

ESCOLA POLITÈCNICA
SUPERIOR



XARXES I COMUNICACIONS

PRÀCTICA 1

RIP, OSPF & BGP

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1 Objectius

L'objectiu principal d'aquesta pràctica és implementar els protocols apresos a classe per a encaminament intern i extern. Per fer l'encaminament intern, utilitzarem els protocols **RIP** i **OSPF**. Per a l'encaminament extern farem ús del protocol **BGP**.

2 RIP

És un protocol de porta d'enllaç interna o IGP (Internal Gateway Protocol) utilitzat pels routers (encaminadors), encara que també poden actuar en equips, per intercanviar informació sobre de xarxes IP. En aquest exercici haurem de realitzar unes preguntes sobre el protocol RIP i sobre el seu funcionament.

2.1 Topologia de la xarxa

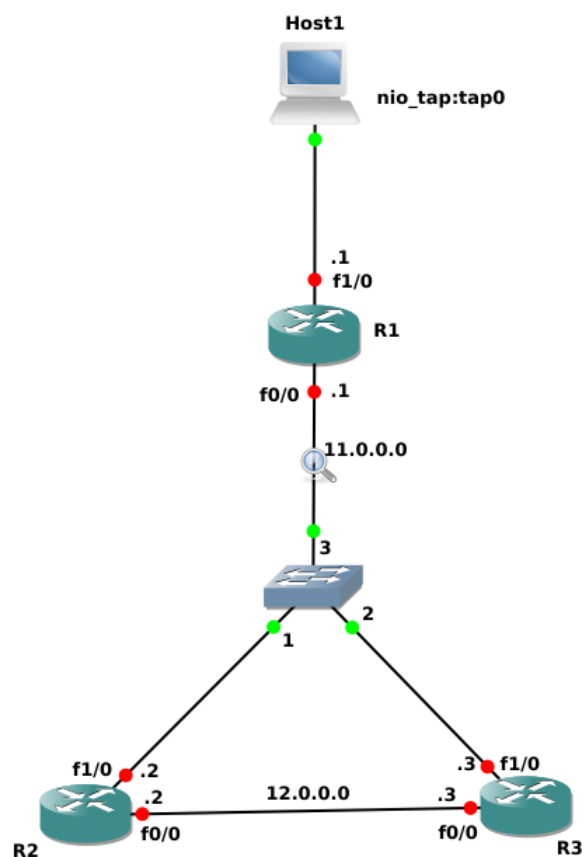


Figura 1: RIP - Topologia de la xarxa a efectuar l'exercici

Per a la realització de aquest exercici utilitzarem encaminadors **Cisco c7200**

2.2 Temps de actualització, rutes invàlides i rutes eliminades per defecte

A continuació, fent ús del programa Wireshark i de comandes al encaminador Cisco, hem de demostrar els diferents temps que té el protocol RIP per actualitzar rutes, marcar-les com invàlides i eliminar-les.

En la següent imatge podem veure com els temps d'actualització s'envien cada 30 segons:

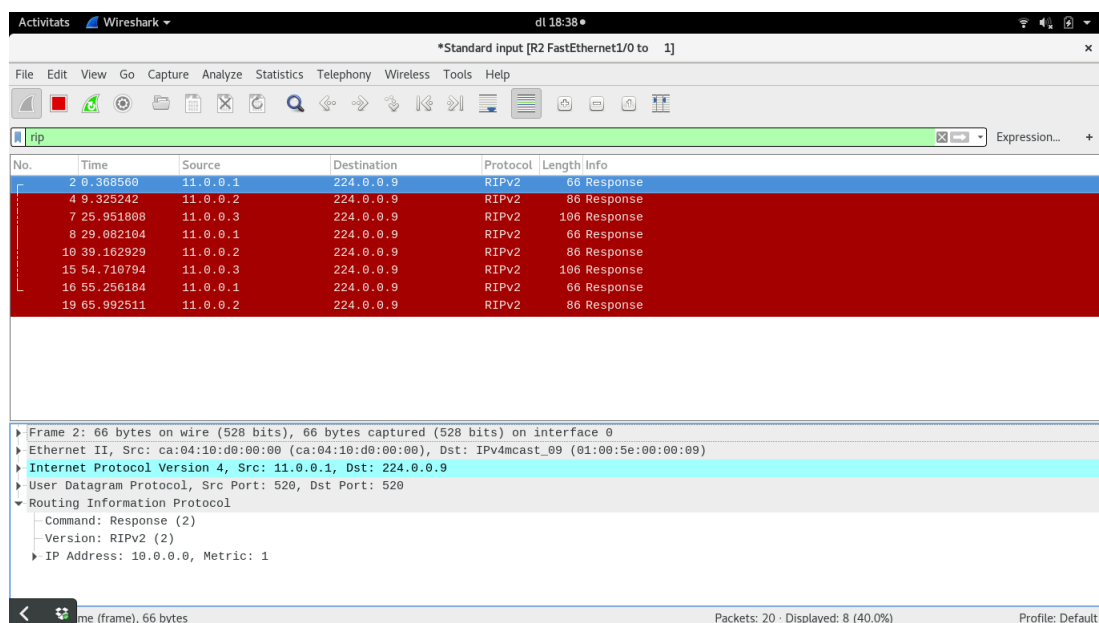


Figura 2: RIP - Temps d'actualització

En la següent imatge s'observa que per defecte, el protocol RIP marca la ruta com invàlida passats 180 segons sense rebre cap paquet d'actualització. En la primera imatge podem veure la hora a la qual hem tancat el encaminador i la seva taula d'encaminament RIP i en la segona imatge podem veure que han passat uns 180 segons i en la seva taula podem veure que hi ha marcat que la ruta és possible que sigui invàlida.

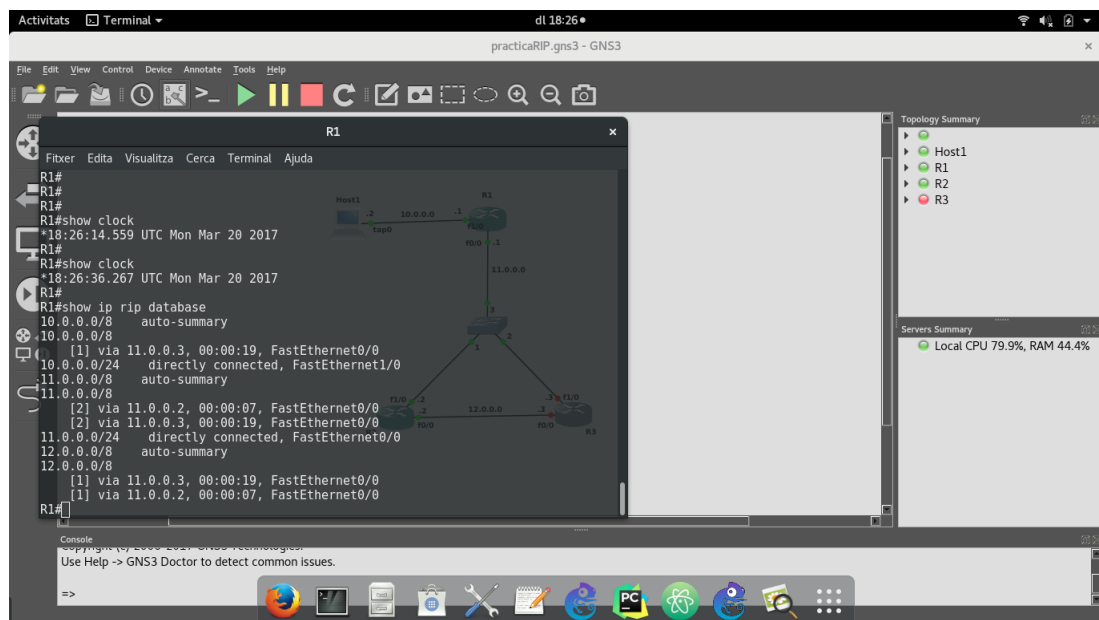


Figura 3: RIP - Temps ruta invàlida

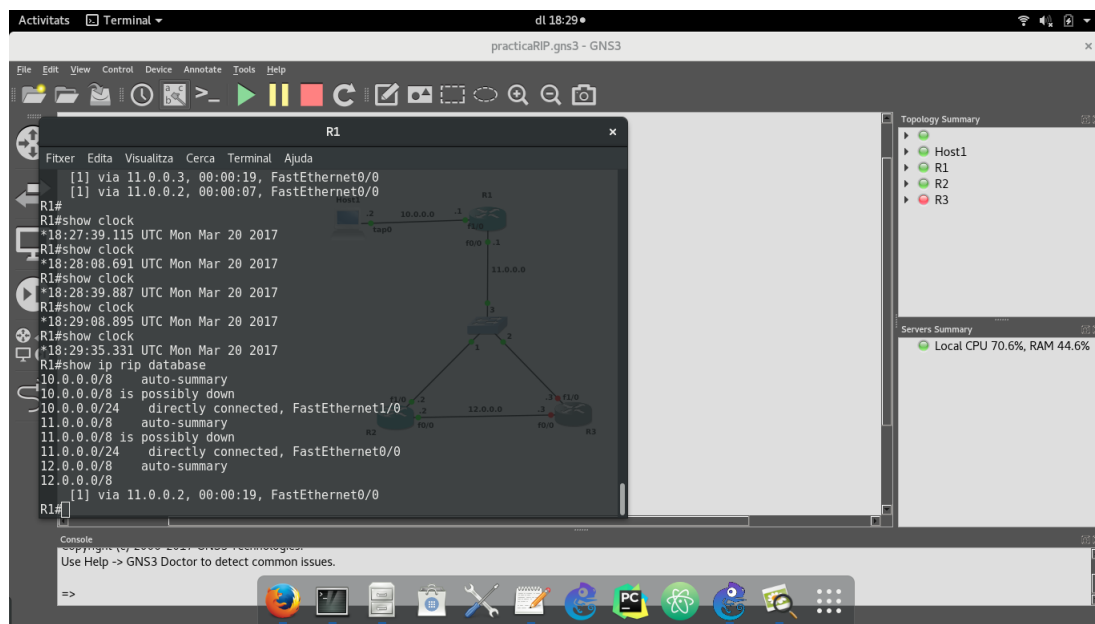


Figura 4: RIP - Temps ruta invàlida

Finalment, en la següent imatge podem veure com després de 240 segons sense cap paquet d'actualització, el protocol RIP per defecte elimina la ruta de la taula d'encaminament del encaminador.

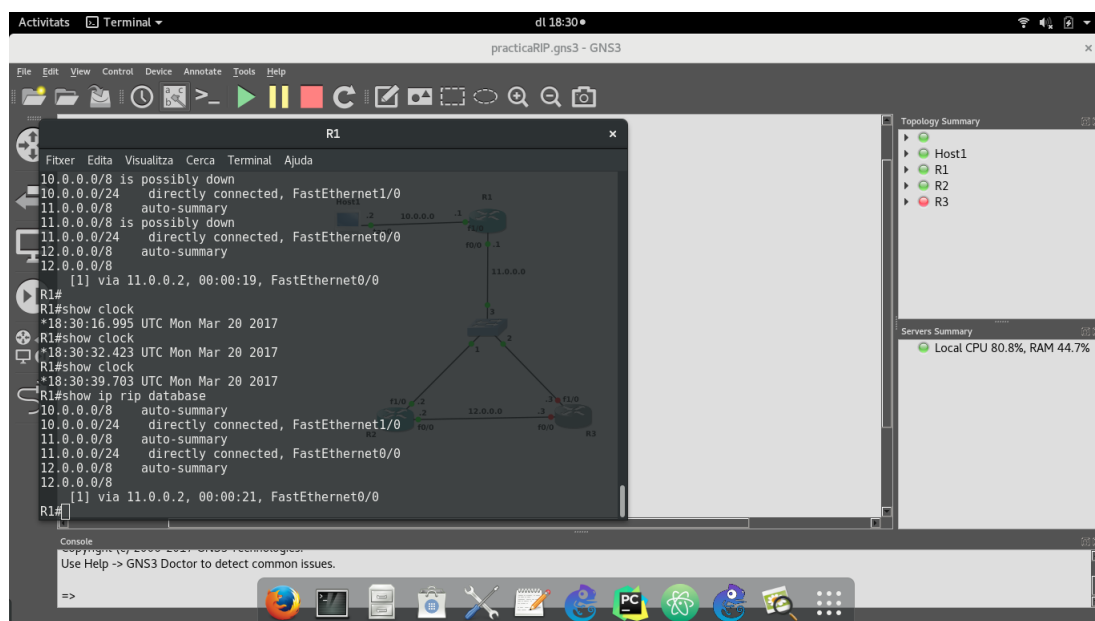


Figura 5: RIP - Temps ruta eliminada

2.3 Demostreu que per defecte split-horizon està activat i poison-reverse desactivat

2.4 Demostreu el problema *count-to-infinity* en la xarxa

Després de desactivar split-horizon per cada interfície de la xarxa i canviar els temps per defecte de BGP (actualitzacions cada 2 segons, invalid als 10 segons, hold-time als 0 segons i eliminar la ruta als 20 segons), hem pogut experimentar que si desconnectem el encaminador R1 és pot produir el problema *count-to-infinity*.

3 OSPF

És un protocol d'encaminament d'estat d'enllaç considerat de porta d'enllaç interna. Utilitza codi obert i envia els paquets primer pel camí més curt. Fa ús de l'algoritme SPF que es basa principalment en el valor de l'amplada de banda de les connexions.

3.1 Topologia de la xarxa

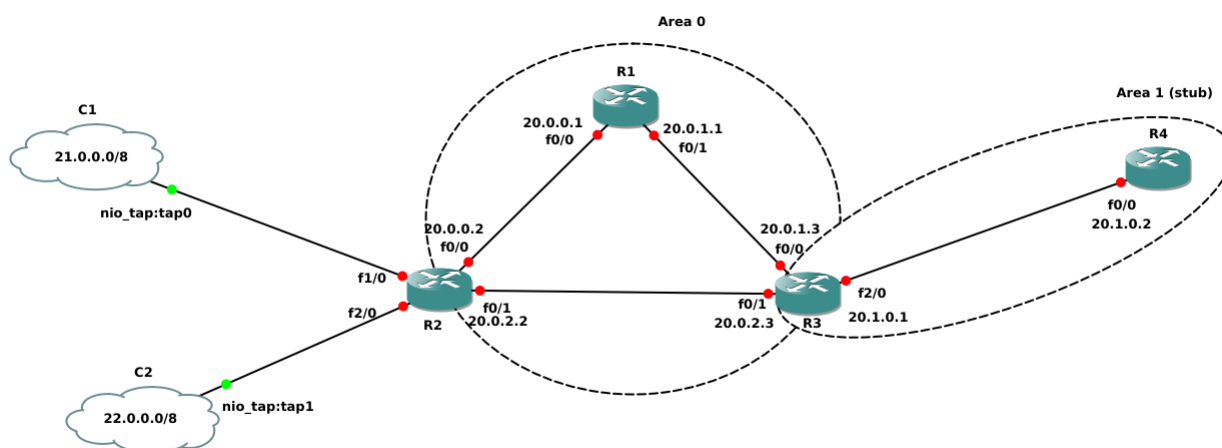


Figura 6: Topologia de la xarxa a efectuar l'exercici

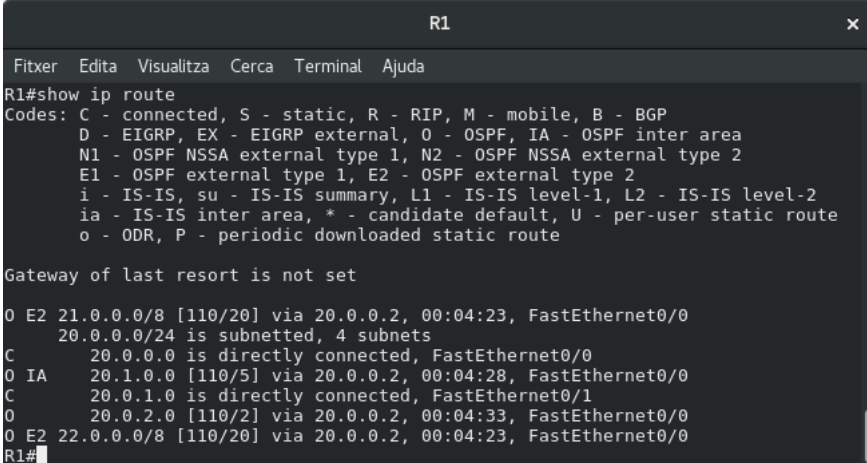
Per a la realització de aquest exercici utilitzarem encaminadors **Cisco c7200**. També hem de utilitzar les següents xarxes:

Instead of:	Use:
10.0.0.0/24	X.0.0.0/24
10.0.1.0/24	X.0.1.0/24
10.0.2.0/24	X.0.2.0/24
10.1.0.0/24	X.1.0.0/24
11.0.0.0/8	(X+1).0.0.0/8
12.0.0.0/8	(X+2).0.0.0/8

Taula 1: Xarxes a utilitzar en l'exercici OSPF

3.2 Imatges de la base de dades OSPF de cada encaminador

3.2.1 Encaminador R1



```

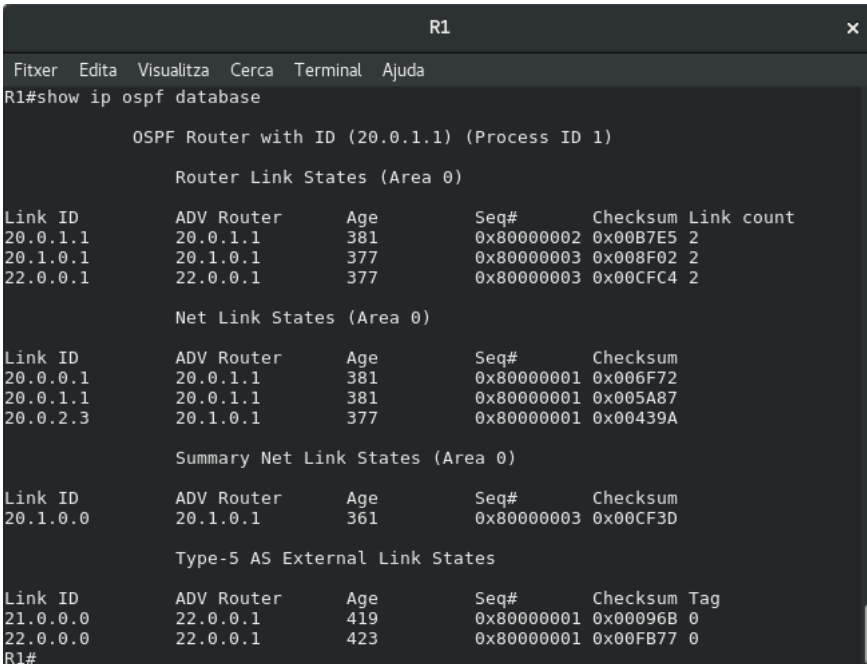
R1
Fitxer  Edita  Visualitza  Cerca  Terminal  Ajuda
R1#show ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
        D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
        N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
        E1 - OSPF external 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

Gateway of last resort is not set

O E2 21.0.0.0/8 [110/20] via 20.0.0.2, 00:04:23, FastEthernet0/0
    20.0.0.0/24 is subnetted, 4 subnets
C    20.0.0.0 is directly connected, FastEthernet0/0
O IA  20.1.0.0 [110/5] via 20.0.0.2, 00:04:28, FastEthernet0/0
C    20.0.1.0 is directly connected, FastEthernet0/1
O    20.0.2.0 [110/2] via 20.0.0.2, 00:04:33, FastEthernet0/0
O E2 22.0.0.0/8 [110/20] via 20.0.0.2, 00:04:23, FastEthernet0/0
R1#

```

Figura 7: OSPF - Comanda *show ip route* en el encaminador R1



```

R1
Fitxer  Edita  Visualitza  Cerca  Terminal  Ajuda
R1#show ip ospf database

        OSPF Router with ID (20.0.1.1) (Process ID 1)

        Router Link States (Area 0)

Link ID        ADV Router    Age          Seq#          Checksum Link count
20.0.1.1       20.0.1.1      381          0x80000002   0x00B7E5 2
20.1.0.1       20.1.0.1      377          0x80000003   0x008F02 2
22.0.0.1       22.0.0.1      377          0x80000003   0x00CFC4 2

        Net Link States (Area 0)

Link ID        ADV Router    Age          Seq#          Checksum
20.0.0.1       20.0.1.1      381          0x80000001   0x006F72
20.0.1.1       20.0.1.1      381          0x80000001   0x005A87
20.0.2.3       20.1.0.1      377          0x80000001   0x00439A

        Summary Net Link States (Area 0)

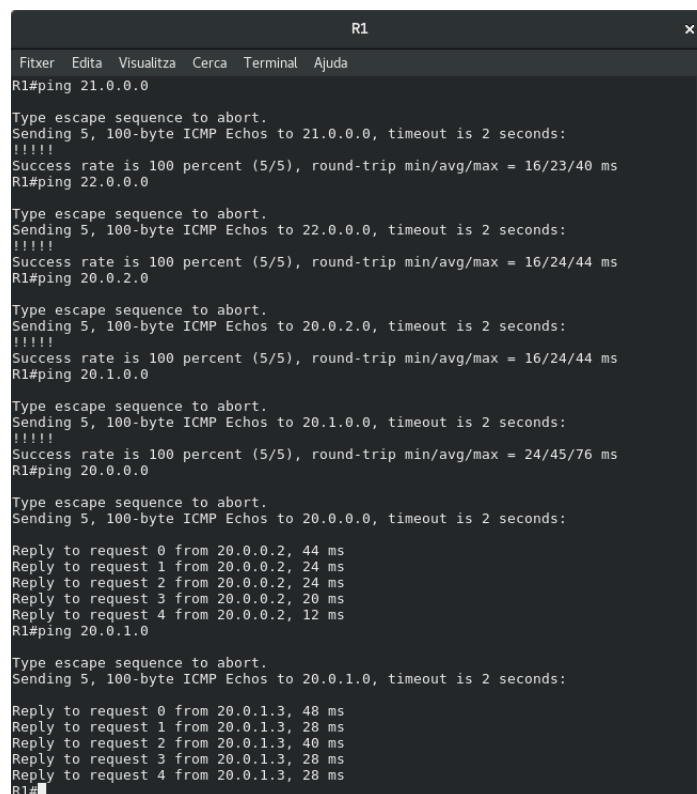
Link ID        ADV Router    Age          Seq#          Checksum
20.1.0.0       20.1.0.1      361          0x80000003   0x00CF3D

        Type-5 AS External Link States

Link ID        ADV Router    Age          Seq#          Checksum Tag
21.0.0.0       22.0.0.1      419          0x80000001   0x00096B 0
22.0.0.0       22.0.0.1      423          0x80000001   0x00FB77 0
R1#

```

Figura 8: OSPF - Comanda *show ip ospf database* en el encaminador R1



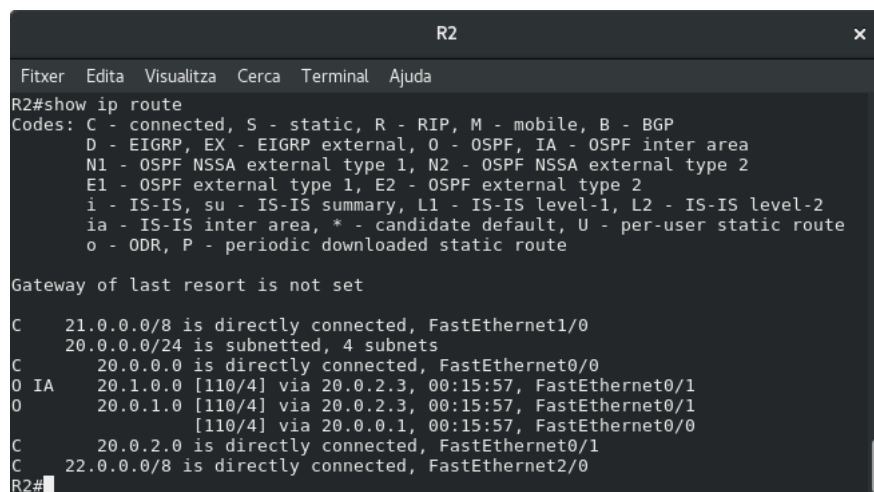
```

R1
Fitxer  Edita  Visualitza  Cerca  Terminal  Ajuda
R1#ping 21.0.0.0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 21.0.0.0, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 16/23/40 ms
R1#ping 22.0.0.0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 22.0.0.0, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 16/24/44 ms
R1#ping 20.0.2.0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 20.0.2.0, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 16/24/44 ms
R1#ping 20.1.0.0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 20.1.0.0, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 24/45/76 ms
R1#ping 20.0.0.0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 20.0.0.0, timeout is 2 seconds:
Reply to request 0 from 20.0.0.2, 44 ms
Reply to request 1 from 20.0.0.2, 24 ms
Reply to request 2 from 20.0.0.2, 24 ms
Reply to request 3 from 20.0.0.2, 20 ms
Reply to request 4 from 20.0.0.2, 12 ms
R1#ping 20.0.1.0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 20.0.1.0, timeout is 2 seconds:
Reply to request 0 from 20.0.1.3, 48 ms
Reply to request 1 from 20.0.1.3, 28 ms
Reply to request 2 from 20.0.1.3, 40 ms
Reply to request 3 from 20.0.1.3, 28 ms
Reply to request 4 from 20.0.1.3, 28 ms
R1#

```

Figura 9: OSPF - Prova de connectivitat a la xarxa des de l'encaminador R1

3.2.2 Encaminador R2



```

R2
Fitxer  Edita  Visualitza  Cerca  Terminal  Ajuda
R2#show ip route
Codes: 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

Gateway of last resort is not set

C    21.0.0.0/8 is directly connected, FastEthernet1/0
C    20.0.0.0/24 is subnetted, 4 subnets
C      20.0.0.0 is directly connected, FastEthernet0/0
O IA  20.1.0.0 [110/4] via 20.0.2.3, 00:15:57, FastEthernet0/1
O      20.0.1.0 [110/4] via 20.0.2.3, 00:15:57, FastEthernet0/1
      [110/4] via 20.0.0.1, 00:15:57, FastEthernet0/0
C      20.0.2.0 is directly connected, FastEthernet0/1
C    22.0.0.0/8 is directly connected, FastEthernet2/0
R2#

```

Figura 10: OSPF - Comanda *show ip route* en el encaminador R2

```

R2
Fitxer  Edita  Visualitza  Cerca  Terminal  Ajuda
R2#show ip ospf database

        OSPF Router with ID (22.0.0.1) (Process ID 1)

        Router Link States (Area 0)

Link ID      ADV Router    Age      Seq#       Checksum Link count
20.0.1.1     20.0.1.1      1016     0x80000002 0x00B7E5 2
20.1.0.1     20.1.0.1      1011     0x80000003 0x008F02 2
22.0.0.1     22.0.0.1      1010     0x80000003 0x00CFC4 2

        Net Link States (Area 0)

Link ID      ADV Router    Age      Seq#       Checksum
20.0.0.1     20.0.1.1      1016     0x80000001 0x006F72
20.0.1.1     20.0.1.1      1016     0x80000001 0x005A87
20.0.2.3     20.1.0.1      1011     0x80000001 0x00439A

        Summary Net Link States (Area 0)

Link ID      ADV Router    Age      Seq#       Checksum
20.1.0.0     22.0.1.0.1    996      0x80000003 0x00CF3D

        Type-5 AS External Link States

Link ID      ADV Router    Age      Seq#       Checksum Tag
21.0.0.0     22.0.0.1      1053     0x80000001 0x00096B 0
22.0.0.0     22.0.0.1      1055     0x80000001 0x00FB77 0
R2#

```

Figura 11: OSPF - Comanda *show ip ospf database* en el encaminador R2

```

R2
Fitxer  Edita  Visualitza  Cerca  Terminal  Ajuda
R2#ping 21.0.0.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 21.0.0.1, timeout is 2 seconds:
!!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/3/4 ms
R2#ping 22.0.0.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 22.0.0.1, timeout is 2 seconds:
!!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/3/4 ms
R2#ping 20.0.2.0

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 20.0.2.0, timeout is 2 seconds:

Reply to request 0 from 20.0.2.3, 44 ms
Reply to request 1 from 20.0.2.3, 32 ms
Reply to request 2 from 20.0.2.3, 8 ms
Reply to request 3 from 20.0.2.3, 44 ms
Reply to request 4 from 20.0.2.3, 32 ms
R2#ping 20.1.0.0

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 20.1.0.0, timeout is 2 seconds:
!!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 16/32/48 ms
R2#ping 20.0.0.0

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 20.0.0.0, timeout is 2 seconds:

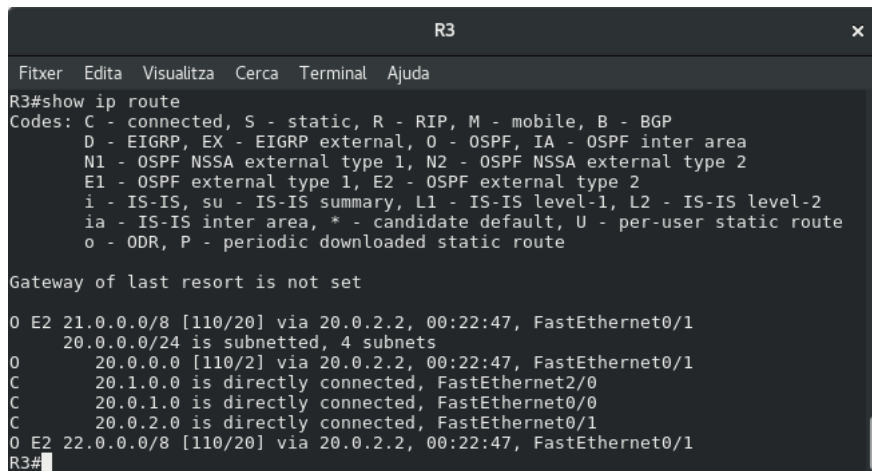
Reply to request 0 from 20.0.0.1, 40 ms
Reply to request 1 from 20.0.0.1, 72 ms
Reply to request 2 from 20.0.0.1, 40 ms
Reply to request 3 from 20.0.0.1, 32 ms
Reply to request 4 from 20.0.0.1, 44 ms
R2#ping 20.0.1.0

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 20.0.1.0, timeout is 2 seconds:
!!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 20/23/32 ms
R2#

```

Figura 12: OSPF - Prova de connectivitat a la xarxa des de l'encaminador R2

3.2.3 Encaminador R3



```

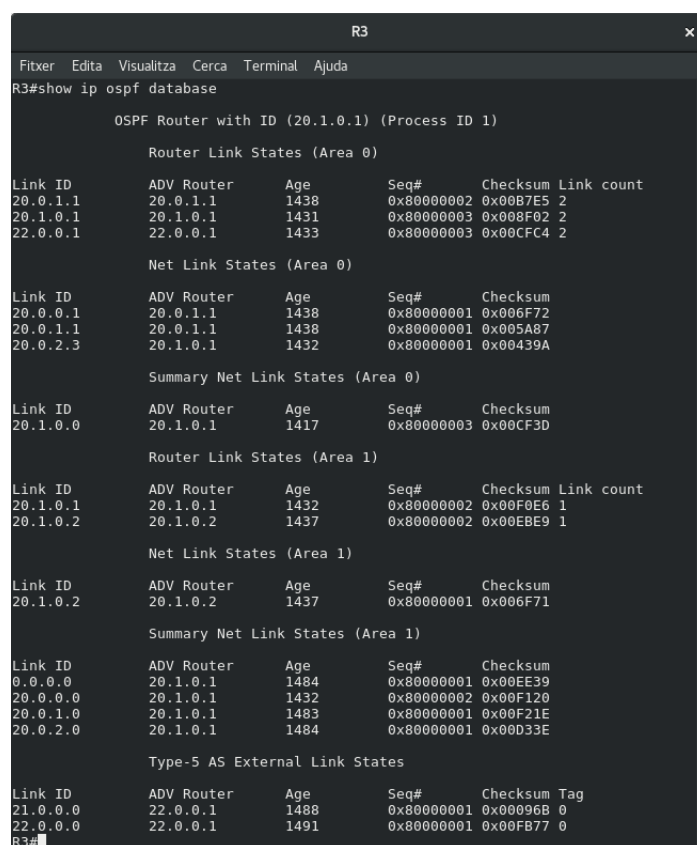
R3#show ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
        D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
        N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
        E1 - OSPF external type 1, E2 - OSPF external type 2
        i - IS-IS, 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

Gateway of last resort is not set

O E2 21.0.0.0/8 [110/20] via 20.0.2.2, 00:22:47, FastEthernet0/1
    20.0.0.0/24 is subnetted, 4 subnets
O    20.0.0.0 [110/2] via 20.0.2.2, 00:22:47, FastEthernet0/1
C    20.1.0.0 is directly connected, FastEthernet2/0
C    20.0.1.0 is directly connected, FastEthernet0/0
C    20.0.2.0 is directly connected, FastEthernet0/1
O E2 22.0.0.0/8 [110/20] via 20.0.2.2, 00:22:47, FastEthernet0/1
R3#

```

Figura 13: OSPF - Comanda *show ip route* en el encaminador R3



```

R3#show ip ospf database

OSPF Router with ID (20.1.0.1) (Process ID 1)

Router Link States (Area 0)

Link ID      ADV Router   Age         Seq#         Checksum Link count
20.0.1.1     20.0.1.1     1438       0x80000002  0x00B7E5  2
20.1.0.1     20.1.0.1     1431       0x80000003  0x008F02  2
22.0.0.1     22.0.0.1     1433       0x80000003  0x00CFC4  2

Net Link States (Area 0)

Link ID      ADV Router   Age         Seq#         Checksum
20.0.0.1     20.0.1.1     1438       0x80000001  0x006F72
20.0.1.1     20.0.1.1     1438       0x80000001  0x005A87
20.0.2.3     20.1.0.1     1432       0x80000001  0x00439A

Summary Net Link States (Area 0)

Link ID      ADV Router   Age         Seq#         Checksum
20.1.0.0     20.1.0.1     1417       0x80000003  0x00CF3D

Router Link States (Area 1)

Link ID      ADV Router   Age         Seq#         Checksum Link count
20.1.0.1     20.1.0.1     1432       0x80000002  0x00F0E6  1
20.1.0.2     20.1.0.2     1437       0x80000002  0x00EBE9  1

Net Link States (Area 1)

Link ID      ADV Router   Age         Seq#         Checksum
20.1.0.2     20.1.0.2     1437       0x80000001  0x006F71

Summary Net Link States (Area 1)

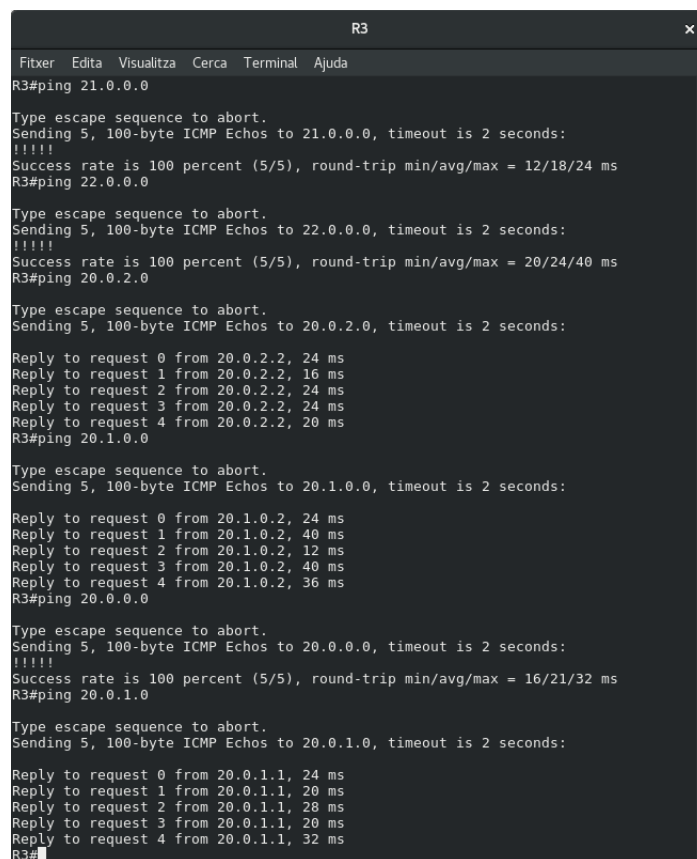
Link ID      ADV Router   Age         Seq#         Checksum
0.0.0.0     20.1.0.1     1484       0x80000001  0x00EE39
20.0.0.0     20.1.0.1     1432       0x80000002  0x00F120
20.0.1.0     20.1.0.1     1483       0x80000001  0x00F21E
20.0.2.0     20.1.0.1     1484       0x80000001  0x00D33E

Type-5 AS External Link States

Link ID      ADV Router   Age         Seq#         Checksum Tag
21.0.0.0     22.0.0.1     1488       0x80000001  0x00096B  0
22.0.0.0     22.0.0.1     1491       0x80000001  0x00FB77  0
R3#

```

Figura 14: OSPF - Comanda *show ip ospf database* en el encaminador R3



```
R3
Fitxer Edita Visualitza Cerca Terminal Ajuda
R3#ping 21.0.0.0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 21.0.0.0, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 12/18/24 ms
R3#ping 22.0.0.0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 22.0.0.0, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 20/24/40 ms
R3#ping 20.0.2.0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 20.0.2.0, timeout is 2 seconds:

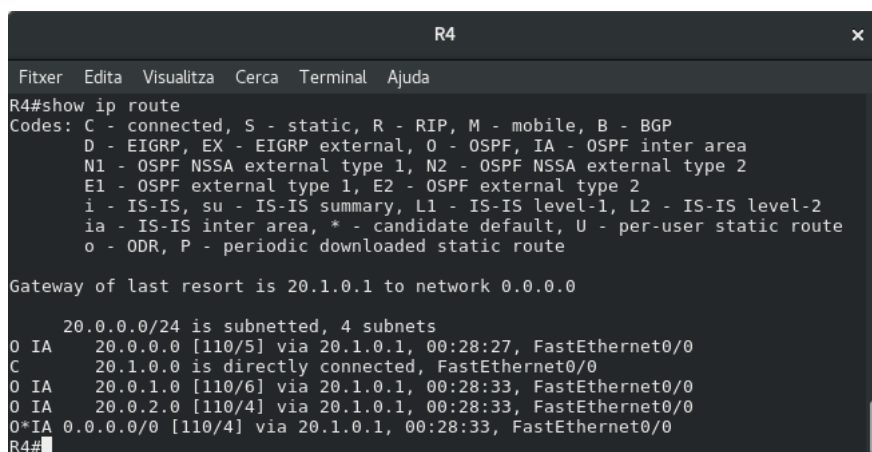
Reply to request 0 from 20.0.2.2, 24 ms
Reply to request 1 from 20.0.2.2, 16 ms
Reply to request 2 from 20.0.2.2, 24 ms
Reply to request 3 from 20.0.2.2, 24 ms
Reply to request 4 from 20.0.2.2, 20 ms
R3#ping 20.1.0.0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 20.1.0.0, timeout is 2 seconds:

Reply to request 0 from 20.1.0.2, 24 ms
Reply to request 1 from 20.1.0.2, 40 ms
Reply to request 2 from 20.1.0.2, 12 ms
Reply to request 3 from 20.1.0.2, 40 ms
Reply to request 4 from 20.1.0.2, 36 ms
R3#ping 20.0.0.0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 20.0.0.0, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 16/21/32 ms
R3#ping 20.0.1.0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 20.0.1.0, timeout is 2 seconds:

Reply to request 0 from 20.0.1.1, 24 ms
Reply to request 1 from 20.0.1.1, 20 ms
Reply to request 2 from 20.0.1.1, 28 ms
Reply to request 3 from 20.0.1.1, 20 ms
Reply to request 4 from 20.0.1.1, 32 ms
R3#
```

Figura 15: OSPF - Prova de connectivitat a la xarxa des de l'encaminador R3

3.2.4 Encaminador R4

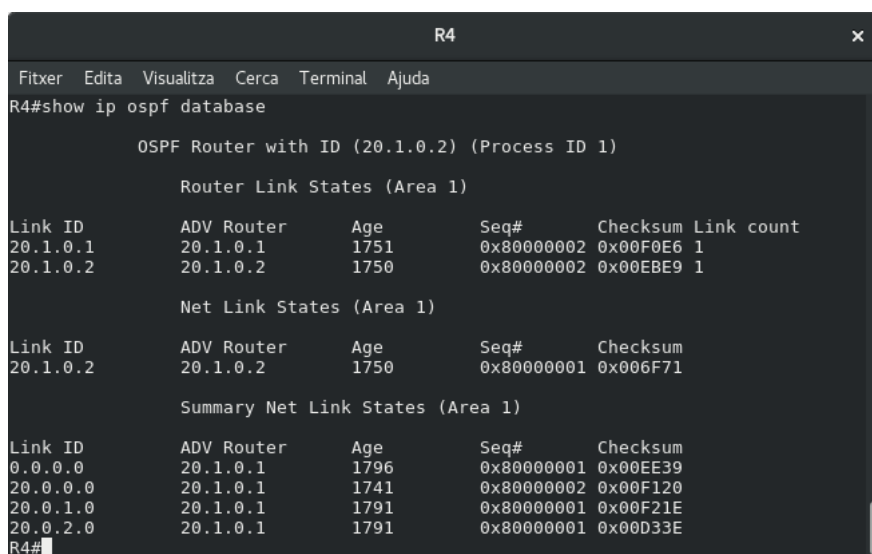


```
R4
Fitxer Edita Visualitza Cerca Terminal Ajuda
R4#show ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 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

Gateway of last resort is 20.1.0.1 to network 0.0.0.0

    20.0.0.0/24 is subnetted, 4 subnets
O IA   20.0.0.0 [110/5] via 20.1.0.1, 00:28:27, FastEthernet0/0
C       20.1.0.0 is directly connected, FastEthernet0/0
O IA   20.0.1.0 [110/6] via 20.1.0.1, 00:28:33, FastEthernet0/0
O IA   20.0.2.0 [110/4] via 20.1.0.1, 00:28:33, FastEthernet0/0
O*IA  0.0.0.0/0 [110/4] via 20.1.0.1, 00:28:33, FastEthernet0/0
R4#
```

Figura 16: OSPF - Comanda *show ip route* en el encaminador R4



```

R4
Fitxer  Edita  Visualitza  Cerca  Terminal  Ajuda
R4#show ip ospf database

        OSPF Router with ID (20.1.0.2) (Process ID 1)

        Router Link States (Area 1)

Link ID        ADV Router    Age         Seq#          Checksum Link count
20.1.0.1       20.1.0.1      1751       0x80000002   0x00F0E6  1
20.1.0.2       20.1.0.2      1750       0x80000002   0x00EBE9  1

        Net Link States (Area 1)

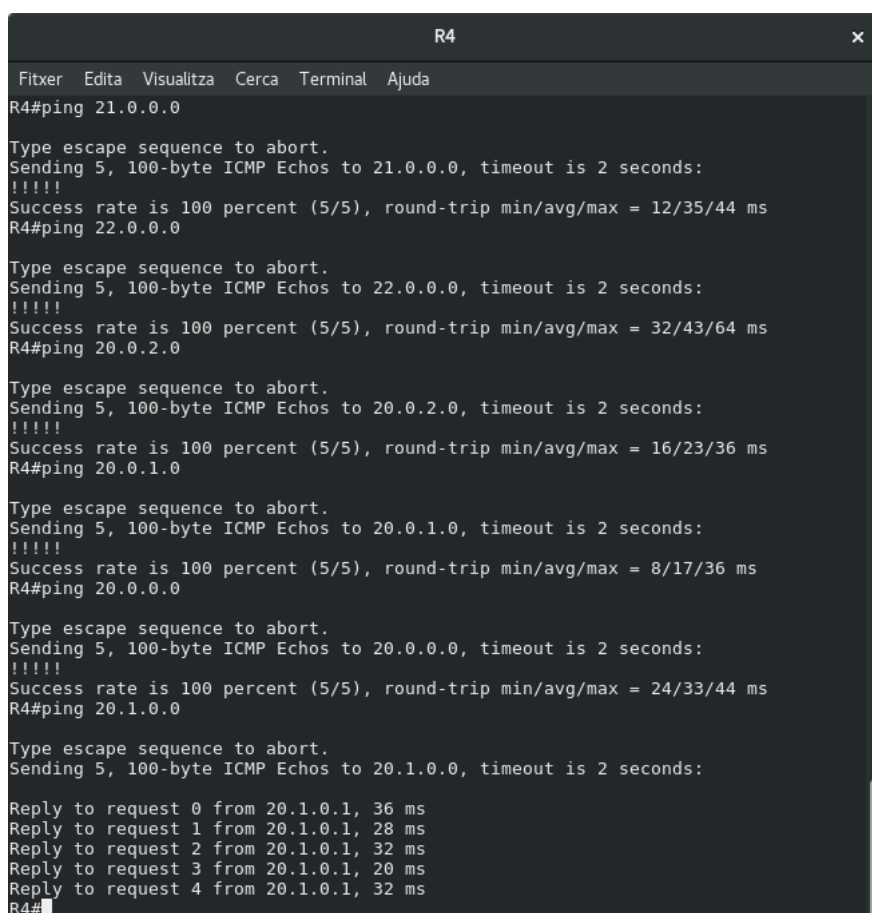
Link ID        ADV Router    Age         Seq#          Checksum
20.1.0.2       20.1.0.2      1750       0x80000001   0x006F71

        Summary Net Link States (Area 1)

Link ID        ADV Router    Age         Seq#          Checksum
0.0.0.0        20.1.0.1      1796       0x80000001   0x00EE39
20.0.0.0       20.1.0.1      1741       0x80000002   0x00F120
20.0.1.0       20.1.0.1      1791       0x80000001   0x00F21E
20.0.2.0       20.1.0.1      1791       0x80000001   0x00D33E
R4#

```

Figura 17: OSPF - Comanda *show ip ospf database* en el encaminador R4



```

R4
Fitxer  Edita  Visualitza  Cerca  Terminal  Ajuda
R4#ping 21.0.0.0

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 21.0.0.0, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 12/35/44 ms
R4#ping 22.0.0.0

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 22.0.0.0, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 32/43/64 ms
R4#ping 20.0.2.0

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 20.0.2.0, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 16/23/36 ms
R4#ping 20.0.1.0

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 20.0.1.0, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 8/17/36 ms
R4#ping 20.0.0.0

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 20.0.0.0, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 24/33/44 ms
R4#ping 20.1.0.0

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 20.1.0.0, timeout is 2 seconds:

Reply to request 0 from 20.1.0.1, 36 ms
Reply to request 1 from 20.1.0.1, 28 ms
Reply to request 2 from 20.1.0.1, 32 ms
Reply to request 3 from 20.1.0.1, 20 ms
Reply to request 4 from 20.1.0.1, 32 ms
R4#

```

Figura 18: OSPF - Prova de connectivitat a la xarxa des de l'encaminador R4

4 BGP

És un protocol de comunicació mitjançant el qual s'intercanvia informació d'encaminament entre sistemes autònoms. Per exemple, els ISP registrats a Internet solen compondre's de diversos sistemes autònoms i per a aquest cas és necessari un protocol com BGP. Entre els sistemes autònoms dels ISP s'intercanvien les seues taules de rutes a través del protocol BGP. Aquest intercanvi d'informació d'encaminament es fa entre els encaminadors externs de cada sistema autònom. Aquests encaminadors han de suportar BGP. Es tracta del protocol més utilitzat per a xarxes amb intenció de configurar un EGP (external gateway protocol)

4.1 Topologia de la xarxa

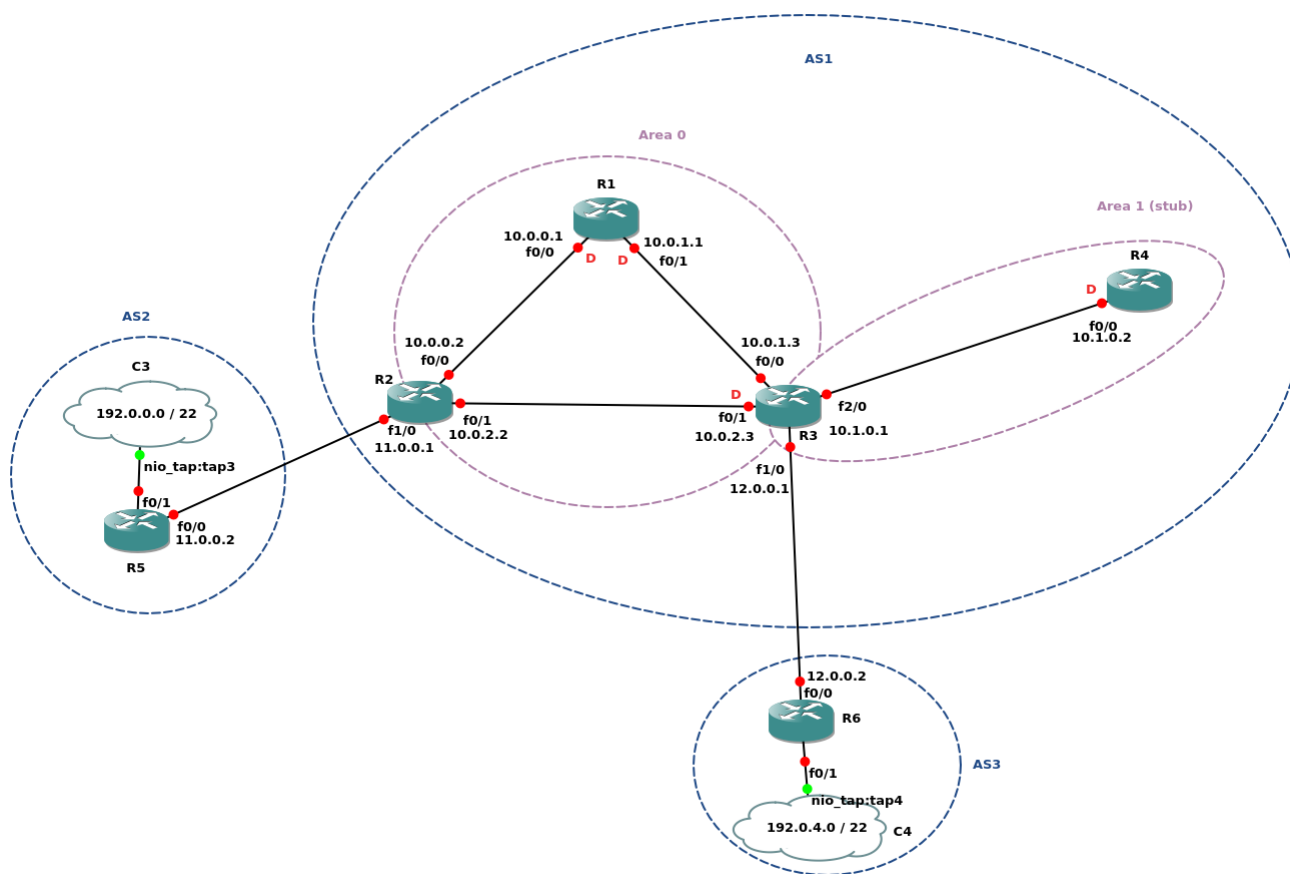
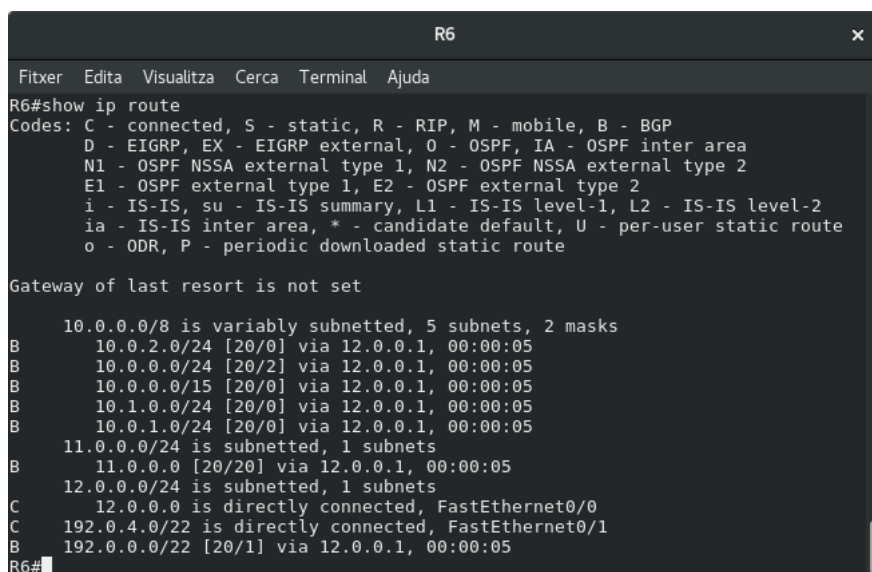


Figura 19: BGP - Topologia de la xarxa a efectuar l'exercici

Per a la realització de aquest exercici utilitzarem encaminadors **Cisco c7200**.

4.2 Connectivitat entre sistemes autònoms

4.2.1 Encaminador R6

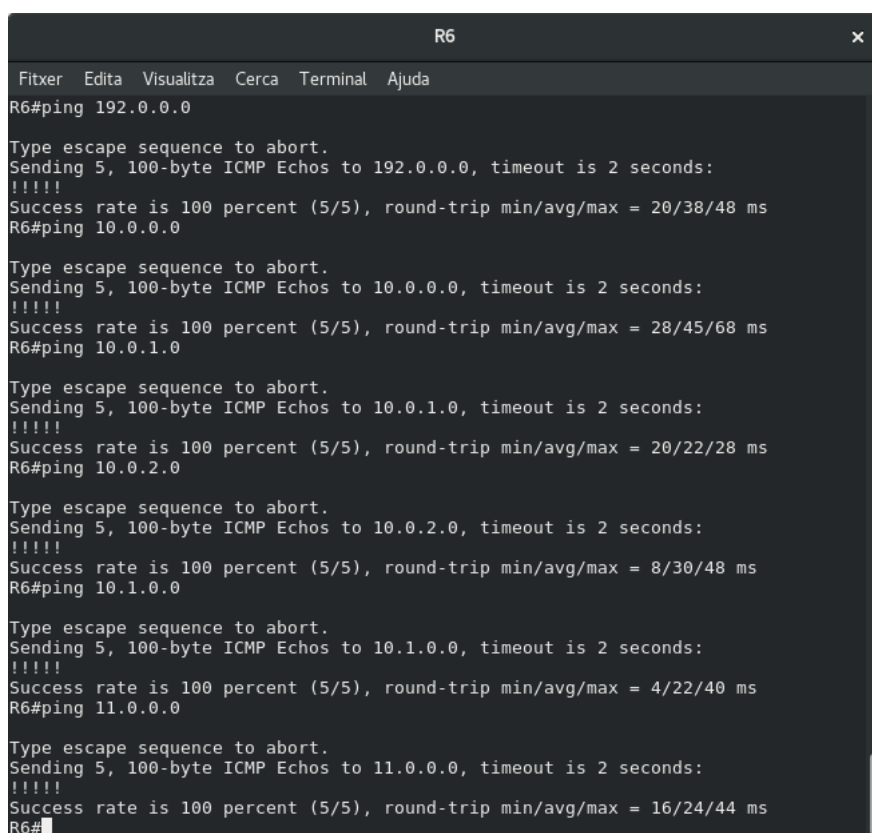


```
R6
Fitxer  Edita  Visualitza  Cerca  Terminal  Ajuda
R6#show ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
        D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
        N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
        E1 - OSPF external 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

Gateway of last resort is not set

  10.0.0.0/8 is variably subnetted, 5 subnets, 2 masks
B       10.0.2.0/24 [20/0] via 12.0.0.1, 00:00:05
B       10.0.0.0/24 [20/2] via 12.0.0.1, 00:00:05
B       10.0.0.0/15 [20/0] via 12.0.0.1, 00:00:05
B       10.1.0.0/24 [20/0] via 12.0.0.1, 00:00:05
B       10.0.1.0/24 [20/0] via 12.0.0.1, 00:00:05
        11.0.0.0/24 is subnetted, 1 subnets
B       11.0.0.0 [20/20] via 12.0.0.1, 00:00:05
        12.0.0.0/24 is subnetted, 1 subnets
C       12.0.0.0 is directly connected, FastEthernet0/0
C       192.0.4.0/22 is directly connected, FastEthernet0/1
B       192.0.0.0/22 [20/1] via 12.0.0.1, 00:00:05
R6#
```

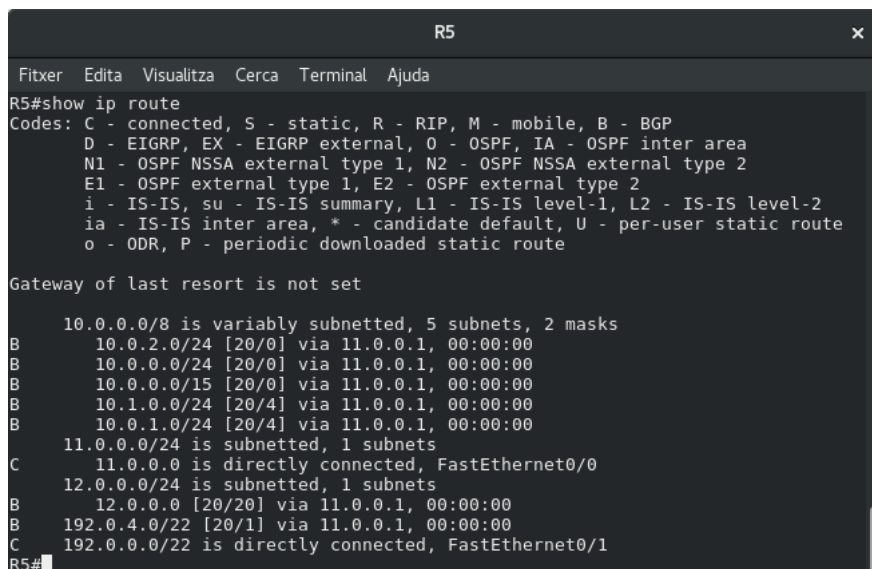
Figura 20: BGP - Comanda *show ip route* en el encaminador R6



```
R6
Fitxer  Edita  Visualitza  Cerca  Terminal  Ajuda
R6#ping 192.0.0.0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.0.0.0, timeout is 2 seconds:
!!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 20/38/48 ms
R6#ping 10.0.0.0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.0.0, timeout is 2 seconds:
!!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 28/45/68 ms
R6#ping 10.0.1.0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.1.0, timeout is 2 seconds:
!!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 20/22/28 ms
R6#ping 10.0.2.0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.2.0, timeout is 2 seconds:
!!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 8/30/48 ms
R6#ping 10.1.0.0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.1.0.0, timeout is 2 seconds:
!!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 4/22/40 ms
R6#ping 11.0.0.0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 11.0.0.0, timeout is 2 seconds:
!!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 16/24/44 ms
R6#
```

Figura 21: BGP - Prova de connectivitat a la xarxa des de l'encaminador R6

4.2.2 Encaminador R5



```

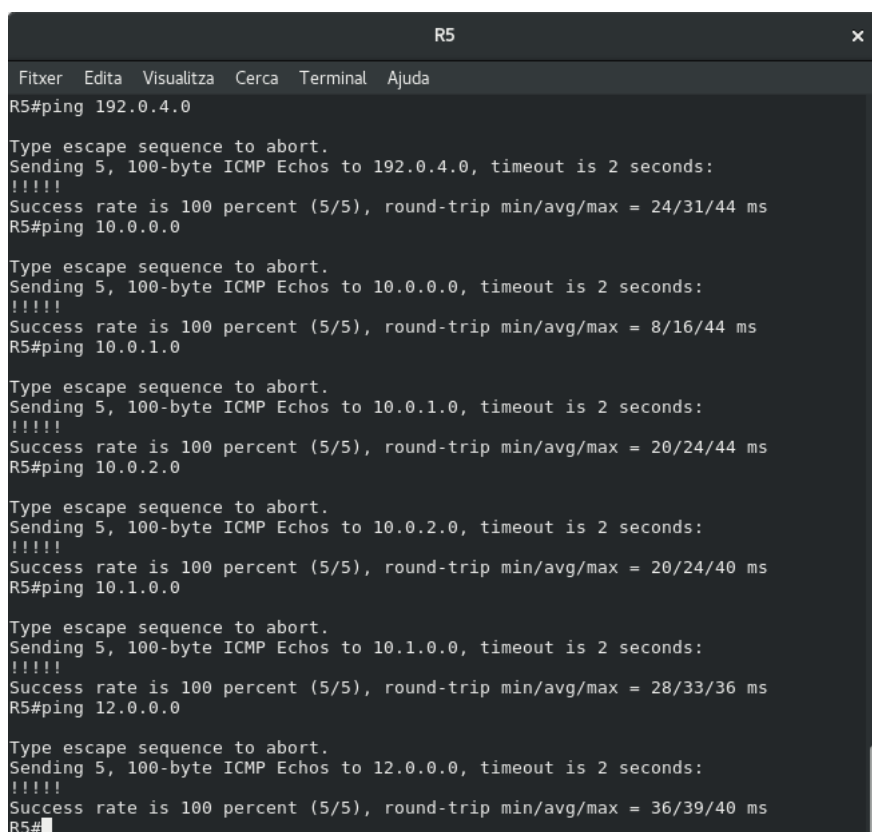
R5#show ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - 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

Gateway of last resort is not set

    10.0.0.0/8 is variably subnetted, 5 subnets, 2 masks
B       10.0.2.0/24 [20/0] via 11.0.0.1, 00:00:00
B       10.0.0.0/24 [20/0] via 11.0.0.1, 00:00:00
B       10.0.0.0/15 [20/0] via 11.0.0.1, 00:00:00
B       10.1.0.0/24 [20/4] via 11.0.0.1, 00:00:00
B       10.0.1.0/24 [20/4] via 11.0.0.1, 00:00:00
C       11.0.0.0/24 is subnetted, 1 subnets
C       11.0.0.0 is directly connected, FastEthernet0/0
C       12.0.0.0/24 is subnetted, 1 subnets
B       12.0.0.0 [20/20] via 11.0.0.1, 00:00:00
B       192.0.4.0/22 [20/1] via 11.0.0.1, 00:00:00
C       192.0.0/22 is directly connected, FastEthernet0/1
R5#

```

Figura 22: BGP - Comanda *show ip route* en el encaminador R5



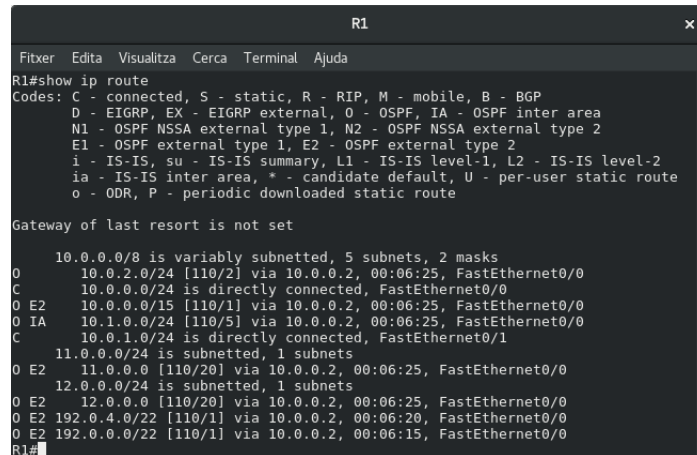
```

R5#ping 192.0.4.0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.0.4.0, timeout is 2 seconds:
!!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 24/31/44 ms
R5#ping 10.0.0.0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.0.0, timeout is 2 seconds:
!!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 8/16/44 ms
R5#ping 10.0.1.0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.1.0, timeout is 2 seconds:
!!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 20/24/44 ms
R5#ping 10.0.2.0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.2.0, timeout is 2 seconds:
!!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 20/24/40 ms
R5#ping 10.1.0.0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.1.0.0, timeout is 2 seconds:
!!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 28/33/36 ms
R5#ping 12.0.0.0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 12.0.0.0, timeout is 2 seconds:
!!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 36/39/40 ms
R5#

```

Figura 23: BGP - Prova de connectivitat a la xarxa des de l'encaminador R5

4.2.3 Encaminador R1



```

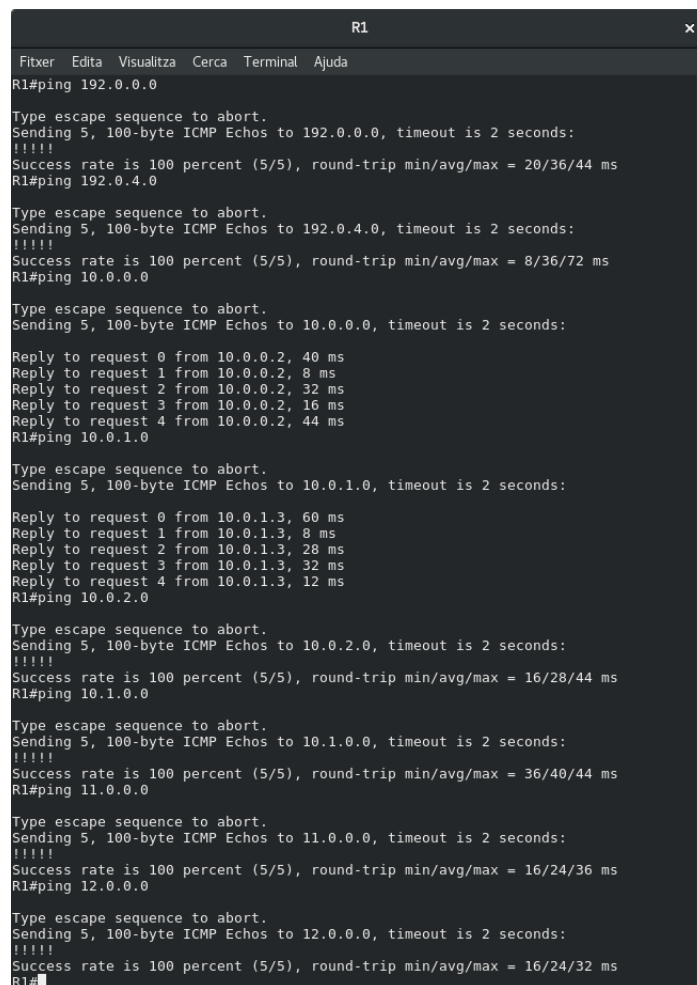
R1
Fitxer Edita Visualitza Cerca Terminal Ajuda
R1#show ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
        O - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
        N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
        E1 - OSPF external type 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

Gateway of last resort is not set

10.0.0.0/8 is variably subnetted, 5 subnets, 2 masks
O    10.0.2.0/24 [110/2] via 10.0.0.2, 00:06:25, FastEthernet0/0
C    10.0.0.0/24 is directly connected, FastEthernet0/0
O E2  10.0.0.0/15 [110/1] via 10.0.0.2, 00:06:25, FastEthernet0/0
O IA  10.1.0.0/24 [110/5] via 10.0.0.2, 00:06:25, FastEthernet0/0
C    10.0.1.0/24 is directly connected, FastEthernet0/1
O E2  11.0.0.0/24 is subnetted, 1 subnets
      11.0.0.0 [110/20] via 10.0.0.2, 00:06:25, FastEthernet0/0
O E2  12.0.0.0/24 is subnetted, 1 subnets
      12.0.0.0 [110/20] via 10.0.0.2, 00:06:25, FastEthernet0/0
O E2  192.0.4.0/22 [110/1] via 10.0.0.2, 00:06:20, FastEthernet0/0
O E2  192.0.0.0/22 [110/1] via 10.0.0.2, 00:06:15, FastEthernet0/0
R1#

```

Figura 24: BGP - Comanda *show ip route* en el encaminador R1



```

R1
Fitxer Edita Visualitza Cerca Terminal Ajuda
R1#ping 192.0.0.0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.0.0.0, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 20/36/44 ms
R1#ping 192.0.4.0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.0.4.0, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 8/36/72 ms
R1#ping 10.0.0.0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.0.0, timeout is 2 seconds:

Reply to request 0 from 10.0.0.2, 40 ms
Reply to request 1 from 10.0.0.2, 8 ms
Reply to request 2 from 10.0.0.2, 32 ms
Reply to request 3 from 10.0.0.2, 16 ms
Reply to request 4 from 10.0.0.2, 44 ms
R1#ping 10.0.1.0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.1.0, timeout is 2 seconds:

Reply to request 0 from 10.0.1.3, 60 ms
Reply to request 1 from 10.0.1.3, 8 ms
Reply to request 2 from 10.0.1.3, 28 ms
Reply to request 3 from 10.0.1.3, 32 ms
Reply to request 4 from 10.0.1.3, 12 ms
R1#ping 10.0.2.0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.2.0, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 16/28/44 ms
R1#ping 10.1.0.0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.1.0.0, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 36/40/44 ms
R1#ping 11.0.0.0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 11.0.0.0, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 16/24/36 ms
R1#ping 12.0.0.0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 12.0.0.0, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 16/24/32 ms
R1#

```

Figura 25: BGP - Prova de connectivitat a la xarxa des de l'encaminador R1

4.3 Principals problemes a la hora de configurar