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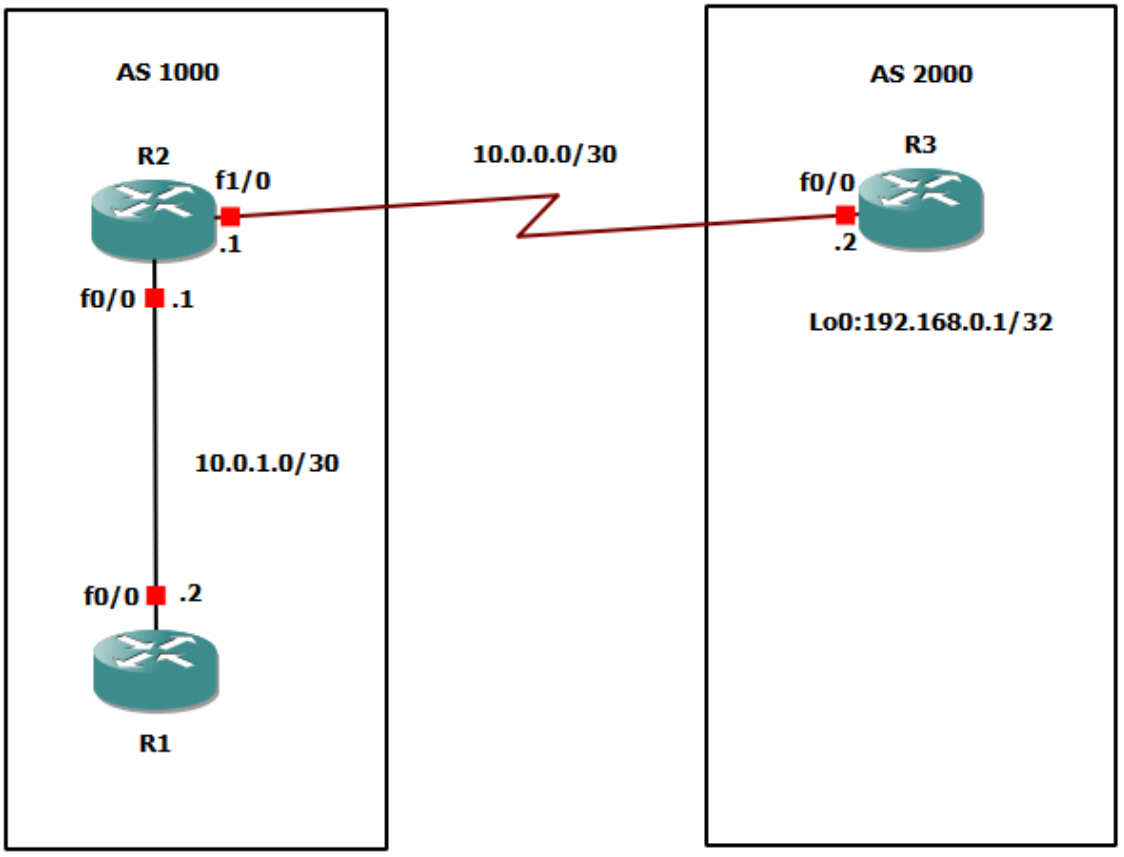
Lista de Exercício BGP

Todas as configurações devem ser apresentadas e devidamente explicadas num relatório

Atividade 1 - Configure os roteadores da rede abaixo com o protocolo de roteamento BGP, de modo que todos os nós sejam alcançáveis de qualquer outro nó da rede. Neste exemplo em particular, o nó R1 deve ser alcançar o nó R3, usando ambos o endereço físico e o endereço da Loopback. Será necessário utilizar o comando NEXT-HOP-SEL .



RESPOSTA QUESTÃO 1

Etapa 1 - Configurar as interfaces dos roteadores R2, R1 e R3, de modo que :

- R2 f0/0 conecta ao R1 f0/0 rede 10.0.1.0/30 (R2 e R1 são do AS 1000);

- R2 f1/0 (AS 1000) conecta ao R3 f0/0 rede 10.0.0.0/30 (AS 2000) Lo0:192.168.0.1/32.

- Configuração da interface de rede do roteador R2

```
! R2
configure terminal
interface FastEthernet0/0
ip address 10.0.1.1 255.255.255.252
no shutdown
write memory

! R2
configure terminal
interface FastEthernet1/0
ip address 10.0.0.1 255.255.255.252
no shutdown
write memory
```

```
R2#show ip interface brief
Interface                  IP-Address      OK? Method Status                Protocol
FastEthernet0/0            10.0.1.1        YES NVRAM  up                    up
FastEthernet1/0            10.0.0.1        YES NVRAM  up                    up
```

- Configuração da interface de rede do roteador R1

```
! R1
configure terminal
interface FastEthernet0/0
ip address 10.0.1.2 255.255.255.252
no shutdown
write memory
```

```
R1#show ip interface brief
Interface                  IP-Address      OK? Method Status                Protocol
FastEthernet0/0            10.0.1.2        YES NVRAM  up                    up
Serial2/0                  unassigned      YES NVRAM  administratively down down
Serial2/1                  unassigned      YES NVRAM  administratively down down
Serial2/2                  unassigned      YES NVRAM  administratively down down
Serial2/3                  unassigned      YES NVRAM  administratively down down
```

- Configuração da interface de rede do roteador R3 e Loopback0

```
! R3
configure terminal
interface FastEthernet0/0
ip address 10.0.0.2 255.255.255.252
no shutdown
write memory

! R3
configure terminal
interface Loopback0
ip address 192.168.0.1 255.255.255.255
no shutdown
write memory
```

```
R3#show ip interface brief
Interface                  IP-Address      OK? Method Status                Protocol
FastEthernet0/0            10.0.0.2        YES NVRAM  up                    up
Serial2/0                  unassigned      YES NVRAM  administratively down down
Serial2/1                  unassigned      YES NVRAM  administratively down down
Serial2/2                  unassigned      YES NVRAM  administratively down down
Serial2/3                  unassigned      YES NVRAM  administratively down down
Loopback0                  192.168.0.1     YES NVRAM  up                    up
```

Etapa 2 : Configurar o BGP (Border Gateway Protocol) no R2, R1 e R3.

- Configuração o BGP no R2 e o **next-hop-self**

```
! Configuração do R2
router bgp 1000
neighbor 10.0.1.2 remote-as 1000  ! R1 (mesmo AS)
neighbor 10.0.0.2 remote-as 2000  ! R3 (outro AS)
network 10.0.1.0 mask 255.255.255.252  ! Anuncia rede entre R1-R2
network 10.0.0.0 mask 255.255.255.252  ! Anuncia rede entre R2-R3
neighbor 10.0.0.2 next-hop-self ! Para R1 alcançar R3 via R2
write memory
```

```
Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
10.0.0.2        4         2000     164     169        5    0    0 02:28:20        2
10.0.1.2        4         1000     165     169        5    0    0 02:28:21        1
R2#
```

- Configuração o BGP no R1

```
!R1
configure terminal
router bgp 1000
neighbor 10.0.1.1 remote-as 1000  ! R2 (AS 1000)
network 10.0.1.0 mask 255.255.255.252
write memory
```

```
Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
10.0.1.1        4         1000     169     165        4    0    0 02:26:19        3
R1#
```

- Configuração o BGP no R3

```
!R3
configure terminal
router bgp 2000
neighbor 10.0.0.1 remote-as 1000    ! R2 (outro AS)
network 10.0.0.0 mask 255.255.255.252 ! Anuncia a rede entre R2 e R3
network 192.168.0.1 mask 255.255.255.255  ! Anuncia a Loopback
write memory
```

```
Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
10.0.0.1        4         1000     169     164        5    0    0 02:26:07        2
R3#
```

Etapa 3: Testar a Conectividade com o Ping

- Testar a conectividade entre as interface de R2

```
R2#ping 10.0.1.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.1.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 4/57/128 ms
R2#ping 10.0.0.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.0.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 12/172/500 ms
R2#ping 192.168.0.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.0.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/250/564 ms
R2#
```

- Testar a conectividade entre as interface de R1

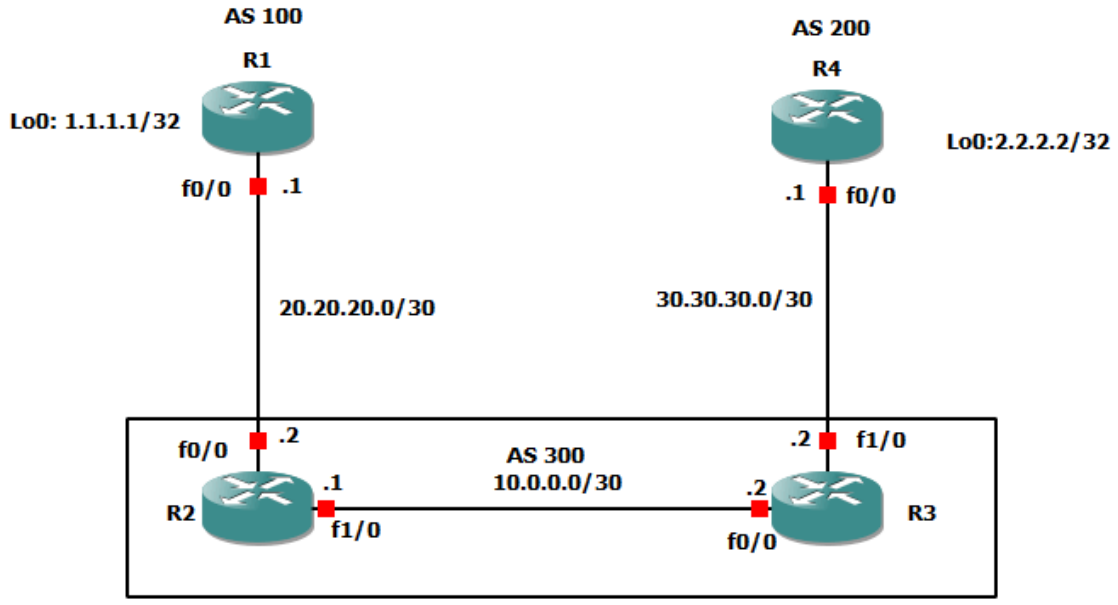
```
R1#ping 10.0.1.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.1.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 4/134/212 ms
R1#ping 192.168.0.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.0.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 4/116/292 ms
R1#
```

- Testar a conectividade entre as interface de R3

```
R3#ping 10.0.1.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.1.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 60/248/492 ms
R3#ping 10.0.1.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.1.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 28/115/216 ms
R3#
```

```
R1#ping 10.0.0.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.0.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 32/381/600 ms
R1#
```

Atividade 2 -Configure a rede da figura abaixo de modo que dos roteadores R1 e R4 se comuniquem via BGP. Para isso, será necessário configurar o eBGP entre AS 100 e AS 300 e entre AS 200 e AS 300, bem como configurar o iBGP entre os roteadores do AS 300.



Etapa 1 - Configurar as interfaces dos roteadores R2, R1, R3 e R4 de modo que :

- R1 f0/0 (AS 100) conecta á R2 f0/0(AS 300) rede 20.20.20.0/30
  - R1 f0/0 20.20.20.1
  - R1 Lo0: 1.1.1.1/32
  - R2 f0/0 20.20.20.2
- R2 f1/0 (AS 300) conecta á R3 f0/0 rede 10.0.0.0/30
  - R2 f1/0 10.0.0.1
  - R3 f0/0 10.0.0.2
- R3 f1/0(AS 300) conecta á R4 f0/0 (AS 200) rede 30.30.30.0/30
  - R3 30.30.30.2
  - R4 30.30.30.
  - R4 Lo0:2.2.2.2/32

- Configuração da interface de rede do roteador R1 e Loopback0

```
! R1
configure terminal
interface f0/0
ip address 20.20.20.1 255.255.255.252
no shutdown
interface loopback 0
ip address 1.1.1.1 255.255.255.255
write memory
```

```
R1#show ip interface brief
Interface                  IP-Address      OK? Method Status                Protocol
FastEthernet0/0            20.20.20.1      YES manual up                    up
Serial2/0                  unassigned      YES unset  administratively down down
Serial2/1                  unassigned      YES unset  administratively down down
Serial2/2                  unassigned      YES unset  administratively down down
Serial2/3                  unassigned      YES unset  administratively down down
Loopback0                  1.1.1.1         YES manual up                    up
R1#
```

- Configuração da interface de rede do roteador R2

```
! R2
configure terminal
interface f0/0
ip address 20.20.20.2 255.255.255.252
no shutdown
interface f1/0
ip address 10.0.0.1 255.255.255.252
no shutdown
write memory
```

```
R2#show ip interface brief
Interface                  IP-Address      OK? Method Status                Protocol
FastEthernet0/0            20.20.20.2      YES manual up                    up
FastEthernet1/0            10.0.0.1        YES manual up                    up
Serial2/0                  unassigned      YES unset  administratively down down
Serial2/1                  unassigned      YES unset  administratively down down
Serial2/2                  unassigned      YES unset  administratively down down
Serial2/3                  unassigned      YES unset  administratively down down
R2#
```

- Configuração da interface de rede do roteador R3

```
! R3
configure terminal
interface f0/0
ip address 10.0.0.2 255.255.255.252
no shutdown
interface f1/0
ip address 30.30.30.2 255.255.255.252
no shutdown
write memory
```

```
R3#show ip interface brief
Interface                  IP-Address      OK? Method Status                Protocol
FastEthernet0/0            10.0.0.2        YES manual up                    up
FastEthernet1/0            30.30.30.2      YES manual up                    up
Serial2/0                  unassigned      YES unset  administratively down down
Serial2/1                  unassigned      YES unset  administratively down down
Serial2/2                  unassigned      YES unset  administratively down down
Serial2/3                  unassigned      YES unset  administratively down down
R3#wr
Building configuration...
[OK]
R3#
```

- Configuração da interface de rede do roteador R4 e Loopback0

```
! R4
configure terminal
interface f0/0
ip address 30.30.30.1 255.255.255.252
no shutdown
interface loopback 0
ip address 2.2.2.2 255.255.255.255
write memory
```

```
R4#show ip interface brief
Interface                  IP-Address      OK? Method Status                Protocol
FastEthernet0/0            30.30.30.1      YES manual up                    up
Serial2/0                  unassigned      YES unset  administratively down down
Serial2/1                  unassigned      YES unset  administratively down down
Serial2/2                  unassigned      YES unset  administratively down down
Serial2/3                  unassigned      YES unset  administratively down down
Loopback0                  2.2.2.2         YES manual up                    up
R4#
```

Etapa 2 : Configurar eBGP entre R1 (AS 100) e R2 (AS 300) e eBGP entre R4 (AS 200) e R3 (AS 300). E Configurar iBGP entre R2 e R3 dentro do AS 300

- R1 (AS 100)

```
router bgp 100
neighbor 20.20.20.2 remote-as 300
network 1.1.1.1 mask 255.255.255.255
network 20.20.20.0 mask 255.255.255.252
```

```
Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
20.20.20.2      4          300       0       0        1    0    0 never    Idle
R1#
```

- R2 (AS 300)

```
router bgp 300
neighbor 20.20.20.1 remote-as 100
network 20.20.20.0 mask 255.255.255.252
neighbor 10.10.10.2 remote-as 300
network 10.0.0.0 mask 255.255.255.252
```

```
Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
10.0.0.2        4          300       9      11        4    0    0 00:05:26        0
20.20.20.1      4          100       9       9        4    0    0 00:03:46        2
R2#
```

- R3 (AS 300)

```
router bgp 300
neighbor 10.10.10.1 remote-as 300
network 10.0.0.0 mask 255.255.255.252
neighbor 30.30.30.1 remote-as 200
network 30.3.30.0 mask 255.255.255.252
```

```
Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
10.0.0.1        4          300      16      14        5    0    0 00:10:29        3
30.30.30.1      4          200       5       6        5    0    0 00:00:39        1
R3#
```

- R4 (AS 200)

```
router bgp 200
neighbor 30.30.30.2 remote-as 300
network 30.3.30.0 mask 255.255.255.252
```

```
Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
30.30.30.2      4          300       7       6        5    0    0 00:01:47        3
R4#
```

Etapa 3: Configurar `next-hop-self`

```
! R2
router bgp 300
neighbor 10.0.0.2 next-hop-self

! R3
router bgp 300
neighbor 10.0.0.1 next-hop-self
```

```
R3(config)#router bgp 300
R3(config-router)# neighbor 10.0.0.1 next-hop-self
```

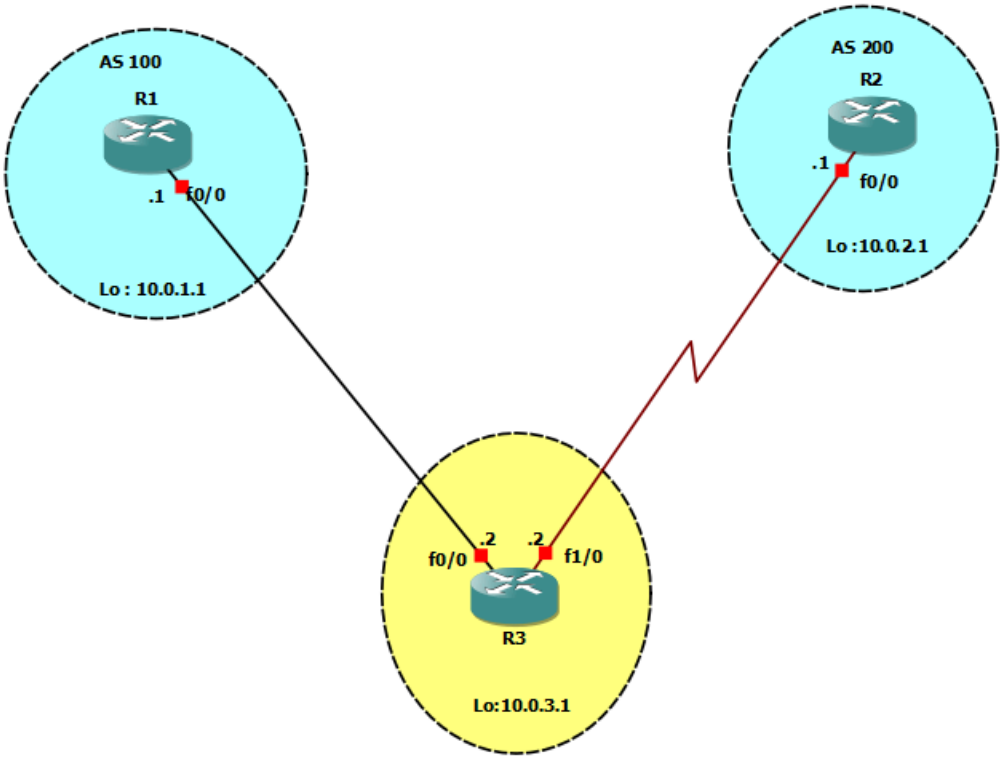
```
R2(config)#router bgp 300
R2(config-router)# neighbor 10.0.0.2 next-hop-self
R2(config-router)#
```

Etapa 4: Testar se os roteadores R1 e R4 se comunicam via BGP.

```
R4#ping 1.1.1.1 source 2.2.2.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 1.1.1.1, timeout is 2 seconds:
Packet sent with a source address of 2.2.2.2
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 8/212/664 ms
```

```
R1#ping 2.2.2.2 source 1.1.1.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2.2.2.2, timeout is 2 seconds:
Packet sent with a source address of 1.1.1.1
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 48/289/756 ms
R1#
```

Atividade 3 - O algoritmo de roteamento BGP é utilizado na troca de dados entres Sistemas Autônomos (AS) na Internet. Para que as redes locais dos AS sejam alcançáveis nos AS remotos deve-se divulgar tais redes locais explicitamente, e uma das maneiras de se fazer isso é utilizando o comando network de configuração do BGP. Dessa forma, pede-se que os sistemas autônomos da figura abaixo sejam configurados de modo que os endereços de loopback de cada AS seja visto nos demais AS. Como nos exercícios anteriores, deve-se utilizar apenas o protocolo de roteamento BGP.



Etapa 1 - Configurar as interfaces dos roteadores R2, R1, R3

- Configuração da interface de rede do roteador R1 e Loopback0

```
configure terminal
interface FastEthernet0/0
ip address 172.16.0.1 255.255.255.252
no shutdown
interface Loopback0
ip address 10.0.1.1 255.255.255.255
no shutdown
write memory
```

```
R1#show ip interface brief
Interface                  IP-Address      OK? Method Status                Protocol
FastEthernet0/0            172.16.0.1      YES manual up                    up
Serial2/0                  unassigned      YES unset  administratively down down
Serial2/1                  unassigned      YES unset  administratively down down
Serial2/2                  unassigned      YES unset  administratively down down
Serial2/3                  unassigned      YES unset  administratively down down
Loopback0                  10.0.1.1        YES manual up                    up
R1#
```

- Configuração da interface de rede do roteador R2 e Loopback0

```
configure terminal
interface FastEthernet0/0
ip address 10.0.9.1 255.255.255.252
no shutdown
interface Loopback0
ip address 10.0.2.1 255.255.255.255
no shutdown
write memory
```

```
R2#show ip interface brief
Interface                  IP-Address      OK? Method Status                Protocol
FastEthernet0/0            10.0.9.1        YES manual up                    up
Serial2/0                  unassigned      YES unset  administratively down down
Serial2/1                  unassigned      YES unset  administratively down down
Serial2/2                  unassigned      YES unset  administratively down down
Serial2/3                  unassigned      YES unset  administratively down down
Loopback0                  10.0.2.1        YES manual up                    up
R2#
```

- Configuração da interface de rede do roteador R3 e Loopback0

```
configure terminal
interface FastEthernet0/0
ip address 172.16.0.2 255.255.255.252
no shutdown
interface FastEthernet1/0
ip address 10.0.9.2 255.255.255.252
no shutdown
interface Loopback0
ip address 10.0.3.1 255.255.255.255
no shutdown
write memory
```

```
R3#show ip interface brief
Interface                  IP-Address      OK? Method Status                Protocol
FastEthernet0/0            172.16.0.2      YES manual up                    up
FastEthernet1/0            10.0.9.2        YES manual up                    up
Serial2/0                  unassigned      YES unset  administratively down down
Serial2/1                  unassigned      YES unset  administratively down down
Serial2/2                  unassigned      YES unset  administratively down down
Serial2/3                  unassigned      YES unset  administratively down down
Loopback0                  10.0.3.1        YES manual up                    up
R3#
```

Etapa 2 - Configurar o protocolo BGP no roteadores

- R1 (AS 100)

```
configure terminal
router bgp 100
neighbor 172.16.0.2 remote-as 300
network 10.0.1.1 mask 255.255.255.255
network 172.16.0.0 mask 255.255.255.252
write memory
```

```
Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
172.16.0.2      4          300      13      13        6    0    0 00:07:42        4
R1#
R1#
```

- R2 (AS 200)

```
configure terminal
router bgp 200
neighbor 10.0.9.2 remote-as 300  ! Estabelece vizinhança com R3 no AS 300
network 10.0.2.1 mask 255.255.255.255  ! Anuncia a Loopback de R2
network 10.0.9.0 mask 255.255.255.252  ! Anuncia a rede entre R2 e R3
write memory
```

```
Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
10.0.9.2        4          300      15       8        6    0    0 00:04:17        4
R2#
```

- R3 (AS 300)

```
configure terminal
router bgp 300
neighbor 172.16.0.1 remote-as 100
neighbor 10.0.9.1 remote-as 200
network 10.0.3.1 mask 255.255.255.255  ! Anuncia a Loopback de R3
network 172.16.0.0 mask 255.255.255.252  ! Anuncia a rede entre R1 e R3
network 10.0.9.0 mask 255.255.255.252  ! Anuncia a rede entre R3 e R2
write memory
```

```
Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
10.0.9.1        4          200       8      15        7    0    0 00:04:21        2
172.16.0.1      4          100      13      16        7    0    0 00:07:50        2
R3#
```

Etapa 3 - Configurar NEXT-HOP-SELF

- Com essa configuração, o R3 informará corretamente aos outros roteadores que ele é o próximo salto para alcançar os endereços de loopback anunciados.

```
R3(config)#router bgp 300
R3(config-router)#neighbor 172.16.0.1 next-hop-self
R3(config-router)#neighbor 10.0.9.1 next-hop-self
```

Etapa 4 : Testar se endereços de loopback de cada AS são visto nos demais AS

- Teste R1

```
R1#ping 10.0.2.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.2.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 12/104/384 ms
R1#ping 10.0.3.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.3.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 16/112/288 ms
R1#
```

- Teste R2

```
R2#ping 10.0.3.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.3.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 24/59/100 ms
R2#ping 10.0.1.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.1.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 4/130/284 ms
R2#
```

- Teste R3

```
R3#ping 10.0.1.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.1.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 20/97/280 ms
R3#ping 10.0.2.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.2.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 4/84/312 ms
R3#
```

Portanto, esta atividade de configuração de BGP entre diferentes Sistemas Autônomos (AS) foi essencial para consolidar o entendimento sobre o funcionamento do BGP, tanto em eBGP quanto iBGP. Ao realizar a configuração dos roteadores, incluindo a definição de interfaces, endereços de loopback e anúncios de redes, foi possível observar como o BGP propaga rotas entre AS diferentes, permitindo a comunicação entre os roteadores.