# COURSE NAME: CCN COURSE CODE: CT-376

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#### Complex Computing Problem Assessment Rubrics

Course Code: CT-376	Course Title: Computer Communication Networks		
Criteria and Scales			
Excellent (3) Criterion 1: Understanding	Good (2) the Problem: How well the prob	Average (1) lem statement is understood by the	Poor (0)
Understands the problem clearly and identify the underlying issues and functionalities.  Criterion 2: Research: The Contains all the	Adequately understands the problem and identifies the underlying issues and functionalities.  amount of research that is used it food research leads to a	Inadequately defines the problem and identifies the underlying issues and functionalities.  In solving the problem  Mediocre research which	Fails to define the problem adequately and does not identify the underlying issues and functionalities.  No apparent research
information needed for solving the problem	successful solution	may or may not lead to an adequate solution	
Criterion 3: Code: How complete the code is along with the assumptions?			
Complete the code according to the selected functionalities of the given case with clear assumptions	Incomplete code according to the selected functionalities of the given case with clear assumptions	Incomplete code accordingto the selected functionalities of the givencase with unclear assumptions	Wrong code and naming conventions
Criterion 4: Report: How thorough and well organized is the solution?			
All the necessary information is organized for easy use insolving the problem	Good information organized well could lead to a good solution	Mediocre information which may or may not lead to a solution	No report provided
Criterion 5: Labeling: How well defined and labeled is the solution?			
All the necessary information is labelled (i.e. port no.) for better understanding	Good information about the topology is labelled	Incomplete label according to the selected functionalitie	Not Labelled

# Report Coverage

- Introduction
- Network Topology Overview
- Configuration
  - DHCP Server Configuration
  - Dynamic Routing using RIP
  - VLAN Configuration
  - Static Routing Configuration
  - Telnet Configuration
  - VLSM
  - Link Aggregation
  - Spanning Tree Protocol (STP)
- Conclusion
- References

#### Introduction

The project on computer communication and networks is implementation of a network infrastructure within an organizational setting. The objective of this project is to design and configure a network that caters to the communication needs of different departments within any type of organization. By establishing a robust network topology, we aim to enhance connectivity, data sharing, and collaboration among the departments and respective heads of the departments, thereby promoting efficient information exchange and productivity.

Throughout this project report, we will delve into the detailed configuration steps, settings, and explanations for each aspect of the network infrastructure.

#### Introduction

The network architecture comprises the following departments along with their network IDs and gateways.

#### 1. Human Resources (HR)

a. Network: 40.40.40.0

b. Gateways: 40.40.40.1 & 40.40.40.9

c. Subnets: 29 and 30

#### 2. Research and Development (R&D)

a. Network: 60.60.60.0 b. Gateway: 60.60.60.1

c. Subnet: 24

#### 3. Marketing

a. Network: 20.20.20.0 b. Gateway: 20.20.20.1

c. Subnet: 24

#### 4. Sales

a. Network: 50.50.20.0 b. Gateway: 50.50.20.1

c. Subnet: 24

#### 5. Finance

a. Network: 50.50.10.0 b. Gateway: 50.50.10.1

c. Subnet: 24

#### 6. Information Technology (IT)

a. Network: 10.10.10.0 b. Gateway: 10.10.10.1

c. Subnet: 24

#### Overview

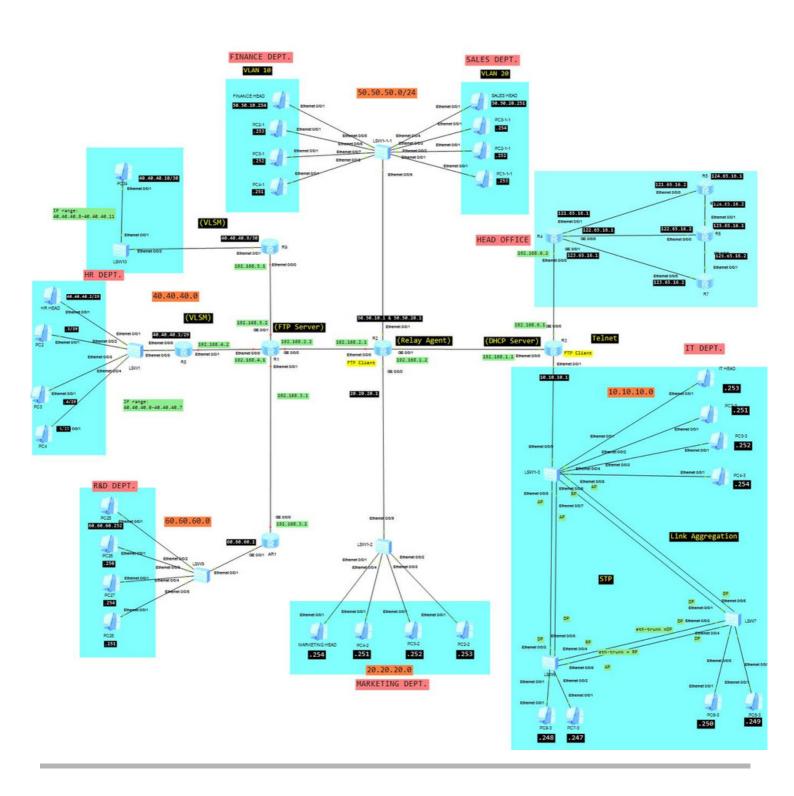
There is a Head Office(R4) of the organization which is connected with the branch of that organization (R3, R5, R6 & R7). Only one campus/branch (R3) has been expanded in this system.

The initial plan for this organizational network is to let the heads of each department communicate with each other and the rest of the pcs would be able to communicate within their network. Head Office can communicate throughout the network and the IT department should have access to the overall system for both communication and configuration.

## Assumption

- ACL has been implemented only in R&D Department because ACL requires AR routers which cause lagging issues. So only the head of R&D dept. will be able to communicate with other departments and vice versa, whereas other pcs won't be able to ping due to denied access using ACL Config. And all other pcs in each department will be communicating with each other.
- Network IP's which are not labelled with any subnet has a subnet of 255.255.255.0 or /24.
- The IPs written in the labelling with PCs may not be correct because due to DHCP IPs are changing everytime when the system is started.

## Network Topology



## Configuration

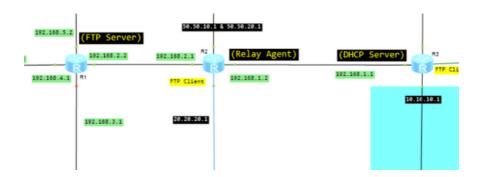
## DHCP Config & Justification:

Router 3 (R3) has been designated as the DHCP server, responsible for assigning IP addresses dynamically to all the networks within the organization. The DHCP server simplifies the process of IP address management by assigning IP's dynamically and eliminates the need for manual IP address assignment.

In this network DHCP is enabled on routers R1, R2, R3.

### DHCP Relays:

There are 3 relay routers Router (R2), Router (R1) and AR1 Router. They are used for communication between the dhcp server and the PC'c in the Network.



### VLAN Config & Justification:

Virtual Local Area Networks (VLANs) are used to logically segment a physical network into multiple virtual networks, providing improved security, manageability, and flexibility. In this project, VLANs have been configured on Sales and Finance Department to achieve network segmentation and enhance overall network performance. There are following configuration of vlan:

- Switch VLAN
- VLAN Trunking
- Inter-VLAN Routing

#### Inter Vlan:

Inter VLANS are used communicate between VLAN 10 AND VLAN 20. vlan10 and vlan20 pools are configured on dhcp server for vlan PC to receive IPs. Broadcast is enabled on router as well to complete this configuration else the VLAN pc's won't be able to communicate with the network.

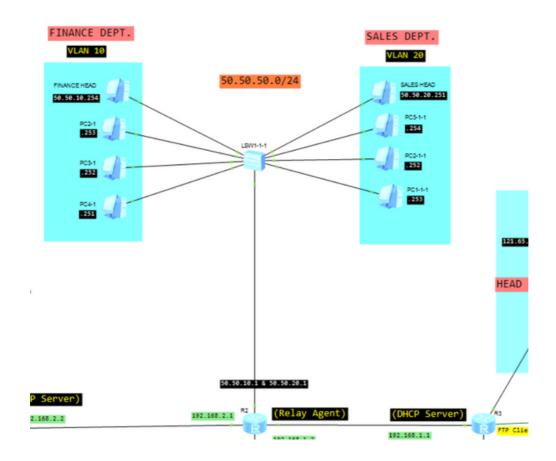
### Vlan Trunking:

Trunk Port is made between Relay Router R2 and Switch to enable vlan 10 and 20 to communicate from one port.

#### Switch Vlan:

Switch has 2 Vlan, Vlan 10 for Sales and Vlan 20 for Finance.

#### **VLAN**



# Dynamic Routing using RIP (Routing Information Protocol):

Dynamic routing protocols are used to automate the exchange of routing information among routers, enabling them to dynamically update and select the best paths for data transmission. In this project, the Routing Information Protocol (RIP) has been implemented for dynamic routing between the routers R1, R2, R3, R8, R9 & AR1 within the organization's network infrastructure.

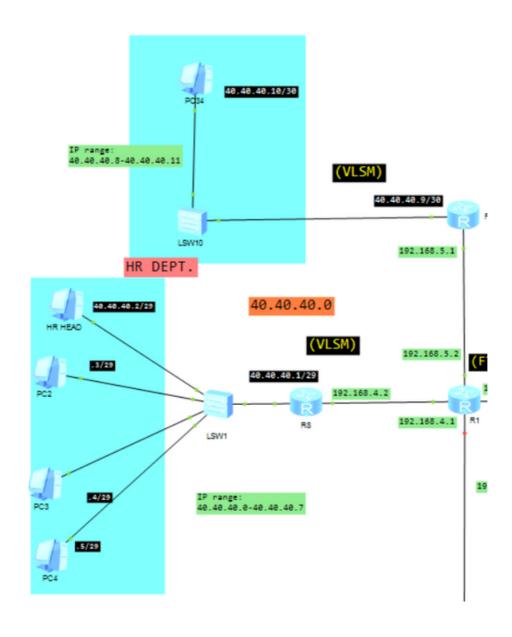
#### **VLSM**

Variable Length Subnet Masking (VLSM) is a technique used to allocate IP addresses more efficiently by subnetting a network into smaller subnets with different subnet mask lengths. In this project, VLSM has been implemented on R8 and R9 using manual IP's.

Network used: 40.40.40.0

R8 router has 4 hosts after applying VLSM the subnet mask configured on R8 is 29 and it's range is 40.40.40.0 - 40.40.40.7.

R9 router has 1 host after applying vlsm the subnet mask is 30 and range is 40.40.40.8 - 40.40.40.11



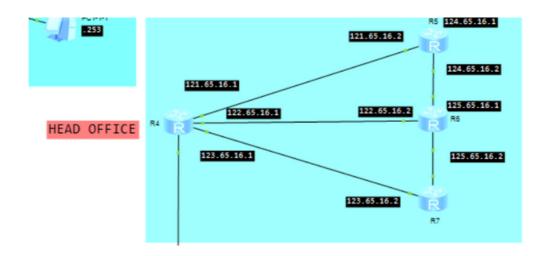
#### FTP

FTP File Transfer Protocol is a standard network protocol used for the transfer of files from one host to another over a TCP-based network, such as the Internet. In This network it is configured on R1 as FTP Server and 2 client routers R2 and R3.



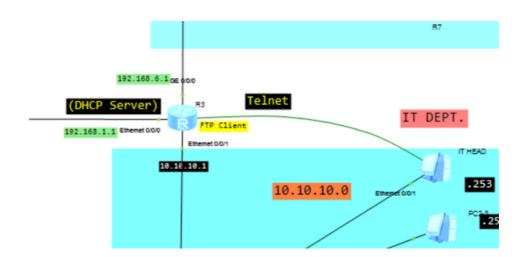
# Static Routing Configuration

Static routing is a method of manually configuring routing paths in a network, where network administrators define specific routes and nexthop destinations for data packets. In this project, static routing has been implemented on Router R4, R5, R6, R7 to establish predetermined routes for optimized network performance.



## Telnet Configuration:

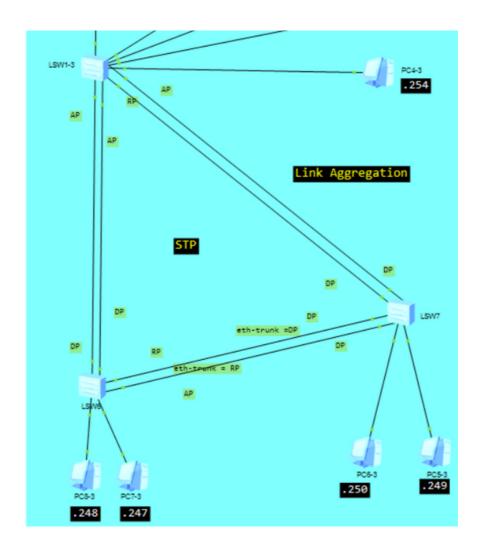
Telnet is a network protocol used for remote management and access to devices over a network. In this project, Telnet access has been configured from our reference Router (R3) connected to the IT department head's PC, enabling remote management and troubleshooting capabilities on the network Routers R1, R2, R3, R8, R9 and AR1.



## Link

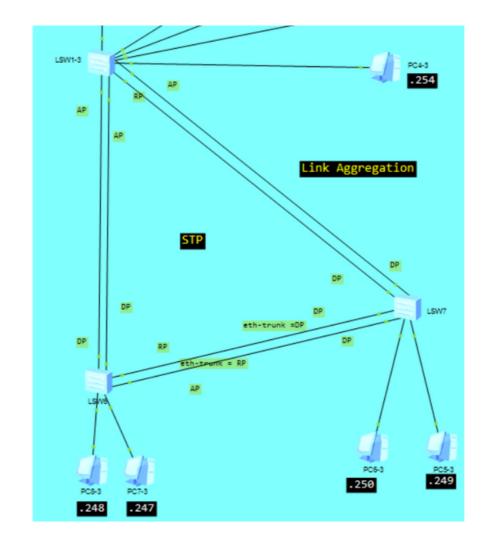
# Aggregation

Link Aggregation, also known as EtherChannel or port trunking, is a technique used to combine multiple physical links between switches or between switches and servers into a single logical link. This bundling of multiple links increases bandwidth, provides fault tolerance, and improves network reliability. In this project, Link Aggregation has been implemented between the three switches of the IT department.



# Spanning Tree Protocol (STP)

Spanning Tree Protocol (STP) is a network protocol that ensures a loop-free topology in Ethernet networks. It prevents the formation of network loops that can cause broadcast storms and network failures. In this project, STP has been implemented to provide redundancy and maintain a stable network environment within the IT department only.





## Conclusion

In conclusion, this project has successfully established a networking infrastructure for an organization with multiple departments. Through the implementation of routers, switches, and various configurations, including DHCP server, dynamic routing using RIP, VLANs, static routing, Telnet access, Link Aggregation, and Spanning Tree Protocol, the network has been optimized for efficient communication, enhanced security, and improved reliability. This comprehensive setup enables seamless connectivity, effective management, and robust data transfer within the organization, meeting the requirements of modern computer communication and networks.dancy and maintain a stable network environment within the IT department.