# EUROPEAN UNIVERSITY OF LEFKE
# Faculty of Engineering
# Department of Computer/Electronics and communication Engineering

# COMP342/EE329 NETWORK DESIGN PROJECT

**PROJECT TITLE**: Faculty building Network design

**SUBMISSION DATE**: 14/6/2022

**GROUP MEMBERS CONTRIBUTION**: **EQUAL CONTRIBUTION**

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## ABSTRACT

The computer network is the physical system that connects computers, other network devices, and the Internet. It's the system that gives a company the processing power and data storage it needs to run smoothly. It's also the infrastructure that enables companies to share information, resources, and collaborate. A computer network is a complex network of wires and switches that connect computers and other devices. They enable the sharing of data and computational power, as well as the exchange of information.

They're used in nearly every aspect of modern life, and they're the foundation for the Internet we have today. Despite the fact that computer networks are getting more complicated and powerful, they still operate on the same principles as they did in the early 1960s. A computer network is the infrastructure that allows computers to communicate with one another. They're the roads that keep our digital lives running smoothly. Computer networks, on the other hand, are complex and time-consuming to set up.


# SECTION A

## 1. INTRODUCTION:

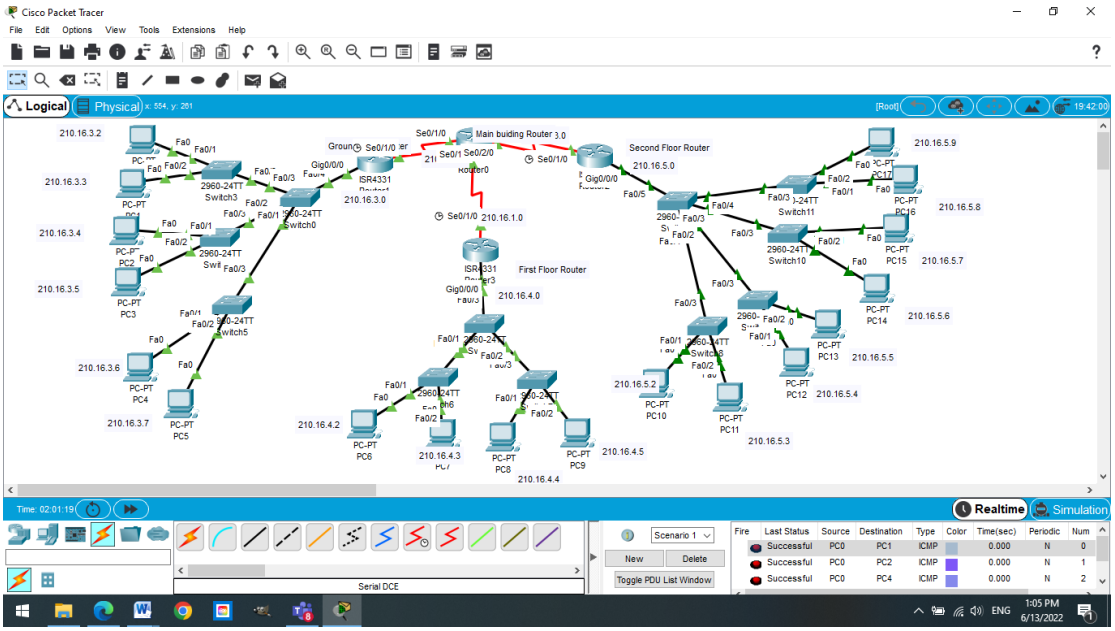
The goal of this project is to develop a network for a university faculty building. A total of 176 people use the faculty, with 60 on the ground floor, 60 on the first floor, and 56 on the second floor. Each floor is around 150 square feet in size and has lab seminar rooms, lecture theaters, laboratories, and staff and administrator offices. Only individuals with special permission will be able to access the network connected to a computer via a cable connection. The internet is a worldwide network of computers that communicate using the Transmission Control Mechanism/Internet Protocol (TCP/IP), a data transfer protocol. TCP/IP is the Internet standard protocol for data transfer between computers connected to the internet. A personal computer or laptop is the most frequent way to connect to the internet. The internet can also be accessible at public libraries, community centers, and schools using a laptop or personal computer. Computer security arose as a result of the growth of computer networks. Computer security protects a computer system from unwanted access by restricting access to certain resources, such as a file or a database. It protects against illegal information disclosure, such as when printing or saving data on disk. Computer security also protects against data and information corruption or damage, unlawful data and information copying, and unauthorized data and information sharing. You can utilize computer networks to help protect yourself and your possessions by encrypting data or securely transmitting it.

## 2. NETWORK DESIGN:

Computer networking, including the design, installation, and maintenance of local area networks (LANs), wide area networks (WANs), and storage area networks (SANs), is the process of connecting all the computers in a single location or over a network. The design

and implementation of computer networks is an integral part of any computer network deployment.

## NETWORK DESIGN

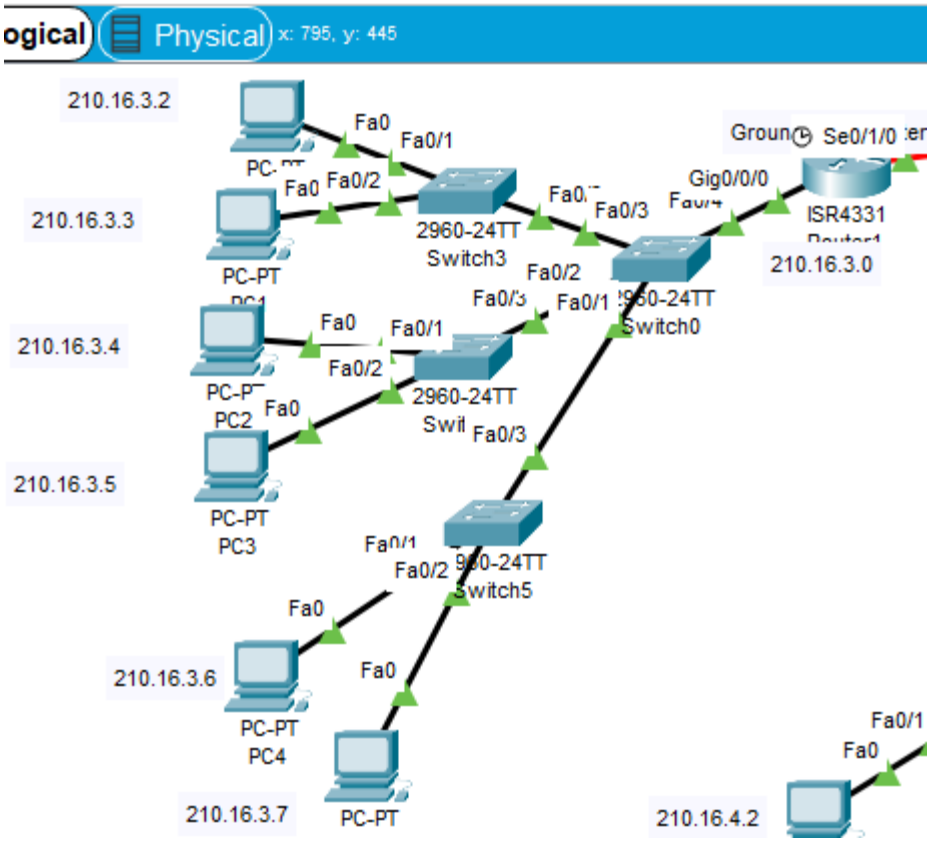



The building is made up of 3 floors:

### Ground floor

In the ground floor, it is divided into 3 work group that are the administration, staff offices and labs, seminar rooms, lecture theater. It requires 60 users on the ground floor. We used a total of 4 switches, 3 in each work group the 4th switch is the main switch that connects all the switches together in the work group and it is connected the the ground floor's router. The number of users are divide below:

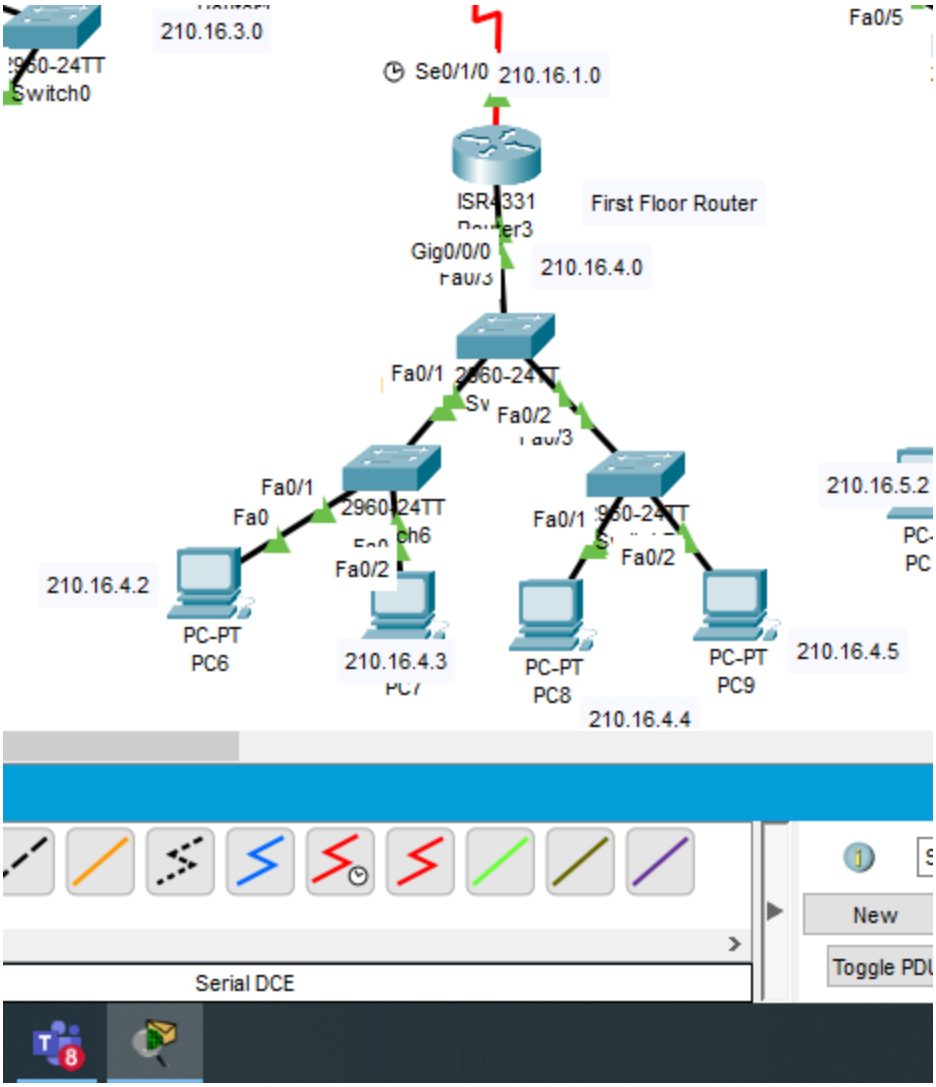
i. Administration office: 7 users
ii. Staff office: 15 users
iii. Labs, seminar room and lecture rooms: 38 users




**First floor**

In the first floor it is made up of 2 work groups that are staff offices and laboratories(MAC, Digital, Research, Project,Micro,games and Multimedia, N/W,Wireless and Cisco). There are a total of 60 users in the first floor. We used a total of 3 switches, 2 in each work group the 3rd switch is the main switch that connects all the switches together int the work group and it is connected to the router on the ground floor. The number of users are divide below:

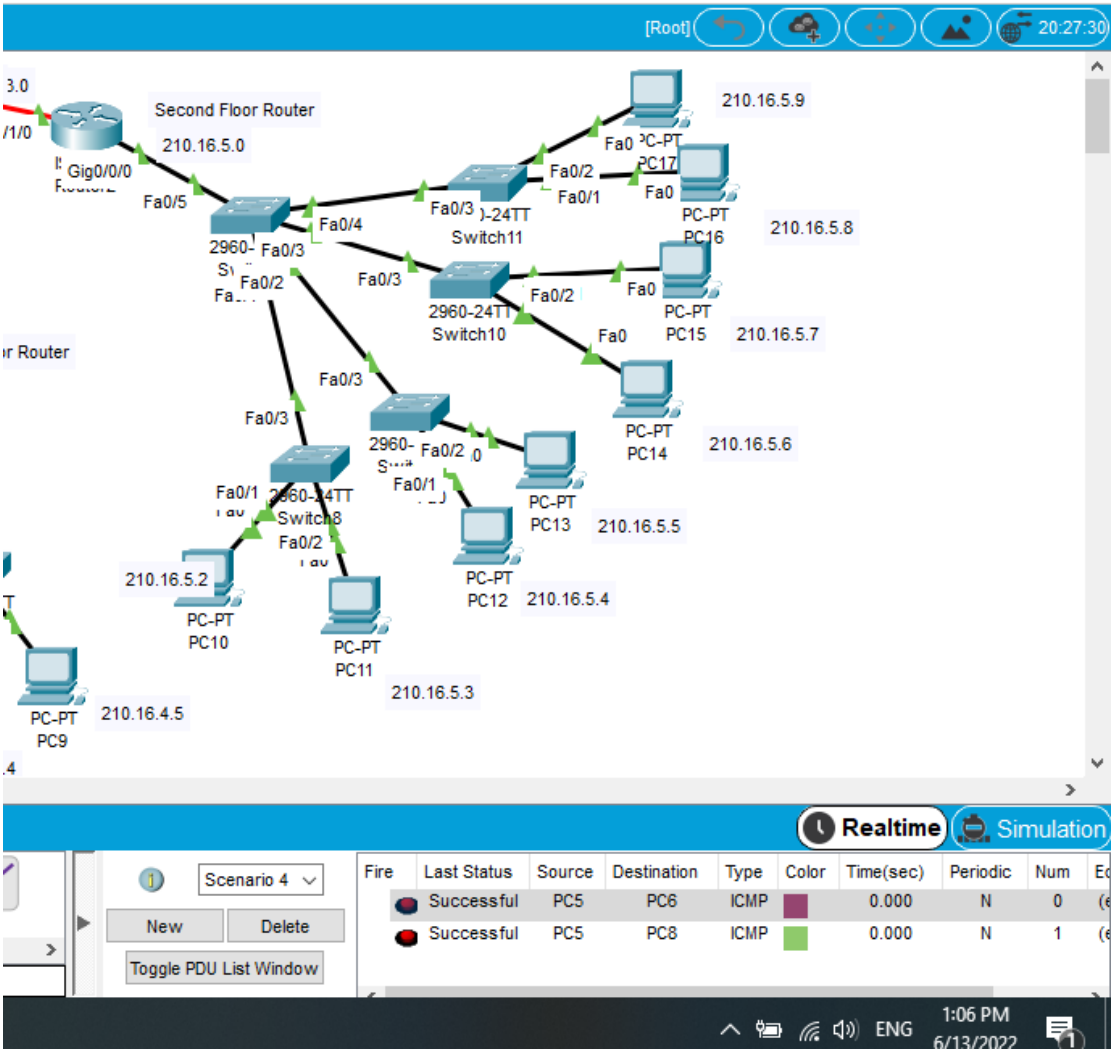
i. Staff office: 28 users
ii. Laboratories: 32 users




**Second floor**

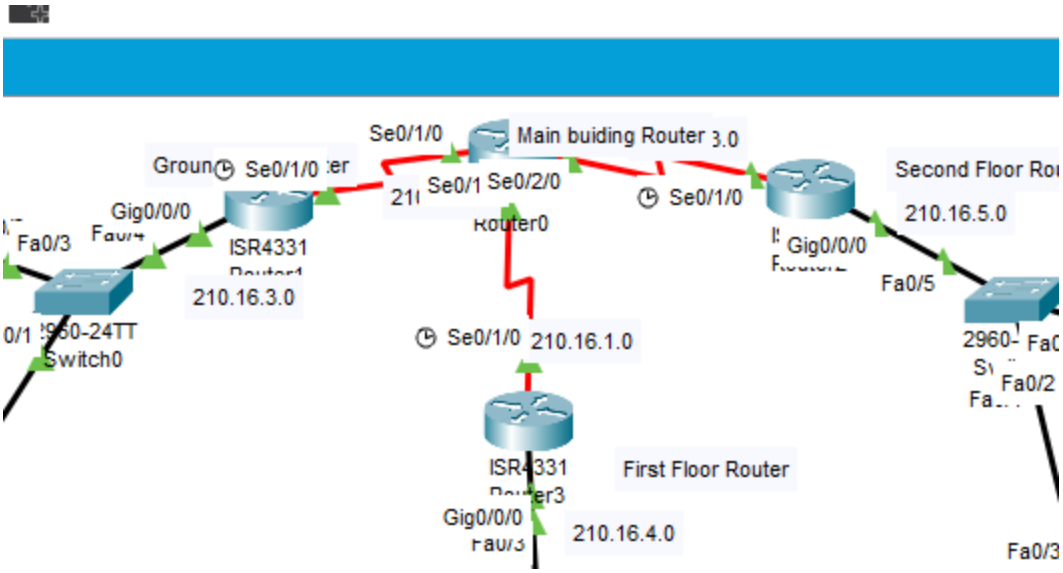
In the second floor, it is made up of Microlabs, seminar room, lecture theater and staff office. There are total of 56 users in the second floor. We used a total of 5 switches, 4 in each work group and the 5th switch is the main switch that connects all the switches together in the work group and it is connected to the second's floor router of the floor.The number of users are divide below:

i. Microlabs: 30 users
ii. Seminar room: 6 users
iii. Lecture theater: 4 users
iv. Staff office: 16 users




We are using 4 routers in total, in the network design of this project. The  main building needs a router to connect to the other 3 routers of each floor in the building.

The diagram is the router for the main building:




## 3. IMPLEMENTATION:

In the making of the simulation project we were able to work with

i. The application CISCO Packet Tracer

ii. 12 switches the model was 29060-24TT

iii. 4 routers, the model was ISR4331 and

iv. 6 subnets

For us to explain the operating principle, it is required for us to first explain the design and explain why each device and kind was picked. The design approach was picked because it best satisfies what we were aiming to achieve while also trying to take the cost constraints into account.

Here's an example of a networked PC on the ground floor connecting to another networked PC. As a result, the data packet must leave its own network and travel over the internet. Data is sent from the computer to the networks that surround it as a result when the data packet arrives at its final destination. The data will then be processed on the internet network in order to assign it to the next router for fresh data from that IP address, which

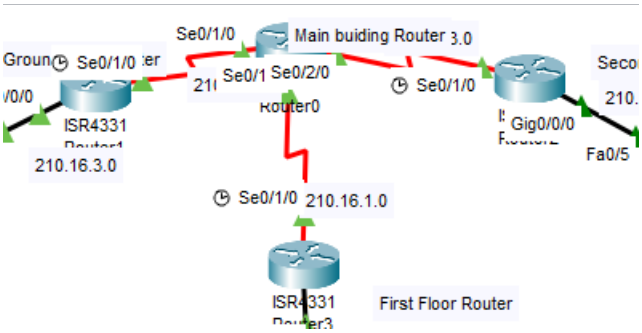
will then find its way to the next network router, and ultimately to the desired target computer.

**The Switches (2960-24TT model ):**

A switch accepts Ethernet connections from network devices and has a lot of ports, for example 0/0/0, 0/0/1, 0/1/1 etc. A switch learns the physical addresses of the devices connected to it, which it subsequently saves as Mac addresses in its database.

In the ground floor 4 Switches were used, 3 for each of the work group (the administrations; staff offices and Labs, seminar room and lecture rooms). The 4th switch was used the connect all the 3 switches into the router.
In the first floor 3 switches were used, 2 for each work group(Staff office and Laboratories). The 3rd switch was used to connect all the 2 switches into the router,
In the second floor 5 switches were used, 4 for each of the work group (Microlabs, Seminar room, Lecture theater and Staff office) and the 5th switch was used to connect the all 4 switches into the router.
There reason for connecting the switches together is so it will enhance its effectiveness.

**The Router (ISR4331 model):**




From the router, a data packet is received. The router examines the data to determine whether it has an IP address and whether it was meant for its own network or for another. It receives it, despite the fact that it is no longer intended for its own network. It forwards the data to a different network. A router can also be used as a network gateway in some cases.

We used an original router (Router-PT) with three serial ports to collect all of the routers for adaptability and a good connection across the networks, and we used a router in each of the floors that is the ground floor, the first floor and the second floor and another one(main building router) connecting all the routers in the building.

## RIP Configuration of all the floors:

**Ground floor**

Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface GigabitEthernet0/0/0
Router(config-if)#no shutdown
Router(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0/0, changed state to up
ip address 210.16.3.1 255.255.255.0
Router(config-if)#ip address 210.16.3.1 255.255.255.0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/1/0
Router(config-if)#no shutdown
Router(config-if)#ip address 210.16.0.1 255.255.255.0
Router(config-if)#ip address 210.16.0.1 255.255.255.0
Router(config-if)#
%LINK-5-CHANGED: Interface Serial0/1/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1/0, changed state to up
Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router rip
Router(config-router)#no network 210.16.6.0
Router(config-router)#no network 210.16.7.0
Router(config-router)#no network 210.16.8.0
Router(config-router)#no network 210.16.9.0
Router(config-router)#no network 210.16.10.0
Router(config-router)#no network 210.16.11.0
Router(config-router)#no network 210.16.12.0
Router(config-router)#no network 210.16.13.0
Router(config-router)#no network 210.16.14.0
Router(config-router)#
Router con0 is now available

**First Floor**

Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface GigabitEthernet0/0/0
Router(config-if)#no shutdown
Router(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0/0, changed state to up
ip address 210.16.4.1 255.255.255.0
Router(config-if)#ip address 210.16.4.1 255.255.255.0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/1/0
Router(config-if)#no shutdown
Router(config-if)#ip address 210.16.1.1 255.255.255.0
Router(config-if)#ip address 210.16.1.1 255.255.255.0
Router(config-if)#
%LINK-5-CHANGED: Interface Serial0/1/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1/0, changed state to up
Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router rip
Router(config-router)#no network 210.16.6.0
Router(config-router)#no network 210.16.7.0
Router(config-router)#no network 210.16.8.0
Router(config-router)#no network 210.16.9.0
Router(config-router)#no network 210.16.10.0
Router(config-router)#no network 210.16.11.0
Router(config-router)#no network 210.16.12.0
Router(config-router)#no network 210.16.13.0
Router(config-router)#no network 210.16.14.0
Router(config-router)#
Router con0 is now available

Press RETURN to get started.

**Second Floor**

Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface GigabitEthernet0/0/0
Router(config-if)#no shutdown
Router(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0/0, changed state to up
ip address 210.16.5.1 255.255.255.0
Router(config-if)#ip address 210.16.5.1 255.255.255.0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/1/0
Router(config-if)#no shutdown
Router(config-if)#ip address 210.16.2.1 255.255.255.0
Router(config-if)#ip address 210.16.2.1 255.255.255.0
Router(config-if)#
%LINK-5-CHANGED: Interface Serial0/1/0, changed state to up

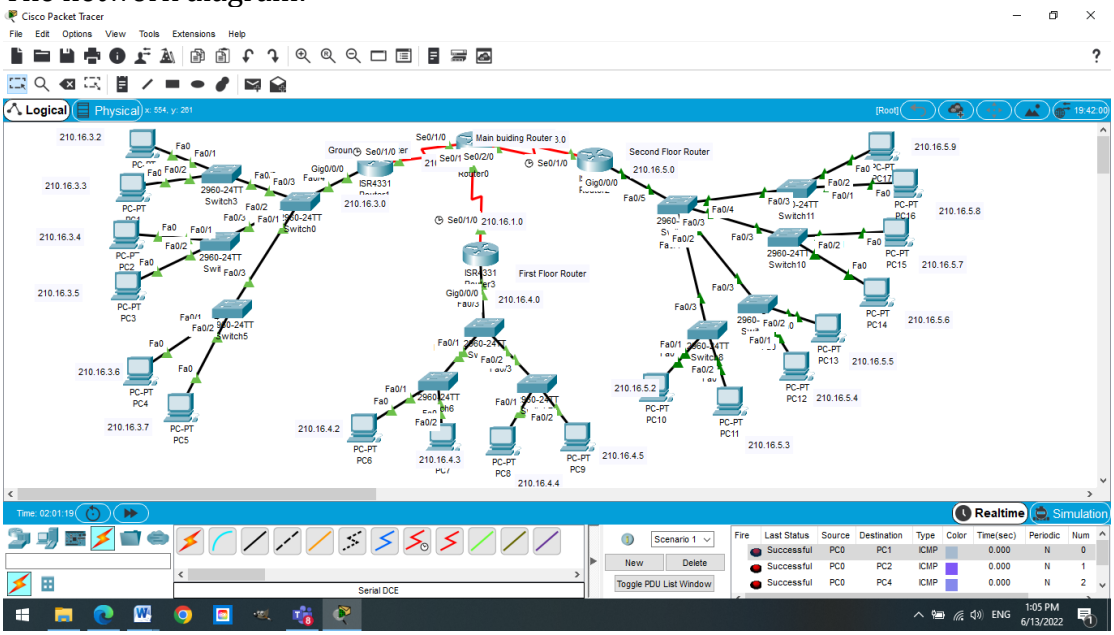
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1/0, changed state to up
Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router rip
Router(config-router)#no network 210.16.6.0
Router(config-router)#no network 210.16.7.0
Router(config-router)#no network 210.16.8.0
Router(config-router)#no network 210.16.9.0
Router(config-router)#no network 210.16.10.0
Router(config-router)#no network 210.16.11.0
Router(config-router)#no network 210.16.12.0
Router(config-router)#no network 210.16.13.0
Router(config-router)#no network 210.16.14.0
Router(config-router)#
Router con0 is now available
Press RETURN to get started.

**Main Building**

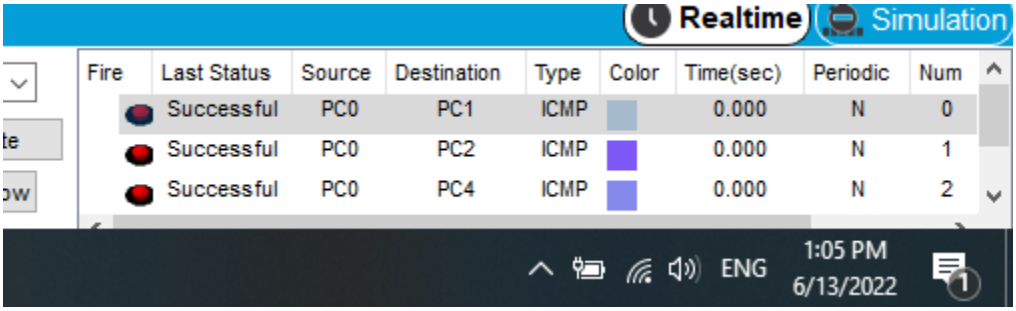
Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router rip
Router(config-router)#no network 210.16.6.0
Router(config-router)#no network 210.16.7.0
Router(config-router)#no network 210.16.8.0
Router(config-router)#no network 210.16.9.0
Router(config-router)#no network 210.16.10.0
Router(config-router)#no network 210.16.11.0
Router(config-router)#no network 210.16.12.0
Router(config-router)#no network 210.16.13.0
Router(config-router)#no network 210.16.14.0
Router(config-router)#
Router con0 is now available
Press RETURN to get started.

## 4. Discussion of the findings

The network diagram:



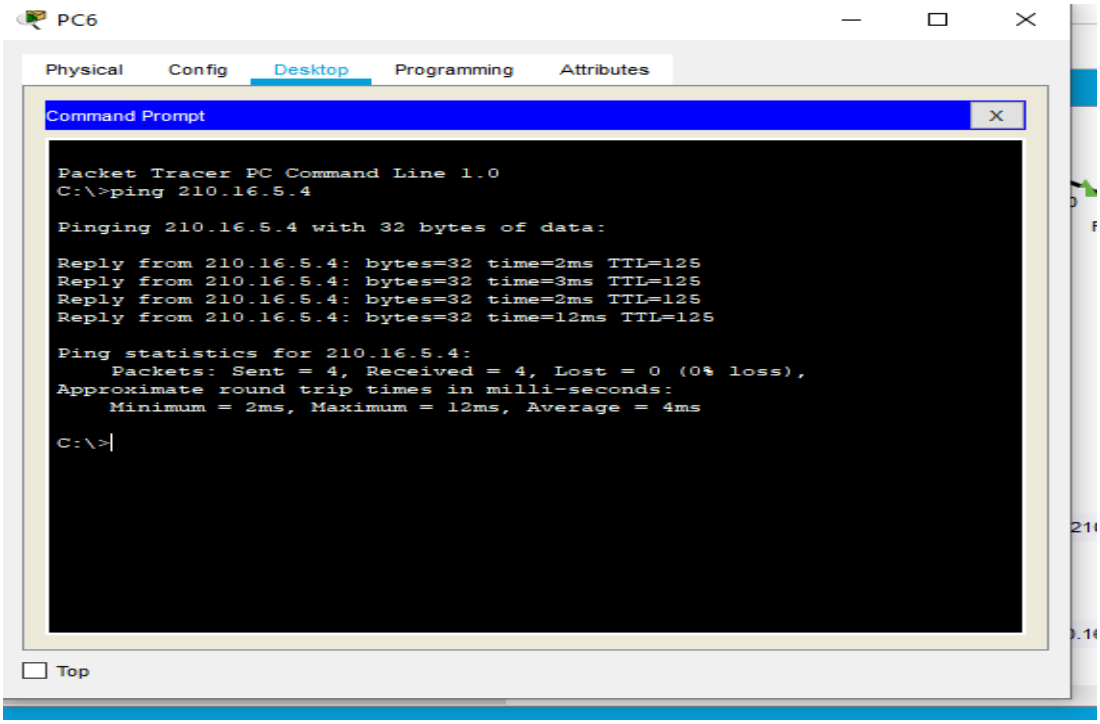
The main building router connects all routers on the three floors, as you can see in the screenshot above. To connect all of the floors to the main building's router, you must first assign IP addresses from the same network subnet, and then enable routing on each accessible router in the network.



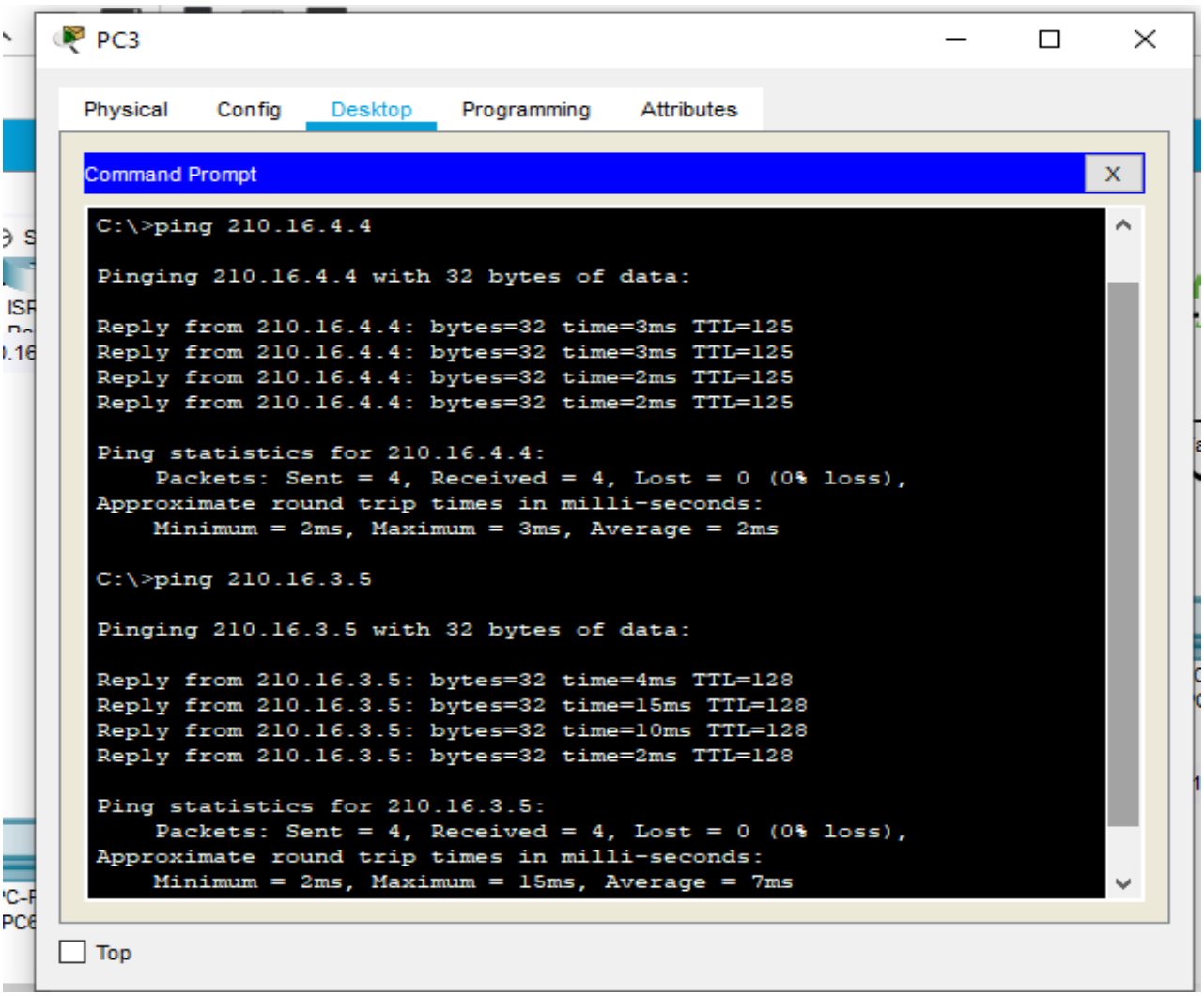

In the same network communication, packets are transferred from the source to the destination by knowing the destination's IP and MAC addresses as shown :

- The PC0 uses the network identifier to calculate the path to travel in order to reach the destination host, which is the PC1, and the ICMP has identified the packet as having arrived successfully at the PC1.
- The packet was also successfully delivered to the host PC2 by the source host PC0.
- The other source host, PC0, was successfully connected to the host PC4.

Ping of 210.16.5.4




Ping from of 210.16.4.4




## SECTION B

### 5. USER REQUIREMENTS:

**INTERACTIVITY:** The network will pay special attention to a computer's capacity to respond to human input as well as the system's response time. Remote device access, such as the internet, touch screen, keyboard, and reaction time, are likely to be linked to interactivity. Students and administrators can engage with the system and receive prompt responses when conducting tasks such as online registration and grading when using this network. A computer network interaction is a communication or interaction between a person and a computer or group of computers across a computer network. A local area network (LAN) or a wide area network (WAN) are two types of computer networks (WAN). In businesses and at home, computer networks are commonly used to connect personal computers and servers. Interactivity is the ability to communicate with a computer, the internet, or another person in a two-way manner. When you ask a question on a website, for example, you can get an almost instantaneous response. You will receive an answer or links to an answer if you ask an inquiry on Yahoo or Google. You get an answer when you ask a question on Facebook or Twitter.

**RELIABILITY:** This network's availability is equivalent with its reliability from the user's perspective. Users must have continuous access to the network system, regardless of when they want to use it, and the level of service they receive must be consistent. The architecture of this network is designed to give consumers entire confidence in it. The dependability of computer networks is influenced by a variety of factors. The design of a network is one of the most significant components of it. The network could become exceedingly unstable if the design is done incorrectly. Another aspect of dependability is the ability to detect and diagnose potential network faults. In computer network architecture, dependability refers to a computer network's ability to provide services as intended or to resume operation after an interruption. The capacity of a network to offer services after a failure is frequently measured in terms of reliability. Many factors influence the stability of a computer network, including the number of network elements and how quickly they may be brought back up.

**ADAPTABILITY**: This could be linked to a process in which an interactive system (adaptive system) adapts its behavior to meet the demands of individual users based on the data it collects. Customers will soon be uninterested with where servers are situated as long as they can access the services they require, as they become increasingly dependant on the network as they use it more. Users will be able to receive and send data from a number of flows over our network, for example. The ability to adapt is critical in network and system design. Scalability, availability, robustness, and security are just a few of the issues it addresses. It requires a high degree of communication as well as a thorough awareness of how activities should be accomplished in general. It's difficult to imagine a computer network that can adapt to changing demands. Continuous network tuning to maximize the network's performance in interacting, receiving, storing, and retrieving

information at any time is physically and emotionally draining, and it necessitates constant vigilance.

**SECURITY**: A network system's security is crucial since it helps to reduce the risk of data theft and sabotage. From the user's perspective, security is essential, and it should protect the user's data as well as access to user and system resources. In this project, we present a comprehensive approach to computer network security that makes use of the growing integration of distributed systems and cloud technologies to enhance computer and communication security. To increase the security of computer, device, and data connections on communications networks, we illustrate how classic computer network security approaches are being complemented with technologies from distributed systems, cloud computing, and the social and behavioral sciences. The benefits of combining these technologies include increased security, more comprehensive and targeted protection, and network resiliency. While the study focuses on computer network security, the methodology can be used to examine other aspects of security. When building a computer network, there are various security factors to keep in mind. One component is selecting appropriate technologies like as firewalls, intrusion detection systems, and antivirus software. Another factor to evaluate is whether the security methods are future-proof and resistant to known security flaws. Physical access integrity must also be considered.

Computer networks are the nervous system of a business. They connect people, systems, and devices together to provide a platform for information and communication. They can also be used to protect information and assets and prevent unauthorized access. Computer networks are used to connect computers and other devices together. They are the systems that allow employees to connect to their computers, email, and the internet. They are also the systems that hackers use to steal information and make fraudulent purchases. The security of computer networks is therefore of great importance to businesses.

## SECTION C

### 6. APPLICATION REQUIREMENTS

1. List the types of applications currently running on the network
   a.) Student Management application systems

      i. Educational Platform for assignments and projects (*MOODLE*).
      ii. Conference call platform for students and lecturers (*Microsoft teams*)
      iii. Online registration system (*O.I.B.S*).
      iv. Student Discussion Forum.

   b.) Administration Management application systems

i. Pharmaceutical and health response service.
ii. Online results grading and updating platform.
iii. Library managements system.
iv. Discussion platform for students, lecturers and Dean office.

c.) Applications running on student machines and laboratories
   a. Adjustable Laboratory time table scheduler.
   b. Research and experimental channel platform.
   c. University store to purchase necessary lab equipments.
   d. Integrated development programs for lab session. (*Matlab, Visual studios e.t.c*).
   e. Updated Channel for Lab manual booklets for various Labs.
   f. Announcements board for various students.
   g. Instructions and precaution guide for newly registered students.

## CONCLUSION

Finally, networks are incredibly vital in today's technology environment. Networks are incredibly significant in today's technology environment. Without the utilization of a network, universities, families, businesses, and other groups would be unable to efficiently interact and exchange data.
We planned and built a network for a university faculty to improve communication, and we conducted the necessary testing. The project was effectively finished with no flaws.

## REFERENCES

https://youtu.be/E-S0NP-650M

https://youtu.be/zMSKL1qYFIw

https://youtu.be/zMSKL1qYFIw

https://youtu.be/7nQgADDQlfw

https://youtu.be/Vh2wkgirFjg

https://youtu.be/eH_beOsgdeI

https://youtu.be/S0Gdz87g2Bc

https://youtu.be/HmtxH5UlIS8