Project

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Assignment / Project

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Module Name:	Enterprise Network Management
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This module is presented on NQF level 6.

5% will be deducted from the student's assignment mark for each calendar day the assignment is submitted late, up to a maximum of three calendar days. The penalty will be based on the official campus submission date.

Assignments submitted later than three calendar days after the deadline or not submitted will get 0%. [1]

This is an individual project

This project contributes 40% towards the final mark.

[1] Under no circumstances will assignments be accepted for marking after the assignments of other students have been marked and returned to the students.

Instructions to Students

1. Please ensure that your answer file (where applicable) is named as follows before submission: **Module Code – Assessment Type – Campus Name – Student Number.**
2. Remember to keep a copy of all submitted assignments.
3. All work must be typed.
4. Please note that you will be evaluated on your writing skills in all your assignments.
5. All work must be submitted through Turnitin. The full originality report will be automatically generated and available for the lecturer to assess. Negative marking will be applied if you are found guilty of plagiarism, poor writing skills, or if you have applied incorrect or insufficient referencing. (See the "instructions to students" book activity before this activity where the application of negative marking is explained.)
6. You are not allowed to offer your work for sale or to purchase the work of other students. This includes the use of professional assignment writers and websites, such as Essay Box. You are also not allowed to make use of artificial intelligence tools, such as ChatGPT, to create content and submit it as your own work. If this should happen, Eduvos reserves the right not to accept future submissions from you.

Section A

Learning Objective

This project aims to provide **real-world enterprise network design, configuration, security, and optimisation** using Cisco Packet Tracer. By working with **multiple interconnected corporate networks**, students will develop skills in **subnetting, IP addressing, and hierarchical network topology design** while ensuring scalability for future growth.

Project Topic

Enterprise network design, network security.

Scope

Week 1 - 6

Technical Aspects

 Use Cisco Packet Tracer for all practical questions.

Marking Criteria

Use discretion when marking

Question 1   30 Marks

Study the scenario and complete the question(s) that follow:

The Johannesburg Headquarters of TransGlobe Logistics hosts four main departments (Finance, HR, IT, and Operations) plus shared services (Server Farm, Corporate Wi-Fi, Guest Wi-Fi, and a dedicated Network Management subnet). You are provided with the block 10.20.0.0/22 for all internal HQ addressing.

The organisation requires both wired LAN and wireless connectivity:

- Finance and HR staff use mainly wired PCs.
- Operations and IT staff need a mix of wired and wireless access.
- Corporate Wi-Fi allows authenticated employee devices.
- Guest Wi-Fi is for visitors and must be isolated from internal resources.
- Servers must be reachable from all departments but isolated in their own VLAN.
- Network Management requires a secure subnet for SNMP, syslog, and administrative access.

Source: Mphahlele, T. 2025.

1.1 Using the address block **10.20.0.0/22**, apply **Variable Length Subnet Masking (VLSM)** to create separate subnets for each HQ zone:

·   Finance (60 devices plus 20 headroom),

·   HR (40 plus 10), IT (25 plus 15),

·   Operations (70 plus 30),

·   Server Farm (20 plus 10),

·   Corporate Wi-Fi (80 plus 40),

·   Guest Wi-Fi (40 plus 20),

·   and Network Management (10 plus 10).

Your design should allocate masks that match the host requirements efficiently, starting with the largest subnet and working downwards to avoid waste.

Present the results in a structured table that includes, for each zone, the required hosts, chosen subnet mask (prefix length), network address, usable range, broadcast address, gateway IP for the SVI or routed interface, and the associated VLAN ID or SSID. Finally, explain the reasoning behind your allocation order and how your design preserves space for route summarisation and future growth. (18 marks)

1.2 Propose a suitable LAN topology for the Johannesburg HQ that makes use of an access distribution model. Explain how VLANs will be deployed across access switches, how trunk links will connect to the distribution layer, and how inter-VLAN routing will be provided, either through router-on-a-stick or Layer 3 switch SVIs.

Describe how wireless access points will be integrated into the design and how the guest Wi-Fi will be kept isolated from corporate resources. Justify your chosen topology in terms of reliability and scalability. (7 marks)

1.3 Recommend two security measures to strengthen the wireless network. These measures may include WPA3-Enterprise with 802.1X authentication, disabling legacy encryption methods, client isolation on guest Wi-Fi, or ACLs to control access.

Explain how each control reduces specific risks such as unauthorised access, interception of traffic, or lateral movement between devices. (5 marks)

[Sub Total 30 Marks]

End of Question 1

Question 2   20 Marks

Study the scenario and complete the question(s) that follow:

As TransGlobe Logistics grows, the Johannesburg HQ must be fully interconnected with the London and Singapore offices, as well as remote warehouses that depend on satellite links. Currently, the WAN uses static routing, which has resulted in inefficient paths, delayed shipment updates, and slow failover when a primary link fails. The executive team has asked for a more scalable and resilient routing strategy that can handle the mixed fibre and satellite environment, while also allowing the network to expand into new regions without frequent redesigns.

Source: Mphahlele, T. 2025.

2.1 Compare two routing protocols in terms of scalability, efficiency, policy control, and behaviour over high-latency satellite links. Discuss how each protocol would affect network performance, fault tolerance, and the ability to grow the WAN as the company expands. (10 marks)

2.2 Recommend one routing protocol (or combination of protocols) for the global WAN. Justify your choice by explaining how it improves routing efficiency, scalability, and resilience in a mixed fibre-and-satellite environment. Your answer should also describe how you would integrate site-level routing with inter-region routing. (10 marks)

[Sub Total 20 Marks]

End of Question 2

Question 3   30 Marks

Study the scenario and complete the question(s) that follow:

The management team wants to see a working prototype of the new network in action before full rollout. You have been tasked with building a Packet Tracer simulation of the Johannesburg HQ, interconnecting it with the London and Singapore offices, and attaching a remote warehouse via a simulated satellite link. The prototype must demonstrate the VLSM subnetting plan from Question 1 and the routing strategy recommended in Question 2. It should also show that the WAN can recover from failures and maintain communication between sites.

Source: Mphahlele, T. 2025.

3.1 Using your VLSM plan from Question 1, configure the HQ LAN with all VLANs, SVIs, and IP addresses. Ensure inter-VLAN routing is working, DHCP scopes are configured where required and all departments can reach the Server Farm. Provide evidence using show vlan brief and show ip interface brief. (12 marks)

3.2 Interconnect the HQ with the London and Singapore offices using your chosen routing protocol from Question 2. Use appropriate subnetting for point-to-point WAN links and advertise loopback addresses (/32) for routers. Attach the remote warehouse to HQ using a serial link to represent the satellite connection. Demonstrate successful reachability (ping/traceroute) between end devices at all sites. (8 marks)

3.3 Simulate a link failure between HQ and Singapore and demonstrate that traffic automatically reroutes via London. Provide screenshots of the routing tables before and after the failure, along with evidence of successful connectivity. Briefly explain how your chosen protocol achieved failover. (10 marks)

[Sub Total 30 Marks]

End of Question 3

Question 4   20 Marks

Study the scenario and complete the question(s) that follow:

While the new WAN design has improved routing and resilience, TransGlobe Logistics is still facing two critical challenges. First, during peak shipment hours, bandwidth congestion is causing jitter and delays in real-time applications such as shipment dashboards and tracking updates. Second, a malware infection on a warehouse PC recently disrupted communications with HQ, raising concerns about how vulnerable hosts could affect the wider network.

Management wants you to recommend a strategy that addresses both performance optimization and endpoint protection, ensuring that the network remains fast and reliable while minimizing the risk of disruptions from infected devices.

Source: Mphahlele, T. 2025.

4.1 Recommend and justify two techniques to optimize performance across the WAN and LAN. Your answer should explain how each technique reduces congestion, improves reliability, or enhances user experience. Examples include QoS, traffic shaping, bandwidth reservation, caching, or local load balancing.
(10 marks)

4.2 Recommend and justify two host-based security controls for PCs and servers. Your answer should explain how each control reduces risks such as malware infections, unauthorized access, or lateral movement within the network. Examples include endpoint detection and response (EDR), RBAC, patch management, or application allow-listing.

(10 marks)

[Sub Total 20 Marks]

End of Question 4