

**Voice over Internet Protocol**

**COMPUTER NETWORKS LAB**



**INSTRUCTOR:**

Ma'am Farwa Shah

**SUBMITTED BY:**

Muhammad Usama. (2020-CS-652)

Abdullah Arif. (2020-CS-694)

Department of Computer Science, New Campus  
**University of Engineering and Technology, Lahore, Pakistan**

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## **Introduction to Voice over Internet Protocol (VoIP):**

Voice over Internet Protocol (VoIP) is a technology that enables the transmission of voice and multimedia content over IP networks such as the internet. Unlike traditional telephone systems that use dedicated analog lines, VoIP converts voice signals into digital data packets that can be transmitted over the internet.

VoIP has become increasingly popular in recent years due to its cost-effectiveness, flexibility, and advanced features such as video conferencing and unified messaging. In this report, we will explore VoIP technology in the context of Cisco Packet Tracer, a network simulation tool used to design, configure, and troubleshoot networks in a virtual environment.

## **Overview of Cisco Packet Tracer:**

Cisco Packet Tracer is a powerful network simulation tool that allows users to design, configure, and troubleshoot networks in a virtual environment. It is a software-based network simulation tool that enables users to create and configure network topologies using a variety of devices, including routers, switches, and IP phones.

Packet Tracer provides a comprehensive set of tools for network simulation, including simulation of traffic flows, routing protocols, and network services such as DHCP and DNS. It is widely used in academic institutions and networking certification programs such as the Cisco Certified Network Associate (CCNA).

## **VoIP in Cisco Packet Tracer:**

Cisco Packet Tracer provides a rich set of tools and features for simulating VoIP networks. The tool supports various VoIP protocols, including Session Initiation Protocol (SIP), H.323, and Media Gateway Control Protocol (MGCP). These protocols are used to establish and manage voice and multimedia sessions between IP phones, gateways, and other network devices.

Packet Tracer supports the simulation of a variety of VoIP network components, including IP phones, softphones, gateways, and call managers. The tool also provides a range of features for simulating VoIP traffic flows, including voice and video codecs, call routing, and Quality of Service (QoS) settings.

## **Configuring VoIP in Cisco Packet Tracer:**

To configure VoIP in Cisco Packet Tracer, we need to create a network topology that includes VoIP devices such as IP phones, gateways, and call managers. We can use Packet Tracer's drag-and-drop interface to add and configure these devices, assign IP addresses, and configure network settings such as VLANs and QoS.

Once the VoIP devices are configured, we need to establish a call routing plan that specifies how calls are routed between devices. This involves configuring dial plans, which are used to translate phone numbers into IP addresses, and setting up call routing rules that determine how calls are routed based on destination numbers.

We can also configure advanced features such as call queuing, conferencing, and voice mail using Packet Tracer's graphical user interface. These features allow us to simulate real-world VoIP

scenarios and test the performance and reliability of our network configurations.

## **Technologies Implemented:**

- Creating a network topology using Cisco Packet Tracer.
- Hierarchical Network Design.
- Connecting Networking devices with Correct cabling.
- Configuring Basic device settings.
- Creating VLANs and assigning ports VLAN numbers.
- Creating both data and voice VLANs and assigning ports VLAN numbers.
- Subnetting and IP Addressing.
- Configuring Inter-VLAN Routing on the Routers (router-on-a-stick).
- Configuring Dedicated DHCP Server device for Data to provide dynamic IP allocation.
- Configuring Routers as DHCP server for Voice to provide IP Phones dynamic IP allocation.
- Configuring SSH for secure Remote access.
- Configuring OSPF as the routing protocol.
- Configuring VoIP or Telephony service configuration in all routers.
- Configuring Routing for VoIP or Dial peering configuration in all routers.
- Host Device Configurations.
- Test and Verifying Network Communication.

## **Process:**

- Design a networked system to meet the given specifications. Use packet tracer software to design your network.
- Routers- Each department is to have VoIP enabled router with server-side LAN attached to the ICT department router. Note: use Cisco 2811 router.
- Switches- Each department has an access layer switch. Note: use Cisco 2960 switch.
- Connections- Use serial connections between a router and a router, then a straightthrough cable between the router to switch, switch to hosts, phones to PCs.
- Subnets- Each department will be accessing two subnetworks, for example, data and voice subnets. Note: carry out appropriate subnetting.
- Basic settings- Configure basic device settings such as hostnames, console passwords, enable passwords, banner messages, encrypt all passwords, and disable IP domain lookup.
- DHCP Server- For voice (VoIP), use the respective router as the DHCP server while for Data use the DHCP server device at the server-side site.
- VLANs- Each department will be in two VLANs. One for data and another for voice. Note: All IP phones in the network should be in VLAN 100.
- Inter-VLAN Routing- Use router-on-a-stick to enable inter-VLAN routing on the network. Note: create subinterfaces for both data and voice VLANs.
- IP Addressing- All devices in the network are expected to obtain an IP address dynamically from the respective DHCP servers while the devices in the server room are to be allocated IP addresses statically.
- Routing protocol- Use OSPF as the routing protocol to advertise routes on the routers.
- Remote Access- Configure SSH in all the routers for remote login.

- Telephony service- Configure VoIP on the routers and allocate dial numbers in this format for the departments, Finance(1..), HR (2..), Sales (3..), and ICT (4..), (where 1.. can be 101 to 199) and so on.
- Routing for VoIP- Configure dial-peering on the routers to allow IP phones from different routers to communicate.
- Finalize- Test Communication, ensure everything configured is working as expected.

## **Testing VoIP in Cisco Packet Tracer:**

Once VoIP is configured in Packet Tracer, we can test the network using a variety of tools and techniques. We can use Packet Tracer's built-in simulation features to test voice and multimedia traffic flows, simulate network congestion, and analyze network performance using tools such as Wireshark.

We can also use Packet Tracer to conduct real-time testing of VoIP networks by placing test calls between devices and analyzing call quality metrics such as latency, jitter, and packet loss. This allows us to identify potential performance issues and optimize our network configurations for maximum efficiency and reliability.

## **Conclusion:**

In conclusion, Cisco Packet Tracer is a powerful network simulation tool that provides a comprehensive set of features for designing, configuring, and troubleshooting VoIP networks. The tool supports a range of VoIP protocols and devices, allowing users to simulate real-world VoIP scenarios and test network performance and reliability.

With Packet Tracer, users can configure VoIP devices such as IP phones, gateways, and call managers, set up call routing plans, and configure advanced features such as call queuing, conferencing, and voice mail. The tool also provides a range of testing and troubleshooting features, including simulation of traffic flows, real-time testing of VoIP networks, and analysis of call quality metrics.

Overall, Cisco Packet Tracer is an essential tool for anyone working with VoIP networks, including students, network administrators, and IT professionals. It allows users to gain practical experience in VoIP network design and troubleshooting, enabling them to develop the skills and knowledge needed to build and maintain efficient and reliable VoIP networks.