

1708179

by Thomas Wood

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Name: Thomas Oliver Wood

University number: 1708179

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some of your headings are incorrect*

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*Extensive list of
figures*

1. Introduction

This element of the portfolio concentrates on building the basic understanding of networking to provide assistance as the portfolio progresses. Within this element extensive research is to be carried out in order to provide knowledge into the working fundamentals of networks. The research concentrates upon the models of computer data transmission and how this data is ultimately transmitted.

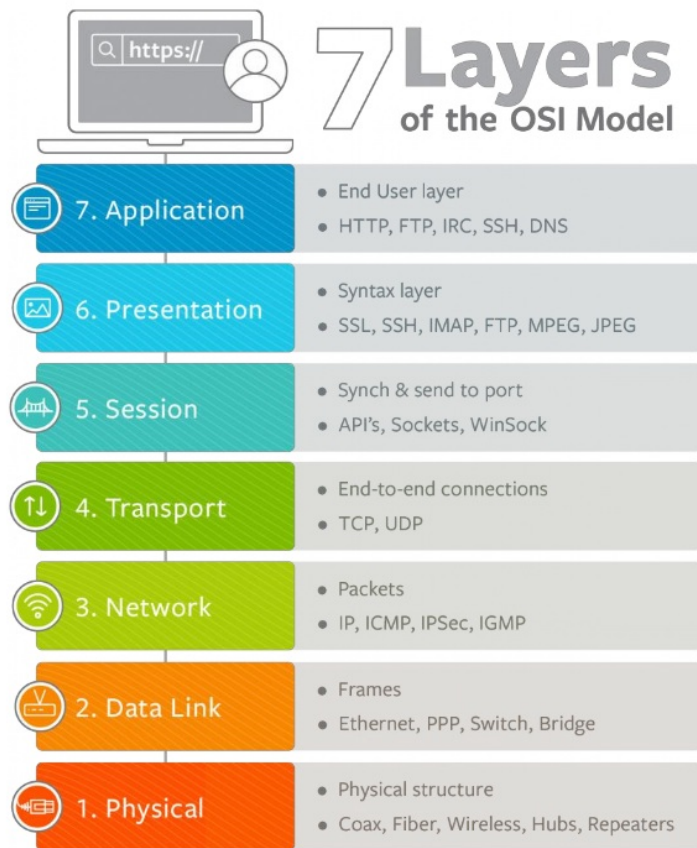
Following on from the research a basic network is to then be built and analysed with several different types of routing, this will allow for the basic advantages and disadvantages of each type of routing to be expressed and understood.

2. Research

2.1 OSI 7-layer model

“The Open Systems Interconnection (OSI) model defines a networking framework to implement protocols in layers, with control passed from one layer to the next.” (Mitchell, 2020), within the OSI 7-layer model there are seven layers these can be seen within **Error! Reference source not found.;**

This error should be rectified



The model shows the seven layers of the OSI model.

The lowest layer of the model is Physical; this layer is concerned with data communication, this is the physical transmission between devices, a common example of this is Wi-Fi or Ethernet.

The second layer of the model is Data Link; this layer is divided into two sub-layers the LLC (Logical Link Control) and the MAC (Media Access Control), the LLC ensures that accurate data is transmitted whereas the MAC is responsible for managing the permission for that data to be sent.

The third layer of the model is Network; this layer is responsible for the routing between devices and -


Figure 1 - 7-layer OSI Model

ensuring the best path is used when transmitting data.

The fourth layer of the model is transport; this layer is concerned with the reliable delivery of data packets, therefore its main priority is controlling the flow of data and ensuring the packet is appropriately processed.

The fifth layer of the model is session; this layer is the first to deal with software, “the session layer manages sessions between servers to coordinate communication.” (Mitchell, 2020).

The sixth layer of the model is presentation; this layer deals with the translation before the application layer, the translation depends upon what syntax the application layer can handle. “This layer can also handle the encryption and decryption required by the application layer.” (Anon., n.d.)

The seventh layer of the model is application; this layer provides network services with end-user applications, a common example of this is HTTP within a web browser.

2.2 OSI 4-layer model

The OSI 4-layer model or as bitterly known as TCP/IP has less layers than the 7-layer model and therefore emulates a couple of layers at once; it can be seen within Figure 2 “The network access layer is equivalent to OSI layers 1 and 2. The Internet Protocol layer is comparable to layer 3 in the OSI model. The host-to-host layer is equivalent to OSI layer 4. These are the TCP and UDP (user datagram protocol) functions. Finally, the application layer is similar to OSI layers 5, 6, and 7 combined.” (Frenzel, 2013)

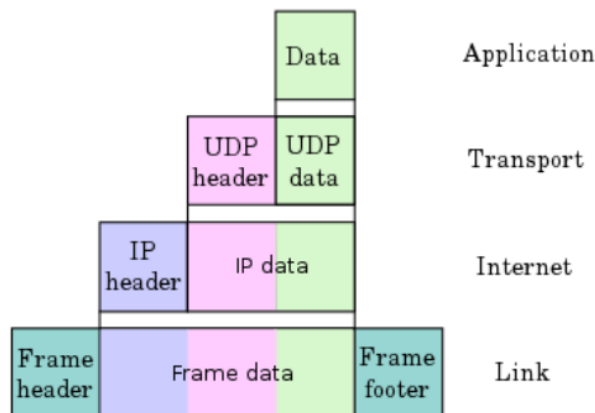
	OSI	TCP/IP
7	Application	Applications (FTP, SMTP, HTTP, etc.)
6	Presentation	
5	Session	
4	Transport	TCP (host-to-host)
3	Network	IP
2	Data link	Network access (usually Ethernet)
1	Physical	

Explanation is supported with a good image

Figure 2 - TCP/IP model

2.3 Encapsulation

Encapsulation is the process in which data is taken from “one protocol and translated into another protocol” (computerhope, 2017), this is done in order to allow this data to move across the network. As a packet travels between layers protocols either add or remove fields from the sent packets header, Encapsulation works when a protocol on the sending hosts address changes or adds data to a sent packet. Figure 3 depicts how data is encapsulated throughout the TCP/IP layers. The process of encapsulation basically provides raw data with the correct information for transmission so that the device that receives the data can understand the data and decapsulate it into data that can be displayed on a human interface.



Good image that supports explanation. There are many grammatical errors here.

Figure 3 - Data Encapsulation

2.4 Decapsulation

Decapsulation is the reverse process of encapsulation, it is the process that is carried out when the receiver gets the encapsulated data from the sender. Once the data is received the first layer is the datalink layer, this ensures that the data has no errors, once this is complete the Decapsulation process begins. This is done by passing the data through each layer, each of the layers then removes protocols from the data until finally the raw data can be displayed on the human interface (application), this process can be seen within Figure 4;

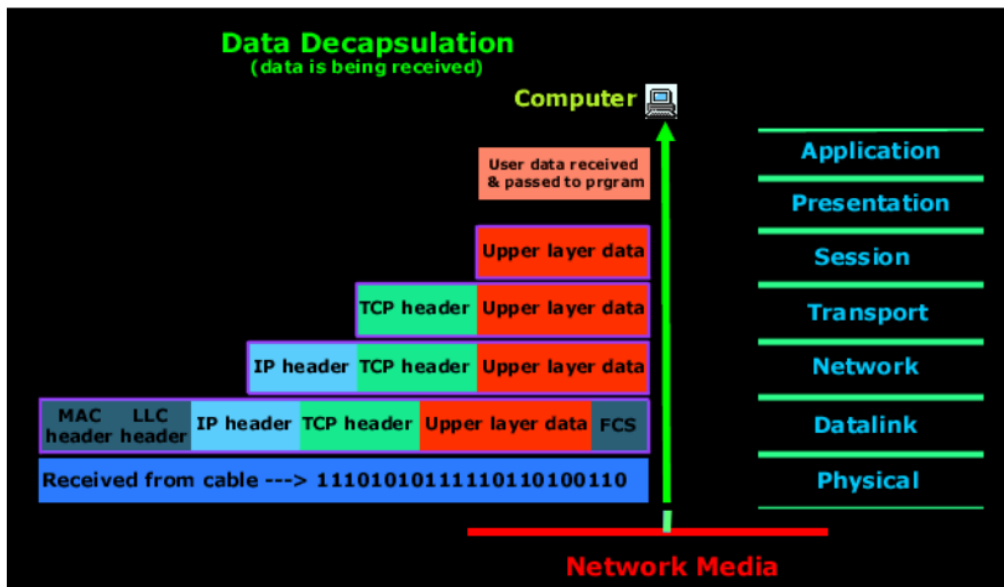


Figure 4 – Decapsulation (Anon., n.d.)

Explanation is good and supported with an informative image

2.5 Broadcasting

Broadcasting is the process in which a sent message is received by all devices within the domain, there are two ways of broadcasting these are through high level network operation “like broadcasting in Message Passing Interface.” (Anon., n.d.), and low level network operation such as Ethernet connections.

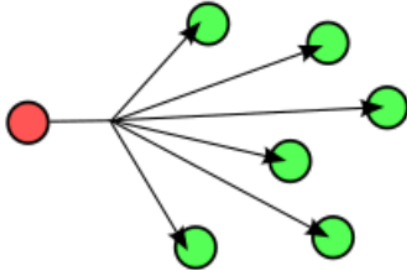


Figure 5 - Broadcasting

Broadcasting is commonly used in LAN's where all computers require communication, Figure 5 shows how the sender would send data to each of the devices upon the domain. Broadcasting is a good way of reducing network traffic as there is no need for packets to cause traffic as they simply just send to each device on the domain.

A common issue with this could be the fact that certain computers need to be secluded from certain messages, therefore in order to overcome this different broadcast addresses could be used in order to remove certain devices from the broadcast message.

2.6 Part allocation

- What are parts (they are software and allocated to protocols)
- How many parts are there (brief explanation)

This is a common issue with this could be the fact that certain computers need to be secluded from certain messages, therefore in order to overcome this different broadcast addresses could be used in order to remove certain devices from the broadcast message.

3. Design requirements

The completion of this portfolio will see a network system that consists of 3 routers and six networks that allow the connection between three remote LAN networks, be designed and developed. Within element one the network is simplified in order to allow for understanding into the design, configuration and implementation of a network.

Therefore, the requirements for this element is to produce a complex networking consisting of three LAN's that are each interconnected and the use of three different classes of addresses to be used.

Several different network designs were considered, the design that was ultimately chosen can be seen within Figure 6,

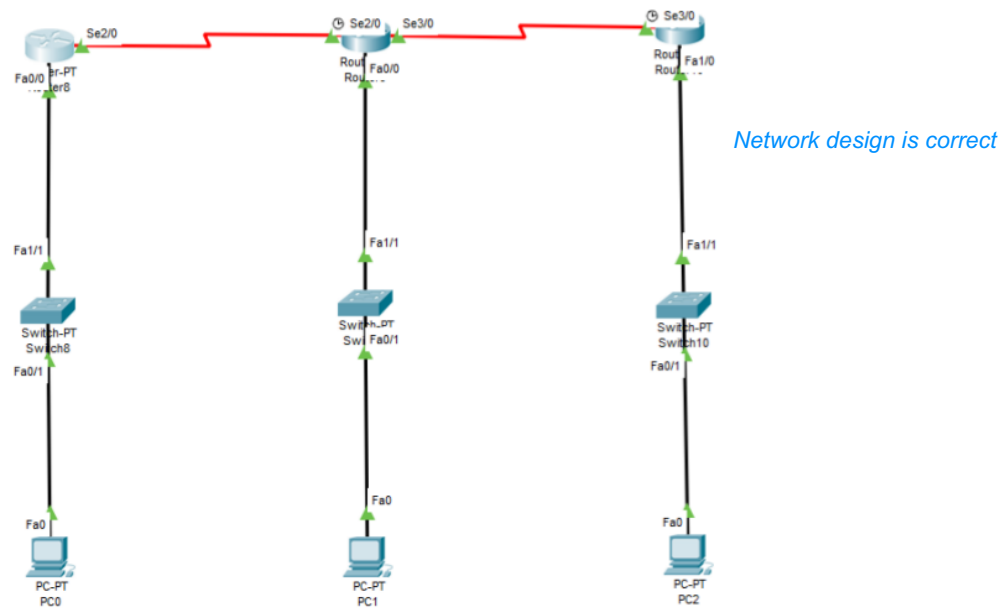


Figure 6 - Network Design

Having designed the network, the addressing was to now be determined, in order to include three different classes of addressing each LAN will be addressed using a different class. The addressing that was decided upon can be seen below;

Class C:

net address - 200.150.1.0

gateway address - 200.150.1.1

initial device address - 200.150.1.254

Class B:

net address - 150.100.0.0

gateway address - 150.100.0.1

initial device address - 150.100.0.254

Class A:

net address - 100.0.0.0

gateway address - 100.0.0.1

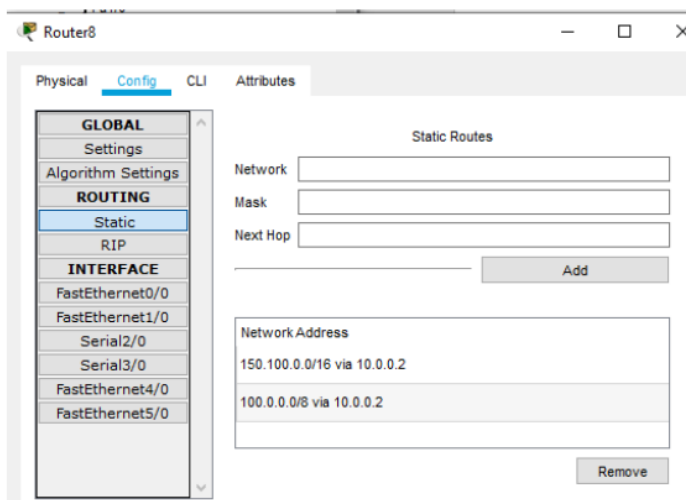
initial device address - 100.0.0.254

*Good
addressin
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scheme.
It would
assist the
implemen
tation
more if
this was
in a table
form*

4. Implementation

4.1 Static Addressing

The first routing that will be carried out upon the developed network will be static routing with static addressing, this requires all the addresses to be manually set upon each device. In order for the routing to work the correct link addresses must be also used to provide a route between the 3 routers.



Within Figure 7 the addressing of router 8 can be seen. The addresses of the other two routers are used with a link address to allow for routing between each LAN.

Figure 7 - Static Addressing of Router 8



Within

Figure 8 the addressing summary can be seen, it is shown that router 8 is connected to router 9 & 10 through the use of static addressing.

Figure 8 - Addressing Summary

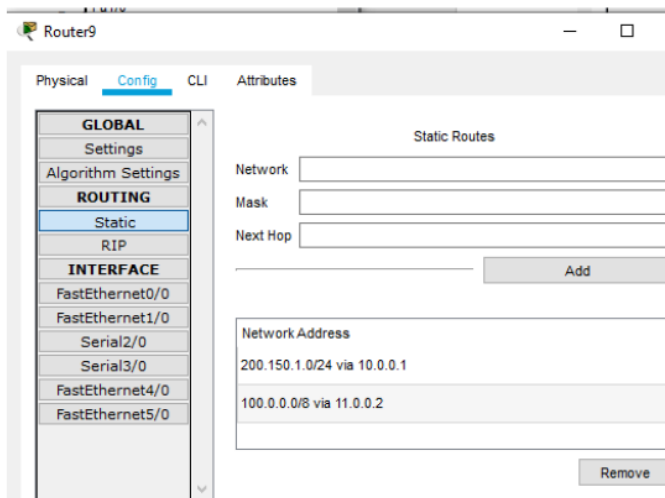


Figure 9 - Static Addressing of Router 9

Figure 9 shows the static addressing of router 9, the addresses of router 8 & 10 can be seen with a link address providing a route to each of these routers.

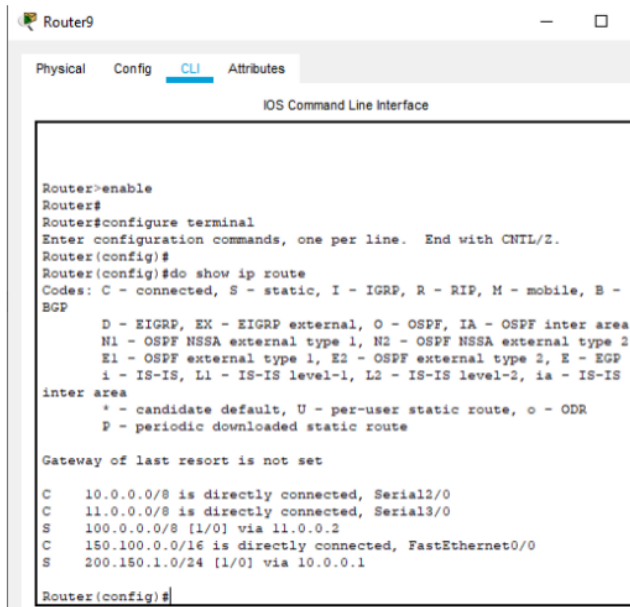


Figure 10 - Addressing Summary

It can be seen in figure 5 that the static addressing is working successfully, this is known as the devices can be seen to be connected through the use of static addressing.

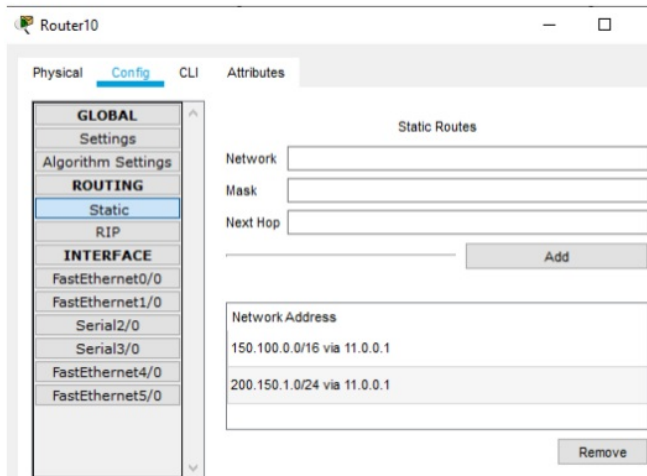


Figure 11 - Static Addressing Router 10

Figure 11 shows the static addressing of router 10, the addresses of router 8 & 9 can be seen with a link address providing a route to each of these routers.

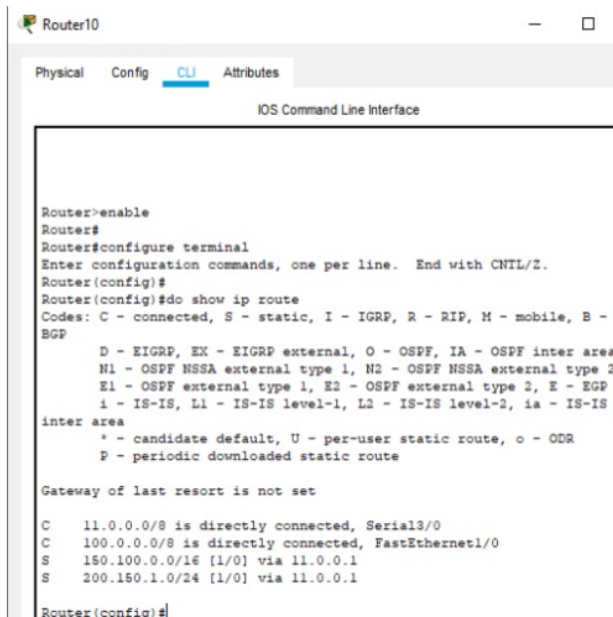


Figure 12 - Addressing Summary

It can be seen in Figure 12 that the static addressing is working successfully, this is known as the devices can be seen to be connected through the use of static addressing.

Screenshots show the static addressing and routing implementation

4.2 RIP (Routing Information Protocol) Routing

The second type of routing that will be utilised is dynamic routing, this will be achieved through the use of RIP routing. The RIP tables that have been created can be seen within

Figure 13,

Figure 14 &

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Router-PI

Switch10

Routing Table for Router8				
Type	Network	Port	Next Hop IP	Metric
C	10.0.0.0/8	Serial2/0	---	0/0
R	11.0.0.0/8	Serial2/0	10.0.0.2	120/1
R	100.0.0.0/8	Serial2/0	10.0.0.2	120/2
R	150.100.0.0/16	Serial2/0	10.0.0.2	120/1
C	200.150.1.0/24	FastEthernet0/0	---	0/0

Within

Figure 13 the RIP routing table for router 8 can be seen.

Figure 13 - RIP Table Router 8

Router-PI

Switch10

Routing Table for Router9				
Type	Network	Port	Next Hop IP	Metric
C	10.0.0.0/8	Serial2/0	---	0/0
C	11.0.0.0/8	Serial3/0	---	0/0
R	100.0.0.0/8	Serial3/0	11.0.0.2	120/1
C	150.100.0.0/16	FastEthernet0/0	---	0/0
R	200.150.1.0/24	Serial2/0	10.0.0.1	120/1

Within Figure 14 the RIP table for router 9 can be seen.

Figure 14 - RIP Table Router 9

Routing Table for Router10				
Type	Network	Port	Next Hop IP	Metric
R	10.0.0.0/8	Serial3/0	11.0.0.1	120/1
C	11.0.0.0/8	Serial3/0	---	0/0
C	100.0.0.0/8	FastEthernet1/0	---	0/0
R	150.100.0.0/16	Serial3/0	11.0.0.1	120/1
R	200.150.1.0/24	Serial3/0	11.0.0.1	120/2

Within Figure 15 the RIP routing for router 10 can be seen.

Figure 15 - RIP Table Router 10

```

Router8
Physical Config CLI Attributes
IOS Command Line Interface
Router(config)#Z
% Invalid input detected at '^' marker.
Router(config)#Z
Router#
%SYS-5-CONFIG_I: Configured from console by console

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
R    11.0.0.0/8 [120/1] via 10.0.0.2, 00:00:06, Serial2/0
R    100.0.0.0/8 [120/2] via 10.0.0.2, 00:00:06, Serial2/0
R    150.100.0.0/16 [120/1] via 10.0.0.2, 00:00:06, Serial2/0
C    200.150.1.0/24 is directly connected, FastEthernet0/0

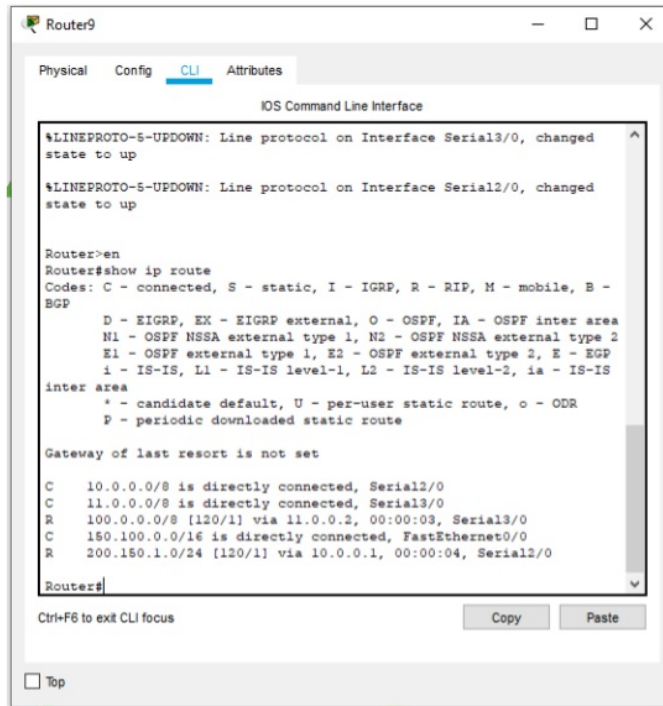
Router#

```

Figure 16 - Router 8 Addressing Summary

RIP tables are correct but there is no explanation here and there is no work missing

Figure 16 shows the summary of the RIP routing that has been set-up on router 8, each device that is connected through RIP routing is shown with the link



```
Router9
Physical Config CLI Attributes
IOS Command Line Interface

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial3/0, 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

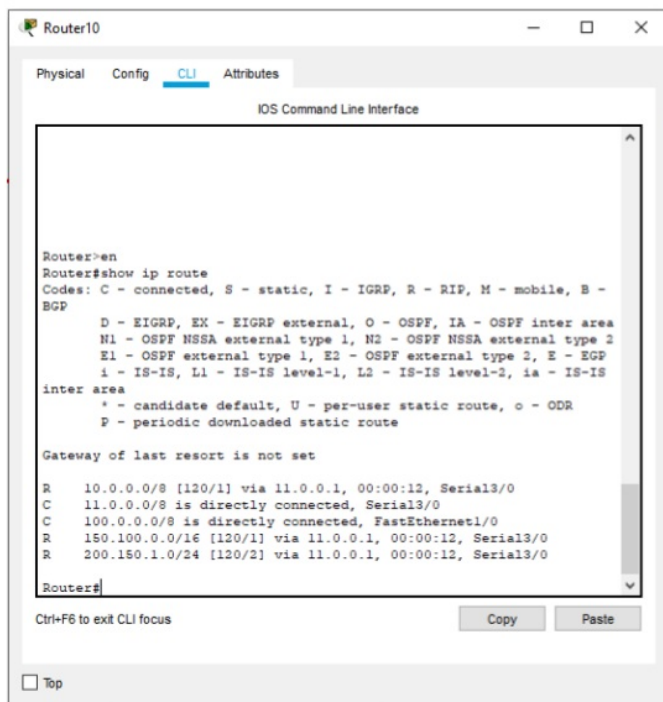
Gateway of last resort is not set

C    10.0.0.0/8 is directly connected, Serial2/0
C    11.0.0.0/8 is directly connected, Serial3/0
R    100.0.0.0/8 [120/1] via 11.0.0.2, 00:00:03, Serial3/0
C    150.100.0.0/16 is directly connected, FastEthernet0/0
R    200.150.1.0/24 [120/1] via 10.0.0.1, 00:00:04, Serial2/0

Router#
```

Figure 17 shows the summary of the RIP routing that has been set-up on router 8, each device that is connected through RIP routing is shown with the link shown.

Figure 17 - Router 9 Addressing Summary



```
Router10
Physical Config CLI Attributes
IOS Command Line Interface

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 11.0.0.1, 00:00:12, Serial3/0
C    11.0.0.0/8 is directly connected, Serial3/0
C    100.0.0.0/8 is directly connected, FastEthernet1/0
R    150.100.0.0/16 [120/1] via 11.0.0.1, 00:00:12, Serial3/0
R    200.150.1.0/24 [120/2] via 11.0.0.1, 00:00:12, Serial3/0

Router#
```

Figure 18 shows the summary of the RIP routing that has been set-up on router 8, each device that is connected through RIP routing is shown with the link shown.

Summary report show the RIP implementation

Figure 18 - Router 10 Addressing Summary

4.3 DHCP Addressing

The routing of the network will now be set up using DHCP, this form of addressing allows one of the routers to be the host. Router 8 will be set up as the host router and router 9 and 10 will be set up using helper address, this will enable cross networking through the use of DHCP. The configuration of the host router (router 8) can be seen within Figure 19,

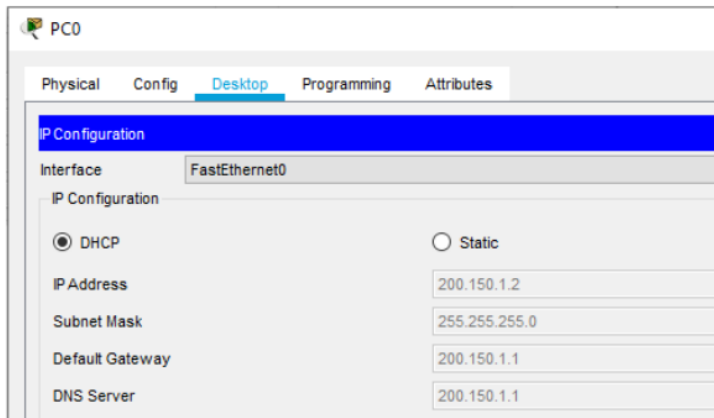
```
Router#conf t
Enter configuration commands, one per line. End with CNTRL/Z.
Router(config)#ip dhcp pool net1
Router(dhcp-config)#net 200.150.1.0 255.255.255.0
Router(dhcp-config)#default-router 200.150.1.1
Router(dhcp-config)#dns-server 200.150.1.1
Router(dhcp-config)#exit
Router(config)#
Router(config)#ip dhcp pool net2
Router(dhcp-config)#net 150.100.0.0 255.255.0.0
Router(dhcp-config)#default-router 150.100.0.1
Router(dhcp-config)#exit
Router(config)#
Router(dhcp-config)#default-router 150.100.0.1
Router(dhcp-config)#dns-server 150.100.0.1
Router(dhcp-config)#exit
Router(config)#
Router(config)#ip dhcp pool net3
Router(dhcp-config)#net 100.0.0.0 255.0.0.0
Router(dhcp-config)#default-router 100.0.0.1
Router(dhcp-config)#dns-server 100.0.0.1
Router(dhcp-config)#exit
Router(config)#
Router(config)#%DHCPD-4-PING_CONFLICT: DHCP address conflict: server pinged 200.150.1.1.
```

Explanation includes the helper address which is significant for DHCP operation

Screenshot shows the configuration of the DHCP

Figure 19 - Set up of Host Router DHCP

After setting the host router up each of the PC's were then changed from static routing to DHCP.



This should state static addressing to DHCP

Figure 20 - PC0 with DHCP

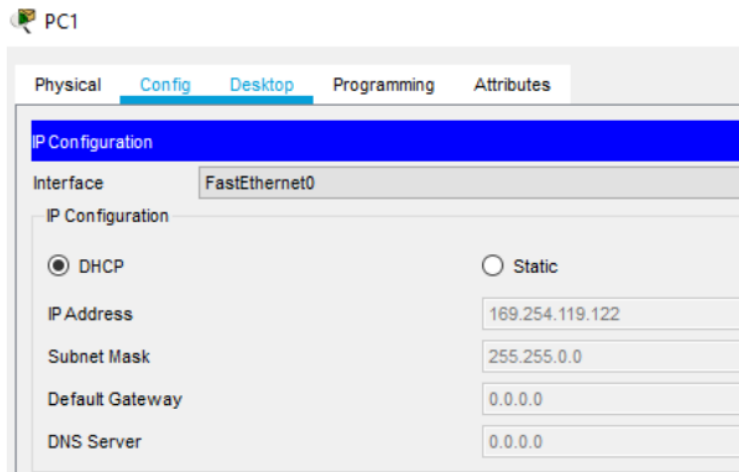


Figure 21 - PC1 with DHCP

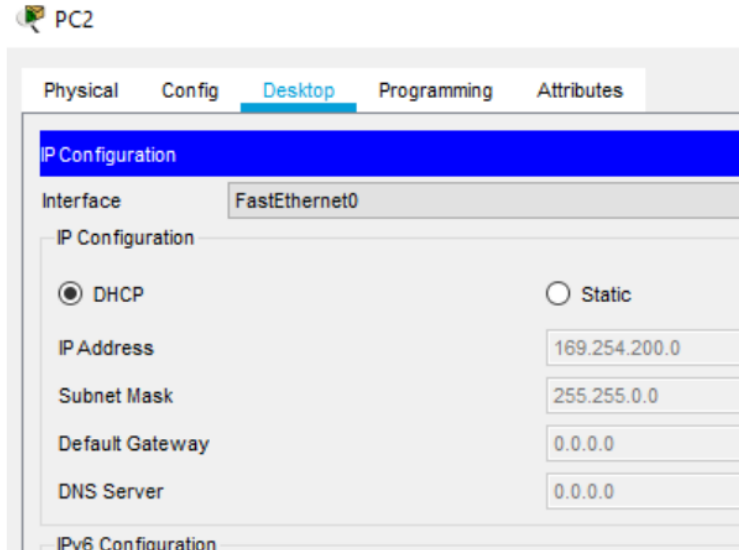


Figure 22 - PC2 with DHCP

Within Figure 20, Figure 21 & Figure 22 the IP addresses have been changed to DHCP it can be seen that the PC on the host LAN has the correct IP address however due to the other PC's not having a helper address the router sets a default address, in order to amend this the helper address is to be set-up. The helper address is the control router serial port address (10.0.0.1).

```

Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#int f0/0
Router(config-if)#ip helper-address 10.0.0.1
Router(config-if)#exit
Router(config)#

```

Figure 23 - Helper address for Router 9

```

Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#f1/0
^
% Invalid input detected at '^' marker.

Router(config)#int f1/0
Router(config-if)#ip helper-address 10.0.0.1
Router(config-if)#exit
Router(config)#

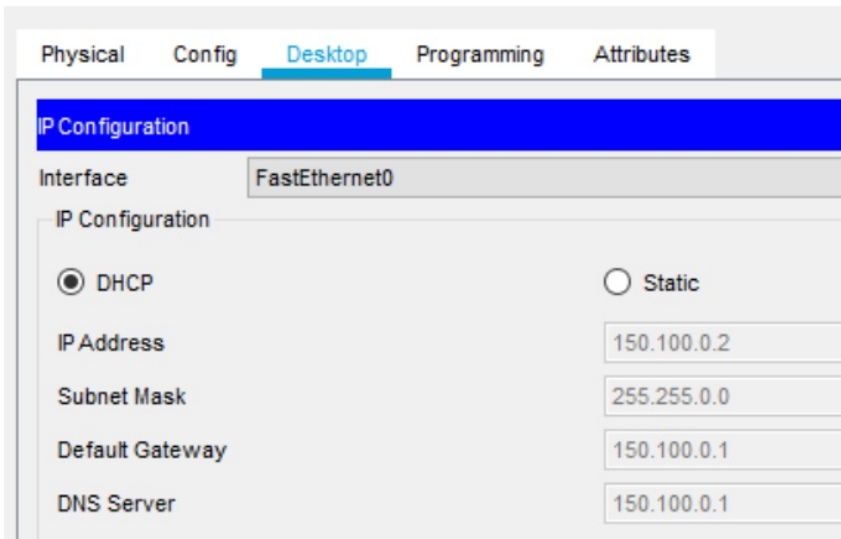
```

Screenshot shows
evidence of helper
address
implementation

Figure 24 - Helper address for router 10

Figure 23 & Figure 24 show the helper address being set-up.

 PC1



IP Configuration	
Interface	FastEthernet0
IP Configuration	
☒ DHCP	☐ Static
IP Address	150.100.0.2
Subnet Mask	255.255.0.0
Default Gateway	150.100.0.1
DNS Server	150.100.0.1

Figure 25 - PC1 with Helper Address

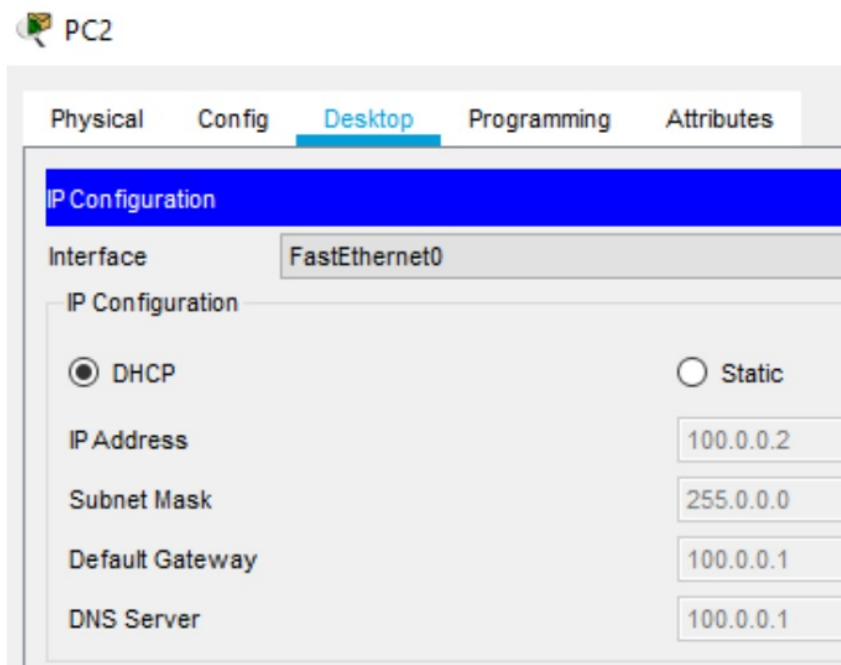


Figure 26 - PC2 with Helper Address

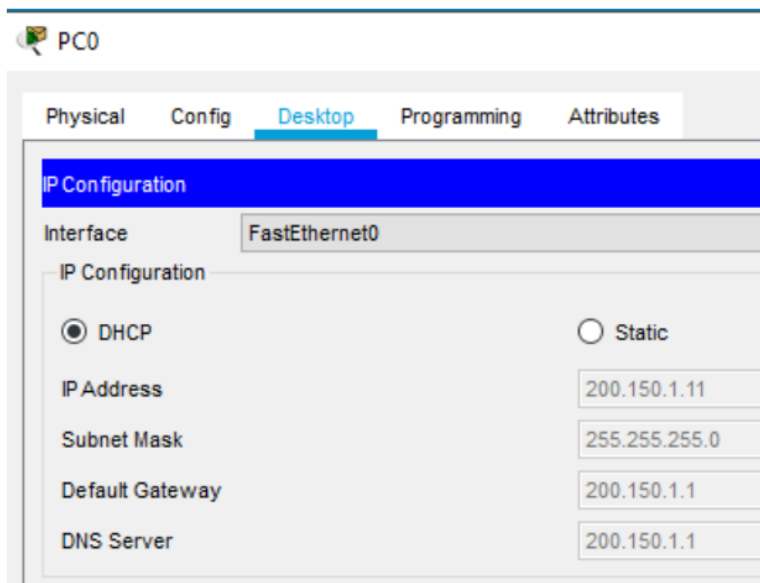
Having provided the helper address the PC1 & PC2 have now been configured dynamically. This can be seen within Figure 25 & Figure 26.

```
Router(config)#ip dhcp excluded-address 150.100.0.1 150.100.0.10
Router(config)#ip dhcp excluded-address 100.0.0.1 100.0.0.10
Router(config)#ip dhcp excluded-address 200.150.1.1 200.150.1.10
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
```

Figure 27 - Excluding current addresses

Figure 27 shows the current addresses being excluded, this should therefore require the host to dynamically produce new IP addresses that are not between 1 and 10 for each LAN.

Screenshot shows the exclusion address range



Screenshot shows the operation of DHCP with exclusion address range implemented. The DHCP assigns the next address after exclusion

Figure 28 - PC0 after Excluding Previous Address

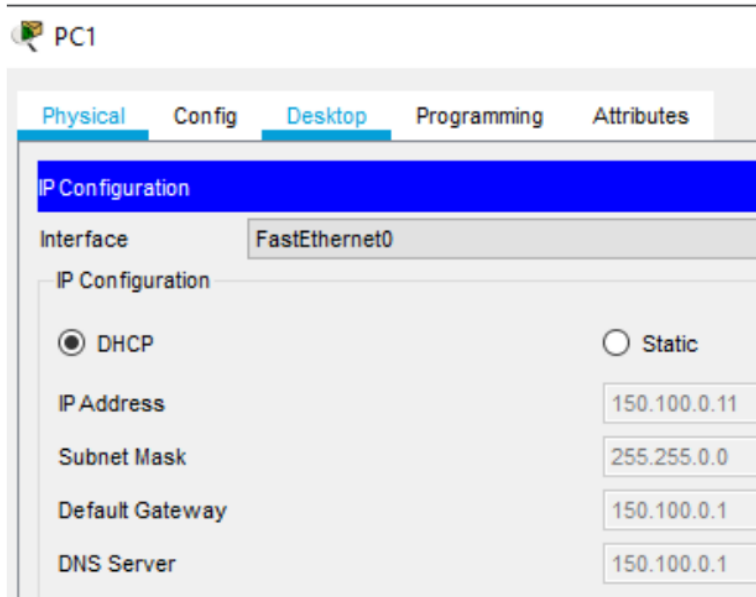


Figure 29 - PC1 after Excluding Previous Address

PC2

Physical Config **Desktop** Programming Attributes

IP Configuration

Interface FastEthernet0

IP Configuration

☒ DHCP ☐ Static

IP Address 100.0.0.11

Subnet Mask 255.0.0.0

Default Gateway 100.0.0.1

DNS Server 100.0.0.1

Good test for DHCP. You should have explained what the outcome would be if no helper addresses are configured

Figure 30 - PC2 after Excluding Previous Address

It can be seen within Figure 28, Figure 29 & Figure 30 that the excluding of addresses has been successful as the new addresses have all been configured to 11 which is not within the excluded addresses of 1 to 10.

5. Test and analysis

5.1 Test on static addressing

In order to confirm that the static addressing for the network worked a test was carried out. This test demonstrates the communication between each LAN through using a ping command to transmit a packet from a device to another, the successful delivery of this packet would confirm communications from that device to another.

The test carried out can be seen within Figure 31, it can be seen that each device has successfully received a packet from each other device.

PDU List Window									
Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	E
	Successful	PC0	Router8	ICMP		0.000	N	0	
	Successful	PC0	PC1	ICMP		0.000	N	1	
	Successful	PC1	PC0	ICMP		0.000	N	2	
	Successful	PC2	PC1	ICMP		0.000	N	3	
	Successful	PC1	PC2	ICMP		0.000	N	4	
	Successful	PC0	PC2	ICMP		0.000	N	5	
	Successful	PC2	PC0	ICMP		0.000	N	6	

Figure 31 - Static Routing Test Results

5.2 Test on dynamic addressing (RIP)

In order to confirm that the RIP routing works correctly a packet tracer will be used. This will use the ping command to send packets one way between devices, by ensuring that each device can successfully send and receive a packet from each other device it can be confirmed that the routing has been configured correctly. It can be seen within Figure 32 that the testing was successful this is known as each device has successfully sent and received a packet from each other device upon the network.

PDU List Window									
Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	E
	Successful	PC0	PC2	ICMP		0.000	N	0	
	Successful	PC2	PC0	ICMP		0.000	N	1	
	Successful	PC0	PC1	ICMP		0.000	N	2	
	Successful	PC1	PC0	ICMP		0.000	N	3	
	Successful	PC1	PC2	ICMP		0.000	N	4	
	Successful	PC2	PC1	ICMP		0.000	N	5	

Figure 32 - Dynamic Routing Test Results

5.3 Test on dynamic addressing (DHCP)

In order to test the DHCP the running configuration for each router will be utilised to illustrate the correct configuration has been undergone.

5.3.1 Router 8

```
ip dhcp excluded-address 200.150.1.10
ip dhcp excluded-address 150.100.0.1 150.100.0.10
ip dhcp excluded-address 100.0.0.1 100.0.0.10
ip dhcp excluded-address 200.150.1.1 200.150.1.10
!
ip dhcp pool net1
 network 200.150.1.0 255.255.255.0
 default-router 200.150.1.1
 dns-server 200.150.1.1
ip dhcp pool net2
 network 150.100.0.0 255.255.0.0
 default-router 150.100.0.1
 dns-server 150.100.0.1
ip dhcp pool net3
 network 100.0.0.0 255.0.0.0
 default-router 100.0.0.1
 dns-server 100.0.0.1

interface FastEthernet0/0
 ip address 200.150.1.1 255.255.255.0
 duplex auto
 speed auto

!
interface FastEthernet1/0
 no ip address
 duplex auto
 speed auto
 shutdown
!
interface Serial2/0
 ip address 10.0.0.1 255.0.0.0
!
interface Serial3/0
 no ip address
 clock rate 2000000
 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 150.100.0.0
 network 200.150.1.0
!
ip classless
!
ip flow-export version 9
```

*Report on router
shows the DHCP
implementation
and the excluded
address range*

Figure 33 - DHCP Routing of Router 8

Figure 33 shows the running configuration for router 8, it can be seen that each network IP is shown with correct mask and router address, the direct link to the device upon this network is also shown under the FastEthernet0/0.

5.3.2 Router 9

```
interface FastEthernet0/0
ip address 150.100.0.1 255.255.0.0
ip helper-address 10.0.0.1
duplex auto
speed auto
!
interface FastEthernet1/0
no ip address
duplex auto
speed auto
shutdown
!
interface Serial2/0
ip address 10.0.0.2 255.0.0.0
clock rate 2000000
!
interface Serial3/0
ip address 11.0.0.1 255.0.0.0
!
interface FastEthernet4/0
no ip address
shutdown
!
interface FastEthernet5/0
no ip address
shutdown
!
router rip
version 2
network 10.0.0.0
network 11.0.0.0
network 100.0.0.0
network 150.100.0.0
!
ip classless
!
ip flow-export version 9
.
```

*Router report
shows all
router config
and the
helper
address*

Figure 34 - DHCP Routing of Router 9

Figure 34 shows the running configuration for router 9, it can be seen that each network IP is shown with correct mask and router address, the direct link to the device upon this network is also shown under the FastEthernet0/0.

5.3.3 Router 10

```
interface FastEthernet0/0
no ip address
duplex auto
speed auto
shutdown
!
interface FastEthernet1/0
ip address 100.0.0.1 255.0.0.0
ip helper-address 10.0.0.1
duplex auto
speed auto
!
interface Serial2/0
no ip address
clock rate 2000000
shutdown
!
interface Serial3/0
ip address 11.0.0.2 255.0.0.0
clock rate 2000000
!

interface FastEthernet4/0
no ip address
shutdown
!
interface FastEthernet5/0
no ip address
shutdown
!
router rip
version 2
network 11.0.0.0
network 100.0.0.0
network 150.100.0.0
!
ip classless
!
ip flow-export version 9
!
```

*Full report for
router 10 has
all the config
settings*

Figure 35 - DHCP Routing of Router 10

Figure 35 shows the running configuration for router 10, it can be seen that each network IP is shown with correct mask and router address, the direct link to the device upon this network is also shown under the FastEthernet1/0.

6. Evaluation

There is some confusion in the explanation here

Through the routing stage of the portfolio 3 different types of routing were utilised, having utilised each of the types it can be concluded that DHCP is the most simple and easiest to set-up. This is evident as it requires the smallest amount of routing compared to RIP and static. Static requires each individual device to be set-up, something that is not needed within a DHCP routed network.

A good point made. It is good practice to design an address pattern especially when the networks expand into larger networks

Whilst setting up the static routing for the network the addresses were all decided upon, it was attempted to keep a clear and concise pattern to these addresses. In hindsight this proved to be very helpful, this is due to the confusion that can occur whilst entering the different addresses into the relevant devices. Therefore, it can be concluded that attempting to keep a methodical list of addresses is a necessity when constructing a new network to avoid possible mistakes being made through confusion.

The research carried out upon this portfolio mainly concentrated upon the sending and receiving of a packet and the basic theories of how this is achieved. From the research conducted it was found that this process has a significant number of steps and becomes extremely complicated at times. Therefore, throughout the remainder of this project more research should be carried out upon this subject to improve the understanding on this subject.

*This is true.
Research must be continued until the last task*

1. Introduction

Within this portfolio a system known as CIDR (Classless Inter-Domain Routing) will be developed and later put into practise. The development of this system will incorporate IP Addresses being set correctly to ensure the network operates.

CIDR/28 will first of all be utilised in order to construct a network containing 3 WAN's each with their own individual LAN's. This same network will then be set up at as a VLSM network making use of CIDR/27 and CIDR/30.

One PC upon the network will then have a VLAN configured upon it, as the most used routing technique understanding VLAN is essential in the growth of networking. Finally, an ACL will be configured an applied upon the network to prevent certain communication.

This should be two VLANs for 2 PCs

2. System Configuration Requirements

2.1 CIDR Explained

CIDR (Classless Inter-Domain Routing) is an Internet Protocol (IP) that is used in order to create unique identifiers for both networks and individual devices. Although at first CIDR can seem complex the standards are actually very easy to understand. In order to understand the addressing scheme an example will be shown.

CIDR will be used in order to route between 3 different networks within this portfolio. The address seen below is an example of a CIDR IP address, from this address the network ID, broadcast ID and usable IP's can be determined;

192.168.50.24 /28

The 28 represents the amount of bits turned on within the subnet.

11111111.11111111.11111111.11110000 this represents the mask. The numerical mask is seen below;

255.255.255.240

From the mask it is known that the only changing numbers are the last 4 bits of the IP. *This is last 4 bits of the last octal value*

In order to find the network ID the 24 will be added to the 4th quadrate of the mask;

00011000 + 11110000 = 00010000 (16)

Therefore, the network ID is 192.168.50.16

The increments can be found by determining the value of the right most 1 within the mask, in this mask the right most 1 is 16.

Therefore, the Broadcast ID is 192.168.50.31

This means that the usable ID's are; 192.168.50.17 to 192.168.50.30

This should be logical AND not plus. If the network address device ip is applied with logical AND with last 8 bits of mask, then the network address is the answer.

This is correct the increments will be in stages of 16 starting at 16. The example for usable addresses for network address 16 is correct

2.2 CIDR/28

The addressing for the LAN networks will now be undergone;

It is known that the mask for CIDR/28 is 255.255.255.240 this therefore means the first three bits can be pre-determined as they will not change. Therefore, it was decided that the first three addresses should be 192.168.50.XXX.

*Good method
planned*

2.2.1 Network 1

Network 1 is located in Estoi, Portugal

Mask	255.255.255.240	1	1	1	1	0	0	0	0
Network ID	192.168.50.16	0	0	0	1	0	0	0	0
Broadcast ID	192.168.50.31	0	0	0	1	1	1	1	1
Gateway	192.168.50.30	0	0	0	1	1	1	1	0
Host 1	192.168.50.20	0	0	0	1	0	1	0	0
Host 2	192.168.50.21	0	0	0	1	0	1	0	1

Table 1 - Network 1

2.2.2 Network 2

Network 2 is located in Cologne, Germany

Mask	255.255.255.240	1	1	1	1	0	0	0	0
Network ID	192.168.50.32	0	0	1	0	0	0	0	0
Broadcast ID	192.168.50.47	0	0	1	0	1	1	1	1
Gateway	192.168.50.46	0	0	1	0	1	1	1	0
Host 1	192.168.50.40	0	0	1	0	1	0	0	0
Host 2	192.168.50.41	0	0	1	0	1	0	0	1

Table 2 - Network 2

2.2.3 Network 3

Network 3 is located in Newport, Wales

Mask	255.255.255.240	1	1	1	1	0	0	0	0
Network ID	192.168.50.48	0	0	1	1	0	0	0	0
Broadcast ID	192.168.50.63	0	0	1	1	1	1	1	1
Gateway	192.168.50.62	0	0	1	1	1	1	1	0
Host 1	192.168.50.50	0	0	1	1	0	0	1	0
Host 2	192.168.50.51	0	0	1	1	0	0	1	1

Table 3 - Network 3

*LAN
addresses
scheme
is
correct*

The addressing for the WAN's will now be undergone;

2.2.4 Network 4

(Estoi to Cologne)

Network ID	192.168.50.64	0	1	0	0	0	0	0	0
Estoi Router	192.168.50.70	0	1	0	0	0	1	1	0
Cologne Router	192.168.50.71	0	1	0	0	0	1	1	1

Table 4 - Network 4

2.2.5 Network 5

(Cologne to Newport)

Network ID	192.168.50.80	0	1	0	1	0	0	0	0
Cologne Router	192.168.50.90	0	1	0	1	1	0	1	0
Newport Router	192.168.50.91	0	1	0	1	1	0	1	1

Table 5 - Network 5

2.2.6 Network 6

(Newport to Estoi)

Network ID	192.168.50.96	0	1	1	0	0	0	0	0
Newport Router	192.168.50.100	0	1	1	0	0	0	1	0
Estoi Router	192.168.50.101	0	1	1	0	0	0	1	1

Table 6 - Network 6

The addressing scheme is good and you have used an order starting at 16. You could have started at any address from 16 and above.

2.3 VLSM (CIDR/27 and CIDR/30)

VLSM stands for Variable-Length Subnet Mask, this process allows for the 'subdividing of subnets' (Little, 2003). This allows for subnets of unequal size to be created and in turn avoids the wasting of IP addresses. This in turn allows for far bigger networks to be built.

The network built in 2.2 will now be routed using VLSM, this will be achieved by using two different sub-nets CIDR/27 and CIDR/30. The addressing scheme built can be seen below;

2.3.1 CIDR/27

Mask;

11111111.11111111.11111111.11100000

255.255.255.224

Good explanation. By this method the broadcast domain minimises redundancies by default

2.3.1.1 Network 1

Network 1 is located in Estoi, Portugal

This mask is

Mask	255.255.255.224	1	1	1	0	0	0	0	0
Network ID	192.168.50.32	0	0	1	0	0	0	0	0
Broadcast ID	192.168.50.63	0	0	1	1	1	1	1	1
Gateway	192.168.50.62	0	0	1	1	1	1	1	0
Host 1	192.168.50.40	0	0	1	0	1	0	0	0
Host 2	192.168.50.50	0	0	1	1	0	0	1	0

Table 7 - Network 1

2.3.1.2 Network 2

Network 2 is located in Cologne, Germany

This mask

Mask	255.255.255.224	1	1	1	1	0	0	0	0
Network ID	192.168.50.64	0	1	0	0	0	0	0	0
Broadcast ID	192.168.50.95	0	1	0	1	1	1	1	1
Gateway	192.168.50.94	0	1	0	1	1	1	1	0
Host 1	192.168.50.70	0	1	0	0	0	1	1	0
Host 2	192.168.50.80	0	1	0	1	0	0	0	0

Table 8 - Network 2

2.3.1.3 Network 3

Network 3 is located in Newport, Wales

This mask must have only three logic 1s

Mask	255.255.255.224	1	1	1	1	0	0	0	0
Network ID	192.168.50.96	0	1	1	0	0	0	0	0
Broadcast ID	192.168.50.127	0	1	1	1	1	1	1	1
Gateway	192.168.50.126	0	1	1	1	1	1	1	0
Host 1	192.168.50.100	0	1	1	0	0	1	0	0
Host 2	192.168.50.110	0	1	1	0	1	1	1	0

Table 9 - Network 3

good use of tables

2.3.2 CIDR/30

Mask;

11111111.11111111.11111111.11111100

255.255.255.252

*The
network
mask is
correct*

2.3.2.1 Network 4

(Estoi to Cologne)

Network ID	192.168.50.4	0	0	0	0	0	1	0	0
Estoi Interface	192.168.50.5	0	0	0	0	0	1	0	1
Cologne Interface	192.168.50.6	0	0	0	0	0	1	1	0

Table 10 - Network 4

2.3.2.2 Network 5

(Cologne to Newport)

Network ID	192.168.50.8	0	0	0	0	1	0	0	0
Cologne Interface	192.168.50.9	0	0	0	0	1	0	0	1
Newport Interface	192.168.50.10	0	0	0	0	1	0	1	0

Table 11 - Network 5

2.3.2.3 Network 6

(Newport to Estoi)

Network ID	192.168.50.12	0	0	0	0	1	1	0	0
Newport Interface	192.168.50.13	0	0	0	0	1	1	0	1
Estoi Interface	192.168.50.14	0	0	0	0	1	1	1	0

Table 12 - Network 6

*The addressing scheme is correct and
good use of tables*

2.4 VLAN Explained

A VLAN is a 'Virtual Local Area Network' (Zhai, 2011) and is used in order to physically separate users or servers into logical groups. An example of this is ensuring that student's computers and teacher's computers haven't got the same access, by utilising two VLAN's messages can be sent to teachers confidentially.

This should be explained in the context of an industrial network VLAN

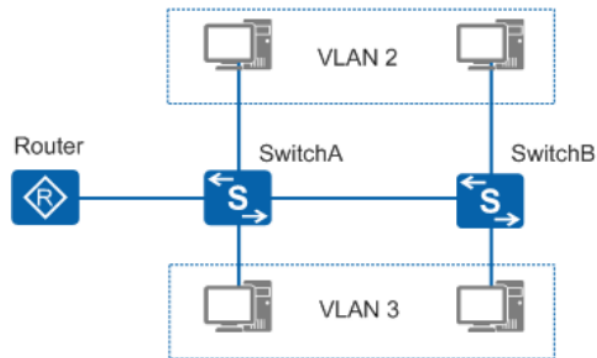


Figure 36 - VLAN

Through the use of a VLAN several LAN's can be incorporated into one and therefore also reduces the overall size of the network due to not requiring as many routers and switches. VLANs also provide a higher security of the network as passwords can be incorporates onto each individual VLAN.

Explanation is correct

2.5 VLAN 1

This VLAN network will contain 3 VLAN's; VLAN 1 (Default), VLAN 50 and VLAN 51. The purpose of the VLAN is to prevent the broadcasting of devices between separate VLANs, for example, devices upon VLAN 50 should not broadcast to those upon VLAN 51. The addresses established can be seen below;

2.5.1 VLAN 50

VLAN Gateway	192.168.50.254	1	1	1	1	1	1	1	0
Host 1	192.168.50.20	0	0	0	1	0	1	0	0
Host 2	192.168.50.40	0	0	1	0	1	0	0	0

Table 13 - VLAN 50

2.5.2 VLAN 51

VLAN Gateway	192.168.51.254	1	1	1	1	1	1	1	0
Host 1	192.168.51.20	0	0	0	1	0	1	0	0
Host 2	192.168.51.40	0	0	1	0	1	0	0	0

Table 14 - VLAN 51

The network set-up can be seen within Figure 37.

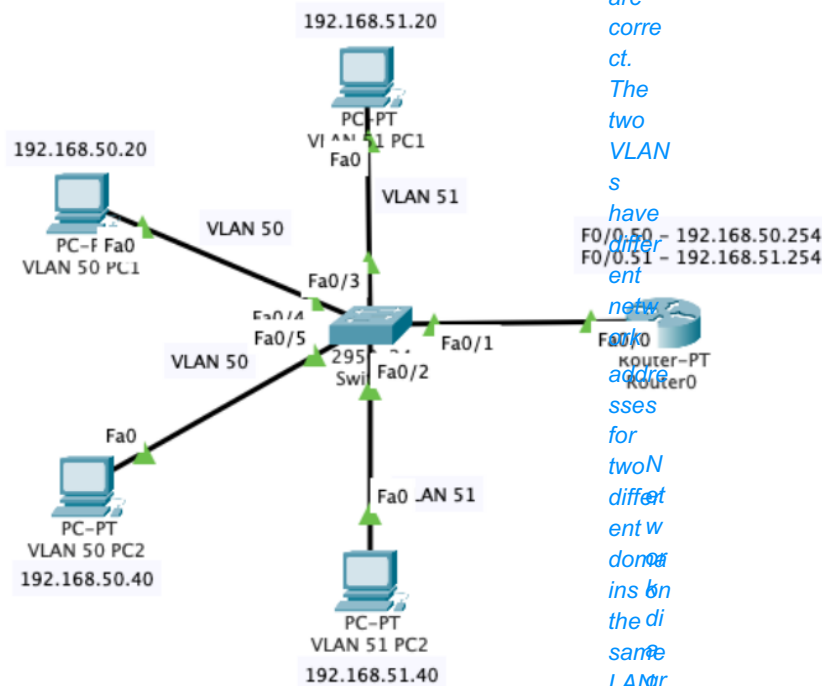


Figure 37 - VLAN Network

VLAN addresses are correct. The two VLANs have different network addresses for two different domains on the same LAN or a m is detailed and sh

2.6 VLAN 2

Another VLAN will now be set-up, this time the VLAN will be on the Newport router of the network produced from VLSM (CIDR/27 and CIDR/30). As the VLAN is its own network a new network ID would be needed;

Mask	255.255.255.224	1	1	1	1	0	0	0	0
Network ID	192.168.50.128	0	1	1	0	0	0	0	0
Broadcast ID	192.168.50.159	0	1	1	1	1	1	1	1
Gateway	192.168.50.158	0	1	1	1	1	1	1	0
Host 1	192.168.50.129	0	1	1	0	0	1	0	0

Table 15 - VLAN Addresses

2.7 ACL

ACL or access-control list is a list that contains a set rules that will either grant or deny access to different parts of a network. Therefore, a network can be configured using multiple ACL's that will allow certain PC's to communicate and block other PC's. There are two forms of ACL standard and extended. A standard ACL is applied closest to the destination whereas an extended ACL is applied closest to the source. A simple way of distinguishing these is the number of the access list between 1 and 99 will be standard and 100 and above is extended.

The Cologne router will now have a standard ACL set-up on it, more specifically a block from sending data to PC2 on the Newport WAN.

*Good
explanation*

3. Implementation

3.1 CIDR/28

The network that has been built through the use of the addressing determined within 2.2 can be seen within Figure 38.

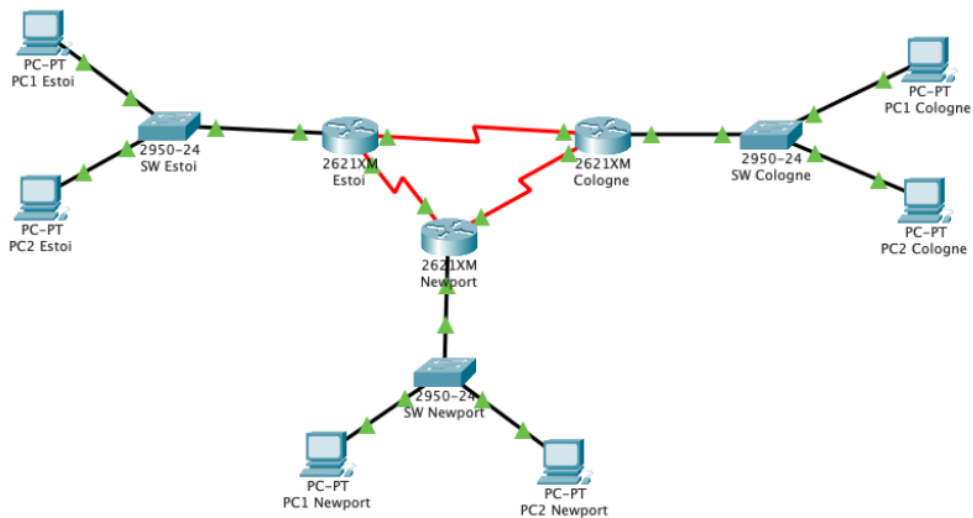


Figure 38 - CIDR/28 Network

This network has been set up through the use of RIP routing, in order to become more familiar with the CLI commands this has been used in order to set up each device throughout this report. Therefore screen captures of the commands being written will be shown throughout the report.

The PC's however were still set up manually, this is simple as the PC's only require the gateway for their LAN and their actual individual IP address.

The commands used to set up the routers can be seen below;

```
Estoi>en
Estoi#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Estoi(config)#router rip
Estoi(config-router)#ver 2
Estoi(config-router)#net 192.168.50.16
Estoi(config-router)#net 192.168.50.64
Estoi(config-router)#net 192.168.50.96
Estoi(config-router)#exit
Estoi(config)#^z
^
```

Figure 39 - Estoi Router Set-up

```

Cologne>en
Cologne#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Cologne(config)#router rip
Cologne(config-router)#ver 2
Cologne(config-router)#net 192.168.50.32
Cologne(config-router)#net 192.168.50.64
Cologne(config-router)#net 192.168.50.80
Cologne(config-router)#exit
Cologne(config)#
Cologne(config)#end
Cologne#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
Cologne#
%SYS-5-CONFIG_I: Configured from console by console

```

Figure 40 - Cologne Router Set-up

```

Newport(config)#router rip
Newport(config-router)#ver 2
Newport(config-router)#net 192.168.50.48
Newport(config-router)#net 192.168.50.80
Newport(config-router)#net 192.168.50.96
Newport(config-router)#exit
Newport(config)#
Newport(config)#end
Newport#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
Newport#
%SYS-5-CONFIG_I: Configured from console by console

```

RIP configuration for CIDR /28 is correct

Figure 41 - Newport Router Set-up

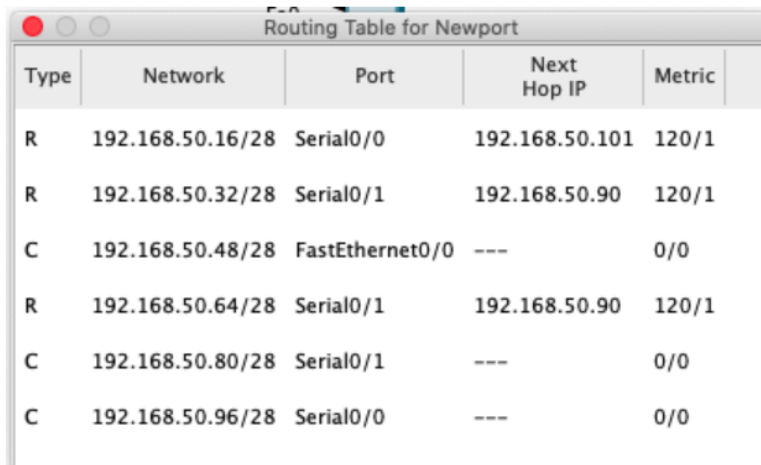
Having successfully set up each router as shown within Figure 39, Figure 40 & Figure 41. The routing tables could now be assessed to determine whether the network had been configured correctly. Within Figure 42, Figure 43 & Figure 44 it could be concluded that the network had been successfully routed, this is known as the relevant network addresses that the router needs to reach have all got a next Hop IP, this shows that a route has been given for communication.

Routing Table for Estoi				
Type	Network	Port	Next Hop IP	Metric
C	192.168.50.16/28	FastEthernet0/0	---	0/0
R	192.168.50.32/28	Serial0/0	192.168.50.71	120/1
R	192.168.50.48/28	Serial0/1	192.168.50.100	120/1
C	192.168.50.64/28	Serial0/0	---	0/0
R	192.168.50.80/28	Serial0/0	192.168.50.71	120/1
R	192.168.50.80/28	Serial0/1	192.168.50.100	120/1
C	192.168.50.96/28	Serial0/1	---	0/0

Figure 42 - Estoi Routing Table

Routing Table for Cologne				
Type	Network	Port	Next Hop IP	Metric
R	192.168.50.16/28	Serial0/0	192.168.50.70	120/1
C	192.168.50.32/28	FastEthernet0/0	---	0/0
R	192.168.50.48/28	Serial0/1	192.168.50.91	120/1
C	192.168.50.64/28	Serial0/0	---	0/0
C	192.168.50.80/28	Serial0/1	---	0/0
R	192.168.50.96/28	Serial0/0	192.168.50.70	120/1
R	192.168.50.96/28	Serial0/1	192.168.50.91	120/1

Figure 43 - Cologne Routing Table



Type	Network	Port	Next Hop IP	Metric
R	192.168.50.16/28	Serial0/0	192.168.50.101	120/1
R	192.168.50.32/28	Serial0/1	192.168.50.90	120/1
C	192.168.50.48/28	FastEthernet0/0	---	0/0
R	192.168.50.64/28	Serial0/1	192.168.50.90	120/1
C	192.168.50.80/28	Serial0/1	---	0/0
C	192.168.50.96/28	Serial0/0	---	0/0

Figure 44 - Newport Routing Table

RIP tables are good

3.2 VLSM (CIDR/27 and CIDR/30)

As with CIDR/28 RIP routing is to be used. The network configuration can be seen within Figure 45

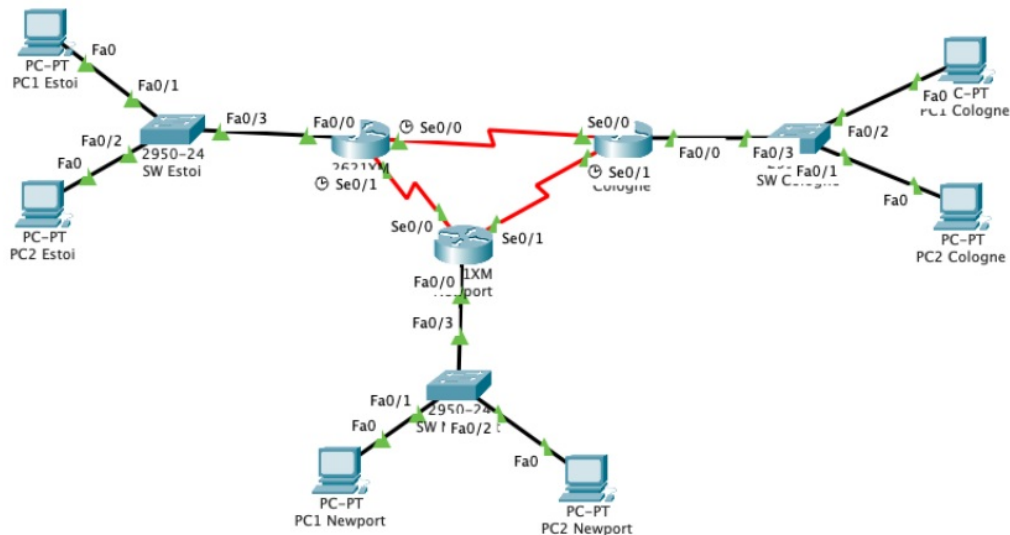


Figure 45 - VLSM

The configuration of the routers are the same as with CIDR/28 however the different addressing scheme developed must be adhered to.

```
Estoi>enable
Estoi#
Estoi#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Estoi(config)#router rip
Estoi(config-router)#ver 2
Estoi(config-router)#net 192.168.60.62
Estoi(config-router)#net 192.168.50.4
Estoi(config-router)#net 192.168.50.12
Estoi(config-router)#exit
Estoi(config)#end
Estoi#
%SYS-5-CONFIG_I: Configured from console by console

Estoi#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
Estoi#
```

Figure 46 - VLSM Estoi Router Configuration

```

Cologne(config)#router rip
Cologne(config-router)#ver 2
Cologne(config-router)#net 192.168.50.94
Cologne(config-router)#net 192.168.50.6
Cologne(config-router)#net 192.168.50.9
Cologne(config-router)#exit
Cologne(config)#end
Cologne#
%SYS-5-CONFIG_I: Configured from console by console

Cologne#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
Cologne#

```

Figure 47 - VLSM Cologne Router Configuration

```

Newport(config)#router rip
Newport(config-router)#ver 2
Newport(config-router)#net 192.168.50.126
Newport(config-router)#net 192.168.50.8
Newport(config-router)#net 192.168.50.12
Newport(config-router)#exit
Newport(config)#end
Newport#
%SYS-5-CONFIG_I: Configured from console by console

Newport#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
Newport#

```

Configuration is correct

Figure 48 - VLSM Newport Router Configuration

The configurations of all the Routers upon the network can be seen within Figure 46, Figure 47 & Figure 48. In order to confirm these configurations are correct and functioning the routing tables will be analysed.

Routing Table for Estoi				
Type	Network	Port	Next Hop IP	Metric
C	192.168.50.4/30	Serial0/0	---	0/0
R	192.168.50.8/30	Serial0/0	192.168.50.6	120/1
R	192.168.50.8/30	Serial0/1	192.168.50.13	120/1
C	192.168.50.12/30	Serial0/1	---	0/0
C	192.168.50.32/27	FastEthernet0/0	---	0/0
R	192.168.50.64/27	Serial0/0	192.168.50.6	120/1
R	192.168.50.96/27	Serial0/1	192.168.50.13	120/1

Figure 49 - Routing Table Estoi

Routing Table for Cologne				
Type	Network	Port	Next Hop IP	Metric
C	192.168.50.4/30	Serial0/0	---	0/0
C	192.168.50.8/30	Serial0/1	---	0/0
R	192.168.50.12/30	Serial0/0	192.168.50.5	120/1
R	192.168.50.12/30	Serial0/1	192.168.50.10	120/1
R	192.168.50.32/27	Serial0/0	192.168.50.5	120/1
C	192.168.50.64/27	FastEthernet0/0	---	0/0
R	192.168.50.96/27	Serial0/1	192.168.50.10	120/1

Figure 50 - Routing Table Cologne

Routing Table for Newport				
Type	Network	Port	Next Hop IP	Metric
R	192.168.50.4/30	Serial0/1	192.168.50.9	120/1
R	192.168.50.4/30	Serial0/0	192.168.50.14	120/1
C	192.168.50.8/30	Serial0/1	---	0/0
C	192.168.50.12/30	Serial0/0	---	0/0
R	192.168.50.32/27	Serial0/0	192.168.50.14	120/1
R	192.168.50.64/27	Serial0/1	192.168.50.9	120/1
C	192.168.50.96/27	FastEthernet0/0	---	0/0

The network routers auto detect the VLSM changes through RIP ver 2

Figure 51 - Routing Table Newport

It can be seen from the routing tables that the routers have been successfully set-up and have communication between each other.

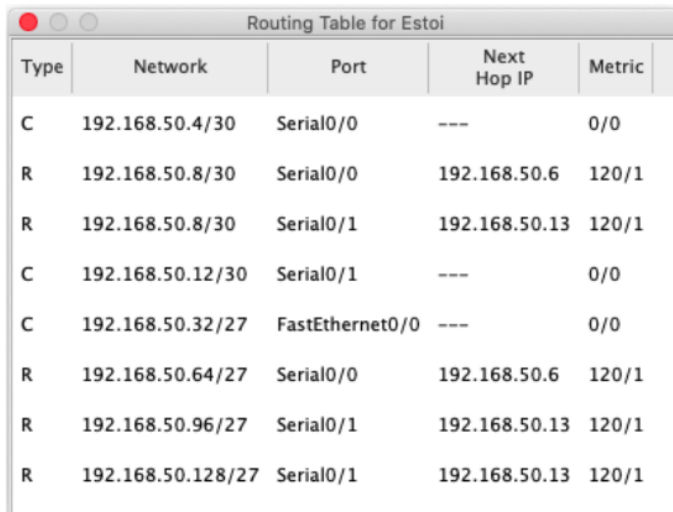
3.3 VLAN 1

Having determined the network configuration and addresses the router and switch were to now be configured. Configuration of a VLAN is more complex than that of RIP routing, this is evident within Appendix 1.

3.4 VLAN 2

The configuration of the VLAN upon the Newport network can be seen within Appendix 2.

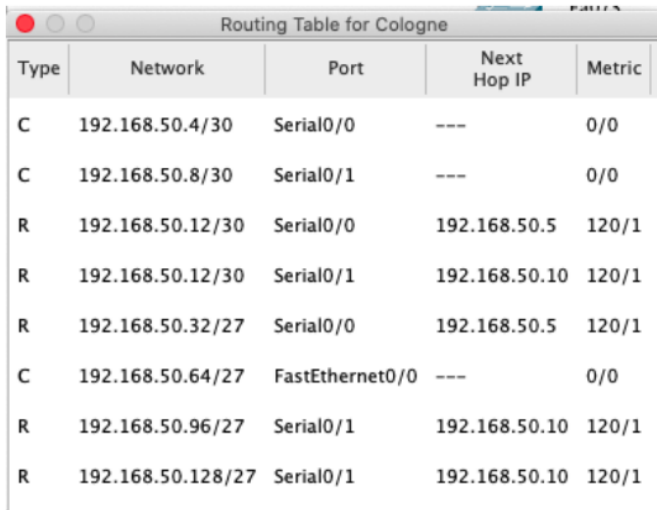
The RIP routing tables after carrying out the configuration of the switch and router can be seen within Figure 52, Figure 53 & Figure 54. It can be seen the VLAN has been incorporated appropriately.



A screenshot of a network router's routing table for the 'Estoi' interface. The table has five columns: Type, Network, Port, Next Hop IP, and Metric. It lists several routes, including a default route (0.0.0.0) and specific network routes with their respective metrics and next-hop IP addresses.

Type	Network	Port	Next Hop IP	Metric
C	192.168.50.4/30	Serial0/0	---	0/0
R	192.168.50.8/30	Serial0/0	192.168.50.6	120/1
R	192.168.50.8/30	Serial0/1	192.168.50.13	120/1
C	192.168.50.12/30	Serial0/1	---	0/0
C	192.168.50.32/27	FastEthernet0/0	---	0/0
R	192.168.50.64/27	Serial0/0	192.168.50.6	120/1
R	192.168.50.96/27	Serial0/1	192.168.50.13	120/1
R	192.168.50.128/27	Serial0/1	192.168.50.13	120/1

Figure 52 - Estoi RIP Table



A screenshot of a network router's routing table for the 'Cologne' interface. The table has five columns: Type, Network, Port, Next Hop IP, and Metric. It lists several routes, including a default route (0.0.0.0) and specific network routes with their respective metrics and next-hop IP addresses.

Type	Network	Port	Next Hop IP	Metric
C	192.168.50.4/30	Serial0/0	---	0/0
C	192.168.50.8/30	Serial0/1	---	0/0
R	192.168.50.12/30	Serial0/0	192.168.50.5	120/1
R	192.168.50.12/30	Serial0/1	192.168.50.10	120/1
R	192.168.50.32/27	Serial0/0	192.168.50.5	120/1
C	192.168.50.64/27	FastEthernet0/0	---	0/0
R	192.168.50.96/27	Serial0/1	192.168.50.10	120/1
R	192.168.50.128/27	Serial0/1	192.168.50.10	120/1

Figure 53 - Cologne RIP Table

RIP version 2 tables show the VLAN networks

Type	Network	Port	Next Hop IP	Metric
R	192.168.50.4/30	Serial0/0	192.168.50.14	120/1
R	192.168.50.4/30	Serial0/1	192.168.50.9	120/1
C	192.168.50.8/30	Serial0/1	---	0/0
C	192.168.50.12/30	Serial0/0	---	0/0
R	192.168.50.32/27	Serial0/0	192.168.50.14	120/1
R	192.168.50.64/27	Serial0/1	192.168.50.9	120/1
C	192.168.50.96/27	FastEthernet0/0.2	---	0/0
C	192.168.50.128/27	FastEthernet0/0.3	---	0/0

Figure 54 - Newport RIP Table

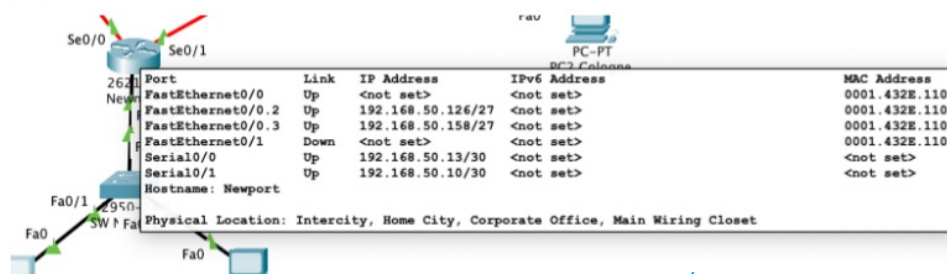


Figure 55 - Router Ports

Figure 55 shows the port allocation of the router it can be seen that the VLAN has been split from the other PC's network correctly (FastEthernet 0/0 split).

Image shows the configuration of the router ports.

3.5 ACL

The configuration of the ACL can be seen below, it can be seen within Figure 56 that an access list is configured, the list deny's the IP address of PC2 Newport and permits any other IP addresses to communicate.

```
Cologne#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Cologne(config)#hostname cologne
Cologne(config)#access-list 1 ?
    deny      Specify packets to reject
    permit    Specify packets to forward
    remark    Access list entry comment
Cologne(config)#access-list 1 deny 192.168.50.129 0.0.0.0
Cologne(config)#access-list 1 permit any
Cologne(config)#
Cologne#
%SYS-5-CONFIG_I: Configured from console by console
```

Figure 56 - Access list Set-up

Within Appendix 3 a show run command is done upon the router it can be seen that the access list has been configured and allows no contact with IP address 192.168.50.129. This access list must now be applied this is done within Figure 57.

```
Cologne#
Cologne#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Cologne(config)#int f0/0
Cologne(config-if)#ip access-group 1 ?
    in    inbound packets
    out   outbound packets
Cologne(config-if)#ip access-group 1 out
Cologne(config-if)#
Cologne#
%SYS-5-CONFIG_I: Configured from console by console
```

ACL configuration is correct

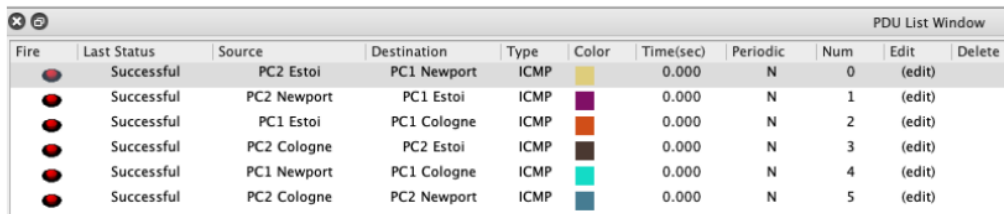
Figure 57 - Setting the Access-list to Outbound

4. Testing and Analysis

4.1 CIDR/28

In order to test the network set-up through the use of CIDR/28 the communication of PC's between the LAN's will be tested. This will confirm that the WAN's are routed and will also in turn ensure the LAN's function. Using the packet tool, data will be sent from the PC's to one another and the communication will either come back successful or failed.

Figure 58 shows the test results, each PC has successfully communicated across the LAN's.

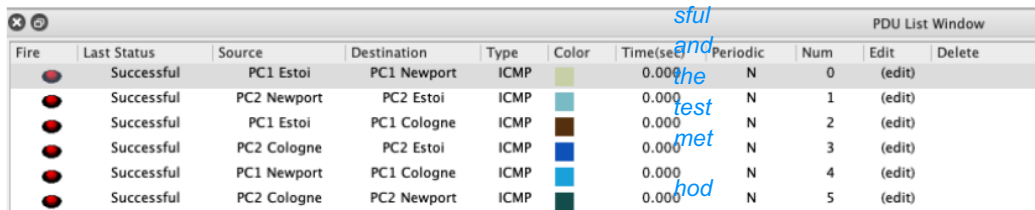


Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	PC2 Estoi	PC1 Newport	ICMP		0.000	N	0	(edit)	
	Successful	PC2 Newport	PC1 Estoi	ICMP		0.000	N	1	(edit)	
	Successful	PC1 Estoi	PC1 Cologne	ICMP		0.000	N	2	(edit)	
	Successful	PC2 Cologne	PC2 Estoi	ICMP		0.000	N	3	(edit)	
	Successful	PC1 Newport	PC1 Cologne	ICMP		0.000	N	4	(edit)	
	Successful	PC2 Cologne	PC2 Newport	ICMP		0.000	N	5	(edit)	

Figure 58 - Testing CIDR/28 Network

4.2 VLSM (CIDR/27 and CIDR/30)

The final test of the network would be to ensure that data being transmitted across the network is successfully sent and received between PC's upon different LAN's. Within Figure 59 it can be seen that when a packet of data was sent between PC's upon different LAN's they have been successful. Therefore, this confirms that the network functions as expected.



Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	PC1 Estoi	PC1 Newport	ICMP		0.000	N	0	(edit)	
	Successful	PC2 Newport	PC2 Estoi	ICMP		0.000	N	1	(edit)	
	Successful	PC1 Estoi	PC1 Cologne	ICMP		0.000	N	2	(edit)	
	Successful	PC2 Cologne	PC2 Estoi	ICMP		0.000	N	3	(edit)	
	Successful	PC1 Newport	PC1 Cologne	ICMP		0.000	N	4	(edit)	
	Successful	PC2 Cologne	PC2 Newport	ICMP		0.000	N	5	(edit)	

Figure 59 - Testing VLSM Network

4.3 VLAN 1

Having successfully set-up the VLAN confirmation that the VLAN functioned correctly was required, in order to achieve this tests were to be carried out,

After initial testing it was found that each PC communicated to the Router except for VLAN 50 PC2 (192.168.50.40). The problem was found to be the incorrect port being utilised (F0/5) therefore, the port required was configured as seen within Figure 60;

```
Switch#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#int f0/5
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 50
Switch(config-if)#exit
Switch(config)#end
Switch#
%SYS-5-CONFIG_I: Configured from console by console

Switch#
Switch#show vlan

VLAN Name                Status    Ports
-----
1    default                active    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
50   vlan50                  active    Fa0/4, Fa0/5
51   vlan51                  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  BrgdMode Trans1 Trans2
-----
1    enet  100001   1500  -      -      -      -    -        0      0
50   enet  100050   1500  -      -      -      -    -        0      0
51   enet  100051   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  BrgdMode Trans1 Trans2
-----
Remote SPAN VLANs
-----

Primary Secondary Type      Ports
-----
Switch#
```

Screenshot shows the two VLANs activated with active interfaces

Figure 60 - Configuring Port F0/5

Having configured the correct port the test was done again, it was found that this test was successful and suggested the problem had been located and amended (Figure 61).

PDU List Window										
Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	VLAN 50 PC2	Router0	ICMP		0.000	N	0	(edit)	
	Successful	VLAN 50 PC1	Router0	ICMP		0.000	N	1	(edit)	
	Successful	VLAN 51 PC1	Router0	ICMP		0.000	N	2	(edit)	
	Successful	VLAN 51 PC2	Router0	ICMP		0.000	N	3	(edit)	
	Successful	Router0	VLAN 51 PC1	ICMP		0.000	N	4	(edit)	
	Successful	Router0	VLAN 50 PC1	ICMP		0.000	N	5	(edit)	
	Successful	Router0	VLAN 50 PC2	ICMP		0.000	N	6	(edit)	
	Successful	Router0	VLAN 51 PC2	ICMP		0.000	N	7	(edit)	

Figure 61 - VLAN Test 1

4.4 VLAN 2

Having configured the VLAN successfully testing was to be carried out to confirm the operation of the VLAN. First of all testing would be carried out between the Newport PC's, following this the VLAN would be tested across all networks. The tests carried out can be seen to be successful within Figure 62, Figure 63 & Figure 64;

The test within Figure 64 was carried out in order to ensure the original network hadn't been affected and was still functioning.

PDU List Window										
Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	PC1 Newport	PC2 Newport	ICMP		0.000	N	0	(edit)	
	Successful	PC2 Newport	PC1 Newport	ICMP		0.000	N	1	(edit)	

Figure 62 - Test between Newport PC's

PDU List Window										
Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	PC2 Newport	PC2 Cologne	ICMP		0.000	N	0	(edit)	
	Successful	PC2 Newport	PC1 Cologne	ICMP		0.000	N	1	(edit)	
	Successful	PC2 Newport	PC1 Estoi	ICMP		0.000	N	2	(edit)	
	Successful	PC2 Newport	PC2 Estoi	ICMP		0.000	N	3	(edit)	
	Successful	PC2 Estoi	PC2 Newport	ICMP		0.000	N	4	(edit)	
	Successful	PC1 Estoi	PC2 Newport	ICMP		0.000	N	5	(edit)	
	Successful	PC1 Cologne	PC2 Newport	ICMP		0.000	N	6	(edit)	
	Successful	PC2 Cologne	PC2 Newport	ICMP		0.000	N	7	(edit)	

Figure 63 - Test VLAN to All PC's

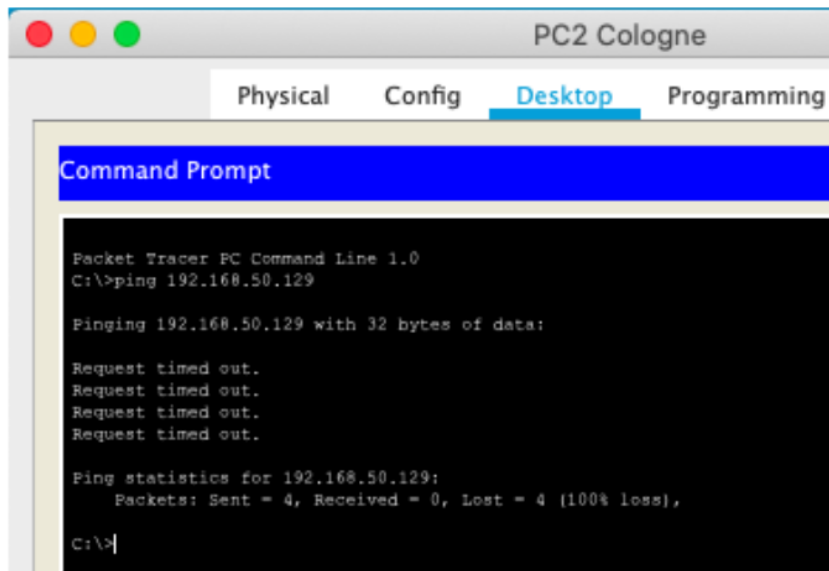
PDU List Window										
Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	PC1 Newport	PC2 Cologne	ICMP		0.000	N	0	(edit)	
	Successful	PC1 Newport	PC1 Cologne	ICMP		0.000	N	1	(edit)	
	Successful	PC2 Cologne	PC1 Newport	ICMP		0.000	N	2	(edit)	
	Successful	PC1 Cologne	PC1 Newport	ICMP		0.000	N	3	(edit)	
	Successful	PC1 Newport	PC1 Estoi	ICMP		0.000	N	4	(edit)	
	Successful	PC1 Newport	PC2 Estoi	ICMP		0.000	N	5	(edit)	
	Successful	PC2 Estoi	PC1 Newport	ICMP		0.000	N	6	(edit)	
	Successful	PC1 Estoi	PC1 Newport	ICMP		0.000	N	7	(edit)	

Figure 64 - Test PC 1

Tests are
successful

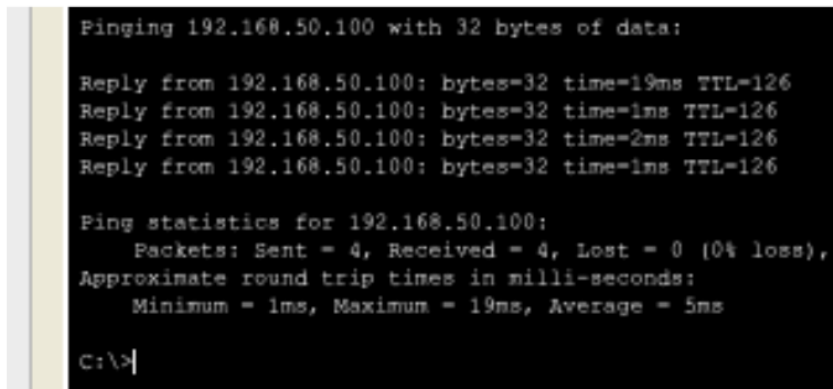
4.5 ACL

Having set-up the ACL testing would now be carried out to ensure communication is blocked to the stated IP address. Testing will be carried out using the command prompt upon the Cologne PC's. The tests carried out can be seen within the figures below, it can be concluded that both Cologne PC's have been blocked from transmitting data to PC2 Newport (192.168.50.129) but have not been blocked from any other IP addresses.



Screenshot shows the denial of service for address .129

Figure 65 - Cologne PC2 failed to communicate with blocked IP (PC2 Newport)



This shows the access for address .100

Figure 66 - Cologne PC2 communicating with PC1 Newport

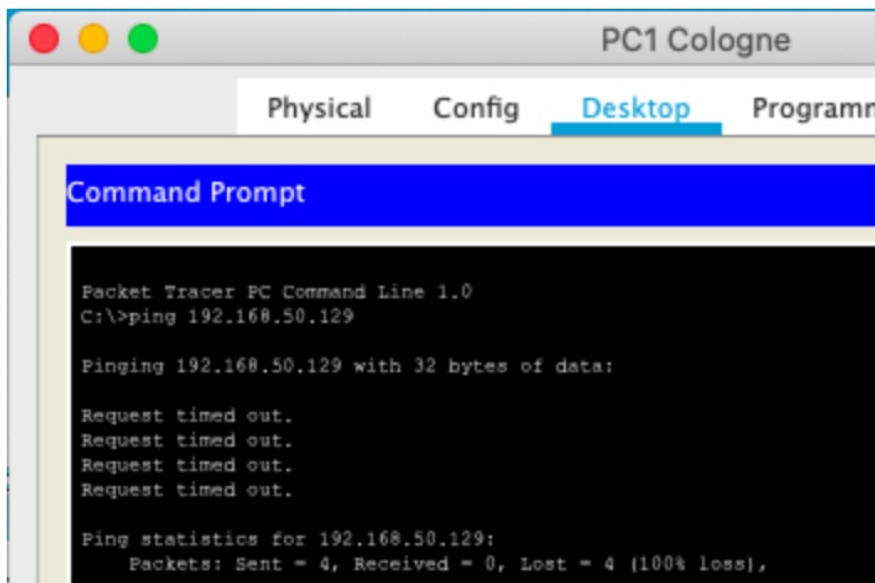


Figure 67 - PC1 Cologne to blocked IP (PC2 Newport)

Test shows denial for address .129 and access for .50

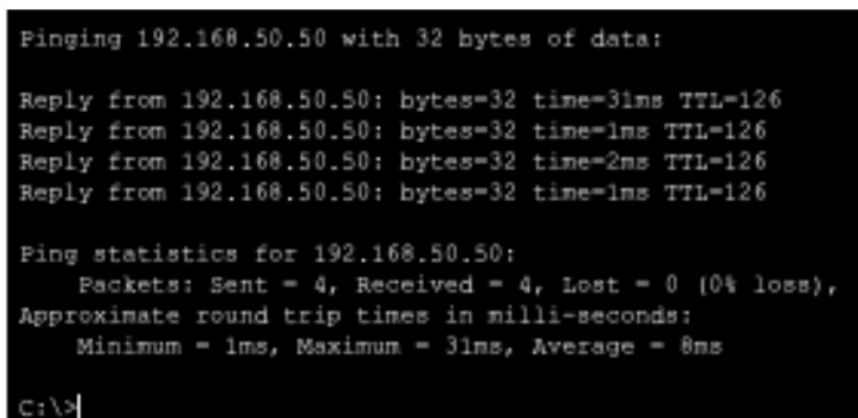


Figure 68 - PC1 Cologne to PC2 Estoi

5. Evaluation

Through the routing of the various different network several different techniques were utilised, some of these being CIDR, VLSM and VLAN. CIDR makes use of different masks in order to make it easier to quickly understand which network a certain IP address is upon, this is due to the increments within the mask that allow you to determine which Network ID a certain IP is upon. In evaluation of CIDR it is believed that if this technique is used appropriately then wasted IP's (as seen within CIDR/28) can be limited. *This should be eliminated*

An example of better implementation of CIDR is the VLSM of the same network, by using two different masks upon the same network, the amount of IP's wasted can be reduced. This is seen as the router IP's have no wasted IP's within the increments selected of 4. The wasted IP's are still present upon the WAN networks however, in evaluation this would not be true in real world network that would contain many more hosts.

VLAN's have been investigated and implemented within this report. The VALN is a very important technique as it is the most frequently used within real world networking. It was concluded after configuring two VLAN's that although they seem complex, they are actually very simple and are very beneficial for the efficiency of a network through network traffic control.

Finally, through the implementation of an ACL within this report an understanding into the working principle of the ACL has been gained. Further investigation into both standard and extended ACLs should be carried out to better this understanding. In evaluation the ACL implemented has shown the capabilities of doing so and clearly underlines the importance of protecting certain data from certain hosts upon a network.

*This is
a good
point.
VLSM
is an
improve
ment

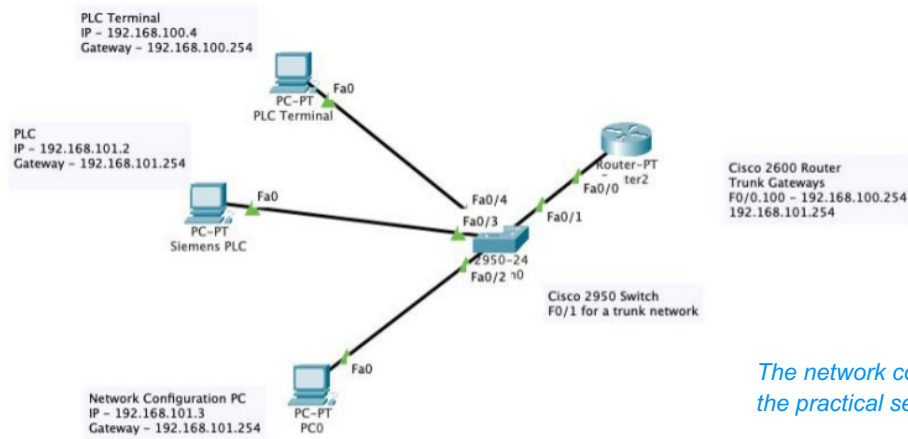
You have
identified here
that the VLSM
and VLANs are
methods of
network
improvement.
This for both
performance
and security
which are the
demands for
industry 4.0*

1. Introduction

Within this element a web server will be set up, this web server will be configured through the use of a network. The network will be set up with two VLANs the PLC and PLC terminal will be put on different VLANs.

*Intro should also
include the network
terminal PC*

2. Network Configuration



The network configuration shows the practical setup

Figure 69 - Network Set-up

The configured network can be seen within Figure 69, the configuration code can be seen within Appendix 4. The testing of the network can be seen below;

```
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
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	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

VLAN	Type	SAID	MTU	Parent	RingNo	BridgeNo	Stp	BrdgMode	Trans1	Trans2
Remote SPAN VLANs										

Primary	Secondary	Type	Ports							

Screen shot shows VLANs are active

Figure 70 - Active Ports

```

show vlan brief

```

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, 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	Fa0/4
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 fddnet	101004	1500	-	-	-	ieee	-	0	0
1005 trnet	101005	1500	-	-	-	ibm	-	0	0

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 fddnet	101004	1500	-	-	-	ieee	-	0	0
1005 trnet	101005	1500	-	-	-	ibm	-	0	0


```

show remote span

```

Primary	Secondary	Type	Ports
Switch#			
Switch#			
Switch#			

Image shows the active VLANs with active interfaces assigned

Figure 71 - Ports Set-up

```

Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#show ip interface brief

```

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#
Router#
Router#
Router#

```

The two sub interfaces are shown which are now the two gateways for the VLANs

Figure 72 - Fast ethernet split into two

```

!
!
!
!
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
!

```

Figure 73 - Vlans set-up

The screenshot shows a 'PLC Terminal' application window with four tabs: 'Physical', 'Config', 'Desktop' (selected), and 'Programm'. Inside the 'Desktop' tab is a 'Command Prompt' window. The Command Prompt displays the following text:

```
C:\>ping 192.168.101.2

Pinging 192.168.101.2 with 32 bytes of data:

Reply from 192.168.101.2: bytes=32 time<1ms TTL=127
Reply from 192.168.101.2: bytes=32 time<1ms TTL=127
Reply from 192.168.101.2: bytes=32 time<1ms TTL=127
Reply from 192.168.101.2: bytes=32 time<1ms TTL=127

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 = 1ms, Average = 0ms

C:\>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=2ms 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 = 2ms, Average = 0ms
```

Test shows the connection to the PLC ip 101.2 and the PC network terminal 101.3. Tested from the PLC terminal address ip 100.4

Figure 74 - Pinging between Vlan

Within the figure above the network is proven to work, this is achieved by pinging from the PLC terminal which is on Vlan 100 to the PLC and Network Configuration Terminal which are on Vlan 101.

3. Server Configuration

The web server is to now be configured. First of all the server must be activated (Figure 75) and the file extensions for the server set. HTML, HTML (Hypertext markup language) and js are used within this configuration.

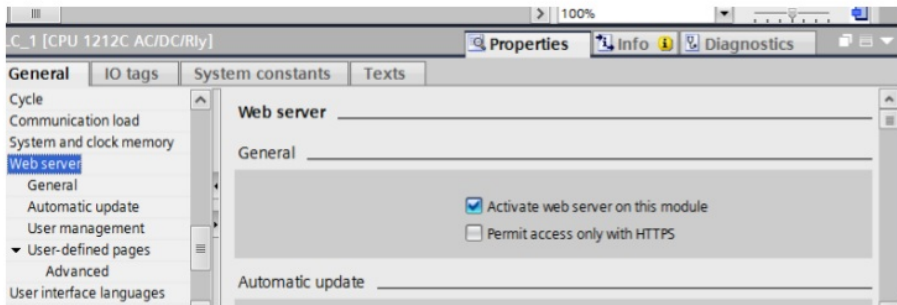


Figure 75 - Web server activation

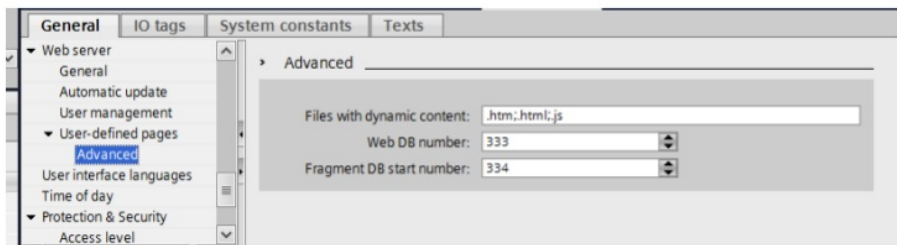


Figure 76 - Setting file types

PLC web server activated and file extensions added. Start address for web server is initialised

The inputs and outputs were now set-up.

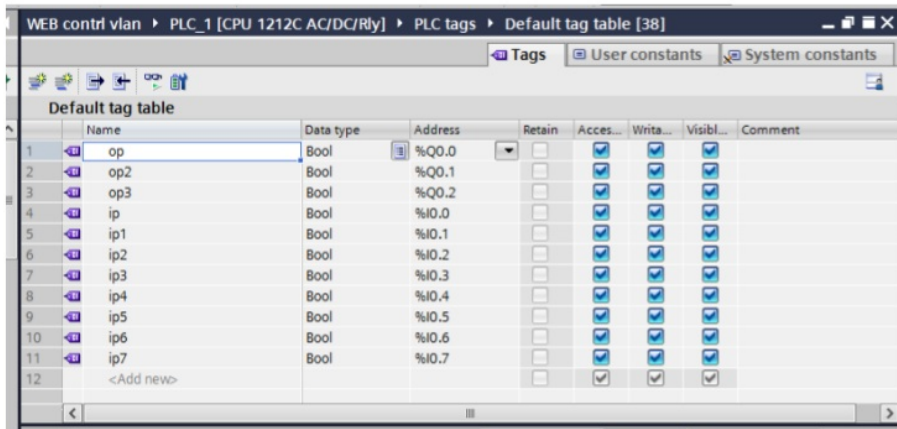
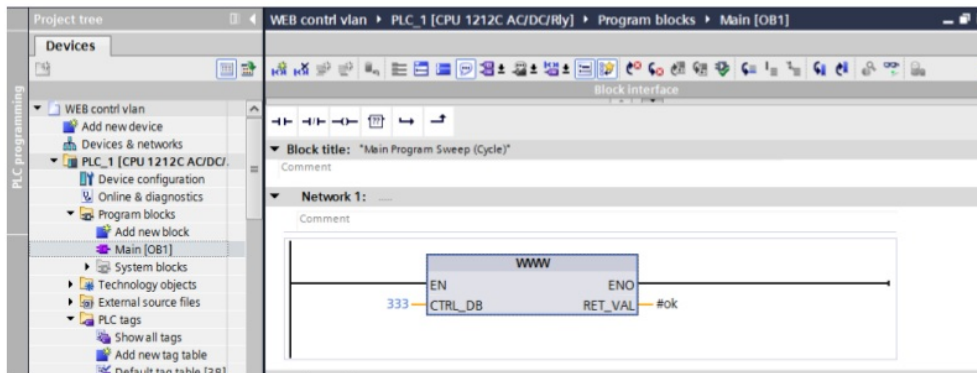


Figure 77 - Inputs and Output

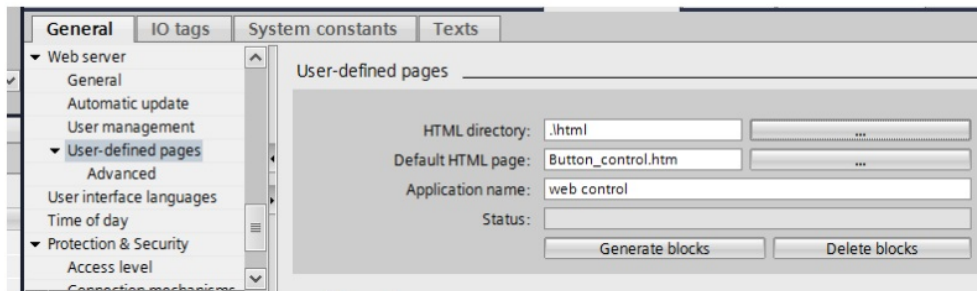
Tags for IO operation are declared in TIA Portal

A web server was then added to the main program function block, seen within Figure 78.



Web server block implemented in Main

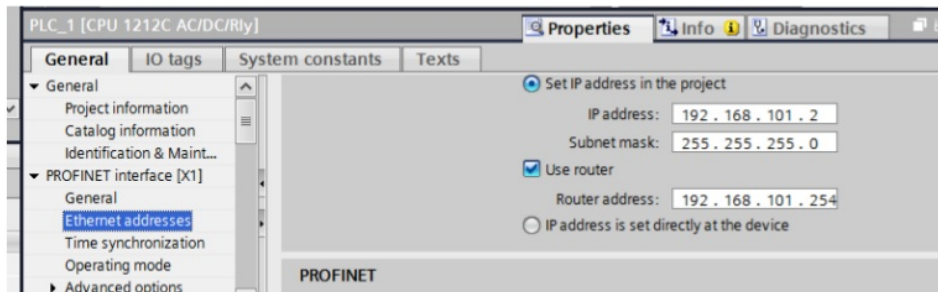
Figure 78 - Web Server block



HTML program is downloaded to the PLC web server

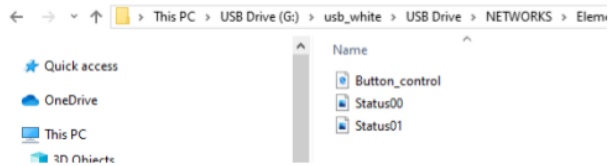
The index .html page is now downloaded into the system.

Once this download is done the PLC can then be configured with the relevant VLAN gateway and IP address, this is seen within Figure 79.



The PLC gateway address is the VLAN gateway ip address

Figure 79 - IP address and Gateway set-up



Web program needs to be located in the TIA project directory

Figure 80 – Files

The web pages are saved within the user files, the files can be seen within Figure 80.

The HTML program that will be utilised in order to activate the output and monitor the input can be seen below;

The start is the heading part of the program which sets title, background colour and the refresh rate of the page Figure 81.

```

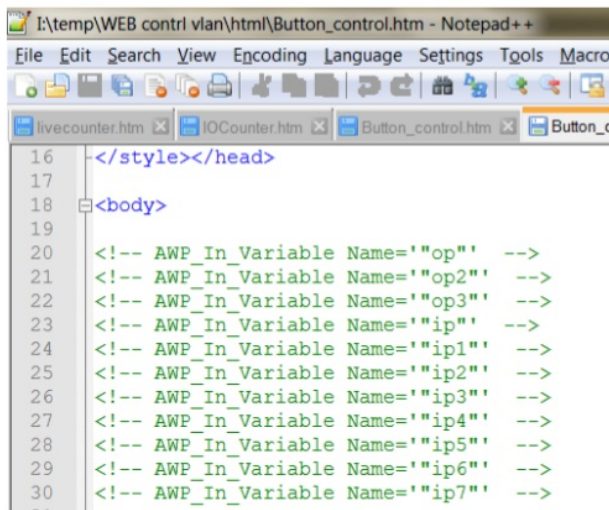
1  <html>
2
3  <head>
4    <meta http-equiv="refresh" content="0.2">
5
6    <title>Web_control</title>
7    <meta http-equiv="Content-Type" content="text/html; charset=iso-8859-1"><style type="text/css">
8    <!--
9      body,td,th {
10         color: #000033;
11      }
12      body {
13         background-color: #CCCCC;
14      }
15    -->
16  </style></head>

```

Start of HTML program

Figure 81 - Start of program

The body of the page is where the dynamic content is contained. This is what is changing on the page every refresh. The PLC tags are declared as shown in the format below.



```

16 </style></head>
17
18 <body>
19
20 <!-- AWP_In_Variable Name='op' -->
21 <!-- AWP_In_Variable Name='op2' -->
22 <!-- AWP_In_Variable Name='op3' -->
23 <!-- AWP_In_Variable Name='ip' -->
24 <!-- AWP_In_Variable Name='ip1' -->
25 <!-- AWP_In_Variable Name='ip2' -->
26 <!-- AWP_In_Variable Name='ip3' -->
27 <!-- AWP_In_Variable Name='ip4' -->
28 <!-- AWP_In_Variable Name='ip5' -->
29 <!-- AWP_In_Variable Name='ip6' -->
30 <!-- AWP_In_Variable Name='ip7' -->

```

Figure 82 - Body of the page

Tags declared in the HTML program

The forms can be seen below, these are writing to the output.



```

31
32 <form>
33 <input type="submit" value="Set_Output_1_1">
34 <input type="hidden" name="op" value="1">
35 </form>
36
37 <form>
38 <input type="submit" value="Set_Output_1_0">
39 <input type="hidden" name="op" value="0">
40 </form>
41
42
43
44 <p>
45 <form>
46 <input type="submit" value="Set_Output_2_1">
47 <input type="hidden" name="op2" value="1">
48 </form>
49 <form>
50 <input type="submit" value="Set_Output_2_0">
51 <input type="hidden" name="op2" value="0">
52 </form>
53
54 <p>
55 <form>
56 <input type="submit" value="Set_Output_3_1">
57 <input type="hidden" name="op3" value="1">
58 </form>
59 <form>
60 <input type="submit" value="Set_Output_3_0">
61 <input type="hidden" name="op3" value="0">
62 </form>

```

Figure 83 - Forms of program

HTML forms that enable boolean data to be sent to the PLC to set and reset outputs

The following section of the program analyses the input values and subsequently sets an LED image that emulates the Boolean condition of the input. For example, if ip 1 is set to logic 0 then this logic 0 is read and used as the second identifier for selecting the correct image. The image for a green LED is called "status00" and the last 0 is determined by the condition of the PLC input.

```

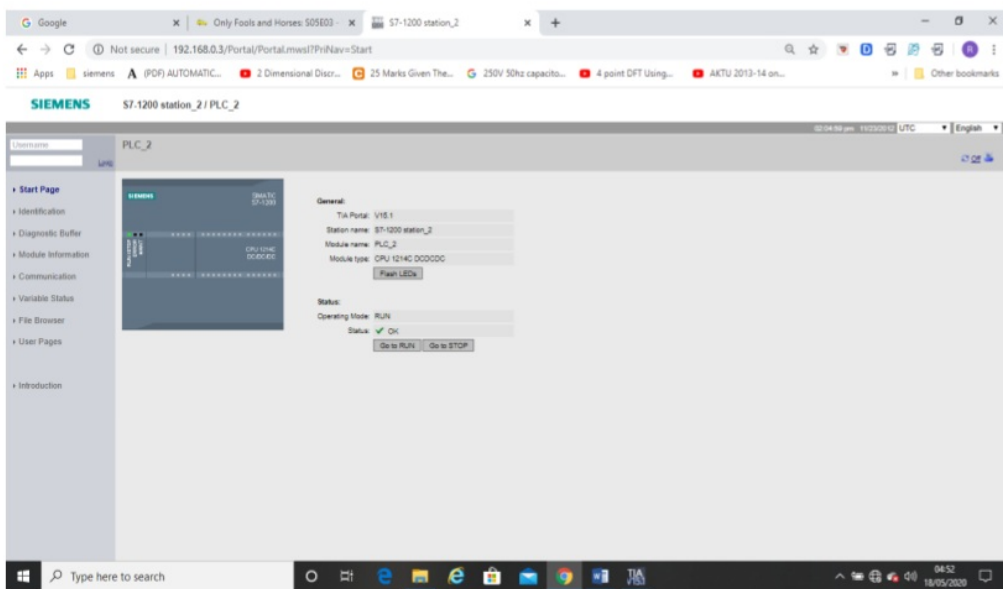
66
67 <p align="center">ip 0 : := "ip": &nbsp;&nbsp;&nbsp;
68 &nbsp;&nbsp;&nbsp;ip 1 : := "ip1": &nbsp;&nbsp;&nbsp;
69 &nbsp;&nbsp;&nbsp;ip 2 : := "ip2": &nbsp;&nbsp;&nbsp;
70 &nbsp;&nbsp;&nbsp;ip 3 : := "ip3": &nbsp;&nbsp;&nbsp;
71 &nbsp;&nbsp;&nbsp;ip 4 : := "ip4": &nbsp;&nbsp;&nbsp;
72 &nbsp;&nbsp;&nbsp;ip 5 : := "ip5": &nbsp;&nbsp;&nbsp;
73 &nbsp;&nbsp;&nbsp;ip 6 : := "ip6": &nbsp;&nbsp;&nbsp;
74 &nbsp;&nbsp;&nbsp;ip 7 : := "ip7": &nbsp;&nbsp;&nbsp;
75 <p align="center">Output 0 : := "op": &nbsp;&nbsp;&nbsp;
76 &nbsp;&nbsp;&nbsp;Output 2 : := "op2": &nbsp;&nbsp;&nbsp;
77 &nbsp;&nbsp;&nbsp;Output 3 : := "op3": &nbsp;&nbsp;&nbsp;
78
79 </body>
80 </html>
81

```

This part of the program reads the input status of the 8 PLC inputs

Figure 84 - Input setting LED images

The first web page that is displayed first is seen below;



The initial web page from the server

Figure 85 - Siemens web page

The user created web pages can then be accessed from this web page.

Two examples of the inputs and outputs being switched on and off from the web page can be seen within Figure 86 & Figure 87.

Inputs: 01111000 Output: 1000000



Figure 86 - Test 1

Input: 10011011 Output: 10100000



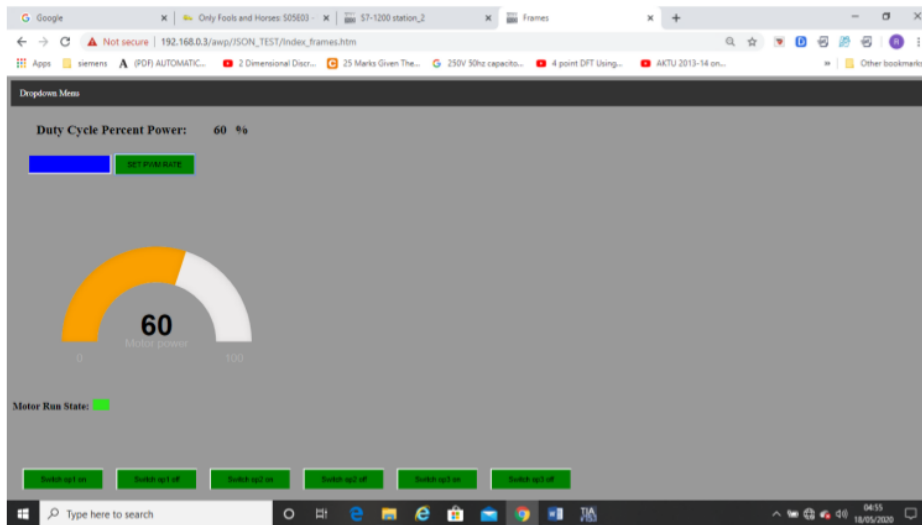
Figure 87 - Test 2

This process shows how industry 4.0 can be implemented into PLC software, by allowing remote control of inputs and outputs through the use of a web page. This can allow for real time monitoring of the states of these inputs and outputs without having to access the PLC physically.

Test
Web
Simulation
Page

4. Evaluation

In evaluation the capabilities of industry 4.0 are clear to see, although the process implemented within this portfolio is relatively simple and user friendly the capabilities can be far larger than just assessing the input and output states. For example, a motors speed could be controlled through the use of a web page. An example of this that has been developed through the use of jQuery, Ajax and JSON libraries, can be seen below,



It can be seen that on this web page the PWM can easily be set-up, this web page also provides power control of the motor by turning off different outputs.

*A good recommendation of what
can be achieved*

5. Appendix

Appendix 1

5.1 Switch Configuration

First of all the switch must be configured so that it knows 2 VLANs are being used (Figure 88).

Following this the port allocation takes place this allows for the switch to understand which VLAN a particular port is upon (Figure 89).

```
Switch>en
Switch#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#vlan 50
Switch(config-vlan)#name vlan 50
      ^
% Invalid input detected at '^' marker.

Switch(config-vlan)#name vlan50
Switch(config-vlan)#exit
Switch(config)#vlan 51
Switch(config-vlan)#name vlan51
Switch(config-vlan)#exit
Switch(config)#^z
      ^
% Invalid input detected at '^' marker.

Switch(config)#end
Switch#
%SYS-5-CONFIG_I: Configured from console by console
```

Figure 88 - Switch Configuring VLAN's

```
Switch#
Switch#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#int f 0/2
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 51
Switch(config-if)#exit
Switch(config)#int f0/1
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 50
Switch(config-if)#exit
Switch(config)#int f0/4
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 50
Switch(config-if)#exit
Switch(config)#int f0/3
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 51
Switch(config-if)#exit
Switch(config)#end
Switch#
%SYS-5-CONFIG_I: Configured from console by console
```

Figure 89 - Switch Configuring VLAN Ports

Figure 90 shows the ports after being allocated to a certain VLAN; VLAN 50 (Fa0/1 and Fa0/4) and VLAN 51 (Fa0/2 and Fa0/3).

```
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
50 vlan50	active	Fa0/1, Fa0/4
51 vlan51	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
50	enet	100050	1500	-	-	-	-	0	0
51	enet	100051	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
1	enet	100001	1500	-	-	-	-	0	0
50	enet	100050	1500	-	-	-	-	0	0
51	enet	100051	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


```
Remote SPAN VLANs
```

Primary	Secondary	Type	Ports

Figure 90 - VLAN's After Setting Ports

The final thing needed on the switch is a port to the router itself, this is configured within Figure 91;

```
Switch#
Switch#
Switch#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#int f0/1
Switch(config-if)#switchport mode trunk
Switch(config-if)#end
Switch#
%SYS-5-CONFIG_I: Configured from console by console
```

Figure 91 - Setting up Port to Router

5.2 Router Configuration

Having configured the switch the router could now be configured. First of all a port from the router to the switch was configured (Figure 92). Secondly the gateways for both VLANs were configured (Figure 93).

```
Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
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
```

Figure 92 - Setting up Port to Switch

```
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#int f0/0
Router(config-if)#no ip address
Router(config-if)#exit
Router(config)#int f0/0.50
Router(config-subif)#
%LINK-5-CHANGED: Interface FastEthernet0/0.50, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0.50, changed state to up

Router(config-subif)#encapsulation dot1Q 50
Router(config-subif)#ip address 192.168.50.254
% Incomplete command.
Router(config-subif)#ip address 192.168.50.254 255.255.255.0
Router(config-subif)#no shutdown
Router(config-subif)#exit
Router(config)#int f0/0.51
Router(config-subif)#
%LINK-5-CHANGED: Interface FastEthernet0/0.51, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0.51, changed state to up

Router(config-subif)#encapsulation dot1Q 51
Router(config-subif)#ip address 192.168.51.254 255.255.255.0
Router(config-subif)#no shutdown
Router(config-subif)#exit
Router(config)#end
Router#
%SYS-5-CONFIG_I: Configured from console by console
```

Figure 93 - Setting up Gateways for Both VLANS

The '#show ip int bri' command seen within Figure 94 is utilised in order to show that the router has been configured, it illustrates that the router now has two VLAN ports upon the Fast Ethernet.

```

Router#show ip int brie
Interface      IP-Address      OK? Method Status      Protocol
FastEthernet0/0 unassigned      YES unset   up          up
FastEthernet0/0.50 192.168.50.254 YES manual   up          up
FastEthernet0/0.51 192.168.51.254 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

```

Figure 94 - VLANs Configured Upon Router

5.3 Switch Configuration

```

London>
London>enable
London#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
London(config)#hostname Newport
Newport(config)#
Newport(config)#vlan 2
Newport(config-vlan)#name vlan2
Newport(config-vlan)#exit
Newport(config)#vlan 3
Newport(config-vlan)#name vlan3
Newport(config-vlan)#exit
Newport(config)#^Z
Newport#
%SYS-5-CONFIG_I: Configured from console by console

Newport#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

2    vlan2                  active
3    vlan3                  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  BrdgMode Trans1 Trans2
-----
1    enet  100001   1500  -     -     -     -   -       0       0
2    enet  100002   1500  -     -     -     -   -       0       0
3    enet  100003   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
-----
Newport#

```

Figure 95 - Configuration of VLANs on Switch

```

Newport#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Newport(config)#int f0/1
Newport(config-if)#switchport mode access
Newport(config-if)#switchport access vlan 2
Newport(config-if)#exit
Newport(config)#int f0/2
Newport(config-if)#switchport access
% Incomplete command.
Newport(config-if)#switchport mode access
Newport(config-if)#switchport access vlan 3
Newport(config-if)#exit
Newport(config)#^Z
Newport#
%SYS-5-CONFIG_I: Configured from console by console

Newport#show vlan

VLAN Name                Status    Ports
-----
1    default                active    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
2    vlan2                  active    Fa0/1
3    vlan3                  active    Fa0/2
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
2    enet     100002    1500  -      -      -      -    -      0      0
3    enet     100003    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
-----

Newport#

```

Figure 96 - Configuring VLAN ports upon Switch

```

Newport#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Newport(config)#int f0/10
Newport(config-if)#
%LINK-3-UPDOWN: Interface FastEthernet0/3, changed state to down

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/3, changed state to down

%LINK-5-CHANGED: Interface FastEthernet0/10, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/10, changed state to up
Newport(config-if)#switchport mode trunk

Newport(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/10, changed state to down

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/10, changed state to up

Newport(config-if)#^Z
Newport#
%SYS-5-CONFIG_I: Configured from console by console

```

Figure 97 - Configuring Port from Switch to Router

```

Newport#show interface trunk
Port      Mode          Encapsulation  Status      Native vlan
Fa0/10    on            802.1q         trunking    1

Port      Vlans allowed on trunk
Fa0/10    1-1005

Port      Vlans allowed and active in management domain
Fa0/10    1,2,3

Port      Vlans in spanning tree forwarding state and not pruned
Fa0/10    1,2,3

Newport#

```

Figure 98 - VLAN's Active upon Port F0/10

5.4 Router Configuration

```
Newport>en
Newport#
Newport#conf t
Translating "conf"...domain server (255.255.255.255)
% Unknown command or computer name, or unable to find computer address

Newport#
Newport#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Newport(config)#int f0/0
Newport(config-if)#no shutdown
Newport(config-if)#no ip address
Newport(config-if)#exi
Newport(config)#int f0/0.2
Newport(config-subif)#
%LINK-5-CHANGED: Interface FastEthernet0/0.2, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0.2, changed state to up

Newport(config-subif)#encapsulation dot1Q 2
Newport(config-subif)#ip address 192.168.50.126 255.255.255.224
Newport(config-subif)#no shutdown
Newport(config-subif)#exit
Newport(config)#int f0/0.3
Newport(config-subif)#
%LINK-5-CHANGED: Interface FastEthernet0/0.3, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0.3, changed state to up

Newport(config-subif)#encapsulation dot1Q 3
Newport(config-subif)#ip address 192.168.50.158 255.255.255.224
Newport(config-subif)#no shutdown
Newport(config-subif)#exit
Newport(config)#^Z
Newport#
%SYS-5-CONFIG_I: Configured from console by console

Newport#
```

Figure 99 - Configuring Router Ports

```
Newport#show ip int brie
```

Interface	IP-Address	OK?	Method	Status	Protocol
FastEthernet0/0	unassigned	YES	manual	up	up
FastEthernet0/0.2	192.168.50.126	YES	manual	up	up
FastEthernet0/0.3	192.168.50.158	YES	manual	up	up
FastEthernet0/1	unassigned	YES	unset	administratively down	down
Serial0/0	192.168.50.13	YES	manual	up	up
Serial0/1	192.168.50.10	YES	manual	up	up

```
Newport#
```

Figure 100 - Router Ports Configured

```
cologne#show run
Building configuration...

Current configuration : 761 bytes
!
version 12.2
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname cologne
!
!
!
!
!
!
!
!
!
no ip cef
no ipv6 cef
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
interface FastEthernet0/0
ip address 192.168.50.94 255.255.255.224
duplex auto
speed auto
!
interface FastEthernet0/1
no ip address
duplex auto
speed auto
shutdown
!
interface Serial0/0
ip address 192.168.50.6 255.255.255.252
!
interface Serial0/1
ip address 192.168.50.9 255.255.255.252
clock rate 64000
!
router rip
version 2
network 192.168.50.0
!
ip classless
!
ip flow-export version 9
!
!
access-list 1 deny host 192.168.50.129
access-list 1 permit any
```

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VLAN configuration:

Switch>enable

Switch#conf t

Switch(config)#vlan 100

Switch(config-vlan)#name vlan100

Switch(config-vlan)#exit

Switch(config)#vlan 101

Switch(config-vlan)#name vlan101

Switch(config-vlan)#exit

Switch(config)#^Z

Switch#show vlan

////////////////////////////////report on vlan config////////////////////////////////

Switch#conf t

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 f0/3

Switch(config-if)#switchport mode access

Switch(config-if)#switchport access vlan 101

Switch(config-if)#exit

Switch(config)#int f0/4

Switch(config-if)#switchport mode access

Switch(config-if)#switchport access vlan 100

Switch(config-if)#exit

Switch(config)#^Z

Switch#

Switch#show vlan

//////////report shows vlans with port config//////////

End of VLAN configuration

Inter VLAN routing

Switch config:

Switch#conf t

Switch(config)#int f0/1

Switch(config-if)#switchport mode trunk

Switch(config-if)#^Z

Switch#

Switch#show interface trunk

//////////report shows trunk config//////////

//////////might have to show this again after router config//////////

Router config:

Router>enable

Router#conf t

Router(config)#int f0/0

Router(config-if)#no shutdown

Router(config-if)#exit

Router(config)#int f0/0

Router(config-if)#no ip address

Router(config-if)#exit

Router(config)#int f0/0.100

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)#encapsulation dot1Q 101
```

```
Router(config-subif)#ip address 192.168.101.254 255.255.255.0
```

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

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

```
Router(config)#^Z
```

```
Router#show ip interfaces brie
```

```
//////////report int status for f0/0.100 and f0/0.101//////////
```

```
Router#show run
```

```
//////////running config for router//////////
```

Good use of appendix

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[Token=IQoJb3JpZ2luX2VjECEaCXVzLWVhc3QtMSJIMEYCIQDTECUl1hQV8Wr6ytmpzhLKUS05zLpsfj1eDOK8ZCLgTQlhANKwRFTla5S%2Bk0yBJtyoBHV9tpxjUBP64cPeNJ9VIC](https://pdf.sciencedirectassets.com/278653/1-s2.0-S1877705812X00043/1-s2.0-S1877705812003475/main.pdf?X-Amz-Security-Token=IQoJb3JpZ2luX2VjECEaCXVzLWVhc3QtMSJIMEYCIQDTECUl1hQV8Wr6ytmpzhLKUS05zLpsfj1eDOK8ZCLgTQlhANKwRFTla5S%2Bk0yBJtyoBHV9tpxjUBP64cPeNJ9VIC)

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*Good relevant
source*

1708179

GRADEMARK REPORT

FINAL GRADE

GENERAL COMMENTS

Instructor

65/100

PAGE 1

PAGE 2

Text Comment. This is port allocation

Text Comment. This is dynamic routing

PAGE 3

Text Comment. Good detail in the list of contents but some of your headings are incorrect

PAGE 4

PAGE 5

PAGE 6

Text Comment. Extensive list of figures

PAGE 7

PAGE 8

Text Comment. This error should be rectified

PAGE 9

Text Comment. 7 layer OSI explanation is good with relevant source

Text Comment. Explanation is supported with a good image

Text Comment. Good image that supports explanation. There are many grammatical errors here.

Text Comment. Explanation is good and supported with an informative image

Text Comment. This is no accurate. Broadcasting will happen with all devices connected to the same LAN. The method of reducing the broadcast domain is using VLANs. The broadcast domain is decreased in size and therefore less traffic on the network.

Text Comment. This should be Port Allocation

Text Comment. Network design is correct

Text Comment. Good addressing scheme. It would assist the implementation more if this was in a table form

Text Comment. Screenshots show the static addressing and routing implementation

Text Comment. There is missing work here!

Text Comment. RIP tables are correct but there is no explanation here and there is obviously work missing

Text Comment. Summary report show the RIP implementation

PAGE 21

Text Comment. Explanation includes the helper address which is significant for DHCP operation

Text Comment. Screenshot shows the configuration of the DHCP

Text Comment. This should state static addressing to DHCP

PAGE 22

PAGE 23

Text Comment. Screenshot shows evidence of helper address implementation

PAGE 24

Text Comment. Screenshot shows the exclusion address range

PAGE 25

Text Comment. Screenshot shows the operation of DHCP with exclusion address range implemented. The DHCP assigns the next address after exclusion

PAGE 26

Text Comment. Good test for DHCP. You should have explained what the outcome would be if no helper addresses are configured

PAGE 27

Text Comment. Test is successful for static parameters

Text Comment. RIP is dynamic routing not addressing

Text Comment. Evidently the RIP tests are successful

PAGE 28

Text Comment. Report on router shows the DHCP implementation and the excluded address range

Text Comment. Router report shows all router config and the helper address

Text Comment. Full report for router 10 has all the config settings

Text Comment. There is some confusion in the explanation here

Text Comment. A good point made. It is good practice to design an address pattern especially when the networks expand into larger networks

Text Comment. This is true. Research must be continued until the last task

Text Comment. This should be two VLANs for 2 PCs

Text Comment. This is last 4 bits of the last octal value

Text Comment. This should be logical 'AND' not plus. If the network address device ip is applied with logical AND with last 8 bits of mask, then the network address is the answer.

Text Comment. This is correct the increments will be in stages of 16 starting at 16. The example for usable addresses for network address 16 is correct

Text Comment. Good method planned

Text Comment. LAN address scheme is correct

Text Comment. The addressing scheme is good and you have used an order starting at 16. You could have started at any address from 16 and above.

Text Comment. Good explanation. By this method the broadcast domain minimises redundancies by default

Text Comment. This mask is correct

Text Comment. This mask must have only three logic 1ns

Text Comment. This mask must have only three logic 1ns

Text Comment. good use of tables

PAGE 37

Text Comment. The network mask is correct

Text Comment. The addressing scheme is correct and good use of tables

PAGE 38

Text Comment. This should be explained in the context of an industrial network VLAN

Text Comment. Explanation is correct

PAGE 39

Text Comment. VLAN addresses are correct. The two VLANs have different network addresses for two different domains on the same LAN

Text Comment. Network diagram is detailed and shows good evidence of the configuration

PAGE 40

Text Comment. Good explanation

PAGE 41

PAGE 42

Text Comment. RIP configuration for CIDR /28 is correct

PAGE 43

Text Comment. RIP tables are good

Text Comment. Configuration is correct

Text Comment. The network routers auto detect the VLSM changes through RIP ver 2

Text Comment. RIP ver 2 tables show the VLAN nets auto configured. If there was an error in the configuration the auto detect would not work

Text Comment. Image shows the FE 0/0 is no longer the gateway because it has been subnetted with 0.2 and 0.3

Text Comment. ACL configuration is correct

Text Comment. CIDR /28 tests are successful and the test method eliminates redundancies

Text Comment. Tests are successful and redundancies eliminated

Text Comment. Screenshot shows the two VLANs activated with active interfaces

Text Comment. Tests are successful and redundant tests eliminated

Text Comment. Tests are successful

PAGE 55

Text Comment. Screenshot shows the denial of service for address .129

Text Comment. This shows the access for address .100

PAGE 56

Text Comment. Test shows denial for address .129 and access for .50

PAGE 57

Text Comment. This should be eliminated

Text Comment. This is a good point. VLSM is an improvement

Text Comment. You have identified here that the VLSM and VLANs are methods of network improvement. This for both performance and security which are the demands for industry 4.0

PAGE 58

Text Comment. Intro should also include the network terminal PC

PAGE 59

Text Comment. The network configuration shows the practical setup

Text Comment. Screen shot shows VLANs are active

PAGE 60

Text Comment. Image shows the active VLANs with active interfaces assigned

Text Comment. The two sub interfaces are shown which are now the two gateways for the VLANs

PAGE 61

PAGE 62

Text Comment. Test shows the connection to the PLC ip 101.2 and the PC network terminal

101.3. Tested from the PLC terminal address ip 100.4

PAGE 63

Text Comment. PLC web server activated and file extensions added. Start address for web server is initialised

Text Comment. Tags for IO operation are declared in TIA Portal

PAGE 64

Text Comment. Web server block implemented in Main

Text Comment. HTML program is downloaded to the PLC web server

Text Comment. The PLC gateway address is the VLAN gateway ip address

PAGE 65

Text Comment. Web program needs to be located in the TIA project directory

Text Comment. Start of HTML program

PAGE 66

Text Comment. Tags declare in the HTML program

Text Comment. HTML forms that enable boolean data to be sent to the PLC to set and reset outputs

PAGE 67

Text Comment. This part of the program reads the input status of the 8 PLC inputs

Text Comment. The initial web page from the server

PAGE 68

Text Comment. Test shows the matching condition on the web page and PLC IO

PAGE 69

Text Comment. A good recommendation of what can be achieved

PAGE 70

PAGE 71

PAGE 72

PAGE 73

PAGE 74

PAGE 75

PAGE 76

PAGE 77

PAGE 78

PAGE 79

PAGE 80

PAGE 81

Text Comment. Good use of appendix

PAGE 82

Text Comment. Good relevant source

GRADING FORM: CSG-RUBIC

THOMAS WOOD

0

RESEARCH-INFORMED LITERATURE



Your research covers most of what is required with

good relevant sources used. There are inaccuracies in parts of your research and incomplete parts. 5/10

5/10

KNOWLEDGE AND UNDERSTANDING



Element 1: Intro needs more details of objectives. The design and implementation of the network is explained with supporting images. There are inaccuracies in this section. There is sufficient evidence for correct implementation. 6/10 Element 2: Introduction explains the requirements clearly. The configuration is explained and documentation requirements for addressing schemes are good and good use of tables for this. There are some errors in this section. 6.5/10 Element 3: The sections from the CAD designs in elements 1 and 2 are implemented using level 2, and 3 Cisco devices. The implementation of the VLAN and web server are documented and supported with explanations and images. Some of the explanations need to be more clear. There is sufficient evidence of the ACL configuration. The web program implementation is achieved over the existing Cisco switch and router and explained clearly. 6.5/10

19/30

ANALYSIS



Element 1: Testing and results need a clearer explanation. However the tests are supported with sufficient images. 3/5 Element 2: Analysis of test results has been carried out with supporting images and a good method of testing used. Explanations could be more clear. Good use of tables in this

16/25

section.6.5/10 Element 3: Good test results obtained. Explanations need to be more clear. There is sufficient evidence of the requirements. 6.5/10

PRACTICAL APPLICATION AND DEP.



Element 1: Design and implementation from address scheme to class A, B and C and serial links are clearly implemented and tested. The procedures followed from design to implementation were efficient which simplified the testing stage. 3/5 Element 2: The configuration is more complex due to the subnetting required and the tables of addressing are very well ordered and follow a pattern. Implementation of the required network parameters has been carried out but the explanations could be clearer. This should have included the reason for RIP ver 2 and not ver 1. The differences are important points. Test procedures and methods eliminate redundant tests while testing all components. 6.5/10 Element 3: The practical implementation was carried out using Cisco level 2 and 3 devices. Explanations here could be improved. However there are supporting images. The testing carried out demonstrated the VLANs and ACL security used in industry networks. 6.5/10

16/25

SKILLS FOR PROFESSIONAL PRAC.



The layout of the report is reasonable but there are some sections which seem out of place. The quality of writing could improve. There are many grammatical errors. 9/15

9/15