FINAL PROJECT IN NET 313 -
ADVANCE NETWORKING

PROJECT TITLE: ADVANCED NETWORK ARCHITECTURE WITH DHCP AND EIGRP OPTIMIZATION

GROUP 11

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 performancewill 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

The tech hub facility provides a collaborative space for startups, IT professionals, and developers. It includesshared work spaces, conference rooms, and a dedicated data center. The network accommodates multipleclients,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:

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

2. Analyze Business Needs

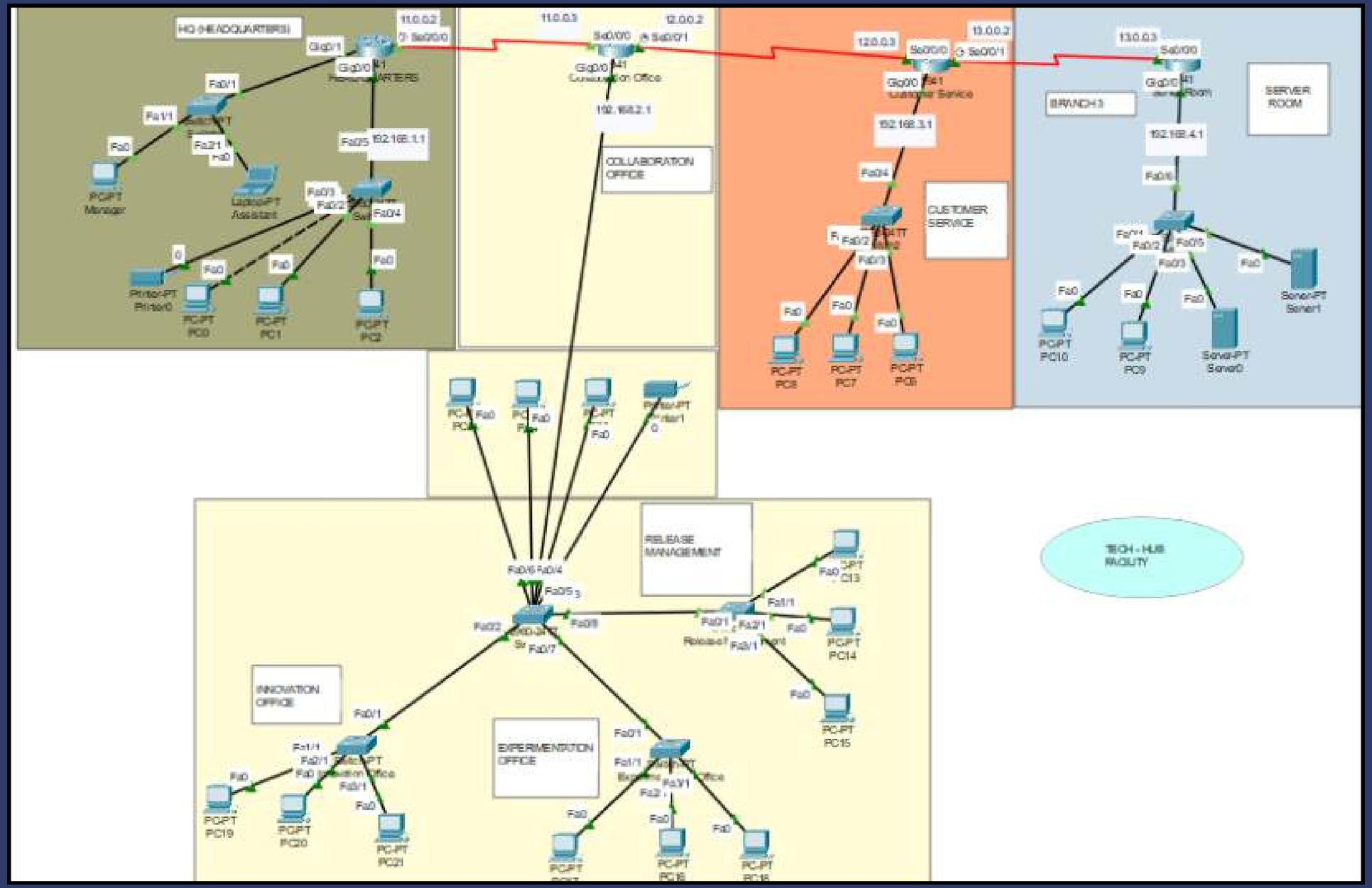
IP Addressing:

- 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


HQ (HEADQUARTERS)
11.0.0.2
Se0/0/0
Gig0/1
Gig0/0
Fa0/1
Fa1/1
Fa0
Fa2/1
Fa0
PC-PT
Manager
Laptop-PT
Assistant
Fa0/5 192.168.1.1
Fa0/3
Fa0/2
Fa0/4
0
Printer-PT
Printer0
PC-PT
PC0
PC-PT
PC1
PC-PT
PC2
11.0.0.3
12.0.0.2
Se0/0/0
Se0/0/1
Gig0/0
Collaboration Office
192.168.2.1
COLLABORATION
OFFICE
12.0.0.3
Se0/0/0
Se0/0/1
Gig0/0
192.168.3.1
Fa0/4
CUSTOMER
SERVICE
PC-PT
PC8
PC-PT
PC7
PC-PT
PC6
13.0.0.3
Se0/0/0
Gig0/0
Room
BRANCH3
SERVER
ROOM
192.168.4.1
Fa0/6
Fa0/2
Fa0/5
Fa0/3
Fa0
PC-PT
PC10
PC-PT
PC9
Server-PT
Server0
Server-PT
Server1
Fa0/6 Fa0/4
Fa0/5
Fa0/2
Fa0/9
Fa0/7
RELEASE
MANAGEMENT
Fa1/1
Fa0/21
Release1
Fa2/1
Fa0/1
PC-PT
PC13
PC-PT
PC14
PC-PT
PC15
INNOVATION
OFFICE
Fa0/1
Fa1/1
Fa2/1
Fa0
Fa0/1
PC-PT
PC19
PC-PT
PC20
PC-PT
PC21
EXPERIMENTATION
OFFICE
Fa0/1
Fa1/1
Fa3/1
Fa0
Fa0
Fa0
PC-PT
PC16
PC-PT
PC17
PC-PT
PC18
TECH - HUB
AVAILITY

1. Network Topology

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

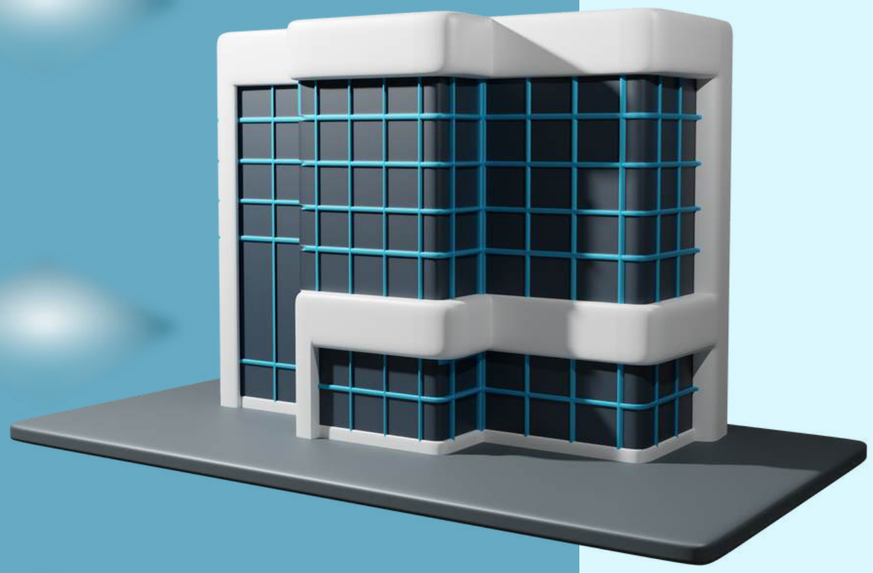
The network design uses a Hybrid Topology, which combines Star Topology for LAN configurations withineachlocation and Point-to-Point WAN links for inter-site connectivity.

Why This Topology is Suitable for the Project:

1. Scalability
2. Reliability and Redundancy
3. Centralized Management
4. Optimized Bandwidth Usage
5. Cost-Effectiveness

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 techlabs.

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 dynamicIPallocation.

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.

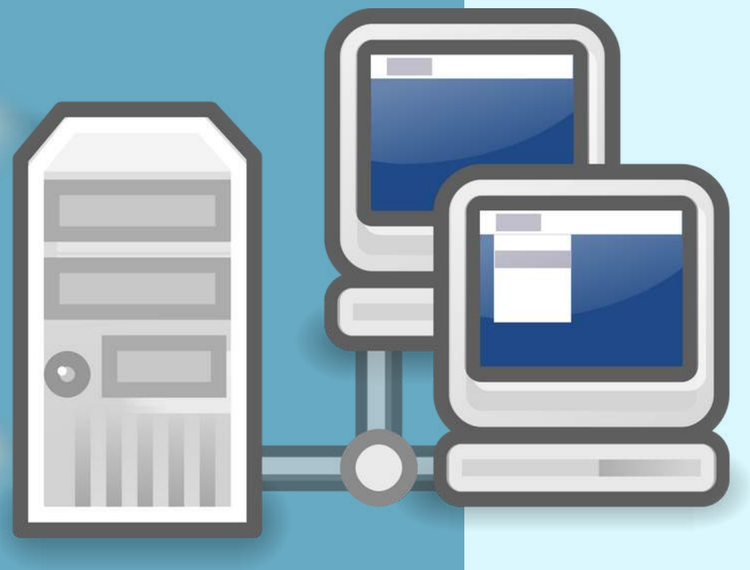
Firewalls and ACLs: Deployed to filter traffic and prevent unauthorized access.

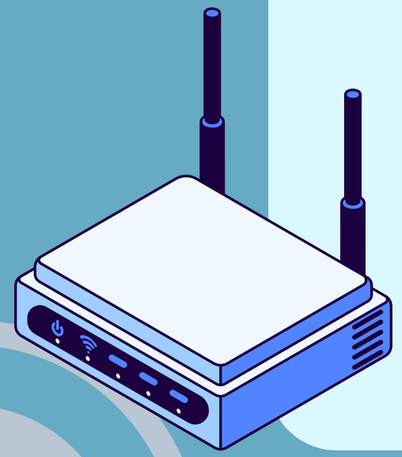
Part 3: Configuration and Implementation

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:





Part 3: Configuration and Implementation

- **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 connectionsisideal for the tech hub facility. This topology meets the project goals of scalability, reliability, and security whileenabling centralized management and efficient resource utilization.

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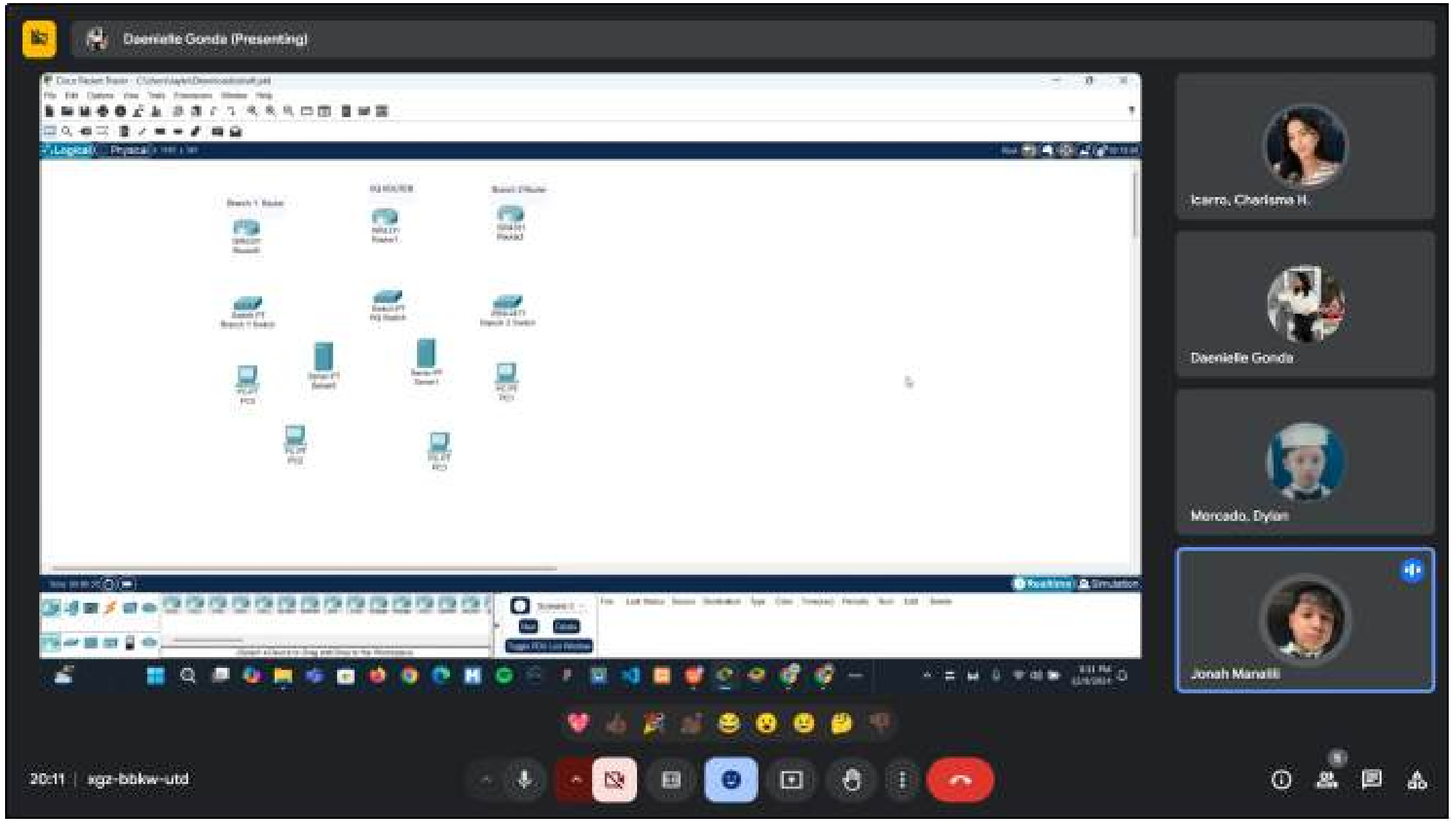

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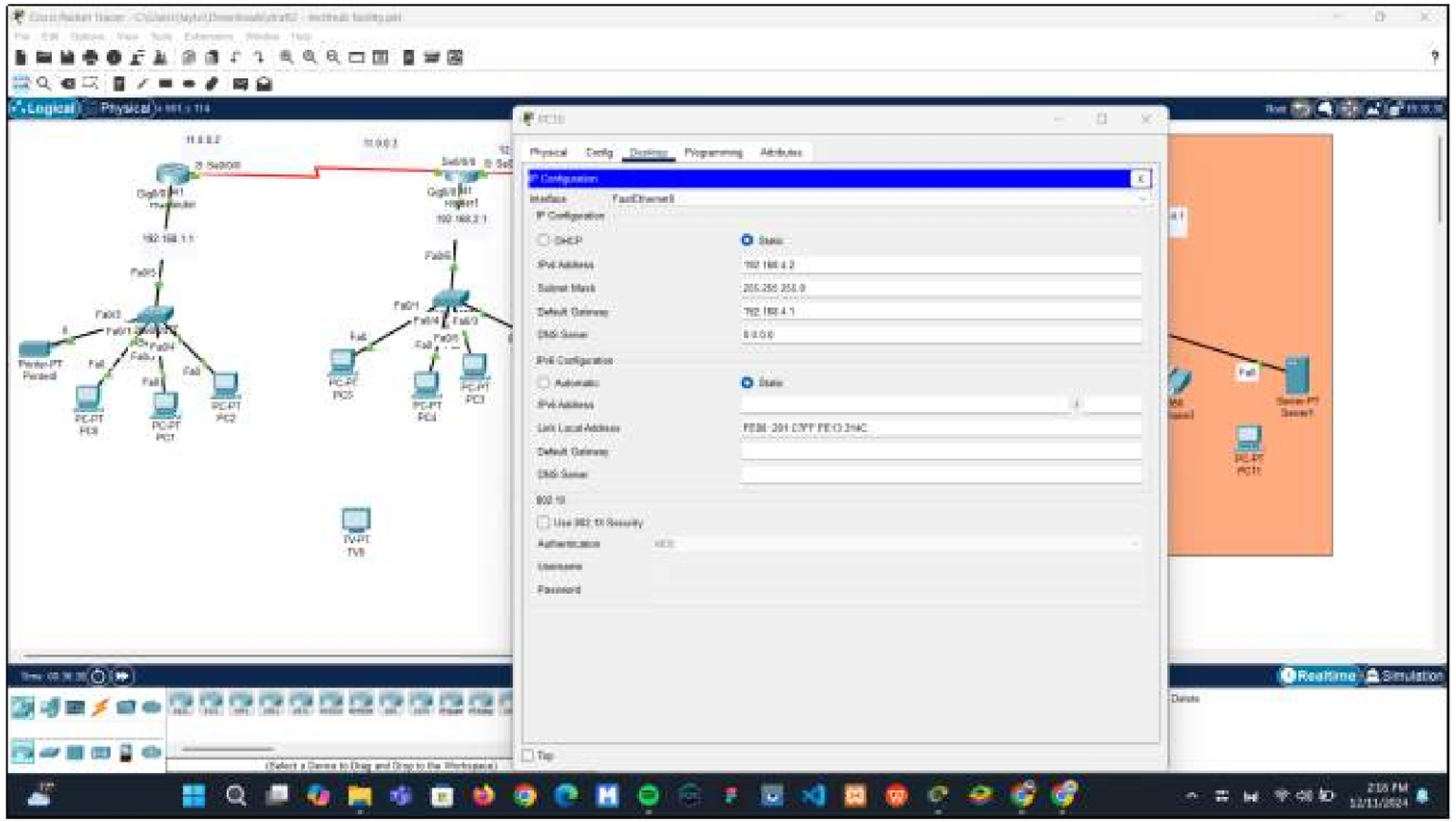

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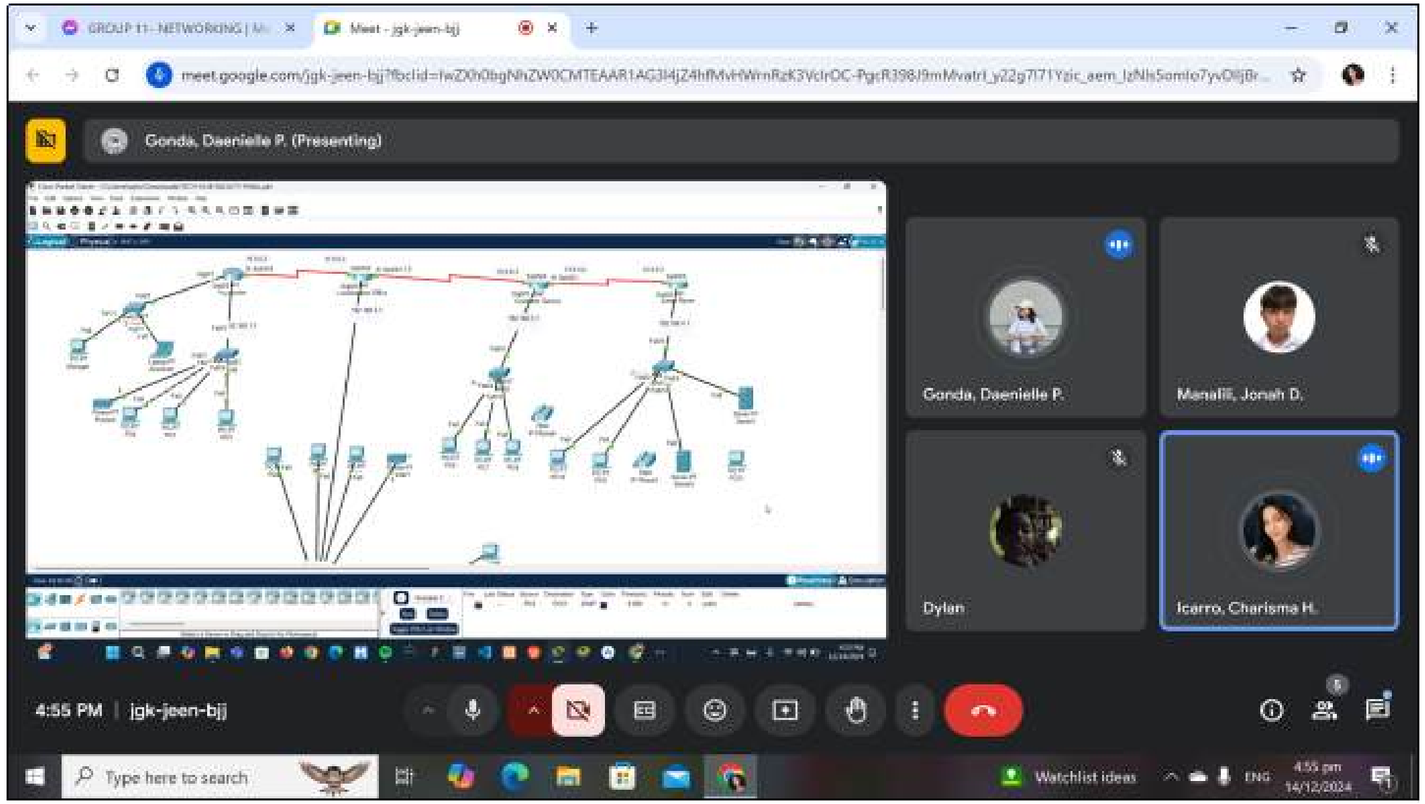

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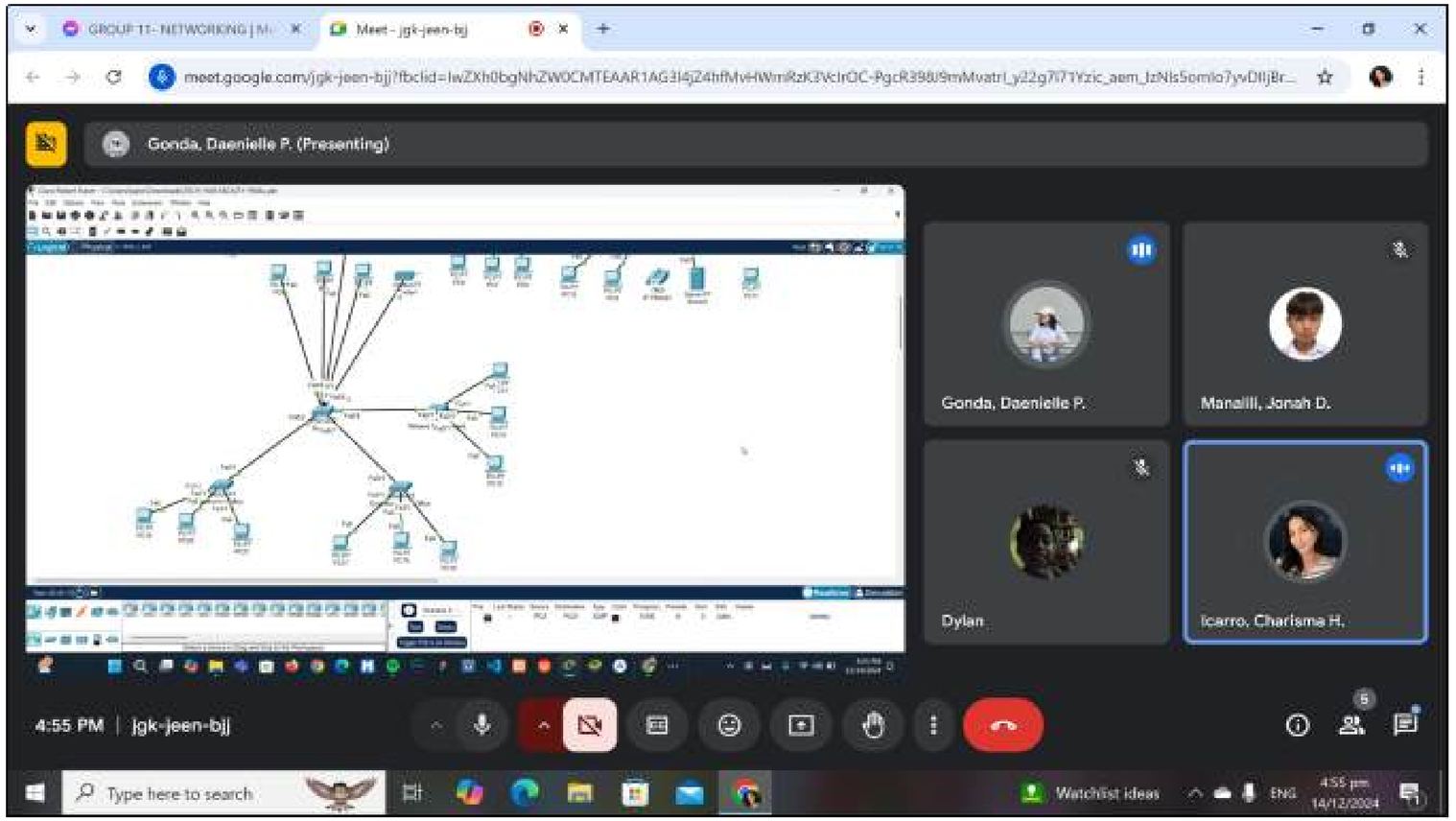

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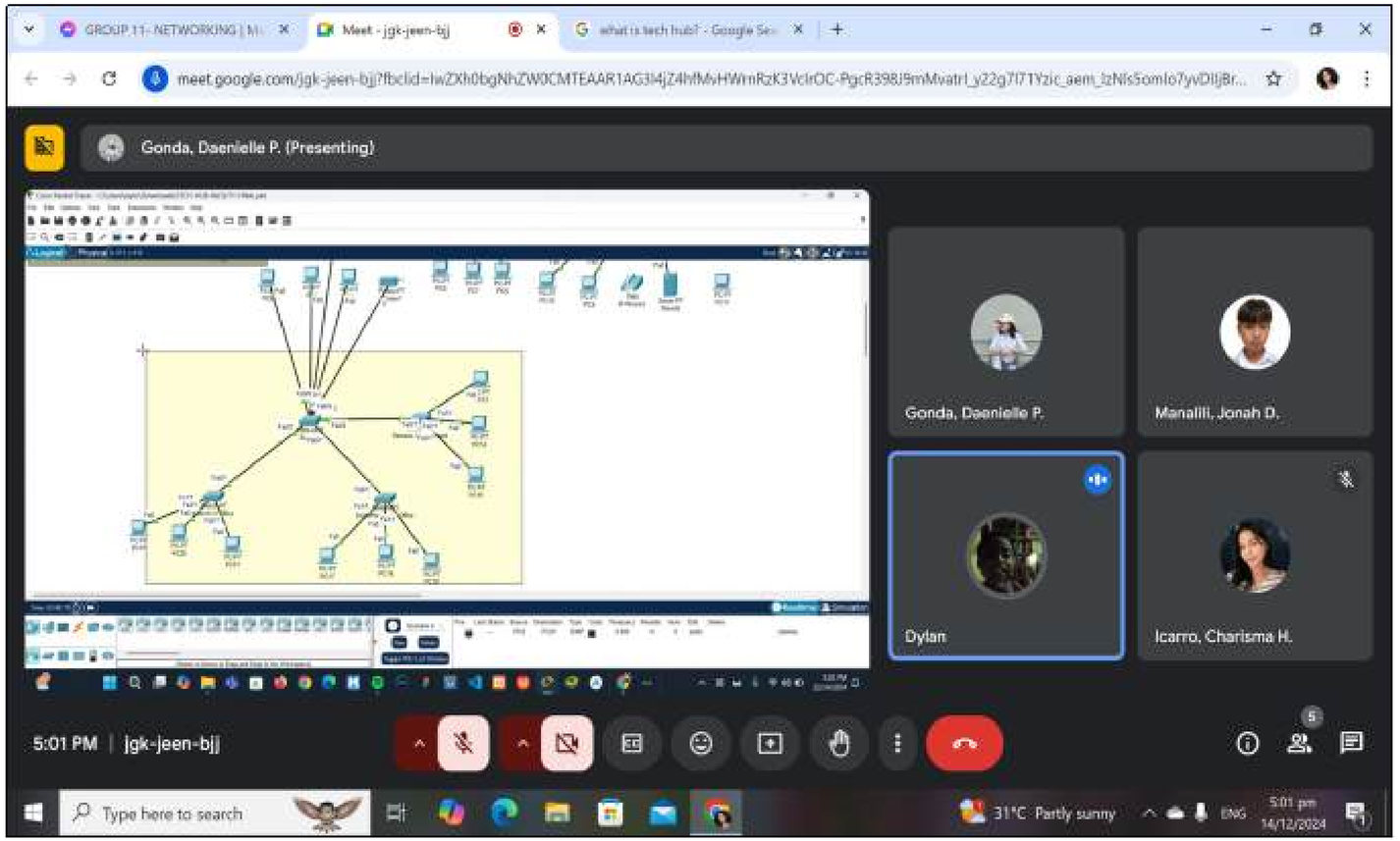

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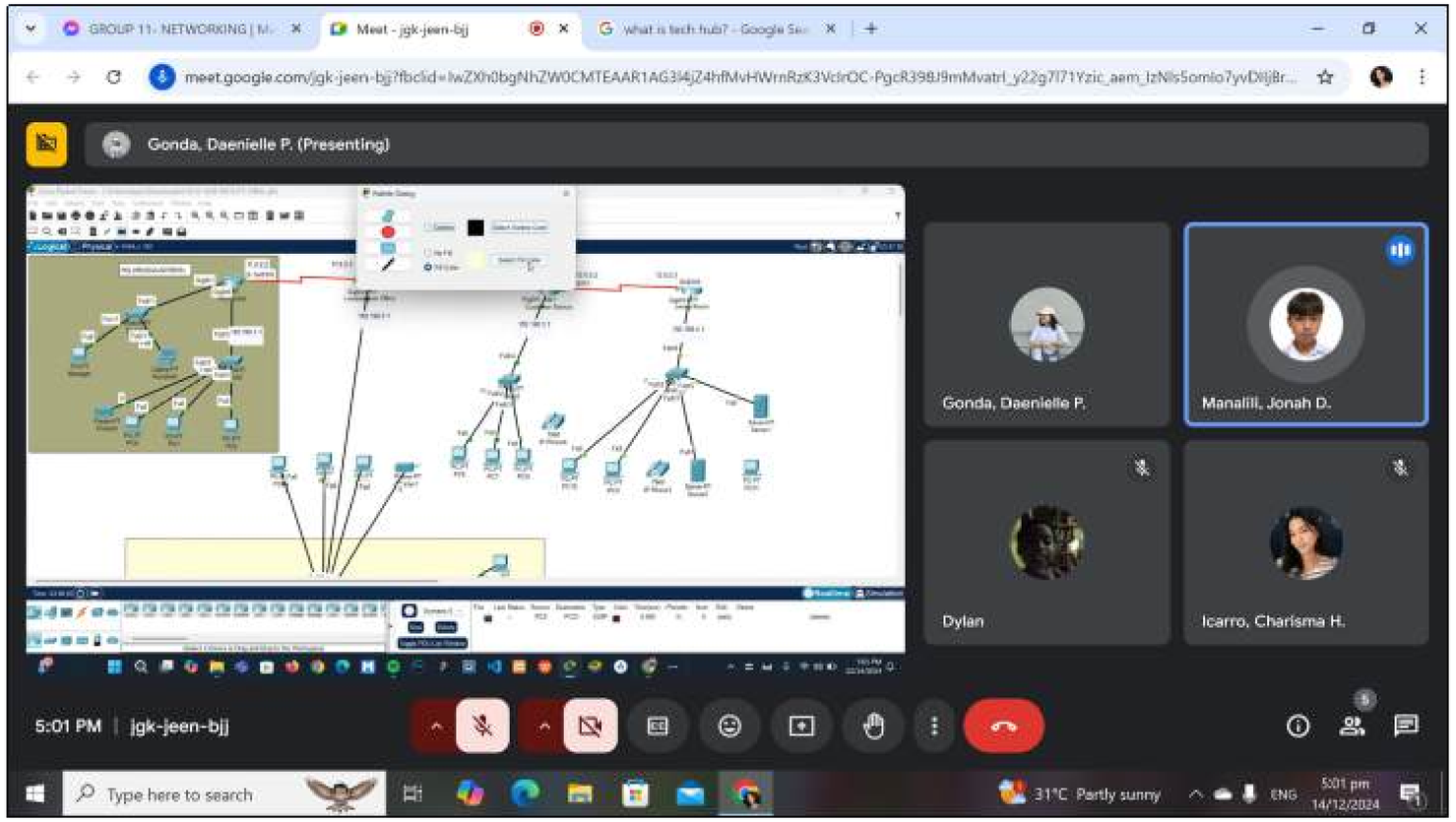

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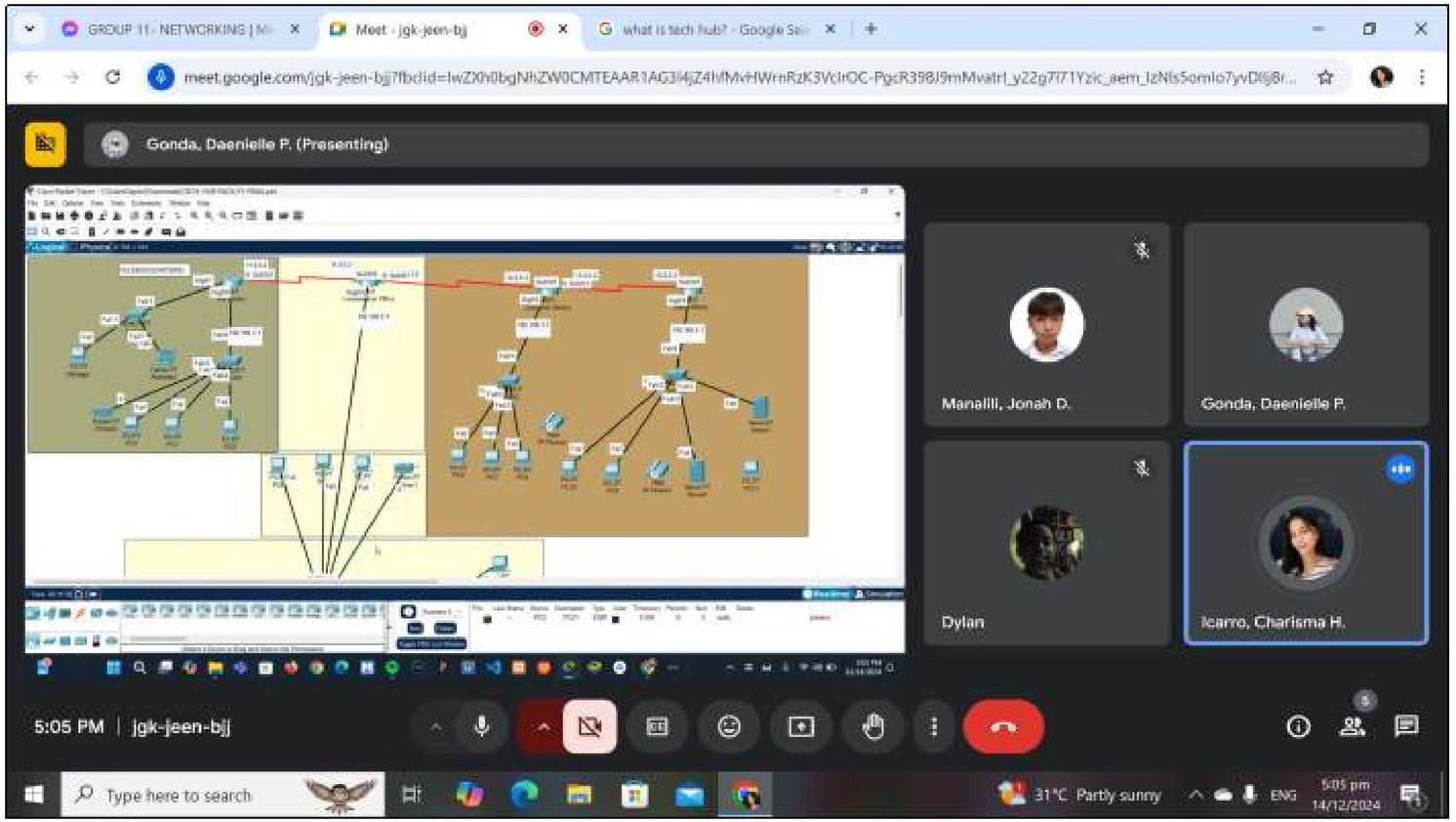

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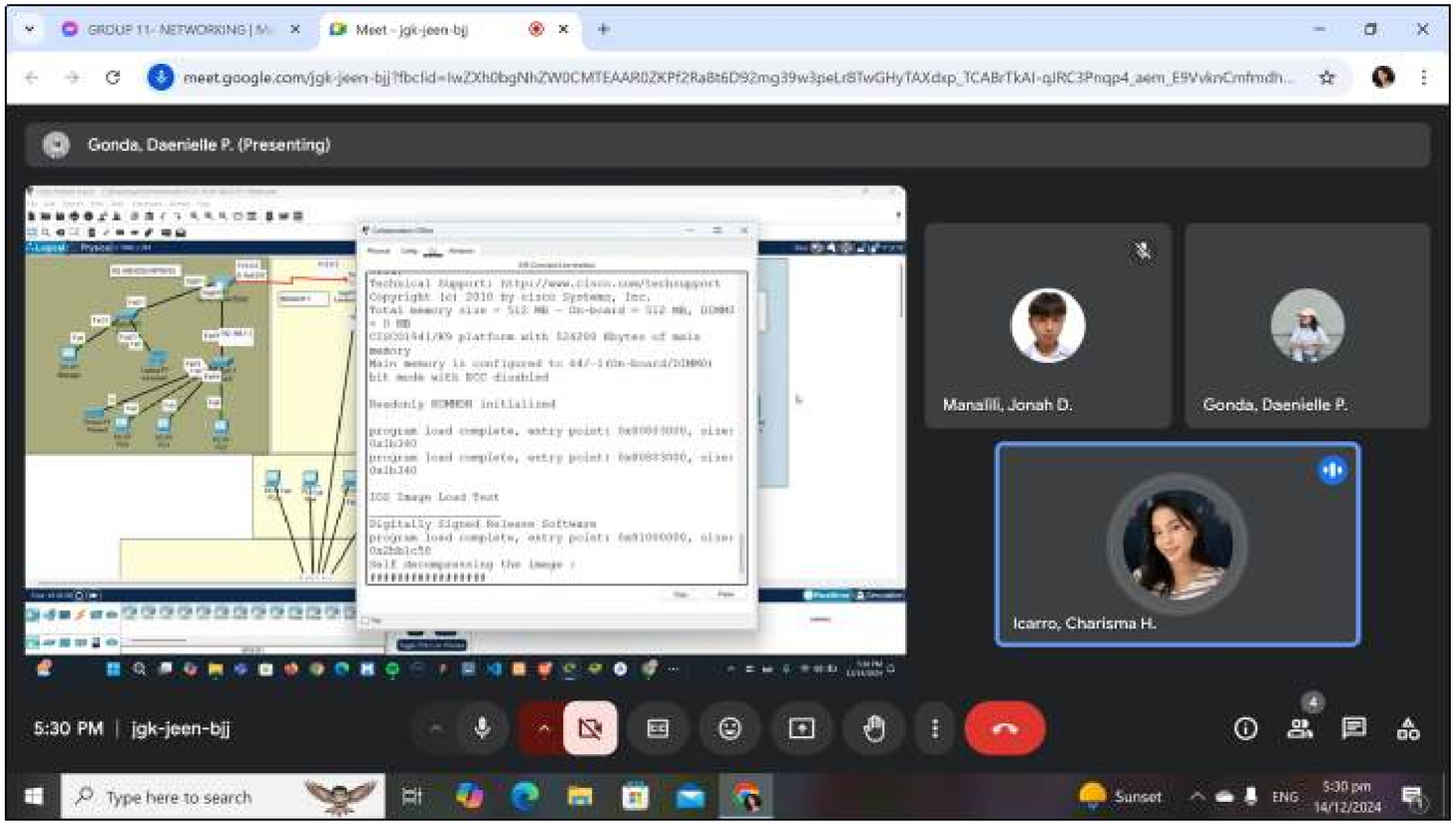

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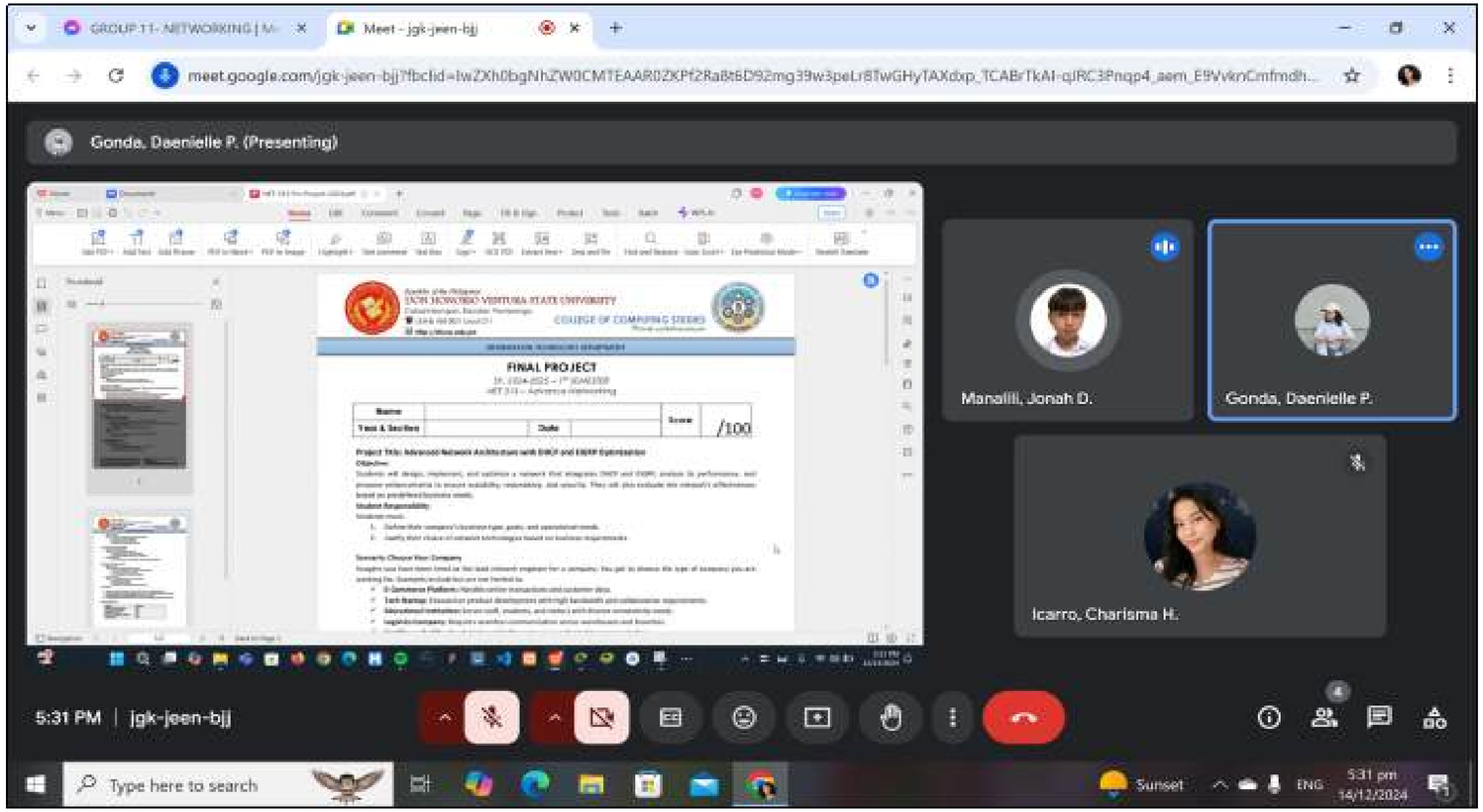

THANK YOU!

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