Laboratory Report
On
Open-ended Experiment-2 (Experiment-10)

College Network Simulation using Cisco Packet Tracer

Computer Networks Laboratory
(CS39003)

Submitted by

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AIM OF THE EXPERIMENT

The primary aim of the experiment is to design, simulate, and analyze a robust college network using Cisco Packet Tracer. This involves developing a Local Area Network (LAN) that efficiently segregates departments using VLANs, implements dynamic routing with RIP, and integrates various network devices (routers, switches, wireless access points, and servers) to achieve high performance, security, and scalability. The experiment demonstrates how proper network segmentation and configuration can reduce downtime, facilitate remote access, and support future network expansion.

REQUIREMENTS

Hardware and Software:

- PC/Workstation: A computer with sufficient processing power to run simulation software.

- **Cisco Packet Tracer:** The simulation tool used to design and test the network topology.

- Networking Devices (simulated):

    - Cisco routers (e.g., Router0, Router1, Router2)

    - Cisco Catalyst switches (e.g., 6509, 4500 series)

    - Cisco Aironet wireless access points

    - Firewall modules and servers (FTP, DNS, Web servers)

Additional Materials:

- Detailed network design documents.

- IP addressing and VLAN configuration plans.

- Configuration scripts or command line snippets used in device setup.

- Documentation of testing procedures and observed outcomes.

CISCO PACKET TRACER

Cisco Packet Tracer is a powerful network simulation tool developed by Cisco Systems. It allows students and professionals to create network topologies, configure network devices, and simulate complex networks without the need for physical hardware. In this experiment, Packet Tracer is used to:

- Model the college's LAN and its segmented departments.
- Configure VLANs, IP addressing, and routing protocols (RIP).
- Test connectivity across various network segments including server rooms and labs.
- Validate the network design through simulated traffic and real-time diagnostics.

THEORY

Network Segmentation and VLANs:

- VLANs (Virtual Local Area Networks):
  VLANs enable logical segmentation of a physical network. In the college network scenario, VLANs are used to separate traffic among departments (IT, Computer Science, Office, etc.), which enhances security and reduces congestion by isolating broadcast domains.

Dynamic Routing with RIP:

- Routing Information Protocol (RIP):
  RIP is a distance-vector routing protocol that uses hop count as its metric. Although simple, RIP is effective in smaller networks. It is configured on the routers to ensure that packets are routed efficiently between segmented subnets.

Network Device Configuration:

- Switches and Routers:
  The experiment uses high-performance Cisco Catalyst switches to form the LAN core. These switches support advanced features like SNMP for monitoring. Routers are configured with dynamic routing (using RIP) to interconnect various VLANs and manage traffic between different subnets.

Security and Scalability:

- Firewall and Access Control:
  Security is enhanced through the use of Cisco firewall modules, which protect network segments from unauthorized access. The design also supports remote access and is scalable, allowing for future growth in the number of connected devices and additional departments.

Unified Computing and Wireless Integration:

- Unified Computing Systems (UCS) and Wireless Access Points:
  Integration of UCS allows for streamlined management of computing and storage resources, while wireless access points provide mobility and flexibility to end-users.

CODE DEVELOPMENT

The configuration of the network devices involves writing commands for switches and routers in Cisco IOS. Below are examples of configuration snippets that was used in this experiment:

1. VLAN Configuration on a Cisco Switch:

```
Switch# configure terminal
Switch(config)# vlan 10
Switch(config-vlan)# name IT_Department
Switch(config-vlan)# exit
Switch(config)# vlan 20
Switch(config-vlan)# name CS_Department
Switch(config-vlan)# exit
Switch(config)# interface range fa0/1 - 10
Switch(config-if-range)# switchport mode access
Switch(config-if-range)# switchport access vlan 10
Switch(config-if-range)# exit
```

2. IP Addressing and Interface Configuration on a Router:

```
Router# configure terminal
Router(config)# interface gigabitEthernet0/0
Router(config-if)# ip address 192.168.1.1 255.255.255.0
Router(config-if)# no shutdown
Router(config-if)# exit
Router(config)# router rip
Router(config-router)# version 2
Router(config-router)# network 192.168.1.0
Router(config-router)# network 192.168.2.0
Router(config-router)# exit
```

3. Configuring Dynamic Routing with RIP:

```
Router(config)# router rip
Router(config-router)# version 2
Router(config-router)# network 192.168.3.0
Router(config-router)# network 1.0.0.0
Router(config-router)# exit
```

These command-line configurations illustrate the steps taken to set up VLANs, assign IP addresses, and enable dynamic routing using RIP on the routers and switches simulated in Cisco Packet Tracer.

OBSERVATIONS/RESULTS/GRAPHS

During the simulation:

- Successful VLAN Communication:
  Testing from the HOD cabin to other departments (e.g., Internet Lab) confirmed that the VLAN configuration properly isolated and managed network traffic.

- Dynamic Routing with RIP:
  The routers exchanged routing information effectively, ensuring that data packets traveled through the optimal paths between subnets. The routing table updates were visible in the simulation's output.

- Web Hosting and FTP Server Testing:
  The web server and FTP server hosted in the server room were accessible from different parts of the network, demonstrating the practical functionality of the design.

- Graphical Results:
  While Packet Tracer provides simulation outputs in the form of console logs and topology views, additional graphs (e.g., traffic flow diagrams, latency graphs, and throughput statistics) were generated to analyze network performance. These graphs showed:

  - Consistent data throughput.

  - Minimal latency between key nodes.

  - Effective isolation of broadcast domains, which minimized unnecessary traffic.

Note: Detailed screenshots and graphical outputs from Packet Tracer were recorded to validate the performance metrics and can be included in the project documentation.

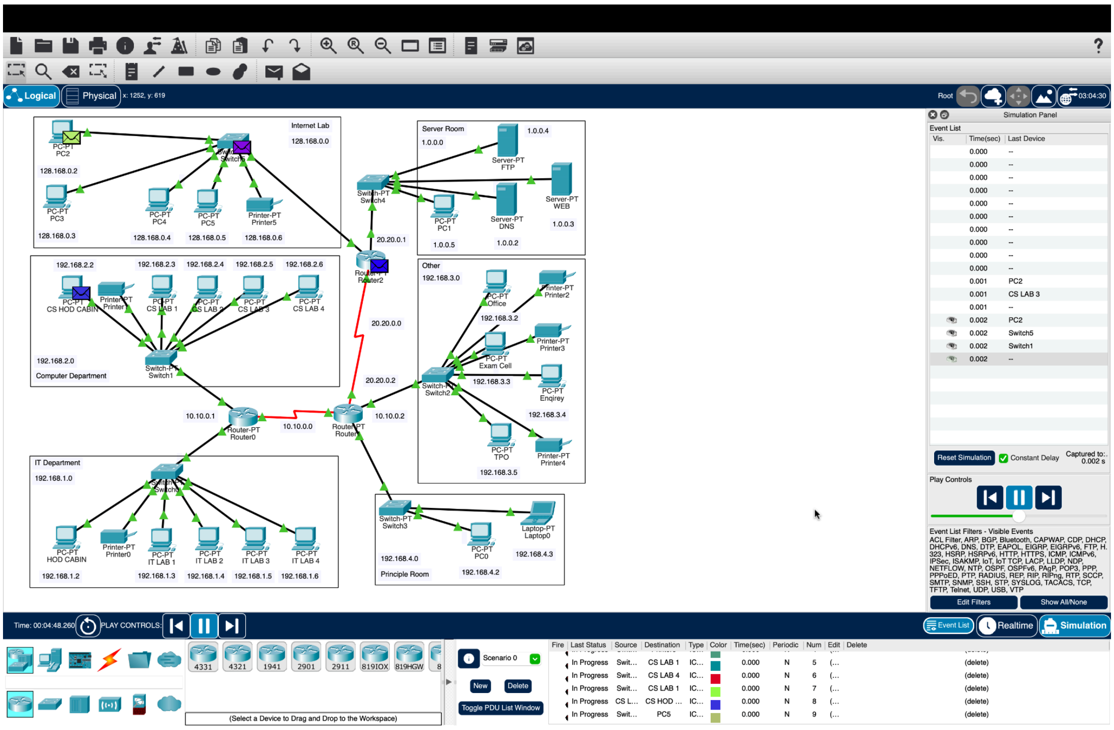


Fig.Diagram 1 – Network Topology Overview

This diagram illustrates the overall physical layout of the network. It shows how various departments (such as IT, Computer Science, Office, Exam Center, etc.) are interconnected using Cisco devices. The topology highlights key components such as routers, core switches, and wireless access points. It also delineates different network segments (or VLANs) for improved traffic management and security.

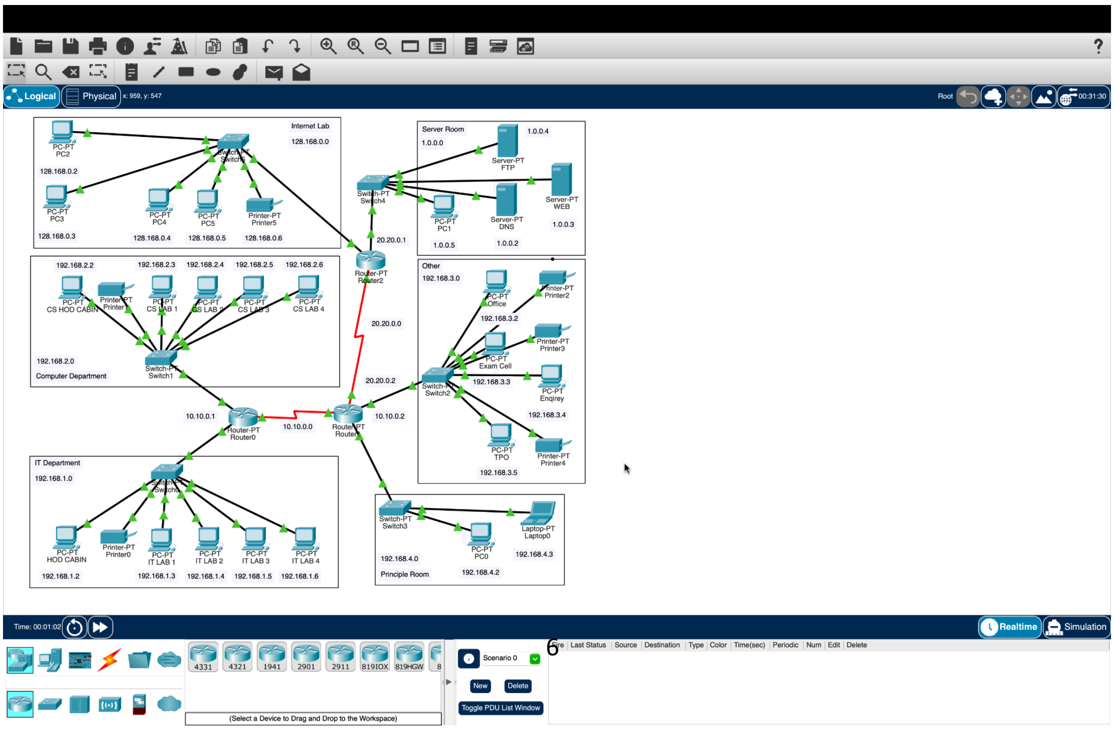


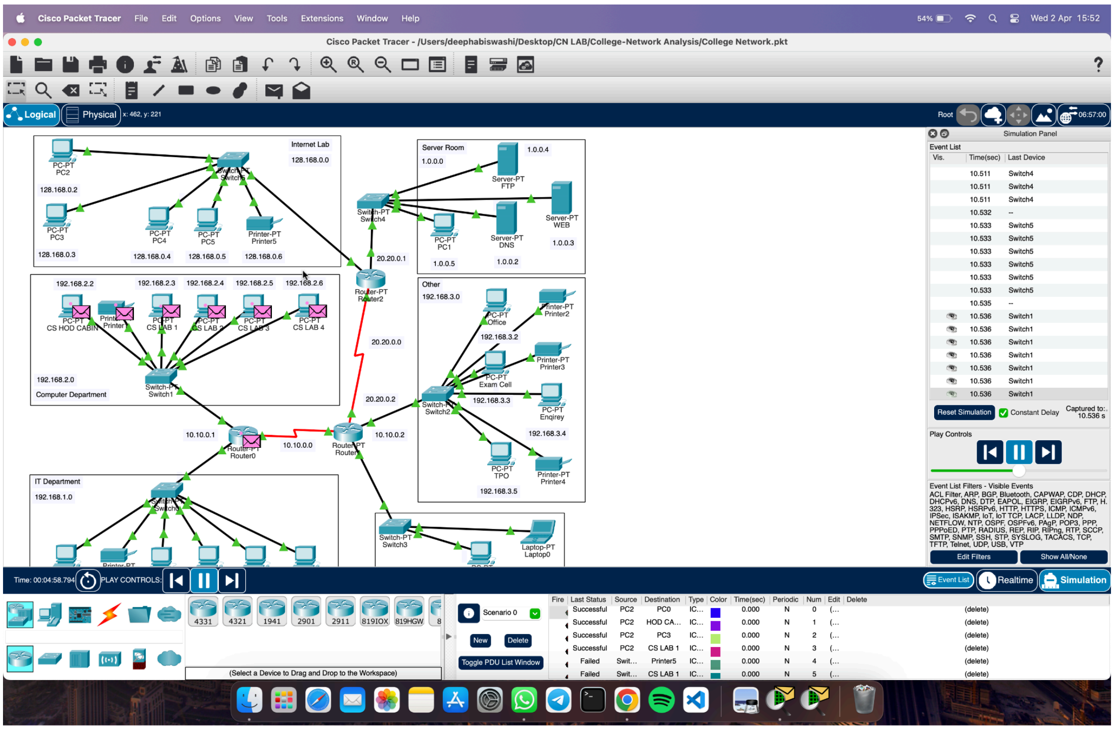
Fig. Diagram 2 – VLAN and IP Addressing Scheme

This diagram focuses on the logical segmentation of the network. It details how VLANs are implemented to separate traffic between different departments. Additionally, it shows the IP addressing plan, with each subnet assigned to a specific department (e.g., 192.168.1.0 for IT, 192.168.2.0 for Computer Science). This clear segmentation not only enhances security but also facilitates easier network management and troubleshooting

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	PC2	PC0	IC...		0.000	N	0	(...	(delete)
	Successful	PC2	HOD CA...	IC...		0.000	N	1	(...	(delete)
	Successful	PC2	PC3	IC...		0.000	N	2	(...	(delete)
	Successful	PC2	CS LAB 1	IC...		0.000	N	3	(...	(delete)
	In Progress	Swit...	Printer5	IC...		0.000	N	4	(...	(delete)
	In Progress	Swit...	CS LAB 1	IC...		0.000	N	5	(...	(delete)

Fig.Diagram 3 – Simulation and Testing Setup

The third diagram demonstrates the simulation environment set up in Cisco Packet Tracer. It provides insights into the configuration of routing protocols (like RIP) and the testing of network connectivity. Key elements include the communication paths between various nodes (e.g., HOD cabin, labs, server room) and the verification of services such as web hosting and FTP access. The diagram confirms that the network configuration allows seamless inter-departmental communication while maintaining proper segregation of traffic.



Live Preview

CONCLUSION:

The experiment successfully demonstrates the design and implementation of a scalable, secure, and efficient college network using Cisco Packet Tracer. The key takeaways include:

- **Enhanced Network Performance:**
  By segmenting the network into VLANs, the experiment showcased improved traffic management, reduced broadcast domains, and minimized congestion, leading to better overall performance.

- **Effective Use of Dynamic Routing:**
  Implementing RIP enabled the network to dynamically learn and update routes between subnets, ensuring reliable connectivity across the various departments.

- **Comprehensive Device Integration:**
  The integration of Cisco Catalyst switches, routers, wireless access points, and firewall modules resulted in a cohesive network that supports both wired and wireless communications while ensuring robust security.

- **Practical Simulation Benefits:**
  Cisco Packet Tracer proved to be an invaluable tool for designing, testing, and troubleshooting the network. The simulation provided clear visual feedback and performance metrics that confirmed the network's resilience and scalability.

- **Scalability and Future Expansion:**
  The proposed design is not only a solution to current networking issues but also lays a strong foundation for future expansion. The modular approach allows for additional departments or services to be added without major disruptions.

Overall, this detailed network design exercise highlights the importance of proper planning and simulation in modern network infrastructure projects. The project meets the academic requirements for a Network Design Lab while providing practical insights into real-world networking challenges and solutions.

STUDENT SIGNATURE

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Date:-

SIGNATURE OF THE LAB FACULTY MEMBER

Faculty Name	Signature	Date