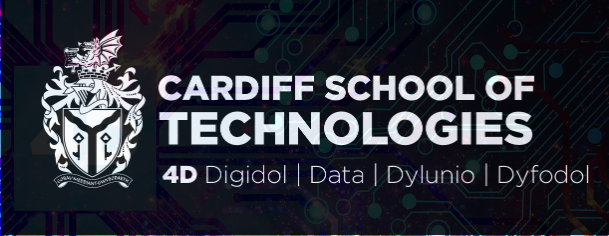
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**CIS5010 - Networks and Communications - 20 Credits**

**Term 2**

**Module Leader: Dr Arslan Ahmad**

WRIT1 MAIN 50%

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# Case study 2

This document covers the setup for case study 2. This is case study was chosen as it is the most practicable and applicable as it is the main campus of Cardiff metropolitan university. The criteria of this case study are as showed:

* Four 2 storeyed building, faculty office and library
* Four Departments
  + Faculty (150 employees)
  + Human Resource (50 employees)
  + IT Support (25 employees)
  + Library (25 employees)
* Wired network access for all the employees
* Data-enabled tablets for IT Support employees
* Secure Wi-Fi network for the premises
* Wi-Fi network for Guests/Student (Approximately 1000)\*
* Data centre holding all university information assets
* Any given day 50 employees can work from home

# Task 1

## Network Diagrams

This section provides details of physical and logical diagram of the selected case study.

### 

### Physical Network Diagram

For the chosen case study, the network is split up in to four two storied buildings which is split between four different faculties which include:

**Building 1**

**Ground Floor**

* Library
* Private Rooms

**First Floor**

* IT Support
* Server Room

**Building 2: Faculty**

**Ground Floor**

* Offices
* Staff lounge
* Conference room

**First Floor**

* Computer Rooms
* Conference room
* Offices
* Server Room

**Building 3: Data Centre**

**Both Floors**

* Server room
* Data Centre

**Building 4: Human Resources**

**Ground Floor**

* Offices

**First Floor**

* Offices

**Graphical user interface

Description automatically generated with medium confidenceCampus Building Layout**

This image shows the campus building layout. The background's purple colour represents the strength of the Wi-Fi signal, which shows that it is a solid colour because the signal is high all throughout the campus and the buildings where the four department are located. To ensure that the primary server rack and routers are safe, they are each located in different server rooms and locations in each building on the campus site.

**Main Wiring**

A picture containing graphical user interface

Description automatically generated

A picture containing text, electronics, circuit, computer

Description automatically generated

This image shows the main wiring of the campus buildings as you can see it shows how the cables connect the hardware to each other and help give each other commands in making a sustainable and functional network environment. Furthermore, each switch in the buildings get their signals from the routers which are then given signals from the main router which is in the Data Centre.

The guest and student Wi-Fi has been constructed and built to use a password to gain access to it, the reason for this is to ensure that both parties can keep their data safe by doing so.

### A picture containing text, computer, screenshot Description automatically generated

### 

The images here show the pcs that are located throughout the campus. As it shows, all of them are connected to the network via LAN cables which is important as it ensures that they have a strong connection towards the network and that it gives a higher level of security from any attack

A picture containing background pattern

Description automatically generated

### Logical Network Diagram

Diagram

Description automatically generated with medium confidence

The network is arranged into four different routers, which get their internet and network connection from the main router, which is in the Data Centre. The routers are spreading the network to the four main faculties within the campus. Furthermore, each PC represents the staff member and student that operating them while inside the university site. The thick black lines represent the straight through wires, and the dashed represent the crossover wires, lastly the red lines represent the serial DCE connection that connects the routers together. The reason for this is to ensure that the campus gets a strong internet connection throughout.

**Ip address allocation**

Addressing the internet protocol is important and crucial when setting a network on to a computer. Every device on that uses the internet has a unique IP address; without one, you won't be able to reach them. In addition, IP addresses also allow computers like PCs and tablets to interact with webpages and streaming services, as well as inform websites about who is connecting.

The table shows the applicable addresses of each VLAN and how the network has been formatted.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No.** | **Network**  **IP Address** | **Subnet Mask** | **Network** | **Broadcast IP** |
| 1 | 192.168.10.2 | 255.255.255.0 | PC  IT Support  First Floor | 192.168.10.255 |
| 2 | 192.168.10.1 | 255.255.255.0 | Router  Faculty  Building 2 | 192.168.10.255 |
| 3 | 192.168.10.9 | 255.255.255.0 | Printer  Library  Ground Floor | 192.168.10.255 |
| 4 | 192.168.0.1 | 255.255.255.0 | Wi-Fi  Ground Floor  Faculty | 192.168.0.255 |
| 5 | 192.168.20.4 | 255.255.255.0 | PC  Faculty  Ground floor | 192.168.20.255 |
| 6 | 192.168.30.1 | 255.255.255.0 | Server  HR  First Floor | 192.168.30.255 |

## Recommended Network Technologies

**Cabling**

In this case study, the main use of cabling is ethernet. The reason for this is that ethernet cabling is used to provide an internet connection, connect devices to a local network. They plug into Ethernet ports on a variety of devices. (Ellis, 2022). An Ethernet cable is most used to connect a Wi-Fi router or broadband to a web entry port or a phone line. It can also be used to hardwire items that demand the use of the internet or a network to function, such as televisions, laptops, and other electronic gadgets. The main cabling source that is used in this network is the category 5 or cat5 cable. Even though the minimum megabits per second (Mbps) for this case study is 20Mbps, this specific cable can easily support the speed of the network to up to 100mbps with the frequency going up to 100MHz within the length of 100m. The Cat 5 performance is set by TIA/EIA which are engineering standards set by a group of individuals to give manufacturers, businesses, and individuals clear expectations on cable performance. (Atkins, 2020).

**Wi-Fi**

There are three main wireless routers used in the network diagram, one in the library and two in ach floor of the faculty department. The router used in the library is accessible for both guests and students to use to connect their devices such as mobile phones, laptops, and tablets. Also, the Wi-Fi has been constructed and built to use a password to gain access to it, the reason for this is to ensure that both parties can keep their personal and private data safe when using the internet. However, the wireless router used in the faculty department, is mainly for staff and students only as they have to login with university email and password to access the internet and no outside third parties will have access to it.

The importance of Wi-Fi is that it connects hot spots, GSM helps mobile phone enterprises, allows users to stay connected with Wi-Fi at all hours, so it can be used for emergencies. (Assis, 2020).

Also, Smartphone users can gain access towards information in a timely manner over the use of wireless connections, which is then allowing them to roam around without being disconnected from the network. thus, it gives them more mobility than the old-fashioned network infrastructure.

**Cloud**

Cloud network and computing is used throughout the campus as it enables both students and staff to recover and backup any data related to their projects and work. The main use is file storage as it helps and enable both parties to work and edit files from home as it is connected to one network, all is needed is an internet connection and you can access your files from any device, anywhere. (Digital Cloud Training, 2020). Also, both parties need to login by using their university Identification details and password in order to use the cloud. The benefit of using cloud is that it provides security towards the user because they can easily keep sensitive data offsite and that they themselves can only access it. Moreover, another benefit is that it provides nearly unlimited storage capacity with relatively low monthly rates, and that you may simply enlarge your storage capacity at any moment and time.

## Recommended QoS Assurance Technologies

Quality of Service (QoS) is a group of technologies that are operated together on a network to ensure and enable that the highest priority of applications and traffic networks are reliably delivered even when network capacity is restricted and constrained.

**Diffserv**

Differentiated services (Diffserv) is a network management system. Users can create a system out of classifications and designate their network data based on content using the differentiated service. Also,

Using DiffServ allows you to manually configure the required parameters on the switches and routers Instead of employing a resource reservation technique. Routers using DiffServ protocols then arrange those packets based on their markings. (McGee, 2022). Some packets, such as voice transmissions, have a higher priority and will always go through immediately. Other packets are held for later transmission or dropped entirely. (McGee, 2022).

This technique can be used for this case study as it can help spread and micro mange the network throughout the campus and departments.

**Multiprotocol Label Switching (MPLS)**

Multi-protocol label switching (MPLS) is tried, and true networking technology has powered enterprise networks for over two decades. Unlike other network protocols that route traffic based on source and destination address, MPLS routes traffic based on predetermined “labels”. (Johnson and Johnson, 2021). MPLS has been used by businesses to interconnect regional local branches that need access to records or applications stored at the company's data centre or headquarters.

This technique can be used in this case study as it can makes sure that a network data packet goes into one direction or are of the network rather than another. Also, this is a cost-effective system that can maybe smoothly incorporate, merged, and connected into any existing network infrastructure, including IP, Frame Relay, ATM, or Ethernet.

# Task 2

## Proposed Network Security Technologies

**VLAN**

VLAN is a collection of devices or network nodes that communicate with one another as if they made up a single LAN, when in reality they exist in one or several LAN segments. (N-able, 2019). A bridge, router, or switch separates a segment from the rest of the LAN in a technical and logical sense, and it is often utilized and deployed for a specific department. Whenever a workstation broadcasts packets, they are received by all of the other workstations on the VLAN but there are none on the outside of it. Also, VLAN reduces the chances of a security risk as it reduces the number of hosts that can obtain the duplicates of the frames flooded by the switches.

**Firewalls**

A firewall is a network security mechanism and system that analyses inbound and outbound network traffic, and it determines whether specific traffic should be allowed or prohibited based on a set of security protocols. Furthermore, a firewall acts as a gatekeeper. It monitors attempts to gain access to your operating system and blocks unwanted traffic or unrecognized sources. (Johansen, 2021). For example, Using a set of rules, a firewalled system analyses network traffic. Only those of inbound connections that have been set to be received are accepted and authorized by a firewall.

## Recommend emerging technologies

**Software-Defined Networking (SDN)**

SDN (Software-Defined Networking) is a core network technique that allows the networks to be automatically and remotely controlled, or 'programmed,' by using application of software. Thus,

regardless of the specific network technology and system, it helps enable operators to manage the entire infrastructure consistently and sustainably. For example, it promises to reduce the complexity of statically defined networks; make automating network functions much easier. (Cooney, 2019). and it also allows Streamline provisioning and administration of networked resources across the board, from the data centre to the university or wide area network.

**Network Function Virtualization (NFV)**

Network function virtualization, or NFV, is a method for telecom operators to save money and speed up service delivery by detaching functions and services like firewalls and encryption from hardware platforms and then going on to shifting them on to virtual servers. Similarly, NFV has the same role and job as SDN whereas, NFV obtains the functions of the network from hardware, SDN obtains it from software.

**Edge computing**

Edge computing is a type of processing that takes place near a platform's data or final end consumer, it is there that the data is flowing from or travelling to. By minimizing delay and lag, edge architecture enables for faster processing. Which is then showing that Edge-based applications and programmers can operate more rapidly and easily, leading to an improved user experience and overall quality.

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