Computer Networks
Case Study
Digital Payment Platform

Mathan Karthick - CB.EN.U4CSE19130

The aim of this case study is to analyze the different types of networks used in a digital payment platform such as Gpay, PhonePe etc. This case study would help us in understanding different types of network infrastructure used in real-world scenarios.
For this case study we have assumed 3 teams, which are : Software Team, Finance Team and Operations Team

Operations Team: This team deals with customer complaints. It also helps in the day to day requirements of the firm. This team requires 10 computers on the network. (Mathan)

Client- Server Configurations:

Operations Team:

Client

Server

IBM Cloud Hosting

Configuration:

Intel Xeon E3-1270 v6

4 Cores, 3.80 GHz

16 GB RAM

1 x 1 TB HDD

CentOS

20 TB bandwidth*

Client- Server Operations :

1. Reads all the feedback given by clients
2. Client - Server chat application.

Client-Server Code:

Mathan - Operations Team

Server Code:

```
import socket
import threading
import random
import string
import pandas as pd
import numpy as np
df1 = pd.DataFrame(pd.read_csv("case_study.csv"))
df1.set_index(['Customer_ID','Name',"Feedback"])

l=[]


def insert(clientsocket,df_df):
    data=[]
    message1="Enter Customer ID"
    clientsocket.send(message1.encode())
    id= clientsocket.recv(1024).decode()
    data.append(id)
    message1="Enter Name"
    clientsocket.send(message1.encode())
    cname= clientsocket.recv(1024).decode()
    data.append(cname)
```

```
    message1 = "Enter Feedback"
    clientsocket.send(message1.encode())
    cp = clientsocket.recv(1024).decode()
    data.append(cp)
    l=len(df_df)
    df_df.loc[l] = data
    j = df_df.to_string()
    clientsocket.send(j.encode())
    df1.to_csv('case_study.csv', index=False)

def chat(clientsocket):
    name = "Assistant"
    clientsocket.send(name.encode())
    s_name = clientsocket.recv(1024).decode()
    print(s_name, "has connected to the chat room\nEnter // to exit chat
room\n")

    while True:
        message = input(str("Me : "))
        if message == "//":
            message = "Left chat room!"
            clientsocket.send(message.encode())
            print("\n")
            break
        clientsocket.send(message.encode())
        message = clientsocket.recv(1024)
```

```
        message = message.decode()
        print(s_name, ":", message)

def on_new_client(clientsocket,addr,host,df1):
    msg = clientsocket.recv(1024).decode()
    print(msg," connected")
    message="Enter options\n-------------\n1.Feedback\n2.Chat with
server"
    clientsocket.send(message.encode())
    msg1 = clientsocket.recv(1024).decode()
    i =int(msg1)
    if i == 1:
        insert(clientsocket,df1)
    elif i == 2:
        chat(clientsocket)
    else:
        a="Trouble in server! Please try again later!"
        clientsocket.send(message.encode())

    clientsocket.close()


s = socket.socket()         # Create a socket object
host = socket.gethostname() # Get local machine name
port = 5001                 # Reserve a port for your service.
print('Server started!')
```

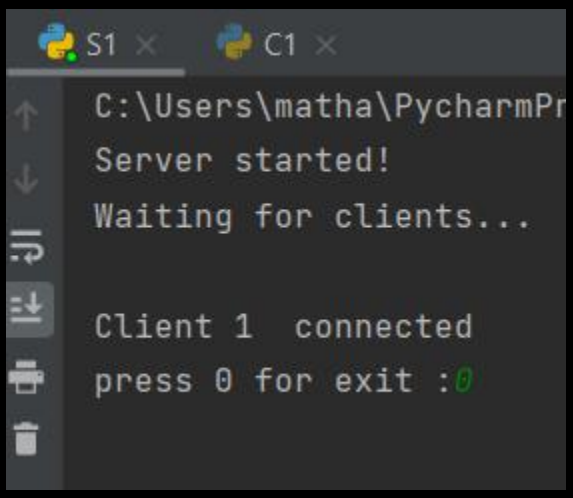
```
print('Waiting for clients...\n')

s.bind((host, port))        # Bind to the port
s.listen(5)
j=True

while j:
   c,addr = s.accept()  # Establish connection with client.
   t = threading.Thread(target=on_new_client, args=(c, addr, host,df1))  #
df[0:5] ########
   t.start()
   t.join()
   e=input("press 0 for exit :")
   if e==0:
       j=False
   else:
       pass

s.close()
```

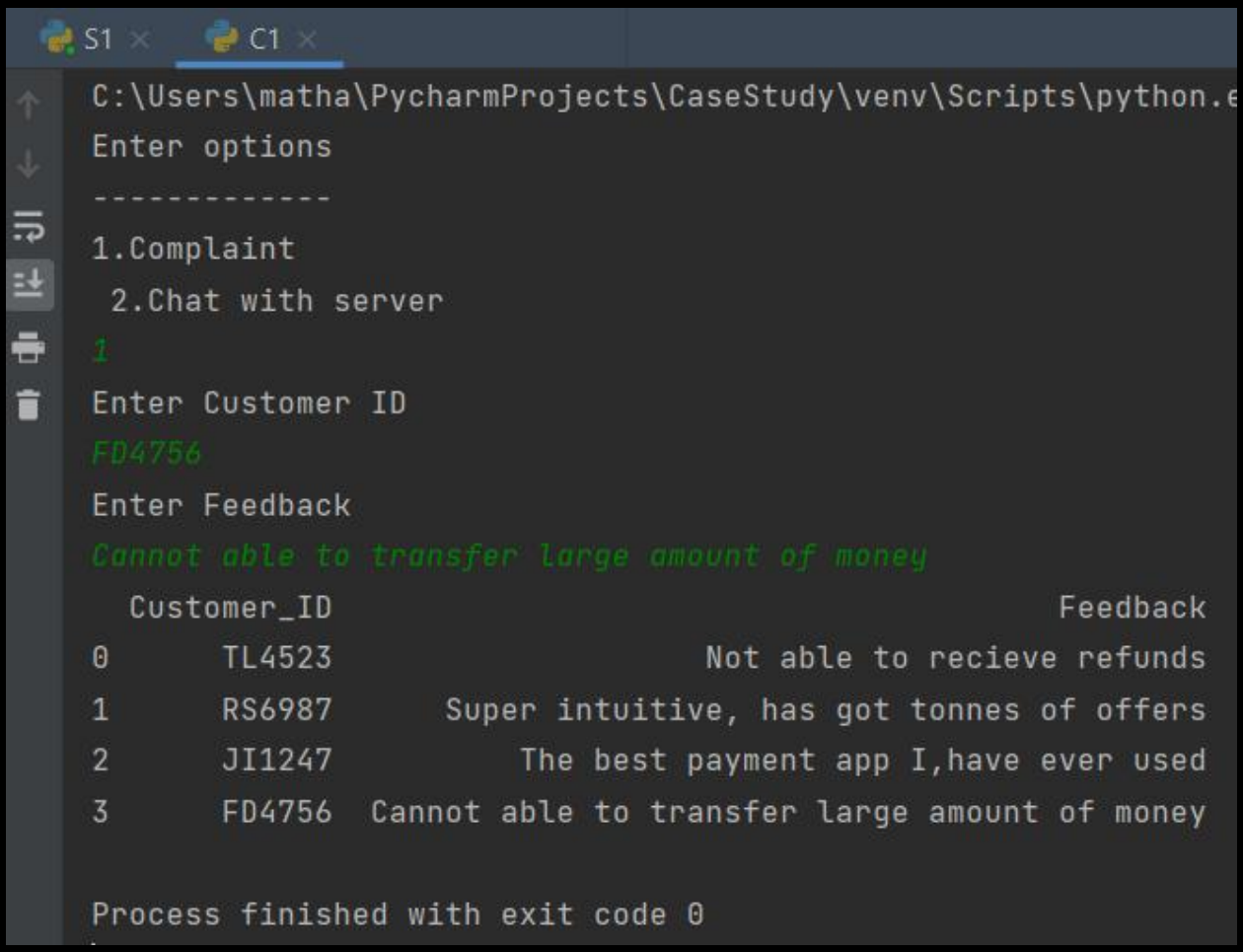
Client Code:

```
import socket
import threading

s = socket.socket()
host = socket.gethostname()
port = 5001

s.connect((host, port))
s.send(bytes("Client 1","utf-8"))

print(s.recv(1024).decode())
i = input()
if i=="1":
    s.send(bytes(i, "utf-8"))
    k1 = s.recv(1024).decode()
    print(k1)
    id = input()
    s.send(bytes(id, "utf-8"))
    k1 = s.recv(1024).decode()
    print(k1)
    name = input()
    s.send(bytes(name, "utf-8"))
    k1 = s.recv(1024).decode()
    print(k1)
```

```
    cp = input()
    s.send(bytes(cp, "utf-8"))
    k1 = s.recv(1024).decode()
    print(k1)
elif i=="2":
    s.send(bytes(i, "utf-8"))
    s_name = s.recv(1024).decode()
    name = str(input("Enter name:"))
    s.send(name.encode())

    print(s_name, "has joined the chat room\nEnter // to exit chat room\n")
    while True:
        message = s.recv(1024).decode()
        print(s_name, ":", message)
        message = input(str("Me : "))
        if message == "//":
            message = "Left chat room!"
            s.send(message.encode())
            print("\n")
            break
        s.send(message.encode())
s.close()
```

O/p:


S1
C1
C:\Users\matha\PycharmPr
Server started!
Waiting for clients...
Client 1 connected
press 0 for exit :0


S1
C1
C:\Users\matha\PycharmProjects\CaseStudy\venv\Scripts\python.e
Enter options
1.Complaint
2.Chat with server
1
Enter Customer ID
FD4756
Enter Feedback
Cannot able to transfer large amount of money
Customer_ID Feedback
0 TL4523 Not able to recieve refunds
1 RS6987 Super intuitive, has got tonnes of offers
2 JI1247 The best payment app I,have ever used
3 FD4756 Cannot able to transfer large amount of money
Process finished with exit code 0

```
Server started!
Waiting for clients...

Client 1  connected
Enter name: Mathan
Karthick has connected to the chat room
Enter // to exit chat room

Me : Good Morning, SIr.
Karthick : Good Morning
Me : How can I help you, Sir?
Karthick : I didn't recieve my refund yet. I have done a transction yesterday which failed due to network problems.
Me : Sorry Sir, We will refund your money as soon as possible.
Karthick : Thank you so much. Make it quick!
Me : Sure, Sir! Thank you.
Karthick : Left chat room!
Me : //


press 0 for exit :
```

```
Enter options
-------------
1.Complaint
 2.Chat with server
2
Enter name:Karthick
Mathan has joined the chat room
Enter // to exit chat room

Karthick : Good Morning, SIr.
Me : Good Morning
Karthick : How can I help you, Sir?
Me : I didn't recieve my refund yet. I have done a transction yesterday which failed due to network problems.
Karthick : Sorry Sir, We will refund your money as soon as possible.
Me : Thank you so much. Make it quick!
Karthick : Sure, Sir! Thank you.
Me : //



Process finished with exit code 0
```

Network Performance Parameters

Performance parameters:

Parameter	Meaning	Formula
Bandwidth	Bandwidth is the capacity of a wired or wireless network communications link to transmit the maximum amount of data from one point to another over a computer network or internet connection in a given amount of time	Expressed as bits per second (bps), modern network links have greater capacity, which is typically measured in millions of bits per second (megabits per second, or Mbps) or billions of bits per second (gigabits per second, or Gbps).
Throughput	Throughput measures the percentage of data packets that are successfully being sent; a low throughput means there are a lot of failed or dropped packets that need to be sent again.	
Packet Loss	Packet loss occurs when one or more packets of data travelling across a computer network fail to reach their destination. Due to network congestion	Efficiency = 100% * (transferred - retransmitted) / transferred Network Loss = 100 - Efficiency
Transmission time	The time required for transmission of a message depends on the size of the message and the bandwidth of the channel.	Transmission time = Message size / Bandwidth

Availability	It is also known as uptime, simply measures whether or not the network is currently operational. You can never guarantee 100% availability, but you want to be aware of any downtime that happens on your network that you weren't expecting. It's important to be alerted when the network goes down, which network monitoring tools will provide for you. However, you should also be able to discover your actual uptime percentage and how often your network goes down.	
Connectivity	Connectivity refers to whether or not the connections between the nodes on your network are working properly. If there is an improper or malfunctioning connection on your network, it can be a major hurdle for your company. Ideally, every connection should be operating at peak levels at all times. However, performance issues like malware can target specific nodes or connections to affect performance in that specific area of the network.	
Retransmission	When packets are lost, the network needs to retransmit it to complete a data request. This retransmission rate lets your enterprise know how often packets are being dropped, which is an indication of congestion on your network. You can analyse retransmission delay, or the time it takes for a dropped packet to be retransmitted, to understand	

	how long it takes your network to recover from packet loss.	
Propagation Time	Propagation time measures the time required for a bit to travel from the source to the destination. The propagation time is calculated by dividing the distance by the propagation speed.	Propagation time = Distance / Propagation speed
Processing Delay	Time taken by the processor to process the data packet is called processing delay.	
Queuing Delay	Time spent by the data packet waiting in the queue before it is taken for execution is called queuing delay.	
Jitter	Jitter is defined as the variation in time delay for the data packets sent over a network. This variable represents an identified disruption in the normal sequencing of data packets. Jitter is related to latency, since the jitter manifests itself in increased or uneven latency between data packets, which can disrupt network performance and lead to packet loss and network congestion. Although some level of jitter is to be expected and can usually be tolerated, quantifying network jitter is an important aspect of comprehensive network	Latency = sum of all delays To measure Jitter, we take the difference between samples, then divide by the number of samples (minus 1).

Operations Department:

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Network Topology:

Devices used:

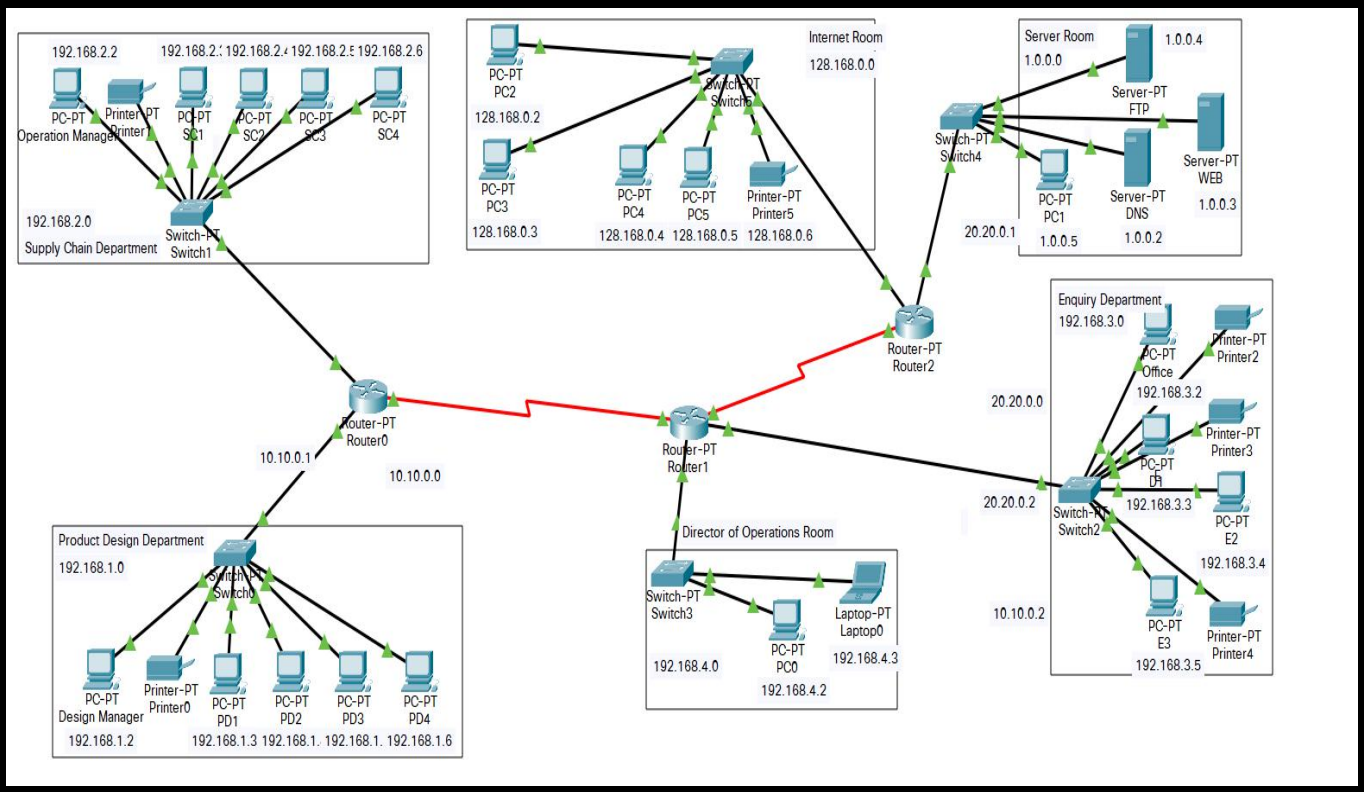
No of PCs & Laptops = 21

No of Printers = 5

No of switches = 6

No of routers = 3

No of servers = 3 (Web Server, FTP Server, DNS Server)



IP Addressing Plan:

Product Design Department (192.168.1.0)

Design Manager	192.168.1.2
PD1	192.168.1.3
PD2	192.168.1.4
PD3	192.168.1.5
PD4	192.168.1.6
Printer0	192.168.1.7

Supply Chain Department(192.168.2.0)

Operations Manager	192.168.2.2
SC1	192.168.2.3
SC2	192.168.2.4
SC3	192.168.2.5
SC4	192.168.2.6
Printer 7	192.168.2.7

Enquiry Department (192.168.3.0)

Office	192.168.3.2
E1	192.168.3.3

E2	192.168.3.4
E3	192.168.3.5
Printer 2	192.168.3.6
Printer 3	192.168.3.7
Printer 4	192.168.3.8

Server Room(1.0.0.0)

DNS Server	1.0.0.2
Web Server	1.0.0.3
FTP Server	1.0.0.4
PC1	1.0.0.5

Internet Room(128.168.0.0)

PC2	128.168.0.2
PC3	128.168.0.3
PC4	128.168.0.4
PC5	128.168.0.5
Printer 5	128.168.0.6

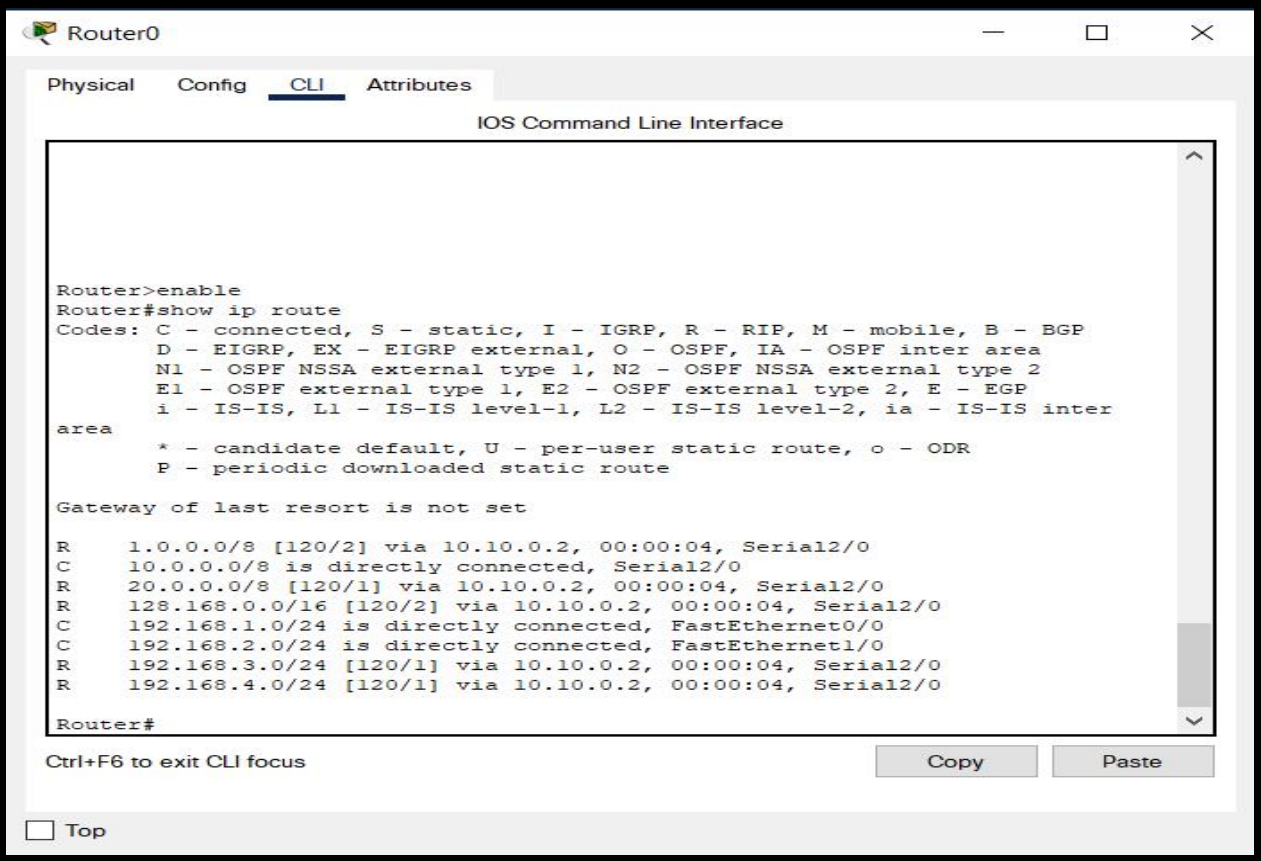
Director of Operations Room(192.168.4.0)

PC0	192.168.4.2
Laptop0	192.168.4.3

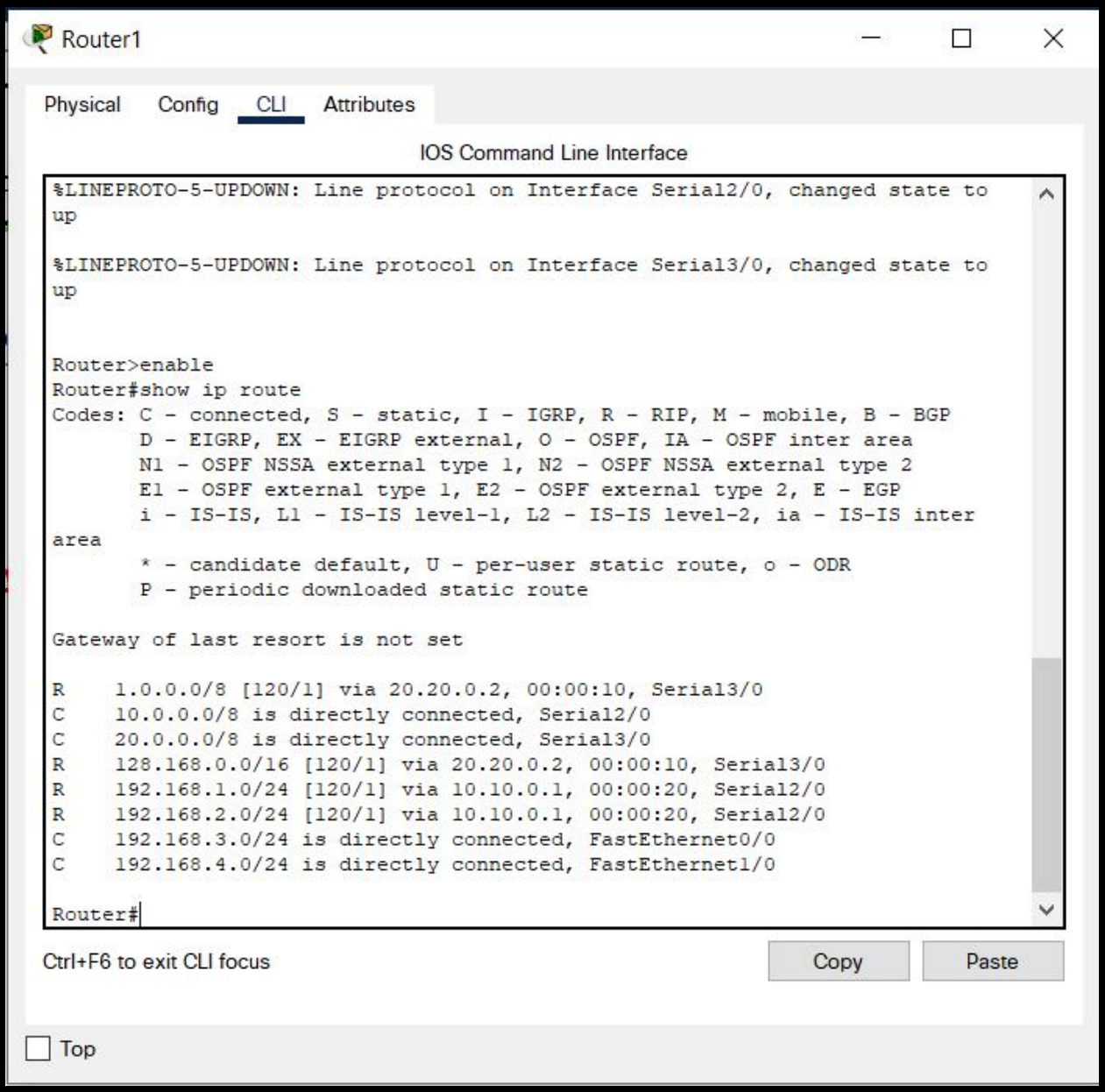
Routing Protocol Plan:

Routing Information Protocol is a dynamic routing protocol which uses hop count as a routing metric to find the best path between the source and the destination network. It is a distance vector routing protocol which has AD value 120 and works on the application layer of OSI model.

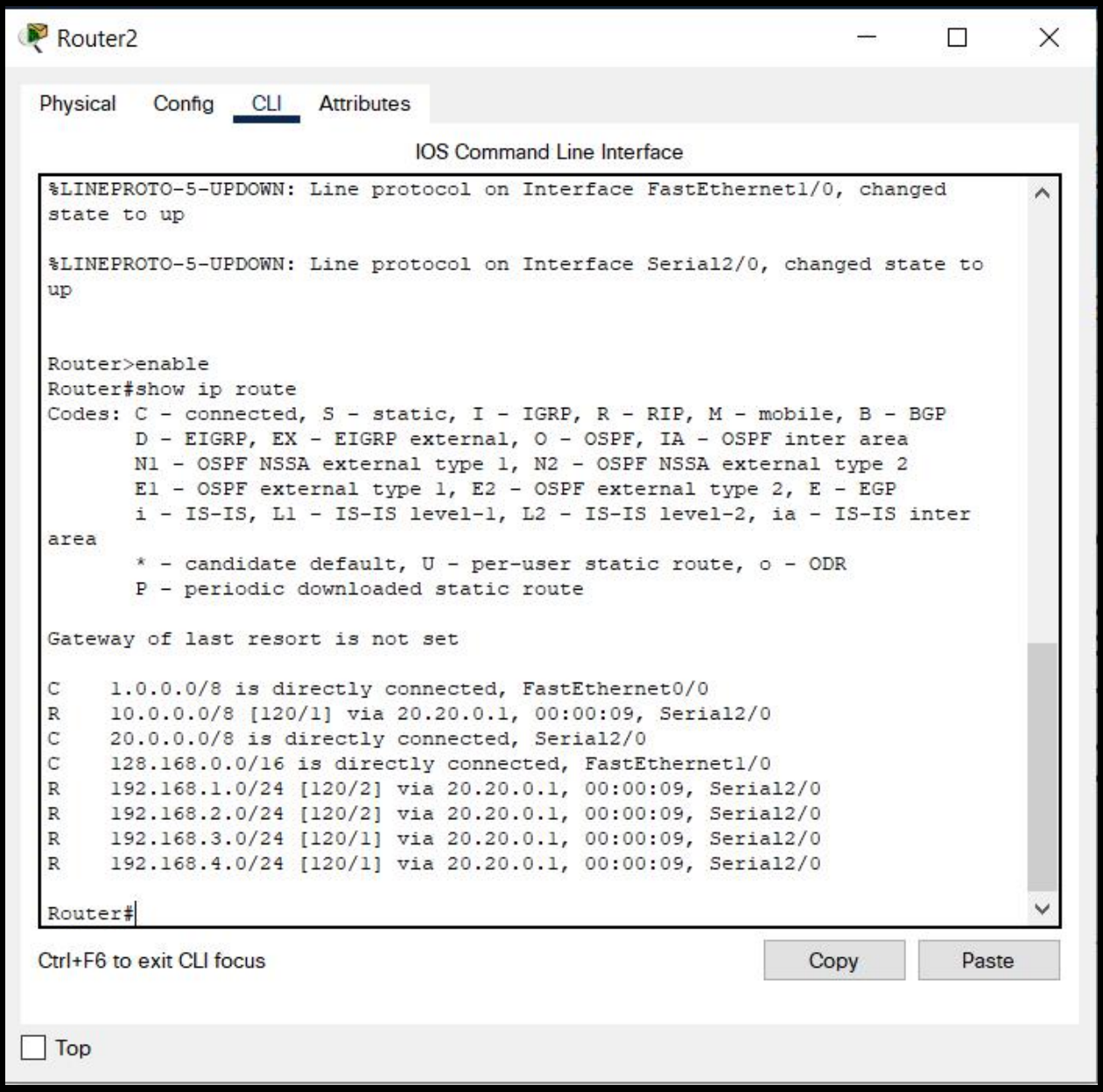
Router 0:



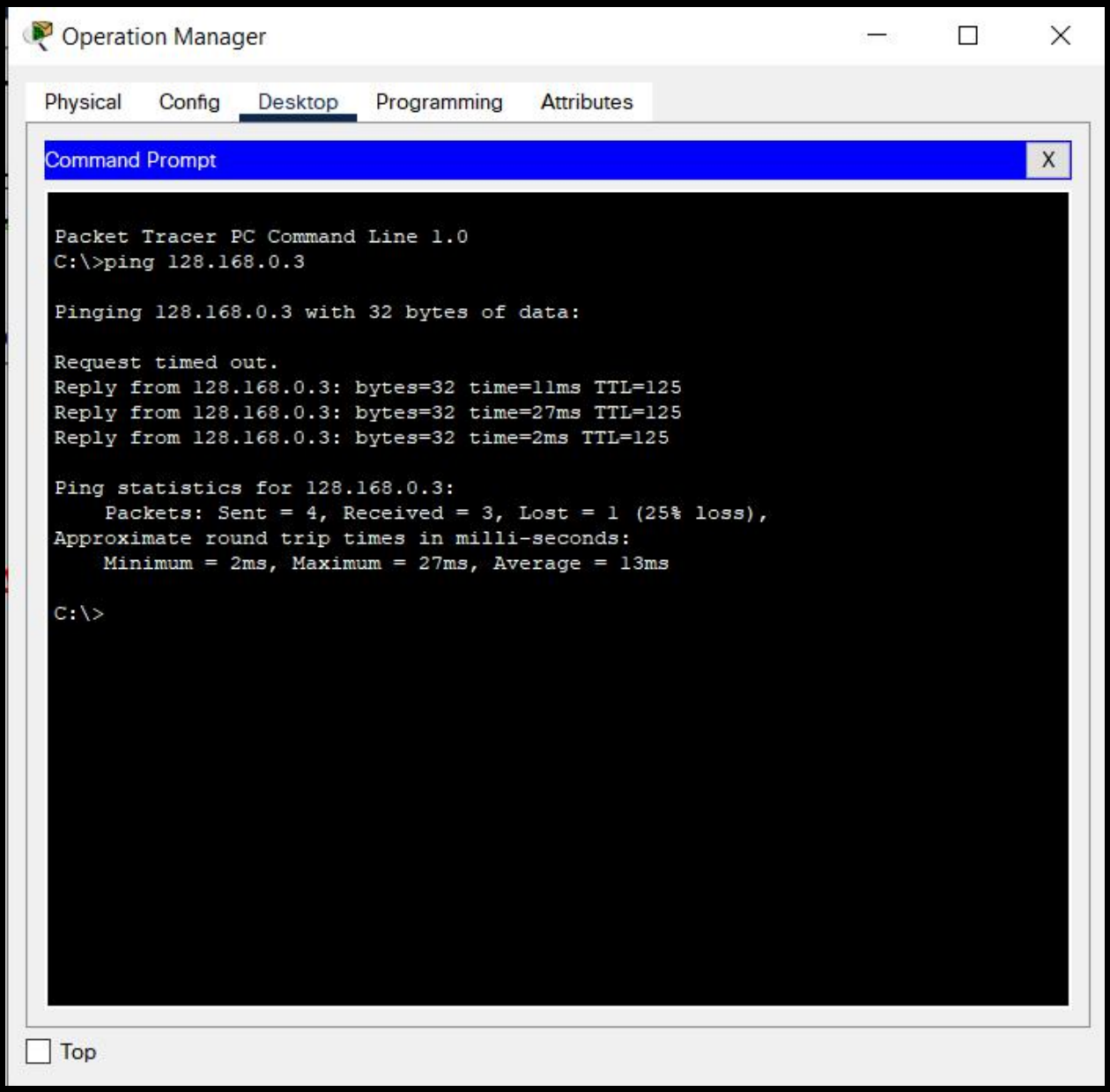
Router 1:


Router1
Physical
Config
CLI
Attributes
IOS Command Line Interface
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial3/0, changed state to up
Router>enable
Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
* - candidate default, U - per-user static route, o - ODR
P - periodic downloaded static route
Gateway of last resort is not set
R 1.0.0.0/8 [120/1] via 20.20.0.2, 00:00:10, Serial3/0
C 10.0.0.0/8 is directly connected, Serial2/0
C 20.0.0.0/8 is directly connected, Serial3/0
R 128.168.0.0/16 [120/1] via 20.20.0.2, 00:00:10, Serial3/0
R 192.168.1.0/24 [120/1] via 10.10.0.1, 00:00:20, Serial2/0
R 192.168.2.0/24 [120/1] via 10.10.0.1, 00:00:20, Serial2/0
C 192.168.3.0/24 is directly connected, FastEthernet0/0
C 192.168.4.0/24 is directly connected, FastEthernet1/0
Router#
Ctrl+F6 to exit CLI focus
Copy
Paste
Top

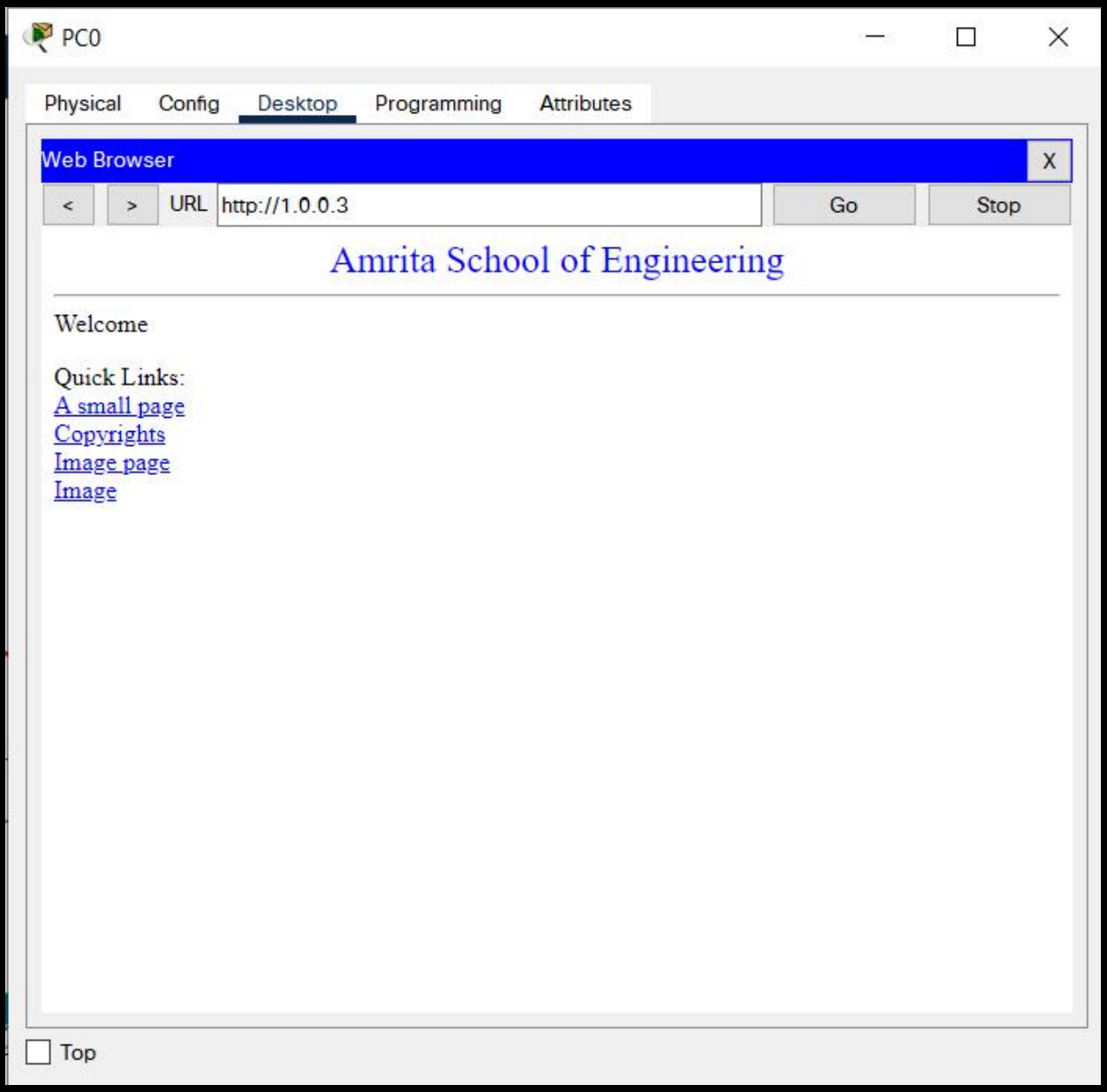
Router 2:


Router2
Physical
Config
CLI
Attributes
IOS Command Line Interface
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet1/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to up
Router>enable
Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
* - candidate default, U - per-user static route, o - ODR
P - periodic downloaded static route
Gateway of last resort is not set
C 1.0.0.0/8 is directly connected, FastEthernet0/0
R 10.0.0.0/8 [120/1] via 20.20.0.1, 00:00:09, Serial2/0
C 20.0.0.0/8 is directly connected, Serial2/0
C 128.168.0.0/16 is directly connected, FastEthernet1/0
R 192.168.1.0/24 [120/2] via 20.20.0.1, 00:00:09, Serial2/0
R 192.168.2.0/24 [120/2] via 20.20.0.1, 00:00:09, Serial2/0
R 192.168.3.0/24 [120/1] via 20.20.0.1, 00:00:09, Serial2/0
R 192.168.4.0/24 [120/1] via 20.20.0.1, 00:00:09, Serial2/0
Router#
Ctrl+F6 to exit CLI focus
Copy
Paste
Top

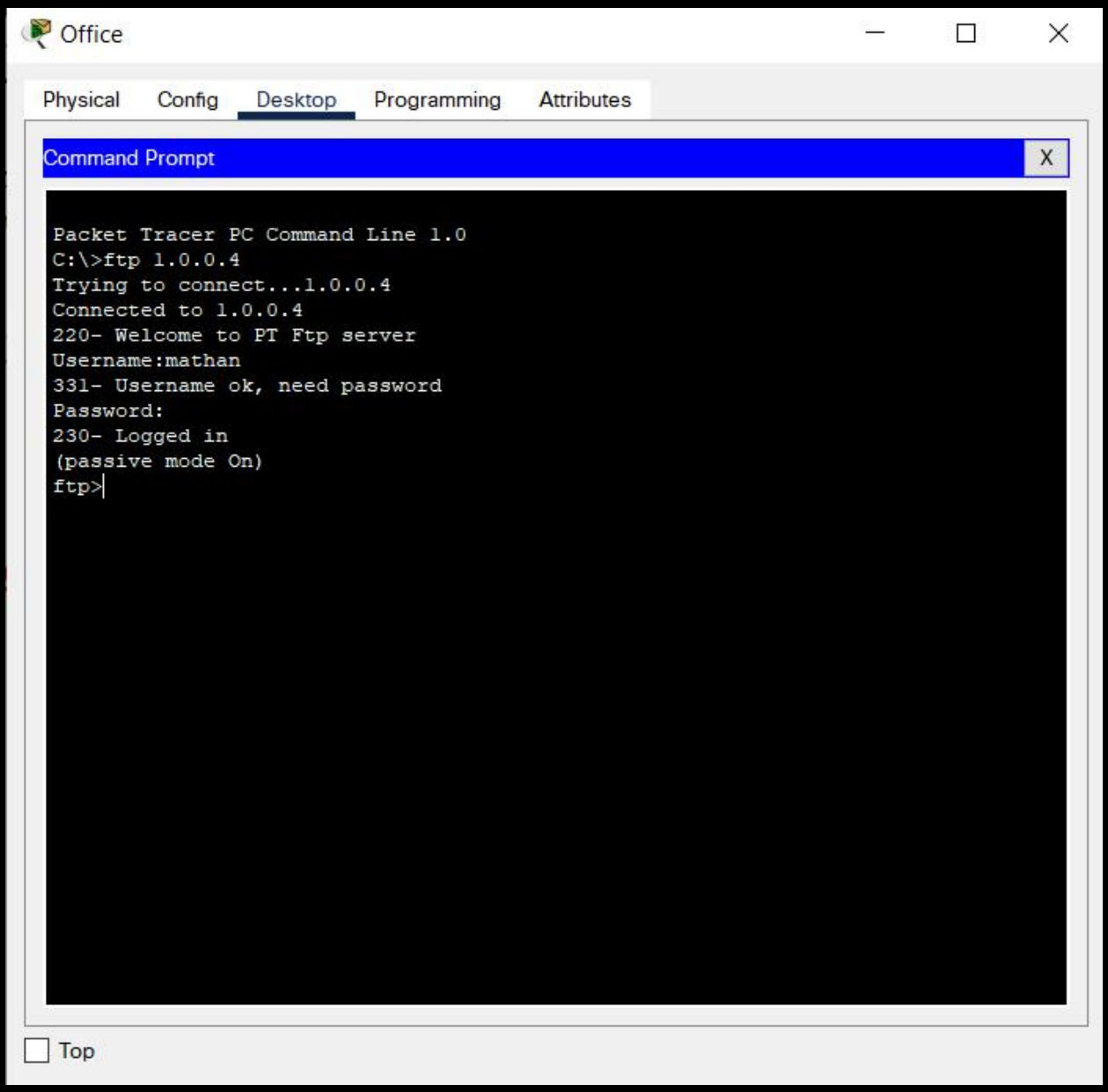
Testing VLAN communication from Supply Chain Department to Internet Room:



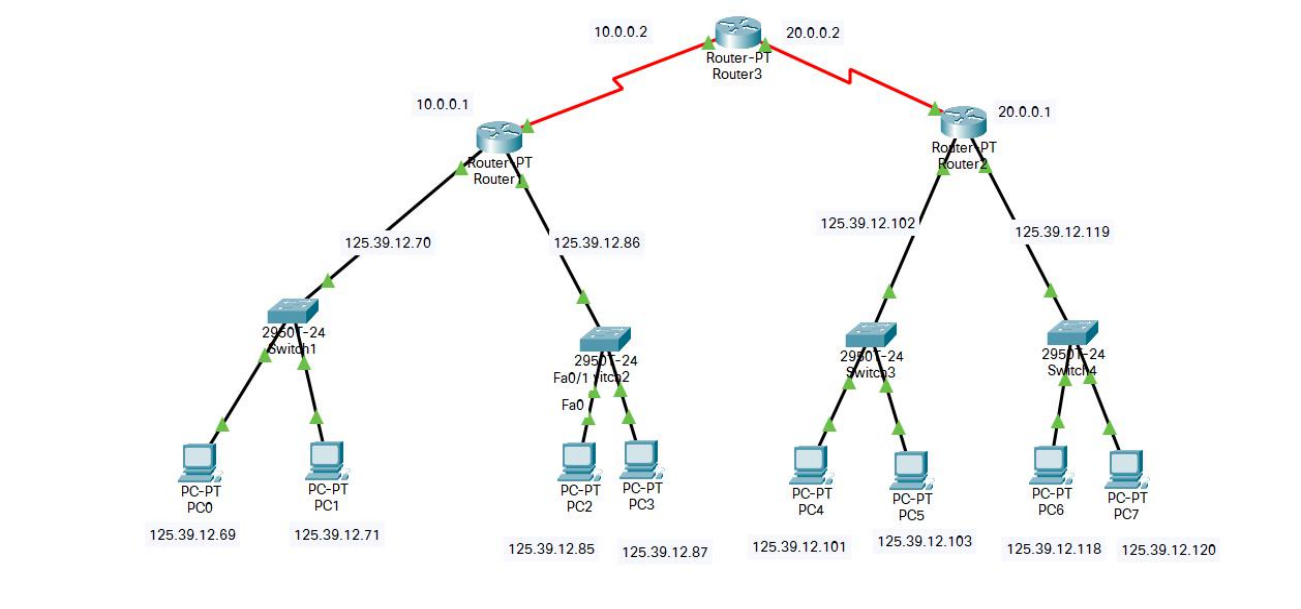
Testing Web Hosting:



Testing FTP Server:



OSPF:



Files attached:

Network-Model(VLAN,RIP,FTP,DNS,WEB) - Main_19130.pkt

OSPF-Model - OSPF_19130.pkt

CLOUD COMPUTING :

Cloud Computing is different styles of computation over internet, or a service running over a remote complex network with high bandwidth and massive storage servers, whose configuration, installation, updation and maintenance is done seamlessly by a third person. A cloud, itself can be seen as a software, a data storage place, a platform (where new applications can be developed) or the whole network. Zheng 2010 suggested that computation is a virtual pool of resources in cloud computing and this virtual pool is accessible through internet for end users. Brian 2008 also suggested a similar idea, that, it is about moving services, computation or

data to an external or internal, location-transparent, centralized facility for business advantage.

CLOUD RELATED TO NETWORKING

The system uses the cloud to manage network devices deployed on-premises at different locations. The solution requires Cisco Meraki cloud-managed devices, which provide full visibility of the network.

Cloud Networking is when all of an organization's networking resources are hosted in the cloud. It can be either public or private, where a company can host. Cloud networking services are unique in relation to customary undertaking network plans. It is an application-based software infrastructure that stores data on services that can be accessed through the internet using various front and back end data storage.

TYPES

We need to identify the type of cloud-managed networking on which our cloud will be implemented. These are different types of cloud networking.

Public Cloud - which provides both services and infrastructure which is shared by all customers.

Private Cloud – which is utilized by a single organization.

Hybrid Cloud - This is a combination of both public and private cloud networks. It allows two platforms to interact for smooth functioning with data stored safely behind the firewalls.

Multi clouds – Multi clouds are a cloud approach made up of more than 1 cloud service, from more than 1 cloud vendor—public or private. All hybrid clouds are multi clouds, but not all multi clouds are hybrid clouds.

Features:

Consistent and explicable configuration

Automatic firmware upgrades

Secure Site-to-Site VPN without previous IPsec knowledge - AutoVPN will automatically build secure IPsec tunnels between them.

Layer 7 traffic visibility – Meraki devices can filter or report traffic on your network based on application level.

Virtual Stacking – All Meraki switches support Virtual Stacking which lets us manage all switch ports as if there were all on a single switch. This rapidly reduces configuration effort.

Intelligent WAN traffic optimisation – Select internet uplink based on the current performance of the line.

Automatic Network Topology Map – Meraki Dashboard builds a dynamic topology map of your networks.

USE OF CLOUD:

Cost

Cloud computing eliminates the capital expense of buying hardware and software and setting up and running on-site data centers—the racks of servers, the round-the-clock electricity for power and cooling, the IT experts for managing the infrastructure. It adds up fast.

Speed

Most cloud computing services are self service and on demand, so even vast amounts of computing resources can be provisioned in minutes, typically with just a few mouse clicks, giving businesses a lot of flexibility and taking the pressure off capacity planning.

Global scale

The benefits of cloud computing services include the ability to scale elastically. In cloud speak, that means delivering the right amount of IT resources—for example, more or less computing power, storage, bandwidth—right when it is needed and from the right geographic location.

Productivity

On-site data centers typically require a lot of "racking and stacking"—hardware setup, software patching, and other time-consuming IT management chores. Cloud computing removes the need for many of these tasks, so IT teams can spend time on achieving more important business goals.

Performance

The biggest cloud computing services run on a worldwide network of secure data centers, which are regularly upgraded to the latest generation of fast and efficient computing hardware. This offers several benefits over a single corporate data center, including reduced network latency for applications and greater economies of scale.

Reliability

Cloud computing makes data backup, disaster recovery and business continuity easier and less expensive because data can be mirrored at multiple redundant sites on the cloud provider's network.

Security

Many cloud providers offer a broad set of policies, technologies and controls that strengthen your security posture overall, helping protect your data, apps and infrastructure from potential threats.

Usage Ideas in the Project:

In the digital payment platform , the server can store the personal information of the user for easier log in whenever they use the app. Also, their payment details can be stored and analysed to provide suggestions for next transaction, depending on the availability and requirement of the payment.

Bank details and their card details can also be stored to provide faster services to the user.