

Portfolio

by Christopher Milner

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Author:

Christopher Milner

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Element 1

Task 1

The OSI model is a concept model that provides a standard for all communication functions of telecommunication and computing systems.

The OSI model consists of seven layers that describe functions of communications and networking independently of underlying technology infrastructure. The image below shows each layer and what level each one describes.

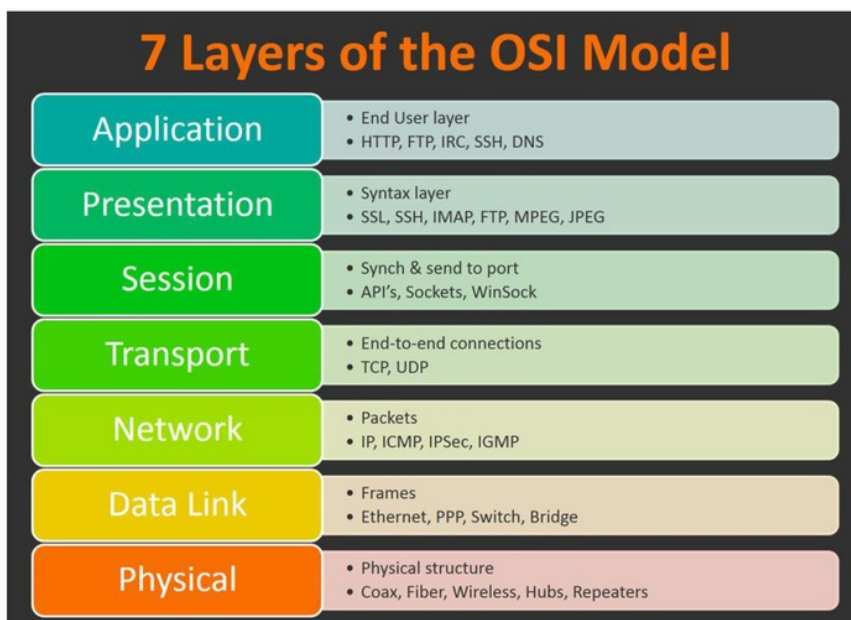


Diagram is good and supports your explanation.

Each layer is described in more detail below.

Physical Layer

The lowest layer of the OSI model describes data communication in the form of electrical, optic or electromagnetic signals physically transmitting information between devices. The Physical Layer is essentially responsible for the communication of unstructured raw data streams over a physical medium. The

hardware includes networking devices, antennas, cables, modem, intermediate devices such as repeaters and hubs.

Data Link Layer

The second layer describes transmission between the nodes within a network and manages the connections between physically connected devices such as switches. The data is transmitted sequentially and the layer expects acknowledgement for the encapsulated raw data sent between the nodes.

Network Layer

The third layer organizes and transmits data between multiple networks. The layer routes the data through the best physical path based on a range of factors including network characteristics, best available path, traffic controls, congestion of data packets and priority of service, among others. Network Layer hardware includes routes, bridge routers, 3-layer switches and protocols such as Internet (IPv4) Protocol version 4 and Internet Protocol version 6 (IPv6).

Transport Layer

The fourth layer ensures delivery of data packets. The Transport Layer provides mechanisms such as error control, flow control and congestion control to keep track of the data packets, check for errors and duplication, and resend the information that fails delivery. Common protocols include the Transmission Control Protocol (TCP) for connection-oriented data transmission and User Datagram Protocol (UDP) for connectionless data transmission.

Session Layer

The Session Layer manages sessions between servers to coordinate the communication – as the first of the top three OSI model layers that deal with the software level. The Session Layer is responsible for a range of functions including opening, closing and re-establishing session activities, authentication and authorization of communication between specific apps and servers, identifying full-duplex or half-duplex operations and synchronizing data streams.

Presentation Layer

The fifth layer converts data formats between applications and the networks.

Responsibilities of the Presentation Layer include data conversion, character code translation, data compression, encryption and decryption. The presentation layer also serializes complex information into transportable formats. The data streams are then deserialized and reassembled into original object format at the destination.

Application Layer

The Application Layer concerns with the networking processes at the application level. This layer interacts directly with end-users to provide support for email, network data sharing, file transfers and directory services, among other distributed information services. The most common Application Layer protocols include File Transfer Protocol (FTP), Simple Mail Transfer Protocol (SMTP) and Domain Name System (DNS). (Raza, n.d.)

Encapsulation is the process of adding a header to a data packet as it moves between the layers of a network. The header contains information directing the path of the packet to a destination i.e. the address of the next node, the type of data enclosed and the source and destination addresses.

In computer networking, broadcasting means that a data packet will be transmitted across a network to be received by every device attached simultaneously. This contrasts with communications between two hosts specified by IP address (unicasting). Broadcasting is a very basic form of network communication and the latest protocols use multicasting instead to avoid network interruptions by large burst of data packets.

Task 2

Configuration of a suitable address scheme that includes class A, B, and C for the LAN networks used.

You have explained most of the required areas except port allocation. There is only evidence of one source.

Class C:

192.168.1.0 – net address

192.168.1.254 – gateway address

192.168.1.1 – initial device address

Class B:

180.10.0.0 – net address

180.10.0.254 – gateway address

180.10.0.1 – initial device address

Class A:

100.0.0.0 – net address

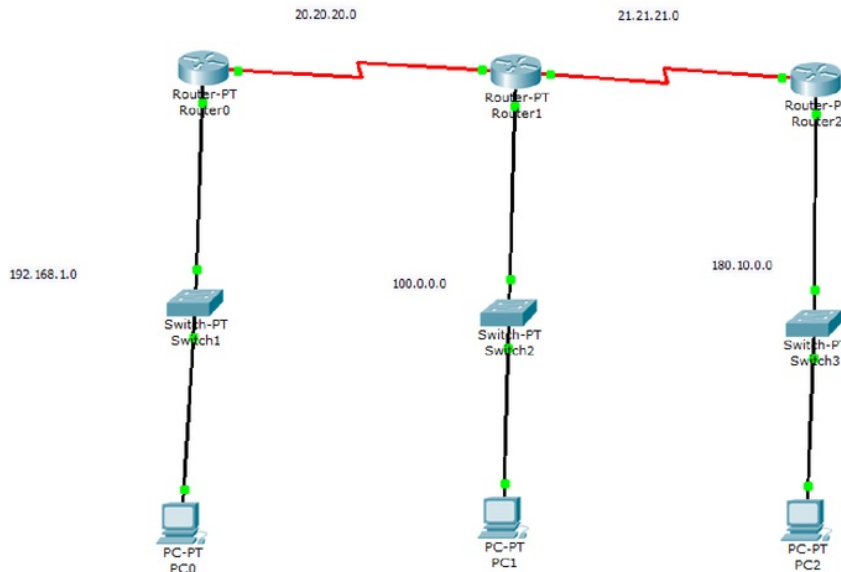
100.0.0.254 – gateway address

100.0.0.1 – initial device address

*Three ip address
classes have been
assigned to the LANs*

Task 3

Static routing using static addressing.



This is the simplified network which has less WANs.

Router 1

Network Address
 100.0.0.0/8 via 20.20.20.2
 180.10.0.0/16 via 20.20.20.2

Remove

Static routing is shown in the router configuration report.

```

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    20.0.0.0/8 is directly connected, Serial2/0
S    100.0.0.0/8 [1/0] via 20.20.20.2
S    180.10.0.0/16 [1/0] via 20.20.20.2
C    192.168.1.0/24 is directly connected, FastEthernet0/0
Router(config)#
  
```

Router 2

Network Address

192.168.1.0/24 via 20.20.20.1

180.10.0.0/16 via 21.21.21.2

Remove

```
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    20.0.0.0/8 is directly connected, Serial2/0
```

```
C    100.0.0.0/8 is directly connected, FastEthernet0/0
```

```
S    192.168.1.0/24 [1/0] via 20.20.20.1
```

```
Router(config)#
```

Router 3

Network Address

100.0.0.0/8 via 21.21.21.1

192.168.1.0/24 via 21.21.21.1

Remove

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 180.10.0.0/16 is directly connected, FastEthernet0/0

Router(config)#

Fire	Last Status	Source	Destination	Type	Color	Time (sec)	Periodic	Num	Edit	Delete
	Successful	PC0	Router0	ICMP		0.000	N	0	(edit)	(delete)
	Successful	PC1	Router1	ICMP		0.000	N	1	(edit)	(delete)
	Successful	PC2	Router2	ICMP		0.000	N	2	(edit)	(delete)
	Successful	Router0	Router1	ICMP		0.000	N	3	(edit)	(delete)
	Successful	Router1	Router2	ICMP		0.000	N	4	(edit)	(delete)
	Successful	PC0	PC2	ICMP		0.000	N	5	(edit)	(delete)
	Successful	PC0	PC1	ICMP		0.000	N	6	(edit)	(delete)
	Successful	PC1	PC2	ICMP		0.000	N	7	(edit)	(delete)

Task 4

Configuring the 3 routers for dynamic routing using RIP (Routing Information Protocol).

Rip routing

Router 1

Network Address
20.0.0.0
100.0.0.0
192.168.1.0

Router 2

Network Address

20.0.0.0
21.0.0.0
100.0.0.0
180.10.0.0
192.168.1.0

Router 3

Network Address

21.0.0.0
100.0.0.0
180.10.0.0

RIP routing is configured but there is no configuration samples or testing carried out for this.

Task 5

Dynamic addressing across networks using DHCP and helper addresses

DHCP

Router1 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

```

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)#exit
Router(config)#ip dhcp pool net2
Router(dhcp-config)#net 100.0.0.0 255.0.0.0
Router(dhcp-config)#default-router 100.0.0.254
Router(dhcp-config)#dns-server 100.0.0.254
Router(dhcp-config)#exit
Router(config)#ip dhcp pool net3
Router(dhcp-config)#net 180.10.0.0 255.255.0.0
Router(dhcp-config)#default-router 180.10.0.254
Router(dhcp-config)#dns-server 180.10.0.254
Router(dhcp-config)#exit
Router(config)#^Z
Router#
%SYS-5-CONFIG_I: Configured from console by console
  
```

DHCP
 CP
 is
 co
 nfi
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 ed
 in
 the
 co
 ntr
 ol
 rou
 ter.

IP Configuration X

☒ DHCP
☐ Static

DHCP request successful.

IP Address	192.168.1.1
Subnet Mask	255.255.255.0
Default Gateway	192.168.1.254
DNS Server	192.168.1.254

DHCP test on control router is
 successful.

IP Configuration X

☒ DHCP
☐ Static

DHCP request failed.

IP Address	
Subnet Mask	
Default Gateway	
DNS Server	

The other routers will not work
 without the helper address.

Router 2 helper

```
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#int f0/0
Router(config-if)#ip helper-address 20.20.20.1
Router(config-if)#exit
Router(config)#^Z
Router#
%SYS-5-CONFIG_I: Configured from console by console
```

Helper
address
is
imple
mented
on
other
routers.

Router 3 helper

```
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#int f0/0
Router(config-if)#ip helper-address 20.20.20.1
Router(config-if)#exit
Router(config)#^Z
Router#
%SYS-5-CONFIG_I: Configured from console by console
```

IP Configuration X

☒ 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

Tests now show the dynamic
address and gateway test is
good.

IP Configuration
X

☒ DHCP
☐ Static

DHCP request successful.

IP Address

180.10.0.1

Subnet Mask

255.255.0.0

Default Gateway

180.10.0.254

DNS Server

180.10.0.254

Dynamic address and gateway is set.

Exclusions

```

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 100.0.0.1 100.0.0.15
Router(config)#ip dhcp excluded-address 192.168.1.1 192.168.1.20
Router(config)#ip dhcp excluded-address 180.10.0.1 180.10.0.15
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
  
```

Exclusion address ranges are configured.

IP Configuration
X

☒ DHCP
☐ Static

DHCP request successful.

IP Address

192.168.1.21

Subnet Mask

255.255.255.0

Default Gateway

192.168.1.254

DNS Server

192.168.1.254

DHCP address starts outside the exclusion range

IP Configuration
X

☒ DHCP
☐ Static

DHCP request successful.

IP Address

100.0.0.16

Subnet Mask

255.0.0.0

Default Gateway

100.0.0.254

DNS Server

100.0.0.254

Exclusion range avoided by DHCP.

IP Configuration
X

☒ DHCP
☐ Static

DHCP request successful.

IP Address

180.10.0.16

Subnet Mask

255.255.0.0

Default Gateway

180.10.0.254

DNS Server

180.10.0.254

Exclusion range avoided by DHCP.

```

ip dhcp excluded-address 192.168.1.10
ip dhcp excluded-address 100.0.0.1 100.0.0.15
ip dhcp excluded-address 192.168.1.1 192.168.1.20
ip dhcp excluded-address 180.10.0.1 180.10.0.15
!
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 100.0.0.0 255.0.0.0
default-router 100.0.0.254
dns-server 100.0.0.254
ip dhcp pool net3
network 180.10.0.0 255.255.0.0
default-router 180.10.0.254
dns-server 180.10.0.254
  
```

This is the configuration for the exclusion ranges

```
interface FastEthernet0/0
ip address 192.168.1.254 255.255.255.0
duplex auto
speed auto
!
interface FastEthernet1/0
no ip address
duplex auto
speed auto
shutdown
!
interface Serial2/0
ip address 20.20.20.1 255.0.0.0
clock rate 2000000
!
interface Serial3/0
no ip address
shutdown
!
interface FastEthernet4/0
no ip address
shutdown
!
interface FastEthernet5/0
no ip address
shutdown
!
router rip
version 2
network 20.0.0.0
network 100.0.0.0
network 192.168.1.0
.

interface FastEthernet0/0
ip address 100.0.0.254 255.0.0.0
ip helper-address 20.20.20.1
duplex auto
speed auto
!
interface FastEthernet1/0
no ip address
duplex auto
speed auto
shutdown
!
interface Serial2/0
ip address 20.20.20.2 255.0.0.0
!
interface Serial3/0
ip address 21.21.21.1 255.0.0.0
clock rate 2000000
!
interface FastEthernet4/0
no ip address
shutdown
!
interface FastEthernet5/0
no ip address
shutdown
!
router rip
version 2
network 20.0.0.0
network 21.0.0.0
network 100.0.0.0
network 180.10.0.0
network 192.168.1.0
.
```

```
interface FastEthernet0/0
ip address 180.10.0.254 255.255.0.0
ip helper-address 20.20.20.1
duplex auto
speed auto
!
interface FastEthernet1/0
no ip address
duplex auto
speed auto
shutdown
!
interface Serial2/0
ip address 21.21.21.2 255.0.0.0
!
interface Serial3/0
no ip address
shutdown
!
interface FastEthernet4/0
no ip address
shutdown
!
interface FastEthernet5/0
no ip address
shutdown
!
router rip
version 2
network 21.0.0.0
network 100.0.0.0
network 180.10.0.0
.
```

Router reports all configurations associated with the router. Each router will report all its configurations so it is possible to check configurations using this report.

Evaluation

- Static addressing
- Dynamic addressing – dynamic addressing enables networks to be controlled remotely.
- Static routing
- Dynamic routing (RIP) – dynamic routing is an operation that lies in layer 3 of the OSI model and is a short cut to WAN and LAN communications
- DHCP – dynamic host control protocol
- Exclusions – Allows automatic addressing from the control router with set address ranges.

The OSI layer model can be used as a reference to all operations and configurations on a specific network. For example routing is a layer 3 operation and a switch is a layer two operation. Together these two elements are the most important for a successful network connection.

Bibliography

Raza, M. (n.d.). BMC. Retrieved from OSI 7 layer model: <https://www.bmc.com/blogs/osi-model-7-layers/>

2. Element 2

1. CIDR 28 network design

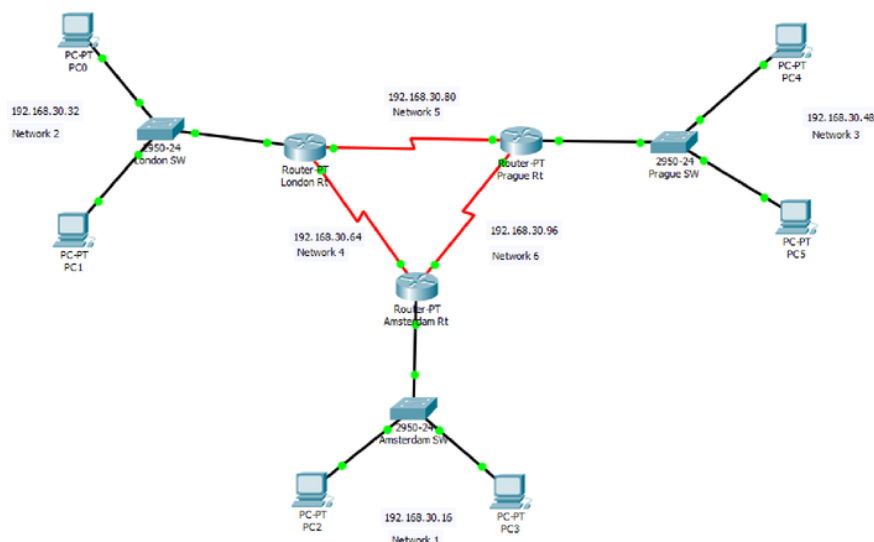
subnet	1	2	4	8	16	32	64	128	256
host	256	128	64	32	16	8	4	2	1
subnet mask	/24	/25	/26	/27	/28	/29	/30	/31	/32

subnet	1	2	4	8	16	32	64	128	256
host	256	128	64	32	16	8	4	2	1
subnet mask	/24	/25	/26	/27	/28	/29	/30	/31	/32

network ID	Subnet mask	Host ID range	# of usable hosts	Broadcast ID
192.168.4.0	/26	192.168.4.1-192.168.4.62	62	192.168.4.63
192.168.4.64	/26	192.168.4.65-192.168.4.126	62	192.168.4.127
192.168.4.128	/26	192.168.4.129-192.168.4.190	62	192.168.4.191
192.168.4.192	/26	192.168.4.193-192.168.4.254	62	192.168.4.255

subnet	1	2	4	8	16	32	64	128	256
host	256	128	64	32	16	8	4	2	1
subnet mask	/24	/25	/26	/27	/28	/29	/30	/31	/32

The
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CIDR/28 Amsterdam Network 1

Network address 192.198.30.16 identifier

Subnet mask	1	1	1	1	0	0	0	0	255.255.255.240
	0	0	0	0	0	0	0	0	Not used
Net addr 16	0	0	0	1	0	0	0	1	Lowest host addr 17 192.168.30.17
Net addr 16	0	0	0	1	0	0	1	0	Next host addr 18 192.168.30.18
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

CIDR/28 London Network 2

Network address 192.198.30.32 identifier

Subnet mask	1	1	1	1	0	0	0	0	255.255.255.240
	0	0	0	0	0	0	0	0	Not used
Net addr 32	0	0	1	0	0	0	0	1	Lowest host addr 33
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

CIDR/28 Prague Network 3

Network address 192.198.30.48 identifier

Subnet mask	1	1	1	1	0	0	0	0	255.255.255.240
	0	0	0	0	0	0	0	0	Not used
Net addr 48	0	0	1	1	0	0	0	1	Lowest host addr 49
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

London-Amsterdam Network 4

London Router	0	1	0	0	1	1	0	1	Fastethernet 0/0 addr 77
Amsterdam Router	0	1	0	0	1	1	1	0	Fastethernet 0/1 addr 78

London-Prague Network 5

London Router	0	1	0	1	1	1	0	1	Fastethernet 0/0 addr 93
Prague Router	0	1	0	1	1	1	1	0	Fastethernet 0/0 addr 94

Prague-Amsterdam Network 6

Prague Router	0	1	1	0	1	1	0	1	Fastethernet 0/1 addr 109
Amsterdam Router	0	1	1	0	1	1	1	0	Fastethernet 0/1 addr 110

The CIDR/28 address scheme has been implemented

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

Tests are successful

London RIP table

```

192.168.30.0/28 is subnetted, 6 subnets
R    192.168.30.16 [120/1] via 192.168.30.78, 00:00:02,
Serial12/0
C    192.168.30.32 is directly connected, FastEthernet0/0
R    192.168.30.48 [120/1] via 192.168.30.94, 00:00:25,
Serial13/0
C    192.168.30.64 is directly connected, Serial12/0
C    192.168.30.80 is directly connected, Serial13/0
R    192.168.30.96 [120/1] via 192.168.30.78, 00:00:02,
Serial12/0
                               [120/1] via 192.168.30.94, 00:00:25,
Serial13/0

```

These tests are successful

Amsterdam RIP table

```

192.168.30.0/28 is subnetted, 6 subnets
C    192.168.30.16 is directly connected, FastEthernet0/0
R    192.168.30.32 [120/1] via 192.168.30.77, 00:00:10,
Serial12/0
R    192.168.30.48 [120/1] via 192.168.30.109, 00:00:19,
Serial13/0
C    192.168.30.64 is directly connected, Serial12/0
R    192.168.30.80 [120/1] via 192.168.30.109, 00:00:19,
Serial13/0
                                     [120/1] via 192.168.30.77, 00:00:10,
Serial12/0
C    192.168.30.96 is directly connected, Serial13/0
  
```

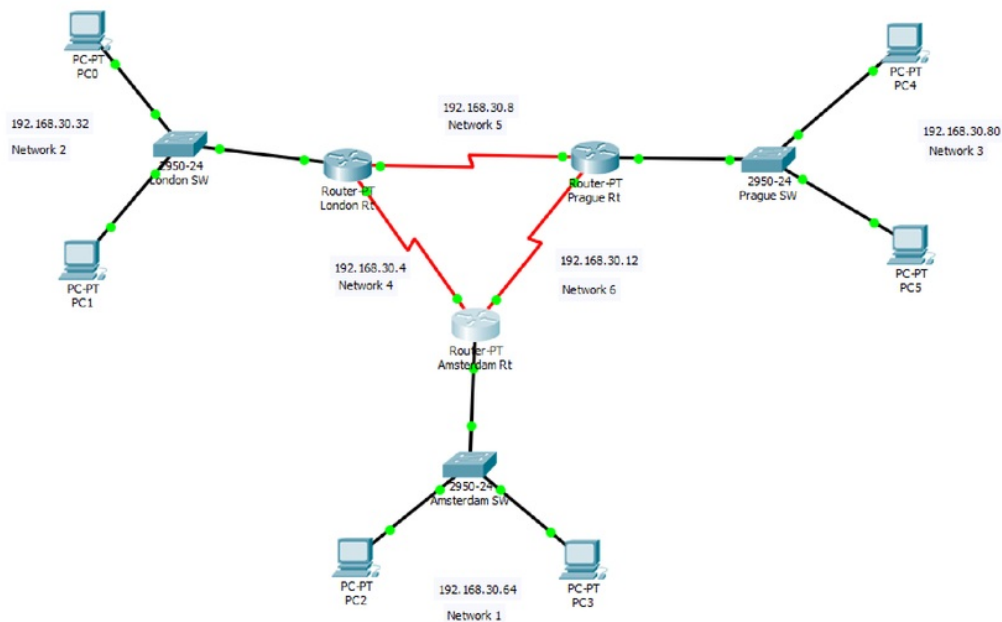
Prague RIP table

```

192.168.30.0/28 is subnetted, 6 subnets
R    192.168.30.16 [120/1] via 192.168.30.110, 00:00:09,
Serial13/0
R    192.168.30.32 [120/1] via 192.168.30.93, 00:00:20,
Serial12/0
C    192.168.30.48 is directly connected, FastEthernet0/0
R    192.168.30.64 [120/1] via 192.168.30.110, 00:00:09,
Serial13/0
                                     [120/1] via 192.168.30.93, 00:00:20,
Serial12/0
C    192.168.30.80 is directly connected, Serial12/0
C    192.168.30.96 is directly connected, Serial13/0
  
```

RIP tables are configured.

2. VLSM CIDR/27 and CIDR/30



CIDR/27 Networks 1, 2 and 3

Subnet mask	1	1	1	0	0	0	0	0	255.255.255.224
	0	0	0	0	0	0	0	0	Not used
Net addr 32	0	0	1	0	0	0	0	1	Lowest host addr 33 London 1
Net addr 32	0	0	1	0	0	0	1	0	Next host addr 34 London 2
Net addr 32	0	0	1	1	1	1	1	0	Highest Router addr 62 London Router
Net addr 64	0	1	0	0	0	0	0	1	Lowest host addr 65 Amsterdam 1
Net addr 64	0	1	0	0	0	0	1	0	Next host addr 66 Amsterdam 2
Net addr 64	0	1	0	1	1	1	1	0	Highest Router addr 94 Amsterdam Router
Net addr 80	0	1	1	0	0	0	0	1	Lowest host addr 97 Prague 1
Net addr 80	0	1	1	0	0	0	1	0	Next host addr 98 Prague 2
Net addr 80	0	1	1	1	1	1	1	0	Highest Router addr 126 Prague Router

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 London serial 0/0
Net addr 4	0	0	0	0	0	1	1	0	Highest interface addr 6 Amsterdam serial 0/0
Net addr 8	0	0	0	0	1	0	0	1	Lowest interface addr 9 London serial 0/1
Net addr 8	0	0	0	0	1	0	1	0	Highest interface addr 10 Prague serial 0/0
Net addr 12	0	0	0	0	1	1	0	1	Lowest interface addr 13 Amsterdam serial 0/1
Net addr 12	0	0	0	0	1	1	1	0	Highest interface addr 14 Prague serial 0/1

*VLSM is correct and
has been implemented*

London Router RIP table

```

192.168.30.0/24 is variably subnetted, 6 subnets, 2 masks
C    192.168.30.4/30 is directly connected, Serial2/0
C    192.168.30.8/30 is directly connected, Serial3/0
R    192.168.30.12/30 [120/1] via 192.168.30.10, 00:00:20,
Serial3/0
                                     [120/16] via 192.168.30.6, 00:00:10,
Serial2/0
C    192.168.30.32/27 is directly connected, FastEthernet0/0
R    192.168.30.64/27 [120/1] via 192.168.30.6, 00:00:10,
Serial2/0
R    192.168.30.96/27 [120/1] via 192.168.30.10, 00:00:20,
Serial3/0
  
```

Prague Router RIP table

```

192.168.30.0/24 is variably subnetted, 6 subnets, 2 masks
R    192.168.30.4/30 [120/1] via 192.168.30.13, 00:00:18,
Serial3/0
                                     [120/1] via 192.168.30.9, 00:00:20,
Serial2/0
C    192.168.30.8/30 is directly connected, Serial2/0
C    192.168.30.12/30 is directly connected, Serial3/0
R    192.168.30.32/27 [120/1] via 192.168.30.9, 00:00:20,
Serial2/0
R    192.168.30.64/27 [120/1] via 192.168.30.13, 00:00:18,
Serial3/0
C    192.168.30.96/27 is directly connected, FastEthernet0/0
  
```

Amsterdam Router RIP table

```

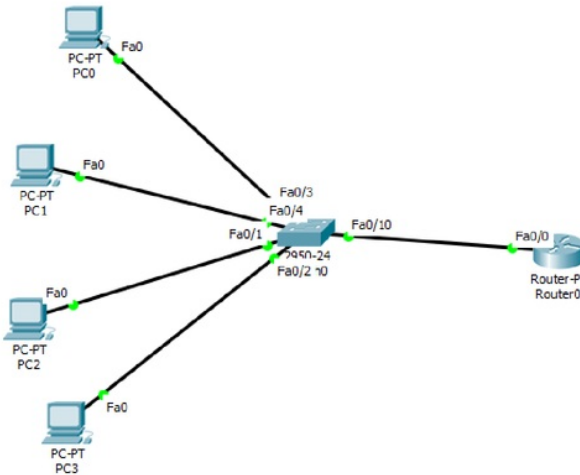
192.168.30.0/24 is variably subnetted, 6 subnets, 2 masks
C    192.168.30.4/30 is directly connected, Serial2/0
R    192.168.30.8/30 [120/1] via 192.168.30.14, 00:00:17,
Serial3/0
                                     [120/1] via 192.168.30.5, 00:00:00,
Serial2/0
C    192.168.30.12/30 is directly connected, Serial3/0
R    192.168.30.32/27 [120/1] via 192.168.30.5, 00:00:00,
Serial2/0
C    192.168.30.64/27 is directly connected, FastEthernet0/0
R    192.168.30.96/27 [120/1] via 192.168.30.14, 00:00:17,
Serial3/0
  
```

RIP tables for the VLSM network

	Successful	PC3	PC5	ICMP	
	Successful	PC1	PC4	ICMP	
	Successful	PC5	PC2	ICMP	
	Successful	PC3	PC0	ICMP	
	Successful	PC4	PC2	ICMP	

Tests are successful

3. VLANs



```

100 vlan100          active   Fa0/1, Fa0/4
101 vlan101          active   Fa0/2, Fa0/3

C 192.168.100.0/24 is directly connected, FastEthernet0/0.100
C 192.168.101.0/24 is directly connected, FastEthernet0/0.101
  
```

```

100 vlan100          active
101 vlan101          active
  
```

Vlan config is good and shows the active Vlans

```

100 vlan100          active   Fa0/2
101 vlan101          active   Fa0/1
  
```

```

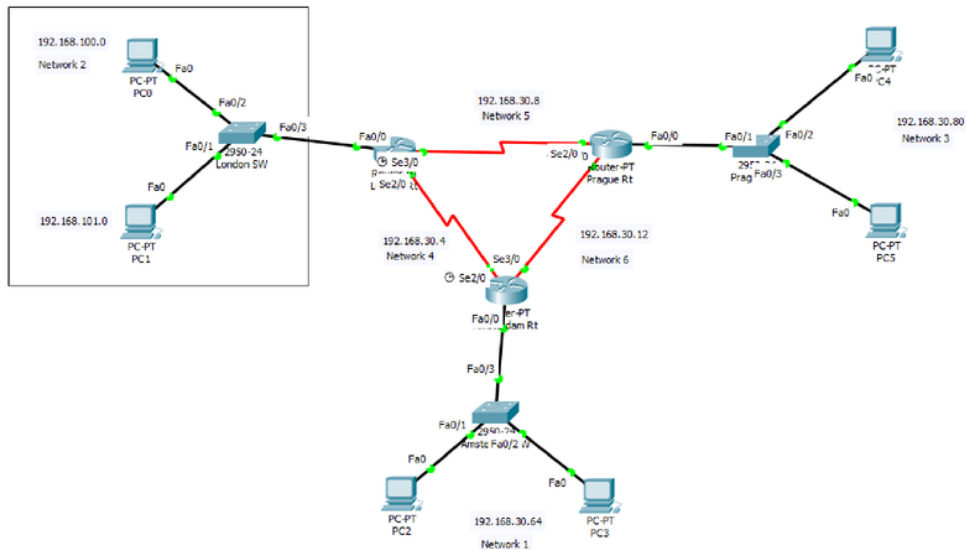
Switch#show interfaces trunk
Port      Mode      Encapsulation  Status      Native vlan
Fa0/3     on        802.1q         trunking    1

Port      Vlans allowed on trunk
Fa0/3     1-1005

Port      Vlans allowed and active in management domain
Fa0/3     1,100,101

Port      Vlans in spanning tree forwarding state and not pruned
Fa0/3     1,100,101
  
```

Encapsulation and trunking is configured which enables the router to be virtually many routers



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

*Vlan addresses
are assigned*

London Router – FastEthernet 0/0.1 ip address 192.168.30.94 255.255.255.224

London Router – FastEthernet 0/0.2 ip address 192.168.30.158 255.255.255.224

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 PC1 London

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

London switch Vlan

```

1      default      active      Fa0/6, Fa0/7,
Fa0/8, Fa0/9
Fa0/12, Fa0/13
Fa0/14, Fa0/15,
Fa0/16, Fa0/17
Fa0/18, Fa0/19,
Fa0/20, Fa0/21
Fa0/22, Fa0/23,
Fa0/24
100   vlan100      active      Fa0/2
101   vlan101      active      Fa0/1
1002  fddi-default  act/unsup
1003  token-ring-default act/unsup
1004  fddinet-default act/unsup
1005  trnet-default act/unsup

```

Vlans are active and interfaces are assigned.

London Running Config

Switch#show running-config
Building configuration...

Current configuration : 1266 bytes

```

!
version 12.1
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Switch
!
!
!
!
spanning-tree mode pvst
spanning-tree extend system-id
!
interface FastEthernet0/1
switchport access vlan 101
switchport mode access
!
interface FastEthernet0/2
switchport access vlan 100
switchport mode access
!
interface FastEthernet0/3
switchport mode trunk
!
interface FastEthernet0/4
switchport access vlan 31
switchport mode access
!
interface FastEthernet0/5
switchport access vlan 31
switchport mode access
!
interface FastEthernet0/6
!
interface FastEthernet0/7
!
interface FastEthernet0/8

```

Trunk configuration on switch is shown

```

!
interface FastEthernet0/9
!
interface FastEthernet0/10
switchport mode trunk
!
interface FastEthernet0/11
!
interface FastEthernet0/12
!
interface FastEthernet0/13
!
interface FastEthernet0/14
!
interface FastEthernet0/15
!
interface FastEthernet0/16
!
interface FastEthernet0/17
!
interface FastEthernet0/18
!
interface FastEthernet0/19
!
interface FastEthernet0/20
!
interface FastEthernet0/21
!
interface FastEthernet0/22
!
interface FastEthernet0/23
!
interface FastEthernet0/24
!
interface Vlan1
no ip address
shutdown
!
!
!
!
line con 0
!
line vty 0 4
login
line vty 5 15
login
!
!
!
end
  
```

	Successful	PC0	PC4	ICMP	
	Successful	PC0	PC5	ICMP	
	Successful	PC0	PC3	ICMP	
	Successful	PC0	PC2	ICMP	
	Successful	PC4	PC0	ICMP	
	Successful	PC4	PC1	ICMP	
	Successful	PC4	PC2	ICMP	
	Successful	PC4	PC3	ICMP	

Test successful

4. ACL

	Successful	PC5	PC0	ICMP	
	Successful	PC5	PC1	ICMP	
	Successful	PC4	PC3	ICMP	
	Failed	PC5	PC2	ICMP	
	Failed	PC4	PC2	ICMP	
	Successful	PC0	PC2	ICMP	
	Successful	PC1	PC2	ICMP	

London RIP route

Router#show ip route

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

Gateway of last resort is not set

192.168.30.0/24 is variably subnetted, 5 subnets, 2 masks
 C 192.168.30.4/30 is directly connected, Serial2/0
 C 192.168.30.8/30 is directly connected, Serial3/0
 R 192.168.30.12/30 [120/1] via 192.168.30.6, 00:00:17, Serial2/0
 [120/1] via 192.168.30.10, 00:00:12, Serial3/0
 R 192.168.30.64/27 [120/1] via 192.168.30.6, 00:00:17, Serial2/0
 R 192.168.30.96/27 [120/1] via 192.168.30.10, 00:00:12, Serial3/0
 C 192.168.31.0/24 is directly connected, FastEthernet0/0.31
 C 192.168.32.0/24 is directly connected, FastEthernet0/0.32
 C 192.168.100.0/24 is directly connected, FastEthernet0/0.100
 C 192.168.101.0/24 is directly connected, FastEthernet0/0.101

Amsterdam RIP route

Router#show ip route

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

Gateway of last resort is not set

192.168.30.0/24 is variably subnetted, 5 subnets, 2 masks
 C 192.168.30.4/30 is directly connected, Serial2/0
 R 192.168.30.8/30 [120/1] via 192.168.30.14, 00:00:22, Serial3/0
 [120/1] via 192.168.30.5, 00:00:00, Serial2/0
 C 192.168.30.12/30 is directly connected, Serial3/0
 C 192.168.30.64/27 is directly connected, FastEthernet0/0
 R 192.168.30.96/27 [120/1] via 192.168.30.14, 00:00:22, Serial3/0
 R 192.168.100.0/24 [120/1] via 192.168.30.5, 00:00:00, Serial2/0

R 192.168.101.0/24 [120/1] via 192.168.30.5, 00:00:00, Serial2/0

Prague RIP route

Router#show ip route

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

Gateway of last resort is not set

192.168.30.0/24 is variably subnetted, 5 subnets, 2 masks

R 192.168.30.4/30 [120/1] via 192.168.30.13, 00:00:16, Serial3/0

[120/1] via 192.168.30.9, 00:00:12, Serial2/0

C 192.168.30.8/30 is directly connected, Serial2/0

C 192.168.30.12/30 is directly connected, Serial3/0

R 192.168.30.64/27 [120/1] via 192.168.30.13, 00:00:16, Serial3/0

C 192.168.30.96/27 is directly connected, FastEthernet0/0

R 192.168.100.0/24 [120/1] via 192.168.30.9, 00:00:12, Serial2/0

R 192.168.101.0/24 [120/1] via 192.168.30.9, 00:00:12, Serial2/0

RIP
routi
ng
is
sho
wn
in

London running config

Router#show running-config

Building configuration...

Current configuration : 1294 bytes

!

version 12.2

no service timestamps log datetime msec

no service timestamps debug datetime msec

no service password-encryption

!

hostname Router

!

!

!

!

!

!

!

ip cef

no ipv6 cef

!

!

!

!

!

!

!

!

!

!

!

!

!

Router config shows all the
config associated with the
router

gs

the

the

listin

```

!
!
!
!
interface FastEthernet0/0
no ip address
duplex auto
speed auto
!
interface FastEthernet0/0.30
encapsulation dot1Q 30
no ip address
!
interface FastEthernet0/0.31
encapsulation dot1Q 31
ip address 192.168.31.254 255.255.255.0
!
interface FastEthernet0/0.32
encapsulation dot1Q 32
ip address 192.168.32.254 255.255.255.0
!
interface FastEthernet0/0.100
encapsulation dot1Q 100
ip address 192.168.100.254 255.255.255.0
!
interface FastEthernet0/0.101
encapsulation dot1Q 101
ip address 192.168.101.245 255.255.255.0
!
interface FastEthernet1/0
no ip address
duplex auto
speed auto
shutdown
!
interface Serial2/0
ip address 192.168.30.5 255.255.255.252
!
interface Serial3/0
ip address 192.168.30.9 255.255.255.252
clock rate 800000
!
interface FastEthernet4/0
no ip address
shutdown
!
interface FastEthernet5/0
no ip address
shutdown
!
router rip
version 2
network 192.168.30.0
network 192.168.100.0
network 192.168.101.0
no auto-summary
!
ip classless
!
ip flow-export version 9
!
!
!
!

```

*The inter Vlan
routing config is
shown*

RIP routing is shown here.



```
Router#show running-config
Building configuration...

Current configuration : 862 bytes
!
version 12.2
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Router
!
!
!
!
!
!
!
!
ip cef
no ipv6 cef
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
interface FastEthernet0/0
ip address 192.168.30.94 255.255.255.224
duplex auto
speed auto
!
interface FastEthernet1/0
no ip address
duplex auto
speed auto
shutdown
!
```

```
interface Serial2/0
ip address 192.168.30.6 255.255.255.252
clock rate 800000
!
interface Serial3/0
ip address 192.168.30.13 255.255.255.252
!
interface FastEthernet4/0
no ip address
shutdown
!
interface FastEthernet5/0
no ip address
shutdown
!
router rip
version 2
network 192.168.30.0
network 192.168.100.0
network 192.168.101.0
no auto-summary
!
ip classless
!
ip flow-export version 9
!
!
!
!
!
!
!
!
line con 0
!
line aux 0
!
line vty 0 4
login
!
!
!
End
```

Prague running config

```
Router#show running-config
Building configuration...

Current configuration : 950 bytes
!
version 12.2
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Router
!
!
!
!
!
!
!
!
ip cef
```

ACL config is shown here

```

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

5. IEEE 802.1Q Encapsulation

Dot1Q encapsulation is a protocol which allows the communication of VLANs across switches. Normal Ethernet frames don't include information to specify which VLAN each frame belongs to, so an extra protocol is needed to send the data to the correct recipient. To allow data from different VLANs to pass between switches using a normal link, the Dot1Q protocol trunks the data, separating the frames from each VLAN. The protocol inserts a tag into each frame containing a sub-frame that has the VLAN identifier included. This extra tag is read by the switch and the data sent to the correct recipient.

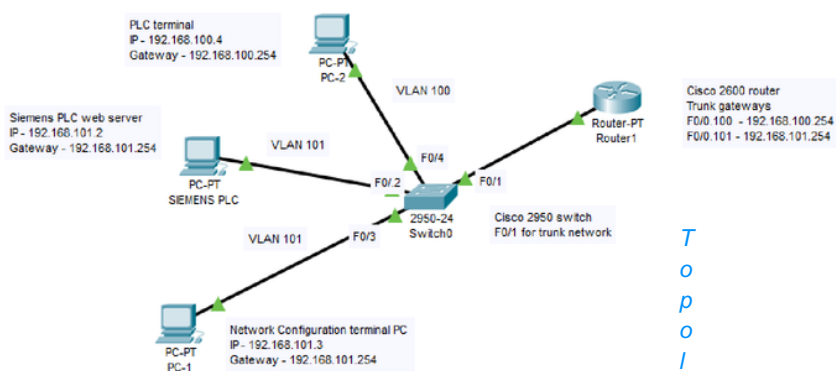
Good explanation.

3. Element 3

1. Hardware Setup

This final element requires the use of protocols already used to facilitate the communication between two PCs and a PLC.

The network topology can be seen below which include the two PCs, a Siemens PLC, a Cisco 2950 switch and a Cisco 2600 router.



Topology

Below is a photo of the physical setup.



A good image of the system

2. VLAN Configuration

The network is to be configured with two VLANs. To do this first the VLANs must be named on the switch.

VLAN configuration:

```
Switch>enable
```

```
Switch#conf t
```

```
Switch(config)#vlan 100
```

```
Switch(config-vlan)#name vlan100
```

```
Switch(config-vlan)#exit
```

```
Switch(config)#vlan 101
```

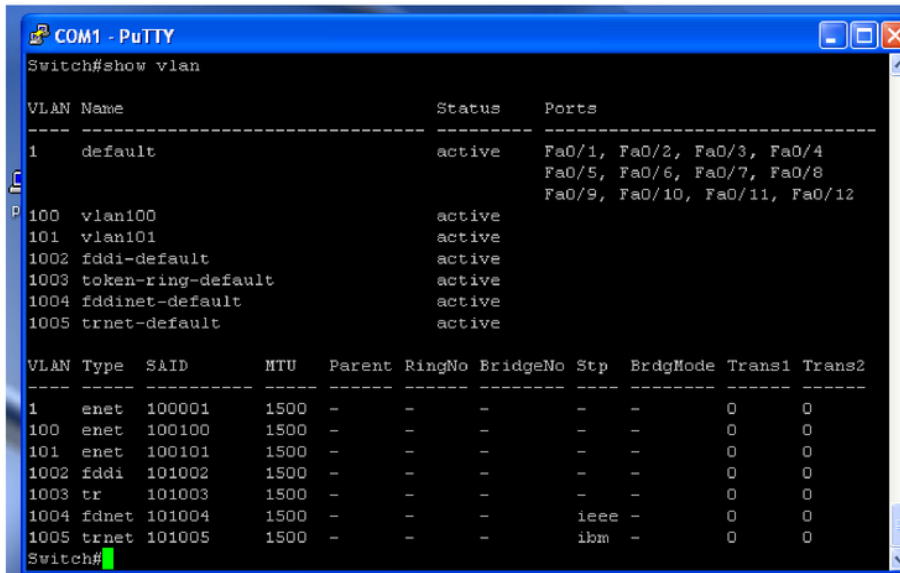
```
Switch(config-vlan)#name vlan101
```

Switch(config-vlan)#exit

Switch(config)#^Z

Switch#show vlan

The results of the commands can be seen below. VLAN100 and VLAN101 can be clearly seen.



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

VLAN	Type	SAID	MTU	Parent	RingNo	BridgeNo	Stp	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

Vlans are configured exactly the same way as the CAD design.

The next step is to assign physical ports to each VLAN. In this case VLAN100 will be assigned port Fa0/4 and VLAN101 will be assigned ports Fa0/2 and Fa0/3.

Setting Ports for Vlans

Switch#conf t

Switch(config)#int f0/2

Switch(config-if)#switchport mode access

Switch(config-if)#switchport access vlan 101

Switch(config-if)#exit

Switch(config)#int f0/3

Switch(config-if)#switchport mode access

Switch(config-if)#switchport access vlan 101

Switch(config-if)#exit

Switch(config)#int f0/4

Switch(config-if)#switchport mode access

Switch(config-if)#switchport access vlan 100

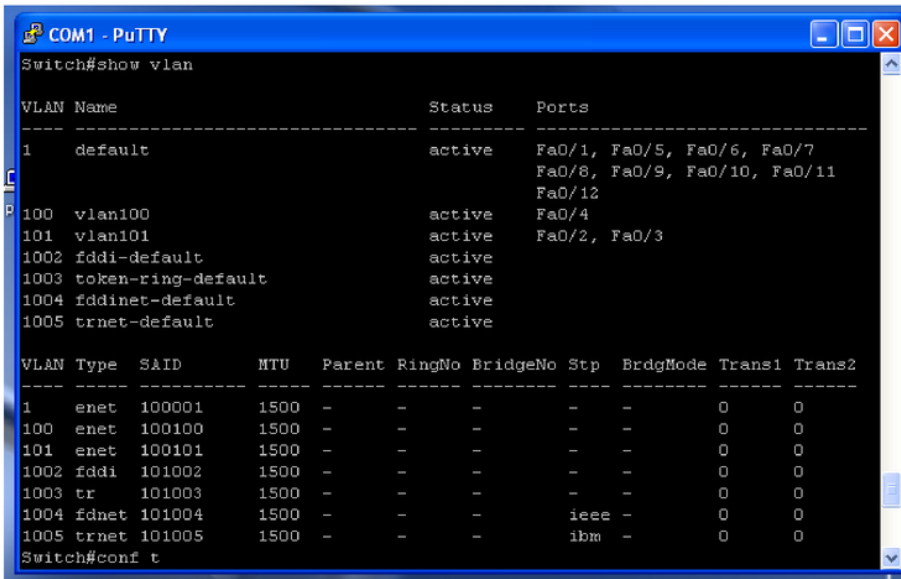
Switch(config-if)#exit

Switch(config)#^Z

Switch#

Switch#show vlan

The port allocation can now be seen below. The switch is now ready to be set up for VLAN routing.



```
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

```
Switch#conf t
```

Interfaces are assigned to the Vlans

3. Inter VLAN routing

The connection between the switch and the router needs to be configured to allow trunked network traffic. This allows the two VLANs to use one connection simultaneously.

Initialising trunking for ports

```
Switch#conf t
```

```
Switch(config)#int f0/1
```

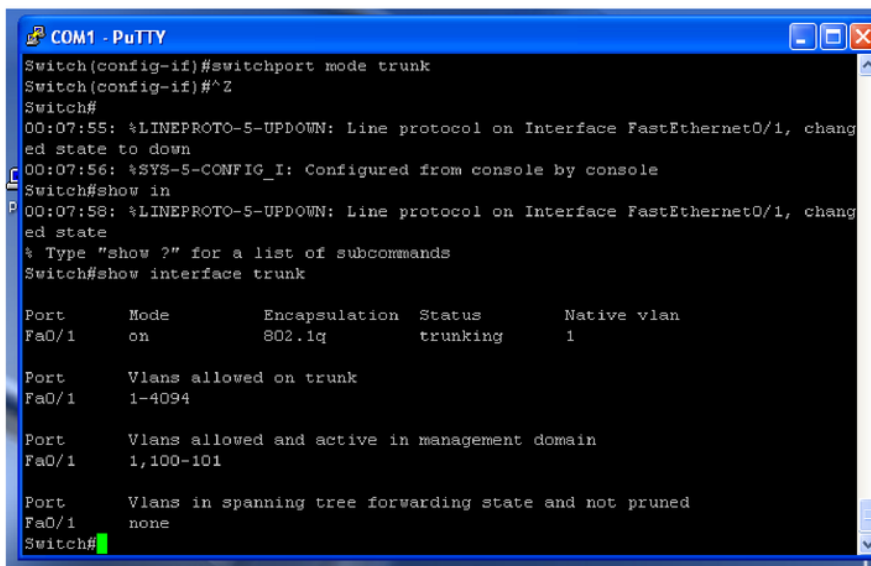
```
Switch(config-if)#switchport mode trunk
```

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

```
Switch#
```

```
Switch#show interface trunk
```

Port Fa0/1 now has trunking enabled.



```
COM1 - PuTTY
Switch(config-if)#switchport mode trunk
Switch(config-if)^Z
Switch#
00:07:55: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to down
00:07:56: %SYS-5-CONFIG_I: Configured from console by console
Switch#show in
00:07:58: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state
% Type "show ?" for a list of subcommands
Switch#show interface trunk

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

Port      Vlans allowed on trunk
Fa0/1     1-4094

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

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

Trunking is configured so that the router can be virtually many routers.

The router also requires configuration to use trunking. Port Fa0/0 will be given sub addresses of Fa0/0.100 and Fa0/0.101.

Then the encapsulation protocol will be set for each VLAN and the gateways addressed in the router.

Subnet interfacing and assigning gateways

```
Router>enable
```

```
Router#conf t
```

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

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

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

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

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

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

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

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

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

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

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

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

```
Router(config-subif)#encapsulation dot1Q 101
```

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

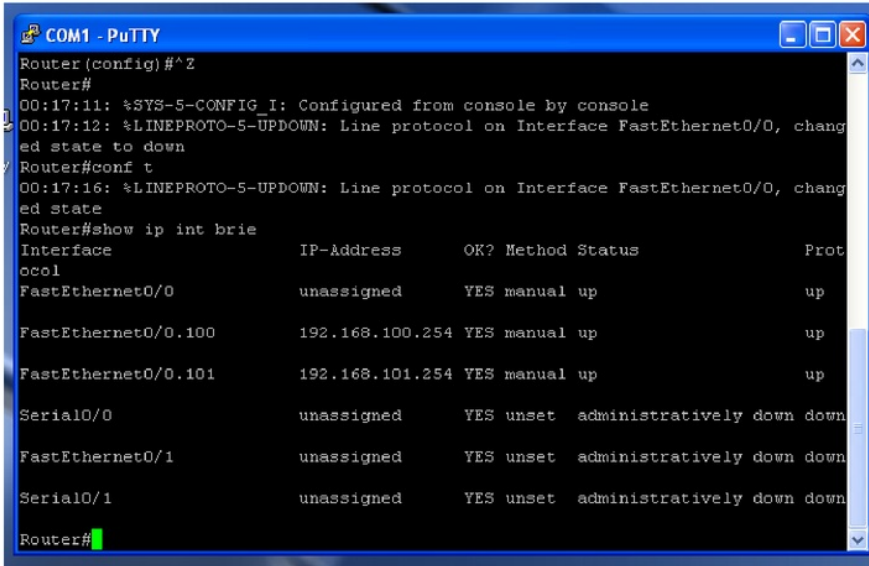
```
Router(config-subif)#no shutdown
```

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

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

Router#show ip interfaces brie

The image below shows the two individual interfaces along with the IP addresses of the gateways.



```
COM1 - PuTTY
Router (config) #^Z
Router#
00:17:11: %SYS-5-CONFIG_I: Configured from console by console
00:17:12: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to down
Router#conf t
00:17:16: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state
Router#show ip int brie
Interface              IP-Address      OK? Method Status  Prot
ocol
FastEthernet0/0        unassigned      YES manual  up      up
FastEthernet0/0.100    192.168.100.254 YES manual  up      up
FastEthernet0/0.101    192.168.101.254 YES manual  up      up
Serial0/0              unassigned      YES unset   administratively down down
FastEthernet0/1        unassigned      YES unset   administratively down down
Serial0/1              unassigned      YES unset   administratively down down
Router#
```

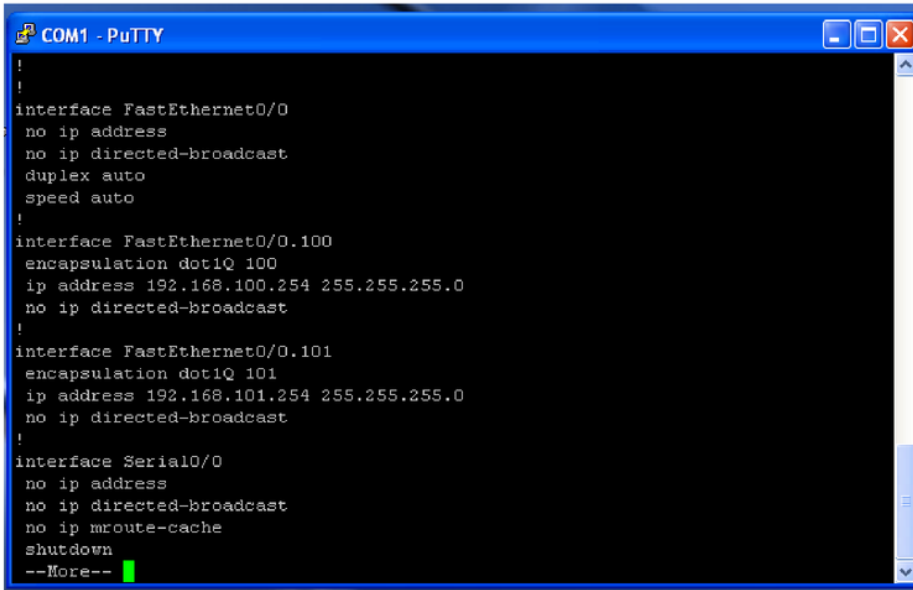
Sub interfaces have been configured so that separate gateways can be implemented.

The configuration of the router can now be checked

Router Config

Router#show run

Below the two interfaces can be seen with encapsulation protocols running and individual gateway addresses.



```
COM1 - PuTTY
!
!
interface FastEthernet0/0
no ip address
no ip directed-broadcast
duplex auto
speed auto
!
interface FastEthernet0/0.100
encapsulation dot1Q 100
ip address 192.168.100.254 255.255.255.0
no ip directed-broadcast
!
interface FastEthernet0/0.101
encapsulation dot1Q 101
ip address 192.168.101.254 255.255.255.0
no ip directed-broadcast
!
interface Serial0/0
no ip address
no ip directed-broadcast
no ip mroute-cache
shutdown
--More--
```

*This is the report
from the router.*

4. Ping Tests

Now the network can be tested by pinging each device.

Initially the PC on the same VLAN as the PLC was tested. The PLC address 192.168.101.2 was pinged from the PC with address 192.168.101.3.

The test was completed successfully as can be seen below.

```

C:\WINDOWS\system32\cmd.exe

Pinging 192.168.101.2 with 32 bytes of data:
Reply from 192.168.101.2: bytes=32 time=2ms TTL=30
Reply from 192.168.101.2: bytes=32 time<1ms TTL=30
Reply from 192.168.101.2: bytes=32 time<1ms TTL=30
Reply from 192.168.101.2: bytes=32 time<1ms TTL=30

Ping statistics for 192.168.101.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 2ms, Average = 0ms

C:\Documents and Settings\Administrator>ipconfig

Windows IP Configuration

Ethernet adapter Local Area Connection:

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

C:\Documents and Settings\Administrator>
C:\Documents and Settings\Administrator>ping 192.168.101.2

Pinging 192.168.101.2 with 32 bytes of data:
Reply from 192.168.101.2: bytes=32 time=2ms TTL=30
Reply from 192.168.101.2: bytes=32 time<1ms TTL=30
Reply from 192.168.101.2: bytes=32 time<1ms TTL=30
Reply from 192.168.101.2: bytes=32 time<1ms TTL=30

Ping statistics for 192.168.101.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 2ms, Average = 0ms

C:\Documents and Settings\Administrator>_
  
```

Ping tests across Vlans to prove inter Vlan routing.

The second ping test carried out was an inter VLAN test. Both devices on VLAN101 were pinged by the PC on VLAN100 to ensure the inter VLAN routing was active and working. Both test were completed as shown below.

```

C:\Users\Leils>ping 192.168.101.3

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

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

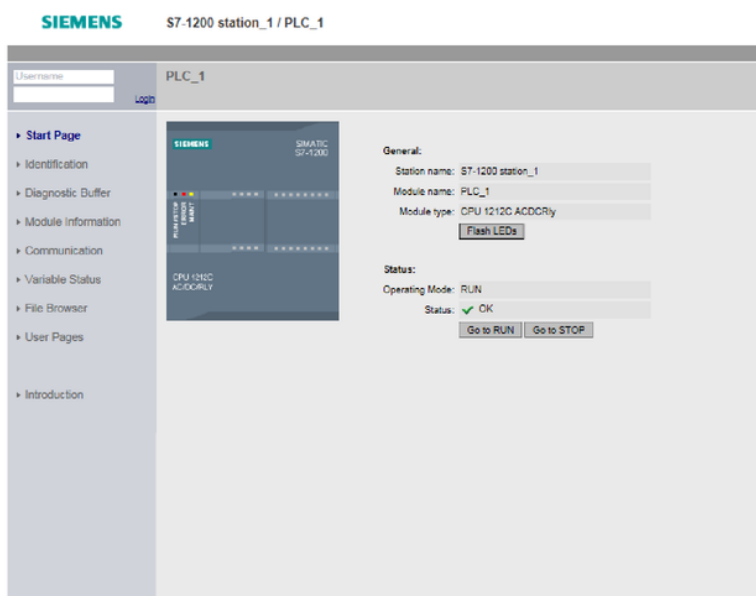
C:\Users\Leils>ping 192.168.101.2

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

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

5. Testing with PLC

With the ping test complete, the network can now be tested with real data. The Siemens PLC has a web server built into it which can be accessed by IP address via a web browser. The front screen can be seen below. If the page is visible it means that the HTTP is working correctly across the network.



The web front page is shown. This can be accessed from browser using the ip address of PLC.

Under the 'user pages' tab was a test screen configured to show inputs from the PLC and allow outputs to be selected.

The PLC has a bank of eight switches connected to digital inputs. The configuration of the switches lights LEDs on the PLC and also changes indicators to green on the web page.



The lights should match up. There are also three outputs that can be configured using buttons on the web page. These also correspond to LEDs on the PLC. *Web page monitors PLC inputs and outputs. The outputs on PLC can be set from the web page.*



A second configuration was also tested as extra proof.



Web page shows the same conditions on the PLC.



6. Conclusions and Recommendations

Overall the exercise was a success. The task was to configure two networks on one switch and router using VLAN protocols. This was completed with the use of two PCs and a PLC which were configured manually by enabling the VLANs, setting up the trunking and assigning subnets and IP addresses. The network was tested using the ping command including devices on the same network and across networks and also tested using real data to and from the PLC. All the tests were completed successfully.

*Conclusion is
reasonable.*

Further additions to the network could include a HMI screen for easy access to the PLC, more PCs to expand the size of the network and wireless capability, allowing mobile devices to connect to and access other devices on the network.

*Wireless is a valid
recommendation but the
web page is an alternative
for the HMI.*

Portfolio

GRADEMARK REPORT

FINAL GRADE

GENERAL COMMENTS

Instructor

54/100

PAGE 1

PAGE 2

PAGE 3

Text Comment. Contents list is good.

Text Comment. No list of figures

PAGE 4

Text Comment. Diagram is good and supports your explanation.

PAGE 5

Text Comment. Network Interface Cards are at this layer

PAGE 6

Text Comment. You have explained most of the required areas except port allocation. There is only evidence of one source.

PAGE 7

Text Comment. Three ip address classes have been assigned to the LANs

PAGE 8

Text Comment. This is the simplified network which has less WANs.

Text Comment. Static routing is shown in the router configuration report.

Text Comment. Tests show successful for the static routing configuration. Each device is tested with all other devices.

Text Comment. RIP routing is configured but there is no configuration samples or testing carried out for this.

Text Comment. DHCP is configured in the control router. The network pools are shown.

Text Comment. DHCP test on control router is successful.

Text Comment. The other routers will not work without the helper address.

Text Comment. Helper address is implemented on other routers.

Text Comment. Tests now show the dynamic address and gateway test is good.

Text Comment. Dynamic address and gateway is set.

Text Comment. Exclusion address ranges are configured.

Text Comment. DHCP address starts outside the exclusion range

Text Comment. Exclusion range avoided by DHCP.

Text Comment. Exclusion range avoided by DHCP.

Text Comment. This is the config for the exclusion ranges

Text Comment. Router reports all configurations associated with the router. Each router will report all its configurations so it is possible to check configurations using this report.

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

Text Comment. The CIDR/28 address scheme has been implemented

Text Comment. Tests are successful

Text Comment. This is the dynamic routing table which shows the configuration.

Text Comment. RIP tables are configured.

Text Comment. VLSM is correct and has been implemented

Text Comment. RIP tables for the VLSM network

Text Comment. Tests are successful

Text Comment. Vlan config is good and shows the active Vlans

Text Comment. Encapsulation and trunking is configured which enables the router to be virtually many routers

Text Comment. Vlan addresses are assigned

PAGE 26

Text Comment. Vlan addresses are assigned and interfaces are assigned.

Text Comment. Trunk configuration on switch is shown

PAGE 27

Text Comment. Tests are successful. Each device is tested against all other devices

PAGE 28

Text Comment. This test shows how the ACL (Active Control List) config can provide some security by denying IP addresses.

PAGE 29

Text Comment. RIP routing is shown in the listings

Text Comment. Router config shows all the config associated with the router

PAGE 30

Text Comment. The inter Vlan routing config is shown

Text Comment. RIP routing is shown here.

PAGE 31

PAGE 32

PAGE 33

Text Comment. ACL config is shown here

PAGE 34

Text Comment. Good explanation.

Text Comment. Topology of the system is shown and identifies the devices connected.

Text Comment. A good image of the system

Text Comment. Vlans are configured exactly the same way as the CAD design.

Text Comment. Interfaces are assigned to the Vlans

Text Comment. Trunking is configured so that the router can be virtually many routers.

Text Comment. Sub interfaces have been configured so that separate gateways can be implemented.

Text Comment. This is the report from the router.

Text Comment. Ping tests across Vlans to prove inter Vlan routing.

Text Comment. Ping tests are successful.

Text Comment. The web front page is shown. This can be accessed from browser using the ip address of PLC.

Text Comment. Web page monitors PLC inputs and outputs. The outputs on PLC can be set from the web page.

Text Comment. Web page shows the same conditions on the PLC.

PAGE 46

Text Comment. Conclusion is reasonable.

Text Comment. WirelEss is a valid recommendation but the web page is an alternative for the HMI.

GRADING FORM: CSG-RUBIC

CHRISTOPHER MILNER

54

RESEARCH-INFORMED LITERATURE



Research should include more relevant sources and images to support the explanations and findings. Encapsulation headers cannot be explained very well without the diagrams. 3/10

3/10

KNOWLEDGE AND UNDERSTANDING



Element1. The simplified network system has been designed and implemented by defining the requirements form the larger system. This was done effectively using three classes of addressing for the Lans. The RIP routing here was not explained or tested well. 5.5/10 Element2. The network parameters were configured for the larger main network which included CIDR28, VLSM 27 and 30

18/30

implementation. This was done and tested. The six networks were all configured correctly with good understanding shown. ACL could have been explained better. 6.5/10 Element3. Practical configuration was completed and tested. Vlan all tested good and the PLC was programmed from across the Vlan using TIA software on a laptop PC. The web server was accessed using the ip address set on the PLC. Images were taken to prove the tests. The HTML program was not listed or explained in this element and the AWL tag commands needed to be explained. The web server configuration should have been explained. 6/10

ANALYSIS



Element1. The test results showed the network operating as expected with no faults. The operation of the network was explained reasonably well and the images support the test results. However RIP was not explained well and not tested in this element. 2.5/5 Element2. The test results of the network configuration were good and explained reasonably well. Each part of the configuration was tested and explained where needed. No evaluation has been done for this element. 5.5/10 Element3. The results from the practical network showed that the Vlan and inter Vlan routing was configured. This was confirmed by the programming and control of the PLC across Vlan. Images support the test results with this test. There should have been an explanation of the HTML program and the configuration of the PLC web server because the PLC tags are accessed via AWS commands. 6/10

14/25

PRACTICAL APPLICATION AND DEP.



Element1. Design and implementation was achieved using good methods by which the address scheme of the three classes of ip address was designed first and then applied to the network for testing. Each LAN was tested individually. WAN networks were configured once the LANs tested successful. No explanation or testing for RIP. 2.5/5 Element2. Each section of this element was done separately. The CIDR/28 was implemented firstly and then the VLSM which is a form of CIDR was implemented and tested. The Vlans were an add on for this element just to test a simulation before element 3 practical. The ACL configuration was implemented successfully. No evaluation. 2.5/5 Element3. Vlans were configured on the Cisco router and switch. The PLC program was done using a laptop on a separate Vlan. The PLC server was downloaded with a htm file and using the ip address of the PLC this was tested. No HTML program or web server was explained. 6/10

11/20

SKILLS FOR PROFESSIONAL PRAC.



Element1. The quality of this element is good apart from the lack of sources researched and there was no list of figures. 2.5/5 Element2. This element covered all that was required but should have included an evaluation. 3/5 Element3. This element covered all areas and the tasks followed the correct pattern. There were however some parts missing. 2.5/5

8/15

