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Enterprise Network Design and Implementation

Sanjana Rai B S . Kushal T. Shashank B N . Rohan T R . Naveen Chandra Gowda

School of Computer Science and Engineering,
REVA University, Bengaluru, India,

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Abstract – One kind of network intended for setting up an internet connection on an enterprise setup in a building is an enterprise network module. It acts as the company's cornerstone. The enterprise network's base is provided by the CCNA learning goals. A private or public network's construction requires the proper tools and procedures to ensure its dependability. Networks are important to organizations, especially virtual and wide area networks. In this article, we plan and implement new network services in a new building. This project is being implemented using Cisco Packet Tracer. A person who studies computer networking and technology gains knowledge of several subjects, such as IP address configuration, topology design, and data transmission.

Index Terms – Cisco Packet Tracer, configuration, enterprise networks.

I. INTRODUCTION

A group of computers connected by network nodes to share resources is called a computer network. Common protocols are used by the computers to communicate with one another over digital connections. Telecommunication technologies, such as wired, optical, and wireless radio-frequency techniques, are used to create the connections within the network. To enable resource sharing and communication between the linked computers, these connections can be set up in a variety of network topologies [1]. A local area network, often known as a LAN (local area network), is a kind of network that connects a cluster of nearby computers and provides networking capabilities to them. In a home office, a local area network can accommodate two or three users, whereas in a company's central office, it can accommodate several hundred users. Network nodes can share resources like printers and network storage when homeowners and IT administrators build up local area networks (LANs)[2].

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A network's primary goal is to increase workspace diversity and decrease the number of isolated users and workgroups. Every system needs to be able to communicate with other systems, deliver the required data, and maintain the connection. Furthermore, physical networking systems and equipment, such laptops and mobile devices, must be able to sustain and deliver adequate security, dependability, and performance. We employed servers, routers, PCs, laptops, tablets, printers, wireless routers, and other devices to develop this project in Cisco Packet Tracer. To ensure optimal network efficiency, we used serial DCE and optical Fiber cables for connectivity. This proposal was created for a business that consists of a single structure with multiple floors of workspace.

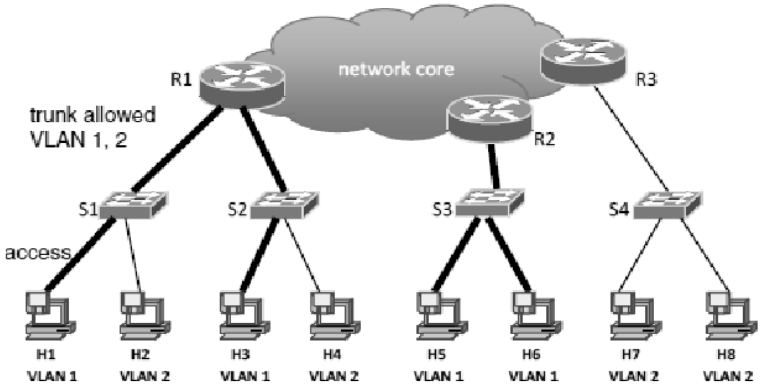


Fig. 1: Enterprise Networks

II. LITERATURE SURVEY

Here we provide the brief literature of considered Enterprise Network algorithms and their usages.

In order to control the flow of company data both internally and externally, business networking is essential. Simplifying data exchange processes, it facilitates communication protocols and system compatibility. Enterprise network systems are used by well-known businesses like Apple, Amazon, Arista, and Citrix to support thousands of users in various geographical locations. The system is made up of many different parts, including servers, switches, and routers. The more these parts are connected together, the more complicated the system becomes. Systems for enterprise networks increase data transfer speeds all over the world. Ensuring security during transmission and access, along with optimizing performance metrics like bandwidth, latency, and jitter, are the top priorities for these systems [3].

Architecture: Business-critical assets require a specific configuration and layout of the enterprise network design, which is known as enterprise network architecture. It supports a variety of tasks, including data storage, data analysis, VoIP as well as telecommunications systems, and more. System administrators can discover more about various network components, including routers, switches, firewalls, and more, via visual modes. To guarantee that every network component is connected in order to provide services, enterprise network architecture is crucial. Enterprise network architecture consists of discrete yet interconnected component domains, like:

- Data center and hybrid clouds: Centralized locations for computing and data storage are known as data centers. Cloud services and on-premises infrastructure are combined in hybrid clouds. When combined, they offer businesses a scalable and adaptable environment for effective data management. Using this method, companies can take advantage of both public and private cloud resources according to their unique demands.
- Wide-area networks (WANs): Wide-Area Networks (WANs) are networks that link several local-area networks (LANs) or data centers over a large geographic area. WANs are critical for businesses with geographically dispersed offices because they facilitate communication and data

transfer between remote locations. To create WAN connections, technologies like routers and leased lines are frequently utilized.

- Campus, branch, and Internet of Things (IoT): This speaks to the considerations of networking in various contexts. "Campus" usually refers to the local network in the actual physical location of an organization. Networks known as "branch" links outlying offices or branches to the main company. The term "Internet of Things (IoT)" refers to the network connectivity of objects other than desktop and server computers. It entails tying commonplace items into the internet to facilitate automation, communication, and data gathering.

Networking Technologies: It can be classified on basis of transmission and the scale of application. Point-to-point and Multi-point are the two types based on transmission. Based on scale of application the types includes LAN, MAN, WAN, PAN and VPN.

Several recent developments and fashions includes:

- Secure Access Service Edge (SASE)
- 5G Connectivity
- Wi-fi 6
- Cloud Management
- AI and Machine Learning

Enterprise Network Security: The term "enterprise network security" describes the all-encompassing set of procedures and guidelines that businesses put in place to protect their data, information systems, and computer networks against threats, illegal access, and attacks. Safeguarding data availability, confidentiality, and integrity within the enterprise network is the main objective [3].

Wireless Networking: The technology that allows communication between devices without the use of physical cables or wires is known as wireless networking. It now forms a crucial component of contemporary networking and communication systems, offering convenience, mobility, and flexibility in connectivity [4].

For business Wi-Fi networks to remain secure, the following procedures must be followed. Below is a synopsis of each:

- Deploy WIDS and WIPS: Install WIPS and WIDS systems for wireless intrusion prevention and detection throughout the network. While WIPS goes one step further by actively preventing unauthorized access and potential security threats, WIDS detects unauthorized activities and alerts administrators about them. This improves the Wi-Fi network's overall security posture.
- Keep Software Updated: Make sure that every piece of software on the network's devices receives regular updates in line with the release of service packs from the developers. Updating software contributes to patching known vulnerabilities, which lowers the possibility of malevolent actors exploiting it. The network's general stability and security are enhanced by regular updates.
- Establish Separate Guest Wi-Fi Networks: Create a separate guest Wi-Fi network from the main network used by the organization. By limiting unwanted access to private company data, this procedure improves security. To protect the confidentiality and integrity of organizational data, guest network traffic can be isolated from the main network using routers that have multiple SSIDs or other wireless isolation features.

From the research it can be seen that by making a few improvement to Society in the Networking.

III. PROPOSED SOLUTIONS

After studying the various techniques used to perform encipherment, we have done the comparison based on the following important factors: A building that is bought by an organization to set up a network has no network. This means that before they can make to move out , new internet network has to be implemented for all the floors. The new building is expected to have three floors ,each floor setup

with different sectors of operation such as Sales ,marketing, HR, etc. The suggested logical solution calls for designing and implementing a network solution for a multi-departmental environment within a building using Cisco Packet Tracer. Switches connect the departments on each floor, which are outfitted with laptops, tablets, printers, and other gadgets. Hubs and routers are also used to create connections to other departments and a central server. All networked devices are dynamically assigned IP addresses by a dedicated DHCP server located in the server room, guaranteeing effective and automated address allocation. Static IP addresses are given to server room devices, though, in order to maintain consistency and predictability. By effectively managing IP address assignments, this all-inclusive solution seeks to establish a network infrastructure that is linked and orderly and facilitates smooth communication and operation.Now all the floors of the building are having wireless internet connection to communicate[5].

The figure below displays the work-flow diagram. Initially, the enterprise building's primary internet connection is provided by the main server. From there, it is routed to the enterprise network server, which serves as the data center and offers connections to every area of the enterprise building. The main building has one line that provides series router connections (Bus Topology) for connections at various floors, most likely the first, second, and third floors. These connections are then extended to the star topology for connections at various departments, including HR, Sales, Admin, ICT, Server room, and so forth.

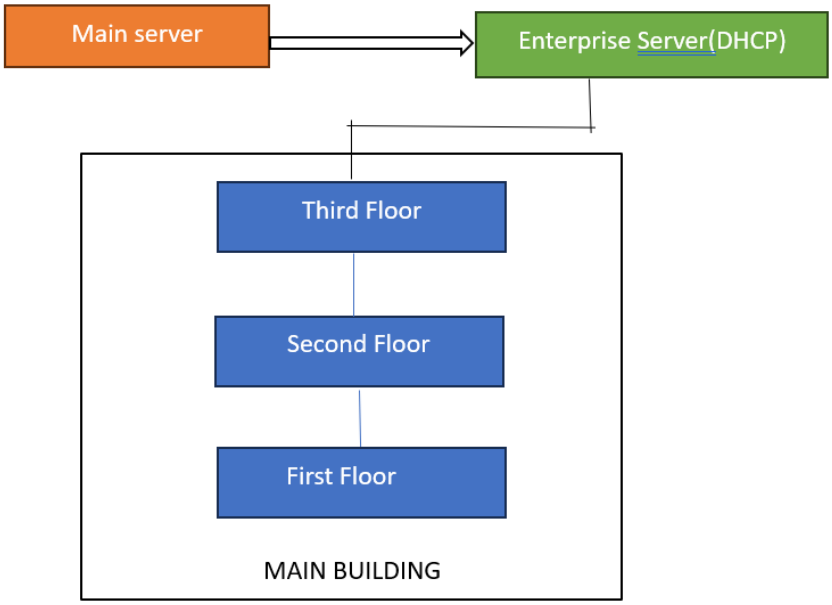


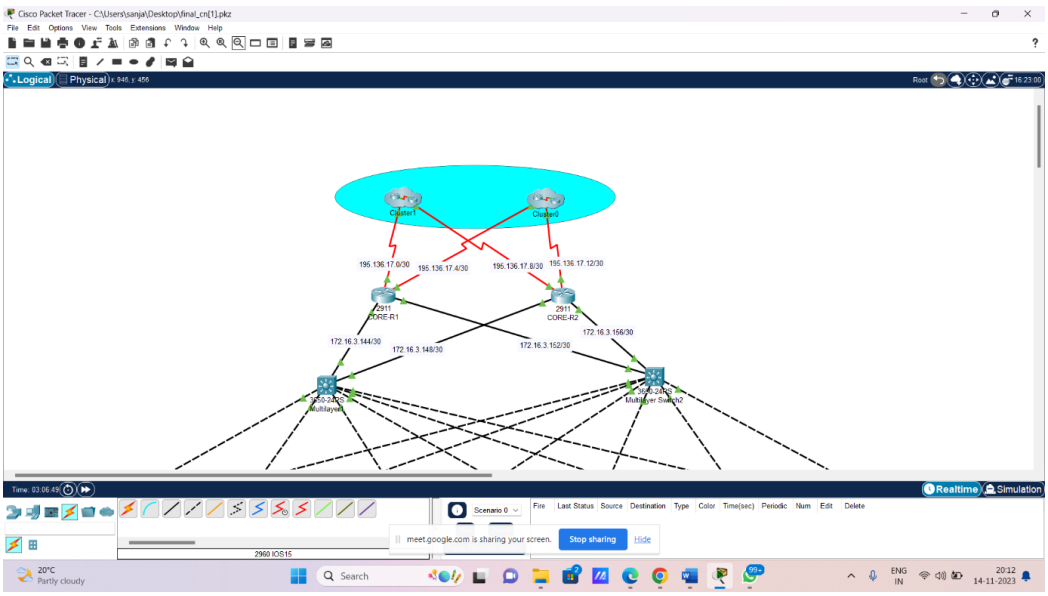
Fig. 2 : Work-Flow Diagram

The three floors of the main building are separated into multiple departments on each floor. Sales and HR, finance, and administrative departments are located on the first floor; the server room and ICT departments are located on the second floor. Every department's gadgets in this enterprise network are wiredly connected to a switch. Access points, which are connected to switches, are the means by which wireless connections, or wi-fi, are established. The multilayer switches that these switches are connected to further enable communication between all floors and departments. These switches are first linked to routers, and subsequently to clusters within the cloud. A DHCP (Dynamic Host Configuration

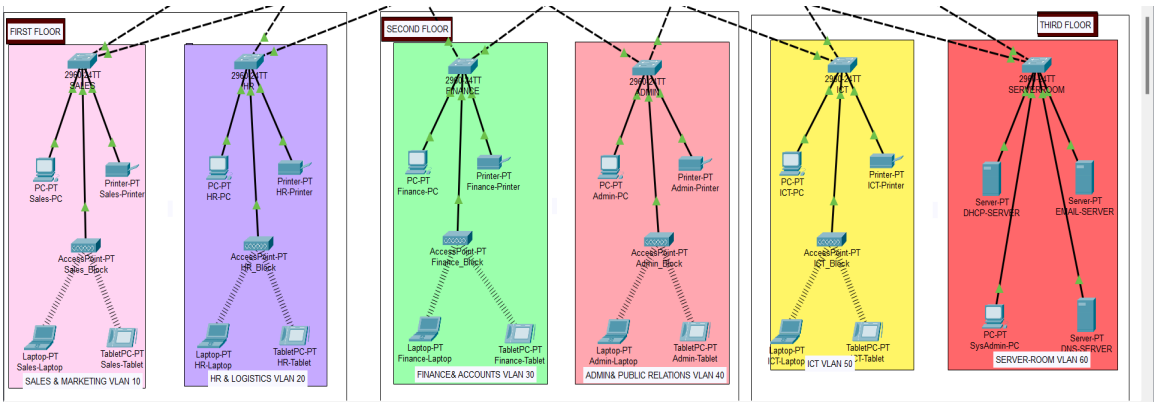
Protocol) server, which is utilized on Internet Protocol networks, is located in the server room on the third floor. It immediately gives an IP address to the [6].

IV. RESULT AND IMPLEMENTATION

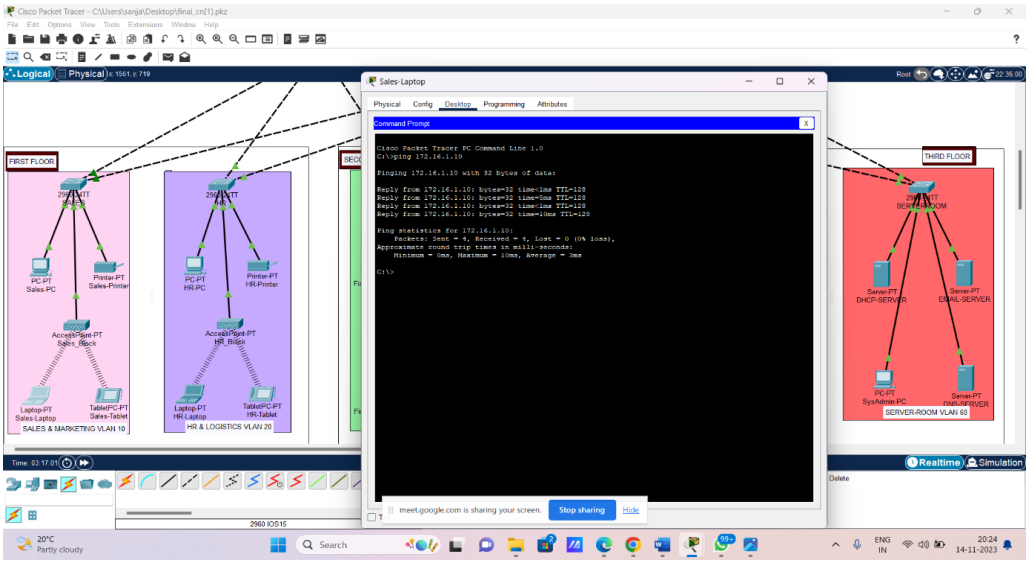
We have implemented the Enterprise networking using Cisco Packet Tracer The below diagram shows the complete implementation of the network used by an enterprise.



- So here, the cluster one and cluster two refers to the ISP(Internet service provider) so the so the main functionality of this cluster is to transfer the information to the external world hand. Here we have used two cluster instead of one cluster and cluster one is the main cluster and cluster zero is the backup cluster. So if anything goes wrong with the cluster one then cluster zero is used to transfer the information.
- Similarly, we have two routers: core R1 serves as the primary router, while core R2 serves as a secondary (backup) router. These routers function similarly to clusters; in the event that something goes wrong with core R1, the backup router, core R2, is used to send the data to the ISPs [7].
- • In this case, multilayer switches are used to link workplace laptops and personal computers to the router by creating a connection between the router and each floor of the building. We have also employed the primary and backup multilayer switches higher. as well as this multiple [8].

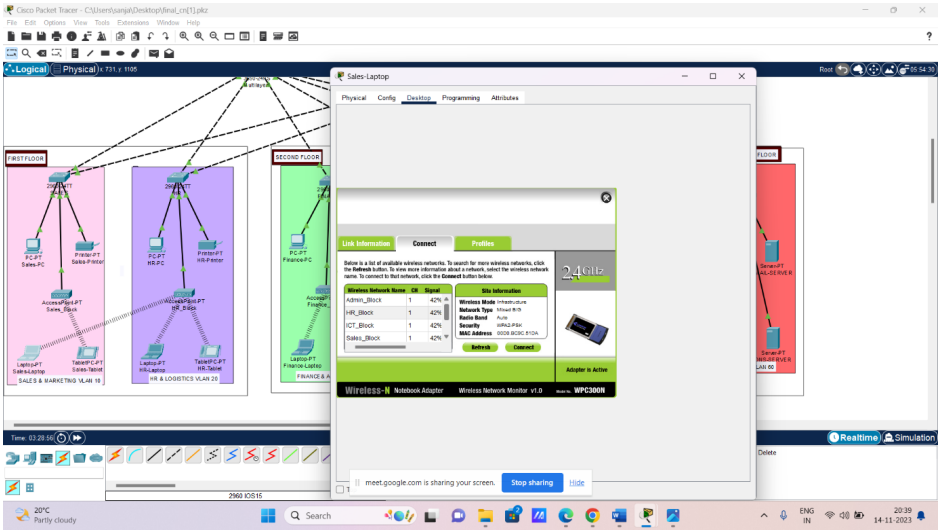


- The main building is three stories tall with multiple departments on each floor.
- Sales and HR are located on the first floor, finance and administrative offices are located on the second floor, and server room and ICT departments are located on the third floor.
- Every department is having a PC,printer which is connected to switch 2960 24TT.
- It also has an access point through which wireless connections are achieved among devices like laptop,tablets and others.
- The access point is further connected to the switch 2960 24TT .
- The Server Room which is located in the third floor has different servers like DHCP server,DNS server,E-Mail server and others .

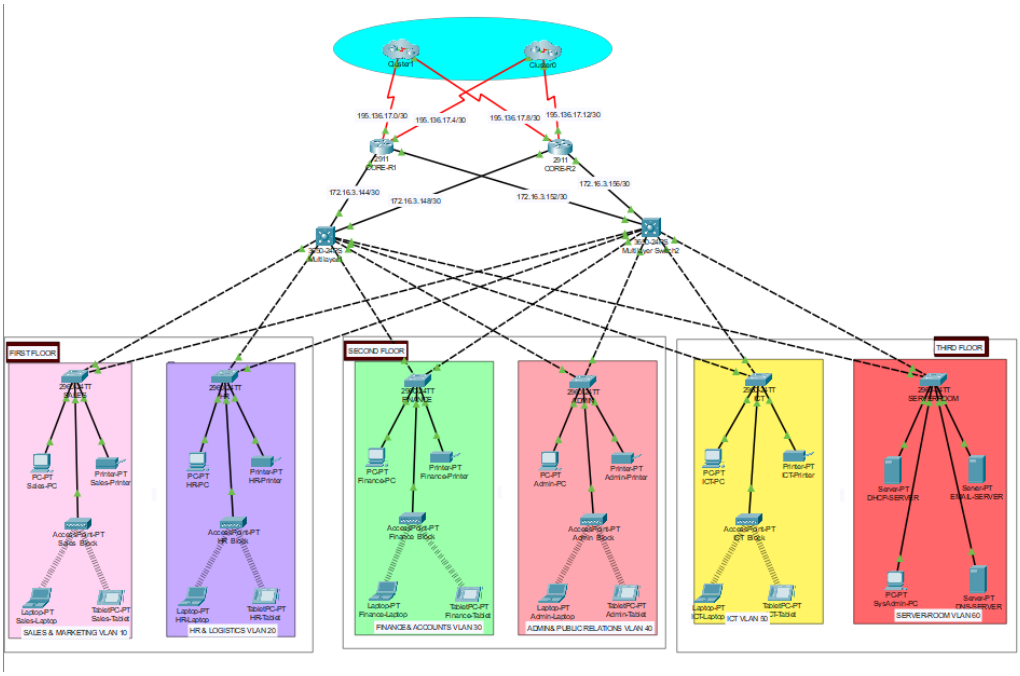


- ping is the most commonly used troubleshooting tool.After sending an echo request, it watches for a response.If the ping is successful, the destination receives the echo request and can respond to it with an echo reply to the source within the predefined window of time.
- Here we have sent 4 packets of 32 byte data to the device with ip 172.16.1.10
- As the connection was successful,all 4 packets which were sent was received successfully with no loss.

- The approximate round trip time was minimum of 0ms,maximum of 10ms and average of 1ms



- The above figure represents the wireless connection between the Sales laptop and access point of HR department
- This connection has a WPA2-PSK security which allows only authorised login .



- For increased reliability, the network infrastructure is designed with two routers and two multilayer switches, utilizing a literal redundancy model at every layer. In order to provide redundancy, the network is set up to connect to a minimum of two Internet service providers (ISPs), with each router creating connections to both ISPs. Every department in the company has a user-only wireless network that is divided into distinct VLANs and subnets. The IP address range 172.16.1.0 is used by the base network, and subnetting has been used to assign the proper IP addresses to each department, resulting in effective address utilization.The company network is a static public Ip addresses 195.136.17.0/30 , 195.136.17.4/30, 195.136.17.8/30 and 195.136.17.1/30 connected to two internet providers.
- The host name,console password,enable password,banner messages and other security measures are configurated.
- Inter-VLAN routing is configured on each multilayer switch so that devices across all departments can communicate with one another[9].
- Multilayer switches, which serve both switching and routing purposes, make up the architecture of the network. Devices connected to the network are automatically assigned IP addresses via the Dynamic Host Configuration Protocol (DHCP), with the exception of devices housed in server rooms. Devices in the server rooms are assigned IP addresses statically, indicating that these particular devices would benefit from manual configuration.

V. CONCLUSION

Therefore, we created the "Enterprise Network Module" in this manner, setting up the network topology with Cisco Packet Tracer. Through the use of Cisco Packet Tracer, we were able to learn how to design and implement a networking module. We successfully installed the enterprise server, primary internet service provider, and enterprise networking module for the main building. The configuration and specifications provided are for the first prototype, and future iterations may improve security,

coverage, and support. To make sure that only registered devices can connect to the network, the suggested security enhancement entails registering device MAC addresses and distributing pass keys. This is proposed as a legitimate design technique for end-to-end IP network connected Local Area Networks (LANs) in anticipation of future developments in network architecture implementations.

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