Introduction:

Technology has reached its highest peak of development, especially in making life easier for people. Well implemented technology is faster than human in processing calculation and is more accurate. Technology has become an important concept in our life. It assists in connecting communities together. The computer network represents a component, especially on how it enhances the functional performance in different fields and organizations, such as companies and schools. A school's computer network performs so many functions, such as connecting students with the university, faculty, and the library. Most universities today use the network to provide online education by connecting widely dispersed students with their professors directly. For this reason, computer networks play a vital role in the education area by providing efficient communications for the university environment.

Objective:

The main goal of this project is to present a complex Local Area Network design suitable for universities in developing countries. Many universities in developing countries are searching for ways to integrate networks that have security, backup, and other features available in a university network in a developed country. The universities in developing countries are faced with challenges in designing a network that is equal in the standards used by developed countries. The main problem developing countries face deals with a profound budget deficit. This research will help these universities to design a network that employs low-cost solutions without unacceptable compromises in security or quality.

Requirements:

For this network we need a lot of network devices. Such as;

1. Desktop pc
2. Laptop
3. Smartphones
4. WRT300N Router
5. 2960-24TT Switch
6. PT Router
7. DHCP Server
8. DNS Server
9. WEB Server
10. Straight through cable
11. Dc Connection
12. Clock

Design specifications:

Here we design this network for Six campus (include Main Campus) With six different networks and also, they are connected between them with Mesh topology. Different subnets are used for each network.

The main Campus

The main campus is consisting of some groups. They are:

Server Room:

All different types of server are placed here. Such as DHCP, DNS, WEB server etc. An admin can handle all the server with a pc.

Classrooms:

The main campus have some classrooms. Each classroom have a LAN connection for Desktop pc and WIFI connection for wireless device.

Employee room:

There are some Employee rooms for the employee. Each classroom have a LAN connection for Desktop pc and WIFI connection for wireless device such as Laptop, smartphone etc. With these devices they can access the University server.

Administrative room:

There is a LAN connection for Desktop pc's and WIFI connection for wireless device such as Laptop, smartphone etc. With these devices they can access the University server and can do all the University related administrative works.

Library:

There is also a LAN connection for Desktop pc's and WIFI connection for wireless device such as Laptop, smartphone etc. By these Students can access the University Library Server.

Labs:

There is a lot of LAN connection for Desktop pc's and WIFI connection for wireless device such as Laptop, smartphone etc. Here students can practice their lab related work.

WIFI Access:

The main campus has Three WIFI router for all the students. Here a student can connect their wireless device for access the internet.

Campus 2:

Some groups of Campus 2 are:

1. Classrooms
2. Labs
3. Employee rooms
4. WIFI access

Campus 3:

Some groups of Campus 3 are:

1. Classrooms
2. Employee rooms
3. WIFI access

Campus 4:

Some groups of Campus 4 are:

1. Classrooms
2. Labs
3. WIFI access

Campus 5:

Some groups of Campus 5 are:

1. Classrooms
2. Labs
3. Employee rooms
4. WIFI access

Campus 6:

Some groups of Campus 6 are:

1. Classrooms
2. Employee rooms
3. WIFI access

Topology:

Here we used the Mesh Topology. Our Six campus are connected between them with mesh.

A mesh topology is a network setup where each computer and network device is interconnected with one another. This topology setup allows for most transmissions to be distributed even if one of the connections goes down.

So. If we lost one connection from a campus then other campus won't be affected by it.

Algorithm:

Here we use the OSPF protocol for the routing.

Open Shortest Path First (OSPF) is a link-state routing protocol that is used to find the best path between the source and the destination router using its own Shortest Path First). OSPF is developed by Internet Engineering Task Force (IETF) as one of the Interior Gateway Protocol (IGP), i.e., the protocol which aims at moving the packet within a large autonomous system or routing domain.

Servers:

DNS:

We used DNS server for our University web server.

The Domain Name System (DNS) is the phonebook of the Internet. When users type domain names such as 'google.com' or 'nytimes.com' into web browsers, DNS is responsible for finding the correct IP address for those sites.

DHCP:

We used it to set a IP, Getaway and DNS for a network device. And This DNS server can serve the IP, Gateway and DNS address to all Networks.

The Dynamic Host Configuration Protocol (DHCP) is a network management protocol used on Internet Protocol (IP) networks, whereby a DHCP server dynamically assigns an IP address and other network configuration parameters to each device on the network, so they can communicate with other IP networks.

WEB:

We use it for our University website.

A web server is a computer that runs websites. It's a computer program that distributes web pages as they are requisitioned. The basic objective of the web server is to store, process and deliver web pages to the users. This intercommunication is done using Hypertext Transfer Protocol (HTTP).

All web Server List that are used in this network:

1. University Web Server
2. Accounting Web Server
3. Admission Web Server
4. Advising Web Server
5. Result Web Server
6. Library management Web Server

Physical diagram:

Here are some pictures of this network.

Fig: Full Network

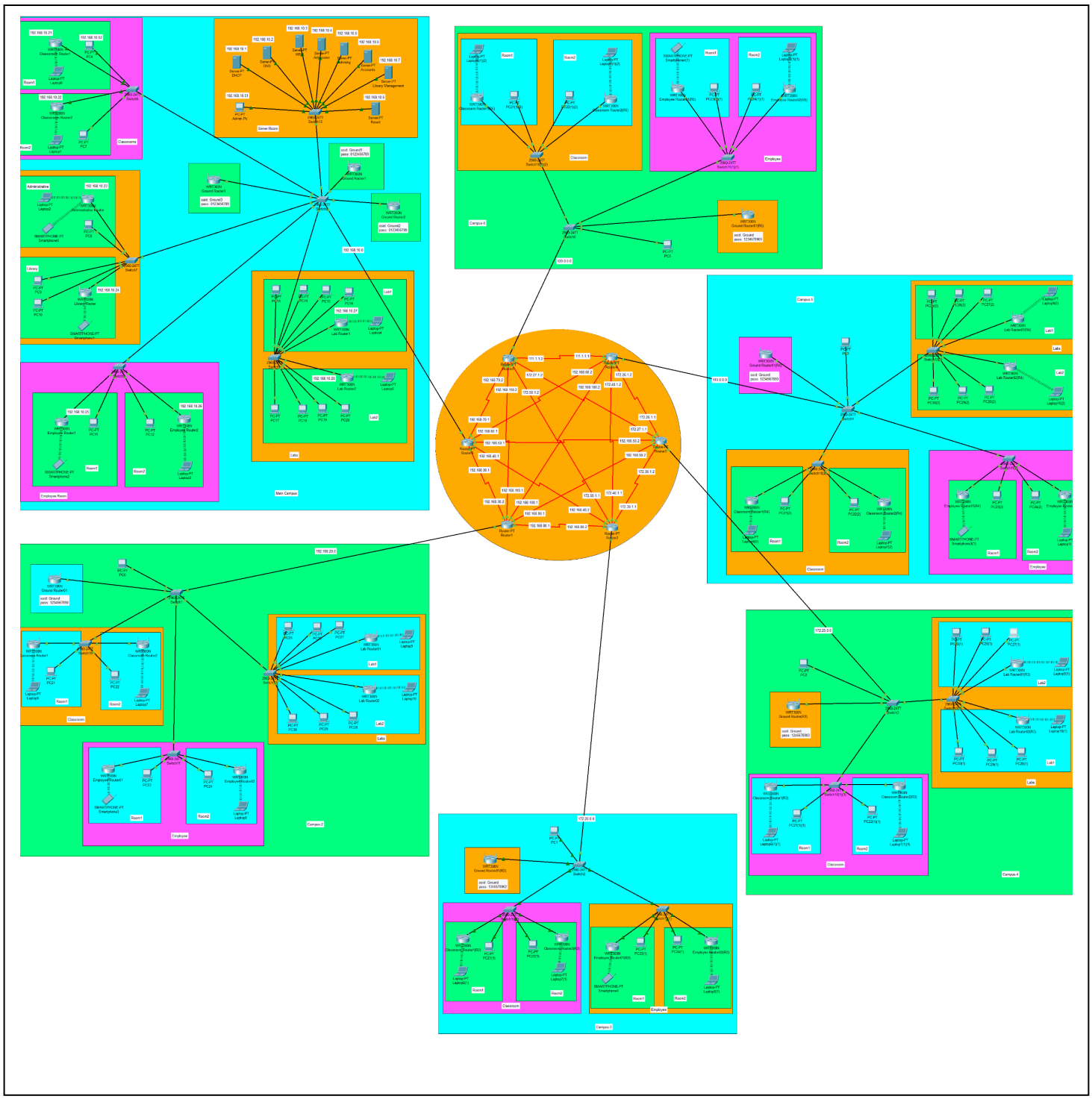


Fig: Main Campus

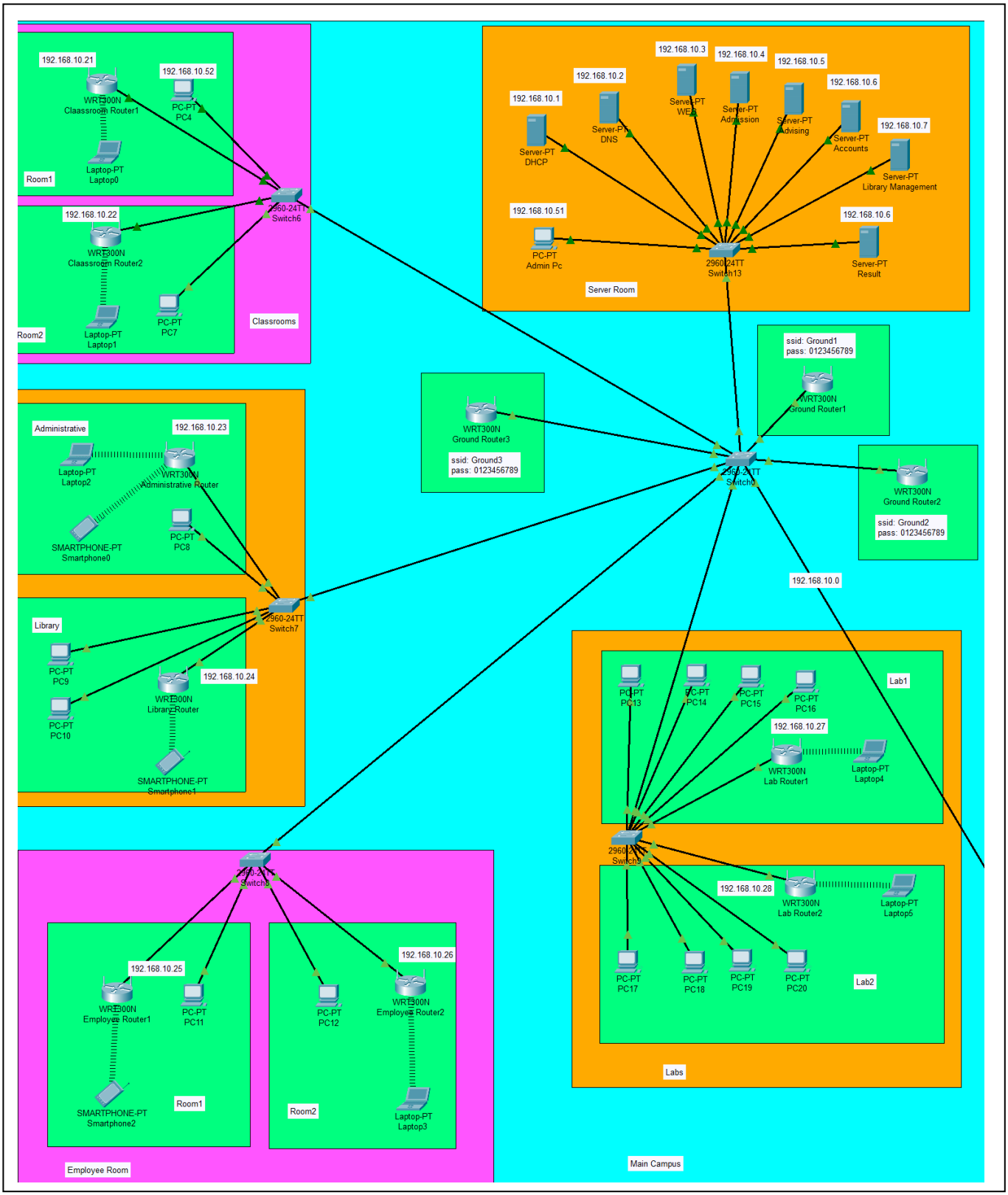


Fig: Campus-2

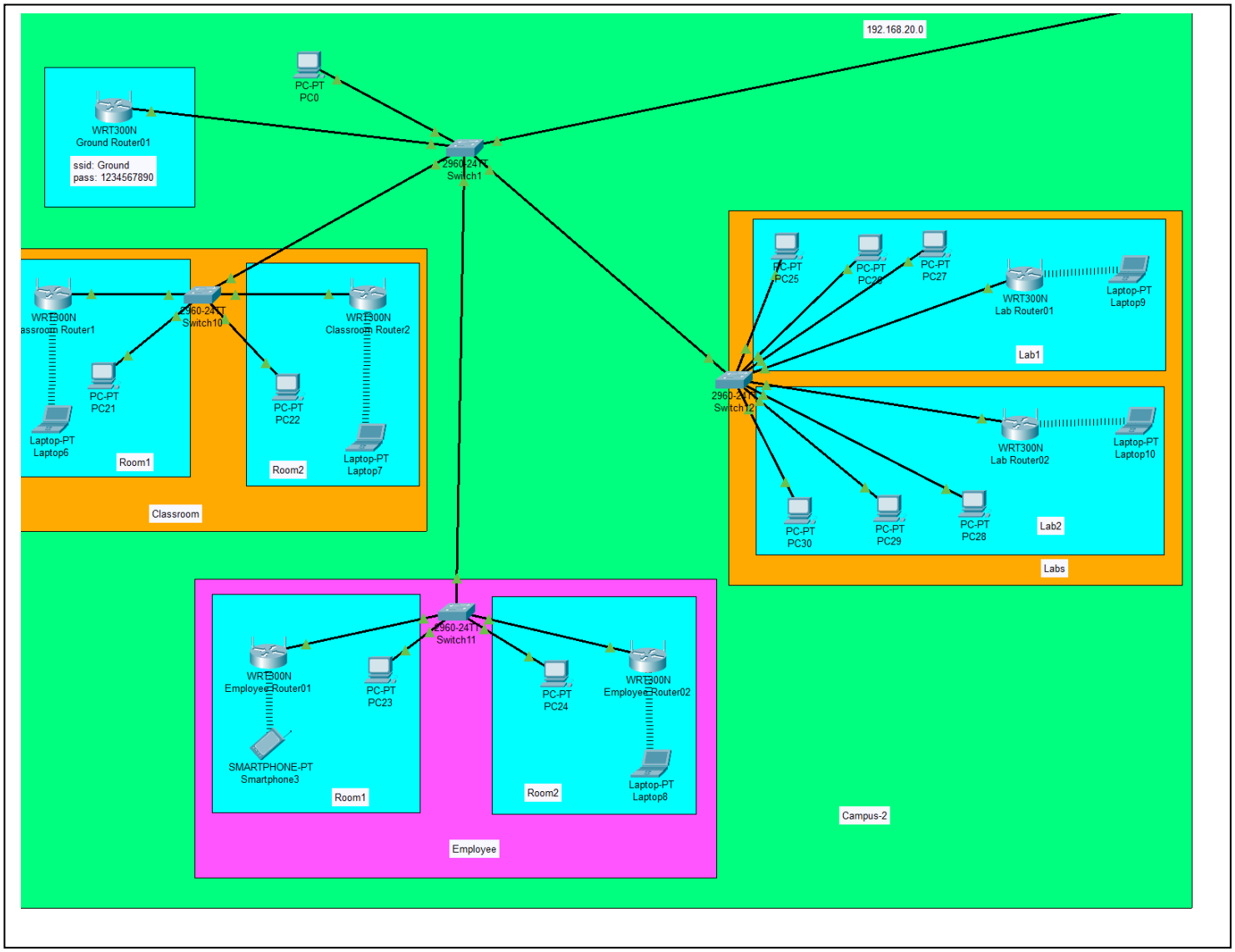

192.168.20.0
PC-PT
PC0
WRT300N
Ground Router01
ssid: Ground
pass: 1234567890
2960-24TT
Switch1
WRT300N
Classroom Router1
2960-24TT
Switch10
WRT300N
Classroom Router2
PC-PT
PC21
PC-PT
PC22
Laptop-PT
Laptop6
Room1
Laptop-PT
Laptop7
Room2
Classroom
PC-PT
PC25
PC-PT
PC26
PC-PT
PC27
WRT300N
Lab Router01
Laptop-PT
Laptop9
Lab1
2960-24TT
Switch12
WRT300N
Lab Router02
Laptop-PT
Laptop10
PC-PT
PC30
PC-PT
PC29
PC-PT
PC28
Lab2
Labs
2960-24TT
Switch11
WRT300N
Employee Router01
PC-PT
PC23
SMARTPHONE-PT
Smartphone3
Room1
PC-PT
PC24
WRT300N
Employee Router02
Laptop-PT
Laptop8
Room2
Employee
Campus-2

Fig: Campus-4

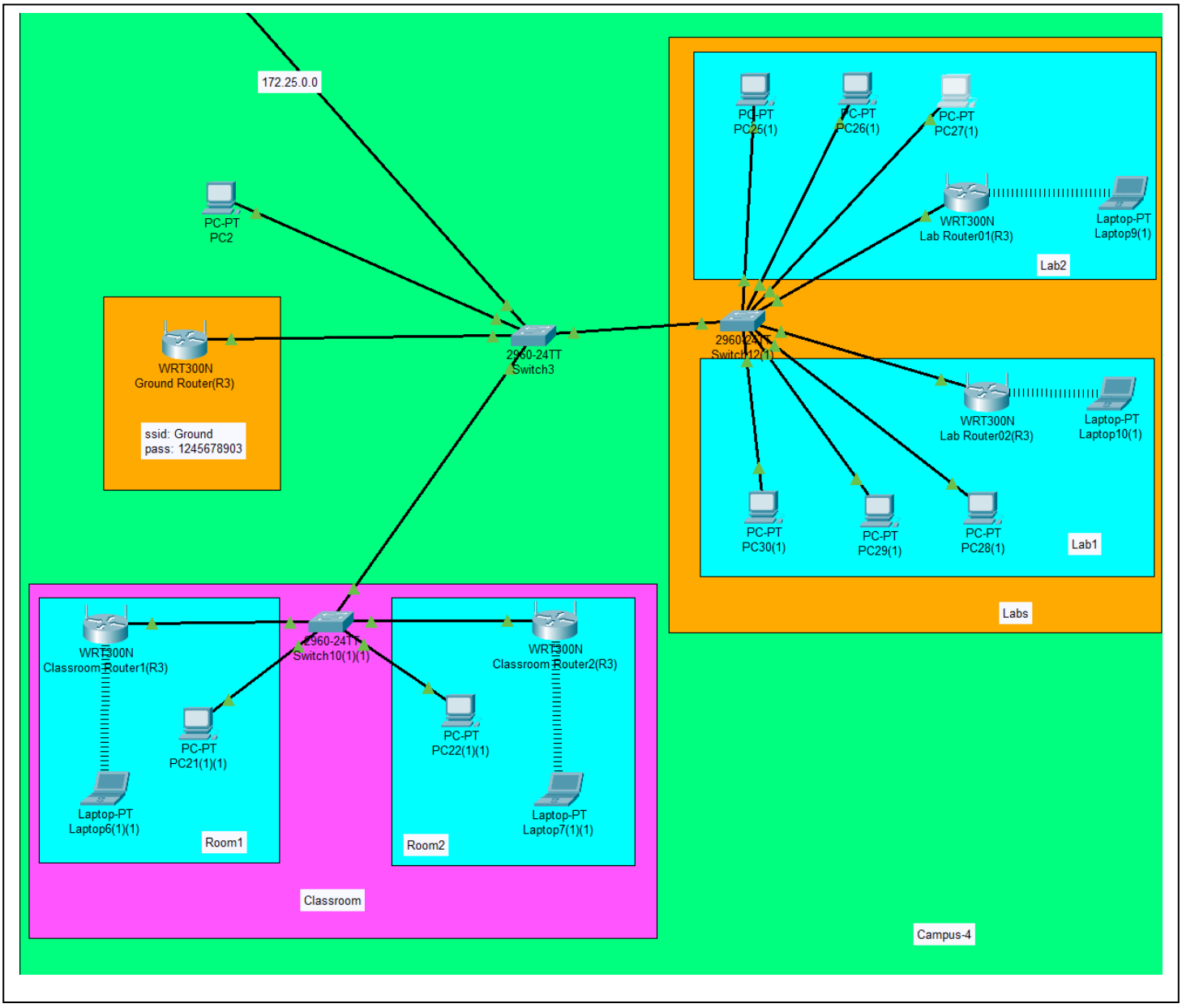
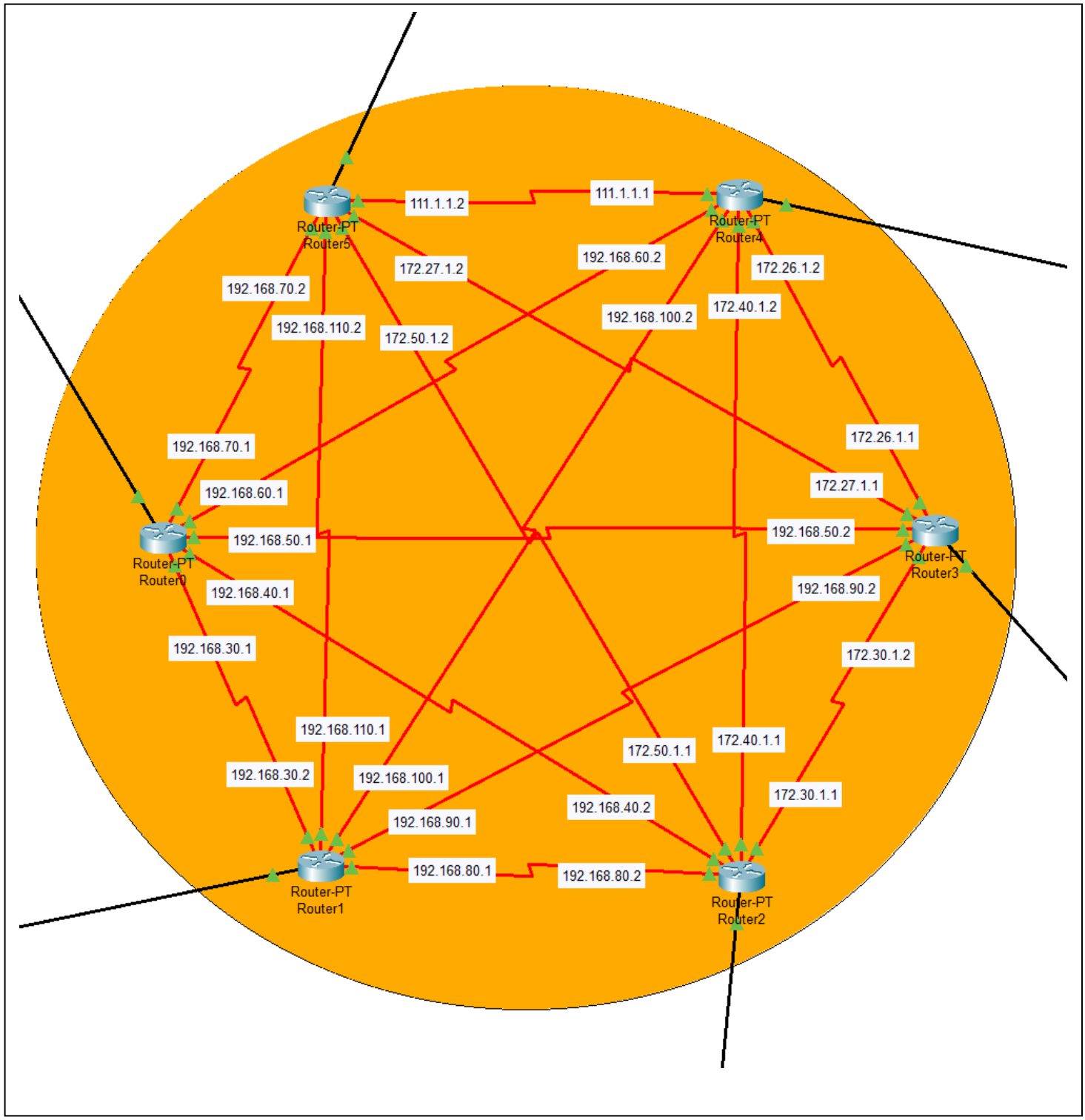

172.25.0.0
PC-PT
PC2
WRT300N
Ground Router(R3)
ssid: Ground
pass: 1245678903
2960-24TT
Switch3
PC-PT
PC25(1)
PC-PT
PC26(1)
PC-PT
PC27(1)
WRT300N
Lab Router01(R3)
Laptop-PT
Laptop9(1)
Lab2
2960-24TT
Switch12(1)
WRT300N
Lab Router02(R3)
Laptop-PT
Laptop10(1)
PC-PT
PC30(1)
PC-PT
PC29(1)
PC-PT
PC28(1)
Lab1
Labs
WRT300N
Classroom Router1(R3)
2960-24TT
Switch10(1)(1)
WRT300N
Classroom Router2(R3)
PC-PT
PC21(1)(1)
PC-PT
PC22(1)(1)
Laptop-PT
Laptop6(1)(1)
Laptop-PT
Laptop7(1)(1)
Room1
Room2
Classroom
Campus-4

Fig: Router Mesh Routing



Design issues:

Number of hosts of the Networks:

Server

Class	Network IP	Range	Number
C	192.168.10.0	192.168.10.1 - 192.168.10.20	20
C	192.168.20.0	192.168.20.1 - 192.168.20.20	20
B	172.26.0.0	172.20.10.1 - 172.20.10.20	20
B	172.26.0.0	172.25.10.1 - 172.25.10.20	20
A	110.0.0.0	110.10.10.1 - 110.10.10.20	20
A	120.0.0.0	120.10.10.1 - 120.10.10.20	20

Router

Class	Network IP	Range	Number
C	192.168.10.0	192.168.10.21 - 192.168.10.50	30
C	192.168.20.0	192.168.20.21 - 192.168.20.50	30
B	172.26.0.0	172.20.10.21 - 172.20.10.50	30
B	172.26.0.0	172.25.10.21 - 172.25.10.50	30
A	110.0.0.0	110.10.10.21 - 110.10.10.50	30
A	120.0.0.0	120.10.10.21 - 120.10.10.50	30

Hosts

Class	Network IP	Range	Number
A	192.168.10.0	192.168.10.51 - 192.168.10.253	202
A	192.168.20.0	192.168.20.51 - 192.168.20. 253	202
B	172.26.0.0	172.20.10.51 - 172.20.10. 253	202
B	172.26.0.0	172.25.10.51 - 172.25.10. 253	202
C	110.0.0.0	110.10.10.51 - 110.10.10. 253	202
C	120.0.0.0	120.10.10.51 - 120.10.10. 253	202

Lines of codes:

For Router configuration we used this code for **Router-0,**

```
config t
interface fa0/0
ip address 192.168.10.254 255.255.255.0
no shut
do wr

exit
interface se2/0
ip address 192.168.30.1 255.255.255.0
clock rate 64000
no shut
do wr

exit
interface se3/0
ip address 192.168.40.1 255.255.255.0
clock rate 64000
no shut
do wr

exit
interface se4/0
ip address 192.168.50.1 255.255.255.0
clock rate 64000
no shut
do wr

exit
interface se5/0
ip address 192.168.60.1 255.255.255.0
clock rate 64000
no shut
do wr

exit
interface se6/0
ip address 192.168.70.1 255.255.255.0
clock rate 64000
no shut
do wr
```

For Router-1:

```
config t
interface fa0/0
ip address 192.168.20.254 255.255.255.0
no shut
do wr

exit
interface se2/0
ip address 192.168.30.2 255.255.255.0
no shut
do wr

exit
interface se3/0
ip address 192.168.80.1 255.255.255.0
clock rate 64000
no shut
do wr

exit
interface se4/0
ip address 192.168.90.1 255.255.255.0
clock rate 64000
no shut
do wr

exit
interface se5/0
ip address 192.168.100.1 255.255.255.0
clock rate 64000
no shut
do wr

exit
interface se6/0
ip address 192.168.110.1 255.255.255.0
clock rate 64000
no shut
do wr
```

Almost Same procedure for Router 2,3,4,5.

For Configure the Router Table:

R0

router ospf 1
network 192.168.10.0 0.0.0.255 area 1
network 192.168.30.0 0.0.0.255 area 1
network 192.168.40.0 0.0.0.255 area 1
network 192.168.50.0 0.0.0.255 area 1
network 192.168.60.0 0.0.0.255 area 1
network 192.168.70.0 0.0.0.255 area 1

exit

R1

router ospf 2
network 192.168.20.0 0.0.0.255 area 1
network 192.168.80.0 0.0.0.255 area 1
network 192.168.90.0 0.0.0.255 area 1
network 192.168.100.0 0.0.0.255 area 1
network 192.168.110.0 0.0.0.255 area 1
network 192.168.30.0 0.0.0.255 area 1

exit

R2

router ospf 3
network 192.168.90.0 0.0.0.255 area 1
network 192.168.80.0 0.0.0.255 area 1
network 172.20.0.0 0.0.255.255 area 1
network 172.30.0.0 0.0.255.255 area 1
network 172.40.0.0 0.0.255.255 area 1
network 172.50.0.0 0.0.255.255 area 1

exit

R3

router ospf 4
network 172.25.0.0 0.0.255.255 area 1
network 172.26.0.0 0.0.255.255 area 1
network 172.27.0.0 0.0.255.255 area 1
network 172.30.0.0 0.0.255.255 area 1
network 192.168.90.0 0.0.0.255 area 1
network 192.168.50.0 0.0.0.255 area 1

exit

R4

router ospf 5
network 110.0.0.0 0.255.255.255 area 1
network 111.0.0.0 0.255.255.255 area 1
network 192.168.100.0 0.0.0.255 area 1
network 192.168.60.0 0.0.0.255 area 1
network 172.40.0.0 0.0.255.255 area 1
network 172.26.0.0 0.0.255.255 area 1

exit

R5

router ospf 6
network 120.0.0.0 0.255.255.255 area 1
network 111.0.0.0 0.255.255.255 area 1
network 192.168.70.0 0.0.0.255 area 1
network 192.168.110.0 0.0.0.255 area 1
network 172.50.0.0 0.0.255.255 area 1
network 172.27.0.0 0.0.255.255 area 1

exit

Future Plan

This project has proven that a standard network system can be designed with less cost. Although we used the cheapest devices in designing the network, we didn't use the security system of this network that's make it very strong. So, we can use the **firewall** and **backup devices** in this network which can unsure this network a good quality. All networks need many servers for doing their work. In this network, we did not use **all servers** because of cost, so can ensure these. But we used some important servers such as DNS and DHCP. These servers help the network to perform their functions in a smooth way.

Conclusion

In this network design, an integrated network design for universities in the developing countries has been presented. This network design is composed of many sections. We started to explain the design constraints and this network is designed for six campuses where we use DHCP server, DNS server, WEB server. A Student or Faculty can access the network with any Lan or wireless device. An administrative can also do their work through this network.