

CCNA 3 Case Study
Switching Basics and Intermediate Routing

By: Daniel Piché

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Instructor: Joy Brown

Scenario

The XYZ Research Company is a small company that is developing high-speed wireless products. The main office occupies two buildings in Sydney. One building is for the Administrators Group. The other building is for the Sales and Marketing Group, and the larger Research and Development Group. The Research Group and the Sales and Marketing Group will each have employees located on all three floors of the main building. The XYZ Research Company also has a Sales Branch Office located in Melbourne.

The company is implementing a wired network that should support 100% growth over the next five to ten years. A logical diagram has been provided. The task is to design, implement and fully document the XYZ Research Company network. In addition to a formal report, the XYZ Research would like to see a prototype of the network built, before it is fully implemented, to verify that it will meet the company's needs.

Phase 1: Requirements

1.1 Logical Diagram

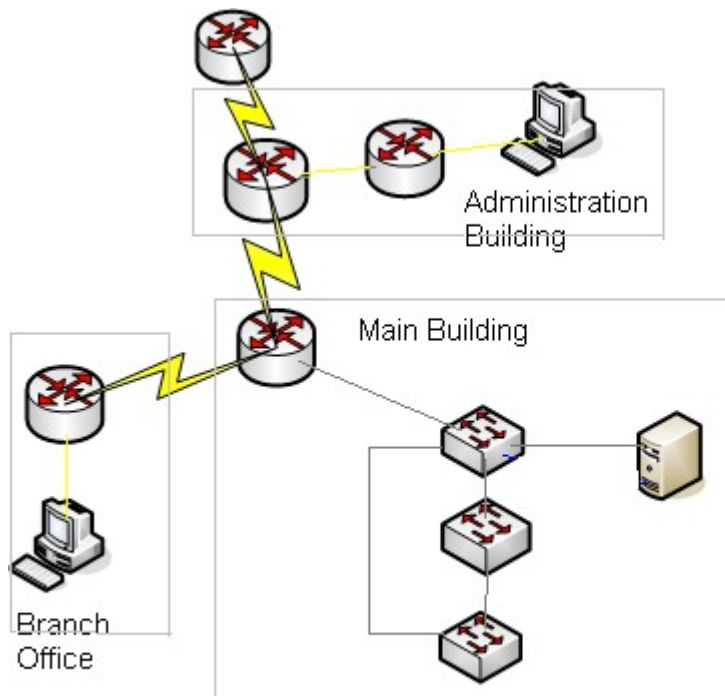


Figure 1.11

1.2 Diagram Description

Company XYZ Research Company is separated into 3 sections.

- Branch Office
- Main Building
- Administration Building

The company occupies two buildings in Sydney. One building is used by the Administrators Group. The other building is occupied by the company servers as well as the Research and Development Group and the Sales and Marketing Group. The second building spans across 3 floors. The Sales Branch Office is located in Melbourne.

At the Branch office in Melbourne there will be a total of five employees so therefore 5 workstations will be required. Because future growth must be taken into consideration we must be able to support at least double the current amount of employees. The following will be needed:

- 14 usable IP addresses for host/network configuration
- 2 usable IP addresses for router configuration

At the Administration building, the same amount of growth is expected. There are seven employees in the Administrative Group so therefore the following will be required:

- 14 usable IP addresses for hosts/network configuration
- 4 IP addresses for router configuration

The Main Building must be able to support twice the current amount of employees. Currently there are 18 employees in the Research and Development Group and 9 employees in the Sales and Marketing Group. There must also be support for a lifetime maximum of 5 servers. The following amount of IP addresses will be required:

- 62 usable IP addresses for host/network configuration on the R&D VLAN
- 30 usable IP addresses for host/network configuration on the S&M VLAN
- 6 usable IP addresses for host/network configuration on the Servers VLAN
- 6 usable addresses for IP management of the switches on all three floors
- 2 usable IP addresses for router configuration

1.3 VLSM Design

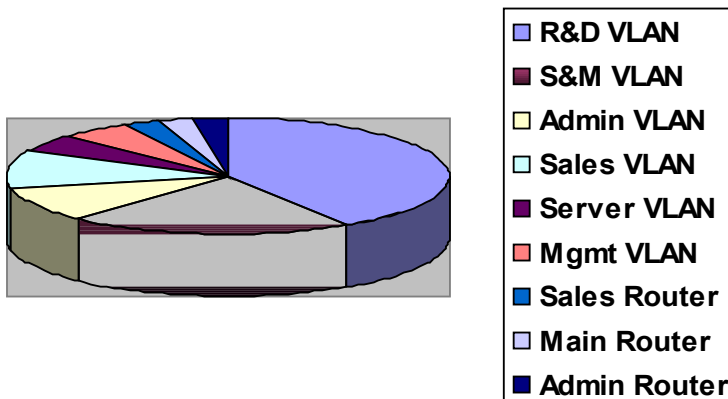


Figure 1.31

Number of host addresses required	Network Address	IP Addressing Scheme			Network Name
		Subnet Mask	Max Number of Hosts Possible	In Use (Yes/No)	
18	223.0.0.0/26	255.255.255.192	64/62 usable	No	R&D VLAN
9	223.0.0.64/27	255.255.255.224	32/30 usable	No	S&M VLAN
7	223.0.0.96/28	255.255.255.240	16/14 usable	No	Admin VLAN
5	223.0.0.112/28	255.255.255.240	16/14 usable	No	Sales VLAN
5	223.0.0.128/29	255.255.255.240	8/6 usable	No	Server VLAN
3	223.0.0.136/29	255.255.255.248	8/6 usable	No	Management VLAN
2	223.0.0.144/30	255.255.255.252	4/2 usable	Yes	Sales/Main
2	223.0.0.148/30	255.255.255.252	4/2 usable	Yes	Main/Admin
2	223.0.0.152/30	255.255.255.252	4/2 usable	Yes	Admin

Table 1.31

To sum everything up, the network IP addressing scheme is designed to support:

- 5 VLAN's for IP addressing of workstations with 136 host capabilities
- 12 addresses for router IP configurations (Serial and Fastethernet Interfaces)
- 8 addresses for switch IP configurations(VLAN1 and Default Gateways)

1.4 Router Layout

Branch Office Router

The branch office router will only make use of two interfaces. The fastethernet interface connects to the sales branch LAN. The serial interface connects the branch office router to the main building router.

Branch Office Router							
Interface Number	Description and Purpose	DCE/DTE	Clock Rate	Network Name	Network Number	Interface IP address	Subnet mask
Serial 0/0	Branch Office	DTE	N/A	Sales	223.0.0.144/30	223.0.0.146	255.255.255.252
Fastethernet 0/0	Branch Office	N/A	N/A	Sales	223.0.0.112/30	223.0.0.113	255.255.255.252
Loopback 0	Loopback	N/A	N/A	Sales	N/A	223.0.0.240	255.255.255.255

Table 1.41

Main Building Router

The main building router will make use of three interfaces. A fastethernet interface connecting to the switch on floor 1. Then there are two serial interfaces that connect the branch office and the administration building.

Main Building Router							
Interface Number	Description and Purpose	DCE/DTE	Clock Rate	Network Name	Network Number	Interface IP address	Subnet mask
Serial 0/0	Main Building	DCE	56000	Main	223.0.0.144/30	223.0.0.147	255.255.255.252
Serial 0/1	Main Building	DCE	56000	Main	223.0.0.148/30	223.0.0.149	255.255.255.252
Fastethernet 0/0.1	Main Building	N/A	N/A	Main	223.0.0.136/29	223.0.0.137	255.255.255.248
Fastethernet	Subinterface	N/A	N/A	Main	223.0.0.0/26	223.0.0.1	255.255.255.192

0/0.2							
Fastethernet	Subinterface	N/A	N/A	Main	223.0.0.64/27	223.0.0.65	255.255.255.224
0/0.3							
Fastethernet	Subinterface	N/A	N/A	Main	223.0.0.128/29	223.0.0.129	255.255.255.248
0/0.4							
Loopback 0	Loopback	N/A	N/A	Sales	N/A	223.0.0.241	255.255.255.255

Table 1.42

Administration Router 1

The administration building has two routers on its site. Administration router 1 is connected to the main building through a serial interface. The fastethernet interface connects from router 1 in the administration building to a second router.

Administration Router 1							
Interface Number	Description and Purpose	DCE/DTE	Clock Rate	Network Name	Network Number	Interface IP address	Subnet mask
Serial 0/1	Admin Building	DTE	N/A	Admin	223.0.0.148/30	223.0.0.150	255.255.255.252
Fastethernet 0/0	Admin Building	N/A	N/A	Admin	223.0.0.152/30	223.0.0.153	255.255.255.252
Loopback 0	Loopback	N/A	N/A	Sales	N/A	223.0.0.242	255.255.255.255

Table 1.43

Administration Router 2

Administration router two is the second router in the administration building. The router connects to administration router 1 through “fastethernet 0/0”. A second interface “fastethernet 0/1” connects administration router 2 to the admin VLAN.

Administration Router 2							
Interface Number	Description and Purpose	DCE/DTE	Clock Rate	Network Name	Network Number	Interface IP address	Subnet mask
FastEthernet 0/0	Admin Building	N/A	N/A	Admin2	223.0.0.152/30	223.0.0.154	255.255.255.252
FastEthernet 0/1	Admin Building	N/A	N/A	Admin2	223.0.0.96/30	223.0.0.97	255.255.255.252
Loopback 0	Loopback	N/A	N/A	Sales	N/A	223.0.0.243	255.255.255.255

Table 1.44

1.5 Switch Layout

Floor 1 Management

Addresses in the IP addressing scheme have been put aside for managing the 3 switches in the main building. The addresses for management are part of the management VLAN and consist of 8 possible addresses.

Floor 1 management will use 2 addresses. One address is assigned to VLAN1 and another address is assigned to the default gateway.

Floor 1 management							
Interface	Description	Network Name	Network Number	Interface IP Address	Subnet Mask	VLAN	Switch port Type
VLAN1	Mgmt. floor1	floor1	223.0.0.136/29	223.0.0.140	255.255.255.248	VLAN1	access
Default Gateway	Mgmt. floor1	Floor1	N/A	223.0.0.137	N/A	N/A	N/A

Table 1.51

Floor 2 Management

Floor 2 will employ one address for the configuration of VLAN1 and the default gateway will be the same as the one that was applied to floor 1 (no need to reapply the default gateway).

Floor 2 management							
Interface	Description	Network Name	Network Number	Interface IP Address	Subnet Mask	VLAN	Switch port Type
VLAN1	Mgmt. floor2	Floor2	223.0.0.136/29	223.0.0.141	255.255.255.248	VLAN1	access
Default Gateway	Mgmt. floor2	Floor2	N/A	223.0.0.137	N/A	N/A	N/A

Table 1.52

Floor 3 Management

Floor 3 management is the same as the two other floors. It requires an address to configure VLAN1.

Floor 3 management							
Interface	Description	Network Name	Network Number	Interface IP Address	Subnet Mask	VLAN	Switch port Type
VLAN1	Mgmt. floor3	Floor3	223.0.0.136/29	223.0.0.142	255.255.255.248	VLAN1	access
Default Gateway	Mgmt. floor3	Floor3	N/A	223.0.0.137	N/A	N/A	N/A

Table 1.53

1.6 Switch Configuration and Network assignment

The switches on all three floors are able to communicate to each other with the 802.1Q encapsulation through a trunk port. The switches all function at full-duplex at a speed of 100 Mbps.

Interfaces “fastethernet 0/4” to “fastethernet 0/7” on the floor 1 switch are reserved for the research and development VLAN. Fastethernet interfaces 0/8 to 0/10 are reserved for the sales and marketing VLAN. Fastethernet interfaces 0/11 to 0/15 are reserved for the server VLAN. Three interfaces are reserved for trunking on the last 3 ports of the switch. One of the ports will connect to the main building router.

Main Building Switch –Floor 1									
Interface	Description	Speed	Duplex	Network Name	Network Number	Subnet Mask	VLAN	Switch port Type	Encapsulation
F0/4 to F0/7	R&D floor1	100 Mbps	Full-Duplex	Floor1	223.0.0.0/26	255.255.255.192	R&D VLAN	Access	802.1Q
F0/8 to F0/10	S&M floor1	100 Mbps	Full-Duplex	Floor1	223.0.0.64/27	255.255.255.224	S&M VLAN	Access	802.1Q
F0/11 to F0/15	Server floor1	100 Mbps	Full-Duplex	Floor1	223.0.0.128/29	255.255.255.240	Server VLAN	Access	802.1Q
F0/23 to 0/24	Trunk floor1	100 Mbps	Full-Duplex	Floor1	N/A	N/A	Floor 1	Trunk	802.1Q

Table 1.61

On floor 2, fastethernet interfaces 0/4 to 0/9 are reserved for the research and development VLAN. The sales and marketing VLAN makes use of fastethernet ports 0/10 to 0/13. Two interfaces on the switch are set aside for trunking.

Main Building Switch –Floor 2									
Interface	Description	Speed	Duplex	Network Name	Network Number	Subnet Mask	VLAN	Switch port Type	Encapsulation
F0/4 to F0/9	R&D floor2	100 Mbps	Full-Duplex	Floor2	223.0.0.1/26	255.255.255.192	R&D VLAN	Access	802.1Q
F0/10 to F0/13	S&M floor2	100 Mbps	Full-Duplex	Floor2	223.0.0.64/27	255.255.255.224	S&M VLAN	Access	802.1Q
F0/23 to 0/24	Trunk Floor 2	100 Mbps	Full-Duplex	Floor2	N/A	N/A	Floor 2	Trunk	802.1Q

Table 1.62

Interfaces 0/4 to 0/11 on floor 3 are reserved for the research and development VLAN. Interfaces 0/12 to 0/13 are reserved for the sales and marketing VLAN and two ports are set aside for trunking.

Main Building Switch –Floor 3									
Interface	Description	Speed	Duplex	Network Name	Network Number	Subnet Mask	VLAN	Switch port Type	Encapsulation
F0/4 to F0/11	R&D floor3	100 Mbps	Full-Duplex	Floor3	223.0.0.1/26	255.255.255.192	R&D VLAN	Access	802.1Q
F0/12 to F0/13	S&M floor3	100 Mbps	Full-Duplex	Floor3	223.0.0.64/27	255.255.255.224	S&M VLAN	Access	802.1Q
F0/23 to 0/24	Trunk Floor3	100 Mbps	Full-Duplex	Floor3	N/A	N/A	Floor 3	Trunk	802.1Q

Table 1.63

1.7 Workstation and Server Configuration

The R&D VLAN consists of 18 PCs and should be configured using addresses within the 223.0.0.0 to 223.0.0.63 range. The table below shows how the addresses are assigned to all the PCs in the R&D VLAN.

R&D VLAN PC's					
LAN Name	PC or Server Name	IP address	Subnet Mask	Gateway	Services Provided
R&D VLAN	R&D Station1	223.0.0.4	255.255.255.192	223.0.0.137	N/A
R&D VLAN	R&D Station2	223.0.0.5	255.255.255.192	223.0.0.137	N/A
R&D VLAN	R&D Station3	223.0.0.6	255.255.255.192	223.0.0.137	N/A
R&D VLAN	R&D Station4	223.0.0.7	255.255.255.192	223.0.0.137	N/A
R&D VLAN	R&D Station5	223.0.0.8	255.255.255.192	223.0.0.138	N/A
R&D VLAN	R&D Station6	223.0.0.9	255.255.255.192	223.0.0.138	N/A
R&D VLAN	R&D Station7	223.0.0.10	255.255.255.192	223.0.0.138	N/A
R&D VLAN	R&D Station8	223.0.0.11	255.255.255.192	223.0.0.138	N/A
R&D VLAN	R&D Station9	223.0.0.12	255.255.255.192	223.0.0.138	N/A
R&D VLAN	R&D Station10	223.0.0.13	255.255.255.192	223.0.0.138	N/A

R&D VLAN	R&D Station11	223.0.0.14	255.255.255.192	223.0.0.139	N/A
R&D VLAN	R&D Station12	223.0.0.15	255.255.255.192	223.0.0.139	N/A
R&D VLAN	R&D Station13	223.0.0.16	255.255.255.192	223.0.0.139	N/A
R&D VLAN	R&D Station14	223.0.0.17	255.255.255.192	223.0.0.139	N/A
R&D VLAN	R&D Station15	223.0.0.18	255.255.255.192	223.0.0.139	N/A
R&D VLAN	R&D Station16	223.0.0.19	255.255.255.192	223.0.0.139	N/A
R&D VLAN	R&D Station17	223.0.0.20	255.255.255.192	223.0.0.139	N/A
R&D VLAN	R&D Station18	223.0.0.21	255.255.255.192	223.0.0.139	N/A

Table 1.71

The S&M VLAN consists of 9 PCs. The addresses assigned to those PCs are in the table below. The addresses used out of the 30 that the VLAN is able to support range from 223.0.0.64 to 223.0.0.95.

S&M VLAN PC's					
LAN Name	PC or Server Name	IP address	Subnet Mask	Gateway	Services Provided
S&M VLAN	S&M Station1	223.0.0.68	255.255.255.224	223.0.0.137	N/A
S&M VLAN	S&M Station2	223.0.0.69	255.255.255.224	223.0.0.137	N/A
S&M VLAN	S&M Station3	223.0.0.70	255.255.255.224	223.0.0.137	N/A
S&M VLAN	S&M Station4	223.0.0.71	255.255.255.224	223.0.0.138	N/A
S&M VLAN	S&M Station5	223.0.0.72	255.255.255.224	223.0.0.138	N/A
S&M VLAN	S&M Station6	223.0.0.73	255.255.255.224	223.0.0.138	N/A
S&M VLAN	S&M Station7	223.0.0.74	255.255.255.224	223.0.0.138	N/A
S&M VLAN	S&M Station8	223.0.0.75	255.255.255.224	223.0.0.139	N/A
S&M VLAN	S&M Station9	223.0.0.76	255.255.255.224	223.0.0.139	N/A

Table 1.72

The Admin VLAN consists of 7 PCs. The addresses to those PCs range from 223.0.0.95 to 223.0.0.111. The table below represents the PC configuration related to addressing and naming.

Admin VLAN PC's					
LAN Name	PC or Server Name	IP address	Subnet Mask	Gateway	Services Provided
Admin VLAN	Admin Station1	223.0.0.100	255.255.255.240	223.0.0.153	N/A
Admin VLAN	Admin Station2	223.0.0.101	255.255.255.240	223.0.0.153	N/A
Admin VLAN	Admin Station3	223.0.0.102	255.255.255.240	223.0.0.153	N/A
Admin VLAN	Admin Station4	223.0.0.103	255.255.255.240	223.0.0.153	N/A
Admin VLAN	Admin Station5	223.0.0.104	255.255.255.240	223.0.0.153	N/A
Admin VLAN	Admin Station6	223.0.0.105	255.255.255.240	223.0.0.153	N/A
Admin VLAN	Admin Station7	223.0.0.106	255.255.255.240	223.0.0.153	N/A

Table 1.73

The Sales VLAN consists of 5 Stations with IP addresses ranging from 223.0.0.112 to 223.0.0.127. The table below displays the configurations that need to be made to the PCs on the Sales VLAN.

Sales VLAN PC's					
LAN Name	PC or Server Name	IP address	Subnet Mask	Gateway	Services Provided
Sales VLAN	Sales Station1	223.0.0.116	255.255.255.112	223.0.0.240	N/A
Sales VLAN	Sales Station2	223.0.0.117	255.255.255.112	223.0.0.240	N/A
Sales VLAN	Sales Station3	223.0.0.118	255.255.255.112	223.0.0.240	N/A
Sales VLAN	Sales Station4	223.0.0.119	255.255.255.112	223.0.0.240	N/A
Sales VLAN	Sales Station5	223.0.0.120	255.255.255.112	223.0.0.240	N/A

Table 1.74

The Server VLAN consists of 5 PCs with addresses ranging from 223.0.0.128 to 223.0.0.135. The table below shows the Server LAN PC configurations.

LAN Name	PC or Server Name	Server VLAN Servers		Gateway	Services Provided
		IP address	Subnet Mask		
Server VLAN	Server Station1	223.0.0.132	255.255.255.240	223.0.0.137	HTTP Server
Server VLAN	Server Station2	223.0.0.133	255.255.255.240	223.0.0.137	N/A
Server VLAN	Server Station3	223.0.0.134	255.255.255.240	223.0.0.137	N/A
Server VLAN	Server Station4	223.0.0.135	255.255.255.240	223.0.0.137	N/A
Server VLAN	Server Station5	223.0.0.136	255.255.255.240	223.0.0.137	N/A

Table 1.75

Phase 2: Routing Protocols

2.1 Why choose OSPF?

OSPF is the routing protocol of choice for the XYZ Research company and the main reason is VLSM support due to the network infrastructure. Another reason for selecting OSPF as the routing protocol of choice would be related to the network design. Being an intermediate sized LAN, OSPF would do a superior job at advertising network changes because of the technology behind the way it distributes routing information.

Routing Protocol	Routing Protocol Comparison				Total
	VLSM Support	Speed of Convergence	Compatibility/Functionality	Stability	
OSPF	+	+	-	-	2
IGRP	-	-	-	+	1
RIP	-	-	-	+	1
EIGRP	+	+	+	-	2

Table 2.11

2.2 VLSM Support

OSPF and EIGRP are the only two routing protocols that support variable length subnet masks. IGRP supports only standard subnet mask IP addressing. RIPv2 does however support VLSM but RIPv1 does not.

2.3 Speed of Convergence

RIP routing operates with the use of routing tables that are passed only to neighboring routers. IGRP functions the same way. When routing, decisions are made based on hop count. The router that is the least amount of hops away will receive the packet. RIP will send updates every 30 seconds and IGRP will send updates every 90 seconds. OSPF and EIGRP converge quickly because updates are sent through all ports for the initial convergence. EIGRP also supports DUAL

2.4 Compatibility/Functionality

EIGRP is considered the protocol that is the most compatible because it is hybrid which means it supports features of both link-state and distance vector protocols. EIGRP is also known to be able to adapt to different protocols such as IGRP within the same autonomous system.

2.5 Stability

RIP and IGRP are the two most stable routing protocols because they are distance vector routing protocols and they advertise their routing tables to their neighbors. Link-State routing protocols are considered to be instable because they flood the network with

updates and that creates a lot of overhead. The routing tables for link-state routing protocols are considered complex.

2.6 Routing Protocol summary

OSPF

- Link-State protocol
- Sends Hello packets every 10 seconds
- Sends dead interval packets every 40 seconds.

RIP

- Distance Vector
- Sends updates every 30 seconds

IGRP

- Distance Vector
- Sends updates every 90 seconds

EIGRP

- Balanced Hybrid
- Rapid convergence with DUAL
- Compatible with IGRP
- Sends Hello packets every 5 seconds
- Default hold time is 15 seconds

Phase 3: OSPF

3.1 Configuration Justifications

The decision to elect the Main building router as the DR was based on the fact that the traffic is centralized at that location. Loopback interfaces are used to help direct traffic more efficiently.

Router Configurations				
Router Name	Network		Role	Loopback Interface
Sales	223.0.0.144	0.0.0.3	BDR	223.0.0.240
	223.0.0.112	0.0.0.15		255.255.255.255
Main	223.0.0.148	0.0.0.3	DR	223.0.0.241
	223.0.0.144	0.0.0.3		255.255.255.255
	223.0.0.0	0.0.0.63		
	223.0.0.64	0.0.0.31		
	223.0.0.128	0.0.0.7		
Admin	223.0.0.136	0.0.0.7	BDR	223.0.0.242
	223.0.0.148	0.0.0.3		255.255.255.255
	223.0.0.152	0.0.0.3		223.0.0.242
Admin 2	223.0.0.152	0.0.0.3		223.0.0.242
	223.0.0.96	0.0.0.15		255.255.255.255

Table 3.11

Phase 4: VLANs

4.1 Discussion about VLAN's, STP and other details

The floor 1 switch will be the root switch because it is the switch that is connected directly to the main router. All three switches will have their default gateway set to “223.0.0.137” because this is the fastethernet port of the main router. As for the VTP mode, floor 1 switch will be in server mode. Floor 2 switch will be in client mode and floor 3 switch will be set to transparent mode. VLAN 1 will be the management VLAN for all three switches and will have there VLAN configured to be different for each switch. All three switches will be the same model and have the same number of ports. Group 1 will be the VTP domain.

Switch h Name	Model	# of Port s	Locatio n	Switch Details		Managemen t VLAN	VTP Mode	VTP Domai n	STP Roo t
				IP Address	Gateway				
Floor1	Cisco2950	24	Floor1	223.0.0.140	223.0.0.137	VLAN1	server	Group1	root
Floor2	Cisco2950	24	Floor2	223.0.0.141	223.0.0.137	VLAN1	client	Group1	n/a
Floor3	Cisco2950	24	Floor3	223.0.0.142	223.0.0.137	VLAN1	transparen t	Group1	n/a

Table 4.11

Phase 5: Physical Layer Design

5.1 Physical Layer Design and Equipment

The three switches will be connected together at the trunking ports using a crossover cable. One of the leftover trunking ports will connect to the fastethernet port of the main building router with a straight through cable. Depending on the switchport assignment, there will be straight through cables going to the ports of the switch to the hosts from the three VLANs. The main building router will run two serial cables on both serial ports to the two other building routers. Serial 0/0 of the main building router will run the branch office router on port serial 0/1. Serial port 0/1 of the main building router will run the the administration building router on serial port 0/1. The branch office router will run a connection to it's VLAN from the fastethernet port and the administration building router will connect to a second router at the fastethernet port from a fastethernet port. The second router in the administration building will connect to it's VLAN with a straight through cable unless you are connecting to a NIC card. Then you would use a crossover cable. All the devices will be configured by connecting a rollover cable to the console port from a PC's COM port.

Equipment Table				
Equipment Type	Model No	Number of Ports	Description/ Function	Cost
Switch	Cisco Catalyst 2950 Series	24	Main Building Floor 1	1650.00\$
Switch	Cisco Catalyst 2950 Series	24	Main Building Floor 2	1650.00\$
Switch	Cisco Catalyst 2950 Series	24	Main Building Floor 3	1650.00\$
Router	Cisco 2600 Series	3 + 2 serial	Branch Office	1749.00\$
Router	Cisco 2600 Series	3 + 2 serial	Main Building	1749.00\$
Router	Cisco 2600 Series	3 + 2 serial	Admin Building	1749.00\$
Router	Cisco 2621 Series	4 + 2 serial	Admin Building	1749.00\$

Table 5.11

Phase 6: Test Network

6.1 Discussion on testing strategies

The procedure that will be used to test the network will be separated into two parts. Part 1 will be a ping test and part 2 will consist of capturing the configurations set on the equipment. Captures will be taken of “show ip route” and “show running-config” command output for routers. For switches, there will be captures of “show vlan” and “show running-config” command output. Accurate results for connectivity testing will be accomplished by pinging the following interfaces:

- Ping from host on sales network to host on admin network
- Ping from host on sales network to host on R&D VLAN
- Ping from host on sales network to host on S&M VLAN
- Ping from host on sales network to host on Server VLAN
- Ping from host on sales network to host on VLAN 1
- Ping from host on admin network to host on sales network
- Ping from host on admin network to host on R&D VLAN
- Ping from host on admin network to host on S&M VLAN
- Ping from host on admin network to host on Server VLAN
- Ping from host on admin network to host on VLAN 1
- Ping from host on R&D VLAN to host on Server VLAN
- Ping from host on R&D VLAN to host on S&M VLAN
- Ping from host on R&D VLAN to host on VLAN 1
- Ping from host on R&D VLAN to host on sales network
- Ping from host on R&D VLAN to host on admin network
- Ping from host on S&M VLAN to host on admin network
- Ping from host on S&M VLAN to host on sales network
- Ping from host on S&M VLAN to host on VLAN 1
- Ping from host on S&M VLAN to host on R&D VLAN
- Ping from host on S&M VLAN to host on Server VLAN
- Ping from host on Server VLAN to host on VLAN 1
- Ping from host on Server VLAN to host on R&D VLAN
- Ping from host on Server VLAN to host on S&M VLAN
- Ping from host on Server VLAN to host on admin network
- Ping from host on Server VLAN to host on sales network

6.2 Floor1 Connectivity Test

Ping from host on floor 1 Server VLAN

```

C:\Documents and Settings\cisco>ipconfig /all

IP Address. . . . . : 223.0.0.134
Subnet Mask . . . . . : 255.255.255.240
Default Gateway . . . . . : 223.0.0.129

C:\Documents and Settings\cisco>ping 223.0.0.5

Pinging 223.0.0.5 with 32 bytes of data:

Reply from 223.0.0.5: bytes=32 time=4ms TTL=127
Reply from 223.0.0.5: bytes=32 time<1ms TTL=127
Reply from 223.0.0.5: bytes=32 time<1ms TTL=127
Reply from 223.0.0.5: bytes=32 time<1ms TTL=127

Ping statistics for 223.0.0.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 4ms, Average = 1ms

C:\Documents and Settings\cisco>ping 223.0.0.69

Pinging 223.0.0.69 with 32 bytes of data:

Reply from 223.0.0.69: bytes=32 time=1ms TTL=127
Reply from 223.0.0.69: bytes=32 time<1ms TTL=127
Reply from 223.0.0.69: bytes=32 time<1ms TTL=127
Reply from 223.0.0.69: bytes=32 time<1ms TTL=127

Ping statistics for 223.0.0.69:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\Documents and Settings\cisco>ping 223.0.0.116

Pinging 223.0.0.116 with 32 bytes of data:

Reply from 223.0.0.116: bytes=32 time=22ms TTL=126
Reply from 223.0.0.116: bytes=32 time=20ms TTL=126
Reply from 223.0.0.116: bytes=32 time=20ms TTL=126
Reply from 223.0.0.116: bytes=32 time=20ms TTL=126

Ping statistics for 223.0.0.116:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 20ms, Maximum = 22ms, Average = 20ms

C:\Documents and Settings\cisco>ping 223.0.0.99

Pinging 223.0.0.99 with 32 bytes of data:

Reply from 223.0.0.99: bytes=32 time=25ms TTL=125
Reply from 223.0.0.99: bytes=32 time=20ms TTL=125
Reply from 223.0.0.99: bytes=32 time=20ms TTL=125
Reply from 223.0.0.99: bytes=32 time=20ms TTL=125

Ping statistics for 223.0.0.99:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 20ms, Maximum = 25ms, Average = 21ms

```

6.3 Floor 1 Configuration

```

!
interface Vlan1
 ip address 223.0.0.140 255.255.255.248
 no ip route-cache
!
ip default-gateway 223.0.0.137
ip http server
!
line con 0
line vty 5 15
!
!
end

```

```

Floor1#
Floor1#
Floor1#show vlan

```

VLAN Name	Status	Ports
1 default	active	Fa0/1, Fa0/2, Fa0/3, Fa0/16 Fa0/17, Fa0/18, Fa0/19, Fa0/20 Fa0/21
2 R&D	active	Fa0/4, Fa0/5, Fa0/6, Fa0/7
3 S&M	active	Fa0/8, Fa0/9, Fa0/10
4 Server	active	Fa0/11, Fa0/12, Fa0/13, Fa0/14

```

Fa0/15
10  vlan10      active
20  RandD      active
30  SandM      active
40  Servers    active
1002 fddi-default  act/unsup
1003 token-ring-default  act/unsup
1004 fddinet-default  act/unsup
1005 trnet-default  act/unsup

VLAN Type SAID      MTU  Parent RingNo BridgeNo Stp  BrdgMode Trans1 Trans2
-----
1  enet 100001  1500 -  -  -  -  -  0  0
2  enet 100002  1500 -  -  -  -  -  0  0
VLAN Type SAID      MTU  Parent RingNo BridgeNo Stp  BrdgMode Trans1 Trans2
-----
3  enet 100003  1500 -  -  -  -  -  0  0
4  enet 100004  1500 -  -  -  -  -  0  0
10 enet 100010  1500 -  -  -  -  -  0  0
20 enet 100020  1500 -  -  -  -  -  0  0
30 enet 100030  1500 -  -  -  -  -  0  0
40 enet 100040  1500 -  -  -  -  -  0  0
1002 fddi 101002  1500 -  -  -  -  -  0  0
1003 tr  101003  1500 -  -  -  -  srb  0  0
1004 fdnet 101004  1500 -  -  -  -  ieee -  0  0
1005 trnet 101005  1500 -  -  -  -  ibm  -  0  0

Remote SPAN VLANs
-----

Primary Secondary Type      Ports
-----

Floor1#

```

6.4 Floor 2 Connectivity Test

Ping from the R&D VLAN on Floor2

```

C:\Documents and Settings\cisco>ipconfig /all

IP Address. . . . . : 223.0.0.5
Subnet Mask . . . . . : 255.255.255.192
Default Gateway . . . . . : 223.0.0.1

C:\Documents and Settings\cisco>ping 223.0.0.134

Pinging 223.0.0.134 with 32 bytes of data:

Reply from 223.0.0.134: bytes=32 time=2ms TTL=127
Reply from 223.0.0.134: bytes=32 time<1ms TTL=127
Reply from 223.0.0.134: bytes=32 time<1ms TTL=127
Reply from 223.0.0.134: bytes=32 time<1ms TTL=127

Ping statistics for 223.0.0.134:
    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\cisco>ping 223.0.0.69

Pinging 223.0.0.69 with 32 bytes of data:

Reply from 223.0.0.69: bytes=32 time=1ms TTL=127
Reply from 223.0.0.69: bytes=32 time<1ms TTL=127
Reply from 223.0.0.69: bytes=32 time<1ms TTL=127
Reply from 223.0.0.69: bytes=32 time<1ms TTL=127

Ping statistics for 223.0.0.69:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\Documents and Settings\cisco>ping 223.0.0.116

Pinging 223.0.0.116 with 32 bytes of data:

Reply from 223.0.0.116: bytes=32 time=22ms TTL=126
Reply from 223.0.0.116: bytes=32 time=20ms TTL=126
Reply from 223.0.0.116: bytes=32 time=20ms TTL=126
Reply from 223.0.0.116: bytes=32 time=20ms TTL=126

Ping statistics for 223.0.0.116:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 20ms, Maximum = 22ms, Average = 20ms

C:\Documents and Settings\cisco>ping 223.0.0.99

Pinging 223.0.0.99 with 32 bytes of data:

Reply from 223.0.0.99: bytes=32 time=21ms TTL=125
Reply from 223.0.0.99: bytes=32 time=20ms TTL=125
Reply from 223.0.0.99: bytes=32 time=20ms TTL=125
Reply from 223.0.0.99: bytes=32 time=20ms TTL=125

Ping statistics for 223.0.0.99:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 20ms, Maximum = 21ms, Average = 20ms

```

6.4 Floor 2 Configuration

Floor2#show run

Building configuration...

Current configuration : 1663 bytes

!

version 12.1

no service pad

service timestamps debug uptime

service timestamps log uptime

no service password-encryption

!

hostname Floor2

!

!

ip subnet-zero

!

!

spanning-tree mode pvst

no spanning-tree optimize bpdu transmission

spanning-tree extend system-id

!

!

!

interface FastEthernet0/1

!

interface FastEthernet0/2

```
!  
interface FastEthernet0/3  
!  
interface FastEthernet0/4  
switchport access vlan 2  
switchport mode access  
!  
interface FastEthernet0/5  
switchport access vlan 2  
switchport mode access  
!  
interface FastEthernet0/6  
switchport access vlan 2  
switchport mode access  
!  
interface FastEthernet0/7  
switchport access vlan 2  
switchport mode access  
!  
interface FastEthernet0/8  
switchport access vlan 2  
switchport mode access  
!  
interface FastEthernet0/9  
switchport access vlan 2  
switchport mode access  
!  
interface FastEthernet0/10  
switchport access vlan 3  
switchport mode access  
!  
interface FastEthernet0/11  
switchport access vlan 3  
switchport mode access  
!  
interface FastEthernet0/12  
switchport access vlan 3  
switchport mode access  
!  
interface FastEthernet0/13  
switchport access vlan 3  
switchport mode access  
!  
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
```



```

switchport mode trunk
!
interface FastEthernet0/24
switchport mode trunk
!
interface Vlan1
ip address 223.0.0.141 255.255.255.248
no ip route-cache
!
ip default-gateway 223.0.0.137
ip http server
!
line con 0
line vty 5 15
!
!
end

```

Floor2#show vlan

VLAN Name	Status	Ports
1 default	active	Fa0/1, Fa0/2, Fa0/3, Fa0/14 Fa0/15, Fa0/16, Fa0/17, Fa0/18 Fa0/19, Fa0/20, Fa0/21, Fa0/22
2 R&D	active	Fa0/4, Fa0/5, Fa0/6, Fa0/7 Fa0/8, Fa0/9
3 S&M	active	Fa0/10, Fa0/11, Fa0/12, Fa0/13
4 Server	active	
10 vlan10	active	
20 RandD	active	
30 SandM	active	
40 Servers	active	
1002 fddi-default	act/unsup	
1003 token-ring-default	act/unsup	
1004 fddinet-default	act/unsup	
1005 trnet-default	act/unsup	

VLAN Type	SAID	MTU	Parent	RingNo	BridgeNo	No Stp	BrdgMode	Trans1	Trans2
1 enet	100001	1500	-	-	-	-	0	0	
2 enet	100002	1500	-	-	-	-	0	0	

VLAN Type	SAID	MTU	Parent	RingNo	BridgeNo	No Stp	BrdgMode	Trans1	Trans2
3 enet	100003	1500	-	-	-	-	0	0	
4 enet	100004	1500	-	-	-	-	0	0	
10 enet	100010	1500	-	-	-	-	0	0	
20 enet	100020	1500	-	-	-	-	0	0	
30 enet	100030	1500	-	-	-	-	0	0	
40 enet	100040	1500	-	-	-	-	0	0	
1002 fddi	101002	1500	-	-	-	-	0	0	
1003 tr	101003	1500	-	-	-	srbrb	0	0	
1004 fdnet	101004	1500	-	-	-	ieee	-	0	0
1005 trnet	101005	1500	-	-	-	ibm	-	0	0

Remote SPAN VLANs

Primary	Secondary	Type	Ports
---------	-----------	------	-------

Floor2#
Floor2#

6.5 Floor 3 Connectivity Test

Ping from S&M VLAN on Floor 3

```
Command Prompt
IP Address. . . . . : 223.0.0.69
Subnet Mask . . . . . : 255.255.255.224
Default Gateway . . . . . : 223.0.0.65

C:\Documents and Settings\cisco>ping 223.0.0.5
Pinging 223.0.0.5 with 32 bytes of data:
Reply from 223.0.0.5: bytes=32 time=2ms TTL=127
Reply from 223.0.0.5: bytes=32 time<1ms TTL=127
Reply from 223.0.0.5: bytes=32 time<1ms TTL=127
Reply from 223.0.0.5: bytes=32 time<1ms TTL=127
Ping statistics for 223.0.0.5:
    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\cisco>ping 223.0.0.134
Pinging 223.0.0.134 with 32 bytes of data:
Reply from 223.0.0.134: bytes=32 time=1ms TTL=127
Reply from 223.0.0.134: bytes=32 time<1ms TTL=127
Reply from 223.0.0.134: bytes=32 time<1ms TTL=127
Reply from 223.0.0.134: bytes=32 time<1ms TTL=127
Ping statistics for 223.0.0.134:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\Documents and Settings\cisco>ping 223.0.0.116
Pinging 223.0.0.116 with 32 bytes of data:
Reply from 223.0.0.116: bytes=32 time=22ms TTL=126
Reply from 223.0.0.116: bytes=32 time=20ms TTL=126
Reply from 223.0.0.116: bytes=32 time=20ms TTL=126
Reply from 223.0.0.116: bytes=32 time=20ms TTL=126
Ping statistics for 223.0.0.116:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 20ms, Maximum = 22ms, Average = 20ms

C:\Documents and Settings\cisco>ping 223.0.0.99
Pinging 223.0.0.99 with 32 bytes of data:
Reply from 223.0.0.99: bytes=32 time=23ms TTL=125
Reply from 223.0.0.99: bytes=32 time=20ms TTL=125
Reply from 223.0.0.99: bytes=32 time=20ms TTL=125
Reply from 223.0.0.99: bytes=32 time=20ms TTL=125
Ping statistics for 223.0.0.99:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 20ms, Maximum = 23ms, Average = 20ms
```

6.6 Floor 3 Configuration

show run

Building configuration...

Current configuration : 1663 bytes

!

version 12.1

no service pad

service timestamps debug uptime

service timestamps log uptime

no service password-encryption

!

hostname Floor3

!

!

ip subnet-zero

!

!

spanning-tree mode pvst

no spanning-tree optimize bpdu transmission

spanning-tree extend system-id

```
!  
!  
!  
!  
interface FastEthernet0/1  
!  
interface FastEthernet0/2  
!  
interface FastEthernet0/3  
!  
interface FastEthernet0/4  
switchport access vlan 2  
switchport mode access  
!  
interface FastEthernet0/5  
switchport access vlan 2  
switchport mode access  
!  
interface FastEthernet0/6  
switchport access vlan 2  
switchport mode access  
!  
interface FastEthernet0/7  
switchport access vlan 2  
switchport mode access  
!  
interface FastEthernet0/8  
switchport access vlan 2  
switchport mode access  
!  
interface FastEthernet0/9  
switchport access vlan 2  
switchport mode access  
!  
interface FastEthernet0/10  
switchport access vlan 2  
switchport mode access  
!  
interface FastEthernet0/11  
switchport access vlan 2  
switchport mode access  
!  
interface FastEthernet0/12  
switchport access vlan 3  
switchport mode access  
!  
interface FastEthernet0/13  
switchport access vlan 3  
switchport mode access  
!  
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
switchport mode trunk
!
interface FastEthernet0/24
switchport mode trunk
!
interface Vlan1
ip address 223.0.0.142 255.255.255.248
no ip route-cache
!
ip default-gateway 223.0.0.137
ip http server
!
line con 0
line vty 5 15
!
!
end

```

```

Floor3#
Floor3#
Floor3#show vlan

```

VLAN Name	Status	Ports
1 default	active	Fa0/1, Fa0/2, Fa0/3, Fa0/14 Fa0/15, Fa0/16, Fa0/17, Fa0/18 Fa0/19, Fa0/20, Fa0/21, Fa0/22
2 R&D	active	Fa0/4, Fa0/5, Fa0/6, Fa0/7 Fa0/8, Fa0/9, Fa0/10, Fa0/11
3 S&M	active	Fa0/12, Fa0/13
4 Server	active	
10 vlan10	active	
20 RandD	active	
30 SandM	active	
40 Servers	active	
1002 fddi-default	act/unsup	
1003 token-ring-default	act/unsup	
1004 fddinet-default	act/unsup	
1005 trnet-default	act/unsup	

VLAN Type	SAID	MTU	Parent	RingNo	BridgeNo	Stp	BrdgMode	Trans1	Trans2
1 enet	100001	1500	-	-	-	-	-	0	0
2 enet	100002	1500	-	-	-	-	-	0	0
3 enet	100003	1500	-	-	-	-	-	0	0
4 enet	100004	1500	-	-	-	-	-	0	0
10 enet	100010	1500	-	-	-	-	-	0	0
20 enet	100020	1500	-	-	-	-	-	0	0
30 enet	100030	1500	-	-	-	-	-	0	0
40 enet	100040	1500	-	-	-	-	-	0	0
1002 fddi	101002	1500	-	-	-	-	-	0	0
1003 tr	101003	1500	-	-	-	-	srbrb	0	0
1004 fdnet	101004	1500	-	-	-	-	ieee	0	0

1005 trnet 101005 1500 - - - ibm - 0 0

Remote SPAN VLANs

Primary Secondary Type Ports

Floor3#

6.7 Main Router Configuration

```
show run
Building configuration...

Current configuration : 1168 bytes
!
version 12.2
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname Main
!
!
ip subnet-zero
!
!
!
!
!
!
interface Loopback0
 ip address 223.0.0.241 255.255.255.255
!
interface FastEthernet0/0
 no ip address
 duplex auto
 speed auto
!
interface FastEthernet0/0.1
 encapsulation dot1Q 1 native
 ip address 223.0.0.137 255.255.255.248
!
interface FastEthernet0/0.2
 encapsulation dot1Q 2
 ip address 223.0.0.1 255.255.255.192
!
interface FastEthernet0/0.3
 encapsulation dot1Q 3
 ip address 223.0.0.65 255.255.255.224
!
interface FastEthernet0/0.4
 encapsulation dot1Q 4
 ip address 223.0.0.129 255.255.255.248
!
interface Serial0/0
 ip address 223.0.0.145 255.255.255.252
 clockrate 56000
!
```

```

interface Serial0/1
ip address 223.0.0.149 255.255.255.252
clockrate 56000
!
router ospf 50
log-adjacency-changes
network 223.0.0.0 0.0.0.63 area 0
network 223.0.0.64 0.0.0.31 area 0
network 223.0.0.128 0.0.0.7 area 0
network 223.0.0.136 0.0.0.7 area 0
network 223.0.0.144 0.0.0.3 area 0
network 223.0.0.148 0.0.0.3 area 0
!
ip classless
ip http server
ip pim bidir-enable
!
!
line con 0
line aux 0
line vty 0 4
!
end
Main#
Main#
Main#
Main#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

    223.0.0.0/24 is variably subnetted, 10 subnets, 6 masks
C       223.0.0.241/32 is directly connected, Loopback0
O       223.0.0.152/30 [110/65] via 223.0.0.150, 00:30:40, Serial0/1
C       223.0.0.148/30 is directly connected, Serial0/1
C       223.0.0.144/30 is directly connected, Serial0/0
C       223.0.0.136/29 is directly connected, FastEthernet0/0.1
C       223.0.0.128/29 is directly connected, FastEthernet0/0.4
C       223.0.0.64/27 is directly connected, FastEthernet0/0.3
O       223.0.0.112/28 [110/65] via 223.0.0.146, 00:30:42, Serial0/0
O       223.0.0.96/28 [110/66] via 223.0.0.150, 00:30:42, Serial0/1
C       223.0.0.0/26 is directly connected, FastEthernet0/0.2
Main#

```

6.8 Sales Router Connectivity Test

Ping from sales VLAN

```

C:\Command Prompt
IP Address . . . . . : 223.0.0.116
Subnet Mask . . . . . : 255.255.255.240
Default Gateway . . . . . : 223.0.0.113

C:\Documents and Settings\cisco>ping 223.0.0.134

Pinging 223.0.0.134 with 32 bytes of data:

Reply from 223.0.0.134: bytes=32 time=24ms TTL=126
Reply from 223.0.0.134: bytes=32 time=20ms TTL=126
Reply from 223.0.0.134: bytes=32 time=20ms TTL=126
Reply from 223.0.0.134: bytes=32 time=20ms TTL=126

Ping statistics for 223.0.0.134:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 20ms, Maximum = 24ms, Average = 21ms

C:\Documents and Settings\cisco>ping 223.0.0.5

Pinging 223.0.0.5 with 32 bytes of data:

Reply from 223.0.0.5: bytes=32 time=22ms TTL=126
Reply from 223.0.0.5: bytes=32 time=20ms TTL=126
Reply from 223.0.0.5: bytes=32 time=20ms TTL=126
Reply from 223.0.0.5: bytes=32 time=20ms TTL=126

Ping statistics for 223.0.0.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 20ms, Maximum = 22ms, Average = 20ms

C:\Documents and Settings\cisco>ping 223.0.0.69

Pinging 223.0.0.69 with 32 bytes of data:

Reply from 223.0.0.69: bytes=32 time=33ms TTL=126
Reply from 223.0.0.69: bytes=32 time=20ms TTL=126
Reply from 223.0.0.69: bytes=32 time=20ms TTL=126
Reply from 223.0.0.69: bytes=32 time=20ms TTL=126

Ping statistics for 223.0.0.69:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 20ms, Maximum = 33ms, Average = 23ms

C:\Documents and Settings\cisco>ping 223.0.0.99

Pinging 223.0.0.99 with 32 bytes of data:

Reply from 223.0.0.99: bytes=32 time=42ms TTL=124
Reply from 223.0.0.99: bytes=32 time=40ms TTL=124
Reply from 223.0.0.99: bytes=32 time=40ms TTL=124
Reply from 223.0.0.99: bytes=32 time=40ms TTL=124

Ping statistics for 223.0.0.99:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 40ms, Maximum = 42ms, Average = 40ms

```

6.9 Sales Router Configuration

```

show run
Building configuration...

Current configuration : 642 bytes
!
version 12.2
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname Sales
!
!
ip subnet-zero
!
!
!
!
!
!
interface Loopback0
 ip address 223.0.0.240 255.255.255.255
!
interface FastEthernet0/0
 ip address 223.0.0.113 255.255.255.240
 duplex auto
 speed auto
!
interface Serial0/0
 ip address 223.0.0.146 255.255.255.252
!

```

```

interface Serial0/1
ip address 223.0.0.146 255.255.255.252
!
router ospf 50
log-adjacency-changes
network 223.0.0.112 0.0.0.15 area 0
network 223.0.0.144 0.0.0.3 area 0
!
ip classless
ip http server
ip pim bidir-enable
!
!
line con 0
line aux 0
line vty 0 4
!
end

Sales#
Sales#
Sales#
Sales#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

    223.0.0.0/24 is variably subnetted, 10 subnets, 6 masks
C       223.0.0.240/32 is directly connected, Loopback0
O       223.0.0.152/30 [110/129] via 223.0.0.145, 00:29:40, Serial0/1
O       223.0.0.148/30 [110/128] via 223.0.0.145, 00:29:40, Serial0/1
C       223.0.0.144/30 is directly connected, Serial0/1
O       223.0.0.136/29 [110/65] via 223.0.0.145, 00:29:40, Serial0/1
O       223.0.0.128/29 [110/65] via 223.0.0.145, 00:29:40, Serial0/1
O       223.0.0.64/27 [110/65] via 223.0.0.145, 00:29:40, Serial0/1
C       223.0.0.112/28 is directly connected, FastEthernet0/0
O       223.0.0.96/28 [110/130] via 223.0.0.145, 00:29:41, Serial0/1
O       223.0.0.0/26 [110/65] via 223.0.0.145, 00:29:41, Serial0/1
Sales#
Sales#

```

6.10 Admin1 Router Configuration

```

show run
Building configuration...

Current configuration : 641 bytes
!
version 12.2
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname Admin
!
!
ip subnet-zero
!
!
!
!
!
!

```



```

!
interface Loopback0
ip address 223.0.0.242 255.255.255.255
!
interface FastEthernet0/0
ip address 223.0.0.153 255.255.255.252
duplex auto
speed auto
!
interface Serial0/0
no ip address
shutdown
no fair-queue
!
interface Serial0/1
ip address 223.0.0.150 255.255.255.252
!
router ospf 50
log-adjacency-changes
network 223.0.0.148 0.0.0.3 area 0
network 223.0.0.152 0.0.0.3 area 0
!
ip classless
ip http server
ip pim bidir-enable
!
!
line con 0
line aux 0
line vty 0 4
!
end

```

Admin#

Admin#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

```

      223.0.0.0/24 is variably subnetted, 10 subnets, 6 masks
C       223.0.0.242/32 is directly connected, Loopback0
C       223.0.0.152/30 is directly connected, FastEthernet0/0
C       223.0.0.148/30 is directly connected, Serial0/1
O       223.0.0.144/30 [110/128] via 223.0.0.149, 00:24:01, Serial0/1
O       223.0.0.136/29 [110/65] via 223.0.0.149, 00:24:01, Serial0/1
O       223.0.0.128/29 [110/65] via 223.0.0.149, 00:24:01, Serial0/1
O       223.0.0.64/27 [110/65] via 223.0.0.149, 00:24:01, Serial0/1
O       223.0.0.112/28 [110/129] via 223.0.0.149, 00:24:02, Serial0/1
O       223.0.0.96/28 [110/2] via 223.0.0.154, 00:24:02, FastEthernet0/0
O       223.0.0.0/26 [110/65] via 223.0.0.149, 00:24:02, Serial0/1

```

Admin#

Admin#

6.11 Admin2 Router Connectivity Test

Ping from host located on the Admin VLAN

```
Command Prompt
IP Address . . . . . : 223.0.0.99
Subnet Mask . . . . . : 255.255.255.240
Default Gateway . . . . . : 223.0.0.97

C:\Documents and Settings\cisco>ping 223.0.0.5
Pinging 223.0.0.5 with 32 bytes of data:
Reply from 223.0.0.5: bytes=32 time=27ms TTL=125
Reply from 223.0.0.5: bytes=32 time=20ms TTL=125
Reply from 223.0.0.5: bytes=32 time=20ms TTL=125
Reply from 223.0.0.5: bytes=32 time=20ms TTL=125
Ping statistics for 223.0.0.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 20ms, Maximum = 27ms, Average = 21ms

C:\Documents and Settings\cisco>ping 223.0.0.69
Pinging 223.0.0.69 with 32 bytes of data:
Reply from 223.0.0.69: bytes=32 time=21ms TTL=125
Reply from 223.0.0.69: bytes=32 time=20ms TTL=125
Reply from 223.0.0.69: bytes=32 time=20ms TTL=125
Reply from 223.0.0.69: bytes=32 time=20ms TTL=125
Ping statistics for 223.0.0.69:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 20ms, Maximum = 21ms, Average = 20ms

C:\Documents and Settings\cisco>ping 223.0.0.134
Pinging 223.0.0.134 with 32 bytes of data:
Reply from 223.0.0.134: bytes=32 time=22ms TTL=125
Reply from 223.0.0.134: bytes=32 time=20ms TTL=125
Reply from 223.0.0.134: bytes=32 time=20ms TTL=125
Reply from 223.0.0.134: bytes=32 time=20ms TTL=125
Ping statistics for 223.0.0.134:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 20ms, Maximum = 22ms, Average = 20ms

C:\Documents and Settings\cisco>ping 223.0.0.116
Pinging 223.0.0.116 with 32 bytes of data:
Reply from 223.0.0.116: bytes=32 time=44ms TTL=124
Reply from 223.0.0.116: bytes=32 time=40ms TTL=124
Reply from 223.0.0.116: bytes=32 time=40ms TTL=124
Reply from 223.0.0.116: bytes=32 time=40ms TTL=124
Ping statistics for 223.0.0.116:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 40ms, Maximum = 44ms, Average = 41ms
```

6.12 Admin2 Router Configuration

```
Admin2#show run
Building configuration...

Current configuration : 699 bytes
!
version 12.2
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname Admin2
!
!
ip subnet-zero
!
!
!
!
!
interface Loopback0
ip address 223.0.0.243 255.255.255.255
!
interface FastEthernet0/0
ip address 223.0.0.154 255.255.255.252
duplex auto
```

```

speed auto
!
interface Serial0/0
no ip address
shutdown
no fair-queue
!
interface FastEthernet0/1
ip address 223.0.0.97 255.255.255.240
duplex auto
speed auto
!
interface Serial0/1
no ip address
shutdown
!
router ospf 50
log-adjacency-changes
network 223.0.0.96 0.0.0.15 area 0
network 223.0.0.152 0.0.0.3 area 0
!
ip classless
ip http server
!
!
line con 0
line aux 0
line vty 0 4
!
end

```

Admin2#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, su - IS-IS summary, 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

```

    223.0.0.0/24 is variably subnetted, 10 subnets, 6 masks
C    223.0.0.243/32 is directly connected, Loopback0
C    223.0.0.152/30 is directly connected, FastEthernet0/0
O    223.0.0.148/30 [110/65] via 223.0.0.153, 00:28:08, FastEthernet0/0
O    223.0.0.144/30 [110/129] via 223.0.0.153, 00:28:08, FastEthernet0/0
O    223.0.0.136/29 [110/66] via 223.0.0.153, 00:28:08, FastEthernet0/0
O    223.0.0.128/29 [110/66] via 223.0.0.153, 00:28:08, FastEthernet0/0
O    223.0.0.64/27 [110/66] via 223.0.0.153, 00:28:09, FastEthernet0/0
O    223.0.0.112/28 [110/130] via 223.0.0.153, 00:28:09, FastEthernet0/0
C    223.0.0.96/28 is directly connected, FastEthernet0/1
O    223.0.0.0/26 [110/66] via 223.0.0.153, 00:28:09, FastEthernet0/0
Admin2#

```

Phase 7: Final Demonstration

7.1 Floor 1 Switch

To configure the floor 1 switch, run the configuration file that matches the configurations in the table below.

```
hostname Floor1
interface VLAN1
ip address 223.0.0.140 255.255.255.248
no shutdown
exit

vlan database
vlan 2 name R&D
vlan 3 name S&M
vlan 4 name Server
exit

config terminal
interface fastethernet 0/4
switchport mode access
switchport access VLAN 2
interface fastethernet 0/5
switchport mode access
switchport access VLAN 2
interface fastethernet 0/6
switchport mode access
switchport access VLAN 2
interface fastethernet 0/7
switchport mode access
switchport access VLAN 2

interface fastethernet 0/8
switchport mode access
switchport access VLAN 3
interface fastethernet 0/9
switchport mode access
switchport access VLAN 3
interface fastethernet 0/10
switchport mode access
switchport access VLAN 3

interface fastethernet 0/11
switchport mode access
switchport access VLAN 4
interface fastethernet 0/12
switchport mode access
switchport access VLAN 4
interface fastethernet 0/13
switchport mode access
switchport access VLAN 4
interface fastethernet 0/14
switchport mode access
switchport access VLAN 4
interface fastethernet 0/15
switchport mode access
switchport access VLAN 4

interface fastethernet 0/23
switchport mode trunk
interface fastethernet 0/24
switchport mode trunk
end
```

```
vlan database
vtp server
vtp domain Group1
exit
```

7.2 Floor 2 Switch

To configure the floor 2 switch, run the configuration file that matches the configurations in the table below.

```
hostname Floor2
interface VLAN1
ip address 223.0.0.141 255.255.255.248
no shutdown
exit
```

```
ip default-gateway 223.0.0.137
exit
```

```
vlan database
vlan 2 name R&D
vlan 3 name S&M
vlan 4 name Server
exit
```

```
config terminal
interface fastethernet 0/4
switchport mode access
switchport access VLAN 2
interface fastethernet 0/5
switchport mode access
switchport access VLAN 2
interface fastethernet 0/6
switchport mode access
switchport access VLAN 2
interface fastethernet 0/7
switchport mode access
switchport access VLAN 2
interface fastethernet 0/8
switchport mode access
switchport access VLAN 2
interface fastethernet 0/9
switchport mode access
switchport access VLAN 2
```

```
interface fastethernet 0/10
switchport mode access
switchport access VLAN 3
interface fastethernet 0/11
switchport mode access
switchport access VLAN 3
interface fastethernet 0/12
switchport mode access
switchport access VLAN 3
interface fastethernet 0/13
switchport mode access
switchport access VLAN 3
```

```
interface fastethernet 0/23
switchport mode trunk
```

```
interface fastethernet 0/24
switchport mode trunk
end

vlan database
vtp client
vtp domain Group1
exit
```

7.3 Floor 3 Switch

To configure the floor 3 switch, run the configuration file that matches the configurations in the table below.

```
hostname Floor3
interface VLAN1
ip address 223.0.0.142 255.255.255.248
no shutdown
exit

ip default-gateway 223.0.0.137
exit

vlan database
vlan 2 name R&D
vlan 3 name S&M
vlan 4 name Server
exit

config terminal
interface fastethernet 0/4
switchport mode access
switchport access VLAN 2
interface fastethernet 0/5
switchport mode access
switchport access VLAN 2
interface fastethernet 0/6
switchport mode access
switchport access VLAN 2
interface fastethernet 0/7
switchport mode access
switchport access VLAN 2
interface fastethernet 0/8
switchport mode access
switchport access VLAN 2
interface fastethernet 0/9
switchport mode access
switchport access VLAN 2
interface fastethernet 0/10
switchport mode access
switchport access VLAN 2
interface fastethernet 0/11
switchport mode access
switchport access VLAN 2

interface fastethernet 0/12
switchport mode access
switchport access VLAN 3
interface fastethernet 0/13
switchport mode access
switchport access VLAN 3

interface fastethernet 0/23
```

```
switchport mode trunk
interface fastethernet 0/24
switchport mode trunk
end
```

```
vlan database
vtp transparent
vtp domain Group1
exit
```

7.4 Main Building Router

To configure the Main Building Router, run the configuration file that matches the configurations in the table below.

```
hostname Main
interface fastethernet 0/0
no shutdown
interface fastethernet 0/0.1
encapsulation dot1q 1 native
ip address 223.0.0.137 255.255.255.248

interface fastethernet 0/0.2
encapsulation dot1q 2
ip address 223.0.0.1 255.255.255.192

interface fastethernet 0/0.3
encapsulation dot1q 3
ip address 223.0.0.65 255.255.255.224

interface fastethernet 0/0.4
encapsulation dot1q 4
ip address 223.0.0.129 255.255.255.248
no shutdown
exit

interface serial 0/0
ip address 223.0.0.147 255.255.255.252
clockrate 56000
no shutdown
exit

interface serial 0/1
ip address 223.0.0.149 255.255.255.252
clockrate 56000
no shutdown
exit

interface loopback 0
ip address 223.0.0.241 255.255.255.255
no shutdown
exit

ip host Sales 223.0.0.113 223.0.0.146
ip host Main 223.0.0.137 223.0.0.147 223.0.0.149
ip host Admin 223.0.0.153 223.0.0.150
ip host Admin2 223.0.0.154 223.0.0.97

router ospf 50
log-adjacency-changes
network 223.0.0.144 0.0.0.3 area 0
network 223.0.0.148 0.0.0.3 area 0
network 223.0.0.136 0.0.0.7 area 0
```

```
network 223.0.0.0 0.0.0.63 area 0
network 223.0.0.64 0.0.0.31 area 0
network 223.0.0.128 0.0.0.7 area 0
exit
```

7.5 Branch Office Router

To configure the Branch Office Router, run the configuration file that matches the configurations in the table below.

```
hostname Sales
interface fastethernet 0/0
ip address 223.0.0.113 255.255.255.240
no shutdown
exit

interface serial 0/1
ip address 223.0.0.146 255.255.255.252
no shutdown
exit

interface loopback 0
ip address 223.0.0.240 255.255.255.255
no shutdown
exit

ip host Sales 223.0.0.113 223.0.0.146
ip host Main 223.0.0.1 223.0.0.147 223.0.0.149
ip host Admin 223.0.0.153 223.0.0.150
ip host Admin2 223.0.0.154 223.0.0.97

router ospf 50
log-adjacency-changes
network 223.0.0.144 0.0.0.3 area 0
network 223.0.0.112 0.0.0.15 area 0
```

7.6 Administration Building Router

To configure the Administration Building Router, run the configuration file that matches the configurations in the table below.

```
hostname Admin
interface fastethernet 0/0
ip address 223.0.0.153 255.255.255.252
no shutdown
exit

interface serial 0/1
ip address 223.0.0.150 255.255.255.252
no shutdown
exit

interface loopback 0
ip address 223.0.0.242 255.255.255.255
no shutdown
exit

ip host Sales 223.0.0.113 223.0.0.146
ip host Main 223.0.0.1 223.0.0.147 223.0.0.149
ip host Admin 223.0.0.153 223.0.0.150
ip host Admin2 223.0.0.154 223.0.0.97

router ospf 50
```



```
log-adjacency-changes
network 223.0.0.148 0.0.0.3 area 0
network 223.0.0.152 0.0.0.3 area 0
```

7.6 Administration Building Router 2

To configure the Administration Building Router 2, run the configuration file that matches the configurations in the table below.

```
hostname Admin2
interface fastethernet 0/0
ip address 223.0.0.154 255.255.255.252
no shutdown
exit

interface fastethernet 0/1
ip address 223.0.0.97 255.255.255.240
no shutdown
exit

interface loopback 0
ip address 223.0.0.243 255.255.255.255
no shutdown
exit

ip host Sales 223.0.0.113 223.0.0.146
ip host Main 223.0.0.1 223.0.0.147 223.0.0.149
ip host Admin 223.0.0.153 223.0.0.150
ip host Admin2 223.0.0.154 223.0.0.97

router ospf 50
log-adjacency-changes
network 223.0.0.152 0.0.0.3 area 0
network 223.0.0.96 0.0.0.15 area 0
```

7.10 Future Upgrades

Future upgrades should not be a problem because there is sufficient room on each VLAN to expand double the current capacity. Because the network was well subnetted, there would even be room to add more VLAN's if the need was there. There would have to be some changes in the router and switch configurations but it is possible if the need was there.