

Networking final

by Phillip Rowe

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TIME SUBMITTED	22-MAY-2019 09:57PM (UTC+0100)	WORD COUNT	5711
SUBMISSION ID	107817539	CHARACTER COUNT	28688

PHILLIP ROWE

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NETWORKING

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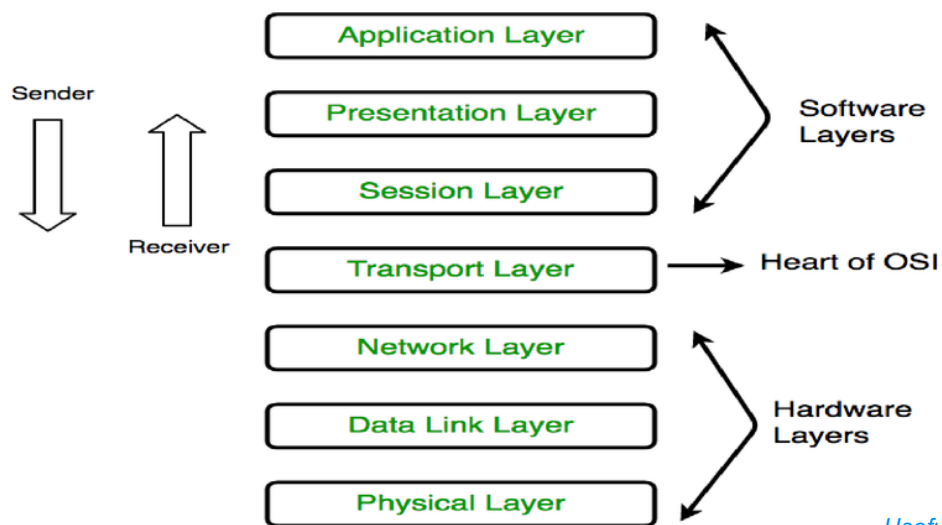
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Element 1

Research

Open systems interconnection (OSI) is a 7 layer architecture where each of the different layers have a different function to perform. The purpose of this 7 layer architecture is to work together in order to transmit data from one person to another from one place in the world to another on a different side of the globe. Below in figure 1 is a breakdown of what those 7 layers are.



Useful diagram to support your explanation.

1. Physical Layer (Layer 1) :

This is the lowest layer in the OSI model. The physical layers job is to make the physical connection between devices. The physical layer contains information which is represented by bits. In this layer when data is received the signal that is inputted it will be converted into 0s and 1s which will then be sent to the data link layer which then in turn will put the frame back together. The specific functions of this layer are:

- Bit synchronization – The physical layer will provide synchronization of the bits by providing a clock, this clock controls both the sender and receiver which provides the synchronization at bit level.
- Physical topologies – In layer one the physical layer specifies the way all of the different devices and nodes are arranged in the network for example star or bus method.
- Bit rate control – This layer will also define the transmission rate which means the number of bits which are sent per second.
- Transmission mode – This layer will also define the way in which the data will flow between the devices which are connected. Some of the transmission modes are half-duplex, full-duplex and simplex.

2. Data Link Layer (DLL) (Layer 2) :

This layer is the layer which is responsible for the delivery of messages from node to node. The main purpose of this layer is to ensure that any data that is transferred is error free when being transferred from one node to the other via the physical layer. When the packet

G
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goes into the network the data link layer has the responsibility of transmitting it to the host via the MAC address. The DDL is also divided into two different layers:

This should be DLL.

- Media access control
- Logical link control

The main functions of the DDL are :

- Framing – This is a function of the DDL which is a way for a send to transmit a number of bits that are needed to the receiver.
- Physical addressing – Once the frames are created the DDL adds the physical address (which is the MAC address) of the sender or receiver in the header of each of the frames.
- Error control – The DDL will also provide the mechanism of error control which will see damaged or lost frames.
- Flow control – The rate of the data must be constant on both sides or a corruption may occur so the flow control will coordinate the amount of data which can be send before receiving acknowledgement.
- Access control – This is used in order to control which device has control over the channel at a certain time.

3. Network Layer (Layer 3) :

This layer is responsible for the transmission of data from host to host in different networks. It also has the responsibility of packet routing which means selecting the shortest path to transmit the packets and also the number of routes available. The receiver and senders IP address are contained in the header by this layer.

The functions of this layer are:

- Routing – This layers protocols will determine which route is suitable for the journey from source to destination. This I known as routing.
- Logical addressing – The network layer also needs to uniquely identify each device in the internetwork so this layer defines the addressing scheme. The IP addresses of the sender and receiver are in the header of this layer.

4. Transport Layer (Layer 4) :

This layer will provide the services to the application layer which takes services from the network layer. Another name for the transport layer is the segment. The purpose of this layer is to provide end to end delivery of a complete message. This layer will also give the acknowledgement of the successful transmission of data and also re-transmits any data if an error is found.

The functions of the transport layer are :

- Segmentation and reassembly – This layer accepts the message and then breaks it down into smaller units. Each segment that is produced will have a header which is associated with itself.
 - Service point addressing – This makes sure that the message is delivered to the correct process.
1. **Service Point Addressing:** In order to deliver the message to correct process, transport layer header includes a type of address called service point address or port address. Thus by specifying this address, transport layer makes sure that the message is delivered to the correct process.

5. Session Layer (Layer 5) :

The session layer is responsible for establishing connection, authentication, maintenance and also enforces security.

The functions of the session layer are :

- Session establishment, termination and maintenance – This layer enables the processes to establish, terminate and use a connection.
- Dialog controller – This layer will also determine which device will be first to communicate and how much data will be sent.
- Synchronization – The session layer will allow the process to add checkpoints which are also thought of as synchronization points into the data. The purpose of this is to help pin point any errors that occur and help the data re-synchronize correctly. This also helps messages not get cut off prematurely so no data is lost.

6. Presentation Layer (Layer 6) :

This layer is also known as the translation layer. Data which comes from the application layer is extracted here and then manipulated in anyway which is required for the data to be transmitted over the network.

The functions of the presentation layer are :

- Compression – This will reduce the amount of bits that need to be transmitted on the network.
- Translation – EBCDIC into ASCII
- Decryption or encryption – Encryption will translate data into another code or form. Any data which is encrypted is known as cipher text and then any data which is decrypted is known as plain text.

7. Application Layer (Layer 7) :

This layer is at the top of the OSI model. The applications will produce the data which need to be transferred over the network. The application layer also will serve as a window for the application services to access the network and used to display any information received for the user.

The functions of the Application layer are:

- Mail services
- Directory services
- Network virtual terminal

The 7 layer model has been explained well and key points identified.

Encapsulation

Generally, a process by which a lower-layer protocol receives data from a higher-layer protocol and then places the data into the data portion of its frame. Thus, encapsulation is the process of enclosing one type of packet using another type of packet. (smith, 2018)

When encapsulation is used at the lowest level in the OSI reference model it is also known as framing. Some example of encapsulation are:

- Any Ethernet frame that encapsulates any type of internet protocol packet which then encapsulates itself an transmission control protocol packet and then finally encapsulates the original data being transmitted over the network.
- Any Ethernet frame encapsulated in an Asynchronous transfer mode frame for the transmission over any Asynchronous transfer mode backbone.

In the OSI model the data link layer which is layer 2 for networking is responsible for the encapsulation/framing of any data which is being transmitted over the physical medium. Inside LAN technologies this is us commonly CSMA/CD (carrier sense multiple access with collision detection). In the case of WAN technologies the data link protocols used will depend on the communications meaning are they point to point or multipoint.

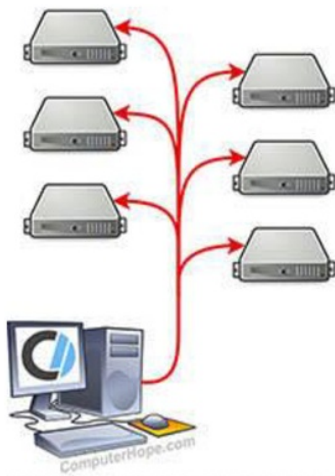
When point to point communications are used the possible WAN data link protocols include PPP (point to point protocol and HDLC (High level data link control protocol.

For multipoint communications, WAN data link protocols include frame relay, ATM and also SMDS (Switched multimegabit data services).

Broadcasting

In the terms of networking, the definition of broadcasting is the process of sending packets of data to a range of recipients at one time. An example of this would be a LAN could be configured to allow any of the devices on a network to broadcast a message to all of the others.

A diagram should have been used here to show the definition headers being added and removed as the packet goes through



Data packets are routed to all devices on the same logical network (Reddy, 2018)

Good diagram to support your explanation.

When two devices want to talk to each other on a network they transmit packets of data to the network's broadcast address. The router of the network also known as the hardware is the device which will send the packets of data to the others on the network. All of the devices are contained in a group and this group is called a broadcast domain. The two types of broadcasting are limited broadcasting and direct broadcasting.

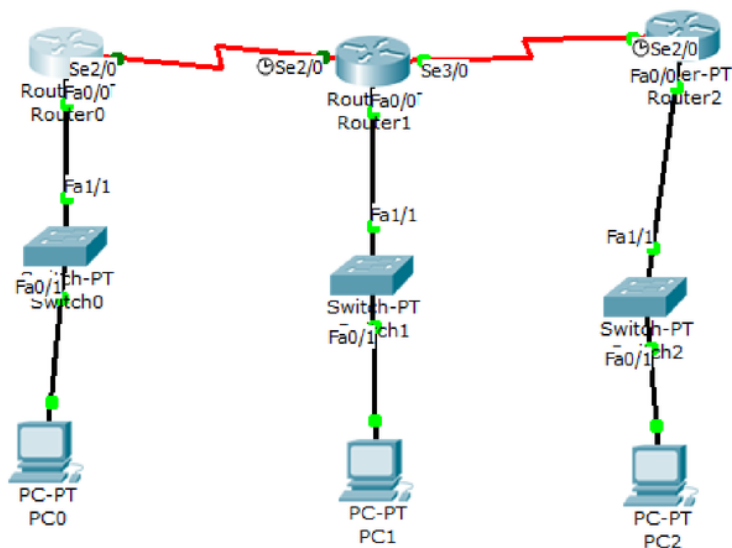
Good explanation.

Port allocation

Ports are software and are allocated to protocols. For example IP/TCP protocols will support both TCP ports and UDP ports. TCP is generally used for applications which are connection orientated. TCP also has a in-built error checker which will then re-send the missing packets. UDP is used for applications which are connection less. It doesn't have the same feature as TCP and wont re transmit the missing packets. The way in which designers decided to use either UDP or TCP is dependent on their connection requirement. An example where TCP is used is in web server.

The port numbers available The research could be included been better here. with diagrams to illustrate.

Task 2



Good image which captures the port allocations.

Configure a suitable address scheme which includes class A, B, C for the LAN networks.

Class C:

193.168.10.0 – net address

192.168.10.254 – gateway address

192.168.10.1 – initial device address

Class B:

170.20.0.0 – net address

170.20.1.254 – gateway address

170.20.1.4 – initial device address

*Address classes
are allocated to the
LANs and the
WANs serial port
addresses are your
choice.*

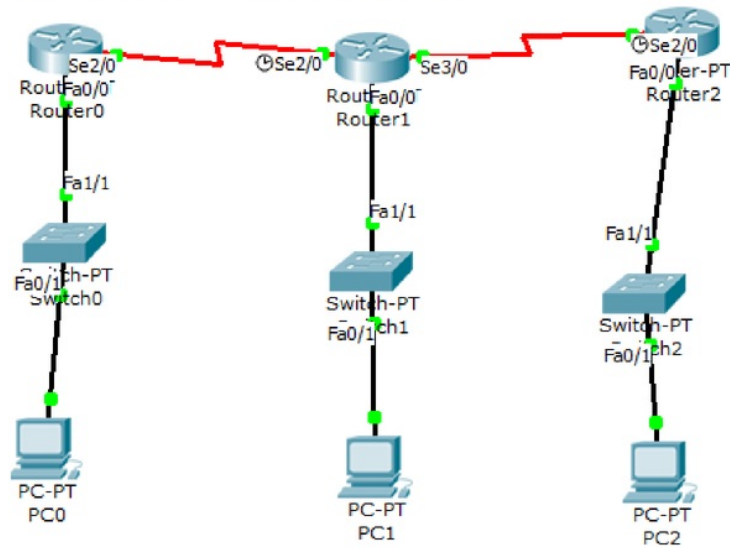
Class A:

100.0.0.0 – net address

100.0.0.254 – gateway address

100.0.0.10 – initial device address

Static Routing using static addressing



Router 0:

Router0

Physical Config CLI

GLOBAL

Settings

Algorithm Settings

ROUTING

Static

RIP

INTERFACE

FastEthernet0/0

FastEthernet1/0

Serial2/0

Serial3/0

FastEthernet4/0

FastEthernet5/0

Static Routes

Network	
Mask	
Next Hop	

Add

Network Address

100.0.0.0/8 via 10.10.10.2

170.20.0.0/16 via 10.10.10.2

Remove

Equivalent IOS Commands

S 170.20.0.0/16 [1/0] via 10.10.10.2

C 193.168.10.0/24 is directly connected, FastEthernet0/0

Router(config)#

Router(config)#

```

%LINK-5-CHANGED: Interface Serial2/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to up

Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip route 170.20.0.0 255.255.0.0 10.10.10.2
Router(config)#do 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    10.0.0.0/8 is directly connected, Serial2/0
S    100.0.0.0/8 [1/0] via 10.10.10.2
S    170.20.0.0/16 [1/0] via 10.10.10.2
C    193.168.10.0/24 is directly connected, FastEthernet0/0
Router(config)#

```

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Router 1:

Router1

Physical Config CLI

GLOBAL

Settings

Algorithm Settings

ROUTING

Static

RIP

INTERFACE

FastEthernet0/0

FastEthernet1/0

Serial2/0

Serial3/0

FastEthernet4/0

FastEthernet5/0

Static Routes

Network

Mask

Next Hop

Add

Network Address

193.168.10.0/24 via 10.10.10.1

170.20.0.0/16 via 11.1.1.1

Remove

Equivalent IOS Commands

Router(config-if)#exit

Router(config)#ip route 170.20.0.0 255.255.0.0 11.1.1.1

Router(config)#

Router(config)#

```

Router(config)#exit
Router(config)#ip route 170.20.0.0 255.255.0.0 11.1.1.1
Router(config)#
Router(config)#show ip route

% Invalid input detected at '^' marker.

Router(config)#do 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    10.0.0.0/8 is directly connected, Serial2/0
C    11.0.0.0/8 is directly connected, Serial3/0
C    100.0.0.0/8 is directly connected, FastEthernet0/0
S    170.20.0.0/16 [1/0] via 11.1.1.1
S    193.168.10.0/24 [1/0] via 10.10.10.1
Router(config)#

```

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Router 2:

Router2

Physical

Config

CLI

GLOBAL

Settings

Algorithm Settings

ROUTING

Static

RIP

INTERFACE

FastEthernet0/0

FastEthernet1/0

Serial2/0

Serial3/0

FastEthernet4/0

FastEthernet5/0

Static Routes

Network

Mask

Next Hop

Add

Network Address

100.0.0.0/8 via 11.1.1.2

193.168.10.0/24 via 11.1.1.2

Remove

Equivalent IOS Commands

```

Router(config)#ip route 193.168.10.0 255.255.255.0 11.1.1.2
Router(config)#
Router(config)#
Router(config)#

```

```

Router2
Physical Config CLI
IOS Command Line Interface

Router(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to up

Router(config-if)#exit
Router(config)#ip route 100.0.0.0 255.0.0.0 11.1.1.2
Router(config)#ip route 193.168.10.0 255.255.255.0 11.1.1.2
Router(config)#
Router(config)#
Router(config)#do 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    11.0.0.0/8 is directly connected, Serial2/0
S    100.0.0.0/8 [1/0] via 11.1.1.2
C    170.20.0.0/16 is directly connected, FastEthernet0/0
S    193.168.10.0/24 [1/0] via 11.1.1.2
Router(config)#
  
```

Static routing is configured and the images show clearly the direct connection, via and routed connections.

Test configuration:

Fire	Last Status	Source	Destination	Type	Color	Time (sec)	Periodic	Nu
	Successful	PC0	PC1	ICMP		0.000	N	0
	Successful	PC1	PC0	ICMP		0.000	N	1
	Successful	PC0	PC2	ICMP		0.000	N	2

Fire	Last Status	Source	Destination	Type	Color	Time (sec)	Periodic	Nu
	Successful	PC2	PC0	ICMP		0.000	N	0
	Successful	PC1	PC2	ICMP		0.000	N	1
	Successful	PC2	PC1	ICMP		0.000	N	2

The testing shows the success if the comms between all devices. This proves the routing configuration.

These tests demonstrate that all communications in every direction is working with no failures. This test makes use of the ping command which sends data packets from one device to the other.

Dynamic routing

In this task all three of the routers will be configured by using RIP routing.

Router 0:

Router0

Physical Config CLI

IOS Command Line Interface

Enter configuration commands, one per line. End with Ctrl-Z.
Router(config)#router rip
Router(config-router)#
Router(config-router)#exit
Router(config)#show ip route
^
% Invalid input detected at '^' marker.

Router(config)#do 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 10.0.0.0/8 is directly connected, Serial2/0
S 100.0.0.0/8 [1/0] via 10.10.10.2
S 170.20.0.0/16 [1/0] via 10.10.10.2
C 193.168.10.0/24 is directly connected, FastEthernet0/0
Router(config)#

Copy Paste

Router1:

Router1

Physical Config CLI

IOS Command Line Interface

```
Router(config)#router rip
Router(config-router)#exit
Router(config)#do 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    10.0.0.0/8 is directly connected, Serial2/0
C    11.0.0.0/8 is directly connected, Serial3/0
C    100.0.0.0/8 is directly connected, FastEthernet0/0
S    170.20.0.0/16 [1/0] via 11.1.1.1
S    193.168.10.0/24 [1/0] via 10.10.10.1
Router(config)#
Router(config)#router rip
Router(config-router)#network 193.168.10.0
Router(config-router)#network 170.20.0.0
Router(config-router)#network 100.0.0.0
Router(config-router)#network 10.0.0.0
Router(config-router)#network 11.0.0.0
Router(config-router)#
```

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Router 2:

Router2

Physical Config CLI

IOS Command Line Interface

```
Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router rip
Router(config-router)#network 193.168.10.0
Router(config-router)#network 170.20.0.0
Router(config-router)#network 100.0.0.0
Router(config-router)#network 10.0.0.0
Router(config-router)#network 11.0.0.0
Router(config-router)#exit
Router(config)#do 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    10.0.0.0/8 [120/1] via 11.1.1.2, 00:00:05, Serial2/0
C    11.0.0.0/8 is directly connected, Serial2/0
S    100.0.0.0/8 [1/0] via 11.1.1.2
C    170.20.0.0/16 is directly connected, FastEthernet0/0
S    193.168.10.0/24 [1/0] via 11.1.1.2
```

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RIP routing is configured for each router.

Following below are the RIP tables for the routers:

Router 0 RIP table:

Routing Table for Router0				
Type	Network	Port	Next Hop IP	Metric
C	10.0.0.0/8	Serial2/0	---	0/0
C	193.168.10.0/24	FastEthernet0/0	---	0/0
S	100.0.0.0/8	---	10.10.10.2	1/0
S	170.20.0.0/16	---	10.10.10.2	1/0

Router 1 RIP table:

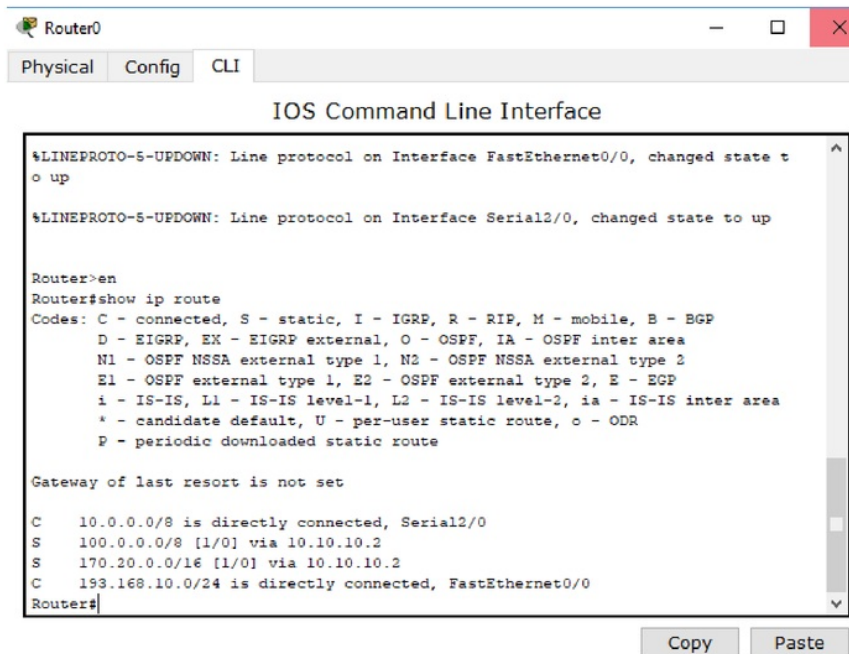
Routing Table for Router1				
Type	Network	Port	Next Hop IP	Metric
C	10.0.0.0/8	Serial2/0	---	0/0
C	100.0.0.0/8	FastEthernet0/0	---	0/0
C	11.0.0.0/8	Serial3/0	---	0/0
S	170.20.0.0/16	---	11.1.1.1	1/0
S	193.168.10.0/24	---	10.10.10.1	1/0

Router 2 RIP table:

Routing Table for Router2				
Type	Network	Port	Next Hop IP	Metric
C	11.0.0.0/8	Serial2/0	---	0/0
C	170.20.0.0/16	FastEthernet0/0	---	0/0
R	10.0.0.0/8	Serial2/0	11.1.1.2	120/1
S	100.0.0.0/8	---	11.1.1.2	1/0
S	193.168.10.0/24	---	11.1.1.2	1/0

Router 0 configuration:

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th
e
di



Router0

Physical Config CLI

IOS Command Line Interface

```
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to up

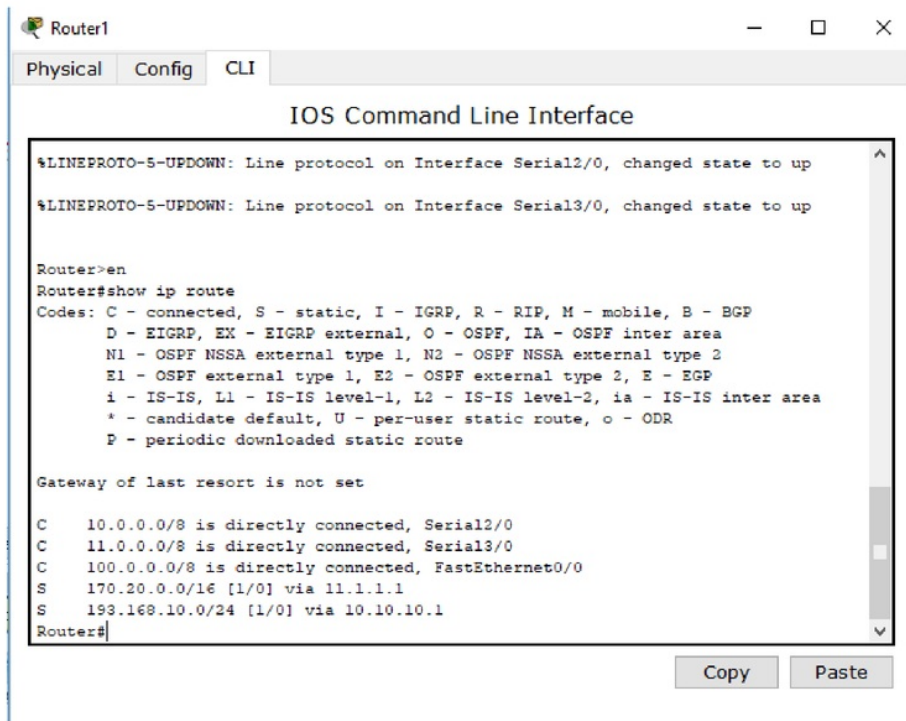
Router>en
Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
        D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
        N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
        E1 - OSPF external type 1, E2 - OSPF external type 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    10.0.0.0/8 is directly connected, Serial2/0
S    100.0.0.0/8 [1/0] via 10.10.10.2
S    170.20.0.0/16 [1/0] via 10.10.10.2
C    193.168.10.0/24 is directly connected, FastEthernet0/0
Router#
```

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Router 1 configuration:



Router1

Physical Config CLI

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>en
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    10.0.0.0/8 is directly connected, Serial2/0
C    11.0.0.0/8 is directly connected, Serial3/0
C    100.0.0.0/8 is directly connected, FastEthernet0/0
S    170.20.0.0/16 [1/0] via 11.1.1.1
S    193.168.10.0/24 [1/0] via 10.10.10.1
Router#
```

Copy Paste

Router 2 configuration :

Router2

PhysicalConfigCLI

IOS Command Line Interface

```

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to
o up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to up

Router>en
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    10.0.0.0/8 [120/1] via 11.1.1.2, 00:00:23, Serial2/0
C    11.0.0.0/8 is directly connected, Serial2/0
S    100.0.0.0/8 [1/0] via 11.1.1.2
C    170.20.0.0/16 is directly connected, FastEthernet0/0
S    193.168.10.0/24 [1/0] via 11.1.1.2
Router#

```

CopyPaste

Tables show the routing connections

Below is all of the tests between every device using RIP routing.

Fire	Last Status	Source	Destination	Type	Color	Time (sec)	Periodic	Nu
	Successful	PC2	PC1	ICMP		0.000	N	0
	Successful	PC2	PC0	ICMP		0.000	N	1
	Successful	PC1	PC2	ICMP		0.000	N	2
< >								

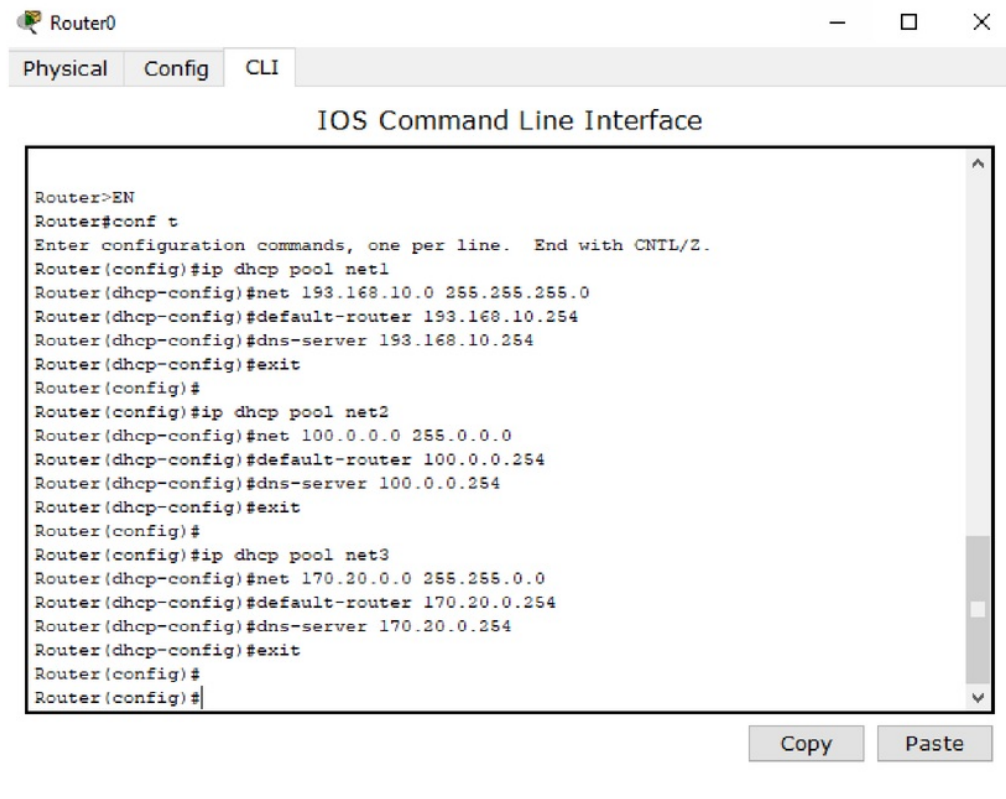
Fire	Last Status	Source	Destination	Type	Color	Time (sec)	Periodic	Nu
	Successful	PC1	PC0	ICMP		0.000	N	0
	Successful	PC0	PC1	ICMP		0.000	N	1
	Successful	PC0	PC2	ICMP		0.000	N	2
< >								

Tests show that the RIP had been configured correctly. Each device is tested with all other devices.

Dynamic addressing across networks using DHCP and helper address

Router 0 will be configured as the control router and the routers 1 and 2 will be the helper addresses which will enable the cross network dynamic addressing using DHCP.

Router 0 configuration:



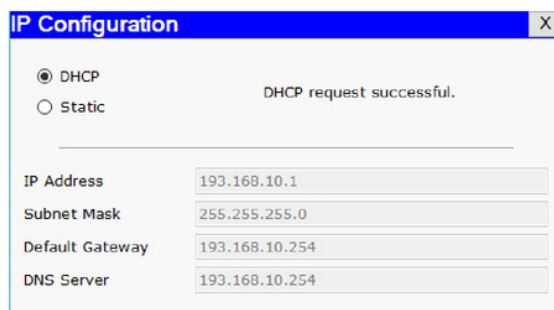
The screenshot shows the Router0 CLI interface with the following commands entered:

```
Router>EN
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip dhcp pool net1
Router(dhcp-config)#net 193.168.10.0 255.255.255.0
Router(dhcp-config)#default-router 193.168.10.254
Router(dhcp-config)#dns-server 193.168.10.254
Router(dhcp-config)#exit
Router(config)#
Router(config)#ip dhcp pool net2
Router(dhcp-config)#net 100.0.0.0 255.0.0.0
Router(dhcp-config)#default-router 100.0.0.254
Router(dhcp-config)#dns-server 100.0.0.254
Router(dhcp-config)#exit
Router(config)#
Router(config)#ip dhcp pool net3
Router(dhcp-config)#net 170.20.0.0 255.255.0.0
Router(dhcp-config)#default-router 170.20.0.254
Router(dhcp-config)#dns-server 170.20.0.254
Router(dhcp-config)#exit
Router(config)#
Router(config)#
```

Buttons for Copy and Paste are visible at the bottom right of the CLI window.

Control router showing the net pools created for DHCP.

Testing the DHCP at PC0:



The screenshot shows the IP Configuration window for PC0. The DHCP radio button is selected, and the message "DHCP request successful." is displayed. The configuration details are as follows:

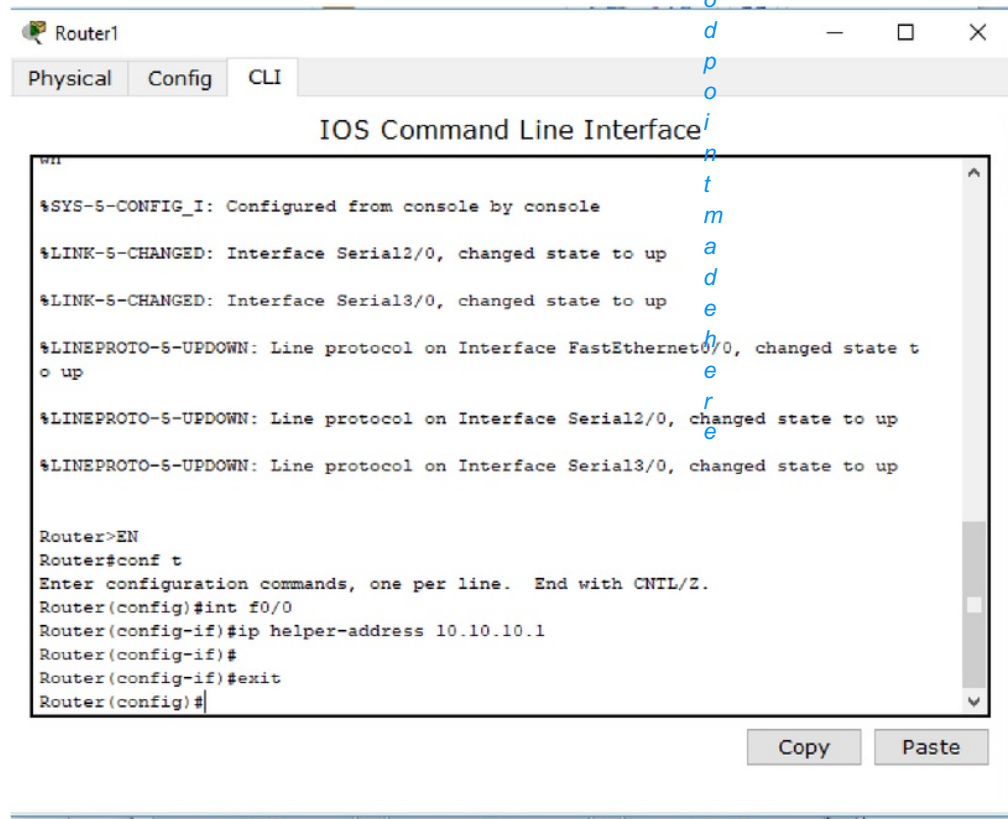
Field	Value
IP Address	193.168.10.1
Subnet Mask	255.255.255.0
Default Gateway	193.168.10.254
DNS Server	193.168.10.254

Test show s DHC P is worki ng for the contr ol route r.

The address configuration has been set dynamically. In both PC1 and PC2 the address configuration has not been set correctly so the default address is set. This is due to the fact that the router needs a

helper address to get across the network. The helper address is the control router serial port address which is 10.10.10.1

Configuring helper address for router 1 and router 2:

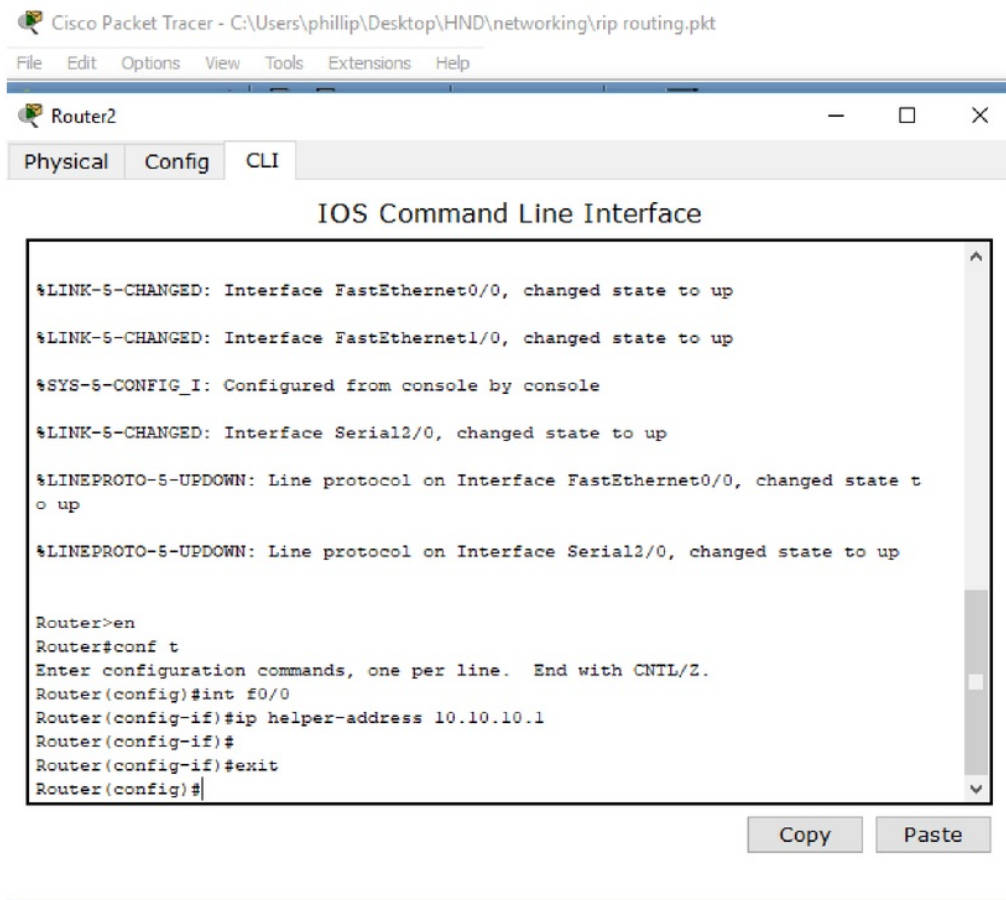


The screenshot shows a window titled "Router1" with tabs for "Physical", "Config", and "CLI". The "CLI" tab is active, displaying the "IOS Command Line Interface". The terminal output shows several system messages: "%SYS-5-CONFIG_I: Configured from console by console", "%LINK-5-CHANGED: Interface Serial2/0, changed state to up", "%LINK-5-CHANGED: Interface Serial3/0, changed state to up", "%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up", "%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to up", and "%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial3/0, changed state to up". Below these messages, the user enters the command "Router>EN", followed by "Router#conf t", then "Router(config)#int f0/0", "Router(config-if)#ip helper-address 10.10.10.1", "Router(config-if)#", "Router(config-if)#exit", and finally "Router(config)#". At the bottom of the window, there are "Copy" and "Paste" buttons.

```
Router1
Physical Config CLI
IOS Command Line Interface

%SYS-5-CONFIG_I: Configured from console by console
%LINK-5-CHANGED: Interface Serial2/0, changed state to up
%LINK-5-CHANGED: Interface Serial3/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
%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

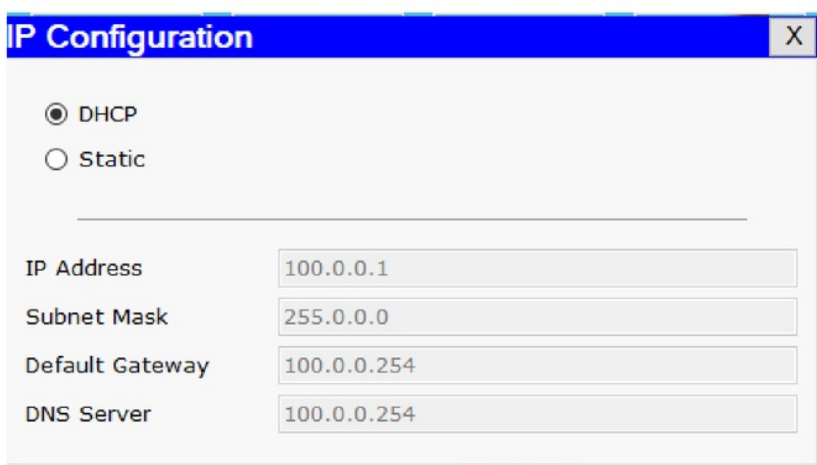
Router>EN
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#int f0/0
Router(config-if)#ip helper-address 10.10.10.1
Router(config-if)#
Router(config-if)#exit
Router(config)#
```



Helper addresses are configured.

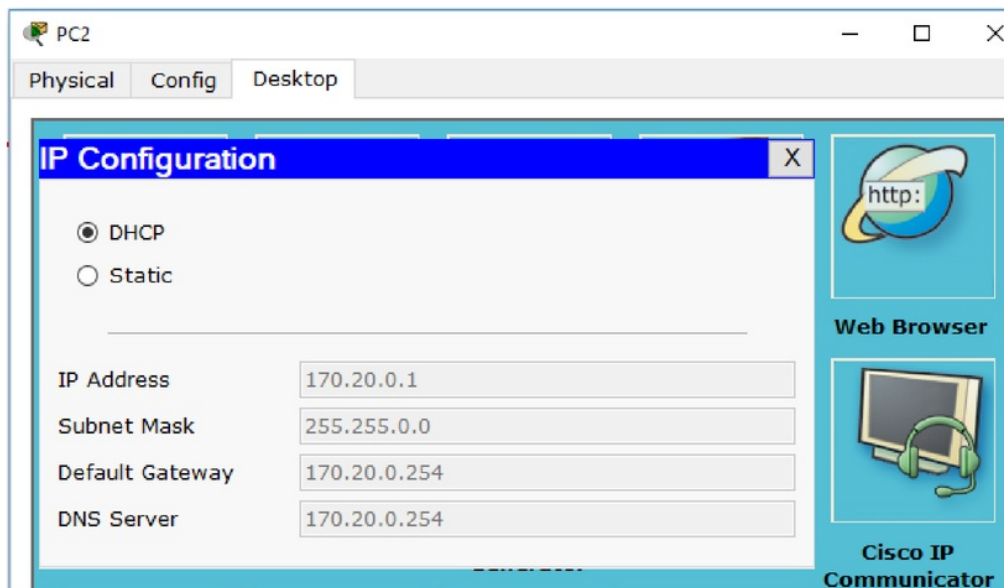
Testing dynamic addressing with helper address configured in router 1+2

PC device 1:



DHCP is tested successful for other routers. The device address and gateway address is set dynamically.

PC device 2:



These test shows that devices 1 and 2 on routers 1 and 2 are now configured dynamically.

Now trying to address using exclusions using router 1 as control device

Router 0:

```
Router#  
%SYS-5-CONFIG_I: Configured from console by console  
  
Router#conf t  
Enter configuration commands, one per line. End with CNTL/Z.  
Router(config)#ip dhcp excluded-address 193.168.10.10  
Router(config)#ip dhcp excluded-address 100.0.0.1 100.0.0.10  
Router(config)#ip dhcp excluded-address 193.168.10.1 193.168.10.10  
Router(config)#ip dhcp excluded-address 170.20.0.1 170.20.0.10  
Router(config)#  
Router(config)#
```

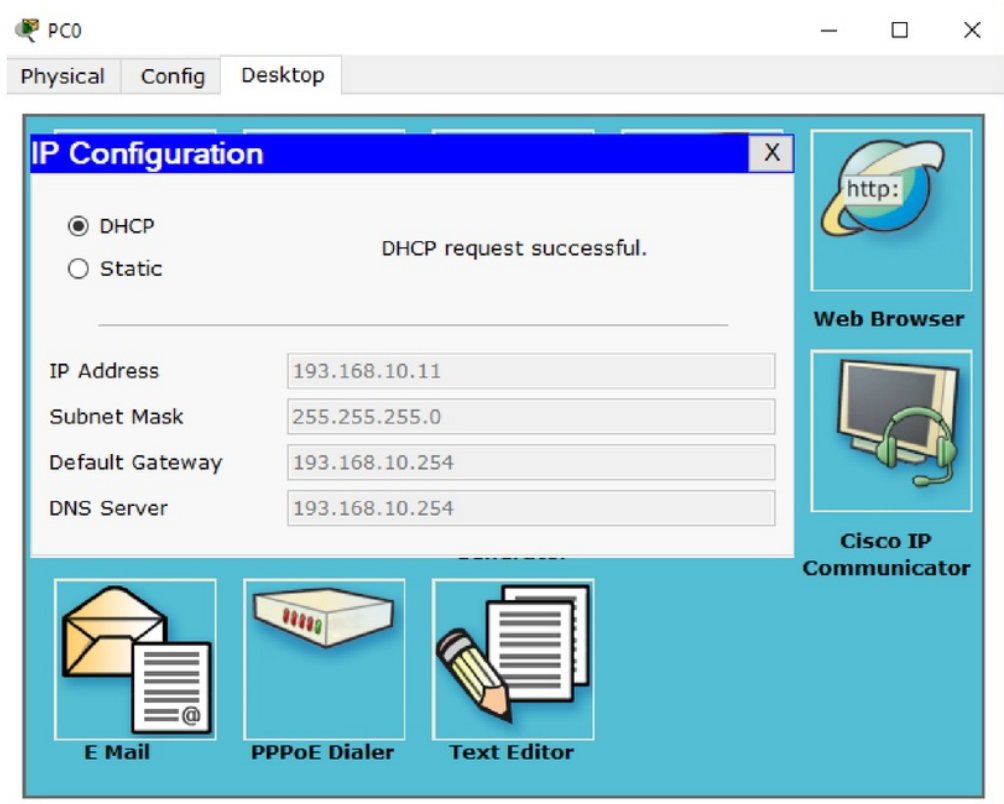
*Address
exclusion
range is set
here.*

Copy

Paste

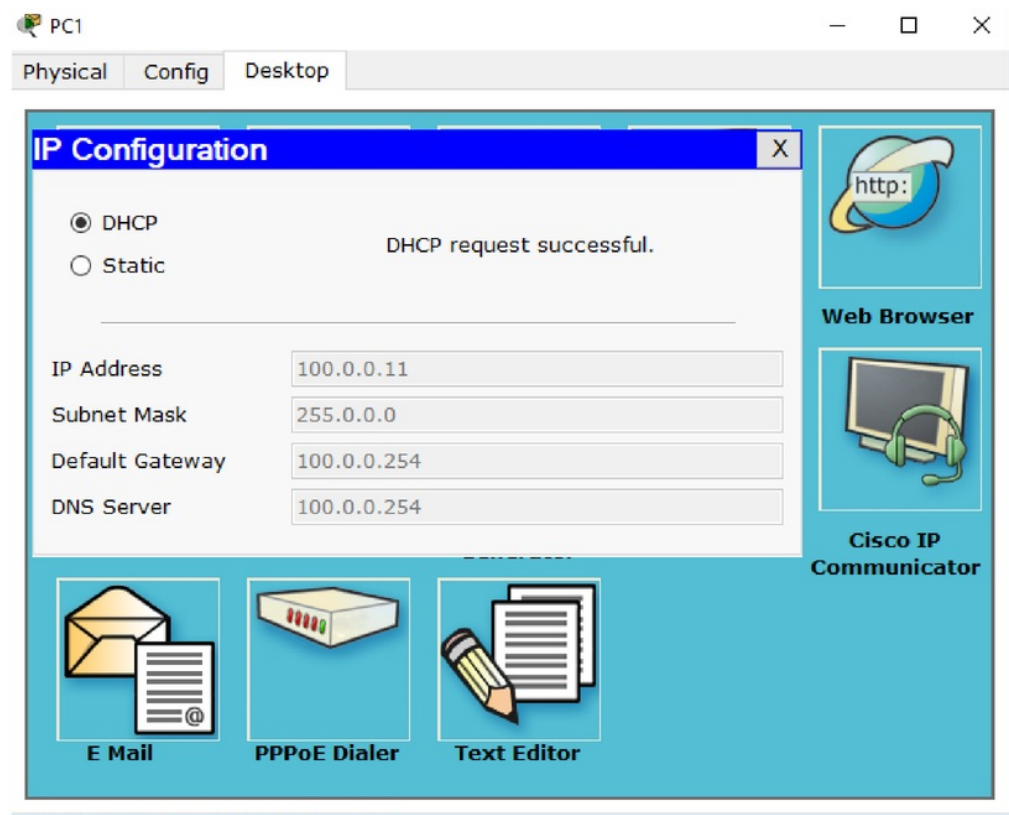
The test for excluded addresses

Device PC0:

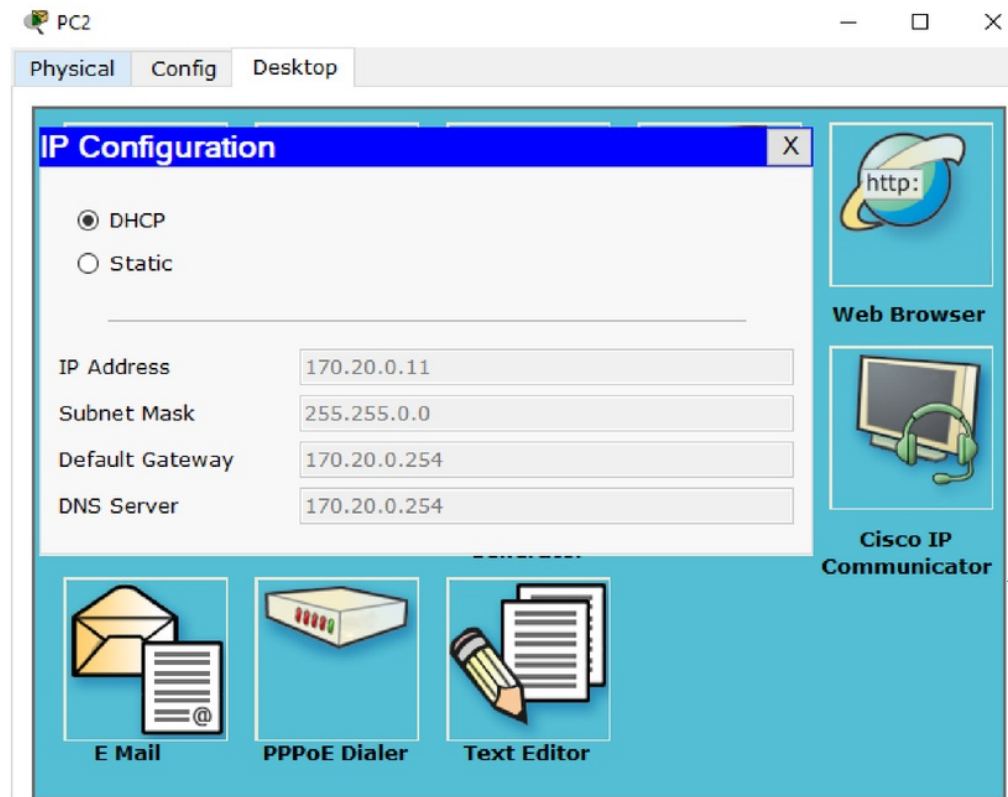


The device address is now set outside the exclusion range. i.e .11

PC1 device test:



PC2 device test:



A devices are set outside of exclusion range.

This test proves that all of the addresses from 1-10 in each of the 3 LANS was completed successfully. This then means that those address can be kept aside for specific controllers.

This final test shows the running configuration of the routers:

```
!
hostname Router
!
!
!
!
ip dhcp excluded-address 193.168.10.10
ip dhcp excluded-address 100.0.0.1 100.0.0.10
ip dhcp excluded-address 193.168.10.1 193.168.10.10
ip dhcp excluded-address 170.20.0.1 170.20.0.10
!
ip dhcp pool net1
network 193.168.10.0 255.255.255.0
default-router 193.168.10.254
--More--
```

The router report shows the exclusion

```
!  
ip dhcp pool net1  
  network 193.168.10.0 255.255.255.0  
  default-router 193.168.10.254  
  dns-server 193.168.10.254  
ip dhcp pool net2  
  network 100.0.0.0 255.0.0.0  
  default-router 100.0.0.254  
  dns-server 100.0.0.254  
ip dhcp pool net3  
  network 170.20.0.0 255.255.0.0  
  default-router 170.20.0.254  
  dns-server 170.20.0.254
```

```
!  
!  
!
```

```
interface FastEthernet0/0  
  ip address 193.168.10.254 255.255.255.0  
  duplex auto  
  speed auto  
!  
interface FastEthernet1/0  
  no ip address  
  duplex auto  
  speed auto  
  shutdown  
!  
interface Serial2/0  
  ip address 10.10.10.1 255.0.0.0  
!  
interface Serial3/0  
  no ip address  
  shutdown  
!  
interface FastEthernet4/0  
  no ip address  
  shutdown  
,
```

```

!
interface FastEthernet5/0
  no ip address
  shutdown
!
router rip
  version 2
  network 10.0.0.0
  network 100.0.0.0
  network 193.168.10.0
!
ip classless
ip route 100.0.0.0 255.0.0.0 10.10.10.2
ip route 170.20.0.0 255.255.0.0 10.10.10.2
!
!
!
!
!
!
line con 0
line vty 0 4
  login

```

Copy

Paste

Router 2 running config

```

interface FastEthernet0/0
  ip address 100.0.0.254 255.0.0.0
  ip helper-address 10.10.10.1
  duplex auto
  speed auto
!
interface FastEthernet1/0
  no ip address
  duplex auto
  speed auto
  shutdown
!
interface Serial2/0
  ip address 10.10.10.2 255.0.0.0
  clock rate 64000
!
interface Serial3/0
  ip address 11.1.1.2 255.0.0.0
!
interface FastEthernet4/0
  no ip address
  shutdown
!
interface FastEthernet5/0

```

Copy

Paste

```
interface FastEthernet5/0
  no ip address
  shutdown
!
router rip
  network 10.0.0.0
  network 11.0.0.0
  network 100.0.0.0
  network 170.20.0.0
  network 193.168.10.0
!
ip classless
ip route 193.168.10.0 255.255.255.0 10.10.10.1
ip route 170.20.0.0 255.255.0.0 11.1.1.1
!
!
!
!
!
!
!
line con 0
line vty 0 4
login
```

Copy

Paste

Router 3:

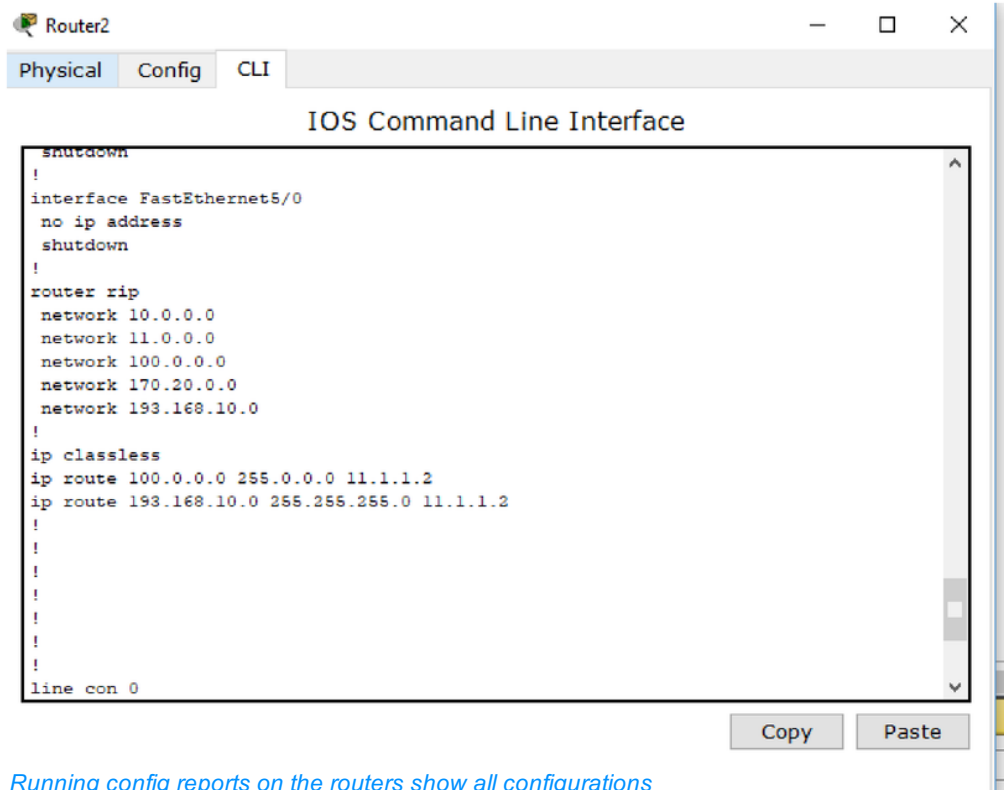
Router2

Physical Config CLI

IOS Command Line Interface

```
interface FastEthernet0/0
ip address 170.20.1.254 255.255.0.0
ip helper-address 10.10.10.1
duplex auto
speed auto
!
interface FastEthernet1/0
no ip address
duplex auto
speed auto
!
interface Serial2/0
ip address 11.1.1.1 255.0.0.0
clock rate 64000
!
interface Serial3/0
no ip address
shutdown
!
interface FastEthernet4/0
no ip address
shutdown
!
```

Copy Paste



Running config reports on the routers show all configurations associated with that router.

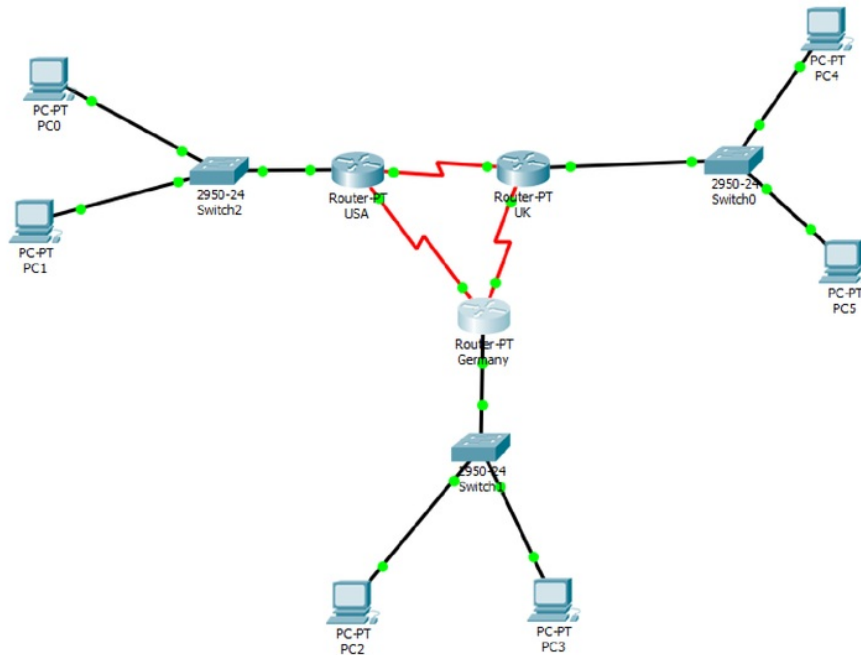
Conclusion and Evaluation

To conclude on this assignment the OSI 7 layer model can be used in order to reference all of the operations of a network and configurations to a specific network. The more important layers in the network connection are layers 3 and 2. Dynamic addressing allows endless remote control of networks whereas static addressing needs you to enter the address every time. Dynamic routing in a 3 layer OSI model operation which was proven to be a short cut to WAN + LAN communications. As the DHCP network was set up with helper address it highlights the advantage of having the auto addressing feature so the network will be self-assigning addresses.

*Good evaluation that shows you
have identified key areas which will
help in future designs.*

Element 2

1. Network design using CIDR/28 subnetting



2. Networks subnetting CIDR/28

11111111.11111111.11111111.11110000 from this the first one is the increment for the subnets which in this case is 16. The first one with the respective number will give you the number that you can increment the networks in.

CIDR/28 USA Network 1 192.168.150.

Subnet mask	1	1	1	1	0	0	0	0	255.255.255.240
	0	0	0	0	0	0	0	0	Not used
Net addr 16	0	0	0	1	0	0	0	1	Lowest host addr 17 pc1
Net addr 16	0	0	0	1	0	0	1	0	Next host addr 18 pc0
Default gateway	0	0	0	1	1	1	1	0	Fastethernet 0/0 addr 30
	0	0	0	1	1	1	1	1	Broadcast 31

The next one network will start at 32

CIDR/28 UK Network 2 Network 1 192.168.150.

Subnet mask	1	1	1	1	0	0	0	0	255.255.255.240
	0	0	0	0	0	0	0	0	Not used
Net addr 32	0	0	1	0	0	0	0	1	Lowest host addr 33 pc4
Net addr 32	0	0	1	0	0	0	1	0	Next host addr 34 pc5
Default gateway	0	0	1	0	1	1	1	0	Fastethernet 0/0 addr 46
	0	0	1	0	1	1	1	1	Broadcast 47

The next one network will start at 48

CIDR/28 Germany Network 3 Network 1 192.168.150.

Subnet mask	1	1	1	1	0	0	0	0	255.255.255.240
	0	0	0	0	0	0	0	0	Not used
Net addr 48	0	0	1	1	0	0	0	1	Lowest host addr 49 pc2
Net addr 48	0	0	1	1	0	0	1	0	Next host addr 50 pc3
Default gateway	0	0	1	1	1	1	1	0	Fastethernet 0/0 addr 62
	0	0	1	1	1	1	1	1	Broadcast 63

The next one network will start at 64

UK – USA Network 4 Network 1 192.168.150.

UK Router	0	1	0	0	1	1	0	1	serial 2/0 addr 77
USA Router	0	1	0	0	1	1	1	0	serial 2/0 addr 94

The next one network will start at 80

Germany – UK Network 5 Network 1 192.168.150.

Germany Router	0	1	0	1	1	1	0	1	serial 3/0 addr 109
UK Router	0	1	0	1	1	1	1	0	serial 3/0 addr 110

The next one network will start at 96

Germany – USA Network 6 Network 1 192.168.150.

Germany Router	0	1	1	0	1	1	0	1	serial 2/0 addr 93
USA Router	0	1	1	0	1	1	1	0	serial 3/0 addr 78

The increments in the table occur as when you are adding a bit it increments the address.

CIDR/28 addressing scheme is correct.

Routing Table for UK

Type	Network	Port	Next Hop IP	Metric
R	192.168.150.16/28	Serial2/0	192.168.150.78	120/1
C	192.168.150.32/28	FastEthernet0/0	---	0/0
R	192.168.150.48/28	Serial3/0	192.168.150.109	120/1
C	192.168.150.64/28	Serial2/0	---	0/0
R	192.168.150.80/28	Serial3/0	192.168.150.109	120/1
R	192.168.150.80/28	Serial2/0	192.168.150.78	120/1
C	192.168.150.96/28	Serial3/0	---	0/0

Routing Table for USA

Type	Network	Port	Next Hop IP	Metric
C	192.168.150.16/28	FastEthernet0/0	---	0/0
R	192.168.150.32/28	Serial3/0	192.168.150.77	120/1
R	192.168.150.48/28	Serial2/0	192.168.150.93	120/1
C	192.168.150.64/28	Serial3/0	---	0/0
C	192.168.150.80/28	Serial2/0	---	0/0
R	192.168.150.96/28	Serial2/0	192.168.150.93	120/1
R	192.168.150.96/28	Serial3/0	192.168.150.77	120/1

Routing Table for Germany

Type	Network	Port	Next Hop IP	Metric
R	192.168.150.16/28	Serial2/0	192.168.150.94	120/1
R	192.168.150.32/28	Serial3/0	192.168.150.110	120/1
C	192.168.150.48/28	FastEthernet0/0	---	0/0
R	192.168.150.64/28	Serial2/0	192.168.150.94	120/1
R	192.168.150.64/28	Serial3/0	192.168.150.110	120/1
C	192.168.150.80/28	Serial2/0	---	0/0
C	192.168.150.96/28	Serial3/0	---	0/0

Routing tables show the RIP configuration.

3. CIDR/27 and CIDR/30

This is the VLSM addressing scheme

CIDR/27 Networks 1,2 and 3 – 192.168.32.0

11111111.11111111.11111111.11100000

The lower the “magic number” (the number undlined) the more amount of networks you can’t have as many devices on that network.

Subnet mask	1	1	1	0	0	0	0	0	255.255.255.224
	0	0	0	0	0	0	0	0	Not used
Net addr 32	0	0	1	0	0	0	0	1	Lowest host addr 33 USA 1
Net addr 32	0	0	1	0	0	0	1	0	Next host addr 34 USA 2
Net addr 32	0	0	1	1	1	1	1	0	Highest Router addr 62 USA Router
Net addr 64	0	1	0	0	0	0	0	1	Lowest host addr 65 Germany 1
Net addr 64	0	1	0	0	0	0	1	0	Next host addr 66 Germany 2
Net addr 64	0	1	0	1	1	1	1	0	Highest Router addr 94 Germany Router
Net addr 96	0	1	1	0	0	0	0	1	Lowest host addr 97 UK 1
Net addr 96	0	1	1	0	0	0	1	0	Next host addr 98 UK 2
Net addr 96	0	1	1	1	1	1	1	0	Highest Router addr 126 UK Router

CIDR/27 is correct

CIDR/30 Networks 4,5 and 6

11111111.11111111.11111111.11111100

Subnet mask	1	1	1	1	1	1	0	0	255.255.255.252
	0	0	0	0	0	0	0	0	Not used
Net addr 192.168.4	0	0	0	0	0	1	0	1	Lowest interface addr 5 USA serial 0/0
Net addr 192.168.4	0	0	0	0	0	1	1	0	Highest interface addr 6 UK serial 0/0
Net addr 192.168.8	0	0	0	0	1	0	0	1	Lowest interface addr 9 USA serial 0/1
Net addr 192.168.8	0	0	0	0	1	0	1	0	Highest interface addr 10 Germany serial 0/0
Net addr 192.168.12	0	0	0	0	1	1	0	1	Lowest interface addr 13 Germany serial 0/1
Net addr 192.168.12	0	0	0	0	1	1	1	0	Highest interface addr 14 UK serial 0/1

*CIDR/30 is
configured for the
serial WAN ports.*

Routing table for USA router

Routing Table for USA					
Type	Network	Port	Next Hop IP	Metric	
C	192.168.150.4/30	Serial3/0	---	0/0	
C	192.168.150.8/30	Serial2/0	---	0/0	
R	192.168.150.12/30	Serial2/0	192.168.150.10	120/1	
R	192.168.150.12/30	Serial3/0	192.168.150.6	120/1	
C	192.168.150.32/27	FastEthernet0/0	---	0/0	
R	192.168.150.64/27	Serial2/0	192.168.150.10	120/1	
R	192.168.150.96/27	Serial3/0	192.168.150.6	120/1	

Routing table for Germany

Routing Table for Germany					
Type	Network	Port	Next Hop IP	Metric	
R	192.168.150.4/30	Serial3/0	192.168.150.14	120/1	
R	192.168.150.4/30	Serial2/0	192.168.150.9	120/1	
C	192.168.150.8/30	Serial2/0	---	0/0	
C	192.168.150.12/30	Serial3/0	---	0/0	
R	192.168.150.32/27	Serial2/0	192.168.150.9	120/1	
C	192.168.150.64/27	FastEthernet0/0	---	0/0	
R	192.168.150.96/27	Serial3/0	192.168.150.14	120/1	

Routing table for UK

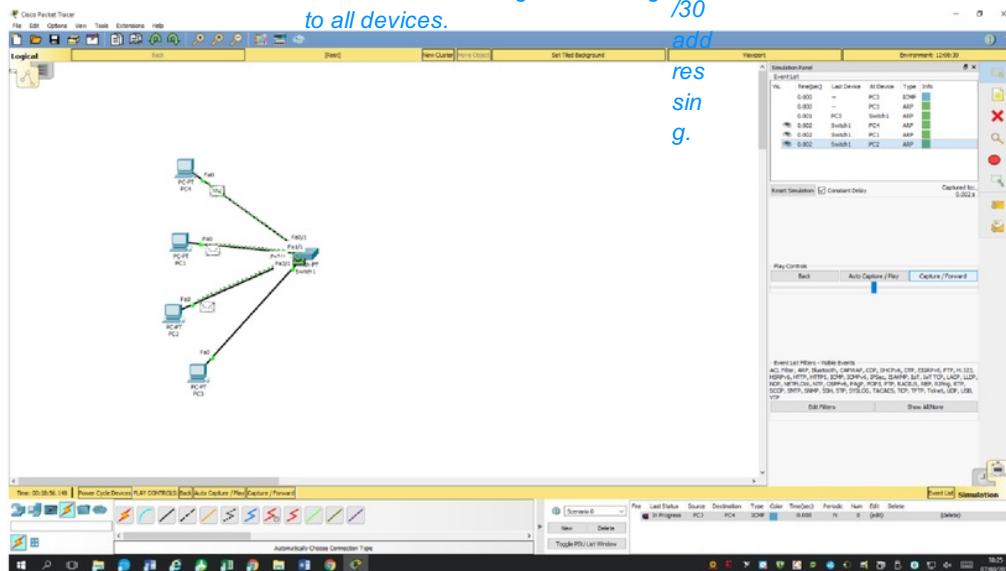
Type	Network	Port	Next Hop IP	Metric
C	192.168.150.4/30	Serial2/0	---	0/0
R	192.168.150.8/30	Serial3/0	192.168.150.13	120/1
R	192.168.150.8/30	Serial2/0	192.168.150.5	120/1
C	192.168.150.12/30	Serial3/0	---	0/0
R	192.168.150.32/27	Serial2/0	192.168.150.5	120/1
R	192.168.150.64/27	Serial3/0	192.168.150.13	120/1
C	192.168.150.96/27	FastEthernet0/0	---	0/0

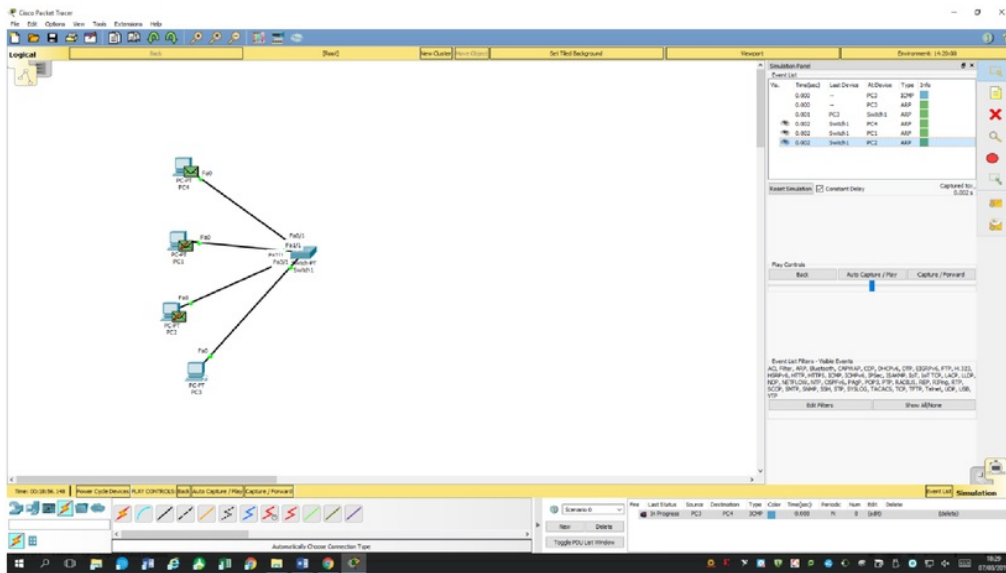
RIP routing tables show the configuration for the /27 and /30 adding.

VLAN

No VLAN test

No Vlan test showing broadcast goes to all devices.

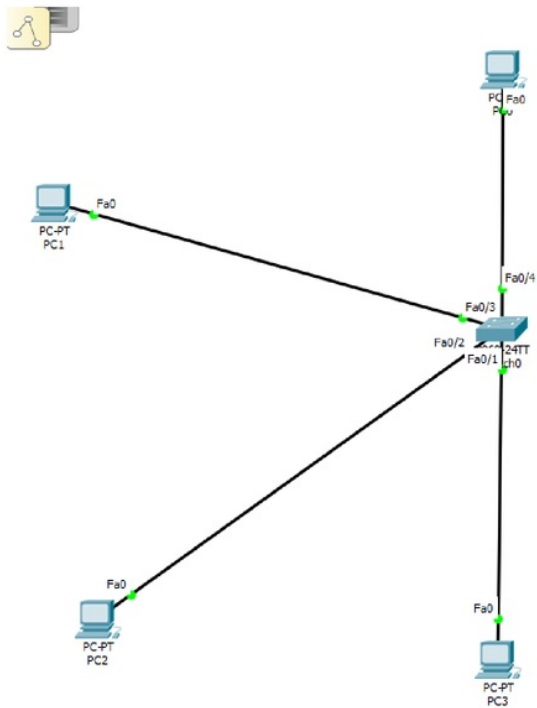




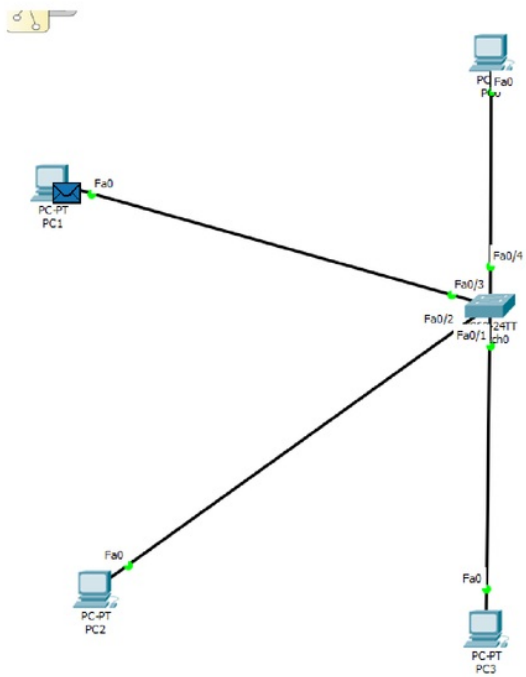
Broadcast is sent out and returned from all devices on the same vlan WHICH IS vlan 1 by default.

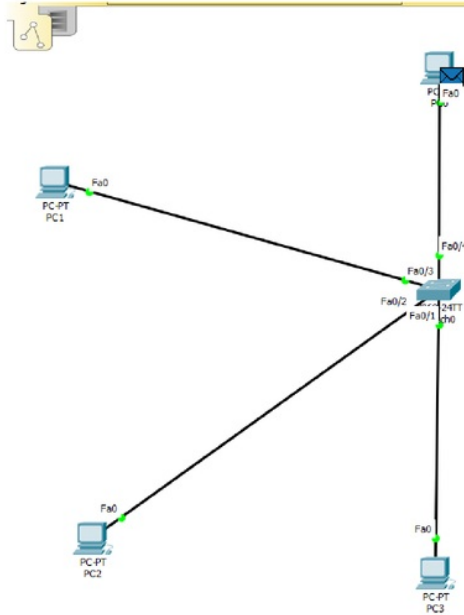
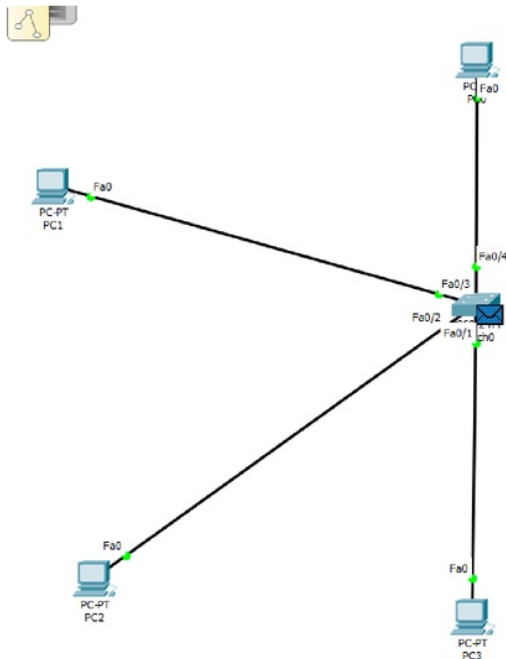
If the vlans are separated then this isolates the devices on each vlan.

The following network was made below in order to set up a VLAN network



Proving that the message is being sent and received between the two PCs.





Broadcast is only to the devices on the same Vlan. In this case PC1 to PC0

Vis.	Time(sec)	Last Device	At Device	Type	Info
	0.000	--	PC1	ICMP	
	0.001	PC1	Switch0	ICMP	
	0.002	Switch0	PC0	ICMP	
	0.003	PC0	Switch0	ICMP	
	0.004	Switch0	PC1	ICMP	

This shows the broadcast goes only to the devices on the same Vlan. Here PC1 and PC0 are on the same Vlan.

Inter VLANING

Switch>enable

Switch#

Switch#configure terminal

Enter configuration commands, one per line. End with CNTL/Z.

Switch(config)#interface FastEthernet0/1

Switch(config-if)#

Switch(config-if)#^Z

Switch#

%SYS-5-CONFIG_I: Configured from console by console

Switch#conf t

Enter configuration commands, one per line. End with CNTL/Z.

Switch(config)#vlan 100

Switch(config-vlan)#name vlan100

Switch(config-vlan)#exit

Switch(config)#vlan101

^

% Invalid input detected at '^' marker.

Switch(config)#vlan 101

Switch(config-vlan)#name vlan101

Switch(config-vlan)#exit

Switch(config)#^Z

Switch#

%SYS-5-CONFIG_I: Configured from console by console

s

% Ambiguous command: "s"

Switch#show vlan

VLAN Name Status Ports

1 default active Fa0/1, Fa0/2, Fa0/3, Fa0/4

Fa0/5, Fa0/6, Fa0/7, Fa0/8

*Inter Vlan
routing is
configured
for comms
across the
Vlans.*

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

100 vlan100 active

101 vlan101 active

1002 fddi-default act/unsup

1003 token-ring-default act/unsup

1004 fddinet-default act/unsup

1005 trnet-default act/unsup

VLAN Type SAID MTU Parent RingNo BridgeNo Stp BrdgMode Trans1 Trans2

1 enet 100001 1500 ----- 0 0

100 enet 100100 1500 ----- 0 0

101 enet 100101 1500 ----- 0 0

1002 fddi 101002 1500 ----- 0 0

1003 tr 101003 1500 ----- 0 0

1004 fdnet 101004 1500 --- ieee - 0 0

1005 trnet 101005 1500 --- ibm - 0 0

Switch#conf t

Enter configuration commands, one per line. End with CNTL/Z.

Switch(config)#int f0/2

Switch(config-if)#switchport mode access

Switch(config-if)#switchport access vlan 101

```
Switch(config-if)#exit
Switch(config)#int f0/1
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 100
Switch(config-if)#exit
Switch(config)#int f0.4
^
% Invalid input detected at '^' marker.
Switch(config)#int f0/4
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 100
Switch(config-if)#exit
Switch(config)#int f0/3
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 101
Switch(config-if)#exit
Switch(config)#^Z
Switch#
%SYS-5-CONFIG_I: Configured from console by console
```

```
Switch#show vlan
```

```
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

100 vlan100 active Fa0/1, Fa0/4

101 vlan101 active Fa0/2, Fa0/3

1002 fddi-default act/unsup

1003 token-ring-default act/unsup

1004 fddinet-default act/unsup

1005 trnet-default act/unsup

VLAN Type SAID MTU Parent RingNo BridgeNo Stp BrdgMode Trans1 Trans2

1 enet 100001 1500 - - - - 0 0

100 enet 100100 1500 - - - - 0 0

101 enet 100101 1500 - - - - 0 0

1002 fddi 101002 1500 - - - - 0 0

1003 tr 101003 1500 - - - - 0 0

1004 fdnet 101004 1500 - - - ieee - 0 0

Switch#conf t

Enter configuration commands, one per line. End with CNTL/Z.

Switch(config)#int f0/10

Switch(config-if)#switchport mode trunk

Switch(config-if)#^Z

Switch#

%SYS-5-CONFIG_I: Configured from console by console

Switch#show interfaces trunk

Switch#show interfaces trunk

Switch#conf t

Enter configuration commands, one per line. End with CNTL/Z.

Switch(config)#int f0/10

Switch(config-if)#switchport mode trunk

Switch(config-if)#

Switch(config-if)#^Z

Switch#

%SYS-5-CONFIG_I: Configured from console by console

%LINK-5-CHANGED: Interface FastEthernet0/5, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/5, changed state to up

Switch#show interfaces trunk

Switch#show interfaces trunk

Switch#show interfaces trunk

```
Switch#conf t
```

```
Enter configuration commands, one per line. End with CNTL/Z.
```

```
Switch(config)#int f0/5
```

```
Switch(config-if)#
```

```
Switch(config-if)#^Z
```

```
Switch#
```

```
%SYS-5-CONFIG_I: Configured from console by console
```

```
Switch#show interfaces trunk
```

```
Switch#conf t
```

```
Enter configuration commands, one per line. End with CNTL/Z.
```

```
Switch(config)#int f0/5
```

```
Switch(config-if)#switchport mode trunk
```

```
Switch(config-if)#
```

```
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/5, changed state to down
```

```
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/5, changed state to up
```

```
^Z
```

```
Switch#
```

```
%SYS-5-CONFIG_I: Configured from console by console
```

```
^Z
```

```
Switch#show interfaces trunk
```

```
Port Mode Encapsulation Status Native vlan
```

```
Fa0/5 on 802.1q trunking 1
```

Port Vlans allowed on trunk

Fa0/5 1-1005

The trunking allows the router to become virtually many routers with many gateways on the same link.

Port Vlans allowed and active in management domain

Fa0/5 1,100,101

Port Vlans in spanning tree forwarding state and not pruned

Fa0/5 1,100,101

Switch#

Router

Router>enable

Router#

Router#configure terminal

Enter configuration commands, one per line. End with CNTL/Z.

Router(config)#

Router(config)#

Router(config)#

Router(config)#int f0/0

Router(config-if)#no shutdown

```
Router(config-if)#
```

```
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up
```

```
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
```

```
Router(config-if)#exit
```

```
Router(config)#
```

```
Router(config)#int f0/0
```

```
Router(config-if)#no ip address
```

```
Router(config-if)#exit
```

```
Router(config)#int f0/0.100
```

```
Router(config-subif)#
```

```
%LINK-5-CHANGED: Interface FastEthernet0/0.100, changed state to up
```

```
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0.100, changed state to up
```

```
Router(config-subif)#encapsulate dot1Q 100
```

```
^
```

```
% Invalid input detected at '^' marker.
```

```
Router(config-subif)#encapsulation dot1Q 100
```

```
Router(config-subif)#ip address 192.168.100.254 255.255.255.0
```

```
Router(config-subif)#no shutdown
```

```
Router(config-subif)#exit
```

```
Router(config)#int f0/0.101
```

```
Router(config-subif)#
```

```
%LINK-5-CHANGED: Interface FastEthernet0/0.101, changed state to up
```

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0.101, changed state to up

encapsulation dot1Q 101

Router(config-subif)#192.168.101.254 255.255.255.0

^

% Invalid input detected at '^' marker.

Router(config-subif)#ip address 192.168.101.254 255.255.255.0

Router(config-subif)#no shutdown

Router(config-subif)#^Z

Router#

%SYS-5-CONFIG_I: Configured from console by console

Router#show ip int brie

Interface IP-Address OK? Method Status Protocol

FastEthernet0/0 unassigned YES unset up up

FastEthernet0/0.100 192.168.100.254 YES manual up up

FastEthernet0/0.101 192.168.101.254 YES manual up up

FastEthernet1/0 unassigned YES unset administratively down down

Serial2/0 unassigned YES unset administratively down down

Serial3/0 unassigned YES unset administratively down down

FastEthernet4/0 unassigned YES unset administratively down down

FastEthernet5/0 unassigned YES unset administratively down down

Router#show run

Building configuration...

*The 'show run' command send a
report of all the configurations for the
router.*

Current configuration : 872 bytes

!

version 12.2

no service timestamps log datetime msec

no service timestamps debug datetime msec

no service password-encryption

!

hostname Router

!

!

!

!

!

!

!

!

ip cef

no ipv6 cef

!

!

!

!

!

!

!

!

!

!

!

!

!

!

!

!

!

!

interface FastEthernet0/0

no ip address

duplex auto

speed auto

!

interface FastEthernet0/0.100

encapsulation dot1Q 100

ip address 192.168.100.254 255.255.255.0

!

interface FastEthernet0/0.101

encapsulation dot1Q 101

ip address 192.168.101.254 255.255.255.0

!

interface FastEthernet1/0

no ip address

duplex auto

speed auto

shutdown

!

interface Serial2/0

no ip address

shutdown

!

interface Serial3/0

no ip address

shutdown

!

interface FastEthernet4/0

no ip address

shutdown

!

interface FastEthernet5/0

no ip address

shutdown

!

ip classless

!

ip flow-export version 9

!

!

!

!

!

!

!

line con 0

!

line aux 0

!

line vty 0 4

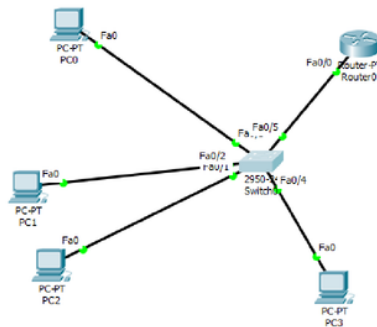
login

!

!

!

End

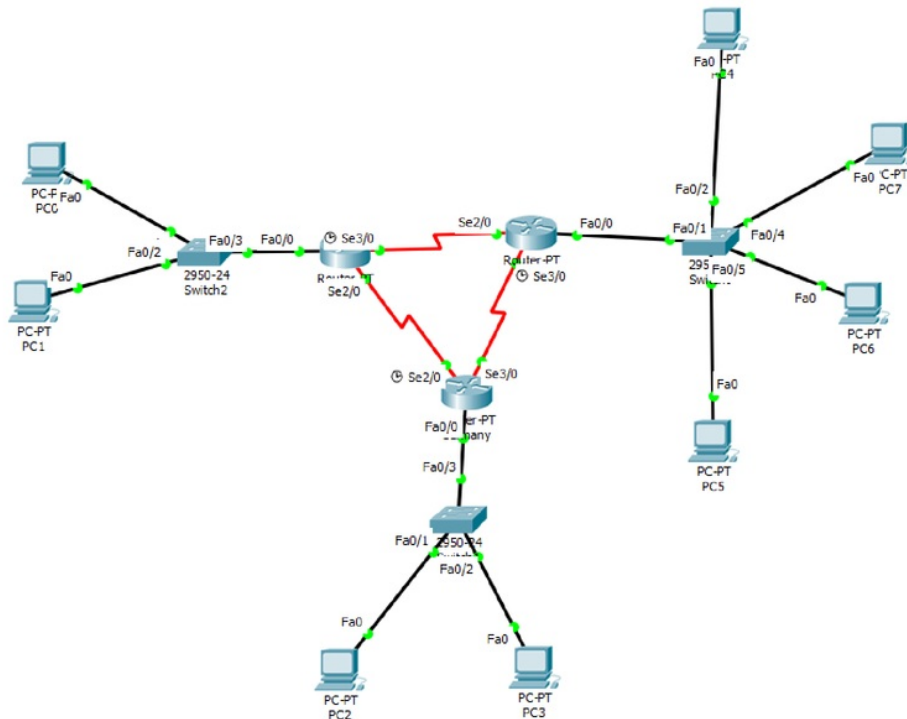


PDU List Window

File	Last Status	Source	Destination	Type	Color	Time(sec)	Pe
	Successful	PC3	PC2	ICMP		0.000	
	Successful	PC3	PC1	ICMP		0.000	
	Successful	PC3	PC0	ICMP		0.000	
	Successful	PC0	PC1	ICMP		0.000	
	Successful	PC0	PC2	ICMP		0.000	

The Vlan tests show successful across the Vlans. This proves the inter Vlan routing protocol configuration.

Networking using VLAN



Germany show IP routing table

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

192.168.150.0/24 is variably subnetted, 6 subnets, 2 masks

R 192.168.150.4/30 [120/1] via 192.168.150.9, 00:00:06, Serial2/0

[120/1] via 192.168.150.14, 00:00:18, Serial3/0

C 192.168.150.8/30 is directly connected, Serial2/0

C 192.168.150.12/30 is directly connected, Serial3/0

R 192.168.150.32/27 [120/1] via 192.168.150.9, 00:00:06, Serial2/0

C 192.168.150.64/27 is directly connected, FastEthernet0/0

R 192.168.150.96/27 [120/1] via 192.168.150.14, 00:00:18, Serial3/0

Showing VLAN

Switch#show vlan

VLAN Name Status Ports

1 default active Fa0/1, Fa0/2, Fa0/3, Fa0/4

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

1002 fddi-default act/unsup

1003 token-ring-default act/unsup

1004 fddinet-default act/unsup

1005 trnet-default act/unsup

VLAN Type SAID MTU Parent RingNo BridgeNo Stp BrdgMode Trans1 Trans2

1 enet 100001 1500 - - - - 0 0

1002 fddi 101002 1500 - - - - 0 0

1003 tr 101003 1500 - - - - 0 0

1004 fdnet 101004 1500 - - - ieee - 0 0

1005 trnet 101005 1500 - - - ibm - 0 0

VLAN Type SAID MTU Parent RingNo BridgeNo Stp BrdgMode Trans1 Trans2

Remote SPAN VLANs

Primary Secondary Type Ports

Type	Network	Port	Next Hop IP	Metric
R	192.168.150.4/30	Serial2/0	192.168.150.9	120/1
R	192.168.150.4/30	Serial3/0	192.168.150.14	120/1
C	192.168.150.8/30	Serial2/0	---	0/0
C	192.168.150.12/30	Serial3/0	---	0/0
R	192.168.150.32/27	Serial2/0	192.168.150.9	120/1
C	192.168.150.64/27	FastEthernet0/0	---	0/0
R	192.168.150.96/27	Serial3/0	192.168.150.14	120/1

PDU List Window

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	PC3	PC2	ICMP		0.000	N	0	(edit)	(delete)
	Successful	PC3	Germany	ICMP		0.000	N	1	(edit)	(delete)
	Successful	PC2	Germany	ICMP		0.000	N	2	(edit)	(delete)
	Successful	PC2	PC7	ICMP		0.000	N	3	(edit)	(delete)
	Successful	PC3	PC0	ICMP		0.000	N	4	(edit)	(delete)

UK Running config

Router#show running-config

Building configuration...

Current configuration : 805 bytes

!

version 12.2

no service timestamps log datetime msec

no service timestamps debug datetime msec

no service password-encryption

!

hostname Router

!

!

!

!

!

!

!

!

ip cef

no ipv6 cef

!

!

!

!

!

!

!

!

!

!

!

!

!

!

!

```
!  
!  
!  
  
interface FastEthernet0/0  
ip address 192.168.150.126 255.255.255.224  
  
duplex auto  
speed auto  
  
!  
  
interface FastEthernet1/0  
no ip address  
  
duplex auto  
speed auto  
  
shutdown  
  
!  
  
interface Serial2/0  
ip address 192.168.150.6 255.255.255.252  
  
!  
  
interface Serial3/0  
ip address 192.168.150.14 255.255.255.252  
  
clock rate 2000000  
  
!  
  
interface FastEthernet4/0  
no ip address  
  
shutdown  
  
!  
  
interface FastEthernet5/0  
no ip address
```

```
shutdown
```

```
!
```

```
router rip
```

```
version 2
```

```
network 192.168.150.0
```

```
!
```

```
ip classless
```

```
!
```

```
ip flow-export version 9
```

```
!
```

```
!
```

```
!
```

```
!
```

```
!
```

```
!
```

```
!
```

```
line con 0
```

```
!
```

```
line aux 0
```

```
!
```

```
line vty 0 4
```

```
login
```

```
!
```

```
!
```

```
!
```

```
end
```

USA Running config

Router>en

Router#show running-config

Building configuration...

Current configuration : 801 bytes

!

version 12.2

no service timestamps log datetime msec

no service timestamps debug datetime msec

no service password-encryption

!

hostname Router

!

!

!

!

!

!

!

!

ip cef

no ipv6 cef

!

!

!

!

!

!

!

!

!

!

!

!

!

!

!

!

!

!

interface FastEthernet0/0

ip address 192.168.150.62 255.255.255.224

duplex auto

speed auto

!

interface FastEthernet1/0

no ip address

duplex auto

speed auto

shutdown

!

interface Serial2/0

ip address 192.168.150.9 255.255.255.252

!

interface Serial3/0

ip address 192.168.150.5 255.255.255.252

clock rate 64000

!

interface FastEthernet4/0

no ip address

shutdown

!

interface FastEthernet5/0

no ip address

shutdown

!

router rip

version 2

network 192.168.150.0

!

ip classless

!

ip flow-export version 9

!

!

!

!

!

!

!

```
line con 0
```

```
!
```

```
line aux 0
```

```
!
```

```
line vty 0 4
```

```
login
```

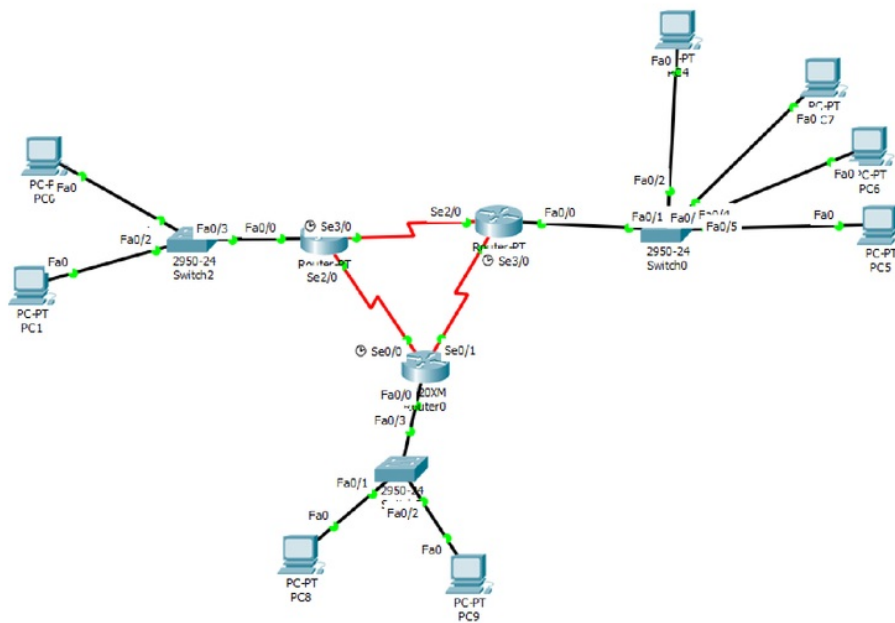
```
!
```

```
!
```

```
!
```

```
End
```

ACLS



Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	PC9	PC1	ICMP		0.000	N	0	(edit)	(delete)
	Successful	PC9	PC0	ICMP		0.000	N	1	(edit)	(delete)
	Failed	PC8	PC1	ICMP		0.000	N	2	(edit)	(delete)
	Failed	PC8	PC0	ICMP		0.000	N	3	(edit)	(delete)
	Successful	PC8	PC9	ICMP		0.000	N	4	(edit)	(delete)

Routing table for VLAN router

Type	Network	Port	Next Hop IP	Metric
R	192.168.150.4/30	Serial0/1	192.168.150.14	120/1
R	192.168.150.4/30	Serial0/0	192.168.150.9	120/1
C	192.168.150.8/30	Serial0/0	---	0/0
C	192.168.150.12/30	Serial0/1	---	0/0
R	192.168.150.32/27	Serial0/0	192.168.150.9	120/1
C	192.168.150.64/27	FastEthernet0/0.100	---	0/0
R	192.168.150.96/27	Serial0/1	192.168.150.14	120/1
C	192.168.150.128/27	FastEthernet0/0.101	---	0/0

test
show
ACL
denial of
service.

Routing table shows the sub
interfaces .100 and .101 for the two
Vlan gateways.

USA Running config

R0#show running-config

Building configuration...

Current configuration : 884 bytes

!

version 12.2

no service timestamps log datetime msec

no service timestamps debug datetime msec

no service password-encryption

!

hostname R0

!

!

!

!

!

!

!

!

ip cef

no ipv6 cef

!

!

!

!

!

!

!

!

!

!

!

!

!

!

!

!

!

!

interface FastEthernet0/0

ip address 192.168.150.62 255.255.255.224

ip access-group 1 out

duplex auto

speed auto

!

interface FastEthernet1/0

no ip address

duplex auto

speed auto

shutdown

!

interface Serial2/0

ip address 192.168.150.9 255.255.255.252

!

interface Serial3/0

ip address 192.168.150.5 255.255.255.252

clock rate 64000

!

interface FastEthernet4/0

no ip address

shutdown

!

interface FastEthernet5/0

no ip address

shutdown

!

router rip

version 2

network 192.168.150.0

!

ip classless

!

ip flow-export version 9

!

!

access-list 1 deny host 192.168.150.65

access-list 1 permit any

!

!

!

!

!

line con 0

!

line aux 0

!

line vty 0 4

login

!

*ACL security
showing
denial of
service to ip
address
192.168.150.
65*

!

!

End

UK Running config

R1#show running-config

Building configuration...

Current configuration : 799 bytes

!

version 12.2

no service timestamps log datetime msec

no service timestamps debug datetime msec

no service password-encryption

!

hostname R1

!

!

!

!

!

!

!

!

ip cef

no ipv6 cef

!

!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!

```
interface FastEthernet0/0
ip address 192.168.150.126 255.255.255.224
duplex auto
speed auto
!
interface FastEthernet1/0
no ip address
duplex auto
speed auto
shutdown
```

!

interface Serial2/0

ip address 192.168.150.6 255.255.255.252

!

interface Serial3/0

ip address 192.168.150.14 255.255.255.252

clock rate 64000

!

interface FastEthernet4/0

no ip address

shutdown

!

interface FastEthernet5/0

no ip address

shutdown

!

router rip

version 2

network 192.168.150.0

!

ip classless

!

ip flow-export version 9

!

!

!

!

```
!  
!  
!  
line con 0  
!  
line aux 0  
!  
line vty 0 4  
login  
!  
!  
!  
end
```

Germany Running config

R2#show running-config

Building configuration...

Current configuration : 791 bytes

```
!  
version 12.2  
no service timestamps log datetime msec  
no service timestamps debug datetime msec  
no service password-encryption  
!
```

hostname R2

!

!

!

!

!

!

!

!

no ip cef

no ipv6 cef

!

!

!

!

!

!

!

!

!

!

!

!

!

!

!

!

```
!  
!  
interface FastEthernet0/0  
  
no ip address  
  
duplex auto  
  
speed auto  
  
!  
  
interface FastEthernet0/0.100  
  
encapsulation dot1Q 100  
  
ip address 192.168.150.94 255.255.255.224  
  
!  
  
interface FastEthernet0/0.101  
  
encapsulation dot1Q 101  
  
ip address 192.168.150.130 255.255.255.224  
  
!  
  
interface Serial0/0  
  
ip address 192.168.150.10 255.255.255.252  
  
clock rate 64000  
  
!  
  
interface Serial0/1  
  
ip address 192.168.150.13 255.255.255.252  
  
!  
  
router rip  
  
version 2  
  
network 192.168.150.0  
  
!  
  
ip classless
```

*This shows the
inter Vlan routing
configuration on
the router with
encapsulation
protocol active.*

```
!  
ip flow-export version 9  
!  
!  
!  
!  
!  
!  
!  
!  
line con 0  
!  
line aux 0  
!  
line vty 0 4  
login  
!  
!  
!  
end
```

Encapsulation dot1Q 100

This is the networking standard that supports VLANs on an IEEE 802.3 Ethernet network. This is the standard which defines a system of VLAN tagging for Ethernet frames and also accompanies the procedure's to be used by the switches and bridges in handling such frames.

This defines the encapsulation protocol used in inter Vlan routing.

Element 3

Following below is the practical set up of the PLC, router and switch and the programming computers.



This image would be better if it was face on to view the front of the router and switch.

Set up vlans with no ports assigned.

```
COM1 - PuTTY
Switch#show vlan

VLAN Name                Status    Ports
-----
1    default                active    Fa0/1, Fa0/2, Fa0/3, Fa0/4
                                           Fa0/5, Fa0/6, Fa0/7, Fa0/8
                                           Fa0/9, Fa0/10, Fa0/11, Fa0/12
100  vlan100                 active
101  vlan101                 active
1002 fddi-default            active
1003 token-ring-default    active
1004 fddinet-default        active
1005 trnet-default          active

VLAN Type  SAID      MTU    Parent RingNo BridgeNo Stp  BrgdMode Trans1 Trans2
-----
1    enet    100001    1500   -       -       -       -   -         0       0
100  enet    100100    1500   -       -       -       -   -         0       0
101  enet    100101    1500   -       -       -       -   -         0       0
1002 fddi     101002    1500   -       -       -       -   -         0       0
1003 tr      101003    1500   -       -       -       -   -         0       0
1004 fdnet   101004    1500   -       -       -       ieee -         0       0
1005 trnet   101005    1500   -       -       -       ibm  -         0       0
Switch#
```

Image shows the Vlans 100 and 101 assigned but not active. No interfaces are assigned to the Vlans.

Vlans set and ports assigned.

```
COM1 - PuTTY
Switch#show vlan

VLAN Name                Status    Ports
-----
1    default                active    Fa0/1, Fa0/5, Fa0/6, Fa0/7
                                   Fa0/8, Fa0/9, Fa0/10, Fa0/11
                                   Fa0/12
100  vlan100                 active    Fa0/4
101  vlan101                 active    Fa0/2, Fa0/3
1002 fddi-default          active
1003 token-ring-default    active
1004 fddinet-default       active
1005 trnet-default         active

VLAN Type  SAID      MTU    Parent RingNo BridgeNo Stp    BrdgMode Trans1 Trans2
-----
1    enet    100001   1500   -      -      -      -      -      0      0
100  enet    100100   1500   -      -      -      -      -      0      0
101  enet    100101   1500   -      -      -      -      -      0      0
1002 fddi    101002   1500   -      -      -      -      -      0      0
1003 tr     101003   1500   -      -      -      -      -      0      0
1004 fdnet  101004   1500   -      -      -      ieee  -      0      0
1005 trnet  101005   1500   -      -      -      isl   -      0      0
Switch#conf t
```

This is the report on the trunk configuration

```
COM1 - PuTTY
Switch(config-if)#switchport mode trunk
Switch(config-if)#^Z
Switch#
00:07:55: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to down
00:07:56: %SYS-5-CONFIG_I: Configured from console by console
Switch#show in
00:07:56: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up
\ Type "show ?" for a list of subcommands
Switch#show interface trunk

Port      Mode      Encapsulation  Status        Native vlan
Fa0/1     on        802.1q         trunking      1

Port      Vlans allowed on trunk
Fa0/1     1-4094

Port      Vlans allowed and active in management domain
Fa0/1     1,100-101

Port      Vlans in spanning tree forwarding state and not pruned
Fa0/1     none
Switch#
```

Trunk configuration enables multiple channels (vlans) on a single gateway and Ethernet cat 5 cable.

Gateways are set in the sub interface configuration and can be as many as 199.

V
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nfi
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ur
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bl
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d
w

The sub interface gateways for intervlan routing are:

192.168.100.254

192.168.101.254

This is the report on sub interface set up. This is inter-vlan routing.

```
COM1 - PuTTY
Router(config)#?
Router#
00:17:11: %SYS-5-CONFIG_I: Configured from console by console
00:17:11: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to down
Router#end t
00:17:16: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state
Router#show ip int br
Interface IP-Address OK? Method Status Protocol
FastEthernet0/0 unassigned YES manual up up
FastEthernet0/0.100 192.168.100.254 YES manual up up
FastEthernet0/0.101 192.168.101.254 YES manual up up
Serial0/0 unassigned YES unset administratively down down
FastEthernet0/1 unassigned YES unset administratively down down
Serial0/1 unassigned YES unset administratively down down
Router#
```

The sub interfaces are shown with the gateways configured.

This is the router configuration confirming all router parameters.

```
COM1 - PuTTY
interface FastEthernet0/0
no ip address
no ip directed-broadcast
duplex auto
speed auto

interface FastEthernet0/0.100
encapsulation dot1Q 100
ip address 192.168.100.254 255.255.255.0
no ip directed-broadcast

interface FastEthernet0/0.101
encapsulation dot1Q 101
ip address 192.168.101.254 255.255.255.0
no ip directed-broadcast

interface Serial0/0
no ip address
no ip directed-broadcast
no ip route-cache
shutdown
--More--
```

This is the router report.

This shows ping testing across the vlans.(101-101)

```
C:\WINDOWS\system32\cmd.exe
Pinging 192.168.101.2 with 32 bytes of data:
Reply from 192.168.101.2: bytes=32 time=2ms TTL=30
Reply from 192.168.101.2: bytes=32 time<1ms TTL=30
Reply from 192.168.101.2: bytes=32 time<1ms TTL=30
Reply from 192.168.101.2: bytes=32 time<1ms TTL=30
Ping statistics for 192.168.101.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 2ms, Average = 0ms
C:\Documents and Settings\Administrator>ipconfig

Windows IP Configuration

Ethernet adapter Local Area Connection:

    Connection-specific DNS Suffix  . : 
    IP Address. . . . . : 192.168.101.3
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 192.168.101.254

C:\Documents and Settings\Administrator>ping 192.168.101.2
Pinging 192.168.101.2 with 32 bytes of data:
Reply from 192.168.101.2: bytes=32 time=2ms TTL=30
Reply from 192.168.101.2: bytes=32 time<1ms TTL=30
Reply from 192.168.101.2: bytes=32 time<1ms TTL=30
Reply from 192.168.101.2: bytes=32 time<1ms TTL=30
Ping statistics for 192.168.101.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 2ms, Average = 0ms
C:\Documents and Settings\Administrator>
```

*Ping tests
prove the
inter Vlan
routing
configuration.*

Ping test for vlan 100-101

```
C:\Users\Leils>ping 192.168.101.3

Pinging 192.168.101.3 with 32 bytes of data:
Reply from 192.168.101.3: bytes=32 time<1ms TTL=127
Reply from 192.168.101.3: bytes=32 time<1ms TTL=127
Reply from 192.168.101.3: bytes=32 time<1ms TTL=127
Reply from 192.168.101.3: bytes=32 time<1ms TTL=127

Ping statistics for 192.168.101.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\Users\Leils>ping 192.168.101.2

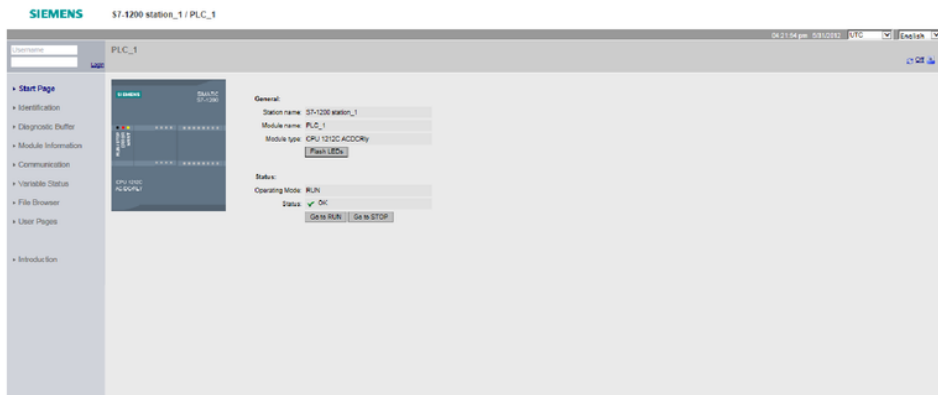
Pinging 192.168.101.2 with 32 bytes of data:
Request timed out.
Reply from 192.168.101.2: bytes=32 time=1ms TTL=29
Reply from 192.168.101.2: bytes=32 time=1ms TTL=29
Reply from 192.168.101.2: bytes=32 time=1ms TTL=29

Ping statistics for 192.168.101.2:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 1ms, Average = 1ms
```

*This demonstrates
the comms across
the Vlans*

TCP IP Protocol and HTTP Test

Siemens web server front page



This is the front page of the web server from the PLC. This is accessed using the device ip address of the PLC and the gateway.

Above is the Siemens station which has the inputs and outputs on the PLC.

The link titled "user pages" above is the link to the index web page for I/O control.

Following below is the testing using inputs and outputs on the PLC which are displayed on the web server.

HTML Webpage (contained in PLC web sever)



This is test number 1 with inputs 2,4 and 5 set on with output 1 set.

Test of web page program downloaded to PLC. This shows



PLC confirms settings.

This is test number 2 where inputs 0,3,4,6 and 7 are set with outputs 0 and 3 set.



Test shows as the conditions on the PLC change the web page reads them and displays the same changes.



The final test shows inputs 0 and 3 set with output 0 also set.



Test is consistent with changes.

Conclusion

Two vlans were set up and configured using a single Cisco router and switch. The two vlans were tested and proved that no communication was possible initially.

Inter-vlan routing was then configured and the two vlans were retested and communicated in both directions, so that the sub interfaces were communicating using the trunk protocol and two separate gateways.

Testing using the ping method proved the IP address communications between each vlan hosts. The final test was to connect the PLC web server which was set up via the PLC software (TIA) and connected using Ethernet cable to the switch.

One PC on a different vlan to the PLC was used to access the PLC webpage via HTTP protocol using google chrome.

Communication and control of PLC from host on separate vlan was carried out by setting the output ports and input ports on the PLC.

Conclusion identifies the process of the practical setup and recognises the HTTP protocol function.

Recommendations

The web page access using the PC to control the PLC i/o can be improved using the wireless protocol which can be done effectively using an ordinary household router e.g. BT.

This method would enable any wireless terminal such as IPad or mobile phone to access the webpage and control the PLC I/O.

*Wireless is a
good
recommendati
on*

References

Reddy, V. (2018, December 3rd). *geeks for geeks*. Retrieved from geeks for geeks:
<https://www.geeksforgeeks.org/computer-network-difference-unicast-broadcast-multicast/>

smith, J. (2018, December 2nd). *The network encyclopedia*. Retrieved from The network
encyclopedia: <http://www.thenetworkencyclopedia.com/entry/encapsulation/>

*There
should
be far
more
relevant
sources
research
ed for
this topic
area.*

Networking final

GRADEMARK REPORT

FINAL GRADE

GENERAL COMMENTS

Instructor

63/100

PAGE 1

PAGE 2

Text Comment. List of contents is good.

Text Comment. No list of figures.

PAGE 3

PAGE 4

Text Comment. Useful diagram to support your explanation.

Text Comment. Good technical points made about this layer.

PAGE 5

Text Comment. This should be DLL.

PAGE 6

PAGE 7

Text Comment. The 7 layer model has been explained well and key points identified.

Text Comment. A diagram should have been used here to show the encapsulation headers being added and removed as the packet goes through the layers.

PAGE 8

Text Comment. Good diagram to support your explanation.

Text Comment. Good explanation.

Text Comment. The port numbers available could be included here.

Text Comment. The research could have been better with diagrams to illustrate.

PAGE 9

Text Comment. Good image which captures the port allocations.

Text Comment. Address classes are allocated to the LANs and the WANs serial port addresses are your choice.

PAGE 10

PAGE 11

PAGE 12

PAGE 13

Text Comment. Static routing is configured and the images show clearly the direct connection, via and routed connections.

Text Comment. The testing shows the success if the comms between all devices. This proves the routing configuration.

PAGE 14

Text Comment. This is the dynamic routing protocol

PAGE 15

Text Comment. RIP routing is configured for each router.

PAGE 16

Text Comment. The tables show the RIP configuration for each router and this determines the routing path.

PAGE 17

PAGE 18

Text Comment. Tables show the routing connections

Text Comment. Tests show that the RIP had been configured correctly. Each device is tested with all other devices.

PAGE 19

Text Comment. Control router showing the net pools created for DHCP.

Text Comment. Test shows DHCP is working for the control router.

PAGE 20

Text Comment. Good point made here.

PAGE 21

Text Comment. Helper addresses are configured.

Text Comment. DHCP is tested successful for other routers. The device address and gateway address is set dynamically.

PAGE 22

Text Comment. Address exclusion range is set here.

PAGE 23

Text Comment. The device address is now set outside the exclusion range. i.e .11

PAGE 24

PAGE 25

Text Comment. A devices are set outside of exclusion range.

Text Comment. The router report shows the exclusion address ranges.

PAGE 26

PAGE 27

PAGE 28

Text Comment. Running config reports on the routers show all configurations associated with that router.

Text Comment. Good evaluation that shows you have identified key areas which will help in future designs.

Text Comment. CIDR/28 addressing scheme is correct.

Text Comment. Routing tables show the RIP configuration.

Text Comment. This is the VLSM addressing scheme

Text Comment. CIDR/27 is correct

Text Comment. CIDR/30 is configured for the serial WAN ports.

Text Comment. RIP routing tables show the configuration for the /27 and /30 addressing.

Text Comment. No Vlan test showing broadcast goes to all devices.

Text Comment. Broadcast is only to the devices on the same Vlan. In this case PC1 to PC0

Text Comment. This shows the broadcast goes only to the devices on the same Vlan. Here PC1 and PC0 are on the same Vlan.

Text Comment. Inter Vlan routing is configured for comms across the Vlans.

Text Comment. The trunking allows the router to become virtually many routers with many gateways on the same link.

Text Comment. The 'show run' command send a report of all the configurations for the router.

Text Comment. The Vlan tests show successful across the Vlans. This proves the inter Vlan routing protocol configuration.

PAGE 57

PAGE 58

PAGE 59

PAGE 60

PAGE 61

PAGE 62

PAGE 63

PAGE 64

PAGE 65

PAGE 66

PAGE 67

PAGE 68

Text Comment. test shows ACL denial of service.

Text Comment. Routing table shows the sub interfaces .100 and .101 for the two Vlan gateways.

PAGE 69

PAGE 70

PAGE 71

Text Comment. ACL security showing denial of service to ip address 192.168.150.65

PAGE 72

PAGE 73

PAGE 74

PAGE 75

PAGE 76

PAGE 77

Text Comment. This shows the inter Vlan routing configuration on the router with encapsulation protocol active.

PAGE 78

Text Comment. This defines the encapsulation protocol used in inter Vlan routing.

PAGE 79

Text Comment. This image would be better if it was face on to view the front of the router and switch.

Text Comment. Image shows the Vlans 100 and 101 assigned but not active. No interfaces are assigned to the Vlans.

PAGE 80

Text Comment. Vlans are assigned interfaces.

Text Comment. Trunk configuration is enabled which is needed for inter Vlan routing. The router can be virtually many routers using this method.

PAGE 81

Text Comment. The sub interfaces are shown with the gateways configured.

Text Comment. This is the router report.

PAGE 82

Text Comment. Ping tests prove the inter Vlan routing configuration.

Text Comment. This demonstrates the comms across the Vlans

PAGE 83

Text Comment. This is the front page of the web server from the PLC. This is accessed using the device ip address of the PLC and the gateway.

Text Comment. Test of web page program downloaded to PLC. This shows the inputs read from PLC and the output set from the web page.

PAGE 84

Text Comment. PLC confirms settings.

Text Comment. Test shows as the conditions on the PLC change the web page reads them and displays the same changes.

PAGE 85

Text Comment. Test is consistent with changes.

Text Comment. Conclusion identifies the process of the practical setup and recognises the HTTP protocol function.

PAGE 86

Text Comment. Wireless is a good recommendation

Text Comment. There should be far more relevant sources researched for this topic area.

GRADING FORM: CSG-RUBIC

PHILLIP ROWE

63

RESEARCH-INFORMED LITERATURE



Research should include more relevant sources and images to support the explanations and findings. Encapsulation headers cannot be explained very well without the diagrams. 5/10

5/10

KNOWLEDGE AND UNDERSTANDING



Element1. The simple network system has been designed and implemented by defining the requirements from the larger system. This was done effectively using three classes of addressing for the Lans. 7/10 Element2. The network parameters were configured for the larger main network which included CIDR28, VLSM 27 and 30 implementation. This was done and tested. The six networks were all configured correctly with good understanding shown. The ACL part of the element was very clear and should have been explained better. 6.5/10 Element3. Practical configuration was completed and tested. Vlans all tested good and the PLC was programmed from across the Vlan using TIA software on a laptop PC. The web server was accessed using the ip address set on the PLC. Images were taken to prove the tests. The HTML program was not listed or explained in this element and the AWL tag commands needed to be explained. The web server configuration should have been explained. 6.5/10

20/30

ANALYSIS



Element1. The test results showed the network operating as expected with no faults. The operation of the network was explained reasonably well and the images support the test results. 3.5/5 Element2. The test results of the network configuration were good and explained reasonably well. Each part of the configuration was tested and explained where needed. Some of the tests carried out should have a heading to clarify what is being tested. 6.5/10 Element3. The results from the practical network

16/25

showed that the Vlans and inter Vlan routing was configured. This was confirmed by the programming and control of the PLC across Vlans. Images support the test results with this test. There should have been an explanation of the HTML program and the configuration of the PLC web server. 6/10

PRACTICAL APPLICATION AND DEP.



Element1. Design and implementation was achieved using good methods by which the address scheme of the three classes of ip address was designed first and then applied to the network for testing. Each LAN was tested individually. WAN networks were configured once the LANs tested successful. 3/5
Element2. Each section of this element was done separately. The CIDR/28 was implemented firstly and then the VLSM which is a form of CIDR was implemented and tested. The Vlans were an add on for this element just to test a simulation before element 3 practical. The ACL configuration was implemented successfully. This was proved with testing by sending and receiving data packets. 3/5
Element3. Vlans were configured on the Cisco router and switch. The PLC program was done using a laptop on a separate Vlan. The PLC server was downloaded with a htm file and using the ip address of the PLC this was tested. No HTML program or web server was explained. 6/10

12/20

SKILLS FOR PROFESSIONAL PRAC.



Element1. The quality of this element is good apart

from the lack of sources researched and there was no list of figures. 2.5/5 Element2. This element covered all that was required but should have made some parts of implementation and testing clearer.. 3/5 Element3. This element covered all areas and the tasks followed the correct pattern. There were however some parts missing. 2.5/5

10/15