Pak-Austria Fachhochschule: Institute of Applied Sciences and Technology, Haripur, Pakistan

Department of School of Computing Sciences

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Project Proposal

COMP 352L | Computer Networks Lab

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Project Proposal

NETWORK INFRASTRUCTURE DESIGN PROPOSAL FOR A UNIVERSITY

INTRODUCTION

This project proposes a basic yet functional network design for a university environment, focusing on essential networking technologies such as VLANs, routing, DHCP, DNS, NAT/PAT, access control, and server setup. The goal is to provide structured connectivity across departments, labs, and administrative units while supporting core services for users.

OBJECTIVES

To design and implement a simple, secure, and scalable network using:

- VLANs for segmentation
- Static and dynamic routing for connectivity
- DHCP & DNS for basic IP services
- NAT/PAT for internet access
- ACLs for security control
- TELNET for remote device management
- Inter-VLAN routing to allow controlled communication

PURPOSE

To build a structured network that:

- Enables smooth communication between departments
- Manages devices efficiently with subnetting and DHCP
- Ensures basic internal and internet services (DNS, Web Server)
- Limits complexity while covering essential CCNA-level concepts

PROBLEM STATEMENT

The university currently uses either an unstructured or underdeveloped network setup. There is:

- No traffic separation (everyone shares one network)
- No IP management or centralized addressing
- No routing or access control between departments
- No ability to manage or remotely access network devices

This results in poor security, lack of scalability, and difficult troubleshooting.

PROPOSED METHOD

1. Topology Overview (Simplified)

- **1 Router**: Handles inter-VLAN routing, NAT/PAT, and connects to the internet.
- **1 Layer 3 Switch**: Routes between VLANs if required (optional based on router configuration).
- **Access Switches** per department/lab.
- **1 Server** (can be virtualized): Acts as DNS, DHCP, and Web Server.
- **End devices**: PCs in labs, admin offices, library, and IT center.

2. VLAN Plan

VLAN ID	VLAN Name	Location/Use
10	CS Lab A	60 PCs
	CS Lab B	50 PCs
	CS Lab C	35 PCs
20	Other Department	Dept A & B (20 PCs each)
30	Students	Wi-Fi and general use
40	Faculty	35 faculty members
50	Admin Block	30 staff, 20 PCs
60	Library	20 PCs, 10 staff
70	IT Center	10 IT professionals
99	Native/VLAN Management	For switch/router Management

3. **Subnetting Example (IPv4)**
    - Use private address range (e.g., **192.168.x.0/24** for each VLAN).
    - **DHCP** will assign IPs within each VLAN.
    - **Static IPs** will be used for servers and router interfaces.

4. **Routing**
    - **Static Routing**: Between router and directly connected VLANs.
    - **Dynamic Routing (RIP or OSPF)**: Can be demonstrated with 2 routers if scalability is simulated.

5. **NAT/PAT Configuration**
    - **NAT Overload (PAT)** allows multiple devices from private IP ranges to access the internet using a single public IP.

6. **Access Control Lists (ACLs)**
    - Block or allow specific VLANs to communicate (e.g., prevent student VLAN from accessing Admin VLAN).
    - Permit Web and DNS access across VLANs.

7. **TELNET Configuration**
    - Enable **TELNET** on the router and switches.
    - Secure with login and password.
    - Use it for remote access simulation.

8. **Server Setup**

Use a single machine (or packet tracer server object) to simulate:

- **DHCP Server** for dynamic IPs
- **DNS Server** for name resolution
- **Web Server** for university homepage or internal portal

9. Devices Required (Simulation or Physical)

Device	Quantity	Role
Routers	1 (or 2)	Inter-VLAN, NAT, routing
L3 Switch	1	VLANs, inter-VLAN (optional)
L2 Switches	5–6	Department/lab distribution
End Devices	~350	PCs in labs/offices
Server	1	DHCP, DNS, Web services

CONCLUSION

This network project provides a strong foundation in core networking principles using VLANs, routing, subnetting, and access control. The design balances educational value and simplicity while maintaining scalability and real-world relevance.