

1451789

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Extensive list of figures

Element 1

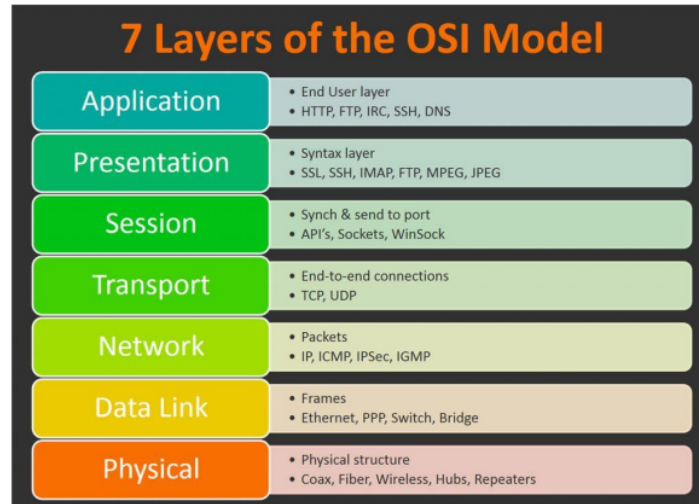
1. Introduction

The following element will consist of a research section that will introduce a number of areas within the Network topic area. Once the research was completed first design of a network was compiled. The network will consist of three LAN networks and connected by two WAN networks. A suitable addressing scheme was chosen as the design element. The implementation will include different types of routing and dynamic addressing. The tests will consist of pinging each router and prove it is successful.

Intro shows the understanding of the brief

2. Research

2.1 OSI 7 Layer



Good supporting image

Figure 1 - OSI 7 Layer Model (Raza, 2018).

Layer 7 – Application

This is “Closest end to the user”, this receives the information directly from the user and displays incoming data to the user. The applications themselves do not reside at the application layer. The layers communicate through the lower layers this is to establish connections through the applications on the other end. The examples of communications in this layer are web browsers such as (Google Chrome, Safari and Firefox) (Shaw, 2022).

Layer 6 – Presentation

Represents the layer that is independent of the data representation at the application layer. This in simpler words represents the preparation or translation of the application format to format the network. The layer “presents” data for the application or the network (Shaw, 2022).

Layer 5 – Session

If two computers or other devices in the network need to talk to one another, a session will need to be created, this will be completed at the Session layer. The functions at this layer involve setup, coordination (the system response time) and the termination between applications at each end of the session (Shaw, 2022).

Layer 4 – Transport

This manages the delivery and error checking of data packets. This regulates in size, sequencing and ultimately transfer of the data between systems and hosts. The most common examples of the transport layer are TCP or Transmission Control Protocol (Forcepoint, 2022).

Layer 3 – Network

This is responsible for receiving frames from the data link layer and delivers them to their intended destinations based on the addresses contained inside the frame. The Network layer finds the appropriate destination by using logical addresses, such as IP (Internet protocol). At this stage the routers are crucial component as they quite literally route the information where it needs to proceed to between the networks (Forcepoint, 2022).

Layer 2 – Data Link

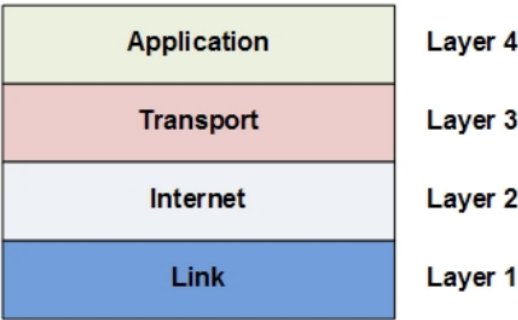
This is very similar to the network layer, except the data link layer facilitates data transfer between the two devices on the same network. The data link layer takes packets from the network layer and breaks them down into smaller pieces called the frames. Like the network layer, the data link layer is also responsible for the flow control and error control in an intra-network, (The inter-network can only achieve the transport layers of the flow control and error control (CloudFlare, 2022).

Layer 1 – Physical

This includes the physical equipment involved in the data transfer, such as the cables and switches. This layer also converts the data into a bit stream, which has the string of 1s and 0s. The physical layer of both devices must also agree on the signal convention, this means that it can be distinguished from the 0s on both devices (CloudFlare, 2022).

2.2 TCP/IP 4 Layer

Layers are explained and identified



Good supporting image

Figure 2 - TCP/IP 4 Layer Model (Pearson, 2011).

Layer 1 – Link

This is the lowest of the layers it is also referred to in previous model as the network interface layer. This link layer combines the physical and data link layer and functions into a single layer. This will include the physical frame of the network functions such as modulation, line coding and bit synchronisation and error detection. The common protocols include Address Resolution Protocol (ARP) and Neighbour Discovery Protocol (NDP) (Pearson, 2011).

Layer 2 – Internet

This is associated with the network layer on the OSI Model. The functions include the traffic routing, traffic control, fragmentation, and the logical addressing. The common protocols include IP, ICMP and IGMP (Pearson, 2011).

Layer 3 – Transport

Is typically related directly with the same layer as the OSI model. The functions of this layer include message segmentation, acknowledgement, traffic control, session multiplexing, error detection and correction. The most used protocols include Transport Control Protocol (TCP) and User Datagram Protocol (UDP) (Pearson, 2011).

Layer 4 – Application

This relates to the session, presentation, and application layers in the OSI model. The application in the TCP/IP model is to handle the process-to-process communication functions. Several functions are carried out in this layer which include, session establishment, maintenance and termination, remote access, and network management (Pearson, 2011).

The combined layers are identified in this model

2.3 Encapsulation

This is one of the fundamentals of OOP (object-oriented programming). This refers to bundling of data with the methods that operate on that data. Encapsulation method is used to hide values or the state of a structured data object, this would be inside a class, preventing unauthorised parties with direct access. Publicly accessible methods can generally be provided in the class, this is to access the values and other client classes call these methods to retrieve and this is to modify values within the object (Braunschweig, 2022).

Most important part of the object orientation is the encapsulation. The main objective is to have the data only accessed through the public interface. If the data is needed that is stored in the object to perform an action or calculate a derived value, this is defined with an appropriated method that is associated with the correct object for this application. Whenever

an action wants to be completed it is called by method in the object. It is bad practice to retrieve information from inside the object and write separate code to perform an action that is out of the object (Braunschweig, 2022).

Reasons why Encapsulation is a good idea:

- The functions are defined in one place and not in multiple places.
- Defined in a logical place – the place where the data is kept (Braunschweig, 2022).
- The data inside the object is not modified unexpectedly by the external code in a different section of the program (Braunschweig, 2022).
- This method, all that needs to be known is what the method produces and not the details about the object's internals. The switch to using an object which is completely different on the inside and not have to change any code because both objects have the same interface (Braunschweig, 2022). *This section is not explained. Decapsulation needs explaining with this. Process of headers being added and removed is what is required*

2.4 Broadcasting

This is the simultaneous transmission of the same message to multiple recipients. Regarding networking the broadcasting occurs when the data packet is received by all the networks. The issues can arise such as security when broadcasting and the lead data can be lost if the network is attacked by intruders (Techopedia, 2014).

Broadcasting can occur two ways:

- The high-level program operation, like broadcasting the Message Passing Interface (MPI).
- The low-level networking operation, this is Ethernet.

Good point here

Broadcasting is limited to basically, the local area network (LAN) systems. The performance of the LAN is impacted by the more substantial in a wide area network (WAN) (Techopedia, 2014).

Internet Protocol Version 6 (IPv6) this uses multicasting, rather than broadcasting this is used to avoid interruption to the network when services are required by the only one or two nodes. When the data is transmitted, IPv6 transmit data directly to devices and will not disturb the network device traffic (Techopedia, 2014).

In normal conditions a computer on the network will receive a packet, they will try and match the MAC address of the packet with their own. If successful it will process the packet and this will process to the OSI layer (Network layer), if it does not match then it will not process

and discarded. If the MAC address is FF:FF:FF:FF:FF:FF they will process this type of packet as it is recognised as a broadcast (Fundamentals, 2022).

MAC source addr	MAC dest. addr	Frame	Protocol	Addr, IP src	Addr, IP dest
00:80:C8:F9:72:F3	FF:FF:FF:FF:FF:FF	IP	UDP->bootps	192.168.0.1	255.255.255.255

Figure 3 - A Typical Network Broadcast

Figure 3 - A Typical Network Broadcast is the broadcast packet, the MAC address is set to FF:FF:FF:FF:FF:FF. The "Address IP destination" is set to 255.255.255.255, this is the IP broadcast address and ensures that no matter what the IP address the receiving computer(s) have it will still process it (Fundamentals, 2022). *Broadcast limitations are not identified*

2.5 Port Allocation

The dynamic port numbers are the port numbers that are available for application use when communicating with any other application, using the internet's Transmission Control Protocol (TCP) or the User Datagram Protocol (UDP) (Sheldon, 2022). *Good significant point*

When a network is TCP/IP every device must have an IP address. The IP address alone is not sufficient for running a network application, as a computer can run multiple applications. The IP address identifies the computer; however, the network port identifies the application or service that is running on the computer. The use of ports allows computers/devices to run on multiple applications and services (Steve, 2021). *Good point here*

The protocols are divided into three categories, and these are based on the range of numbers that are available (0 to 65535) (Sheldon, 2022).

System Ports – these are the well-known ports, includes the ports 0 to 1023 and support the commonly used services (Sheldon, 2022).

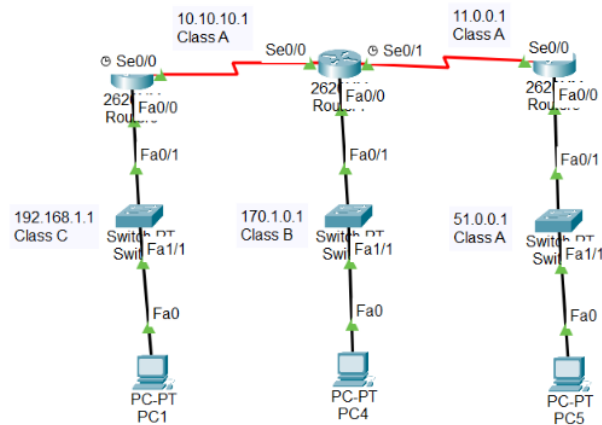
User Ports – these are known as the registered port, includes ports 1024 to 49151 and these are assigned to specific services and based on services applications submitted to IANA (Sheldon, 2022).

Dynamic Ports – the ports known as the private or ephemeral ports, this are the ports from 49152 to 65535 and are never assigned (Sheldon, 2022).

Good identification of port allocation

3. Design Requirements

3.1 Topology of the 3 LAN Networks connected by 2 WAN Networks



Schematic diagram includes net addresses. Minor error with net addresses as these end with .0

Figure 4 – Set-up of the Network

Figure 4 is the network set-up of three routers, three switch boards and three PCs. The connections are made by serial links and the three routers are connected through the switchboards using a LAN connection.

Switches

3.2 IP configuration in each of the classes

Class C

192.168.1.0 – Net Address

192.168.1.254 – Gateway address

192.168.1.1 – First Device address

Class B

170.1.0.0 – Net Address

170.1.0.254 – Gateway Address

170.1.0.1 – First Device Address

Class A

51.0.0.0 – Net address

51.0.0.254 – Gateway Address

51.0.0.1 – First Device Address

Serial Port Addresses

Address schematic is identified

10.10.10.1 – 2 – 3

11.0.0.1 – 2 – 3

Listed above are the address allocation for each device, this shows three different types of network classes. This IP configuration will be used for the routing element.

3.3 Static Routing Configuration

Below shows the static routing of each of the routers (Router 1, 2, 3).

3.3.1 IP route - Router 1

Network Address

170.1.0.0/16 via 10.10.10.2

51.0.0.0/8 via 10.10.10.2

```
C 10.0.0.0/8 is directly connected, Serial0/0
S 51.0.0.0/8 [1/0] via 10.10.10.2
S 170.1.0.0/16 [1/0] via 10.10.10.2
C 192.168.1.0/24 is directly connected, FastEthernet0/0
```

3.3.2 IP Route – Router 2

Network Address

192.168.1.0/24 via 10.10.10.1

51.0.0.0/8 via 11.0.0.2

```
C 10.0.0.0/8 is directly connected, Serial0/0
C 11.0.0.0/8 is directly connected, Serial0/1
S 51.0.0.0/8 [1/0] via 11.0.0.2
C 170.1.0.0/16 is directly connected, FastEthernet0/0
S 192.168.1.0/24 [1/0] via 10.10.10.1
```

3.3.3 IP Route – Router 3

Network Address

170.1.0.0/16 via 11.0.0.1

192.168.1.0/24 via 11.0.0.1

```
C 11.0.0.0/8 is directly connected, Serial0/0
C 51.0.0.0/8 is directly connected, FastEthernet0/0
S 170.1.0.0/16 [1/0] via 11.0.0.1
S 192.168.1.0/24 [1/0] via 11.0.0.1
```

Reports show correct routing

3.3.4 Test the Configuration

Fire	Last Status	Source	Destination	Type	Color
	Successful	PC1	PC4	ICMP	
	Successful	PC1	PC5	ICMP	
	Successful	PC4	PC1	ICMP	
	Successful	PC4	PC5	ICMP	
	Successful	PC5	PC1	ICMP	
	Successful	PC5	PC4	ICMP	

Figure 5 - Static Address Testing

Good set of test results with meaning

Figure 5 is showing the tests between each of the PCs, this is showing simple packages being sent to prove that the communication between the devices has been established.

3.4 Configuration of the three routers for the dynamic routing using the RIP (Routing Information Protocol).

```
Router(config)#conf t
%Invalid hex value
Router(config)#router rip
Router(config-router)#ver 2
Router(config-router)#net 192.168.1.0
Router(config-router)#net 10.10.10.1
Router(config-router)#net 170.1.0.0
Router(config-router)#^Z
Router#
%SYS-5-CONFIG_I: Configured from console by console
```

Figure 6 - IP Configuration for Router 1

```
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 170.1.0.0
Router(config-router)#net 10.10.10.1
Router(config-router)#net 192.168.1.0
Router(config-router)#net 11.0.0.1
Router(config-router)#net 51.0.0.0^Z
Router#
%SYS-5-CONFIG_I: Configured from console by console
```

Figure 7 - IP Configuration for Router 2

RIP configuration is correct for the address

```
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 170.1.0.0
Router(config-router)#net 11.0.0.1
Router(config-router)#net 51.0.0.0
Router(config-router)#^Z
Router#
%SYS-5-CONFIG_I: Configured from console by console
```

Figure 8 - IP Configuration for Router 3

Each IP configuration is shown in the figures above.

3.4.1 Routing RIP Tables

Type	Network	Port	Next Hop IP	Metric
C	10.0.0.0/8	Serial0/0	---	0/0
R	11.0.0.0/8	Serial0/0	10.10.10.2	120/1
R	51.0.0.0/8	Serial0/0	10.10.10.2	120/2
R	170.1.0.0/16	Serial0/0	10.10.10.2	120/1
C	192.168.1.0/24	FastEthernet0/0	---	0/0

Figure 9 - Routing Table for Router 1

Type	Network	Port	Next Hop IP	Metric
C	10.0.0.0/8	Serial0/0	---	0/0
C	11.0.0.0/8	Serial0/1	---	0/0
R	51.0.0.0/8	Serial0/1	11.0.0.2	120/1
C	170.1.0.0/16	FastEthernet0/0	---	0/0
R	192.168.1.0/24	Serial0/0	10.10.10.1	120/1

Figure 10 - Routing Table for Router 2

Type	Network	Port	Next Hop IP	Metric
R	10.0.0.0/8	Serial0/0	11.0.0.1	120/1
C	11.0.0.0/8	Serial0/0	---	0/0
C	51.0.0.0/8	FastEthernet0/0	---	0/0
R	170.1.0.0/16	Serial0/0	11.0.0.1	120/1
R	192.168.1.0/24	Serial0/0	11.0.0.1	120/2

RIP tables show routing configurations

Figure 11 - Routing Table for Router 3

The figures above are showing each of the router RIP tables.

3.4.2 RIP Configuration

```
IOS Command Line Interface

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, Serial0/0
R    11.0.0.0/8 [120/1] via 10.10.10.2, 00:00:20, Serial0/0
R    51.0.0.0/8 [120/2] via 10.10.10.2, 00:00:20, Serial0/0
R    170.1.0.0/16 [120/1] via 10.10.10.2, 00:00:20, Serial0/0
C    192.168.1.0/24 is directly connected, FastEthernet0/0
```

Figure 12 - RIP Configuration of Router 1

```
IOS Command Line Interface

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, 00:00:04, Serial0/0
C    11.0.0.0/8 is directly connected, Serial0/0
C    51.0.0.0/8 is directly connected, FastEthernet0/0
R    170.1.0.0/16 [120/1] via 11.0.0.1, 00:00:04, Serial0/0
R    192.168.1.0/24 [120/2] via 11.0.0.1, 00:00:04, Serial0/0
Router>
```

Figure 13 - RIP Configuration of Router 2

```
IOS Command Line Interface

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, Serial0/0
C    11.0.0.0/8 is directly connected, Serial0/1
R    51.0.0.0/8 [120/1] via 11.0.0.2, 00:00:27, Serial0/1
C    170.1.0.0/16 is directly connected, FastEthernet0/0
R    192.168.1.0/24 [120/1] via 10.10.10.1, 00:00:03,
Serial0/0
Router>
```

Reports prove config

Figure 14 - RIP Configuration of Router 3

The above is showing the RIP routing configuration.

3.4.3 Testing the RIP ping command

Fire	Last Status	Source	Destination	Type	Color
	Successful	PC1	PC4	ICMP	
	Successful	PC1	PC5	ICMP	
	Successful	PC4	PC1	ICMP	
	Successful	PC4	PC5	ICMP	
	Successful	PC5	PC1	ICMP	
	Successful	PC5	PC4	ICMP	

Test proves net operation, however this could be further explained for meaning. Purpose for dual direction test.

Figure 15 - The Test of the RIP Routing

Shown in Figure 15 is the successful test of the ping command to all PCs in the network. This shows that this RIP routing works in the network. Figure 15 - The Test of the RIP Routing

3.5 DHCP Configuration

3.5.1 DHCP routing

```

IOS Command Line Interface
Router#^Z
Router#^Z
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#^Z
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip dhcp pool net1
Router(dhcp-config)#net 192.168.1.0 255.255.255.0
Router(dhcp-config)#default-router 192.168.1.254
Router(dhcp-config)#dns-server 192.168.1.254
Router(dhcp-config)#exit
Router(config)#ip dhcp pool net2
Router(dhcp-config)#net 51.0.0.0 255.0.0.0
Router(dhcp-config)#default-router 51.0.0.254
Router(dhcp-config)#dns-server 51.0.0.254
Router(dhcp-config)#exit
Router(config)#ip dhcp pool net3
Router(dhcp-config)#net 170.1.0.0 255.255.0.0
Router(dhcp-config)#default-router 170.1.0.254
Router(dhcp-config)#dns-server 170.1.0.254
Router(dhcp-config)#exit
Router(config)#

```

Good evidence of configuration

Figure 16 - DHCP Routing Configuration

Figure 16 is the DHCP configuration.

3.5.2 Test DHCP without Helper Configuration

Shown below is the DHCP configuration, once they had been configured these were tested.

IP Configuration	
☒ DHCP	☐ Static
IPv4 Address	192.168.1.1
Subnet Mask	255.255.255.0
Default Gateway	192.168.1.254
DNS Server	192.168.1.254

Figure 17 - Device PC1

IP Configuration	
☒ DHCP	☐ Static
IPv4 Address	169.254.192.222
Subnet Mask	255.255.0.0
Default Gateway	0.0.0.0
DNS Server	0.0.0.0

Test proves the problem with
DHCP

Figure 18 - Device PC4

IP Configuration	
☒ DHCP	☐ Static
IPv4 Address	169.254.35.21
Subnet Mask	255.255.0.0
Default Gateway	0.0.0.0
DNS Server	0.0.0.0

Figure 19 - Device PC5

3.5.3 Helper Addressing

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

Figure 20 - Helper Addressing Router 2

Helper addresses are configured here

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

Figure 21 - Helper Addressing Router 3

Figure 20 and Figure 21 is the helper addressing for Router 2 and Router 3.

3.5.4 DHCP Helper Address Configuring Test

IP Configuration	
☒ DHCP	☐ Static
DHCP request successful.	
IPv4 Address	192.168.1.1
Subnet Mask	255.255.255.0
Default Gateway	192.168.1.254
DNS Server	192.168.1.254

Evidence of rectified problem

Figure 22 - PC1 Helper Address Test

IP Configuration	
☒ DHCP	☐ Static
DHCP request successful.	
IPv4 Address	170.1.0.1
Subnet Mask	255.255.0.0
Default Gateway	170.1.0.254
DNS Server	170.1.0.254

Figure 23 - PC4 Helper Address Test

Figure 22 and Figure 23 is the helper address, as both figures show the DHCP request was successfully transmitted.

The explanations could include the reason for the problem.

3.5.5 Address exclusion

```
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip dhcp excluded-address 192.168.1.10
Router(config)#ip dhcp excluded-address 51.0.0.1 51.0.0.10
Router(config)#ip dhcp excluded-address 192.168.1.1 192.168.1.10
Router(config)#ip dhcp excluded-address 170.1.0.1 170.1.1.10
Router(config)#exit
```

Exclusions are configured

Figure 24 - Exclusion of the Address

Figure 24 is the exclusion this is the configuration then that was tested.

3.5.6 Test for Address Exclusion

IP Configuration	
☒ DHCP	☐ Static
DHCP request successful.	
IPv4 Address	192.168.1.11
Subnet Mask	255.255.255.0
Default Gateway	192.168.1.254
DNS Server	192.168.1.254

Figure 25 - Address Exclusion Test of PC1

IP Configuration	
☒ DHCP	☐ Static
DHCP request successful.	
IPv4 Address	170.1.1.11
Subnet Mask	255.255.0.0
Default Gateway	170.1.0.254
DNS Server	170.1.0.254

Test is successful for exclusion addresses

Figure 26 - Address Exclusion Test of PC4

IP Configuration	
☒ DHCP	☐ Static
DHCP request successful.	
IPv4 Address	51.0.0.11
Subnet Mask	255.0.0.0
Default Gateway	51.0.0.254
DNS Server	51.0.0.254

More explanation here is needed for the reason and how this could be altered for any range.

Figure 27 - Address Exclusion Test of PC5

In the above figures is each of the PCs tested for the DHCP address exclusion, each test proved to be successful.

Each running configuration of the router is shown in Appendix 1.

4. Evaluation of Element 1

The research section proved to be a good starting point for the other tasks going forward. This gave an understanding into what a network is doing and what is the processes involved in networking. With this understanding the design requirements took shape, and the topology was formed. From this the topology different methods were explored such as static routing and what was found is that the router must be configured at the terminal manually. The other method, RIP dynamic routing processed many devices quickly. It also allows the router to be configured remotely, only if the IP address on the router is established. The configuration was the DHCP (Dynamic Host Communication Protocol) this is the most complex out of the configuration, when connected with the router the devices do not need the IP address as this would be automatically assigned. The findings in this configuration are that certain address can be excluded from the assignment of addresses. Overall, the research links with configurations that were tested as it gives the understanding on the behaviour of the configurations and how the tests should be presented.

Good evaluation

Element 2

1. Introduction

Grammatical error

The second element of will use the understanding of the knowledge gained in Element 1 to compile a new network to consist of the CIDR/27, CIDR/30, VLAN and ACL. The focus in this element will be on the CIDR/28 network as this can give the understanding to complete the other networks. This can also be used to assist in the implementation of the wider network with RIP routing being the focus of configuration.

Intro indicates an understanding of requirements

2. System Configuration & Requirements

The network will be triangular, three routers will be in the three cities. The ones chosen are London, Paris, and Rome. The six separate networks will include 3 LAN networks and 3 WAN networks. The connections from the router to the PCs are the LAN networks and the inter-router networks will be the WAN networks.

3. CIDR/28 Networking

3.1 Designing a Network using the CIDR/28 subnetting

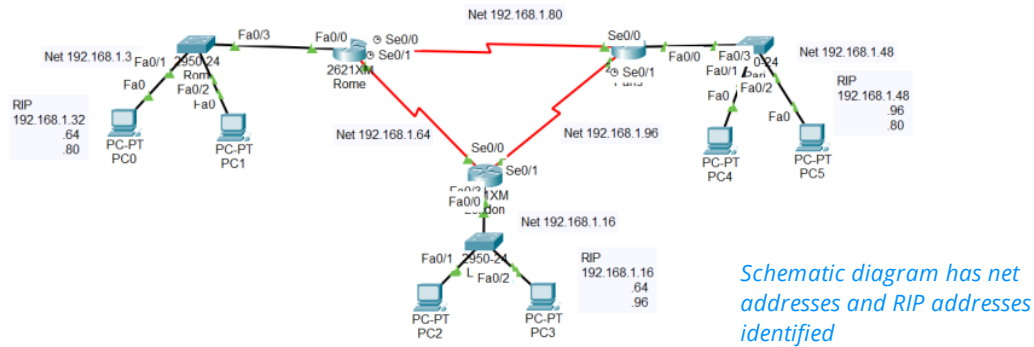


Figure 28 - A Network Creation with Packed Tracer

Figure 28 is the network that was configured to the system requirements.

3.2 CIDR/28 Network Design

Table 1 - CIDR/28 London Network 1 and Lan Address 16

Subnet is identified

Subnet mask	1	1	1	1	0	0	0	0	255.255.255.240	/28	
Net address 16	0	0	0	1	0	0	0	1	Lowest host address 17		192.168.1.17
Net address 16	0	0	0	1	0	0	1	0	Next host address18		192.168.1.18
Default gateway	0	0	0	1	1	1	1	0	Fast ethernet 0/0 address 30		192.168.1.30
	0	0	0	1	1	1	1	1	Broadcast 31		

Table is correct for .16

Table 2 - CIDR/28 Rome Network 2 and Lan Address 32

Subnet mask	1	1	1	1	0	0	0	0	255.255.255.240	/28	
Net address 32	0	0	1	0	0	0	0	1	Lowest host address 33		192.168.1.33
Net address 32	0	0	1	0	0	0	1	0	Next host address 34		192.168.1.34
Default gateway	0	0	1	0	1	1	1	0	Fast ethernet 0/0 address 46		192.168.1.46
	0	0	1	0	1	1	1	1	Broadcast 47		

Correct for .32

Table 3 - CIDR/28 Paris Network 3 and LAN address 64 This should be 48

Subnet mask	1	1	1	1	0	0	0	0	255.255.255.240	/28	
Net address 48	0	0	1	1	0	0	0	1	Lowest host address 49		192.168.1.49
Net address 48	0	0	1	1	0	0	1	0	Next host address 50		192.168.1.50
Default gateway	0	0	1	1	1	1	1	0	Fast ethernet 0/0 address 62		192.168.1.62
	0	0	1	1	1	1	1	1	Broadcast 63		

Heading is incorrect but table is correct for .48

3.2.1 WAN Networks 4,5 and 6

Table 4 - London – Rome Network 6 (Network Address 64)

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

Table is correct for .64

Table 5 - Rome – Paris Network 4 (Network Address 80)

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

Table is correct for .80

Table 6 - Paris –London Network 5 (Network address 96)

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

Table is correct for .96

3.3 Routing Tables CIDR/28

Routing Table for Rome

Type	Network	Port	Next Hop IP	Metric
R	192.168.1.16/28	Serial0/1	192.168.1.77	120/1
C	192.168.1.32/28	FastEthernet0/0	---	0/0
R	192.168.1.48/28	Serial0/0	192.168.1.93	120/1
C	192.168.1.64/28	Serial0/1	---	0/0
C	192.168.1.80/28	Serial0/0	---	0/0
R	192.168.1.96/28	Serial0/0	192.168.1.93	120/1
R	192.168.1.96/28	Serial0/1	192.168.1.77	120/1

RIP tables are configured

Figure 29 - Routing Table for Rome

Routing Table for Paris

Type	Network	Port	Next Hop IP	Metric
R	192.168.1.16/28	Serial0/1	192.168.1.110	120/1
R	192.168.1.32/28	Serial0/0	192.168.1.94	120/1
C	192.168.1.48/28	FastEthernet0/0	---	0/0
R	192.168.1.64/28	Serial0/0	192.168.1.94	120/1
R	192.168.1.64/28	Serial0/1	192.168.1.110	120/1
C	192.168.1.80/28	Serial0/0	---	0/0
C	192.168.1.96/28	Serial0/1	---	0/0

Figure 30 - Routing Table for Paris

Routing Table for London

Type	Network	Port	Next Hop IP	Metric
C	192.168.1.16/28	FastEthernet0/0	---	0/0
R	192.168.1.32/28	Serial0/0	192.168.1.78	120/1
R	192.168.1.48/28	Serial0/1	192.168.1.109	120/1
C	192.168.1.64/28	Serial0/0	---	0/0
R	192.168.1.80/28	Serial0/0	192.168.1.78	120/1
R	192.168.1.80/28	Serial0/1	192.168.1.109	120/1
C	192.168.1.96/28	Serial0/1	---	0/0

Figure 31 - Routing Table for London

3.4 Testing CIDR/28

PDU List Window ✕

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	PC0	PC2	ICMP		0.000	N	0	(edit)	(delete)
	Successful	PC3	PC0	ICMP		0.000	N	1	(edit)	(delete)
	Successful	PC3	PC4	ICMP		0.000	N	2	(edit)	(delete)
	Successful	PC5	PC2	ICMP		0.000	N	3	(edit)	(delete)
	Successful	PC1	PC4	ICMP		0.000	N	4	(edit)	(delete)
	Successful	PC5	PC0	ICMP		0.000	N	5	(edit)	(delete)

Figure 32 - Ping Test for the CIDR/28

Test table proves configuration

Figure 32 is showing the test that was completed on the CIDR/28 network. By sending prompt messages between each of the PCs. This evidence shows that all the tests were successful.

Appendix 2 is showing the London, Paris and Rome running configurations.

4. CIDR/27 Network Design

Table 7 - CIDR/27

Subnet is identified

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 Address 32	0	0	1	0	0	0	0	1	Lowest Host Address 33 Rome 1	192.168.1.33	
Net Address 32	0	0	1	0	0	0	1	0	Next Host Address 34 Rome 2	192.168.1.34	Correct
Net Address 32	0	0	1	1	1	1	1	0	Highest Router Address 62 Rome Router	192.168.1.62	
Net Address 64	0	1	0	0	0	0	0	1	Lowest Host Address 65 London 1	192.168.1.65	
Net Address 64	0	1	0	0	0	0	1	0	Next Host Address 66 London 2	192.168.1.66	Correct
Net Address 64	0	1	0	1	1	1	1	0	Highest Router Address 94 London Router	192.168.1.94	
Net Address 96	0	1	1	0	0	0	0	1	Lowest Host Address 97 Paris 1	192.168.1.97	
Net Address 96	0	1	1	0	0	0	1	0	Next Host Address 98 Paris 2	192.168.1.98	Correct
Net Address 96	0	1	1	1	1	1	1	0	Highest Router Address 126 Paris Router	192.168.1.126	

4.1 CIDR/30 Network Design

Table 8 - CIDR/30

Subnet is 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 Address 4	0	0	0	0	0	1	0	1	Lowest interface Address 5 Rome serial 0/0	192.168.1.5	
Net Address 4	0	0	0	0	0	1	1	0	Highest interface Address 6 Paris serial 0/0	192.168.1.6	
Net Address 8	0	0	0	0	1	0	0	1	Lowest interface Address 9 Rome serial 0/1	192.168.1.9	
Net Address 8	0	0	0	0	1	0	1	0	Highest interface Address 10 London serial 0/0	192.168.1.10	
Net Address 12	0	0	0	0	1	1	0	1	Lowest interface Address 13 London serial 0/1	192.168.1.13	
Net Address 12	0	0	0	0	1	1	1	0	Highest interface Address 14 Paris serial 0/1	192.168.1.14	

Table is correct

Table 7 and Table 8 are showing the network assignments for the CIDR/27 and CIDR/30. These were used to assist in implementation in the design of the networks. The CIDR/27 is implemented into the LAN (Local Area Network) and the CIDR/30 is implemented into the WAN (Wide Area Network) this is best suited to addressing for smaller networks with little devices on that network.

The broadcast address should be explained

4.3 Routing Tables for CIDR/27 and CIDR/30

The RIP routing for this configuration is shown in the below figures. By applying the CIDR class changes these can be automatically detected through the subnet mask, along with the correct IP addresses.

Significant point is identified

Type	Network	Port	Next Hop IP	Metric
C	192.168.1.4/30	Serial0/0	---	0/0
C	192.168.1.8/30	Serial0/1	---	0/0
R	192.168.1.12/30	Serial0/1	192.168.1.10	120/1
R	192.168.1.12/30	Serial0/0	192.168.1.6	120/1
C	192.168.1.32/27	FastEthernet0/0	---	0/0
R	192.168.1.64/27	Serial0/1	192.168.1.10	120/1
R	192.168.1.96/27	Serial0/0	192.168.1.6	120/1

Figure 33 - Routing Table for Rome (CIDR/27 and CIDR/30)

Type	Network	Port	Next Hop IP	Metric
R	192.168.1.4/30	Serial0/0	192.168.1.9	120/1
R	192.168.1.4/30	Serial0/1	192.168.1.14	120/1
C	192.168.1.8/30	Serial0/0	---	0/0
C	192.168.1.12/30	Serial0/1	---	0/0
R	192.168.1.32/27	Serial0/0	192.168.1.9	120/1
C	192.168.1.64/27	FastEthernet0/0	---	0/0
R	192.168.1.96/27	Serial0/1	192.168.1.14	120/1

Figure 34 - Routing Table for London (CIDR/27 and CIDR/30)

Type	Network	Port	Next Hop IP	Metric
C	192.168.1.4/30	Serial0/0	---	0/0
R	192.168.1.8/30	Serial0/0	192.168.1.5	120/1
C	192.168.1.12/30	Serial0/1	---	0/0
R	192.168.1.32/27	Serial0/0	192.168.1.5	120/1
R	192.168.1.64/27	Serial0/1	192.168.1.13	120/1
C	192.168.1.96/27	FastEthernet0/0	---	0/0

Figure 35 - Routing Table for Paris (CIDR/27 and CIDR/30)

4.4 Testing CIDR/27 and CIDR/30

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit
	Successful	PC0	PC2	ICMP		0.000	N	0	(edit)
	Successful	PC1	PC2	ICMP		0.000	N	1	(edit)
	Successful	PC2	PC0	ICMP		0.000	N	2	(edit)
	Successful	PC3	PC1	ICMP		0.000	N	3	(edit)
	Successful	PC2	PC4	ICMP		0.000	N	4	(edit)
	Successful	PC3	PC5	ICMP		0.000	N	5	(edit)
	Successful	PC4	PC3	ICMP		0.000	N	6	(edit)
	Successful	PC5	PC2	ICMP		0.000	N	7	(edit)
	Successful	PC4	PC1	ICMP		0.000	N	8	(edit)
	Successful	PC5	PC1	ICMP		0.000	N	9	(edit)
	Successful	PC0	PC4	ICMP		0.000	N	10	(edit)
	Successful	PC5	PC0	ICMP		0.000	N	11	(edit)

Test results prove configuration

Figure 36 - CIDR/27 and CIDR/30 Ping Command Test

To test the CIDR/27 and CIDR/30 were functioning correctly, the ping test was performed. This was completed by sending packets from LAN to LAN, these tests were all successful shown in Figure 36.

The running configuration for each of the routers are displayed in Appendix 3.

5. System and Design Requirements for the VLAN Network

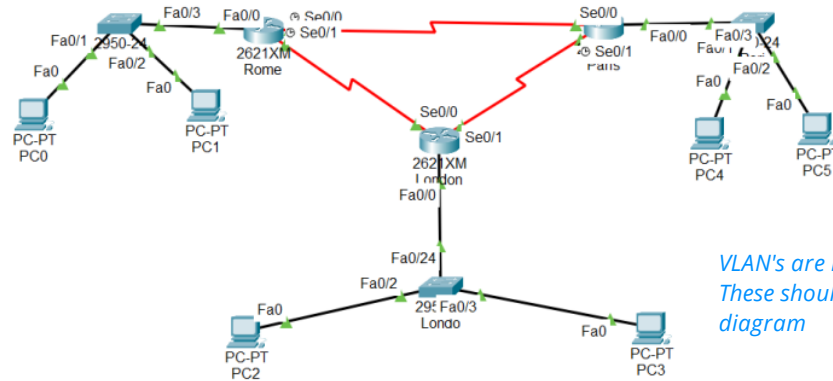


Figure 37 - VLAN Network

Figure 37 is showing the VLAN network that has been configured with the addresses shown in Table 9.

Table 9 - VLAN Network Addresses

VLAN London Network Addresses									
FastEthernet 0/0.2	0	1	0	1	1	1	1	0	Net Addresses 64 i/f Addresses 94
FastEthernet 0/0.3	1	0	0	1	1	1	1	0	Net Addresses 128 i/f Addresses 158
PC2 London	0	1	0	0	0	0	0	1	Net Addresses 64 host Addresses 65
PC3 London	1	0	0	0	0	0	0	1	Net Addresses 128 host Addresses 129

Good table
identifying port
allocation

London Router – FastEthernet 0/0.2 ip address 192.168.1.94 - 255.255.255.224

London Router – FastEthernet 0/0.3 ip address 192.168.1.158 - 255.255.255.224

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 PC2 London

Good work here

London Switch – FastEthernet 0/3 – set as vlan 3 linked to PC3 London

5.1 Implementation of the London VLAN Network

IOS Command Line Interface			
Fa0/9, Fa0/10			Fa0/11, Fa0/12,
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	Fa0/2
3	vlan3	active	Fa0/3
1002	fddi-default	active	
1003	token-ring-default	active	
1004	fddinet-default	active	
1005	trnet-default	active	

Figure 38 - VLAN Configuration

Shown in Figure 38 is the VLAN evidence of successful configuration.

IOS Command Line Interface			
FastEthernet0/24, changed state to up			
London(config-if)#^Z			
London#			
%SYS-5-CONFIG_I: Configured from console by console			
London#show interface trunk			
Port	Mode	Encapsulation	Status
vlan			Native
Fa0/24	on	802.1q	trunking
			1
Port	Vlans allowed on trunk		
Fa0/24	1-1005		
Port	Vlans allowed and active in management domain		
Fa0/24	1,2,3		
Port	Vlans in spanning tree forwarding state and not		
pruned			
Fa0/24	1,2,3		

Figure 39 - VLAN Shared Gateway Code

Figure 39 is the shared gateway code for the VLAN, this shows that the interface trunk has a connection.

```

IOS Command Line Interface
London(config-subif)#exit
London(config)#^Z
London#
%SYS-5-CONFIG_I: Configured from console by console

London#show ip int bri
Interface          IP-Address      OK? Method Status
Protocol
FastEthernet0/0    unassigned      YES manual up
up
FastEthernet0/0.2  192.168.1.94    YES manual up
up
FastEthernet0/0.3  192.168.1.158   YES manual up
up
FastEthernet0/1    unassigned      YES unset
administratively down
Serial0/0          192.168.1.10    YES manual up
up
Serial0/1          192.168.1.13    YES manual up
up

```

Figure 40 - Sub-Interface Command

Figure 40 is the IP int bri command this can show the sub interfaces in the London router.

```

London(config-subif)#encapsulation dot1Q 2
London(config-subif)#ip address 192.168.1.94 255.255.255.224
London(config-subif)#no shutdown
London(config-subif)#exit
London(config)#
London(config)#int f0/0.3
London(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

London(config-subif)#encapsulation dot1Q 3
London(config-subif)#ip address 192.168.1.158 255.255.255.224
London(config-subif)#no shutdown
London(config-subif)#exit
London(config)#^Z
London#
%SYS-5-CONFIG I: Configured from console by console

```

*Config for VLANs is
determined*

Figure 41 – Encapsulation

Figure 41 shows the method of Encapsulation on the London router this is showing the data working together within the one unit.

*The purpose of the trunking protocol should be
explained*

5.2 VLAN RIP Routing for Rome

Routing Table for Rome

Type	Network	Port	Next Hop IP	Metric
C	192.168.1.4/30	Serial0/0	---	0/0
C	192.168.1.8/30	Serial0/1	---	0/0
R	192.168.1.12/30	Serial0/0	192.168.1.6	120/1
R	192.168.1.12/30	Serial0/1	192.168.1.10	120/1
C	192.168.1.32/27	FastEthernet0/0	---	0/0
R	192.168.1.64/27	Serial0/1	192.168.1.10	120/1
R	192.168.1.96/27	Serial0/0	192.168.1.6	120/1
R	192.168.1.128/27	Serial0/1	192.168.1.10	120/1

RIP table is updated automatically

Figure 42 - Rome RIP Routing Table

The RIP routing was performed in Figure 42 this shows the VLAN sub interface gateways have been updated to the routing table dynamically. *Good significant point*

5.3 VLAN Testing

PDU List Window

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	PC2	PC3	ICMP		0.000	N	0	(edit)	(delete)
	Successful	PC3	PC2	ICMP		0.000	N	1	(edit)	(delete)
	Successful	PC2	PC1	ICMP		0.000	N	2	(edit)	(delete)
	Successful	PC2	PC0	ICMP		0.000	N	3	(edit)	(delete)
	Successful	PC3	PC1	ICMP		0.000	N	4	(edit)	(delete)
	Successful	PC3	PC0	ICMP		0.000	N	5	(edit)	(delete)
	Successful	PC3	PC4	ICMP		0.000	N	6	(edit)	(delete)
	Successful	PC3	PC5	ICMP		0.000	N	7	(edit)	(delete)

Good set of test results

Figure 43 - VLAN Ping Command Test

Using the ping command (Figure 43) the VLAN could successfully be tested through pinging messages across from one device to another.

```
Command Prompt
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.1.65

Pinging 192.168.1.65 with 32 bytes of data:

Reply from 192.168.1.65: bytes=32 time=10ms TTL=128
Reply from 192.168.1.65: bytes=32 time=2ms TTL=128
Reply from 192.168.1.65: bytes=32 time=2ms TTL=128
Reply from 192.168.1.65: bytes=32 time=3ms TTL=128

Ping statistics for 192.168.1.65:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 2ms, Maximum = 10ms, Average = 4ms
```

Ping test proves network configurations

Figure 44 - Ping in Command Prompt (PC2 to PC3)

```
Command Prompt
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.1.129

Pinging 192.168.1.129 with 32 bytes of data:

Reply from 192.168.1.129: bytes=32 time<1ms TTL=128
Reply from 192.168.1.129: bytes=32 time=3ms TTL=128
Reply from 192.168.1.129: bytes=32 time=4ms TTL=128
Reply from 192.168.1.129: bytes=32 time=2ms TTL=128

Ping statistics for 192.168.1.129:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 4ms, Average = 2ms
```

Figure 45 - Ping in Command Prompt (PC3 to PC2)

The last test (Figure 44 and Figure 45) this would test between the two London PCs. As the evidence shows the two commands transmitted the data successfully.

5.4 Access Control Lists (ACL)

This method ACL (Access Control Lists) can allow a router to deny access to the delegated device that is connected in the network. This is completed by implementing a local firewall that can be applied to a network using the configuration commands. With the configured network the Paris router will be used to deny access from the London (PC3) and London (PC2) but can access the Paris devices with permission (Figure 46). The full list of the configuration is shown in Appendix 3.3.

Good explanation

Paris(config)#hostname Paris

Paris(config)#access-list 1 deny 192.168.1.129 0.0.0.0

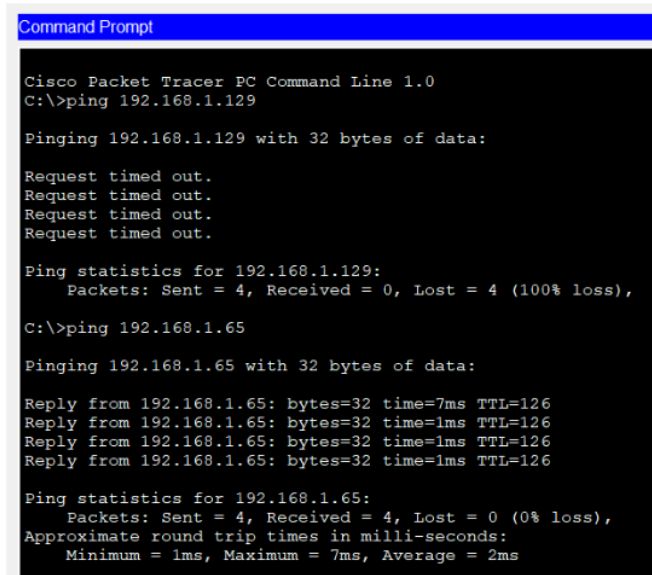
Paris(config)#access-list 1 permit any

Good evidence

Figure 46 - ACL on the VLAN

5.5 Access Control Lists (ACL) Test

Seen in Figure 47 is the command prompt window and by applying the London PC3s IP (192.168.1.129) to access the Paris network the access has been declined and the ping command has timed out, meaning that the Paris did not receive any communication or data. Further down the commands the London PC2s (192.168.1.65) has been given access to the Paris network by receiving the data successfully (Figure 47).



```
Command Prompt

Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.1.129

Pinging 192.168.1.129 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 192.168.1.129:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\>ping 192.168.1.65

Pinging 192.168.1.65 with 32 bytes of data:

Reply from 192.168.1.65: bytes=32 time=7ms TTL=126
Reply from 192.168.1.65: bytes=32 time=1ms TTL=126
Reply from 192.168.1.65: bytes=32 time=1ms TTL=126
Reply from 192.168.1.65: bytes=32 time=1ms TTL=126

Ping statistics for 192.168.1.65:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 7ms, Average = 2ms
```

Test proves the configuration of the firewall

Figure 47 - Command Prompt for the ACL

6. Evaluation of Element 2

Looking through all the tasks in Element 2, all the tasks were completed and were a success. The method of using the CIDR and VLAN were successfully implemented and were tested to show a fully communicating and functional network. The tests on each of these methodologies were configured and communicating through a series of testing procedures. The ping test was the main method and proved the efficient way as this could instantly send the packet from one device to another. From the evidence above this showed that the LAN networks received that data successfully.

After the testing on the CIDR/28 was complete, the network had adjustments for a CIDR/27 and CIDR/30 network. This was compiled to have the use of a Virtual Local Area Network; the London network was used to complete the application to reduce the traffic on that network and reduce the risk of collisions on the network. The VLAN network methodology was thoroughly learned as the actions were visible and it shows how the implementation can be produced in day to day running of most networks. The data was transmitted through packets like previous tasks and each route were successfully operating from PC to PC.

The last section of Element 2 involved the implementation of the ACL (Access Control Lists) this was successfully configured onto the Paris network. The prevention of any data breach was proven through the chosen methods. This shows that it could be implemented into any network to prevent unwanted access.

The overall conclusion from this is that all the networks were configured in such a way that certain tasks could be carried out. To prevent access into networks and how efficient a virtual network can be. The knowledge and understanding of this type of network can be a building block towards Element 3 tasks and future projects.

Very good evaluation

Element 3

1. Introduction

This Element will focus on the expansion of the network that was created in the second Element. The reconfigured London network was used to configure the physical LAN network and will be tested for its practicality. Two PCs were used in this task, one was used for the network terminal and the other was used for the PLC terminal. The LAN network had the VLAN implemented across its network. The network was configured and then the Siemens (TIA Portal) webserver was configured in a S7-1200 PLC, once configured the IP address was typed in a web browser and this was used to control the speed of the motor.

Intro demonstrates an understanding of the requirements

2. System and Design Requirements VLAN on the London Switch

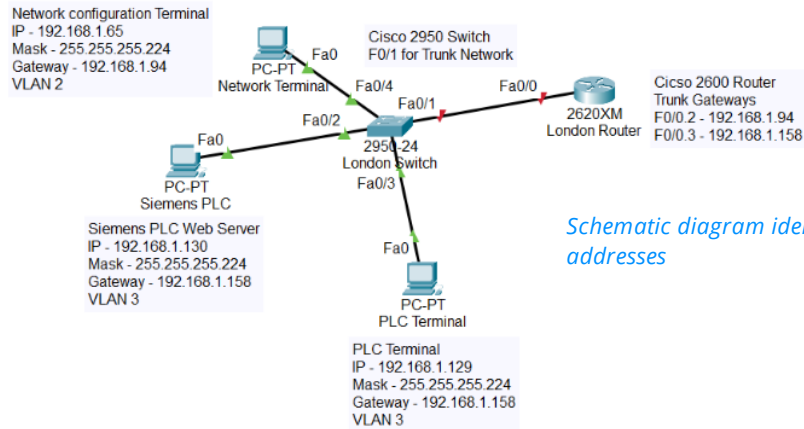


Figure 48 - Network Topology of the reconfigured London Network

Figure 48 is the configuration of the London switch as the figure shows the hardware has been configured and additions have been made; two laptop PCs, a Siemens S7-1200 PLC, a Cisco 2600 router, and a Cisco 2950 switch. This shows that when the terminal can be adjusted to control an industrial device like the PLC over a WAN network.

Good explanation

3. Implementation of the VLAN on the London Network

The implementation involved changing some sections of the Element 2, this was to allow for the practical implementation that would be required for Element 3. The switch that was used in Element 2 which was the 2950-24, a 24-channel switch and the trunk port of F0/24 was replaced with the 2950-12 switch, a 12-channel switch, and the trunk port F0/1. Once this was changed the VLAN configuration can be completed. The running of the configuration is shown in Appendix 4. Before the configuration took place reset of the router and switch took place (Appendix 4.1). *Configuration evidence is supported in the appendix*

The gateways that were configured into the PCs and the PLC are shown in Table 10.

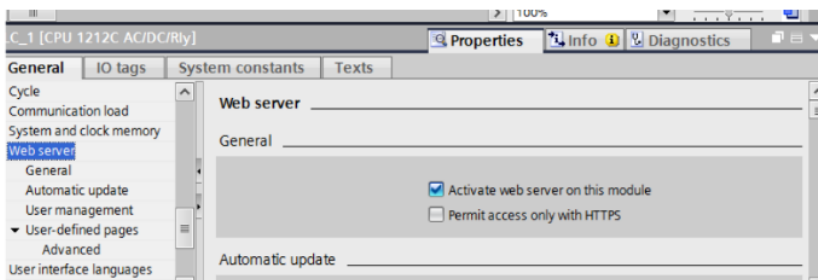
Table 10 - Gateway Addressing for Element 3

Implementation of the Gateway	
Terminal PC	192.168.1.158
PLC Gateway	192.168.1.158
PLC Programming Control PC	192.168.1.94

Table identifies VLAN address allocation

3.1 Siemens Webserver

Using the TIA Portal software, a new project was created and by editing the properties on the system device (S7-1200), the “activate web server” was issued (Figure 49).



Web server in PLC is activated

Figure 49 - Webserver activation on TIA Portal

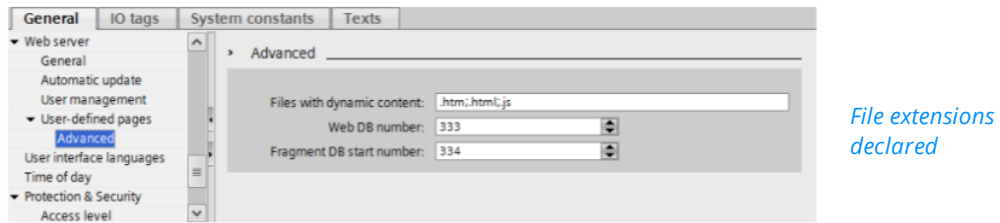


Figure 50 - The Web Server File Extensions

Figure 50 is illustrating the file extensions that were added to the program. As shown the extensions added were; htm (Hypertext Markup), html (Hypertext Markup Language), .js (Javascript) and .json (Javascript Object Notation). As this is not a S7-1500 the .js is most likely not to be accepted on the S7-1200 format but to get around this the .js program can be implemented into the HTML or HTM using the format .json. [Good point here](#)

Default tag table			
	Name	Data type	Address
<I>	Motor Speed PWM	Word	%QW1000
<I>	Motor RUN	Bool	%I0.4
<I>	Motor PWM output	Bool	%Q1.1

Figure 51 - PLC tags for the Motor Control

Figure 51 is showing the PLC tags that were made to use for the motor control. Input to start the running of the motor and an output to run the motor. The PWM speed output would be illustrated as an analogue output word.

11	Motor_PWM	Int	0
3	web_ok	Int	

Figure 52 - Data Block Tags

The values in the data block are shown in Figure 52 these will provide the data inside the data block.

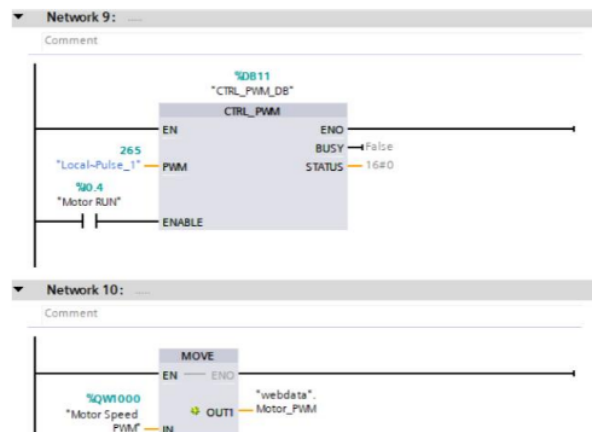


Figure 53 - Ladder for the Motor Control

Figure 53 is the ladder control on the webserver as the input of the motor is put into the data block and then the output is put into the move function and applied to the web data of the motor PWM.

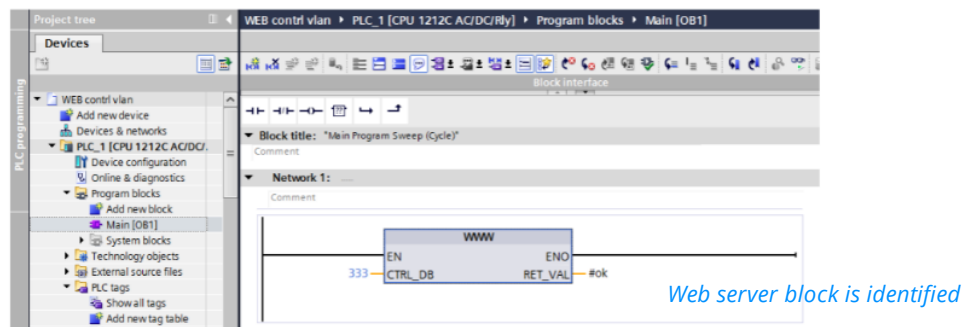


Figure 54 - Function Block that is added to the Webserver

Figure 54 is implemented into the program for remote control and the variable data values are used for the monitoring.

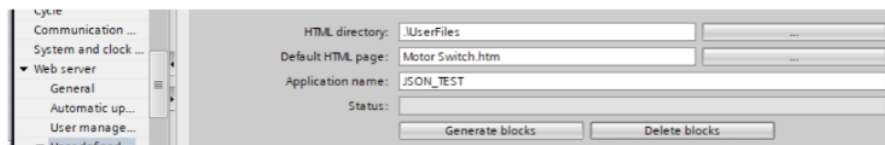
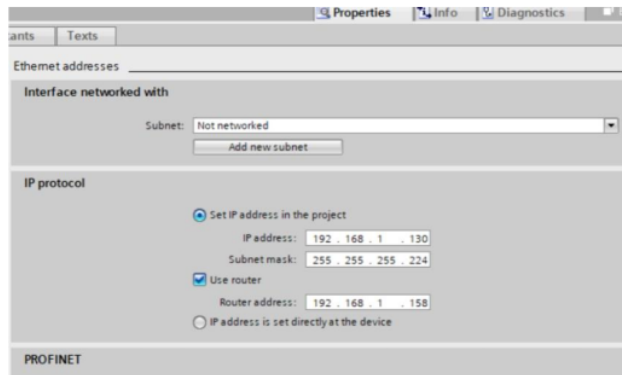


Figure 55 - The Downloaded Index

Figure 55 is the index that was downloaded into the program. This is the motor switch HTML page.



The router gateway is configured

Figure 56 – The PLC IP Configuration

Figure 56 is the IP addresses that were applied to the PLC device properties as these were chosen from the network topology (Figure 48).

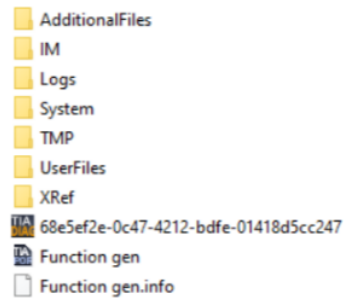


Figure 57 - PLC User Files

The user files for the PLC (Figure 57).

From each of the figures above shows how the webserver was implemented into the PLC. The HTML has two images that represent the PLC conditions. The implementation of the Javascript libraries (jQuery and json) allowed the real time data monitoring to be enabled without the use of a page refresh. Completing this visibly showed a smooth page and an increase speed of data on the refresh. After all the processes were implemented the variable data values and motor speed control were used as web pages for monitoring conditions and for remote controlling of the device.

Significant points covered

4. Program Flow Chart

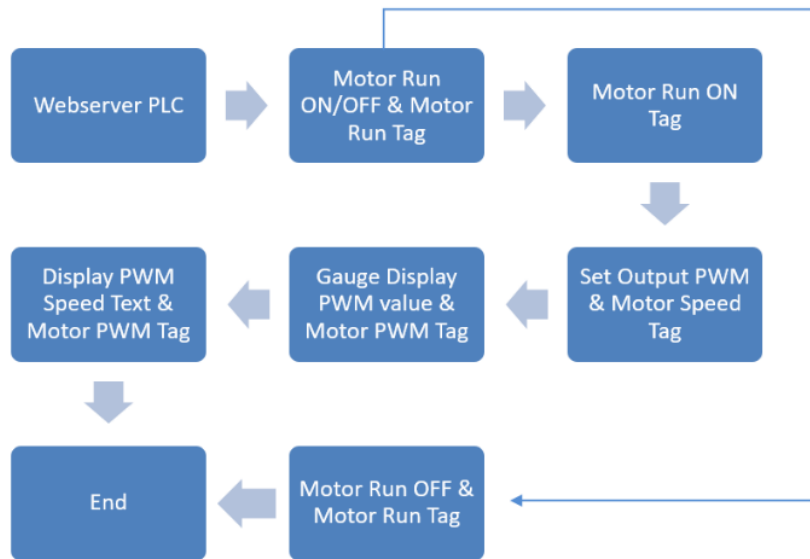


Figure 58 - Flow Chart of the Program

Figure 58 is showing the program flow chart, this is the expected outcome of the program running. This will be referred to when testing the program and see if it follows these functions.

A good illustration of the interaction of the web server

5. Testing of the VLAN with the Webserver

```
C:\Users\Joshua\ipconfig
Windows IP Configuration

Ethernet adapter Local Area Connection:

Media State . . . . . : Media disconnected
Connection-specific DNS Suffix . . : colegsirger.ac.uk

Ethernet adapter Ethernet:

Connection-specific DNS Suffix . . :
Link-local IPv6 Address . . . . . : fe80::9c84:4ccda032:1bc6%4
IPv4 Address. . . . . : 192.168.1.129
Subnet Mask . . . . . : 255.255.255.224
IPv4 Address. . . . . : 192.168.6.145
Subnet Mask . . . . . : 255.255.255.224
Default Gateway . . . . . : 192.168.1.150

C:\Users\Joshua>ping 192.168.1.65

Pinging 192.168.1.65 with 32 bytes of data:
Reply from 192.168.1.65: bytes=32 time=1ms TTL=127
Reply from 192.168.1.65: bytes=32 time=1ms TTL=127
Reply from 192.168.1.65: bytes=32 time=1ms TTL=127
Reply from 192.168.1.65: bytes=32 time=1ms TTL=127

Ping statistics for 192.168.1.65:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\Users\Joshua>ping 192.168.1.130

Pinging 192.168.1.130 with 32 bytes of data:
Reply from 192.168.1.130: bytes=32 time=1ms TTL=30
Reply from 192.168.1.130: bytes=32 time=1ms TTL=30
Reply from 192.168.1.130: bytes=32 time=1ms TTL=30
Reply from 192.168.1.130: bytes=32 time=1ms TTL=30

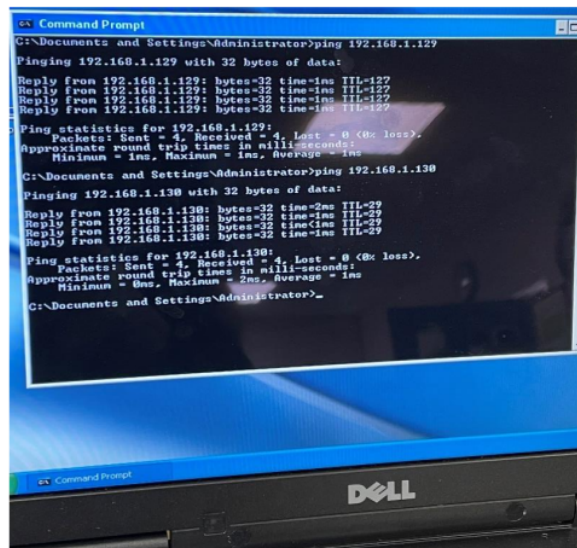
Ping statistics for 192.168.1.130:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 1ms

C:\Users\Joshua>
```

Test proves the VLAN operation

Figure 59 - VLAN Ping Test for the PLC Terminal

In Figure 59, the command prompt ping test was configured to proof the communication was established. This was between the PLC terminal to the Siemens S7-1200 and the network terminal.



Evidence of test results

Figure 60 - Ping Test of the Network Terminal

Figure 60 is showing the established communication between the network terminal to the S7-1200 and the PC terminal. The tests had been completed on both PCs and both pings show successful communication on both.

5.1 Siemens Webserver Testing

The Siemens webserver is illustrated in the images below. The design was configured for the control, speed, and the state of the motor. The technology used for this process was the Java Script. Each of the motor tests are shown below at three different duty cycle speeds.

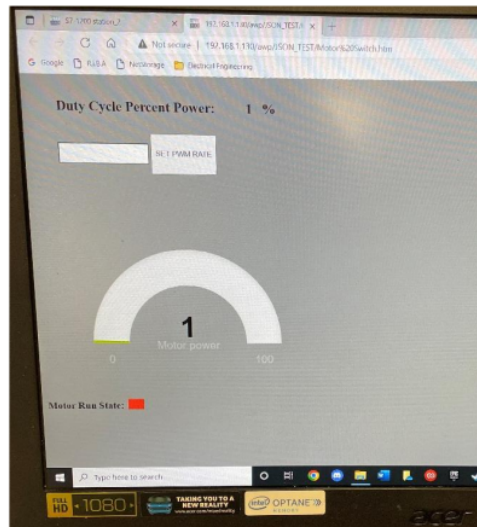
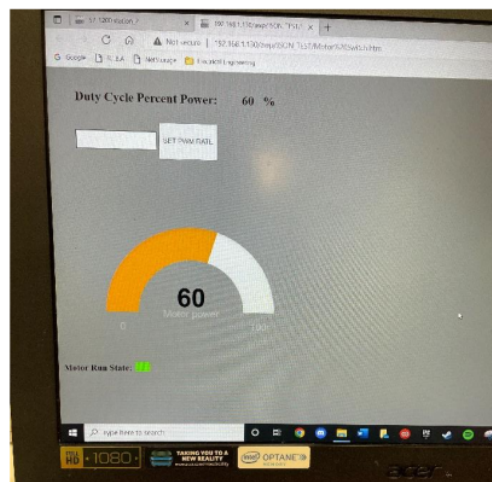


Figure 61 - Motor Duty Cycle at 1%

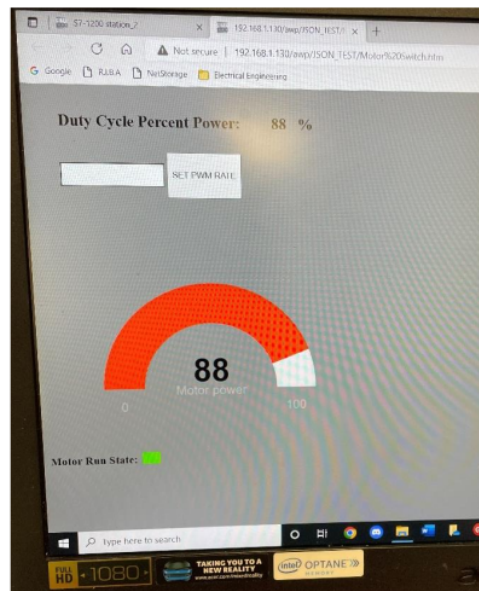
Figure 61 is the duty cycle at 1% Off State this is shown through the red lamp on, and the motor was not running. The IP address (192.168.1.130) was searched into the web browser and the webpage would be produced in the Siemens webserver.



Browser test is using VLANs configured

Figure 62 - Motor Duty Cycle at 60%

Figure 62 is the motor duty cycle at 60% this is completed by applying 60 and the motor is in the run state. The motor would run at this constant speed.



Web browser test shows results from PLC. This also needs something to confirm the same result from the PLC tag

Figure 63 - Motor Duty Cycle at 88%

Figure 63 is the 88% duty cycle, this is energised by varying the duty cycle and using the PWM (Pulse Width Modulation). This method was applied to all the different speeds.

6. Evaluation of Element 3

Element 3 of the portfolio shows that giving a HTML program that is not too complicated can produce the conditions of the PLC. Using jQuery as the program language and JSON libraries, this could be used more throughout modern technologies.

The overall tests proved a success as the data seamlessly transferred from one network to another. The security issues may arise in the real-world conditions, as this would be produced on a larger scale in industry or data transfer between countries. This is the purpose of industry 4.0 and this small concept gives an understanding of how the devices can be connected to communicate with each other. This then provides services of machinery operation and valuable data that assists personnel in everyday running of plant operations.

By introducing the implementation of JavaScript into PLC systems more intricate web pages can be produced in future. This way of displaying content could even produce more accurate data than HMIs. Using suitable security procedures and the correct setting, this can be used in worldwide networks and can be used to monitor applications from anywhere in the world.

Citation List

Braunschweig, D., 2022. *Encapsulation*. [Online]

Available at:

<https://press.rebus.community/programmingfundamentals/chapter/encapsulation/>

[Accessed 25 May 2022].

CloudFlare, 2022. *What is the OSI Model?*. [Online]

Available at: <https://www.cloudflare.com/en-gb/learning/ddos/glossary/open-systems-interconnection-model-osi/>

[Accessed 23 May 2022].

Forcepoint, 2022. *Forcepoint*. [Online]

Available at: <https://www.forcepoint.com/cyber-edu/osi-model>

[Accessed 23 May 2022].

Fundamentals, N., 2022. *Network Broadcast*. [Online]

Available at: <https://www.firewall.cx/networking-topics/general-networking/109-network-broadcast.html>

[Accessed 25 May 2022].

Pearson, 2011. *OSI and TCP/IP Model Layers*. [Online]

Available at: <https://www.pearsonitcertification.com/articles/article.aspx?p=1804869>

[Accessed 23 May 2022].

Raza, M., 2018. *OSI Model: The 7 Layers of Network Architecture*. [Online]

Available at: <https://www.bmc.com/blogs/osi-model-7-layers/>

[Accessed 23 May 2022].

Shaw, K., 2022. *The OSI model explained and how to easily remember its 7 layers*. [Online]

Available at: <https://www.networkworld.com/article/3239677/the-osi-model-explained-and-how-to-easily-remember-its-7-layers.html>

[Accessed 23 May 2022].

Sheldon, R., 2022. *Dynamic Port Numbers*. [Online]

Available at: <https://www.techtarget.com/searchnetworking/definition/dynamic-port-numbers>

[Accessed 25 May 2022].

Steve, 2021. *TCP/IP Ports and Sockets Explained*. [Online]

Available at: <http://www.steves-internet-guide.com/tcpip-ports-sockets/>

[Accessed 25 May 2022].

Techopedia, 2014. *Broadcasting*. [Online]

Available at: <https://www.techopedia.com/definition/6271/broadcasting>

[Accessed 25 May 2022].

Good number of sources

Appendix

Appendix 1

Router 1 running config

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

```
Router(config)#ip dhcp excluded-address 192.168.1.10
```

```
Router(config)#ip dhcp excluded-address 51.0.0.1 51.0.0.10
```

```
Router(config)#ip dhcp excluded-address 192.168.1.1 192.168.1.10
```

```
Router(config)#ip dhcp excluded-address 170.1.0.1 170.1.1.10
```

```
Router(config)#exit
```

```
Router#
```

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

```
Router#show run
```

```
Building configuration...
```

```
Current configuration : 1171 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 192.168.1.10
```

```
ip dhcp excluded-address 51.0.0.1 51.0.0.10
```

```
ip dhcp excluded-address 192.168.1.1 192.168.1.10
```

```
ip dhcp excluded-address 170.1.0.1 170.1.1.10
```

```
ip dhcp pool net1
```

```
network 192.168.1.0 255.255.255.0
```

```
default-router 192.168.1.254
```

```
dns-server 192.168.1.254
```

```
ip dhcp pool net2
```

```
network 51.0.0.0 255.0.0.0
```

```
default-router 51.0.0.254
```

```
dns-server 51.0.0.254
```

```
ip dhcp pool net3
network 170.1.0.0 255.255.0.0
default-router 170.1.0.254
dns-server 170.1.0.254
no ip cef
no ipv6 cef
interface FastEthernet0/0
ip address 192.168.1.254 255.255.255.0
duplex auto
speed auto
interface Serial0/0
ip address 10.10.10.1 255.0.0.0
clock rate 64000
interface Serial0/1
no ip address
clock rate 2000000
shutdown
router rip
version 2
network 10.0.0.0
network 51.0.0.0
network 170.1.0.0
network 192.168.1.0
network 198.168.1.0
ip classless
ip flow-export version 9
line con 0
line aux 0
line vty 0 4
login
end
```

Appendix 1.1

Router 2 Running Config

```
Router#show run
Building configuration...
Current configuration : 696 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 170.1.0.254 255.255.0.0
ip helper-address 10.10.10.1
duplex auto
speed auto
interface Serial0/0
ip address 10.10.10.2 255.0.0.0
interface Serial0/1
ip address 11.0.0.1 255.0.0.0
clock rate 64000
router rip
version 2
network 10.0.0.0
network 11.0.0.0
network 51.0.0.0
network 170.1.0.0
network 192.168.1.0
ip classless
ip flow-export version 9
line con 0
```

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

Appendix 1.2

Router 3 Running Config

```
Router>en
Router#show run
Building configuration...
Current configuration : 648 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 51.0.0.254 255.0.0.0
ip helper-address 10.10.10.1
duplex auto
speed auto
interface Serial0/0
ip address 11.0.0.2 255.0.0.0
interface Serial0/1
no ip address
clock rate 2000000
shutdown
router rip
version 2
network 11.0.0.0
network 51.0.0.0
```

```
network 170.1.0.0
ip classless
ip flow-export version 9
line con 0
line aux 0
line vty 0 4
login
end
```

[Appendix 2](#)

Config Rome

```
Rome>en
Rome# show run
Building configuration...
Current configuration: 710 bytes
version 12.2
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
hostname Rome
no ip cef
no ipv6 cef
interface FastEthernet0/0
ip address 192.168.1.46 255.255.255.240
duplex auto
speed auto
interface FastEthernet0/1
no ip address
duplex auto
speed auto
shutdown
interface Serial0/0
ip address 192.168.1.94 255.255.255.240
```

```
clock rate 64000
interface Serial0/1
ip address 192.168.1.78 255.255.255.240
clock rate 64000
router rip
version 2
network 192.168.1.0
ip classless
ip flow-export version 9
line con 0
line aux 0
line vty 0 4
login
end.
```

[Appendix 2.1](#)

Config London

```
London>
London> en
London# show run
Building configuration...
Current configuration: 677 bytes
version 12.2
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
hostname London
no ip cef
no ipv6 cef
interface FastEthernet0/0
ip address 192.168.1.30 255.255.255.240
duplex auto
speed auto
```

```
interface FastEthernet0/1
no ip address
duplex auto
speed auto
shutdown
interface Serial0/0
ip address 192.168.1.77 255.255.255.240
interface Serial0/1
ip address 192.168.1.110 255.255.255.240
router rip
version 2
network 192.168.1.0
ip classless
ip flow-export version 9
line con 0
line aux 0
line vty 0 4
login
end.
```

[Appendix 2.2](#)

Config Paris

```
Paris> en
Paris# show run
Building configuration...
Current configuration: 694 bytes
version 12.2
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
hostname Paris
no ip cef
no ipv6 cef
```

```
interface FastEthernet0/0
ip address 192.168.1.62 255.255.255.240
duplex auto
speed auto
interface FastEthernet0/1
no ip address
duplex auto
speed auto
shutdown
interface Serial0/0
ip address 192.168.1.93 255.255.255.240
interface Serial0/1
ip address 192.168.1.109 255.255.255.240
clock rate 64000
router rip
version 2
network 192.168.1.0
ip classless
ip flow-export version 9
line con 0
line aux 0
line vty 0 4
login
end.
```

Router reports confirm configurations

[Appendix 3](#)

Rome CIDR/27 and CIDR/30 Running Configuration

```
Rome> en
Rome# show run
Building configuration...
Current configuration: 708 bytes
version 12.2
no service timestamps log datetime msec
```

```
no service timestamps debug datetime msec
no service password-encryption
hostname Rome
no ip cef
no ipv6 cef
interface FastEthernet0/0
ip address 192.168.1.62 255.255.255.224
duplex auto
speed auto
interface FastEthernet0/1
no ip address
duplex auto
speed auto
shutdown
interface Serial0/0
ip address 192.168.1.5 255.255.255.252
clock rate 64000
interface Serial0/1
ip address 192.168.1.9 255.255.255.252
clock rate 64000
router rip
version 2
network 192.168.1.0
ip classless
ip flow-export version 9
line con 0
line aux 0
line vty 0 4
login
end.
```

[Appendix 3.1](#)

London CIDR/27 and CIDR/30 Running Configuration

```
London> en
London# show run
Building configuration...
Current configuration: 676 bytes
version 12.2
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
hostname London
no ip cef
no ipv6 cef
interface FastEthernet0/0
ip address 192.168.1.94 255.255.255.224
duplex auto
speed auto
interface FastEthernet0/1
no ip address
duplex auto
speed auto
shutdown
interface Serial0/0
ip address 192.168.1.10 255.255.255.252
interface Serial0/1
ip address 192.168.1.13 255.255.255.252
router rip
version 2
network 192.168.1.0
ip classless
ip flow-export version 9
line con 0
line aux 0
line vty 0 4
```

login

end.

[Appendix 3.2](#)

Paris CIDR/27 and CIDR/30 Running Configuration

Paris> en

Paris# show run

Building configuration...

Current configuration: 693 bytes

version 12.2

no service timestamps log datetime msec

no service timestamps debug datetime msec

no service password-encryption

hostname Paris

no ip cef

no ipv6 cef

interface FastEthernet0/0

ip address 192.168.1.126 255.255.255.224

duplex auto

speed auto

interface FastEthernet0/1

no ip address

duplex auto

speed auto

shutdown

interface Serial0/0

ip address 192.168.1.6 255.255.255.252

interface Serial0/1

ip address 192.168.1.14 255.255.255.252

clock rate 64000

router rip

version 2

network 192.168.1.0

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

[Appendix 3.3](#)

```
Paris#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Paris(config)#hostname Paris
Paris(config)#access-list 1 deny 192.168.1.129 0.0.0.0
Paris(config)#access-list 1 permit any
Paris(config)#exit
Paris#
%SYS-5-CONFIG_I: Configured from console by console
Paris#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Paris(config)#int f0/0
Paris(config-if)#ip access-group 1 out
Paris(config-if)#exit
Paris(config)#
Paris(config)#^Z
Paris#
%SYS-5-CONFIG_I: Configured from console by console
Paris# show run
Building configuration...
Current configuration: 779 bytes
version 12.2
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
```

```
hostname Paris
no ip cef
no ipv6 cef
interface FastEthernet0/0
ip address 192.168.1.126 255.255.255.224
ip access-group 1 out
duplex auto
speed auto
interface FastEthernet0/1
no ip address
duplex auto
speed auto
shutdown
interface Serial0/0
ip address 192.168.1.6 255.255.255.252
interface Serial0/1
ip address 192.168.1.14 255.255.255.252
clock rate 64000
router rip
version 2
network 192.168.1.0
ip classless
ip flow-export version 9
access-list 1 deny host 192.168.1.129
access-list 1 permit any
line con 0
line aux 0
line vty 0 4
login
end.
```

Router reports confirm configuration in routers

Appendix 4

VLAN configuration:

Switch>enable

Switch#conf t

Switch(config)#vlan 2

Switch(config-vlan)#name vlan2

Switch(config-vlan)#exit

Switch is configured for VLANs

Switch(config)#vlan 3

Switch(config-vlan)#name vlan3

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 3

Switch(config-if)#exit

Switch(config)#int f0/3

Switch(config-if)#switchport mode access

Switch(config-if)#switchport access vlan 3

Switch(config-if)#exit

Switch(config)#int f0/4

Switch(config-if)#switchport mode access

Switch(config-if)#switchport access vlan 2

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 f0/0.2

Router(config-subif)#encapsulation dot1Q 2

Router(config-subif)#ip address 192.168.1.94 255.255.255.224

Router(config-subif)#no shutdown

Router(config-subif)#exit

Router(config)#int f0/0.3

Two gateways are configured for the two VLANs and the protocols

```
Router(config-subif)#encapsulation dot1Q 3
```

```
Router(config-subif)#ip address 192.168.1.158 255.255.255.224
```

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

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

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

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

```
//////////report int status for f0/0.2 and f0/0.3//////////
```

```
Router#show run
```

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

Appendix 4.1

Reset the Cisco Switch:

```
Switch#delete vlan.dat
```

```
Switch#reload
```

Reset the Cisco Router:

```
Router#erase startup-config
```

```
Router#reload
```

FINAL GRADE

GENERAL COMMENTS

Instructor

67 / 100

PAGE 1

PAGE 2

PAGE 3

PAGE 4

Text Comment. Good detailed table of contents

PAGE 5

Text Comment. Extensive list of figures

PAGE 6

Text Comment. Intro shows the understanding of the brief

PAGE 7

Text Comment. Good supporting image

PAGE 8

Text Comment. Layers are explained and identified

Text Comment. Good supporting image

PAGE 9

Text Comment. The combined layers are identified in this model

PAGE 10

Text Comment. This section is not explained. Decapsulation needs explaining with this. Process of headers being added and removed is what is required

Text Comment. Good point here

PAGE 11

Text Comment. Broadcast limitations are not identified

Text Comment. Good significant point

Text Comment. Good point here

Text Comment. Good identification of port allocation

PAGE 12

Text Comment. Schematic diagram includes net addresses. Minor error with net addresses as these end with .0

Text Comment. Switches

PAGE 13

Text Comment. Address schematic is identified

Text Comment. Reports show correct routing

Text Comment. Good set of test results with meaning

PAGE 14

Text Comment. RIP configuration is correct for the address

PAGE 15

Text Comment. RIP tables show routing configurations

PAGE 16

Text Comment. Reports prove config

PAGE 17

Text Comment. Test proves net operation, however this could be further explained for meaning. Purpose for dual direction test.

Text Comment. Good evidence of configuration

PAGE 18

Text Comment. Test proves the problem with DHCP

PAGE 19

Text Comment. Helper addresses are configured here

Text Comment. Evidence of rectified problem

Text Comment. The explanations could include the reason for the problem.

PAGE 20

Text Comment. Exclusions are configured

Text Comment. Test is successful for exclusion addresses

Text Comment. More explanation here is needed for the reason and how this could be altered for any range.

PAGE 21

Text Comment. Good evaluation

PAGE 22

Text Comment. Grammatical error

Text Comment. Intro indicates an understanding of requirements

PAGE 23

PAGE 24

Text Comment. Schematic diagram has net addresses and RIP addresses identified

Text Comment. Subnet is identified

Text Comment. Table is correct for .16

Text Comment. Correct for .32

Text Comment. This should be 48

Text Comment. Heading is incorrect but table is correct for .48

PAGE 25

Text Comment. Table is correct for .64

Text Comment. Table is correct for .80

Text Comment. Table is correct for .96

PAGE 26

Text Comment. RIP tables are configured

PAGE 27

Text Comment. Test table proves configuration

PAGE 28

Text Comment. Subnet is identified

Text Comment. Correct

Text Comment. Correct

Text Comment. Correct

Text Comment. Subnet is identified

Text Comment. Table is correct

Text Comment. The broadcast address should be explained

PAGE 29

Text Comment. Significant point is identified

PAGE 30

Text Comment. Test results prove configuration

PAGE 31

Text Comment. VLAN's are not identified here. These should be annotated in the diagram

Text Comment. Good table identifying port allocation

Text Comment. Good work here

PAGE 32

PAGE 33

Text Comment. Config for VLANs is determined

Text Comment. The purpose of the trunking protocol should be explained

PAGE 34

Text Comment. RIP tale is updated automatically

Text Comment. Good significant point

Text Comment. Good set of test results

PAGE 35

Text Comment. Ping test proves network configurations

Text Comment. Good explanation

Text Comment. Good evidence

Text Comment. Test proves the configuration of the firewall

Text Comment. Very good evaluation

Text Comment. Intro demonstrates an understanding of the requirements

Text Comment. Schematic diagram identifies the VLANs and addresses

Text Comment. Good explanation

Text Comment. Configuration evidence is supported in the appendix

Text Comment. Table identifies VLAN address allocation

Text Comment. Web server in PLC is activated

Text Comment. File extensions declared

Text Comment. Good point here

Text Comment. Web server block is identified

Text Comment. The router gateway is configured

Text Comment. Significant points covered

Text Comment. A good illustration of the interaction of the web server

PAGE 45

Text Comment. Test proves the VLAN operation

PAGE 46

Text Comment. Evidence of test results

PAGE 47

Text Comment. Browser test is using VLANs configured

PAGE 48

Text Comment. Web browser test shows results from PLC. This also needs something to confirm the same result from the PLC tag

Text Comment. Evaluation includes some good points. There should be something about the VLAN implementation on The Cisco hardware

PAGE 49

Text Comment. Good number of sources

PAGE 50

PAGE 51

PAGE 52

PAGE 53

PAGE 54

PAGE 55

PAGE 56

PAGE 57

Text Comment. Router reports confirm configurations

PAGE 58

PAGE 59

PAGE 60

PAGE 61

PAGE 62

Text Comment. Router reports confirm configuration in routers

PAGE 63

Text Comment. Switch is configured for VLANs

PAGE 64

PAGE 65

Text Comment. Two gateways are configured for the two VLANs and the protocols

GRADING FORM: CSG-RUBIC

JOSHUA WILLIAMS

67

RESEARCH-INFORMED LITERATURE



Research has parts missing, however relevant ref sources are included. Encapsulation / decapsulation is not explained with ref to the network. Broadcast limitations and remedy is not included. 5/10

5

KNOWLEDGE AND UNDERSTANDING



Element 1 - Error with schematic diagram and limited explanations. 7/10 Element 2 - Minor error in tables of addresses. VLANs not identified in diagram. Trunk protocol should be explained. Some explanations are limited and significant point missed. 6.5/10 Element 3 - VLAN has good explanations with discrepancies identified. Functions should be explained in the program. Implementation is successful. 6.5/10

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ANALYSIS



Element 1- test explanations are limited. Test evidence is included. Good evaluation. 3/5 Element 2 - 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. ACL testing proved successful with evidence of the test outcomes. Good evaluation. Minor error in address table plan . 7/10 Element 3 - practical VLAN is implemented with good address plan. Practical discrepancies are included. No test carried out to associate PLC values with web browser values. 7/10

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PRACTICAL APPLICATION AND DEP.



Element 1- implementation has the technical evidence, however there are minor errors. Testing proved successful. 3.5/5 Element 2 - Implementation evidence for CIDR is included. Good address plan and schematic diagrams. Some explanations are limited and significant points missed. 3.5/5 Element 3 - Missing explanations

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about Cisco hardware and function calls have not been explained. However system has been implemented and successfully tested. 7/10

SKILLS FOR PROFESSIONAL PRAC.



Report is a good standard and follows a logical sequence. 11/15

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