

PROJECT REPORT

VoIP- IP Telephony System Network design using cisco packet tracer



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ABSTRACT

A private company Limited, a growing IT infrastructure solution provider, has recently acquired a new branch and requires a scalable and reliable VoIP network. The project focuses on the design and implementation of a comprehensive VoIP-enabled infrastructure using Cisco Packet Tracer. The design includes interconnecting three departments—Finance, HR, and Sales—while maintaining central server access from the ICT department.

This proposal outlines the use of VLANs for separating data and voice traffic, DHCP configuration, inter-VLAN routing, OSPF-based dynamic routing, VoIP and dial-peer configurations, and security features like SSH and password protection. The network simulates a realistic environment for internal voice communication between departments, supporting both scalability and availability.

MOTIVATION

As a private company Limited expands globally, there's a need for a flexible, scalable, and cost-efficient communication network. VoIP provides all these benefits by eliminating traditional phone systems and integrating voice communication over existing IP infrastructure. This project not only supports real-time communication but also helps reduce operational costs while improving performance and manageability.

PROJECT STATEMENT

This project aims to create a complete VoIP-enabled network infrastructure for private company Limited's new branch. The network connects Finance, HR, Sales, and ICT departments, where each user has a PC and IP Phone connected in series. It includes OSPF for routing, VLAN segmentation, dynamic IP assignment, inter-VLAN routing using router-on-a-stick, and telephony service configuration to enable internal voice communication.

Components

Packet Tracer: Used to simulate Cisco networking devices and configurations.

Routers (Cisco 2811): Each department has a VoIP-enabled router. Inter-router links use 10.10.10.0/24 IP range.

Switches (Cisco 2960): Used in each department to connect phones and PCs.

IP Phones: Connected directly to PCs. Assigned IPs via router-based DHCP. Extensions: Finance (1xx), HR (2xx), Sales (3xx), ICT (4xx).

Servers: DHCP, DNS, HTTP, and Email servers located in the ICT department. DHCP for data is handled centrally; routers provide DHCP for voice VLAN.

VLANs: VLAN 100 for voice, department-specific VLANs for data.

Inter-VLAN Routing: Achieved using router-on-a-stick technique by configuring subinterfaces.

Security: SSH access on routers, password encryption, and banner messages applied.

Routing Protocol: OSPF used to advertise all routes between department routers.

Dial-Peering: Configured to enable IP Phones from different routers to communicate.

WORK DONE

1. Software and Hardware Requirements

- Cisco Packet Tracer
- Cisco 2811 Routers
- Cisco 2960 Switches
- IP Phones (7960)
- PCs and necessary cabling (Serial, Straight-through)

2. Network Design and Topology

- Designed a hierarchical network interconnecting all departments.
- Server-side LAN connected to ICT router.

3. Subnetting

- 192.168.100.0/24 used for Data
- 172.16.100.0/24 used for Voice
- 10.10.10.0/24 used between routers

4. VLANs and Inter-VLAN Routing

- Created VLANs for data and voice per department.

- Configured subinterfaces on routers for router-on-a-stick.
- 5. DHCP Configuration**
 - DHCP server in ICT department for data.
 - Routers assign voice IPs using DHCP.
- 6. VoIP Setup**
 - Enabled telephony service on all routers.
 - Configured ephone-dn and ephone for IP Phones.
 - Allocated extension numbers per department (e.g., Finance 101-199).
- 7. Dial Peering**
 - Configured to allow inter-department IP Phone communication.
- 8. Security Setup**
 - SSH enabled with secure passwords.
 - Console and VTY access protected.
- 9. Routing (OSPF)**
 - Configured on all routers for dynamic routing.
- 10. Testing and Verification**
 - Verified DHCP assignments, VLAN isolation, successful ping and call tests.

IMPLEMENTATION

The VoIP network was implemented step-by-step as follows:

- 1. Topology Design:**
 - Designed a hierarchical network including Finance, HR, Sales, and ICT departments.
 - Each department has a router and a switch.

- The ICT department has additional servers connected via LAN.
- 2. Device Connections:**
 - Used serial cables between routers.
 - Used straight-through cables between routers and switches, and between switches and IP Phones/PCs.
 - PCs are connected to the IP Phones.
- 3. IP Addressing and Subnetting:**
 - Subnetting applied for data (192.168.100.0/24), voice (172.16.100.0/24), and inter-router connections (10.10.10.0/24).
- 4. DHCP Configuration:**
 - Data IPs provided by a centralized DHCP server in the ICT department.
 - Voice IPs are assigned by the local routers configured as DHCP servers.
- 5. VLAN Creation:**
 - Created VLAN 100 for all voice traffic.
 - Created separate data VLANs per department.
- 6. Router-on-a-Stick Configuration:**
 - Configured subinterfaces on each router for data and voice VLANs.
 - Enabled trunking between routers and switches.
- 7. VoIP Setup:**
 - Enabled telephony service on all routers.
 - Assigned ephone-dn and ephone entries.
 - Provided extensions according to department codes.
- 8. Dial-Peer Configuration:**
 - Dial-peer voice configuration enabled calling between different departments.
- 9. Security Measures:**
 - Set console, enable, and VTY passwords.
 - Enabled SSH on all routers.
 - Disabled IP domain lookup.

10. **OSPF Configuration:**

- Configured to advertise all directly connected networks on each router.

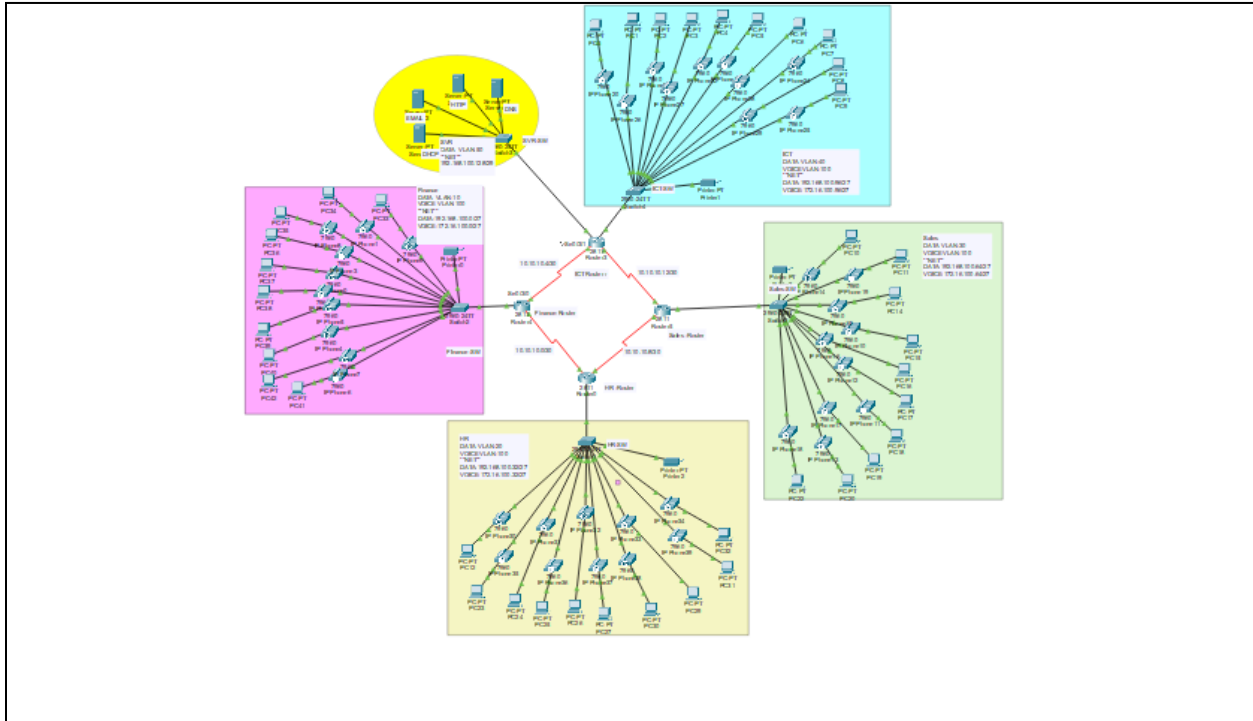
11. **Testing:**

- Verified IP assignment.
- Tested ping between devices.
- Tested IP phone communication across departments.

SECURITY

- **Console, Enable, and VTY Passwords:** Passwords have been set on each router's console, enable, and VTY lines to prevent unauthorized access and ensure only authorized users can configure the devices.
- **SSH Configuration:** SSH (Secure Shell) is configured on all routers for secure remote access instead of Telnet. This encrypts the login session and enhances network security.
- **IP Domain Lookup Disabled:** This feature is disabled to avoid delays caused by mistyped commands being interpreted as hostnames.

Network Design



FUTURE WORK

The current setup serves as an initial prototype. Future improvements may include:

- Implementing SIP for advanced VoIP features
- Adding QoS to enhance voice call quality
- Expanding the network to more departments/branches

CONCLUSION

The VoIP infrastructure project for a private company Limited provides a scalable and reliable network supporting internal voice communication across departments. With features like VLANs, dynamic routing, remote access, and telephony integration, this solution is designed to meet modern enterprise networking demands while preparing students with hands-on Cisco configuration skills.