Case Study

Semester 2 - 2021

Network Design and Implementation

V4.5

Due Date

Sunday 17 Oct 2021 23:59 hours

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Phase 0 – Ensure you read this

1. Assignment - Team or Individual

a) For students doing the unit for the first time:

- This is a **Team** assignment.
- The Case Study is to be completed by a team of up to 4 persons
- Team members can be drawn from across the Unit, they are not restricted to your lab class.
- Your team has to be registered on ESP (https://esp.swin.edu.au/).
- **Please form your team, by week 2.**
- **Email pgranville@swin.edu.au for Case Study specifications.**
    - **Include the following in the email:**
        - **ESP Team Number**
        - **Each Team member's:**
            - **Student Id**
            - **Name**
            - **Session Time**

b) For students repeating the unit:

- This is an **Individual** assignment. Please inform your Tutor that you are a repeating student.
- You have to be registered on ESP (https://esp.swin.edu.au/).
- **Please form your team, by week 2.**
- **Email pgranville@swin.edu.au for Case Study Specifications.**
    - **Include the following in the email:**
        - **ESP Team Number**
        - **Student Id**
        - **Name**
        - **Session Time**

2. Case Study Deliverables

1) **A Case Study Report –** structure outlined below
    a) Identification Details: Team or Individual
    b) Report Structure
2) **A Packet Tracer Prototype, latest V8 version**
3) **A Video Presentation file**
4) **Individual Reflection Report**

3.Case Study Submission - Details

1) The Case Study Report, Packet Tracer Prototype, and Video Presentation must be submitted to ESP
2) **The Individual Reflection Report must the emailed to your session tutor**
3) **Due Date**: **Sunday 17 Oct 2021 23:59 hours**
4) **Late submission: A late penalty of 10% per day or part there of applies.**

Phase 1 - Case Study Overview

Vehicles Are Us Ltd is a company that leases buys and sells and repairs cars, trucks and buses. The Head Office is at the Gooty site. The other company sites are in Pamidi, Kadiri and Narpala.

The company is implementing a network that should support potential growth over the next five years. The task is to design, implement and fully document the proposed Vehicles Are Us Company network. You must prepare:

1. A Written Report
2. A Video Presentation were each member of the team outlines their contributions to the project
3. A **prototype** of the network, built using Packet Tracer V8 as a proof of concept that your team can build a network that will satisfy the company's requirements.

4. Please note the following:

- You have **11 weeks** (which includes the Mid-Semester Break) to complete the case study. It is important to form your team and get your Case Study specifications from **pgranville@swin.edu.au**

- Given the nature of the case study, it is not possible to cover all the required knowledge in lectures before you start and finish the case study. However, unit lecture material and CISCO guides are available on Canvas for you to reference. You can also access information on the Cisco company website
- The case study is:
    - a team assessment for **first time** students
    - an **individual** assessment for **repeating** students.

- In forming a team: it is the responsibility of each student to negotiate with other students within the unit to form the team.
  Go to Canvas Discussions, Case Study – Looking for Team Members

- This case study requires the building and configuration of a network using skills gained through studying the Unit material.

- It is important to read and understand each requirement to ensure that the case study is completed accurately.

- **Case Study Specifications**
    - Specification Number (Spec No)
    - *Pseudo private* Class A Internal network address (to ensure uniqueness between assignments)
    - Class B NAT Pool Public IP address range
    - Class C ISP Network Connection IP addresses
    - Class B ISP Internet Web Server IP address
    - Wireless deployment site
    - Expected Percentage Growth of staff for VLSM design
    - Switch Management VLAN number

5. Company Site Layouts

At Gooty:

- The Leasing, Marketing and Vehicle Servicing groups are on floor 1.
- The Business group is on floor 2
- The Servers are on floor 1
- Site size 1500metres x 1500metres
- Building Floor size 100metres x 200metres
- Technical Support group on floor 1

At Pamidi:

- Leasing, Vehicle Servicing and Technical Support groups are on the ground floor of a single level building
- Site size 1500metres x 2000metres
- Building Floor size 120metres x 30metres

At Narpala:

- Sales, Vehicle Servicing and Technical Support groups are on the ground floor of a single level building
- Site size 2000metres x 2000metres
- Building Floor size 225metres x 30metres

At Kadiri:

- Sales, Vehicle Servicing and Technical Support groups are on the ground floor of a single level building
- Site size 1250metres x 2000metres
- Building Floor size 125metres x 40metres

Phase 2 – IP addressing and VLSM Design

The Vehicles Are Us Company requires you to use Packet Tracer V8 for development and demonstration of the prototype. The prototype **does not need to have in it all the devices** that would be required in the actual physical implementation.

In implementing your VLSM design, you need to consider the following:

1. The Company workgroups

- Gooty
  - Leasing group
  - Marketing group
  - Business group
- Pamidi
  - Leasing group
- Narpala
  - Sales group
- Kadiri
  - Sales group
- All Sites
  - Security group
  - Technical Support group
  - Vehicle Servicing group

2. The number of staff

Each staff member will have either a desktop PC or a Laptop PC.

- Gooty
  - 125 staff in the Leasing group
  - 180 staff in the Marketing group
  - 200 staff in the Business group
- Pamidi
  - 80 staff in the Leasing group
- Narpala
  - 140 staff in the Sales group.
- Kadiri
  - 125 staff in the Sales group
- All sites
  - 20 staff in the Security group, 5 staff at each site.
  - 20 staff in the Technical Support group, 5 staff at each site
  - 20 staff in the Vehicle Servicing group, 5 staff at each site

3. Server Farm

- Separate company Server Farm VLAN at the Gooty site. You can decide the number and type of servers required. You must allow for IP address space for the Server farm in your VLSM design.

4. Switch Management VLANs

- A Switch Management VLAN must be created at each site
- For the Management VLAN number refer to your specifications

5. Printer

- Allow for 1 printer for at each company site

6. VLSM Implementation

The company requires the use of VLSM Design to ensure efficient use of the IP address space.

- Use *pseudo private* class A network (refer to your specifications) for internal addressing
- Take into account the for expected % growth (refer to your specifications) of current IP requirements when determining size of subnets.
- Clearly identify ip address space that is available for future use.
- Record details in table A to show the subnets that meet the Company requirements.

Table A: VLSM Design

Number of host addresses required	Subnet Network Address	Subnet Mask	Subnet Prefix	Max Number of Hosts Possible	Address Space Future Use Y/N	VLAN Name	Site Location

Phase 3 – Routing Protocol Planning

The company network will use OSPF as the routing protocol:

- OSPF MD5 authentication is required on the link between Gooty and Kadiri routers
- The bandwidth on all internal router to router serial links must be set to 256
- Set passive interface for relevant interfaces
- Configure a default route to Kadiri ISP
- Advertise default route to other internal routers
- Gooty Only: router must be accessible via SSH for maintenance by Technical Support group

Phase 4 – Switch and VLAN Planning

- All sites
    - Rather than use VLAN 1 as the default management VLAN at each site, configure a Management VLAN with VLAN number provided by your specifications.
      All switches will be in this Management VLAN.
    - All unallocated switch ports must be shutdown
    - All access switches must have one access port for each VLAN configured, except for the Management VLAN
- Pamidi Only: access switch ports must be secured using port security
- Kadiri Only: access switches require path redundancy to a distribution switch. The distribution switch must be configured as the route bridge for all VLANs
- Gooty Only: switches at this site must be accessible via SSH for maintenance by Technical Support group

Phase 5 – Configure Switches, VLANs

- Refer to Phases 2, 4
- There must be a PC (clearly identified and connected eg PC Sales) on each VLAN to allowing testing of the network
- For each site, record Switch details in table B:

Table B: Switch Details

Name	Model	# of Ports	Location	Management VLAN IP Address	Default Gateway IP Address	Management Vlan

Phase 6 – Ether Channel

- The company wants to implement Ether Channel.
- In the **prototype** just implement LACP Ether Channel only for the Narpala site

Phase 7 – Configure Routers and Routing Protocol

- Refer to Phase 2 for VLSM subnets and IP Address assignment.
- Refer to Phase 3 for details regarding OSPF.
- The Internet Web Server attached to Kadiri ISP has a Class B address (given by your lab tutor). This Web Server represents the "Internet".
- Configure a static route on Kadiri ISP to the internal network
- For each site, record Router IP address details in table C.

Table C: Router Details

Site: Router Name:

Interface/Sub Interface Type/Number	**Description and Purpose**	**Network/VLAN Name**	**Network Address**	**Interface IP address**	**Subnet Mask /value**

Phase 8 – Configuring IP Addresses

8.1 DHCP – Pamidi Site

- The company wants to use DHCP.
- In the **prototype** just implement DHCP only for Pamidi site.
- DHCP must dynamically provide IP address information to PC workstations/Laptops.
- Use the information documented in Phase 1 to configure each DHCP pool.
- Connect only 1 PC workstation to a switch for each of the appropriate VLANs .
- Label the PCs, for example PCLeasing. This will aid your team and the Tutor in testing the Packet Tracer prototype

8.2 Other Sites

- Directly configure all devices with an IP address

Table D: Pamidi DHCP Server Pool IP Host Addresses

VLAN Name	**IP Address Pool Range**	**Subnet mask** /value	**Default Gateway** IP Address

Table E: Statically assigned IP Host Addresses – Servers, Printers etc

Server/Printer etc **Name**	**In which VLAN**	**IP Address**	**Subnet Mask /Value**	**Default Gateway IP Address**	**Service/s Provided**

Phase 9 – PPP

- Configure PPP and CHAP authentication on the link to the ISP.

Phase 10 – Wireless LAN Deployment Site

- In the prototype, you will implement a wireless LAN only at the deployment site given in your specification.
- The Site Security group must have access to the network via the wireless LAN.
- Determine the number of Wireless Access Points that are required at the site to support the Security group. Show the details of your calculation.
- With the help of graph paper (scan it to include in the report), show to scale the deployment of the wireless access points across the site.
- In the prototype configure one wireless access point, and test that a Security group laptop can ping all devices within the site.

Table F: Wireless Access Point Details

Name	**Model**	**SSID**	**Channel**					

Phase 11 – NAT Configuration

The company wants to use private addresses. The addresses provide by your tutor do not actually belong to the private range, but are sufficient for the purpose of building the prototype network.

1. Configure NAT on the router that is acting as your gateway router to the Internet as follows:

- Define the NAT pool. Please use the Class B NAT pool public address given to you by your lab tutor.
- Use Static NAT to assign a static public address to each of the servers in Server Farm
- The rest of the address range can be used with the NAT pool.
- Define an access control list, which will permit all IP traffic from permitted internal addresses.
- Overload your NAT pool

2. Test that NAT is working from a host on any LAN or VLAN. The host should be able to ping and browse to the Internet Web Server.

Phase 12 – Access Control at Gooty Site

The company requires the implementation of ACLs to control the flow of IP traffic within its network and to the Internet. In the **prototype**, you will implement Named Access Control Lists**,** at the **Gooty** site only.

i. Before you implement the ACLs, test that each PC is able to browse and ping the Internet Web Server, all the Internal Servers and PCs on other VLANs

ii. You are to implement ACLs that will control IP traffic flow between the VLANs and the Internet as follows:
   a. ACL Rules for Server Farm LAN Access
      You must decide the ACL access rules as to which VLANs can access which servers in the Server Farm VLAN
   b. ACL Rules for Group Access VLANs
      i. All VLANs are permitted access to Internet unless specifically denied below
      ii. All VLANs are permitted access to other VLANs unless specifically denied below
      iii. PC hosts in the Marketing VLAN denied access to the Leasing VLAN.
      iv. PC hosts in Vehicle Servicing VLAN is denied access all other VLANs
      v. PC hosts in all other VLANs are denied access to Technical Support VLAN

iii. Use a table to record the testing of the ACLs (add Rows as needed):

Table G: Record of ACL Testing Gooty

Source Host	**Destination Host/Server**	**Protocol**	**Expected Result** Permitted/Denied	**Achieved** Yes/No
Host on Leasing Only	Internet Web Server	HTTP		

Title Page, Identification and Specification Information

Note: If you do not provide the correct Identification Details – Team, Full Names, Student Ids and Lab Classes as shown in examples below it will be difficult to record your results.
Marks are allocated for providing full and correct Title Page, Identification and Specification Information.

Identification Details: Team OR Individual

i) Team Identification Details

- Team Title Page
- For each team member provide, student name, id, lab day/time/room, unit code

Example Title Page:

*** Team Case Study ***

ESP Team: T022 – First Time Students

Team Members

Mick Mouse	**123456789**	**Tuesday**	**11:30**	**ATC328**	**TNE20002**
Black Cat	**765432112**	**Tuesday**	**11:30**	**ATC328**	**TNE70003**
Snow White	**123331234**	**Wednesday**	**14:30**	**ATC329**	**TNE20002**

Specification Information

- Specification Number : _____
- Class A Internal network address : _____
- Class B NAT pool public address : _____
- Class C ISP network connection address: _____
- Class B ISP Internet Web server address: _____
- Wireless Deployment Site : _____
- Management VLAN Number : _____
- Percentage Growth (VLSM) : _____
- Who provided specification ? : _____

ii) Individual Identification Details

- Individual Title Page
- Provide student name, id, lab day/time/room, unit code
- Indicate whether Repeating or First Time student

Example Title:

*** Individual Case Study ***

ESP No: T022

Fred Flintstone 1234567 Tuesday 11:30 ATC329 TNE20002

Please indicate status: Repeating ☐ First Time ☐

Specification Information

- Specification Number : _____
- Class A Internal network address : _____
- Class B NAT pool public address : _____
- Class C ISP network connection address: _____
- Class B ISP Internet Web server address: _____
- Wireless Deployment Site : _____
- Management VLAN Number : _____
- Percentage Growth (VLSM) : _____
- Who provided specification ? : _____

Case Study Report Structure

The report should include concise explanation, rationale and justification for your design and implementation. The report (excluding tables A to H) should not exceed 20 pages.

- Discussion of Network Design Issues
  - Discuss and provide rationale/justifications for your design choices for the following:
    - IP VLSM Design
    - Routing Protocols
    - Switches: VLANs, STP, EtherChannel
    - Wireless LANs and Site Layout for the specified site
    - DHCP
    - NAT
    - Security and Access Control Policies
    - System Testing and Verification Strategy

- Tables A to G

- **Note: DO NOT include show run output in your report**

Case Study Report Group - Mark Allocation

Title Page, Identification, and Specification Information - Correct and Complete (4 marks)

Discussion of Network Design Issues

IP VLSM Design (4 marks)
Routing Protocols (4 marks)
Switches: VLANs, STP, EtherChannel (4 marks)
Wireless LANs and Site Layout for the specified site (6 marks)
DHCP (3 marks)
NAT (4 marks)
Security and Access Control Policies (4 marks)
System Testing and Verification Strategy (6 marks)

Total (35 marks)

Report Structure and Layout

Clear statements of issues and good presentation style (8 marks)
Tables A to H provided (2 marks)

Total (10 marks)

Network Prototype Group - Mark Allocation

Implementation and Functionality

Switch Implementation (6 marks)
Wireless LAN Implementation (4 marks)
Router Implementation (14 marks)
Security Polices and Access Control Implementation (15 marks)

Total (39 marks)

Case Study Video Presentation - Group

The team must put together a Video Presentation. Each team member must give an overview of their contribution to the Case Study.

Marked out of 10, with marks allocated as follows:

- **Organisation – 3 marks**
  - Overall organisation of the presentation for all group members. This will be assessed on the structure of the presentation.
- **Presentation Skills – 4 marks**
  - How well do the presenters articulate the material and engage the viewer.
- **Content – 3 marks**
  - How well does the presenters cover the required content.

Total 10 marks

Case Study Reflection Report - Individual

Marked out of 2

Each team member prepares a Reflection Report

A critical reflection is the process of reviewing how things went in the case study.
You should reflect on your actions, considering what worked well and what did not.
What did you learn from this experience?
How would you approach a future team assignment?
Etc