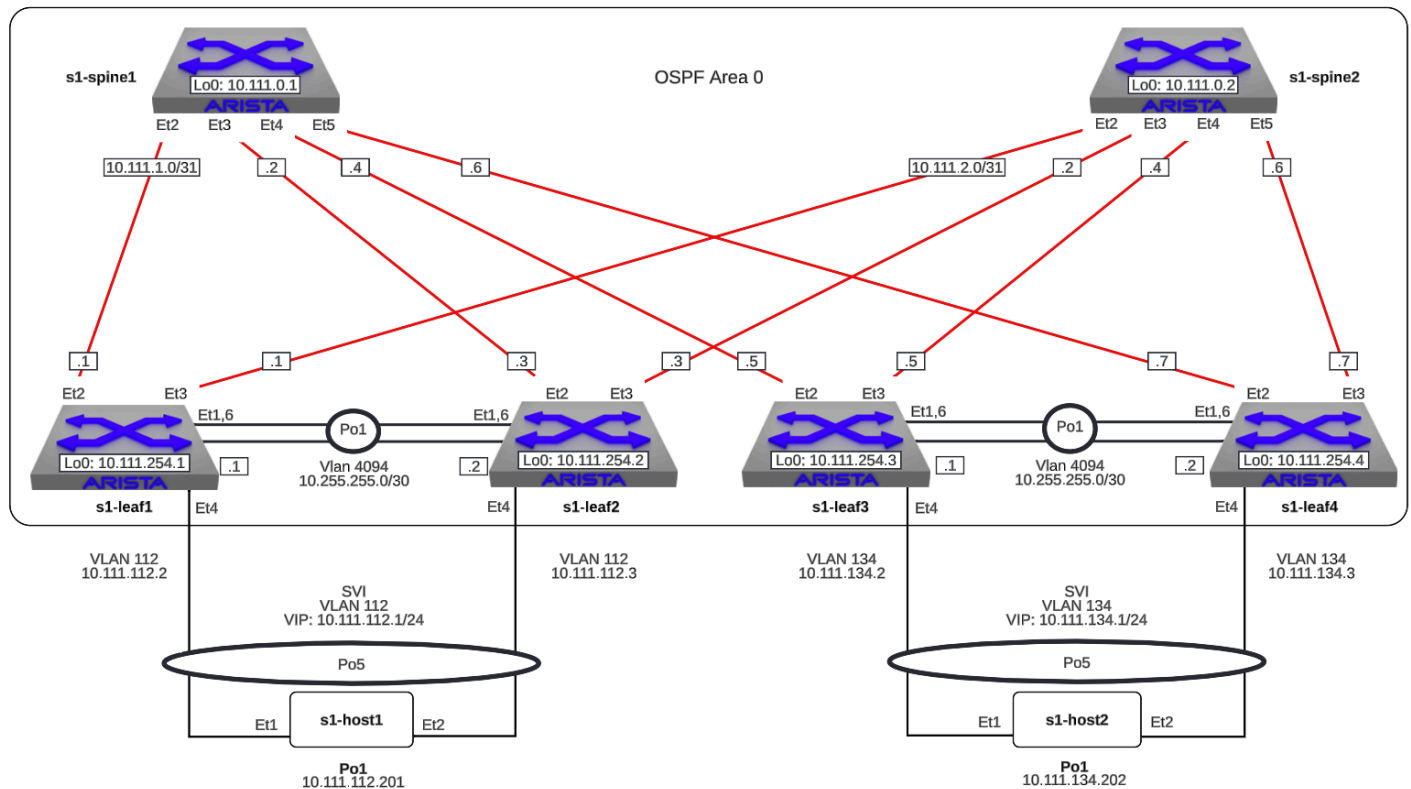# Layer 3 Leaf-Spine with OSPF

(_images/nested_l3ls-ospf_topo_1.png)

> **Note**
>
> The manually-entered commands below that are part of this lab are equivalent to
> `L3LS-OSPF_s1-leaf4_complete`.

1. Log into the **LabAccess** jumpserver:

    a. Type `l3ls-ospf` at the prompt. The script will configure the datacenter with the exception of **s1-leaf4**.

    > **Note**
    >
    > Did you know the "l3ls-ospf" script is composed of Python code that uses the CloudVision Portal REST API to automate the provisioning of CVP Configlets. The configlets that are config-ured via the REST API are `L3LS-OSPF_s1-spine1`, `L3LS-OSPF_s1-spine2`, `L3LS-OSPF_s1-leaf1`, `L3LS-OSPF_s1-leaf2`, `L3LS-OSPF_s1-leaf3`, `L3LS-OSPF_s1-leaf4`.

2. Configure SVI and VARP Virtual IP on the **s1-leaf4** switch using the following criteria

    a. Create the vARP MAC Address in Global Configuration mode

    > **Note**

Arista EOS utilizes the Industry-Standard CLI. When entering configuration commands, be sure to first type `configure` to enter configuration mode.

```
ip virtual-router mac-address 00:1c:73:00:00:34
```

b. Create the VLAN, SVI and the Virtual Router Address

```
vlan 134
    name Host_Network_134
!
interface vlan 134
    ip address 10.111.134.3/24
    ip virtual-router address 10.111.134.1
```

c. Validate the configuration with the following:

```
s1-leaf4#show ip interface brief
                                                                   Address
Interface          IP Address            Status        Protocol         MTU   Owner
----------------   --------------------  ------------  --------------  ---------- -------
Management0        192.168.0.15/24       up            up               1500
Vlan134            10.111.134.3/24       up            up               1500
Vlan4094           10.255.255.2/30       up            up               1500

s1-leaf4#show ip virtual-router
IP virtual router is configured with MAC address: 001c.7300.0034
IP virtual router address subnet routes not enabled
MAC address advertisement interval: 30 seconds

Protocol: U - Up, D - Down, T - Testing, UN - Unknown
          NP - Not Present, LLD - Lower Layer Down

Interface       Vrf           Virtual IP Address        Protocol        State
--------------  -------------  -----------------------  --------------  ------
Vl134           default        10.111.134.1              U               active
```

3. Configure OSPF on the **s1-leaf4** switch using the following criteria

a. Based on the diagram, configure L3 interfaces to **s1-spine1/s1-spine2** and interface Loopback0

```
interface Ethernet2
    description L3 Uplink - s1-spine1
    no switchport
    ip address 10.111.1.7/31
!
interface Ethernet3
    description L3 Uplink - s1-spine2
    no switchport
    ip address 10.111.2.7/31
!
interface Loopback0
    description Management and Router-id
    ip address 10.111.254.4/32
```

b. Validate the configuration with the following:

```
s1-leaf4#show ip interface brief

                                                                  Address
Interface        IP Address           Status      Protocol        MTU   Owner
---------------- -------------------- ----------- -------------- ----------- -------
Ethernet2        10.111.1.7/31        up          up               1500
Ethernet3        10.111.2.7/31        up          up               1500
Loopback0        10.111.254.4/32      up          up              65535
Management0      192.168.0.15/24      up          up               1500
Vlan134          10.111.134.3/24      up          up               1500
Vlan4094         10.255.255.2/30      up          up               1500
```

c. Based on the diagram, enable OSPF and configure the interfaces on **s1-leaf4**. Connections to **s1-spine1/s1-spine2** and **s1-leaf3** with be part of Area 0.

> **Note**
>
> In EOS, process-level configuration happens with the OSPF context and peer-specific configu-
> ration such as Area and Authentication happen under the interface.

```
interface Ethernet2
    ip ospf area 0.0.0.0
    ip ospf network point-to-point
!
interface Ethernet3
    ip ospf area 0.0.0.0
    ip ospf network point-to-point
!
interface Vlan4094
    ip ospf area 0.0.0.0
    ip ospf network point-to-point
!
router ospf 100
    router-id 10.111.254.4
```

> **Note**
>
> We are leveraging OSPF Point-to-Point networks to eliminate the need for DR elections on non-broadcast networks.

d. Validate the configuration and process status.

```
s1-leaf4(config-router-ospf)#show active
router ospf 100
    router-id 10.111.254.4
    max-lsa 12000
s1-leaf4(config-router-ospf)#show run interfaces Ethernet 2-3
interface Ethernet2
    description L3 Uplink - s1-spine1
    no switchport
    ip address 10.111.1.7/31
    ip ospf area 0.0.0.0
    ip ospf network point-to-point
interface Ethernet3
    description L3 Uplink - s1-spine2
    no switchport
    ip address 10.111.2.7/31
    ip ospf area 0.0.0.0
    ip ospf network point-to-point
s1-leaf4(config-router-ospf)#show ip ospf summary
OSPF instance 100 with ID 10.111.254.4, VRF default
Time since last SPF: 122 s
Max LSAs: 12000, Total LSAs: 1
Type-5 Ext LSAs: 0
ID               Type    Intf   Nbrs (full) RTR LSA NW LSA  SUM LSA ASBR LSA TYPE-7 LSA
0.0.0.0          normal 3       0    (0   ) 1       0       0       0        0
```

4. Enable OSPF Authentication on **s1-leaf4** to peer to **s1-spine1/s1-spine2** and **s1-leaf3**

a. Add the following Authentication commands to OSPF Interfaces on **s1-leaf4**:

```
interface Ethernet2
    ip ospf authentication message-digest
    ip ospf message-digest-key 1 sha512 Arista123!
!
interface Ethernet3
    ip ospf authentication message-digest
    ip ospf message-digest-key 1 sha512 Arista123!
!
interface Vlan4094
    ip ospf authentication message-digest
    ip ospf message-digest-key 1 sha512 Arista123!
```

b. Verify that peering is established to directly connected neighbors.

```
s1-leaf4(config-if-Vl4094)#show ip ospf neighbor
Neighbor ID      Instance VRF      Pri State             Dead Time   Address
10.111.0.1       100      default  0   FULL              00:00:38    10.111.1.6
10.111.0.2       100      default  0   FULL              00:00:37    10.111.2.6
10.111.254.3     100      default  1   FULL              00:00:31    10.255.255.1
```

c. Enable OSPF Advertisement of local networks on **s1-leaf4**.

```
interface Loopback0
    ip ospf area 0.0.0.0
!
interface Vlan134
    ip ospf area 0.0.0.0
```

d. However, we do not want to form OSPF adjacencies on these interfaces, so enable passive-inter-
   face functionality on **s1-leaf4**.

```
router ospf 100
    passive-interface default
    no passive-interface Ethernet2
    no passive-interface Ethernet3
    no passive-interface Vlan4094
```

e. Check the OSPF Database and IP route tables on **s1-leaf4** as well as each of the **Spines** and
   Leafs

```
s1-leaf4#show ip ospf database

            OSPF Router with ID(10.111.254.4) (Instance ID 100) (VRF default)


                    Router Link States (Area 0.0.0.0)

Link ID         ADV Router      Age        Seq#          Checksum Link count
10.111.0.2      10.111.0.2      356        0x80000011    0x4670   6
10.111.0.1      10.111.0.1      355        0x80000011    0x3be    6
10.111.254.3    10.111.254.3    358        0x80000013    0x691    6
10.111.254.2    10.111.254.2    1198       0x8000000f    0x58f3   5
10.111.254.4    10.111.254.4    354        0x80000018    0x3b28   8
10.111.254.1    10.111.254.1    1198       0x8000000f    0x5ff8   5

                    Network Link States (Area 0.0.0.0)

Link ID         ADV Router      Age        Seq#          Checksum
10.255.255.2    10.111.254.2    3600       0x80000116    0x6448
10.111.2.3      10.111.254.2    1198       0x80000002    0x5ded
10.111.2.1      10.111.254.1    1198       0x80000002    0x6de1
10.111.2.5      10.111.254.3    1198       0x80000002    0x4df9
10.111.1.1      10.111.254.1    1198       0x80000002    0x6ae6
10.111.1.5      10.111.254.3    1198       0x80000002    0x4afe
10.111.1.3      10.111.254.2    1198       0x80000002    0x5af2
s1-leaf4#show ip ospf database detail 10.111.254.1

            OSPF Router with ID(10.111.254.4) (Instance ID 100) (VRF default)

  LS Age: 1294
  Options: (E DC)
  LS Type: Router Links
  Link State ID: 10.111.254.1
  Advertising Router: 10.111.254.1
  LS Seq Number: 0x8000000f
  Checksum: 0x5ff8
  Length: 84
  Number of Links: 5

    Link connected to: a Transit Network
     (Link ID) Designated Router address: 10.111.1.1
     (Link Data) Router Interface address: 10.111.1.1
      Number of TOS metrics: 0
        TOS 0 Metrics: 10


    Link connected to: a Stub Network
     (Link ID) Network/subnet number: 10.111.254.1
     (Link Data) Network Mask: 255.255.255.255
      Number of TOS metrics: 0
        TOS 0 Metrics: 10
```

```
      Link connected to: a Transit Network
       (Link ID) Designated Router address: 10.111.2.1
       (Link Data) Router Interface address: 10.111.2.1
        Number of TOS metrics: 0
         TOS 0 Metrics: 10



      Link connected to: a Transit Network
       (Link ID) Designated Router address: 10.255.255.2
       (Link Data) Router Interface address: 10.255.255.1
        Number of TOS metrics: 0
         TOS 0 Metrics: 10



      Link connected to: a Stub Network
       (Link ID) Network/subnet number: 10.111.112.0
       (Link Data) Network Mask: 255.255.255.0
        Number of TOS metrics: 0
         TOS 0 Metrics: 10
 s1-leaf4#show ip route 10.111.112.0/24

 VRF: default
 Source Codes:
       C - connected, S - static, K - kernel,
       O - OSPF, IA - OSPF inter area, E1 - OSPF external type 1,
       E2 - OSPF external type 2, N1 - OSPF NSSA external type 1,
       N2 - OSPF NSSA external type2, B - Other BGP Routes,
       B I - iBGP, B E - eBGP, R - RIP, I L1 - IS-IS level 1,
       I L2 - IS-IS level 2, O3 - OSPFv3, A B - BGP Aggregate,
       A O - OSPF Summary, NG - Nexthop Group Static Route,
       V - VXLAN Control Service, M - Martian,
       DH - DHCP client installed default route,
       DP - Dynamic Policy Route, L - VRF Leaked,
       G  - gRIBI, RC - Route Cache Route,
       CL - CBF Leaked Route

  O        10.111.112.0/24 [110/30]
             via 10.111.1.6, Ethernet2
             via 10.111.2.6, Ethernet3
```

> **Note**
>
> ECMP is automatically enabled in OSPF as it is an IGP.

5. Validate connectivity from **s1-host1** to **s1-host2**. From **s1-host1** execute:

```
ping 10.111.134.202
traceroute 10.111.134.202
```

a. Verify **s1-leaf4**'s IP address is in the traceroute path, either interface 10.111.1.7 via **s1-spine1** or interface 10.111.2.7 via **s1-spine2**. If traffic is hashing via **s1-leaf3**'s 10.111.1.5 or 10.111.2.5 interfaces perform the optional `shutdown` steps below on **s1-leaf3**

```
interface Ethernet2-3
   shutdown
```

b. Rerun traceroute/verification from **s1-host1** to **s1-host2** then revert the `shutdown` changes on **s1-leaf3**

```
interface Ethernet2-3
   no shutdown
```

6. Other OSPF features to play with if you have time:

a. Route Redistribution: For fun, do a `watch 1 diff show ip route | begin Gateway` on **s1-leaf1** and let that run while you execute the following commands on **s1-leaf4**. You will see the new route being injected into the route table of **s1-leaf1**.

```
ip route 0.0.0.0/0 Null0
!
router ospf 100
   redistribute static
```

b. BFD: BFD is a low-overhead, protocol-independent mechanism which adjacent systems can use instead for faster detection of faults in the path between them. BFD is a simple mechanism which detects the liveness of a connection between adjacent systems, allowing it to quickly detect failure of any element in the connection. Note that BFD is not running on the other devices so the BFD neighbor will not come up until you configure it on multiple devices.

```
router ospf 100
   bfd default
```

7. Troubleshooting BGP:

```
show ip ospf summary
show ip ospf
show ip ospf neighbor <neighbor_ip>
show run section ospf
show log
```

LAB COMPLETE!

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