19CSE301-
COMPUTER NETWORKS
Case Study
R.NO:CB.EN.U4CSE19156
V S S K CHAITANYA

Title: Railway Zone Management

Department Name	**Purpose**	**Network Details (No of nodes,servers,Protocols)**
Tourism And Catering Department	Catering Department is used to serve food in trains.	35 nodes, 4 servers,RIP,OSPF,FTP
Railway Hospital Department	Railway Hospital is used for emergency surgeries and for Railway employees treatment.	22 nodes, 4 servers,RIP,OSPF,FTP
Railway Reservation Department	Railway Reservation Department manages ticket bookings and special bookings like tatkal.	30 nodes, 4 servers,RIP,OSPF,FTP
Accounts Department	Manages employee salary and bills.	20 nodes, 4 servers,RIP,OSPF,FTP

ROLL Number	**Name**	**Contribution in Case Study**
CB.EN.U4CSE19153	T. Krishna Chaitanya	Tourism And Catering Department
CB.EN.U4CSE19155	U. Yeshwanth	Railway Hospital Department
CB.EN.U4CSE19156	V. S. S. K. Chaitanya	Railway Reservation Department
CB.EN.U4CSE19165	P. Prem Sai	Accounts Department

Topic	Page No in the document	Supporting file name
Problem Statement	**3**	
Objective of the case study	**3**	
Network Architecture Diagram	**23**	
Performance Parameters	**9**	
Department Details in the case study with description	**3**	
Subnet ip scheme followed [Solving the IP address allocation process for each subnetwork]	**23**	
Socket programming	**13**	Res_server.py,res_client.py,res_client_2.py
Cisco packet tracer – Application layer protocols	**25**	
Cisco packet tracer – Virtual Local Area Network	**26**	
Cisco packet tracer – OSPF	**25**	
Cisco packet tracer – RIP	**25**	
GoBack N and Selective Repeat protocol	**28**	
Cloud concepts	**29**	
Cloud and Networking	**29**	
How is cloud related to your application?	**30**	

Name: V.S.S.K.Chaitanya

Roll Number : CB.EN.U4CSE19156

Problem Staement:
To design a computer network that organize and manage various railway departments within a railway zone.

Objective of the case study:
To design a network architecture for Railway Zone Management

Description of the case study:

Railway zones play a very crucial part in maintenance of Indian Railway system

various data that need to be managed between the stations coming under a particular zone such as maintaining the record of passenger data, health system, amount sanctioned to the station for development etc. All this data must be collected from various stations falling under a particular zone must be managed by the zone headquarters

So In order to operate effectively exchange of data among railway stations located in various place is crucial and needs a proper architecture. Our case study is aimed to demonstrate how different detpartments within a railway zone headquarter mange this effectively.

Railway Reservation Department:

In this department railway bookings, cancellation and many other services that are provided to the customers are managed.

In the network along with sub networks connection with same department across other branch is also shown.

Railway Zone Network

NETWORKS

Tourism And Catering Department – Wide Area Network

Railway Reservation – Wide Area Network

Railway Hospital – Local Area Network

Accounts Department – Virtual Private Network

Client configuration	**Server Configuration**
Intel(R) Core 4005U Series Processor	2 Intel(R) Itanium 2 9100 Series Processors
8 GB RAM	23.98 GB RAM
8 MB Cache	12 MB Cache
1 TB	4.5 TB Storage (EMC Box)
Dual External Storage Connectivity	Dual External Storage Connectivity
DVD ROM Drive	DVD ROM Drive

SERVERS

Database Server

Proxy Server

Mail Server

Application Server

Client Server

CABLES

Coaxial Fibre

Twisted Fibre

Optical Fibre

TOPOLOGY

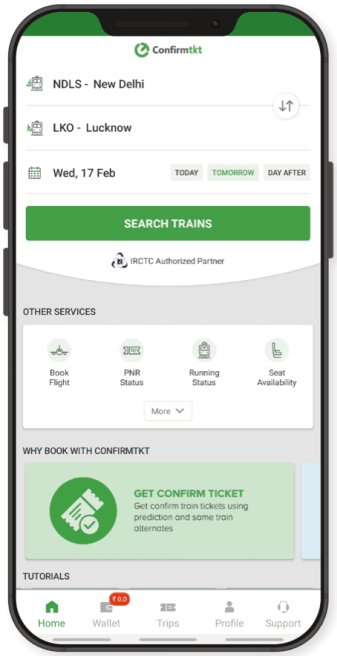
Reservation, Accounts - Star Topology

Medical - Bus Topology

Tourism And Catering Department -

6


IRCTC
irctc .com
IRCTC TOURISM
(A Government of India Enterprise)
1800110139
FLIGHTS
PACKAGES
STAY
BUDDHIST TRAIN
BHARAT DARSHAN
AC TOURIST TRAIN
MAHARAJAS
HILL RAILWAYS
CHARTER
BOOK YOUR COACH/TRAIN
GALLERY
ABOUT US
FAQ'S
TERMS & CONDITIONS
TRAVEL AGENTS
CONTACT US
All Tours
Rail Tours
Air Tours
Land Package
Search your nearby listings and more
Domestic
Search
FLIGHTS
CRUISE
STAY
BUDDHIST TRAIN
BHARAT DARSHAN
TOURIST TRAIN
MAHARAJAS
HILL RAILWAYS
TRAIN TICKETS
HERITAGE TRAIN


Confirmtkt
NDLS - New Delhi
LKO - Lucknow
Wed, 17 Feb
TODAY
TOMORROW
DAY AFTER
SEARCH TRAINS
IRCTC Authorized Partner
OTHER SERVICES
Book Flight
PNR Status
Running Status
Seat Availability
More
WHY BOOK WITH CONFIRMTKT
GET CONFIRM TICKET
Get confirm train tickets using prediction and same train alternates
TUTORIALS
Home
Wallet
Trips
Profile
Support

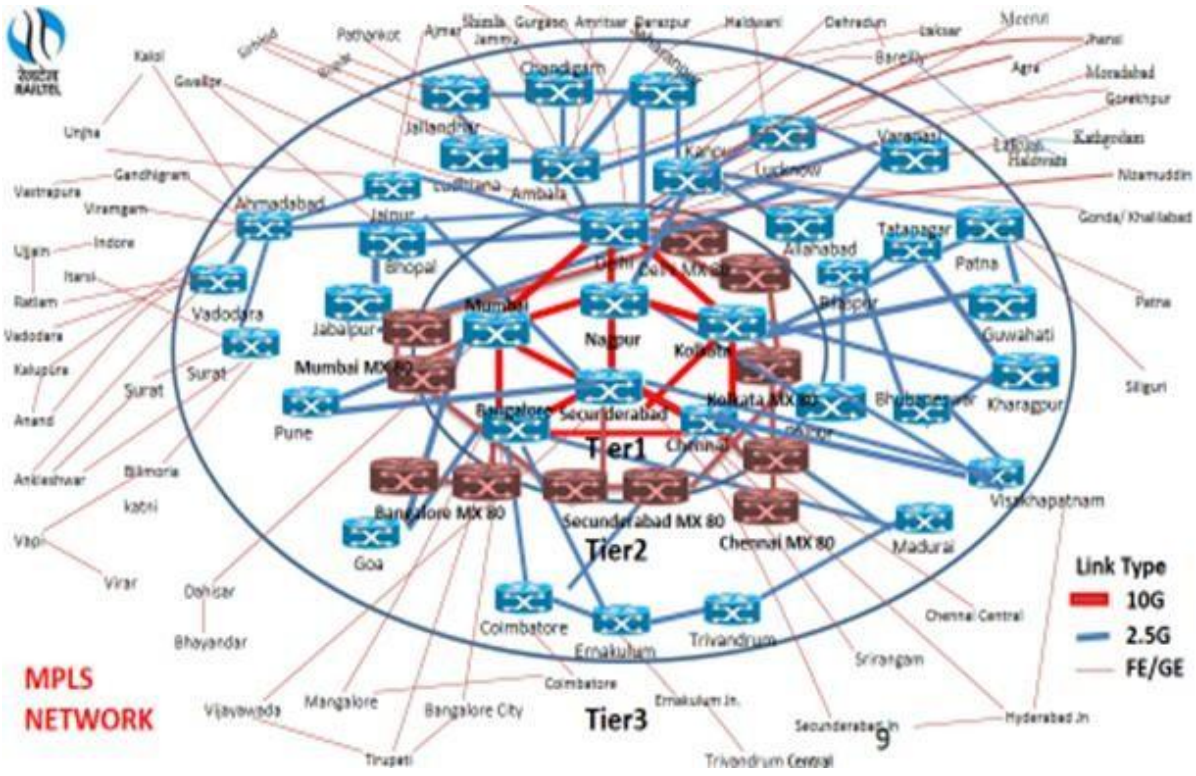

DIVISIONAL RAILWAY HOSPITAL
DIVISIONAL RAILWAY HOSPITAL
BENGALURU


मध्य रेल
CENTRAL RAILWAY
मंडल रेल प्रबंधक कार्यालय
DIVISIONAL RAILWAY MANAGER OFFICE

8

Why is Networking required?

As we saw before railway zone headquarters needs to collect and send info to various railway stations and should be able to manage the passenger data. So computer network plays a vital role to establish a proper connection between various departments. A proper architecture is needed because various devices like printer, ip phone, pcs are to be connected. So that a zone headquarter can manage all the railway stations effectively.



List of Network performance parameters:

Bandwidth:

bandwidth is defined as the maximum number of bits that can flow through a network connection in a given period of time. The fundamental unit of network bandwidth is bits per second.

Formula:

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).

Possible Value In General Scenario.

normally speeds ranging from 10–1,000 Mbps

Throughput:

The purpose of throughput is measuring the number of messages successfully transmitted per unit time.

Formula:

F = Frames per minute

A = Average of bits each frame carries

Through Put = ((F x A)/Unit Time)

Possible Value In General Scenario:

16.2 mbps

Latency (Delay):

Latency meaning in networking is best thought of as the amount of time it takes for a packet of data to be captured, transmitted, processed through multiple devices, then received at its destination and decoded.

Formula:

Propagation time = Distance/Propagation speed

Transmission time=Message size / Bandwidth

Queuing Time = Directly Proportional to the congestion in the network

Processing Delay = Directly proportional to processing speed of the routers.

Latency = Propagation Time + Transmission Time + Queuing Time + Processing Delay

Possible Value In General Scenario:

1ms to 20ms

Bandwidth-Delay Product:

Bandwidth and delay are two performance measurements of a link. However, what is significant in data communications is the product of the two, the bandwidth-delay product.

Formula:

Bandwidth x Delay

Possible Value In General Scenario:

500kb
Example is Residential Cable internet

Jitter:

JItter is used to describe the amount of inconsistency in latency across the network, while latency measures the time it takes for data to reach its destination and ultimately make a round trip

Formula:

To measure Jitter, we take the difference between samples,then divide by the number of samples (minus-1)

Possible Value In General Scenario:

below 30ms

Railway reservation department manages the passenger reservation count of trains based on different classes like sleeper class, 3A class, 2A class.

Description of CSV file:

It consists of five columns

Train_id: Train Id is an unique id which is given to each train to avoid confusion with trains having same names.

Train name: Name of the Train.

Sleeper/3a/2a : Passenger count of respective classes on a particular day.

b. List of operations completed with the File

1.Adding new train details.

2.updating existing train details.

3.Retrieving the particular train details.

4.Viewing all train details on a particular Day.

CODE:
SERVER.PY

```
import socket
import threading
import pandas as pd
df=pd.read_csv('train_list.csv')
df=df.set_index('train_id')
print(df)
s=socket.socket(socket.AF_INET,socket.SOCK_STREAM)
port=6000
host=socket.gethostname()
s.bind((host,port))
s.listen()
print('Server is listening ...Passenger_Reservation__Department')
```

```
        data=con.recv(1024)
        f=repr(data.decode())
        print(f)
        f=f[1:]
        f=f[:len(f)-1]
        f=f.split('_')
        print(f)

        if f[0]=="1":
            p=f[1:]

df2=pd.DataFrame.from_records([{'train_id':p[0],'train':p[1],'sleeper':int(p[2]),'3a':int(p[3]),'2a':int(p[4])}],index='train_id
')
            print(df2)
            df=df.append(df2)
            print(df)
            df.to_csv('train_list.csv')

        if f[0]=="2":
            p=f[1:]
            df.at[int(p[0]),p[1]]=p[2]

        if f[0]=="3":
            d=get_info(f[1:],df)
            print(d)
            con.send(str(d).encode())

        if f[0]=="4":
            c=False
         if f[0]=="5":
```

```
            dfi=str(df)
            con.send(dfi.encode())
def get_info(p,df):
    id=df.index
    if (p[1] not in df):
        return 'Not exist'
    return df.at[int(p[0]),p[1]]
while True:

    con,addr=s.accept()
    print('Connection established from ',addr)
    thread=threading.Thread(target=handle_client,args=(con,df,addr))
    thread.start()
```

CLIENT.PY

```
import socket
s=socket.socket(socket.AF_INET,socket.SOCK_STREAM)
host=socket.gethostname()
port=6000
s.connect((host,port))
print("WELCOME TO RAILWAY PASSNGER RESERVATION DEPARTMENT")
s1=0
while s1!=4:

   print("Select the actions below")
   print('1-add_info')
   print('2-update_info')
   print('3-get_info')
   print('4-stop')
   s1=int(input())
   if s1==1:
      train_id=input('enter train id:')
      train=input('enter train name:')
      sleeper=input('enter number of passengers in sleeper:')
      ac3=input('enter no of passengers in 3A:')
      ac2=input('enter no of passengers in 2A:')
      p=str(s1)+'_'+str(train_id)+'_'+str(train)+'_'+str(sleeper)+'_'+str(ac3)+'_'+str(ac2)

      s.send(p.encode())
      print('sent')
   if s1==2:
```

```
    train_id=input('enter train id:')
    sleeper=input('enter class(sleeper/3a/2a:')
    num=input('enter no of passengers to update:')
    p=str(s1)+'_'+str(train_id)+'_'+str(sleeper)+'_'+str(num)

    p=str(p)
    s.send(p.encode())
    print('updated')

if s1==3:
    train=input('enter train id:')
    sleeper=input('enter class(sleeper/3a/2a:')


    p=str(s1)+'_'+str(train)+'_'+str(sleeper)
    p=str(p)
    s.send(p.encode())
    print('sent')
    data=s.recv(1024)
    print('no of pasengers are',data.decode())
if s1==4:
    break
```

Client 3.py:

```
import socket
import pandas as pd
s=socket.socket()
host=socket.gethostname()
port=6000
s.connect((host,port))
print("WELCOME TO RAILWAY PASSNGER RESERVATION DEPARTMENT")
s1=0
while s1!=4:

    print("Select the actions below")
    print('5-view data')
    print('4-stop')
    s1=int(input())
    if s1==5:

        p=str(s1)


        s.send(p.encode())
        print('sent')
        data=s.recv(1024)
        l=data.decode()
        d=""
        for i in l:
            if i!="\n" and i!="\r":
                if i==",":
                    d+=" "
```

```
            else:
                d+=i
        elif i=="\n":
            print(d)
            d=""




if s1==4:
    break
```

Output screen shorts:

SERVER:

```
(venv) C:\Users\Chait\Desktop\books\computer networks>python res_server.py
             train  sleeper  3a  2a
train_id
11        rajadhani       45  33  22
12          vishaka       56  34  21
13         pinakini       72  45  34
14           kerala       67  45  34
Server is listening ...Passenger_Reservation__Department
Connection established from  ('192.168.56.1', 6420)
'2_13_2a_33'
['2', '13', '2a', '33']
Connection established from  ('192.168.56.1', 6421)
'3_14_sleeper'
['3', '14', 'sleeper']
67
'1_15_nizamuddin_70_56_45'
['1', '15', 'nizamuddin', '70', '56', '45']
              train  sleeper  3a  2a
train_id
15        nizamuddin       70  56  45
              train  sleeper  3a  2a
train_id
11         rajadhani       45  33  22
12           vishaka       56  34  21
13          pinakini       72  45  33
14            kerala       67  45  34
15        nizamuddin       70  56  45
```

CLIENT 1:

```
(venv) C:\Users\Chait\Desktop\books\computer networks>python res_client.py
WELCOME TO RAILWAY PASSNGER RESERVATION DEPARTMENT
Select the actions below
1-add_info
2-update_info
3-get_info
4-stop
2
enter train id:13
enter class(sleeper/3a/2a:2a
enter no of passengers to update:33
updated
Select the actions below
1-add_info
2-update_info
3-get_info
4-stop
```

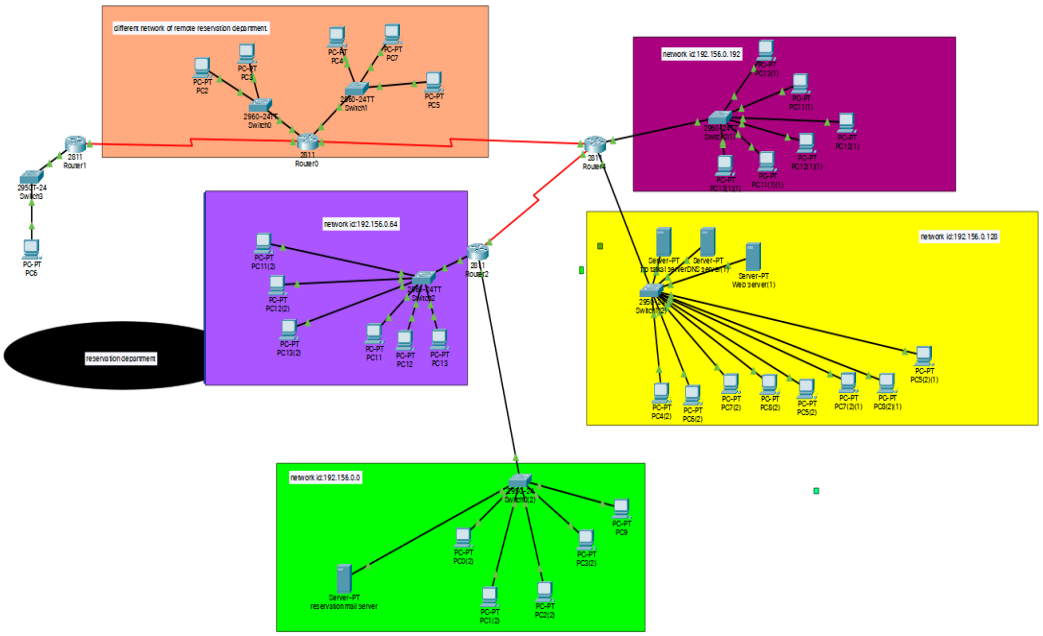
CLIENT 2:

```
(venv) C:\Users\Chait\Desktop\books\computer networks>python res_client.py
WELCOME TO RAILWAY PASSNGER RESERVATION DEPARTMENT
Select the actions below
1-add_info
2-update_info
3-get_info
4-stop
3
enter train id:14
enter class(sleeper/3a/2a:sleeper
sent
no of pasengers are 67
Select the actions below
1-add_info
2-update_info
3-get_info
4-stop
1
enter train id:15
enter train name:nizamuddin
enter number of passengers in sleeper:70
enter no of passengers in 3A:56
enter no of passengers in 2A:45
sent
Select the actions below
1-add_info
2-update_info
3-get_info
4-stop
```

Client 3:

```
(venv) C:\Users\Chait\Desktop\books\computer networks>python res_client_2.py
WELCOME TO RAILWAY PASSNGER RESERVATION DEPARTMENT
Select the actions below
5-view data
4-stop
5
sent
train_id train sleeper 3a 2a
11 rajadhani 45 33 22
12 vishaka 56 34 21
13 pinakini 72 45 33
14 kerala 67 45 34
15 nizamuddin 70 56 45
Select the actions below
5-view data
4-stop
```

Cisco Packet Tracer Design(RAILWAY RESERVATION):

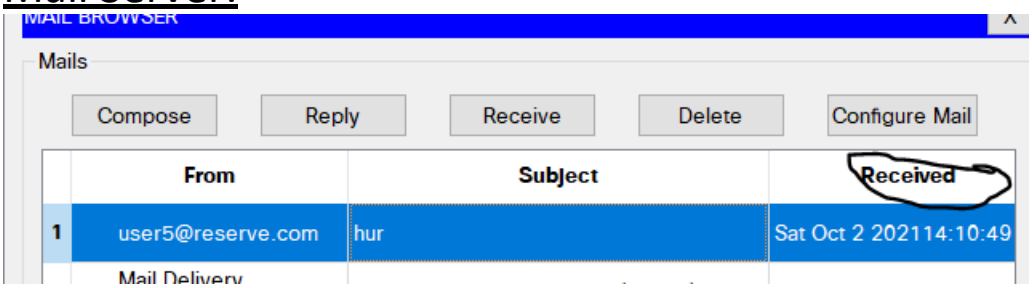


Subnet Allocation:

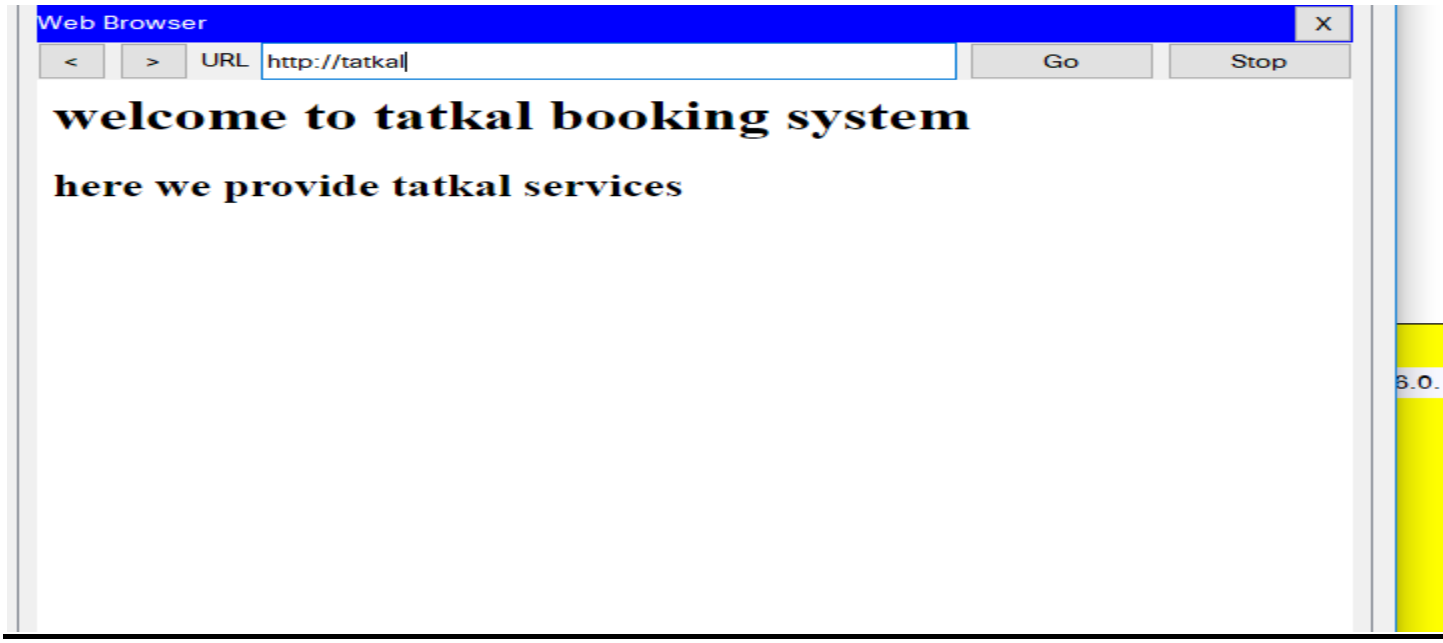
Subnetting with range of IP addresses possible of 64 and starting from subnet address as 196.156.0.0 for first subnet and following for other three mentioned in table.

Reservation Department Local Office	Reservation	Range of IP address: 192.156.0.1-192.156.0.63 Subnet address: 192.156.0.0 Subnet mask :255.255.255.192 Protocols configured:ospf	Organizing reservation info.
	Tatkal	Range of IP address: 192.156.0.65-192.156.0.127 Subnet address: 192.156.0.64 Subnet mask :255.255.255.192 Protocols configured:ospf	Managing Tatkal operations
	Management	Range of IP address: 192.156.0.129-192.156.0.191 Subnet address: 192.156.0.128 Subnet mask :255.255.255.192 Protocols configured:ospf	Updating reservation info about any changes
	Subnetwork name	Range of IP address: 192.156.0.193-192.156.0.255 Subnet address: 192.156.0.192 Subnet mask :255.255.255.192 Protocols configured:ospf	Back office management
Remote Reservation Offices		Showing how remote networks are connected.	
	FTP server	Category: FTP	
	Email server	Category: Email	
	Application server	Category: Web	
	OSPF	Routing protocol	Between subnets and outer network
	RIP	Routing protocol	Between remote office and local office.

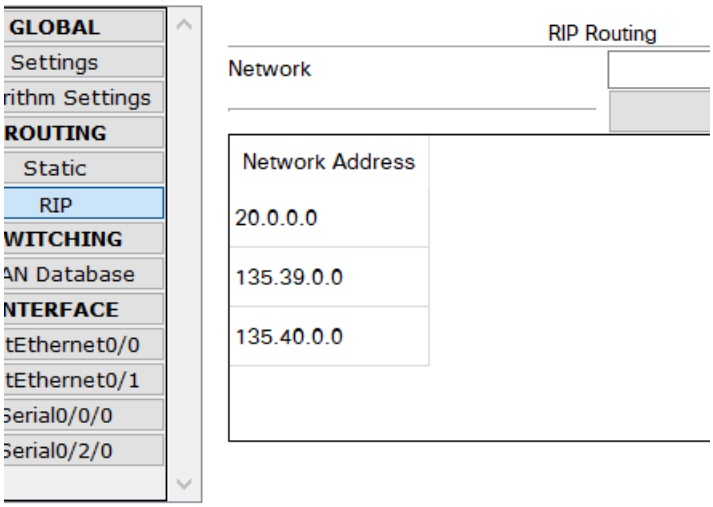
Mail Server:



Web Server:



RIP:



OSPF:

```
Router#SHOW IP OSPF NEIGHBOR

Neighbor ID     Pri   State           Dead Time   Address         Interface
192.167.12.1      0   FULL/  -        00:00:34    30.0.0.2        Serial0/0/0
Router#
```

```
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to
up

00:00:20: %OSPF-5-ADJCHG: Process 1, Nbr 192.156.0.204 on Serial0/0/0 from
LOADING to FULL, Loading Done
```

VLAN:

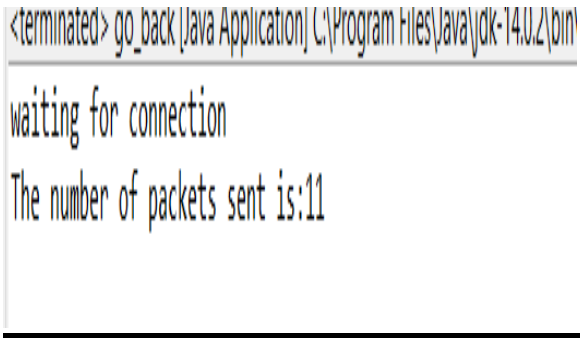
```
Switch#SHOW VLAN BRIEF

VLAN Name                             Status    Ports
---- -------------------------------- ---------
--------------------------------
1    default                          active    Fa0/5, Fa0/6, Fa0/7, Fa0/8
                                                Fa0/9, Fa0/10, Fa0/11, Fa0/12
                                                Fa0/13, Fa0/14, Fa0/15,
Fa0/16
                                                Fa0/17, Fa0/18, Fa0/19,
Fa0/20
                                                Fa0/21, Fa0/22, Fa0/23,
Fa0/24
                                                Gig0/1, Gig0/2
10   VLAN0010                         active    Fa0/1, Fa0/4
20   VLAN0020                         active    Fa0/2
```

Inter vlan:

```
Interface              IP-Address      OK? Method Status
Protocol
FastEthernet0/0        135.39.12.224   YES manual up                    up
FastEthernet0/1        unassigned      YES manual up                    up
FastEthernet0/1.10     192.167.12.1    YES manual up                    up
FastEthernet0/1.20     135.40.0.1      YES manual up                    up
Serial0/0/0            30.0.0.2        YES manual up                    up
Serial0/2/0            20.0.0.1        YES manual up                    up
Vlan1                  unassigned      YES unset  administratively down down
Router#
```

Go back N and Selective Repeat:

Server side:




```
package snippet;

import java.io.DataInputStream;
   import java.io.DataOutputStream;
   import java.io.IOException;
   import java.net.ServerSocket;
   import java.net.Socket;
   import java.net.SocketException;

public class go_back {

            static ServerSocket Serversocket;
    static DataInputStream dis;
    static DataOutputStream dos;

    public static void main(String[] args) throws
SocketException {

    try {
       int a[] = { 100,30, 40, 50, 60, 70, 80, 90,
100, 110,40 };
       Serversocket = new ServerSocket(8011);
       System.out.println("waiting for
connection");
       Socket client = Serversocket.accept();
       dis = new
DataInputStream(client.getInputStream());
       dos = new
DataOutputStream(client.getOutputStream());
       System.out.println("The number of packets
sent is:" + a.length);
       int y = a.length;
       dos.write(y);
       dos.flush();

       for (int i = 0; i < a.length; i++) {
          dos.write(a[i]);
          dos.flush();
       }

       int k = dis.read();

       dos.write(a[k]);
       dos.flush();

       } catch (IOException e) {
          System.out.println(e);
       } finally {
          try {
             dis.close();
             dos.close();
   }  catch (IOException e) {
             e.printStackTrace(); }
 \\\
```

Client Side:

```
Localhost/127.0.0.1
No of frame is:11
100
30
40
50
60
70
80
90
100
110
40
Received frame is: 100
Received frame is: 30
Received frame is: 40
Received frame is: -1
Received frame is: 60
Received frame is: 70
Received frame is: 80
Received frame is: 90
Received frame is: 100
Received frame is: 110
Received frame is: 40
Request to retransmit packet no 4 again!!

Received frame is: 50
quiting
```


```
package snippet;

import java.lang.System;
import java.net.*;
import java.io.*;

public class client {
   static Socket connection;

   public static void main(String a[]) throws SocketException
{
      try {
         int v[] = new int[11];
         //int g[] = new int[8];
         int n = 0;
         InetAddress addr =
InetAddress.getByName("Localhost");
         System.out.println(addr);
         connection = new Socket(addr, 8011);
         DataOutputStream out = new DataOutputStream(
               connection.getOutputStream());
         DataInputStream in = new DataInputStream(
               connection.getInputStream());
         int p = in.read();
         System.out.println("No of frame is:" + p);

         for (int i = 0; i < p; i++) {
            v[i] = in.read();
            System.out.println(v[i]);
            //g[i] = v[i];
         }
         v[3] = -1;
         for (int i = 0; i < p; i++)
          {
            System.out.println("Received frame is: " + v[i]);
 }
         for (int i = 0; i < p; i++)
            if (v[i] == -1) {
         System.out.println("Request to retransmit packet no
"
                     + (i+1) + " again!!");
               n = i;
               out.write(n);
               out.flush();
            }
         System.out.println();
                  v[n] = in.read();
         System.out.println("Received frame is: " + v[n]);
    System.out.println("quiting");
      } catch (Exception e) {
         System.out.println(e);
      }

   }
}
```

Cloud Virtualization:

Now a days it is very difficult to bring every employee around the world to work at same place where all the data centers of a company are located or it will be very costly for a small organization to purchase heavy hardware material for limited amount of work.

To answer all these problems , CLOUD concept comes into play where you can virtually use hardware or software present in some other parts of the world right from your home.

Having physical devices or copies of these things can be difficult to move or copy when you need to move something. A virtual server or desktop can be easily moved and accessed from a different location.
In addition, physical devices are limited by the specific set of hardware they're installed on, while virtual devices can easily be allocated resources as necessary. Physical hardware can be consolidated, and a virtual machine could access resources from multiple pieces of hardware.

Cloud and Networking:

Normally with the help of internet you can login to your cloud provider. After that within the cloud you can create your virtual private cloud and access the storage and software facilities so that your data is protected from accessing by some other clients.Cloud providers will provide separate network ids and subnets to work on.

Cloud is not different from normal network but a part of network where the hardware ot software that needed to be installed in different geographical locations are offered as a remote service that can be accessed by people belonging to different areas.

Cloud In Railway Zone Management:

Railway requires huge software support in order to provide services relentlessly . So software that is being used can be a part of cloud and data that is needed to be accessed within departments also uses cloud.

Mostly in Railway Department cloud is an important means of storage and crucial part of network. A private cloud is used for official purpose and is accessed by employees from various geographical locations who are connected to the railway computer network.

In this way virtualization is possible along with proper security and effective management.