CT043-3-1

INTRODUCTION TO NETWORKING

APU1F1902

1. Contents

2. Marking scheme

Assessment Criteria	Students				
		Student 1	**Student 2**	**Student 3**	**Student 4**
	Name:				
	TP. No:				
	Group Assignment				
Section 1: Teamwork Skills	**Weight**	**Student 1**	**Student 2**	**Student 3**	**Student 4**
Alternate Roles	**10**				
Peer Evaluation - Good relationship with group members - Respect and accept opinions	**5**				
Progress Report (Week 7)	**10**				
Referencing	**5**				
Section 1: Social Skills & Responsibilities	**Weight**				
Topology / IP Addressing Justification	**15**				
Network Characteristics	**10**				
Individual Reflection	**5**				
Section 1: Practical Skills	**Weight**				
Demonstration	**10**				
Subtotal Marks	**70%**				
Practical Test					
Section 2: Practical Skills	**Weight**	**Student 1**	**Student 2**	**Student 3**	**Student 4**
Network diagram (Packet Tracer)	**10**				
IP Addressing Scheme	**5**				
Configuration	**10**				
Ability to complete on time	**5**				
Subtotal Marks	**30%**				
Total Marks	**100%**				

3. Marking rubric

3.1 For section 1

Only for Section 1						
Criteria	**0-1.0** **(Fail)**	**1.5-2.0** **(Marginal Fail)**	**2.5-3.0** **(Pass)**	**3.5-4.0** **(Credit)**	**4.5-5.0** **(Distinction)**	**Weight**	**Score**
Alternate Roles	No clear evidence of ability to assume alternate role as a group leader and member.	Attempt to demonstrate the ability to assume alternate roles as a group leader and member with limited effect and require improvements.	Able to demonstrate the ability to assume alternate roles as a group leader and member with some effect and require minor improvements	Clear evidence of ability to assume alternate role as a group leader and member to achieve the same goal.	Very clear evidence to assume alternate role as a group leader and member to demonstrated in practice.	2	10
Peer Evaluation	Not Attends group meetings and also no contribution for the group work of assignment.	Adequately attends group meetings. Not complete group work of assignment by time.	Attends group meetings regularly and arrives on time but incomplete of group work.	Attends group meetings regularly and arrives on time. Completes group assignme	Attends group meetings regularly and arrives on time. Contributes meaningfully to group discussions and complete by time.	1	5

				nts on time.			
Progress Report	Not showing any progress.	Missed out the progress report schedule.\n\nIncomplete work presented - has evidence of last minute work	Presented the progress on time, but showing incomplete work. Need major modifications to the work done	Complete work presented on time. However, work need some changes and modifications for improvement.	Very good quality of work presented. Well prepared, and not doing last minute work	**2**	**10**
Referencing	No in-text citation and very minimal references. Major issues in the referencing format.	Minimal in-text citation and references used. Minor issues in the referencing format.	Sufficient number of references and citation in the report. No issue in the referencing format	Recent source of references used, with proper reference list. Limited in-text citation in the report.	Very good quality of references used, with proper citation and reference list for all facts and diagrams used	**1**	**5**
Topology / IP Addressing Justification	Not able to propose for topology and IP address	Propose incomplete Topology / IP Addressing plan with	Propose complete Topology / IP Addressing plan with	Propose good Topology / IP Addressing plan	Propose very good Topology / IP Addressing plan with justification,	**3**	**15**

	plan for the scenario	weak justification	minimal justification	with justification, suitable for APU community	suitable for APU community with supporting evidence.		
Network Characteristics	Limited discussion of network characteristics	Minimal discussion of network characteristics, with no contribution to the society	Sufficient discussion of network characteristics but with limited contribution to the society	Good discussion of network characteristics with sufficient contribution to the society	Very good discussion of network characteristics but with excellent contribution to the society	**2**	**10**
Individual Reflection	No positive attitude and good values demonstrated in the reflection report	Minimal positive attitude and good values demonstrated through reflection report.	Good values demonstrated in in the assignment based on reflection report, but no evidence of time management skills in the work produced.	Some good values shown in reflection such as responsibility, and tolerance. Good in time management skills but only related to own work.	Able to show good values such as responsible towards their own well-being, displaying care and concerns, tolerance. Proactive to ensure the completion of task for all group members.	**1**	**5**

Demonstration	Not turn up for project demonstration.	Major issues in configuration (some parts are unable to ping).	Minimal issues in configuration – not fully working according to the proposed plan Able to modify the network configuration with help of friends during demonstration	Successful network configuration (able to ping to all devices) Able to modify the network configuration without any help during demonstration	Successful network configuration (able to ping to all devices) Excellent skills in modifying network configuration during demonstration	2	10
Total Marks (Section -1)							**70**

3.2 For section 2

Only for Section 2 (Practical Test)							
Criteria	**0-1.0** **(Fail)**	**1.5-2.0** **(Marginal Fail)**	**2.5-3.0** **(Pass)**	**3.5-4.0** **(Credit)**	**4.5-5.0** **(Distinction)**	**Weight**	**Score**
Network Diagram	Not chosen any devices and	No proper devices and cables chosen for the given	Appropriate devices and cables chosen for the given	Good network design showing complete	Good quality / complexity of network design.	2	10

	cables for the given network diagram.	network diagram.	network diagram.	setting of the network		
IP Addressing Scheme	No calculation of IP address scheme.	Wrong calculation of IP address scheme.	Incomplete calculation of IP address scheme.	Correct calculation of IP addressing scheme.	Correct calculation of IP addressing scheme with neat structure.	**5**	**5**
Configuraion	Poor understanding on the configuration	Able to show minimal understanding on the configuration done	Show good understanding in configuration, but minimal knowledge on the work	Very good understanding in configuration. Able to answer most of the questions	Outstanding configuration skills, exceeding the expectation. Able to answer all questions posed perfectly.	**2**	**10**
Ability to complete on time	Not able to complete the work on time	Incomplete of work within specific time.	Partially completed the work.	Completed in order on time.	Completed before on time.	**5**	**5**
Total Marks (Section -2)							**30**
Comments:							

4. Introduction

4.1 Objectives

As network technicians, our team aims to deliver a network design that is optimal in terms of its usability, reliability, security and maintenance, as well as in terms of the architecture of the target buildings. In the process of delivering such standards, we are required to ensure the effectiveness of the planned network design through an appropriate simulation software such as packet tracer. This software will simulate the functionality of various features in our planned network design including network devices such as router and switches along with the IP addressing scheme.

4.2 Scope

Our Team will start the project with the design of a floor plan consisting of 2 blocks with 3 floors each. The design will be constructed via the Visio Professional tool, following a specific guideline to maintain the general promised quality of our system. We will then decide on the network devices, networking schemes, and IP configurations for use in the campus building. An appropriate justification of these will be given and later we will proceed to the construction of a functioning network simulation through the Cisco Packet Tracer afterwards.

4.3 Limitations

While the simulation is meant to serve as an estimation of the functionality of a real network, it must be understood that this estimation is rather limited and do not cover all the relevant aspects of the functionality of a network. One such example is the length of wire as well as the way it is used (twisted or turned around the corners) may limit the its functionality. Same goes for the usage of wireless access points, the functionality of which may get affected by its surrounding as well as the number of users using it.

4.4 Assumptions

Despite being an estimation, packet tracer will give a good enough picture of the actual functionality of network design. The IP addressing used in the packet tracer for various segments of a network, where large number of end-devices are used, is represented by only two end devices. These two end devices are given the first and the last IP address of the range of IP addresses assigned to those. Furthermore, the switch being used in packet tracer has 24 ports, while at some places the number of end devices is more than the number of available ports in one switch or even two switches, in that case only one switch has been used since, in real-life these switches can be daisy-chained to get the desired functionality.

5. Floor plan

The following are floor plans along with appropriate justification for each. These have been designed by our team for the new training center that is managed by APU's cooperate training services. The training center consists of two blocks of building each with three floors.

5.1 Block A

5.1.1 Ground floor

The ground floor is less occupied then all the other floors as it mainly includes the administration services and facilities. It consists of two departments which are the

administration office and the finance department. It also includes two auditoriums and a staff lounge accompanied with an activity area in the center of the floor for the staff. The auditoriums can withstand the capacity of 100 students and are well equipped with projectors and a display area along with a personal computer for the lecturer or the host. The restrooms are located at the bottom area of the floor near the stairs where it is the most accessible to everyone entering or leaving the floor. All in all, most of the facilities of this floor are easily accessible since it's a less dense floor which is mainly to avoid traffic in the opening view of the premise - administrations office.

5.1.2 First floor
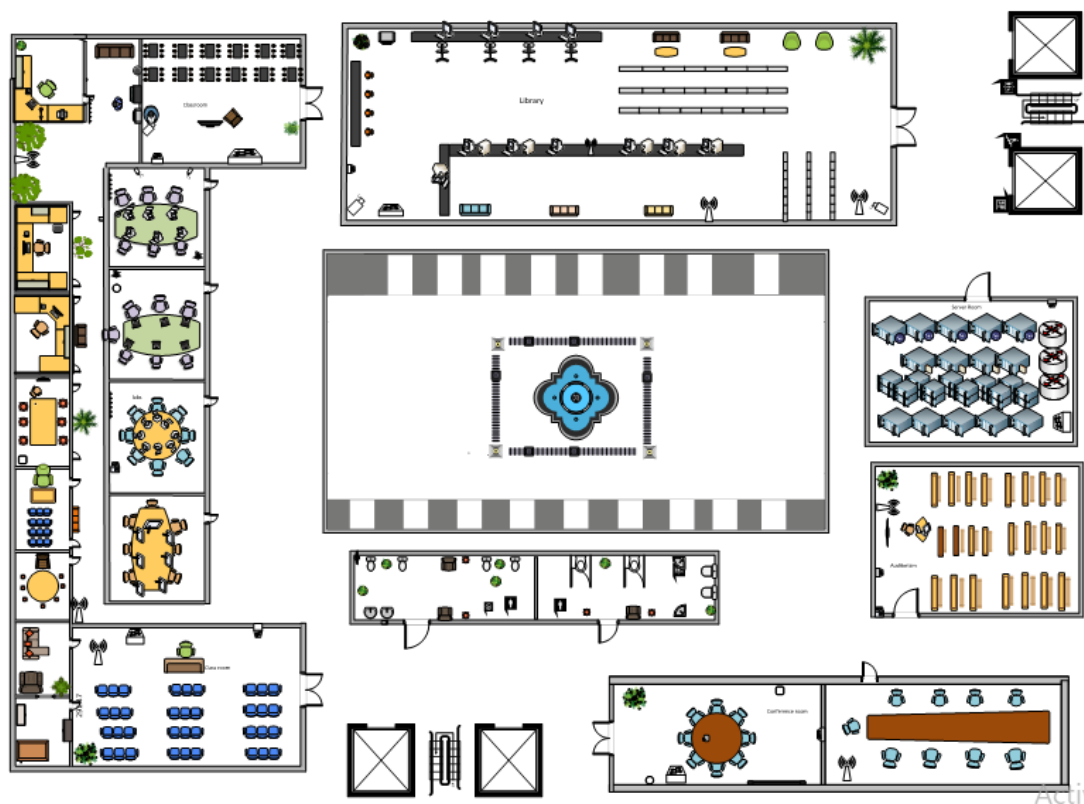
First floor consists of two auditoriums each one is of same size having capacity of around 100 students where mostly seminars and big lectures are held, one is on the left-hand side next to the server room and two conference rooms. These conference rooms are mainly for the teacher or management meetings and the other auditorium is on the right-hand side with all the computer labs and they are four in number. All the management and admin offices are also on the right-hand side. Also, there in one class room next to the library.

Library is quite easily accessible as its near to the left side lifts and staircase in between those. Library has a wide range of books to help students with their studies and has all the relevant material to aid them in their studies. In the middle there is a fountain to give some

natural mildness to the technical architecture of this floor, and washrooms are also near to it to be used by both genders: male and female. There are two more lifts between the auditorium and the conference rooms and one more staircase between the lifts.

5.1.3 Second floor
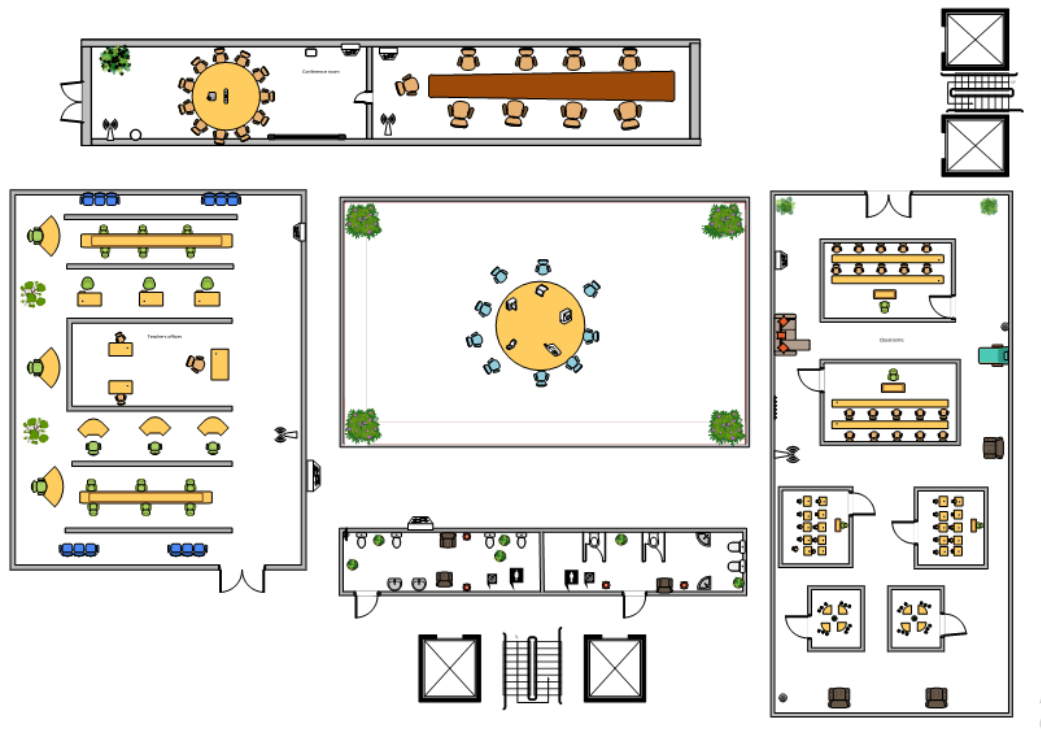
Second floor consists of classrooms and the lecturers' office. On the right side there are classes rooms where all the lectures and tutorials are held and on the left-hand side there are all the lecturers' offices. In the middle there is a sitting area for the students and the teachers for a breather.

Washrooms are midway of classes and the offices and these facilitate both genders: males and females. Moreover, there are two conference rooms on the top, which are used for the faculty meetings and also by students for discussion or for any event planning.

There are four lifts and two staircase, two lifts and one staircase at the bottom near the washrooms and other two lifts and the staircase on the right side near the classes and the conference rooms allowing the students and lecturers easy access.

## 5.2 Block B

5.2.1 Ground floor
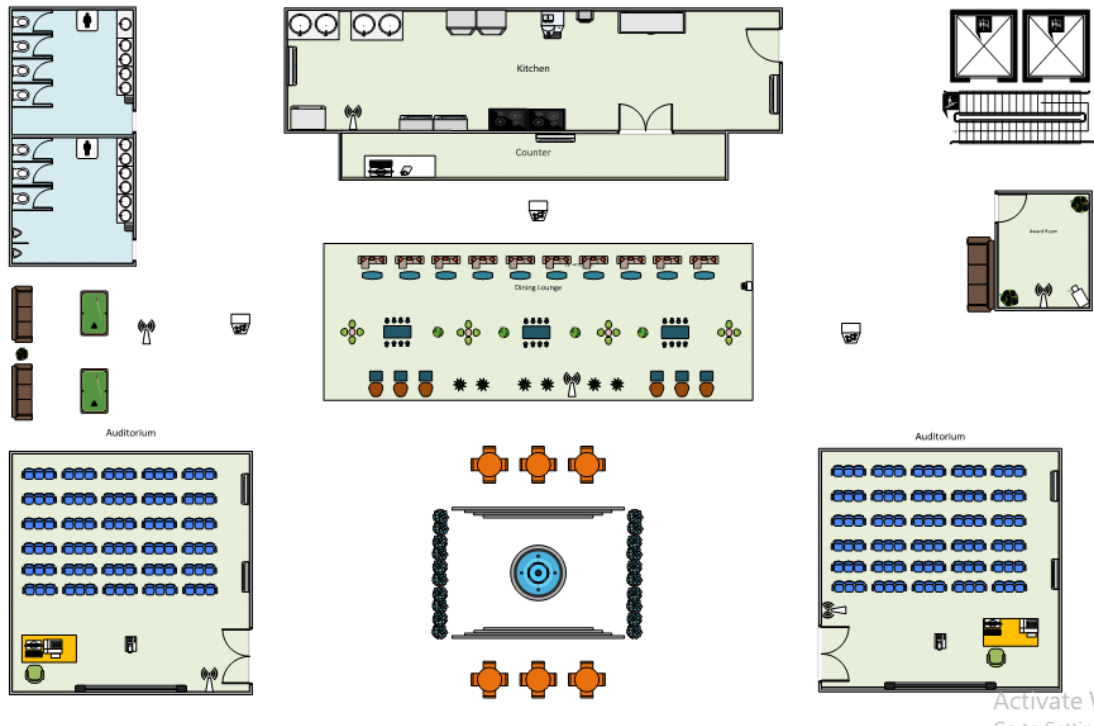
The ground floor includes two spacious auditoriums, each with 60 chairs for students as well as a desk and a chair for the lecturer. The lecturer has access to PC as well as a printer present on the table to aid his teaching and to take care of any unexpected printing. The Auditorium has two air conditioners to give the attendants a calm environment for study, and one projector to aid the teaching of the lecturer.

Furthermore, right outside the auditoriums is a fountain along with some tables, where the students who are waiting for their turn of lecture in auditorium can wait, as well as those students who have just attended their lectures. Incase if they need some more refreshment, they can enjoy the pool on the two available pool tables on the top of the auditorium on the left. They have sitting arrangement along with the pool tables as well. Just above that are washrooms for both genders. Right in the center of the floor is a larger dining lounge where students and faculty can enjoy their meals and above it is the kitchen along with the counter to buy the desired food.

On the right of the ground floor, above auditorium, is the award room where all the awards won till date by the students in various competitions along with the awards given to the training center for its excellent services are present for the students to view and particularly to boast as the pride of the training center to various visiting dignitaries. There is also a CCTV

camera present in the award room to ensure the security of these precious prizes. Above it, there are two lifts and stairs two allow the people access to above two floors.

5.2.2 First floor
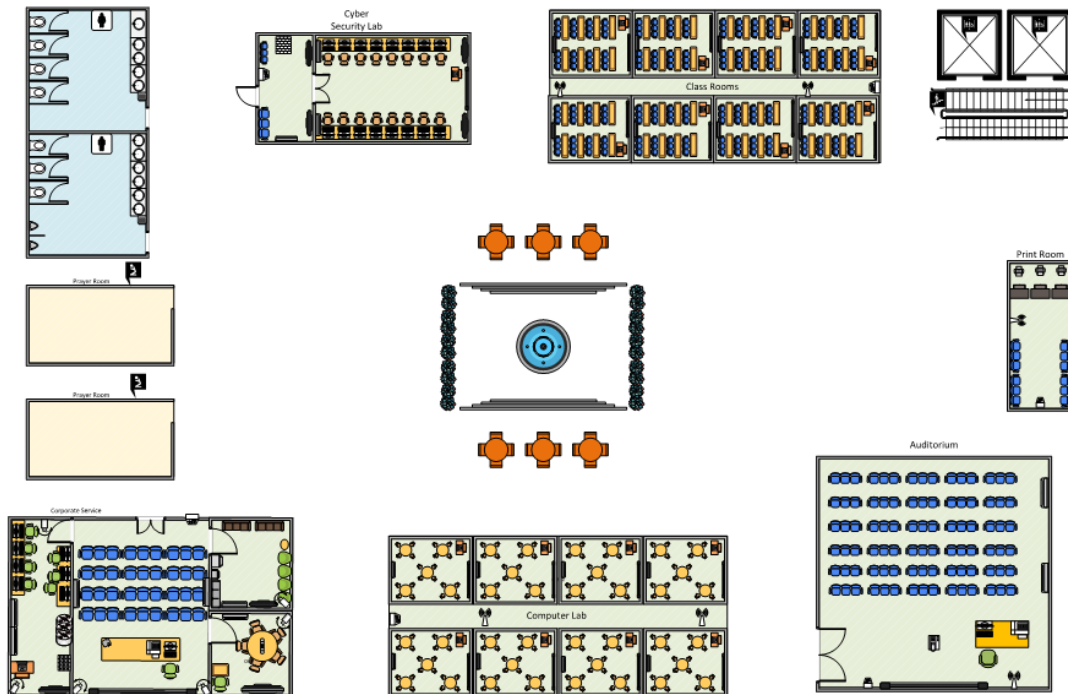
On the first floor there is one auditorium with similar facilities as that of the ones on the ground floor. On the left is a large computer lab for students to practice their skills and if to meet their printing needs on the top of the auditorium a print shop is available as well. On the left of the computer lab is the area for co-operate services. In the center of it is briefing place where experts can be briefed about the technicalities of their projects along with the is a workstation where various professional do their part on the relevant projects. There is a discussion room and a waiting area available as well. Each of these rooms are monitored with CCTV seeing the sensitiveness of the co-operate projects. Above the co-operate services area are the praying areas for each gender to help them with their spiritual needs.

In the center is the fountain along with some tables for those who wish to relax themselves a bit. On the top left we have washrooms for each gender, and in the center, there is the computer security lab as well as a set of classrooms. The class rooms are used for small lectures, or tutorials by various trainers, while the computer security lab is a specialized lab for the information security specialists for the future generations to develop their skills and to work on their assignments and projects. One the right most, again there are two lifts and stairs, which gives access to floor above and below.

5.2.3 Second floor
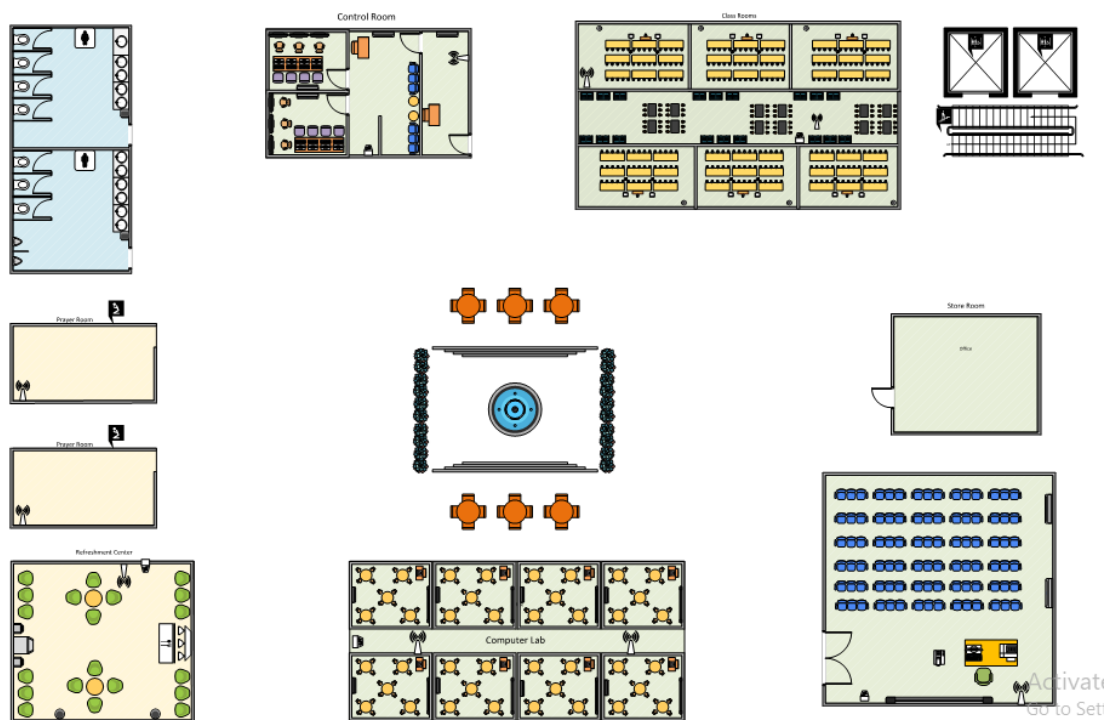
On the second floor there is again an auditorium with similar facilities as the ones present on the floors below. On the left of the auditorium is a computer lab similar to floor two, however above the auditorium is the store room. Where additional furniture, computer peripherals, and other hardware is stored among other things as backup. In the center there is again a fountain along with table to give the faculty members and students a place to sit and relax a bit. For further refreshment there is a refreshment center.

Above the refreshment center are two prayer rooms for each gender to help them with their spiritual needs. Above it is washrooms for each gender. On its right is the control room, from where the security personals monitor various important areas of the training center. Further to the right is a set of classrooms to help students and instructors with the training. These classrooms are mostly meant to be used for short tutorials. Lastly there are two lifts and stairs on the right of the classrooms for the members of the training to center to access the floors below.

Significant aspects of block B

One significant aspect which is noteworthy that the position of washrooms, praying areas, lifts and stairs are in similar position for either for the access or because in case of lifts and stairs, it had to be in the same place obviously. The control room has been decided to be placed in the second floor seeing the significance of security. Anyone planning anything

troublesome will have to go through two floors to access it. Lastly seeing the specialist set of software programs which cyber security students need, it has been decided that a special isolated lab will be given to these students with access to appropriate software programs.

6. Network devices

Following is a brief description of the network devices used to create network design in Packet Tracer.

6.1 Routers

Router is a layer 3 device that essentially contains or isolates broadcast domains (networks). Arguably, its main functionality is to stop broadcast from spreading across it. Rather it allows unicast and multicast communication between devices across its interfaces. Commonly for a single router, it is said that each of its interface represents a separate device. And unlike switches it is software based, hence is feature rich and upgradeable.

Usage in the network design

The router used in the network design is Cisco's 2911 router, the pic of which is given below. One router is used for each floor in both buildings. Depending on the floor and the number of networks used, one or more of router's interfaces are utilized to provide the relevant isolation and connecting between different networks. Furthermore, all the routers in each building are interconnected as well.

6.2 Servers

Definition

A server is a program which provides some form of functionality or service to other computer programs which are usually known as its clients or users (WhatIs.com, 2014).

Usage of server in network design

In this case for our network we are going to use a total of 5 servers with the following features.

FreeIPA on a Linux server for the AAA service

Linux servers for being the opensource servers are the primary choice. The source code Linux operating is freely available under various open-source licenses including GPL. However, for the complementary services (such as troubleshooting), you need buy subscription from respective companies such as Red Hat in case of Red Hat Enterprise Linux (RHEL) or from Suse in case of using their services for their operating system (Suse).

FreeIPA can be used for Authorization, Authentication, and Accounting of various members of APU new building. Freeipa includes other services such as Kerberos authentication, DNS server, and Network time protocol (NTP) server etc. These features when utilized fully provide quite a robust system for AAA.

Samba server

Samba is another open source package available on Linux servers under GPLv3. it is used primarily for robust interoperability of Linux and Windows by providing file and print service to various Microsoft clients, which is quite useful seeing that most of the members of APU's new building will be Microsoft Window users. (LINAGORA, 2019)

Apache HTTP server

Apache http server or commonly known as Apache web server is an open-source software released under apache license 2.0. (B, 2019) It mostly works with Linux servers however can also provide similar functionality on Microsoft servers and other Unix-likes servers as well.

Mysql as database server

MySQL is a popular opensource relational database management system (MySQL Tutorial, 2019). MySQL can be used to record key facts and figures about the members and

various resources in APU's new building; this is especially useful for the library provided in Block 1.

Postfix as a mail server

Postfix is free and open-source mail transfer agent under IBM's public license 1.0 and is easily available on various Linux distribution. (Postfix.org, 2019) This can be used to provide various members of APU's new building a centralized mail server.

6.3 Switches

A switch is a third generation, smart device which falls in layer 2 of OSI model. It serves as a single broadcast domain and multiple collision domains. In layman terms, a switch serves as a central connection point for the devices plugged into it within a network. It is basically packed with ASIC chips which are meant to provide the same functionality as bridges, however ASIC is hardware based which bridges are software-based. Due to ASIC switches can transmit data to relevant port at wire speed. While switches typically have 24 or 48 ports but these can be connected together to serve bigger networks.

Usage in network design

The switch used in the network design is Cisco's 2960 24TT switch, the pic of which is given below. It has a total of 24 Fast Ethernet and 2 Gigabit Ethernet ports. These switches have been used to allow the access layer devices to communicate within a single network. Wherever needed, switched were connected to serve larger networks. Any link from a switch to router or firewall went through Gigabit Ethernet port taking into consideration any high bandwidth requirements.
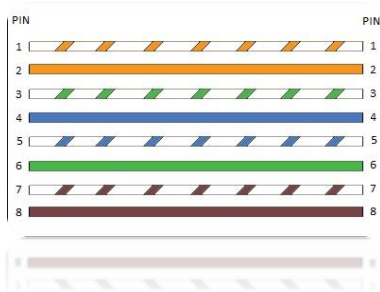
## 6.4 Cables

Straight through

This type of cable is also known as a patch cable and are mainly used in places where a wireless connection is not available. The straight through cable could be used mostly in four different ways-

- To connect a computer to a switch port
- Connecting a computer to a cable or DSL modem LAN port
- Connecting a routers WAN port to a cable or DSL modem LAN port
- Connecting a switch to a router's LAN port.

(Anon, 2019)

In this project we decided to use straight through cables to connect all the routers with switches and switches with firewalls and end devices present in the floor plan developed. This cable was the technically the right option for us as the straight through cable is best in connecting unlike devices together compared to the cross-over and the serial cable.
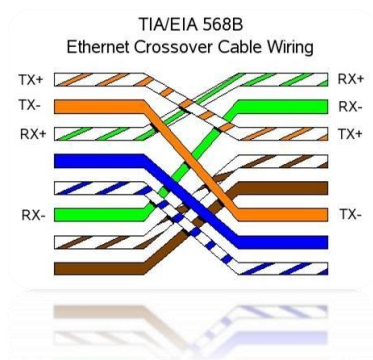
(Anon, 2019)

Cross-Over Cable

A cross-over cable is generally used to connect two computing devices together. It also known as an ethernet cable. it is used to connect a LAN port of a router to a switch or a hub port and also to connect two switches together by using a regular port. In this project the cross-over cable was mainly used to connect all the like devices together such as two switches together. A crossover able could be Cat5, Cat5e, Cat6, the difference between each of these cables is the different quality of these cables due to their differing amount of twists of copper wire present in the cable.

Serial cable

A serial port in a computer is usually used to transfer information or data between devices using communication or bit to bit techniques. These cables are mainly differentiated according to their interface and standards. In the case of a serial cable it, in this assignment, is generally used to establish a connection between two routers. Some of the different types of serial cables used around the world are
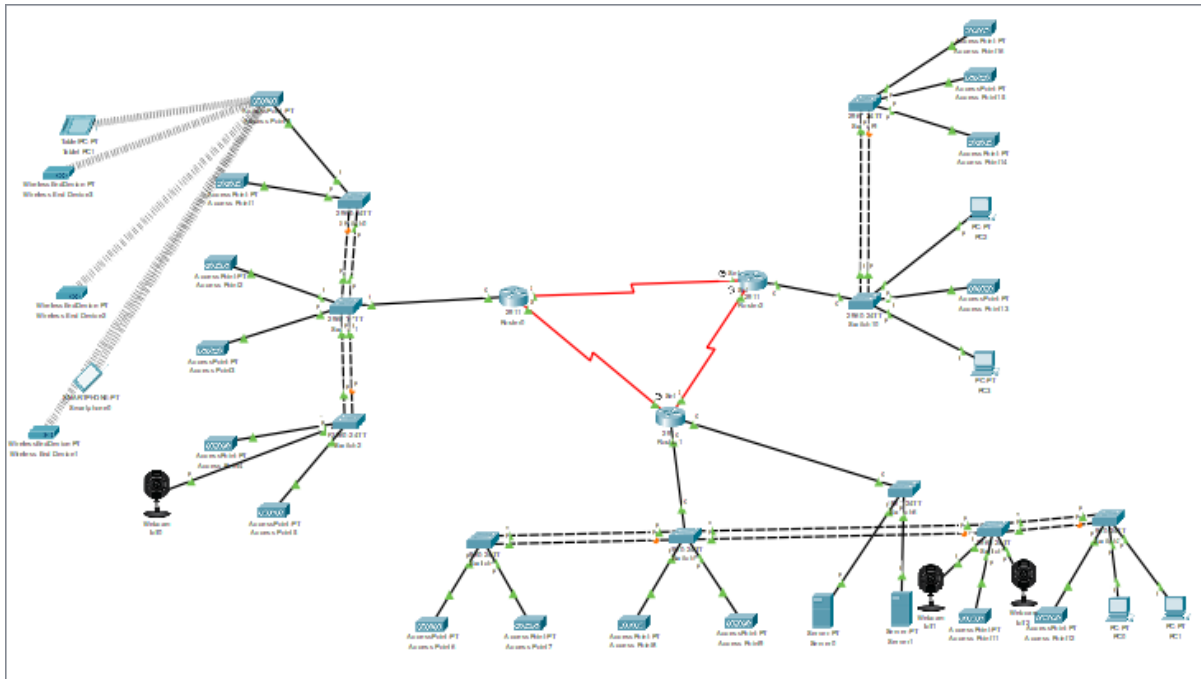

(Anon, 2019)

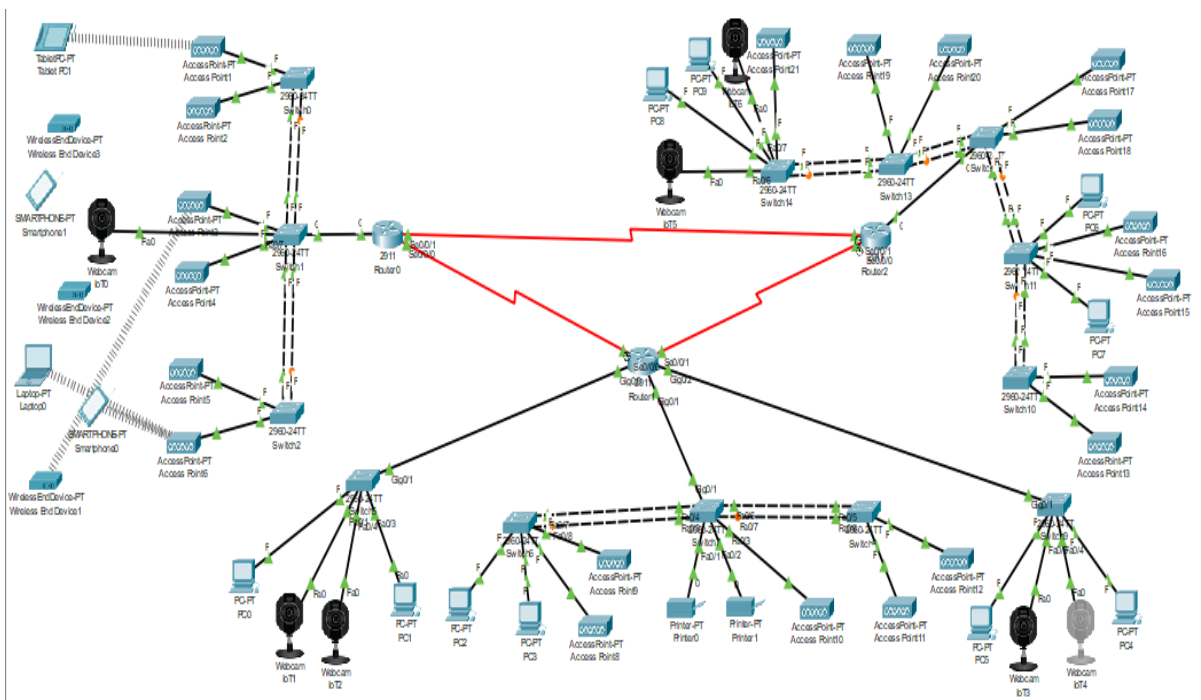- Basic DTE-DCE

- Null modem cable

- Two-wire DTE-DCE

- V.35 Crossover

# 7. Network layout

7.1 Building 1

7.2 Building 2

8. Network topology:

8.1 Topology of office building

Topologies should be studied before implementing since there is a certain manner by which a network and peripheral devices should be connected to ultimately have a smooth and stable connectivity stability.

Network topologies come in different standard layouts and design patterns and those should be chosen accordingly as they are the fundamental building blocks of a successful network design. Some of the most common topologies are mesh, ring, tree, star and bus etc. Following figure gives some example of various topologies
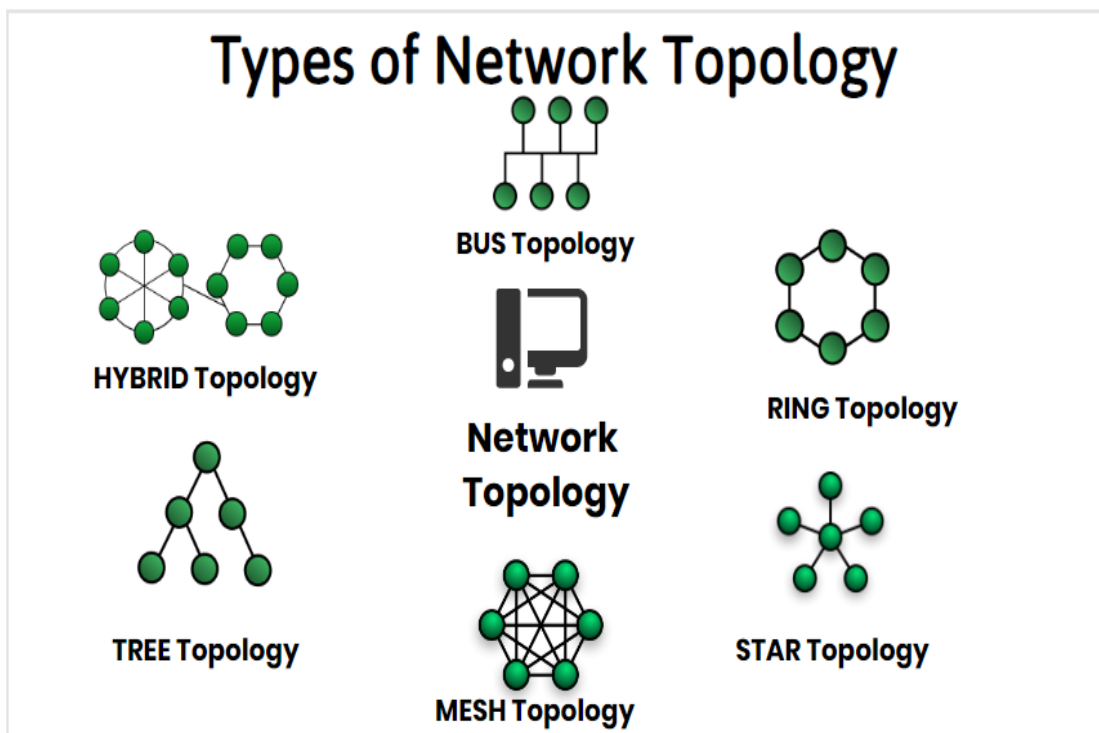

Google.com, 2019

Topologies used in the network

Partial mesh topology for access layer

Partial mesh topology essentially provides some redundancy (where deemed necessary) while in cases where the network doesn't get affected significantly adversary in case of a failure, only single connection is provided. This topology is used to connect devices within each floor. The switches are interconnected with two crossover wires to ensure redundancy, while end devices are connected to only one device at access layer.
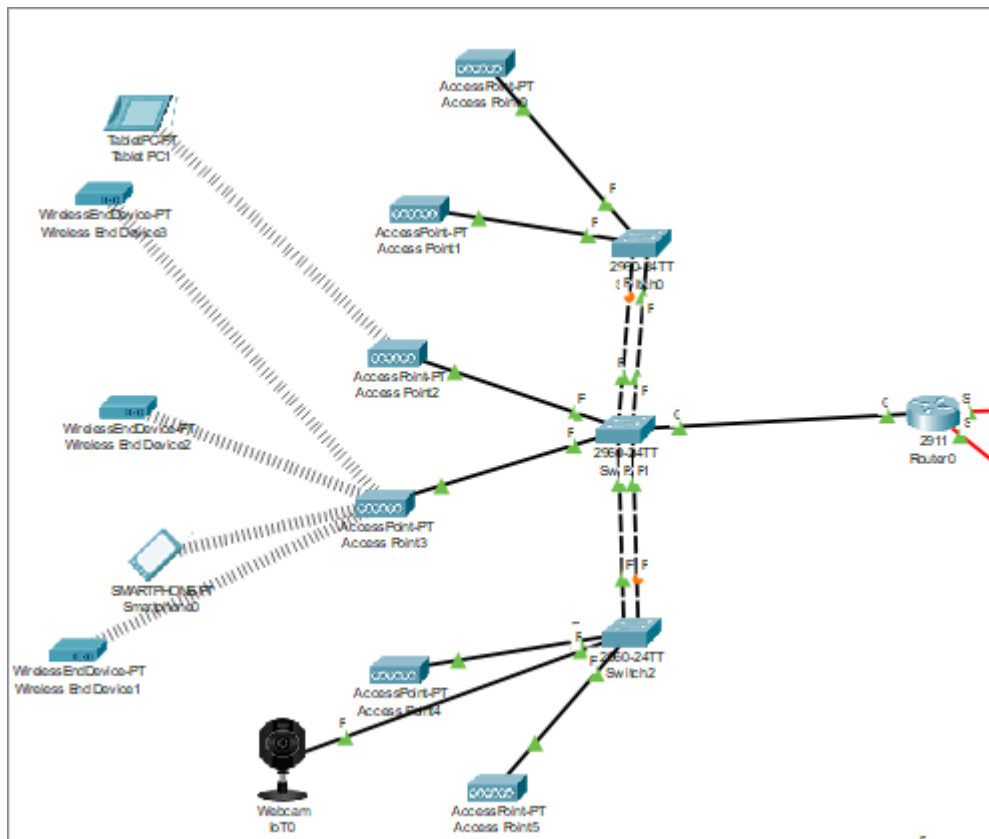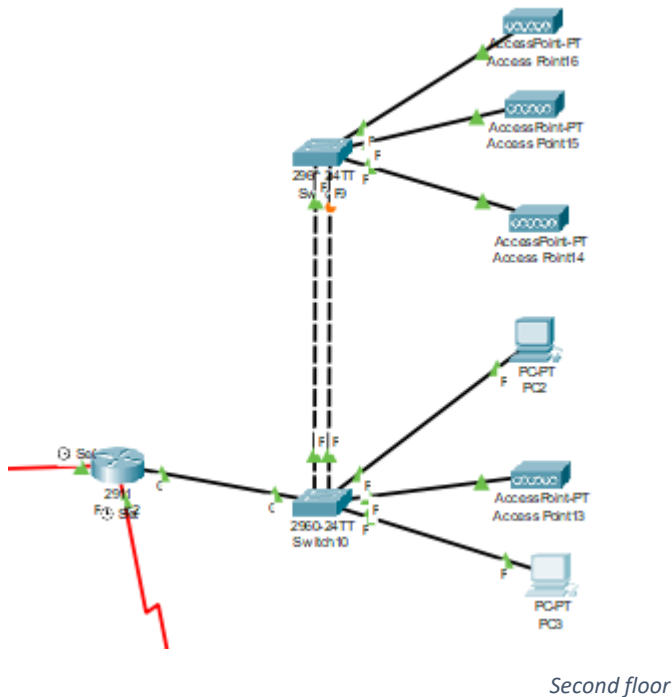
ground floor
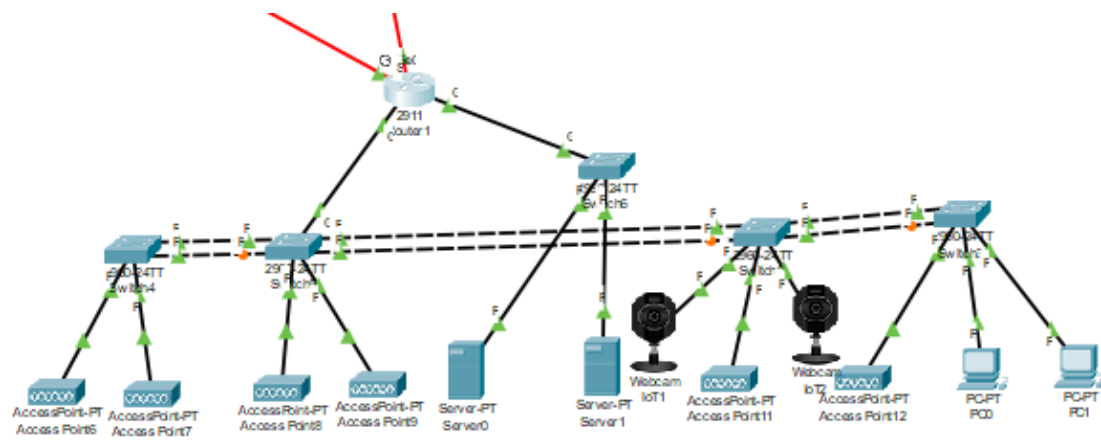
first floor

Second floor

Full mesh topology between routers

Full mesh topology is best when redundancy is a significant factor, which in this case is. One router has been allocated for each floor. To get certain critical services, such as those offered by servers on first floor, end-devices on other floors must communicate through these routers. Hence redundancy is critically important to ensure continuous availability of service.

Building 1 routers
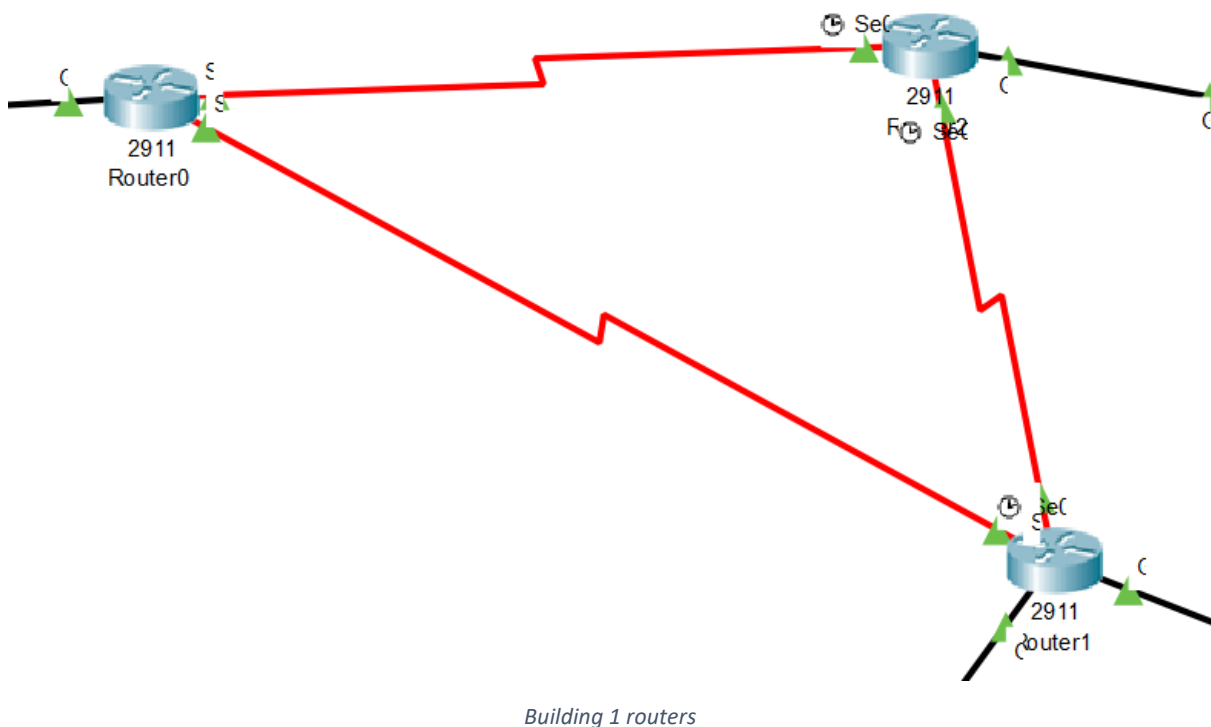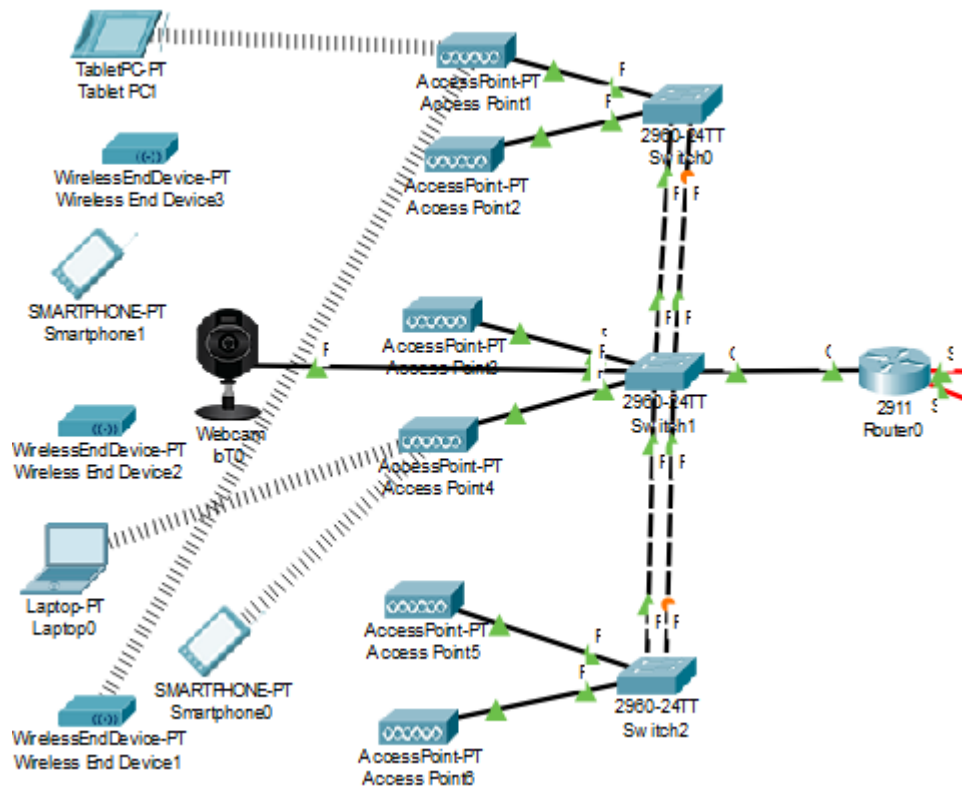
8.2 Topology of Office Building

Network topology refers to the physical and logical arrangement of devices in a network. It also represents how the data is exchanged between the devices in a network. Physical topology looks at the physical aspects of a network like how the devices been connected physically in a network whereas the logical topology goes through the logical aspects like how the data is exchanged or transferred among the network devices.

There are five basic models of topology which includes:

- Bus topology: all the devices are connected in the same transmission line sequentially, it's a simple and low-cost topology.

- Star topology: all the devices are connected to a single hub or switch via cables if any devices has some failure it doesn't affects the network but if the center device goes down it causes a network failure, it's the most popular topology model used.

- Ring topology: its kind of same as bus topology as all the devices are connected in the same transmission line except that it starts and end with the same node making a ring, it shares the same features as of bus topology.

- Tree topology: a root node is connected to one or more sub level nodes it has features of both bus and star topology as it may have the same backbone while the low-level nodes connect using star topology

- Mesh topology: each node is connected to some or all other nodes present in a network which makes the network highly fault tolerant although it's quite costly and used in highly critical networks.

- Hybrid topology: it uses mixture of two or more topologies which includes the bus, star, ring, mesh and tree topology.
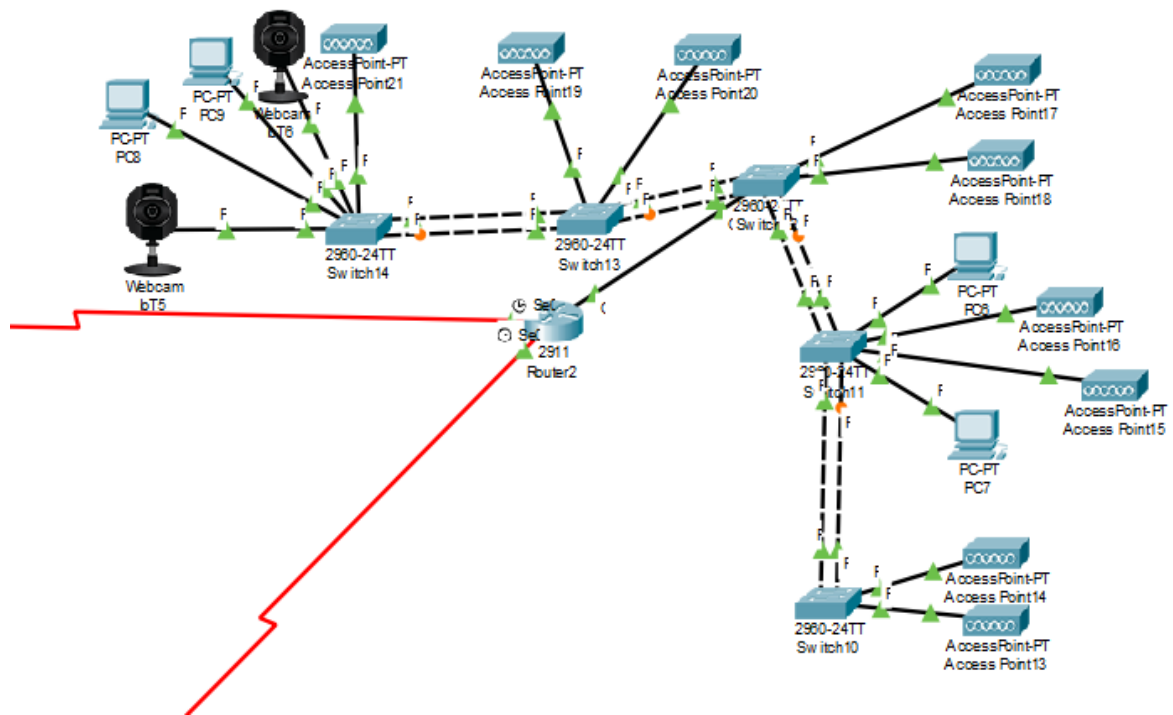
Topologies used in the network

As far as building 2 is concerned we have used partial-mesh and mesh topologies. Floor wise topology used is partial-mesh whereas mesh is used among the routers to fault tolerant connection between networks of different floors as shown in the following figures.
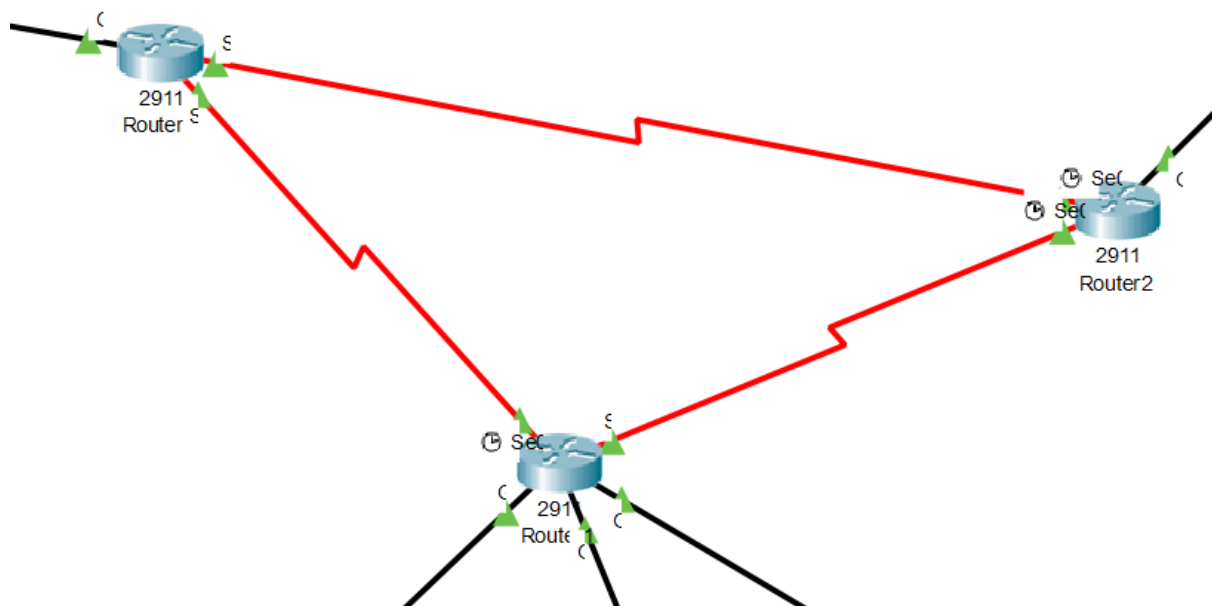
ground floor
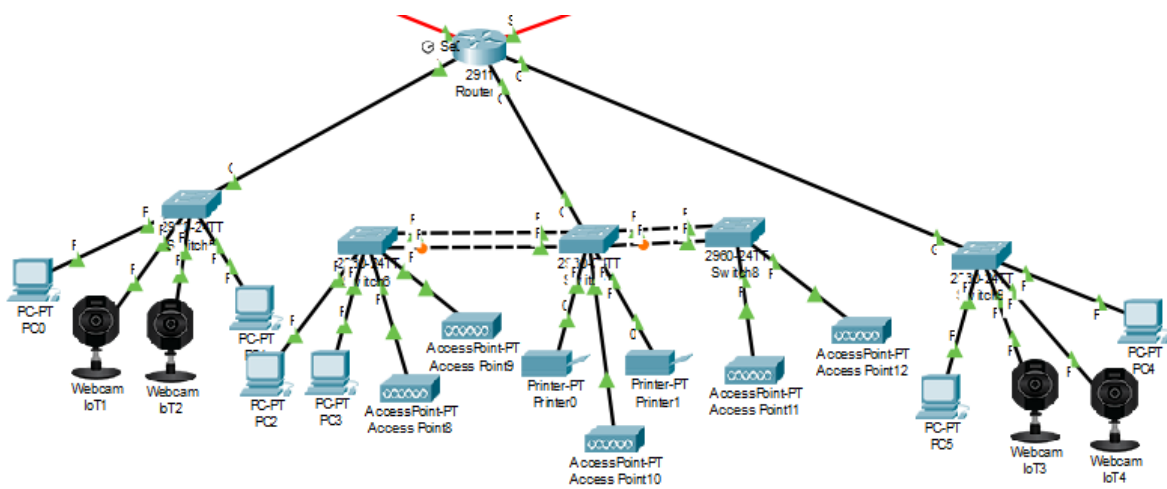
first floor

second floor

Mesh topology between routers

9. IP Addressing scheme and justification

9.1 IP addressing of office building

Ground floor

Network IP:192.168.10.0

Subnet mask: 255.255.255.0

Default gateway: 192.168.10.1

Range of assignable IP addresses: 192.168.10.2 – 192.168.10.254

Broadcast ID: 192.168.10.255

Justification

The devices that are going to connect to the network are mostly going to use wireless as a medium and the range is not well defined; in-fact it may vary with time. Hence a total of 252 IP addresses are made available for end device (excluding the IP assigned to camera).

For first floor (in general)

Network used: 192.168.11.0

Subnet mask: 255.255.255.0

Default gateway: 192.168.11.1

Range of assignable IP addresses: 192.168.11.2 – 192.168.11.254

Broadcast ID: 192.168.11.255

Justification

In this case, there is a mix of end-devices using wired connections and wireless. The wired ones (such as those in labs) are going to be assigned fixed IPs while remaining cause use any from the large pool of over 200 available IPs.

For first floor (server room)

Network used: 192.168.12.0

Subnet mask: 255.255.255.248

Default gateway: 192.168.12.1

Range of assignable IP addresses: 192.168.12.1 – 192.168.12.6

Justification

The available range meets the limited number of server (5 in total) used in the building.

For second floor

Network used: 192.168.13.0

Subnet mask: 255.255.255.0

Default gateway: 192.168.13.1

Range of useable IP addresses by hosts: 192.168.13.2 – 192.168.13.254

Broadcast ID: 192.168.13.255

Justification

Again, a range of wireless and wired devices with get connected to the network, hence a large pool of IP addresses in made available.

IP addresses assigned for links between routers

Router0 to Router1

192.168.14.5/30 to 192.168.14.6/30 respectively

Router0 to Router 2

192.168.14.1/30 to 192.168.14.2/30 respectively

Router1 to Router2

192.168.14.9/30 to 192.168.14.10/30 respectively

Justification

Here the subnet mask of 252 is used seeing that each serial connection between routers needs only two IP addresses.

Static routing configuration on routers

Router 0

Network ID	Subnet	Next hop
192.168.11.0	255.255.255.0	192.168.14.6
192.168.12.0	255.255.255.248	192.168.14.6
192.168.13.0	255.255.255.0	192.168.14.2

Router 1

Network ID	Subnet	Next hop
192.168.10.0	255.255.255.0	192.168.14.5

| 192.168.13.0 | 255.255.255.0 | 192.168.5.14.10 |

Router 2

Network ID	Subnet	Next hop
192.168.10.0	255.255.255.0	192.168.14.1
192.168.11.0	255.255.255.0	192.168.14.9
192.168.12.0	255.255.255.248	192.168.14.9

9.2 IP addressing of training building

For ground floor

Network used: 192.168.0.0

Subnet mask: 255.255.255.0

Default gateway: 192.168.0.1

Range of useable IP addresses by hosts: 192.168.0.2 – 192.168.0.254

Broadcast ID: 192.168.0.255

Justification

A range of devices are going to be used and these will mostly be served by wireless access points present throughout the ground floor. Hence a range of 253 available IP addresses (other than NID, BID, and default gateway) is enough to meet the needs of the various members, visitors, and other user of APU.

For floor one corporate office

Network used: 192.168.1.0

Subnet mask: 255.255.255.192

Default gateway: 192.168.1.1

Range of useable IP addresses by hosts: 192.168.1.2 – 192.168.1.62

Broadcast ID: 192.168.1.63

Justification

Since this is the corporate office and the number of users is fixed (about 50) along with 5 cameras, they have been granted an appropriate range to meet the needs of their devices. Seeing the security concerns, no WAP is given and all the devices are statically assigned their respective IP addresses and for the same range of IP addresses in also limited.

For floor one computer lab, auditorium, print shop

Network used: 192.168.2.0

Subnet mask: 255.255.255.0

Default gateway: 192.168.2.1

Range of useable IP addresses by hosts: 192.168.2.2 – 192.168.2.254

Broadcast ID: 192.168.2.255

Justification

For all these three places a number of WAP are available to suit the dynamic networking needs of various members along with some fixed IP addresses for the printers in printshop and for the computers in computer lab.

For floor one cybersecurity lab

Network used: 192.168.3.0

Subnet mask: 255.255.255.192

Default gateway: 192.168.3.1

Range of useable IP addresses by hosts: 192.168.3.2 – 192.168.3.62

Broadcast ID: 192.168.3.63

Justification

The number of computers in the cybersecurity lab are fixed and hence have been provided the relevant IP addresses statically for the security reason. The range of available IP addresses is also limited and no WAP is provided seeing the security concerns.

For floor 2

Network used: 192.168.4.0

Subnet mask: 255.255.255.0

Default gateway: 192.168.4.1

Range of useable IP addresses by hosts: 192.168.4.2 – 192.168.4.254

Broadcast ID: 192.168.4.255

Justification

There is range of devices that need network connectivity from various wireless devices to PC is computer lab through a wired connection or by the means of wireless access points. Hence a class C network with a total of 253 useable hosts has been used.

In between routers

The serial cable between router0 and router1 has been given the IP addresses of 192.168.5.1/30 and 192.168.5.2/30 respectively. For the serial cable between router0 and router2, the IP addresses of 192.168.5.5/30 and 192.168.5.6/30 has been used respectively. Lastly the serial cable between router1 and router2 has been giver the addresses of 192.168.5.9/30 and 192.168.5.10/30 respectively. Seeing the fact that only two useable addresses are needed for one serial cable between two routers, the subnet mask of 30 is used.

Static Routing configuration on routers

Router 0

Network ID	Subnet	Next hop
192.168.1.0	255.255.255.192	192.168.5.2
192.168.2.0	255.255.255.0	192.168.5.2
192.168.3.0	255.255.255.192	192.168.5.2
192.168.4.0	255.255.255.0	192.168.5.6

Router 1

Network ID	Subnet	Next hop
192.168.0.0	255.255.255.0	192.168.5.1
192.168.4.0	255.255.255.0	192.168.5.10

Router 2

Network ID	Subnet	Next hop
192.168.0.0	255.255.255.0	192.168.5.5
192.168.1.0	255.255.255.192	192.168.5.9
192.168.2.0	255.255.255.0	192.168.5.9
192.168.3.0	255.255.255.192	192.168.5.9

10. Network characteristics (individual work)

10.1 Network manageability training building

Management of network can include installation of various software packages or patches on various end devices including servers and clients, to the management of switches or related layer 2 devices, to management of routers (layer 3 devices), all the way to the management of interconnecting cablings (layer 1).

These devices can be managed either by approaching to them physically and using an appropriate connecting device, such as console cable in case of the management of various cisco devices, or by connecting to them remotely by using telnet or SSH.

The physical presence of network or system administrator is required either when the device is not yet setup for telnet or SSH: a fresh unconfigured device for example, or when the connectivity to the device is broken. Usually however, after doing the basic configuration, these devices are managed through SSH or telnet. Both of these require basic IP addressing to be configured on the relevant devices. The difference between telnet and SSH is that telnet is insecure meaning that the data transferred through it is unencrypted or plain text, while SSH send data after encrypting it essentially protecting the data from a man in the middle attack. Furthermore, telnet uses TCP port 23 (Gridelli, 2018) while SSH uses TCP port 22 (Linux.com, 2017). Particularly these devices can either be password protected or for ease of manageability, keypairs can also be used in-place of password.

Various software packages, such as putty and Tera Term, can be used to manage these devices locally or remotely.

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APPENDIX

WORK BREAKDOWN STRUCTURE

| GROUP SECTION			
		Member's Name	Member's Name
Introduction • Objective • Scope / Limitations • Assumptions			
Floor Plan • Diagram • Justification			
Network Design • Network Diagram • Topology • Packet Tracer Configuration			
IP Addressing • •			
INDIVIDUAL SECTION			

□□□□□□□□□□ □ Devices (Hardware) □ Cloud Computing	□ Servers (software) □ Internet of Things (IoT)	□ Routing □ Network Reliability	□ Transmission Medium □ Network Security

GANTT CHART

REMINDER OF INSTRUCTIONS

1.   As part of project management, you are required to develop a Gantt chart (project plan) that indicates clearly the activities that are required in order for the project to be a success.

2.   Attach the completed Work Breakdown Structure (WBS) and Marking Scheme in your final report. WBS must be signed and agreed by all group members.

3.   Your report must be typed using Microsoft Word with Times New Roman font size 12. Word count 3500 with +/- 10% words. You need to include a word count at the end of the report. Report should be in 1.5 spacing.

4.   The report has to be well presented and should be *typed*. Submission of reports that are *unprofessional* in its outlook will not fare well when marks are allocated.

5.   Your report must combine all the deliverables in one coherent document.

6.   Ensure that the report is printed on standard A4 (210 X 297 mm) sized paper. Paper weight of 80 grams and above is highly recommended.

7.   The report should have a one (1") margin all around the page as illustrated below:
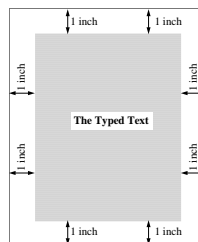
8.   The assignment should attach front cover, table of contents and marking scheme. A transparent plastic sheet can be placed in front of the report to protect the front cover.

Table: Assessment Criteria (Marks Breakdown)

Assessment Criteria	Students				
		Student 1	Student 2	Student 3	Student 4
	Name:				
	TP. No:				
	Group Assignment				
Section 1: Teamwork Skills	Weight	Student 1	Student 2	Student 3	Student 4
Alternate Roles	10				
Peer Evaluation - Good relationship with group members - Respect and accept opinions	5				
Progress Report (Week 7)	10				
Referencing	5				
Section 1: Social Skills & Responsibilities	Weight				
Topology / IP Addressing Justification	15				
Network Characteristics	10				
Individual Reflection	5				
Section 1: Practical Skills	Weight				
Demonstration	10				
Subtotal Marks	70%				
Practical Test					

Section 2: Practical Skills	Weight	Student 1	Student 2	Student 3	Student 4
Network diagram (Packet Tracer)	10				
IP Addressing Scheme	5				
Configuration	10				
Ability to complete on time	5				
Subtotal Marks	**30%**				
Total Marks	**100%**				

Only for Section 1						
Criteria	**0-1.0** (Fail)	**1.5-2.0** (Marginal Fail)	**2.5-3.0** (Pass)	**3.5-4.0** (Credit)	**4.5-5.0** (Distinction)	**Weight** / **Score**
Alternate Roles	No clear evidence of ability to assume alternate role as a group leader and member.	Attempt to demonstrate the ability to assume alternate roles as a group leader and member with limited effect and require improvements.	Able to demonstrate the ability to assume alternate roles as a group leader and member with some effect and require minor improvements	Clear evidence of ability to assume alternate role as a group leader and member to achieve the same goal.	Very clear evidence to assume alternate role as a group leader and member to demonstrated in practice.	2 / 10
Peer Evaluation	Not Attends group meetings and also no	Adequately attends group meetings. Not complete	Attends group meetings regularly and arrives on time	Attends group meetings regularly and arrives on time.	Attends group meetings regularly and arrives on time.	1 / 5

	contribution for the group work of assignment.	group work of assignment by time.	but incomplete of group work.	Completes group assignments on time.	Contributes meaningfully to group discussions and complete by time.		
Progress Report	Not showing any progress.	Missed out the progress report schedule. Incomplete work presented - has evidence of last minute work	Presented the progress on time, but showing incomplete work. Need major modifications to the work done	Complete work presented on time. However, work need some changes and modifications for improvement.	Very good quality of work presented. Well prepared, and not doing last minute work	2	10
Referencing	No in-text citation and very minimal references. Major issues in the referencing format.	Minimal in-text citation and references used. Minor issues in the referencing format.	Sufficient number of references and citation in the report. No issue in the referencing format	Recent source of references used, with proper reference list. Limited in-text citation in the report.	Very good quality of references used, with proper citation and reference list for all facts and diagrams used	1	5
Topology / IP Addressing Justification	Not able to propose for topology and IP address plan for the scenario	Propose incomplete Topology / IP Addressing plan with weak justification	Propose complete Topology / IP Addressing plan with minimal justification	Propose good Topology / IP Addressing plan with justification, suitable for APU community	Propose very good Topology / IP Addressing plan with justification, suitable for APU community with supporting evidence.	3	15
Network Characteristics	Limited discussion of network characteristics	Minimal discussion of network characteristics, with no	Sufficient discussion of network characteristics but with limited	Good discussion of network characteristics with sufficient	Very good discussion of network characteristics but with excellent	2	10

		contribution to the society	contribution to the society	contribution to the society	contribution to the society		
Individual Reflection	No positive attitude and good values demonstrated in the reflection report	Minimal positive attitude and good values demonstrated through reflection report.	Good values demonstrated in in the assignment based on reflection report, but no evidence of time management skills in the work produced.	Some good values shown in reflection such as responsibility, and tolerance. Good in time management skills but only related to own work.	Able to show good values such as responsible towards their own well-being, displaying care and concerns, tolerance. Proactive to ensure the completion of task for all group members.	1	5
Demonstration	Not turn up for project demonstration.	Major issues in configuration (some parts are unable to ping).	Minimal issues in configuration – not fully working according to the proposed plan Able to modify the network configuration with help of friends during demonstration	Successful network configuration (able to ping to all devices) Able to modify the network configuration without any help during demonstration	Successful network configuration (able to ping to all devices) Excellent skills in modifying network configuration during demonstration	2	10
Total Marks (Section -1)							70

Checklist for floor plans.

There is one server room and staff lounge located in the office building, meanwhile the training building has cafeteria and a control room for the Technical Assistant to be on standby to manage and monitor the network