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LD7082 Computer Networks and Security

DFS Network Design

Submitted By

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Section 1 | Network Design Research

Network Design is a critical component of a businesses IT infrastructure. The performance, security and performance of a network can vary dramatically, depending on the design implemented. There is no one size fits all approach to networking due to specialisation depending on use case, for example a home network doesn't need the intricacies of a government network. Whilst the home network may have less security, its performance could be better and would be better suited for the average user to use and adapt. In terms of organisational IT infrastructure, a poorly designed network would lead to bad performance, issues with scalability and vulnerabilities in the security configurations. In this essay, I will critically appraise several design principles to achieve performance, scalability, and security throughout the Open Systems Interconnection (OSI) Model.

The OSI model is a reference for how data is transmitted through networks. It identifies data transmission through seven different layers with separate interconnecting functions. The Physical Layer, Data Link, Network, Transport, Session, Presentation, and application layers. The OSI model is theoretical and thus has some limitations; some protocols used in networking span multiple layers, some of the layers such as the presentation layer aren't always necessary, and the model's implementation is not standardised.

An overview of these layers is as below:

- The Physical layer concerns physical connectivity and devices.
- The Data Link layer is used to limit data transmission errors.
- The network layer handles routing of data.
- The transport layer ensures transmission from source to destination without corruption.
- The session layer manages sessions between applications.
- The presentation layer translates data between protocols and applications.
- The application layer holds the interface used to interact through the network

Each of these layers is stacked on top of each other starting from the physical layer at the core of networking to the application layer at the surface.

Due to the specialised nature of networking, there are several different network design principles. These principles are usually chosen based on a business's requirements and can conflict with each other. Principles which I've identified include modularity, hierarchical structuring, and redundancy consciousness.

Modularity in network designs means ensuring that networking hardware can be easily replaced and upgraded. At the physical layer and data link layers of the OSI model modularity means that hardware and connections can be adjusted to improve performance. At the network layer modularity allows for different routing protocols to be utilised as required by the business, helping with changing organisational needs. Also, at the application layer modularity allows for applications and software to be replaced/upgraded to enhance performance and security. Lastly having the network designed with modular components and software implementations increases the scalability of the businesses network. In practical application an example of modular design would be the use of network segmentation through VLANs, which helps provide increased security whilst the use of VLANs makes it easier for the networking engineers to scale the network in individual segments and as a whole.

A well-adopted principle of network designs is the hierarchical network principle. Hierarchical networking means the networking devices are arranged to perform specific functions; the division of hardware responsibilities helps to make the network more manageable for IT professionals as they would be able to identify different components which need configuration easier than if there was no hierarchy. At the physical and data link layers of the OSI model, hierarchical design allows for the use of different network segments such as LANs/WANs and DMZs which can be individually optimised for specified traffic, improving the performance. At the network layer a hierarchy makes it easier to implement different routing protocols to improve performance and security. Finally at the transport layer, hierarchical networks can assist by enabling secure VPNs which can be optimised to ensure integrity is maintained as data is transferred over the entire hierarchy.

Another principle when designing a network is being redundancy conscious, taking steps to ensure a network has suitable redundancy built in to protect against issues with accessing or transmitting data across it. At the network layer, incorporating redundancy means allowing the use of multiple routing protocols such as EIGRP redistribution with OSPF or RIPv2, having multiple routing protocols enables a fallback if any fail and could improve the performance of the network by optimising traffic through assigning it to different protocols. At the data link layer redundancy planning allows for the use of multiple networking paths from a source to a destination, this would improve performance by helping to reduce network congestion. To protect against redundancy problem these paths could utilise features such as link aggregation which would improve the availability of the network, it's the available bandwidth and therefore result in better performance.

The UK government guidelines for networking principles identifies designing for interworking and flexibility as a core value (Cabinet Office, 2015). Designing for interworking in network design means ensuring that systems and protocols are integrated using industry standards. For example, using TCP/IP. Using standardised methodologies and technologies

would allow for more efficient exchanges of data through a network and reduces the need for independently specialised hardware. The interworking principle therefore would improve scalability of an organisations network, by reducing the requirements of specialised configurations to adapt at the hardware and software related layers of the OSI Model. Flexibility would be achieved through principles such as the modularity one discussed earlier and thus has the same impact at the layers of the OSI model. Whilst these two principles could be beneficial for business objectives and would improve network performance, they come at the cost of security. Using purely standardised procedures and protocols could increase the attack surface of network design, especially if the design allows for integration of different systems which haven't been appropriately vetted for security flaws.

In conclusion, I have listed some not all the network design principles used in professional practice. The principles vary largely in terms of their objectives making it clear to see how multiple used in conjunction would be required to create a network design suitable for specified organisational needs. By applying the principles I've identified a network engineer could optimise the performance, scalability, and security of their design across the OSI model. However as the benefits of the individual principles span over multiple layers of the OSI model, appraising the principles against the model can only help to identify sections to work on the design. The model doesn't necessarily improve or assist with the implementation itself.

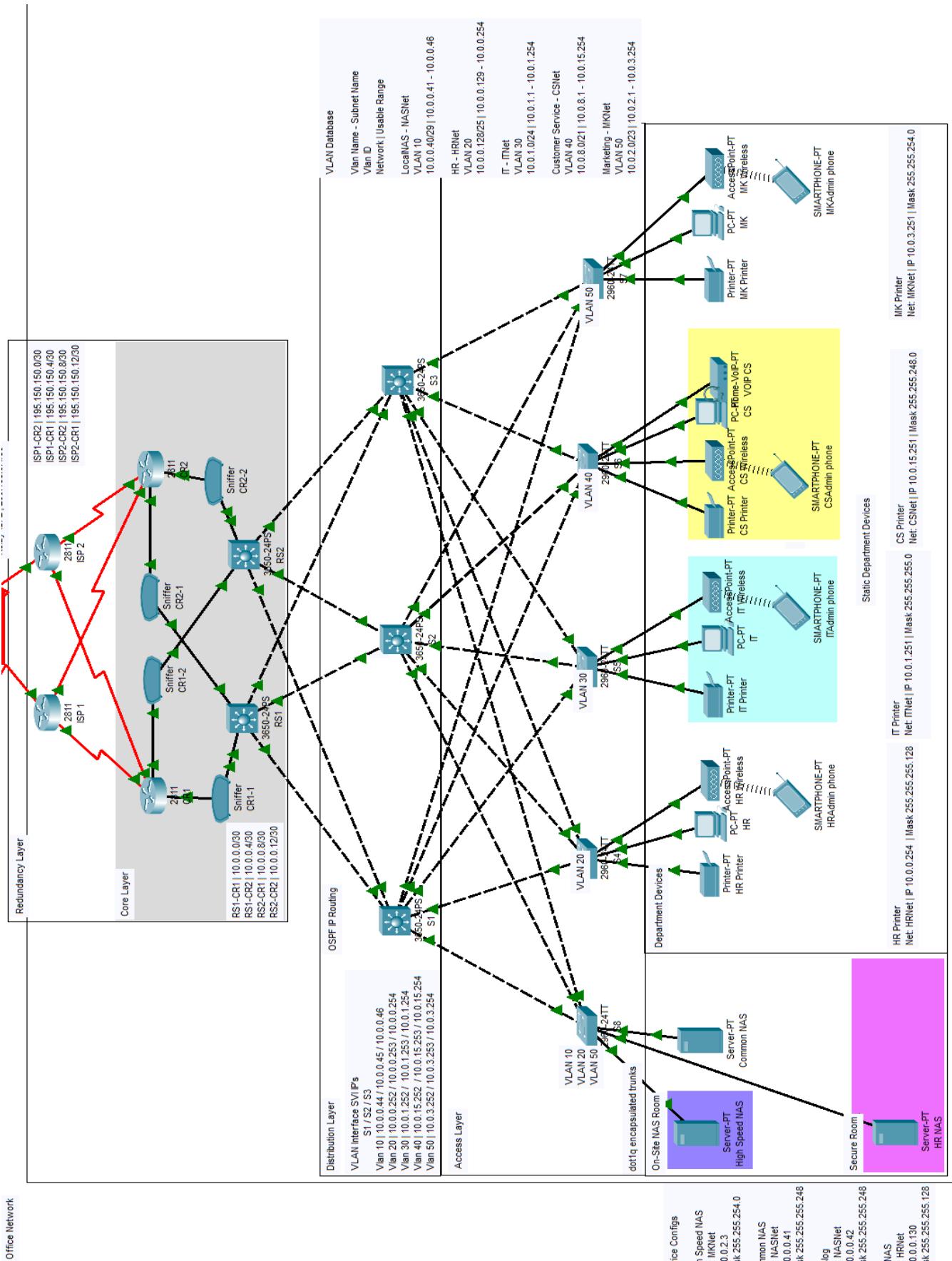
Section 2 | Design

Design Considerations

2.1 Hierarchical Network Design Model

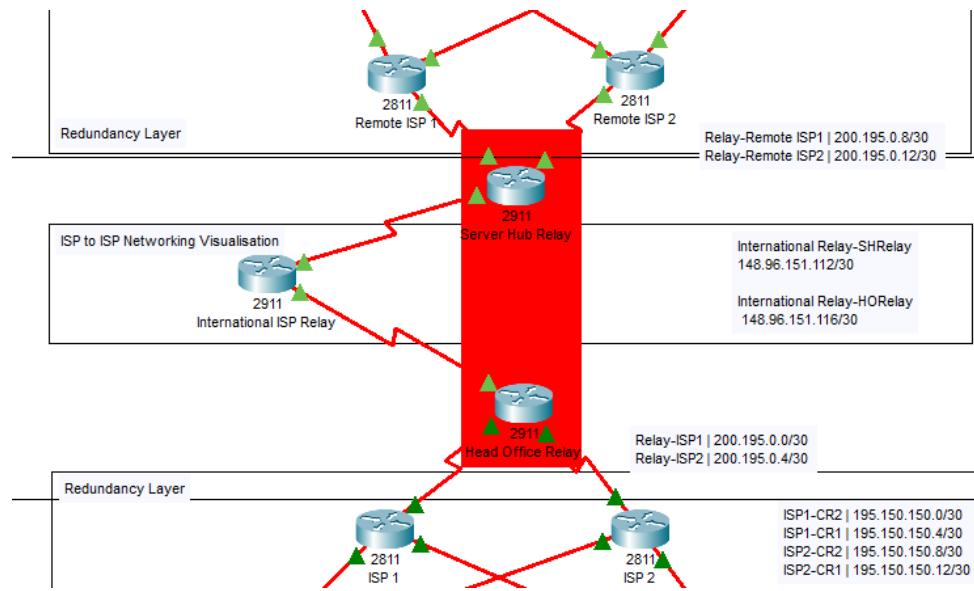
Both the on-site and offsite networks utilise a hierarchical mesh design. Using a 3-tier network topology and separated core, distribution, and access layers. With redundancy built in using two ISPs at each site.

On-Site Head Office Network



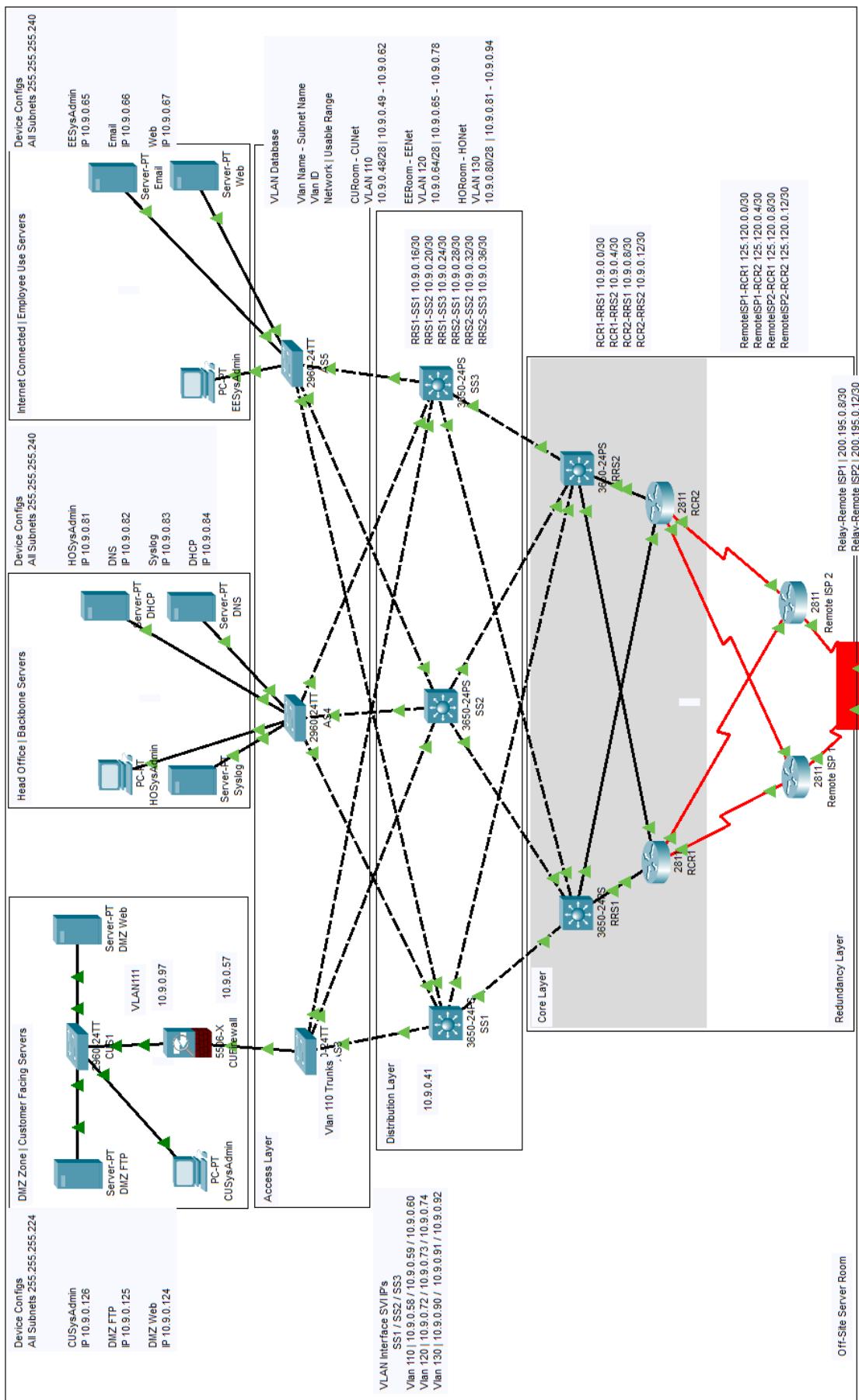
Site to Site Connection

It is assumed that the company will have full root access to configurations from the Head office and server hub relay. An IPSec vpn is to be placed between the two relays.



As with all the network, the routing protocol is OSPF however, between the relays and international ISP's there is also EIGRP configured for VPN Usage's.

Off-Site Server Site Network



2.2 Subnetting Allocation

On-Site

Starting from a network address of 10.0.0.0/20, I subnetted to create IP allocations for the router on a stick OSPF network routing and to provide each of the four departments with a total number of IP's suitable for business use. I have also added another subnet for NAS storage on-site.

Use	Subnet address	Netmask	Range of addresses	Useable IPs	Hosts
RS1-CR1	10.0.0.0/30	255.255.255.252	10.0.0.0 - 10.0.0.3	10.0.0.1 - 10.0.0.2	2
RS1-CR2	10.0.0.4/30	255.255.255.252	10.0.0.4 - 10.0.0.7	10.0.0.5 - 10.0.0.6	2
RS2-CR1	10.0.0.8/30	255.255.255.252	10.0.0.8 - 10.0.0.11	10.0.0.9 - 10.0.0.10	2
RS2-CR2	10.0.0.12/30	255.255.255.252	10.0.0.12 - 10.0.0.15	10.0.0.13 - 10.0.0.14	2
RS1-S1	10.0.0.16/30	255.255.255.252	10.0.0.16 - 10.0.0.19	10.0.0.17 - 10.0.0.18	2
RS1-S2	10.0.0.20/30	255.255.255.252	10.0.0.20 - 10.0.0.23	10.0.0.21 - 10.0.0.22	2
RS1-S3	10.0.0.24/30	255.255.255.252	10.0.0.24 - 10.0.0.27	10.0.0.25 - 10.0.0.26	2
RS2-S1	10.0.0.28/30	255.255.255.252	10.0.0.28 - 10.0.0.31	10.0.0.29 - 10.0.0.30	2
RS2-S2	10.0.0.32/30	255.255.255.252	10.0.0.32 - 10.0.0.35	10.0.0.33 - 10.0.0.34	2
RS2-S3	10.0.0.36/30	255.255.255.252	10.0.0.36 - 10.0.0.39	10.0.0.37 - 10.0.0.38	2
NASNet	10.0.0.40/29	255.255.255.248	10.0.0.40 - 10.0.0.47	10.0.0.41 - 10.0.0.46	6
Reserved	10.0.0.48/28	255.255.255.240	10.0.0.48 - 10.0.0.63	10.0.0.49 - 10.0.0.62	14
Reserved	10.0.0.64/26	255.255.255.192	10.0.0.64 - 10.0.0.127	10.0.0.65 - 10.0.0.126	62
HRNet	10.0.0.128/25	255.255.255.128	10.0.0.128 - 10.0.0.255	10.0.0.129 - 10.0.0.254	126
ITNet	10.0.1.0/24	255.255.255.0	10.0.1.0 - 10.0.1.255	10.0.1.1 - 10.0.1.254	254
MKNet	10.0.2.0/23	255.255.254.0	10.0.2.0 - 10.0.3.255	10.0.2.1 - 10.0.3.254	510
Reserved	10.0.4.0/22	255.255.252.0	10.0.4.0 - 10.0.7.255	10.0.4.1 - 10.0.7.254	1022
CSNet	10.0.8.0/21	255.255.248.0	10.0.8.0 - 10.0.15.255	10.0.8.1 - 10.0.15.254	2046

Subnetwork Allocation Breakdown:

Assuming each department requires a printer, and each employee uses 4 devices, the following IP estimates were made to create a suitable subnet table. Expecting the DFS to have a 1 Year Growth Projection of 30%

HR 24 Employees

IP's Required: 96, Growth Projected IP's: 126

IT 45 Employees

IP's Required: 180, Growth Projected IP's: 235

CS 390 Employees

IP's Required: 1560, Growth Projected IP's: 2029

MK 95 Employees

IP's Required: 380, Growth Projected IP's: 495

LocalNAS

IP's Required: 6, This local NAS network is only intended for managers of each department.

Off-Site

Starting from a network address of 10.9.0.0/24, I have sub netted to create IP allocations for the router on a stick OSPF network routing. Four usable Vlans have been created:

Use Case	Subnet address	Netmask	Range of addresses	Useable IPs	Hosts
RCR1-RS1	10.9.0.0/30	255.255.255.252	10.9.0.0 - 10.9.0.3	10.9.0.1 - 10.9.0.2	2
RCR1-RS2	10.9.0.4/30	255.255.255.252	10.9.0.4 - 10.9.0.7	10.9.0.5 - 10.9.0.6	2
RCR2-RS1	10.9.0.8/30	255.255.255.252	10.9.0.8 - 10.9.0.11	10.9.0.9 - 10.9.0.10	2
RCR2-RS2	10.9.0.12/30	255.255.255.252	10.9.0.12 - 10.9.0.15	10.9.0.13 - 10.9.0.14	2
RRS1-SS1	10.9.0.16/30	255.255.255.252	10.9.0.16 - 10.9.0.19	10.9.0.17 - 10.9.0.18	2
RRS1-SS2	10.9.0.20/30	255.255.255.252	10.9.0.20 - 10.9.0.23	10.9.0.21 - 10.9.0.22	2
RRS1-SS3	10.9.0.24/30	255.255.255.252	10.9.0.24 - 10.9.0.27	10.9.0.25 - 10.9.0.26	2
RRS2-SS1	10.9.0.28/30	255.255.255.252	10.9.0.28 - 10.9.0.31	10.9.0.29 - 10.9.0.30	2
RRS2-SS2	10.9.0.32/30	255.255.255.252	10.9.0.32 - 10.9.0.35	10.9.0.33 - 10.9.0.34	2
RRS2-SS3	10.9.0.36/30	255.255.255.252	10.9.0.36 - 10.9.0.39	10.9.0.37 - 10.9.0.38	2
Reserved	10.9.0.40/30	255.255.255.252	10.9.0.40 - 10.9.0.43	10.9.0.41 - 10.9.0.42	2
Reserved	10.9.0.44/30	255.255.255.252	10.9.0.44 - 10.9.0.47	10.9.0.45 - 10.9.0.46	2
CUNet	10.9.0.48/28	255.255.255.240	10.9.0.48 - 10.9.0.63	10.9.0.49 - 10.9.0.62	14
EENet	10.9.0.64/28	255.255.255.240	10.9.0.64 - 10.9.0.79	10.9.0.65 - 10.9.0.78	14
HONet	10.9.0.80/28	255.255.255.240	10.9.0.80 - 10.9.0.95	10.9.0.81 - 10.9.0.94	14
ArmedCUNet	10.9.0.96/27	255.255.255.224	10.9.0.96 - 10.9.0.127	10.9.0.97 - 10.9.0.126	30
Reserved	10.9.0.128/25	255.255.255.128	10.9.0.128 - 10.9.0.255	10.9.0.129 - 10.9.0.254	126

CUNet – Routed Subnet to connect to ArmedCUNet

EENet - Used for Employee Use Servers, contains an Email and Web Server.

HONet – Used for critical head office operational use, contains DNS, DHCP and Syslog servers

ArmedCUNet – Only accessible by HR and IT for secure communication. Contains a Web and FTP server.

Site to site

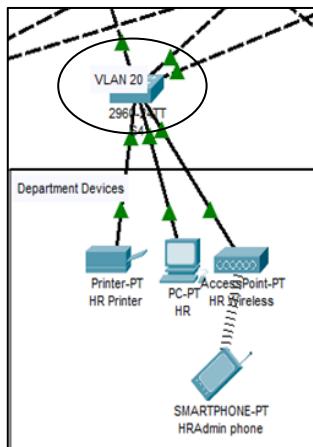
Use	Subnet address	Netmask	Range of addresses	Useable IPs
Relay-ISP1	200.195.0.0/30	255.255.255.252	200.195.0.0 - 200.195.0.3	200.195.0.1 - 200.195.0.2
Relay-ISP2	200.195.0.4/30	255.255.255.252	200.195.0.4 - 200.195.0.7	200.195.0.5 - 200.195.0.6
Relay-Remote ISP1	200.195.0.8/30	255.255.255.252	200.195.0.8 - 200.195.0.11	200.195.0.9 - 200.195.0.10
Relay-Remote ISP2	200.195.0.12/30	255.255.255.252	200.195.0.12 - 200.195.0.15	200.195.0.13 - 200.195.0.14
International Relay-Server Hub Relay	148.96.151.112/30	255.255.255.252	148.96.151.112 - 148.96.151.115	148.96.151.113 - 148.96.151.114
International Relay – Head Office Relay	148.96.151.116/30	255.255.255.252	148.96.151.116 - 148.96.151.119	148.96.151.117 - 148.96.151.118

2.3 | Setup Configuration

The formatting of this section will first show the section being worked on, then screenshots of the work done.

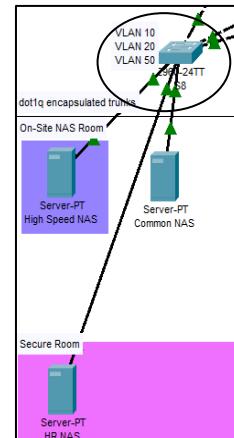
2.3.1 Access Layer Switch Setup

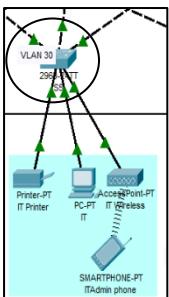
2.3.1.1 Head Office Devices



```
S4>
S4>enable
S4#conf t
Enter configuration commands, one per line. End with CNTL/Z.
S4(config)#
S4(config)#
S4(config)#hostname HRSwitch
HRSwitch(config)#banner motd #Authorized Access required - Contact IT#
HRSwitch(config)#no ip domain lookup
```

```
Switch>en
Switch#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#hostname NASSwitch
NASSwitch(config)#no ip domain lookup
NASSwitch(config)#banner motd #Authorized Access Required - Contact
IT#
NASSwitch(config)#do wr
Building configuration...
[OK]
NASSwitch(config)#exit
NASSwitch#
SYS-5-CONFIG_I: Configured from console by console
```





```

S5>en
S5#conf t
Enter configuration commands, one per line. End with CNTL/Z.
S5(config)#hostname ITSwitch
ITSwitch(config)#no ip domain lookup
ITSwitch(config)#banner motd #Authorized Access Required - Contact
IT#
^
* Invalid input detected at '^' marker.

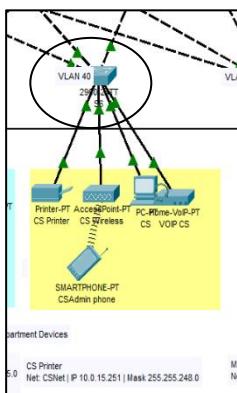
ITSwitch(config)#config t
^
* Invalid input detected at '^' marker.

ITSwitch(config)#conf t
^
* Invalid input detected at '^' marker.

ITSwitch(config)#do wr
Building configuration...
[OK]
ITSwitch(config)#exit
ITSwitch#
*SYS-5-CONFIG_I: Configured from console by console

ITSwitch#conf t
Enter configuration commands, one per line. End with CNTL/Z.
ITSwitch(config)#banner motd #Authorized Access Required - Contact
IT#
ITSwitch(config)#do wr
Building configuration...
[OK]
ITSwitch(config)#exit
ITSwitch#
*SYS-5-CONFIG_I: Configured from console by console

```

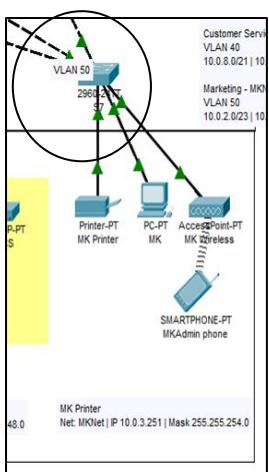


```

S6>
S6>en
S6#conf t
Enter configuration commands, one per line. End with CNTL/Z.
S6(config)#hostname CSSwitch
CSSwitch(config)#no ip domain lookup
CSSwitch(config)#banner motd #Authorized Access Required - Contact
IT#
^
* Invalid input detected at '^' marker.

CSSwitch(config)#banner motd #Authorized Access Required - Contact
IT#
CSSwitch(config)#do wr
Building configuration...
[OK]
CSSwitch(config)#exit
CSSwitch#
*SYS-5-CONFIG_I: Configured from console by console
exit

```

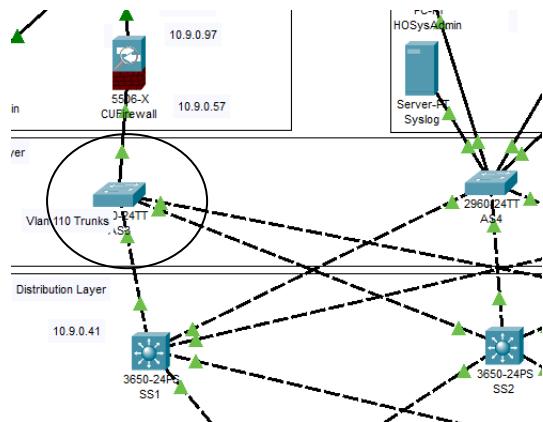


```

S7>en
S7#conf t
Enter configuration commands, one per line. End with CNTL/Z.
S7(config)#hostname MKSwitch
MKSwitch(config)#no ip domain lookup
MKSwitch(config)#banner motd #Authorized Access Required - Contact
IT#
MKSwitch(config)#do wr
Building configuration...
[OK]
MKSwitch(config)#exit
MKSwitch#
*SYS-5-CONFIG_I: Configured from console by console

```

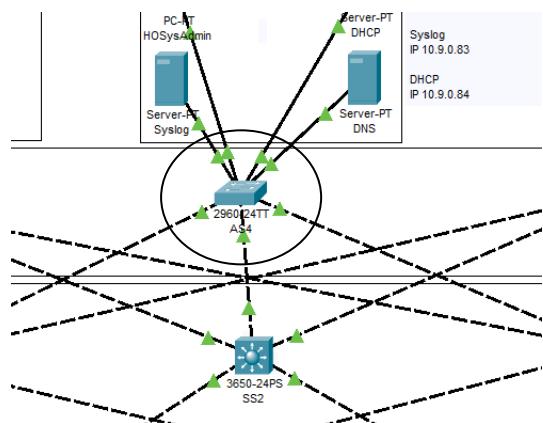
2.3.1.2 Off-Site Devices



```

Switch>en
Switch#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#hostname CUSwitch
CUSwitch(config)#no ip domain lookup
CUSwitch(config)#banner motd #Authorized Access Required - Contact
IT#
CUSwitch(config)#do wr
Building configuration...
[OK]
CUSwitch(config)#exit
CUSwitch#
%SYS-5-CONFIG_I: Configured from console by console

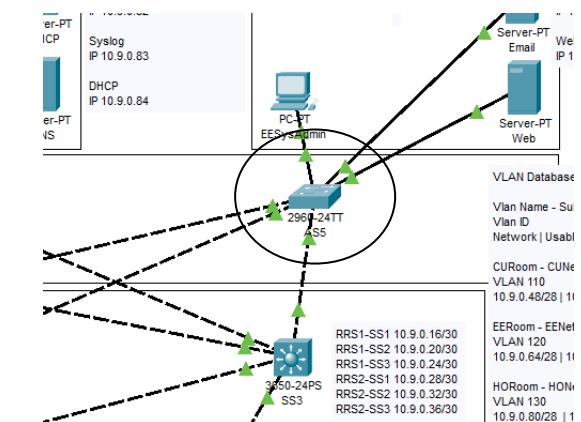
```



```

Switch>en
Switch#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#hostname HOSwitch
HOSwitch(config)#no ip domain lookup
HOSwitch(config)#banner motd #Authorized Access Required - Contact
IT#
HOSwitch(config)#do wr
Building configuration...
[OK]
HOSwitch(config)#exit

```



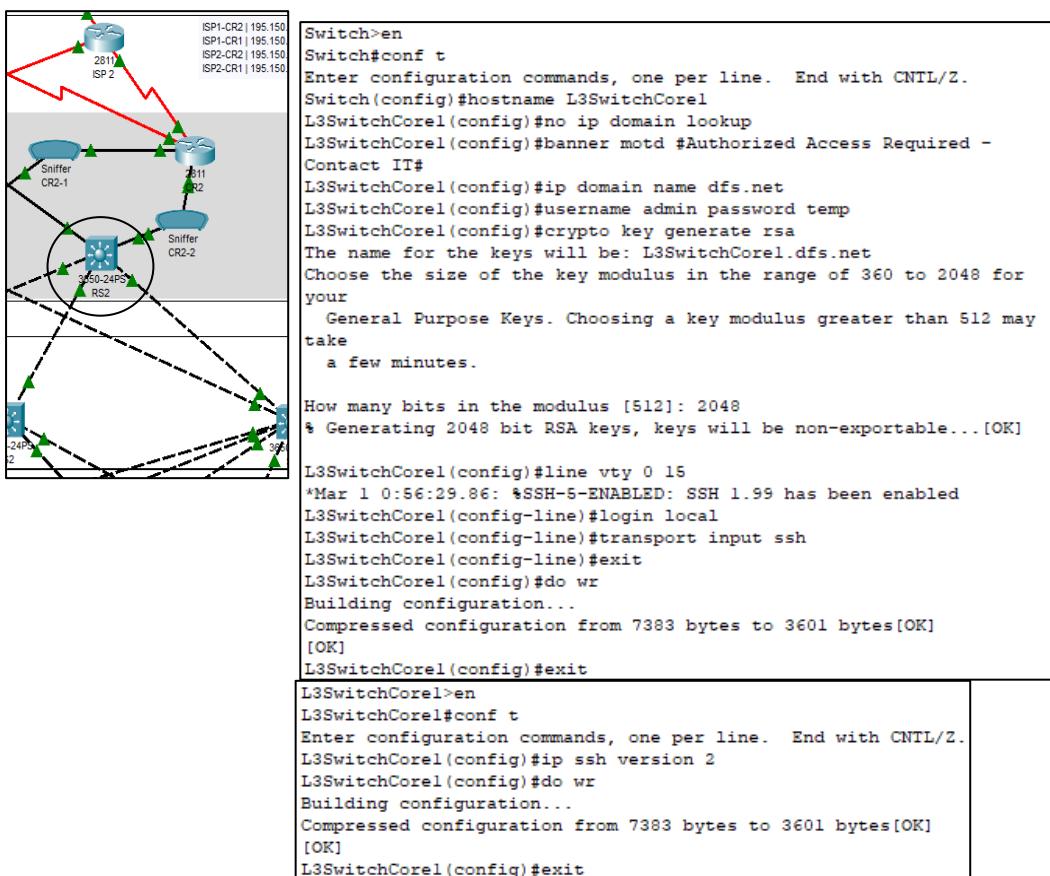
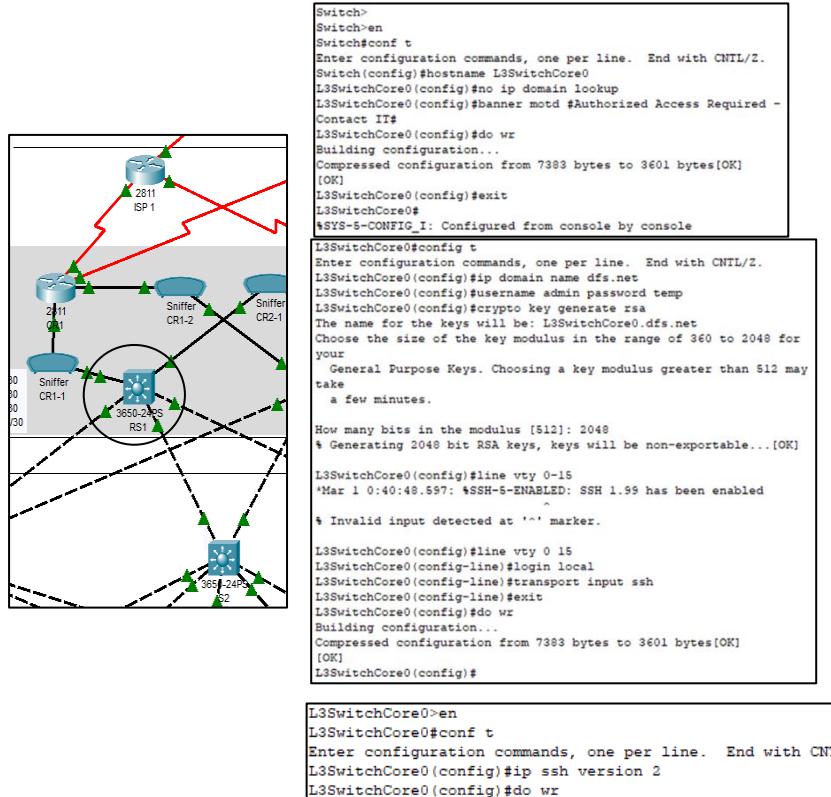
```

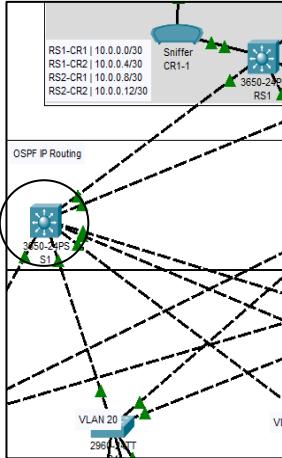
Switch>en
Switch#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#hostname EESwitch
EESwitch(config)#no ip domain lookup
EESwitch(config)#banner motd #Authorized Access Required - Contact
IT#
EESwitch(config)#do wr
Building configuration...
[OK]
EESwitch(config)#exit

```

2.3.2 Core/Distribution Switch Setup (SSH Enabled)

2.3.2.1 Head Office





```

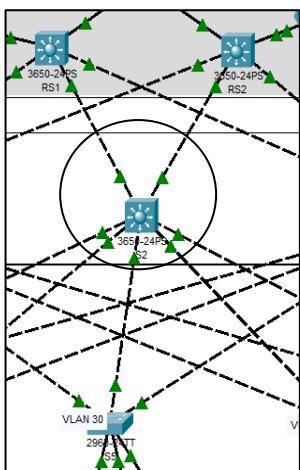
Switch>en
Switch#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#hostname L3SwitchDist1
L3SwitchDist1(config)#no ip domain lookup
L3SwitchDist1(config)#banner motd #Authorized Access Required -
Contact IT#
L3SwitchDist1(config)#ip domain name dfs.net
L3SwitchDist1(config)#username admin password temp
L3SwitchDist1(config)#crypto key generate rsa
The name for the keys will be: L3SwitchDist1.dfs.net
Choose the size of the key modulus in the range of 360 to 2048 for
your
General Purpose Keys. Choosing a key modulus greater than 512 may
take
a few minutes.

How many bits in the modulus [512]: 2048
* Generating 2048 bit RSA keys, keys will be non-exportable...[OK]

L3SwitchDist1(config)#line vty 0 15
*Mar 1 3:14:53.513: %SSH-5-ENABLED: SSH 1.99 has been enabled
L3SwitchDist1(config-line)#login local
L3SwitchDist1(config-line)#transport input ssh
L3SwitchDist1(config-line)#exit
L3SwitchDist1(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
L3SwitchDist1(config)#exit
L3SwitchDist1#
*SYS-5-CONFIG_I: Configured from console by console

L3SwitchDist1>en
L3SwitchDist1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchDist1(config)#ip ssh version 2
L3SwitchDist1(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
L3SwitchDist1(config)#exit
L3SwitchDist1#
*SYS-5-CONFIG_I: Configured from console by console

```



```

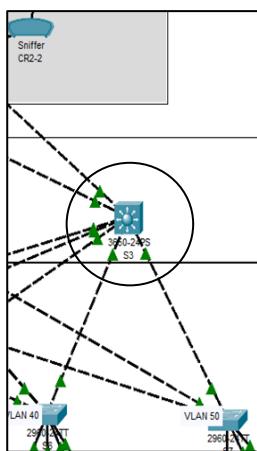
Switch>en
Switch#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#hostname L3SwitchDist2
L3SwitchDist2(config)#no ip domain lookup
L3SwitchDist2(config)#banner motd #Authorized Access Required -
Contact IT#
L3SwitchDist2(config)#ip domain name dfs.net
L3SwitchDist2(config)#username admin password temp
L3SwitchDist2(config)#crypto key generate rsa
The name for the keys will be: L3SwitchDist2.dfs.net
Choose the size of the key modulus in the range of 360 to 2048 for
your
General Purpose Keys. Choosing a key modulus greater than 512 may
take
a few minutes.

How many bits in the modulus [512]: 2048
* Generating 2048 bit RSA keys, keys will be non-exportable...[OK]

L3SwitchDist2(config)#line vty 0 15
*Mar 1 3:17:12.152: %SSH-5-ENABLED: SSH 1.99 has been enabled
L3SwitchDist2(config-line)#login local
L3SwitchDist2(config-line)#transport input ssh
L3SwitchDist2(config-line)#exit
L3SwitchDist2(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
L3SwitchDist2(config)#exit
L3SwitchDist2#
*SYS-5-CONFIG_I: Configured from console by console

L3SwitchDist2>en
L3SwitchDist2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchDist2(config)#ip ssh version 2
L3SwitchDist2(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
L3SwitchDist2(config)#exit
L3SwitchDist2#
*SYS-5-CONFIG_I: Configured from console by console

```



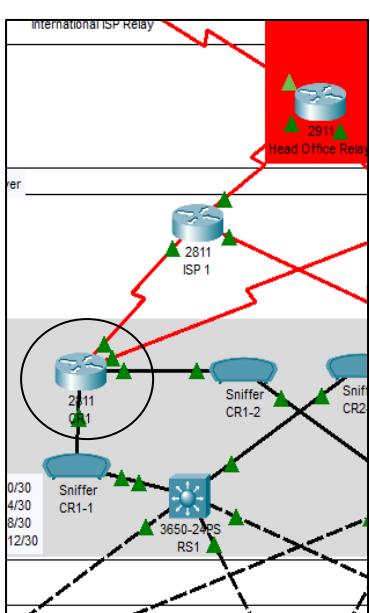
```

Switch>en
Switch#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#hostname L3SwitchDist3
L3SwitchDist3(config)#no ip domain lookup
L3SwitchDist3(config)#banner motd #Authorized Access Required - Contact IT#
L3SwitchDist3(config)#ip domain name dfs.net
L3SwitchDist3(config)#username admin password temp
L3SwitchDist3(config)#crypto key generate rsa
The name for the keys will be: L3SwitchDist3.dfs.net
Choose the size of the key modulus in the range of 360 to 2048 for your
General Purpose Keys. Choosing a key modulus greater than 512 may take
a few minutes.

How many bits in the modulus [512]: 2048
* Generating 2048 bit RSA keys, keys will be non-exportable...[OK]

L3SwitchDist3(config)#line vty 0 15
*Mar 1 3:20:21.590: %SSH-5-ENABLED: SSH 1.99 has been enabled
L3SwitchDist3(config-line)#login local
L3SwitchDist3(config-line)#transport input ssh
L3SwitchDist3(config-line)#exit
L3SwitchDist3(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
L3SwitchDist3(config)#exit
L3SwitchDist3#
*SYS-5-CONFIG_I: Configured from console by console
L3SwitchDist3>en
L3SwitchDist3#conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchDist3(config)#ip ssh version 2
L3SwitchDist3(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
L3SwitchDist3(config)#exit
L3SwitchDist3#
*SYS-5-CONFIG_I: Configured from console by console

```



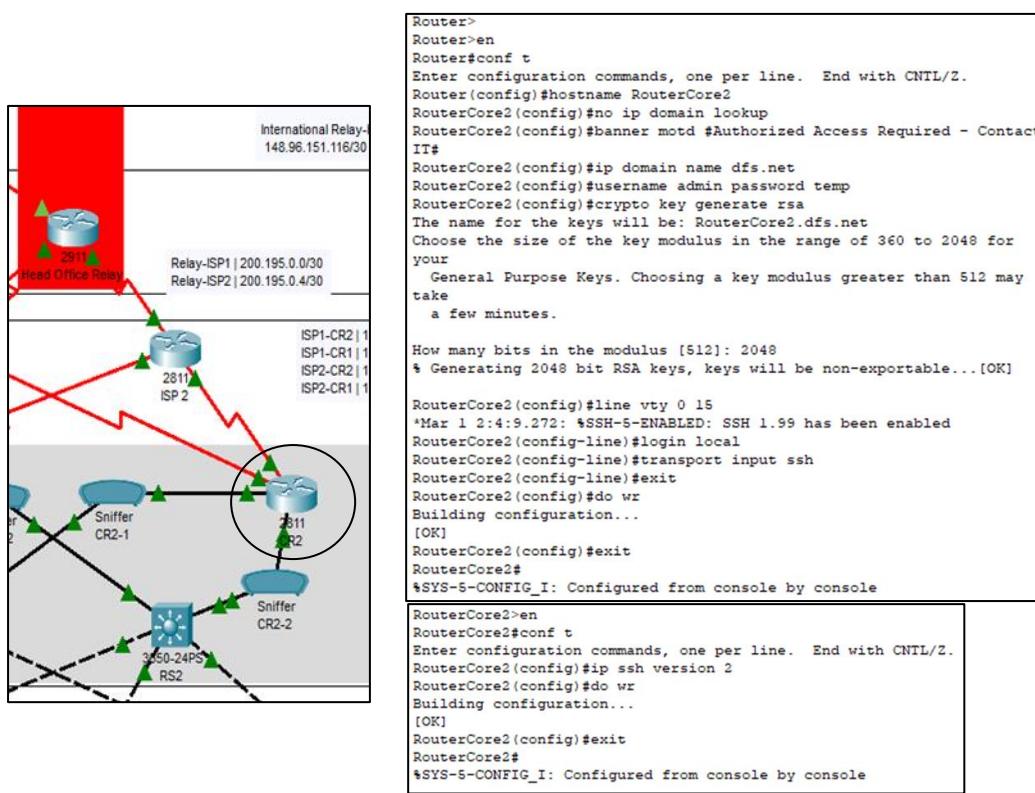
```

Router#en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#hostname RouterCore1
RouterCore1(config)#no ip domain lookup
RouterCore1(config)#banner motd #Authorized Access Required - Contact IT#
RouterCore1(config)#ip domain name dfs.net
RouterCore1(config)#username admin password temp
RouterCore1(config)#crypto key generate rsa
The name for the keys will be: RouterCore1.dfs.net
Choose the size of the key modulus in the range of 360 to 2048 for your
General Purpose Keys. Choosing a key modulus greater than 512 may take
a few minutes.

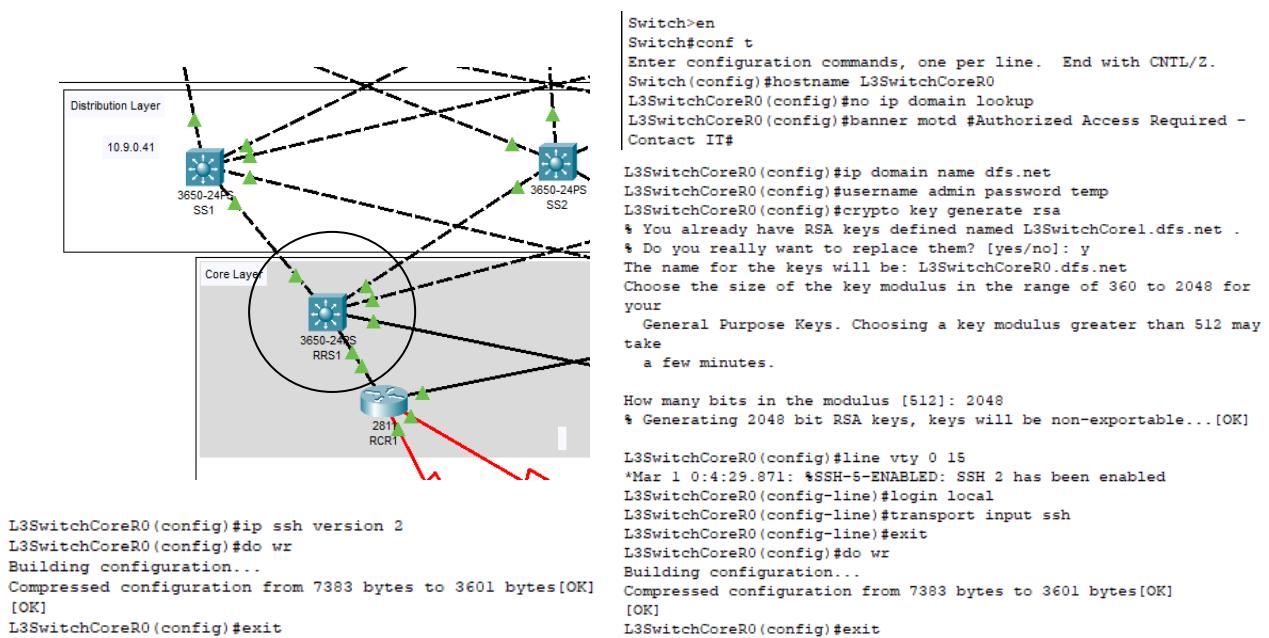
How many bits in the modulus [512]: 2048
* Generating 2048 bit RSA keys, keys will be non-exportable...[OK]

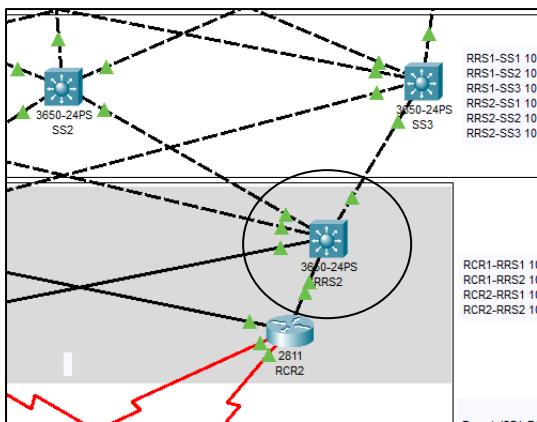
RouterCore1(config)#line vty 0 15
*Mar 1 1:59:33.260: %SSH-5-ENABLED: SSH 1.99 has been enabled
RouterCore1(config-line)#login local
RouterCore1(config-line)#transport input ssh
RouterCore1(config-line)#exit
RouterCore1(config)#do wr
Building configuration...
[OK]
RouterCore1(config)#exit
RouterCore1#
*SYS-5-CONFIG_I: Configured from console by console
RouterCore1>en
RouterCore1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
RouterCore1(config)#ip ssh version 2
RouterCore1(config)#do wr
Building configuration...
[OK]
RouterCore1(config)#exit
RouterCore1#
*SYS-5-CONFIG_I: Configured from console by console

```



2.3.2.2 Off-Site





```

Switch>en
Switch#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#hostname L3SwitchCoreR1
L3SwitchCoreR1(config)#no ip domain lookup
L3SwitchCoreR1(config)#banner motd #Authorized Access Required -
Contact IT#

```

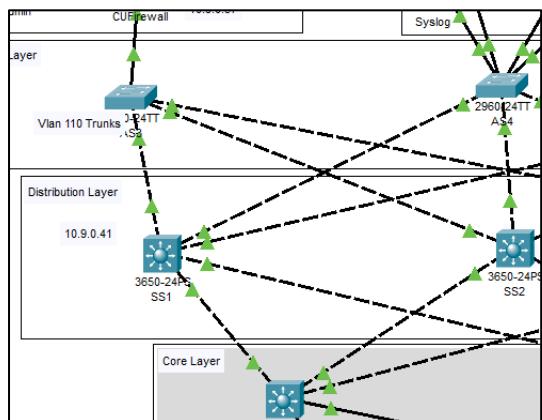
```

L3SwitchCoreR1(config)#ip domain name dfs.net
L3SwitchCoreR1(config)#username admin password temp
L3SwitchCoreR1(config)#crypto key generate rsa
# You already have RSA keys defined named L3SwitchCore0.dfs.net .
# Do you really want to replace them? [yes/no]: y
The name for the keys will be: L3SwitchCoreR1.dfs.net
Choose the size of the key modulus in the range of 360 to 2048 for
your
General Purpose Keys. Choosing a key modulus greater than 512 may
take
a few minutes.

How many bits in the modulus [512]: 2048
* Generating 2048 bit RSA keys, keys will be non-exportable...[OK]

L3SwitchCoreR1(config)#line vty 0 15
*Mar 1 1:30:8.840: %SSH-5-ENABLED: SSH 2 has been enabled
L3SwitchCoreR1(config-line)#login local
L3SwitchCoreR1(config-line)#transport input ssh
L3SwitchCoreR1(config-line)#exit
L3SwitchCoreR1(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
L3SwitchCoreR1(config)#exit

```



```

Switch>en
Switch#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#hostname L3SwitchDistR1
L3SwitchDistR1(config)#no ip domain lookup
L3SwitchDistR1(config)#banner motd #Authorized Access Required -
Contact IT#
L3SwitchDistR1(config)#

```

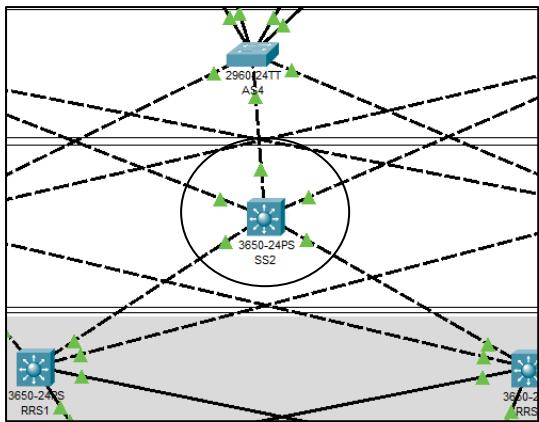
```

L3SwitchDistR1(config)#ip domain name dfs.net
L3SwitchDistR1(config)#username admin password temp
L3SwitchDistR1(config)#crypto key generate rsa
The name for the keys will be: L3SwitchDistR1.dfs.net
Choose the size of the key modulus in the range of 360 to 2048 for
your
General Purpose Keys. Choosing a key modulus greater than 512 may
take
a few minutes.

How many bits in the modulus [512]: 2048
* Generating 2048 bit RSA keys, keys will be non-exportable...[OK]

L3SwitchDistR1(config)#line vty 0 15
*Mar 1 0:3:3.599: %SSH-5-ENABLED: SSH 1.99 has been enabled
L3SwitchDistR1(config-line)#login local
L3SwitchDistR1(config-line)#transport input ssh
L3SwitchDistR1(config-line)#exit
L3SwitchDistR1(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
L3SwitchDistR1(config)#exit

```

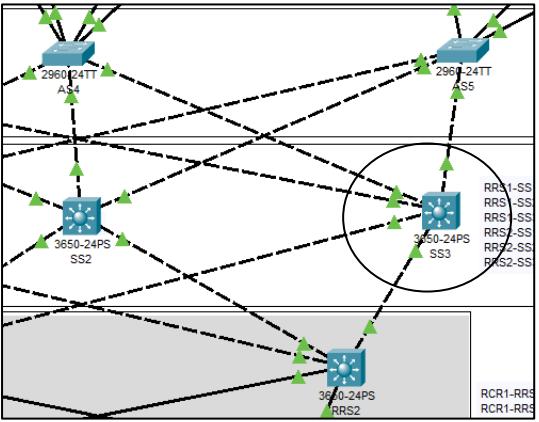


```
L3SwitchDistR2>en
L3SwitchDistR2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchDistR2(config)#ip ssh version 2
L3SwitchDistR2(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
L3SwitchDistR2(config)#exit
```

```
Switch>en
Switch#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#hostname L3SwitchDistR2
L3SwitchDistR2(config)#no ip domain lookup
L3SwitchDistR2(config)#banner motd #Authorized Access Required -
Contact IT#
L3SwitchDistR2(config)#ip domain name dfs.net
L3SwitchDistR2(config)#username admin password temp
L3SwitchDistR2(config)#crypto key generate rsa
The name for the keys will be: L3SwitchDistR2.dfs.net
Choose the size of the key modulus in the range of 360 to 2048 for
your
General Purpose Keys. Choosing a key modulus greater than 512 may
take
a few minutes.

How many bits in the modulus [512]: 2048
* Generating 2048 bit RSA keys, keys will be non-exportable...[OK]

L3SwitchDistR2(config)#line vty 0 15
*Mar 1 0:48:810: *SSH-5-ENABLED: SSH 1.99 has been enabled
L3SwitchDistR2(config-line)#login local
L3SwitchDistR2(config-line)#transport input ssh
L3SwitchDistR2(config-line)#exit
L3SwitchDistR2(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
L3SwitchDistR2(config)#exit
L3SwitchDistR2#
*SYS-5-CONFIG_I: Configured from console by console
```

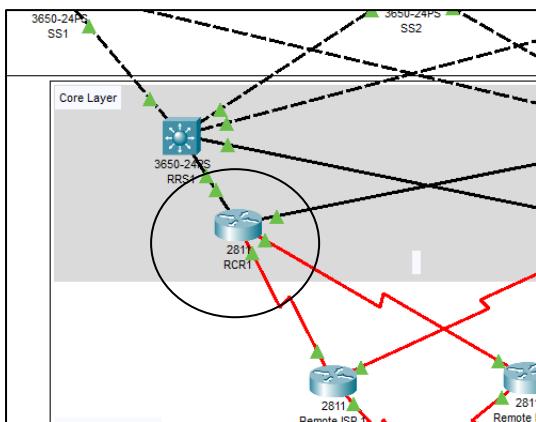


```
L3SwitchDistR3>en
L3SwitchDistR3#conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchDistR3(config)#ip ssh version 2
L3SwitchDistR3(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
L3SwitchDistR3(config)#exit
L3SwitchDistR3#
*SYS-5-CONFIG_I: Configured from console by console
```

```
Switch>en
Switch#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#hostname L3SwitchDistR3
L3SwitchDistR3(config)#no ip domain lookup
L3SwitchDistR3(config)#banner motd #Authorized Access Required -
Contact IT#
L3SwitchDistR3(config)#ip domain name dfs.net
L3SwitchDistR3(config)#username admin password temp
L3SwitchDistR3(config)#crypto key generate rsa
The name for the keys will be: L3SwitchDistR3.dfs.net
Choose the size of the key modulus in the range of 360 to 2048 for
your
General Purpose Keys. Choosing a key modulus greater than 512 may
take
a few minutes.

How many bits in the modulus [512]: 2048
* Generating 2048 bit RSA keys, keys will be non-exportable...[OK]

L3SwitchDistR3(config)#line vty 0 15
*Mar 1 0:8:1.856: *SSH-5-ENABLED: SSH 1.99 has been enabled
L3SwitchDistR3(config-line)#login local
L3SwitchDistR3(config-line)#transport input ssh
L3SwitchDistR3(config-line)#exit
L3SwitchDistR3(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
```

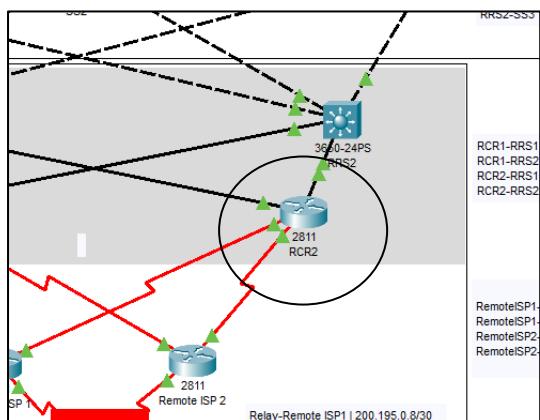


```
RouterCoreR1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
RouterCoreR1(config)#ip ssh version 2
RouterCoreR1(config)#do wr
Building configuration...
[OK]
RouterCoreR1(config)#exit
RouterCoreR1#
%SYS-5-CONFIG_I: Configured from console by console
```

```
Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#hostname RouterCoreR1
RouterCoreR1(config)#no ip domain lookup
RouterCoreR1(config)#banner motd #Authorized Access Required - Contact IT#
RouterCoreR1(config)#ip domain name dfs.net
RouterCoreR1(config)#username admin password temp
RouterCoreR1(config)#crypto key generate rsa
# You already have RSA keys defined named RouterCore2.dfs.net .
# Do you really want to replace them? [yes/no]: y
The name for the keys will be: RouterCoreR1.dfs.net
Choose the size of the key modulus in the range of 360 to 2048 for your
General Purpose Keys. Choosing a key modulus greater than 512 may take
a few minutes.

How many bits in the modulus [512]: 2048
* Generating 2048 bit RSA keys, keys will be non-exportable...[OK]

RouterCoreR1(config)#line vty 0 15
*Mar 1 1:54:10.860: %SSH-5-ENABLED: SSH 2 has been enabled
RouterCoreR1(config-line)#login local
RouterCoreR1(config-line)#transport input ssh
RouterCoreR1(config-line)#exit
RouterCoreR1(config)#do wr
Building configuration...
[OK]
RouterCoreR1(config)#exit
RouterCoreR1#
%SYS-5-CONFIG_I: Configured from console by console
```



```
RouterCoreR2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
RouterCoreR2(config)#ip ssh version 2
RouterCoreR2(config)#do wr
Building configuration...
[OK]
RouterCoreR2(config)#exit
RouterCoreR2#
%SYS-5-CONFIG_I: Configured from console by console
```

```
Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#hostname RouterCoreR2
RouterCoreR2(config)#no ip domain lookup
RouterCoreR2(config)#banner motd #Authorized Access Required - Contact IT#
RouterCoreR2(config)#ip domain name dfs.net
RouterCoreR2(config)#username admin password temp
RouterCoreR2(config)#crypto key generate rsa
# You already have RSA keys defined named RouterCore1.dfs.net .
# Do you really want to replace them? [yes/no]: y
The name for the keys will be: RouterCoreR2.dfs.net
Choose the size of the key modulus in the range of 360 to 2048 for your
General Purpose Keys. Choosing a key modulus greater than 512 may take
a few minutes.

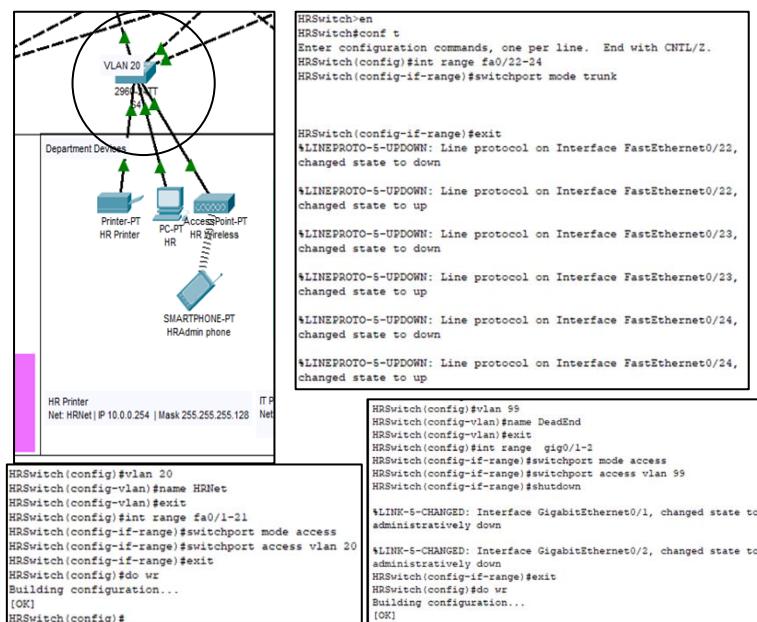
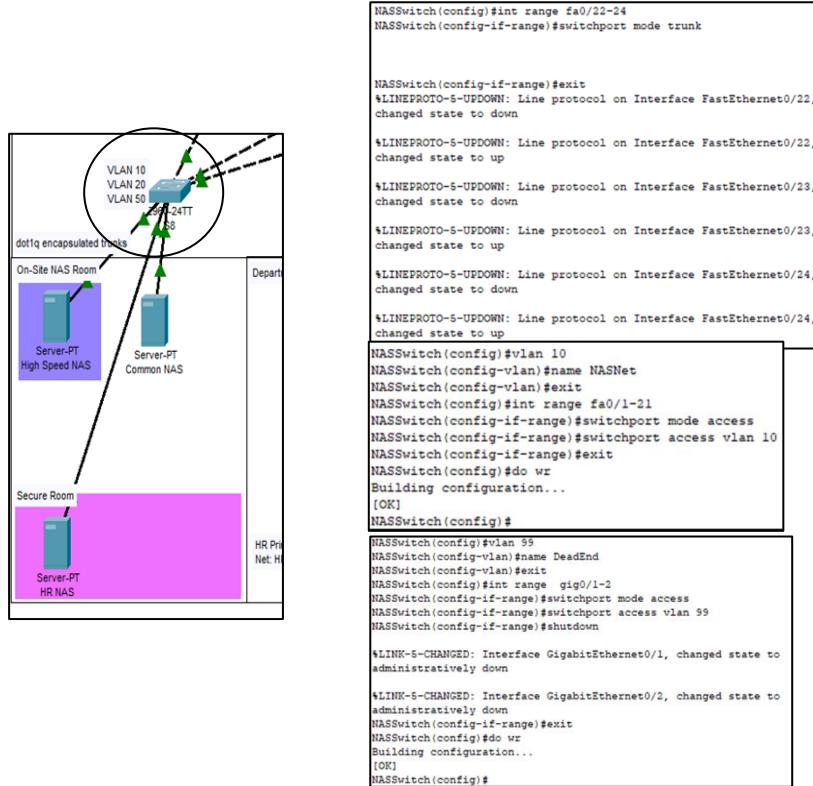
How many bits in the modulus [512]: 2048
* Generating 2048 bit RSA keys, keys will be non-exportable...[OK]

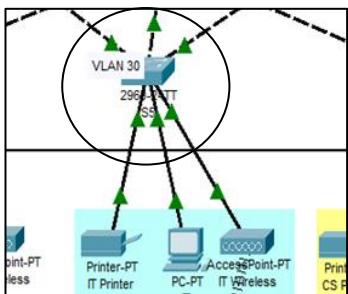
RouterCoreR2(config)#line vty 0 15
*Mar 1 1:57:23.402: %SSH-5-ENABLED: SSH 2 has been enabled
RouterCoreR2(config-line)#login local
RouterCoreR2(config-line)#transport input ssh
RouterCoreR2(config-line)#exit
RouterCoreR2(config)#do wr
Building configuration...
[OK]
RouterCoreR2(config)#exit
RouterCoreR2#
%SYS-5-CONFIG_I: Configured from console by console
```

2.3.3 Access Layer, L2 Switch Setup, VLAN Trunking

Each switch had interface connections to Layer 3 switches changed to trunks, Appropriate Virtual-Lans assigned, unused ports were shut down and assigned to Vlan 99.

2.3.3.0.1 Head Office





```

ITSwitch(config)#vlan 99
ITSwitch(config-vlan)#name DeadEnd
ITSwitch(config-vlan)#exit
ITSwitch(config)#int range gig0/1-2
ITSwitch(config-if-range)#switchport mode access
ITSwitch(config-if-range)#switchport access vlan 99
ITSwitch(config-if-range)#shutdown

*LINK-5-CHANGED: Interface GigabitEthernet0/1, changed state to administratively down
*LINK-5-CHANGED: Interface GigabitEthernet0/2, changed state to administratively down
ITSwitch(config)#exit
ITSwitch(config)#do wr
Building configuration...
[OK]

```

```

ITSwitch>en
ITSwitch#conf t
Enter configuration commands, one per line. End with CNTL/Z.
ITSwitch(config)#int range fa0/22-24
ITSwitch(config-if-range)#switchport mode trunk

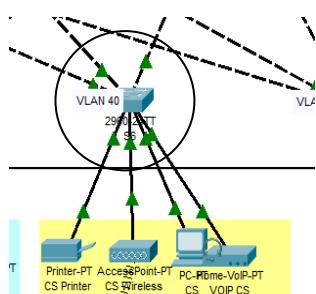
ITSwitch(config-if-range)#exit
*LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/22, changed state to down
*LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/22, changed state to up
*LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/23, changed state to down
*LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/23, changed state to up
*LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/24, changed state to down
*LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/24, changed state to up

```

```

ITSwitch(config)#vlan 30
ITSwitch(config-vlan)#name ITNet
ITSwitch(config-vlan)#exit
ITSwitch(config)#int range fa0/1-21
ITSwitch(config-if-range)#switchport mode access
ITSwitch(config-if-range)#switchport access vlan 30
ITSwitch(config-if-range)#exit
ITSwitch(config)#do wr
Building configuration...
[OK]

```



```

CSSSwitch(config)#vlan 99
CSSwitch(config-vlan)#name DeadEnd
CSSwitch(config-vlan)#exit
CSSwitch(config)#int range gig0/1-2
CSSwitch(config-if-range)#switchport mode access
CSSwitch(config-if-range)#switchport access vlan 99
CSSwitch(config-if-range)#shutdown

*LINK-5-CHANGED: Interface GigabitEthernet0/1, changed state to administratively down
*LINK-5-CHANGED: Interface GigabitEthernet0/2, changed state to administratively down
CSSwitch(config-if-range)#exit
CSSwitch(config)#do wr
Building configuration...
[OK]

```

```

CSSwitch>en
CSSwitch#conf t
Enter configuration commands, one per line. End with CNTL/Z.
CSSwitch(config)#int range fa0/22-24
CSSwitch(config-if-range)#switchport mode trunk

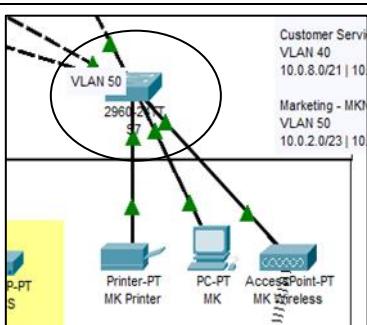
```

```

CSSwitch(config-if-range)#exit
*LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/22, changed state to down
*LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/22, changed state to up
*LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/23, changed state to down
*LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/23, changed state to up
*LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/24, changed state to down
*LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/24, changed state to up

CSSwitch(config)#vlan 40
CSSwitch(config-vlan)#name CSNet
CSSwitch(config-vlan)#exit
CSSwitch(config)#int range fa0/1-21
CSSwitch(config-if-range)#switchport mode access
CSSwitch(config-if-range)#switchport access vlan 40
CSSwitch(config-if-range)#exit
CSSwitch(config)#do wr
Building configuration...
[OK]
CSSwitch(config)#

```



```

MKSswitch(config-if-range)#exit
*LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/22, changed state to down
*LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/22, changed state to up
*LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/23, changed state to down
*LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/23, changed state to up
*LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/24, changed state to down
*LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/24, changed state to up

```

```

MKSswitch(config)#vlan 99
MKSswitch(config-vlan)#name DeadEnd
MKSswitch(config-vlan)#exit
MKSswitch(config)#int range gig0/1-2
MKSswitch(config-if-range)#switchport mode access
MKSswitch(config-if-range)#switchport access vlan 99
MKSswitch(config-if-range)#shutdown

*LINK-5-CHANGED: Interface GigabitEthernet0/1, changed state to administratively down
*LINK-5-CHANGED: Interface GigabitEthernet0/2, changed state to administratively down
MKSswitch(config-if-range)#exit
MKSswitch(config)#do wr
Building configuration...
[OK]

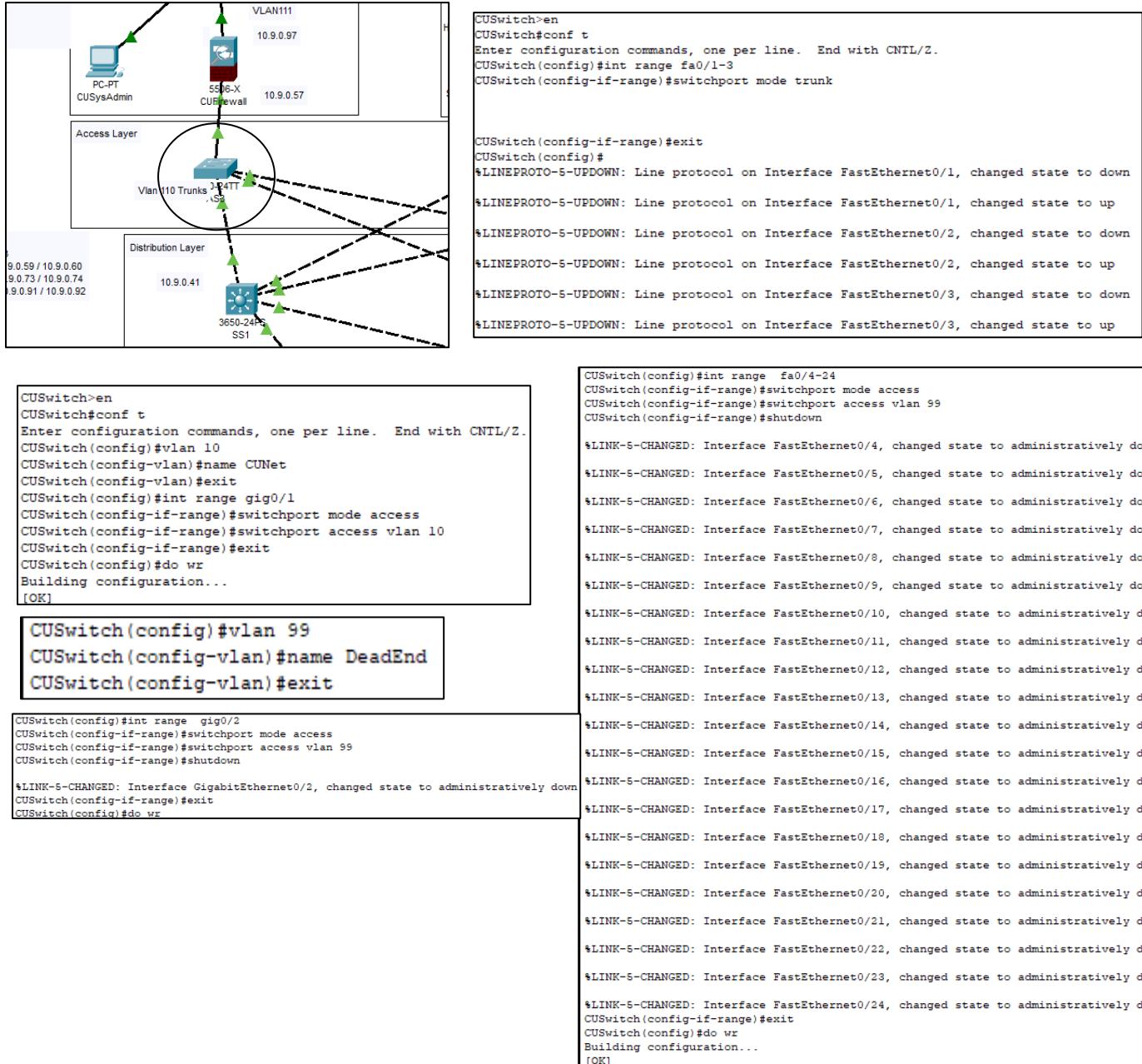
```

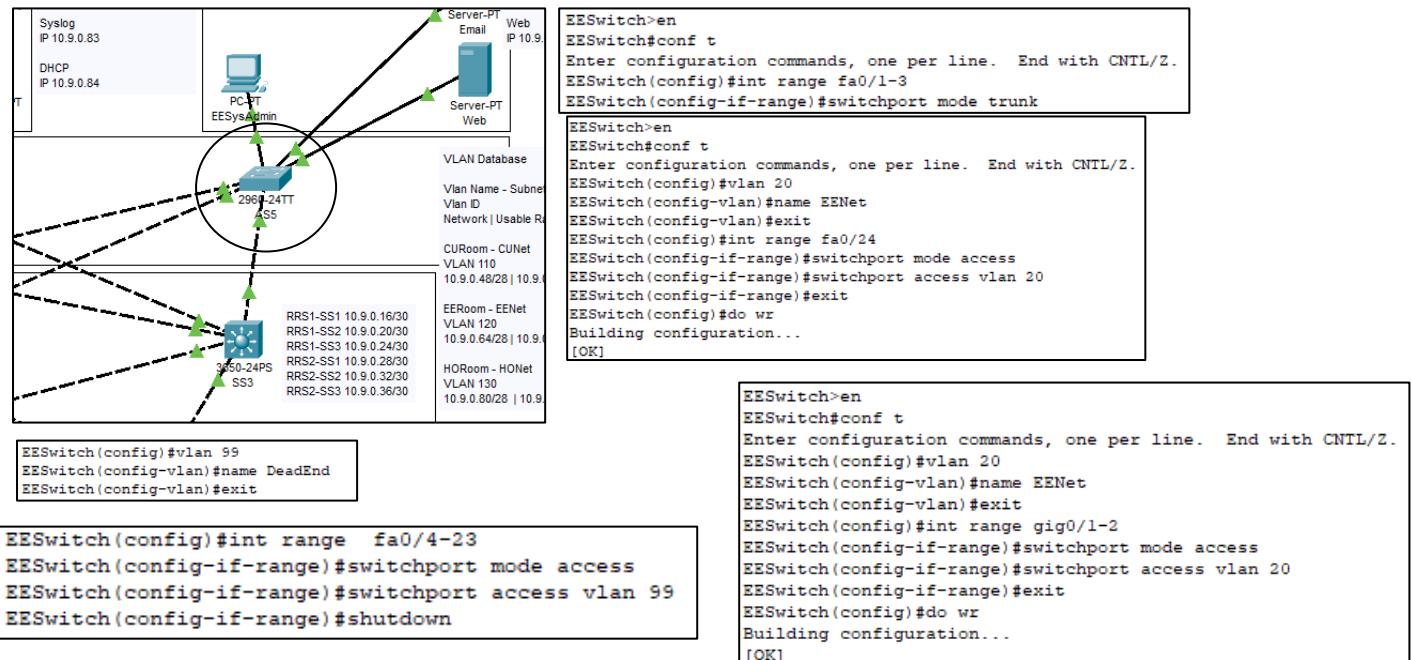
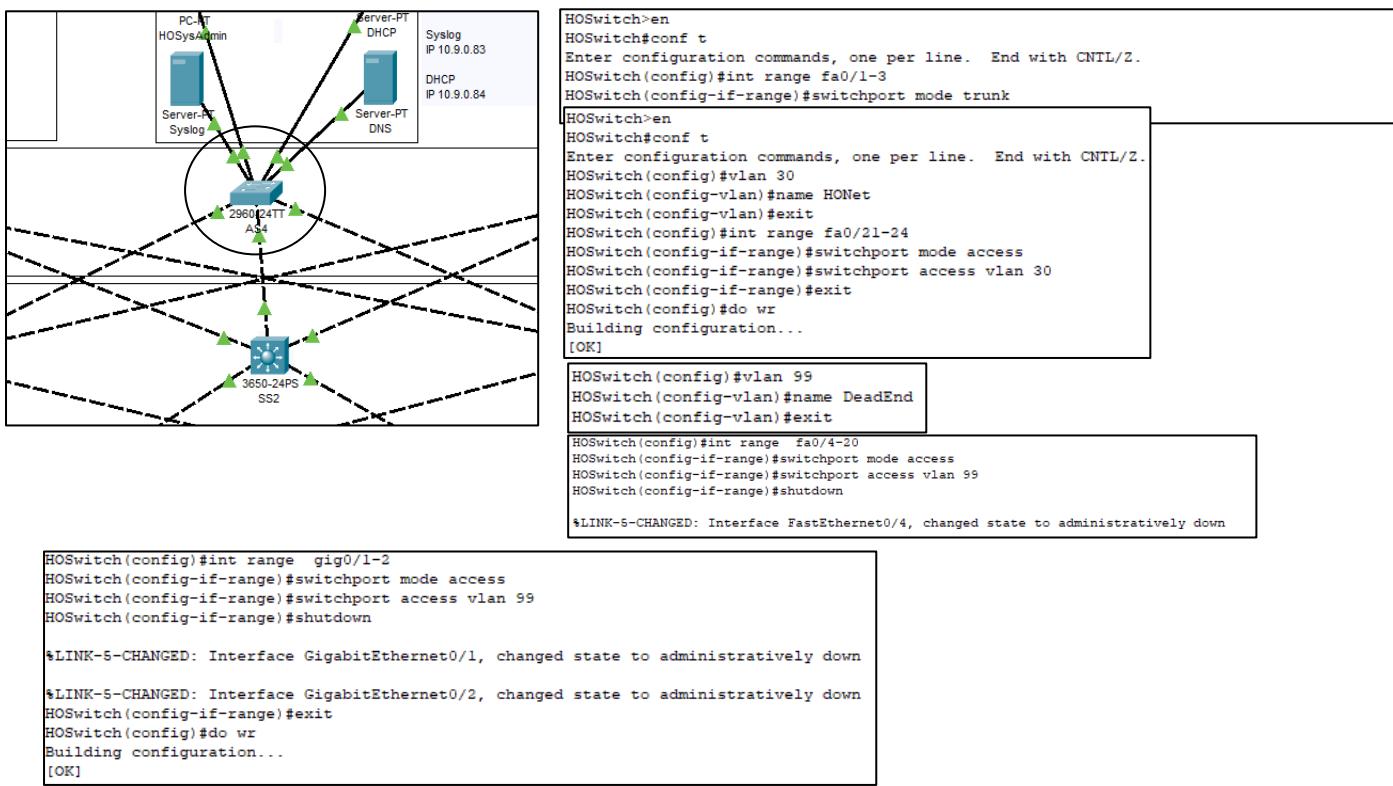
```

MKSswitch(config)#vlan 50
MKSswitch(config-vlan)#name MKNet
MKSswitch(config-vlan)#exit
MKSswitch(config)#int range fa0/1-21
MKSswitch(config-if-range)#switchport mode access
MKSswitch(config-if-range)#switchport access vlan 50
MKSswitch(config-if-range)#exit
MKSswitch(config)#do wr
Building configuration...
[OK]

```

2.3.3.0.2 Off-Site

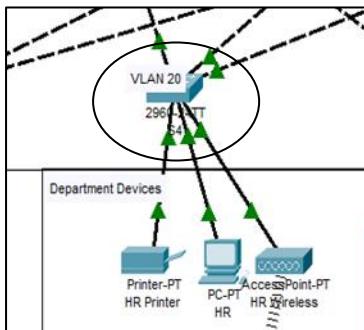




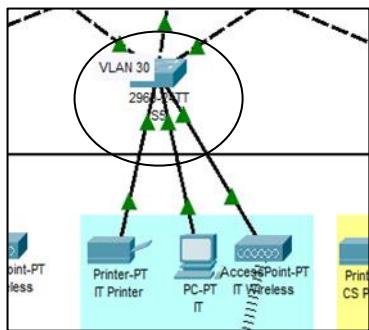
2.3.3.1 Switchport Security

For testing purposes switchport security was applied to limit access on each switch. Max devices are set to testing values, department requirements will determine the actual max devices per switch. A physical security use consideration.

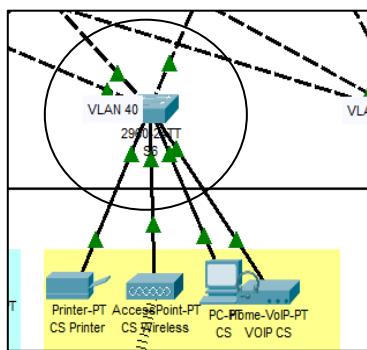
Head Office



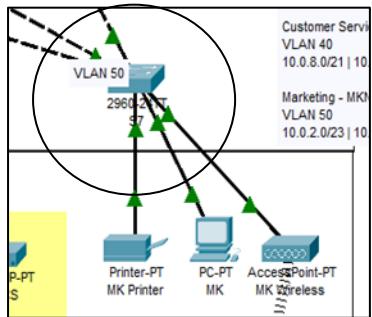
```
HRswitch>en
HRswitch#conf t
Enter configuration commands, one per line. End with CNTL/Z.
HRswitch(config)#int range fa0/1-21
HRswitch(config-if-range)#switchport port-security
HRswitch(config-if-range)#switchport port-security maximum 10
HRswitch(config-if-range)#switchport port-security mac-address sticky
HRswitch(config-if-range)#switchport port-security violation shutdown
HRswitch(config-if-range)#exit
HRswitch(config)#do wr
Building configuration...
[OK]
```



```
ITSwitch>en
ITSwitch#conf t
Enter configuration commands, one per line. End with CNTL/Z.
ITSwitch(config)#int range fa0/1-21
ITSwitch(config-if-range)#switchport port-security
ITSwitch(config-if-range)#switchport port-security maximum 15
ITSwitch(config-if-range)#switchport port-security mac-address sticky
ITSwitch(config-if-range)#switchport port-security violation shutdown
ITSwitch(config-if-range)#exit
ITSwitch(config)#do wr
Building configuration...
[OK]
```



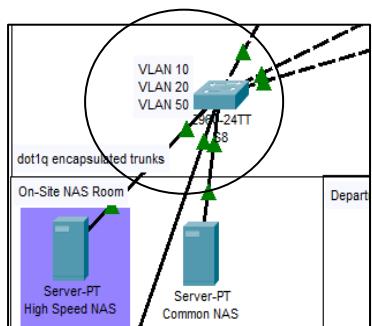
```
CSSwitch>en
CSSwitch#conf t
Enter configuration commands, one per line. End with CNTL/Z.
CSSwitch(config)#int range fa0/1-21
CSSwitch(config-if-range)#switchport port-security
CSSwitch(config-if-range)#switchport port-security maximum 20
CSSwitch(config-if-range)#switchport port-security mac-address sticky
CSSwitch(config-if-range)#switchport port-security violation shutdown
CSSwitch(config-if-range)#exit
CSSwitch(config)#do wr
Building configuration...
[OK]
```



```

MKSwitch>en
MKSwitch#conf t
Enter configuration commands, one per line. End with CNTL/Z.
MKSwitch(config)#int range fa0/1-21
MKSwitch(config-if-range)#switchport port-security
MKSwitch(config-if-range)#switchport port-security maximum 15
MKSwitch(config-if-range)#switchport port-security mac-address sticky
MKSwitch(config-if-range)#switchport port-security violation shutdown
MKSwitch(config-if-range)#exit
MKSwitch(config)#do wr
Building configuration...
[OK]
MKSwitch(config)#

```

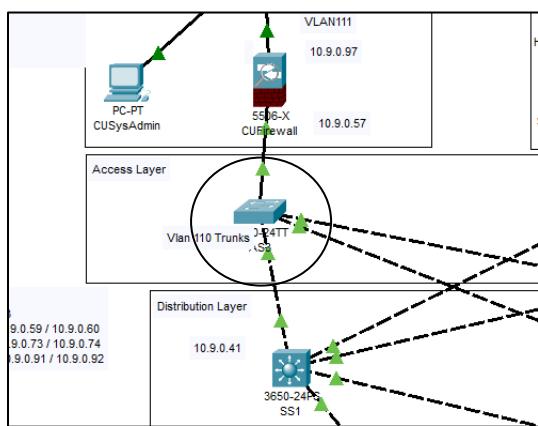


```

NASSwitch>en
NASSwitch#conf t
Enter configuration commands, one per line. End with CNTL/Z.
NASSwitch(config)#int range fa0/1-21
NASSwitch(config-if-range)#switchport port-security
NASSwitch(config-if-range)#switchport port-security maximum 4
NASSwitch(config-if-range)#switchport port-security mac-address sticky
NASSwitch(config-if-range)#switchport port-security violation shutdown
NASSwitch(config-if-range)#exit
NASSwitch(config)#do wr
Building configuration...
[OK]
NASSwitch(config)#

```

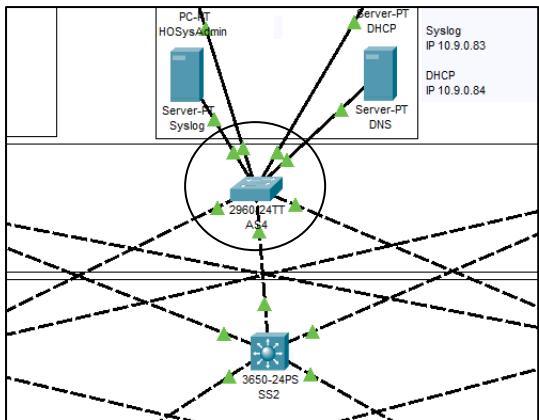
Off-Site



```

CUSwitch>en
CUSwitch#conf t
Enter configuration commands, one per line. End with CNTL/Z.
CUSwitch(config)#int range fa0/4-24, gig0/1-2
CUSwitch(config-if-range)#switchport port-security
CUSwitch(config-if-range)#switchport port-security maximum 3
CUSwitch(config-if-range)#switchport port-security mac-address sticky
CUSwitch(config-if-range)#switchport port-security violation shutdown
CUSwitch(config-if-range)#exit
CUSwitch(config)#do wr
Building configuration...
[OK]

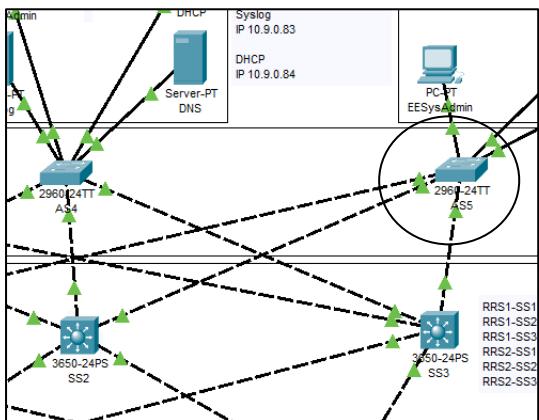
```



```

HOSwitch>en
HOSwitch#conf t
Enter configuration commands, one per line. End with CNTL/Z.
HOSwitch(config)#int range fa0/4-24, gig0/1-2
HOSwitch(config-if-range)#switchport port-security
HOSwitch(config-if-range)#switchport port-security maximum 4
HOSwitch(config-if-range)#switchport port-security mac-address sticky
HOSwitch(config-if-range)#switchport port-security violation shutdown
HOSwitch(config-if-range)#exit
HOSwitch(config)#do wr
Building configuration...
[OK]

```



```

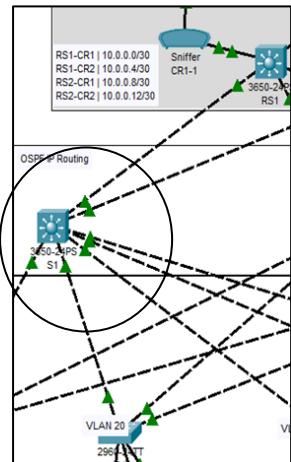
EESwitch>en
EESwitch#conf t
Enter configuration commands, one per line. End with CNTL/Z.
EESwitch(config)#int range fa0/4-24, gig0/1-2
EESwitch(config-if-range)#switchport port-security
EESwitch(config-if-range)#switchport port-security maximum 3
EESwitch(config-if-range)#switchport port-security mac-address sticky
EESwitch(config-if-range)#switchport port-security violation shutdown
EESwitch(config-if-range)#exit
EESwitch(config)#do wr
Building configuration...
[OK]

```

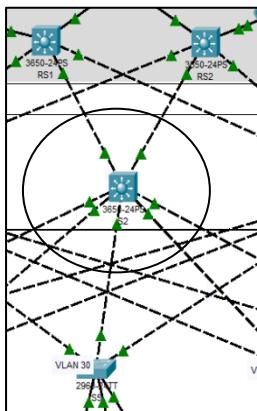
2.3.4 L3 VLAN Trunking Setup, VLAN 802.1q/dot1q encapsulation

Errors Made: VLANS were initially identified on all L3 switches, this was later removed using no vlan command.

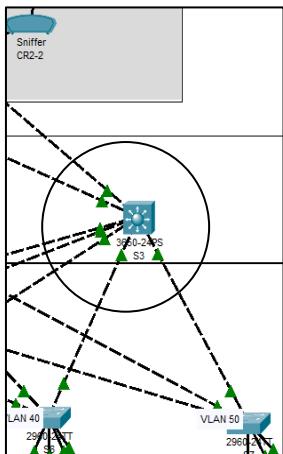
2.3.4.1 Head Office



```
L3SwitchDist1>en
L3SwitchDist1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchDist1(config)#int range gigl/0/20-24
L3SwitchDist1(config-if-range)#switchport trunk encapsulation dot1q
L3SwitchDist1(config-if-range)#switchport mode trunk
L3SwitchDist1(config-if-range)#exit
L3SwitchDist1(config)#vlan 10
L3SwitchDist1(config-vlan)#name NASNet
L3SwitchDist1(config-vlan)#vlan 20
L3SwitchDist1(config-vlan)#name HRNet
L3SwitchDist1(config-vlan)#vlan 30
L3SwitchDist1(config-vlan)#name ITNet
L3SwitchDist1(config-vlan)#vlan 40
L3SwitchDist1(config-vlan)#name CSNet
L3SwitchDist1(config-vlan)#vlan 50
L3SwitchDist1(config-vlan)#name MKNet
L3SwitchDist1(config-vlan)#exit
L3SwitchDist1(config)#do wr
```

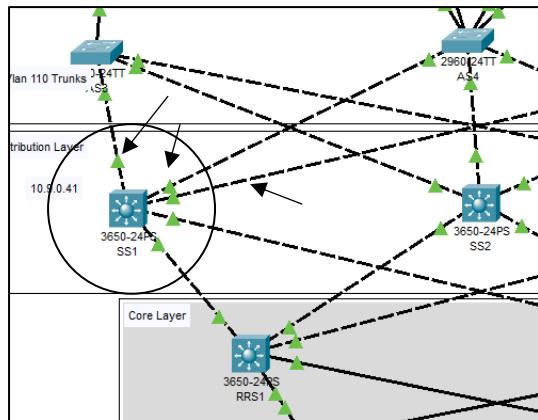


```
L3SwitchDist2>en
L3SwitchDist2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchDist2(config)#int range gigl/0/20-24
L3SwitchDist2(config-if-range)#switchport trunk encapsulation dot1q
L3SwitchDist2(config-if-range)#switchport mode trunk
L3SwitchDist2(config-if-range)#exit
L3SwitchDist2(config)#vlan 10
L3SwitchDist2(config-vlan)#name NASNet
L3SwitchDist2(config-vlan)#vlan 20
L3SwitchDist2(config-vlan)#name HRNet
L3SwitchDist2(config-vlan)#vlan 30
L3SwitchDist2(config-vlan)#name ITNet
L3SwitchDist2(config-vlan)#vlan 40
L3SwitchDist2(config-vlan)#name CSNet
L3SwitchDist2(config-vlan)#vlan 50
L3SwitchDist2(config-vlan)#name MKNet
L3SwitchDist2(config-vlan)#exit
L3SwitchDist2(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
```

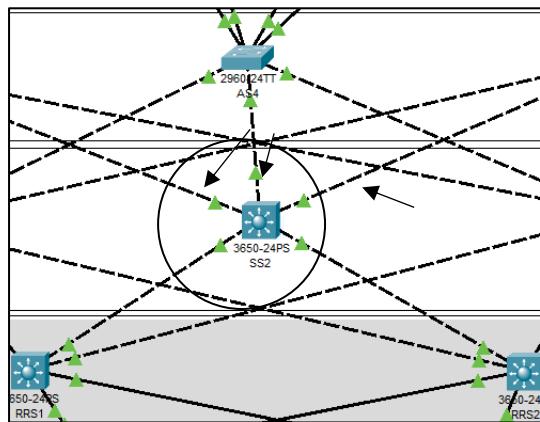


```
L3SwitchDist3>
L3SwitchDist3#en
L3SwitchDist3#conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchDist3(config)#int range gigl/0/20-24
L3SwitchDist3(config-if-range)#switchport trunk encapsulation dot1q
L3SwitchDist3(config-if-range)#switchport mode trunk
L3SwitchDist3(config-if-range)#exit
L3SwitchDist3(config)#vlan 10
L3SwitchDist3(config-vlan)#name NASNet
L3SwitchDist3(config-vlan)#vlan 20
L3SwitchDist3(config-vlan)#name HRNet
L3SwitchDist3(config-vlan)#vlan 30
L3SwitchDist3(config-vlan)#name ITNet
L3SwitchDist3(config-vlan)#vlan 40
L3SwitchDist3(config-vlan)#name CSNet
L3SwitchDist3(config-vlan)#vlan 50
L3SwitchDist3(config-vlan)#name MKNet
L3SwitchDist3(config-vlan)#exit
L3SwitchDist3(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
```

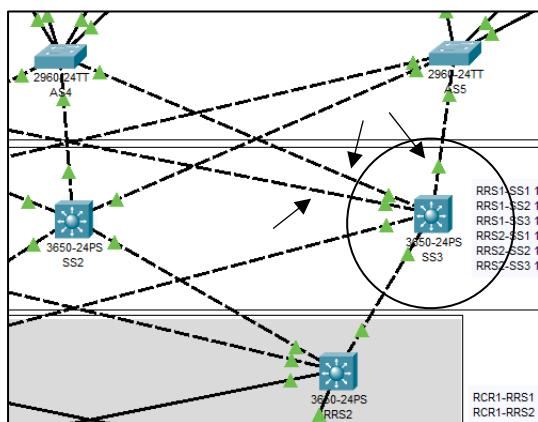
2.3.4.2 Off-Site



```
L3SwitchDistR1>en
L3SwitchDistR1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchDistR1(config)#int range gig1/0/3-5
L3SwitchDistR1(config-if-range)#switchport trunk encapsulation dot1q
L3SwitchDistR1(config-if-range)#switchport mode trunk
L3SwitchDistR1(config-if-range)#exit
L3SwitchDistR1(config)#vlan 10
L3SwitchDistR1(config-vlan)#name CUNet
L3SwitchDistR1(config-vlan)#vlan 20
L3SwitchDistR1(config-vlan)#name EENet
L3SwitchDistR1(config-vlan)#vlan 30
L3SwitchDistR1(config-vlan)#name HONet
L3SwitchDistR1(config-vlan)#exit
L3SwitchDistR1(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
```



```
L3SwitchDistR2>en
L3SwitchDistR2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchDistR2(config)#int range gig1/0/3-5
L3SwitchDistR2(config-if-range)#switchport trunk encapsulation dot1q
L3SwitchDistR2(config-if-range)#switchport mode trunk
L3SwitchDistR2(config-if-range)#exit
L3SwitchDistR2(config)#vlan 10
L3SwitchDistR2(config-vlan)#name CUNet
L3SwitchDistR2(config-vlan)#vlan 20
L3SwitchDistR2(config-vlan)#name EENet
L3SwitchDistR2(config-vlan)#vlan 30
L3SwitchDistR2(config-vlan)#name HONet
L3SwitchDistR2(config-vlan)#exit
L3SwitchDistR2(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
```

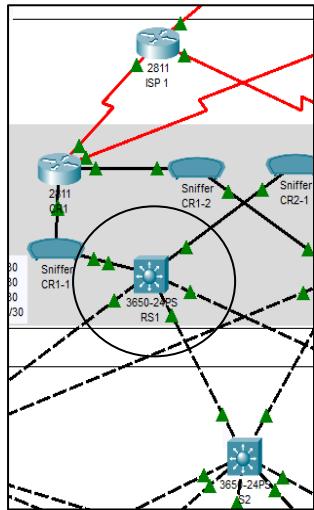


```
L3SwitchDistR3>en
L3SwitchDistR3#conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchDistR3(config)#int range gig1/0/3-5
L3SwitchDistR3(config-if-range)#switchport trunk encapsulation dot1q
L3SwitchDistR3(config-if-range)#switchport mode trunk
L3SwitchDistR3(config-if-range)#exit
L3SwitchDistR3(config)#vlan 10
L3SwitchDistR3(config-vlan)#name CUNet
L3SwitchDistR3(config-vlan)#vlan 20
L3SwitchDistR3(config-vlan)#name EENet
L3SwitchDistR3(config-vlan)#vlan 30
L3SwitchDistR3(config-vlan)#name HONet
L3SwitchDistR3(config-vlan)#exit
L3SwitchDistR3(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
```

2.3.5 L3/Router Interface/IP Routing Setup, Interface IP Allocation

Router to Router interfaces set to IP routing, Routing IP's allocated. All L3 Switches Have gig1/0/1-6 Reserved for routing.

2.3.5.1 Head Office

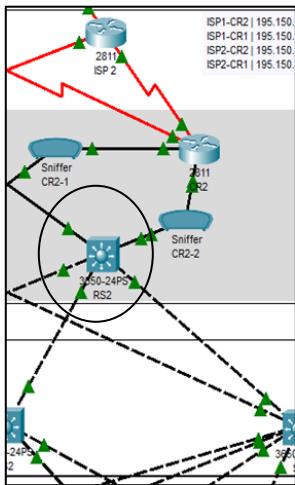


```
L3SwitchCore0>en
L3SwitchCore0#conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchCore0(config)#int range gig1/0/1-5
L3SwitchCore0(config-if-range)#no switchport
L3SwitchCore0(config-if-range)#do wr
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/1, changed state to down
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/2, changed state to down
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/2, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/3, changed state to down
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/3, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/4, changed state to down
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/4, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/5, changed state to down
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/5, changed state to up
```

```
L3SwitchCore0(config)#int gig1/0/6
L3SwitchCore0(config-if)#no switchport
L3SwitchCore0(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/6, changed state to down
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/6, changed state to up
do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
```

```
L3SwitchCore0>en
L3SwitchCore0#conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchCore0(config)#int gig1/0/2
L3SwitchCore0(config-if)#ip add 10.0.0.18 255.255.255.252
L3SwitchCore0(config-if)#no sh
L3SwitchCore0(config-if)#ex
L3SwitchCore0(config-if)#int gig1/0/1
L3SwitchCore0(config-if)#ip add 10.0.0.22 255.255.255.252
L3SwitchCore0(config-if)#no sh
L3SwitchCore0(config-if)#ex
L3SwitchCore0(config-if)#int gig1/0/3
L3SwitchCore0(config-if)#ip add 10.0.0.26 255.255.255.252
L3SwitchCore0(config-if)#no sh
L3SwitchCore0(config-if)#ex
L3SwitchCore0(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
L3SwitchCore0(config) #
```

```
L3SwitchCore0>en
L3SwitchCore0#conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchCore0(config)#int gig1/0/5
L3SwitchCore0(config-if)#ip add 10.0.0.5 255.255.255.252
L3SwitchCore0(config-if)#no sh
L3SwitchCore0(config-if)#ex
L3SwitchCore0(config-if)#int gig1/0/6
L3SwitchCore0(config-if)#ip add 10.0.0.6 255.255.255.252
L3SwitchCore0(config-if)#no sh
L3SwitchCore0(config-if)#ex
L3SwitchCore0(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
```



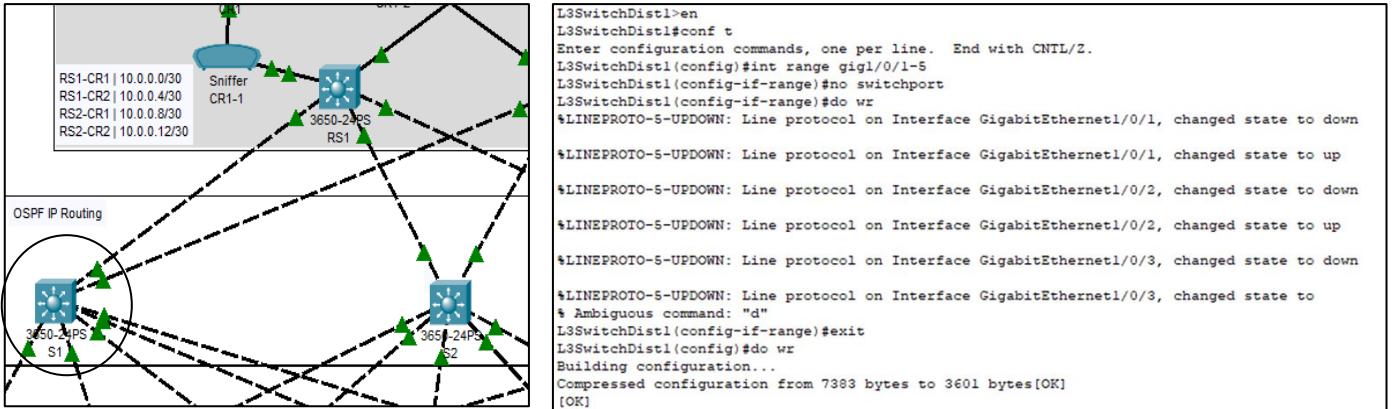
```
L3SwitchCore1>en
L3SwitchCore1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchCore1(config)#int range gig1/0/1-5
L3SwitchCore1(config-if-range)#no switchport
L3SwitchCore1(config-if-range)#do wr
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/1, changed state to down
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/2, changed state to down
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/2, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/3, changed state to down
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/3, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/4, changed state to down
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/4, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/5, changed state to down
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/5, changed state to up
```

```
L3SwitchCore1>en
L3SwitchCore1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchCore1(config)#int gig1/0/6
L3SwitchCore1(config-if)#no switchport
L3SwitchCore1(config-if)# 
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/6, changed state to down
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/6, changed state to up
do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
```

```
L3SwitchCore1>en
L3SwitchCore1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchCore1(config)#int gig1/0/5
L3SwitchCore1(config-if)#ip add 10.0.0.9 255.255.255.252
L3SwitchCore1(config-if)#no sh
L3SwitchCore1(config-if)#ex
L3SwitchCore1(config-if)#int gig1/0/6
L3SwitchCore1(config-if)#ip add 10.0.0.13 255.255.255.252
L3SwitchCore1(config-if)#no sh
L3SwitchCore1(config-if)#ex
L3SwitchCore1(config-if)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
```

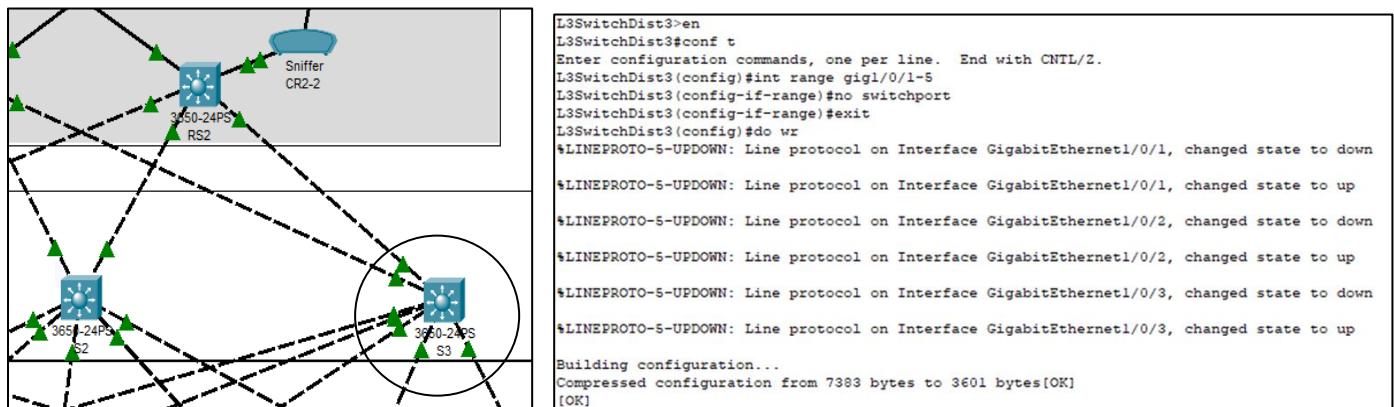


```
L3SwitchCore1>en
L3SwitchCore1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchCore1(config)#int gig1/0/3
L3SwitchCore1(config-if)#ip add 10.0.0.30 255.255.255.252
L3SwitchCore1(config-if)#no sh
L3SwitchCore1(config-if)#ex
L3SwitchCore1(config-if)#int gig1/0/2
L3SwitchCore1(config-if)#ip add 10.0.0.34 255.255.255.252
L3SwitchCore1(config-if)#no sh
L3SwitchCore1(config-if)#ex
L3SwitchCore1(config-if)#int gig1/0/1
L3SwitchCore1(config-if)#ip add 10.0.0.38 255.255.255.252
L3SwitchCore1(config-if)#no sh
L3SwitchCore1(config-if)#ex
L3SwitchCore1(config-if)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
```



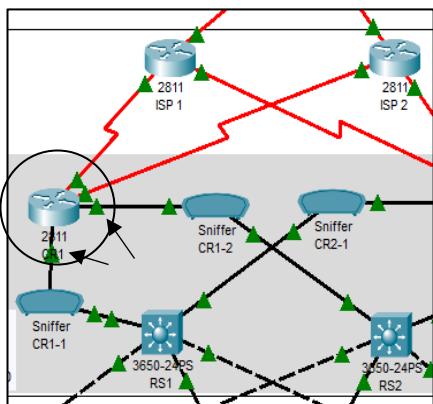
```
L3SwitchDist1#en
L3SwitchDist1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchDist1(config)#int range gig1/0/1-2
L3SwitchDist1(config-if-range)#no switchport
L3SwitchDist1(config-if-range)#exit
L3SwitchDist1(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
L3SwitchDist1(config)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/1, changed state to down
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/2, changed state to down
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/2, changed state to up
```

```
L3SwitchDist1>en
L3SwitchDist1>conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchDist1(config)#int gig1/0/1
L3SwitchDist1(config-if)#ip add 10.0.0.17 255.255.255.252
L3SwitchDist1(config-if)#no sh
L3SwitchDist1(config-if)#exit
L3SwitchDist1(config)#int gig1/0/2
L3SwitchDist1(config-if)#ip add 10.0.0.29 255.255.255.252
L3SwitchDist1(config-if)#no sh
L3SwitchDist1(config-if)#exit
L3SwitchDist1(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes [OK]
```



```
L3SwitchDist3>en
L3SwitchDist3#conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchDist3(config)#int range gig1/0/1-2
L3SwitchDist3(config-if-range)#no switchport
L3SwitchDist3(config-if-range)#exit
L3SwitchDist3(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
L3SwitchDist3(config)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/1, changed state to down
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/2, changed state to down
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/2, changed state to up
```

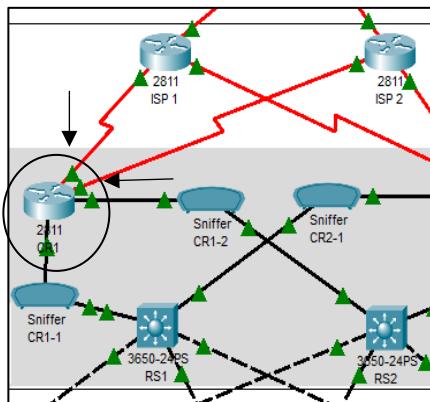
```
L3SwitchDist3>
L3SwitchDist3#en
L3SwitchDist3#conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchDist3(config)#int gig1/0/2
L3SwitchDist3(config-if)#ip add 10.0.0.25 255.255.255.252
L3SwitchDist3(config-if)#no sh
L3SwitchDist3(config-if)#ex
L3SwitchDist3(config)#int gig1/0/1
L3SwitchDist3(config-if)#ip add 10.0.0.37 255.255.255.252
L3SwitchDist3(config-if)#no sh
L3SwitchDist3(config-if)#ex
L3SwitchDist3(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
```



```

RouterCore1>en
RouterCore1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
RouterCore1(config)#int Fa0/0
RouterCore1(config-if)#ip add 10.0.0.2 255.255.255.252
RouterCore1(config-if)#no sh
RouterCore1(config-if)#ex
RouterCore1(config)#int Fa0/1
RouterCore1(config-if)#ip add 10.0.0.10 255.255.255.252
RouterCore1(config-if)#no sh
RouterCore1(config-if)#ex
RouterCore1(config)#do wr
Building configuration...
[OK]

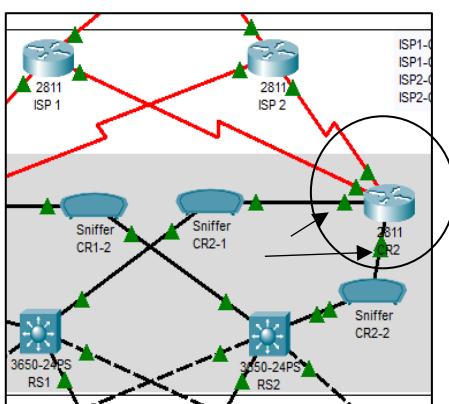
```



```

RouterCore1>en
RouterCore1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
RouterCore1(config)#int Se0/2/1
RouterCore1(config-if)#clock rate 64000
RouterCore1(config-if)#ip add 195.150.150.13 255.255.255.252
RouterCore1(config-if)#no sh
RouterCore1(config-if)#ex
RouterCore1(config)#int Se0/2/0
RouterCore1(config-if)#clock rate 64000
RouterCore1(config-if)#ip add 195.150.150.5 255.255.255.252
RouterCore1(config-if)#no sh
RouterCore1(config-if)#ex
RouterCore1(config)#

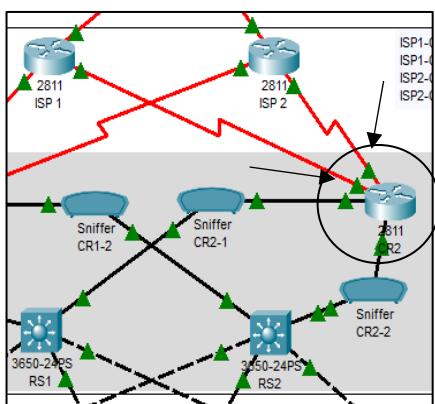
```



```

RouterCore2>en
RouterCore2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
RouterCore2(config)#int Fa0/0
RouterCore2(config-if)#ip add 10.0.0.14 255.255.255.252
RouterCore2(config-if)#no sh
RouterCore2(config-if)#ex
RouterCore2(config)#int Fa0/1
RouterCore2(config-if)#ip add 10.0.0.6 255.255.255.252
RouterCore2(config-if)#no sh
RouterCore2(config-if)#ex
RouterCore2(config)#do wr
Building configuration...
[OK]

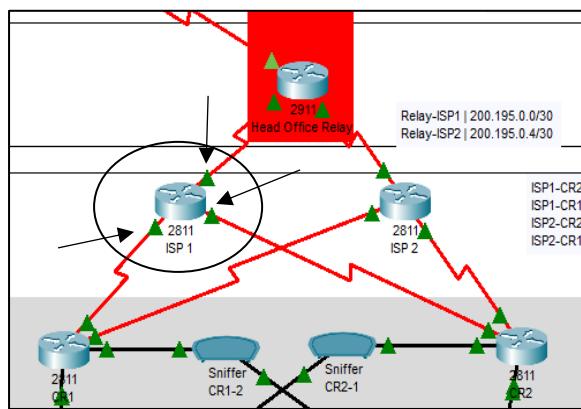
```



```

RouterCore2>en
RouterCore2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
RouterCore2(config)#int Se0/2/1
RouterCore2(config-if)#clock rate 64000
RouterCore2(config-if)#ip add 195.150.150.1 255.255.255.252
RouterCore2(config-if)#no sh
RouterCore2(config-if)#ex
RouterCore2(config)#int Se0/2/0
RouterCore2(config-if)#clock rate 64000
RouterCore2(config-if)#ip add 195.150.150.9 255.255.255.252
RouterCore2(config-if)#no sh
RouterCore2(config-if)#ex
RouterCore2(config)#do wr
Building configuration...
[OK]

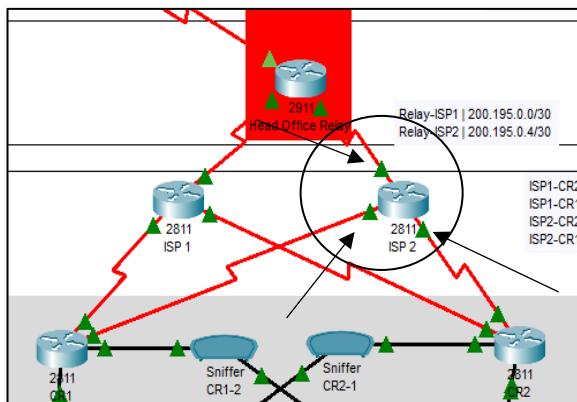
```



ISP 1	
	Config
GLOBAL	
Settings	
Algorithm Settings	
ROUTING	
Static	
RIP	
SWITCHING	
VLAN Database	
INTERFACE	
FastEthernet0/0	
FastEthernet0/1	
Serial0/0/0	
Serial0/0/1	Serial0/0/1
Serial0/2/0	
Serial0/2/1	

Serial0/2/1	
Port Status	
Duplex	Full Duplex
Clock Rate	64000
IP Configuration	
IPv4 Address	200.195.0.30
Subnet Mask	255.255.255.252
Tx Ring Limit	10

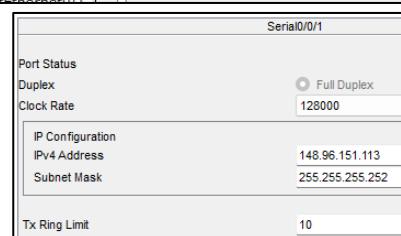
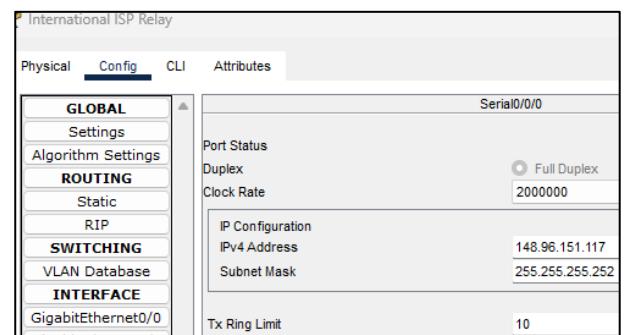
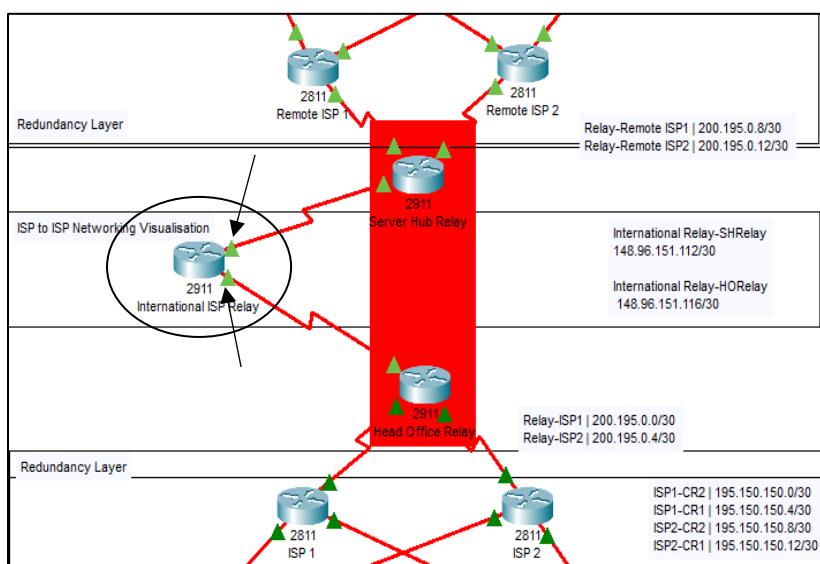
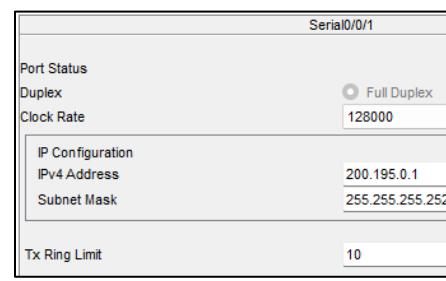
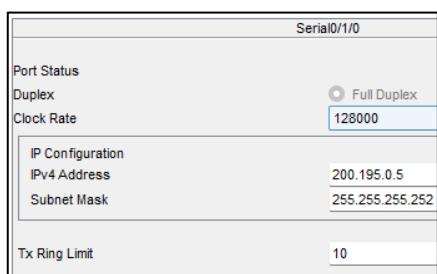
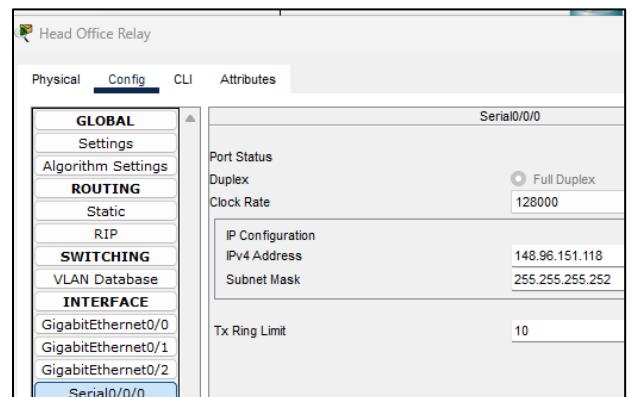
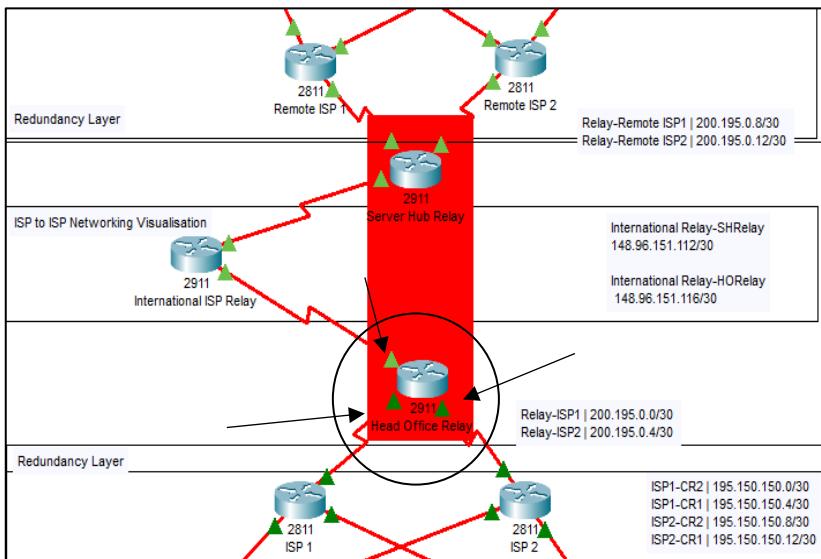
Serial0/2/0	
Port Status	
Duplex	Full Duplex
Clock Rate	64000
IP Configuration	
IPv4 Address	200.195.0.2
Subnet Mask	255.255.255.252
Tx Ring Limit	10



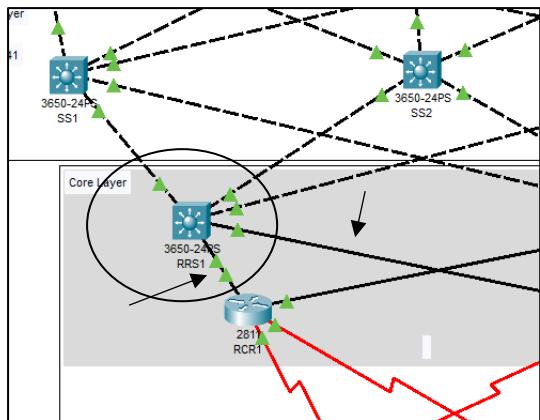
ISP 2	
	Config
GLOBAL	
Settings	
Algorithm Settings	
ROUTING	
Static	
RIP	
SWITCHING	
VLAN Database	
INTERFACE	
FastEthernet0/0	
FastEthernet0/1	
Serial0/0/0	Serial0/0/0
Serial0/0/1	
Serial0/2/0	
Serial0/2/1	Serial0/2/1

Serial0/2/0	
Port Status	
Duplex	Full Duplex
Clock Rate	2000000
IP Configuration	
IPv4 Address	195.150.150.2
Subnet Mask	255.255.255.252
Tx Ring Limit	10

Serial0/2/1	
Port Status	
Duplex	Full Duplex
Clock Rate	2000000
IP Configuration	
IPv4 Address	195.150.150.14
Subnet Mask	255.255.255.252
Tx Ring Limit	10



2.3.5.2 Off-Site



```
L3SwitchCoreR0>en
L3SwitchCoreR0#conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchCoreR0(config)#int range gig1/0/1-6
L3SwitchCoreR0(config-if-range)#no switchport
L3SwitchCoreR0(config-if-range)#exit
L3SwitchCoreR0(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
L3SwitchCoreR0(config)#
*L1PROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/1, changed state to down
*L1PROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/1, changed state to up
*L1PROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/2, changed state to down
*L1PROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/2, changed state to up
*L1PROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/3, changed state to down
*L1PROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/3, changed state to up
*L1PROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/5, changed state to down
*L1PROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/5, changed state to up
*L1PROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/6, changed state to down
*L1PROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/6, changed state to up
```

```
L3SwitchCoreR0>en
L3SwitchCoreR0#conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchCoreR0(config)#int gig1/0/5
L3SwitchCoreR0(config-if)#ip add 10.9.0.1 255.255.255.252
L3SwitchCoreR0(config-if)#no sh
L3SwitchCoreR0(config-if)#ex
L3SwitchCoreR0(config-if)#int gig1/0/6
L3SwitchCoreR0(config-if)#ip add 10.9.0.9 255.255.255.252
L3SwitchCoreR0(config-if)#no sh
L3SwitchCoreR0(config-if)#ex
L3SwitchCoreR0(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
```

Missing Evidence for the other two connections to distribution layer,

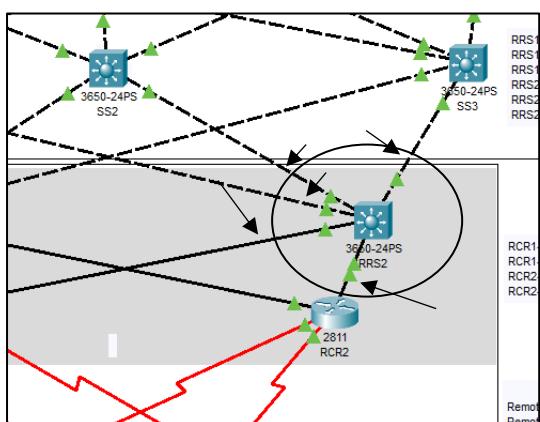
gig1/0/1 (RRS1-SS1)

10.9.0.18 255.255.255.252

gig1/0/2 (RRS1-SS2)

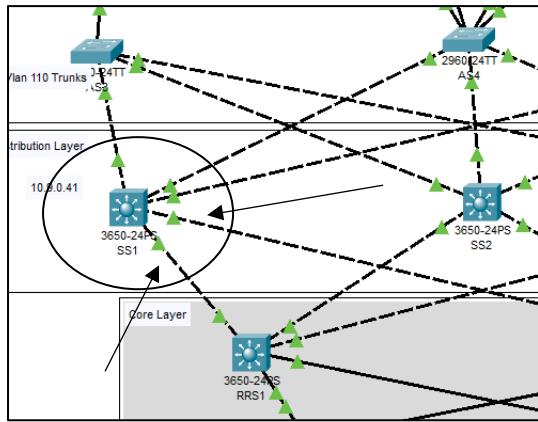
10.9.0.22 255.255.255.252

```
L3SwitchCoreR0(config)#int gig1/0/3
L3SwitchCoreR0(config-if)#ip add 10.9.0.26 255.255.255.252
L3SwitchCoreR0(config-if)#no sh
L3SwitchCoreR0(config-if)#ex
L3SwitchCoreR0(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
```



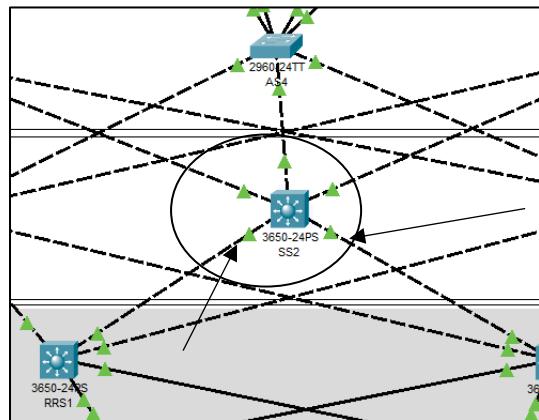
```
L3SwitchCoreR1>en
L3SwitchCoreR1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchCoreR1(config)#int range gig1/0/1-6
L3SwitchCoreR1(config-if-range)#no switchport
L3SwitchCoreR1(config-if-range)#exit
L3SwitchCoreR1(config)#do wr
*L1PROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/1, changed state to down
*L1PROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/1, changed state to up
*L1PROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/2, changed state to down
*L1PROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/2, changed state to up
*L1PROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/3, changed state to down
*L1PROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/3, changed state to up
*L1PROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/5, changed state to down
*L1PROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/5, changed state to up
*L1PROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/6, changed state to down
*L1PROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/6, changed state to up
```

```
L3SwitchCoreR1>en
L3SwitchCoreR1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchCoreR1(config)#int gig1/0/5
L3SwitchCoreR1(config-if)#ip add 10.9.0.5 255.255.255.252
L3SwitchCoreR1(config-if)#no sh
L3SwitchCoreR1(config-if)#ex
L3SwitchCoreR1(config)#int gig1/0/6
L3SwitchCoreR1(config-if)#ip add 10.9.0.13 255.255.255.252
L3SwitchCoreR1(config-if)#no sh
L3SwitchCoreR1(config-if)#ex
L3SwitchCoreR1(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
```



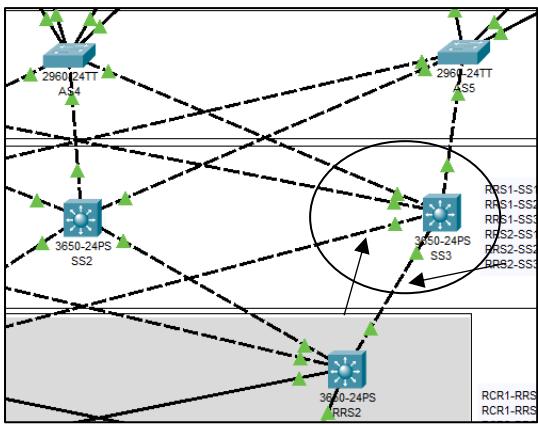
```
L3SwitchDistR1>en
L3SwitchDistR1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchDistR1(config)#int range gig1/0/1-2
L3SwitchDistR1(config-if-range)#no switchport
L3SwitchDistR1(config-if-range)#exit
L3SwitchDistR1(config)#do wr
*LINPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/1, changed state to down
*LINPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/1, changed state to up
*LINPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/2, changed state to down
*LINPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/2, changed state to up
```

```
L3SwitchDistR1>en
L3SwitchDistR1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchDistR1(config)#int gig1/0/1
L3SwitchDistR1(config-if)#ip add 10.9.0.17 255.255.255.252
L3SwitchDistR1(config-if)#no sh
L3SwitchDistR1(config-if)#ex
L3SwitchDistR1(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
L3SwitchDistR1(config)#
```



```
L3SwitchDistR2>en
L3SwitchDistR2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchDistR2(config)#int range gig1/0/1-2
L3SwitchDistR2(config-if-range)#no switchport
L3SwitchDistR2(config-if-range)#exit
L3SwitchDistR2(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
L3SwitchDistR2(config)#
*LINPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/1, changed state to down
*LINPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/1, changed state to up
*LINPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/2, changed state to down
*LINPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/2, changed state to up
```

```
L3SwitchDistR2>en
L3SwitchDistR2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchDistR2(config)#int gig1/0/1
L3SwitchDistR2(config-if)#ip add 10.9.0.21 255.255.255.252
L3SwitchDistR2(config-if)#no sh
L3SwitchDistR2(config-if)#ex
L3SwitchDistR2(config)#int gig1/0/2
L3SwitchDistR2(config-if)#ip add 10.9.0.33 255.255.255.252
L3SwitchDistR2(config-if)#no sh
L3SwitchDistR2(config-if)#ex
L3SwitchDistR2(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
```



```

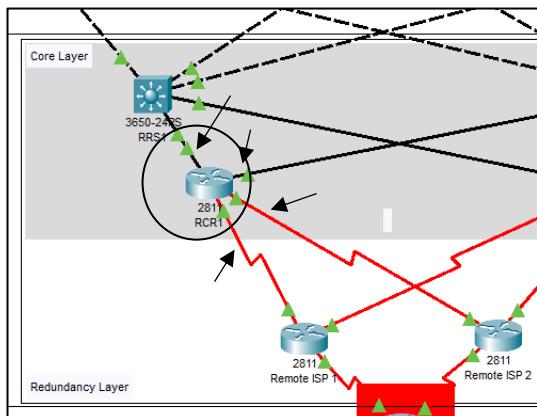
L3SwitchDistR3>en
L3SwitchDistR3#conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchDistR3(config)#int range gig1/0/1-2
L3SwitchDistR3(config-if-range)#no switchport
L3SwitchDistR3(config-if-range)#exit
L3SwitchDistR3(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
L3SwitchDistR3(config)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/1, changed state to down
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/2, changed state to down
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/2, changed state to up

```

```

L3SwitchDistR3>en
L3SwitchDistR3#conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchDistR3(config)#int gig1/0/1
L3SwitchDistR3(config-if)#ip add 10.9.0.25 255.255.255.252
L3SwitchDistR3(config-if)#no sh
L3SwitchDistR3(config-if)#ex
L3SwitchDistR3(config)#int gig1/0/2
L3SwitchDistR3(config-if)#ip add 10.9.0.37 255.255.255.252
L3SwitchDistR3(config-if)#no sh
L3SwitchDistR3(config-if)#ex
L3SwitchDistR3(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]

```



```

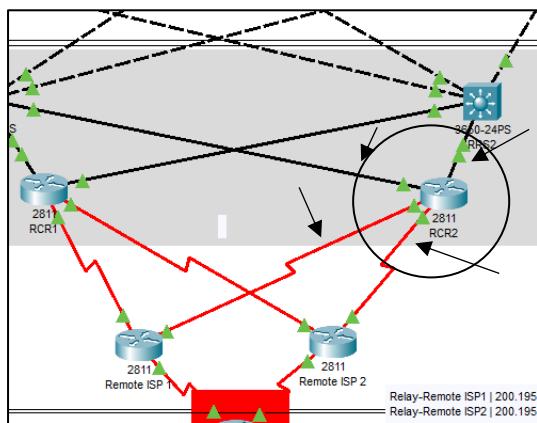
RouterCoreR1>en
RouterCoreR1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
RouterCoreR1(config)#int Fa0/0
RouterCoreR1(config-if)#ip add 10.9.0.2 255.255.255.252
RouterCoreR1(config-if)#no sh
RouterCoreR1(config-if)#ex
RouterCoreR1(config)#int Fa0/1
RouterCoreR1(config-if)#ip add 10.9.0.6 255.255.255.252
RouterCoreR1(config-if)#no sh
RouterCoreR1(config-if)#ex
RouterCoreR1(config)#do wr
Building configuration...
[OK]

```

```

RouterCoreR1>en
RouterCoreR1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
RouterCoreR1(config)#int Se0/2/1
RouterCoreR1(config-if)#clock rate 64000
RouterCoreR1(config-if)#ip add 125.120.0.9 255.255.255.252
RouterCoreR1(config-if)#no sh
RouterCoreR1(config-if)#ex
RouterCoreR1(config)#int Se0/2/0
RouterCoreR1(config-if)#clock rate 64000
RouterCoreR1(config-if)#ip add 125.120.0.1 255.255.255.252
RouterCoreR1(config-if)#no sh
RouterCoreR1(config-if)#ex
RouterCoreR1(config)#do wr
Building configuration...
[OK]
RouterCoreR1(config)#

```



```

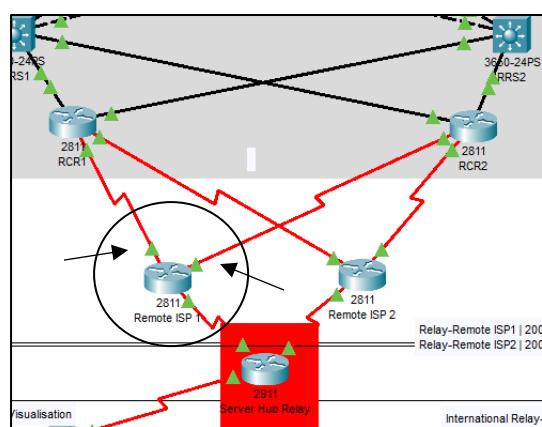
RouterCoreR2>en
RouterCoreR2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
RouterCoreR2(config)#int Fa0/0
RouterCoreR2(config-if)#ip add 10.9.0.14 255.255.255.252
RouterCoreR2(config-if)#no sh
RouterCoreR2(config-if)#ex
RouterCoreR2(config)#int Fa0/1
RouterCoreR2(config-if)#ip add 10.9.0.10 255.255.255.252
RouterCoreR2(config-if)#no sh
RouterCoreR2(config-if)#ex
RouterCoreR2(config)#do wr
Building configuration...
[OK]

```

```

RouterCoreR2>en
RouterCoreR2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
RouterCoreR2(config)#int Se0/2/1
RouterCoreR2(config-if)#clock rate 64000
RouterCoreR2(config-if)#ip add 125.120.0.5 255.255.255.252
RouterCoreR2(config-if)#no sh
RouterCoreR2(config-if)#ex
RouterCoreR2(config)#int Se0/2/0
RouterCoreR2(config-if)#clock rate 64000
RouterCoreR2(config-if)#ip add 125.120.0.13 255.255.255.252
RouterCoreR2(config-if)#no sh
RouterCoreR2(config-if)#ex
RouterCoreR2(config)#
RouterCoreR2(config)#do wr
Building configuration...
[OK]
RouterCoreR2(config)#

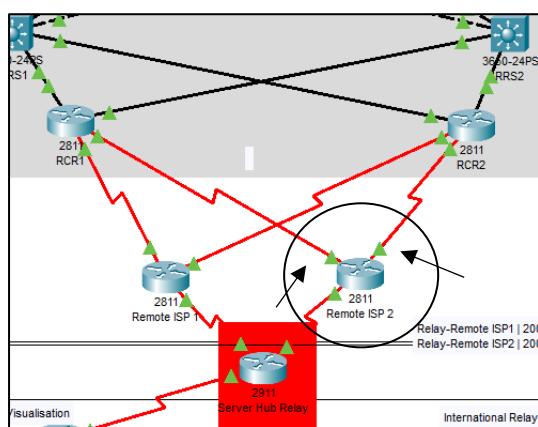
```



```

Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#hostname RemoteISP1
RemoteISP1(config)#int Se0/2/1
RemoteISP1(config-if)#clock rate 64000
This command applies only to DCE interfaces
RemoteISP1(config-if)#ip add 125.120.0.2 255.255.255.252
RemoteISP1(config-if)#no sh
RemoteISP1(config-if)#ex
RemoteISP1(config)#int Se0/2/0
RemoteISP1(config-if)#clock rate 64000
This command applies only to DCE interfaces
RemoteISP1(config-if)#ip add 125.120.0.6 255.255.255.252
RemoteISP1(config-if)#no sh
RemoteISP1(config-if)#ex
RemoteISP1(config)#do wr
Building configuration...
[OK]

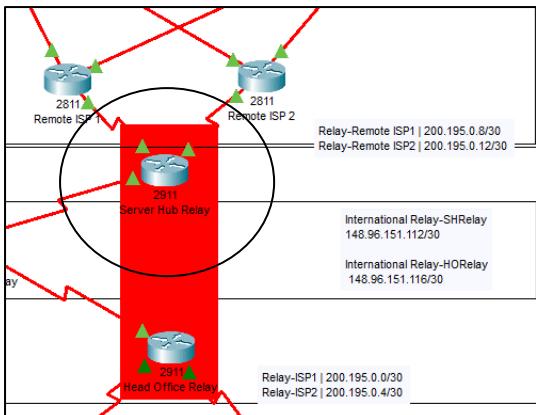
```



```

Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#hostname RemoteISP2
RemoteISP2(config)#en
% Ambiguous command: "en"
RemoteISP2(config)#conf t
%Invalid hex value
RemoteISP2(config)#int Se0/2/1
RemoteISP2(config-if)#ip add 125.120.0.10 255.255.255.252
RemoteISP2(config-if)#no sh
RemoteISP2(config-if)#ex
RemoteISP2(config)#int Se0/2/0
RemoteISP2(config-if)#ip add 125.120.0.14 255.255.255.252
RemoteISP2(config-if)#no sh
RemoteISP2(config-if)#ex

```



```
Device Name: Server Hub Relay
Device Model: 2911
Hostname: SHRelay
```

Port	Link	VLAN	IP Address
GigabitEthernet0/0	Down	--	<not set>
GigabitEthernet0/1	Down	--	<not set>
GigabitEthernet0/2	Down	--	<not set>
Serial0/0/0	Up	--	148.96.151.114/30
Serial0/0/1	Up	--	200.195.0.9/30
Serial0/1/0	Up	--	200.195.0.13/30
Serial0/1/1	Down	--	<not set>
Vlan1	Down	1	<not set>

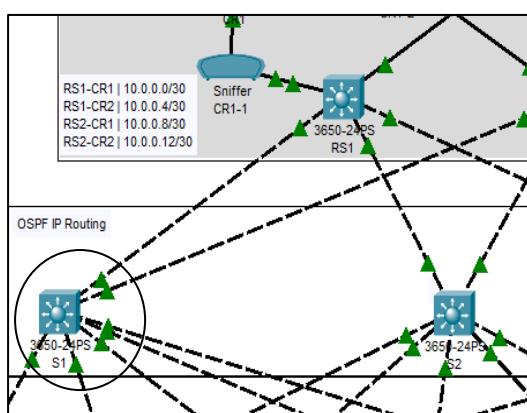
2.3.5.1 Distribution Layer to Access Layer, HSRP and VLAN interfacing, Inter-VLAN Routing

HSRP used to allocate routing priority. VLAN IP's assigned to SVIs for inter-VLAN routing.

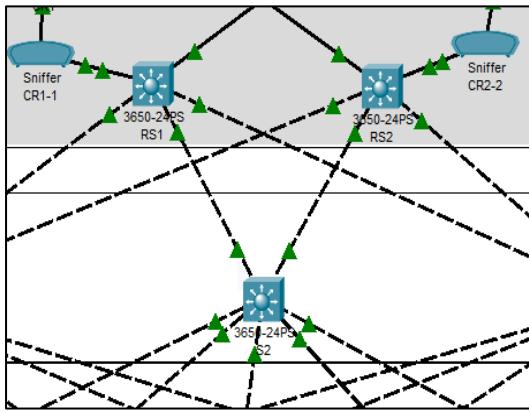
2.3.5.1.0 Head Office

HSRP Priorities			
	S1	S2	S3
Vlan 10	105	96	95
Vlan 20	103	102	98
Vlan 30	99	105	101
Vlan 40	98	103	104
Vlan 50	95	96	105

VLAN IPs			
	S1	S2	S3
Vlan 10	10.0.0.44	10.0.0.45	10.0.0.46
Vlan 20	10.0.0.252	10.0.0.253	10.0.0.254
Vlan 30	10.0.1.252	10.0.1.253	10.0.1.254
Vlan 40	10.0.15.252	10.0.15.253	10.0.15.254
Vlan 50	10.0.3.252	10.0.3.253	10.0.3.254



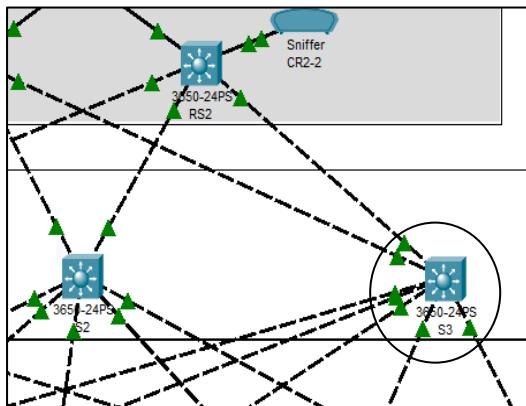
```
L3SwitchDist1>en
L3SwitchDist1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchDist1(config)#int vlan 10
L3SwitchDist1(config-if)#ip add 10.0.0.44 255.255.255.248
L3SwitchDist1(config-if)#standby 10 ip 10.0.0.40
L3SwitchDist1(config-if)#standby 10 priority 105
L3SwitchDist1(config-if)#standby 10 preempt
L3SwitchDist1(config-if)#no shut
L3SwitchDist1(config-if)#int vlan 20
L3SwitchDist1(config-if)#ip address 10.0.0.252 255.255.255.128
L3SwitchDist1(config-if)#standby 20 ip 10.0.0.128
L3SwitchDist1(config-if)#standby 20 priority 103
L3SwitchDist1(config-if)#standby 20 preempt
L3SwitchDist1(config-if)#no shut
L3SwitchDist1(config-if)#int vlan 30
L3SwitchDist1(config-if)#ip add 10.0.1.252 255.255.255.0
L3SwitchDist1(config-if)#standby 30 ip 10.0.1.0
L3SwitchDist1(config-if)#standby 30 priority 99
L3SwitchDist1(config-if)#standby 30 preempt
L3SwitchDist1(config-if)#no shut
L3SwitchDist1(config-if)#int vlan 40
L3SwitchDist1(config-if)#ip address 10.0.15.252 255.255.248.0
L3SwitchDist1(config-if)#standby 40 ip 10.0.8.0
L3SwitchDist1(config-if)#standby 40 priority 98
L3SwitchDist1(config-if)#standby 40 preempt
L3SwitchDist1(config-if)#no shut
L3SwitchDist1(config-if)#int vlan 50
L3SwitchDist1(config-if)#ip add 10.0.3.252 255.255.254.0
L3SwitchDist1(config-if)#standby 50 ip 10.0.2.0
L3SwitchDist1(config-if)#standby 50 priority 95
L3SwitchDist1(config-if)#standby 50 preempt
L3SwitchDist1(config-if)#no shut
01:37:04: *OSPF-5-ADJCHG: Process 10, Nbr 3.3.3.3 on Vlan10 from
01:37:04: *OSPF-5-ADJCHG: Process 10, Nbr 3.3.3.3 on Vlan20 from
01:37:04: *OSPF-5-ADJCHG: Process 10, Nbr 3.3.3.3 on Vlan30 from
01:37:04: *OSPF-5-ADJCHG: Process 10, Nbr 3.3.3.3 on Vlan40 from
01:37:04: *OSPF-5-ADJCHG: Process 10, Nbr 3.3.3.3 on Vlan50 from
01:37:14: *OSPF-5-ADJCHG: Process 10, Nbr 5.5.5.5 on Vlan20 from
01:37:14: *OSPF-5-ADJCHG: Process 10, Nbr 5.5.5.5 on Vlan30 from
01:37:14: *OSPF-5-ADJCHG: Process 10, Nbr 5.5.5.5 on Vlan40 from
01:37:14: *OSPF-5-ADJCHG: Process 10, Nbr 4.4.4.4 on Vlan50 from
```



```

L3SwitchDist2(config-if)#ip add 10.0.0.45 255.255.255.248
L3SwitchDist2(config-if)#standby 10 ip 10.0.0.40
L3SwitchDist2(config-if)#standby 10 priority 96
L3SwitchDist2(config-if)#standby 10 preempt
L3SwitchDist2(config-if)#no shut
L3SwitchDist2(config-if)#int vlan 20
L3SwitchDist2(config-if)#ip address 10.0.0.253 255.255.255.128
L3SwitchDist2(config-if)#standby 20 ip 10.0.0.128
L3SwitchDist2(config-if)#standby 20 priority 102
L3SwitchDist2(config-if)#standby 20 preempt
L3SwitchDist2(config-if)#no shut
L3SwitchDist2(config-if)#int vlan 30
L3SwitchDist2(config-if)#ip add 10.0.1.253 255.255.255.0
L3SwitchDist2(config-if)#standby 30 ip 10.0.1.0
L3SwitchDist2(config-if)#standby 30 priority 105
L3SwitchDist2(config-if)#standby 30 preempt
L3SwitchDist2(config-if)#no shut
L3SwitchDist2(config-if)#int vlan 40
L3SwitchDist2(config-if)#ip address 10.0.15.253 255.255.248.0
L3SwitchDist2(config-if)#standby 40 ip 10.0.8.0
L3SwitchDist2(config-if)#standby 40 priority 103
L3SwitchDist2(config-if)#standby 40 preempt
L3SwitchDist2(config-if)#no shut
L3SwitchDist2(config-if)#int vlan 50
L3SwitchDist2(config-if)#ip add 10.0.3.253 255.255.254.0
L3SwitchDist2(config-if)#standby 50 ip 10.0.2.0
L3SwitchDist2(config-if)#standby 50 priority 96
L3SwitchDist2(config-if)#standby 50 preempt
L3SwitchDist2(config-if)#no shut
01:42:04: %OSPF-5-ADJCHG: Process 10, Nbr 4.4.4.4 on Vlan10 from EXSTART
01:42:04: %OSPF-5-ADJCHG: Process 10, Nbr 3.3.3.3 on Vlan10 from INIT to
01:42:04: %OSPF-5-ADJCHG: Process 10, Nbr 5.5.5.5 on Vlan20 from EXSTART
01:42:04: %OSPF-5-ADJCHG: Process 10, Nbr 3.3.3.3 on Vlan20 from FULL to
01:42:04: %OSPF-5-ADJCHG: Process 10, Nbr 4.4.4.4 on Vlan30 from EXSTART
01:42:04: %OSPF-5-ADJCHG: Process 10, Nbr 3.3.3.3 on Vlan30 from FULL to
01:42:04: %OSPF-5-ADJCHG: Process 10, Nbr 4.4.4.4 on Vlan40 from EXSTART
01:42:04: %OSPF-5-ADJCHG: Process 10, Nbr 3.3.3.3 on Vlan40 from FULL to
01:42:04: %OSPF-5-ADJCHG: Process 10, Nbr 4.4.4.4 on Vlan50 from EXSTART
01:42:04: %OSPF-5-ADJCHG: Process 10, Nbr 3.3.3.3 on Vlan50 from FULL to
%HSRP-6-STATECHANGE: Vlan40 Grp 40 state Standby -> Active
01:42:06: %OSPF-5-ADJCHG: Process 10, Nbr 3.3.3.3 on Vlan10 from LOADING
%HSRP-6-STATECHANGE: Vlan30 Grp 30 state Standby -> Active
%HSRP-6-STATECHANGE: Vlan50 Grp 50 state Standby -> Active

```



```

01:45:37: %OSPF-5-ADJCHG: Process 10, Nbr 4.4.4.4 on Vlan20 from
01:45:47: %OSPF-5-ADJCHG: Process 10, Nbr 2.2.2.2 on GigabitEther
L3SwitchDist3>en
L3SwitchDist3#conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchDist3(config)#int vlan 10
L3SwitchDist3(config-if)#ip add 10.0.0.46 255.255.255.248
L3SwitchDist3(config-if)#standby 10 ip 10.0.0.40
L3SwitchDist3(config-if)#standby 10 priority 95
L3SwitchDist3(config-if)#standby 10 preempt
L3SwitchDist3(config-if)#no shut
L3SwitchDist3(config-if)#int vlan 20
L3SwitchDist3(config-if)#ip address 10.0.0.254 255.255.255.128
L3SwitchDist3(config-if)#standby 20 ip 10.0.0.128
L3SwitchDist3(config-if)#standby 20 priority 98
L3SwitchDist3(config-if)#standby 20 preempt
L3SwitchDist3(config-if)#no shut
L3SwitchDist3(config-if)#int vlan 30
L3SwitchDist3(config-if)#ip add 10.0.1.254 255.255.255.0
L3SwitchDist3(config-if)#standby 30 ip 10.0.1.0
L3SwitchDist3(config-if)#standby 30 priority 101
L3SwitchDist3(config-if)#standby 30 preempt
L3SwitchDist3(config-if)#no shut
L3SwitchDist3(config-if)#int vlan 40
L3SwitchDist3(config-if)#ip address 10.0.15.254 255.255.248.0
L3SwitchDist3(config-if)#standby 40 ip 10.0.8.0
L3SwitchDist3(config-if)#standby 40 priority 104
L3SwitchDist3(config-if)#standby 40 preempt
L3SwitchDist3(config-if)#no shut
L3SwitchDist3(config-if)#int vlan 50
L3SwitchDist3(config-if)#ip add 10.0.3.254 255.255.254.0
L3SwitchDist3(config-if)#standby 50 ip 10.0.2.0
L3SwitchDist3(config-if)#standby 50 priority 105
L3SwitchDist3(config-if)#standby 50 preempt
L3SwitchDist3(config-if)#no shut
01:45:50: %OSPF-5-ADJCHG: Process 10, Nbr 4.4.4.4 on Vlan10 from
01:45:50: %OSPF-5-ADJCHG: Process 10, Nbr 3.3.3.3 on Vlan10 from
01:45:50: %OSPF-5-ADJCHG: Process 10, Nbr 4.4.4.4 on Vlan20 from
01:45:50: %OSPF-5-ADJCHG: Process 10, Nbr 3.3.3.3 on Vlan30 from
01:45:50: %OSPF-5-ADJCHG: Process 10, Nbr 4.4.4.4 on Vlan30 from

```

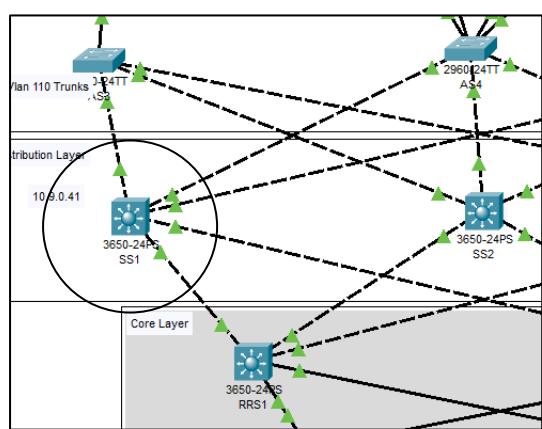
2.3.5.1.1 Off-Site

HSRP Priorities

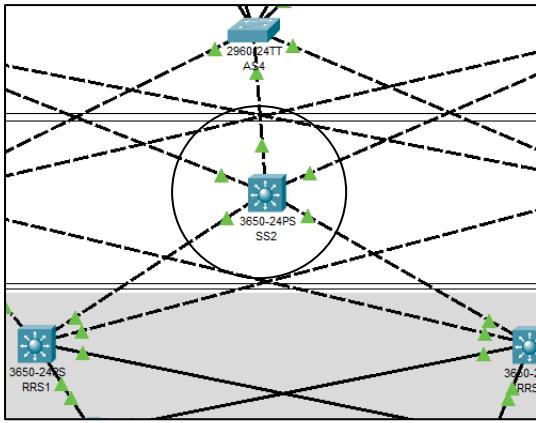
	SS1	SS2	SS3
Vlan 110	105	96	95
Vlan 130	103	102	98
Vlan 120	99	105	101

VLAN IPs

	SS1	SS2	SS3
Vlan 110	10.9.0.58	10.9.0.59	10.9.0.60
Vlan 120	10.9.0.74	10.9.0.75	10.9.0.76
Vlan 130	10.9.0.90	10.9.0.91	10.9.0.92

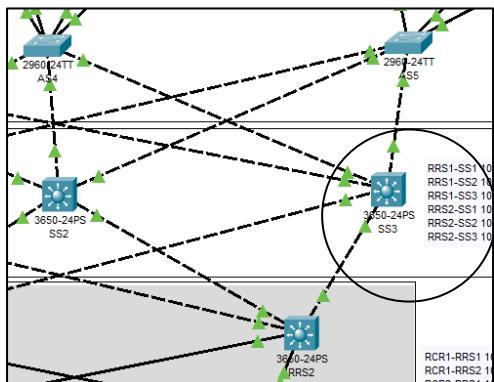


```
L3SwitchDistR1>en
L3SwitchDistR1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchDistR1(config)#int vlan 110
L3SwitchDistR1(config-if)#ip add 10.9.0.58 255.255.255.240
L3SwitchDistR1(config-if)#standby 110 ip 10.9.0.48
L3SwitchDistR1(config-if)#standby 110 priority 105
L3SwitchDistR1(config-if)#standby 110 preempt
L3SwitchDistR1(config-if)#no shut
L3SwitchDistR1(config-if)#int vlan 120
L3SwitchDistR1(config-if)#ip address 10.9.0.74 255.255.255.240
L3SwitchDistR1(config-if)#standby 120 ip 10.9.0.64
L3SwitchDistR1(config-if)#standby 120 priority 103
L3SwitchDistR1(config-if)#standby 120 preempt
L3SwitchDistR1(config-if)#no shut
L3SwitchDistR1(config-if)#int vlan 130
L3SwitchDistR1(config-if)#ip add 10.9.0.90 255.255.255.240
L3SwitchDistR1(config-if)#standby 130 ip 10.9.0.80
L3SwitchDistR1(config-if)#standby 130 priority 99
L3SwitchDistR1(config-if)#standby 130 preempt
L3SwitchDistR1(config-if)#no shut
L3SwitchDistR1(config-if)#ex
L3SwitchDistR1(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
L3SwitchDistR1(config)#
%HSRP-6-STATECHANGE: Vlan120 Grp 120 state Speak -> Standby
%HSRP-6-STATECHANGE: Vlan120 Grp 120 state Standby -> Active
%HSRP-6-STATECHANGE: Vlan130 Grp 130 state Speak -> Standby
%HSRP-6-STATECHANGE: Vlan130 Grp 130 state Standby -> Active
%HSRP-6-STATECHANGE: Vlan110 Grp 110 state Speak -> Standby
%HSRP-6-STATECHANGE: Vlan110 Grp 110 state Standby -> Active
```



```
L3SwitchDistR2>en
L3SwitchDistR2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchDistR2(config)#int vlan 110
L3SwitchDistR2(config-if)#ip add 10.9.0.59 255.255.255.240
L3SwitchDistR2(config-if)#standby 110 ip 10.9.0.48
L3SwitchDistR2(config-if)#standby 110 priority 96
L3SwitchDistR2(config-if)#standby 110 preempt
L3SwitchDistR2(config-if)#no shut
L3SwitchDistR2(config-if)#int vlan 120
L3SwitchDistR2(config-if)#ip address 10.9.0.75 255.255.255.240
L3SwitchDistR2(config-if)#standby 120 ip 10.9.0.64
L3SwitchDistR2(config-if)#standby 120 priority 102
L3SwitchDistR2(config-if)#standby 120 preempt
L3SwitchDistR2(config-if)#no shut
L3SwitchDistR2(config-if)#int vlan 130
L3SwitchDistR2(config-if)#ip add 10.9.0.91 255.255.255.240
L3SwitchDistR2(config-if)#standby 130 ip 10.9.0.80
L3SwitchDistR2(config-if)#standby 130 priority 105
L3SwitchDistR2(config-if)#standby 130 preempt
L3SwitchDistR2(config-if)#no shut
L3SwitchDistR2(config-if)#
 *HSRP-6-STATECHANGE: Vlan130 Grp 130 state Standby -> Active
ex
L3SwitchDistR2(config)#
L3SwitchDistR2(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
L3SwitchDistR2(config)#
%HSRP-6-STATECHANGE: Vlan120 Grp 120 state Speak -> Standby

%HSRP-6-STATECHANGE: Vlan110 Grp 110 state Speak -> Standby
```



```
L3SwitchDistR3>en
L3SwitchDistR3#conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchDistR3(config)#int vlan 110
L3SwitchDistR3(config-if)#ip add 10.9.0.60 255.255.255.240
L3SwitchDistR3(config-if)#standby 110 ip 10.9.0.48
L3SwitchDistR3(config-if)#standby 110 priority 95
L3SwitchDistR3(config-if)#standby 110 preempt
L3SwitchDistR3(config-if)#no shut
L3SwitchDistR3(config-if)#int vlan 120
L3SwitchDistR3(config-if)#ip address 10.9.0.76 255.255.255.240
L3SwitchDistR3(config-if)#standby 120 ip 10.9.0.64
L3SwitchDistR3(config-if)#standby 120 priority 98
L3SwitchDistR3(config-if)#standby 120 preempt
L3SwitchDistR3(config-if)#no shut
L3SwitchDistR3(config-if)#int vlan 130
L3SwitchDistR3(config-if)#ip add 10.9.0.92 255.255.255.240
L3SwitchDistR3(config-if)#standby 130 ip 10.9.0.80
L3SwitchDistR3(config-if)#standby 130 priority 101
L3SwitchDistR3(config-if)#standby 130 preempt
L3SwitchDistR3(config-if)#no shut
L3SwitchDistR3(config-if)#
L3SwitchDistR3(config-if)#ex
L3SwitchDistR3(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
L3SwitchDistR3(config)#

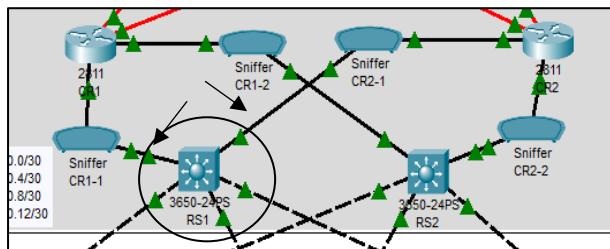
```

2.3.6 Dynamic Routing Protocol Configuration using OSPF

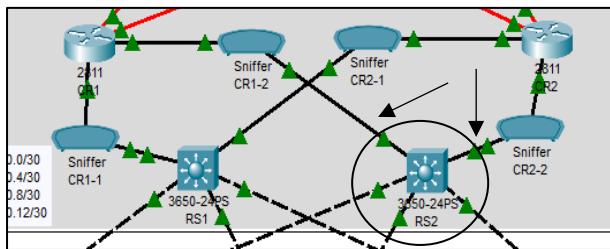
OSPF was chosen over RIPV2 due to mass industry adoption/preference. Networks to advertise declared. Router ID Assigned.

Errors: Initially irrelevant VLAN networks were declared, this was removed.

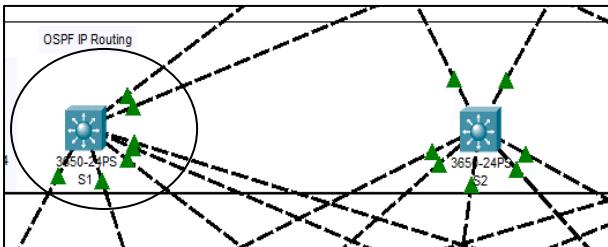
2.3.6.1 Head Office



```
L3SwitchCore0>En
L3SwitchCore0#Conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchCore0(config)#Ip routing
L3SwitchCore0(config)#router ospf 10
L3SwitchCore0(config-router)#router-id 1.1.1.1
L3SwitchCore0(config-router)#network 10.0.0.0 0.0.0.3 area 0
L3SwitchCore0(config-router)#network 10.0.0.4 0.0.0.3 area 0
L3SwitchCore0(config-router)#network 10.0.0.16 0.0.0.3 area 0
L3SwitchCore0(config-router)#network 10.0.0.20 0.0.0.3 area 0
L3SwitchCore0(config-router)#network 10.0.0.24 0.0.0.3 area 0
L3SwitchCore0(config-router)#ex
L3SwitchCore0(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
```



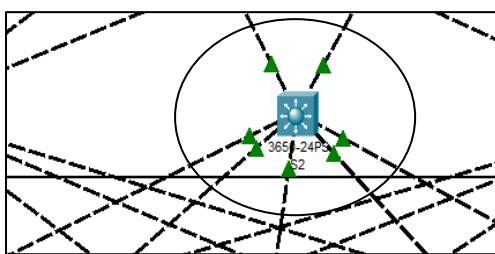
```
L3SwitchCore1>En
L3SwitchCore1#Conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchCore1(config)#ip routing
L3SwitchCore1(config)#router ospf 10
L3SwitchCore1(config-router)#router-id 2.2.2.2
L3SwitchCore1(config-router)#network 10.0.0.8 0.0.0.3 area 0
L3SwitchCore1(config-router)#network 10.0.0.12 0.0.0.3 area 0
L3SwitchCore1(config-router)#network 10.0.0.28 0.0.0.3 area 0
L3SwitchCore1(config-router)#network 10.0.0.32 0.0.0.3 area 0
L3SwitchCore1(config-router)#network 10.0.0.36 0.0.0.3 area 0
L3SwitchCore1(config-router)#ex
L3SwitchCore1(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
```



```
L3SwitchDist1>En
L3SwitchDist1#Conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchDist1(config)#ip routing
L3SwitchDist1(config)#router ospf 10
L3SwitchDist1(config-router)#router-id 3.3.3.3
L3SwitchDist1(config-router)#network 10.0.0.16 0.0.0.3 area 0
L3SwitchDist1(config-router)#network 10.0.0.28 0.0.0.3 area 0
L3SwitchDist1(config-router)#ex
L3SwitchDist1(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
L3SwitchDist1(config)#
01:51:45: %OSPF-5-ADJCHG: Process 10, Nbr 2.2.2.2 on
GigabitEthernet1/0/2 from LOADING to FULL, Loading Done

01:51:48: %OSPF-5-ADJCHG: Process 10, Nbr 1.1.1.1 on
GigabitEthernet1/0/1 from LOADING to FULL, Loading Done
```

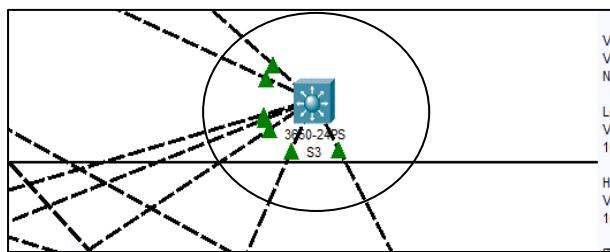
```
L3SwitchDist1>En
L3SwitchDist1#Conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchDist1(config)#Router ospf 10
L3SwitchDist1(config-router)#Network 10.0.0.40 0.0.0.7 area 0
L3SwitchDist1(config-router)#Network 10.0.0.128 0.0.0.127 area 0
L3SwitchDist1(config-router)#Network 10.0.1.0 0.0.0.255 area 0
L3SwitchDist1(config-router)#Network 10.0.8.0 0.0.7.255 area 0
L3SwitchDist1(config-router)#Network 10.0.2.0 0.0.1.255 area 0
L3SwitchDist1(config-router)#ex
L3SwitchDist1(config)#do wr
```



```
L3SwitchDist2>En
L3SwitchDist2#Conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchDist2(config)#ip routing
L3SwitchDist2(config)#router ospf 10
L3SwitchDist2(config-router)#router-id 4.4.4.4
L3SwitchDist2(config-router)#network 10.0.0.20 0.0.0.3 area 0
L3SwitchDist2(config-router)#network 10.0.0.32 0.0.0.3 area 0
L3SwitchDist2(config-router)#ex
L3SwitchDist2(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
L3SwitchDist2(config)#
01:53:25: %OSPF-5-ADJCHG: Process 10, Nbr 2.2.2.2 on GigabitEthernet1/0/2 from LOADING to FULL, Loading Done

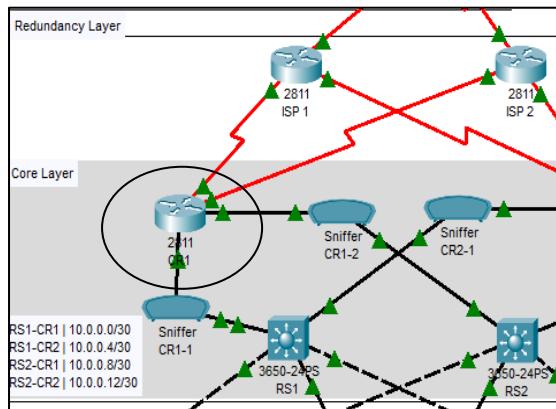
01:53:28: %OSPF-5-ADJCHG: Process 10, Nbr 1.1.1.1 on GigabitEthernet1/0/1 from LOADING to FULL, Loading Done
```

```
L3SwitchDist2>En
L3SwitchDist2#Conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchDist2(config)#Router ospf 10
L3SwitchDist2(config-router)#Network 10.0.0.40 0.0.0.7 area 0
L3SwitchDist2(config-router)#Network 10.0.0.128 0.0.0.127 area 0
L3SwitchDist2(config-router)#Network 10.0.1.0 0.0.0.255 area 0
L3SwitchDist2(config-router)#Network 10.0.8.0 0.0.7.255 area 0
L3SwitchDist2(config-router)#Network 10.0.2.0 0.0.1.255 area 0
L3SwitchDist2(config-router)#ex
L3SwitchDist2(config)#do wr
```

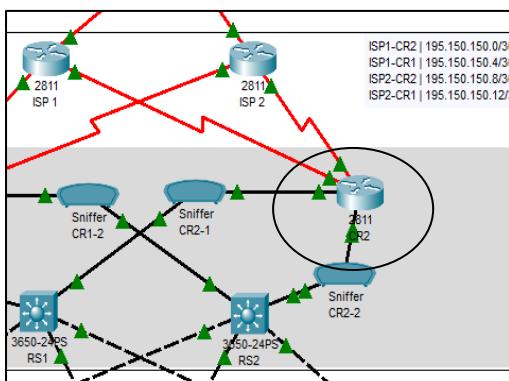


```
L3SwitchDist3>En
L3SwitchDist3#Conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchDist3(config)#Router ospf 10
L3SwitchDist3(config-router)#Network 10.0.0.40 0.0.0.7 area 0
L3SwitchDist3(config-router)#Network 10.0.0.128 0.0.0.127 area 0
L3SwitchDist3(config-router)#Network 10.0.1.0 0.0.0.255 area 0
L3SwitchDist3(config-router)#Network 10.0.8.0 0.0.7.255 area 0
L3SwitchDist3(config-router)#Network 10.0.2.0 0.0.1.255 area 0
L3SwitchDist3(config-router)#ex
L3SwitchDist3(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
```

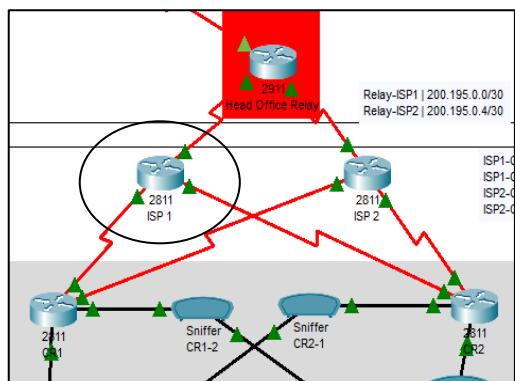
```
L3SwitchDist3>En
L3SwitchDist3#Conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchDist3(config)#ip routing
L3SwitchDist3(config)#router ospf 10
L3SwitchDist3(config-router)#router-id 5.5.5.5
L3SwitchDist3(config-router)#network 10.0.0.24 0.0.0.3 area 0
L3SwitchDist3(config-router)#network 10.0.0.36 0.0.0.3 area 0
L3SwitchDist3(config-router)#ex
L3SwitchDist3(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
L3SwitchDist3(config)#
01:54:33: %OSPF-5-ADJCHG: Process 10, Nbr 1.1.1.1 on
GigabitEthernet1/0/2 from LOADING to FULL, Loading Done
01:54:36: %OSPF-5-ADJCHG: Process 10, Nbr 2.2.2.2 on
GigabitEthernet1/0/1 from LOADING to FULL, Loading Done
```



```
RouterCore1>En
RouterCore1#Conf t
Enter configuration commands, one per line. End with CNTL/Z.
RouterCore1(config)#router ospf 10
RouterCore1(config-router)#router-id 6.6.6.6
RouterCore1(config-router)#network 10.0.0.8 0.0.0.3 area 0
RouterCore1(config-router)#network 10.0.0.0 0.0.0.3 area 0
RouterCore1(config-router)#network 10.0.0.0 0.0.0.3 area 0
RouterCore1(config-router)#network 195.150.150.4 0.0.0.3 area 0
RouterCore1(config-router)#network 195.150.150.12 0.0.0.3 area 0
RouterCore1(config-router)#
00:45:02: %OSPF-5-ADJCHG: Process 10, Nbr 1.1.1.1 on FastEthernet0/0 from LOADING to FULL, Loading Done
00:45:02: %OSPF-5-ADJCHG: Process 10, Nbr 2.2.2.2 on FastEthernet0/1 from LOADING to FULL, Loading Done
```



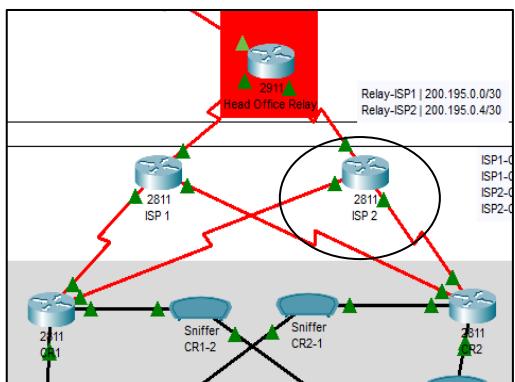
```
RouterCore2>En
RouterCore2#Conf t
Enter configuration commands, one per line. End with CNTL/Z.
RouterCore2(config)#router ospf 10
RouterCore2(config-router)#router-id 7.7.7.7
RouterCore2(config-router)#network 10.0.0.12 0.0.0.3 area 0
RouterCore2(config-router)#network 10.0.0.4 0.0.0.3 area 0
RouterCore2(config-router)#network 195.150.150.8 0.0.0.3 area 0
RouterCore2(config-router)#network 195.150.150.0 0.0.0.3 area 0
RouterCore2(config-router)#
00:53:22: %OSPF-5-ADJCHG: Process 10, Nbr 2.2.2.2 on FastEthernet0/0 from LOADING to FULL, Loading Done
```



```

Router>En
Router#Conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router ospf 10
Router(config-router)#router-id 8.8.8.8
Router(config-router)#network 195.150.150.4 0.0.0.3 area 0
Router(config-router)#network 195.150.150.0 0.0.0.3 area 0
Router(config-router)#
01:01:49: %OSPF-5-ADJCHG: Process 10, Nbr 6.6.6.6 on Serial0/2/0 from LOADING to FULL, Loading Done
01:01:53: %OSPF-5-ADJCHG: Process 10, Nbr 7.7.7.7 on Serial0/2/1 from LOADING to FULL, Loading Done

```

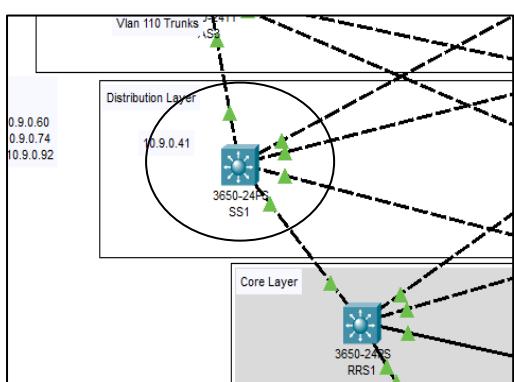


```

Router>En
Router#Conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router ospf 10
Router(config-router)#router-id 9.9.9.9
Router(config-router)#network 195.150.150.12 0.0.0.3 area 0
Router(config-router)#network 195.150.150.8 0.0.0.3 area 0
Router(config-router)#
01:06:32: %OSPF-5-ADJCHG: Process 10, Nbr 6.6.6.6 on Serial0/2/1 from LOADING to FULL, Loading Done
01:06:33: %OSPF-5-ADJCHG: Process 10, Nbr 7.7.7.7 on Serial0/2/0 from LOADING to FULL, Loading Done

```

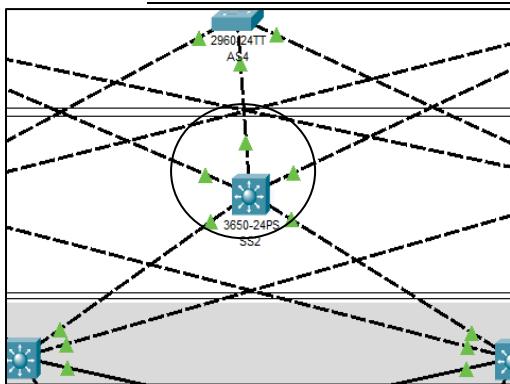
2.3.6.2 Off-Site



```

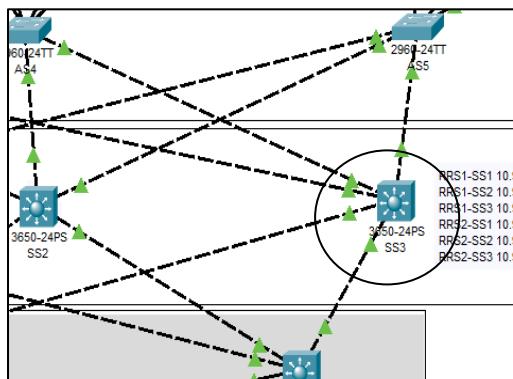
L3SwitchDistR1>en
L3SwitchDistR1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchDistR1(config)#ip routing
L3SwitchDistR1(config-router)#router ospf 10
L3SwitchDistR1(config-router)#router-id 17.17.17.17
L3SwitchDistR1(config-router)#network 10.9.0.16 0.0.0.3 area 0
L3SwitchDistR1(config-router)#network 10.9.0.28 0.0.0.3 area 0
L3SwitchDistR1(config-router)#ex
L3SwitchDistR1(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
L3SwitchDistR1>En
L3SwitchDistR1#Conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchDistR1(config)#Router ospf 10
L3SwitchDistR1(config-router)#Network 10.9.0.48 0.0.0.15 area 0
L3SwitchDistR1(config-router)#Network 10.9.0.64 0.0.0.15 area 0
L3SwitchDistR1(config-router)#Network 10.9.0.80 0.0.0.15 area 0
L3SwitchDistR1(config-router)#Ex
L3SwitchDistR1(config)#Ex
L3SwitchDistR1#Clear ip ospf process
Reset ALL OSPF processes? [no]: Y

```



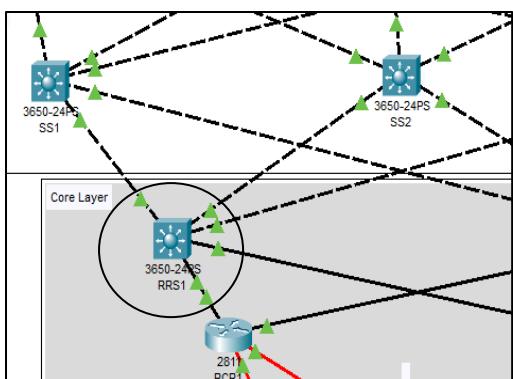
```
L3SwitchDistR2>en
L3SwitchDistR2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchDistR2(config)#ip routing
L3SwitchDistR2(config)#router ospf 10
L3SwitchDistR2(config-router)#router-id 18.18.18.18
L3SwitchDistR2(config-router)#network 10.9.0.20 0.0.0.3 area 0
L3SwitchDistR2(config-router)#network 10.9.0.32 0.0.0.3 area 0
L3SwitchDistR2(config-router)#ex
L3SwitchDistR2(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
```

```
L3SwitchDistR2#En
L3SwitchDistR2#Conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchDistR2(config)#Router ospf 10
L3SwitchDistR2(config-router)#Network 10.9.0.48 0.0.0.15 area 0
L3SwitchDistR2(config-router)#Network 10.9.0.64 0.0.0.15 area 0
L3SwitchDistR2(config-router)#Network 10.9.0.80 0.0.0.15 area 0
L3SwitchDistR2(config-router)#ex
L3SwitchDistR2(config)#clear ip ospf process
^
```

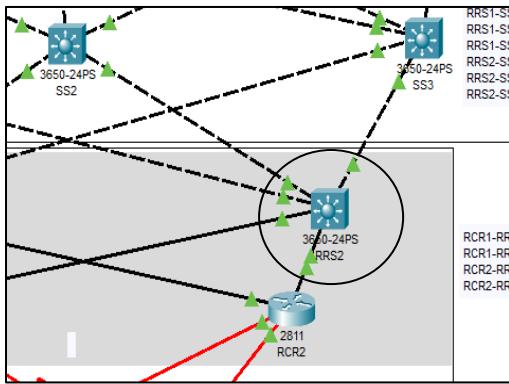


```
L3SwitchDistR3>en
L3SwitchDistR3#conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchDistR3(config)#ip routing
L3SwitchDistR3(config)#router ospf 10
L3SwitchDistR3(config-router)#router-id 19.19.19.19
L3SwitchDistR3(config-router)#network 10.9.0.24 0.0.0.3 area 0
L3SwitchDistR3(config-router)#network 10.9.0.36 0.0.0.3 area 0
L3SwitchDistR3(config-router)#ex
L3SwitchDistR3(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
```

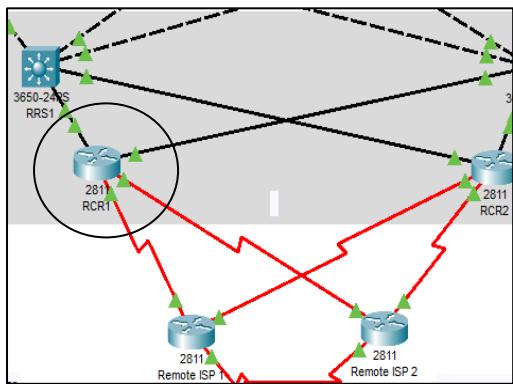
```
L3SwitchDistR3>En
L3SwitchDistR3#Conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchDistR3(config)#Router ospf 10
L3SwitchDistR3(config-router)#Network 10.9.0.48 0.0.0.15 area 0
L3SwitchDistR3(config-router)#Network 10.9.0.64 0.0.0.15 area 0
L3SwitchDistR3(config-router)#Network 10.9.0.80 0.0.0.15 area 0
L3SwitchDistR3(config-router)#Ex
L3SwitchDistR3(config)#ex
```



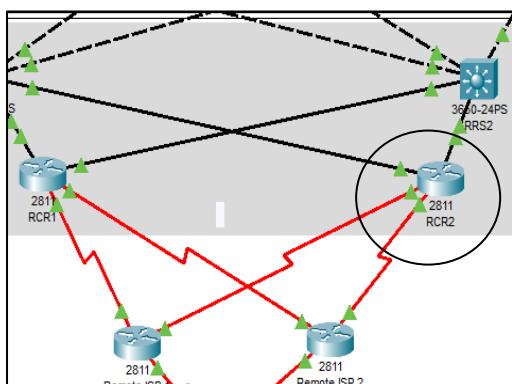
```
L3SwitchCoreR0>en
L3SwitchCoreR0#conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchCoreR0(config)#ip routing
L3SwitchCoreR0(config)#router ospf 10
L3SwitchCoreR0(config-router)#router-id 15.15.15.15
L3SwitchCoreR0(config-router)#network 10.9.0.16 0.0.0.3 area 0
L3SwitchCoreR0(config-router)#network 10.9.0.20 0.0.0.3 area 0
L3SwitchCoreR0(config-router)#network 10.9.0.24 0.0.0.3 area 0
L3SwitchCoreR0(config-router)#network 10.9.0.0 0.0.0.3 area 0
L3SwitchCoreR0(config-router)#network 10.9.0.8 0.0.0.3 area 0
L3SwitchCoreR0(config-router)#ex
L3SwitchCoreR0(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
```



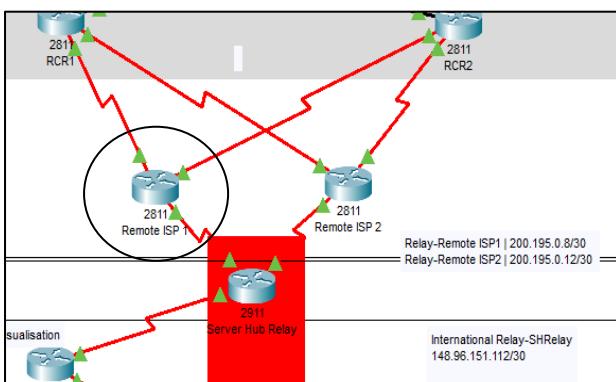
```
L3SwitchCoreR1>en
L3SwitchCoreR1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchCoreR1(config)#ip routing
L3SwitchCoreR1(config)#router ospf 10
L3SwitchCoreR1(config-router)#router-id 16.16.16.16
L3SwitchCoreR1(config-router)#network 10.9.0.28 0.0.0.3 area 0
L3SwitchCoreR1(config-router)#network 10.9.0.32 0.0.0.3 area 0
L3SwitchCoreR1(config-router)#network 10.9.0.36 0.0.0.3 area 0
L3SwitchCoreR1(config-router)#network 10.9.0.4 0.0.0.3 area 0
L3SwitchCoreR1(config-router)#network 10.9.0.12 0.0.0.3 area 0
L3SwitchCoreR1(config-router)#ex
L3SwitchCoreR1(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
```



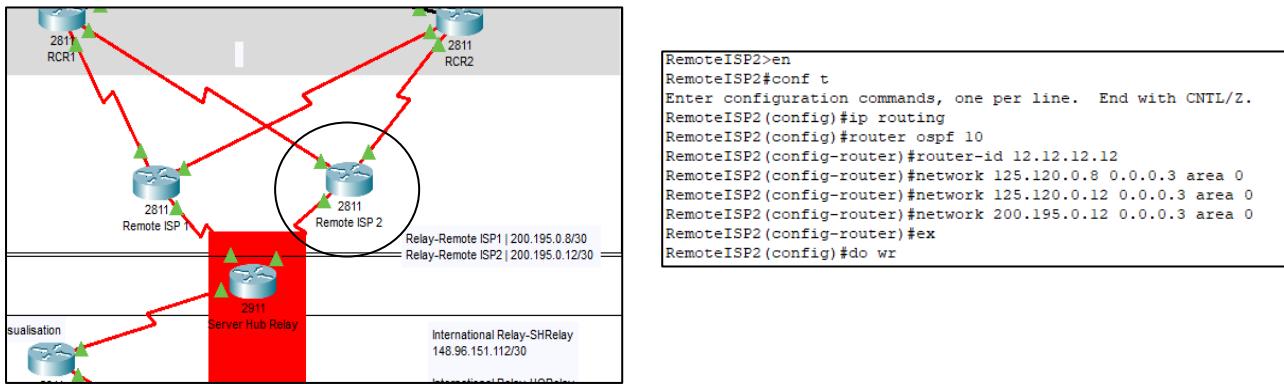
```
RouterCoreR1>en
RouterCoreR1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
RouterCoreR1(config)#ip routing
RouterCoreR1(config)#router ospf 10
RouterCoreR1(config-router)#router-id 13.13.13.13
RouterCoreR1(config-router)#network 10.9.0.0 0.0.0.3 area 0
RouterCoreR1(config-router)#network 10.9.0.4 0.0.0.3 area 0
RouterCoreR1(config-router)#network 125.120.0.0 0.0.0.3 area 0
RouterCoreR1(config-router)#network 125.120.0.8 0.0.0.3 area 0
RouterCoreR1(config-router)#ex
RouterCoreR1(config)#do wr
Building configuration...
[OK]
```



```
RouterCoreR2>en
RouterCoreR2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
RouterCoreR2(config)#ip routing
RouterCoreR2(config)#router ospf 10
RouterCoreR2(config-router)#router-id 14.14.14.14
RouterCoreR2(config-router)#network 10.9.0.8 0.0.0.3 area 0
RouterCoreR2(config-router)#network 10.9.0.12 0.0.0.3 area 0
RouterCoreR2(config-router)#network 125.120.0.4 0.0.0.3 area 0
RouterCoreR2(config-router)#network 125.120.0.12 0.0.0.3 area 0
RouterCoreR2(config-router)#ex
RouterCoreR2(config)#do wr
Building configuration...
[OK]
```

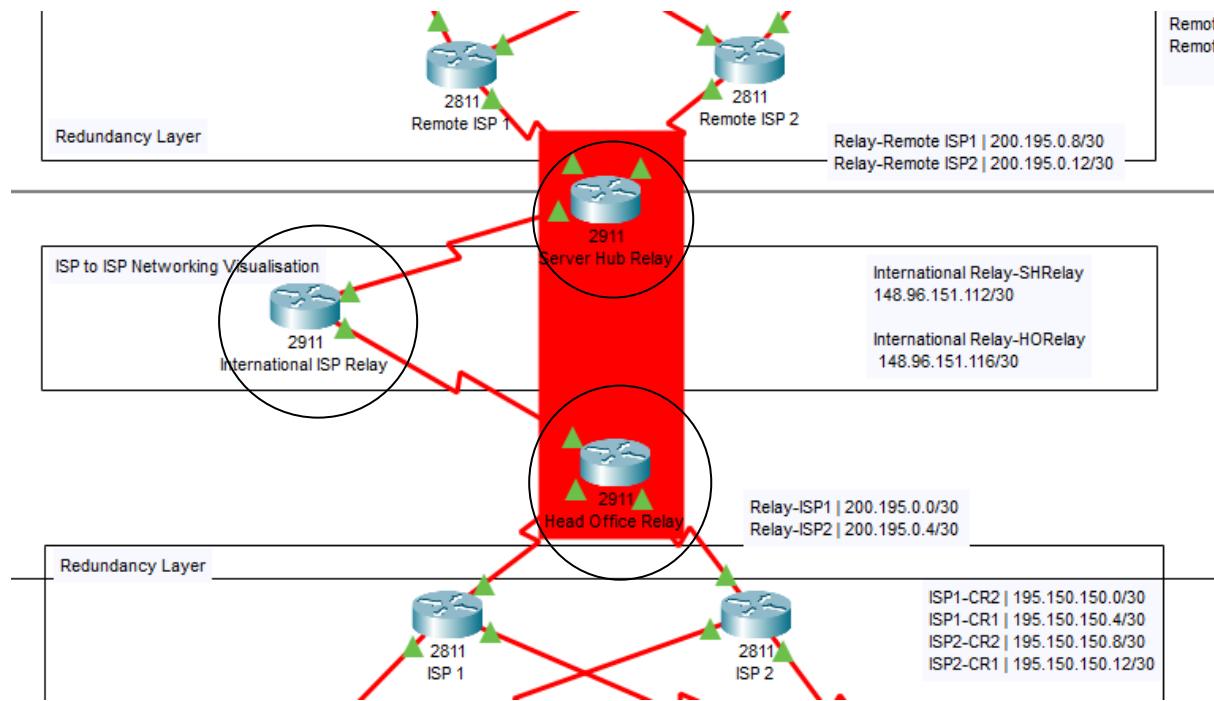


```
RemoteISPI>en
RemoteISPI#conf t
Enter configuration commands, one per line. End with CNTL/Z.
RemoteISPI(config)#ip routing
RemoteISPI(config)#router ospf 10
RemoteISPI(config-router)#router-id 11.11.11.11
RemoteISPI(config-router)#network 125.120.0.0 0.0.0.3 area 0
RemoteISPI(config-router)#network 125.120.0.4 0.0.0.3 area 0
RemoteISPI(config-router)#network 200.195.0.8 0.0.0.3 area 0
RemoteISPI(config-router)#ex
RemoteISPI(config)#do wr
Building configuration...
[OK]
```



2.3.6.3 Site to Site

Site to site connected via OSPF and EIGRP Routing protocol. EIGRP redistribution was needed due to IPsec VPN limitations with OSPF.



Head Office Relay

Physical Config **CLI** Attributes

IOS Command Line Interface

```
router eigrp 10
 redistribute ospf 10 metric 10000 1000 255 1 1500
 network 148.96.151.116 0.0.0.3
!
router ospf 10
 log-adjacency-changes
 redistribute rip subnets
 redistribute eigrp 10 subnets
 network 200.195.0.0 0.0.0.3 area 0
 network 200.195.0.4 0.0.0.3 area 0
 default-information originate
```

International ISP Relay

Physical Config **CLI** Attributes

IOS Command Line Interface

```
router eigrp 10
 network 148.96.151.112 0.0.0.3
 network 148.96.151.116 0.0.0.3
```

Server Hub Relay

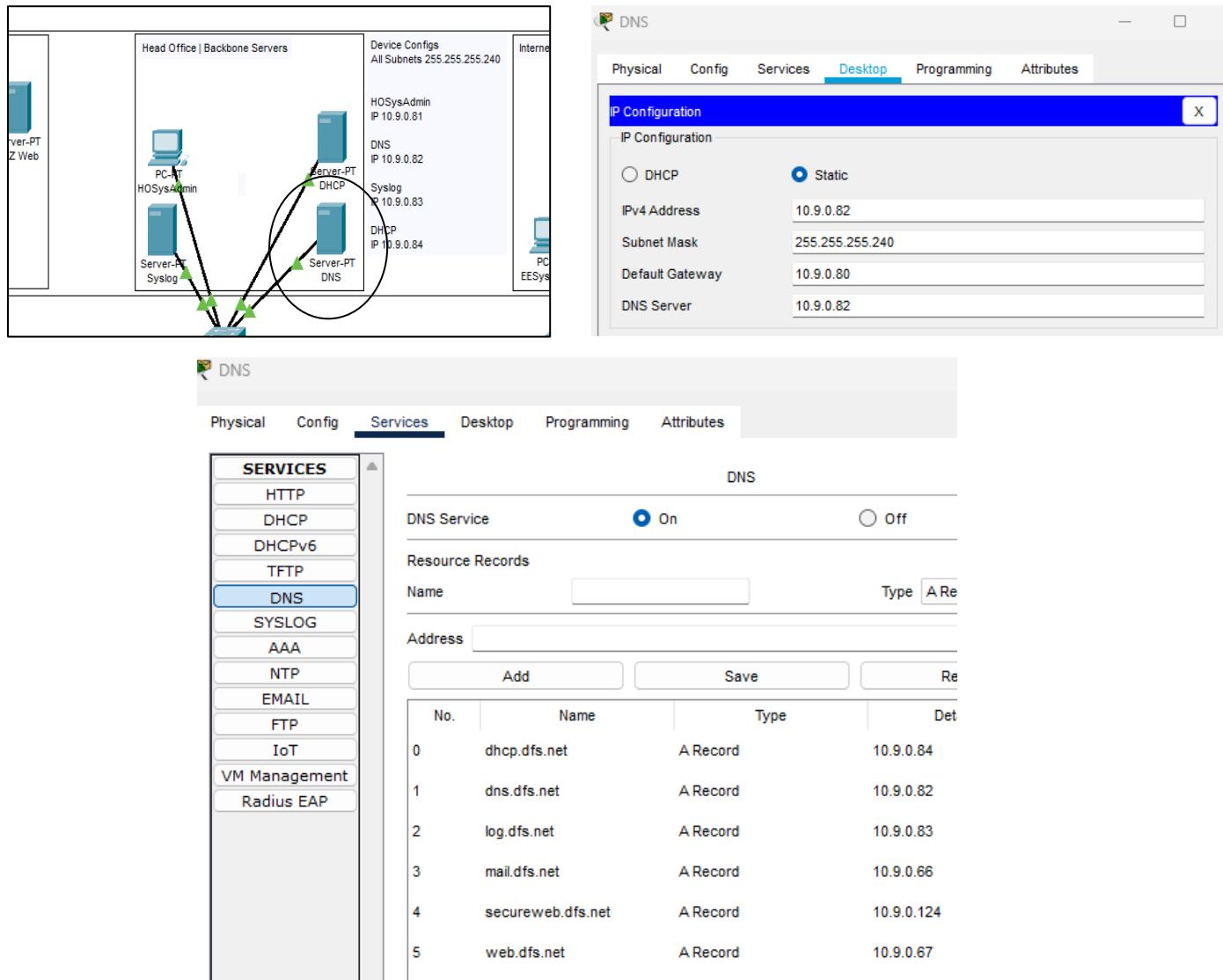
Physical Config **CLI** Attributes

IOS Command Line Interface

```
router eigrp 10
 redistribute ospf 10 metric 10000 1000 255 1 1500
 network 148.96.151.112 0.0.0.3
!
router ospf 10
 log-adjacency-changes
 redistribute rip subnets
 redistribute eigrp 10 subnets
 network 200.195.0.8 0.0.0.3 area 0
 network 200.195.0.12 0.0.0.3 area 0
 default-information originate
```

2.3.7 Server Setup and Application

2.3.7.1 DNS Server



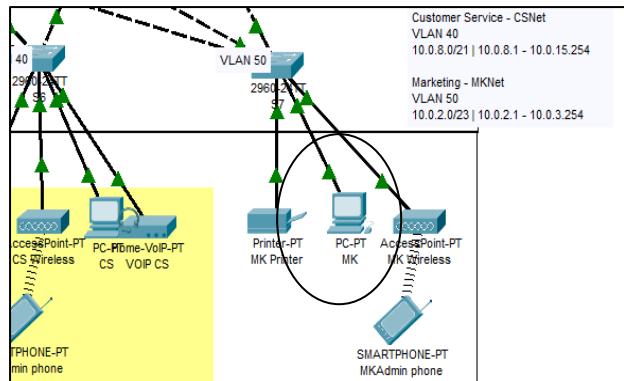
The image consists of two screenshots of a network management interface. The top screenshot shows a network topology for 'Head Office | Backbone Servers'. It includes a 'PC-RT' node, a 'HOSysAdmin' node, and a 'Server-PT' node. The 'Server-PT' node is connected to both the 'HOSysAdmin' and 'PC-RT' nodes. A callout box highlights the 'Server-PT' node, showing its IP address (10.9.0.82), port (DNS 10.9.0.82), and port (Syslog 10.9.0.83). The bottom screenshot shows the 'DNS' service configuration. The 'Services' tab is selected, and the 'DNS' service is set to 'On'. The 'Resource Records' table lists six entries:

No.	Name	Type	Det
0	dhcp.dfs.net	A Record	10.9.0.84
1	dns.dfs.net	A Record	10.9.0.82
2	log.dfs.net	A Record	10.9.0.83
3	mail.dfs.net	A Record	10.9.0.66
4	secureweb.dfs.net	A Record	10.9.0.124
5	web.dfs.net	A Record	10.9.0.67

2.3.7.2 Email Server

The left panel displays network configurations for subnets 255.255.255.240, including device and service configurations. The right panel shows the 'Email' service configuration window with tabs for Physical, Config, Services, Desktop, Programming, and Attributes. The 'Services' tab is selected, showing the SMTP Service (ON) and POP3 Service (ON). The 'Domain Name' is set to 'dfsmail.com'. The 'User Setup' section lists users: hadmin, itadmin, csadmin, mkadmin, and admin.

Device Setup



MK

Configure Mail

User Information

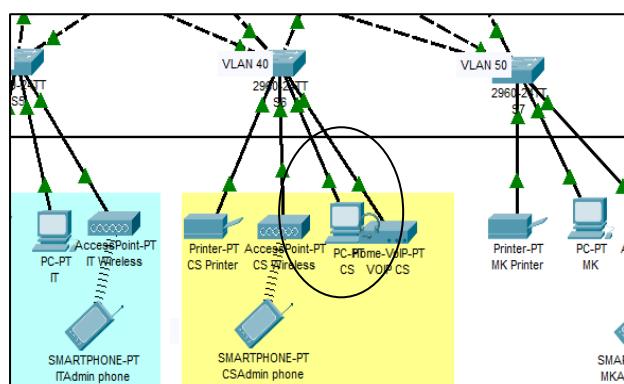
Your Name:	mkuser
Email Address:	mkadmin@dfsmail.com

Server Information

Incoming Mail Server:	mail.dfs.net
Outgoing Mail Server:	mail.dfs.net

Logon Information

User Name:	mkadmin
Password:	*****



CS

Configure Mail

User Information

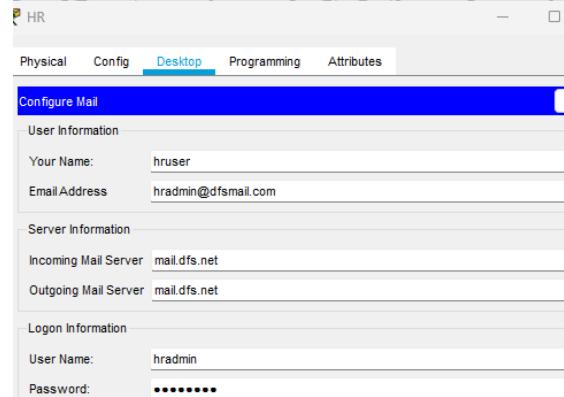
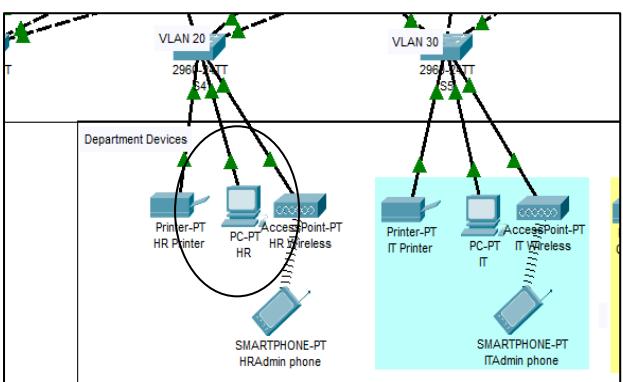
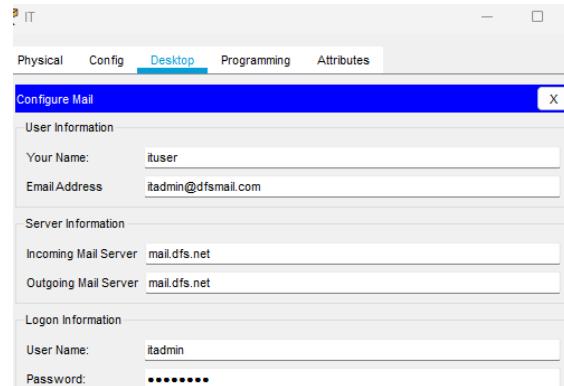
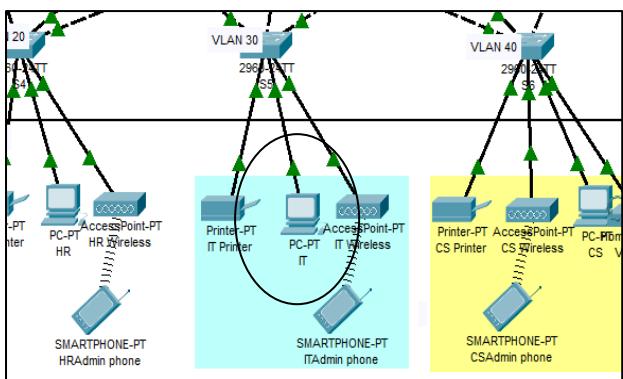
Your Name:	csuser
Email Address:	csadmin@dfsmail.com

Server Information

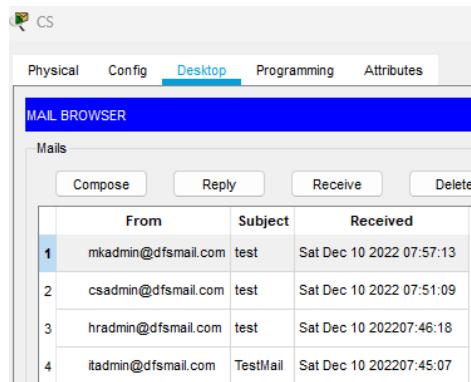
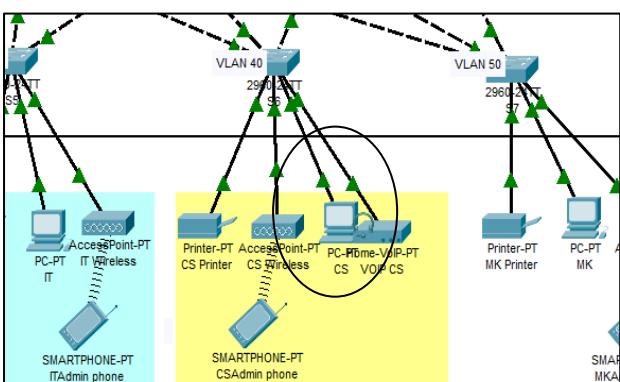
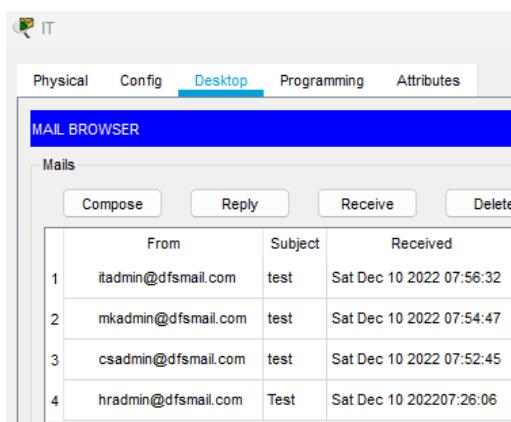
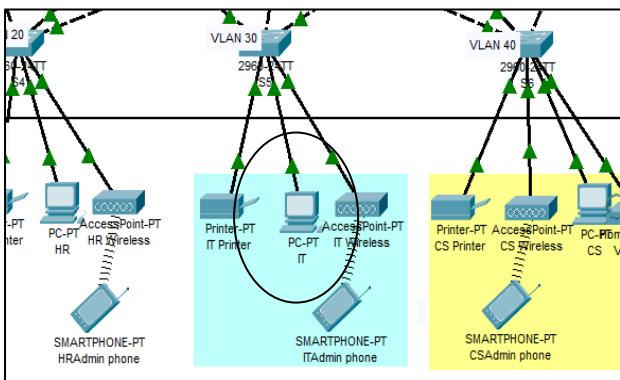
Incoming Mail Server:	mail.dfs.net
Outgoing Mail Server:	mail.dfs.net

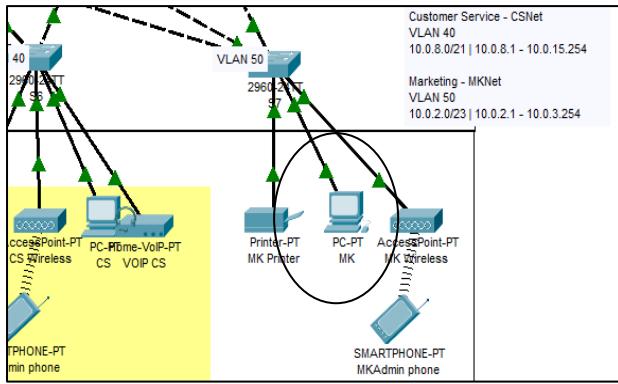
Logon Information

User Name:	csadmin
Password:	*****



Verifying Emailing Works





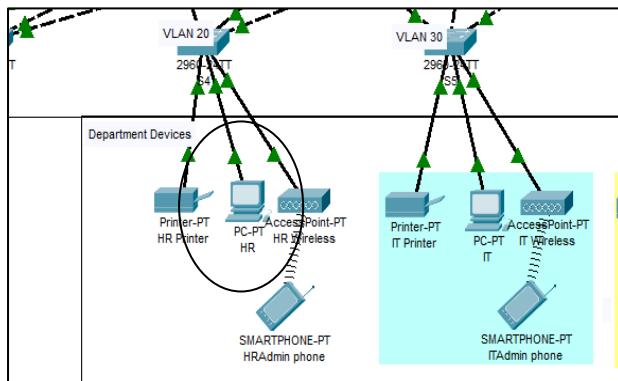
MK

Physical Config Desktop Programming Attributes

MAIL BROWSER

Mails

	From	Subject	Received
1	csadmin@dfsmail.com	test	Sat Dec 10 2022 07:57:57
2	mkadmin@dfsmail.com	test	Sat Dec 10 2022 07:57:01
3	hadmin@dfsmail.com	test	Sat Dec 10 2022 07:46:30
4	itadmin@dfsmail.com	TestMail	Sat Dec 10 2022 07:45:12



HR

Physical Config Desktop Programming Attributes

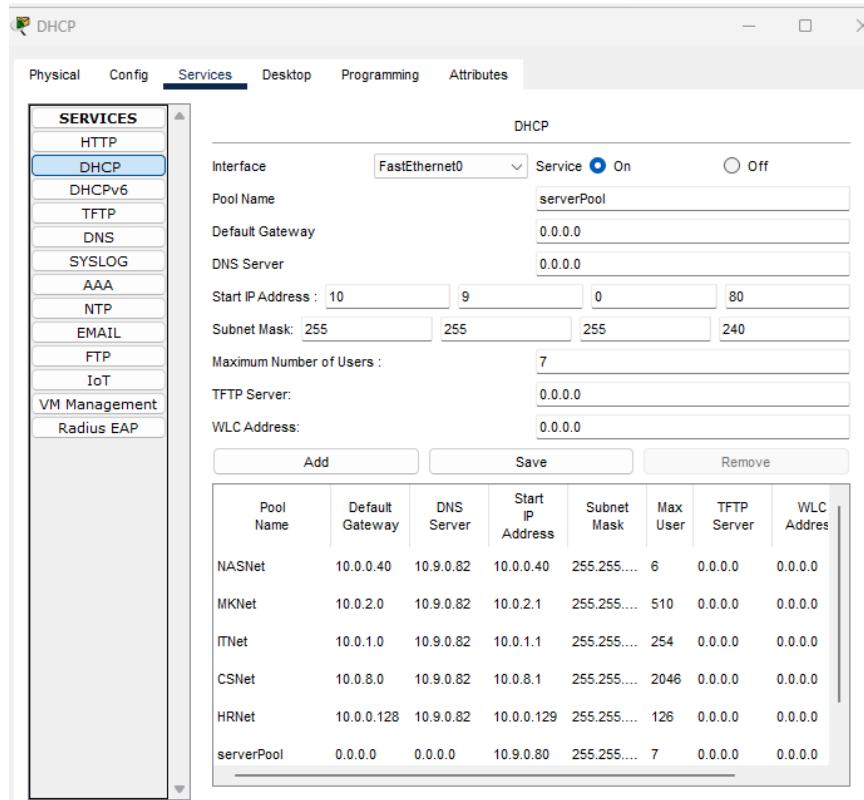
MAIL BROWSER

Mails

	From	Subject	Received
1	mkadmin@dfsmail.com	test	Sat Dec 10 2022 07:58:32
2	hadmin@dfsmail.com	test	Sat Dec 10 2022 07:58:20
3	csadmin@dfsmail.com	test	Sat Dec 10 2022 07:51:33
4	itadmin@dfsmail.com	TestMail	Sat Dec 10 2022 07:44:59

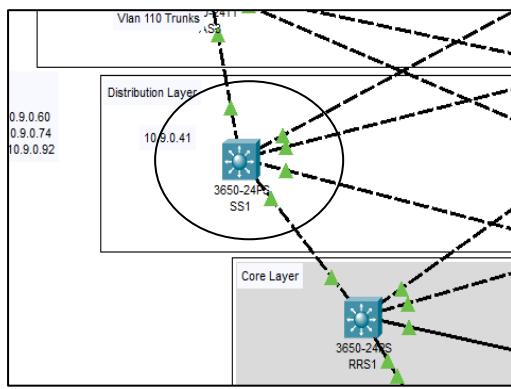
2.3.7.3 DHCP Server

The DHCP server is only used by head office departments, the off-site server network is statically assigned IP's

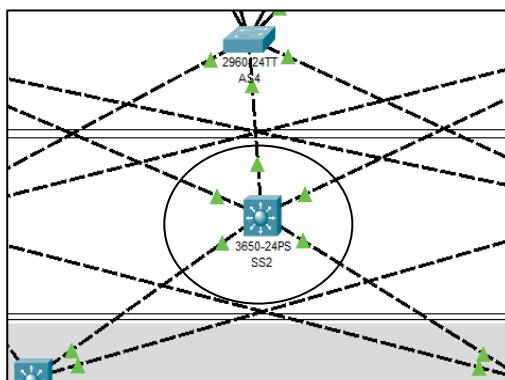


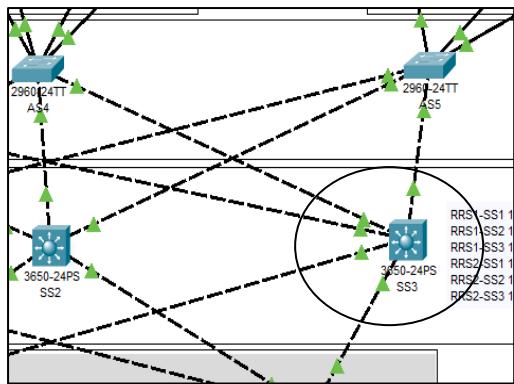
Enabled DHCP on access layer, excluding addresses used by SVI's or statically assigned elsewhere.

```
L3SwitchDist1>en
L3SwitchDist1>conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchDist1(config)#service dhcp
L3SwitchDist1(config)#int vlan 10
L3SwitchDist1(config-if)#ip helper-address 10.9.0.84
L3SwitchDist1(config-if)#ip dhcp excluded-address 10.0.0.44
L3SwitchDist1(config)#int vlan 10
L3SwitchDist1(config-if)#ip dhcp excluded-address 10.0.0.45
L3SwitchDist1(config)#int vlan 10
L3SwitchDist1(config-if)#ip dhcp excluded-address 10.0.0.46
L3SwitchDist1(config)#int vlan 10
L3SwitchDist1(config-if)#ip dhcp excluded-address 10.0.0.41
L3SwitchDist1(config)#int vlan 20
L3SwitchDist1(config-if)#ip helper-address 10.9.0.84
L3SwitchDist1(config-if)#ip dhcp excluded-address 10.0.0.251
L3SwitchDist1(config)#int vlan 20
L3SwitchDist1(config-if)#ip dhcp excluded-address 10.0.0.252
L3SwitchDist1(config)#int vlan 20
L3SwitchDist1(config-if)#ip dhcp excluded-address 10.0.0.253
L3SwitchDist1(config)#int vlan 20
L3SwitchDist1(config-if)#ip dhcp excluded-address 10.0.0.254
L3SwitchDist1(config)#int vlan 30
L3SwitchDist1(config-if)#ip helper-address 10.9.0.84
L3SwitchDist1(config-if)#ip dhcp excluded-address 10.0.1.251
L3SwitchDist1(config)#int vlan 30
L3SwitchDist1(config-if)#ip dhcp excluded-address 10.0.1.252
L3SwitchDist1(config)#int vlan 30
L3SwitchDist1(config-if)#ip dhcp excluded-address 10.0.1.253
L3SwitchDist1(config-if)#int vlan 30
L3SwitchDist1(config-if)#ip dhcp excluded-address 10.0.1.254
L3SwitchDist1(config)#int vlan 40
L3SwitchDist1(config-if)#ip helper-address 10.9.0.84
L3SwitchDist1(config-if)#ip dhcp excluded-address 10.0.15.251
L3SwitchDist1(config)#int vlan 40
L3SwitchDist1(config-if)#ip dhcp excluded-address 10.0.15.252
L3SwitchDist1(config-if)#int vlan 40
L3SwitchDist1(config-if)#ip dhcp excluded-address 10.0.15.253
L3SwitchDist1(config-if)#int vlan 40
L3SwitchDist1(config-if)#ip dhcp excluded-address 10.0.15.254
L3SwitchDist1(config)#int vlan 50
L3SwitchDist1(config-if)#ip helper-address 10.9.0.84
L3SwitchDist1(config-if)#ip dhcp excluded-address 10.0.3.251
L3SwitchDist1(config)#int vlan 50
L3SwitchDist1(config-if)#ip dhcp excluded-address 10.0.3.252
L3SwitchDist1(config)#int vlan 50
L3SwitchDist1(config-if)#ip dhcp excluded-address 10.0.3.253
L3SwitchDist1(config-if)#int vlan 50
L3SwitchDist1(config-if)#ip dhcp excluded-address 10.0.3.254
L3SwitchDist1(config-if)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
```



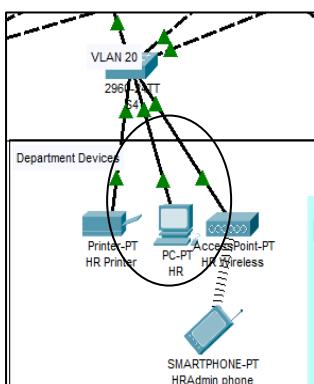
```
L3SwitchDist2>en
L3SwitchDist2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchDist2(config)#service dhcp
L3SwitchDist2(config)#int vlan 10
L3SwitchDist2(config-if)#ip helper-address 10.9.0.84
L3SwitchDist2(config-if)#ip dhcp excluded-address 10.0.0.44
L3SwitchDist2(config-if)#int vlan 10
L3SwitchDist2(config-if)#ip dhcp excluded-address 10.0.0.45
L3SwitchDist2(config-if)#int vlan 10
L3SwitchDist2(config-if)#ip dhcp excluded-address 10.0.0.46
L3SwitchDist2(config-if)#int vlan 10
L3SwitchDist2(config-if)#ip dhcp excluded-address 10.0.0.47
L3SwitchDist2(config-if)#int vlan 20
L3SwitchDist2(config-if)#ip helper-address 10.9.0.84
L3SwitchDist2(config-if)#ip dhcp excluded-address 10.0.0.251
L3SwitchDist2(config-if)#int vlan 20
L3SwitchDist2(config-if)#ip dhcp excluded-address 10.0.0.252
L3SwitchDist2(config-if)#int vlan 20
L3SwitchDist2(config-if)#ip dhcp excluded-address 10.0.0.253
L3SwitchDist2(config-if)#int vlan 20
L3SwitchDist2(config-if)#ip dhcp excluded-address 10.0.0.254
L3SwitchDist2(config-if)#int vlan 30
L3SwitchDist2(config-if)#ip dhcp excluded-address 10.0.1.251
L3SwitchDist2(config-if)#int vlan 30
L3SwitchDist2(config-if)#ip dhcp excluded-address 10.0.1.252
L3SwitchDist2(config-if)#int vlan 30
L3SwitchDist2(config-if)#ip dhcp excluded-address 10.0.1.253
L3SwitchDist2(config-if)#int vlan 30
L3SwitchDist2(config-if)#ip dhcp excluded-address 10.0.1.254
L3SwitchDist2(config-if)#int vlan 40
L3SwitchDist2(config-if)#ip helper-address 10.9.0.84
L3SwitchDist2(config-if)#ip dhcp excluded-address 10.0.15.251
L3SwitchDist2(config-if)#int vlan 40
L3SwitchDist2(config-if)#ip dhcp excluded-address 10.0.15.252
L3SwitchDist2(config-if)#int vlan 40
L3SwitchDist2(config-if)#ip dhcp excluded-address 10.0.15.253
L3SwitchDist2(config-if)#int vlan 40
L3SwitchDist2(config-if)#ip dhcp excluded-address 10.0.15.254
L3SwitchDist2(config-if)#int vlan 50
L3SwitchDist2(config-if)#ip helper-address 10.9.0.84
L3SwitchDist2(config-if)#ip dhcp excluded-address 10.0.3.251
L3SwitchDist2(config-if)#int vlan 50
L3SwitchDist2(config-if)#ip dhcp excluded-address 10.0.3.252
L3SwitchDist2(config-if)#int vlan 50
L3SwitchDist2(config-if)#ip dhcp excluded-address 10.0.3.253
L3SwitchDist2(config-if)#int vlan 50
L3SwitchDist2(config-if)#ip dhcp excluded-address 10.0.3.254
L3SwitchDist2(config-if)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
```





```
L3SwitchDist3>en
L3SwitchDist3#conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchDist3(config)#service dhcp
L3SwitchDist3(config)#int vlan 10
L3SwitchDist3(config-if)#ip helper-address 10.9.0.84
L3SwitchDist3(config-if)#ip dhcp excluded-address 10.0.0.44
L3SwitchDist3(config-if)#int vlan 10
L3SwitchDist3(config-if)#ip dhcp excluded-address 10.0.0.45
L3SwitchDist3(config-if)#int vlan 10
L3SwitchDist3(config-if)#ip dhcp excluded-address 10.0.0.46
L3SwitchDist3(config-if)#int vlan 10
L3SwitchDist3(config-if)#ip dhcp excluded-address 10.0.0.41
L3SwitchDist3(config)#int vlan 20
L3SwitchDist3(config-if)#ip helper-address 10.9.0.84
L3SwitchDist3(config-if)#ip dhcp excluded-address 10.0.0.251
L3SwitchDist3(config-if)#int vlan 20
L3SwitchDist3(config-if)#ip dhcp excluded-address 10.0.0.252
L3SwitchDist3(config-if)#int vlan 20
L3SwitchDist3(config-if)#ip dhcp excluded-address 10.0.0.253
L3SwitchDist3(config-if)#int vlan 20
L3SwitchDist3(config-if)#ip dhcp excluded-address 10.0.0.254
L3SwitchDist3(config-if)#int vlan 30
L3SwitchDist3(config-if)#ip helper-address 10.9.0.84
L3SwitchDist3(config-if)#ip dhcp excluded-address 10.0.1.251
L3SwitchDist3(config)#int vlan 30
L3SwitchDist3(config-if)#ip helper-address 10.9.0.84
L3SwitchDist3(config-if)#ip dhcp excluded-address 10.0.1.252
L3SwitchDist3(config-if)#int vlan 30
L3SwitchDist3(config-if)#ip dhcp excluded-address 10.0.1.253
L3SwitchDist3(config-if)#int vlan 30
L3SwitchDist3(config-if)#ip dhcp excluded-address 10.0.1.254
L3SwitchDist3(config-if)#int vlan 40
L3SwitchDist3(config-if)#ip helper-address 10.9.0.84
L3SwitchDist3(config-if)#ip dhcp excluded-address 10.0.15.251
L3SwitchDist3(config-if)#int vlan 40
L3SwitchDist3(config-if)#ip dhcp excluded-address 10.0.15.252
L3SwitchDist3(config-if)#int vlan 40
L3SwitchDist3(config-if)#ip dhcp excluded-address 10.0.15.253
L3SwitchDist3(config-if)#int vlan 40
L3SwitchDist3(config-if)#ip dhcp excluded-address 10.0.15.254
L3SwitchDist3(config-if)#int vlan 50
L3SwitchDist3(config-if)#ip helper-address 10.9.0.84
L3SwitchDist3(config-if)#ip dhcp excluded-address 10.0.3.251
L3SwitchDist3(config-if)#int vlan 50
L3SwitchDist3(config-if)#ip dhcp excluded-address 10.0.3.252
L3SwitchDist3(config-if)#int vlan 50
L3SwitchDist3(config-if)#ip dhcp excluded-address 10.0.3.253
L3SwitchDist3(config-if)#int vlan 50
L3SwitchDist3(config-if)#ip dhcp excluded-address 10.0.3.254
L3SwitchDist3(config-if)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
```

Verifying DHCP Works



Physical	Config	Desktop	Programming	Attributes								
<h3>IP Configuration</h3> <p>Interface FastEthernet0</p> <p>IP Configuration</p> <p><input checked="" type="radio"/> DHCP <input type="radio"/> Static</p> <table> <tr> <td>IPv4 Address</td> <td>10.0.0.130</td> </tr> <tr> <td>Subnet Mask</td> <td>255.255.255.128</td> </tr> <tr> <td>Default Gateway</td> <td>10.0.0.128</td> </tr> <tr> <td>DNS Server</td> <td>10.9.0.82</td> </tr> </table>					IPv4 Address	10.0.0.130	Subnet Mask	255.255.255.128	Default Gateway	10.0.0.128	DNS Server	10.9.0.82
IPv4 Address	10.0.0.130											
Subnet Mask	255.255.255.128											
Default Gateway	10.0.0.128											
DNS Server	10.9.0.82											

IT

Physical Config Desktop Programming Attributes

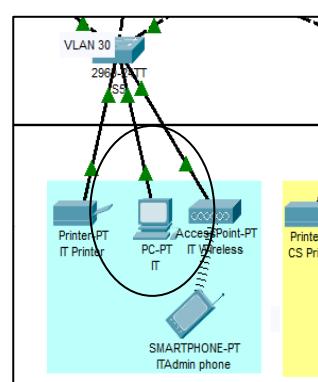
IP Configuration

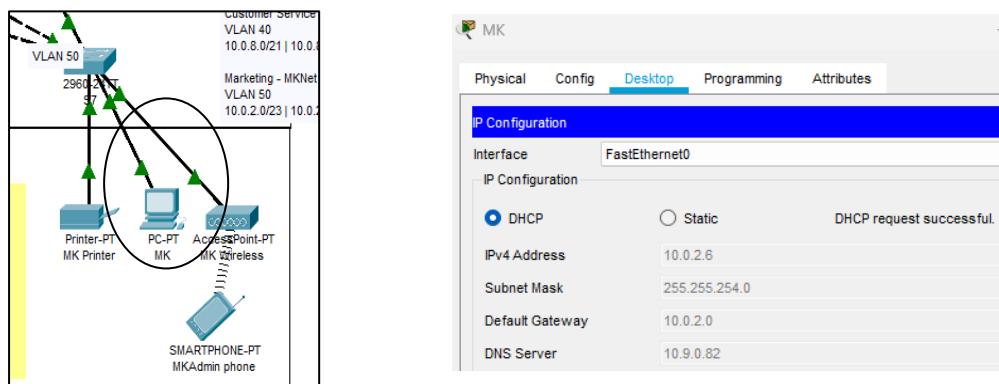
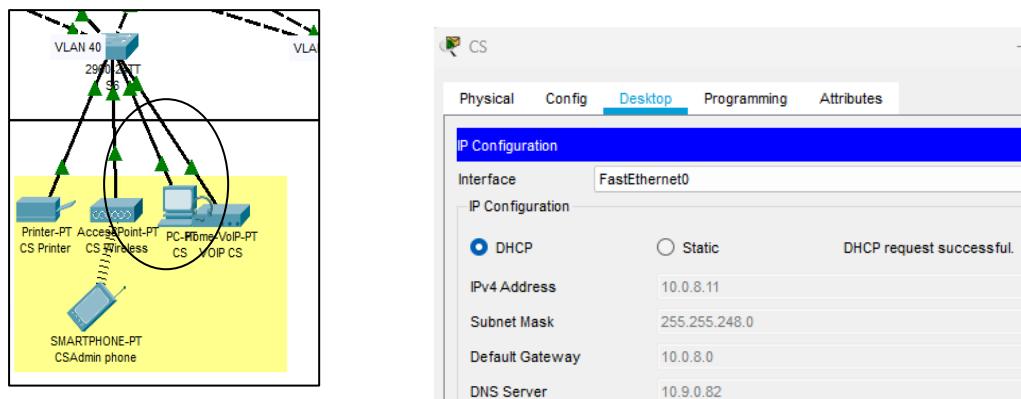
Interface FastEthernet0

IP Configuration

DHCP Static DHCP request successful.

IPv4 Address	10.0.1.2
Subnet Mask	255.255.255.0
Default Gateway	10.0.1.0
DNS Server	10.9.0.82





2.3.7.4 Web Server

Web IP Configuration:

IP Configuration	
IP Configuration	
<input type="radio"/> DHCP	<input checked="" type="radio"/> Static
IPv4 Address	10.9.0.67
Subnet Mask	255.255.255.240
Default Gateway	10.9.0.64
DNS Server	10.9.0.82

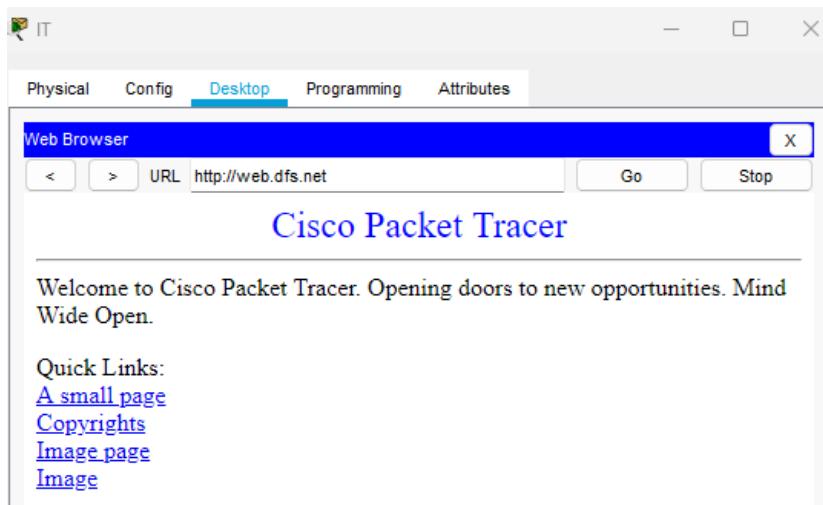
Web Services Configuration:

HTTP		HTTPS	
<input checked="" type="radio"/> On	<input type="radio"/> Off	<input checked="" type="radio"/> On	<input type="radio"/> Off

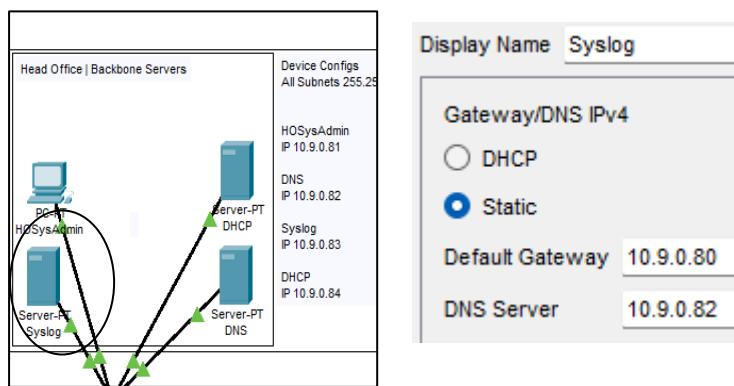
File Manager:

File Name	Edit	Delete
1 copyrights.html	(edit)	(delete)
2 cscptlogo177x111.jpg		
3 helloWorld.html	(edit)	(delete)
4 image.html	(edit)	(delete)
5 index.html	(edit)	(delete)

Verifying Usability



2.3.7.4 Syslog Server



Every network device was set up to log to the syslog server in the following way.

```
RouterCorel>en
RouterCorel#conf t
Enter configuration commands, one per line. End with CNTL/Z.
RouterCorel(config)#logging 10.9.0.83
RouterCorel(config)#ex
RouterCorel#do wr
%SYS-5-CONFIG_I: Configured from console by console
%SYS-6-LOGGINGHOST_STARTSTOP: Logging to host 10.9.0.83 port 514
started - CLI initiated
```

This led to logging working, but with no details.

Syslog		
Service	Time	HostName
1 -	-	195.150.150.9
2 -	-	195.150.150.1
3 -	-	10.0.0.5
4 -	-	10.0.0.9
5 -	-	10.0.0.13
6 -	-	10.0.0.29
7 -	-	10.0.0.17
8 -	-	10.0.0.21
9 -	-	10.0.0.33
10 -	-	10.0.0.25
11 -	-	10.0.0.37
12 -	-	10.9.0.18
13 -	-	10.9.0.22
14 -	-	10.9.0.38
15 -	-	10.9.0.34
16 -	-	10.9.0.90
17 -	-	10.9.0.90
18 -	-	10.9.0.91
19 -	-	10.9.0.91
20 -	-	10.9.0.92
21 -	-	10.9.0.92

Each device was adjusted to include further detail as below.

```
RouterCore1>en
RouterCore1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
RouterCore1(config)#service timestamps log datetime msec
RouterCore1(config)#ex
RouterCore1#
*Mar 01, 00:18:58.1818: SYS-5-CONFIG_I: Configured from console by
console
```

Verifying Usability

Syslog

Service

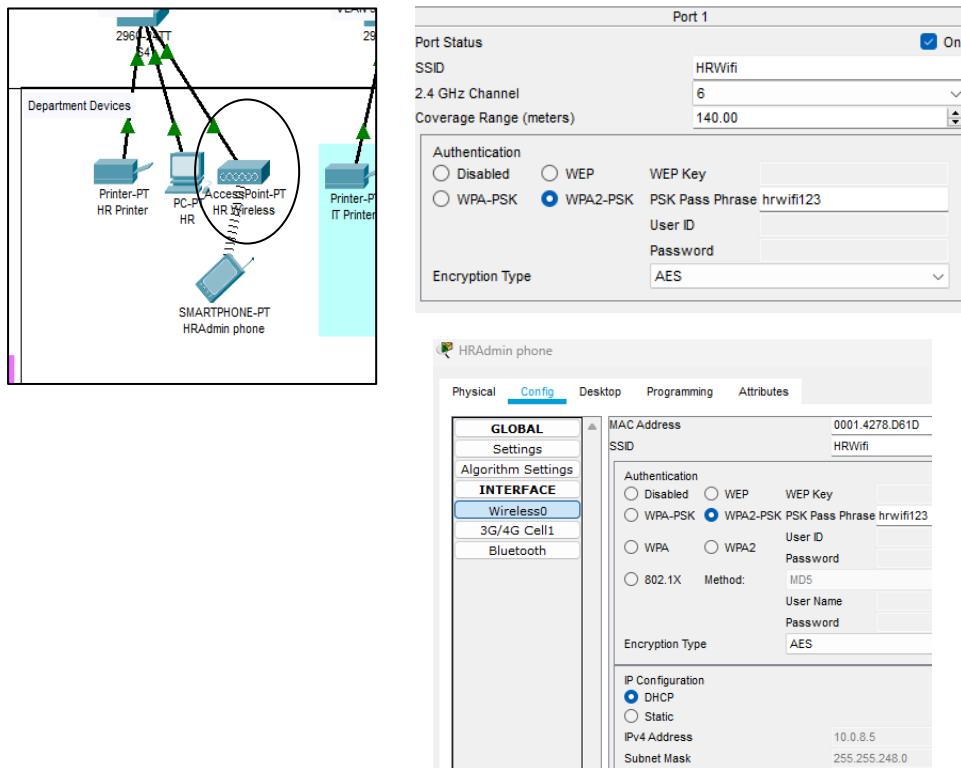
On Off

	Time	HostName	Message
1	03.01.1993 12:34:11.513 AM	195.150.150.9	00:34:11: %OSPF-5-ADJCHG: Process 10, Nbr 2.2.2....
2	03.01.1993 12:34:10.883 AM	10.0.0.33	00:34:10: %OSPF-5-ADJCHG: Process 10, Nbr 2.2.2....
3	03.01.1993 12:34:10.867 AM	10.0.0.9	00:34:10: %OSPF-5-ADJCHG: Process 10, Nbr 6.6.6....
4	03.01.1993 12:34:10.847 AM	10.0.0.13	00:34:10: %OSPF-5-ADJCHG: Process 10, Nbr 7.7.7....
5	03.01.1993 12:34:10.846 AM	10.0.0.13	00:34:10: %OSPF-5-ADJCHG: Process 10, Nbr 5.5.5....
6	03.01.1993 12:34:10.867 AM	195.150.150.5	00:34:10: %OSPF-5-ADJCHG: Process 10, Nbr 2.2.2....
7	03.01.1993 12:34:10.846 AM	10.0.0.37	00:34:10: %OSPF-5-ADJCHG: Process 10, Nbr 2.2.2....
8	03.01.1993 12:34:10.751 AM	10.0.0.9	00:34:10: %OSPF-5-ADJCHG: Process 10, Nbr 4.4.4....
9	03.01.1993 12:34:10.448 AM	10.0.0.17	00:34:10: %OSPF-5-ADJCHG: Process 10, Nbr 2.2.2....
10	03.01.1993 12:34:10.450 AM	10.0.0.13	00:34:10: %OSPF-5-ADJCHG: Process 10, Nbr 3.3.3....

2.3.8 Miscellaneous Additions

2.3.8.1 WIFI Access Points

Each department is expected to have wireless devices, so each has a Wi-Fi access point configured.



Network Diagram:

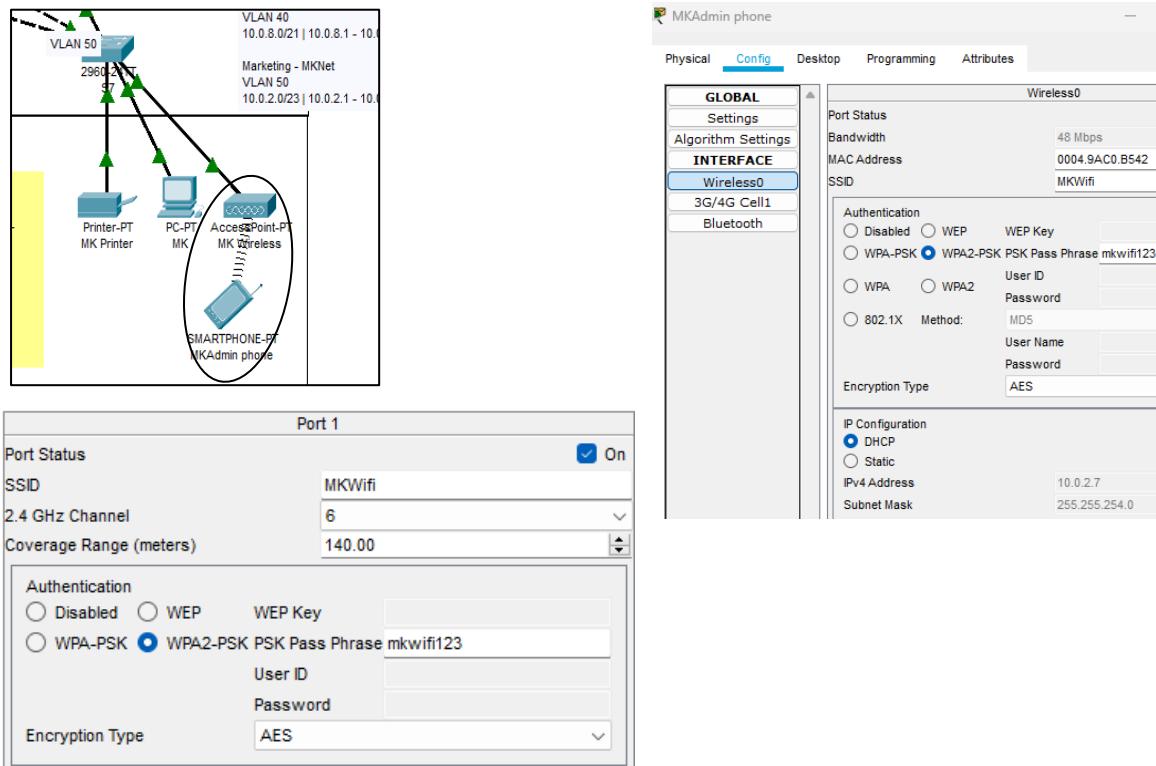
ITAdmin phone Configuration:

Physical		Config	Desktop	Programming	Attributes
GLOBAL					
Settings					
Algorithm Settings					
INTERFACE					
Wireless0					
3G/4G Cell1					
Bluetooth					
Wireless0					
Port Status					
Bandwidth 54 Mbps					
MAC Address 0090.2BBC.DEC8					
SSID ITWifi					
Authentication					
<input type="radio"/> Disabled	<input type="radio"/> WEP	WEP Key			
<input type="radio"/> WPA-PSK	<input checked="" type="radio"/> WPA2-PSK	PSK Pass Phrase itwifi123			
<input type="radio"/> WPA	<input type="radio"/> WPA2	User ID			
<input type="radio"/> 802.1X	Method:	Password			
User Name					
Password					
Encryption Type AES					
IP Configuration					
<input checked="" type="radio"/> DHCP					
<input type="radio"/> Static					
IPv4 Address 10.0.0.135					
Subnet Mask 255.255.255.128					

CSAdmin phone Configuration:

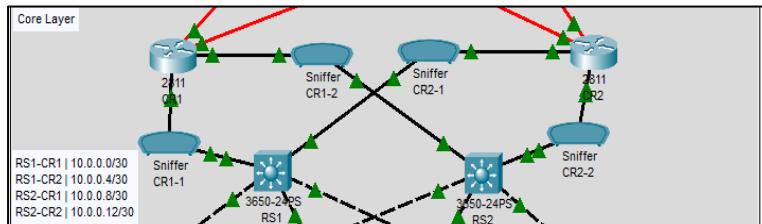
Physical		Config	Desktop	Programming	Attributes
GLOBAL					
Settings					
Algorithm Settings					
INTERFACE					
Wireless0					
3G/4G Cell1					
Bluetooth					
Wireless0					
Port Status					
Bandwidth 54 Mbps					
MAC Address 0090.21CB.12C6					
SSID CSWifi					
Authentication					
<input type="radio"/> Disabled	<input type="radio"/> WEP	WEP Key			
<input type="radio"/> WPA-PSK	<input checked="" type="radio"/> WPA2-PSK	PSK Pass Phrase cswifi123			
<input type="radio"/> WPA	<input type="radio"/> WPA2	User ID			
<input type="radio"/> 802.1X	Method:	Password			
User Name					
Password					
Encryption Type AES					
IP Configuration					
<input checked="" type="radio"/> DHCP					
<input type="radio"/> Static					
IPv4 Address 10.0.1.5					
Subnet Mask 255.255.255.0					
Port 1					
Port Status On					
SSID CSWifi					
2.4 GHz Channel 6					
Coverage Range (meters) 140.00					
Authentication					
<input type="radio"/> Disabled	<input type="radio"/> WEP	WEP Key			
<input type="radio"/> WPA-PSK	<input checked="" type="radio"/> WPA2-PSK	PSK Pass Phrase cswifi123			
<input type="radio"/> WPA	<input type="radio"/> WPA2	User ID			
<input type="radio"/> 802.1X	Method:	Password			
User Name					
Password					
Encryption Type AES					

Network Diagram:



2.3.8.2 Sniffer Devices

Sniffer devices added to monitor traffic at the core layer of head office.



CR1-1

Physical Config **GUI** Attributes

Service: On Off
Incoming Packets: Port0 Port1
Buffer Size: 256

Event List Filters - Visible Events:

```
ARP, BGP, Bluetooth, CAPWAP, CDP, DHCP, DHCPv6, DNS, DTP, EAPOL, EIGRP, EIGRPv6, FTP, H.323, HSRP, HSRPv6, HTTP, HTTPS, ICMP, ICMPv6, IPsec, ISAKMP, IoT, IoT TCP, LACP, LLDP, NDP, NETFLOW, NTP, OSPF, OSPFv6, PAgP, POP3, PPP, PPPoED, PTP, RADIUS, REP, RIP, RIPng, RTP, SCCP, SMTP, SNMP, SSH, STP, SYSLOG, TACACS, TCP, TFTT, Telnet, UDP, USB, VTP
```

Top

CR1-2

Physical Config **GUI** Attributes

Service: On Off
Incoming Packets: Port0 Port1
Buffer Size: 256

Event List Filters - Visible Events:

```
ARP, BGP, Bluetooth, CAPWAP, CDP, DHCP, DHCPv6, DNS, DTP, EAPOL, EIGRP, EIGRPv6, FTP, H.323, HSRP, HSRPv6, HTTP, HTTPS, ICMP, ICMPv6, IPsec, ISAKMP, IoT, IoT TCP, LACP, LLDP, NDP, NETFLOW, NTP, OSPF, OSPFv6, PAgP, POP3, PPP, PPPoED, PTP, RADIUS, REP, RIP, RIPng, RTP, SCCP, SMTP, SNMP, SSH, STP, SYSLOG, TACACS, TCP, TFTT, Telnet, UDP, USB, VTP
```

Top

CR2-1

Physical Config **GUI** Attributes

Service: On Off
Incoming Packets: Port0 Port1
Buffer Size: 256

Event List Filters - Visible Events:

```
ARP, BGP, Bluetooth, CAPWAP, CDP, DHCP, DHCPv6, DNS, DTP, EAPOL, EIGRP, EIGRPv6, FTP, H.323, HSRP, HSRPv6, HTTP, HTTPS, ICMP, ICMPv6, IPsec, ISAKMP, IoT, IoT TCP, LACP, LLDP, NDP, NETFLOW, NTP, OSPF, OSPFv6, PAgP, POP3, PPP, PPPoED, PTP, RADIUS, REP, RIP, RIPng, RTP, SCCP, SMTP, SNMP, SSH, STP, SYSLOG, TACACS, TCP, TFTT, Telnet, UDP, USB, VTP
```

Top

CR2-2

Physical Config **GUI** Attributes

Service: On Off
Incoming Packets: Port0 Port1
Buffer Size: 256

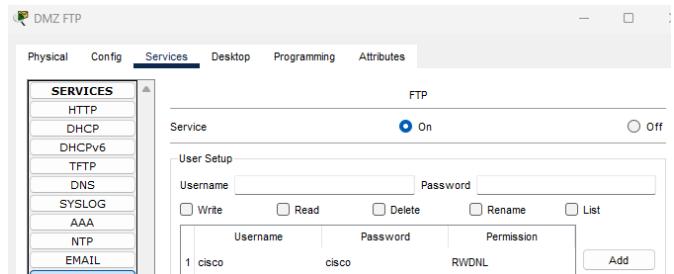
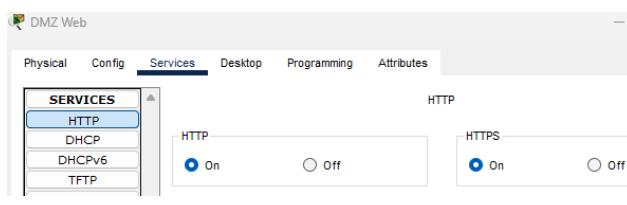
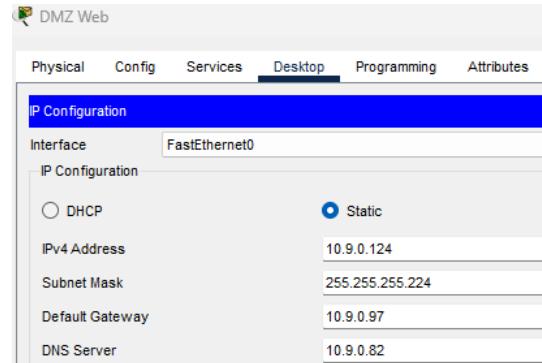
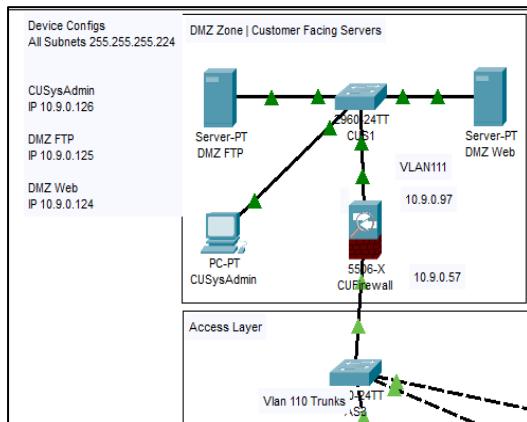
Event List Filters - Visible Events:

```
ARP, BGP, Bluetooth, CAPWAP, CDP, DHCP, DHCPv6, DNS, DTP, EAPOL, EIGRP, EIGRPv6, FTP, H.323, HSRP, HSRPv6, HTTP, HTTPS, ICMP, ICMPv6, IPsec, ISAKMP, IoT, IoT TCP, LACP, LLDP, NDP, NETFLOW, NTP, OSPF, OSPFv6, PAgP, POP3, PPP, PPPoED, PTP, RADIUS, REP, RIP, RIPng, RTP, SCCP, SMTP, SNMP, SSH, STP, SYSLOG, TACACS, TCP, TFTT, Telnet, UDP, USB, VTP
```

Top

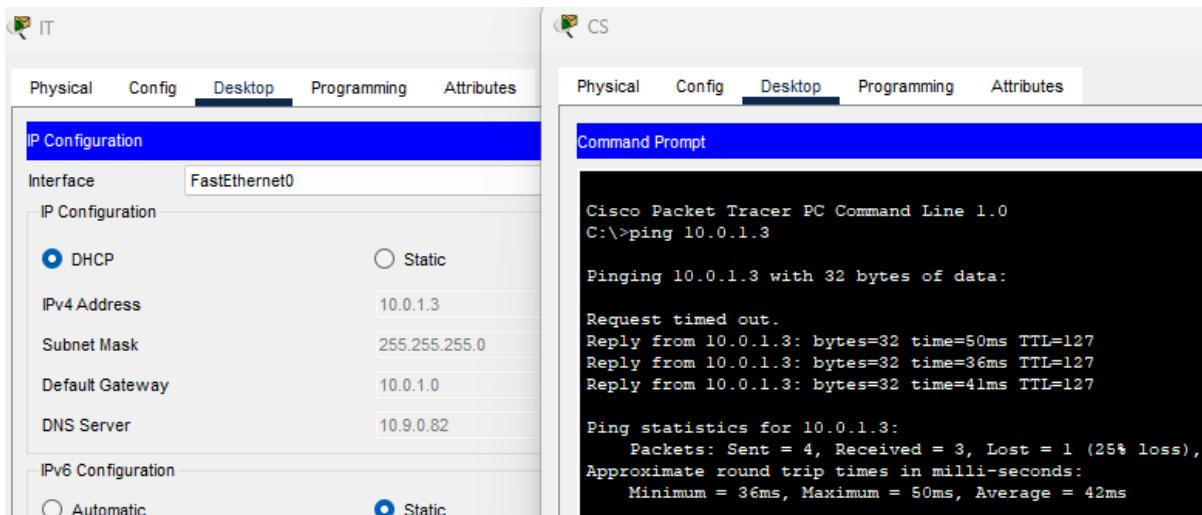
2.3.8.3 DMZ Zone

DMZ configured for HR and IT access only. Contains an FTP and Web Server. Further expansion detailed in section 3.



2.3.9 Design Connectivity Verification

Inter-VLAN Routing Proof



Site to Site Connectivity Proof

HOSysAdmin to Marketing

```
Pinging 10.0.2.2 with 32 bytes of data:  
  
Reply from 10.0.2.2: bytes=32 time=4ms TTL=119  
Reply from 10.0.2.2: bytes=32 time=10ms TTL=119  
Reply from 10.0.2.2: bytes=32 time=3ms TTL=119  
Reply from 10.0.2.2: bytes=32 time=5ms TTL=119  
  
Ping statistics for 10.0.2.2:  
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),  
    Approximate round trip times in milli-seconds:  
        Minimum = 3ms, Maximum = 10ms, Average = 5ms
```

Marketing to HOSysAdmin

```
Packet Tracer PC Command Line 1.0  
C:\>ping 10.9.0.81  
  
Pinging 10.9.0.81 with 32 bytes of data:  
  
Request timed out.  
Reply from 10.9.0.81: bytes=32 time=17ms TTL=119  
Request timed out.  
Reply from 10.9.0.81: bytes=32 time=5ms TTL=119  
  
Ping statistics for 10.9.0.81:  
    Packets: Sent = 4, Received = 2, Lost = 2 (50% loss),  
    Approximate round trip times in milli-seconds:  
        Minimum = 5ms, Maximum = 17ms, Average = 11ms  
  
C:\>
```

Section 3 | Security Implementation Evaluation

Several steps were taken when creating the network to ensure it is secure by implementing access control, managing user privileges, and using a site-to-site VPN to secure data in transmission.

User Privileges

Cisco's Networking devices have 3 modes concerning access:

- User Exec Mode or User Mode

This allows basic monitoring and troubleshooting commands and navigation to other modes. No changes to the device configuration are permitted.

- Privileged Exec Mode

This is the second level of access available on cisco cli. In this mode users can execute all user exec mode commands and make changes to configuration files.

- Global Exec Mode

Global exec mode is a sub-level within privileged exec mode. This allows changes to the device that affect the overall operation of a router/switch. For example, changing passwords and configuring a set of interfaces.

To protect the networking devices in the DFS hierarchy. I have configured console and privileged exec mode passwords on all the devices as follows.

```
L3SwitchDistR1>en
L3SwitchDistR1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
L3SwitchDistR1(config)#line console 0
L3SwitchDistR1(config-line)#password temppass123
L3SwitchDistR1(config-line)#login
L3SwitchDistR1(config-line)#line vty 0 4
L3SwitchDistR1(config-line)#password dfspass123
L3SwitchDistR1(config-line)#login
L3SwitchDistR1(config-line)#exit
L3SwitchDistR1(config)#enable secret dfspass123
L3SwitchDistR1(config)#enable password temppass123
L3SwitchDistR1(config)#service password-encryption
L3SwitchDistR1(config)#ex
L3SwitchDistR1#
```

Setting passwords for the console and privileged exec mode, greatly reduces risks to the network by preventing access to the router's settings. The enable secret password protects the privileged exec mode allowing for granular control towards configuration.

With these passwords in place, the following is presented when accessing the cli.

```
User Access Verification

Password:
Password:

L3SwitchDistR1>en
Password:
L3SwitchDistR1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
L3SwitchDistR1(config)#
```

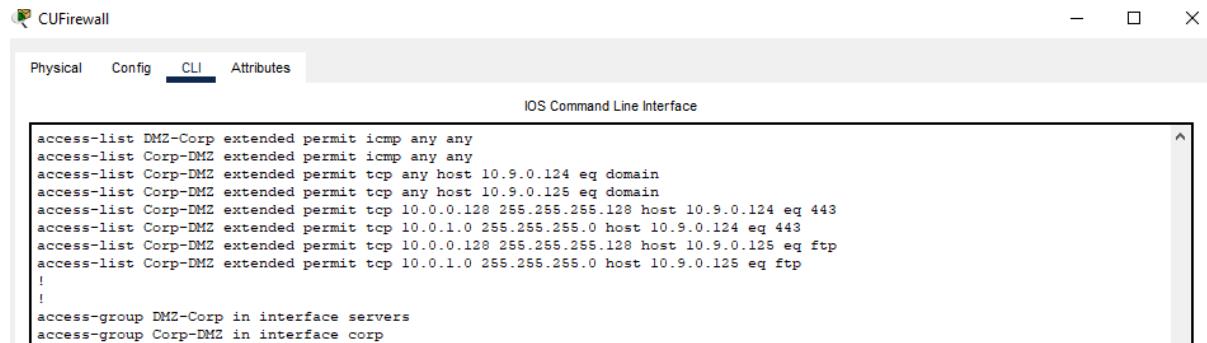
The use of the command 'service password-encryption', encrypts the passwords stored on the cli. By default, only a secret password is encrypted. This adds an additional layer of security.

Extended Access Control Lists

Access Control Lists are useful in preventing unauthorized access to network components. They can filter traffic based on IP addresses and traffic type, these filters are used in my network. A standard access control list can only filter traffic based on an IP address; an extended access control list enables filtration with more specificity. I've utilised the benefits of an extended ACL in the DMZ designed for HR and IT.

The DMZ ACL

The ASA used in the DMZ zone is configured as follows.



```
access-list DMZ-Corp extended permit icmp any any
access-list Corp-DMZ extended permit icmp any any
access-list Corp-DMZ extended permit tcp any host 10.9.0.124 eq domain
access-list Corp-DMZ extended permit tcp any host 10.9.0.125 eq domain
access-list Corp-DMZ extended permit tcp 10.0.0.128 255.255.255.128 host 10.9.0.124 eq 443
access-list Corp-DMZ extended permit tcp 10.0.1.0 255.255.255.0 host 10.9.0.124 eq 443
access-list Corp-DMZ extended permit tcp 10.0.0.128 255.255.255.128 host 10.9.0.125 eq ftp
access-list Corp-DMZ extended permit tcp 10.0.1.0 255.255.255.0 host 10.9.0.125 eq ftp
!
access-group DMZ-Corp in interface servers
access-group Corp-DMZ in interface corp
```

ICMP was left open for all connections for network monitoring purposes.

Pings are allowed to the DMZ Servers

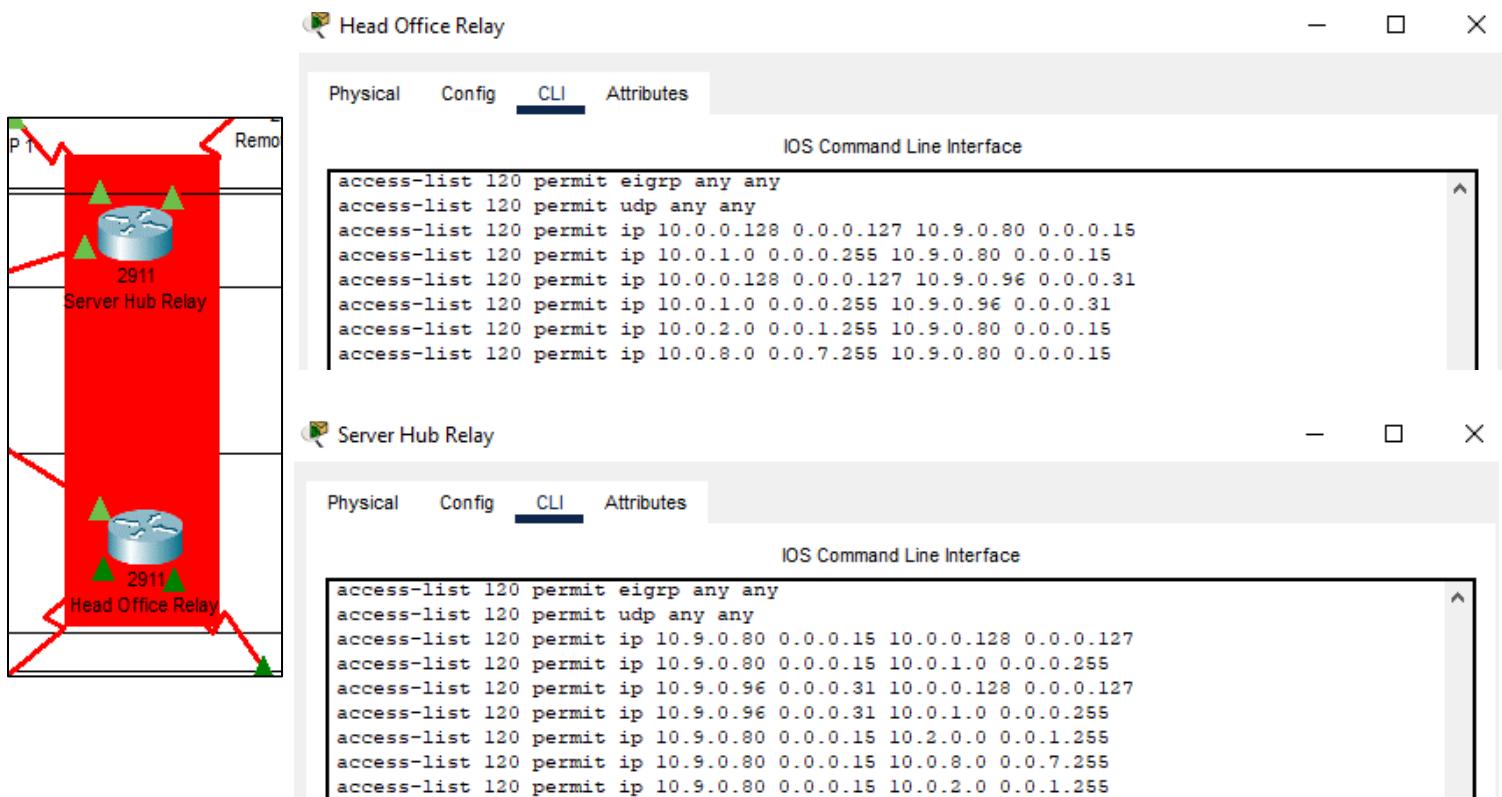
Domain services are allowed for dns name resolution.

Only addresses from IT and HR can access the FTP and Web Server in the DMZ. This is to limit access for essential staff only. These DMZ servers are intended for HR, however limited IT staff would be given access.

The web server can only receive and send HTTPS packets, HTTP is blocked. The web server is to be used for HR related activities, as such forcing HTTPS is necessary.

The IPSec VPN ACL's

An extended ACL was needed for IPSec VPN Implementation and was set up as follows.

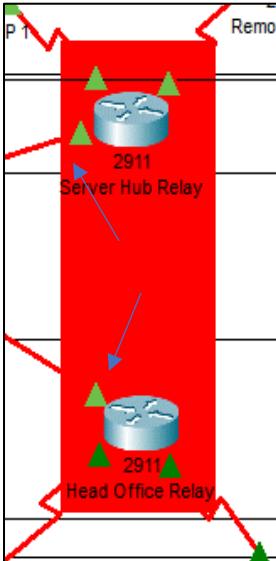


These access lists when applied with the IPSec VPN, enable encryption of traffic from:

- ITNet/HRNet to the DMZ Subnet (ArmedCUNet)
- ITNet/HRNet/CSNet/MKNet to Backend Servers

IPsec VPN Configuration

The IPsec VPN was configured as below.



Head Office Relay

Physical Config **CLI** Attributes

IOS Command Line Interface

```
crypto isakmp policy 14
encr aes
authentication pre-share
group 2
lifetime 28800
!
crypto isakmp key default123 address 148.96.151.114
!
!
crypto ipsec transform-set MyTransform esp-aes esp-sha-hmac
!
crypto map MAP 14 ipsec-isakmp
description VPN connection to BR
set peer 148.96.151.114
set transform-set MyTransform
match address 120
```

Head Office Relay

Physical Config **CLI** Attributes

IOS Command Line Interface

```
interface Serial0/0/0
ip address 148.96.151.118 255.255.255.252
clock rate 128000
crypto map MAP
```

Server Hub Relay

Physical Config **CLI** Attributes

IOS Command Line Interface

```
crypto isakmp policy 14
encr aes
authentication pre-share
group 2
lifetime 28800
!
crypto isakmp key default123 address 148.96.151.118
!
!
crypto ipsec transform-set MyTransform esp-aes esp-sha-hmac
!
crypto map MAP 14 ipsec-isakmp
description VPN connection to HO
set peer 148.96.151.118
set transform-set MyTransform
match address 120
```

Server Hub Relay

Physical Config **CLI** Attributes

IOS Command Line Interface

```
interface Serial0/0/0
ip address 148.96.151.114 255.255.255.252
crypto map MAP
```

I've utilised AES encryption, AES is widely used and provides a high-level of security. However, upon review AES-256 should have been used to provide the most secure encryption.

Pre shared authentication ensures both parties of the VPN share the same secret key, to validate the connection.

The group 2 DH group provides a moderate strength secret key for the connection. The ESP protocol is used with AES and SHA for authentication. Upon review, group 5 would have been better security as it has a larger prime modulus, meaning more security as the shared secret key is more difficult to compromise.

Verification of IPSec functionality

```
ISPRelay#sh crypto ipsec sa
interface: Serial0/0/0
    Crypto map tag: MAP, local addr 148.96.151.118

    protected vrf: (none)
    local ident (addr/mask/prot/port): (0.0.0.0/0.0.0.0/17/0)
    remote ident (addr/mask/prot/port): (0.0.0.0/0.0.0.0/17/0)
    current_peer 148.96.151.114 port 500
        PERMIT, flags={origin_is_acl,}
    #pkts encaps: 224, #pkts encrypt: 224, #pkts digest: 0
    #pkts decaps: 116, #pkts decrypt: 116, #pkts verify: 0
    #pkts compressed: 0, #pkts decompressed: 0
    #pkts not compressed: 0, #pkts compr. failed: 0
    #pkts not decompressed: 0, #pkts decompress failed: 0
    #send errors 1, #recv errors 0
```

Miscellaneous Access Control

The network has NAS devices set up on-site. These NAS servers have limited access based on their use case.

The High-Speed Nas server can only be accessed by MKNet, ITNet and HONet

The Common Nas can only be accessed by Head Office Subnets.

The HR Nas can only be accessed by HRNet, ITNet and HONet.

Access to these servers is controlled using inbound rules on their respective firewalls as shown below.

High Speed NAS

Physical Config Services Desktop Programming Attributes

Firewall

Service On Off

Interface FastEthernet0

Inbound Rules

Action	Protocol	Remote IP	Remote Wild Card	Remote Port	Local Port
1 Allow	IP	10.0.2.0	0.0.1.255	-	-
2 Allow	IP	10.0.1.0	0.0.0.255	-	-
3 Allow	IP	10.9.0.0	0.0.0.255	-	-

Save Remove Add

Common NAS

Physical Config Services Desktop Programming Attributes

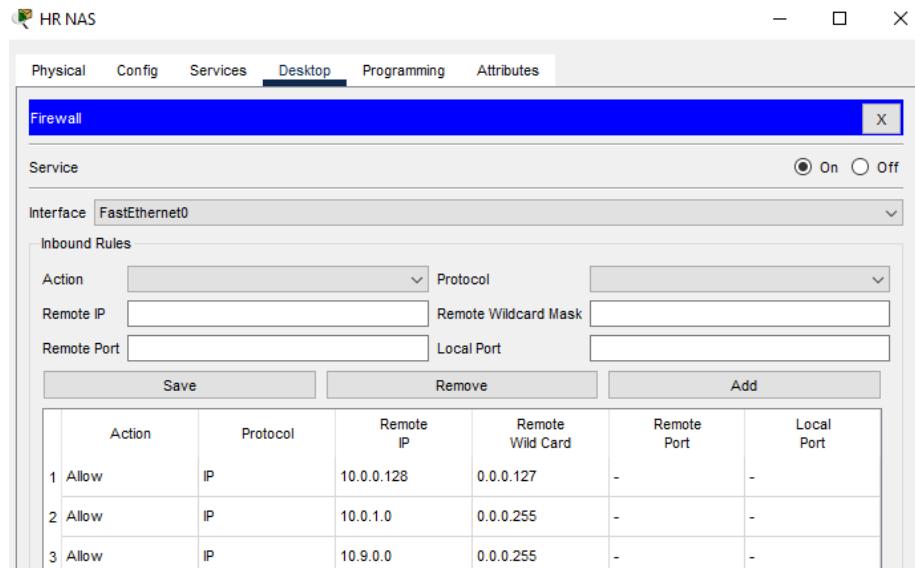
Firewall

Service On Off

Interface FastEthernet0

Inbound Rules

Action	Protocol	Remote IP	Remote Wild Card	Remote Port	Local Port
1 Allow	IP	10.0.2.0	0.0.1.255	-	-
2 Allow	IP	10.0.1.0	0.0.0.255	-	-
3 Allow	IP	10.0.8.0	0.0.7.255	-	-
4 Allow	IP	10.0.0.128	0.0.0.127	-	-
5 Allow	IP	10.9.0.0	0.0.0.255	-	-



Other Security Evaluations:

In my network design, access layer switches have additional switch port security. I have implemented this security on the devices to ensure mac addresses match and to shut down physical ports that aren't required. Doing so would greatly help in limiting access to the network, especially from physical attacks.

In summary, my network has sufficient access control and use of user privileges. The IPsec VPN ensures confidentiality with sensitive information from HR, and critical components such as DHCP and DNS are secured for all departments. The access control lists are effective and designed for specific use cases, such as limiting a web server to HTTPS.

The main critique is that all passwords configured are all the same and shared across devices or set to default values, furthermore the encryption algorithms chosen for the IPsec VPN aren't the best available, this would need to be addressed, especially considering the nature of a Digital Finance Services business, which could attract heightened threats.

Section 4 | Ethical Considerations

Computer Security Designers need to act in a professional manner adhering to the values set in the CIA Triad, Confidentiality, Integrity, Accessibility. The CIA Triad helps guide professional practice adherence towards protecting against cyber attacks on infrastructure such as my proposed network design. To protect the proposed network design, the triads values were considered.

To address the value of confidentiality when designing my network access controls, encryption, and network segmentation through subnetting enabled me to ensure that sensitive information was only accessible by the relevant departments. Limiting the access to authorized individuals was one consideration taken to protect the network from cyber threats. The Integrity value was addressed through implementing password controls and authorised users controls throughout the network. For example, the email service is password and username protected. Furthermore, the use of an IPsec VPN helps ensure data transferred between sites remains reliable and secure. Finally, Availability was heavily addressed through my network design as redundancy was built into the network from the start, to ensure availability of connectivity. Steps were taken to protect against failures such as utilising a large mesh design with failover ISPS, the large mesh design allows for component failures without causing the network to go down.

To further protect the proposed network design a set of sniffer devices were set to monitor incoming traffic in the head office. The use of sniffer devices helps to provide insight towards the traffic entering the network, however, to better protect the system an intrusion protection system (IPS) would be ideal. Both an IPS and the sniffer devices could be considered monitoring instruments. The use of these tools “helps the network administrators to examine the captured packets showing the vulnerabilities and abuse of organization's IT assets by employees” (Diye, et al., 2018, p. 20) . As these protection methods monitor the activity of users on the network, there are potential privacy concerns that could be raised ethically.

The monitoring of employees has legal implications in relations to the General Data Protection Regulation, article 5(1) states that personal data must be “processed lawfully, fairly and in a transparent manner in relation to the data subject ('lawfulness, fairness, transparency')” (europa, 2016). Due diligence is required to ensure the data is managed fairly and transparently. To comply with GDPR requirements while monitoring the network, consent would have to be obtained from the employees with a clear and honest explanation of the monitoring purposes and scope, both an ethical and legal obligation towards staff. An IT professional must also take steps to further protect the privacy rights of employees, such as redacting and removing any personal data non pertinent to business use from the monitoring database.

During the network design, several steps were taken to provide the human resources department with secure storage and transmission of data. These considerations help to protect the confidentiality of sensitive HR related documents. A social and ethical consideration concerning the availability of personal data for the organisation. To assist in protecting against consequences of a security breach which may cause issues for employees such as the compromising of hr files, access to the HR equipment was limited to only HR and IT departments. Relevant controls would have to be placed to limit the transparency of the documents to IT staff, as IT staff should only have access for diagnosis purposes because there is no legal necessity for read access to these files by employees outside the HR department. Furthermore, regular audits to assess the integrity of the network would be required to guarantee controls are implemented successfully. This would include independent audits to remove potential bias.

GDPR follows a “privacy by design” suggested methodology. To effectively provide privacy by design, privacy must be a consideration whilst implementing a network design. To suitably “identify and examine possible data protection problems when designing new technology”, we have an ethical responsibility to assess risks and implement knowledge gained from risk assessments to protect a network, enabling professionals to “incorporate privacy protection into the overall design, instead of having to come up with laborious and time-consuming “patches” later on” (Schaar, 2010, p. 267). I have based the network design off of common basic risks, however a risk assessment for a digital finance service may identify required compliance with PCI DSS, this would mean the network may need restructuring to ensure financial information held is protected adequately. This would be done by configuring firewalls, encrypting cardholder data, and restricting access within the business, along with other technical controls. To effectively manage adherence to multiple policies such as PCI DSS, GDPR and the Data Protection Act, a security designer must adhere to information governance policies set by the business, which should detail the required controls they will implement. The use or creation of an information governance policy by security designers would also help adhere to the integrity value by providing a transparent accessible document which details security practices in use through the network.

A Digital Finance Service organisation would hold a large amount of sensitive data, ranging from financial details to intellectual property. To protect the confidentiality of this data strict access controls and authentication methods must be utilised to ensure that only authorized users can access the data. To ensure the integrity of user access, authentication methods such as two factor authentication should be used within the network providing an extra security mechanism to assist with adherence towards the requirements set out in the GDPR where processing of sensitive data should only be done following authorised instruction.

A significant social consideration to take which would greatly benefit the network design in relation to cyber attacks is employee education. It's a well-known fact that "the majority of information security incidents pertain to human error" (Evans, et al., 2019, p. 2), cyber attacks are ever evolving and as such security professionals have a responsibility to ensure the risks are understood by employees. Teaching users' methods to stay safe online and procedures to protect the data transmitted over the proposed network, such as utilising a VPN for connectivity to the head office would assist in maintaining confidentiality of the data they interact with. Teaching ethical data handling would reduce risks by preventing unnecessary data transfers over the network. Furthermore, educating employees could help reduce instances of attacks such as phishing or insider threats, by helping staff identify risks.

To conclude social and ethical considerations must be factored into the network design and any plans to protect it. A security designer must be able to protect the privacy and security of users on the network, adequately assess risks and consequences of cyber attacks to appropriately protect the infrastructure and lastly should incorporate privacy at the design level for the network to ensure that data transmitted is handled correctly. A computer security engineer is not the only party relevant to protecting the safety of the network, however they are likely the most informed about the protections required. To help provide a herd immunity towards cyber-attacks, the designers should ensure that all relevant parties have the information they need to successfully manage cyber risks. To be able to show due diligence towards complying with legal obligations the security engineers should follow or create an information governance policy which clearly details controls and measures to ensure successful compliance with necessary industry standards and legal frameworks such as GDPR and the Data protection act. The documentation would help provide transparency into the technical applications of security.

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