LAN Simulation Project Documentation

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Project Overview

This project involves the design and simulation of a multi-department Local Area Network using Cisco Packet Tracer. The network implements Virtual Local Area Networks (VLANs) to separate four academic departments while enabling controlled communication through inter-VLAN routing. This project is based on concepts from the research paper: ”Design and Simulation of Local Area Network Using Cisco Packet Tracer.”

Project Repository

The complete project files, configurations, and additional documentation are available on GitHub:

GitHub Repository: `https://github.com/ZiadzWael/Design-and-Simulation-of-Local-A`

Project Team

Name	Student ID	Primary Responsibilities
Ziad Wael	221001480	Network architecture, VLAN configuration, router setup
Sama Eldessouky	221000579	Documentation, testing, IP addressing scheme
Abdullah Ramzy	221001781	Physical topology, switch configuration, validation

Academic Supervision

Dr. Islam Tharwat Abdelhalim
Project Supervisor and Course Instructor

Project Description

This project designs and simulates a functional Local Area Network for a university faculty with multiple departments. The core concept implements Virtual Local Area Networks (VLANs) to create logical separation between different academic departments while maintaining controlled inter-department communication through inter-VLAN routing. The network follows a hierarchical design with access, distribution, and routing layers, implementing VLAN segmentation, IP subnetting, trunking, and router-on-a-stick methodology for inter-VLAN routing. The project includes deployment of DNS services for name resolution and comprehensive testing to validate connectivity and functionality.

Technical Specifications

VLAN Architecture

VLAN ID	VLAN Name	Department	IP Subnet	Devices
10	CS_Dept	Computer Science	192.168.10.0/24	CS1, CS2
20	ENG_Dept	Engineering	192.168.20.0/24	ENG1, ENG2
30	BUS_Dept	Business	192.168.30.0/24	BUS1, BUS2
40	BIO_Dept	Biotechnology	192.168.40.0/24	BIO1, BIO2
99	SERVERS	Server Network	192.168.99.0/24	DNS1

IP Addressing Scheme

Device	VLAN	IP Address	Gateway	DNS Server
CS1	10	192.168.10.10	192.168.10.1	192.168.99.10
CS2	10	192.168.10.20	192.168.10.1	192.168.99.10
ENG1	20	192.168.20.10	192.168.20.1	192.168.99.10
ENG2	20	192.168.20.20	192.168.20.1	192.168.99.10
BUS1	30	192.168.30.10	192.168.30.1	192.168.99.10
BUS2	30	192.168.30.20	192.168.30.1	192.168.99.10
BIO1	40	192.168.40.10	192.168.40.1	192.168.99.10
BIO2	40	192.168.40.20	192.168.40.1	192.168.99.10
DNS1	99	192.168.99.10	192.168.99.1	192.168.99.10

Device Inventory

- 1 × Cisco 2911 Router (R1)
- 2 × Cisco 2960-24TT Switches (SW1, SW2)

- 8 × PC end devices
- 1 × Server (DNS1)
- Copper Straight-Through cables for all connections

Implementation Phases

Phase 1: Physical Topology Construction

Devices were placed in Cisco Packet Tracer workspace and connected according to the planned topology. Router R1 was connected to switch SW1, SW1 was connected to SW2, and all end devices were connected to their respective switches.

Phase 2: Switch VLAN Configuration

VLANs were created on both switches with appropriate names and IDs. Switch ports were configured as access ports and assigned to their corresponding VLANs based on connected devices. Trunk ports were configured between switches and between SW1 and the router.

Phase 3: Router Inter-VLAN Routing

Router R1 was configured using router-on-a-stick methodology with subinterfaces created for each VLAN. Each subinterface was configured with 802.1Q encapsulation and assigned an IP address serving as the default gateway for devices in that VLAN.

Phase 4: End Device Configuration

All PCs and the DNS server were configured with static IP addresses according to the predefined addressing scheme. DNS services were configured on the server with hostname mappings for all network devices.

Testing and Results

Testing Methodology

Connectivity tests were performed including intra-VLAN communication, inter-VLAN routing, gateway accessibility, DNS resolution, and server access from all departments.

Verification Methods

Network verification was performed using standard commands to check VLAN configurations, router interface status, and connectivity between devices.

Results

All tests were successfully completed, demonstrating proper network functionality including successful intra-VLAN and inter-VLAN communication, correct gateway accessibility, functioning DNS name resolution, and effective network segmentation.

Conclusion

This project successfully implemented a multi-department LAN using Cisco Packet Tracer, demonstrating practical application of VLAN technology and inter-VLAN routing. The implementation followed concepts from existing research on LAN design and simulation, providing a functional model for departmental network segmentation. The project validated key networking concepts and provides a foundation for more complex network implementations.