Visvesvaraya Technological University
Belagavi, Karnataka-590 018

"internship/professional practice on Cisco Networking"

Submitted for partial fulfillment of the requirement for the award

of the degree Of

Bachelor of Engineering

in

Electrical and Electronics Engineering

Submitted by

Name	USN
MADHU GOWDA H K	**4AD18EE015**

Under the Guidance of

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2021-2022

ATME College of Engineering, Mysuru-570028
Department of Electrical and Electronics Engineering

CERTIFICATE

This is to certify that the Internship report is a bonafide work carried out by **MADHU GOWDA H K : 4AD18EE015,** in partial fulfillment for the award of Bachelor **of Engineering** in **Electrical and Electronics Engineering**, of the **Visvesvaraya Technological University, Belagavi -590 018** during the year 2021-2022. It is certified that all corrections/suggestions indicated for the Internal Assessment have been incorporated in the report deposited in the departmental library. The Internship report has been approved as it satisfies the academic requirements in respect of work prescribed for the said Degree.

Dr. Sathish K R	Dr. Parthasarathy L	Dr. L Basavaraj
Internal Guide	**Head of the Department**	**Principal**

External Examiners

Name of the examiner Signature with date

1.

2.

Corporate Social Responsibility

Certificate of Course Completion

Cisco Networking Academy

CCNAv7: Introduction to Networks

The student has successfully achieved student level credential for completing CCNAv7: Introduction to Networks course administered by the undersigned instructor. The student was able to proficiently:

- Configure switches and end devices to provide access to local and remote network resources.
- Explain how physical and data link layer protocols support the operation of Ethernet in a switched network.
- Configure routers to enable end-to-end connectivity between remote devices.
- Create IPv4 and IPv6 addressing schemes and verify network connectivity between devices
- Explain how the upper layers of the OSI model support network applications.
- Configure a small network with security best practices.
- Troubleshoot connectivity in a small network.

MADHU GOWDA H K

Student

ATME College of Engineering

Academy Name

India | **21 Oct 2021**

Location | Date

Kiran B

Instructor

Instructor Signature

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MADHU GOWDA H K

Student

ATME College of Engineering

Academy Name

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Location | Date

Laura Quintana
VP & General Manager, Cisco Networking Academy

DECLARATION

I, **MADHU GOWDA H K : 4AD18EE015,** student of VIII semester, **Department of Electrical and Electronics Engineering**, **ATME College of Engineering, Mysuru-570028** declare that the Internship training has been successfully completed. This work is submitted to **Visvesvaraya Technological University, Belagavi-590 018**, in partial fulfillment of the requirements for the award of Degree of **Bachelor of Engineering in Electrical and Electronics Engineering** during the academic year 2021-2022.

Name	USN	Signature with date
MADHU GOWDA H K	**4AD18EE015**	

ACKNOWLEDGEMENT

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I take this opportunity to express my profound gratitude and deep regards To **Prof. Dr. Parthasarathy L, Head, Department of Electrical and Electronics Engineering, ATME College of Engineering, Mysuru,** for the continuous encouragement and inspiration. The blessing, help and guidance given by him, time to time shall carry us a long way in the journey of our life on which I am about to embark..

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MADHU GOWDA H K 4AD18EE015

ABSTRACT

In CCNA the Cisco Packet Tracer is a simulation-based learning environment that allows to experiment with computer networks behaviors and helps to develop the skill such as decision making, critical thinking and problem solving. This software provides a visual simulation of complex networking concepts and configurations and allows to practice using a command- line interface. These simulation capabilities can help simplify the learning process and other visual representation of internal networking functions, such as real-time dynamic data transfers and packet content expansion.

Keywords: Cisco, CCNA, Packet Tracer, Network

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CHAPTER-1

INTRODUCTION

ABOUT INTERNSHIP

The Internship program is done under Cisco Networking Academy in Cisco Center of Excellence at Department of Computer Science and Engineering, ATME College of Engineering Mysuru.

Cisco was founded in 1984 in order to enable communication, found by Len Bo sack and Sandy Lerner who were experimenting at Stanford University to connect detached networks in two separate buildings on campus. Further it has been established as Cisco Networking Academy in 1997.It is an IT skills and career building program which provide training on networks for institutions and individuals worldwide. Since 1997, Cisco Networking Academy has been working toward a single goal "fostering the technical and entrepreneurial skills that people, educators, and companies need to change the world for the better". They support education worldwide by helping young people learn IT skills and enabling them to innovate like technologists, think like entrepreneurs, and act as social change agents solving today's problems using technology.

For 20 years, Cisco Networking Academy has changed the lives of 9.2 million students in 180 countries by providing education, technical training, and career mentorship. More than 5.5 million people have joined the Networking Academy and become a force for change in the global economy. From secondary schools to universities to community organizations, more than 9000 institutions in 170+ countries offer the Networking Academy curriculum. It is the flagship program of Cisco Corporate Social Responsibility (CSR) efforts. Together, they are building the workforce of tomorrow.

Cisco Center of Excellence houses a Cisco Net Academy in its premises, for providing the Latest Technology Experience to its students. This academy provides the latest courses on the Networking domain to its students inside the campus to keep them

updated about the latest .advancements. This Platform is a online e-learning platform that is accessible to students worldwide. Students can choose from a variety of learning resources and courses, based on their particular interests, required skills for job placements, and location preferences. Students may choose to take self-paced, online courses offered directly by Cisco or may choose to take self- paced or instructor led Cisco Networking Academy courses offered by partners who are Academies authorized by Cisco to use our teaching materials and resources.

The support provided by CISCO for the course includes:

- Establishment of Latest Technology Labs
- Train the Trainer Program
- Student Engagement

ABOUT THE DEPARTMENT

CCNA

CCNA stands for Cisco Certified Network Associate and it is one of the two most popular network-related certifications provided by Cisco Systems, Inc. Cisco systems manufactures and sells networking equipment and is the largest networking company in the world right now. A networking professional does not need any pre-requisite certifications to apply for CCNA certification except for CCDA (CC Design Associate).CCNA is given for many domains such as routing and switching, cloud, CyberOps, security, service provider industrial plants and wireless .CCNA Routing and Switching certification is almost similar to the older CCNA certification and also the popular among all the types of domain-specific CCNA.

The CCNA certification has been devised by CISCO and stands for Cisco Certified Network Associate. The certificate validates a professional's ability to understand, configure, operate, configure and troubleshoot medium-level switched and routed networks and also includes the verification and implementation of connections via remote sites using WAN.

Although the CCNA certification is only a beginner-level certification, it still attracts a series of benefits for the certification holder: validates one's specific technical skills, considerably increasing the possessor's professional credibility - persons who have obtained the CCNA certification have better prospects of occupying stable job positions inside renowned ,reputed IT companies; is an indicator of expertise in working with networks that have fewer than100 nodes validates one's ability to work in small and medium sized businesses and organizations that use less extensive networks; represents a prerequisite for obtaining higher level Cisco certifications individuals who are interested in obtaining a professional or expert level in the Cisco Career Certification tracks need to obtain the CCNA certification first.

Individuals who have obtained the CCNA certification have proved good skills and experience in installing, configuring and operating LAN, WAN and dial access services for networks that have fewer than 100 nodes; using IP, IGRP, Serial, Frame Relay, VLANs, RIP, IP RIP, Access Lists and Ethernet network protocols; installing and configuring various Cisco switches and routers in internetworks which use multiple protocols and have LAN and WAN interfaces; ensuring network performance and security; providing beginner level network troubleshooting services.

MISSION AND VISION

MISSION:

The mission statement of CISCO is short and not very specific. There are two parts of the mission statement. The first part is about shaping the future of the internet. CISCO deals in products related to connectivity and communications. The second part is about creating unprecedented value for all the stakeholders. However, the mission statement is not detailed or specific in any of the two parts. It makes a generic statement about its business in the first part and then about creating value for the stakeholders in the second. Apart from being specific, it has to be feasible.

VISION:

The vision statement of CISCO has grown totally outdated and will need to be changed. It states no clear future position for the brand. It is also difficult to relate it with the brand's purpose. A vision statement provides guidance on how the brand can continue to move into its future. CISCO's Vision statement talks of anything but the future. It does not say anything about its employees, customers or even the business. From market size to market position or other things, it does not provide the faintest inkling of how CISCO plans to grow its business.

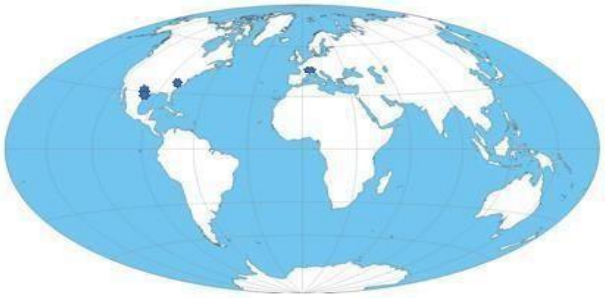
PRODUCTS AND SERVICES:

Cisco provides a wide range of networking products such as Cisco Switches, Routers, Network interfaces, modules, wireless access points, outdoor and industrial access points and controllers. Security products such as Next Generation Firewalls, Advance Malware Protection, Multi-factor Authentication, VPN Security of Client ,Email Security and Web Security.

Services Provided by Cisco:

- **Advisory:** Achieve desired business results with technology guidance and expertise.
- **Implementation:** Speed deployments and simplify IT with proven methods.
- **Training:** Develop talent truly capable of transforming businesses in the digital age. Improve efficiency, performance, and productivity to boost the value of your resources.
- **Managed:** Manage and optimize your IT and network assets in the cloud and on- premises.
- **Technical:** Keep IT working consistently, efficiently, and securely.

Cisco Networking Academy leverages its own data centers to deliver the Program globally. The Cisco Networking Academy data centers are currently located in the following countries



Location	**Data center name**
Americas	Cisco Data Center, Richardson, TX (2 data centers)
Americas	AWS Data Center, N Virginia
Europe	Out Scale Data Center, Paris, France

INTRODUCTION TO NETWORKS:

A Network is a group of devices that are connected together in order to communicate. In today's world, through the use of networks, we are connected like never before. People with ideas can communicate instantly with others to make those ideas a reality. News events and discoveries are known worldwide in seconds. Individuals can even connect and play games with friends separated by oceans and continent. Advancements in networking technologies are perhaps the most significant changes in the world today. They are helping to create a world in which national borders, geographic distances, and physical limitations become less relevant presenting ever-diminishing obstacles. Although Internet has changed the manner in which social, commercial, political, and personal interactions occur. The immediate nature of communications over the Internet encourages the creation of global communities. Global communities allow for social interaction that is independent of location or time zone. The creation of online communities for the exchange of ideas and information has the potential to increase productivity opportunities across the globe. Cisco refers to this as the human network. The human network centers on the impact of the Internet and networks on people and businesses.

Networks have changed the way we learn. Access to high quality instruction is no longer restricted to students living in proximity to where that instruction is being delivered. Online distance learning has removed geographic barriers and improved student opportunity. Robust and reliable networks support and enrich student learning experiences. They deliver learning material in a wide range of formats including interactive activities, assessments, and feedback. The globalization of the Internet has used in new forms of communication that empower individuals to create information that can be accessed by a global audience. Some forms of communication includes texting, social, media, collaboration tools, blogs, wikis, podcasting, file sharing. In the business world, data networks were initially used by businesses to internally record and manage financial information, customer information, and employee payroll systems. These business networks evolved to enable the transmission of many different types of information services, including email, video, messaging, and telephony.

NETWORK ARCHITECTURE:

Networks must support a wide range of applications and services, as well as operate over many different types of cables and devices, which make up the physical infrastructure. The network architectures classified into two types Client-Server architecture and Peer to Peer architecture.

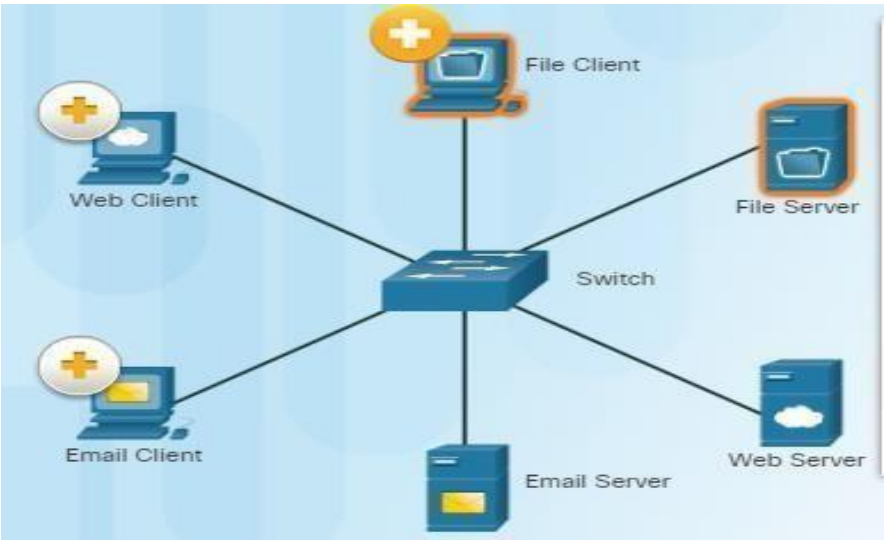


Figure 1.1: Client –Server architecture

Servers are computers with software that enable them to provide information, like email or web pages, to other end devices on the network. Each service requires separate server software. For example, a server requires web server software in order to provide web services to the network. A computer with server software can provide services simultaneously to one or many clients. Additionally, a single computer can run multiple types of server software. In a home or small business, it may be necessary for one computer to act as a file server, a web server, and an email server.

Clients are computers with software installed that enable them to request and display the information obtained from the server. An example of client software is a web browser, like Chrome or Firefox. A single computer can also run multiple types of client software. For example, a user can check email and view a web page while instant messaging and listening to Internet radio.

Peer to peer:

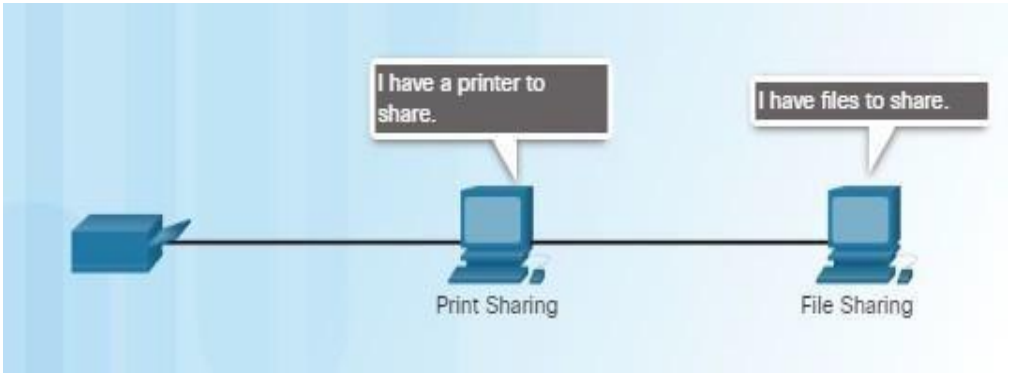


Figure 1.2: Peer to Peer Architecture

Client and server software usually runs on separate computers, but it is also possible for one computer to carry out both roles at the same time. In small businesses and homes, many computers function as the servers and clients on the network. This type of network is called a peer-to-peer network.

OVER VIEW OF NETWORK COMPONENTS:

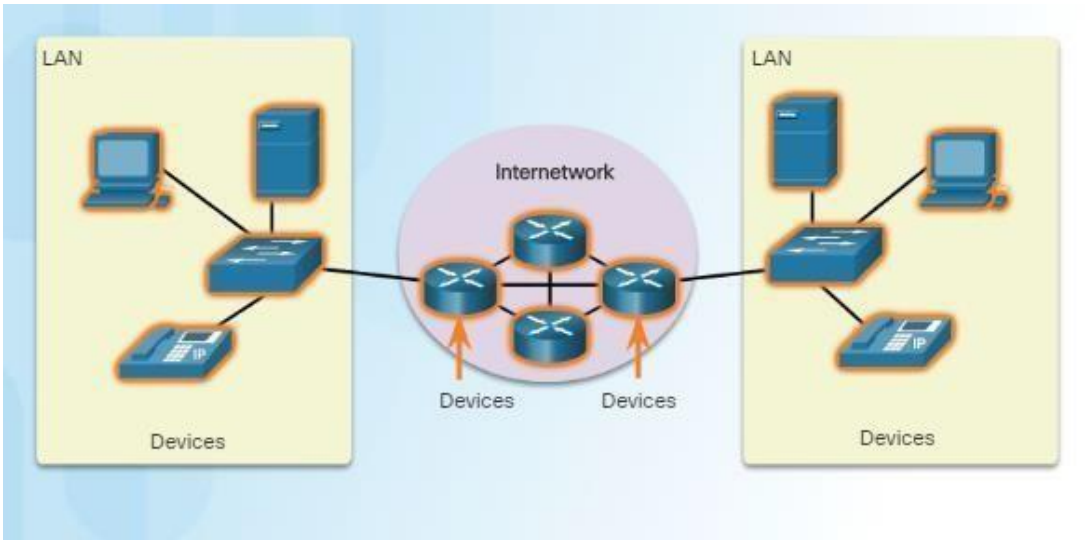


Figure 1.3: Components of Network

The path that a message takes from source to destination can be as simple as a single cable connecting one computer to another, or as complex as a collection of networks that literally spans the globe. This network infrastructure provides the stable and reliable

these communications occur. The network infrastructure contains three categories of network components: Devices, Media, and Services.

End devices: The network devices that people are most familiar with are called end devices. An end device is either the source or destination of a message transmitted over the network.

NETWORK MEDIA:

Communication across a network is carried on a medium. The medium provides the channel over which the message travels from source to destination. Modern networks primarily use three types of media to interconnect devices and to provide the pathway over which data can be transmitted.

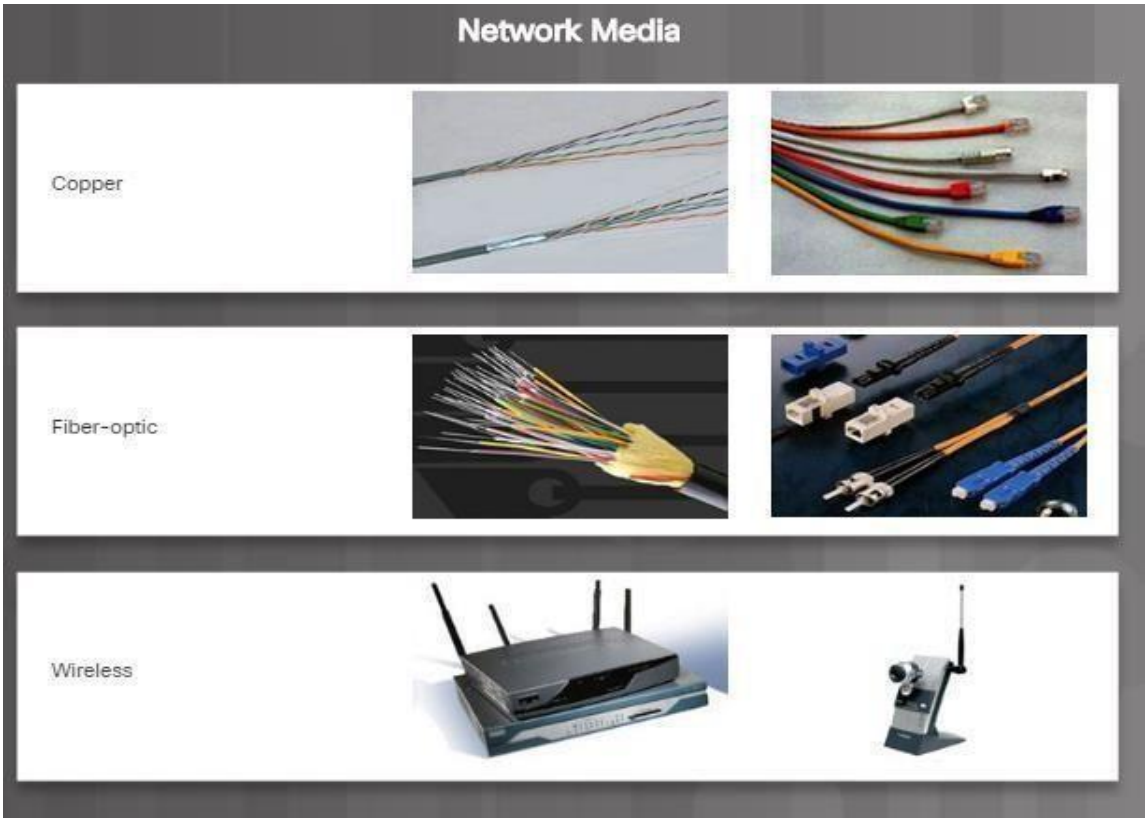


Figure 1.4: Different Network Media

- **Metallic wires within cables** - data is encoded into electrical impulses
- **Glass or plastic fibers (fiber optic cable)** - data is encoded as pulses of light

- **Wireless transmission** - data is encoded using wavelengths from the electromagnetic spectrum

TYPES OF NETWORK:

- **Local Area Network (LAN)** - A network infrastructure that provides access to users and end devices in a small geographical area, which is typically an enterprise, home, or small business network owned and managed by an individual or IT department.

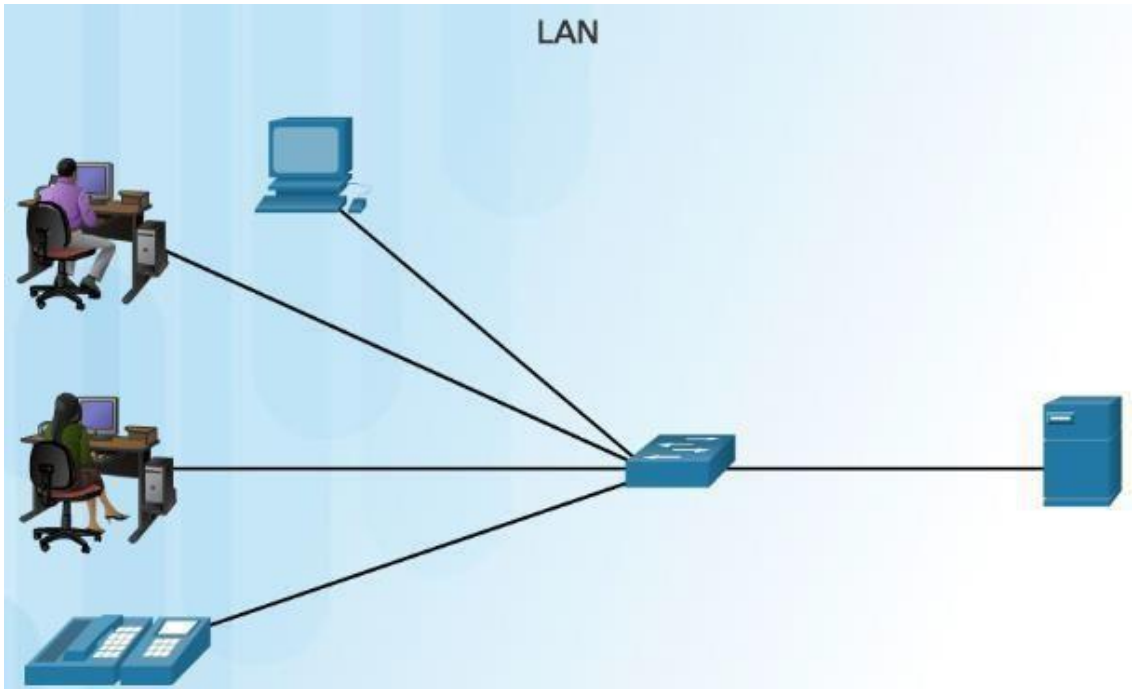


Figure 1.5: Over view of LAN

- **Wide Area Network (WAN)** - A network infrastructure that provides access to other networks over a wide geographical area, which is typically owned and managed by a telecommunications service provider.

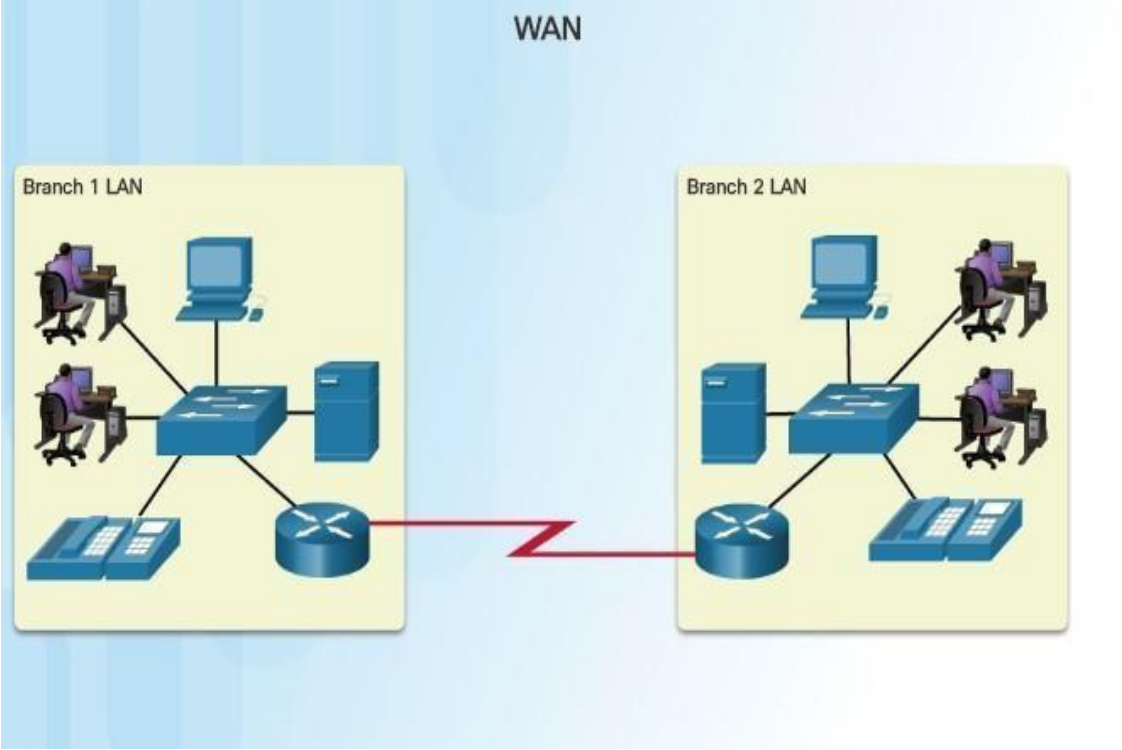


Figure 1.6: Overview of WAN

Other types of networks include:

- **Metropolitan Area Network (MAN) -** A network infrastructure that spans a physical area larger than a LAN but smaller than a WAN (e.g., a city). MANs are typically operated by a single entity such as a large organization.

- **Wireless LAN (WLAN) -** Similar to a LAN but wirelessly interconnects users and end points in a small geographical area.

- **Storage Area Network (SAN) -** A network infrastructure designed to support file servers and provide data storage, retrieval, and replication.

THE INTERNET:

The Internet is a worldwide collection of interconnected networks (internetworks or internet for short). Some of the LAN examples are connected to each other through a WAN connection. WANs are then connected to each other. The red WAN connection lines represent all the varieties of ways we connect networks. WANs can connect through copper wires, fiber optic cables, and wireless transmissions.

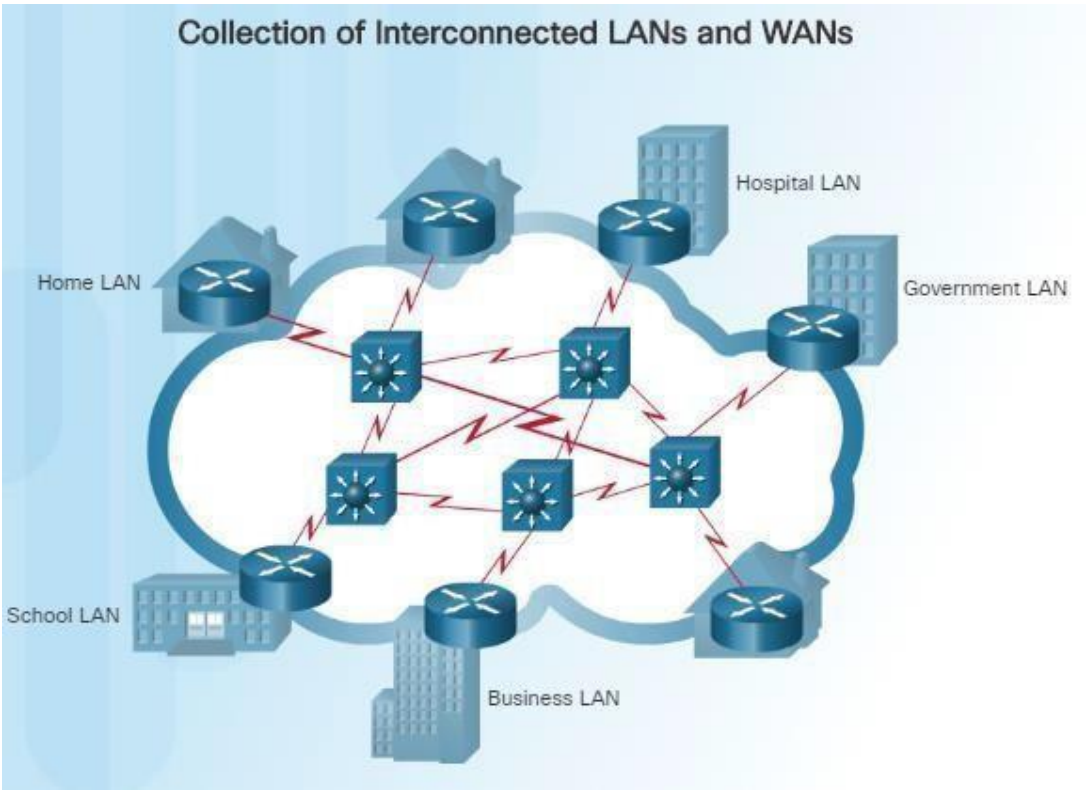


Figure 1.7: Overview of Internet

The Internet is not owned by any individual or group. There are organizations that have been developed for the purpose of helping to maintain structure and standardization of Internet protocols and processes. These organizations include the Internet Engineering Task Force (IETF), Internet Corporation for Assigned Names and Numbers (ICANN), and the Internet Architecture Board (IAB), plus many others

Internet Access technology:

There are many different ways to connect users and organizations to the Internet.

Home users, teleworkers (remote workers), and small offices typically require a connection to an Internet Service Provider (ISP) to access the Internet. Connection options vary greatly between ISP and geographical location. However, popular choices include broadband cable, broadband digital subscriber line (DSL), wireless WANs, and mobile services.

Organizations typically require access to other corporate sites and the Internet. Fast connections are required to support business services including IP phones, video conferencing, and data center storage.

Business-class interconnections are usually provided by service providers (SP). Popular business-class services include business DSL, leased lines, and Metro Ethernet.

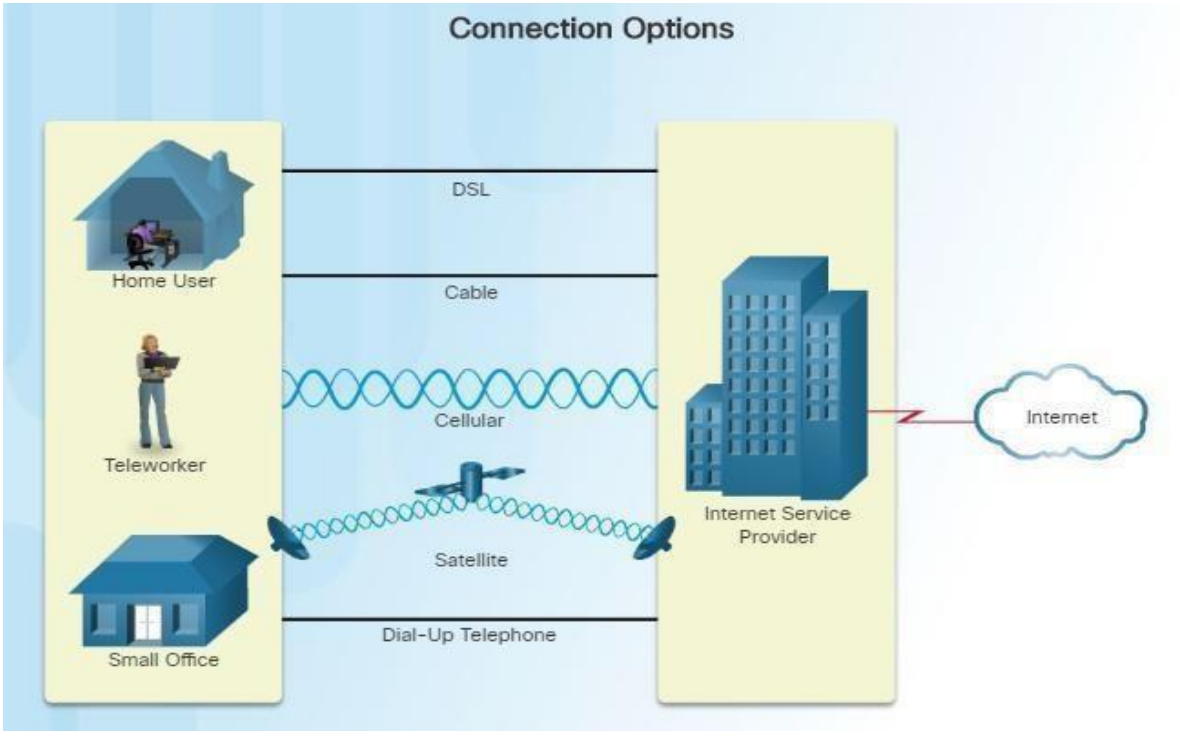


Figure 1.8: Connection Options

CHAPTER-3

OBJECTIVE

Objective:

- To use skills acquisition and a combination of multiple learning theories to support mastery, and build competence and confidence.
- To give Networking Career advice that focuses on the fundamentals of how to be employable as a technology expert in the field of networking.

CHAPTER-3

HARDWARE AND SOFTWARE

REQUIREMENT SPECIFICATIONS

SOFTWARE REQUIREMENTS

- **CPU** : Intel Pentium 4, 2.53 GHz or equivalent
- **OS** : Microsoft Windows 7, 8.1, 10, Ubuntu Linux 16.04 LTS (Ubuntu12.04or 14.04 LTS not supported anymore)
- **RAM** : 2 GB
- **Storage** : 1.4 GB of free disk space
- **Display resolution**: 1024 x 768
- Language fonts supporting Unicode encoding (if viewing in languages other than English)
- Latest video card drivers and operating system updates

HARDWARE REQUIREMENTS

- **Switches**: Cisco catalyst 2950T
- **Routers**: Cisco 1800 series, Cisco 2400 series
- **Flash Memory and RAM**: At least 64MB flash and 192MB of RAM for the 1800 series 128MB flash and 512MB RAM for the 2800 series.
- **Cables and USB cable**

TOOLS USED ABOUT PACKET TRACER:

Packet Tracer is a cross-platform visual simulation tool designed by Cisco Systems that allows users to create network topologies and imitate modern computer networks. The software allows users to simulate the configuration of Cisco routers and switches using a simulated command line interface. Packet Tracer makes use of a drag and drop user interface, allowing users to add and remove simulated network devices as they see fit.

The software is mainly focused towards Certified Cisco Network Associate Academy students as an educational tool for helping them learn fundamental CCNA concepts. Previously students enrolled in a CCNA Academy program could freely download and use the tool free of charge for educational use.

Packet Tracer is virtual networking simulation software developed by Cisco, to learn and understand various concepts in computer networks. Networking devices appear in packet tracer as they look in reality and a student can interact with various networking devices, by customizing the configurations, by turning them on and off etc. Packet Tracer is teaching and learning software and a tool, easy to work with, thus after working with virtual environment, a student gains lot of confidence, when it comes to working in real-time environment. We can track the path of a packet, when it moves from source to destination, and also learn and understand, how to troubleshoot a network, when a packet doesn't reach the destination. Packet Tracer can be used to learn concepts more clearly by creating different scenarios. Since Networking is all about imagination and it's difficult to track movement of packets in a real-time environment, thus various networking concepts can be explained by creating a virtual environment, showing the moment of packets, exactly as it would happen in real-time.

PACKET TRACER WORKSPACE:

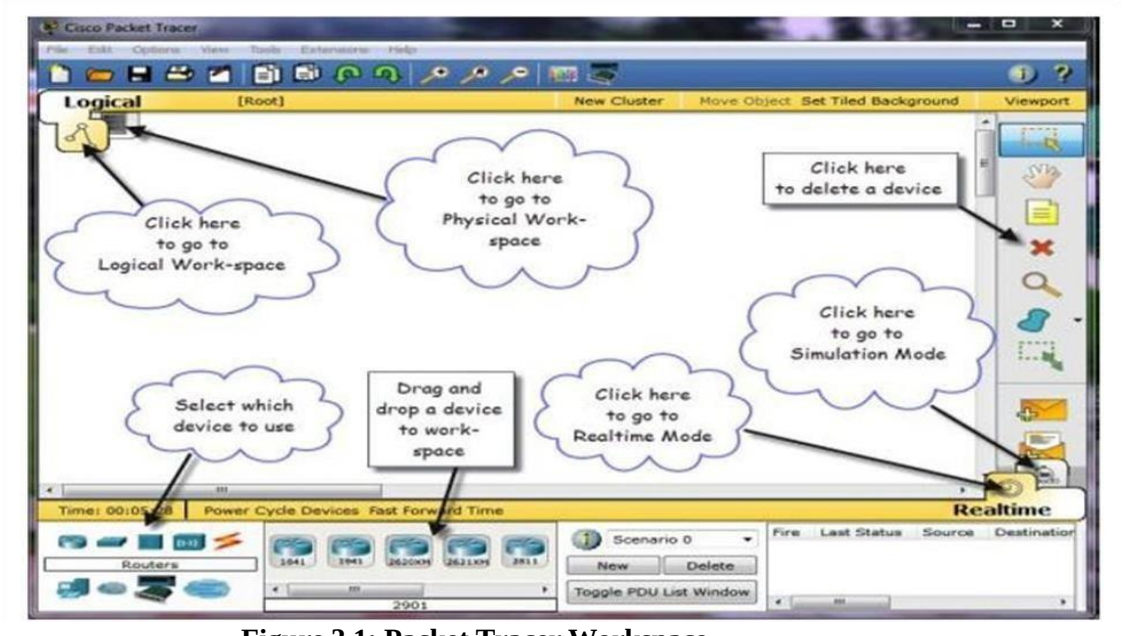


Figure 3.1: Packet Tracer Workspace

Workspaces: There are two types of work space Logical Work-space, It allows users to build logical network topologies and various devices can be dragged and dropped to logical workspace. Physical work-space, it allows a user to create a network, the way as it would, where different networking devices can be shown as connected at different locations of the city. Modes: There are two types Modes

- **Real-time Mode:** The devices in a network behave as real devices do and look similar to real devices.
- **Simulation Mode:** In this mode, a student can see and control time intervals, to learn how to troubleshoot network failures.

NETWORKING DEVICES:

There are various networking devices which can be used to create different networking scenarios. E.g. Routers, Switches, Hubs, Wireless Devices, Connections, End Devices, WAN Emulation, Custom Made Devices, Multi-user Connection, Personal Computer, Laptops, Servers, Printers, IP Phones, VOIP Devices, Analog-Phones, TVs, Wireless-Tablets, PDAs, Wireless End Devices, Wired End Devices etc.

CONNECTIONS:

Various types of cables which can be used to connect various networking devices in a packet tracer are Consolecable, Copper straight-through cable, Copper Cross-over Cable, Fiber Cable, Phone Cable, Coaxial Cable, Serial DTE, Serial DCE, and Octal Cable.

While connecting various cables to connect various networking devices, it is important to know which type of cable to use and to which port the cable should be connected to a particular networking device. Most of the times we deal with a pc, switch and a router, thus it's important to know what type of cable can be used to connect these devices On a PC, we can add a module based on the requirement, enable firewall rules, assign IPV4 and IPV6 address, default- gateway and subnet mask to an interface. We can also create a dial-up connection and use the terminal software to access the CLI of a router using console cable. We can run various diagnostics tests using Command Prompt; also we can use Web Browser, Wireless connection, VPN, Traffic Generator, MIB Browser, Cisco Ip Communicator, Email, PPPoE Dialer, Text Editor.

DEVICES	CABLE
Pc to Pc	Cross-Over Cable
Pc to Router	Cross-Over Cable
Pc to Switch	Straight Cable
Switch to Router	Straight Cable
Router to Router	Serial Cable

Table 3.1: Types of cables to connect devices

SERVICES:

We can also use the following services on a server HTTP, DHCP, TFTP, DNS, SYSLOG, AAA, NTP, EMAIL, FTP, FIREWALL, IPV6 FIREWALL, and test these services

from the client machine. Packet tracer has a user friendly CLI mode, where a user can type different commands to configure various network devices. It is important to know which mode a student is using, what are the command scan be used in that mode and how to navigate between different modes of a networking device.

Figure 3.2: Various Services on Packet Tracer

MODE	SYMBOL
User Mode	Router>
Privilege Mode	Router#
Global Configuration Mode	Router(config)#
Interface Configuration Mode	Router(config- if)#
Line Configuration Mode	Router(config-line)#

Table3.2: Basic Modes of Router

These are the basic modes of a router, which are recognized by the symbols shown in the table below. A user needs to know which mode he is in, what are the various commands that he can type in that mode? And navigate between different modes of a router. If a user is not sure of what are the commands to be typed in any mode, then he can type the "?" Symbol to get help, or can get the list of commands to be given in that mode.

FEATURES OF PACKET TRACER:

Packet creates a simulation environment where a student gets visualization experience. An instructor can set up an activity wizard to assess the students by giving them different grades. There is also a multi-user feature, where students at different physical locations can work together on the same project, assignment or lab. Packet tracer has both Logical and physical workspace to create customized scenario based labs and it has got both Real-time and simulation Modes to understand various networking concepts, the same way as it would have happened in real time. Packet trace also has got user friendly GUI and CLI interfaces, Another most important feature of packet tracer is that it can support multiple languages and it is platform independent. It is an open-source software which can be downloaded free of cost from the internet. Packet tracer also helps to understand the concept of logical troubleshooting and it can also be used for case studies. There are integrated tutorials along with the software to understand use of various features of packet tracer. It also supports group and individual labs, homework, exams, games, problem solving etc.

CHAPTER-4
CASE STUDY

CASE STUDY

DIFFERENT CLASS REPRESENTATION OF NETWORKS

The 32 bit IP address is divided into five sub-classes. These are:

- Class A
- Class B
- Class C
- Class D
- Class E

Each of these classes has a valid range of IP addresses. The Class A ranges from 0 to 127, Class B from 128 to 191, Class C from 192-223,Classes D and E are reserved for multicast and experimental purposes respectively.

The order of bits present in the first octet determines the classes of IP address. IPv4 address is divided into two parts:

- **Network ID**
- **Host ID**

Class	Address range	Supports
Class A	1.0.0.1 to 126.255.255.254	Supports 16 million hosts on each of 127 networks.
Class B	128.1.0.1 to 191.255.255.254	Supports 65,000 hosts on each of 16,000 networks.
Class C	1.0.0.1 to 126.255.255.254	Supports 254 hosts on each of 2 million networks.
Class D	224.0.0.0 to 239.255.255.255	Reserved for multicast groups.
Class E	240.0.0.0 to 254.255.255.254	Reversed for future use, or research and development purpose.

Table 4.1: Different class representation

	8bits	8bits	8bits	8bits
Class A	Network	Host	Host	Host
Class B	Network	Network	Host	Host
Class C	Network	Network	Network	Host

Reserved network bits and host bits cannot be used in Subnetting. After excluding reserved network bits and host bits, remaining bits are considered as Subnetting eligible host bits.

Introduction to Subnetting

Subnetting allows us to create multiple logical networks that exist within a single Class A, B or C. If subnetting is not done, only one network from a particular Class network could be used but this would result in wasting of other usable ip address which is unrealistic.

Each data link on a network must have a unique network address, with every host on that link being a member of the same network. If a major network is broken (Class A, B, or C) to smaller subnetworks, we can create a network of interconnected subnetworks. Each data link on this network would then have a unique network/subnetwork ID.

To subnet a network, extend the mask using some of the bits from the host ID portion of the address to create a subnet work ID.

Example: Consider network of 172.16.1.0/26, Assume that each subnet should have 50 host. Find the maximum subnets that could be created and its subnet mask.

Solution: This is a IPv4 address and its network size is 32 bits in binary. 24 bits are used up for network portion and the 8 bits are used as host portion. A network consists of a network address, broadcast address and usable ip address that can be assigned to the network devices.

The subnets can be created in this manner:

172.16.1.0 – 10101100.00010000. 00000001.00000000

The address on the left is in the dotted decimal notation and the binary representation is on the right. When planning for subnetting, it is easier to visualize the different portions for the network address when it is in binary format.

The required number of hosts is 50. But this does not include the network and broadcast addresses.

For First Subnet:

Subnet	Ip Address	Binary Representation
Subnet Address	172.16.1.0	10101100.00010000.00000001.00000000
Broadcast Address	172.16.1.63	10101100.00010000.00000001.01000001
Subnet mask	255.255.255.192	11111111.11111111.11111111.11000000

Therefore, the total addresses available from the 1st subnet are 64 but only 62 addresses can be assigned as host (i.e. 192.168.100.1 to 192.168.100.62). The subnet mask is 255.255.255.192.

By extending the mask to be 255.255.255.192, we have considered by taking two bits from the original host portion of the address and used them to make subnets. With these two bits, four subnets could be created. With the remaining six host IP bits, each subnet can have up to 64 host addresses. A single subnet can be split up into four64-host subnets.

Subnet Network Table / Addressing Table

Subnet number	Subnet address	Broadcast address	Subnet mask
Subnet 1	192.168.100.0/26	192.168.100.63/26	255.255.255.192
Subnet 2	192.168.100.64/26	192.168.100.127/26	255.255.255.192
Subnet 3	192.168.100.128/26	192.168.100.191/26	255.255.255.192
Subnet 4	192.168.100.192/26	192.168.100.255/26	255.255.255.192

case1:Trouble shooting

Scenario/ Background

After an update to the network, some devices were misconfigured. You have been tasked with correcting the configurations and verifying that all the PCs can access the websites, R1, switches, and other PC can access R1 using SSH.

Router R1 and all the switches have been preconfigured with the following:

- o Enable password: **Ciscoenpa55**
- o Console password: C**iscoconpa55**
- o Admin username and password: **Admin1**/**Admin1pa55**

Required number of hosts per subnet:

- o IT: 50 hosts
- o Marketing: 50 hosts
- o R&D: 100 hosts

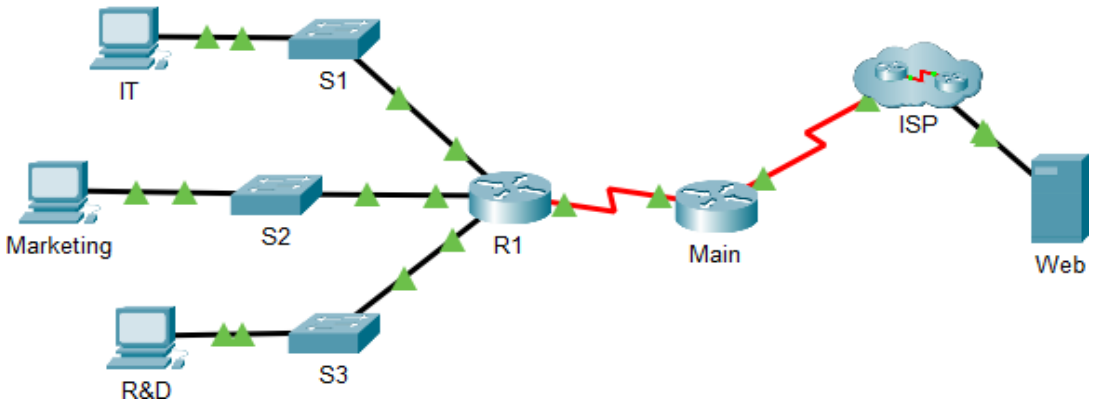


Figure 4.1: Topology

Device	Interface	IPv4 Address	Subnet Mask	Default Gateway
		IPv6 Address/Prefix	IPv6 Link-local	
R1	G0/0	172.16.1.62	255.255.255.192	N/A
		2001:DB8:CAFE::1/64	FE80::1	N/A
	G0/1	172.16.1.126	255.255.255.192	N/A
		2001:DB8:CAFE:1::1/64	FE80::1	N/A
	G0/2	172.16.1.254	255.255.255.128	N/A
		2001:DB8:CAFE:2::1/64	FE80::1	N/A
	S0/0/1	10.0.0.2	255.255.255.252	N/A
		2001:DB8:2::1/64	FE80::1	N/A
Main	S0/0/0	209.165.200.226	255.255.255.252	N/A
		2001:DB8:1::1/64	FE80::2	N/A
	S0/0/1	10.0.0.1	255.255.255.252	N/A
		2001:DB8:2::2/64	FE80::2	N/A
S1	VLAN 1	172.16.1.61	255.255.255.192	172.16.1.62
S2	VLAN 1	172.16.1.125	255.255.255.192	172.16.1.126
S3	VLAN 1	172.16.1.253	255.255.255.128	172.16.1.254
IT	NIC	172.16.1.1	255.255.255.192	172.16.1.62
		2001:DB8:CAFE::2/64	FE80::2	FE80::1
Marketing	NIC	172.16.1.65	255.255.255.192	172.16.1.126
		2001:DB8:CAFE:1::2/64	FE80::2	FE80::1
R&D	NIC	172.16.1.129	255.255.255.128	172.16.1.254
		2001:DB8:CAFE:2::2/64	FE80::2	FE80::1
Web	NIC	64.100.0.3	255.255.255.248	64.100.0.1
		2001:DB8:ACAD::3/64	FE80::2	FE80::1

Table 4.2: Addressing table

Requirements

- IT, Marketing, and R&D PCs can navigate to **www.cisco.pka** and **www.cisco6.pka**.
- IT, Marketing, and R&D PCs can SSH into R1 with the username **Admin1** and encrypted password **Admin1pa55**.
- All PCs should be able to ping R1, S1, S2, S3, and other PCs.

Step 1:

1. IT PC Configuration

- Incorrect IPv4 address
- Incorrect default gateway

2. R&D PC Configuration

- Incorrect IPv6 address

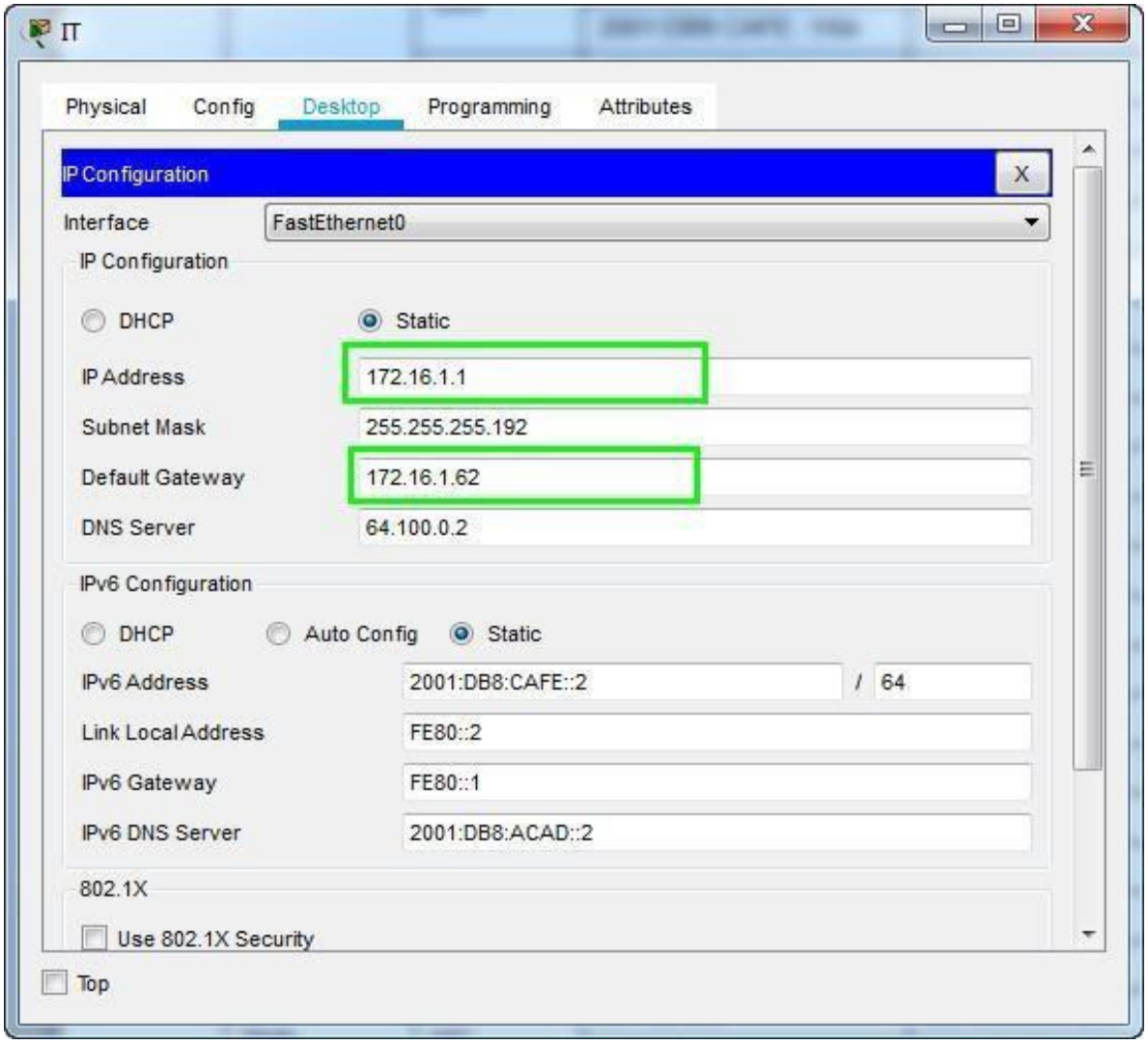


Figure 4.2: IT PC Configuration

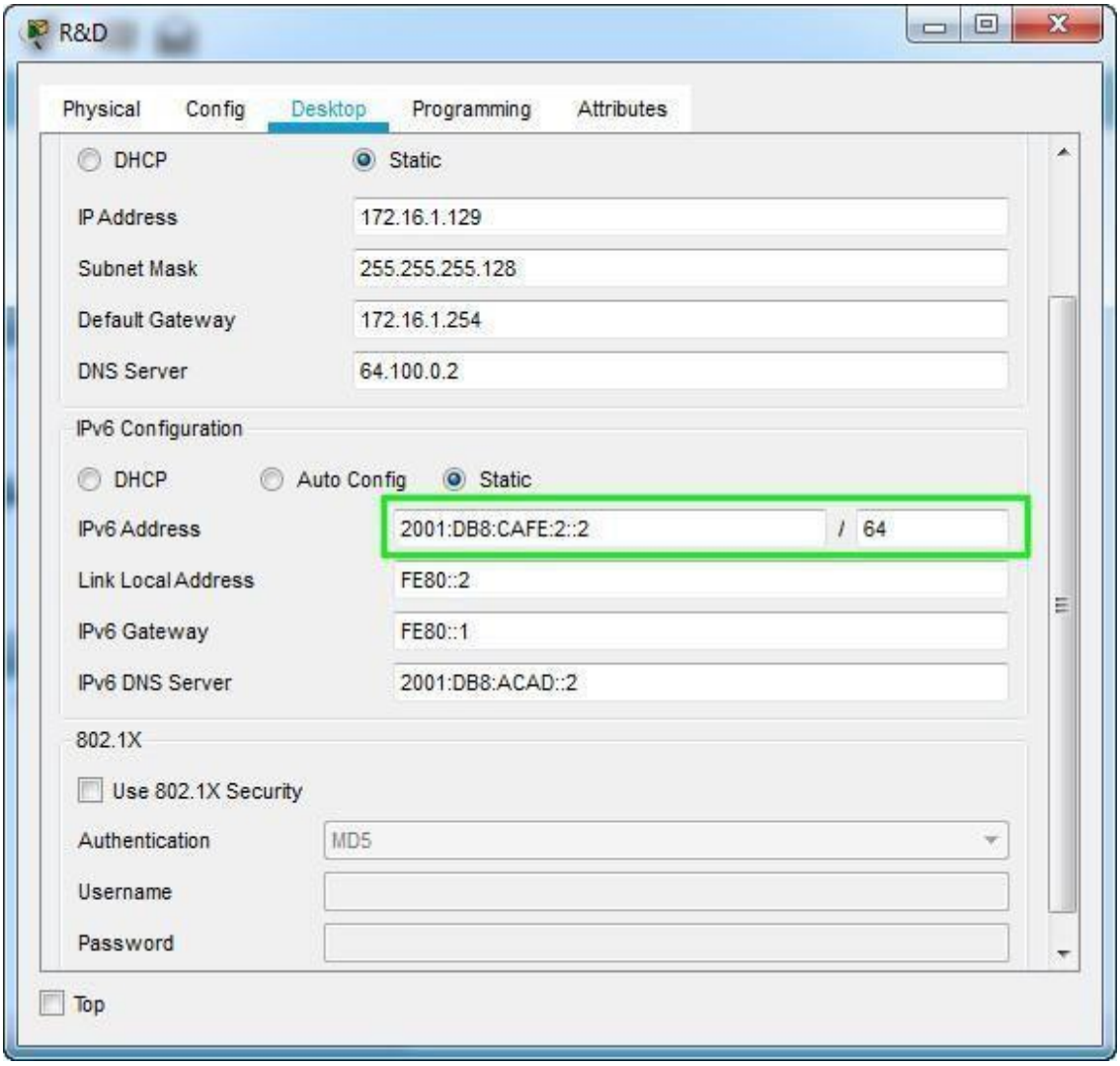


Figure 4.3: R&D PC Configuration

Step 2 :

Configure **R1** Configuration

- In order to configure R1,
  a) click on the router R1.
  b) click on the CLI tab.

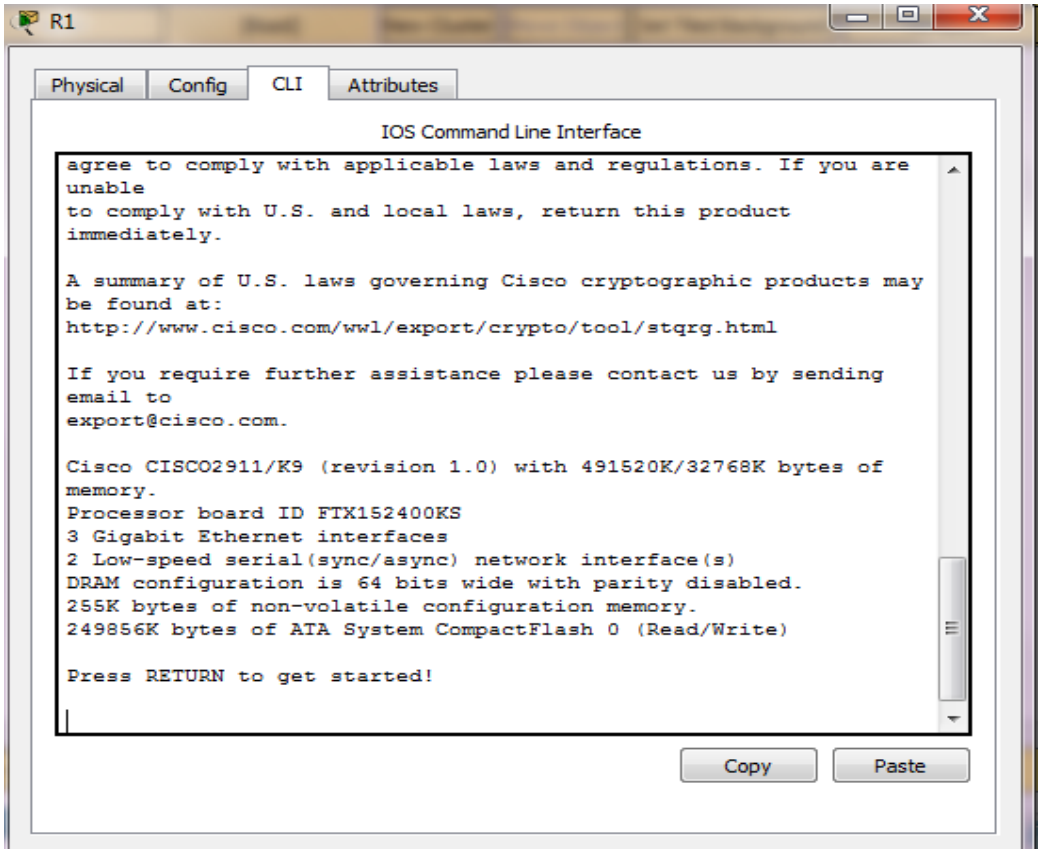


Figure 4.4: Configuring R1 using CLI

c) Finally configure router R1 with IPV4 addressing by using following commands

```
Password:Ciscoconpa55
R1>enable
Password:Ciscoenpa55
R1#configure terminal
R1(config)#interface gigabit Ethernet  0/1
R1(config-if)#ip address 172.16.1.126
255.255.255.192 R1(config-if)#username Admin1
secret Admin1pa55 R1(config-if)#line vty 0  4
R1(config-if)#transport
input ssh R1(config-if)#no
shutdown
```

Figure 4.5: Commands to configure R1

Step 3:

Configure **S2** with IPv4 addressing.

a) Click on the Switch S2.

b) Click on the CLI tab.

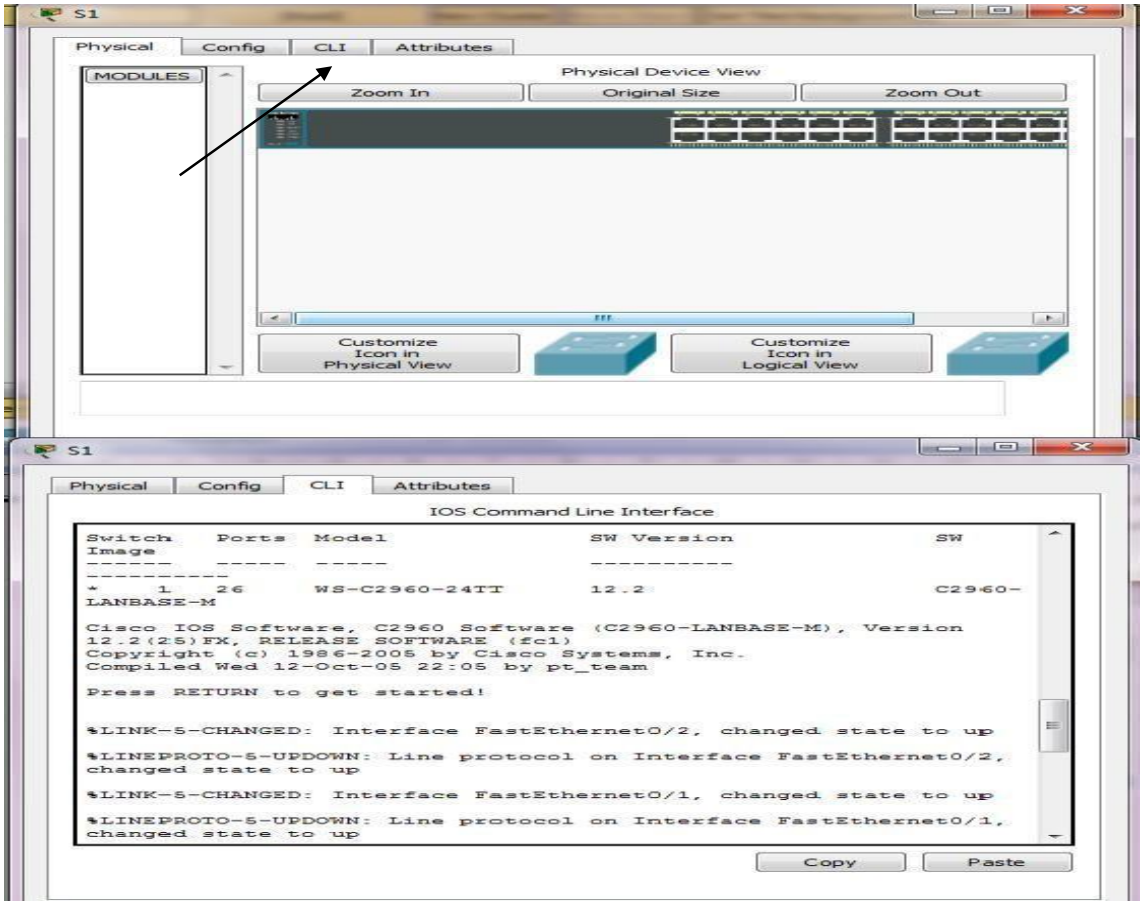


Figure 4.6: Configuring S2 using CLI

c) Finally configure Switch S1 with IPV4 addressing by using following commands

```
Password:Ciscoconpa55

S1>enable

Password:Ciscoenpa55

S1#configure terminal

S1(config)#interface vlan 1

S1(config-if)#ip address 172.16.1.125

255.255.255.192 S1(config-if)#no shutdown

S1(config-if)#exit
```

Figure 4.7: Commands to configure S2

Case 2: Subnetting scenario

In this activity, you are given the network address of 192.168.100.0/24 to subnet and provide the IP addressing for the network shown in the topology. Each LAN in the network requires enough space for, at least, 25 addresses for end devices, the switch and the router. The connection between R1 to R2 will require an IP address for each end of the link.

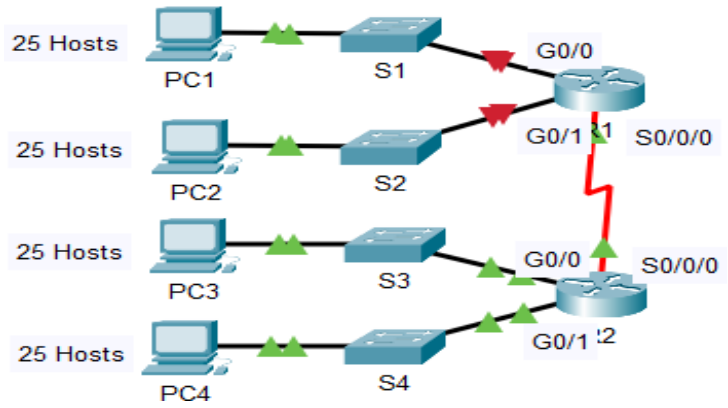


Figure 4.8: Topology

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	G0/0	192.168.100.1	255.255.255.224	N/A
	G0/1	192.168.100.33	255.255.255.224	N/A
	S0/0/0	192.168.100.129	255.255.255.224	N/A
R2	G0/0	192.168.100.65	255.255.255.224	N/A
	G0/1	192.168.100.97	255.255.255.224	N/A
	S0/0/0	192.168.100.158	255.255.255.224	N/A
S1	VLAN 1	192.168.100.2	255.255.255.224	192.168.100.1
S2	VLAN 1	192.168.100.34	255.255.255.224	192.168.100.33
S3	VLAN 1	192.168.100.66	255.255.255.224	192.168.100.65
S4	VLAN 1	192.168.100.98	255.255.255.224	192.168.100.97
PC1	NIC	192.168.100.30	255.255.255.224	192.168.100.1
PC2	NIC	192.168.100.62	255.255.255.224	192.168.100.33
PC3	NIC	192.168.100.94	255.255.255.224	192.168.100.65
PC4	NIC	192.168.100.126	255.255.255.224	192.168.100.97

Table 4.3: Completion of Addressing Table

Objectives

Part 1: Design an IP Addressing Scheme

Part 2: Assign IP Addresses to Network Devices and Verify Connectivity

Part 1: Design an IP Addressing Scheme

Step 1: Subnet the 192.168.100.0/24 network into the appropriate number of subnets.

a. Based on the topology, how many subnets are needed? **5**

b. How many bits must be borrowed to support the number of subnets in the topology table?3

c. How many subnets does this create? **8**

d. How many usable hosts does this create per subnet? **30**

Note: If your answer is less than the 25 hosts required, then you borrowed too many bits.

e. Calculate the binary value for the first five subnets. The first subnet is already shown.

Net 0: 192 . 168 . 100 . 0 0 0 0 0 0 0 0

Net 1: 192 . 168 . 100 . **0 0 1 0 0 0 0 0**

Net 2: 192 . 168 . 100 . **0 1 0 0 0 0 0 0**

Net 3: 192 . 168 . 100 . **0 1 1 0 0 0 0 0**

Net 4: 192 . 168 . 100 . **1 0 0 0 0 0 0 0**

f. Calculate the binary and decimal value of the new subnet mask.

11111111.11111111.11111111. **11100000** 255 . 255 . 255 . **224**

g..Fill in the **Subnet Table**, listing the decimal value of all available subnets, the first & last usable host address, and the broadcast address. Repeat until all addresses are listed.

Subnet Table

Subnet Number	Subnet Address	First Usable Host Address	Last Usable Host Address	Broadcast Address
0	192.168.100.0	192.168.100.1	192.168.100.30	192.168.100.31
1	192.168.100.32	192.168.100.33	192.168.100.62	192.168.100.63
2	192.168.100.64	192.168.100.65	192.168.100.94	192.168.100.95
3	192.168.100.96	192.168.100.97	192.168.100.126	192.168.100.127
4	192.168.100.128	192.168.100.129	192.168.100.158	192.168.100.159
5	192.168.100.160	192.168.100.161	192.168.100.190	192.168.100.191
6	192.168.100.192	192.168.100.193	192.168.100.222	192.168.100.223
7	192.168.100.224	192.168.100.225	192.168.100.254	192.168.100.255

Table 4.4: Completion of Subnet Table

Step 2: Assign the subnets to the network shown in the topology.

a. Assign Subnet 0 to the LAN connected to the Gigabit Ethernet 0/0 interface of **R1:192.168.100.0/27**

b. Assign Subnet 1 to the LAN connected to the Gigabit Ethernet 0/1 interface of **R1:192.168.100.32/27**

c. Assign Subnet 2 to the LAN connected to the Gigabit Ethernet 0/0 interface of **R2:192.168.100.64/27**

d. Assign Subnet 3 to the LAN connected to the Gigabit Ethernet 0/1 interface of **R2:192.168.100.96/27**

e. Assign Subnet 4 to the WAN link between R1 to **R2:192.168.100.128/27**

Step 3: Document the addressing scheme.

Fill in the **Addressing Table** using the following guidelines:

a. Assign the first usable IP addresses to R1 for the two LAN links and the WAN link.

b. Assign the first usable IP addresses to R2 for the LANs links. Assign the last usable IP address for the WAN link.

c. Assign the second usable IP addresses to the switches.

d. Assign the last usable IP addresses to the hosts.

Part 2: Assign IP Addresses to Network Devices and Verify Connectivity

Most of the IP addressing is already configured on this network. Implement the following steps to complete the addressing configuration.

Step 1: Configure IP addressing on R1 LAN interfaces.

```
Configuration R1:

enable
configure terminal
interface g0/0
 ip address 192.168.100.1 255.255.255.224
 no shutdown
interface g0/1
 ip address 192.168.100.33 255.255.255.224
 no shutdown
 exit
```

Fig 4.9: Commands to Configure R2

Step 2: Configure IP addressing on S3, including the default gateway.

```
Configuration S3:

enable
configure terminal
ip default-gateway 192.168.100.65
interface vlan 1
 ip address 192.168.100.66 255.255.255.224
 no shutdown
 exit
```

Fig 4.10: Commands to Configure Switch S3

Step 3: Configure IP addressing on PC4, including the default gateway.

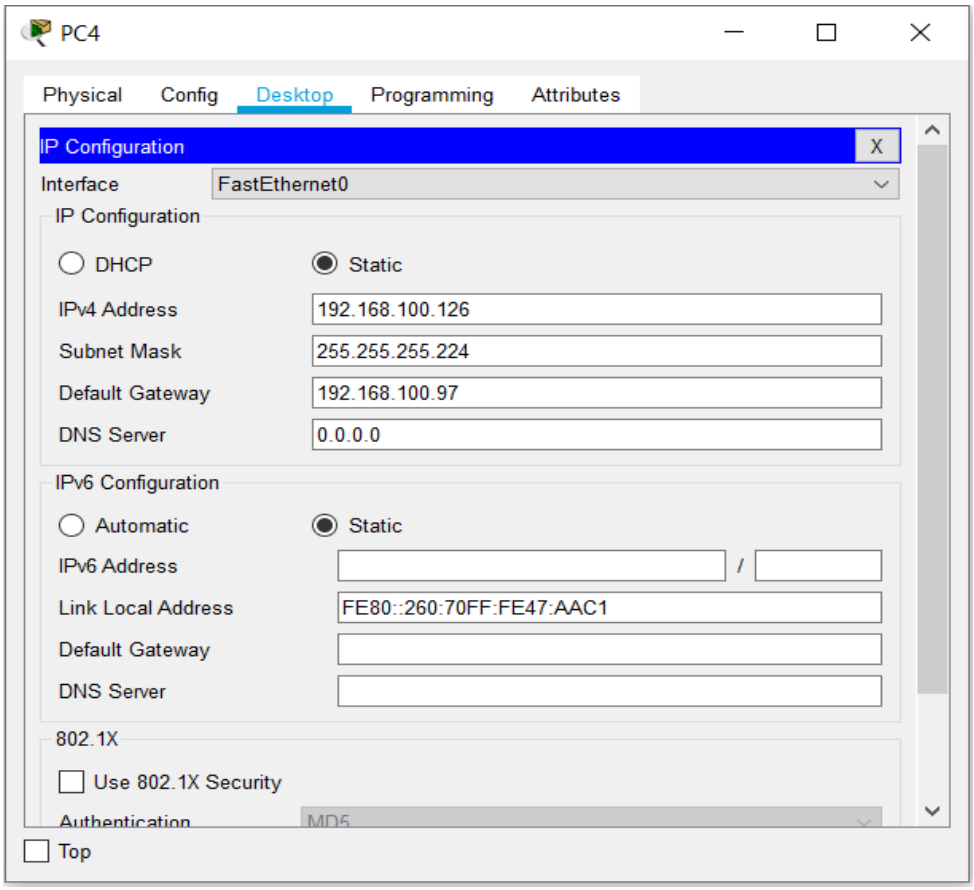


Fig 4.11: Completion of IP Configuration

Step 4: Verify connectivity.

You can only verify connectivity from R1, S3, and PC4. However, you should be able to ping every IP address listed in the **Addressing Table**

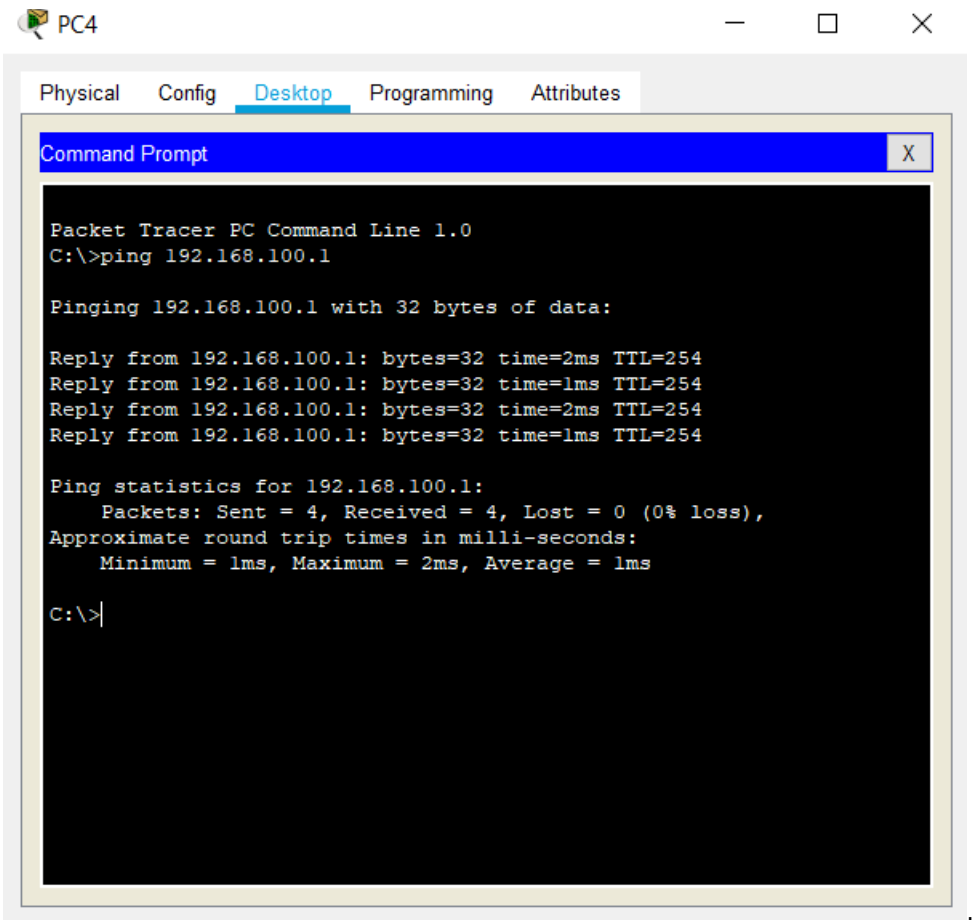


Fig 4.12: Verification of Connectivity

CHAPTER-5

ADVANTAGES AND APPLICATIONS OF COMPUTER NETWORKS

ADVANTAGES AND APPLICATIONS OF COMPUTER NETWORKS

Advantages

1. Sharing of devices such as printer and scanner
2. Sharing of program/software
3. Sharing of files
4. Sharing of data
5. Sharing of Information
6. Sharing of single high-speed internet connection
7. Can access server centered database
8. Better communication using internet services such as email, mailing list and Internet Relate Chat (IRC)

Applications

1. Resources Sharing
   - Hardware (computing resources, disks, printers)
   - Software (application software)
2. Sharing
   - Easy accessibility from anywhere (files, databases)
   - Search Capability (WWW)
3. Communication
   - Email
   - Message broadcast

CHAPTER-6

SKILL-SET

Skill-set acquired during the program

The internship was carried out for 4 weeks about the Routing and Switching: Introduction to Networks course concepts which was organized by CISCO Center of Excellence at ATME College of Engineering, Mysuru.

I was trained to perform tasks related to connecting to the internet. The three requirements for an internet connection are a physical connection, a logical connection and a web browser. We tested connectivity using ping commands. I was thought to form a network with two or more computers and shared resources such as data, internet connection, applications, etc. and connected LAN cables to the computers and tested its connectivity.

I got a practical exposure by working with the tool called packet tracer. Packet tracer is a cross-platform visual simulation tool designed by Cisco Systems that allows users to create network topologies and imitate modern computer networks. The software allows users to simulate the configuration of Cisco routers and switches using a simulated command line interface. The software is mainly focused towards Certified Cisco Network Associate Academy students as an educational tool for helping them learn fundamental CCNA concepts.

I performed tasks such as forming a network with two or more devices and the packets were sent from one device to another, and checked whether the packets sent from the source were received at the destination. Switches were used to connect computers within a network whereas Routers were used to connect multiple networks together.

I also learnt how to set console, privilege, telnet and auxiliary password to routers and switches. Encrypting password and recovering password through commands were the major tasks performed.

After each chapter an online test was conducted which helped me to understand each and every concept clearly since it covered all the important concepts. All the test marks are added in the end and a merit certificate is issued. Apart from the online test there was a hands-on on theory concepts where I could practically perform tasks using components like switches, routers, cables and other devices.

At the end of the internship I was able to perform the following tasks proficiently and confidently

- Implement basic network connectivity between devices
- To access local and remote network resources
- Describe router hardware
- Switching operation in a small and medium - sized business networks
- Design an IP addressing scheme to provide network connectivity for a small to medium – sized business network
- Configure initial settings on a network device
- Configure monitoring tools available for small to medium - sized business networks

CHAPTER-7

CONCLUSION AND REFERENCES

CONCLUSION

The network technology is covered with protocols and theory at deeper levels reflective of University practices. From this Internship learned the architecture, structure, functions, components, and models of the Internet and computer networks. The principles of IP addressing and fundamentals of Ethernet concepts, media, and operations are introduced to provide a foundation for the curriculum. By the end of the course, able to build simple LANs, perform basic configurations for routers and switches, and implement IP addressing schemes.

IPV6 addressing such as unicast addressing and multicast addressing, commands like ping and others, connection between various networking components like switches, routers etc. learnt about types of cables like straight through and cross over and also learnt how to transfer data from one node to another, three modes of operations – user mode, privileged mode and global configuration mode. Learnt to set password for each of the user mode and privileged mode, also learnt about colour coding in Ethernet cable and IP address classes and subnet mask.

In the case study given, a network has been created using two switches and five end devices. All the switches and end devices are set with IP addresses and packets are transferred from one node to other and If a port is configured as a secure port and the maximum number of secure MAC addresses is reached, when the MAC address of a workstation attempting to access the port is different from any of the identified secure MAC addresses, a security violation occurs.

To brief, learnt about different network components, creating networks using these components and transfer packets from one node to another node in same or different network and the same has been implemented in the case study.

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