ISIS Accept Policies & Advanced IP routing with SPB - Test Setups
VSP9000 Release 4.0

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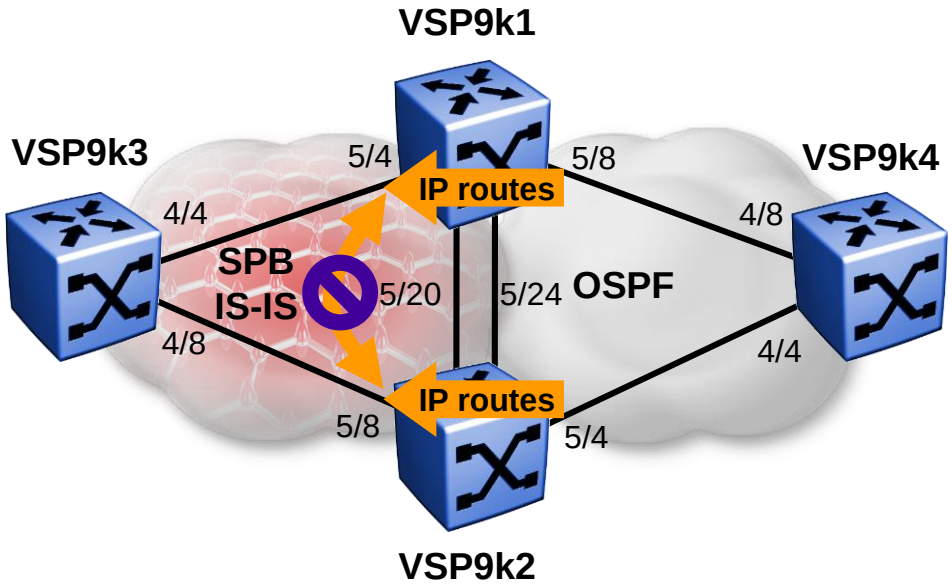
- February 2018
- Version 4 (pdf version)

ISIS Accept policies

Last tested with: 4.0.0.0_B037

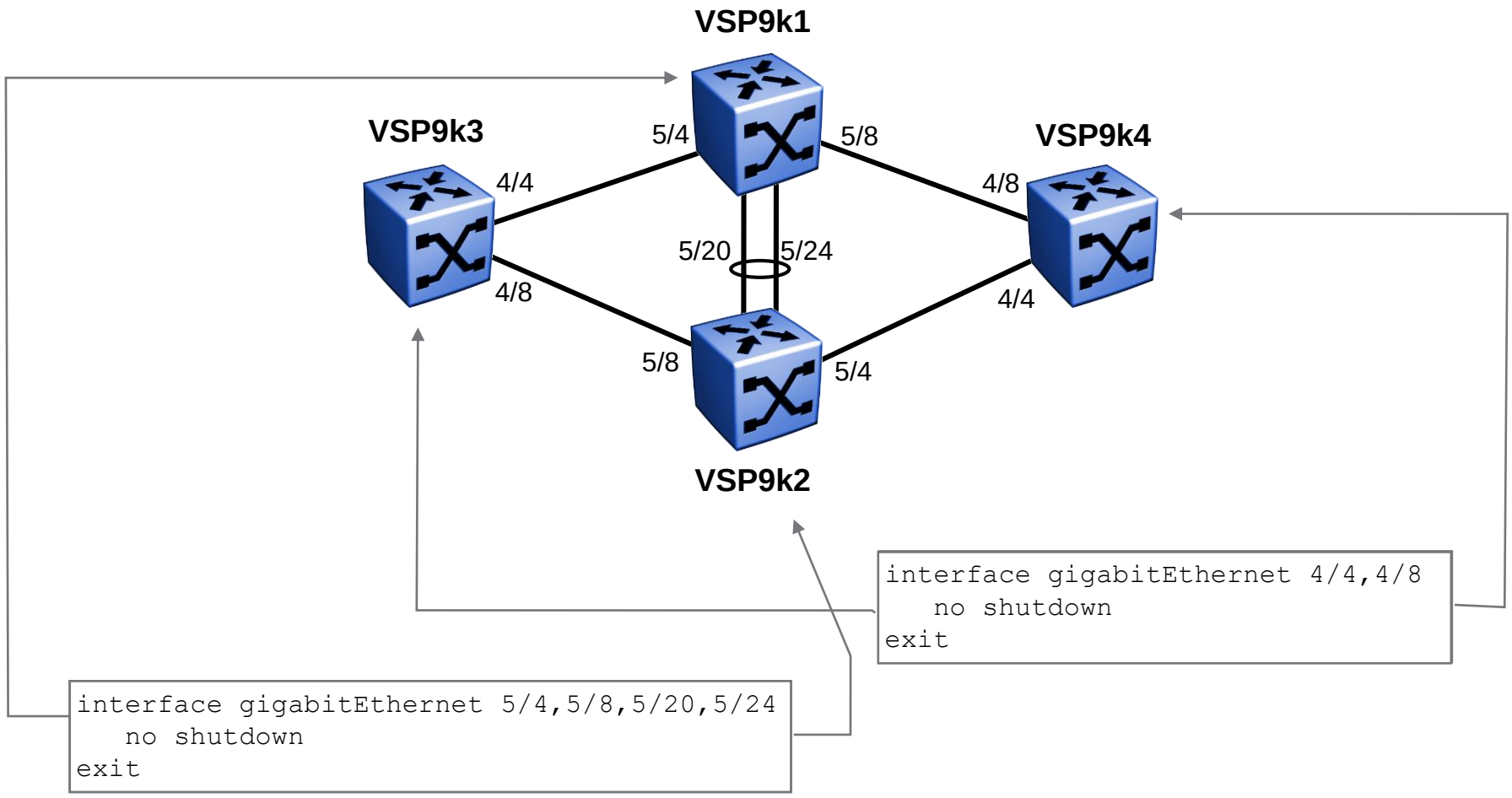
Example use #1

ISIS Accept policies to stop routing loops
Goal

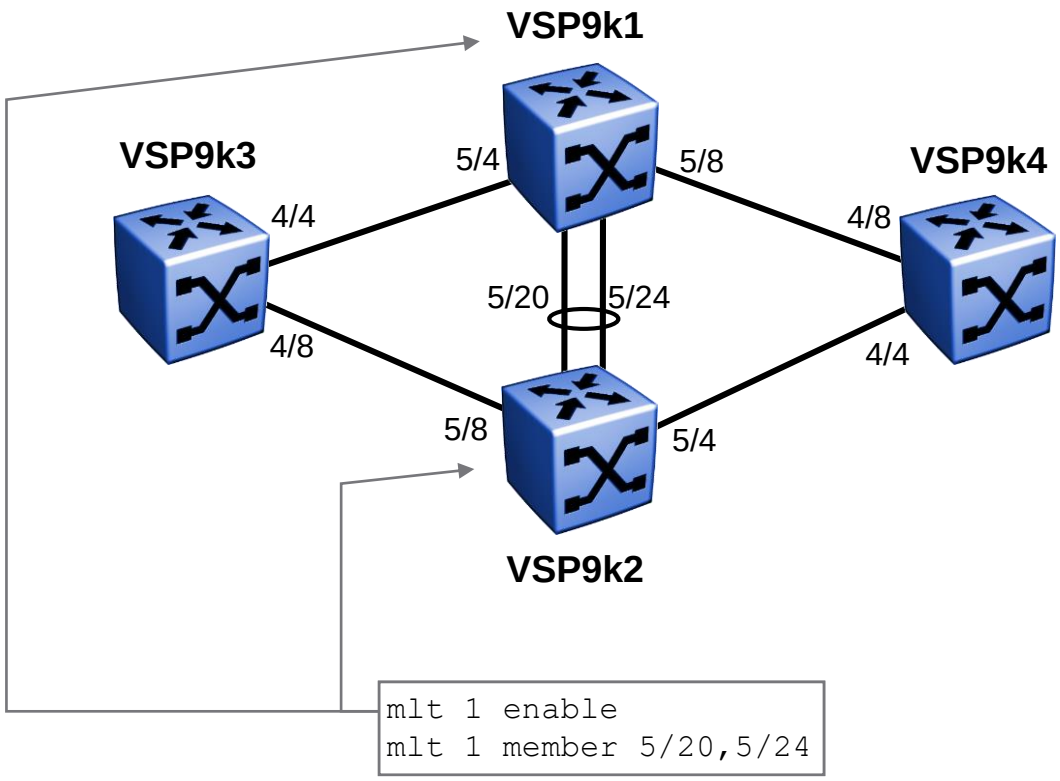


- Both VSP9k1 & VSP9k2 redistribute OSPF routes into ISIS
- ISIS has a higher preference (7) than OSPF (20,25,120,125)
  - Lowest numerical value = highest preference
- Need to ensure that VSP9k1 & VSP9k2 do not learn from each other the OSPF routes as ISIS routes

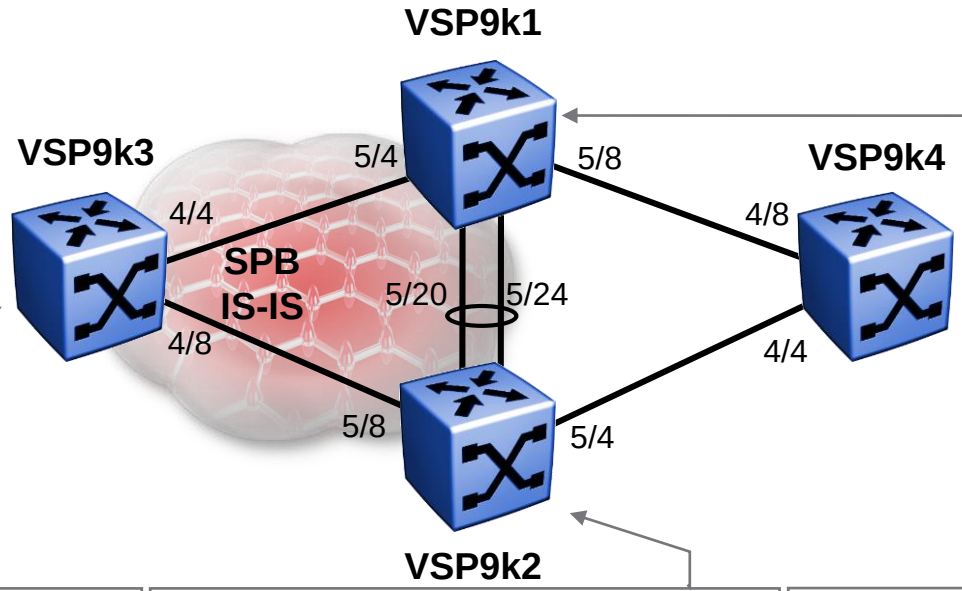
ISIS Accept policies to stop routing loops
Interfaces used



ISIS Accept policies to stop routing loops
MLT config



ISIS Accept policies to stop routing loops
SPB Global Config

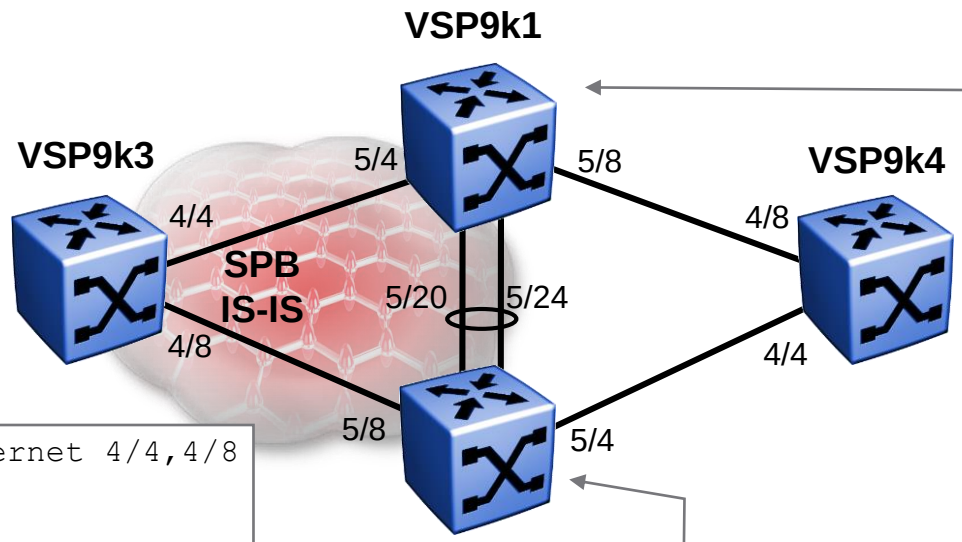



```
interface loopback 1
   ip address 10.0.0.93/255.255.255.255
exit
spbm
router isis
   system-id 00bb.0000.9300
   manual-area 49.0000
   ip-source-address 10.0.0.93
   spbm 1
   spbm 1 nick-name 0.00.93
   spbm 1 b-vid 4051-4052 primary 4051
   spbm 1 ip enable
exit
vlan create 4051 name "B-VLAN-1" type spbm-bvlan
vlan create 4052 name "B-VLAN-2" type spbm-bvlan
router isis enable
cfm spbm mepid 93
cfm spbm enable
```

```
interface loopback 1
   ip address 10.0.0.92/255.255.255.255
exit
spbm
router isis
   system-id 00bb.0000.9200
   manual-area 49.0000
   ip-source-address 10.0.0.92
   spbm 1
   spbm 1 nick-name 0.00.92
   spbm 1 b-vid 4051-4052 primary 4051
   spbm 1 ip enable
exit
vlan create 4051 name "B-VLAN-1" type spbm-bvlan
vlan create 4052 name "B-VLAN-2" type spbm-bvlan
router isis enable
cfm spbm mepid 92
cfm spbm enable
```

```
interface loopback 1
   ip address 10.0.0.91/255.255.255.255
exit
spbm
router isis
   system-id 00bb.0000.9100
   manual-area 49.0000
   ip-source-address 10.0.0.91
   spbm 1
   spbm 1 nick-name 0.00.91
   spbm 1 b-vid 4051-4052 primary 4051
   spbm 1 ip enable
exit
vlan create 4051 name "B-VLAN-1" type spbm-bvlan
vlan create 4052 name "B-VLAN-2" type spbm-bvlan
router isis enable
cfm spbm mepid 91
cfm spbm enable
```

ISIS Accept policies to stop routing loops
SPB Interface Config

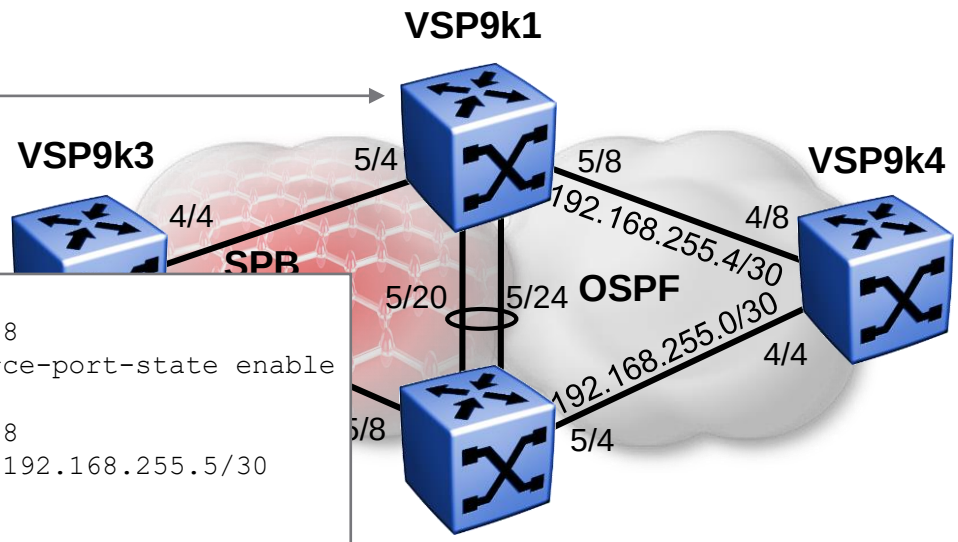



```
interface GigabitEthernet 4/4,4/8
   isis
   isis spbm 1
   isis enable
exit
```

```
interface GigabitEthernet 5/8
   isis
   isis spbm 1
   isis enable
exit
interface mlt 1
   isis
   isis spbm 1
   isis enable
exit
```

```
interface GigabitEthernet 5/4
   isis
   isis spbm 1
   isis enable
exit
interface mlt 1
   isis
   isis spbm 1
   isis enable
exit
```

ISIS Accept policies to stop routing loops
OSPF Config

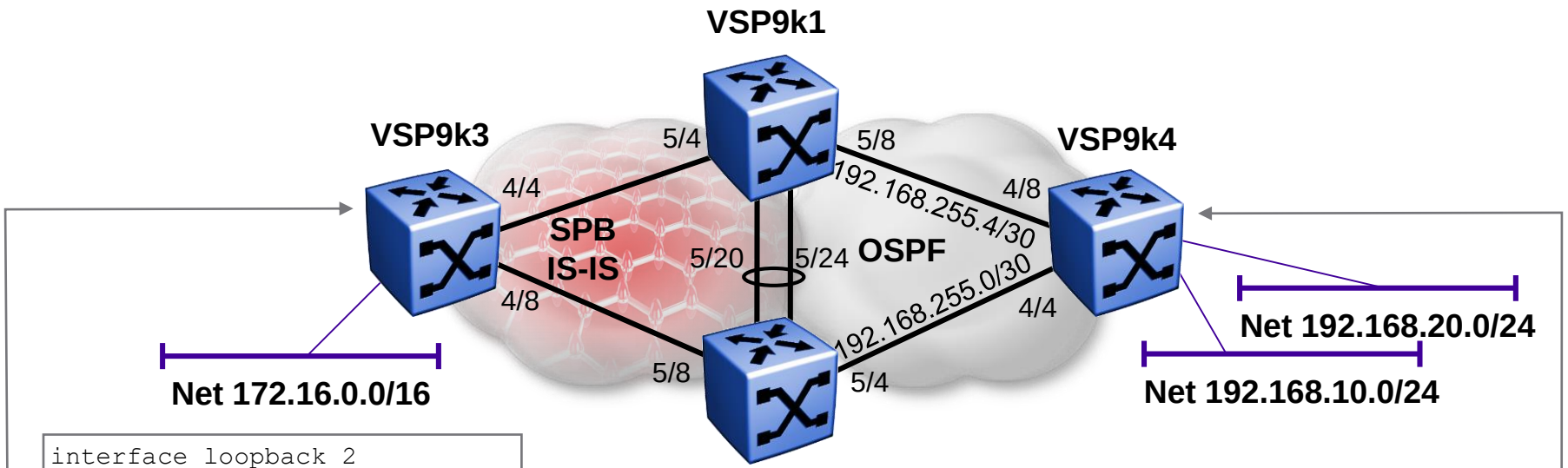



```
vlan members remove 1 5/8
interface gigabitEthernet 5/8
   no spanning-tree mstp force-port-state enable
exit
interface GigabitEthernet 5/8
   brouter vlan 3902 subnet 192.168.255.5/30
   ip ospf enable
exit
router ospf
   router-id 10.0.0.91
exit
router ospf enable
```

```
vlan members remove 1 5/4
interface gigabitEthernet 5/4
   no spanning-tree mstp force-port-state enable
exit
interface GigabitEthernet 5/4
   brouter vlan 3901 subnet 192.168.255.1/30
   ip ospf enable
exit
router ospf
   router-id 10.0.0.92
exit
router ospf enable
```

```
vlan members remove 1 4/4,4/8
interface gigabitEthernet 4/4,4/8
   no spanning-tree mstp force-port-state enable
exit
interface GigabitEthernet 4/4,4/8
   brouter port 4/8 vlan 3902 subnet 192.168.255.6/30
   brouter port 4/4 vlan 3901 subnet 192.168.255.2/30
   ip ospf enable
exit
interface loopback 1
   ip address 10.0.0.94/32
   ip ospf
exit
router ospf
   router-id 10.0.0.94
exit
router ospf enable
```

ISIS Accept policies to stop routing loops
Test networks config using CLIPs

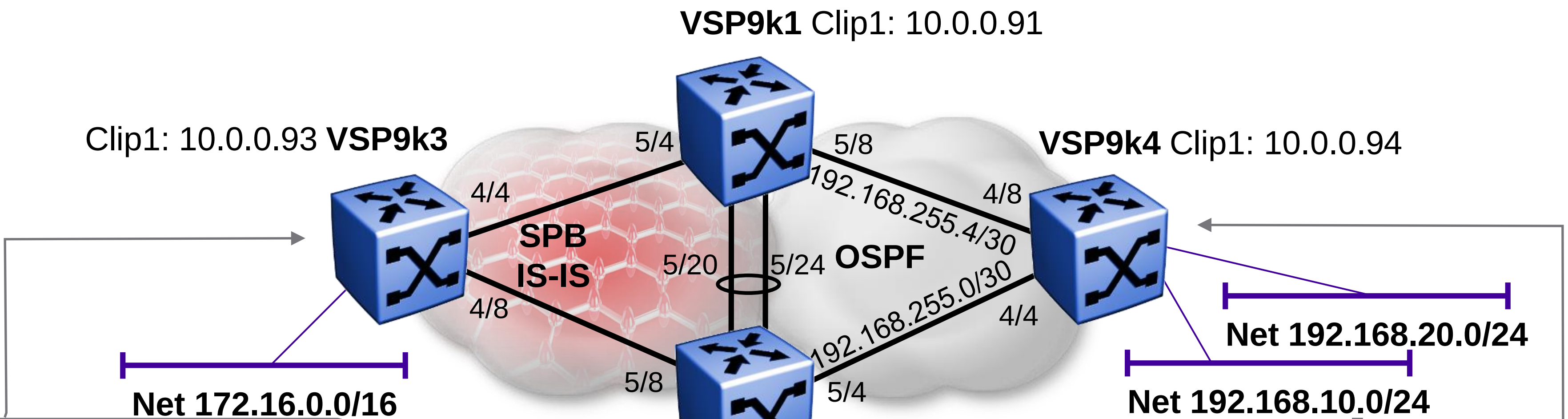



```
interface loopback 2
   ip address 172.16.0.1/16
exit
router isis
   redistribute direct
   redistribute direct enable
exit
isis apply redistribute direct
```

```
interface loopback 2
   ip address 192.168.10.1/24
   ip ospf
exit
interface loopback 3
   ip address 192.168.20.1/24
exit
router ospf
   as-boundary-router enable
   redistribute direct
   redistribute direct enable
exit
ip ospf apply redistribute direct
```

- Net 192.168.10.0/24 will be an OSPF intra-area route
- Net 192.168.20.0/24 will be an OSPF AS external route

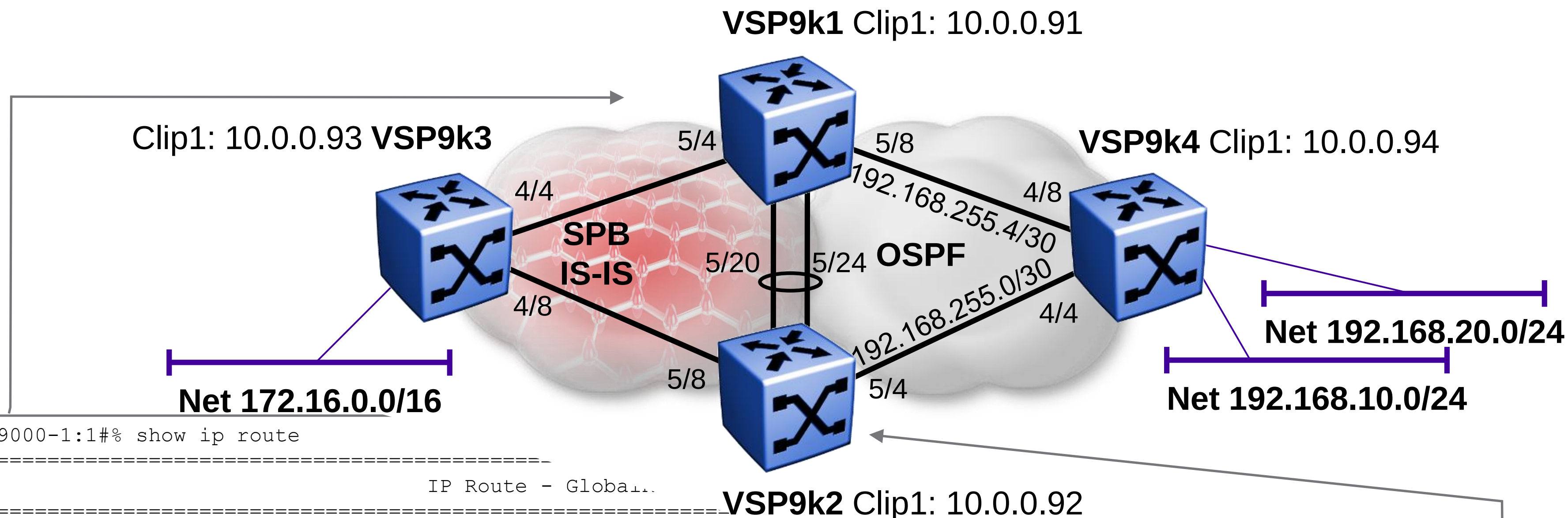
ISIS Accept policies to stop routing loops
IP routes before ISIS ⇔ OSPF redistribution




```
VSP9000-3:1#% show ip route
======================================
                               IP Route - 
========================================================
DST            MASK            NEXT                NH-VRF          COST IF    PROT AGE TYPE PRF
------------------------------------------------------------------------------------------------
10.0.0.91      255.255.255.255 VSP9000-1           GlobalRouter    10   4051  ISIS 0   IBS  7
10.0.0.92      255.255.255.255 VSP9000-2           GlobalRouter    10   4051  ISIS 0   IBS  7
10.0.0.93      255.255.255.255 10.0.0.93           -               1    0     LOC  0   DB   0
172.16.0.0     255.255.0.0     172.16.0.1          -               1    0     LOC  0   DB   0
```

```
VSP9000-4:1#% show ip route
================================================================================================
                               IP Route - GlobalRouter
================================================================================================
DST            MASK            NEXT                NH-VRF          COST IF    PROT AGE TYPE PRF
------------------------------------------------------------------------------------------------
10.0.0.94      255.255.255.255 10.0.0.94           -               1    0     LOC  0   DB   0
192.168.10.0   255.255.255.0   192.168.10.1        -               1    0     LOC  0   DB   0
192.168.20.0   255.255.255.0   192.168.20.1        -               1    0     LOC  0   DB   0
192.168.255.0  255.255.255.252 192.168.255.2       -               1      4/4 LOC  0   DB   0
192.168.255.4  255.255.255.252 192.168.255.6       -               1      4/8 LOC  0   DB   0
```

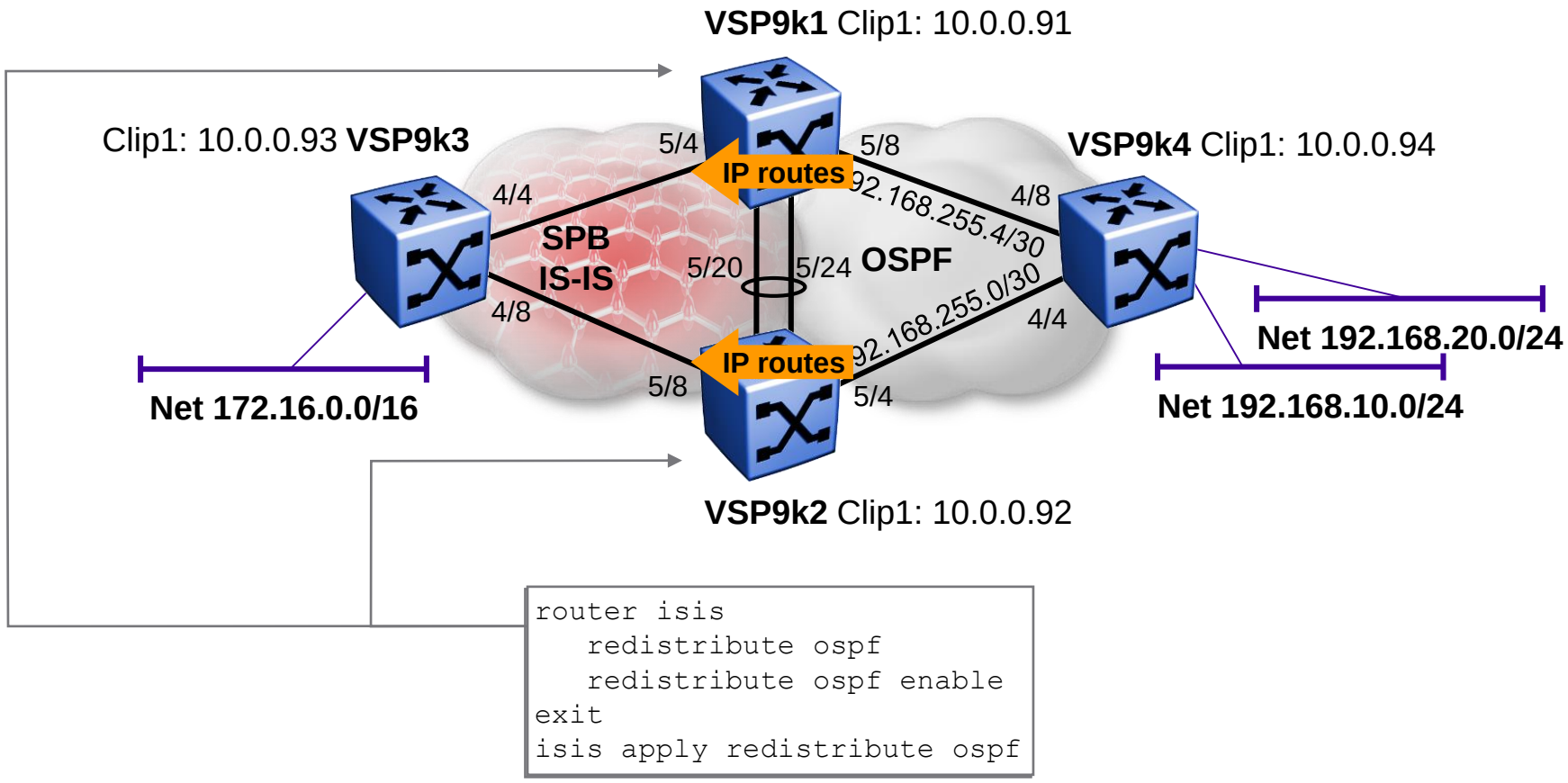
ISIS Accept policies to stop routing loops
IP routes before ISIS ⇔ OSPF redistribution




```
VSP9000-1:1#% show ip route
==============================================
                              IP Route - Globa...
====================================================
DST            MASK            NEXT                NH-VRF          OST IF    PROT AGE TYPE PRF
-------------------------------------------------------------------------------------------------
10.0.0.91      255.255.255.255 10.0.0.91           -               1   0     LOC  0   DB   0
10.0.0.92      255.255.255.255 VSP9000-2           GlobalRouter    10  4051  ISIS 0   IBS  7
10.0.0.93      255.255.255.255 VSP9000-3           GlobalRouter    10  4051  ISIS 0   IBS  7
10.0.0.94      255.255.255.
172.16.0.0     255.255.0.0
192.168.10.0   255.255.255.
192.168.20.0   255.255.255.
192.168.255.0  255.255.255.
192.168.255.4  255.255.255.
```

```
VSP9000-2:1#% show ip route
==================================================================================================
                                    IP Route - GlobalRouter
==================================================================================================
DST            MASK            NEXT                NH-VRF          COST IF    PROT AGE TYPE PRF
--------------------------------------------------------------------------------------------------
10.0.0.91      255.255.255.255 VSP9000-1           GlobalRouter    10   4051  ISIS 0   IBS  7
10.0.0.92      255.255.255.255 10.0.0.92           -               1    0     LOC  0   DB   0
10.0.0.93      255.255.255.255 VSP9000-3           GlobalRouter    10   4051  ISIS 0   IBS  7
10.0.0.94      255.255.255.255 192.168.255.2       GlobalRouter    11    5/4  OSPF 0   IB   20
172.16.0.0     255.255.0.0     VSP9000-3           GlobalRouter    10   4051  ISIS 0   IBS  7
192.168.10.0   255.255.255.0   192.168.255.2       GlobalRouter    11    5/4  OSPF 0   IB   20
192.168.20.0   255.255.255.0   192.168.255.2       GlobalRouter    1     5/4  OSPF 0   IB   125
192.168.255.0  255.255.255.252 192.168.255.1       -               1     5/4  LOC  0   DB   0
192.168.255.4  255.255.255.252 192.168.255.2       GlobalRouter    2     5/4  OSPF 0   IB   20
```

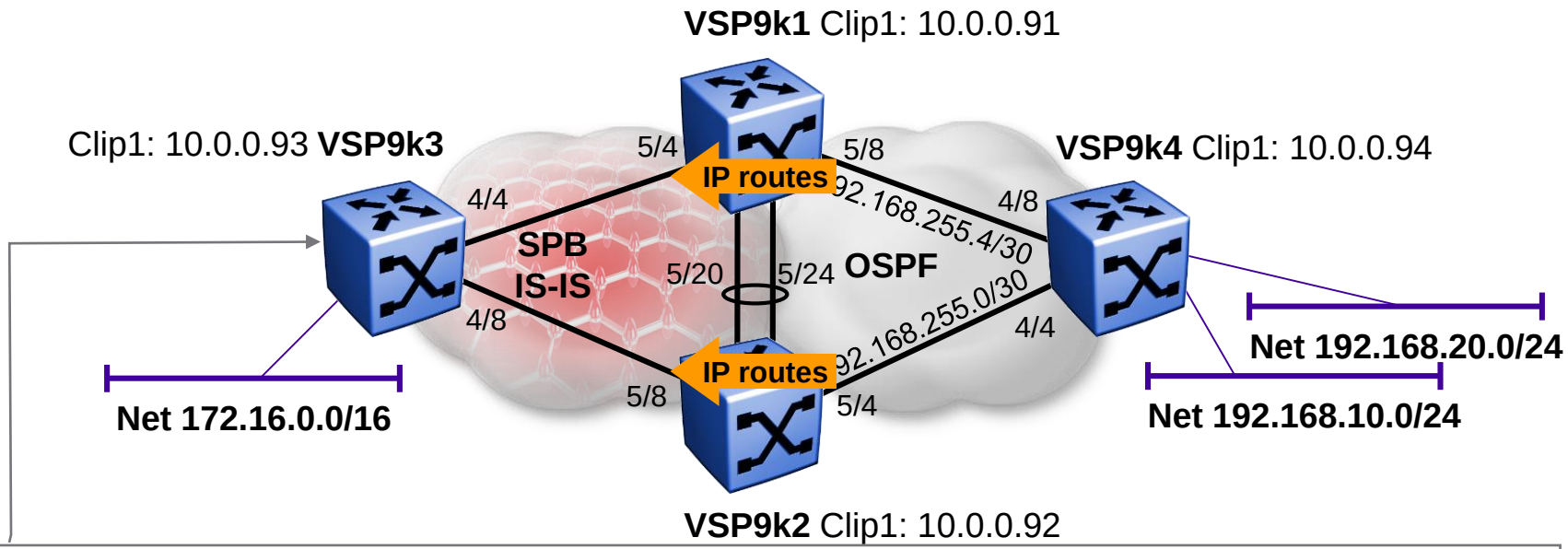
ISIS Accept policies to stop routing loops
OSPF ➔ IS-IS Redistribution




```
router isis
   redistribute ospf
   redistribute ospf enable
exit
isis apply redistribute ospf
```

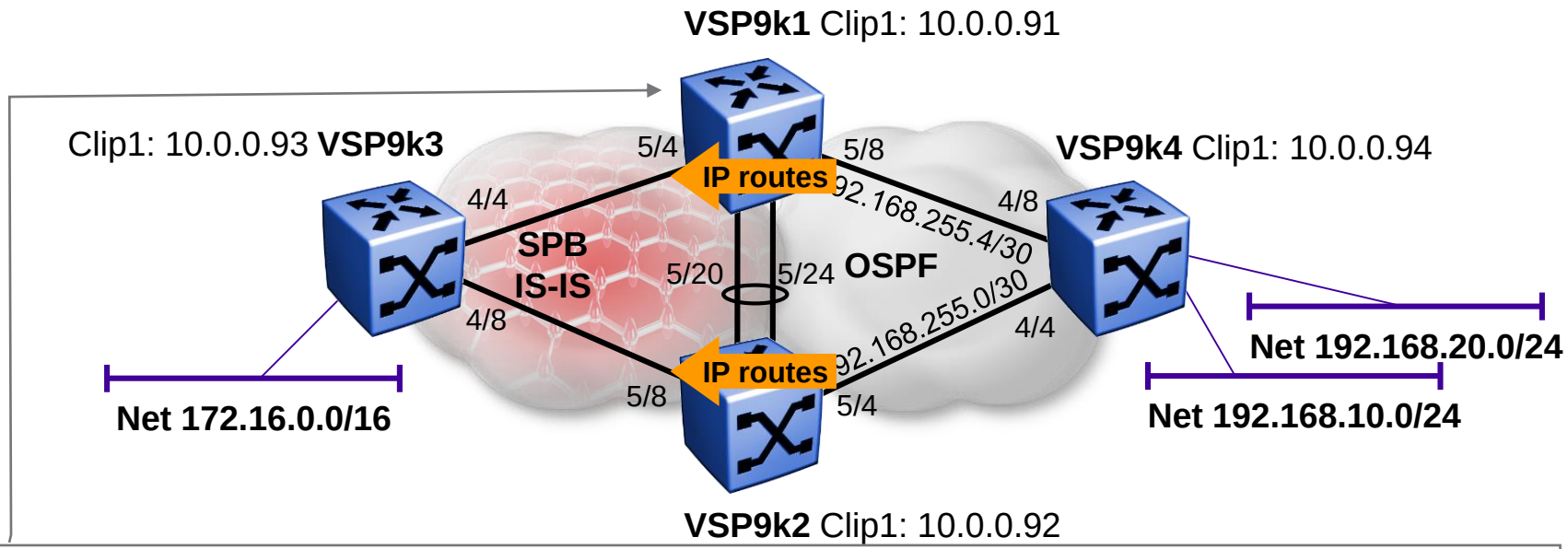
- We can safely redistribute all OSPF routes
- As ISIS route have a default higher preference (7) there is no chance an OSPF route can replace an existing ISIS one

ISIS Accept policies to stop routing loops
OSPF ➔ IS-IS Redistribution / Looking good...



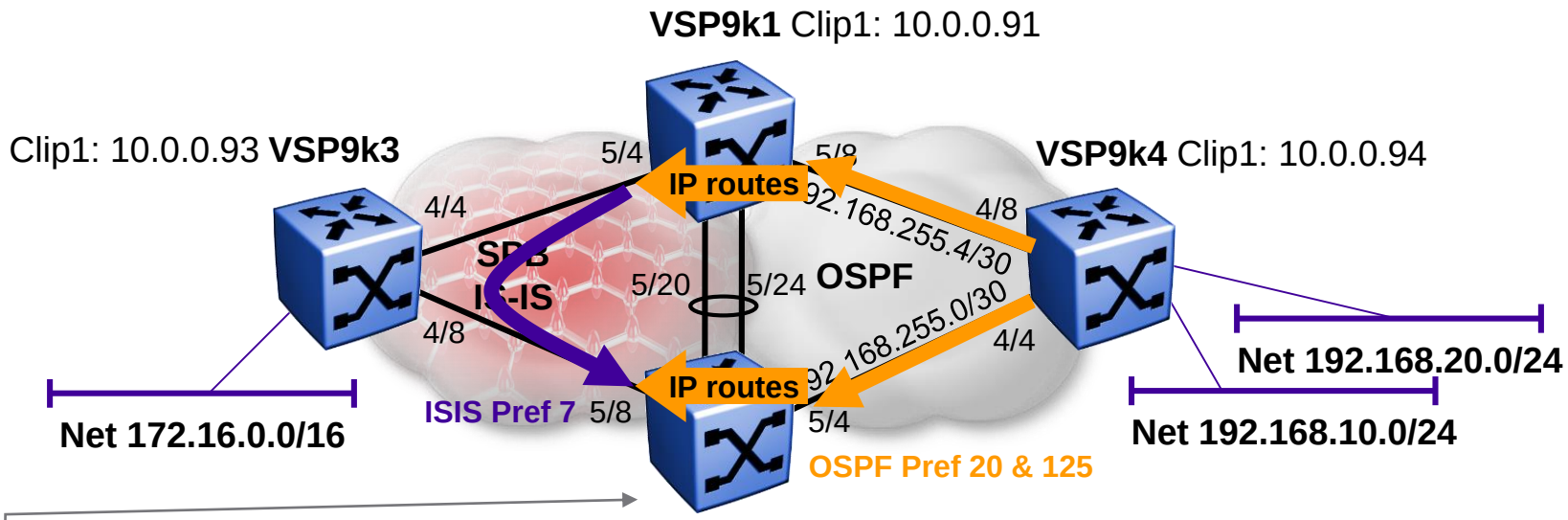

```
VSP9000-3:1#% show ip route
================================================================================================
                                    IP Route - GlobalRouter
================================================================================================
DST             MASK            NEXT                NH-VRF          COST IF    PROT AGE TYPE PRF
------------------------------------------------------------------------------------------------
10.0.0.91       255.255.255.255 VSP9000-1           GlobalRouter    10   4051  ISIS 0   IBS  7
10.0.0.92       255.255.255.255 VSP9000-2           GlobalRouter    10   4051  ISIS 0   IBS  7
10.0.0.93       255.255.255.255 10.0.0.93           -               1    0     LOC  0   DB   0
10.0.0.94       255.255.255.255 VSP9000-1           GlobalRouter    10   4051  ISIS 0   IBS  7
172.16.0.0      255.255.0.0     172.16.0.1          -               1    0     LOC  0   DB   0
192.168.10.0    255.255.255.0   VSP9000-1           GlobalRouter    10   4051  ISIS 0   IBS  7
192.168.20.0    255.255.255.0   VSP9000-1           GlobalRouter    10   4051  ISIS 0   IBS  7
192.168.255.0   255.255.255.252 VSP9000-1           GlobalRouter    10   4051  ISIS 0   IBS  7
192.168.255.4   255.255.255.252 VSP9000-2           GlobalRouter    10   4051  ISIS 0   IBS  7
```

ISIS Accept policies to stop routing loops
OSPF ➔ IS-IS Redistribution / Looking good...




```
VSP9000-1:1#% show ip route
=================================================================================================
                                    IP Route - GlobalRouter
=================================================================================================
DST             MASK            NEXT                NH-VRF          COST IF    PROT AGE TYPE PRF
-------------------------------------------------------------------------------------------------
10.0.0.91       255.255.255.255 10.0.0.91           -               1    0     LOC  0   DB   0
10.0.0.92       255.255.255.255 VSP9000-2           GlobalRouter    10   4051  ISIS 0   IBS  7
10.0.0.93       255.255.255.255 VSP9000-3           GlobalRouter    10   4051  ISIS 0   IBS  7
10.0.0.94       255.255.255.255 192.168.255.6       GlobalRouter    11    5/8  OSPF 0   IB   20
172.16.0.0      255.255.0.0     VSP9000-3           GlobalRouter    10   4051  ISIS 0   IBS  7
192.168.10.0    255.255.255.0   192.168.255.6       GlobalRouter    11    5/8  OSPF 0   IB   20
192.168.20.0    255.255.255.0   192.168.255.6       GlobalRouter    1     5/8  OSPF 0   IB   125
192.168.255.0   255.255.255.252 192.168.255.6       GlobalRouter    2     5/8  OSPF 0   IB   20
192.168.255.4   255.255.255.252 192.168.255.5       -               1     5/8  LOC  0   DB   0
```

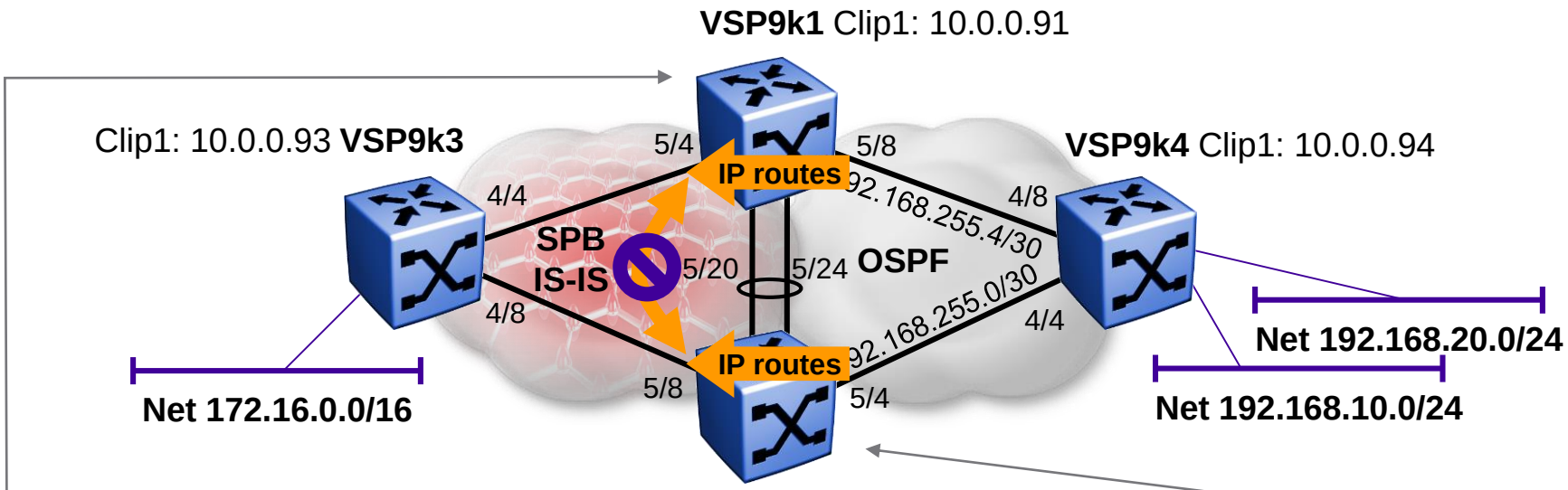
ISIS Accept policies to stop routing loops
OSPF ➔ IS-IS Redistribution / Oops!!




```
VSP9000-2:1#% show ip route
================================================================================================
                                    IP Route - GlobalRouter
================================================================================================
DST             MASK            NEXT            NH-VRF          COST IF    PROT AGE TYPE PRF
------------------------------------------------------------------------------------------------
10.0.0.91       255.255.255.255 VSP9000-1       GlobalRouter    10   4051  ISIS 0   IBS  7
10.0.0.92       255.255.255.255 10.0.0.92       -               1    0     LOC  0   DB   0
10.0.0.93       255.255.255.255 VSP9000-3       GlobalRouter    10   4051  ISIS 0   IBS  7
10.0.0.94       255.255.255.255 VSP9000-1       GlobalRouter    10   4051  ISIS 0   IBS  7
172.16.0.0      255.255.0.0     VSP9000-3       GlobalRouter    10   4051  ISIS 0   IBS  7
192.168.10.0    255.255.255.0   VSP9000-1       GlobalRouter    10   4051  ISIS 0   IBS  7
192.168.20.0    255.255.255.0   VSP9000-1       GlobalRouter    10   4051  ISIS 0   IBS  7
192.168.255.0   255.255.255.252 192.168.255.1   -               1    5/4   LOC  0   DB   0
192.168.255.4   255.255.255.252 192.168.255.2   GlobalRouter    2    5/4   OSPF 0   IB   20
```

Argh!

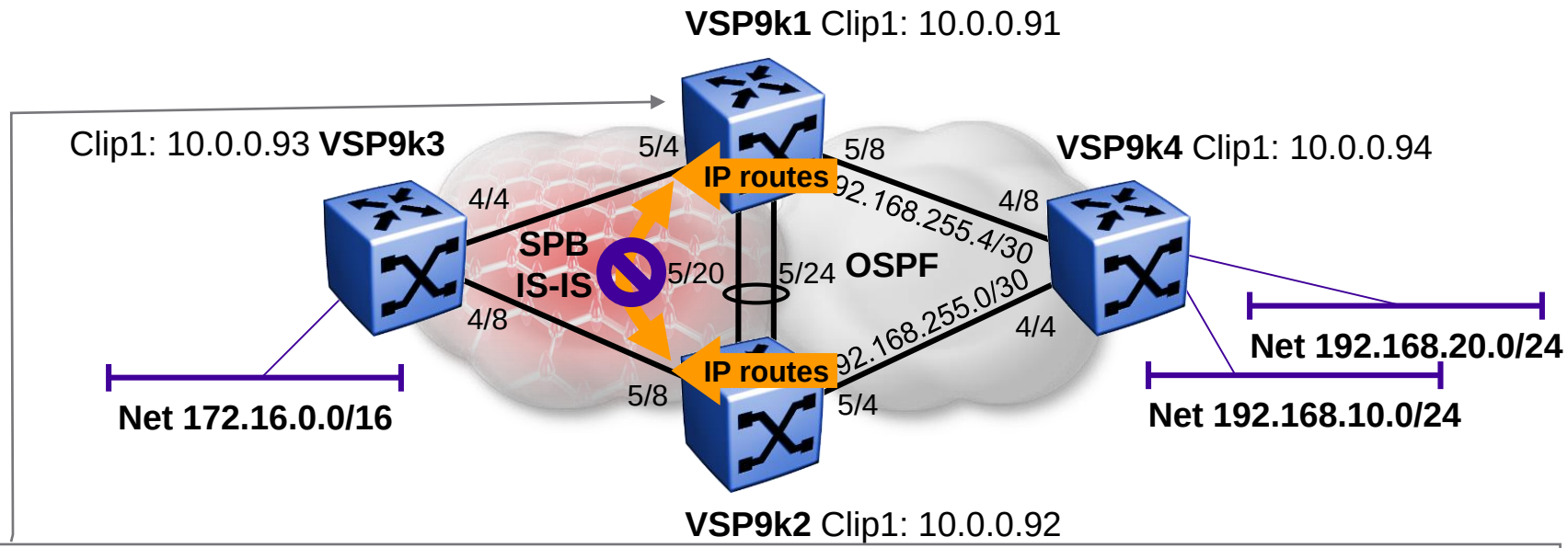
ISIS Accept policies to stop routing loops
Config ISIS Accept Policy




```
route-map "reject" 1
   no permit
   enable
exit
router isis
   accept adv-rtr 0.00.92
   accept adv-rtr 0.00.92 route-map "reject"
   accept adv-rtr 0.00.92 enable
exit
isis apply accept
```

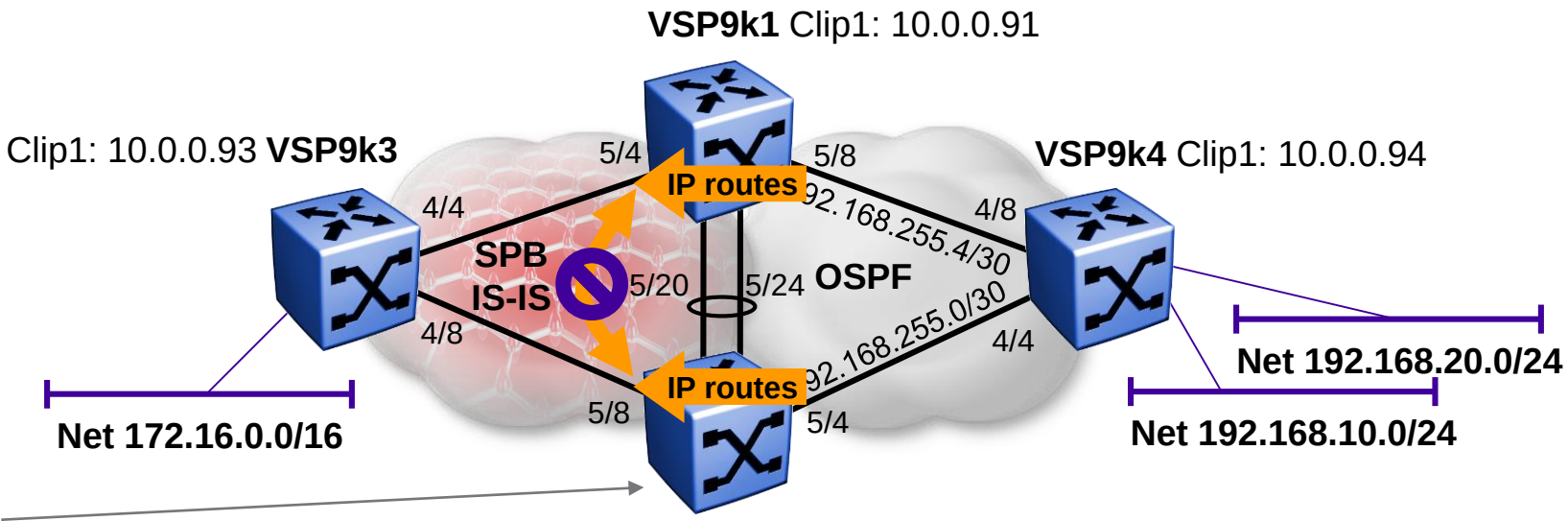
```
route-map "reject" 1
   no permit
   enable
exit
router isis
   accept adv-rtr 0.00.91
   accept adv-rtr 0.00.91 route-map "reject"
   accept adv-rtr 0.00.91 enable
exit
isis apply accept
```

ISIS Accept policies to stop routing loops Checking - ok



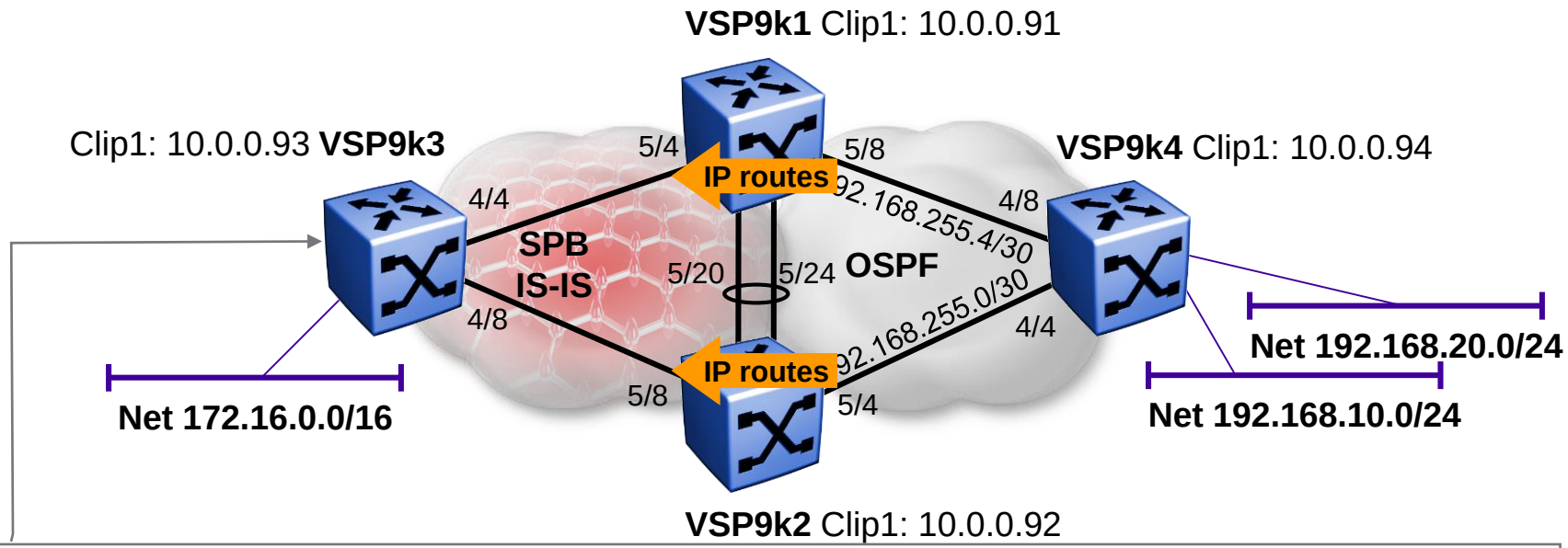

```
VSP9000-1:1#% show ip route
================================================================================================
                                        IP Route - GlobalRouter
================================================================================================
DST             MASK            NEXT                NH-VRF          COST IF    PROT AGE TYPE PRF
------------------------------------------------------------------------------------------------
10.0.0.91       255.255.255.255 10.0.0.91           -               1    0     LOC  0   DB   0
10.0.0.93       255.255.255.255 VSP9000-3           GlobalRouter    10   4051  ISIS 0   IBS  7
10.0.0.94       255.255.255.255 192.168.255.6       GlobalRouter    11    5/8  OSPF 0   IB   20
172.16.0.0      255.255.0.0     VSP9000-3           GlobalRouter    10   4051  ISIS 0   IBS  7
192.168.10.0    255.255.255.0   192.168.255.6       GlobalRouter    11    5/8  OSPF 0   IB   20
192.168.20.0    255.255.255.0   192.168.255.6       GlobalRouter    1     5/8  OSPF 0   IB   125
192.168.255.0   255.255.255.252 192.168.255.6       GlobalRouter    2     5/8  OSPF 0   IB   20
192.168.255.4   255.255.255.252 192.168.255.5       -               1     5/8  LOC  0   DB   0
```

ISIS Accept policies to stop routing loops Checking - ok



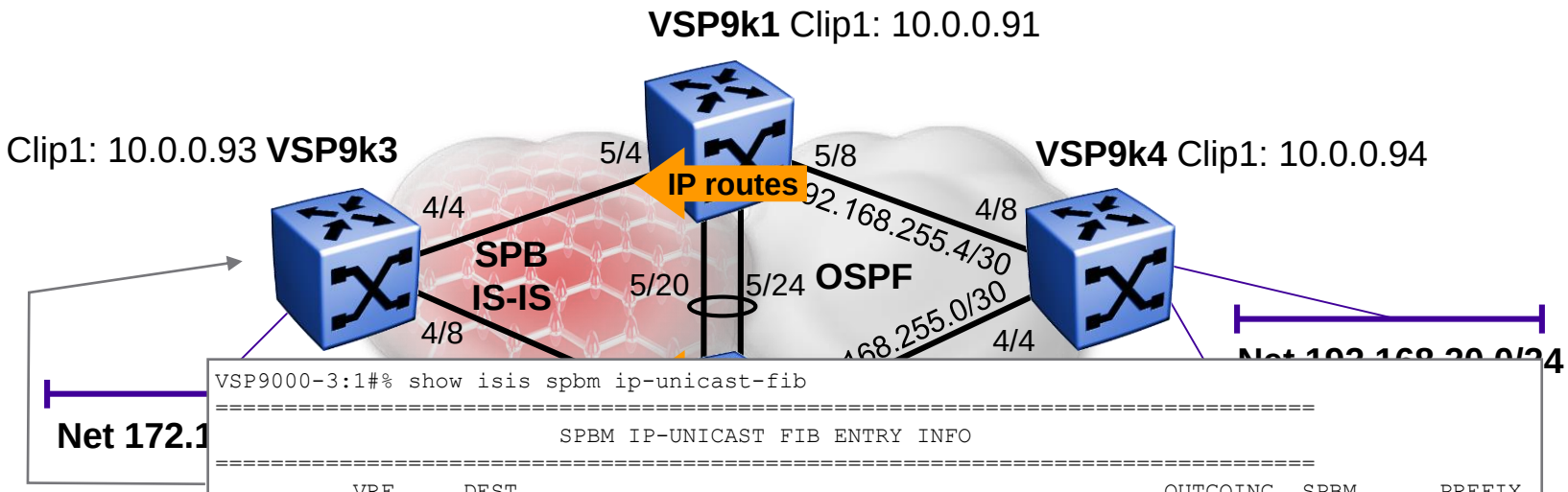

```
VSP9000-2:1#% show ip route
=================================================================================================
                                    IP Route - GlobalRouter
=================================================================================================
DST             MASK            NEXT            NH-VRF          COST IF    PROT AGE TYPE PRF
-------------------------------------------------------------------------------------------------
10.0.0.92       255.255.255.255 10.0.0.92       -               1    0     LOC  0   DB   0
10.0.0.93       255.255.255.255 VSP9000-3       GlobalRouter    10   4051  ISIS 0   IBS  7
10.0.0.94       255.255.255.255 192.168.255.2   GlobalRouter    11    5/4  OSPF 0   IB   20
172.16.0.0      255.255.0.0     VSP9000-3       GlobalRouter    10   4051  ISIS 0   IBS  7
192.168.10.0    255.255.255.0   192.168.255.2   GlobalRouter    11    5/4  OSPF 0   IB   20
192.168.20.0    255.255.255.0   192.168.255.2   GlobalRouter    1     5/4  OSPF 0   IB   125
192.168.255.0   255.255.255.252 192.168.255.1   -               1     5/4  LOC  0   DB   0
192.168.255.4   255.255.255.252 192.168.255.2   GlobalRouter    2     5/4  OSPF 0   IB   20
```

ISIS Accept policies to stop routing loops Checking - ok




```
VSP9000-3:1#% show ip route
=============================================================================================================
                                        IP Route - GlobalRouter
=============================================================================================================
DST             MASK            NEXT                NH-VRF          COST IF    PROT AGE TYPE PRF
-------------------------------------------------------------------------------------------------------------
10.0.0.91       255.255.255.255 VSP9000-1           GlobalRouter    10   4051  ISIS 0   IBS  7
10.0.0.92       255.255.255.255 VSP9000-2           GlobalRouter    10   4051  ISIS 0   IBS  7
10.0.0.93       255.255.255.255 10.0.0.93           -               1    0     LOC  0   DB   0
10.0.0.94       255.255.255.255 VSP9000-1           GlobalRouter    10   4051  ISIS 0   IBS  7
172.16.0.0      255.255.0.0     172.16.0.1          -               1    0     LOC  0   DB   0
192.168.10.0    255.255.255.0   VSP9000-1           GlobalRouter    10   4051  ISIS 0   IBS  7
192.168.20.0    255.255.255.0   VSP9000-1           GlobalRouter    10   4051  ISIS 0   IBS  7
192.168.255.0   255.255.255.252 VSP9000-1           GlobalRouter    10   4051  ISIS 0   IBS  7
192.168.255.4   255.255.255.252 VSP9000-2           GlobalRouter    10   4051  ISIS 0   IBS  7
```

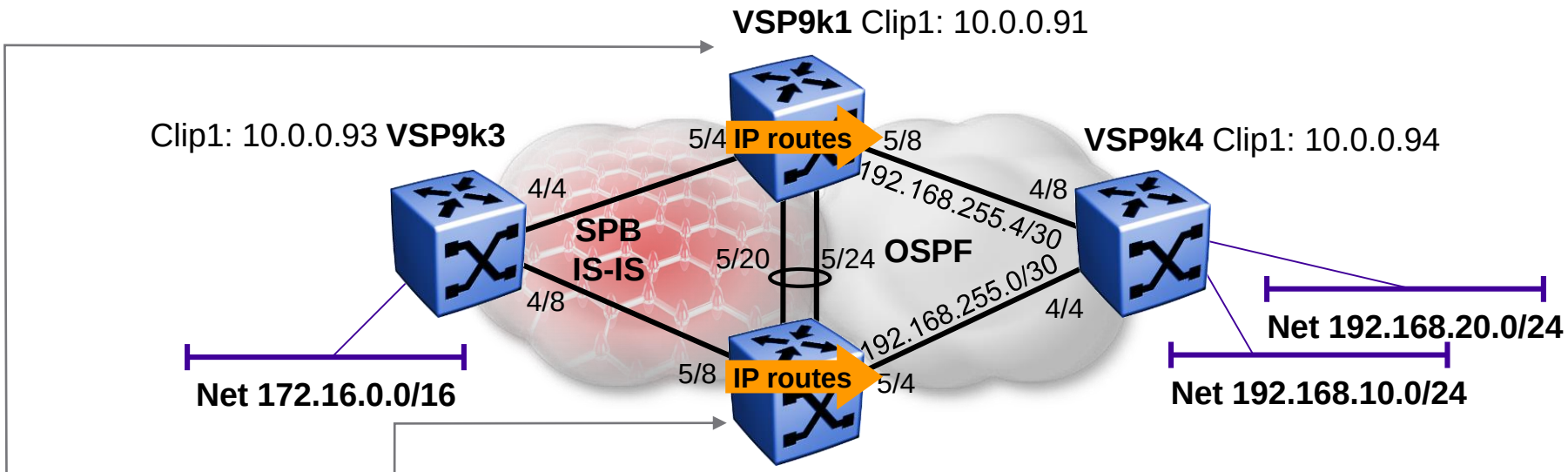
ISIS Accept policies to stop routing loops
SPBM IP unicast FIB



- Once the issue is resolved, VSP9k3 will get the OSPF routes via both VSP9k1 & VSP9k2

```
VSP9000-3:1#% show isis spbm ip-unicast-fib
================================================================================
                        SPBM IP-UNICAST FIB ENTRY INFO
================================================================================
             VRF      DEST                                          OUTGOING  SPBM       PREFIX
VRF          ISID     ISID     Destination        NH BEB          VLAN INTERFACE COST       COST
--------------------------------------------------------------------------------
GRT          -        -        10.0.0.91/32       VSP9000-1       4051 4/4       10         1
GRT          -        -        10.0.0.91/32       VSP9000-1       4052 4/4       10         1
GRT          -        -        10.0.0.92/32       VSP9000-2       4051 4/8       10         1
GRT          -        -        10.0.0.92/32       VSP9000-2       4052 4/8       10         1
GRT          -        -        10.0.0.94/32       VSP9000-1       4051 4/4       10        11
GRT          -        -        10.0.0.94/32       VSP9000-1       4052 4/4       10        11
GRT          -        -        10.0.0.94/32       VSP9000-2       4051 4/8       10        11
GRT          -        -        10.0.0.94/32       VSP9000-2       4052 4/8       10        11
GRT          -        -        192.168.10.0/24    VSP9000-1       4051 4/4       10        11
GRT          -        -        192.168.10.0/24    VSP9000-1       4052 4/4       10        11
GRT          -        -        192.168.10.0/24    VSP9000-2       4051 4/8       10        11
GRT          -        -        192.168.10.0/24    VSP9000-2       4052 4/8       10        11
GRT          -        -        192.168.20.0/24    VSP9000-1       4051 4/4       10         1
GRT          -        -        192.168.20.0/24    VSP9000-1       4052 4/4       10         1
GRT          -        -        192.168.20.0/24    VSP9000-2       4051 4/8       10         1
GRT          -        -        192.168.20.0/24    VSP9000-2       4052 4/8       10         1
GRT          -        -        192.168.255.0/30   VSP9000-1       4051 4/4       10         2
GRT          -        -        192.168.255.0/30   VSP9000-1       4052 4/4       10         2
GRT          -        -        192.168.255.4/30   VSP9000-2       4051 4/8       10         2
GRT          -        -        192.168.255.4/30   VSP9000-2       4052 4/8       10         2
```

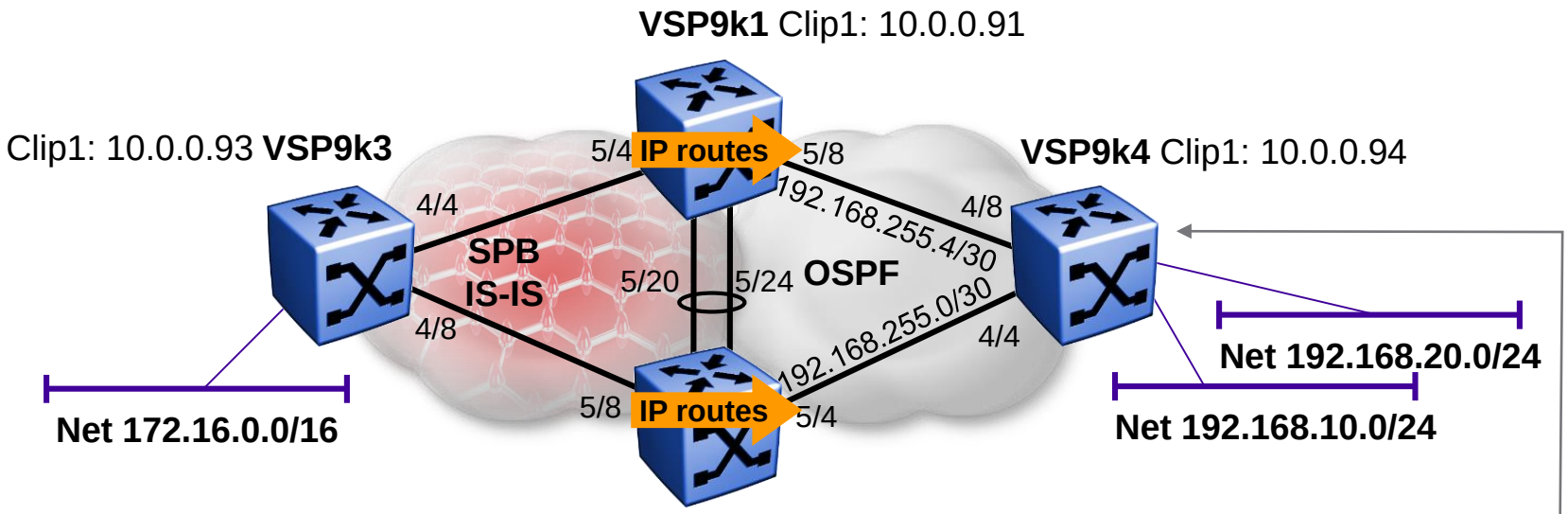
ISIS Accept policies to stop routing loops
IS-IS ➔ OSPF Redistribution




```
router ospf
   as-boundary-router enable
   redistribute isis
   redistribute isis enable
exit
ip ospf apply redistribute isis
```

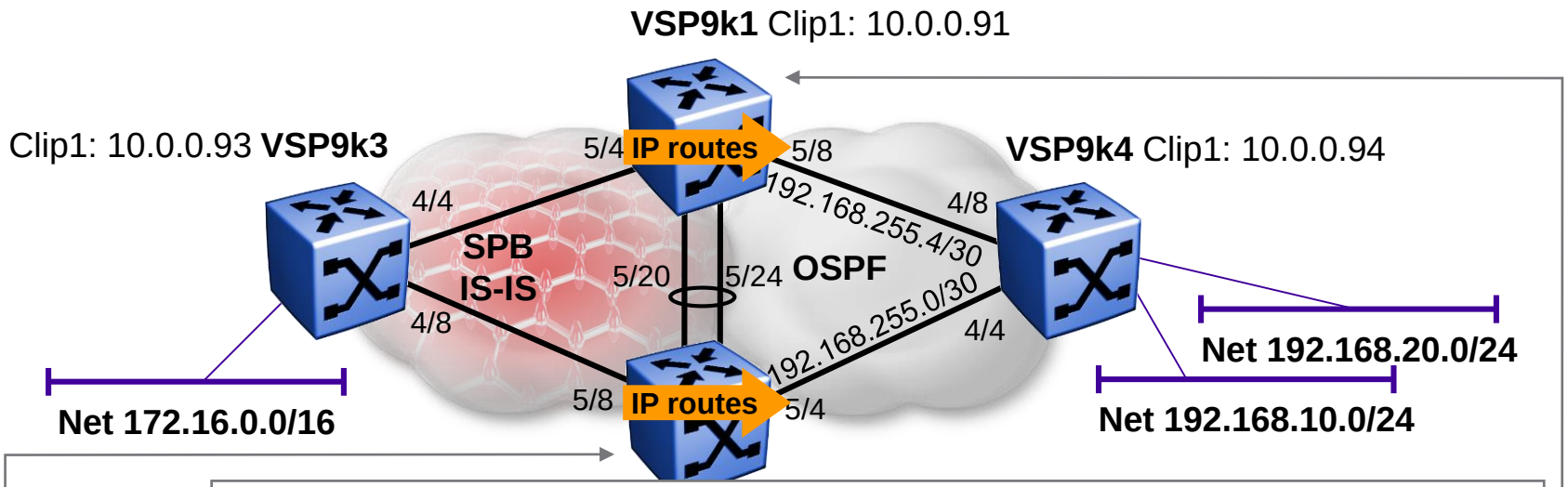
- We redistribute all IS-IS routes
- NOTE: VSP9k1 & VSP9k2 need to be OSPF ASBRs

ISIS Accept policies to stop routing loops
IS-IS ➔ OSPF Redistribution / Looking good...




```
VSP9000-4:1#% show ip route
================================================================================================
                                    IP Route - GlobalRouter
================================================================================================
DST             MASK            NEXT                NH-VRF          COST IF    PROT AGE TYPE PRF
------------------------------------------------------------------------------------------------
10.0.0.93       255.255.255.255 192.168.255.1       GlobalRouter    10    4/4  OSPF 0   IB   125
10.0.0.94       255.255.255.255 10.0.0.94           -               1     0    LOC  0   DB   0
172.16.0.0      255.255.0.0     192.168.255.1       GlobalRouter    10    4/4  OSPF 0   IB   125
192.168.10.0    255.255.255.0   192.168.10.1        -               1     0    LOC  0   DB   0
192.168.20.0    255.255.255.0   192.168.20.1        -               1     0    LOC  0   DB   0
192.168.255.0   255.255.255.252 192.168.255.2       -               1     4/4  LOC  0   DB   0
192.168.255.4   255.255.255.252 192.168.255.6       -               1     4/8  LOC  0   DB   0
```

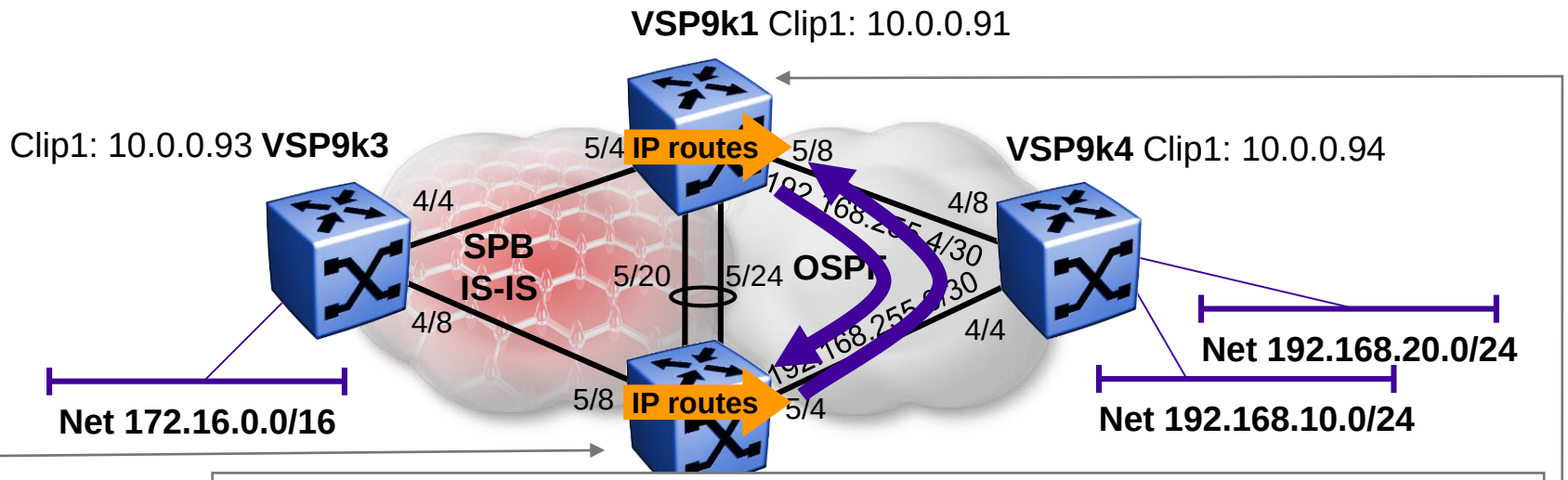
ISIS Accept policies to stop routing loops
IS-IS ➔ OSPF Redistribution / Looking good...




```
VSP9000-1:1#% show ip route
================================================================================================================
                                        IP Route - GlobalRouter
================================================================================================================
DST              MASK             NEXT                NH-VRF           COST IF    PROT AGE TYPE PRF
----------------------------------------------------------------------------------------------------------------
10.0.0.91        255.255.255.255 10.0.0.91           -                1    0     LOC  0   DB   0
10.0.0.93        255.255.255.255 VSP9000-3           GlobalRouter     10   4051  ISIS 0   IBS  7
10.0.0.94        255.255.255.255 192.168.255.6       GlobalRouter     11    5/8  OSPF 0   IB   20
172.16.0.0       255.255.0.0     VSP9000-3           GlobalRouter     10   4051  ISIS 0   IBS  7
192.168.10.0     255.255.255.0   192.168.255.6       GlobalRouter     11    5/8  OSPF 0   IB   20
192.168.20.0     255.255.255.0   192.168.255.6       GlobalRouter     1     5/8  OSPF 0   IB   125
192.168.255.0    255.255.255.252 192.168.255.6       GlobalRouter     2     5/8  OSPF 0   IB   20
192.168.255.4    255.255.255.252 192.168.255.5       -                1     5/8  LOC  0   DB   0
```

```
VSP9000-2:1#% show ip rout
==========================

==========================
DST              MASK
--------------------------
10.0.0.92        255.255.255.255 10.0.0.92           -                1    0     LOC  0   DB   0
10.0.0.93        255.255.255.255 VSP9000-3           GlobalRouter     10   4051  ISIS 0   IBS  7
10.0.0.94        255.255.255.255 192.168.255.2       GlobalRouter     11    5/4  OSPF 0   IB   20
172.16.0.0       255.255.0.0     VSP9000-3           GlobalRouter     10   4051  ISIS 0   IBS  7
192.168.10.0     255.255.255.0   192.168.255.2       GlobalRouter     11    5/4  OSPF 0   IB   20
192.168.20.0     255.255.255.0   192.168.255.2       GlobalRouter     1     5/4  OSPF 0   IB   125
192.168.255.0    255.255.255.252 192.168.255.1       -                1     5/4  LOC  0   DB   0
192.168.255.4    255.255.255.252 192.168.255.2       GlobalRouter     2     5/4  OSPF 0   IB   20
```

ISIS Accept policies to stop routing loops
IS-IS ➔ OSPF Redistribution / … not so good

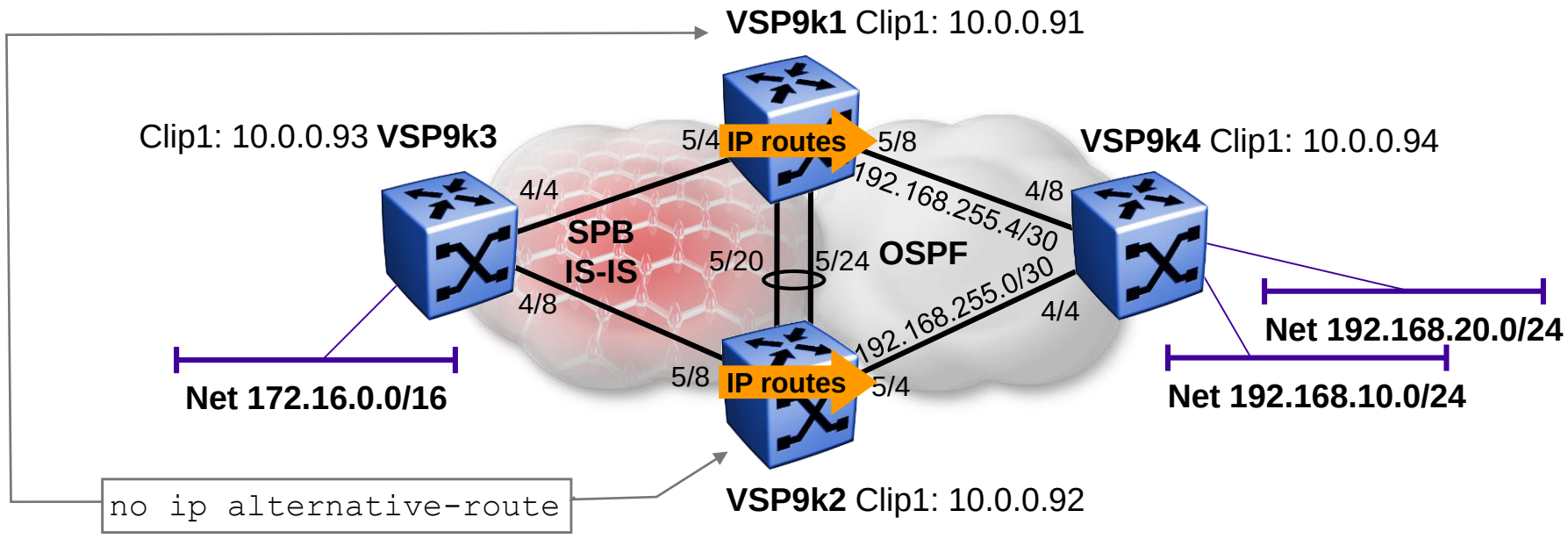


Oops!

```
VSP9000-1:1#% show ip route alternative
================================================================================================
                                    IP Route - GlobalRouter
================================================================================================
DST             MASK            NEXT                NH-VRF          COST IF    PROT AGE TYPE PRF
------------------------------------------------------------------------------------------------
10.0.0.91       255.255.255.255 10.0.0.91           -               1    0     LOC  0   DB   0
10.0.0.93       255.255.255.255 VSP9000-3           GlobalRouter    10   4051  ISIS 0   IBS  7
10.0.0.93       255.255.255.255 192.168.255.6       GlobalRouter    10   5/8   OSPF 0   IA   125
10.0.0.94       255.255.255.255 192.168.255.6       GlobalRouter    11   5/8   OSPF 0   IB   20
172.16.0.0      255.255.0.0     VSP9000-3           GlobalRouter    10   4051  ISIS 0   IBS  7
172.16.0.0      255.255.0.0     192.168.255.6       GlobalRouter    10   5/8   OSPF 0   IA   125
192.168.10.0    255.255.255.0   192.168.255.6       GlobalRouter    11   5/8   OSPF 0   IB   20
192.168.20.0    255.255.255.0   192.168.255.6       GlobalRouter    1    5/8   OSPF 0   IB   125
192.168.255.0   255.255.255.252 192.168.255.6       GlobalRouter    2    5/8   OSPF 0   IB   20
192.168.255.4   255.255.255.252 192.168.255.5       -               1    5/8   LOC  0   DB   0
```

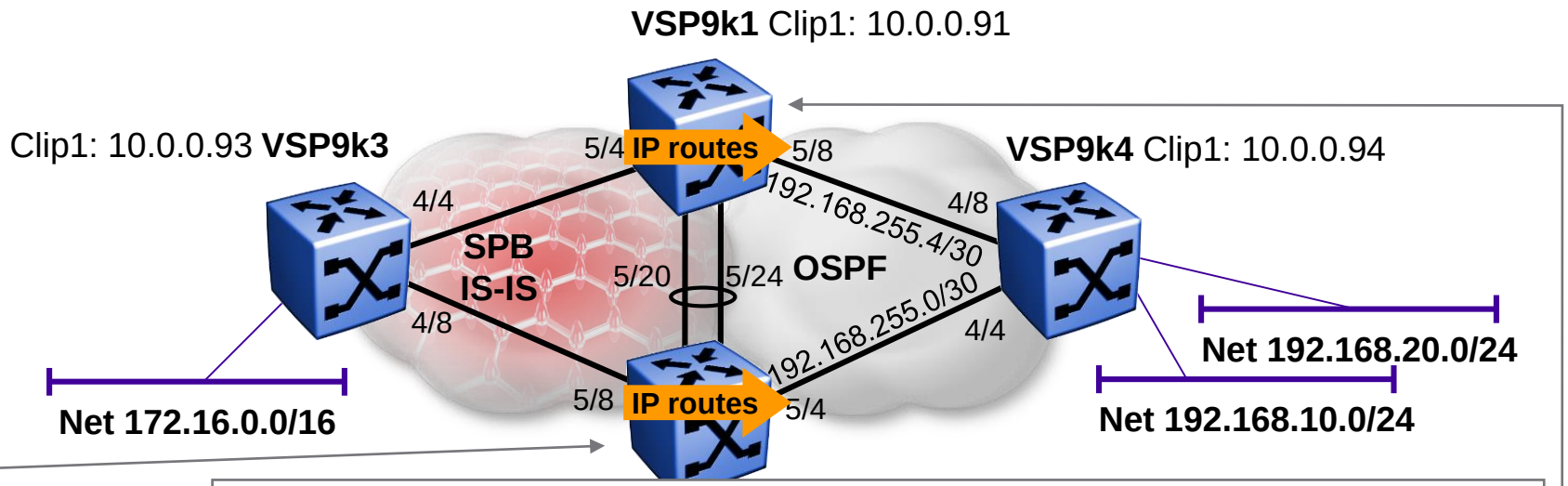
```
VSP9000-2:1#% show ip route
============================

============================
DST             MASK
----------------------------
10.0.0.92       255.255.255.
10.0.0.93       255.255.255.
10.0.0.93       255.255.255.
10.0.0.94       255.255.255.
172.16.0.0      255.255.0.0     VSP9000-3           GlobalRouter    10   4051  ISIS 0   IBS  7
172.16.0.0      255.255.0.0     192.168.255.2       GlobalRouter    10   5/4   OSPF 0   IA   125
192.168.10.0    255.255.255.0   192.168.255.2       GlobalRouter    11   5/4   OSPF 0   IB   20
192.168.20.0    255.255.255.0   192.168.255.2       GlobalRouter    1    5/4   OSPF 0   IB   125
192.168.255.0   255.255.255.252 192.168.255.1       -               1    5/4   LOC  0   DB   0
192.168.255.4   255.255.255.252 192.168.255.2       GlobalRouter    2    5/4   OSPF 0   IB   20
```

ISIS Accept policies to stop routing loops
Config no IP alternative routes



- ISIS routes are preferred over OSPF ones, so the “alternative” OSPF routes that VSP9k1 & VSP9k2 learn from each other for ISIS networks that have been re-distributed into OSPF will not get installed
- However, if those ISIS routes were to become unavailable (e.g. reboot of VSP9k3) then both VSP9k1 & VSP9k2 would immediately remove the ISIS routes and replace them with these alternative OSPF routes, which would cause a temporary routing loop, with VSP9k1 & VSP9k2 temporarily announcing those routes back into SPB (which is where they originated from)
- To avoid this, one could also create OSPF Accept policies to prevent VSP9k1 & VSP9k2 from learning OSPF routes from each other (as we did for ISIS); however a better and more general solution is to simply disable alternative IP routes on the border routers, which is what we are doing here. This approach will also work if the OSPF cloud is replaced with a RIP cloud (where accept policies would not work)

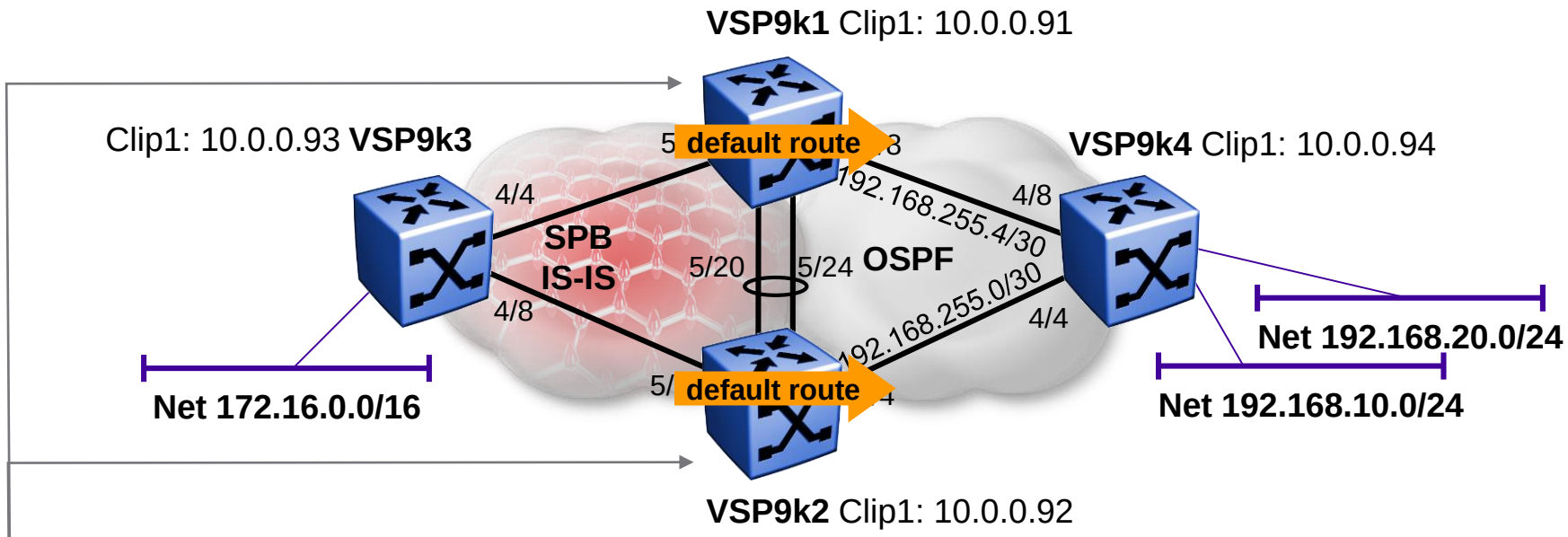
ISIS Accept policies to stop routing loops
IS-IS ➔ OSPF Redistribution / … fixed!




```
VSP9000-1:1#% show ip route alternative
================================================================================================================
                                        IP Route - GlobalRouter
================================================================================================================
DST             MASK            NEXT                NH-VRF           COST IF    PROT AGE TYPE PRF
----------------------------------------------------------------------------------------------------------------
10.0.0.92       255.255.255.255 10.0.0.92           -                1    0     LOC  0   DB   0
10.0.0.93       255.255.255.255 VSP9000-3           GlobalRouter     10   4051  ISIS 0   IBS  7
10.0.0.94       255.255.255.255 192.168.255.2       GlobalRouter     11    5/4  OSPF 0   IB   20
172.16.0.0      255.255.0.0     VSP9000-3           GlobalRouter     10   4051  ISIS 0   IBS  7
192.168.10.0    255.255.255.0   192.168.255.2       GlobalRouter     11    5/4  OSPF 0   IB   20
192.168.20.0    255.255.255.0   192.168.255.2       GlobalRouter     1     5/4  OSPF 0   IB   125
192.168.255.0   255.255.255.252 192.168.255.1       -                1     5/4  LOC  0   DB   0
192.168.255.4   255.255.255.252 192.168.255.2       GlobalRouter     2     5/4  OSPF 0   IB   20
```

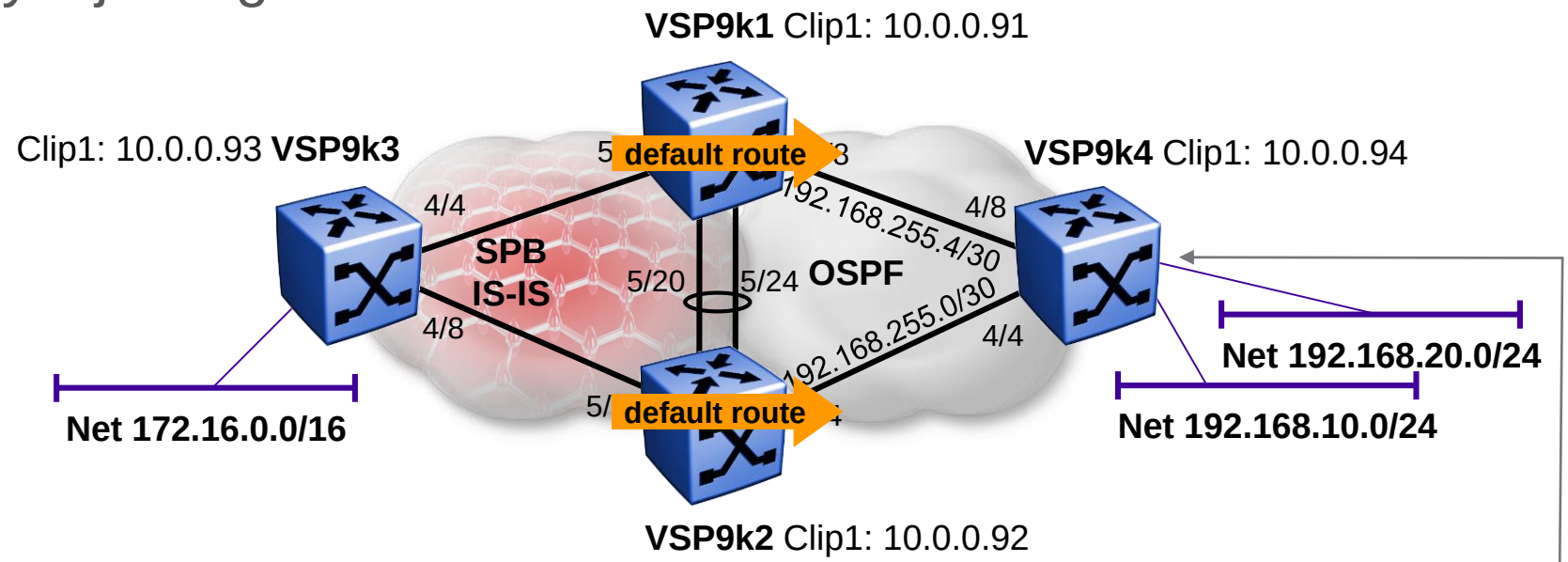
```
VSP9000-2:1#% show ip route
================================

================================
DST             MASK
--------------------------------
10.0.0.91       255.255.255.
10.0.0.93       255.255.255.255 VSP9000-3           GlobalRouter     10   4051  ISIS 0   IBS  7
10.0.0.94       255.255.255.255 192.168.255.6       GlobalRouter     11    5/8  OSPF 0   IB   20
172.16.0.0      255.255.0.0     VSP9000-3           GlobalRouter     10   4051  ISIS 0   IBS  7
192.168.10.0    255.255.255.0   192.168.255.6       GlobalRouter     11    5/8  OSPF 0   IB   20
192.168.20.0    255.255.255.0   192.168.255.6       GlobalRouter     1     5/8  OSPF 0   IB   125
192.168.255.0   255.255.255.252 192.168.255.6       GlobalRouter     2     5/8  OSPF 0   IB   20
192.168.255.4   255.255.255.252 192.168.255.5       -                1     5/8  LOC  0   DB   0
```

ISIS Accept policies to stop routing loops
Only injecting a default route into OSPF



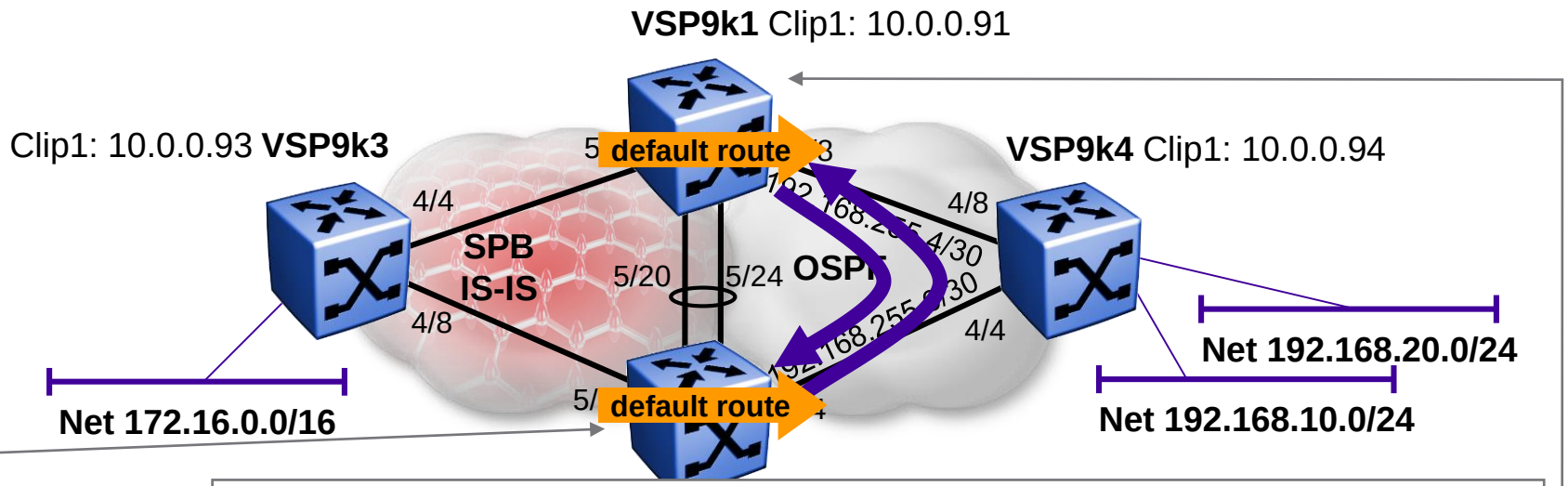

```
ip prefix-list "default" 0.0.0.0/0
route-map "inject-default" 1
   enable
   set injectlist "default"
exit
router ospf
   redistribute isis route-policy "inject-default"
exit
ip ospf apply redistribute isis
```

ISIS Accept policies to stop routing loops
Only injecting a default route into OSPF / Seems ok




```
VSP9000-4:1#% show ip route
================================================================================================
                                    IP Route - GlobalRouter
================================================================================================
DST             MASK            NEXT                NH-VRF          COST IF    PROT AGE TYPE PRF
------------------------------------------------------------------------------------------------
0.0.0.0         0.0.0.0         192.168.255.1       GlobalRouter    10    4/4  OSPF 0   IB   125
10.0.0.94       255.255.255.255 10.0.0.94           -               1     0    LOC  0   DB   0
192.168.10.0    255.255.255.0   192.168.10.1        -               1     0    LOC  0   DB   0
192.168.20.0    255.255.255.0   192.168.20.1        -               1     0    LOC  0   DB   0
192.168.255.0   255.255.255.252 192.168.255.2       -               1     4/4  LOC  0   DB   0
192.168.255.4   255.255.255.252 192.168.255.6       -               1     4/8  LOC  0   DB   0
```

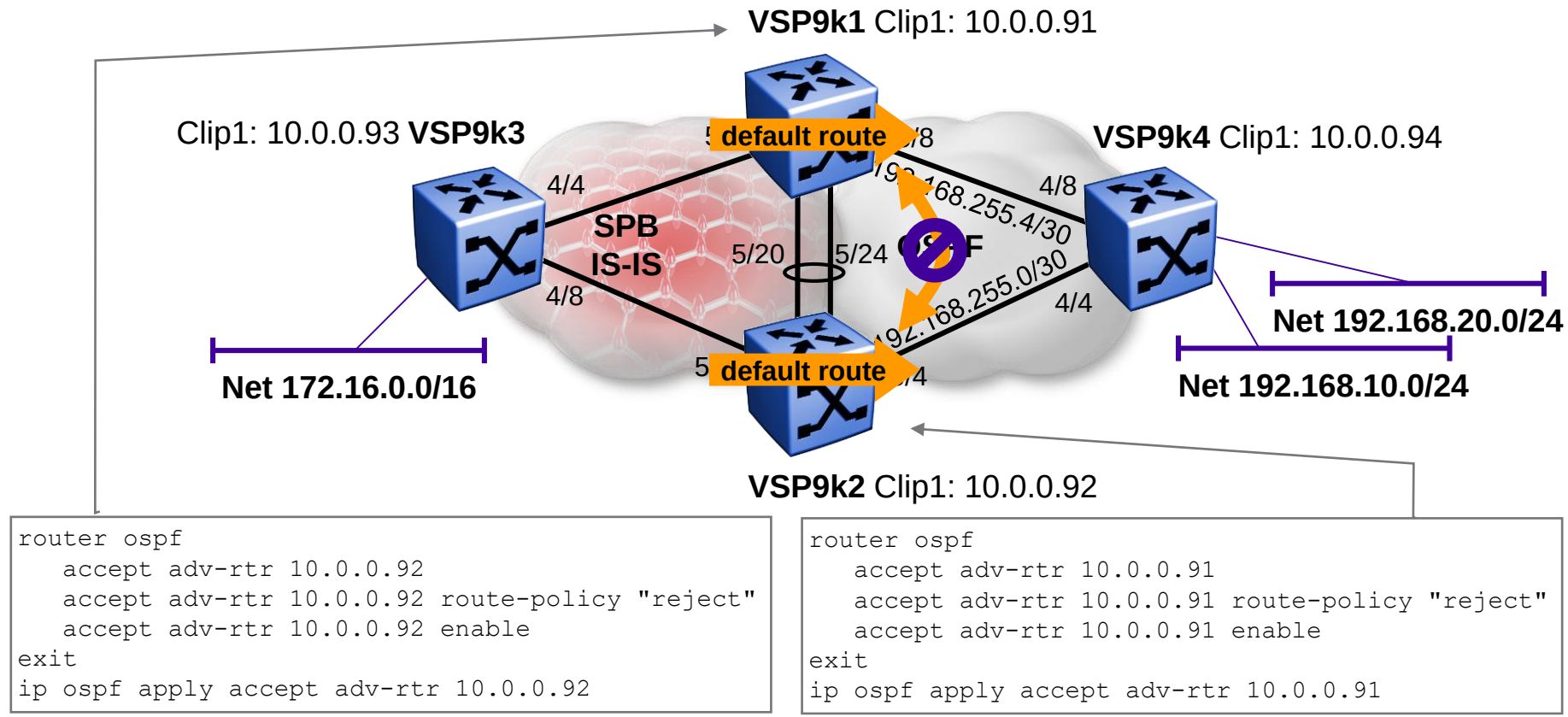
ISIS Accept policies to stop routing loops
Only injecting a default route into OSPF …problem




```
VSP9000-1:1#% show ip route
================================================================================================================
                                        IP Route - GlobalRouter
================================================================================================================
DST             MASK            NEXT                NH-VRF          COST IF    PROT AGE TYPE PRF
----------------------------------------------------------------------------------------------------------------
0.0.0.0         0.0.0.0         192.168.255.6       GlobalRouter    10     5/8   OSPF 0   IB   125
10.0.0.91       255.255.255.255 10.0.0.91           -               1      0     LOC  0   DB   0
10.0.0.93       255.255.255.255 VSP9000-3           GlobalRouter    10     4051  ISIS 0   IBS  7
10.0.0.94       255.255.255.255 192.168.255.6       GlobalRouter    11     5/8   OSPF 0   IB   20
172.16.0.0      255.255.0.0     VSP9000-3           GlobalRouter    10     4051  ISIS 0   IBS  7
192.168.10.0    255.255.255.0   192.168.255.6       GlobalRouter    11     5/8   OSPF 0   IB   20
192.168.20.0    255.255.255.0   192.168.255.6       GlobalRouter    1      5/8   OSPF 0   IB   125
192.168.255.0   255.255.255.252 192.168.255.5       -               1      5/8   LOC  0   DB   0
192.168.255.4   255.255.255.252 192.168.255.6       GlobalRouter    2      5/8   OSPF 0   IB   20
```

```
VSP9000-2:1#% show ip route
================================================================================================================
                                        IP Route - GlobalRouter
================================================================================================================
DST             MASK            NEXT                NH-VRF          COST IF    PROT AGE TYPE PRF
----------------------------------------------------------------------------------------------------------------
0.0.0.0         0.0.0.0         192.168.255.2       GlobalRouter    10     5/4   OSPF 0   IB   125
10.0.0.92       255.255.255.255 10.0.0.92           -               1      0     LOC  0   DB   0
10.0.0.93       255.255.255.255 VSP9000-3           GlobalRouter    10     4051  ISIS 0   IBS  7
10.0.0.94       255.255.255.255 192.168.255.2       GlobalRouter    11     5/4   OSPF 0   IB   20
172.16.0.0      255.255.0.0     VSP9000-3           GlobalRouter    10     4051  ISIS 0   IBS  7
192.168.10.0    255.255.255.0   192.168.255.2       GlobalRouter    11     5/4   OSPF 0   IB   20
192.168.20.0    255.255.255.0   192.168.255.2       GlobalRouter    1      5/4   OSPF 0   IB   125
192.168.255.0   255.255.255.252 192.168.255.1       -               1      5/4   LOC  0   DB   0
192.168.255.4   255.255.255.252 192.168.255.2       GlobalRouter    2      5/4   OSPF 0   IB   20
```

ISIS Accept policies to stop routing loops
Config OSPF Accept Policy

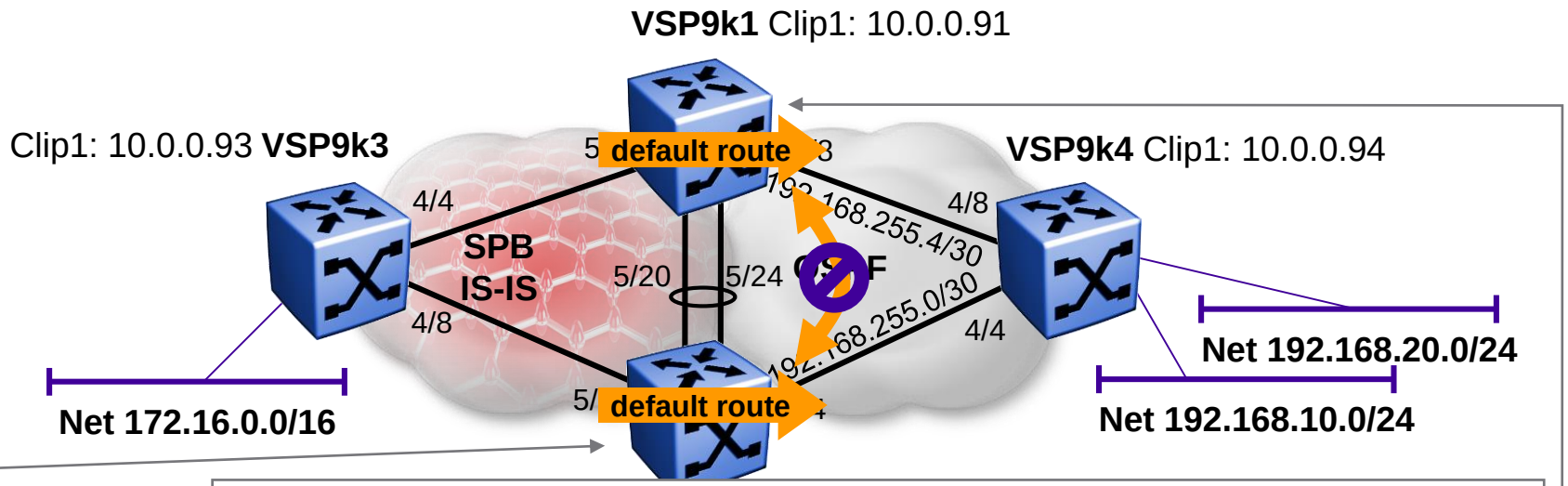



```
router ospf
   accept adv-rtr 10.0.0.92
   accept adv-rtr 10.0.0.92 route-policy "reject"
   accept adv-rtr 10.0.0.92 enable
exit
ip ospf apply accept adv-rtr 10.0.0.92
```

```
router ospf
   accept adv-rtr 10.0.0.91
   accept adv-rtr 10.0.0.91 route-policy "reject"
   accept adv-rtr 10.0.0.91 enable
exit
ip ospf apply accept adv-rtr 10.0.0.91
```

- In this setup the default route is injected into OSPF, but does not actually exist in ISIS. That is why the disabling of alternative IP routes did not work in this case, and we thus need to resort to OSPF Accept policies as well

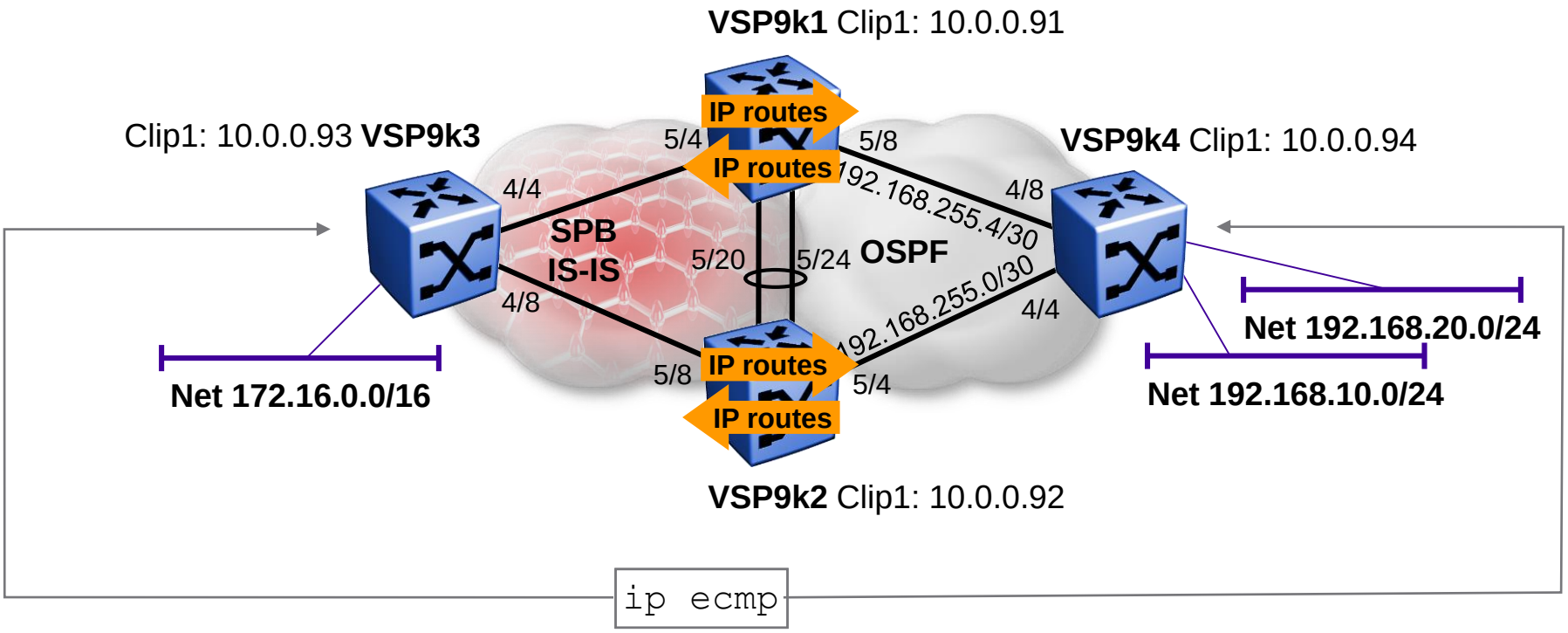
ISIS Accept policies to stop routing loops
Only injecting a default route into OSPF …fixed!



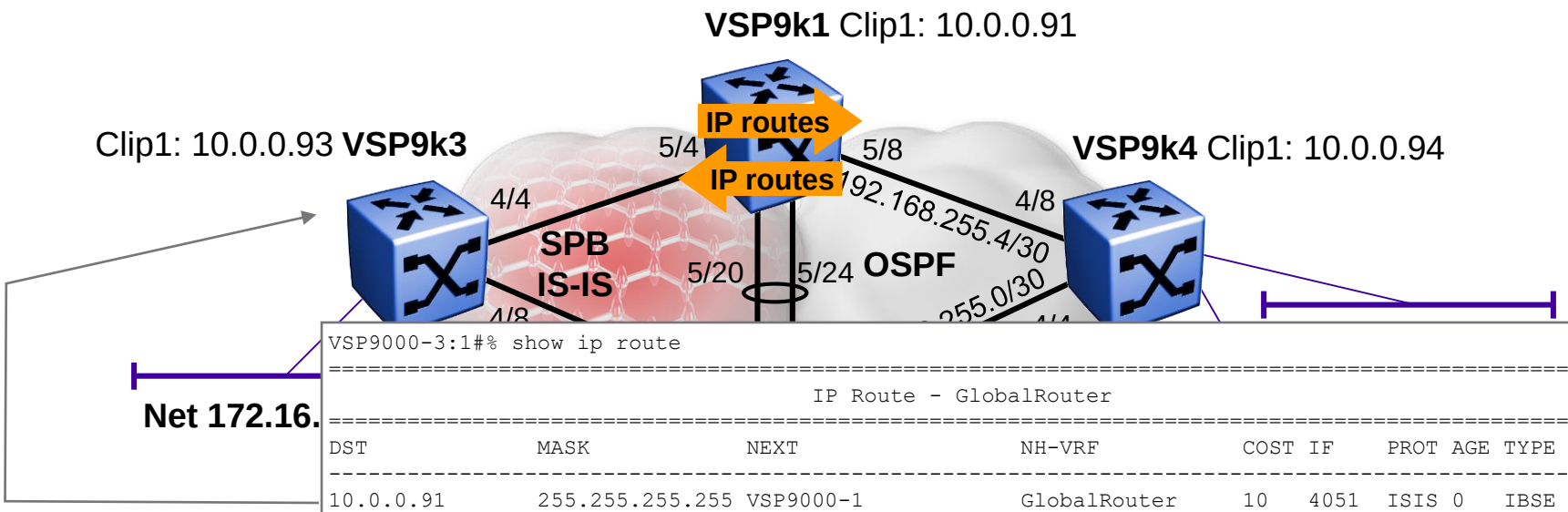

```
VSP9000-1:1#% show ip route
================================================================================================================
                                        IP Route - GlobalRouter
================================================================================================================
DST             MASK            NEXT                NH-VRF           COST IF    PROT AGE TYPE PRF
----------------------------------------------------------------------------------------------------------------
10.0.0.91       255.255.255.255 10.0.0.91           -                1    0     LOC  0   DB   0
10.0.0.93       255.255.255.255 VSP9000-3           GlobalRouter     10   4051  ISIS 0   IBS  7
10.0.0.94       255.255.255.255 192.168.255.6       GlobalRouter     11    5/8  OSPF 0   IB   20
172.16.0.0      255.255.0.0     VSP9000-3           GlobalRouter     10   4051  ISIS 0   IBS  7
192.168.10.0    255.255.255.0   192.168.255.6       GlobalRouter     11    5/8  OSPF 0   IB   20
192.168.20.0    255.255.255.0   192.168.255.6       GlobalRouter     1     5/8  OSPF 0   IB   125
192.168.255.0   255.255.255.252 192.168.255.6       GlobalRouter     2     5/8  OSPF 0   IB   20
192.168.255.4   255.255.255.252 192.168.255.5       -                1     5/8  LOC  0   DB   0
```

```
VSP9000-2:1#% show ip route
================================

================================
DST             MASK
--------------------------------
10.0.0.92       255.255.255.255
10.0.0.93       255.255.255.255 VSP9000-3           GlobalRouter     10   4051  ISIS 0   IBS  7
10.0.0.94       255.255.255.255 192.168.255.2       GlobalRouter     11    5/4  OSPF 0   IB   20
172.16.0.0      255.255.0.0     VSP9000-3           GlobalRouter     10   4051  ISIS 0   IBS  7
192.168.10.0    255.255.255.0   192.168.255.2       GlobalRouter     11    5/4  OSPF 0   IB   20
192.168.20.0    255.255.255.0   192.168.255.2       GlobalRouter     1     5/4  OSPF 0   IB   125
192.168.255.0   255.255.255.252 192.168.255.1       -                1     5/4  LOC  0   DB   0
192.168.255.4   255.255.255.252 192.168.255.2       GlobalRouter     2     5/4  OSPF 0   IB   20
```

ISIS Accept policies to stop routing loops
Enabling ECMP



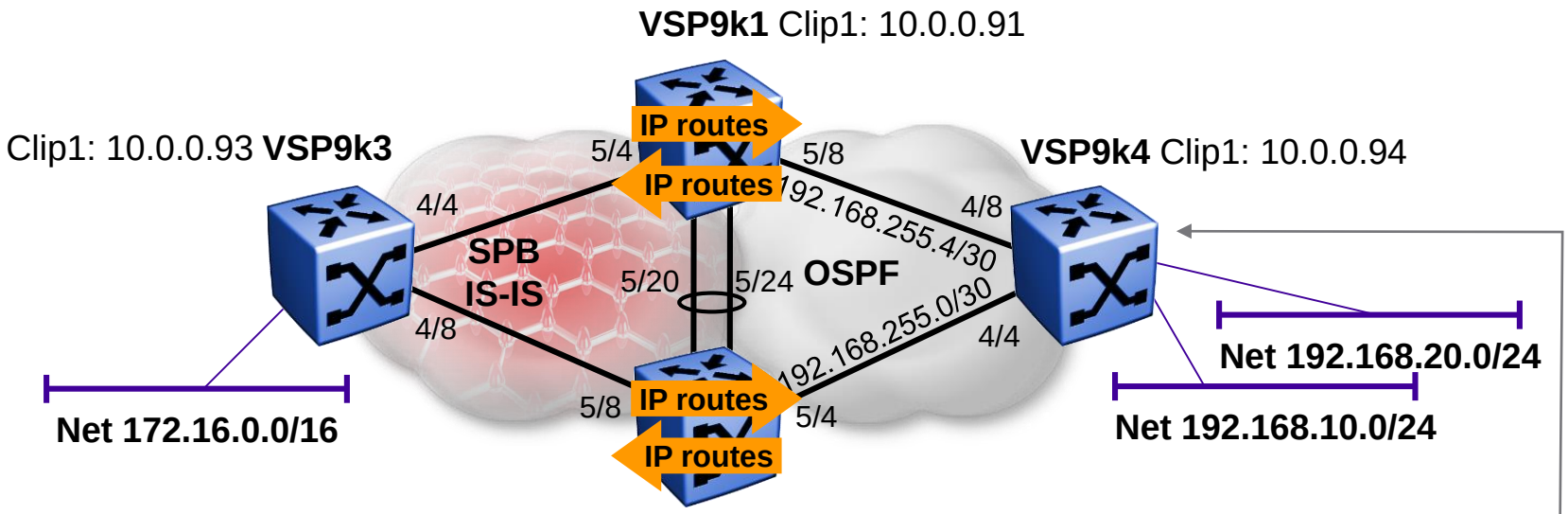
ISIS Accept policies to stop routing loops
Enabling ECMP



- 4 ECMP routes as there are 2 paths and 2 BVLANs

```
VSP9000-3:1#% show ip route
================================================================================================================
                                          IP Route - GlobalRouter
================================================================================================================
DST             MASK            NEXT                NH-VRF          COST IF    PROT AGE TYPE PRF
----------------------------------------------------------------------------------------------------------------
10.0.0.91       255.255.255.255 VSP9000-1           GlobalRouter    10   4051  ISIS 0   IBSE 7
10.0.0.91       255.255.255.255 VSP9000-1           GlobalRouter    10   4052  ISIS 0   IBSE 7
10.0.0.92       255.255.255.255 VSP9000-2           GlobalRouter    10   4051  ISIS 0   IBSE 7
10.0.0.92       255.255.255.255 VSP9000-2           GlobalRouter    10   4052  ISIS 0   IBSE 7
10.0.0.93       255.255.255.255 10.0.0.93           -               1    0     LOC  0   DB   0
10.0.0.94       255.255.255.255 VSP9000-1           GlobalRouter    10   4051  ISIS 0   IBSE 7
10.0.0.94       255.255.255.255 VSP9000-2           GlobalRouter    10   4051  ISIS 0   IBSE 7
10.0.0.94       255.255.255.255 VSP9000-1           GlobalRouter    10   4052  ISIS 0   IBSE 7
10.0.0.94       255.255.255.255 VSP9000-2           GlobalRouter    10   4052  ISIS 0   IBSE 7
172.16.0.0      255.255.0.0     172.16.0.1          -               1    0     LOC  0   DB   0
192.168.10.0    255.255.255.0   VSP9000-1           GlobalRouter    10   4051  ISIS 0   IBSE 7
192.168.10.0    255.255.255.0   VSP9000-2           GlobalRouter    10   4051  ISIS 0   IBSE 7
192.168.10.0    255.255.255.0   VSP9000-1           GlobalRouter    10   4052  ISIS 0   IBSE 7
192.168.10.0    255.255.255.0   VSP9000-2           GlobalRouter    10   4052  ISIS 0   IBSE 7
192.168.20.0    255.255.255.0   VSP9000-1           GlobalRouter    10   4051  ISIS 0   IBSE 7
192.168.20.0    255.255.255.0   VSP9000-2           GlobalRouter    10   4051  ISIS 0   IBSE 7
192.168.20.0    255.255.255.0   VSP9000-1           GlobalRouter    10   4052  ISIS 0   IBSE 7
192.168.20.0    255.255.255.0   VSP9000-2           GlobalRouter    10   4052  ISIS 0   IBSE 7
192.168.255.0   255.255.255.252 VSP9000-1           GlobalRouter    10   4051  ISIS 0   IBSE 7
192.168.255.0   255.255.255.252 VSP9000-1           GlobalRouter    10   4052  ISIS 0   IBSE 7
192.168.255.4   255.255.255.252 VSP9000-2           GlobalRouter    10   4051  ISIS 0   IBSE 7
192.168.255.4   255.255.255.252 VSP9000-2           GlobalRouter    10   4052  ISIS 0   IBSE 7
```

ISIS Accept policies to stop routing loops
Enabling ECMP



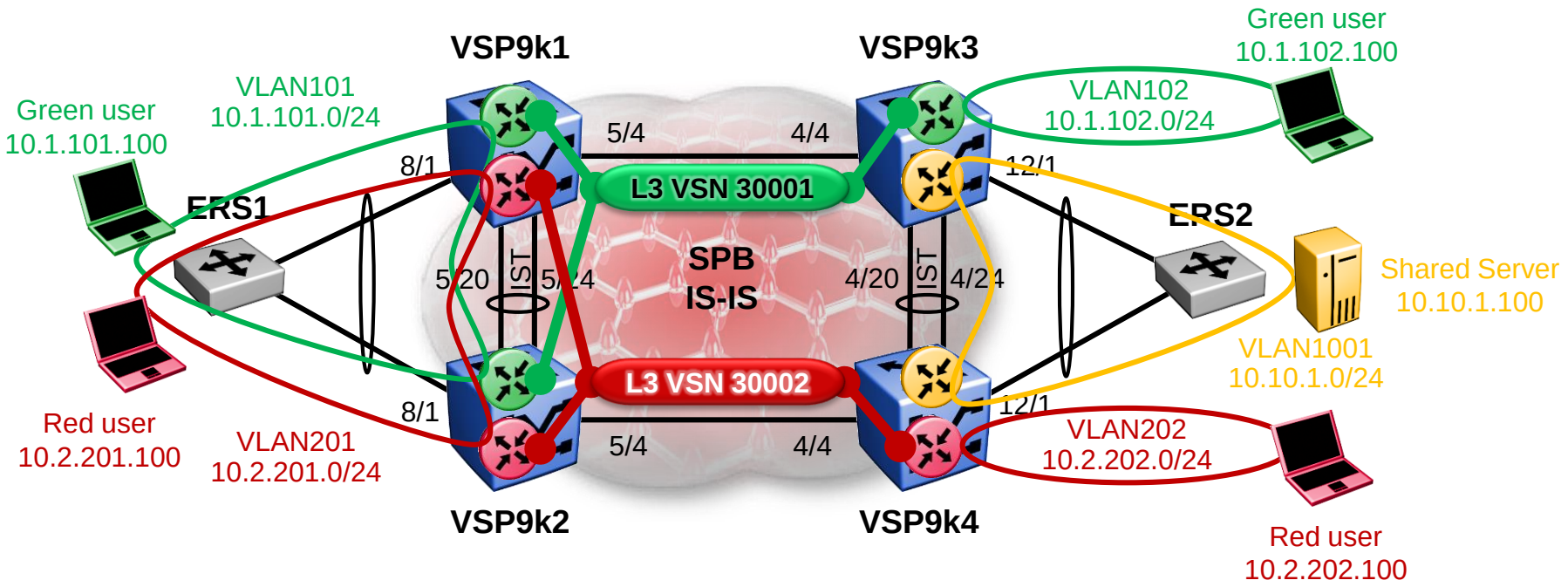

```
VSP9000-4:1#% show ip route
================================================================================================
                                    IP Route - GlobalRouter
================================================================================================
DST             MASK            NEXT                NH-VRF          COST IF    PROT AGE TYPE PRF
------------------------------------------------------------------------------------------------
0.0.0.0         0.0.0.0         192.168.255.1       GlobalRouter    10    4/4  OSPF 0   IBE  125
0.0.0.0         0.0.0.0         192.168.255.5       GlobalRouter    10    4/8  OSPF 0   IBE  125
10.0.0.94       255.255.255.255 10.0.0.94           -               1     0    LOC  0   DB   0
192.168.10.0    255.255.255.0   192.168.10.1        -               1     0    LOC  0   DB   0
192.168.20.0    255.255.255.0   192.168.20.1        -               1     0    LOC  0   DB   0
192.168.255.0   255.255.255.252 192.168.255.2       -               1     4/4  LOC  0   DB   0
192.168.255.4   255.255.255.252 192.168.255.6       -               1     4/8  LOC  0   DB   0
```

ISIS Accept policies

Last tested with: 4.0.0.0_B069

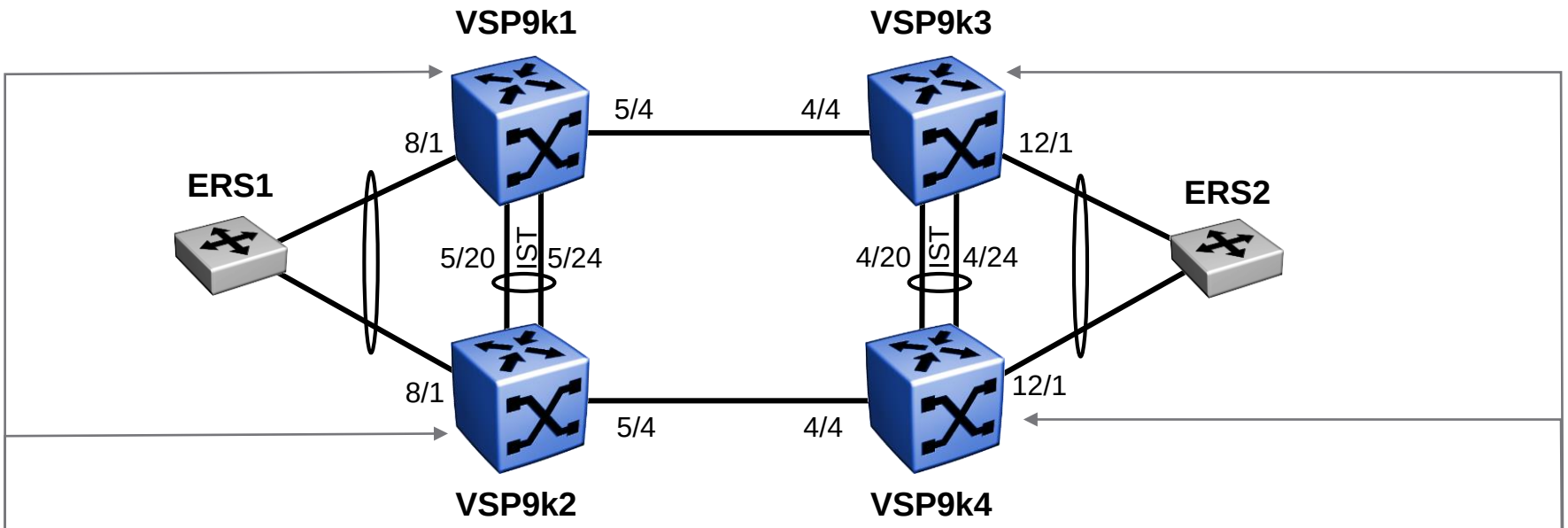
Example use #2
Inter-L3VSN route redistribution
Shared Servers/Subnets

Inter VRF-L3VSN route redistribution Goal



- Green users can communicate with other green users
- Red users can communicate with other red users
- Green and red users cannot communicate together
- Both green and red users can communicate with shared server
- NOTE: For this architecture we need ISIS Accept policies to be supported across all L3 BEBs
  - On our roadmap, VSP4000, VSP8000 and ERS8800 are all supposed to pick up ISIS Accept policies

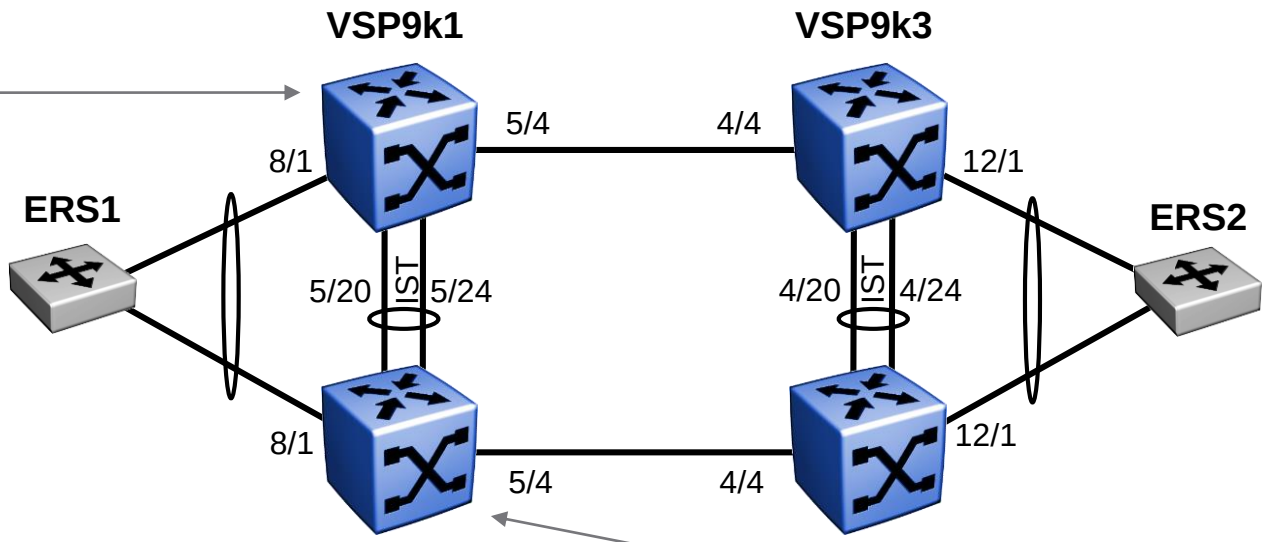
Inter VRF-L3VSN route redistribution
Interfaces used




```
interface gigabitEthernet 5/4,5/20,5/24,8/1
   no shutdown
exit
```

```
interface gigabitEthernet 4/4,4/20,4/24,12/1,12/13
   no shutdown
exit
```

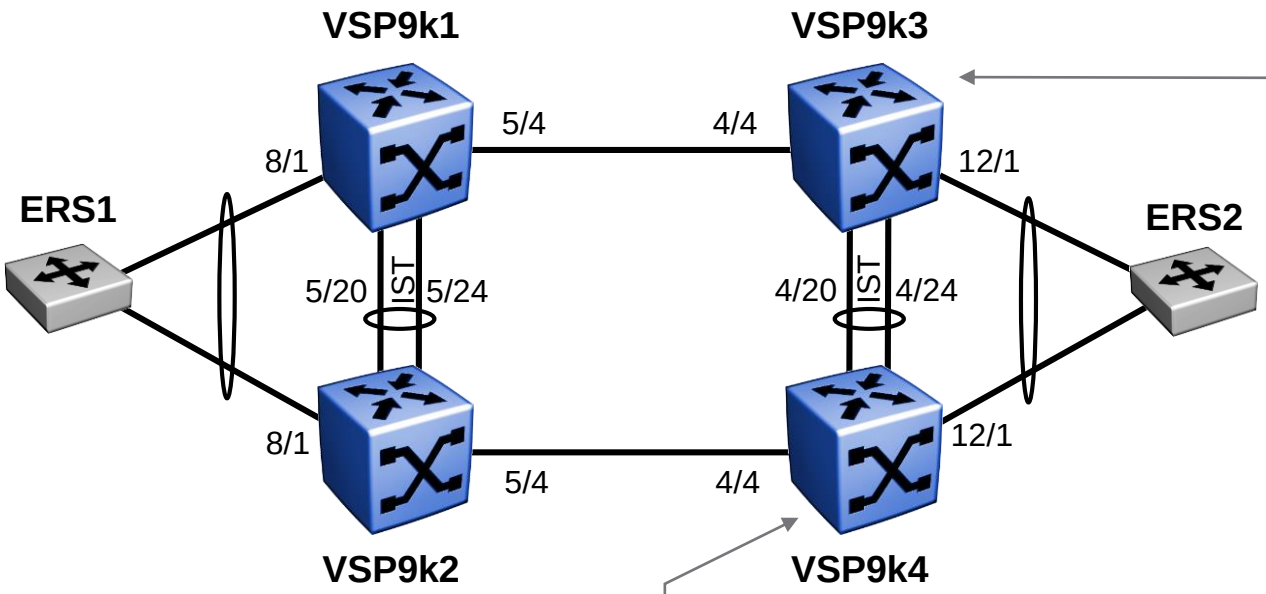
Inter VRF-L3VSN route redistribution
SMLT Config




```
vlan create 4000 name "IST" type port-mstprstp 0
interface vlan 4000
   ip address 192.168.255.1 255.255.255.252
exit
mlt 512 enable name "IST"
mlt 512 member 5/20,5/24
mlt 512 vlan 4000
mlt 512 encapsulation dot1q
interface mlt 512
   ist peer-ip 192.168.255.2 vlan 4000
   ist enable
exit
mlt 1 enable name "ERS1"
mlt 1 member 8/1
mlt 1 encapsulation dot1q
interface mlt 1
   smlt
exit
```

```
vlan create 4000 name "IST" type port-mstprstp 0
interface vlan 4000
   ip address 192.168.255.2 255.255.255.252
exit
mlt 512 enable name "IST"
mlt 512 member 5/20,5/24
mlt 512 vlan 4000
mlt 512 encapsulation dot1q
interface mlt 512
   ist peer-ip 192.168.255.1 vlan 4000
   ist enable
exit
mlt 1 enable name "ERS1"
mlt 1 member 8/1
mlt 1 encapsulation dot1q
interface mlt 1
   smlt
exit
```

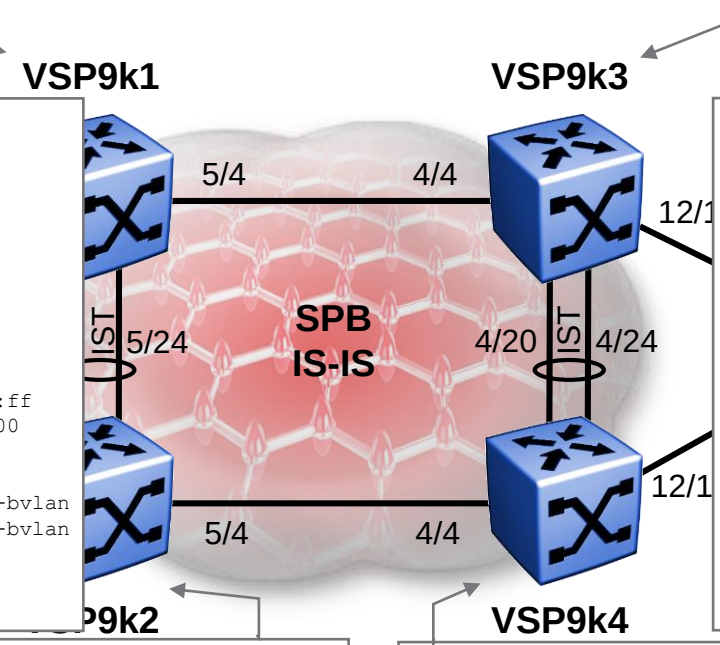
Inter VRF-L3VSN route redistribution
SMLT Config




```
vlan create 4000 name "IST" type port-mstprstp 0
interface vlan 4000
   ip address 192.168.255.2 255.255.255.252
exit
mlt 512 enable name "IST"
mlt 512 member 4/20,4/24
mlt 512 vlan 4000
mlt 512 encapsulation dot1q
interface mlt 512
   ist peer-ip 192.168.255.1 vlan 4000
   ist enable
exit
mlt 1 enable name "ERS2"
mlt 1 member 12/1
mlt 1 encapsulation dot1q
interface mlt 1
   smlt
exit
```

```
vlan create 4000 name "IST" type port-mstprstp 0
interface vlan 4000
   ip address 192.168.255.1 255.255.255.252
exit
mlt 512 enable name "IST"
mlt 512 member 4/20,4/24
mlt 512 vlan 4000
mlt 512 encapsulation dot1q
interface mlt 512
   ist peer-ip 192.168.255.2 vlan 4000
   ist enable
exit
mlt 1 enable name "ERS2"
mlt 1 member 12/1
mlt 1 encapsulation dot1q
interface mlt 1
   smlt
exit
```

Inter VRF-L3VSN route redistribution
SPB Global Config



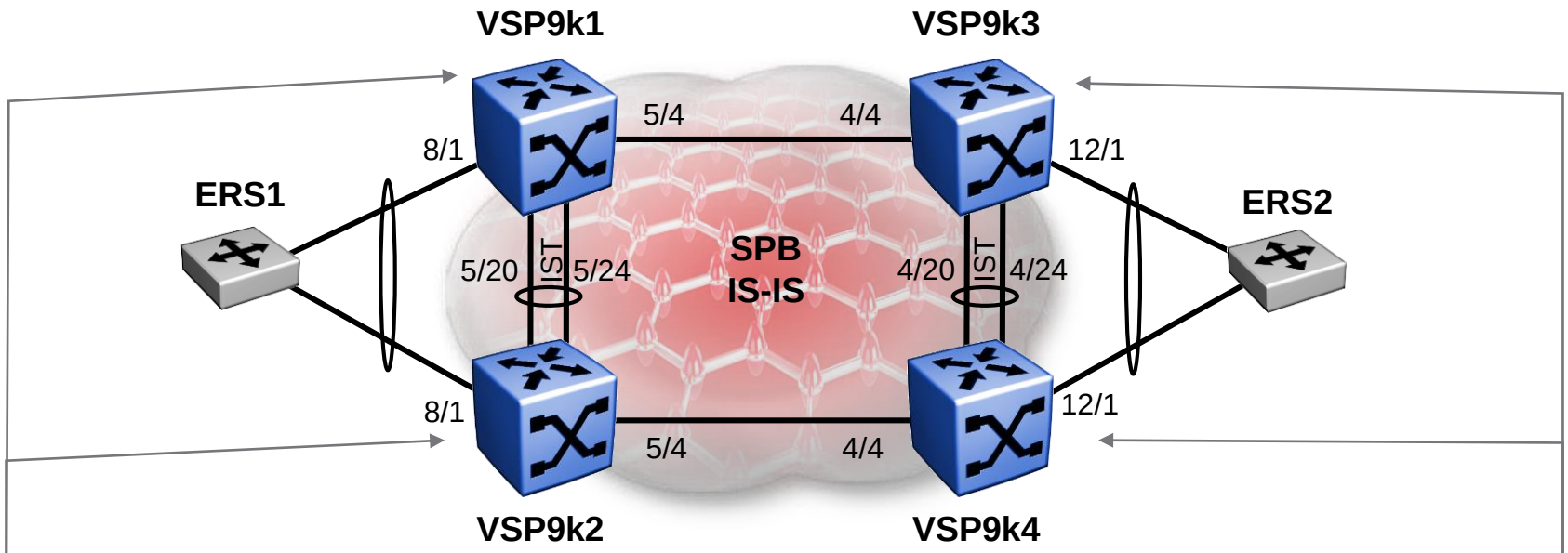

```
interface loopback 1
   ip address 10.0.0.91/255.255.255.255
exit
spbm
router isis
   system-id 00bb.0000.9100
   manual-area 49.0000
   ip-source-address 10.0.0.91
   spbm 1
   spbm 1 nick-name 0.00.91
   spbm 1 b-vid 4051-4052 primary 4051
   spbm 1 smlt-virtual-bmac 00:bb:00:00:91:ff
   spbm 1 smlt-peer-system-id 00bb.0000.9200
   spbm 1 ip enable
exit
vlan create 4051 name "B-VLAN-1" type spbm-bvlan
vlan create 4052 name "B-VLAN-2" type spbm-bvlan
router isis enable
cfm spbm mepid 91
cfm spbm enable
```

```
interface loopback 1
   ip address 10.0.0.93/255.255.255.255
exit
spbm
router isis
   system-id 00bb.0000.9300
   manual-area 49.0000
   ip-source-address 10.0.0.93
   spbm 1
   spbm 1 nick-name 0.00.93
   spbm 1 b-vid 4051-4052 primary 4051
   spbm 1 smlt-virtual-bmac 00:bb:00:00:93:ff
   spbm 1 smlt-peer-system-id 00bb.0000.9400
   spbm 1 ip enable
exit
vlan create 4051 name "B-VLAN-1" type spbm-bvlan
vlan create 4052 name "B-VLAN-2" type spbm-bvlan
router isis enable
cfm spbm mepid 93
cfm spbm enable
```

```
interface loopback 1
   ip address 10.0.0.92/255.255.255.255
exit
spbm
router isis
   system-id 00bb.0000.9200
   manual-area 49.0000
   ip-source-address 10.0.0.92
   spbm 1
   spbm 1 nick-name 0.00.92
   spbm 1 b-vid 4051-4052 primary 4051
   spbm 1 smlt-virtual-bmac 00:bb:00:00:91:ff
   spbm 1 smlt-peer-system-id 00bb.0000.9100
   spbm 1 ip enable
exit
vlan create 4051 name "B-VLAN-1" type spbm-bvlan
vlan create 4052 name "B-VLAN-2" type spbm-bvlan
router isis enable
cfm spbm mepid 92
cfm spbm enable
```

```
interface loopback 1
   ip address 10.0.0.94/255.255.255.255
exit
spbm
router isis
   system-id 00bb.0000.9400
   manual-area 49.0000
   ip-source-address 10.0.0.94
   spbm 1
   spbm 1 nick-name 0.00.94
   spbm 1 b-vid 4051-4052 primary 4051
   spbm 1 smlt-virtual-bmac 00:bb:00:00:93:ff
   spbm 1 smlt-peer-system-id 00bb.0000.9300
   spbm 1 ip enable
exit
vlan create 4051 name "B-VLAN-1" type spbm-bvlan
vlan create 4052 name "B-VLAN-2" type spbm-bvlan
router isis enable
cfm spbm mepid 94
cfm spbm enable
```

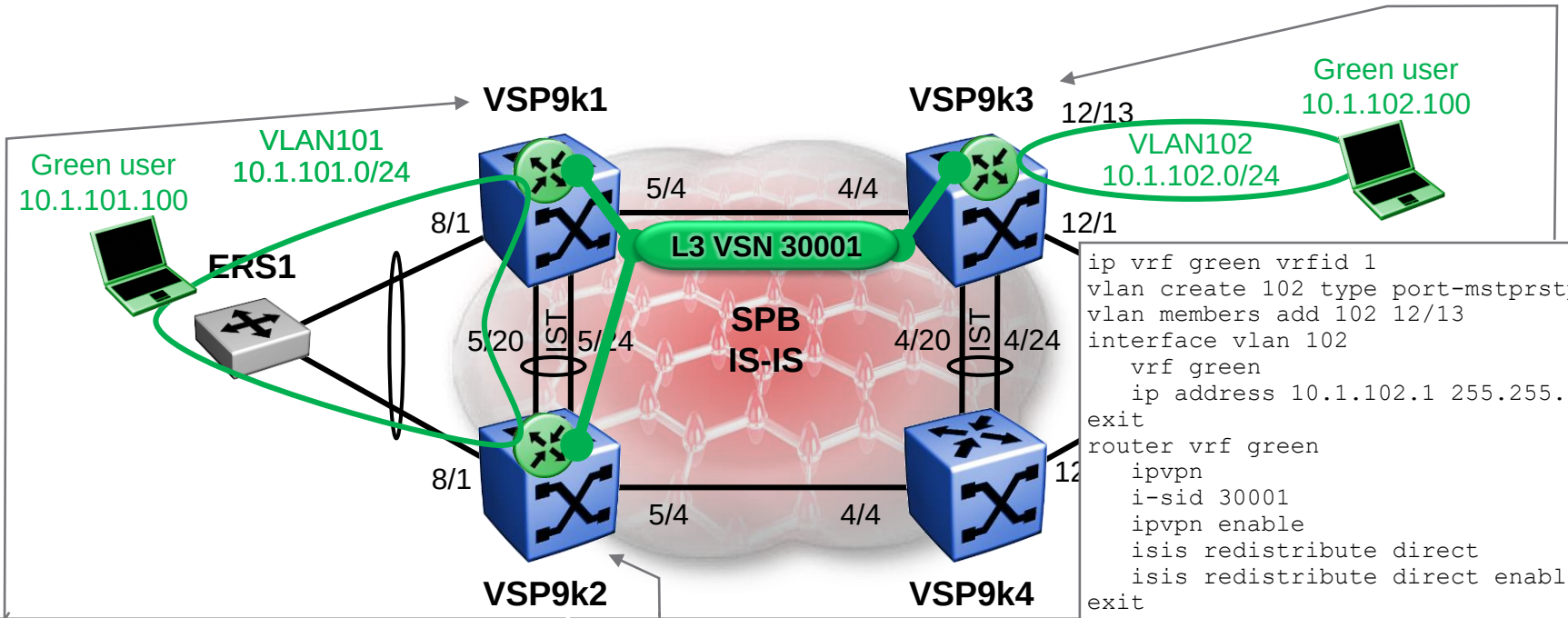
Inter VRF-L3VSN route redistribution
SPB Interface Config




```
interface GigabitEthernet 5/4
   isis
   isis spbm 1
   isis enable
exit
interface mlt 512
   isis
   isis spbm 1
   isis enable
exit
```

```
interface GigabitEthernet 4/4
   isis
   isis spbm 1
   isis enable
exit
interface mlt 512
   isis
   isis spbm 1
   isis enable
exit
```

Inter VRF-L3VSN route redistribution
Green VSN Config

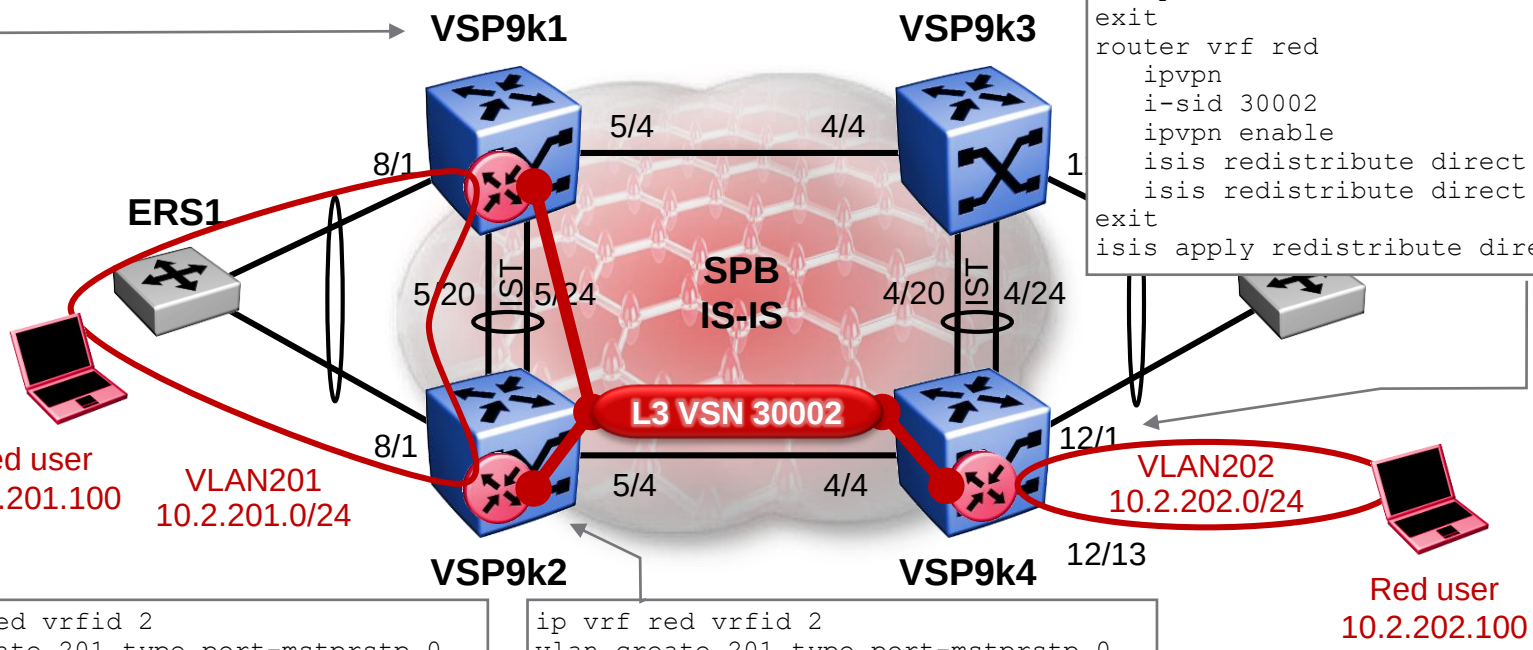



```
ip vrf green vrfid 1
vlan create 101 type port-mstprstp 0
vlan mlt 101 1
vlan mlt 101 512
interface vlan 101
   vrf green
   ip address 10.1.101.1 255.255.255.0
   ip rsmlt
   ip rsmlt holdup-timer 9999
exit
router vrf green
   ipvpn
   i-sid 30001
   ipvpn enable
   isis redistribute direct
   isis redistribute direct enable
exit
isis apply redistribute direct vrf green
```

```
ip vrf green vrfid 1
vlan create 101 type port-mstprstp 0
vlan mlt 101 1
vlan mlt 101 512
interface vlan 101
   vrf green
   ip address 10.1.101.2 255.255.255.0
   ip rsmlt
   ip rsmlt holdup-timer 9999
exit
router vrf green
   ipvpn
   i-sid 30001
   ipvpn enable
   isis redistribute direct
   isis redistribute direct enable
exit
isis apply redistribute direct vrf green
```

```
ip vrf green vrfid 1
vlan create 102 type port-mstprstp 0
vlan members add 102 12/13
interface vlan 102
   vrf green
   ip address 10.1.102.1 255.255.255.0
exit
router vrf green
   ipvpn
   i-sid 30001
   ipvpn enable
   isis redistribute direct
   isis redistribute direct enable
exit
isis apply redistribute direct vrf green
```

Inter VRF-L3VSN route redistribution
Red VSN Config

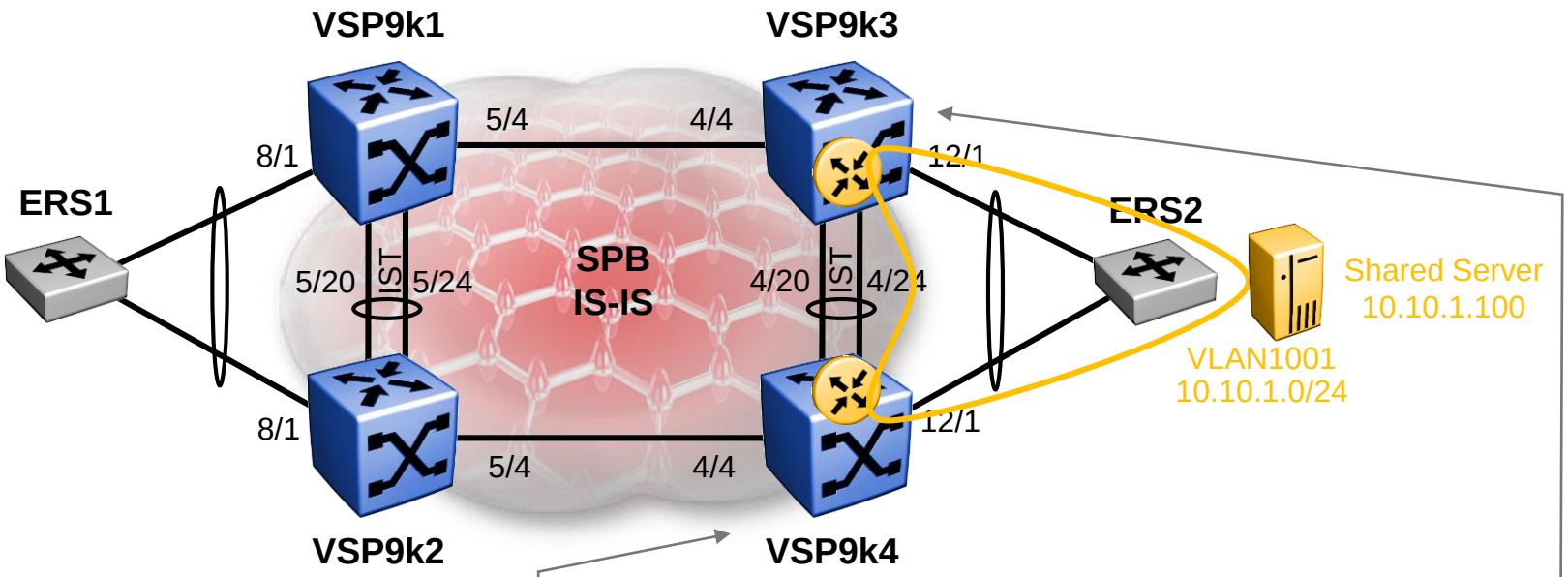



```
ip vrf red vrfid 2
vlan create 202 type port-mstprstp 0
vlan members add 202 12/13
interface vlan 202
   vrf red
   ip address 10.2.202.1 255.255.255.0
exit
router vrf red
   ipvpn
   i-sid 30002
   ipvpn enable
   isis redistribute direct
   isis redistribute direct enable
exit
isis apply redistribute direct vrf red
```

```
ip vrf red vrfid 2
vlan create 201 type port-mstprstp 0
vlan mlt 201 1
vlan mlt 201 512
interface vlan 201
   vrf red
   ip address 10.2.201.1 255.255.255.0
   ip rsmlt
   ip rsmlt holdup-timer 9999
exit
router vrf red
   ipvpn
   i-sid 30002
   ipvpn enable
   isis redistribute direct
   isis redistribute direct enable
exit
isis apply redistribute direct vrf red
```

```
ip vrf red vrfid 2
vlan create 201 type port-mstprstp 0
vlan mlt 201 1
vlan mlt 201 512
interface vlan 201
   vrf red
   ip address 10.2.201.2 255.255.255.0
   ip rsmlt
   ip rsmlt holdup-timer 9999
exit
router vrf red
   ipvpn
   i-sid 30002
   ipvpn enable
   isis redistribute direct
   isis redistribute direct enable
exit
isis apply redistribute direct vrf red
```

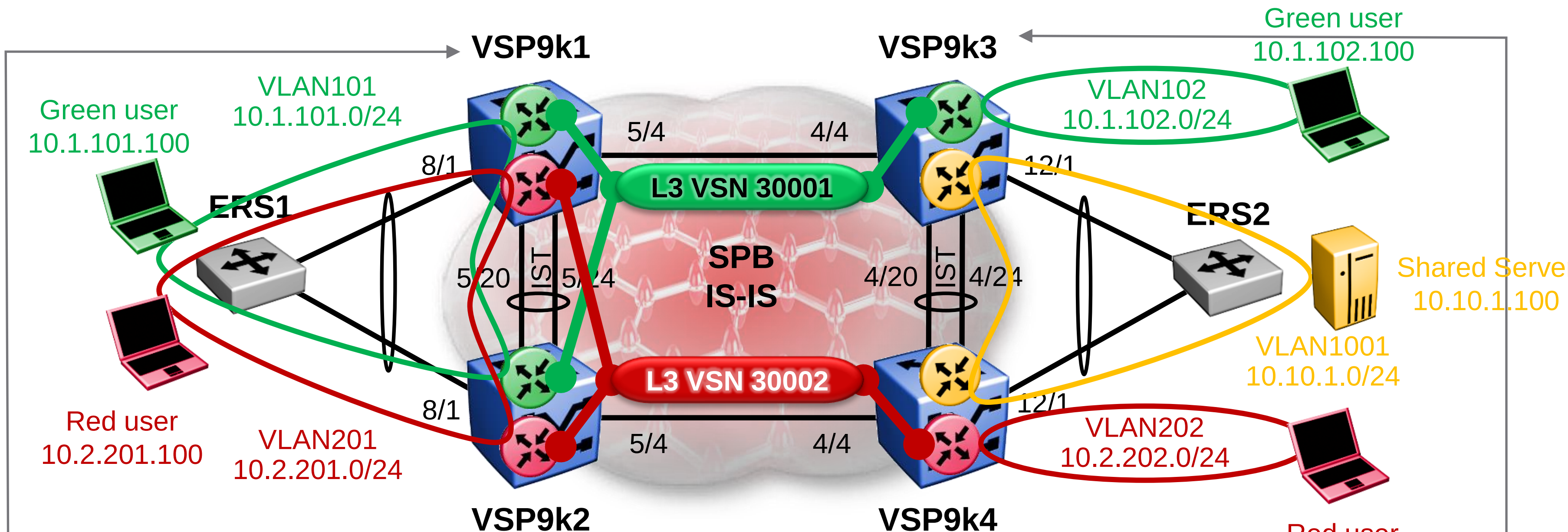
Inter VRF-L3VSN route redistribution
Server VRF Config




```
ip vrf shared vrfid 10
vlan create 1001 type port-mstprstp 0
vlan mlt 1001 1
vlan mlt 1001 512
interface vlan 1001
   vrf shared
   ip address 10.10.1.2 255.255.255.0
   ip rsmlt
   ip rsmlt holdup-timer 9999
exit
```

```
ip vrf shared vrfid 10
vlan create 1001 type port-mstprstp 0
vlan mlt 1001 1
vlan mlt 1001 512
interface vlan 1001
   vrf shared
   ip address 10.10.1.1 255.255.255.0
   ip rsmlt
   ip rsmlt holdup-timer 9999
exit
```

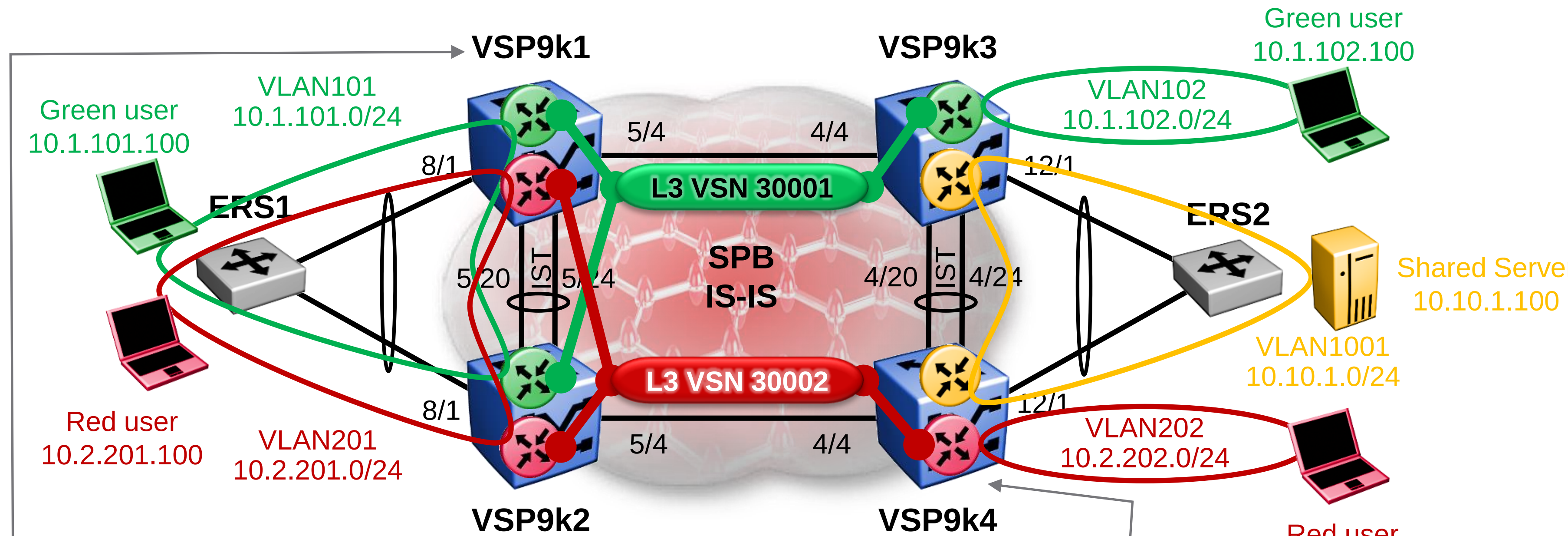
Inter VRF-L3VSN route redistribution
Checking Green VRF routes




```
VSP9000-3:1#% show ip route vrf green
================================================================================
                                IP Route - VRF green
================================================================================
                                                 NH                 INTER
DST            MASK            NEXT              VRF           COST FACE  PROT  AGE TYPE PRF
--------------------------------------------------------------------------------
10.1.101.0     255.255.255.0   VSP9000-1         green         10   4051  ISIS  0   IBSV 7
10.1.102.0     255.255.255.0   10.1.102.1        -             1    102   LOC   0   DB   0
```

```
VSP9000-1:1#% show ip route vrf green
================================================================================
                                IP Route - VRF green
================================================================================
                                                 NH                 INTER
DST            MASK            NEXT              VRF           COST FACE  PROT  AGE TYPE PRF
--------------------------------------------------------------------------------
10.1.101.0     255.255.255.0   10.1.101.1        -             1    101   LOC   0   DB   0
10.1.102.0     255.255.255.0   VSP9000-3         green         10   4051  ISIS  0   IBSV 7
```

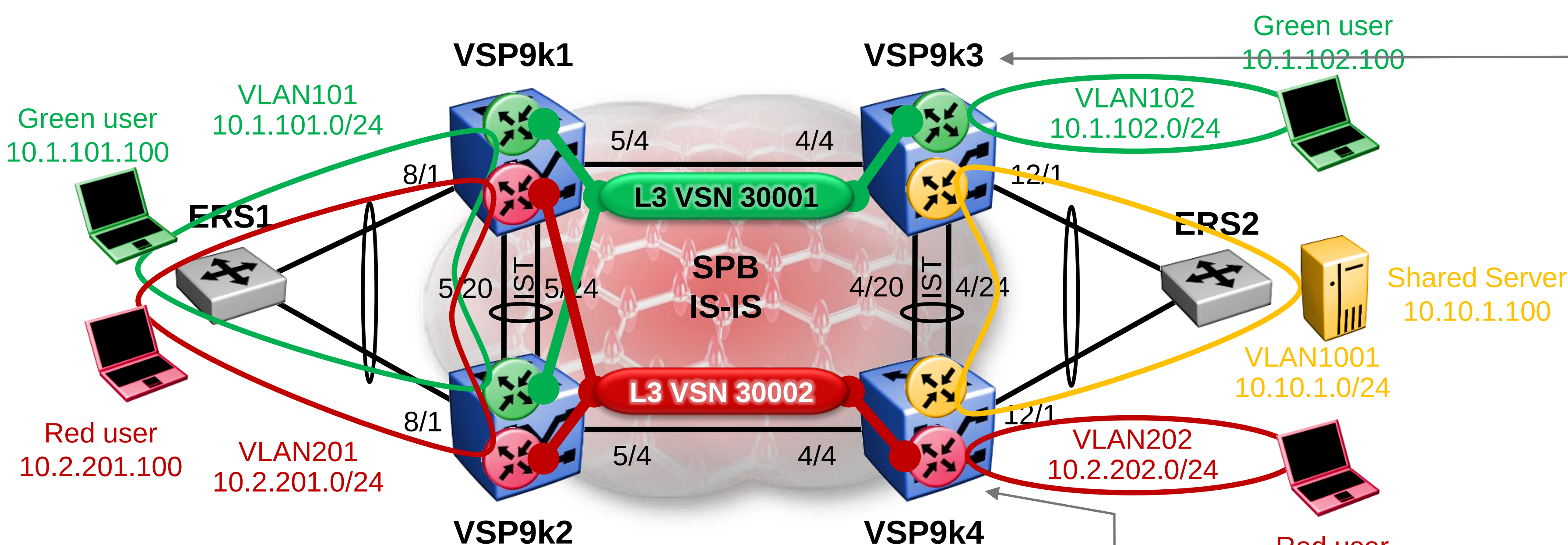
Inter VRF-L3VSN route redistribution
Checking Red VRF routes




```
VSP9000-4:1#% show ip route vrf red
================================================================================
                           IP Route - VRF red
================================================================================
                                              NH                   INTER
DST            MASK           NEXT            VRF             COST FACE  PROT AGE TYPE PRF
--------------------------------------------------------------------------------
10.2.201.0     255.255.255.0  VSP9000-2       red             10   4051  ISIS 0   IBSV 7
10.2.202.0     255.255.255.0  10.2.202.1      -               1    202   LOC  0   DB   0
```

```
VSP9000-1:1#% show ip route vrf red
================================================================================
                           IP Route - VRF red
================================================================================
                                              NH                   INTER
DST            MASK           NEXT            VRF             COST FACE  PROT AGE TYPE PRF
--------------------------------------------------------------------------------
10.2.201.0     255.255.255.0  10.2.201.1      -               1    201   LOC  0   DB   0
10.2.202.0     255.255.255.0  VSP9000-4       red             20   4051  ISIS 0   IBSV 7
```

Inter VRF-L3VSN route redistribution
Checking Shared VRF routes




```
VSP9000-4:1#% show ip route vrf shared
================================================================================
                          IP Route - VRF shared
================================================================================
                                            NH                     INTER
DST            MASK           NEXT          VRF              COST  FACE   PROT AGE TYPE PRF
--------------------------------------------------------------------------------
10.10.1.0      255.255.255.0  10.10.1.2     -                1     1001   LOC  0   DB   0
```

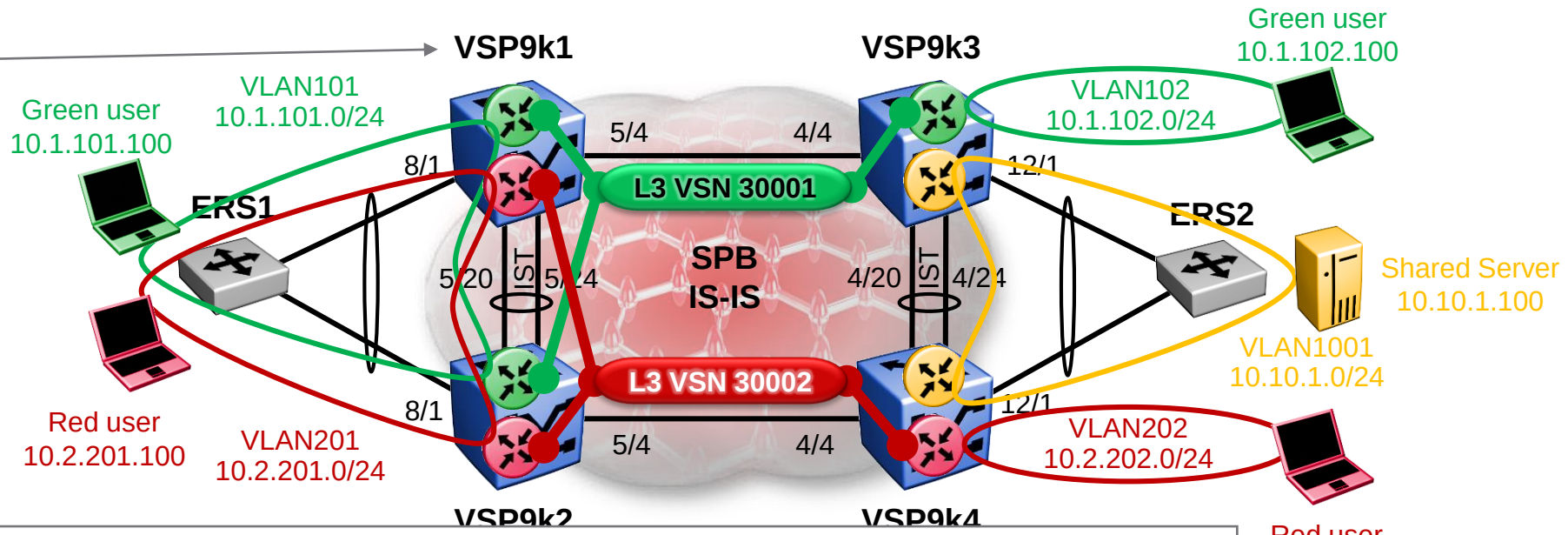
```
VSP9000-3:1#% show ip route vrf shared
================================================================================
                          IP Route - VRF shared
================================================================================
                                            NH                     INTER
DST            MASK           NEXT          VRF              COST  FACE   PROT AGE TYPE PRF
--------------------------------------------------------------------------------
10.10.1.0      255.255.255.0  10.10.1.1     -                1     1001   LOC  0   DB   0
```

Inter VRF-L3VSN route redistribution Checkpoint

- The VSNs (L3VSN / VRFs) have been created
- We have not configured any IP route redistribution between the L3VSNs yet
  - In the preceding slides we can see that only the IP routes within the same L3VSN I-SID are learnt
- So right now only users within the same L3VSN can communicate

- Next step is to redistribute the shared VRF IP routes into both the Green and Red VSNs

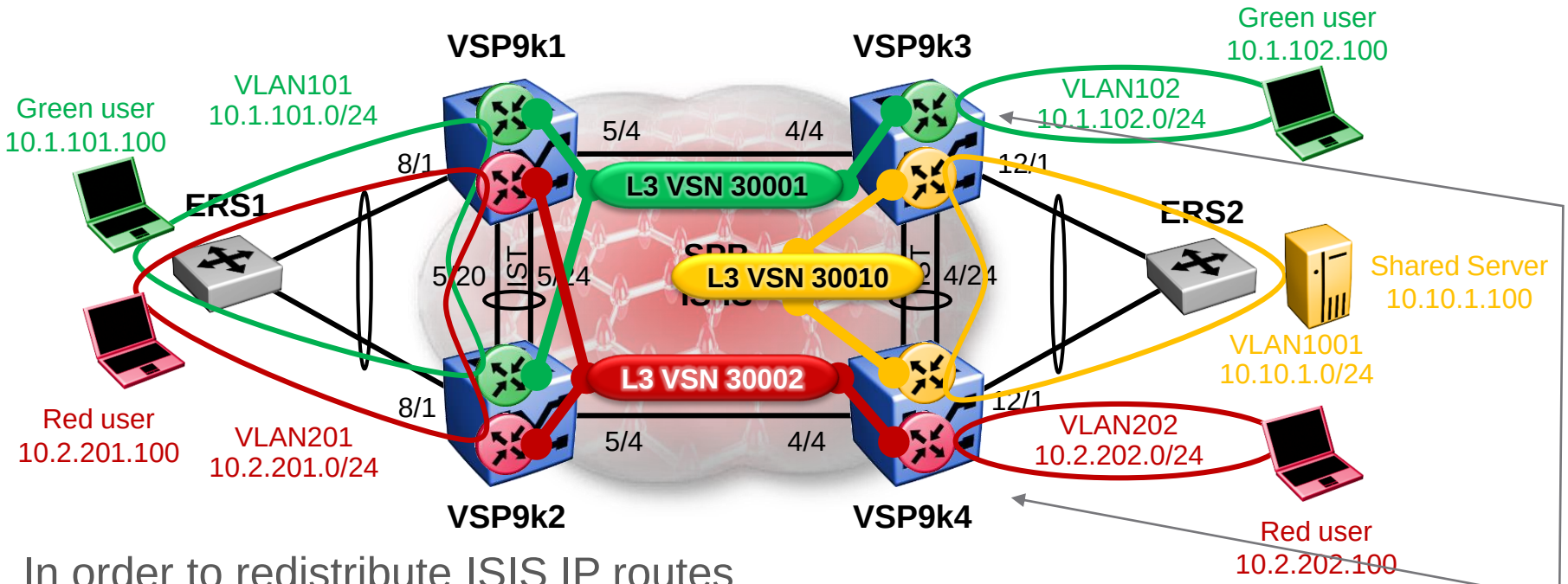
Inter VRF-L3VSN route redistribution
Checking available ISIS IP routes




```
VSP9000-1:1# show isis lsdb ip-unicast
================================================================================
                        ISIS IP-UNICAST-ROUTE SUMMARY
================================================================================
                              PREFIX          TLV    LSP    HOST
I-SID      ADDRESS            LENGTH  METRIC  TYPE   FRAG   NAME
--------------------------------------------------------------------------------
-          10.0.0.91          32      1       135    0x2    VSP9000-1
30001      10.1.101.0         24      1       184    0x3    VSP9000-1
30002      10.2.201.0         24      1       184    0x3    VSP9000-1
-          10.0.0.92          32      1       135    0x2    VSP9000-2
30001      10.1.101.0         24      1       184    0x3    VSP9000-2
30002      10.2.201.0         24      1       184    0x3    VSP9000-2
-          10.0.0.93          32      1       135    0x2    VSP9000-3
30001      10.1.102.0         24      1       184    0x3    VSP9000-3
-          10.0.0.94          32      1       135    0x2    VSP9000-4
30002      10.2.202.0         24      1       184    0x3    VSP9000-4
```

- This new command in 4.0.0.0 shows all the available IP routes contained in the ISIS LSDB
- Note that we are missing the shared VRF IP route

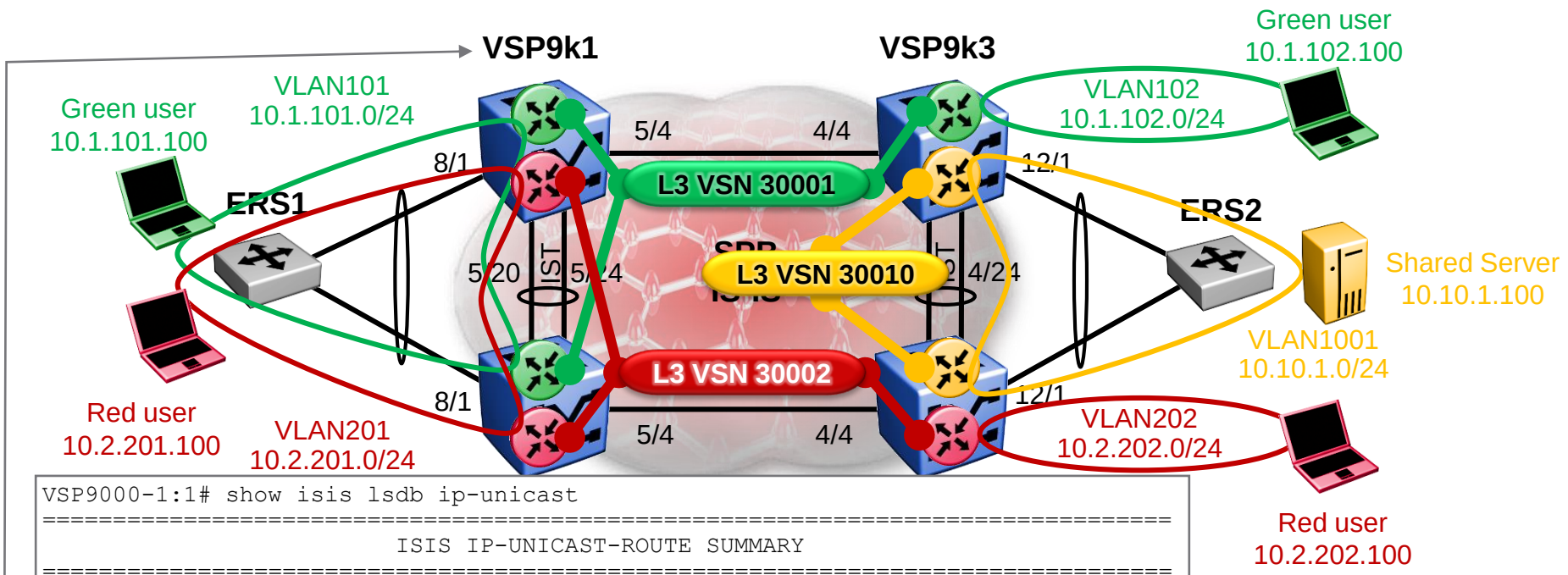
Inter VRF-L3VSN route redistribution
Redist Shared VSN routes into Green & Red



- In order to redistribute ISIS IP routes into a VRF we need those routes to be advertised in ISIS against a L3VSN I-SID
- So, even though the Shared VRF does not need to be L3VSN extended across the Fabric here, we will need to create a L3VSN for it anyway

```
router vrf shared
   ipvpn
   i-sid 30010
   ipvpn enable
   isis redistribute direct
   isis redistribute direct enable
exit
isis apply redistribute direct vrf shared
```

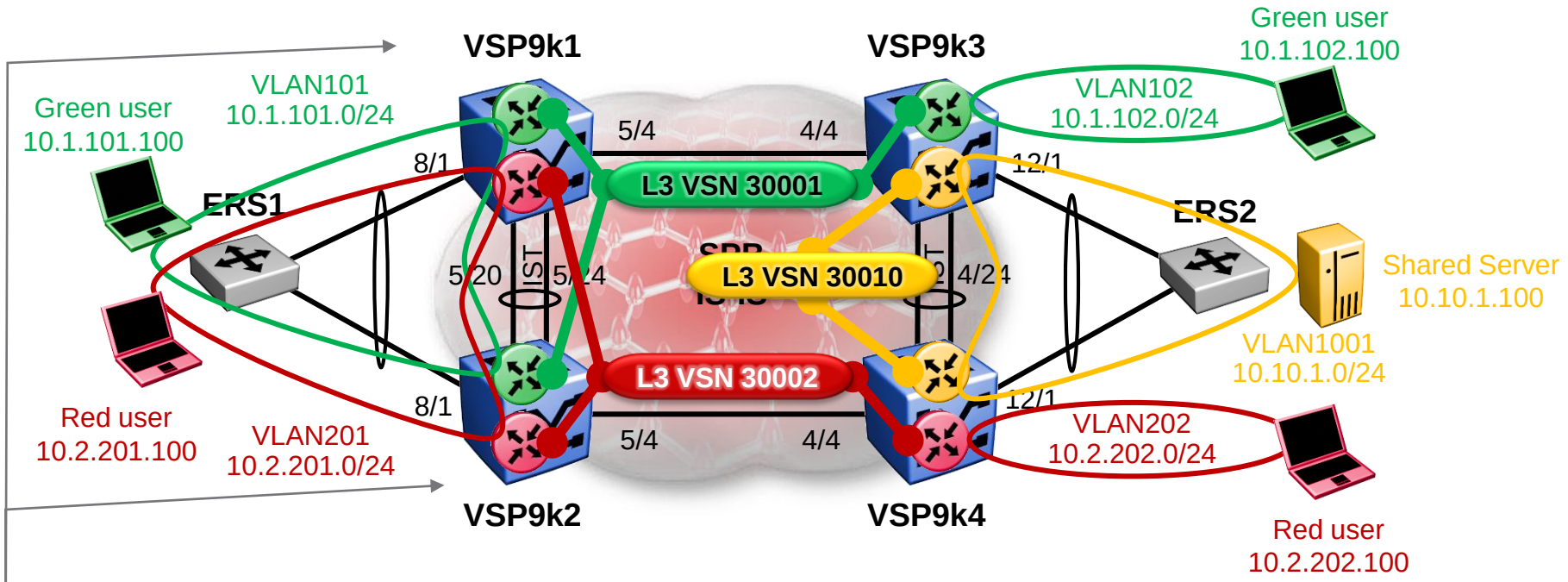
Inter VRF-L3VSN route redistribution
Checking available ISIS IP routes again




```
VSP9000-1:1# show isis lsdb ip-unicast
================================================================================
                          ISIS IP-UNICAST-ROUTE SUMMARY
================================================================================
                              PREFIX          TLV    LSP    HOST
I-SID      ADDRESS            LENGTH  METRIC  TYPE   FRAG   NAME
--------------------------------------------------------------------------------
-          10.0.0.91          32      1       135    0x2    VSP9000-1
30001      10.1.101.0         24      1       184    0x3    VSP9000-1
30002      10.2.201.0         24      1       184    0x3    VSP9000-1
-          10.0.0.92          32      1       135    0x2    VSP9000-2
30001      10.1.101.0         24      1       184    0x3    VSP9000-2
30002      10.2.201.0         24      1       184    0x3    VSP9000-2
-          10.0.0.93          32      1       135    0x2    VSP9000-3
30001      10.1.102.0         24      1       184    0x3    VSP9000-3
30010      10.10.1.0          24      1       184    0x3    VSP9000-3
-          10.0.0.94          32      1       135    0x2    VSP9000-4
30002      10.2.202.0         24      1       184    0x3    VSP9000-4
30010      10.10.1.0          24      1       184    0x3    VSP9000-4
```

- Now we also see the shared VRF IP route

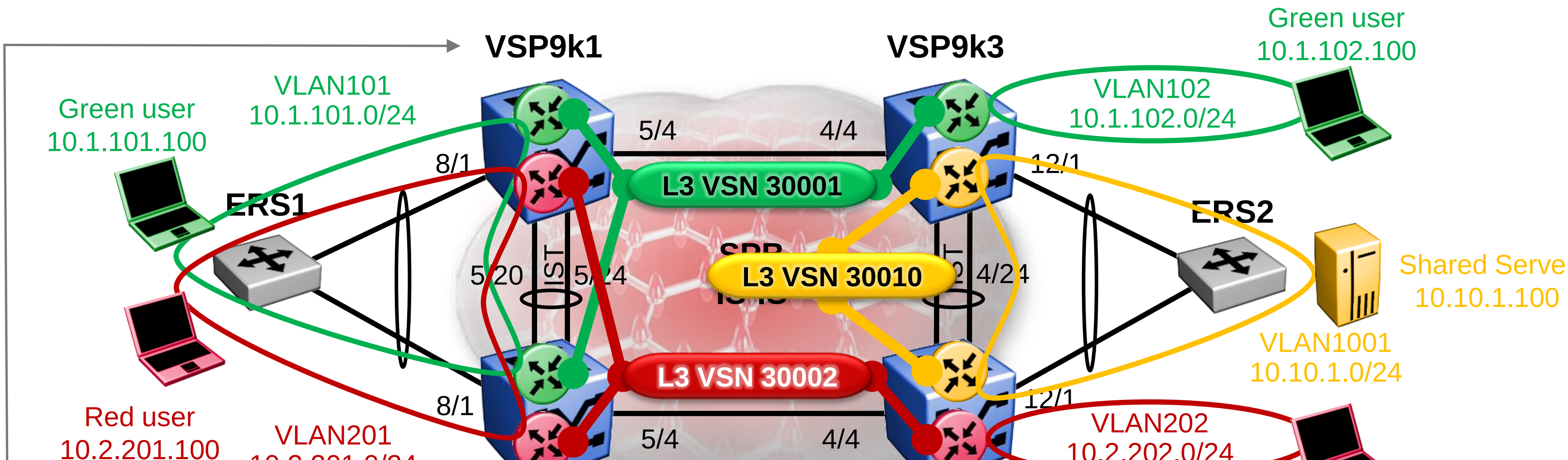
Inter VRF-L3VSN route redistribution
Accept Shared VSN routes into Green & Red VSNs




```
router vrf green
   isis accept i-sid 30010 enable
exit
isis apply accept vrf green

router vrf red
   isis accept i-sid 30010 enable
exit
isis apply accept vrf red
```

- New ISIS Accept policies in Rel 4.0
- Here accepting all IP routes with I-SID 30010

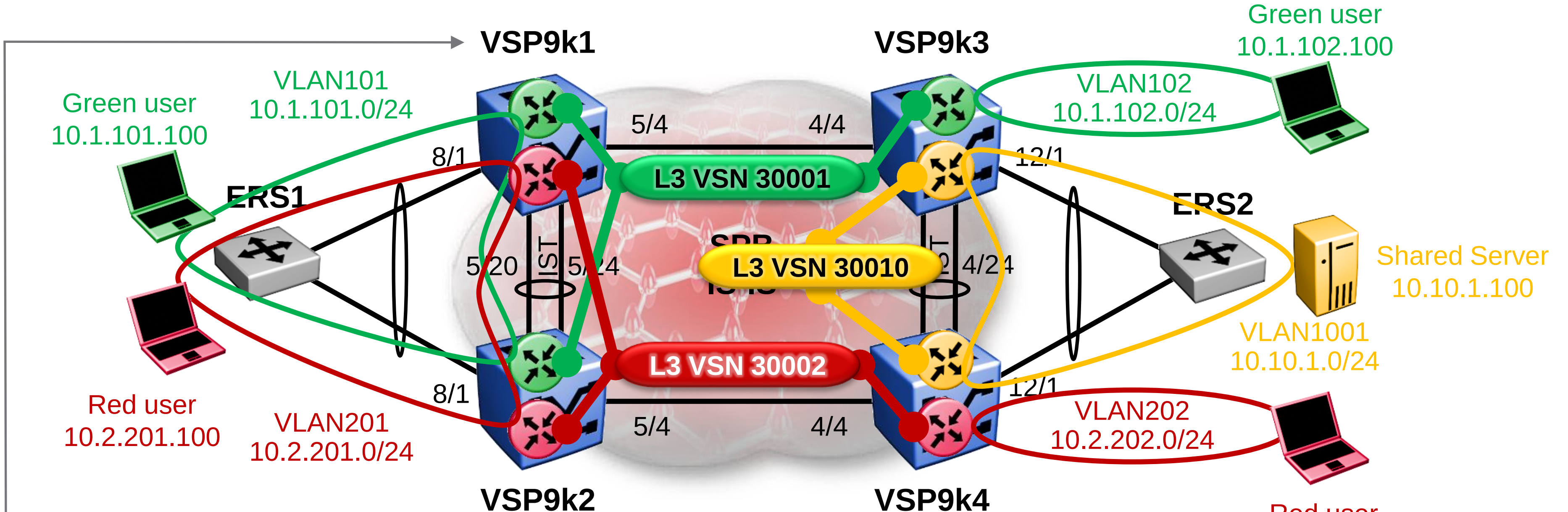
Inter VRF-L3VSN route redistribution
Accept Shared VSN routes into Green & Red VSNs




```
VSP9000-1:1#% show ip route vrf green
==========================================================================================
                                 IP Route - VRF green
==========================================================================================
                                                     NH                    INTER
DST             MASK            NEXT                 VRF/ISID        COST  FACE  PROT AGE TYPE PRF
------------------------------------------------------------------------------------------
10.1.101.0      255.255.255.0   10.1.101.1           -               1     101   LOC  0   DB   0
10.1.102.0      255.255.255.0   VSP9000-3            green           10    4051  ISIS 0   IBSV 7
10.10.1.0       255.255.255.0   VSP9000-3            30010           10    4051  ISIS 0   IBSV 200
```

```
VSP9000-1:1#% show ip route vrf red
==========================================================================================
                                  IP Route - VRF red
==========================================================================================
                                                     NH                    INTER
DST             MASK            NEXT                 VRF/ISID        COST  FACE  PROT AGE TYPE PRF
------------------------------------------------------------------------------------------
10.2.201.0      255.255.255.0   10.2.201.1           -               1     201   LOC  0   DB   0
10.2.202.0      255.255.255.0   VSP9000-4            red             20    4051  ISIS 0   IBSV 7
10.10.1.0       255.255.255.0   VSP9000-3            30010           10    4051  ISIS 0   IBSV 200
```

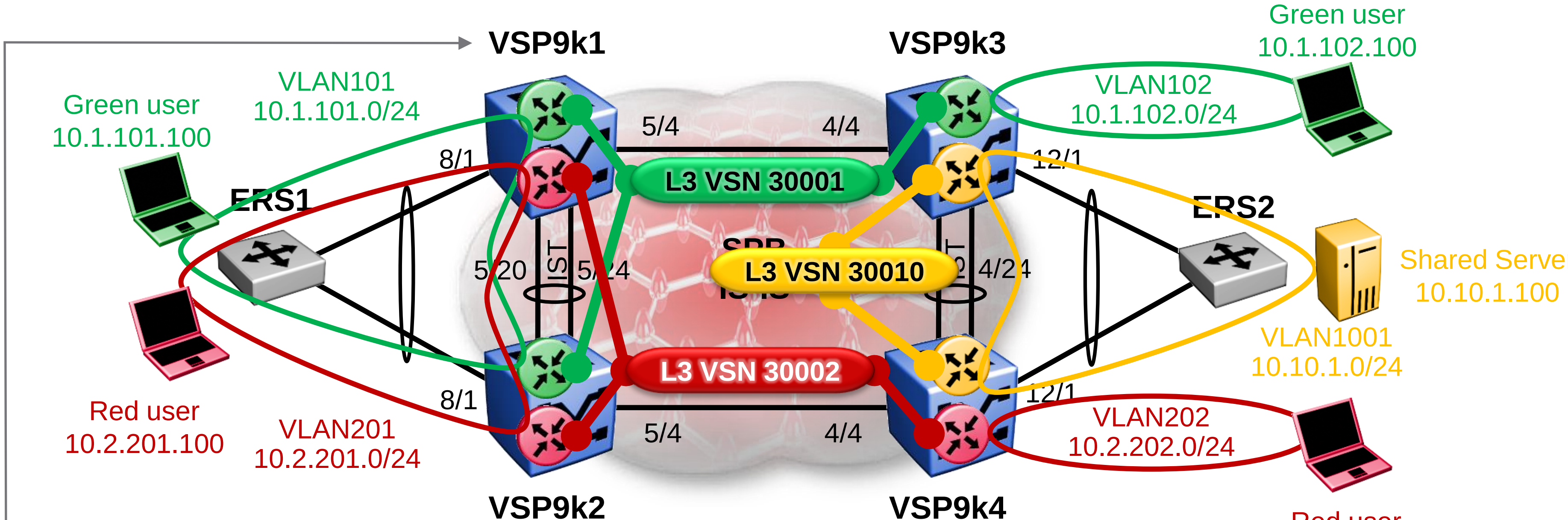
Inter VRF-L3VSN route redistribution
Accept Shared VSN routes into Green & Red VSNs




```
VSP9000-1:1#% show isis spbm ip-unicast-fib id 30001
==========================================================================================
                              SPBM IP-UNICAST FIB ENTRY INFO
==========================================================================================
        VRF    DEST                                                OUTGOING  SPBM     PREFIX   IP ROUTE
VRF     ISID   ISID   Destination      NH BEB            VLAN INTERFACE COST     COST     PREFERENCE
------------------------------------------------------------------------------------------
green   30001  30001  10.1.101.0/24    VSP9000-2         4051 IST       10       1        7
green   30001  30001  10.1.101.0/24    VSP9000-2         4052 IST       10       1        7
green   30001  30001  10.1.102.0/24    VSP9000-3         4051 5/4       10       1        7
green   30001  30001  10.1.102.0/24    VSP9000-3         4052 5/4       10       1        7
green   30001  30010  10.10.1.0/24     VSP9000-3         4051 5/4       10       1        200
green   30001  30010  10.10.1.0/24     VSP9000-3         4052 5/4       10       1        200
green   30001  30010  10.10.1.0/24     VSP9000-4         4051 IST       20       1        200
green   30001  30010  10.10.1.0/24     VSP9000-4         4052 5/4       20       1        200
```

- Lowest Pref, and lowest cost route was installed; Note pref=200 for inter I-SID

Inter VRF-L3VSN route redistribution
Accept Shared VSN routes into Green & Red VSNs



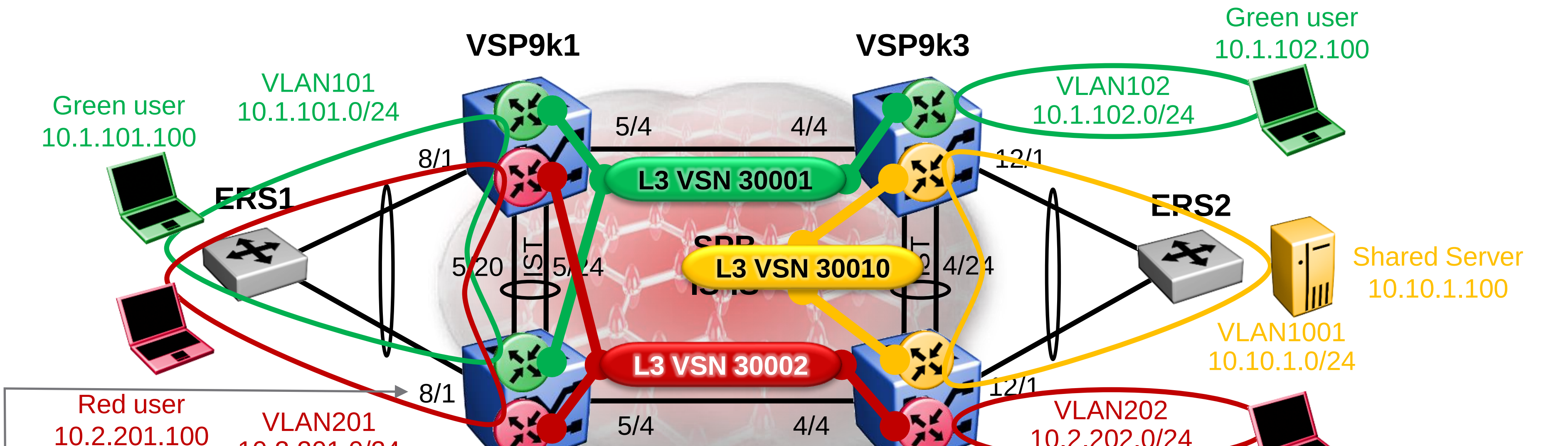
VSP9000-1:1#% show isis spbm ip-unicast-fib id 30002

SPBM IP-UNICAST FIB ENTRY INFO

VRF	VRF ISID	DEST ISID	Destination	NH BEB	VLAN	OUTGOING INTERFACE	SPBM COST	PREFIX COST	IP ROUTE PREFERENCE
red	30002	30002	10.2.201.0/24	VSP9000-2	4051	IST	10	1	7
red	30002	30002	10.2.201.0/24	VSP9000-2	4052	IST	10	1	7
red	30002	30002	10.2.202.0/24	VSP9000-4	4051	IST	20	1	7
red	30002	30002	10.2.202.0/24	VSP9000-4	4052	5/4	20	1	7
red	30002	30010	10.10.1.0/24	VSP9000-3	4051	5/4	10	1	200
red	30002	30010	10.10.1.0/24	VSP9000-3	4052	5/4	10	1	200
red	30002	30010	10.10.1.0/24	VSP9000-4	4051	IST	20	1	200
red	30002	30010	10.10.1.0/24	VSP9000-4	4052	5/4	20	1	200

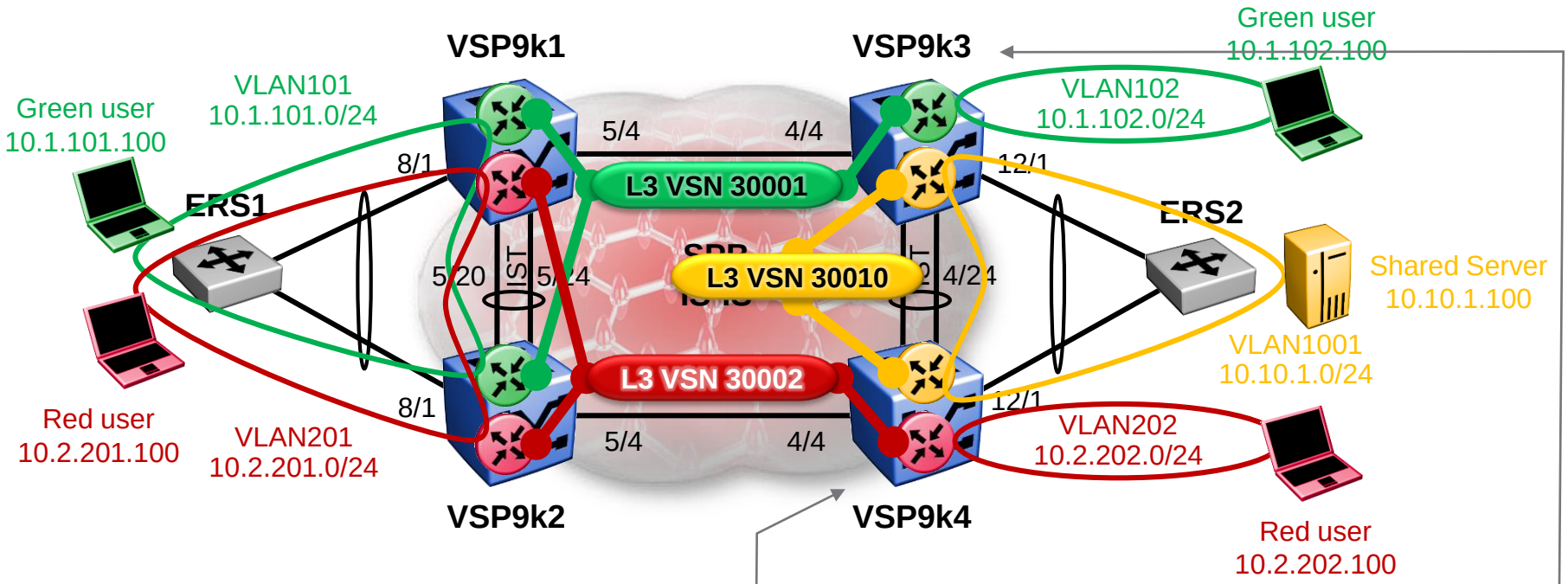
- Lowest Pref, and lowest cost route was installed; Note pref=200 for inter I-SID

Inter VRF-L3VSN route redistribution
Accept Shared VSN routes into Green & Red VSNs




```
VSP9000-2:1#% show ip route vrf green
================================================================================
                            IP Route - VRF green
================================================================================
                                                NH              INTER
DST              MASK             NEXT          VRF/ISID    COST FACE  PROT AGE TYPE PRF
--------------------------------------------------------------------------------
10.1.101.0       255.255.255.0    10.1.101.2    -           1    101   LOC  0   DB   0
10.1.102.0       255.255.255.0    VSP9000-3     green       20   4051  ISIS 0   IBSV 7
10.10.1.0        255.255.255.0    VSP9000-4     30010       10   4051  ISIS 0   IBSV 200

VSP9000-2:1#% show ip route vrf red
================================================================================
                             IP Route - VRF red
================================================================================
                                                NH              INTER
DST              MASK             NEXT          VRF/ISID    COST FACE  PROT AGE TYPE PRF
--------------------------------------------------------------------------------
10.2.201.0       255.255.255.0    10.2.201.2    -           1    201   LOC  0   DB   0
10.2.202.0       255.255.255.0    VSP9000-4     red         10   4051  ISIS 0   IBSV 7
10.10.1.0        255.255.255.0    VSP9000-4     30010       10   4051  ISIS 0   IBSV 200
```

Inter VRF-L3VSN route redistribution
Accept Shared VSN routes into Green & Red VSNs

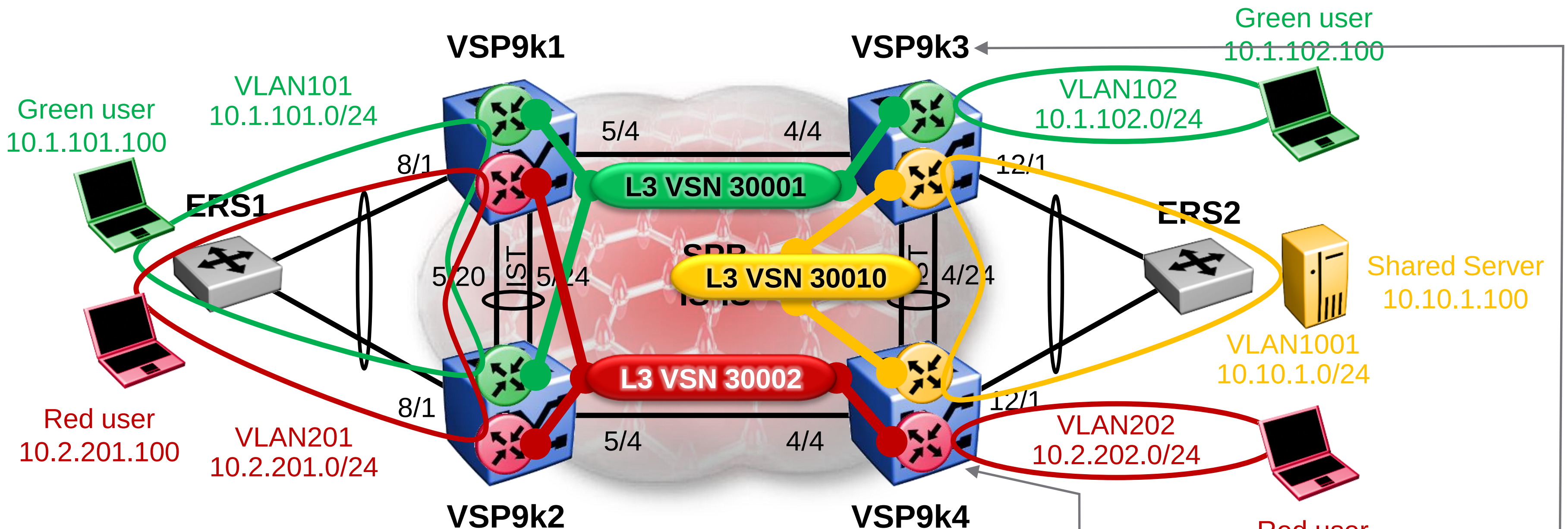


- New ISIS Accept policies in Rel 4.0
- Note that on these BEBs we are effectively going to achieve IP route redistribution between the local VRFs

```
router vrf green
   isis accept i-sid 30010 enable
exit
isis apply accept vrf green
```

```
router vrf red
   isis accept i-sid 30010 enable
exit
isis apply accept vrf red
```

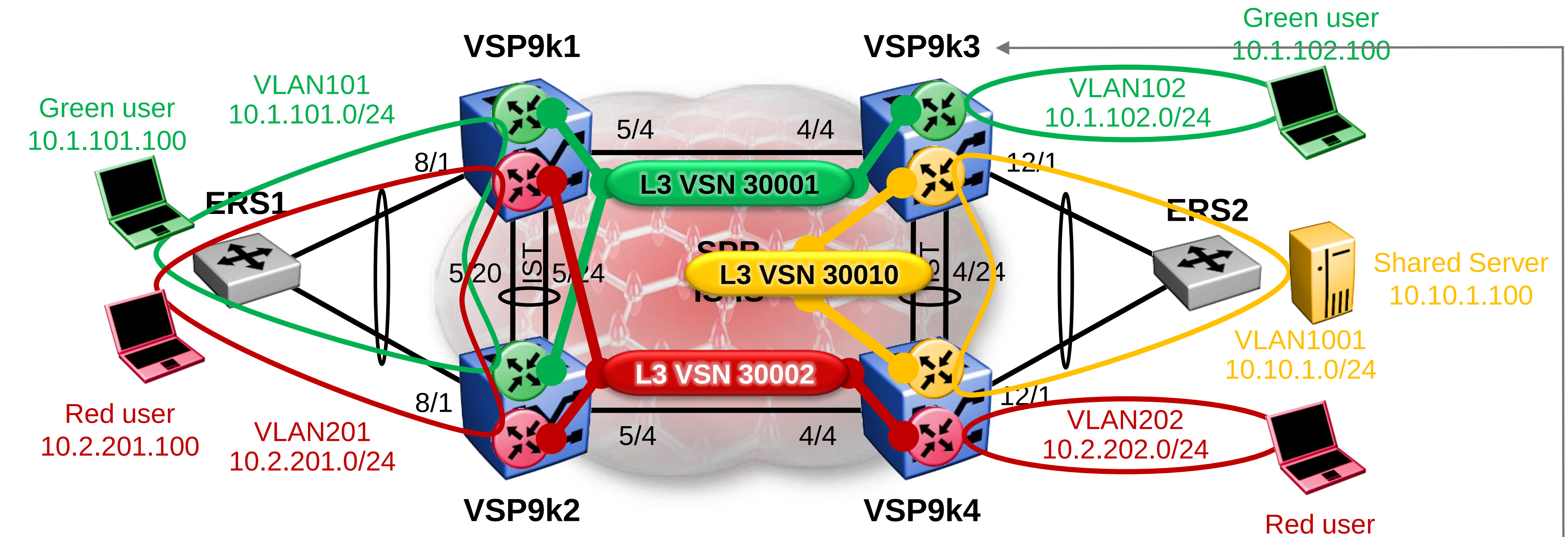
Inter VRF-L3VSN route redistribution
Accept Shared VSN routes into Green & Red VSNs




```
VSP9000-4:1#% show ip route vrf red
================================================================================
                              IP Route - VRF red
================================================================================
                                          NH                    INTER
DST           MASK           NEXT             VRF/ISID     COST FACE PROT AGE TYPE PRF
--------------------------------------------------------------------------------
10.2.201.0    255.255.255.0  VSP9000-2        red          10   4051 ISIS 0   IBSV 7
10.2.202.0    255.255.255.0  10.2.202.1       -            1    202  LOC  0   DB   0
10.10.1.0     255.255.255.0  10.10.1.2        shared       0    1001 ISIS 0   IB   200
```

```
VSP9000-3:1#% show ip route vrf green
================================================================================
                              IP Route - VRF green
================================================================================
                                          NH                    INTER
DST           MASK           NEXT             VRF/ISID     COST FACE PROT AGE TYPE PRF
--------------------------------------------------------------------------------
10.1.101.0    255.255.255.0  VSP9000-1        green        10   4051 ISIS 0   IBSV 7
10.1.102.0    255.255.255.0  10.1.102.1       -            1    102  LOC  0   DB   0
10.10.1.0     255.255.255.0  10.10.1.1        shared       0    1001 ISIS 0   IB   200
```

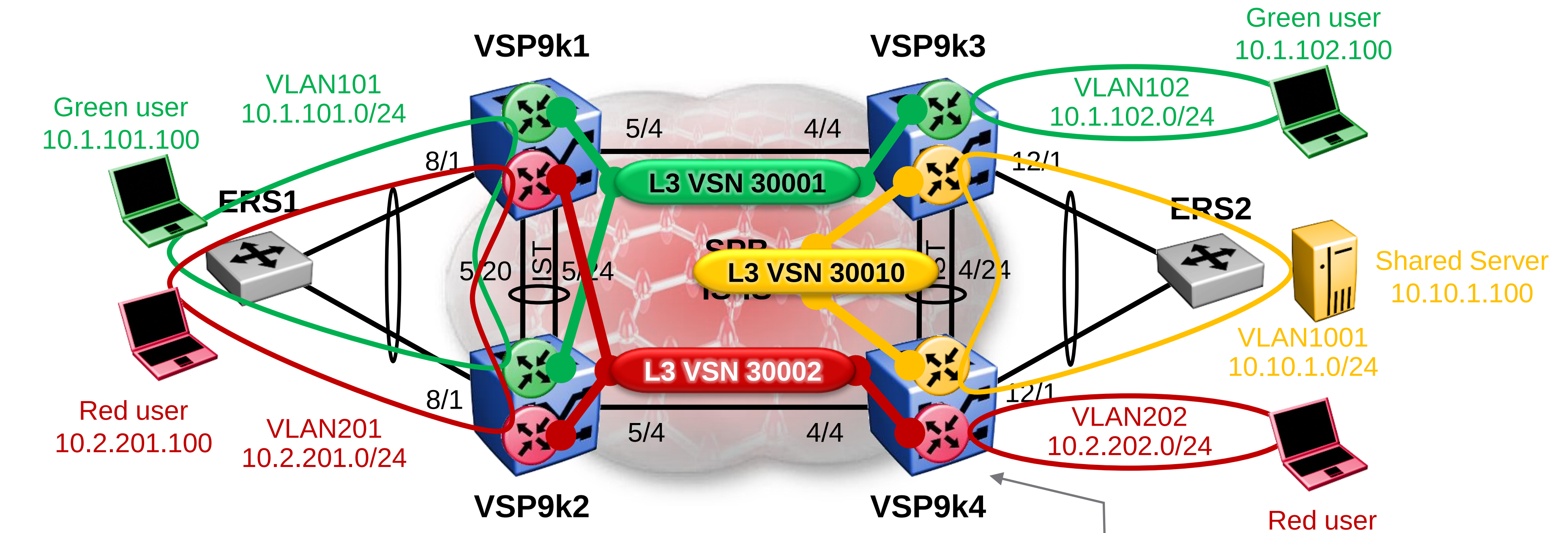
Inter VRF-L3VSN route redistribution
Accept Shared VSN routes into Green & Red VSNs




```
VSP9000-3:1#% show isis spbm ip-unicast-fib id 30001
==========================================================================================
                              SPBM IP-UNICAST FIB ENTRY INFO
==========================================================================================
         VRF      DEST                                       OUTGOING  SPBM     PREFIX   IP ROUTE
VRF      ISID     ISID     Destination      NH BEB      VLAN INTERFACE COST     COST     PREFERENCE
------------------------------------------------------------------------------------------
green    30001    30001    10.1.101.0/24    VSP9000-1   4051 4/4       10       1        7
green    30001    30001    10.1.101.0/24    VSP9000-1   4052 4/4       10       1        7
green    30001    30001    10.1.101.0/24    VSP9000-2   4051 4/4       20       1        7
green    30001    30001    10.1.101.0/24    VSP9000-2   4052 IST       20       1        7
green    30001    30010    10.10.1.0/24     VSP9000-3   1001 Local     0        1        200
green    30001    30010    10.10.1.0/24     VSP9000-4   4051 IST       10       1        200
green    30001    30010    10.10.1.0/24     VSP9000-4   4052 IST       10       1        200
```

- Lowest Pref, and lowest cost route was installed; Note Local route has cost=0

Inter VRF-L3VSN route redistribution
Accept Shared VSN routes into Green & Red VSNs




```
VSP9000-4:1#% show isis spbm ip-unicast-fib id 30002
```

SPBM IP-UNICAST FIB ENTRY INFO

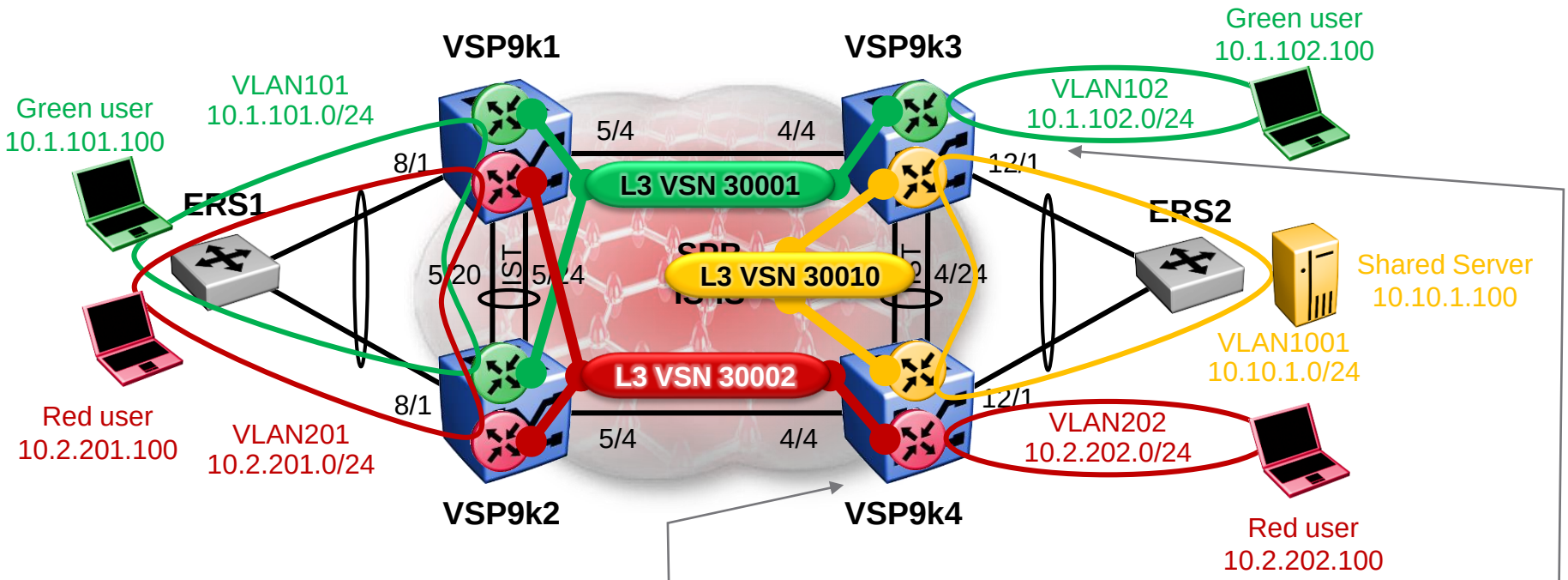
VRF	VRF ISID	DEST ISID	Destination	NH BEB	VLAN	OUTGOING INTERFACE	SPBM COST	PREFIX COST	IP ROUTE PREFERENCE
red	30002	30002	10.2.201.0/24	VSP9000-1	4051	4/4	20	1	7
red	30002	30002	10.2.201.0/24	VSP9000-1	4052	IST	20	1	7
red	30002	30002	10.2.201.0/24	VSP9000-2	4051	4/4	10	1	7
red	30002	30002	10.2.201.0/24	VSP9000-2	4052	4/4	10	1	7
red	30002	30010	10.10.1.0/24	VSP9000-3	4051	IST	10	1	200
red	30002	30010	10.10.1.0/24	VSP9000-3	4052	IST	10	1	200
red	30002	30010	10.10.1.0/24	VSP9000-4	1001	Local	0	1	200

- Lowest Pref, and lowest cost route was installed; Note Local route has cost=0

Inter VRF-L3VSN route redistribution Checkpoint

- We have now succeeded in redistribution the Shared VRF IP route into both the Green and Red VSNs
- However the Green and Red users are still not able to communicate with the Shared Server because the Shared VRF does not have a return IP route towards the Green and Red users
  - Yes packets from Green & Red Users now reach the Shared Server
  - But the Shared Server's replies will get dropped in the Shared VRF due to no IP route to destination
- We therefore need to also redistribute the Green and Red IP subnets into the Shared VRFs

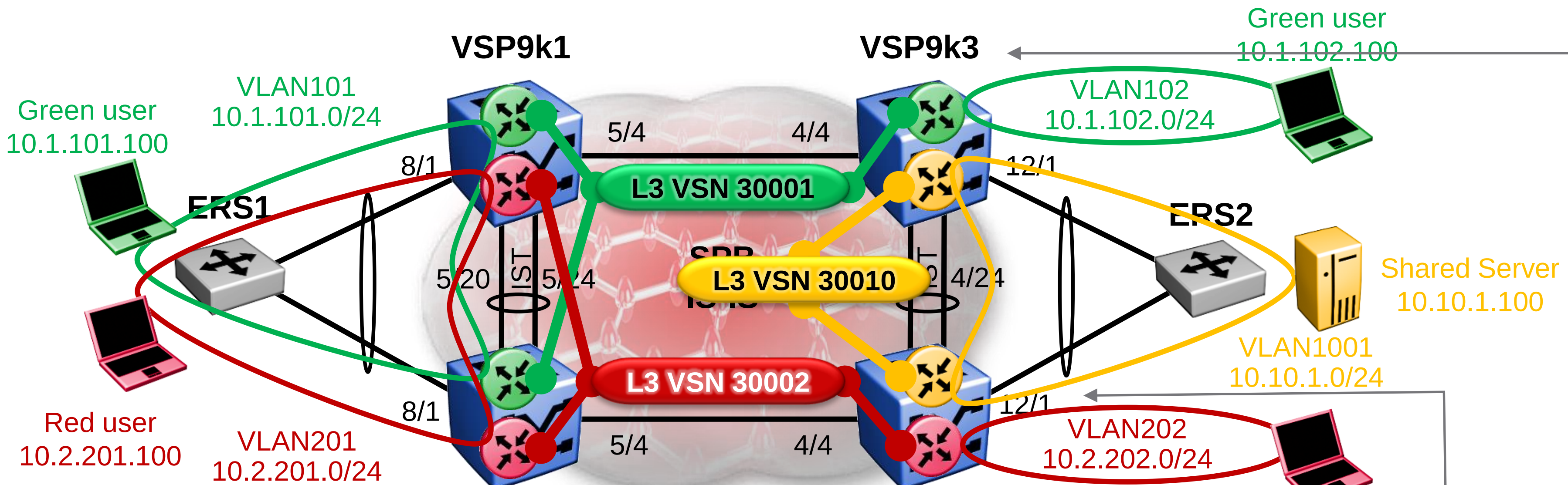
Inter VRF-L3VSN route redistribution
Accept Green & Red VSN routes into Shared VRF




```
router vrf shared
   ip isid-list users list 30001,30002
   isis accept isid-list users enable
exit
isis apply accept vrf shared
```

- New ISIS Accept policies in Rel 4.0
- Note that this time we are using an ISID-List as this is an easier way to accept IP routes from 2 or more L3 I-SIDs

Inter VRF-L3VSN route redistribution
Accept Green & Red VSN routes into Shared VRF



VSP9000-4:1#% show ip route vrf shared

IP Route - VRF shared

DST	MASK	NEXT	NH VRF/ISID	COST	INTER FACE	PROT	AGE	TYPE	PRF
10.1.101.0	255.255.255.0	VSP9000-2	30001	10	4051	ISIS	0	IBSV	200
10.1.102.0	255.255.255.0	VSP9000-3	30001	10	4051	ISIS	0	IBSV	200
10.2.201.0	255.255.255.0	VSP9000-2	red	10	4051	ISIS	0	IBSV	200
10.2.202.0	255.255.255.0	10.2.202.1	red	0	202	ISIS	0	IB	200
10.10.1.0	255.255.255.0	10.10.1.2	-	1	1001	LOC	0	DB	0

0

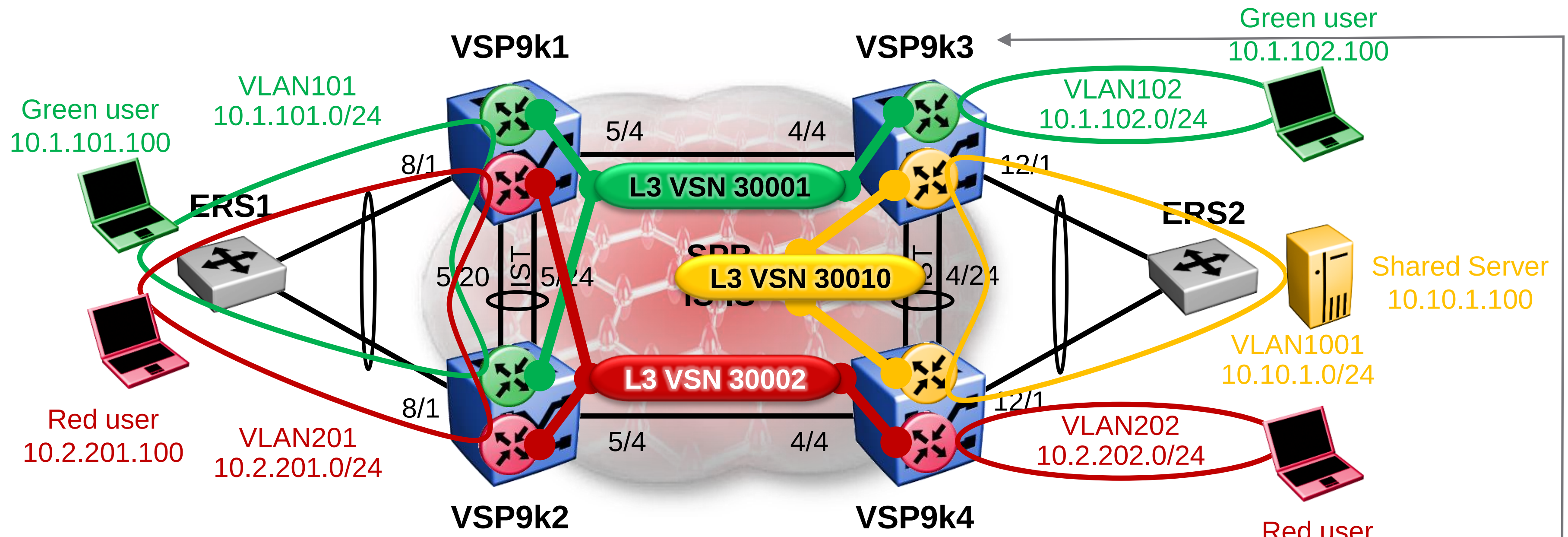
VSP9000-3:1#%

IP Route - VRF shared

DST	MASK	NEXT	NH VRF/ISID	COST	INTER FACE	PROT	AGE	TYPE	PRF
10.1.101.0	255.255.255.0	VSP9000-1	green	10	4051	ISIS	0	IBSV	200
10.1.102.0	255.255.255.0	10.1.102.1	green	0	102	ISIS	0	IB	200
10.2.201.0	255.255.255.0	VSP9000-1	30002	10	4051	ISIS	0	IBSV	200
10.2.202.0	255.255.255.0	VSP9000-4	30002	10	4051	ISIS	0	IBSV	200
10.10.1.0	255.255.255.0	10.10.1.1	-	1	1001	LOC	0	DB	0

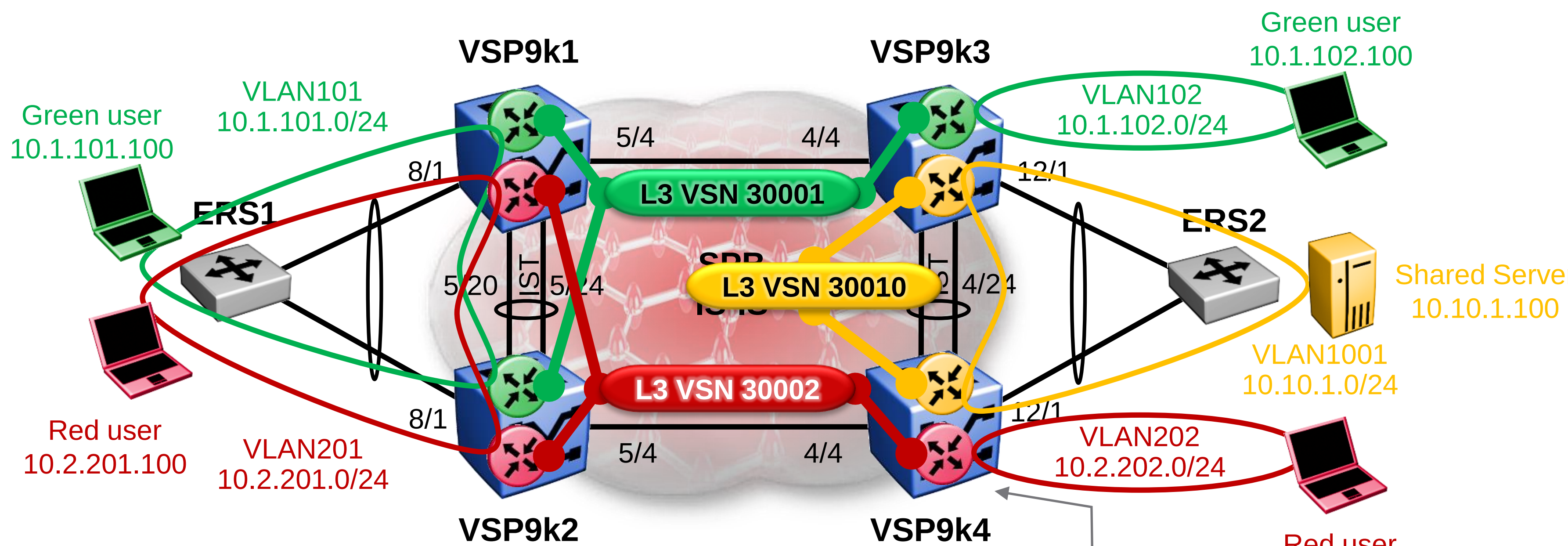
- Note how NH VRF/I-SID only resolves to VRF name if we have that VRF locally configured

Inter VRF-L3VSN route redistribution
Accept Green & Red VSN routes into Shared VRF




```
VSP9000-3:1#% show isis spbm ip-unicast-fib id 30010
==========================================================================================
                              SPBM IP-UNICAST FIB ENTRY INFO
==========================================================================================
          VRF     DEST                                          OUTGOING  SPBM      PREFIX    IP ROUTE
VRF       ISID    ISID    Destination      NH BEB          VLAN INTERFACE COST      COST      PREFERENCE
------------------------------------------------------------------------------------------
shared    30010   30001   10.1.101.0/24    VSP9000-1       4051 4/4       10        1         200
shared    30010   30001   10.1.101.0/24    VSP9000-1       4052 4/4       10        1         200
shared    30010   30001   10.1.101.0/24    VSP9000-2       4051 4/4       20        1         200
shared    30010   30001   10.1.101.0/24    VSP9000-2       4052 IST       20        1         200
shared    30010   30001   10.1.102.0/24    VSP9000-3       102  Local     0         1         200
shared    30010   30002   10.2.201.0/24    VSP9000-1       4051 4/4       10        1         200
shared    30010   30002   10.2.201.0/24    VSP9000-1       4052 4/4       10        1         200
shared    30010   30002   10.2.201.0/24    VSP9000-2       4051 4/4       20        1         200
shared    30010   30002   10.2.201.0/24    VSP9000-2       4052 IST       20        1         200
shared    30010   30002   10.2.202.0/24    VSP9000-4       4051 IST       10        1         200
shared    30010   30002   10.2.202.0/24    VSP9000-4       4052 IST       10        1         200
shared    30010   30010   10.10.1.0/24     VSP9000-4       4051 IST       10        1         7
shared    30010   30010   10.10.1.0/24     VSP9000-4       4052 IST       10        1         7
```

Inter VRF-L3VSN route redistribution
Accept Green & Red VSN routes into Shared VRF

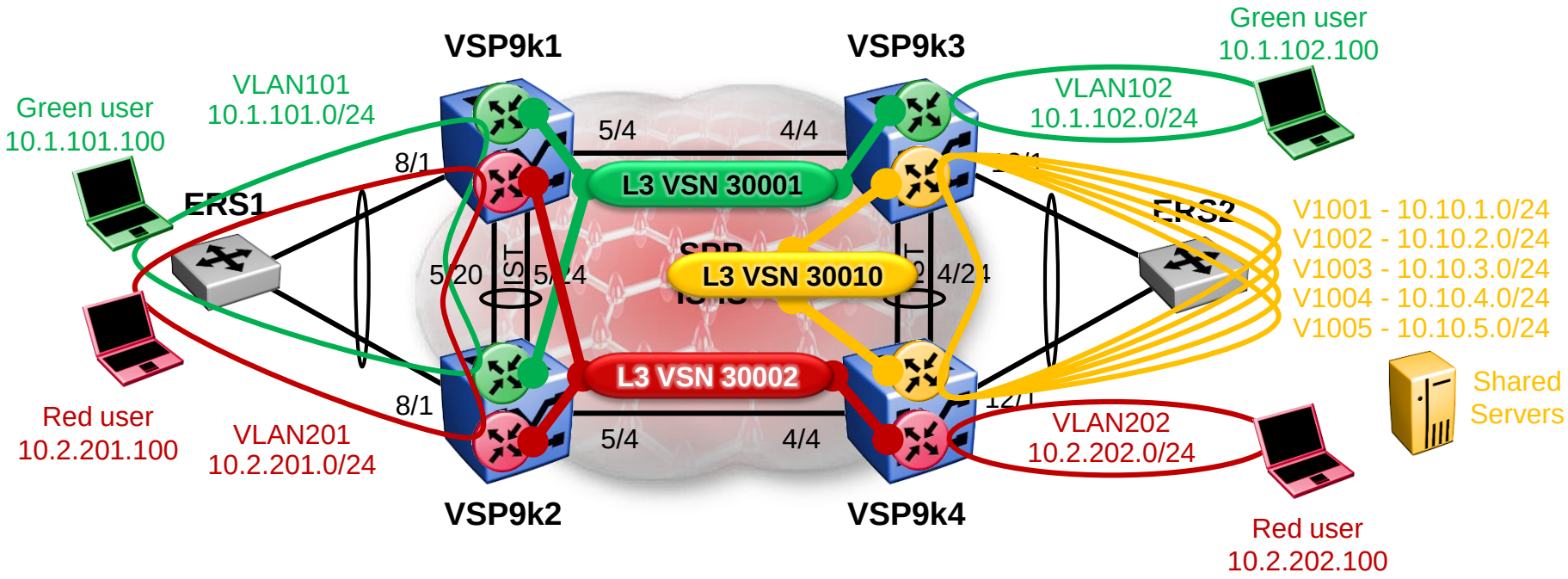



```
VSP9000-4:1#% show isis spbm ip-unicast-fib id 30010
================================================================================================
                                  SPBM IP-UNICAST FIB ENTRY INFO
================================================================================================
          VRF      DEST                                         OUTGOING  SPBM      PREFIX    IP ROUTE
VRF       ISID     ISID     Destination       NH BEB            VLAN INTERFACE COST      COST      PREFERENCE
------------------------------------------------------------------------------------------------
shared    30010    30001    10.1.101.0/24     VSP9000-1         4051 4/4       20        1         200
shared    30010    30001    10.1.101.0/24     VSP9000-1         4052 IST       20        1         200
shared    30010    30001    10.1.101.0/24     VSP9000-2         4051 4/4       10        1         200
shared    30010    30001    10.1.101.0/24     VSP9000-2         4052 4/4       10        1         200
shared    30010    30001    10.1.102.0/24     VSP9000-3         4051 IST       10        1         200
shared    30010    30001    10.1.102.0/24     VSP9000-3         4052 IST       10        1         200
shared    30010    30002    10.2.201.0/24     VSP9000-1         4051 4/4       20        1         200
shared    30010    30002    10.2.201.0/24     VSP9000-1         4052 IST       20        1         200
shared    30010    30002    10.2.201.0/24     VSP9000-2         4051 4/4       10        1         200
shared    30010    30002    10.2.201.0/24     VSP9000-2         4052 4/4       10        1         200
shared    30010    30002    10.2.202.0/24     VSP9000-4         202  Local     0         1         200
shared    30010    30010    10.10.1.0/24      VSP9000-3         4051 IST       10        1         7
shared    30010    30010    10.10.1.0/24      VSP9000-3         4052 IST       10        1         7
```

Inter VRF-L3VSN route redistribution Checkpoint

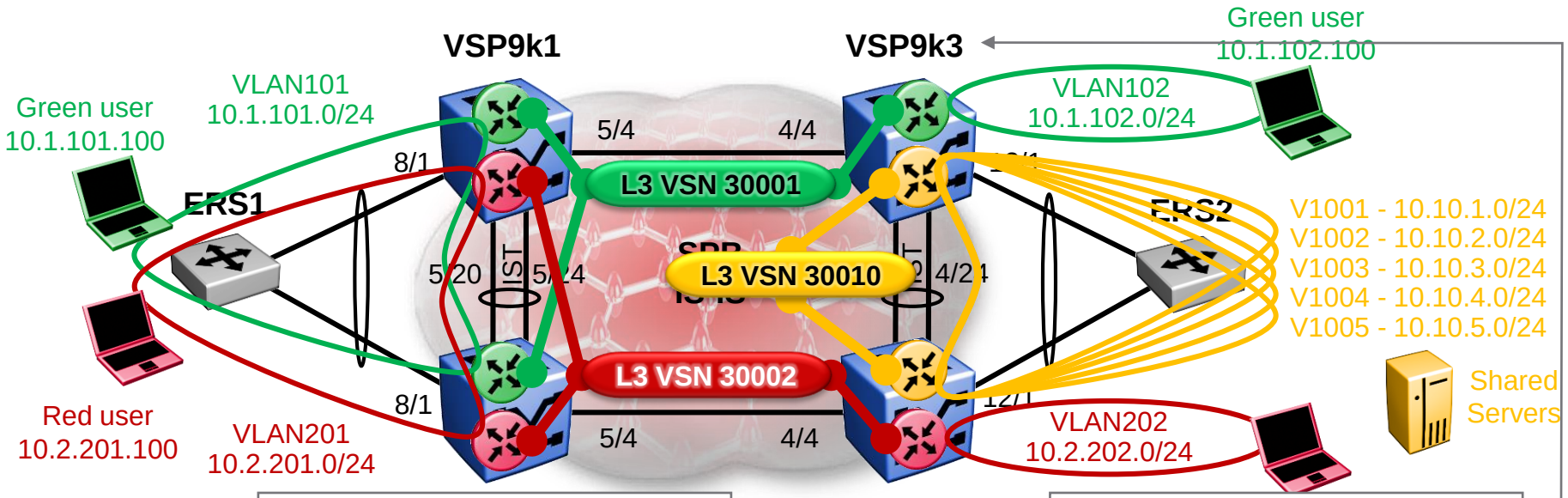
- We have now succeeded in redistribution the Shared VRF IP route into both the Green and Red VSNs
- And we have redistributed all the Green & Red user subnets into the Shared VRF
- So Green & Red users can now communicate with the Shared Server
- But can Green & Red users talk to each other ?
  - No, because within the Green VRF there is no IP route to reach the Red IP subnets
    - And vice-versa
  - However, the same would not be the case if we had redistributed a default route from the Shared VRF into the Green & Red VSNs
    - This scenario is covered in example use #4

Inter VRF-L3VSN route redistribution
Redistribute Summarised Shared VSN routes



- We now have lots of Server subnets in the Shared VRF
- We want to summarize these subnets as 1 single IP route 10.10.0.0/21

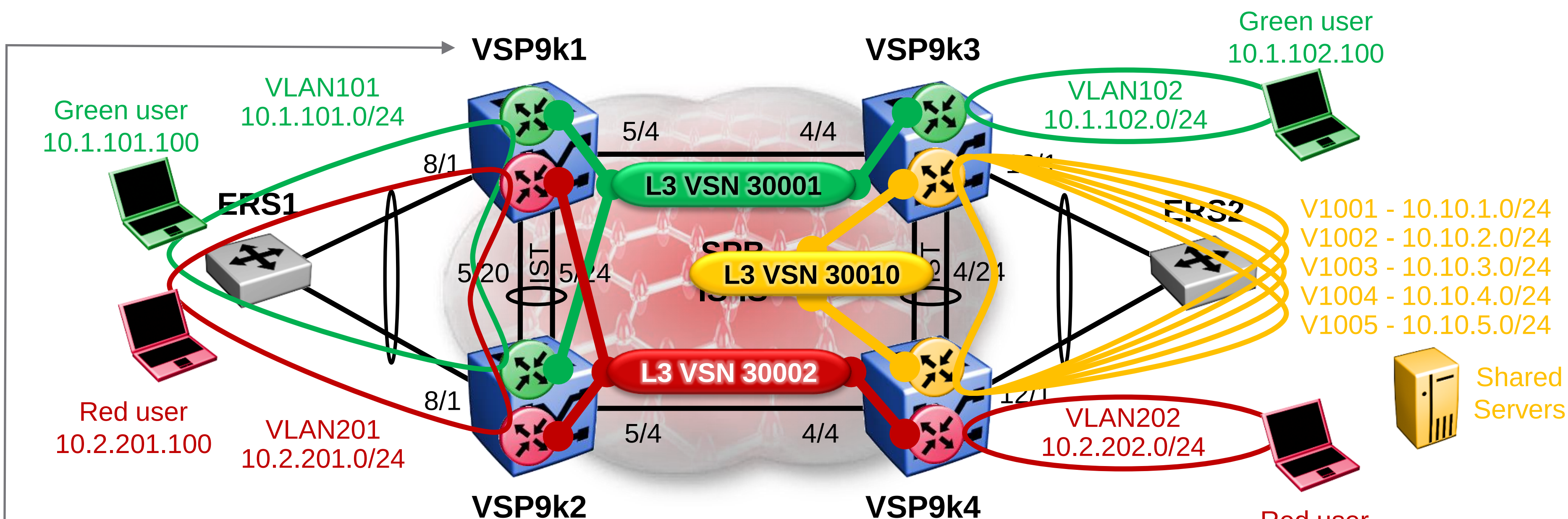
Inter VRF-L3VSN route redistribution
Shared VRF additional subnets Config




```
vlan create 1002 type port-mstprstp 0
vlan create 1003 type port-mstprstp 0
vlan create 1004 type port-mstprstp 0
vlan create 1005 type port-mstprstp 0
mlt 1 vlan 1002,1003,1004,1005
mlt 512 vlan 1002,1003,1004,1005
interface vlan 1002
   vrf shared
   ip address 10.10.2.2 255.255.255.0
exit
interface vlan 1003
   vrf shared
   ip address 10.10.3.2 255.255.255.0
exit
interface vlan 1004
   vrf shared
   ip address 10.10.4.2 255.255.255.0
exit
interface vlan 1005
   vrf shared
   ip address 10.10.5.2 255.255.255.0
exit
```

```
vlan create 1002 type port-mstprstp 0
vlan create 1003 type port-mstprstp 0
vlan create 1004 type port-mstprstp 0
vlan create 1005 type port-mstprstp 0
mlt 1 vlan 1002,1003,1004,1005
mlt 512 vlan 1002,1003,1004,1005
interface vlan 1002
   vrf shared
   ip address 10.10.2.1 255.255.255.0
exit
interface vlan 1003
   vrf shared
   ip address 10.10.3.1 255.255.255.0
exit
interface vlan 1004
   vrf shared
   ip address 10.10.4.1 255.255.255.0
exit
interface vlan 1005
   vrf shared
   ip address 10.10.5.1 255.255.255.0
exit
```

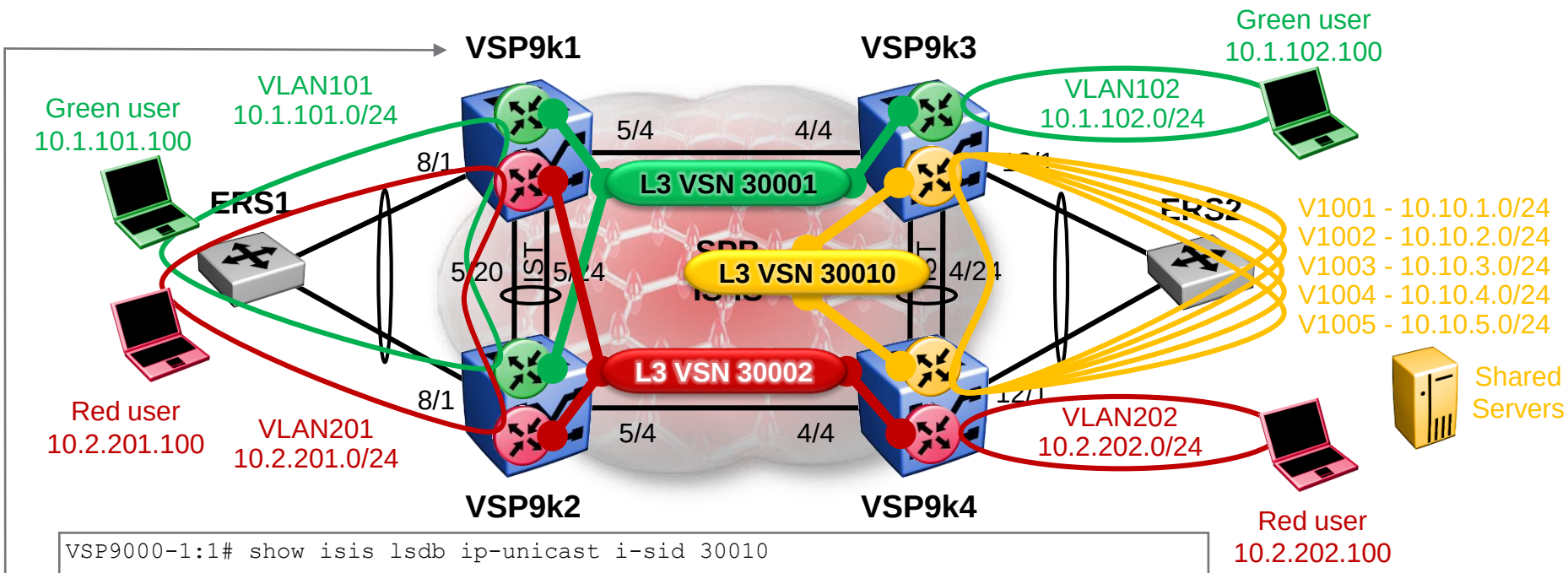
Inter VRF-L3VSN route redistribution
Shared VRF additional subnets Config




```
VSP9000-1:1#% show ip route vrf green
================================================================================
                              IP Route - VRF green
================================================================================
                                                NH                  INTER
DST            MASK             NEXT            VRF/ISID      COST  FACE   PROT AGE TYPE PRF
--------------------------------------------------------------------------------
10.1.101.0     255.255.255.0    10.1.101.1      -             1     101    LOC  0   DB   0
10.1.102.0     255.255.255.0    VSP9000-3       green         10    4051   ISIS 0   IBSV 7
10.10.1.0      255.255.255.0    VSP9000-3       30010         10    4051   ISIS 0   IBSV 200
10.10.2.0      255.255.255.0    VSP9000-3       30010         10    4051   ISIS 0   IBSV 200
10.10.3.0      255.255.255.0    VSP9000-3       30010         10    4051   ISIS 0   IBSV 200
10.10.4.0      255.255.255.0    VSP9000-3       30010         10    4051   ISIS 0   IBSV 200
10.10.5.0      255.255.255.0    VSP9000-3       30010         10    4051   ISIS 0   IBSV 200
```

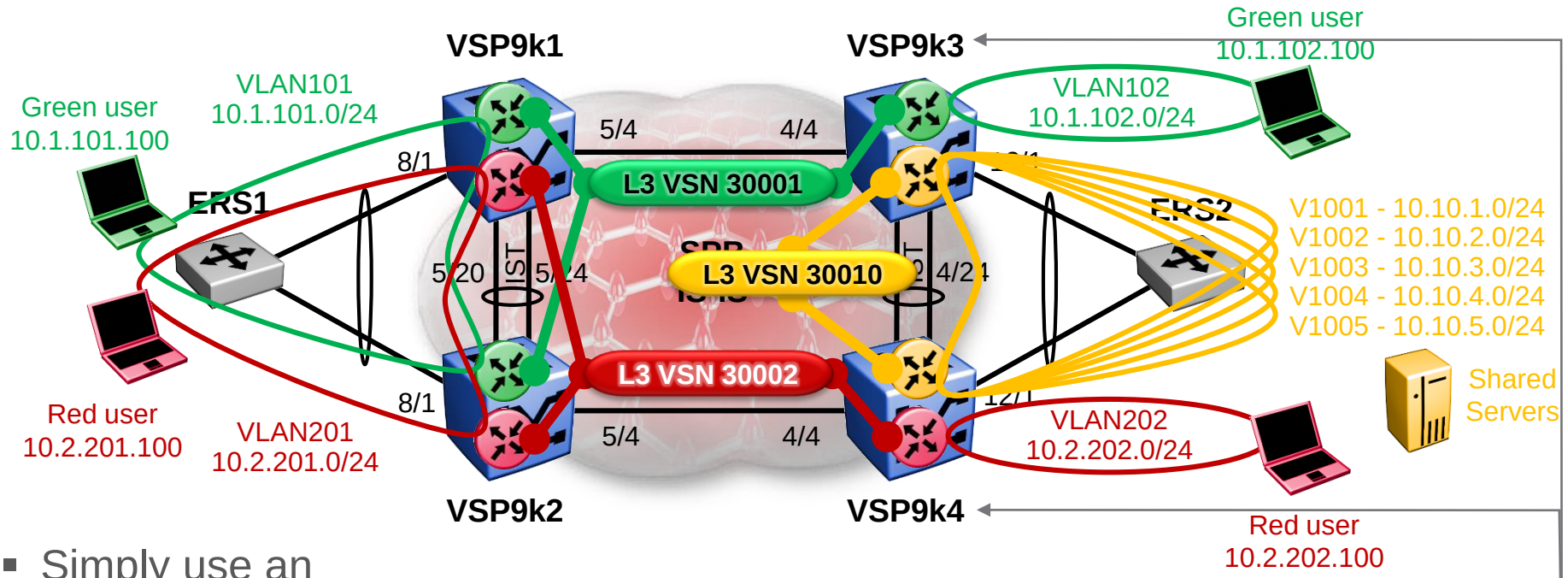
- We want to summarise the Server subnets as 1 single 10.10.0.0/21 network

Inter VRF-L3VSN route redistribution
Redist Summarised Shared VSN routes




```
VSP9000-1:1# show isis lsdb ip-unicast i-sid 30010
================================================================================
                          ISIS IP-UNICAST-ROUTE SUMMARY
================================================================================
                              PREFIX          TLV    LSP    HOST
I-SID      ADDRESS            LENGTH  METRIC  TYPE   FRAG   NAME
--------------------------------------------------------------------------------
30010      10.10.1.0          24      1       184    0x3    VSP9000-3
30010      10.10.2.0          24      1       184    0x3    VSP9000-3
30010      10.10.3.0          24      1       184    0x3    VSP9000-3
30010      10.10.4.0          24      1       184    0x3    VSP9000-3
30010      10.10.5.0          24      1       184    0x3    VSP9000-3
30010      10.10.1.0          24      1       184    0x3    VSP9000-4
30010      10.10.2.0          24      1       184    0x3    VSP9000-4
30010      10.10.3.0          24      1       184    0x3    VSP9000-4
30010      10.10.4.0          24      1       184    0x3    VSP9000-4
30010      10.10.5.0          24      1       184    0x3    VSP9000-4
```

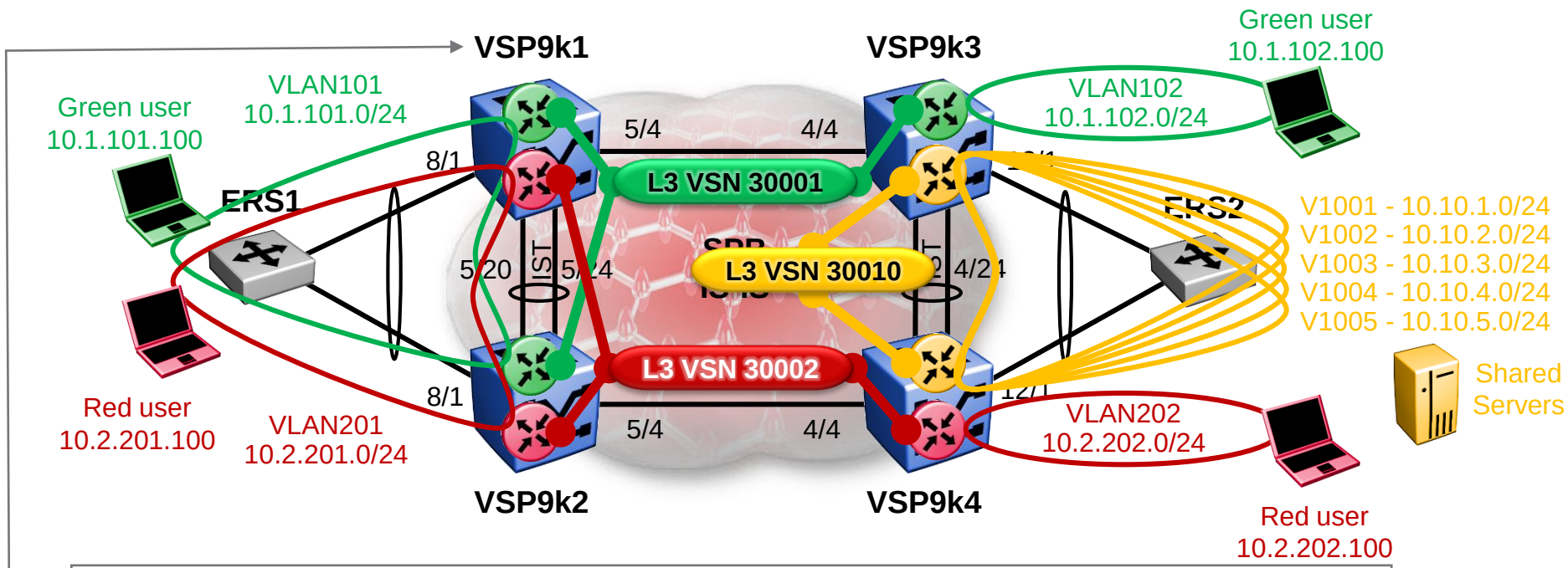
Inter VRF-L3VSN route redistribution
Redist Summarised Shared VSN routes



- Simply use an injectlist and apply it to the already existing ISIS redistribution of direct routes in the Shared VRF

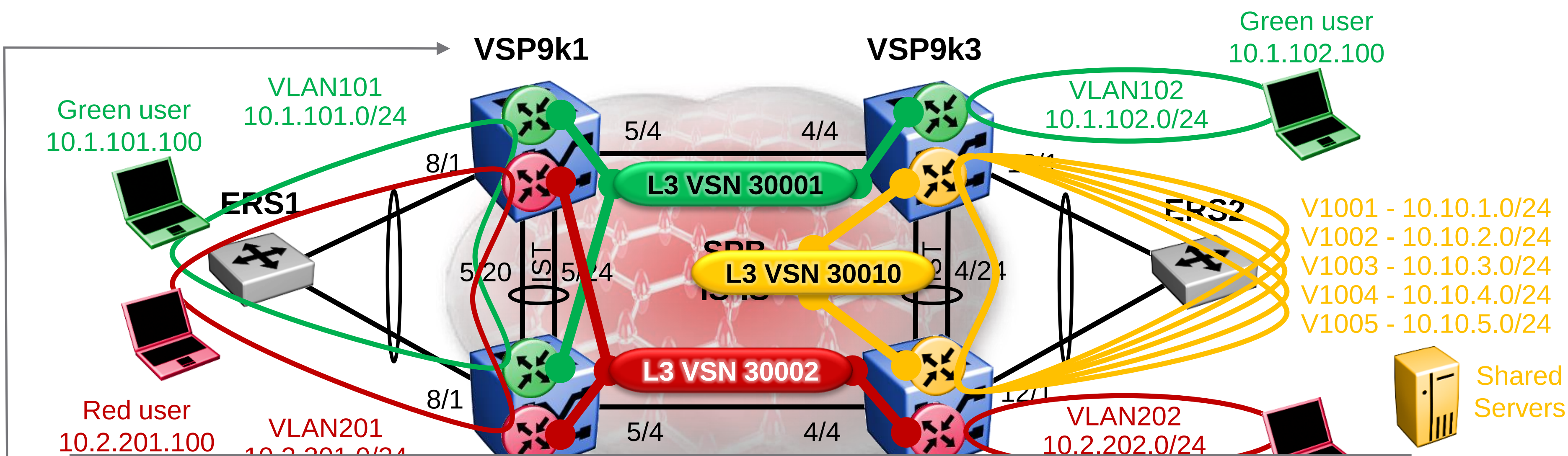
```
router vrf shared
   ip prefix-list "server_nets" 10.10.0.0/21
   route-map "summarize-server_nets" 1
      enable
      set injectlist "server_nets"
   exit
   isis redistribute direct route-map "summarize-server_nets"
exit
isis apply redistribute direct vrf shared
```

Inter VRF-L3VSN route redistribution
Redist Summarised Shared VSN routes



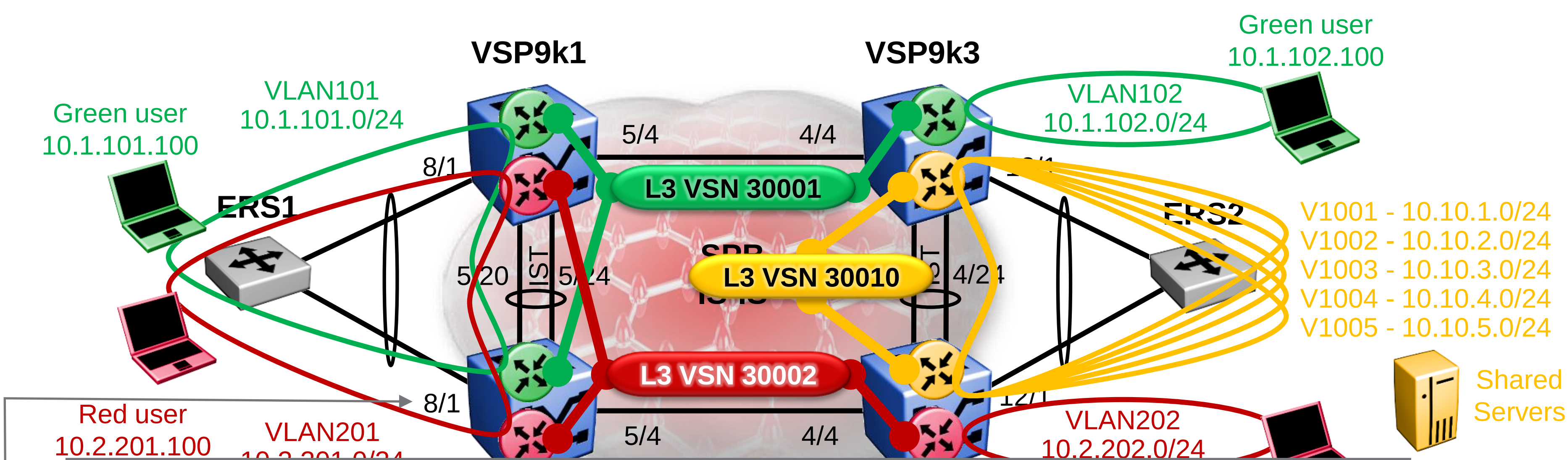

```
VSP9000-1:1# show isis lsdb ip-unicast i-sid 30010
================================================================================
                          ISIS IP-UNICAST-ROUTE SUMMARY
================================================================================
                            PREFIX          TLV    LSP    HOST
I-SID     ADDRESS           LENGTH  METRIC  TYPE   FRAG   NAME
--------------------------------------------------------------------------------
30010     10.10.0.0         21      1       184    0x3    VSP9000-3
30010     10.10.0.0         21      1       184    0x3    VSP9000-4
--------------------------------------------------------------------------------
2 out of 12 Total Num of Entries
```

Inter VRF-L3VSN route redistribution
Redist Summarised Shared VSN routes



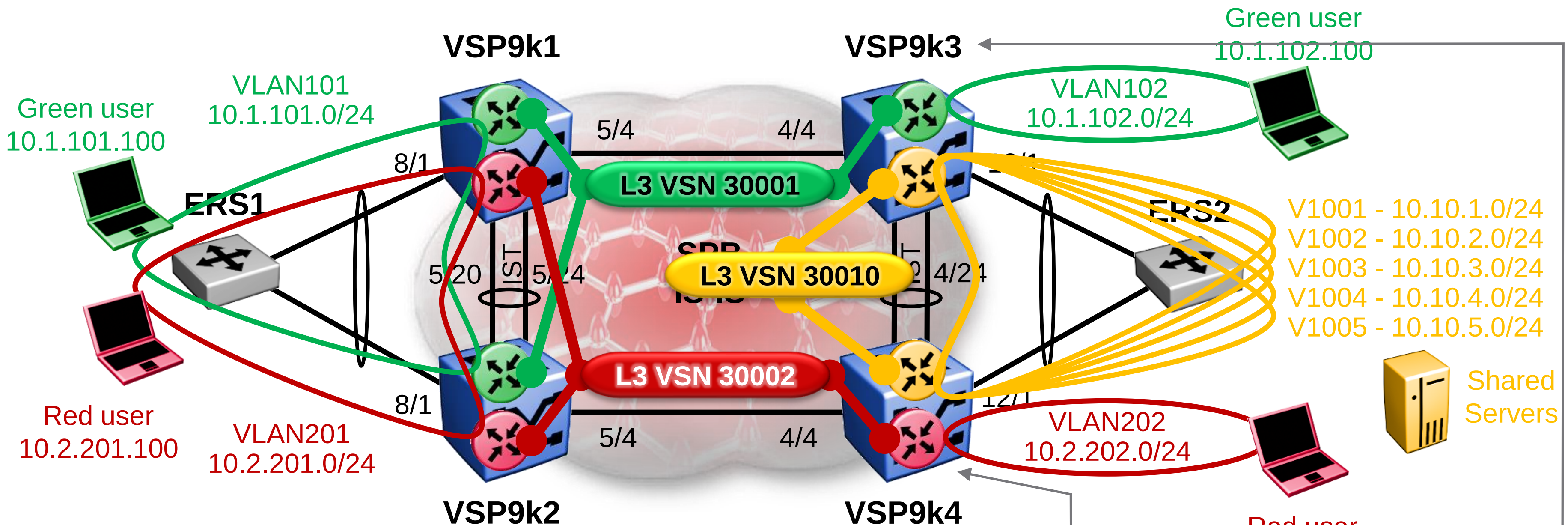

```
VSP9000-1:1#% show ip route vrf green
================================================================================================
                                   IP Route - VRF green
================================================================================================
                                                  NH                      INTER
DST            MASK           NEXT                VRF/ISID           COST FACE  PROT AGE TYPE PRF
------------------------------------------------------------------------------------------------
10.1.101.0     255.255.255.0  10.1.101.1          -                  1    101   LOC  0   DB   0
10.1.102.0     255.255.255.0  VSP9000-3           green              10   4051  ISIS 0   IBSV 7
10.10.0.0      255.255.248.0  VSP9000-3           30010              10   4051  ISIS 0   IBSV 200

VSP9000-1:1#% show ip route vrf red
================================================================================================
                                   IP Route - VRF red
================================================================================================
                                                  NH                      INTER
DST            MASK           NEXT                VRF/ISID           COST FACE  PROT AGE TYPE PRF
------------------------------------------------------------------------------------------------
10.2.201.0     255.255.255.0  10.2.201.1          -                  1    201   LOC  0   DB   0
10.2.202.0     255.255.255.0  VSP9000-4           red                20   4051  ISIS 0   IBSV 7
10.10.0.0      255.255.248.0  VSP9000-3           30010              10   4051  ISIS 0   IBSV 200
```

Inter VRF-L3VSN route redistribution
Redist Summarised Shared VSN routes




```
VSP9000-2:1#% show ip route vrf green
================================================================================
                         IP Route - VRF green
================================================================================
                                               NH                 INTER
DST            MASK            NEXT            VRF/ISID     COST  FACE  PROT AGE TYPE PRF
--------------------------------------------------------------------------------
10.1.101.0     255.255.255.0   10.1.101.2      -            1     101   LOC  0   DB   0
10.1.102.0     255.255.255.0   VSP9000-3       green        20    4051  ISIS 0   IBSV 7
10.10.0.0      255.255.248.0   VSP9000-4       30010        10    4051  ISIS 0   IBSV 200

VSP9000-2:1#% show ip route vrf red
================================================================================
                         IP Route - VRF red
================================================================================
                                               NH                 INTER
DST            MASK            NEXT            VRF/ISID     COST  FACE  PROT AGE TYPE PRF
--------------------------------------------------------------------------------
10.2.201.0     255.255.255.0   10.2.201.2      -            1     201   LOC  0   DB   0
10.2.202.0     255.255.255.0   VSP9000-4       red          10    4051  ISIS 0   IBSV 7
10.10.0.0      255.255.248.0   VSP9000-4       30010        10    4051  ISIS 0   IBSV 200
```

Inter VRF-L3VSN route redistribution
Summarised routes will not work on local VRFs

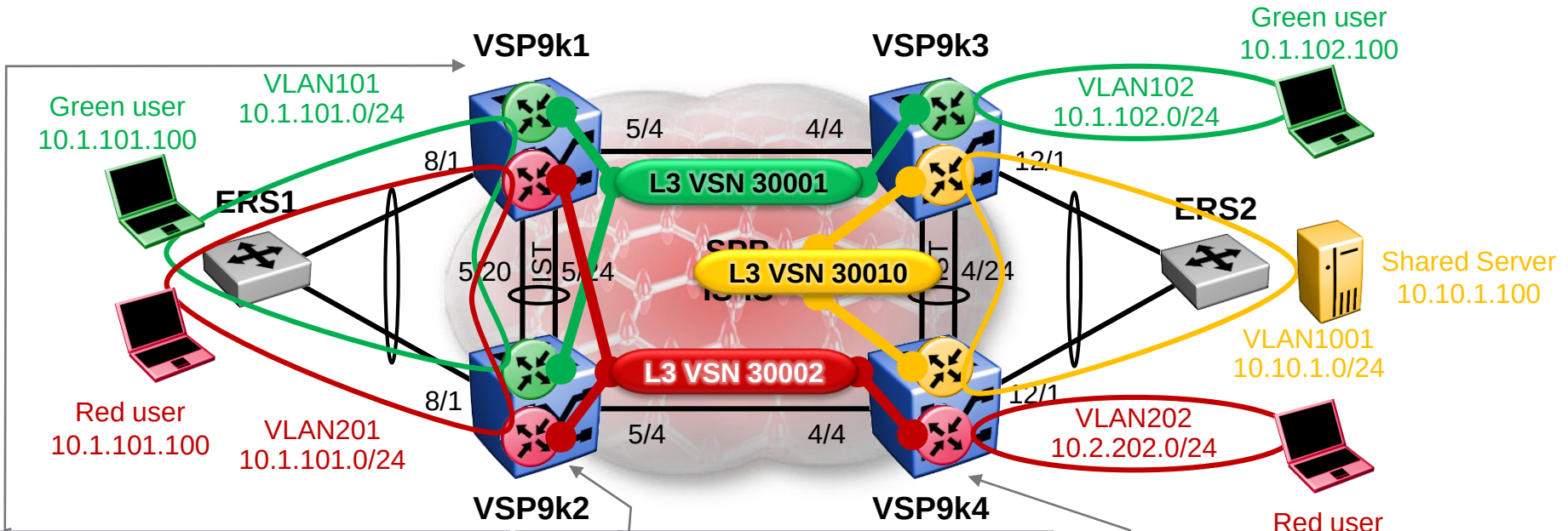



```
VSP9000-4:1#% show ip route vrf red
================================================================================
                              IP Route - VRF red
================================================================================
                                                NH                  INTER
DST             MASK            NEXT            VRF/ISID            COST  FACE  PROT AGE TYPE PRF
--------------------------------------------------------------------------------
10.2.201.0      255.255.255.0   VSP9000-2       red                 10    4051  ISIS 0   IBSV 7
10.2.202.0      255.255.255.0   10.2.202.1      -                   1     202   LOC  0   DB   0
```

```
VSP9000-3:1#% show i
====================

====================
                                            NH                  INTER
DST             MASK            NEXT            VRF/ISID            COST FACE  PROT AGE TYPE PRF
--------------------------------------------------------------------------------
10.1.101.0      255.255.255.0   VSP9000-1       green               10   4051  ISIS 0   IBSV 7
10.1.102.0      255.255.255.0   10.1.102.1      -                   1    102   LOC  0   DB   0
```

- NOTE, summarizing the VSN routes can only be done when they will only be ISIS accepted on a different BEB from the one where they were summarized

Inter VRF-L3VSN route redistribution
Overlapping subnets / Control which route to accept



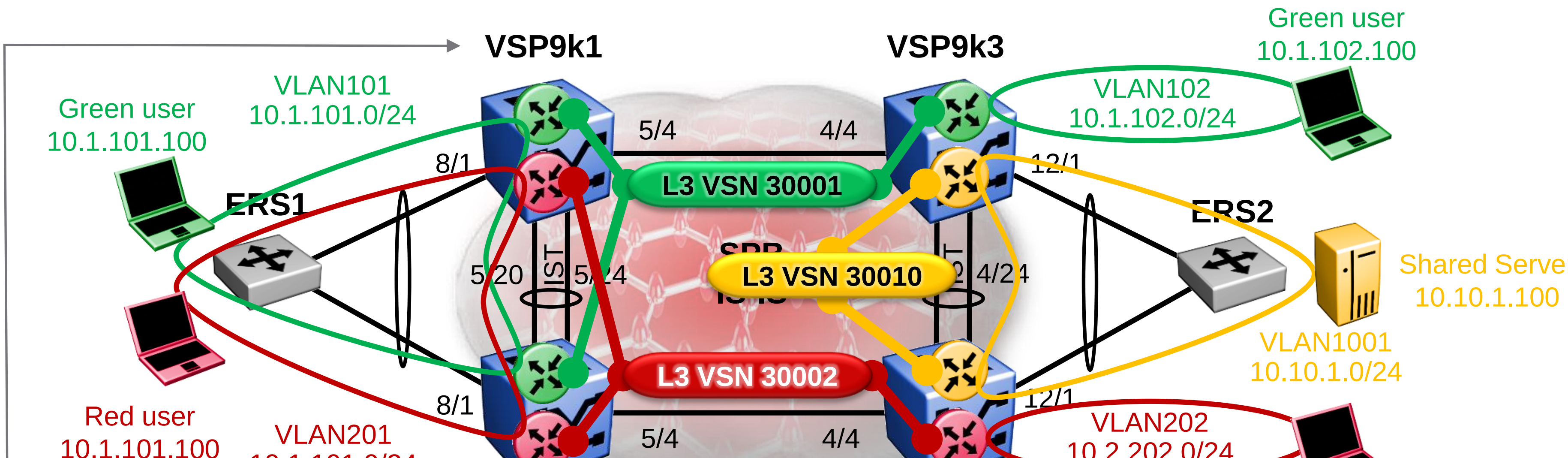

```
interface vlan 201
   no ip address 10.2.201.1
   ip address 10.1.101.1 255.255.255.0
   ip rsmlt
   ip rsmlt holdup-timer 9999
exit
```

```
interface vlan 201
   no ip address 10.2.201.2
   ip address 10.1.101.2 255.255.255.0
   ip rsmlt
   ip rsmlt holdup-timer 9999
exit
```

```
interface vlan 202
   no ip address 10.2.202.1
   ip address 10.1.102.1 255.255.255.0
exit
```

- In this setup variant, the IP subnets of the Red L3VSN are changed to overlap the IP subnets of Green L3VSN
- We want to test how we can control which IP routes the Shared VRFs accept

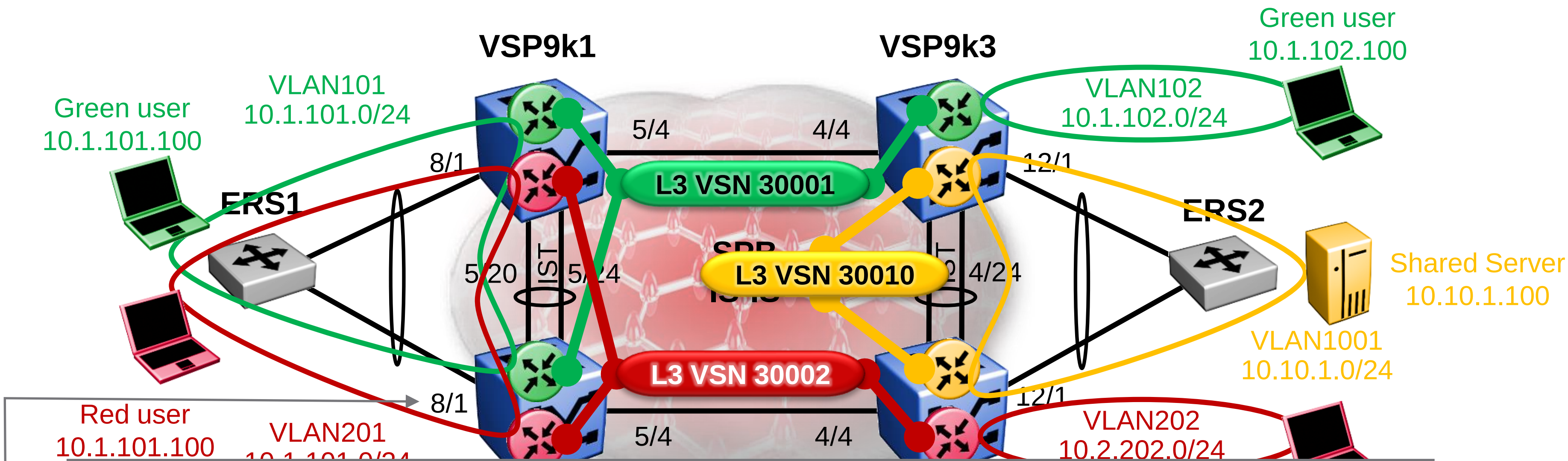
Inter VRF-L3VSN route redistribution
Overlapping subnets / Control which route to accept




```
VSP9000-1:1#% show ip route vrf green
================================================================================
                          IP Route - VRF green
================================================================================
                                              NH                 INTER
DST             MASK            NEXT          VRF/ISID      COST FACE  PROT AGE TYPE PRF
--------------------------------------------------------------------------------
10.1.101.0      255.255.255.0   10.1.101.1    -             1    101   LOC  0   DB   0
10.1.102.0      255.255.255.0   VSP9000-3     green         10   4051  ISIS 0   IBSV 7
10.10.1.0       255.255.255.0   VSP9000-3     30010         10   4051  ISIS 0   IBSV 200

VSP9000-1:1#% show ip route vrf red
================================================================================
                          IP Route - VRF red
================================================================================
                                              NH                 INTER
DST             MASK            NEXT          VRF/ISID      COST FACE  PROT AGE TYPE PRF
--------------------------------------------------------------------------------
10.1.101.0      255.255.255.0   10.1.101.1    -             1    201   LOC  0   DB   0
10.1.102.0      255.255.255.0   VSP9000-4     red           20   4051  ISIS 0   IBSV 7
10.10.1.0       255.255.255.0   VSP9000-3     30010         10   4051  ISIS 0   IBSV 200
```

- Ok

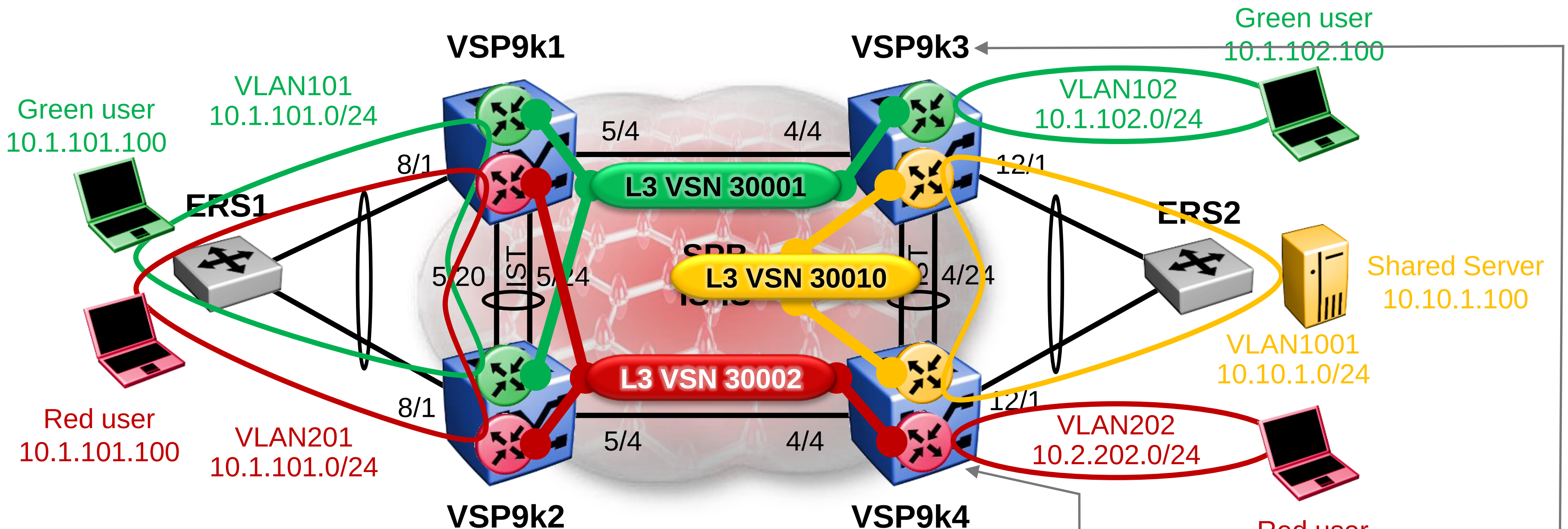
Inter VRF-L3VSN route redistribution
Overlapping subnets / Control which route to accept




```
VSP9000-2:1#% show ip route vrf green
================================================================================
                          IP Route - VRF green
================================================================================
                                          NH                 INTER
DST            MASK            NEXT          VRF/ISID     COST FACE  PROT AGE TYPE PRF
--------------------------------------------------------------------------------
10.1.101.0     255.255.255.0   10.1.101.2    -            1    101   LOC  0   DB   0
10.1.102.0     255.255.255.0   VSP9000-3     green        20   4051  ISIS 0   IBSV 7
10.10.1.0      255.255.255.0   VSP9000-4     30010        10   4051  ISIS 0   IBSV 200

VSP9000-2:1#% show ip route vrf red
================================================================================
                          IP Route - VRF red
================================================================================
                                          NH                 INTER
DST            MASK            NEXT          VRF/ISID     COST FACE  PROT AGE TYPE PRF
--------------------------------------------------------------------------------
10.1.101.0     255.255.255.0   10.1.101.2    -            1    201   LOC  0   DB   0
10.1.102.0     255.255.255.0   VSP9000-4     red          10   4051  ISIS 0   IBSV 7
10.10.1.0      255.255.255.0   VSP9000-4     30010        10   4051  ISIS 0   IBSV 200
```

- Ok

Inter VRF-L3VSN route redistribution
Overlapping subnets / Control which route to accept

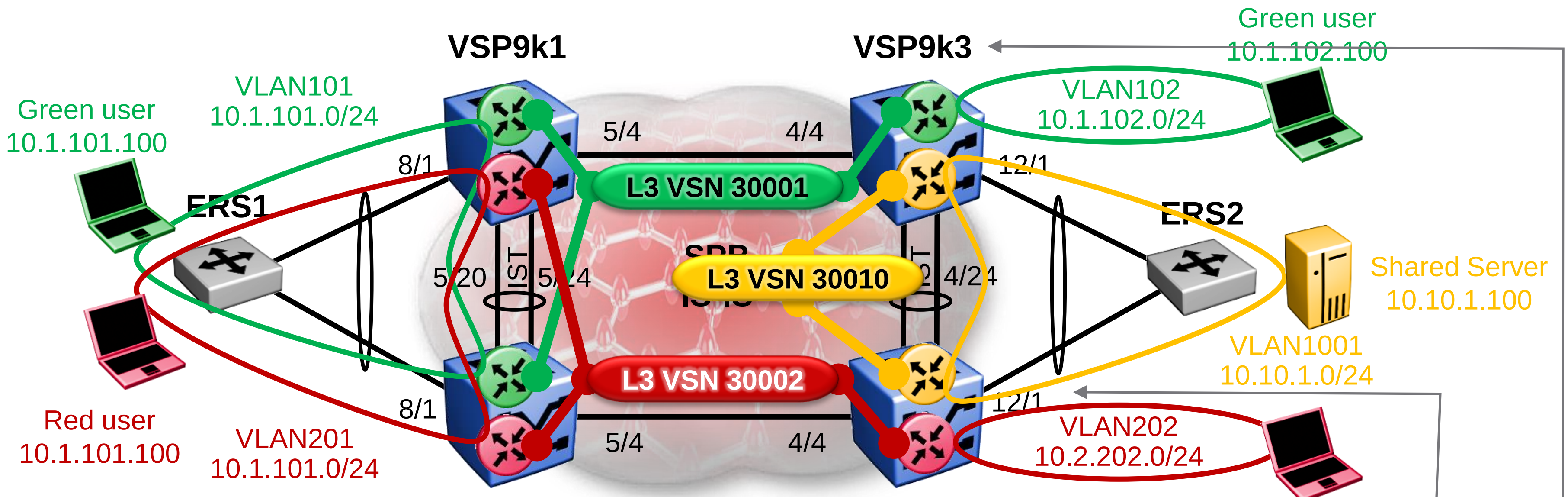



```
VSP9000-4:1#% show ip route vrf red
================================================================================
                              IP Route - VRF red
================================================================================
                                          NH                   INTER
DST            MASK           NEXT        VRF/ISID        COST FACE  PROT AGE TYPE PRF
--------------------------------------------------------------------------------
10.1.101.0     255.255.255.0  VSP9000-2   red             10   4051  ISIS 0   IBSV 7
10.1.102.0     255.255.255.0  10.1.102.1  -               1    202   LOC  0   DB   0
10.10.1.0      255.255.255.0  10.10.1.2   shared          0    1001  ISIS 0   IB   200
```

```
VSP9000-3:1#% show ip route vrf green
================================================================================
                              IP Route - VRF green
================================================================================
                                          NH                   INTER
DST            MASK           NEXT        VRF/ISID        COST FACE  PROT AGE TYPE PRF
--------------------------------------------------------------------------------
10.1.101.0     255.255.255.0  VSP9000-1   green           10   4051  ISIS 0   IBSV 7
10.1.102.0     255.255.255.0  10.1.102.1  -               1    102   LOC  0   DB   0
10.10.1.0      255.255.255.0  10.10.1.1   shared          0    1001  ISIS 0   IB   200
```

- Ok

Inter VRF-L3VSN route redistribution
Overlapping subnets / Control which route to accept

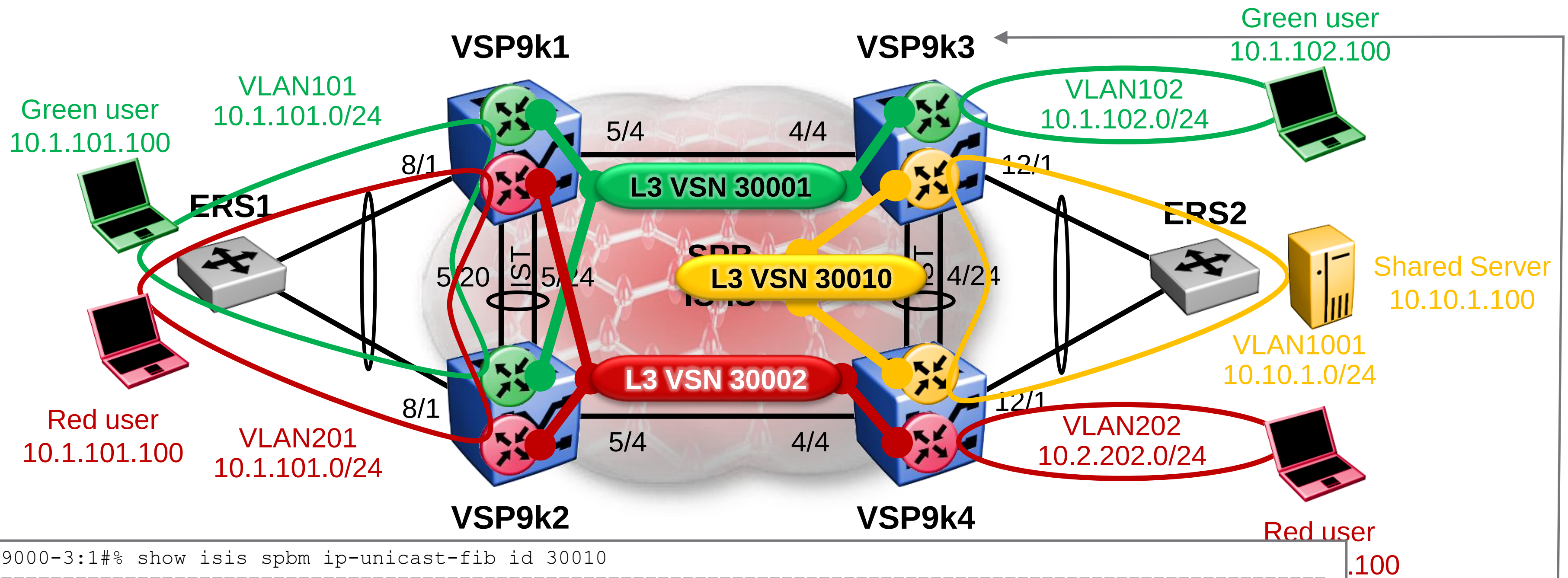



```
VSP9000-4:1#% show ip route vrf shared
================================================================================================
                              IP Route - VRF shared
================================================================================================
                                                         NH                INTER
DST          MASK          NEXT                VRF/ISID        COST  FACE  PROT  AGE  TYPE  PRF
------------------------------------------------------------------------------------------------
10.1.101.0   255.255.255.0 VSP9000-2           30001           10    4051  ISIS  0    IBSV  200
10.1.102.0   255.255.255.0 10.1.102.1          red             0     202   ISIS  0    IB    200
10.10.1.0    255.255.255.0 10.10.1.2           -               1     1001  LOC   0    DB    0
```

```
VSP9000-3:1#% show ip route vrf shared
================================================================================================
                              IP Route - VRF shared
================================================================================================
                                                         NH                INTER
DST          MASK          NEXT                VRF/ISID        COST  FACE  PROT  AGE  TYPE  PRF
------------------------------------------------------------------------------------------------
10.1.101.0   255.255.255.0 VSP9000-1           green           10    4051  ISIS  0    IBSV  200
10.1.102.0   255.255.255.0 10.1.102.1          green           0     102   ISIS  0    IB    200
10.10.1.0    255.255.255.0 10.10.1.1           -               1     1001  LOC   0    DB    0
```

- Ouch!
- Not consistent

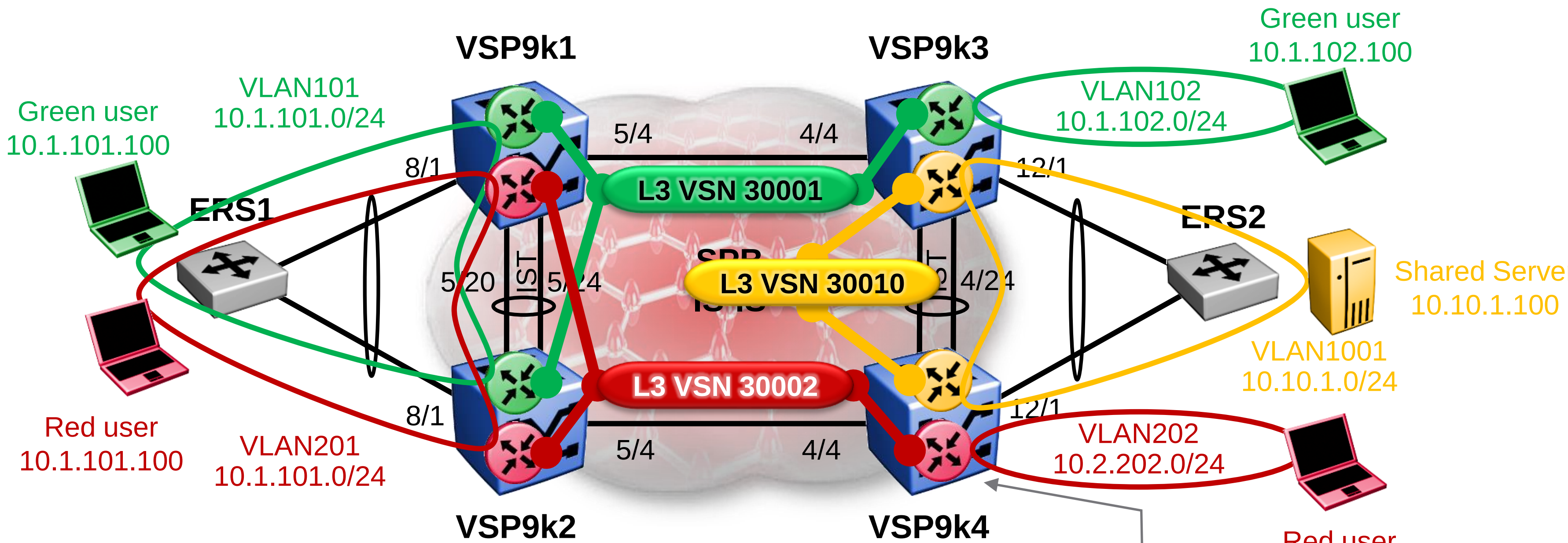
Inter VRF-L3VSN route redistribution
Overlapping subnets / Control which route to accept




```
VSP9000-3:1#% show isis spbm ip-unicast-fib id 30010
==========================================================================================
                               SPBM IP-UNICAST FIB ENTRY INFO
==========================================================================================
        VRF     DEST                                       OUTGOING  SPBM      PREFIX   IP ROUTE
VRF     ISID    ISID    Destination      NH BEB       VLAN INTERFACE COST      COST     PREFERENCE
------------------------------------------------------------------------------------------
shared  30010   30001   10.1.101.0/24    VSP9000-1    4051 4/4       10        1        200
shared  30010   30001   10.1.101.0/24    VSP9000-1    4052 4/4       10        1        200
shared  30010   30002   10.1.101.0/24    VSP9000-1    4051 4/4       10        1        200
shared  30010   30002   10.1.101.0/24    VSP9000-1    4052 4/4       10        1        200
shared  30010   30001   10.1.101.0/24    VSP9000-2    4051 4/4       20        1        200
shared  30010   30001   10.1.101.0/24    VSP9000-2    4052 IST       20        1        200
shared  30010   30002   10.1.101.0/24    VSP9000-2    4051 4/4       20        1        200
shared  30010   30002   10.1.101.0/24    VSP9000-2    4052 IST       20        1        200
shared  30010   30001   10.1.102.0/24    VSP9000-3    102  Local     0         1        200
shared  30010   30002   10.1.102.0/24    VSP9000-4    4051 IST       10        1        200
shared  30010   30002   10.1.102.0/24    VSP9000-4    4052 IST       10        1        200
shared  30010   30010   10.10.1.0/24     VSP9000-4    4051 IST       10        1        7
shared  30010   30010   10.10.1.0/24     VSP9000-4    4052 IST       10        1        7
```

- Installed routes are highlighted

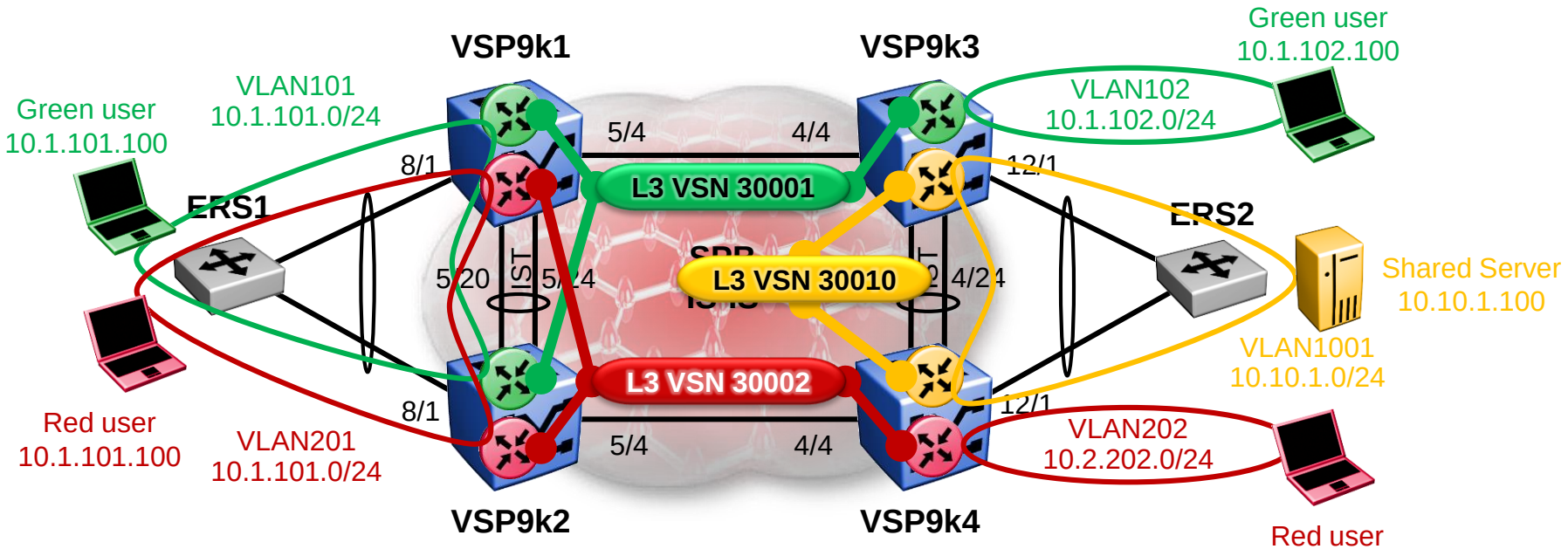
Inter VRF-L3VSN route redistribution
Overlapping subnets / Control which route to accept




```
VSP9000-4:1#% show isis spbm ip-unicast-fib id 30010
==========================================================================================
                              SPBM IP-UNICAST FIB ENTRY INFO
==========================================================================================
        VRF     DEST                                            OUTGOING  SPBM      PREFIX    IP ROUTE
VRF     ISID    ISID    Destination        NH BEB          VLAN INTERFACE COST      COST      PREFERENCE
------------------------------------------------------------------------------------------
shared  30010   30001   10.1.101.0/24      VSP9000-1       4051 4/4       20        1         200
shared  30010   30001   10.1.101.0/24      VSP9000-1       4052 IST       20        1         200
shared  30010   30002   10.1.101.0/24      VSP9000-1       4051 4/4       20        1         200
shared  30010   30002   10.1.101.0/24      VSP9000-1       4052 IST       20        1         200
shared  30010   30001   10.1.101.0/24      VSP9000-2       4051 4/4       10        1         200
shared  30010   30001   10.1.101.0/24      VSP9000-2       4052 4/4       10        1         200
shared  30010   30002   10.1.101.0/24      VSP9000-2       4051 4/4       10        1         200
shared  30010   30002   10.1.101.0/24      VSP9000-2       4052 4/4       10        1         200
shared  30010   30001   10.1.102.0/24      VSP9000-3       4051 IST       10        1         200
shared  30010   30001   10.1.102.0/24      VSP9000-3       4052 IST       10        1         200
shared  30010   30002   10.1.102.0/24      VSP9000-4       202  Local     0         1         200
shared  30010   30010   10.10.1.0/24       VSP9000-3       4051 IST       10        1         7
shared  30010   30010   10.10.1.0/24       VSP9000-3       4052 IST       10        1         7
```

- Installed routes are highlighte d

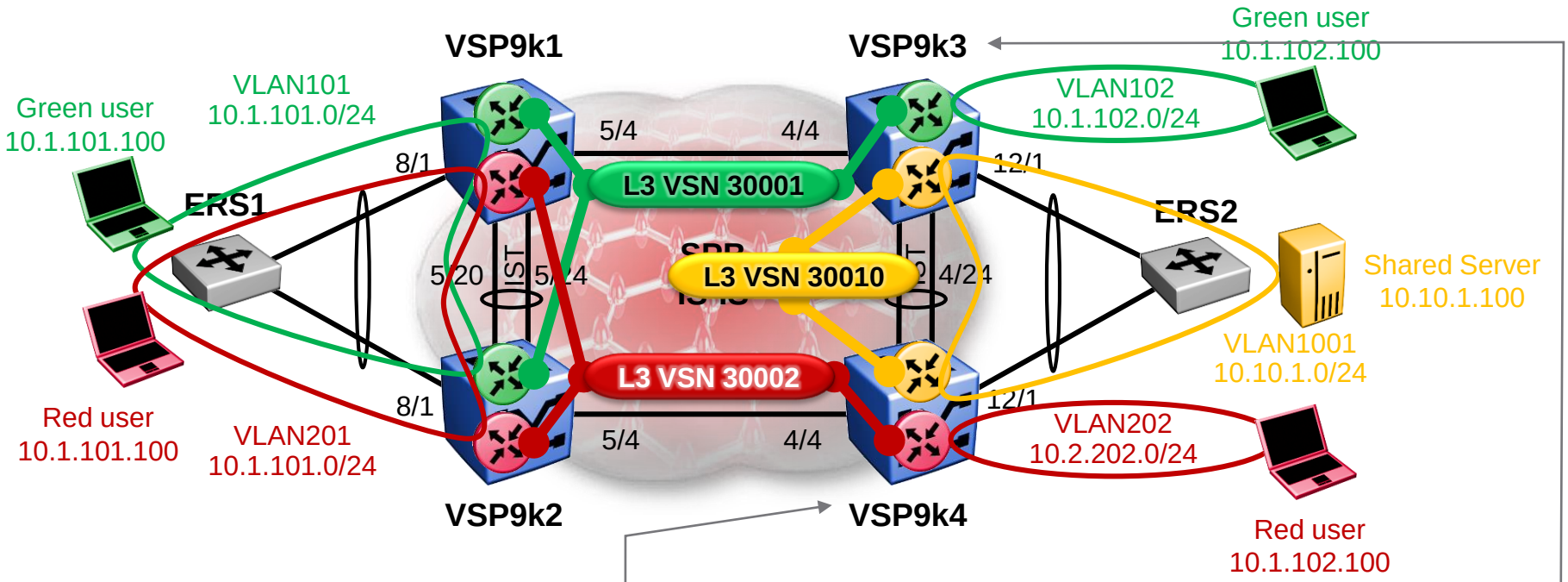
Inter VRF-L3VSN route redistribution
Overlapping subnets / Control which route to accept



- Tie breaking rules:
  - Local Routes preferred over Inter VSN routes
  - Routes with lowest route preference
    - can be changed using route-map policy on accept side
  - Routes with lowest SPBM cost
  - Routes with lowest prefix cost
    - can be changed using route-map on redistributing side
  - Routes with lower ISID preferred
  - Choose route from lowest BMAC

- NOTE that in case of equal cost, the routes will never go into ECMP as they do not lead to the same destination (even if the route is the same)
- In this scenario we want to override which of the overlapping Green/Red IP routes is accepted in the Shared VRFs
- We are going to try and give priority to the Red VSN IP routes over the Green ones
- We could use a route-map to only accept those IP routes from Red VSN (and not Green) but it could always happen that accidentally the same route is seen from different VSNs for which we import all routes. So we want a more general solution to make sure we remain consistent if that happens

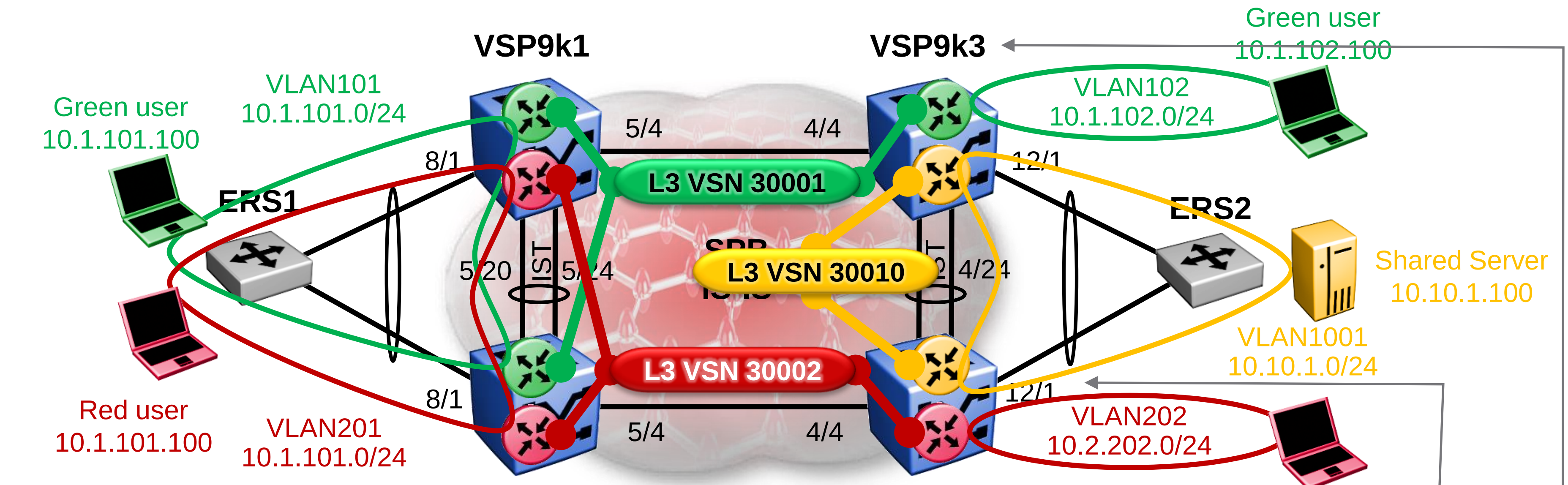
Inter VRF-L3VSN route redistribution
Overlapping subnets / Control which route to accept



- Here we are simply forcing all Red/30002 IP routes to use a Pref of 180 (instead of default 200)

```
router vrf shared
   route-map "pref180" 1
      enable
      set ip-preference 180
   exit
exit
router vrf shared
   isis accept i-sid 30001 enable
   isis accept i-sid 30002 enable
   isis accept i-sid 30002 route-map "pref180"
exit
isis apply accept vrf shared
```

Inter VRF-L3VSN route redistribution
Overlapping subnets / Control which route to accept

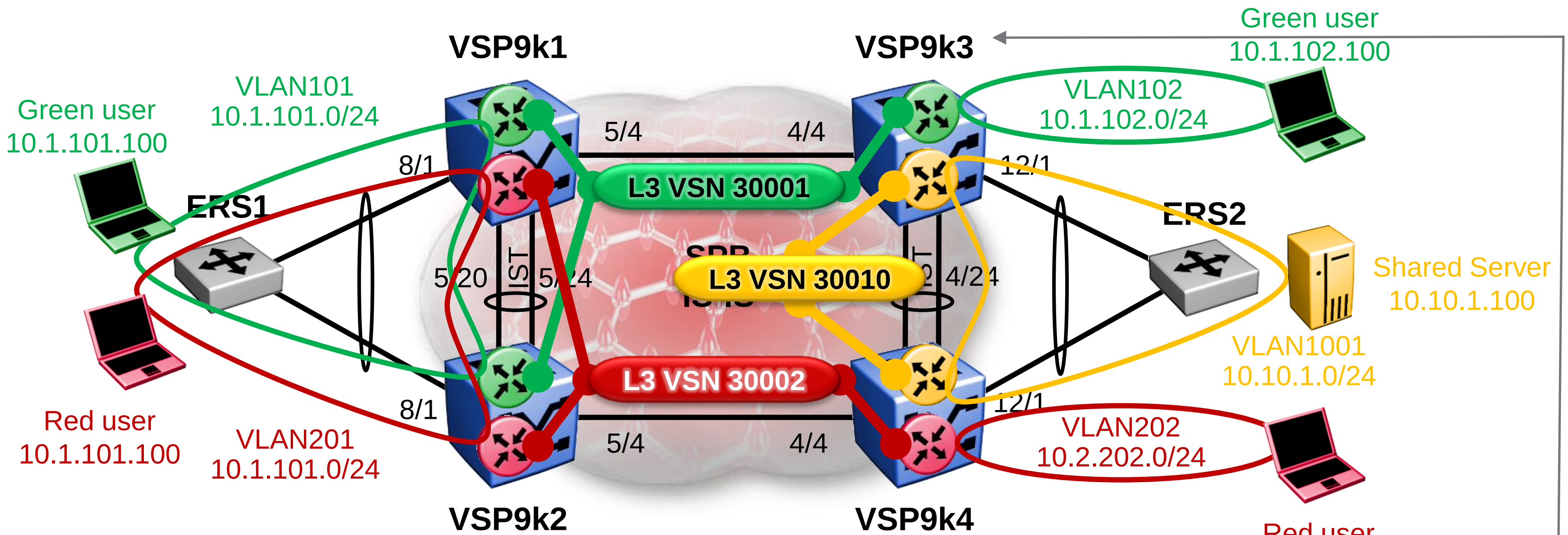



```
VSP9000-4:1#% show ip route vrf shared
================================================================================
                        IP Route - VRF shared
================================================================================
                                     NH                    INTER
DST           MASK          NEXT          VRF/ISID          COST FACE  PROT AGE TYPE PRF
--------------------------------------------------------------------------------
10.1.101.0    255.255.255.0 VSP9000-2     red               10   4051  ISIS 0   IBSV 180
10.1.102.0    255.255.255.0 10.1.102.1    red               0    202   ISIS 0   IB   180
10.10.1.0     255.255.255.0 10.10.1.2     -                 1    1001  LOC  0   DB   0
```

```
VSP9000-3:1#% show ip route vrf shared
================================================================================
                        IP Route - VRF shared
================================================================================
                                     NH                    INTER
DST           MASK          NEXT          VRF/ISID          COST FACE  PROT AGE TYPE PRF
--------------------------------------------------------------------------------
10.1.101.0    255.255.255.0 VSP9000-1     30002             10   4051  ISIS 0   IBSV 180
10.1.102.0    255.255.255.0 VSP9000-4     30002             10   4051  ISIS 0   IBSV 180
10.10.1.0     255.255.255.0 10.10.1.1     -                 1    1001  LOC  0   DB   0
```

- Success!
- Note pref=180

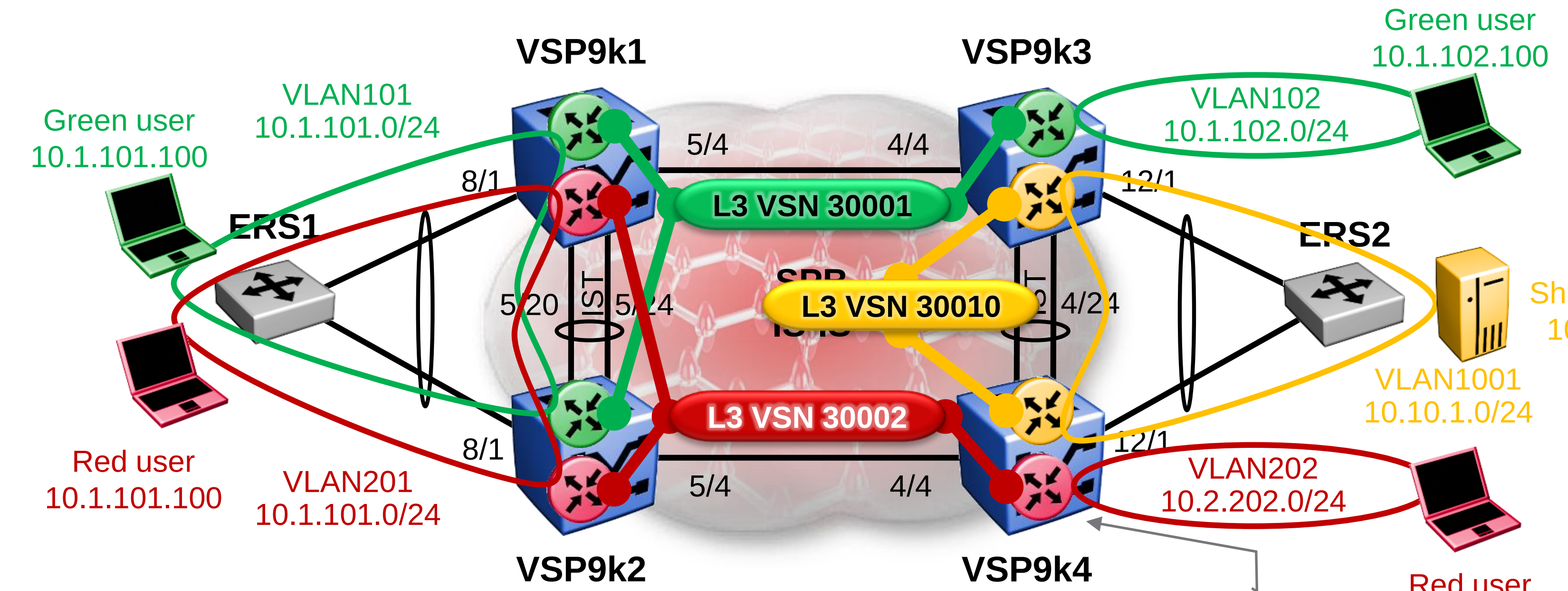
Inter VRF-L3VSN route redistribution
Overlapping subnets / Control which route to accept




```
VSP9000-3:1#% show isis spbm ip-unicast-fib id 30010
==========================================================================================
                           SPBM IP-UNICAST FIB ENTRY INFO
==========================================================================================
        VRF     DEST                                      OUTGOING  SPBM      PREFIX   IP ROUTE
VRF     ISID    ISID    Destination       NH BEB     VLAN INTERFACE COST      COST     PREFERENCE
------------------------------------------------------------------------------------------
shared  30010   30001   10.1.101.0/24     VSP9000-1  4051 4/4       10        1        200
shared  30010   30001   10.1.101.0/24     VSP9000-1  4052 4/4       10        1        200
shared  30010   30002   10.1.101.0/24     VSP9000-1  4051 4/4       10        1        180
shared  30010   30002   10.1.101.0/24     VSP9000-1  4052 4/4       10        1        180
shared  30010   30001   10.1.101.0/24     VSP9000-2  4051 4/4       20        1        200
shared  30010   30001   10.1.101.0/24     VSP9000-2  4052 IST       20        1        200
shared  30010   30002   10.1.101.0/24     VSP9000-2  4051 4/4       20        1        180
shared  30010   30002   10.1.101.0/24     VSP9000-2  4052 IST       20        1        180
shared  30010   30001   10.1.102.0/24     VSP9000-3  102  Local     0         1        200
shared  30010   30002   10.1.102.0/24     VSP9000-4  4051 IST       10        1        180
shared  30010   30002   10.1.102.0/24     VSP9000-4  4052 IST       10        1        180
shared  30010   30010   10.10.1.0/24      VSP9000-4  4051 IST       10        1        7
shared  30010   30010   10.10.1.0/24      VSP9000-4  4052 IST       10        1        7
```

- Installed routes are highlighted

Inter VRF-L3VSN route redistribution
Overlapping subnets / Control which route to accept




```
VSP9000-4:1#% show isis spbm ip-unicast-fib id 30010
================================================================================================
                              SPBM IP-UNICAST FIB ENTRY INFO
================================================================================================
         VRF      DEST                                         OUTGOING  SPBM      PREFIX     IP ROUTE
VRF      ISID     ISID     Destination        NH BEB      VLAN INTERFACE COST      COST       PREFERENCE
------------------------------------------------------------------------------------------------
shared   30010    30001    10.1.101.0/24      VSP9000-1   4051 4/4       20        1          200
shared   30010    30001    10.1.101.0/24      VSP9000-1   4052 IST       20        1          200
shared   30010    30002    10.1.101.0/24      VSP9000-1   4051 4/4       20        1          180
shared   30010    30002    10.1.101.0/24      VSP9000-1   4052 IST       20        1          180
shared   30010    30001    10.1.101.0/24      VSP9000-2   4051 4/4       10        1          200
shared   30010    30001    10.1.101.0/24      VSP9000-2   4052 4/4       10        1          200
shared   30010    30002    10.1.101.0/24      VSP9000-2   4051 4/4       10        1          180
shared   30010    30002    10.1.101.0/24      VSP9000-2   4052 4/4       10        1          180
shared   30010    30001    10.1.102.0/24      VSP9000-3   4051 IST       10        1          200
shared   30010    30001    10.1.102.0/24      VSP9000-3   4052 IST       10        1          200
shared   30010    30002    10.1.102.0/24      VSP9000-4   202  Local     0         1          180
shared   30010    30010    10.10.1.0/24       VSP9000-3   4051 IST       10        1          7
shared   30010    30010    10.10.1.0/24       VSP9000-3   4052 IST       10        1          7
```

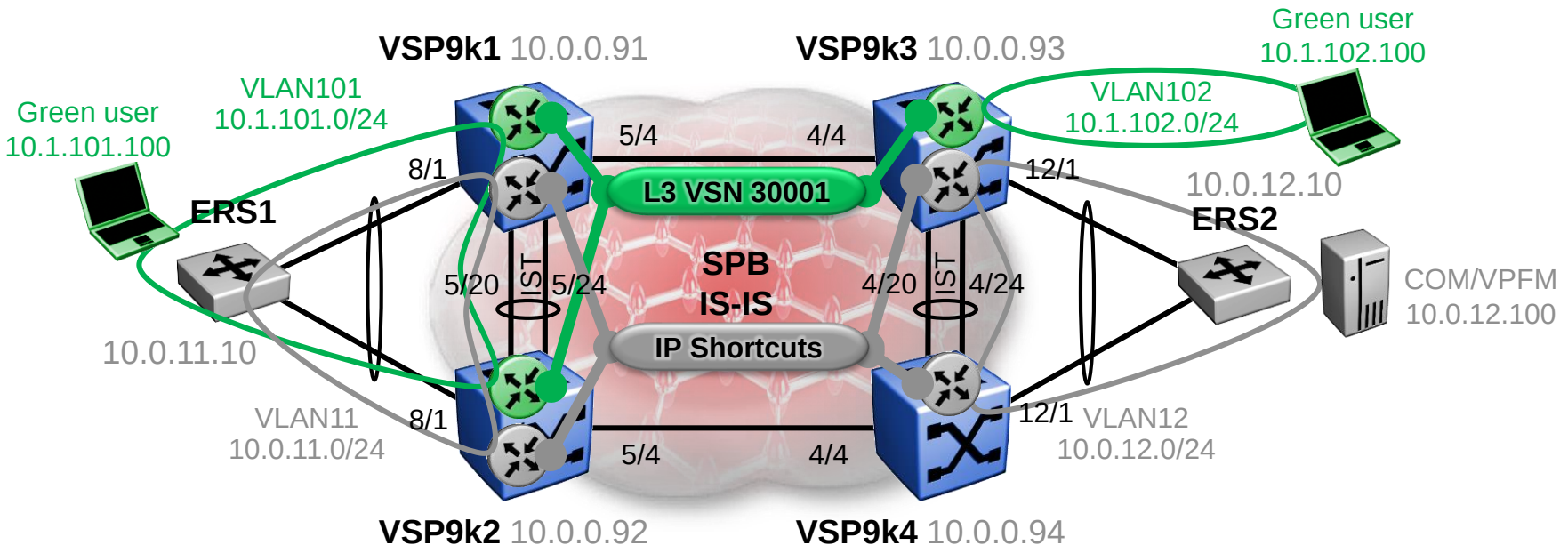
- Installed routes are highlighted

ISIS Accept policies

Last tested with: 0.0.0.0int537

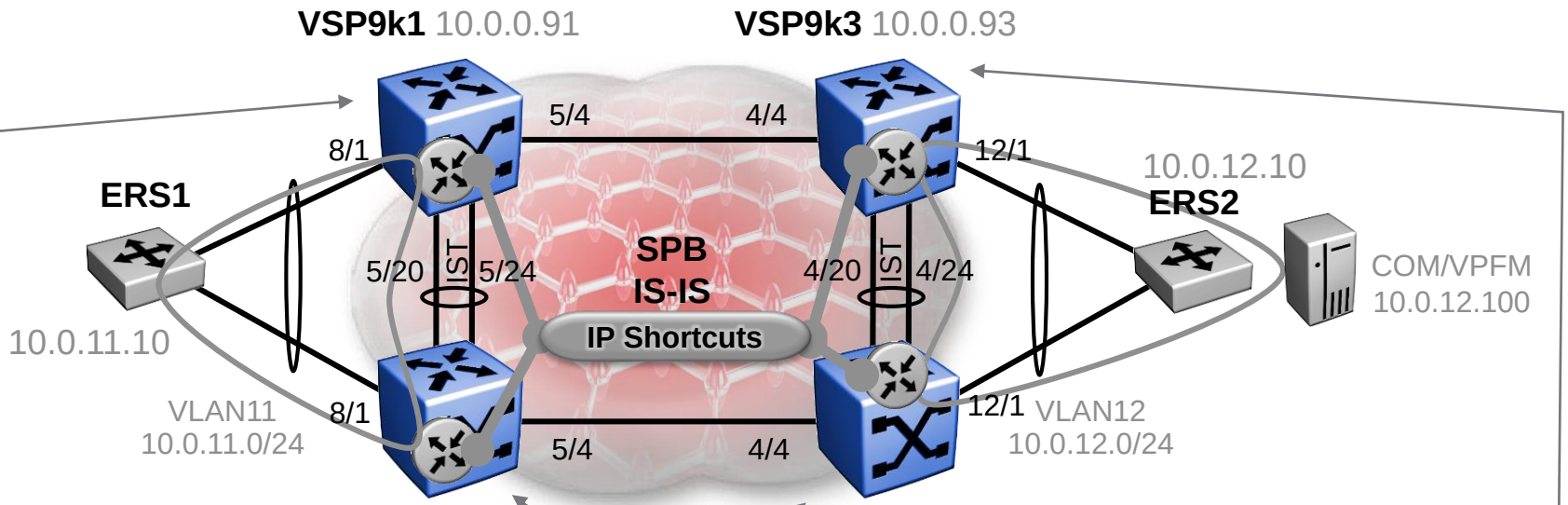
Example use #3
GRT IP Shortcuts ←→ L3VSN route redistribution
Giving management access to L3VSN users

Inter VRF-L3VSN & GRT IP Shortcut route redist Goal



- Green users can communicate with other green users
- COM/VPFM server can manage all switches
- Green users are to be given access only to VSP9000 Mgmt CLIPs (10.0.0.x/32) and to COM/VPFM subnet (10.0.12.0/24)
  - So that Green users can be allowed to manage VRF L3 config on the VSP9000s
- Red users (not shown) have no access to GRT and hence cannot manage the network
- This section simply adds delta config to previous section

Inter VRF-L3VSN & GRT IP Shortcut route redist GRT Mgmt Config



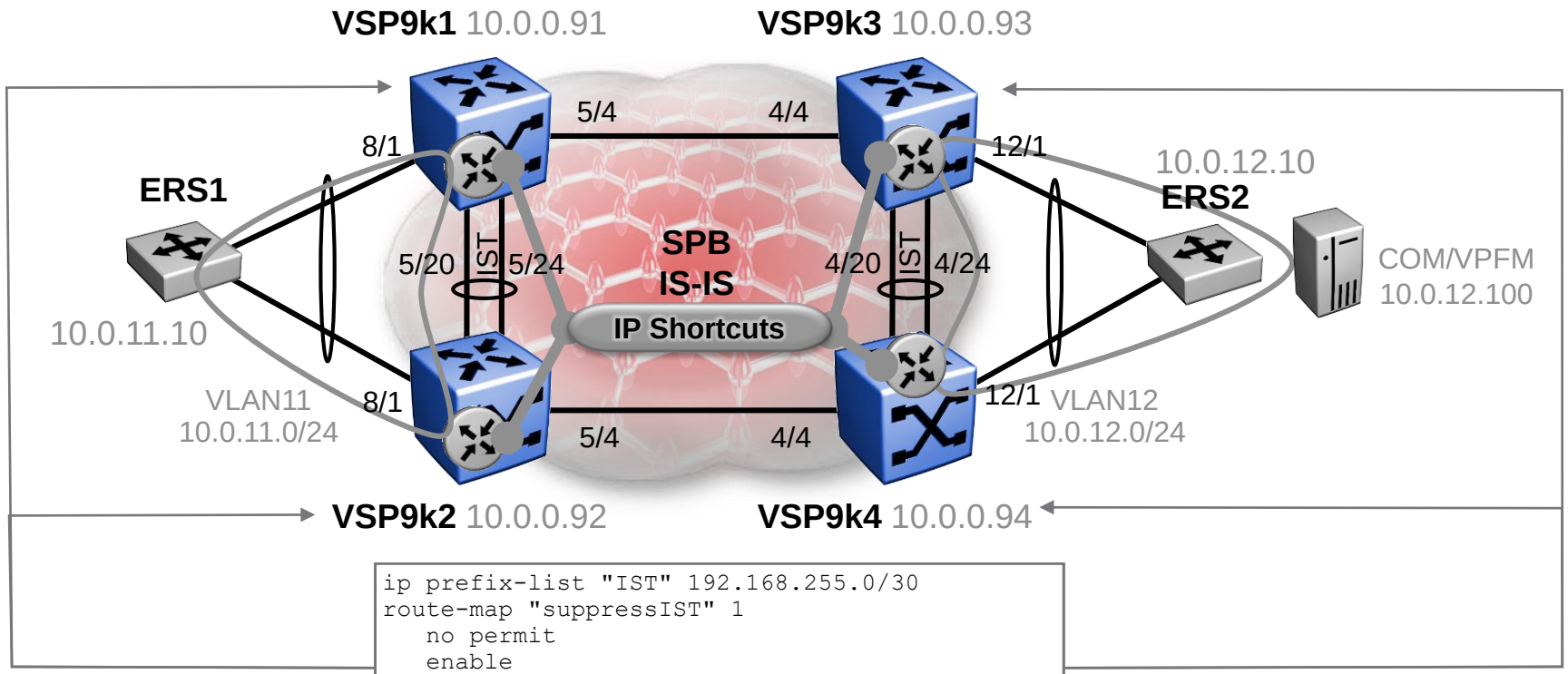

```
vlan create 11 type port-mstprstp 0
vlan mlt 11 1
vlan mlt 11 512
interface vlan 11
   ip address 10.0.11.1 255.255.255.0
   ip rsmlt
   ip rsmlt holdup-timer 9999
exit
```

```
vlan create 12 type port-mstprstp 0
vlan mlt 12 1
vlan mlt 12 512
interface vlan 12
   ip address 10.0.12.1 255.255.255.0
   ip rsmlt
   ip rsmlt holdup-timer 9999
exit
```

```
vlan create 11 type port-mstprstp 0
vlan mlt 11 1
vlan mlt 11 512
interface vlan 11
   ip address 10.0.11.2 255.255.255.0
   ip rsmlt
   ip rsmlt holdup-timer 9999
exit
```

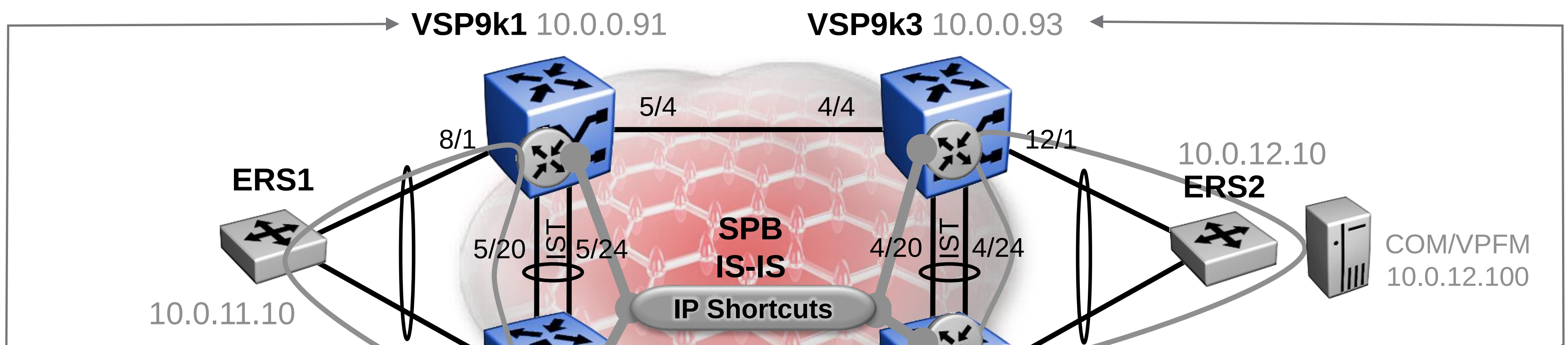
```
vlan create 12 type port-mstprstp 0
vlan mlt 12 1
vlan mlt 12 512
interface vlan 12
   ip address 10.0.12.2 255.255.255.0
   ip rsmlt
   ip rsmlt holdup-timer 9999
exit
```

Inter VRF-L3VSN & GRT IP Shortcut route redist GRT Mgmt Config




```
ip prefix-list "IST" 192.168.255.0/30
route-map "suppressIST" 1
   no permit
   enable
   match network "IST"
exit
route-map "suppressIST" 2
   enable
exit
router isis
   redistribute direct
   redistribute direct route-map "suppressIST"
   redistribute direct enable
exit
isis apply redistribute direct
```

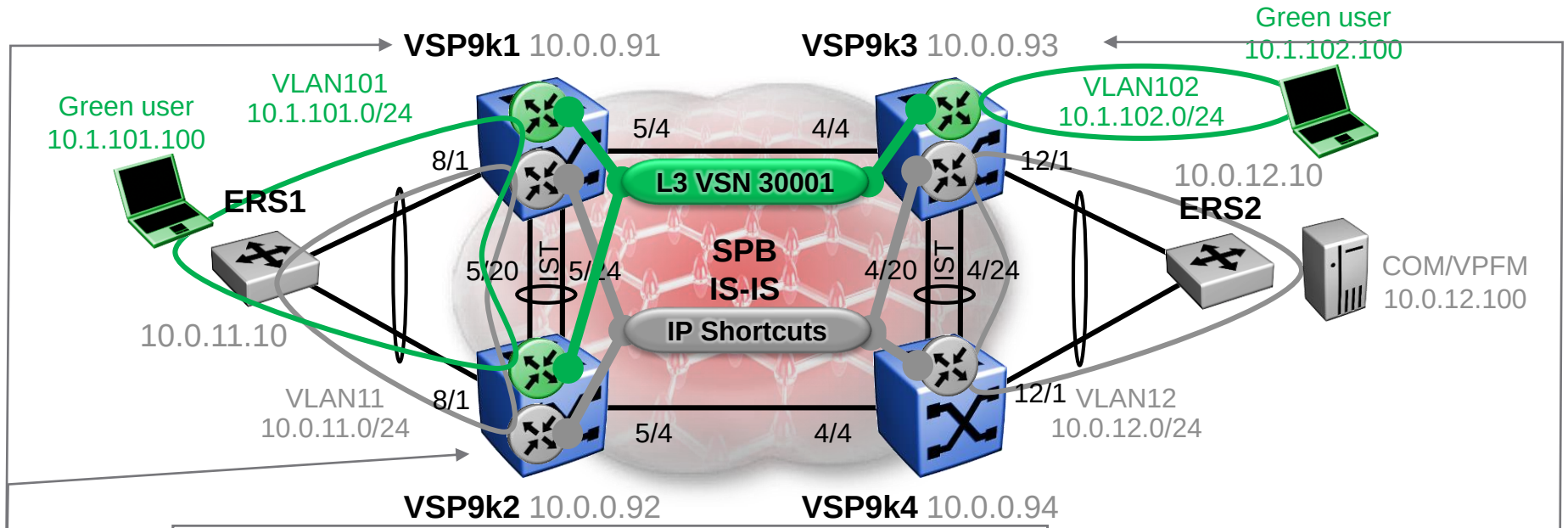
Inter VRF-L3VSN & GRT IP Shortcut route redist
GRT Mgmt Config – Routes before redistribution




```
VSP9000-3:1#% show ip route
================================================================================
                              IP Route - VRF green
================================================================================
                                                        NH                 INTER
DST             MASK             NEXT                   VRF/ISID      COST FACE  PROT AGE TYPE PRF
--------------------------------------------------------------------------------
10.0.0.91       255.255.255.255 10.0.0.91               -             1    0     LOC  0   DB   0
10.0.0.92       255.255.255.255 VSP9000-2               GlobalRouter  10   4051  ISIS 0   IBS  7
10.0.0.93       255.255.255.255 VSP9000-3               GlobalRouter  10   4051  ISIS 0   IBS  7
10.0.0.94       255.255.255.255 VSP9000-4               GlobalRouter  20   4051  ISIS 0   IBS  7
10.0.11.0       255.255.255.0   10.0.11.1               -             1    11    LOC  0   DB   0
10.0.12.0       255.255.255.0   VSP9000-3               GlobalRouter  10   4051  ISIS 0   IBS  7
192.168.255.0   255.255.255.252 192.168.255.1           -             1    4000  LOC  0   DB   0
```

```
VSP9000-1:1#% s
===============

===============
                                                        NH                 INTER
DST             MASK             NEXT                   VRF/ISID      COST FACE  PROT AGE TYPE PRF
--------------------------------------------------------------------------------
10.0.0.91       255.255.255.255 10.0.0.91               -             1    0     LOC  0   DB   0
10.0.0.92       255.255.255.255 VSP9000-2               GlobalRouter  10   4051  ISIS 0   IBS  7
10.0.0.93       255.255.255.255 VSP9000-3               GlobalRouter  10   4051  ISIS 0   IBS  7
10.0.0.94       255.255.255.255 VSP9000-4               GlobalRouter  20   4051  ISIS 0   IBS  7
10.0.11.0       255.255.255.0   10.0.11.1               -             1    11    LOC  0   DB   0
10.0.12.0       255.255.255.0   VSP9000-3               GlobalRouter  10   4051  ISIS 0   IBS  7
192.168.255.0   255.255.255.252 192.168.255.1           -             1    4000  LOC  0   DB   0
```

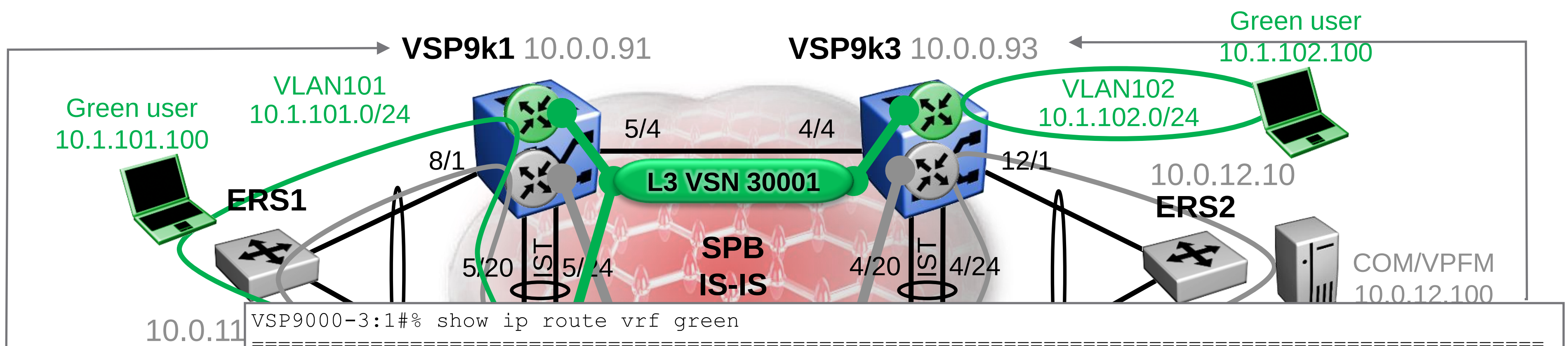
Inter VRF-L3VSN & GRT IP Shortcut route redist
Accept GRT selected subnets into Green VSN




```
router vrf green
   ip prefix-list "grt_mgmt" 10.0.0.0/24 ge 32 le 32
   ip prefix-list "grt_mgmt" 10.0.12.0/24
   route-map "accept-grt_mgmt" 1
      match network "grt_mgmt"
      enable
   exit
   route-map "accept-grt_mgmt" 2
      no permit
      enable
   exit
   isis accept i-sid 0 route-map "accept-grt_mgmt"
   isis accept i-sid 0 enable
exit
isis apply accept vrf green
```

- We only want host /32 routes matching 10.0.0.0/24 hence the ge/le setting
- NOTE to accept GRT IP Shortcut routes we specify an I-SID = 0

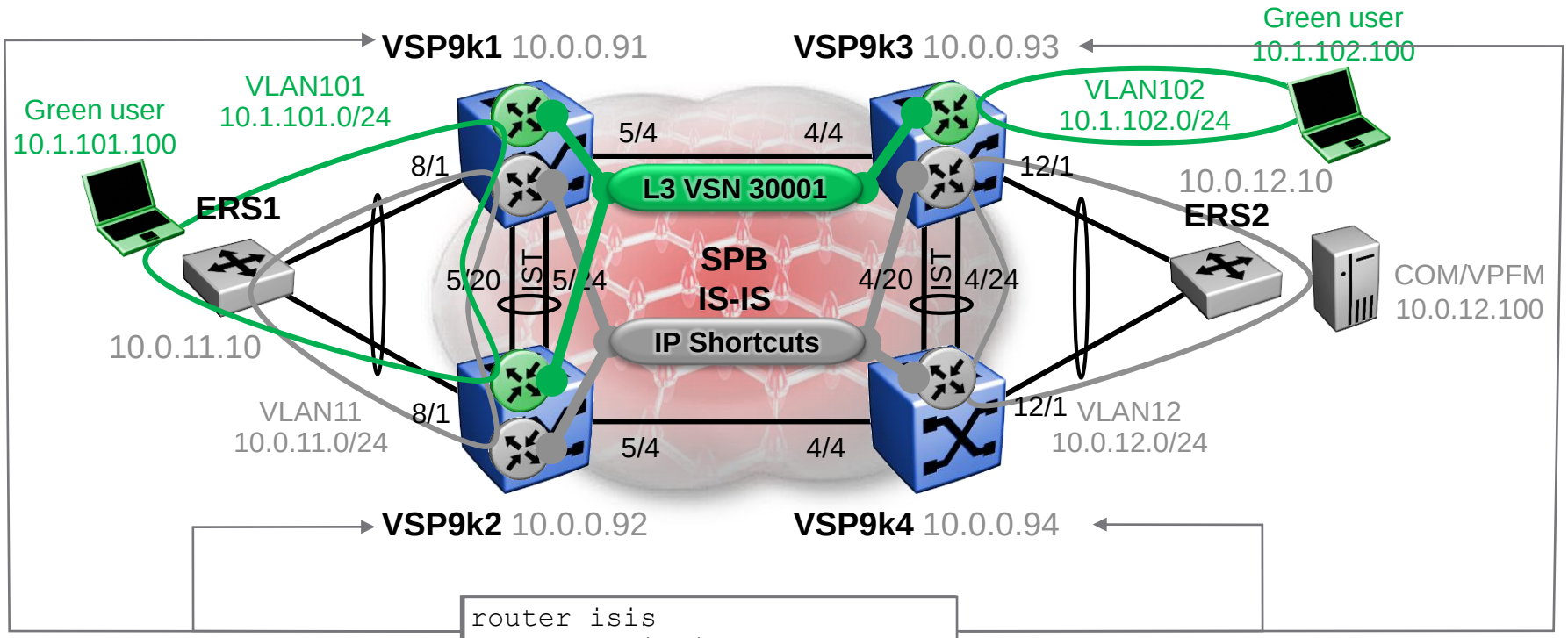
Inter VRF-L3VSN & GRT IP Shortcut route redist
Accept GRT selected subnets into Green VSN




```
VSP9000-3:1#% show ip route vrf green
================================================================================================
                                  IP Route - VRF green
================================================================================================
                                                  NH                      INTER
DST              MASK             NEXT            VRF/ISID         COST  FACE   PROT  AGE TYPE PRF
------------------------------------------------------------------------------------------------
10.0.0.91        255.255.255.255 VSP9000-1        GlobalRouter     10    4051   ISIS  0   IBSV 200
10.0.0.92        255.255.255.255 VSP9000-2        GlobalRouter     20    4051   ISIS  0   IBSV 200
10.0.0.93        255.255.255.255 10.0.0.93        GlobalRouter     0     0      ISIS  0   IB   200
10.0.0.94        255.255.255.255 VSP9000-4        GlobalRouter     10    4051   ISIS  0   IBSV 200
10.0.12.0        255.255.255.0   10.0.12.1        GlobalRouter     0     12     ISIS  0   IB   200
10.1.101.0       255.255.255.0   VSP9000-1        green            10    4051   ISIS  0   IBSV 7
10.1.102.0       255.255.255.0   10.1.102.1       -                1     102    LOC   0   DB   0
```

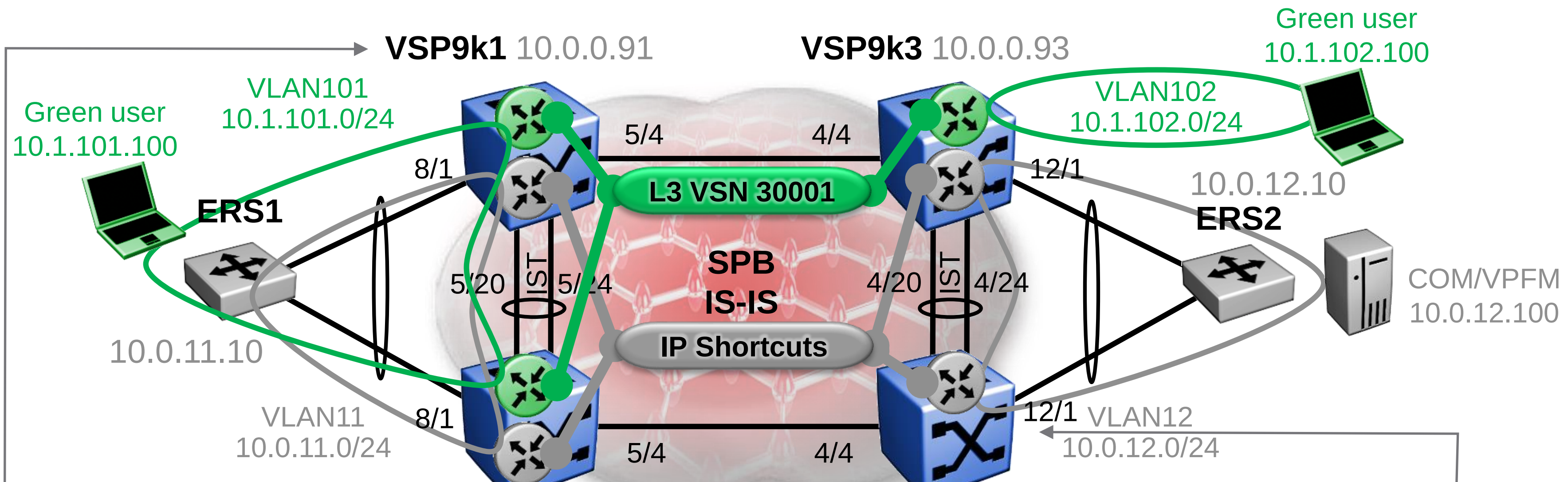
```
VSP9000-1:1#% s
================================================================================================
                                  IP Route - VRF green
================================================================================================
                                                  NH                      INTER
DST              MASK             NEXT            VRF/ISID         COST  FACE   PROT  AGE TYPE PRF
------------------------------------------------------------------------------------------------
10.0.0.91        255.255.255.255 10.0.0.91        GlobalRouter     0     0      ISIS  0   IB   200
10.0.0.92        255.255.255.255 VSP9000-2        GlobalRouter     10    4051   ISIS  0   IBSV 200
10.0.0.93        255.255.255.255 VSP9000-3        GlobalRouter     10    4051   ISIS  0   IBSV 200
10.0.0.94        255.255.255.255 VSP9000-4        GlobalRouter     20    4051   ISIS  0   IBSV 200
10.0.12.0        255.255.255.0   VSP9000-3        GlobalRouter     10    4051   ISIS  0   IBSV 200
10.1.101.0       255.255.255.0   10.1.101.1       -                1     101    LOC   0   DB   0
10.1.102.0       255.255.255.0   VSP9000-3        green            10    4051   ISIS  0   IBSV 7
```

Inter VRF-L3VSN & GRT IP Shortcut route redist
Accept Green VSN subnets into GRT




```
router isis
   accept i-sid 30001 enable
exit
isis apply accept
```

Inter VRF-L3VSN & GRT IP Shortcut route redist
Accept Green VSN subnets into GRT




```
VSP9000-4:1#% show ip route
================================================================================
                             IP Route - GlobalRouter
================================================================================
                                                NH                 INTER
DST            MASK            NEXT             VRF/ISID     COST  FACE  PROT AGE TYPE PRF
--------------------------------------------------------------------------------
10.0.0.91      255.255.255.255 VSP9000-1        GlobalRouter 20    4051  ISIS 0   IBS  7
10.0.0.92      255.255.255.255 VSP9000-2        GlobalRouter 10    4051  ISIS 0   IBS  7
10.0.0.93      255.255.255.255 VSP9000-3        GlobalRouter 10    4051  ISIS 0   IBS  7
10.0.0.94      255.255.255.255 10.0.0.94        -            1     0     LOC  0   DB   0
10.0.11.0      255.255.255.0   VSP9000-2        GlobalRouter 10    4051  ISIS 0   IBS  7
10.0.12.0      255.255.255.0   10.0.12.2        -            1     12    LOC  0   DB   0
10.1.101.0     255.255.255.0   VSP9000-2        30001        10    4051  ISIS 0   IBSV 200
10.1.102.0     255.255.255.0   VSP9000-3        30001        10    4051  ISIS 0   IBSV 200
192.168.255.0  255.255.255.252 192.168.255.2    -            1     4000  LOC  0   DB   0
```

```
VSP9000-1:1#% sh
================

================

DST
----------------
10.0.0.91
10.0.0.92
10.0.0.93
10.0.0.94
10.0.11.0
10.0.12.0      255.255.255.0   VSP9000-3        GlobalRouter 10    4051  ISIS 0   IBS  7
10.1.101.0     255.255.255.0   10.1.101.1       green        0     101   ISIS 0   IB   200
10.1.102.0     255.255.255.0   VSP9000-3        green        10    4051  ISIS 0   IBSV 200
192.168.255.0  255.255.255.252 192.168.255.1    -            1     4000  LOC  0   DB   0
```

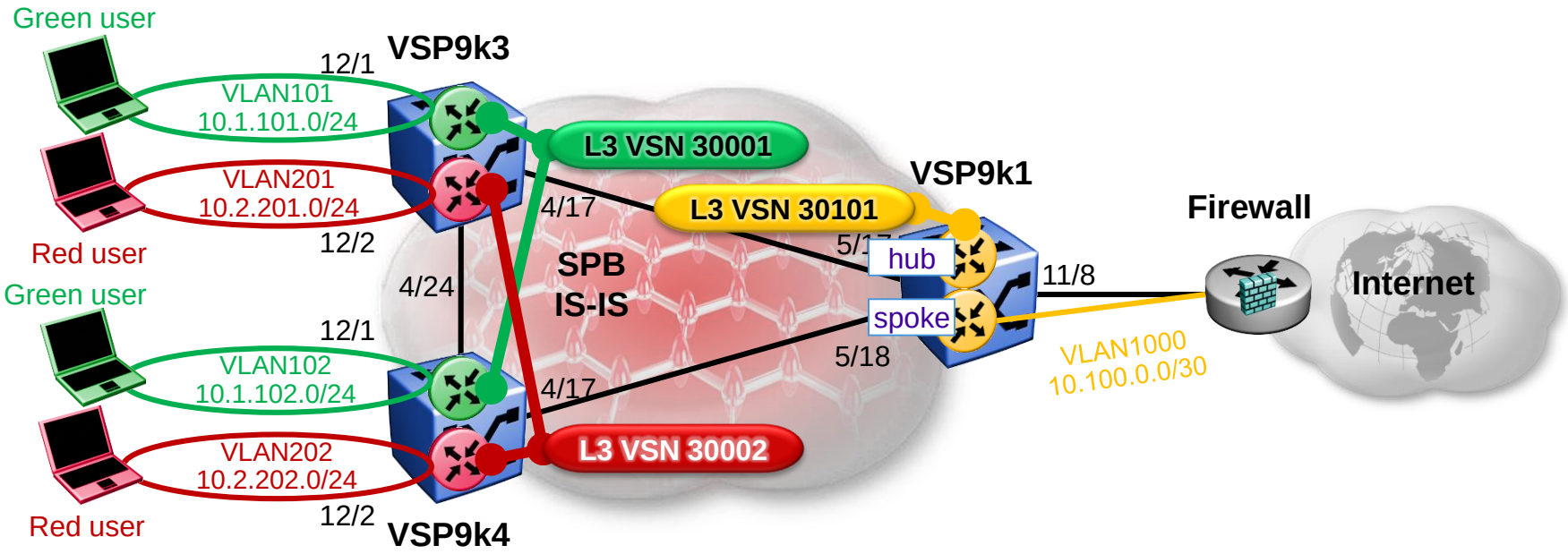
ISIS Accept policies

Last tested with: 4.1.1.0 GA

Example use #4
Inter-L3VSN route redistribution
Shared Firewall / Internet Access

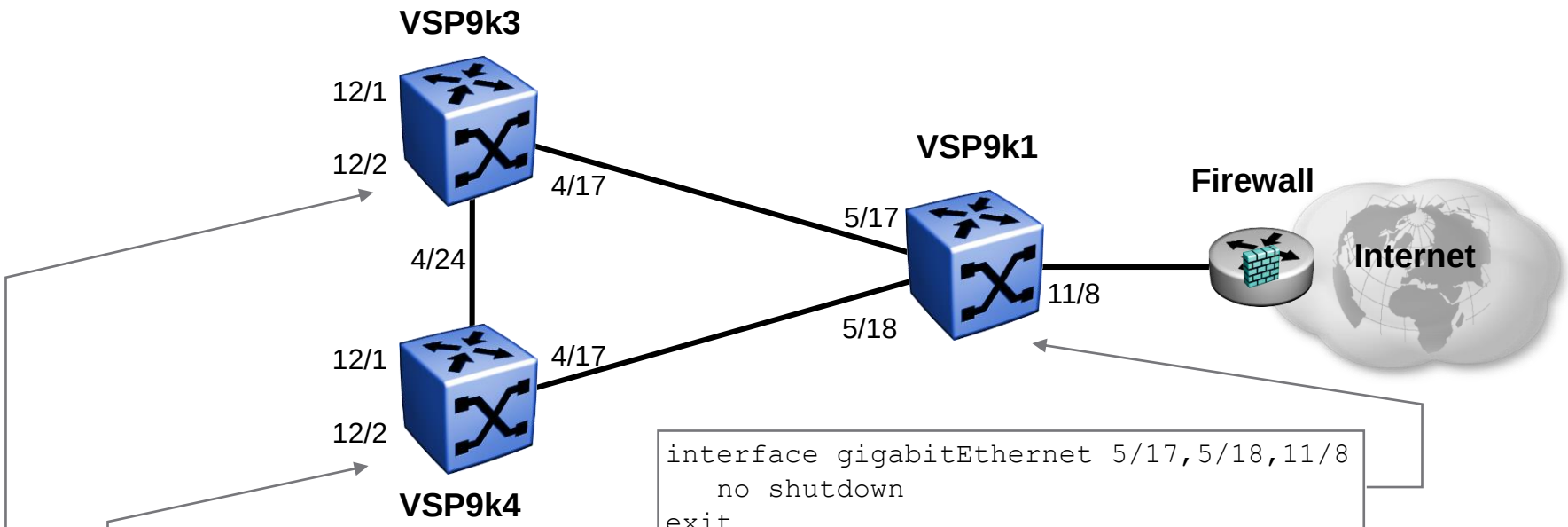
In v3 of this deck, this test has been re-run with software 4.1.1.0 GA and gen2 IO card 9048XS-2 in VSP9k1 slot 5. The original slides tried to use 2 IP interfaces on the Firewall but this was found to be unworkable, so now a new approach is used which uses a single IP interface on the Firewall.

Shared Internet Firewall



- Green and red users cannot communicate together
- Both green and red users need to share the Internet Firewall, which supplies a default route
- However must ensure that green and red users are not allowed to communicate by following the default route to the orange VRF where Firewall connected
- So we need to split the Firewall VRF into 2 VRFs; one supplies the default route; the other accepts all green and red subnets
- A single IP interface must be used on the Firewall (Firewalls need to see statefull traffic ingressing and egressing the same IP interface)

Shared Internet Firewall
Interfaces used

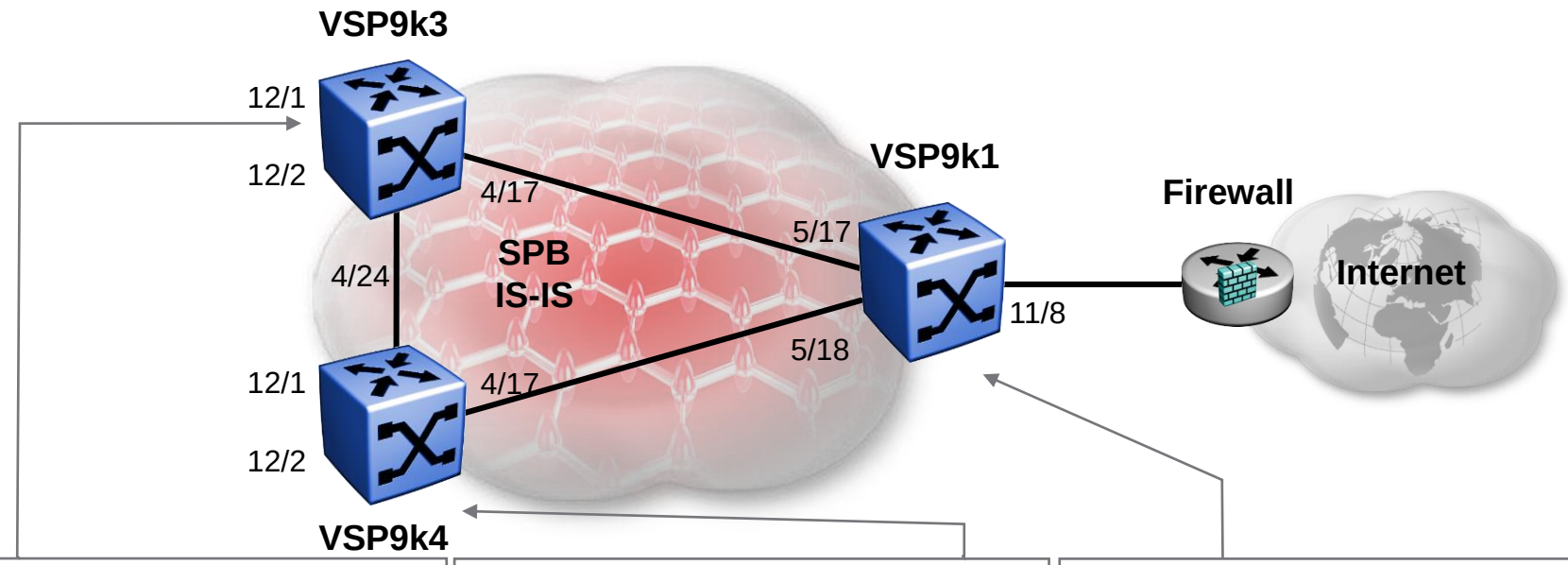



```
interface gigabitEthernet 5/17,5/18,11/8
   no shutdown
exit
```

```
interface gigabitEthernet 4/17,4/24,12/1,12/2
   no shutdown
exit
```

```
interface gigabitEthernet 4/17,4/24,12/1,12/2
   no shutdown
exit
```

Shared Internet Firewall
SPB Global Config

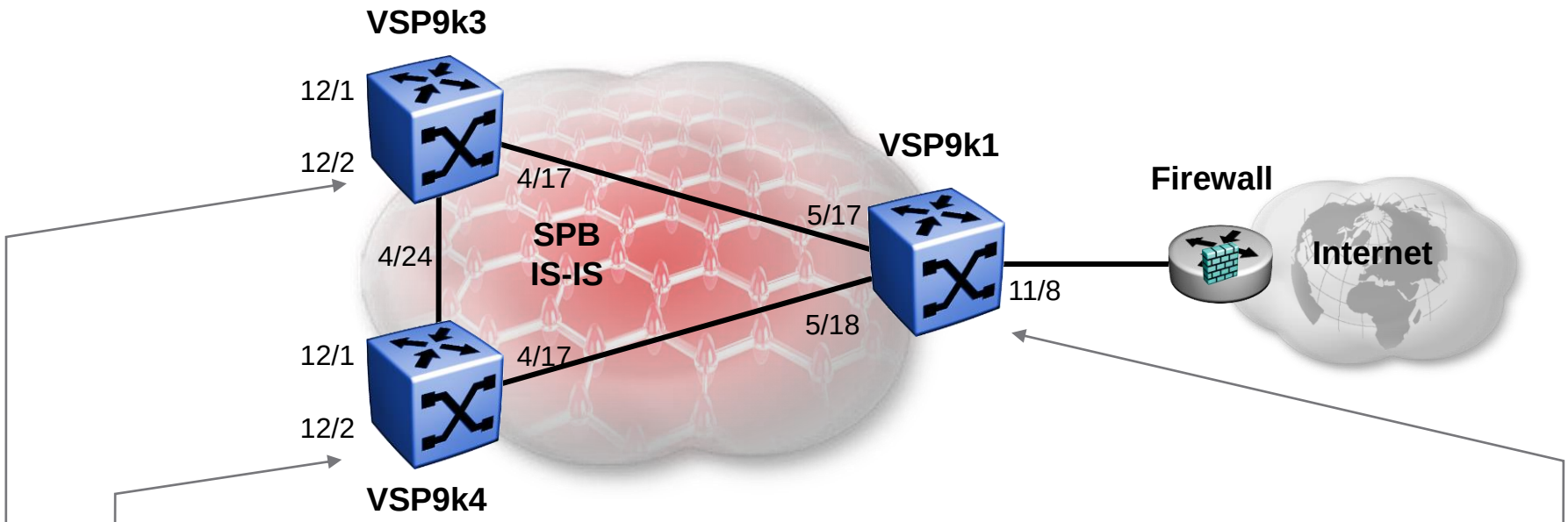



```
interface loopback 1
   ip address 10.0.0.93/255.255.255.255
exit
spbm
router isis
   system-id 00bb.0000.9300
   manual-area 49.0000
   ip-source-address 10.0.0.93
   spbm 1
   spbm 1 nick-name 0.00.93
   spbm 1 b-vid 4051-4052 primary 4051
   spbm 1 ip enable
exit
vlan create 4051 name "B-VLAN-1" type spbm-bvlan
vlan create 4052 name "B-VLAN-2" type spbm-bvlan
router isis enable
cfm spbm mepid 93
cfm spbm enable
```

```
interface loopback 1
   ip address 10.0.0.94/255.255.255.255
exit
spbm
router isis
   system-id 00bb.0000.9400
   manual-area 49.0000
   ip-source-address 10.0.0.94
   spbm 1
   spbm 1 nick-name 0.00.94
   spbm 1 b-vid 4051-4052 primary 4051
   spbm 1 ip enable
exit
vlan create 4051 name "B-VLAN-1" type spbm-bvlan
vlan create 4052 name "B-VLAN-2" type spbm-bvlan
router isis enable
cfm spbm mepid 94
cfm spbm enable
```

```
interface loopback 1
   ip address 10.0.0.91/255.255.255.255
exit
spbm
router isis
   system-id 00bb.0000.9100
   manual-area 49.0000
   ip-source-address 10.0.0.91
   spbm 1
   spbm 1 nick-name 0.00.91
   spbm 1 b-vid 4051-4052 primary 4051
   spbm 1 ip enable
exit
vlan create 4051 name "B-VLAN-1" type spbm-bvlan
vlan create 4052 name "B-VLAN-2" type spbm-bvlan
router isis enable
cfm spbm mepid 91
cfm spbm enable
```

Shared Internet Firewall
SPB Interface Config

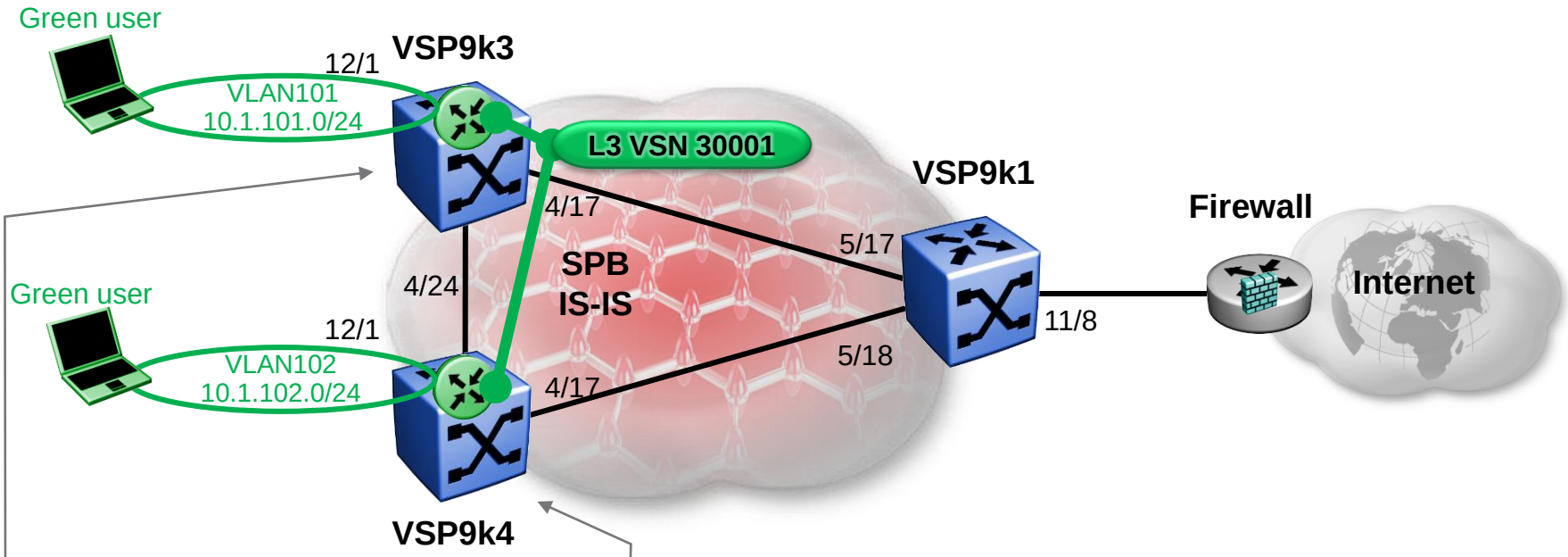



```
interface GigabitEthernet 4/17,4/24
   isis
   isis spbm 1
   isis enable
exit
```

```
interface GigabitEthernet 5/17,5/18
   isis
   isis spbm 1
   isis enable
exit
```

```
interface GigabitEthernet 4/17,4/24
   isis
   isis spbm 1
   isis enable
exit
```

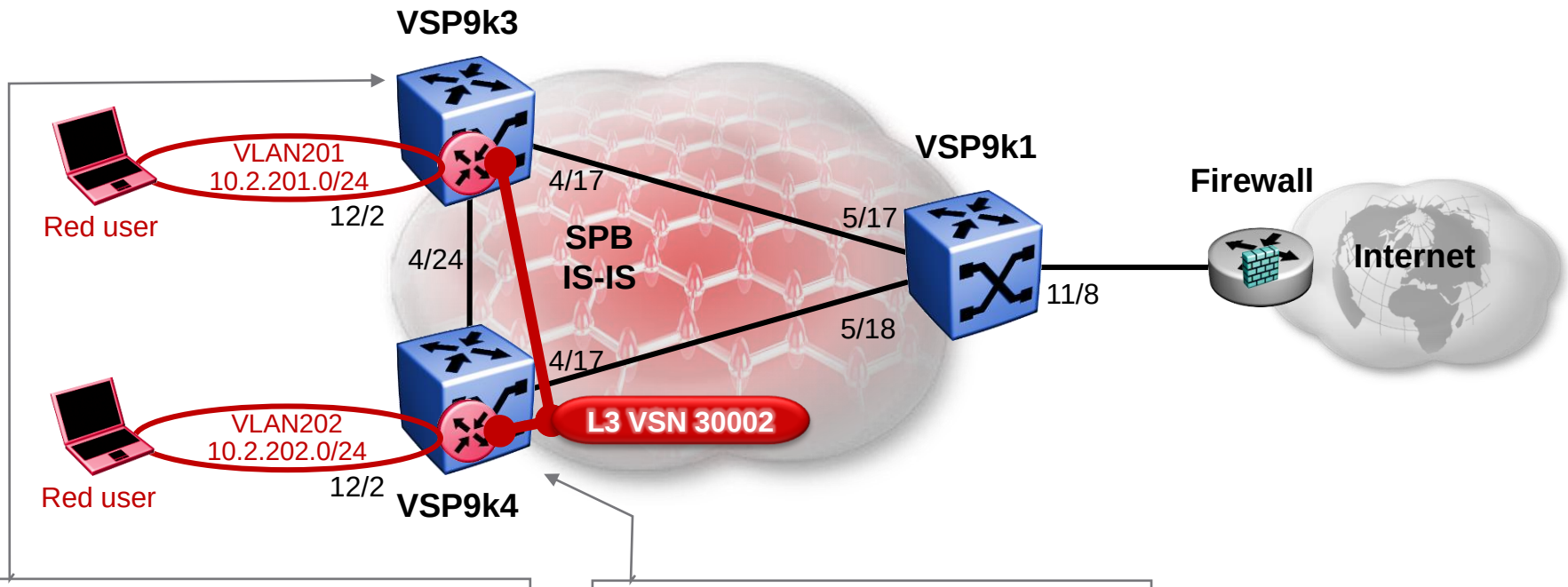
Shared Internet Firewall
Green VSN Config




```
ip vrf green vrfid 1
vlan create 101 type port-mstprstp 0
vlan members add 101 12/1
interface vlan 101
   vrf green
   ip address 10.1.101.1 255.255.255.0
exit
router vrf green
   ipvpn
   i-sid 30001
   ipvpn enable
   isis redistribute direct
   isis redistribute direct enable
exit
isis apply redistribute direct vrf green
```

```
ip vrf green vrfid 1
vlan create 102 type port-mstprstp 0
vlan members add 102 12/1
interface vlan 102
   vrf green
   ip address 10.1.102.1 255.255.255.0
exit
router vrf green
   ipvpn
   i-sid 30001
   ipvpn enable
   isis redistribute direct
   isis redistribute direct enable
exit
isis apply redistribute direct vrf green
```

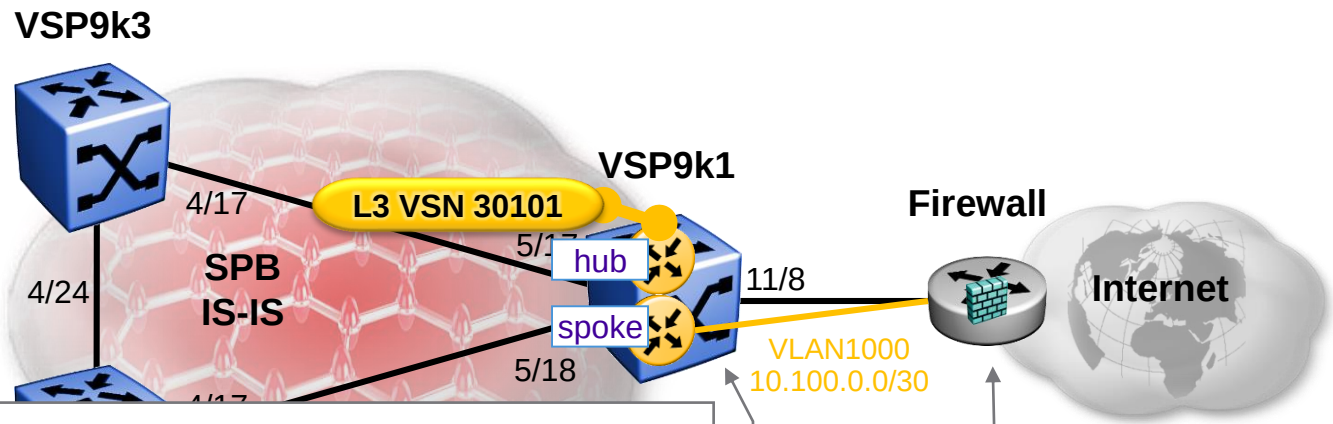
Shared Internet Firewall
Red VSN Config




```
ip vrf red vrfid 2
vlan create 201 type port-mstprstp 0
vlan members add 201 12/2
interface vlan 201
   vrf red
   ip address 10.2.201.1 255.255.255.0
exit
router vrf red
   ipvpn
   i-sid 30002
   ipvpn enable
   isis redistribute direct
   isis redistribute direct enable
exit
isis apply redistribute direct vrf red
```

```
ip vrf red vrfid 2
vlan create 202 type port-mstprstp 0
vlan members add 202 12/2
interface vlan 202
   vrf red
   ip address 10.2.202.1 255.255.255.0
exit
router vrf red
   ipvpn
   i-sid 30002
   ipvpn enable
   isis redistribute direct
   isis redistribute direct enable
exit
isis apply redistribute direct vrf red
```

Shared Internet Firewall
Firewall VSN Config

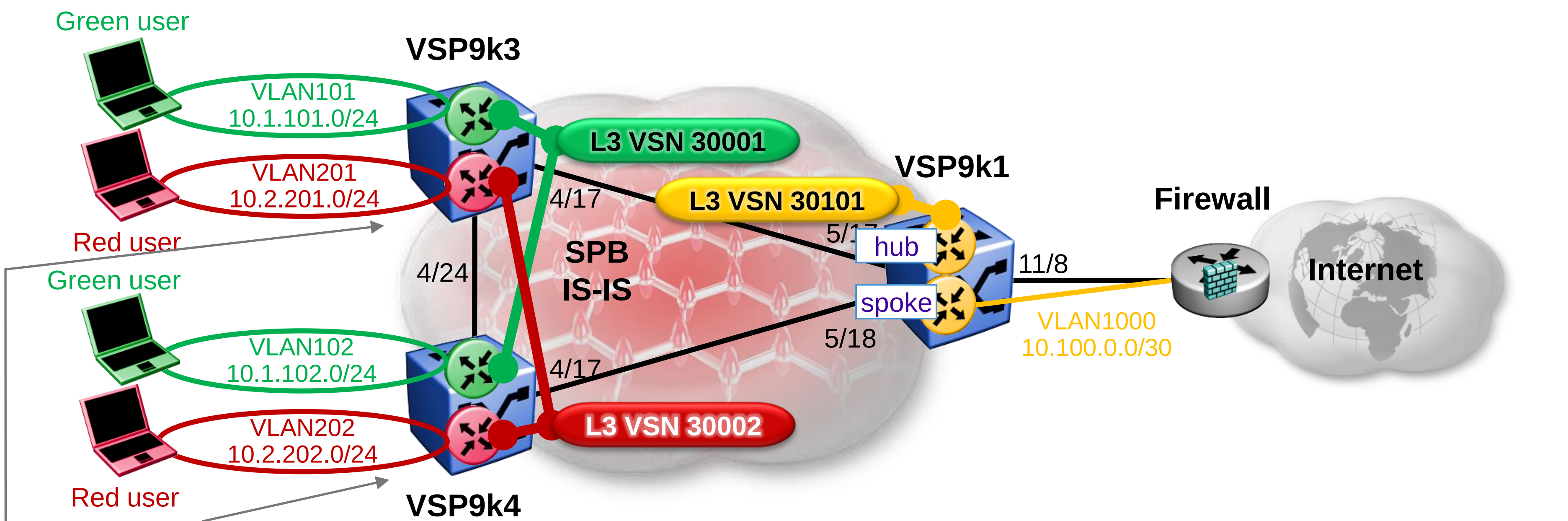



```
ip vrf fw-hub vrfid 101
ip vrf fw-spoke vrfid 102
vlan create 1000 type port-mstprstp 0
interface gigabitEthernet 11/8
   encapsulation dot1q
exit
vlan members remove 1 11/8
vlan members add 1000 11/8
interface vlan 1000
   vrf fw-spoke
   ip address 10.100.0.1 255.255.255.252
exit
router vrf fw-hub
   ip route 0.0.0.0 0.0.0.0 10.100.0.2 weight 10 next-hop-vrf fw-spoke
   ipvpn
   i-sid 30101
   ipvpn enable
   isis redistribute static
   isis redistribute static enable
exit
isis apply redistribute static vrf fw-hub
```

```
interface vlan 1000
   ip address 10.100.0.2 255.255.255.252
exit
```

- VRF Hub has the default route so we need it to be L3VSN so that we can pick up the default route elsewhere in the Fabric

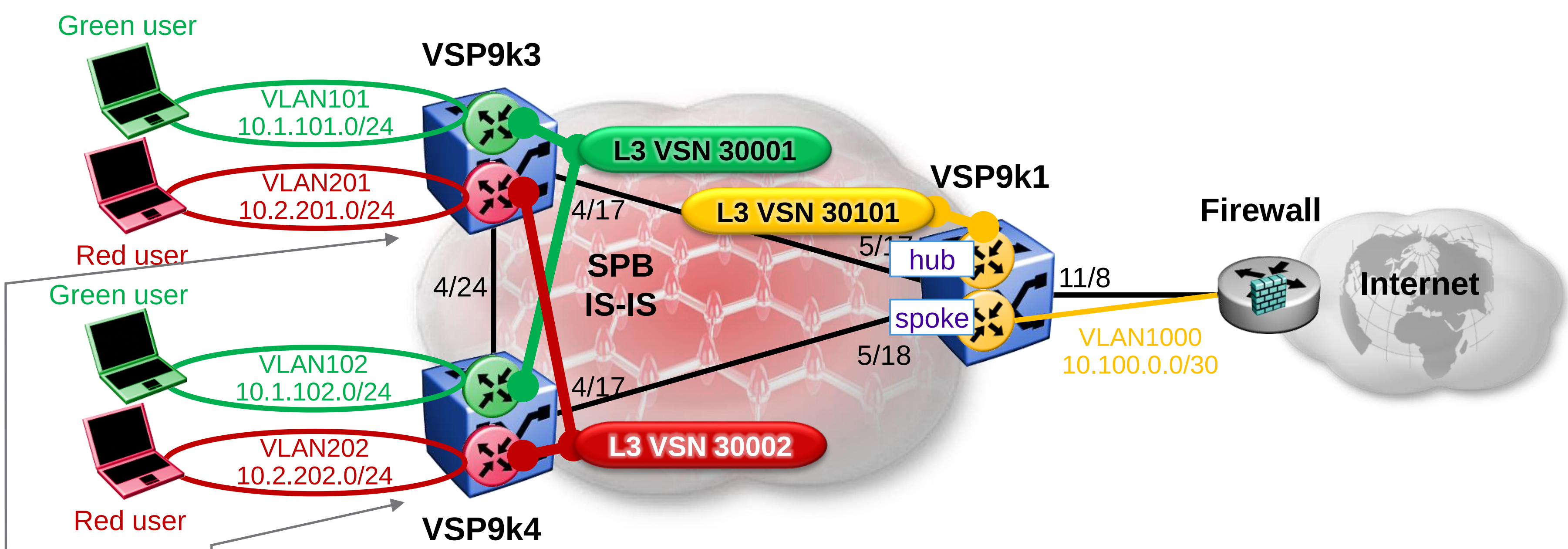
Shared Internet Firewall
Checking Green VSN routes




```
VSP9000-4:1#% show ip route vrf green
================================================================================================
                                IP Route - VRF green
================================================================================================
                                                   NH                      INTER
DST              MASK             NEXT             VRF/ISID          COST  FACE   PROT  AGE  TYPE  PRF
------------------------------------------------------------------------------------------------
10.1.101.0       255.255.255.0    VSP9000-3        green             10    4051   ISIS  0    IBSV  7
10.1.102.0       255.255.255.0    10.1.102.1       -                 1     102    LOC   0    DB    0
```

```
VSP9000-3:1#% show ip route vrf green
================================================================================================
                                IP Route - VRF green
================================================================================================
                                                   NH                      INTER
DST              MASK             NEXT             VRF/ISID          COST  FACE   PROT  AGE  TYPE  PRF
------------------------------------------------------------------------------------------------
10.1.101.0       255.255.255.0    10.1.101.1       -                 1     101    LOC   0    DB    0
10.1.102.0       255.255.255.0    VSP9000-4        green             10    4051   ISIS  0    IBSV  7
```

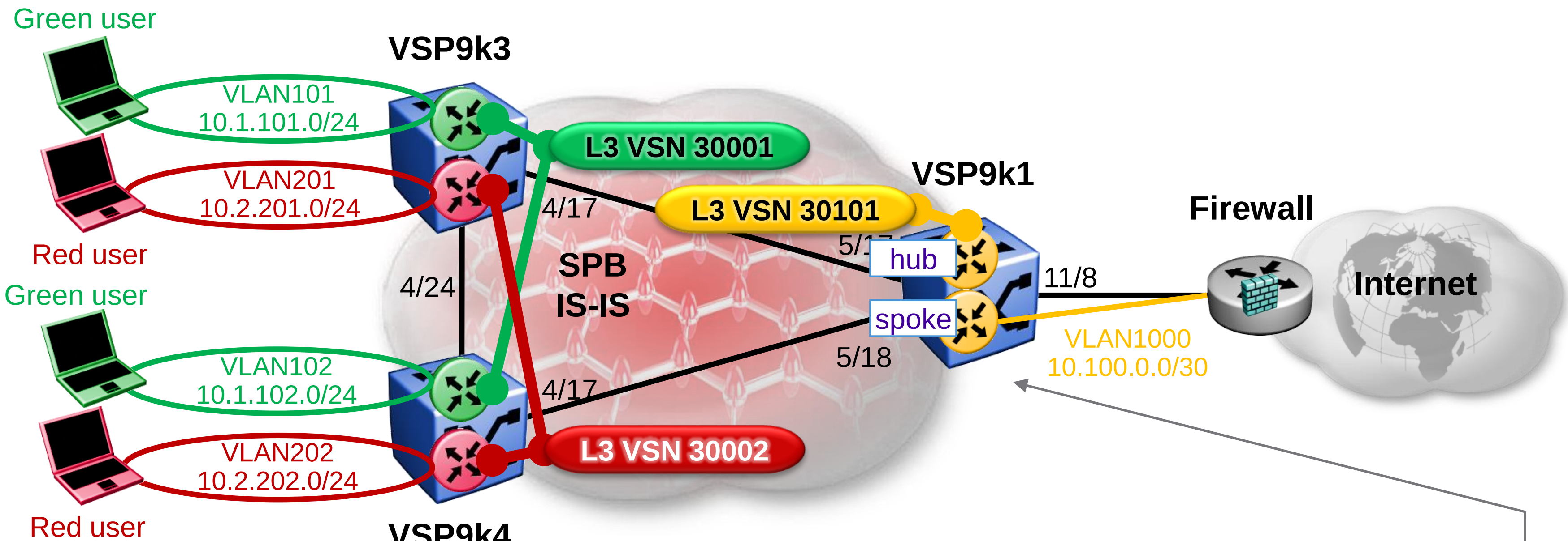
Shared Internet Firewall
Checking Red VSN routes




```
VSP9000-4:1#% show ip route vrf red
==========================================================================================
                                  IP Route - VRF red
==========================================================================================
                                                          NH                   INTER
DST             MASK             NEXT                     VRF/ISID        COST FACE  PROT AGE TYPE PRF
------------------------------------------------------------------------------------------
10.2.201.0      255.255.255.0    VSP9000-3                red             10   4051  ISIS 0   IBSV 7
10.2.202.0      255.255.255.0    10.2.202.1               -               1    202   LOC  0   DB   0
```

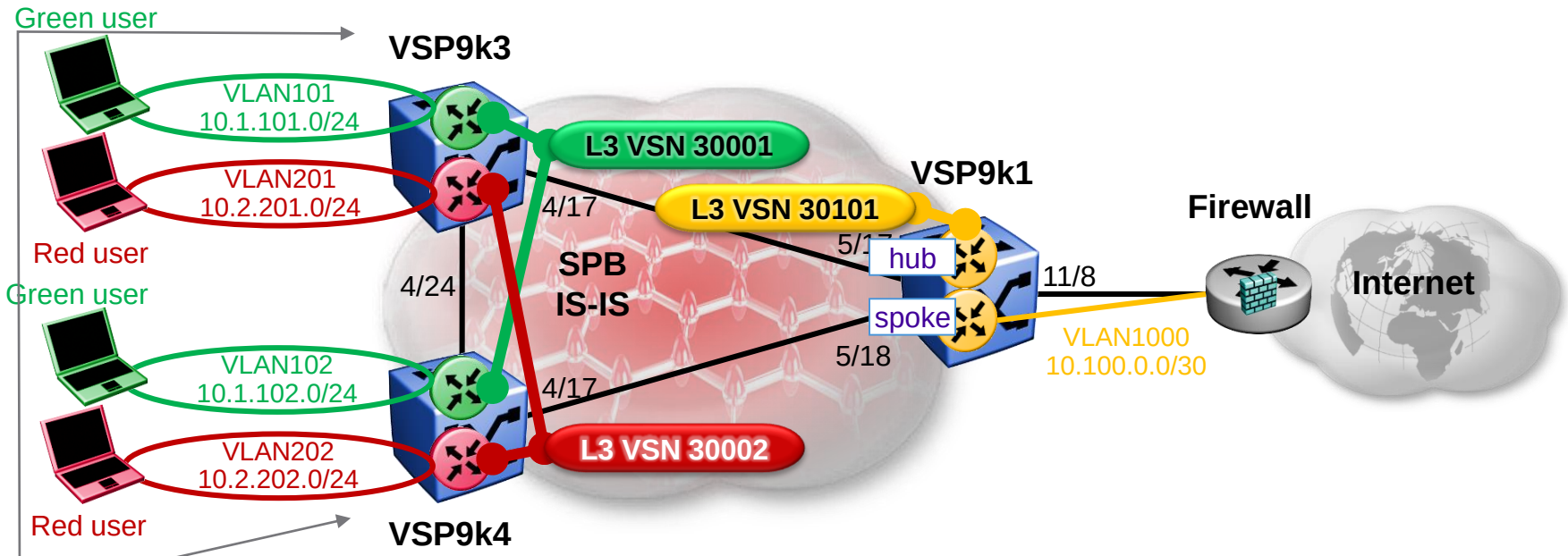
```
VSP9000-3:1#% show ip route vrf red
==========================================================================================
                                  IP Route - VRF red
==========================================================================================
                                                          NH                   INTER
DST             MASK             NEXT                     VRF/ISID        COST FACE  PROT AGE TYPE PRF
------------------------------------------------------------------------------------------
10.2.201.0      255.255.255.0    10.2.201.1               -               1    201   LOC  0   DB   0
10.2.202.0      255.255.255.0    VSP9000-4                red             10   4051  ISIS 0   IBSV 7
```

Shared Internet Firewall
Checking Firewall VRF routes



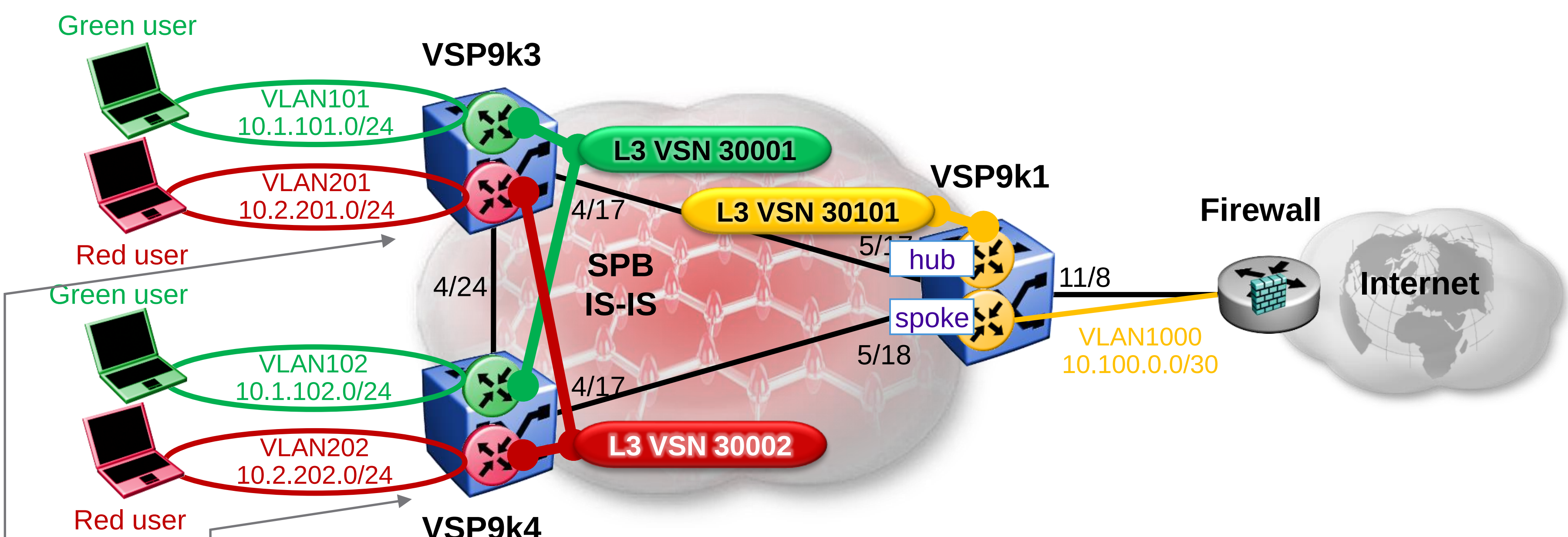

```
VSP9000-1:1#% show ip route vrf fw-hub
================================================================================================
                                    IP Route - VRF fw-hub
================================================================================================
                                                     NH                   INTER
DST              MASK             NEXT               VRF/ISID        COST FACE  PROT AGE TYPE PRF
------------------------------------------------------------------------------------------------
0.0.0.0          0.0.0.0          10.100.0.2         fw-spoke        10   1000  STAT 0   IB    5

VSP9000-1:1#% show ip route vrf fw-spoke
================================================================================================
                                   IP Route - VRF fw-spoke
================================================================================================
                                                     NH                   INTER
DST              MASK             NEXT               VRF/ISID        COST FACE  PROT AGE TYPE PRF
------------------------------------------------------------------------------------------------
10.100.0.0       255.255.255.252  10.100.0.1         -               1    1000  LOC  0   DB    0
```

Shared Internet Firewall
Accept default route into Green & Red VSNs




```
router vrf green
   isis accept i-sid 30101 enable
exit
isis apply accept vrf green

router vrf red
   isis accept i-sid 30101 enable
exit
isis apply accept vrf red
```

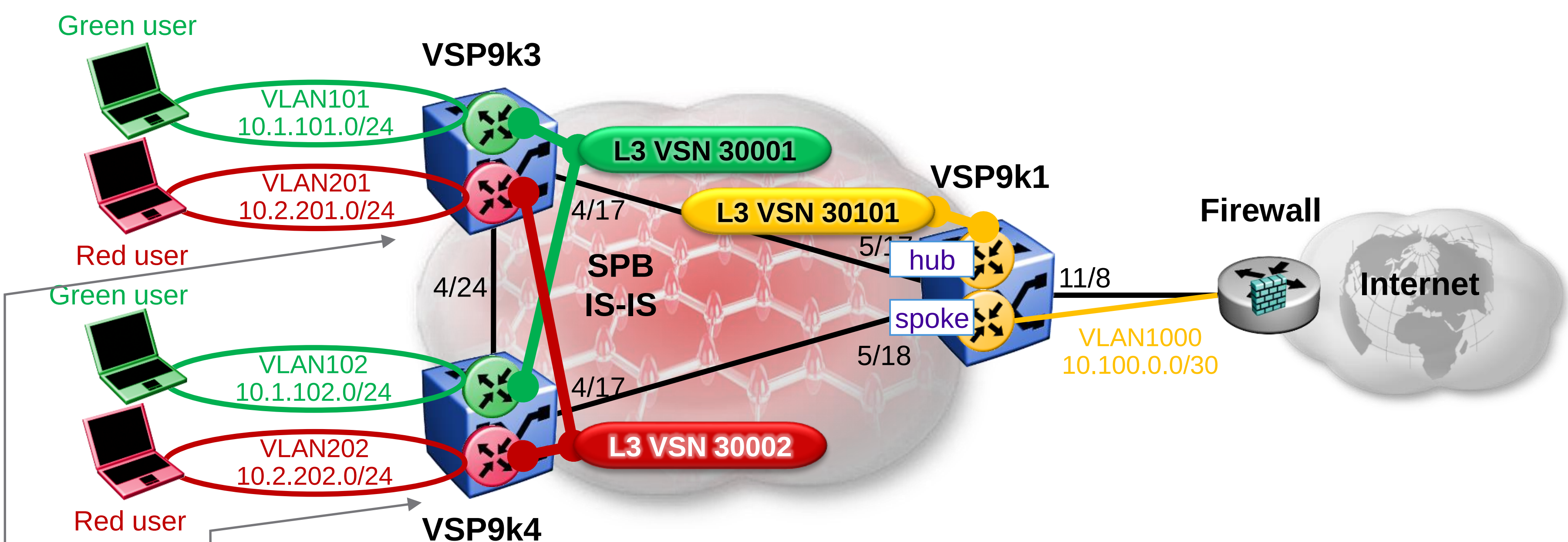
Shared Internet Firewall
Checking Green VSN Routes




```
VSP9000-4:1#% show ip route vrf green
================================================================================
                              IP Route - VRF green
================================================================================
                                            NH                    INTER
DST            MASK            NEXT         VRF/ISID         COST FACE   PROT AGE TYPE PRF
--------------------------------------------------------------------------------
0.0.0.0        0.0.0.0         VSP9000-1    30101            10   4051   ISIS 0   IBSV 200
10.1.101.0     255.255.255.0   VSP9000-3    green            10   4051   ISIS 0   IBSV 7
10.1.102.0     255.255.255.0   10.1.102.1   -                1    102    LOC  0   DB   0
```

```
VSP9000-3:1#% s
================================================================================
                              IP Route - VRF green
================================================================================
                                            NH                    INTER
DST            MASK            NEXT         VRF/ISID         COST FACE   PROT AGE TYPE PRF
--------------------------------------------------------------------------------
0.0.0.0        0.0.0.0         VSP9000-1    30101            10   4051   ISIS 0   IBSV 200
10.1.101.0     255.255.255.0   10.1.101.1   -                1    101    LOC  0   DB   0
10.1.102.0     255.255.255.0   VSP9000-4    green            10   4051   ISIS 0   IBSV 7
```

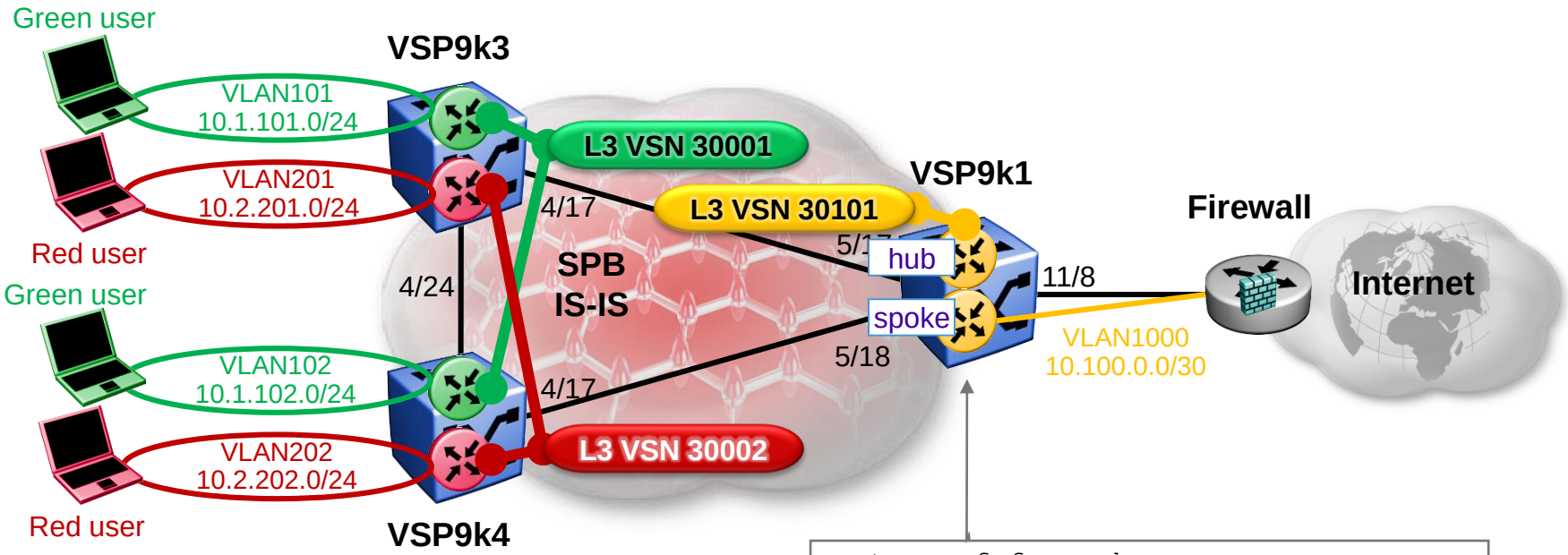
Shared Internet Firewall
Checking Red VSN Routes




```
VSP9000-4:1#% show ip route vrf red
================================================================================
                              IP Route - VRF red
================================================================================
                                          NH                          INTER
DST          MASK            NEXT             VRF/ISID         COST  FACE  PROT  AGE  TYPE  PRF
--------------------------------------------------------------------------------
0.0.0.0      0.0.0.0         VSP9000-1        30101            10    4051  ISIS  0    IBSV  200
10.2.201.0   255.255.255.0   VSP9000-3        red              10    4051  ISIS  0    IBSV  7
10.2.202.0   255.255.255.0   10.2.202.1       -                1     202   LOC   0    DB    0
```

```
VSP9000-3:1#% s
================================================================================
                              IP Route - VRF red
================================================================================
                                          NH                          INTER
DST          MASK            NEXT             VRF/ISID         COST  FACE  PROT  AGE  TYPE  PRF
--------------------------------------------------------------------------------
0.0.0.0      0.0.0.0         VSP9000-1        30101            10    4051  ISIS  0    IBSV  200
10.2.201.0   255.255.255.0   10.2.201.1       -                1     201   LOC   0    DB    0
10.2.202.0   255.255.255.0   VSP9000-4        red              10    4051  ISIS  0    IBSV  7
```

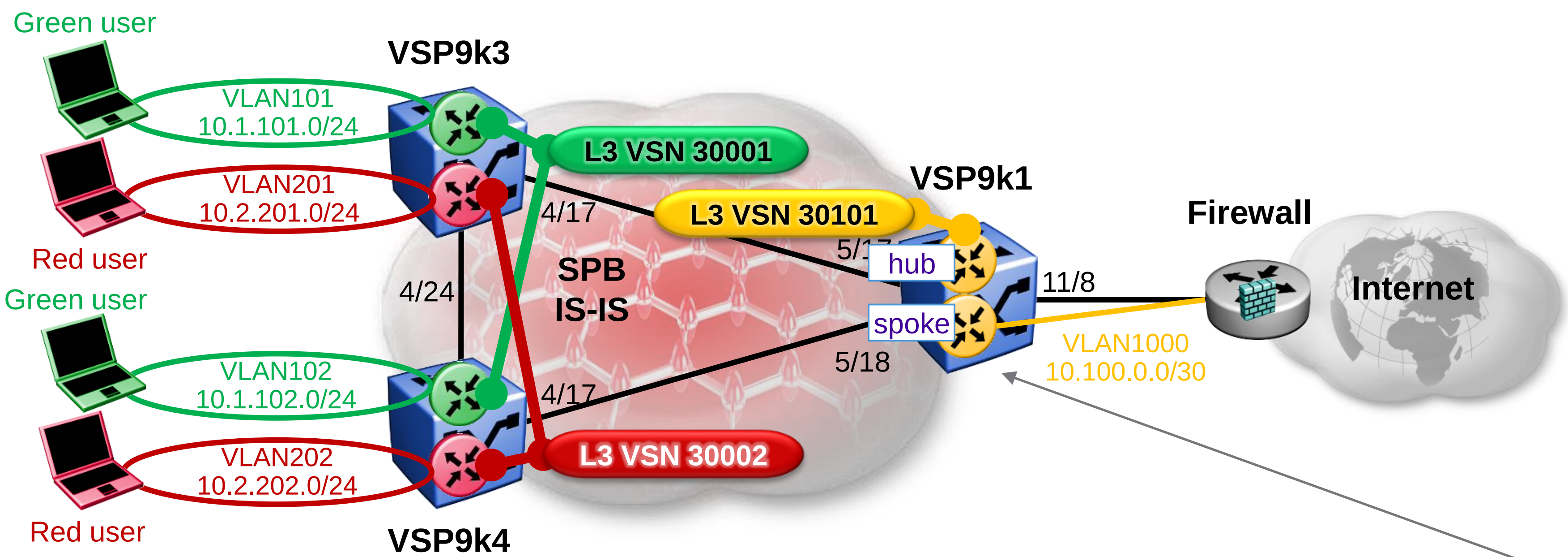
Shared Internet Firewall
Accept Green & Red subnets into VRF FW-Spoke




```
router vrf fw-spoke
   ipvpn
   i-sid 30102
   ipvpn enable
   ip isid-list users 30001
   ip isid-list users 30002
   isis accept isid-list users enable
exit
isis apply accept vrf fw-spoke
```

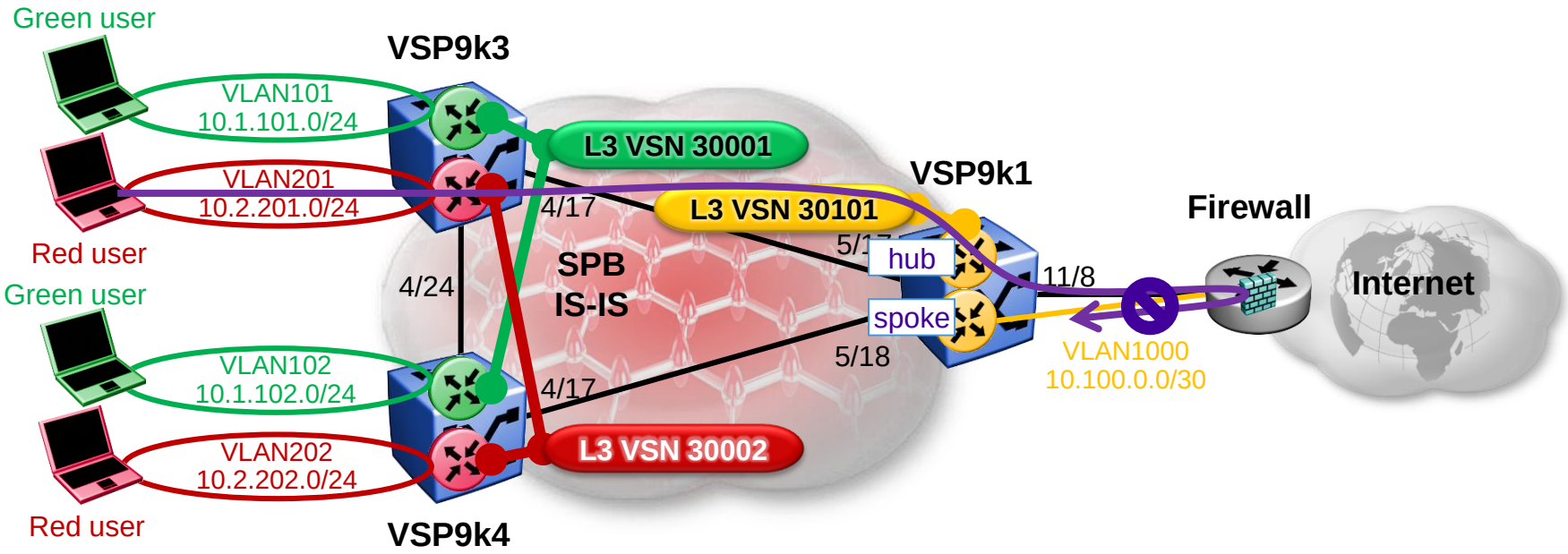
- In order to ISIS Accept IP routes, we need ISIS (IPVPN) to be enabled on the VRF
- In order to enable IPVPN an I-SID needs to be assigned
  - So in this case I-SID 30102 will not actually be used to advertise any IP routes

Shared Internet Firewall
Checking VRF FW-Spoke Routes



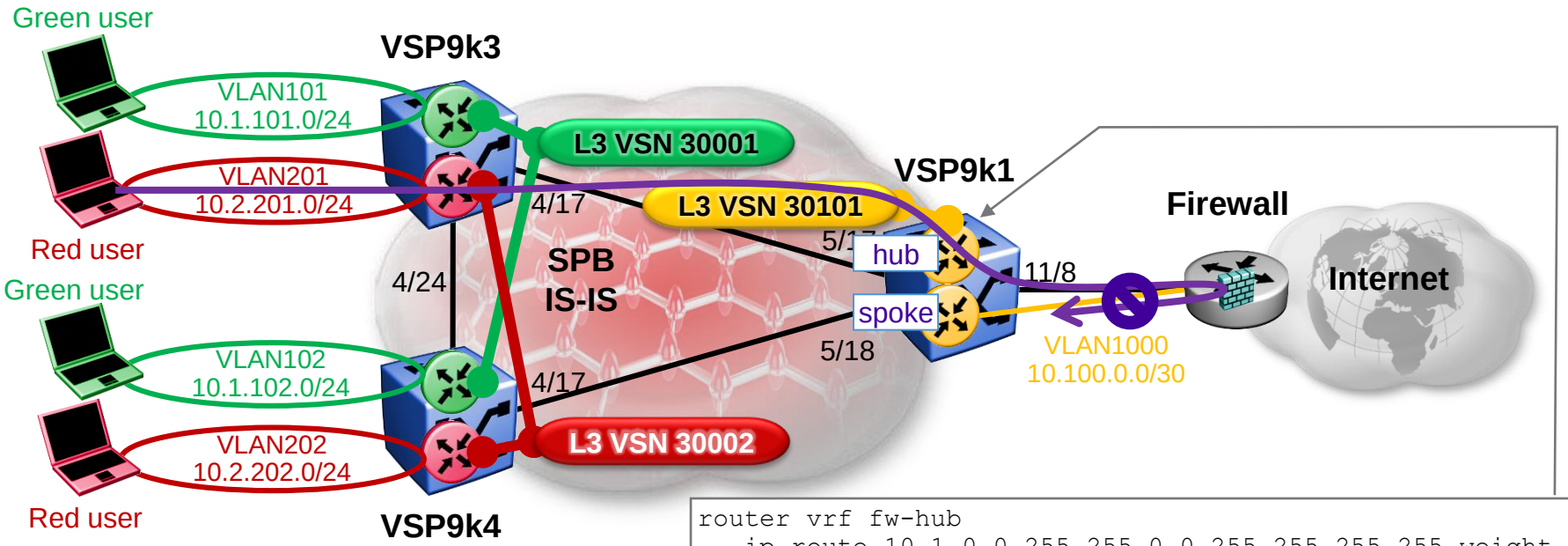

```
VSP9000-1:1#% show ip route vrf fw-spoke
================================================================================
                              IP Route - VRF fw-spoke
================================================================================
                                                NH                   INTER
DST             MASK            NEXT            VRF/ISID        COST FACE   PROT AGE TYPE PRF
--------------------------------------------------------------------------------
10.1.101.0      255.255.255.0   VSP9000-3       30001           10   4051   ISIS 0   IBSV 200
10.1.102.0      255.255.255.0   VSP9000-4       30001           10   4051   ISIS 0   IBSV 200
10.2.201.0      255.255.255.0   VSP9000-3       30002           10   4051   ISIS 0   IBSV 200
10.2.202.0      255.255.255.0   VSP9000-4       30002           10   4051   ISIS 0   IBSV 200
10.100.0.0      255.255.255.252 10.100.0.1      -               1    1000   LOC  0   DB   0
```

Shared Internet Firewall
Spoke – Spoke Routing considerations



- The design intent is that Green and Red users cannot communicate
- It must therefore not be possible for any traffic to be IP routed between the Green and Red VSNs by following the default route to the Firewall
- A rule on the Firewall should be used to prevent any such spoke-spoke IP routing

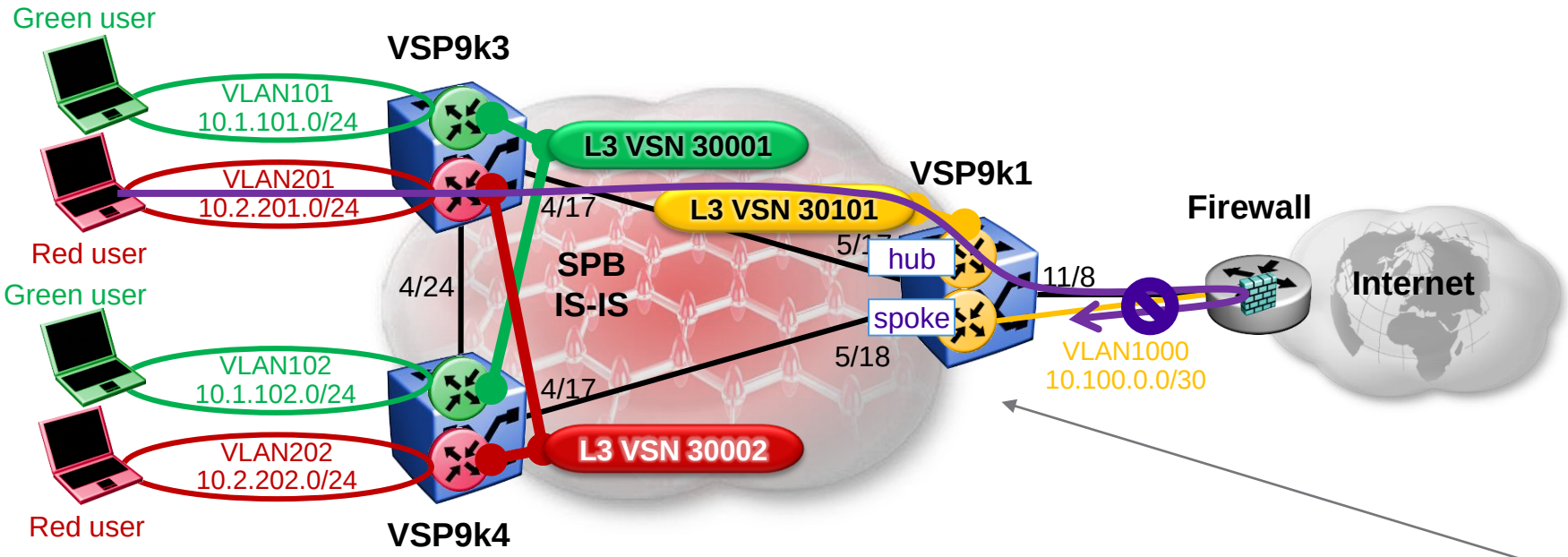
Shared Internet Firewall
Spoke – Spoke Routing considerations cont.




```
router vrf fw-hub
   ip route 10.1.0.0 255.255.0.0 255.255.255.255 weight 1
   ip route 10.2.0.0 255.255.0.0 255.255.255.255 weight 1
exit
```

- To be 100% safe, you could also configure a black-hole static route on the Fw-Hub VRF such that any packet received from the Fabric (from Green or Red VSNs because it followed the default route) should be dropped if its IP destination corresponds to a Green or Red VSN subnet
  - Note: Although this will not work for Green/Red VRFs co-located on the same BEB as the FW-Hub VRF, as the default route they import will carry with it the next-hop IP of the Firewall

Shared Internet Firewall
Checking VRF FW-Hub Black-Hole Routes




```
VSP9000-1:1#% show ip route vrf fw-hub
================================================================================================
                                        IP Route - VRF fw-hub
================================================================================================
                                                    NH                          INTER
DST             MASK            NEXT                VRF/ISID        COST FACE   PROT AGE TYPE PRF
------------------------------------------------------------------------------------------------
0.0.0.0         0.0.0.0         10.100.0.2          fw-spoke        10   1000   STAT 0   IB   5
10.1.0.0        255.255.0.0     255.255.255.255     -               1    0      STAT 0   IB   5
10.2.0.0        255.255.0.0     255.255.255.255     -               1    0      STAT 0   IB   5
```

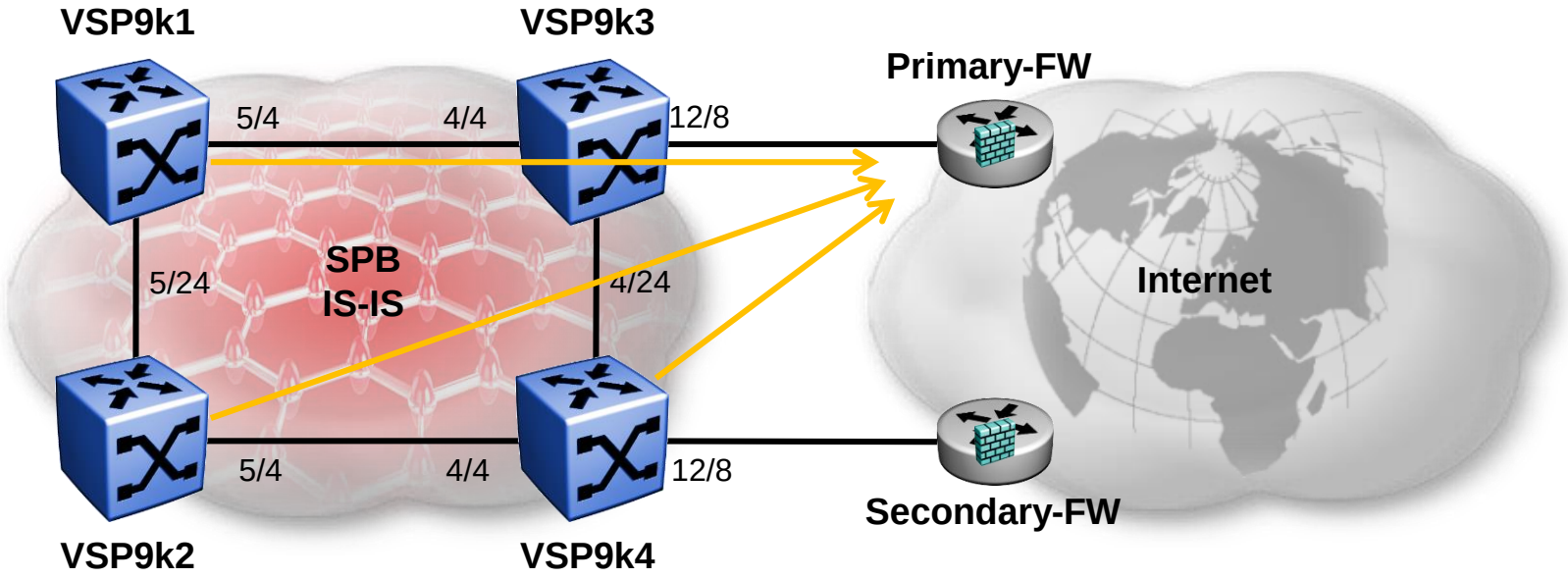
- Next-hop IP 255.255.255.255 = black-hole route

Using static routes over SPB ISIS

Last tested with: 4.0.0.0_B037

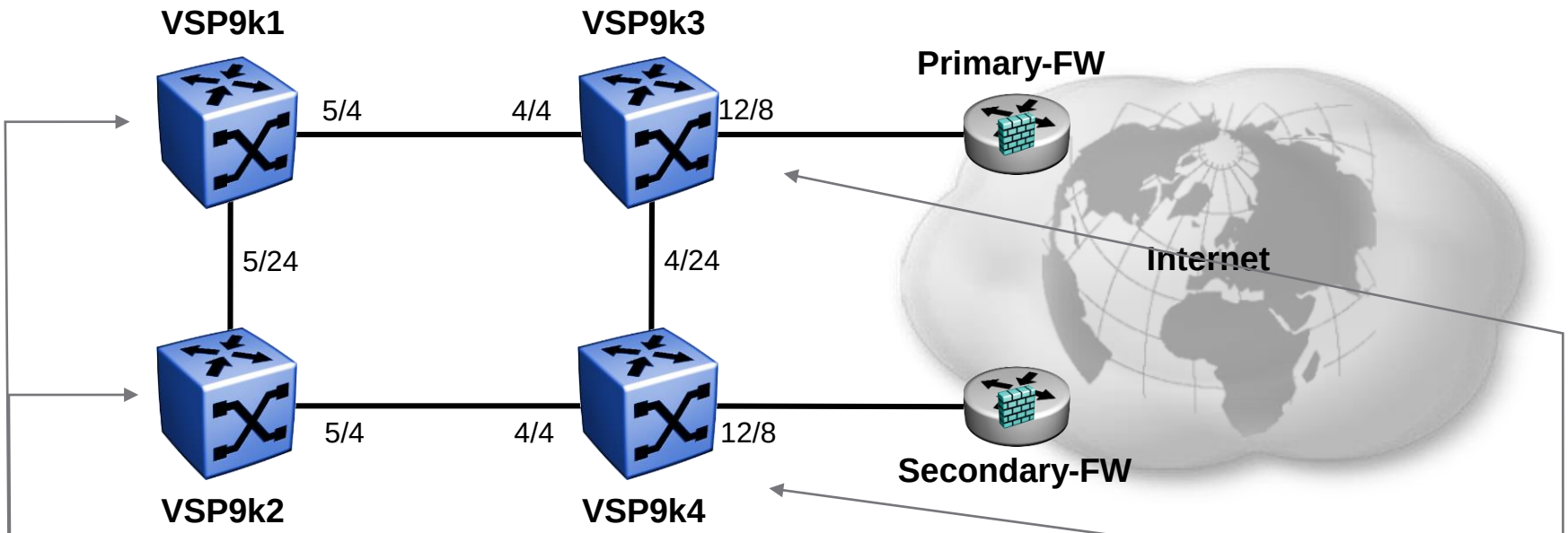
Example use #5

Forcing SPB traffic to a Primary FW
Goal



- Both VSP9k3 & VSP9k4 have a static route pointing to their connected Firewall
- Both VSP9k3 & VSP9k4 redistribute this static route into ISIS
- We want SPB Fabric to always follow default route to Primary-FW
  - Only follow default route to Secondary-FW if Primary-FW fails
- Challenge: from VSP9k2 the default route to Primary-FW is not the shortest path default route
- NOTE: The config using non-local static routes used in this section only works on GRT

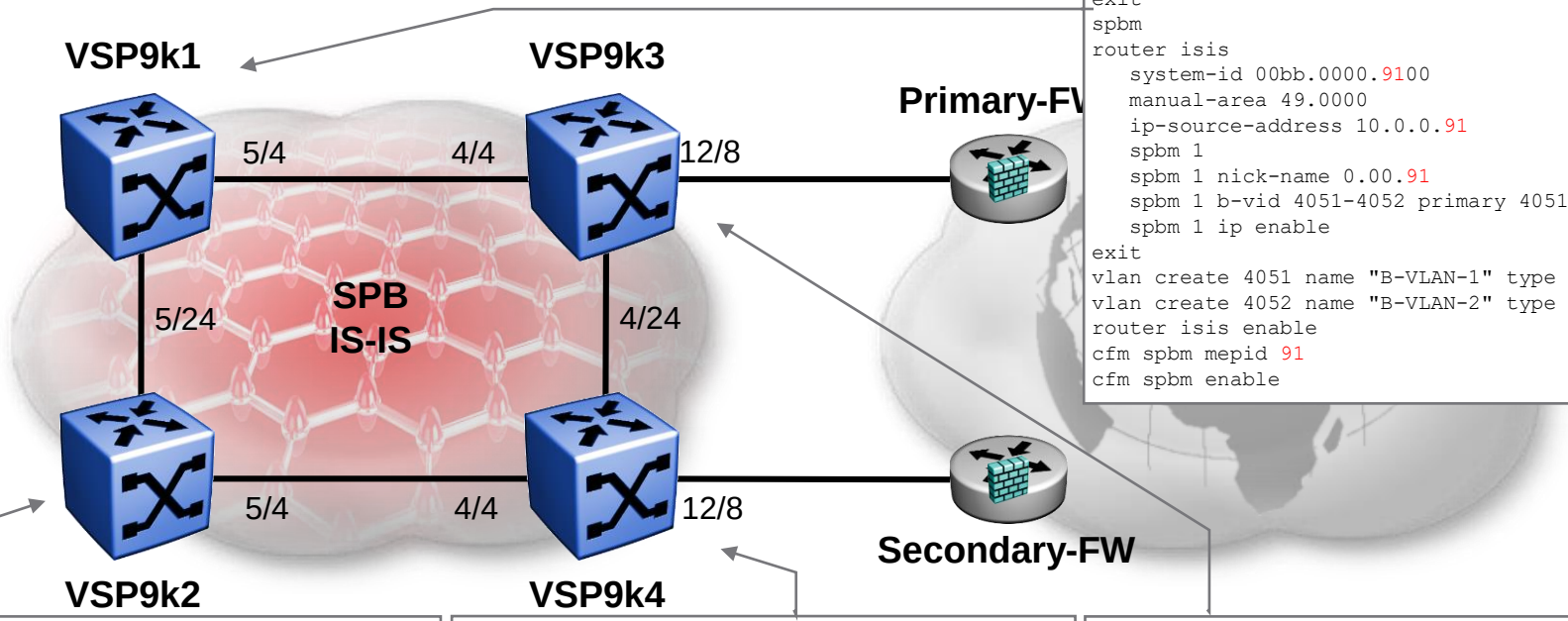
Forcing SPB traffic to a Primary FW
Interfaces used




```
interface gigabitEthernet 5/4,5/24
   no shutdown
exit
```

```
interface gigabitEthernet 4/4,4/24,12/8
   no shutdown
exit
```

Forcing SPB traffic to a Primary FW
SPB Global Config



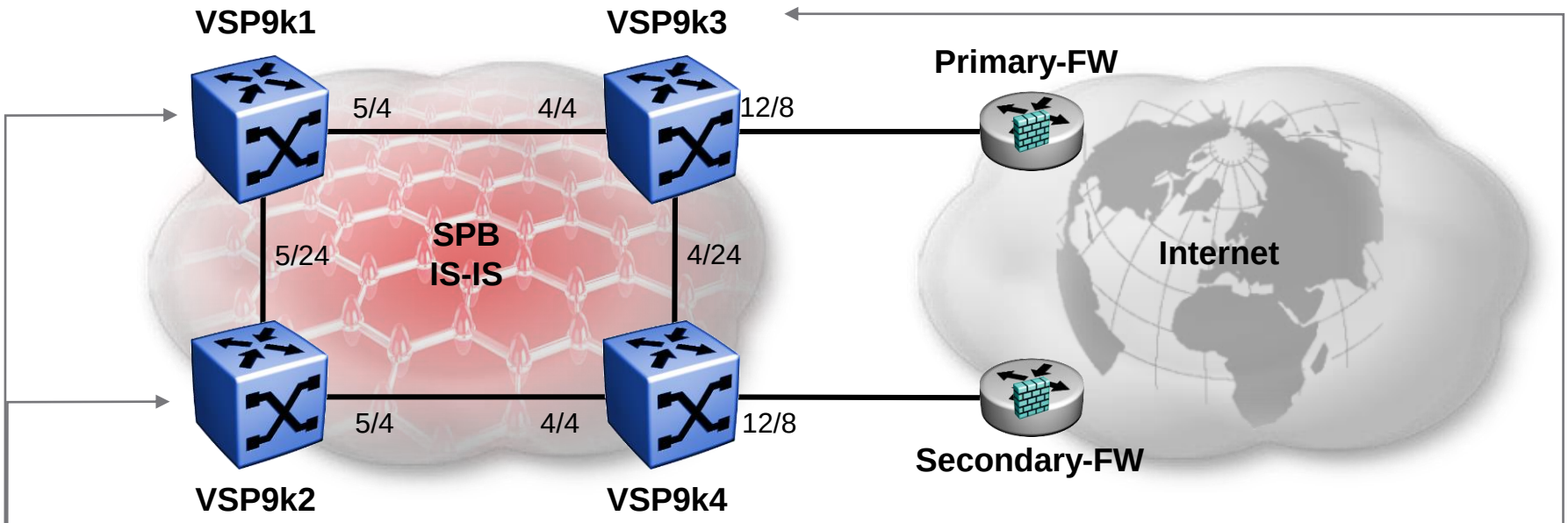

```
interface loopback 1
   ip address 10.0.0.91/255.255.255.255
exit
spbm
router isis
   system-id 00bb.0000.9100
   manual-area 49.0000
   ip-source-address 10.0.0.91
   spbm 1
   spbm 1 nick-name 0.00.91
   spbm 1 b-vid 4051-4052 primary 4051
   spbm 1 ip enable
exit
vlan create 4051 name "B-VLAN-1" type spbm-bvlan
vlan create 4052 name "B-VLAN-2" type spbm-bvlan
router isis enable
cfm spbm mepid 91
cfm spbm enable
```

```
interface loopback 1
   ip address 10.0.0.92/255.255.255.255
exit
spbm
router isis
   system-id 00bb.0000.9200
   manual-area 49.0000
   ip-source-address 10.0.0.92
   spbm 1
   spbm 1 nick-name 0.00.92
   spbm 1 b-vid 4051-4052 primary 4051
   spbm 1 ip enable
exit
vlan create 4051 name "B-VLAN-1" type spbm-bvlan
vlan create 4052 name "B-VLAN-2" type spbm-bvlan
router isis enable
cfm spbm mepid 92
cfm spbm enable
```

```
interface loopback 1
   ip address 10.0.0.94/255.255.255.255
exit
spbm
router isis
   system-id 00bb.0000.9400
   manual-area 49.0000
   ip-source-address 10.0.0.94
   spbm 1
   spbm 1 nick-name 0.00.94
   spbm 1 b-vid 4051-4052 primary 4051
   spbm 1 ip enable
exit
vlan create 4051 name "B-VLAN-1" type spbm-bvlan
vlan create 4052 name "B-VLAN-2" type spbm-bvlan
router isis enable
cfm spbm mepid 94
cfm spbm enable
```

```
interface loopback 1
   ip address 10.0.0.93/255.255.255.255
exit
spbm
router isis
   system-id 00bb.0000.9300
   manual-area 49.0000
   ip-source-address 10.0.0.93
   spbm 1
   spbm 1 nick-name 0.00.93
   spbm 1 b-vid 4051-4052 primary 4051
   spbm 1 ip enable
exit
vlan create 4051 name "B-VLAN-1" type spbm-bvlan
vlan create 4052 name "B-VLAN-2" type spbm-bvlan
router isis enable
cfm spbm mepid 93
cfm spbm enable
```

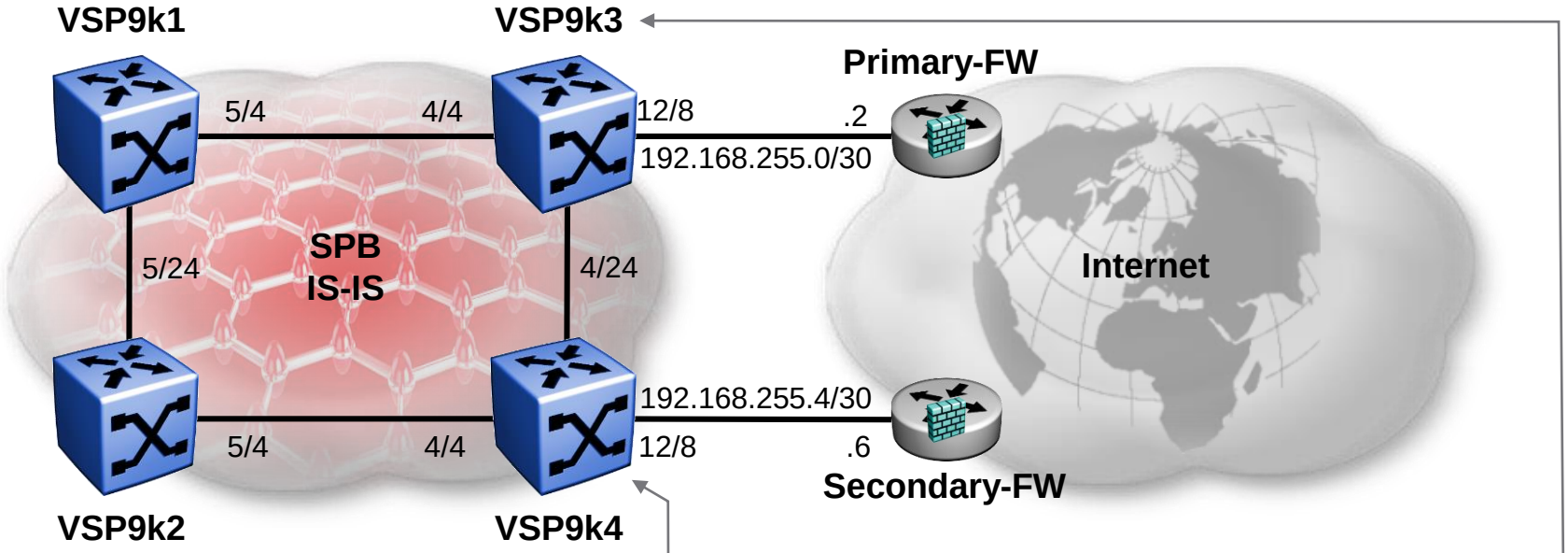
Forcing SPB traffic to a Primary FW
SPB Interface Config




```
interface GigabitEthernet 5/4,5/24
   isis
   isis spbm 1
   isis enable
exit
```

```
interface GigabitEthernet 4/4,4/24
   isis
   isis spbm 1
   isis enable
exit
```

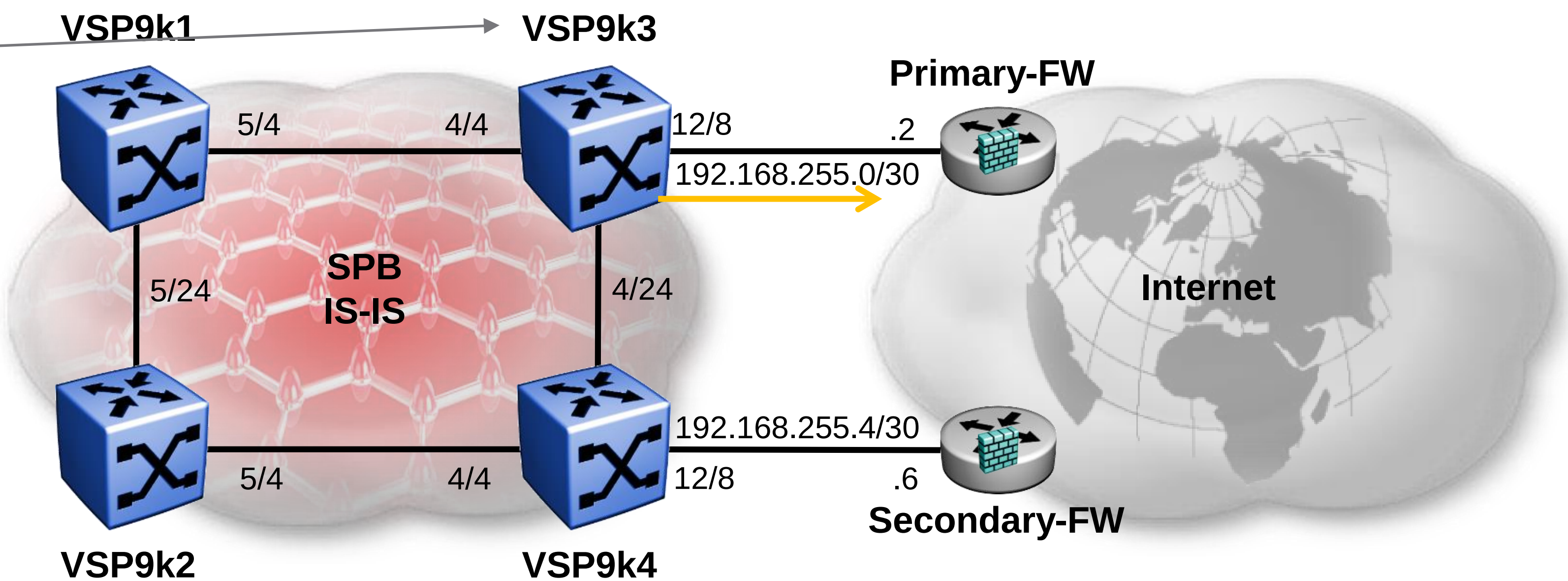
Forcing SPB traffic to a Primary FW
ISIS Redistribution on BEBs connected to FWs




```
vlan members remove 1 12/8
interface gigabitEthernet 12/8
   no spanning-tree mstp force-port-state enable
exit
interface GigabitEthernet 12/8
   brouter vlan 3901 subnet 192.168.255.5/30
exit
ip route 0.0.0.0 0.0.0.0 192.168.255.6 weight 200
router isis
   redistribute direct
   redistribute direct enable
   redistribute static
   redistribute static enable
exit
isis apply redistribute direct
isis apply redistribute static
```

```
vlan members remove 1 12/8
interface gigabitEthernet 12/8
   no spanning-tree mstp force-port-state enable
exit
interface GigabitEthernet 12/8
   brouter vlan 3901 subnet 192.168.255.1/30
exit
ip route 0.0.0.0 0.0.0.0 192.168.255.2 weight 100
router isis
   redistribute direct
   redistribute direct enable
   redistribute static
   redistribute static enable
exit
isis apply redistribute direct
isis apply redistribute static
```

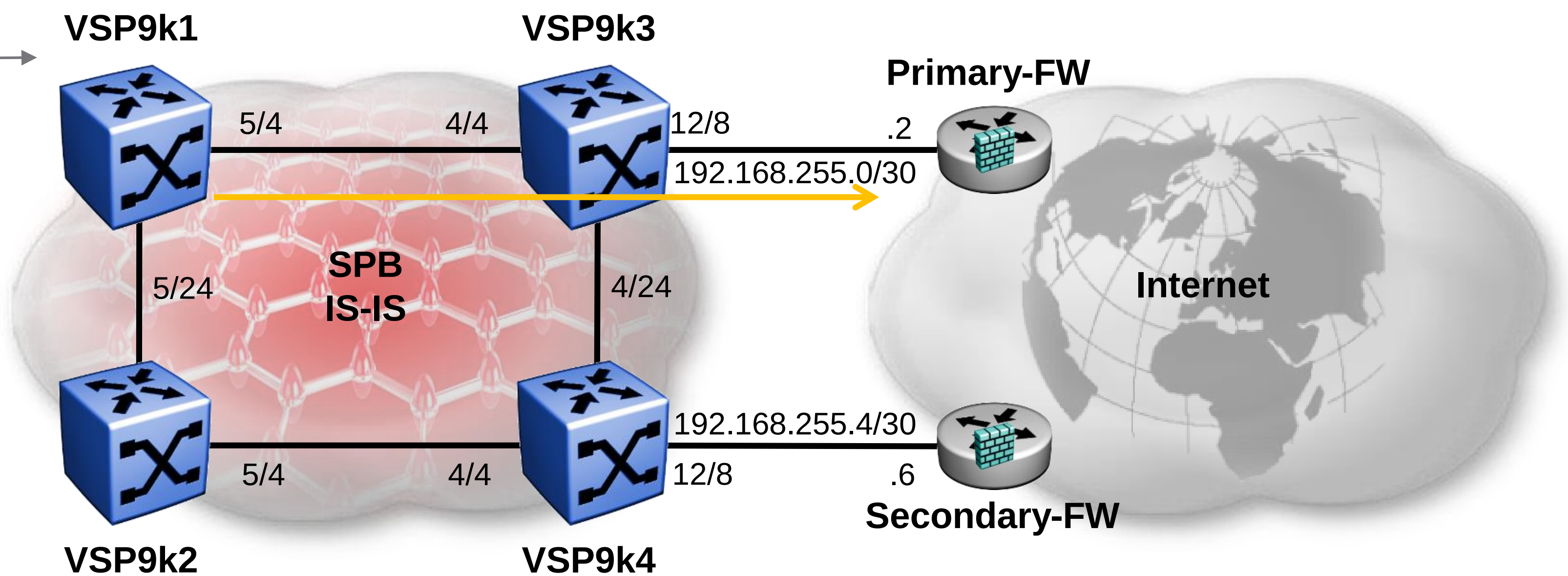
Forcing SPB traffic to a Primary FW
Checking IP routes




```
VSP9000-3:1#% show ip route
================================================================================
                            IP Route - GlobalRouter
================================================================================
                                                NH                    INTER
DST             MASK            NEXT            VRF/ISID        COST  FACE   PROT AGE TYPE PRF
--------------------------------------------------------------------------------
0.0.0.0         0.0.0.0         192.168.255.2   GlobalRouter    100   12/8   STAT 0   IB   5
10.0.0.91       255.255.255.255 VSP9000-1       GlobalRouter    10    4051   ISIS 0   IBS  7
10.0.0.92       255.255.255.255 VSP9000-2       GlobalRouter    20    4051   ISIS 0   IBS  7
10.0.0.93       255.255.255.255 10.0.0.93       -               1     0      LOC  0   DB   0
10.0.0.94       255.255.255.255 VSP9000-4       GlobalRouter    10    4051   ISIS 0   IBS  7
192.168.255.0   255.255.255.252 192.168.255.1   -               1     12/8   LOC  0   DB   0
192.168.255.4   255.255.255.252 VSP9000-4       GlobalRouter    10    4051   ISIS 0   IBS  7
```

- OK, so far so good

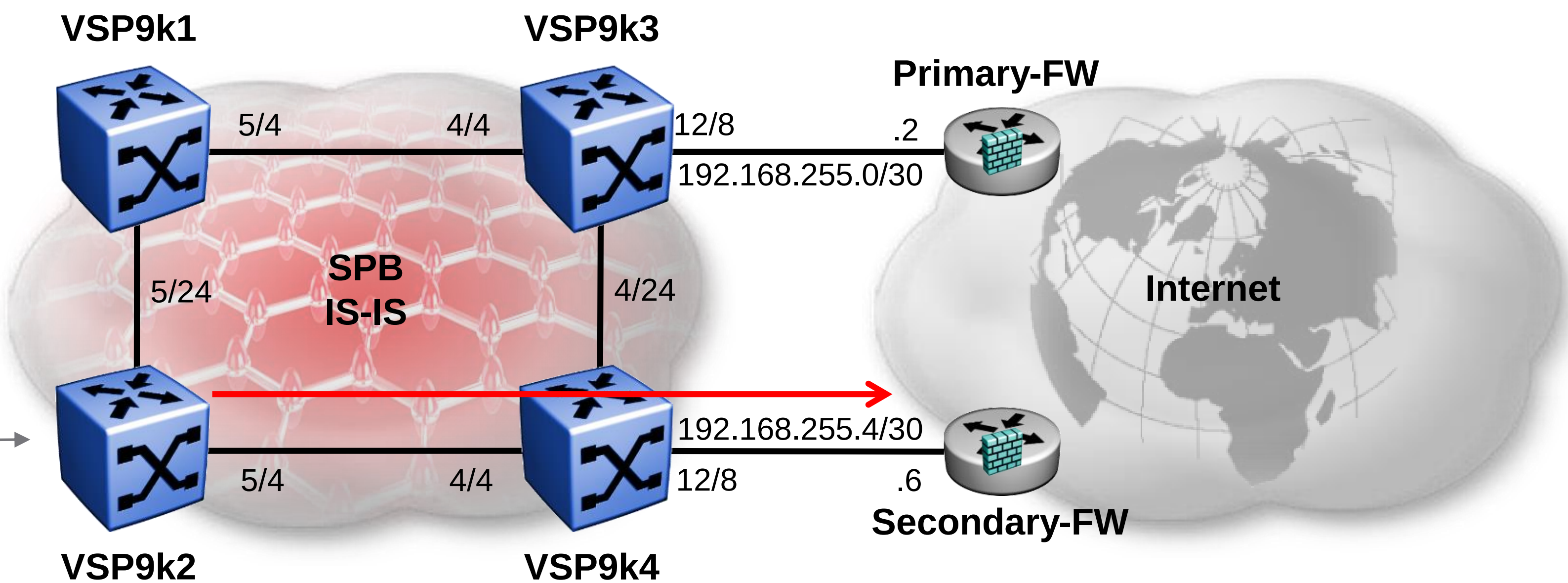
Forcing SPB traffic to a Primary FW
Checking IP routes




```
VSP9000-1:1#% show ip route
================================================================================
                              IP Route - GlobalRouter
================================================================================
                                                NH                  INTER
DST             MASK            NEXT            VRF/ISID       COST FACE  PROT AGE TYPE PRF
--------------------------------------------------------------------------------
0.0.0.0         0.0.0.0         VSP9000-3       GlobalRouter   10   4051  ISIS 0   IBS  7
10.0.0.91       255.255.255.255 10.0.0.91       -              1    0     LOC  0   DB   0
10.0.0.92       255.255.255.255 VSP9000-2       GlobalRouter   10   4051  ISIS 0   IBS  7
10.0.0.93       255.255.255.255 VSP9000-3       GlobalRouter   10   4051  ISIS 0   IBS  7
10.0.0.94       255.255.255.255 VSP9000-4       GlobalRouter   20   4051  ISIS 0   IBS  7
192.168.255.0   255.255.255.252 VSP9000-3       GlobalRouter   10   4051  ISIS 0   IBS  7
192.168.255.4   255.255.255.252 VSP9000-4       GlobalRouter   20   4051  ISIS 0   IBS  7
```

- OK, so far so good

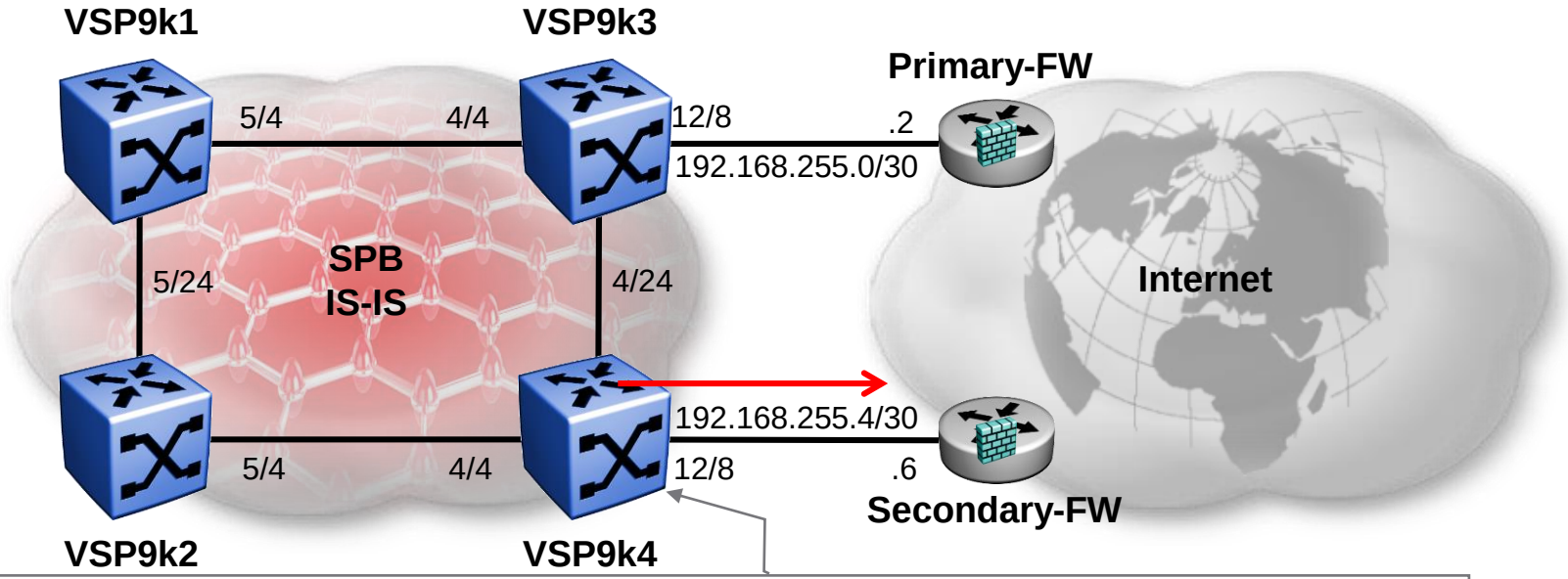
Forcing SPB traffic to a Primary FW
Checking IP routes




```
VSP9000-2:1#% show ip route
================================================================================
                              IP Route - GlobalRouter
================================================================================
                                                NH                  INTER
DST             MASK            NEXT            VRF/ISID       COST FACE  PROT AGE TYPE PRF
--------------------------------------------------------------------------------
0.0.0.0         0.0.0.0         VSP9000-4       GlobalRouter   10   4051  ISIS 0   IBS  7
10.0.0.91       255.255.255.255 VSP9000-1       GlobalRouter   10   4051  ISIS 0   IBS  7
10.0.0.92       255.255.255.255 10.0.0.92       -              1    0     LOC  0   DB   0
10.0.0.93       255.255.255.255 VSP9000-3       GlobalRouter   20   4051  ISIS 0   IBS  7
10.0.0.94       255.255.255.255 VSP9000-4       GlobalRouter   10   4051  ISIS 0   IBS  7
192.168.255.0   255.255.255.252 VSP9000-3       GlobalRouter   20   4051  ISIS 0   IBS  7
192.168.255.4   255.255.255.252 VSP9000-4       GlobalRouter   10   4051  ISIS 0   IBS  7
```

- VSP9k2 is pointing at Secondary-FW; this is not what we wanted

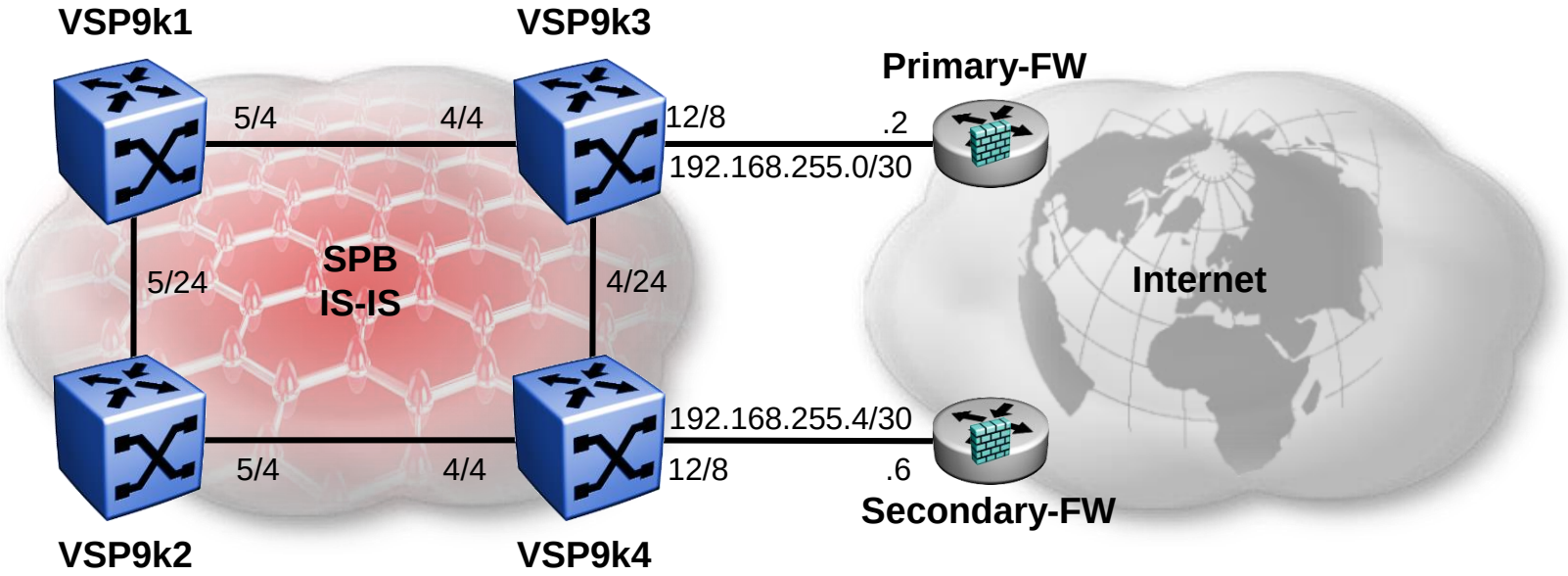
Forcing SPB traffic to a Primary FW
Checking IP routes




```
VSP9000-4:1#% show ip route
=============================================================================================================
                                        IP Route - GlobalRouter
=============================================================================================================
                                                    NH                          INTER
DST             MASK            NEXT                VRF/ISID        COST FACE   PROT AGE TYPE PRF
-------------------------------------------------------------------------------------------------------------
0.0.0.0         0.0.0.0         192.168.255.6       GlobalRouter    200  12/8   STAT 0   IB   5
10.0.0.91       255.255.255.255 VSP9000-1           GlobalRouter    20   4051   ISIS 0   IBS  7
10.0.0.92       255.255.255.255 VSP9000-2           GlobalRouter    10   4051   ISIS 0   IBS  7
10.0.0.93       255.255.255.255 VSP9000-3           GlobalRouter    10   4051   ISIS 0   IBS  7
10.0.0.94       255.255.255.255 10.0.0.94           -               1    0      LOC  0   DB   0
192.168.255.0   255.255.255.252 VSP9000-3           GlobalRouter    10   4051   ISIS 0   IBS  7
192.168.255.4   255.255.255.252 192.168.255.5       -               1    12/8   LOC  0   DB   0
```

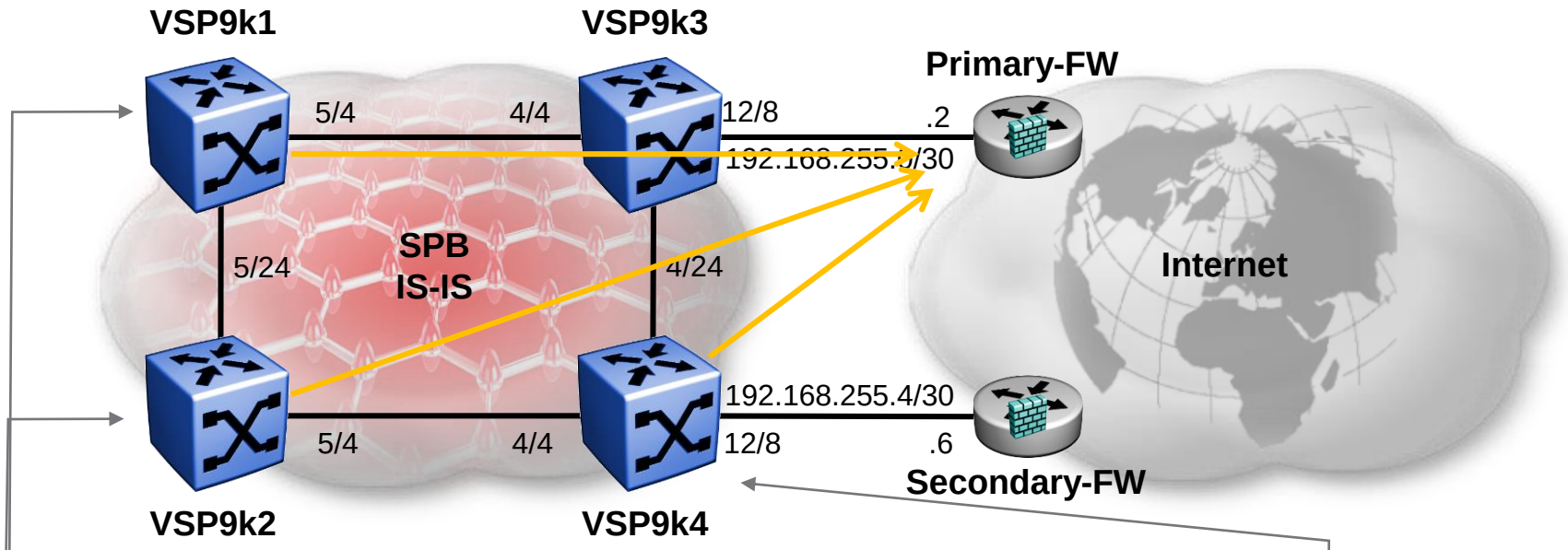
- VSP9k4 is pointing at Secondary-FW; this is not what we wanted

Forcing SPB traffic to a Primary FW
External/Internal type routes



- In a future software release it will be possible to mark SPB ISIS IP routes as one of 2 possible types:
  - Internal : These routes will always be preferred over External routes; between Internal routes, the route with the lowest SPB path cost will be preferred and the external route metric is only used as a tie breaker (current default behaviour of SPB IP)
  - External : With these, if we learn the same route twice as External, then the route with the lowest external metric is preferred.
    - In this example, we would simply configure VSP9k3 & VSP9k4 to redistribute their default static route as an External type route, with VSP9k3 using a lower external metric
- As this is not possible today, the following slides will demonstrate an alternative approach based on non-local static routes (NOTE: this works only in GRT)

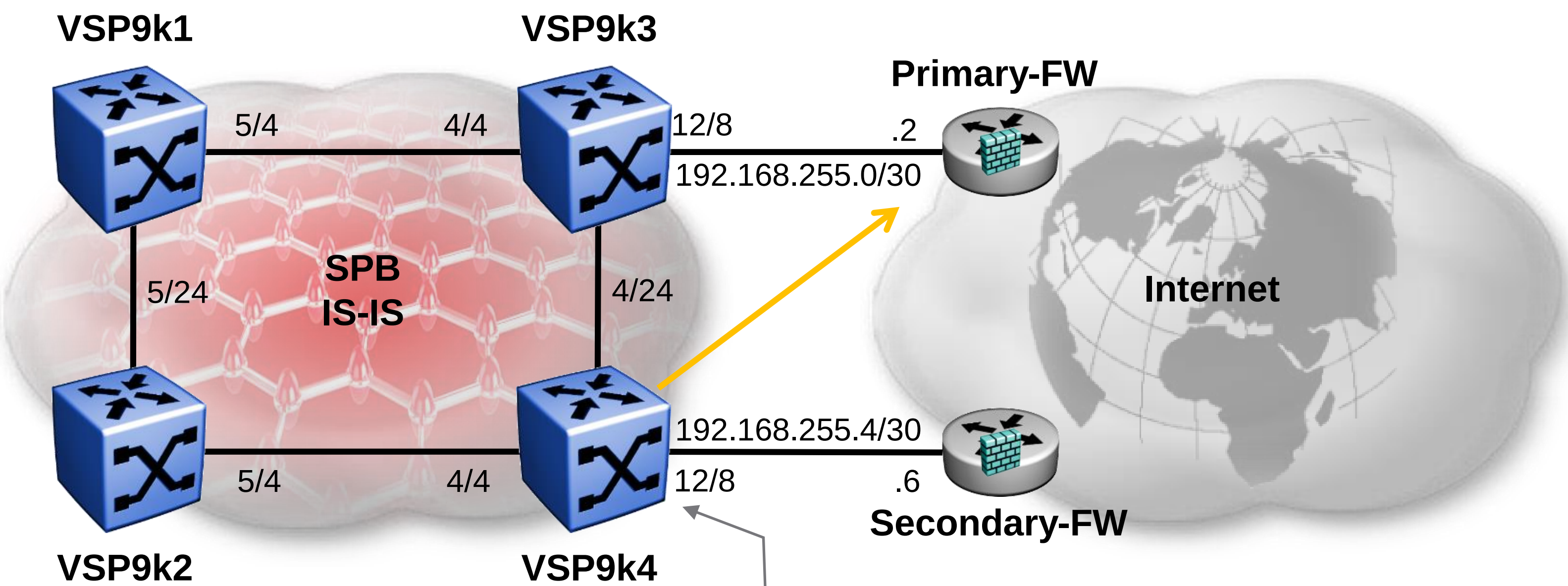
Forcing SPB traffic to a Primary FW
Using Non-local static routes




```
ip route 0.0.0.0 0.0.0.0 192.168.255.1 weight 10
no ip route 0.0.0.0 0.0.0.0 192.168.255.1 enable
no ip route 0.0.0.0 0.0.0.0 192.168.255.1 local-next-hop enable
ip route 0.0.0.0 0.0.0.0 192.168.255.1 enable
```

- We need this non-local static route on all BEBs except VSP9k3
- Use the IP address on VSP9k3's connection to the Primary-FW as the next-hop IP
  - This will ensure that these routes de-activate if that link or the Primary-FW fails

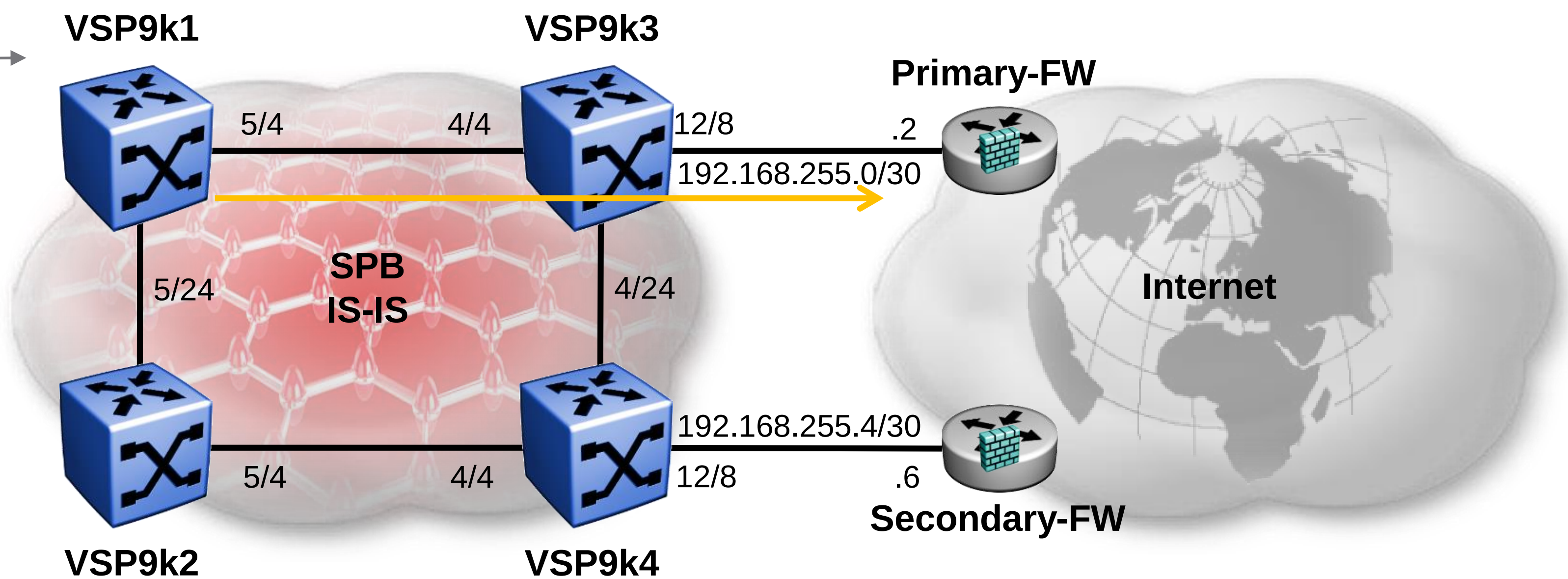
Forcing SPB traffic to a Primary FW
Checking IP routes




```
VSP9000-4:1#% show ip route
================================================================================
                              IP Route - GlobalRouter
================================================================================
                                                  NH                     INTER
DST              MASK             NEXT             VRF/ISID         COST FACE PROT AGE TYPE PRF
--------------------------------------------------------------------------------
0.0.0.0          0.0.0.0          VSP9000-3        GlobalRouter     10   4051 STAT 0   IBS  5
10.0.0.91        255.255.255.255  VSP9000-1        GlobalRouter     20   4051 ISIS 0   IBS  7
10.0.0.92        255.255.255.255  VSP9000-2        GlobalRouter     10   4051 ISIS 0   IBS  7
10.0.0.93        255.255.255.255  VSP9000-3        GlobalRouter     10   4051 ISIS 0   IBS  7
10.0.0.94        255.255.255.255  10.0.0.94        -                1    0    LOC  0   DB   0
192.168.255.0    255.255.255.252  VSP9000-3        GlobalRouter     10   4051 ISIS 0   IBS  7
192.168.255.4    255.255.255.252  192.168.255.5    -                1    12/8 LOC  0   DB   0
```

- Design objective achieved !

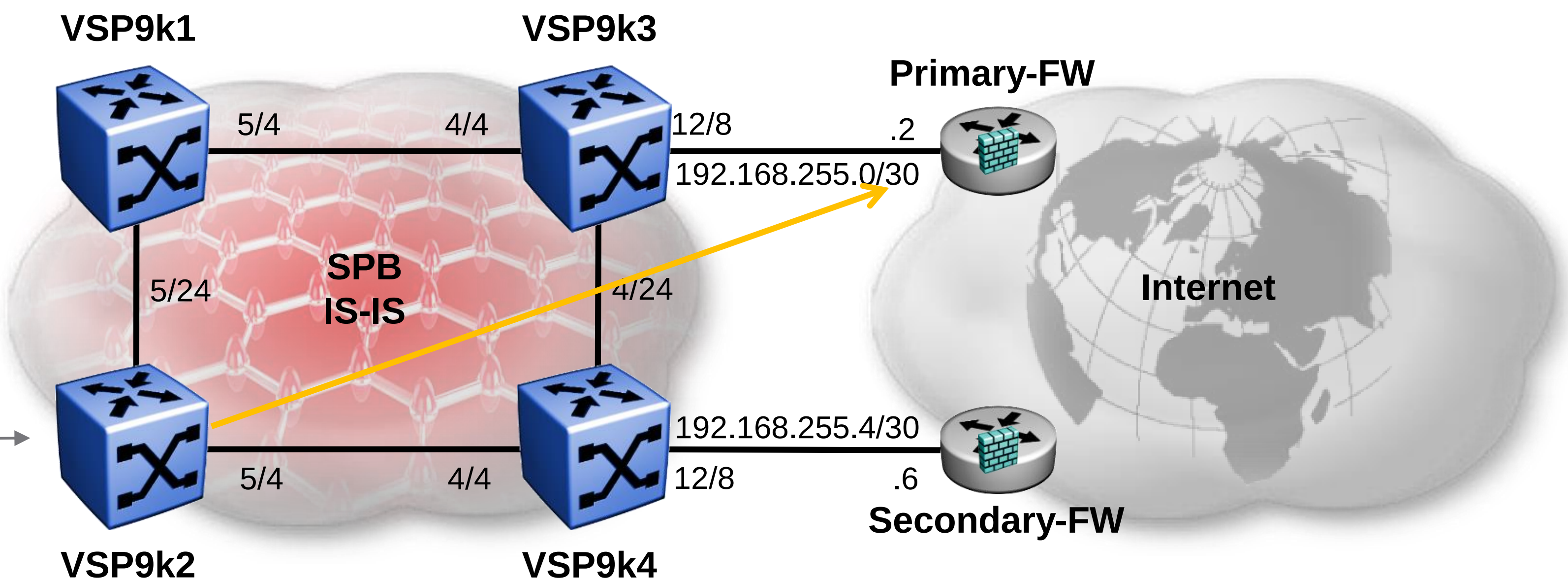
Forcing SPB traffic to a Primary FW
Checking IP routes




```
VSP9000-1:1#% show ip route
================================================================================================
                                    IP Route - GlobalRouter
================================================================================================
                                                    NH                      INTER
DST             MASK            NEXT                VRF/ISID          COST  FACE   PROT AGE TYPE PRF
------------------------------------------------------------------------------------------------
0.0.0.0         0.0.0.0         VSP9000-3           GlobalRouter      10    4051   STAT 0   IBS  5
10.0.0.91       255.255.255.255 10.0.0.91           -                 1     0      LOC  0   DB   0
10.0.0.92       255.255.255.255 VSP9000-2           GlobalRouter      10    4051   ISIS 0   IBS  7
10.0.0.93       255.255.255.255 VSP9000-3           GlobalRouter      10    4051   ISIS 0   IBS  7
10.0.0.94       255.255.255.255 VSP9000-4           GlobalRouter      20    4051   ISIS 0   IBS  7
192.168.255.0   255.255.255.252 VSP9000-3           GlobalRouter      10    4051   ISIS 0   IBS  7
192.168.255.4   255.255.255.252 VSP9000-4           GlobalRouter      20    4051   ISIS 0   IBS  7
```

- Design objective achieved !

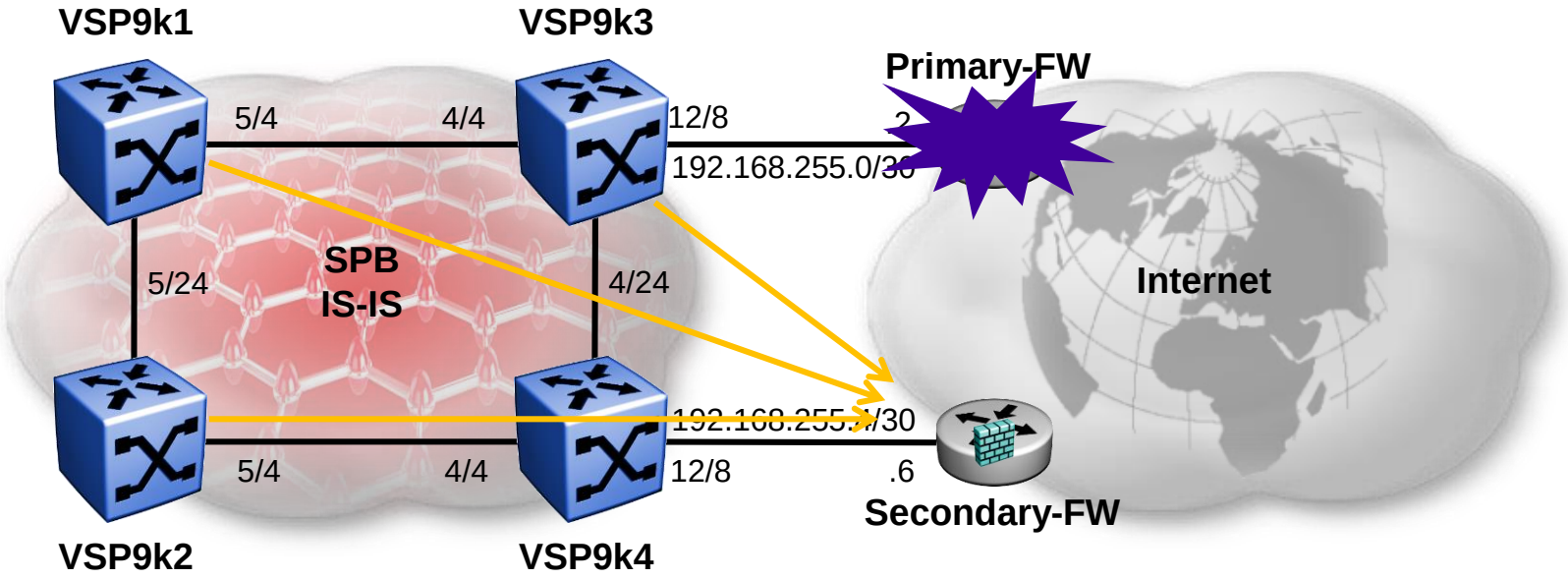
Forcing SPB traffic to a Primary FW
Checking IP routes




```
VSP9000-2:1#% show ip route
================================================================================
                              IP Route - GlobalRouter
================================================================================
                                              NH                   INTER
DST            MASK           NEXT            VRF/ISID       COST  FACE  PROT AGE TYPE PRF
--------------------------------------------------------------------------------
0.0.0.0        0.0.0.0        VSP9000-3       GlobalRouter   10    4051  STAT 0   IBS  5
10.0.0.91      255.255.255.255 VSP9000-1      GlobalRouter   10    4051  ISIS 0   IBS  7
10.0.0.92      255.255.255.255 10.0.0.92      -              1     0     LOC  0   DB   0
10.0.0.93      255.255.255.255 VSP9000-3      GlobalRouter   20    4051  ISIS 0   IBS  7
10.0.0.94      255.255.255.255 VSP9000-4      GlobalRouter   10    4051  ISIS 0   IBS  7
192.168.255.0  255.255.255.252 VSP9000-3      GlobalRouter   20    4051  ISIS 0   IBS  7
192.168.255.4  255.255.255.252 VSP9000-4      GlobalRouter   10    4051  ISIS 0   IBS  7
```

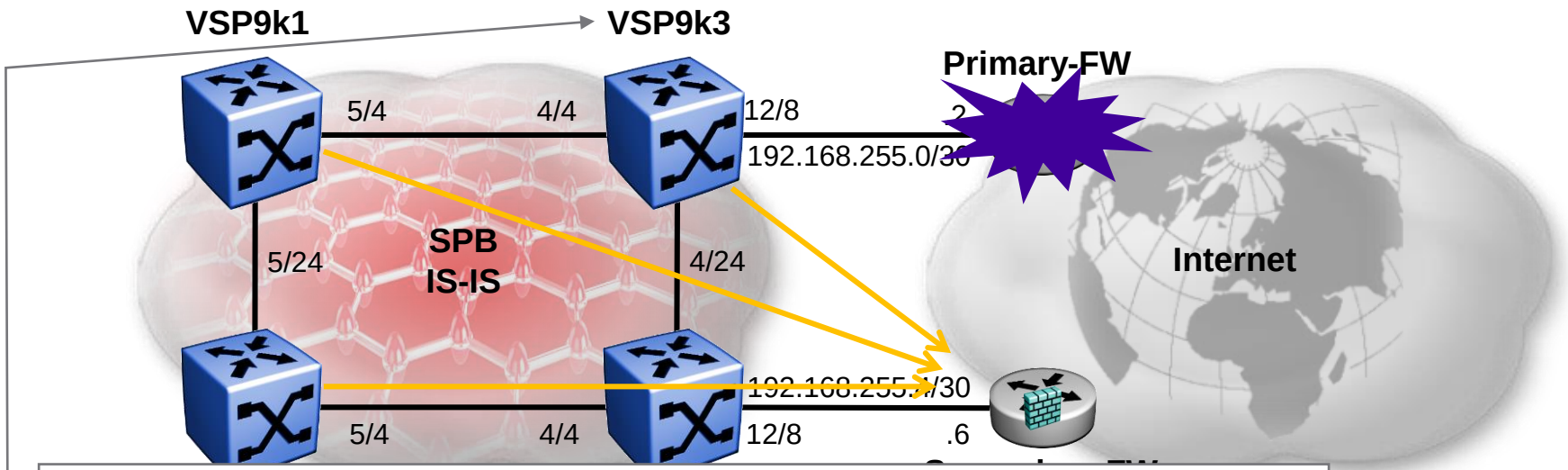
- Design objective achieved !

Forcing SPB traffic to a Primary FW
Primary-FW failure



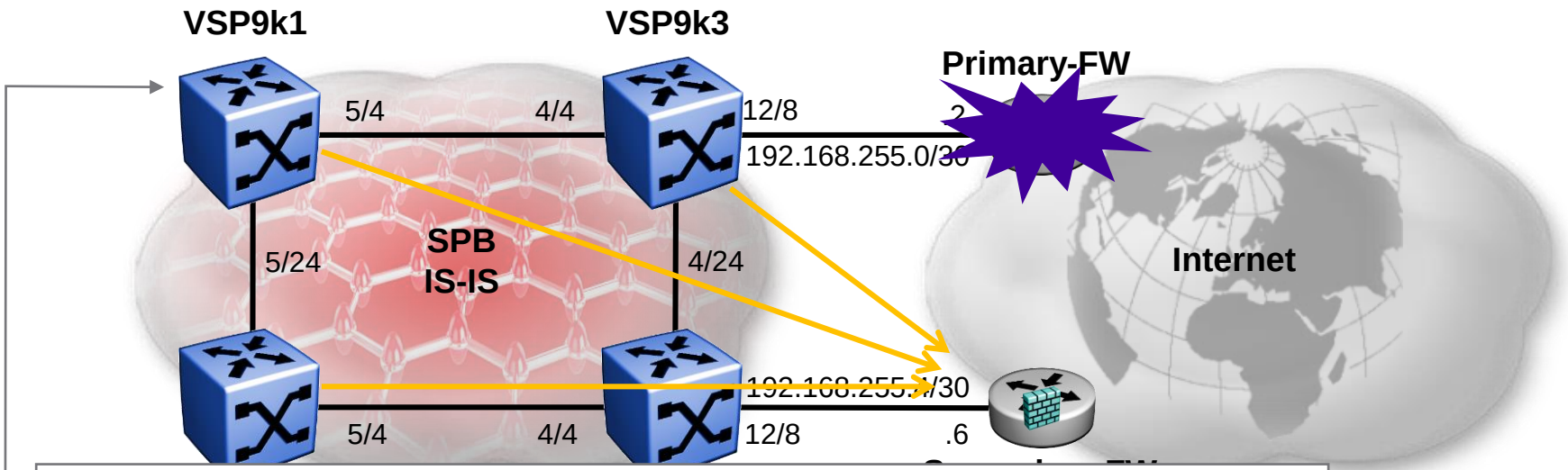
- If the Primary-FW link on port 12/8 goes down
  - Local default static route on VSP9k3 will immediately go down
  - Non-local default static route on other VSP9ks will also immediately go down
  - Sub-second failover
- If VSP9k3 was an ERS8800 we could also use BFD to detect failure of the Primary-FW even if no link down on port 12/8
  - But BFD is not yet supported on VSP9000

Forcing SPB traffic to a Primary FW
Primary-FW failure



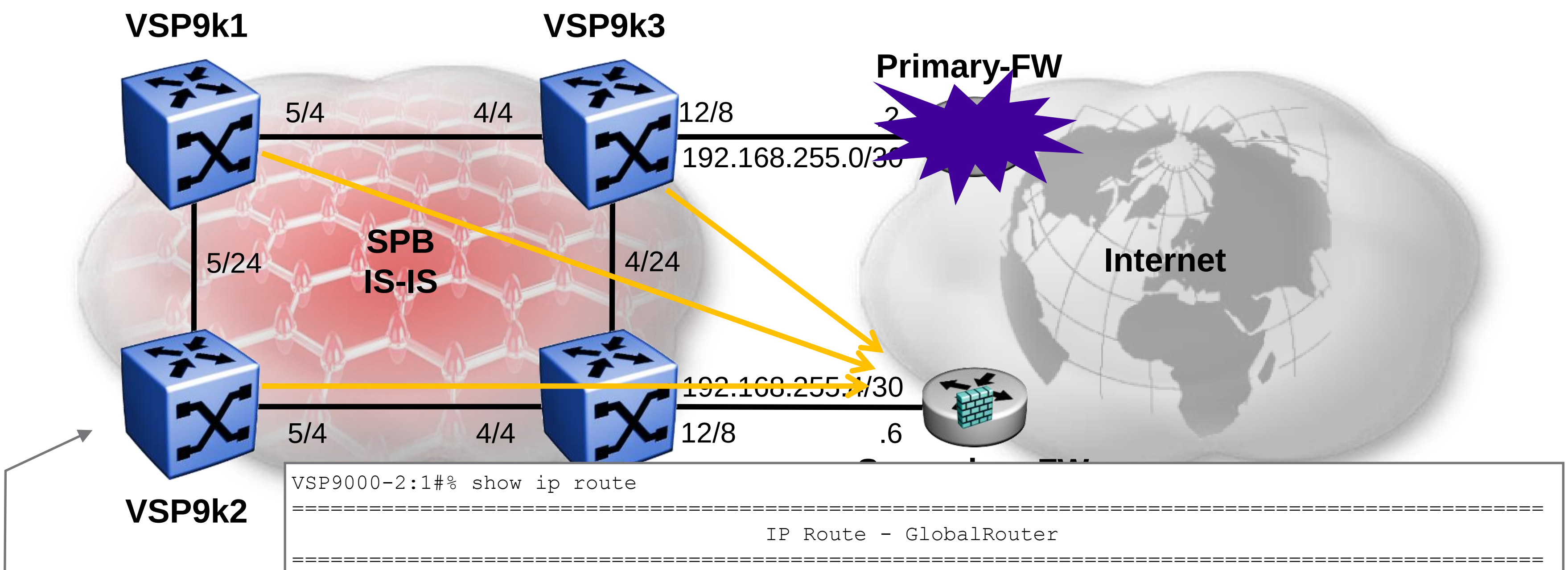

```
VSP9000-3:1#% show ip route
================================================================================================
                                    IP Route - GlobalRouter
================================================================================================
                                                    NH                    INTER
DST             MASK            NEXT                VRF/ISID        COST  FACE   PROT AGE TYPE PRF
------------------------------------------------------------------------------------------------
0.0.0.0         0.0.0.0         VSP9000-4           GlobalRouter    10    4051   ISIS 0   IBS  7
10.0.0.91       255.255.255.255 VSP9000-1           GlobalRouter    10    4051   ISIS 0   IBS  7
10.0.0.92       255.255.255.255 VSP9000-2           GlobalRouter    20    4051   ISIS 0   IBS  7
10.0.0.93       255.255.255.255 10.0.0.93           -               1     0      LOC  0   DB   0
10.0.0.94       255.255.255.255 VSP9000-4           GlobalRouter    10    4051   ISIS 0   IBS  7
192.168.255.4   255.255.255.252 VSP9000-4           GlobalRouter    10    4051   ISIS 0   IBS  7

VSP9000-3:1# show ip route static
================================================================================================
                                  IP Static Route - GlobalRouter
================================================================================================
DEST            MASK            NEXT            NH-VRF          COST PREF LCLNHOP STATUS ENABLE
------------------------------------------------------------------------------------------------
0.0.0.0         0.0.0.0         192.168.255.2   GlobalRouter    100  5    TRUE     INACTV TRUE
```

Forcing SPB traffic to a Primary FW
Primary-FW failure



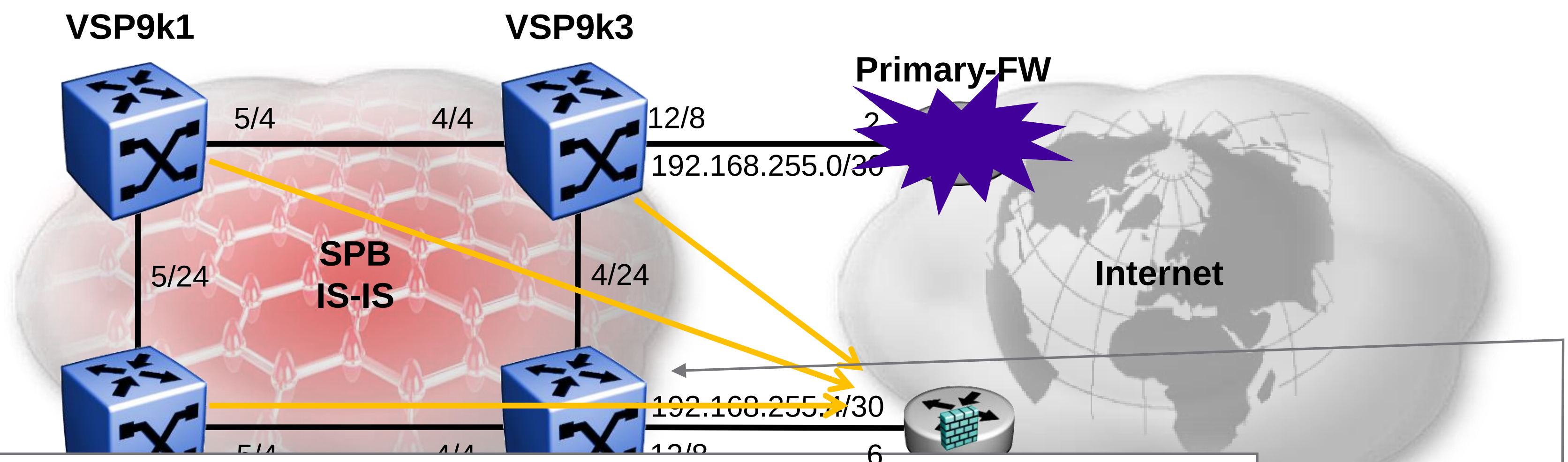

```
VSP9000-1:1#% show ip route
================================================================================================
                                    IP Route - GlobalRouter
================================================================================================
                                                  NH                    INTER
DST             MASK            NEXT            VRF/ISID        COST  FACE   PROT AGE TYPE PRF
------------------------------------------------------------------------------------------------
0.0.0.0         0.0.0.0         VSP9000-4       GlobalRouter    20    4051   ISIS 0   IBS  7
10.0.0.91       255.255.255.255 10.0.0.91       -               1     0      LOC  0   DB   0
10.0.0.92       255.255.255.255 VSP9000-2       GlobalRouter    10    4051   ISIS 0   IBS  7
10.0.0.93       255.255.255.255 VSP9000-3       GlobalRouter    10    4051   ISIS 0   IBS  7
10.0.0.94       255.255.255.255 VSP9000-4       GlobalRouter    20    4051   ISIS 0   IBS  7
192.168.255.4   255.255.255.252 VSP9000-4       GlobalRouter    20    4051   ISIS 0   IBS  7

VSP9000-1:1# show ip route static
================================================================================================
                                  IP Static Route - GlobalRouter
================================================================================================
DEST            MASK            NEXT            NH-VRF          COST PREF LCLNHOP STATUS ENABLE
------------------------------------------------------------------------------------------------
0.0.0.0         0.0.0.0         192.168.255.1   GlobalRouter    10   5    FALSE   INACTV TRUE
```

Forcing SPB traffic to a Primary FW
Primary-FW failure



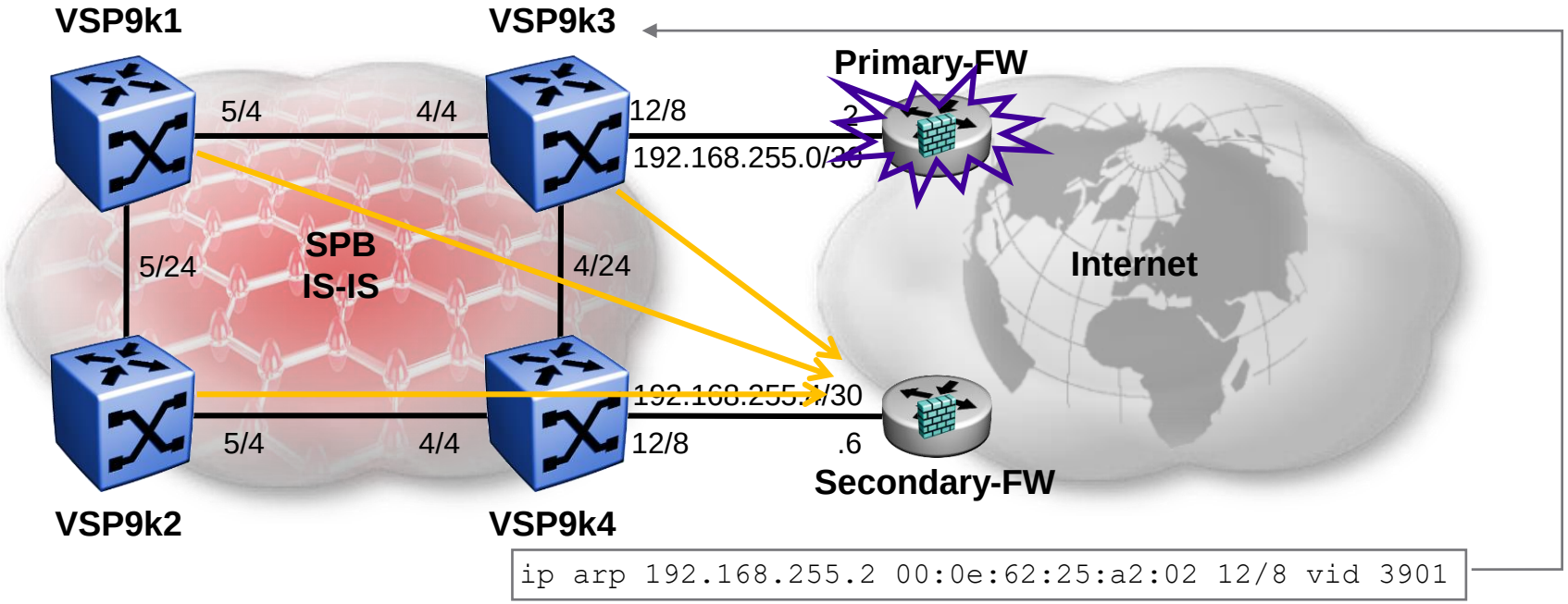

```
VSP9000-2:1#% show ip route
================================================================================================
                                   IP Route - GlobalRouter
================================================================================================
                                                          NH                     INTER
DST             MASK            NEXT                      VRF/ISID          COST FACE  PROT AGE TYPE PRF
------------------------------------------------------------------------------------------------
0.0.0.0         0.0.0.0         VSP9000-4                 GlobalRouter      10   4051  ISIS 0   IBS  7
10.0.0.91       255.255.255.255 VSP9000-1                 GlobalRouter      10   4051  ISIS 0   IBS  7
10.0.0.92       255.255.255.255 10.0.0.92                 -                 1    0     LOC  0   DB   0
10.0.0.93       255.255.255.255 VSP9000-3                 GlobalRouter      20   4051  ISIS 0   IBS  7
10.0.0.94       255.255.255.255 VSP9000-4                 GlobalRouter      10   4051  ISIS 0   IBS  7
192.168.255.4   255.255.255.252 VSP9000-4                 GlobalRouter      10   4051  ISIS 0   IBS  7

VSP9000-2:1# show ip route static
================================================================================================
                                IP Static Route - GlobalRouter
================================================================================================
DEST            MASK            NEXT             NH-VRF           COST PREF LCLNHOP STATUS ENABLE
------------------------------------------------------------------------------------------------
0.0.0.0         0.0.0.0         192.168.255.1    GlobalRouter     10   5    FALSE   INACTV TRUE
```

Forcing SPB traffic to a Primary FW
Primary-FW failure



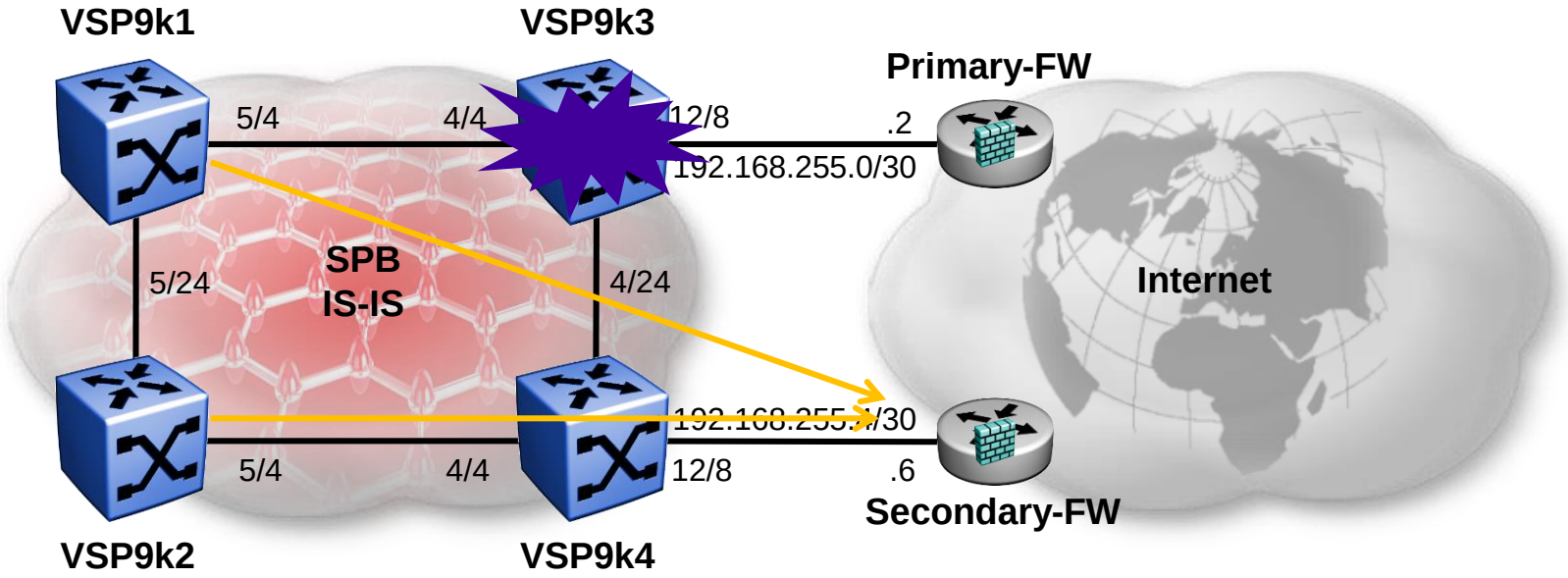

```
VSP9000-4:1#% show ip route
================================================================================================
                                    IP Route - GlobalRouter
================================================================================================
                                                     NH                   INTER
DST             MASK            NEXT                 VRF/ISID         COST FACE   PROT AGE TYPE PRF
------------------------------------------------------------------------------------------------
0.0.0.0         0.0.0.0         192.168.255.6        GlobalRouter     200  12/8   STAT 0   IB   5
10.0.0.91       255.255.255.255 VSP9000-1            GlobalRouter     20   4051   ISIS 0   IBS  7
10.0.0.92       255.255.255.255 VSP9000-2            GlobalRouter     10   4051   ISIS 0   IBS  7
10.0.0.93       255.255.255.255 VSP9000-3            GlobalRouter     10   4051   ISIS 0   IBS  7
10.0.0.94       255.255.255.255 10.0.0.94            -                1    0      LOC  0   DB   0
192.168.255.4   255.255.255.252 192.168.255.5        -                1    12/8   LOC  0   DB   0

VSP9000-4:1# show ip route static
================================================================================================
                                 IP Static Route - GlobalRouter
================================================================================================
DEST            MASK            NEXT            NH-VRF           COST PREF LCLNHOP STATUS ENABLE
------------------------------------------------------------------------------------------------
0.0.0.0         0.0.0.0         192.168.255.1   GlobalRouter     10   5    FALSE   INACTV TRUE
0.0.0.0         0.0.0.0         192.168.255.6   GlobalRouter     200  5    TRUE    ACTIVE TRUE
```

Forcing SPB traffic to a Primary FW
Primary-FW recovery



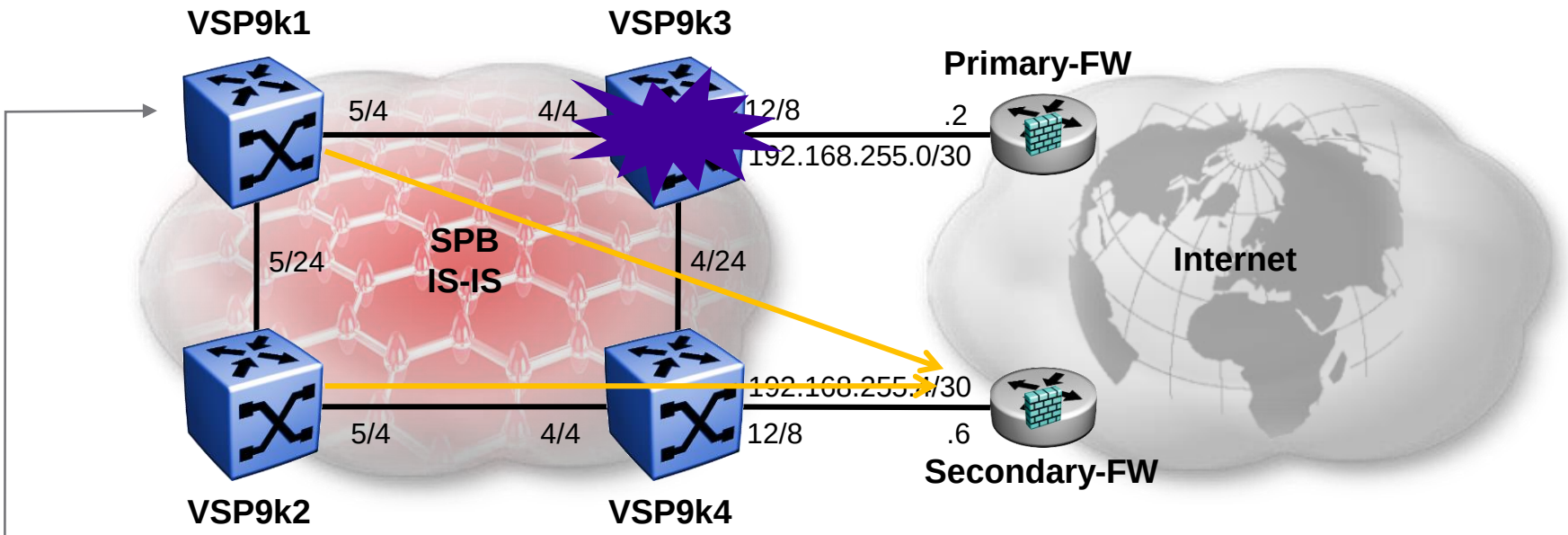
- NOTE, on recovery, when the Primary-FW link on port 12/8 comes back up, there can be up to a 30 seconds delay between VSP9k3's IP interface 192.168.255.1 coming up (this will activate the non-local static routes on the other VSP9ks) and the default static route to the Primary-FW becoming active again (which requires VSP9k3 to re-ARP for 192.168.255.2)
- During this time traffic following the default route will be dropped
- Configuring on VSP9k3 a static ARP entry for 192.168.255.2 solves this and sub-second failover can be achieved on recovery as well

Forcing SPB traffic to a Primary FW
VSP9k3 failure



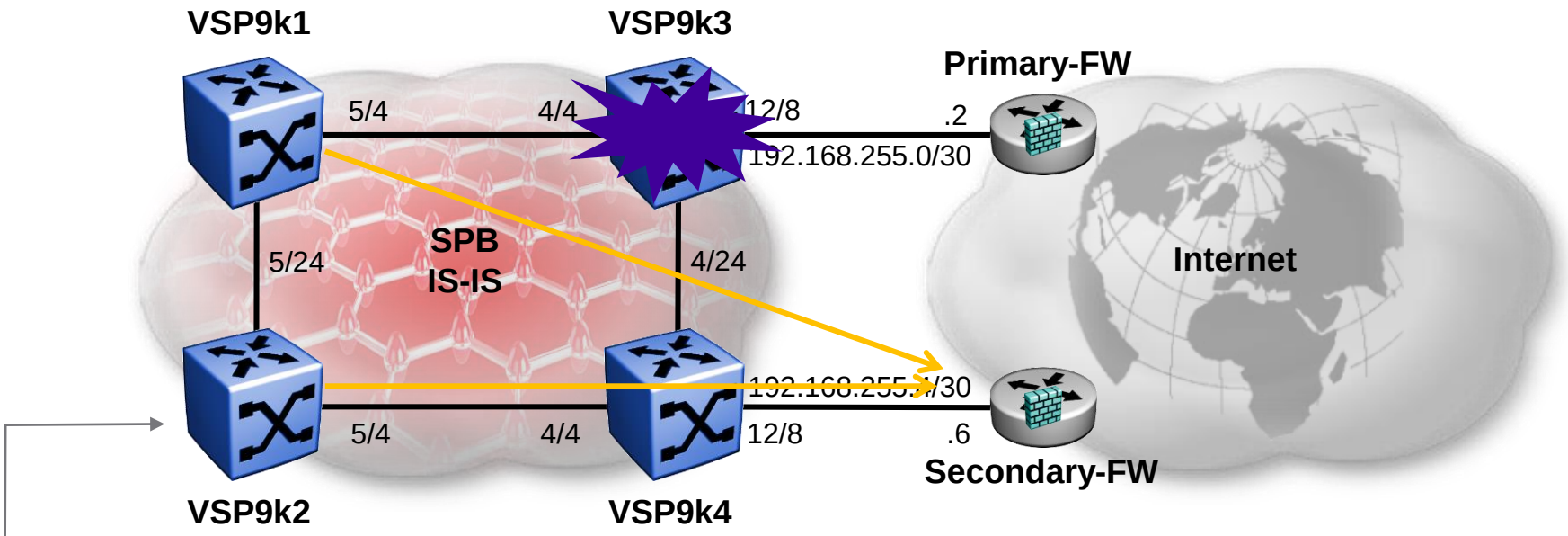
- If the VSP9k3 BEB fails, it will stop announcing network 192.168.255.0/30
- Which will result in all other nodes de-activating their non-local default static-route and following instead the remaining default route announced by VSP9k4
  - Sub-second failover (failure & recovery)

Forcing SPB traffic to a Primary FW
VSP9k3 failure



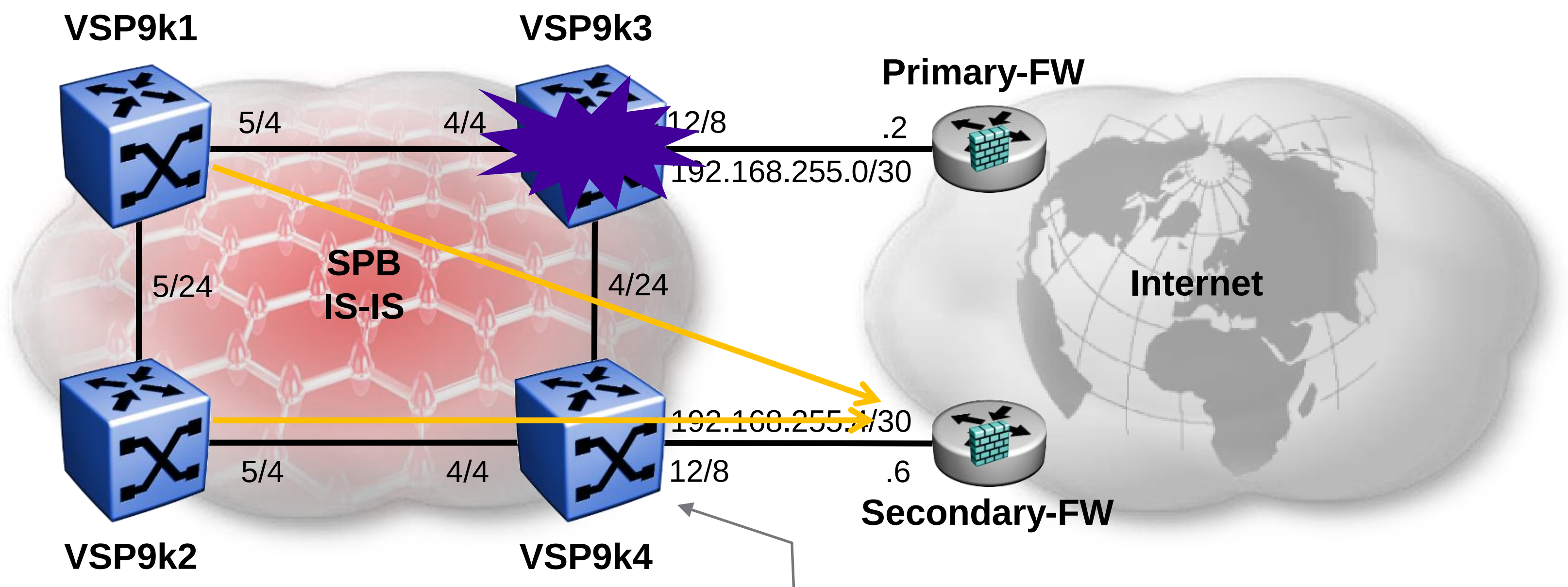

```
VSP9000-1:1#% show ip route
================================================================================================
                                        IP Route - GlobalRouter
================================================================================================
                                                    NH                          INTER
DST             MASK            NEXT                VRF/ISID        COST FACE   PROT AGE TYPE PRF
------------------------------------------------------------------------------------------------
0.0.0.0         0.0.0.0         VSP9000-4           GlobalRouter    20   4051   ISIS 0   IBS  7
10.0.0.91       255.255.255.255 10.0.0.91           -               1    0      LOC  0   DB   0
10.0.0.92       255.255.255.255 VSP9000-2           GlobalRouter    10   4051   ISIS 0   IBS  7
10.0.0.94       255.255.255.255 VSP9000-4           GlobalRouter    20   4051   ISIS 0   IBS  7
192.168.255.4   255.255.255.252 VSP9000-4           GlobalRouter    20   4051   ISIS 0   IBS  7
```

Forcing SPB traffic to a Primary FW
VSP9k3 failure




```
VSP9000-2:1#% show ip route
================================================================================================
                                        IP Route - GlobalRouter
================================================================================================
                                                    NH                          INTER
DST             MASK            NEXT                VRF/ISID        COST FACE   PROT AGE TYPE PRF
------------------------------------------------------------------------------------------------
0.0.0.0         0.0.0.0         VSP9000-4           GlobalRouter    10   4051   ISIS 0   IBS  7
10.0.0.91       255.255.255.255 VSP9000-1           GlobalRouter    10   4051   ISIS 0   IBS  7
10.0.0.92       255.255.255.255 10.0.0.92           -               1    0      LOC  0   DB   0
10.0.0.94       255.255.255.255 VSP9000-4           GlobalRouter    10   4051   ISIS 0   IBS  7
192.168.255.4   255.255.255.252 VSP9000-4           GlobalRouter    10   4051   ISIS 0   IBS  7
```

Forcing SPB traffic to a Primary FW
VSP9k3 failure



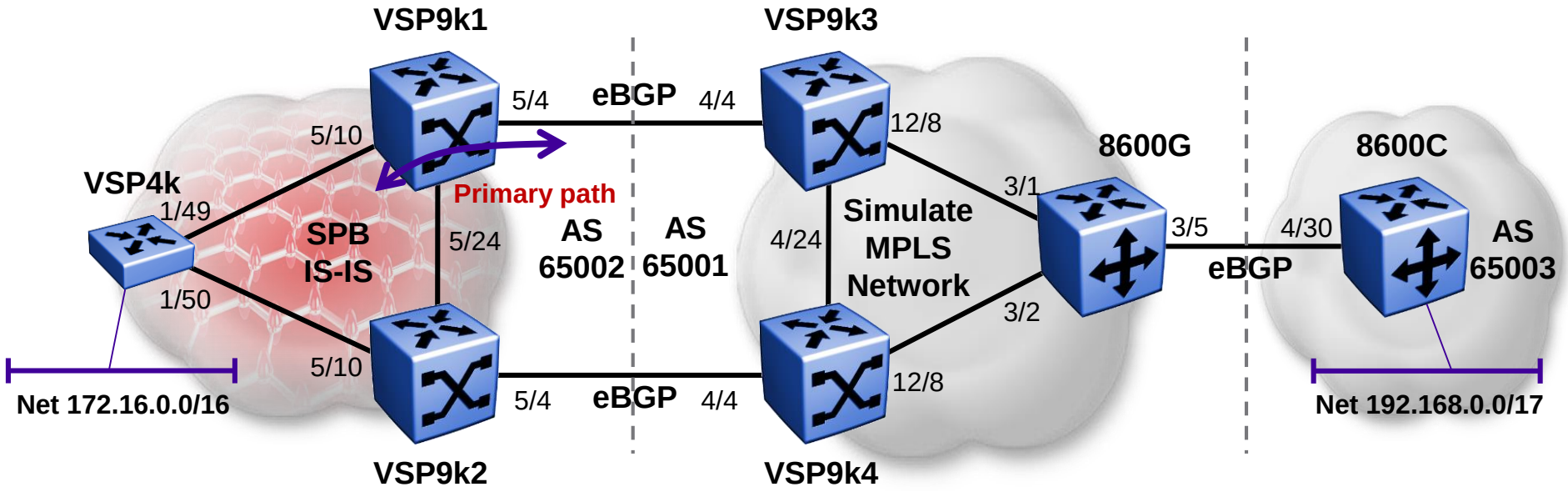

```
VSP9000-4:1#% show ip route
================================================================================
                            IP Route - GlobalRouter
================================================================================
                                                 NH                INTER
DST             MASK            NEXT             VRF/ISID     COST FACE  PROT AGE TYPE PRF
--------------------------------------------------------------------------------
0.0.0.0         0.0.0.0         192.168.255.6    GlobalRouter 200  12/8  STAT 0   IB   5
10.0.0.91       255.255.255.255 VSP9000-1        GlobalRouter 20   4051  ISIS 0   IBS  7
10.0.0.92       255.255.255.255 VSP9000-2        GlobalRouter 10   4051  ISIS 0   IBS  7
10.0.0.94       255.255.255.255 10.0.0.94        -            1    0     LOC  0   DB   0
192.168.255.4   255.255.255.252 192.168.255.5    -            1    12/8  LOC  0   DB   0
```

Route redistributing between SPB/ISIS and BGP

Last tested with: 4.0.0.0_B037

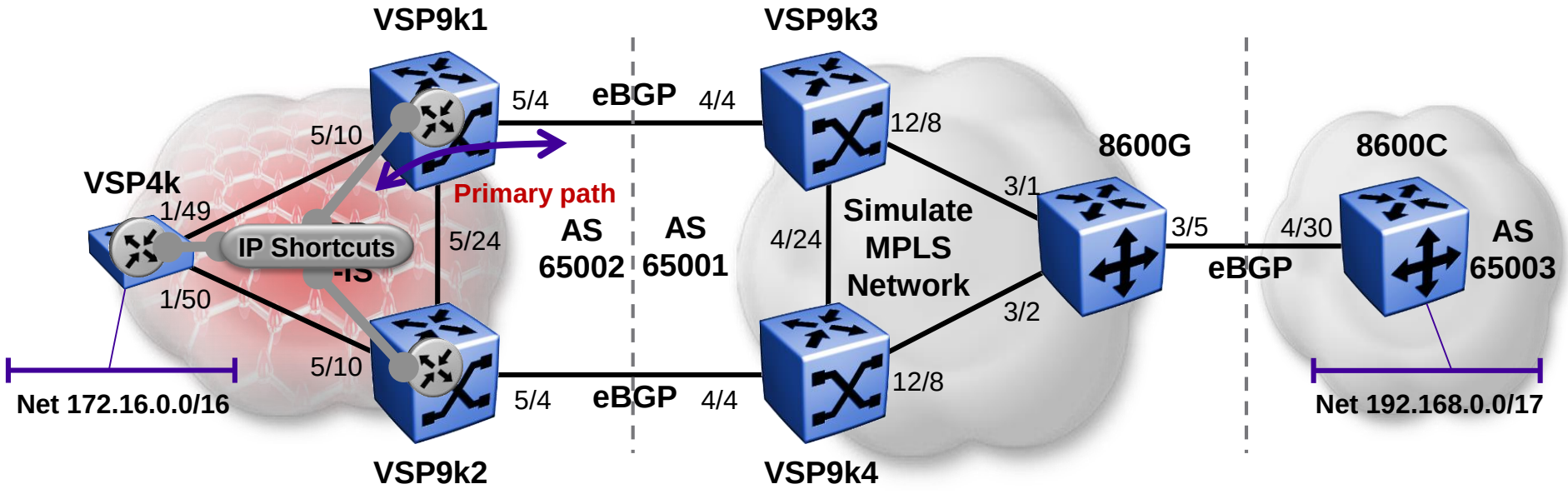
Example use #6
(a) using GRT
(b) using VRFs

Forcing paths with BGP and SPB
Goal



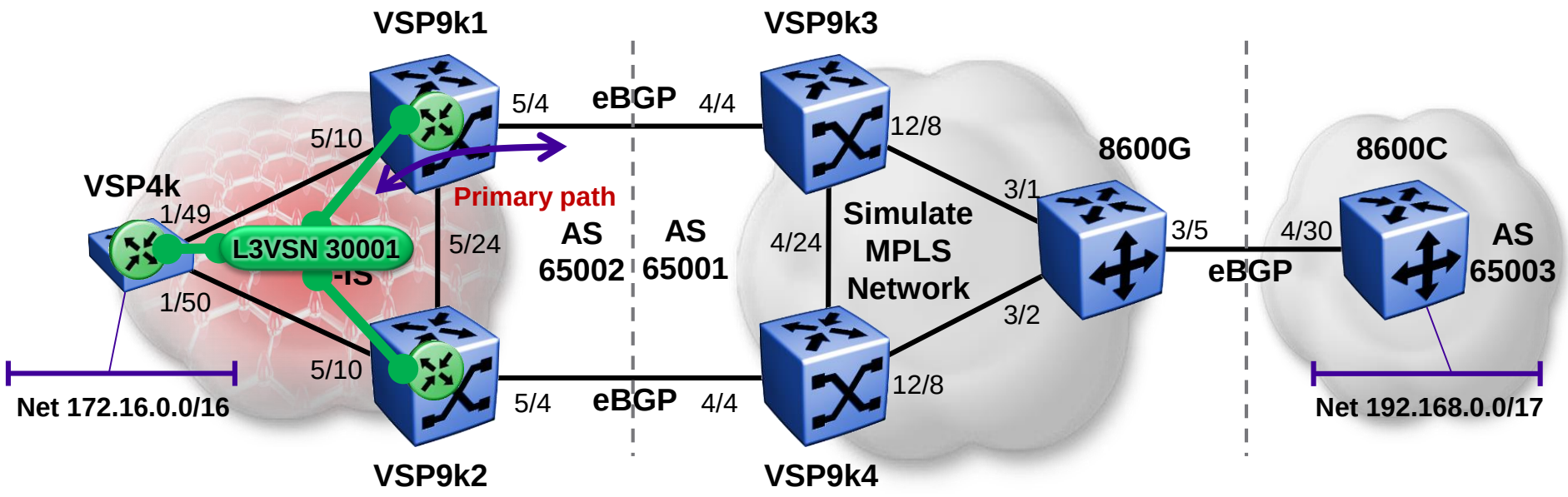
- It is desired that all traffic flowing between the SPB cloud and the BGP cloud follow the path over VSP9k1 and that the path over VSP9k2 only be used in case of failure
- Configuration should avoid spelling out individual subnets in redistribution route-maps
  - I.e. if new BGP or ISIS subnets appear, there should be no need to reconfigure the redistribution on the border routers
- (a) Case where SPB GRT IP Shortcuts are used
  - Following BGP by the book, and using iBGP between VSP9k1 & VSP9k2
- (b) Case where SPB VRF L3VSN is used
  - We lack iBGP support on VRFs; so here we have to use a different approach in order to avoid BGP routes from distant ASes (here 65003) being reflected back into the MPLS core network

Forcing paths with BGP and SPB
(a) GRT IP Shortcuts



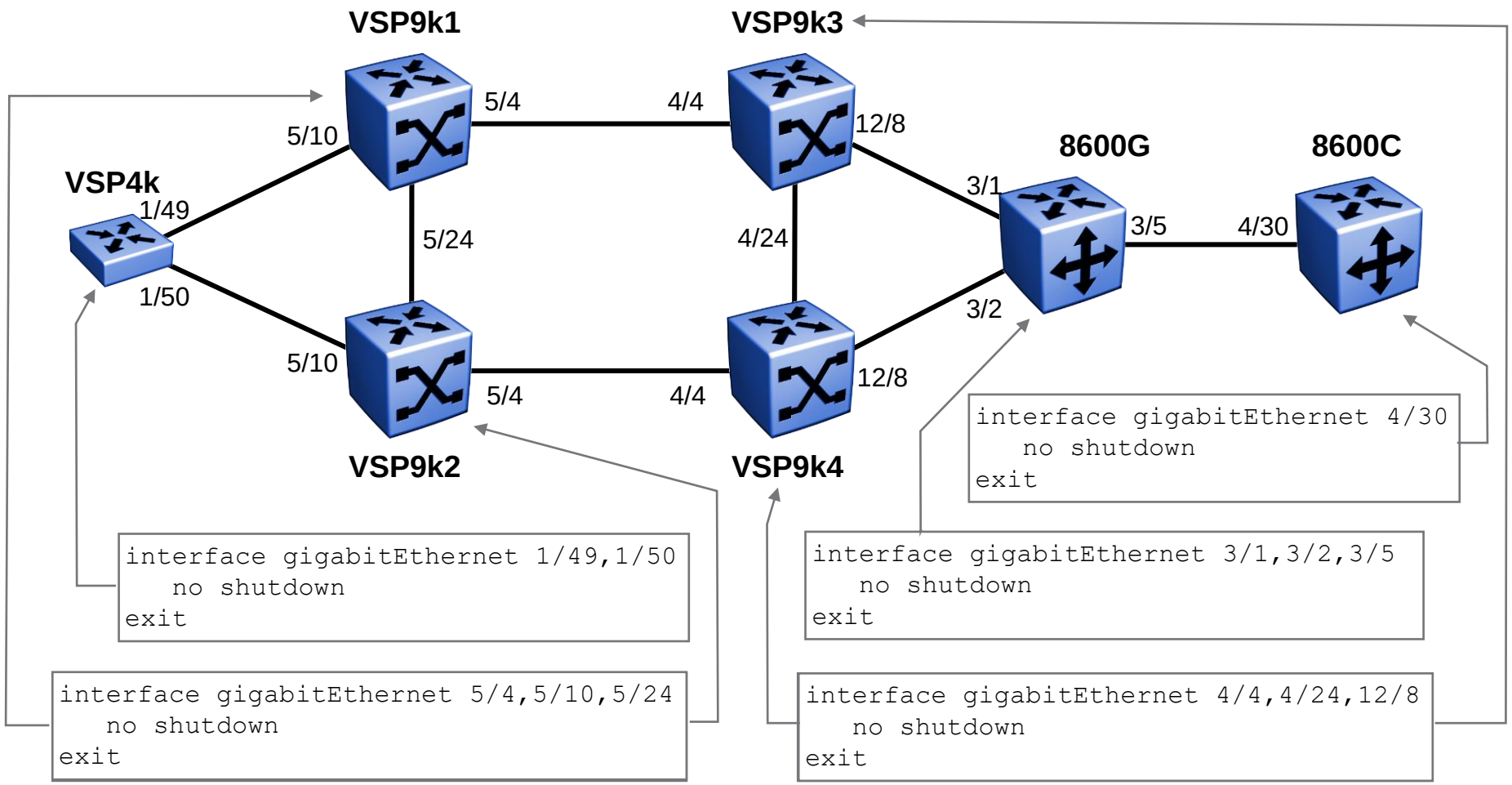
- The SPB nodes will be redistributing BGP routes into IP Shortcuts and vice versa
- VSP9k1 and VSP9k2 will have an iBGP peering to each other
- The BGP nodes have a single routing instance in all cases and in this setup VSP9k3, VSP9k4 & 8600G are simulating a BGP/MPLS network

Forcing paths with BGP and SPB
(b) VRF L3VSN

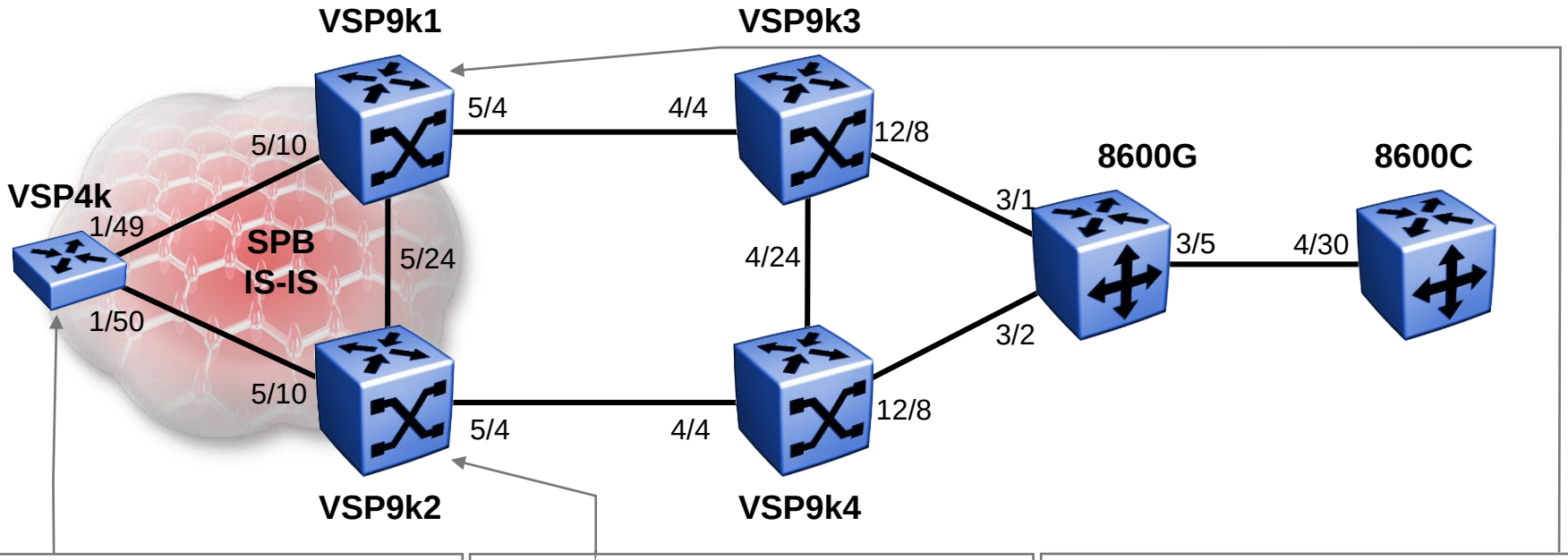


- The SPB nodes will be redistributing BGP routes into a VRF extended via L3VSN
- There cannot be any iBGP peering on a VRF, as we lack this support today
- The BGP nodes have a single routing instance in all cases and in this setup VSP9k3, VSP9k4 & 8600G are simulating a BGP/MPLS network

Forcing paths with BGP and SPB
Interfaces used



Forcing paths with BGP and SPB
SPB Global Config

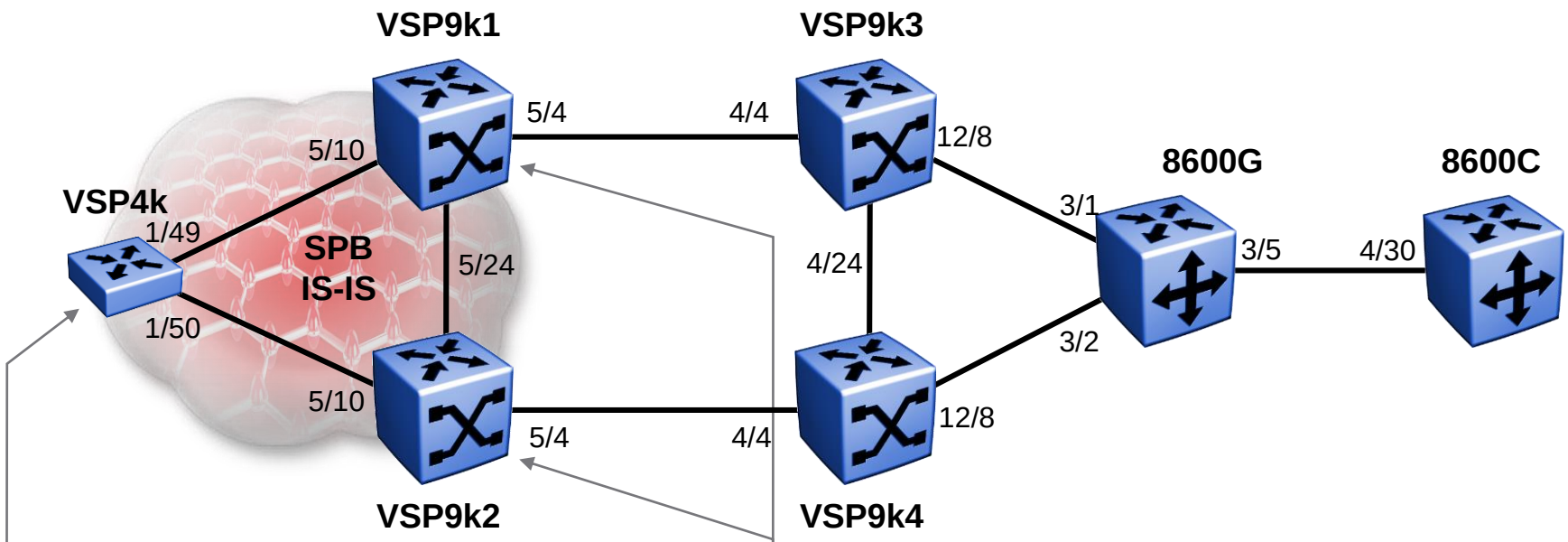



```
interface loopback 1
   ip address 10.0.0.41/255.255.255.255
exit
spbm
router isis
   system-id 00bb.0000.4100
   manual-area 49.0000
   ip-source-address 10.0.0.41
   spbm 1
   spbm 1 nick-name 0.00.41
   spbm 1 b-vid 4051-4052 primary 4051
spbm 1 ip enable
exit
vlan create 4051 name "B-VLAN-1" type spbm-bvlan
vlan create 4052 name "B-VLAN-2" type spbm-bvlan
router isis enable
cfm spbm mepid 41
cfm spbm enable
```

```
interface loopback 1
   ip address 10.0.0.92/255.255.255.255
exit
spbm
router isis
   system-id 00bb.0000.9200
   manual-area 49.0000
   ip-source-address 10.0.0.92
   spbm 1
   spbm 1 nick-name 0.00.92
   spbm 1 b-vid 4051-4052 primary 4051
   spbm 1 ip enable
exit
vlan create 4051 name "B-VLAN-1" type spbm-bvlan
vlan create 4052 name "B-VLAN-2" type spbm-bvlan
router isis enable
cfm spbm mepid 92
cfm spbm enable
```

```
interface loopback 1
   ip address 10.0.0.91/255.255.255.255
exit
spbm
router isis
   system-id 00bb.0000.9100
   manual-area 49.0000
   ip-source-address 10.0.0.91
   spbm 1
   spbm 1 nick-name 0.00.91
   spbm 1 b-vid 4051-4052 primary 4051
   spbm 1 ip enable
exit
vlan create 4051 name "B-VLAN-1" type spbm-bvlan
vlan create 4052 name "B-VLAN-2" type spbm-bvlan
router isis enable
cfm spbm mepid 91
cfm spbm enable
```

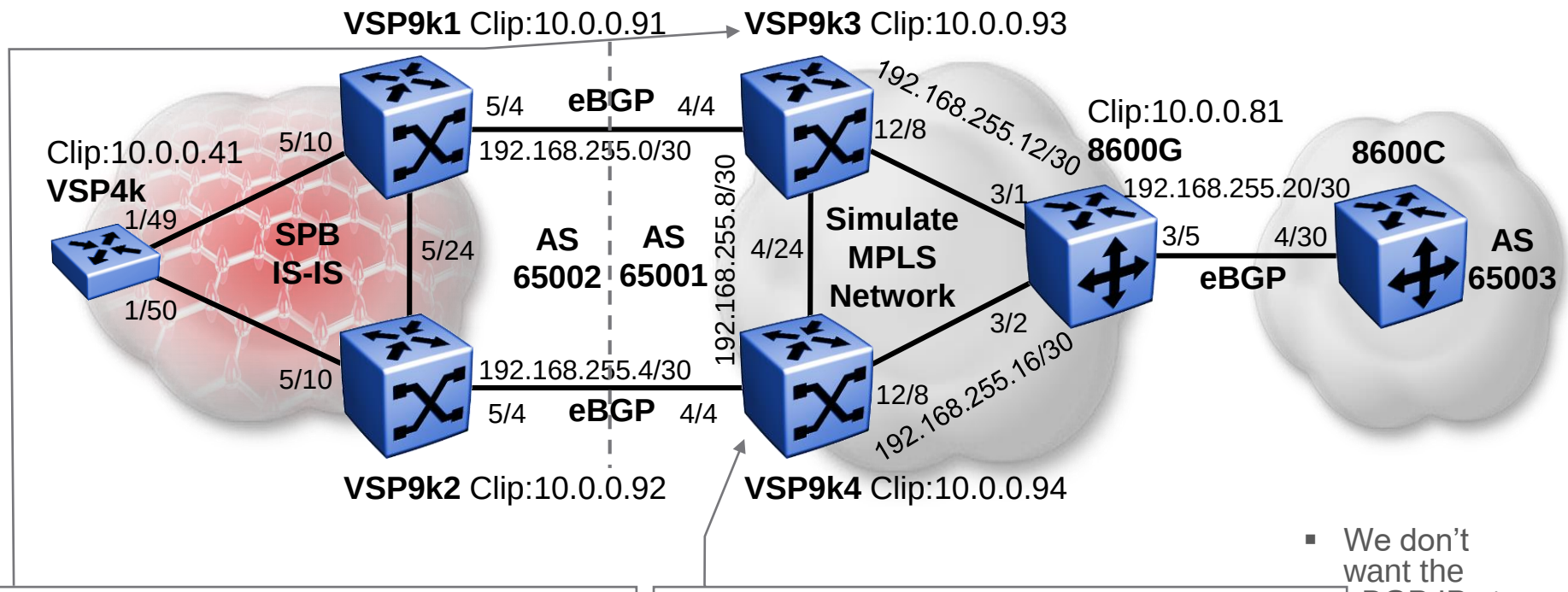
Forcing paths with BGP and SPB
SPB Interface Config




```
interface GigabitEthernet 1/49,1/50
   isis
   isis spbm 1
   isis enable
exit
```

```
interface GigabitEthernet 5/10,5/24
   isis
   isis spbm 1
   isis enable
exit
```

Forcing paths with BGP and SPB
IGP (OSPF) Config

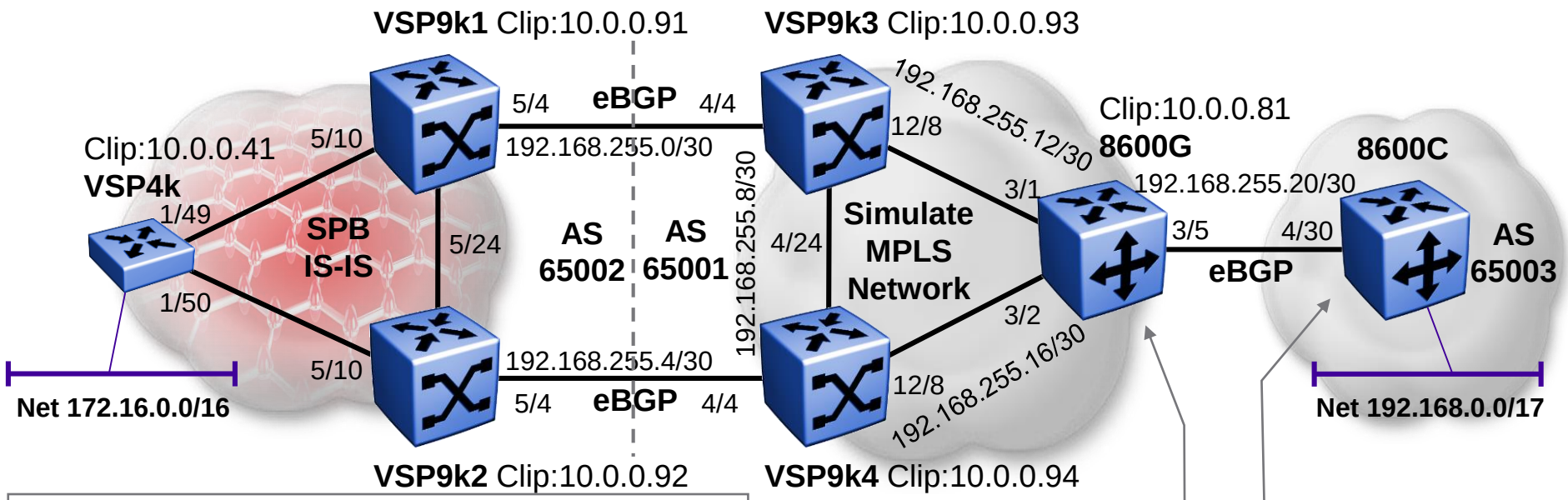



```
interface loopback 1
   ip address 10.0.0.93/32
   ip ospf
exit
interface GigabitEthernet 4/4,4/24,12/8
   brouter port 4/4 vlan 2500 subnet 192.168.255.1/30
   brouter port 4/24 vlan 2508 subnet 192.168.255.9/30
   brouter port 12/8 vlan 2512 subnet 192.168.255.13/30
   ip ospf port 4/4 network passive
   ip ospf enable
exit
router ospf
   router-id 10.0.0.93
exit
router ospf enable
```

```
interface loopback 1
   ip address 10.0.0.94/32
   ip ospf
exit
interface GigabitEthernet 4/4,4/24,12/8
   brouter port 4/4 vlan 2504 subnet 192.168.255.5/30
   brouter port 4/24 vlan 2508 subnet 192.168.255.10/30
   brouter port 12/8 vlan 2516 subnet 192.168.255.17/30
   ip ospf port 4/4 network passive
   ip ospf enable
exit
router ospf
   router-id 10.0.0.94
exit
router ospf enable
```

- We don't want the eBGP IPs to be running OSPF but we need them to be reachable via IGP otherwise BGP routes will not get accepted

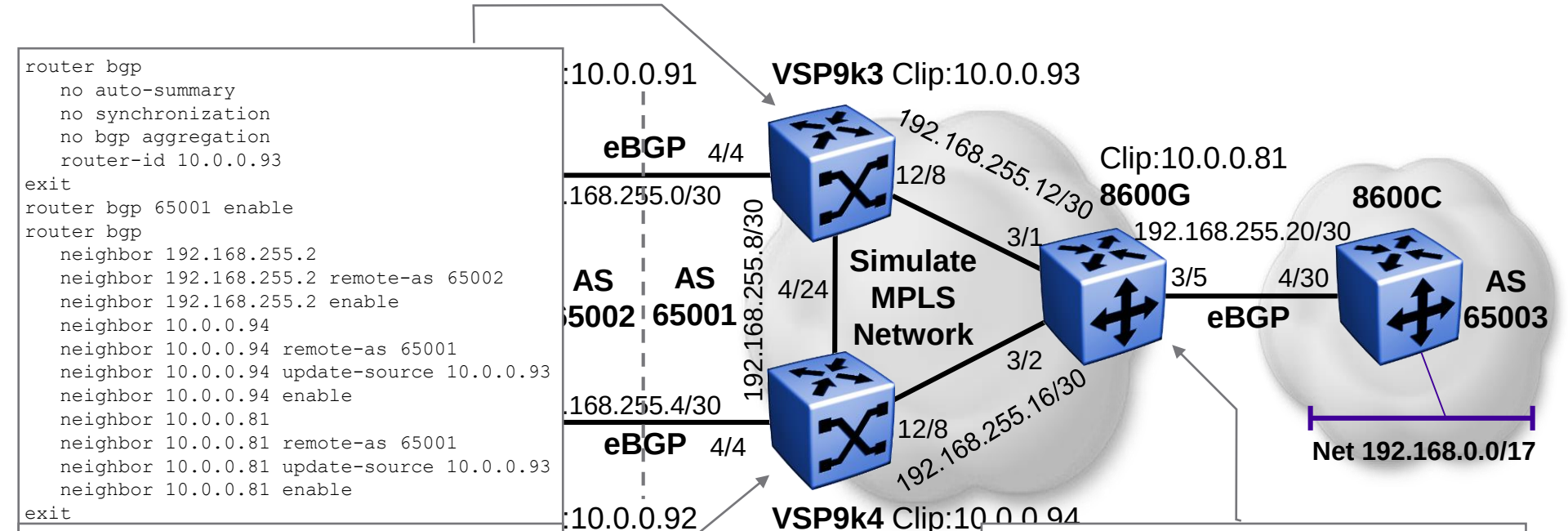
Forcing paths with BGP and SPB IGP (OSPF) Config cont




```
interface loopback 1
   ip address 10.0.0.81/32
   ip ospf
exit
interface GigabitEthernet 3/1,3/2,3/5
   brouter port 3/1 vlan 2512 subnet 192.168.255.14/30
   brouter port 3/2 vlan 2516 subnet 192.168.255.18/30
   brouter port 3/5 vlan 2520 subnet 192.168.255.21/30
   ip ospf port 3/5 network passive
   ip ospf enable
exit
router ospf
   router-id 10.0.0.81
exit
router ospf enable
```

```
interface loopback 1
   ip address 192.168.0.82/17
exit
interface GigabitEthernet 4/30
   brouter vlan 2520 subnet 192.168.255.22/30
exit
```

Forcing paths with BGP and SPB
BGP Config

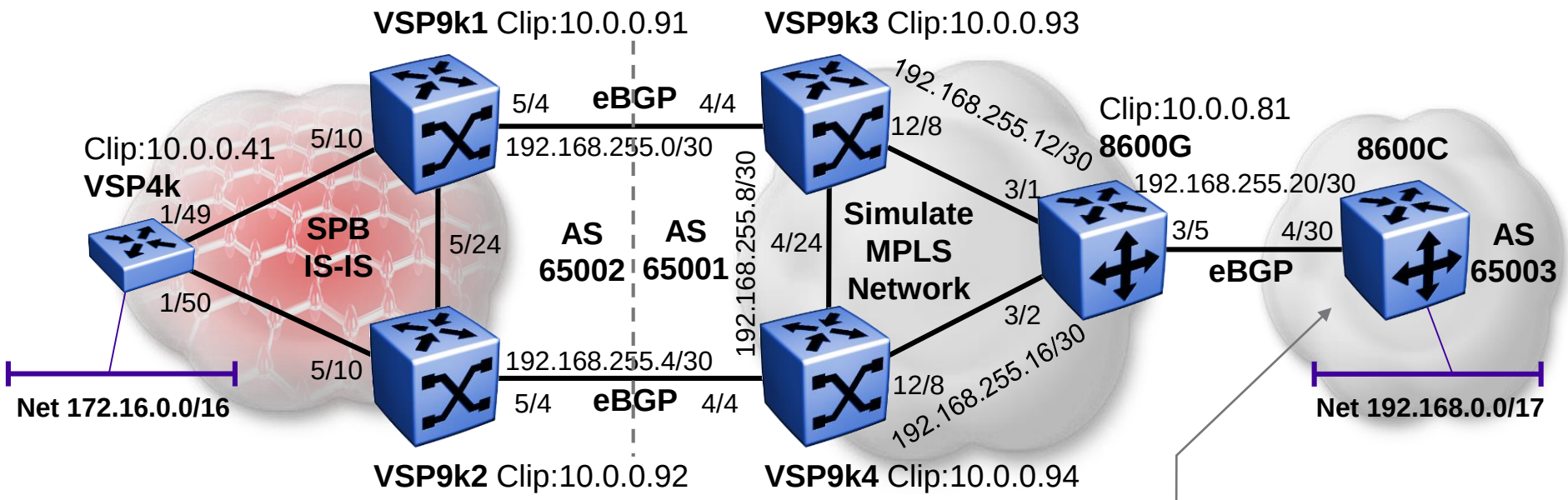



```
router bgp
   no auto-summary
   no synchronization
   no bgp aggregation
   router-id 10.0.0.93
exit
router bgp 65001 enable
router bgp
   neighbor 192.168.255.2
   neighbor 192.168.255.2 remote-as 65002
   neighbor 192.168.255.2 enable
   neighbor 10.0.0.94
   neighbor 10.0.0.94 remote-as 65001
   neighbor 10.0.0.94 update-source 10.0.0.93
   neighbor 10.0.0.94 enable
   neighbor 10.0.0.81
   neighbor 10.0.0.81 remote-as 65001
   neighbor 10.0.0.81 update-source 10.0.0.93
   neighbor 10.0.0.81 enable
exit
```

```
router bgp
   no auto-summary
   no synchronization
   no bgp aggregation
   router-id 10.0.0.94
exit
router bgp 65001 enable
router bgp
   neighbor 192.168.255.6
   neighbor 192.168.255.6 remote-as 65002
   neighbor 192.168.255.6 enable
   neighbor 10.0.0.93
   neighbor 10.0.0.93 remote-as 65001
   neighbor 10.0.0.93 update-source 10.0.0.94
   neighbor 10.0.0.93 enable
   neighbor 10.0.0.81
   neighbor 10.0.0.81 remote-as 65001
   neighbor 10.0.0.81 update-source 10.0.0.94
   neighbor 10.0.0.81 enable
exit
```

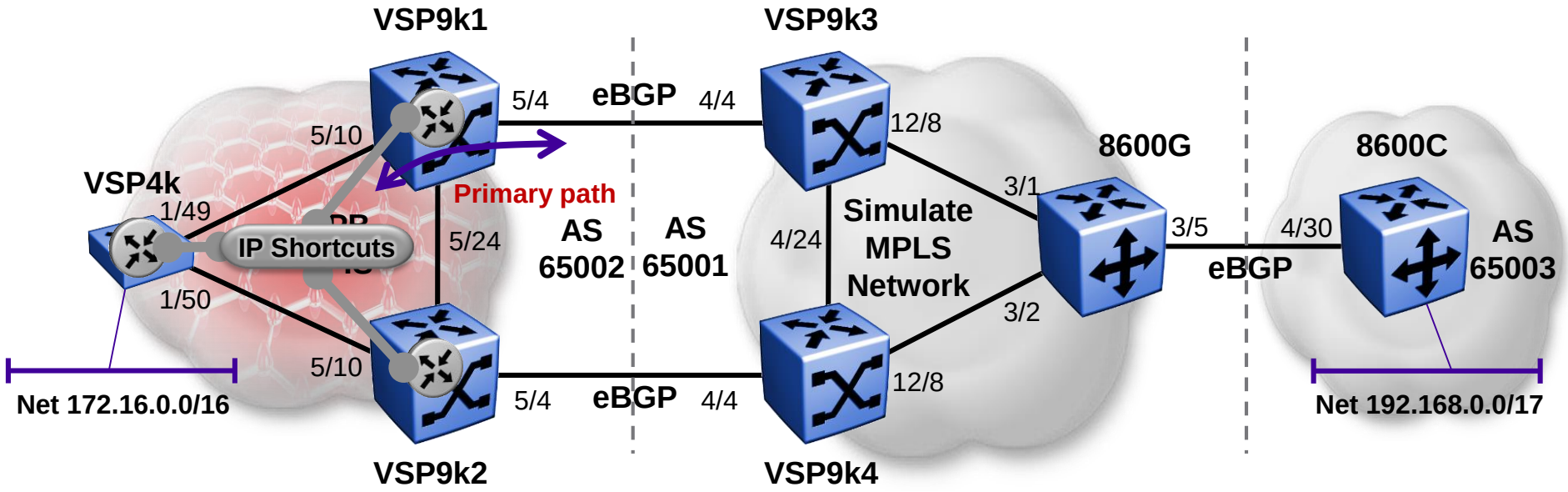
```
router bgp
   no auto-summary
   no synchronization
   no bgp aggregation
   router-id 10.0.0.81
exit
router bgp 65001 enable
router bgp
   neighbor 192.168.255.22
   neighbor 192.168.255.22 remote-as 65003
   neighbor 192.168.255.22 enable
   neighbor 10.0.0.93
   neighbor 10.0.0.93 remote-as 65001
   neighbor 10.0.0.93 update-source 10.0.0.81
   neighbor 10.0.0.93 enable
   neighbor 10.0.0.94
   neighbor 10.0.0.94 remote-as 65001
   neighbor 10.0.0.94 update-source 10.0.0.81
   neighbor 10.0.0.94 enable
exit
```

Forcing paths with BGP and SPB
BGP Config



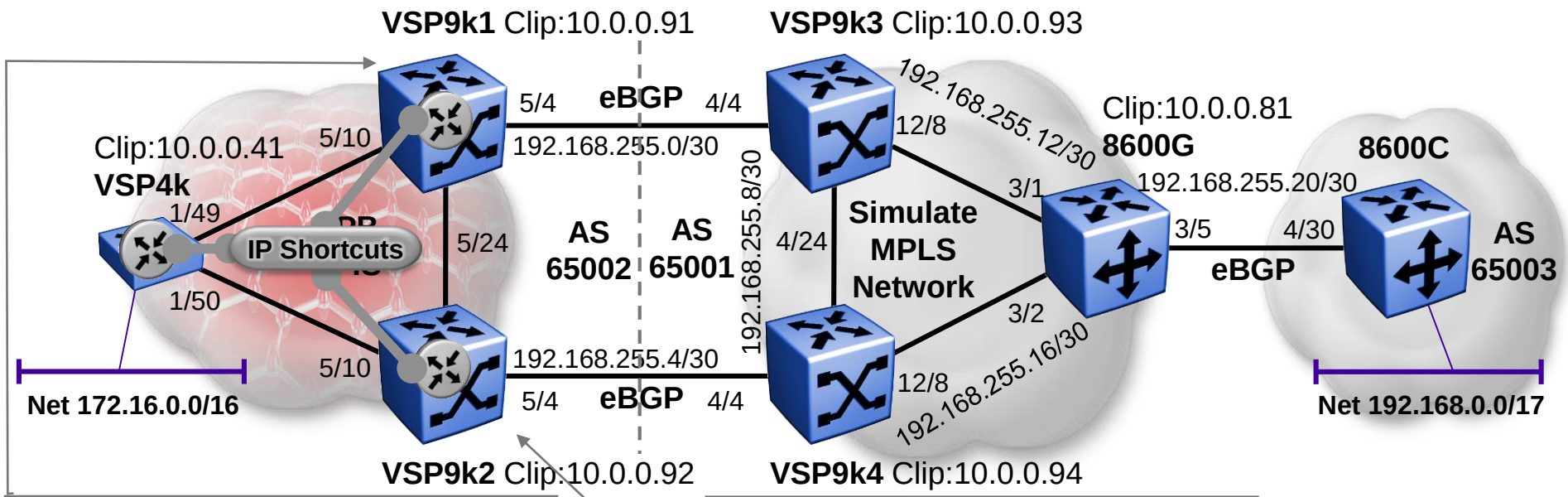

```
router bgp
   no auto-summary
   no synchronization
   no bgp aggregation
   router-id 10.0.0.82
exit
router bgp 65003 enable
router bgp
   network 192.168.0.0/17
   neighbor 192.168.255.21
   neighbor 192.168.255.21 remote-as 65001
   neighbor 192.168.255.21 enable
exit
```

Forcing paths with BGP and SPB
(a) GRT IP Shortcuts



- We are now going to look at the case where BGP is redistributed into SPB GRT IP Shortcuts

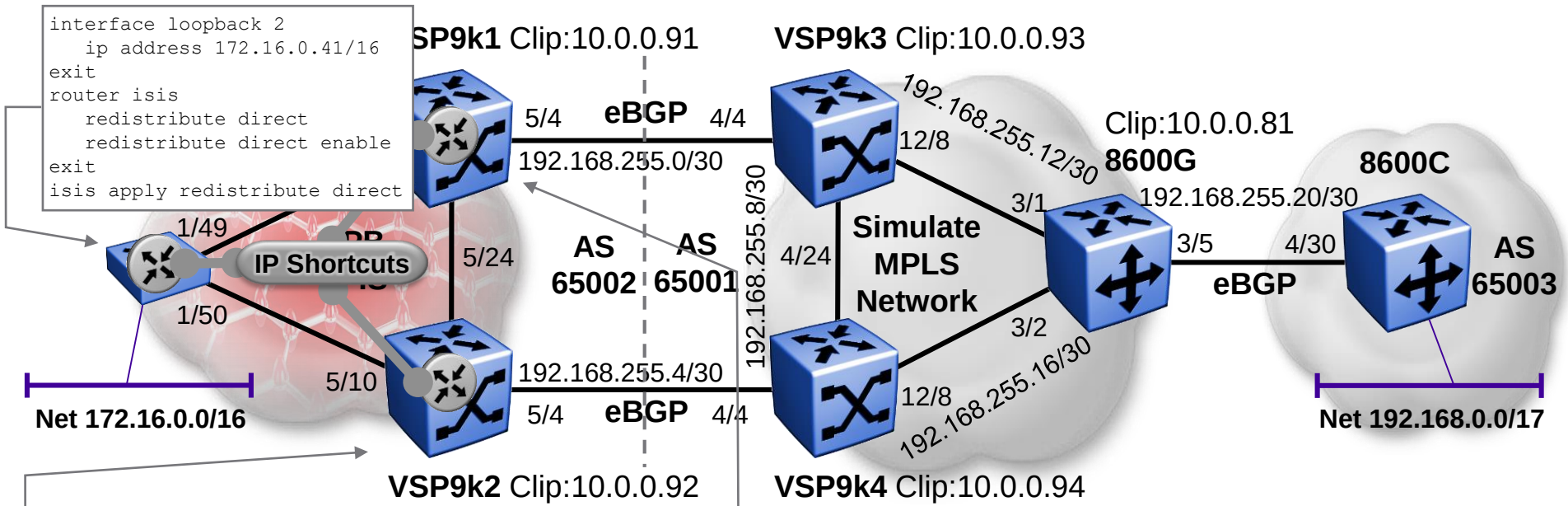
Forcing paths with BGP and SPB
(a) GRT IP Shortcuts – BGP config




```
interface GigabitEthernet 5/4
   brouter vlan 2500 subnet 192.168.255.2/30
exit
router bgp
   no auto-summary
   no synchronization
   no bgp aggregation
   router-id 10.0.0.91
exit
router bgp 65002 enable
router bgp
   neighbor 192.168.255.1
   neighbor 192.168.255.1 remote-as 65001
   neighbor 192.168.255.1 enable
   neighbor 10.0.0.92
   neighbor 10.0.0.92 remote-as 65002
   neighbor 10.0.0.92 update-source 10.0.0.91
   neighbor 10.0.0.92 enable
exit
```

```
interface GigabitEthernet 5/4
   brouter vlan 2504 subnet 192.168.255.6/30
exit
router bgp
   no auto-summary
   no synchronization
   no bgp aggregation
   router-id 10.0.0.92
exit
router bgp 65002 enable
router bgp
   neighbor 192.168.255.5
   neighbor 192.168.255.5 remote-as 65001
   neighbor 192.168.255.5 enable
   neighbor 10.0.0.91
   neighbor 10.0.0.91 remote-as 65002
   neighbor 10.0.0.91 update-source 10.0.0.92
   neighbor 10.0.0.91 enable
exit
```

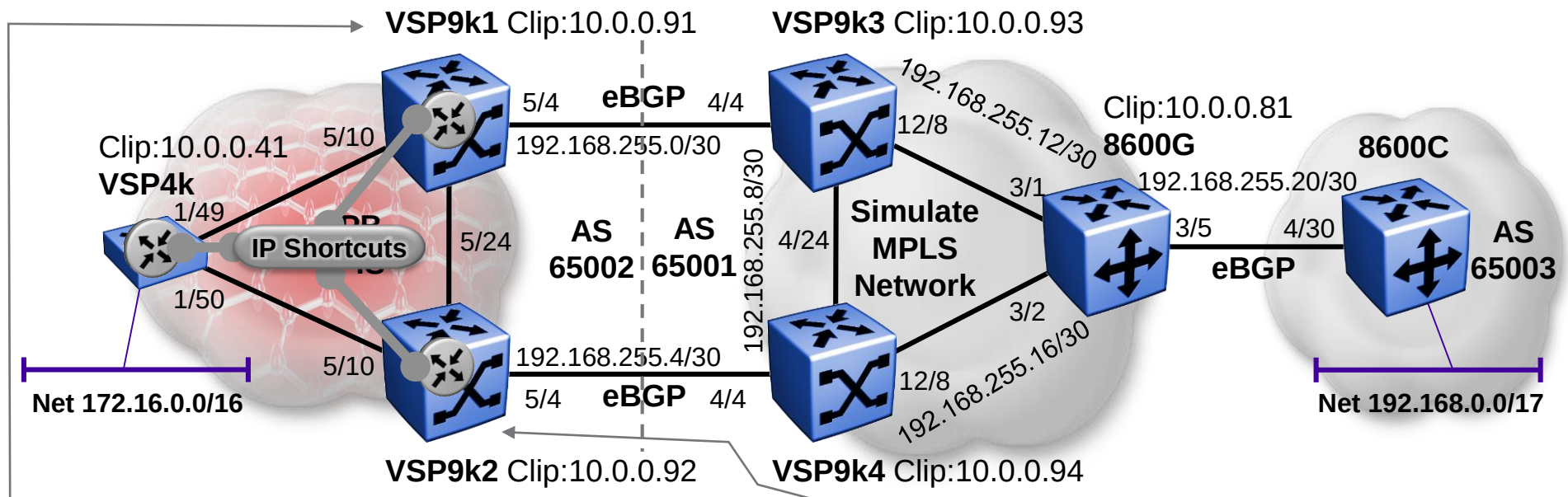
Forcing paths with BGP and SPB
(a) GRT IP Shortcuts – BGP config




```
ip route preference protocol spbm-level1 50
router isis
   redistribute direct
   redistribute direct enable
   redistribute bgp
   redistribute bgp enable
exit
router bgp
   redistribute isis
   redistribute isis enable
exit
no ip alternative-route
isis apply redistribute direct
isis apply redistribute bgp
ip bgp apply redistribute isis
```

- We set the SPB/ISIS preference to 50 so that:
  - eBGP routes (pref 45) will win over ISIS routes
  - ISIS routes will win over iBGP routes (pref 175)
    - Otherwise we end up with a routing loop for ISIS routes getting re-learnt via iBGP between VSP9k1 & VSP9k2
- Always disable ip alternative-route on boundary routers

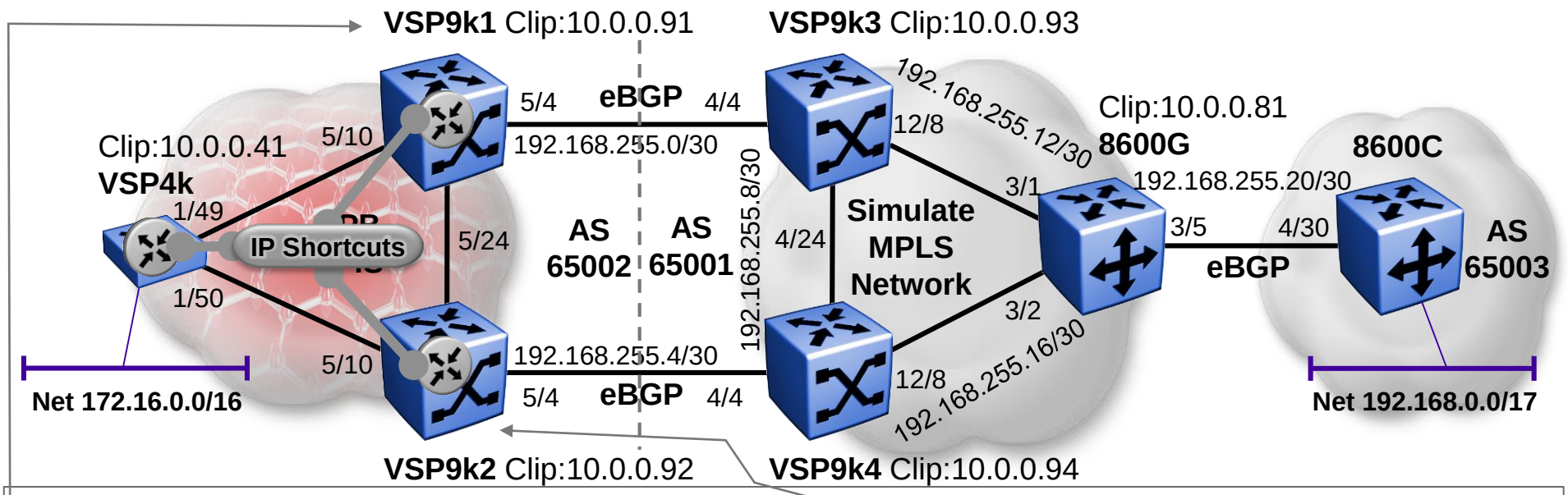
Forcing paths with BGP and SPB
(a) GRT IP Shortcuts – Checking BGP Routes




```
VSP9000-1:1#% show ip bgp route
================================================================
                        BGP Routes - GlobalRouter
================================================================
NETWORK/MASK        PEER REM ADDR    NEXTHOP ADDRESS ORG LOC PREF
----------------------------------------------------------------
10.0.0.41/32        10.0.0.92        10.0.0.92       INC 100
        AS_PATH: path-is-empty
10.0.0.91/32        10.0.0.92        10.0.0.92       INC 100
        AS_PATH: path-is-empty
172.16.0.0/16       10.0.0.92        10.0.0.92       INC 100
        AS_PATH: path-is-empty
192.168.0.0/17      192.168.255.1    192.168.255.1   IGP 100
        AS_PATH: (65001 65003)
192.168.0.0/17      10.0.0.92        192.168.255.5   IGP 100
        AS_PATH: (65001 65003)
192.168.255.0/30    10.0.0.92        10.0.0.92       INC 100
        AS_PATH: path-is-empty
```

```
VSP9000-2:1#% show ip bgp route
================================================================
                        BGP Routes - GlobalRouter
================================================================
NETWORK/MASK        PEER REM ADDR    NEXTHOP ADDRESS ORG LOC PREF
----------------------------------------------------------------
10.0.0.41/32        10.0.0.91        10.0.0.91       INC 100
        AS_PATH: path-is-empty
10.0.0.92/32        10.0.0.91        10.0.0.91       INC 100
        AS_PATH: path-is-empty
172.16.0.0/16       10.0.0.91        10.0.0.91       INC 100
        AS_PATH: path-is-empty
192.168.0.0/17      192.168.255.5    192.168.255.5   IGP 100
        AS_PATH: (65001 65003)
192.168.0.0/17      10.0.0.91        192.168.255.1   IGP 100
        AS_PATH: (65001 65003)
192.168.255.4/30    10.0.0.91        10.0.0.91       INC 100
        AS_PATH: path-is-empty
```

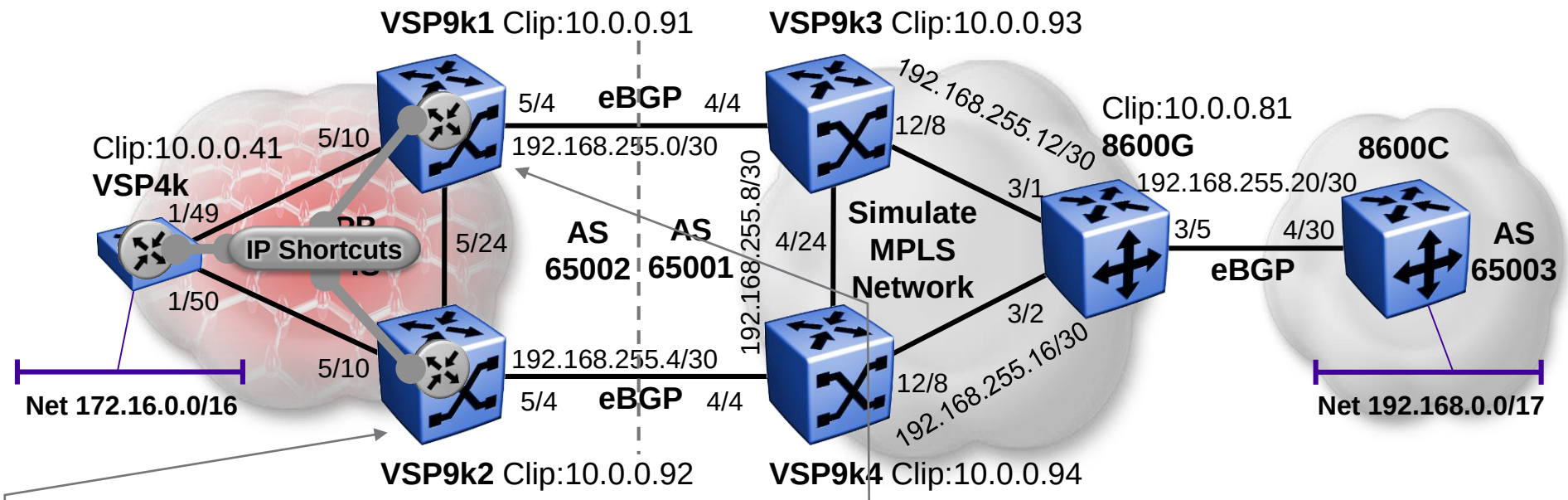
Forcing paths with BGP and SPB
(a) GRT IP Shortcuts – Checking BGP Routes




```
VSP9000-1:1#% show ip bgp route
================================================================
                        BGP Routes - GlobalRouter
================================================================
NETWORK/MASK       PEER REM ADDR   NEXTHOP ADDRESS ORG LOC PREF
----------------------------------------------------------------
10.0.0.41/32       10.0.0.92       10.0.0.92       INC 100
       AS_PATH: path-is-empty
10.0.0.91/32       10.0.0.92       10.0.0.92       INC 100
       AS_PATH: path-is-empty
172.16.0.0/16      10.0.0.92       10.0.0.92       INC 100
       AS_PATH: path-is-empty
192.168.0.0/17     192.168.255.1   192.168.255.1   IGP 100
       AS_PATH: (65001 65003)
192.168.0.0/17     10.0.0.92       192.168.255.5   IGP 100
       AS_PATH: (65001 65003)
192.168.255.0/30   10.0.0.92       10.0.0.92       INC 100
       AS_PATH: path-is-empty
```

```
VSP9000-2:1#% show ip bgp route
================================================================
                        BGP Routes - GlobalRouter
================================================================
NETWORK/MASK       PEER REM ADDR   NEXTHOP ADDRESS ORG LOC PREF
----------------------------------------------------------------
10.0.0.41/32       10.0.0.91       10.0.0.91       INC 100
       AS_PATH: path-is-empty
10.0.0.92/32       10.0.0.91       10.0.0.91       INC 100
       AS_PATH: path-is-empty
172.16.0.0/16      10.0.0.91       10.0.0.91       INC 100
       AS_PATH: path-is-empty
192.168.0.0/17     192.168.255.5   192.168.255.5   IGP 100
       AS_PATH: (65001 65003)
192.168.0.0/17     10.0.0.91       192.168.255.1   IGP 100
       AS_PATH: (65001 65003)
192.168.255.4/30   10.0.0.91       10.0.0.91       INC 100
       AS_PATH: path-is-empty
```

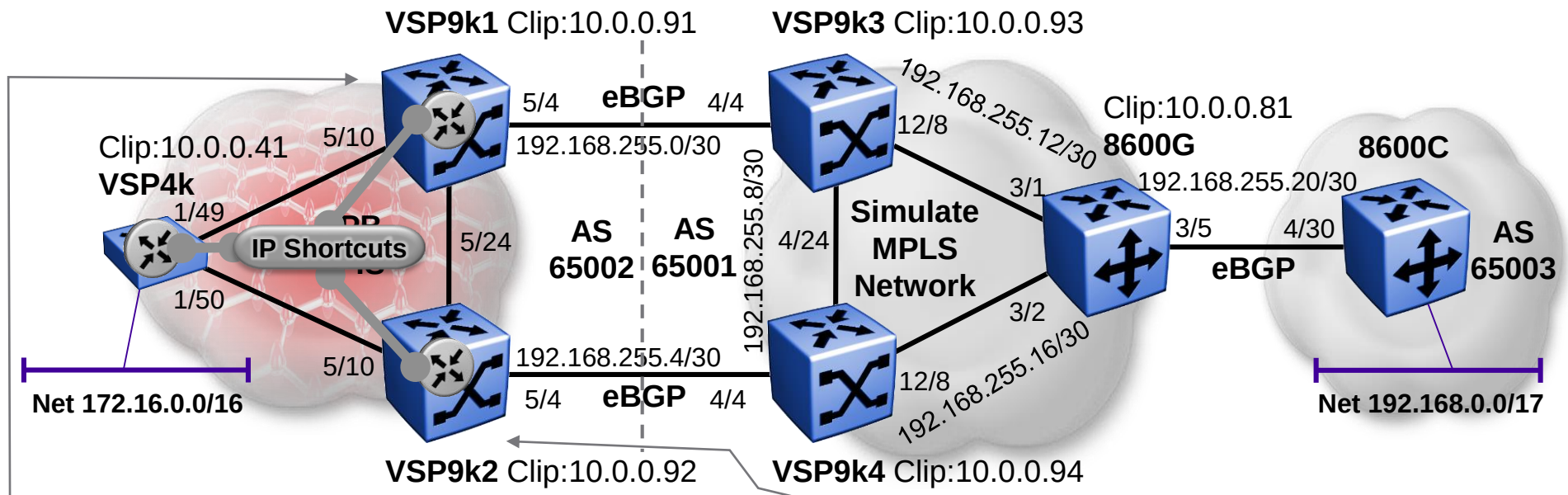
Forcing paths with BGP and SPB
(a) GRT IP Shortcuts – Checking BGP Routes




```
ip prefix-list ebgp-net 192.168.255.0/24 ge 30 le 30
route-map suppress-ebgp-net 1
   no permit
   match network ebgp-net
   enable
exit
route-map suppress-ebgp-net 2
   permit
   enable
exit
router bgp
   redistribute isis route-map suppress-ebgp-net
exit
ip bgp apply redistribute isis
```

- In previous slide we could see the 192.168.255.0/30 and 192.168.255.4/30 networks being redistributed into BGP from ISIS
- We suppress these here

Forcing paths with BGP and SPB
(a) GRT IP Shortcuts – Checking BGP Routes




```
VSP9000-1:1#% show ip bgp route
================================================================
                        BGP Routes - GlobalRouter
================================================================
NETWORK/MASK        PEER REM ADDR    NEXTHOP ADDRESS ORG LOC PREF
----------------------------------------------------------------
10.0.0.41/32        10.0.0.92        10.0.0.92       INC 100
        AS_PATH: path-is-empty
10.0.0.91/32        10.0.0.92        10.0.0.92       INC 100
        AS_PATH: path-is-empty
172.16.0.0/16       10.0.0.92        10.0.0.92       INC 100
        AS_PATH: path-is-empty
192.168.0.0/17      192.168.255.1    192.168.255.1   IGP 100
        AS_PATH: (65001 65003)
192.168.0.0/17      10.0.0.92        192.168.255.5   IGP 100
        AS_PATH: (65001 65003)
```

```
VSP9000-2:1#% show ip bgp route
================================================================
                        BGP Routes - GlobalRouter
================================================================
NETWORK/MASK        PEER REM ADDR    NEXTHOP ADDRESS ORG LOC PREF
----------------------------------------------------------------
10.0.0.41/32        10.0.0.91        10.0.0.91       INC 100
        AS_PATH: path-is-empty
10.0.0.92/32        10.0.0.91        10.0.0.91       INC 100
        AS_PATH: path-is-empty
172.16.0.0/16       10.0.0.91        10.0.0.91       INC 100
        AS_PATH: path-is-empty
192.168.0.0/17      192.168.255.5    192.168.255.5   IGP 100
        AS_PATH: (65001 65003)
192.168.0.0/17      10.0.0.91        192.168.255.1   IGP 100
        AS_PATH: (65001 65003)
```

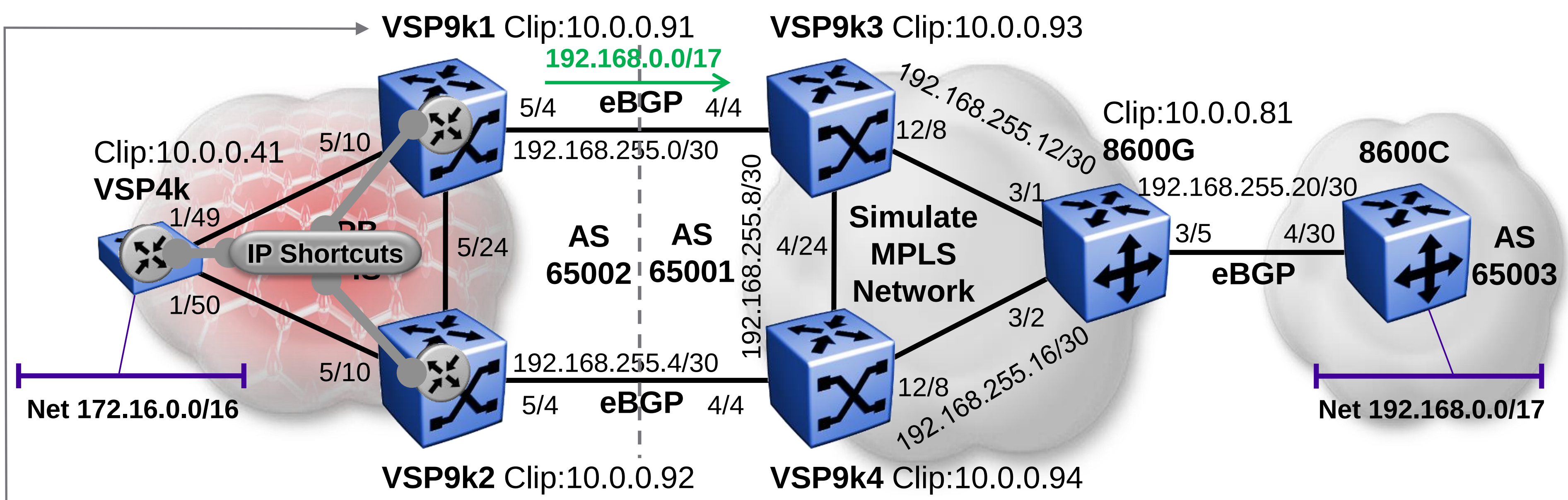
Forcing paths with BGP and SPB
(a) GRT IP Shortcuts – Checking BGP Routes

- This is the route path for the routes in yellow below:
- 10.0.0.41/32 : 4k ➔ ISIS ➔ 9k2 ➔ iBGP ➔ 9k1 (➔ ISIS)
- 10.0.0.91/32: 9k1 ➔ ISIS ➔ 9k2 ➔ iBGP ➔ 9k1 (➔ ISIS)
- 172.16.0.0/16: 4k ➔ ISIS ➔ 9k2 ➔ iBGP ➔ 9k1 (➔ ISIS)
  - 10.0.0.41/32 : 4k ➔ ISIS ➔ 9k1 ➔ iBGP ➔ 9k2 (➔ ISIS)
  - 10.0.0.92/32: 9k2 ➔ ISIS ➔ 9k1 ➔ iBGP ➔ 9k2 (➔ ISIS)
  - 172.16.0.0/16: 4k ➔ ISIS ➔ 9k1 ➔ iBGP ➔ 9k2 (➔ ISIS)
- Potentially these routes could loop as both VSP9k1 & VSP9k2 redistribute BGP routes into ISIS
- We will address these later when we limit BGP ➔ ISIS redistribution to only eBGP routes

```
10.0.0.41/32        10.0.0.92       10.0.0.92       INC 100
        AS_PATH: path-is-empty
10.0.0.91/32        10.0.0.92       10.0.0.92       INC 100
        AS_PATH: path-is-empty
172.16.0.0/16       10.0.0.92       10.0.0.92       INC 100
        AS_PATH: path-is-empty
192.168.0.0/17      192.168.255.1   192.168.255.1   IGP 100
        AS_PATH: (65001 65003)
192.168.0.0/17      10.0.0.92       192.168.255.5   IGP 100
        AS_PATH: (65001 65003)
```

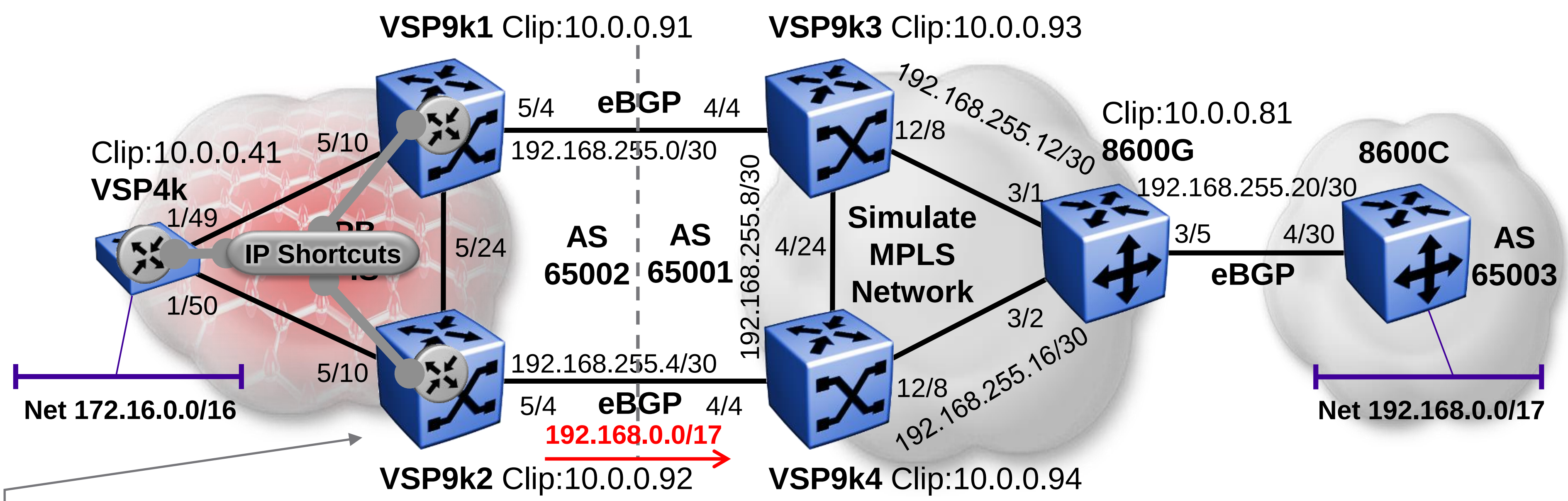
```
10.0.0.41/32        10.0.0.91       10.0.0.91       INC 100
        AS_PATH: path-is-empty
10.0.0.92/32        10.0.0.91       10.0.0.91       INC 100
        AS_PATH: path-is-empty
172.16.0.0/16       10.0.0.91       10.0.0.91       INC 100
        AS_PATH: path-is-empty
192.168.0.0/17      192.168.255.5   192.168.255.5   IGP 100
        AS_PATH: (65001 65003)
192.168.0.0/17      10.0.0.91       192.168.255.1   IGP 100
        AS_PATH: (65001 65003)
```

Forcing paths with BGP and SPB
(a) GRT IP Shortcuts – Checking IP Routes




```
VSP9000-1:1#% show ip route
================================================================================
                              IP Route - GlobalRouter
================================================================================
                                               NH                INTER
DST             MASK            NEXT           VRF/ISID     COST FACE  PROT AGE TYPE PRF
--------------------------------------------------------------------------------
10.0.0.41       255.255.255.255 VSP4000        GlobalRouter 10   4051  ISIS 0   IBS  50
10.0.0.91       255.255.255.255 10.0.0.91      -            1    0     LOC  0   DB   0
10.0.0.92       255.255.255.255 VSP9000-2      GlobalRouter 10   4051  ISIS 0   IBS  50
172.16.0.0      255.255.0.0     VSP4000        GlobalRouter 10   4051  ISIS 0   IBS  50
192.168.0.0     255.255.128.0   192.168.255.1  GlobalRouter 2     5/4  BGP  0   IB   45
192.168.255.0   255.255.255.252 192.168.255.2  -            1     5/4  LOC  0   DB   0
192.168.255.4   255.255.255.252 VSP9000-2      GlobalRouter 10   4051  ISIS 0   IBS  50
```

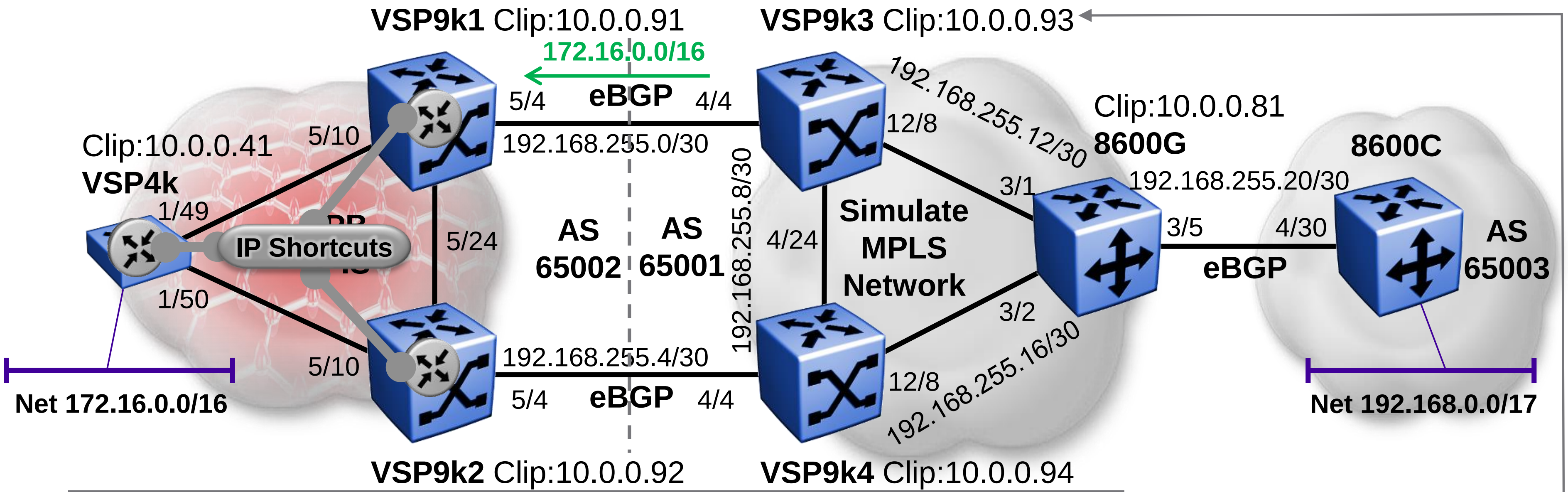
Forcing paths with BGP and SPB
(a) GRT IP Shortcuts – Checking IP Routes




```
VSP9000-2:1#% show ip route
================================================================================
                              IP Route - GlobalRouter
================================================================================
                                                 NH                INTER
DST             MASK            NEXT             VRF/ISID          COST FACE  PROT AGE TYPE PRF
--------------------------------------------------------------------------------
10.0.0.41       255.255.255.255 VSP4000          GlobalRouter      10   4051  ISIS 0   IBS  50
10.0.0.91       255.255.255.255 VSP9000-1        GlobalRouter      10   4051  ISIS 0   IBS  50
10.0.0.92       255.255.255.255 10.0.0.92        -                 1    0     LOC  0   DB   0
172.16.0.0      255.255.0.0     VSP4000          GlobalRouter      10   4051  ISIS 0   IBS  50
192.168.0.0     255.255.128.0   192.168.255.5    GlobalRouter      2     5/4  BGP  0   IB   45
192.168.255.0   255.255.255.252 VSP9000-1        GlobalRouter      10   4051  ISIS 0   IBS  50
192.168.255.4   255.255.255.252 192.168.255.6    -                 1     5/4  LOC  0   DB   0
```

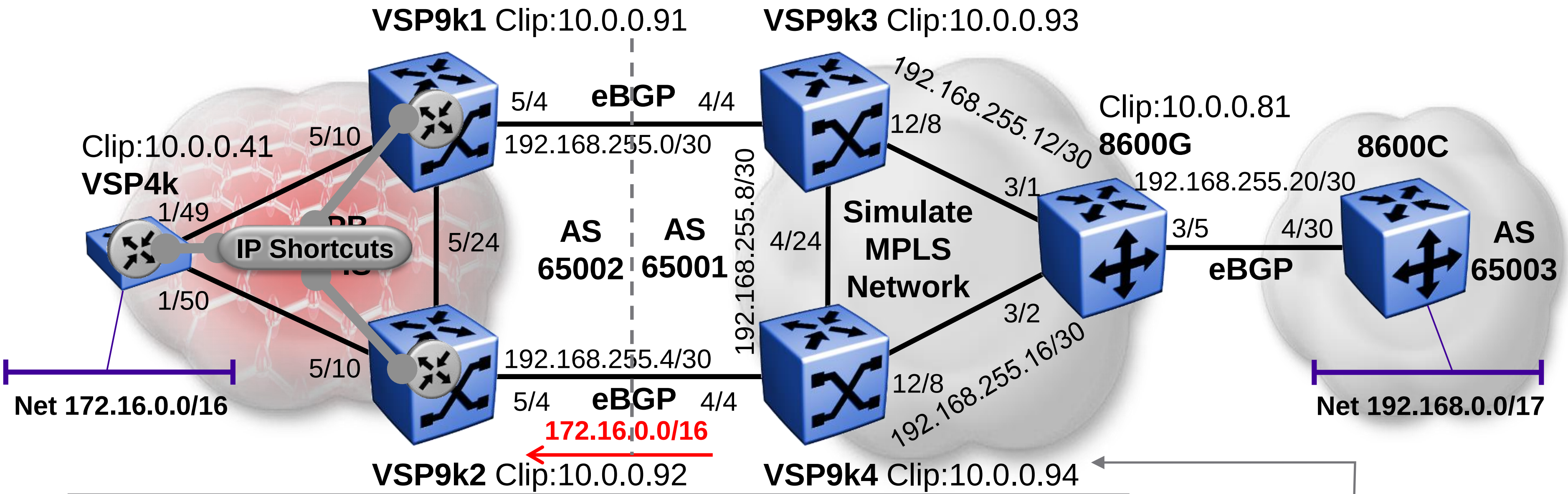
- This is not what not what we want so we'll have to fix this

Forcing paths with BGP and SPB
(a) GRT IP Shortcuts – Checking IP Routes




```
VSP9000-3:1#% show ip route
==========================================================================================
                                  IP Route - GlobalRouter
==========================================================================================
                                                  NH                    INTER
DST             MASK            NEXT              VRF/ISID        COST  FACE  PROT AGE TYPE PRF
------------------------------------------------------------------------------------------
10.0.0.41       255.255.255.255 192.168.255.2     GlobalRouter    1      4/4  BGP  0   IB   45
10.0.0.81       255.255.255.255 192.168.255.14    GlobalRouter    11    12/8  OSPF 0   IB   20
10.0.0.91       255.255.255.255 192.168.255.2     GlobalRouter    1      4/4  BGP  0   IB   45
10.0.0.92       255.255.255.255 192.168.255.2     GlobalRouter    1      4/4  BGP  0   IB   45
10.0.0.93       255.255.255.255 10.0.0.93         -               1     0     LOC  0   DB   0
10.0.0.94       255.255.255.255 192.168.255.10    GlobalRouter    11     4/24 OSPF 0   IB   20
172.16.0.0      255.255.0.0     192.168.255.2     GlobalRouter    1      4/4  BGP  0   IB   45
192.168.0.0     255.255.128.0   192.168.255.14    GlobalRouter    1     12/8  BGP  0   IB   175
192.168.255.0   255.255.255.252 192.168.255.1     -               1      4/4  LOC  0   DB   0
192.168.255.4   255.255.255.252 192.168.255.10    GlobalRouter    2      4/24 OSPF 0   IB   20
192.168.255.8   255.255.255.252 192.168.255.9     -               1      4/24 LOC  0   DB   0
192.168.255.12  255.255.255.252 192.168.255.13    -               1     12/8  LOC  0   DB   0
192.168.255.16  255.255.255.252 192.168.255.10    GlobalRouter    2      4/24 OSPF 0   IB   20
192.168.255.20  255.255.255.252 192.168.255.14    GlobalRouter    2     12/8  OSPF 0   IB   20
```

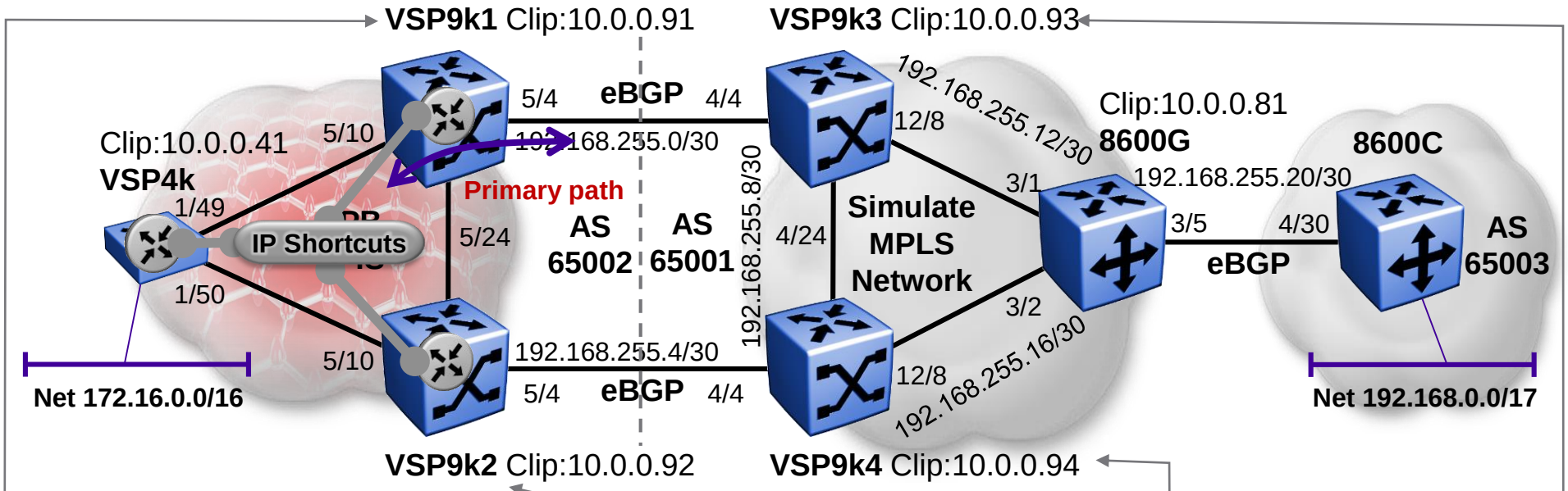
Forcing paths with BGP and SPB
(a) GRT IP Shortcuts – Checking IP Routes




```
VSP9000-4:1#% show ip route
================================================================================================
                                     IP Route - GlobalRouter
================================================================================================
                                                    NH                     INTER
DST             MASK            NEXT                VRF/ISID        COST   FACE  PROT AGE TYPE PRF
------------------------------------------------------------------------------------------------
10.0.0.41       255.255.255.255 192.168.255.6       GlobalRouter    1       4/4  BGP  0   IB   45
10.0.0.81       255.255.255.255 192.168.255.18      GlobalRouter    11     12/8  OSPF 0   IB   20
10.0.0.91       255.255.255.255 192.168.255.6       GlobalRouter    1       4/4  BGP  0   IB   45
10.0.0.92       255.255.255.255 192.168.255.6       GlobalRouter    1       4/4  BGP  0   IB   45
10.0.0.93       255.255.255.255 192.168.255.9       GlobalRouter    11      4/24 OSPF 0   IB   20
10.0.0.94       255.255.255.255 10.0.0.94           -               1      0     LOC  0   DB   0
172.16.0.0      255.255.0.0     192.168.255.6       GlobalRouter    1       4/4  BGP  0   IB   45
192.168.0.0     255.255.128.0   192.168.255.18      GlobalRouter    1      12/8  BGP  0   IB   175
192.168.255.0   255.255.255.252 192.168.255.9       GlobalRouter    2       4/24 OSPF 0   IB   20
192.168.255.4   255.255.255.252 192.168.255.5       -               1       4/4  LOC  0   DB   0
192.168.255.8   255.255.255.252 192.168.255.10      -               1       4/24 LOC  0   DB   0
192.168.255.12  255.255.255.252 192.168.255.9       GlobalRouter    2       4/24 OSPF 0   IB   20
192.168.255.16  255.255.255.252 192.168.255.17      -               1      12/8  LOC  0   DB   0
192.168.255.20  255.255.255.252 192.168.255.18      GlobalRouter    2      12/8  OSPF 0   IB   20
```

- This is not what we want so we'll have to fix this

Forcing paths with BGP and SPB
(a) GRT IP Shortcuts – Setting Local_PREF




```
no router bgp enable
router bgp
   bgp default local-preference 20
exit
router bgp 65002 enable
```

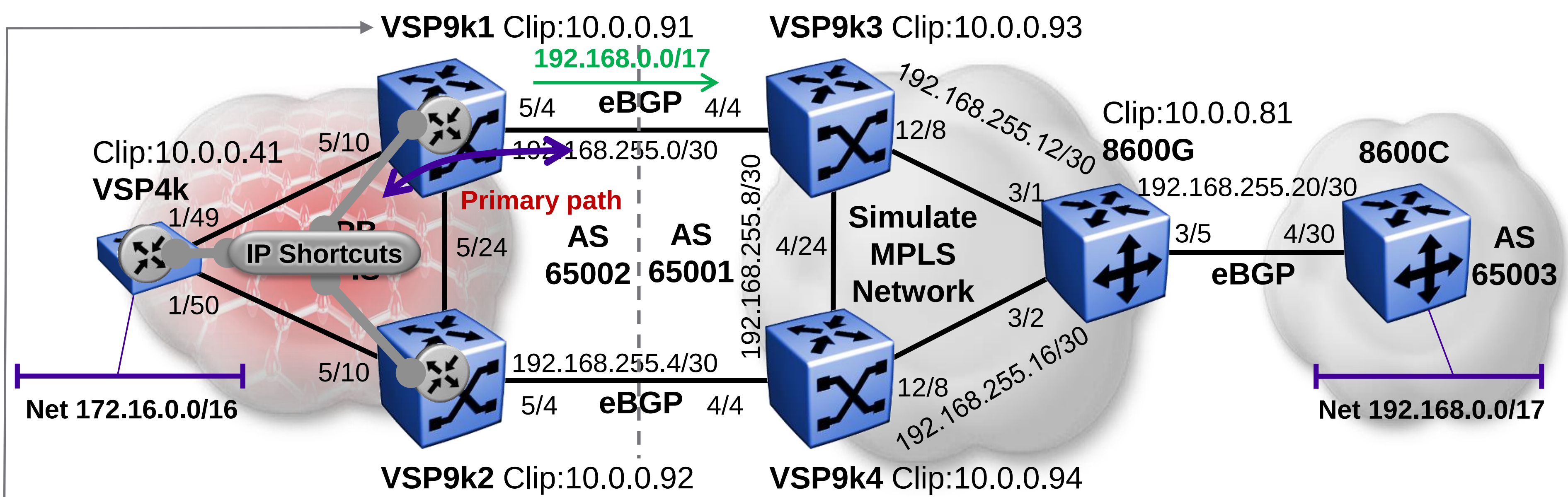
```
no router bgp enable
router bgp
   bgp default local-preference 20
exit
router bgp 65001 enable
```

- BGP local-PREF is by default set to 100
- So we increase it on VSP9k1 & VSP9k3 and decrease it on VSP9k2 and VSP9k4

```
no router bgp enable
router bgp
   bgp default local-preference 200
exit
router bgp 65002 enable
```

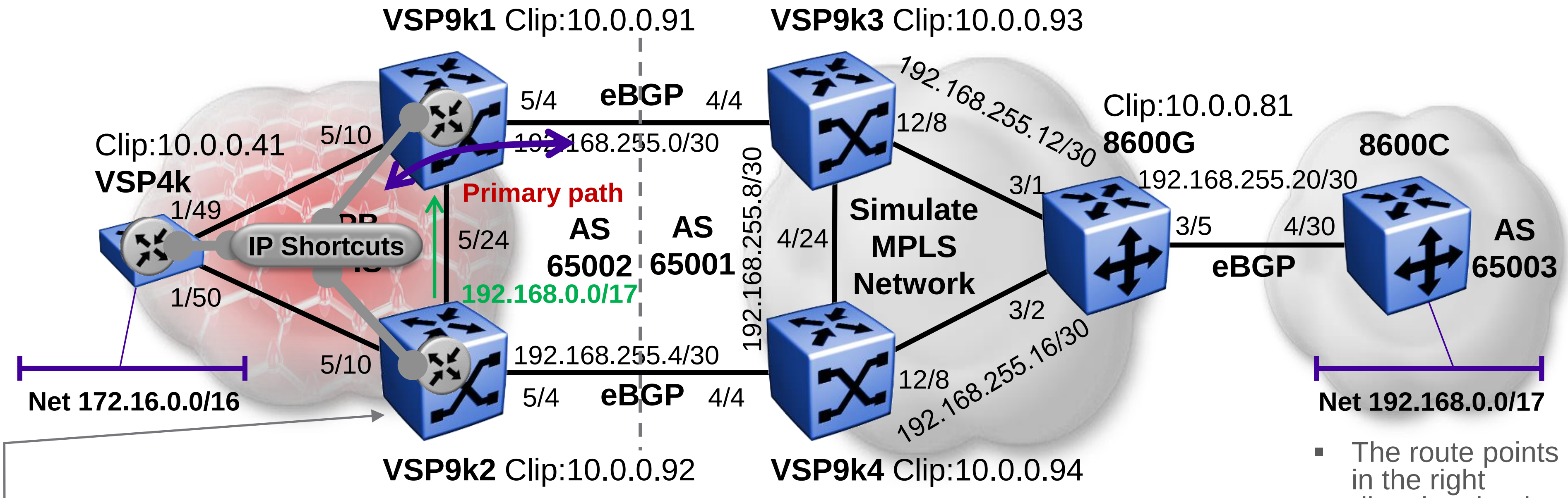
```
no router bgp enable
router bgp
   bgp default local-preference 200
exit
router bgp 65001 enable
```

Forcing paths with BGP and SPB
(a) GRT IP Shortcuts – Checking IP Routes




```
VSP9000-1:1#% show ip route
================================================================================
                            IP Route - GlobalRouter
================================================================================
                                                  NH                 INTER
DST             MASK            NEXT              VRF/ISID      COST FACE  PROT AGE TYPE PRF
--------------------------------------------------------------------------------
10.0.0.41       255.255.255.255 VSP4000           GlobalRouter  10   4051  ISIS 0   IBS  50
10.0.0.91       255.255.255.255 10.0.0.91         -             1    0     LOC  0   DB   0
10.0.0.92       255.255.255.255 VSP9000-2         GlobalRouter  10   4051  ISIS 0   IBS  50
172.16.0.0      255.255.0.0     VSP4000           GlobalRouter  10   4051  ISIS 0   IBS  50
192.168.0.0     255.255.128.0   192.168.255.1     GlobalRouter  2     5/4  BGP  0   IB   45
192.168.255.0   255.255.255.252 192.168.255.2     -             1     5/4  LOC  0   DB   0
192.168.255.4   255.255.255.252 VSP9000-2         GlobalRouter  10   4051  ISIS 0   IBS  50
```

Forcing paths with BGP and SPB
(a) GRT IP Shortcuts – Checking IP Routes

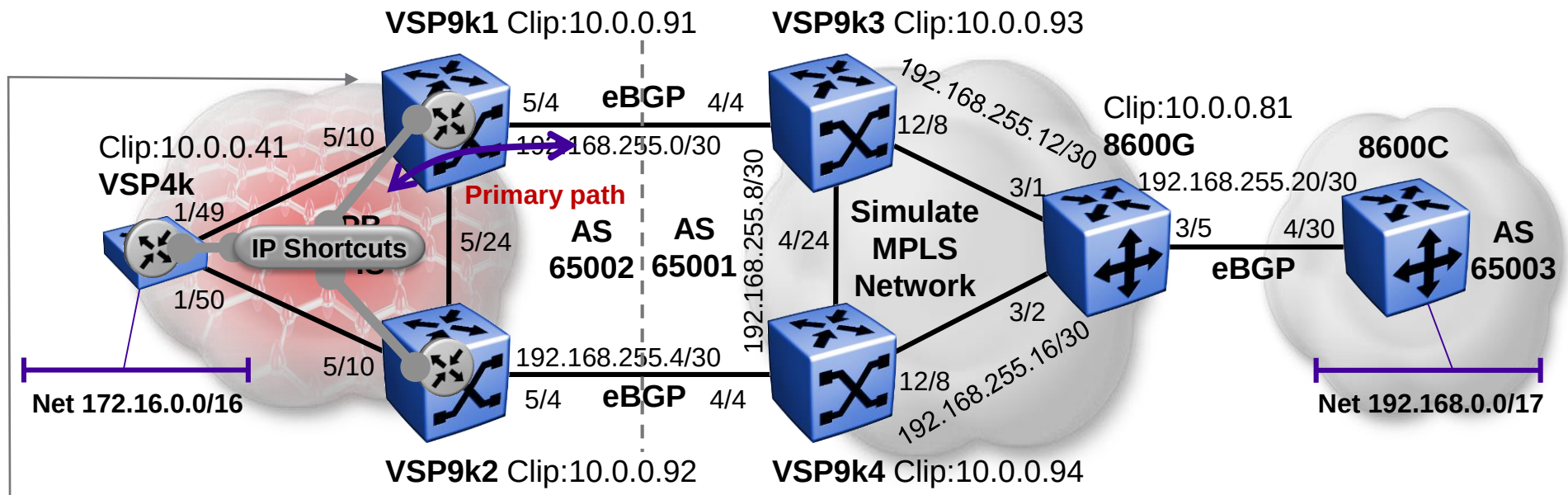



```
VSP9000-2:1#% show ip route
================================================================================
                         IP Route - GlobalRouter
================================================================================
                                            NH                   INTER
DST             MASK            NEXT            VRF/ISID         COST  FACE  PROT  AGE  TYPE  PRF
--------------------------------------------------------------------------------
10.0.0.41       255.255.255.255 VSP4000         GlobalRouter     10    4051  ISIS  0    IBS   50
10.0.0.91       255.255.255.255 VSP9000-1       GlobalRouter     10    4051  ISIS  0    IBS   50
10.0.0.92       255.255.255.255 10.0.0.92       -                1     0     LOC   0    DB    0
172.16.0.0      255.255.0.0     VSP4000         GlobalRouter     10    4051  ISIS  0    IBS   50
192.168.0.0     255.255.128.0   VSP9000-1       GlobalRouter     10    4051  ISIS  0    IBS   50
192.168.255.0   255.255.255.252 VSP9000-1       GlobalRouter     10    4051  ISIS  0    IBS   50
192.168.255.4   255.255.255.252 192.168.255.6   -                1      5/4  LOC   0    DB    0
```

- The route points in the right direction, but it is a BGP route showing up as an ISIS route

This is not good, because we are redistributing all ISIS routes into BGP so this route will get re-advertised into BGP with its attributes stripped off

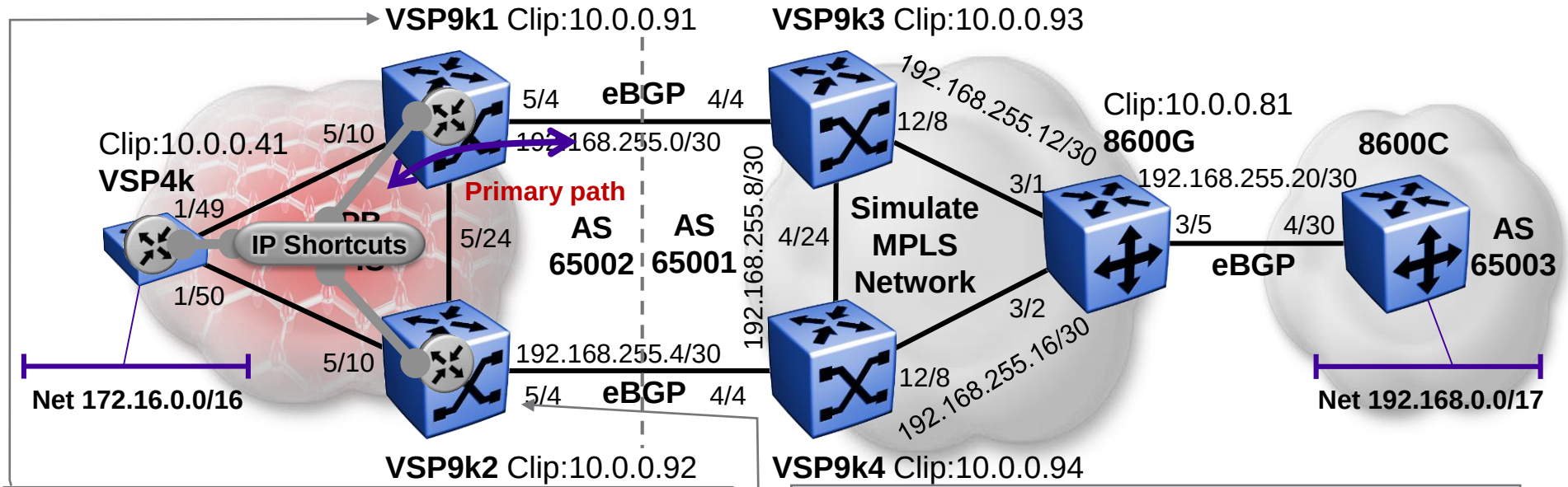
Forcing paths with BGP and SPB
(a) GRT IP Shortcuts – Checking BGP Routes




```
VSP9000-1:1#% show ip bgp route
================================================================
                        BGP Routes - GlobalRouter
================================================================
NETWORK/MASK       PEER REM ADDR   NEXTHOP ADDRESS ORG LOC PREF
----------------------------------------------------------------
10.0.0.41/32       10.0.0.92       10.0.0.92       INC 20
        AS_PATH: path-is-empty
10.0.0.91/32       10.0.0.92       10.0.0.92       INC 20
        AS_PATH: path-is-empty
172.16.0.0/16      10.0.0.92       10.0.0.92       INC 20
        AS_PATH: path-is-empty
192.168.0.0/17     192.168.255.1   192.168.255.1   IGP 200
        AS_PATH: (65001 65003)
192.168.0.0/17     10.0.0.92       10.0.0.92       INC 20
        AS_PATH: path-is-empty
```

- So, VSP9k1 prefers the eBGP route (local_PREF 200) installs it in the routing table and redistributes it into ISIS
- VSP9k2 prefers the iBGP route from VSP9k1 (local_PREF 200) but fails to install it in the routing table because same route is available from VSP9k1 via ISIS which has a higher preference (50 vs 175) – see pervious slide -; so it installs the ISIS route instead and hence redistributes this same route back into BGP (the route attributes like AS-path are now lost) and hence it appears in red in VSP9k1's BGP routes on the left
- This constitutes a routing loop which needs to be eliminated otherwise it will create problems later

Forcing paths with BGP and SPB
(a) GRT IP Shortcuts – Solving routing loop

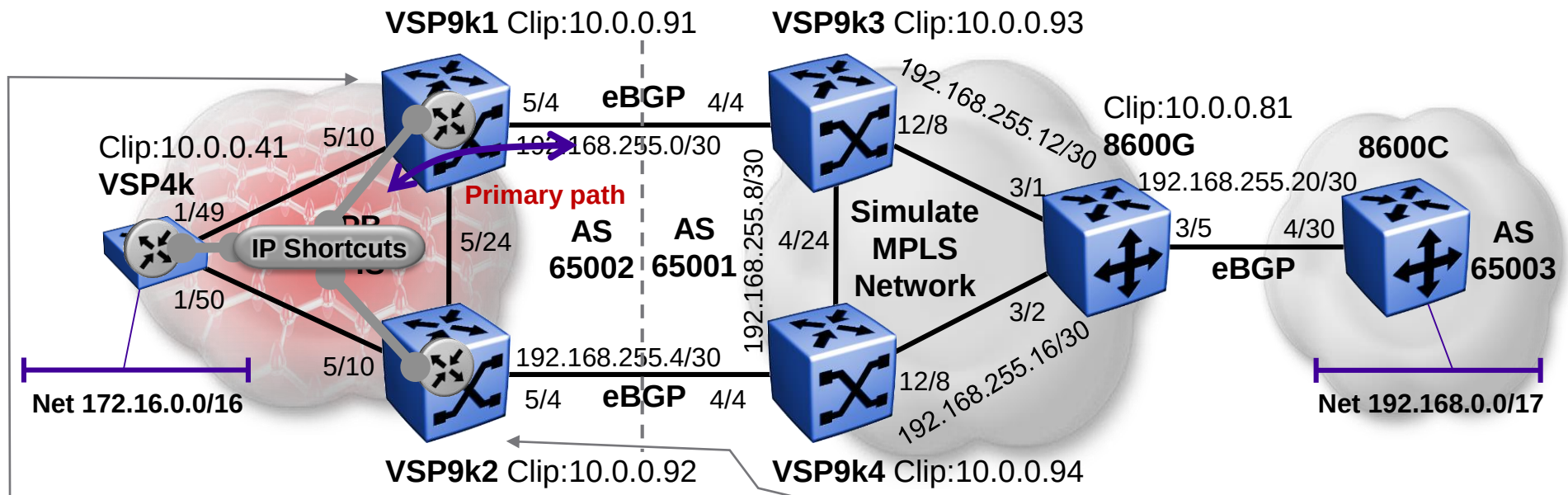



```
ip prefix-list local-nets 10.0.0.0/24 ge 32 le 32
ip prefix-list local-nets 192.168.255.0/24 ge 30 le 30
route-map accept-only-local-nets 1
   permit
   match network local-nets
   enable
exit
route-map accept-only-local-nets 2
   no permit
   enable
exit
router isis
   accept adv-rtr 0.00.92
   accept adv-rtr 0.00.92 route-map "accept-only-local-nets"
   accept adv-rtr 0.00.92 enable
exit
isis apply accept
```

```
ip prefix-list local-nets 10.0.0.0/24 ge 32 le 32
ip prefix-list local-nets 192.168.255.0/24 ge 30 le 30
route-map accept-only-local-nets 1
   permit
   match network local-nets
   enable
exit
route-map accept-only-local-nets 2
   no permit
   enable
exit
router isis
   accept adv-rtr 0.00.91
   accept adv-rtr 0.00.91 route-map "accept-only-local-nets"
   accept adv-rtr 0.00.91 enable
exit
isis apply accept
```

- Only accept ISIS routes for CLIP and eBGP IP nets from VSP9k1 / VSP9k2

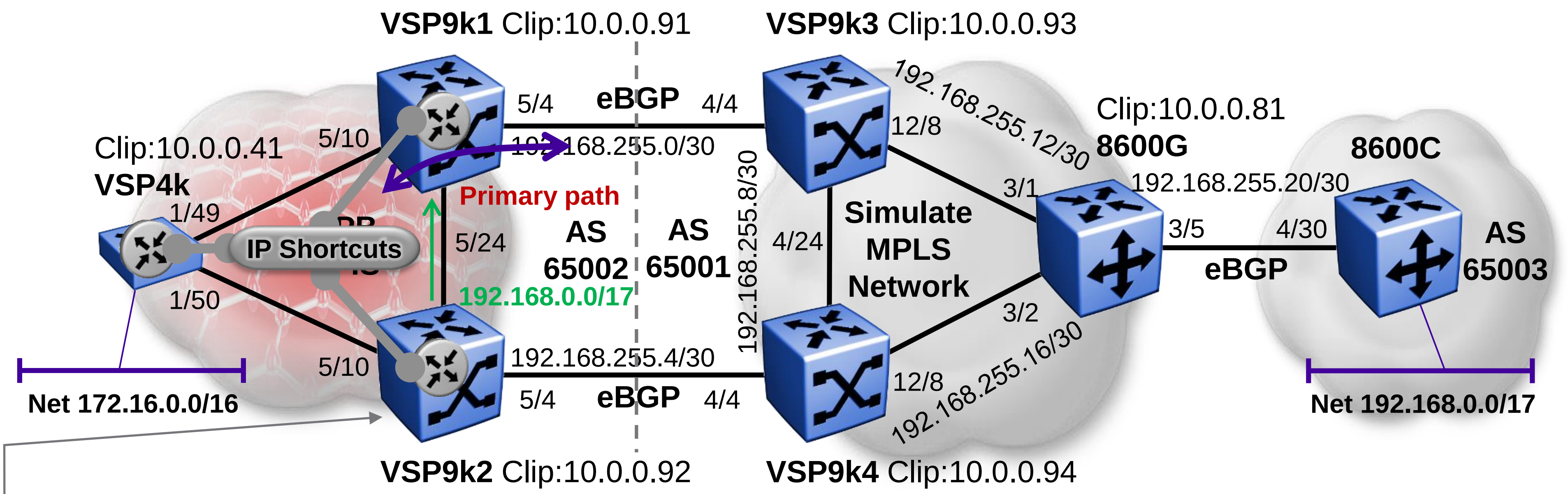
Forcing paths with BGP and SPB
(a) GRT IP Shortcuts – Checking BGP Routes




```
VSP9000-1:1#% show ip bgp route
================================================================
                        BGP Routes - GlobalRouter
================================================================
NETWORK/MASK       PEER REM ADDR   NEXTHOP ADDRESS ORG LOC PREF
----------------------------------------------------------------
10.0.0.41/32       10.0.0.92       10.0.0.92       INC 20
        AS_PATH: path-is-empty
10.0.0.91/32       10.0.0.92       10.0.0.92       INC 20
        AS_PATH: path-is-empty
172.16.0.0/16      10.0.0.92       10.0.0.92       INC 20
        AS_PATH: path-is-empty
192.168.0.0/17     192.168.255.1   192.168.255.1   IGP 200
        AS_PATH: (65001 65003)
192.168.0.0/17     10.0.0.92       192.168.255.5   IGP 20
        AS_PATH: (65001 65003)
```

```
VSP9000-2:1#% show ip bgp route
================================================================
                        BGP Routes - GlobalRouter
================================================================
NETWORK/MASK       PEER REM ADDR   NEXTHOP ADDRESS ORG LOC PREF
----------------------------------------------------------------
10.0.0.41/32       10.0.0.91       10.0.0.91       INC 200
        AS_PATH: path-is-empty
10.0.0.92/32       10.0.0.91       10.0.0.91       INC 200
        AS_PATH: path-is-empty
172.16.0.0/16      10.0.0.91       10.0.0.91       INC 200
        AS_PATH: path-is-empty
192.168.0.0/17     10.0.0.91       192.168.255.1   IGP 200
        AS_PATH: (65001 65003)
192.168.0.0/17     192.168.255.5   192.168.255.5   IGP 20
        AS_PATH: (65001 65003)
```

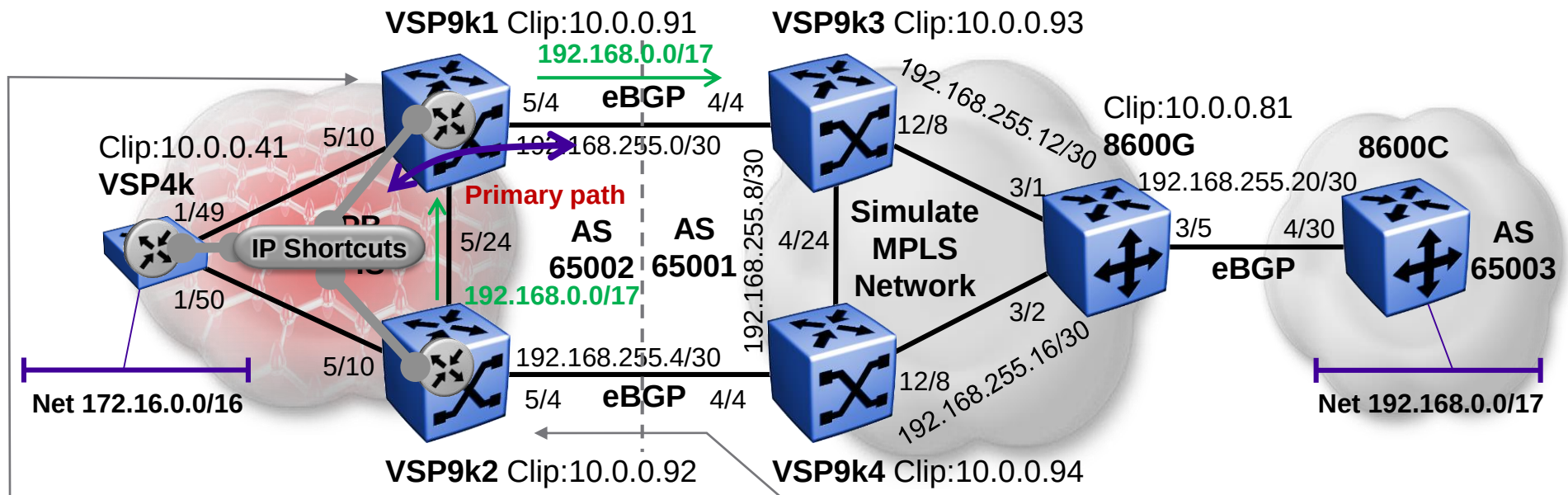
Forcing paths with BGP and SPB
(a) GRT IP Shortcuts – Checking IP Routes




```
VSP9000-2:1#% show ip route
================================================================================
                              IP Route - GlobalRouter
================================================================================
                                            NH                 INTER
DST            MASK            NEXT         VRF/ISID      COST FACE  PROT AGE TYPE PRF
--------------------------------------------------------------------------------
10.0.0.41      255.255.255.255 VSP4000      GlobalRouter  10   4051  ISIS 0   IBS  50
10.0.0.91      255.255.255.255 VSP9000-1    GlobalRouter  10   4051  ISIS 0   IBS  50
10.0.0.92      255.255.255.255 10.0.0.92    -             1    0     LOC  0   DB   0
172.16.0.0     255.255.0.0     VSP4000      GlobalRouter  10   4051  ISIS 0   IBS  50
192.168.0.0    255.255.128.0   VSP9000-1    GlobalRouter  2    4051  BGP  0   IBS  175
192.168.255.0  255.255.255.252 VSP9000-1    GlobalRouter  10   4051  ISIS 0   IBS  50
192.168.255.4  255.255.255.252 192.168.255.6 -            1     5/4  LOC  0   DB   0
```

- Looking good

Forcing paths with BGP and SPB
(a) GRT IP Shortcuts – Checking BGP Routes

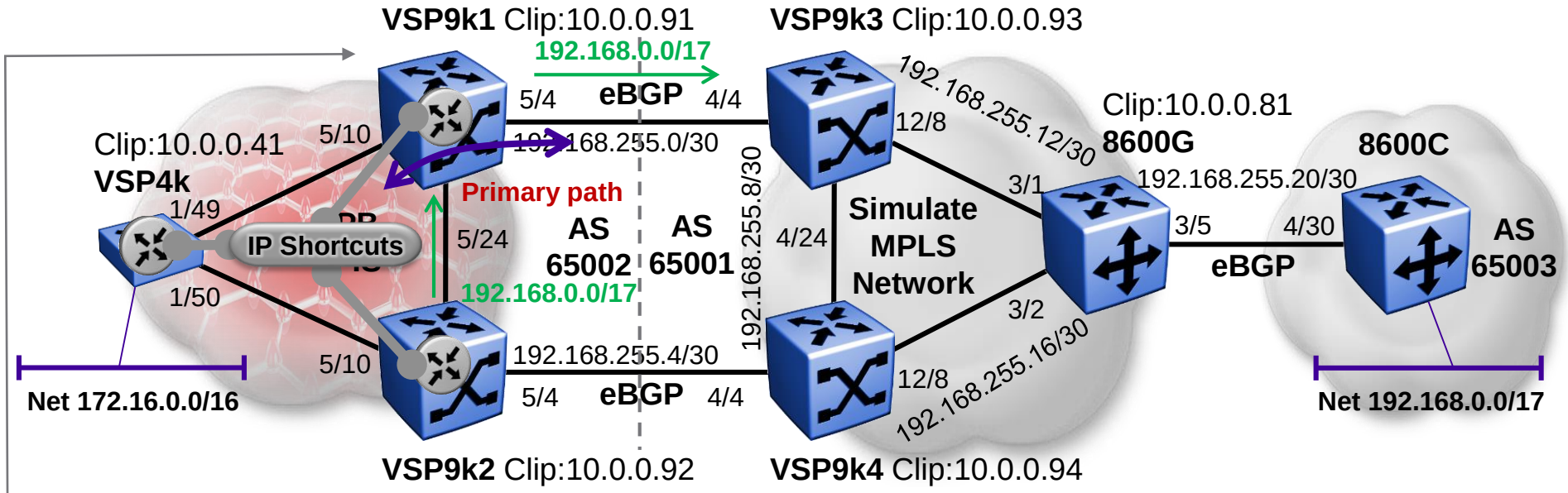


- So far this is looking good

```
VSP9000-1:1#% show ip bgp route
================================================================
                        BGP Routes - GlobalRouter
================================================================
NETWORK/MASK       PEER REM ADDR   NEXTHOP ADDRESS ORG LOC PRE
----------------------------------------------------------------
10.0.0.41/32       10.0.0.92       10.0.0.92       INC 20
       AS_PATH: path-is-empty
10.0.0.91/32       10.0.0.92       10.0.0.92       INC 20
       AS_PATH: path-is-empty
172.16.0.0/16      10.0.0.92       10.0.0.92       INC 20
       AS_PATH: path-is-empty
192.168.0.0/17     192.168.255.1   192.168.255.1   IGP 200
       AS_PATH: (65001 65003)
192.168.0.0/17     10.0.0.92       192.168.255.5   IGP 20
       AS_PATH: (65001 65003)
```

```
VSP9000-2:1#% show ip bgp route
================================================================
                        BGP Routes - GlobalRouter
================================================================
NETWORK/MASK       PEER REM ADDR   NEXTHOP ADDRESS ORG LOC PREF
----------------------------------------------------------------
10.0.0.41/32       10.0.0.91       10.0.0.91       INC 200
       AS_PATH: path-is-empty
10.0.0.92/32       10.0.0.91       10.0.0.91       INC 200
       AS_PATH: path-is-empty
172.16.0.0/16      10.0.0.91       10.0.0.91       INC 200
       AS_PATH: path-is-empty
192.168.0.0/17     10.0.0.91       192.168.255.1   IGP 200
       AS_PATH: (65001 65003)
192.168.0.0/17     192.168.255.5   192.168.255.5   IGP 20
       AS_PATH: (65001 65003)
```

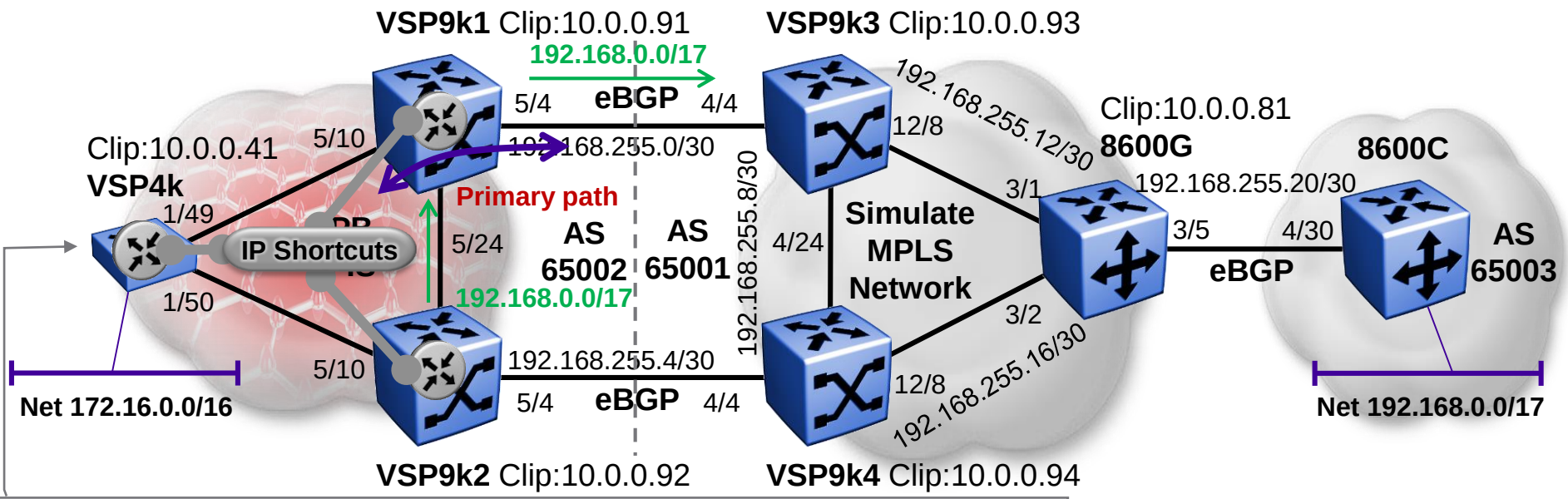
Forcing paths with BGP and SPB
(a) GRT IP Shortcuts – Checking ISIS LSDB Routes




```
VSP9000-1:1# show isis lsdb ip-unicast
================================================================================
                          ISIS IP-UNICAST-ROUTE SUMMARY
================================================================================
                              PREFIX          TLV   LSP   HOST
I-SID     ADDRESS             LENGTH  METRIC  TYPE  FRAG  NAME
--------------------------------------------------------------------------------
-         10.0.0.41           32      1       135   0x2   VSP4000
-         172.16.0.0          16      1       135   0x2   VSP4000
-         10.0.0.91           32      1       135   0x2   VSP9000-1
-         192.168.255.0       30      1       135   0x2   VSP9000-1
-         192.168.0.0         17      2       135   0x2   VSP9000-1
-         10.0.0.92           32      1       135   0x2   VSP9000-2
-         192.168.255.4       30      1       135   0x2   VSP9000-2
-         192.168.0.0         17      2       135   0x2   VSP9000-2
```

- ISIS LSDB IP routes can be checked on any node in the SPB Fabric (the LSDB is the same for all nodes)
- What we have here is not so good
- VSP9k2 is installing an iBGP route for network 192.168.0.0/17 and redistributing it into ISIS
- iBGP routes should not be redistributed into ISIS

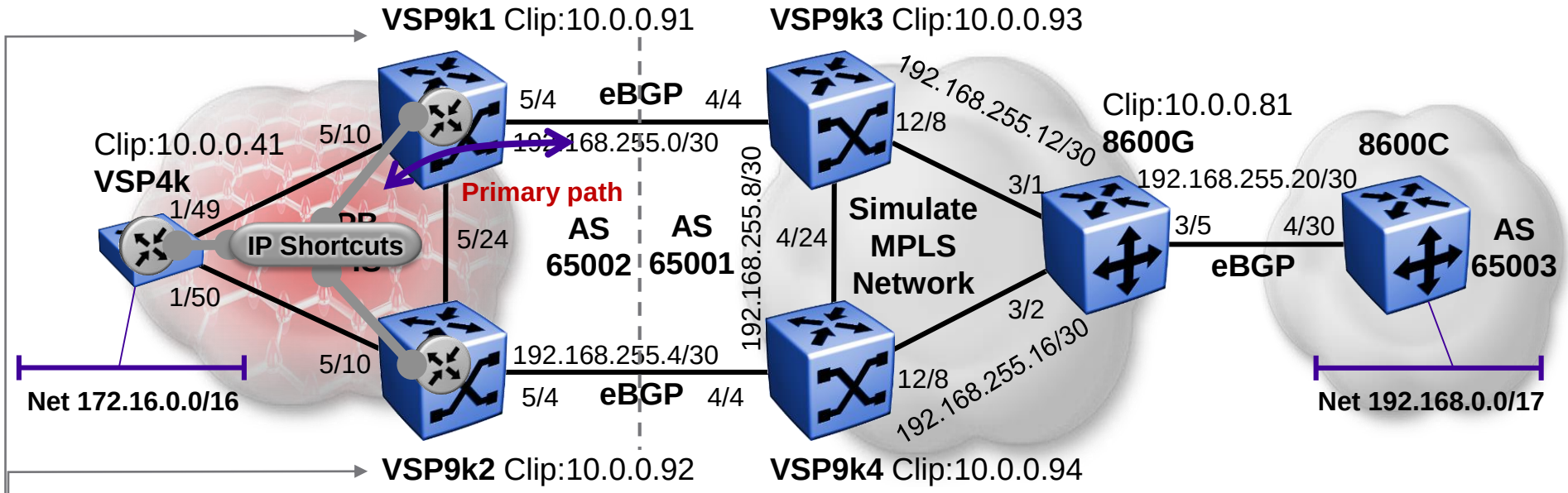
Forcing paths with BGP and SPB
(a) GRT IP Shortcuts – Checking SPB IP Routes




```
VSP4000:1# show isis spbm ip-unicast-fib
================================================================================
                        SPBM IP-UNICAST FIB ENTRY INFO
================================================================================
                                                          OUTGOING  SPBM       PREFIX
VRF       ISID    Destination        NH BEB              VLAN INTERFACE COST       COST
--------------------------------------------------------------------------------
GRT       -       10.0.0.91/32       VSP9000-1           4051 1/49      10         1
GRT       -       10.0.0.91/32       VSP9000-1           4052 1/49      10         1
GRT       -       10.0.0.92/32       VSP9000-2           4051 1/50      10         1
GRT       -       10.0.0.92/32       VSP9000-2           4052 1/50      10         1
GRT       -       192.168.0.0/17     VSP9000-1           4051 1/49      10         2
GRT       -       192.168.0.0/17     VSP9000-1           4052 1/49      10         2
GRT       -       192.168.0.0/17     VSP9000-2           4051 1/50      10         2
GRT       -       192.168.0.0/17     VSP9000-2           4052 1/50      10         2
GRT       -       192.168.255.0/30   VSP9000-1           4051 1/49      10         1
GRT       -       192.168.255.0/30   VSP9000-1           4052 1/49      10         1
GRT       -       192.168.255.4/30   VSP9000-2           4051 1/50      10         1
GRT       -       192.168.255.4/30   VSP9000-2           4052 1/50      10         1
```

- It does not make sense for VSP9k1 & VSP9k2 to redistribute iBGP routes into ISIS otherwise other BEBs in the fabric will install IP routes towards VSP9k2 instead of VSP9k1 (or ECMP towards both of them)

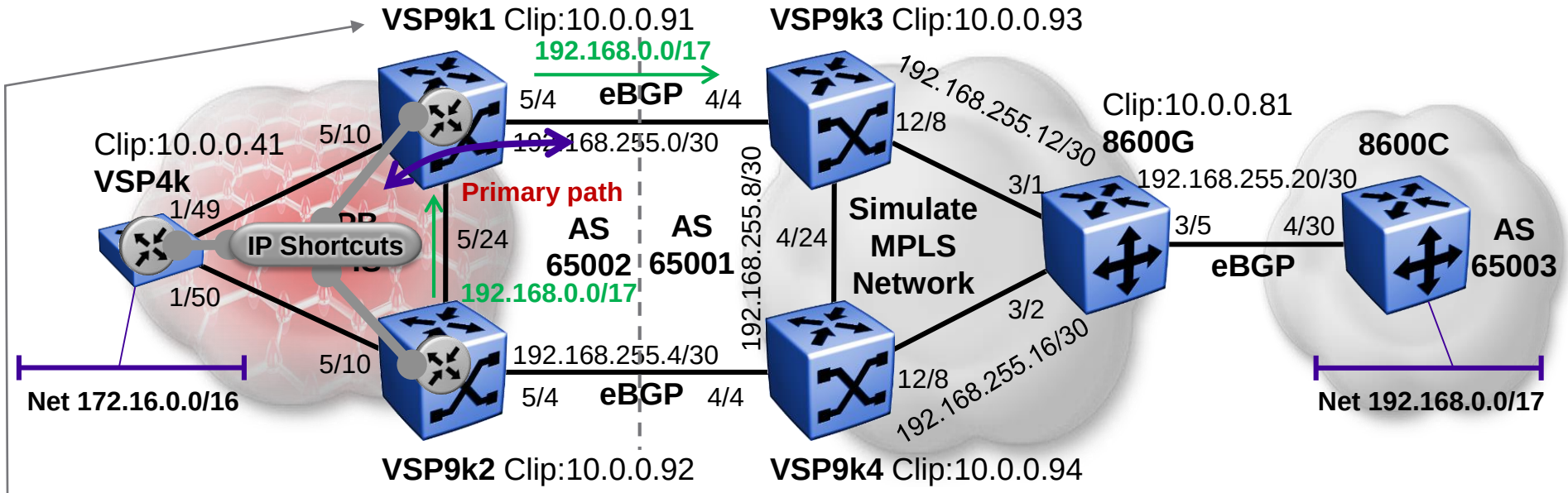
Forcing paths with BGP and SPB
(a) GRT IP Shortcuts – only redistributing eBGP




```
route-map "ebgp-only-routes" 1
   permit
   match protocol ebgp
   enable
exit
router isis
   redistribute bgp route-map "ebgp-only-routes"
exit
isis apply redistribute bgp
```

- Only redistribute eBGP (and not iBGP) routes into ISIS

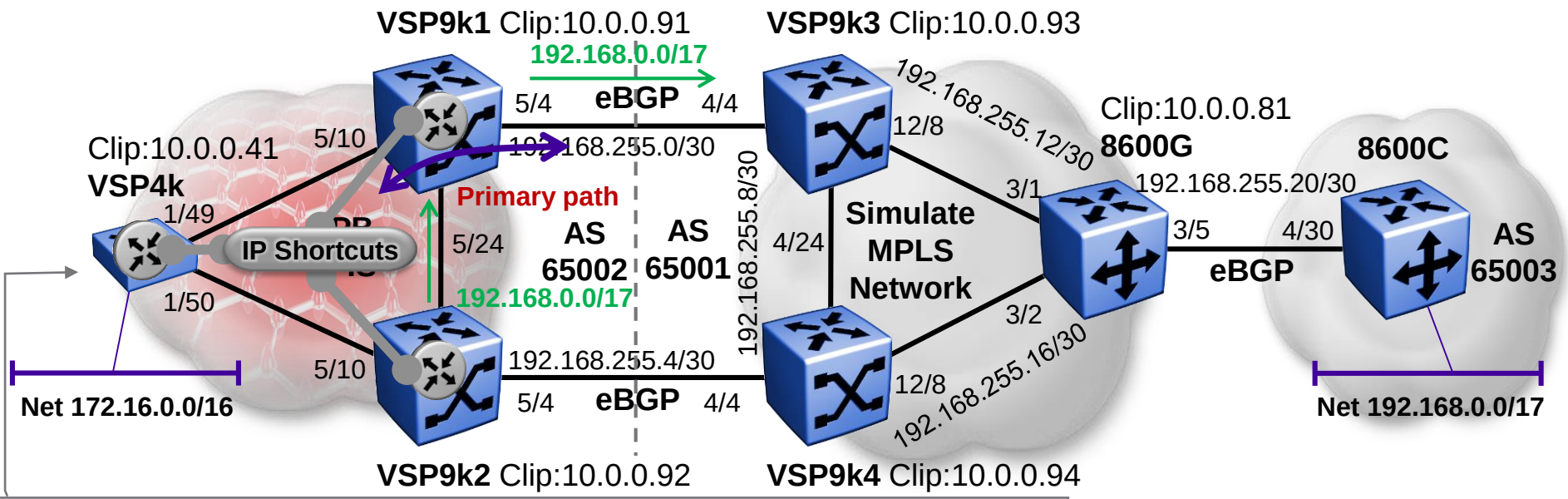
Forcing paths with BGP and SPB
(a) GRT IP Shortcuts – Checking ISIS LSDB Routes




```
VSP9000-1:1# show isis lsdb ip-unicast
================================================================================
                          ISIS IP-UNICAST-ROUTE SUMMARY
================================================================================
                              PREFIX          TLV    LSP    HOST
I-SID     ADDRESS             LENGTH  METRIC  TYPE   FRAG   NAME
--------------------------------------------------------------------------------
-         10.0.0.41           32      1       135    0x2    VSP4000
-         172.16.0.0          16      1       135    0x2    VSP4000
-         10.0.0.91           32      1       135    0x2    VSP9000-1
-         192.168.255.0       30      1       135    0x2    VSP9000-1
-         192.168.0.0         17      2       135    0x2    VSP9000-1
-         10.0.0.92           32      1       135    0x2    VSP9000-2
-         192.168.255.4       30      1       135    0x2    VSP9000-2
```

- Ok now

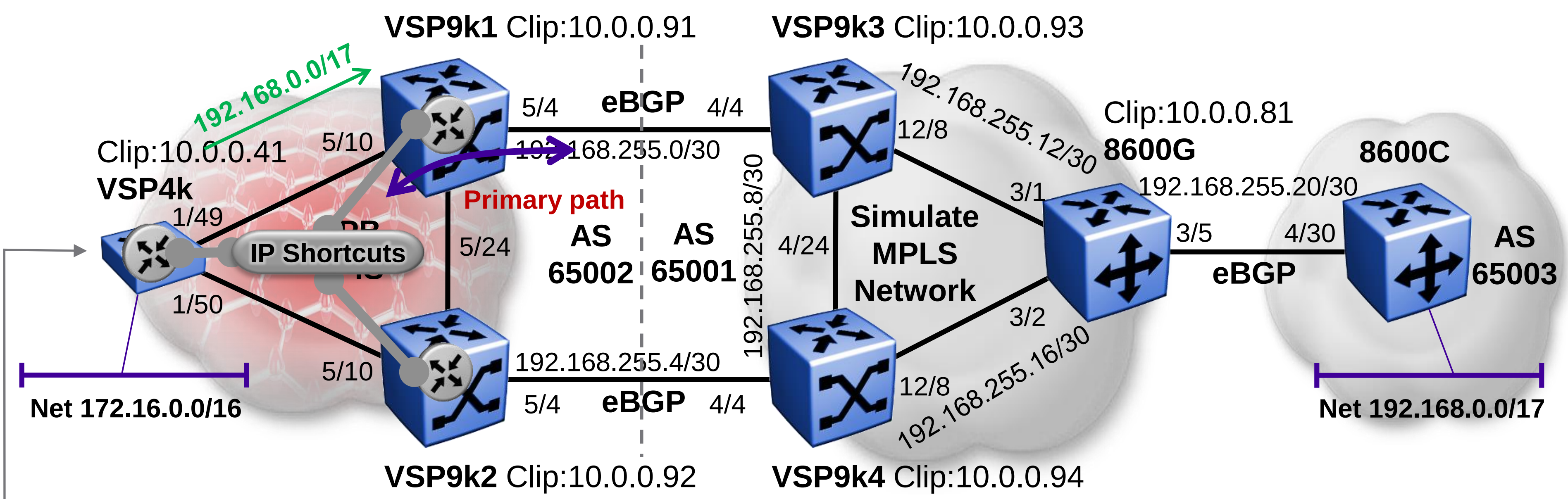
Forcing paths with BGP and SPB
(a) GRT IP Shortcuts – Checking SPB IP Routes




```
VSP4000:1# show isis spbm ip-unicast-fib
================================================================================
                        SPBM IP-UNICAST FIB ENTRY INFO
================================================================================
                                                          OUTGOING  SPBM       PREFIX
VRF       ISID    Destination        NH BEB              VLAN INTERFACE COST       COST
--------------------------------------------------------------------------------
GRT       -       10.0.0.91/32       VSP9000-1           4051 1/49      10         1
GRT       -       10.0.0.91/32       VSP9000-1           4052 1/49      10         1
GRT       -       10.0.0.92/32       VSP9000-2           4051 1/50      10         1
GRT       -       10.0.0.92/32       VSP9000-2           4052 1/50      10         1
GRT       -       192.168.0.0/17     VSP9000-1           4051 1/49      10         2
GRT       -       192.168.0.0/17     VSP9000-1           4052 1/49      10         2
GRT       -       192.168.255.0/30   VSP9000-1           4051 1/49      10         1
GRT       -       192.168.255.0/30   VSP9000-1           4052 1/49      10         1
GRT       -       192.168.255.4/30   VSP9000-2           4051 1/50      10         1
GRT       -       192.168.255.4/30   VSP9000-2           4052 1/50      10         1
```

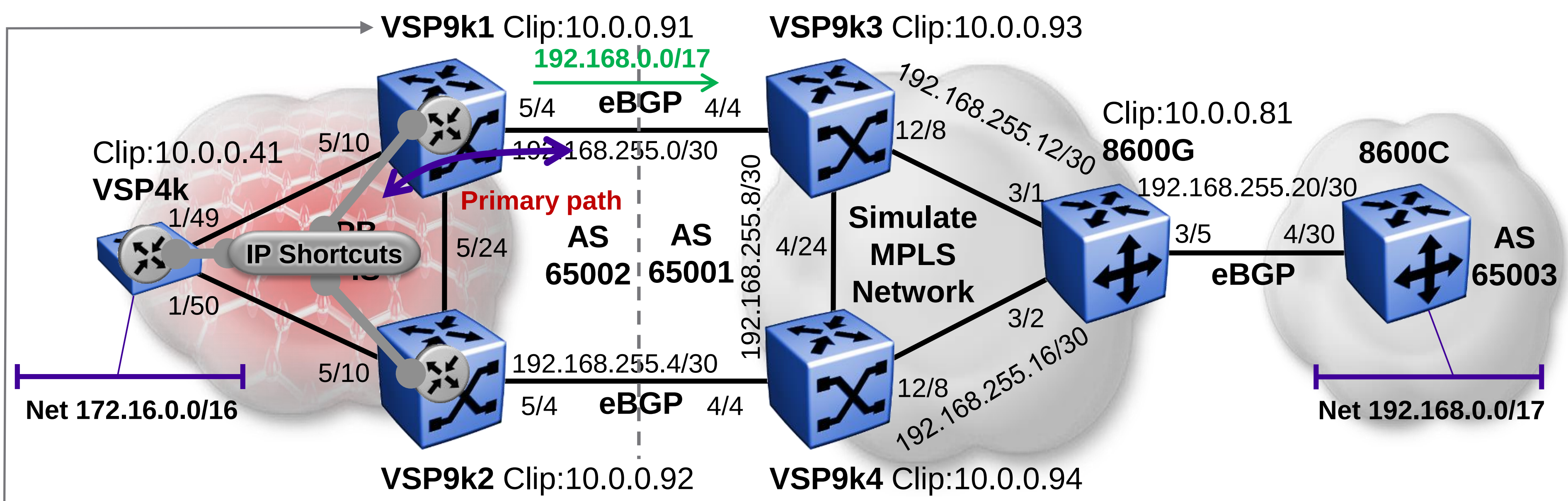
- Ok now

Forcing paths with BGP and SPB
(a) GRT IP Shortcuts – Checking IP Routes



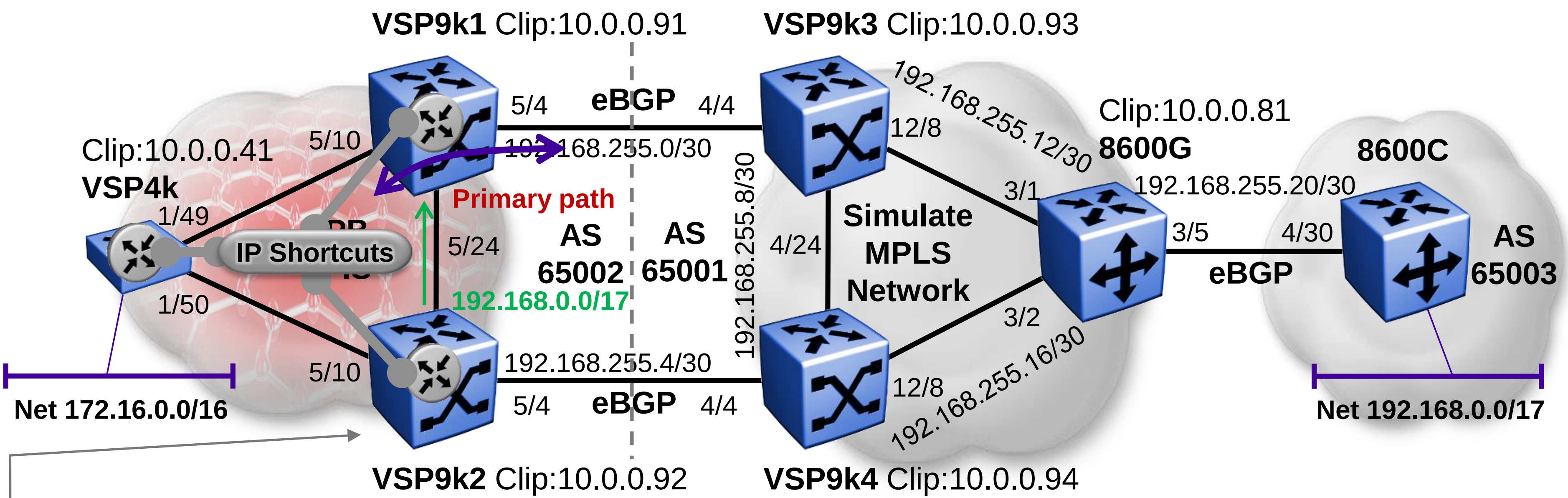

```
VSP4000:1#% show ip route
================================================================================
                              IP Route - GlobalRouter
================================================================================
                                                 NH                   INTER
DST             MASK            NEXT             VRF             COST FACE  PROT AGE TYPE PRF
--------------------------------------------------------------------------------
10.0.0.41       255.255.255.255 10.0.0.41        -               1    0     LOC  0   DB   0
10.0.0.91       255.255.255.255 VSP9000-1        GlobalRouter    10   4051  ISIS 0   IBS  7
10.0.0.92       255.255.255.255 VSP9000-2        GlobalRouter    10   4051  ISIS 0   IBS  7
172.16.0.0      255.255.0.0     172.16.0.41      -               1    0     LOC  0   DB   0
192.168.0.0     255.255.128.0   VSP9000-1        GlobalRouter    10   4051  ISIS 0   IBS  7
192.168.255.0   255.255.255.252 VSP9000-1        GlobalRouter    10   4051  ISIS 0   IBS  7
192.168.255.4   255.255.255.252 VSP9000-2        GlobalRouter    10   4051  ISIS 0   IBS  7
```

Forcing paths with BGP and SPB
(a) GRT IP Shortcuts – Checking IP Routes



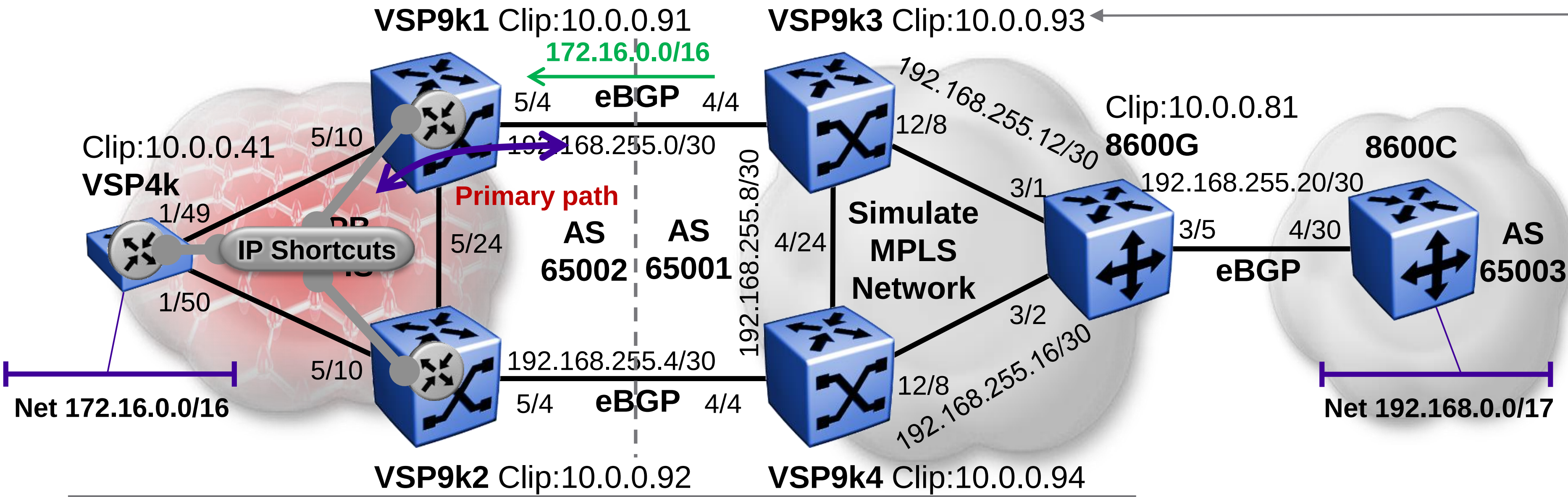

```
VSP9000-1:1#% show ip route
================================================================================
                              IP Route - GlobalRouter
================================================================================
                                                 NH                INTER
DST             MASK            NEXT             VRF/ISID     COST FACE  PROT AGE TYPE PRF
--------------------------------------------------------------------------------
10.0.0.41       255.255.255.255 VSP4000          GlobalRouter  10  4051  ISIS 0   IBS  50
10.0.0.91       255.255.255.255 10.0.0.91        -             1   0     LOC  0   DB   0
10.0.0.92       255.255.255.255 VSP9000-2        GlobalRouter  10  4051  ISIS 0   IBS  50
172.16.0.0      255.255.0.0     VSP4000          GlobalRouter  10  4051  ISIS 0   IBS  50
192.168.0.0     255.255.128.0   192.168.255.1    GlobalRouter  2    5/4  BGP  0   IB   45
192.168.255.0   255.255.255.252 192.168.255.2    -             1    5/4  LOC  0   DB   0
192.168.255.4   255.255.255.252 VSP9000-2        GlobalRouter  10  4051  ISIS 0   IBS  50
```

Forcing paths with BGP and SPB
(a) GRT IP Shortcuts – Checking IP Routes



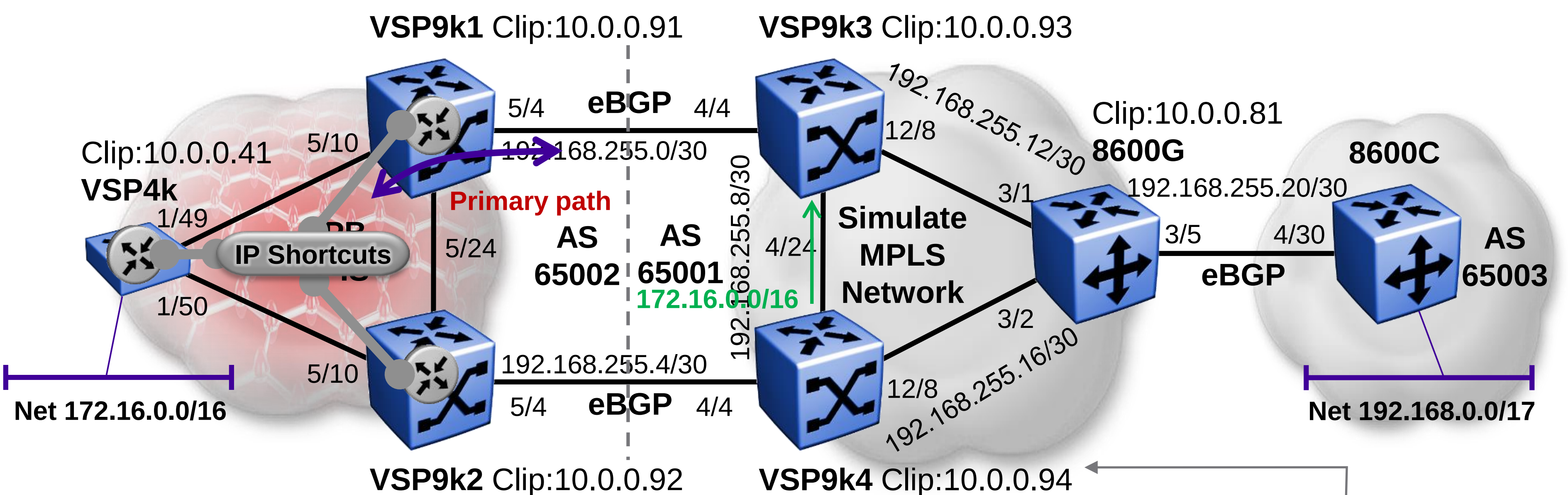

```
VSP9000-2:1#% show ip route
================================================================================
                                IP Route - GlobalRouter
================================================================================
                                                 NH               INTER
DST              MASK            NEXT            VRF/ISID    COST FACE  PROT AGE TYPE PRF
--------------------------------------------------------------------------------
10.0.0.41        255.255.255.255 VSP4000         GlobalRouter 10   4051  ISIS 0   IBS  50
10.0.0.91        255.255.255.255 VSP9000-1       GlobalRouter 10   4051  ISIS 0   IBS  50
10.0.0.92        255.255.255.255 10.0.0.92       -            1    0     LOC  0   DB   0
172.16.0.0       255.255.0.0     VSP4000         GlobalRouter 10   4051  ISIS 0   IBS  50
192.168.0.0      255.255.128.0   VSP9000-1       GlobalRouter 2    4051  BGP  0   IBS  175
192.168.255.0    255.255.255.252 VSP9000-1       GlobalRouter 10   4051  ISIS 0   IBS  50
192.168.255.4    255.255.255.252 192.168.255.6   -            1     5/4  LOC  0   DB   0
```

Forcing paths with BGP and SPB
(a) GRT IP Shortcuts – Checking IP Routes



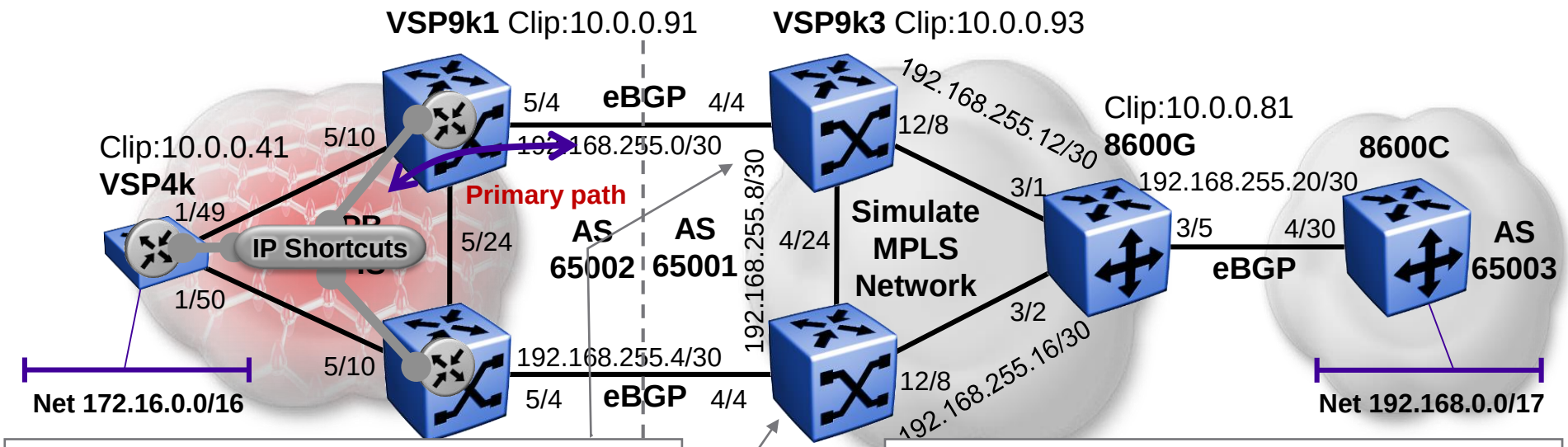

```
VSP9000-3:1#% show ip route
================================================================================
                          IP Route - GlobalRouter
================================================================================
                                              NH                     INTER
DST           MASK            NEXT            VRF/ISID          COST FACE  PROT AGE TYPE PRF
--------------------------------------------------------------------------------
10.0.0.41     255.255.255.255 192.168.255.2   GlobalRouter      1     4/4  BGP  0   IB   45
10.0.0.81     255.255.255.255 192.168.255.14  GlobalRouter      11   12/8  OSPF 0   IB   20
10.0.0.91     255.255.255.255 192.168.255.2   GlobalRouter      1     4/4  BGP  0   IB   45
10.0.0.92     255.255.255.255 192.168.255.2   GlobalRouter      1     4/4  BGP  0   IB   45
10.0.0.93     255.255.255.255 10.0.0.93       -                 1    0     LOC  0   DB   0
10.0.0.94     255.255.255.255 192.168.255.10  GlobalRouter      11    4/24 OSPF 0   IB   20
172.16.0.0    255.255.0.0     192.168.255.2   GlobalRouter      1     4/4  BGP  0   IB   45
192.168.0.0   255.255.128.0   192.168.255.14  GlobalRouter      1    12/8  BGP  0   IB   175
192.168.255.0 255.255.255.252 192.168.255.1   -                 1     4/4  LOC  0   DB   0
192.168.255.4 255.255.255.252 192.168.255.10  GlobalRouter      2     4/24 OSPF 0   IB   20
192.168.255.8 255.255.255.252 192.168.255.9   -                 1     4/24 LOC  0   DB   0
192.168.255.12 255.255.255.252 192.168.255.13 -                 1    12/8  LOC  0   DB   0
192.168.255.16 255.255.255.252 192.168.255.10 GlobalRouter      2     4/24 OSPF 0   IB   20
192.168.255.20 255.255.255.252 192.168.255.14 GlobalRouter      2    12/8  OSPF 0   IB   20
```

Forcing paths with BGP and SPB
(a) GRT IP Shortcuts – Checking IP Routes




```
VSP9000-4:1#% show ip route
================================================================================
                              IP Route - GlobalRouter
================================================================================
                                                 NH                 INTER
DST             MASK            NEXT             VRF/ISID     COST  FACE PROT AGE TYPE PRF
--------------------------------------------------------------------------------
10.0.0.41       255.255.255.255 192.168.255.9    GlobalRouter  1     4/24 BGP  0   IB   175
10.0.0.81       255.255.255.255 192.168.255.18   GlobalRouter  11    12/8 OSPF 0   IB   20
10.0.0.91       255.255.255.255 192.168.255.9    GlobalRouter  1     4/24 BGP  0   IB   175
10.0.0.92       255.255.255.255 192.168.255.9    GlobalRouter  1     4/24 BGP  0   IB   175
10.0.0.93       255.255.255.255 192.168.255.9    GlobalRouter  11    4/24 OSPF 0   IB   20
10.0.0.94       255.255.255.255 10.0.0.94        -             1     0    LOC  0   DB   0
172.16.0.0      255.255.0.0     192.168.255.9    GlobalRouter  1     4/24 BGP  0   IB   175
192.168.0.0     255.255.128.0   192.168.255.18   GlobalRouter  1     12/8 BGP  0   IB   175
192.168.255.0   255.255.255.252 192.168.255.9    GlobalRouter  2     4/24 OSPF 0   IB   20
192.168.255.4   255.255.255.252 192.168.255.5    -             1     4/4  LOC  0   DB   0
192.168.255.8   255.255.255.252 192.168.255.10   -             1     4/24 LOC  0   DB   0
192.168.255.12  255.255.255.252 192.168.255.9    GlobalRouter  2     4/24 OSPF 0   IB   20
192.168.255.16  255.255.255.252 192.168.255.17   -             1     12/8 LOC  0   DB   0
192.168.255.20  255.255.255.252 192.168.255.18   GlobalRouter  2     12/8 OSPF 0   IB   20
```

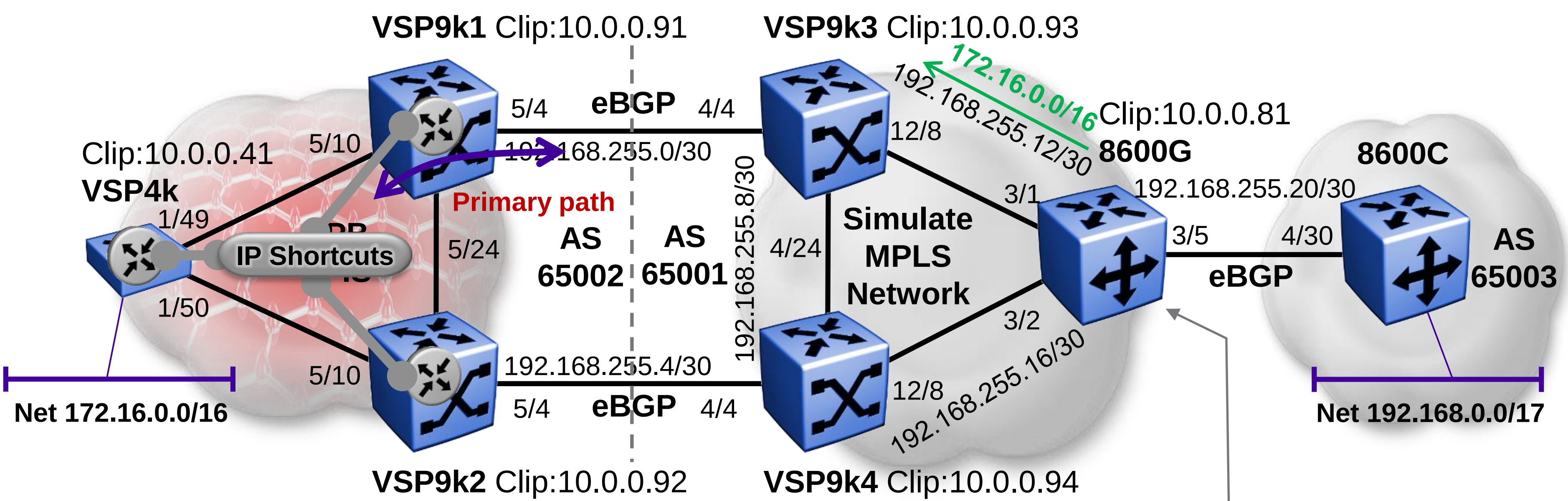
Forcing paths with BGP and SPB
(a) GRT IP Shortcuts – Checking BGP Routes




```
VSP9000-3:1#% show ip bgp route
================================================================
                        BGP Routes - GlobalRouter
================================================================
NETWORK/MASK       PEER REM ADDR   NEXTHOP ADDRESS ORG LOC PREF
----------------------------------------------------------------
10.0.0.41/32       192.168.255.2   192.168.255.2   INC 200
        AS_PATH: (65002)
10.0.0.41/32       10.0.0.94       192.168.255.6   INC 20
        AS_PATH: (65002)
10.0.0.91/32       192.168.255.2   192.168.255.2   INC 200
        AS_PATH: (65002)
10.0.0.91/32       10.0.0.94       192.168.255.6   INC 20
        AS_PATH: (65002)
10.0.0.92/32       192.168.255.2   192.168.255.2   INC 200
        AS_PATH: (65002)
10.0.0.92/32       10.0.0.94       192.168.255.6   INC 20
        AS_PATH: (65002)
172.16.0.0/16      192.168.255.2   192.168.255.2   INC 200
        AS_PATH: (65002)
172.16.0.0/16      10.0.0.94       192.168.255.6   INC 20
        AS_PATH: (65002)
192.168.0.0/17     10.0.0.81       192.168.255.22  IGP 100
        AS_PATH: (65003)
```

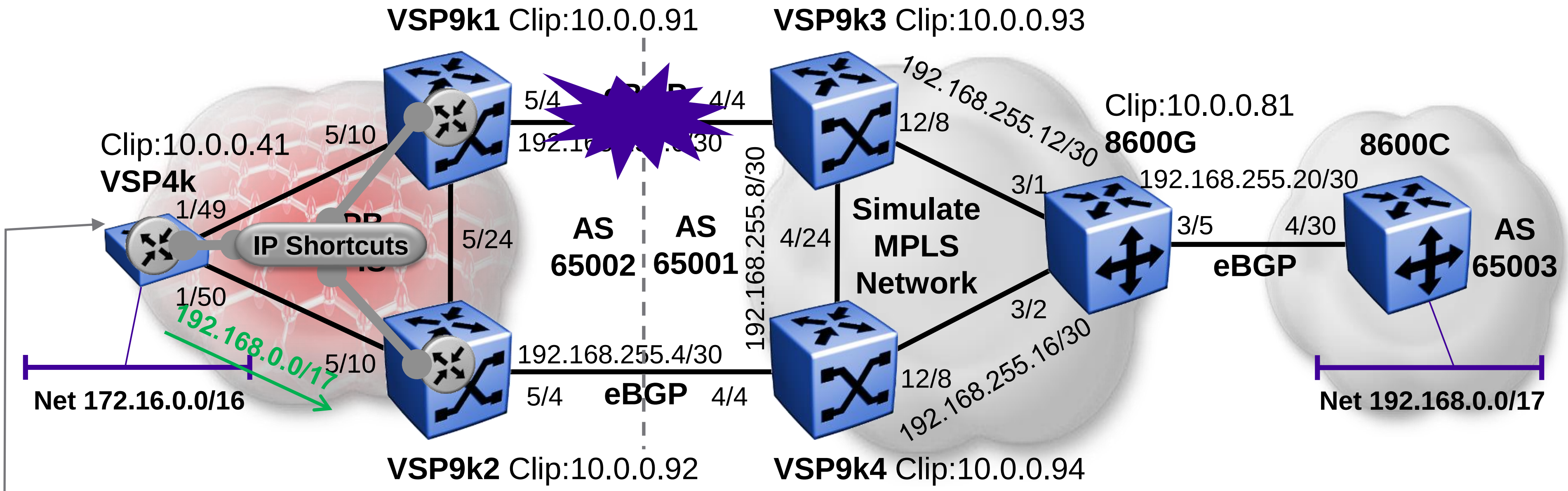
```
VSP9000-4:1#% show ip bgp route
================================================================
                        BGP Routes - GlobalRouter
================================================================
NETWORK/MASK       PEER REM ADDR   NEXTHOP ADDRESS ORG LOC PREF
----------------------------------------------------------------
10.0.0.41/32       10.0.0.93       192.168.255.2   INC 200
        AS_PATH: (65002)
10.0.0.41/32       192.168.255.6   192.168.255.6   INC 20
        AS_PATH: (65002)
10.0.0.91/32       10.0.0.93       192.168.255.2   INC 200
        AS_PATH: (65002)
10.0.0.91/32       192.168.255.6   192.168.255.6   INC 20
        AS_PATH: (65002)
10.0.0.92/32       10.0.0.93       192.168.255.2   INC 200
        AS_PATH: (65002)
10.0.0.92/32       192.168.255.6   192.168.255.6   INC 20
        AS_PATH: (65002)
172.16.0.0/16      10.0.0.93       192.168.255.2   INC 200
        AS_PATH: (65002)
172.16.0.0/16      192.168.255.6   192.168.255.6   INC 20
        AS_PATH: (65002)
192.168.0.0/17     10.0.0.81       192.168.255.22  IGP 100
        AS_PATH: (65003)
```

Forcing paths with BGP and SPB
(a) GRT IP Shortcuts – Checking IP Routes



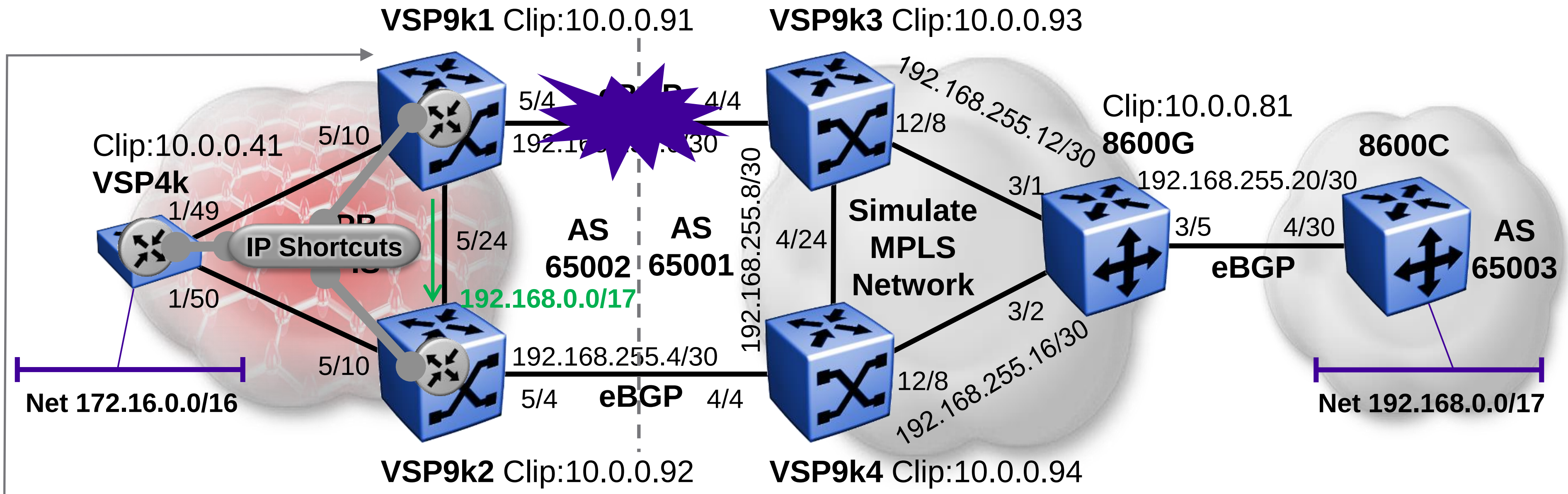

```
8600G:5#% show ip route
==========================================================================================
                                 IP Route - GlobalRouter
==========================================================================================
                                                      NH              INTER
DST             MASK            NEXT                  VRF          COST FACE  PROT AGE TYPE PRF
------------------------------------------------------------------------------------------
10.0.0.41       255.255.255.255 192.168.255.13        GlobalRout~ 1      3/1  BGP  0   IB   175
10.0.0.81       255.255.255.255 10.0.0.81              -          1    0      LOC  0   DB   0
10.0.0.91       255.255.255.255 192.168.255.13        GlobalRout~ 1      3/1  BGP  0   IB   175
10.0.0.92       255.255.255.255 192.168.255.13        GlobalRout~ 1      3/1  BGP  0   IB   175
10.0.0.93       255.255.255.255 192.168.255.13        GlobalRout~ 11     3/1  OSPF 0   IB   20
10.0.0.94       255.255.255.255 192.168.255.17        GlobalRout~ 11     3/2  OSPF 0   IB   20
172.16.0.0      255.255.0.0     192.168.255.13        GlobalRout~ 1      3/1  BGP  0   IB   175
192.168.0.0     255.255.128.0   192.168.255.22        GlobalRout~ 1      3/5  BGP  0   IB   45
192.168.255.0   255.255.255.252 192.168.255.13        GlobalRout~ 2      3/1  OSPF 0   IB   20
192.168.255.4   255.255.255.252 192.168.255.17        GlobalRout~ 2      3/2  OSPF 0   IB   20
192.168.255.8   255.255.255.252 192.168.255.17        GlobalRout~ 2      3/2  OSPF 0   IB   20
192.168.255.12  255.255.255.252 192.168.255.14         -          1      3/1  LOC  0   DB   0
192.168.255.16  255.255.255.252 192.168.255.18         -          1      3/2  LOC  0   DB   0
192.168.255.20  255.255.255.252 192.168.255.21         -          1      3/5  LOC  0   DB   0
```

Forcing paths with BGP and SPB
(a) GRT IP Shortcuts – Checking IP Routes



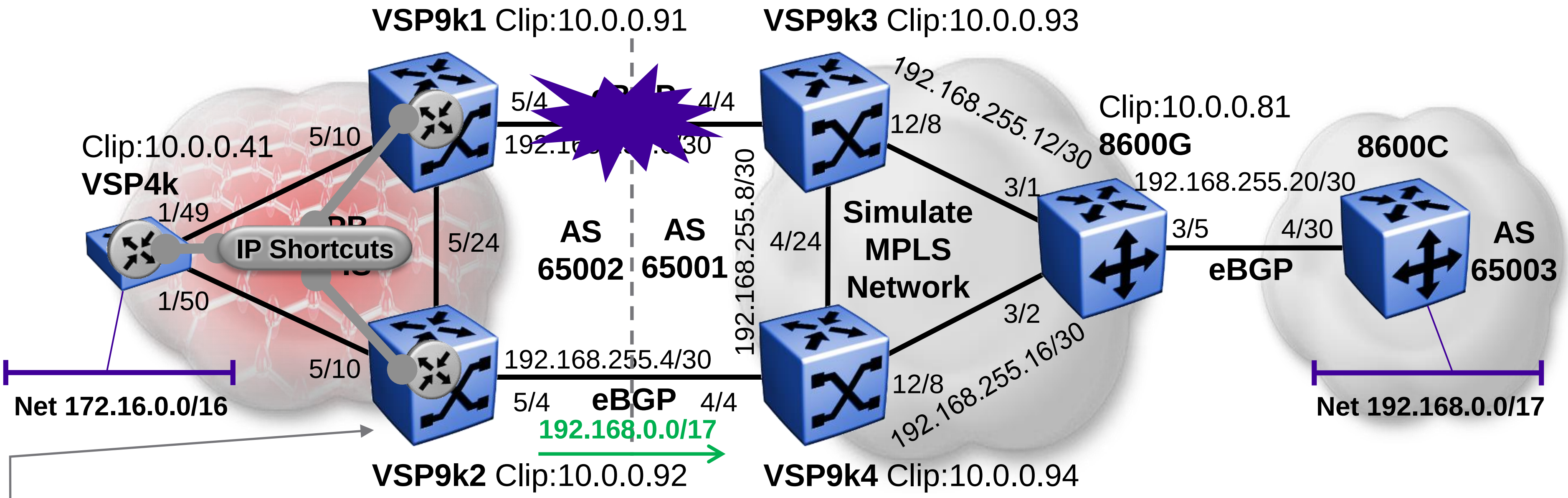

```
VSP4000:1#% show ip route
================================================================================
                              IP Route - GlobalRouter
================================================================================
                                             NH                 INTER
DST            MASK            NEXT          VRF            COST FACE  PROT AGE TYPE PRF
--------------------------------------------------------------------------------
10.0.0.41      255.255.255.255 10.0.0.41     -              1    0     LOC  0   DB   0
10.0.0.91      255.255.255.255 VSP9000-1     GlobalRouter   10   4051  ISIS 0   IBS  7
10.0.0.92      255.255.255.255 VSP9000-2     GlobalRouter   10   4051  ISIS 0   IBS  7
172.16.0.0     255.255.0.0     172.16.0.41   -              1    0     LOC  0   DB   0
192.168.0.0    255.255.128.0   VSP9000-2     GlobalRouter   10   4051  ISIS 0   IBS  7
192.168.255.4  255.255.255.252 VSP9000-2     GlobalRouter   10   4051  ISIS 0   IBS  7
```

Forcing paths with BGP and SPB
(a) GRT IP Shortcuts – Checking IP Routes



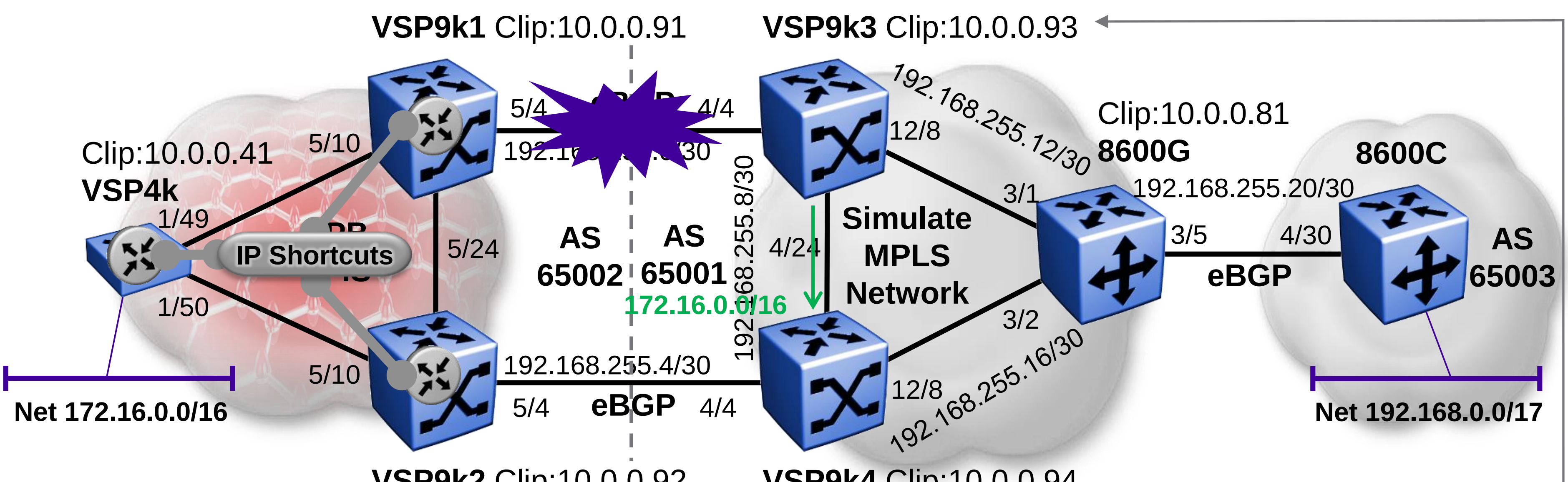

```
VSP9000-1:1#% show ip route
================================================================================
                              IP Route - GlobalRouter
================================================================================
                                                 NH                INTER
DST             MASK            NEXT             VRF/ISID     COST FACE  PROT AGE TYPE PRF
--------------------------------------------------------------------------------
10.0.0.41       255.255.255.255 VSP4000          GlobalRouter 10   4051  ISIS 0   IBS  50
10.0.0.91       255.255.255.255 10.0.0.91        -            1    0     LOC  0   DB   0
10.0.0.92       255.255.255.255 VSP9000-2        GlobalRouter 10   4051  ISIS 0   IBS  50
172.16.0.0      255.255.0.0     VSP4000          GlobalRouter 10   4051  ISIS 0   IBS  50
192.168.0.0     255.255.128.0   VSP9000-2        GlobalRouter 2    4051  BGP  0   IBS  175
192.168.255.4   255.255.255.252 VSP9000-2        GlobalRouter 10   4051  ISIS 0   IBS  50
```

Forcing paths with BGP and SPB
(a) GRT IP Shortcuts – Checking IP Routes



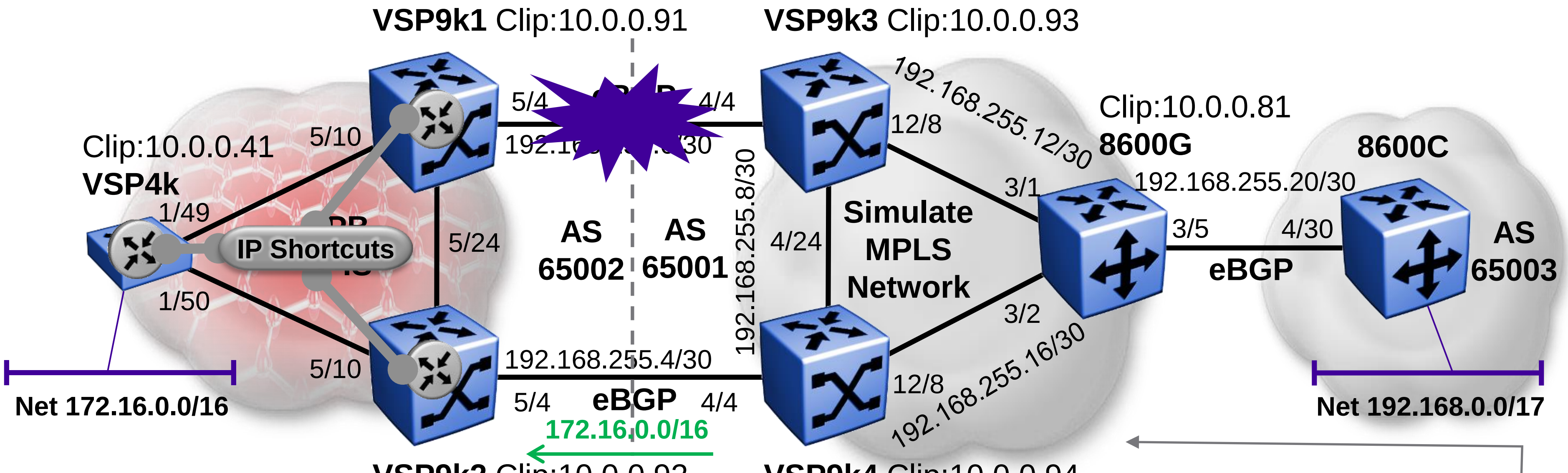

```
VSP9000-2:1#% show ip route
==========================================================================================
                                  IP Route - GlobalRouter
==========================================================================================
                                                    NH                   INTER
DST            MASK            NEXT                 VRF/ISID        COST FACE   PROT AGE TYPE PRF
------------------------------------------------------------------------------------------
10.0.0.41      255.255.255.255 VSP4000              GlobalRouter    10   4051   ISIS 0   IBS  50
10.0.0.91      255.255.255.255 VSP9000-1            GlobalRouter    10   4051   ISIS 0   IBS  50
10.0.0.92      255.255.255.255 10.0.0.92            -               1    0      LOC  0   DB   0
172.16.0.0     255.255.0.0     VSP4000              GlobalRouter    10   4051   ISIS 0   IBS  50
192.168.0.0    255.255.128.0   192.168.255.5        GlobalRouter    2     5/4   BGP  0   IB   45
192.168.255.4  255.255.255.252 192.168.255.6        -               1     5/4   LOC  0   DB   0
```

Forcing paths with BGP and SPB
(a) GRT IP Shortcuts – Checking IP Routes



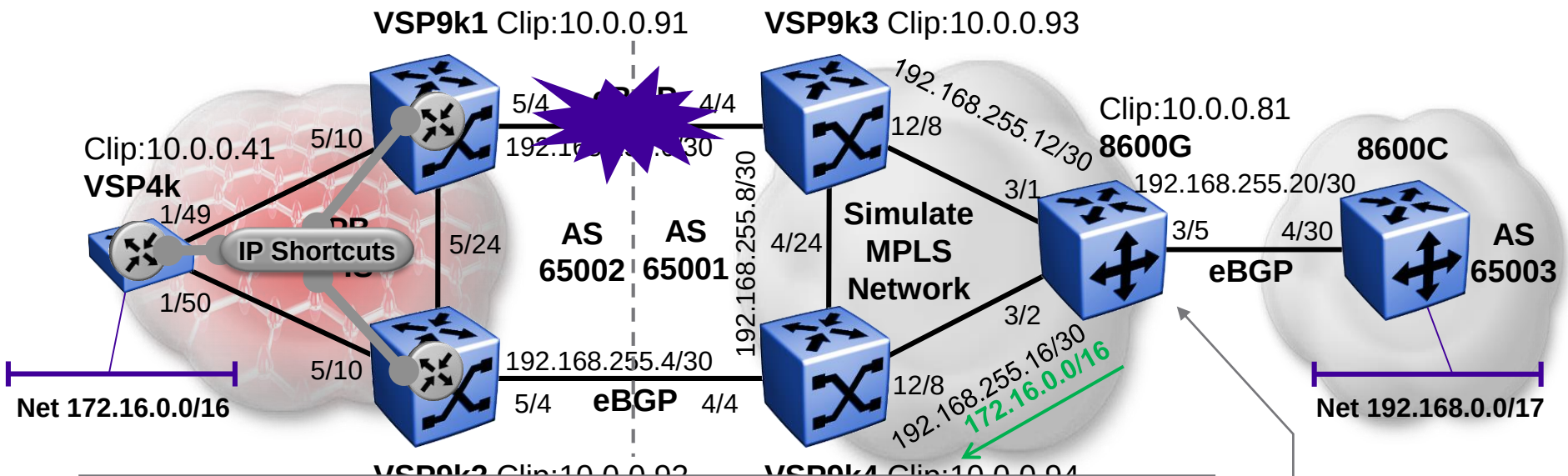

```
VSP9000-3:1#% show ip route
================================================================================================
                                    IP Route - GlobalRouter
================================================================================================
                                                    NH                  INTER
DST             MASK            NEXT                VRF/ISID        COST FACE   PROT AGE TYPE PRF
------------------------------------------------------------------------------------------------
10.0.0.41       255.255.255.255 192.168.255.10      GlobalRouter    1     4/24  BGP   0   IB   175
10.0.0.81       255.255.255.255 192.168.255.14      GlobalRouter    11   12/8   OSPF  0   IB   20
10.0.0.91       255.255.255.255 192.168.255.10      GlobalRouter    1     4/24  BGP   0   IB   175
10.0.0.92       255.255.255.255 192.168.255.10      GlobalRouter    1     4/24  BGP   0   IB   175
10.0.0.93       255.255.255.255 10.0.0.93           -               1    0      LOC   0   DB   0
10.0.0.94       255.255.255.255 192.168.255.10      GlobalRouter    11    4/24  OSPF  0   IB   20
172.16.0.0      255.255.0.0     192.168.255.10      GlobalRouter    1     4/24  BGP   0   IB   175
192.168.0.0     255.255.128.0   192.168.255.14      GlobalRouter    1    12/8   BGP   0   IB   175
192.168.255.4   255.255.255.252 192.168.255.10      GlobalRouter    2     4/24  OSPF  0   IB   20
192.168.255.8   255.255.255.252 192.168.255.9       -               1     4/24  LOC   0   DB   0
192.168.255.12  255.255.255.252 192.168.255.13      -               1    12/8   LOC   0   DB   0
192.168.255.16  255.255.255.252 192.168.255.10      GlobalRouter    2     4/24  OSPF  0   IB   20
192.168.255.20  255.255.255.252 192.168.255.14      GlobalRouter    2    12/8   OSPF  0   IB   20
```

Forcing paths with BGP and SPB
(a) GRT IP Shortcuts – Checking IP Routes



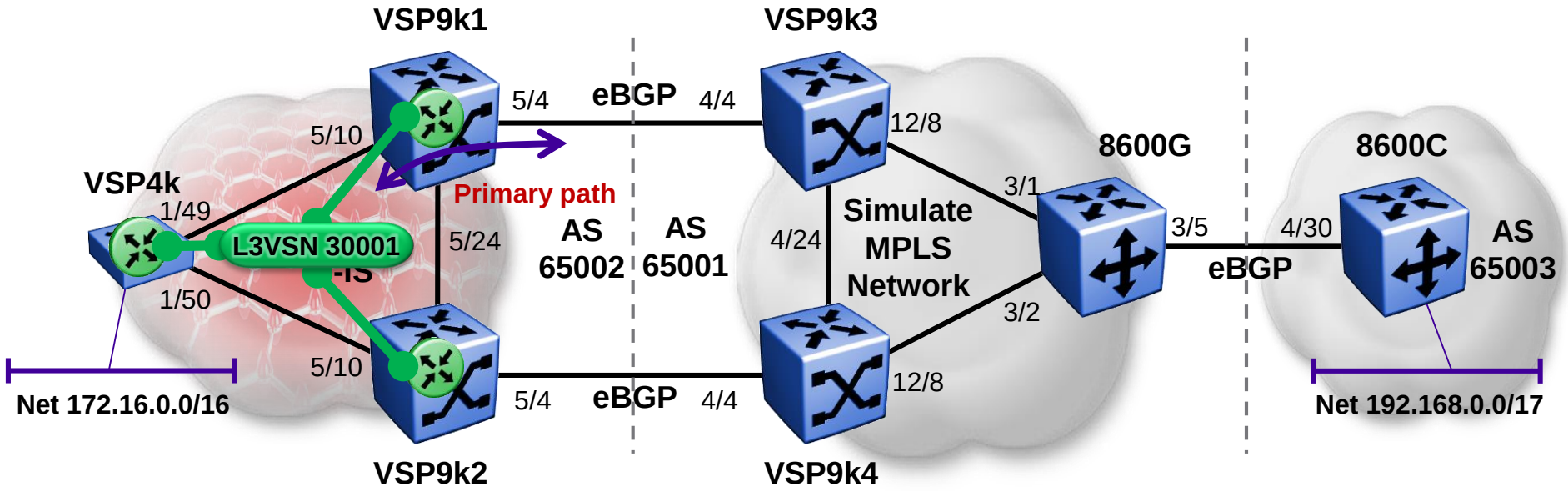

```
VSP9000-4:1#% show ip route
================================================================================================
                                  IP Route - GlobalRouter
================================================================================================
                                                    NH                       INTER
DST             MASK            NEXT                VRF/ISID          COST   FACE   PROT AGE TYPE PRF
------------------------------------------------------------------------------------------------
10.0.0.41       255.255.255.255 192.168.255.6       GlobalRouter      1       4/4   BGP  0   IB   45
10.0.0.81       255.255.255.255 192.168.255.18      GlobalRouter      11     12/8   OSPF 0   IB   20
10.0.0.91       255.255.255.255 192.168.255.6       GlobalRouter      1       4/4   BGP  0   IB   45
10.0.0.92       255.255.255.255 192.168.255.6       GlobalRouter      1       4/4   BGP  0   IB   45
10.0.0.93       255.255.255.255 192.168.255.9       GlobalRouter      11      4/24  OSPF 0   IB   20
10.0.0.94       255.255.255.255 10.0.0.94           -                 1      0      LOC  0   DB   0
172.16.0.0      255.255.0.0     192.168.255.6       GlobalRouter      1       4/4   BGP  0   IB   45
192.168.0.0     255.255.128.0   192.168.255.18      GlobalRouter      1      12/8   BGP  0   IB   175
192.168.255.4   255.255.255.252 192.168.255.5       -                 1       4/4   LOC  0   DB   0
192.168.255.8   255.255.255.252 192.168.255.10      -                 1       4/24  LOC  0   DB   0
192.168.255.12  255.255.255.252 192.168.255.9       GlobalRouter      2       4/24  OSPF 0   IB   20
192.168.255.16  255.255.255.252 192.168.255.17      -                 1      12/8   LOC  0   DB   0
192.168.255.20  255.255.255.252 192.168.255.18      GlobalRouter      2      12/8   OSPF 0   IB   20
```

Forcing paths with BGP and SPB
(a) GRT IP Shortcuts – Checking IP Routes



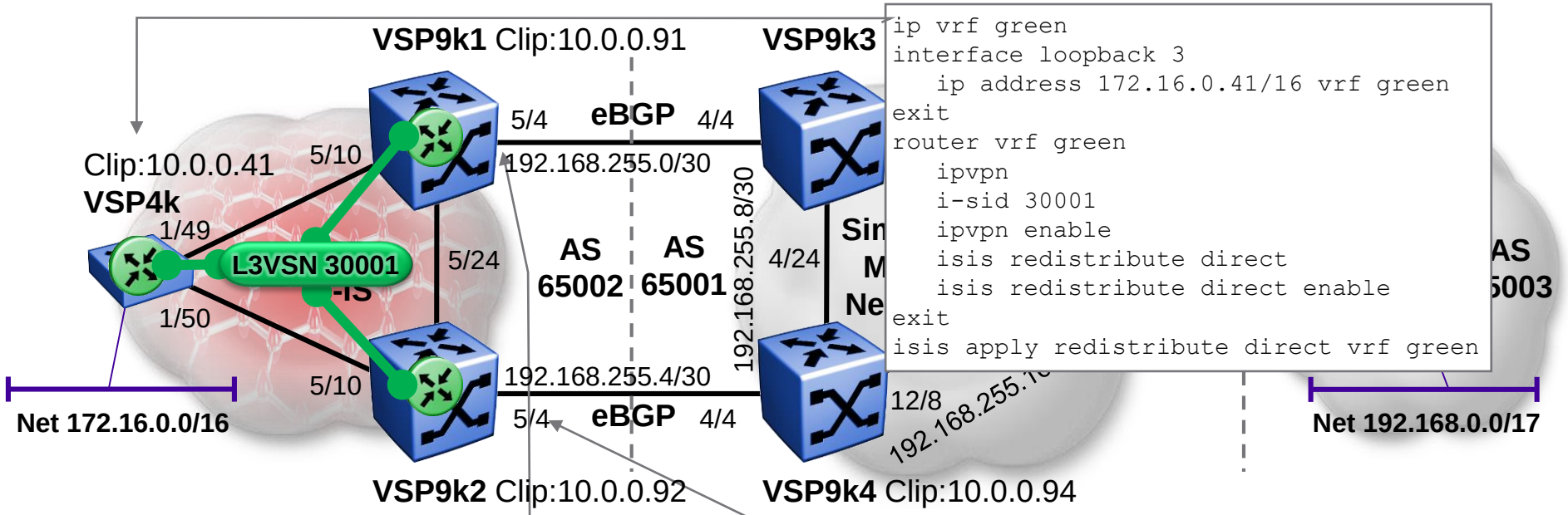

```
8600G:5#% show ip route
================================================================================
                              IP Route - GlobalRouter
================================================================================
                                                    NH              INTER
DST             MASK            NEXT                VRF         COST FACE  PROT AGE TYPE PRF
--------------------------------------------------------------------------------
10.0.0.41       255.255.255.255 192.168.255.17      GlobalRout~ 1     3/2  BGP  0   IB   175
10.0.0.81       255.255.255.255 10.0.0.81           -           1    0    LOC  0   DB   0
10.0.0.91       255.255.255.255 192.168.255.17      GlobalRout~ 1     3/2  BGP  0   IB   175
10.0.0.92       255.255.255.255 192.168.255.17      GlobalRout~ 1     3/2  BGP  0   IB   175
10.0.0.93       255.255.255.255 192.168.255.13      GlobalRout~ 11    3/1  OSPF 0   IB   20
10.0.0.94       255.255.255.255 192.168.255.17      GlobalRout~ 11    3/2  OSPF 0   IB   20
172.16.0.0      255.255.0.0     192.168.255.17      GlobalRout~ 1     3/2  BGP  0   IB   175
192.168.0.0     255.255.128.0   192.168.255.22      GlobalRout~ 1     3/5  BGP  0   IB   45
192.168.255.4   255.255.255.252 192.168.255.17      GlobalRout~ 2     3/2  OSPF 0   IB   20
192.168.255.8   255.255.255.252 192.168.255.17      GlobalRout~ 2     3/2  OSPF 0   IB   20
192.168.255.12  255.255.255.252 192.168.255.14      -           1     3/1  LOC  0   DB   0
192.168.255.16  255.255.255.252 192.168.255.18      -           1     3/2  LOC  0   DB   0
192.168.255.20  255.255.255.252 192.168.255.21      -           1     3/5  LOC  0   DB   0
```

Forcing paths with BGP and SPB
(b) VRF L3VSN



- We are now going to look at the case where BGP is redistributed into SPB VRF L3VSN

Forcing paths with BGP and SPB
(b) VRF L3VSN – VRF config



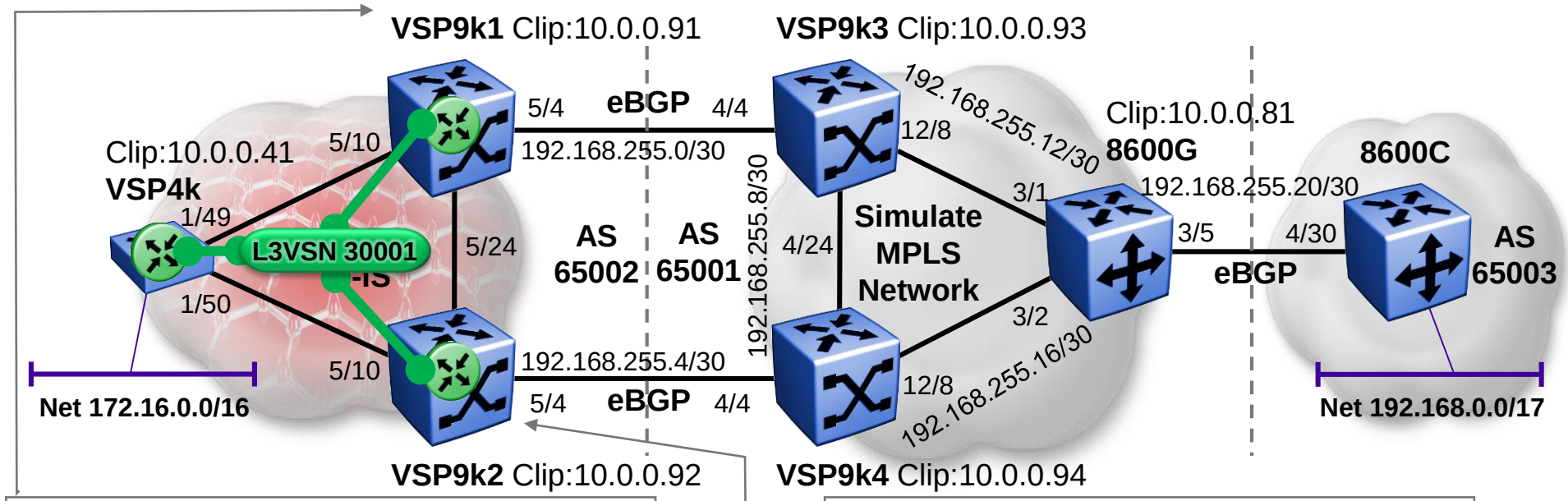

```
ip vrf green
interface loopback 3
   ip address 172.16.0.41/16 vrf green
exit
router vrf green
   ipvpn
   i-sid 30001
   ipvpn enable
   isis redistribute direct
   isis redistribute direct enable
exit
isis apply redistribute direct vrf green
```

```
ip vrf green
interface GigabitEthernet 5/4
   vrf green
   brouter vlan 2500 subnet 192.168.255.2/30
exit
router vrf green
   ipvpn
   i-sid 30001
   ipvpn enable
exit
```

```
ip vrf green
interface GigabitEthernet 5/4
   vrf green
   brouter vlan 2504 subnet 192.168.255.6/30
exit
router vrf green
   ipvpn
   i-sid 30001
   ipvpn enable
exit
```

- Since we can't use iBGP here, no need to redistribute directs to get the eBGP IP interfaces into ISIS

Forcing paths with BGP and SPB
(b) VRF L3VSN – BGP config

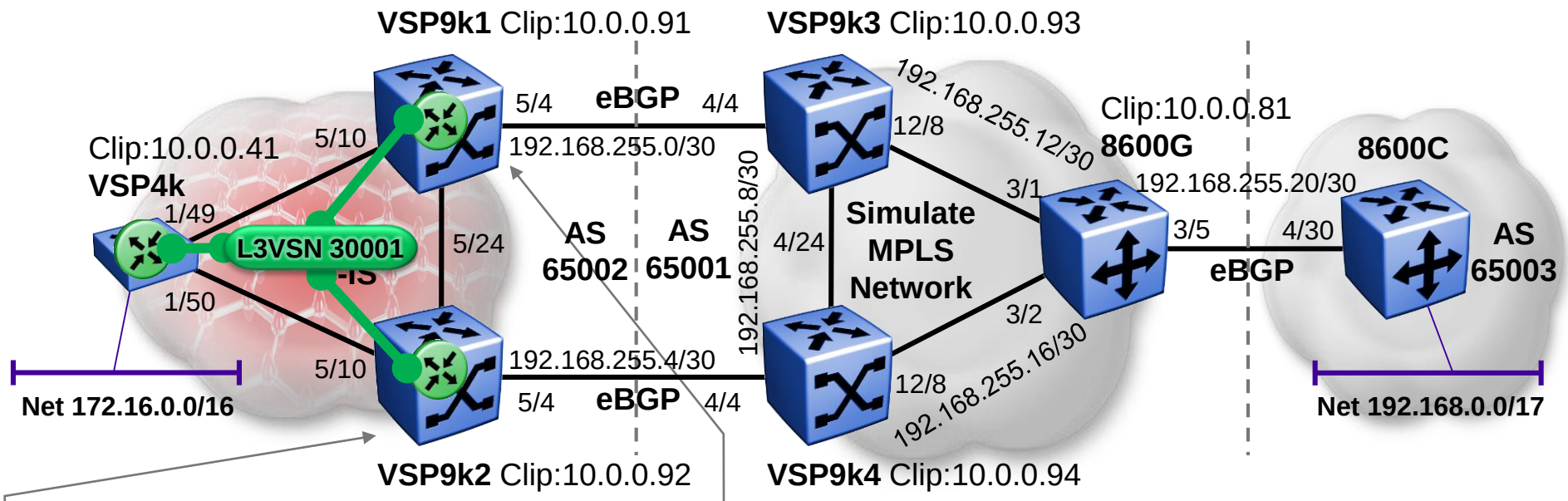



```
router bgp 65002
router vrf green
   ip bgp
   no ip bgp auto-summary
   no ip bgp synchronization
   no ip bgp aggregation
   ip bgp router-id 10.1.0.91
   ip bgp enable
   ip bgp neighbor 192.168.255.1
   ip bgp neighbor 192.168.255.1 remote-as 65001
   ip bgp neighbor 192.168.255.1 enable
exit
```

```
router bgp 65002
router vrf green
   ip bgp
   no ip bgp auto-summary
   no ip bgp synchronization
   no ip bgp aggregation
   ip bgp router-id 10.1.0.92
   ip bgp enable
   ip bgp neighbor 192.168.255.5
   ip bgp neighbor 192.168.255.5 remote-as 65001
   ip bgp neighbor 192.168.255.5 enable
exit
```

- Unfortunately iBGP is not supported on VRFs, so we can't leverage BGP Local_PREF as we did for the GRT
- Since we have no iBGP peerings, no real need to create a CLIP for 10.1.0.91 & 10.1.0.92 in the VRF

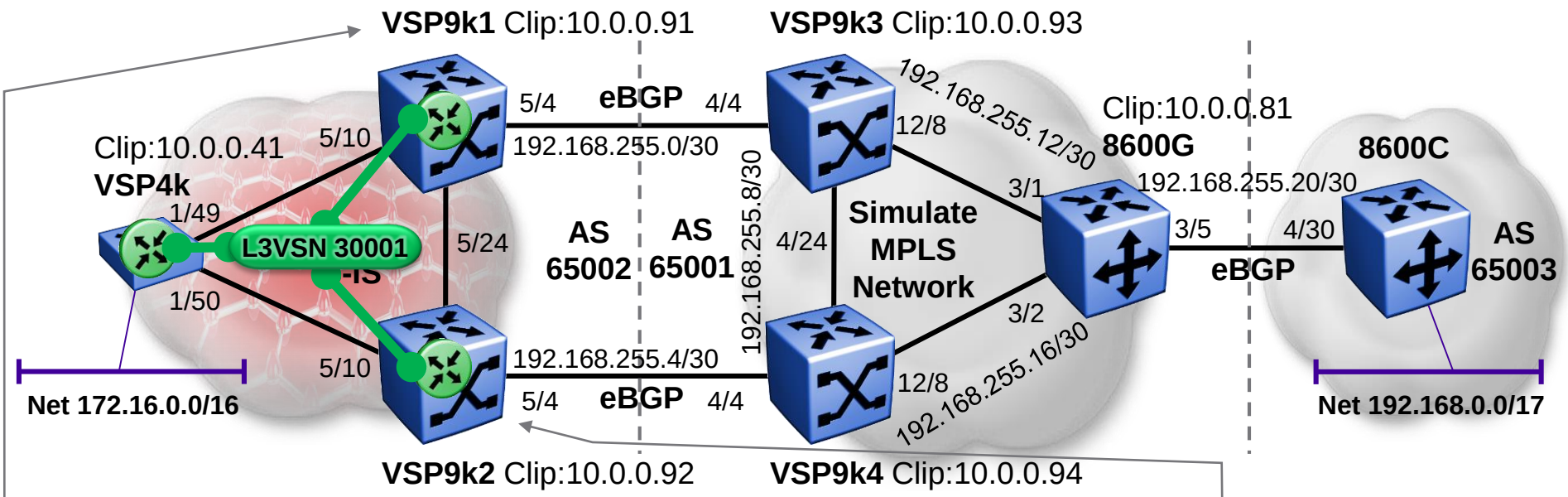
Forcing paths with BGP and SPB
(b) VRF L3VSN – BGP config




```
router vrf green
   ip route preference protocol spbm-level1 50
   isis redistribute bgp
   isis redistribute bgp enable
   ip bgp redistribute isis
   ip bgp redistribute isis enable
   no ip alternative-route
exit
isis apply redistribute bgp vrf green
ip bgp apply redistribute isis vrf green
```

- We set the SPB/ISIS preference to 50 so that:
  - eBGP routes (pref 45) will win over ISIS routes
- We will have to tinker with this setting later to achieve our goal
- Always disable ip alternative-route on redistributing routers

Forcing paths with BGP and SPB
(b) VRF L3VSN – Checking BGP Routes

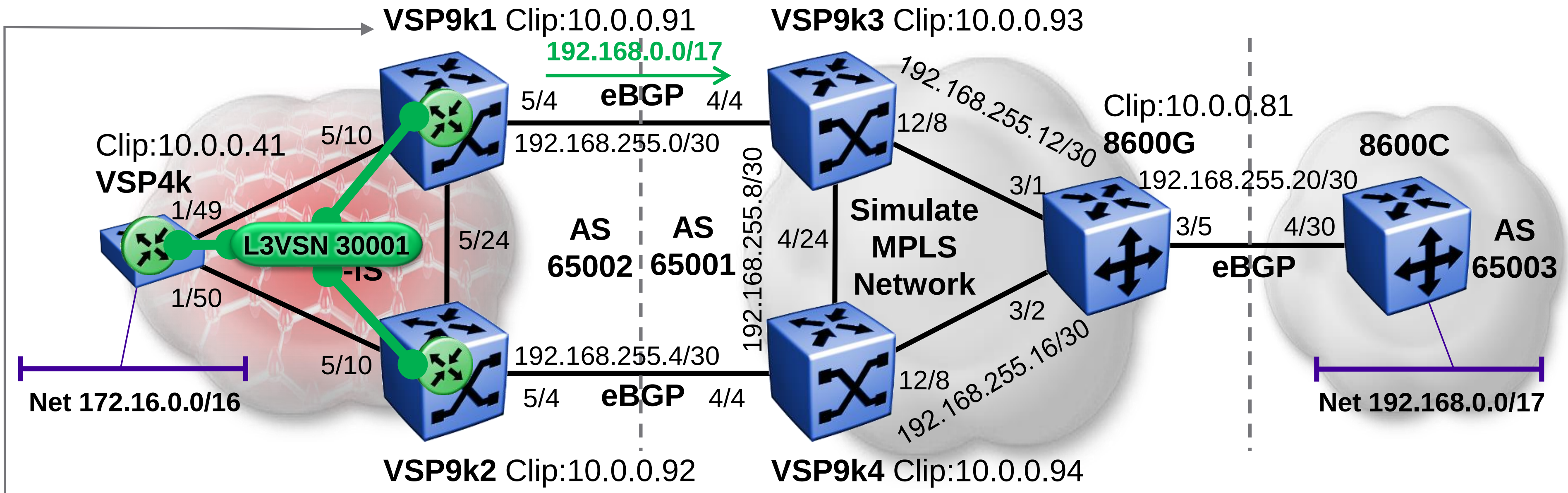



```
VSP9000-1:1# show ip bgp route vrf green
================================================================================
                            BGP Routes - VRF green
================================================================================
NETWORK/MASK       PEER REM ADDR   NEXTHOP ADDRESS ORG LOC PREF
--------------------------------------------------------------------------------
192.168.0.0/17     192.168.255.1   192.168.255.1   IGP 100
        AS_PATH: (65001 65003)
```

```
VSP9000-2:1# show ip bgp route vrf green
================================================================================
                            BGP Routes - VRF green
================================================================================
NETWORK/MASK       PEER REM ADDR   NEXTHOP ADDRESS ORG LOC PREF
--------------------------------------------------------------------------------
192.168.0.0/17     192.168.255.5   192.168.255.5   IGP 100
        AS_PATH: (65001 65003)
```

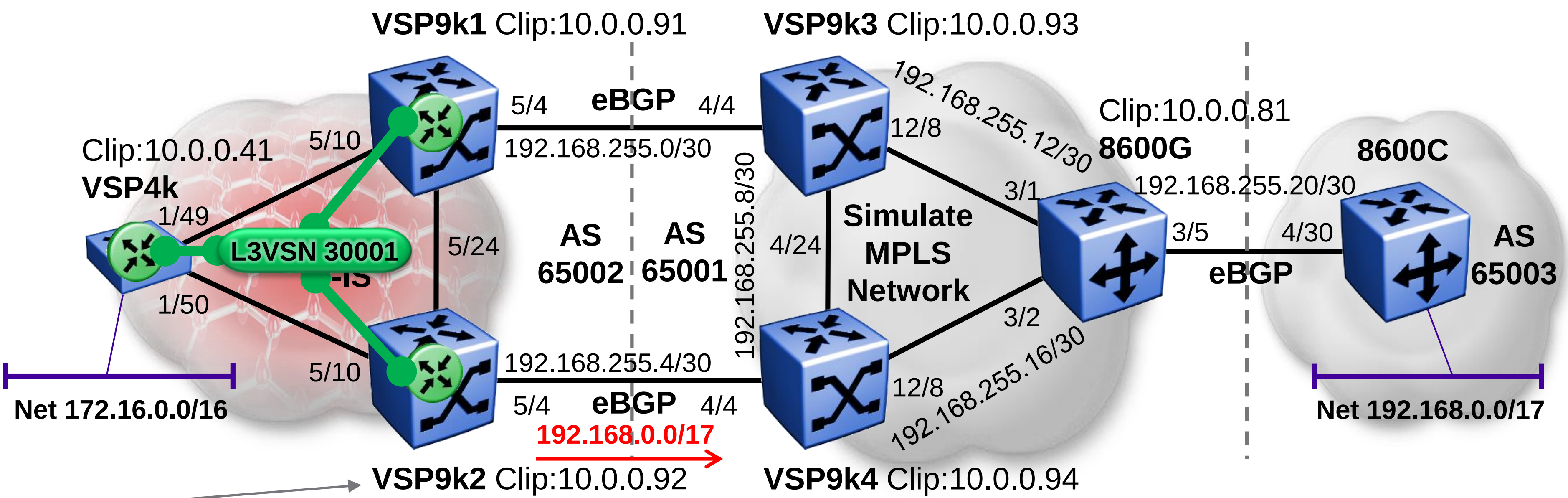
- Nice and simple, so far

Forcing paths with BGP and SPB
(b) VRF L3VSN – Checking IP Routes




```
VSP9000-1:1#% show ip route vrf green
==========================================================================================
                                   IP Route - VRF green
==========================================================================================
                                                   NH                  INTER
DST              MASK             NEXT             VRF/ISID       COST FACE  PROT AGE TYPE PRF
------------------------------------------------------------------------------------------
172.16.0.0       255.255.0.0      VSP4000-1        green          10   4051  ISIS 0   IBSV 50
192.168.0.0      255.255.128.0    192.168.255.1    green          2     5/4  BGP  0   IB   45
192.168.255.0    255.255.255.252  192.168.255.2    -              1     5/4  LOC  0   DB   0
```

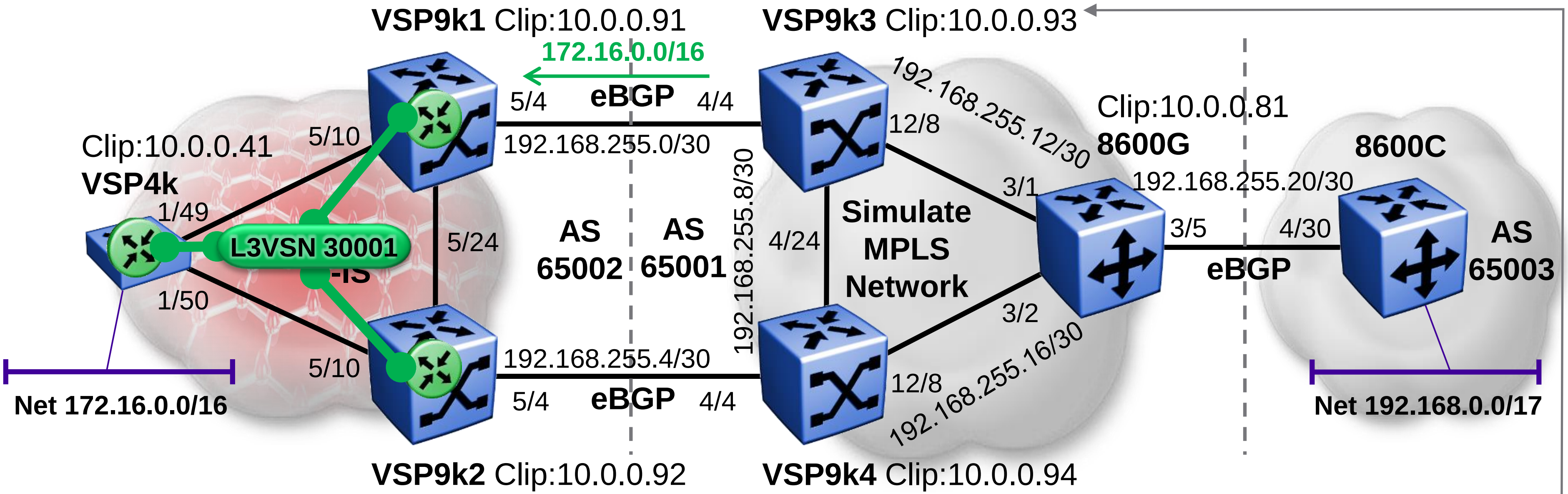
Forcing paths with BGP and SPB
(b) VRF L3VSN – Checking IP Routes




```
VSP9000-2:1#% show ip route vrf green
================================================================================
                                IP Route - VRF green
================================================================================
                                                NH                    INTER
DST              MASK             NEXT             VRF/ISID        COST  FACE  PROT AGE  TYPE PRF
--------------------------------------------------------------------------------
172.16.0.0       255.255.0.0      VSP4000-1        green           10    4051  ISIS 0    IBSV 50
192.168.0.0      255.255.128.0    192.168.255.5    green           2      5/4  BGP  0    IB   45
192.168.255.4    255.255.255.252  192.168.255.6    -               1      5/4  LOC  0    DB   0
```

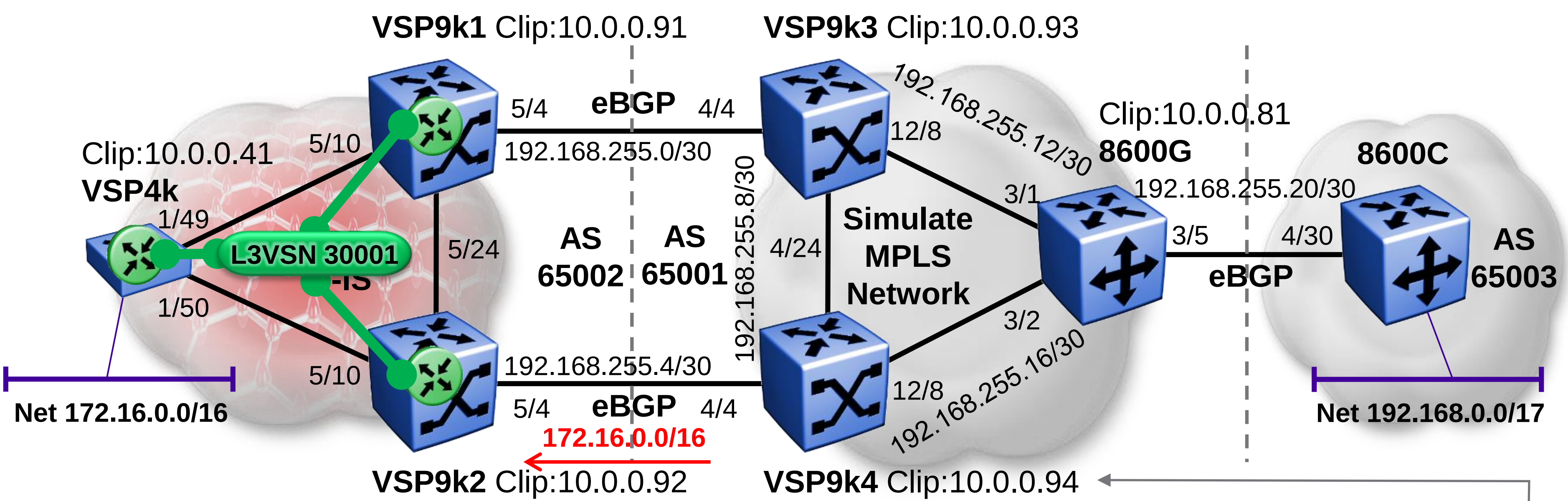
- This is not what we want so we'll have to fix this

Forcing paths with BGP and SPB
(b) VRF L3VSN – Checking IP Routes




```
VSP9000-3:1#% show ip route
==============================================================================================
                                IP Route - GlobalRouter
==============================================================================================
                                                    NH                      INTER
DST             MASK            NEXT                VRF/ISID          COST  FACE   PROT AGE TYPE PRF
----------------------------------------------------------------------------------------------
10.0.0.81       255.255.255.255 192.168.255.14      GlobalRouter      11    12/8   OSPF 0   IB   20
10.0.0.93       255.255.255.255 10.0.0.93           -                 1     0      LOC  0   DB   0
10.0.0.94       255.255.255.255 192.168.255.10      GlobalRouter      11     4/24  OSPF 0   IB   20
172.16.0.0      255.255.0.0     192.168.255.2       GlobalRouter      1      4/4   BGP  0   IB   45
192.168.0.0     255.255.128.0   192.168.255.14      GlobalRouter      1     12/8   BGP  0   IB   175
192.168.255.0   255.255.255.252 192.168.255.1       -                 1      4/4   LOC  0   DB   0
192.168.255.4   255.255.255.252 192.168.255.10      GlobalRouter      2      4/24  OSPF 0   IB   20
192.168.255.8   255.255.255.252 192.168.255.9       -                 1      4/24  LOC  0   DB   0
192.168.255.12  255.255.255.252 192.168.255.13      -                 1     12/8   LOC  0   DB   0
192.168.255.16  255.255.255.252 192.168.255.10      GlobalRouter      2      4/24  OSPF 0   IB   20
192.168.255.20  255.255.255.252 192.168.255.14      GlobalRouter      2     12/8   OSPF 0   IB   20
```

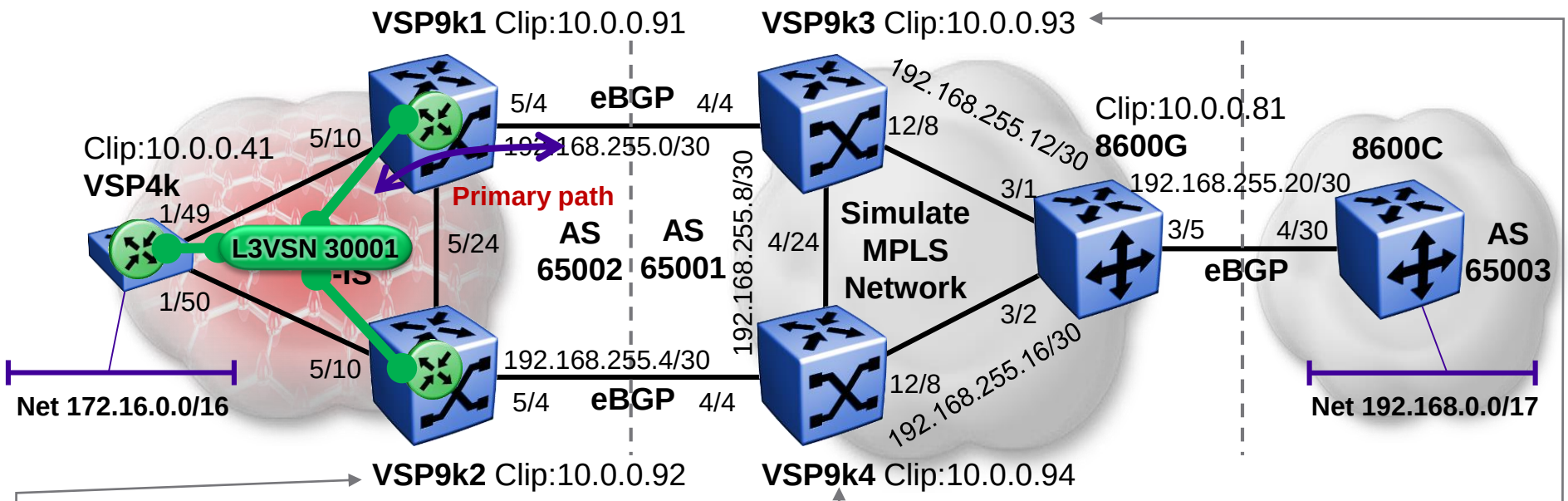
Forcing paths with BGP and SPB
(b) VRF L3VSN – Checking IP Routes




```
VSP9000-4:1#% show ip route
================================================================================================
                                    IP Route - GlobalRouter
================================================================================================
                                                     NH                    INTER
DST             MASK            NEXT                 VRF/ISID         COST FACE  PROT AGE TYPE PRF
------------------------------------------------------------------------------------------------
10.0.0.81       255.255.255.255 192.168.255.18       GlobalRouter     11   12/8  OSPF 0   IB   20
10.0.0.93       255.255.255.255 192.168.255.9        GlobalRouter     11    4/24 OSPF 0   IB   20
10.0.0.94       255.255.255.255 10.0.0.94            -                1    0     LOC  0   DB   0
172.16.0.0      255.255.0.0     192.168.255.6        GlobalRouter     1     4/4  BGP  0   IB   45
192.168.0.0     255.255.128.0   192.168.255.18       GlobalRouter     1    12/8  BGP  0   IB   175
192.168.255.0   255.255.255.252 192.168.255.9        GlobalRouter     2     4/24 OSPF 0   IB   20
192.168.255.4   255.255.255.252 192.168.255.5        -                1     4/4  LOC  0   DB   0
192.168.255.8   255.255.255.252 192.168.255.10       -                1     4/24 LOC  0   DB   0
192.168.255.12  255.255.255.252 192.168.255.9        GlobalRouter     2     4/24 OSPF 0   IB   20
192.168.255.16  255.255.255.252 192.168.255.17       -                1    12/8  LOC  0   DB   0
192.168.255.20  255.255.255.252 192.168.255.18       GlobalRouter     2    12/8  OSPF 0   IB   20
```

- This is not what we want so we'll have to fix this

Forcing paths with BGP and SPB
(b) VRF L3VSN – Setting Local_PREF



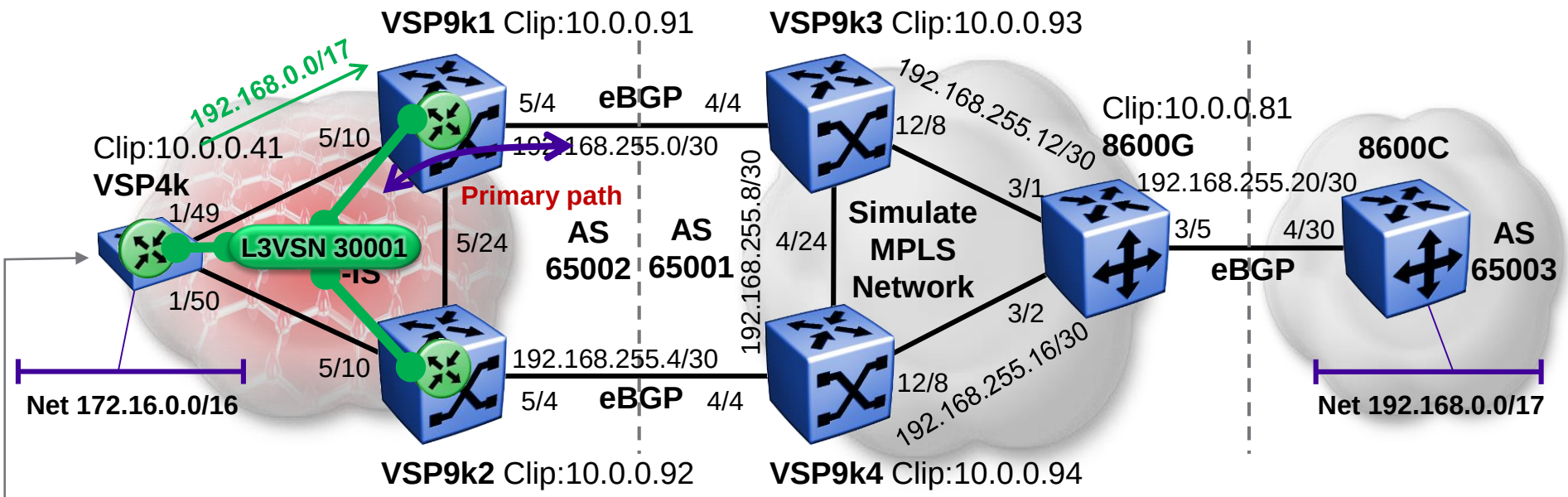

```
router vrf green
   ip route preference protocol spbm-level1 7
exit
```

```
no router bgp enable
router bgp
   bgp default local-preference 20
exit
router bgp 65001 enable
```

```
no router bgp enable
router bgp
   bgp default local-preference 200
exit
router bgp 65001 enable
```

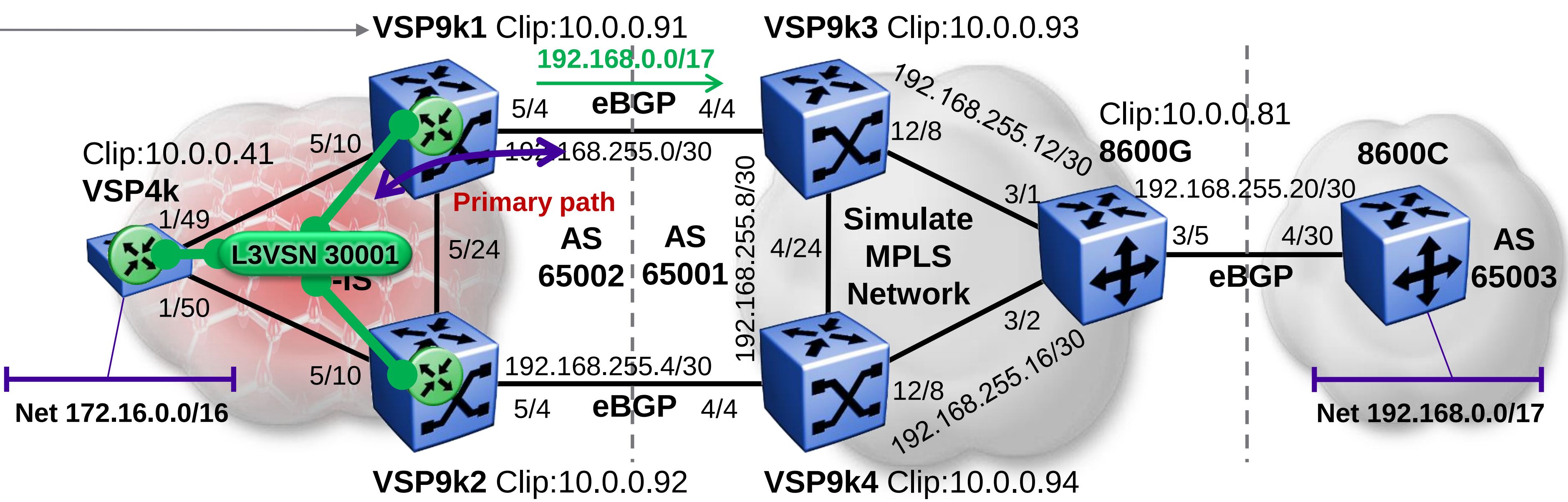
- So, we are now restoring the default ISIS-SPB preference default (7) on VSP9k2
- This will ensure that VSP9k1 will prefer eBGP over ISIS
- While VSP9k2 will prefer ISIS over eBGP

Forcing paths with BGP and SPB
(b) VRF L3VSN – Checking IP Routes



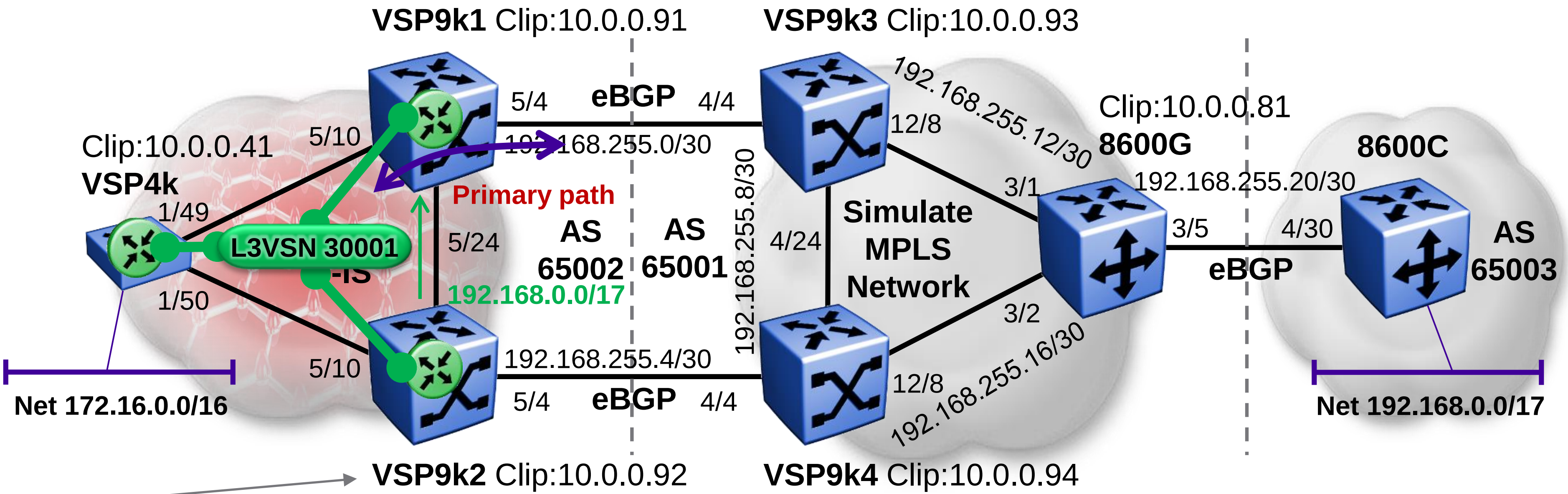

```
VSP4000:1#% show ip route vrf green
=================================================================================================
                                        IP Route - VRF green
=================================================================================================
                                                    NH                          INTER
DST             MASK            NEXT                VRF             COST FACE  PROT AGE TYPE PRF
-------------------------------------------------------------------------------------------------
172.16.0.0      255.255.0.0     172.16.0.41         -               1    0     LOC  0   DB   0
192.168.0.0     255.255.128.0   VSP9000-1           GlobalRouter    10   4051  ISIS 0   IBSV 7
```

Forcing paths with BGP and SPB
(b) VRF L3VSN – Checking IP Routes



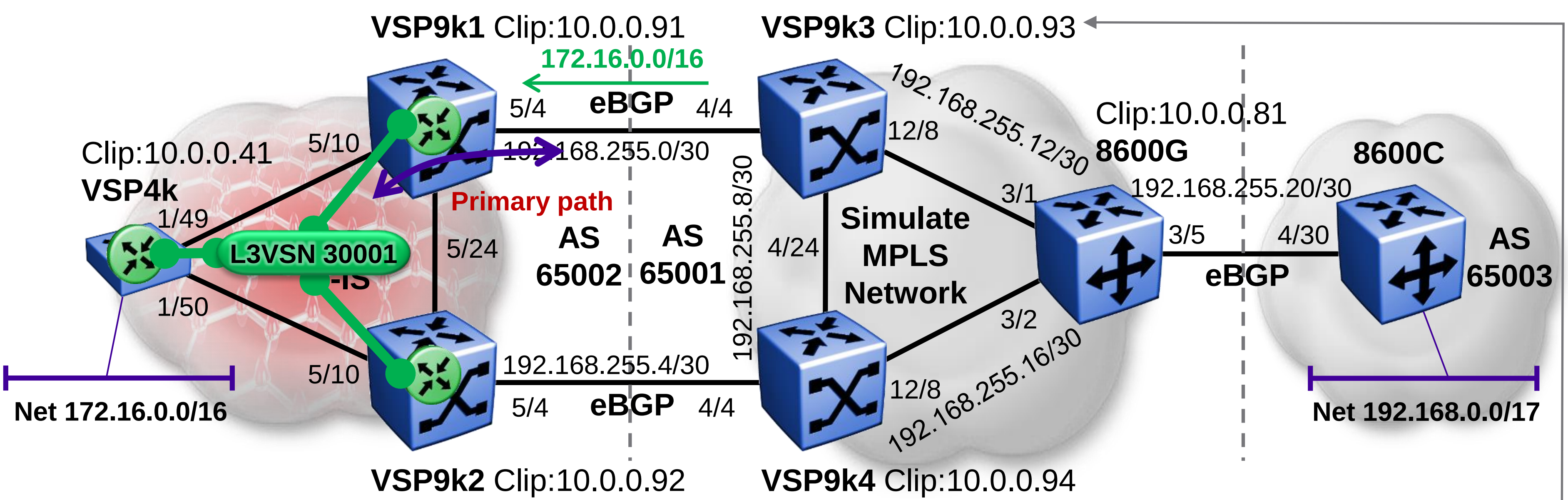

```
VSP9000-1:1#% show ip route vrf green
==========================================================================================
                                  IP Route - VRF green
==========================================================================================
                                                   NH                    INTER
DST              MASK             NEXT             VRF/ISID        COST  FACE  PROT AGE TYPE PRF
------------------------------------------------------------------------------------------
172.16.0.0       255.255.0.0      VSP4000          green           10    4051  ISIS 0   IBSV 50
192.168.0.0      255.255.128.0    192.168.255.1    green           2      5/4  BGP  0   IB   45
192.168.255.0    255.255.255.252  192.168.255.2    -               1      5/4  LOC  0   DB   0
```

Forcing paths with BGP and SPB
(b) VRF L3VSN – Checking IP Routes



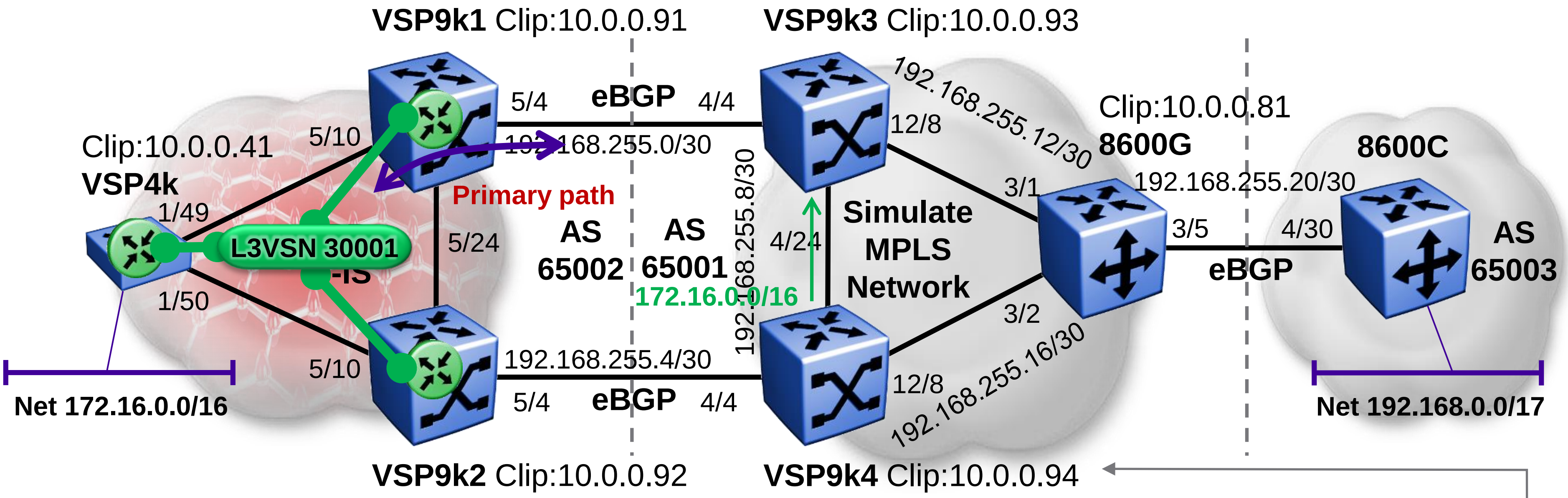

```
VSP9000-2:1#% show ip route vrf green
================================================================================
                                IP Route - VRF green
================================================================================
                                                    NH                 INTER
DST             MASK            NEXT                VRF/ISID      COST FACE  PROT AGE TYPE PRF
--------------------------------------------------------------------------------
172.16.0.0      255.255.0.0     VSP4000             green         10   4051  ISIS 0   IBSV 7
192.168.0.0     255.255.128.0   VSP9000-1           green         10   4051  ISIS 0   IBSV 7
192.168.255.4   255.255.255.252 192.168.255.6       -             1     5/4  LOC  0   DB   0
```

Forcing paths with BGP and SPB
(b) VRF L3VSN – Checking IP Routes



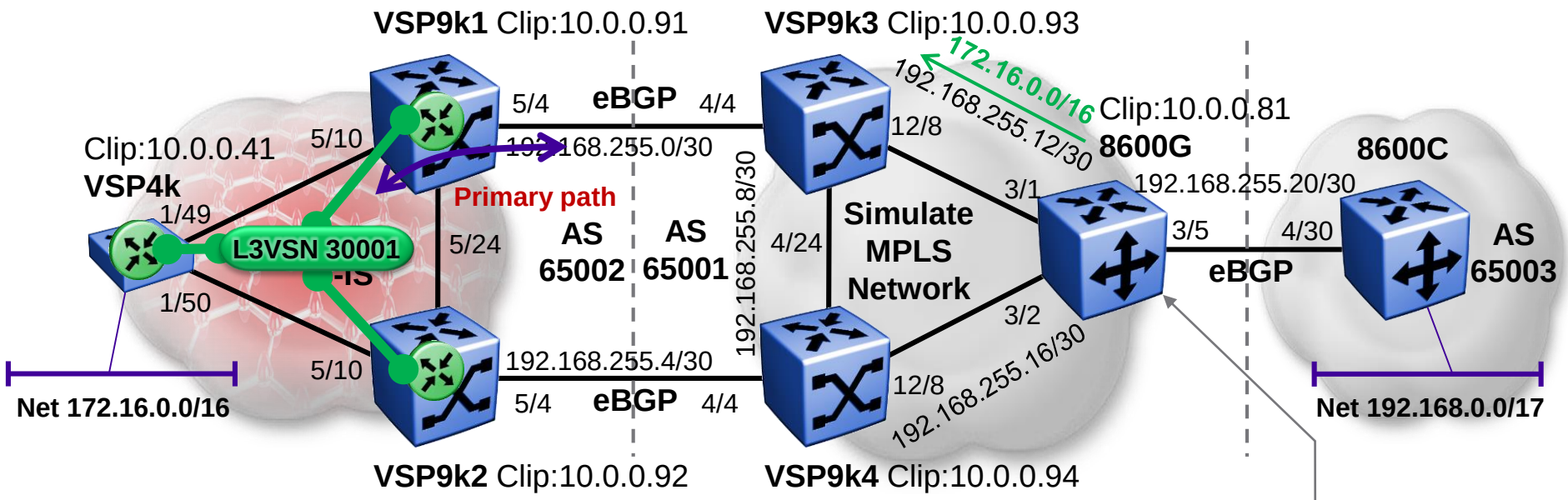

```
VSP9000-3:1#% show ip route
================================================================================
                            IP Route - GlobalRouter
================================================================================
                                          NH                   INTER
DST             MASK            NEXT              VRF/ISID       COST  FACE  PROT AGE TYPE PRF
--------------------------------------------------------------------------------
10.0.0.81       255.255.255.255 192.168.255.14    GlobalRouter   11    12/8  OSPF 0   IB   20
10.0.0.93       255.255.255.255 10.0.0.93         -              1     0     LOC  0   DB   0
10.0.0.94       255.255.255.255 192.168.255.10    GlobalRouter   11     4/24 OSPF 0   IB   20
172.16.0.0      255.255.0.0     192.168.255.2     GlobalRouter   1      4/4  BGP  0   IB   45
192.168.0.0     255.255.128.0   192.168.255.14    GlobalRouter   1     12/8  BGP  0   IB   175
192.168.255.0   255.255.255.252 192.168.255.1     -              1      4/4  LOC  0   DB   0
192.168.255.4   255.255.255.252 192.168.255.10    GlobalRouter   2      4/24 OSPF 0   IB   20
192.168.255.8   255.255.255.252 192.168.255.9     -              1      4/24 LOC  0   DB   0
192.168.255.12  255.255.255.252 192.168.255.13    -              1     12/8  LOC  0   DB   0
192.168.255.16  255.255.255.252 192.168.255.10    GlobalRouter   2      4/24 OSPF 0   IB   20
192.168.255.20  255.255.255.252 192.168.255.14    GlobalRouter   2     12/8  OSPF 0   IB   20
```

Forcing paths with BGP and SPB
(b) VRF L3VSN – Checking IP Routes



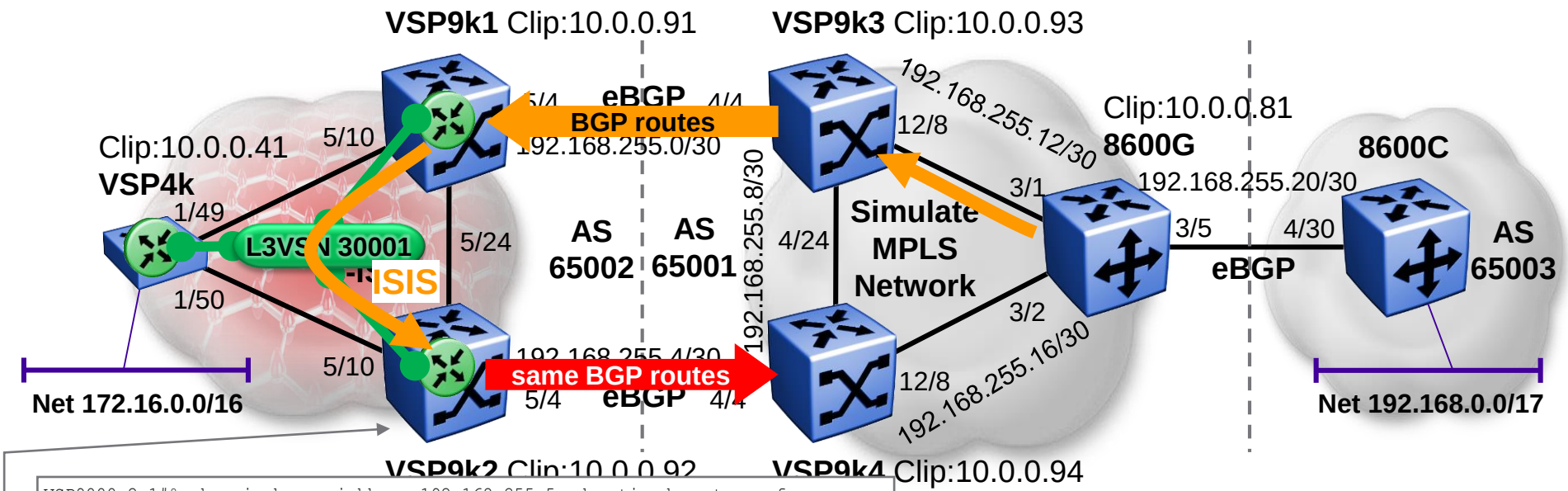

```
VSP9000-4:1#% show ip route
================================================================================
                              IP Route - GlobalRouter
================================================================================
                                                NH                      INTER
DST             MASK            NEXT            VRF/ISID        COST  FACE  PROT AGE TYPE PRF
--------------------------------------------------------------------------------
10.0.0.81       255.255.255.255 192.168.255.18  GlobalRouter    11    12/8  OSPF 0   IB   20
10.0.0.93       255.255.255.255 192.168.255.9   GlobalRouter    11     4/24 OSPF 0   IB   20
10.0.0.94       255.255.255.255 10.0.0.94       -               1     0     LOC  0   DB   0
172.16.0.0      255.255.0.0     192.168.255.9   GlobalRouter    1      4/24 BGP  0   IB   175
192.168.0.0     255.255.128.0   192.168.255.18  GlobalRouter    1     12/8  BGP  0   IB   175
192.168.255.0   255.255.255.252 192.168.255.9   GlobalRouter    2      4/24 OSPF 0   IB   20
192.168.255.4   255.255.255.252 192.168.255.5   -               1      4/4  LOC  0   DB   0
192.168.255.8   255.255.255.252 192.168.255.10  -               1      4/24 LOC  0   DB   0
192.168.255.12  255.255.255.252 192.168.255.9   GlobalRouter    2      4/24 OSPF 0   IB   20
192.168.255.16  255.255.255.252 192.168.255.17  -               1     12/8  LOC  0   DB   0
192.168.255.20  255.255.255.252 192.168.255.18  GlobalRouter    2     12/8  OSPF 0   IB   20
```

Forcing paths with BGP and SPB
(b) VRF L3VSN – Checking IP Routes




```
ERS8000:5#% show ip route
=============================================================================================
                                IP Route - GlobalRouter
=============================================================================================
                                                    NH                 INTER
DST             MASK            NEXT                VRF          COST  FACE   PROT AGE TYPE PRF
---------------------------------------------------------------------------------------------
10.0.0.81       255.255.255.255 10.0.0.81            -           1     0      LOC  0   DB   0
10.0.0.93       255.255.255.255 192.168.255.13      GlobalRout~ 11     3/1    OSPF 0   IB   20
10.0.0.94       255.255.255.255 192.168.255.17      GlobalRout~ 11     3/2    OSPF 0   IB   20
172.16.0.0      255.255.0.0     192.168.255.13      GlobalRout~ 1      3/1    BGP  0   IB   175
192.168.0.0     255.255.128.0   192.168.255.22      GlobalRout~ 1      3/5    BGP  0   IB   45
192.168.255.0   255.255.255.252 192.168.255.13      GlobalRout~ 2      3/1    OSPF 0   IB   20
192.168.255.4   255.255.255.252 192.168.255.17      GlobalRout~ 2      3/2    OSPF 0   IB   20
192.168.255.8   255.255.255.252 192.168.255.17      GlobalRout~ 2      3/2    OSPF 0   IB   20
192.168.255.12  255.255.255.252 192.168.255.14       -          1      3/1    LOC  0   DB   0
192.168.255.16  255.255.255.252 192.168.255.18       -          1      3/2    LOC  0   DB   0
192.168.255.20  255.255.255.252 192.168.255.21       -          1      3/5    LOC  0   DB   0
```

Forcing paths with BGP and SPB
(b) VRF L3VSN – Routing Loop Problem

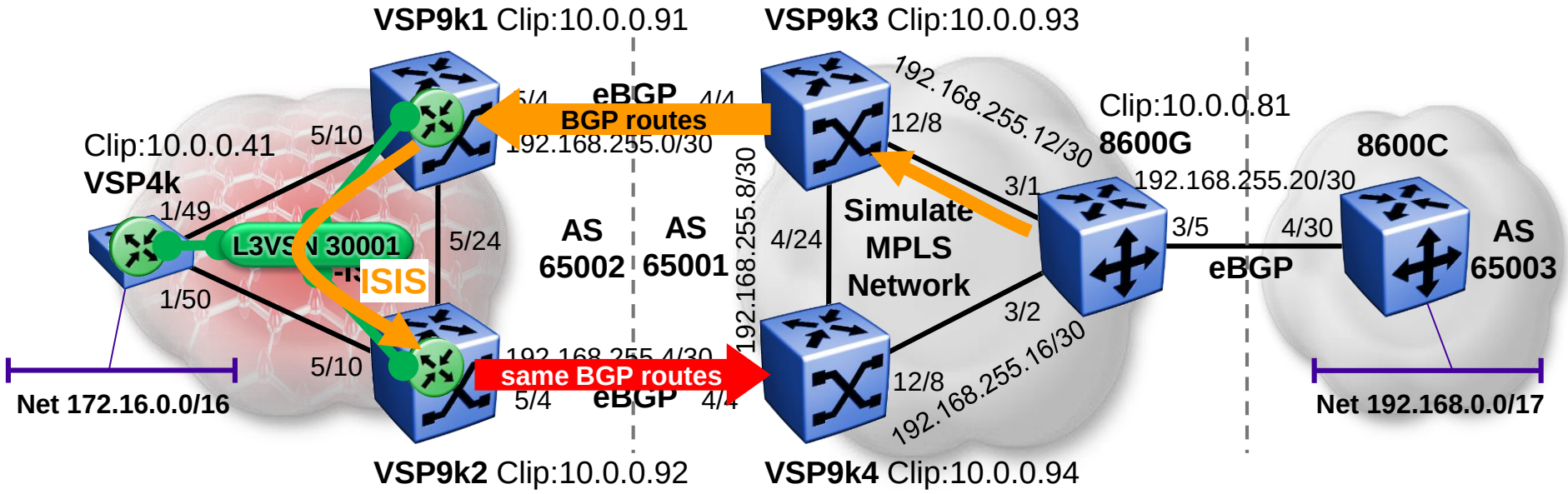



```
VSP9000-2:1#% show ip bgp neighbors 192.168.255.5 advertised-routes vrf green
================================================================================
                  BGP Neighbor Advertised Routes - VRF green
================================================================================
NETWORK/MASK       NEXTHOP ADDRESS LOC PREF ORG   STATUS
--------------------------------------------------------------------------------
172.16.0.0/16      127.1.0.9       100      INC   import
192.168.0.0/17     127.1.0.11      100      INC   import
```

```
VSP9000-4:1#% show ip bgp route
================================================================================
                            BGP Routes - GlobalRouter
================================================================================
NETWORK/MASK       PEER REM ADDR   NEXTHOP ADDRESS ORG LOC PREF
--------------------------------------------------------------------------------
172.16.0.0/16      10.0.0.93       192.168.255.2   INC 200
        AS_PATH: (65002)
172.16.0.0/16      192.168.255.6   192.168.255.6   INC 20
        AS_PATH: (65002)
192.168.0.0/17     10.0.0.81       192.168.255.22  IGP 100
        AS_PATH: (65003)
192.168.0.0/17     192.168.255.6   192.168.255.6   INC 20
        AS_PATH: (65002)
```

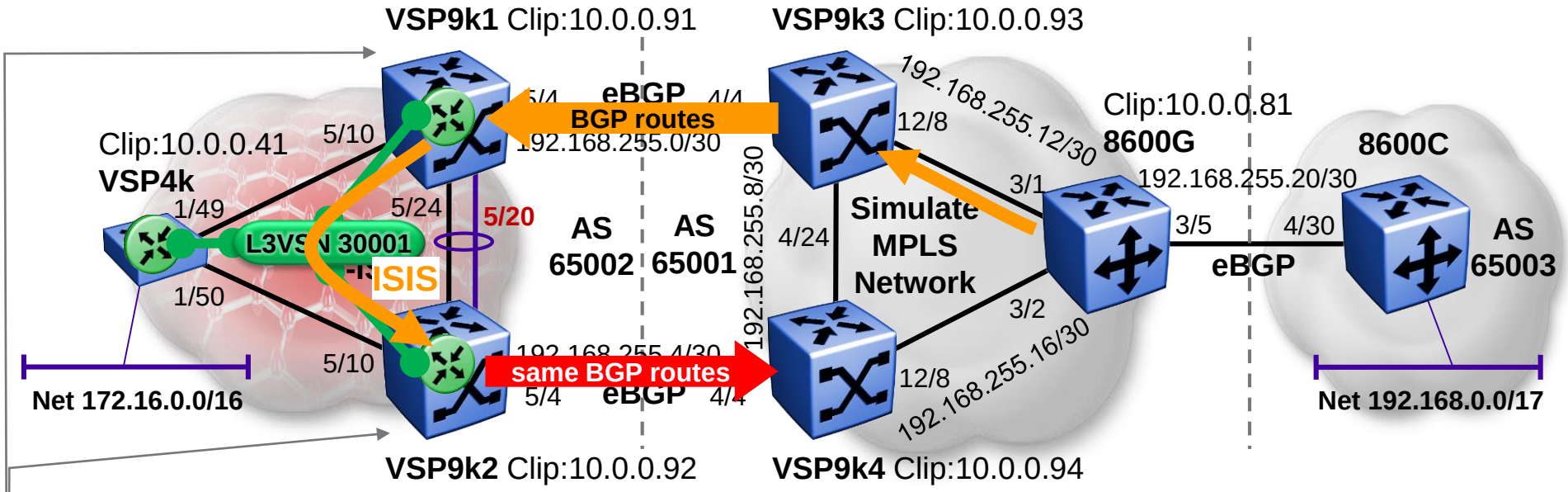
- We need to find a way to prevent VSP9k2 from re-redistributing BGP routes which were learnt by VSP9k1 and redistributed into ISIS

Forcing paths with BGP and SPB
(b) VRF L3VSN – Routing Loop Discussion



- A number of approaches were investigated:
  - Marking the external metric of these routes as they are injected into ISIS by VSP9k1; then VSP9k2's BGP redistribution would filter these out via a route-map
    - The 1st part works, but the 2nd part fails, as we cannot match on ISIS route metric (this info is not in the IP routing table)
  - Marking the route preference as it is accepted by VSP9k2 into its IP routing table; then VSP9k2's BGP redistribution would filter these out via a route-map
    - The 1st part works, but the 2nd part fails, as we cannot match on route preference using current route-map functionality (missing "match ip-preference" route-map option); a fix for this was offered but it was too late to make release 4.0
  - Marking the ISIS path cost between VSP9k1 & VSP9k2 to a well known value which will be unique in the Fabric to all ISIS routes learnt from VSP9k1 (e.g. 1); then VSP9k2's BGP redistribution would filter these out via a route-map
    - This works, but it would stop working if the 5/24 link between VSP9k1 & VSP9k2 failed; so that link needs to be made redundant by turning it into an MLT bundle; **this approach is shown here, as we have no other viable option**
- Note that ultimately the cleanest solution will be for us to support ISIS external & internal route types
  - or simply iBGP support in VRFs

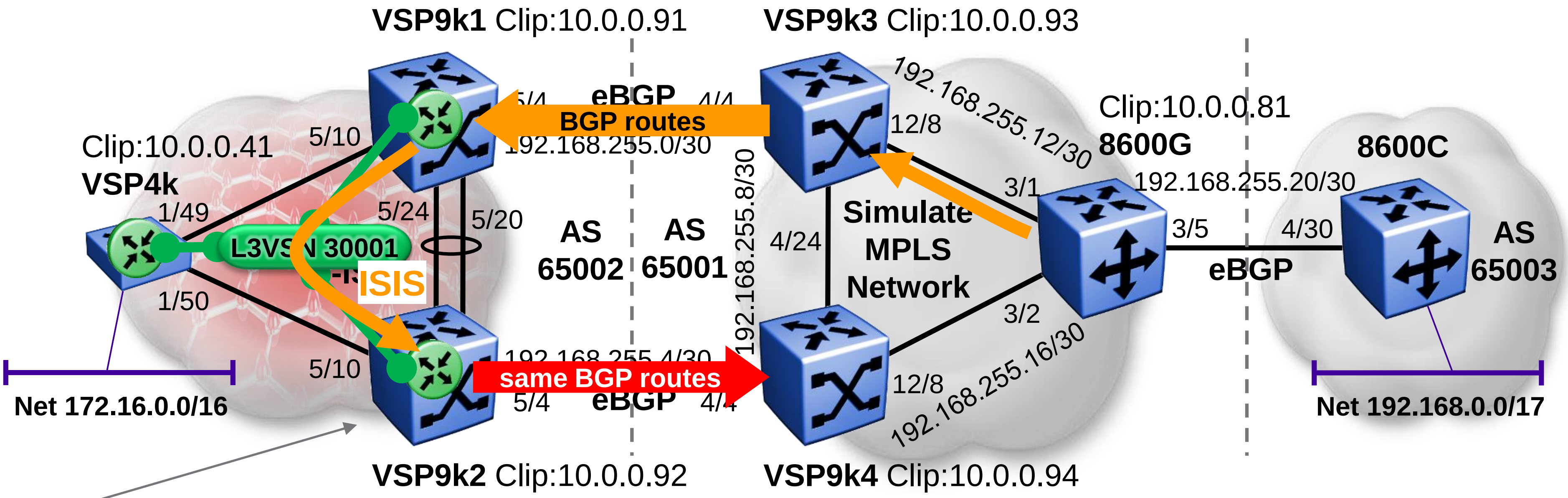
Forcing paths with BGP and SPB
(b) VRF L3VSN – Routing Loop – Create MLT NNI




```
interface gigabitEthernet 5/20
   no shutdown
exit
interface gigabitEthernet 5/24
   no isis
exit
mlt 1 enable
mlt 1 member 5/20,5/24
interface mlt 1
   isis
   isis spbm 1
   isis spbm 1 l1-metric 1
   isis enable
exit
```

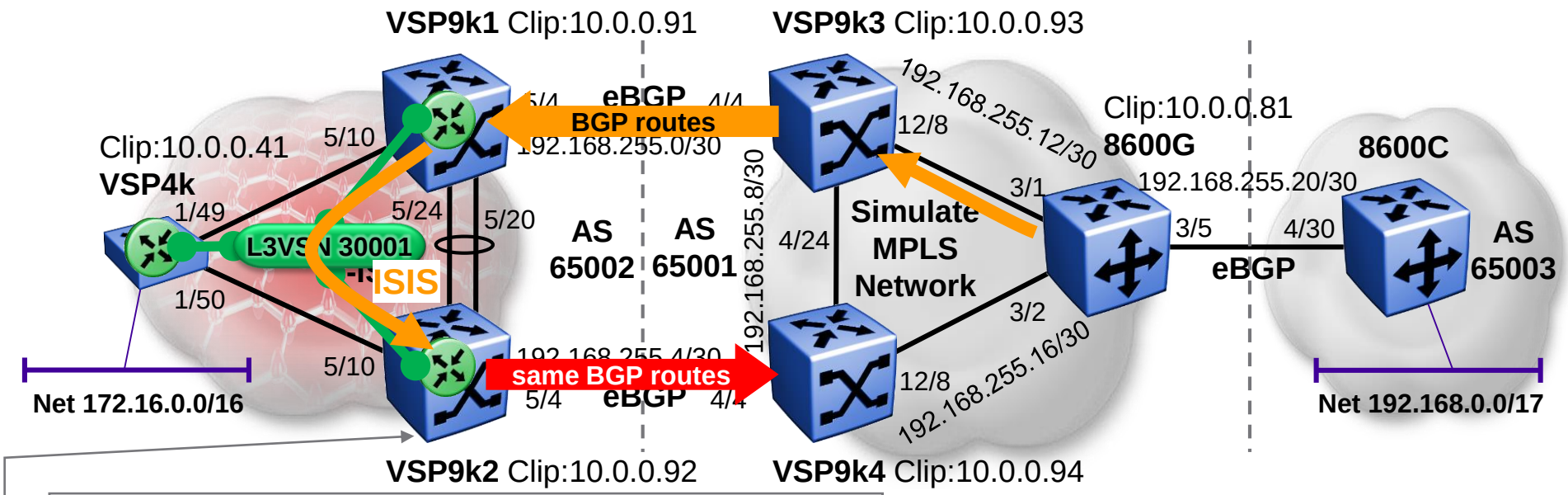
- We turn the connection between VSP9k1 & VSP9k2 into an MLT NNI and we lower its SPB metric to 1, such that any ISIS IP route one of the VSP9000s learns from each other will have that internal SPB cost of 1
- All other VSP9000 ISIS interfaces will have default SPB metric of 10 or higher
- Which means no other ISIS route on the VSP9000s will have such a small internal cost

Forcing paths with BGP and SPB
(b) VRF L3VSN – Routing Loop – Check metrics




```
VSP9000-2:1# show ip route vrf green
================================================================================
                           IP Route - VRF green
================================================================================
                                               NH                  INTER
DST             MASK            NEXT           VRF/ISID        COST FACE  PROT AGE TYPE PRF
--------------------------------------------------------------------------------
172.16.0.0      255.255.0.0     VSP4000        green           10   4051  ISIS 0   IBSV 7
192.168.0.0     255.255.128.0   VSP9000-1      green           1    4051  ISIS 0   IBSV 7
192.168.255.4   255.255.255.252 192.168.255.6  -               1     5/4  LOC  0   DB   0
```

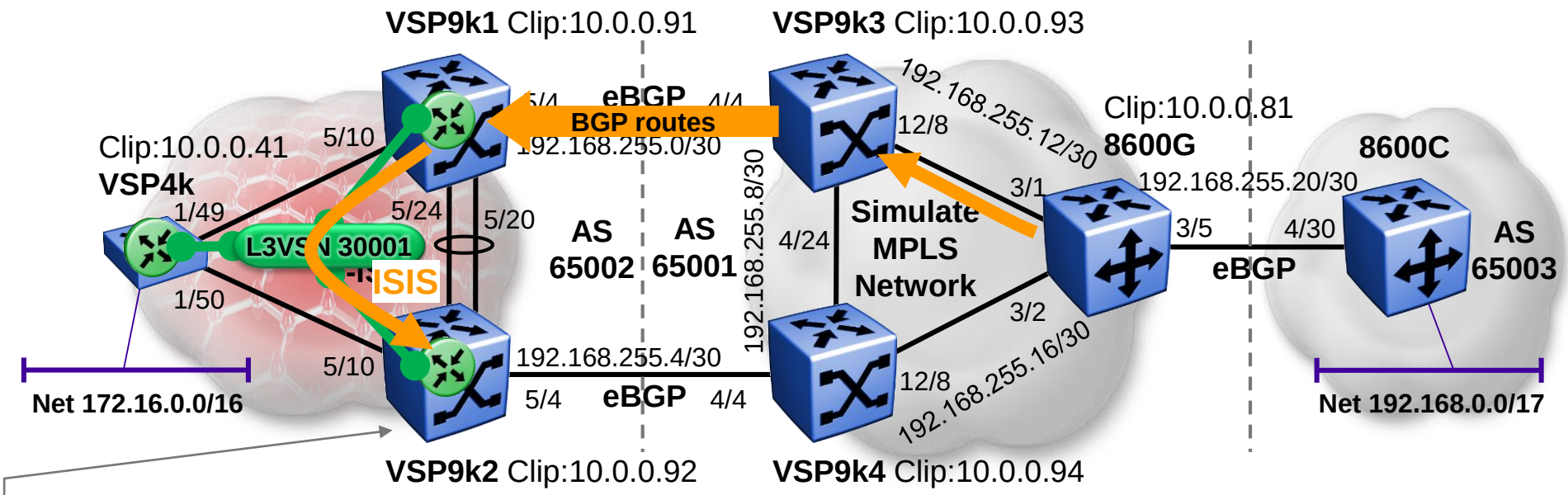
Forcing paths with BGP and SPB
(b) VRF L3VSN – Routing Loop – Prevent it




```
router vrf green
   route-map "peer-reject" 1
      no permit
      match metric 1
      enable
   exit
   route-map "peer-reject" 2
      permit
      enable
   exit
   ip bgp redistribute isis route-map "peer-reject"
exit
ip bgp apply redistribute isis vrf green
```

- On VSP9k2 we reject, from BGP redistribution, any ISIS IP route with has a metric of 1

Forcing paths with BGP and SPB
(b) VRF L3VSN – Routing Loop – Fixed !

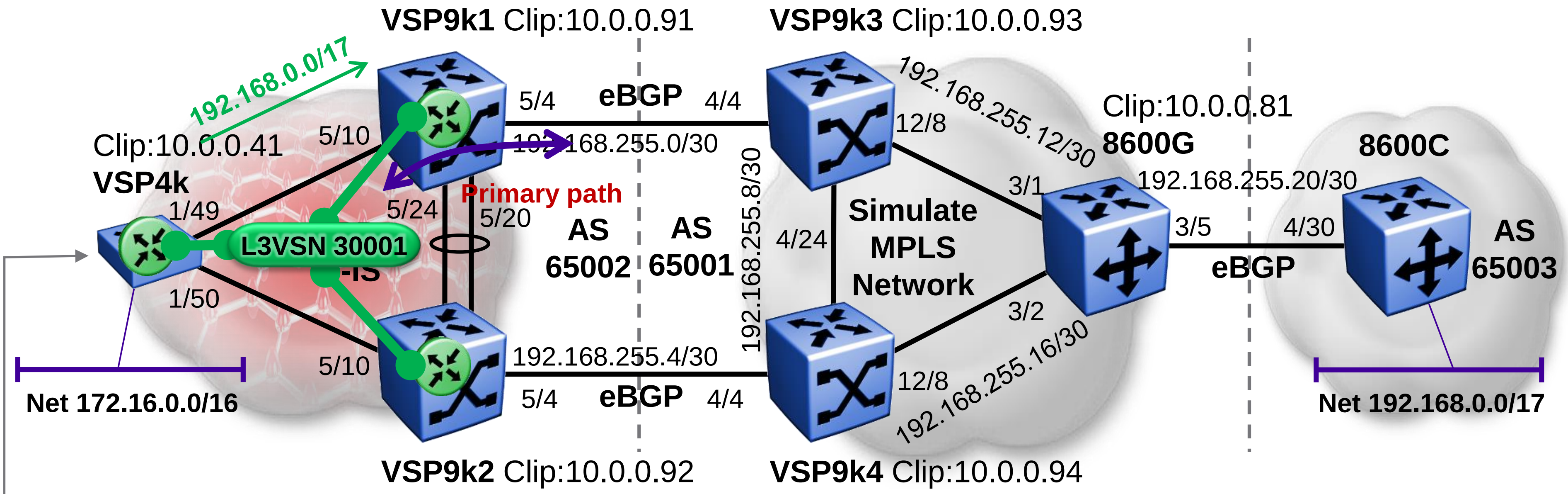



```
VSP9000-2:1#% show ip bgp neighbors 192.168.255.5 advertised-routes vrf green
================================================================================
                  BGP Neighbor Advertised Routes - VRF green
================================================================================
NETWORK/MASK       NEXTHOP ADDRESS LOC PREF ORG    STATUS
--------------------------------------------------------------------------------
172.16.0.0/16      127.1.0.9       100      INC    import
```

```
VSP9000-4:1#% show ip bgp route
================================================================================
                           BGP Routes - GlobalRouter
================================================================================
NETWORK/MASK       PEER REM ADDR   NEXTHOP ADDRESS ORG LOC PREF
--------------------------------------------------------------------------------
172.16.0.0/16      10.0.0.93       192.168.255.2   INC 200
        AS_PATH: (65002)
172.16.0.0/16      192.168.255.6   192.168.255.6   INC 20
        AS_PATH: (65002)
192.168.0.0/17     10.0.0.81       192.168.255.22  IGP 100
        AS_PATH: (65003)
```

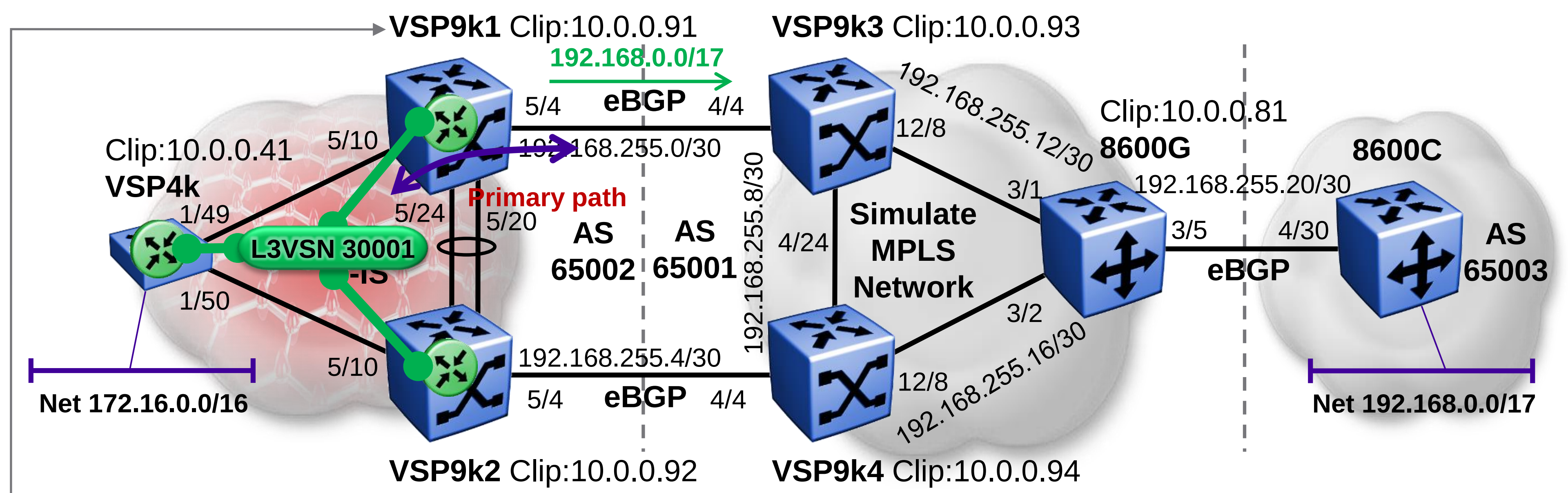
- Success!

Forcing paths with BGP and SPB
(b) VRF L3VSN – Checking IP Routes



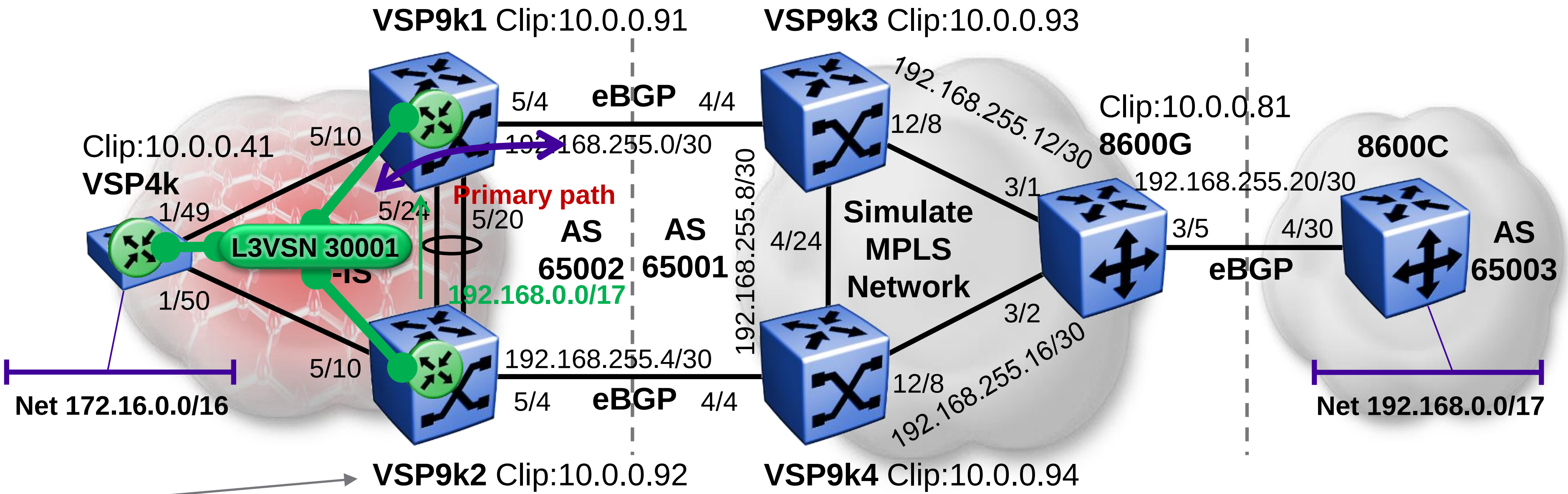

```
VSP4000:1#% show ip route vrf green
================================================================================
                           IP Route - VRF green
================================================================================
                                                       NH                      INTER
DST             MASK             NEXT                  VRF             COST    FACE   PROT  AGE  TYPE  PRF
--------------------------------------------------------------------------------
172.16.0.0      255.255.0.0      172.16.0.41           -               1       0      LOC   0    DB    0
192.168.0.0     255.255.128.0    VSP9000-1             GlobalRouter    10      4051   ISIS  0    IBSV  7
```

Forcing paths with BGP and SPB
(b) VRF L3VSN – Checking IP Routes



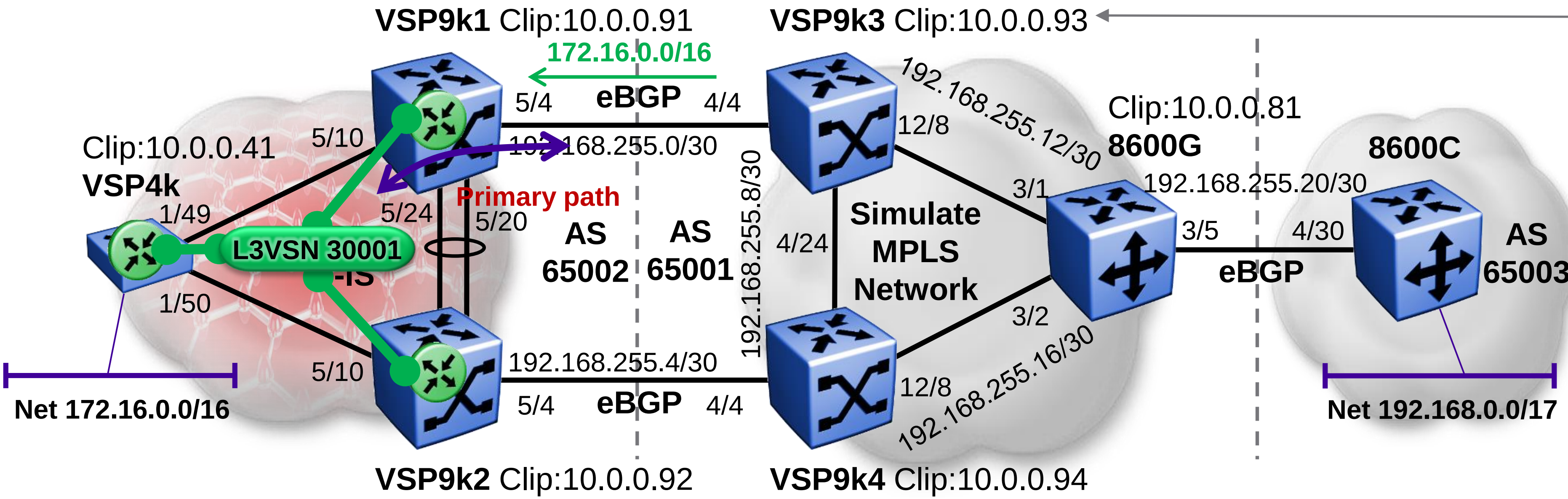

```
VSP9000-1:1#% show ip route vrf green
================================================================================
                                   IP Route - VRF green
================================================================================
                                                NH                 INTER
DST             MASK            NEXT            VRF/ISID      COST FACE   PROT AGE TYPE PRF
--------------------------------------------------------------------------------
172.16.0.0      255.255.0.0     VSP4000         green         10   4051   ISIS 0   IBSV 50
192.168.0.0     255.255.128.0   192.168.255.1   green         2     5/4   BGP  0   IB   45
192.168.255.0   255.255.255.252 192.168.255.2   -             1     5/4   LOC  0   DB   0
```

Forcing paths with BGP and SPB
(b) VRF L3VSN – Checking IP Routes



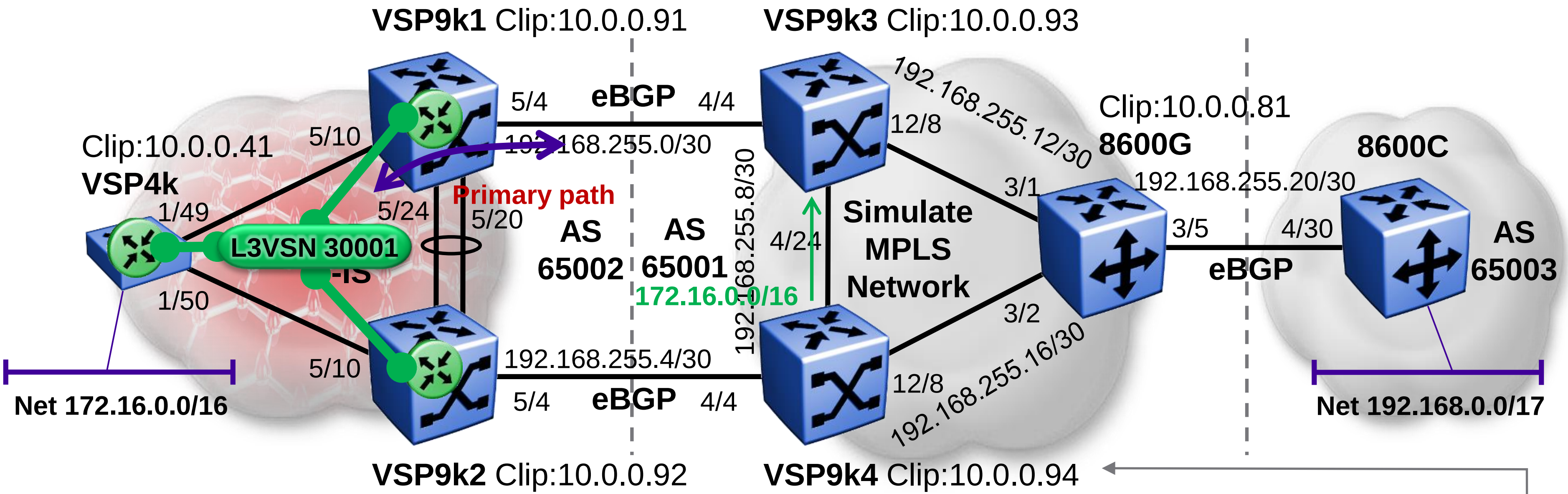

```
VSP9000-2:1#% show ip route vrf green
================================================================================
                                IP Route - VRF green
================================================================================
                                                  NH                    INTER
DST             MASK            NEXT              VRF/ISID      COST  FACE   PROT  AGE  TYPE  PRF
--------------------------------------------------------------------------------
172.16.0.0      255.255.0.0     VSP4000           green         10    4051   ISIS  0    IBSV  7
192.168.0.0     255.255.128.0   VSP9000-1         green         1     4051   ISIS  0    IBSV  7
192.168.255.4   255.255.255.252 192.168.255.6     -             1      5/4   LOC   0    DB    0
```

Forcing paths with BGP and SPB
(b) VRF L3VSN – Checking IP Routes



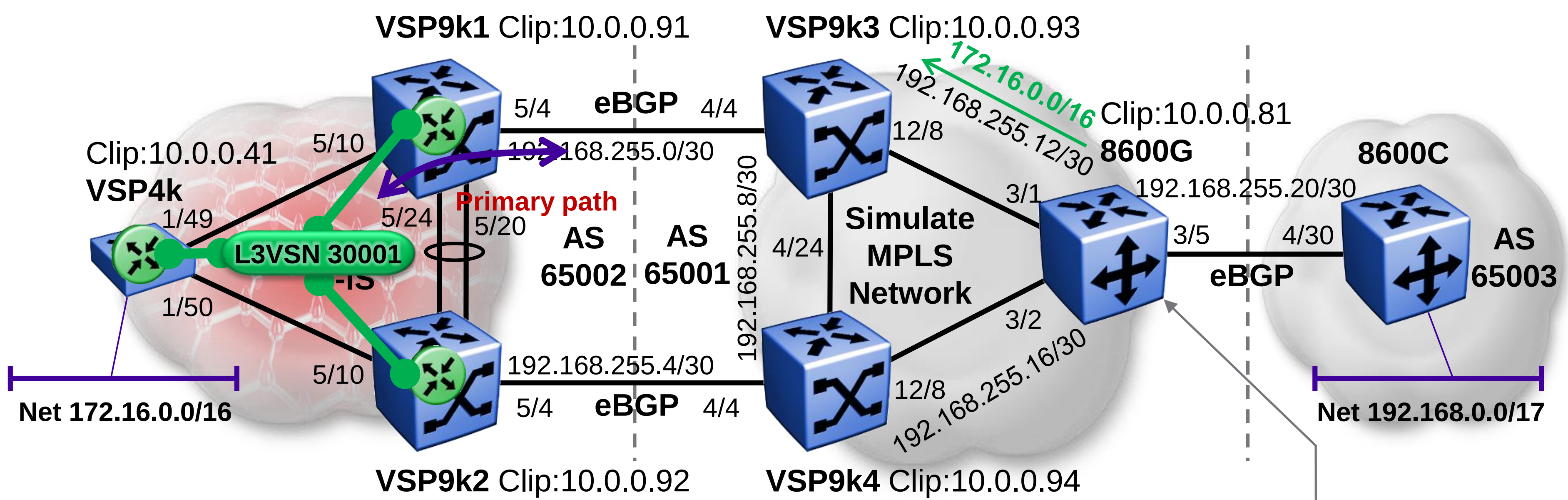

```
VSP9000-3:1#% show ip route
==================================================================================================
                                     IP Route - GlobalRouter
==================================================================================================
                                                     NH                     INTER
DST             MASK            NEXT                 VRF/ISID         COST  FACE   PROT AGE TYPE PRF
--------------------------------------------------------------------------------------------------
10.0.0.81       255.255.255.255 192.168.255.14       GlobalRouter     11    12/8   OSPF 0   IB    20
10.0.0.93       255.255.255.255 10.0.0.93            -                1     0      LOC  0   DB    0
10.0.0.94       255.255.255.255 192.168.255.10       GlobalRouter     11     4/24  OSPF 0   IB    20
172.16.0.0      255.255.0.0     192.168.255.2        GlobalRouter     1      4/4   BGP  0   IB    45
192.168.0.0     255.255.128.0   192.168.255.14       GlobalRouter     1     12/8   BGP  0   IB    175
192.168.255.0   255.255.255.252 192.168.255.1        -                1      4/4   LOC  0   DB    0
192.168.255.4   255.255.255.252 192.168.255.10       GlobalRouter     2      4/24  OSPF 0   IB    20
192.168.255.8   255.255.255.252 192.168.255.9        -                1      4/24  LOC  0   DB    0
192.168.255.12  255.255.255.252 192.168.255.13       -                1     12/8   LOC  0   DB    0
192.168.255.16  255.255.255.252 192.168.255.10       GlobalRouter     2      4/24  OSPF 0   IB    20
192.168.255.20  255.255.255.252 192.168.255.14       GlobalRouter     2     12/8   OSPF 0   IB    20
```

Forcing paths with BGP and SPB
(b) VRF L3VSN – Checking IP Routes



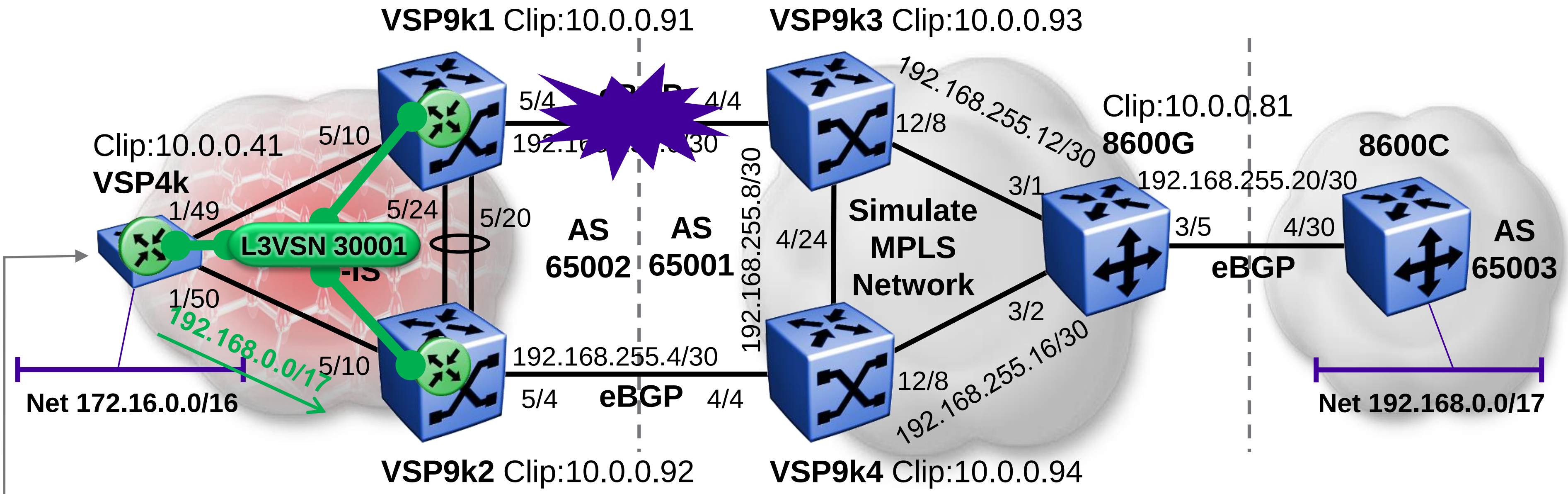

```
VSP9000-4:1#% show ip route
================================================================================
                              IP Route - GlobalRouter
================================================================================
                                          NH                       INTER
DST             MASK            NEXT            VRF/ISID          COST FACE  PROT AGE TYPE PRF
--------------------------------------------------------------------------------
10.0.0.81       255.255.255.255 192.168.255.18  GlobalRouter      11   12/8  OSPF 0   IB   20
10.0.0.93       255.255.255.255 192.168.255.9   GlobalRouter      11    4/24 OSPF 0   IB   20
10.0.0.94       255.255.255.255 10.0.0.94       -                 1    0     LOC  0   DB   0
172.16.0.0      255.255.0.0     192.168.255.9   GlobalRouter      1     4/24 BGP  0   IB   175
192.168.0.0     255.255.128.0   192.168.255.18  GlobalRouter      1    12/8  BGP  0   IB   175
192.168.255.0   255.255.255.252 192.168.255.9   GlobalRouter      2     4/24 OSPF 0   IB   20
192.168.255.4   255.255.255.252 192.168.255.5   -                 1     4/4  LOC  0   DB   0
192.168.255.8   255.255.255.252 192.168.255.10  -                 1     4/24 LOC  0   DB   0
192.168.255.12  255.255.255.252 192.168.255.9   GlobalRouter      2     4/24 OSPF 0   IB   20
192.168.255.16  255.255.255.252 192.168.255.17  -                 1    12/8  LOC  0   DB   0
192.168.255.20  255.255.255.252 192.168.255.18  GlobalRouter      2    12/8  OSPF 0   IB   20
```

Forcing paths with BGP and SPB
(b) VRF L3VSN – Checking IP Routes



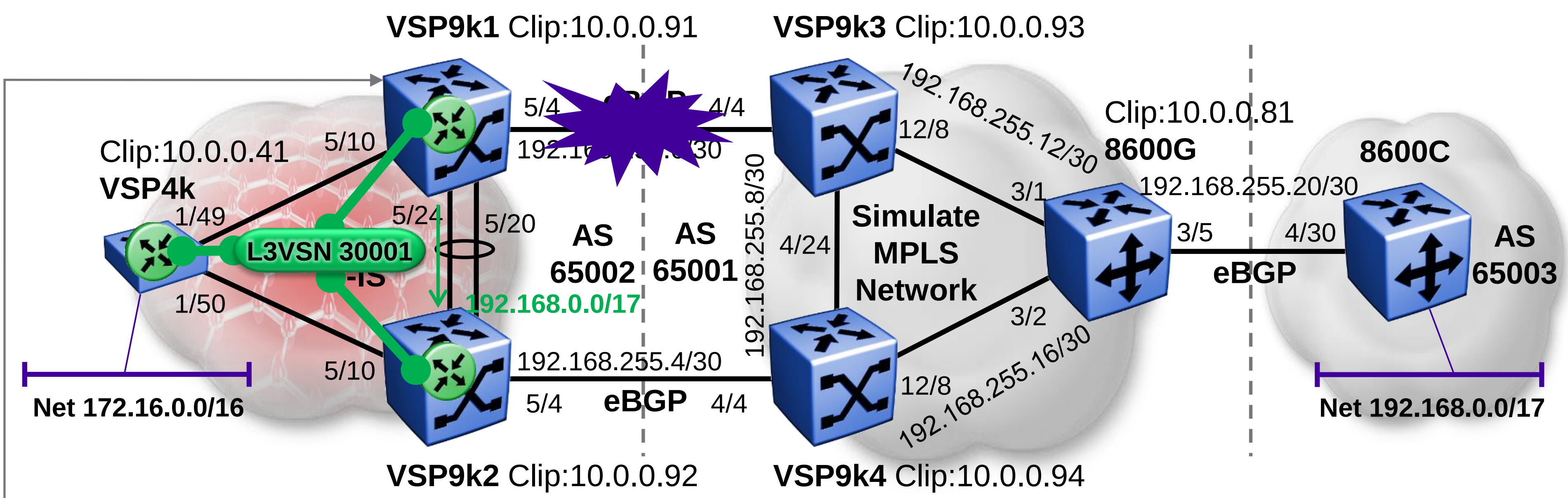

```
ERS8000:5#% show ip route
=============================================================================================
                              IP Route - GlobalRouter
=============================================================================================
                                                     NH                INTER
DST             MASK            NEXT                 VRF          COST FACE   PROT AGE TYPE PRF
---------------------------------------------------------------------------------------------
10.0.0.81       255.255.255.255 10.0.0.81             -           1    0      LOC  0   DB   0
10.0.0.93       255.255.255.255 192.168.255.13       GlobalRout~ 11    3/1    OSPF 0   IB   20
10.0.0.94       255.255.255.255 192.168.255.17       GlobalRout~ 11    3/2    OSPF 0   IB   20
172.16.0.0      255.255.0.0     192.168.255.13       GlobalRout~ 1     3/1    BGP  0   IB   175
192.168.0.0     255.255.128.0   192.168.255.22       GlobalRout~ 1     3/5    BGP  0   IB   45
192.168.255.0   255.255.255.252 192.168.255.13       GlobalRout~ 2     3/1    OSPF 0   IB   20
192.168.255.4   255.255.255.252 192.168.255.17       GlobalRout~ 2     3/2    OSPF 0   IB   20
192.168.255.8   255.255.255.252 192.168.255.17       GlobalRout~ 2     3/2    OSPF 0   IB   20
192.168.255.12  255.255.255.252 192.168.255.14        -           1    3/1    LOC  0   DB   0
192.168.255.16  255.255.255.252 192.168.255.18        -           1    3/2    LOC  0   DB   0
192.168.255.20  255.255.255.252 192.168.255.21        -           1    3/5    LOC  0   DB   0
```

Forcing paths with BGP and SPB
(b) VRF L3VSN – Checking IP Routes



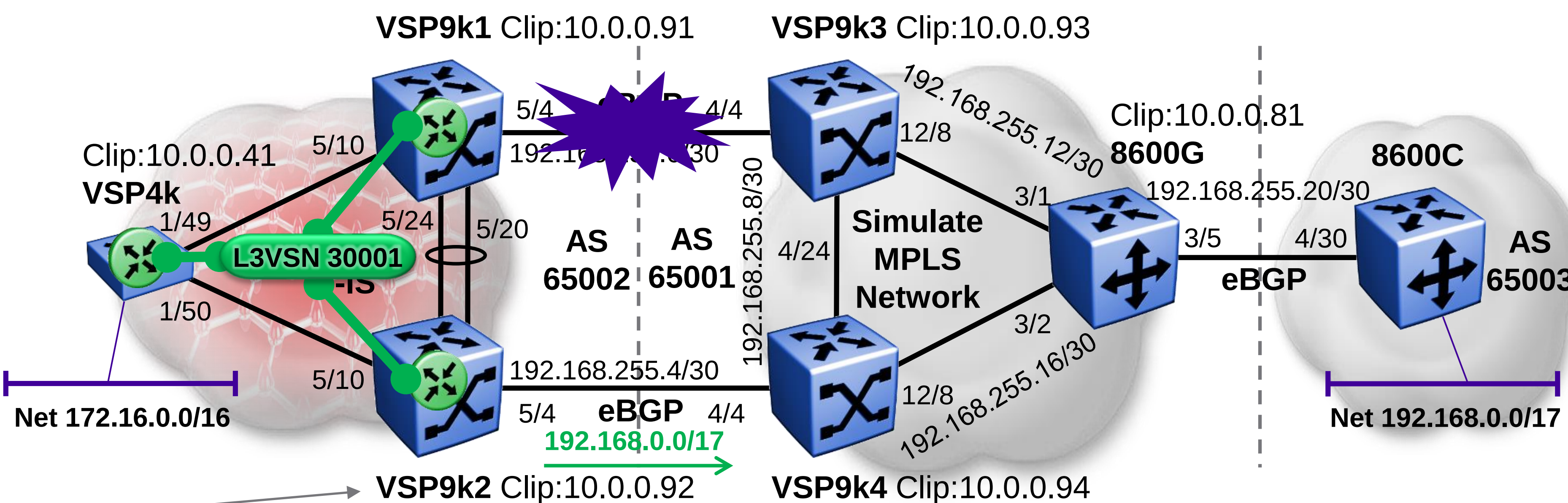

```
VSP4000:1#% show ip route vrf green
================================================================================
                              IP Route - VRF green
================================================================================
                                                    NH                 INTER
DST             MASK            NEXT                VRF             COST  FACE   PROT  AGE  TYPE  PRF
--------------------------------------------------------------------------------
172.16.0.0      255.255.0.0     172.16.0.41         -               1     0      LOC   0    DB    0
192.168.0.0     255.255.128.0   VSP9000-2           GlobalRouter    10    4051   ISIS  0    IBSV  7
```

Forcing paths with BGP and SPB
(b) VRF L3VSN – Checking IP Routes



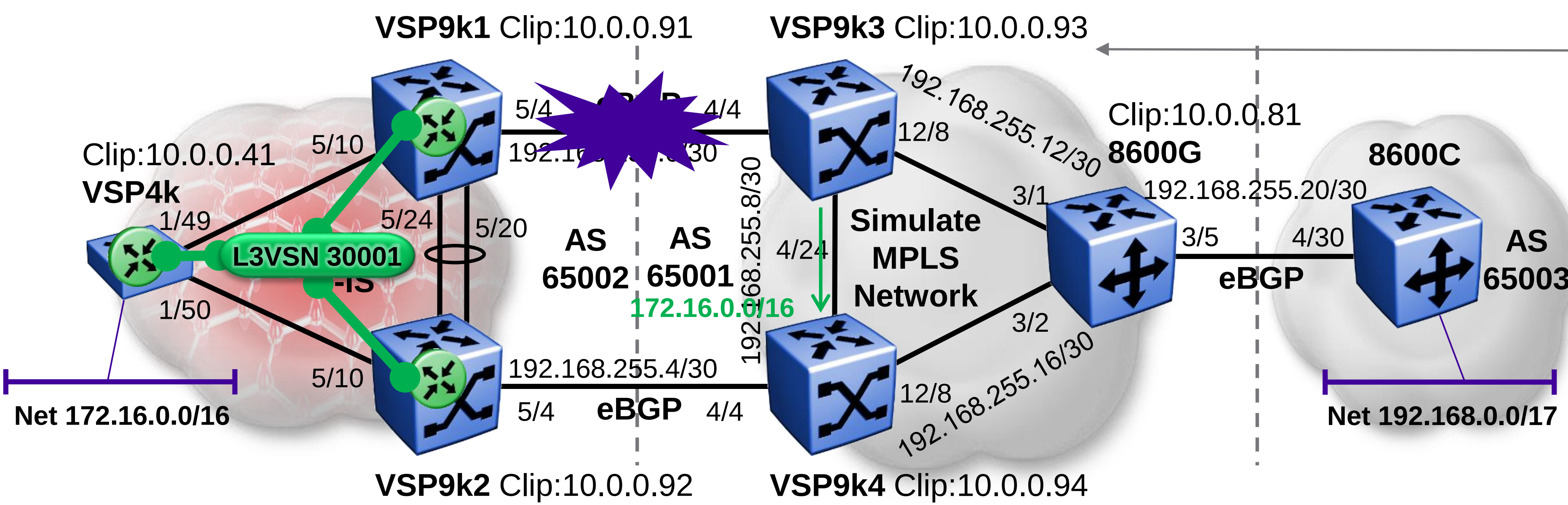

```
VSP9000-1:1#% show ip route vrf green
==============================================================================
                              IP Route - VRF green
==============================================================================
                                                NH               INTER
DST              MASK             NEXT          VRF/ISID    COST FACE  PROT AGE TYPE PRF
------------------------------------------------------------------------------
172.16.0.0       255.255.0.0      VSP4000       green       10   4051  ISIS 0   IBSV 50
192.168.0.0      255.255.128.0    VSP9000-2     green       1    4051  ISIS 0   IBSV 50
```

Forcing paths with BGP and SPB
(b) VRF L3VSN – Checking IP Routes



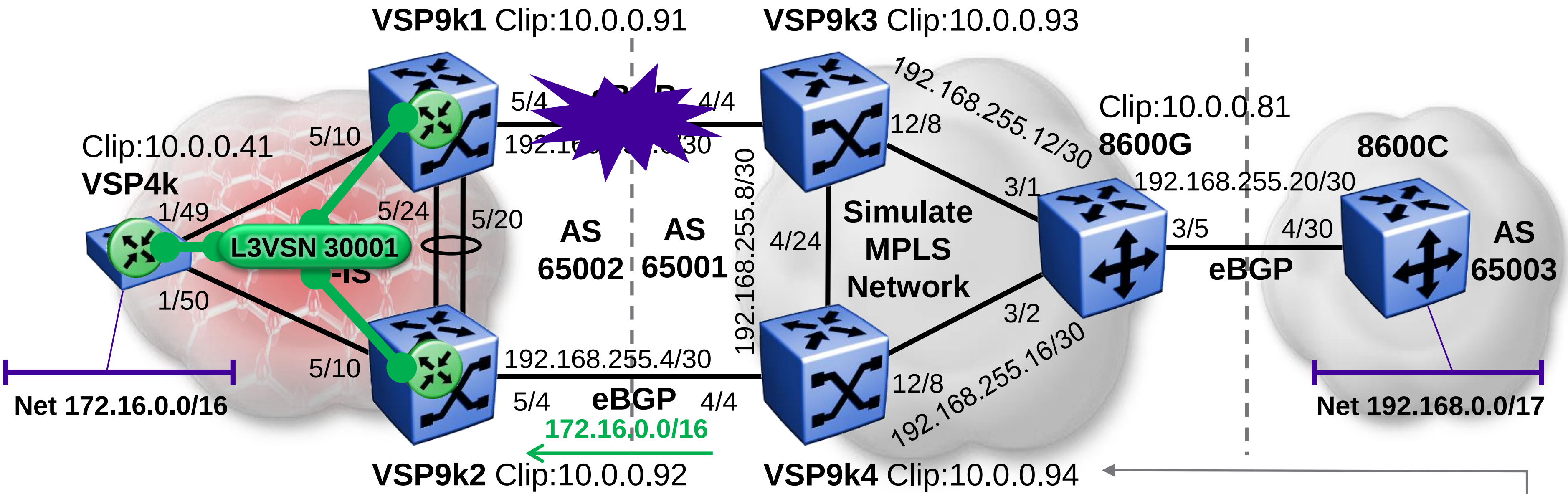

```
VSP9000-2:1#% show ip route vrf green
================================================================================
                                IP Route - VRF green
================================================================================
                                                 NH                 INTER
DST             MASK            NEXT             VRF/ISID      COST FACE  PROT AGE TYPE PRF
--------------------------------------------------------------------------------
172.16.0.0      255.255.0.0     VSP4000          green         10   4051  ISIS 0   IBSV 7
192.168.0.0     255.255.128.0   192.168.255.5    green         2     5/4  BGP  0   IB   45
192.168.255.4   255.255.255.252 192.168.255.6    -             1     5/4  LOC  0   DB   0
```

Forcing paths with BGP and SPB
(b) VRF L3VSN – Checking IP Routes



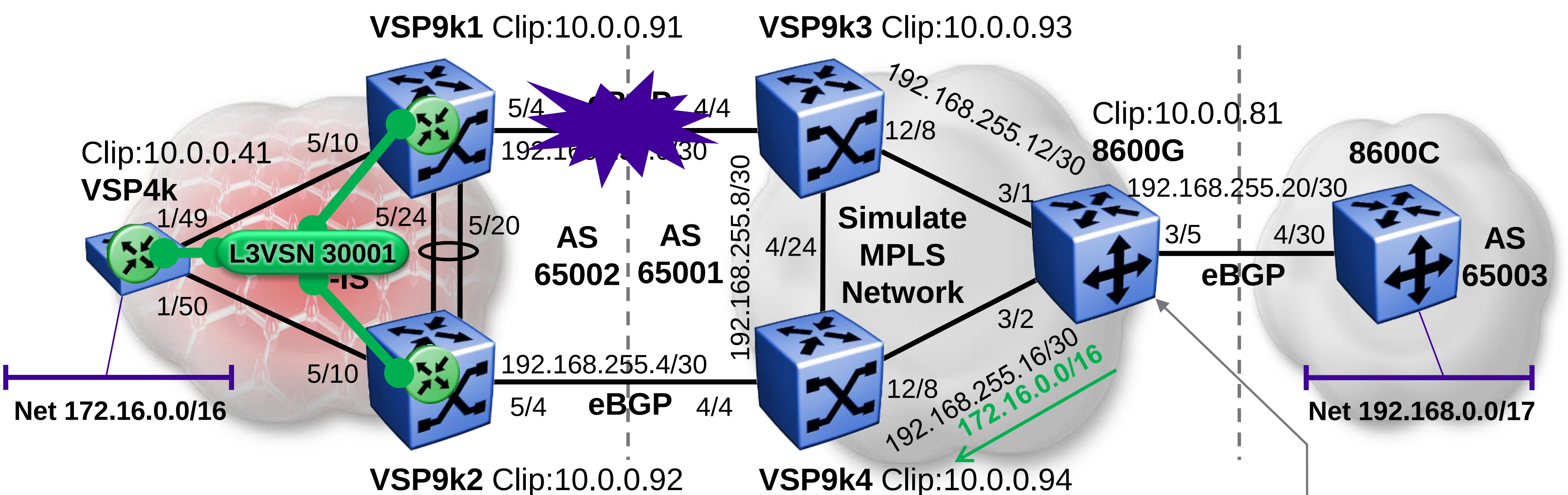

```
VSP9000-3:1#% show ip route
================================================================================
                              IP Route - GlobalRouter
================================================================================
                                              NH                    INTER
DST            MASK            NEXT           VRF/ISID        COST  FACE   PROT AGE TYPE PRF
--------------------------------------------------------------------------------
10.0.0.81      255.255.255.255 192.168.255.14 GlobalRouter    11    12/8   OSPF 0   IB    20
10.0.0.93      255.255.255.255 10.0.0.93      -               1     0      LOC  0   DB    0
10.0.0.94      255.255.255.255 192.168.255.10 GlobalRouter    11     4/24  OSPF 0   IB    20
172.16.0.0     255.255.0.0     192.168.255.10 GlobalRouter    1      4/24  BGP  0   IB    175
192.168.0.0    255.255.128.0   192.168.255.14 GlobalRouter    1     12/8   BGP  0   IB    175
192.168.255.4  255.255.255.252 192.168.255.10 GlobalRouter    2      4/24  OSPF 0   IB    20
192.168.255.8  255.255.255.252 192.168.255.9  -               1      4/24  LOC  0   DB    0
192.168.255.12 255.255.255.252 192.168.255.13 -               1     12/8   LOC  0   DB    0
192.168.255.16 255.255.255.252 192.168.255.10 GlobalRouter    11     4/24  OSPF 0   IB    20
192.168.255.20 255.255.255.252 192.168.255.14 GlobalRouter    2     12/8   OSPF 0   IB    20
```

Forcing paths with BGP and SPB
(b) VRF L3VSN – Checking IP Routes




```
VSP9000-4:1#% show ip route
================================================================================
                              IP Route - GlobalRouter
================================================================================
                                                 NH                   INTER
DST              MASK              NEXT             VRF/ISID         COST  FACE   PROT  AGE  TYPE  PRF
--------------------------------------------------------------------------------
10.0.0.81        255.255.255.255 192.168.255.9    GlobalRouter     12    4/24 OSPF 0    IB    20
10.0.0.93        255.255.255.255 192.168.255.9    GlobalRouter     11    4/24 OSPF 0    IB    20
10.0.0.94        255.255.255.255 10.0.0.94        -                1     0    LOC  0    DB    0
172.16.0.0       255.255.0.0     192.168.255.6    GlobalRouter     1     4/4  BGP  0    IB    45
192.168.0.0      255.255.128.0   192.168.255.9    GlobalRouter     1     4/24 BGP  0    IB    175
192.168.255.4    255.255.255.252 192.168.255.5    -                1     4/4  LOC  0    DB    0
192.168.255.8    255.255.255.252 192.168.255.10   -                1     4/24 LOC  0    DB    0
192.168.255.12   255.255.255.252 192.168.255.9    GlobalRouter     2     4/24 OSPF 0    IB    20
192.168.255.16   255.255.255.252 192.168.255.17   -                1     12/8 LOC  0    DB    0
192.168.255.20   255.255.255.252 192.168.255.9    GlobalRouter     3     4/24 OSPF 0    IB    20
```

Forcing paths with BGP and SPB
(b) VRF L3VSN – Checking IP Routes




```
ERS8000:5#% show ip route
==========================================================================================
                                 IP Route - GlobalRouter
==========================================================================================
                                                     NH              INTER
DST             MASK             NEXT                VRF          COST  FACE   PROT  AGE  TYPE  PRF
------------------------------------------------------------------------------------------
10.0.0.81       255.255.255.255 10.0.0.81            -            1     0      LOC   0    DB    0
10.0.0.93       255.255.255.255 192.168.255.13       GlobalRout~ 20      3/1   OSPF  0    IB    20
10.0.0.94       255.255.255.255 192.168.255.17       GlobalRout~ 20      3/2   OSPF  0    IB    20
172.16.0.0      255.255.0.0     192.168.255.17       GlobalRout~ 1       3/2   BGP   0    IB    175
192.168.0.0     255.255.128.0   192.168.255.22       GlobalRout~ 1       3/5   BGP   0    IB    45
192.168.1.1     255.255.255.255 192.168.1.1          -            1     0      LOC   0    DB    0
192.168.255.4   255.255.255.252 192.168.255.17       GlobalRout~ 11      3/2   OSPF  0    IB    20
192.168.255.8   255.255.255.252 192.168.255.17       GlobalRout~ 11      3/2   OSPF  0    IB    20
192.168.255.12  255.255.255.252 192.168.255.14       -            1      3/1   LOC   0    DB    0
192.168.255.16  255.255.255.252 192.168.255.18       -            1      3/2   LOC   0    DB    0
192.168.255.20  255.255.255.252 192.168.255.21       -            1      3/5   LOC   0    DB    0
```

Thank You

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