

2119237

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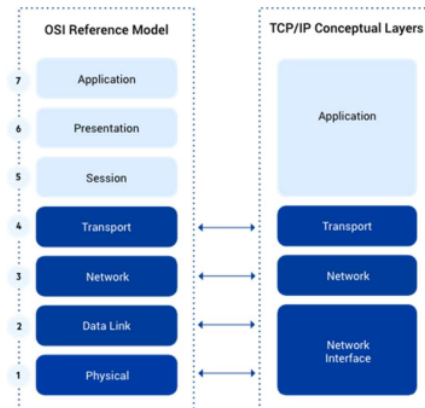
Figure 58 Watch Table..... 46

Good extensive list of figures

Element 1

1.1 Research

Network layers



Good relevant diagram

Figure 1 OSI 7 And 4 Layer Model

The TCP/IP 4-layer model is an explanatory structure for the protocol suite, whereas the OSI 7-layer model was designed for reference purposes.

TCP/IP, also called the internet protocol suite, comprises a collection of communication protocols utilized for the internet, named after two critical protocols within it. It can be seen as a series of layers, with each layer addressing specific data transmission challenges. *Good points made*

(NETWORKWORLD, 2022) *Citation is correct*

The OSI (Open Systems Interconnection) model is a framework that organizes the functions of a telecommunication or computing system into seven layers. Each layer has its specific roles and interacts with neighbouring layers to ensure effective communication across networks. Here's a summary of each layer:

7. Physical Layer: Deals with the physical connections between devices and sets the specifications for transmitting raw data.
6. Data Link Layer: Establishes connections between devices on the same network, handles error detection, and ensures reliable communication.
5. Network Layer: Routes packets across multiple networks, manages logical addressing (IP), and controls traffic.
4. Transport Layer: Manages end-to-end communication, data segmentation, error checking, and flow control.
3. Session Layer: Establishes, maintains, and terminates communication sessions between applications.
2. Presentation Layer: Handles data translation, encryption, and decryption for application compatibility.
1. Application Layer: Provides an interface for user applications to access network services. *Layers are identified*

The OSI model simplifies understanding and troubleshooting network issues by breaking down complex processes into distinct layers with specific responsibilities. (imperva, 2024)

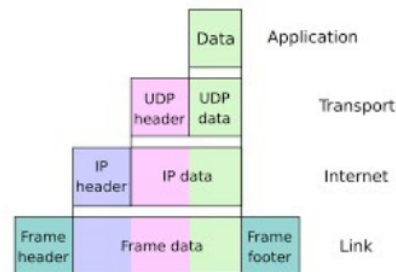
The 4-layer TCP/IP model is a simplified version of the widely used TCP/IP protocol suite for Internet networking and communication. Here's an overview of its layers:

4. Application Layer: This layer combines the top three layers of the OSI model and includes protocols like HTTP, FTP, SMTP, and DNS for user applications to access network services.
3. Transport Layer: Equivalent to the OSI Transport layer, it manages end-to-end communication, ensuring reliable data delivery, error handling, flow control, and data segmentation using TCP and UDP protocols.
2. Internet Layer: Like the OSI Network layer, it handles IP addressing, packet routing across networks, and packet fragmentation and reassembly.
1. Link Layer: Also called the Network Access or Data Link layer, it deals with physical connections, hardware addressing, error detection, and data framing for transmission over the network medium.

The 4-layer TCP/IP model simplifies network communication functions compared to the more detailed OSI 7-layer model. (AVG, 2024)

Good work

Encapsulation



Relevant diagram

Figure 2 Encapsulation Model

Encapsulation is a core idea in both programming and networking, especially in object-oriented programming and communication protocols. It refers to the grouping of data and the functions that work with that data into a unified entity.

In networking, encapsulation plays a vital role in protocols like the OSI model and TCP/IP. Here, data packets are wrapped with headers and trailers at every layer of the protocol stack. These additions include control details for tasks like routing, error detection, and data management. This layered approach to encapsulation enables efficient and dependable data transfer throughout networks. (ComputerNetworkingNotes, 2024)

This is the point here

Good work with encapsulation, however, decapsulation needs to be explained also.

Broadcasting

Broadcasting is a technique employed in computer networks to send data or information from a single sender to multiple recipients at the same time, typically in situations where a broad audience or numerous devices need to be reached. Unlike unicast (individual communication) and multicast (group-focused communication), broadcasting entails transmitting data packets to every device or node within a network segment without specifying individual addresses for each recipient. *Good point*

(IONOS, 2024) *Correct citation*

Broadcasting comes in two main types:

1. Unlimited or Directed Broadcasting: This method sends the broadcast message to every device within the network segment, without singling out any specific target. Each device within the segment receives and handles the broadcast message.
2. Limited or Local Broadcasting: Unlike unlimited broadcasting, this type confines the broadcast message to devices within a designated local network or subnet. Devices outside this subnet do not receive the broadcast, leading to reduced network congestion and avoiding unnecessary processing. *Very good point here*

(PracticalNetworking, 2024) *Correct citation*

Port Allocation

Port allocation is the process of assigning software ports to specific protocols within a computer network. These ports serve as endpoints for communication in networking protocols, enabling multiple applications or services to operate concurrently on a single device. Here's an explanation: *Good point*

Ports are essentially numerical identifiers utilized by networking protocols to differentiate between various services or applications running on a device. They allow the device to manage incoming and outgoing data traffic for different protocols. (CloudFlare, 2024)

Port Numbers: Port numbers are 16-bit unsigned integers ranging from 0 to 65535. They are categorized into three main ranges: *Good point. Port numbers are identified as software entities.*

1. Well-known ports (0 to 1023): These ports are reserved for standard services and protocols such as HTTP, FTP, and SMTP. They are well-known and typically used for widely recognized services.
2. Registered ports (1024 to 49151): These ports are specifically assigned to services by the Internet Assigned Numbers Authority (IANA) or are registered with the IANA. They are commonly used for less widely known or specialized services.
3. Dynamic or private ports (49152 to 65535): These ports are utilized for temporary connections and are dynamically allocated by the operating system. They are often used for client-server communications, where the client is assigned a random available port for its session. (ScienceDirect, 2017)

Understanding port numbers and their allocation is crucial for efficient communication and management of network services and applications.

Port allocation is essentially about assigning port numbers to protocols and services. This process aids in facilitating communication between applications and devices in a network, guaranteeing that data is routed accurately to its intended destination.

Good work here

1.2 Routing

Class C:
192.168.6.0 – net address
192.168.6.254 – gateway address
192.168.6.1 – initial device address

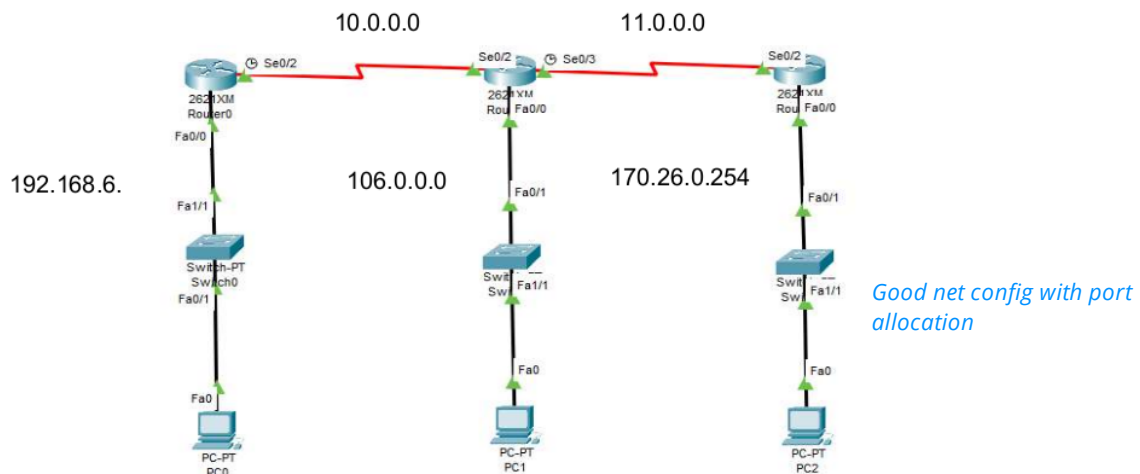
Class B:
170.26.0.0 – net address
170.26.0.254 – gateway address
170.26.0.1 – initial device address

Class A:
106.0.0.0 – net address
106.0.0.254 – gateway address
106.0.0.1 – initial device address

Router0
10.0.0.1
Router1
10.0.0.2
11.0.0.1
Router3
11.0.0.2

Excellent work here

The network configuration includes three routers, three *switches*, and three PCs. The routers are interconnected through serial links, and each router is linked to a computer via a switchboard using LAN connections.



Good net config with port allocation

Figure 3 Topology of 3 LAN Networks

Static Routing Configuration:
Router0:

The screenshot shows the Router0 configuration window with the 'Config' tab selected. The left sidebar shows the configuration tree with 'Static' selected under 'ROUTING'. The main area is titled 'Static Routes' and contains the following fields:

- Network:
- Mask:
- Next Hop:
-

Below these fields is a table of configured static routes:

Network Address
106.0.0.0/8 via 10.0.0.2
170.26.0.0/16 via 10.0.0.2

Good evidence

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

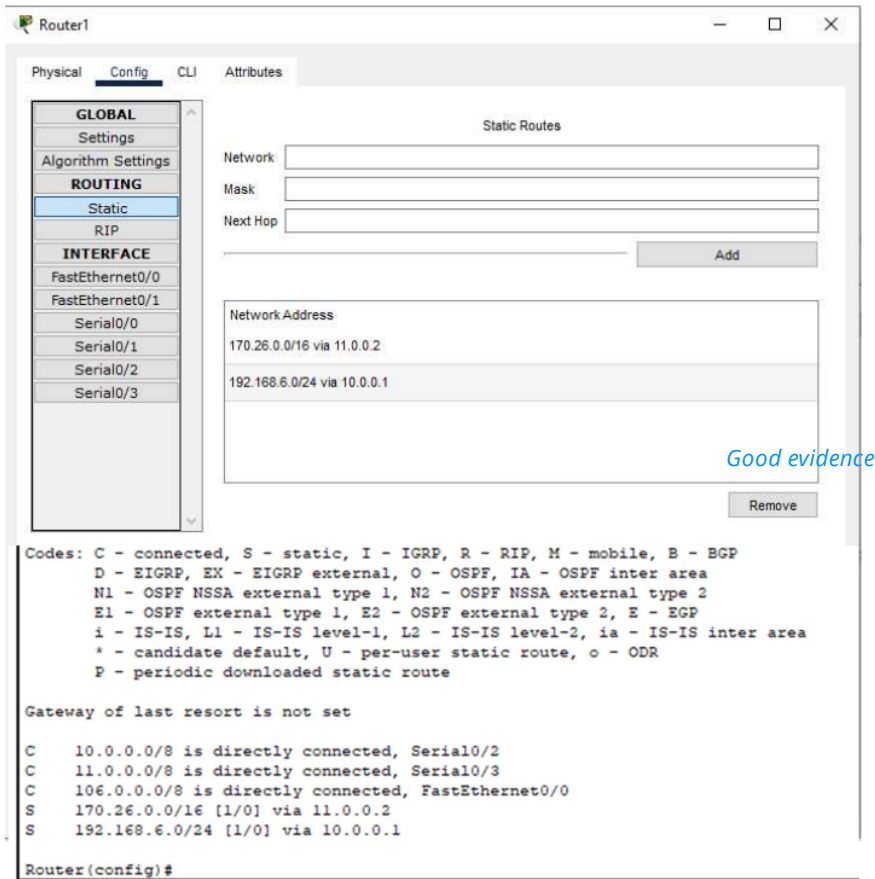
Gateway of last resort is not set

```
C 10.0.0.0/8 is directly connected, Serial0/2
S 106.0.0.0/8 [1/0] via 10.0.0.2
S 170.26.0.0/16 [1/0] via 10.0.0.2
C 192.168.6.0/24 is directly connected, FastEthernet0/0
```

Router(config)#

Figure 4 Static Routing Configuration Router0

Router1



The screenshot shows the 'Router1' configuration window with the 'Config' tab selected. The left sidebar contains a tree view with categories: GLOBAL, ROUTING, and INTERFACE. Under 'ROUTING', 'Static' is selected. The main area is titled 'Static Routes' and contains input fields for 'Network', 'Mask', and 'Next Hop', followed by an 'Add' button. Below these is a table of configured static routes:

Network Address
170.26.0.0/16 via 11.0.0.2
192.168.6.0/24 via 10.0.0.1

Below the table is a 'Remove' button. At the bottom of the window, there is a legend for codes and a list of configured routes:

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

```

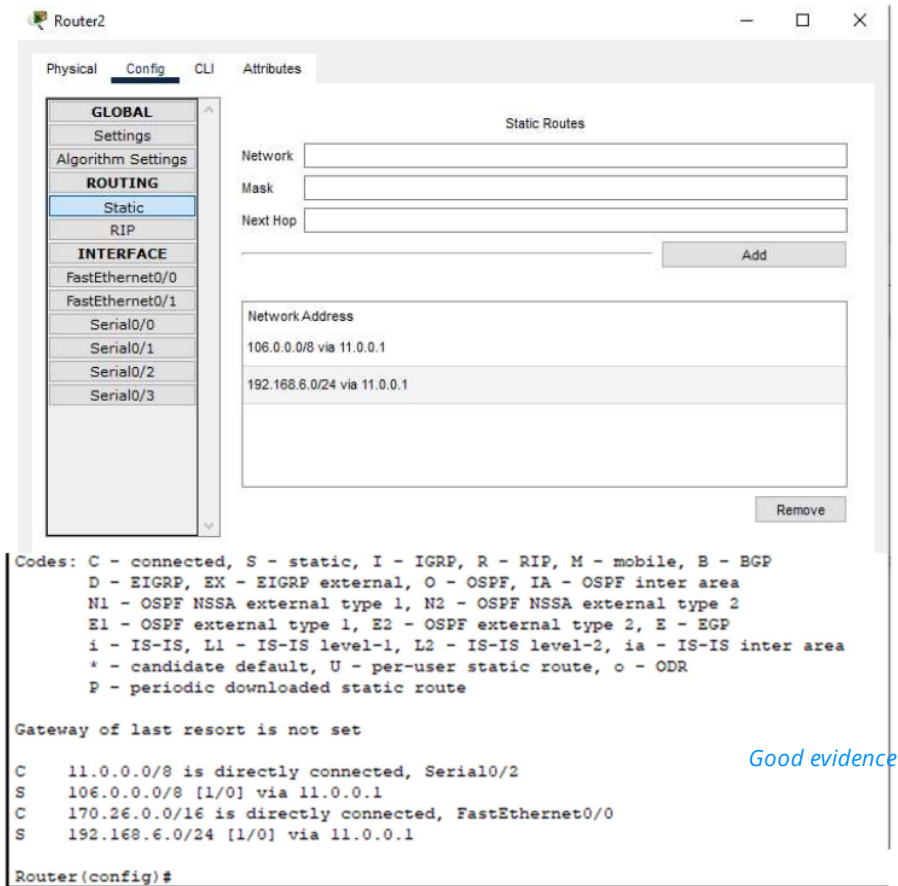
C    10.0.0.0/8 is directly connected, Serial0/2
C    11.0.0.0/8 is directly connected, Serial0/3
C    106.0.0.0/8 is directly connected, FastEthernet0/0
S    170.26.0.0/16 [1/0] via 11.0.0.2
S    192.168.6.0/24 [1/0] via 10.0.0.1
Router(config)#

```

Good evidence

Figure 5 Static Routing Configuration Router1

Router2:



Good evidence

Figure 6 Static Routing Configuration Router2

Good test results showing comms across networks in both directions

PDU List Window

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	PC0	PC1	ICMP		0.000	N	0	(edit)	(delete)
	Successful	PC0	PC2	ICMP		0.000	N	1	(edit)	(delete)
	Successful	PC1	PC0	ICMP		0.000	N	2	(edit)	(delete)
	Successful	PC2	PC1	ICMP		0.000	N	3	(edit)	(delete)
	Successful	PC1	PC2	ICMP		0.000	N	4	(edit)	(delete)
	Successful	PC2	PC0	ICMP		0.000	N	5	(edit)	(delete)

Figure 7 Test Using Static Addressing and Routing Protocols

The image above shows a table that displays the results of sending data between each of the PCs to show that the network is functioning.

Dynamic Routing using RIP

Router0

```
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router rip
Router(config-router)#ver 2
Router(config-router)#net 192.168.6.0
Router(config-router)#net 10.0.0.0
Router(config-router)#net 106.0.0.0
Router(config-router)#^Z
Router#
%SYS-5-CONFIG_I: Configured from console by console
```

Figure 8 Router 0 Configuration

Router1

```
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router rip
Router(config-router)#ver 2
Router(config-router)#net 106.0.0.0
Router(config-router)#net 10.0.0.0
Router(config-router)#net 11.0.0.0
Router(config-router)#net 170.26.0.0
Router(config-router)#^Z
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router rip
Router(config-router)#net 192.168.6.0
Router(config-router)#^Z
Router#
%SYS-5-CONFIG_I: Configured from console by console
```

Figure 9 Router 1 Configuration

Router2

```
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router rip
Router(config-router)#ver 2
Router(config-router)#net 170.26.0.0
Router(config-router)#net 11.0.0.0
Router(config-router)#net 106.0.0.0
Router(config-router)#^Z
Router#
%SYS-5-CONFIG_I: Configured from console by console
```

Config evidence shows the address allocations

Figure 10 Router 2 Configuration

Routing Table for Router0

Type	Network	Port	Next Hop IP	Metric
C	10.0.0.0/8	Serial0/2	---	0/0
R	11.0.0.0/8	Serial0/2	10.0.0.2	120/1
R	106.0.0.0/8	Serial0/2	10.0.0.2	120/1
R	170.26.0.0/16	Serial0/2	10.0.0.2	120/2
C	192.168.6.0/24	FastEthernet0/0	---	0/0

Figure 11

Routing Table for Router1

Type	Network	Port	Next Hop IP	Metric
C	10.0.0.0/8	Serial0/2	---	0/0
C	11.0.0.0/8	Serial0/3	---	0/0
C	106.0.0.0/8	FastEthernet0/0	---	0/0
R	170.26.0.0/16	Serial0/3	11.0.0.2	120/1
R	192.168.6.0/24	Serial0/2	10.0.0.1	120/1

Figure 12

Routing Table for Router2

Type	Network	Port	Next Hop IP	Metric
R	10.0.0.0/8	Serial0/2	11.0.0.1	120/1
C	11.0.0.0/8	Serial0/2	---	0/0
R	106.0.0.0/8	Serial0/2	11.0.0.1	120/1
C	170.26.0.0/16	FastEthernet0/0	---	0/0
R	192.168.6.0/24	Serial0/2	11.0.0.1	120/2

routing tables show correct routing net addresses

Figure 14

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	PC0	PC1	ICMP		0.000	N	0	(edit)	
	Successful	PC0	PC2	ICMP		0.000	N	1	(edit)	
	Successful	PC1	PC0	ICMP		0.000	N	2	(edit)	
	Successful	PC1	PC2	ICMP		0.000	N	3	(edit)	
	Successful	PC2	PC0	ICMP		0.000	N	4	(edit)	
	Successful	PC2	PC1	ICMP		0.000	N	5	(edit)	

Figure 13 Testing For RIP Routing

Good set of test results

The image above shows the testing results for the RIP Routing. And from the image we can see that it was all successful and working correctly.

This could have been explained a little more in detail

DHCP Test-without helper address

Router0 Configuration

```
Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip dhcp pool net1
Router(dhcp-config)#net 192.168.6.0 255.255.255.0
Router(dhcp-config)#default-router 192.168.6.254
Router(dhcp-config)#dns-server 192.168.6.254
Router(dhcp-config)#exit
Router(config)#
Router(config)#ip dhcp pool net2
Router(dhcp-config)#net 106.0.0.0 255.0.0.0
Router(dhcp-config)#default-router 106.0.0.254
Router(dhcp-config)#dns-server 106.0.0.254
Router(dhcp-config)#exit
Router(config)#
Router(config)#ip dhcp pool net3
Router(dhcp-config)#net 170.26.0.0 255.255.0.0
Router(dhcp-config)#default-router 170.26.0.254
Router(dhcp-config)#dns-server 170.26.0.254
Router(dhcp-config)#exit
Router(config)#
```

Good config evidence

Figure 15 Router0 Configuration Without Helper Address

Shown below is the dynamic routing for each of the PCs, and these routers were configured to not use the first 10 addresses.

PC0

192.168.6.1
255.255.255.0
192.168.6.254
192.168.6.254

Good test

Figure 16 PC0 Without Helper Address

PC1

169.254.80.194
255.255.0.0
0.0.0.0
0.0.0.0

Test showing error

PC2

Figure 17 PC1 Without Helper Address

169.254.19.55
255.255.0.0
0.0.0.0
0.0.0.0

Test showing error

Figure 18 PC2 Without Helper Address

The address configuration has not been set correctly for PC1 and PC2 and a default address is set. This is because the router needs the helper address to get across the network. The helper address is the control router serial port address (10.0.0.1).

Good explanation

DHCP Test-with helper address

Router1 Configuration

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

Figure 19 Router1 Configuration With Helper Address

Router2 Configuration

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

Good config showing helper addresses

Figure 20 Router2 Configuration With Helper Address

PC1

106.0.0.1
255.0.0.0
106.0.0.254
106.0.0.254

Figure 21 PC1 With Helper Address

PC2

Test results show error is rectified

170.26.0.1
255.255.0.0
170.26.0.254
170.26.0.254

Figure 22 PC2 With Helper Address

The test shows that devices PC1 and PC2 on routers 2 and 3 are now configured dynamically.

Address exclusion configuration using Router1 as control device:

Router0

```
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip dhcp excluded-address 192.168.6.10
Router(config)#ip dhcp excluded-address 106.0.0.1 106.0.0.10
Router(config)#ip dhcp excluded-address 192.168.6.1 192.168.6.10
Router(config)#ip dhcp excluded-address 170.26.0.1 170.26.0.10
Router(config)#
Router(config)#
```

Good config evidence

Figure 23 Router1 as Control Device Configuration Address Exclusion

PC0

192.168.6.11
255.255.255.0
192.168.6.254
192.168.6.254

Figure 24 PC0 Excluded Address

PC1

106.0.0.11
255.0.0.0
106.0.0.254
106.0.0.254

Figure 25 PC1 Excluded Address

PC2

170.26.0.11
255.255.0.0
170.26.0.254
170.26.0.254

Test shows excluded addresses for first 10 addresses

Figure 26 PC2 Excluded Address

The test proves that the excluded addresses from 1 to 10 in each LAN has been successful and this means that addresses for specific controllers can be kept static and not be affected by the DHCP dynamic addressing protocol. *A very good point*

1.3 Evaluation

Based on the research conducted on task layout, the exploration involved different routing methods and the use of various IP classes.

Firstly, static routing was examined, requiring manual configuration of each device and router via the terminal. Conversely, the dynamic routing protocol RIP allowed for quicker routing of multiple devices and enabled remote router configuration, provided the router's IP address is known.

Dynamic Host Communication Protocol (DHCP) posed a more complex configuration on the router, but once set up, connected devices were automatically assigned IP addresses without manual configuration. Additionally, DHCP allowed for certain addresses to be excluded from automatic assignment.

Overall, the practical tasks aligned with the research and are crucial for delving deeper into these concepts in the subsequent part of the element.

Good evaluation

Appendix

The final test to show the running configuration of the routers:

Router0 running config:

```
Router>en
Router#show run
Building configuration...
Current configuration : 1373 bytes
version 12.2
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
hostname Router
ip dhcp excluded-address 192.168.6.10
ip dhcp excluded-address 106.0.0.1 106.0.0.10
ip dhcp excluded-address 192.168.6.1 192.168.6.10
ip dhcp excluded-address 170.26.0.1 170.26.0.10
ip dhcp pool net1
network 192.168.6.0 255.255.255.0
default-router 192.168.6.254
dns-server 192.168.6.254
ip dhcp pool net2
network 106.0.0.0 255.0.0.0
default-router 106.0.0.254
dns-server 106.0.0.254
ip dhcp pool net3
network 170.26.0.0 255.255.0.0
default-router 170.26.0.254
dns-server 170.26.0.254
no ip cef
no ipv6 cef
interface FastEthernet0/0
ip address 192.168.6.254 255.255.255.0
duplex auto
speed auto
interface FastEthernet0/1
no ip address
duplex auto
speed auto
shutdown
interface Serial0/0
no ip address
clock rate 2000000
shutdown
interface Serial0/1
no ip address
clock rate 2000000
shutdown
interface Serial0/2
ip address 10.0.0.1 255.0.0.0
clock rate 2000000
interface Serial0/3
no ip address
```

```
clock rate 2000000
shutdown
router rip
version 2
network 10.0.0.0
network 100.0.0.0
network 106.0.0.0
network 192.168.6.0
ip classless
ip flow-export version 9
line con 0
line aux 0
line vty 0 4
login
end
```

Router2 running config:

```
Router>en
Router#show run
Building configuration...
Current configuration : 906 bytes
version 12.2
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
hostname Router
no ip cef
no ipv6 cef
interface FastEthernet0/0
ip address 106.0.0.254 255.0.0.0
ip helper-address 10.0.0.1
duplex auto
speed auto
interface FastEthernet0/1
no ip address
duplex auto
speed auto
shutdown
interface Serial0/0
no ip address
clock rate 2000000
shutdown
interface Serial0/1
no ip address
clock rate 2000000
shutdown
interface Serial0/2
ip address 10.0.0.2 255.0.0.0
interface Serial0/3
ip address 11.0.0.1 255.0.0.0
clock rate 2000000
router rip
version 2
network 10.0.0.0
network 11.0.0.0
network 106.0.0.0
network 170.26.0.0
network 192.168.6.0
ip classless
ip flow-export version 9
line con 0
line aux 0
line vty 0 4
login
end
```

Router3 running config:

```
Router>en
Router#show run
Building configuration...
Current configuration : 864 bytes
version 12.2
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
hostname Router
no ip cef
no ipv6 cef
interface FastEthernet0/0
ip address 170.26.0.254 255.255.0.0
ip helper-address 10.0.0.1
duplex auto
speed auto
interface FastEthernet0/1
no ip address
duplex auto
speed auto
shutdown
interface Serial0/0
no ip address
clock rate 2000000
shutdown
interface Serial0/1
no ip address
clock rate 2000000
shutdown
interface Serial0/2
ip address 11.0.0.2 255.0.0.0
interface Serial0/3
no ip address
clock rate 2000000
shutdown
router rip
version 2
network 11.0.0.0
network 106.0.0.0
network 170.26.0.0
ip classless
ip flow-export version 9
line con 0
line aux 0
line vty 0 4
login
end
```

Good router reports confirming all configuration details

Element 2

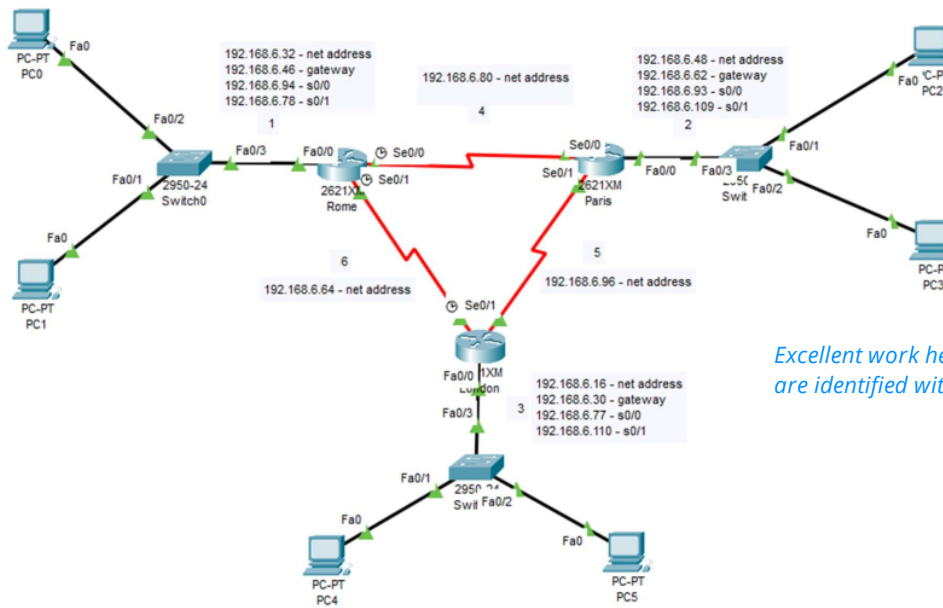
2.1 Introduction

Element *Avoid first person terms*

In this segment, we'll apply the knowledge and expertise acquired from the prior section to construct a new network. This network will incorporate CIDR/27, CIDR/30, VLAN, and ACL implementations by the time this element is complete. Additionally, we'll utilize CIDR/28 throughout this segment to enhance our comprehension of CIDR's functionality and its integration into a larger network context, utilizing RIP routing as well.

This covers all tasks, but in the incorrect order

2.2 Design Requirements



Excellent work here. Net addresses are identified with port allocation

Figure 27

Networks subnetting CIDR/28

LAN Networks 1, 2 and 3

CIDR/28 London Network 3 Lan address 16 (192.168.6.16)

Subnet mask	1	1	1	1	0	0	0	0	255.255.255.240	/28
	0	0	0	0	0	0	0	0	Not used	
Net addr 16	0	0	0	1	0	0	0	1	Lowest host addr 17	
Net addr 16	0	0	0	1	0	0	1	0	Next host addr 18	
Default gateway	0	0	0	1	1	1	1	0	Fastethernet 0/0 addr 30	
Broadcast	0	0	0	1	1	1	1	1	Broadcast 31	

Correct net for London

CIDR/28 Rome Network 1 Lan address 32 (192.168.6.32)

Subnet mask	1	1	1	1	0	0	0	0	255.255.255.240 /28
	0	0	0	0	0	0	0	0	Not used
Net addr 32	0	0	1	0	0	0	0	1	Lowest host addr 33
Net addr 32	0	0	1	0	0	0	1	0	Next host addr 34
Default gateway	0	0	1	0	1	1	1	0	Fastethernet 0/0 addr 46
Broadcast	0	0	1	0	1	1	1	1	Broadcast 47

Correct net address

CIDR/28 Paris Network 2 Lan address 48 (192.168.6.48)

Subnet mask	1	1	1	1	0	0	0	0	255.255.255.240 /28
	0	0	0	0	0	0	0	0	Not used
Net addr 48	0	0	1	1	0	0	0	1	Lowest host addr 49
Net addr 48	0	0	1	1	0	0	1	0	Next host addr 50
Default gateway	0	0	1	1	1	1	1	0	Fastethernet 0/0 addr 62
Broadcast	0	0	1	1	1	1	1	1	Broadcast 63

Good work. Correct net addresses are identified

WAN Networks 4, 5 and 6

London – Rome Network 6 Network address 64 (192.168.6.64)

London Router	0	1	0	0	1	1	0	1	Serial 0/0 addr 77
Rome Router	0	1	0	0	1	1	1	0	Serial 0/1 addr 78

Rome – Paris Network 4 Network address 80 (192.168.6.80)

Paris Router	0	1	0	1	1	1	0	1	Serial 0/0 addr 93
Rome Router	0	1	0	1	1	1	1	0	Serial 0/0 addr 94

Serial link addresses are identified

Paris –London Network 5 Network address 96 (192.168.6.96)

Paris Router	0	1	1	0	1	1	0	1	Serial 0/1 addr 109
London Router	0	1	1	0	1	1	1	0	Serial 0/1 addr 110

2.3 Implementation

CIDR/28

```
Rome#en
Rome#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Rome(config)#router rip
Rome(config-router)#ver 2
Rome(config-router)#net 192.168.6.32
Rome(config-router)#net 192.168.6.64
Rome(config-router)#net 192.168.6.80
Rome(config-router)#exit
Rome(config)#
```

Figure 28 Rome Configuration

```
London>en
London#conf t
Enter configuration commands, one per line. End with CNTL/Z.
London(config)#router rip
London(config-router)#ver 2
London(config-router)#net 192.168.6.16
London(config-router)#net 192.168.6.64
London(config-router)#net 192.168.6.96
London(config-router)#exit
London(config)#
London(config)#end
```

Figure 29 London Configuration

```
Paris>en
Paris#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Paris(config)#router rip
Paris(config-router)#ver 2
Paris(config-router)#net 192.168.6.48
Paris(config-router)#net 192.168.6.96
Paris(config-router)#net 192.168.6.80
Paris(config-router)#exit
Paris(config)#
Paris(config)#end
Paris#
```

Good evidence of implementation

Figure 30 Paris Configuration

Type	Network	Port	Next Hop IP	Metric
R	192.168.6.16/28	Serial0/1	192.168.6.77	120/1
C	192.168.6.32/28	FastEthernet0/0	---	0/0
R	192.168.6.48/28	Serial0/0	192.168.6.93	120/1
C	192.168.6.64/28	Serial0/1	---	0/0
C	192.168.6.80/28	Serial0/0	---	0/0
R	192.168.6.96/28	Serial0/0	192.168.6.93	120/1
R	192.168.6.96/28	Serial0/1	192.168.6.77	120/1

Figure 32

Type	Network	Port	Next Hop IP	Metric
R	192.168.6.16/28	Serial0/1	192.168.6.110	120/1
R	192.168.6.32/28	Serial0/0	192.168.6.94	120/1
C	192.168.6.48/28	FastEthernet0/0	---	0/0
R	192.168.6.64/28	Serial0/0	192.168.6.94	120/1
R	192.168.6.64/28	Serial0/1	192.168.6.110	120/1
C	192.168.6.80/28	Serial0/0	---	0/0
C	192.168.6.96/28	Serial0/1	---	0/0

Figure 31

Type	Network	Port	Next Hop IP	Metric
C	192.168.6.16/28	FastEthernet0/0	---	0/0
R	192.168.6.32/28	Serial0/0	192.168.6.78	120/1
R	192.168.6.48/28	Serial0/1	192.168.6.109	120/1
C	192.168.6.64/28	Serial0/0	---	0/0
R	192.168.6.80/28	Serial0/1	192.168.6.109	120/1
R	192.168.6.80/28	Serial0/0	192.168.6.78	120/1
C	192.168.6.96/28	Serial0/1	---	0/0

Routing tables are correct and show all the net addresses

Figure 33

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic
	Successful	PC0	PC2	ICMP		0.000	N
	Successful	PC2	PC0	ICMP		0.000	N
	Successful	PC3	PC5	ICMP		0.000	N
	Successful	PC5	PC3	ICMP		0.000	N
	Successful	PC1	PC4	ICMP		0.000	N
	Successful	PC4	PC1	ICMP		0.000	N

Good set of test results

Figure 34 Testing Results For CIDR/28 Networking

CIDR 27&30

CIDR/27 Networks 1,2 and 3

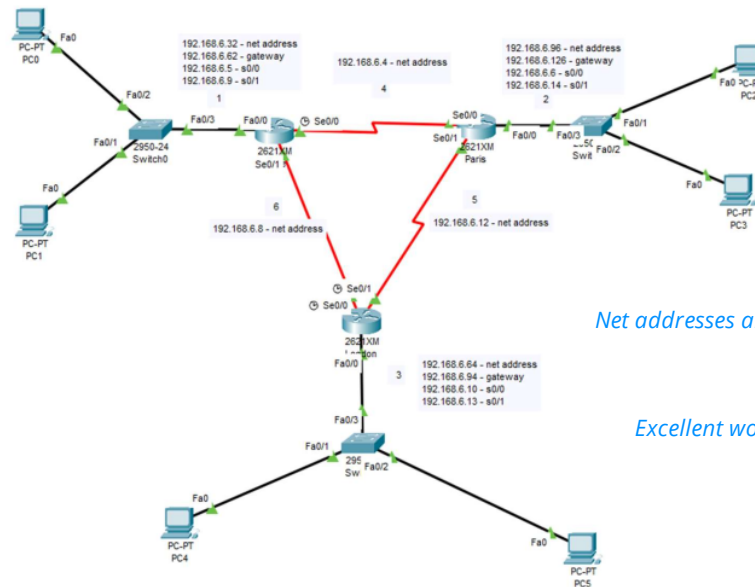
Subnet mask	1	1	1	0	0	0	0	0	255.255.255.224
	0	0	0	0	0	0	0	0	Not used
Net addr 32	0	0	1	0	0	0	0	1	Lowest host addr 33 Rome 1
Net addr 32	0	0	1	0	0	0	1	0	Next host addr 34 Rome 2
Net addr 32	0	0	1	1	1	1	1	0	Highest Router addr 62 Rome Router
Net addr 64	0	1	0	0	0	0	0	1	Lowest host addr 65 London 1
Net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

Good work. Addresses are identified

CIDR/30 Networks 4,5 and 6

Subnet mask	1	1	1	1	1	1	0	0	255.255.255.252
	0	0	0	0	0	0	0	0	Not used
Net addr 4	0	0	0	0	0	1	0	1	Lowest interface addr 5 Rome serial 0/0
Net addr 4	0	0	0	0	0	1	1	0	Highest interface addr 6 Paris serial 0/0
Net addr 8	0	0	0	0	1	0	0	1	Lowest interface addr 9 Rome serial 0/1
Net addr 8	0	0	0	0	1	0	1	0	Highest interface addr 10 London serial 0/0
Net addr 12	0	0	0	0	1	1	0	1	Lowest interface addr 13 London serial 0/1
Net addr 12	0	0	0	0	1	1	1	0	Highest interface addr 14 Paris serial 0/1

Addresses are identified for serial links



Net addresses and ports are identified

Excellent work here

Figure 35

Rome:

```
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router rip
Router(config-router)#ver 2
Router(config-router)#net 192.168.6.32
Router(config-router)#net 192.168.6.4
Router(config-router)#net 192.168.6.8
Router(config-router)#exit
Router(config)#
```

Figure 36

Paris:

```
Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router rip
Router(config-router)#ver 2
Router(config-router)#net 192.168.6.96
Router(config-router)#net 192.168.6.4
Router(config-router)#net 192.168.6.12
Router(config-router)#exit
Router(config)#
```

Figure 37

London:

```
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router rip
Router(config-router)#ver 2
Router(config-router)#net 192.168.6.64
      ^
% Invalid input detected at '^' marker.

Router(config-router)#net 192.168.6.64
Router(config-router)#net 192.168.6.8
Router(config-router)#net 192.168.6.12
Router(config-router)#^Z
Router#
%SYS-5-CONFIG_I: Configured from console by console
```

Good config evidence

Figure 38

Routing Table for Rome				
Type	Network	Port	Next Hop IP	Metric
C	192.168.6.4/30	Serial0/0	---	0/0
C	192.168.6.8/30	Serial0/1	---	0/0
R	192.168.6.12/30	Serial0/1	192.168.6.10	120/1
R	192.168.6.12/30	Serial0/0	192.168.6.6	120/1
C	192.168.6.32/27	FastEthernet0/0	---	0/0
R	192.168.6.64/27	Serial0/1	192.168.6.10	120/1
R	192.168.6.96/27	Serial0/0	192.168.6.6	120/1

Figure 39

Type	Network	Port	Next Hop IP	Metric
C	192.168.6.4/30	Serial0/0	---	0/0
R	192.168.6.8/30	Serial0/1	192.168.6.13	120/1
R	192.168.6.8/30	Serial0/0	192.168.6.5	120/1
C	192.168.6.12/30	Serial0/1	---	0/0
R	192.168.6.32/27	Serial0/0	192.168.6.5	120/1
R	192.168.6.64/27	Serial0/1	192.168.6.13	120/1
C	192.168.6.96/27	FastEthernet0/0	---	0/0

Figure 40

Type	Network	Port	Next Hop IP	Metric
R	192.168.6.4/30	Serial0/1	192.168.6.14	120/1
R	192.168.6.4/30	Serial0/0	192.168.6.9	120/1
C	192.168.6.8/30	Serial0/0	---	0/0
C	192.168.6.12/30	Serial0/1	---	0/0
R	192.168.6.32/27	Serial0/0	192.168.6.9	120/1
C	192.168.6.64/27	FastEthernet0/0	---	0/0
R	192.168.6.96/27	Serial0/1	192.168.6.14	120/1

Dynamic routing tables are correct and show all net addresses

Figure 41

PDU List Window							
Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic
	Successful	PC0	PC2	ICMP		0.000	N
	Successful	PC2	PC0	ICMP		0.000	N
	Successful	PC5	PC3	ICMP		0.000	N
	Successful	PC3	PC5	ICMP		0.000	N
	Successful	PC1	PC4	ICMP		0.000	N
	Successful	PC4	PC1	ICMP		0.000	N

Good set of test results

Figure 42 Testing Results For CIDR/27 & CIDR/30

VLANs London Router/Switch for CIDR/27 sub network

FastEthernet 0/0.1	0	1	0	1	1	1	1	0	Net addr 64 i/f addr 94
FastEthernet 0/0.2	1	0	0	1	1	1	1	0	Net addr 128 i/f addr 158
PC1 London	0	1	0	0	0	0	0	1	Net addr 64 host addr 65
PC2 London	1	0	0	0	0	0	0	1	Net addr 128 host addr 129

*Good work.
Additional
address is
identified*

London Router – FastEthernet 0/0.1 ip address 192.168.30.94 255.255.255.224 *Inter-Vlan routing*

London Router – FastEthernet 0/0.2 ip address 192.168.30.158 255.255.255.224 *identified*

London Switch – FastEthernet 0/24 – linked to London Router with encapsulation vlan 2 and vlan 3

London Switch – FastEthernet 0/2 – set as vlan 2 linked to PC1 London

London Switch – FastEthernet 0/3 – set as vlan 3 linked to PC2 London

London, located in network 2, will serve as the router for configuring VLANs. The VLAN setup relies on the established and validated CIDR/27 and CIDR/30 networks. The concept behind VLAN networking involves connecting two distinct networks to the same router port through a switch. *Good point made*

```
London#show ip int brie
Interface      IP-Address      OK? Method Status      Protocol
FastEthernet0/0 unassigned      YES manual up          up
FastEthernet0/0.2 192.168.6.94    YES manual up          up
FastEthernet0/0.3 192.168.6.158   YES manual up          up
FastEthernet0/1    unassigned      YES unset  administratively down down
Serial0/0         192.168.6.10    YES manual up          up
Serial0/1         192.168.6.13    YES manual up          up
```

Good evidence of config

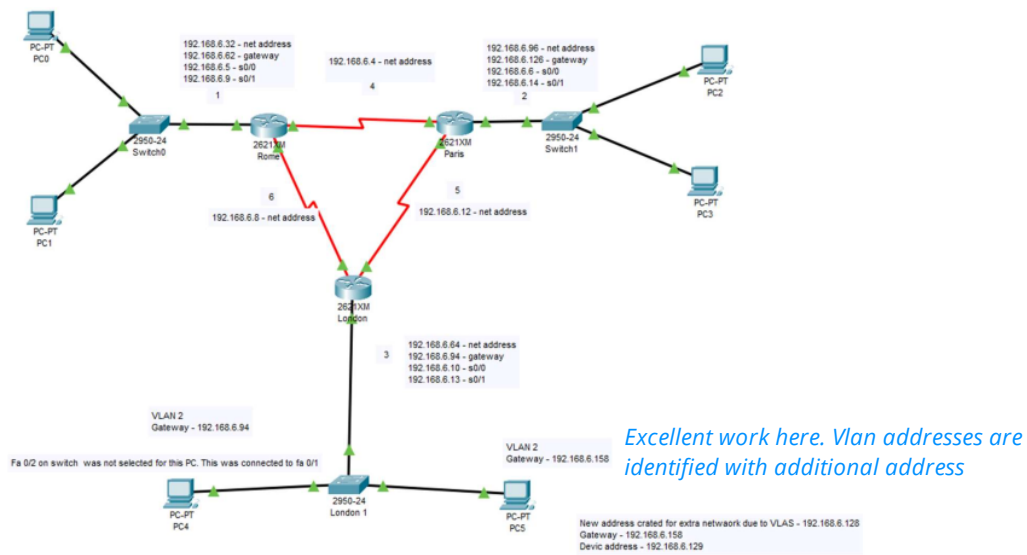


Figure 43

To ensure that the network was in full working order, the data was sent between the PCs to see if they were successful in doing so. As you can see there was some fails however after repeating the same source and destination again it shown it was successful. *A good realistic comment*

PDU List Window						
Fire	Last Status	Source	Destination	Type	Color	Time(sec)
	Successful	PC4	PC5	ICMP		0.000
	Successful	PC5	PC4	ICMP		0.000
	Successful	PC3	PC5	ICMP		0.000
	Failed	PC5	PC2	ICMP		0.000
	Successful	PC5	PC2	ICMP		0.000
	Failed	PC5	PC0	ICMP		0.000
	Successful	PC5	PC0	ICMP		0.000
	Successful	PC4	PC3	ICMP		0.000
	Failed	PC4	PC1	ICMP		0.000
	Successful	PC4	PC1	ICMP		0.000

Good test result showing the error has been corrected. The simulation like the prac takes around 35 seconds to reset. This is the reason for errors.

Figure 44 Testing Results For VLAN

2.4 Evaluation

The successful construction and thorough testing of CIDR networks and VLANs demonstrate a solid understanding of these concepts. Every aspect of the network has been carefully verified to ensure it operates as intended, and it's appropriate to use the knowledge and understanding to help with continuing these activities in the next element.

This should be more detailed

Element 3

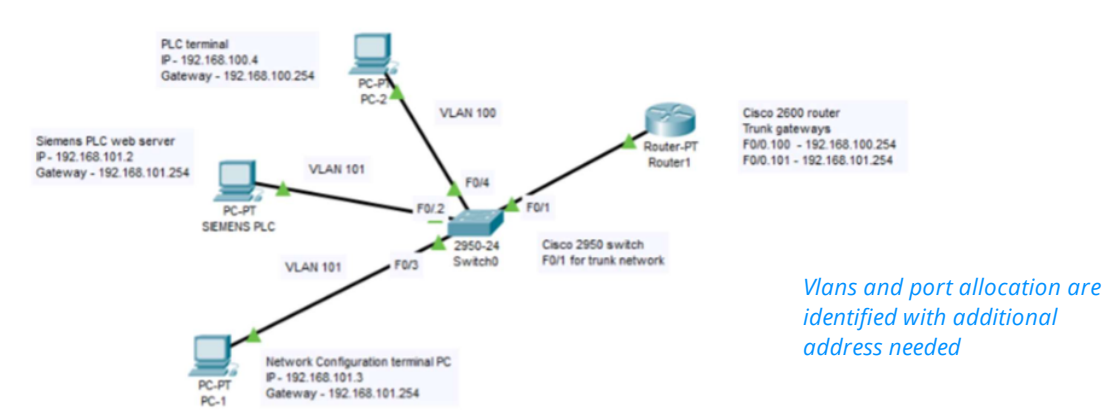
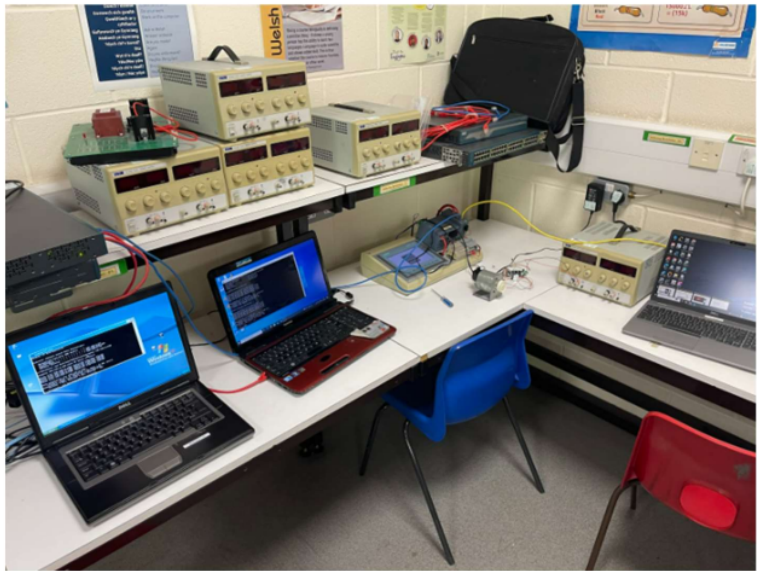


Figure 46 Diagram of Physical System



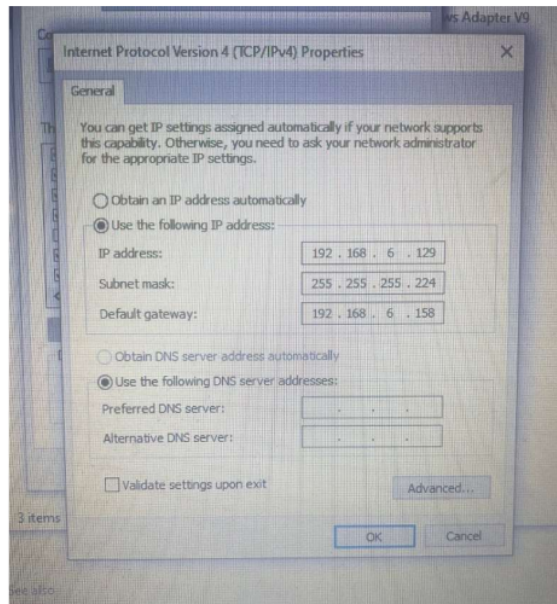
Good image of prac setup

Figure 45 Physical Setup

3.1 Router and Switch Configuration

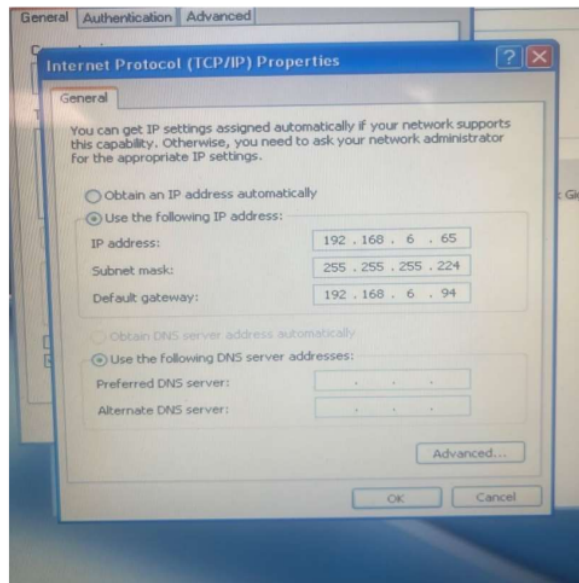
The physical setup consists of 3 Laptops, Siemens PLC, Cisco 2600 router and a Cisco 2950 switch.

Shown below is the IP address setup



Good evidence of address config

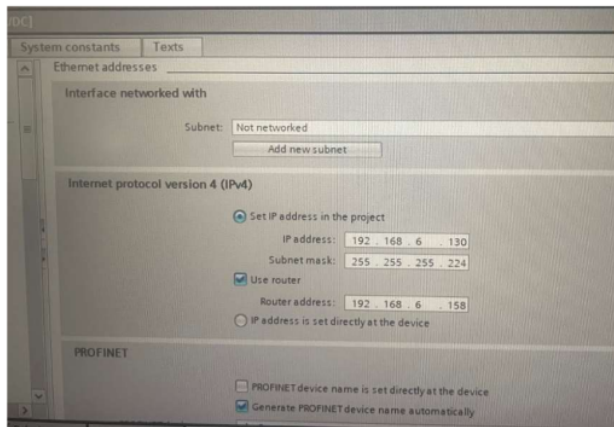
Figure 47



Good evidence

Figure 48

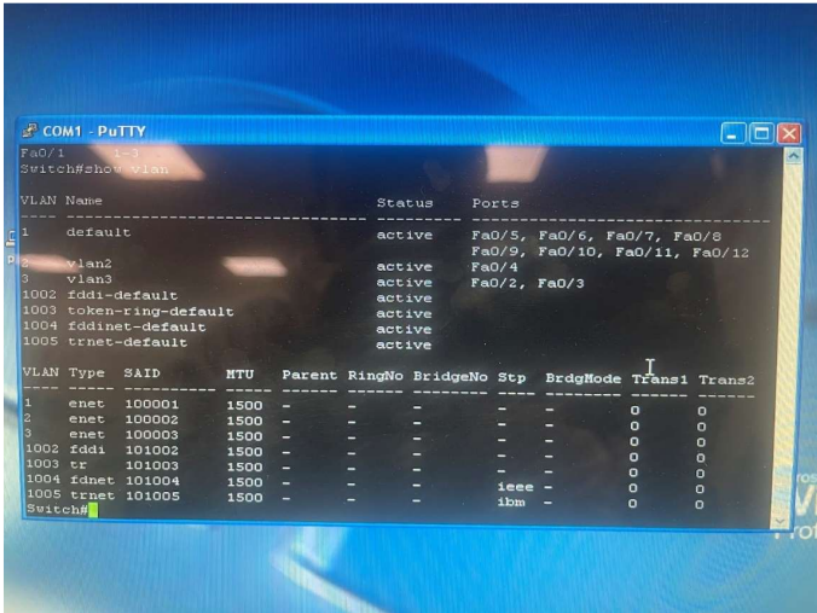
Below is an image of the PLC IP address being setup



Good evidence of PLC gateway using router config

Figure 49

The images below show the configuration stages of the VLAN.



COM1 - PuTTY

```
Fa0/1 1-3
Switch#show vlan
```

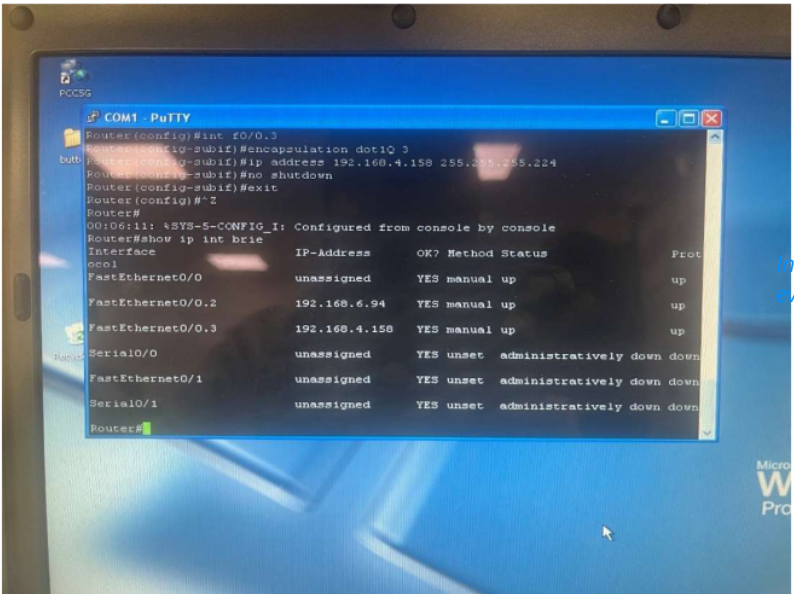
VLAN	Name	Status	Ports
1	default	active	Fa0/5, Fa0/6, Fa0/7, Fa0/8
2	vlan2	active	Fa0/9, Fa0/10, Fa0/11, Fa0/12
3	vlan3	active	Fa0/4
1002	fdi-default	active	Fa0/2, Fa0/3
1003	token-ring-default	active	
1004	fdinet-default	active	
1005	trnet-default	active	

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	fdi	101002	1500	-	-	-	-	-	0	0
1003	tr	101003	1500	-	-	-	-	-	0	0
1004	fdnet	101004	1500	-	-	-	ieee	-	0	0
1005	trnet	101005	1500	-	-	-	ibm	-	0	0

Switch#

Evidence of Vlan config with port allocation

Figure 50



COM1 - PuTTY

```
Router(config)#int f0/0.3
Router(config-subif)#encapsulation dot1Q 3
Router(config-subif)#ip address 192.168.4.158 255.255.255.224
Router(config-subif)#no shutdown
Router(config-subif)#exit
Router(config)#^Z
Router#
00:06:11: %SYS-5-CONFIG_I: Configured from console by console
Router#show ip int brie
```

Interface	IP-Address	OK?	Method	Status	Prot
FastEthernet0/0	unassigned	YES	manual	up	up
FastEthernet0/0.2	192.168.6.94	YES	manual	up	up
FastEthernet0/0.3	192.168.4.158	YES	manual	up	up
Serial0/0	unassigned	YES	unset	administratively down	down
FastEthernet0/1	unassigned	YES	unset	administratively down	down
Serial0/1	unassigned	YES	unset	administratively down	down

Router#

Inter-Vlan routing evidence

Figure 51

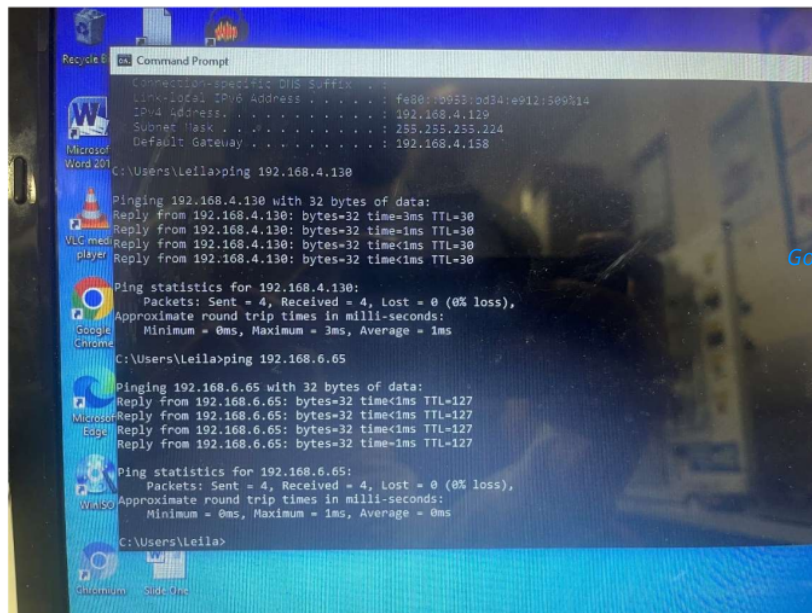


Figure 52

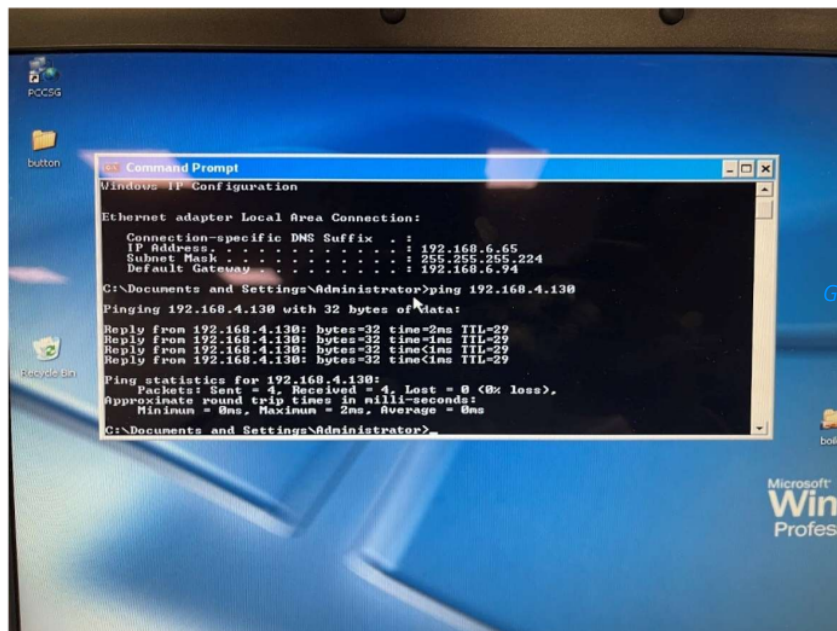


Figure 53

Tests show comms over Vlans

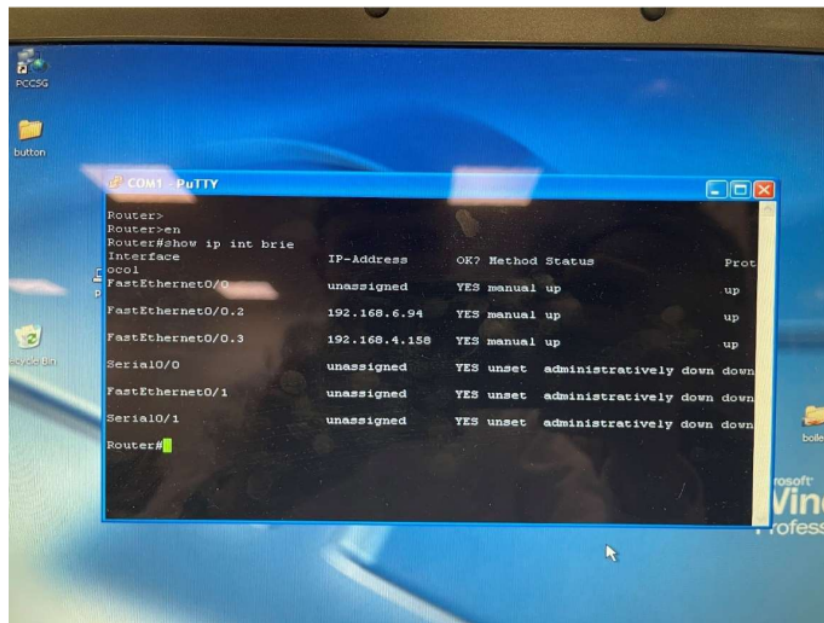


Figure 54

The PLC program with web server should be explained here

3.2 Test and Analysis

DC motor ruuning with 60% PWM duty cycle selected and motor run staus on:

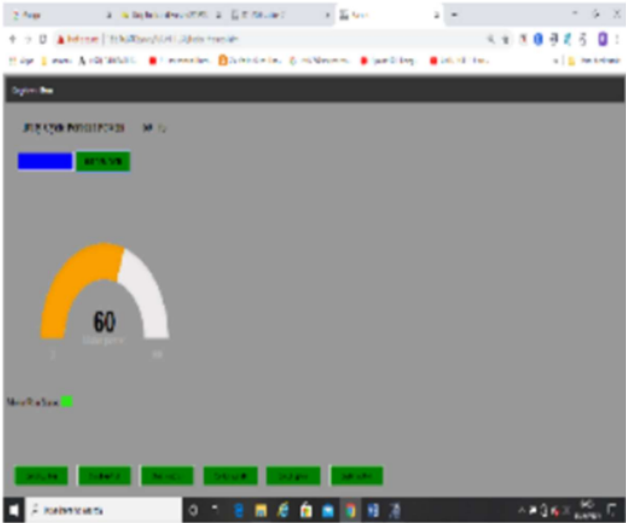


Figure 55 Motor Test

Good test showing motor speed control over browser

Name	Address	Display format	Monitor value	Mo
*Motor Speed ...	%QW1000	Hex	16#003C	
Motor RUN	%IO.4	Bool	TRUE	
webdata.Motor...		DEC+/-	60	

Figure 56 Watch Table

This should have some explanation

DC motor ruuning with 20% PWM duty cycle selected and motor run staus on:

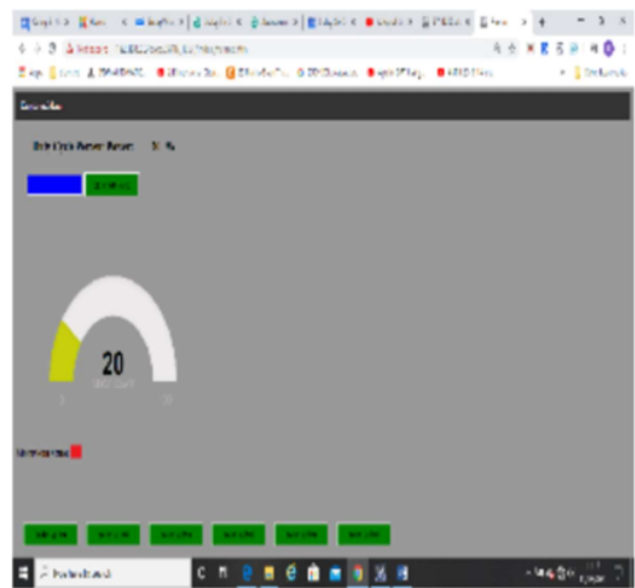


Figure 57 Motor Test

Good test over Vlan

Name	Address	Display format	Monitor value
*Motor Speed ...	%QW1000	Hex	16#0000
*Motor RUN"	%IO.4	Bool	FALSE
*webdata".Motor...		DEC+/-	0

Figure 58 Watch Table

3.3 Evaluation

In the prototype element, the PLC was positioned adjacent to the PC. However, in a real-world scenario with enhanced security measures, the PC and PLC could be located at opposite ends of the globe. This concept aligns with the fundamental principle of Industry 4.0, currently under development. In Industry 4.0, all devices theoretically have the capability to connect and communicate with one another, offering extensive production feedback and enhanced self-diagnostic possibilities. *Good point*

An important aspect of Industry 4.0 is that communication primarily occurs over Ethernet networks, as demonstrated in this element. With future advancements in PLC systems and the integration of JavaScript, the potential for utilizing more complex web pages increases. These web pages could offer capabilities and responsiveness comparable to, or even surpassing, traditional HMI screens.

Moreover, with adequate security measures in place, these systems could be connected to the global network, allowing access and monitoring from any location worldwide.

Good evaluation

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Good number of sources

FINAL GRADE

GENERAL COMMENTS

65/100

PAGE 1

PAGE 2

Text Comment. Good detailed table of contents

PAGE 3

PAGE 4

Text Comment. Good extensive list of figures

PAGE 5

Text Comment. Good relevant diagram

Text Comment. Good points made

Text Comment. Citation is correct

Text Comment. Layers are identified

PAGE 6

Text Comment. Good work

Text Comment. Relevant diagram

Text Comment. This is the point here

Text Comment. Good work with encapsulation, however, decapsulation needs to be explained also.

PAGE 7

Text Comment. Good point

Text Comment. Correct citation

Text Comment. Very good point here

Text Comment. Correct citation

Text Comment. Good point

Text Comment. Good point. Port numbers are identified as software entities.

Text Comment. Good work here

PAGE 8

Text Comment. Excellent work here

Text Comment. switches

Text Comment. Good net config with port allocation

PAGE 9

Text Comment. Good evidence

PAGE 10

Text Comment. Good evidence

PAGE 11

Text Comment. Good evidence

Text Comment. Good test results showing comms across networks in both directions

Text Comment. Config evidence shows the address allocations

Text Comment. routing tables show correct routing net addresses

Text Comment. Good set of test results

Text Comment. This could have been explained a little more in detail

Text Comment. Good config evidence

Text Comment. Good test

Text Comment. Test showing error

Text Comment. Test showing error

Text Comment. Good explanation

Text Comment. Good config showing helper addresses

Text Comment. Test results show error is rectified

Text Comment. Good config evidence

Text Comment. Test shows excluded addresses for first 10 addresses

Text Comment. A very good point

Text Comment. Good evaluation

PAGE 20

PAGE 21

PAGE 22

PAGE 23

Text Comment. Good router reports confirming all configuration details

PAGE 24

Text Comment. Avoid first person terms

Text Comment. Element

Text Comment. This covers all tasks, but in the incorrect order

PAGE 25

Text Comment. Excellent work here. Net addresses are identified with port allocation

Text Comment. Correct net for London

PAGE 26

Text Comment. Correct net address

Text Comment. Good work. Correct net addresses are identified

Text Comment. Serial link addresses are identified

PAGE 27

PAGE 28

Text Comment. Good evidence of implementation

PAGE 29

PAGE 30

Text Comment. Routing tables are correct and show all the net addresses

Text Comment. Good set of test results

PAGE 31

Text Comment. Good work. Addresses are identified

Text Comment. Addresses are identified for serial links

PAGE 32

Text Comment. Net addresses and ports are identified

Text Comment. Excellent work here

PAGE 33

Text Comment. Good config evidence

PAGE 34

Text Comment. Dynamic routing tables are correct and show all net addresses

PAGE 35

Text Comment. Good set of test results

PAGE 36

Text Comment. Good work. Additional address is identified

Text Comment. Inter-Vlan routing identified

Text Comment. Good point made

Text Comment. Good evidence of config

PAGE 37

Text Comment. Excellent work here. Vlan addresses are identified with additional address

Text Comment. A good realistic comment

Text Comment. Good test result showing the error has been corrected. The simulation like the prac takes around 35 seconds to reset. This is the reason for errors.

PAGE 38

Text Comment. This should be more detailed

PAGE 39

Text Comment. Vlans and port allocation are identified with additional address needed

Text Comment. Good image of prac setup

PAGE 40

Text Comment. Good evidence of address config

PAGE 41

Text Comment. Good evidence

Text Comment. Good evidence of PLC gateway using router config

PAGE 42

Text Comment. Evidence of Vlan config with port allocation

Text Comment. Inter-Vlan routing evidence

PAGE 43

Text Comment. Good test from host

Text Comment. Good test from host

Text Comment. Tests show comms over Vlans

PAGE 44

Text Comment. The PLC program with web server should be explained here

PAGE 45

Text Comment. Good test showing motor speed control over browser

Text Comment. This should have some explanation

PAGE 46

Text Comment. Good test over Vlan

PAGE 47

Text Comment. Good point

Text Comment. Good evaluation

PAGE 48

Text Comment. Good number of sources

GRADING FORM: CSG-RUBIC

JOSHUA THOMAS

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RESEARCH-INFORMED LITERATURE



Research includes very good significant points and identifies ports as software entities.
Decapsulation not explained.
Good number of sources used.

7/10

KNOWLEDGE AND UNDERSTANDING



E1. is designed with a good schematic address table and implemented using the chosen address scheme. The exclusion address config is included. 7/10

Element 2 address tables are correct. There should be more explanations about the Vlan section.

E2. Evaluation should be more detailed.

practical has been configured. . 6/10

E3. The program files have not been explained. No explanation for PLC web server config and program for display on browser. 6/10

19/30

ANALYSIS



E1 test evidence is included and explained. The tests are successful and in a good order. Limited evaluation. 3/5

E2 - The test results prove the operation of the network for all CIDR arrangements. The VLAN is developed from the final CIDR design and tests prove the configuration. 7/10

E3 - Practical VLAN test evidence is provided and indicate the correct functioning of the network. The PLC functions are tested with evidence directly from the PLC and browser matching. A good evaluation. Explaantions should be given. 6/10

16/25

PRACTICAL APPLICATION AND DEP.



E1 - Implementation from topology design carried out using address schema table method. Testing procedure tested every device in every direction and proved successful. 4/5

E2 - Implementations for CIDR are successful.

13/20

Network was further developed for VLAN. 3.5/5
E3. The practical network has been successfully
implemented and tested. The PLC router config
evidence is missing and the program files have not
been explained.

No implementation explanation for PLC program
and web server config. 5.5/10

SKILLS FOR PROFESSIONAL PRAC.



A good report despite some minor errors and
some content missing. 10/15

10/15