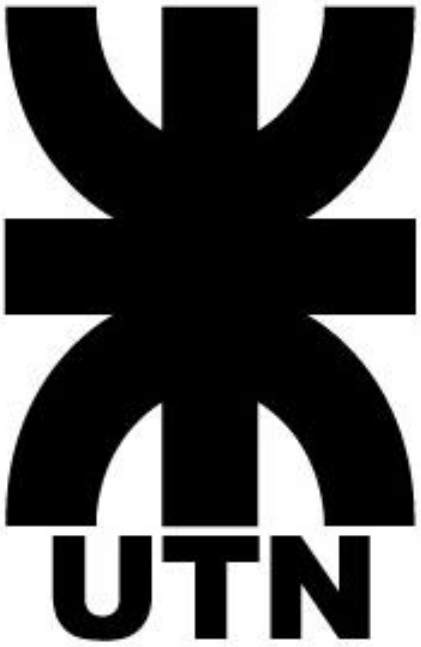
Universidad Tecnológica Nacional



Facultad Regional Delta

Laboratorio de redes de información

2024

Trabajo Práctico N°7 | Enrutamiento BGP

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[UNIVERSIDAD TECNOLOGICA NACIONAL]
[FACULTAD REGIONAL DELTA]

Laboratorio de Redes de información – Trabajo Practico N°7 | Enrutamiento BGP

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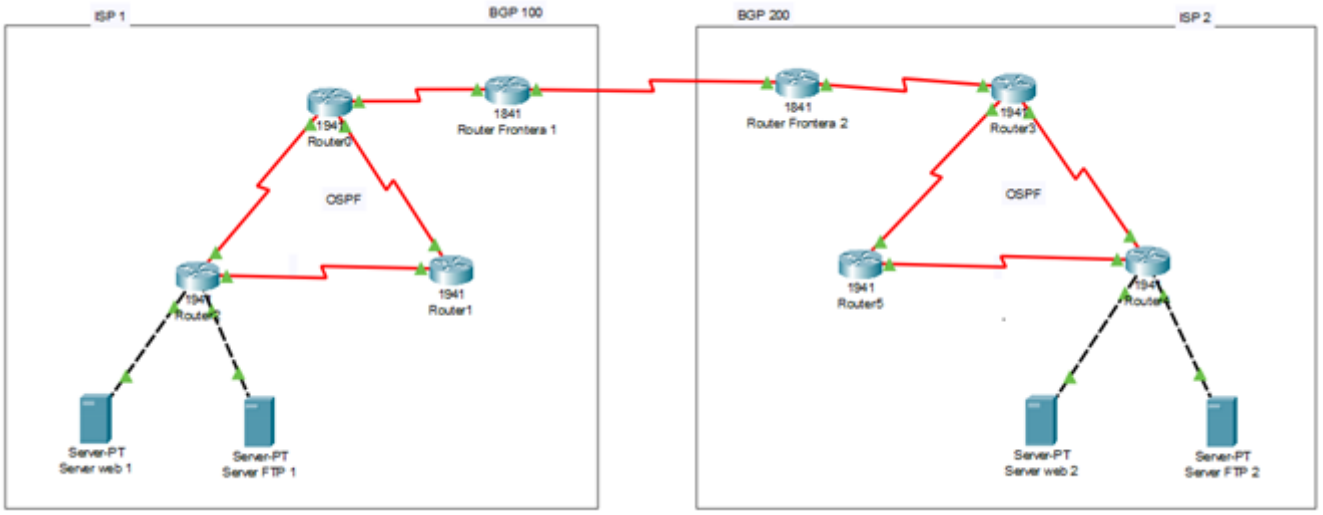
		2024

Contenido

Consignas

Utilice el diagrama del práctico de OSPF y ajústelo para generar dos AS que queden comunicados de la siguiente manera:



Configure lógicamente el diagrama tomando direccionamiento IP clase A públicas en los routers fronteras y clase B en los routers interiores.

· Utilice enrutamiento interior OSPF.

· Establezca enrutamiento BGP entre los routers frontera. Respete los números de sistemas autónomos establecidos para cada ISP (ASXXX)

EJ:

Router(config)#router bgp 100

Router(config-router)# no synchronization

Router(config-router)# bgp log-neighbor-changes

Router(config-router)#neighbor 11.0.0.2 remote-as 200

· Redistribuya la red OSPF en BGP

Router(config-router)# redistribute ospf 1

Redistribuya la red BGP en OSPF

1) Documente

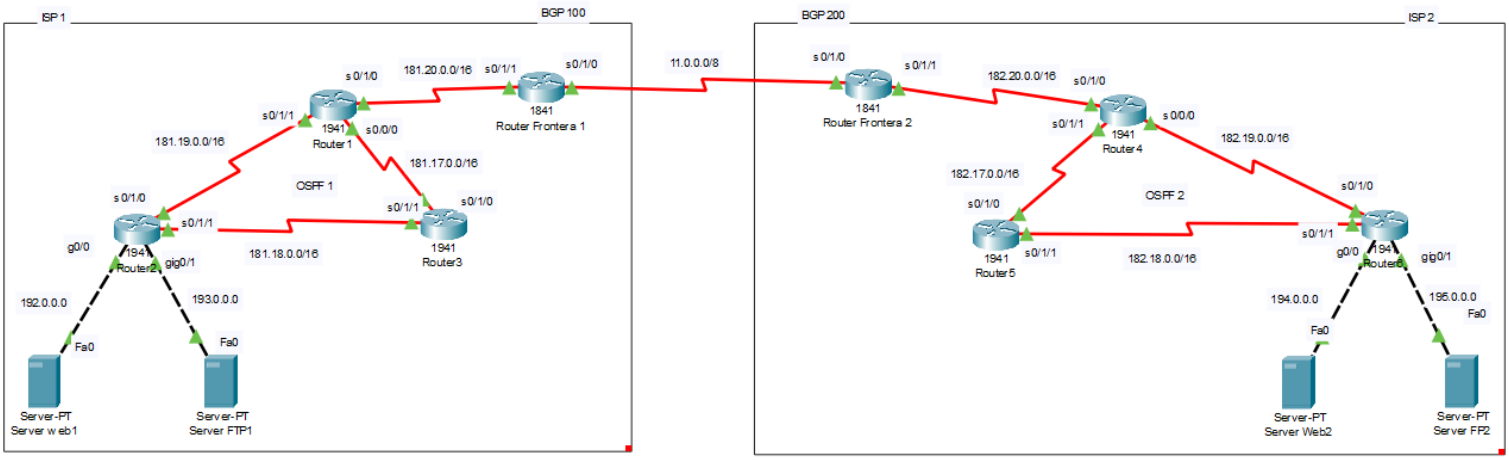
a) Comunicación entre los dos servidores web.

b) Tabla de enrutamiento de los Routers frontera.

Adjunto archivo .pkg

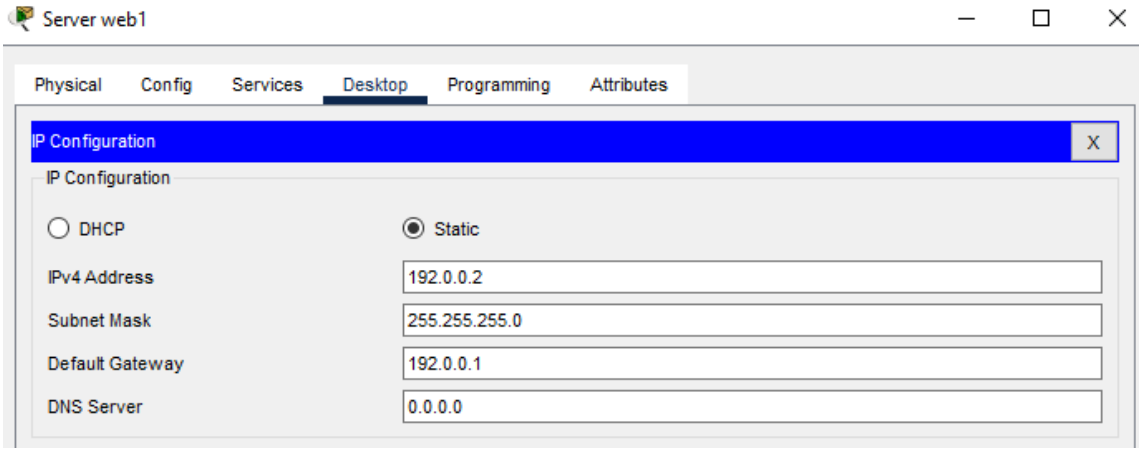
Resolución

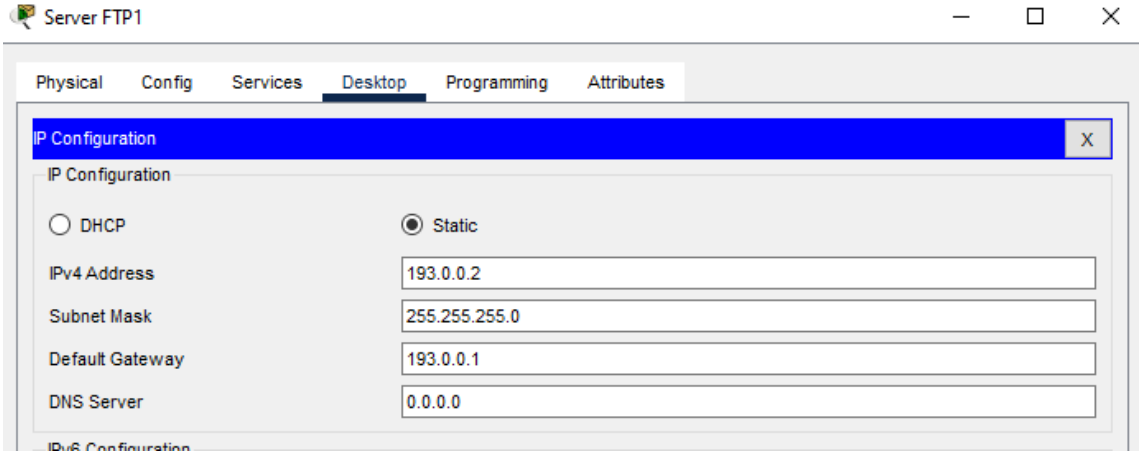
El diagrama de red armado en Packet Tracer queda:



Comienzo trabajando con el ISP 1.

Debo asignarle las IPs a los distintos servidores, para el servidor web 1 y servidor FTP 1:





Continuamos configurando los distintos routers, se le configura la dirección IP a las interfaces y el protocolo OSPF a cada uno. La running-config queda…

Para el router 1:

```
interface Serial0/0/0
 ip address 181.17.0.1 255.255.0.0
 clock rate 64000
!
interface Serial0/0/1
 no ip address
 clock rate 2000000
 shutdown
!
interface Serial0/1/0
 ip address 181.20.0.2 255.255.0.0
!
interface Serial0/1/1
 ip address 181.19.0.1 255.255.0.0
 clock rate 2000000
!
interface Vlan1
 no ip address
 shutdown
!
router ospf 1
 log-adjacency-changes
 network 181.17.0.0 0.0.255.255 area 0
 network 181.19.0.0 0.0.255.255 area 0
 network 181.20.0.0 0.0.255.255 area 0
!
```

Y su tabla de enrutamiento:

```
     181.17.0.0/16 is variably subnetted, 2 subnets, 2 masks
C       181.17.0.0/16 is directly connected, Serial0/0/0
L       181.17.0.1/32 is directly connected, Serial0/0/0
O    181.18.0.0/16 [110/128] via 181.17.0.2, 00:08:34, Serial0/0/0
                   [110/128] via 181.19.0.2, 00:08:34, Serial0/1/1
     181.19.0.0/16 is variably subnetted, 2 subnets, 2 masks
C       181.19.0.0/16 is directly connected, Serial0/1/1
L       181.19.0.1/32 is directly connected, Serial0/1/1
     181.20.0.0/16 is variably subnetted, 2 subnets, 2 masks
C       181.20.0.0/16 is directly connected, Serial0/1/0
L       181.20.0.2/32 is directly connected, Serial0/1/0
O    192.0.0.0/24 [110/65] via 181.19.0.2, 00:08:34, Serial0/1/1
O    193.0.0.0/24 [110/65] via 181.19.0.2, 00:08:34, Serial0/1/1
```

Para el router 2:

```
interface GigabitEthernet0/0
 ip address 192.0.0.1 255.255.255.0
 duplex auto
 speed auto
!
interface GigabitEthernet0/1
 ip address 193.0.0.1 255.255.255.0
 duplex auto
 speed auto
!
interface Serial0/1/0
 ip address 181.19.0.2 255.255.0.0
!
interface Serial0/1/1
 ip address 181.18.0.2 255.255.0.0
 clock rate 64000
!
interface Vlan1
 no ip address
 shutdown
!
router ospf 1
 log-adjacency-changes
 network 192.0.0.0 0.255.255.255 area 0
 network 193.0.0.0 0.255.255.255 area 0
 network 181.18.0.0 0.0.255.255 area 0
 network 181.19.0.0 0.0.255.255 area 0
!
```

Y su tabla de enrutamiento:

```
O    181.17.0.0/16 [110/128] via 181.19.0.1, 00:03:57, Serial0/1/0
                   [110/128] via 181.18.0.1, 00:03:57, Serial0/1/1
     181.18.0.0/16 is variably subnetted, 2 subnets, 2 masks
C       181.18.0.0/16 is directly connected, Serial0/1/1
L       181.18.0.2/32 is directly connected, Serial0/1/1
     181.19.0.0/16 is variably subnetted, 2 subnets, 2 masks
C       181.19.0.0/16 is directly connected, Serial0/1/0
L       181.19.0.2/32 is directly connected, Serial0/1/0
O    181.20.0.0/16 [110/128] via 181.19.0.1, 00:02:45, Serial0/1/0
     192.0.0.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.0.0.0/24 is directly connected, GigabitEthernet0/0
L       192.0.0.1/32 is directly connected, GigabitEthernet0/0
     193.0.0.0/24 is variably subnetted, 2 subnets, 2 masks
C       193.0.0.0/24 is directly connected, GigabitEthernet0/1
L       193.0.0.1/32 is directly connected, GigabitEthernet0/1
```

Para el router 3:

```
interface Serial0/1/0
 ip address 181.17.0.2 255.255.0.0
!
interface Serial0/1/1
 ip address 181.18.0.1 255.255.0.0
!
interface Vlan1
 no ip address
 shutdown
!
router ospf 1
 log-adjacency-changes
 network 181.18.0.0 0.0.255.255 area 0
 network 181.17.0.0 0.0.255.255 area 0
!
```

Y su tabla de enrutamiento:

```
     181.17.0.0/16 is variably subnetted, 2 subnets, 2 masks
C       181.17.0.0/16 is directly connected, Serial0/1/0
L       181.17.0.2/32 is directly connected, Serial0/1/0
     181.18.0.0/16 is variably subnetted, 2 subnets, 2 masks
C       181.18.0.0/16 is directly connected, Serial0/1/1
L       181.18.0.1/32 is directly connected, Serial0/1/1
O    181.19.0.0/16 [110/128] via 181.18.0.2, 00:11:03, Serial0/1/1
                   [110/128] via 181.17.0.1, 00:11:03, Serial0/1/0
O    181.20.0.0/16 [110/128] via 181.17.0.1, 00:09:41, Serial0/1/0
O    192.0.0.0/24 [110/65] via 181.18.0.2, 00:13:49, Serial0/1/1
O    193.0.0.0/24 [110/65] via 181.18.0.2, 00:13:49, Serial0/1/1
```

Para el router frontera 1:

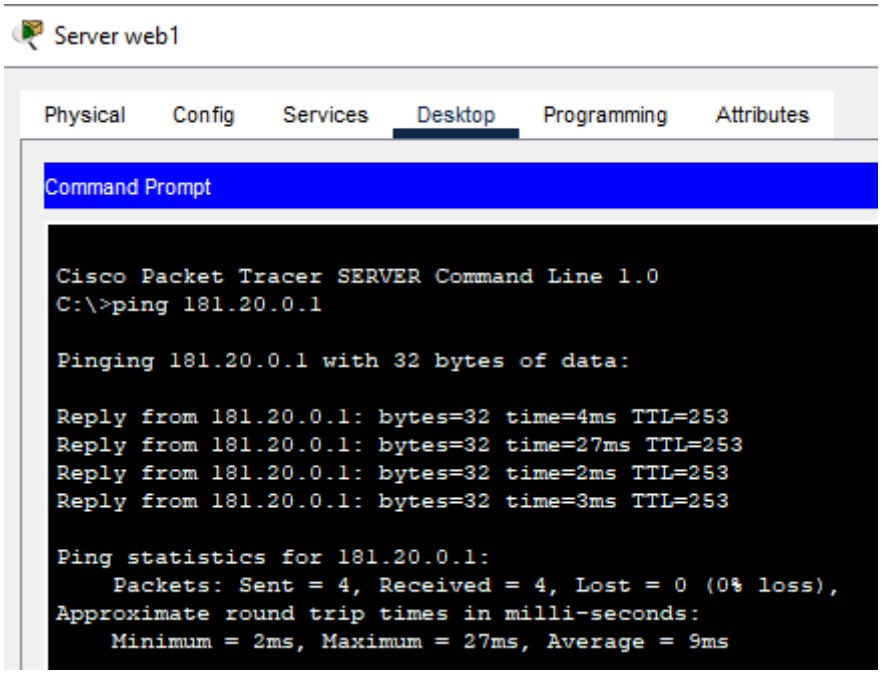
```
interface Serial0/1/1
 ip address 181.20.0.1 255.255.0.0
 clock rate 64000
!
interface Vlan1
 no ip address
 shutdown
!
router ospf 1
 log-adjacency-changes
 network 181.20.0.0 0.0.255.255 area 0
!
```

Y su tabla de enrutamiento:

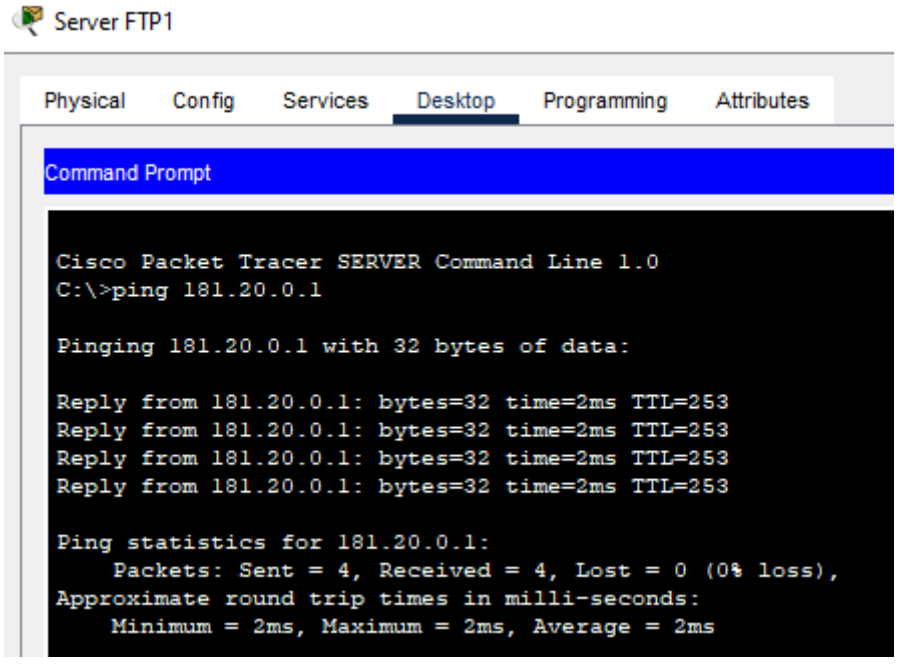
```
O    181.17.0.0/16 [110/128] via 181.20.0.2, 00:09:57, Serial0/1/1
O    181.18.0.0/16 [110/192] via 181.20.0.2, 00:09:57, Serial0/1/1
O    181.19.0.0/16 [110/128] via 181.20.0.2, 00:09:57, Serial0/1/1
C    181.20.0.0/16 is directly connected, Serial0/1/1
O    192.0.0.0/24 [110/129] via 181.20.0.2, 00:09:57, Serial0/1/1
O    193.0.0.0/24 [110/129] via 181.20.0.2, 00:09:57, Serial0/1/1
```

Comprobamos la documentación entre los servidores con el router frontera 1…

Para el servidor web 1:

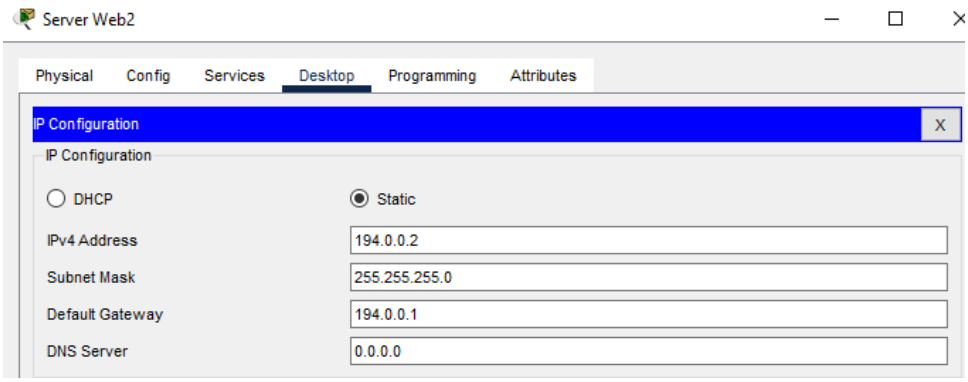


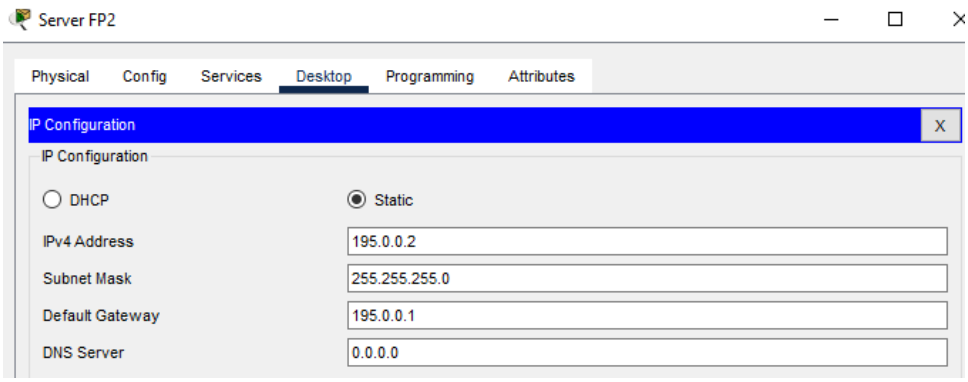
Para el servidor FTP1:



Luego, realizamos la configuración correspondiente para el ISP 2.

Para los servidores web2 y FTP2:





Luego configuro las direcciones IP de las interfaces de los routers y el protocolo OSPF dentro de cada uno.

Para el router 4:

```
interface Serial0/0/0
 ip address 182.19.0.1 255.255.0.0
 clock rate 64000
!
interface Serial0/0/1
 no ip address
 clock rate 2000000
 shutdown
!
interface Serial0/1/0
 ip address 182.20.0.2 255.255.0.0
!
interface Serial0/1/1
 ip address 182.17.0.1 255.255.0.0
 clock rate 64000
!
interface Vlan1
 no ip address
 shutdown
!
router ospf 2
 log-adjacency-changes
 network 182.19.0.0 0.0.255.255 area 0
 network 182.17.0.0 0.0.255.255 area 0
 network 182.20.0.0 0.0.255.255 area 0
!
```

Y la tabla de enrutamiento:

```
     182.17.0.0/16 is variably subnetted, 2 subnets, 2 masks
C       182.17.0.0/16 is directly connected, Serial0/1/1
L       182.17.0.1/32 is directly connected, Serial0/1/1
O    182.18.0.0/16 [110/128] via 182.19.0.2, 00:04:52, Serial0/0/0
                   [110/128] via 182.17.0.2, 00:04:52, Serial0/1/1
     182.19.0.0/16 is variably subnetted, 2 subnets, 2 masks
C       182.19.0.0/16 is directly connected, Serial0/0/0
L       182.19.0.1/32 is directly connected, Serial0/0/0
     182.20.0.0/16 is variably subnetted, 2 subnets, 2 masks
C       182.20.0.0/16 is directly connected, Serial0/1/0
L       182.20.0.2/32 is directly connected, Serial0/1/0
O    194.0.0.0/24 [110/65] via 182.19.0.2, 00:05:02, Serial0/0/0
O    195.0.0.0/24 [110/65] via 182.19.0.2, 00:05:02, Serial0/0/0
```

Para el router 5:

```
interface Serial0/1/0
 ip address 182.17.0.2 255.255.0.0
!
interface Serial0/1/1
 ip address 182.18.0.1 255.255.0.0
 clock rate 64000
!
interface Vlan1
 no ip address
 shutdown
!
router ospf 2
 log-adjacency-changes
 network 182.18.0.0 0.0.255.255 area 0
 network 182.17.0.0 0.0.255.255 area 0
!
```

Y su tabla de enrutamiento:

```
     182.17.0.0/16 is variably subnetted, 2 subnets, 2 masks
C       182.17.0.0/16 is directly connected, Serial0/1/0
L       182.17.0.2/32 is directly connected, Serial0/1/0
     182.18.0.0/16 is variably subnetted, 2 subnets, 2 masks
C       182.18.0.0/16 is directly connected, Serial0/1/1
L       182.18.0.1/32 is directly connected, Serial0/1/1
O    182.19.0.0/16 [110/128] via 182.18.0.2, 00:06:12, Serial0/1/1
                   [110/128] via 182.17.0.1, 00:06:12, Serial0/1/0
O    182.20.0.0/16 [110/128] via 182.17.0.1, 00:02:57, Serial0/1/0
O    194.0.0.0/24 [110/65] via 182.18.0.2, 00:08:34, Serial0/1/1
O    195.0.0.0/24 [110/65] via 182.18.0.2, 00:08:34, Serial0/1/1
```

Para el router 6:

```
interface GigabitEthernet0/0
 ip address 194.0.0.1 255.255.255.0
 duplex auto
 speed auto
!
interface GigabitEthernet0/1
 ip address 195.0.0.1 255.255.255.0
 duplex auto
 speed auto
!
interface Serial0/1/0
 ip address 182.19.0.2 255.255.0.0
!
interface Serial0/1/1
 ip address 182.18.0.2 255.255.0.0
!
interface Vlan1
 no ip address
 shutdown
!
router ospf 2
 log-adjacency-changes
 network 182.18.0.0 0.0.255.255 area 0
 network 182.19.0.0 0.0.255.255 area 0
 network 194.0.0.0 0.255.255.255 area 0
 network 195.0.0.0 0.255.255.255 area 0
```

Y su tabla de enrutamiento:

```
O    182.17.0.0/16 [110/128] via 182.18.0.1, 00:08:33, Serial0/1/1
                   [110/128] via 182.19.0.1, 00:08:33, Serial0/1/0
     182.18.0.0/16 is variably subnetted, 2 subnets, 2 masks
C       182.18.0.0/16 is directly connected, Serial0/1/1
L       182.18.0.2/32 is directly connected, Serial0/1/1
     182.19.0.0/16 is variably subnetted, 2 subnets, 2 masks
C       182.19.0.0/16 is directly connected, Serial0/1/0
L       182.19.0.2/32 is directly connected, Serial0/1/0
O    182.20.0.0/16 [110/128] via 182.19.0.1, 00:05:08, Serial0/1/0
     194.0.0.0/24 is variably subnetted, 2 subnets, 2 masks
C       194.0.0.0/24 is directly connected, GigabitEthernet0/0
L       194.0.0.1/32 is directly connected, GigabitEthernet0/0
     195.0.0.0/24 is variably subnetted, 2 subnets, 2 masks
C       195.0.0.0/24 is directly connected, GigabitEthernet0/1
L       195.0.0.1/32 is directly connected, GigabitEthernet0/1
```

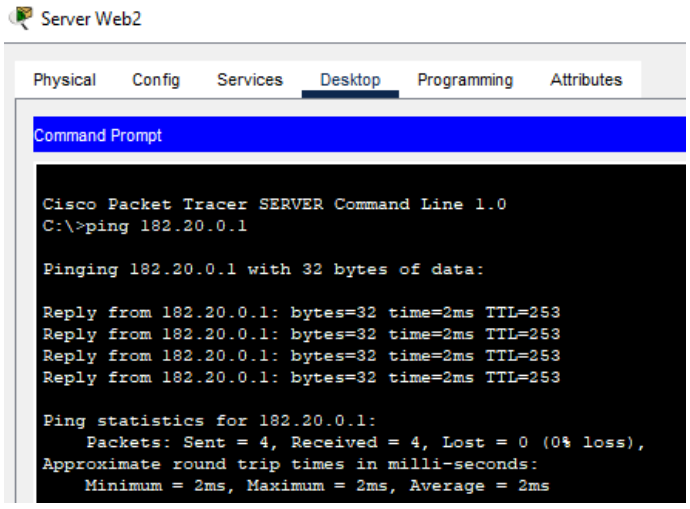
Para el router frontera 2:

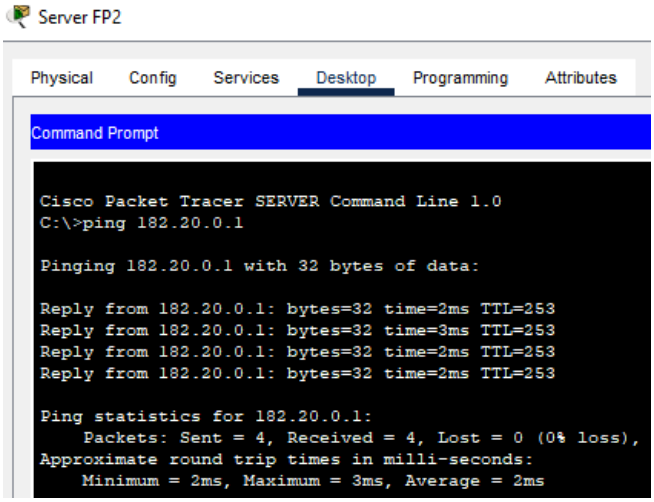
```
interface Serial0/1/1
 ip address 182.20.0.1 255.255.0.0
 clock rate 64000
!
interface Vlan1
 no ip address
 shutdown
!
router ospf 2
 log-adjacency-changes
 network 182.20.0.0 0.0.255.255 area 0
!
```

Y su tabla de enrutamiento:

```
O    182.17.0.0/16 [110/128] via 182.20.0.2, 00:06:21, Serial0/1/1
O    182.18.0.0/16 [110/192] via 182.20.0.2, 00:06:21, Serial0/1/1
O    182.19.0.0/16 [110/128] via 182.20.0.2, 00:06:21, Serial0/1/1
C    182.20.0.0/16 is directly connected, Serial0/1/1
O    194.0.0.0/24 [110/129] via 182.20.0.2, 00:06:21, Serial0/1/1
O    195.0.0.0/24 [110/129] via 182.20.0.2, 00:06:21, Serial0/1/1
```

Comprobamos la comunicación de server Web2 y FTP2 con el router frontera 2:





Y se comprueba que el existe la conexión.

En este punto, tenemos configurados los dos sistemas autónomos ISP 1 y ISP 2, lo siguiente es configurar el protocolo BGP entre los routers frontera de los dos sistemas autónomos.

Un ejemplo de configuración es:

Router(config)#router bgp 100

Router(config-router)# no synchronization

Router(config-router)# bgp log-neighbor-changes

Router(config-router)#neighbor 11.0.0.2 remote-as 200

Y para distribuir la red OSPF que se desea compartir, se utiliza:

Router(config-router)# redistribute ospf 1

Por lo tanto, aplicando estas configuraciones al router frontera 1, obtenemos:

```
interface Serial0/1/0
 ip address 11.0.0.1 255.0.0.0
 clock rate 64000
!
interface Serial0/1/1
 ip address 181.20.0.1 255.255.0.0
 clock rate 64000
!
interface Vlan1
 no ip address
 shutdown
!
router ospf 1
 log-adjacency-changes
 redistribute bgp 100 subnets
 network 181.20.0.0 0.0.255.255 area 0
!
router bgp 100
 bgp log-neighbor-changes
 no synchronization
 neighbor 11.0.0.2 remote-as 200
 redistribute ospf 1
```

Y su tabla de enrutamiento:

```
C    11.0.0.0/8 is directly connected, Serial0/1/0
O    181.17.0.0/16 [110/128] via 181.20.0.2, 00:49:03, Serial0/1/1
O    181.18.0.0/16 [110/192] via 181.20.0.2, 00:49:03, Serial0/1/1
O    181.19.0.0/16 [110/128] via 181.20.0.2, 00:49:03, Serial0/1/1
C    181.20.0.0/16 is directly connected, Serial0/1/1
B    182.17.0.0/16 [20/128] via 11.0.0.2, 00:00:00
B    182.18.0.0/16 [20/192] via 11.0.0.2, 00:00:00
B    182.19.0.0/16 [20/128] via 11.0.0.2, 00:00:00
B    182.20.0.0/16 [20/20] via 11.0.0.2, 00:00:00
O    192.0.0.0/24 [110/129] via 181.20.0.2, 00:49:03, Serial0/1/1
O    193.0.0.0/24 [110/129] via 181.20.0.2, 00:49:03, Serial0/1/1
B    194.0.0.0/24 [20/129] via 11.0.0.2, 00:00:00
B    195.0.0.0/24 [20/129] via 11.0.0.2, 00:00:00
```

En los cuales se marca con B las redes obtenidas por el protocolo BGP.

Para el router frontera 2:

```
interface Serial0/1/0
 ip address 11.0.0.2 255.0.0.0
!
interface Serial0/1/1
 ip address 182.20.0.1 255.255.0.0
 clock rate 64000
!
interface Vlan1
 no ip address
 shutdown
!
router ospf 2
 log-adjacency-changes
 redistribute bgp 200 subnets
 network 182.20.0.0 0.0.255.255 area 0
!
router bgp 200
 bgp log-neighbor-changes
 no synchronization
 neighbor 11.0.0.1 remote-as 100
 redistribute ospf 2
!
```

Y su tabla de enrutamiento:

```
C    11.0.0.0/8 is directly connected, Serial0/1/0
B    181.17.0.0/16 [20/128] via 11.0.0.1, 00:00:00
B    181.18.0.0/16 [20/192] via 11.0.0.1, 00:00:00
B    181.19.0.0/16 [20/128] via 11.0.0.1, 00:00:00
B    181.20.0.0/16 [20/20] via 11.0.0.1, 00:00:00
O    182.17.0.0/16 [110/128] via 182.20.0.2, 00:15:09, Serial0/1/1
O    182.18.0.0/16 [110/192] via 182.20.0.2, 00:15:09, Serial0/1/1
O    182.19.0.0/16 [110/128] via 182.20.0.2, 00:15:09, Serial0/1/1
C    182.20.0.0/16 is directly connected, Serial0/1/1
B    192.0.0.0/24 [20/129] via 11.0.0.1, 00:00:00
B    193.0.0.0/24 [20/129] via 11.0.0.1, 00:00:00
O    194.0.0.0/24 [110/129] via 182.20.0.2, 00:15:09, Serial0/1/1
O    195.0.0.0/24 [110/129] via 182.20.0.2, 00:15:09, Serial0/1/1
```

Donde se observa también que hay redes marcadas con B, lo cual indica que se obtienen mediante el uso del protocolo BGP.

Si tomamos un router aleatorio del ISP 1, como por ejemplo el router 1, observamos que su tabla de enrutamiento es:

Router1

Physical Config CLI Attributes

IOS Command Line Interface

```
O    11.0.0.0/8 [110/128] via 181.20.0.1, 00:04:20, Serial0/1/0
     181.17.0.0/16 is variably subnetted, 2 subnets, 2 masks
C       181.17.0.0/16 is directly connected, Serial0/0/0
L       181.17.0.1/32 is directly connected, Serial0/0/0
O    181.18.0.0/16 [110/128] via 181.17.0.2, 01:00:28, Serial0/0/0
                   [110/128] via 181.19.0.2, 01:00:28, Serial0/1/1
     181.19.0.0/16 is variably subnetted, 2 subnets, 2 masks
C       181.19.0.0/16 is directly connected, Serial0/1/1
L       181.19.0.1/32 is directly connected, Serial0/1/1
     181.20.0.0/16 is variably subnetted, 2 subnets, 2 masks
C       181.20.0.0/16 is directly connected, Serial0/1/0
L       181.20.0.2/32 is directly connected, Serial0/1/0
O    182.17.0.0/16 [110/256] via 181.20.0.1, 00:01:55, Serial0/1/0
O    182.18.0.0/16 [110/320] via 181.20.0.1, 00:01:55, Serial0/1/0
O    182.19.0.0/16 [110/256] via 181.20.0.1, 00:01:55, Serial0/1/0
O    182.20.0.0/16 [110/192] via 181.20.0.1, 00:01:55, Serial0/1/0
O    192.0.0.0/24 [110/65] via 181.19.0.2, 01:00:28, Serial0/1/1
O    193.0.0.0/24 [110/65] via 181.19.0.2, 01:00:28, Serial0/1/1
O    194.0.0.0/24 [110/257] via 181.20.0.1, 00:01:55, Serial0/1/0
O    195.0.0.0/24 [110/257] via 181.20.0.1, 00:01:55, Serial0/1/0
```

En donde se observa que ahora también tiene las direcciones correspondientes al ISP 2.

Si tomamos un router aleatorio del ISP 2, por ejemplo, el router 4:

Router4

Physical Config CLI Attributes

IOS Command Line Interface

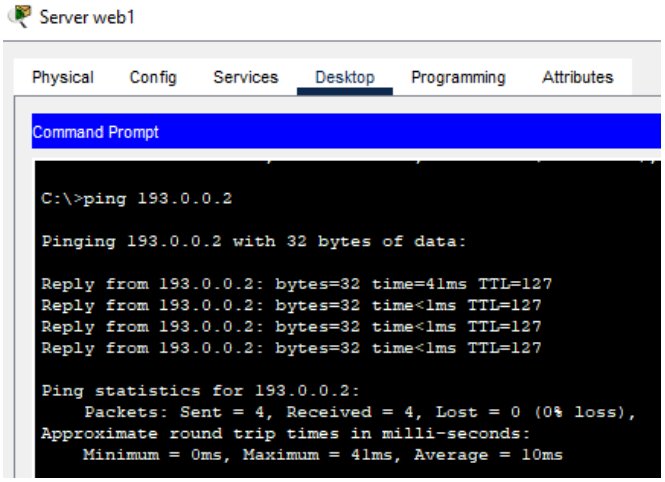
```
O    11.0.0.0/8 [110/128] via 182.20.0.1, 00:03:57, Serial0/1/0
O    181.17.0.0/16 [110/256] via 182.20.0.1, 00:03:47, Serial0/1/0
O    181.18.0.0/16 [110/320] via 182.20.0.1, 00:03:47, Serial0/1/0
O    181.19.0.0/16 [110/256] via 182.20.0.1, 00:03:47, Serial0/1/0
O    181.20.0.0/16 [110/192] via 182.20.0.1, 00:03:47, Serial0/1/0
     182.17.0.0/16 is variably subnetted, 2 subnets, 2 masks
C       182.17.0.0/16 is directly connected, Serial0/1/1
L       182.17.0.1/32 is directly connected, Serial0/1/1
O    182.18.0.0/16 [110/128] via 182.19.0.2, 00:31:28, Serial0/0/0
                   [110/128] via 182.17.0.2, 00:31:28, Serial0/1/1
     182.19.0.0/16 is variably subnetted, 2 subnets, 2 masks
C       182.19.0.0/16 is directly connected, Serial0/0/0
L       182.19.0.1/32 is directly connected, Serial0/0/0
     182.20.0.0/16 is variably subnetted, 2 subnets, 2 masks
C       182.20.0.0/16 is directly connected, Serial0/1/0
L       182.20.0.2/32 is directly connected, Serial0/1/0
O    192.0.0.0/24 [110/257] via 182.20.0.1, 00:03:47, Serial0/1/0
O    193.0.0.0/24 [110/257] via 182.20.0.1, 00:03:47, Serial0/1/0
O    194.0.0.0/24 [110/65] via 182.19.0.2, 00:31:38, Serial0/0/0
O    195.0.0.0/24 [110/65] via 182.19.0.2, 00:31:38, Serial0/0/0
```

Y se observa que ahora tiene las direcciones IP correspondientes al ISP 1.

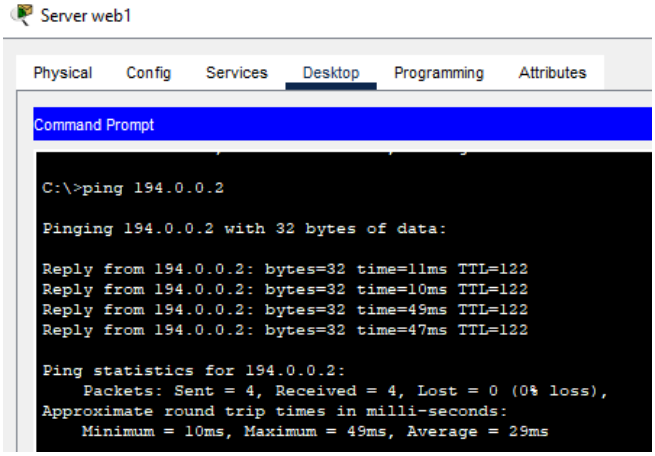
Por último, chequeamos la comunicación entre los distintos servidores.

Desde el servidor Web1…

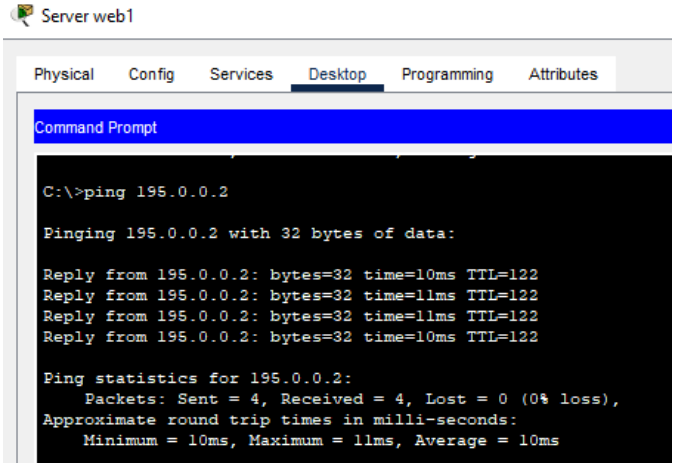
Con el servidor FTP1:



Con el servidor Web2:

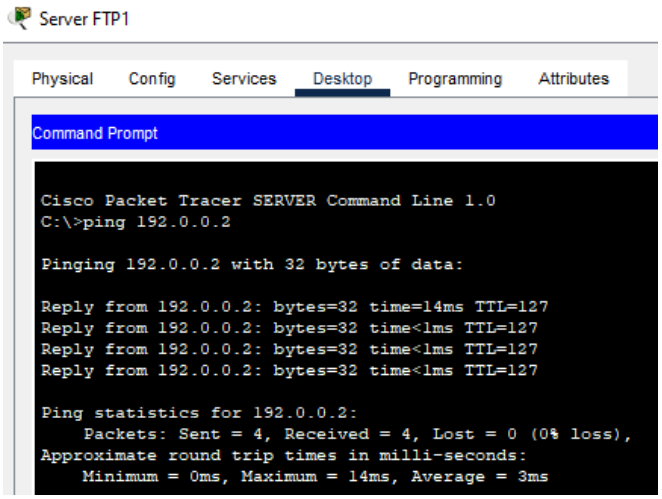


Con el servidor FTP2:

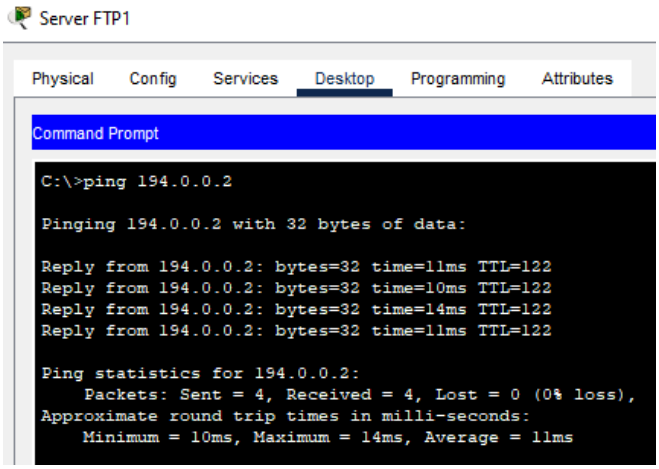


Desde el servidor FTP1...

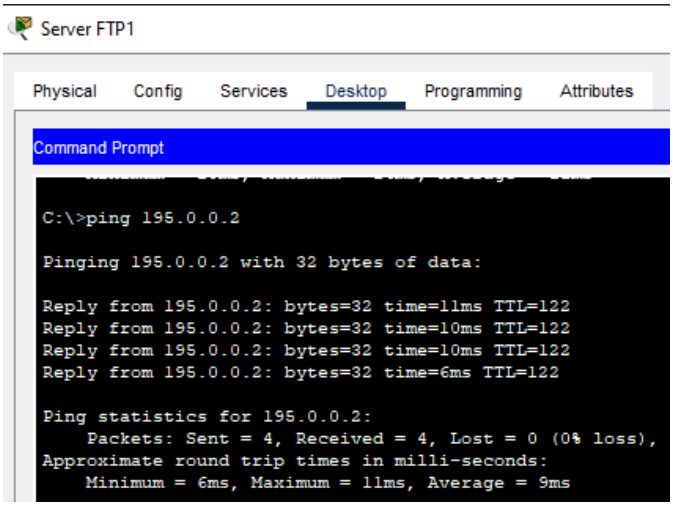
Con el servidor web1:



Con el servidor Web2:

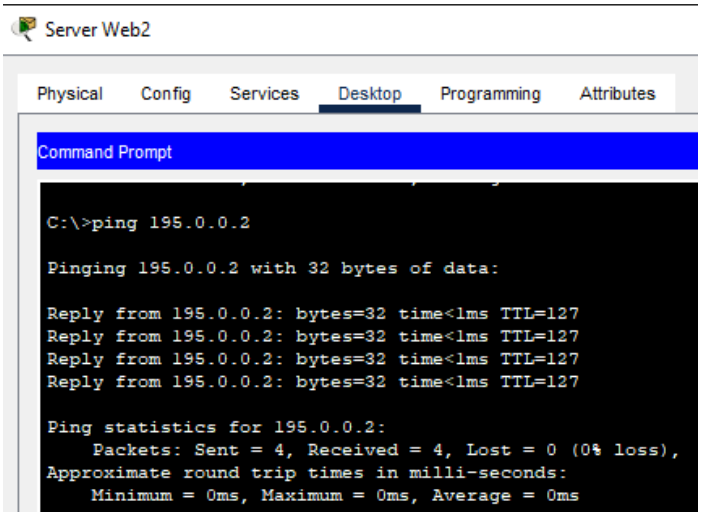


Con el servidor FTP2:

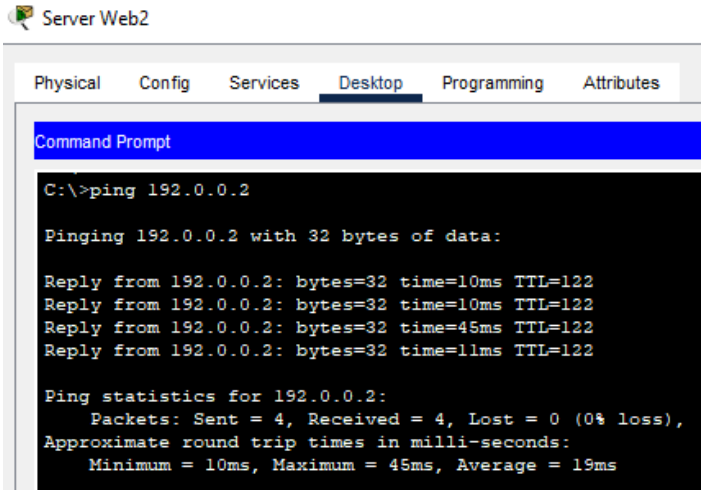


Desde el servidor Web2…

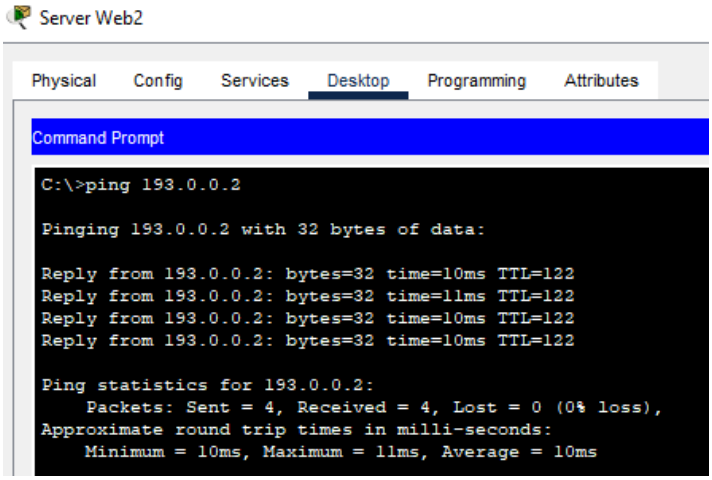
Con el servidor FTP2:



Con el servidor Web1:

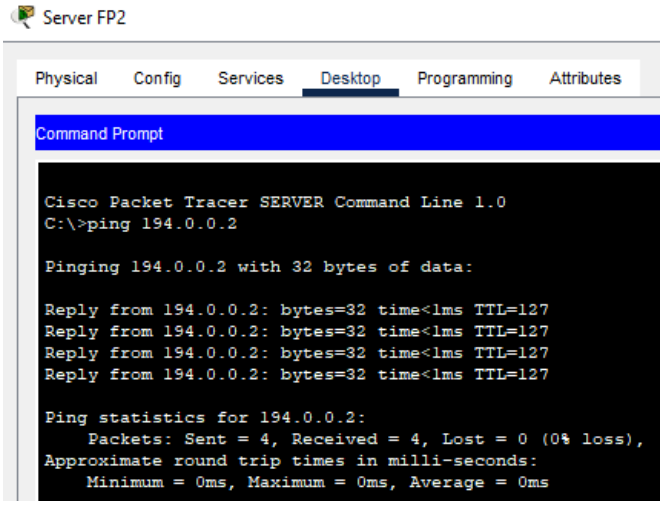


Con el servidor FTP1:

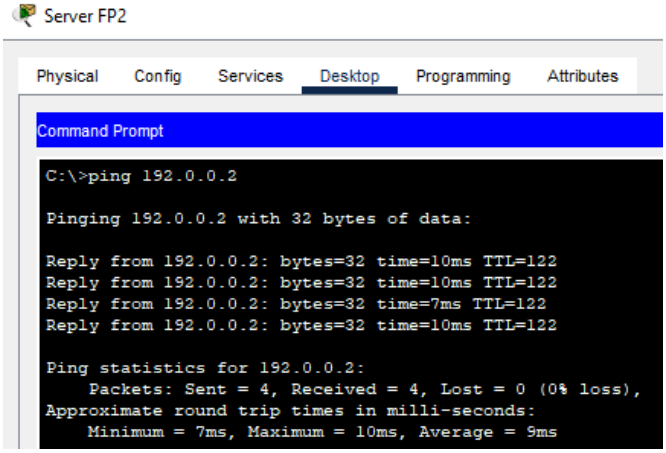


Por ultimo, desde el servidor FTP2...

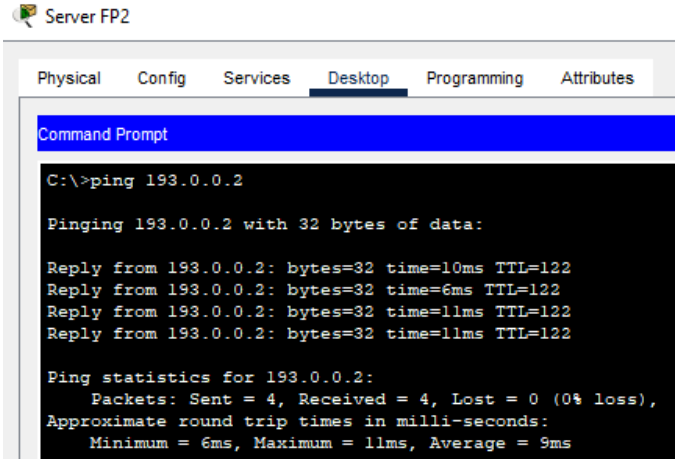
Con el servidor Web2:



Con el servidor Web1:



Con el servidor FTP1:



Con lo cual se observa que todos los servidores de los sistemas autónomos están conectados entre sí.

Conclusión

En esta práctica, se pudo observar como hacen los sistemas autónomos para comunicarse entre sí, además, se pudo entender como se configura el protocolo BGP y como se comparten las tablas de enrutamiento mediante la distribución de las tablas obtenidas por el protocolo OSFP. Gracias a la práctica, pude ver como funcionan los protocolos combinados entre si para asi formar una ruta desde un servidor en un sistema autónomo hacia otro servidor en otro sistema autónomo, con lo que, en resumen, resulto en una experiencia enriquecedora en cuanto al entendimiento de los protocolos que se utilizan en las redes.