

Configurazione tra Router cliente to CPE to PE (provider)

Analisi per local-preference, as-path prepend and ospf internal lan broadcast

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1 Architettura di riferimento

Architettura di riferimento:

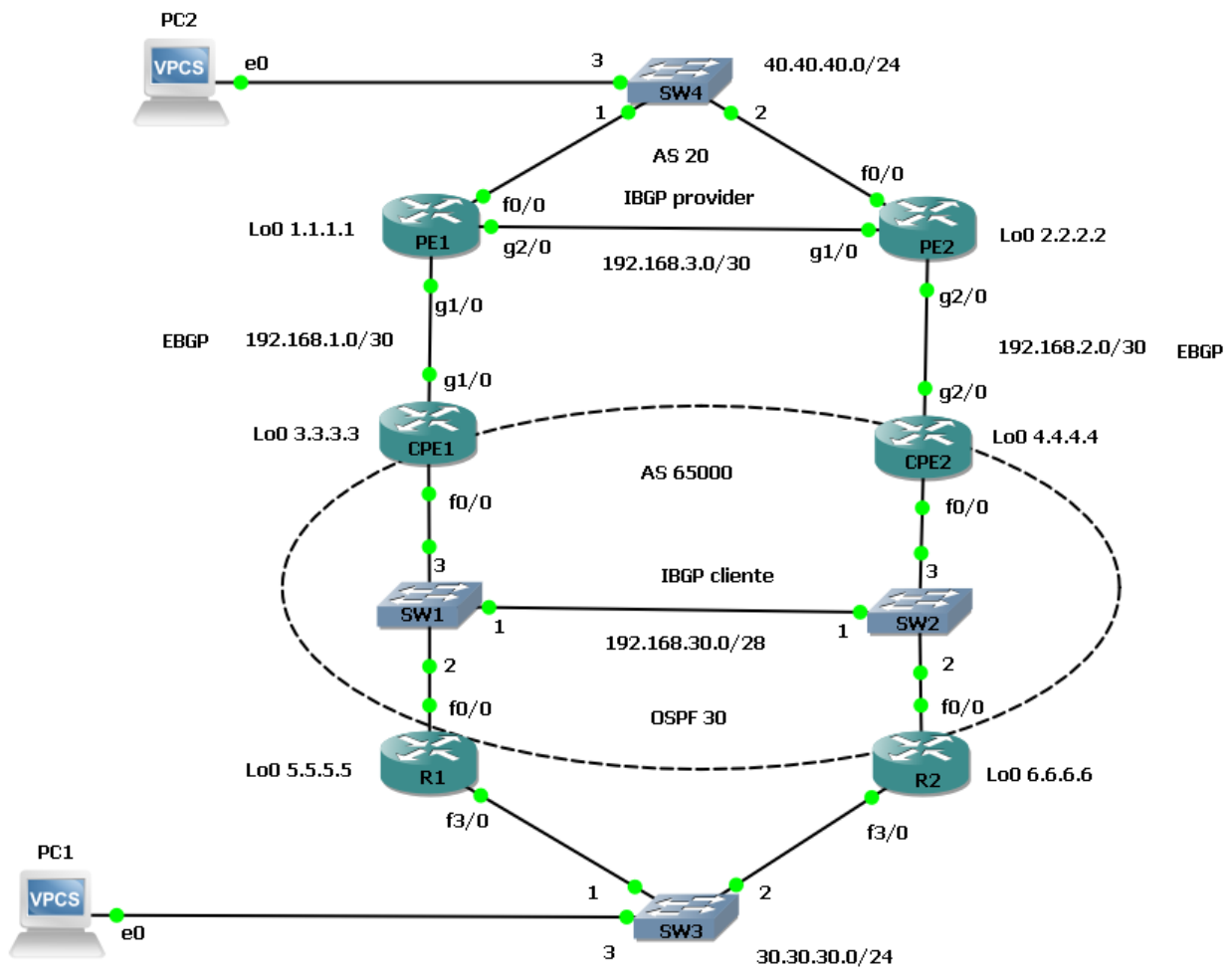


Figura 1: architettura di riferimento

2 Configurazione base

Partendo dalla configurazione base:

2.1 R1 cliente

```
interface Loopback0
ip address 5.5.5.5 255.255.255.255
!
interface FastEthernet0/0
description transito
ip address 192.168.30.4 255.255.255.240
duplex full
!
interface FastEthernet3/0
description LAN-cliente
ip address 30.30.30.1 255.255.255.0
duplex auto
speed auto
standby 30 ip 30.30.30.3
standby 30 priority 150
standby 30 preempt
!
router ospf 30
router-id 5.5.5.5
log-adjacency-changes
passive-interface FastEthernet3/0
network 5.5.5.5 0.0.0.0 area 0
network 30.30.30.0 0.0.0.255 area 0
network 192.168.30.0 0.0.0.15 area 0
```

2.2 R2 cliente

```
interface Loopback0
ip address 6.6.6.6 255.255.255.255
!
interface FastEthernet0/0
description transito
ip address 192.168.30.5 255.255.255.240
duplex full
standby 6 ip 192.168.30.6
standby 6 preempt
!
interface FastEthernet3/0
description LAN-cliente
ip address 30.30.30.2 255.255.255.0
duplex auto
speed auto
standby 30 ip 30.30.30.3
```

```
standby 30 preempt
!  
router ospf 30  
router-id 6.6.6.6  
log-adjacency-changes  
passive-interface FastEthernet3/0  
network 6.6.6.6 0.0.0.0 area 0  
network 30.30.30.0 0.0.0.255 area 0  
network 192.168.30.0 0.0.0.15 area 0
```

2.3 CPE1 cliente

```
interface Loopback0  
ip address 3.3.3.3 255.255.255.255  
!  
interface FastEthernet0/0  
description transito  
ip address 192.168.30.1 255.255.255.240  
duplex full  
!  
interface GigabitEthernet1/0  
description to-PE1  
ip address 192.168.1.2 255.255.255.252  
negotiation auto  
!  
router ospf 30  
router-id 3.3.3.3  
log-adjacency-changes  
network 3.3.3.3 0.0.0.0 area 0  
network 192.168.30.0 0.0.0.15 area 0  
!  
router bgp 65000  
no synchronization  
bgp log-neighbor-changes  
neighbor 192.168.1.1 remote-as 20  
neighbor 192.168.1.1 version 4  
neighbor 192.168.1.1 timers 15 45  
neighbor 192.168.30.2 remote-as 65000  
neighbor 192.168.30.2 version 4  
neighbor 192.168.30.2 timers 15 45  
neighbor 192.168.30.2 next-hop-self  
no auto-summary
```

2.4 CPE2 cliente

```
interface Loopback0
ip address 4.4.4.4 255.255.255.255
!
interface FastEthernet0/0
description transito
ip address 192.168.30.2 255.255.255.240
duplex full
!
interface GigabitEthernet2/0
description to-PE2
ip address 192.168.2.2 255.255.255.252
negotiation auto
!
router ospf 30
router-id 4.4.4.4
log-adjacency-changes
network 4.4.4.4 0.0.0.0 area 0
network 192.168.30.0 0.0.0.15 area 0
!
router bgp 65000
no synchronization
bgp log-neighbor-changes
neighbor 192.168.2.1 remote-as 20
neighbor 192.168.2.1 version 4
neighbor 192.168.2.1 timers 15 45
neighbor 192.168.30.1 remote-as 65000
neighbor 192.168.30.1 version 4
neighbor 192.168.30.1 timers 15 45
neighbor 192.168.30.1 next-hop-self
no auto-summary
```

2.5 PE1 provider

```
interface Loopback0
ip address 1.1.1.1 255.255.255.255
!
interface FastEthernet0/0
description IP
ip address 40.40.40.1 255.255.255.0
duplex full
!
interface GigabitEthernet1/0
description to-CPE1
ip address 192.168.1.1 255.255.255.252
negotiation auto
!
interface GigabitEthernet2/0
description IBGP-Provider
```

```
ip address 192.168.3.1 255.255.255.252
negotiation auto
!
router bgp 20
no synchronization
bgp log-neighbor-changes
neighbor 192.168.1.2 remote-as 65000
neighbor 192.168.1.2 version 4
neighbor 192.168.1.2 timers 15 45
neighbor 192.168.3.2 remote-as 20
neighbor 192.168.3.2 version 4
neighbor 192.168.3.2 timers 15 45
neighbor 192.168.3.2 next-hop-self
no auto-summary
```

2.6 PE2 provider

```
interface Loopback0
ip address 2.2.2.2 255.255.255.255
!
interface FastEthernet0/0
description IP
ip address 40.40.40.2 255.255.255.0
duplex full
!
interface GigabitEthernet1/0
description IBGP-Provider
ip address 192.168.3.2 255.255.255.252
negotiation auto
!
interface GigabitEthernet2/0
description to-CPE2
ip address 192.168.2.1 255.255.255.252
negotiation auto
!
router bgp 20
no synchronization
bgp log-neighbor-changes
neighbor 192.168.2.2 remote-as 65000
neighbor 192.168.2.2 version 4
neighbor 192.168.2.2 timers 15 45
neighbor 192.168.3.1 remote-as 20
neighbor 192.168.3.1 version 4
neighbor 192.168.3.1 timers 15 45
neighbor 192.168.3.1 next-hop-self
no auto-summary
```

3 Considerazione OSPF LAN Broadcast

Considerazioni OSPF: il cliente tra i suoi router R1-R2 aventi ruolo di gateway per la rete interna 30.30.30.0/24 utilizza per la sua redistribuzione un processo di routing dinamico OSPF

La rete è di tipo Broadcast (LAN):

- Examples include Ethernet, Token Ring, and ATM.
- OSPF will elect DRs and BDRs.
- Traffic to DRs and BDRs is multicast to 224.0.0.6.
- Traffic from DRs and BDRs to other routers is multicast to 224.0.0.5.
- Neighbors do not need to be manually specified.

3.1 HSRP lato cliente gateway

Verifica active standby HSRP per la rete LAN interna

```
R1#show standby brief
```

```
    P indicates configured to preempt.
```

```
|
```

Interface	Grp	Pri	P	State	Active	Standby	Virtual IP
Fa3/0	30	150	P	Active	local	30.30.30.2	30.30.30.3

```
R2#sh standby brief
```

```
    P indicates configured to preempt.
```

```
|
```

Interface	Grp	Pri	P	State	Active	Standby	Virtual IP
Fa3/0	30	100	P	Standby	30.30.30.1	local	30.30.30.3

```
PC1> ping 30.30.30.3
```

```
84 bytes from 30.30.30.3 icmp_seq=1 ttl=255 time=20.001 ms
```

```
84 bytes from 30.30.30.3 icmp_seq=2 ttl=255 time=30.000 ms
```

3.2 OSPF NEIGHBOR e DATABASE

Verifica delle neighborship da ciascun routers:

Ricordiamo i criteri di selezione DR / BDR

Priority = 0 un router non potrà mai diventare DR o BDR (in questo caso abbiamo sempre valore = 1)
Se il DR si guasta, il BDR lo sostituisce con una nuova elezione del nuovo BDR

Diventa DR:

- ✓ il router che manda gli hello packets con la priorità più alta
- ✓ a parità di priorità, il router che manda gli hello packets con il RID più alto
 - il RID generalmente significa l'indirizzo di loopback
 - qualora non ci fosse il RID, la selezione fa riferimento all'indirizzo IP più alto configurato sulle interfacce fisiche

Diventa BDR:

- ✓ il router con il secondo valore di priorità più alto
- ✓ se un router ospf con priorità più alta si mette in linea DOPO che l'elezione è avvenuta, questo non diventa DR o BDR, finché non si guasta il DR/BDR in corso (in questo caso potrebbe essere utile il comando: clear ip ospf process)

R1#sh ip ospf neighbor

Neighbor ID	Pri	State	Dead Time	Address	Interface
3.3.3.3	1	FULL/DROTHER	00:00:36	192.168.30.1	FastEthernet0/0
4.4.4.4	1	FULL/DROTHER	00:00:33	192.168.30.2	FastEthernet0/0
6.6.6.6	1	FULL/ DR	00:00:37	192.168.30.5	FastEthernet0/0

R1#sh ip ospf database

OSPF Router with ID (5.5.5.5) (Process ID 30)

Router Link States (Area 0)

Link ID	ADV Router	Age	Seq#	Checksum	Link count
3.3.3.3	3.3.3.3	798	0x80000002	0x007B6C	2
4.4.4.4	4.4.4.4	798	0x80000002	0x006B6F	2
5.5.5.5	5.5.5.5	807	0x80000002	0x000C55	3
6.6.6.6	6.6.6.6	808	0x80000002	0x00381C	3

Net Link States (Area 0)

Link ID	ADV Router	Age	Seq#	Checksum
192.168.30.5	6.6.6.6	798	0x80000002	0x0077DB

R2#sh ip ospf neighbor

Neighbor ID	Pri	State	Dead Time	Address	Interface
3.3.3.3	1	FULL/DROTHER	00:00:30	192.168.30.1	FastEthernet0/0
4.4.4.4	1	FULL/DROTHER	00:00:37	192.168.30.2	FastEthernet0/0
5.5.5.5	1	FULL/ BDR	00:00:38	192.168.30.4	FastEthernet0/0

R2#sh ip ospf database

OSPF Router with ID (6.6.6.6) (Process ID 30)

Router Link States (Area 0)

Link ID	ADV Router	Age	Seq#	Checksum	Link count
3.3.3.3	3.3.3.3	942	0x80000002	0x007B6C	2
4.4.4.4	4.4.4.4	942	0x80000002	0x006B6F	2
5.5.5.5	5.5.5.5	952	0x80000002	0x000C55	3
6.6.6.6	6.6.6.6	952	0x80000002	0x00381C	3

Net Link States (Area 0)

Link ID	ADV Router	Age	Seq#	Checksum
192.168.30.5	6.6.6.6	942	0x80000002	0x0077DB

CPE1#sh ip ospf neighbor

Neighbor ID	Pri	State	Dead Time	Address	Interface
4.4.4.4	1	2WAY/DROTHER	00:00:32	192.168.30.2	FastEthernet0/0
5.5.5.5	1	FULL/BDR	00:00:33	192.168.30.4	FastEthernet0/0
6.6.6.6	1	FULL/DR	00:00:36	192.168.30.5	FastEthernet0/0

CPE1#sh ip ospf database

OSPF Router with ID (3.3.3.3) (Process ID 30)

Router Link States (Area 0)

Link ID	ADV Router	Age	Seq#	Checksum	Link count
3.3.3.3	3.3.3.3	1132	0x80000002	0x007B6C	2
4.4.4.4	4.4.4.4	1134	0x80000002	0x006B6F	2
5.5.5.5	5.5.5.5	1143	0x80000002	0x000C55	3
6.6.6.6	6.6.6.6	1143	0x80000002	0x00381C	3

Net Link States (Area 0)

Link ID	ADV Router	Age	Seq#	Checksum
192.168.30.5	6.6.6.6	1133	0x80000002	0x0077DB

CPE2#sh ip ospf neighbor

Neighbor ID	Pri	State	Dead Time	Address	Interface
3.3.3.3	1	2WAY/DROTHER	00:00:36	192.168.30.1	FastEthernet0/0
5.5.5.5	1	FULL/BDR	00:00:34	192.168.30.4	FastEthernet0/0
6.6.6.6	1	FULL/DR	00:00:37	192.168.30.5	FastEthernet0/0

```
CPE2#sh ip ospf database
```

```
OSPF Router with ID (4.4.4.4) (Process ID 30)
```

```
Router Link States (Area 0)
```

Link ID	ADV Router	Age	Seq#	Checksum	Link count
3.3.3.3	3.3.3.3	1257	0x80000002	0x007B6C	2
4.4.4.4	4.4.4.4	1256	0x80000002	0x006B6F	2
5.5.5.5	5.5.5.5	1266	0x80000002	0x000C55	3
6.6.6.6	6.6.6.6	1266	0x80000002	0x00381C	3

```
Net Link States (Area 0)
```

Link ID	ADV Router	Age	Seq#	Checksum
192.168.30.5	6.6.6.6	1256	0x80000002	0x0077DB

On a multi-access network, OSPF routers will only form Full adjacencies with DRs and BDRs. Non-DRs and non-BDRs will still form adjacencies, but will remain in a 2-Way State. This is normal OSPF behavior.

4 Tabelle di Routing

4.1 Tabella di routing a seguito configurazione base senza redistribuzioni

Nella configurazione di base (senza redistribuzioni di routes), le tabelle di routing per ciascun routers sono:

4.1.1 R1 cliente

```
R1#sh 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
```

```
3.0.0.0/32 is subnetted, 1 subnets  
O   3.3.3.3 [110/2] via 192.168.30.1, 00:26:42, FastEthernet0/0  
192.168.30.0/28 is subnetted, 1 subnets  
C   192.168.30.0 is directly connected, FastEthernet0/0  
4.0.0.0/32 is subnetted, 1 subnets  
O   4.4.4.4 [110/2] via 192.168.30.2, 00:26:42, FastEthernet0/0  
5.0.0.0/32 is subnetted, 1 subnets
```

- C 5.5.5.5 is directly connected, Loopback0
- 6.0.0.0/32 is subnetted, 1 subnets
- O 6.6.6.6 [110/2] via 192.168.30.5, 00:26:42, FastEthernet0/0
- 30.0.0.0/24 is subnetted, 1 subnets
- C 30.30.30.0 is directly connected, FastEthernet3/0

4.1.2 R2 cliente

R2#sh 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

- 3.0.0.0/32 is subnetted, 1 subnets
- O 3.3.3.3 [110/2] via 192.168.30.1, 00:29:11, FastEthernet0/0
- 192.168.30.0/28 is subnetted, 1 subnets
- C 192.168.30.0 is directly connected, FastEthernet0/0
- 4.0.0.0/32 is subnetted, 1 subnets
- O 4.4.4.4 [110/2] via 192.168.30.2, 00:29:11, FastEthernet0/0
- 5.0.0.0/32 is subnetted, 1 subnets
- O 5.5.5.5 [110/2] via 192.168.30.4, 00:29:11, FastEthernet0/0
- 6.0.0.0/32 is subnetted, 1 subnets
- C 6.6.6.6 is directly connected, Loopback0
- 30.0.0.0/24 is subnetted, 1 subnets
- C 30.30.30.0 is directly connected, FastEthernet3/0

4.1.3 CPE1 cliente

CPE1#sh 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

- 3.0.0.0/32 is subnetted, 1 subnets
- C 3.3.3.3 is directly connected, Loopback0
- 192.168.30.0/28 is subnetted, 1 subnets
- C 192.168.30.0 is directly connected, FastEthernet0/0
- 4.0.0.0/32 is subnetted, 1 subnets
- O 4.4.4.4 [110/2] via 192.168.30.2, 00:32:32, FastEthernet0/0
- 5.0.0.0/32 is subnetted, 1 subnets
- O 5.5.5.5 [110/2] via 192.168.30.4, 00:32:32, FastEthernet0/0
- 6.0.0.0/32 is subnetted, 1 subnets

- O 6.6.6.6 [110/2] via 192.168.30.5, 00:32:32, FastEthernet0/0
192.168.1.0/30 is subnetted, 1 subnets
- C 192.168.1.0 is directly connected, GigabitEthernet1/0
30.0.0.0/24 is subnetted, 1 subnets
- O 30.30.30.0 [110/2] via 192.168.30.5, 00:32:33, FastEthernet0/0
[110/2] via 192.168.30.4, 00:32:33, FastEthernet0/0

4.1.4 CPE2 cliente

CPE2#sh 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

- 3.0.0.0/32 is subnetted, 1 subnets
- O 3.3.3.3 [110/2] via 192.168.30.1, 00:33:53, FastEthernet0/0
192.168.30.0/28 is subnetted, 1 subnets
- C 192.168.30.0 is directly connected, FastEthernet0/0
- 4.0.0.0/32 is subnetted, 1 subnets
- C 4.4.4.4 is directly connected, Loopback0
- 5.0.0.0/32 is subnetted, 1 subnets
- O 5.5.5.5 [110/2] via 192.168.30.4, 00:33:53, FastEthernet0/0
- 6.0.0.0/32 is subnetted, 1 subnets
- O 6.6.6.6 [110/2] via 192.168.30.5, 00:33:53, FastEthernet0/0
192.168.2.0/30 is subnetted, 1 subnets
- C 192.168.2.0 is directly connected, GigabitEthernet2/0
30.0.0.0/24 is subnetted, 1 subnets
- O 30.30.30.0 [110/2] via 192.168.30.5, 00:33:53, FastEthernet0/0
[110/2] via 192.168.30.4, 00:33:53, FastEthernet0/0

4.1.5 PE1 provider

PE1#sh 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

- 1.0.0.0/32 is subnetted, 1 subnets
- C 1.1.1.1 is directly connected, Loopback0

40.0.0.0/24 is subnetted, 1 subnets
C 40.40.40.0 is directly connected, FastEthernet0/0
192.168.1.0/30 is subnetted, 1 subnets
C 192.168.1.0 is directly connected, GigabitEthernet1/0
192.168.3.0/30 is subnetted, 1 subnets
C 192.168.3.0 is directly connected, GigabitEthernet2/0

4.1.6 PE2 provider

PE2#sh 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

2.0.0.0/32 is subnetted, 1 subnets
C 2.2.2.2 is directly connected, Loopback0
40.0.0.0/24 is subnetted, 1 subnets
C 40.40.40.0 is directly connected, FastEthernet0/0
192.168.2.0/30 is subnetted, 1 subnets
C 192.168.2.0 is directly connected, GigabitEthernet2/0
192.168.3.0/30 is subnetted, 1 subnets
C 192.168.3.0 is directly connected, GigabitEthernet1/0

4.2 Tabella di routing a seguito redistribuzione di routing tra CPE e PE

Redistribuzione:

- Processo OSPF dentro BGP dai router CPE
- Le direttamente connesse dentro BGP dai router CPE
- Le direttamente connesse dentro BGP dai router PE

4.2.1 CPE1 cliente: redistribuzione delle connesse e del processo ospf into bgp

CPE1#

```
router bgp 65000
no synchronization
bgp log-neighbor-changes
redistribute connected
redistribute ospf 30
```

```
neighbor 192.168.1.1 remote-as 20
neighbor 192.168.1.1 version 4
neighbor 192.168.1.1 timers 15 45
neighbor 192.168.30.2 remote-as 65000
neighbor 192.168.30.2 version 4
neighbor 192.168.30.2 timers 15 45
neighbor 192.168.30.2 next-hop-self
no auto-summary
```

!

CPE1#sh 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

```
1.0.0.0/32 is subnetted, 1 subnets
B 1.1.1.1 [20/0] via 192.168.1.1, 00:02:42
2.0.0.0/32 is subnetted, 1 subnets
B 2.2.2.2 [20/0] via 192.168.1.1, 00:02:12
3.0.0.0/32 is subnetted, 1 subnets
C 3.3.3.3 is directly connected, Loopback0
192.168.30.0/28 is subnetted, 1 subnets
C 192.168.30.0 is directly connected, FastEthernet0/0
4.0.0.0/32 is subnetted, 1 subnets
O 4.4.4.4 [110/2] via 192.168.30.2, 00:59:51, FastEthernet0/0
5.0.0.0/32 is subnetted, 1 subnets
O 5.5.5.5 [110/2] via 192.168.30.4, 00:59:51, FastEthernet0/0
6.0.0.0/32 is subnetted, 1 subnets
O 6.6.6.6 [110/2] via 192.168.30.5, 00:59:52, FastEthernet0/0
40.0.0.0/24 is subnetted, 1 subnets
B 40.40.40.0 [20/0] via 192.168.1.1, 00:02:42
192.168.1.0/30 is subnetted, 1 subnets
C 192.168.1.0 is directly connected, GigabitEthernet1/0
192.168.2.0/30 is subnetted, 1 subnets
B 192.168.2.0 [200/0] via 192.168.30.2, 00:09:38
192.168.3.0/30 is subnetted, 1 subnets
B 192.168.3.0 [20/0] via 192.168.1.1, 00:02:42
30.0.0.0/24 is subnetted, 1 subnets
O 30.30.30.0 [110/2] via 192.168.30.5, 00:59:52, FastEthernet0/0
[110/2] via 192.168.30.4, 00:59:52, FastEthernet0/0
```

4.2.2 CPE2 cliente: redistribuzione delle connesse e del processo ospf into bgp

CPE2#

```
router bgp 65000
no synchronization
bgp log-neighbor-changes
redistribute connected
redistribute ospf 30
neighbor 192.168.2.1 remote-as 20
neighbor 192.168.2.1 version 4
neighbor 192.168.2.1 timers 15 45
neighbor 192.168.30.1 remote-as 65000
neighbor 192.168.30.1 version 4
neighbor 192.168.30.1 timers 15 45
neighbor 192.168.30.1 next-hop-self
no auto-summary
```

!

CPE2#sh 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

```
1.0.0.0/32 is subnetted, 1 subnets
B 1.1.1.1 [20/0] via 192.168.2.1, 00:06:04
2.0.0.0/32 is subnetted, 1 subnets
B 2.2.2.2 [20/0] via 192.168.2.1, 00:05:34
3.0.0.0/32 is subnetted, 1 subnets
O 3.3.3.3 [110/2] via 192.168.30.1, 01:03:13, FastEthernet0/0
192.168.30.0/28 is subnetted, 1 subnets
C 192.168.30.0 is directly connected, FastEthernet0/0
4.0.0.0/32 is subnetted, 1 subnets
C 4.4.4.4 is directly connected, Loopback0
5.0.0.0/32 is subnetted, 1 subnets
O 5.5.5.5 [110/2] via 192.168.30.4, 01:03:13, FastEthernet0/0
6.0.0.0/32 is subnetted, 1 subnets
O 6.6.6.6 [110/2] via 192.168.30.5, 01:03:14, FastEthernet0/0
40.0.0.0/24 is subnetted, 1 subnets
B 40.40.40.0 [20/0] via 192.168.2.1, 00:05:34
192.168.1.0/30 is subnetted, 1 subnets
B 192.168.1.0 [200/0] via 192.168.30.1, 00:13:25
192.168.2.0/30 is subnetted, 1 subnets
C 192.168.2.0 is directly connected, GigabitEthernet2/0
192.168.3.0/30 is subnetted, 1 subnets
B 192.168.3.0 [20/0] via 192.168.2.1, 00:05:34
```

30.0.0.0/24 is subnetted, 1 subnets
O 30.30.30.0 [110/2] via 192.168.30.5, 01:03:14, FastEthernet0/0
[110/2] via 192.168.30.4, 01:03:14, FastEthernet0/0

4.2.3 PE1 provider: redistribuzione delle connesse into bgp

PE1#

```
router bgp 20
no synchronization
bgp log-neighbor-changes
redistribute connected
neighbor 192.168.1.2 remote-as 65000
neighbor 192.168.1.2 version 4
neighbor 192.168.1.2 timers 15 45
neighbor 192.168.3.2 remote-as 20
neighbor 192.168.3.2 version 4
neighbor 192.168.3.2 timers 15 45
neighbor 192.168.3.2 next-hop-self
no auto-summary
```

!

PE1#sh 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

```
1.0.0.0/32 is subnetted, 1 subnets
C 1.1.1.1 is directly connected, Loopback0
2.0.0.0/32 is subnetted, 1 subnets
B 2.2.2.2 [200/0] via 192.168.3.2, 00:27:12
3.0.0.0/32 is subnetted, 1 subnets
B 3.3.3.3 [20/0] via 192.168.1.2, 00:42:20
192.168.30.0/28 is subnetted, 1 subnets
B 192.168.30.0 [20/0] via 192.168.1.2, 00:42:20
4.0.0.0/32 is subnetted, 1 subnets
B 4.4.4.4 [200/0] via 192.168.3.2, 00:42:20
5.0.0.0/32 is subnetted, 1 subnets
B 5.5.5.5 [20/2] via 192.168.1.2, 00:41:45
6.0.0.0/32 is subnetted, 1 subnets
B 6.6.6.6 [20/2] via 192.168.1.2, 00:41:45
40.0.0.0/24 is subnetted, 1 subnets
C 40.40.40.0 is directly connected, FastEthernet0/0
192.168.1.0/30 is subnetted, 1 subnets
C 192.168.1.0 is directly connected, GigabitEthernet1/0
192.168.2.0/30 is subnetted, 1 subnets
B 192.168.2.0 [200/0] via 192.168.3.2, 00:27:13
```



```
192.168.3.0/30 is subnetted, 1 subnets
C 192.168.3.0 is directly connected, GigabitEthernet2/0
30.0.0.0/24 is subnetted, 1 subnets
B 30.30.30.0 [20/2] via 192.168.1.2, 00:41:45
```

4.2.4 PE2 provider: redistribuzione delle connesse into bgp

PE2#

```
router bgp 20
no synchronization
bgp log-neighbor-changes
redistribute connected
neighbor 192.168.2.2 remote-as 65000
neighbor 192.168.2.2 version 4
neighbor 192.168.2.2 timers 15 45
neighbor 192.168.3.1 remote-as 20
neighbor 192.168.3.1 version 4
neighbor 192.168.3.1 timers 15 45
neighbor 192.168.3.1 next-hop-self
no auto-summary
```

!

PE2#sh 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

```
1.0.0.0/32 is subnetted, 1 subnets
B 1.1.1.1 [200/0] via 192.168.3.1, 00:53:00
2.0.0.0/32 is subnetted, 1 subnets
C 2.2.2.2 is directly connected, Loopback0
3.0.0.0/32 is subnetted, 1 subnets
B 3.3.3.3 [200/0] via 192.168.3.1, 01:07:10
192.168.30.0/28 is subnetted, 1 subnets
B 192.168.30.0 [20/0] via 192.168.2.2, 01:07:10
4.0.0.0/32 is subnetted, 1 subnets
B 4.4.4.4 [20/0] via 192.168.2.2, 01:07:10
5.0.0.0/32 is subnetted, 1 subnets
B 5.5.5.5 [20/2] via 192.168.2.2, 01:07:10
6.0.0.0/32 is subnetted, 1 subnets
B 6.6.6.6 [20/2] via 192.168.2.2, 01:07:10
40.0.0.0/24 is subnetted, 1 subnets
C 40.40.40.0 is directly connected, FastEthernet0/0
```

192.168.1.0/30 is subnetted, 1 subnets
B 192.168.1.0 [200/0] via 192.168.3.1, 00:53:00
 192.168.2.0/30 is subnetted, 1 subnets
 C 192.168.2.0 is directly connected, GigabitEthernet2/0
 192.168.3.0/30 is subnetted, 1 subnets
 C 192.168.3.0 is directly connected, GigabitEthernet1/0
 30.0.0.0/24 is subnetted, 1 subnets
B 30.30.30.0 [20/2] via 192.168.2.2, 01:07:10

4.3 Tabella di routing a seguito redistribuzione di routing per i router cliente R1 e R2

Per la conoscenza delle subnet IP annunciate dal BGP via PE, è necessario redistribuire il processo BGP dentro OSPF lato routers CPE:

CPE1#

```
router ospf 30
router-id 3.3.3.3
log-adjacency-changes
redistribute bgp 65000 subnets
network 3.3.3.3 0.0.0.0 area 0
network 192.168.30.0 0.0.0.15 area 0
!
```

CPE2#

```
router ospf 30
router-id 4.4.4.4
log-adjacency-changes
redistribute bgp 65000 subnets
network 4.4.4.4 0.0.0.0 area 0
network 192.168.30.0 0.0.0.15 area 0
```

4.3.1 tabella di routing R1 cliente

R1#sh 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

```

1.0.0.0/32 is subnetted, 1 subnets
O E2 1.1.1.1 [110/1] via 192.168.30.2, 00:17:22, FastEthernet0/0
    [110/1] via 192.168.30.1, 00:17:22, FastEthernet0/0
2.0.0.0/32 is subnetted, 1 subnets
O E2 2.2.2.2 [110/1] via 192.168.30.2, 00:17:22, FastEthernet0/0
    [110/1] via 192.168.30.1, 00:17:22, FastEthernet0/0
3.0.0.0/32 is subnetted, 1 subnets
O 3.3.3.3 [110/2] via 192.168.30.1, 00:17:22, FastEthernet0/0
192.168.30.0/28 is subnetted, 1 subnets
C 192.168.30.0 is directly connected, FastEthernet0/0
4.0.0.0/32 is subnetted, 1 subnets
O 4.4.4.4 [110/2] via 192.168.30.2, 00:17:22, FastEthernet0/0
5.0.0.0/32 is subnetted, 1 subnets
C 5.5.5.5 is directly connected, Loopback0
6.0.0.0/32 is subnetted, 1 subnets
O 6.6.6.6 [110/2] via 192.168.30.5, 00:17:23, FastEthernet0/0
40.0.0.0/24 is subnetted, 1 subnets
O E2 40.40.40.0 [110/1] via 192.168.30.2, 00:17:23, FastEthernet0/0
    [110/1] via 192.168.30.1, 00:17:23, FastEthernet0/0
192.168.3.0/30 is subnetted, 1 subnets
O E2 192.168.3.0 [110/1] via 192.168.30.2, 00:17:23, FastEthernet0/0
    [110/1] via 192.168.30.1, 00:17:23, FastEthernet0/0
30.0.0.0/24 is subnetted, 1 subnets
C 30.30.30.0 is directly connected, FastEthernet3/0

```

4.3.2 tabella di routing R2 cliente

R2#sh 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

```

1.0.0.0/32 is subnetted, 1 subnets
O E2 1.1.1.1 [110/1] via 192.168.30.2, 00:19:11, FastEthernet0/0
    [110/1] via 192.168.30.1, 00:19:11, FastEthernet0/0
2.0.0.0/32 is subnetted, 1 subnets
O E2 2.2.2.2 [110/1] via 192.168.30.2, 00:19:11, FastEthernet0/0
    [110/1] via 192.168.30.1, 00:19:11, FastEthernet0/0
3.0.0.0/32 is subnetted, 1 subnets
O 3.3.3.3 [110/2] via 192.168.30.1, 00:19:11, FastEthernet0/0
192.168.30.0/28 is subnetted, 1 subnets
C 192.168.30.0 is directly connected, FastEthernet0/0
4.0.0.0/32 is subnetted, 1 subnets
O 4.4.4.4 [110/2] via 192.168.30.2, 00:19:11, FastEthernet0/0
5.0.0.0/32 is subnetted, 1 subnets
O 5.5.5.5 [110/2] via 192.168.30.4, 00:19:12, FastEthernet0/0

```

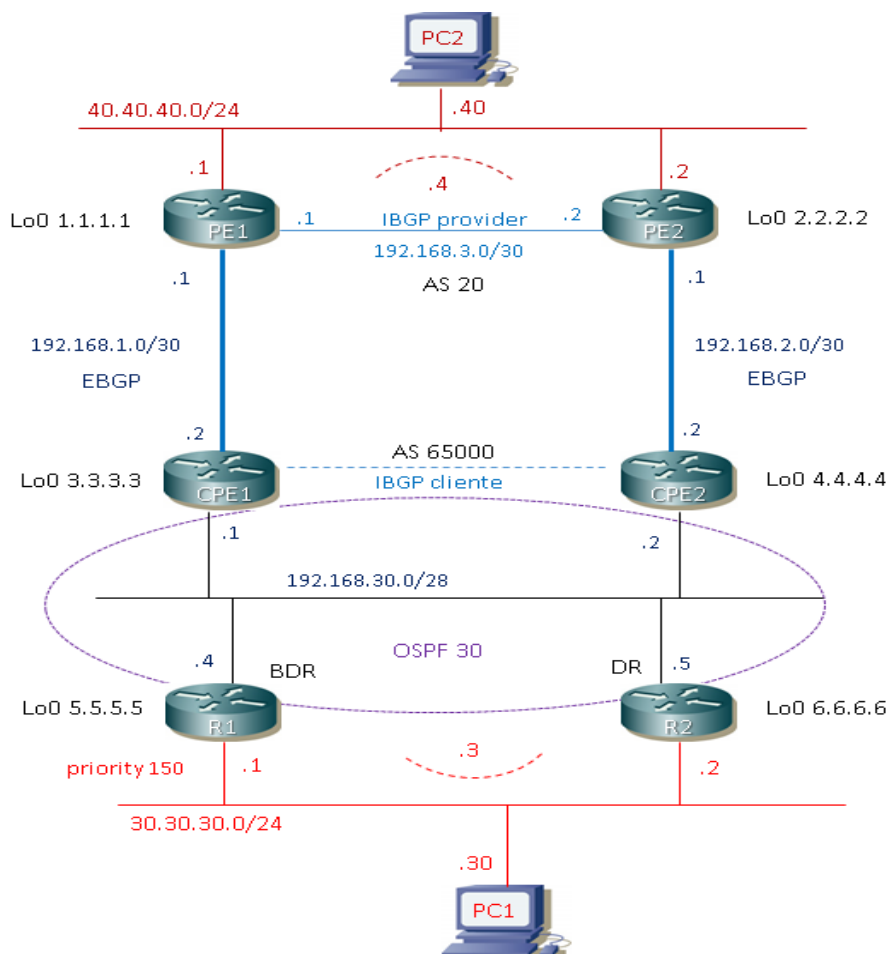
- 6.0.0.0/32 is subnetted, 1 subnets
- C 6.6.6.6 is directly connected, Loopback0
- 40.0.0.0/24 is subnetted, 1 subnets
- O E2 40.40.40.0** [110/1] via 192.168.30.2, 00:19:12, FastEthernet0/0
- [110/1] via 192.168.30.1, 00:19:12, FastEthernet0/0
- 192.168.3.0/30 is subnetted, 1 subnets
- O E2 192.168.3.0** [110/1] via 192.168.30.2, 00:19:12, FastEthernet0/0
- [110/1] via 192.168.30.1, 00:19:12, FastEthernet0/0
- 30.0.0.0/24 is subnetted, 1 subnets
- C 30.30.30.0 is directly connected, FastEthernet3/0

5 Considerazioni dei percorsi (path) di traffico

5.1 Show Path (percorso from PC1 to PC2) senza manipolazione del traffico

Dalle suddette configurazioni e tabelle di routing (solo con la redistribuzione dei processi, senza nessuna manipolazione dei percorsi via BGP), i due PC remoti si pingano e i loro path (traceroute) sono:

La rete di riferimento è la seguente:



From PC1#

PC1> ping 40.40.40.40

84 bytes from 40.40.40.40 icmp_seq=1 ttl=61 time=70.000 ms
84 bytes from 40.40.40.40 icmp_seq=2 ttl=61 time=80.000 ms
84 bytes from 40.40.40.40 icmp_seq=3 ttl=61 time=130.000 ms
84 bytes from 40.40.40.40 icmp_seq=4 ttl=61 time=110.000 ms
84 bytes from 40.40.40.40 icmp_seq=5 ttl=61 time=40.000 ms

PC1> trace 40.40.40.40 -P 1

trace to 40.40.40.40, 8 hops max (ICMP), press Ctrl+C to stop

```
 1 30.30.30.1 10.000 ms 0.000 ms 10.000 ms
 2 192.168.30.1 60.000 ms 30.000 ms 30.001 ms
 3 192.168.1.1 30.000 ms 50.000 ms 40.000 ms
 4 40.40.40.40 90.000 ms 110.000 ms 80.000 ms
```

From PC2#

PC2> ping 30.30.30.30

84 bytes from 30.30.30.30 icmp_seq=1 ttl=61 time=50.000 ms
84 bytes from 30.30.30.30 icmp_seq=2 ttl=61 time=90.000 ms
84 bytes from 30.30.30.30 icmp_seq=3 ttl=61 time=90.000 ms
84 bytes from 30.30.30.30 icmp_seq=4 ttl=61 time=50.000 ms
84 bytes from 30.30.30.30 icmp_seq=5 ttl=61 time=40.000 ms

PC2> trace 30.30.30.30 -P 1

trace to 30.30.30.30, 8 hops max (ICMP), press Ctrl+C to stop

```
 1 40.40.40.1 10.000 ms 10.000 ms 10.000 ms
 2 192.168.1.2 60.001 ms 40.000 ms 20.000 ms
 3 192.168.30.5 40.000 ms 80.000 ms 40.000 ms
 4 30.30.30.30 50.000 ms 70.000 ms 50.000 ms
```

FROM R1#

R1#ping 40.40.40.40

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 40.40.40.40, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 40/64/92 ms

!

R1#sh ip route ospf

```
 1.0.0.0/32 is subnetted, 1 subnets
O E2 1.1.1.1 [110/1] via 192.168.30.2, 01:35:06, FastEthernet0/0
    [110/1] via 192.168.30.1, 01:35:06, FastEthernet0/0
 2.0.0.0/32 is subnetted, 1 subnets
O E2 2.2.2.2 [110/1] via 192.168.30.2, 01:35:06, FastEthernet0/0
    [110/1] via 192.168.30.1, 01:35:06, FastEthernet0/0
 3.0.0.0/32 is subnetted, 1 subnets
O 3.3.3.3 [110/2] via 192.168.30.1, 02:13:54, FastEthernet0/0
 4.0.0.0/32 is subnetted, 1 subnets
```

```
O 4.4.4.4 [110/2] via 192.168.30.2, 02:13:54, FastEthernet0/0
6.0.0.0/32 is subnetted, 1 subnets
O 6.6.6.6 [110/2] via 192.168.30.5, 02:13:54, FastEthernet0/0
40.0.0.0/24 is subnetted, 1 subnets
O E2 40.40.40.0 [110/1] via 192.168.30.2, 01:35:06, FastEthernet0/0
[110/1] via 192.168.30.1, 01:35:06, FastEthernet0/0
192.168.3.0/30 is subnetted, 1 subnets
O E2 192.168.3.0 [110/1] via 192.168.30.2, 01:35:06, FastEthernet0/0
[110/1] via 192.168.30.1, 01:35:06, FastEthernet0/0
!
R1#traceroute 40.40.40.40
Type escape sequence to abort.
Tracing the route to 40.40.40.40
1 192.168.30.1 32 msec
192.168.30.2 12 msec
192.168.30.1 20 msec
2 192.168.2.1 20 msec
192.168.1.1 36 msec
192.168.2.1 12 msec
3 40.40.40.40 72 msec 60 msec 40 msec
```

FROM R2#

```
R2#ping 40.40.40.40
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 40.40.40.40, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 8/68/132 ms
!
```

```
R2#sh ip route ospf
1.0.0.0/32 is subnetted, 1 subnets
O E2 1.1.1.1 [110/1] via 192.168.30.2, 01:40:09, FastEthernet0/0
[110/1] via 192.168.30.1, 01:40:09, FastEthernet0/0
2.0.0.0/32 is subnetted, 1 subnets
O E2 2.2.2.2 [110/1] via 192.168.30.2, 01:40:09, FastEthernet0/0
[110/1] via 192.168.30.1, 01:40:09, FastEthernet0/0
3.0.0.0/32 is subnetted, 1 subnets
O 3.3.3.3 [110/2] via 192.168.30.1, 02:18:57, FastEthernet0/0
4.0.0.0/32 is subnetted, 1 subnets
O 4.4.4.4 [110/2] via 192.168.30.2, 02:18:57, FastEthernet0/0
5.0.0.0/32 is subnetted, 1 subnets
O 5.5.5.5 [110/2] via 192.168.30.4, 02:18:57, FastEthernet0/0
40.0.0.0/24 is subnetted, 1 subnets
O E2 40.40.40.0 [110/1] via 192.168.30.2, 01:40:09, FastEthernet0/0
[110/1] via 192.168.30.1, 01:40:09, FastEthernet0/0
192.168.3.0/30 is subnetted, 1 subnets
O E2 192.168.3.0 [110/1] via 192.168.30.2, 01:40:09, FastEthernet0/0
[110/1] via 192.168.30.1, 01:40:09, FastEthernet0/0
!
R2#traceroute 40.40.40.40
Type escape sequence to abort.
```

Tracing the route to 40.40.40.40

```
1 192.168.30.2 24 msec
  192.168.30.1 8 msec
  192.168.30.2 52 msec
2 192.168.1.1 40 msec
  192.168.2.1 28 msec
  192.168.1.1 60 msec
3 40.40.40.40 96 msec 72 msec
```

FROM CPE1#

CPE1#ping 40.40.40.40

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 40.40.40.40, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 20/36/60 ms

!

CPE1#sh ip route bgp

```
1.0.0.0/32 is subnetted, 1 subnets
B   1.1.1.1 [20/0] via 192.168.1.1, 01:48:47
2.0.0.0/32 is subnetted, 1 subnets
B   2.2.2.2 [20/0] via 192.168.1.1, 01:48:47
40.0.0.0/24 is subnetted, 1 subnets
B   40.40.40.0 [20/0] via 192.168.1.1, 01:48:47
192.168.2.0/30 is subnetted, 1 subnets
B   192.168.2.0 [200/0] via 192.168.30.2, 01:48:47
192.168.3.0/30 is subnetted, 1 subnets
B   192.168.3.0 [20/0] via 192.168.1.1, 01:48:47
```

!

CPE1#traceroute 40.40.40.40

Type escape sequence to abort.

Tracing the route to 40.40.40.40

```
1 192.168.1.1 24 msec 48 msec 12 msec
2 *
  40.40.40.40 [AS 20] 36 msec 16 msec
```

FROM CPE2#

CPE2#ping 40.40.40.40

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 40.40.40.40, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 44/60/80 ms

!

CPE2#sh ip route bgp

```
1.0.0.0/32 is subnetted, 1 subnets
B   1.1.1.1 [20/0] via 192.168.2.1, 01:52:44
2.0.0.0/32 is subnetted, 1 subnets
B   2.2.2.2 [20/0] via 192.168.2.1, 01:52:44
```

```

40.0.0.0/24 is subnetted, 1 subnets
B   40.40.40.0 [20/0] via 192.168.2.1, 01:52:44
    192.168.1.0/30 is subnetted, 1 subnets
B   192.168.1.0 [200/0] via 192.168.30.1, 01:52:44
    192.168.3.0/30 is subnetted, 1 subnets
B   192.168.3.0 [20/0] via 192.168.2.1, 01:52:44
!
CPE2#traceroute 40.40.40.40

```

Type escape sequence to abort.
Tracing the route to 40.40.40.40

```

 1 192.168.2.1 4 msec 20 msec 40 msec
 2 *
   40.40.40.40 [AS 20] 20 msec 68 msec

```

5.2 show ip bgp from CPE routers prima della manipolazione del traffic via BGP

FROM CPE1#

```

CPE1#sh ip bgp
BGP table version is 26, local router ID is 3.3.3.3
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
               r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

```

Network	Next Hop	Metric	LocPrf	Weight	Path
* i1.1.1.1/32	192.168.30.2	0	100	0	20 ?
*>	192.168.1.1	0		0	20 ?
* i2.2.2.2/32	192.168.30.2	0	100	0	20 ?
*>	192.168.1.1			0	20 ?
* i3.3.3.3/32	192.168.30.2	2	100	0	?
*>	0.0.0.0	0		32768	?
*> 4.4.4.4/32	192.168.30.2	2		32768	?
* i	192.168.30.2	0	100	0	?
* i5.5.5.5/32	192.168.30.2	2	100	0	?
*>	192.168.30.4	2		32768	?
* i6.6.6.6/32	192.168.30.2	2	100	0	?
*>	192.168.30.5	2		32768	?
* i30.30.30.0/24	192.168.30.2	2	100	0	?
*>	192.168.30.4	2		32768	?
* i40.40.40.0/24	192.168.30.2	0	100	0	20 ?
*>	192.168.1.1	0		0	20 ?
* 192.168.1.0/30	192.168.1.1	0		0	20 ?
*>	0.0.0.0	0		32768	?
* 192.168.2.0/30	192.168.1.1			0	20 ?
*>i	192.168.30.2	0	100	0	?
* i192.168.3.0/30	192.168.30.2	0	100	0	20 ?
*>	192.168.1.1	0		0	20 ?
* i192.168.30.0/28	192.168.30.2	0	100	0	?
*>	0.0.0.0	0		32768	?

FROM CPE2#

CPE2#sh ip bgp

BGP table version is 34, local router ID is 4.4.4.4

Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
r RIB-failure, S Stale

Origin codes: i - IGP, e - EGP, ? - incomplete

Network	Next Hop	Metric	LocPrf	Weight	Path
*> 1.1.1.1/32	192.168.2.1			0	20 ?
* i	192.168.30.1	0	100	0	20 ?
* i2.2.2.2/32	192.168.30.1	0	100	0	20 ?
*>	192.168.2.1	0		0	20 ?
*> 3.3.3.3/32	192.168.30.1	2		32768	?
* i	192.168.30.1	0	100	0	?
* i4.4.4.4/32	192.168.30.1	2	100	0	?
*>	0.0.0.0	0		32768	?
* i5.5.5.5/32	192.168.30.1	2	100	0	?
*>	192.168.30.4	2		32768	?
* i6.6.6.6/32	192.168.30.1	2	100	0	?
*>	192.168.30.5	2		32768	?
* i30.30.30.0/24	192.168.30.1	2	100	0	?
*>	192.168.30.4	2		32768	?
* i40.40.40.0/24	192.168.30.1	0	100	0	20 ?
*>	192.168.2.1	0		0	20 ?
* 192.168.1.0/30	192.168.2.1			0	20 ?
*>i	192.168.30.1	0	100	0	?
* 192.168.2.0/30	192.168.2.1	0		0	20 ?
*>	0.0.0.0	0		32768	?
* i192.168.3.0/30	192.168.30.1	0	100	0	20 ?
*>	192.168.2.1	0		0	20 ?
* i192.168.30.0/28	192.168.30.1	0	100	0	?
*>	0.0.0.0	0		32768	?

5.3 setting Outbound Traffic via Local-Preference from CPE1 e verifica path PC1 to PC2

CPE1#sh run | b r bgp

router bgp 65000

no synchronization

bgp default local-preference 150

bgp log-neighbor-changes

redistribute connected

redistribute ospf 30

neighbor 192.168.1.1 remote-as 20

neighbor 192.168.1.1 version 4

neighbor 192.168.1.1 timers 15 45

neighbor 192.168.30.2 remote-as 65000

```

neighbor 192.168.30.2 version 4
neighbor 192.168.30.2 timers 15 45
neighbor 192.168.30.2 next-hop-self
no auto-summary
!
```

La local-preference è un attributo che forza il punto di uscita da un AS per il traffic outbound ed ha valore solo all'interno del proprio AS; dopo questo setting, il CPE2 ha conoscenza di quale path preferire per raggiungere la destinazione.

5.3.1 show ip bgp from CPE1 dopo setting local-preference

```

CPE1#sh ip bgp
BGP table version is 38, local router ID is 3.3.3.3
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
               r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete
```

Network	Next Hop	Metric	LocPrf	Weight	Path
*> 1.1.1.1/32	192.168.1.1	0		0	20 ?
*> 2.2.2.2/32	192.168.1.1			0	20 ?
* i3.3.3.3/32	192.168.30.2	2	100	0	? ?
*>	0.0.0.0	0		32768	? ?
*> 4.4.4.4/32	192.168.30.2	2		32768	? ?
* i	192.168.30.2	0	100	0	? ?
* i5.5.5.5/32	192.168.30.2	2	100	0	? ?
*>	192.168.30.4	2		32768	? ?
* i6.6.6.6/32	192.168.30.2	2	100	0	? ?
*>	192.168.30.5	2		32768	? ?
* i30.30.30.0/24	192.168.30.2	2	100	0	? ?
*>	192.168.30.4	2		32768	? ?
*> 40.40.40.0/24	192.168.1.1	0		0	20 ?
* 192.168.1.0/30	192.168.1.1	0		0	20 ?
*>	0.0.0.0	0		32768	? ?
*> 192.168.2.0/30	192.168.1.1			0	20 ?
* i	192.168.30.2	0	100	0	? ?
Network	Next Hop	Metric	LocPrf	Weight	Path
*> 192.168.3.0/30	192.168.1.1	0		0	20 ?
* i192.168.30.0/28	192.168.30.2	0	100	0	? ?
*>	0.0.0.0	0		32768	? ?

5.3.2 show ip bgp from CPE2 dopo setting local-preference

```
CPE2#sh ip bgp
```

```
BGP table version is 47, local router ID is 4.4.4.4
```

```
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,  
r RIB-failure, S Stale
```

```
Origin codes: i - IGP, e - EGP, ? - incomplete
```

Network	Next Hop	Metric	LocPrf	Weight	Path
r 1.1.1.1/32	192.168.2.1			0	20 ?
r>i	192.168.30.1	0	150	0	20 ?
r>i2.2.2.2/32	192.168.30.1	0	150	0	20 ?
r	192.168.2.1	0		0	20 ?
*> 3.3.3.3/32	192.168.30.1	2		32768	? ?
* i	192.168.30.1	0	150	0	? ?

Network	Next Hop	Metric	LocPrf	Weight	Path
* i4.4.4.4/32	192.168.30.1	2	150	0	? ?
*>	0.0.0.0	0		32768	? ?
* i5.5.5.5/32	192.168.30.1	2	150	0	? ?
*>	192.168.30.4	2		32768	? ?
* i6.6.6.6/32	192.168.30.1	2	150	0	? ?
*>	192.168.30.5	2		32768	? ?
* i30.30.30.0/24	192.168.30.1	2	150	0	? ?
*>	192.168.30.4	2		32768	? ?
r>i40.40.40.0/24	192.168.30.1	0	150	0	20 ?
r	192.168.2.1	0		0	20 ?
* 192.168.1.0/30	192.168.2.1			0	20 ?
*>i	192.168.30.1	0	150	0	? ?
* i192.168.2.0/30	192.168.30.1	0	150	0	20 ?
*	192.168.2.1	0		0	20 ?
*>	0.0.0.0	0		32768	? ?
r>i192.168.3.0/30	192.168.30.1	0	150	0	20 ?
r	192.168.2.1	0		0	20 ?
* i192.168.30.0/28	192.168.30.1	0	150	0	? ?
*>	0.0.0.0	0		32768	? ?

5.3.3 verifica path from PC1 to PC2 dopo setting local-preference

```
FROM PC1#
```

```
PC1> ping 40.40.40.40
```

```
84 bytes from 40.40.40.40 icmp_seq=1 ttl=61 time=90.000 ms
```

```
84 bytes from 40.40.40.40 icmp_seq=2 ttl=61 time=90.000 ms
```

```
84 bytes from 40.40.40.40 icmp_seq=3 ttl=61 time=110.000 ms
```

```
84 bytes from 40.40.40.40 icmp_seq=4 ttl=61 time=50.000 ms
```

```
84 bytes from 40.40.40.40 icmp_seq=5 ttl=61 time=40.000 ms
```

```
!
```

```
PC1> trace 40.40.40.40 -P 1
```

```
trace to 40.40.40.40, 8 hops max (ICMP), press Ctrl+C to stop
```

```
1 30.30.30.1 10.000 ms 10.001 ms 30.000 ms
2 192.168.30.1 20.000 ms 50.000 ms 20.000 ms
3 192.168.1.1 70.000 ms 100.000 ms 70.000 ms
4 40.40.40.40 120.000 ms 60.000 ms 60.000 ms
```

FROM R1#

```
R1#traceroute 40.40.40.40
```

```
Type escape sequence to abort.
Tracing the route to 40.40.40.40
```

```
1 192.168.30.1 24 msec 28 msec 20 msec
2 192.168.1.1 44 msec 56 msec 60 msec
3 40.40.40.40 60 msec 92 msec 68 msec
```

Prima del setting della local-preferece il traceroute di R1 era:

```
R1#traceroute 40.40.40.40
```

```
Type escape sequence to abort.
Tracing the route to 40.40.40.40
```

```
1 192.168.30.1 32 msec
  192.168.30.2 12 msec
  192.168.30.1 20 msec
2 192.168.2.1 20 msec
  192.168.1.1 36 msec
  192.168.2.1 12 msec
3 40.40.40.40 72 msec 60 msec 40 msec
```

FROM R2#

```
R2#traceroute 40.40.40.40
```

```
Type escape sequence to abort.
Tracing the route to 40.40.40.40
```

```
1 192.168.30.1 44 msec 40 msec 28 msec
2 192.168.1.1 40 msec 40 msec 12 msec
3 40.40.40.40 100 msec 80 msec 100 msec
```

Prima del setting della local-preferece il traceroute di R2 era:

```
R2#traceroute 40.40.40.40
```

```
Type escape sequence to abort.
Tracing the route to 40.40.40.40
```

```
1 192.168.30.2 24 msec
  192.168.30.1 8 msec
```

192.168.30.2 52 msec
2 192.168.1.1 40 msec
192.168.2.1 28 msec
192.168.1.1 60 msec
3 40.40.40.40 96 msec 72 msec

FROM CPE1:

CPE1#traceroute 40.40.40.40

Type escape sequence to abort.
Tracing the route to 40.40.40.40

1 192.168.1.1 36 msec 32 msec 20 msec
2 40.40.40.40 [AS 20] 68 msec 32 msec 60 msec

Stesso tracert rispetto al primo traceroute from CPE1 ed è giusto così.

FROM CPE2:

CPE2#traceroute 40.40.40.40

Type escape sequence to abort.
Tracing the route to 40.40.40.40

1 192.168.30.1 44 msec 20 msec 40 msec → CPE1
2 192.168.1.1 52 msec 100 msec 80 msec → CPE1 to PE1
3 40.40.40.40 68 msec 60 msec 92 msec

Prima del setting della local-preferece il traceroute di CPE2 era:

CPE2#traceroute 40.40.40.40

Type escape sequence to abort.
Tracing the route to 40.40.40.40

1 192.168.2.1 4 msec 20 msec 40 msec → CPE2 to PE2
2 40.40.40.40 [AS 20] 20 msec 68 msec

5.4 setting Inbound Traffic via AS-path Prepend from CPE2

In assenza di manipolazione del traffico Inbound rispetto all'AS 65000 (del cliente), I router PE (Provider) hanno la seguente tabella bgp:

5.4.1 show ip bgp from PE1 prima dell'as-path prepend

```
PE1#sh ip bgp
```

```
BGP table version is 14, local router ID is 1.1.1.1
```

```
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,  
r RIB-failure, S Stale
```

```
Origin codes: i - IGP, e - EGP, ? - incomplete
```

Network	Next Hop	Metric	LocPrf	Weight	Path
*> 1.1.1.1/32	0.0.0.0	0		32768	?
*>i2.2.2.2/32	192.168.3.2	0	100	0	?
*> 3.3.3.3/32	192.168.1.2	0		0	65000 ?
* 4.4.4.4/32	192.168.1.2	2		0	65000 ?
*>i	192.168.3.2	0	100	0	65000 ?
* i5.5.5.5/32	192.168.3.2	2	100	0	65000 ?
*>	192.168.1.2	2		0	65000 ?
* i6.6.6.6/32	192.168.3.2	2	100	0	65000 ?
*>	192.168.1.2	2		0	65000 ?
* i30.30.30.0/24	192.168.3.2	2	100	0	65000 ?
*>	192.168.1.2	2		0	65000 ?
* i40.40.40.0/24	192.168.3.2	0	100	0	?
*>	0.0.0.0	0		32768	?
* 192.168.1.0/30	192.168.1.2	0		0	65000 ?
*>	0.0.0.0	0		32768	?
*>i192.168.2.0/30	192.168.3.2	0	100	0	?
* i192.168.3.0/30	192.168.3.2	0	100	0	?
*>	0.0.0.0	0		32768	?
*> 192.168.30.0/28	192.168.1.2	0		0	65000 ?
* i	192.168.3.2	0	100	0	65000 ?

```
PE1#traceroute 30.30.30.30 source fastEthernet 0/0
```

```
Type escape sequence to abort.
```

```
Tracing the route to 30.30.30.30
```

```
 1 192.168.1.2 24 msec 12 msec 48 msec  
 2 192.168.30.5 [AS 65000] 20 msec 72 msec 56 msec  
 3 30.30.30.30 [AS 65000] 80 msec 60 msec 60 msec
```

5.4.2 show ip bgp from PE2 prima dell'as-path prepend

```
PE2#sh ip bgp
```

```
BGP table version is 16, local router ID is 2.2.2.2
```

```
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,  
r RIB-failure, S Stale
```

```
Origin codes: i - IGP, e - EGP, ? - incomplete
```

Network	Next Hop	Metric	LocPrf	Weight	Path
*>i1.1.1.1/32	192.168.3.1	0	100	0	?
*> 2.2.2.2/32	0.0.0.0	0		32768	?
* 3.3.3.3/32	192.168.2.2	2		0	65000 ?
*>i	192.168.3.1	0	100	0	65000 ?
*> 4.4.4.4/32	192.168.2.2	0		0	65000 ?

Network	Next Hop	Metric	LocPrf	Weight	Path
*> 5.5.5.5/32	192.168.2.2	2		0	65000 ?
* i	192.168.3.1	2	100	0	65000 ?
*> 6.6.6.6/32	192.168.2.2	2		0	65000 ?
* i	192.168.3.1	2	100	0	65000 ?
*> 30.30.30.0/24	192.168.2.2	2		0	65000 ?
* i	192.168.3.1	2	100	0	65000 ?
* i40.40.40.0/24	192.168.3.1	0	100	0	?
*>	0.0.0.0	0		32768	?
* 192.168.1.0/30	192.168.2.2			0	65000 ?
*>i	192.168.3.1	0	100	0	?
* 192.168.2.0/30	192.168.2.2	0	0		65000 ?
*>	0.0.0.0	0		32768	?
* i192.168.3.0/30	192.168.3.1	0	100	0	?
*>	0.0.0.0	0		32768	?
* i192.168.30.0/28	192.168.3.1	0	100	0	65000 ?
*>	192.168.2.2	0		0	65000 ?

5.4.3 Configurazione prepend from CPE2

```
CPE2#sh run | b r bgp
```

```
router bgp 65000
```

```
no synchronization
```

```
bgp log-neighbor-changes
```

```
redistribute connected
```

```
redistribute ospf 30
```

```
neighbor 192.168.2.1 remote-as 20
```

```
neighbor 192.168.2.1 version 4
```

```
neighbor 192.168.2.1 timers 15 45
```

```
neighbor 192.168.2.1 route-map PREPEND out
```

```
neighbor 192.168.30.1 remote-as 65000
```

```
neighbor 192.168.30.1 version 4
```

```
neighbor 192.168.30.1 timers 15 45
```

```
neighbor 192.168.30.1 next-hop-self
```

```
no auto-summary
```

```
!
```

```
route-map PREPEND permit 10
set as-path prepend 65000
```

5.4.4 show ip bgp from PE1 dopo dell'as-path prepend

```
PE1#sh ip bgp
```

```
BGP table version is 14, local router ID is 1.1.1.1
```

```
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
r RIB-failure, S Stale
```

```
Origin codes: i - IGP, e - EGP, ? - incomplete
```

Network	Next Hop	Metric	LocPrf	Weight	Path
*> 1.1.1.1/32	0.0.0.0	0		32768	?
*>i2.2.2.2/32	192.168.3.2	0	100	0	?
*> 3.3.3.3/32	192.168.1.2	0		0	65000 ?
* 4.4.4.4/32	192.168.1.2	2		0	65000 ?
*>i	192.168.3.2	0	100	0	65000 ?
* i5.5.5.5/32	192.168.3.2	2	100	0	65000 ?
*>	192.168.1.2	2		0	65000 ?
* i6.6.6.6/32	192.168.3.2	2	100	0	65000 ?
*>	192.168.1.2	2		0	65000 ?
* i30.30.30.0/24	192.168.3.2	2	100	0	65000 ?
*>	192.168.1.2	2		0	65000 ?
* i40.40.40.0/24	192.168.3.2	0	100	0	?
*>	0.0.0.0	0		32768	?
* 192.168.1.0/30	192.168.1.2	0		0	65000 ?
*>	0.0.0.0	0		32768	?
*>i192.168.2.0/30	192.168.3.2	0	100	0	?
* i192.168.3.0/30	192.168.3.2	0	100	0	?
*>	0.0.0.0	0		32768	?
*> 192.168.30.0/28	192.168.1.2	0		0	65000 ?
* i	192.168.3.2	0	100	0	65000 ?

5.4.5 show ip bgp from PE2 dopo dell'as-path prepend

PE2#sh ip bgp

BGP table version is 22, local router ID is 2.2.2.2

Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
r RIB-failure, S Stale

Origin codes: i - IGP, e - EGP, ? - incomplete

Network	Next Hop	Metric	LocPrf	Weight	Path
*>i1.1.1.1/32	192.168.3.1	0	100	0	?
*>2.2.2.2/32	0.0.0.0	0		32768	?
*3.3.3.3/32	192.168.2.2	2		0	65000 65000 ?
*>i	192.168.3.1	0	100	0	65000 ?
*>i4.4.4.4/32	192.168.3.1	2	100	0	65000 ?
*	192.168.2.2	0		0	65000 65000 ?
*5.5.5.5/32	192.168.2.2	2		0	65000 65000 ?
*>i	192.168.3.1	2	100	0	65000 ?
*6.6.6.6/32	192.168.2.2	2		0	65000 65000 ?
*>i	192.168.3.1	2	100	0	65000 ?
* 30.30.30.0/24	192.168.2.2	2		0	65000 65000 ?
*>i	192.168.3.1	2	100	0	65000 ?
*i40.40.40.0/24	192.168.3.1	0	100	0	?
*>	0.0.0.0	0		32768	?
*192.168.1.0/30	192.168.2.2			0	65000 65000 ?
*>i	192.168.3.1	0	100	0	?
*192.168.2.0/30	192.168.2.2	0		0	65000 65000 ?
*>	0.0.0.0	0		32768	?
*i192.168.3.0/30	192.168.3.1	0	100	0	?
*>	0.0.0.0	0		32768	?
*>i192.168.30.0/28	192.168.3.1	0	100	0	65000 ?
*	192.168.2.2	0		0	65000 65000 ?

PE2#traceroute 30.30.30.30

Type escape sequence to abort.

Tracing the route to 30.30.30.30

- 1 192.168.3.1 12 msec 20 msec 12 msec → to PE1
- 2 192.168.1.2 48 msec 72 msec 60 msec → PE1 to CPE1
- 3 192.168.30.4 [AS 65000] 80 msec 80 msec 80 msec
- 4 30.30.30.30 [AS 65000] 68 msec 100 msec 48 msec