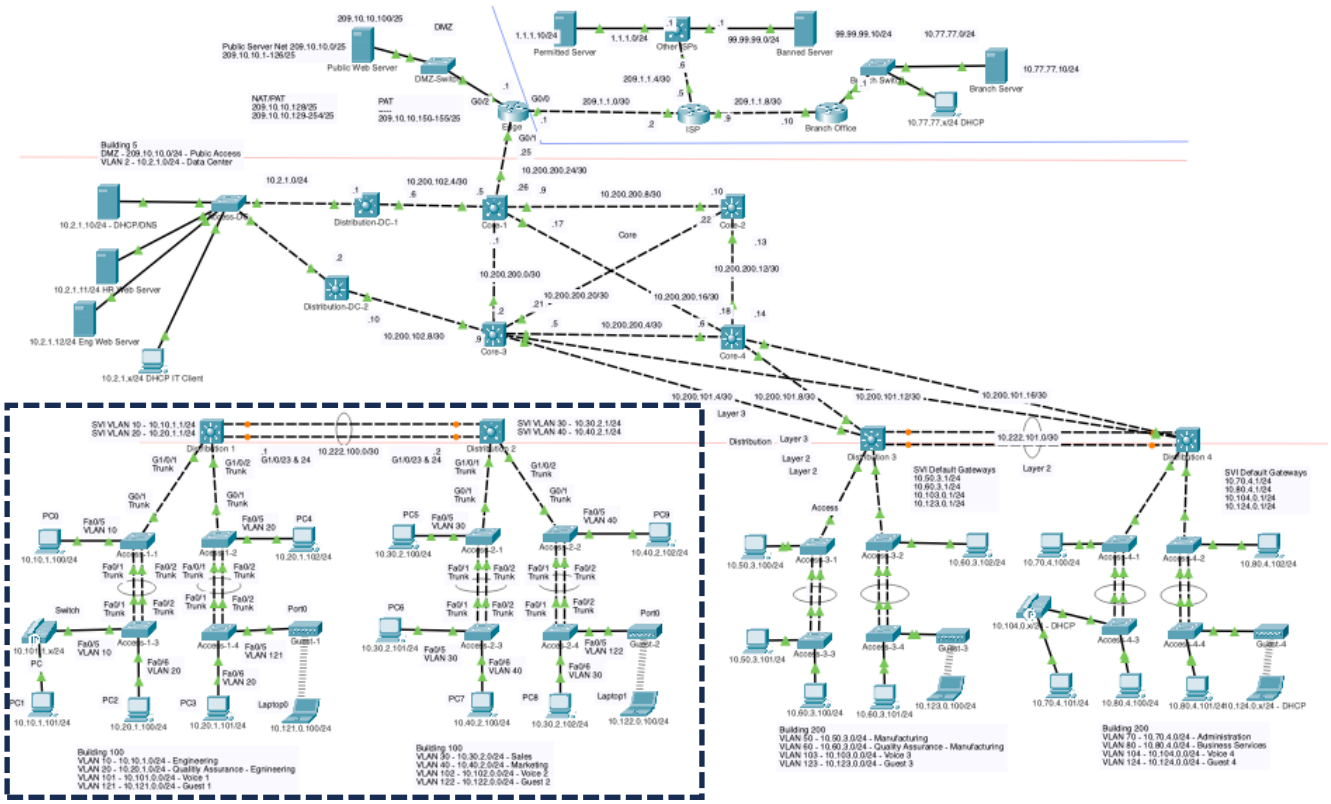
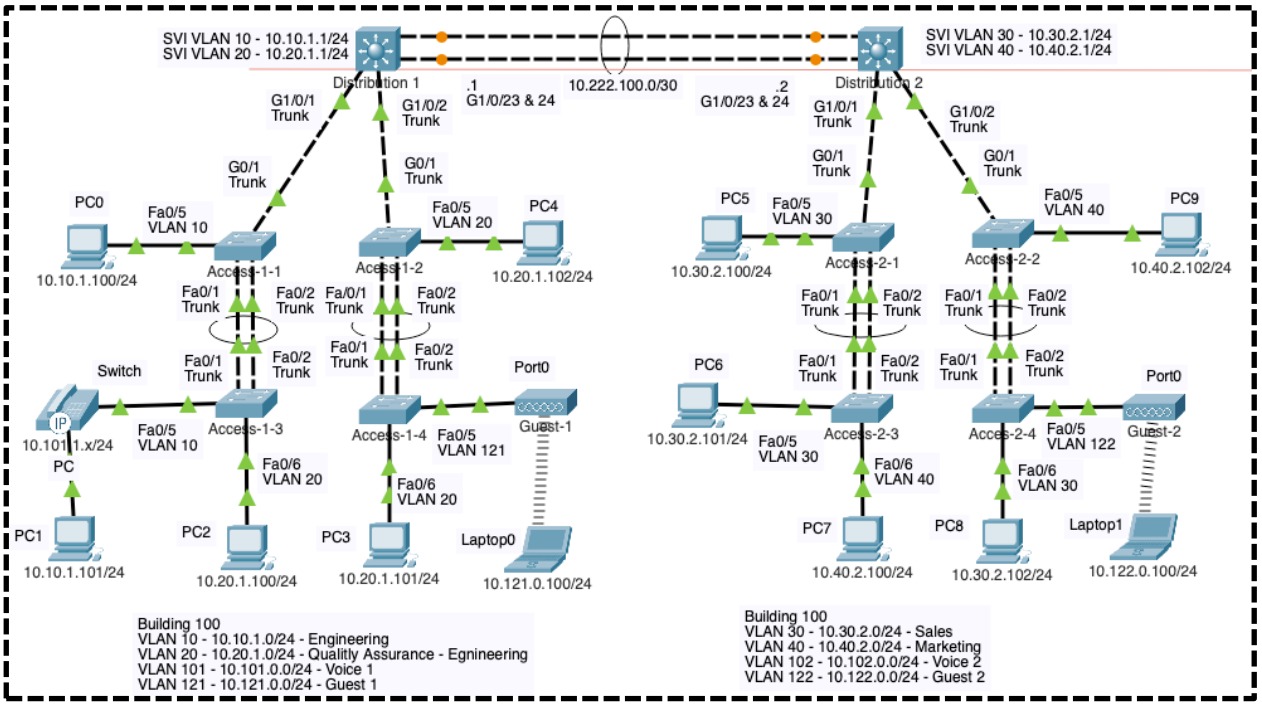
Enterprise Network

Lab 6 - Connecting to the Core





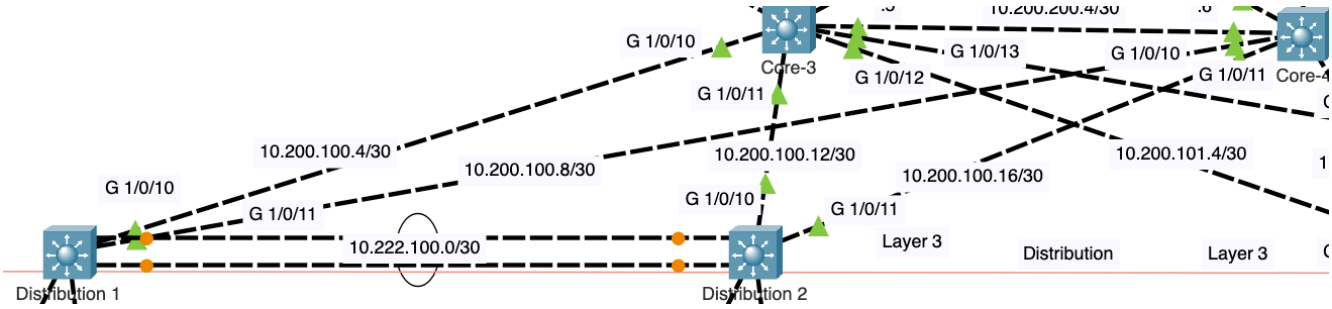
Note: SVIs and routed ports have been configured. Static routes provide reachability between Distribution-1 and Distribution-2 networks.

Current Topology and Objectives

Here are the objectives for this lab:

- Establish physical connections between distribution and core switches.
- Configure IPv4 addresses on routed interfaces.
- Verify interface status and IP connectivity.
- Remove existing static routes.
- Enable basic OSPF configuration as an introduction to dynamic routing.

Establish the Physical Connections



Connect the following interfaces using Ethernet cables:

1. **Distribution-1 to Core-3:**
   - Connect **G1/0/10** on **Distribution-1** to **G1/0/10** on **Core-3**.
2. **Distribution-1 to Core-4:**
   - Connect **G1/0/11** on **Distribution-1** to **G1/0/10** on **Core-4**.
3. **Distribution-2 to Core-3:**
   - Connect **G1/0/10** on **Distribution-2** to **G1/0/11** on **Core-3**.
4. **Distribution-2 to Core-4:**
   - Connect **G1/0/11** on **Distribution-2** to **G1/0/11** on **Core-4**.

After making the physical connections, verify that the interfaces are **connected** using the following command on each switch:

```
distribution-1# show interface status
Port      Name               Status       Vlan       Duplex  Speed Type
Po2                          connected    routed     auto    auto
Gig1/0/1                     connected    trunk      auto    auto  10/100BaseTX
Gig1/0/2                     connected    trunk      auto    auto  10/100BaseTX
Gig1/0/3                     notconnect   1          auto    auto  10/100BaseTX
Gig1/0/4                     notconnect   1          auto    auto  10/100BaseTX
Gig1/0/5                     notconnect   1          auto    auto  10/100BaseTX
Gig1/0/6                     notconnect   1          auto    auto  10/100BaseTX
Gig1/0/7                     notconnect   1          auto    auto  10/100BaseTX
Gig1/0/8                     notconnect   1          auto    auto  10/100BaseTX
Gig1/0/9                     notconnect   1          auto    auto  10/100BaseTX
Gig1/0/10                    connected    1          auto    auto  10/100BaseTX
Gig1/0/11                    connected    1          auto    auto  10/100BaseTX
```

```
<output omitted for brevity
```

Configuring IPv4 Addressing on Distribution Switches

In this step, you will configure IPv4 addressing on **Distribution-1** and **Distribution-2** to establish Layer 3 connectivity with **Core-3** and **Core-4**. The IP addressing for **Core-3** and **Core-4** has already been configured, so students only need to assign the correct addresses to the interfaces on the **distribution switches**.

To conserve IPv4 address space, we are using **/30 subnet masks**. This allows for **two valid host addresses** per subnet—one for each connected device—while also providing a **network address and a broadcast address**. This constraint is necessary due to IPv4's limited address space, but **IPv6 simplifies this significantly by offering a much larger pool of addresses**.

The four IPv4 subnets being used for these connections are:

- **10.200.100.4/30** – Two valid host addresses: **.5** and **.6**, broadcast address: **.7**
- **10.200.100.8/30** – Two valid host addresses: **.9** and **.10**, broadcast address: **.11**
- **10.200.100.12/30** – Two valid host addresses: **.13** and **.14**, broadcast address: **.15**
- **10.200.100.16/30** – Two valid host addresses: **.17** and **.18**, broadcast address: **.19**

The four IPv4 subnets in binary for the last octet are:

- **10.200.100.4/30** – **10.200.100. 0 0 0 0 0 1** 0 0 with two hosts 0 1 (.5) and 1 0 (.6)
- **10.200.100.8/30** – **10.200.100. 0 0 0 0 1 0** 0 0 with two hosts 0 1 (.9) and 1 0 (.10)
- **10.200.100.12/30** – **10.200.100. 0 0 0 0 1 1** 0 0 with two hosts 0 1 (.13) and 1 0 (.14)
- **10.200.100.16/30** – **10.200.100. 0 0 0 1 0 0** 0 0 with two hosts 0 1 (.17) and 1 0 (.18)

In our IPv4 addressing scheme, each **Core switch** has been assigned the **first usable IP address** in each /30 subnet, while each **Distribution switch** will use the **second (last) usable IP address** in the subnet. This ensures a consistent and predictable assignment of IP addresses within the network.

As a result, the **Distribution switches** will be assigned the second (last) usable address in each subnet:

- **Distribution-1**
  - **G1/0/10 → 10.200.100.6/30** connects to **Core-3 G 1/0/10 → 10.200.100.5**)
  - **G1/0/11 → 10.200.100.10/30** connects to **Core-4 G 1/0/11 → 10.200.100.9**)
- **Distribution-2**
  - **G1/0/10 → 10.200.100.14/30** connects to **Core-3 G 1/0/10 → 10.200.100.13**)
  - **G1/0/11 → 10.200.100.18/30** connects to **Core-4 G 1/0/11 → 10.200.100.17**)

This configuration follows best practices in enterprise networking by keeping **consistent addressing conventions**, making it easier to manage and troubleshoot.

Configure the **appropriate IP addresses** on the interfaces of **Distribution-1 and Distribution-2** according to the assigned subnets.

Note: Remember, we need to use the **no switchport** command to make the port a Layer 3 routed port.

Distribution-1: Interface configuration of IPv4 addresses

```
distribution-1(config)# interface g 1/0/10
distribution-1(config-if)# no switchport
distribution-1(config-if)# ip address 10.200.100.6 255.255.255.252
distribution-1(config-if)# no shutdown
distribution-1(config-if)# exit

distribution-1(config)# interface g 1/0/11
distribution-1(config-if)# no switchport
distribution-1(config-if)# ip address 10.200.100.10 255.255.255.252
distribution-1(config-if)# no shutdown
distribution-1(config-if)# end
```

Distribution-2: Interface configuration of IPv4 addresses

```
distribution-2(config)# interface g 1/0/10
distribution-2(config-if)# no switchport
distribution-2(config-if)# ip address 10.200.100.14 255.255.255.252
distribution-2(config-if)# no shutdown
distribution-2(config-if)# exit

distribution-2(config)# interface g 1/0/11
distribution-2(config-if)# no switchport
distribution-2(config-if)# ip address 10.200.100.18 255.255.255.252
distribution-2(config-if)# no shutdown
distribution-2(config-if)# end
```

Verify Current Interface Configurations and Connectivity

To verify the IPv4 addressing and connectivity between the **Distribution** and **Core** switches, the show ip interface brief command was used on **Distribution-1** and **Distribution-2**. This command confirms that the correct IP addresses have been assigned to the **GigabitEthernet interfaces**, and that their status is **up/up**, indicating they are operational.

Additionally, **ICMP ping tests** were conducted from each distribution switch to its respective **Core switch neighbors**. The successful pings (with an 80% success rate) confirm basic Layer 3 connectivity, verifying that the **point-to-point links are functional** and that the assigned IP addresses are reachable. The first ping had failed due to an ARP Request being sent and waiting for the ARP Reply. Subsequent packets would be sent at 100% success rate unless there were other issues such as network congestion.

Distribution-1: Verification of IPv4 addresses

```
distribution-1# show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
Port-channel2          10.222.100.1    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  down                  down
GigabitEthernet1/0/4   unassigned      YES unset  down                  down
GigabitEthernet1/0/5   unassigned      YES unset  down                  down
GigabitEthernet1/0/6   unassigned      YES unset  down                  down
GigabitEthernet1/0/7   unassigned      YES unset  down                  down
GigabitEthernet1/0/8   unassigned      YES unset  down                  down
GigabitEthernet1/0/9   unassigned      YES unset  down                  down
GigabitEthernet1/0/10  10.200.100.6    YES manual up                    up
GigabitEthernet1/0/11  10.200.100.10   YES manual up                    up
<output omitted brevity>

distribution-1# ping 10.200.100.5

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.200.100.5, timeout is 2 seconds:
.!!!!
Success rate is 80 percent (4/5), round-trip min/avg/max = 0/0/0 ms

distribution-1# ping 10.200.100.9

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.200.100.9, timeout is 2 seconds:
.!!!!
Success rate is 80 percent (4/5), round-trip min/avg/max = 0/0/0 ms

distribution-1#
```

Distribution-2: Verification of IPv4 addresses

```
distribution-2#show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
Port-channel2          10.222.100.2    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  down                  down
GigabitEthernet1/0/4   unassigned      YES unset  down                  down
GigabitEthernet1/0/5   unassigned      YES unset  down                  down
GigabitEthernet1/0/6   unassigned      YES unset  down                  down
GigabitEthernet1/0/7   unassigned      YES unset  down                  down
GigabitEthernet1/0/8   unassigned      YES unset  down                  down
GigabitEthernet1/0/9   unassigned      YES unset  down                  down
GigabitEthernet1/0/10  10.200.100.14   YES manual up                    up
```

```
GigabitEthernet1/0/11  10.200.100.18   YES manual up                    up
<output omitted for brevity>

distribution-2#ping 10.200.100.13

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.200.100.13, timeout is 2 seconds:
.!!!!
Success rate is 80 percent (4/5), round-trip min/avg/max = 0/0/0 ms

distribution-2#ping 10.200.100.17

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.200.100.17, timeout is 2 seconds:
.!!!!
Success rate is 80 percent (4/5), round-trip min/avg/max = 0/0/0 ms

distribution-2#
```

Routing

View Current Routing Tables

The current routing tables on **Distribution-1** and **Distribution-2** show that each switch is aware of its **directly connected networks**. These include **SVIs** (VLAN interfaces) and **routed ports**, which are interfaces configured with an IP address for point-to-point connections. The **directly connected networks** include the previously established **SVIs** and **routed links between the two distribution switches**, along with the newly configured **routed links to the core switches**.

Additionally, each distribution switch has **static routes** that were previously configured to provide reachability to remote networks on the **opposite distribution switch**, ensuring proper interconnectivity.

Distribution-1 IPv4 Routing Table

```
distribution-1#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

     10.0.0.0/8 is variably subnetted, 7 subnets, 2 masks
C       10.10.1.0/24 is directly connected, Vlan10
C       10.20.1.0/24 is directly connected, Vlan20
S       10.30.2.0/24 [1/0] via 10.222.100.2
S       10.40.2.0/24 [1/0] via 10.222.100.2
C       10.200.100.4/30 is directly connected, GigabitEthernet1/0/10
C       10.200.100.8/30 is directly connected, GigabitEthernet1/0/11
C       10.222.100.0/30 is directly connected, Port-channel2

distribution-1#
```

Distribution-2 IPv4 Routing Table

```
distribution-2#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

     10.0.0.0/8 is variably subnetted, 7 subnets, 2 masks
S       10.10.1.0/24 [1/0] via 10.222.100.1
S       10.20.1.0/24 [1/0] via 10.222.100.1
C       10.30.2.0/24 is directly connected, Vlan30
C       10.40.2.0/24 is directly connected, Vlan40
C       10.200.100.12/30 is directly connected, GigabitEthernet1/0/10
C       10.200.100.16/30 is directly connected, GigabitEthernet1/0/11
C       10.222.100.0/30 is directly connected, Port-channel2

distribution-2#
```

Removal of Current Static routes

To review the existing **static routes**, the command **show running-config | section ip route** was used. This filters the running configuration to display only the static route entries, making it easy to identify manually configured routes.

To remove the static routes, the **no ip route command** was issued in **global configuration mode**, followed by the specific route details. This method effectively deletes the static routes from the configuration.

Finally, the command **show ip route** static was executed to verify that no static routes remain in the routing table. Since the command produced no output, this confirms that all static routes were successfully removed. At this point, the switches only rely on **directly connected networks** for routing.

Removing current static routes on Distribution-1

```
distribution-1# show running-config | section ip route
ip route 10.30.2.0 255.255.255.0 10.222.100.2
ip route 10.40.2.0 255.255.255.0 10.222.100.2
distribution-1#

distribution-1# conf t
distribution-1(config)# no ip route 10.30.2.0 255.255.255.0 10.222.100.2
distribution-1(config)# no ip route 10.40.2.0 255.255.255.0 10.222.100.2
distribution-1(config)# end

distribution-1# show ip route static
distribution-1#
```

Removing current static routes on Distribution-2

```
distribution-2# show running-config | section ip route
ip route 10.10.1.0 255.255.255.0 10.222.100.1
ip route 10.20.1.0 255.255.255.0 10.222.100.1
distribution-2#

distribution-2# conf t
distribution-2(config)# no ip route 10.10.1.0 255.255.255.0 10.222.100.1
distribution-2(config)# no ip route 10.20.1.0 255.255.255.0 10.222.100.1
distribution-2(config)# end

distribution-2# show ip route static
distribution-2#
```

Enabling Dynamic Routing with OSPF

Our enterprise network routers, including multilayer switches, is currently using OSPF routing protocol to dynamically learn about remote networks and route packets. Core-3 and Core-4 have their interfaces currently enable to participate in OSPF with Distribution-1 and Distribution-2.

We will configure Distribution-1 and Distribution-2 to participate in OSPF with each other and the core routers. Do not be concerned about the details if you are new to OSPF.

```
Distribution-1(config)# router ospf 1
Distribution-1(config-router)# router-id 1.0.0.0
Distribution-1(config-router)# auto-cost reference-bandwidth 10000
Distribution-1(config-router)# network 10.0.0.0 0.255.255.255 area 0
Distribution-1(config-router)# exit
Distribution-1(config)#

Distribution-1(config)# interface  gig 1/0/10
Distribution-1(config-if)# ip ospf network point-to-point
Distribution-1(config-if)# exit

Distribution-1(config)# interface  gig 1/0/11
Distribution-1(config-if)# ip ospf network point-to-point
Distribution-1(config-if)# exit

Distribution-1(config)# interface gig 1/0/23
Distribution-1(config-if)# ip ospf network point-to-point
Distribution-1(config-if)# exit

Distribution-1(config)# interface gig 1/0/24
Distribution-1(config-if)# ip ospf network point-to-point
Distribution-1(config-if)# exit

Distribution-1(config)# end

Distribution-1# clear ip ospf process
Reset ALL OSPF processes? [no]: yes

Distribution-1#
```

```
Distribution-2(config)# router ospf 1
Distribution-2(config-router)# router-id 2.0.0.0
Distribution-2(config-router)# auto-cost reference-bandwidth 10000
Distribution-2(config-router)# network 10.0.0.0 0.255.255.255 area 0
Distribution-2(config-router)# exit
Distribution-2(config)#

Distribution-2(config)# interface  gig 1/0/10
Distribution-2(config-if)# ip ospf network point-to-point
Distribution-2(config-if)# exit

Distribution-2(config)# interface  gig 1/0/11
Distribution-2(config-if)# ip ospf network point-to-point
Distribution-2(config-if)# exit

Distribution-2(config)# interface gig 1/0/23
Distribution-2(config-if)# ip ospf network point-to-point
Distribution-2(config-if)# exit

Distribution-2(config)# interface gig 1/0/24
Distribution-2(config-if)# ip ospf network point-to-point
Distribution-2(config-if)# exit

Distribution-2(config)# end

Distribution-2# clear ip ospf process
Reset ALL OSPF processes? [no]: yes

Distribution-2#
```

Distribution-1

```
router ospf 1
router-id 1.0.0.0
log-adjacency-changes
auto-cost reference-bandwidth 10000
network 10.0.0.0 0.255.255.255 area 0
exit

interface  gig 1/0/10
ip ospf network point-to-point
exit

interface  gig 1/0/11
ip ospf network point-to-point
exit

inter gig 1/0/23
ip ospf network point-to-point
exit

inter gig 1/0/24
ip ospf network point-to-point
exit
```

Distribution-2

```
router ospf 1
router-id 2.0.0.0
log-adjacency-changes
auto-cost reference-bandwidth 10000
network 10.0.0.0 0.255.255.255 area 0
exit

interface  gig 1/0/10
ip ospf network point-to-point
exit

interface  gig 1/0/11
ip ospf network point-to-point
exit

inter gig 1/0/23
ip ospf network point-to-point
exit

inter gig 1/0/24
ip ospf network point-to-point
exit
```

Packet tracer port channel issues

There are a few issues with Packet Tracer 8.2.2 and Layer 3 switches.

- You cannot configure all OSPF commands, such as **ip ospf network point-to-point** on the port-channel
- Although OSPF adjacencies are created over the port channel, OSPF is choosing the longer router through a core router.

Reachability

At this point any enterprise PC should be able to reach all other enterprise PCs and the external server at 1.1.1.10.

From PC at 10.10.1.100/24

```
C:\>ping 10.20.1.101

<output omitted>
<May include 'Request timed out' due ARP>
Reply from 10.20.1.101: bytes=32 time<1ms TTL=127

C:\>ping 10.30.2.101

<output omitted>
<May include 'Request timed out' due ARP>
Reply from 10.30.2.101: bytes=32 time<1ms TTL=125

C:\>ping 10.60.3.101

<output omitted>
<May include 'Request timed out' due ARP>
Reply from 10.60.3.101: bytes=32 time<1ms TTL=125


C:\>ping 10.80.4.101

<output omitted>
<May include 'Request timed out' due ARP>
Reply from 10.80.4.101: bytes=32 time<1ms TTL=125

C:\>ping 10.2.1.10

<output omitted>
<May include 'Request timed out' due ARP>
Reply from 10.2.1.10: bytes=32 time<1ms TTL=124


C:\>ping 209.10.10.100

<output omitted>
<May include 'Request timed out' due ARP>
Reply from 209.10.10.100: bytes=32 time=1ms TTL=124

C:\>ping 1.1.1.10

<output omitted>
<May include 'Request timed out' due ARP>
Reply from 1.1.1.10: bytes=32 time<1ms TTL=122

C:\>
```