TLEN5370 - Lab 1

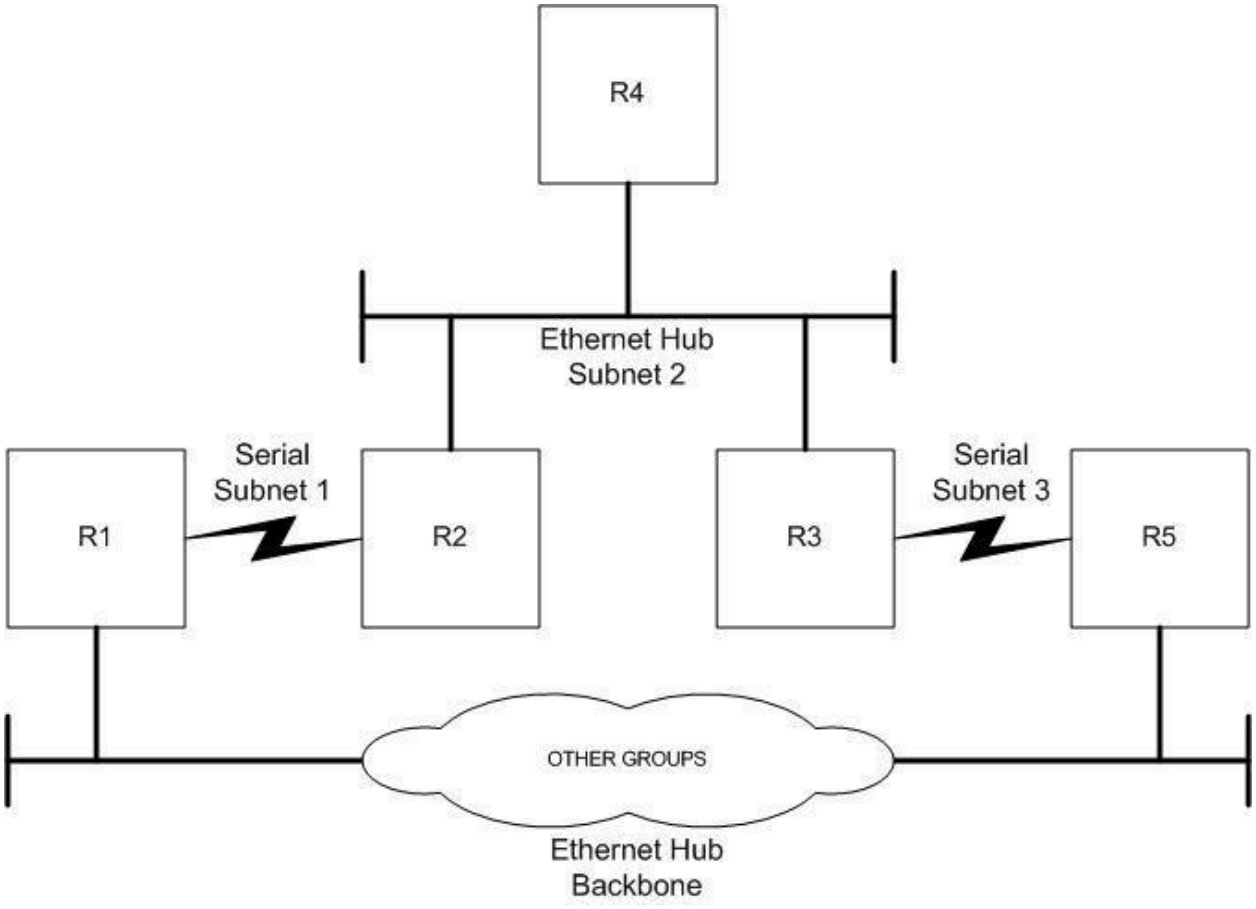
Logistics

- Wire the lab according to the diagram below. Be sure that the subnet 2 'hub' is actually a switch with VLAN capabilities.
- Write erase the routers and start from scratch with a default config.
- Connect to your routers with the console and console cables or by configuring the terminal server.

Objectives

- Set up RIP Routing
- Set up OSPF Single Area Routing
- Set up OSPF Multi Area Routing
- Set up OSPF/RIP route redistribution

Network Topology



Useful Cisco Commands

- show ip route
- clear ip route *

- reload
- show running-config

Objective 1
Configure OSI Layers 1-3 on the routers. Be sure you have a VLAN capable ethernet switch for subnet 2.

- Each group will use X.0.0.0/8 for their address space where X is the group number. 3.0.0.0/8
- Configure IP addressing on you routers. /32s for loopbacks, /30s or /31s for serial segments and /24s for ethernet segments.
- Configure IP addressing of backbone ethernet to be 200.200.200.xr/24, where x is your group number, r is the router number.
- Be sure to name your routers using the scheme xRr, where x is your group number, r is the router number. 3R1,3R2,3R3,3R4,3R5
- Question 1.1 - How do you tell if all your routers interfaces are 'up' and working. Paste output from one router showing this.
    - show ip int brief

```
[OK]
3R1#sh ip int br
Interface                  IP-Address      OK? Method Status                Protocol
GigabitEthernet0/0         unassigned      YES unset  administratively down down
GigabitEthernet0/1         unassigned      YES unset  administratively down down
Serial0/2/0                3.0.0.1         YES manual up                    up
Serial0/2/1                unassigned      YES unset  down                  down
Serial0/3/0                unassigned      YES unset  administratively down down
Serial0/3/1                unassigned      YES unset  administratively down down
FastEthernet1/0            unassigned      YES unset  administratively down down
FastEthernet2/0            unassigned      YES unset  administratively down down
3R1#
```

    - It will say up in the output.
- Question 1.2 - How do you configure the box to never time out the console connection. Paste the relevant config section.
    - conf t
    - line console 0
    - session-timeout 0

Objective 2
Configure RIP routing in your domain.

- Configure RIPv2 on all 5 routers

```
3R5#sh run | sec rip
 description "Uplink to R3"
router rip
 version 2
 network 3.0.0.0
 no auto-summary
```

- Question 2.1 - show reachability using 'ping' between R1 and R5.

```
3R5#ping 3.0.0.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 3.0.0.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/4 ms
3R5#ping 3.0.0.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 3.0.0.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/4 ms
3R5#ping 3.0.0.5
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 3.0.0.5, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/4 ms
3R5#ping 3.0.0.6
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 3.0.0.6, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/4 ms
3R5#ping 3.0.1.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 3.0.1.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/4 ms
3R5#ping 3.0.1.3
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 3.0.1.3, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/4 ms
3R5#ping 3.0.1.4
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 3.0.1.4, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/4 ms
3R5#
```

- Question 2.2 - Do not advertise RIP onto the backbone ethernet, show relevant config statements to accomplish this.

```
3R1(config-router)#do sho ru | sec rip
% Ambiguous command:  "sho ru "
3R1(config-router)#do show run | sec rip
router rip
 version 2
 passive-interface GigabitEthernet0/0
 network 3.0.0.0
 no auto-summary
3R1(config-router)#
```

- Question 2.3 - Show successful ping from R5 to R1 (subnet 1 interface) and R1 to R5 (subnet 3 interface.)

```
*Mar  7 00:42:02.539: %SYS-5-CONFIG_I: Configured from console by console3.0.0.4
3R1#ping 3.0.0.6
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 3.0.0.6, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/4 ms
3R1#
```

- Run the following command on your backbone routers.
  - term mon
  - debug ip rip

```
3R5#term mon
% Console already monitors
3R5#debug ip rip
RIP protocol debugging is on
3R5#
```

- To turn off debug you would type 'no debug all'
- Question 2.4 - Observe and log the debug messages for 1 minute. Turn in a sample of the log and a description in your words of what the debug messages mean.

```
3R5#
*Mar  7 02:25:17.980: RIP: sending v2 update to 224.0.0.9 via Serial0/2/0 (3.0.0.6)
*Mar  7 02:25:17.980: RIP: build update entries - suppressing null update
*Mar  7 02:25:41.044: RIP: received v2 update from 3.0.0.5 on Serial0/2/0
*Mar  7 02:25:41.044:      3.0.0.0/30 via 0.0.0.0 in 2 hops
*Mar  7 02:25:41.044:      3.0.1.0/24 via 0.0.0.0 in 1 hops
*Mar  7 02:25:47.008: RIP: sending v2 update to 224.0.0.9 via Serial0/2/0 (3.0.0.6)
*Mar  7 02:25:47.008: RIP: build update entries - suppressing null update
*Mar  7 02:26:10.512: RIP: received v2 update from 3.0.0.5 on Serial0/2/0
*Mar  7 02:26:10.516:      3.0.0.0/30 via 0.0.0.0 in 2 hops
*Mar  7 02:26:10.516:      3.0.1.0/24 via 0.0.0.0 in 1 hops
*Mar  7 02:26:14.048: RIP: sending v2 update to 224.0.0.9 via Serial0/2/0 (3.0.0.6)
*Mar  7 02:26:14.048: RIP: build update entries - suppressing null update
3R5#no debug all
All possible debugging has been turned off
3R5#
```

- Question 2.5 - Using the log from 2.4 how do you know RIP is not being advertised to the backbone?

```
3R1(config-if)#end
3R1#
*Mar  7 00:49:36.243: %SYS-5-CONFIG_I: Configured from console by console
*Mar  7 00:49:36.331: RIP: ignored v1 packet from 200.200.200.15 (not enabled on GigabitEthernet0/0)
3R1#
*Mar  7 00:49:39.463: RIP: received v2 update from 3.0.0.2 on Serial0/2/0
```

- Enable RIP fully on the backbone network.
- Work with other groups to ensure interpod connectivity.
- Question 2.6 - Can you reach other groups routers via ping? Why, why not?
  - yes because rip is enabled on the other devices and has a route to the other routers.
- Work with other groups to fix any interpod connectivity problems.
- Question 2.7 - Write up a short description of how you fixed any interpod connectivity problems.
  - There was no errors as of our testing
- Question 2.8 - Write up a short hypothesize on the timeframe for the next instruction using your working knowledge of RIP.
  - It takes approximately 30 sec to use the other route

- 'Fail' the link between R3 and R5 by unplugging it. How long before R3 can reach R5? Use logging or debug as necessary to understand the sequence of events.
    - ~30 seconds
- Question 2.9 - Show and explain the actual timeframe using your logs for support. Explain any difference from your hypothesis.
    - The difference from our hypothesis is that it took way less time to converge. It was converging with other networks that also had RIP enabled. It did a ping to 224.0.0.9 which is a multicast advertising that it needs a new route.

```
*Mar  7 02:54:35.900: %LINK-3-UPDOWN: Interface Serial0/2/0, changed state to down
*Mar  7 02:54:36.848: RIP: received v2 update from 200.200.200.41 on GigabitEthernet0/0
*Mar  7 02:54:36.848:      4.0.0.1/32 via 0.0.0.0 in 1 hops
*Mar  7 02:54:36.848:      4.0.0.2/32 via 0.0.0.0 in 2 hops
*Mar  7 02:54:36.848:      4.0.0.4/32 via 0.0.0.0 in 3 hops
*Mar  7 02:54:36.848:      4.0.1.0/24 via 0.0.0.0 in 2 hops
*Mar  7 02:54:36.848:      4.0.2.0/30 via 0.0.0.0 in 1 hops
*Mar  7 02:54:36.900: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/2/0, changed state to down
*Mar  7 02:54:37.276: RIP: sending v2 update to 224.0.0.9 via GigabitEthernet0/0 (200.200.200.35)
*Mar  7 02:54:37.276: RIP: build update entries
*Mar  7 02:54:37.276:   3.0.0.4/30 via 0.0.0.0, metric 16, tag 0
*Mar  7 02:54:37.276:   3.0.1.0/24 via 0.0.0.0, metric 16, tag 0
*Mar  7 02:54:37.900: RIP: sending v2 flash update to 224.0.0.9 via GigabitEthernet0/0 (200.200.200.35)
*Mar  7 02:54:37.900: RIP: build flash update entries
```


- Plug the link back in and wait for the network to converge.
    - It took 15 seconds

```
*Mar  7 03:06:10.980: %LINK-3-UPDOWN: Interface Serial0/2/0, changed state to up
*Mar  7 03:06:11.980: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/2/0, changed state to up
*Mar  7 03:06:11.980: RIP: sending request on Serial0/2/0 to 224.0.0.9
*Mar  7 03:06:11.980: RIP: received v2 request from 3.0.0.5 on Serial0/2/0
*Mar  7 03:06:11.980: RIP: sending update with long TTL
*Mar  7 03:06:11.980: RIP: sending v2 update to 3.0.0.5 via Serial0/2/0 (3.0.0.6)
*Mar  7 03:06:11.980: RIP: build update entries
```

```
*Mar  7 03:06:27.820:      4.0.2.4/30 via 0.0.0.0 in 1 hops
*Mar  7 03:06:29.296: RIP: received v2 update from 200.200.200.21 on GigabitEthernet0/0
*Mar  7 03:06:29.296:      2.0.0.1/32 via 0.0.0.0 in 1 hops
*Mar  7 03:06:29.296:      2.0.0.2/32 via 0.0.0.0 in 2 hops
*Mar  7 03:06:29.296:      2.0.0.4/32 via 0.0.0.0 in 3 hops
*Mar  7 03:06:29.296:      2.2.2.0/24 via 0.0.0.0 in 2 hops
*Mar  7 03:06:29.296:      2.2.3.0/30 via 0.0.0.0 in 1 hops
*Mar  7 03:06:29.824: RIP: sending v2 flash update to 224.0.0.9 via Serial0/2/0 (3.0.0.6)
*Mar  7 03:06:29.824: RIP: build flash update entries
```

- Question 2.10 - Write up a short hypothesis on the timeframe for the next instruction using your working knowledge of RIP.
    - it will take 180-240 seconds
- On the subnet 2 switch, move R3's subnet 2 interface into a new VLAN. How long before R3 can reach R4?
    - It took us ~180 seconds.

- Question 2.11 - Show and explain the actual time frame using your logs for support. Explain any difference from your hypothesis.

```
3R3#
3R3#ping 44.44.44.44
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 44.44.44.44, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/4 ms
3R3#
```

- Fix the VLAN mismatch
    - we did on int Gi 1/0/4
    - no access vlan 3
    - exit

- Question 2.12 - Write up a short hypothesis on the timeframe for the next instruction using your working knowledge of RIP.
  We think it should take somewhere around 240 sec. It will send a flash update with an infinite metric (16).
- 'Fail' R3 by unplugging it. How long before R4 can reach R5? Use logging or debug as necessary to understand the sequence of events.
- Question 2.13 - Show and explain the actual time frame using your logs for support. Explain any difference from your hypothesis.
  - It took 240 seconds to converge.

```
*Mar  7 04:29:34.131: %LINK-3-UPDOWN: Interface Serial0/2/0, changed state to down
*Mar  7 04:29:35.131: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/2/0, changed state to down
*Mar  7 04:29:36.131: RIP: sending v2 flash update to 224.0.0.9 via GigabitEthernet0/0 (200.200.200.35)
*Mar  7 04:29:36.131: RIP: build flash update entries
*Mar  7 04:29:36.131:   3.0.0.4/30 via 0.0.0.0, metric 16, tag 0
*Mar  7 04:29:36.131:   3.0.1.0/24 via 0.0.0.0, metric 16, tag 0
*Mar  7 04:29:36.131:   33.33.33.33/32 via 0.0.0.0, metric 16, tag 0
*Mar  7 04:29:36.131:   44.44.44.44/32 via 0.0.0.0, metric 16, tag 0
*Mar  7 04:29:36.131: RIP: sending v2 flash update to 224.0.0.9 via Loopback0 (55.55.55.55)
*Mar  7 04:29:36.131: RIP: build flash update entries
```

```
*Mar  7 04:33:44.259: RIP: sending v2 update to 224.0.0.9 via GigabitEthernet0/0 (200.200.200.35)
*Mar  7 04:33:44.259: RIP: build update entries
*Mar  7 04:33:44.259:   55.55.55.55/32 via 0.0.0.0, metric 1, tag 0
*Mar  7 04:33:44.671: RIP: received v2 update from 200.200.200.45 on GigabitEthernet0/0
*Mar  7 04:33:44.671:      4.0.0.5/32 via 0.0.0.0 in 1 hops
*Mar  7 04:33:44.895: RIP: received v2 update from 200.200.200.41 on GigabitEthernet0/0
*Mar  7 04:33:44.895:      4.0.0.1/32 via 0.0.0.0 in 1 hops
*Mar  7 04:33:44.895:      4.0.0.2/32 via 0.0.0.0 in 2 hops
*Mar  7 04:33:44.895:      4.0.0.4/32 via 0.0.0.0 in 3 hops
*Mar  7 04:33:44.895:      4.0.1.0/24 via 0.0.0.0 in 2 hops
*Mar  7 04:33:44.895:      4.0.2.0/30 via 0.0.0.0 in 1 hops
*Mar  7 04:33:46.599: RIP: sending v2 update to 224.0.0.9 via Loopback0 (55.55.55.55)
*Mar  7 04:33:46.599: RIP: build update entries
```

- Continue observations, power R3 back on and wait for the network to converge.
- Question 2.14 - Any impact as R3 joins the topology?
  - The routes of R4 converged to prefer anything going to R5 through R3 instead of R2. When the router turned on, RIP realized the hop count was less and chose R3 as the faster route.

```
*Mar  7 04:29:34.131: %LINK-3-UPDOWN: Interface Serial0/2/0, changed state to down
*Mar  7 04:29:35.131: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/2/0, changed state to down
*Mar  7 04:29:36.131: RIP: sending v2 flash update to 224.0.0.9 via GigabitEthernet0/0 (200.200.200.35)
*Mar  7 04:29:36.131: RIP: build flash update entries
*Mar  7 04:29:36.131:   3.0.0.4/30 via 0.0.0.0, metric 16, tag 0
*Mar  7 04:29:36.131:   3.0.1.0/24 via 0.0.0.0, metric 16, tag 0
*Mar  7 04:29:36.131:   33.33.33.33/32 via 0.0.0.0, metric 16, tag 0
*Mar  7 04:29:36.131:   44.44.44.44/32 via 0.0.0.0, metric 16, tag 0
```

- Question 2.15 - Explain the difference if any between the three failure and one recovery scenario.
  - When there is link failure between 3R3 and 3R5 it is faster to converge compared to others when there is complete shutdown it will take 240 seconds and if it is a vlan change the interface still shows up and takes around 180 seconds to reach the loopback.
- Question 2.16 - How did you test the convergence times across these scenarios? Discuss the positives and negatives of this test method.

  - We issued constant pings between the two routers and determined convergence when they could ping each other. It is good because it provides instant feedback of convergence. It is bad because it could mislead what routes have converged and what routes have not. Certain routes can be on different networks and pinging just one network cannot check for all of that.

OBJECTIVE 3

Configure OSPF routing in your domain.

- Remove RIP from all routers, 'no router rip' on each box will do the trick.
- Configure OSPF on your routers, do NOT enable OSPF on any backbone facing links.
- Question 3.1 - show reachability using 'ping' between R1 and R5

```
3R1#ping 55.55.55.55
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 55.55.55.55, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/4 ms
3R1#
```

```
3R5#ping 11.11.11.11
*Mar  7 22:58:29.851: %SYS-5-CONFIG_I: Configured from console by console
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 11.11.11.11, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/4 ms
3R5#
```


- Question 3.2 - Debug OSPF such that you can view the neighbor establishment between 2 routers. Turn in a sample of the log and a description in your words of what is occuring at each stage of the neighbor establishment.

```
*Mar  7 21:28:04.718: OSPF-1 PAK  : rcv. v:2 t:4 l:100 rid:22.22.22.22 aid:0.0.0.0 chk:0 aut:2
 keyid:1 seq:0x65EA5232 from Serial0/2/0
*Mar  7 21:28:05.390: OSPF-1 PAK  : rcv. v:2 t:1 l:48 rid:22.22.22.22 aid:0.0.0.0 chk:0 aut:2
keyid:1 seq:0x65EA5233 from Serial0/2/0
*Mar  7 21:28:15.246: OSPF-1 PAK  : rcv. v:2 t:1 l:48 rid:22.22.22.22 aid:0.0.0.0 chk:0 aut:2
keyid:1 seq:0x65EA523C from Serial0/2/0
*Mar  7 21:28:24.726: OSPF-1 PAK  : rcv. v:2 t:1 l:48 rid:22.22.22.22 aid:0.0.0.0 chk:0 aut:2
keyid:1 seq:0x65EA5246 from Serial0/2/0
*Mar  7 21:28:34.658: OSPF-1 PAK  : rcv. v:2 t:1 l:48 rid:22.22.22.22 aid:0.0.0.0 chk:0 aut:2
keyid:1 seq:0x65EA524F from Serial0/2/0
*Mar  7 21:28:44.602: OSPF-1 PAK  : rcv. v:2 t:1 l:48 rid:22.22.22.22 aid:0.0.0.0 chk:0 aut:2
keyid:1 seq:0x65EA5259 from Serial0/2/0
*Mar  7 21:28:53.806: OSPF-1 PAK  : rcv. v:2 t:1 l:48 rid:22.22.22.22 aid:0.0.0.0 chk:0 aut:2
keyid:1 seq:0x65EA5262 from Serial0/2/0
*Mar  7 21:29:03.262: OSPF-1 PAK  : rcv. v:2 t:1 l:48 rid:22.22.22.22 aid:0.0.0.0 chk:0 aut:2
keyid:1 seq:0x65EA526B from Serial0/2/0
*Mar  7 21:29:12.406: OSPF-1 PAK  : rcv. v:2 t:1 l:48 rid:22.22.22.22 aid:0.0.0.0 chk:0 aut:2
keyid:1 seq:0x65EA5274 from Serial0/2/0
*Mar  7 21:29:21.762: OSPF-1 PAK  : rcv. v:2 t:1 l:48 rid:22.22.22.22 aid:0.0.0.0 chk:0 aut:2
keyid:1 seq:0x65EA527D from Serial0/2/0
*Mar  7 21:29:31.446: OSPF-1 PAK  : rcv. v:2 t:1 l:48 rid:22.22.22.22 aid:0.0.0.0 chk:0 aut:2
keyid:1 seq:0x65EA5287 from Serial0/2/0
```

- Question 3.3 - Provide output and a reason for the current DR/BDR setup of your R2, R3, R4 ethernet link.
    - There is no specific reasoning behind our DR/BDR set up. It was delegated based on our loopback IPs which were assigned according to the router number.

```
3R4#show ip ospf nei

Neighbor ID     Pri   State           Dead Time   Address         Interface
22.22.22.22       1   FULL/BDR        00:00:39    3.0.1.2         GigabitEthernet0/0
33.33.33.33       1   FULL/DROTHER    00:00:39    3.0.1.3         GigabitEthernet0/0
3R4#
```

```
3R3>en
3R3#show ip ospf nei

Neighbor ID     Pri   State           Dead Time   Address         Interface
22.22.22.22       1   FULL/BDR        00:00:37    3.0.1.2         GigabitEthernet0/0
44.44.44.44       1   FULL/DR         00:00:39    3.0.1.4         GigabitEthernet0/0
55.55.55.55       0   FULL/  -        00:00:36    3.0.0.6         Serial0/2/0
3R3#
```

- Question 3.4 - Configure the routers such that R2 is the DR, and R4 is the BDR, and R3 will never compete in an election. Provide show command output showing the new setup/configuration. Did this work after configuration changes or require something additional? Why?
    - It did work but I had to restart the routers first. This is because the DR/BDR/DROTHER was already set from the previous configs and only a restart can update that table.

```
ADING to FULL, Loading Doneen
3R3#sho ip ospf nei

Neighbor ID     Pri   State           Dead Time   Address         Interface
24.44.44.44       1   FULL/BDR        00:00:35    3.0.1.4         GigabitEthernet0/0
32.22.22.22       1   FULL/DR         00:00:32    3.0.1.2         GigabitEthernet0/0
55.55.55.55       0   FULL/  -        00:00:38    3.0.0.6         Serial0/2/0
3R3#
```

```
3R2>en
3R2#show ip ospf nei

Neighbor ID     Pri   State           Dead Time   Address         Interface
13.33.33.33       1   FULL/DROTHER    00:00:38    3.0.1.3         GigabitEtherne
t0/0
24.44.44.44       1   FULL/BDR        00:00:31    3.0.1.4         GigabitEtherne
t0/0
11.11.11.11       0   FULL/  -        00:00:35    3.0.0.1         Serial0/2/0
3R2#
```

- Configure OSPF router authentication on the ethernet R2, R3, and R4 routers. Purposely configure one of the routers to have an incorrect password.
- Question 3.5 - Show relevant debug output which details the authentication issue. Fix the issue.

```
*Mar  7 23:47:11.291: %OSPF-5-ADJCHG: Process 1, Nbr 32.22.22.22 on GigabitEthernet0/0 from FU
LL to DOWN, Neighbor Down: Dead timer expired
*Mar  7 23:47:11.439: %OSPF-5-ADJCHG: Process 1, Nbr 13.33.33.33 on GigabitEthernet0/0 from FU
LL to DOWN, Neighbor Down: Dead timer expired
 (255.255.255.255)
```

When the issue was fixed, the BDR was delegated to the DROTHER and R4 is now set to DROTHER.

- Question 3.6 - Examine the LSA database on a group router. Paste a sample along with a description of each field header.

```
3R5#show ip ospf database

            OSPF Router with ID (55.55.55.55) (Process ID 1)

                Router Link States (Area 0)

Link ID         ADV Router      Age         Seq#       Checksum Link count
11.11.11.11     11.11.11.11     569         0x8000000A 0x00148B 3
13.33.33.33     13.33.33.33     507         0x80000004 0x003702 4
24.44.44.44     24.44.44.44     148         0x80000007 0x003DDA 3
32.22.22.22     32.22.22.22     519         0x80000004 0x008F8C 4
33.33.33.3      33.33.33.3      945         0x80000006 0x0087C1 4
33.33.33.33     33.33.33.33     1687        0x80000008 0x000114 4
44.44.44.44     44.44.44.44     800         0x80000008 0x00010C 2
55.55.55.55     55.55.55.55     557         0x8000000A 0x002D49 3

                Net Link States (Area 0)

Link ID         ADV Router      Age         Seq#       Checksum
3.0.1.2         32.22.22.22     151         0x80000004 0x0071E9
3.0.1.4         24.44.44.44     154         0x80000001 0x00B9CE
3R5#
```


- Link ID is the router ID. ADV router is the source IP of where it got the LSA. Age is how long it has been in the database. Seq# is used to detect old or redundant LSA records. Checksum is an identifier of the OSPF packet. Link count Link count is number of directly connected links.

- Configure your group such that R1 and R5 are ABRs with their backbone links in Area 0 and their group facing links in Area x, where x is group number. All other routers in the group are part of the site area.

```
3R1(config-if)#
*Mar  7 22:45:15.606: %OSPF-5-ADJCHG: Process 1, Nbr 5.0.3.1 on GigabitEthernet0/0 from LOADIN
G to FULL, Loading Done
*Mar  7 22:45:15.606: %OSPF-5-ADJCHG: Process 1, Nbr 200.200.200.51 on GigabitEthernet0/0 from
 LOADING to FULL, Loading Doneend
3R1#show ip route
```

- Question 3.7 - Ping the loopback for R1 from R5, be sure to use the loopback of R5 as the ping source. Cut and paste the command showing this.

```
3R5#ping 11.11.11.11 source 55.55.55.55
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 11.11.11.11, timeout is 2 seconds:
Packet sent with a source address of 55.55.55.55
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/4 ms
3R5#
```


- Question 3.8 - Examine the LSA database and routing table of R1 and R5, how are they the same/different. Why?
  They are the same in that they show all of the neighboring networks in the OSPF database. It shows where these routers can reach.

But, the routing table shows only network IPs, what type of connection it is, and the outgoing interface. It really only shows neighboring connections and is limited off of interface.
While the OSPF database shows all IPs and networks of everything within the database. It shows LSAs 1-3, both networks inside and outside of its own area. It also shows networks by area, which could be useful in identifying which IPs are where.

- Question 3.9 - Ping successfully between your R5 router and another group's R5 router. Cut and paste the results.

```
3R5#ping 5.0.4.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 5.0.4.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
3R5#
```


- Question 3.10 - Write up a short hypothesis on the timeframe for the next instruction using your working knowledge of OSPF.
    - I think it will converge quickly as the convergence time should be less than RIP, there is a table of available routes all the way to the destination already set unlike RIP.
- 'Fail' the link between R3 and R5 by unplugging it. How long before R3 can reach R5. Use logging or debug as necessary to understand the sequence of events and specify how you tested the convergence.
- Question 3.11 - Show and explain the actual time frame using your logs for support. Explain any difference from your hypothesis.

```
keyid:1 seq:0x65EA4BBF from GigabitEthernet0/0
*Mar  8 01:03:14.754: OSPF-1 PAK  : rcv. v:2 t:1 l:56 rid:5.0.3.1 aid:0.0.0.0 chk:0 aut:2 keyi
d:1 seq:0x65EA51D8 from GigabitEthernet0/0
*Mar  8 01:03:14.810: %LINK-3-UPDOWN: Interface Serial0/2/0, changed state to down
*Mar  8 01:03:14.810: OSPF EVENT Se0/2/0: Route adjust
*Mar  8 01:03:14.810: %OSPF-5-ADJCHG: Process 1, Nbr 13.33.33.33 on Serial0/2/0 from FULL to D
OWN, Neighbor Down: Interface down or detached
*Mar  8 01:03:14.810: OSPF-1 EVENT: Query for Serial0/2/0
*Mar  8 01:03:15.810: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/2/0, changed sta
te to down
*Mar  8 01:03:17.082: OSPF-1 PAK  : rcv. v:2 t:1 l:56 rid:200.200.200.51 aid:0.0.0.0 chk:0 aut
:2 keyid:1 seq:0x65EA620E from GigabitEthernet0/0
```

```
keyid:1 seq:0x65EA6188 from GigabitEthernet0/0
*Mar  7 23:19:19.931: %LINK-3-UPDOWN: Interface Serial0/2/0, changed state to down
*Mar  7 23:19:19.931: OSPF EVENT Se0/2/0: Route adjust
*Mar  7 23:19:19.931: %OSPF-5-ADJCHG: Process 1, Nbr 55.55.55.55 on Serial0/2/0 from FULL to D
OWN, Neighbor Down: Interface down or detached
*Mar  7 23:19:19.931: OSPF-1 EVENT: Query for Serial0/2/0
*Mar  7 23:19:20.431: OSPF-1 PAK  : rcv. v:2 t:4 l:76 rid:24.44.44.44 aid:0.0.0.3 chk:0 aut:2
keyid:1 seq:0x65EA618A from GigabitEthernet0/0
*Mar  7 23:19:20.931: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/2/0, changed sta
```

No difference from hypothesis, convergence took ~3 seconds.

- Plug the link back in and wait for the network to converge.
- Question 3.12 - Write up a short hypothesis on the timeframe for the next instruction using your working knowledge of OSPF.
    - It will take 10 seconds for the update.
- On the subnet 2 switch, move R3's subnet 2 interface into a new VLAN. How long before R3 can reach R4.
- Question 3.13 - Show and explain the actual time frame using your logs for support. Explain any difference from your hypothesis.

- It took approximately 6 seconds for convergence. It was faster than our hypothesis.

```
*Mar  8 01:12:28.439: %OSPF-5-ADJCHG: Process 1, Nbr 13.33.33.33 on GigabitEthernet0/0 from FU
LL to DOWN, Neighbor Down: Dead timer expired.
```

```
Gateway of last resort is not set

      3.0.0.0/8 is variably subnetted, 5 subnets, 3 masks
O        3.0.0.0/30 [110/65] via 3.0.1.2, 00:01:59, GigabitEthernet0/0
```

```
      3.0.0.0/8 is variably subnetted, 5 subnets, 3 masks
O IA     3.0.0.0/30 [110/129] via 3.0.0.6, 00:11:44, Serial0/2/0
```

- Question 3.14 - Write up a short hypothesis on the timeframe for the next instruction using your working knowledge of OSPF.
  - We think it will be as fast as the serial disconnection.
- 'Fail' R3 by unplugging it. How long before R4 can reach R5? Use logging or debug as necessary to understand the sequence of events.

```
Gateway of last resort is not set

      3.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
O        3.0.0.0/30 [110/129] via 3.0.0.5, 00:01:19, Serial0/2/0
O        3.0.1.0/24 [110/65] via 3.0.0.5, 00:01:19, Serial0/2/0
```

```
      3.0.0.0/8 is variably subnetted, 3 subnets, 2 masks
O IA     3.0.0.0/30 [110/65] via 200.200.200.31, 00:00:02, GigabitEthernet0/0
O IA     3.0.0.4/30 [110/130] via 200.200.200.31, 00:00:02, GigabitEthernet0/0
O IA     3.0.1.0/24 [110/66] via 200.200.200.31, 00:00:02, GigabitEthernet0/0
```

- Question 3.15 - Show and explain the actual time frame using your logs for support. Explain any difference from your hypothesis.

```
*Mar  8 01:34:27.675: %OSPF-5-ADJCHG: Process 1, Nbr 13.33.33.33 on GigabitEthernet0/0 from FU
LL to DOWN, Neighbor Down: Dead timer expired...!!
Success rate is 40 percent (2/5), round-trip min/avg/max = 1/1/1 ms
3R4#ping 55.55.55.55
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 55.55.55.55, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/4 ms
3R4#
```


Convergence on R5 was around 5 seconds. Convergence on R4 was around 40 seconds due to the dead timer.

- Continue observations, power R3 back on and wait for the network to converge.
- Question 3.16 - Any impact as R3 joins the topology?
  - It changes the next hop on other routers. BDR and DR changed.
- Question 3.17 - Explain the difference if any between the three failure and one recovery scenario.
  - VLAN takes the longest because it still notices the link up.
- Question 3.18 - How did you test the convergence times across these scenarios? Discuss the positives and negatives of this test method.
  - Ping, show ip route, debug ip ospf events.

    - Positives - instant feedback from ping and other show commands
    - Negatives - doesn't show other routers connectivity or routes to make sure there is a full connection.
- Configure your group area to be a stub.
- Question 3.19 - Examine the LSA database and routing table of R1 and R5, how are they same/different from Question 3.8? Explain any differences.
    - Lack of LSA4 entries in the database
- Confirm that you still have full connectivity.

```
3R1#ping 55.55.55.55
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 55.55.55.55, timeout is 2 seconds:
!!!!!
```

OBJECTIVE 4

Configure RIP/OSPF redistribution.

- Change back to a standard area and remove OSPF completely from R4. Remove OSPF from R2 and R3 on the R4 facing link.
- Configure RIP on R4 and on R2 and R3 links facing R4. Be sure to passive interface non RIP interfaces on R2 and R3

```
3R4#sh run | sec rip
router rip
 version 2
 network 3.0.0.0
 network 24.0.0.0
 no auto-summary
3R4#
```

- Question 4.1 - Which routers have full intra group connectivity? Which routers have full inter group connectivity? Why?
    - Intra - Routers 1,2,3,4,5 - 2,3,4 RIP intra group. 1,2,3,5 OSPF intra group (and backbone).
    - Inter - 2,4 - due to RIP and OSPF being configured it acts as a ASBR almost in OSPF
- Configure RIP/OSPF redistribution.
- Question 4.2 - What type of LSA will the RIP networks from a different group show up as on your R1 and R5 routers? Show me an output proving your answer.

```
                Type-5 AS External Link States

Link ID         ADV Router      Age         Seq#       Checksum Tag
3.0.1.0         13.33.33.33     393         0x80000001 0x0088A3 0
3.0.1.0         32.22.22.22     712         0x80000001 0x00C475 0
5.0.1.0         5.0.1.53        395         0x80000004 0x00630C 0
5.0.1.0         5.250.250.250   271         0x80000004 0x0013A1 0
5.200.200.200   5.0.1.53        395         0x80000004 0x008C89 0
5.250.250.250   5.250.250.250   271         0x80000004 0x00C301 0
24.44.44.44     13.33.33.33     393         0x80000001 0x00CFC3 0
3R1#
```

- Question 4.3 - What LSA do the R1 and R5 routers in your group use to route to the RIP networks in a different group. Show me an output proving your answer.

```
                Type-5 AS External Link States

Link ID         ADV Router      Age         Seq#       Checksum Tag
3.0.1.0         13.33.33.33     962         0x80000001 0x0088A3 0
3.0.1.0         32.22.22.22     1280        0x80000001 0x00C475 0
5.0.1.0         5.0.1.53        965         0x80000004 0x00630C 0
5.0.1.0         5.250.250.250   841         0x80000004 0x0013A1 0
5.200.200.200   5.0.1.53        965         0x80000004 0x008C89 0
5.250.250.250   5.250.250.250   841         0x80000004 0x00C301 0
24.44.44.44     13.33.33.33     962         0x80000001 0x00CFC3 0
3R2#
```

- Question 4.4 - Traceroute between your R4 router's loopback and a different group's R4 router loopback. Show me the output. For each router in the path between R5 routers explain how the router knew where to forward it onto next. I'm interested in understanding the routing updates and LSA types flowing along the path.

```
3R4>
3R4>
3R4>
3R4>en
3R4#traceroute 5.200.200.200
Type escape sequence to abort.
Tracing the route to 5.200.200.200
VRF info: (vrf in name/id, vrf out name/id)
  1 3.0.1.2 0 msec
    3.0.1.3 0 msec
    3.0.1.2 0 msec
  2 3.0.0.6 0 msec
    3.0.0.1 0 msec
    3.0.0.6 0 msec
  3 200.200.200.55 0 msec 0 msec 0 msec
  4 5.0.2.5 4 msec 0 msec 0 msec
  5 5.0.1.54 4 msec 0 msec *
3R4#
```

3.0.1.2 - LSA2
3.0.1.3 - LSA2
3.0.0.6 - LSA4&5
3.0.0.1 - LSA4&5
200.200.200.55 - LSA4&5
5.0.2.5 - LSA4&5
5.0.1.54 - LSA4&5

- Question 4.5 - Show me successful output of pings from your R4 router's loopback to every other R4 router's loopback in the network.

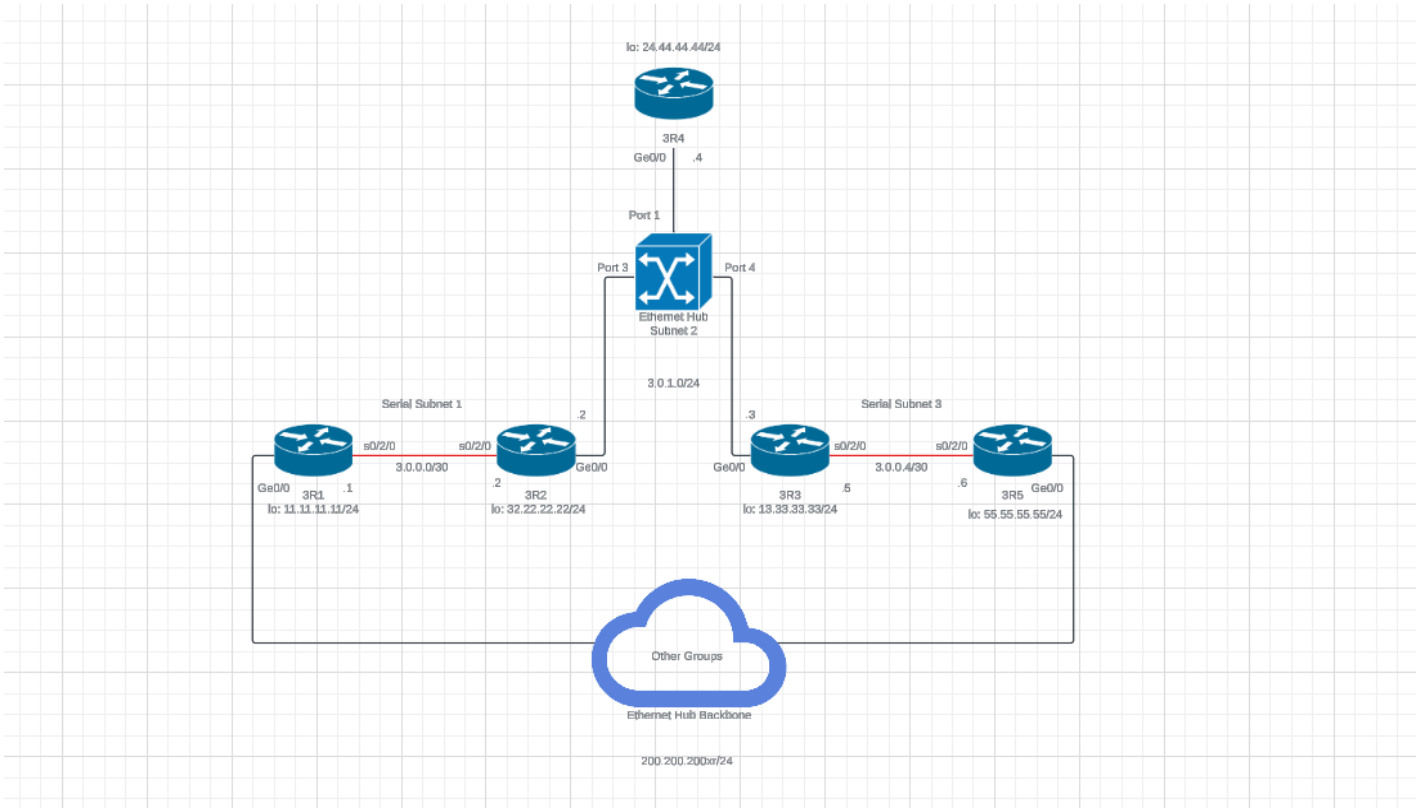
```
3R4#ping 5.200.200.200
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 5.200.200.200, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/4 ms
3R4#
```

OBJECTIVE 5
Wrap up

- Question 5.1 - What did you learn from this lab?
    - Logan- I learned about how RIP and OSPF interact when initially being turned on in a network. I also increased my understanding of route tables and LSA databases and what to look for when troubleshooting specific outage scenarios.
    - Nipun- Clear knowledge on RIP and OSPF setup and how they are different and how link state routing protocols converge quicker.
- Question 5.2 - What was the least useful part of this lab?
    - Logan- Even though it is critical to learn about layer 1 connection, it was the least of our problems when getting through this lab!
    - Nipun- I think it's a pretty good lab to get clear knowledge on protocols.
- Question 5.3 - What was the most useful part of this lab?
    - Logan- The most useful part of this lab was not only setting up OSPF and RIP, but having fail case scenarios really helped with my understanding of these protocols.
    - Nipun- Setting everything up and testing it myself hands-on is the best part of the lab.

OBJECTIVE 6
Juniper it Up

- Did you finish early? Overachievers? Want a good job after graduation? If so, replace R1 with a Juniper and rerun objectives 2 and 3.


lo: 24.44.44.44/24
3R4
Ge0/0
.4
Port 1
Port 3
Port 4
Ethernet Hub
Subnet 2
3.0.1.0/24
Serial Subnet 1
Serial Subnet 3
.2
.3
s0/2/0
s0/2/0
3.0.0.0/30
Ge0/0
Ge0/0
3R1
.1
lo: 11.11.11.11/24
.2
3R2
lo: 32.22.22.22/24
Ge0/0
Ge0/0
3R3
lo: 13.33.33.33/24
s0/2/0
s0/2/0
3.0.0.4/30
.5
.6
3R5
Ge0/0
lo: 55.55.55.55/24
Other Groups
Ethernet Hub Backbone
200.200.200.x/24