

1708159

by Jonathon Williams

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1 ELEMENT 1

1.1 RESEARCH

Every network should follow the OSI 7-layer model. The model is shown below in Figure 1.

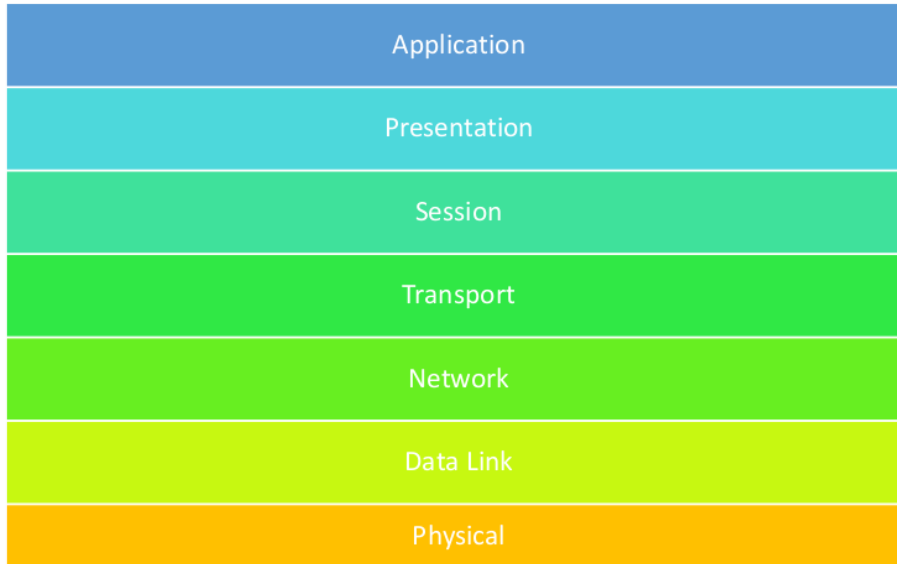


Figure 1: OSI 7-layer model

The layers must be in the specific order as shown above with application being the top layer and physical being the bottom.

The physical layer is the layer that transmits and defines how data is sent over the network. The data link is the layer that would retransmit a packet if one was corrupted. It is responsible for low level error detection. The next layer, 'Network' is responsible for routing packets across the network. The transport layer is an intermediate layer that the higher layers use to commutative to the 'network' layer. The session layer is the interface that the user would use to access the network. This manages the connection or session to the network. The presentation layer ensures that all devices are speaking the same language. This layer will encode or decode binary data for transport as well as convert text to ASCII or EBCDIC. (Marshall, 2001)

There is also a different model to networking for IP/TCP which is the OSI 4-layer model. Figure 2 below shows this model and how it compares with the 7-layer.

	7-Layer	4-Layer
7	Application	Applications (FTP,SMTP,HTTP,etc.)
6	Presentation	
5	Session	
4	Transport	TCO (host-to-host)
3	Network	IP
2	Data Link	Network access (usually ethernet)
1	Physical	

Figure 2: 7 Layer vs 4 Layer

Explanations are good
and cover the 7 layers

Good informative image
showing the combined layers

The four-layer model was being developed as OSI was published. TC/IP (4-layer) is what is used when the internet is concerned.

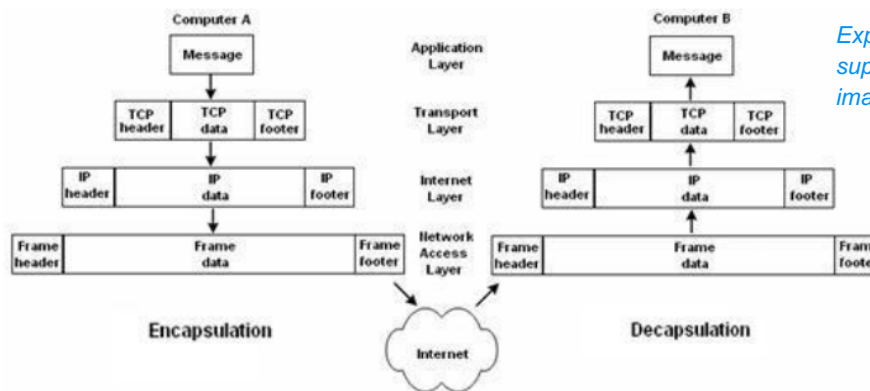
Good point here. The 4 layer was developed for networking and not so much for the application side.

Used for network to network communications. It disregards the top layers as they are for the client and not needed for network to network communications.

In both these models, information starts at one of the tables, then when it is sent, it starts at the same level it was received on and goes up as seen below.

Encapsulation is the process of putting protocol information onto data so that it can talk between the different layers. During the process of encapsulation, it will either add information in front of the data (a header) or after data (a trailer).

Decapsulation is the reverse effect where the header and trailer are removed, leaving only the data. Figure 3 below shows the system of the encapsulating and encapsulating where the headers and trailers are added and removed as the message is sent through the different layers.



Explanation is good and supported by an informative image

Figure 3: Encapsulation/ decapsulation diagram

(Network Cyclopedia, 2020)

Broadcasting is where a data packets are sent to all devices on a network simultaneously. This is illustrated in Figure 4.

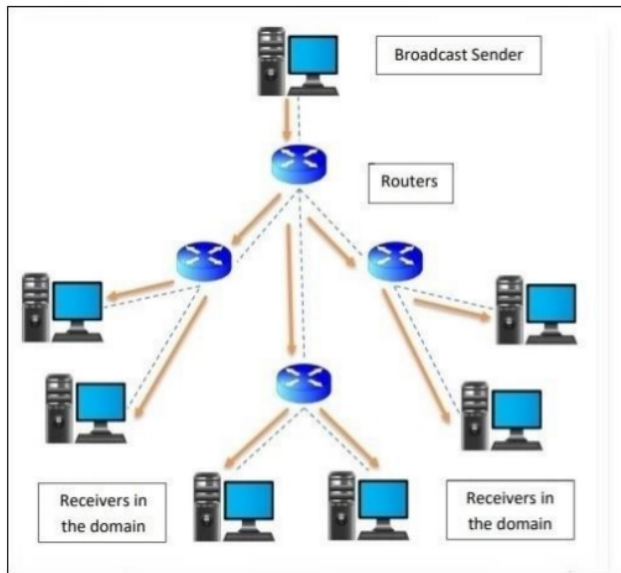


Figure 4: Broadcasting in a network

(Moumita, 2019)

Broadcasting is carried out by the broadcast sender, sending data to the broadcast address, the routers or switches in the network, then do the sending to other devices. The other types of broadcasting are unicast which is one to one and multicast which is to a group in a network. The different types are illustrated below in Figure 5. The purpose of broadcasting to be able to send data packets to revisers across the network at the same time.

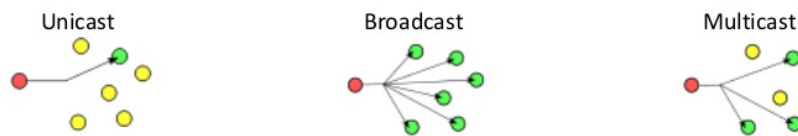


Figure 5: Broadcasting Types

The issue with broadcasting, is that it can be used by hackers to make a network redundant in denial of service attacks. The risk from these attacks can be minimised by the use of firewalls and configuring routers and switches correctly.

(US Department of Homeland Security CISA Cyber + Infrastructure , 2010)

A port is a communication end point. It has a software and protocol assigned to each number. Ports are a 1bit unsigned integer so range from 0 to 65535. The first 1023 ports are reserved for services, these are known as system ports or 'well-known ports'. A list of common ports can easily be found online. However, Table 1 below contains a list of common ports and their assignment.

(Postel, 1981)

Good image to support your explanation

Good explanation. You could also have pointed

out how to minimise broadcast domains for better security and improved performance

Table 1: Common Port Allocation

Port number	Assignment
20	File Transfer Protocol (FTP) Data Transfer
21	File Transfer Protocol (FTP) Command Control
22	Secure Shell (SSH) Secure Login
23	Telnet remote login service, unencrypted text messages
25	Simple Mail Transfer Protocol (SMTP) E-mail routing
53	Domain Name System (DNS) service
67, 68	Dynamic Host Configuration Protocol (DHCP)
80	Hypertext Transfer Protocol (HTTP) used in the World Wide Web
110	Post Office Protocol (POP3)
119	Network News Transfer Protocol (NNTP)
123	Network Time Protocol (NTP)
143	Internet Message Access Protocol (IMAP) Management of digital mail
161	Simple Network Management Protocol (SNMP)
194	Internet Relay Chat (IRC)
443	HTTP Secure (HTTPS) HTTP over TLS/SSL

*Explanation
is good and
supported
with the
table of

significant
assigned
ports*

1.2 ADDRESS SCHEME

A suitable address scheme has been configured which includes class A, B and C for LAN networks.

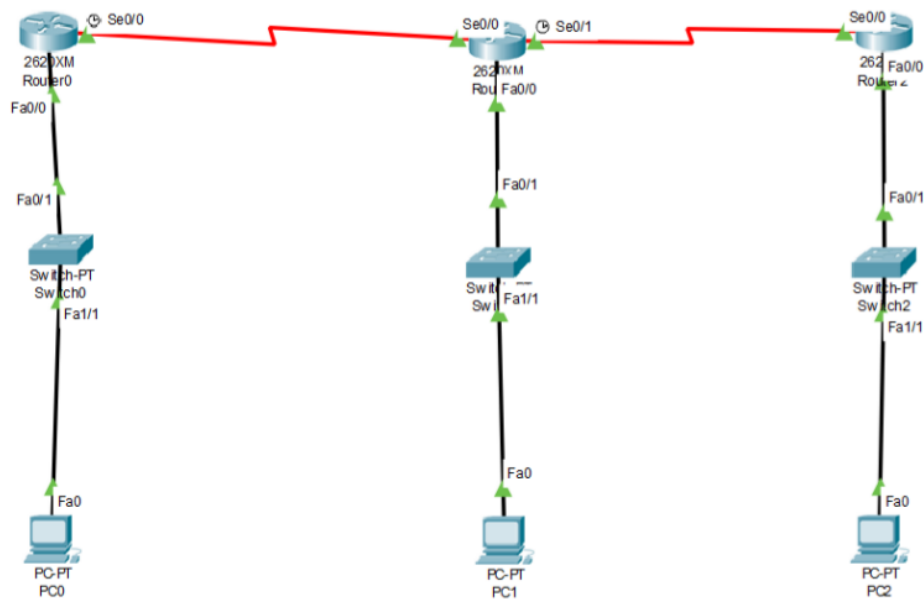


Figure 6: Network topology

Table 2: Address scheme

	Network 1	Network 2	Network 3
Network Address	192.168.2.0	100.0.0.0	170.30.0.0
Gateway Address	192.168.2.254	100.1.0.254	170.30.0.254
Device Address	192.168.2.1	100.1.0.1	170.30.0.1

Good table of address scheme with class A, B and C included

	Network 4	Network 4 & 5	Network 5
Network Address	10.10.20.0		11.1.0.0
	10.10.20.1	10.10.20.2	
		11.1.0.1	11.1.0.1

Data packets were then sent between devices to test the configuration. The successful results can be seen in Figure 7.

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

Figure 7: Addresses Test

A good set of results. This shows that a good test method is used which eliminates the redundant tests

1.3 STATIC ROUTING ADDRESSING

Each router was then configured for static routing addressing. This is shown in Figure 8 to Figure 13.

1.3.1 Router 0

The screenshot shows the configuration interface for Router0. The 'Config' tab is active, and the 'Static Routes' section is selected in the left sidebar. The main area contains fields for 'Network', 'Mask', and 'Next Hop', followed by an 'Add' button. Below these fields is a table of configured static routes:

Network Address	
100.0.0.0/8	via 10.10.20.2
170.30.0.0/16	via 10.10.20.2

At the bottom, there is a 'Remove' button and a section for 'Equivalent IOS Commands' which displays the following commands:

```
S 100.0.0.0/8 [1/0] via 10.10.20.2
S 170.30.0.0/16 [1/0] via 10.10.20.2
C 192.168.2.0/24 is directly connected, FastEthernet0/0

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

A 'Top' button is located at the bottom left of the window.

Figure 8: Static routing addressing - router 0

```

Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#
Router(config)#
Router(config)#do show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B -
BGP
        D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
        N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
        E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
        i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS
inter area
        * - candidate default, U - per-user static route, o - ODR
        P - periodic downloaded static route

Gateway of last resort is not set

C    10.0.0.0/8 is directly connected, Serial0/0
S    100.0.0.0/8 [1/0] via 10.10.20.2
S    170.30.0.0/16 [1/0] via 10.10.20.2
C    192.168.2.0/24 is directly connected, FastEthernet0/0

Router(config)#

```

Figure 9: Static routing addressing - router 0

1.3.2 Router 1

The screenshot shows the 'Router1' configuration window with the 'Config' tab selected. The left sidebar contains a tree view with the following categories and items:

- GLOBAL
 - Settings
 - Algorithm Settings
- ROUTING
 - Static (highlighted)
 - RIP
- INTERFACE
 - FastEthernet0/0
 - Serial0/0
 - Serial0/1

The main area is titled 'Static Routes' and contains the following fields:

- Network:
- Mask:
- Next Hop:

Below these fields is an 'Add' button. A table below the 'Add' button shows the configured static routes:

Network Address
170.30.0.0/16 via 11.1.0.2
192.168.2.0/24 via 10.10.20.1

Below the table is a 'Remove' button. At the bottom of the window, there is a section titled 'Equivalent IOS Commands' with a text area containing the following commands:

```
Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line. End with CNIL/Z.
Router(config)#
Router(config)#
```

At the very bottom left, there is a 'Top' button.

Figure 10: Static routing addressing - router 1

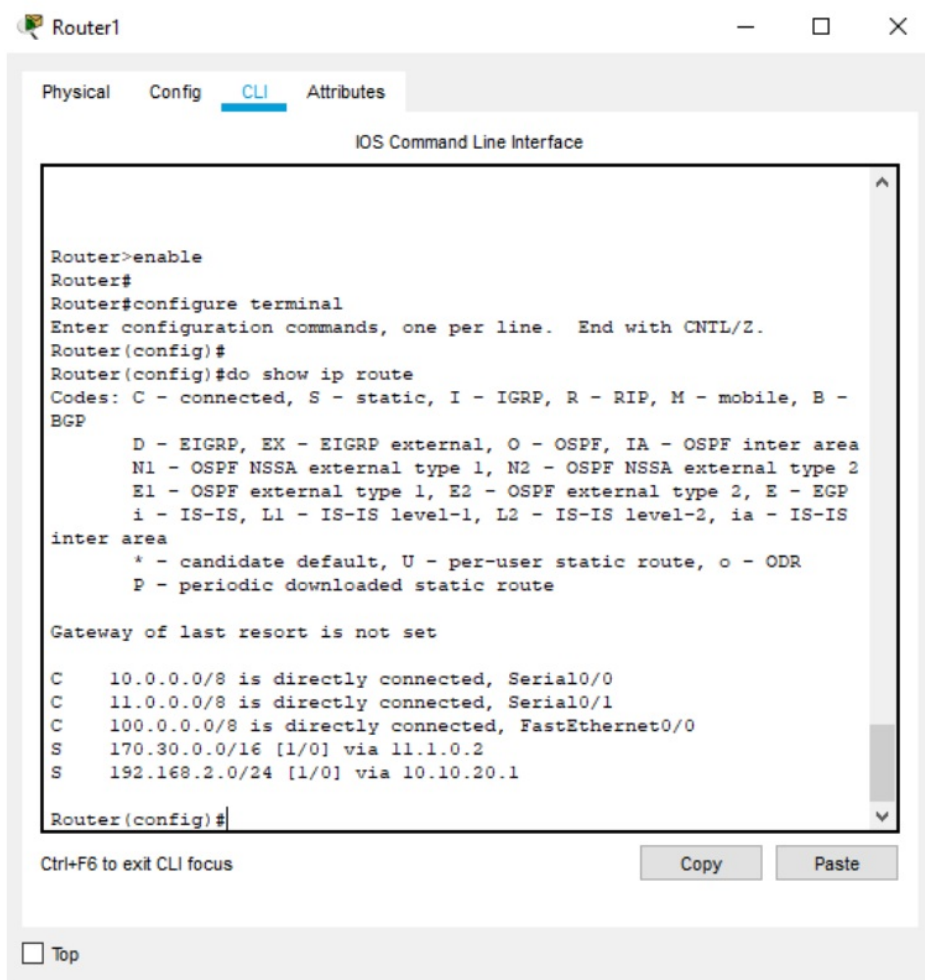


Figure 11: Static routing addressing - router 1

1.3.3 Router 2

Router2

Physical

Config

CLI

Attributes

GLOBAL

Settings

Algorithm Settings

ROUTING

Static

RIP

INTERFACE

FastEthernet0/0

Serial0/0

Serial0/1

Static Routes

Network

Mask

Next Hop

Add

Network Address

100.0.0.0/8 via 11.1.0.1

192.168.2.0/24 via 11.1.0.1

Remove

Equivalent IOS Commands

Router>enable

Router#

Router#configure terminal

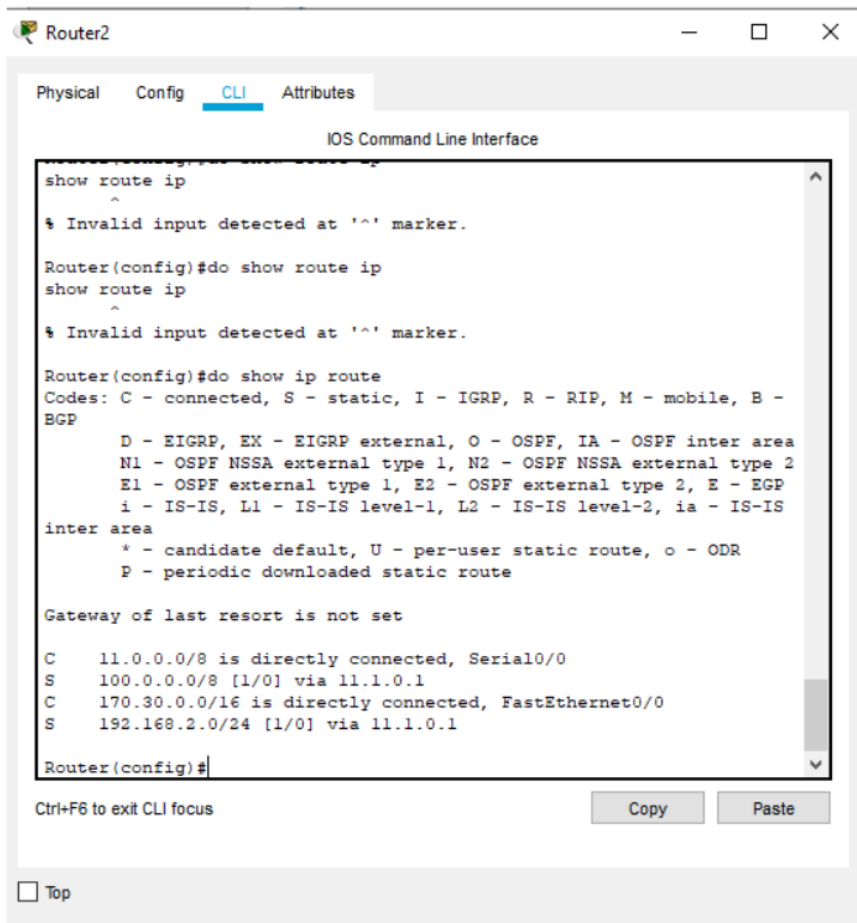
Enter configuration commands, one per line. End with CNTL/Z.

Router (config)#

Router (config)#

Top

Figure 12: Static routing addressing - router 2



Screenshots show the implementation of static parameters

Figure 13: Static routing addressing - router 2

1.4 CONFIGURE THE 3 ROUTERS FOR DYNAMIC ROUTING USING RIP (ROUTING INFORMATION PROTOCOL).

Each router was configured for RIP routing. This is shown in Figure 14 to Figure 20. This was then tested and the results can be seen in Figure 21.

```
router rip
version 2
network 10.0.0.0
network 100.0.0.0
network 192.168.2.0
```

Figure 14: Router 0 RIP

```
router rip
version 2
network 10.0.0.0
network 11.0.0.0
network 100.0.0.0
network 170.0.0.0
network 170.30.0.0
network 192.168.2.0
```

Figure 15: Router 1 RIP

```
router rip
version 2
network 11.0.0.0
network 100.0.0.0
network 170.30.0.0
```

Figure 16: Router 2 RIP

1.4.1 RIP Tables

Routing Table for Router0				
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	10.10.20.2	120/1
R	100.0.0.0/8	Serial0/0	10.10.20.2	120/1
R	170.30.0.0/16	Serial0/0	10.10.20.2	120/2
C	192.168.2.0/24	FastEthernet0/0	---	0/0

Routing Table for Router1				
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
C	100.0.0.0/8	FastEthernet0/0	---	0/0
R	170.30.0.0/16	Serial0/1	11.1.0.2	120/1
R	192.168.2.0/24	Serial0/0	10.10.20.1	120/1

Routing Table for Router2				
Type	Network	Port	Next Hop IP	Metric
R	10.0.0.0/8	Serial0/0	11.1.0.1	120/1
C	11.0.0.0/8	Serial0/0	---	0/0
R	100.0.0.0/8	Serial0/0	11.1.0.1	120/1
C	170.30.0.0/16	FastEthernet0/0	---	0/0
R	192.168.2.0/24	Serial0/0	11.1.0.1	120/2

RIP tables

Figure 17: RIP Tables for all routers

1.4.2 RIP Configuration

```
Router>en
Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B -
BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS
inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

C    10.0.0.0/8 is directly connected, Serial0/0
R    11.0.0.0/8 [120/1] via 10.10.20.2, 00:00:03, Serial0/0
R    100.0.0.0/8 [120/1] via 10.10.20.2, 00:00:03, Serial0/0
R    170.30.0.0/16 [120/2] via 10.10.20.2, 00:00:03, Serial0/0
C    192.168.2.0/24 is directly connected, FastEthernet0/0

Router#
```

Figure 18: Router 0 RIP Config

```
Router#en
Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B -
BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS
inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

C    10.0.0.0/8 is directly connected, Serial0/0
C    11.0.0.0/8 is directly connected, Serial0/1
C    100.0.0.0/8 is directly connected, FastEthernet0/0
R    170.30.0.0/16 [120/1] via 11.1.0.2, 00:00:25, Serial0/1
R    192.168.2.0/24 [120/1] via 10.10.20.1, 00:00:28, Serial0/0

Router#
```

Figure 19: Router 1 RIP Config

*Router reports show
the connected and
routed addresses*

```

Router>en
Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B -
BGP
        D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
        N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
        E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
        i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS
inter area
        * - candidate default, U - per-user static route, o - ODR
        P - periodic downloaded static route

Gateway of last resort is not set

R    10.0.0.0/8 [120/1] via 11.1.0.1, 00:00:20, Serial0/0
C    11.0.0.0/8 is directly connected, Serial0/0
R    100.0.0.0/8 [120/1] via 11.1.0.1, 00:00:20, Serial0/0
C    170.30.0.0/16 is directly connected, FastEthernet0/0
R    192.168.2.0/24 [120/2] via 11.1.0.1, 00:00:20, Serial0/0

```

Figure 20: Router 3 config

Fire	Last Status	Source	Destination	Type	Color
	Successful	PC0	PC1	ICMP	
	Successful	PC1	PC0	ICMP	
	Successful	PC1	PC2	ICMP	
	Successful	PC2	PC1	ICMP	
	Successful	PC0	PC2	ICMP	
	Successful	PC2	PC0	ICMP	

Figure 21: Communication Tests

Tests
are
succ
essfu
l and
redu
ndant
tests
are
elimi
nated

1.5 DYNAMIC ADDRESSING ACROSS NETWORKS USING DHCP AND HELPER ADDRESSES

Router R1 is configured as the control router and routers R2 and R3 are configured with the helper address to enable cross network dynamic addressing using DHCP.

```
ip dhcp pool net1
network 192.168.2.0 255.255.255.0
default-router 192.168.2.254
dns-server 192.168.2.254
ip dhcp pool net2
network 100.0.0.0 255.0.0.0
default-router 100.1.0.254
dns-server 100.1.0.254
ip dhcp pool net3
network 170.30.0.0 255.255.0.0
default-router 170.30.0.254
dns-server 170.30.0.254
```

The screenshot clearly shows the configuration for DHCP

Figure 22: Router 0 DHCP config

☒ DHCP ☐ Static	
IP Address	192.168.2.11
Subnet Mask	255.255.255.0
Default Gateway	192.168.2.254
DNS Server	192.168.2.254

Screenshot shows the DHCP assigned address

Figure 23: DHCP Address of Device 0

IP is starting at 11 due to exclusions of addresses 1 -10.

This test should be placed after the config of the excluded address range is explained

☒ DHCP ☐ Static	
IP Address	169.254.200.67
Subnet Mask	255.255.0.0
Default Gateway	0.0.0.0
DNS Server	0.0.0.0

☒ DHCP ☐ Static	
IP Address	169.254.137.146
Subnet Mask	255.255.0.0
Default Gateway	0.0.0.0
DNS Server	0.0.0.0

Default address due to no helper address implemented

Figure 24: IP address starting at 11

IP addresses for PCs 1 and 2 are wrong due to no helper address. The address is the control router serial port.

```
interface FastEthernet0/0
ip address 100.1.0.254 255.0.0.0
ip helper-address 10.10.20.1
```

Figure 25: Router 1 helper IP

```

interface FastEthernet0/0
ip address 170.30.0.254 255.255.0.0
ip helper-address 10.10.20.1
duplex auto
speed auto

```

Figure 26: Router 2 helper IP

Test dynamic addressing with helper address configured in R2 and R3:

☒ DHCP	☐ Static
IP Address	100.0.0.1
Subnet Mask	255.0.0.0
Default Gateway	100.0.0.254
DNS Server	100.0.0.254

Figure 27: Device PC1 with helper address IP test

Image shows the correct operation of DHCP

☒ DHCP	☐ Static
IP Address	170.20.0.1
Subnet Mask	255.255.0.0
Default Gateway	170.20.0.254
DNS Server	170.20.0.254

Figure 28: Device PC2 with helper address IP test

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

Routers were then configured to exclude addresses 1 – 10.

```

ip dhcp excluded-address 192.168.2.1
ip dhcp excluded-address 100.0.0.1 100.10.0.10
ip dhcp excluded-address 192.168.2.1 192.168.2.10
ip dhcp excluded-address 170.30.0.1 170.30.0.10

```

Excluded address test above should be placed here

Figure 29: Router 0 exclusion addresses

This was tested by loading PC0 and requesting a DHCP address.

☒ DHCP	☐ Static	DHCP request successful.
IP Address	192.168.2.11	
Subnet Mask	255.255.255.0	
Default Gateway	192.168.2.254	
DNS Server	192.168.2.254	

Figure 30: PC0 DHCP with addresses exclusions

Test shows the excluded address range is working and the next available address is assigned

IP Configuration	
☒ DHCP	☐ Static
IP Address	100.10.0.11
Subnet Mask	255.0.0.0
Default Gateway	100.1.0.254
DNS Server	100.1.0.254

Figure 31: PC1 DHCP with addresses exclusions

IP Configuration	
☒ DHCP	☐ Static
IP Address	170.30.0.11
Subnet Mask	255.255.0.0
Default Gateway	170.30.0.254
DNS Server	170.30.0.254

Figure 32: PC2 DHCP with addresses excluded

DHCP with exclusion address range is successful

The test that was undertaken proves that addresses 1 to 10 in each LAN have been excluded, meaning that addresses for specific controllers can be kept static. This means that they will not be affected by the DHCP protocol.

1.6 ROUTER# SHOW RUN COMMAND

The final test is to show the running configurations for all routers. The show run for routers 0 to 2 can be seen in Figure 33 to Figure 35

```
Router>en
Router#show run
Building configuration...

Current configuration : 1144 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 192.168.2.1
ip dhcp excluded-address 100.0.0.1 100.10.0.10
ip dhcp excluded-address 192.168.2.1 192.168.2.10
ip dhcp excluded-address 170.30.0.1 170.30.0.10
!
ip dhcp pool net1
network 192.168.2.0 255.255.255.0
default-router 192.168.2.254
dns-server 192.168.2.254
ip dhcp pool net2
network 100.0.0.0 255.0.0.0
default-router 100.1.0.254
dns-server 100.1.0.254
ip dhcp pool net3
network 170.30.0.0 255.255.0.0
default-router 170.30.0.254
dns-server 170.30.0.254
!
!
!
no ip cef
no ipv6 cef
!
!
!
!
!
!
!
```

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Figure 33: Router 0 Running Configuration

```
Router>en
Router#show run
Building configuration...

Current configuration : 717 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 100.1.0.254 255.0.0.0
ip helper-address 10.10.20.1
duplex auto
speed auto
!
interface Serial0/0
```

An example is enough in this section. The rest of the router config reports can go in the appendix

An example is enough in this section. The rest of the router config reports can go in the appendix

```

ip address 10.10.20.2 255.0.0.0
!
interface Serial0/1
ip address 11.1.0.1 255.0.0.0
clock rate 2000000
!
router rip
version 2
network 10.0.0.0
network 11.0.0.0
network 100.0.0.0
network 170.0.0.0
network 170.30.0.0
network 192.168.2.0
!
ip classless
!
ip flow-export version 9
!
!
!
!
!
!
!
!
line con 0
!
line aux 0
!
line vty 0 4
login
!
!
!
end

```

Figure 34: Router 1 Running Configuration

```

Router>en
Router#show run
Building configuration...

Current configuration : 654 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 170.30.0.254 255.255.0.0  
ip helper-address 10.10.20.1  
duplex auto  
speed auto  
!  
  
interface Serial0/0  
ip address 11.1.0.2 255.0.0.0  
!  
  
interface Serial0/1  
no ip address  
clock rate 2000000  
shutdown  
!  
  
router rip  
version 2  
network 11.0.0.0  
network 100.0.0.0  
network 170.30.0.0  
!  
ip classless  
!  
ip flow-export version 9
```

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

Figure 35: Router 2 Running Configuration

2 ELEMENT 2

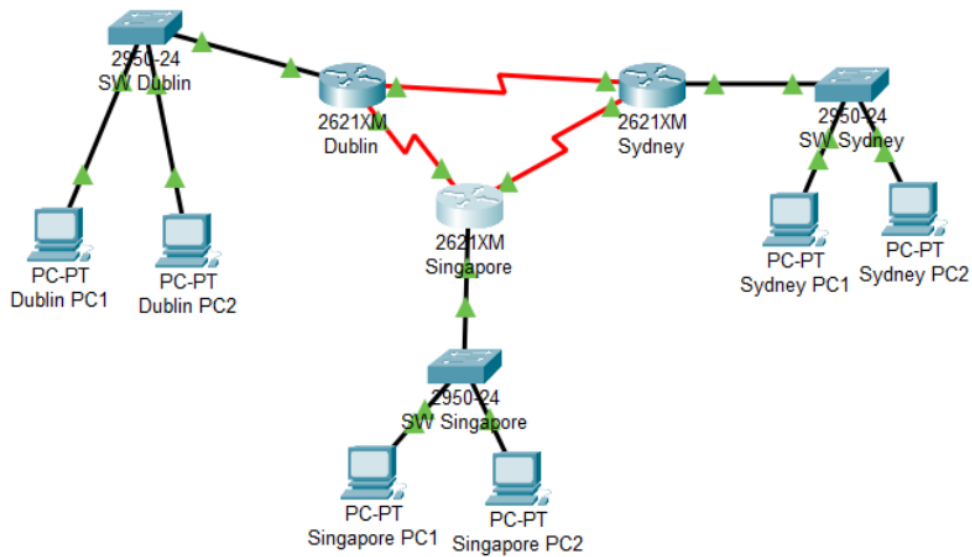


Figure 36: Network Diagram

2.1 NETWORKS SUBNETTING CIDR/28

2.1.1 LAN Networks 1, 2 and 3

2.1.1.1 CIDR/28 Singapore Network 1 Lan address 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
	0	0	0	1	1	1	1	1	Broadcast	31

Table of address scheme is correct

2.1.1.2 CIDR/28 Dublin Network 2 Lan address 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
	0	0	1	0	1	1	1	1	Broadcast 47

2.1.1.3 CIDR/28 Sydney Network 3 Lan address 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
	0	0	1	1	1	1	1	1	Broadcast 63

2.1.2 WAN Networks 4, 5 and 6

LAN addresses are correct and good use of tables

2.1.2.1 Singapore – Dublin Network 4 Network address 64

Singapore Router	0	1	0	0	1	1	0	1	Serial 0/0 addr 77
Dublin Router	0	1	0	0	1	1	1	0	Serial 0/1 addr 78

2.1.2.2 Dublin – Sydney Network 5 Network address 80

Sydney Router	0	1	0	1	1	1	0	1	Serial 0/0 addr 93
Dublin Router	0	1	0	1	1	1	1	0	Serial 0/0 addr 94

2.1.2.3 Sydney –Singapore Network 6 Network address 96

WAN serial link network addresses are correct and follow a sequence which is good practice

Sydney Router	0	1	1	0	1	1	0	1	Serial 0/1 addr 109
Singapore Router	0	1	1	0	1	1	1	0	Serial 0/1 addr 110

2.1.3 Router RIP Tables

Routing Table for Singapore ×					
Type	Network	Port	Next Hop IP	Metric	
C	192.168.60.16/28	FastEthernet0/0	---	0/0	
R	192.168.60.32/28	Serial0/0	192.168.60.78	120/1	
R	192.168.60.48/28	Serial0/1	192.168.60.109	120/1	
C	192.168.60.64/28	Serial0/0	---	0/0	
R	192.168.60.80/28	Serial0/0	192.168.60.78	120/1	
R	192.168.60.80/28	Serial0/1	192.168.60.109	120/1	
C	192.168.60.96/28	Serial0/1	---	0/0	

Figure 37: Singapore RIP routing table

Type	Network	Port	Next Hop IP	Metric
R	192.168.60.16/28	Serial0/1	192.168.60.77	120/1
C	192.168.60.32/28	FastEthernet0/0	---	0/0
R	192.168.60.48/28	Serial0/0	192.168.60.93	120/1
C	192.168.60.64/28	Serial0/1	---	0/0
C	192.168.60.80/28	Serial0/0	---	0/0
R	192.168.60.96/28	Serial0/1	192.168.60.77	120/1
R	192.168.60.96/28	Serial0/0	192.168.60.93	120/1

Figure 38: Dublin RIP routing table

Type	Network	Port	Next Hop IP	Metric
R	192.168.60.16/28	Serial0/1	192.168.60.110	120/1
R	192.168.60.32/28	Serial0/0	192.168.60.94	120/1
C	192.168.60.48/28	FastEthernet0/0	---	0/0
R	192.168.60.64/28	Serial0/0	192.168.60.94	120/1
R	192.168.60.64/28	Serial0/1	192.168.60.110	120/1
C	192.168.60.80/28	Serial0/0	---	0/0
C	192.168.60.96/28	Serial0/1	---	0/0

RIP tables show the connected and routed address links

Figure 39: RIP Routing table

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num
	Successful	Dublin PC1	Singapore PC1	ICMP		0.000	N	0
	Failed	Singapore PC2	Dublin PC2	ICMP		0.000	N	1
	Successful	Singapore PC2	Dublin PC2	ICMP		0.000	N	2
	Failed	Dublin PC1	Sydney PC1	ICMP		0.000	N	3
	Successful	Dublin PC1	Sydney PC1	ICMP		0.000	N	4
	Successful	Sydney PC2	Dublin PC2	ICMP		0.000	N	5
	Successful	Singapore PC1	Sydney PC1	ICMP		0.000	N	6
	Successful	Singapore PC2	Sydney PC2	ICMP		0.000	N	7

Figure 40: Packet capture test for RIP routing

Tests are successful and show the failures tested has been retested and passed. Good test method used to eliminate redundancy

2.2 CIDR/27 AND CIDR/30

2.2.1 CIDR/27 Networks 1,2 and 3

This is the VLSM part. You should explain the purpose of VLSM

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 Dublin 1
Net addr 32	0	0	1	0	0	0	1	0	Next host addr 34 Dublin 2
Net addr 32	0	0	1	1	1	1	1	0	Highest Router addr 62 Dublin Router
Net addr 64	0	1	0	0	0	0	0	1	Lowest host addr 65 Singapore 1
Net addr 64	0	1	0	0	0	0	1	0	Next host addr 66 Singapore 2
Net addr 64	0	1	0	1	1	1	1	0	Highest Router addr 94 Singapore Router
Net addr 96	0	1	1	0	0	0	0	1	Lowest host addr 97 Sydney 1
Net addr 96	0	1	1	0	0	0	1	0	Next host addr 98 Sydney 2
Net addr 96	0	1	1	1	1	1	1	0	Highest Router addr 126 Sydney Router

*CIDR address allocation is correct.
Good use of table*

2.2.2 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 Dublin serial 0/0
Net addr 4	0	0	0	0	0	1	1	0	Highest interface addr 6 Sydney serial 0/0
Net addr 8	0	0	0	0	1	0	0	1	Lowest interface addr 9 Dublin serial 0/1
Net addr 8	0	0	0	0	1	0	1	0	Highest interface addr 10 Singapore serial 0/0
Net addr 12	0	0	0	0	1	1	0	1	Lowest interface addr 13 Singapore serial 0/1
Net addr 12	0	0	0	0	1	1	1	0	Highest interface addr 14 Sydney serial 0/1

Address allocation for CIDR /30 is correct

You need to put headings and a short explanation before going from one section to the next.

```
Dublin#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
* - candidate default, U - per-user static route, o - ODR
P - periodic downloaded static route
```

Gateway of last resort is not set

```
192.168.60.0/24 is variably subnetted, 6 subnets, 2 masks
C 192.168.60.4/30 is directly connected, Serial0/0
C 192.168.60.8/30 is directly connected, Serial0/1
R 192.168.60.12/30 [120/1] via 192.168.60.6, 00:00:05, Serial0/0
[120/1] via 192.168.60.10, 00:00:15, Serial0/1
C 192.168.60.32/27 is directly connected, FastEthernet0/0
R 192.168.60.64/27 [120/1] via 192.168.60.10, 00:00:15, Serial0/1
R 192.168.60.96/27 [120/1] via 192.168.60.6, 00:00:05, Serial0/0
```

Figure 41: Dublin IP route

```
Sydney#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
* - candidate default, U - per-user static route, o - ODR
P - periodic downloaded static route
```

Gateway of last resort is not set

```
192.168.60.0/24 is variably subnetted, 6 subnets, 2 masks
C 192.168.60.4/30 is directly connected, Serial0/0
R 192.168.60.8/30 [120/1] via 192.168.60.5, 00:00:04, Serial0/0
[120/1] via 192.168.60.13, 00:00:02, Serial0/1
C 192.168.60.12/30 is directly connected, Serial0/1
R 192.168.60.32/27 [120/1] via 192.168.60.5, 00:00:04, Serial0/0
R 192.168.60.64/27 [120/1] via 192.168.60.13, 00:00:02, Serial0/1
C 192.168.60.96/27 is directly connected, FastEthernet0/0
```

Figure 42: Sydney Show IP Route

Singapore#show ip route

Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
* - candidate default, U - per-user static route, o - ODR
P - periodic downloaded static route

Gateway of last resort is not set

192.168.60.0/24 is variably subnetted, 6 subnets, 2 masks

R 192.168.60.4/30 [120/1] via 192.168.60.14, 00:00:05, Serial0/1
[120/1] via 192.168.60.9, 00:00:16, Serial0/0

C 192.168.60.8/30 is directly connected, Serial0/0

C 192.168.60.12/30 is directly connected, Serial0/1

R 192.168.60.32/27 [120/1] via 192.168.60.9, 00:00:16, Serial0/0

C 192.168.60.64/27 is directly connected, FastEthernet0/0

R 192.168.60.96/27 [120/1] via 192.168.60.14, 00:00:05, Serial0/1

One of these reports is enough here for an example to explain. The others should be in the appendix and referenced from the main report

Figure 43: Singapore Show IP Route

Test to show networking routing using VLSM.

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Failed	Singapore PC1	Dublin PC2	ICMP		0.000	N	0	(edit)	
	Successful	Dublin PC2	Singapore PC1	ICMP		0.000	N	1	(edit)	
	Successful	Dublin PC1	Singapore PC2	ICMP		0.000	N	2	(edit)	
	Successful	Singapore PC2	Sydney PC1	ICMP		0.000	N	3	(edit)	
	Successful	Sydney PC2	Singapore PC1	ICMP		0.000	N	4	(edit)	
	Successful	Dublin PC1	Sydney PC1	ICMP		0.000	N	5	(edit)	
	Successful	Sydney PC2	Dublin PC2	ICMP		0.000	N	6	(edit)	
	Successful	Singapore PC1	Dublin PC2	ICMP		0.000	N	7	(edit)	

Figure 44: Packet capture showing successful tests using the VLSM addresses

Tests are successful

2.3 VIRTUAL LOCAL AREA NETWORK (VLAN)

A VLAN is a virtual local area network. The purpose of this is that several networks can work virtually as one LAN. The advantages of this is that VLANS can reduce broadcast traffic. VLANS also give the capability to group devices into the same network, even if they are not physically connected to the same switch.

Using the command line interface, ports can be assigned to VLANs. VLAN 1 was left as the default so anything not specified would be placed on this VLAN.

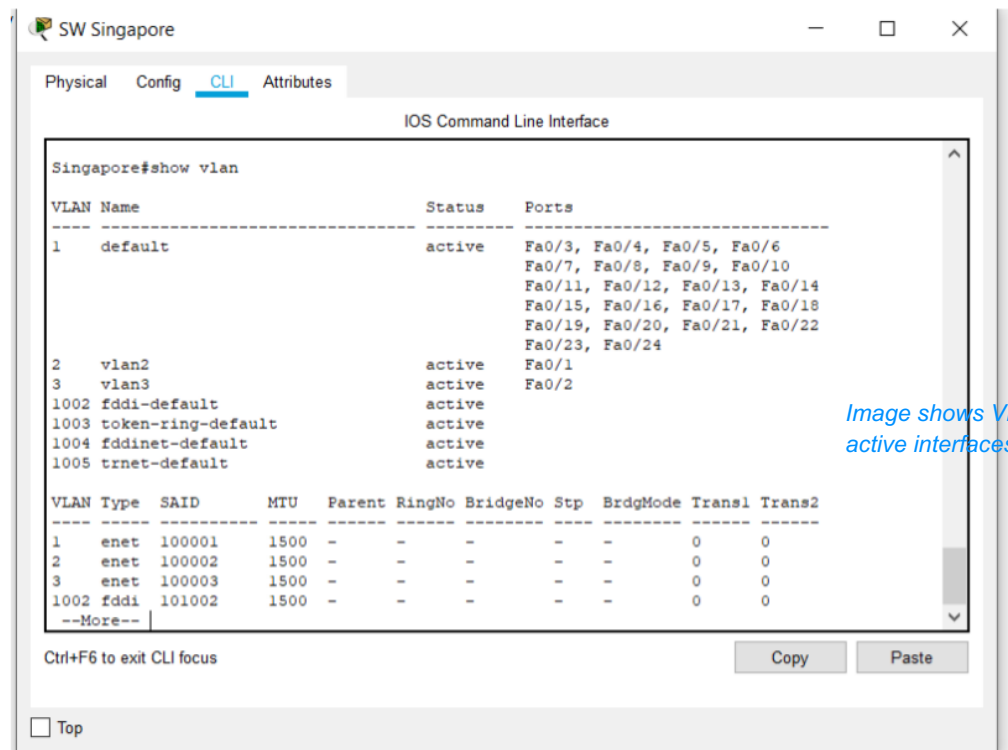


Figure 45: VLANs allowed on trunk

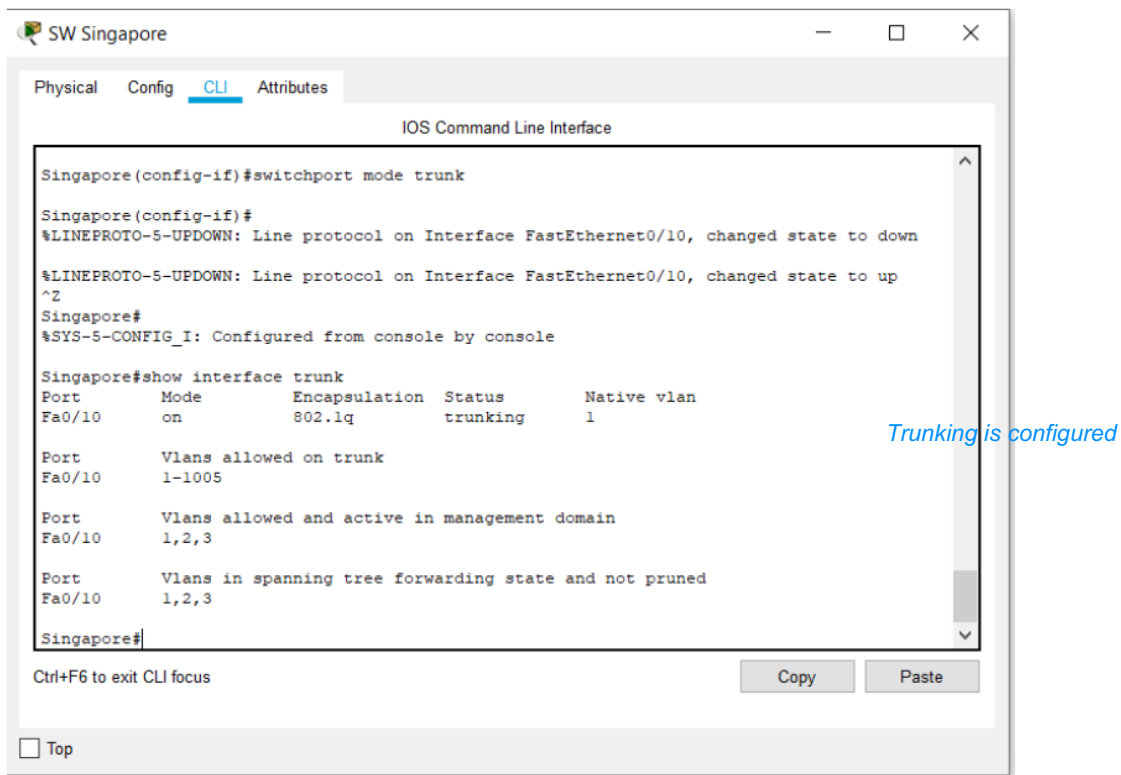


Figure 46: VLANs allowed on trunk

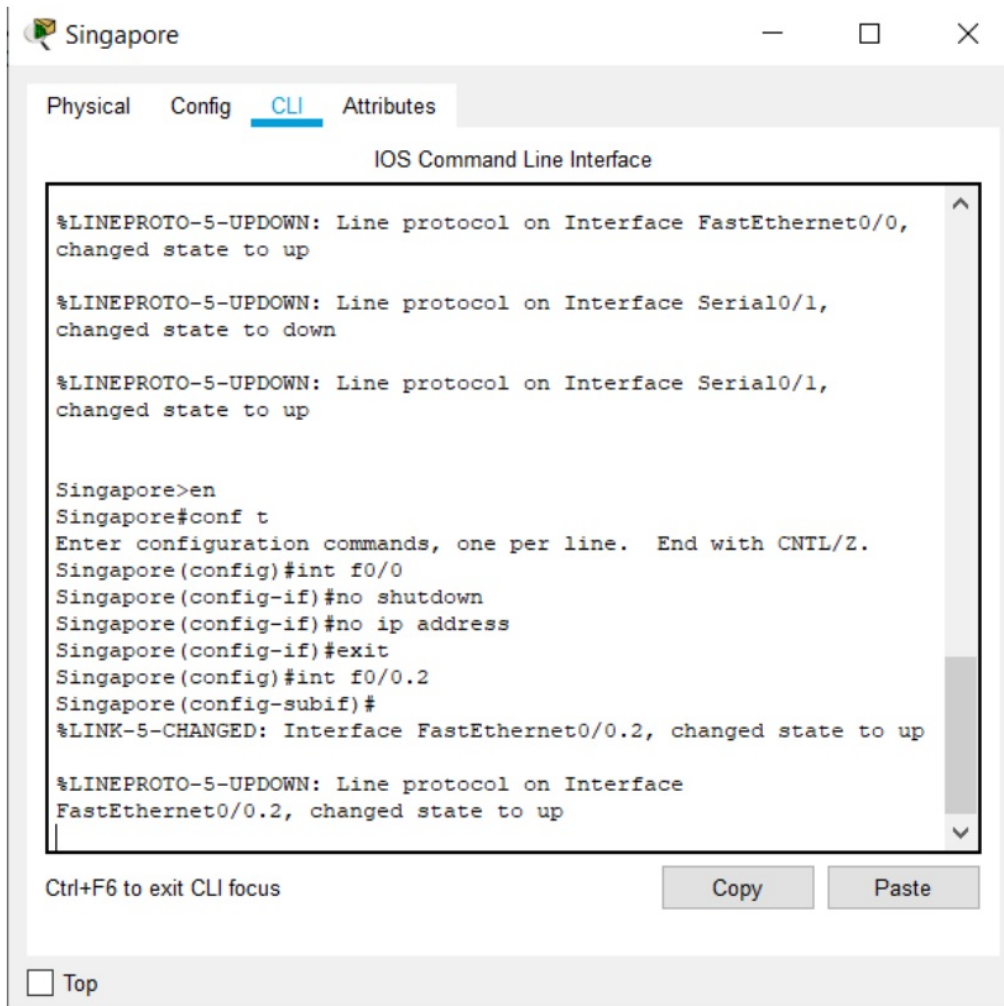
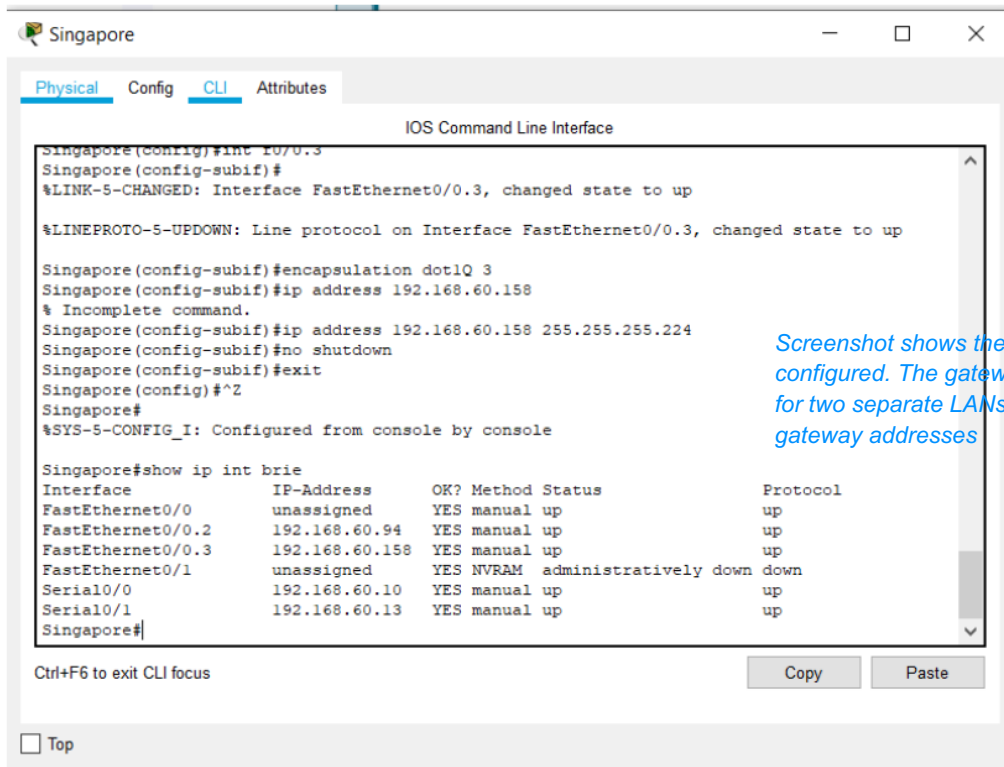


Figure 47: CLI for router

Figure 47 shows the CLI for not assigning an IP address to the two connections as these will be split into sub interface.



Screenshot shows the VLANs are configured. The gateway is configure for two separate LANs with separate gateway addresses

Figure 48: Setting up sub interface

Viewing the RIP routing tables of the other two routers. The tables show the new address of subnet .128, as seen below in Figure 50 and Figure 51. Figure 52 shows the routing table for the switch.

Routing Table for Sydney

Type	Network	Port	Next Hop IP	Metric
C	192.168.60.4/30	Serial0/0	---	0/0
R	192.168.60.8/30	Serial0/1	192.168.60.13	120/1
R	192.168.60.8/30	Serial0/0	192.168.60.5	120/1
C	192.168.60.12/30	Serial0/1	---	0/0
R	192.168.60.32/27	Serial0/0	192.168.60.5	120/1
R	192.168.60.64/27	Serial0/1	192.168.60.13	120/1
C	192.168.60.96/27	FastEthernet0/0	---	0/0
R	192.168.60.128/27	Serial0/1	192.168.60.13	120/1

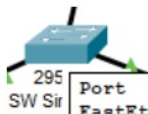
Figure 49: Routing table for Sydney

Routing Table for Dublin

Type	Network	Port	Next Hop IP	Metric
C	192.168.60.4/30	Serial0/0	---	0/0
C	192.168.60.8/30	Serial0/1	---	0/0
R	192.168.60.12/30	Serial0/0	192.168.60.6	120/1
R	192.168.60.12/30	Serial0/1	192.168.60.10	120/1
C	192.168.60.32/27	FastEthernet0/0	---	0/0
R	192.168.60.64/27	Serial0/1	192.168.60.10	120/1
R	192.168.60.96/27	Serial0/0	192.168.60.6	120/1
R	192.168.60.128/27	Serial0/1	192.168.60.10	120/1

Figure 50: Routing table for Dublin

The RIP tables will auto configure only if the configuration is correct. This is correct here



Port	Link	VLAN	IP Address	MAC Address
FastEthernet0/1	Up	2	--	00D0.BC64.2A01
FastEthernet0/2	Up	3	--	00D0.BC64.2A02
FastEthernet0/3	Down	1	--	00D0.BC64.2A03
FastEthernet0/4	Down	1	--	00D0.BC64.2A04
FastEthernet0/5	Down	1	--	00D0.BC64.2A05
FastEthernet0/6	Down	1	--	00D0.BC64.2A06
FastEthernet0/7	Down	1	--	00D0.BC64.2A07
FastEthernet0/8	Down	1	--	00D0.BC64.2A08
FastEthernet0/9	Down	1	--	00D0.BC64.2A09
FastEthernet0/10	Up	--	--	00D0.BC64.2A0A
FastEthernet0/11	Down	1	--	00D0.BC64.2A0B
FastEthernet0/12	Down	1	--	00D0.BC64.2A0C
FastEthernet0/13	Down	1	--	00D0.BC64.2A0D
FastEthernet0/14	Down	1	--	00D0.BC64.2A0E
FastEthernet0/15	Down	1	--	00D0.BC64.2A0F
FastEthernet0/16	Down	1	--	00D0.BC64.2A10
FastEthernet0/17	Down	1	--	00D0.BC64.2A11
FastEthernet0/18	Down	1	--	00D0.BC64.2A12
FastEthernet0/19	Down	1	--	00D0.BC64.2A13
FastEthernet0/20	Down	1	--	00D0.BC64.2A14
FastEthernet0/21	Down	1	--	00D0.BC64.2A15
FastEthernet0/22	Down	1	--	00D0.BC64.2A16
FastEthernet0/23	Down	1	--	00D0.BC64.2A17
FastEthernet0/24	Down	1	--	00D0.BC64.2A18
Vlan1	Down	1	<not set>	0001.63B5.CC0B
Hostname: Singapore				
Physical Location: Intercity, Home City, Corporate Office, Main Wiring Closet				

The switch port 10 is up and is the trunk channel for the two VLANs

Figure 51: Singapore Routing Table

Using the packet capture, this shows that the routing still works with the VLANs.

PDU List Window										
Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	Singapore PC1	Singapore PC2	ICMP		0.000	N	0	(edit)	
	Successful	Singapore PC2	Singapore PC1	ICMP		0.000	N	1	(edit)	
	Successful	Singapore PC1	Dublin PC2	ICMP		0.000	N	2	(edit)	
	Successful	Dublin PC1	Singapore PC1	ICMP		0.000	N	3	(edit)	
	Successful	Singapore PC2	Dublin PC1	ICMP		0.000	N	4	(edit)	
	Successful	Dublin PC2	Singapore PC2	ICMP		0.000	N	5	(edit)	
	Successful	Singapore PC2	Sydney PC1	ICMP		0.000	N	6	(edit)	
	Successful	Sydney PC1	Singapore PC2	ICMP		0.000	N	7	(edit)	
	Successful	Singapore PC1	Sydney PC2	ICMP		0.000	N	8	(edit)	
	Successful	Sydney PC2	Singapore PC1	ICMP		0.000	N	9	(edit)	

Figure 52: Packet capture after VLAN implementation

Tests are
successful

2.4 ACLS

Access Control Lists are list of IPs which can be allowed or denied to a device on the network.

In this element, ACLs were set up on the Sydney router, to deny IPs on the Singapore PC2 VLAN. 192.168.60.129/27 but allow all other IP addresses.

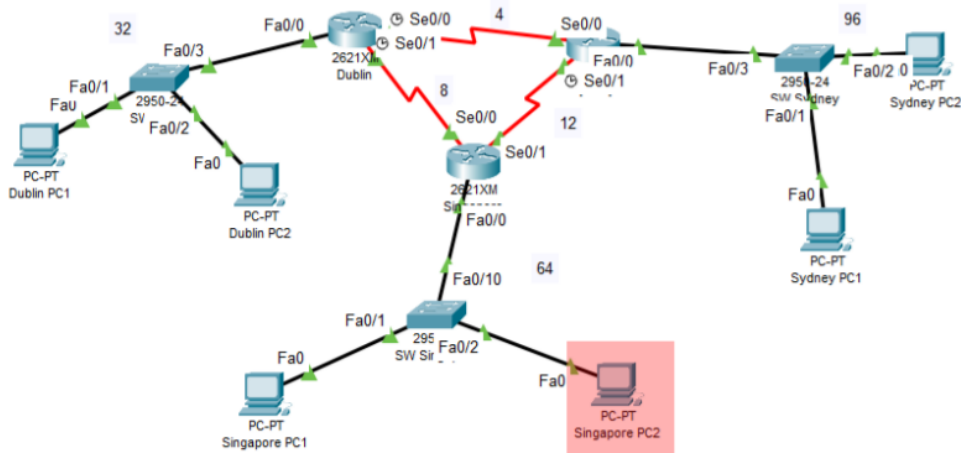


Figure 53: Network diagram, denied IP

The firewall was set up on Sydney router as it was the nearest to the destination, focusing on the Fa0/0 connection. The ACL 1 was used which is part of the standard ACL list which denies or permit source IPs. Standard ACLs use lists 1 – 99 where extended ACLs run from 100 – 199. The extended lists denies or permits destination IP addresses, denies or permits port (services) in addition to the standard denies or permits source IP Addresses. The following commands were used to set up the ACL.

```
sydney>en
sydney#conf t
Enter configuration commands, one per line. End with CNTL/Z.
sydney(config)#hostname Sydney
Sydney(config)#access-list 1 deny 192.168.60.129 0.0.0.0
Sydney(config)#access-list 1 permit any
Sydney(config)#
Sydney(config)#^Z
Sydney#
%SYS-5-CONFIG_I: Configured from console by console
```

Denial of service is configured in the ACL

The deny IP address is that 192.168.60.129, the four 0s that follow it are wildcard bit. Wild card bit is the inverse to the subnet mask 0.0.0.0 as it is a just the one host that is to be denied.

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

The implementation of this can be proven by using the command prompt feature on the PC and attempt to ping the IP.

Figure 54 shows the request time out when the Sydney PC tries to ping the denied IP address, whereas Figure 55 shows the successful ping from a permitted IP.

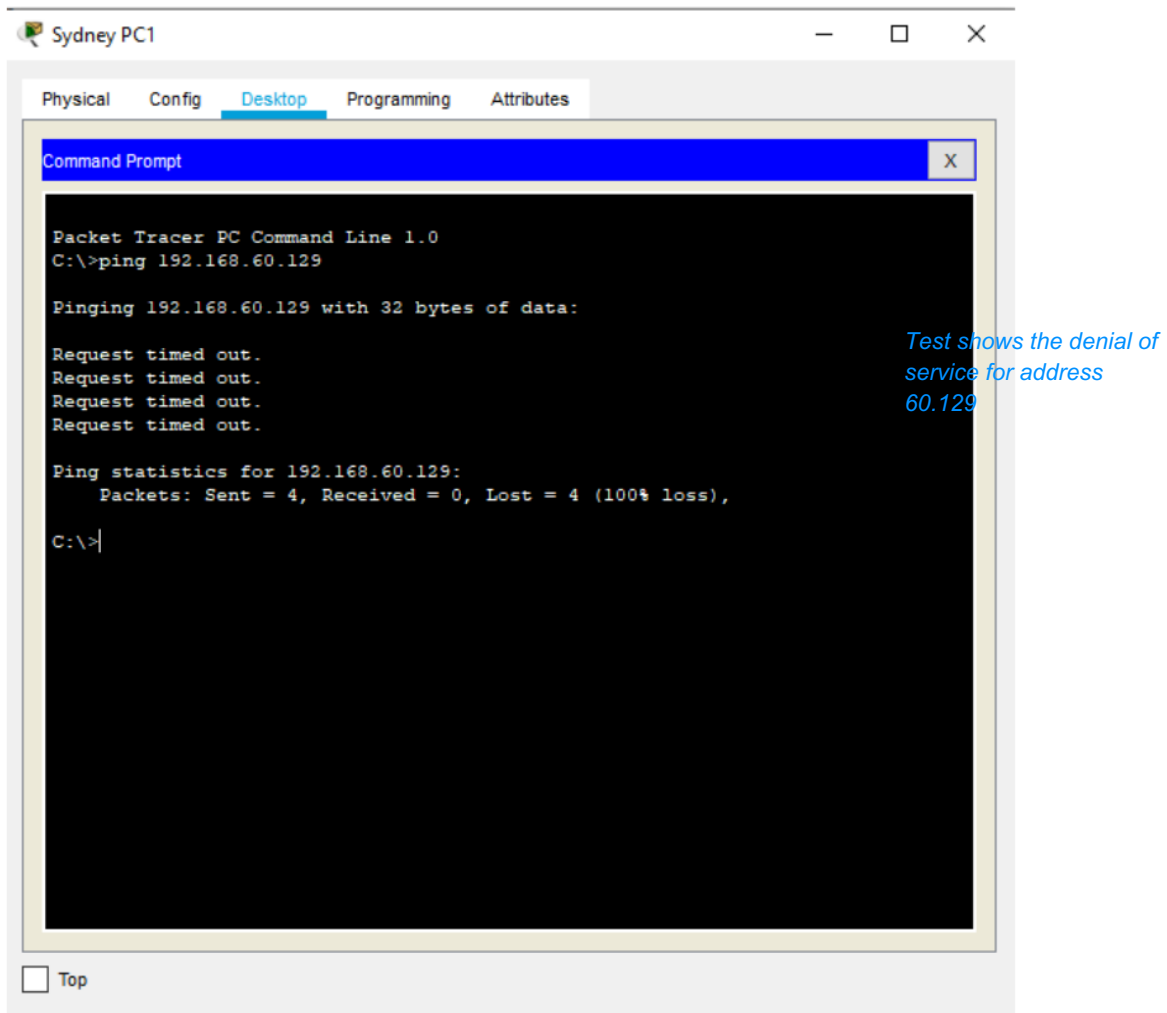


Figure 54: Ping denied IP

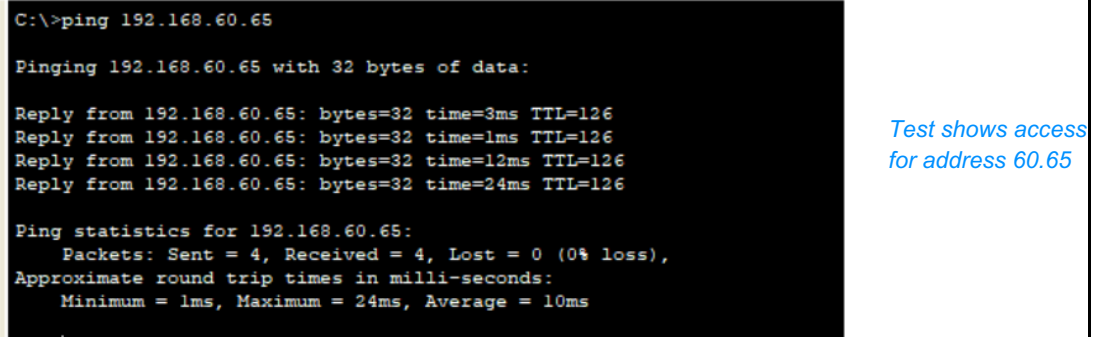


Figure 55: Ping Permitted IP

2.5 APPENDIX 2A

```
Dublin>en
Dublin#show run
Building configuration...

Current configuration : 714 bytes
!
version 12.2
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Dublin
!
!
!
!
!
!
!
!
!
no ip cef
no ipv6 cef
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
interface FastEthernet0/0
ip address 192.168.60.62 255.255.255.224
duplex auto
speed auto
!
interface FastEthernet0/1
no ip address
duplex auto
speed auto
shutdown
```

```
!  
interface Serial0/0  
ip address 192.168.60.5 255.255.255.252  
clock rate 64000  
!  
interface Serial0/1  
ip address 192.168.60.9 255.255.255.252  
clock rate 64000  
!  
router rip  
version 2  
network 192.168.60.0  
!  
ip classless  
!  
ip flow-export version 9  
!  
!  
!  
!  
!  
!  
!  
line con 0  
!  
line aux 0  
!  
line vty 0 4  
login  
!  
!  
!  
end
```

Figure 56: Dublin ShowRun Configuration

2.6 APPENDIX 2B

```
Sydney>en
Sydney#show run
Building configuration...

Current configuration : 785 bytes
!
version 12.2
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Sydney
!
!
!
!
!
!
!
!
!
!
no ip cef
no ipv6 cef
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
interface FastEthernet0/0
ip address 192.168.60.126 255.255.255.224
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 192.168.60.6 255.255.255.252  
!  
interface Serial0/1  
ip address 192.168.60.14 255.255.255.252  
clock rate 64000  
!  
router rip  
version 2  
network 192.168.60.0  
!  
ip classless  
!  
ip flow-export version 9  
!  
!  
access-list 1 deny host 192.168.60.129  
access-list 1 permit any  
!  
!  
!  
!  
!  
line con 0  
!  
line aux 0  
!  
line vty 0 4  
login  
!  
!  
!  
end
```

Figure 57: Sydney ShowRun configuration

2.7 APPENDIX 2C

```
Singapore>en
Singapore#show run
Building configuration...

Current configuration : 847 bytes
!
version 12.2
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Singapore
!
!
!
!
!
!
!
!
!
!
no ip cef
no ipv6 cef
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
interface FastEthernet0/0
no ip address
duplex auto
speed auto
!
interface FastEthernet0/0.2
encapsulation dot1Q 2
ip address 192.168.60.94 255.255.255.224
!
interface FastEthernet0/0.3
```

```
encapsulation dot1Q 3
ip address 192.168.60.158 255.255.255.224
!
interface FastEthernet0/1
no ip address
duplex auto
speed auto
shutdown
!
interface Serial0/0
ip address 192.168.60.10 255.255.255.252
!
interface Serial0/1
ip address 192.168.60.13 255.255.255.252
!
router rip
version 2
network 192.168.60.0
!
ip classless
!
ip flow-export version 9
!
!
!
!
!
!
!
!
line con 0
!
line aux 0
!
line vty 0 4
login
!
!
!
end
```

Figure 58: Singapore ShowRun Configuration

*The appendices
should be at the end
of the report*

3 ELEMENT 3

3.1 HARDWARE SETUP

This element takes the knowledge built in the previous two elements and puts it into practice.

The following hardware was used in this element:

- Switch – Cisco 2950
- Router – Cisco 2600
- PLC – Siemens S7-1200
- PC for webpage
- PC for configuring the terminal.

Hardware is identified

Figure 59 shows the network topology for this element. Figure 60 shows the equipment set up.

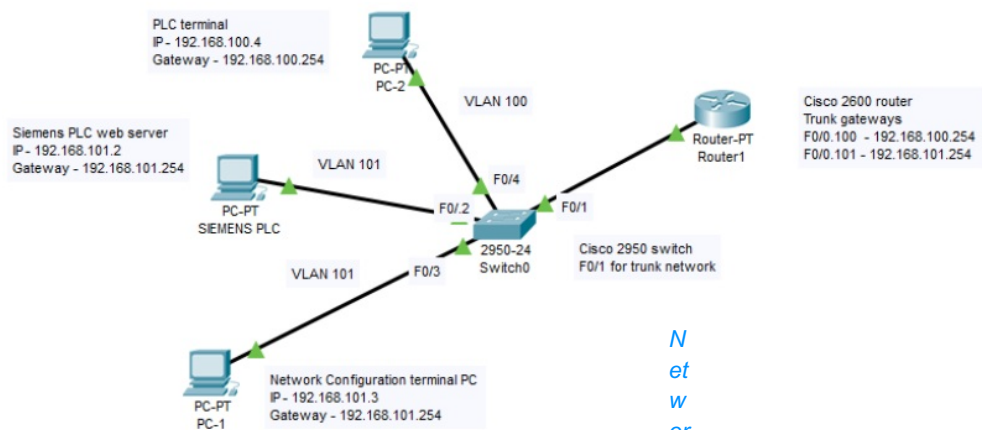


Figure 59: Network Topology

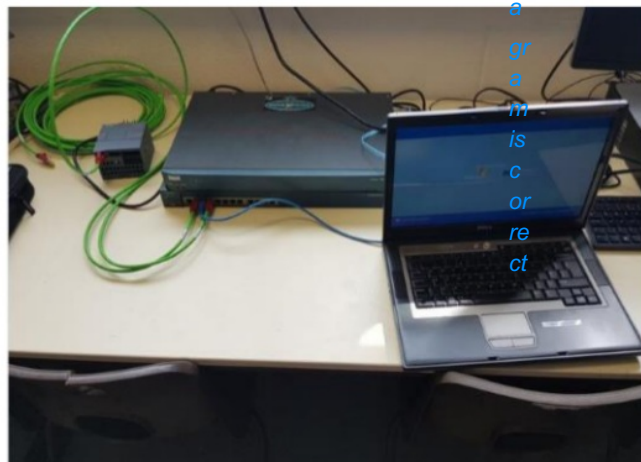


Figure 60: Physical set-up

Network diagram is correct

Image showing connections to Cisco router and switch

As shown above, there are two VLANs in the network. VLAN 100 and 101. These VLANs are two LANs just plugged into the same switch, however are two separate networks. The sub-sub-netting shows this.

Using a terminal emulator software, such as Cmdr of PuTTY, the switches and routers can be configured using the commands shown in Figure 61 to Figure 64 below. The commands used to configure the hardware physically are the same used in Cisco's CAD package, 'Cisco Packet Tracer'.

```
Switch>enable
Switch#conf t
Switch(config)#vlan 100
Switch(config-vlan)#name vlan100
Switch(config-vlan)#exit
Switch(config)#vlan 101
Switch(config-vlan)#name vlan101
Switch(config-vlan)#exit
Switch(config)#^Z
```

*A good point to make.
The configuration is no
different to the CAD
design*

Figure 61: VLAN configuration

```
Switch#conf t
Switch(config)#int f0/2
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 101
Switch(config-if)#exit
```

Figure 62: Interface f0/2 set up

```
Switch(config)#int f0/3
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 101
Switch(config-if)#exit
```

Figure 63: Interface f0/3 set up

```
Switch(config)#int f0/4
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 100
Switch(config-if)#exit
Switch(config)#^Z
```

Figure 64: Interface f0/4 set up

Figure 65 below shows the command to set up the inter VLAN routing.

```
Switch#conf t
Switch(config)#int f0/1
Switch(config-if)#switchport mode trunk
Switch(config-if)#^Z
Switch#
Switch#show interface trunk
```

Figure 65: Inter VLAN routing

Figure 66 to Figure 68 show the configurations CLIs for the router.

```
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
```

Figure 66: no ip address command for router

```
Router(config)#int f0/0.100
Router(config-subif)#encapsulation dot1Q 100
Router(config-subif)#ip address 192.168.100.254 255.255.255.0
Router(config-subif)#no shutdown
Router(config-subif)#exit
```

Figure 67: Encapsulation for VLAN 100

```
Router(config)#int f0/0.101
Router(config-subif)#encapsulation dot1Q 101
Router(config-subif)#ip address 192.168.101.254 255.255.255.0
Router(config-subif)#no shutdown
Router(config-subif)#exit
Router(config)#^Z
```

Figure 68: Encapsulation for VLAN 101

*Config should be in the
appendix*

Using the `#show vlan` command. The vlan configuration will be displayed. As shown in figure 1, port Fa0/4 is now on VLAN100 and FA0/2 and Fa0/3 are now on VLAN101.

```
Switch#show vlan
```

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

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

Image shows the VLANs active with active interfaces

Ip addresses were then 'pinged' to prove the setup is functioning correctly.

First test command (Figure 69) would return the results shown in Figure 70

```
C:\Users\jnathon>ping 192.168.101.2
```

Figure 69: Ping ip 192.169.101.2

```
Pinging 192.168.101.2 with 32 bytes of data:
Reply from 192.168.101.2: bytes=32 time=6ms TTL=29
Reply from 192.168.101.2: bytes=32 time=1ms TTL=29
Reply from 192.168.101.2: bytes=32 time<1ms TTL=29
Reply from 192.168.101.2: bytes=32 time<1ms TTL=29

Ping statistics for 192.168.101.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 6ms, Average = 1ms
```

Test shows the PLC is reachable from the PLC terminal PC which has TIA Portal

Figure 70: 192.168.100.2 ping reply

Second test command (Figure 71) would return the results shown in Figure 72.

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

Figure 71: Ping ip 192.169.101.3

```
Pinging 192.168.101.3 with 32 bytes of data:  
Request timed out.  
Reply from 192.168.101.3: bytes=32 time=1ms TTL=127  
Reply from 192.168.101.3: bytes=32 time<1ms TTL=127  
Reply from 192.168.101.3: bytes=32 time<1ms TTL=127  
  
Ping statistics for 192.168.101.3:  
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),  
    Approximate round trip times in milli-seconds:  
        Minimum = 0ms, Maximum = 1ms, Average = 0ms
```

*Test shows the other PC
network terminal is also
reachable*

Figure 72: 192.168.100.3 ping reply

3.2 SIEMENS PLC WEB SERVER CONFIGURATION

When opening a new PLC project, the web servers are not active by default. Web serves must be activated and configured in the CPU properties. They can be activated by just checking the box shown in Figure 73.

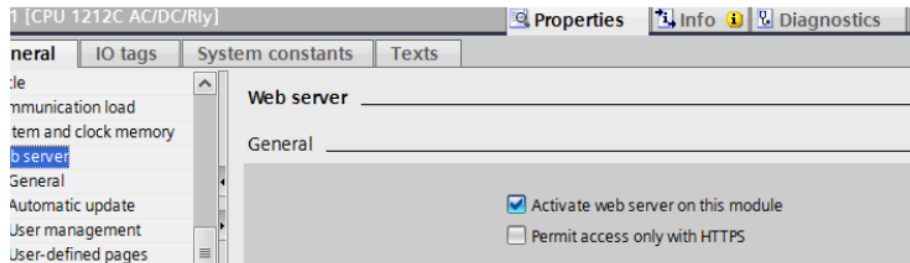


Figure 73: Activation of web server

Under the 'User-defined pages' setting, the file extensions can be added.

PLC web server enabled

There are different file extensions for web programming, such as,

.js – javascript (jquery, ajax)

.json – an extension library of javascript

HTML – Hypertext Markup Language

HTM – Allowable short version of HTML. Both extensions are permitted.

The file extensions used by the web server are identified

Siemens PLC older than the S7-1500 series, do not accept the .js file extension. A work around for this is to embed the .js in the extension file of an HTML or HTM file.

Figure shows the configuration for the web server, in case, HMT, HTML, and .js is used.

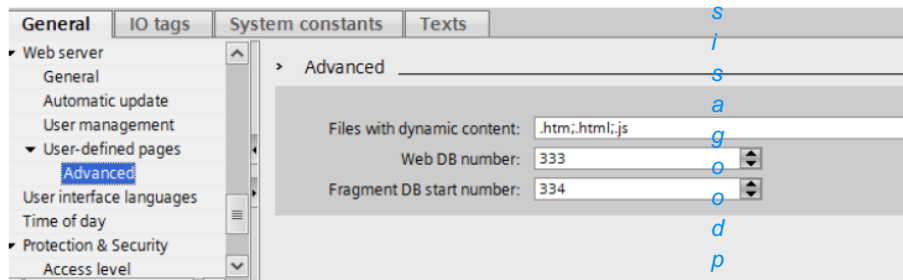


Figure 74: File extension configuration

Image shows the file extensions entered in the PLC config

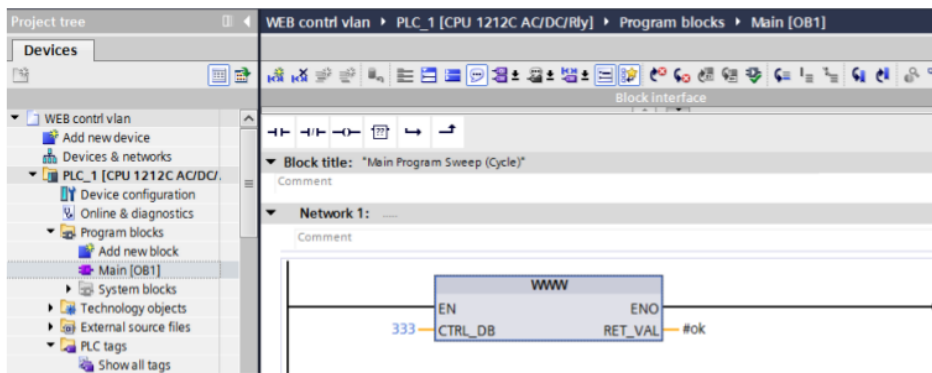
The program used is basic, switching LEDs as a result of different inputs. The tags are shown in Figure 75.

	Name	Data type	Address
1	op	Bool	%Q0.0
2	op2	Bool	%Q0.1
3	op3	Bool	%Q0.2
4	ip	Bool	%I0.0
5	ip1	Bool	%I0.1
6	ip2	Bool	%I0.2
7	ip3	Bool	%I0.3
8	ip4	Bool	%I0.4
9	ip5	Bool	%I0.5
10	ip6	Bool	%I0.6
11	ip7	Bool	%I0.7
12	<Add new>		

PLC IO tags declared for use in the web HTML program

Figure 75: Tag list

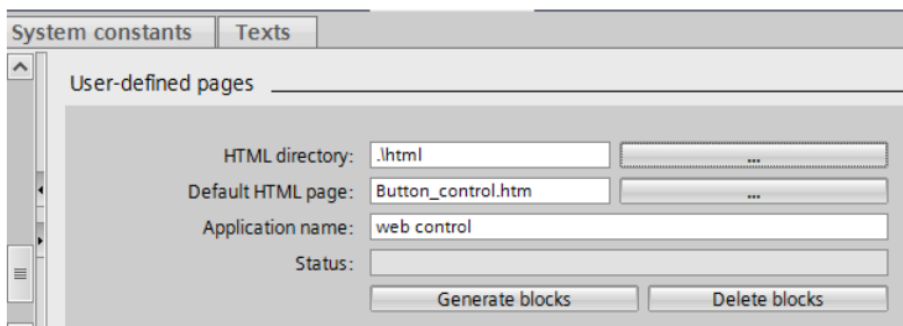
The web server block (www) is added into the main OB1 of the program.



Web server block is implemented in Main

Figure 76: Web server block

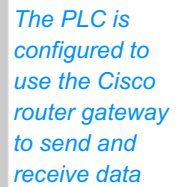
Next, the index .html page with the http:// source for the index page was downloaded. (Figure 77)



Web HTML program is downloaded to PLC web server

Figure 77: html index setup

Once this was done, the VLAN gateway and ip addresses were set. This is shown in Figure 78.



The web page program is stored in the project file under the folder 'UserFiles'. This file also contains all relevant files for the webpage. The full HTML code for the web page can be seen in appendix A.

```
66 <p align="center">ip 0 : :="ip";&nbsp;&nbsp;&nbsp;  
67 &nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;& ip 1 : :="i1";&nbsp;&nbsp;&nbsp;  
68 &nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;& ip 2 : :="i2";&nbsp;&nbsp;&nbsp;  
69 &nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;& ip 3 : :="i3";&nbsp;&nbsp;&nbsp;  
70 &nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;& ip 4 : :="i4";&nbsp;&nbsp;&nbsp;  
71 &nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;& ip 5 : :="i5";&nbsp;&nbsp;&nbsp;  
72 &nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;& ip 6 : :="i6";&nbsp;&nbsp;&nbsp;  
73 &nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;& ip 7 : :="i7";&nbsp;&nbsp;&nbsp;  
74  
75 <p align="center">Output 0 : :="op";&nbsp;&nbsp;&nbsp;  
76 &nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;& Output 2 : :="o2";&nbsp;&nbsp;&nbsp;  
77 &nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;& Output 3 : :="o3";&nbsp;&nbsp;&nbsp;  
78  
79 </body>  
80 </html>  
81
```

This shows the part of the program that reads the

This shows the part of the HTML program that reads the input tags status of the PLC. Images are used to display the status

SIEMENS SIMATIC 300 station_2 / PLC_2

02.04.2018 10:11:23:02:13 UTC English

PLC_2

Start Page

Identification

Diagnostic Buffer

Module Information

Communication

Variable Status

File Browser

User Pages

Introduction

General:

Title: V18.1

Station name: SIMATIC 300 station_2

Module name: PLC_2

Module type: CPU 314C-2 DP

Properties

Status:

Operating mode: RUN

Status: OK

Go to STOP Go to RUN

The opening web page from the PLC server

From this page, select the 'User Pages' option which will load the web page which was created.

Three tests were conducted to show that the web page was displaying the correct results. Figure 81 to Figure 83 show the results below, comparing the LED lights on the physical PLC, to that displayed on the webpage.

Input: 01111000 | Output: 1000000



Test
shows the
HTML
web
page
reading
the
IO
status
of
the
PLC

Figure 81: Web test 1

Input: 10011011 | Output: 1010000

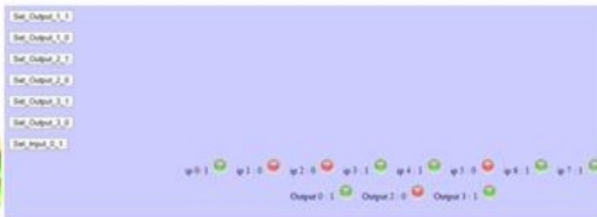


Figure 82: Web test 2

Input: 10010000 | Output: 1000000



Figure 83: Web test 3

3.3 ELEMENT 3 CONCLUSION AND EVALUATION

This last element brought together the knowledge built upon for the previous elements. By using the programming PC on a different VLAN to the PLC, it meant that the routing had to be correct in order for the communication to work. This element links into the industry 4.0 concept where all devices are talking to each other over networks, not hardwired. Giving access for monitoring and analysing performance various locations remotely rather than having to physically be in front of the equipment.

Conclusion is
brief but there is a
good point made
ad
co
re
ctl
y
by
th
e
HT
M
L
we
b
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m

3.4 APPENDIX 3A

```
<html>

<head>
<meta http-equiv="refresh" content="0.2">

<title>Web_control</title>
<meta http-equiv="Content-Type" content="text/html; charset=iso-8859-1"><style
type="text/css">
<!--
body,td,th {
    color: #000033;
}
body {
    background-color: #CCCCCC;
}
-->
</style></head>

<body>

<!-- AWP_In_Variable Name=""op"" -->
<!-- AWP_In_Variable Name=""op2"" -->
<!-- AWP_In_Variable Name=""op3"" -->
<!-- AWP_In_Variable Name=""ip"" -->
<!-- AWP_In_Variable Name=""ip1"" -->
<!-- AWP_In_Variable Name=""ip2"" -->
<!-- AWP_In_Variable Name=""ip3"" -->
<!-- AWP_In_Variable Name=""ip4"" -->
<!-- AWP_In_Variable Name=""ip5"" -->
<!-- AWP_In_Variable Name=""ip6"" -->
<!-- AWP_In_Variable Name=""ip7"" -->

<form>
<input type="submit" value="Set_Output_1_1">
<input type="hidden" name=""op"" value="1">
</form>

<form>
<input type="submit" value="Set_Output_1_0">
<input type="hidden" name=""op"" value="0">
</form>

<p>
<form>
<input type="submit" value="Set_Output_2_1">
<input type="hidden" name=""op2"" value="1">
```


WORKS CITED

- Alpern, N. J. & Shimonski, R. J., 2010. *Eleventh Hour Network+*. [Online]
Available at: <https://www.sciencedirect.com/topics/computer-science/broadcast-network>
[Accessed 18th January 2020].
- BBC, ND. *Network topologies, protocols and layers*. [Online]
Available at: <https://www.bbc.co.uk/bitesize/guides/z666pbk/revision/5>
- Comer, D. E., 2015. *Computer networks and internets*. 6th ed. s.l.:Pearson.
- Forouzan, B. A., 2013. *Data communications and networking*. 5th ed. New York: McGraw-Hill.
- Marshall, D., 2001. *The OSI 7 Layer Model for Network Protocol*. [Online]
Available at: <http://users.cs.cf.ac.uk/Dave.Marshall/Internet/node51.html>
[Accessed 23rd January 2020].
- Medhi, D. & Ramasamy, K., 2018. *Network Routing (Second Edition)*. [Online]
Available at: <https://www.sciencedirect.com/topics/computer-science/broadcast-network>
[Accessed 18th January 2020].
- Moumita, 2019. *What is Broadcasting in Computer Network?*. [Online]
Available at: <https://www.tutorialspoint.com/what-is-broadcasting-in-computer-network#>
[Accessed 18th January 2020].
- Network Cyclopedia, 2020. *Encapsulation*. [Online]
Available at: <https://networkencyclopedia.com/encapsulation/>
[Accessed 18th January 2020].
- Pigan, R. & Metter, M., 2008. *Automating with PROFINET*. 2nd Rev ed. s.l.:Publicis Publishing.
- Postel, J., 1981. *TRANSMISSION CONTROL PROTOCOL*. [Online]
Available at: <https://www.ietf.org/rfc/rfc793.txt>
[Accessed 18th January 2020].
- US Department of Homeland Security CISA Cyber + Infrastructure , 2010. *Understanding Denial-of-Service Attacks*. [Online]
Available at: <https://www.us-cert.gov/ncas/tips/ST04-015>
[Accessed 19th January 2020].

*Good list
of
sources*

FINAL GRADE

GENERAL COMMENTS

Instructor

66/100

PAGE 1

PAGE 2

Text Comment. Good detailed list of contents

PAGE 3

PAGE 4

Text Comment. Extensive list of figures

PAGE 5

Text Comment. Explanations are good and cover the 7 layers

Text Comment. Good informative image showing the combined layers

PAGE 6

Text Comment. Good point here. The 4 layer was developed for networking and not so much for the application side

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

PAGE 7

Text Comment. Good image to support your explanation

Text Comment. Good explanation. You could also have pointed out how to minimise broadcast domains for better security and improved performance

Text Comment. Explanation is good and supported with the table of significant assigned ports

Text Comment. Good table of address scheme with class A, B and C included

Text Comment. A good set of results. This shows that a good test method is used which eliminates the redundant tests

Text Comment. Screenshots show the implementation of static parameters

Text Comment. RIP tables are correct

Text Comment. Router reports show the connected and routed addresses

Text Comment. Tests are successful and redundant tests are eliminated

Text Comment. The screenshot clearly shows the configuration for DHCP

Text Comment. Screenshot shows the DHCP assigned address

Text Comment. This test should be placed after the config of the excluded address range is explained

Text Comment. Default address due to no helper address implemented

PAGE 21

Text Comment. Image shows the correct operation of DHCP

Text Comment. Excluded address test above should be placed here

Text Comment. Test shows the excluded address range is working and the next available address is assigned

PAGE 22

Text Comment. DHCP with exclusion address range is successful

PAGE 23

Text Comment. The router report shows all configuration on the router

PAGE 24

PAGE 25

Text Comment. An example is enough in this section. The rest of the router config reports can go in the appendix

PAGE 26

PAGE 27

PAGE 28

PAGE 29

Text Comment. There is no explanation for CIDR and its purpose.

Text Comment. Table of address scheme is correct

PAGE 30

Text Comment. LAN addresses are correct and good use of tables

Text Comment. WAN serial link network addresses are correct and follow a sequence which is good practice

Text Comment. RIP tables show the connected and routed address links

Text Comment. Tests are successful and show the fail test has been re-tested and passed. Good test method used to eliminate redundant tests

Text Comment. This is the VLSM part. You should explain the purpose of VLSM

Text Comment. CIDR address allocation is correct. Good use of table

Text Comment. Address allocation for CIDR /30 is correct

Text Comment. You need to put headings and a short explanation before going from one section to the next.

Text Comment. One of these reports is enough here for an example to explain. The others should be in the appendix and referenced from the main report

Text Comment. Tests are successful

Text Comment. Image shows VLANs active with active interfaces

Text Comment. Trunking is configured

Text Comment. Screenshot shows the VLANs are configured. The gateway is configure for two separate LANs with separate gateway addresses

Text Comment. The RIP tables will auto configure only if the configuration is correct. This is correct here

Text Comment. The switch port 10 is up and is the trunk channel for the two VLANs

Text Comment. Tests are successful

Text Comment. Denial of service is configured in the ACL

Text Comment. Test shows the denial of service for address 60.129

Text Comment. Test shows access for address 60.65

Text Comment. The appendices should be at the end of the report

Text Comment. Hardware is identified

Text Comment. Network diagram is correct

Text Comment. Image showing connections to Cisco router and switch

PAGE 53

Text Comment. A good point to make. The configuration is no different to the CAD design

PAGE 54

Text Comment. Config should be in the appendix

Text Comment. Images show the VLAN config for the Cisco switch and router

PAGE 55

Text Comment. Image shows the VLANs active with active interfaces

Text Comment. Test shows the PLC is reachable from the PLC terminal PC which has TIA Portal

PAGE 56

Text Comment. Test shows the other PC network terminal is also reachable

PAGE 57

Text Comment. PLC web server enabled

Text Comment. The file extensions used by the web server are identified

Text Comment. This is a good point

Text Comment. Image shows the file extensions entered in the PLC config

PAGE 58

Text Comment. PLC IO tags declared for use in the web HTML program

Text Comment. Web server block is implemented in Main

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

Text Comment. The PLC is configured to use the Cisco router gateway to send and receive data

Text Comment. This shows the part of the HTML program that reads the input tags status of the PLC. Images are used to display the status

Text Comment. The opening web page from the PLC server

Text Comment. Test shows the HTML web page reading the IO status of the PLC

Text Comment. Tests prove that the IO status is read correctly by the HTML web program

Text Comment. Conclusion is brief but there is a good point made

Text Comment. Good list of sources

GRADING FORM: CSG-RUBIC

JONATHON
WILLIAMS

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RESEARCH-INFORMED LITERATURE



Your research covers most of what is required with good relevant sources used. Parts of the research is brief and does not explain enough. 6/10

6/10

KNOWLEDGE AND UNDERSTANDING



Element 1: No intro to indicate the objectives of this section. The design and implementation of the network is not explained but there are supporting images. Some parts do not have headings. There is sufficient evidence for correct implementation. 6/10

Element 2: No introduction to explain the requirements clearly. There is very little explanation and headings missing in parts. The documentation requirements for addressing schemes are good and good use of tables for this. 6/10

Element 3: Explanations and headings are better in this section. The implementation of the VLAN and web server are documented and supported with images. Some of the explanations need to be more clear. There is sufficient evidence of the ACL configuration. The web program implementation is achieved over the existing Cisco switch and router and explained clearly. 7/10

19/30

ANALYSIS



Element 1: Testing and results need a clearer explanation and headings to indicate what the tests are for. However the tests are supported with sufficient images. 3/5

Element 2: Analysis of test results has been carried out with supporting images and a good method of testing used. Explanations should be used with headings. Good use of tables in

16/25

this section.6/10 Element 3: Good test results obtained. Explanations are better in this section There is sufficient evidence of the requirements. 7/10

PRACTICAL APPLICATION AND DEP.



Element 1: Design and implementation from address scheme to class A, B and C and serial links are clearly implemented and tested. The procedures followed from design to implementation were efficient which simplified the testing stage. 3/5 Element 2: The configuration is more complex due to the subnetting required and the tables of addressing are very well ordered and follow a pattern. Implementation of the required network parameters has been carried out but explanations are limited with headings missing in some parts. This should have included the reason for RIP ver 2 and not ver 1. The differences are important points. 6/10 Element 3: The practical implementation was carried out using Cisco level 2 and 3 devices. Explanations here are better with supporting images. The testing carried out demonstrated the VLANs and ACL security used in industry networks. Conclusion could have been more detailed. 7/10

16/25

SKILLS FOR PROFESSIONAL PRAC.



The layout of the report is good but with missing headings and explanations some parts seemed to merge with others which is confusing.

9/15