Assessment 3

Designing and implementing a network

CSE2NFX Network engineering fundamentals

Objectives

- Examine the given scenario and create a performance analysis document.
- Apply appropriate network physical standards for different network scenarios.
- Determine and plan the appropriate classless IP addressing scheme for the given scenario.
- Assign proper subnets / VLSM subnets.
- Configure the networking devices.

Copying and plagiarism

This is an individual assignment. Students are not permitted to work in a group when writing this assignment. Plagiarism is the submission of another person's work in a manner that gives the impression that the work is their own. La Trobe University treats plagiarism seriously. When detected, penalties are strictly imposed.

Further information can be found on http://www.latrobe.edu.au/students/academic-integrity/explanation/plagiarism

Submission guidelines

Your assignment submission should be typed, not written/drawn by hand.

Submit the electronic copy of your assignment through the subject LMS.

Submission after the deadline will incur a penalty of 5% of the available assignment mark per day capped at 5 days. No assignment will be accepted after 5 days. If you have encountered difficulties that lead to late submission or no submission, you should apply for special consideration.

Part A: Design the proposed network topology

Scenario

The 'StarStudent Higher Institute' (AHI) is a higher education provider which is in the heart of the city. The existing network backbone in the 6-storey building was designed and implemented in the late 1990s. The networking technology at that time was mainly based on coaxial cables with 2 end connectors on its topology. When there were issues on the existing network in the past, several different IT contractors have been employed to implement a 'quick fix' on the network. As a result, the network topology they have at present is running with a combination of old and semi-old networking technology.

This year there has been an increase in student numbers at AHI in comparison with previous years. Due to the increased number of network users on the old backbone cable, there is a noticeable delay during network transactions like browsing the web or transferring files across the network.

Figure 1 shown below illustrates the current network setup at AHI.

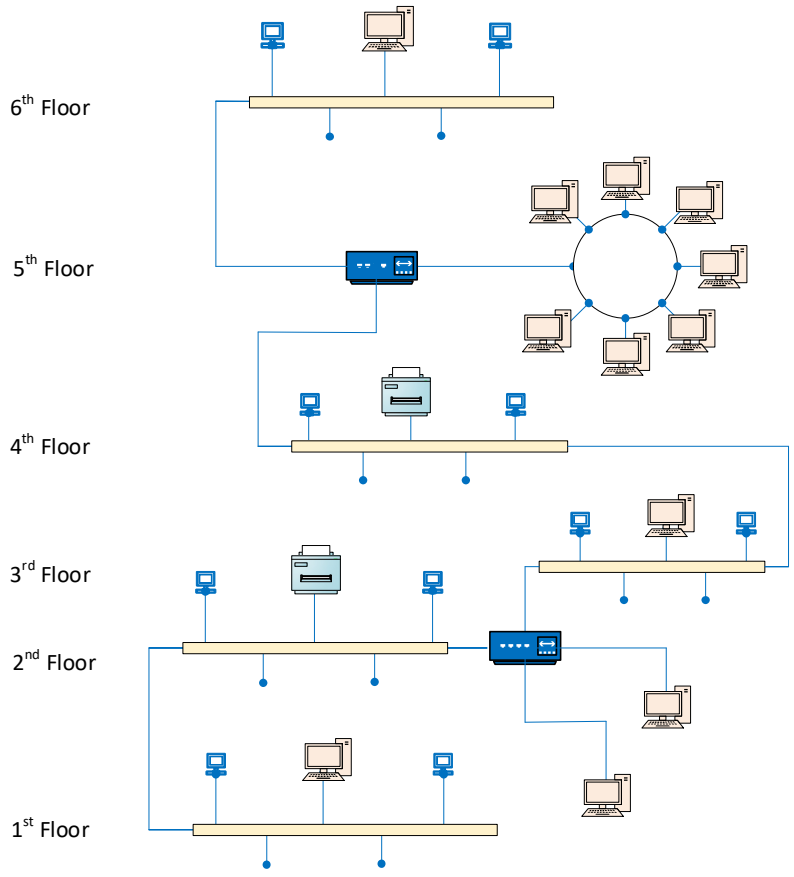

Figure 1

In the setup above (Figure 1);

- The network media is composed of 10Base-2 coaxial cable with BNC connectors, T-connectors and End connectors together with Cat3 UTP cable and RJ45 connectors.
- A coaxial cable connects all the computers on the 6th floor.
- The 4th floor and the 6th floor are connected to the hub located on the 5th floor using coaxial cables.

- Similarly, the 1st and the 3rd floors are connected to the hub located on the 2nd floor using coaxial cables.
- PCs on the 5th floor and 2nd floor are connected to the hub using Cat3 cables and RJ45 connectors, whereas PCs on other floors are connected to the coaxial cable using BNC and T-connectors.

Note

Figure 2 shows a special type of hub that **AHI** has been using on the 2nd and 5th floors that connect coaxial and cat 3 cables. Please note that this is only to illustrate the *type* of device that they use.

Figure 2

Requirement

You have been appointed to redesign an appropriate Local Area Network (LAN) for AHI. The design should ideally be such that all the staff from one level can communicate with all other staff within the office with good speeds. The managing director of AHI also expects users to experience fast download speeds when browsing the internet. To avoid a slow and sluggish network, the managing director of AHI has asked you to propose a LAN design to fulfil the above requirements

Table 1 shows the host and networking requirements for each of the floors.

Floor	Number of hosts	Network type
6th Floor	102	Wired
5th Floor	48	Wired
4th Floor	29	Wired
3rd Floor	12	Wired
2nd Floor	15	Wired
1st Floor	4	Wired

Table 1

Note

- This design needs only one router and the managing director has already purchased a Cisco router, model number 2811. So when attempting **Task 1** (below), you are NOT required to suggest the router model.
- Your focus should be on improving the LAN performance.

You need to perform the following task.

Task 1: Produce a performance analysis document

Based on the above information, you are required to produce a performance analysis document, including the following.

a) Examine the existing local area network topology (as shown in **Figure 1**) and perform an analysis on why the current network performance is slow.
b) Your recommendations for improving LAN performance.

Note

In your recommendations, you need to focus on topology, LAN devices, cables, etc.

c) Recommended network components as part of improving the LAN performance. Provide a list of network components, network component specifications, quantity, location and compliance IEEE standards of the selected networking components.

You can use **Table 2**, shown below, as a template to list the components of your topology. The first two rows are examples. Starting from the third row, you will have to provide an answer for the Cisco 2811 router and your chosen network components.

Component	Specification (Number of ports, speed, connector type)	Quantity	Location	Compliant standards
Hub (example)	*16 ports, RJ45 connector*	*How many hubs?*	*Level number*	*IEEE 802.3af*
Cable (example)	*UTP*	*N/A*	*Everywhere*	*Cat3*
Cisco 2811 router (Given to you by DGD)	2 built-in Gigabit Ethernet ports	1 unit	Level 1	<research and provide the standards for this device>

	More expansion slots are available to add more Ethernet ports.			

Table 2

Note

Add all the written answers in a Word file named **xxx_cse2nfx_assessment3.docx** (where xxx is your student number). Mention the task number in the Word file.

Part B: Implement IP routing in a simulated environment

Scenario

Stoinis Marketing and Advertising (SMA) is an enterprise marketing and advertising firm with its main office in Adelaide. As a part of their expansion, SMA is planning to open a new branch office in Melbourne. The managing director of SMA has decided to use IPv4 class B network address 130.10.0.0/16 for both offices.

Before moving to the actual design and implementation phase, the managing director provided you with a simulated design of the proposed network (as shown in **Figure 3**), which will assist you in understanding the entire network topology.

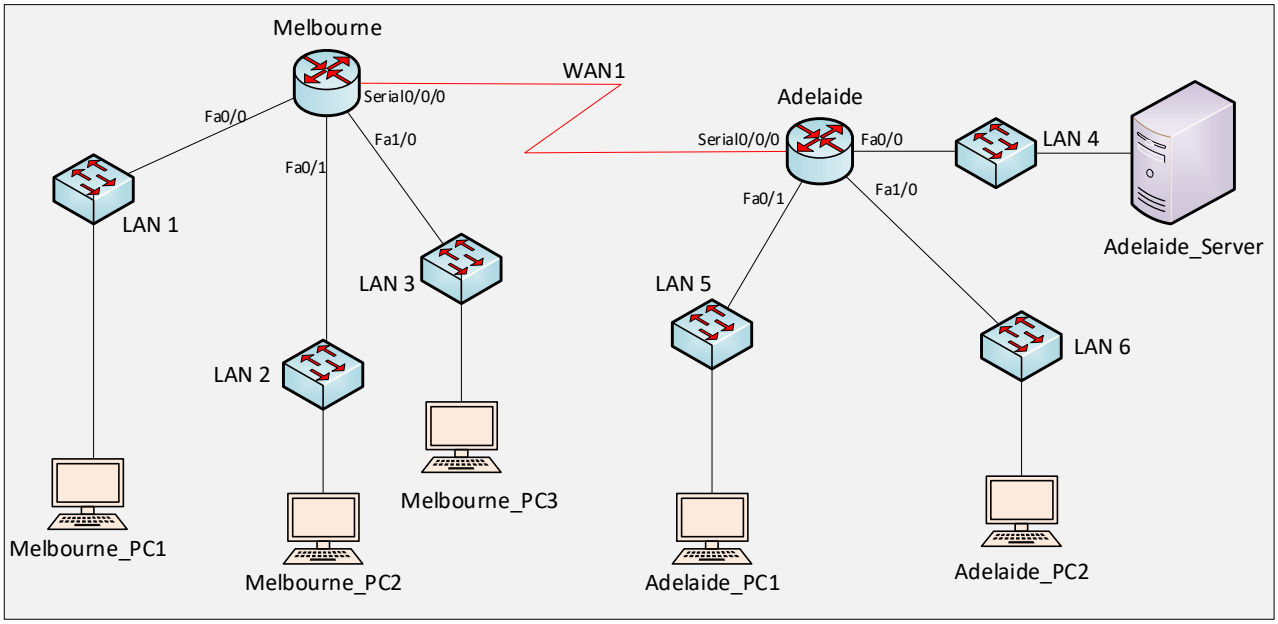

Figure 3

Note

- **Figure 3** does not show all end devices and LAN switches.
- You need to use Cisco Packet Tracer software to configure the routers. Therefore, for simulation purposes, consider that all the routers are Cisco 2811 series.
- Only the devices shown in **Figure 3** are to be used throughout this assessment.
- Add all the screenshots and written answers in a Word file named **xxx_cse2nfx_assessment3.docx** (where xxx is your student number). Mention the task number in the Word file.

Table 3 shows the number of host addresses for both branches' LANs and the WAN.

Connected router	Network	Number of hosts
Melbourne	LAN1	1020
	LAN2	120
	LAN3	251
	WAN1 (Melbourne to Adelaide)	1
Adelaide	LAN4	680
	LAN5	110
	LAN6	58
	WAN1 (Adelaide to Melbourne)	1

Table 3

You have been hired as a network engineer to effectively design the IP addressing scheme for each LAN and WAN link by minimum address wastage. Each LAN has a different number of host requirements, so, in this scenario, the FLSM method is not a good idea. You need to apply the VLSM method and perform the following task.

Task 1: Design the IP addressing scheme

This is a critical planning step. To support your planning, two table templates (**Table 4** and **Table 5**) are given below.

a) Fill **Table 4** with the planned IP addressing scheme (in dotted decimal notation) for each LAN by using the VLSM method.

LAN1	
Customised subnet mask (VLSM subnet mask)	
Address prefix length (i.e., 130.10.0.0./?)	
VLSM subnetted network address	
First usable IP address	
Last usable IP address	
LAN2	
Customised subnet mask (VLSM subnet mask)	
Address prefix length (i.e., 130.10.0.0./?)	
VLSM subnetted network address	
First usable IP address	
Last usable IP address	
LAN3	
Customised subnet mask (VLSM subnet mask)	
Address prefix length (i.e., 130.10.0.0./?)	
VLSM subnetted network address	
First usable IP address	
Last usable IP address	
LAN4	
Customised subnet mask (VLSM subnet mask)	
Address prefix length (i.e., 130.10.0.0./?)	
VLSM subnetted network address	

First usable IP address	
Last usable IP address	
LAN5	
Customised subnet mask (VLSM subnet mask)	
Address prefix length (i.e., 130.10.0.0./?)	
VLSM subnetted network address	
First usable IP address	
Last usable IP address	
LAN6	
Customised subnet mask (VLSM subnet mask)	
Address prefix length (i.e., 130.10.0.0./?)	
VLSM subnetted network address	
First usable IP address	
Last usable IP address	

Table 4

b) Fill **Table 5** with the planned IP addressing scheme (in dotted decimal notation) for the WAN link by using the VLSM method.

WAN1	
Customised subnet mask (VLSM subnet mask)	
Address prefix length (i.e., 130.10.0.0./?)	
VLSM subnetted network address	
First usable IP address	
Last usable IP address	

Table 5

Task 2: Build the topology

After designing the IP addressing scheme, you need to create the network diagram shown in **Figure 3** using the Cisco Packet Tracer. Use suitable cable types when cabling the devices (for example, Ethernet or serial). Label the devices as depicted in **Figure 3**.

a) Save the Cisco Packet Tracer file as **xxx_cse2nfx_assessment3.pkt** (where xxx is your student number).
b) Include a screenshot of your topology as evidence of the completion of this task.

Note

No configuration is required in Task 2; only a network diagram with relevant devices and cables.

Task 3: IP address assignment

Fill **Table 6** with the appropriate IP addresses, subnet masks and gateways, as per the IP addressing scheme from **Task 1**. Once you complete **Tables 6** and **7**, it will be easy for you to configure the Ethernet and serial interfaces in **Task 4**.

Network	**Device/interface**	**IP address (in dotted decimal notation)**	**Subnet mask (in dotted decimal notation)**	**Default gateway**
	Melbourne router F0/0 interface			N/A
	Melbourne router F0/1 interface			N/A
	Melbourne router F1/0 interface			N/A
LAN1	Melbourne_PC1	*Example 172.16.x.x*	*Example 255.255.x.x*	*Example 172.16.x.x*
LAN2	Melbourne_PC2			
LAN3	Melbourne_PC3			
	Adelaide router F0/0 interface			N/A
	Adelaide router F0/1 interface			N/A
	Adelaide router F1/0 interface			N/A
LAN4	Adelaide _Server			
LAN5	Adelaide_PC1			
LAN6	Adelaide_ PC2			

Table 6

Fill **Table 7** with your planned IP addresses for the WAN1 link.

Network	Device/interface	IP address (in dotted decimal notation)	Subnet mask (in dotted decimal notation)
Melbourne to Adelaide (WAN1)	Serial interface on Melbourne (Serial0)		
	Serial interface on Adelaide (Serial0)		

Table 7

Task 4: Configure the Ethernet and serial interfaces

a) Configure Ethernet interfaces of all the end devices (i.e., Melbourne_PC1, Melbourne _PC2, Melbourne_PC3, Adelaide_PC1, Adelaide_PC2 and Adelaide_Server) with the IP addresses, subnet masks and default gateways from **Table 6**.
b) For Melbourne_PC1, Melbourne_PC2, Adelaide_PC1, and Adelaide_Server take screenshots of the completed IP configuration window as evidence of the completion of this task and include them in the Word file.
c) Configure and activate the Ethernet and serial interfaces on each router using IP addresses and subnet masks from **Tables 6** and **7**.

Note

Configure the serial interface clock rate as 128,000.

d) Issue the command 'show ip interface brief' on both routers and provide screenshots of the output.

Task 5: Configure the Melbourne and Adelaide routers

Perform basic configuration of both routers (i.e., Melbourne and Adelaide) as per the given instructions in **Table 8** (below).

Melbourne	Adelaide
a) Hostname	h) Hostname
Hostname of the router should be **Melbourne**.	Hostname of the router should be **Adelaide**.
b) Passwords	i) Passwords

Passwords on the router should be as follows. • Plain text mode password as **enpass** • Encrypted password as **ensecret** • Console password as **conpass**	Passwords on the router should be as follows. • Plain text mode password as **enpass** • Encrypted password as **ensecret** • Console password as **conpass**
c) MOTD	j) MOTD
Message of the day banner (MOTD) should be seen on the router as '**This assessment is about designing and implementing an internetwork!**'.	Message of the day banner (MOTD) should be seen on the router as '**This assessment is about designing and implementing an internetwork!**'.
d) Saving configuration	k) Saving configuration
Ensure that you have saved the above configuration to NVRAM.	Ensure that you have saved the above configuration to NVRAM.
e) Static routing	l) Static routing
Routing and linking the internetworks of Melbourne and Adelaide routers. Static routes should be implemented between Melbourne and Adelaide routers to route the packets between the networks of those routers.	Routing and linking the internetworks of Adelaide and Melbourne routers. Static routes should be implemented between Adelaide and Melbourne routers to route the packets between the networks of those routers.
f) Connectivity test	m) Connectivity test
• Issue the 'ping' command from Melbourne_PC1 to Adelaide_PC1. • Issue the 'ping' command from Melbourne_PC2 to Adelaide_Server. (*All ping results should be successful.*)	• Issue the 'ping' command from Adelaide_PC1 to Melbourne_PC3. • Issue the 'ping' command from Adelaide_PC2 to Melbourne_PC1. (*All ping results should be successful.*)
g) Evidence gathering	n) Evidence gathering
Provide screenshots of router configurations (startup-config file) in tabulated form (side by side as shown here in **Table 8**).	Provide screenshots of router configurations (startup-config file) in tabulated form (side by side as shown here in **Table 8**).

Table 8

Part C: Short answer questions

Note

Part C of this assessment is not YES/NO answers. Each of the questions should be answered in an elaborated form with pros and cons to support your answer.

Q1. In Part A you have a wired network. Just imagine, there is a requirement to connect all devices wirelessly on 1st floor. What is the LAN device required to achieve this connectivity? Explain briefly as to why you've chosen the device.

Q2. In Part B, Task 4, you have configured Ethernet and serial interfaces. And in Task 5: e) you were asked to configure static routing on the routers. Just imagine that you forgot to configure static routing on each of the routers. Explain the effect of not configuring IP routing on the routers.

Q3. Explain the difference between FLSM and VLSM. Provide two example scenarios to use each method. (one for FLSM and one for VLSM)

Submitting your assessment

When you have completed all the tasks, submit the assessment on the LP.

You should submit the following:

- Submit your assignment in a single Word document called **xxx_cse2nfx_assessment3.docx** (where xxx is your student number).
- Submit your packet tracer file called **xxx_cse2nfx_assessment3.pkt** (where xxx is your student number).

Assessment marking criteria

Part A: Design the proposed network topology		
Technical proposal document has been provided with the following:	**Mark/Item**	**Mark/Task**
A.1.1 Existing topology has been carefully analysed.	4	24
A.1.2 Explanation of why the existing network is slow.	4	
A.2.1 Suggestions have been provided for improvement on the LAN.	8	
A.3.1 List of network components has been provided.	1	
A.3.2 Network component specification has been provided in tabulated format.	2	
A.3.3 Quantity for each network component provided.	2	
A.3.4 Network component location listed.	1	
A.3.5 Compliance IEEE standards for networking devices have been provided.	2	
Part B: Implement IP routing in a simulated environment		
Part B – Task 1		
B.1.1 Filled table with planned IP addressing scheme for LAN1.	5	40
B.1.2 Filled table with planned IP addressing scheme for LAN2.	5	
B.1.3 Filled table with planned IP addressing scheme for LAN3.	5	
B.1.4 Filled table with planned IP addressing scheme for LAN4.	5	
B.1.5 Filled table with planned IP addressing scheme for LAN5.	5	
B.1.6 Filled table with planned IP addressing scheme for LAN6.	5	
B.1.7 Filled table with planned IP addressing scheme for WAN link.	5	
B.1.8 Filled table with planned IP addressing scheme for WAN link.	5	
Part B – Task 2		
B.2.1 Network topology has been created using Packet Tracer.	4	

B.2.1 Packet Tracer file saved correctly.	4	12
B.2.2 Topology screenshot provided.	4	
Part B – Task 3		
B.3.1 Filled table with appropriate IP addresses, subnet masks and gateways (in dotted decimal notation).	4	8
B.3.2 Filled table with planned IP addresses for WAN1.	4	
Part B – Task 4		
B.4.1 Configured Ethernet interfaces of all the end devices with the planned IP addresses, subnet masks and default gateways.	4	20
B.4.2 Screenshots of the completed IP configuration window have been provided.	4	
B.4.3 Configured and activated Ethernet and serial interfaces on each router.	4	
B.4.4 Proposed IP addresses, and subnet masks have been used during configuration.	4	
B.4.5 Screenshots of 'show ip interface brief' command have been provided.	4	
Part B – Task 5		
B.5.1 Hostname configured correctly on Melbourne router.	1	14
B.5.2 Passwords configured correctly on Melbourne router.	1	
B.5.3 Message of the day banner (MOTD) configured correctly on Melbourne router.	1	
B.5.4 Configuration has been saved in NVRAM of Melbourne router.	1	
B.5.5 Static routing implemented correctly.	1	
B.5.6 Successful ping results provided.	1	
B.5.7 Screenshots of the startup-config file have been provided.	1	
B.5.8 Hostname configured correctly on Adelaide router.	1	
B.5.9 Passwords configured correctly on Adelaide router.	1	

B.5.10 Message of the day banner (MOTD) configured correctly on Adelaide router.	1	
B.5.11 Configuration has been saved in NVRAM of Adelaide router.	1	
B.5.12 Static routing implemented correctly.	1	
B.5.13 Successful ping results provided.	1	
B.5.14 Screenshots of the startup-config file have been provided.	1	
Part C: Short answer questions		
C.1.1 Explanation is fully correct and acceptable.	5	15
C.2.1 Explanation is fully correct and acceptable.	5	
C.3.1 Explanation is fully correct and acceptable.	5	
	Total	**133**