

Case Study

Semester 2 - 2018

Network Design and Implementation

V3.7

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 3 to 4 persons. **If your team is less than 3 members you will not get the team mark.**
- 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, and inform a tutor of your ESP Team Number, Members' Names, Student IDs and Lab Classes.**
- **A tutor will issue with your network address specifications.**

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 inform, by week 2, a tutor of your ESP Team Number, Name, Student ID and Lab Class**
- **A tutor will issue with your network address specifications.**

2. Mark Allocation Guide

Mark Allocation Guide is available on Blackboard.

3. Case Study Deliverables

The following **three** deliverables must be submitted:

- 1) **A Case Study Report** – structure outlined below
 - a) Identification Details: Team or Individual
 - b) Report Structure
- 2) **A Packet Tracer V7 Network Prototype**
- 3) **A Video Presentation file**

4. Case Study Submission - Deadline

The deliverables must be submitted via ESP by **Sunday 14 October 2018 23:59 hours**

Late submission - a late penalty of 10% per day or part there of applies.

Phase 1 - Case Study Overview

Flat Land Ltd is a company that maintains, leases, buys and sells new and used trucks, bulldozes mobile cranes, graders etc. The Head Office is at the Karachi site. The other company sites are in Multan, Quetta and Lahore.

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 Flat Land Company network. You must prepare:

1. A Formal Written Report
2. A Video Presentation where each member of the team outlines their contributions to the project
3. A **prototype** of the network, built using Packet Tracer V7 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 **10 weeks** (which includes the Mid-Semester Break) to complete the case study. It is important to **form your team and get your specifications from a tutor early.**
- 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 Blackboard 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.
- 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.**
- **The following information is needed from a Tutor.**
 - Specification Number (Spec No)
 - **Pseudo private** Class A Internal network address (to ensure uniqueness between assignments)
 - Class B NAT Pool Public address
 - Class C ISP Network Connection address
 - Class B ISP Internet Web Server address.

Phase 2 – IP addressing and VLSM Design

The Flat Land Company require you to use Packet Tracer V7 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.

1. The Company workgroups are:

- Karachi
 - Leasing group
 - Marketing group
 - Business group
- All Sites
 - Security group
 - Technical Support group
 - Vehicle Servicing group
- Multan
 - Leasing group
- Lahore
 - Sales group
- Quetta
 - Sales group

2. Company Employees and IP addresses

Each employee will have either a desktop PC or a Laptop PC.

- Karachi
 - 125 employees in the [Leasing group](#)
 - 180 employees in the [Marketing group](#)
 - 200 employees in the [Business group](#)
- All sites
 - 20 employees in the [Security group](#) must have access to the network via a wireless LAN, 5 employees at each site.
 - 20 employees in the [Technical Support group](#), 5 employees at each site
 - 20 employees in the [Vehicle Servicing group](#), 5 employees at each site
- Multan
 - 80 employees in the [Leasing group](#)
- Lahore
 - 140 employees in the [Sales group](#).
- Quetta
 - 125 employees in the [Sales group](#)

3 .Other IP address Issues

- Allow address space for a
 - Separate company **Server Farm LAN**. It must be created at the Karachi site. You can decide the number and type of servers required.
 - **Switch Management VLAN**, at each site
 - **Printer VLAN** at each site
- The ISP for the company is based in Quetta. Use Class C ISP Network connection address (given by your lab tutor) for connection to the Quetta ISP router.
- Use *pseudo private* class A network (given by your lab tutor) for internal addressing.
- Use VLSM for the IP addressing scheme.
- Expect **80% growth** of current IP requirements when determining size of subnets.

5. VLSM Implementation

The company requires the use of VLSM Design to ensure efficient use of the IP address space. Record details in table A to show the subnets that meet the Company requirements. Clearly identify subnets that are available for future use.

Table A: VLSM Design

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

6. Network Diagram

Produce a **Logical Network Diagram** that includes, for each site:

- Routers and switches, with device names
- Subnet addresses
- Site Identification
- PCs used for Testing – label with VLAN Id and VLAN Name

Phase 3 – Routing Protocol Planning

The company network will use EIGRP as the routing protocol:

- EIGRP MD5 authentication is required on each link between internal routers
- Indicate bandwidth on all router interfaces
- Set passive interface for relevant interfaces
- Configure a default route to Quetta ISP
- Advertise default route to other internal routers
- Routers must be accessible via SSH for maintenance by Technical Support group

Phase 4 – Switch and VLAN Planning

Switches:

- Reliability and redundancy must be considered
- Rather than use VLAN 1 as the default management VLAN, at each site create VLAN 666 as the Switch Management VLAN. At each site, all switches will be in VLAN 666.
- Switch ports must be secured
- All unallocated switch ports must be shutdown
- Switches must be accessible via SSH for maintenance by Technical Support group
- Spanning Tree Protocol must be implemented at each site

At Karachi:

- The Leasing, Marketing and Vehicle Servicing groups are on floor 1.
- The Business group is on floor 2
- The Servers are on floor 1
- The Site Security group must have access to the network via a wireless LAN.
- Site size 3000metres x 3000metres
- Building Floor size 500metres x 300metres
- Technical Support group on floor 1

At Multan:

- Leasing, Vehicle Servicing and Technical Support groups are on the ground floor of a single level building
- The Site Security group must have access to the network via a wireless LAN.
- Site size 150metres x 200metres
- Building Floor size 20metres x 30metres

At Lahore:

- Sales, Vehicle Servicing and Technical Support groups are on the ground floor of a single level building
- The Site Security group must have access to the network via a wireless LAN.
- Site size 100metres x 100metres
- Building Floor size 25metres x 30metres

At Quetta:

- Sales, Vehicle Servicing and Technical Support groups are on the ground floor of a single level building
- The Site Security group must have access to the network via a wireless LAN.
- Site size 125metres x 100metres
- Building Floor size 25metres x 40metres

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	VTP Mode	VTP Domain

Phase 6 – Ether Channel

- The company wants to implement Ether Channel.
- In the **prototype** just implement LACP Ether Channel **only** for the **Lahore** 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 EIGRP.
- The Internet Web Server attached to Quetta ISP has a Class B address (given by your lab tutor). This Web Server represents the “Internet”.
- Configure a static route on Quetta 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 – Multan Site

- The company wants to use DHCP.
- In the **prototype** just implement DHCP **only** for **Multan** site.
- DHCP must dynamically provide IP address information to PC workstations/Laptops.
- DHCP must manually provide an IP address to the printer
- 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: Multan 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 – Configure Frame Relay and PPP

- Configure a Cloud in Packet Tracer as Frame Relay Switch, use it to connect the company's sites
- Configure PPP and CHAP authentication on the link to the ISP.

Phase 10 – Wireless LAN at Karachi Site

- The company require a wireless LAN at each site. In the **prototype**, you will implement a wireless LAN **only** at the **Karachi** site.
- Determine the number of Wireless Access Points that are needed at the Karachi 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.
- Assign a static address to each of the servers.
- 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 Karachi 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 Access Control Lists **only** at the **Karachi** site.

- 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 the Security wireless LAN are only permitted ping access to devices within the site.
 - vi. 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 Karachi

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

Phase 13 - Case Study Report Title Page and Identification

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 Identification Details !

Identification Details: Team OR Individual

i) **Team Identification Details (remember a team must have at least 3 members)**

- 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: _____
-
- **Tutor** 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: _____
- _____
- **Tutor** who provided specification: _____

Case Study Report – 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.

- Section A - Logical Network Diagram
- Section B – Discussion of Network Design Issues, describe and provide rationale/justifications for your design choices for the following:
 - Section B1 - IP VLSM Design
 - Section B2 - Routing Protocols
 - Section B3 – Switches: VLANs, STP, EtherChannel
 - Section B4 - Wireless LANs and Karachi Site Layout
 - Section B5 - DHCP
 - Section B6 - NAT
 - Section B7 - Security Policies and Access Control
 - Section B8 - System Testing and Verification Strategy
- Section C - Tables A to G
- **Note: DO NOT include show run output in your report**