B.M.S. COLLEGE OF ENGINEERING BENGALURU
Autonomous Institute, Affiliated to VTU

Lab Record

Computer Networks – 23CS5PCCON

Submitted in partial fulfillment for the 5th Semester Laboratory

Bachelor of Engineering
in
Computer Science and Engineering

Submitted by:

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August 2025-December 2025

B.M.S. COLLEGE OF ENGINEERING

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CERTIFICATE

This is to certify that the Computer Networks (23CS5PCCON) laboratory has been carried out by DHRUVDEEP NAYAK (1BM23CS093) during the 5th Semester August 2025-December 2025.

Signature of the Faculty Incharge:

Sarala D V
Assistant Professor

Department of Computer Science and Engineering

B.M.S. College of Engineering, Bangalore

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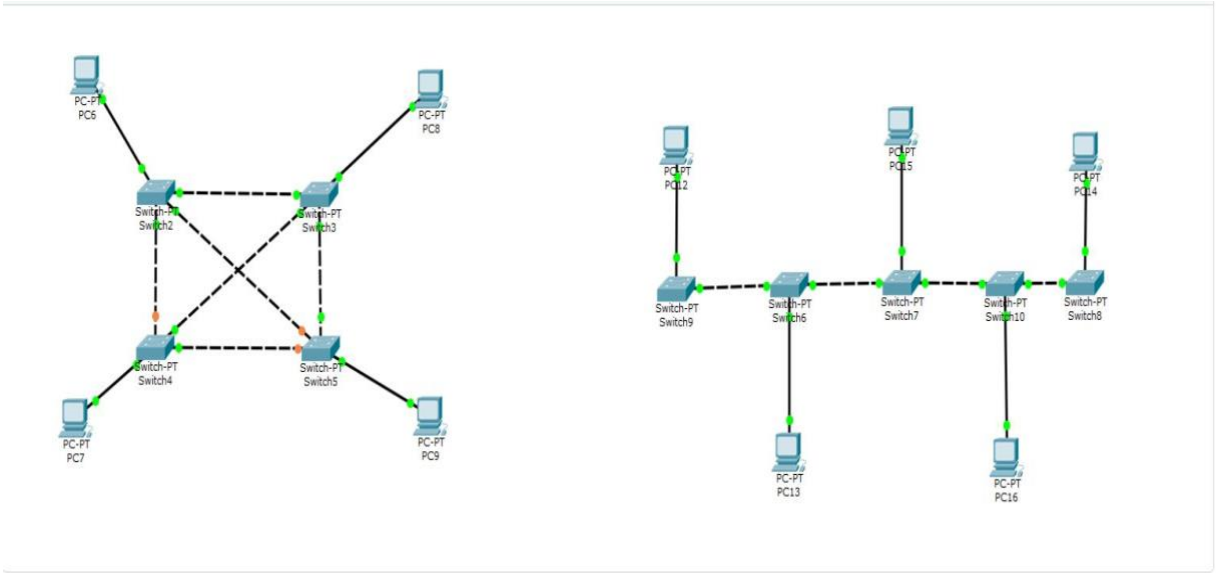
PART - A

Program 1: Create a topology and simulate sending a simple PDU from source to destination using hub and switch as connecting devices and demonstrate ping messages.

Network diagram:



Configuration:

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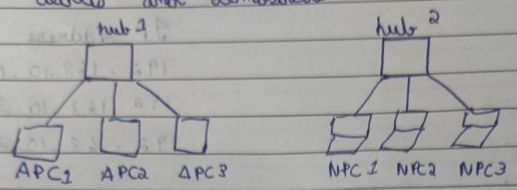
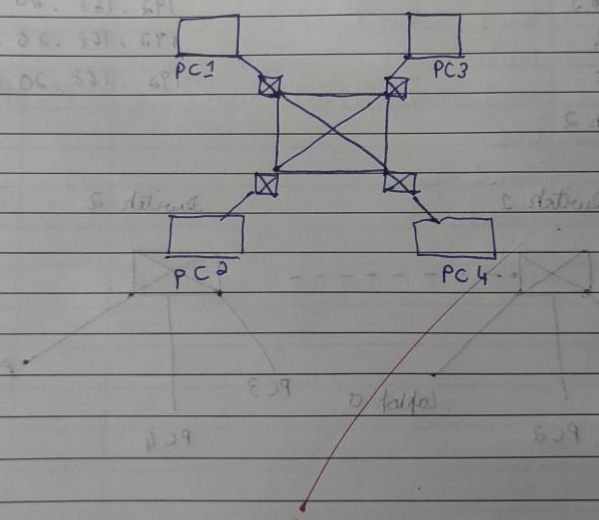
Create topology sending a simple PDU from source to destination using a hub and switch as connecting devices and demonstrate

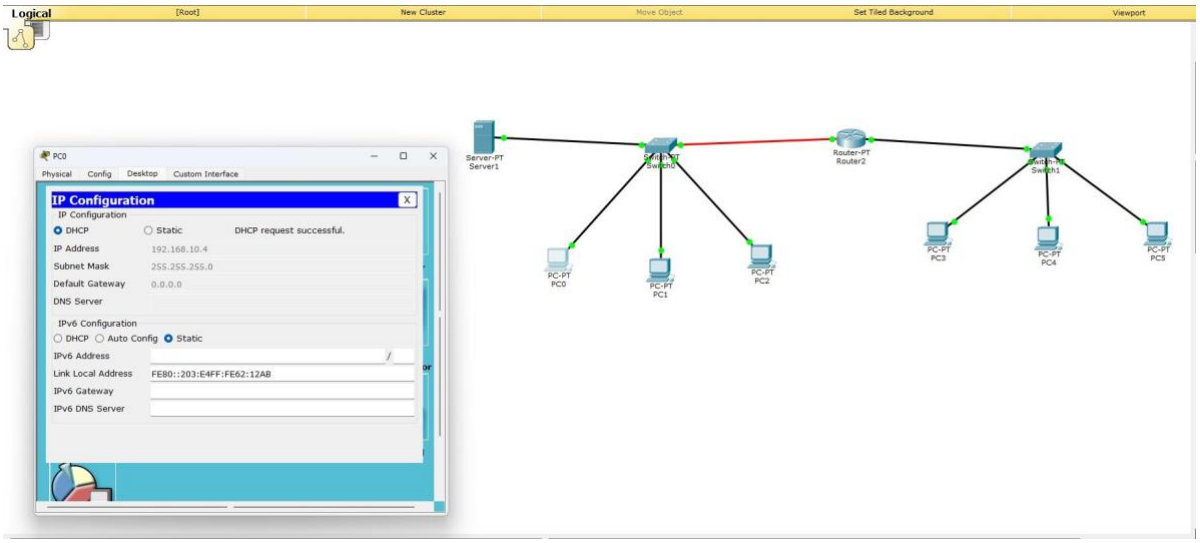


Mesh topology

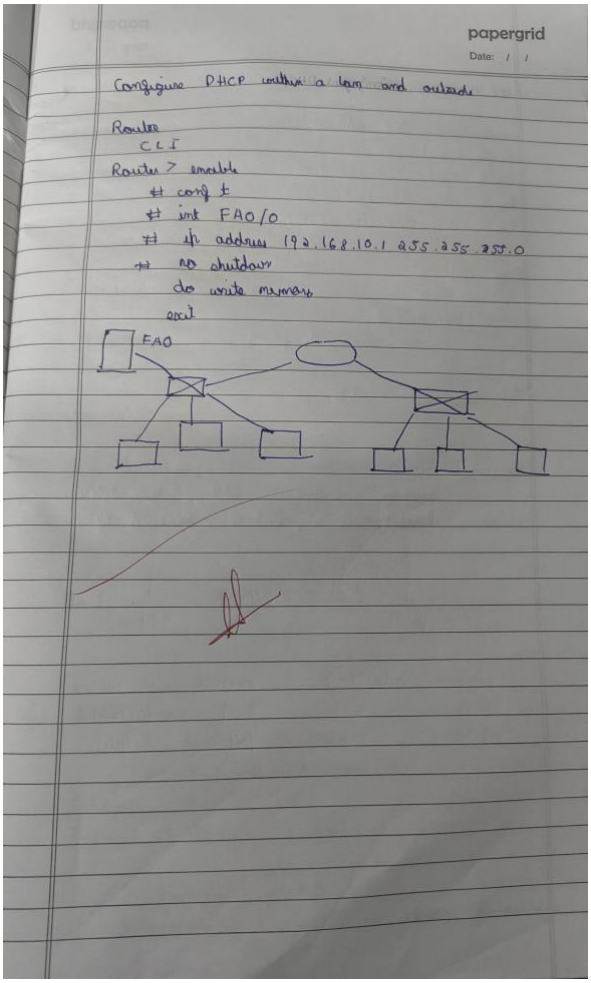


Program 2: Configure DHCP within a LAN and outside LAN.

Network diagram:

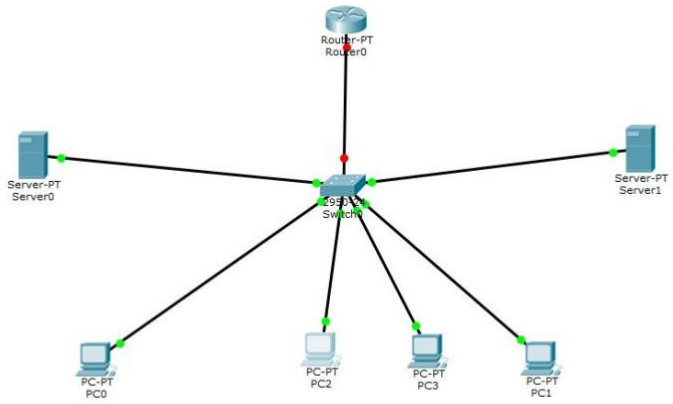


Configuration:



Program 3: Configure Web Server, DNS within a LAN.

Network diagram:



Configuration:

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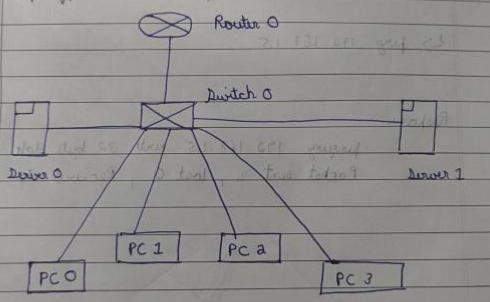
1. Configure web server, DNS with LAN

2. Configure IP address to router in packet tracer. Explore the following messages

i) Ping response
ii) Destination unreachable
iii) Request timeout
iv) Reply

Topology



① DNS server

↳ Services → DNS

name : www.letslearn.com

Address : 192.168.1.6

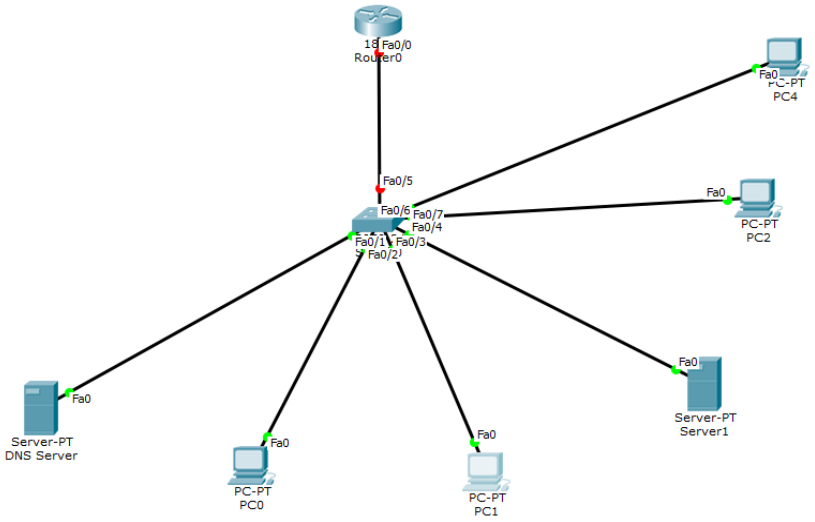
Type : A Record → add

↳ Services → HTTP

helloworld.html → edit → change the message

Program 4: Configure IP address to routers in packet tracer. Explore the following messages: ping responses, destination unreachable, request timed out, reply.

Network diagram:



Configuration:

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Date: / /

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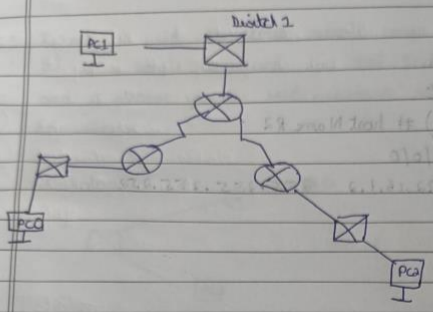
Configure IPV4 with static



Router 1

↳CLI

↳no

Router> enable

Router> conf t

interface serial 0/0/0

ip address 172.16.1.1 255.255.255.252

no shutdown

exit

interface Gigabit Ethernet 0/0

ip address 192.168.10.1 255.255.255.0

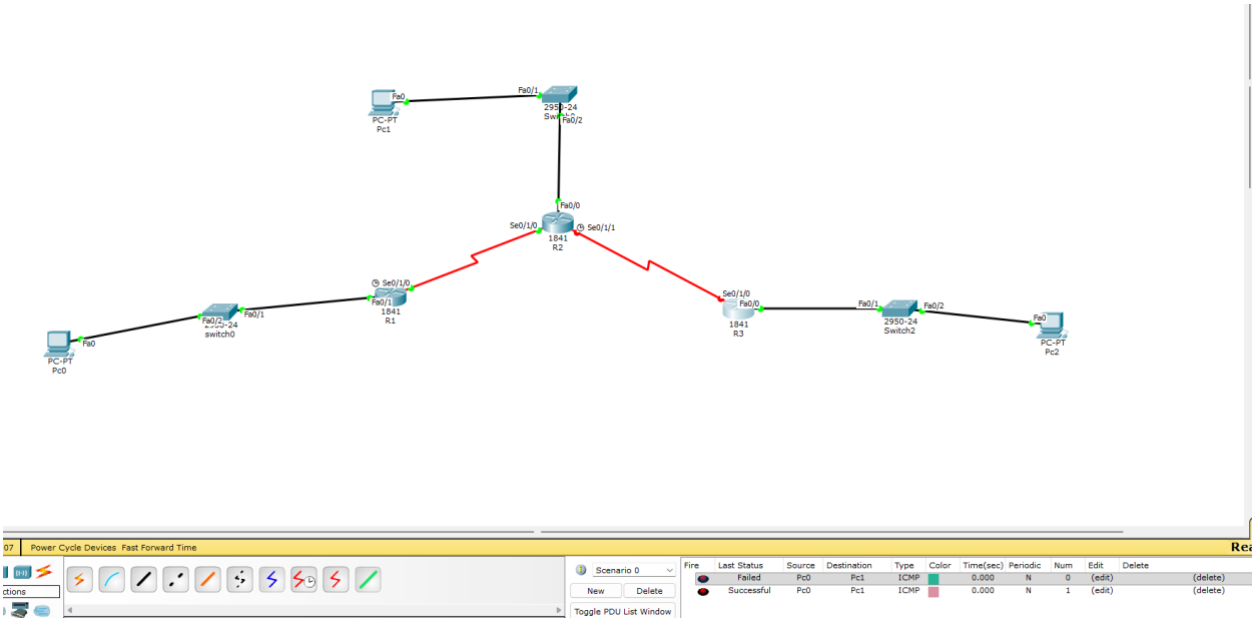
no shutdown

exit

write memory

Program 5: Configure default route, static route to the Router.

Network diagram:



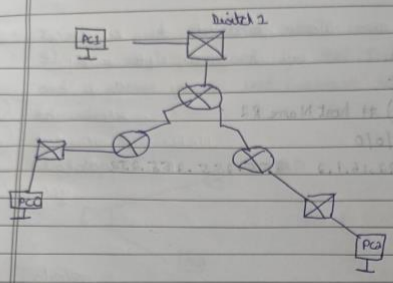
Configuration:

papergrid

Date: / /

17/9/25

Configure IPV4 with static



Router 1

↳CLI

↳no

Router> enable

Router> conf t

interface Serial 0/0/0

ip address 172.16.1.1 255.255.255.252

no shutdown

exit

interface Gigabit Ethernet 0/0

ip address 192.168.10.1 255.255.255.0

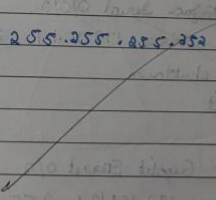
no shutdown

exit

write memory

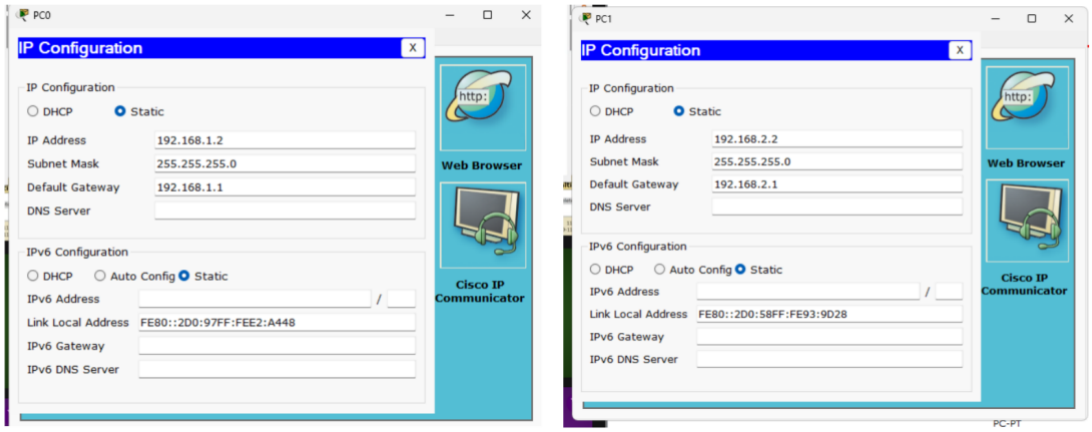
Router 2
↳ CLI
↳ no
Router> enable
Router> conf t
Router(config)# host Name R2
interface S/0/0/0
ip address 172.16.1.2 255.255.255.252
no shutdown
exit

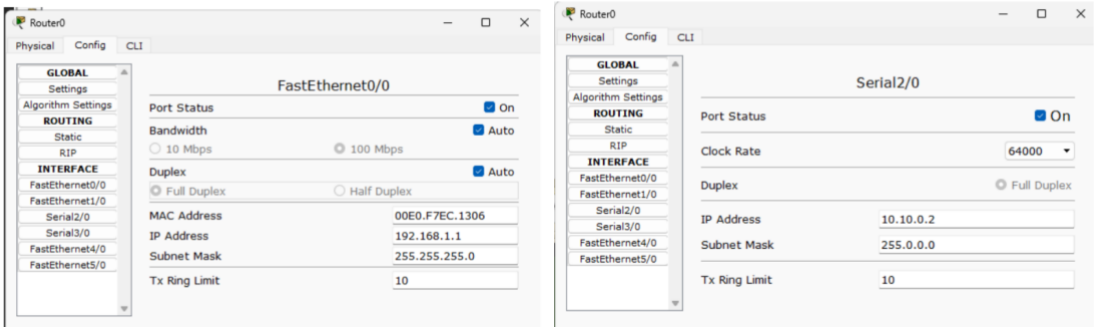
Router 3
↳ CLI
↳ no
Router> enable
Router> conf t
host name R3
int S/0/0/1
ip address 172.16.2.2 255.255.255.252
no shutdown
exit

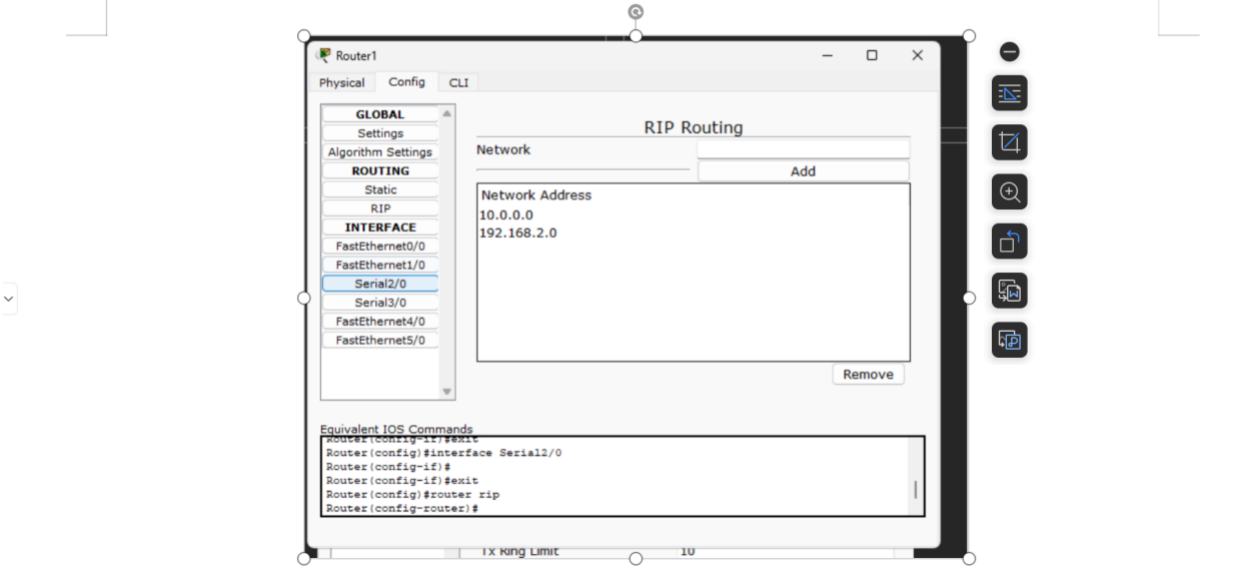


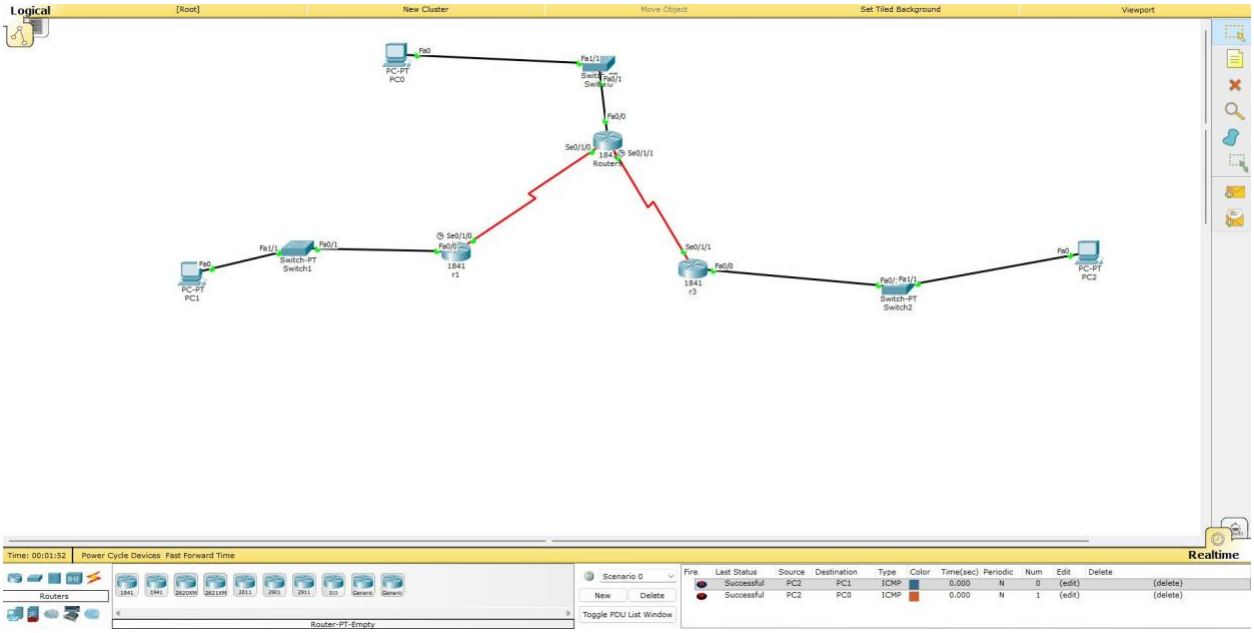
Program 6: Configure RIP routing Protocol in Routers.

Network diagram:





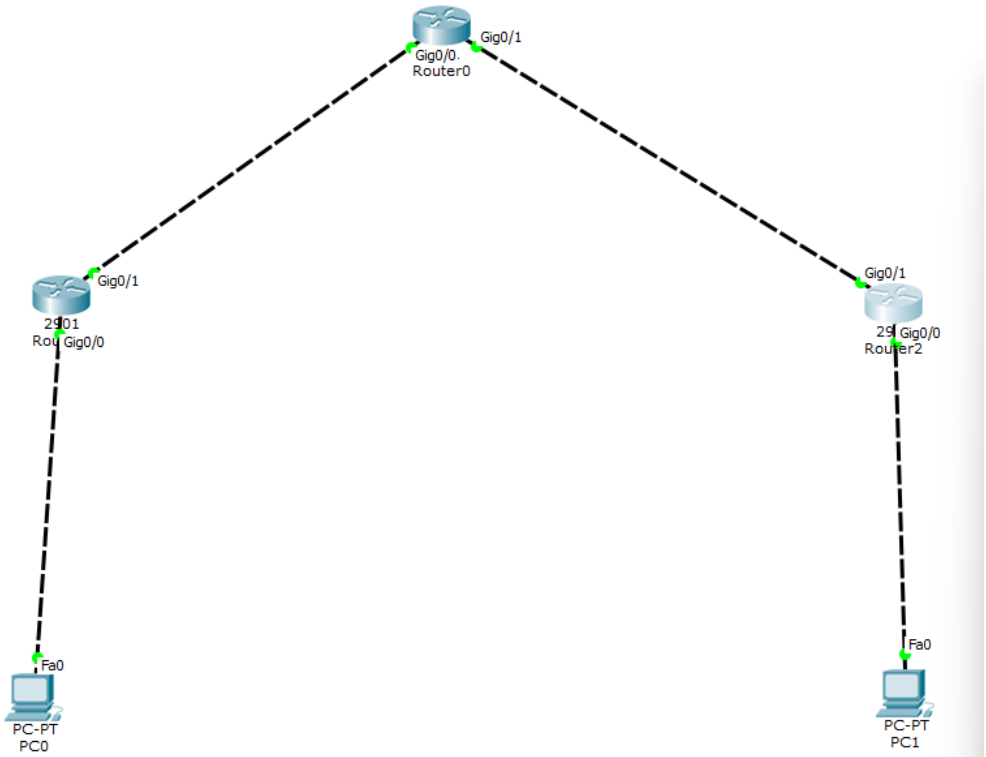


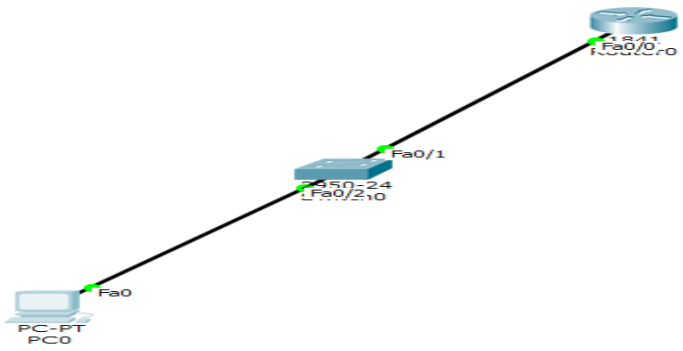


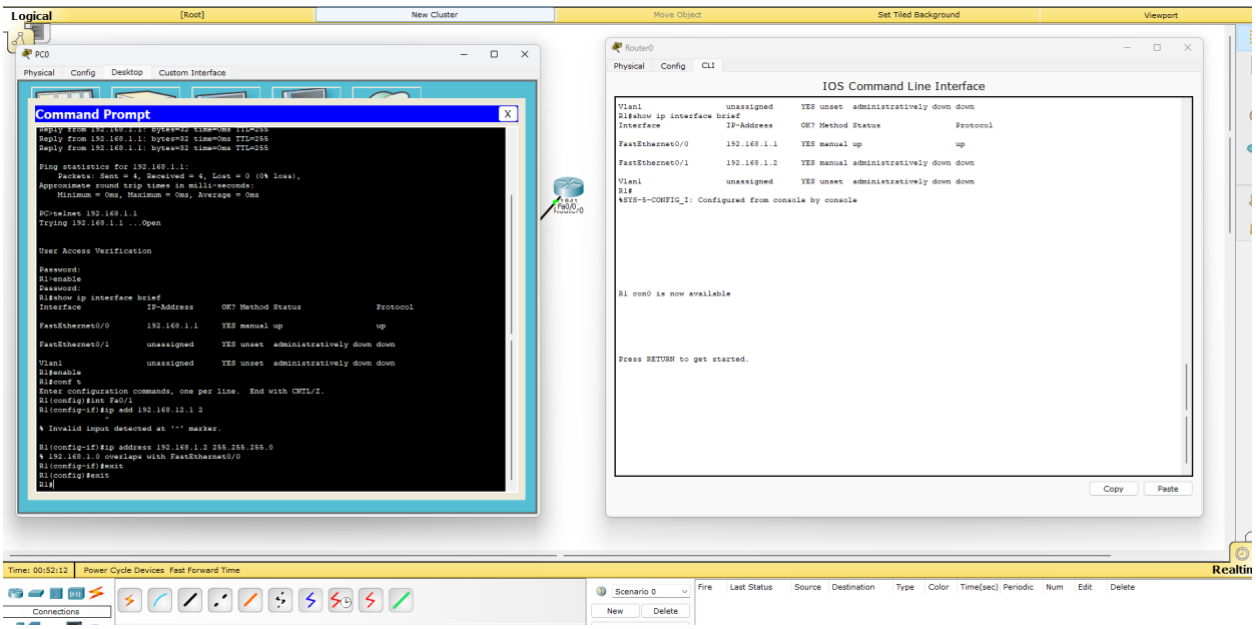
Configuration:

Program 7: Configure OSPF routing protocol.

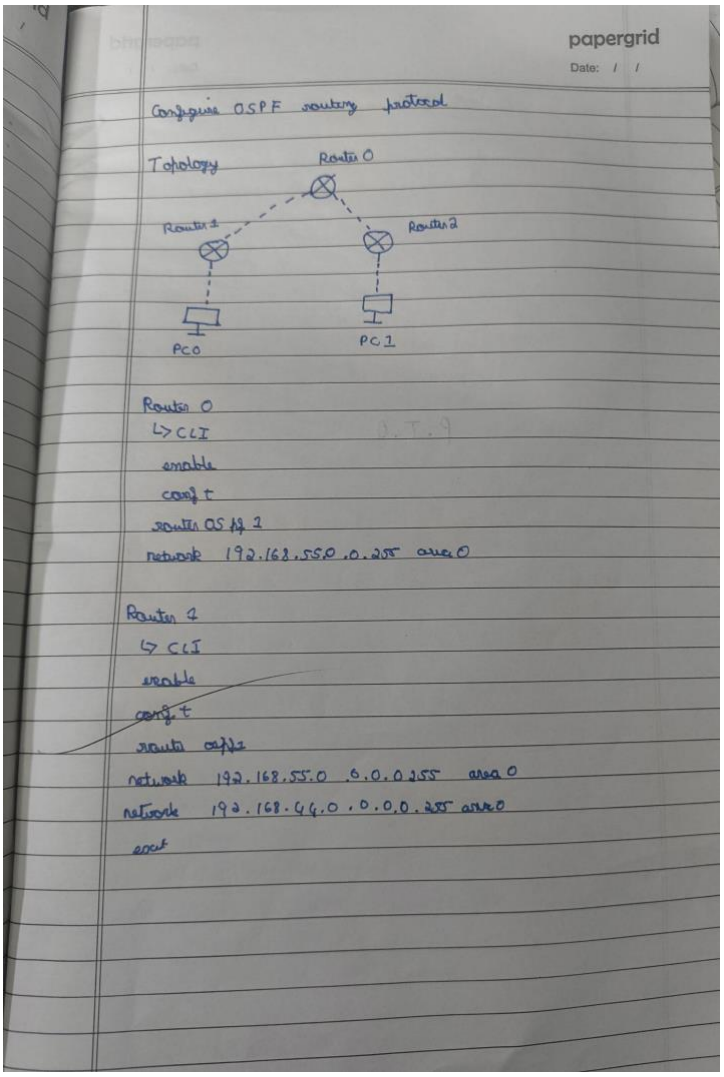
Network diagram:


Gig0/1
Gig0/0
Router0
Gig0/1
2901
Gig0/0
Gig0/1
Gig0/0
Fa0
PC-PT
PC0
Fa0
PC-PT
PC1


Fa0/0
Fa0/1
Fa0
PC-PT
PC0

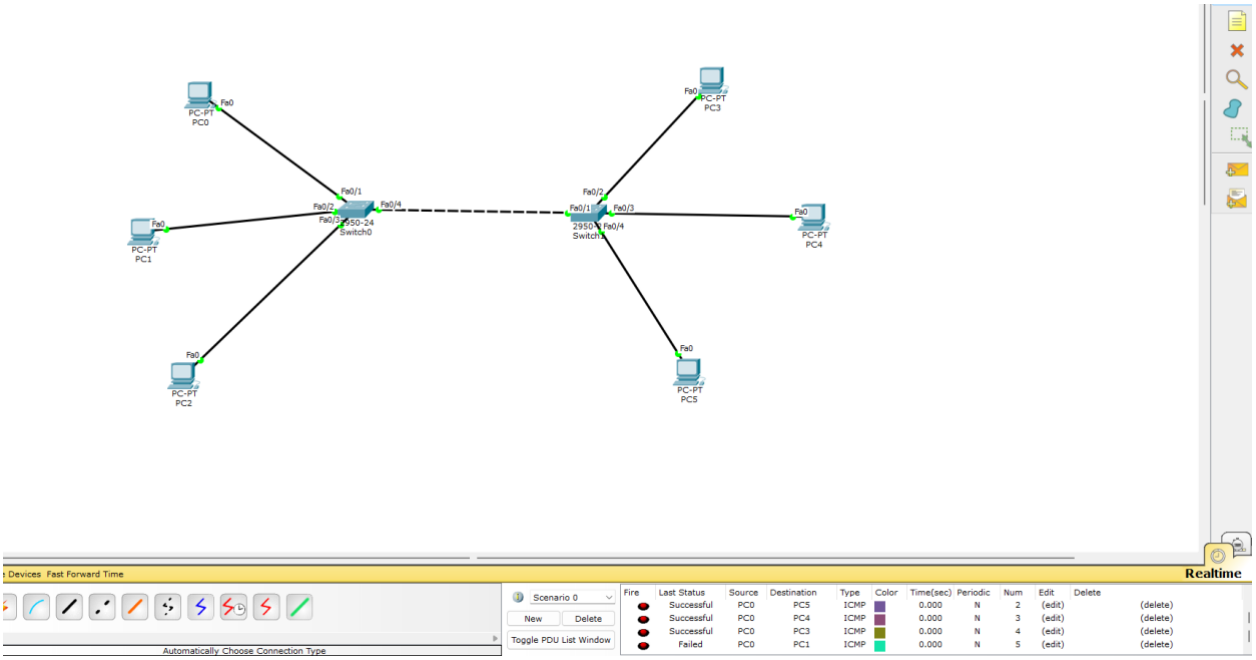


Configuration:

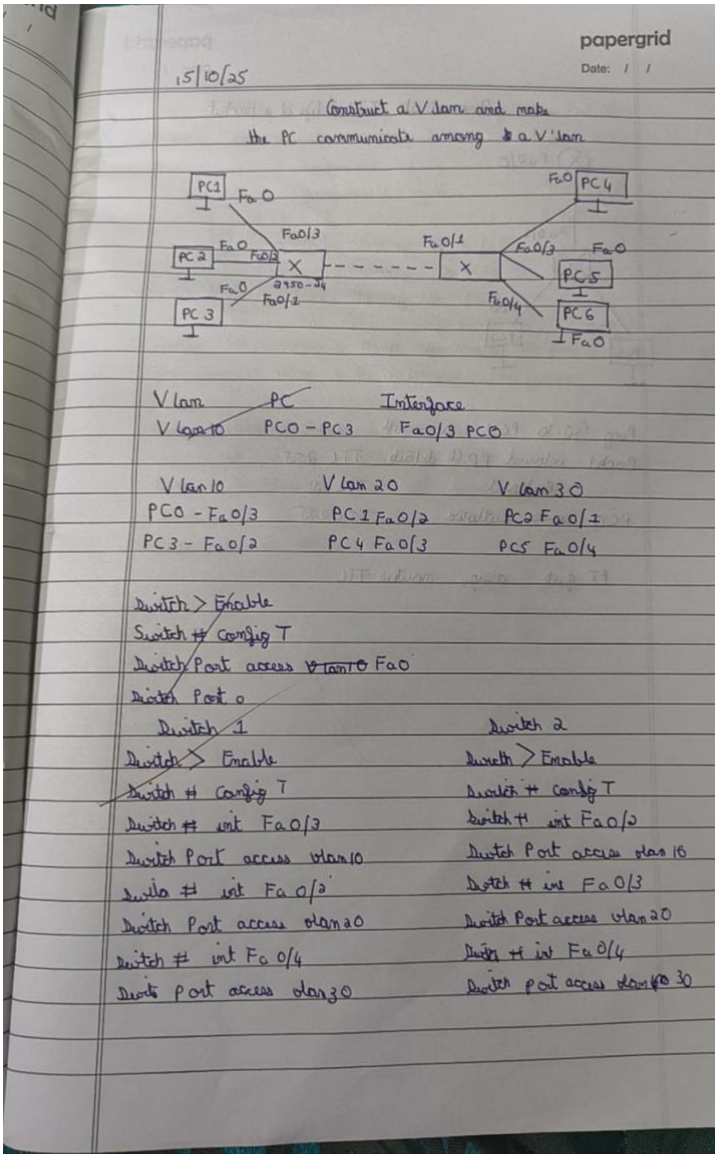


Program 8: To construct a VLAN and make the PC's communicate among a VLAN.

Network diagram:

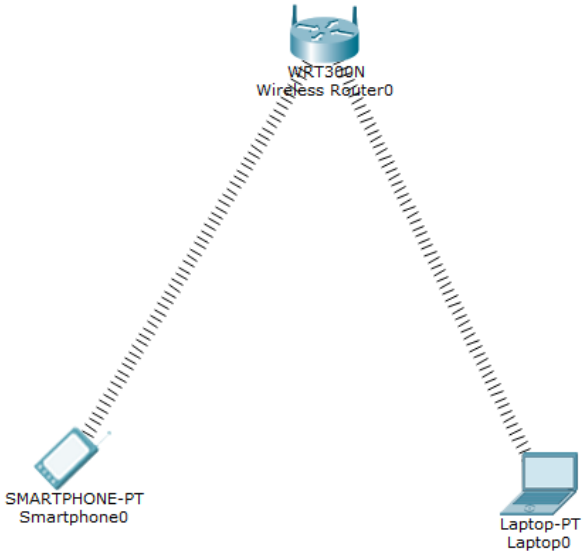


Configuration:

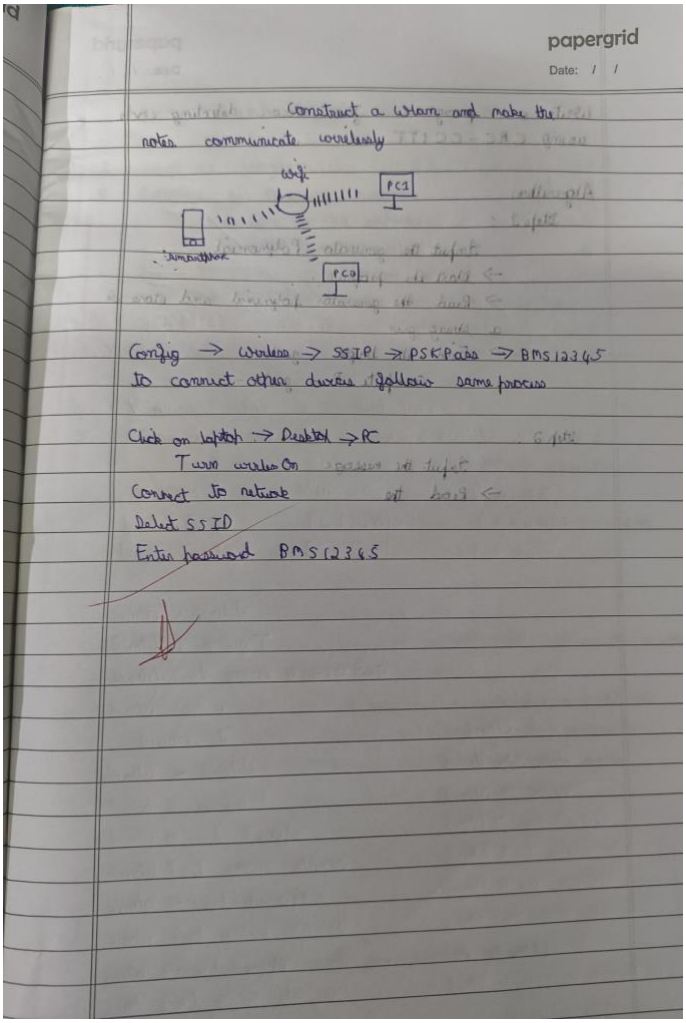


Program 9: To construct a WLAN and make the nodes communicate wirelessly.

Network diagram:

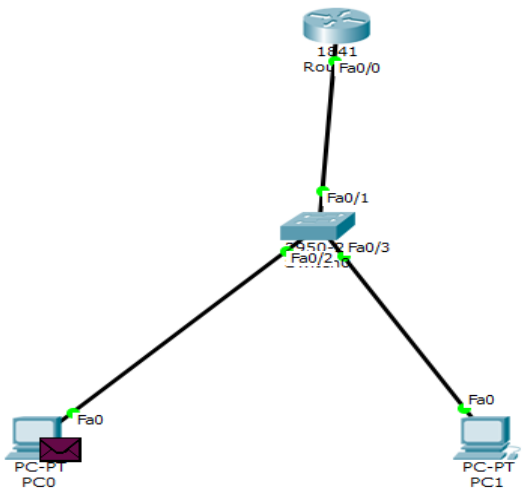


Configuration:

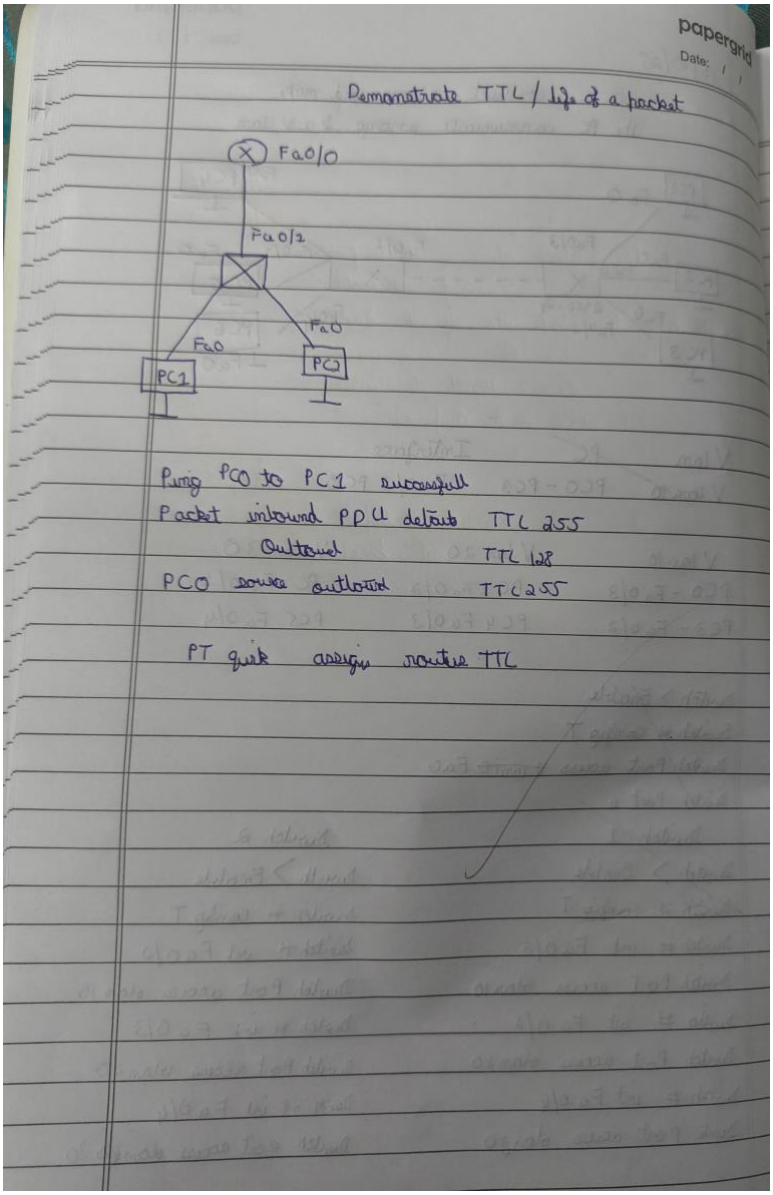


Program 10: Demonstrate the TTL/ Life of a Packet.

Network diagram:

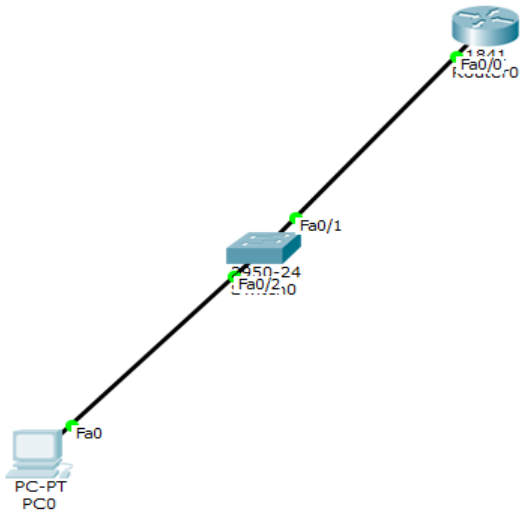


Configuration:



Program 11: To understand the operation of TELNET by accessing the router in the server room from a PC in the IT office.

Network diagram:

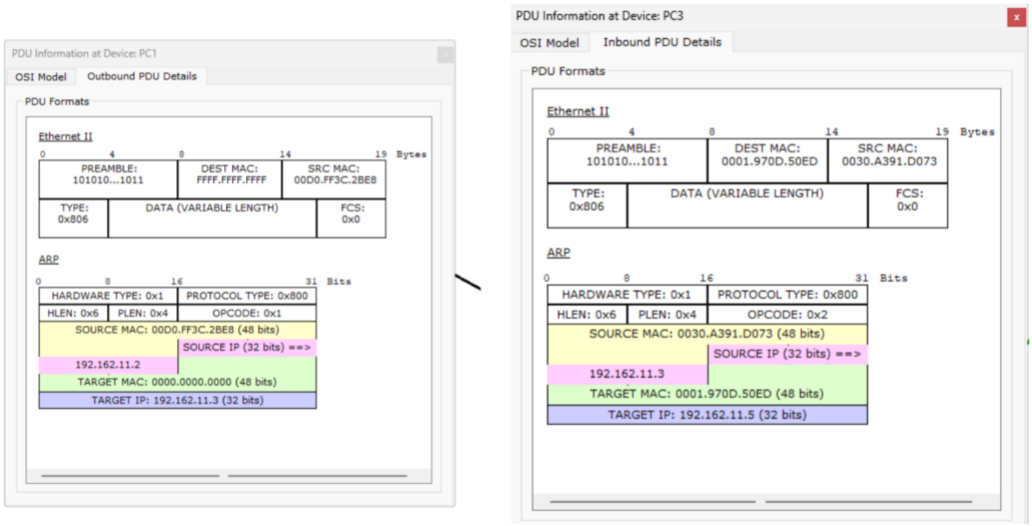


Configuration:

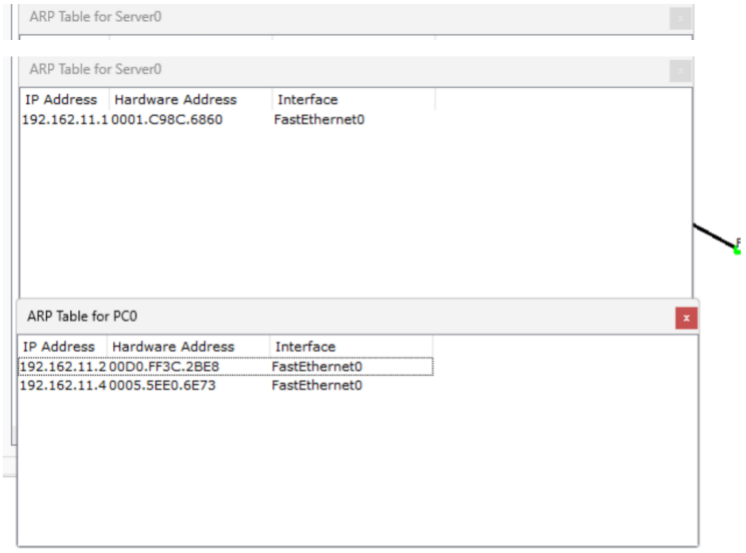
Program 12: To construct simple LAN and understand the concept and operation of Address Resolution Protocol (ARP).

Network diagram:

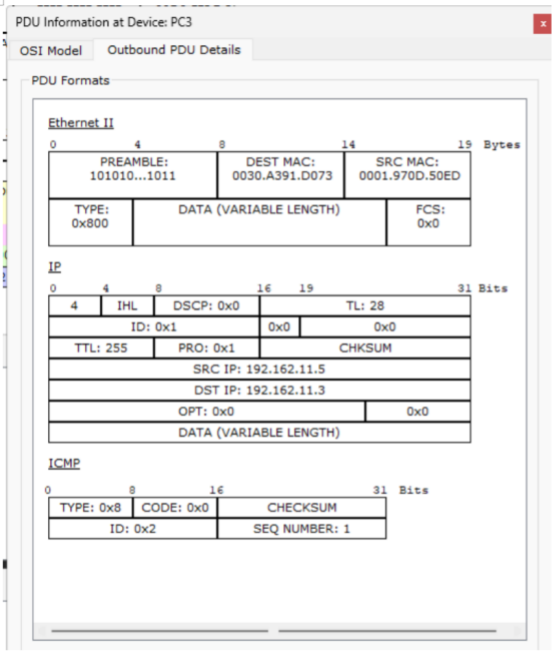
ARP



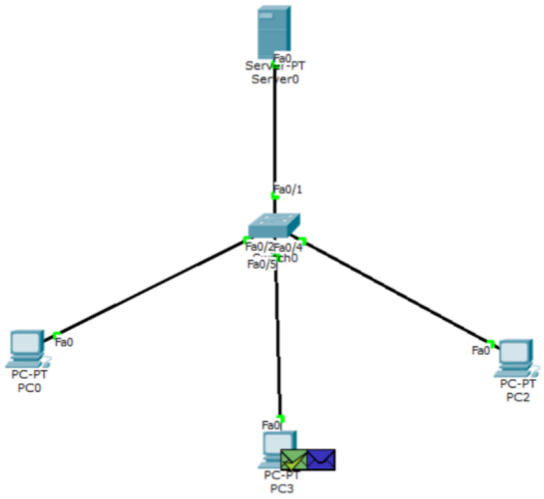
THE MAC ADDRESS before and after encrypting and sending



ARP table of pc0 and server after sending a simple PDU

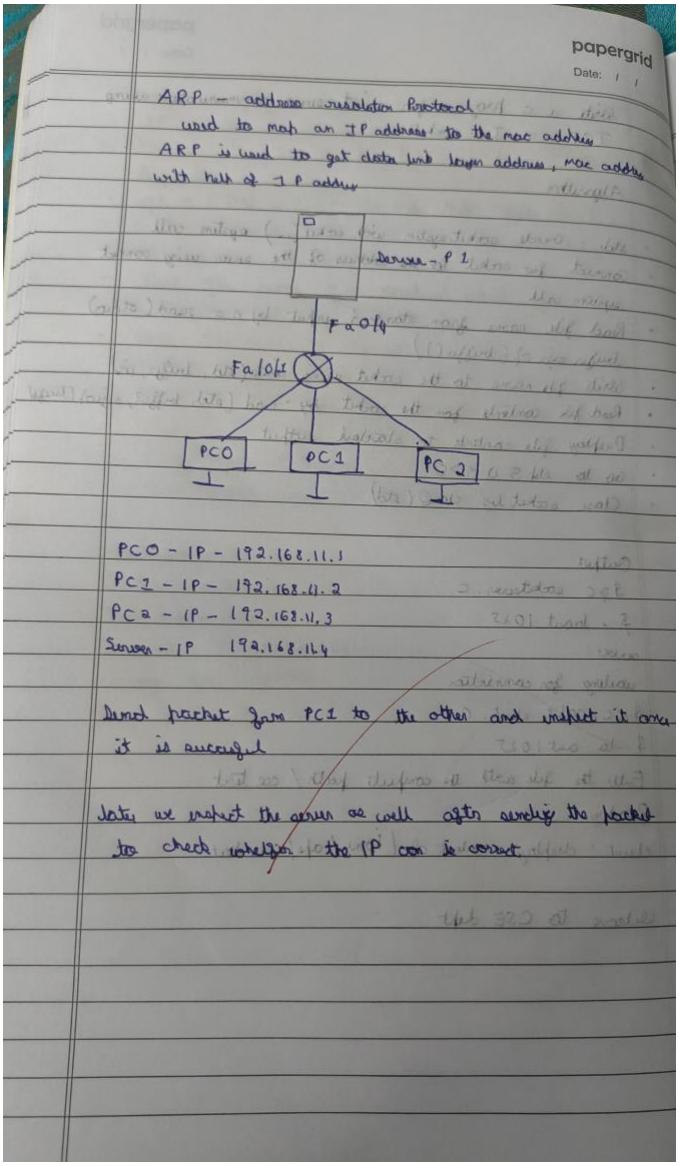


The address of sent one



topology

Configuration:



PART - B

Program 1: Write a program for congestion control using Leaky bucket algorithm.

Code:

```
#include <stdio.h>
int min(int x, int y)
{
   return (x < y) ? x : y;
}
int main()
{
```

```
    int drop = 0, mini, nsec, cap, count = 0, i, inp[25], process;
    printf("Enter the bucket size:\n");
    scanf("%d", &cap);
    printf("Enter the processing rate:\n");
    scanf("%d", &process);
    printf("Enter the number of seconds you want to simulate:\n");
    scanf("%d", &nsec);
    for (i = 0; i < nsec; i++)
    {
       printf("Enter the size of the packet entering at %d sec:\n", i + 1);
       scanf("%d", &inp[i]);
    }
    printf("\n Second | Packet received | Packet sent | Packet left | Dropped\n");
    printf("-----------------------------------------------------------------\n");
    for (i = 0; i < nsec; i++)
{
       printf("Enter the size of the packet entering at %d sec:\n", i + 1);
       scanf("%d", &inp[i]);
    }

    printf("\n Second | Packet received | Packet sent | Packet left | Dropped\n");
    printf("-----------------------------------------------------------------\n");

    for (i = 0; i < nsec; i++)
    {
       count += inp[i];

       if (count > cap)
       {
          drop = count - cap;
          count = cap;
       }

       printf("%6d | %15d |", i + 1, inp[i]);

       mini = min(count, process);
       printf(" %11d |", mini);

       count -= mini;
       printf(" %12d | %7d\n", count, drop);

       drop = 0;
    }
    // Process remaining packets after all seconds
    for (; count != 0; i++)
    {
  if (count > cap)
       {
```

```
            drop = count - cap;
            count = cap;
        }

        printf("%6d | %15d |", i + 1, 0);

        mini = min(count, process);
        printf(" %11d |", mini);

        count -= mini;
        printf(" %12d | %7d\n", count, drop);
    }

    return 0;
}
```

Output:

Program 2: Using TCP/IP sockets, write a client-server program to make the client send the file name and the server to send back the contents of the requested file if present.

Code:

```
#include <stdio.h>

#include <stdlib.h>

#include <string.h>

#include <sys/types.h>

#include <sys/socket.h>

#include <netinet/in.h>

#include <netdb.h>


int main(int argc, char *argv[])

{

    int sockfd, portno, n;

    struct sockaddr_in serv;
```

```
    struct hostent *server;
    char buffer[256];
    char c[20000];

    if (argc < 3) {
        printf("Error: insufficient arguments.\n");
        printf("Usage: %s <hostname> <port>\nExample: %s 127.0.0.1 7777\n",
argv[0], argv[0]);
        exit(1);
    }

    portno = atoi(argv[2]);

    // Create socket
    sockfd = socket(AF_INET, SOCK_STREAM, 0);
    if (sockfd < 0) {
        perror("Error opening socket");
        exit(1);
    }

    // Get server by name/IP
    server = gethostbyname(argv[1]);
    if (server == NULL) {
        fprintf(stderr, "Error: no such host.\n");
        exit(1);
    }
```

```
    // Zero out the structure
    bzero((char *)&serv, sizeof(serv));
    serv.sin_family = AF_INET;
    bcopy((char *)server->h_addr, (char *)&serv.sin_addr.s_addr, server-
>h_length);
    serv.sin_port = htons(portno);

    // Connect to server
    if (connect(sockfd, (struct sockaddr *)&serv, sizeof(serv)) < 0) {
        perror("Error connecting");
        exit(1);
    }

    printf("Enter the file path (complete path): ");
    scanf("%s", buffer);

    // Send filename to server
    n = write(sockfd, buffer, strlen(buffer));
    if (n < 0) {
        perror("Error writing to socket");
        exit(1);
    }

    bzero(c, sizeof(c));
    printf("Reading file contents from server...\n");

    // Read file contents
```

```
    n = read(sockfd, c, sizeof(c) - 1);
    if (n < 0) {
        perror("Error reading from socket");
        exit(1);
    }

    printf("\nClient: Display content of %s\n----------------------------------\n",
buffer);
    fputs(c, stdout);
    printf("\n----------------------------------\n");

    close(sockfd);
    return 0;
}
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <unistd.h>
#include <sys/types.h>
#include <sys/socket.h>
#include <netinet/in.h>

int main(int argc, char *argv[])
{
    int sockfd, newsockfd, portno, len, n;
    char buffer[256], c[2000], cc[20000];
    struct sockaddr_in serv, cli;
```

```
FILE *fd;

if (argc < 2) {
    printf("Error: no port number provided.\n");
    printf("Usage: %s <port>\nExample: %s 7777\n", argv[0], argv[0]);
    exit(1);
}

// Create socket
sockfd = socket(AF_INET, SOCK_STREAM, 0);
if (sockfd < 0) {
    perror("Error opening socket");
    exit(1);
}

// Initialize server address structure
bzero((char *)&serv, sizeof(serv));
portno = atoi(argv[1]);
serv.sin_family = AF_INET;
serv.sin_addr.s_addr = INADDR_ANY;
serv.sin_port = htons(portno);

// Bind socket
if (bind(sockfd, (struct sockaddr *)&serv, sizeof(serv)) < 0) {
    perror("Error on binding");
    close(sockfd);
    exit(1);
```

```
}

// Listen for incoming connections
listen(sockfd, 5);
len = sizeof(cli);
printf("Server: waiting for connection on port %d...\n", portno);

// Accept a client
newsockfd = accept(sockfd, (struct sockaddr *)&cli, (socklen_t *)&len);
if (newsockfd < 0) {
    perror("Error on accept");
    close(sockfd);
    exit(1);
}

// Read filename from client
bzero(buffer, 255);
n = read(newsockfd, buffer, 255);
if (n < 0) {
    perror("Error reading from socket");
    close(newsockfd);
    close(sockfd);
    exit(1);
}

printf("Server received filename: %s\n", buffer);
```

```
    // Try to open the file
    fd = fopen(buffer, "r");
    if (fd != NULL) {
        printf("Server: file '%s' found, reading and sending...\n", buffer);
        bzero(cc, sizeof(cc));
        while (fgets(c, sizeof(c), fd) != NULL) {
            strcat(cc, c);
        }
        fclose(fd);

        // Send file content to client
        n = write(newsockfd, cc, strlen(cc));
        if (n < 0)
            perror("Error writing to socket");
        else
            printf("File transfer complete.\n");
    } else {
        printf("Server: file not found.\n");
        n = write(newsockfd, "Error: file not found.\n", 24);
        if (n < 0)
            perror("Error writing to socket");
    }

    close(newsockfd);
    close(sockfd);
    return 0;
}
```

Output:

Program 3: Using UDP sockets, write a client-server program to make the client send the file name and the server to send back the contents of the requested file if present.

Code:

```
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <unistd.h>
#include <arpa/inet.h>

#define PORT 8080
#define MAXLINE 1024

int main() {
    int sockfd;
    char buffer[MAXLINE];
    struct sockaddr_in servaddr, cliaddr;
    socklen_t len;
    ssize_t n;

    // Create UDP socket
    if ((sockfd = socket(AF_INET, SOCK_DGRAM, 0)) < 0) {
        perror("socket creation failed");
        exit(EXIT_FAILURE);
```

```
    }

    memset(&servaddr, 0, sizeof(servaddr));
    memset(&cliaddr, 0, sizeof(cliaddr));

    // Server info
    servaddr.sin_family = AF_INET;
    servaddr.sin_addr.s_addr = INADDR_ANY;
    servaddr.sin_port = htons(PORT);

    // Bind socket to the port
    if (bind(sockfd, (const struct sockaddr *)&servaddr, sizeof(servaddr)) < 0) {
        perror("bind failed");
        close(sockfd);
        exit(EXIT_FAILURE);
    }

    printf("UDP Server is running on port %d...\n", PORT);

    len = sizeof(cliaddr);

    // Receive filename from client
    n = recvfrom(sockfd, (char *)buffer, MAXLINE, 0, (struct sockaddr *)&cliaddr,
&len);
    buffer[n] = '\0';
    printf("Client requested file: %s\n", buffer);
```

```
    FILE *fp = fopen(buffer, "r");
    if (fp == NULL) {
        char *msg = "File not found!";
        sendto(sockfd, msg, strlen(msg), 0, (struct sockaddr *)&cliaddr, len);
        printf("File not found, message sent to client.\n");
    } else {
        // Read and send file content
        while (fgets(buffer, MAXLINE, fp) != NULL) {
            sendto(sockfd, buffer, strlen(buffer), 0, (struct sockaddr *)&cliaddr, len);
        }
        fclose(fp);
        printf("File sent successfully.\n");
    }

    close(sockfd);
    return 0;
}
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <unistd.h>
#include <arpa/inet.h>

#define PORT 8080
#define MAXLINE 1024

int main() {
```

```
    int sockfd;
    char buffer[MAXLINE];
    struct sockaddr_in servaddr;
    socklen_t len;

    // Create UDP socket
    if ((sockfd = socket(AF_INET, SOCK_DGRAM, 0)) < 0) {
        perror("socket creation failed");
        exit(EXIT_FAILURE);
    }

    memset(&servaddr, 0, sizeof(servaddr));

    servaddr.sin_family = AF_INET;
    servaddr.sin_port = htons(PORT);
    servaddr.sin_addr.s_addr = INADDR_ANY;

    printf("Enter the filename to request: ");
    fgets(buffer, MAXLINE, stdin);
    buffer[strcspn(buffer, "\n")] = '\0';  // remove newline

    // Send filename to server
    sendto(sockfd, buffer, strlen(buffer), 0, (const struct sockaddr *)&servaddr,
sizeof(servaddr));

    printf("Request sent. Waiting for file content...\n\n");
```

```
    len = sizeof(servaddr);

    // Receive file contents
    ssize_t n;
    while ((n = recvfrom(sockfd, buffer, MAXLINE, 0, (struct sockaddr
*)&servaddr, &len)) > 0) {
        buffer[n] = '\0';
        printf("%s", buffer);
        if (n < MAXLINE - 1) break;  // assume end of file
    }

    printf("\n\nFile transfer complete.\n");

    close(sockfd);
    return 0;
}
```

Output:

Program 4: Write a program for error detecting code using CRC-CCITT (16-bits).

Code:

```
#include <stdio.h>
#include <string.h>
#include <stdlib.h>

int main()
```

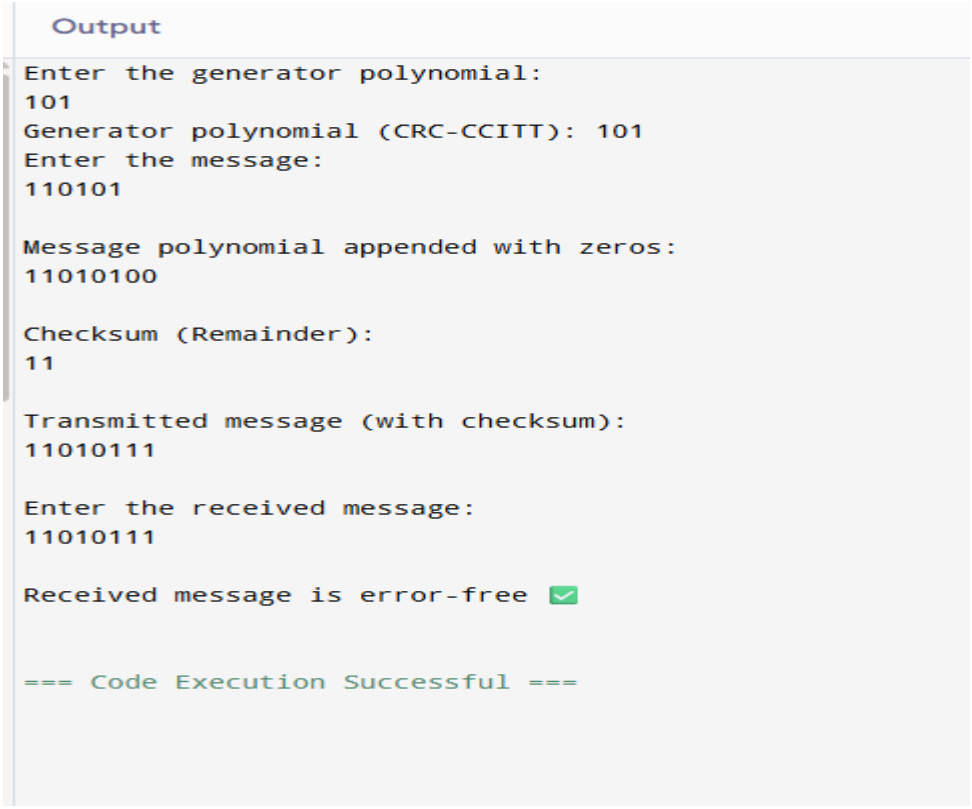
```
{
    char rem[50], a[50], s[50], c, msj[50], gen[30];
    int i, genlen, t, j, flag = 0, k, n;

    printf("Enter the generator polynomial:\n");
    fgets(gen, sizeof(gen), stdin);
    gen[strcspn(gen, "\n")] = '\0';  // remove newline if present
    printf("Generator polynomial (CRC-CCITT): %s\n", gen);

    genlen = strlen(gen);
    k = genlen - 1;

    printf("Enter the message:\n");
    fgets(msj, sizeof(msj), stdin);
    msj[strcspn(msj, "\n")] = '\0';  // remove newline

    n = strlen(msj);

    // Append k zeros to the message
    for (i = 0; i < n; i++)
        a[i] = msj[i];
    for (i = 0; i < k; i++)
        a[n + i] = '0';
    a[n + k] = '\0';

    printf("\nMessage polynomial appended with zeros:\n");
    puts(a);
```

```
// Division (XOR)
for (i = 0; i < n; i++)
{
    if (a[i] == '1')
    {
        t = i;
        for (j = 0; j <= k; j++)
        {
            if (a[t] == gen[j])
                a[t] = '0';
            else
                a[t] = '1';
            t++;
        }
    }
}
// Get remainder
for (i = 0; i < k; i++)
    rem[i] = a[n + i];
rem[k] = '\0';
printf("\nChecksum (Remainder):\n");
puts(rem);
// Append checksum to message
printf("\nTransmitted message (with checksum):\n");
for (i = 0; i < n; i++)
    a[i] = msj[i];
```

```
for (i = 0; i < k; i++)
    a[n + i] = rem[i];
a[n + k] = '\0';
puts(a);
// Receiver side
printf("\nEnter the received message:\n");
fgets(s, sizeof(s), stdin);
s[strcspn(s, "\n")] = '\0';  // remove newline
n = strlen(s);
// Division on received message
for (i = 0; i < n - k; i++)
{
    if (s[i] == '1')
    {
        t = i;
        for (j = 0; j <= k; j++, t++)
        {
            if (s[t] == gen[j])
                s[t] = '0';
            else
                s[t] = '1';
        }
    }
}
for (i = 0; i < k; i++)
    rem[i] = s[n - k + i];
rem[k] = '\0';
```

```
    // Check for error
    flag = 0;
    for (i = 0; i < k; i++)
    {
        if (rem[i] == '1')
            flag = 1;
    }
    if (flag == 0)
        printf("\nReceived message is error-free ✅\n");
    else
        printf("\nReceived message contains errors ❌\n");
    return 0;
}
```

Output:



```
Output

Enter the generator polynomial:
101
Generator polynomial (CRC-CCITT): 101
Enter the message:
110101

Message polynomial appended with zeros:
11010100

Checksum (Remainder):
11

Transmitted message (with checksum):
11010111

Enter the received message:
11010111

Received message is error-free ✅


=== Code Execution Successful ===
```