International Journal of
Computational Learning & Intelligence
Vol. 03, Issue 01 (January) 2024

RESEARCH ARTICLE OPEN ACCESS

Hotel Management System, designing and implementing a hotel network.

Nishanth R . Mishael David . Dheeraj Skanda V . Y Darshan . Naveen Chandra Gowda

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

DOI: **10.5281/zenodo.10634539**
Received: 18 October 2023 / Revised: 16 November 2023 / Accepted: 01 December 2023

Abstract – Modern Hotel network project which involves designing and implementing a modern hotel network with three floors and various departments. The project includes considerations like routers connecting each floor, specific VLANs for each department, Wi-Fi networks, printers, OSPF routing protocol, DHCP server configuration, SSH setup, and port security with a test PC. We emphasize the increasing complexity of each project, seeking viewer support through subscriptions and engagement.

Index Terms – VLAN, Packet Tracer, OSPF, DHCP, SSH

I. INTRODUCTION

The Modern Hotel network project aims to establish a robust and reliable computer network infrastructure tailored to the specific needs of a hotel with diverse departments on each floor. The goal is to enhance hotel operations by improving communication, resource management, and the overall guest experience. The proposed network design incorporates a hierarchical topology, dividing the network into layers for scalability and efficient resource management. This includes access switches on each floor, distribution switches for interconnecting these access switches, and a core layer for high-speed backbone connectivity. To ensure seamless inter-floor connectivity, three routers will be strategically placed, utilizing OSPF as the routing protocol. VLANs will be created for each department, enhancing security and facilitating efficient traffic management. DHCP will dynamically assign IP addresses to devices within each VLAN, and inter-VLAN routing will be implemented to enable communication between different departments while maintaining network segmentation for security.

Thorough testing and verification of network communication will be conducted post-implementation to ensure performance expectations are met. The entire design and implementation process will be documented comprehensively, serving as a valuable resource for future reference and troubleshooting. This comprehensive approach aims to deliver a stable, secure, and easily manageable

network infrastructure that enhances the overall experience for hotel guests and staff, positioning the hotel competitively in the hospitality industry. a network design and implementation project that aims to provide a seamless and secure network infrastructure for hotels. The project is implemented using Packet Tracer, a network simulation tool developed by Cisco Systems. The project involves designing a network topology for a hotel that includes different departments such as reception, housekeeping, and restaurant. The network topology is designed to provide internet connectivity, VoIP telephony services, and other network services to the hotel staff and guests. The project is an excellent example of how network simulation tools such as Packet Tracer can be used to design and implement complex network infrastructures. The project provides a hands-on experience in designing and implementing a network infrastructure for hotels.

II. LITERATURE SURVEY

Designing and implementing a network for a Hotel requires careful planning and configuration.

Network Design for Multi-Floor Environments

Researching into the network design principles for multi-floor buildings, such as hotels, office complexes, and educational institutions. [1] Studies on the physical placement of network equipment, including routers, switches, and access points, to optimize network coverage and performance on multiple floors is required. Designing a network for a multi-floor environment like a hotel requires careful consideration of various factors. The physical layout of the hotel should dictate the placement of network equipment. Ensuring that the server room is located centrally on the third floor, making it easier to distribute network connections to other floors of the hotel. The central router placed in the IT department on the third floor serves as the core router connecting all floors. It should have a robust and scalable design to handle the traffic from various departments. By Implementing proper access controls to ensures that only authorized users can access their respective VLANs. Configuring switches on each floor to support the assigned VLANs.

The design of wireless networks is critical in a hotel. Deploying Wi-Fi access points strategically to provide optimal coverage in public areas, guest rooms, and meeting spaces. Implement strong security measures for Wi-Fi networks, including encryption (WPA3 or WPA2), strong passwords, and regular password changes. Ensure that the network is well-secured. Implement firewalls at the network perimeter and between VLANs to control and monitor traffic. Maintaining detailed network documentation that includes network diagrams, IP address assignments, VLAN configurations, and router and switch configurations[2]. Prior to deploying the network, conduct thorough testing to ensure that all components are functioning as expected. Test network connectivity, bandwidth, and failover mechanisms to ensure the network can handle the expected load. Given the hotel industry's unique data protection and privacy requirements, ensure that the network design complies with regulations like GDPR or local data protection laws. Implementing strong security measures to protect guest and customer data is very important. In a hotel environment, network reliability and security are paramount. The network should support guest services, administrative functions, and the unique needs of each department. Thorough planning and attention to detail are crucial to a successful network design that meets the hotel's specific requirements.

Router and Interconnectivity Solutions:

The central router is a critical component in the network design. It serves as the core router for the entire hotel, connecting all floors and departments. Selecting a robust and enterprise-grade router that can handle the expected network traffic and provide the necessary features for security and routing. Consider a router that supports Virtual LAN (VLAN) configurations, access control, and Quality of Service (QoS) to ensure efficient traffic management. Routers on each floor should be connected to the

central router using serial DCE (Data Communications Equipment) cables.Serial DCE cables are commonly used for point-to-point serial connections between routers. Ensure that the cables are of high quality to maintain a reliable connection. Assign IP addresses to the router interfaces based on a structured IP addressing plan. For example, as previously mentioned, you can use IP addresses like 10.10.10.1/30 for the central router and 10.10.10.2/30 for the third-floor router, and similar configurations for other floors. Ensuring that the IP addressing plan is well-documented and easy to manage. Implement a dynamic routing protocol, such as OSPF (Open Shortest Path First) or EIGRP (Enhanced Interior Gateway Routing Protocol), to enable automatic route updates between routers.[3] The choice of routing protocol should depend on factors like network size, complexity, and familiarity with the protocol. The selected protocol should provide efficient routing and adapt to network changes. The router and interconnectivity solutions are pivotal to the network's success, and careful planning and configuration are required to ensure a stable, secure, and highly available network for Vic Modem Hotel.

Vlan configuration:

VLAN configuration and segmentation are fundamental to the network design for Vic Modem Hotel. Properly implemented VLANs improve network security, simplify management, and enhance performance by reducing broadcast domains and ensuring that traffic is efficiently and securely segmented. VLANs are used to logically segment a single physical network into multiple isolated virtual networks. [9] VLANs has separate different departments, such as Reception, Finance, and IT, into isolated broadcast domains. For example, we can prioritize voice traffic in the VoIP phones used at the reception desk. VLANs can simplify network management by allowing administrators to apply policies, permissions, and security settings to specific groups of devices or users. As the hotel grows, VLANs can be used to accommodate additional departments or services without the need to reconfigure the entire network. Assign VLAN IDs to each department, as previously mentioned. For example, Reception might be assigned VLAN 10, Store VLAN 20, Finance VLAN 40, IT VLAN 70, and so on. This assignment ensures that devices within each department are part of the appropriate VLAN.

Configuration of Router, Switch and DHCP:

To enable communication between VLANs and control routing between them, the central router needs to be configured with subinterfaces or virtual interfaces for each VLAN. These subinterfaces are assigned an IP address within the respective VLAN's subnet. For example, the central router may have subinterfaces like VLAN 10 (Reception) with IP 192.168.10.1, VLAN 20 (Store) with IP 192.168.20.1, and so on. Configure each floor's switch to support the VLANs assigned to that floor. Ports on the switch should be assigned to the correct VLAN according to the department they serve.[4][5]. Implement VLAN tagging (IEEE 802.1Q) on the switch ports that connect to the central router and ensure they are configured as trunk ports. Trunk ports allow traffic from multiple VLANs to flow over a single physical link between the switch and router. Dynamic Host Configuration Protocol (DHCP) is a network protocol used to automatically assign and manage IP addresses and network configuration settings to devices within a local area network (LAN). DHCP simplifies the process of IP address assignment and configuration by automating it, which is especially useful in larger networks, such as the one in Vic Modem Hotel. Each VLAN should have its own DHCP (Dynamic Host Configuration Protocol) server or relay agent to provide IP address assignments within the correct IP subnet. DHCP relay agents can forward DHCP requests from clients to a centralized DHCP server.

III. PROPOSED WORK

As a part of the networking project, we are aiming to design and implement a Modem Hotel network. The hotel has three floors, in the fist floor there three departments (Reception, store and Logistics), in the second floor there are three departments (Finance, HK and Sales Marketing), While

the third floor hosts the IT and Admin. Therefore, certain considerations has to be made during the design and implementation of a modem hotel. There should be three routers connecting each floor (all placed in the server room inIT department). All routers should be connected to each other using senal DCE cable. The network between the routers should be 10.10.10.0/30,10.10.10.4 30,10.10.10.8/30 and each floor is expected to have one switch (placed in the respective floor). Each floor is expected to have WIFI networks connected to laptops and phones and each department has a printer.

Each department is expected to be in dafferent VLAN with the following details.

- 1st Floor:
  Reception- VLAN 80, Network of 192.168.8.0/24
  Store- VLAN 70, Network of 192.168.7.0/24
  Logistics. VLAN 60, Network of 192.168.6.0/24
- 2nd Floor:
  Finance- VLAN 50, Network of 192.168.5.0/24
  HR VLAN 40, Network of 192.168.4.0/24
  Sales: VLAN 30, Nerwork of 192.168.3.0/24
- 3rd Floor:
  Admin LAN 20, Network of 192.168.2.0/24
  IT-SLAN 10, Network of 192 168.1.0/24

Using OSPF as the routing protocol to advertise routes and all the devices in the network are expected to obtain IP address dynamically with their respective router configured as the DHCP server. Making all the devices in the network to communicate with each other. Configure the SSH in all the routers for remote login and configure port security to IT-dept switch to allow only Test-PC to access port fa0/1.

IV. IMPLEMENTATION AND RESULTS

The successful implementation of Vic Modern Hotel's network involved a step-by-step configuration process, ensuring that each element of the proposed design was meticulously executed. This section provides a detailed account of the implementation, accompanied by screenshots to elucidate key steps and outcomes.

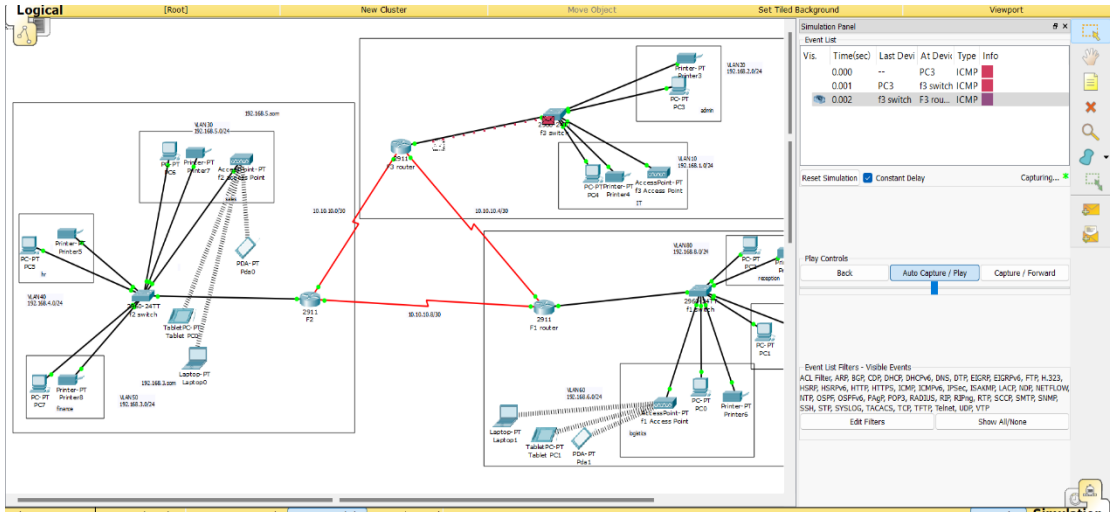

Fig. 1: Physical Topology for Hotel Management System.

Physical Connectivity:

The initial step in the implementation process involved the physical connectivity of routers, switches, and access points. Routers for each floor were placed in the server room within the IT department, and serial DCE cables were used to interconnect them, forming the backbone of the network. Each floor's switch was connected to its respective router, creating a hierarchical structure.[1]

VLAN Configuration:

VLANs were configured on each router to logically separate departments on each floor. This involved assigning VLAN IDs, names, and associating specific subnets with each VLAN. The configuration ensures that devices within a VLAN can communicate seamlessly while maintaining isolation from devices in other VLANs.[9]

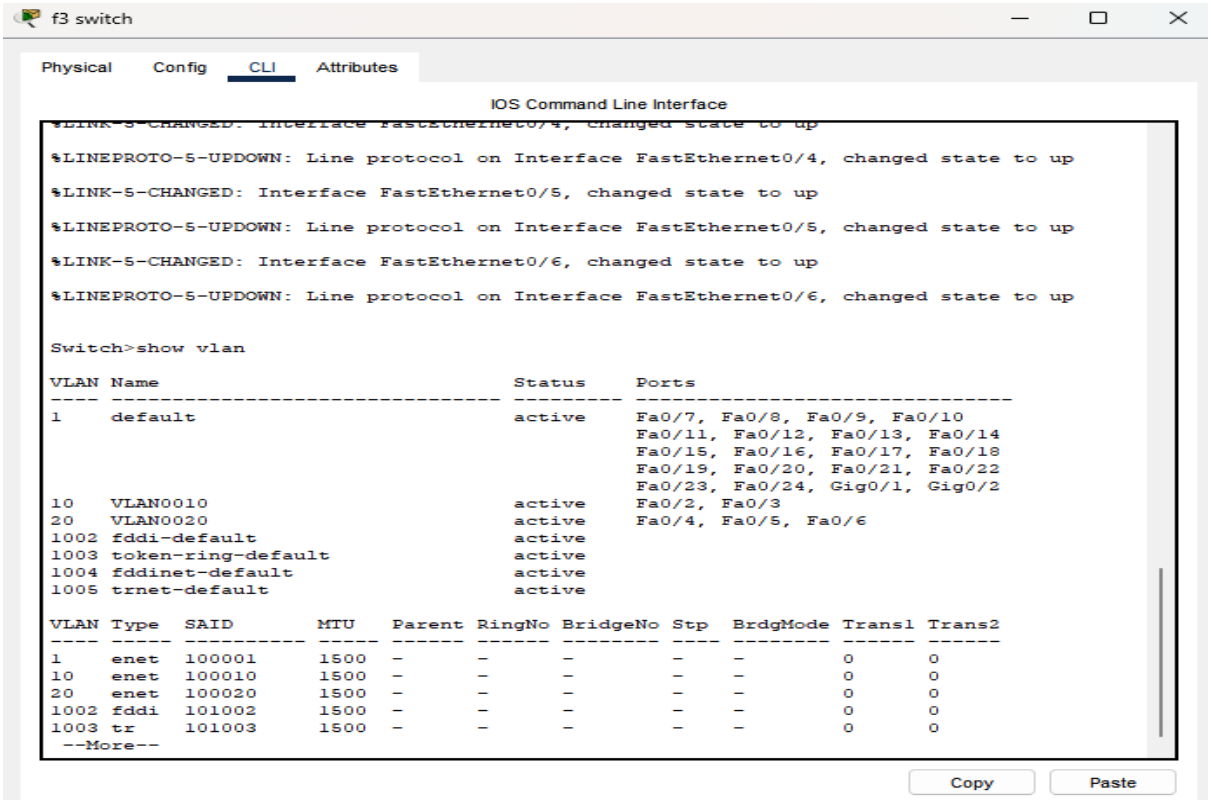

Fig. 2: Vlan Configuration for f3 switch.

Routing Configuration with OSPF:

OSPF was configured as the routing protocol to facilitate dynamic routing between routers. This involved specifying OSPF process IDs, configuring router interfaces, and defining network areas. The OSPF configuration ensures that routers can effectively communicate and share routing information, enabling optimal path selection.[3]

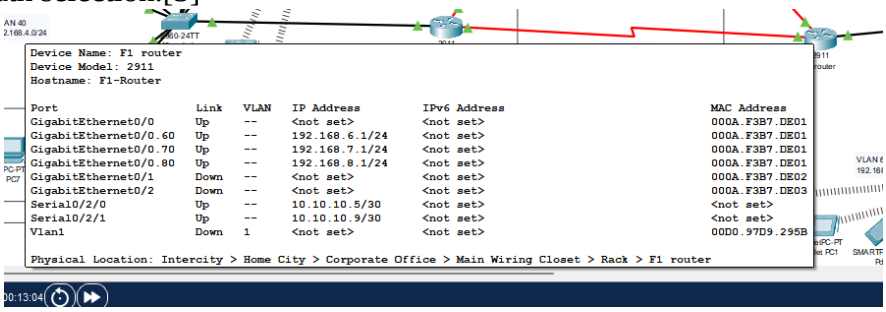

Fig. 3: OSPF Configuration of f1 router.

DHCP Server Configuration:

Each router was configured as a DHCP server for its respective floor, dynamically allocating IP addresses to devices within each VLAN. DHCP configurations included specifying IP address pools, default gateways, and DNS servers. This centralized DHCP management streamlines IP address assignment.[6]

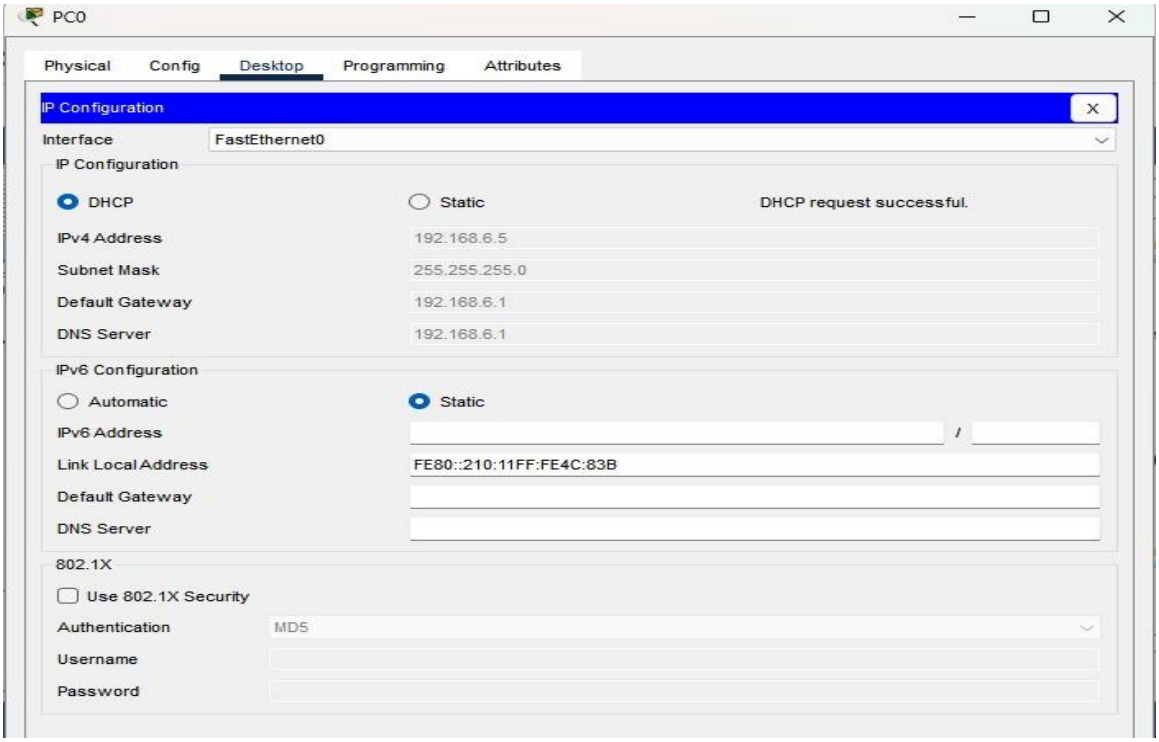

Fig. 4: Dynamically allocated ipv4 address configuration of pc0.

Secure Remote Access with SSH:

Secure Shell (SSH) was configured on all routers to enable secure remote access. This involved setting up authentication parameters, including usernames and passwords. SSH ensures that authorized personnel can remotely manage network devices securely.[7]

Port Security Measures:

Port security was implemented on the IT department's switch to allow only the designated Test-PC to access port fa0/1. This configuration prevents unauthorized devices from connecting to critical network resources.[5]

Wireless Network Configuration:

Wireless networks were configured on each floor using Cisco Access Points. This involved specifying SSIDs, security protocols, and associating each wireless network with the corresponding VLAN. The configuration ensures reliable and secure wireless communication.[8]

Testing and Verification:

After the configuration was completed, thorough testing was conducted to verify network communication, DHCP functionality, secure remote access, and port security measures. Ping tests, traceroutes, and remote login attempts were executed to ensure the network's robustness.[1]

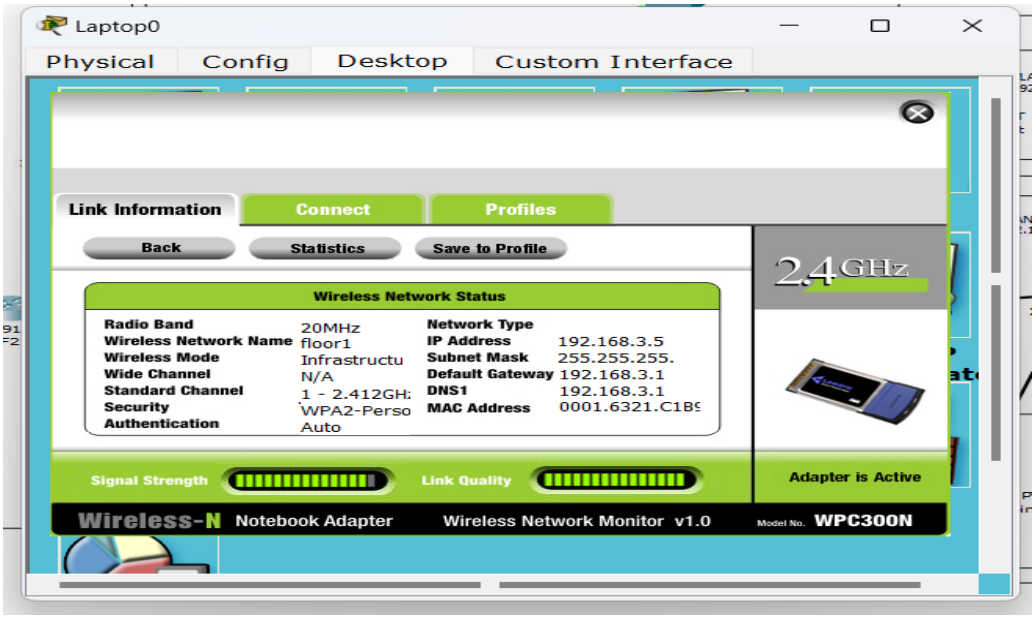

Fig. 5: Wireless Network Configuration.

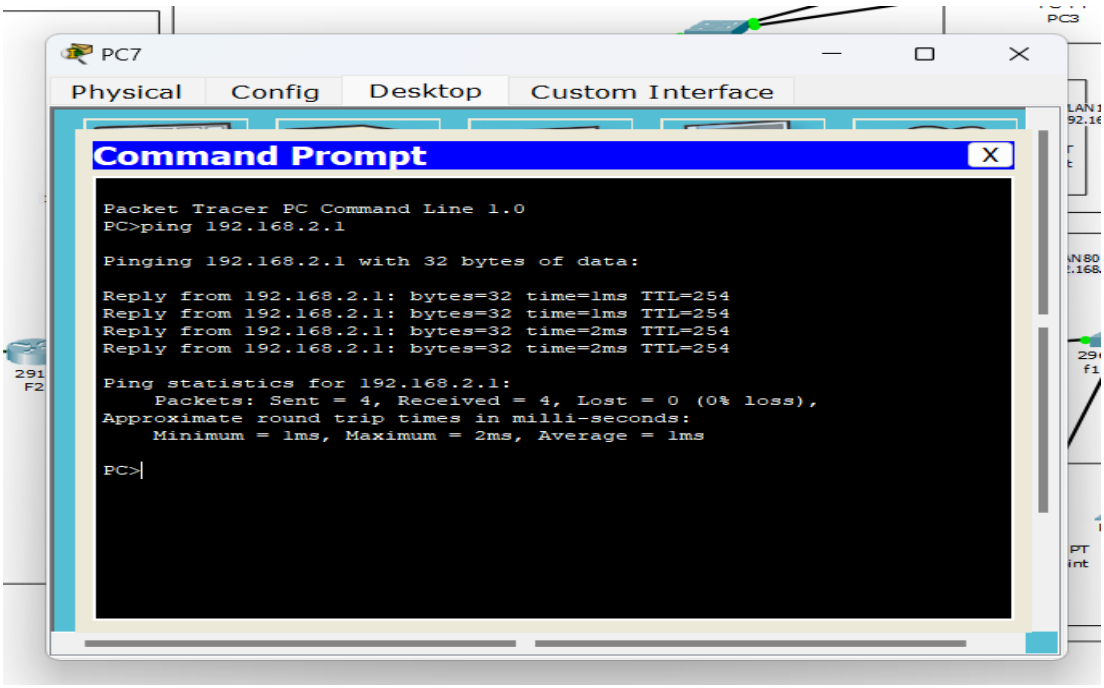

Fig. 6: Ping status.

A hierarchical network topology that connects different departments across different floors of the hotel. Implementation of OSPF as the routing protocol to advertise routes between the routers. Creation of different VLANs for each department with their own unique IP address range. Configuration of DHCP servers on the routers to assign IP addresses dynamically to devices. Configuration of SSH for secure remote access to network devices. Implementation of port security on the switches to limit access to the network by allowing only authorized devices. Creation of wireless networks for each floor to connect laptops and phones. All devices in the network can communicate with each other.

V. CONCLUSION

In conclusion, the Hotel Management Networking Project is a network design and implementation project that aims to provide a seamless and secure network infrastructure for hotels. The project is implemented using Packet Tracer, a network simulation tool developed by Cisco Systems. This project involves designing a network topology for a hotel that includes different departments such as reception, housekeeping, and restaurant. The network topology is designed to provide internet connectivity, VoIP telephony services, and other network services to the hotel staff and guests. This project is an excellent example of how network simulation tools such as Packet Tracer can be used to design and implement complex network infrastructures. The project provides a hands-on experience in designing and implementing a network infrastructure for hotels.

REFERENCES

1. "Computer Networks." *Pearson.Forouzan, B. A. (2012).*
2. "Data Communications and Networking." *McGraw-Hill Education.Cisco. (2021).*
3. "OSPF Configuration Guide." *Retrieved from Cisco OSPF Configuration Guide.Stallings, W. (2013).*
4. "Network Security Essentials." *Pearson.Cisco. (2019).*
5. "Configuring Port Security on Catalyst Switches." *Retrieved from Cisco Port Security Configuration Guide.Cisco. (2022).*
6. "Configuring DHCP." *Retrieved from Cisco DHCP Configuration Guide.Cisco. (2021).*
7. "Configuring SSH." *Retrieved from Cisco SSH Configuration Guide.Cisco. (2020).*
8. "Wireless LAN Configuration Guide." *Retrieved from Cisco Wireless LAN Configuration Guide.Hotel Technology. (2022).*
9. "VLAN Configuration Guide." Retrieved from Cisco VLAN Configuration Guide.