



Operating Systems & Networking Fundamentals

Year 1 (2021/22), Semester 2

SCHOOL OF INFOCOMM TECHNOLOGY
Diploma in Cybersecurity & Digital Forensics
Diploma in Information Technology

Assignment Home Network & Fibre Broadband

Duration: Weeks 12 - 17

Weightage: 30%

Individual/Team/Both: Both

Deadline: Group Report (15%)
Softcopy (MeL Assignment)
6 Feb 2022, 23:59hrs (Monday)

Individual Walkthrough Test (15%)
Hardcopy Test Paper – Practical Session
Week 17 (8 Feb to 11 Feb 2022)

Tutorial Group:	Team Number:	Team Grade
P08	6	

Team members:

No.	Student Name	Student ID
1	Han Xihe	S10222998
2	Lim Kai Chong	S10226797
3	Dominic Lee Yu Yee	S10222894
4		

Assignment Group Report (15%) – Research Tasks (50 marks)

1. The team collates information of the fibre broadband plan subscribed and the network devices in the Home Network for each team member. Complete the table below.

Name of Team Member	Internet Service Provider (ISP) & Broadband Plan Subscribed	Download Speed & Upload Speed	Residential Gateway (Brand and model number)	ONT (Brand and model number)
Xihe	Singtel 1Gbps Broadband	576.75 Mbps download 568.32 Mbps upload	Aztech FG7003GR(AR)	ZTE ZXA10 F620G
Kai Chong	M1 1Gbps Fibre Broadband Plan	Download speed: 776.87Mbps Upload speed: 734.46Mbps	ASUS RT-AC1200G+	Huawei EG8240H
Dominic	Starhub 1 Gbps Broadband plan	(Wireless) 81.8 Mbps download 96.7 Mbps upload	ASUS RT-AX928 2 Pack	Huawei Echo Life Hg8240H

Hint: To do a speed test of your broadband Internet connection, use a **wired Gigabit Ethernet** connection (using RJ45 UTP cable). Go to <https://www.speedtest.net>, click on "Go".

(4 marks)

2. Based on the download speed of the selected Home Network recorded in Task 1, determine the estimated time to download a file of 1GB (Gigabyte). [Show your workings clearly]

<p>Selected home network – Member 1 (Xihe)</p> <p>576.75 Megabits per Second – $576.75/8000$ Gigabytes per Second = 0.07209375 GB/s</p> <p>Download speed = $1\text{GB} / 0.07209375\text{ GB/s} = 13.9\text{ s}$ (3 sig. fig.)</p>

(4 marks)

3. Research on the fibre broadband connection in terms of the type of optical fibre, type of connector and the technique used to support simultaneous download and upload streams over a single strand of optical fibre.

The technique used to do this is called shared fibre. Its main feature is the use of a single strand of optical fibre to support multiple destinations or customers. It does this by implementing a point-to-multipoint architecture instead of a point-to-point architecture. Shared fibre also uses unpowered fibre-optic splitters to separate and collect optical signals as they move through the network. Lastly, by splitting the fibre at locations close to the end-user, shared fibre aka PON involves less infrastructure than traditional dedicated fibre as well as fewer powered equipment making it more cost-effective. The connector often used is the ATZ cable.

(2 marks)

4. Based on the selected Home Network, take relevant **screenshots of the residential gateway (or wireless router) configuration/settings** and answer the questions.

(a) Relevant screenshot(s) of the LAN configuration/settings:

Singtel

Local Area Network (LAN) Setup

Configure the Residential Gateway IP Address and Subnet Mask for LAN interface.

IP Address: 192.168.1.254
 Subnet Mask: 255.255.255.0
 Host Name: Singtel
 Domain Name:

☐ Disable DHCP Server
☒ Enable DHCP Server
 Start IP Address: 192.168.1.1
 End IP Address: 192.168.1.253
 Subnet Mask: 255.255.255.0
 Leased Time (hour): 4

☐ Configure the second IP Address and Subnet Mask for LAN interface

☒ Enable Public IP Pass Through
☐ Enable UPnP
☒ Enable ICMP Snooping
☐ Standard Mode
☒ Blocking Mode

Save/Reboot

- (i) What is the range of IP addresses that would be assigned to hosts?

192.168.1.1 to 192.168.1.253

- (ii) Are they statically or dynamically assigned?

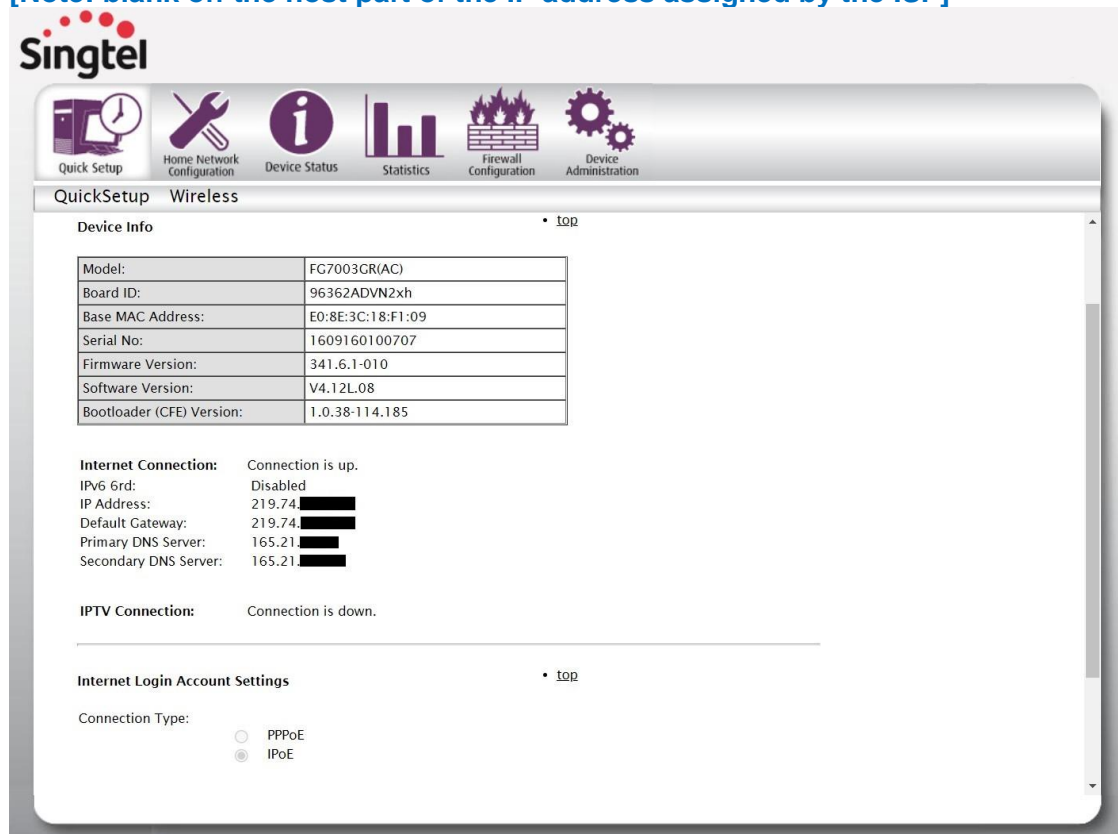
Dynamically assigned

- (iii) Are they public or private IP addresses?

Private IP addresses

(4 marks)

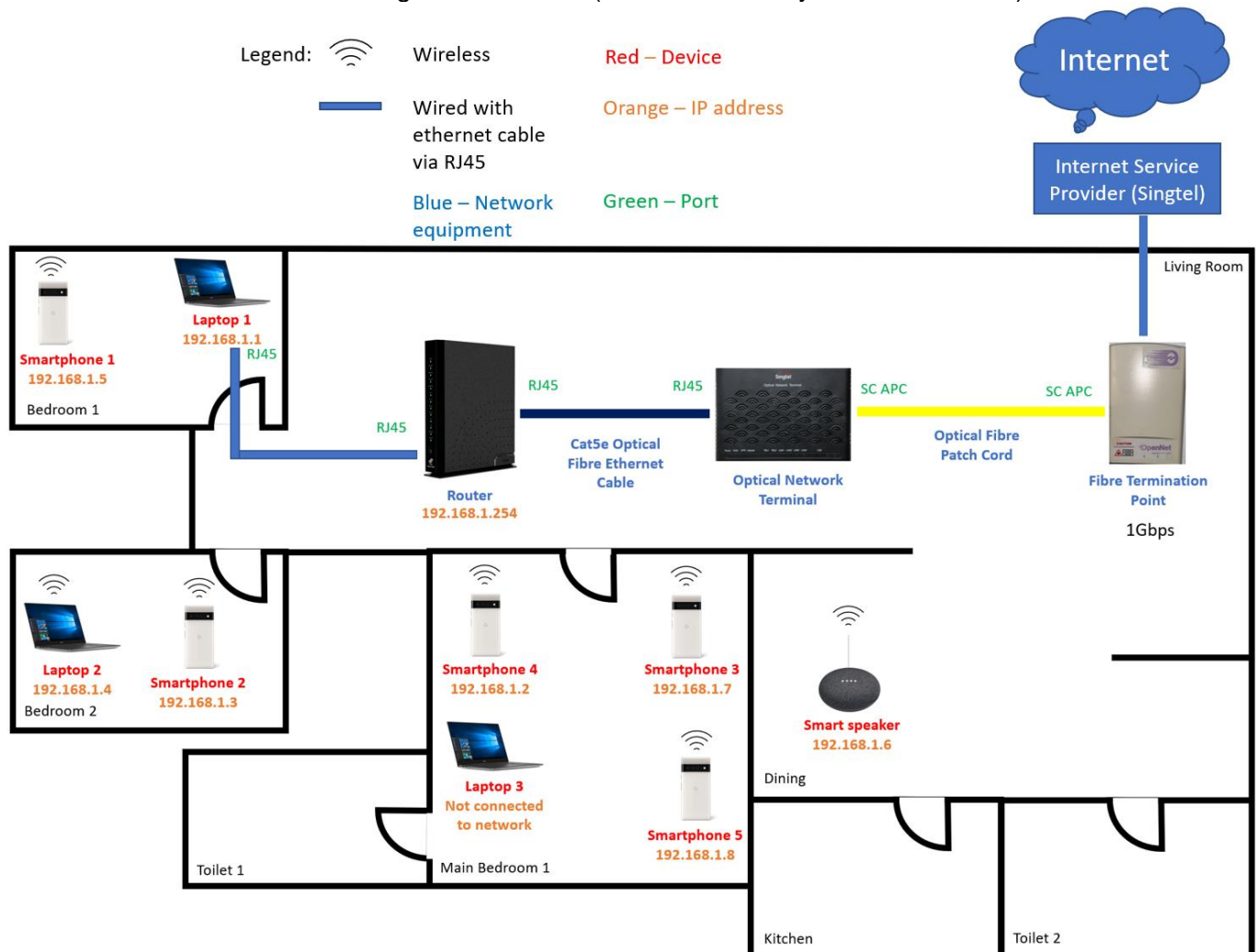
(b) Relevant screenshot(s) of the Internet (or WAN) configuration/settings:
[Note: blank off the host part of the IP address assigned by the ISP]



- (i) What Class of IP address is assigned by the ISP?
Class C
- (ii) Is it statically or dynamically assigned?
Statically assigned
- (iii) Is it a public or private IP address?
Public IP address
- (iv) Briefly describe the function of the software component in the residential gateway that allow multiple home devices to use a single IP address from the ISP to access the Internet.
This software component is the NAT (Network Address Translation). It is an internet standard where a LAN can use a set of public IP addresses or just one IP address for Internet access, while having another set of private IP addresses for Intranet use.

(5 marks)

5. With the **floor plan** of the selected Home Network, draw a network diagram showing where the network devices and network-enabled devices are located and how they are interconnected. The diagram should show the followings with clear labelling:
- network devices e.g. Termination Point, ONT, etc
 - network-enabled devices e.g. desktop, laptop, printer, etc
 - types of network cables and connectors
 - IP addresses assigned to devices (both static and dynamic addresses)



(20 marks)

Image credits:

- Picture of smartphone: https://store.google.com/product/pixel_6_pro
- Picture of laptop: <https://www.hiclipart.com/free-transparent-background-png-clipart-mfeda>
- Picture of smart speaker: <https://www.hiclipart.com/free-transparent-background-png-clipart-lfssu>
- Picture of router: <https://www.hardreset99.com/routers/aztech/aztech-fg7003grv-ac-factory-reset/>

6. Take relevant screenshot(s) of the **wireless 5GHz Band** configuration/settings and answer the questions.

Relevant screenshot(s) of the wireless 5 GHz Band configuration/settings:

The screenshot shows the Singtel wireless 5GHz Band configuration page. The left sidebar contains a menu with options: Device Info, Device Status, Device Statistics, Home Network, ARP, Settings, WLAN, 2.4G, 5G, Basic Settings, Advanced Setup, Firewall, Management, Troubleshooting, and Access Control. The main content area displays various configuration settings for the 5GHz band. The settings are organized into sections: WPA Group Rekey Interval (0), WPA Encryption (TKIP+AES), Advance Settings, and a list of other parameters. The Advance Settings section includes Band (5GHz), Channel (Auto, Current: 149), Auto Channel Timer (0), 802.11n/EWC (Auto), Bandwidth (80MHz, Current: 80MHz), 802.11n Rate (Auto), 802.11n Protection (Auto), Support 802.11n Client Only (Off), OBSS Coexistence (Disable), 54g Rate (6 Mbps), Multicast Rate (Auto), Basic Rate (Default), Fragmentation Threshold (2346), RTS Threshold (2347), DTIM Interval (1), Beacon Interval (100), XPress Technology (Enabled), Regulatory Mode (Disabled), Pre-Network Radar Check (-1), In-Network Radar Check (-1), TPC Mitigation (0(off)), Afterburner Technology (Disabled), Transmit Power (100%), STBC (Disabled), WMM (Wi-Fi Multimedia) (Enabled), WMM No Acknowledgement (Disabled), and WMM APSD (Enabled). A Save/Apply button is located at the bottom of the configuration area.

- (i) What is the security mode?
Mixed WPA2/WPA-PSK
- (ii) What are the IEEE 802.11 standards (or modes) supported?
a, b, g, n and ac
- (iii) What are the Channel Bandwidths supported?
8

(3 marks)

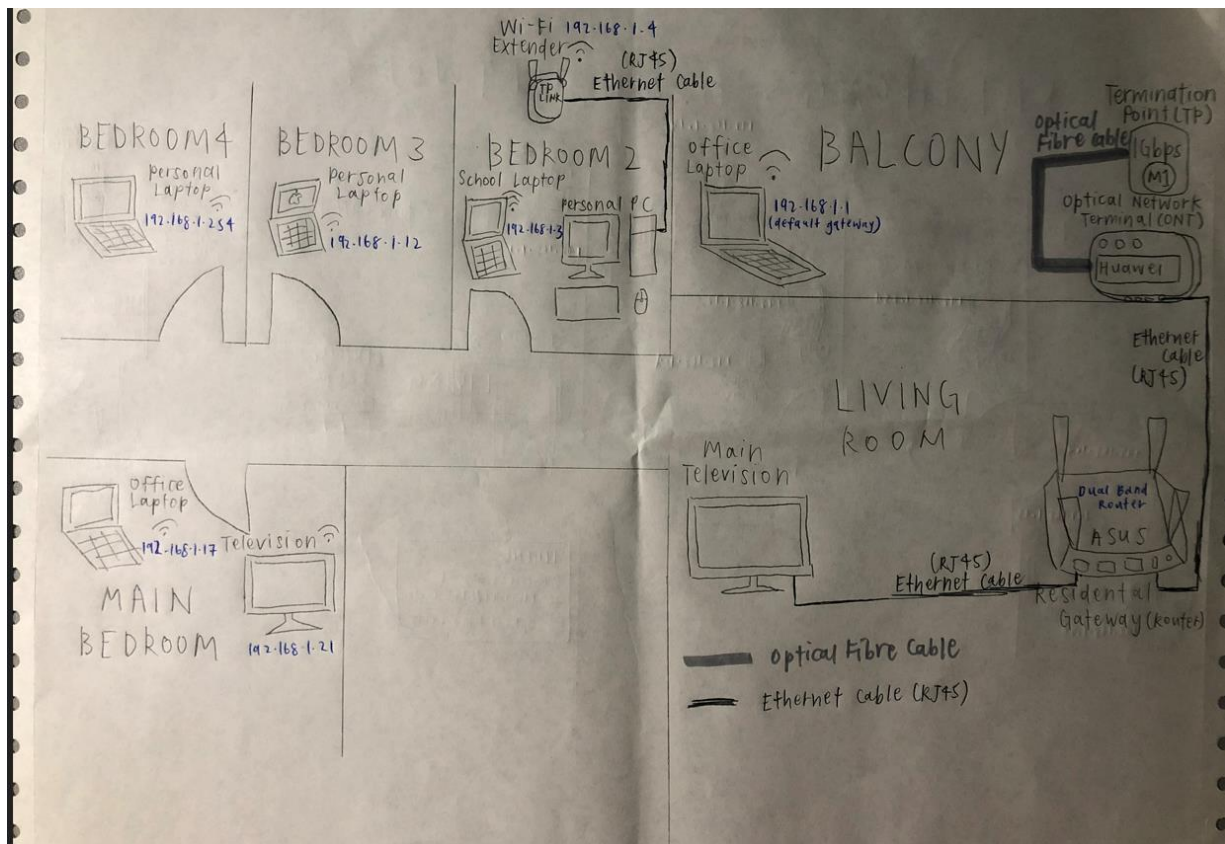
7. For one of the rooms, the wireless connection to a laptop in the room is unstable when the door is closed.
- (a) What is the likely cause of this problem?
 - (b) Evaluate TWO suitable solutions to provide stable wireless connection for the laptop.
 - (c) Select the preferred solution with justifications in the context of the selected Home Network.

- (a) A wireless network uses radio frequency (RF) waves as a transmission medium instead of cables. When the door is closed, there is a larger amount of impedance affecting the connection process between the Wireless Network Interface Controller and the Wireless Access Point. This is especially amplified if the door is made from materials such as solid wood or reinforced steel, which are dense structural materials. This makes it so that it is harder for the Wireless Network Interface Controller in the laptop to receive connection signals from the Wireless Access Point, resulting in an overall weaker and more unstable connection between these hardware devices in a Wide Local Area Network.
- (b) The first solution is to determine which frequency band is better for the selected home network. This is because the 5 GHz frequency band provides higher speed with the same channel width, but at the same time, it covers a shorter range than the 2.4 GHz frequency band. Thus, if the range is not an issue, using a 5GHz frequency band might be the solution or if the range is the issue, then changing from 5GHz to 2.4GHz might be optimal. The second solution is to install a wireless access point in near the room with the laptop. It is to be connected to the router in the network and placed near the laptop where the Wi-Fi signal is weak. Devices that are used within the area will connect to that access point instead of the router, where the signal stability will be improved as the wireless access points has a shorter distance to the laptop compared to the router which is further away.
- (c) If the laptop in bedroom 1 has slow internet when the door is closed, our group's preferred solution will be the first one. With reference to our selected Home Network diagram, the router has already been optimally positioned near multiple laptops in the home including the laptop in bedroom 1. Hence, it would be better to optimize the frequency band for the home network. In this case, since the Wireless Access Point has already been optimally positioned, and the devices are well within the range of the access point, it would be better to use 5 GHz connectivity as it offers a higher speed than 2.4 GHz connectivity with the issue being that the 5 GHz frequency band covers a shorter range. However, since the house is small, and the router is already optimally positioned, the range between the laptop and router should be a non-factor for the laptop's slow speed, thus using the 5 GHz frequency band, which is the frequency band with the higher speed, is the optimal solution in this case.

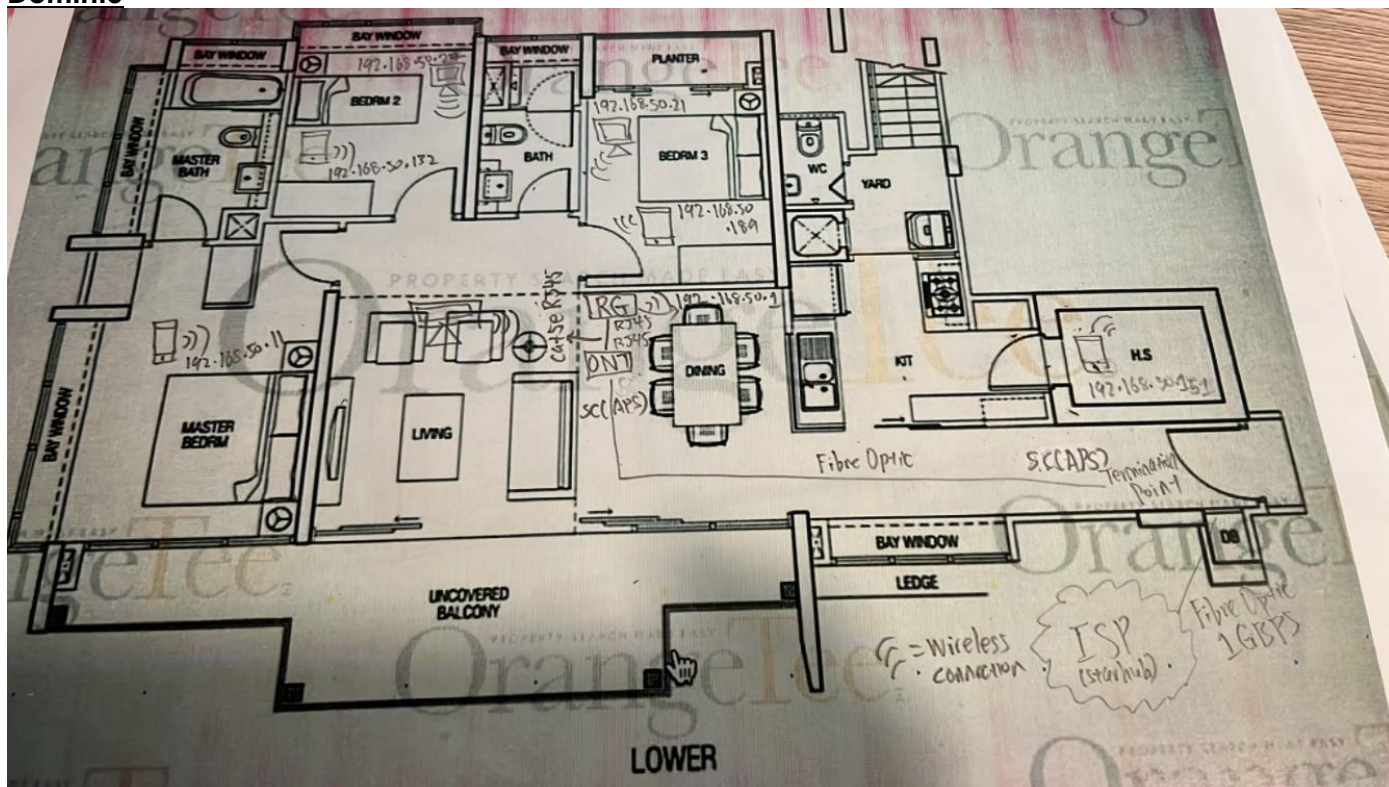
(8 marks)

Appendix A: Home Network documentation of each member (individual contribution)

Kai Chong



Dominic



Xihe

