VŠB – Technická univerzita Ostrava
Fakulta elektrotechniky a informatiky
Katedra informatiky

SPS - Semestrální projekt

SPS - Semestral project

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Abstrakt

SPS

Klíčová slova: SPS

Abstract

SPS

Keywords: SPS

Obsah

1 Plán číslování VLAN a implementace VLAN

Název	Číslo	Popis
Klient 101	101	
Klient 102	102	
Klient 103	103	
Klient 301	301	
Klient 302	301	
Klient 303	303	
g	9	datový provoz
M	91	management VRF
MA	18	management VRF
unused	998	nevyužité porty
native	999	nativní

2 L2 v access a distribuční vrstvě

2.1 VLANs

do sh vlan

```
ALSW1(config)#do sh vlan

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active
18   MA                               active    Gi1/0
101  klient101                        active    Gi0/3
102  klient102                        active
103  klient103                        active
301  server301                        active    Gi0/0
302  server302                        active
303  server303                        active
998  unused                           active
999  native                           active
1002 fddi-default                     act/unsup
1003 token-ring-default               act/unsup
1004 fddinet-default                  act/unsup
1005 trnet-default                    act/unsup

VLAN Type  SAID       MTU   Parent RingNo BridgeNo Stp  BrdgMode Trans1 Trans2
---- ----- ---------- ----- ------ ------ -------- ---- -------- ------ ------
1    enet  100001     1500  -      -      -        -    -        0      0
18   enet  100018     1500  -      -      -        -    -        0      0
101  enet  100101     1500  -      -      -        -    -        0      0
102  enet  100102     1500  -      -      -        -    -        0      0
103  enet  100103     1500  -      -      -        -    -        0      0
301  enet  100301     1500  -      -      -        -    -        0      0
302  enet  100302     1500  -      -      -        -    -        0      0
303  enet  100303     1500  -      -      -        -    -        0      0
998  enet  100998     1500  -      -      -        -    -        0      0
999  enet  100999     1500  -      -      -        -    -        0      0
1002 fddi  101002     1500  -      -      -        -    -        0      0
1003 tr    101003     1500  -      -      -        -    -        0      0
1004 fdnet 101004     1500  -      -      -        ieee -        0      0
1005 trnet 101005     1500  -      -      -        ibm  -        0      0

Remote SPAN VLANs
------------------------------------------------------------------------------


Primary Secondary Type              Ports
------- --------- ----------------- ------------------------------------------
```

Obrázek 1: ALSW1 VLANs

```
DLSW1(config)#do sh vlan

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Gi0/3
18   MA                               active
101  klient101                        active
102  klient102                        active
103  klient103                        active
301  server301                        active
302  server302                        active
303  server303                        active
998  unused                           active
999  native                           active
1002 fddi-default                     act/unsup
1003 token-ring-default               act/unsup
1004 fddinet-default                  act/unsup
1005 trnet-default                    act/unsup

VLAN Type  SAID       MTU   Parent RingNo BridgeNo Stp  BrdgMode Trans1 Trans2
---- ----- ---------- ----- ------ ------ -------- ---- -------- ------ ------
1    enet  100001     1500  -      -      -        -    -        0      0
18   enet  100018     1500  -      -      -        -    -        0      0
101  enet  100101     1500  -      -      -        -    -        0      0
102  enet  100102     1500  -      -      -        -    -        0      0
103  enet  100103     1500  -      -      -        -    -        0      0
301  enet  100301     1500  -      -      -        -    -        0      0
302  enet  100302     1500  -      -      -        -    -        0      0
303  enet  100303     1500  -      -      -        -    -        0      0
998  enet  100998     1500  -      -      -        -    -        0      0
999  enet  100999     1500  -      -      -        -    -        0      0
1002 fddi  101002     1500  -      -      -        -    -        0      0
1003 tr    101003     1500  -      -      -        -    -        0      0
1004 fdnet 101004     1500  -      -      -        ieee -        0      0
1005 trnet 101005     1500  -      -      -        ibm  -        0      0

Remote SPAN VLANs
------------------------------------------------------------------------------


Primary Secondary Type              Ports
------- --------- ----------------- ------------------------------------------
```

Obrázek 2: DLSW1 VLANs

```
DLSW2(config)#do sh vlan

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Gi0/3
18   MA                               active
101  klient101                        active
102  klient102                        active
103  klient103                        active
301  server301                        active
302  server302                        active
303  server303                        active
998  unused                           active
999  native                           active
1002 fddi-default                     act/unsup
1003 token-ring-default               act/unsup
1004 fddinet-default                  act/unsup
1005 trnet-default                    act/unsup

VLAN Type  SAID       MTU   Parent RingNo BridgeNo Stp  BrdgMode Trans1 Trans2
---- ----- ---------- ----- ------ ------ -------- ---- -------- ------ ------
1    enet  100001     1500  -      -      -        -    -        0      0
18   enet  100018     1500  -      -      -        -    -        0      0
101  enet  100101     1500  -      -      -        -    -        0      0
102  enet  100102     1500  -      -      -        -    -        0      0
103  enet  100103     1500  -      -      -        -    -        0      0
301  enet  100301     1500  -      -      -        -    -        0      0
302  enet  100302     1500  -      -      -        -    -        0      0
303  enet  100303     1500  -      -      -        -    -        0      0
998  enet  100998     1500  -      -      -        -    -        0      0
999  enet  100999     1500  -      -      -        -    -        0      0
1002 fddi  101002     1500  -      -      -        -    -        0      0
1003 tr    101003     1500  -      -      -        -    -        0      0
1004 fdnet 101004     1500  -      -      -        ieee -        0      0
1005 trnet 101005     1500  -      -      -        ibm  -        0      0

Remote SPAN VLANs
------------------------------------------------------------------------------


Primary Secondary Type              Ports
------- --------- ----------------- ------------------------------------------
```

Obrázek 3: DLSW2 VLANs

2.2 Trunks

do sh int trunk

```
ALSW1(config)#do sh int trunk

Port        Mode             Encapsulation  Status        Native vlan
Gi0/1       on               802.1q         trunking      999
Gi0/2       on               802.1q         trunking      999
Gi1/1       on               802.1q         trunking      999
Gi1/2       on               802.1q         trunking      999
Gi1/3       on               802.1q         trunking      999

Port        Vlans allowed on trunk
Gi0/1       18,101-103,301-303,999
Gi0/2       18,101-103,301-303,999
Gi1/1       998
Gi1/2       998
Gi1/3       998

Port        Vlans allowed and active in management domain
Gi0/1       18,101-103,301-303,999
Gi0/2       18,101-103,301-303,999
Gi1/1       998
Gi1/2       998
Gi1/3       998

Port        Vlans in spanning tree forwarding state and not pruned
Gi0/1       18,301-303,999
Gi0/2       18,101-103,999
Gi1/1       998
Gi1/2       998
Gi1/3       998
```

Obrázek 4: ALSW1 Trunks

```
DLSW1(config)#do sh int trunk

Port        Mode             Encapsulation  Status        Native vlan
Gi0/0       on               802.1q         trunking      999
Gi0/1       on               802.1q         trunking      999
Gi1/0       on               802.1q         trunking      999
Po1         on               802.1q         trunking      999

Port        Vlans allowed on trunk
Gi0/0       998
Gi0/1       18,101-103,301-303,999
Gi1/0       18,101-103,301-303,999
Po1         18,101-103,301-303,999

Port        Vlans allowed and active in management domain
Gi0/0       998
Gi0/1       18,101-103,301-303,999
Gi1/0       18,101-103,301-303,999
Po1         18,101-103,301-303,999

Port        Vlans in spanning tree forwarding state and not pruned
Gi0/0       998
Gi0/1       18,101-103,301-303,999
Gi1/0       18,101-103,301-303,999
Po1         18,101-103,301-303,999
```

Obrázek 5: DLSW1 Trunks

```
DLSW2(config)#do sh int trunk

Port        Mode             Encapsulation  Status        Native vlan
Gi0/0       on               802.1q         trunking      999
Gi0/1       on               802.1q         trunking      999
Gi1/0       on               802.1q         trunking      999
Po1         on               802.1q         trunking      999

Port        Vlans allowed on trunk
Gi0/0       998
Gi0/1       18,101-103,301-303,999
Gi1/0       18,101-103,301-303,999
Po1         18,101-103,301-303,999

Port        Vlans allowed and active in management domain
Gi0/0       998
Gi0/1       18,101-103,301-303,999
Gi1/0       18,101-103,301-303,999
Po1         18,101-103,301-303,999

Port        Vlans in spanning tree forwarding state and not pruned
Gi0/0       998
Gi0/1       18,101-103,301-303,999
Gi1/0       18,101-103,301-303,999
Po1         101-103,301-303
```

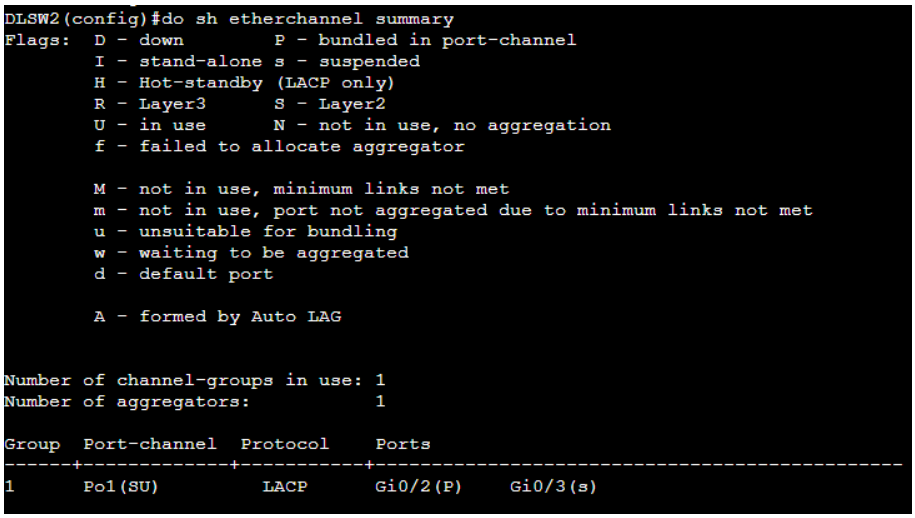
Obrázek 6: DLSW2 Trunks

2.3 LACP

do sh etherchannel summary

```
DLSW1(config)#do sh etherchannel summary
Flags:  D - down        P - bundled in port-channel
        I - stand-alone s - suspended
        H - Hot-standby (LACP only)
        R - Layer3      S - Layer2
        U - in use      N - not in use, no aggregation
        f - failed to allocate aggregator

        M - not in use, minimum links not met
        m - not in use, port not aggregated due to minimum links not met
        u - unsuitable for bundling
        w - waiting to be aggregated
        d - default port

        A - formed by Auto LAG


Number of channel-groups in use: 1
Number of aggregators:           1

Group  Port-channel  Protocol    Ports
------+-------------+-----------+-----------------------------------------------
1      Po1(SU)         LACP      Gi0/2(P)    Gi0/3(s)
```

Obrázek 7: DLSW1 LACP



Obrázek 8: DLSW2 LACP

3 Spanning Tree

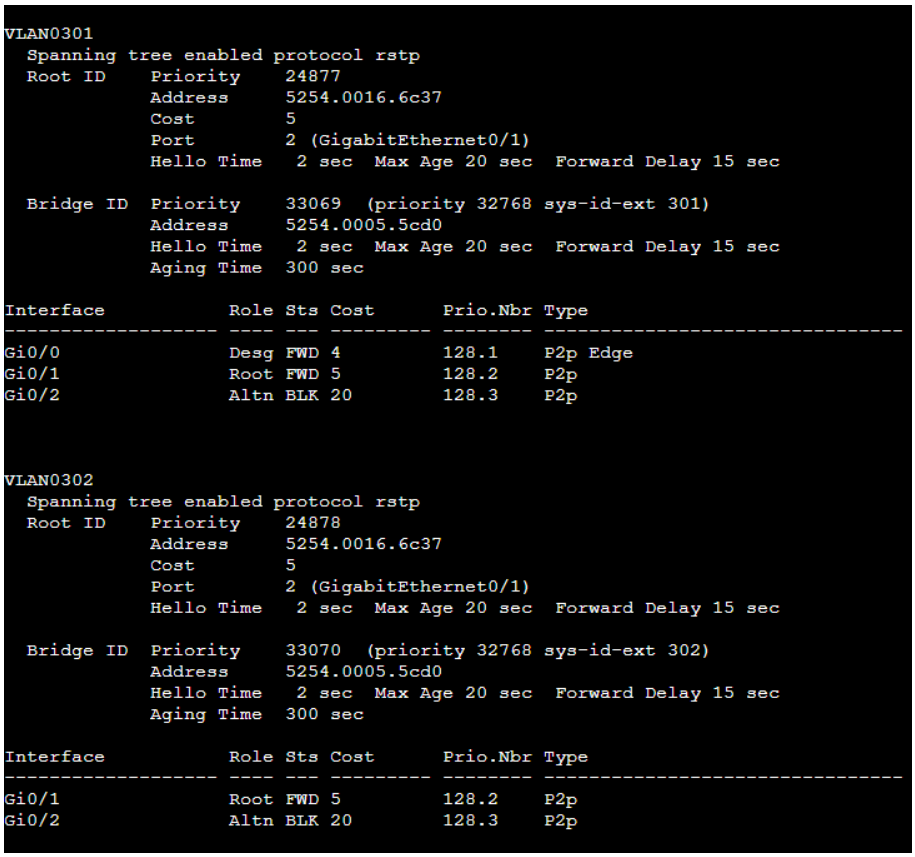
do sh spanning-tree

```
ALSW1(config)#do sh spanning-tree

VLAN0018
  Spanning tree enabled protocol rstp
  Root ID     Priority    32786
              Address     5254.0005.5cd0
              This bridge is the root
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    32786  (priority 32768 sys-id-ext 18)
              Address     5254.0005.5cd0
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
              Aging Time  300 sec

Interface           Role Sts Cost      Prio.Nbr Type
------------------- ---- --- --------- -------- --------------------------------
Gi0/1               Desg FWD 4         128.2    P2p
Gi0/2               Desg FWD 4         128.3    P2p
Gi1/0               Desg FWD 4         128.5    P2p



VLAN0101
  Spanning tree enabled protocol rstp
  Root ID     Priority    28773
              Address     5254.0016.6c37
              Cost        9
              Port        3 (GigabitEthernet0/2)
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    32869  (priority 32768 sys-id-ext 101)
              Address     5254.0005.5cd0
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
              Aging Time  300 sec

Interface           Role Sts Cost      Prio.Nbr Type
------------------- ---- --- --------- -------- --------------------------------
Gi0/1               Altn BLK 20        128.2    P2p
Gi0/2               Root FWD 5         128.3    P2p
Gi0/3               Desg FWD 4         128.4    P2p Edge
```

Obrázek 9: ALSW1 SPT 1/5

```
VLAN0102
  Spanning tree enabled protocol rstp
  Root ID     Priority    28774
              Address     5254.0016.6c37
              Cost        9
              Port        3 (GigabitEthernet0/2)
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    32870  (priority 32768 sys-id-ext 102)
              Address     5254.0005.5cd0
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
              Aging Time  300 sec

Interface           Role Sts Cost      Prio.Nbr Type
------------------- ---- --- --------- -------- --------------------------------
Gi0/1               Altn BLK 20        128.2    P2p
Gi0/2               Root FWD 5         128.3    P2p


VLAN0103
  Spanning tree enabled protocol rstp
  Root ID     Priority    28775
              Address     5254.0016.6c37
              Cost        9
              Port        3 (GigabitEthernet0/2)
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    32871  (priority 32768 sys-id-ext 103)
              Address     5254.0005.5cd0
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
              Aging Time  300 sec

Interface           Role Sts Cost      Prio.Nbr Type
------------------- ---- --- --------- -------- --------------------------------
Gi0/1               Altn BLK 20        128.2    P2p
Gi0/2               Root FWD 5         128.3    P2p
```

Obrázek 10: ALSW1 SPT 2/5



Obrázek 11: ALSW1 SPT 3/5

```
VLAN0303
  Spanning tree enabled protocol rstp
  Root ID     Priority    24879
              Address     5254.0016.6c37
              Cost        5
              Port        2 (GigabitEthernet0/1)
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    33071  (priority 32768 sys-id-ext 303)
              Address     5254.0005.5cd0
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
              Aging Time  300 sec

Interface           Role Sts Cost      Prio.Nbr Type
------------------- ---- --- --------- -------- --------------------------------
Gi0/1               Root FWD 5         128.2    P2p
Gi0/2               Altn BLK 20        128.3    P2p


VLAN0998
  Spanning tree enabled protocol rstp
  Root ID     Priority    33766
              Address     5254.0005.5cd0
              This bridge is the root
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    33766  (priority 32768 sys-id-ext 998)
              Address     5254.0005.5cd0
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
              Aging Time  300 sec

Interface           Role Sts Cost      Prio.Nbr Type
------------------- ---- --- --------- -------- --------------------------------
Gi1/1               Desg FWD 4         128.6    P2p
Gi1/2               Desg FWD 4         128.7    P2p
Gi1/3               Desg FWD 4         128.8    P2p
```

Obrázek 12: ALSW1 SPT 4/5

```
VLAN0999
  Spanning tree enabled protocol rstp
  Root ID     Priority    33767
              Address     5254.0005.5cd0
              This bridge is the root
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    33767  (priority 32768 sys-id-ext 999)
              Address     5254.0005.5cd0
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
              Aging Time  300 sec

Interface           Role Sts Cost      Prio.Nbr Type
------------------- ---- --- --------- -------- --------------------------------
Gi0/1               Desg FWD 4         128.2    P2p
Gi0/2               Desg FWD 4         128.3    P2p
```

Obrázek 13: ALSW1 SPT 5/5

```
DLSW1(config)#do sh spanning-tree

VLAN0018
  Spanning tree enabled protocol rstp
  Root ID     Priority    32786
              Address     5254.0005.5cd0
              Cost        4
              Port        5 (GigabitEthernet1/0)
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    32786  (priority 32768 sys-id-ext 18)
              Address     5254.0016.6c37
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
              Aging Time  300 sec

Interface           Role Sts Cost      Prio.Nbr Type
------------------- ---- --- --------- -------- --------------------------------
Gi0/1               Desg FWD 4         128.2    P2p
Gi1/0               Root FWD 4         128.5    P2p
Po1                 Desg FWD 4         128.65   P2p



VLAN0101
  Spanning tree enabled protocol rstp
  Root ID     Priority    28773
              Address     5254.0016.6c37
              This bridge is the root
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    28773  (priority 28672 sys-id-ext 101)
              Address     5254.0016.6c37
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
              Aging Time  300 sec

Interface           Role Sts Cost      Prio.Nbr Type
------------------- ---- --- --------- -------- --------------------------------
Gi0/1               Desg FWD 4         128.2    P2p
Gi1/0               Desg FWD 20        128.5    P2p
Po1                 Desg FWD 4         128.65   P2p
```

Obrázek 14: DLSW1 SPT 1/5

```
VLAN0102
  Spanning tree enabled protocol rstp
  Root ID     Priority    28774
              Address     5254.0016.6c37
              This bridge is the root
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    28774  (priority 28672 sys-id-ext 102)
              Address     5254.0016.6c37
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
              Aging Time  300 sec

Interface           Role Sts Cost      Prio.Nbr Type
------------------- ---- --- --------- -------- --------------------------------
Gi0/1               Desg FWD 4         128.2    P2p
Gi1/0               Desg FWD 20        128.5    P2p
Po1                 Desg FWD 4         128.65   P2p


VLAN0103
  Spanning tree enabled protocol rstp
  Root ID     Priority    28775
              Address     5254.0016.6c37
              This bridge is the root
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    28775  (priority 28672 sys-id-ext 103)
              Address     5254.0016.6c37
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
              Aging Time  300 sec

Interface           Role Sts Cost      Prio.Nbr Type
------------------- ---- --- --------- -------- --------------------------------
Gi0/1               Desg FWD 4         128.2    P2p
Gi1/0               Desg FWD 20        128.5    P2p
Po1                 Desg FWD 4         128.65   P2p
```

Obrázek 15: DLSW1 SPT 2/5

```
VLAN0301
  Spanning tree enabled protocol rstp
  Root ID     Priority    24877
              Address     5254.0016.6c37
              This bridge is the root
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    24877  (priority 24576 sys-id-ext 301)
              Address     5254.0016.6c37
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
              Aging Time  300 sec

Interface           Role Sts Cost      Prio.Nbr Type
------------------- ---- --- --------- -------- --------------------------------
Gi0/1               Desg FWD 4         128.2    P2p
Gi1/0               Desg FWD 5         128.5    P2p
Po1                 Desg FWD 4         128.65   P2p


VLAN0302
  Spanning tree enabled protocol rstp
  Root ID     Priority    24878
              Address     5254.0016.6c37
              This bridge is the root
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    24878  (priority 24576 sys-id-ext 302)
              Address     5254.0016.6c37
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
              Aging Time  300 sec

Interface           Role Sts Cost      Prio.Nbr Type
------------------- ---- --- --------- -------- --------------------------------
Gi0/1               Desg FWD 4         128.2    P2p
Gi1/0               Desg FWD 5         128.5    P2p
Po1                 Desg FWD 4         128.65   P2p
```

Obrázek 16: DLSW1 SPT 3/5

```
VLAN0303
  Spanning tree enabled protocol rstp
  Root ID     Priority    24879
              Address     5254.0016.6c37
              This bridge is the root
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    24879  (priority 24576 sys-id-ext 303)
              Address     5254.0016.6c37
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
              Aging Time  300 sec

Interface           Role Sts Cost      Prio.Nbr Type
------------------- ---- --- --------- -------- --------------------------------
Gi0/1               Desg FWD 4         128.2    P2p
Gi1/0               Desg FWD 5         128.5    P2p
Po1                 Desg FWD 4         128.65   P2p


VLAN0998
  Spanning tree enabled protocol rstp
  Root ID     Priority    33766
              Address     5254.0016.6c37
              This bridge is the root
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    33766  (priority 32768 sys-id-ext 998)
              Address     5254.0016.6c37
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
              Aging Time  300 sec

Interface           Role Sts Cost      Prio.Nbr Type
------------------- ---- --- --------- -------- --------------------------------
Gi0/0               Desg FWD 4         128.1    P2p
```

Obrázek 17: DLSW1 SPT 4/5

```
VLAN0999
  Spanning tree enabled protocol rstp
  Root ID     Priority    33767
              Address     5254.0005.5cd0
              Cost        4
              Port        5 (GigabitEthernet1/0)
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    33767  (priority 32768 sys-id-ext 999)
              Address     5254.0016.6c37
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
              Aging Time  300 sec

Interface           Role Sts Cost      Prio.Nbr Type
------------------- ---- --- --------- -------- --------------------------------
Gi0/1               Desg FWD 4         128.2    P2p
Gi1/0               Root FWD 4         128.5    P2p
Po1                 Desg FWD 4         128.65   P2p
```

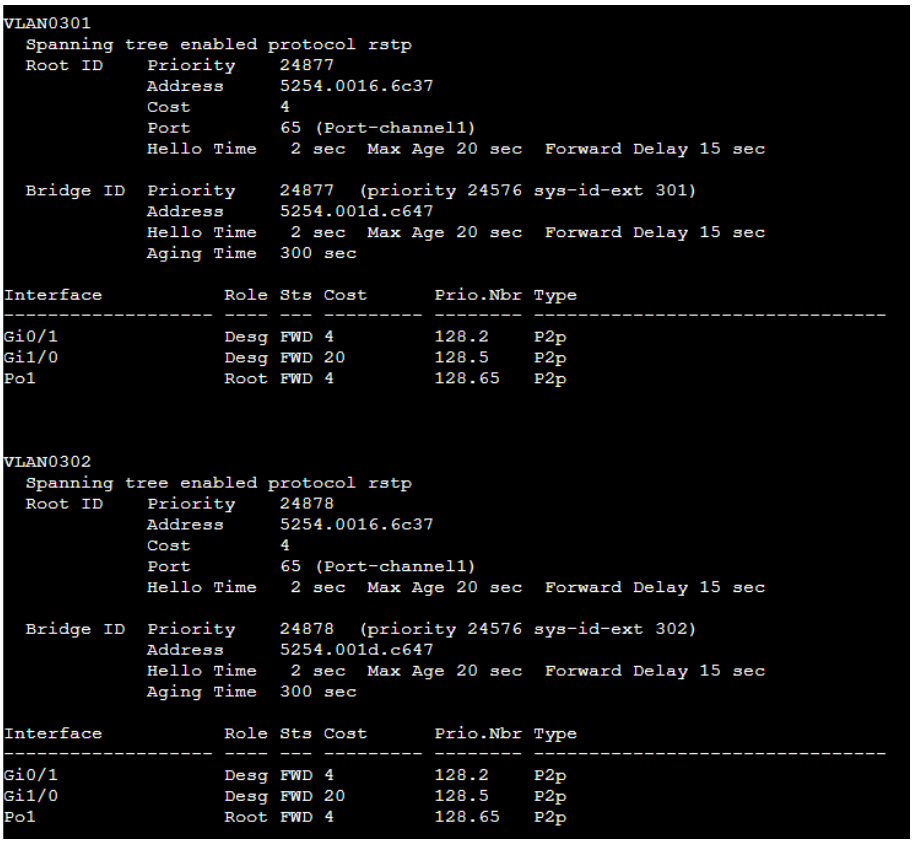
Obrázek 18: DLSW1 SPT 5/5

```
DLSW2(config)#do sh spanning-tree

VLAN0018
  Spanning tree enabled protocol rstp
  Root ID     Priority    32786
              Address     5254.0005.5cd0
              Cost        4
              Port        5 (GigabitEthernet1/0)
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    32786  (priority 32768 sys-id-ext 18)
              Address     5254.001d.c647
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
              Aging Time  300 sec

Interface           Role Sts Cost      Prio.Nbr Type
------------------- ---- --- --------- -------- --------------------------------
Gi0/1               Desg FWD 4         128.2    P2p
Gi1/0               Root FWD 4         128.5    P2p
Po1                 Altn BLK 4         128.65   P2p


VLAN0101
  Spanning tree enabled protocol rstp
  Root ID     Priority    28773
              Address     5254.0016.6c37
              Cost        4
              Port        65 (Port-channel1)
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    28773  (priority 28672 sys-id-ext 101)
              Address     5254.001d.c647
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
              Aging Time  300 sec

Interface           Role Sts Cost      Prio.Nbr Type
------------------- ---- --- --------- -------- --------------------------------
Gi0/1               Desg FWD 4         128.2    P2p
Gi1/0               Desg FWD 5         128.5    P2p
Po1                 Root FWD 4         128.65   P2p
```

Obrázek 19: DLSW2 SPT 1/5

```
VLAN0102
  Spanning tree enabled protocol rstp
  Root ID     Priority    28774
              Address     5254.0016.6c37
              Cost        4
              Port        65 (Port-channel1)
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    28774  (priority 28672 sys-id-ext 102)
              Address     5254.001d.c647
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
              Aging Time  300 sec

Interface           Role Sts Cost      Prio.Nbr Type
------------------- ---- --- --------- -------- --------------------------------
Gi0/1               Desg FWD 4         128.2    P2p
Gi1/0               Desg FWD 5         128.5    P2p
Po1                 Root FWD 4         128.65   P2p


VLAN0103
  Spanning tree enabled protocol rstp
  Root ID     Priority    28775
              Address     5254.0016.6c37
              Cost        4
              Port        65 (Port-channel1)
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    28775  (priority 28672 sys-id-ext 103)
              Address     5254.001d.c647
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
              Aging Time  300 sec

Interface           Role Sts Cost      Prio.Nbr Type
------------------- ---- --- --------- -------- --------------------------------
Gi0/1               Desg FWD 4         128.2    P2p
Gi1/0               Desg FWD 5         128.5    P2p
Po1                 Root FWD 4         128.65   P2p
```

Obrázek 20: DLSW2 SPT 2/5



Obrázek 21: DLSW2 SPT 3/5

```
VLAN0303
  Spanning tree enabled protocol rstp
  Root ID     Priority    24879
              Address     5254.0016.6c37
              Cost        4
              Port        65 (Port-channel1)
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    24879  (priority 24576 sys-id-ext 303)
              Address     5254.001d.c647
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
              Aging Time  300 sec

Interface           Role Sts Cost      Prio.Nbr Type
------------------- ---- --- --------- -------- --------------------------------
Gi0/1               Desg FWD 4         128.2    P2p
Gi1/0               Desg FWD 20        128.5    P2p
Po1                 Root FWD 4         128.65   P2p


VLAN0998
  Spanning tree enabled protocol rstp
  Root ID     Priority    33766
              Address     5254.001d.c647
              This bridge is the root
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    33766  (priority 32768 sys-id-ext 998)
              Address     5254.001d.c647
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
              Aging Time  300 sec

Interface           Role Sts Cost      Prio.Nbr Type
------------------- ---- --- --------- -------- --------------------------------
Gi0/0               Desg FWD 4         128.1    P2p
```

Obrázek 22: DLSW2 SPT 4/5

```
VLAN0999
  Spanning tree enabled protocol rstp
  Root ID     Priority    33767
              Address     5254.0005.5cd0
              Cost        4
              Port        5 (GigabitEthernet1/0)
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    33767  (priority 32768 sys-id-ext 999)
              Address     5254.001d.c647
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
              Aging Time  300 sec

Interface           Role Sts Cost      Prio.Nbr Type
------------------- ---- --- --------- -------- --------------------------------
Gi0/1               Desg FWD 4         128.2    P2p
Gi1/0               Root FWD 4         128.5    P2p
Po1                 Altn BLK 4         128.65   P2p
```

Obrázek 23: DLSW2 SPT 5/5

4 Adresování

4.1 IPv4

Klient/server

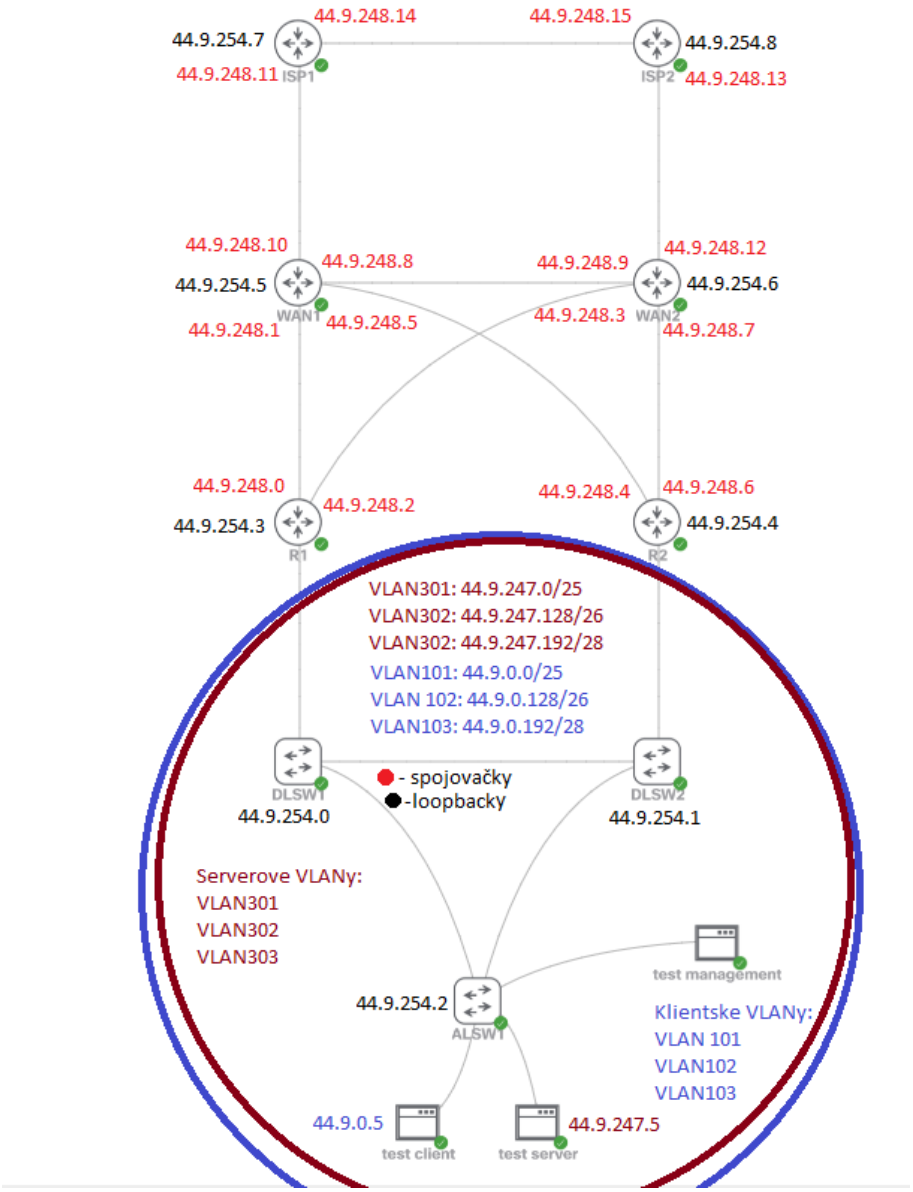
Name	Network address	Description
VLAN 101	44.9.0.0/25	Client VLAN 1
VLAN 102	44.9.0.128/26	Client VLAN 2
VLAN 103	44.9.0.192/28	Client VLAN 3
Client 1	44.9.1.0/25	First client subnet
...	...	...
Client 200	44.9.100.128/25	Last client subnet
...	...	...
Server 1	44.9.222.0/25	First server subnet
...	...	...
Server 50	44.9.246.128/25	Last server subnet
VLAN 301	44.9.247.0/25	Server VLAN 1
VLAN 302	44.9.247.128/26	Server VLAN 2
VLAN 303	44.9.247.192/28	Server VLAN 3

Global

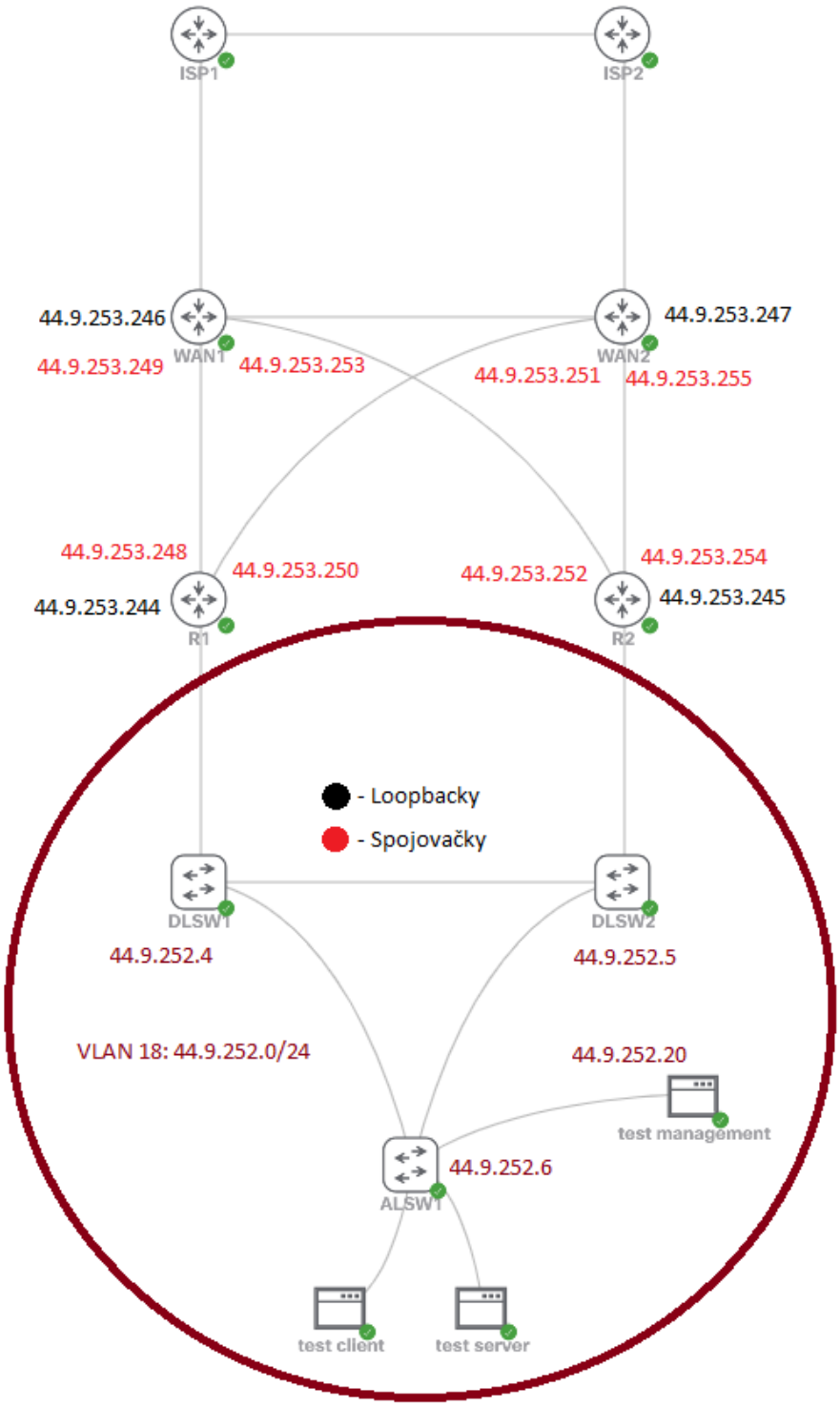
Name	Network address	First address	Second address	Description
R1-WAN1	44.9.248.0/31	44.9.248.0	44.9.248.1	IC Link
DLSW1	44.9.254.0/32	44.9.254.0	-	Loopback0

Management

Name	Network address	First address	Second address	Description
R1-WAN1	44.9.253.248/31	44.9.253.248	44.9.253.249	IC Link
R1-WAN2	44.9.253.250/31	44.9.253.250	44.9.253.251	IC Link
R2-WAN1	44.9.253.252/31	44.9.253.252	44.9.253.253	IC Link
R2-WAN2	44.9.253.254/31	44.9.253.254	44.9.253.255	IC Link
VRRP	44.9.252.0/24	44.9.252.1	-	R1 & R2 virtual
R1	44.9.252.0/24	44.9.252.2	-	Adress on interface
R2	44.9.252.0/24	44.9.252.3	-	Adress on interface
DLSW1	44.9.252.0/24	44.9.252.4	-	VLAN 18
DLSW2	44.9.252.0/24	44.9.252.5	-	VLAN 18
ALSW1	44.9.252.0/24	44.9.252.6	-	VLAN 18
TEST PC	44.9.252.0/24	44.9.252.20	-	VLAN 18
R1	44.9.253.244/32	44.9.253.244	-	Loopback1
R2	44.9.253.245/32	44.9.253.245	-	Loopback1
WAN1	44.9.253.246/32	44.9.253.246	-	Loopback1
WAN2	44.9.253.247/32	44.9.253.247	-	Loopback1



Obrázek 24: IPv4 addressing



Obrázek 25: IPv4 management addressing

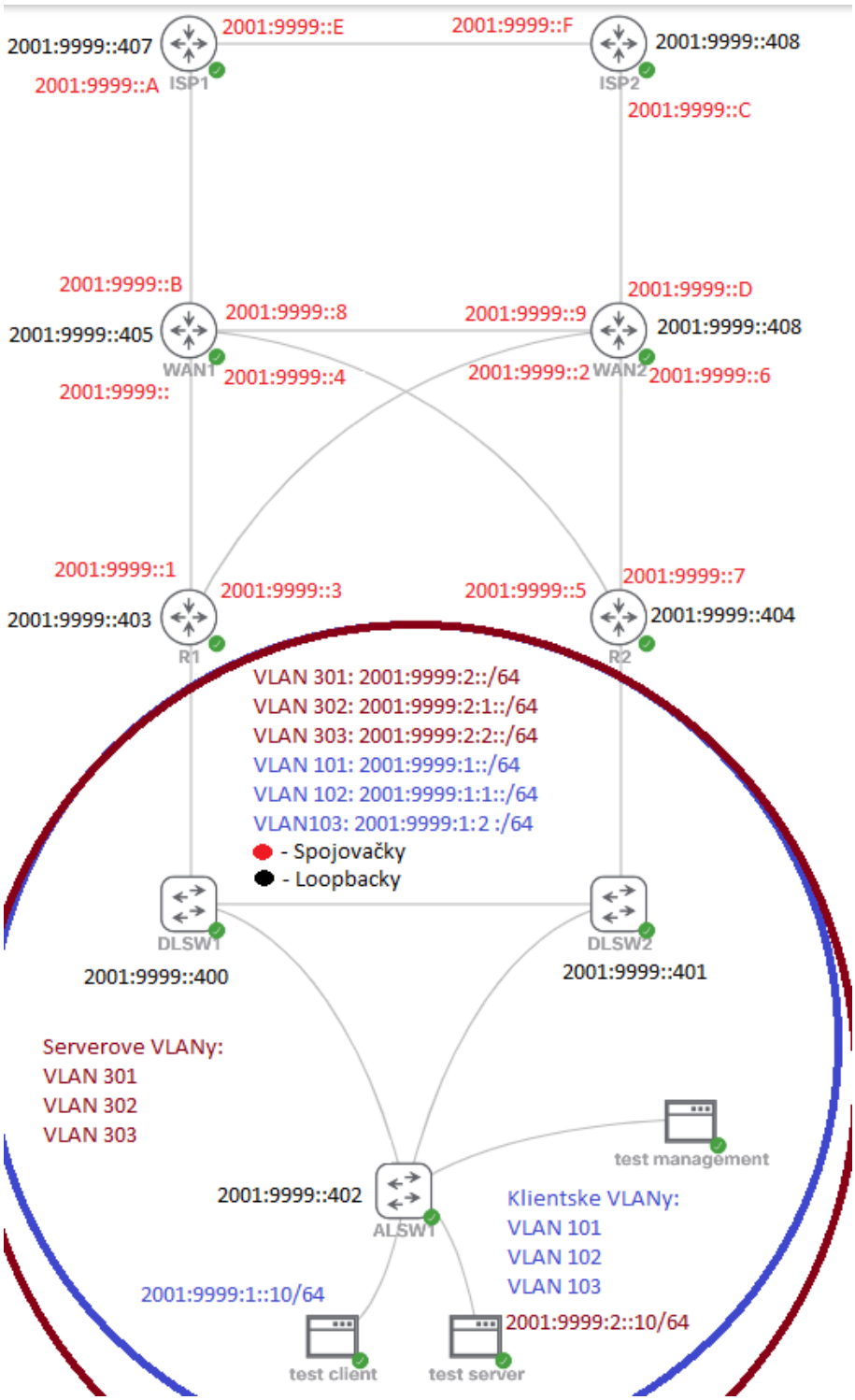
4.2 IPv6

Klient/server

Name	Network address	Description
VLAN 101	44.9.0.0/25	Client VLAN 1
VLAN 102	44.9.0.128/26	Client VLAN 2
VLAN 103	44.9.0.192/28	Client VLAN 3
Client 1	44.9.1.0/25	First client subnet
...	...	...
Client 200	44.9.100.128/25	Last client subnet
...	...	...
Server 1	44.9.222.0/25	First server subnet
...	...	...
Server 50	44.9.246.128/25	Last server subnet
VLAN 301	44.9.247.0/25	Server VLAN 1
VLAN 302	44.9.247.128/26	Server VLAN 2
VLAN 303	44.9.247.192/28	Server VLAN 3

Global

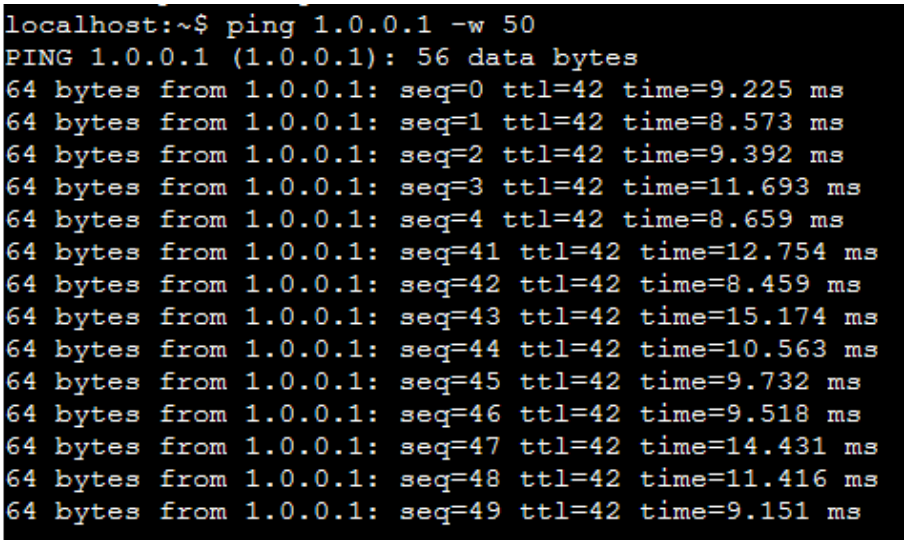
Name	Network address	First address	Second address	Description
R1-WAN1	44.9.248.0/31	44.9.248.0	44.9.248.1	IC Link
DLSW1	44.9.254.0/32	44.9.254.0	-	Loopback0



Obrázek 26: IPv6 addressing

4.3 Rekonvergence

V IGP je primárně preferována cesta přes WAN1, při výpadku cesty trvá cca 35 s než dojde k převzetí jinou cestou



Obrázek 27: IPv4 rekonvergence

5 FHRP

5.1 Implementace

do sh standby br

```
R1(config-subif)#do sh standby br
                  P indicates configured to preempt.
                  |
Interface   Grp  Pri P State   Active          Standby         Virtual IP
Gi0/1.101   11   120 P Standby FE80::5054:FF:FE17:C2F3
                                               local           FE80::5:73FF:FEA0:B
Gi0/1.101   101  120 P Standby 44.9.0.3        local           44.9.0.1
Gi0/1.102   12   120 P Standby FE80::5054:FF:FE17:C2F3
                                               local           FE80::5:73FF:FEA0:C
Gi0/1.102   102  120 P Standby 44.9.0.131      local           44.9.0.129
Gi0/1.103   13   120 P Standby FE80::5054:FF:FE17:C2F3
                                               local           FE80::5:73FF:FEA0:D
Gi0/1.103   103  120 P Standby 44.9.0.195      local           44.9.0.193
Gi0/1.301   1    150 P Active  local           44.9.247.3      44.9.247.1
Gi0/1.301   21   150 P Active  local           FE80::5054:FF:FE17:C2F3
                                               FE80::5:73FF:FEA0:15
Gi0/1.302   2    150 P Active  local           44.9.247.131    44.9.247.129
Gi0/1.302   22   150 P Active  local           FE80::5054:FF:FE17:C2F3
                                               FE80::5:73FF:FEA0:16
Gi0/1.303   3    150 P Active  local           44.9.247.195    44.9.247.193
Gi0/1.303   23   150 P Active  local           FE80::5054:FF:FE17:C2F3
                                               FE80::5:73FF:FEA0:17
```

Obrázek 28: R1 FHRP implementace

```
R2(config-subif)#do sh standby br
                  P indicates configured to preempt.
                  |
Interface   Grp  Pri P State   Active          Standby         Virtual IP
Gi0/1.101   11   120 P Active  local           FE80::5054:FF:FE06:69A1
                                               FE80::5:73FF:FEA0:B
Gi0/1.101   101  150 P Active  local           44.9.0.2        44.9.0.1
Gi0/1.102   12   150 P Active  local           FE80::5054:FF:FE06:69A1
                                               FE80::5:73FF:FEA0:C
Gi0/1.102   102  150 P Active  local           44.9.0.130      44.9.0.129
Gi0/1.103   13   150 P Active  local           FE80::5054:FF:FE06:69A1
                                               FE80::5:73FF:FEA0:D
Gi0/1.103   103  150 P Active  local           44.9.0.194      44.9.0.193
Gi0/1.301   1    120 P Standby 44.9.247.2       local           44.9.247.1
Gi0/1.301   21   120 P Standby FE80::5054:FF:FE06:69A1
                                               local           FE80::5:73FF:FEA0:15
Gi0/1.302   2    120 P Standby 44.9.247.130     local           44.9.247.129
Gi0/1.302   22   120 P Standby FE80::5054:FF:FE06:69A1
                                               local           FE80::5:73FF:FEA0:16
Gi0/1.303   3    120 P Standby 44.9.247.194     local           44.9.247.193
Gi0/1.303   23   120 P Standby FE80::5054:FF:FE06:69A1
                                               local           FE80::5:73FF:FEA0:17
```

Obrázek 29: R2 FHRP implementace

5.2 Tracking

do sh standby

```
R1(config-if)#do sh standby
GigabitEthernet0/1.101 - Group 11 (version 2)
  State is Standby
    5 state changes, last state change 00:05:20
  Link-Local Virtual IPv6 address is FE80::5:73FF:FEA0:B (impl auto EUI64)
    Virtual IPv6 address 2001:9999:1::/64
  Active virtual MAC address is 0005.73a0.000b
    Local virtual MAC address is 0005.73a0.000b (v2 IPv6 default)
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 2.288 secs
  Preemption enabled
  Active router is FE80::5054:FF:FE17:C2F3, priority 120 (expires in 9.184 sec)
    MAC address is 5254.0017.c2f3
  Standby router is local
  Priority 120 (configured 120)
  Group name is "hsrp-Gi0/1.101-11" (default)
GigabitEthernet0/1.101 - Group 101 (version 2)
  State is Standby
    6 state changes, last state change 00:05:19
  Virtual IP address is 44.9.0.1
  Active virtual MAC address is 0000.0c9f.f065
    Local virtual MAC address is 0000.0c9f.f065 (v2 default)
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 0.192 secs
  Preemption enabled
  Active router is 44.9.0.3, priority 150 (expires in 8.848 sec)
    MAC address is 5254.0017.c2f3
  Standby router is local
  Priority 120 (configured 120)
  Group name is "hsrp-Gi0/1.101-101" (default)
```

Obrázek 30: R1 FHRP detail 1/6

```
GigabitEthernet0/1.102 - Group 12 (version 2)
  State is Standby
    6 state changes, last state change 00:05:20
  Link-Local Virtual IPv6 address is FE80::5:73FF:FEA0:C (impl auto EUI64)
    Virtual IPv6 address 2001:9999:1:1::/64
  Active virtual MAC address is 0005.73a0.000c
    Local virtual MAC address is 0005.73a0.000c (v2 IPv6 default)
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 0.448 secs
  Preemption enabled
  Active router is FE80::5054:FF:FE17:C2F3, priority 150 (expires in 10.000 sec)
    MAC address is 5254.0017.c2f3
  Standby router is local
  Priority 120 (configured 120)
  Group name is "hsrp-Gi0/1.102-12" (default)
GigabitEthernet0/1.102 - Group 102 (version 2)
  State is Standby
    6 state changes, last state change 00:05:20
  Virtual IP address is 44.9.0.129
  Active virtual MAC address is 0000.0c9f.f066
    Local virtual MAC address is 0000.0c9f.f066 (v2 default)
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 0.160 secs
  Preemption enabled
  Active router is 44.9.0.131, priority 150 (expires in 7.776 sec)
    MAC address is 5254.0017.c2f3
  Standby router is local
  Priority 120 (configured 120)
  Group name is "hsrp-Gi0/1.102-102" (default)
```

Obrázek 31: R1 FHRP detail 2/6

```
GigabitEthernet0/1.103 - Group 13 (version 2)
  State is Standby
    3 state changes, last state change 00:05:18
  Link-Local Virtual IPv6 address is FE80::5:73FF:FEA0:D (impl auto EUI64)
    Virtual IPv6 address 2001:9999:1:2::/64
  Active virtual MAC address is 0005.73a0.000d
    Local virtual MAC address is 0005.73a0.000d (v2 IPv6 default)
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 1.392 secs
  Preemption enabled
  Active router is FE80::5054:FF:FE17:C2F3, priority 150 (expires in 8.448 sec)
    MAC address is 5254.0017.c2f3
  Standby router is local
  Priority 120 (configured 120)
  Group name is "hsrp-Gi0/1.103-13" (default)
GigabitEthernet0/1.103 - Group 103 (version 2)
  State is Standby
    3 state changes, last state change 00:05:21
  Virtual IP address is 44.9.0.193
  Active virtual MAC address is 0000.0c9f.f067
    Local virtual MAC address is 0000.0c9f.f067 (v2 default)
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 0.864 secs
  Preemption enabled
  Active router is 44.9.0.195, priority 150 (expires in 9.760 sec)
    MAC address is 5254.0017.c2f3
  Standby router is local
  Priority 120 (configured 120)
  Group name is "hsrp-Gi0/1.103-103" (default)
```

Obrázek 32: R1 FHRP detail 3/6

```
GigabitEthernet0/1.301 - Group 1 (version 2)
  State is Active
    4 state changes, last state change 00:05:41
  Virtual IP address is 44.9.247.1
  Active virtual MAC address is 0000.0c9f.f001
    Local virtual MAC address is 0000.0c9f.f001 (v2 default)
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 0.864 secs
  Preemption enabled
  Active router is local
  Standby router is 44.9.247.3, priority 120 (expires in 10.848 sec)
  Priority 150 (configured 150)
    Track object 301 state Up decrement 30
  Group name is "hsrp-Gi0/1.301-1" (default)
GigabitEthernet0/1.301 - Group 21 (version 2)
  State is Active
    4 state changes, last state change 00:05:41
  Link-Local Virtual IPv6 address is FE80::5:73FF:FEA0:15 (impl auto EUI64)
    Virtual IPv6 address 2001:9999:2::/64
  Active virtual MAC address is 0005.73a0.0015
    Local virtual MAC address is 0005.73a0.0015 (v2 IPv6 default)
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 2.672 secs
  Preemption enabled
  Active router is local
  Standby router is FE80::5054:FF:FE17:C2F3, priority 120 (expires in 10.880 sec)
  Priority 150 (configured 150)
    Track object 31 state Up decrement 30
  Group name is "hsrp-Gi0/1.301-21" (default)
```

Obrázek 33: R1 FHRP detail 4/6

```
GigabitEthernet0/1.302 - Group 2 (version 2)
  State is Active
    4 state changes, last state change 00:05:42
  Virtual IP address is 44.9.247.129
  Active virtual MAC address is 0000.0c9f.f002
    Local virtual MAC address is 0000.0c9f.f002 (v2 default)
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 1.040 secs
  Preemption enabled
  Active router is local
  Standby router is 44.9.247.131, priority 120 (expires in 11.360 sec)
  Priority 150 (configured 150)
    Track object 302 state Up decrement 30
  Group name is "hsrp-Gi0/1.302-2" (default)
GigabitEthernet0/1.302 - Group 22 (version 2)
  State is Active
    4 state changes, last state change 00:05:41
  Link-Local Virtual IPv6 address is FE80::5:73FF:FEA0:16 (impl auto EUI64)
    Virtual IPv6 address 2001:9999:2:1::/64
  Active virtual MAC address is 0005.73a0.0016
    Local virtual MAC address is 0005.73a0.0016 (v2 IPv6 default)
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 0.128 secs
  Preemption enabled
  Active router is local
  Standby router is FE80::5054:FF:FE17:C2F3, priority 120 (expires in 8.000 sec)
  Priority 150 (configured 150)
    Track object 32 state Up decrement 30
  Group name is "hsrp-Gi0/1.302-22" (default)
```

Obrázek 34: R1 FHRP detail 5/6

```
GigabitEthernet0/1.303 - Group 3 (version 2)
  State is Active
    4 state changes, last state change 00:05:42
  Virtual IP address is 44.9.247.193
  Active virtual MAC address is 0000.0c9f.f003
    Local virtual MAC address is 0000.0c9f.f003 (v2 default)
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 1.136 secs
  Preemption enabled
  Active router is local
  Standby router is 44.9.247.195, priority 120 (expires in 9.680 sec)
  Priority 150 (configured 150)
    Track object 303 state Up decrement 30
  Group name is "hsrp-Gi0/1.303-3" (default)
GigabitEthernet0/1.303 - Group 23 (version 2)
  State is Active
    4 state changes, last state change 00:05:41
  Link-Local Virtual IPv6 address is FE80::5:73FF:FEA0:17 (impl auto EUI64)
    Virtual IPv6 address 2001:9999:2:2::/64
  Active virtual MAC address is 0005.73a0.0017
    Local virtual MAC address is 0005.73a0.0017 (v2 IPv6 default)
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 0.464 secs
  Preemption enabled
  Active router is local
  Standby router is FE80::5054:FF:FE17:C2F3, priority 120 (expires in 10.288 sec)
  Priority 150 (configured 150)
    Track object 33 state Up decrement 30
  Group name is "hsrp-Gi0/1.303-23" (default)
```

Obrázek 35: R1 FHRP detail 6/6

```
R2(config-if)#do sh standby
GigabitEthernet0/1.101 - Group 11 (version 2)
  State is Active
    2 state changes, last state change 01:54:45
  Link-Local Virtual IPv6 address is FE80::5:73FF:FEA0:B (impl auto EUI64)
    Virtual IPv6 address 2001:9999:1::/64
  Active virtual MAC address is 0005.73a0.000b
    Local virtual MAC address is 0005.73a0.000b (v2 IPv6 default)
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 0.112 secs
  Preemption enabled
  Active router is local
  Standby router is FE80::5054:FF:FE06:69A1, priority 120 (expires in 8.688 sec)
  Priority 120 (configured 120)
    Track object 11 state Up decrement 30
  Group name is "hsrp-Gi0/1.101-11" (default)
GigabitEthernet0/1.101 - Group 101 (version 2)
  State is Active
    1 state change, last state change 01:55:07
  Virtual IP address is 44.9.0.1
  Active virtual MAC address is 0000.0c9f.f065
    Local virtual MAC address is 0000.0c9f.f065 (v2 default)
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 2.288 secs
  Preemption enabled
  Active router is local
  Standby router is 44.9.0.2, priority 120 (expires in 8.816 sec)
  Priority 150 (configured 150)
    Track object 101 state Up decrement 30
  Group name is "hsrp-Gi0/1.101-101" (default)
```

Obrázek 36: R2 FHRP detail 1/6

```
GigabitEthernet0/1.102 - Group 12 (version 2)
  State is Active
    1 state change, last state change 01:55:07
  Link-Local Virtual IPv6 address is FE80::5:73FF:FEA0:C (impl auto EUI64)
    Virtual IPv6 address 2001:9999:1:1::/64
  Active virtual MAC address is 0005.73a0.000c
    Local virtual MAC address is 0005.73a0.000c (v2 IPv6 default)
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 0.576 secs
  Preemption enabled
  Active router is local
  Standby router is FE80::5054:FF:FE06:69A1, priority 120 (expires in 9.600 sec)
  Priority 150 (configured 150)
    Track object 12 state Up decrement 30
  Group name is "hsrp-Gi0/1.102-12" (default)
GigabitEthernet0/1.102 - Group 102 (version 2)
  State is Active
    1 state change, last state change 01:55:06
  Virtual IP address is 44.9.0.129
  Active virtual MAC address is 0000.0c9f.f066
    Local virtual MAC address is 0000.0c9f.f066 (v2 default)
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 2.192 secs
  Preemption enabled
  Active router is local
  Standby router is 44.9.0.130, priority 120 (expires in 8.176 sec)
  Priority 150 (configured 150)
    Track object 102 state Up decrement 30
  Group name is "hsrp-Gi0/1.102-102" (default)
```

Obrázek 37: R2 FHRP detail 2/6

```
GigabitEthernet0/1.103 - Group 13 (version 2)
  State is Active
    2 state changes, last state change 01:52:38
  Link-Local Virtual IPv6 address is FE80::5:73FF:FEA0:D (impl auto EUI64)
    Virtual IPv6 address 2001:9999:1:2::/64
  Active virtual MAC address is 0005.73a0.000d
    Local virtual MAC address is 0005.73a0.000d (v2 IPv6 default)
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 0.528 secs
  Preemption enabled
  Active router is local
  Standby router is FE80::5054:FF:FE06:69A1, priority 120 (expires in 10.608 sec)
  Priority 150 (configured 150)
    Track object 13 state Up decrement 30
  Group name is "hsrp-Gi0/1.103-13" (default)
GigabitEthernet0/1.103 - Group 103 (version 2)
  State is Active
    2 state changes, last state change 01:52:48
  Virtual IP address is 44.9.0.193
  Active virtual MAC address is 0000.0c9f.f067
    Local virtual MAC address is 0000.0c9f.f067 (v2 default)
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 0.688 secs
  Preemption enabled
  Active router is local
  Standby router is 44.9.0.194, priority 120 (expires in 9.840 sec)
  Priority 150 (configured 150)
    Track object 103 state Up decrement 30
  Group name is "hsrp-Gi0/1.103-103" (default)
```

Obrázek 38: R2 FHRP detail 3/6

```
GigabitEthernet0/1.301 - Group 1 (version 2)
  State is Standby
    4 state changes, last state change 00:17:50
  Virtual IP address is 44.9.247.1
  Active virtual MAC address is 0000.0c9f.f001
    Local virtual MAC address is 0000.0c9f.f001 (v2 default)
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 1.824 secs
  Preemption enabled
  Active router is 44.9.247.2, priority 150 (expires in 10.032 sec)
    MAC address is 5254.0006.69a1
  Standby router is local
  Priority 120 (configured 120)
  Group name is "hsrp-Gi0/1.301-1" (default)
GigabitEthernet0/1.301 - Group 21 (version 2)
  State is Standby
    4 state changes, last state change 00:17:50
  Link-Local Virtual IPv6 address is FE80::5:73FF:FEA0:15 (impl auto EUI64)
    Virtual IPv6 address 2001:9999:2::/64
  Active virtual MAC address is 0005.73a0.0015
    Local virtual MAC address is 0005.73a0.0015 (v2 IPv6 default)
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 2.544 secs
  Preemption enabled
  Active router is FE80::5054:FF:FE06:69A1, priority 150 (expires in 7.680 sec)
    MAC address is 5254.0006.69a1
  Standby router is local
  Priority 120 (configured 120)
  Group name is "hsrp-Gi0/1.301-21" (default)
```

Obrázek 39: R2 FHRP detail 4/6

```
GigabitEthernet0/1.302 - Group 2 (version 2)
  State is Standby
    4 state changes, last state change 00:17:50
  Virtual IP address is 44.9.247.129
  Active virtual MAC address is 0000.0c9f.f002
    Local virtual MAC address is 0000.0c9f.f002 (v2 default)
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 1.136 secs
  Preemption enabled
  Active router is 44.9.247.130, priority 150 (expires in 10.944 sec)
    MAC address is 5254.0006.69a1
  Standby router is local
  Priority 120 (configured 120)
  Group name is "hsrp-Gi0/1.302-2" (default)
GigabitEthernet0/1.302 - Group 22 (version 2)
  State is Standby
    4 state changes, last state change 00:17:50
  Link-Local Virtual IPv6 address is FE80::5:73FF:FEA0:16 (impl auto EUI64)
    Virtual IPv6 address 2001:9999:2:1::/64
  Active virtual MAC address is 0005.73a0.0016
    Local virtual MAC address is 0005.73a0.0016 (v2 IPv6 default)
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 0.272 secs
  Preemption enabled
  Active router is FE80::5054:FF:FE06:69A1, priority 150 (expires in 8.288 sec)
    MAC address is 5254.0006.69a1
  Standby router is local
  Priority 120 (configured 120)
  Group name is "hsrp-Gi0/1.302-22" (default)
```

Obrázek 40: R2 FHRP detail 5/6

```
GigabitEthernet0/1.303 - Group 3 (version 2)
  State is Standby
    4 state changes, last state change 00:17:50
  Virtual IP address is 44.9.247.193
  Active virtual MAC address is 0000.0c9f.f003
    Local virtual MAC address is 0000.0c9f.f003 (v2 default)
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 0.304 secs
  Preemption enabled
  Active router is 44.9.247.194, priority 150 (expires in 8.192 sec)
    MAC address is 5254.0006.69a1
  Standby router is local
  Priority 120 (configured 120)
  Group name is "hsrp-Gi0/1.303-3" (default)
GigabitEthernet0/1.303 - Group 23 (version 2)
  State is Standby
    4 state changes, last state change 00:17:48
  Link-Local Virtual IPv6 address is FE80::5:73FF:FEA0:17 (impl auto EUI64)
    Virtual IPv6 address 2001:9999:2:2::/64
  Active virtual MAC address is 0005.73a0.0017
    Local virtual MAC address is 0005.73a0.0017 (v2 IPv6 default)
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 1.552 secs
  Preemption enabled
  Active router is FE80::5054:FF:FE06:69A1, priority 150 (expires in 8.000 sec)
    MAC address is 5254.0006.69a1
  Standby router is local
  Priority 120 (configured 120)
  Group name is "hsrp-Gi0/1.303-23" (default)
```

Obrázek 41: R2 FHRP detail 6/6

do sh track

```
R1(config-if)#do sh track
Track 31
  IPv6 route 2001:9999:2::/64 reachability
  Reachability is Up (connected)
    1 change, last change 01:50:00
  First-hop interface is GigabitEthernet0/1.301
  Tracked by:
    HSRP GigabitEthernet0/1.301 21
Track 32
  IPv6 route 2001:9999:2:1::/64 reachability
  Reachability is Up (connected)
    1 change, last change 01:50:00
  First-hop interface is GigabitEthernet0/1.302
  Tracked by:
    HSRP GigabitEthernet0/1.302 22
Track 33
  IPv6 route 2001:9999:2:2::/64 reachability
  Reachability is Up (connected)
    1 change, last change 01:50:00
  First-hop interface is GigabitEthernet0/1.303
  Tracked by:
    HSRP GigabitEthernet0/1.303 23
Track 301
  IP route 44.9.247.0 255.255.255.128 reachability
  Reachability is Up (connected)
    2 changes, last change 02:19:48
  First-hop interface is GigabitEthernet0/1.301
  Tracked by:
    HSRP GigabitEthernet0/1.301 1
Track 302
  IP route 44.9.247.128 255.255.255.192 reachability
  Reachability is Up (connected)
    2 changes, last change 02:19:48
  First-hop interface is GigabitEthernet0/1.302
  Tracked by:
    HSRP GigabitEthernet0/1.302 2
Track 303
  IP route 44.9.247.192 255.255.255.240 reachability
  Reachability is Up (connected)
    2 changes, last change 02:19:48
  First-hop interface is GigabitEthernet0/1.303
  Tracked by:
    HSRP GigabitEthernet0/1.303 3
```

Obrázek 42: R1 Tracking

```
R2(config-if)#do sh track
Track 11
  IPv6 route 2001:9999:1::/64 reachability
  Reachability is Up (connected)
    1 change, last change 01:59:35
  First-hop interface is GigabitEthernet0/1.101
  Tracked by:
    HSRP GigabitEthernet0/1.101 11
Track 12
  IPv6 route 2001:9999:1:1::/64 reachability
  Reachability is Up (connected)
    1 change, last change 01:59:35
  First-hop interface is GigabitEthernet0/1.102
  Tracked by:
    HSRP GigabitEthernet0/1.102 12
Track 13
  IPv6 route 2001:9999:1:2::/64 reachability
  Reachability is Up (connected)
    1 change, last change 01:59:35
  First-hop interface is GigabitEthernet0/1.103
  Tracked by:
    HSRP GigabitEthernet0/1.103 13
Track 101
  IP route 44.9.0.0 255.255.255.128 reachability
  Reachability is Up (connected)
    2 changes, last change 02:28:14
  First-hop interface is GigabitEthernet0/1.101
  Tracked by:
    HSRP GigabitEthernet0/1.101 101
Track 102
  IP route 44.9.0.128 255.255.255.192 reachability
  Reachability is Up (connected)
    2 changes, last change 02:28:14
  First-hop interface is GigabitEthernet0/1.102
  Tracked by:
    HSRP GigabitEthernet0/1.102 102
Track 103
  IP route 44.9.0.192 255.255.255.240 reachability
  Reachability is Up (connected)
    2 changes, last change 02:28:14
  First-hop interface is GigabitEthernet0/1.103
  Tracked by:
    HSRP GigabitEthernet0/1.103 103
```

Obrázek 43: R2 Tracking

6 BGP

do sh ip bgp
do sh bgp ipv6
prefixy

7 Management

7.1 IPv4 VRRP

8 IGP

do sh ip int br

```
ISP2(config)#do sh ip int br
Interface                  IP-Address      OK? Method Status                Protocol
GigabitEthernet0/0         unassigned      YES unset  administratively down down
GigabitEthernet0/1         44.9.248.15     YES manual up                    up
GigabitEthernet0/2         44.9.248.13     YES manual up                    up
GigabitEthernet0/3         unassigned      YES unset  administratively down down
Loopback0                  44.9.254.8      YES manual up                    up
Loopback100                2.0.0.1         YES manual up                    up
```

Obrázek 44: ISP1 IPv4 interface brief

```
ISP1(config)#do sh ip int br
Interface                  IP-Address      OK? Method Status                Protocol
GigabitEthernet0/0         unassigned      YES unset  administratively down down
GigabitEthernet0/1         44.9.248.14     YES manual up                    up
GigabitEthernet0/2         44.9.248.11     YES manual up                    up
GigabitEthernet0/3         unassigned      YES unset  administratively down down
Loopback0                  44.9.254.7      YES manual up                    up
Loopback100                1.0.0.1         YES manual up                    up
```

Obrázek 45: ISP2 IPv4 interface brief

```
WAN1(config-if)#do sh ip int br
Interface                  IP-Address      OK? Method Status                Protocol
GigabitEthernet0/0         unassigned      YES unset  administratively down down
GigabitEthernet0/1         44.9.248.8      YES manual up                    up
GigabitEthernet0/2         44.9.248.10     YES manual up                    up
GigabitEthernet0/3         unassigned      YES unset  up                    up
GigabitEthernet0/3.9       44.9.248.1      YES manual up                    up
GigabitEthernet0/3.91      44.9.253.249    YES manual up                    up
GigabitEthernet0/4         unassigned      YES unset  up                    up
GigabitEthernet0/4.9       44.9.248.5      YES manual up                    up
GigabitEthernet0/4.91      44.9.253.253    YES manual up                    up
Loopback0                  44.9.254.5      YES manual up                    up
Loopback1                  44.9.253.246    YES manual up                    up
```

Obrázek 46: WAN1 IPv4 interface brief

```
WAN2(config-router)#do sh ip int br
Interface                  IP-Address      OK? Method Status                Protocol
GigabitEthernet0/0         unassigned      YES unset  administratively down down
GigabitEthernet0/1         44.9.248.9      YES manual up                    up
GigabitEthernet0/2         44.9.248.12     YES manual up                    up
GigabitEthernet0/3         unassigned      YES unset  up                    up
GigabitEthernet0/3.9       44.9.248.7      YES manual up                    up
GigabitEthernet0/3.91      44.9.253.255    YES manual up                    up
GigabitEthernet0/4         unassigned      YES unset  up                    up
GigabitEthernet0/4.9       44.9.248.3      YES manual up                    up
GigabitEthernet0/4.91      44.9.253.251    YES manual up                    up
Loopback0                  44.9.254.6      YES manual up                    up
Loopback1                  44.9.253.247    YES manual up                    up
```

Obrázek 47: WAN2 IPv4 interface brief

```
R1(config)#do sh ip int br
Interface                  IP-Address      OK? Method Status                Protocol
GigabitEthernet0/0         unassigned      YES unset  up                    up
GigabitEthernet0/0.9       unassigned      YES manual deleted               down
GigabitEthernet0/1         unassigned      YES unset  up                    up
GigabitEthernet0/1.18      44.9.252.2      YES manual up                    up
GigabitEthernet0/1.101     44.9.0.2        YES manual up                    up
GigabitEthernet0/1.102     44.9.0.130      YES manual up                    up
GigabitEthernet0/1.103     44.9.0.194      YES manual up                    up
GigabitEthernet0/1.301     44.9.247.2      YES manual up                    up
GigabitEthernet0/1.302     44.9.247.130    YES manual up                    up
GigabitEthernet0/1.303     44.9.247.194    YES manual up                    up
GigabitEthernet0/2         unassigned      YES unset  up                    up
GigabitEthernet0/2.9       44.9.248.2      YES manual up                    up
GigabitEthernet0/2.91      44.9.253.250    YES manual up                    up
GigabitEthernet0/3         unassigned      YES unset  up                    up
GigabitEthernet0/3.9       44.9.248.0      YES manual up                    up
GigabitEthernet0/3.91      44.9.253.248    YES manual up                    up
Loopback0                  44.9.254.3      YES manual up                    up
Loopback1                  44.9.253.244    YES manual up                    up
```

Obrázek 48: R1 IPv4 interface brief

```
R2(config)#do sh ip int br
Interface                  IP-Address      OK? Method Status                Protocol
GigabitEthernet0/0         unassigned      YES unset  up                    up
GigabitEthernet0/0.9       unassigned      YES manual deleted               down
GigabitEthernet0/1         unassigned      YES unset  up                    up
GigabitEthernet0/1.18      44.9.252.3      YES manual up                    up
GigabitEthernet0/1.101     44.9.0.3        YES manual up                    up
GigabitEthernet0/1.102     44.9.0.131      YES manual up                    up
GigabitEthernet0/1.103     44.9.0.195      YES manual up                    up
GigabitEthernet0/1.301     44.9.247.3      YES manual up                    up
GigabitEthernet0/1.302     44.9.247.131    YES manual up                    up
GigabitEthernet0/1.303     44.9.247.195    YES manual up                    up
GigabitEthernet0/2         unassigned      YES unset  up                    up
GigabitEthernet0/2.9       44.9.248.4      YES manual up                    up
GigabitEthernet0/2.91      44.9.253.252    YES manual up                    up
GigabitEthernet0/3         unassigned      YES unset  up                    up
GigabitEthernet0/3.9       44.9.248.6      YES manual up                    up
GigabitEthernet0/3.91      44.9.253.254    YES manual up                    up
Loopback0                  44.9.254.4      YES manual up                    up
Loopback1                  44.9.253.245    YES manual up                    up
```

Obrázek 49: R2 IPv4 interface brief

```
DLSW1(config)#do sh ip int br
Interface              IP-Address      OK? Method Status                Protocol
GigabitEthernet0/0     unassigned      YES unset  up                    up
GigabitEthernet0/1     unassigned      YES unset  up                    up
GigabitEthernet0/2     unassigned      YES unset  up                    up
GigabitEthernet0/3     unassigned      YES unset  up                    down
GigabitEthernet1/0     unassigned      YES unset  up                    up
Loopback0              44.9.254.0      YES manual up                    up
Port-channel1          unassigned      YES unset  up                    up
Vlan18                 44.9.252.4      YES manual up                    up
```

Obrázek 50: DLSW1 IPv4 interface brief

```
DLSW2(config)#do sh ip int br
Interface              IP-Address      OK? Method Status                Protocol
GigabitEthernet0/0     unassigned      YES unset  up                    up
GigabitEthernet0/1     unassigned      YES unset  up                    up
GigabitEthernet0/2     unassigned      YES unset  up                    up
GigabitEthernet0/3     unassigned      YES unset  up                    down
GigabitEthernet1/0     unassigned      YES unset  up                    up
Loopback0              44.9.254.1      YES manual up                    up
Port-channel1          unassigned      YES unset  up                    up
Vlan18                 44.9.252.5      YES manual up                    up
```

Obrázek 51: DLSW2 IPv4 interface brief

```
ALSW1(config-if)#do sh ip int br
Interface              IP-Address      OK? Method Status                Protocol
GigabitEthernet0/0     unassigned      YES unset  up                    up
GigabitEthernet0/1     unassigned      YES unset  up                    up
GigabitEthernet0/2     unassigned      YES unset  up                    up
GigabitEthernet0/3     unassigned      YES unset  up                    up
GigabitEthernet1/0     unassigned      YES unset  up                    up
GigabitEthernet1/1     unassigned      YES unset  up                    up
GigabitEthernet1/2     unassigned      YES unset  up                    up
GigabitEthernet1/3     unassigned      YES unset  up                    up
Loopback0              44.9.254.2      YES manual up                    up
Vlan18                 44.9.252.6      YES manual up                    up
Vlan101                44.9.0.126      YES manual up                    up
Vlan102                44.9.0.190      YES manual up                    up
Vlan103                44.9.0.206      YES manual up                    up
Vlan301                44.9.247.126    YES manual up                    up
Vlan302                44.9.247.190    YES manual up                    up
Vlan303                44.9.247.206    YES manual up                    up
```

Obrázek 52: ALSW1 IPv4 interface brief

do sh ipv6 int br

```
ISP1(config)#do sh ipv6 int br
GigabitEthernet0/0      [administratively down/down]
    unassigned
GigabitEthernet0/1      [up/up]
    FE80::5054:FF:FE15:C3EB
    2001:9999::E
GigabitEthernet0/2      [up/up]
    FE80::5054:FF:FE14:A49F
    2001:9999::A
GigabitEthernet0/3      [administratively down/down]
    unassigned
Loopback0               [up/up]
    FE80::5054:FF:FE09:3F75
    2001:9999::407
Loopback100             [up/up]
    FE80::5054:FF:FE09:3F75
    2001:9999:1000::1
```

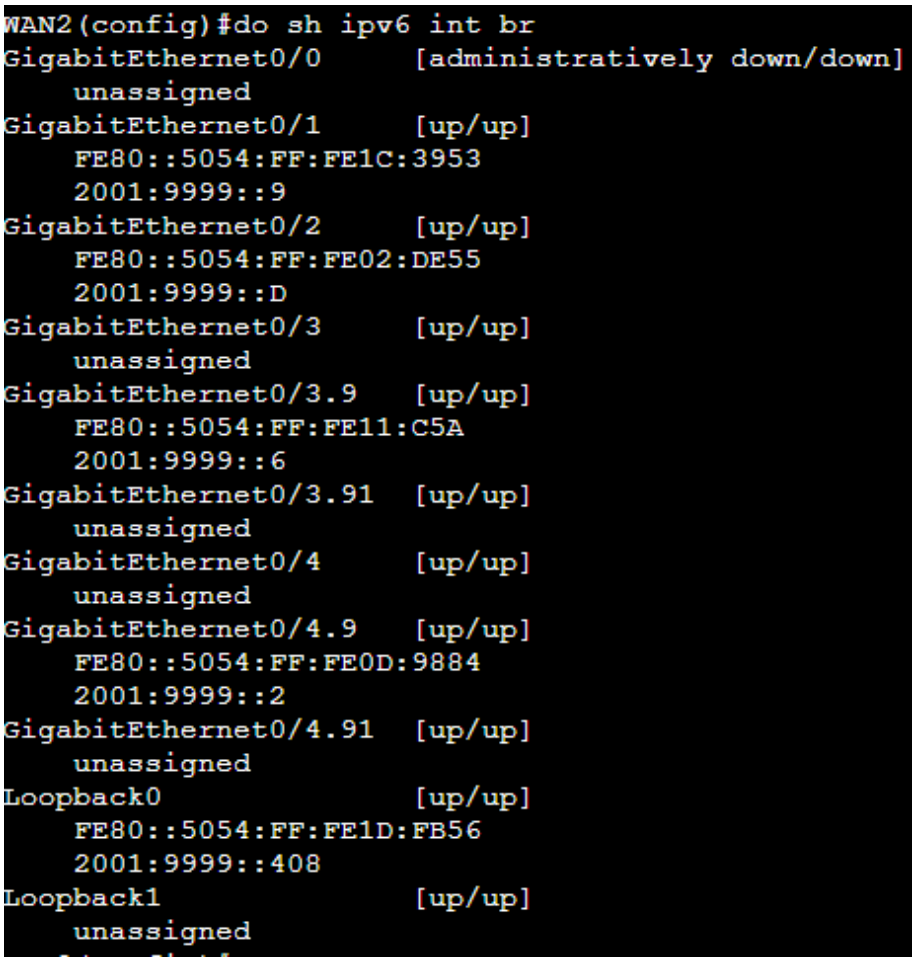
Obrázek 53: ISP1 IPv6 interface brief

```
ISP2(config)#do sh ipv6 int br
GigabitEthernet0/0      [administratively down/down]
    unassigned
GigabitEthernet0/1      [up/up]
    FE80::5054:FF:FE03:212C
    2001:9999::F
GigabitEthernet0/2      [up/up]
    FE80::5054:FF:FE06:8F9B
    2001:9999::C
GigabitEthernet0/3      [administratively down/down]
    unassigned
Loopback0               [up/up]
    FE80::5054:FF:FE10:E291
    2001:9999::408
Loopback100             [up/up]
    FE80::5054:FF:FE10:E291
    2001:9999:2000::1
```

Obrázek 54: ISP2 IPv6 interface brief

```
WAN1(config)#do sh ipv6 int br
GigabitEthernet0/0      [administratively down/down]
    unassigned
GigabitEthernet0/1      [up/up]
    FE80::5054:FF:FE1B:E376
    2001:9999::8
GigabitEthernet0/2      [up/up]
    FE80::5054:FF:FE1B:4A54
    2001:9999::B
GigabitEthernet0/3      [up/up]
    unassigned
GigabitEthernet0/3.9    [up/up]
    FE80::5054:FF:FE0A:6D0E
    2001:9999::
GigabitEthernet0/3.91   [up/up]
    unassigned
GigabitEthernet0/4      [up/up]
    unassigned
GigabitEthernet0/4.9    [up/up]
    FE80::5054:FF:FE13:CC01
    2001:9999::4
GigabitEthernet0/4.91   [up/up]
    unassigned
Loopback0               [up/up]
    FE80::5054:FF:FE0D:670B
    2001:9999::405
Loopback1               [up/up]
    unassigned
```

Obrázek 55: WAN1 IPv6 interface brief



Obrázek 56: WAN2 IPv6 interface brief

```
R1(config)#do sh ipv6 int br
GigabitEthernet0/0      [up/up]
    unassigned
GigabitEthernet0/0.9    [deleted/down]
    unassigned
GigabitEthernet0/1      [up/up]
    unassigned
GigabitEthernet0/1.18   [up/up]
    unassigned
GigabitEthernet0/1.101  [up/up]
    FE80::5054:FF:FE06:69A1
    2001:9999:1::
    2001:9999:1::1
GigabitEthernet0/1.102  [up/up]
    FE80::5054:FF:FE06:69A1
    2001:9999:1:1::
    2001:9999:1:1::1
GigabitEthernet0/1.103  [up/up]
    FE80::5054:FF:FE06:69A1
    2001:9999:1:2::
    2001:9999:1:2::1
GigabitEthernet0/1.301  [up/up]
    FE80::5054:FF:FE06:69A1
    2001:9999:2::
    2001:9999:2::1
GigabitEthernet0/1.302  [up/up]
    FE80::5054:FF:FE06:69A1
    2001:9999:2:1::
    2001:9999:2:1::1
GigabitEthernet0/1.303  [up/up]
    FE80::5054:FF:FE06:69A1
    2001:9999:2:2::
    2001:9999:2:2::1
GigabitEthernet0/2      [up/up]
    unassigned
GigabitEthernet0/2.9    [up/up]
    FE80::5054:FF:FE02:5CF
    2001:9999::3
GigabitEthernet0/2.91   [up/up]
    unassigned
GigabitEthernet0/3      [up/up]
    unassigned
GigabitEthernet0/3.9    [up/up]
```

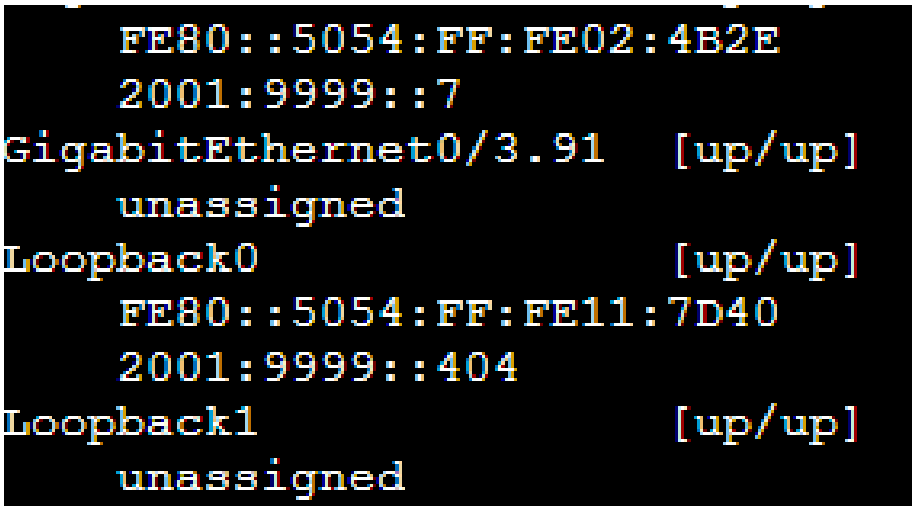
Obrázek 57: R1 IPv6 interface brief 1/2

```
    2001:9999::
    2001:9999::1
GigabitEthernet0/3.91   [up/up]
    unassigned
Loopback0               [up/up]
    FE80::5054:FF:FE08:4BB5
    2001:9999::403
Loopback1               [up/up]
    unassigned
```

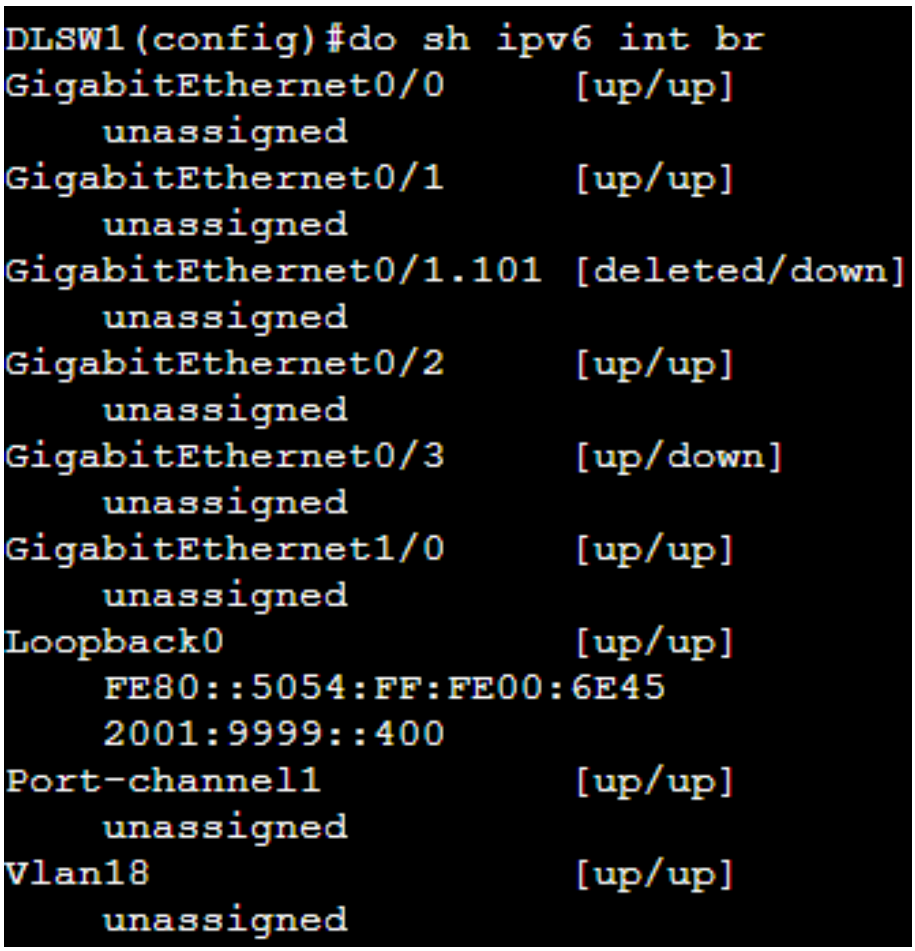
Obrázek 58: R1 IPv6 interface brief 2/2

```
R2(config)#do sh ipv6 int br
GigabitEthernet0/0      [up/up]
    unassigned
GigabitEthernet0/0.9    [deleted/down]
    unassigned
GigabitEthernet0/1      [up/up]
    unassigned
GigabitEthernet0/1.18   [up/up]
    unassigned
GigabitEthernet0/1.101  [up/up]
    FE80::5054:FF:FE17:C2F3
    2001:9999:1::
    2001:9999:1::2
GigabitEthernet0/1.102  [up/up]
    FE80::5054:FF:FE17:C2F3
    2001:9999:1:1::
    2001:9999:1:1::2
GigabitEthernet0/1.103  [up/up]
    FE80::5054:FF:FE17:C2F3
    2001:9999:1:2::
    2001:9999:1:2::2
GigabitEthernet0/1.301  [up/up]
    FE80::5054:FF:FE17:C2F3
    2001:9999:2::
    2001:9999:2::2
GigabitEthernet0/1.302  [up/up]
    FE80::5054:FF:FE17:C2F3
    2001:9999:2:1::
    2001:9999:2:1::2
GigabitEthernet0/1.303  [up/up]
    FE80::5054:FF:FE17:C2F3
    2001:9999:2:2::
    2001:9999:2:2::2
GigabitEthernet0/2      [up/up]
    unassigned
GigabitEthernet0/2.9    [up/up]
    FE80::5054:FF:FE1B:7390
    2001:9999::5
GigabitEthernet0/2.91   [up/up]
    unassigned
GigabitEthernet0/3      [up/up]
    unassigned
GigabitEthernet0/3.9    [up/up]
```

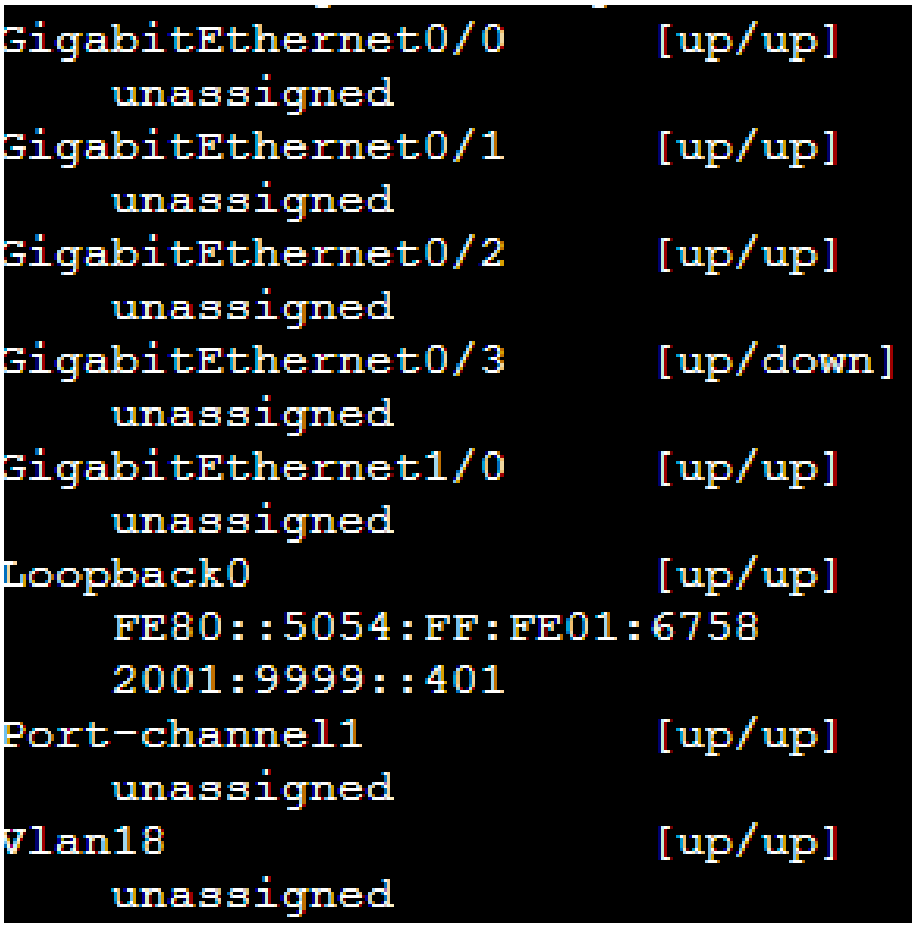
Obrázek 59: R2 IPv6 interface brief 1/2



Obrázek 60: R2 IPv6 interface brief 1/2



Obrázek 61: DLSW1 IPv6 interface brief



Obrázek 62: DLSW2 IPv6 interface brief

```
ALSW1(config)#do sh ipv6 int br
GigabitEthernet0/0       [up/up]
    unassigned
GigabitEthernet0/1       [up/up]
    unassigned
GigabitEthernet0/2       [up/up]
    unassigned
GigabitEthernet0/3       [up/up]
    unassigned
GigabitEthernet1/0       [up/up]
    unassigned
GigabitEthernet1/1       [up/up]
    unassigned
GigabitEthernet1/2       [up/up]
    unassigned
GigabitEthernet1/3       [up/up]
    unassigned
Loopback0                [up/up]
    FE80::5054:FF:FE0A:F92C
    2001:9999::402
Vlan18                   [up/up]
    unassigned
Vlan101                  [up/up]
    FE80::5054:FF:FE0A:8065
    2001:9999:1::3
Vlan102                  [up/up]
    unassigned
Vlan103                  [up/up]
    unassigned
Vlan301                  [up/up]
    unassigned
Vlan302                  [up/up]
    unassigned
Vlan303                  [up/up]
    unassigned
```

Obrázek 63: ALSW1 IPv6 interface brief

do sh ip route

```
      1.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C        1.0.0.0/8 is directly connected, Loopback100
L        1.0.0.1/32 is directly connected, Loopback100
      2.0.0.0/16 is subnetted, 1 subnets
B        2.0.0.0 [200/0] via 44.9.254.8, 02:15:52
      44.0.0.0/8 is variably subnetted, 12 subnets, 5 masks
B        44.9.0.0/25 [20/1] via 44.9.248.10, 01:32:08
B        44.9.0.128/26 [20/1] via 44.9.248.10, 01:32:08
B        44.9.0.192/28 [20/1] via 44.9.248.10, 01:32:08
B        44.9.247.0/25 [20/1] via 44.9.248.10, 01:32:08
B        44.9.247.128/26 [20/1] via 44.9.248.10, 01:32:08
B        44.9.247.192/28 [20/1] via 44.9.248.10, 01:32:08
C        44.9.248.10/31 is directly connected, GigabitEthernet0/2
L        44.9.248.11/32 is directly connected, GigabitEthernet0/2
C        44.9.248.14/31 is directly connected, GigabitEthernet0/1
L        44.9.248.14/32 is directly connected, GigabitEthernet0/1
C        44.9.254.7/32 is directly connected, Loopback0
S        44.9.254.8/32 [1/0] via 44.9.248.15
```

Obrázek 64: ISP1 IPv4 routes

```
B     1.0.0.0/8 [200/0] via 44.9.254.7, 02:16:01
      2.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C        2.0.0.0/16 is directly connected, Loopback100
L        2.0.0.1/32 is directly connected, Loopback100
      44.0.0.0/8 is variably subnetted, 9 subnets, 5 masks
B        44.9.247.0/25 [20/1] via 44.9.248.12, 02:03:24
B        44.9.247.128/26 [20/1] via 44.9.248.12, 02:03:24
B        44.9.247.192/28 [20/1] via 44.9.248.12, 02:03:24
C        44.9.248.12/31 is directly connected, GigabitEthernet0/2
L        44.9.248.13/32 is directly connected, GigabitEthernet0/2
C        44.9.248.14/31 is directly connected, GigabitEthernet0/1
L        44.9.248.15/32 is directly connected, GigabitEthernet0/1
S        44.9.254.7/32 [1/0] via 44.9.248.14
C        44.9.254.8/32 is directly connected, Loopback0
```

Obrázek 65: ISP2 IPv4 routes

```
B     1.0.0.0/8 [20/0] via 44.9.248.11, 02:04:29
      2.0.0.0/16 is subnetted, 1 subnets
B        2.0.0.0 [20/0] via 44.9.248.11, 02:04:29
      44.0.0.0/8 is variably subnetted, 20 subnets, 5 masks
O E2     44.9.0.0/25 [110/1] via 44.9.248.4, 00:33:14, GigabitEthernet0/4.9
                     [110/1] via 44.9.248.0, 01:33:24, GigabitEthernet0/3.9
O E2     44.9.0.128/26 [110/1] via 44.9.248.4, 00:33:14, GigabitEthernet0/4.9
                       [110/1] via 44.9.248.0, 01:33:24, GigabitEthernet0/3.9
O E2     44.9.0.192/28 [110/1] via 44.9.248.4, 00:33:14, GigabitEthernet0/4.9
                       [110/1] via 44.9.248.0, 01:33:24, GigabitEthernet0/3.9
O E2     44.9.247.0/25 [110/1] via 44.9.248.4, 00:33:14, GigabitEthernet0/4.9
                       [110/1] via 44.9.248.0, 01:33:24, GigabitEthernet0/3.9
O E2     44.9.247.128/26
           [110/1] via 44.9.248.4, 00:33:14, GigabitEthernet0/4.9
           [110/1] via 44.9.248.0, 01:33:24, GigabitEthernet0/3.9
O E2     44.9.247.192/28
           [110/1] via 44.9.248.4, 00:33:14, GigabitEthernet0/4.9
           [110/1] via 44.9.248.0, 01:33:24, GigabitEthernet0/3.9
C        44.9.248.0/31 is directly connected, GigabitEthernet0/3.9
L        44.9.248.1/32 is directly connected, GigabitEthernet0/3.9
O        44.9.248.2/31 [110/51] via 44.9.248.9, 01:33:24, GigabitEthernet0/1
C        44.9.248.4/31 is directly connected, GigabitEthernet0/4.9
L        44.9.248.5/32 is directly connected, GigabitEthernet0/4.9
O        44.9.248.6/31 [110/51] via 44.9.248.9, 01:33:24, GigabitEthernet0/1
C        44.9.248.8/31 is directly connected, GigabitEthernet0/1
L        44.9.248.8/32 is directly connected, GigabitEthernet0/1
C        44.9.248.10/31 is directly connected, GigabitEthernet0/2
L        44.9.248.10/32 is directly connected, GigabitEthernet0/2
O        44.9.254.3/32 [110/10] via 44.9.248.0, 01:33:24, GigabitEthernet0/3.9
O        44.9.254.4/32 [110/10] via 44.9.248.4, 00:33:14, GigabitEthernet0/4.9
C        44.9.254.5/32 is directly connected, Loopback0
O        44.9.254.6/32 [110/1] via 44.9.248.9, 01:33:24, GigabitEthernet0/1
```

Obrázek 66: WAN1 IPv4 routes

```
B      1.0.0.0/8 [20/0] via 44.9.248.13, 02:06:41
       2.0.0.0/16 is subnetted, 1 subnets
B         2.0.0.0 [20/0] via 44.9.248.13, 02:06:41
       44.0.0.0/8 is variably subnetted, 20 subnets, 5 masks
O E2      44.9.0.0/25 [110/1] via 44.9.248.8, 00:35:29, GigabitEthernet0/1
O E2      44.9.0.128/26 [110/1] via 44.9.248.8, 00:35:29, GigabitEthernet0/1
O E2      44.9.0.192/28 [110/1] via 44.9.248.8, 00:35:29, GigabitEthernet0/1
O E2      44.9.247.0/25 [110/1] via 44.9.248.8, 00:35:29, GigabitEthernet0/1
O E2      44.9.247.128/26 [110/1] via 44.9.248.8, 00:35:29, GigabitEthernet0/1
O E2      44.9.247.192/28 [110/1] via 44.9.248.8, 00:35:29, GigabitEthernet0/1
O         44.9.248.0/31 [110/11] via 44.9.248.8, 01:35:25, GigabitEthernet0/1
C         44.9.248.2/31 is directly connected, GigabitEthernet0/4.9
L         44.9.248.3/32 is directly connected, GigabitEthernet0/4.9
O         44.9.248.4/31 [110/11] via 44.9.248.8, 00:35:19, GigabitEthernet0/1
C         44.9.248.6/31 is directly connected, GigabitEthernet0/3.9
L         44.9.248.7/32 is directly connected, GigabitEthernet0/3.9
C         44.9.248.8/31 is directly connected, GigabitEthernet0/1
L         44.9.248.9/32 is directly connected, GigabitEthernet0/1
C         44.9.248.12/31 is directly connected, GigabitEthernet0/2
L         44.9.248.12/32 is directly connected, GigabitEthernet0/2
O         44.9.254.3/32 [110/11] via 44.9.248.8, 01:35:25, GigabitEthernet0/1
O         44.9.254.4/32 [110/11] via 44.9.248.8, 00:35:29, GigabitEthernet0/1
O         44.9.254.5/32 [110/1] via 44.9.248.8, 01:35:25, GigabitEthernet0/1
C         44.9.254.6/32 is directly connected, Loopback0
```

Obrázek 67: WAN2 IPv4 routes

```
O*E2   0.0.0.0/0 [110/1] via 44.9.248.1, 01:10:48, GigabitEthernet0/3.9
       44.0.0.0/8 is variably subnetted, 23 subnets, 5 masks
C         44.9.0.0/25 is directly connected, GigabitEthernet0/1.101
L         44.9.0.2/32 is directly connected, GigabitEthernet0/1.101
C         44.9.0.128/26 is directly connected, GigabitEthernet0/1.102
L         44.9.0.130/32 is directly connected, GigabitEthernet0/1.102
C         44.9.0.192/28 is directly connected, GigabitEthernet0/1.103
L         44.9.0.194/32 is directly connected, GigabitEthernet0/1.103
C         44.9.247.0/25 is directly connected, GigabitEthernet0/1.301
L         44.9.247.2/32 is directly connected, GigabitEthernet0/1.301
C         44.9.247.128/26 is directly connected, GigabitEthernet0/1.302
L         44.9.247.130/32 is directly connected, GigabitEthernet0/1.302
C         44.9.247.192/28 is directly connected, GigabitEthernet0/1.303
L         44.9.247.194/32 is directly connected, GigabitEthernet0/1.303
C         44.9.248.0/31 is directly connected, GigabitEthernet0/3.9
L         44.9.248.0/32 is directly connected, GigabitEthernet0/3.9
C         44.9.248.2/31 is directly connected, GigabitEthernet0/2.9
L         44.9.248.2/32 is directly connected, GigabitEthernet0/2.9
O         44.9.248.4/31 [110/20] via 44.9.248.1, 00:10:31, GigabitEthernet0/3.9
O         44.9.248.6/31 [110/61] via 44.9.248.1, 01:10:48, GigabitEthernet0/3.9
O         44.9.248.8/31 [110/11] via 44.9.248.1, 01:10:48, GigabitEthernet0/3.9
C         44.9.254.3/32 is directly connected, Loopback0
O         44.9.254.4/32 [110/20] via 44.9.248.1, 00:10:41, GigabitEthernet0/3.9
O         44.9.254.5/32 [110/10] via 44.9.248.1, 01:10:48, GigabitEthernet0/3.9
O         44.9.254.6/32 [110/11] via 44.9.248.1, 01:10:48, GigabitEthernet0/3.9
```

Obrázek 68: R1 IPv4 routes

```
O*E2  0.0.0.0/0 [110/1] via 44.9.248.5, 00:11:11, GigabitEthernet0/2.9
      44.0.0.0/8 is variably subnetted, 23 subnets, 5 masks
C        44.9.0.0/25 is directly connected, GigabitEthernet0/1.101
L        44.9.0.3/32 is directly connected, GigabitEthernet0/1.101
C        44.9.0.128/26 is directly connected, GigabitEthernet0/1.102
L        44.9.0.131/32 is directly connected, GigabitEthernet0/1.102
C        44.9.0.192/28 is directly connected, GigabitEthernet0/1.103
L        44.9.0.195/32 is directly connected, GigabitEthernet0/1.103
C        44.9.247.0/25 is directly connected, GigabitEthernet0/1.301
L        44.9.247.3/32 is directly connected, GigabitEthernet0/1.301
C        44.9.247.128/26 is directly connected, GigabitEthernet0/1.302
L        44.9.247.131/32 is directly connected, GigabitEthernet0/1.302
C        44.9.247.192/28 is directly connected, GigabitEthernet0/1.303
L        44.9.247.195/32 is directly connected, GigabitEthernet0/1.303
O        44.9.248.0/31 [110/20] via 44.9.248.5, 00:11:11, GigabitEthernet0/2.9
O        44.9.248.2/31 [110/61] via 44.9.248.5, 00:11:11, GigabitEthernet0/2.9
C        44.9.248.4/31 is directly connected, GigabitEthernet0/2.9
L        44.9.248.4/32 is directly connected, GigabitEthernet0/2.9
C        44.9.248.6/31 is directly connected, GigabitEthernet0/3.9
L        44.9.248.6/32 is directly connected, GigabitEthernet0/3.9
O        44.9.248.8/31 [110/11] via 44.9.248.5, 00:11:11, GigabitEthernet0/2.9
O        44.9.254.3/32 [110/20] via 44.9.248.5, 00:11:11, GigabitEthernet0/2.9
C        44.9.254.4/32 is directly connected, Loopback0
O        44.9.254.5/32 [110/10] via 44.9.248.5, 00:11:11, GigabitEthernet0/2.9
O        44.9.254.6/32 [110/11] via 44.9.248.5, 00:11:11, GigabitEthernet0/2.9
```

Obrázek 69: R2 IPv4 routes

do sh ipv6 route

```
C   2001:9999::A/127 [0/0]
     via GigabitEthernet0/2, directly connected
L   2001:9999::A/128 [0/0]
     via GigabitEthernet0/2, receive
C   2001:9999::E/127 [0/0]
     via GigabitEthernet0/1, directly connected
L   2001:9999::E/128 [0/0]
     via GigabitEthernet0/1, receive
LC  2001:9999::407/128 [0/0]
     via Loopback0, receive
S   2001:9999::408/128 [1/0]
     via 2001:9999::F
C   2001:9999:1000::/48 [0/0]
     via Loopback100, directly connected
L   2001:9999:1000::1/128 [0/0]
     via Loopback100, receive
L   FF00::/8 [0/0]
     via Null0, receive
```

Obrázek 70: ISP1 IPv6 routes

```
C   2001:9999::C/127 [0/0]
     via GigabitEthernet0/2, directly connected
L   2001:9999::C/128 [0/0]
     via GigabitEthernet0/2, receive
C   2001:9999::E/127 [0/0]
     via GigabitEthernet0/1, directly connected
L   2001:9999::F/128 [0/0]
     via GigabitEthernet0/1, receive
S   2001:9999::407/128 [1/0]
     via 2001:9999::E
LC  2001:9999::408/128 [0/0]
     via Loopback0, receive
B   2001:9999:1000::/48 [200/0]
     via 2001:9999::407
C   2001:9999:2000::/56 [0/0]
     via Loopback100, directly connected
L   2001:9999:2000::1/128 [0/0]
     via Loopback100, receive
L   FF00::/8 [0/0]
     via Null0, receive
```

Obrázek 71: ISP2 IPv6 routes

```
C   2001:9999::/127 [0/0]
     via GigabitEthernet0/3.9, directly connected
O   2001:9999::2/127 [110/51]
     via FE80::5054:FF:FE1C:3953, GigabitEthernet0/1
C   2001:9999::4/127 [0/0]
     via GigabitEthernet0/4.9, directly connected
L   2001:9999::4/128 [0/0]
     via GigabitEthernet0/4.9, receive
O   2001:9999::6/127 [110/51]
     via FE80::5054:FF:FE1C:3953, GigabitEthernet0/1
C   2001:9999::8/127 [0/0]
     via GigabitEthernet0/1, directly connected
L   2001:9999::8/128 [0/0]
     via GigabitEthernet0/1, receive
C   2001:9999::A/127 [0/0]
     via GigabitEthernet0/2, directly connected
L   2001:9999::B/128 [0/0]
     via GigabitEthernet0/2, receive
O   2001:9999::403/128 [110/10]
     via FE80::5054:FF:FE1F:1E47, GigabitEthernet0/3.9
O   2001:9999::404/128 [110/10]
     via FE80::5054:FF:FE1B:7390, GigabitEthernet0/4.9
LC  2001:9999::405/128 [0/0]
     via Loopback0, receive
O   2001:9999::408/128 [110/1]
     via FE80::5054:FF:FE1C:3953, GigabitEthernet0/1
B   2001:9999:1000::/48 [20/0]
     via FE80::5054:FF:FE14:A49F, GigabitEthernet0/2
L   FF00::/8 [0/0]
     via Null0, receive
```

Obrázek 72: WAN1 IPv6 routes

```
O   2001:9999::/127 [110/11]
     via FE80::5054:FF:FE1B:E376, GigabitEthernet0/1
C   2001:9999::2/127 [0/0]
     via GigabitEthernet0/4.9, directly connected
L   2001:9999::2/128 [0/0]
     via GigabitEthernet0/4.9, receive
O   2001:9999::4/127 [110/11]
     via FE80::5054:FF:FE1B:E376, GigabitEthernet0/1
C   2001:9999::6/127 [0/0]
     via GigabitEthernet0/3.9, directly connected
L   2001:9999::6/128 [0/0]
     via GigabitEthernet0/3.9, receive
C   2001:9999::8/127 [0/0]
     via GigabitEthernet0/1, directly connected
L   2001:9999::9/128 [0/0]
     via GigabitEthernet0/1, receive
C   2001:9999::C/127 [0/0]
     via GigabitEthernet0/2, directly connected
L   2001:9999::D/128 [0/0]
     via GigabitEthernet0/2, receive
O   2001:9999::403/128 [110/11]
     via FE80::5054:FF:FE1B:E376, GigabitEthernet0/1
O   2001:9999::404/128 [110/11]
     via FE80::5054:FF:FE1B:E376, GigabitEthernet0/1
O   2001:9999::405/128 [110/1]
     via FE80::5054:FF:FE1B:E376, GigabitEthernet0/1
LC  2001:9999::408/128 [0/0]
     via Loopback0, receive
B   2001:9999:1000::/48 [20/0]
     via FE80::5054:FF:FE06:8F9B, GigabitEthernet0/2
L   FF00::/8 [0/0]
     via Null0, receive
```

Obrázek 73: WAN2 IPv6 routes

```
OE2 ::/0 [110/1], tag 2
     via FE80::5054:FF:FE0A:6D0E, GigabitEthernet0/3.9
C   2001:9999::/127 [0/0]
     via GigabitEthernet0/3.9, directly connected
L   2001:9999::/128 [0/0]
     via GigabitEthernet0/3.9, receive
L   2001:9999::1/128 [0/0]
     via GigabitEthernet0/3.9, receive
C   2001:9999::2/127 [0/0]
     via GigabitEthernet0/2.9, directly connected
L   2001:9999::3/128 [0/0]
     via GigabitEthernet0/2.9, receive
O   2001:9999::4/127 [110/20]
     via FE80::5054:FF:FE0A:6D0E, GigabitEthernet0/3.9
O   2001:9999::6/127 [110/61]
     via FE80::5054:FF:FE0A:6D0E, GigabitEthernet0/3.9
O   2001:9999::8/127 [110/11]
     via FE80::5054:FF:FE0A:6D0E, GigabitEthernet0/3.9
LC  2001:9999::403/128 [0/0]
     via Loopback0, receive
O   2001:9999::404/128 [110/20]
     via FE80::5054:FF:FE0A:6D0E, GigabitEthernet0/3.9
O   2001:9999::405/128 [110/10]
     via FE80::5054:FF:FE0A:6D0E, GigabitEthernet0/3.9
O   2001:9999::408/128 [110/11]
     via FE80::5054:FF:FE0A:6D0E, GigabitEthernet0/3.9
C   2001:9999:1::/64 [0/0]
     via GigabitEthernet0/1.101, directly connected
```

Obrázek 74: R1 IPv6 routes 1/2

```
L   2001:9999:1::1/128 [0/0]
     via GigabitEthernet0/1.101, receive
C   2001:9999:1:1::/64 [0/0]
     via GigabitEthernet0/1.102, directly connected
L   2001:9999:1:1::1/128 [0/0]
     via GigabitEthernet0/1.102, receive
C   2001:9999:1:2::/64 [0/0]
     via GigabitEthernet0/1.103, directly connected
L   2001:9999:1:2::1/128 [0/0]
     via GigabitEthernet0/1.103, receive
C   2001:9999:2::/64 [0/0]
     via GigabitEthernet0/1.301, directly connected
L   2001:9999:2::/128 [0/0]
     via GigabitEthernet0/1.301, receive
L   2001:9999:2::1/128 [0/0]
     via GigabitEthernet0/1.301, receive
C   2001:9999:2:1::/64 [0/0]
     via GigabitEthernet0/1.302, directly connected
L   2001:9999:2:1::/128 [0/0]
     via GigabitEthernet0/1.302, receive
L   2001:9999:2:1::1/128 [0/0]
     via GigabitEthernet0/1.302, receive
C   2001:9999:2:2::/64 [0/0]
     via GigabitEthernet0/1.303, directly connected
L   2001:9999:2:2::/128 [0/0]
     via GigabitEthernet0/1.303, receive
L   2001:9999:2:2::1/128 [0/0]
     via GigabitEthernet0/1.303, receive
L   FF00::/8 [0/0]
     via Null0, receive
```

Obrázek 75: R1 IPv6 routes 2/2

```
OE2 ::/0 [110/1], tag 2
     via FE80::5054:FF:FE13:CC01, GigabitEthernet0/2.9
O   2001:9999::/127 [110/20]
     via FE80::5054:FF:FE13:CC01, GigabitEthernet0/2.9
O   2001:9999::2/127 [110/61]
     via FE80::5054:FF:FE13:CC01, GigabitEthernet0/2.9
C   2001:9999::4/127 [0/0]
     via GigabitEthernet0/2.9, directly connected
L   2001:9999::5/128 [0/0]
     via GigabitEthernet0/2.9, receive
C   2001:9999::6/127 [0/0]
     via GigabitEthernet0/3.9, directly connected
L   2001:9999::7/128 [0/0]
     via GigabitEthernet0/3.9, receive
O   2001:9999::8/127 [110/11]
     via FE80::5054:FF:FE13:CC01, GigabitEthernet0/2.9
O   2001:9999::403/128 [110/20]
     via FE80::5054:FF:FE13:CC01, GigabitEthernet0/2.9
LC  2001:9999::404/128 [0/0]
     via Loopback0, receive
O   2001:9999::405/128 [110/10]
     via FE80::5054:FF:FE13:CC01, GigabitEthernet0/2.9
O   2001:9999::408/128 [110/11]
     via FE80::5054:FF:FE13:CC01, GigabitEthernet0/2.9
```

Obrázek 76: R2 IPv6 routes 1/2

```
C   2001:9999:1::/64 [0/0]
     via GigabitEthernet0/1.101, directly connected
L   2001:9999:1::/128 [0/0]
     via GigabitEthernet0/1.101, receive
L   2001:9999:1::2/128 [0/0]
     via GigabitEthernet0/1.101, receive
C   2001:9999:1:1::/64 [0/0]
     via GigabitEthernet0/1.102, directly connected
L   2001:9999:1:1::/128 [0/0]
     via GigabitEthernet0/1.102, receive
L   2001:9999:1:1::2/128 [0/0]
     via GigabitEthernet0/1.102, receive
C   2001:9999:1:2::/64 [0/0]
     via GigabitEthernet0/1.103, directly connected
L   2001:9999:1:2::/128 [0/0]
     via GigabitEthernet0/1.103, receive
L   2001:9999:1:2::2/128 [0/0]
     via GigabitEthernet0/1.103, receive
C   2001:9999:2::/64 [0/0]
     via GigabitEthernet0/1.301, directly connected
L   2001:9999:2::2/128 [0/0]
     via GigabitEthernet0/1.301, receive
C   2001:9999:2:1::/64 [0/0]
     via GigabitEthernet0/1.302, directly connected
L   2001:9999:2:1::2/128 [0/0]
     via GigabitEthernet0/1.302, receive
C   2001:9999:2:2::/64 [0/0]
     via GigabitEthernet0/1.303, directly connected
L   2001:9999:2:2::2/128 [0/0]
     via GigabitEthernet0/1.303, receive
L   FF00::/8 [0/0]
     via Null0, receive
```

Obrázek 77: R2 IPv6 routes 2/2

do sh ospfv3 int br

```
R1(config)#do sh ospfv3 int br
Interface    PID   Area            AF         Cost  State Nbrs F/C
Lo0          1     0               ipv4       1     LOOP  0/0
Gi0/3.9      1     0               ipv4       10    DR    1/1
Gi0/2.9      1     0               ipv4       50    DR    1/1
Lo0          2     0               ipv6       1     LOOP  0/0
Gi0/3.9      2     0               ipv6       10    DR    1/1
Gi0/2.9      2     0               ipv6       50    DR    1/1
Gi0/0.9      4     0               ipv4       1     DR    0/0
Gi0/1.103    4     1               ipv4       1     DR    0/0
Gi0/1.102    4     1               ipv4       1     DR    0/0
Gi0/1.101    4     1               ipv4       1     DR    0/0
Gi0/1.303    4     2               ipv4       1     DR    0/0
Gi0/1.302    4     2               ipv4       1     DR    0/0
Gi0/1.301    4     2               ipv4       1     DR    0/0
Gi0/0.9      6     0               ipv6       1     DR    0/0
Gi0/1.103    6     1               ipv6       1     DR    0/0
Gi0/1.102    6     1               ipv6       1     DR    0/0
Gi0/1.101    6     1               ipv6       1     DR    0/0
Gi0/1.303    6     2               ipv6       1     DR    0/0
Gi0/1.302    6     2               ipv6       1     DR    0/0
Gi0/1.301    6     2               ipv6       1     DR    0/0
```

Obrázek 78: R1 OSPFv3 Brief

```
R2(config-if)#do sh ospfv3 int br
Interface    PID   Area            AF         Cost  State Nbrs F/C
Lo0          1     0               ipv4       1     LOOP  0/0
Gi0/3.9      1     0               ipv4       50    BDR   1/1
Gi0/2.9      1     0               ipv4       10    DR    0/0
Lo0          2     0               ipv6       1     LOOP  0/0
Gi0/3.9      2     0               ipv6       50    BDR   1/1
Gi0/2.9      2     0               ipv6       10    DR    0/0
Gi0/0.9      4     0               ipv4       1     DR    0/0
Gi0/1.103    4     1               ipv4       1     DR    0/0
Gi0/1.102    4     1               ipv4       1     DR    0/0
Gi0/1.101    4     1               ipv4       1     DR    0/0
Gi0/1.303    4     2               ipv4       1     DR    0/0
Gi0/1.302    4     2               ipv4       1     DR    0/0
Gi0/1.301    4     2               ipv4       1     DR    0/0
Gi0/0.9      6     0               ipv6       1     DR    0/0
Gi0/1.103    6     1               ipv6       1     DR    0/0
Gi0/1.102    6     1               ipv6       1     DR    0/0
Gi0/1.101    6     1               ipv6       1     DR    0/0
Gi0/1.303    6     2               ipv6       1     DR    0/0
Gi0/1.302    6     2               ipv6       1     DR    0/0
Gi0/1.301    6     2               ipv6       1     DR    0/0
```

Obrázek 79: R2 OSPFv3 Brief

```
WAN1(config-if)#do sh ospfv3 int br
Interface    PID   Area            AF         Cost  State Nbrs F/C
Lo0          1     0               ipv4       1     LOOP  0/0
Gi0/4.9      1     0               ipv4       10    DOWN  0/0
Gi0/3.9      1     0               ipv4       10    BDR   1/1
Gi0/1        1     0               ipv4       1     BDR   1/1
Lo0          2     0               ipv6       1     LOOP  0/0
Gi0/4.9      2     0               ipv6       10    DOWN  0/0
Gi0/3.9      2     0               ipv6       10    BDR   1/1
Gi0/1        2     0               ipv6       1     BDR   1/1
```

Obrázek 80: WAN1 OSPFv3 Brief

```
WAN2(config-router)#do sh ospfv3 int br
Interface    PID   Area            AF         Cost  State Nbrs F/C
Lo0          1     0               ipv4       1     LOOP  0/0
Gi0/4.9      1     0               ipv4       50    BDR   1/1
Gi0/3.9      1     0               ipv4       50    DR    1/1
Gi0/1        1     0               ipv4       1     DR    1/1
Lo0          2     0               ipv6       1     LOOP  0/0
Gi0/4.9      2     0               ipv6       50    BDR   1/1
Gi0/3.9      2     0               ipv6       50    DR    1/1
Gi0/1        2     0               ipv6       1     DR    1/1
```

Obrázek 81: WAN2 OSPFv3 Brief

9 Link state

žádné bodíky nebudou :(

10 Konektivita IPv4

10.1 Ping

10.2 Traceroute

11 Konektivita IPv6

11.1 Ping

11.2 Traceroute