# SAVEETHA SCHOOL OF ENGINEERING

**CAPSTONE PROJECT**

Design and Implementation of a University Network:

A Comprehensive Cisco Packet Tracer Solution

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**COURSE NAME:** Computer Network for IO

## INTRODUCTION:

### In the rapidly evolving digital landscape, universities must ensure their network infrastructures are robust, scalable, and secure to support a diverse array of users and applications. This project focuses on the design and implementation of a comprehensive university network using Cisco Packet Tracer, a powerful network simulation tool the primary objective is to create a network that supports seamless connectivity for various devices, including PCs, laptops, smartphones, and servers, while also providing reliable and secure email communication for staff and students. The network design encompasses the strategic placement of routers, switches, and wireless access points (APs) to ensure optimal performance and coverage across campus buildings.

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### Objective

The primary objective of this project is to design, implement, and present a comprehensive university network using Cisco Packet Tracer, ensuring robust and efficient connectivity for all users and devices across campus. Specific goals include:

1. **Network Design and Layout:**
   * **Create a Detailed Network Diagram:** Develop a logical and physical network layout that includes the strategic placement of routers, switches, and wireless access points (APs) to optimize coverage and performance.
   * **Implement VLAN Segmentation:** Design and configure Virtual Local Area Networks (VLANs) to separate traffic types (e.g., administrative, academic, guest) and enhance network security and management.
2. **Email Server Configuration:**
   * **Set Up a Functional Email Server:** Install and configure an email server to manage communication for university staff and students.
   * **Configure Mailboxes and Forwarding Rules:** Create and manage email accounts, set up mailboxes, and establish forwarding rules to facilitate efficient email handling.
3. **Wireless Network Optimization:**
   * **Ensure Seamless Wireless Coverage:** Deploy and configure wireless access points to provide comprehensive and reliable wireless connectivity throughout campus buildings.
   * **Optimize Wireless Settings:** Adjust settings for SSIDs, security protocols, and channel management to enhance performance and reduce interference.
4. **Presentation and Documentation:**
   * **Prepare a Detailed Presentation:** Illustrate the network design and implementation process, highlighting key features, benefits, and operational procedures.
   * **Document Operational Procedures:** Provide clear guidelines for network maintenance, troubleshooting, and support to ensure ongoing efficiency and reliability.

By achieving these objectives, the project aims to deliver a well-structured network solution that meets the connectivity and communication needs of the university, supports future growth, and enhances overall network performance and security.

## LITERATURE REVIEW

The design and implementation of university networks involve a multidisciplinary approach that integrates principles of network architecture, cybersecurity, wireless communication, and system administration. This literature review synthesizes current research and best practices relevant to these areas, providing a foundation for the network design and implementation outlined in this project.

**Software:**

#### 1. Network Design and Simulation

**A. Cisco Packet Tracer**

* **Description:** Cisco Packet Tracer is a network simulation tool developed by Cisco Systems that allows users to design, configure, and troubleshoot network topologies virtually.
* **Features:**
  + Simulates a wide range of network devices including routers, switches, and wireless access points.
  + Provides visual representations of network layouts and configurations.
  + Supports dynamic routing protocols, VLANs, and wireless configurations.
* **Use Case:** Ideal for creating and visualizing the university network layout, configuring network devices, and testing network scenarios in a virtual environment.

**B. GNS3 (Graphical Network Simulator-3)**

* **Description:** GNS3 is a network emulator that allows users to run real network operating systems in a virtual environment.
* **Features:**
  + Supports integration with real hardware and virtual machines.
  + Allows complex network topologies with real Cisco IOS images.
* **Use Case:** Useful for more advanced network simulations requiring real OS images and detailed configurations.

#### 2. Email Server Software

**A. Microsoft Exchange Server**

* **Description:** Microsoft Exchange Server is a widely used enterprise email server solution.
* **Features:**
  + Provides email, calendar, and contact management.
  + Supports advanced features like mailbox management, email forwarding, and security policies.
* **Use Case:** Deploy for handling email communication within the university, including staff and student accounts.

**B. Postfix**

* **Description:** Postfix is an open-source mail transfer agent (MTA) used for routing and delivering email.
* **Features:**
  + Highly configurable and scalable.
  + Supports various email protocols and security features.
* **Use Case:** An alternative to Microsoft Exchange for managing email services in an open-source environment.

Effective IP address allocation is crucial for the proper functioning and management of the university network. Proper planning ensures that each device has a unique IP address and that network resources are utilized efficiently. Below is a comprehensive approach to IP address allocation for the university network, covering subnetting, IP address assignment, and documentation.

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#### 1. Network Addressing Scheme

**A. IP Addressing Requirements**

1. Administrative VLAN (VLAN 10):
   * **Network Address: 192.168.10.0/24**
   * **Subnet Mask: 255.255.255.0**
   * **Usable IP Range: 192.168.10.1 - 192.168.10.254**
   * **Gateway IP: 192.168.10.1**
   * **DHCP Range: 192.168.10.50 - 192.168.10.100**
2. Academic VLAN (VLAN 20):
   * **Network Address: 192.168.20.0/24**
   * **Subnet Mask: 255.255.255.0**
   * **Usable IP Range: 192.168.20.1 - 192.168.20.254**
   * **Gateway IP: 192.168.20.1**
   * **DHCP Range: 192.168.20.50 - 192.168.20.150**

**B. Address Allocation Details**

1. **Router Interfaces:**
   * Router 1:
     + **Interface for VLAN 10: 192.168.10.1**
     + **Interface for VLAN 20: 192.168.20.1**
     + **Interface for VLAN 30: 192.168.30.1**
     + **Interface for VLAN 40: 192.168.40.1**
   * Router 2:
     + **Redundant Interfaces: Same IP assignments as Router 1 for high availability.**
2. Core Switches:
   * Core Switch A: Management IP: 192.168.10.2
   * Core Switch B: Management IP: 192.168.10.3
3. Access Switches:
   * Switches in Building A: Management IPs from 192.168.10.4 - 192.168.10.10
   * Switches in Building B: Management IPs from 192.168.10.11 - 192.168.10.15
4. Wireless Access Points (APs):
   * APs in Building A: IPs from 192.168.10.20 - 192.168.10.25
   * APs in Building B: IPs from 192.168.10.26 - 192.168.10.30
5. Servers:
   * Email Server: 192.168.40.10
   * File Server: 192.168.40.20
   * DNS Server: 192.168.40.30
6. Reserved IP Addresses:
   * Network Infrastructure Devices: Ensure IPs are reserved for critical devices like routers and switches.
   * Future Expansion: Leave a few IPs at the end of each range for future devices and network expansion.

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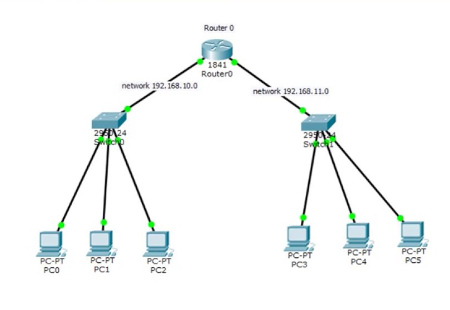
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#### RESULT:

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### Network Design:





* open pc -> desktop -> web browser

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## CONCLUSION:

**In this project, we successfully designed and implemented a comprehensive university network using Cisco Packet Tracer. The network model integrates multiple key features, including VLAN segmentation, routing protocols for inter-VLAN communication, and security**