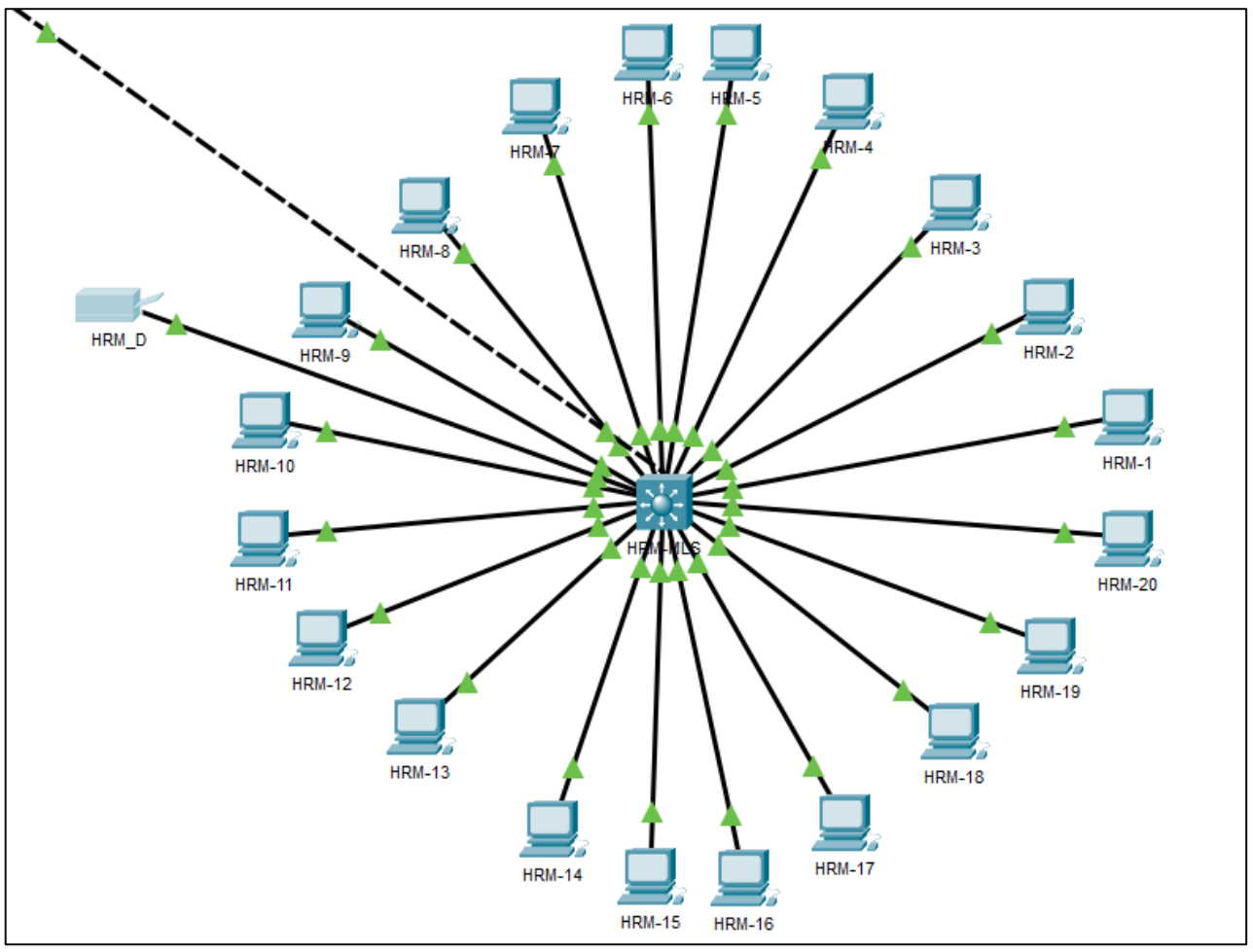





```
Device Name: O-MLS
Device Model: 3650-24PS
Hostname: O-MLS

Port                    Link   VLAN   IP Address        IPv6 Address                              MAC Address
GigabitEthernet1/0/1    Up     30     <not set>         <not set>                                 0001.C917.CD25
GigabitEthernet1/0/2    Up     30     <not set>         <not set>                                 0007.EC51.C023
GigabitEthernet1/0/3    Up     30     <not set>         <not set>                                 00D0.D365.05B7
GigabitEthernet1/0/4    Up     30     <not set>         <not set>                                 0060.7027.E047
GigabitEthernet1/0/5    Up     30     <not set>         <not set>                                 0004.9ADA.0D57
GigabitEthernet1/0/6    Up     30     <not set>         <not set>                                 00E0.F923.7DE1
GigabitEthernet1/0/7    Up     30     <not set>         <not set>                                 0050.0FE7.979B
GigabitEthernet1/0/8    Up     30     <not set>         <not set>                                 0001.C721.4A28
GigabitEthernet1/0/9    Up     30     <not set>         <not set>                                 0060.70B6.A178
GigabitEthernet1/0/10   Up     30     <not set>         <not set>                                 000B.BE3B.61A6
GigabitEthernet1/0/11   Up     30     <not set>         <not set>                                 0004.9A31.7697
GigabitEthernet1/0/12   Up     30     <not set>         <not set>                                 0003.E467.5E55
GigabitEthernet1/0/13   Up     30     <not set>         <not set>                                 0001.C738.EBED
GigabitEthernet1/0/14   Up     30     <not set>         <not set>                                 0003.E469.95DC
GigabitEthernet1/0/15   Up     30     <not set>         <not set>                                 0001.6495.9D6A
GigabitEthernet1/0/16   Up     30     <not set>         <not set>                                 0001.C975.560C
GigabitEthernet1/0/17   Up     30     <not set>         <not set>                                 0030.A3E3.1B1D
GigabitEthernet1/0/18   Up     30     <not set>         <not set>                                 0001.63DE.6302
GigabitEthernet1/0/19   Up     30     <not set>         <not set>                                 0090.2191.2C29
GigabitEthernet1/0/20   Up     30     <not set>         <not set>                                 0050.0FC0.B63A
GigabitEthernet1/0/21   Down   30     <not set>         <not set>                                 0050.0F24.E21B
GigabitEthernet1/0/22   Down   30     <not set>         <not set>                                 00D0.BC38.AD3E
GigabitEthernet1/0/23   Up     30     <not set>         <not set>                                 00D0.BC32.5169
GigabitEthernet1/0/24   Up     30     <not set>         <not set>                                 0001.642B.561E
GigabitEthernet1/1/1    Down   1      <not set>         <not set>                                 00D0.9777.BD6C
GigabitEthernet1/1/2    Down   1      <not set>         <not set>                                 0060.5C0A.88B8
GigabitEthernet1/1/3    Down   1      <not set>         <not set>                                 0090.21A6.5211
GigabitEthernet1/1/4    Down   1      <not set>         <not set>                                 00E0.B09D.D2CE
Vlan1                   Down   1      <not set>         <not set>                                 0004.9A04.533D

Physical Location: Intercity > Home City > Corporate Office > Main Wiring Closet > Rack > O-MLS
```

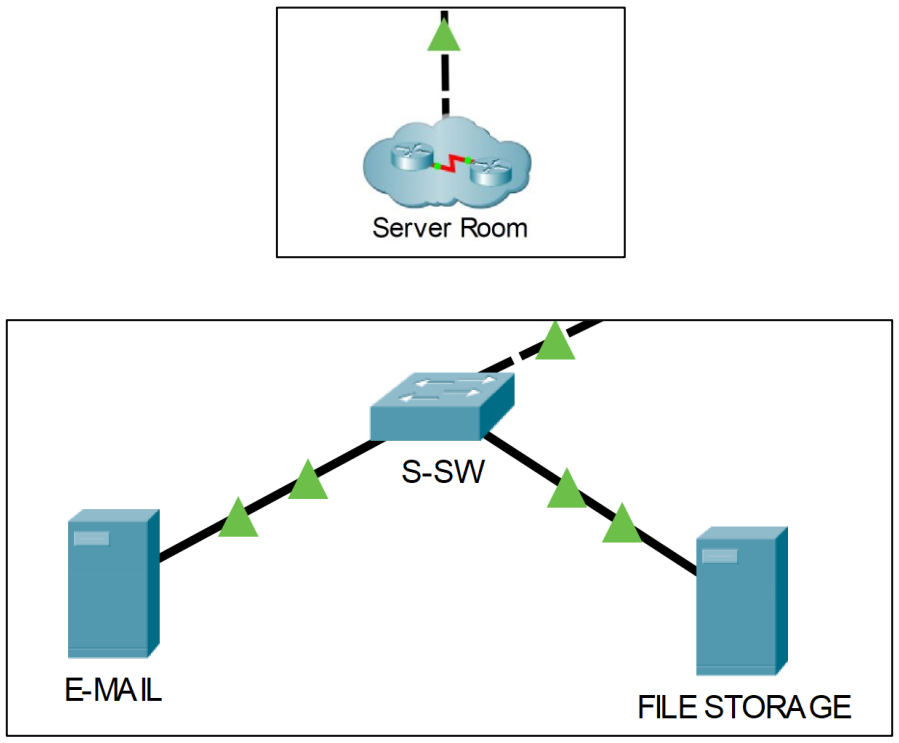
Human resource management





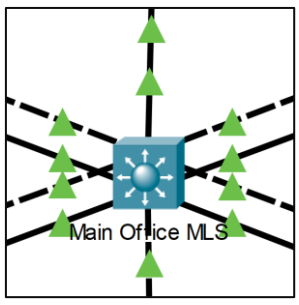

```
Device Name: HRM-MLS
Device Model: 3650-24PS
Hostname: HRM-MLS

Port                 Link   VLAN   IP Address        IPv6 Address                MAC Address
GigabitEthernet1/0/1 Up     40     <not set>         <not set>                   000B.BE1A.3349
GigabitEthernet1/0/2 Up     40     <not set>         <not set>                   0001.6391.0417
GigabitEthernet1/0/3 Up     40     <not set>         <not set>                   0001.C7D4.B4B9
GigabitEthernet1/0/4 Up     40     <not set>         <not set>                   0090.0C55.4690
GigabitEthernet1/0/5 Up     40     <not set>         <not set>                   0060.2F24.4247
GigabitEthernet1/0/6 Up     40     <not set>         <not set>                   0090.0C7B.4B10
GigabitEthernet1/0/7 Up     40     <not set>         <not set>                   0006.2A63.AB33
GigabitEthernet1/0/8 Up     40     <not set>         <not set>                   0001.6304.6400
GigabitEthernet1/0/9 Up     40     <not set>         <not set>                   000A.41A5.1B12
GigabitEthernet1/0/10 Up    40     <not set>         <not set>                   0090.0C16.1A7A
GigabitEthernet1/0/11 Up    40     <not set>         <not set>                   00D0.FFA9.E872
GigabitEthernet1/0/12 Up    40     <not set>         <not set>                   0060.5C50.59C8
GigabitEthernet1/0/13 Up    40     <not set>         <not set>                   0010.1186.21E1
GigabitEthernet1/0/14 Up    40     <not set>         <not set>                   0090.2131.72BA
GigabitEthernet1/0/15 Up    40     <not set>         <not set>                   0001.6328.4EE0
GigabitEthernet1/0/16 Up    40     <not set>         <not set>                   000A.4152.9993
GigabitEthernet1/0/17 Up    40     <not set>         <not set>                   0006.2A1B.2452
GigabitEthernet1/0/18 Up    40     <not set>         <not set>                   0090.0C21.34D3
GigabitEthernet1/0/19 Up    40     <not set>         <not set>                   0001.97E9.B367
GigabitEthernet1/0/20 Up    40     <not set>         <not set>                   0002.4A5C.D7C6
GigabitEthernet1/0/21 Down  40     <not set>         <not set>                   000A.418A.C71B
GigabitEthernet1/0/22 Down  40     <not set>         <not set>                   0001.C9E4.C474
GigabitEthernet1/0/23 Up    40     <not set>         <not set>                   0001.6415.92BB
GigabitEthernet1/0/24 Up    40     <not set>         <not set>                   000A.F304.A386
GigabitEthernet1/1/1 Down   1      <not set>         <not set>                   0002.178D.D5C8
GigabitEthernet1/1/2 Down   1      <not set>         <not set>                   0090.2108.EB19
GigabitEthernet1/1/3 Down   1      <not set>         <not set>                   0040.0B09.535A
GigabitEthernet1/1/4 Down   1      <not set>         <not set>                   0001.649B.59A5
Vlan1                Down   1      <not set>         <not set>                   0030.A3B6.B4C9

Physical Location: Intercity > Home City > Corporate Office > Main Wiring Closet > Rack > HRM-MLS
```

Server



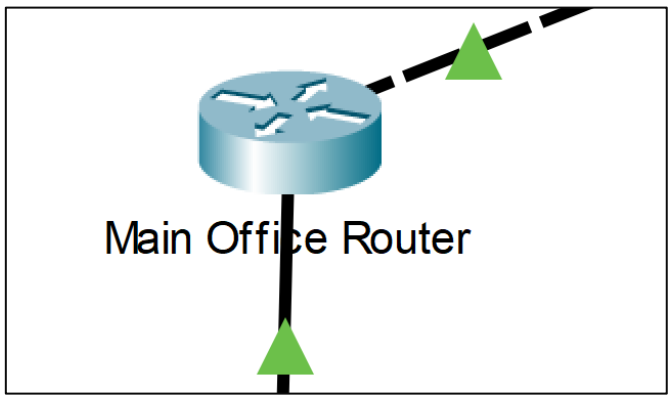

```
Device Name: S-SW
Device Model: Switch-PT-Empty
Hostname: Switch

Port                Link   VLAN   IP Address          MAC Address
GigabitEthernet0/1  Up     50     --                  000A.F34E.2650
GigabitEthernet1/1  Up     50     --                  0006.2A61.9334
GigabitEthernet2/1  Up     50     --                  0090.219C.E288
GigabitEthernet3/1  Down   50     --                  00E0.A329.3901
GigabitEthernet4/1  Down   50     --                  0030.A3E6.7277
Vlan1               Down   1      <not set>           0002.1730.8236

Physical Location: Intercity > Home City > Corporate Office > Main Wiring Closet > Rack > S-SW
```

Main office multi_layer switch



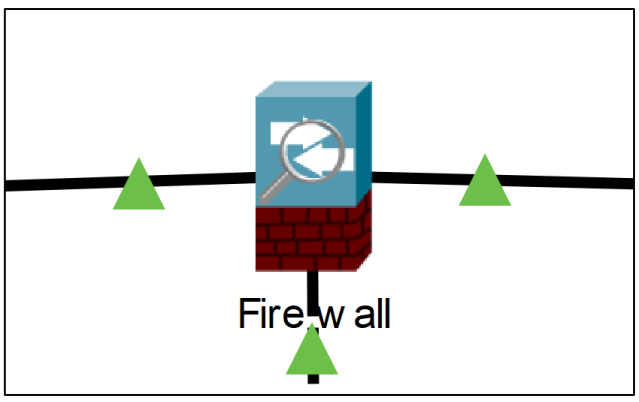

```
Device Name: Main Office MLS
Device Model: 3650-24PS
Hostname: MLS--Main

Port                 Link   VLAN   IP Address          IPv6 Address                MAC Address
GigabitEthernet1/0/1 Up     10     <not set>           <not set>                   0090.2120.C701
GigabitEthernet1/0/2 Up     20     <not set>           <not set>                   0090.2120.C702
GigabitEthernet1/0/3 Up     30     <not set>           <not set>                   0090.2120.C703
GigabitEthernet1/0/4 Up     40     <not set>           <not set>                   0090.2120.C704
GigabitEthernet1/0/5 Up     50     <not set>           <not set>                   0090.2120.C705
GigabitEthernet1/0/6 Up     1      <not set>           <not set>                   0090.2120.C706
GigabitEthernet1/0/7 Up     1      <not set>           <not set>                   0090.2120.C707
GigabitEthernet1/0/8 Up     1      <not set>           <not set>                   0090.2120.C708
GigabitEthernet1/0/9 Up     1      <not set>           <not set>                   0090.2120.C709
GigabitEthernet1/0/10 Down  1      <not set>           <not set>                   0090.2120.C70A
GigabitEthernet1/0/11 Down  1      <not set>           <not set>                   0090.2120.C70B
GigabitEthernet1/0/12 Down  1      <not set>           <not set>                   0090.2120.C70C
GigabitEthernet1/0/13 Down  1      <not set>           <not set>                   0090.2120.C70D
GigabitEthernet1/0/14 Down  1      <not set>           <not set>                   0090.2120.C70E
GigabitEthernet1/0/15 Down  1      <not set>           <not set>                   0090.2120.C70F
GigabitEthernet1/0/16 Down  1      <not set>           <not set>                   0090.2120.C710
GigabitEthernet1/0/17 Down  1      <not set>           <not set>                   0090.2120.C711
GigabitEthernet1/0/18 Down  1      <not set>           <not set>                   0090.2120.C712
GigabitEthernet1/0/19 Down  1      <not set>           <not set>                   0090.2120.C713
GigabitEthernet1/0/20 Down  1      <not set>           <not set>                   0090.2120.C714
GigabitEthernet1/0/21 Down  1      <not set>           <not set>                   0090.2120.C715
GigabitEthernet1/0/22 Down  1      <not set>           <not set>                   0090.2120.C716
GigabitEthernet1/0/23 Down  1      <not set>           <not set>                   0090.2120.C717
GigabitEthernet1/0/24 Up    --     <not set>           <not set>                   0090.2120.C718
GigabitEthernet1/1/1 Down   1      <not set>           <not set>                   0004.9A20.D501
GigabitEthernet1/1/2 Down   1      <not set>           <not set>                   0004.9A20.D502
GigabitEthernet1/1/3 Down   1      <not set>           <not set>                   0004.9A20.D503
GigabitEthernet1/1/4 Down   1      <not set>           <not set>                   0004.9A20.D504
Vlan1                Down   1      <not set>           <not set>                   0001.C965.0C36

Physical Location: Intercity > Home City > Corporate Office > Main Wiring Closet > Rack > Main Office MLS
```

Main office router



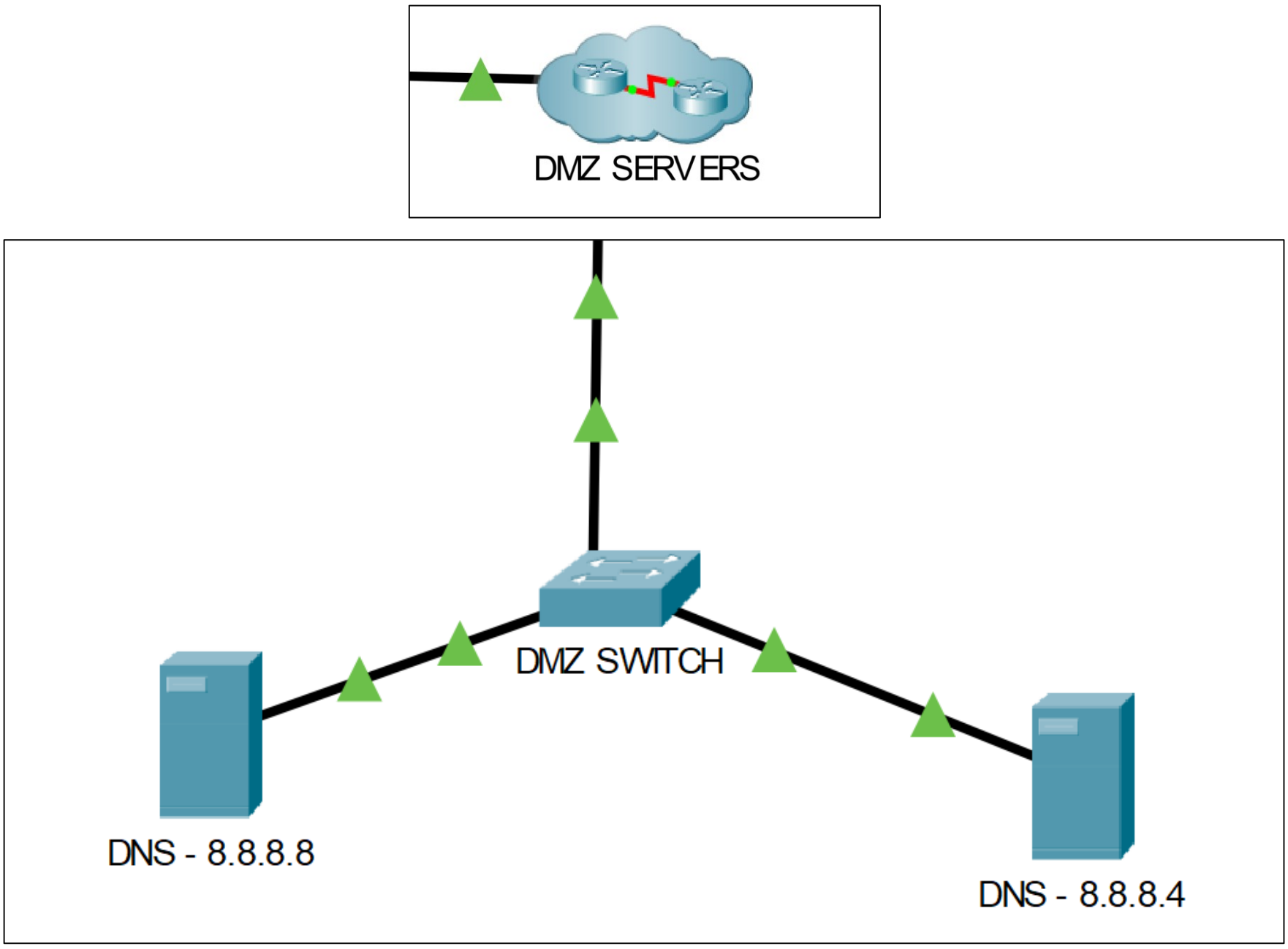

```
Device Name: Main Office Router
Device Model: Router-PT-Empty
Hostname: Router

Port                  Link   IP Address          IPv6 Address                            MAC Address
GigabitEthernet0/0    Up     192.168.120.2/30    <not set>                               00D0.D305.96BE
GigabitEthernet1/0    Up     <not set>           <not set>                               0004.9AAE.062C
GigabitEthernet1/0.10 Up     192.168.144.30/27   <not set>                               0004.9AAE.062C
GigabitEthernet1/0.20 Up     192.168.144.62/27   <not set>                               0004.9AAE.062C
GigabitEthernet1/0.30 Up     192.168.144.94/27   <not set>                               0004.9AAE.062C
GigabitEthernet1/0.40 Up     192.168.144.126/27  <not set>                               0004.9AAE.062C
GigabitEthernet1/0.50 Up     192.168.144.254/29  <not set>                               0004.9AAE.062C
GigabitEthernet2/0    Up     <not set>           <not set>                               0060.2F83.CC69
GigabitEthernet3/0    Up     <not set>           <not set>                               0060.5CAE.6040
Serial4/0             Down   <not set>           <not set>                               <not set>
Serial5/0             Down   <not set>           <not set>                               <not set>
GigabitEthernet6/0    Down   <not set>           <not set>                               0060.5C89.B1AC
GigabitEthernet7/0    Down   <not set>           <not set>                               00D0.D391.BDE5
GigabitEthernet8/0    Down   <not set>           <not set>                               00D0.D34E.CB48
GigabitEthernet9/0    Down   <not set>           <not set>                               0003.E43A.4BB2
Loopback1             Up     8.8.8.8/32          <not set>                               0001.6315.23E3

Physical Location: Intercity > Home City > Corporate Office > Main Wiring Closet > Rack > Main Office Router
```

Firewall



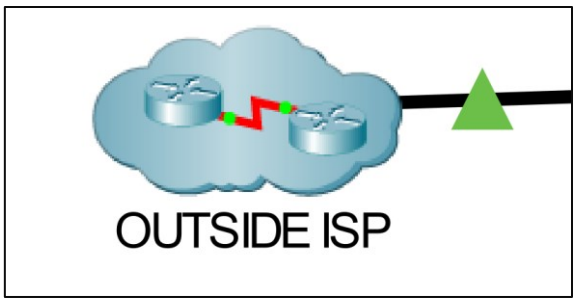

```
Device Name: Firewall
Device Model: 5506-X
Hostname: ISP-ASA

Port                 Link   VLAN   IP Address          IPv6 Address                            MAC Address
GigabitEthernet1/1   Up     --     10.10.10.2/30       <not set>                               0001.6392.5301
GigabitEthernet1/2   Up     --     192.168.120.1/30    <not set>                               0001.6392.5302
GigabitEthernet1/3   Up     --     8.8.8.1/8           <not set>                               0001.6392.5303
GigabitEthernet1/4   Down   --     <not set>           <not set>                               0001.6392.5304
GigabitEthernet1/5   Down   --     <not set>           <not set>                               0001.6392.5305
GigabitEthernet1/6   Down   --     <not set>           <not set>                               0001.6392.5306
GigabitEthernet1/7   Down   --     <not set>           <not set>                               0001.6392.5307
GigabitEthernet1/8   Down   --     <not set>           <not set>                               0001.6392.5308
Management1/1        Down   --     <not set>           <not set>                               0001.6392.5309

Physical Location: Intercity > Home City > Corporate Office > Main Wiring Closet > Rack > Firewall
```

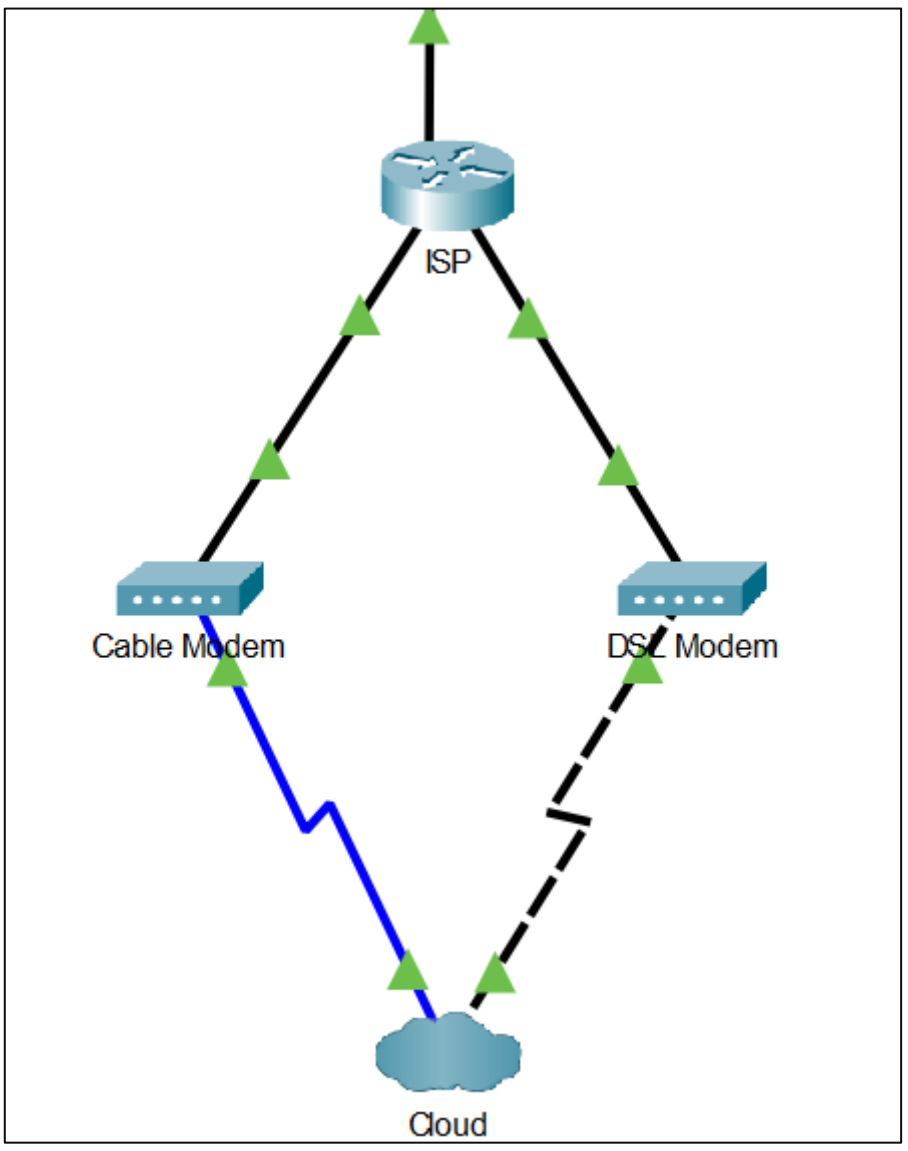
DMZ




```
Device Name: DNS - 8.8.8.8
Device Model: Server-PT

Port                Link   IP Address          IPv6 Address                              MAC Address
GigabitEthernet0    Up     8.8.8.8/8           <not set>                                 0060.4772.4D83

Gateway: 8.8.8.1
DNS Server: <not set>
Line Number:  <not set>

Physical Location: Intercity > Home City > Corporate Office > Main Wiring Closet > Rack > DNS - 8.8.8.8
```

```
Device Name: DNS - 8.8.8.4
Device Model: Server-PT

Port                Link   IP Address          IPv6 Address                              MAC Address
GigabitEthernet0    Up     8.8.8.4/8           <not set>                                 0060.2F85.246A

Gateway: 8.8.8.1
DNS Server: <not set>
Line Number:  <not set>

Physical Location: Intercity > Home City > Corporate Office > Main Wiring Closet > Rack > DNS - 8.8.8.4
```





3.2.3. Routing protocols

Implemented to ensure secure communication between the departments, which will help in preventing data breaches and cyber-attacks.

Static

RIP

OSCP

3.2.4. Access controls

Be implemented to restrict access to sensitive data and resources, ensuring that only authorized personnel can access the information.

3.2.5. Quality of services

To ensure that critical applications and services receive the necessary bandwidth, which will help in increasing productivity and efficiency.

3.3. Testing

3.3.1. Connectivity

Ensure that all devices can communicate with each other, which will help in ensuring seamless communication between departments.

PDU

PDU List Window

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	S&M-1	S&M-11	ICMP		0.000	N	0	(edit)	
	Successful	S&M-2	F-3	ICMP		0.000	N	1	(edit)	
	Successful	S&M-3	HRM-4	ICMP		0.000	N	2	(edit)	
	Successful	S&M-6	O-16	ICMP		0.000	N	3	(edit)	
	Successful	F-11	F-19	ICMP		0.000	N	4	(edit)	
	Successful	F-1	S&M-6	ICMP		0.000	N	5	(edit)	
	Successful	F-9	HRM-3	ICMP		0.000	N	6	(edit)	
	Successful	F-16	O-15	ICMP		0.000	N	7	(edit)	
	Successful	O-20	O-16	ICMP		0.000	N	8	(edit)	
	Successful	O-19	HRM-7	ICMP		0.000	N	9	(edit)	
	Successful	O-2	F-2	ICMP		0.000	N	10	(edit)	
	Successful	O-12	S&M-17	ICMP		0.000	N	11	(edit)	
	Successful	HRM-13	HRM-15	ICMP		0.000	N	12	(edit)	
	Successful	HRM-15	S&M-4	ICMP		0.000	N	13	(edit)	
	Successful	HRM-10	O-3	ICMP		0.000	N	14	(edit)	
	Successful	HRM-4	F-14	ICMP		0.000	N	15	(edit)	

Ping

S&M-1

Physical | Config | Desktop | Programming | Attributes

Command Prompt

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.144.10

Pinging 192.168.144.10 with 32 bytes of data:

Reply from 192.168.144.10: bytes=32 time<1ms TTL=128
Reply from 192.168.144.10: bytes=32 time<1ms TTL=128
Reply from 192.168.144.10: bytes=32 time<1ms TTL=128
Reply from 192.168.144.10: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.144.10:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>ping 192.168.144.40

Pinging 192.168.144.40 with 32 bytes of data:

Reply from 192.168.144.40: bytes=32 time<1ms TTL=127
Reply from 192.168.144.40: bytes=32 time<1ms TTL=127
Reply from 192.168.144.40: bytes=32 time<1ms TTL=127
Reply from 192.168.144.40: bytes=32 time<1ms TTL=127

Ping statistics for 192.168.144.40:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

```
C:\>ping 192.168.144.80

Pinging 192.168.144.80 with 32 bytes of data:

Reply from 192.168.144.80: bytes=32 time<1ms TTL=127
Reply from 192.168.144.80: bytes=32 time<1ms TTL=127
Reply from 192.168.144.80: bytes=32 time<1ms TTL=127
Reply from 192.168.144.80: bytes=32 time<1ms TTL=127

Ping statistics for 192.168.144.80:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>ping 192.168.144.110

Pinging 192.168.144.110 with 32 bytes of data:

Request timed out.
Reply from 192.168.144.110: bytes=32 time<1ms TTL=127
Reply from 192.168.144.110: bytes=32 time<1ms TTL=127
Reply from 192.168.144.110: bytes=32 time<1ms TTL=127

Ping statistics for 192.168.144.110:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

F-7

Physical | Config | Desktop | Programming | Attributes

Command Prompt

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.144.50

Pinging 192.168.144.50 with 32 bytes of data:

Reply from 192.168.144.50: bytes=32 time<1ms TTL=128
Reply from 192.168.144.50: bytes=32 time<1ms TTL=128
Reply from 192.168.144.50: bytes=32 time<1ms TTL=128
Reply from 192.168.144.50: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.144.50:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>ping 192.168.144.11

Pinging 192.168.144.11 with 32 bytes of data:

Request timed out.
Reply from 192.168.144.11: bytes=32 time<1ms TTL=127
Reply from 192.168.144.11: bytes=32 time<1ms TTL=127
Reply from 192.168.144.11: bytes=32 time<1ms TTL=127

Ping statistics for 192.168.144.11:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

```
C:\>ping 192.168.144.101

Pinging 192.168.144.101 with 32 bytes of data:

Request timed out.
Reply from 192.168.144.101: bytes=32 time<1ms TTL=127
Reply from 192.168.144.101: bytes=32 time<1ms TTL=127
Reply from 192.168.144.101: bytes=32 time=10ms TTL=127

Ping statistics for 192.168.144.101:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 10ms, Average = 3ms

C:\>ping 192.168.144.72

Pinging 192.168.144.72 with 32 bytes of data:

Reply from 192.168.144.72: bytes=32 time<1ms TTL=127
Reply from 192.168.144.72: bytes=32 time<1ms TTL=127
Reply from 192.168.144.72: bytes=32 time<1ms TTL=127
Reply from 192.168.144.72: bytes=32 time<1ms TTL=127

Ping statistics for 192.168.144.72:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

HRM-4

Physical | Config | Desktop | Programming | Attributes

Command Prompt

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.144.10

Pinging 192.168.144.10 with 32 bytes of data:

Request timed out.
Reply from 192.168.144.10: bytes=32 time=1ms TTL=127
Reply from 192.168.144.10: bytes=32 time=1ms TTL=127
Reply from 192.168.144.10: bytes=32 time=1ms TTL=127

Ping statistics for 192.168.144.10:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 1ms, Average = 1ms

C:\>ping 192.168.144.40

Pinging 192.168.144.40 with 32 bytes of data:

Request timed out.
Reply from 192.168.144.40: bytes=32 time=2ms TTL=127
Reply from 192.168.144.40: bytes=32 time<1ms TTL=127
Reply from 192.168.144.40: bytes=32 time=10ms TTL=127

Ping statistics for 192.168.144.40:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 10ms, Average = 4ms
```

```
C:\>ping 192.168.144.70

Pinging 192.168.144.70 with 32 bytes of data:

Request timed out.
Reply from 192.168.144.70: bytes=32 time=1ms TTL=127
Reply from 192.168.144.70: bytes=32 time=1ms TTL=127
Reply from 192.168.144.70: bytes=32 time=10ms TTL=127

Ping statistics for 192.168.144.70:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 10ms, Average = 4ms

C:\>ping 192.168.144.100

Pinging 192.168.144.100 with 32 bytes of data:

Reply from 192.168.144.100: bytes=32 time=15ms TTL=128
Reply from 192.168.144.100: bytes=32 time=18ms TTL=128
Reply from 192.168.144.100: bytes=32 time<1ms TTL=128
Reply from 192.168.144.100: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.144.100:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 18ms, Average = 8ms
```

O-13

Physical | Config | Desktop | Programming | Attributes

Command Prompt

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.144.5

Pinging 192.168.144.5 with 32 bytes of data:

Request timed out.
Reply from 192.168.144.5: bytes=32 time=1ms TTL=127
Reply from 192.168.144.5: bytes=32 time=10ms TTL=127
Reply from 192.168.144.5: bytes=32 time=1ms TTL=127

Ping statistics for 192.168.144.5:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 10ms, Average = 4ms

C:\>ping 192.168.144.45

Pinging 192.168.144.45 with 32 bytes of data:

Request timed out.
Reply from 192.168.144.45: bytes=32 time<1ms TTL=127
Reply from 192.168.144.45: bytes=32 time=5ms TTL=127
Reply from 192.168.144.45: bytes=32 time<1ms TTL=127

Ping statistics for 192.168.144.45:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 5ms, Average = 1ms
```

```
C:\>ping 192.168.144.75

Pinging 192.168.144.75 with 32 bytes of data:

Reply from 192.168.144.75: bytes=32 time<1ms TTL=128
Reply from 192.168.144.75: bytes=32 time=1ms TTL=128
Reply from 192.168.144.75: bytes=32 time=1ms TTL=128
Reply from 192.168.144.75: bytes=32 time=1ms TTL=128

Ping statistics for 192.168.144.75:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>ping 192.168.144.105

Pinging 192.168.144.105 with 32 bytes of data:

Request timed out.
Reply from 192.168.144.105: bytes=32 time=1ms TTL=127
Reply from 192.168.144.105: bytes=32 time=10ms TTL=127
Reply from 192.168.144.105: bytes=32 time=1ms TTL=127

Ping statistics for 192.168.144.105:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 10ms, Average = 4ms
```

3.3.2. Performance

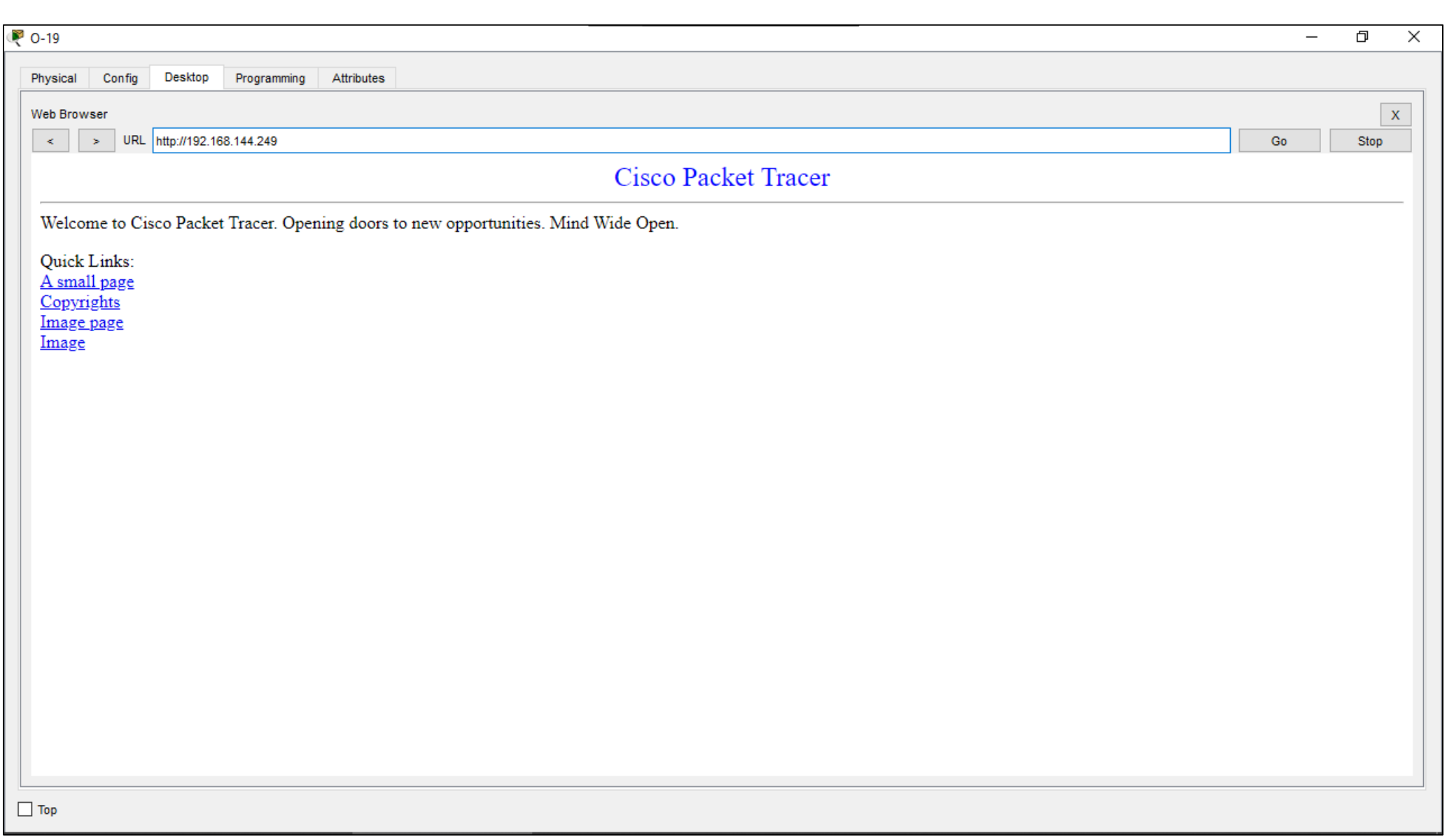
Network performs optimally, which will help in increasing productivity and efficiency.

DNS: Domain Name System

- Phonebook of the Internet; used to access information online
- To view Internet Resources, changes domain name to IP address
- Protocol used in application layer

WEB-SERVER

- Service offered by servers to nodes communicating via internet for serving web documents (HTMLs, JSON, XML, IMAGES)



HRM-3

Physical | Config | Desktop | Programming | Attributes

Command Prompt

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 8.8.8.8

Pinging 8.8.8.8 with 32 bytes of data:

Reply from 8.8.8.8: bytes=32 time<1ms TTL=255
Reply from 8.8.8.8: bytes=32 time<1ms TTL=255
Reply from 8.8.8.8: bytes=32 time<1ms TTL=255
Reply from 8.8.8.8: bytes=32 time=1ms TTL=255

Ping statistics for 8.8.8.8:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>
```

DHCP: Dynamic Host Configuration Protocol

- Automated distribution and assignment of IP address, default gateways and other network characteristics
- Reply to broadcast request from clients, on lease
- More time consuming with network administrator manually configuring each new client
- Client-Server model based on DORA - Discovery, Offer, Request, ACK.
- Port Server: 67 Client: 68
- NAK, Release, Decline

FTP, AAA, DHCP

Physical | Config | Services | Desktop | Programming | Attributes

SERVICES: HTTP | DHCP | DHCPv6 | TFTP | DNS | SYSLOG | AAA | NTP | EMAIL | FTP | IoT | VM Management | Radius EAP

DHCP

Interface: GigabitEthernet0 — Service: On / Off

Pool Name: HRM-Pool

Default Gateway: 192.168.120.254

DNS Server: 192.168.144.250

Start IP Address : 192 . 168 . 120 . 193

Subnet Mask: 255 . 255 . 255 . 192

Maximum Number of Users : 62

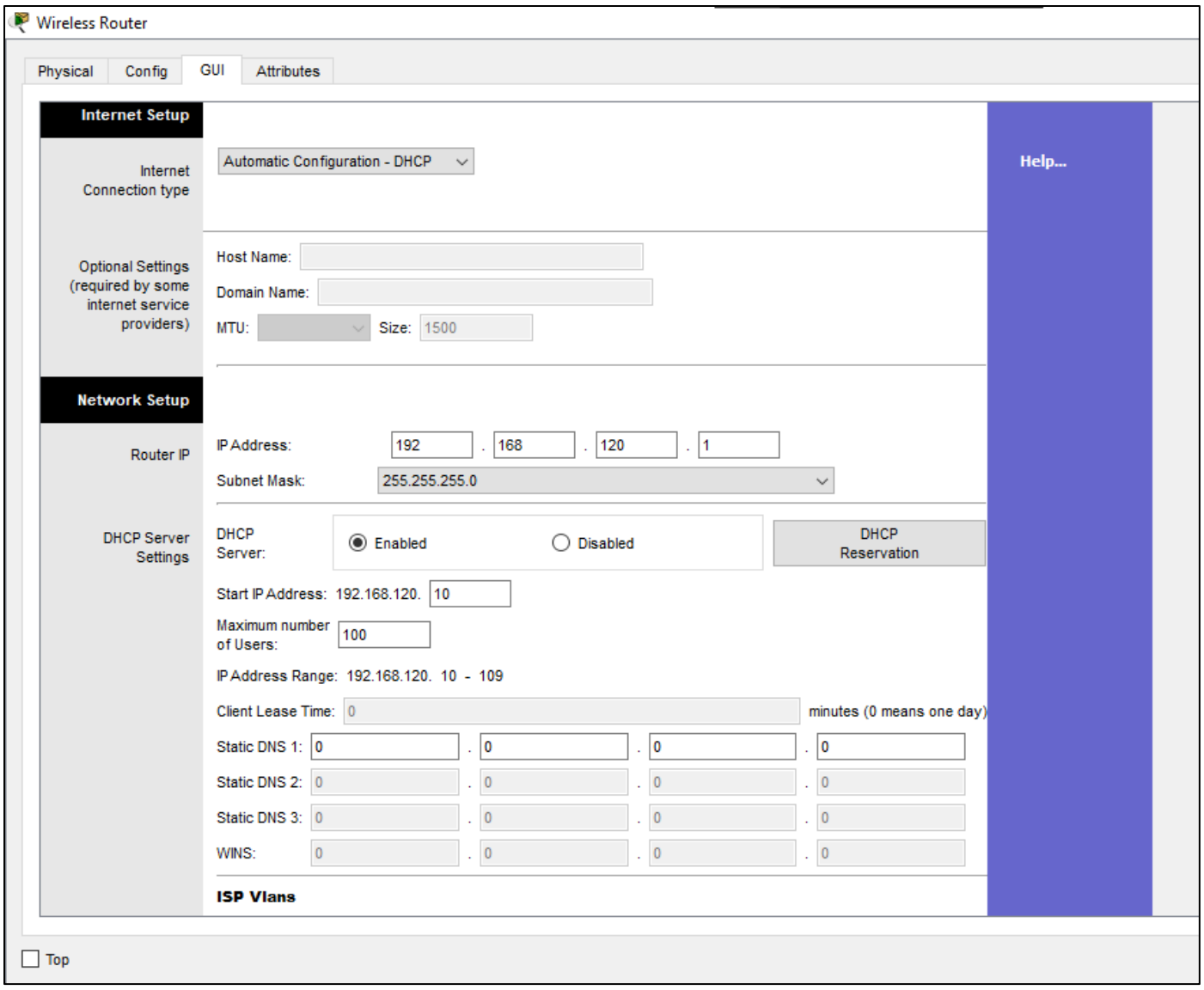
TFTP Server: 192.168.144.250

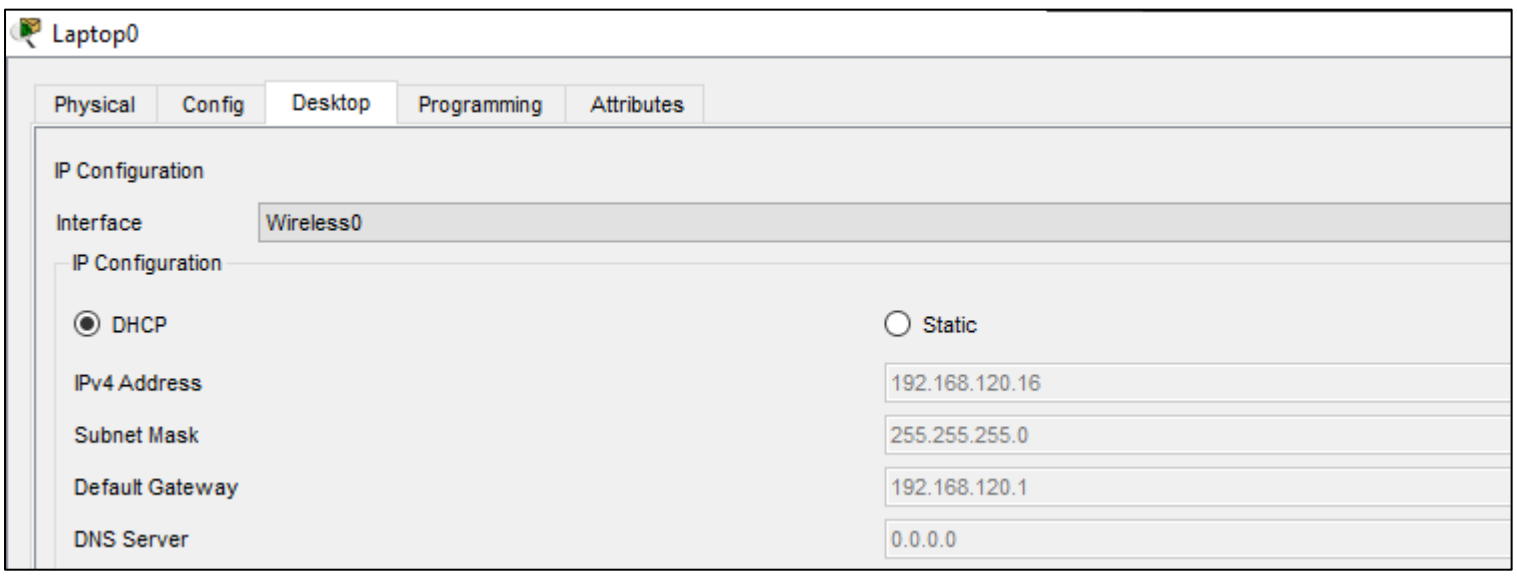
WLC Address: 0.0.0.0

Add | Save | Remove

Pool Name	Default Gateway	DNS Server	Start IP Address	Subnet Mask	Max User	TFTP Server	WLC Address
HRM-Pool	192.168.120.254	192.168.144.250	192.168.120.193	255.255.255.192	62	192.168.144.250	0.0.0.0
F-Pool	192.168.120.190	192.168.144.250	192.168.120.129	255.255.255.192	62	192.168.144.250	0.0.0.0
O-Pool	192.168.120.126	192.168.144.250	192.168.120.65	255.255.255.192	62	192.168.144.250	0.0.0.0
S&M-Pool	192.168.120.62	192.168.144.250	192.168.120.1	255.255.255.192	62	192.168.144.250	0.0.0.0
serverPool	0.0.0.0	0.0.0.0	192.168.144.248	255.255.255.248	512	0.0.0.0	0.0.0.0

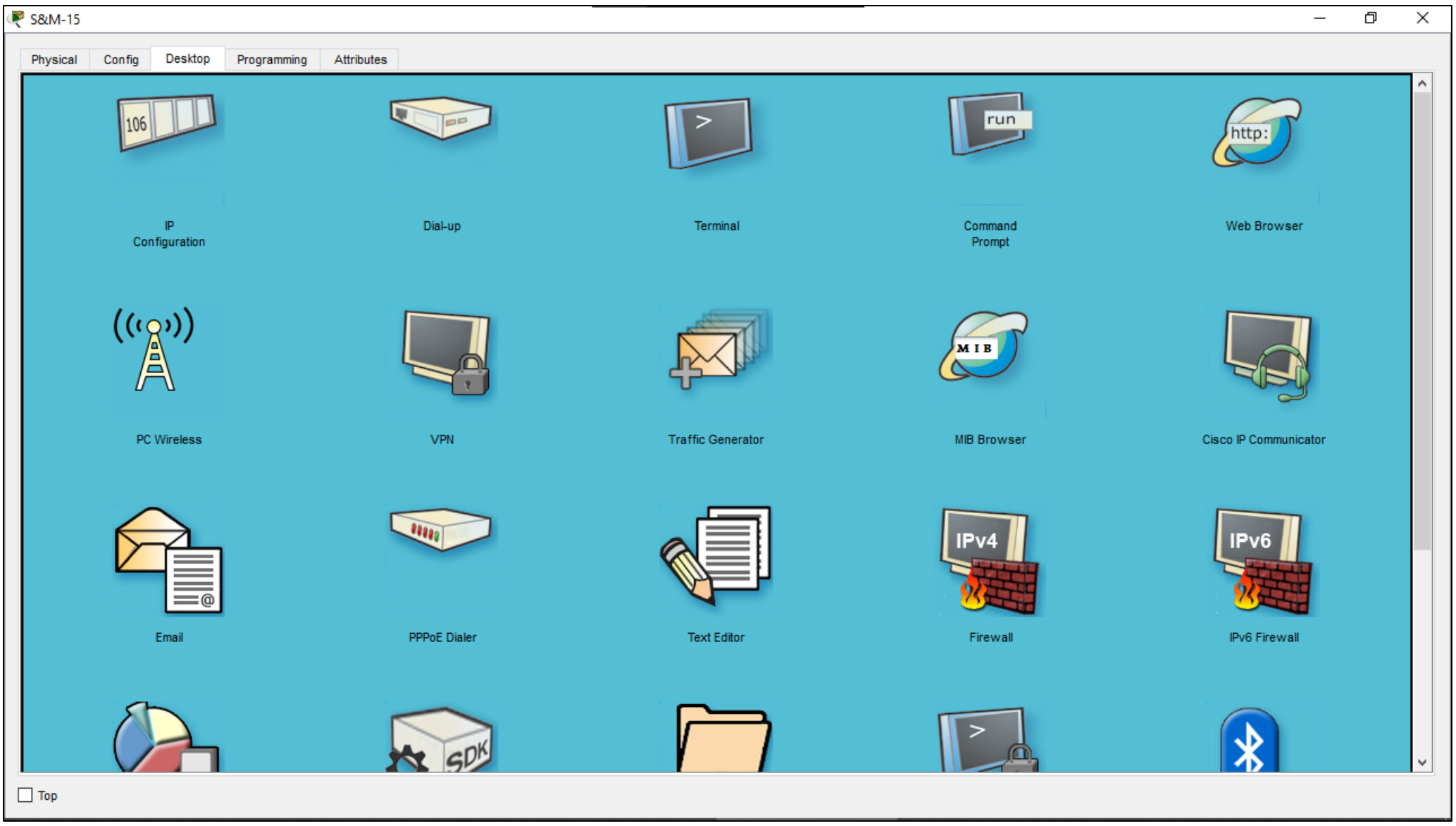
Top

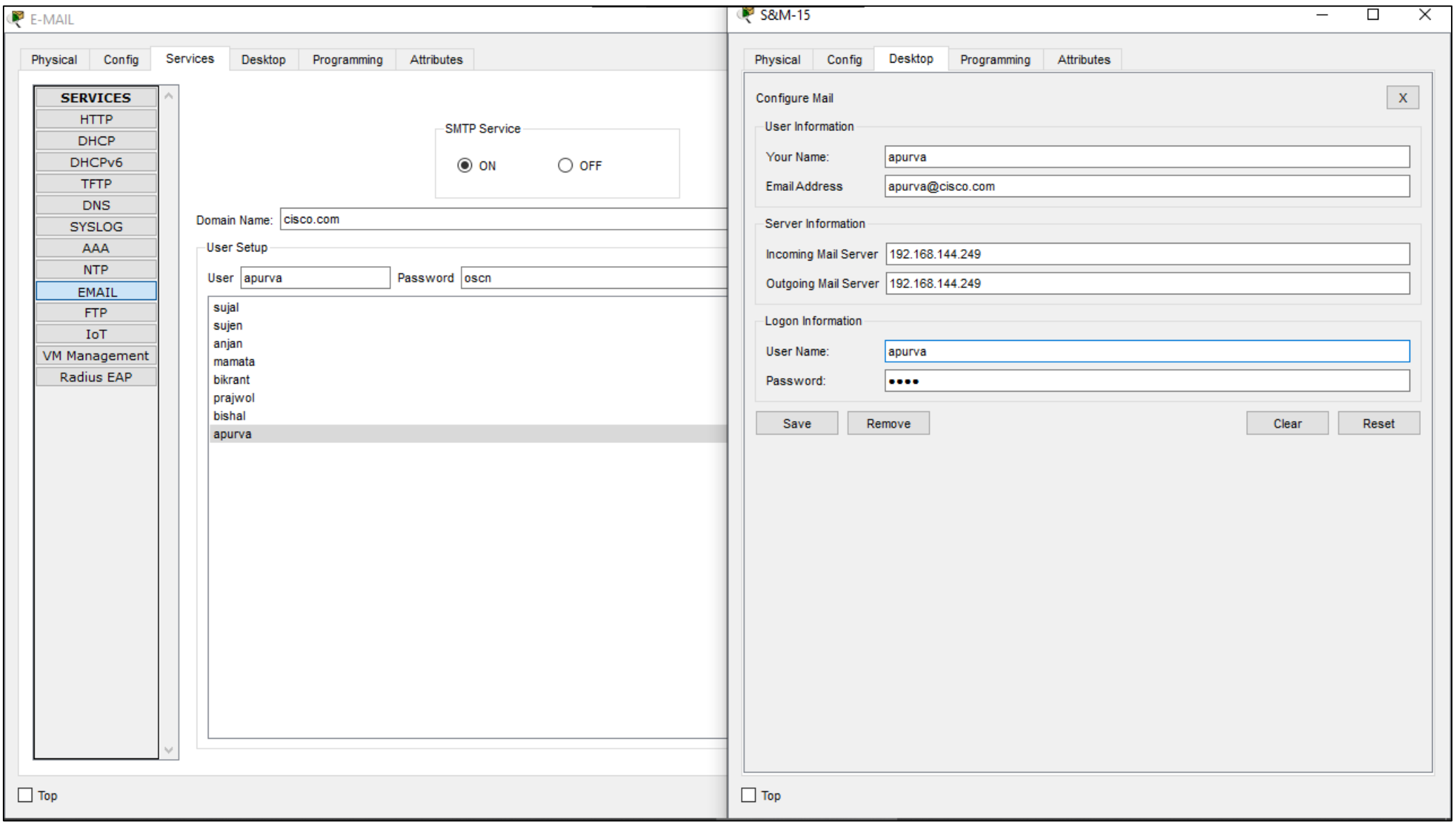




EMAIL

- System that transmits and receives email.
- Extremely effective communication technique to communicate
- Typed message is digitally transmitted over the internet instead of envelope and stamps


S&M-15
Physical
Config
Desktop
Programming
Attributes
IP Configuration
Dial-up
Terminal
Command Prompt
Web Browser
PC Wireless
VPN
Traffic Generator
MIB Browser
Cisco IP Communicator
Email
PPPoE Dialer
Text Editor
Firewall
IPv6 Firewall
Top


E-MAIL
Physical
Config
Services
Desktop
Programming
Attributes
SERVICES
HTTP
DHCP
DHCPv6
TFTP
DNS
SYSLOG
AAA
NTP
EMAIL
FTP
IoT
VM Management
Radius EAP
SMTP Service
ON
OFF
Domain Name: cisco.com
User Setup
User apurva
Password oscn
sujal
sujen
anjan
mamata
bikrant
prajwol
bishal
apurva
Top
S&M-15
Physical
Config
Desktop
Programming
Attributes
Configure Mail
X
User Information
Your Name: apurva
Email Address apurva@cisco.com
Server Information
Incoming Mail Server 192.168.144.249
Outgoing Mail Server 192.168.144.249
Logon Information
User Name: apurva
Password: ••••
Save
Remove
Clear
Reset
Top

S&M-15

Physical | Config | Desktop | Programming | Attributes

Compose Mail

X

Send

To: sujal@cisco.com

Subject: checking email services

check working of email server services

S&M-1

Physical | Config | Desktop | Programming | Attributes

MAIL BROWSER

X

Mails

Compose | Reply | Receive | Delete | Configure Mail

	From	Subject	Received
1	apurva@cisco.com	checking email services	Tue Jul 4 2023 23:05:37

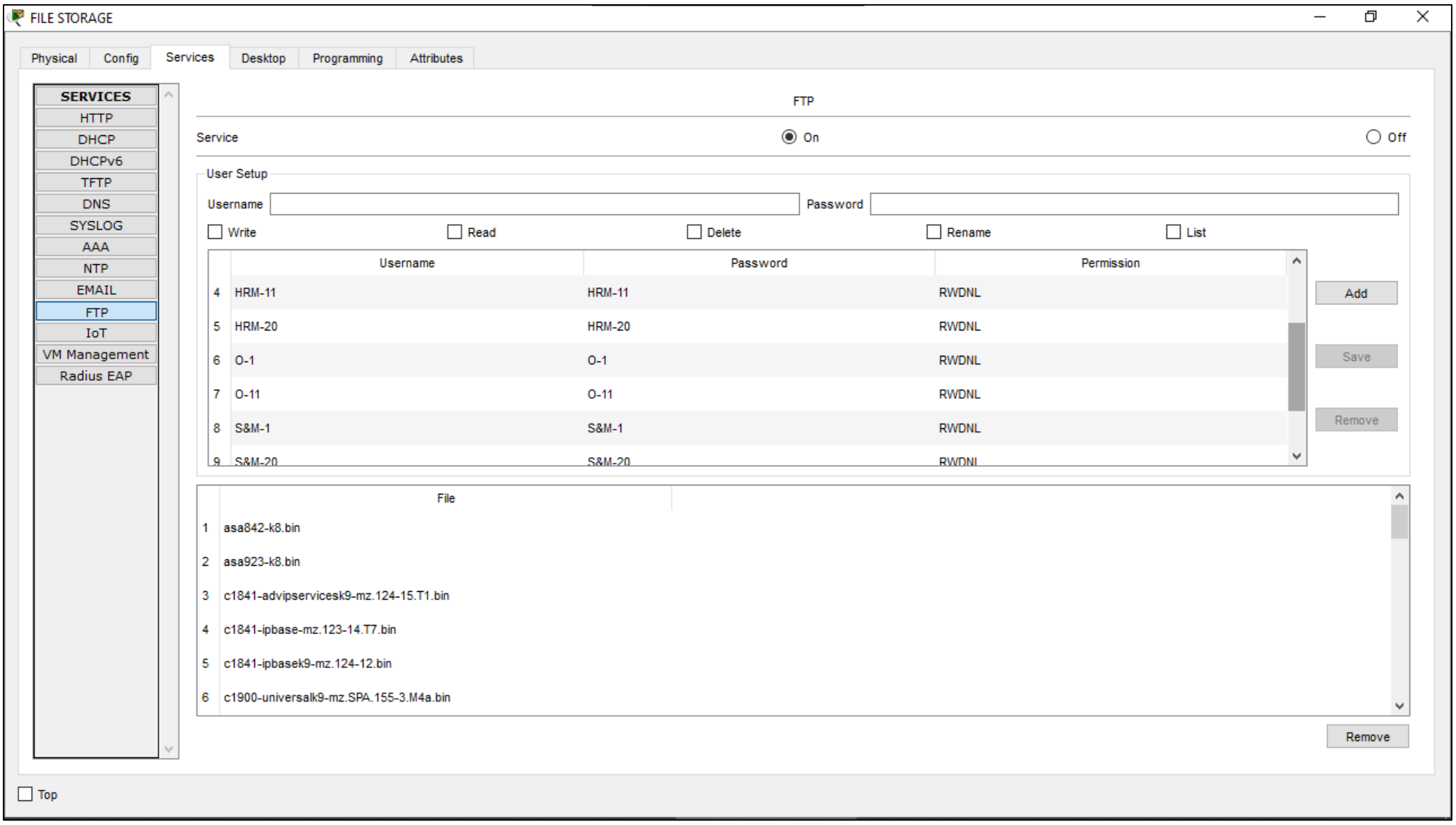
Receiving mail from POP3 Server 192.168.144.249
Receive Mail Success.

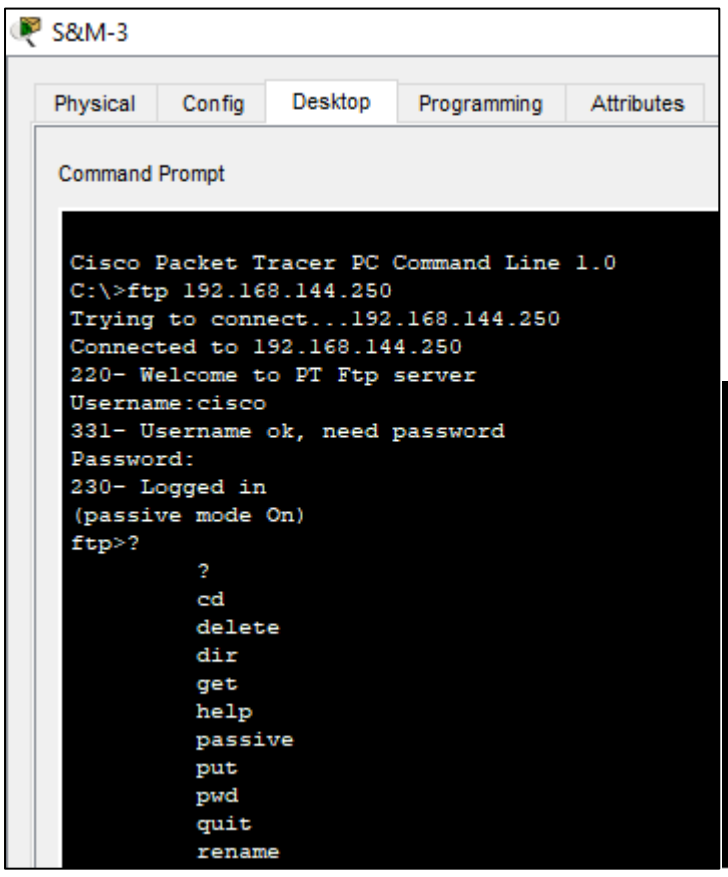
Cancel
Send/Receive

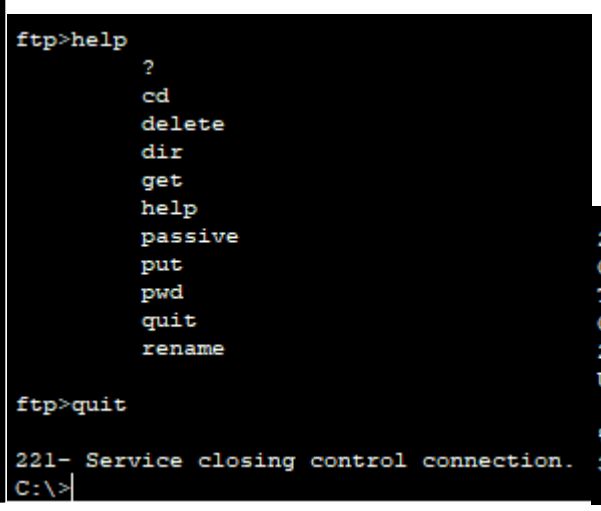
Top

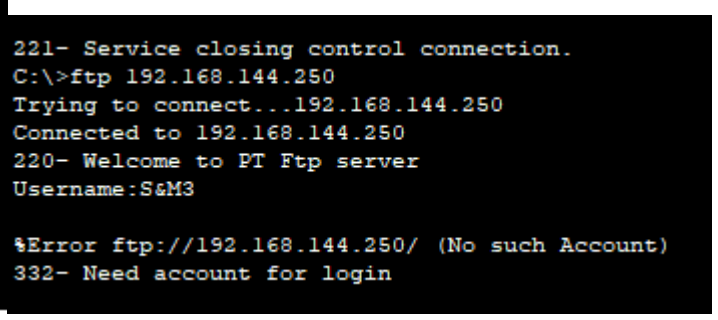
FTP: File Transfer

- Use TCP/IP connections to send files between computers using FTP
- End user – local host, server – remote host









3.3.3. Security

- Network is secure from external threats, which will help in preventing data breaches and cyber-attacks.
- There are a lot of techniques to protect the network from interior and exterior attackers
- Using strong security Firewall, router, switches policies and procedures

3.3.4. Fault tolerance

That the network can recover from failures, which will help in maintaining network uptime.

3.3.5. Other issue identification and resolve

a. Hierarchical model
b. Connected to isp with dsl and cable modem
c. Configure basic device settings hostnames, console passwords, enable passwords, banner messages, disable ip domain lookup
d. Multilayer switch should be able to carry both routing and switching functionalities
e. Wireless network obtains ip address dynamically form dhcp server and pool
f. Using ospf routing
g. Configure ssh for remote login
h. Configure port security
i. Configure nat pat to outbound interface, using acl rules

3.4. International Standard Organization Common Language/Command Line Interface

Basic settings plus ssh on router and switches Multi-Layer Switch

S&M
Switch> enable
Switch# configure terminal
Switch (config) # hostname S&M-MLS
S&M-MLS (config) # banner motd #!! NO UN-AUTHORIZED ACCESS !!#
S&M-MLS (config) # no ip domain lookup
S&M-MLS (config) # line console 0
S&M-MLS (config-line) # password cisco
S&M-MLS (config-line) # login
S&M-MLS (config-line) # exit
S&M-MLS (config) # enable password cisco
S&M-MLS (config) # service password-encryption
S&M-MLS (config) # do write
S&M-MLS (config) # exit
Control-C/Z

F
Switch> enable
Switch# configure terminal
Switch (config) # hostname F-MLS
F-MLS (config) # banner motd #!! NO UN-AUTHORIZED ACCESS !!#
F-MLS (config) # no ip domain lookup
F-MLS (config) # line console 0
F-MLS (config-line) # password cisco
F-MLS (config-line) # login
F-MLS (config-line) # exit
F-MLS (config) # enable password cisco
F-MLS (config) # service password-encryption
F-MLS (config) # do write
F-MLS (config) # exit

Control-C/Z

O

Switch> enable

Switch# configure terminal

Switch (config) # hostname O-MLS

O-MLS (config) # banner motd #!! NO UN-AUTHORIZED ACCESS !!#

O-MLS (config) # no ip domain lookup

O-MLS (config) # line console 0

O-MLS (config-line) # password cisco

O-MLS (config-line) # login

O-MLS (config-line) # exit

O-MLS (config) # enable password cisco

O-MLS (config) # service password-encryption

O-MLS (config) # do write

O-MLS (config) # exit

Control-C/Z

HRM

Switch> enable

Switch# configure terminal

Switch (config) # hostname HRM-MLS

HRM-MLS (config) # banner motd #!! NO UN-AUTHORIZED ACCESS !!#

HRM-MLS (config) # no ip domain lookup

HRM-MLS (config) # line console 0

HRM-MLS (config-line) # password cisco

HRM-MLS (config-line) # login

HRM-MLS (config-line) # exit

HRM-MLS (config) # enable password cisco

HRM-MLS (config) # service password-encryption

HRM-MLS (config) # do write

HRM-MLS (config) # exit

Control-C/Z

SVR

Switch> enable

Switch# configure terminal

Switch (config) # hostname SVR-MLS

SVR-MLS (config) # banner motd #!! NO UN-AUTHORIZED ACCESS !!#

SVR-MLS (config) # no ip domain lookup

SVR-MLS (config) # line console 0

SVR-MLS (config-line) # password cisco

SVR-MLS (config-line) # login

SVR-MLS (config-line) # exit

SVR-MLS (config) # enable password cisco

SVR-MLS (config) # service password-encryption

SVR-MLS (config) # do write

SVR-MLS (config) # exit

Control-C/Z

MAIN MLS

Switch> enable

Switch# configure terminal

Switch (config) # hostname MLS-Main

MLS-Main (config) # banner motd #!! NO UN-AUTHORIZED ACCESS !!#

MLS-Main (config) # no ip domain lookup

MLS-Main (config) # line console 0

MLS-Main (config-line) # password cisco

MLS-Main (config-line) # login

MLS-Main (config-line) # exit

MLS-Main (config) # enable password cisco

MLS-Main (config) # service password-encryption

MLS-Main (config) # do write

MLS-Main (config) # ip domain-name cisco.net

MLS-Main (config) #username admin password cisco

MLS-Main (config) # crypto key generates rsa 1024

MLS-Main (config) # line vty 0 15

```
MLS-Main (config-line) #login-local
MLS-Main (config-line) # transport input ssh
MLS-Main (config-line) # exit
MLS-Main (config) # ip ssh version 2
MLS-Main (config) # do write
Control-C/Z
```

Router

```
Router> enable
Router# configure terminal
Router (config) # hostname RTR-Main
RTR-Main (config) # banner motd #!! NO UN-AUTHORIZED ACCESS !!#
RTR-Main (config) # no ip domain lookup
RTR-Main (config) # line console 0
RTR-Main (config-line) # password cisco
RTR-Main (config-line) # login
RTR-Main (config-line) # exit
RTR-Main (config) # enable password cisco
RTR-Main (config) # service password-encryption
RTR-Main (config) # do write
RTR-Main (config) # ip domain-name cisco.net
RTR-Main (config) #username admin password cisco
RTR-Main (config) # crypto key generate rsa: 1024
RTR-Main (config) # line vty 0 15
RTR-Main (config-line) #login-local
RTR-Main (config-line) # transport input ssh
RTR-Main (config-line) # exit
RTR-Main (config) # ip ssh version 2
RTR-Main (config) # do write
```

Vlan assignments plus access and trunk port L3 depart with Switchport security

S&M-MLS

Password: cisco

S&M-MLS> enable

Password: cisco

S&M-MLS# configure terminal

S&M-MLS (config) # vlan 10

S&M-MLS (config-vlan) # name S&M

S&M-MLS (config-vlan) # exit

S&M-MLS (config) # interface range Gig1/0/1-24

S&M-MLS (config-if-range) # switchport mode access

S&M-MLS (config-if-range) # switchport access vlan 10

S&M-MLS (config-if-range) # exit

S&M-MLS (config) # do write

F-MLS

Password: cisco

F-MLS> enable

Password: cisco

F-MLS# configure terminal

F-MLS (config) # vlan 20

F-MLS (config-vlan) # name F

F-MLS (config-vlan) # exit

F-MLS (config) # interface range Gig1/0/1-24

F-MLS (config-if-range) # switchport mode access

F-MLS (config-if-range) # switchport access vlan 20

F-MLS (config-if-range) # exit

F-MLS (config) # do write

O-MLS

Password: cisco

O-MLS> enable

Password: cisco

O-MLS# configure terminal

O-MLS (config) # vlan 30

O-MLS (config-vlan) # name O

O-MLS (config-vlan) # exit

O-MLS (config) # interface range Gig1/0/1-24

O-MLS (config-if-range) # switchport mode access

O-MLS (config-if-range) # switchport access vlan 30

O-MLS (config-if-range) # exit

O-MLS (config) # do write

HRM-MLS

Password: cisco

HRM-MLS> enable

Password: cisco

HRM-MLS# configure terminal

HRM-MLS (config) # vlan 40

HRM-MLS (config-vlan) # name HRM

HRM-MLS (config-vlan) # exit

HRM-MLS (config) # interface range Gig1/0/1-24

HRM-MLS (config-if-range) # switchport mode access

HRM-MLS (config-if-range) # switchport access vlan 40

HRM-MLS (config-if-range) # exit

HRM-MLS (config) # do write

SVR-SW

Password: cisco

SVR-SW> enable

Password: cisco

SVR-SW# configure terminal

SVR-SW (config) # vlan 50

SVR-SW (config-vlan) # name SVR

SVR-SW (config-vlan) # exit

SVR-SW (config) # interface Gig0/1

```
SVR-SW (config-if) # switchport mode access
SVR-SW (config-if) # switchport access vlan 50
SVR-SW (config-if) # switchport port-security maximum 1
SVR-SW (config-if) # switchport port-security mac-address sticky
SVR-SW (config-if) # switchport port-security violation shutdown

SVR-SW (config) # interface Gig1/1
SVR-SW (config-if) # switchport mode access
SVR-SW (config-if) # switchport access vlan 50
SVR-SW (config-if) # switchport port-security maximum 1
SVR-SW (config-if) # switchport port-security mac-address sticky
SVR-SW (config-if) # switchport port-security violation shutdown

SVR-SW (config) # interface Gig2/1
SVR-SW (config-if) # switchport mode access
SVR-SW (config-if) # switchport access vlan 50
SVR-SW (config-if) # switchport port-security maximum 1
SVR-SW (config-if) # switchport port-security mac-address sticky
SVR-SW (config-if) # switchport port-security violation shutdown

SVR-SW (config) # interface Gig3/1
SVR-SW (config-if) # switchport mode access
SVR-SW (config-if) # switchport access vlan 50
SVR-SW (config-if) # switchport port-security maximum 1
SVR-SW (config-if) # switchport port-security mac-address sticky
SVR-SW (config-if) # switchport port-security violation shutdown

SVR-SW (config) # interface Gig4/1
SVR-SW (config-if) # switchport mode access
SVR-SW (config-if) # switchport access vlan 50
SVR-SW (config-if) # switchport port-security maximum 1
SVR-SW (config-if) # switchport port-security mac-address sticky
```

SVR-SW (config-if) # switchport port-security violation shutdown

SVR-SW (config) # do write

SVR-SW (config) # do show port-security

MLS-Main

MLS-Main> enable

Password: cisco

MLS-Main# configure terminal

MLS-Main (config) # interface range gig1/0/1-5

MLS-Main (config-if-range) # switchport mode trunk

MLS-Main (config-if-range) # exit

MLS-Main (config) # vlan 10

MLS-Main (config-vlan) # name S&M

MLS-Main (config-vlan) # exit

MLS-Main (config) # vlan 20

MLS-Main (config-vlan) # name F

MLS-Main (config-vlan) # exit

MLS-Main (config) # vlan 30

MLS-Main (config-vlan) # name O

MLS-Main (config-vlan) # exit

MLS-Main (config) # vlan 40

MLS-Main (config-vlan) # name HRM

MLS-Main (config-vlan) # exit

MLS-Main (config-vlan) # exit

MLS-Main (config) # vlan 50

MLS-Main (config-vlan) # name SVR

MLS-Main (config-vlan) # exit

MLS-Main (config) # do write

MLS-Main (config-if) # int g1/0/1

MLS-Main (config-if) # sw m a

MLS-Main (config-if) # sw a v 10

MLS-Main (config-if) # int g1/0/2

MLS-Main (config-if) # sw m a

MLS-Main (config-if) # sw a v 20

MLS-Main (config-if) # int g1/0/3

MLS-Main (config-if) # sw m a

MLS-Main (config-if) # sw a v 30

MLS-Main (config-if) # int g1/0/4

MLS-Main (config-if) # sw m a

MLS-Main (config-if) # sw a v 40

MLS-Main (config-if) # int g1/0/5

MLS-Main (config-if) # sw m a

MLS-Main (config-if) # sw a v 50

MLS-Main (config-if) #end

MLS-Main(config)#int g1/0/24

MLS-Main(config-if) #switchport trunk encapsulation dot1q

MLS-Main(config-if) #switchport mode trunk

Main Office Router

Router>en

Router#conf t

Router(config)#int g1/0.10

Router(config-subif) #encapsulation dot1Q 10

Router(config-subif) #ip address 192.168.144.30 255.255.255.224

Router(config-subif) #ex

Router(config)#int g1/0.20

Router(config-subif) #encapsulation dot1Q 20

Router(config-subif) #ip address 192.168.144.62 255.255.255.224

Router(config-subif) #ex

Router(config)#int g1/0.30

Router(config-subif) #encapsulation dot1Q 30

Router(config-subif) #ip address 192.168.144.94 255.255.255.224

Router(config-subif) #ex

Router(config)#int g1/0.40

```
Router(config-subif) #encapsulation dot1Q 40
Router(config-subif) #ip address 192.168.144.126 255.255.255.224
Router(config-subif) #ex
Router(config)#int g1/0.50
Router(config-subif) #encapsulation dot1Q 50
Router (config-subif) #ip address 192.168.144.254 255.255.255.248
Router(config-subif) #ex
Router(config)#do war

Router(config)#service duck
Router(config)#ip duck pool S&M-pool
Router(dhcp-config) #network 192.168.144.0 255.255.255.224
Router(dhcp-config) #default-router 192.168.144.30
Router(dhcp-config) #dns-server 192.168.144.30
Router(dhcp-config) #ex

Router(config)#ip dhcp pool F-pool
Router(dhcp-config) #network 192.168.144.32 255.255.255.224
Router(dhcp-config) #default-router 192.168.144.62
Router(dhcp-config) #dns-server 192.168.144.62
Router(dhcp-config) #ex

Router(config)#ip dhcp pool O-pool
Router(dhcp-config) #network 192.168.144.64 255.255.255.224
Router(dhcp-config) #default-router 192.168.144.94
Router(dhcp-config) #dns-server 192.168.144.94
Router(dhcp-config) #ex

Router(config)#ip dhcp pool HRM-pool
Router(dhcp-config) #network 192.168.144.96 255.255.255.224
Router(dhcp-config) #default-router 192.168.144.126
Router(dhcp-config) #dns-server 192.168.144.126
```

```
Router(dhcp-config) #ex
Router(config)#do wr
```

Subnet ip

```
MLS-Main
MLS-Main (config) # interface range gig1/0/24
MLS-Main (config-if-range) # no switchport
MLS-Main (config-if-range) # exit
MLS-Main (config) # do write
MLS-Main (config) # interface gig1/0/24
MLS-Main (config-if) # ip address 192.168.144. 255.255.255.252
MLS-Main (config-if) # no shutdown
MLS-Main (config) # do write


RTR-Main
Password: cisco
RTR-Main> enable
Password: cisco
RTR-Main# configure terminal
RTR-Main (config) # interface gig1/0
RTR-Main (config-if) # ip address 192.168.144. 255.255.255.252
RTR-Main (config-if) # no shutdown
```

Ospf on router and switches

```
MLS-Main
MLS-Main> enable
Password: cisco
MLS-Main# configure terminal
MLS-Main (config) # ip routing
MLS-Main (config) # router ospf 10
MLS-Main (config- router) # router-ip 1.1.1.1
MLS-Main (config- router) # network 192.168.144.0 0.0.0.31 area 0
MLS-Main (config- router) # network 192.168.144.32 0.0.0.31 area 0
```

```
MLS-Main (config- router) # network 192.168.144.64 0.0.0.31 area 0
MLS-Main (config- router) # network 192.168.144.96 0.0.0.31 area 0
MLS-Main (config- router) # network 192.168.144.248 0.0.0.7 area 0
MLS-Main (config- router) # network 192.168.144. 0.0.0.3 area 0
MLS-Main (config- router) # network 192.168.144.0 0.0.0.31 area 0
MLS-Main (config- router) # exit
MLS-Main (config) # do reload
Yes
MLS-Main (config) # do show ip ospf neighbour
MLS-Main (config) # do clear ip ospf process
yes
```

Inter vlan rioting plus ip dhcp helper address

```
MLS-Main
MLS-Main> enable
MLS-Main# configure terminal
MLS-Main (config) # int vlan 10
MLS-Main (config-if) # no shut
MLS-Main (config-if) # ip address 192.168.144.0 255.255.255.224
MLS-Main (config-if) # ip helper-address 192.168.144.250
MLS-Main (config-if) # exit
MLS-Main (config) # int vlan 20
MLS-Main (config-if) # no shut
MLS-Main (config-if) # ip address 192.168.144.0 255.255.255.224
MLS-Main (config-if) # ip helper-address 192.168.144.250
MLS-Main (config-if) # exit
MLS-Main (config) # int vlan 30
MLS-Main (config-if) # no shut
MLS-Main (config-if) # ip address 192.168.144.0 255.255.255.224
MLS-Main (config-if) # ip helper-address 192.168.144.250
MLS-Main (config-if) # exit
MLS-Main (config) # int vlan 40
MLS-Main (config-if) # no shut
```

```
MLS-Main (config-if) # ip address 192.168.144.0 255.255.255.224
MLS-Main (config-if) # ip helper-address 192.168.144.250
MLS-Main (config-if) # exit
MLS-Main (config) # int vlan 50
MLS-Main (config-if) # no shut
MLS-Main (config-if) # ip address 192.168.144.0 255.255.255.224
MLS-Main (config-if) # ip helper-address 192.168.144.250
MLS-Main (config-if) # exit
MLS-Main (config) # do write
```

Pat + acl +default static route

```
RTR-Main
RTR-Main> enable
RTR-Main# configure terminal
RTR-Main (config) # ip nat inside source list 1 interface gig0/0 overload
RTR-Main (config) # access-list 1 permit 192.168.144.0 0.0.0.31
RTR-Main (config) # access-list 1 permit 192.168.144.32 0.0.0.31
RTR-Main (config) # access-list 1 permit 192.168.144.64 0.0.0.31
RTR-Main (config) # access-list 1 permit 192.168.144.96 0.0.0.31
RTR-Main (config) # access-list 1 permit 192.168.144.248 0.0.0.7
RTR-Main (config) # int gig1/0
RTR-Main (config-if) # ip nat inside
RTR-Main (config-if) # exit
RTR-Main (config) # int gig0/0
RTR-Main (config-if) # ip nat outside
RTR-Main (config-if) # exit
RTR-Main (config) # int gig1/0
RTR-Main (config-if) # ip nat inside
RTR-Main (config-if) # do write


MLS-Main (config) # Ip route 0.0.0.0 0.0.0.0 gig1/0/24
```

ASA0

```
ciscoasa>enable
Password: [ENTER]
ciscoasa#configure terminal
```

Host and Domain name

```
ciscoasa(config)#hostname ISP-ASA
ISP-ASA (config)#domain-name companyciscosecurity.com
ISP-ASA (config)#enable password cisco
ISP-ASA (config)#ex
ISP-ASA#ex


ISP-ASA>en
Password: cisco
ISP-ASA#conf t
ISP-ASA (config)#int g1/2
ISP-ASA (config-if) #sw m a
ISP-ASA (config-if) #int vlan 99
ISP-ASA (config-if) #ex
```

assign ip on asa and isp

```
Router>enable
Router#configure terminal
Router(config)#interface GigabitEthernet0/0
Router(config-if) #no shutdown
Router(config-if) #no ip address
Router(config-if) #ip address 10.10.10.1 255.0.0.0
Router(config-if) #ip address 10.10.10.1 255.255.255.252


Router>enable
Router#configure terminal
Router(config)#interface GigabitEthernet0/0
```

```
ISP-ASA (config-if) #exit
ISP-ASA  (config)#interface  GigabitEthernet1/1ISP-ASA (config-if) #ip address 10.10.10.2 255.0.0.0
ISP-ASA (config-if) #ip address 10.10.10.2 255.255.255.252
ISP-ASA (config-if) #exit
ISP-ASA (config)#interface GigabitEthernet1/2
ISP-ASA (config)#interface GigabitEthernet1/3
ISP-ASA (config-if) #ip address 8.8.8.1 255.0.0.0
ISP-ASA (config-if) #ip address 8.8.8.1 255.0.0.0
ISP-ASA (config-if) #ex
```

Router(config-if) #ip address 192.168.120.2 255.255.255.252 Router(config)#int g0/1/0 Router(config-if) #ip add 20.1.1.1 255.0.0.0 Router(config-if) #sw m a Router(config-if) #ip address 10.10.10.1 255.255.0.0 Router(config-if) #ex	ISP-ASA>enable ISP-ASA>ip address 192.168.216.1 255.255.255.252 Router>ip address 192.168.216.2 255.255.255.252

set inside dmz outside

ISP-ASA (config)#int g1/2

ISP-ASA (config-if) #no shut

ISP-ASA (config-if) #nameif INSIDE

ISP-ASA (config-if) #ip address 192.168.120.1 255.255.255.0

ISP-ASA (config-if) #security-level 100

ISP-ASA (config-if) #exit

ISP-ASA (config)#int g1/1

ISP-ASA (config-if) #no shut

ISP-ASA (config-if) #nameif OUTSIDE

ISP-ASA (config-if) #security-level 0

ISP-ASA (config-if) #exit

ISP-ASA (config)#int g1/3

ISP-ASA (config-if) #no shut

ISP-ASA (config-if) #nameif DMZ

ISP-ASA (config-if) #security-level 50

ISP-ASA (config-if) #wr me

ISP-ASA (config-if) #exit

ISP-ASA (config)#interface GigabitEthernet1/2

```
ISP-ASA (config-if) #ip address 192.168.120.1 255.255.255.252

ISP-ASA (config-if) #ex
```

configure dhcp and dns ip

```
ISP-ASA (config)#dhcpd address 192.168.120.10-192.168.120.160 INSIDE

ISP-ASA (config)#dhcpd dns 192.168.120.1

ISP-ASA (config)#dhcpd enable INSIDE

ISP-ASA (config)#ex

ISP-ASA#wr me
```

configure default route

```
ISP-ASA#en

ISP-ASA#conf t

ISP-ASA (config)#route outside 0.0.0.0 0.0.0.0 10.10.10.1
```

configure ospf on isp

```
Router#conf t

Router(config)#router ospf 1

Router(config-router) #network 10.10.10.0 0.0.0.3 area 0
```

create object network

```
ISP-ASA (config)#object network LAN

ISP-ASA (config-network-object) #subnet 192.168.120.0 255.255.255.252
```

enable nat

```
ISP-ASA (config-network-object) #nat (inside, outside) dynamic interface

ISP-ASA (config-network-object) #ex
```

create acl

```
ISP-ASA#conf t
ISP-ASA (config)#access-list COMPANY2INTERNET extended permit tcp any top
ISP-ASA (config)#access-list COMPANY2INTERNET extended permit icmp any any
ISP-ASA (config)#access-group COMPANY2INTERNET IN interface OUTSIDE
ISP-ASA#show nat
ISP-ASA#show xlate
```

```
Router>enable
Router#configure terminal
Router(config)#interface GigabitEthernet1/0
Router(config-if) #ip address 192.168.120.1 255.255.255.0


Router>en
Router#conf t
Router(config)#ip dhcp pool WIRELESS
Router(dhcp-config)#network 192.168.120.1 255.255.255.0
Router(dhcp-config)#default-router 192.168.120.2
Router(dhcp-config)#dns-server 192.168.120.3
Router(dhcp-config)#ex
Router(config)#ip dhcp excluded-address 192.168.120.2 192.168.120.10
Router(config)#ex


MLS-Main>enable
MLS-Main#configure terminal
MLS-Main(config)#interface GigabitEthernet1/1/1
MLS-Main(config-if)#no switchport
MLS-Main(config-if)#interface GigabitEthernet1/1/2
MLS-Main(config-if)#no switchport
MLS-Main(config-if)#interface GigabitEthernet1/1/3
MLS-Main(config-if)#no switchport
```

```
MLS-Main(config-if)#interface GigabitEthernet1/1/4
MLS-Main(config-if)#no switchport
MLS-Main(config-if)#exit
MLS-Main(config)#interface GigabitEthernet1/1/1
MLS-Main(config-if)#ip address 192.168.120.62 255.255.255.192
MLS-Main(config-if)#exit
MLS-Main(config)#interface GigabitEthernet1/1/2
MLS-Main(config-if)#ip address 192.168.120.126 255.255.255.192
MLS-Main(config-if)#ip address 192.168.120.126 255.255.255.192
MLS-Main(config-if)#exit
MLS-Main(config)#interface GigabitEthernet1/1/3
MLS-Main(config-if)#ip address 192.168.120.190 255.255.255.192
MLS-Main(config-if)#ip address 192.168.120.190 255.255.255.192
MLS-Main(config-if)#exit
MLS-Main(config)#interface GigabitEthernet1/1/4
MLS-Main(config-if)#ip address 192.168.120.254 255.255.255.192
MLS-Main(config-if)#ip address 192.168.120.254 255.255.255.192
```

3.5. Creativity and originality in network design

3.5.1. Using innovative technologies

Multi-layer switch

- Combines layer 2, 3 and 4 exchanging advances
- Provides high-speed scalability with low latency. It is mostly used mostly within internal networks
- Low in cost with high port density. It can move traffic at wire speed and also provides layer 3 routing.
- Permit for network between diverse gadgets and organize
- User-friendly interfacing that makes it simple for clients to arrange
- Can be overseen remotely, permitting for simple investigating and arrangement changes indeed when the client isn't physically display.

Firewall

- Cisco ASA stands for adaptive security appliance.
- That combines firewall, antivirus, interference shirking, and virtual private organize (VPN) capabilities.
- It gives proactive danger defense that stops assaults some time recently they spread through the arrange.
- A valuable and flexible device used as a security solution for both small and large networks.
- An equipment or program gadget that sits as a rule at the edge of a arrange and gives security by permitting or denying activity based upon a set of pre-configured rules.
- Prevent unauthorized traffic from entering the network from the outside or being passed between security zones internally within a network.
- Stateful firewall keeps track of all the sessions that have been started from client gadgets interior the organize and permits the reacting activity from exterior the arrange to pass through to the starting gadget.
- checks an get to control list to see on the off chance that the source or goal IP address (and/or ports) of the approaching bundle is permitted get to makes the organize or not.
- Numerous physical interfacing which can be encourage isolated into “sub-interfaces” utilizing VLANs.

3.5.2. Performance enhancing solutions

Using a gigabit ethernet is an enlargement and improvement in network as it also sends and receive a signal much faster than with a fast ethernet connection. It moreover has way better transmission capacity which interprets to a capacity to capture more information at once, you'll too take note a speedier in general encounter because it increments web speed as they give 1 GBPS and more whereas supporting full compatibility with hubs.

3.5.3. Security enhancing solutions

- Using ssh
- Assigning vlans
- Switchport security settings
- Set inside and outside on firewall
- Create object network
- Enable nat, Create acls

REFERENCES

Shemsi, "Boosting Campus Network Design Using Cisco Packet Tracer," International Journal of Innovative Science and Research Technology, vol. 2, no. 11, 2017

Network Basics Companion Guide, Cisco Networking Academy, Cisco Press, 2014.

Cisco Systems Inc. http://www.cisco.com

Todd Lammle, "CCNA", sixth Edition

Nathaniel S. Tarkaa, Paul I. Iannah, IsaacT. Iber "design and simulation of local area network using cisco pocket tracer", the International Journal of Engineering and Science (IJES), volume 6, issue 10, page 63-77, 2017

Paulami Pathak, Sayanti Majumder, Chandra mondal, prof. Manikandan K "College Network Scenario Implementation by Using Cisco Packet Tracer", International Journal of Advance Research in Computer and Communication Engineering (IJARCCE), volume 7, issue 1, January 2017.

Garima Jain, Nasreen Noorani, Nisha Kiran, Sourabh Sharma, Designing & simulation of topology network using Packet Tracer, International Research Journal of Engineering and Technology (IRJET), 2(2), 2015

P. Pathak, S. Majunder, C. Mondal, and M. K., "College Network Scenario Implementation by using Cisco Packet Tracer," International Journal of Advanced Research in Computer and Communication Engineering, vol. 7, no. 1, pp. 299-304, 2018

V. Sahiti, A. Nikhila Sri, S. Sunil Kumar, K. Phaneendra, Lakshman. P “Design Of An Enterprise Network Infrastructure For A Company Using Cisco Packet Tracer” , International Journal Of Scientific & Technology Research Volume 9, Issue 02, February 2020 Issn 2277-8616

N. Sanam, "Performance Evaluation of Wide Area Network using Cisco Packet Tracer," International Journal of Advanced Trends in Computer Science and Engineering, vol. 8, no. 6, pp. 2915-2919, 2019, doi: 10.30534/ijatcse/2019/38862019.

Shemsi, "Boosting Campus Network Design Using Cisco Packet Tracer," International Journal of Innovative Science and Research Technology, vol. 2, no. 11, 2017

Md. A. Hossain, and M. Zannat, "Simulation and Design of University Area Network Scenario(UANS) using Cisco Packet Tracer," Global Journal of Computer Science and Technology: G Interdisciplinary, vol. 19, no. 3, 2019, doi: 10.34257/GJCSTGVOL19IS3PG7.

Marking rubrics total marks: 100

Criteria	Full mark	Excellent	Good fair		Poor
		16~20	11~15	6~10	0~5
Problem analysis	20	The problem is clearly identified and well-defined with appropriate contextual details.	The problem is identified, but lacks contextual details or is not well-defined.	The problem is identified, but lacks clarity or relevance.	The problem is not clearly identified or is irrelevant.
Choice of devices with proper explanation	20	The student has identified multiple devices that are relevant and appropriate for the task.	The student has identified some devices that are relevant and appropriate for the task.	The student has identified some devices, but they are not all relevant or appropriate for the task.	The student has not identified any relevant or appropriate devices.
		The student has provided a clear and detailed explanation of why each device was chosen, including how it meets the task requirements and any advantages or disadvantages.	The student has provided a sufficient explanation of why each device was chosen, including how it meets the task requirements and any advantages or disadvantages.	The student has provided a brief or unclear explanation of why each device was chosen, including how it meets the task requirements and any advantages or disadvantages.	The student has not provided any explanation or justification for why each device was chosen.
Proper format: Cover page (with title, student name, student's id), table of content, include labels put on diagrams on screenshots Proper heading and sub-heading, appropriate paragraphing, page, numbering, references.	5	All formats were available, and all were correct.	Most formats were available, and most were correct.	Most formats were available but only some were correct.	Some formats were available but not correct.
		All images/screenshots are clear.	Most images/screenshots are clear.	Some images/screenshots are clear.	Most images/screenshots are blurry.

Design of the network using cisco packet tracer.	40	The student has designed a complex network topology that meets all the requirements, including redundancy, scalability, security, and efficiency.	The student has designed a network topology that meets most of the requirements, including redundancy, scalability, security, and efficiency.	The student has designed a network topology that meets some of the requirements, but lacks some key features or is not fully optimized.	The student has designed a network topology that does not meet the requirements and lacks essential features.
		The student has configured all network devices with appropriate settings, including IP addresses, VLANs, routing protocols, access control, and quality of service.	The student has configured most network devices with appropriate settings, but some configurations may be incomplete or incorrect.	The student has configured some network devices with appropriate settings, but some key configurations may be missing or incorrect.	The student has not configured network devices with appropriate settings or has made significant errors in the configuration.
		The student has tested the network design thoroughly, including connectivity, performance, security, and fault tolerance, and has identified and resolved any issues that arose.	The student has tested most aspects of the network design and has identified and resolved most issues that arose.	The student has tested some aspects of the network design and has identified and resolved some issues, but may have missed some key issues.	The student has not tested the network design thoroughly or has not identified and resolved issues that arose.
		The student has demonstrated creativity and originality in the network design, including the use of innovative technologies or solutions that enhance the performance or security of the network.	The student has demonstrated some creativity or originality in the network design, including the use of some innovative technologies or solutions that enhance the performance or security of the network.	The student has not demonstrated much creativity or originality in the network design and has relied on standard configurations and solutions.	The student has not demonstrated any creativity or originality in the network design and has used only basic configurations and solutions.

Presentation	15	Clear and concise in communication.	Clear communication.	Fairly clear communication.	Lacks sufficient clarity of communication.
		Fluent and easy to follow. Attractive presentation.	Effective style. Clear presentation.	Reasonable presentation.	Fails to show satisfactory style of presentation. Inappropriate modes of presentation.
		Effective modes of expression	Able to answer questions, although not fluently	Able to answer some of the questions	Unable to answer questions correctly
		Fluent when answering questions.	Good Participation by all members	Minimal Participation by all members	A member did not Participate
		Excellent Participation by all members	All members are punctual.	Some members are punctual.	Most members are not punctual.
		All members are punctual. Student demonstrates full knowledge by answering question with explanation and elaboration, without referring to notes	Student is at ease with expected answer to question, with elaboration but reading from notes	Student is uncomfortable with information and is able to answer the question, without elaboration and without referring to notes	Student has little grasp of information; Student answer the question about subject, without elaboration but reading from the notes