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Topology Diagrams

Abstract

The purpose of this case study is to demonstrate all the skills, techniques and knowledge gained from taking the “Advance Networking II” course. The following report includes written explanations, screenshots of configurations and network diagrams showing how our group would design an Enterprise network. The Enterprise network contains the following modules; campus, core, data center, and internet edge module. The entire topology can be seen on page ???, this diagram includes the VLAN and IP subnet information that would be used when implementing this topology. To demonstrate that we can apply the knowledge that we learned, we have included screenshots from the terminals of the switches/router showing that the proper configurations have been implemented properly. To complement the configurations, we have also included discussion sections to fully explain why we have setup the network in the way that we have done.

Proof of Group Collaboration

This is where the we would print out a piece of paper stating what we have done, scan it and put it here.

Evidence of Configuration/Implementation

This is where we configure the steps required in the case study and provide relevant screenshots to prove that we have done so.

Task 1: Disable the links between the access layer switches – use your own methods of discovery to learn which ports these are.

Solution: The first thing that we had done is shut all ports in all switches and only brought the ones back up that we need for the configuration [1].

The commands that were used is as following for ALS1-2 [11]: (Changing the hostname for the switch that you are one)

```
-> conf t
-> hostname ALS1
-> no ip domain-lookup
-> int range G1/0/1-18
-> shutdown
-> ip routing
```

The commands that were used for DLS1-2 [11]: (Changing the hostname for the switch that you are one)

```
-> conf t
-> hostname DLS1
-> ip routing
-> int range G10/24,G1/1/1-4
-> shutdown
```

Evidence of commands being run on switches:

```
GigabitEthernet1/0/26 unassigned YES unset administratively down down
GigabitEthernet1/0/27 unassigned YES unset administratively down down
GigabitEthernet1/0/28 unassigned YES unset administratively down down
ALS1#show ip int brief
Interface IP-Address OK? Method Status Protocol
Vlan1 unassigned YES unset up down
FastEthernet0 unassigned YES unset up up
GigabitEthernet1/0/1 unassigned YES unset administratively down down
GigabitEthernet1/0/2 unassigned YES unset administratively down down
GigabitEthernet1/0/3 unassigned YES unset administratively down down
GigabitEthernet1/0/4 unassigned YES unset administratively down down
GigabitEthernet1/0/5 unassigned YES unset administratively down down
GigabitEthernet1/0/6 unassigned YES unset administratively down down
GigabitEthernet1/0/7 unassigned YES unset administratively down down
GigabitEthernet1/0/8 unassigned YES unset administratively down down
GigabitEthernet1/0/9 unassigned YES unset administratively down down
GigabitEthernet1/0/10 unassigned YES unset administratively down down
GigabitEthernet1/0/11 unassigned YES unset administratively down down
GigabitEthernet1/0/12 unassigned YES unset administratively down down
GigabitEthernet1/0/13 unassigned YES unset administratively down down
GigabitEthernet1/0/14 unassigned YES unset administratively down down
GigabitEthernet1/0/15 unassigned YES unset administratively down down
GigabitEthernet1/0/16 unassigned YES unset administratively down down
GigabitEthernet1/0/17 unassigned YES unset administratively down down
GigabitEthernet1/0/18 unassigned YES unset administratively down down
GigabitEthernet1/0/19 unassigned YES unset administratively down down
GigabitEthernet1/0/20 unassigned YES unset administratively down down
GigabitEthernet1/0/21 unassigned YES unset administratively down down
GigabitEthernet1/0/22 unassigned YES unset administratively down down
GigabitEthernet1/0/23 unassigned YES unset administratively down down
GigabitEthernet1/0/24 unassigned YES unset administratively down down
GigabitEthernet1/0/25 unassigned YES unset administratively down down
GigabitEthernet1/0/26 unassigned YES unset administratively down down
GigabitEthernet1/0/27 unassigned YES unset administratively down down
GigabitEthernet1/0/28 unassigned YES unset administratively down down
ALS1#
```

```
Please select a device or type 'exit' to logout: 8
[Resuming connection 4 to p7sw4 ... ]

ALS2(config)#
ALS2(config)#
ALS2(config)#exit
ALS2#
Mar 21 10:00:32.198: *SYS-5-CONFIG_I: Configured from console by console
ALS2#show ip int brief
Interface IP-Address OK? Method Status Protocol
Vlan1 unassigned YES unset administratively down down
FastEthernet0 unassigned YES unset administratively down down
GigabitEthernet1/0/1 unassigned YES unset administratively down down
GigabitEthernet1/0/2 unassigned YES unset administratively down down
GigabitEthernet1/0/3 unassigned YES unset administratively down down
GigabitEthernet1/0/4 unassigned YES unset administratively down down
GigabitEthernet1/0/5 unassigned YES unset administratively down down
GigabitEthernet1/0/6 unassigned YES unset administratively down down
GigabitEthernet1/0/7 unassigned YES unset administratively down down
GigabitEthernet1/0/8 unassigned YES unset administratively down down
GigabitEthernet1/0/9 unassigned YES unset administratively down down
GigabitEthernet1/0/10 unassigned YES unset administratively down down
GigabitEthernet1/0/11 unassigned YES unset administratively down down
GigabitEthernet1/0/12 unassigned YES unset administratively down down
GigabitEthernet1/0/13 unassigned YES unset administratively down down
GigabitEthernet1/0/14 unassigned YES unset administratively down down
GigabitEthernet1/0/15 unassigned YES unset administratively down down
GigabitEthernet1/0/16 unassigned YES unset administratively down down
GigabitEthernet1/0/17 unassigned YES unset administratively down down
GigabitEthernet1/0/18 unassigned YES unset administratively down down
GigabitEthernet1/0/19 unassigned YES unset administratively down down
GigabitEthernet1/0/20 unassigned YES unset administratively down down
GigabitEthernet1/0/21 unassigned YES unset administratively down down
GigabitEthernet1/0/22 unassigned YES unset administratively down down
GigabitEthernet1/0/23 unassigned YES unset administratively down down
GigabitEthernet1/0/24 unassigned YES unset administratively down down
GigabitEthernet1/0/25 unassigned YES unset administratively down down
GigabitEthernet1/0/26 unassigned YES unset administratively down down
GigabitEthernet1/0/27 unassigned YES unset administratively down down
GigabitEthernet1/0/28 unassigned YES unset administratively down down
ALS2#
```

```

Please select a device or type 'exit' to logout: 6
(Resuming connection 2 to p7sw2 ... )

DSL2(config)#
DSL2(config)#
DSL2(config)#exit
DSL2#show ip

*Mar 21 22:01:23.930: %SYS-5-CONFIG_I: Configured from console by console int brief
Interface          IP-Address      OK? Method Status           Protocol
GigabitEthernet0/0 unassigned       YES unset up              up
Vlan1             unassigned       YES unset administratively down down
GigabitEthernet0/1 unassigned       YES unset administratively down down
GigabitEthernet1/0/2 unassigned     YES unset administratively down down
GigabitEthernet1/0/3 unassigned     YES unset administratively down down
GigabitEthernet1/0/4 unassigned     YES unset administratively down down
GigabitEthernet1/0/5 unassigned     YES unset administratively down down
GigabitEthernet1/0/6 unassigned     YES unset administratively down down
GigabitEthernet1/0/7 unassigned     YES unset administratively down down
GigabitEthernet1/0/8 unassigned     YES unset administratively down down
GigabitEthernet1/0/9 unassigned     YES unset administratively down down
GigabitEthernet1/0/10 unassigned    YES unset administratively down down
GigabitEthernet1/0/11 unassigned    YES unset administratively down down
GigabitEthernet1/0/12 unassigned    YES unset administratively down down
GigabitEthernet1/0/13 unassigned    YES unset administratively down down
GigabitEthernet1/0/14 unassigned    YES unset administratively down down
GigabitEthernet1/0/15 unassigned    YES unset administratively down down
GigabitEthernet1/0/16 unassigned    YES unset administratively down down
GigabitEthernet1/0/17 unassigned    YES unset administratively down down
GigabitEthernet1/0/18 unassigned    YES unset administratively down down
GigabitEthernet1/0/19 unassigned    YES unset administratively down down
GigabitEthernet1/0/20 unassigned    YES unset administratively down down
GigabitEthernet1/0/21 unassigned    YES unset administratively down down
GigabitEthernet1/0/22 unassigned    YES unset administratively down down
GigabitEthernet1/0/23 unassigned    YES unset administratively down down
GigabitEthernet1/0/24 unassigned    YES unset administratively down down
GigabitEthernet1/1/1 unassigned    YES unset administratively down down
GigabitEthernet1/1/2 unassigned    YES unset administratively down down
GigabitEthernet1/1/3 unassigned    YES unset administratively down down
GigabitEthernet1/1/4 unassigned    YES unset administratively down down
DSL2#

```

```

*Mar 21 22:00:34.201: %SYS-5-CONFIG_I: Configured from console by consolew ip int brief
Interface          IP-Address      OK? Method Status       Protocol
GigabitEthernet0/0  unassigned     YES unset up           up
Vlan1              unassigned     YES unset administratively down
GigabitEthernet1/0/1 unassigned     YES unset administratively down
GigabitEthernet1/0/2 unassigned     YES unset administratively down
GigabitEthernet1/0/3 unassigned     YES unset administratively down
GigabitEthernet1/0/4 unassigned     YES unset administratively down
GigabitEthernet1/0/5 unassigned     YES unset administratively down
GigabitEthernet1/0/6 unassigned     YES unset administratively down
GigabitEthernet1/0/7 unassigned     YES unset administratively down
GigabitEthernet1/0/8 unassigned     YES unset administratively down
GigabitEthernet1/0/9 unassigned     YES unset administratively down
GigabitEthernet1/0/10 unassigned    YES unset administratively down
GigabitEthernet1/0/11 unassigned    YES unset administratively down
GigabitEthernet1/0/12 unassigned    YES unset administratively down
GigabitEthernet1/0/13 unassigned    YES unset administratively down
GigabitEthernet1/0/14 unassigned    YES unset administratively down
GigabitEthernet1/0/15 unassigned    YES unset administratively down
GigabitEthernet1/0/16 unassigned    YES unset administratively down
GigabitEthernet1/0/17 unassigned    YES unset administratively down
GigabitEthernet1/0/18 unassigned    YES unset administratively down
GigabitEthernet1/0/19 unassigned    YES unset administratively down
GigabitEthernet1/0/20 unassigned    YES unset administratively down
GigabitEthernet1/0/21 unassigned    YES unset administratively down
GigabitEthernet1/0/22 unassigned    YES unset administratively down
GigabitEthernet1/0/23 unassigned    YES unset administratively down
GigabitEthernet1/0/24 unassigned    YES unset administratively down
GigabitEthernet1/1/1 unassigned    YES unset administratively down
GigabitEthernet1/1/2 unassigned    YES unset administratively down
GigabitEthernet1/1/3 unassigned    YES unset administratively down
GigabitEthernet1/1/4 unassigned    YES unset administratively down

```

Task 2: Place all switches in the VTP domain UOIT and set all switches to VTP mode transparent.

The commands that were run on all switches [3] [11]:

```
-> conf t  
-> vtp domain UOIT  
-> vtp version 2  
-> vtp mode transparent
```

```

Please select a device or type 'exit' to logout: 5
[Resuming connection 1 to p7sw1 ... ]

% Type "show ?" for a list of subcommands
DLSI#
DLSI#show vtp ?
  counters      VTP statistics
  devices       VTP3 domain device information
  interface     VTP interface status and configuration
  password      VTP password
  status        VTP domain status

DLSI#show vtp status
VTP Version capable          : 1 to 3
VTP version running          : 2
VTP Domain Name               : UOIT
VTP Pruning Mode              : Disabled
VTP Traps Generation         : Disabled
Device ID                    : d5b1.9092.fff8
Configuration last modified by 0.0.0.0 at 3-21-17 21:54:54

Feature VLAN:
-----
VTP Operating Mode           : Transparent
Maximum VLANs supported locally : 1005
Number of existing VLANs      : 5
Configuration Revision        : 0
MD5 digest                   : 0x1F 0xB7 0xF2 0x59 0x8E
                                0x40 0xC0 0xE0 0xE8

```

```
Please select a device or type 'exit' to logout: 6
[Resuming connection 2 to p7sw2 ... ]

DLS2#
DLS2#show vtp ?
  counters      VTP statistics
  devices       VTP domain device information
  interface     VTP interface status and configuration
  password      VTP password
  status        VTP domain status

DLS2#show vtp status
VTP Version capable          : 1 to 3
VTP version running          : 2
VTP Domain Name               : UOIT
VTP Pruning Mode              : Disabled
VTP Traps Generation         : Disabled
Device ID                    : 80e0.1d30.a100
Configuration last modified by 0.0.0.0 at 3-21-17 21:56:09

Feature VLAN:
-----
VTP Operating Mode           : Transparent
Maximum VLANs supported locally : 1005
Number of existing VLANs     : 5
Configuration Revision       : 0
MD5 digest                  : 0x1F 0xB2 0xF2 0x59 0x F4 0xC B 0x95 C
                                0x40 0xC0 0xE0 0xE8 0x B C 0xE CE 0xB A C

DLS2#
```

```
Please select a device or type 'exit' to logout: 7
[Resuming connection 3 to p7sw3 ...]

ALS1#show vtp ?
  counters      VTP statistics
  devices       VTP3 domain device information
  interface     VTP interface status and configuration
  password      VTP password
  status        VTP domain status

ALS1#show vtp status
VTP Version capable          : 1 to 3
VTP version running          : 2
VTP Domain Name               : UQUIT
VTP Pruning Mode              : Disabled
VTP Traps Generation          : Disabled
Device ID                    : 84b5.178b.bc80
Configuration last modified by 0.0.0.0 at 2-8-15 10:33:29

Feature VLAN:
-----
VTP Operating Mode           : Transparent
Maximum VLANs supported locally : 1005
Number of existing VLANs      : 5
Configuration Revision        : 0
MD5 digest                   : 0x1F 0xBF 0xF2 0x59 0xF4 0xCB 0x95 0xF
                                0x40 0xC0 0xE0 0xE8 0xB8 0xCE 0xBA 0xCF

ALS1#
```

```
Please select a device or type 'exit' to logout: 8
[Resuming connection 4 to p7sw4 ... ]

ALS2#show vtp status
VTP Version Capable          : 1 to 3
VTP version running          : 2
VTP Domain Name               : UOIT
VTP Pruning Mode              : Disabled
VTP Traps Generation          : Disabled
Device ID                     : 84b5.17fc.0b80
Configuration last modified by 0.0.0.0 at 3-21-17 09:54:38

Feature VLAN:
-----
VTP Operating Mode            : Transparent
Maximum VLANs supported locally : 1005
Number of existing VLANs       : 5
Configuration Revision         : 0
MD5 digest                     : 0x1F 0xBF 0xF2 0x59 0xF4 0xCB 0x95 0x5F
                                0x40 0xC0 0xE0 0xE8 0xBC 0xCE 0xBA 0xCF

ALS2#
```

Task 3: Configure all switches for Rapid PVST+

These were the commands that were run on all the devices [4] [13].

```
-> conf t
-> spanning-tree mode rapid-pvst
-> end
-> clear spanning-tree detected-protocols
```

Evidence of commands run on switches

```
Please select a device or type 'exit' to logout: 7
[Resuming connection 5 to p8sw3 ... ]

ALS1(config)#
ALS1(config)#
ALS1(config)#exit
ALS1#
Feb 12 07:55:48.398: %SYS-5-CONFIG_I: Configured from console by console
ALS1#
ALS1#
ALS1#
ALS1#show run | inc spanning-tree mode
spanning-tree mode rapid-pvst
ALS1#
```

```
ALS2>en
ALS2#show run | inc spanning-tree mode
spanning-tree mode rapid-pvst
ALS2#
```

```
Please select a device or type 'exit' to logout: 5
[Resuming connection 3 to p8sw1 ... ]

DLS1#
DLS1#
DLS1#
DLS1#
DLS1#show run | inc spanning-tree mode
spanning-tree mode rapid-pvst
DLS1#
```

```
Press RETURN to get started.

DLS2>
DLS2>
DLS2>en
DLS2#show run | inc spanning
DLS2#show run | inc spanning-tree mode
spanning-tree mode rapid-pvst
DLS2#
```

Task 4: Configure all inter-switch links statically as 802.1q trunk links. Enable LACP EtherChannels along links between the Access layer and the Distribution layer switches. Enable PAgP EtherChannel between the two distribution layer switches. It's your decision on how the channel groups are formed.

Commands for Switches [3] [12]:

DLS1	DLS2	ALS1	ALS2
<pre>-> int range G1/0/1-2 -> shutdown -> switchport mode trunk</pre>	<pre>-> int range G1/0/1-2 -> shutdown -> switchport mode trunk</pre>	<pre>-> int range G1/0/1-2 -> shutdown -> switchport mode trunk</pre>	<pre>-> int range G1/0/1-2 -> shutdown -> switchport mode trunk</pre>

```
Please select a device or type 'exit' to logout: 7
Please select a device or type 'exit' to logout: 8
[Resuming connection 4 to p7sw4 ... ]

ALS2(config-if-range)#end
ALS2#
Mar 21 10:25:47.467: %SYS-5-CONFIG_I: Configured from console by console
ALS2#show etherchannel summary
Flags: D - down      P - bundled in port-channel
       I - stand-alone  S - suspended
       H - Hot-standby (LACP only)
       R - Layer3      S - Layer2
       U - in use       f - failed to allocate aggregator
       M - not in use, minimum links not met
       u - unsuitable for bundling
       w - waiting to be aggregated
       d - default port

Number of channel-groups in use: 2
Number of aggregators: 2

Group Port-channel Protocol Ports
-----+-----+-----+-----+
3     Po3(SU)      LACP    G11/0/7(P)  G11/0/8(P)
5     Po5(SU)      LACP    G11/0/1(P)  G11/0/2(P)
```

```
Please select a device or type 'exit' to logout: 5
[Resuming connection 1 to p7sw1 ... ]

Mar 21 22:22:10.546: %LINK-3-UPDOWN: Interface GigabitEthernet1/0/3, changed state to up
Mar 21 22:22:10.698: %LINK-3-UPDOWN: Interface GigabitEthernet1/0/4, changed state to up
Mar 21 22:22:14.487: %LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/3, changed state to up
Mar 21 22:22:14.547: %LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/4, changed state to up
DLS1(config-if-range)#
DLS1(config-if-range)#exit
DLS1(config)#
DLS1#
Mar 21 22:26:18.938: %SYS-5-CONFIG_I: Configured from console by console
DLS1#show etherchannel sum
DLS1#show etherchannel summary
Flags: D - down      P - bundled in port-channel
       I - stand-alone  S - suspended
       H - Hot-standby (LACP only)
       R - Layer3      S - Layer2
       U - in use       f - failed to allocate aggregator
       M - not in use, minimum links not met
       u - unsuitable for bundling
       w - waiting to be aggregated
       d - default port
       A - formed by Auto LAG

Number of channel-groups in use: 3
Number of aggregators: 3

Group Port-channel Protocol Ports
-----+-----+-----+-----+
1     Po1(SU)      LACP    G11/0/1(P)  G11/0/2(P)
2     Po2(SU)      PAgP   G11/0/3(P)  G11/0/4(P)
5     Po5(SU)      LACP    G11/0/7(P)  G11/0/8(P)
```

-> channel-group 1 mode active -> no shut -> int range G1/0/7-8 -> switchport mode trunk -> shutdown -> channel-group 5 mode active -> no shut -> int range G1/0/3-4 -> switchport mode trunk -> shutdown -> channel-group 2 mode desirable -> no shut	-> channel-group 4 mode active -> no shut -> int range G1/0/7-8 -> shutdown -> switchport mode trunk -> channel-group 3 mode active -> no shut -> int range G1/0/3-4 -> shutdown -> switchport mode trunk -> channel-group 2 mode desirable -> no shut	-> channel-group 1 mode active -> no shut -> int range G1/0/3-4 -> shutdown -> switchport mode trunk -> channel-group 4 mode active -> no shut	-> channel-group 5 mode active -> no shut -> int range G1/0/7-8 -> shutdown -> switchport mode trunk -> channel-group 3 mode active -> no shut
---	---	--	--

Task 5: Create VLANs 40 and 99 on all switches. Configure DLS1 and DLS2 SVIs and assign addresses in the appropriate subnet.

Commands that were run to create vlans on all switches [5] [11] [14]

ALS1	ALS2	DLS1	DLS2
-> vlan 40 -> name Shared -> vlan 99 -> name Management	-> vlan 40 -> name Shared -> vlan 99 -> name Management	-> vlan 40 -> name Shared -> vlan 99 -> name Management Commands run on distribution switches only -> int vlan 40 -> ip add 10.11.40.1 255.255.255.0 -> no shut -> int vlan 99 -> ip add 10.11.99.1 255.255.255.0 -> no shut	-> vlan 40 -> name Shared -> vlan 99 -> name Management Commands run on distribution switches only -> int vlan 40 -> ip add 10.11.40.2 255.255.255.0 -> no shut -> int vlan 99 -> ip add 10.11.99.2 255.255.255.0 -> no shut

Evidence of commands being run on switches:

```
Please select a device or type 'exit' to logout: 7
[Resuming connection 3 to p7sw3 ... ]

ALS1#show vlan brief
VLAN Name          Status    Ports
----- -----
1    default        active   Gi1/0/5, Gi1/0/6, Gi1/0/7
                           Gi1/0/8, Gi1/0/9, Gi1/0/10
                           Gi1/0/11, Gi1/0/12, Gi1/0/13
                           Gi1/0/14, Gi1/0/15, Gi1/0/16
                           Gi1/0/17, Gi1/0/18, Gi1/0/19
                           Gi1/0/20, Gi1/0/21, Gi1/0/22
                           Gi1/0/23, Gi1/0/24, Gi1/0/25
                           Gi1/0/26, Gi1/0/27, Gi1/0/28
40   Shared          active
99   Management     active
1002 fddi-default  act/unsup
1003 trcrf-default act/unsup
1004 fddinet-default act/unsup
1005 trbrf-default act/unsup
ALS1#
```

```
Please select a device or type 'exit' to logout: 8
[Resuming connection 4 to p7sw4 ... ]

ALS2#show vlan brief
VLAN Name          Status    Ports
----- -----
1    default        active   Gi1/0/3, Gi1/0/4, Gi1/0/5
                           Gi1/0/6, Gi1/0/9, Gi1/0/10
                           Gi1/0/11, Gi1/0/12, Gi1/0/13
                           Gi1/0/14, Gi1/0/15, Gi1/0/16
                           Gi1/0/17, Gi1/0/18, Gi1/0/19
                           Gi1/0/20, Gi1/0/21, Gi1/0/22
                           Gi1/0/23, Gi1/0/24, Gi1/0/25
                           Gi1/0/26, Gi1/0/27, Gi1/0/28
40   Shared          active
99   Management     active
1002 fddi-default  act/unsup
1003 trcrf-default act/unsup
1004 fddinet-default act/unsup
1005 trbrf-default act/unsup
ALS2#
```

```
DLS1#show vlan brief
VLAN Name          Status    Ports
-----  -----
1   default        active    G11/0/5, G11/0/6, G11/0/9
                           G11/0/10, G11/0/11, G11/0/12
                           G11/0/13, G11/0/14, G11/0/15
                           G11/0/16, G11/0/17, G11/0/18
                           G11/0/19, G11/0/20, G11/0/21
                           G11/0/22, G11/0/23, G11/0/24
                           G11/1/1, G11/1/2, G11/1/3
                           G11/1/4
40   Shared         active
99   Management    active
1002 fddi-default  act/unsup
1003 trcrf-default act/unsup
1004 fdinnet-default act/unsup
1005 trbrf-default act/unsup
DLS1#
```

```
DLS2#show vlan brief
VLAN Name          Status    Ports
-----  -----
1   default        active    G11/0/5, G11/0/6, G11/0/9
                           G11/0/10, G11/0/11, G11/0/12
                           G11/0/13, G11/0/14, G11/0/15
                           G11/0/16, G11/0/17, G11/0/18
                           G11/0/19, G11/0/20, G11/0/21
                           G11/0/22, G11/0/23, G11/0/24
                           G11/1/1, G11/1/2, G11/1/3
                           G11/1/4
40   Shared         active
99   Management    active
1002 fddi-default  act/unsup
1003 trcrf-default act/unsup
1004 fdinnet-default act/unsup
1005 trbrf-default act/unsup
DLS2#
```

```
Please select a device or type 'exit' to logout: 5
[Resuming connection 1 to p7sw1 ... ]
watching turbo vector

DLS1#show ip int brief
Interface      IP-Address      OK? Method Status      Protocol
GigabitEthernet0/0 unassigned      YES unset up           up
Vlan1          unassigned      YES unset administratively down down
Vlan40         10.11.40.1     YES manual up           up
Vlan99         10.11.99.1     YES manual up           up
GigabitEthernet1/0/1 unassigned      YES unset up           up
GigabitEthernet1/0/2 unassigned      YES unset up           up
GigabitEthernet1/0/3 unassigned      YES unset up           up
GigabitEthernet1/0/4 unassigned      YES unset up           up
```

```
Please select a device or type 'exit' to logout: 6
[Resuming connection 2 to p7sw2 ... ]

*Mar 21 22:42:11.811: %SYS-5-CONFIG_I: Configured from console by console
DLS2#show ip int brief
Interface      IP-Address      OK? Method Status      Protocol
GigabitEthernet0/0 unassigned      YES unset up           up
Vlan1          unassigned      YES unset administratively down down
Vlan40         10.11.40.2     YES manual up           up
Vlan99         10.11.99.2     YES manual up           up
GigabitEthernet1/0/1 unassigned      YES unset up           up
GigabitEthernet1/0/2 unassigned      YES unset up           up
GigabitEthernet1/0/3 unassigned      YES unset up           up
```

Task 6: Configure DLS1 and DLS2 to use HSRP for VLANS 40 and 99. Make DLS1 the primary gateway for VLAN 40 and DLS2 the primary gateway for VLAN 99. Enable preemption on both switches.

DLS1	DLS2
<pre>-> int vlan 40 -> ip add 10.11.40.1 255.255.255.0 -> standby 40 ip 10.11.40.5 -> standby 40 preempt -> standby 40 priority 110 -> no shut -> int vlan 99 -> ip add 10.11.99.1 255.255.255.0 -> standby 99 ip 10.11.99.5 -> standby 99 preempt -> no shut</pre>	<pre>-> int vlan 40 -> ip add 10.11.40.2 255.255.255.0 -> standby 40 ip 10.11.40.5 -> standby 40 preempt -> no shut -> int vlan 99 -> ip add 10.11.99.2 255.255.255.0 -> standby 99 ip 10.11.99.5 -> standby 99 preempt -> standby 99 priority 110 -> no shut</pre>

Evidence of commands being run on switches [6] [16]:

```
DLS1#show standby
Vlan40 - Group 40
State is Active
 2 state changes, last state change 03:02:09
Virtual IP address is 10.11.40.5
Active virtual MAC address is 0000.0c07.ac28 (MAC In Use)
  Local virtual MAC address is 0000.0c07.ac28 (vl default)
Hello time 3 sec, hold time 10 sec
  Next hello sent in 1.152 secs
Preemption enabled
Active router is local
Standby router is 10.11.40.2, priority 100 (expires in 9.824 sec)
Priority 110 (configured 110)
Group name is "hsrp-V140-40" (default)
DLS1#
```

```
DLS2#show standby
Vlan99 - Group 99
State is Active
 2 state changes, last state change 00:01:44
Virtual IP address is 10.11.99.5
Active virtual MAC address is 0000.0c07.ac63 (MAC In Use)
  Local virtual MAC address is 0000.0c07.ac63 (vl default)
Hello time 3 sec, hold time 10 sec
  Next hello sent in 1.888 secs
Preemption enabled
Active router is local
Standby router is unknown
Priority 110 (configured 110)
Group name is "hsrp-V199-99" (default)
DLS2#
```

Task 7: Using the table provided, assign the switchports as access ports.

Step 1: Create all the VLANs on the switches and name them correctly

Create and name the VLANs on all switches, the access layer switches only need the local VLANs whereas the distribution needs all configured VLANs for upstream redundancy [15].

ALS1	ALS2	DLS1	DLS2
<pre>-> vlan 10 -> name L1_Helpdesk -> vlan 20 -> name L2_Helpdesk -> vlan 30 -> name Supervisors</pre>	<pre>-> vlan 15 -> name Sales -> vlan 25 -> name Business -> vlan 35 -> name Accounting</pre>	<pre>-> vlan 15 -> name Sales -> vlan 25 -> name Business -> vlan 35 -> name Accounting -> vlan 10 -> name L1_Helpdesk -> vlan 20 -> name L2_Helpdesk -> vlan 30 -> name Supervisors</pre>	<pre>-> vlan 15 -> name Sales -> vlan 25 -> name Business -> vlan 35 -> name Accounting -> vlan 10 -> name L1_Helpdesk -> vlan 20 -> name L2_Helpdesk -> vlan 30 -> name Supervisors</pre>

Step 2: Assign the correct ports to the correct switches [15].

ALS1	ALS2
<pre>-> int range G1/0/10-12 -> switchport mode access -> switchport access vlan 10 -> no shut -> int range G1/0/13-16 -> switchport mode access -> switchport access vlan 20 -> no shut -> int range G1/0/17-18 -> switchport mode access -> switchport access vlan 30 -> no shut -> int range G1/0/19-24 -> switchport mode access -> switchport vlan 40 -> no shut</pre>	<pre>-> int range G1/0/10-12 -> switchport mode access -> switchport access vlan 15 -> no shut -> int range G1/0/13-16 -> switchport mode access -> switchport access vlan 25 -> no shut -> int range G1/0/17-18 -> switchport mode access -> switchport access vlan 35 -> no shut -> int range G1/0/19-24 -> switchport mode access -> switchport vlan 99 -> no shut</pre>

Evidence of commands being run on switches:

```
Please select a device or type 'exit' to logout: 5
[Resuming connection 1 to p7sw1 ... ]

DLS1#show vlan brief

VLAN Name          Status    Ports
-----  -----
1      default      active   Gi1/0/5, Gi1/0/6, Gi1/0/9
                           Gi1/0/10, Gi1/0/11, Gi1/0/12
                           Gi1/0/13, Gi1/0/14, Gi1/0/15
                           Gi1/0/16, Gi1/0/17, Gi1/0/18
                           Gi1/0/19, Gi1/0/20, Gi1/0/21
                           Gi1/0/22, Gi1/0/23, Gi1/0/24
                           Gi1/1/1, Gi1/1/2, Gi1/1/3
                           Gi1/1/4

10     L1_Helpdesk  active
15     Sales         active
20     L2_Helpdesk  active
25     Business      active
30     Supervisors   active
35     Accounting    active
40     Shared         active
50     VOICE         active
99     Management    active
1002   fddi-default act/unsup
1003   trcrf-default act/unsup
1004   fddinet-default act/unsup
--More--
```

```
Please select a device or type 'exit' to logout: 6
[Resuming connection 2 to p7sw2 ... ]

DLS2#show vlan brief

VLAN Name          Status    Ports
-----  -----
1      default      active   Gi1/0/5, Gi1/0/6, Gi1/0/9
                           Gi1/0/10, Gi1/0/11, Gi1/0/12
                           Gi1/0/13, Gi1/0/14, Gi1/0/15
                           Gi1/0/16, Gi1/0/17, Gi1/0/18
                           Gi1/0/19, Gi1/0/20, Gi1/0/21
                           Gi1/0/22, Gi1/0/23, Gi1/0/24
                           Gi1/1/1, Gi1/1/2, Gi1/1/3
                           Gi1/1/4

10     L1_Helpdesk  active
15     Sales         active
20     L2_Helpdesk  active
25     Business      active
30     Supervisors   active
35     Accounting    active
40     Shared         active
50     VOICE         active
99     Management    active
1002   fddi-default act/unsup
1003   trcrf-default act/unsup
1004   fddinet-default act/unsup
--More--
```

Step 8: Enable PortFast and BPDU guard on all access ports. Shutdown any unused ports at the Distribution layer.

Commands that were run on ALS1 and ALS2 [4]:

```
ALS1#show vlan brief
VLAN Name          Status    Ports
----- 
1     default      active    Gi1/0/5, Gi1/0/6, Gi1/0/7
                           Gi1/0/8, Gi1/0/9, Gi1/0/25
                           Gi1/0/26, Gi1/0/27, Gi1/0/28
10    L1_Helpdesk   active    Gi1/0/10, Gi1/0/11, Gi1/0/12
20    L2_Helpdesk   active    Gi1/0/13, Gi1/0/14, Gi1/0/15
                           Gi1/0/16
30    Supervisors   active    Gi1/0/17, Gi1/0/18
40    Shared        active    Gi1/0/19, Gi1/0/20, Gi1/0/21
                           Gi1/0/22, Gi1/0/23, Gi1/0/24
50    VOICE         active
99    Management   active
1002 fddi-default act/unsup
1003 token-ring-default act/unsup
1004 fddinet-default act/unsup
1005 trnet-default act/unsup
ALS1#
```

```
ALS2#show vlan brief
VLAN Name          Status    Ports
----- 
1     default      active    Gi1/0/3, Gi1/0/4, Gi1/0/5
                           Gi1/0/6, Gi1/0/9, Gi1/0/25
                           Gi1/0/26, Gi1/0/27, Gi1/0/28
15    Sales         active    Gi1/0/10, Gi1/0/11, Gi1/0/12
25    Business     active    Gi1/0/13, Gi1/0/14, Gi1/0/15
                           Gi1/0/16
35    Accounting   active    Gi1/0/17, Gi1/0/18
40    Shared        active    Gi1/0/19, Gi1/0/20, Gi1/0/21
                           Gi1/0/22, Gi1/0/23, Gi1/0/24
50    VOICE         active
99    Management   active
1002 fddi-default act/unsup
1003 token-ring-default act/unsup
1004 fddinet-default act/unsup
1005 trnet-default act/unsup
ALS2#
```

ALS1	ALS2
-> int range G1/0/10-12 -> spanning-tree portfast -> spanning-tree bpduguard enable -> no shut	-> int range G1/0/10-12 -> spanning-tree portfast -> spanning-tree bpduguard enable -> no shut
-> int range G1/0/13-16 -> spanning-tree portfast -> spanning-tree bpduguard enable -> no shut	-> int range G1/0/13-16 -> spanning-tree portfast -> spanning-tree bpduguard enable -> no shut
-> int range G1/0/17-18 -> spanning-tree portfast -> spanning-tree bpduguard enable -> no shut	-> int range G1/0/17-18 -> spanning-tree portfast -> spanning-tree bpduguard enable -> no shut
-> int range G1/0/19-24 -> spanning-tree portfast -> spanning-tree bpduguard enable -> no shut	-> int range G1/0/19-24 -> spanning-tree portfast -> spanning-tree bpduguard enable -> no shut

Proof that the commands were run.

ALS1:

```
ALS1#show running-config int G1/0/10
Building configuration...
Current configuration : 146 bytes
!
interface GigabitEthernet1/0/10
switchport access vlan 10
switchport mode access
spanning-tree portfast
spanning-tree bpduguard enable
end

ALS1#
```

```
ALS1#show running-config int G1/0/11
Building configuration...
Current configuration : 146 bytes
!
interface GigabitEthernet1/0/11
switchport access vlan 10
switchport mode access
spanning-tree portfast
spanning-tree bpduguard enable
end

ALS1#
```

```
ALS1#show running-config int G1/0/12
Building configuration...
Current configuration : 146 bytes
!
interface GigabitEthernet1/0/12
switchport access vlan 10
switchport mode access
spanning-tree portfast
spanning-tree bpduguard enable
end

ALS1#
```

```
ALS1#show running-config int G1/0/13
Building configuration...
Current configuration : 146 bytes
!
interface GigabitEthernet1/0/13
switchport access vlan 20
switchport mode access
spanning-tree portfast
spanning-tree bpduguard enable
end

ALS1#
```

```
ALS1#show running-config int G1/0/14
Building configuration...
Current configuration : 146 bytes
!
interface GigabitEthernet1/0/14
switchport access vlan 20
switchport mode access
spanning-tree portfast
spanning-tree bpduguard enable
end

ALS1#
```

```
ALS1#show running-config int G1/0/15
Building configuration...
Current configuration : 146 bytes
!
interface GigabitEthernet1/0/15
switchport access vlan 20
switchport mode access
spanning-tree portfast
spanning-tree bpduguard enable
end

ALS1#
```

```
ALS1#show running-config int G1/0/16
Building configuration...
Current configuration : 146 bytes
!
interface GigabitEthernet1/0/16
switchport access vlan 20
switchport mode access
spanning-tree portfast
spanning-tree bpduguard enable
end

ALS1#
```

```
ALS1#show running-config int G1/0/17
Building configuration...
Current configuration : 146 bytes
!
interface GigabitEthernet1/0/17
switchport access vlan 30
switchport mode access
spanning-tree portfast
spanning-tree bpduguard enable
end

ALS1#
```

```

ALS1#show running-config int G1/0/18
Building configuration...

Current configuration : 146 bytes
!
interface GigabitEthernet1/0/18
switchport access vlan 30
switchport mode access
spanning-tree portfast
spanning-tree bpduguard enable
end

ALS1#

```

ALS2:

```

Please select a device or type 'exit' to logo
[Resuming connection 4 to p7sw4 ... ]
Mar 21 11:24:55.974: %SYS-5-CONFIG_I: Configu
ALS2#
ALS2#show running-config int G1/0/10
Building configuration...

Current configuration : 146 bytes
!
interface GigabitEthernet1/0/10
switchport access vlan 15
switchport mode access
spanning-tree portfast
spanning-tree bpduguard enable
end

ALS2#

```

```

ALS2#show running-config int G1/0/11
Building configuration...

Current configuration : 146 bytes
!
interface GigabitEthernet1/0/11
switchport access vlan 15
switchport mode access
spanning-tree portfast
spanning-tree bpduguard enable
end

ALS2#

```

```

ALS2#show running-config int G1/0/12
Building configuration...

Current configuration : 146 bytes
!
interface GigabitEthernet1/0/12
switchport access vlan 15
switchport mode access
spanning-tree portfast
spanning-tree bpduguard enable
end

ALS2#

```

```

ALS2#show running-config int G1/0/13
Building configuration...

Current configuration : 146 bytes
!
interface GigabitEthernet1/0/13
switchport access vlan 25
switchport mode access
spanning-tree portfast
spanning-tree bpduguard enable
end

ALS2#

```

```

ALS2#show running-config int G1/0/14
Building configuration...

Current configuration : 146 bytes
!
interface GigabitEthernet1/0/14
switchport access vlan 25
switchport mode access
spanning-tree portfast
spanning-tree bpduguard enable
end

ALS2#

```

```

ALS2#show running-config int G1/0/15
Building configuration...

Current configuration : 146 bytes
!
interface GigabitEthernet1/0/15
switchport access vlan 25
switchport mode access
spanning-tree portfast
spanning-tree bpduguard enable
end

ALS2#

```

```

ALS2#show running-config int G1/0/16
Building configuration...

Current configuration : 146 bytes
!
interface GigabitEthernet1/0/16
switchport access vlan 25
switchport mode access
spanning-tree portfast
spanning-tree bpduguard enable
end

ALS2#

```

```

ALS2#show running-config int G1/0/17
Building configuration...

Current configuration : 146 bytes
!
interface GigabitEthernet1/0/17
switchport access vlan 35
switchport mode access
spanning-tree portfast
spanning-tree bpduguard enable
end

ALS2#

```

```

ALS2#show running-config int G1/0/18
Building configuration...

Current configuration : 146 bytes
!
interface GigabitEthernet1/0/18
switchport access vlan 35
switchport mode access
spanning-tree portfast
spanning-tree bpduguard enable
end

ALS2#

```

Step 9: Configure ALS1 and ALS2 G1/0/19 through G1/0/24 for use with Cisco IP phones with a voice VLAN of 50.

Commands that were run on the switches ALS1 and ALS2 [3]:

ALS1	ALS2
-> vlan 50 -> name VOICE	-> vlan 50 -> name VOICE

<pre>-> int range G1/0/19-24 -> switchport mode access -> switchport voice vlan 50 -> spanning-tree portfast -> spanning-tree bpduguard enable -> no shut</pre>	<pre>-> int range G1/0/19-24 -> switchport mode access -> switchport voice vlan 50 -> spanning-tree portfast -> spanning-tree bpduguard enable -> no shut</pre>
---	---

ALS1:

<pre>ALS1#show running-config int G1/0/19 Building configuration... Current configuration : 145 bytes ! interface GigabitEthernet1/0/19 switchport mode access switchport voice vlan 50 spanning-tree portfast spanning-tree bpduguard enable end ALS1#</pre>	<pre>ALS1#show running-config int G1/0/20 Building configuration... Current configuration : 145 bytes ! interface GigabitEthernet1/0/20 switchport mode access switchport voice vlan 50 spanning-tree portfast spanning-tree bpduguard enable end ALS1#</pre>	<pre>ALS1#show running-config int G1/0/21 Building configuration... Current configuration : 145 bytes ! interface GigabitEthernet1/0/21 switchport mode access switchport voice vlan 50 spanning-tree portfast spanning-tree bpduguard enable end ALS1#</pre>	<pre>ALS1#show running-config int G1/0/22 Building configuration... Current configuration : 145 bytes ! interface GigabitEthernet1/0/22 switchport mode access switchport voice vlan 50 spanning-tree portfast spanning-tree bpduguard enable end ALS1#</pre>
--	--	--	--

<pre>ALS1#show running-config int G1/0/23 Building configuration... Current configuration : 145 bytes ! interface GigabitEthernet1/0/23 switchport mode access switchport voice vlan 50 spanning-tree portfast spanning-tree bpduguard enable end ALS1#</pre>	<pre>ALS1#show running-config int G1/0/24 Building configuration... Current configuration : 145 bytes ! interface GigabitEthernet1/0/24 switchport mode access switchport voice vlan 50 spanning-tree portfast spanning-tree bpduguard enable end ALS1#</pre>	<pre>ALS1#show vlan brief VLAN Name Status Ports -----+ 1 default active G1/0/5, G1/0/6, G1/0/7 G1/0/8, G1/0/9, G1/0/25 G1/0/26, G1/0/27, G1/0/28 10 L1_Helpdesk active G1/0/10, G1/0/11, G1/0/12 20 L2_Helpdesk active G1/0/13, G1/0/14, G1/0/15 30 Supervisors active G1/0/17, G1/0/18 40 Shared active G1/0/19, G1/0/20, G1/0/21 50 VOICE active G1/0/22, G1/0/23, G1/0/24 99 Management active act/unsup 1002 fddi-default act/unsup 1003 token-ring-default act/unsup 1004 fddinet-default act/unsup 1005 trnet-default act/unsup ALS1#</pre>
--	--	---

ALS2:

<pre>ALS2#show running-config int G1/0/19 Building configuration... Current configuration : 145 bytes ! interface GigabitEthernet1/0/19 ALS2#show running-config int G1/0/23 Building configuration... Current configuration : 145 bytes ! interface GigabitEthernet1/0/23 switchport mode access switchport voice vlan 50 spanning-tree portfast spanning-tree bpduguard enable end ALS2#</pre>	<pre>ALS2#show running-config int G1/0/20 Building configuration... Current configuration : 145 bytes ! interface GigabitEthernet1/0/20 switchport mode access ALS2#show running-config int G1/0/24 Building configuration... Current configuration : 145 bytes ! interface GigabitEthernet1/0/24 switchport mode access switchport voice vlan 50 spanning-tree portfast spanning-tree bpduguard enable end ALS2#</pre>	<pre>ALS2#show running-config int G1/0/21 Building configuration... Current configuration : 145 bytes ! interface GigabitEthernet1/0/21 switchport mode access switchport voice vlan 50 spanning-tree portfast spanning-tree bpduguard enable end ALS2#</pre>	<pre>ALS2#show running-config int G1/0/22 Building configuration... Current configuration : 145 bytes ! interface GigabitEthernet1/0/22 switchport mode access switchport voice vlan 50 spanning-tree portfast spanning-tree bpduguard enable end ALS2#</pre>
--	---	--	--

```

ALS2#show vlan brief
VLAN Name          Status    Ports
----- 
1     default      active    Gi1/0/3, Gi1/0/4, Gi1/0/5
                           Gi1/0/6, Gi1/0/9, Gi1/0/25
                           Gi1/0/26, Gi1/0/27, Gi1/0/28
15    Sales         active    Gi1/0/10, Gi1/0/11, Gi1/0/12
25    Business      active    Gi1/0/13, Gi1/0/14, Gi1/0/15
                           Gi1/0/16
35    Accounting    active    Gi1/0/17, Gi1/0/18
40    Shared         active    Gi1/0/19, Gi1/0/20, Gi1/0/21
                           Gi1/0/22, Gi1/0/23, Gi1/0/24
50    VOICE         active    Gi1/0/19, Gi1/0/20, Gi1/0/21
                           Gi1/0/22, Gi1/0/23, Gi1/0/24
99    Management   active
1002 fddi-default act/unsup
1003 token-ring-default act/unsup
1004 fddinet-default act/unsup
1005 trnet-default  act/unsup
ALS2#

```

Step 10: Configure ALS2 G1/0/17 and G1/0/18 for port security. Allow only up to three MAC addresses to be learned on each port and then drop any traffic from other MAC addresses and set the violate mode to protect.

These are the commands that were run on the switch [7] [19] [20].

ALS2
<pre> -> int range G1/0/17-18 -> switchport port-security -> switchport port-security violation protect -> switchport port-security maximum 3 </pre>

Evidence that the commands were run on the switch.

<pre> Please select a device or type 'exit' to logout: 8 [Resuming connection 2 to p7sw4 ...] ALS2#conf t Enter configuration commands, one per line. End with CNTL/Z. ALS2#int range G1/0/17-18 ALS2(config-if-range)#switchport port-security ALS2(config-if-range)#switchport port-security violation protect ALS2(config-if-range)#switchport port-security maximum 3 ALS2(config-if-range)# </pre>

<pre> ALS2#show running-config int G1/0/17 Building configuration... Current configuration : 252 bytes ! interface GigabitEthernet1/0/17 switchport access vlan 35 switchport mode access switchport port-security maximum 3 switchport port-security switchport port-security violation protect spanning-tree portfast spanning-tree bpduguard enable end ALS2# </pre>
--

<pre> ALS2#show running-config int G1/0/18 Building configuration... Current configuration : 252 bytes ! interface GigabitEthernet1/0/18 switchport access vlan 35 switchport mode access switchport port-security maximum 3 switchport port-security switchport port-security violation protect spanning-tree portfast spanning-tree bpduguard enable end ALS2# </pre>
--

Step 11: Configure ALS1 G1/0/17 and G1/0/18 to only allow the MAC addresses of the two supervisor laptops (aka the two team members completing this case study). Assign only one MAC address per port and **shutdown** if a violation occurs.

ALS1
<pre> -> int G1/0/17 -> switchport mode access -> switchport port-security -> switchport port-security violation shutdown -> switchport port-security mac-address 28F1.0E13.EF57 -> int G1/0/18 -> switchport mode access -> switchport port-security -> switchport port-security violation shutdown -> switchport port-security mac-address 28F1.0E13.DD59 </pre>

Evidence that the commands were run on the switch [7] [19] [20]

```
ALS1#show running-config int G1/0/17
Building configuration...

Current configuration : 225 bytes
!
interface GigabitEthernet1/0/17
switchport access vlan 30
switchport mode access
switchport port-security
switchport port-security mac-address 28f1.0e13.ef57
spanning-tree portfast
spanning-tree bpdu-guard enable
end

ALS1#
```

```
ALS1#show running-config int G1/0/18
Building configuration...

Current configuration : 225 bytes
!
interface GigabitEthernet1/0/18
switchport access vlan 30
switchport mode access
switchport port-security
switchport port-security mac-address 28f1.0e13.dd59
spanning-tree portfast
spanning-tree bpdu-guard enable
end

ALS1#
```

Step 12: Create a routed port on DLS1 and DLS2 at Port G1/0/18 that leads to R1 and R3. Use the addressing scheme shown.

These were the commands that were run on the switches [5].

DLS1	DLS2
<pre>-> int g1/0/18 -> no switchport -> ip add 172.17.11.2 255.255.255.252 -> no shut</pre>	<pre>-> int g1/0/18 -> no switchport -> ip add 172.17.11.10 255.255.255.252 -> no shut</pre>

Evidence that the commands were run successfully:

```
DLS1#show running-config int G1/0/18
Building configuration...

Current configuration : 94 bytes
!
interface GigabitEthernet1/0/18
no switchport
ip address 172.17.11.2 255.255.255.252
end

DLS1#
```

```
DLS2#show running-config int G1/0/18
Building configuration...

Current configuration : 95 bytes
!
interface GigabitEthernet1/0/18
no switchport
ip address 172.17.11.10 255.255.255.252
end

DLS2#
```

Step 13: Set remaining configurations on the serial interfaces for the routers, enable EIGRP routing on DLS1, DLS2, R1 and R3 and advertise all connected networks.

These are the commands that were run on the switch [17] [18].

DLS1	DLS2	R1	R3
<pre>-> router eigrp 65505 -> network 10.0.0.0 -> network 172.17.11.0 0.0.0.3 -> network 172.17.11.4 0.0.0.3 -> network 172.17.11.8 0.0.0.3 -> auto-summary</pre>	<pre>-> router eigrp 65505 -> network 10.0.0.0 -> network 172.17.11.0 0.0.0.3 -> network 172.17.11.4 0.0.0.3 -> network 172.17.11.8 0.0.0.3 -> auto-summary</pre>	<pre>-> int G0/1 -> ip add 172.17.11.1 255.255.255.252 -> no shut -> int s0/0/1 -> ip add 172.17.11.5 255.255.255.252 -> no shut -> router eigrp 65505 -> network 172.17.11.4 0.0.0.3 -> network 172.17.11.0 0.0.0.3</pre>	<pre>-> int s0/0/0 -> ip add 172.17.11.6 255.255.255.252 -> clock rate 9600 -> no shut -> int G0/1 -> ip add 172.17.11.9 255.255.255.252 -> no shut -> router eigrp 65505 -> network 172.17.11.4 0.0.0.3</pre>

		-> auto-summary	-> network 172.17.11.8 0.0.0.3 -> auto-summary
--	--	-----------------	--

Evidence that the commands were run on the switches:

R1:

```
R1#show running-config int G0/1
Building configuration...

Current configuration : 101 bytes
!
interface GigabitEthernet0/1
 ip address 172.17.11.1 255.255.255.252
 duplex auto
 speed auto
end

R1#show running-config int S0/0/1
Building configuration...

Current configuration : 69 bytes
!
interface Serial0/0/1
 ip address 172.17.11.5 255.255.255.252
end

R1#show ip eigrp 65505 interfaces
EIGRP-IPv4 Interfaces for AS(65505)
          Xmit Queue  PeerQ      Mean    Pacing Time   Multicast   Pending
Interface    Peers Un/Reliable Un/Reliable SRTT  Un/Reliable Flow Timer Routes
Se0/0/1        1     0/0          0/0       473      0/16        2472         0
Gi0/1         1     0/0          0/0        7      0/0          50         0
R1#show ip eigrp 65505 neighbors
EIGRP-IPv4 Neighbors for AS(65505)
H  Address           Interface            Hold Uptime    SRTT    RTO   Q   Seq
   (sec)          (ms)          Cnt Num
1  172.17.11.2      Gi0/1             11 00:11:53    7  100  0  76
0  172.17.11.6      Se0/0/1          11 00:14:07  473  2838  0  23
R1#
```

R3:

```
R3#show ip eigrp 65505 interfaces
EIGRP-IPv4 Interfaces for AS(65505)
          Xmit Queue  PeerQ      Mean    Pacing Time   Multicast   Pending
Interface    Peers Un/Reliable Un/Reliable SRTT  Un/Reliable Flow Timer Routes
Se0/0/0        1     0/0          0/0       282      0/16        904         0
Gi0/1         1     0/0          0/0        5      0/0          50         0
R3#show ip eigrp 65505 neighbors
EIGRP-IPv4 Neighbors for AS(65505)
H  Address           Interface            Hold Uptime    SRTT    RTO   Q   Seq
   (sec)          (ms)          Cnt Num
1  172.17.11.10     Gi0/1             12 00:14:53    5  100  0  53
0  172.17.11.5      Se0/0/0          12 00:15:00  282  1692  0  22
R3#
```

```
R3#show running-config int G0/1
Building configuration...
Current configuration : 101 bytes
!
interface GigabitEthernet0/1
 ip address 172.17.11.9 255.255.255.252
 duplex auto
 speed auto
end
R3#
```

```
R3#show running-config int S0/0/0
Building configuration...
Current configuration : 86 bytes
!
interface Serial0/0/0
 ip address 172.17.11.6 255.255.255.252
 clock rate 9600
end
R3#
```

Step 14: Implement one additional upgrade that you have learned in this course.

This is implementing a layer 3 etherchannel across the distribution layer [21] [22].

```
DLS2# show etherchannel summary
Flags: D - down P - bundled in port-channel
I - stand-alone s - suspended
H - Hot-standby (LACP only)
R - Layer3 S - Layer2
U - in use f - failed to allocate aggregator

M - not in use, minimum links not met
U - unsuitable for bundling
w - waiting to be aggregated
d - default port

A - formed by Auto LAG

Number of channel-groups in use: 3
Number of aggregators: 3

Group Port-channel Protocol Ports
-----+-----+-----+
3 Po3 (SU) LACP Gi1/0/7(P) Gi1/0/8(P)
4 Po4 (SU) LACP Gi1/0/1(P) Gi1/0/2(P)
7 Po7 (RU) PAagP Gi1/0/3(P) Gi1/0/4(P)

DLS2#
```

```
DLS1#show etherchannel summary
Flags: D - down P - bundled in port-channel
I - stand-alone s - suspended
H - Hot-standby (LACP only)
R - Layer3 S - Layer2
U - in use f - failed to allocate aggregator

M - not in use, minimum links not met
u - unsuitable for bundling
w - waiting to be aggregated
d - default port

A - formed by Auto LAG

Number of channel-groups in use: 3
Number of aggregators: 3

Group Port-channel Protocol Ports
-----+-----+-----+
1 Po1 (SU) LACP Gi1/0/1(P) Gi1/0/2(P)
5 Po5 (SU) LACP Gi1/0/7(P) Gi1/0/8(P)
7 Po7 (RU) PAagP Gi1/0/3(P) Gi1/0/4(P)

DLS1#
```

This is implementing the root bridges for the specific VLANs. This is making DLS1 the root bridge for VLANs 10,20,30, and 40. This is also making DLS2 the root bridge for VLAN 15,25,35, and 99 [8] [13].

```
DLS1#
DLS1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
DLS1(config)#spanning-tree vlan 10,20,30,40 root primary
DLS1(config)#spanning-tree vlan 15,25,35,99 root secondary
DLS1(config)#
```

```
Please select a device or type 'exit' to logout: 6
[Resuming connection 4 to p7sw2 ... ]

DLS2#
DLS2#
DLS2#
DLS2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
DLS2(config)#spanning-tree vlan 15,25,35,99 root primary
DLS2(config)#spanning-tree vlan 10,20,30,40 root secondary
DLS2(config)#
```

DLS1:

DLS1#show spanning-tree vlan 10	DLS1#show spanning-tree vlan 15	DLS1#show spanning-tree vlan 20
VLAN0010 Spanning tree enabled protocol rstp Root ID Priority 24586 Address 188b.9d98.ds80 This bridge is the root Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec	VLAN0015 Spanning tree enabled protocol rstp Root ID Priority 24591 Address 188b.9d24.7a80 Cost 3 Port 2316 (Port-channel2) Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec	VLAN0020 Spanning tree enabled protocol rstp Root ID Priority 24596 Address 188b.9d98.ds80 This bridge is the root Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Bridge ID Priority 24586 (priority 24576 sys-id-ext 10) Address 188b.9d98.ds80 Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec Aging Time 300 sec	Bridge ID Priority 28687 (priority 28672 sys-id-ext 15) Address 188b.9d98.ds80 Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec Aging Time 300 sec	Bridge ID Priority 24596 (priority 24576 sys-id-ext 20) Address 188b.9d98.ds80 Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec Aging Time 300 sec
Interface Role Sts Cost Prio.Nbr Type Po1 Desg FWD 3 128.2315 P2p Po2 Desg FWD 3 128.2316 P2p	Interface Role Sts Cost Prio.Nbr Type Po1 Desg FWD 3 128.2315 P2p Po2 Root FWD 3 128.2316 P2p	Interface Role Sts Cost Prio.Nbr Type Po1 Desg FWD 3 128.2315 P2p Po2 Desg FWD 3 128.2316 P2p
DLS1#	DLS1#	DLS1#
DLS1#show spanning-tree vlan 25	DLS1#show spanning-tree vlan 30	DLS1#show spanning-tree vlan 35
VLAN025 Spanning tree enabled protocol rstp Root ID Priority 24601 Address 188b.9d24.7a80 Cost 3 Port 2316 (Port-channel2) Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec	VLAN030 Spanning tree enabled protocol rstp Root ID Priority 24606 Address 188b.9d98.ds80 This bridge is the root Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec	VLAN035 Spanning tree enabled protocol rstp Root ID Priority 24611 Address 188b.9d24.7a80 Cost 3 Port 2316 (Port-channel2) Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Bridge ID Priority 28697 (priority 28672 sys-id-ext 25) Address 188b.9d98.ds80 Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec Aging Time 300 sec	Bridge ID Priority 24606 (priority 24576 sys-id-ext 30) Address 188b.9d98.ds80 Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec Aging Time 300 sec	Bridge ID Priority 28707 (priority 28672 sys-id-ext 35) Address 188b.9d98.ds80 Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec Aging Time 300 sec
Interface Role Sts Cost Prio.Nbr Type Po1 Desg FWD 3 128.2315 P2p Po2 Root FWD 3 128.2316 P2p	Interface Role Sts Cost Prio.Nbr Type Po1 Desg FWD 3 128.2315 P2p Po2 Desg FWD 3 128.2316 P2p	Interface Role Sts Cost Prio.Nbr Type Po1 Desg FWD 3 128.2315 P2p Po2 Root FWD 3 128.2316 P2p
DLS1#	DLS1#	DLS1#
DLS1#show spanning-tree vlan 40	DLS1#show spanning-tree vlan 99	
VLAN040 Spanning tree enabled protocol rstp Root ID Priority 24616 Address 188b.9d98.ds80 This bridge is the root Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec	VLAN099 Spanning tree enabled protocol rstp Root ID Priority 24675 Address 188b.9d24.7a80 Cost 3 Port 2316 (Port-channel2) Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec	
Bridge ID Priority 24616 (priority 24576 sys-id-ext 40) Address 188b.9d98.ds80 Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec Aging Time 300 sec	Bridge ID Priority 28771 (priority 28672 sys-id-ext 99) Address 188b.9d98.ds80 Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec Aging Time 300 sec	
Interface Role Sts Cost Prio.Nbr Type Po1 Desg FWD 3 128.2315 P2p Po2 Desg FWD 3 128.2316 P2p	Interface Role Sts Cost Prio.Nbr Type Po1 Desg FWD 3 128.2315 P2p Po2 Root FWD 3 128.2316 P2p	
DLS1#	DLS1#	

DLS2:

DLS2#show spanning-tree vlan 10	DLS2#show spanning-tree vlan 15	DLS2#show spanning-tree vlan 20
VLAN0010 Spanning tree enabled protocol rstp Root ID Priority 24586 Address 188b.9d98.d580 Cost 3 Port 2316 (Port-channel2) Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec	VLAN0015 Spanning tree enabled protocol rstp Root ID Priority 24591 Address 188b.9d24.7a80 This bridge is the root Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec	VLAN0020 Spanning tree enabled protocol rstp Root ID Priority 24596 Address 188b.9d98.d580 Cost 3 Port 2316 (Port-channel2) Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Bridge ID Priority 28682 (priority 28672 sys-id-ext 10) Address 188b.9d24.7a80 Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec Aging Time 300 sec	Bridge ID Priority 24591 (priority 24576 sys-id-ext 15) Address 188b.9d24.7a80 Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec Aging Time 300 sec	Bridge ID Priority 28692 (priority 28672 sys-id-ext 20) Address 188b.9d24.7a80 Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec Aging Time 300 sec
Interface Role Sts Cost Prio.Nbr Type Po2 Root FWD 3 128.2316 P2p Po4 Desg FWD 3 128.2318 P2p	Interface Role Sts Cost Prio.Nbr Type Po2 Desg FWD 3 128.2316 P2p Po4 Desg FWD 3 128.2318 P2p	Interface Role Sts Cost Prio.Nbr Type Po2 Root FWD 3 128.2316 P2p Po4 Desg FWD 3 128.2318 P2p
DLS2#	DLS2#	DLS2#
DLS2#show spanning-tree vlan 25	DLS2#show spanning-tree vlan 30	DLS2#show spanning-tree vlan 40
VLAN0025 Spanning tree enabled protocol rstp Root ID Priority 24601 Address 188b.9d24.7a80 This bridge is the root Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec	VLAN0030 Spanning tree enabled protocol rstp Root ID Priority 24606 Address 188b.9d98.d580 Cost 3 Port 2316 (Port-channel2) Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec	VLAN0040 Spanning tree enabled protocol rstp Root ID Priority 24616 Address 188b.9d24.7a80 Cost 3 Port 2316 (Port-channel2) Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Bridge ID Priority 24601 (priority 24576 sys-id-ext 25) Address 188b.9d24.7a80 Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec Aging Time 300 sec	Bridge ID Priority 28702 (priority 28672 sys-id-ext 30) Address 188b.9d24.7a80 Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec Aging Time 300 sec	Bridge ID Priority 28712 (priority 28672 sys-id-ext 40) Address 188b.9d24.7a80 Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec Aging Time 300 sec
Interface Role Sts Cost Prio.Nbr Type Po2 Desg FWD 3 128.2316 P2p Po4 Desg FWD 3 128.2318 P2p	Interface Role Sts Cost Prio.Nbr Type Po2 Root FWD 3 128.2316 P2p Po4 Desg FWD 3 128.2318 P2p	Interface Role Sts Cost Prio.Nbr Type Po2 Root FWD 3 128.2316 P2p Po4 Desg FWD 3 128.2318 P2p
DLS2#	DLS2#	DLS2#

```
DLS2#show spanning-tree vlan 35

VLAN035
  Spanning tree enabled protocol rstp
    Root ID Priority 24611
      Address 188b.9d24.7a80
      This bridge is the root
      Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec

  Bridge ID Priority 24611 (priority 24576 sys-id-ext 35)
    Address 188b.9d24.7a80
    Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
    Aging Time 300 sec

Interface Role Sts Cost Prio.Nbr Type
----- -----
Po2 Desg FWD 3 128.2316 P2p
Po4 Desg FWD 3 128.2318 P2p

DLS2#
```

```
DLS2#show spanning-tree vlan 99

VLAN0099
  Spanning tree enabled protocol rstp
  Root ID    Priority    24675
              Address    18B8.9d24.7a80
              This bridge is the root
              Hello Time   2 sec Max Age 20 sec Forward Delay 15 sec

  Bridge ID Priority    24675 (priority 24576 sys-id-ext 99)
  Address    18B8.9d24.7a80
  Hello Time   2 sec Max Age 20 sec Forward Delay 15 sec
  Aging Time  300 sec

Interface      Role Sts Cost      Prio.Nbr Type
-----+-----+-----+-----+-----+-----+
Po2          Desg FWD 3        128.2316 P2p
Po4          Desg FWD 3        128.2318 P2p

DLS2#
```

Another additional upgrade that we have implemented are primary and backup DHCP servers [15].

```
DLS1(config)#
DLS1(config)#
DLS1(config)#
DLS1(config)# ip dhcp excluded-address 10.11.10.1 10.11.10.10
DLS1(config)# ip dhcp excluded-address 10.11.10.129 10.11.10.255
DLS1(config)# ip dhcp pool DLS1VLAN10
DLS1(dhcp-config)#network 10.11.10.0 255.255.255.0
DLS1(dhcp-config)#default-router 10.11.10.5
DLS1(dhcp-config)#lease 0 12 0
DLS1(dhcp-config)#
DLS1(dhcp-config)#
DLS1(dhcp-config)#ip dhcp excluded-address 10.11.15.1 10.11.15.128
DLS1(config)# ip dhcp pool DLS1VLAN15
DLS1(dhcp-config)#network 10.11.15.0 255.255.255.0
DLS1(dhcp-config)#default-router 10.11.15.5
DLS1(dhcp-config)#lease 0 12 0
DLS1(dhcp-config)#
DLS1(dhcp-config)#
DLS1(dhcp-config)#ip dhcp excluded-address 10.11.20.1 10.11.20.10
DLS1(config)# ip dhcp excluded-address 10.11.20.129 10.11.20.255
DLS1(config)# ip dhcp pool DLS1VLAN20
DLS1(dhcp-config)#network 10.11.20.0 255.255.255.0
DLS1(dhcp-config)#default-router 10.11.20.5
DLS1(dhcp-config)#lease 0 12 0
DLS1(dhcp-config)#
DLS1(dhcp-config)#
DLS1(dhcp-config)#ip dhcp excluded-address 10.11.25.1 10.11.25.128
DLS1(config)# ip dhcp pool DLS1VLAN25
DLS1(dhcp-config)#network 10.11.25.0 255.255.255.0
DLS1(dhcp-config)#default-router 10.11.25.5
DLS1(dhcp-config)#lease 0 12 0
DLS1(dhcp-config)#
DLS1(dhcp-config)#
DLS1(dhcp-config)#ip dhcp excluded-address 10.11.30.1 10.11.30.10
DLS1(config)# ip dhcp excluded-address 10.11.30.129 10.11.30.255
DLS1(config)# ip dhcp pool DLS1VLAN30
DLS1(dhcp-config)#network 10.11.30.0 255.255.255.0
DLS1(dhcp-config)#default-router 10.11.30.5
DLS1(dhcp-config)#lease 0 12 0
DLS1(dhcp-config)#
DLS1(dhcp-config)#
DLS1(dhcp-config)#ip dhcp excluded-address 10.11.35.1 10.11.35.128
DLS1(config)# ip dhcp pool DLS1VLAN35
DLS1(dhcp-config)#network 10.11.35.0 255.255.255.0
DLS1(dhcp-config)#default-router 10.11.35.5
DLS1(dhcp-config)#lease 0 12 0
DLS1(dhcp-config)#
DLS1(dhcp-config)#
DLS1(dhcp-config)#ip dhcp excluded-address 10.11.40.1 10.11.40.10
DLS1(config)# ip dhcp pool DLS1VLAN40
DLS1(dhcp-config)#network 10.11.40.0 255.255.255.0
DLS1(dhcp-config)#default-router 10.11.40.5
DLS1(dhcp-config)#lease 0 12 0
DLS1(dhcp-config)#
DLS1(dhcp-config)#
DLS1(dhcp-config)#ip dhcp excluded-address 10.11.99.1 10.11.99.10
DLS1(config)# ip dhcp pool DLS1VLAN99
DLS1(dhcp-config)#network 10.11.99.0 255.255.255.128
DLS1(dhcp-config)#default-router 10.11.99.5
DLS1(dhcp-config)#lease 0 12 0
```

```

DLS2(config)#ip dhcp excluded-address 10.11.10.1 10.11.10.10
DLS2(config)#ip dhcp pool DLS2VLAN10
DLS2(dhcp-config)#network 10.11.10.0 255.255.255.0
DLS2(dhcp-config)#default-router 10.11.10.5
DLS2(dhcp-config)#lease 0 12 0
DLS2(dhcp-config)#exit
DLS2(config)#
DLS2(config)#
DLS2(config)#ip dhcp excluded-address 10.11.15.1 10.11.15.10
DLS2(config)#ip dhcp excluded-address 10.11.15.129 10.11.15.255
DLS2(config)#ip dhcp pool DLS2VLAN15
DLS2(dhcp-config)#network 10.11.15.0 255.255.255.0
DLS2(dhcp-config)#default-router 10.11.15.5
DLS2(dhcp-config)#lease 0 12 0
DLS2(dhcp-config)#exit
DLS2(config)#
DLS2(config)#
DLS2(config)#ip dhcp excluded-address 10.11.20.1 10.11.20.10
DLS2(config)#ip dhcp pool DLS2VLAN20
DLS2(dhcp-config)#network 10.11.20.0 255.255.255.0
DLS2(dhcp-config)#default-router 10.11.20.5
DLS2(dhcp-config)#lease 0 12 0
DLS2(dhcp-config)#exit
DLS2(config)#
DLS2(config)#
DLS2(config)#ip dhcp excluded-address 10.11.25.1 10.11.25.10
DLS2(config)#ip dhcp excluded-address 10.11.25.129 10.11.25.255
DLS2(config)#ip dhcp pool DLS2VLAN25
DLS2(dhcp-config)#network 10.11.25.0 255.255.255.0
DLS2(dhcp-config)#default-router 10.11.25.5
DLS2(dhcp-config)#lease 0 12 0
DLS2(dhcp-config)#exit
DLS2(config)#
DLS2(config)#
DLS2(config)#ip dhcp excluded-address 10.11.30.1 10.11.30.10
DLS2(config)#ip dhcp pool DLS2VLAN30
DLS2(dhcp-config)#network 10.11.30.0 255.255.255.0
DLS2(dhcp-config)#default-router 10.11.30.5
DLS2(dhcp-config)#lease 0 12 0
DLS2(dhcp-config)#exit
DLS2(config)#
DLS2(config)#
DLS2(config)#ip dhcp excluded-address 10.11.35.1 10.11.35.10
DLS2(config)#ip dhcp excluded-address 10.11.35.129 10.11.35.255
DLS2(config)#ip dhcp pool DLS2VLAN35
DLS2(dhcp-config)#network 10.11.35.0 255.255.255.128
DLS2(dhcp-config)#default-router 10.11.35.5
DLS2(dhcp-config)#lease 0 12 0
DLS2(dhcp-config)#
DLS2(dhcp-config)#
DLS2(dhcp-config)#ip dhcp excluded-address 10.11.40.1 10.11.40.10
DLS2(config)#ip dhcp pool DLS2VLAN40
DLS2(dhcp-config)#network 10.11.40.0.129 255.255.255.128
DLS2(dhcp-config)#default-router 10.11.40.5
DLS2(dhcp-config)#lease 0 12 0
DLS2(dhcp-config)#
DLS2(dhcp-config)#
DLS2(dhcp-config)#ip dhcp excluded-address 10.11.99.1 10.11.99.10
DLS2(config)#ip dhcp pool DLS2VLAN99
DLS2(dhcp-config)#network 10.11.99.0.129 255.255.255.128
DLS2(dhcp-config)#default-router 10.11.99.5
DLS2(dhcp-config)#lease 0 12 0

```

This is setting up HSRP for all VLANs that were configured in the lab [16].

DLS1:

```
Please select a device or type 'exit' to logout:  
[Resuming connection 3 to p7sw1 ... ]  
  
DLS1(config)#  
DLS1(config)#  
DLS1(config)#int vlan 10  
DLS1(config-if)#ip add 10.11.10.1 255.255.255.0  
DLS1(config-if)#standby 10 ip 10.11.10.5  
DLS1(config-if)#standby 10 preempt  
DLS1(config-if)#standby 10 priority 110  
DLS1(config-if)#no shut  
DLS1(config-if)#  
DLS1(config-if)#int vlan 15  
DLS1(config-if)#ip add 10.11.15.1 255.255.255.0  
DLS1(config-if)#standby 15 ip 10.11.15.5  
DLS1(config-if)#no shut  
DLS1(config-if)#  
DLS1(config-if)#int vlan 20  
DLS1(config-if)#ip add 10.11.20.1 255.255.255.0  
DLS1(config-if)#standby 20 ip 10.11.20.5  
DLS1(config-if)#standby 20 preempt  
DLS1(config-if)#standby 20 priority 110  
DLS1(config-if)#no shut  
DLS1(config-if)#  
DLS1(config-if)#int vlan 25  
DLS1(config-if)#ip add 10.11.25.1 255.255.255.0  
DLS1(config-if)#standby 25 ip 10.11.25.5  
DLS1(config-if)#no shut  
DLS1(config-if)#  
DLS1(config-if)#int vlan 30  
DLS1(config-if)#ip add 10.11.30.1 255.255.255.0  
DLS1(config-if)#standby 30 ip 10.11.30.5  
DLS1(config-if)#standby 30 preempt  
DLS1(config-if)#standby 30 priority 110  
DLS1(config-if)#no shut  
DLS1(config-if)#  
DLS1(config-if)#int vlan 35  
DLS1(config-if)#ip add 10.11.35.1 255.255.255.0  
DLS1(config-if)#standby 35 ip 10.11.35.5  
DLS1(config-if)#no shut  
DLS1(config-if)#
```

```
DLS1#show groupd vlan 20
Vlan20 - Group 20
  State is Active
    2 state changes, last state change 00:03:58
  Virtual IP address is 10.11.20.5
  Active virtual MAC address is 0000.0c07.ac14 (MAC In Use)
    Local virtual MAC address is 0000.0c07.ac14 (vl default)
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 0.992 secs
  Preemption enabled
  Active router is local
  Standby router is 10.11.20.2, priority 100 (expires in 8.848 sec)
  Priority 110 (configured 110)
  Group name is "hsrp-V120-20" (default)
DLS1#
```

```
DLSI#show standby vlan 25
Vlan25 - Group 25
  State is Standby
    4 state changes, last state change 00:02:54
  Virtual IP address is 10.11.25.5
  Active virtual MAC address is 0000.0c07.ac19 (MAC Not In Use)
    Local virtual MAC address is 0000.0c07.ac19 (v1 default)
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 1.088 secs
  Preemption disabled
  Active router is 10.11.25.2, priority 110 (expires in 8.896 sec)
  Standby router is local
  Priority 100 (default 100)
  Group name is "hsrp-VL25-25" (default)
DLSI#
```

```
DLSI#show standby vlan 30
Vlan30 - Group 30
  State is Active
    2 state changes, last state change 00:04:41
    Virtual IP address is 10.11.30.5
    Active virtual MAC address is 0000.0c07.acfe (MAC In Use)
      Local virtual MAC address is 0000.0c07.acfe (VI default)
    Hello time 3 sec, hold time 10 sec
    Next hello sent in 2.464 secs
  Preemption enabled
  Active router is local
  Standby router is 10.11.30.2, priority 100 (expires in 8.544 sec)
  Priority 110 (configured 110)
  Group name is "hsrp-Vl30-30" (default)
DLSI#
```

```
Vlan15 - Group 15
 State is Standby
   4 state changes, last state change 00:02:12
 Virtual IP address is 10.11.15.5
 Active virtual MAC address is 0000.0c07.ac0f (MAC Not In Use)
 Local virtual MAC address is 0000.0c07.ac0f (vl1 default)
 Hello time 3 sec, hold time 10 sec
 Next hello sent in 1.376 secs
 Preemption disabled
 Active router is 10.11.15.2, priority 110 (expires in 9.760 sec)
 Standby router is local
 Priority 100 (default 100)
 Group name is "hsrp-Vl15-15" (default)
DIS15
```

DLS2

```
Please select a device or type 'exit' to logout: 6
[Resuming connection 4 to p7sw2 ...]

DLS2>
DLS2>
DLS2>en
DLS2>conf t
Enter configuration commands, one per line. End with CNTL/Z.
DLS2 [config]#int wlan 10
DLS2 [config-if]#ip add 10.11.10.2 255.255.255.0
DLS2 [config-if]#standby 10 ip 10.11.10.5
DLS2 [config-if]#no shut
DLS2 [config-if]#
DLS2 [config-if]#int wlan 15
DLS2 [config-if]#ip add 10.11.15.2 255.255.255.0
DLS2 [config-if]#standby 15 ip 10.11.15.5
DLS2 [config-if]#preempt
DLS2 [config-if]#standby 15 priority 110
DLS2 [config-if]#no shut
DLS2 [config-if]#
DLS2 [config-if]#int wlan 20
DLS2 [config-if]#ip add 10.11.20.2 255.255.255.0
DLS2 [config-if]#standby 20 ip 10.11.20.5
DLS2 [config-if]#no shut
DLS2 [config-if]#
DLS2 [config-if]#int wlan 25
DLS2 [config-if]#ip add 10.11.25.2 255.255.255.0
DLS2 [config-if]#standby 25 ip 10.11.25.5
DLS2 [config-if]#preempt
DLS2 [config-if]#standby 25 priority 110
DLS2 [config-if]#no shut
DLS2 [config-if]#
DLS2 [config-if]#int wlan 30
DLS2 [config-if]#ip add 10.11.30.2 255.255.255.0
DLS2 [config-if]#standby 30 ip 10.11.30.5
DLS2 [config-if]#no shut
DLS2 [config-if]#
DLS2 [config-if]#int wlan 35
DLS2 [config-if]#ip add 10.11.35.2 255.255.255.0
DLS2 [config-if]#standby 35 ip 10.11.35.5
DLS2 [config-if]#preempt
DLS2 [config-if]#standby 35 priority 110
DLS2 [config-if]#no shut
DLS2 [config-if]#
```

```
DLS1#show standby vlan 10
Vlan10 - Group 10
  State is Active
    2 state changes, last state change 00:02:58
  Virtual IP address is 10.11.10.5
  Active virtual MAC address is 0000.0c07.ac0a (MAC In Use)
    Local virtual MAC address is 0000.0c07.ac0a (vl default)
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 2.672 secs
  Preemption enabled
  Active router is local
  Standby router is 10.11.10.2, priority 100 (expires in 11.376 sec)
  Priority 110 (configured 110)
  Group name is "hsrp-Vl10-10" (default)
DLS1#
```

```
DLS2#show standby Vlan15
Vlan15 - Group 15
  State is Active
    1 state change, last state change 00:04:29
    Virtual IP address is 10.11.15.5
    Active virtual MAC address is 0000.0c07.ac0f (MAC In Use)
      Local virtual MAC address is 0000.0c07.ac0f (vl default)
    Hello time 3 sec, hold time 10 sec
    Next hello sent in 0.944 secs
    Preemption enabled
    Active router is local
    Standby router is 10.11.15.1, priority 100 (expires in 9.168 sec)
    Priority 110 (configured 110)
    Group name is "hsrp-Vl15-15" (default)
DLS2#
```

```
DLS2#show standby vlan 20
Vlan20 - Group 20
  State is Standby
    1 state change, last state change 00:04:24
  Virtual IP address is 10.11.20.5
  Active virtual MAC address is 0000.0c07.ac14 (MAC Not In Use)
    Local virtual MAC address is 0000.0c07.ac14 (vl default)
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 1.072 secs
  Preemption disabled
  Active router is 10.11.20.1, priority 110 (expires in 10.336 sec)
  Standby router is local
    Priority 100 (default 100)
  Group name is "hsrp-V120-20" (default)
DLS2#
```

```
DLS2#show standby vlan 25
Vlan25 - Group 25
  State is Active
    1 state change, last state change 00:04:59
    Virtual IP address is 10.11.25.5
    Active virtual MAC address is 0000.0c07.ac19 (MAC In Use)
      Local virtual MAC address is 0000.0c07.ac19 (vl default)
    Hello time 3 sec, hold time 10 sec
    Next hello sent in 0.640 secs
  Preemption enabled
  Active router is local
  Standby router is 10.11.25.1, priority 100 (expires in 10.320 sec)
  Priority 110 (configured 110)
  Group name is "hsrp-VL25-25" (default)
DLS2#[
```

```
DLS2#show standby vlan 30
Vlan30 - Group 30
  State is Standby
    1 state change, last state change 00:05:08
  Virtual IP address is 10.11.30.5
  Active virtual MAC address is 0000.0c07.ac1e (MAC Not In Use)
    Local virtual MAC address is 0000.0c07.ac1e (v1 default)
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 1.072 secs
  Preemption disabled
  Active router is 10.11.30.1, priority 110 (expires in 8.144 sec)
  Standby router is local
  Priority 100 (default 100)
  Group name is "hsrp-V130-30" (default)
```

```
DLS2#show standby vlan 10
Vlan10 - Group 10
  State is Standby
    1 state change, last state change 00:03:31
  Virtual IP address is 10.11.10.5
  Active virtual MAC address is 0000.0c07.ac0a (MAC Not In Use)
    Local virtual MAC address is 0000.0c07.ac0a (via default)
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 1.440 secs
  Preemption disabled
  Active router is 10.11.10.1, priority 110 (expires in 10.208 sec)
  Standby router is local
  Priority 100 (default 100)
  Group name is "hsrp-V110-10" (default)
```

Upgrade Discussion Section

The first upgrade that we have implemented is to connect the distribution level switches with a layer 3 etherchannel [2] [3]. This was done because it would eliminate any layer 2 loops in the topology [2] [4]. A layer 3 link across the distribution switches in the topology would prevent spanning-tree from blocking links that would than create a suboptimal path[6]. Because spanning-tree is now more predictable in terms of blocking links, a more optimized path to upstream devices can be achieved.

The second upgrade that we have implemented is primary and backup DHCP servers for all VLANs configured on both switches [15]. The way that we have set this is up is that the primary DHCP server for the each VLAN will give out addresses .11-.127 and the backup server gave out .129-.254 in the respective /24 subnet. We had reserved the first 10 addresses in each pool for static configuration [5]. The primary DHCP server is setup on the local distribution switch. In this case the primary DHCP server for VLANs on ALS1, VLANs 10,20,30, and 40 is located on DLS1. VLANs 15,25,35,99 configured on ALS2 are located on DLS2. The back-up DHCP servers are the opposite distribution switches (ALS1 backup DHCP is DLS2, ALS2 backup DHCP is DLS1). This setup of primary and backup servers works because of the spanning-tree setup that was implemented so that the local distribution switch is always the root bridge for the local access switch [6]. Setting up this spanning-tree topology is our third upgrade.

The third upgrade that we chosen to implement is configuring Rapid PVST+ to have certain root bridges depending on the VLAN [13]. In our case we wanted to create the most efficient route for traffic [6]. In order to do that, the traffic should flow directly northbound to their specific distribution level switch. In our case, the VLANs configured on ALS1 will have a root bridge of DLS1 and will flow directly to DLS1. Same for the VLANs configured on ALS2, the root bridge will be DLS2 allowing the traffic to go directly to DLS2. How this makes an extremely predictable traffic path is that because the direct northbound links are now root, and the link across the distribution layers is now layer 3, the only layer 2 link that spanning-tree blocks is the diagonal links (ALS1 -> DLS2, ALS2 -> DLS1). This is the reason that the above upgrade of primary and back-up DHCP servers works is that the access layer switches only have access to 1 distribution layer switch at a time. As soon as a distribution switch goes down, spanning-tree will unblock the diagonal link and the hosts will receive DHCP configurations and send traffic through the opposite side distribution switch.

The fourth upgrade that was configured is HSRP. Alongside the Spanning-Tree configuration we have set up HSRP to provide an optimized route[6]. We have setup HSRP to be in an “Active” state on distribution layer switches for VLANs that have the same bridge as root for spanning-tree. For example, in our case, we set up HSRP for VLANs 10,20,30, and 40 to be active on DLS1 and made the DLS1 the root bridge for those identical VLANs [16]. That way the traffic flows from ALS1 to DLS1 to the directly connected core router and does not take any unneeded hops to the opposite side distribution layer switch.

Additional Deliverables:

1. A ping issued from any host in any VLAN will reach the routers (doesn't matter which router).

This is the ping to 172.17.11.6 (The IP's configured between the 2 routers)

```
C:\Windows\System32>ping 172.17.11.6
Pinging 172.17.11.6 with 32 bytes of data:
Reply from 172.17.11.6: bytes=32 time=58ms TTL=254
Reply from 172.17.11.6: bytes=32 time=59ms TTL=254
Reply from 172.17.11.6: bytes=32 time=60ms TTL=254
Reply from 172.17.11.6: bytes=32 time=58ms TTL=254

Ping statistics for 172.17.11.6:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 58ms, Maximum = 60ms, Average = 58ms
C:\Windows\System32>
```

2. A trace issued from any host in any VLAN will reach the routers (doesn't matter which router) using the active HSRP active router.

This is pinging the an interface on R3. The first tracert is through DLS1 SVI which is configured as the "Active" switch. The second tracert I bring down the SVI to force DLS2 to become the "Active".

```
C:\Windows\System32>
C:\Windows\System32>tracert 172.17.11.5
Tracing route to 172.17.11.5 over a maximum of 30 hops
  1      2 ms      2 ms      2 ms  10.11.10.1
  2     87 ms     87 ms     87 ms  172.17.11.5
Trace complete.

C:\Windows\System32>tracert 172.17.11.5
Tracing route to 172.17.11.5 over a maximum of 30 hops
  1      2 ms      2 ms      2 ms  10.11.10.2
  2     <1 ms     <1 ms     <1 ms  172.17.11.9
  3    171 ms    171 ms    170 ms  172.17.11.5
Trace complete.

C:\Windows\System32>
```

3. When the active HSRP router fails, the passive router will switchover. Further, when the active HSRP router comes back up, preemption takes place and the desired active router regains the active role.

```
DLS1(config-if)#do show standby vlan 10
Vlan10 - Group 10
  State is Active
  6 state changes, last state change 00:02:51
  Virtual IP address is 10.11.10.5
  Active virtual MAC address is 0000.0c07.ac0a (MAC In Use)
    Local virtual MAC address is 0000.0c07.ac0a (v1 default)
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 2.288 secs
  Preemption enabled
  Active router is local
  Standby router is 10.11.10.2, priority 100 (expires in 8.416 sec)
  Priority 110 (configured 110)
  Group name is "hsrp-Vl10-10" (default)
DLS1(config-if)#[
```

```

*Mar 23 00:21:46.915: %DUAL-5-NBRCHANGE: EIGRP-IPv4 65505: Neighbor 10.11.10.2 (Vlan10) is down: holding time expired
DLS1>
DLS1>
DLS1>
DLS1>en
DLS1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
DLS1(config)#int vlan 10
DLS1(config-if)#shut
DLS1(config-if)#
*Mar 23 00:22:55.112: %DUAL-5-NBRCHANGE: EIGRP-IPv4 65505: Neighbor 10.11.10.2 (Vlan10) is down: interface down
*Mar 23 00:22:57.104: %LINK-5-CHANGED: Interface Vlan10, changed state to administratively down
*Mar 23 00:22:58.107: %LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan10, changed state to down
*Mar 23 00:22:58.107: %HSRP-5-STATECHANGE: Vlan10 Grp 10 state Active -> Init
DLS1(config-if)#no shut
DLS1(config-if)#
*Mar 23 00:27:53.115: %LINK-3-UPDOWN: Interface Vlan10, changed state to up
*Mar 23 00:27:54.115: %LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan10, changed state to up
*Mar 23 00:27:54.677: %DUAL-5-NBRCHANGE: EIGRP-IPv4 65505: Neighbor 10.11.10.2 (Vlan10) is up: new adjacency
*Mar 23 00:27:56.836: %HSRP-5-STATECHANGE: Vlan10 Grp 10 state Listen -> Active

```

The screenshot above shows that the DLS1 became the active switch for vlan 10 when I brought the SVI back up.

```

DLS1(config-if)#do show standby vlan 10
Vlan10 - Group 10
  State is Init (interface down)
    7 state changes, last state change 00:00:09
  Virtual IP address is 10.11.10.5
  Active virtual MAC address is unknown (MAC Not In Use)
    Local virtual MAC address is 0000.0c07.ac0a (v1 default)
  Hello time 3 sec, hold time 10 sec
  Preemption enabled
  Active router is unknown
  Standby router is unknown
  Priority 110 (configured 110)
  Group name is "hsrp-Vl10-10" (default)
DLS1(config-if)#

```

Above is what the standby looks like for VLAN 10 when I bring down the SVI for VLAN 10.

```

DLS2#show standby vlan 10
Vlan10 - Group 10
  State is Standby
    12 state changes, last state change 00:01:43
  Virtual IP address is 10.11.10.5
  Active virtual MAC address is 0000.0c07.ac0a (MAC Not In Use)
    Local virtual MAC address is 0000.0c07.ac0a (v1 default)
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 1.248 secs
  Preemption disabled
  Active router is 10.11.10.1, priority 110 (expires in 10.400 sec)
  Standby router is local
  Priority 100 (default 100)
  Group name is "hsrp-Vl10-10" (default)
DLS2#

```

This is DLS2 showing the standby configuration waiting for DLS1 SVI 10 to go down.

```

Please select a device or type 'exit' to logout: 6
[Resuming connection 2 to p9sw2 ... ]

DLS2#
*Mar 23 01:16:11.569: %HSRP-5-STATECHANGE: Vlan10 Grp 10 state Standby -> Active
DLS2#
*Mar 23 01:16:14.508: %DUAL-5-NBRCHANGE: EIGRP-IPv4 65505: Neighbor 10.11.10.1 (Vlan10) is down: holding time expired
DLS2#
DLS2#show standby vlan 10
Vlan10 - Group 10
  State is Active
    13 state changes, last state change 00:00:08
  Virtual IP address is 10.11.10.5
  Active virtual MAC address is 0000.0c07.ac0a (MAC In Use)
    Local virtual MAC address is 0000.0c07.ac0a (v1 default)
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 0.160 secs
  Preemption disabled
  Active router is local
  Standby router is unknown
  Priority 100 (default 100)
  Group name is "hsrp-V110-10" (default)
DLS2#

```

This is showing DLS2 HSRP becoming active for VLAN 10 when the DLS1 SVI 10 is brought down.

4. Port security violations will act as anticipated. i.e. The supervisor ports will shut down when a violation occurs and the accounting ports will transition to protect mode.

```

ALS1(config)#
ALS1(config)#
ALS1(config)#
Feb  9 13:18:42.307: %PM-4-ERR_DISABLE: psecure-violation error detected on Gi1/0/18, putting Gi1/0/18 in err-disable state
Feb  9 13:18:42.310: %PORT_SECURITY-2-PSECURE_VIOLATION: Security violation occurred, caused by MAC address 28f1.0e13.ef57 on port GigabitEthernet1/0/18.

```

```

ALS1(config)#
Feb  9 13:18:42.307: %PM-4-ERR_DISABLE: psecure-violation error detected on Gi1/0/18, putting Gi1/0/18 in err-disable state
Feb  9 13:18:42.310: %PORT_SECURITY-2-PSECURE_VIOLATION: Security violation occurred, caused by MAC address 28f1.0e13.ef57 on port GigabitEthernet1/0/18.
ALS1(config)#do show status int G1/0/18
^
* Invalid input detected at '^' marker.

ALS1(config)#do show port-security int G1/0/18
Port Security      : Enabled
Port Status        : Secure-shutdown
Violation Mode    : Shutdown
Aging Time        : 0 mins
Aging Type        : Absolute
SecureStatic Address Aging : Disabled
Maximum MAC Addresses : 1
Total MAC Addresses : 1
Configured MAC Addresses : 1
Sticky MAC Addresses : 0
Last Source Address:Vlan : 28f1.0e13.ef57:30
Security Violation Count : 1

ALS1(config)#

```

```
ALS1(config-if)#shut
ALS1(config-if)#no shut
ALS1(config-if)#do show port-security int G1/0/18
Feb 9 13:23:58.568: %LINK-5-CHANGED: Interface GigabitEthernet1/0/18, changed state to administratively down
Port Security          : Enabled
Port Status            : Secure-down
Violation Mode         : Shutdown
Aging Time             : 0 mins
Aging Type             : Absolute
SecureStatic Address Aging : Disabled
Maximum MAC Addresses : 1
Total MAC Addresses   : 1
Configured MAC Addresses : 1
Sticky MAC Addresses  : 0
Last Source Address:Vlan : 28f1.0e13.ef57:30
Security Violation Count : 1

ALS1(config-if)#
Feb 9 13:24:00.749: %LINK-3-UPDOWN: Interface GigabitEthernet1/0/18, changed state to down
```

The above screenshots show the port being disabled, viewing the status of the port and then re-enabling the port from an err-disabled state.

Enterprise Network Design

Section 1

Please refer to Diagram ???? in the topology section

Section 2

We will provide the subnet info and VLAN info here as to do it on the diagram will be too crowded.

Building 1

The screenshots of the configurations were taken for this building.

Switch	VLANS	L3 VLAN SVI's	IP Subnets (Configured on switch)
ALS1	10,20,30,40,99	N/A	N/A
ALS2	15,25,35,40,99	N/A	N/A
DLS1	10,15,20,25,30,35,40,99	10,15,20,25,30,35,40,99	10.11.10.0/24, 10.11.15.0/24 10.11.20.0/24, 10.11.25.0/24 10.11.30.0/24, 10.11.35.0/24 10.11.40.0/24 10.11.99.0/24
DLS2	10,15,20,25,30,35,40,99	10,15,20,25,30,35,40,99	10.11.10.0/24, 10.11.15.0/24 10.11.20.0/24, 10.11.25.0/24 10.11.30.0/24, 10.11.35.0/24 10.11.40.0/24 10.11.99.0/24

Building 1 to Core Module

Device	IP	Device	IP
C1	172.17.11.17	DLS1	172.17.11.18
C2	172.17.11.1	DLS1	172.17.11.2
C1	172.17.11.9	DLS2	172.17.11.10
C2	172.17.11.5	DLS2	172.17.11.6

Building 2

Switch	VLANS	L3 VLAN SVI's	IP Subnets (Configured on switch)
ALS1	11,21,31,40,99	N/A	N/A
ALS2	16,26,36,40,99	N/A	N/A
DLS1	11,21,31,36,26,36,40,99	11,21,31,36,26,36,40,99	10.11.11.0/24, 10.11.16.0/24 10.11.21.0/24, 10.11.26.0/24 10.11.31.0/24, 10.11.36.0/24 10.11.40.0/24 10.11.99.0/24
DLS2	11,21,31,36,26,36,40,99	11,21,31,36,26,36,40,99	10.11.11.0/24, 10.11.16.0/24 10.11.21.0/24, 10.11.26.0/24 10.11.31.0/24, 10.11.36.0/24 10.11.40.0/24 10.11.99.0/24

Building 2 to Core Module

Device	IP	Device	IP
C1	172.17.11.25	DLS1	172.17.11.26
C2	172.17.11.29	DLS1	172.17.11.30

C1	172.17.11.21	DLS2	172.17.11.22
C2	172.17.11.33	DLS2	172.17.11.34

Building 3

Switch	VLANS	L3 VLAN SVI's	IP Subnets (Configured on switch)
ALS1	12,22,32,40,99	N/A	N/A
ALS2	17,27,37,40,99	N/A	N/A
DLS1	12,22,32,17,27,37,40,99	12,22,32,17,27,37,40,99	10.11.12.0/24, 10.11.17.0/24 10.11.22.0/24, 10.11.27.0/24 10.11.32.0/24, 10.11.37.0/24 10.11.40.0/24 10.11.99.0/24
DLS2	12,22,32,17,27,37,40,99	12,22,32,17,27,37,40,99	10.11.12.0/24, 10.11.17.0/24 10.11.22.0/24, 10.11.27.0/24 10.11.32.0/24, 10.11.37.0/24 10.11.40.0/24 10.11.99.0/24

Building 3 to Core Module

Device	IP	Device	IP
C3	172.17.11.37	DLS1	172.17.11.38
C4	172.17.11.41	DLS1	172.17.11.42
C3	172.17.11.45	DLS2	172.17.11.46
C4	172.17.11.49	DLS2	172.17.11.50

Building 4

Switch	VLANS	L3 VLAN SVI's	IP Subnets (Configured on switch)
ALS1	13,23,33,40,99	N/A	N/A
ALS2	18,28,38,40,99	N/A	N/A
DLS1	13,23,33,18,28,38,40,99	13,23,33,18,28,38,40,99	10.11.13.0/24, 10.11.18.0/24 10.11.23.0/24, 10.11.28.0/24 10.11.33.0/24, 10.11.38.0/24 10.11.40.0/24 10.11.99.0/24
DLS2	13,23,33,18,28,38,40,99	13,23,33,18,28,38,40,99	10.11.13.0/24, 10.11.18.0/24 10.11.23.0/24, 10.11.28.0/24 10.11.33.0/24, 10.11.38.0/24 10.11.40.0/24 10.11.99.0/24

Building 4 to Core Module

Device	IP	Device	IP
C3	172.17.11.53	DLS1	172.17.11.54
C4	172.17.11.57	DLS1	172.17.11.58
C3	172.17.11.61	DLS2	172.17.11.62
C4	172.17.11.65	DLS2	172.17.11.66

Core Module

Device	IP	Device	IP
C1	172.17.11.69	C2	172.17.11.70
C2	172.17.11.73	C3	172.17.11.74
C3	172.17.11.77	C4	172.17.11.78
C4	172.17.11.81	C2	172.17.11.82
C1	172.17.11.85	C3	172.17.11.86

Data Centre Module

Device	IP	Device	IP
C2	172.17.11.109	Server1	172.17.11.110
C3	172.17.11.113	Server1	172.17.11.114
C2	172.17.11.117	Server2	172.17.11.118
C3	172.17.11.121	Server2	172.17.11.122
Server1	172.17.11.125	Server2	172.17.11.126

Internet Edge Module

Device	IP	Device	IP
C1	172.17.11.89	IEM1	172.17.11.90
C4	172.17.11.93	IEM1	172.17.11.94
C1	172.17.11.97	IEM2	172.17.11.98
C4	172.17.11.101	IEM2	172.17.11.102
IEM1	172.17.11.105	IEM2	172.17.11.106

Section 3

a) L3 Routing Protocols

- i) For layer 3 protocols, we have implemented EIGRP across the distribution layer switches as we had made distribution switch to distribution switch connected via routed ports. This will prevent layer 2 loops from forming between the local access switch and both distribution switches [2]. Because of this topology setup, it means that STP will not block the links across the distribution switches. Layer 3 from the distribution layer switches northbound will allow more robust configuration of FHRP protocols going to the core layer. Even if both connections from a distribution switch northbound to the core layer go down then a layer 3 FHRP can route the traffic through the other distribution switch.
- ii) We have also implemented EIGRP on all devices in the core layer as to provide redundancy and provide the lowest cost to get out of the network. EIGRP allows this as EIGRP measures each links cost to provide the most efficient means routing traffic through the network [2]. This will also cut down on manual configuration. The slight downside is that there will be increased overhead of the EIGRP advertisements through the core layer.

b)

i) The type of Spanning-Tree that we would use would be Rapid Spanning-Tree. This is because we want fast convergence when a section of the network goes down. Because we are using local VLANs in this topology, all the VLAN's are terminated at distribution switch. As the VLAN's terminate at their local distribution switch, there would be very few links that are in layer 2 [3]; hence, Rapid PVST+ should handle the traffic without a problem. The use of Rapid PVST+ would also allow different switches to become root for different VLANs, what this would allow for is optimized routes to the core and back again. An example of this would be making the DLS1 switch the root bridge for VLANs 10,20,30, and 40. As well as making DLS1 the active switch for the subnets corresponding to these VLANs, all of the traffic in these VLANs would be switched/routed through DLS1. This helps load balance the network and provides a very predictable path through the network as the VLANs mentioned above would only be routed through DLS1 except for when there is an outage.[6]

ii) An upgrade that we have utilized is a layer 3 link between the distribution layer's as it then can utilize both upstream links to the distribution switches. As well as we had optimized the route for the traffic to take through the distribution layer switches by load balancing between the distribution switches. DLS1 is the primary root bridge for the VLANs 10,20, and 30 and DLS2 is the root bridge for VLANs 15,25, and 35 [6].

c) FHRP's

i) The First Hop Redundancy Protocol that we would use is VRRP. The main reason is that it is not a Cisco proprietary protocol. This would allow for many different vendors of switches/routers to be used in the topology [6] [16]. If we were to use GLBP or HSRP, we would then have to stick with Cisco equipment restricting the flexibility of equipment that can be used in the network. This is the same reason that we decided not to go with GLBP as it is also a Cisco proprietary protocol. GLBP also load balances between routers automatically which can cause a sub-optimal path for packets to take to and from the core layer and back again [6]. Load balancing can be done manually in VRRP by assigning certain VLAN SVIs to different groups and assigning appropriate priorities to the groups. This coupled with manual configuration of Spanning-Tree root bridges can create optimal paths through the network. [13]

ii) The active switches in the topology will be VLAN dependent. For VLAN 10,20,30, and 40 DLS1 will be the active switch. For VLANs 15,25,35, and 99 DLS2 will be the active switch. This is set up in conjunction with root the bridges set up the same way for specific VLANs to have an optimum routing path [6].

d) Link Aggregation

i) All the links present in the topology are 1 GBPS links.

Distribution switch = Cisco 3650 = 24 + 4 ports [9]

Access switch = Cisco 2960X = 28 ports [10]

Total Gigabit Access Layer ports = 48

Total upstream bandwidth to Distribution layer = 4

Access to Distribution oversubscription ratio = 12

Total Gigabit Distribution Layer ports = 48

Total upstream bandwidth to Core layer = 8

Distribution to Core oversubscription ratio = 6

ii) We would implement link aggregation in all sections of our topology. From each access switch to the distribution switch will have an etherchannel bundle of 2 X 1GBPS cables. From the distribution switch to the core switches we have doubled the amount of links to 4 X 1 GPBS. The reasoning behind the number of links used in each section is based off of the “optimized ratio” of 20:1 from access to distribution and 4:1 from distribution to core [2]. Etherchannels allow the ratio to become this low as they aggregate several links into one single link. This allows the load to be spread across several links and allows for better optimization for the resources that given.

e) Layer 2 security features

The layer 2 security features that we would implement is physical port security. We would assign static MAC addresses to all the access ports [7]. This will prevent any rogue machines from plugging into the switch. Assuming that the end devices attached to the access ports will be desktop workstations, the MAC addresses will rarely change, providing a very secure and efficient means of securing the ports.

Appendix

Running configurations of all devices

ALS1:

```
hostname ALS1
!
boot-start-marker
boot-end-marker
!
no ip domain-lookup
vtp domain UOIT
vtp mode transparent
!
spanning-tree mode rapid-pvst
spanning-tree extend system-id
!
vlan internal allocation policy
ascending
!
vlan 10
name L1_Helpdesk
!
vlan 20
name L2_Helpdesk
!
vlan 30
name Supervisors
!
vlan 40
name Shared
!
vlan 50
name VOICE
!
vlan 99
name Management
!
interface Port-channel1
switchport mode trunk
!
interface Port-channel4
switchport mode trunk
!
interface FastEthernet0
no ip address
no ip route-cache
!
interface GigabitEthernet1/0/1
switchport mode trunk
channel-group 1 mode active
!
interface GigabitEthernet1/0/2
switchport mode trunk
channel-group 1 mode active
!
interface GigabitEthernet1/0/3
switchport mode trunk
channel-group 4 mode active
!
interface GigabitEthernet1/0/4
switchport mode trunk
channel-group 4 mode active
!
interface GigabitEthernet1/0/5
shutdown
!
interface GigabitEthernet1/0/6
shutdown
!
interface GigabitEthernet1/0/7
shutdown
!
interface GigabitEthernet1/0/8
shutdown
!
interface GigabitEthernet1/0/9
shutdown
!
interface GigabitEthernet1/0/10
switchport access vlan 10
switchport mode access
spanning-tree portfast
spanning-tree bpduguard enable
!
interface GigabitEthernet1/0/11
switchport access vlan 10
switchport mode access
spanning-tree portfast
spanning-tree bpduguard enable
!
interface GigabitEthernet1/0/12
switchport access vlan 10
switchport mode access
spanning-tree portfast
spanning-tree bpduguard enable
!
interface GigabitEthernet1/0/13
switchport access vlan 20
switchport mode access
spanning-tree portfast
spanning-tree bpduguard enable
!
interface GigabitEthernet1/0/14
switchport access vlan 20
switchport mode access
spanning-tree portfast
spanning-tree bpduguard enable
!
interface GigabitEthernet1/0/15
switchport access vlan 20
switchport mode access
spanning-tree portfast
spanning-tree bpduguard enable
!
interface GigabitEthernet1/0/16
switchport access vlan 20
switchport mode access
spanning-tree portfast
spanning-tree bpduguard enable
!
interface GigabitEthernet1/0/17
switchport access vlan 30
switchport mode access
switchport port-security
switchport port-security mac-
address 28f1.0e13.ef57
spanning-tree portfast
spanning-tree bpduguard enable
!
interface GigabitEthernet1/0/18
switchport access vlan 30
switchport mode access
switchport port-security
spanning-tree portfast
spanning-tree bpduguard enable
!
```

```

interface GigabitEthernet1/0/19
switchport access vlan 40
switchport mode access
switchport voice vlan 50
spanning-tree portfast
spanning-tree bpduguard enable
!
interface GigabitEthernet1/0/20
switchport access vlan 40
switchport mode access
switchport voice vlan 50
spanning-tree portfast
spanning-tree bpduguard enable
!
interface GigabitEthernet1/0/21
switchport access vlan 40
switchport mode access
switchport voice vlan 50
spanning-tree portfast
spanning-tree bpduguard enable
!
interface GigabitEthernet1/0/22
switchport access vlan 40
switchport mode access
switchport voice vlan 50
spanning-tree portfast
spanning-tree bpduguard enable
!
interface GigabitEthernet1/0/23
switchport access vlan 40
switchport mode access
switchport voice vlan 50
spanning-tree portfast
spanning-tree bpduguard enable
!
interface GigabitEthernet1/0/24
switchport access vlan 40
switchport mode access
switchport voice vlan 50
spanning-tree portfast
!
interface Vlan1
no ip address
!
line con 0
line vty 5 15

spanning-tree bpduguard enable
!
interface GigabitEthernet1/0/25
shutdown
!
interface GigabitEthernet1/0/26
shutdown
!
interface GigabitEthernet1/0/27
shutdown
!
interface GigabitEthernet1/0/28
shutdown
!
interface Vlan1
no ip address
!
line con 0
line vty 5 15

```

ALS2:

```

hostname ALS2
!
boot-start-marker
boot-end-marker
!
no ip domain-lookup
vtp domain UOIT
vtp mode transparent
!
spanning-tree mode rapid-pvst
spanning-tree extend system-id
!
vlan internal allocation policy
ascending
!
vlan 15
name Sales
!
vlan 25
name Business
!
vlan 35
name Accounting
!
vlan 40
name Shared

!
vlan 50
name VOICE
!
vlan 99
name Management
!
interface Port-channel3
switchport mode trunk
!
interface Port-channel5
switchport mode trunk
!
interface FastEthernet0
no ip address
shutdown
!
interface GigabitEthernet1/0/1
switchport mode trunk
channel-group 5 mode active
!
interface GigabitEthernet1/0/2
switchport mode trunk
channel-group 5 mode active
!
interface GigabitEthernet1/0/3
shutdown
!
interface GigabitEthernet1/0/4
shutdown
!
interface GigabitEthernet1/0/5
shutdown
!
interface GigabitEthernet1/0/6
shutdown
!
interface GigabitEthernet1/0/7
switchport mode trunk
channel-group 3 mode active
!
interface GigabitEthernet1/0/8
switchport mode trunk
channel-group 3 mode active
!
interface GigabitEthernet1/0/9
shutdown
!
interface GigabitEthernet1/0/10
switchport access vlan 15
switchport mode access
spanning-tree portfast

```

```

spanning-tree bpduguard enable
!
interface GigabitEthernet1/0/11
switchport access vlan 15
switchport mode access
spanning-tree portfast
spanning-tree bpduguard enable
!
interface GigabitEthernet1/0/12
switchport access vlan 15
switchport mode access
spanning-tree portfast
spanning-tree bpduguard enable
!
interface GigabitEthernet1/0/13
switchport access vlan 25
switchport mode access
spanning-tree portfast
spanning-tree bpduguard enable
!
interface GigabitEthernet1/0/14
switchport access vlan 25
switchport mode access
spanning-tree portfast
spanning-tree bpduguard enable
!
interface GigabitEthernet1/0/15
switchport access vlan 25
switchport mode access
spanning-tree portfast
spanning-tree bpduguard enable
!
interface GigabitEthernet1/0/16
switchport access vlan 25
switchport mode access
spanning-tree portfast
spanning-tree bpduguard enable
!
interface GigabitEthernet1/0/17
switchport access vlan 35
switchport mode access
spanning-tree portfast
spanning-tree bpduguard enable
maximum 3
switchport port-security
switchport port-security violation
protect
spanning-tree portfast
spanning-tree bpduguard enable
!
interface GigabitEthernet1/0/18
switchport access vlan 35
switchport mode access
switchport port-security
maximum 3
switchport port-security
switchport port-security violation
protect
spanning-tree portfast
spanning-tree bpduguard enable
!
interface GigabitEthernet1/0/19
switchport access vlan 40
switchport mode access
switchport voice vlan 50
spanning-tree portfast
spanning-tree bpduguard enable
!
interface GigabitEthernet1/0/20
switchport access vlan 40
switchport mode access
switchport voice vlan 50
spanning-tree portfast
spanning-tree bpduguard enable
!
interface GigabitEthernet1/0/21
switchport access vlan 40
switchport mode access
switchport voice vlan 50
spanning-tree portfast
spanning-tree bpduguard enable
!
interface GigabitEthernet1/0/22
switchport access vlan 40
switchport mode access
switchport voice vlan 50
spanning-tree portfast
spanning-tree bpduguard enable
!
interface GigabitEthernet1/0/23
switchport access vlan 40
switchport mode access
switchport voice vlan 50
spanning-tree portfast
spanning-tree bpduguard enable
!
interface GigabitEthernet1/0/24
switchport access vlan 40
switchport mode access
switchport voice vlan 50
spanning-tree portfast
spanning-tree bpduguard enable
!
interface GigabitEthernet1/0/25
shutdown
!
interface GigabitEthernet1/0/26
shutdown
!
interface GigabitEthernet1/0/27
shutdown
!
interface GigabitEthernet1/0/28
shutdown
!
interface Vlan1
no ip address
shutdown
!
line con 0
line vty 5 15

```

```

hostname DLS1
!
boot-start-marker
boot-end-marker
!
vrf definition Mgmt-vrf
!
address-family ipv4
exit-address-family
!
address-family ipv6
exit-address-family
!
ip routing
!
ip dhcp excluded-address
10.11.10.1 10.11.10.10
ip dhcp excluded-address
10.11.10.129 10.11.10.255
ip dhcp excluded-address
10.11.15.1 10.11.15.128
ip dhcp excluded-address
10.11.20.1 10.11.20.10
ip dhcp excluded-address
10.11.20.129 10.11.20.255
ip dhcp excluded-address
10.11.25.1 10.11.25.128
ip dhcp excluded-address
10.11.30.1 10.11.30.10
ip dhcp excluded-address
10.11.30.129 10.11.30.255
ip dhcp excluded-address
10.11.35.1 10.11.35.128
ip dhcp excluded-address
10.11.40.1 10.11.40.10
ip dhcp excluded-address
10.11.99.1 10.11.99.10
!
ip dhcp pool DLS1VLAN10
network 10.11.10.0
255.255.255.0
default-router 10.11.10.5
lease 0 12
!
ip dhcp pool DLS1VLAN15
network 10.11.15.0
255.255.255.0
default-router 10.11.15.5
lease 0 12
!
ip dhcp pool DLS1VLAN20
network 10.11.20.0
255.255.255.0
default-router 10.11.20.5
lease 0 12
!
ip dhcp pool DLS1VLAN25
network 10.11.25.0
255.255.255.0
default-router 10.11.25.5
lease 0 12
!
ip dhcp pool DLS1VLAN30
network 10.11.30.0
255.255.255.0
default-router 10.11.30.5
lease 0 12
!
ip dhcp pool DLS1VLAN35
network 10.11.35.0
255.255.255.0
default-router 10.11.35.5
lease 0 12
!
ip dhcp pool DLS1VLAN40
network 10.11.40.0
255.255.255.0
default-router 10.11.40.5
lease 0 12
!
ip dhcp pool DLS1VLAN99
network 10.11.99.0
255.255.255.128
default-router 10.11.99.5
lease 0 12
!
qos queue-softmax-multiplier 100
vtp domain UOIT
vtp mode transparent
!
spanning-tree mode rapid-pvst
spanning-tree extend system-id
spanning-tree vlan 10,20,30,40
priority 24576
spanning-tree vlan 15,25,35,99
priority 28672
hw-switch switch 1 logging
onboard message level 3
!
vlan 10
name L1_Helpdesk
!
vlan 15
name Sales
!
vlan 20
name L2_Helpdesk
!
vlan 25
name Business
!
vlan 30
name Supervisors
!
vlan 35
name Accounting
!
vlan 40
name Shared
!
vlan 50
name VOICE
!
vlan 99
name Management
!
interface Port-channel1
switchport mode trunk
!
interface Port-channel5
switchport mode trunk
!
interface Port-channel7
no switchport
ip address 172.17.11.13
255.255.255.252
!
interface GigabitEthernet0/0
vrf forwarding Mgmt-vrf
no ip address
negotiation auto
!
interface GigabitEthernet1/0/1
switchport mode trunk
channel-group 1 mode active
!
interface GigabitEthernet1/0/2

```

```

switchport mode trunk
channel-group 1 mode active
!
interface GigabitEthernet1/0/3
no switchport
no ip address
channel-group 7 mode desirable
!
interface GigabitEthernet1/0/4
no switchport
no ip address
channel-group 7 mode desirable
!
interface GigabitEthernet1/0/5
shutdown
!
interface GigabitEthernet1/0/6
shutdown
!
interface GigabitEthernet1/0/7
switchport mode trunk
channel-group 5 mode active
!
interface GigabitEthernet1/0/8
switchport mode trunk
channel-group 5 mode active
!
interface GigabitEthernet1/0/9
shutdown
!
interface GigabitEthernet1/0/10
shutdown
!
interface GigabitEthernet1/0/11
shutdown
!
interface GigabitEthernet1/0/12
shutdown
!
interface GigabitEthernet1/0/13
shutdown
!
interface GigabitEthernet1/0/14
shutdown
!
interface GigabitEthernet1/0/15
shutdown
!
interface GigabitEthernet1/0/16

shutdown
!
interface GigabitEthernet1/0/17
shutdown
!
interface GigabitEthernet1/0/18
no switchport
ip address 172.17.11.2
255.255.255.0
standby 15 ip 10.11.15.5
!
interface Vlan15
ip address 10.11.15.1
255.255.255.0
standby 15 priority 110
standby 15 preempt
!
interface Vlan20
ip address 10.11.20.1
255.255.255.0
standby 20 ip 10.11.20.5
standby 20 priority 110
standby 20 preempt
!
interface Vlan25
ip address 10.11.25.1
255.255.255.0
standby 25 ip 10.11.25.5
!
interface Vlan30
ip address 10.11.30.1
255.255.255.0
standby 30 ip 10.11.30.5
standby 30 priority 110
standby 30 preempt
!
interface Vlan35
ip address 10.11.35.1
255.255.255.0
standby 35 ip 10.11.35.5
!
interface Vlan40
ip address 10.11.40.1
255.255.255.0
standby 40 ip 10.11.40.5
standby 40 priority 110
standby 40 preempt
!
interface Vlan99
ip address 10.11.99.1
255.255.255.0
standby 99 ip 10.11.99.5
standby 99 preempt
!
router eigrp 65505
network 10.0.0.0
network 172.17.11.0 0.0.0.3
network 172.17.11.4 0.0.0.3
network 172.17.11.8 0.0.0.3

```

auto-summary	line con 0	line aux 0
!	stopbits 1	line vty 5 15
DLS2:		
hostname DLS2	lease 0 12	spanning-tree vlan 15,25,35,99
!	!	priority 24576
ip routing	ip dhcp pool DLS2VLAN25	!
!	network 10.11.25.0	vlan 10
ip dhcp excluded-address	255.255.255.0	name L1_Helpdesk
10.11.10.1 10.11.10.10	default-router 10.11.25.5	!
ip dhcp excluded-address	lease 0 12	vlan 15
10.11.15.1 10.11.15.10	!	name Sales
ip dhcp excluded-address	ip dhcp pool DLS2VLAN30	!
10.11.15.129 10.11.15.255	network 10.11.30.0	vlan 20
ip dhcp excluded-address	255.255.255.0	name L2_Helpdesk
10.11.20.1 10.11.20.10	default-router 10.11.30.5	!
ip dhcp excluded-address	lease 0 12	vlan 25
10.11.25.1 10.11.25.10	!	name Business
ip dhcp excluded-address	ip dhcp pool DLS2VLAN35	!
10.11.25.129 10.11.25.255	network 10.11.35.0	vlan 30
ip dhcp excluded-address	255.255.255.128	name Supervisors
10.11.30.1 10.11.30.10	default-router 10.11.35.5	!
ip dhcp excluded-address	lease 0 12	vlan 35
10.11.35.1 10.11.35.10	!	name Accounting
ip dhcp excluded-address	ip dhcp pool DLS2VLAN40	!
10.11.35.129 10.11.35.255	network 10.11.40.128	vlan 40
ip dhcp excluded-address	255.255.255.128	name Shared
10.11.40.1 10.11.40.10	default-router 10.11.40.5	!
ip dhcp excluded-address	lease 0 12	vlan 50
10.11.99.1 10.11.99.10	!	name VOICE
!	ip dhcp pool DLS2VLAN99	!
ip dhcp pool DLS2VLAN10	network 10.11.99.128	vlan 99
network 10.11.10.0	255.255.255.128	name Management
255.255.255.0	default-router 10.11.99.5	!
default-router 10.11.10.5	lease 0 12	interface Port-channel3
lease 0 12	!	switchport mode trunk
!	qos queue-softmax-multiplier 100	!
ip dhcp pool DLS2VLAN15	vtp domain UOIT	interface Port-channel4
network 10.11.15.0	vtp mode transparent	switchport mode trunk
255.255.255.0	!	!
default-router 10.11.15.5	diagnostic bootup level minimal	interface Port-channel7
lease 0 12	!	no switchport
!	spanning-tree mode rapid-pvst	ip address 172.17.11.14
ip dhcp pool DLS2VLAN20	spanning-tree extend system-id	255.255.255.252
network 10.11.20.0	spanning-tree vlan 10,20,30,40	!
255.255.255.0	priority 28672	interface GigabitEthernet0/0
default-router 10.11.20.5		vrf forwarding Mgmt-vrf

```
no ip address
negotiation auto
!
interface GigabitEthernet1/0/1
switchport mode trunk
channel-group 4 mode active
!
interface GigabitEthernet1/0/2
switchport mode trunk
channel-group 4 mode active
!
interface GigabitEthernet1/0/3
no switchport
no ip address
channel-group 7 mode desirable
!
interface GigabitEthernet1/0/4
no switchport
no ip address
channel-group 7 mode desirable
!
interface GigabitEthernet1/0/5
shutdown
!
interface GigabitEthernet1/0/6
shutdown
!
interface GigabitEthernet1/0/7
switchport mode trunk
channel-group 3 mode active
!
interface GigabitEthernet1/0/8
switchport mode trunk
channel-group 3 mode active
!
interface GigabitEthernet1/0/9
shutdown
!
interface GigabitEthernet1/0/10
shutdown
!
interface GigabitEthernet1/0/11
shutdown
!
interface GigabitEthernet1/0/12
shutdown
!
interface GigabitEthernet1/0/13
shutdown

!
interface GigabitEthernet1/0/14
shutdown
!
interface GigabitEthernet1/0/15
shutdown
!
interface GigabitEthernet1/0/16
shutdown
!
interface GigabitEthernet1/0/17
shutdown
!
interface GigabitEthernet1/0/18
no switchport
ip address 172.17.11.10
255.255.255.252
!
interface GigabitEthernet1/0/19
shutdown
!
interface GigabitEthernet1/0/20
shutdown
!
interface GigabitEthernet1/0/21
shutdown
!
interface GigabitEthernet1/0/22
shutdown
!
interface GigabitEthernet1/0/23
shutdown
!
interface GigabitEthernet1/0/24
shutdown
!
interface GigabitEthernet1/1/1
shutdown
!
interface GigabitEthernet1/1/2
shutdown
!
interface GigabitEthernet1/1/3
shutdown
!
interface GigabitEthernet1/1/4
shutdown
!
interface Vlan1
```

no ip address
shutdown
!
interface Vlan10
ip address 10.11.10.2
255.255.255.0
standby 10 ip 10.11.10.5
!
interface Vlan15
ip address 10.11.15.2
255.255.255.0
standby 15 ip 10.11.15.5
standby 15 priority 110
standby 15 preempt
!
interface Vlan20
ip address 10.11.20.2
255.255.255.0
standby 20 ip 10.11.20.5
!
interface Vlan25
ip address 10.11.25.2
255.255.255.0
standby 25 ip 10.11.25.5
standby 25 priority 110
standby 25 preempt
!
interface Vlan30
ip address 10.11.30.2
255.255.255.0
standby 30 ip 10.11.30.5
!
interface Vlan35
ip address 10.11.35.2
255.255.255.0
standby 35 ip 10.11.35.5
standby 35 priority 110
standby 35 preempt
!
interface Vlan40
ip address 10.11.40.2
255.255.255.0
standby 40 ip 10.11.40.5
standby 40 preempt
!
interface Vlan99
ip address 10.11.99.2
255.255.255.0
standby 99 ip 10.11.99.5

```
standby 99 priority 110
standby 99 preempt
!
router eigrp 65505
  network 10.0.0.0
  network 172.17.11.0 0.0.0.3
network 172.17.11.4 0.0.0.3
network 172.17.11.8 0.0.0.3
auto-summary

Router 1:
hostname R1
!
boot-start-marker
boot-end-marker
!
!
no aaa new-model
memory-size iomem 10
!
ip cef
no ipv6 cef
!
interface Embedded-Service-
Engine0/0
  no ip address
  shutdown
!
interface GigabitEthernet0/0
```

R3:

hostname R3

!

boot-start-marker

```
boot-end-marker
interface Embedded-Service-
Engine0/0
no ip address
shutdown
!
interface GigabitEthernet0/0
no ip address
shutdown
duplex auto
speed auto
!
interface GigabitEthernet0/1
ip address 172.17.11.9
255.255.255.252
duplex auto
speed auto
!
interface Serial0/0/0
ip address 172.17.11.6
255.255.255.252
clock rate 9600
!
interface Serial0/0/1
no ip address
shutdown
!
interface Serial0/1/0
no ip address
shutdown
!
clock rate 2000000
!
interface Serial0/1/1
no ip address
shutdown
clock rate 2000000
!
!
router eigrp 65505
network 172.17.11.4 0.0.0.3
network 172.17.11.8 0.0.0.3
auto-summary
```

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