INSTITUTO TECNOLÓGICO SUPERIOR DE FELIPE CARRILLO PUERTO

ORGANISMO PÚBLICO Y DESCENTRALIZADO DEL GOBIERNO DEL ESTADO DE QUINTANA ROO.

Conmutación y Enrutamiento de Redes de datos

PRACTICA DE LABORATORIO
5.1.1.9

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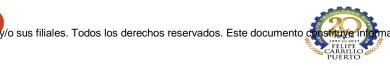- Luis Fernando Matos Mis
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Ingeniería en Sistemas Computacionales

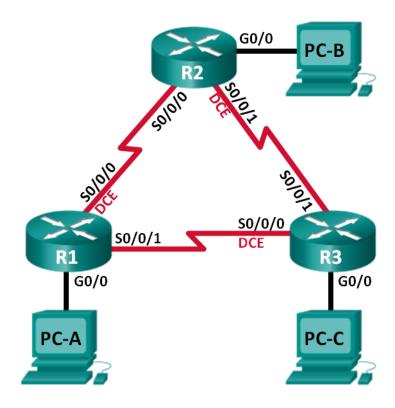SEMESTRE: VII   GRUPO: B   AULA: J-4

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Práctica de laboratorio: configuración de OSPFv2 básico de área única

Topología

Tabla de asignación de direcciones

Dispositivo	Interfaz	Dirección IP	Máscara de subred	Gateway predeterminado
R1	G0/0	192.168.1.1	255.255.255.0	N/A
	S0/0/0 (DCE)	192.168.12.1	255.255.255.252	N/A
	S0/0/1	192.168.13.1	255.255.255.252	N/A
R2	G0/0	192.168.2.1	255.255.255.0	N/A
	S0/0/0	192.168.12.2	255.255.255.252	N/A
	S0/0/1 (DCE)	192.168.23.1	255.255.255.252	N/A
R3	G0/0	192.168.3.1	255.255.255.0	N/A
	S0/0/0 (DCE)	192.168.13.2	255.255.255.252	N/A
	S0/0/1	192.168.23.2	255.255.255.252	N/A
PC-A	NIC	192.168.1.3	255.255.255.0	192.168.1.1
PC-B	NIC	192.168.2.3	255.255.255.0	192.168.2.1
PC-C	NIC	192.168.3.3	255.255.255.0	192.168.3.1

Objetivos

Parte 1: armar la red y configurar los parámetros básicos de los dispositivos

Parte 2: configurar y verificar el routing OSPF

Parte 3: cambiar las asignaciones de ID del router

Parte 4: configurar interfaces OSPF pasivas

Parte 5: cambiar las métricas de OSPF

Información básica/situación

El protocolo OSPF (Open Shortest Path First) es un protocolo de routing de estado de enlace para las redes IP. OSPFv2 se define para redes IPv4 y OSPFv3 se define para redes IPv6. OSPF detecta cambios en la topología, como fallas de enlace, y converge en una nueva estructura de routing sin bucles muy rápidamente. Computa cada ruta con el algoritmo de Dijkstra, un algoritmo SPF (Shortest Path First).

En esta práctica de laboratorio, configurará la topología de la red con routing OSPFv2, cambiará las asignaciones de ID de router, configurará interfaces pasivas, ajustará las métricas de OSPF y utilizará varios comandos de CLI para ver y verificar la información de routing OSPF.

Nota: los routers que se utilizan en las prácticas de laboratorio de CCNA son routers de servicios integrados (ISR) Cisco 1941 con IOS de Cisco versión 15.2(4)M3 (imagen universalk9). Pueden utilizarse otros routers y otras versiones del IOS de Cisco. Según el modelo y la versión de IOS de Cisco, los comandos disponibles y los resultados que se obtienen pueden diferir de los que se muestran en las prácticas de laboratorio. Consulte la tabla Resumen de interfaces del router que se encuentra al final de esta práctica de laboratorio para obtener los identificadores de interfaz correctos.

Nota: asegúrese de que los routers se hayan borrado y no tengan configuraciones de inicio. Si no está seguro, consulte al instructor.

Recursos necesarios

- 3 routers (Cisco 1941 con Cisco IOS, versión 15.2(4)M3, imagen universal o similar)
- 3 computadoras (Windows 7, Vista o XP con un programa de emulación de terminal, como Tera Term)
- Cables de consola para configurar los dispositivos con IOS de Cisco mediante los puertos de consola
- Cables Ethernet y seriales, como se muestra en la topología.

Parte 1: Armar la red y configurar los parámetros básicos de los dispositivos

En la parte 1, establecerá la topología de la red y configurará los parámetros básicos en los equipos host y los routers.

Paso 1: Realizar el cableado de red tal como se muestra en la topología.

Paso 2: Inicialice y vuelva a cargar los routers, según sea necesario.

Paso 3: Configure los parámetros básicos para cada router.

a. Desactive la búsqueda del DNS.

b. Configure el nombre del dispositivo como se muestra en la topología.

c. Asigne **class** como la contraseña del modo EXEC privilegiado.

d. Asigne **cisco** como la contraseña de consola y la contraseña de vty.

e. Configure un aviso de mensaje del día (MOTD) para advertir a los usuarios que el acceso no autorizado está prohibido.

f. Configure **logging synchronous** para la línea de consola.

g. Configure la dirección IP incluida en la tabla de direccionamiento para todas las interfaces.

h. Establezca la frecuencia de reloj para todas las interfaces seriales DCE en **128000**.

i. Copie la configuración en ejecución en la configuración de inicio

Paso 4: Configure los host del equipo.

Paso 5: Probar la conectividad.

Los routers deben poder hacer ping entre sí, y cada equipo debe ser capaz de hacer ping a su gateway predeterminado. Las computadoras no pueden hacer ping a otras computadoras hasta que no se haya configurado el routing OSPF. Verifique y resuelva los problemas si es necesario.

Parte 2: Configurar y verificar el enrutamiento OSPF

En la parte 2, configurará el routing OSPFv2 en todos los routers de la red y, luego, verificará que las tablas de routing se hayan actualizado correctamente. Después de verificar OSPF, configurará la autenticación de OSPF en los enlaces para mayor seguridad.

Paso 1: Configure el protocolo OSPF en R1.

a. Use el comando **router ospf** en el modo de configuración global para habilitar OSPF en el R1.

```
R1(config)# router ospf 1
```

Nota: la ID del proceso OSPF se mantiene localmente y no tiene sentido para los otros routers de la red.

b. Configure las instrucciones **network** para las redes en el R1. Utilice la ID de área 0.

```
R1(config-router)# network 192.168.1.0 0.0.0.255 area 0
R1(config-router)# network 192.168.12.0 0.0.0.3 area 0
R1(config-router)# network 192.168.13.0 0.0.0.3 area 0
```

Paso 2: Configure OSPF en el R2 y el R3.

Use el comando **router ospf** y agregue las instrucciones **network** para las redes en el R2 y el R3. Cuando el routing OSPF está configurado en el R2 y el R3, se muestran mensajes de adyacencia de vecino en el R1.

```
R1#
00:22:29: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.23.1 on Serial0/0/0 from LOADING to
FULL, Loading Done
R1#
00:23:14: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.23.2 on Serial0/0/1 from LOADING to
FULL, Loading Done
R1#
```

Paso 3: verificar los vecinos OSPF y la información de routing.

a. Emita el comando **show ip ospf neighbor** para verificar que cada router indique a los demás routers en la red como vecinos.

```
R1# show ip ospf neighbor

Neighbor ID     Pri   State           Dead Time   Address         Interface
192.168.23.2      0   FULL/  -        00:00:33    192.168.13.2    Serial0/0/1
192.168.23.1      0   FULL/  -        00:00:30    192.168.12.2    Serial0/0/0
```

b. Emita el comando **show ip route** para verificar que todas las redes aparezcan en la tabla de routing de todos los routers.

```
R1# show ip route
Codes: L - local, C - connected, S - static, 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

     192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.1.0/24 is directly connected, GigabitEthernet0/0
L       192.168.1.1/32 is directly connected, GigabitEthernet0/0
O    192.168.2.0/24 [110/65] via 192.168.12.2, 00:32:33, Serial0/0/0
O    192.168.3.0/24 [110/65] via 192.168.13.2, 00:31:48, Serial0/0/1
     192.168.12.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.12.0/30 is directly connected, Serial0/0/0
L       192.168.12.1/32 is directly connected, Serial0/0/0
     192.168.13.0/24 is variably subnetted, 2 subnets, 2 masks
```

```
C        192.168.13.0/30 is directly connected, Serial0/0/1
L        192.168.13.1/32 is directly connected, Serial0/0/1
     192.168.23.0/30 is subnetted, 1 subnets
O        192.168.23.0/30 [110/128] via 192.168.12.2, 00:31:38, Serial0/0/0
                         [110/128] via 192.168.13.2, 00:31:38, Serial0/0/1
```

¿Qué comando utilizaría para ver solamente las rutas OSPF en la tabla de routing?

El comando que se utilizaria es el " **show ip route ospf** "

Paso 4: verificar la configuración del protocolo OSPF.

El comando **show ip protocols** es una manera rápida de verificar información fundamental de configuración de OSPF. Esta información incluye la ID del proceso OSPF, la ID del router, las redes que anuncia el router, los vecinos de los que el router recibe actualizaciones y la distancia administrativa predeterminada, que para OSPF es 110.

```
R1# show ip protocols
*** IP Routing is NSF aware ***

Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 192.168.13.1
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    192.168.1.0 0.0.0.255 area 0
    192.168.12.0 0.0.0.3 area 0
    192.168.13.0 0.0.0.3 area 0
  Routing Information Sources:
    Gateway         Distance      Last Update
    192.168.23.2        110       00:19:16
    192.168.23.1        110       00:20:03
  Distance: (default is 110)
```

Paso 5: verificar la información del proceso OSPF.

Use el comando **show ip ospf** para examinar la ID del proceso OSPF y la ID del router. Este comando muestra información de área OSPF y la última vez que se calculó el algoritmo SPF.

```
R1# show ip ospf
 Routing Process "ospf 1" with ID 192.168.13.1
 Start time: 00:20:23.260, Time elapsed: 00:25:08.296
 Supports only single TOS(TOS0) routes
 Supports opaque LSA
 Supports Link-local Signaling (LLS)
 Supports area transit capability
 Supports NSSA (compatible with RFC 3101)
 Event-log enabled, Maximum number of events: 1000, Mode: cyclic
 Router is not originating router-LSAs with maximum metric
 Initial SPF schedule delay 5000 msecs
 Minimum hold time between two consecutive SPFs 10000 msecs
```

```
           Maximum wait time between two consecutive SPFs 10000 msecs
           Incremental-SPF disabled
           Minimum LSA interval 5 secs
           Minimum LSA arrival 1000 msecs
           LSA group pacing timer 240 secs
           Interface flood pacing timer 33 msecs
           Retransmission pacing timer 66 msecs
           Number of external LSA 0. Checksum Sum 0x000000
           Number of opaque AS LSA 0. Checksum Sum 0x000000
           Number of DCbitless external and opaque AS LSA 0
           Number of DoNotAge external and opaque AS LSA 0
           Number of areas in this router is 1. 1 normal 0 stub 0 nssa
           Number of areas transit capable is 0
           External flood list length 0
           IETF NSF helper support enabled
           Cisco NSF helper support enabled
           Reference bandwidth unit is 100 mbps
              Area BACKBONE(0)
                  Number of interfaces in this area is 3
                  Area has no authentication
                  SPF algorithm last executed 00:22:53.756 ago
                  SPF algorithm executed 7 times
                  Area ranges are
                  Number of LSA 3. Checksum Sum 0x019A61
                  Number of opaque link LSA 0. Checksum Sum 0x000000
                  Number of DCbitless LSA 0
                  Number of indication LSA 0
                  Number of DoNotAge LSA 0
                  Flood list length 0
```

Paso 6: verificar la configuración de la interfaz OSPF.

a. Emita el comando **show ip ospf interface brief** para ver un resumen de las interfaces con OSPF habilitado.

```
R1# show ip ospf interface brief
Interface   PID   Area          IP Address/Mask    Cost  State Nbrs F/C
Se0/0/1     1     0             192.168.13.1/30    64    P2P   1/1
Se0/0/0     1     0             192.168.12.1/30    64    P2P   1/1
Gi0/0       1     0             192.168.1.1/24     1     DR    0/0
```

b. Para obtener una lista detallada de todas las interfaces con OSPF habilitado, emita el comando **show ip ospf interface**.

```
R1# show ip ospf interface
Serial0/0/1 is up, line protocol is up
  Internet Address 192.168.13.1/30, Area 0, Attached via Network Statement
  Process ID 1, Router ID 192.168.13.1, Network Type POINT_TO_POINT, Cost: 64
  Topology-MTID   Cost    Disabled    Shutdown       Topology Name
       0           64        no          no            Base
  Transmit Delay is 1 sec, State POINT_TO_POINT
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
```

```
      oob-resync timeout 40
      Hello due in 00:00:01
    Supports Link-local Signaling (LLS)
    Cisco NSF helper support enabled
    IETF NSF helper support enabled
    Index 3/3, flood queue length 0
    Next 0x0(0)/0x0(0)
    Last flood scan length is 1, maximum is 1
    Last flood scan time is 0 msec, maximum is 0 msec
    Neighbor Count is 1, Adjacent neighbor count is 1
      Adjacent with neighbor 192.168.23.2
    Suppress hello for 0 neighbor(s)
  Serial0/0/0 is up, line protocol is up
    Internet Address 192.168.12.1/30, Area 0, Attached via Network Statement
    Process ID 1, Router ID 192.168.13.1, Network Type POINT_TO_POINT, Cost: 64
    Topology-MTID    Cost    Disabled    Shutdown      Topology Name
        0            64       no           no            Base
    Transmit Delay is 1 sec, State POINT_TO_POINT
    Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
      oob-resync timeout 40
      Hello due in 00:00:03
    Supports Link-local Signaling (LLS)
    Cisco NSF helper support enabled
    IETF NSF helper support enabled
    Index 2/2, flood queue length 0
    Next 0x0(0)/0x0(0)
    Last flood scan length is 1, maximum is 1
    Last flood scan time is 0 msec, maximum is 0 msec
    Neighbor Count is 1, Adjacent neighbor count is 1
      Adjacent with neighbor 192.168.23.1
    Suppress hello for 0 neighbor(s)
  GigabitEthernet0/0 is up, line protocol is up
    Internet Address 192.168.1.1/24, Area 0, Attached via Network Statement
    Process ID 1, Router ID 192.168.13.1, Network Type BROADCAST, Cost: 1
    Topology-MTID    Cost    Disabled    Shutdown      Topology Name
        0            1        no           no            Base
    Transmit Delay is 1 sec, State DR, Priority 1
    Designated Router (ID) 192.168.13.1, Interface address 192.168.1.1
    No backup designated router on this network
    Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
      oob-resync timeout 40
      Hello due in 00:00:01
    Supports Link-local Signaling (LLS)
    Cisco NSF helper support enabled
    IETF NSF helper support enabled
    Index 1/1, flood queue length 0
    Next 0x0(0)/0x0(0)
    Last flood scan length is 0, maximum is 0
    Last flood scan time is 0 msec, maximum is 0 msec
```

```
        Neighbor Count is 0, Adjacent neighbor count is 0
        Suppress hello for 0 neighbor(s)
```

Paso 7: Verifique la conectividad de extremo a extremo.

Se debería poder hacer ping entre todas las computadoras de la topología. Verifique y resuelva los problemas si es necesario.

Nota: puede ser necesario inhabilitar el firewall del equipo para hacer ping entre los equipos.

```
R1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#router ospf 1
R1(config-router)#network 192.168.1.0 0.0.0.255 area 0
R1(config-router)#network 192.168.12.0 0.0.0.3 area 0
R1(config-router)#network 192.168.13.0 0.0.0.3 area 0
```

```
R3#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R3(config)#router ospf 1
R3(config-router)#network 192.168.3.0 0.0.0.255 area 0
R3(config-router)#network 192.168.13.0 0.0.0.3 area 0
R3(config-router)#network 192.168.13.0 0.0.0.3 area 0
00:24:35: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.13.1 on Serial0/0/0 from LOADING to FULL, Loading Done

R3(config-router)#network 192.168.23.0 0.0.0.3 area 0
R3(config-router)#
00:24:57: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.23.1 on Serial0/0/1 from LOADING to FULL, Loading Done
```

```
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.12.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/5/21 ms

R2#ping 192.168.23.3

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.23.3, timeout is 2 seconds:

Reply to request 0 from 192.168.23.2, 24 ms
Reply to request 1 from 192.168.23.2, 1 ms
Reply to request 2 from 192.168.23.2, 1 ms
Reply to request 3 from 192.168.23.2, 7 ms
Reply to request 4 from 192.168.23.2, 1 ms

R2#
R2#ping 192.168.23.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.23.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/4/17 ms

R2#
R2#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R2(config)#router ospf 1
R2(config-router)#network 192.168.2.0 0.0.0.255 area 0
R2(config-router)#network 192.168.12.0 0.0.0.3 area 0
R2(config-router)#network 192.168.23.0 0.0.0.3 area 0
R2(config-router)#
00:23:39: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.13.1 on Serial0/0/0 from LOADING to FULL, Loading Done

R2(config-router)#network 192.168.23.0 0.0.0.3 area 0
00:25:08: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.23.2 on Serial0/0/1 from LOADING to FULL, Loading Done
```

```
R1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#router ospf 1
R1(config-router)#network 192.168.1.0 0.0.0.255 area 0
R1(config-router)#network 192.168.12.0 0.0.0.3 area 0
R1(config-router)#network 192.168.13.0 0.0.0.3 area 0
R1(config-router)#
00:23:53: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.23.1 on Serial0/0/0 from LOADING to FULL, Loading Done

00:25:00: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.23.2 on Serial0/0/1 from LOADING to FULL, Loading Done
```

```
R1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#router ospf 1
R1(config-router)#network 192.168.1.0 0.0.0.255 area 0
R1(config-router)#network 192.168.12.0 0.0.0.3 area 0
R1(config-router)#network 192.168.13.0 0.0.0.3 area 0
R1(config-router)#
00:23:53: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.23.1 on Serial0/0/0 from LOADING to FULL, Loading Done

00:25:00: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.23.2 on Serial0/0/1 from LOADING to FULL, Loading Done

R1(config-router)#end
R1#
%SYS-5-CONFIG_I: Configured from console by console

R1#show ip ospf neighbor


Neighbor ID     Pri   State           Dead Time   Address         Interface
192.168.23.2      0   FULL/   -       00:00:32    192.168.13.2    Serial0/0/1
192.168.23.1      0   FULL/   -       00:00:38    192.168.12.2    Serial0/0/0
```

```
Reply to request 0 from 192.168.23.2, 24 ms
Reply to request 1 from 192.168.23.2, 1 ms
Reply to request 2 from 192.168.23.2, 1 ms
Reply to request 3 from 192.168.23.2, 7 ms
Reply to request 4 from 192.168.23.2, 1 ms

R2#
R2#ping 192.168.23.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.23.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/4/17 ms

R2#
R2#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R2(config)#router ospf 1
R2(config-router)#network 192.168.2.0 0.0.0.255 area 0
R2(config-router)#network 192.168.12.0 0.0.0.3 area 0
R2(config-router)#network 192.168.23.0 0.0.0.3 area 0
R2(config-router)#
00:23:39: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.13.1 on Serial0/0/0 from LOADING to FULL, Loading Done

R2(config-router)#network 192.168.23.0 0.0.0.3 area 0
00:25:08: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.23.2 on Serial0/0/1 from LOADING to FULL, Loading Done

R2(config-router)#end
R2#
%SYS-5-CONFIG_I: Configured from console by console

R2#show ip ospf neighbor


Neighbor ID     Pri   State           Dead Time   Address         Interface
192.168.13.1      0   FULL/   -       00:00:37    192.168.12.1    Serial0/0/0
192.168.23.2      0   FULL/   -       00:00:35    192.168.23.2    Serial0/0/1
R2#
```

```
R3#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R3(config)#router ospf 1
R3(config-router)#network 192.168.3.0 0.0.0.255 area 0
R3(config-router)#network 192.168.13.0 0.0.0.3 area 0
R3(config-router)#network 192.168.13.0 0.0.0.3 area 0
00:24:35: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.13.1 on Serial0/0/0 from LOADING to FULL, Loading Done

R3(config-router)#network 192.168.23.0 0.0.0.3 area 0
R3(config-router)#
00:24:57: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.23.1 on Serial0/0/1 from LOADING to FULL, Loading Done

R3(config-router)#end
R3#
%SYS-5-CONFIG_I: Configured from console by console

R3#show ip ospf neighbor


Neighbor ID     Pri   State           Dead Time   Address         Interface
192.168.13.1      0   FULL/   -       00:00:32    192.168.13.1    Serial0/0/0
192.168.23.1      0   FULL/   -       00:00:35    192.168.23.1    Serial0/0/1
R3#
```

```
R1(config-router)#end
R1#
%SYS-5-CONFIG_I: Configured from console by console

R1#show ip ospf neighbor


Neighbor ID     Pri   State           Dead Time   Address         Interface
192.168.23.2      0   FULL/  -        00:00:32    192.168.13.2    Serial0/0/1
192.168.23.1      0   FULL/  -        00:00:38    192.168.12.2    Serial0/0/0
R1#
R1#show ip route
Codes: L - local, C - connected, S - static, 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

      192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.1.0/24 is directly connected, GigabitEthernet0/0
L        192.168.1.1/32 is directly connected, GigabitEthernet0/0
O     192.168.2.0/24 [110/65] via 192.168.12.2, 00:04:18, Serial0/0/0
O     192.168.3.0/24 [110/65] via 192.168.13.2, 00:03:11, Serial0/0/1
      192.168.12.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.12.0/30 is directly connected, Serial0/0/0
L        192.168.12.1/32 is directly connected, Serial0/0/0
      192.168.13.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.13.0/30 is directly connected, Serial0/0/1
L        192.168.13.1/32 is directly connected, Serial0/0/1
      192.168.23.0/30 is subnetted, 1 subnets
O        192.168.23.0/30 [110/128] via 192.168.12.2, 00:02:49, Serial0/0/0
                         [110/128] via 192.168.13.2, 00:02:49, Serial0/0/1
```

```
R2(config-router)#end
R2#
%SYS-5-CONFIG_I: Configured from console by console

R2#show ip ospf neighbor


Neighbor ID     Pri   State          Dead Time   Address         Interface
192.168.13.1     0    FULL/  -       00:00:37    192.168.12.1    Serial0/0/0
192.168.23.2     0    FULL/  -       00:00:35    192.168.23.2    Serial0/0/1
R2#show ip route
Codes: L - local, C - connected, S - static, 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

O    192.168.1.0/24 [110/65] via 192.168.12.1, 00:04:35, Serial0/0/0
     192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.2.0/24 is directly connected, GigabitEthernet0/0
L       192.168.2.1/32 is directly connected, GigabitEthernet0/0
O    192.168.3.0/24 [110/65] via 192.168.23.2, 00:03:07, Serial0/0/1
     192.168.12.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.12.0/30 is directly connected, Serial0/0/0
L       192.168.12.2/32 is directly connected, Serial0/0/0
     192.168.13.0/30 is subnetted, 1 subnets
O       192.168.13.0/30 [110/128] via 192.168.12.1, 00:03:07, Serial0/0/0
                        [110/128] via 192.168.23.2, 00:03:07, Serial0/0/1
     192.168.23.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.23.0/30 is directly connected, Serial0/0/1
L       192.168.23.1/32 is directly connected, Serial0/0/1

R2#
```

```
R3(config-router)#end
R3#
%SYS-5-CONFIG_I: Configured from console by console

R3#show ip ospf neighbor


Neighbor ID      Pri   State           Dead Time    Address        Interface
192.168.13.1       0   FULL/  -        00:00:32     192.168.13.1   Serial0/0/0
192.168.23.1       0   FULL/  -        00:00:35     192.168.23.1   Serial0/0/1
R3#
R3#show ip route
Codes: L - local, C - connected, S - static, 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

O    192.168.1.0/24 [110/65] via 192.168.13.1, 00:03:42, Serial0/0/0
O    192.168.2.0/24 [110/65] via 192.168.23.1, 00:03:20, Serial0/0/1
     192.168.3.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.3.0/24 is directly connected, GigabitEthernet0/0
L       192.168.3.1/32 is directly connected, GigabitEthernet0/0
     192.168.12.0/30 is subnetted, 1 subnets
O       192.168.12.0/30 [110/128] via 192.168.13.1, 00:03:20, Serial0/0/0
                        [110/128] via 192.168.23.1, 00:03:20, Serial0/0/1
     192.168.13.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.13.0/30 is directly connected, Serial0/0/0
L       192.168.13.2/32 is directly connected, Serial0/0/0
     192.168.23.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.23.0/30 is directly connected, Serial0/0/1
L       192.168.23.2/32 is directly connected, Serial0/0/1

R3#
```

```
R1#show ip route ospf
O    192.168.2.0 [110/65] via 192.168.12.2, 00:05:23, Serial0/0/0
O    192.168.3.0 [110/65] via 192.168.13.2, 00:04:16, Serial0/0/1
     192.168.23.0/30 is subnetted, 1 subnets
O       192.168.23.0 [110/128] via 192.168.12.2, 00:03:54, Serial0/0/0
                     [110/128] via 192.168.13.2, 00:03:54, Serial0/0/1

R1#
```

```
R2#show ip route ospf
O    192.168.1.0 [110/65] via 192.168.12.1, 00:05:29, Serial0/0/0
O    192.168.3.0 [110/65] via 192.168.23.2, 00:04:01, Serial0/0/1
     192.168.13.0/30 is subnetted, 1 subnets
O       192.168.13.0 [110/128] via 192.168.12.1, 00:04:01, Serial0/0/0
                     [110/128] via 192.168.23.2, 00:04:01, Serial0/0/1

R2#
```

```
R3#show ip route ospf
O    192.168.1.0 [110/65] via 192.168.13.1, 00:04:30, Serial0/0/0
O    192.168.2.0 [110/65] via 192.168.23.1, 00:04:08, Serial0/0/1
     192.168.12.0/30 is subnetted, 1 subnets
O       192.168.12.0 [110/128] via 192.168.13.1, 00:04:08, Serial0/0/0
                     [110/128] via 192.168.23.1, 00:04:08, Serial0/0/1
R3#
```

```
R1#show ip protocols

Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 192.168.13.1
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    192.168.1.0 0.0.0.255 area 0
    192.168.12.0 0.0.0.3 area 0
    192.168.13.0 0.0.0.3 area 0
  Routing Information Sources:
    Gateway         Distance      Last Update
    192.168.13.1         110      00:05:12
    192.168.23.1         110      00:04:50
    192.168.23.2         110      00:04:50
  Distance: (default is 110)

R1#
```

```
R2#show ip protocols

Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 192.168.23.1
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    192.168.2.0 0.0.0.255 area 0
    192.168.12.0 0.0.0.3 area 0
    192.168.23.0 0.0.0.3 area 0
  Routing Information Sources:
    Gateway         Distance      Last Update
    192.168.13.1         110      00:06:20
    192.168.23.1         110      00:05:58
    192.168.23.2         110      00:05:58
  Distance: (default is 110)

R2#
```

```
R3#show ip protocols

Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 192.168.23.2
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    192.168.3.0 0.0.0.255 area 0
    192.168.13.0 0.0.0.3 area 0
    192.168.23.0 0.0.0.3 area 0
  Routing Information Sources:
    Gateway          Distance       Last Update
    192.168.13.1          110        00:06:33
    192.168.23.1          110        00:06:11
    192.168.23.2          110        00:06:11
  Distance: (default is 110)

R3#
```

```
  Routing for Networks:
    192.168.1.0 0.0.0.255 area 0
    192.168.12.0 0.0.0.3 area 0
    192.168.13.0 0.0.0.3 area 0
  Routing Information Sources:
    Gateway          Distance       Last Update
    192.168.13.1          110        00:05:12
    192.168.23.1          110        00:04:50
    192.168.23.2          110        00:04:50
  Distance: (default is 110)

R1#show ip ospf
 Routing Process "ospf 1" with ID 192.168.13.1
 Supports only single TOS(TOS0) routes
 Supports opaque LSA
 SPF schedule delay 5 secs, Hold time between two SPFs 10 secs
 Minimum LSA interval 5 secs. Minimum LSA arrival 1 secs
 Number of external LSA 0. Checksum Sum 0x000000
 Number of opaque AS LSA 0. Checksum Sum 0x000000
 Number of DCbitless external and opaque AS LSA 0
 Number of DoNotAge external and opaque AS LSA 0
 Number of areas in this router is 1. 1 normal 0 stub 0 nssa
 External flood list length 0
    Area BACKBONE(0)
        Number of interfaces in this area is 3
        Area has no authentication
        SPF algorithm executed 6 times
        Area ranges are
        Number of LSA 3. Checksum Sum 0x00c59a
        Number of opaque link LSA 0. Checksum Sum 0x000000
        Number of DCbitless LSA 0
        Number of indication LSA 0
        Number of DoNotAge LSA 0
        Flood list length 0

R1#
```

```
GigabitEthernet0/0 is up, line protocol is up
  Internet address is 192.168.1.1/24, Area 0
  Process ID 1, Router ID 192.168.13.1, Network Type BROADCAST, Cost: 1
  Transmit Delay is 1 sec, State DR, Priority 1
  Designated Router (ID) 192.168.13.1, Interface address 192.168.1.1
  No backup designated router on this network
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:09
  Index 1/1, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 0, Adjacent neighbor count is 0
  Suppress hello for 0 neighbor(s)
Serial0/0/0 is up, line protocol is up
  Internet address is 192.168.12.1/30, Area 0
  Process ID 1, Router ID 192.168.13.1, Network Type POINT-TO-POINT, Cost: 64
  Transmit Delay is 1 sec, State POINT-TO-POINT, Priority 0
  No designated router on this network
  No backup designated router on this network
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:07
  Index 2/2, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 1 , Adjacent neighbor count is 1
    Adjacent with neighbor 192.168.23.1
  Suppress hello for 0 neighbor(s)
Serial0/0/1 is up, line protocol is up
  Internet address is 192.168.13.1/30, Area 0
  Process ID 1, Router ID 192.168.13.1, Network Type POINT-TO-POINT, Cost: 64
  Transmit Delay is 1 sec, State POINT-TO-POINT, Priority 0
  No designated router on this network
  No backup designated router on this network
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:05
  --More--
```

```
Pinging 192.168.2.3 with 32 bytes of data:

Reply from 192.168.2.3: bytes=32 time=1ms TTL=126
Reply from 192.168.2.3: bytes=32 time=10ms TTL=126
Reply from 192.168.2.3: bytes=32 time=11ms TTL=126
Reply from 192.168.2.3: bytes=32 time=5ms TTL=126

Ping statistics for 192.168.2.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 11ms, Average = 6ms
```

Parte 3: cambiar las asignaciones de ID del router

El ID del router OSPF se utiliza para identificar de forma única el router en el dominio de enrutamiento OSPF. Los routers Cisco derivan la ID del router en una de estas tres formas y con la siguiente prioridad:

1) Dirección IP configurada con el comando de OSPF **router-id**, si la hubiera

2) Dirección IP más alta de cualquiera de las direcciones de loopback del router, si la hubiera

3) Dirección IP activa más alta de cualquiera de las interfaces físicas del router

Dado que no se ha configurado ningún ID o interfaz de loopback en los tres routers, el ID de router para cada ruta se determina según la dirección IP más alta de cualquier interfaz activa.

En la parte 3, cambiará la asignación de ID del router OSPF con direcciones de loopback. También usará el comando **router-id** para cambiar la ID del router.

Paso 1: Cambie las ID de router con direcciones de loopback.

a. Asigne una dirección IP al loopback 0 en el R1.

```
R1(config)# interface lo0
R1(config-if)# ip address 1.1.1.1 255.255.255.255
R1(config-if)# end
```

b. Asigne direcciones IP al loopback 0 en el R2 y el R3. Utilice la dirección IP 2.2.2.2/32 para el R2 y 3.3.3.3/32 para el R3.

c. Guarde la configuración en ejecución en la configuración de inicio de todos los routers.

d. Debe volver a cargar los routers para restablecer la ID del router a la dirección de loopback. Emita el comando **reload** en los tres routers. Presione Enter para confirmar la recarga.

e. Una vez que se haya completado el proceso de recarga del router, emita el comando **show ip protocols** para ver la nueva ID del router.

```
R1# show ip protocols
*** IP Routing is NSF aware ***

Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 1.1.1.1
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    192.168.1.0 0.0.0.255 area 0
    192.168.12.0 0.0.0.3 area 0
    192.168.13.0 0.0.0.3 area 0
  Routing Information Sources:
    Gateway         Distance      Last Update
    3.3.3.3              110      00:01:00
    2.2.2.2              110      00:01:14
  Distance: (default is 110)
```

f. Emita el comando **show ip ospf neighbor** para mostrar los cambios de ID de router de los routers vecinos.

```
R1# show ip ospf neighbor

Neighbor ID     Pri   State           Dead Time   Address          Interface
3.3.3.3           0   FULL/  -        00:00:35    192.168.13.2     Serial0/0/1
2.2.2.2           0   FULL/  -        00:00:32    192.168.12.2     Serial0/0/0
R1#
```

Paso 2: cambiar la ID del router R1 con el comando router-id.

El método de preferencia para establecer la ID del router es mediante el comando **router-id**.

a. Emita el comando **router-id 11.11.11.11** en el R1 para reasignar la ID del router. Observe el mensaje informativo que aparece al emitir el comando **router-id**.

```
R1(config)# router ospf 1
R1(config-router)# router-id 11.11.11.11
Reload or use "clear ip ospf process" command, for this to take effect
R1(config)# end
```

b. Recibirá un mensaje informativo en el que se le indique que debe volver a cargar el router o usar el comando **clear ip ospf process** para que se aplique el cambio. Emita el comando **clear ip ospf process** en los tres routers. Escriba **yes** (sí) como respuesta al mensaje de verificación de restablecimiento y presione Enter.

c. Establezca la ID del router R2 **22.22.22.22** y la ID del router R3 **33.33.33.33**. Luego, use el comando **clear ip ospf process** para restablecer el proceso de routing de OSPF.

d. Emita el comando **show ip protocols** para verificar que la ID del router R1 haya cambiado.

```
R1# show ip protocols
*** IP Routing is NSF aware ***

Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 11.11.11.11
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    192.168.1.0 0.0.0.255 area 0
    192.168.12.0 0.0.0.3 area 0
    192.168.13.0 0.0.0.3 area 0
  Passive Interface(s):
    GigabitEthernet0/1
  Routing Information Sources:
    Gateway         Distance      Last Update
    33.33.33.33          110      00:00:19
    22.22.22.22          110      00:00:31
    3.3.3.3              110      00:00:41
    2.2.2.2              110      00:00:41
  Distance: (default is 110)
```

e. Emita el comando **show ip ospf neighbor** en el R1 para verificar que se muestren las nuevas ID de los routers R2 y R3.

```
R1# show ip ospf neighbor

Neighbor ID     Pri   State           Dead Time   Address         Interface
33.33.33.33       0   FULL/  -        00:00:36    192.168.13.2    Serial0/0/1
22.22.22.22       0   FULL/  -        00:00:32    192.168.12.2    Serial0/0/0
```

```
R3#show ip protocols

Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 192.168.23.2
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    192.168.3.0 0.0.0.255 area 0
    192.168.13.0 0.0.0.3 area 0
    192.168.23.0 0.0.0.3 area 0
  Routing Information Sources:
    Gateway          Distance      Last Update
    192.168.13.1          110       00:06:33
    192.168.23.1          110       00:06:11
    192.168.23.2          110       00:06:11
  Distance: (default is 110)

R3#
R3#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R3(config)#int lo0

R3(config-if)#
%LINK-5-CHANGED: Interface Loopback0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Loopback0, changed state to up

R3(config-if)#ip add 3.3.3.3 255.255.255.255
R3(config-if)#end
R3#
%SYS-5-CONFIG_I: Configured from console by console

R3#copy run start
```

```
R3#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R3(config)#int lo0

R3(config-if)#
%LINK-5-CHANGED: Interface Loopback0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Loopback0, changed state to up

R3(config-if)#ip add 3.3.3.3 255.255.255.255
R3(config-if)#end
R3#
%SYS-5-CONFIG_I: Configured from console by console

R3#copy run start
Destination filename [startup-config]?
Building configuration...
[OK]
R3#reload
Proceed with reload? [confirm]
System Bootstrap, Version 15.1(4)M4, RELEASE SOFTWARE (fc1)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 2010 by cisco Systems, Inc.
Total memory size = 512 MB - On-board = 512 MB, DIMM0 = 0 MB
CISCO1941/K9 platform with 524288 Kbytes of main memory
Main memory is configured to 64/-1(On-board/DIMM0) bit mode with ECC disabled

Readonly ROMMON initialized

program load complete, entry point: 0x80803000, size: 0x1b340
program load complete, entry point: 0x80803000, size: 0x1b340

IOS Image Load Test

_____
Digitally Signed Release Software
program load complete, entry point: 0x81000000, size: 0x2bb1c58
Self decompressing the image :
```

```
R2#
%SYS-5-CONFIG_I: Configured from console by console

R2#
%LINK-5-CHANGED: Interface Serial0/0/1, changed state to down

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/1, changed state to down

00:40:28: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.23.2 on Serial0/0/1 from FULL to DOWN, Neighbor Down: Interface down or detached

R2#c
%LINK-5-CHANGED: Interface Serial0/0/1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/1, changed state to up
opy run start
Destination filename [startup-config]?
Building configuration...
[OK]
R2#reload
Proceed with reload? [confirm]
System Bootstrap, Version 15.1(4)M4, RELEASE SOFTWARE (fc1)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 2010 by cisco Systems, Inc.
Total memory size = 512 MB - On-board = 512 MB, DIMM0 = 0 MB
CISCO1941/K9 platform with 524288 Kbytes of main memory
Main memory is configured to 64/-1(On-board/DIMM0) bit mode with ECC disabled

Readonly ROMMON initialized

program load complete, entry point: 0x80803000, size: 0x1b340
program load complete, entry point: 0x80803000, size: 0x1b340

IOS Image Load Test
_____
Digitally Signed Release Software
program load complete, entry point: 0x81000000, size: 0x2bb1c58
Self decompressing the image :
```

```
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/1, changed state to up

%LINK-5-CHANGED: Interface Serial0/0/0, changed state to down

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to down

00:41:02: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.23.1 on Serial0/0/0 from FULL to DOWN, Neighbor Down: Interface down or detached

00:41:02: %OSPF-5-ADJCHG: Process 1, Nbr 3.3.3.3 on Serial0/0/1 from LOADING to FULL, Loading Done

R1#
%LINK-5-CHANGED: Interface Serial0/0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to up
copy run start
Destination filename [startup-config]?
Building configuration...
[OK]
R1#reload
Proceed with reload? [confirm]
System Bootstrap, Version 15.1(4)M4, RELEASE SOFTWARE (fc1)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 2010 by cisco Systems, Inc.
Total memory size = 512 MB - On-board = 512 MB, DIMM0 = 0 MB
CISCO1941/K9 platform with 524288 Kbytes of main memory
Main memory is configured to 64/-1(On-board/DIMM0) bit mode with ECC disabled

Readonly ROMMON initialized

program load complete, entry point: 0x80803000, size: 0x1b340
program load complete, entry point: 0x80803000, size: 0x1b340

IOS Image Load Test
_____
Digitally Signed Release Software
program load complete, entry point: 0x81000000, size: 0x2bb1c58
Self decompressing the image :
```

```
R1#show ip pro

Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 1.1.1.1
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    192.168.1.0 0.0.0.255 area 0
    192.168.12.0 0.0.0.3 area 0
    192.168.13.0 0.0.0.3 area 0
  Routing Information Sources:
    Gateway          Distance      Last Update
    1.1.1.1              110        00:00:30
    2.2.2.2              110        00:00:30
    3.3.3.3              110        00:00:30
    192.168.13.1         110        00:00:58
    192.168.23.1         110        00:01:19
    192.168.23.2         110        00:16:46
  Distance: (default is 110)
```

```
R2#show ip pro

Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 2.2.2.2
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    192.168.2.0 0.0.0.255 area 0
    192.168.12.0 0.0.0.3 area 0
    192.168.23.0 0.0.0.3 area 0
  Routing Information Sources:
    Gateway          Distance      Last Update
    1.1.1.1              110        00:00:51
    2.2.2.2              110        00:00:51
    3.3.3.3              110        00:00:51
    192.168.13.1         110        00:01:20
    192.168.23.1         110        00:01:41
    192.168.23.2         110        00:17:08
  Distance: (default is 110)
```

```
R3#show ip pro

Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 3.3.3.3
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    192.168.3.0 0.0.0.255 area 0
    192.168.13.0 0.0.0.3 area 0
    192.168.23.0 0.0.0.3 area 0
  Routing Information Sources:
    Gateway          Distance      Last Update
    1.1.1.1               110      00:01:12
    2.2.2.2               110      00:01:12
    3.3.3.3               110      00:01:12
    192.168.13.1          110      00:01:40
    192.168.23.1          110      00:02:01
    192.168.23.2          110      00:17:28
  Distance: (default is 110)
```

```
R1#show ip pro

Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 1.1.1.1
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    192.168.1.0 0.0.0.255 area 0
    192.168.12.0 0.0.0.3 area 0
    192.168.13.0 0.0.0.3 area 0
  Routing Information Sources:
    Gateway          Distance      Last Update
    1.1.1.1               110      00:00:30
    2.2.2.2               110      00:00:30
    3.3.3.3               110      00:00:30
    192.168.13.1          110      00:00:58
    192.168.23.1          110      00:01:19
    192.168.23.2          110      00:16:46
  Distance: (default is 110)

R1#show ip ospf neighbor


Neighbor ID     Pri   State           Dead Time   Address         Interface
3.3.3.3           0   FULL/  -        00:00:38    192.168.13.2    Serial0/0/1
2.2.2.2           0   FULL/  -        00:00:38    192.168.12.2    Serial0/0/0
R1#
```

```
R1#show ip pro

Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 11.11.11.11
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    192.168.1.0 0.0.0.255 area 0
    192.168.12.0 0.0.0.3 area 0
    192.168.13.0 0.0.0.3 area 0
  Routing Information Sources:
    Gateway          Distance      Last Update
    1.1.1.1              110       00:05:46
    2.2.2.2              110       00:01:37
    3.3.3.3              110       00:00:46
    11.11.11.11          110       00:00:02
    22.22.22.22          110       00:00:11
    33.33.33.33          110       00:00:11
    192.168.13.1         110       00:06:15
    192.168.23.1         110       00:06:36
    192.168.23.2         110       00:22:03
  Distance: (default is 110)


R1#
00:06:11: %OSPF-5-ADJCHG: Process 1, Nbr 33.33.33.33 on Serial0/0/1 from LOADING to FULL, Loading Done
```

```
R1#show ip pro

Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 11.11.11.11
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    192.168.1.0 0.0.0.255 area 0
    192.168.12.0 0.0.0.3 area 0
    192.168.13.0 0.0.0.3 area 0
  Routing Information Sources:
    Gateway          Distance      Last Update
    1.1.1.1              110       00:05:46
    2.2.2.2              110       00:01:37
    3.3.3.3              110       00:00:46
    11.11.11.11          110       00:00:02
    22.22.22.22          110       00:00:11
    33.33.33.33          110       00:00:11
    192.168.13.1         110       00:06:15
    192.168.23.1         110       00:06:36
    192.168.23.2         110       00:22:03
  Distance: (default is 110)

R1#
00:06:11: %OSPF-5-ADJCHG: Process 1, Nbr 33.33.33.33 on Serial0/0/1 from LOADING to FULL, Loading Done

R1#
R1#show ip ospf neighbor


Neighbor ID     Pri   State           Dead Time   Address         Interface
33.33.33.33       0   FULL/  -        00:00:33    192.168.13.2    Serial0/0/1
22.22.22.22       0   FULL/  -        00:00:33    192.168.12.2    Serial0/0/0
R1#
```

```
R2#show ip pro

Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 22.22.22.22
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    192.168.2.0 0.0.0.255 area 0
    192.168.12.0 0.0.0.3 area 0
    192.168.23.0 0.0.0.3 area 0
  Routing Information Sources:
    Gateway          Distance      Last Update
    1.1.1.1               110      00:07:36
    2.2.2.2               110      00:03:27
    3.3.3.3               110      00:02:36
    11.11.11.11           110      00:01:47
    22.22.22.22           110      00:02:01
    33.33.33.33           110      00:01:47
    192.168.13.1          110      00:08:04
    192.168.23.1          110      00:08:25
    192.168.23.2          110      00:23:52
  Distance: (default is 110)

R2#show ip ospf neighbor



Neighbor ID      Pri   State          Dead Time   Address        Interface
11.11.11.11        0   FULL/  -       00:00:35    192.168.12.1   Serial0/0/0
33.33.33.33        0   FULL/  -       00:00:37    192.168.23.2   Serial0/0/1
R2#
```

```
R3#show ip pro

Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 33.33.33.33
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    192.168.3.0 0.0.0.255 area 0
    192.168.13.0 0.0.0.3 area 0
    192.168.23.0 0.0.0.3 area 0
  Routing Information Sources:
    Gateway          Distance      Last Update
    1.1.1.1               110      00:08:04
    2.2.2.2               110      00:03:55
    3.3.3.3               110      00:03:04
    11.11.11.11           110      00:02:15
    22.22.22.22           110      00:02:29
    33.33.33.33           110      00:02:15
    192.168.13.1          110      00:08:32
    192.168.23.1          110      00:08:53
    192.168.23.2          110      00:24:20

R3#show ip ospf neighbor



Neighbor ID      Pri   State          Dead Time   Address        Interface
11.11.11.11        0   FULL/  -       00:00:31    192.168.13.1   Serial0/0/0
22.22.22.22        0   FULL/  -       00:00:32    192.168.23.1   Serial0/0/1
R3#
```

Parte 4: configurar las interfaces pasivas de OSPF

El comando **passive-interface** evita que se envíen actualizaciones de routing a través de la interfaz de router especificada. Esto se hace comúnmente para reducir el tráfico en las redes LAN, ya que no necesitan recibir comunicaciones de protocolo de routing dinámico. En la parte 4, utilizará el comando **passive-interface** para configurar una única interfaz como pasiva. También configurará OSPF para que todas las interfaces del router sean pasivas de manera predeterminada y, luego, habilitará anuncios de routing OSPF en interfaces seleccionadas.

Paso 1: configurar una interfaz pasiva.

a. Emita el comando **show ip ospf interface g0/0** en el R1. Observe el temporizador que indica cuándo se espera el siguiente paquete de saludo. Los paquetes de saludo se envían cada 10 segundos y se utilizan entre los routers OSPF para verificar que sus vecinos estén activos.

```
R1# show ip ospf interface g0/0
GigabitEthernet0/0 is up, line protocol is up
  Internet Address 192.168.1.1/24, Area 0, Attached via Network Statement
  Process ID 1, Router ID 11.11.11.11, Network Type BROADCAST, Cost: 1
  Topology-MTID    Cost    Disabled    Shutdown      Topology Name
       0             1         no          no             Base
  Transmit Delay is 1 sec, State DR, Priority 1
  Designated Router (ID) 11.11.11.11, Interface address 192.168.1.1
  No backup designated router on this network
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    oob-resync timeout 40
    Hello due in 00:00:02
  Supports Link-local Signaling (LLS)
  Cisco NSF helper support enabled
  IETF NSF helper support enabled
  Index 1/1, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 0, maximum is 0
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 0, Adjacent neighbor count is 0
  Suppress hello for 0 neighbor(s)
```

b. Emita el comando **passive-interface** para cambiar la interfaz G0/0 en el R1 a pasiva.

```
R1(config)# router ospf 1
R1(config-router)# passive-interface g0/0
```

c. Vuelva a emitir el comando **show ip ospf interface g0/0** para verificar que la interfaz G0/0 ahora sea pasiva.

```
R1# show ip ospf interface g0/0
GigabitEthernet0/0 is up, line protocol is up
  Internet Address 192.168.1.1/24, Area 0, Attached via Network Statement
  Process ID 1, Router ID 11.11.11.11, Network Type BROADCAST, Cost: 1
  Topology-MTID    Cost    Disabled    Shutdown      Topology Name
       0             1         no          no             Base
  Transmit Delay is 1 sec, State DR, Priority 1
  Designated Router (ID) 11.11.11.11, Interface address 192.168.1.1
  No backup designated router on this network
```

```
        Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
          oob-resync timeout 40
          No Hellos (Passive interface)
        Supports Link-local Signaling (LLS)
        Cisco NSF helper support enabled
        IETF NSF helper support enabled
        Index 1/1, flood queue length 0
        Next 0x0(0)/0x0(0)
        Last flood scan length is 0, maximum is 0
        Last flood scan time is 0 msec, maximum is 0 msec
        Neighbor Count is 0, Adjacent neighbor count is 0
        Suppress hello for 0 neighbor(s)
```

d. Emita el comando **show ip route** en el R2 y el R3 para verificar que todavía haya disponible una ruta a la red 192.168.1.0/24.

```
R2# show ip route
Codes: L - local, C - connected, S - static, 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
       i - IS-IS, su - IS-IS summary, 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, H - NHRP, l - LISP
       + - replicated route, % - next hop override


Gateway of last resort is not set

      2.0.0.0/32 is subnetted, 1 subnets
C        2.2.2.2 is directly connected, Loopback0
O     192.168.1.0/24 [110/65] via 192.168.12.1, 00:58:32, Serial0/0/0
      192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.2.0/24 is directly connected, GigabitEthernet0/0
L        192.168.2.1/32 is directly connected, GigabitEthernet0/0
O     192.168.3.0/24 [110/65] via 192.168.23.2, 00:58:19, Serial0/0/1
      192.168.12.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.12.0/30 is directly connected, Serial0/0/0
L        192.168.12.2/32 is directly connected, Serial0/0/0
      192.168.13.0/30 is subnetted, 1 subnets
O        192.168.13.0 [110/128] via 192.168.23.2, 00:58:19, Serial0/0/1
                      [110/128] via 192.168.12.1, 00:58:32, Serial0/0/0
      192.168.23.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.23.0/30 is directly connected, Serial0/0/1
L        192.168.23.1/32 is directly connected, Serial0/0/1
```

Paso 2: establecer la interfaz pasiva como la interfaz predeterminada en un router.

a. Emita el comando **show ip ospf neighbor** en el R1 para verificar que el R2 aparezca como un vecino OSPF.

```
R1# show ip ospf neighbor
```

```
Neighbor ID     Pri   State           Dead Time   Address         Interface
33.33.33.33       0   FULL/  -        00:00:31    192.168.13.2    Serial0/0/1
22.22.22.22       0   FULL/  -        00:00:32    192.168.12.2    Serial0/0/0
```

b. Emita el comando **passive-interface default** en el R2 para establecer todas las interfaces OSPF como pasivas de manera predeterminada.

```
R2(config)# router ospf 1
R2(config-router)# passive-interface default
R2(config-router)#
*Apr  3 00:03:00.979: %OSPF-5-ADJCHG: Process 1, Nbr 11.11.11.11 on Serial0/0/0 from
FULL to DOWN, Neighbor Down: Interface down or detached
*Apr  3 00:03:00.979: %OSPF-5-ADJCHG: Process 1, Nbr 33.33.33.33 on Serial0/0/1 from
FULL to DOWN, Neighbor Down: Interface down or detached
```

c. Vuelva a emitir el comando **show ip ospf neighbor** en el R1. Una vez que el temporizador de tiempo muerto haya caducado, el R2 ya no se mostrará como un vecino OSPF.

```
R1# show ip ospf neighbor


Neighbor ID     Pri   State           Dead Time   Address         Interface
33.33.33.33       0   FULL/  -        00:00:34    192.168.13.2    Serial0/0/1
```

d. Emita el comando **show ip ospf interface S0/0/0** en el R2 para ver el estado de OSPF de la interfaz S0/0/0.

```
R2# show ip ospf interface s0/0/0
Serial0/0/0 is up, line protocol is up
  Internet Address 192.168.12.2/30, Area 0, Attached via Network Statement
  Process ID 1, Router ID 22.22.22.22, Network Type POINT_TO_POINT, Cost: 64
  Topology-MTID    Cost    Disabled    Shutdown      Topology Name
        0           64        no          no            Base
  Transmit Delay is 1 sec, State POINT_TO_POINT
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    oob-resync timeout 40
    No Hellos (Passive interface)
  Supports Link-local Signaling (LLS)
  Cisco NSF helper support enabled
  IETF NSF helper support enabled
  Index 2/2, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 0, maximum is 0
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 0, Adjacent neighbor count is 0
  Suppress hello for 0 neighbor(s)
```

e. Si todas las interfaces en el R2 son pasivas, no se anuncia ninguna información de routing. En este caso, el R1 y el R3 ya no deberían tener una ruta a la red 192.168.2.0/24. Esto se puede verificar mediante el comando **show ip route**.

f. En el R2, emita el comando **no passive-interface** para que el router envíe y reciba actualizaciones de routing OSPF. Después de introducir este comando, verá un mensaje informativo que explica que se estableció una adyacencia de vecino con el R1.

```
R2(config)# router ospf 1
R2(config-router)# no passive-interface s0/0/0
```

```
R2(config-router)#
```
<mark>*Apr 3 00:18:03.463: %OSPF-5-ADJCHG: Process 1, Nbr 11.11.11.11 on Serial0/0/0 from LOADING to FULL, Loading Done</mark>

g. Vuelva a emitir los comandos **show ip route** y **show ip ospf neighbor** en el R1 y el R3, y busque una ruta a la red 192.168.2.0/24.

¿Qué interfaz usa R3 para enrutarse a la red 192.168.2.0/24?

La interfaz que usariaos es el 192.168.13.1, Serial0/0/0

¿Cuál es la métrica de costo acumulado para la red 192.168.2.0/24 en el R3?

La metrica de costo es 129

¿El R2 aparece como vecino OSPF en el R1?

En el R1 el OSPF SI aparece como vecino del R2

¿El R2 aparece como vecino OSPF en el R3?

En el R3 el OSPF NO aparece como vecino del R2

¿Qué indica esta información?

La información ya menciona indica que si quisiera mandar un paquete pasaría primero por el R1 y de ahí iria a R2 por que no se pueden mandar paquetes a R2 directamente

h. Cambie la interfaz S0/0/1 en el R2 para permitir que anuncie las rutas OSPF. Registre los comandos utilizados a continuación.

R2(config)router ospf 1

R2(config-router)no passive-interface s0/1/1

i. Vuelva a emitir el comando **show ip route** en el R3.

¿Qué interfaz usa R3 para enrutarse a la red 192.168.2.0/24?

192.168.23.1, Serial0/0/1

¿Cuál es la métrica de costo acumulado para la red 192.168.2.0/24 en el R3 y cómo se calcula?

65, 64+1 (para una S0/ es 64 y para una G0/ es 1)

¿El R2 aparece como vecino OSPF del R3?

En el R3 el OSPF SI aparece como vecino del R2

```
R1#show ip ospf int g0/0

GigabitEthernet0/0 is up, line protocol is up
  Internet address is 192.168.1.1/24, Area 0
  Process ID 1, Router ID 11.11.11.11, Network Type BROADCAST, Cost: 1
  Transmit Delay is 1 sec, State DR, Priority 1
  Designated Router (ID) 11.11.11.11, Interface address 192.168.1.1
  No backup designated router on this network
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:05
  Index 1/1, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 0, Adjacent neighbor count is 0
  Suppress hello for 0 neighbor(s)
R1#
```

```
R1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#router ospf 1
R1(config-router)#passive-int g0/0
R1(config-router)#end
R1#
%SYS-5-CONFIG_I: Configured from console by console
conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#end
R1#
%SYS-5-CONFIG_I: Configured from console by console

R1#show ip ospf int g0/0

GigabitEthernet0/0 is up, line protocol is up
  Internet address is 192.168.1.1/24, Area 0
  Process ID 1, Router ID 11.11.11.11, Network Type BROADCAST, Cost: 1
  Transmit Delay is 1 sec, State WAITING, Priority 1
  No designated router on this network
  No backup designated router on this network
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    No Hellos (Passive interface)
  Index 1/1, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 0, Adjacent neighbor count is 0
  Suppress hello for 0 neighbor(s)
R1#
```

```
R2#show ip ospf neighbor


Neighbor ID      Pri   State           Dead Time   Address         Interface
11.11.11.11        0   FULL/  -        00:00:35    192.168.12.1    Serial0/0/0
33.33.33.33        0   FULL/  -        00:00:37    192.168.23.2    Serial0/0/1
R2#
R2#show ip route
Codes: L - local, C - connected, S - static, 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

      2.0.0.0/32 is subnetted, 1 subnets
C        2.2.2.2/32 is directly connected, Loopback0
O     192.168.1.0/24 [110/65] via 192.168.12.1, 00:07:06, Serial0/0/0
      192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.2.0/24 is directly connected, GigabitEthernet0/0
L        192.168.2.1/32 is directly connected, GigabitEthernet0/0
O     192.168.3.0/24 [110/65] via 192.168.23.2, 00:06:36, Serial0/0/1
      192.168.12.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.12.0/30 is directly connected, Serial0/0/0
L        192.168.12.2/32 is directly connected, Serial0/0/0
      192.168.13.0/30 is subnetted, 1 subnets
O        192.168.13.0/30 [110/128] via 192.168.23.2, 00:06:36, Serial0/0/1
                         [110/128] via 192.168.12.1, 00:06:36, Serial0/0/0
      192.168.23.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.23.0/30 is directly connected, Serial0/0/1
L        192.168.23.1/32 is directly connected, Serial0/0/1
```

```
R2#show ip route
Codes: L - local, C - connected, S - static, 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

      2.0.0.0/32 is subnetted, 1 subnets
C        2.2.2.2/32 is directly connected, Loopback0
O     192.168.1.0/24 [110/65] via 192.168.12.1, 00:07:06, Serial0/0/0
      192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.2.0/24 is directly connected, GigabitEthernet0/0
L        192.168.2.1/32 is directly connected, GigabitEthernet0/0
O     192.168.3.0/24 [110/65] via 192.168.23.2, 00:06:36, Serial0/0/1
      192.168.12.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.12.0/30 is directly connected, Serial0/0/0
L        192.168.12.2/32 is directly connected, Serial0/0/0
      192.168.13.0/30 is subnetted, 1 subnets
O        192.168.13.0/30 [110/128] via 192.168.23.2, 00:06:36, Serial0/0/1
                         [110/128] via 192.168.12.1, 00:06:36, Serial0/0/0
      192.168.23.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.23.0/30 is directly connected, Serial0/0/1
L        192.168.23.1/32 is directly connected, Serial0/0/1

R2#
R2#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R2(config)#router ospf 1
R2(config-router)#passive-int default
R2(config-router)#
00:14:29: %OSPF-5-ADJCHG: Process 1, Nbr 11.11.11.11 on Serial0/0/0 from FULL to DOWN, Neighbor Down: Interface down or detached

00:14:29: %OSPF-5-ADJCHG: Process 1, Nbr 33.33.33.33 on Serial0/0/1 from FULL to DOWN, Neighbor Down: Interface down or detached

Gateway of last resort is not set

      1.0.0.0/32 is subnetted, 1 subnets
C        1.1.1.1/32 is directly connected, Loopback0
      192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.1.0/24 is directly connected, GigabitEthernet0/0
L        192.168.1.1/32 is directly connected, GigabitEthernet0/0
O     192.168.2.0/24 [110/65] via 192.168.12.2, 00:04:56, Serial0/0/0
O     192.168.3.0/24 [110/65] via 192.168.13.2, 00:04:24, Serial0/0/1
      192.168.12.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.12.0/30 is directly connected, Serial0/0/0
L        192.168.12.1/32 is directly connected, Serial0/0/0
      192.168.13.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.13.0/30 is directly connected, Serial0/0/1
L        192.168.13.1/32 is directly connected, Serial0/0/1
      192.168.23.0/30 is subnetted, 1 subnets
O        192.168.23.0/30 [110/128] via 192.168.13.2, 00:04:24, Serial0/0/1
                         [110/128] via 192.168.12.2, 00:04:24, Serial0/0/0

R1#
R1#show ip ospf neighbor


Neighbor ID     Pri   State           Dead Time   Address         Interface
33.33.33.33       0   FULL/  -        00:00:37    192.168.13.2    Serial0/0/1
22.22.22.22       0   FULL/  -        00:00:37    192.168.12.2    Serial0/0/0
R1#
00:14:50: %OSPF-5-ADJCHG: Process 1, Nbr 22.22.22.22 on Serial0/0/0 from FULL to DOWN, Neighbor Down: Dead timer expired

00:14:50: %OSPF-5-ADJCHG: Process 1, Nbr 22.22.22.22 on Serial0/0/0 from FULL to DOWN, Neighbor Down: Interface down or detached

R1#show ip ospf neighbor


Neighbor ID     Pri   State           Dead Time   Address         Interface
33.33.33.33       0   FULL/  -        00:00:36    192.168.13.2    Serial0/0/1
R1#
```

```
R2#
R2#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R2(config)#router ospf 1
R2(config-router)#passive-int default
R2(config-router)#
00:14:29: %OSPF-5-ADJCHG: Process 1, Nbr 11.11.11.11 on Serial0/0/0 from FULL to DOWN, Neighbor Down: Interface down or detached

00:14:29: %OSPF-5-ADJCHG: Process 1, Nbr 33.33.33.33 on Serial0/0/1 from FULL to DOWN, Neighbor Down: Interface down or detached

R2(config-router)#
R2(config-router)#end
R2#
%SYS-5-CONFIG_I: Configured from console by console

R2#show ip ospf int s0/0/0

Serial0/0/0 is up, line protocol is up
  Internet address is 192.168.12.2/30, Area 0
  Process ID 1, Router ID 22.22.22.22, Network Type POINT-TO-POINT, Cost: 64
  Transmit Delay is 1 sec, State POINT-TO-POINT, Priority 0
  No designated router on this network
  No backup designated router on this network
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    No Hellos (Passive interface)
  Index 3/3, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Suppress hello for 0 neighbor(s)
R2#
```

```
R2#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R2(config)#router ospf 1
R2(config-router)#passive-int default
R2(config-router)#
00:14:29: %OSPF-5-ADJCHG: Process 1, Nbr 11.11.11.11 on Serial0/0/0 from FULL to DOWN, Neighbor Down: Interface down or detached

00:14:29: %OSPF-5-ADJCHG: Process 1, Nbr 33.33.33.33 on Serial0/0/1 from FULL to DOWN, Neighbor Down: Interface down or detached

R2(config-router)#
R2(config-router)#end
R2#
%SYS-5-CONFIG_I: Configured from console by console

R2#show ip ospf int s0/0/0

Serial0/0/0 is up, line protocol is up
  Internet address is 192.168.12.2/30, Area 0
  Process ID 1, Router ID 22.22.22.22, Network Type POINT-TO-POINT, Cost: 64
  Transmit Delay is 1 sec, State POINT-TO-POINT, Priority 0
  No designated router on this network
  No backup designated router on this network
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    No Hellos (Passive interface)
  Index 3/3, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Suppress hello for 0 neighbor(s)
R2#
R2#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R2(config)#router ospf 1
R2(config-router)#no passive-int s0/0/0
R2(config-router)#
00:18:19: %OSPF-5-ADJCHG: Process 1, Nbr 11.11.11.11 on Serial0/0/0 from LOADING to FULL, Loading Done
```

```
R1#
00:18:00: %OSPF-5-ADJCHG: Process 1, Nbr 22.22.22.22 on Serial0/0/0 from LOADING to FULL, Loading Done

R1#show ip route
Codes: L - local, C - connected, S - static, 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

      1.0.0.0/32 is subnetted, 1 subnets
C        1.1.1.1/32 is directly connected, Loopback0
      192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.1.0/24 is directly connected, GigabitEthernet0/0
L        192.168.1.1/32 is directly connected, GigabitEthernet0/0
O     192.168.2.0/24 [110/65] via 192.168.12.2, 00:00:34, Serial0/0/0
O     192.168.3.0/24 [110/65] via 192.168.13.2, 00:12:23, Serial0/0/1
      192.168.12.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.12.0/30 is directly connected, Serial0/0/0
L        192.168.12.1/32 is directly connected, Serial0/0/0
      192.168.13.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.13.0/30 is directly connected, Serial0/0/1
L        192.168.13.1/32 is directly connected, Serial0/0/1
      192.168.23.0/30 is subnetted, 1 subnets
O        192.168.23.0/30 [110/128] via 192.168.13.2, 00:00:34, Serial0/0/1
                         [110/128] via 192.168.12.2, 00:00:34, Serial0/0/0

R1#show ip ospf neighbor


Neighbor ID     Pri   State          Dead Time   Address         Interface
33.33.33.33       0   FULL/  -       00:00:36    192.168.13.2    Serial0/0/1
22.22.22.22       0   FULL/  -       00:00:36    192.168.12.2    Serial0/0/0
R1#
```

```
R3#show ip route
Codes: L - local, C - connected, S - static, 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

      3.0.0.0/32 is subnetted, 1 subnets
C        3.3.3.3/32 is directly connected, Loopback0
O     192.168.1.0/24 [110/65] via 192.168.13.1, 00:13:05, Serial0/0/0
O     192.168.2.0/24 [110/129] via 192.168.13.1, 00:01:11, Serial0/0/0
      192.168.3.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.3.0/24 is directly connected, GigabitEthernet0/0
L        192.168.3.1/32 is directly connected, GigabitEthernet0/0
      192.168.12.0/30 is subnetted, 1 subnets
O        192.168.12.0/30 [110/128] via 192.168.13.1, 00:04:22, Serial0/0/0
      192.168.13.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.13.0/30 is directly connected, Serial0/0/0
L        192.168.13.2/32 is directly connected, Serial0/0/0
      192.168.23.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.23.0/30 is directly connected, Serial0/0/1
L        192.168.23.2/32 is directly connected, Serial0/0/1

R3#
R3#show ip ospf neighbor


Neighbor ID     Pri   State           Dead Time   Address         Interface
11.11.11.11       0   FULL/  -        00:00:37    192.168.13.1    Serial0/0/0
R3#
```

```
Neighbor ID      Pri   State         Dead Time   Address       Interface
11.11.11.11       0   FULL/  -        00:00:37    192.168.13.1  Serial0/0/0
R3#
R3#
00:27:01: %OSPF-5-ADJCHG: Process 1, Nbr 22.22.22.22 on Serial0/0/1 from LOADING to FULL, Loading Done

R3#show ip route
Codes: L - local, C - connected, S - static, 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

      3.0.0.0/32 is subnetted, 1 subnets
C        3.3.3.3/32 is directly connected, Loopback0
O     192.168.1.0/24 [110/65] via 192.168.13.1, 00:20:39, Serial0/0/0
O     192.168.2.0/24 [110/65] via 192.168.23.1, 00:00:24, Serial0/0/1
      192.168.3.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.3.0/24 is directly connected, GigabitEthernet0/0
L        192.168.3.1/32 is directly connected, GigabitEthernet0/0
      192.168.12.0/30 is subnetted, 1 subnets
O        192.168.12.0/30 [110/128] via 192.168.23.1, 00:00:24, Serial0/0/1
                         [110/128] via 192.168.13.1, 00:00:24, Serial0/0/0
      192.168.13.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.13.0/30 is directly connected, Serial0/0/0
L        192.168.13.2/32 is directly connected, Serial0/0/0
      192.168.23.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.23.0/30 is directly connected, Serial0/0/1
L        192.168.23.2/32 is directly connected, Serial0/0/1
```

```
R1#show int g0/0
GigabitEthernet0/0 is up, line protocol is up (connected)
  Hardware is CN Gigabit Ethernet, address is 00d0.ff2e.9301 (bia 00d0.ff2e.9301)
  Internet address is 192.168.1.1/24
  MTU 1500 bytes, BW 1000000 Kbit, DLY 100 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
  Full-duplex, 100Mb/s, media type is RJ45
  output flow-control is unsupported, input flow-control is unsupported
  ARP type: ARPA, ARP Timeout 04:00:00,
  Last input 00:00:08, output 00:00:05, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0 (size/max/drops); Total output drops: 0
  Queueing strategy: fifo
  Output queue :0/40 (size/max)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     0 packets input, 0 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     0 watchdog, 1017 multicast, 0 pause input
     0 input packets with dribble condition detected
     59 packets output, 3776 bytes, 0 underruns
     0 output errors, 0 collisions, 1 interface resets
     0 unknown protocol drops
     0 babbles, 0 late collision, 0 deferred
     0 lost carrier, 0 no carrier
     0 output buffer failures, 0 output buffers swapped out
```

```
R1#
R1#show ip route ospf
O    192.168.2.0 [110/65] via 192.168.12.2, 00:16:55, Serial0/0/0
O    192.168.3.0 [110/65] via 192.168.13.2, 00:28:44, Serial0/0/1
     192.168.23.0/30 is subnetted, 1 subnets
O       192.168.23.0 [110/128] via 192.168.13.2, 00:16:55, Serial0/0/1
                     [110/128] via 192.168.12.2, 00:16:55, Serial0/0/0
```

Parte 5: cambiar las métricas de OSPF

En la parte 5, cambiará las métricas de OSPF con los comandos **auto-cost reference-bandwidth**, **bandwidth** e **ip ospf cost**.

Nota: en la parte 1, se deberían haber configurado todas las interfaces DCE con una frecuencia de reloj de 128000.

Paso 1: cambiar el ancho de banda de referencia en los routers.

El ancho de banda de referencia predeterminado para OSPF es 100 Mb/s (velocidad Fast Ethernet). Sin embargo, la mayoría de los dispositivos de infraestructura moderna tienen enlaces con una velocidad superior a 100 Mb/s. Debido a que la métrica de costo de OSPF debe ser un número entero, todos los enlaces con velocidades de transmisión de 100 Mb/s o más tienen un costo de 1. Esto da como resultado interfaces Fast Ethernet, Gigabit Ethernet y 10G Ethernet con el mismo costo. Por eso, se debe cambiar el ancho de banda de referencia a un valor más alto para admitir redes con enlaces más rápidos que 100 Mb/s.

a. Emita el comando **show interface** en el R1 para ver la configuración del ancho de banda predeterminado para la interfaz G0/0.

```
R1# show interface g0/0
GigabitEthernet0/0 is up, line protocol is up
  Hardware is CN Gigabit Ethernet, address is c471.fe45.7520 (bia c471.fe45.7520)
  MTU 1500 bytes, BW 1000000 Kbit/sec, DLY 100 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
  Full Duplex, 100Mbps, media type is RJ45
  output flow-control is unsupported, input flow-control is unsupported
  ARP type: ARPA, ARP Timeout 04:00:00
  Last input never, output 00:17:31, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue: 0/40 (size/max)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     0 packets input, 0 bytes, 0 no buffer
     Received 0 broadcasts (0 IP multicasts)
     0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
     0 watchdog, 0 multicast, 0 pause input
     279 packets output, 89865 bytes, 0 underruns
     0 output errors, 0 collisions, 1 interface resets
     0 unknown protocol drops
     0 babbles, 0 late collision, 0 deferred
     1 lost carrier, 0 no carrier, 0 pause output
     0 output buffer failures, 0 output buffers swapped out
```

Nota: si la interfaz del equipo host solo admite velocidad Fast Ethernet, la configuración de ancho de banda de G0/0 puede diferir de la que se muestra arriba. Si la interfaz del equipo host no admite velocidad de gigabit, es probable que el ancho de banda se muestre como 100 000 Kbit/s.

b. Emita el comando **show ip route ospf** en el R1 para determinar la ruta a la red 192.168.3.0/24.

```
R1# show ip route ospf
Codes: L - local, C - connected, S - static, 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
       i - IS-IS, su - IS-IS summary, 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, H - NHRP, l - LISP
       + - replicated route, % - next hop override


Gateway of last resort is not set

O     192.168.2.0/24 [110/65] via 192.168.12.2, 00:01:08, Serial0/0/0
O     192.168.3.0/24 [110/65] via 192.168.13.2, 00:00:57, Serial0/0/1
      192.168.23.0/30 is subnetted, 1 subnets
O        192.168.23.0 [110/128] via 192.168.13.2, 00:00:57, Serial0/0/1
```

```
                         [110/128] via 192.168.12.2, 00:01:08, Serial0/0/0
```

Nota: el costo acumulado del R1 a la red 192.168.3.0/24 es 65.

c. Emita el comando **show ip ospf interface** en el R3 para determinar el costo de routing para G0/0.

```
R3# show ip ospf interface g0/0
GigabitEthernet0/0 is up, line protocol is up
  Internet Address 192.168.3.1/24, Area 0, Attached via Network Statement
  Process ID 1, Router ID 3.3.3.3, Network Type BROADCAST, Cost: 1
  Topology-MTID    Cost    Disabled    Shutdown      Topology Name
       0            1         no          no              Base
  Transmit Delay is 1 sec, State DR, Priority 1
  Designated Router (ID) 192.168.23.2, Interface address 192.168.3.1
  No backup designated router on this network
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    oob-resync timeout 40
    Hello due in 00:00:05
  Supports Link-local Signaling (LLS)
  Cisco NSF helper support enabled
  IETF NSF helper support enabled
  Index 1/1, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 0, maximum is 0
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 0, Adjacent neighbor count is 0
  Suppress hello for 0 neighbor(s)
```

d. Emita el comando **show ip ospf interface s0/0/1** en el R1 para ver el costo de routing para S0/0/1.

```
R1# show ip ospf interface s0/0/1
Serial0/0/1 is up, line protocol is up
  Internet Address 192.168.13.1/30, Area 0, Attached via Network Statement
  Process ID 1, Router ID 1.1.1.1, Network Type POINT_TO_POINT, Cost: 64
  Topology-MTID    Cost    Disabled    Shutdown      Topology Name
       0            64        no          no              Base
  Transmit Delay is 1 sec, State POINT_TO_POINT
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    oob-resync timeout 40
    Hello due in 00:00:04
  Supports Link-local Signaling (LLS)
  Cisco NSF helper support enabled
  IETF NSF helper support enabled
  Index 3/3, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 1, Adjacent neighbor count is 1
    Adjacent with neighbor 192.168.23.2
  Suppress hello for 0 neighbor(s)
```

La suma de los costos de estas dos interfaces es el costo acumulado de la ruta a la red 192.168.3.0/24 en el R3 (1 + 64 = 65), como puede observarse en el resultado del comando **show ip route**.

e. Emita el comando **auto-cost reference-bandwidth 10000** en el R1 para cambiar la configuración de ancho de banda de referencia predeterminado. Con esta configuración, las interfaces de 10 Gb/s tendrán un costo de 1, las interfaces de 1 Gb/s tendrán un costo de 10, y las interfaces de 100 Mb/s tendrán un costo de 100.

```
R1(config)# router ospf 1
R1(config-router)# auto-cost reference-bandwidth 10000
% OSPF: Reference bandwidth is changed.
        Please ensure reference bandwidth is consistent across all routers.
```

f. Emita el comando **auto-cost reference-bandwidth 10000** en los routers R2 y R3.

g. Vuelva a emitir el comando **show ip ospf interface** para ver el nuevo costo de G0/0 en el R3 y de S0/0/1 en el R1.

```
R3# show ip ospf interface g0/0
GigabitEthernet0/0 is up, line protocol is up
  Internet Address 192.168.3.1/24, Area 0, Attached via Network Statement
  Process ID 1, Router ID 3.3.3.3, Network Type BROADCAST, Cost: 10
  Topology-MTID    Cost    Disabled    Shutdown        Topology Name
        0           10       no          no                Base
  Transmit Delay is 1 sec, State DR, Priority 1
  Designated Router (ID) 192.168.23.2, Interface address 192.168.3.1
  No backup designated router on this network
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    oob-resync timeout 40
    Hello due in 00:00:02
  Supports Link-local Signaling (LLS)
  Cisco NSF helper support enabled
  IETF NSF helper support enabled
  Index 1/1, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 0, maximum is 0
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 0, Adjacent neighbor count is 0
  Suppress hello for 0 neighbor(s)
```

Nota: si el dispositivo conectado a la interfaz G0/0 no admite velocidad de Gigabit Ethernet, el costo será diferente del que se muestra en el resultado. Por ejemplo, el costo será de 100 para la velocidad Fast Ethernet (100 Mb/s).

```
R1# show ip ospf interface s0/0/1
Serial0/0/1 is up, line protocol is up
  Internet Address 192.168.13.1/30, Area 0, Attached via Network Statement
  Process ID 1, Router ID 1.1.1.1, Network Type POINT_TO_POINT, Cost: 6476
  Topology-MTID    Cost    Disabled    Shutdown        Topology Name
        0          6476      no          no                Base
  Transmit Delay is 1 sec, State POINT_TO_POINT
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    oob-resync timeout 40
    Hello due in 00:00:05
  Supports Link-local Signaling (LLS)
  Cisco NSF helper support enabled
  IETF NSF helper support enabled
```

```
Index 3/3, flood queue length 0
Next 0x0(0)/0x0(0)
Last flood scan length is 1, maximum is 1
Last flood scan time is 0 msec, maximum is 0 msec
Neighbor Count is 1, Adjacent neighbor count is 1
  Adjacent with neighbor 192.168.23.2
Suppress hello for 0 neighbor(s)
```

h. Vuelva a emitir el comando **show ip route ospf** para ver el nuevo costo acumulado de la ruta 192.168.3.0/24 (10 + 6476 = 6486).

Nota: si el dispositivo conectado a la interfaz G0/0 no admite velocidad de Gigabit Ethernet, el costo total será diferente del que se muestra en el resultado. Por ejemplo, el costo acumulado será 6576 si G0/0 está funcionando con velocidad Fast Ethernet (100 Mb/s).

```
R1# show ip route ospf
Codes: L - local, C - connected, S - static, 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
       i - IS-IS, su - IS-IS summary, 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, H - NHRP, l - LISP
       + - replicated route, % - next hop override

Gateway of last resort is not set

O     192.168.2.0/24 [110/6486] via 192.168.12.2, 00:05:40, Serial0/0/0
O     192.168.3.0/24 [110/6486] via 192.168.13.2, 00:01:08, Serial0/0/1
      192.168.23.0/30 is subnetted, 1 subnets
O        192.168.23.0 [110/12952] via 192.168.13.2, 00:05:17, Serial0/0/1
                      [110/12952] via 192.168.12.2, 00:05:17, Serial0/0/
```

Nota: cambiar el ancho de banda de referencia en los routers de 100 a 10 000 cambió los costos acumulados de todas las rutas en un factor de 100, pero el costo de cada enlace y ruta de interfaz ahora se refleja con mayor precisión.

i. Para restablecer el ancho de banda de referencia al valor predeterminado, emita el comando **auto-cost reference-bandwidth 100** en los tres routers.

```
R1(config)# router ospf 1
R1(config-router)# auto-cost reference-bandwidth 100
% OSPF: Reference bandwidth is changed.
        Please ensure reference bandwidth is consistent across all routers.
```

¿Por qué querría cambiar el ancho de banda de referencia OSPF predeterminado?

Para tener una mayor Precision

_____

Paso 2: cambiar el ancho de banda de una interfaz.

En la mayoría de los enlaces seriales, la métrica del ancho de banda será 1544 Kbits de manera predeterminada (la de un T1). Si esta no es la velocidad real del enlace serial, se deberá cambiar la configuración del ancho de banda para que coincida con la velocidad real, a fin de permitir que el costo de la

ruta se calcule correctamente en OSPF. Use el comando **bandwidth** para ajusta la configuración del ancho de banda de una interfaz.

Nota: un concepto erróneo habitual es suponer que con el comando **bandwidth** se cambia el ancho de banda físico, o la velocidad, del enlace. El comando modifica la métrica de ancho de banda que utiliza OSPF para calcular los costos de routing, pero no modifica el ancho de banda real (la velocidad) del enlace.

a. Emita el comando **show interface s0/0/0** en el R1 para ver la configuración actual del ancho de banda de S0/0/0. Aunque la velocidad de enlace/frecuencia de reloj en esta interfaz estaba configurada en 128 Kb/s, el ancho de banda todavía aparece como 1544 Kb/s.

```
R1# show interface s0/0/0
Serial0/0/0 is up, line protocol is up
  Hardware is WIC MBRD Serial
  Internet address is 192.168.12.1/30
  MTU 1500 bytes, BW 1544 Kbit/sec, DLY 20000 usec,
      reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation HDLC, loopback not set
  Keepalive set (10 sec)
<Resultado omitido>
```

b. Emita el comando **show ip route ospf** en el R1 para ver el costo acumulado de la ruta a la red 192.168.23.0/24 con S0/0/0. Observe que hay dos rutas con el mismo costo (128) a la red 192.168.23.0/24, una a través de S0/0/0 y otra a través de S0/0/1.

```
R1# show ip route ospf
Codes: L - local, C - connected, S - static, 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
       i - IS-IS, su - IS-IS summary, 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, H - NHRP, l - LISP
       + - replicated route, % - next hop override


Gateway of last resort is not set

O    192.168.2.0/24 [110/65] via 192.168.12.2, 00:00:26, Serial0/0/0
O    192.168.3.0/24 [110/65] via 192.168.13.2, 00:00:26, Serial0/0/1
     192.168.23.0/30 is subnetted, 1 subnets
O       192.168.23.0 [110/128] via 192.168.13.2, 00:00:26, Serial0/0/1
                     [110/128] via 192.168.12.2, 00:00:26, Serial0/0/0
```

c. Emita el comando **bandwidth 128** para establecer el ancho de banda en S0/0/0 en 128 Kb/s.

```
R1(config)# interface s0/0/0
R1(config-if)# bandwidth 128
```

d. Vuelva a emitir el comando **show ip route ospf**. En la tabla de routing, ya no se muestra la ruta a la red 192.168.23.0/24 a través de la interfaz S0/0/0. Esto es porque la mejor ruta, la que tiene el costo más bajo, ahora es a través de S0/0/1.

```
R1# show ip route ospf
Codes: L - local, C - connected, S - static, 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
          i - IS-IS, su - IS-IS summary, 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, H - NHRP, l - LISP
          + - replicated route, % - next hop override

Gateway of last resort is not set

O       192.168.2.0/24 [110/129] via 192.168.12.2, 00:01:47, Serial0/0/0
O       192.168.3.0/24 [110/65] via 192.168.13.2, 00:04:51, Serial0/0/1
        192.168.23.0/30 is subnetted, 1 subnets
O          192.168.23.0 [110/128] via 192.168.13.2, 00:04:51, Serial0/0/1
```

e. Emita el comando **show ip ospf interface brief**. El costo de S0/0/0 cambió de 64 a 781, que es una representación precisa del costo de la velocidad del enlace.

```
R1# show ip ospf interface brief
Interface   PID   Area          IP Address/Mask    Cost   State  Nbrs F/C
Se0/0/1     1     0             192.168.13.1/30    64     P2P    1/1
Se0/0/0     1     0             192.168.12.1/30    781    P2P    1/1
Gi0/0       1     0             192.168.1.1/24     1      DR     0/0
```

f. Cambie el ancho de banda de la interfaz S0/0/1 a la misma configuración que S0/0/0 en el R1.

g. Vuelva a emitir el comando **show ip route ospf** para ver el costo acumulado de ambas rutas a la red 192.168.23.0/24. Observe que otra vez hay dos rutas con el mismo costo (845) a la red 192.168.23.0/24: una a través de S0/0/0 y otra a través de S0/0/1.

```
R1# show ip route ospf
Codes: L - local, C - connected, S - static, 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
       i - IS-IS, su - IS-IS summary, 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, H - NHRP, l - LISP
       + - replicated route, % - next hop override

Gateway of last resort is not set

O       192.168.2.0/24 [110/782] via 192.168.12.2, 00:00:09, Serial0/0/0
O       192.168.3.0/24 [110/782] via 192.168.13.2, 00:00:09, Serial0/0/1
        192.168.23.0/30 is subnetted, 1 subnets
O          192.168.23.0 [110/845] via 192.168.13.2, 00:00:09, Serial0/0/1
                        [110/845] via 192.168.12.2, 00:00:09, Serial0/0/0
```

Explique la forma en que se calcularon los costos del R1 a las redes 192.168.3.0/24 y 192.168.23.0/30.

Dado a que el costo del serial0/0/1 cambio a 781 y el cost del Fa es 1 = 781 + 1 = 782 para la red 192.168.3.0/24.

Para 192.168.3.0/24 fue el costo del serial 781+64 = 845.

h. Emita el comando **show ip route ospf** en el R3. El costo acumulado de 192.168.1.0/24 todavía se muestra como 65. A diferencia del comando **clock rate**, el comando **bandwidth** se tiene que aplicar en ambos extremos de un enlace serial.

```
R3# show ip route ospf
Codes: L - local, C - connected, S - static, 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
       i - IS-IS, su - IS-IS summary, 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, H - NHRP, l - LISP
       + - replicated route, % - next hop override


Gateway of last resort is not set

O       192.168.1.0/24 [110/65] via 192.168.13.1, 00:30:58, Serial0/0/0
O       192.168.2.0/24 [110/65] via 192.168.23.1, 00:30:58, Serial0/0/1
        192.168.12.0/30 is subnetted, 1 subnets
O          192.168.12.0 [110/128] via 192.168.23.1, 00:30:58, Serial0/0/1
                        [110/128] via 192.168.13.1, 00:30:58, Serial0/0/0
```

i. Emita el comando **bandwidth 128** en todas las interfaces seriales restantes de la topología.

¿Cuál es el nuevo costo acumulado a la red 192.168.23.0/24 en el R1? ¿Por qué?

1564 por que esta tomando los costos de direccionamiento de ruta que son 782+782= 1564.

_____

Paso 3: cambiar el costo de la ruta.

De manera predeterminada, OSPF utiliza la configuración de ancho de banda para calcular el costo de un enlace. Sin embargo, puede reemplazar este cálculo si configura manualmente el costo de un enlace mediante el comando **ip ospf cost**. Al igual que el comando **bandwidth**, el comando **ip ospf cost** solo afecta el lado del enlace en el que se aplicó.

a. Emita el comando **show ip route ospf** en el R1.

```
R1# show ip route ospf
Codes: L - local, C - connected, S - static, 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
       i - IS-IS, su - IS-IS summary, 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, H - NHRP, l - LISP
       + - replicated route, % - next hop override


Gateway of last resort is not set

O       192.168.2.0/24 [110/782] via 192.168.12.2, 00:00:26, Serial0/0/0
O       192.168.3.0/24 [110/782] via 192.168.13.2, 00:02:50, Serial0/0/1
        192.168.23.0/30 is subnetted, 1 subnets
O          192.168.23.0 [110/1562] via 192.168.13.2, 00:02:40, Serial0/0/1
```

```
                           [110/1562] via 192.168.12.2, 00:02:40, Serial0/0/0
```

b. Aplique el comando **ip ospf cost 1565** a la interfaz S0/0/1 en el R1. Un costo de 1565 es mayor que el costo acumulado de la ruta a través del R2, que es 1562.

```
R1(config)# interface s0/0/1
R1(config-if)# ip ospf cost 1565
```

c. Vuelva a emitir el comando **show ip route ospf** en el R1 para mostrar el efecto que produjo este cambio en la tabla de routing. Todas las rutas OSPF para el R1 ahora se enrutan a través del R2.

```
R1# show ip route ospf
Codes: L - local, C - connected, S - static, 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
       i - IS-IS, su - IS-IS summary, 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, H - NHRP, l - LISP
       + - replicated route, % - next hop override


Gateway of last resort is not set

O      192.168.2.0/24 [110/782] via 192.168.12.2, 00:02:06, Serial0/0/0
O      192.168.3.0/24 [110/1563] via 192.168.12.2, 00:05:31, Serial0/0/0
       192.168.23.0/30 is subnetted, 1 subnets
O         192.168.23.0 [110/1562] via 192.168.12.2, 01:14:02, Serial0/0/0
```

Nota: la manipulación de costos de enlace mediante el comando **ip ospf cost** es el método de preferencia y el más fácil para cambiar los costos de las rutas OSPF. Además de cambiar el costo basado en el ancho de banda, un administrador de red puede tener otros motivos para cambiar el costo de una ruta, como la preferencia por un proveedor de servicios específico o el costo monetario real de un enlace o de una ruta.

Explique la razón por la que la ruta a la red 192.168.3.0/24 en el R1 ahora atraviesa el R2.

Por que el costo de la ruta directa al R3 es mas elevado es 1565 y si pasa atraves del router 2 seria 1563 como muestra con el comando show ip route ospf, seria; 781+781+1=1563 de costo seria menos.

Reflexión

1. ¿Por qué es importante controlar la asignación de ID de router al utilizar el protocolo OSPF?

Por que si tienes los ids por defecto, es un tanto confuso y si se activan o desactivan interfaces estas cambiarian igual, por lo cual no es conveniente

2. ¿Por qué el proceso de elección de DR/BDR no es una preocupación en esta práctica de laboratorio?

Por que no es una red de multiacceso, esta que se esta manejando es de punto a punto con solo 2 routers vecinos por lo cual no es necesario.

3. ¿Por qué querría configurar una interfaz OSPF como pasiva?

Para poder ahorrar ancho de banda por que de esta manera no se desperdicia al mandar paquetes de saludo, y para que no se pueda acceder a la información de las terminales.

_____

```
R3#
R3#show ip ospf int g0/0

GigabitEthernet0/0 is up, line protocol is up
  Internet address is 192.168.3.1/24, Area 0
  Process ID 1, Router ID 33.33.33.33, Network Type BROADCAST, Cost: 1
  Transmit Delay is 1 sec, State DR, Priority 1
  Designated Router (ID) 33.33.33.33, Interface address 192.168.3.1
  No backup designated router on this network
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:00
  Index 1/1, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 0, Adjacent neighbor count is 0
  Suppress hello for 0 neighbor(s)
R3#
```

```
R1#
R1#show ip ospf int s0/01
%Invalid interface type and number
R1#show ip ospf int s0/0/1

Serial0/0/1 is up, line protocol is up
  Internet address is 192.168.13.1/30, Area 0
  Process ID 1, Router ID 11.11.11.11, Network Type POINT-TO-POINT, Cost: 64
  Transmit Delay is 1 sec, State POINT-TO-POINT, Priority 0
  No designated router on this network
  No backup designated router on this network
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:07
  Index 2/2, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 1 , Adjacent neighbor count is 1
    Adjacent with neighbor 33.33.33.33
  Suppress hello for 0 neighbor(s)
R1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#router ospf 1
R1(config-router)#auto cost reference-bandwidth 10000
                       ^
% Invalid input detected at '^' marker.

R1(config-router)#auto-cost reference-bandwidth 10000
% OSPF: Reference bandwidth is changed.
        Please ensure reference bandwidth is consistent across all routers.
R1(config-router)#
```

```
R2#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R2(config)#router ospf 1
R2(config-router)#auto-cost reference-bandwidth 10000
% OSPF: Reference bandwidth is changed.
        Please ensure reference bandwidth is consistent across all routers.
R2(config-router)#
```

```
R3#show ip ospf int g0/0

GigabitEthernet0/0 is up, line protocol is up
  Internet address is 192.168.3.1/24, Area 0
  Process ID 1, Router ID 33.33.33.33, Network Type BROADCAST, Cost: 1
  Transmit Delay is 1 sec, State DR, Priority 1
  Designated Router (ID) 33.33.33.33, Interface address 192.168.3.1
  No backup designated router on this network
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:00
  Index 1/1, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 0, Adjacent neighbor count is 0
  Suppress hello for 0 neighbor(s)
R3#
R3#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R3(config)#router ospf 1
R3(config-router)#auto-cost reference-bandwidth 10000
% OSPF: Reference bandwidth is changed.
        Please ensure reference bandwidth is consistent across all routers.
R3(config-router)#
```

```
R3#
R3#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R3(config)#router ospf 1
R3(config-router)#auto-cost reference-bandwidth 10000
% OSPF: Reference bandwidth is changed.
        Please ensure reference bandwidth is consistent across all routers.
R3(config-router)#
R3(config-router)#end
R3#
%SYS-5-CONFIG_I: Configured from console by console

R3#show ip ospf int g0/0

GigabitEthernet0/0 is up, line protocol is up
  Internet address is 192.168.3.1/24, Area 0
  Process ID 1, Router ID 33.33.33.33, Network Type BROADCAST, Cost: 100
  Transmit Delay is 1 sec, State DR, Priority 1
  Designated Router (ID) 33.33.33.33, Interface address 192.168.3.1
  No backup designated router on this network
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:01
  Index 1/1, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 0, Adjacent neighbor count is 0
  Suppress hello for 0 neighbor(s)
R3#
```

```
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 1 , Adjacent neighbor count is 1
    Adjacent with neighbor 33.33.33.33
  Suppress hello for 0 neighbor(s)
R1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#router ospf 1
R1(config-router)#auto cost reference-bandwidth 10000
                       ^
% Invalid input detected at '^' marker.

R1(config-router)#auto-cost reference-bandwidth 10000
% OSPF: Reference bandwidth is changed.
        Please ensure reference bandwidth is consistent across all routers.
R1(config-router)#
R1(config-router)#end
R1#
%SYS-5-CONFIG_I: Configured from console by console

R1#show ip ospf int s0/0/1

Serial0/0/1 is up, line protocol is up
  Internet address is 192.168.13.1/30, Area 0
  Process ID 1, Router ID 11.11.11.11, Network Type POINT-TO-POINT, Cost: 6476
  Transmit Delay is 1 sec, State POINT-TO-POINT, Priority 0
  No designated router on this network
  No backup designated router on this network
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:02
  Index 2/2, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 1 , Adjacent neighbor count is 1
    Adjacent with neighbor 33.33.33.33
  Suppress hello for 0 neighbor(s)
R1#
```

```
R1(config)#router ospf 1
R1(config-router)#auto cost reference-bandwidth 10000
                       ^
% Invalid input detected at '^' marker.

R1(config-router)#auto-cost reference-bandwidth 10000
% OSPF: Reference bandwidth is changed.
        Please ensure reference bandwidth is consistent across all routers.
R1(config-router)#
R1(config-router)#end
R1#
%SYS-5-CONFIG_I: Configured from console by console

R1#show ip ospf int s0/0/1

Serial0/0/1 is up, line protocol is up
  Internet address is 192.168.13.1/30, Area 0
  Process ID 1, Router ID 11.11.11.11, Network Type POINT-TO-POINT, Cost: 6476
  Transmit Delay is 1 sec, State POINT-TO-POINT, Priority 0
  No designated router on this network
  No backup designated router on this network
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:02
  Index 2/2, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 1 , Adjacent neighbor count is 1
    Adjacent with neighbor 33.33.33.33
  Suppress hello for 0 neighbor(s)
R1#show ip route ospf
O    192.168.2.0 [110/6576] via 192.168.12.2, 00:03:10, Serial0/0/0
O    192.168.3.0 [110/6576] via 192.168.13.2, 00:02:24, Serial0/0/1
     192.168.23.0/30 is subnetted, 1 subnets
O       192.168.23.0 [110/12952] via 192.168.13.2, 00:02:24, Serial0/0/1
                     [110/12952] via 192.168.12.2, 00:02:24, Serial0/0/0

R1#
```

```
% OSPF: Reference bandwidth is changed.
        Please ensure reference bandwidth is consistent across all routers.
R1(config-router)#
R1(config-router)#end
R1#
%SYS-5-CONFIG_I: Configured from console by console

R1#show ip ospf int s0/0/1

Serial0/0/1 is up, line protocol is up
  Internet address is 192.168.13.1/30, Area 0
  Process ID 1, Router ID 11.11.11.11, Network Type POINT-TO-POINT, Cost: 6476
  Transmit Delay is 1 sec, State POINT-TO-POINT, Priority 0
  No designated router on this network
  No backup designated router on this network
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:02
  Index 2/2, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 1 , Adjacent neighbor count is 1
    Adjacent with neighbor 33.33.33.33
  Suppress hello for 0 neighbor(s)
R1#show ip route ospf
O    192.168.2.0 [110/6576] via 192.168.12.2, 00:03:10, Serial0/0/0
O    192.168.3.0 [110/6576] via 192.168.13.2, 00:02:24, Serial0/0/1
     192.168.23.0/30 is subnetted, 1 subnets
O       192.168.23.0 [110/12952] via 192.168.13.2, 00:02:24, Serial0/0/1
                     [110/12952] via 192.168.12.2, 00:02:24, Serial0/0/0

R1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#router ospf 1
R1(config-router)#auto-cost reference-bandwidth 100
% OSPF: Reference bandwidth is changed.
        Please ensure reference bandwidth is consistent across all routers.
R1(config-router)#
```

```
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#router ospf 1
R1(config-router)#auto-cost reference-bandwidth 100
% OSPF: Reference bandwidth is changed.
        Please ensure reference bandwidth is consistent across all routers.
R1(config-router)#end
R1#
%SYS-5-CONFIG_I: Configured from console by console

R1#
R1#show interface s0/0/0
Serial0/0/0 is up, line protocol is up (connected)
  Hardware is HD64570
  Internet address is 192.168.12.1/30
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation HDLC, loopback not set, keepalive set (10 sec)
  Last input never, output never, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0 (size/max/drops); Total output drops: 0
  Queueing strategy: weighted fair
  Output queue: 0/1000/64/0 (size/max total/threshold/drops)
     Conversations  0/0/256 (active/max active/max total)
     Reserved Conversations 0/0 (allocated/max allocated)
     Available Bandwidth 1158 kilobits/sec
  5 minute input rate 68 bits/sec, 0 packets/sec
  5 minute output rate 70 bits/sec, 0 packets/sec
     347 packets input, 25900 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     366 packets output, 26592 bytes, 0 underruns
     0 output errors, 0 collisions, 1 interface resets
     0 output buffer failures, 0 output buffers swapped out
     0 carrier transitions
     DCD=up  DSR=up  DTR=up  RTS=up  CTS=up
```

```
%SYS-5-CONFIG_I: Configured from console by console

R1#
R1#show interface s0/0/0
Serial0/0/0 is up, line protocol is up (connected)
  Hardware is HD64570
  Internet address is 192.168.12.1/30
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation HDLC, loopback not set, keepalive set (10 sec)
  Last input never, output never, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0 (size/max/drops); Total output drops: 0
  Queueing strategy: weighted fair
  Output queue: 0/1000/64/0 (size/max total/threshold/drops)
     Conversations  0/0/256 (active/max active/max total)
     Reserved Conversations 0/0 (allocated/max allocated)
     Available Bandwidth 1158 kilobits/sec
  5 minute input rate 68 bits/sec, 0 packets/sec
  5 minute output rate 70 bits/sec, 0 packets/sec
     347 packets input, 25900 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     366 packets output, 26592 bytes, 0 underruns
     0 output errors, 0 collisions, 1 interface resets
     0 output buffer failures, 0 output buffers swapped out
     0 carrier transitions
     DCD=up  DSR=up  DTR=up  RTS=up  CTS=up

R1#
R1#show ip route ospf
O    192.168.2.0 [110/65] via 192.168.12.2, 00:03:50, Serial0/0/0
O    192.168.3.0 [110/65] via 192.168.13.2, 00:03:38, Serial0/0/1
     192.168.23.0/30 is subnetted, 1 subnets
O       192.168.23.0 [110/128] via 192.168.13.2, 00:03:28, Serial0/0/1
                     [110/128] via 192.168.12.2, 00:03:28, Serial0/0/0
```

```
    No Hellos (Passive interface)
  Index 1/1, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 0, Adjacent neighbor count is 0
  Suppress hello for 0 neighbor(s)
Serial0/0/1 is up, line protocol is up
  Internet address is 192.168.13.1/30, Area 0
  Process ID 1, Router ID 11.11.11.11, Network Type POINT-TO-POINT, Cost: 64
  Transmit Delay is 1 sec, State POINT-TO-POINT, Priority 0
  No designated router on this network
  No backup designated router on this network
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:01
  Index 2/2, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 1 , Adjacent neighbor count is 1
    Adjacent with neighbor 33.33.33.33
  Suppress hello for 0 neighbor(s)
Serial0/0/0 is up, line protocol is up
  Internet address is 192.168.12.1/30, Area 0
  Process ID 1, Router ID 11.11.11.11, Network Type POINT-TO-POINT, Cost: 781
  Transmit Delay is 1 sec, State POINT-TO-POINT, Priority 0
  No designated router on this network
  No backup designated router on this network
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:04
  Index 3/3, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 1 , Adjacent neighbor count is 1
    Adjacent with neighbor 22.22.22.22
  Suppress hello for 0 neighbor(s)
R1#
```

```
     No Hellos (Passive interface)
  Index 1/1, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 0, Adjacent neighbor count is 0
  Suppress hello for 0 neighbor(s)
Serial0/0/1 is up, line protocol is up
  Internet address is 192.168.13.1/30, Area 0
  Process ID 1, Router ID 11.11.11.11, Network Type POINT-TO-POINT, Cost: 64
  Transmit Delay is 1 sec, State POINT-TO-POINT, Priority 0
  No designated router on this network
  No backup designated router on this network
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:01
  Index 2/2, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 1 , Adjacent neighbor count is 1
    Adjacent with neighbor 33.33.33.33
  Suppress hello for 0 neighbor(s)
Serial0/0/0 is up, line protocol is up
  Internet address is 192.168.12.1/30, Area 0
  Process ID 1, Router ID 11.11.11.11, Network Type POINT-TO-POINT, Cost: 781
  Transmit Delay is 1 sec, State POINT-TO-POINT, Priority 0
  No designated router on this network
  No backup designated router on this network
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:04
  Index 3/3, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 1 , Adjacent neighbor count is 1
    Adjacent with neighbor 22.22.22.22
  Suppress hello for 0 neighbor(s)
R1#
```

```
  No backup designated router on this network
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:04
  Index 3/3, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 1 , Adjacent neighbor count is 1
    Adjacent with neighbor 22.22.22.22
  Suppress hello for 0 neighbor(s)
R1#
R1#show int s0/0/0
Serial0/0/0 is up, line protocol is up (connected)
  Hardware is HD64570
  Internet address is 192.168.12.1/30
  MTU 1500 bytes, BW 128 Kbit, DLY 20000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation HDLC, loopback not set, keepalive set (10 sec)
  Last input never, output never, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0 (size/max/drops); Total output drops: 0
  Queueing strategy: weighted fair
  Output queue: 0/1000/64/0 (size/max total/threshold/drops)
    Conversations  0/0/256 (active/max active/max total)
    Reserved Conversations 0/0 (allocated/max allocated)
    Available Bandwidth 96 kilobits/sec
  5 minute input rate 60 bits/sec, 0 packets/sec
  5 minute output rate 63 bits/sec, 0 packets/sec
    422 packets input, 31044 bytes, 0 no buffer
    Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
    0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
    441 packets output, 31904 bytes, 0 underruns
    0 output errors, 0 collisions, 1 interface resets
    0 output buffer failures, 0 output buffers swapped out
    0 carrier transitions
    DCD=up  DSR=up  DTR=up  RTS=up  CTS=up
```

```
R1#
R1#show int s0/0/0
Serial0/0/0 is up, line protocol is up (connected)
  Hardware is HD64570
  Internet address is 192.168.12.1/30
  MTU 1500 bytes, BW 128 Kbit, DLY 20000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation HDLC, loopback not set, keepalive set (10 sec)
  Last input never, output never, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0 (size/max/drops); Total output drops: 0
  Queueing strategy: weighted fair
  Output queue: 0/1000/64/0 (size/max total/threshold/drops)
     Conversations  0/0/256 (active/max active/max total)
     Reserved Conversations 0/0 (allocated/max allocated)
     Available Bandwidth 96 kilobits/sec
  5 minute input rate 59 bits/sec, 0 packets/sec
  5 minute output rate 63 bits/sec, 0 packets/sec
     441 packets input, 32388 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     459 packets output, 33248 bytes, 0 underruns
     0 output errors, 0 collisions, 1 interface resets
     0 output buffer failures, 0 output buffers swapped out
     0 carrier transitions
     DCD=up  DSR=up  DTR=up  RTS=up  CTS=up

R1#
R1#
R1#show ip route ospf
O    192.168.2.0 [110/129] via 192.168.13.2, 00:03:45, Serial0/0/1
O    192.168.3.0 [110/65] via 192.168.13.2, 00:16:56, Serial0/0/1
     192.168.23.0/30 is subnetted, 1 subnets
O       192.168.23.0 [110/128] via 192.168.13.2, 00:03:45, Serial0/0/1
```

```
R1#
R1#
R1#show ip route ospf
O    192.168.2.0 [110/129] via 192.168.13.2, 00:03:45, Serial0/0/1
O    192.168.3.0 [110/65] via 192.168.13.2, 00:16:56, Serial0/0/1
     192.168.23.0/30 is subnetted, 1 subnets
O       192.168.23.0 [110/128] via 192.168.13.2, 00:03:45, Serial0/0/1

R1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#int s0/0/1
R1(config-if)#bandwidth 128
R1(config-if)#end
R1#
%SYS-5-CONFIG_I: Configured from console by console

R1#show ip route ospf
O    192.168.2.0 [110/782] via 192.168.12.2, 00:00:05, Serial0/0/0
O    192.168.3.0 [110/782] via 192.168.13.2, 00:00:05, Serial0/0/1
     192.168.23.0/30 is subnetted, 1 subnets
O       192.168.23.0 [110/845] via 192.168.13.2, 00:00:05, Serial0/0/1
                      [110/845] via 192.168.12.2, 00:00:05, Serial0/0/0
```

```
R1#show ip route ospf
O    192.168.2.0 [110/782] via 192.168.12.2, 00:12:51, Serial0/0/0
O    192.168.3.0 [110/782] via 192.168.13.2, 00:12:51, Serial0/0/1
     192.168.23.0/30 is subnetted, 1 subnets
O       192.168.23.0 [110/1562] via 192.168.13.2, 00:01:43, Serial0/0/1
                     [110/1562] via 192.168.12.2, 00:01:43, Serial0/0/0
```

```
R1#show ip route ospf
O    192.168.2.0 [110/782] via 192.168.12.2, 00:12:51, Serial0/0/0
O    192.168.3.0 [110/782] via 192.168.13.2, 00:12:51, Serial0/0/1
     192.168.23.0/30 is subnetted, 1 subnets
O       192.168.23.0 [110/1562] via 192.168.13.2, 00:01:43, Serial0/0/1
                     [110/1562] via 192.168.12.2, 00:01:43, Serial0/0/0

R1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#ip ospf cost
                ^
% Invalid input detected at '^' marker.

R1(config)#int s0/0/1
R1(config-if)#ip ospf cost 1565
R1(config-if)#
```

```
R1#show ip route ospf
O    192.168.2.0 [110/782] via 192.168.12.2, 00:12:51, Serial0/0/0
O    192.168.3.0 [110/782] via 192.168.13.2, 00:12:51, Serial0/0/1
     192.168.23.0/30 is subnetted, 1 subnets
O       192.168.23.0 [110/1562] via 192.168.13.2, 00:01:43, Serial0/0/1
                     [110/1562] via 192.168.12.2, 00:01:43, Serial0/0/0

R1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#ip ospf cost
               ^
% Invalid input detected at '^' marker.

R1(config)#int s0/0/1
R1(config-if)#ip ospf cost 1565
R1(config-if)#end
R1#
%SYS-5-CONFIG_I: Configured from console by console

R1#show ip route ospf
O    192.168.2.0 [110/782] via 192.168.12.2, 00:16:46, Serial0/0/0
O    192.168.3.0 [110/1563] via 192.168.12.2, 00:00:18, Serial0/0/0
     192.168.23.0/30 is subnetted, 1 subnets
O       192.168.23.0 [110/1562] via 192.168.12.2, 00:00:18, Serial0/0/0

R1#
```

Tabla de resumen de interfaces del router

Resumen de interfaces del router				
Modelo de router	**Ethernet Interface #1**	**Ethernet Interface #2**	**Serial Interface #1**	**Serial Interface #2**
1800	Fast Ethernet 0/0 (F0/0)	Fast Ethernet 0/1 (F0/1)	Serial 0/0/0 (S0/0/0)	Serial 0/0/1 (S0/0/1)
1900	Gigabit Ethernet 0/0 (G0/0)	Gigabit Ethernet 0/1 (G0/1)	Serial 0/0/0 (S0/0/0)	Serial 0/0/1 (S0/0/1)
2801	Fast Ethernet 0/0 (F0/0)	Fast Ethernet 0/1 (F0/1)	Serial 0/1/0 (S0/1/0)	Serial 0/1/1 (S0/1/1)
2811	Fast Ethernet 0/0 (F0/0)	Fast Ethernet 0/1 (F0/1)	Serial 0/0/0 (S0/0/0)	Serial 0/0/1 (S0/0/1)
2900	Gigabit Ethernet 0/0 (G0/0)	Gigabit Ethernet 0/1 (G0/1)	Serial 0/0/0 (S0/0/0)	Serial 0/0/1 (S0/0/1)
Nota: para conocer la configuración del router, observe las interfaces a fin de identificar el tipo de router y cuántas interfaces tiene. No existe una forma eficaz de confeccionar una lista de todas las combinaciones de configuraciones para cada clase de router. En esta tabla, se incluyen los identificadores para las posibles combinaciones de interfaces Ethernet y seriales en el dispositivo. En esta tabla, no se incluye ningún otro tipo de interfaz, si bien puede haber interfaces de otro tipo en un router determinado. La interfaz BRI ISDN es un ejemplo. La cadena entre paréntesis es la abreviatura legal que se puede utilizar en los comandos de IOS de Cisco para representar la interfaz.				