

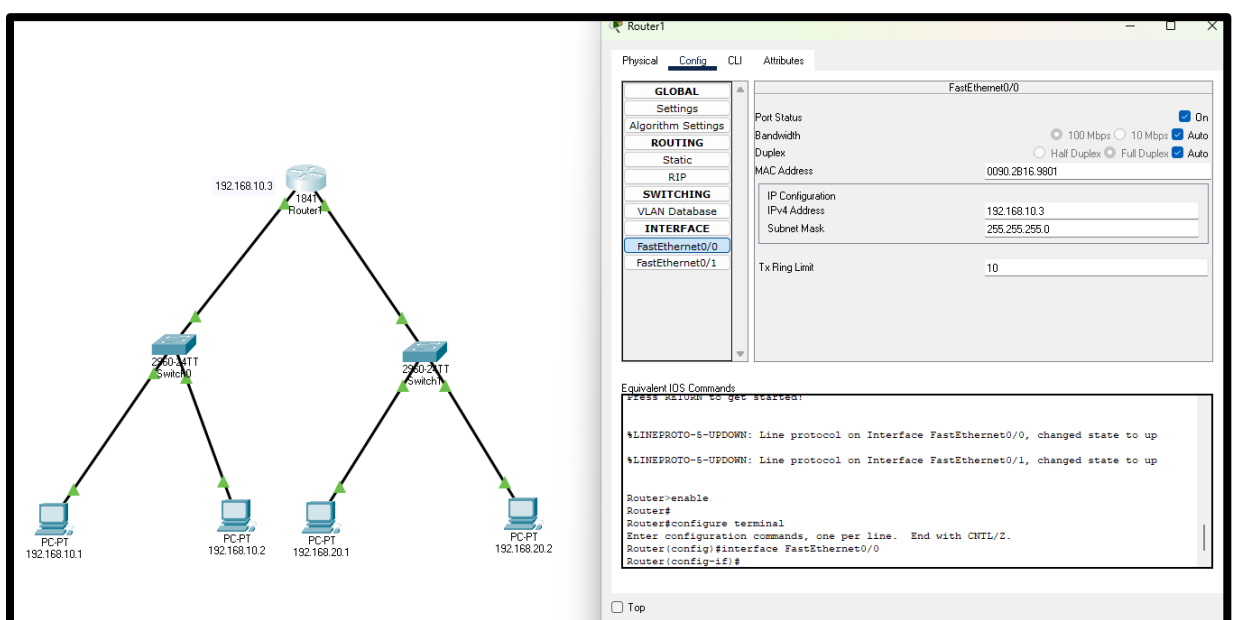
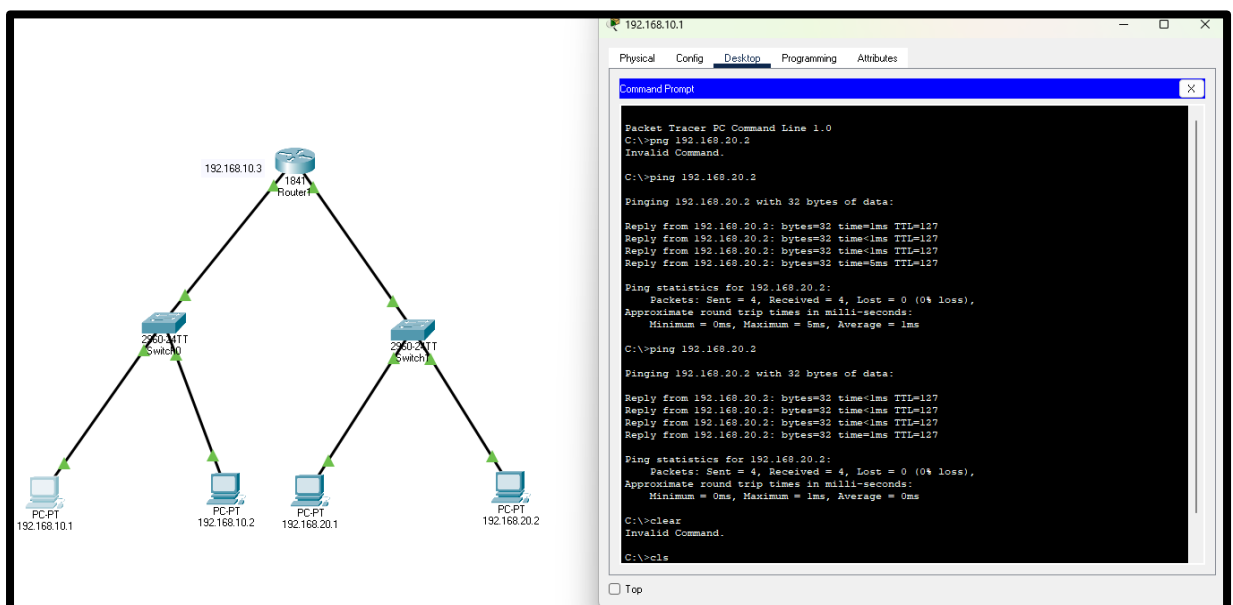
Date: 9/12/2025

# Lab Practical #11:

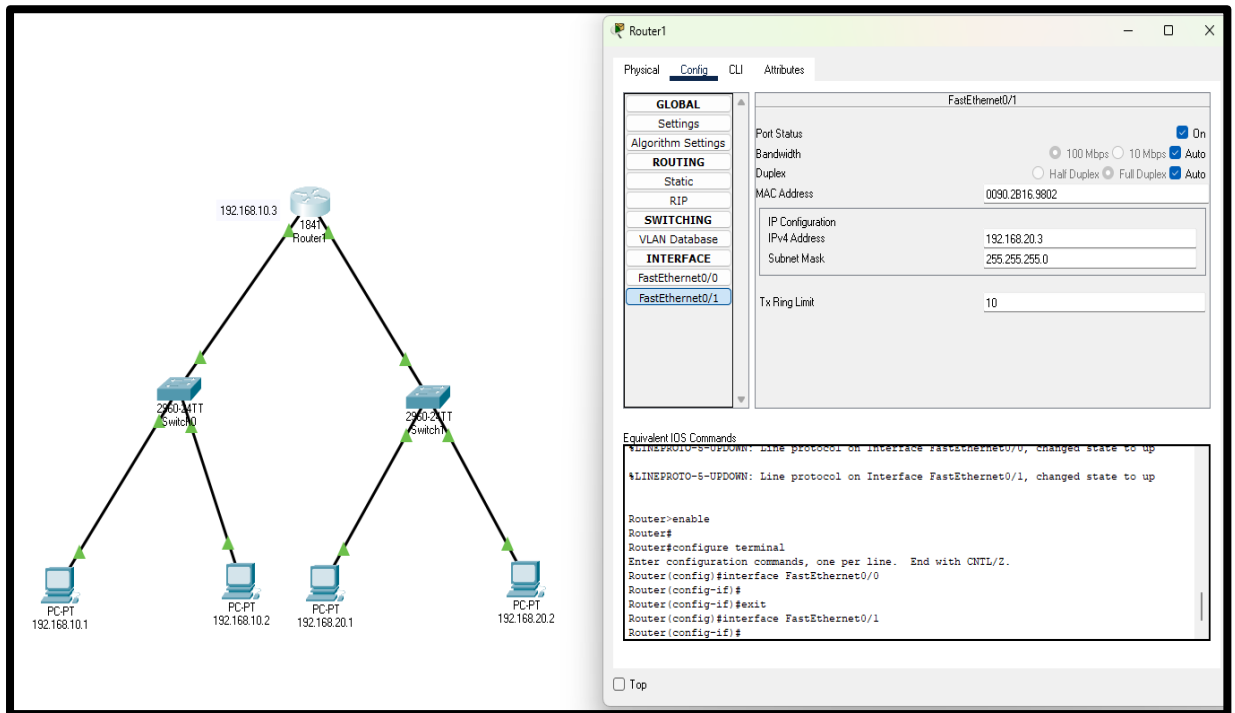
Study the concept of routing using packet tracer. (Dynamic Routing)

## Practical Assignment #11:

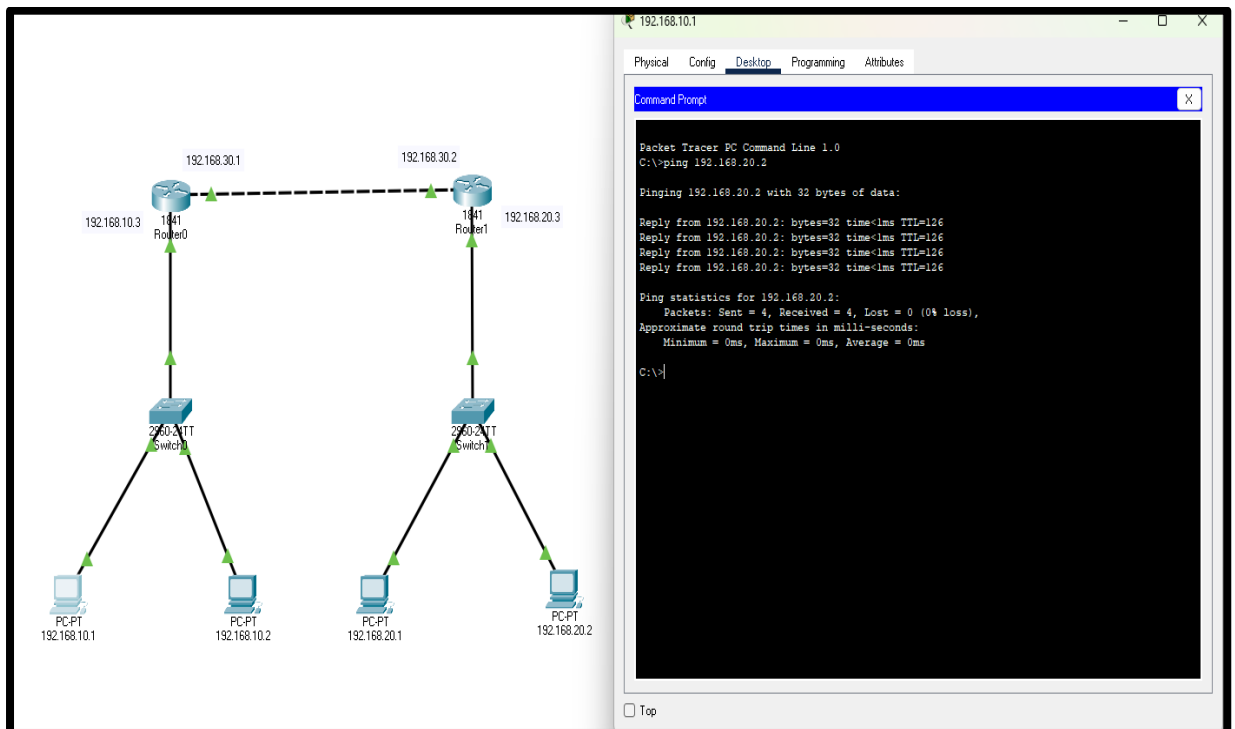
1. Connect the two different networks based on the calculated IP addresses and subnet using a packet tracer.



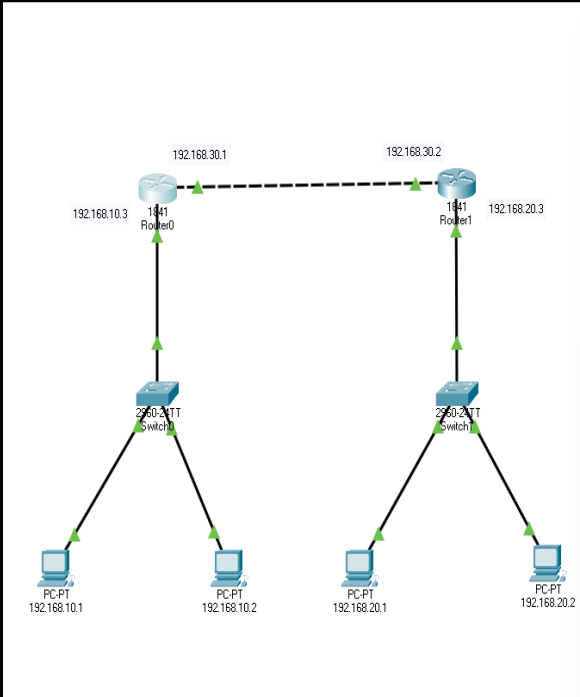
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## 2. Connect the three different networks based on the calculated IP addresses and subnet using a packet tracer.



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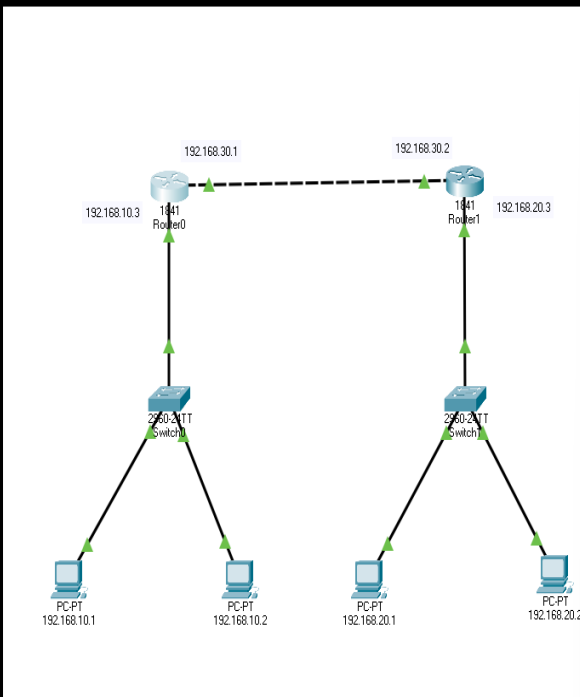


**Router0 Configuration (FastEthernet0/0):**

```

Router0#configure router
Router0(config)#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router0(config)#router rip
Router0(config-router)#
%SYS-5-CONFIG_I: Configured from console by console

Router0(config-router)#end
Router0#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router0(config)#interface FastEthernet0/0
Router0(config-if)#
%SYS-5-CONFIG_I: Configured from console by console
          
```



**Router0 Configuration (FastEthernet0/1):**

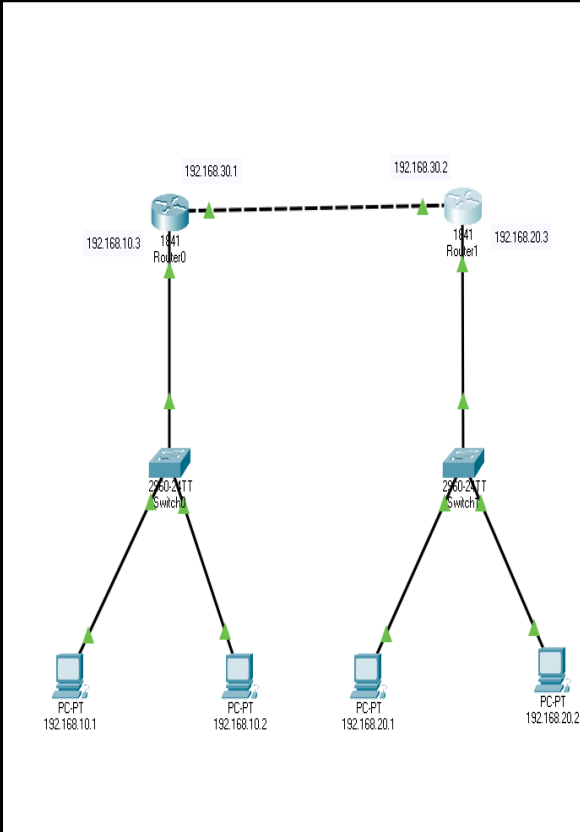
```

Router0#configure router rip
Router0(config-router)#
%SYS-5-CONFIG_I: Configured from console by console

Router0(config-router)#end
Router0#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router0(config)#interface FastEthernet0/0
Router0(config-if)#
%SYS-5-CONFIG_I: Configured from console by console

Router0(config-if)#exit
Router0(config)#interface FastEthernet0/1
Router0(config-if)#
          
```

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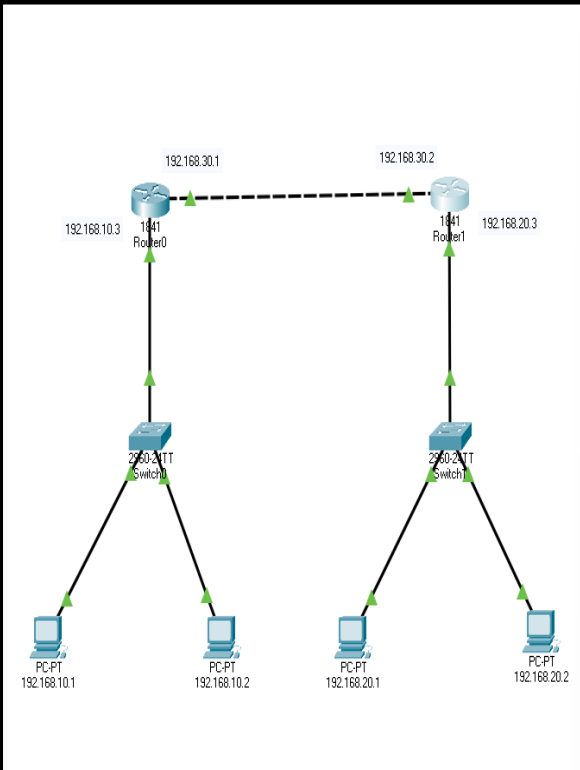


**Router1 Configuration (FastEthernet0/0)**

Port Status	On
Bandwidth	100 Mbps
Duplex	Full Duplex
MAC Address	0001.C760.1501
IP Configuration	
IPv4 Address	192.168.20.3
Subnet Mask	255.255.255.0
Tx Ring Limit	10

**Equivalent IOS Commands:**

```
Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface FastEthernet0/0
Router(config-if)#
```



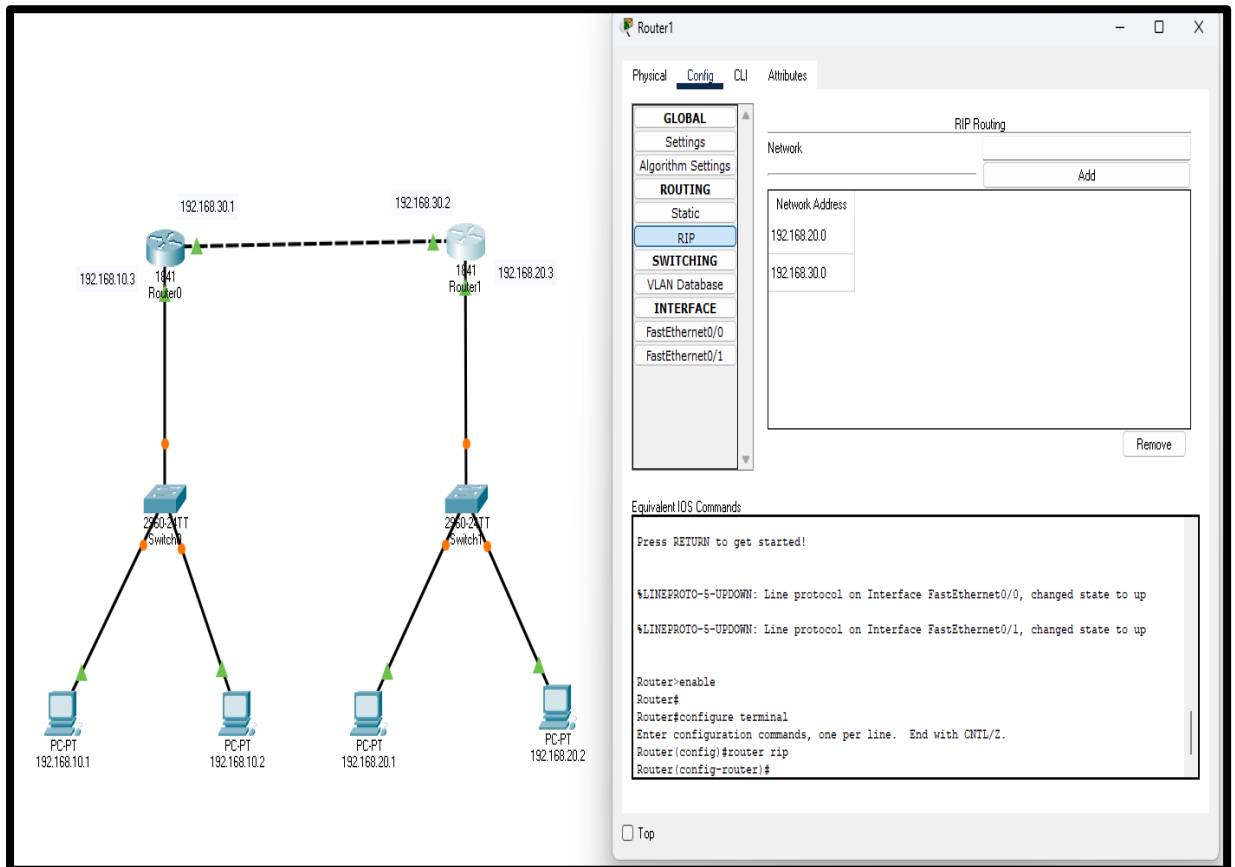
**Router1 Configuration (FastEthernet0/1)**

Port Status	On
Bandwidth	100 Mbps
Duplex	Full Duplex
MAC Address	0001.C760.1502
IP Configuration	
IPv4 Address	192.168.30.2
Subnet Mask	255.255.255.0
Tx Ring Limit	10

**Equivalent IOS Commands:**

```
Router#
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface FastEthernet0/0
Router(config-if)#exit
Router(config)#interface FastEthernet0/1
Router(config-if)#
Router(config-if)#exit
Router(config)#interface FastEthernet0/1
Router(config-if)#
Router(config-if)#exit
Router(config)#interface FastEthernet0/1
Router(config-if)#
Router(config-if)#exit
Router(config)#interface FastEthernet0/1
Router(config-if)#
```

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The network diagram shows two routers, Router0 and Router1, connected via their serial interfaces. Router0 has IP 192.168.30.1 on its serial interface and 192.168.10.3 on its Ethernet interface. Router1 has IP 192.168.30.2 on its serial interface and 192.168.20.3 on its Ethernet interface. Both routers are connected to a 2602-TT switch. Each switch is connected to two PCs. The PCs under Router0 have IP addresses 192.168.10.1 and 192.168.10.2. The PCs under Router1 have IP addresses 192.168.20.1 and 192.168.20.2.

The Router1 configuration window shows the following settings:

- GLOBAL**
  - Settings
  - Algorithm Settings
  - ROUTING**
    - Static
    - RIP**
  - SWITCHING**
    - VLAN Database
  - INTERFACE**
    - FastEthernet0/0
    - FastEthernet0/1

**RIP Routing**

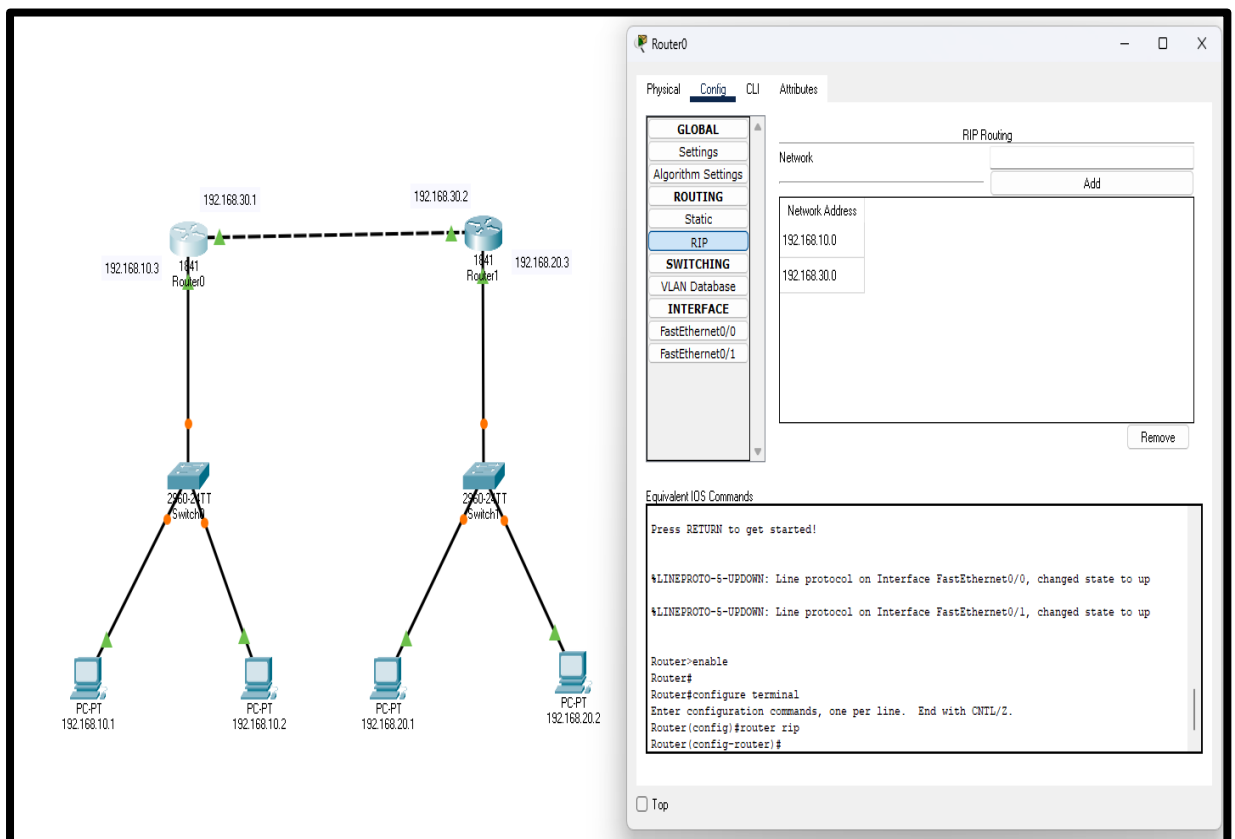
Network Address

- 192.168.20.0
- 192.168.30.0

Remove

**Equivalent IOS Commands**

```
Press RETURN to get started!  
  
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up  
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, 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)#
```



The network diagram is identical to the one above, showing two routers connected via their serial interfaces, each with a switch and two PCs.

The Router0 configuration window shows the following settings:

- GLOBAL**
  - Settings
  - Algorithm Settings
  - ROUTING**
    - Static
    - RIP**
  - SWITCHING**
    - VLAN Database
  - INTERFACE**
    - FastEthernet0/0
    - FastEthernet0/1

**RIP Routing**

Network Address

- 192.168.10.0
- 192.168.30.0

Remove

**Equivalent IOS Commands**

```
Press RETURN to get started!  
  
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up  
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, 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)#
```

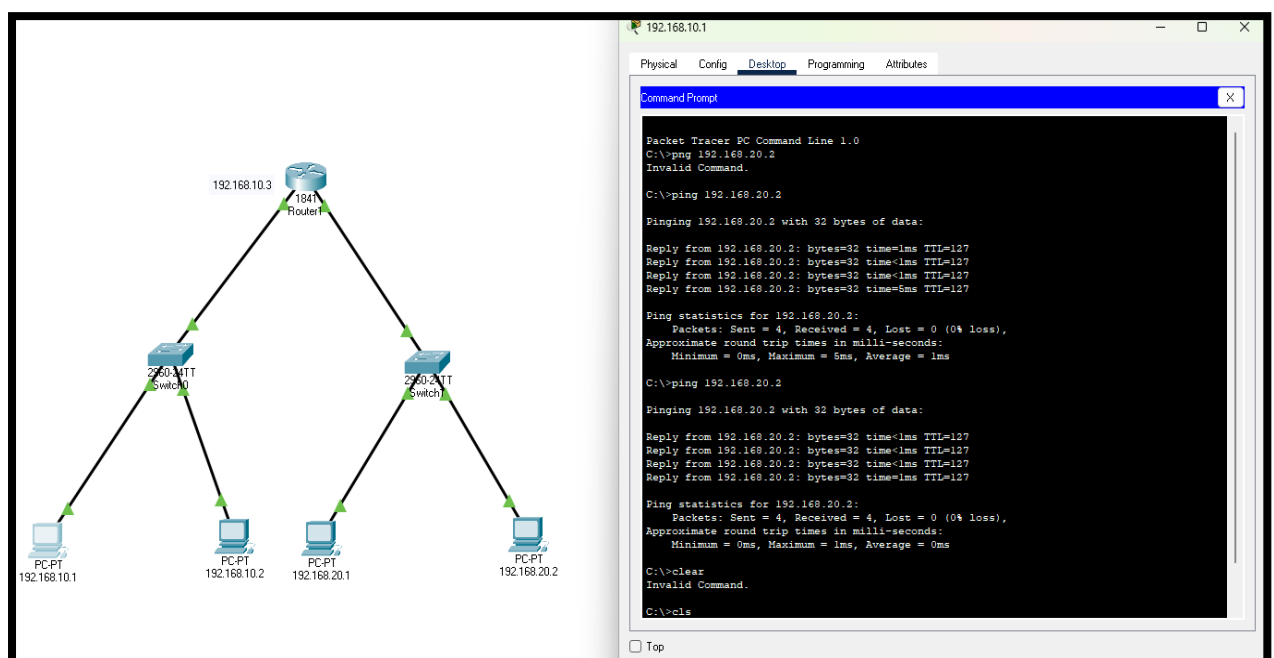
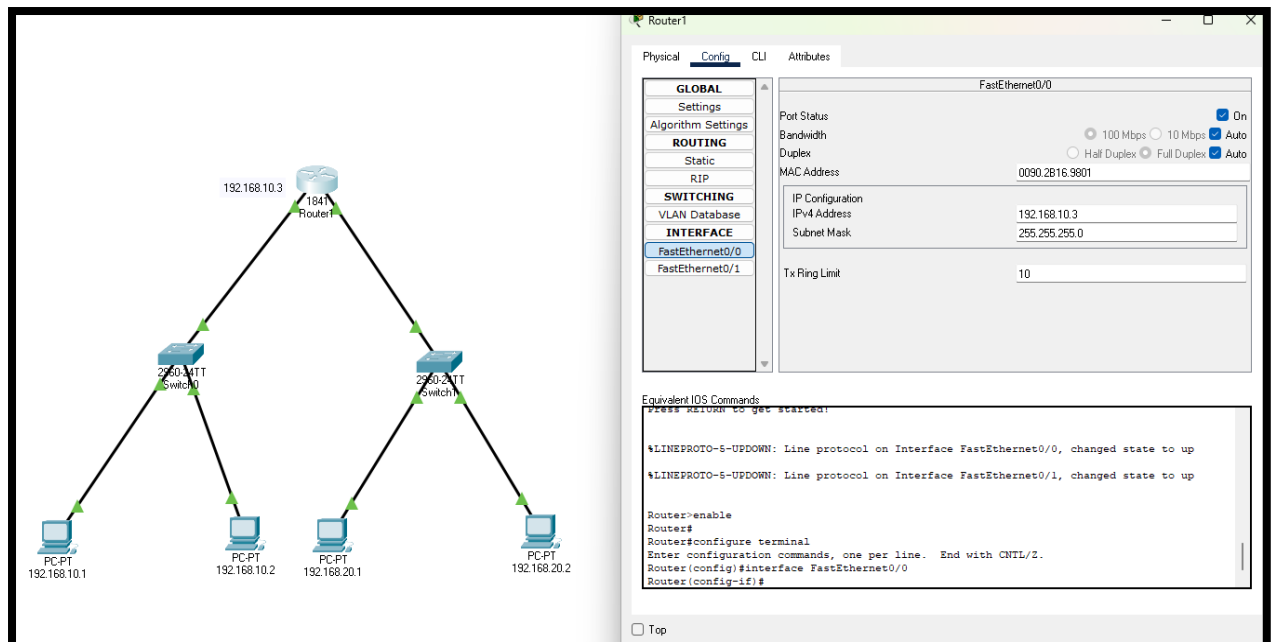
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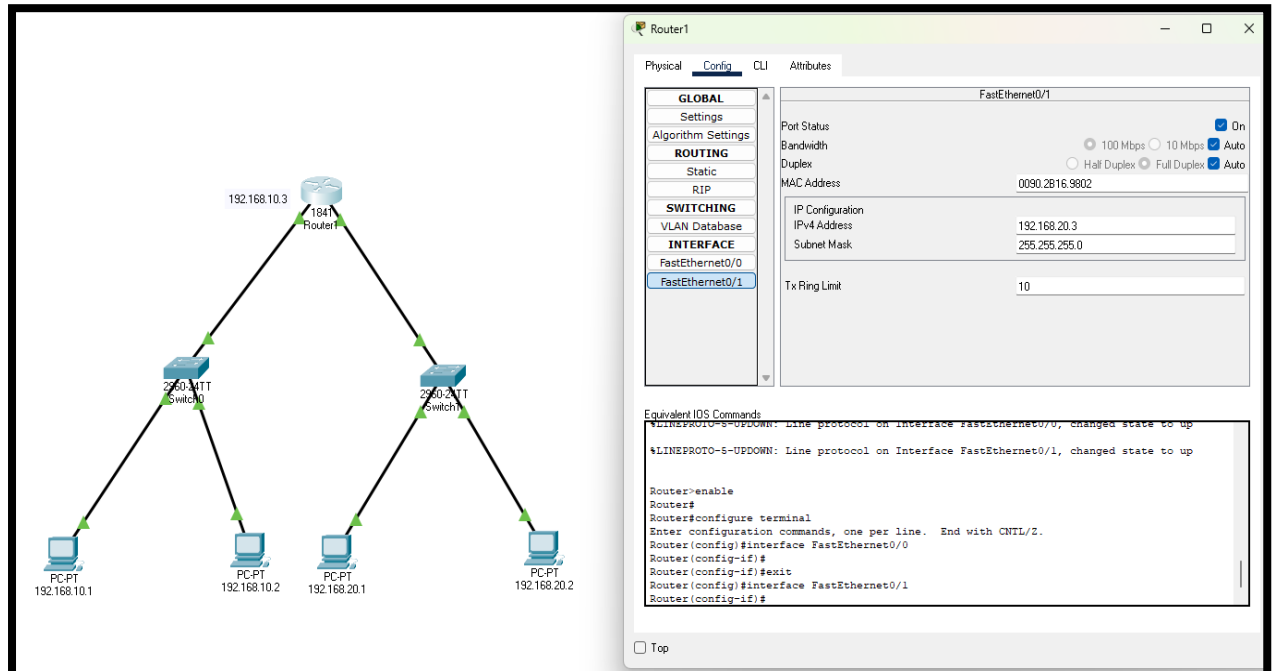
# Lab Practical #12:

Study the concept of routing using packet tracer. (Static Routing)

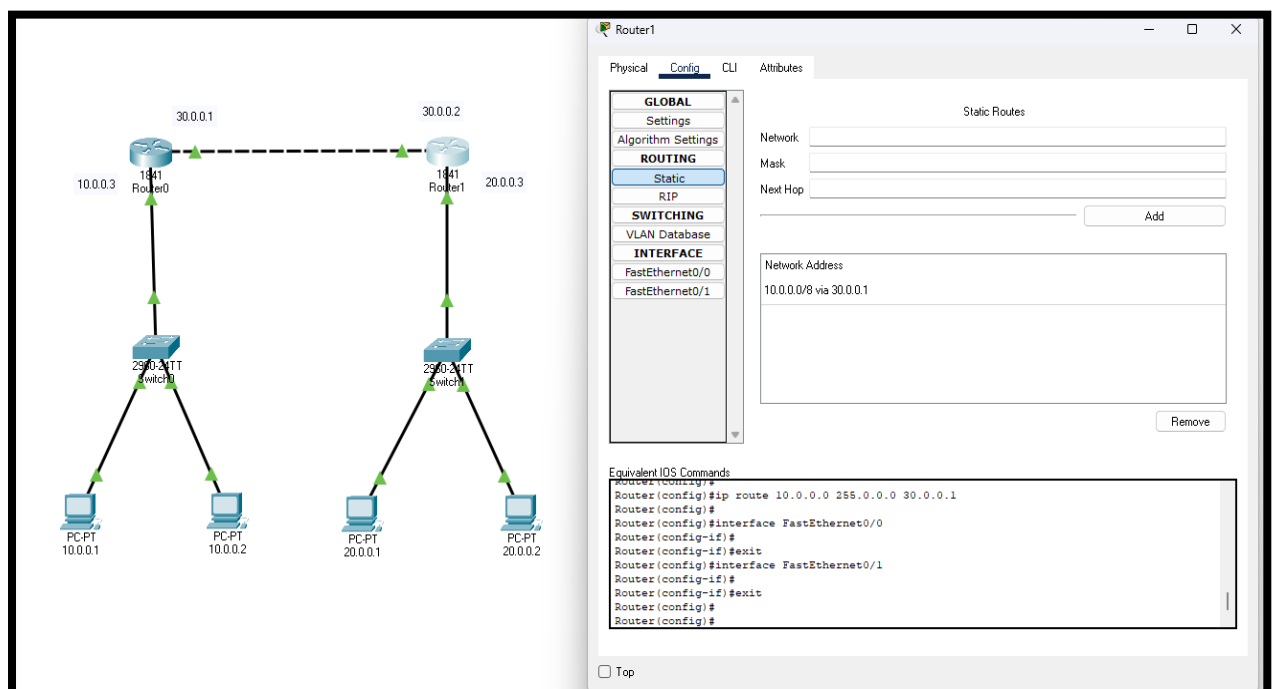
## Practical Assignment #12:

1. Connect the two different networks based on the calculated IP addresses and subnet using a packet tracer.

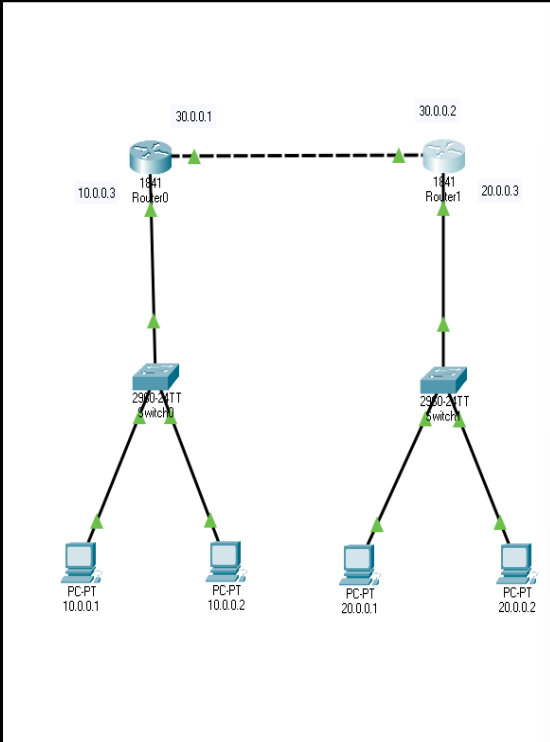




2. Connect the three different networks based on the calculated IP addresses and subnet using a packet tracer.



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**Router1 Configuration**

**FastEthernet0/1**

Port Status: ☒ On

Bandwidth: 100 Mbps ☐ 10 Mbps ☒ Auto

Duplex: ☐ Half Duplex ☒ Full Duplex ☒ Auto

MAC Address: 0002.17C1.2502

IP Configuration:

IPv4 Address: 30.0.0.2

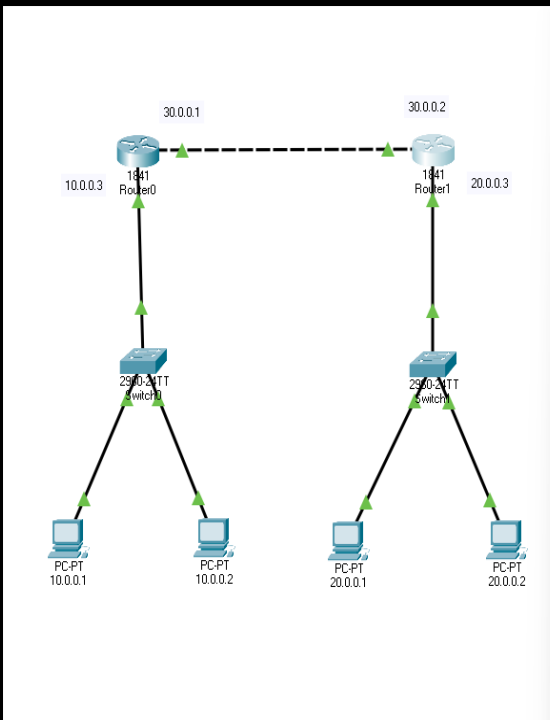
Subnet Mask: 255.0.0.0

Tx Ring Limit: 10

**Equivalent IOS Commands**

```

%LINK-S-CHANGED: Interface FastEthernet0/1, changed state to up
%LINEPROTO-S-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up
ip address 30.0.0.2 255.0.0.0
Router(config-if)#
Router(config-if)#exit
Router(config)#
Router(config)#ip route 10.0.0.0 255.0.0.0 30.0.0.1
Router(config)#
Router(config)#interface FastEthernet0/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface FastEthernet0/1
Router(config-if)#
                    
```



**Router1 Configuration**

**FastEthernet0/0**

Port Status: ☒ On

Bandwidth: 100 Mbps ☐ 10 Mbps ☒ Auto

Duplex: ☐ Half Duplex ☒ Full Duplex ☒ Auto

MAC Address: 0002.17C1.2501

IP Configuration:

IPv4 Address: 20.0.0.3

Subnet Mask: 255.0.0.0

Tx Ring Limit: 10

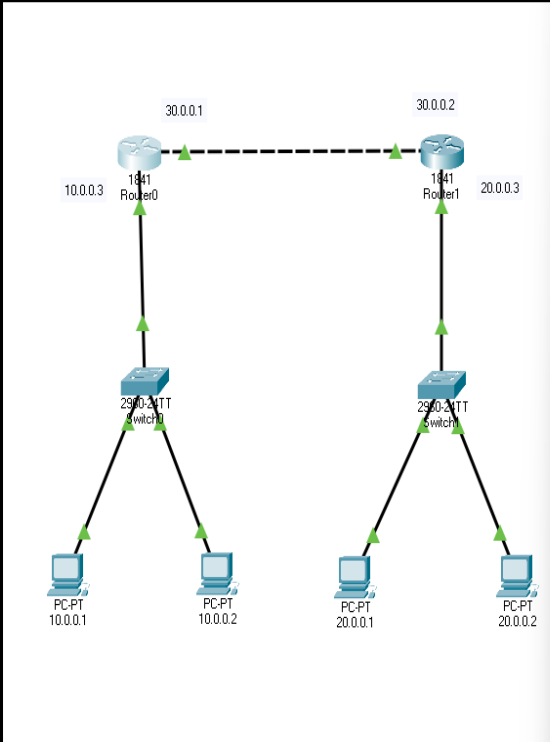
**Equivalent IOS Commands**

```

Router(config)#interface FastEthernet0/1
Router(config-if)#no shutdown
Router(config-if)#
Router(config-if)#exit
%LINK-S-CHANGED: Interface FastEthernet0/1, changed state to up
%LINEPROTO-S-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up
ip address 30.0.0.2 255.0.0.0
Router(config-if)#
Router(config-if)#exit
Router(config)#
Router(config)#ip route 10.0.0.0 255.0.0.0 30.0.0.1
Router(config)#
Router(config)#interface FastEthernet0/0
Router(config-if)#
                    
```



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### Router0 Configuration

**Physical** | **Config** | CLI | Attributes

**GLOBAL**

- Settings
- Algorithm Settings
- ROUTING**
  - Static
  - RIP
- SWITCHING
- VLAN Database
- INTERFACE**
  - FastEthernet0/0
  - FastEthernet0/1

**Static Routes**

Network:

Mask:

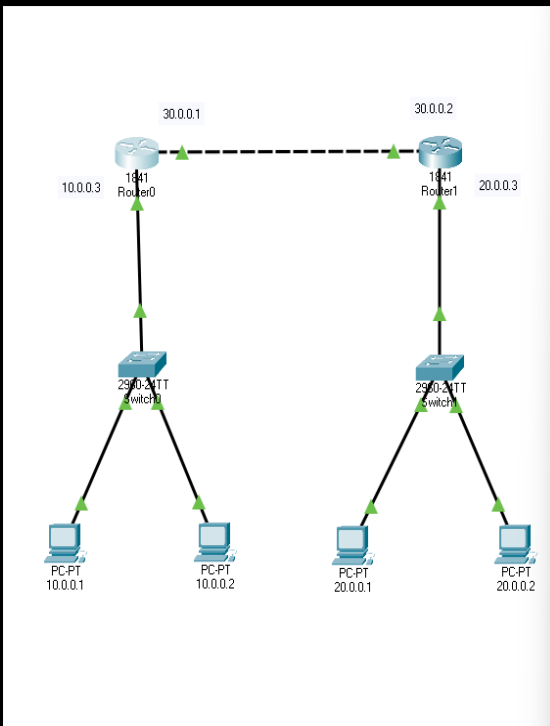
Next Hop:

Network Address: 20.0.0.0/8 via 30.0.0.2

**Equivalent IOS Commands**

```
Router(config)#ip route 20.0.0.0 255.0.0.0 30.0.0.2
Router(config)#
Router(config)#interface FastEthernet0/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface FastEthernet0/1
Router(config-if)#
Router(config-if)#exit
Router(config)#
Router(config)#
```

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### Router0 Configuration

**Physical** | **Config** | CLI | Attributes

**GLOBAL**

- Settings
- Algorithm Settings
- ROUTING**
  - Static
  - RIP
- SWITCHING
- VLAN Database
- INTERFACE**
  - FastEthernet0/0**
  - FastEthernet0/1

**FastEthernet0/0**

Port Status: ☒ On

Bandwidth: ☒ 100 Mbps ☐ 10 Mbps ☒ Auto

Duplex: ☐ Half Duplex ☒ Full Duplex ☒ Auto

MAC Address: 0001.962E.8901

IP Configuration

IPv4 Address: 10.0.0.3

Subnet Mask: 255.0.0.0

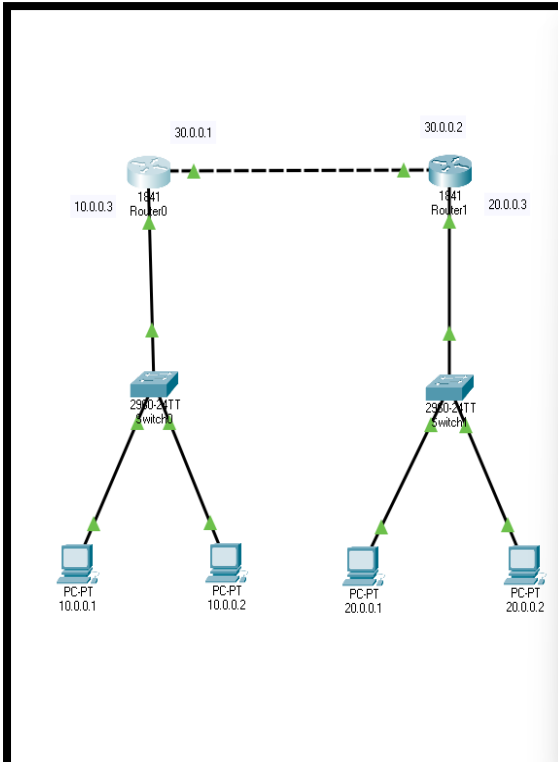
Tx Ring Limit: 10

**Equivalent IOS Commands**

```
Router(config-if)#no shutdown
Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up
Router(config-if)#exit
Router(config)#
Router(config)#
Router(config)#
Router(config)#ip route 20.0.0.0 255.0.0.0 30.0.0.2
Router(config)#
Router(config)#interface FastEthernet0/0
Router(config-if)#
```

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**Router0 Configuration**

**FastEthernet0/1**

Port Status: ☒ On

Bandwidth: ☒ 100 Mbps ☐ 10 Mbps ☒ Auto

Duplex: ☐ Half Duplex ☒ Full Duplex ☒ Auto

MAC Address: 0001.962E.8902

IP Configuration:

IPv4 Address: 30.0.0.1

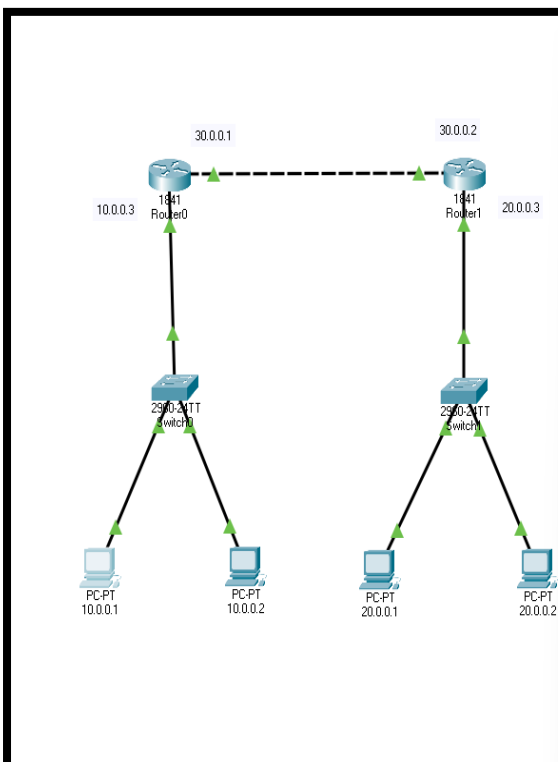
Subnet Mask: 255.0.0.0

Tx Ring Limit: 10

**Equivalent IOS Commands**

```

$LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up
Router(config-if)#exit
Router(config)#
Router(config)#
Router(config)#
Router(config)#ip route 20.0.0.0 255.0.0.0 30.0.0.2
Router(config)#
Router(config)#interface FastEthernet0/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface FastEthernet0/1
Router(config-if)#
                    
```



**10.0.0.1 Command Prompt**

```

Packet Tracer PC Command Line 1.0
C:\>ping 20.0.0.1

Pinging 20.0.0.1 with 32 bytes of data:

Reply from 20.0.0.1: bytes=32 time<1ms TTL=126
Reply from 20.0.0.1: bytes=32 time<1ms TTL=126
Reply from 20.0.0.1: bytes=32 time<1ms TTL=126
Reply from 20.0.0.1: bytes=32 time<1ms TTL=126

Ping statistics for 20.0.0.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>
                    
```

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# Lab Practical #13:

To develop network using distance vector routing protocol and link state routing protocol.

## Practical Assignment #13:

### 1. C/Java Program: Distance Vector Routing Algorithm using Bellman Ford's Algorithm.

```
import java.util.*;

public class DistanceVectorRouting {
    private static final int INF = 9999;

    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);

        System.out.print("Enter the number of routers: ");
        int numRouters = scanner.nextInt();

        int[][] costMatrix = new int[numRouters][numRouters];
        System.out.println("Enter the cost matrix (use " + INF + " for infinity):");
        for (int i = 0; i < numRouters; i++) {
            for (int j = 0; j < numRouters; j++) {
                costMatrix[i][j] = scanner.nextInt();
            }
        }

        int[][] distanceVector = new int[numRouters][numRouters];
        int[][] nextHop = new int[numRouters][numRouters];

        for (int i = 0; i < numRouters; i++) {
            for (int j = 0; j < numRouters; j++) {
                distanceVector[i][j] = costMatrix[i][j];
                nextHop[i][j] = (costMatrix[i][j] != INF && i != j) ? j : -1;
            }
        }

        boolean updated;
        do {
            updated = false;
            for (int i = 0; i < numRouters; i++) {
```

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```
        for (int j = 0; j < numRouters; j++) {
            for (int k = 0; k < numRouters; k++) {
                if (distanceVector[i][k] + distanceVector[k][j] <
distanceVector[i][j]) {
                    distanceVector[i][j] = distanceVector[i][k] +
distanceVector[k][j];
                    nextHop[i][j] = nextHop[i][k];
                    updated = true;
                }
            }
        }
    }
} while (updated);

System.out.println("\nFinal Distance Vector Table:");
for (int i = 0; i < numRouters; i++) {
    System.out.println("Router " + (i + 1) + ":");
    for (int j = 0; j < numRouters; j++) {
        if (distanceVector[i][j] == INF) {
            System.out.print("INF ");
        } else {
            System.out.print((distanceVector[i][j] + 1) + " ");
        }
    }
    System.out.println();
}

scanner.close();
}
```

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### Output:

```
D:\se\DV.exe
Enter the number of nodes : 3
Enter the cost matrix :
0 2 7
2 0 1
7 1 0

For router 1
node 1 via 1 Distance 0
node 2 via 2 Distance 2
node 3 via 2 Distance 3

For router 2
node 1 via 1 Distance 2
node 2 via 2 Distance 0
node 3 via 3 Distance 1

For router 3
node 1 via 2 Distance 3
node 2 via 2 Distance 1
node 3 via 3 Distance 0
```

## 2. C/Java Program: Link state routing algorithm.

```
import java.util.*;
```

```
public class LinkStateRouting {
    private static final int INF = 9999;

    private static int minDistance(int[] dist, boolean[] visited, int n) {
        int min = INF, minIndex = -1;
        for (int v = 0; v < n; v++) {
            if (!visited[v] && dist[v] < min) {
                min = dist[v];
                minIndex = v;
            }
        }
        return minIndex;
    }

    private static void printPath(int[] prev, int j) {
        if (prev[j] == -1) {
            System.out.print((j + 1));
            return;
        }
    }
}
```

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```
printPath(prev, prev[j]);
System.out.print(" -> " + (j + 1));
}

public static void main(String[] args) {
    Scanner scanner = new Scanner(System.in);

    System.out.print("Enter the number of routers: ");
    int numRouters = scanner.nextInt();

    int[][] costMatrix = new int[numRouters][numRouters];
    System.out.println("Enter the cost matrix (use " + INF + " for infinity):");
    for (int i = 0; i < numRouters; i++) {
        for (int j = 0; j < numRouters; j++) {
            costMatrix[i][j] = scanner.nextInt();
        }
    }

    for (int src = 0; src < numRouters; src++) {
        int[] dist = new int[numRouters];
        int[] prev = new int[numRouters];
        boolean[] visited = new boolean[numRouters];

        Arrays.fill(dist, INF);
        Arrays.fill(prev, -1);

        dist[src] = 0;

        for (int count = 0; count < numRouters - 1; count++) {
            int u = minDistance(dist, visited, numRouters);
            if (u == -1) break;
            visited[u] = true;

            for (int v = 0; v < numRouters; v++) {
                if (!visited[v] && costMatrix[u][v] != INF && dist[u] != INF &&
                    dist[u] + costMatrix[u][v] < dist[v]) {
                    dist[v] = dist[u] + costMatrix[u][v];
                    prev[v] = u;
                }
            }
        }
    }
}
```

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```
}  
  
System.out.println("\nRouting Table for Router " + (src + 1) + ":");  
System.out.println("Destination\tCost\tPath");  
for (int dest = 0; dest < numRouters; dest++) {  
    if (dist[dest] == INF) {  
        System.out.println((dest + 1) + "\t\tINF\tNo path");  
    } else {  
        System.out.print((dest + 1) + "\t\t" + dist[dest] + "\t");  
        printPath(prev, dest);  
        System.out.println();  
    }  
}  
}  
}  
  
scanner.close();  
}  
}
```

### Output:



```
D:\CN\LinkState.exe x + v  
Enter the cost matrix values:  
0->0:1  
0->1:5  
0->2:4  
1->0:6  
1->1:7  
1->2:4  
2->0:3  
2->1:2  
2->2:6  
  
Enter the source router:4  
  
4==>0:Path taken:0  
<--4  
Shortest path cost:0  
4==>1:Path taken:1  
<--4  
Shortest path cost:0  
4==>2:Path taken:2  
<--4  
Shortest path cost:0  
-----  
Process exited after 123.1 seconds with return value 3  
Press any key to continue . . .
```

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# Lab Practical #14:

Implementation of parity bit check Using C/Java language with example.

## Practical Assignment #14:

**C/Java Program: Implementation of parity bit check Using C/Java language.**

```
import java.util.Scanner;

public class ParityBitCheck {

    public static String addParityBit(String dataBits, String parityType) {
        int countOnes = 0;
        for (char bit : dataBits.toCharArray()) {
            if (bit == '1') countOnes++;
        }

        char parityBit;

        if (parityType.equalsIgnoreCase("even")) {
            parityBit = (countOnes % 2 == 0) ? '0' : '1';
        } else {
            parityBit = (countOnes % 2 == 0) ? '1' : '0';
        }

        return dataBits + parityBit;
    }

    public static boolean checkParity(String data, String parityType) {
        char parityBit = data.charAt(data.length() - 1);
        String dataBits = data.substring(0, data.length() - 1);

        int countOnes = 0;
```



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```
for (char bit : dataBits.toCharArray()) {
    if (bit == '1') countOnes++;
}

boolean isValid;
if (parityType.equalsIgnoreCase("even")) {
    isValid = ((countOnes % 2 == 0) && parityBit == '0') ||
              ((countOnes % 2 == 1) && parityBit == '1');
} else {
    isValid = ((countOnes % 2 == 0) && parityBit == '1') ||
              ((countOnes % 2 == 1) && parityBit == '0');
}

return isValid;
}

public static void main(String[] args) {
    Scanner scanner = new Scanner(System.in);

    System.out.print("Enter binary data (without parity bit): ");
    String dataBits = scanner.nextLine();

    System.out.print("Enter parity type (even/odd): ");
    String parityType = scanner.nextLine();

    String dataWithParity = addParityBit(dataBits, parityType);
    System.out.println("Data with " + parityType + " parity bit: " +
dataWithParity);

    if (checkParity(dataWithParity, parityType)) {
        System.out.println("Parity check PASSED.");
    }
}
```

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```
} else {  
    System.out.println("Parity check FAILED.");  
}  
  
scanner.close();  
}  
}
```

```
Enter binary data (without parity bit): 1011  
Enter parity type (even/odd): even  
Data with even parity bit: 10111  
Parity check PASSED.
```

```
Enter binary data (without parity bit): 1011  
Enter parity type (even/odd): odd  
Data with odd parity bit: 10110  
Parity check PASSED.
```

```
Enter binary data (without parity bit): 1100  
Enter parity type (even/odd): even  
Data with even parity bit: 11000  
Parity check PASSED.
```

```
Enter binary data (without parity bit): 1100  
Enter parity type (even/odd): odd  
Data with odd parity bit: 11001  
Parity check PASSED.
```

Date: 16/09/2025

# Lab Practical #15:

Implementation of parity bit check Using C/Java language with example.

## Practical Assignment #15:

**C/Java Program: Implementation of Bit stuffing Using C/Java language.**

```
import java.util.Scanner;

public class BitStuffing {

    public static String stuffBits(String data) {
        StringBuilder stuffed = new StringBuilder();
        int count = 0;

        for (char bit : data.toCharArray()) {
            stuffed.append(bit);
            if (bit == '1') {
                count++;
                if (count == 5) {
                    stuffed.append('0');
                    count = 0;
                }
            } else {
                count = 0;
            }
        }

        return stuffed.toString();
    }

    public static String destuffBits(String stuffedData) {
        StringBuilder destuffed = new StringBuilder();
        int count = 0;
```



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```
for (int i = 0; i < stuffedData.length(); i++) {  
    char bit = stuffedData.charAt(i);  
    destuffed.append(bit);  
  
    if (bit == '1') {  
        count++;  
        if (count == 5 && i + 1 < stuffedData.length() && stuffedData.charAt(i +  
1) == '0') {  
            i++;  
            count = 0;  
        }  
    } else {  
        count = 0;  
    }  
}  
  
return destuffed.toString();  
}
```

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```
public static void main(String[] args) {  
    Scanner scanner = new Scanner(System.in);  
  
    System.out.print("Enter binary data: ");  
    String data = scanner.nextLine();  
  
    String stuffed = stuffBits(data);  
    System.out.println("Stuffed Data: " + stuffed);  
  
    String destuffed = destuffBits(stuffed);  
    System.out.println("Destuffed Data: " + destuffed);  
  
    scanner.close();  
}  
}
```

**1. Enter the binary data: 011111101111110**

**Bit-stuffed data: 0111110101111010**

```
Enter binary data: 011111101111110  
Stuffed Data:      0111110101111010  
Destuffed Data:    011111101111110
```

**2. Enter the binary data: 11111011111**

**Bit-stuffed data: 1 1 1 1 1 0 0 1 1 1 1 0 1**

```
Enter binary data: 011111101111110  
Stuffed Data:      0111110101111010  
Destuffed Data:    011111101111110
```