A Mini Project Report on

Small Organization Network

Submitted by

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BONAFIDE CERTIFICATE

Certified that this project report **" Small Organization Network"** is the Bonafide work of **" Amit Kumar Thakur "** who carried out the project work under my supervision.

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Submitted for the project viva-voce examination held on_____

INTERNAL EXAMINER

ABSTRACT

This project presents the design and implementation of a structured small organizational network using Cisco Packet Tracer. The network topology simulates a real-world business environment with multiple departments—HR, Computer Science (CS), and IT—each configured with its own subnet for improved organization, security, and traffic management. A central router is used to interconnect the subnets and manage inter-departmental communication, while individual switches are assigned to each department to ensure local connectivity.

The network also includes an Admin PC and a Server in a separate subnet, allowing centralized administration and resource sharing. Static IP addressing is employed for simplicity and control, with proper gateway configuration to ensure successful routing between all departments. This simulation demonstrates key networking concepts such as subnetting, switching, routing, and network segmentation, providing a foundational model for scalable and secure organizational network design.

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Chapter1- INTRODUCTION

1.1 Introduction/Feature of the Project

The growing demand for efficient and secure computer networks has made it essential for every organization—small or large—to adopt structured networking systems. This project focuses on simulating a small organizational network using Cisco Packet Tracer, a powerful network simulation tool widely used for learning and prototyping.

The designed network provides a structured environment where different departments (HR, CS, and IT) are logically separated using subnetting. This segmentation helps in managing traffic, enhancing security, and simplifying troubleshooting. A central router handles communication between subnets, while each department is connected via dedicated switches for intra-department connectivity. The network also includes a central server and an Admin PC for configuration, monitoring, and centralized services like file sharing or DNS.

Key Features:

- Department-wise segmentation using different subnets.
- Static IP addressing for clear network mapping and control.
- Centralized router for inter-subnet communication.
- Dedicated switches for each department to reduce collision domains.
- Central Server accessible to all departments.
- Admin PC for managing and monitoring the network.
- Scalable design, suitable for expanding the network with more departments or devices.

1.2 Client Identification and Recognition of need

This network simulation is developed considering the requirements of a small organization that consists of three main departments:

- Human Resources (HR)

- Computer Science (CS)
- Information Technology (IT)

Each department needs:

- Internal communication between PCs
- Access to central services (e.g., file servers)
- Secure and controlled access to other departments
- A network topology that allows future scalability

The client's core needs identified were:

- Organized structure based on departments
- Efficient routing between departments
- Easy network maintenance and management
- Possibility to implement future technologies like VLANs, ACLs, and DHCP
- Realistic simulation for educational or training purposes

1.3 Need For the App:

Networking forms the backbone of any organization. The need for this simulation project arises from the necessity to:

- Understand basic networking principles including subnetting, switching, and routing.
- Visualize and practice real-world network design using Cisco Packet Tracer.
- Provide a testbed for experimenting with network features like inter-VLAN routing, static routing, and more.
- Help IT students and professionals develop, simulate, and troubleshoot network topologies.
- Enable the organization to evaluate network designs before actual implementation.

With this application, learners and professionals can simulate a realistic small office network, understand how devices communicate, and prepare for real-world networking scenarios.

Chapter -2

Literature Review and Problem Identification

2.1. Literature Review

Computer networking plays a crucial role in enabling communication, data sharing, and collaboration within organizations. Over the years, various architectures and technologies have been developed to meet growing demands for speed, reliability, and scalability. Literature and prior studies in the field of network design provide insights into best practices, challenges, and innovative solutions.

Historical Background:

- Early networks like ARPANET laid the foundation for today's complex network systems.
- With the emergence of the OSI and TCP/IP models, a structured and standardized approach to network communication evolved.

Previous Works:

- Studies show that subnetting improves performance by reducing broadcast domains and enhancing security.
- The use of static IP addressing in small organizations gives greater control over IP management and easier troubleshooting.
- Research emphasizes the importance of centralized routing for efficient inter-departmental communication.
- Use of simulation tools like Cisco Packet Tracer has been widely recommended in academic and training environments for understanding real-time network behavior without needing physical devices.

Current Trends:

- Organizations are shifting towards software-defined networks (SDN) for better flexibility.
- Virtual LANs (VLANs) and Access Control Lists (ACLs) are being used for added security and traffic management.
- Cisco Packet Tracer remains a preferred tool for prototyping due to its user-friendly interface and feature-rich environment.

2.2. Problem Identification

In small organizations, unmanaged or poorly designed networks often lead to:

- Congestion due to lack of segmentation
- Inefficient routing and limited scalability
- Insecure inter-department communication
- Difficulty in troubleshooting and monitoring

2.3 Objectives of the Project

The main goal of this project is to simulate an optimized and departmentalized network for a small organization using Cisco Packet Tracer. The detailed objectives are:

- To design a segmented network structure for HR, CS, and IT departments.
- To implement static IP addressing for ease of configuration and control.
- To use centralized routing to enable communication between all departments.
- To connect devices using switches for local communication and a router for inter-network communication.
- To ensure all departments have access to a central server for shared resources.
- To develop a cost-effective and scalable network design suitable for real-world deployment.
- To provide a platform for hands-on learning and demonstration of networking principles.

Chapter -3

Preliminary Design

3.1 Constraints Identification

While designing a network for a small organization, several constraints must be taken into consideration to ensure successful implementation. These include:

a. Budget Constraints

- Limited financial resources restrict the use of advanced networking equipment.
- Preference is given to cost-effective solutions like Layer 2 switches and single routers.

b. Physical Limitations

- The network is designed for a simulation environment, assuming limited office space per department.

c. Device Limitations

- In a simulated environment (Cisco Packet Tracer), not all real-world protocols and behaviors can be perfectly emulated.

d. Performance Constraints

- Need for minimizing congestion and broadcast storms within departments.
- High reliance on static routing for simplicity, though it lacks dynamic adaptability.

e. Scalability Concerns

- Although scalable, the design must remain within manageable limits to maintain simplicity.

3.2 Analysis of Features and Finalization Subject to Constraints

Taking the constraints into account, the following features were finalized in the network design:

a. Static IP Addressing

- Each device is manually assigned an IP to avoid DHCP dependency and ensure easy management.

b. Department-wise Segmentation

- The network is logically divided into HR, CS, and IT departments, improving

manageability and security.

c. Centralized Routing

- A single router handles communication between departments.
- Interfaces:
  - f0/0 – connected to CS dept (192.168.3.1)
  - f0/1 – connected to Switch0 (Admin & Server, 192.168.1.1)
  - f1/0 – connected to IT dept (192.168.4.1)
  - f1/1 – connected to HR dept (192.168.2.1)

d. Server Accessibility

- The server (192.168.1.100) is placed in the Admin zone and is accessible to all departments through the router.

e. Switch-based LANs

- Layer 2 switches are used in each department to manage intra-departmental communication.

3.3 Identification of Appropriate Standards

For the simulated network, the following networking standards and protocols were considered:

Standard/Protocol	Purpose
IEEE 802.3	Ethernet (LAN communication)
TCP/IP Model	Communication & addressing
IPv4 Addressing	Static IP configuration
Cisco IOS	Router and switch configuration
OSI Model Reference	Network layer understanding
RFC 1918	Private IP addressing scheme

These standards ensure the network follows real-world practices even in a simulated environment.

3.4 Design Selection

Based on the constraints and feature analysis, the following network design was selected:

- **Hierarchical Topology** with three layers:
  - **Access Layer** (Switches in each department)

- **Distribution Layer** (Router for inter-department routing)
- **Core Layer** (Server and Admin systems)

Design Justifications:

- Segregates traffic and improves security.
- Simplifies troubleshooting.
- Ensures all departments are independently functional and centrally connected.
- Provides reliable access to shared resources.

The design balances simplicity, cost, functionality, and scalability—making it ideal for small organizations and academic demonstrations.

Chapter4

DETAILED SYSTEM DESIGN/TECHNICAL DETAILS

4.1 Use of Modern Tools in Design and Analysis

To design and simulate the organizational network, **Cisco Packet Tracer** was used, which is an advanced network simulation tool developed by Cisco Systems. It allows students and professionals to model network behavior, configure devices, and visualize packet flow without needing physical hardware.

Modern Tools Used:

- **Cisco Packet Tracer**
  - Used to simulate routers, switches, PCs, and servers.
  - Enabled testing of inter-network communication and routing.
  - Provided real-time packet flow visualization and debugging.
- **IP Addressing Calculator (Subnet Calculator)**
  - Assisted in calculating subnet ranges and assigning static IPs.
- **Command Line Interface (CLI)** within Packet Tracer
  - Used for configuring router interfaces and verifying connectivity (e.g., using ping, show ip route, etc.).

Technical Features Configured:

- Static IPs for all hosts and routers.
- IP configuration via CLI for interfaces:

  Example:

bash

Copy code

Router(config)# interface f0/0

Router(config-if)# ip address 192.168.3.1 255.255.255.0

Router(config-if)# no shutdown

- Proper default gateways set for all devices in their respective networks.

4.2 Discussion and Report/Results Analysis

After completing the configuration, several tests were conducted to evaluate the performance and connectivity of the network:

Results:

- **Successful intra-departmental communication:**
  All PCs within a department could communicate via their switch.
- **Successful inter-departmental communication:**
  All devices could ping each other through the central router, confirming correct routing.
- **Server Accessibility:**
  All departments could access the central server, demonstrating cross-subnet connectivity.
- **Ping Tests Example:**
  - PC in HR → PC in IT: Successful
  - CS PC → Server: Successful
  - Server → Admin PC: Successful

Analysis:

- Static IP assignment ensured clarity in tracking devices.
- Subnetting helped in reducing unnecessary traffic and isolating departments.
- Packet Tracer provided an intuitive platform to simulate, test, and debug effectively.

4.3 Project Management and Professional Communication

Effective project planning and communication are essential for successful project execution. The project followed a step-by-step approach:

Project Management Techniques Used:

- Planning Phase:
  Requirements analysis and network design blueprint.
- Design Phase:
  Logical and physical topology creation using Packet Tracer.
- Implementation Phase:
  Device configuration, IP addressing, and routing setup.

- Testing Phase:

  Ping tests and validation of communication paths.

Professional Communication:

- Documented configuration steps clearly.
- Maintained proper communication structure in the report.
- Ensured clear visual representation of the network topology.
- Utilized technical terminology and diagrams to enhance clarity and professionalism.

4.4 Conclusion

This project successfully demonstrates how a small organizational network can be designed and simulated using Cisco Packet Tracer. By leveraging modern tools and applying fundamental networking concepts, the network meets real-world needs like scalability, security, and simplicity.

Key Takeaways:

- Static IPs and subnetting provide clarity and segmentation.
- Cisco Packet Tracer is an excellent tool for academic and prototype purposes.
- Proper planning and layered design lead to efficient and functional networks.
- The simulated design offers a strong foundation for future real-world implementation or integration with advanced technologies like VLANs, ACLs, and dynamic routing.

CHAPTER-5

Connections/Results

5.1 Connections

This section details all the devices used in the network design along with the precise connection mapping between routers, switches, and PCs.

Devices Required:

- 1 Router (central)
- 4 Switches (Switch0 – Switch3)
- 1 Server
- 13 PCs (Admin PC + PC1 to PC12)
- Connecting cables (copper straight-through)
- Cisco Packet Tracer software

Router Connections:

Router Interface	Connected To	Switch Port
f1/1	Switch0 (Admin)	fa0/3
f0/0	Switch1 (CS Department)	fa0/5
f0/1	Switch2 (HR Department)	fa0/5
f1/0	Switch3 (IT Department)	fa0/5

Switch Connections and PC Configuration:

- **Switch0 – Admin Section**

Device	Switch Port	IP Address	Default Gateway
Admin PC	fa0/1	192.168.1.2	192.168.1.1
Server	fa0/2 (assumed)	192.168.1.100	192.168.1.1

- **Switch1 – HR Department**

PC	Switch Port	IP Address	Default Gateway
PC1	fa0/1	192.168.2.2	192.168.2.1
PC2	fa0/2	192.168.2.3	192.168.2.1
PC3	fa0/3	192.168.2.4	192.168.2.1
PC4	fa0/4	192.168.2.5	192.168.2.1

- **Switch2 – CS Department**

PC	Switch Port	IP Address	Default Gateway
PC5	fa0/1	192.168.3.2	192.168.3.1
PC6	fa0/2	192.168.3.3	192.168.3.1
PC7	fa0/3	192.168.3.4	192.168.3.1
PC8	fa0/4	192.168.3.5	192.168.3.1

- **Switch3 – IT Department**

PC	Switch Port	IP Address	Default Gateway
PC9	fa0/1	192.168.4.2	192.168.4.1
PC10	fa0/2	192.168.4.3	192.168.4.1
PC11	fa0/3	192.168.4.4	192.168.4.1
PC12	fa0/4	192.168.4.5	192.168.4.1

5.2 Results

After establishing all hardware and IP configurations in Cisco Packet Tracer:

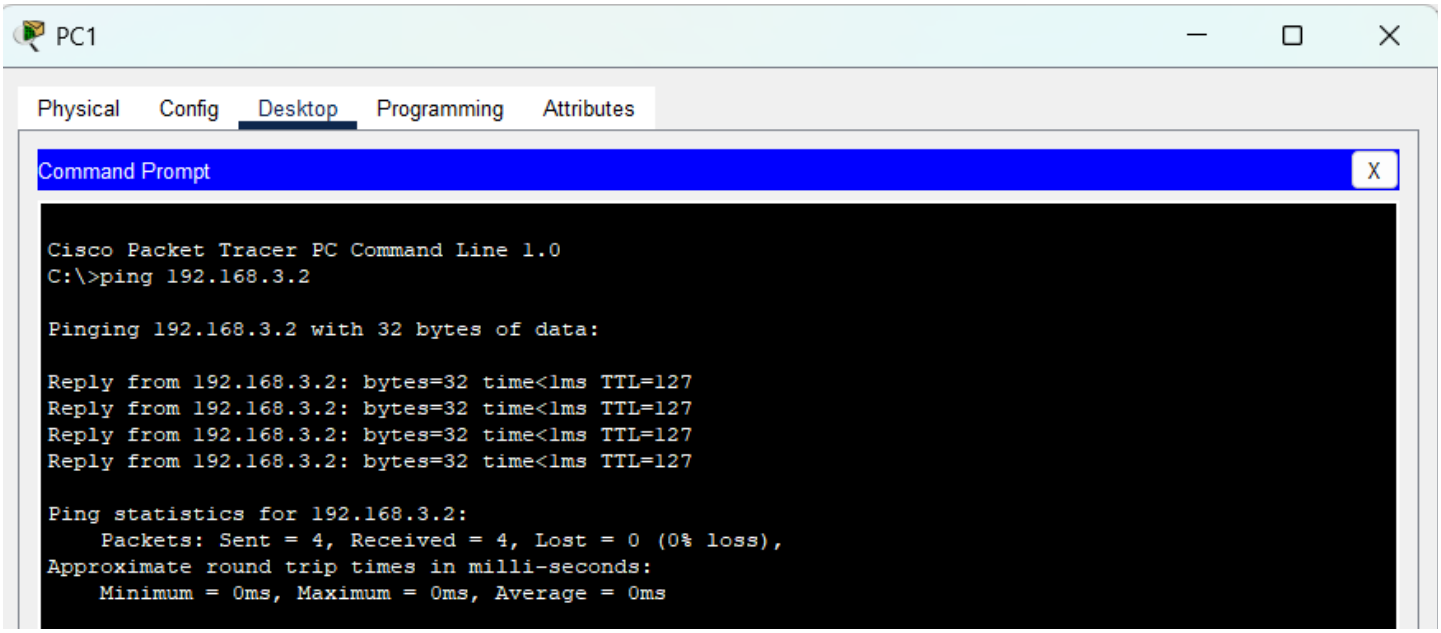
✅ **Functionality Validation:**

- All PCs were assigned **static IPs** in their respective subnets.
- **Default gateways** were set to the IP of the connected router interface.

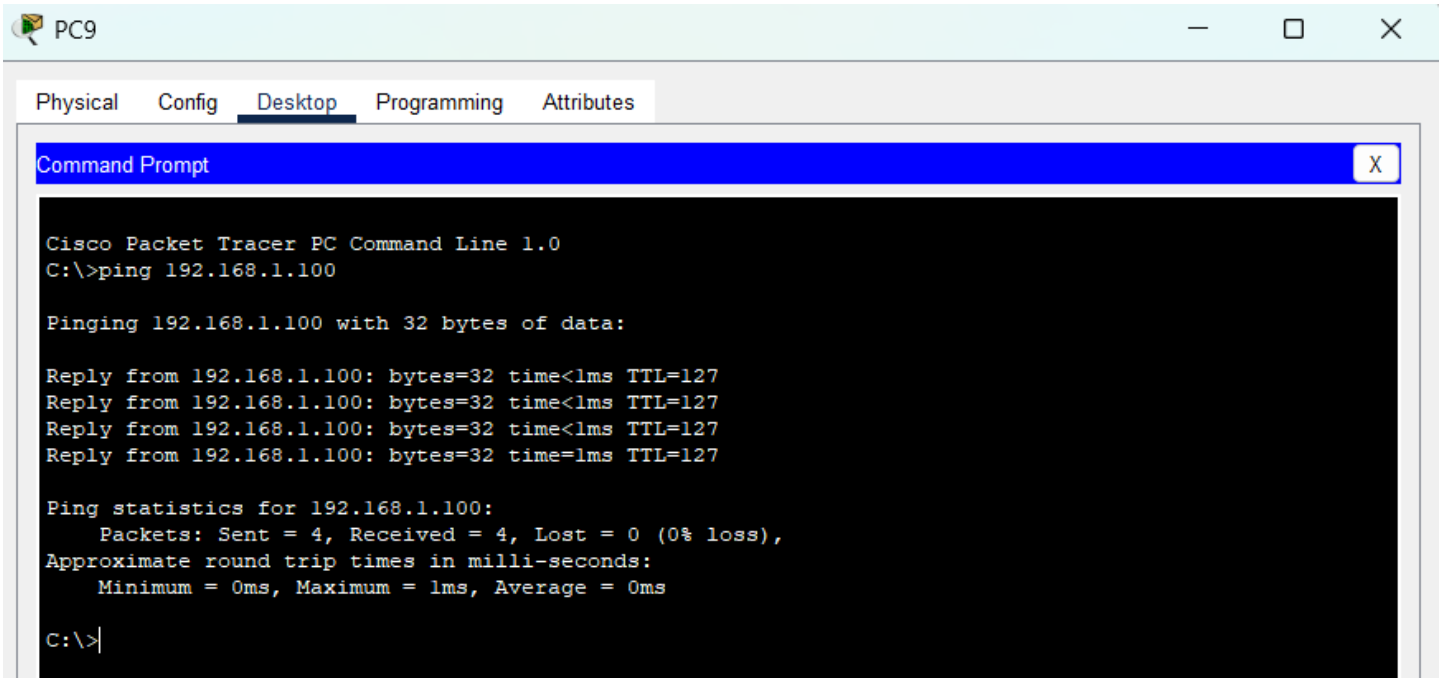
- **Successful ping tests** confirmed proper intra-department and inter-department communication.
- Admin PC and Server were accessible from all PCs, confirming a central file-sharing environment.

🧪 **Sample Ping Results:**

- PC1 (192.168.2.2) → PC5 (192.168.3.2):



- PC9 (192.168.4.2) → Server (192.168.1.100):



- PC6 → PC11:

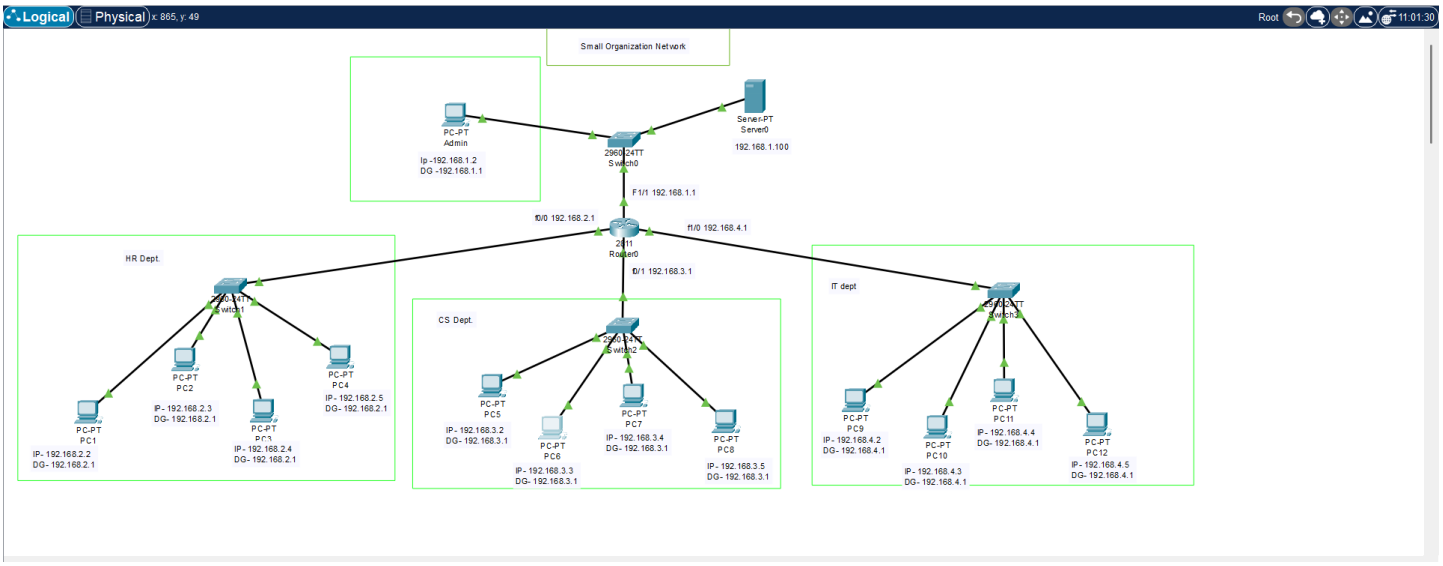
PC6

Physical Config Desktop Programming Attributes

Command Prompt

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.4.4

Pinging 192.168.4.4 with 32 bytes of data:

Request timed out.
Reply from 192.168.4.4: bytes=32 time<1ms TTL=127
Reply from 192.168.4.4: bytes=32 time<1ms TTL=127
Reply from 192.168.4.4: bytes=32 time<1ms TTL=127

Ping statistics for 192.168.4.4:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>ping 192.168.4.4

Pinging 192.168.4.4 with 32 bytes of data:

Reply from 192.168.4.4: bytes=32 time=1ms TTL=127
Reply from 192.168.4.4: bytes=32 time=7ms TTL=127
Reply from 192.168.4.4: bytes=32 time<1ms TTL=127
Reply from 192.168.4.4: bytes=32 time=3ms TTL=127

Ping statistics for 192.168.4.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 7ms, Average = 2ms

C:\>
```

Network Design:



5.3 Conclusion

This Cisco Packet Tracer simulation successfully modeled a departmental network for a small organization. By logically segmenting the network and assigning proper IPs and gateways, seamless communication was ensured.

The network is:

- Modular
- Scalable
- Secure within departments
- Fully interconnected through a central router