UTM

UNIVERSITI TEKNOLOGI MALAYSIA

FACULTY OF ENGINEERING

SCHOOL OF COMPUTING

SECR/SCSR1213 - 03

NETWORK COMMUNICATION

PROJECT - TASK 4

GROUP G

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Introduction

This is task 4 namely "MAKING THE CONNECTIONS – LAN and WAN" of the project of SCSR1213 Network Communication. As the name itself, continuation from task 3 where we need to identify the devices for the proposed new building, in task 4 we are required to get the devices connected. Particularly, we need to consider four aspects: work area, telecommunications room (distribution facility), backbone or vertical cabling, and distribution or horizontal cabling. Before we start, I think we need to know what exactly are those in order to get started. Basically, those are the components in structured cabling. Structured cabling is a system, a standard for enterprise-wide cabling. The main components are the work area, IDF (which refers to the telecommunication room in the project instruction, MDF, backbone(or vertical cabling), horizontal cabling and entrance facility.

Telecommunication room is where the switches, hubs and other network connectivity devices sit. One important property is that it is the endpoint for all horizontal cabling runs from the work areas.

Horizontal cabling is the way cables go horizontally from the telecommunication room to the data jack. Both twisted pair cable or fiber cable could be used, but there are limits for the length of the twisted pair cable used, which is commonly 100 meters as show in **Table 1**.

Attribute	Category 5e	Category 6	Category 6A	Category 7/7$_A$	Category 8
Frequency	100 MHz	250 MHz	500 MHz	1000 MHz	2000 MHz
Maximum Data Rate	1000Base-T	1000Base-T	10GBase-T	10GBase-T	25GBase-T 40GBase-T
Distance	100 meters	100 meters	100 meters	100 meters	30 meters

Table 1 : Cable Types

Work area is where the end-user telecommunication equipment is connected to the termination point of the horizontal cabling, which in this case is referring to a data outlet. Patch cable/cord is used to connect them. The channel in **Figure 1** below also means the connection. The length of patch cable from data outlet to the user devices should be limited to 3 meters. The length of the horizontal cabling run from the data outlet to patch panel is advised to not longer than 90 meters and last but not least the length of patch cable from patch panel to connectivity devices in

telecommunication room should be limited to 6 meters. In which overall, the whole length should be within 100 meters.

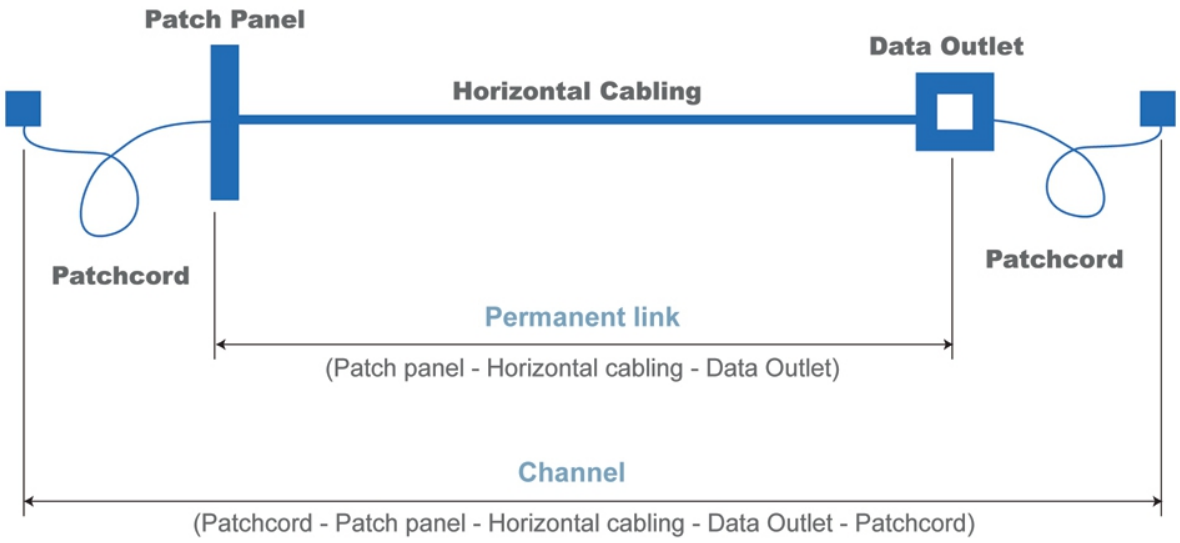


Figure 1 : Channel

MDF which is known as the main distribution frame is the central point of the entire network. The reason for that is because it is the central distribution point of the IDF/ telecommunication room, and the gateway between external network and internal network. This is also where the router sits.

Backbone/vertical cabling can be inter-building cabling or intra-building cabling, or in layman words, building to building cabling or floor to floor cabling (which is in our case where the building is double story). It is suggested that the twisted pair cable should not be more than 30 meters. Note that even though the name is called vertical cabling it is not necessarily physically vertical.

At this point I think I already have a fairly sufficient understanding of what are those components already, so we can finally get started.

Work Area

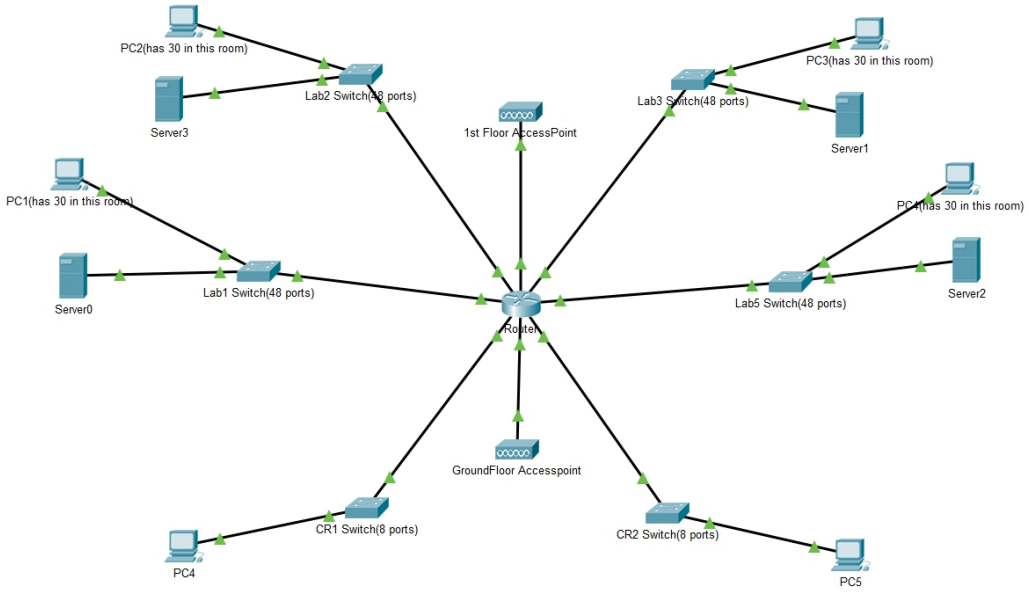


Figure 2 : Network Topology

Figure 2 shows the topology of our network inside the proposed building. Based on **Figure 3**, the area at the bottom will be the devices placed at the ground floor whereas the area at the top will be the devices placed at the first floor.

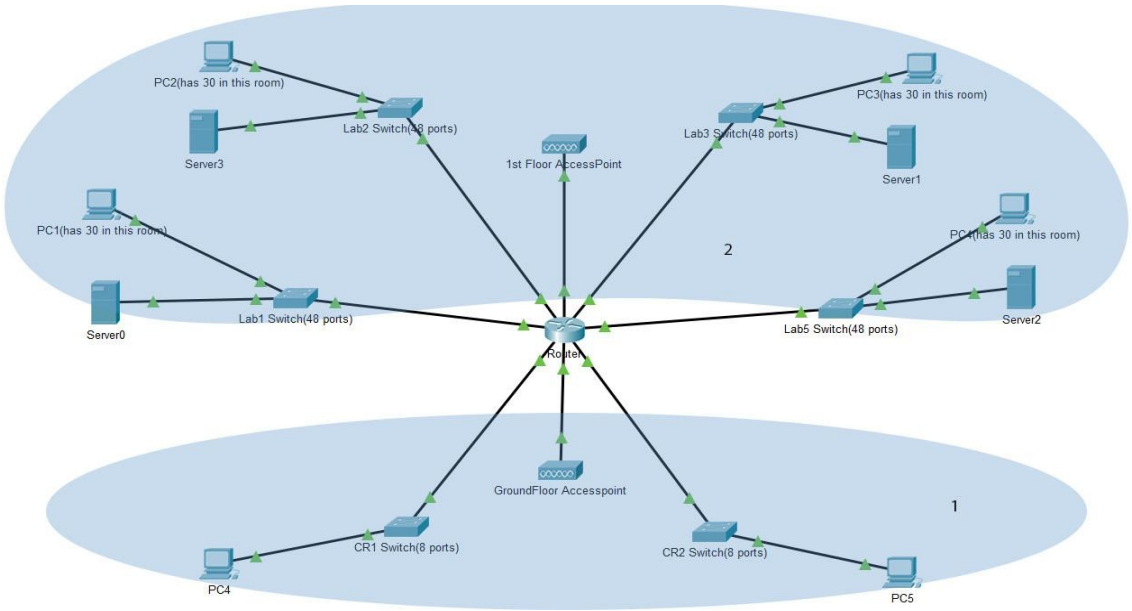


Figure 3 : Area of devices

There will be 30 workstations at respective labs. All 30 workstations are represented by just 1 PC each together with 1 multi-terabyte server. Hence, a 48-ports switch was used in those labs. On the ground floor, 8 ports switch was used as we expect there will not be much workstation needed to connect to the Internet in the video conferencing room. We also placed 1 access point on each level of the building which can cover up to 5500 feet squares in order to provide wireless connectivity for the entire building.

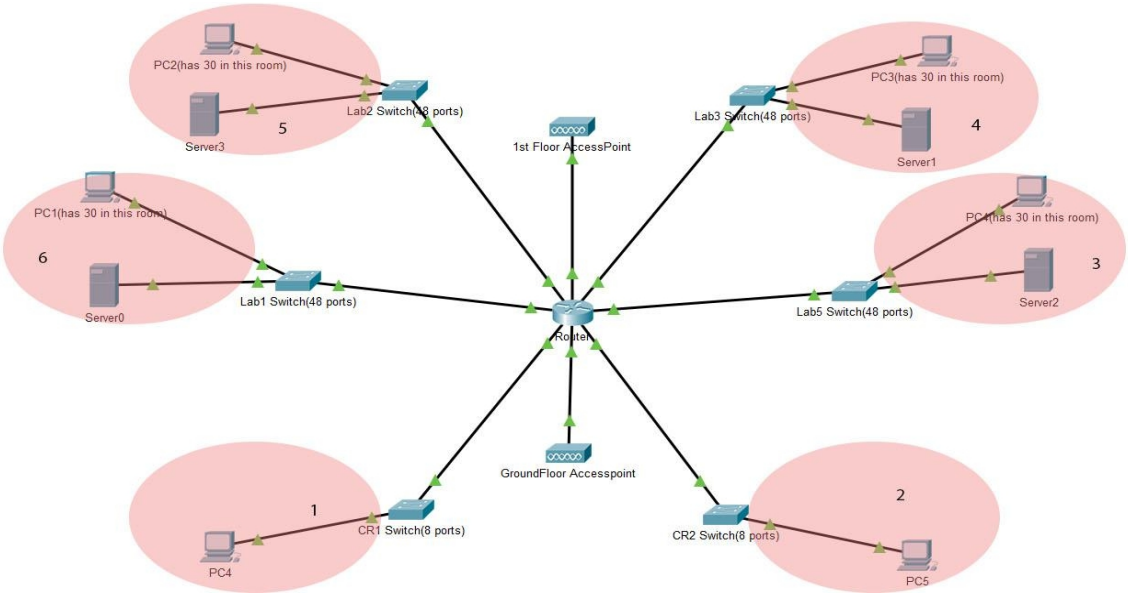


Figure 4 : Work area in topology

The areas that shaded pink in **Figure 4** are the work area in our topology. There are 2 on the ground floor and 4 on the first floor, which make it a total of 6 work areas.

Connections, patch cords and switch ports

Having known our amount of work area, now we can do some calculation to determine the number of connections, patch cords as well as switch ports needed.

First of all, let's start from the ground floor, consider both the video conferencing room is connecting the maximum number of end devices we expected which are 8, this will result in 8*2 (times 2 because 2 video conferencing room) = **16 connections**, 16*2 (times 2 because there are 2 sections of patch cord needed in order to form a horizontal cabling) = **32 patch cords** and finally **16 switch ports**. Note that these are the total for ground floor alone. The switch bought which has 8-ports which is just enough for this situation.

Next, we move on to the first floor. There are 4 labs located on the first floor, with 30 workstations + 1 lecturer's workstation and 1 server, which result in 32*4 (times 4 because there are 4 labs and 32 because 30+1+1 server) **128 connections**, 128*2 = **256 patch cords** and finally **128 switch ports**. 48-ports switch was bought for each of the labs which will be having 192 switch ports available in total for first floor uses.

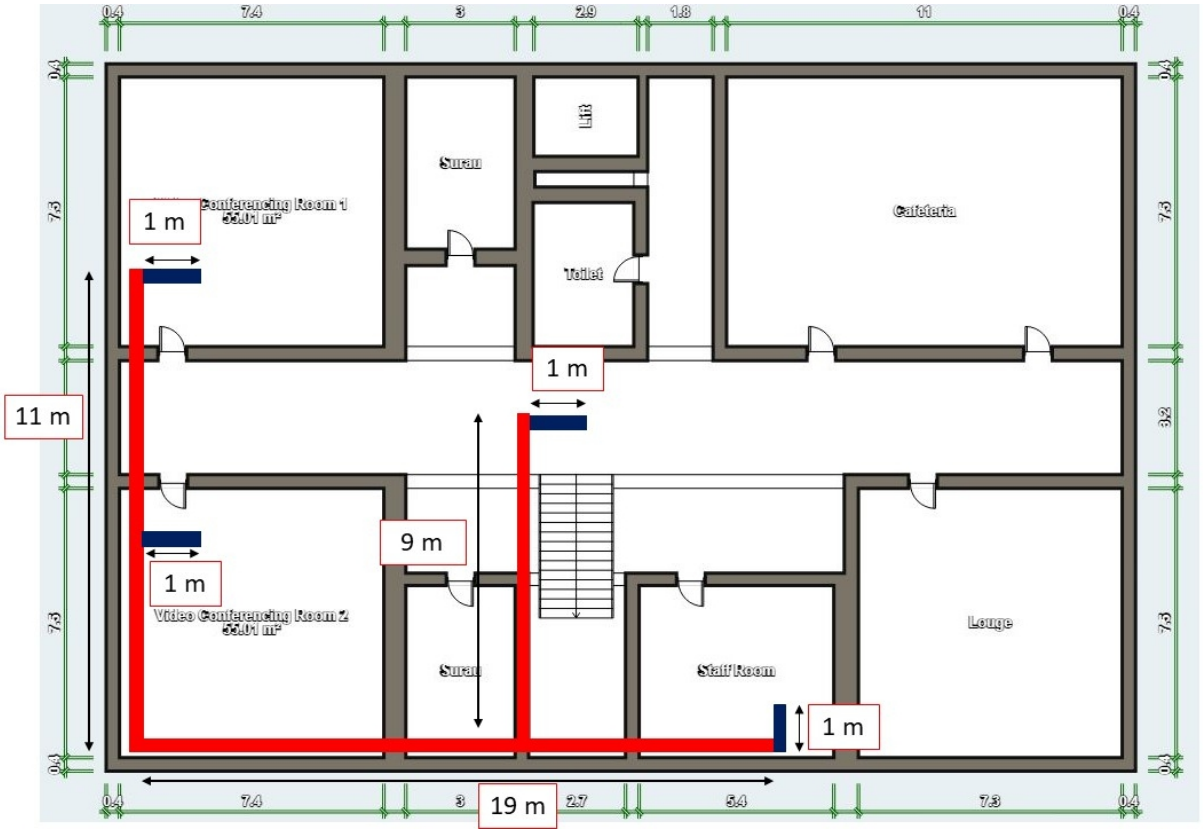
All in all, a **total** of 16+128 = **144 connections**, 32+256 = **288 patch cords**, and 16+128 = **144 switch ports** are needed for the entire building. Access points are also installed inside the building in order to provide Internet connectivity for devices that connect wirelessly.

Floor plan

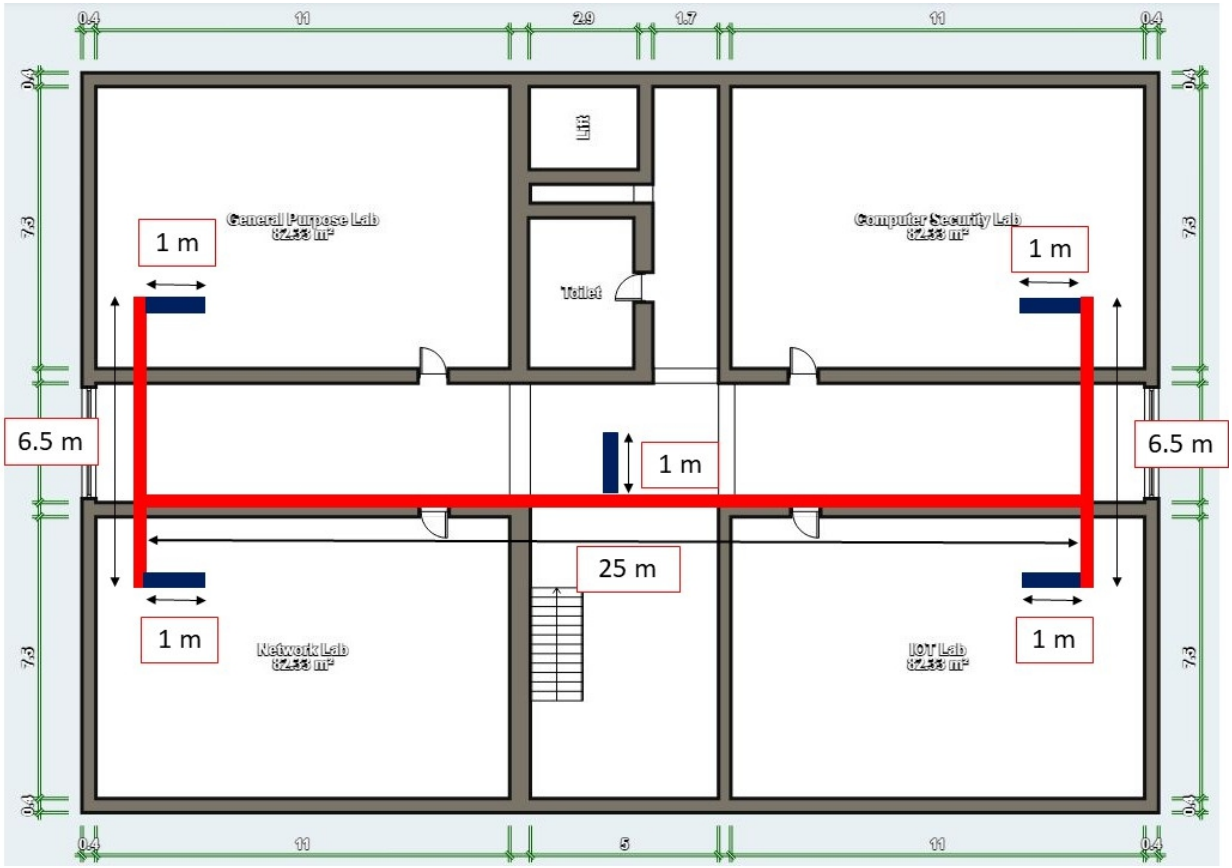
- Backbone/Vertical Cabling

Cat5 and Cat6 cables are used in this case study where the total length of Cat5 and Cat6 cables are 77m and 9m respectively.

a) Ground Floor



b) First Floor



Symbol

CAT5 Cable

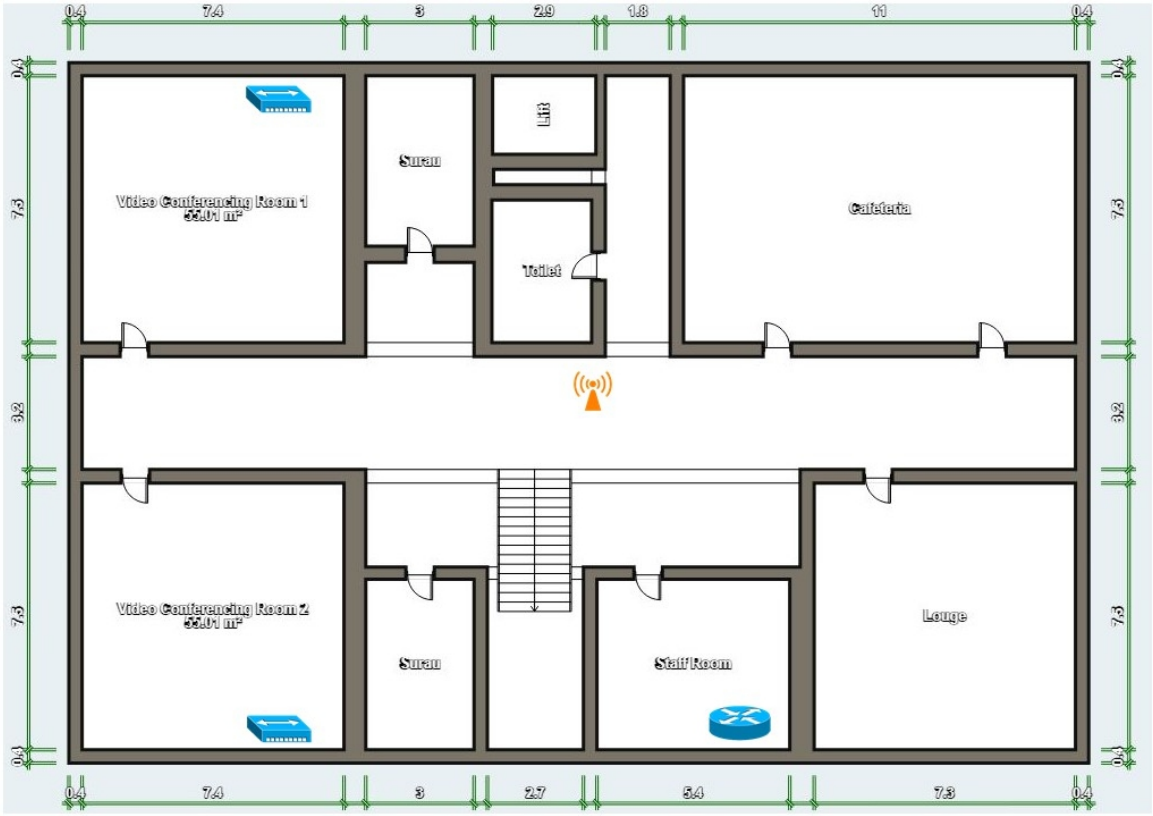
CAT6 Cable

Legend 1

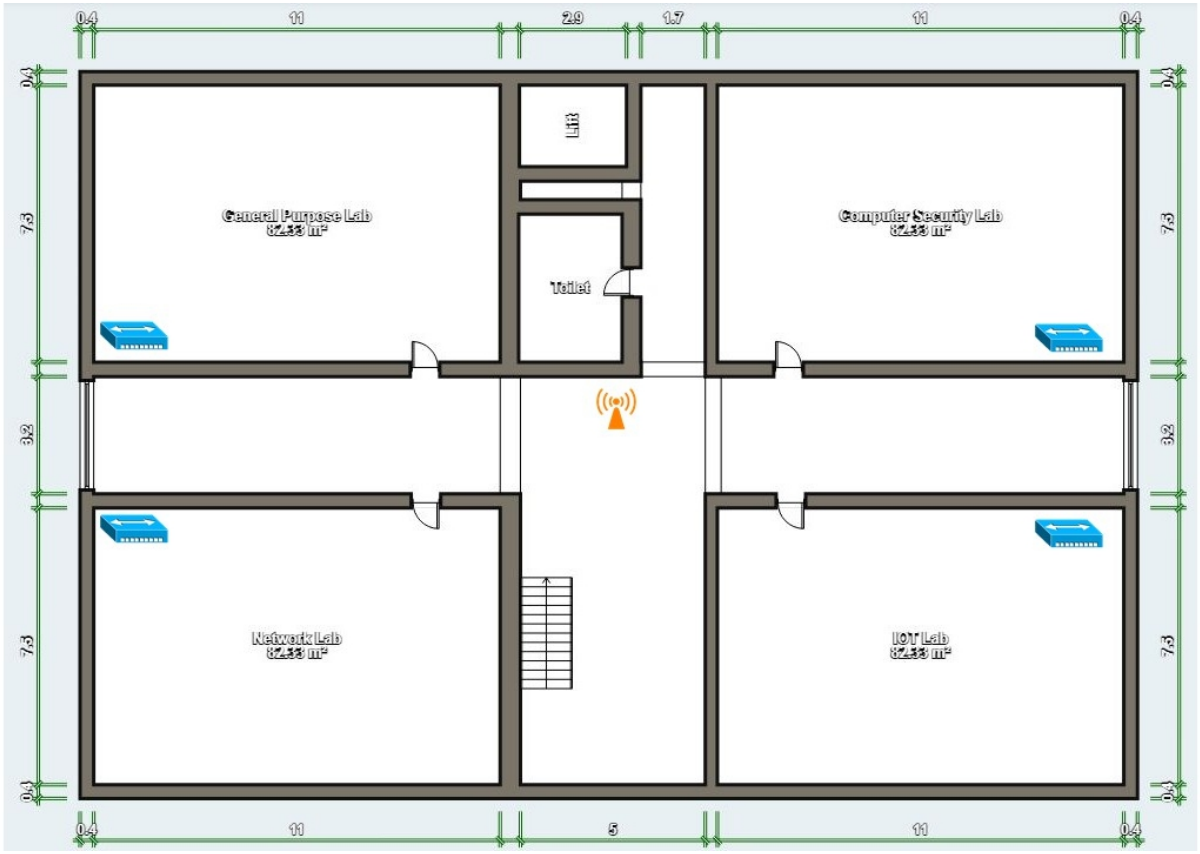
- Access Point, Router and Switches

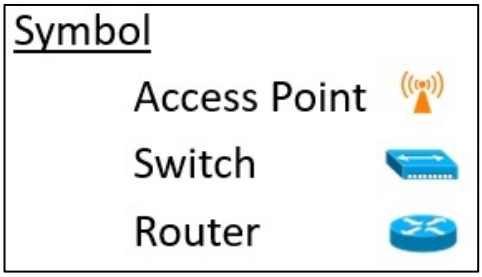
As shown in Figure 3 above, each floor is provided with 1 access point and router is placed on the ground floor in the staff room. Switches are placed in each lab and video conference room. There are total of 6 switches,4 48-port switch and 2 8-port switch, 2 access points and 1 router.

a) Ground Floor



b) First Floor





Legend 2

- Distribution/Horizontal Cabling

The cabling will be implemented on the floor either using on-floor or in-floor raceway. **Figure 5, 6** and **7** below shows height and length for based on estimation that has been done. In **Figure 5**, the calculation are in foot. Assuming the wall height for each floor is approximately 3m, the door should be about 2m. **Figure 6** shows the suitable length and height for PC desk to apply ergonomic effectively. The calculation are in cm and angle are in degree. This is important for calculating the cable length needed to connect between the PCs and multi-terabyte storage server. Meanwhile, **Figure 7** shows the length needed for conference table to be put inside the video conference room. All the calculations for the cable length is shown in **Figure 8**.

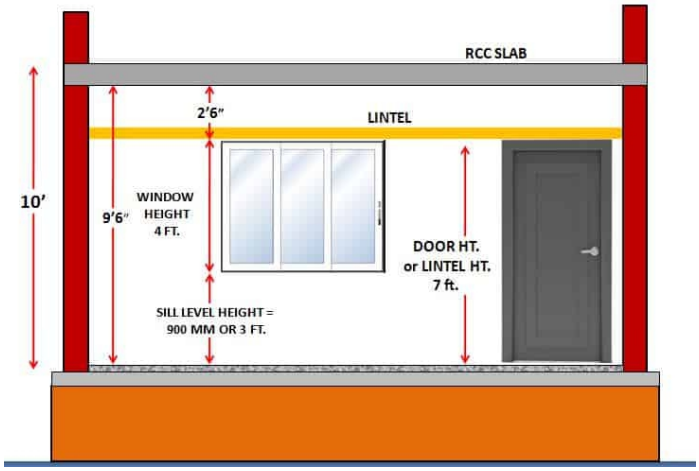


Figure 5 : Wall and Door (*https://civiconcepts.com/2020/03/standard-height-of-window-from-floor-level/*)

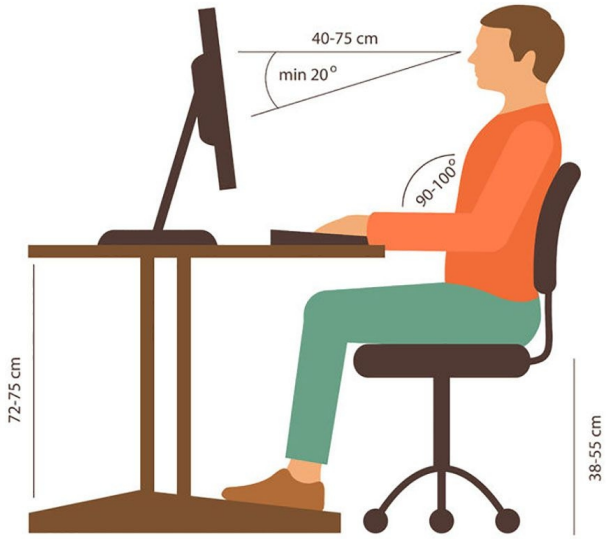


Figure 6 : PC Desk (*https://www.pinterest.com/pin/468304061244957549/*)

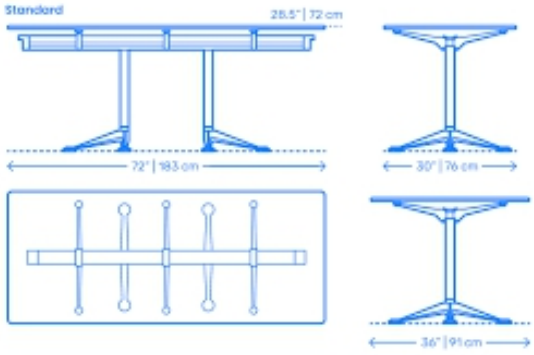
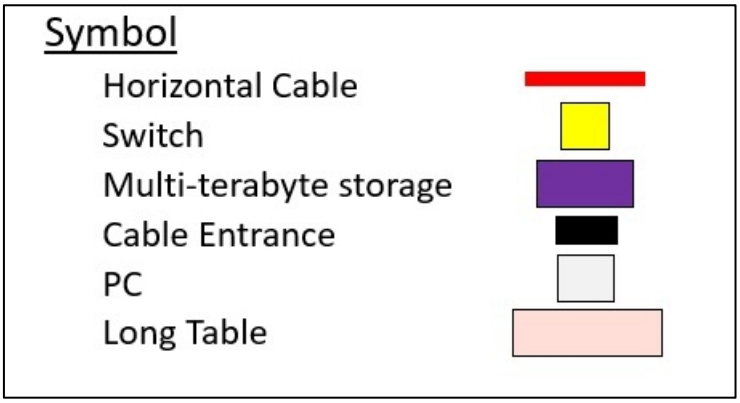


Figure 7 : Conference Table (*https://www.dimensions.com/element/burdick-group-tables-rectangular*)

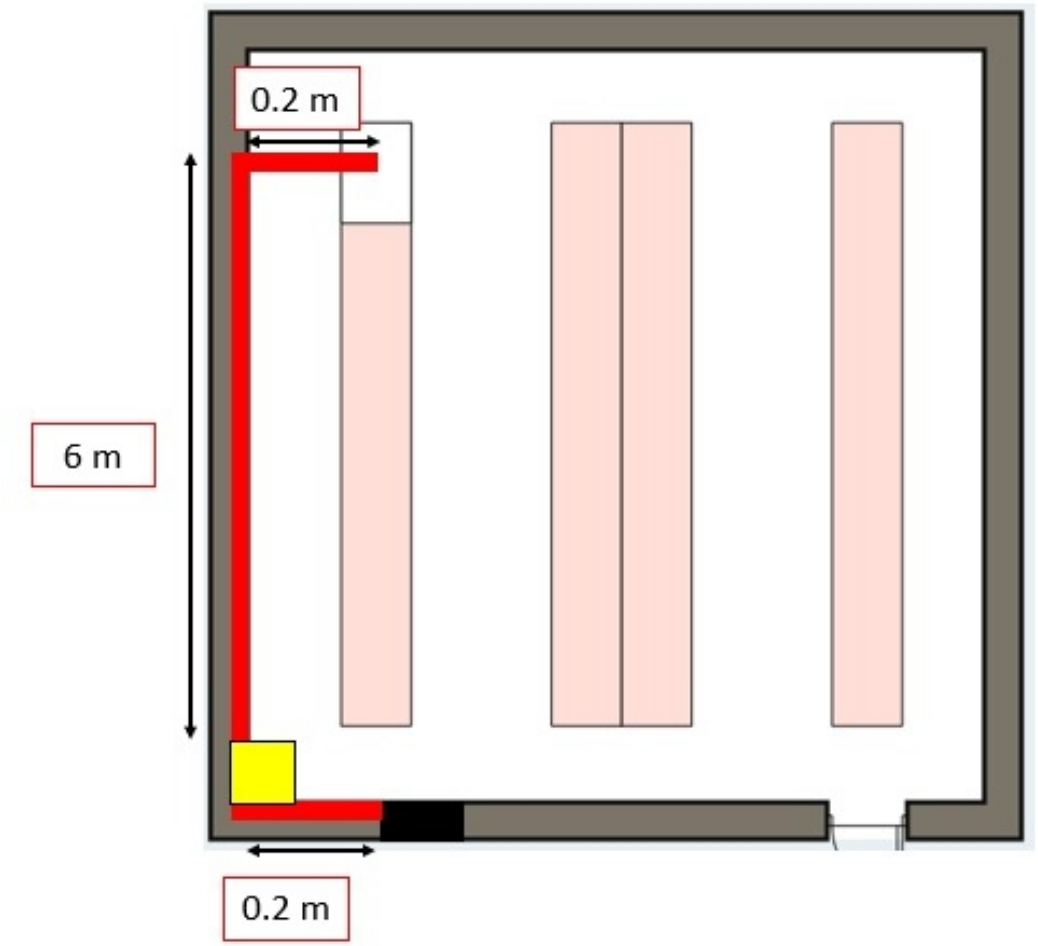


Legend 3

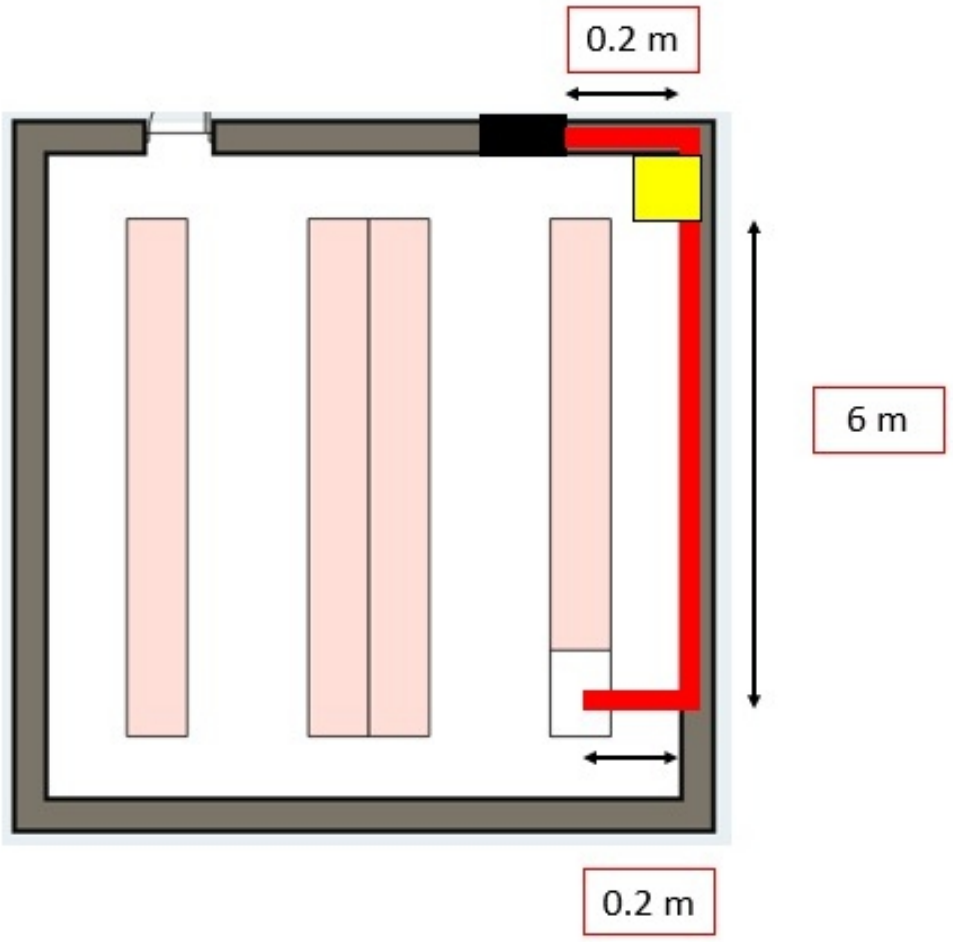
a) Ground Floor

For this floor, the cable is only used in video conferencing room 1 and 2. The type of cable that we use is cat6 cable. As mentioned above, all cable will be implemented on the floor. There are 1 PC, 4 long table and a 8-port switch.

- Video Conferencing Room 1



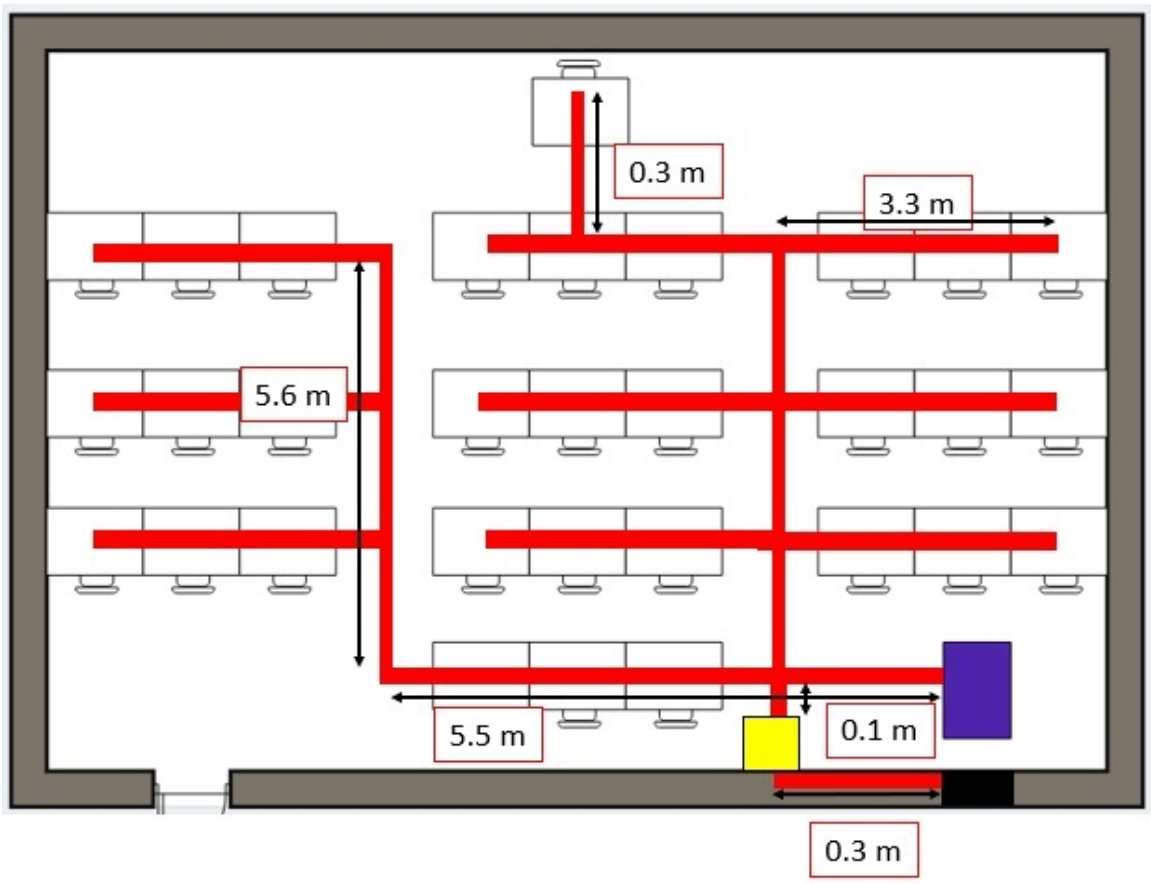
- Video Conferencing Room 2



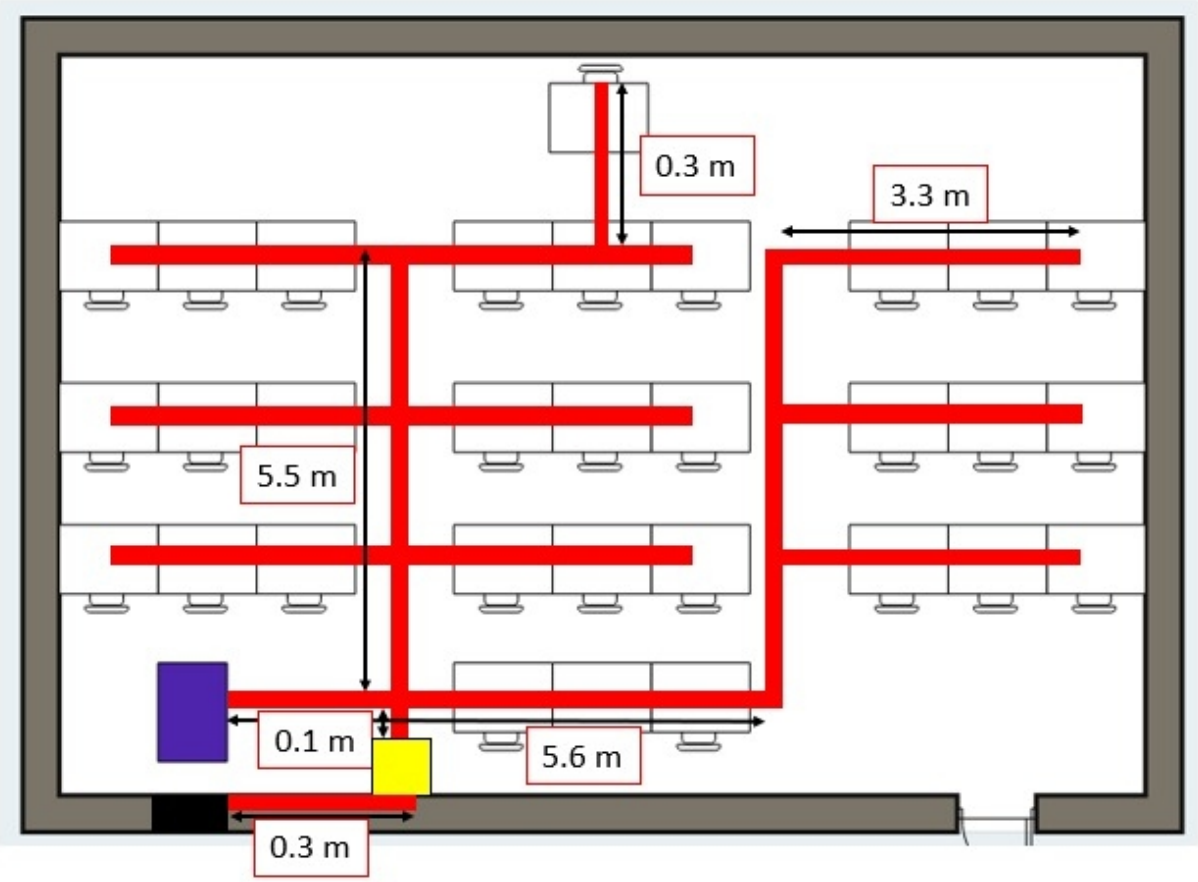
b) First Floor

All 4 labs are equipped with same devices but in different arrangement. There are 30 PCs and 1 multi-terabyte storage server in this lab. The desk are placed using 3:3 coordination since it is neater and more convenience for cabling and friendly environment. Besides, 48-port switch and Cat6 cable is used for each lab.

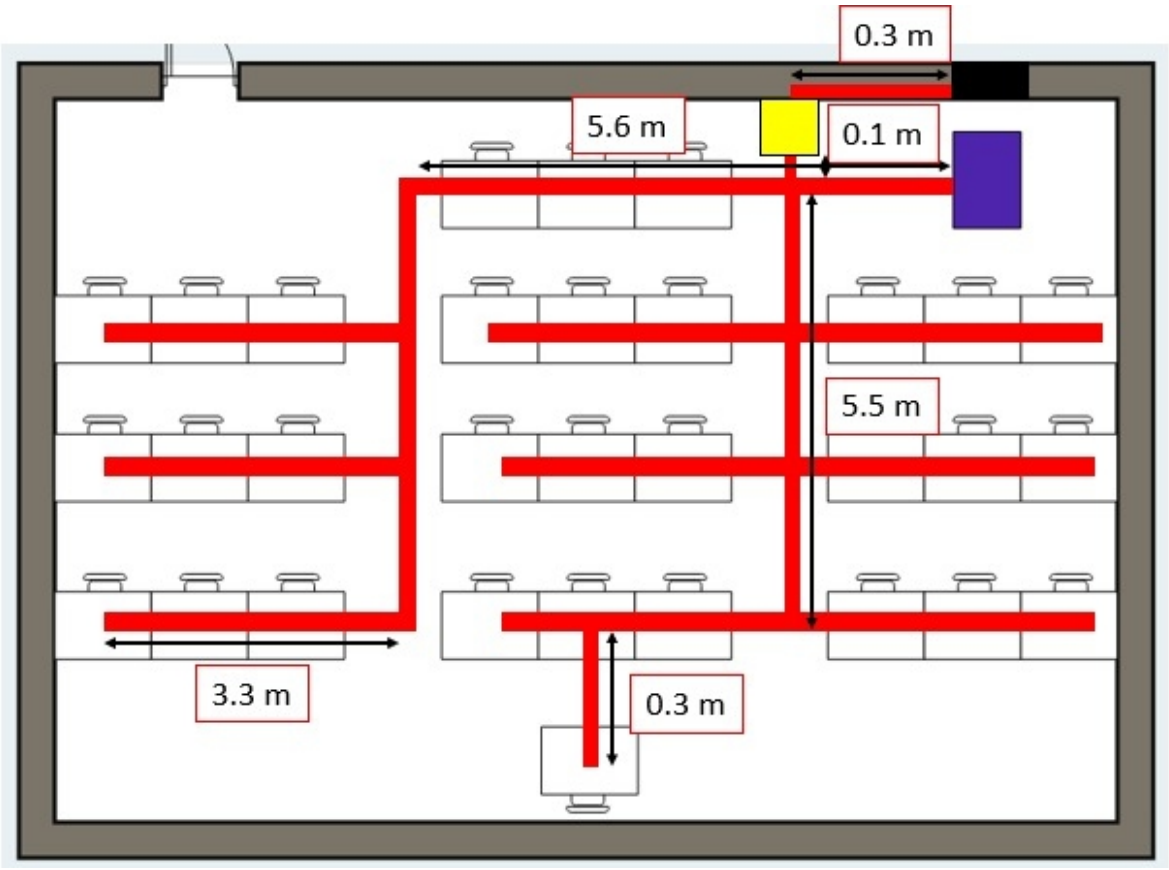
- Computer Security Lab



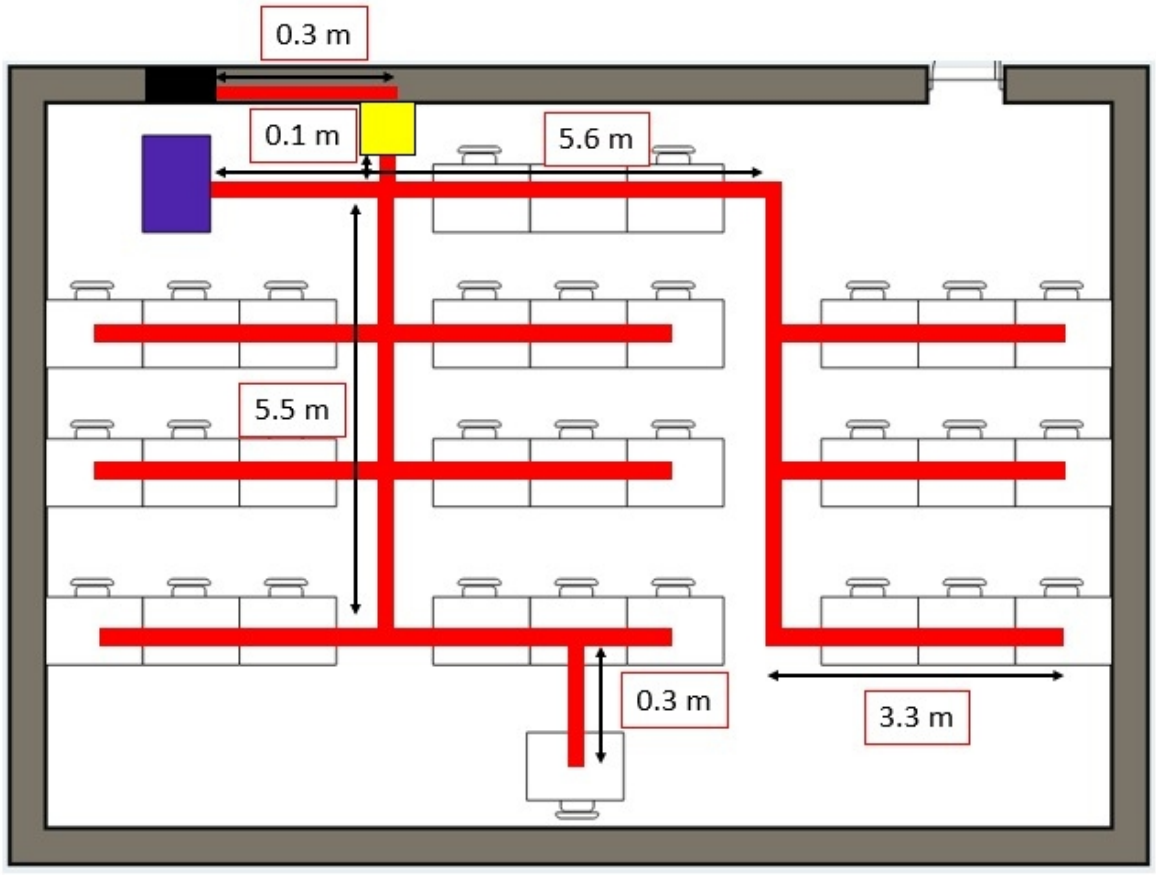
- General Purpose Lab



- IOT Lab



- Network Lab



Cat5 Cable

Total = Main (GF) + Main (1F)

= 43 m + 42 m

= 85 m

Cat6 Cable

Total = Main (GF) + Main(1F) + (4 Lab) + (2 Video Conferencing Room)

= 4 m + 5 m + 188 m + 13 m

= 210 m

Figure 8 : Cable Length Calculation

References

1. Rosenberg, P. (2000, April 1). The basics of structured cabling. Retrieved from https://www.ecmweb.com/basics/article/20897067/the-basics-of-structured-cabling
2. Warren & Brown Networks. (2014, April 29). Structured cabling and understanding the difference between permanent link and channel link. Retrieved from https://wbnetworks.com.au/blog/structured-cabling-and-understanding-the-difference-between-permanent-link-and-channel-link
3. Orenda, M. (2016, November 4). Key Components to Form a Structured Cabling System. Retrieved from Key Components to Form a Structured Cabling System (linkedin.com)