FINAL PROJECT IN
NET 313 - ADVANCE NETWORKING

Project Title: Advanced Network Architecture with DHCP and EIGRP Optimization for Tech Hub Facility

BSIT-3M
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FINAL PROJECT

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NET 313 – Advance Networking

Name				Score	/100
Year & Section		Date			

Project Title: Advanced Network Architecture with DHCP and EIGRP Optimization for Tech Hub Facility

Objective:

Design, implement, and optimize a network infrastructure for a technology hub facility using Cisco Packet Tracer. The network must meet the scalability, redundancy, and security demands of a tech-driven environment. Network performance will be evaluated, and enhancements proposed based on real-world business needs.

Part 1: Company and Network Requirements

1. Define Your Company

Company Type: Technology Hub Facility

Description:

The tech hub facility provides a collaborative space for startups, IT professionals, and developers. It includes shared work spaces, conference rooms, and a dedicated data center. The network accommodates multiple clients, ensuring secure high-speed internet, dependable connectivity, and strong security measures.

Unique Networking Requirements:

- High bandwidth to handle concurrent operations and extensive data transfers.
- Segmented networks for tenant isolation and administrator access.
- Scalable infrastructure to accommodate up to 500 users simultaneously.

Goals:

1. **Performance:** Ensure stable, low-latency connections.
2. **Scalability:** Expand seamlessly as the user base increases.
3. **Security:** Protect client data and comply with industry standards.

2. Analyze Business Needs

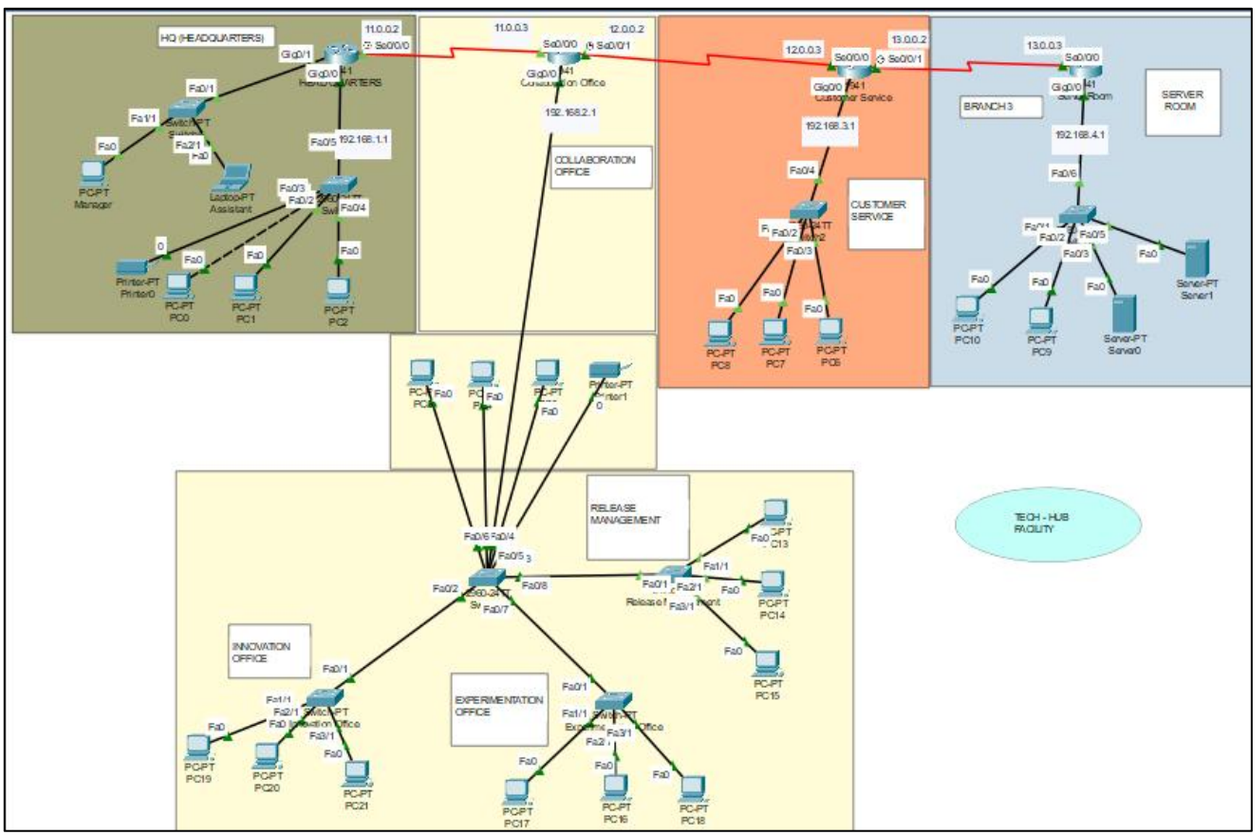
IP Addressing:

- Static IPs: Reserved for critical devices such as routers, servers, and printers.
- Dynamic IP Allocation: Provided via DHCP for client devices in each subnet.

Security Requirements:

- VLAN segmentation to isolate tenant traffic from administrative operations.
- Strong device authentication (e.g., WPA3) and encryption protocols (SSL/TLS).
- Firewalls, intrusion detection/prevention systems (IDS/IPS), and access control lists (ACLs).

Part 2: Network Design and Planning



1. Network Topology

Topology Type: Hybrid Topology (Star + Point-to-Point WAN)

The network design uses a Hybrid Topology, which combines Star Topology for LAN configurations within each location and Point-to-Point WAN links for inter-site connectivity.

Why This Topology is Suitable for the Project:

1. Scalability:

- The star configuration at each site allows the easy addition of devices without affecting the rest of the network.
- The point-to-point WAN design enables adding new branches by establishing direct links to the HQ, supporting future growth.

2. Reliability and Redundancy:

- Local star topologies ensure that individual device failures do not disrupt other devices within the branch.
- The point-to-point WAN links, combined with EIGRP, allow rapid fail over and re-convergence in case of a link failure.

3. Centralized Management:

- HQ acts as the central hub, managing core services such as DHCP, VLAN configurations, and security policies for the entire network.

- This simplifies configuration and ensures consistent management across all locations.

4. Optimized Bandwidth Usage:

- Point-to-point WAN links ensure efficient use of bandwidth by isolating branch-specific traffic and preventing unnecessary broadcast traffic.

5. Cost-Effectiveness:

- The hybrid approach avoids the expense and complexity of a full mesh topology while delivering a balance of performance and fault tolerance.

Network Overview:

- **Headquarters (HQ): Subnet 192.168.1.0/24**
- **Branch 1: Subnet 192.168.2.0/24**
- **Branch 2: Subnet 192.168.3.0/24**
- **Branch 3: Subnet 192.168.4.0/24**
- **WAN Links: Using the range 10.0.0.0/30 for point-to-point inter-site connections.**

Headquarters (HQ):

- **Subnet:** 192.168.1.0/24
- **Core Devices:**

1. Router R1 with GigabitEthernet and Serial interfaces.

2. PCs (PC0-5), Printer0, and a centralized DHCP server.

Branch 1:

- **Subnet:** 192.168.2.0/24
- **Core Devices:**

1. Router R2 connected to HQ via a Serial link.

2. PCs (PC6-8), IP Phone6, and Printer1.

Branch 2:

Subnet: 192.168.3.0/24

Core Devices:

1. Router R3 connected to HQ via Serial link.

2. PCs (PC9-11), IP Phone3, and a server cluster.

Branch 3:

- **Subnet: 192.168.4.0/24**

- **Core Devices:**

1. Router R4 connected to HQ via a Serial link.

2. Devices include PCs (PC12-15) and IoT devices (e.g., sensors, smart boards) used for collaborative tech labs.

WAN Network:

IP Range: 10.0.0.0/30 for Serial links between routers (HQ to Branch 1, 2, and 3).

2. Design Explanation

DHCP Configuration:

- **Centralized DHCP Server:** Located at HQ, serving the local subnet (192.168.1.0/24).
- **DHCP Relay Agents:** Configured on R2, R3, and R4 for Branch 1, Branch 2, and Branch 3 to enable dynamic IP allocation.

Static Assignments:

Static IPs are assigned to critical devices for reliability:

- HQ Router R1: 192.168.1.1
- Branch 1 Router R2: 192.168.2.1
- Branch 2 Router R3: 192.168.3.1
- Branch 3 Router R4: 192.168.4.1

Security Features:

VLANs: Configured to segment tenant traffic and administrative traffic.

Encryption: Use of secure protocols such as WPA3 for wireless and SSL/TLS for management interfaces.

Firewalls and ACLs: Deployed to filter traffic and prevent unauthorized access.

Part 3: Configuration and Implementation

1. Router and Switch Configuration

- Hostnames, encrypted passwords, and basic security applied to all devices.
- **DHCP Setup:**

1. Centralized DHCP server with relay agents at each branch.
2. Static bindings for servers and printers to ensure consistent addressing.VLAN Configuration:

- **VLAN Configuration:**

- VLANs for tenant and admin traffic, with inter-VLAN routing for management.

2. Security Configuration

- ACLs applied to control traffic flows.

- Encrypted passwords and management access.
- IDS/IPS for monitoring and firewall for traffic filtering.

Part 4: Advanced Testing and Analysis

1. Simulations and Tests

Scenarios:

- **Redundancy:**

- Simulate device and link failures to validate EIGRP failover mechanisms and redundancy.

- **DHCP Testing:**

- Validate dynamic IP allocation at HQ, Branch 1, Branch 2, and Branch 3, ensuring proper relay agent functionality.

- **EIGRP Performance:**

- Validate convergence times and routing table accuracy.

Testing Tools:

Cisco Packet Tracer for simulation and analysis.

2. Document and Evaluate

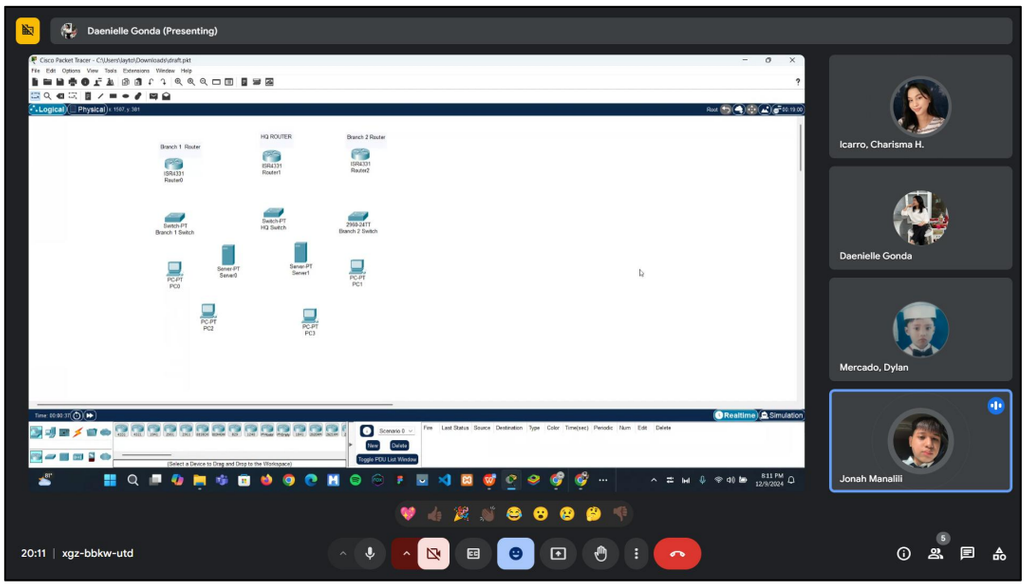
Testing Results:

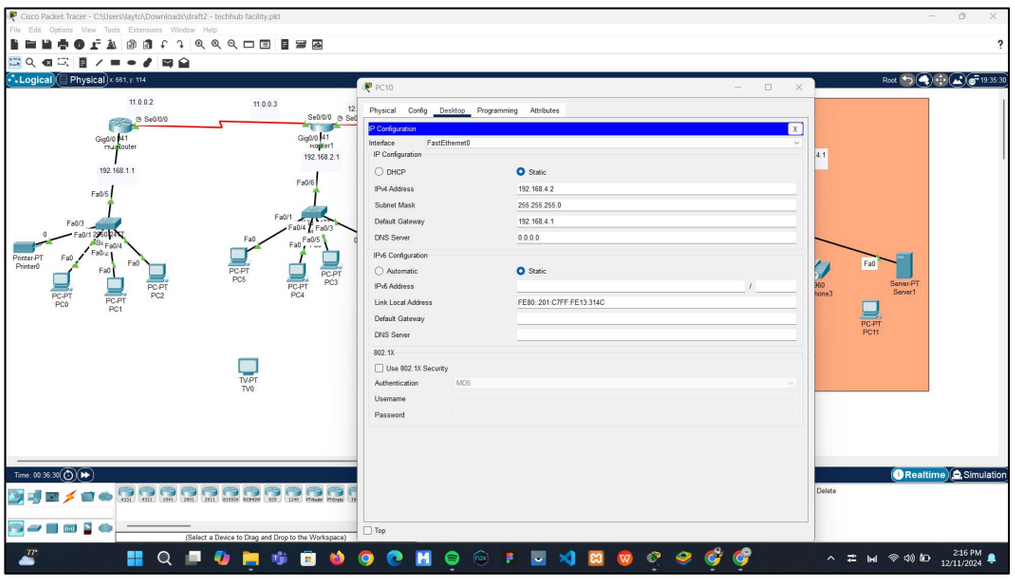
- Successful DHCP Allocation: Confirmed for all subnets.
- EIGRP Failover: Verified seamless route failover and reconvergence.
- Connectivity: Full end-to-end communication validated across all devices and locations.

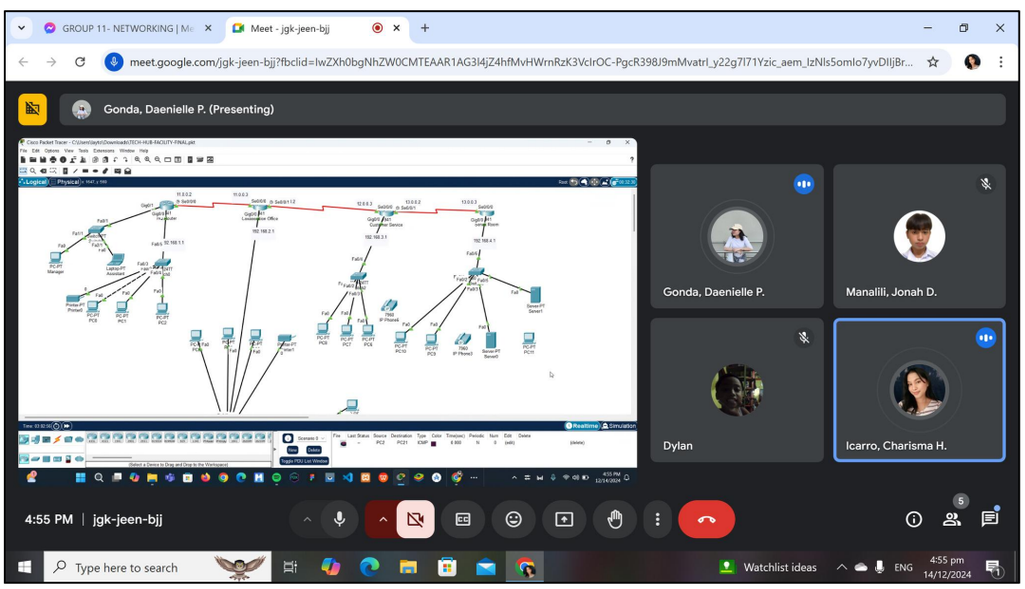
Conclusion:

The Hybrid Topology combining Star Topology for LANs and Point-to-Point WAN links for branch connections is ideal for the tech hub facility. This topology meets the project goals of scalability, reliability, and security while enabling centralized management and efficient resource utilization.

Documentation:





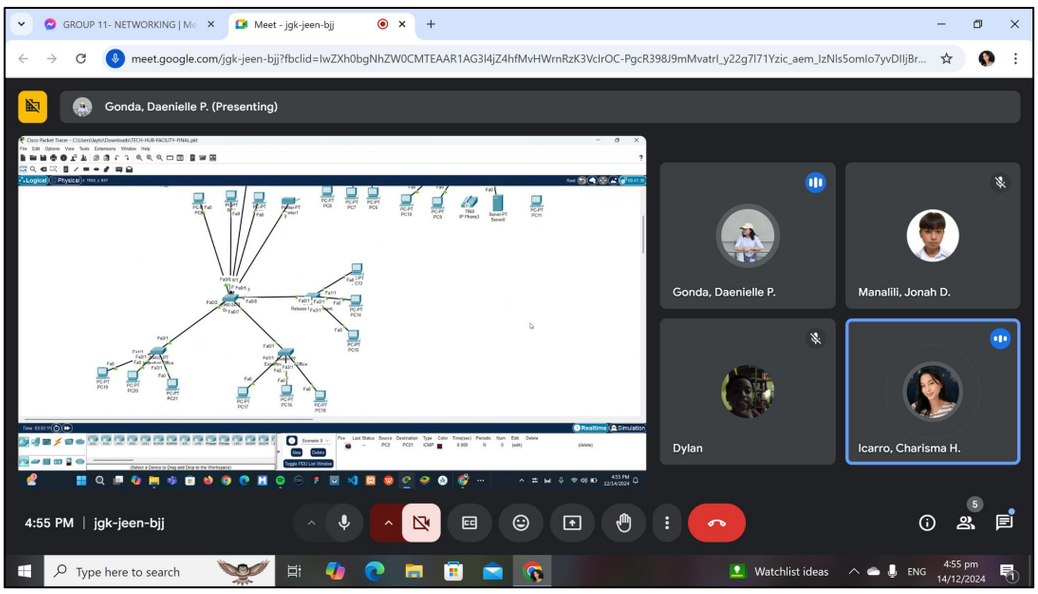


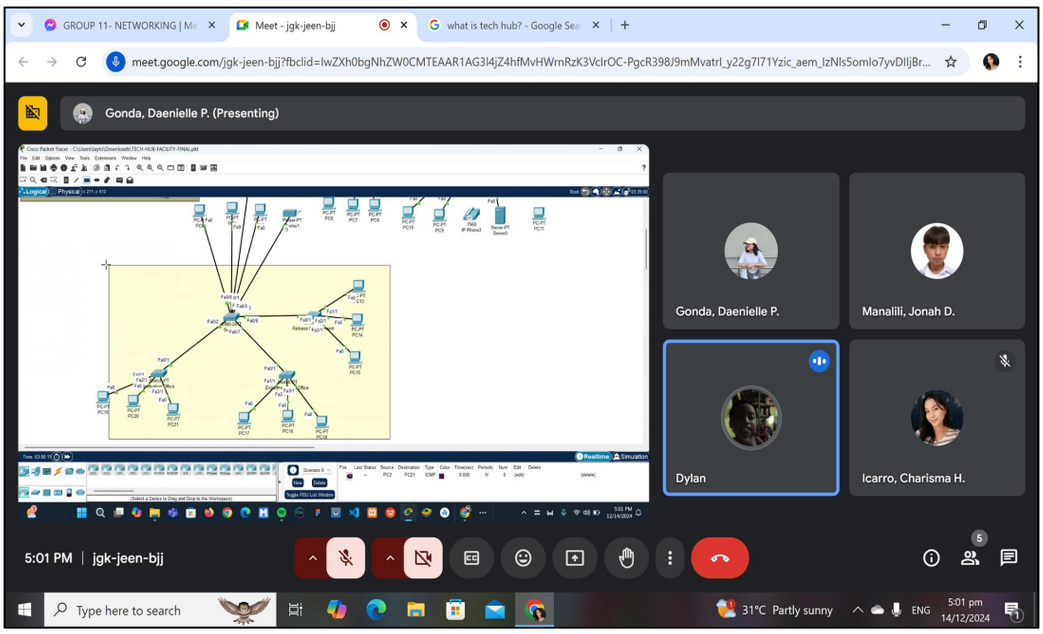
UNIVERSITY VISION: DHVSU envisions of becoming one of the lead universities in the ASEAN Region in producing globally competitive professionals who are capable of creating, applying and transferring knowledge and technology for the sustainable development of the humanity and society.

UNIVERSITY MISSION. DHVSU commits itself to provide a conducive environment for the holistic development of students to become globally competitive professionals through quality instruction and services; innovation and research towards the sustainable development of society.

GENDER SENSITIVENESS: During the examination and other aspects of instruction, the following will be observed:

- Use non-sexiest words,
- show respect regardless of gender,
- reduce barriers in developing a personal and academic success created by sexism,
- recognize gender issues arising from their different social position and gender roles.





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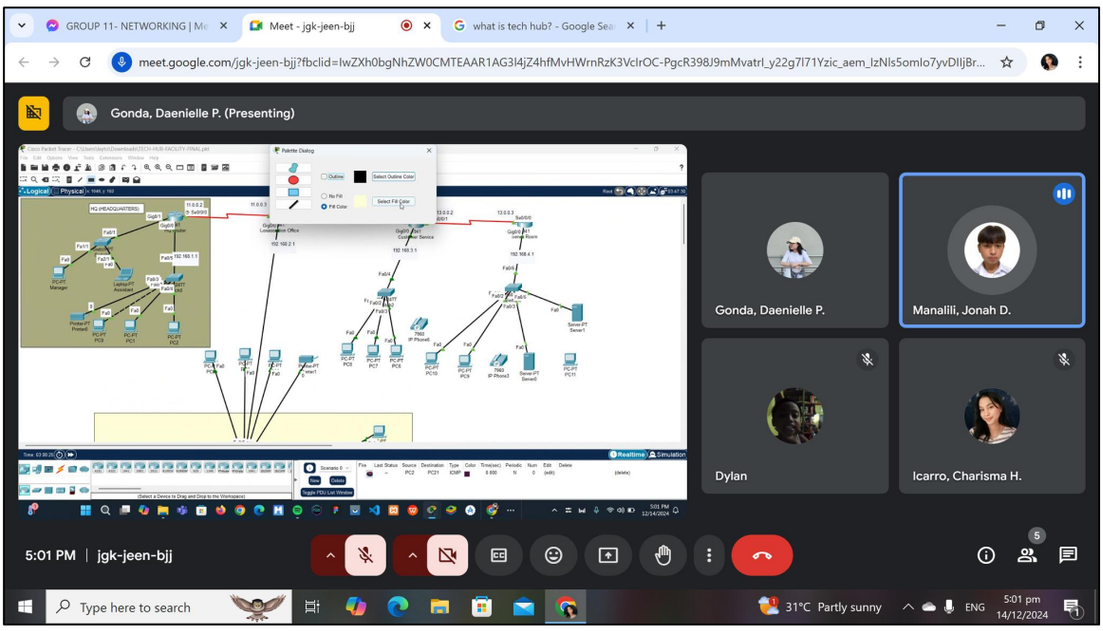

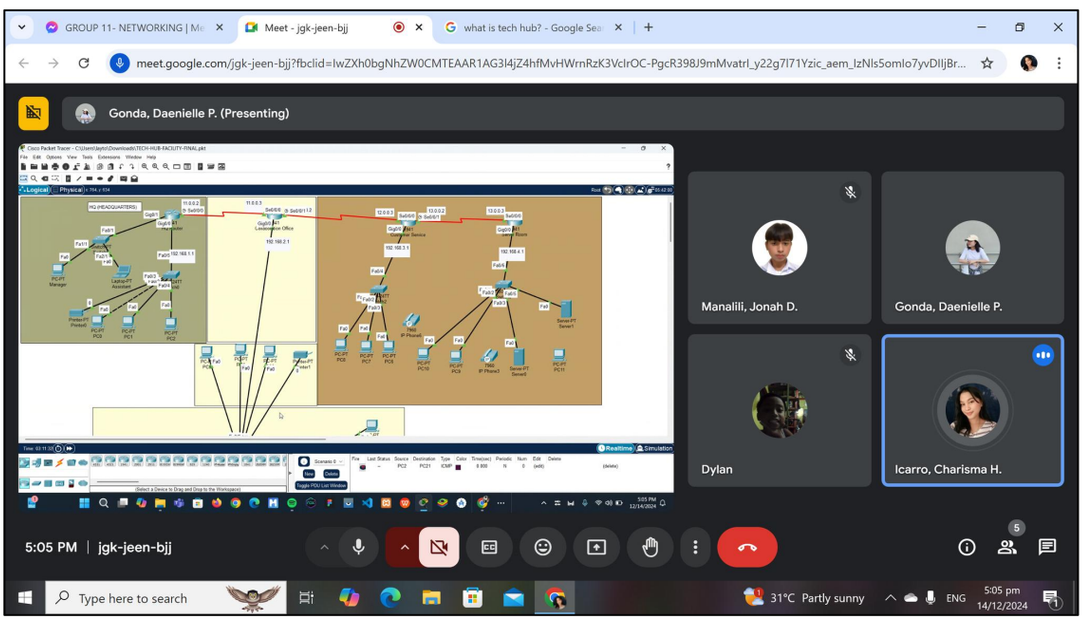

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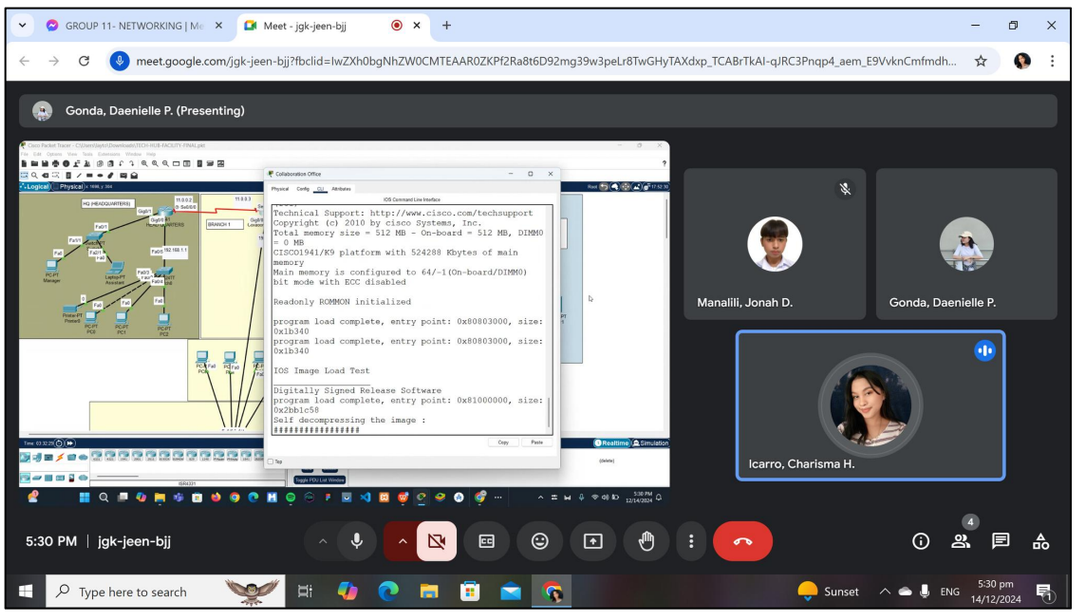

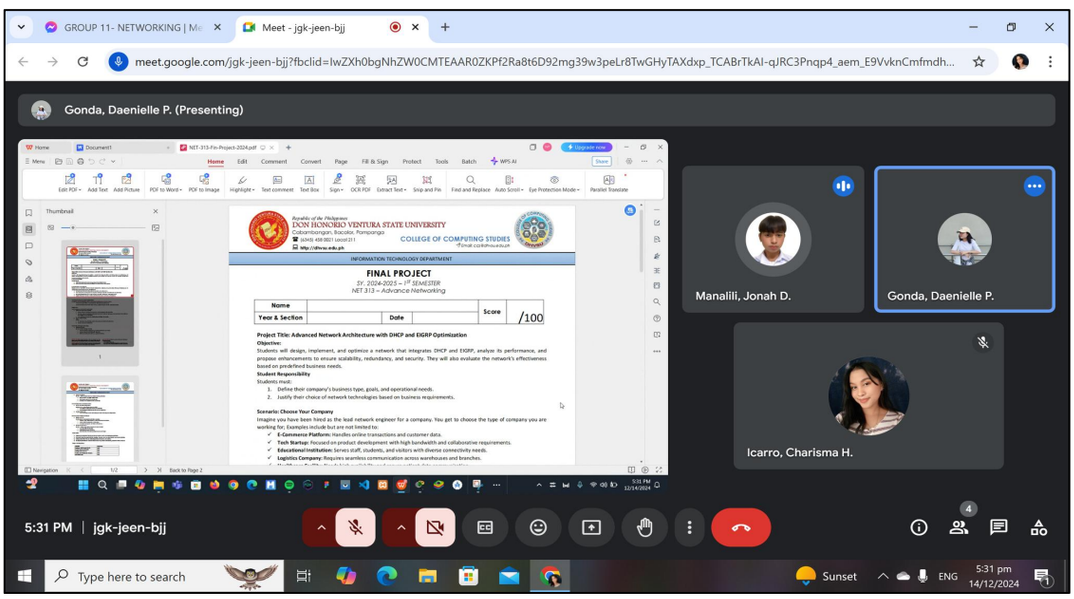

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Deliverables

1. **Company Description:** Explain your chosen business and its networking requirements.
2. **Network Design Document:** Include topology diagrams and an explanation of your design decisions.
3. **Configuration Files:** Provide full configurations for routers and switches.
4. **Testing Report:** Include results of connectivity tests, fail over simulations, and performance analyses.

Project Grading Criteria

CRITERIA	Weightage
Company and Network Needs	**15%**
Network Design and Planning	**25%**
Configuration Accuracy	**20%**
Testing and Performance Analysis	**25%**
Documentation	**15%**

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