

VŠB – Technical University of Ostrava
Faculty of Electrical Engineering and Computer Science
Department of Computer Science

SPS - Semestral project

SPS - Semestrální projekt

Abstrakt

Semestrální projekt do SPS

Klíčová slova: SPS, IPv4, IPv6, OSPFv3, BGP, Spanning Tree, STP, RPVST+, Agregace, VRF MGMT, Konvergence, FHRP, Standby, VRRP, PortChannel

Abstract

SPS's semestral project

Keywords: SPS, IPv4, IPv6, OSPFv3, BGP, Spanning Tree, STP, RPVST+, Aggregation, VRF MGMT, Convergence, FHRP, Standby, VRRP, PortChannel

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1 VLANs plan

Name	Number	Description
Klient 101	101	
Klient 102	102	
Klient 103	103	
Server 301	301	
Server 302	301	
Server 303	303	
g	9	data traffic
M	91	management VRF
MA	18	management VRF
unused	998	not used ports
native	999	native

2 L2 access & distribution

2.1 VLANs implementation

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
---------	-----------	------	-------

Figure 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
---------	-----------	------	-------

Figure 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
---------	-----------	------	-------

Figure 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

```

Figure 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

```

Figure 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

Figure 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)

Figure 7: DLSW1 LACP

```

DLSW2(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)

```

Figure 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
```

Figure 9: ALSW1 STP 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

```

Figure 10: ALSW1 STP 2/5

```

VLAN0301
  Spanning tree enabled protocol rstp
  Root ID    Priority    24877
            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    33069 (priority 32768 sys-id-ext 301)
            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
-----
Gi0/0                    Desg FWD 4        128.1   P2p Edge
Gi0/1                    Root FWD 5        128.2   P2p
Gi0/2                    Altn BLK 20     128.3   P2p

VLAN0302
  Spanning tree enabled protocol rstp
  Root ID    Priority    24878
            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    33070 (priority 32768 sys-id-ext 302)
            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

```

Figure 11: ALSW1 STP 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

```

Figure 12: ALSW1 STP 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

```

Figure 13: ALSW1 STP 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

```

Figure 14: DLSW1 STP 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

```

Figure 15: DLSW1 STP 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

```

Figure 16: DLSW1 STP 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

```

Figure 17: DLSW1 STP 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
  
```

Figure 18: DLSW1 STP 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
  
```

Figure 19: DLSW2 STP 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

```

Figure 20: DLSW2 STP 2/5

```

VLAN0301
  Spanning tree enabled protocol rstp
  Root ID    Priority    24877
            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    24877 (priority 24576 sys-id-ext 301)
            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

VLAN0302
  Spanning tree enabled protocol rstp
  Root ID    Priority    24878
            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    24878 (priority 24576 sys-id-ext 302)
            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

```

Figure 21: DLSW2 STP 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

```

Figure 22: DLSW2 STP 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

```

Figure 23: DLSW2 STP 5/5

4 Addressing

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	2001:9999:0:1::/127	2001:9999:0:1::1	2001:9999:0:1::	IC Link
R1-WAN2	2001:9999:0:1::2/127	2001:9999:0:1::3	2001:9999:0:1::2	IC Link
R2-WAN1	2001:9999:0:1::4/127	2001:9999:0:1::5	2001:9999:0:1::4	IC Link
R2-WAN2	2001:9999:0:1::6/127	2001:9999:0:1::7	2001:9999:0:1::6	IC Link
WAN1-WAN2	2001:9999:0:1::8/127	2001:9999:0:1::8	2001:9999:0:1::9	IC Link
WAN1-ISP1	2001:9999:0:1::A/127	2001:9999:0:1::B	2001:9999:0:1::A	IC Link
WAN2-ISP2	2001:9999:0:1::C/127	2001:9999:0:1::D	2001:9999:0:1::C	IC Link
ISP1-ISP2	2001:9999:0:1::E/127	2001:9999:0:1::E	2001:9999:0:1::F	IC Link
DLSW1	2001:9999:0:1::400/128	2001:9999:0:1::400	-	Loopback0
DLSW2	2001:9999:0:1::401/128	2001:9999:0:1::401	-	Loopback0
ALSW1	2001:9999:0:1::402/128	2001:9999:0:1::402	-	Loopback0
R1	2001:9999:0:1::403/128	2001:9999:0:1::403	-	Loopback0
R2	2001:9999:0:1::404/128	2001:9999:0:1::404	-	Loopback0
WAN1	2001:9999:0:1::405/128	2001:9999:0:1::405	-	Loopback0
WAN2	2001:9999:0:1::406/128	2001:9999:0:1::406	-	Loopback0
ISP1	2001:9999:0:1::407/128	2001:9999:0:1::407	-	Loopback0
ISP2	2001:9999:0:1::408/128	2001:9999:0:1::408	-	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

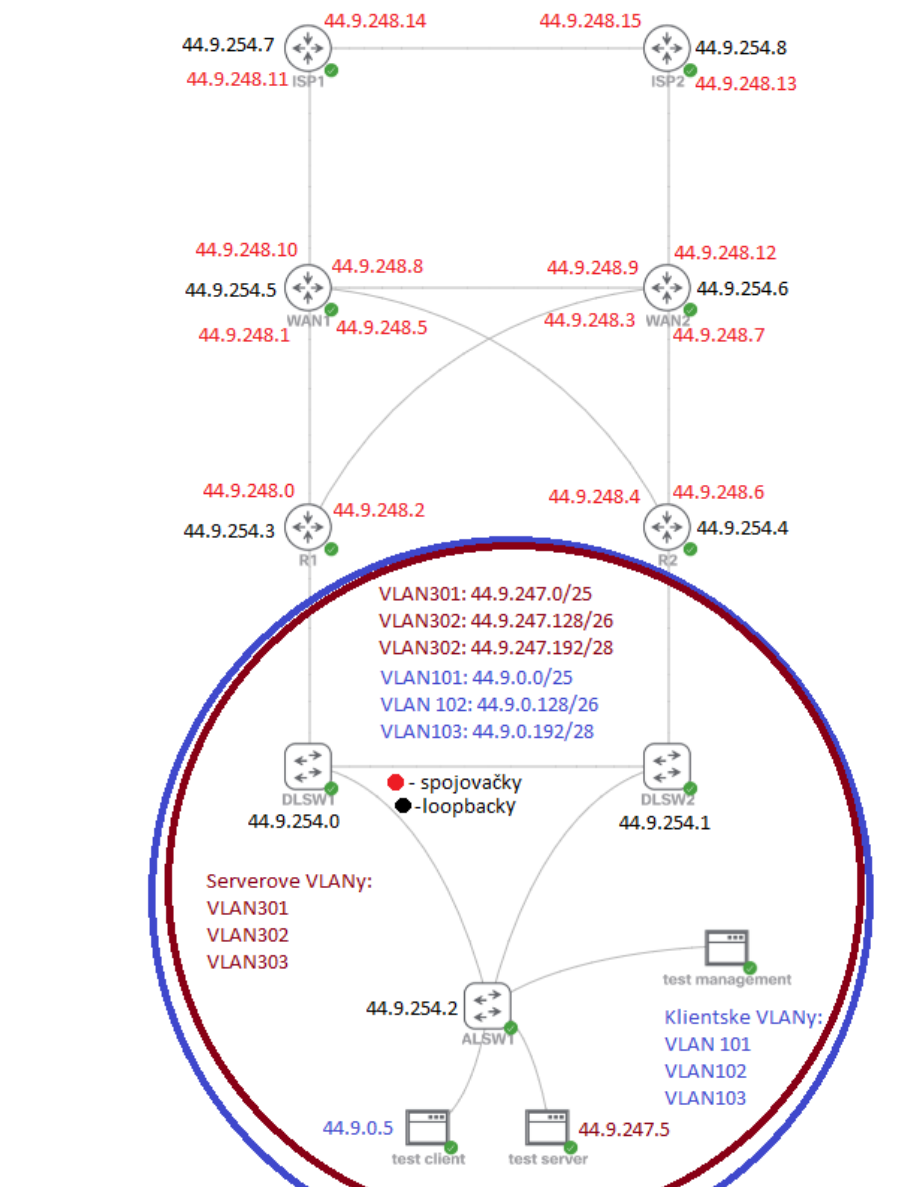


Figure 24: IPv4 addressing

4.2 IPv6

Klient/server

Name	Network address	Description
VLAN 101	2001:9999:1::/64	Client VLAN 1
VLAN 102	2001:9999:1:1::/64	Client VLAN 2
VLAN 103	2001:9999:1:2::/64	Client VLAN 3
Client 1	2001:9999:1:3:/64	First client subnet
...
Client 200	2001:9999:1:ca::/64	Last client subnet
VLAN 301	2001:9999:2::/64	Server VLAN 1
VLAN 302	2001:9999:2:1::/64	Server VLAN 2
VLAN 303	2001:9999:2:2::/64	Server VLAN 3
Server 1	2001:9999:2:3:/64	First server subnet
...
Server 50	2001:9999:2:34::/64	Last server subnet

Global

Name	Network address	First address	Second address	Description
R1-WAN1	2001:9999:0:1::/127	2001:9999:0:1::1	2001:9999:0:1::	IC Link
R1-WAN2	2001:9999:0:1:2/127	2001:9999:0:1::3	2001:9999:0:1::2	IC Link
R2-WAN1	2001:9999:0:1:4/127	2001:9999:0:1::5	2001:9999:0:1::4	IC Link
R2-WAN2	2001:9999:0:1:6/127	2001:9999:0:1::7	2001:9999:0:1::6	IC Link
WAN1-WAN2	2001:9999:0:1:8/127	2001:9999:0:1::8	2001:9999:0:1::9	IC Link
WAN1-ISP1	2001:9999:0:1:A/127	2001:9999:0:1::B	2001:9999:0:1::A	IC Link
WAN2-ISP2	2001:9999:0:1:C/127	2001:9999:0:1::D	2001:9999:0:1::C	IC Link
ISP1-ISP2	2001:9999:0:1:E/127	2001:9999:0:1::E	2001:9999:0:1::F	IC Link
DLSW1	2001:9999:0:1:400/128	2001:9999:0:1:400	-	Loopback0
DLSW2	2001:9999:0:1:401/128	2001:9999:0:1:401	-	Loopback0
ALSW1	2001:9999:0:1:402/128	2001:9999:0:1:402	-	Loopback0
R1	2001:9999:0:1:403/128	2001:9999:0:1:403	-	Loopback0
R2	2001:9999:0:1:404/128	2001:9999:0:1:404	-	Loopback0
WAN1	2001:9999:0:1:405/128	2001:9999:0:1:405	-	Loopback0
WAN2	2001:9999:0:1:406/128	2001:9999:0:1:406	-	Loopback0
ISP1	2001:9999:0:1:407/128	2001:9999:0:1:407	-	Loopback0
ISP2	2001:9999:0:1:408/128	2001:9999:0:1:408	-	Loopback0

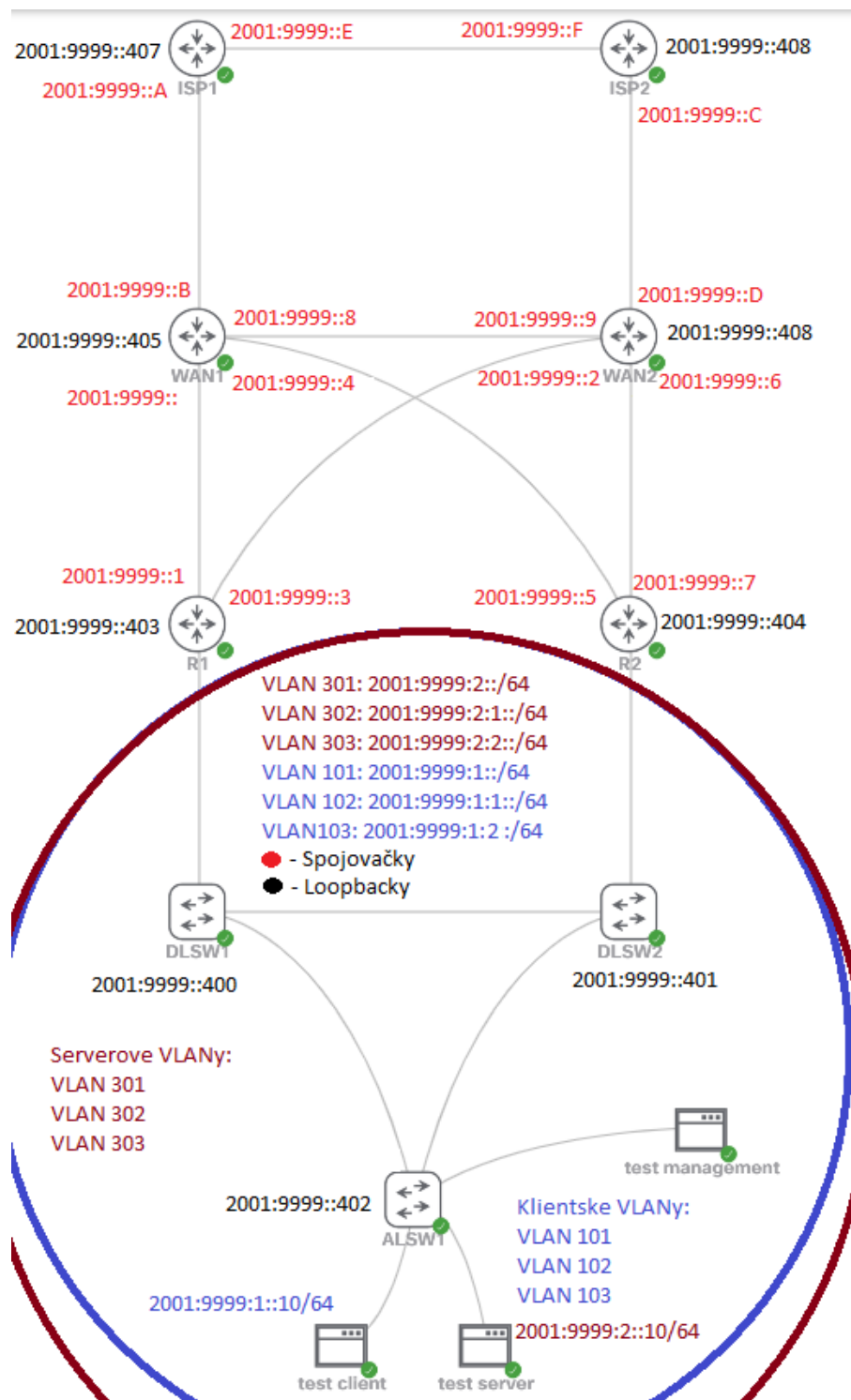


Figure 25: IPv6 addressing

4.3 Convergence

Routing from client to 2.0.0.1/2001:9999:2000::1 prefers route through R2-WAN1-ISP1-ISP2
standby took 0s STP - took 6s

```
localhost:~$ ping 2.0.0.1
PING 2.0.0.1 (2.0.0.1): 56 data bytes
64 bytes from 2.0.0.1: seq=0 ttl=42 time=13.931 ms
64 bytes from 2.0.0.1: seq=1 ttl=42 time=11.964 ms
64 bytes from 2.0.0.1: seq=2 ttl=42 time=16.135 ms
64 bytes from 2.0.0.1: seq=3 ttl=42 time=10.684 ms
64 bytes from 2.0.0.1: seq=9 ttl=42 time=1026.999 ms
64 bytes from 2.0.0.1: seq=10 ttl=42 time=27.915 ms
64 bytes from 2.0.0.1: seq=11 ttl=42 time=11.829 ms
64 bytes from 2.0.0.1: seq=12 ttl=42 time=9.769 ms
64 bytes from 2.0.0.1: seq=13 ttl=42 time=11.090 ms
```

Figure 26: IPv4 STP convergence

```
localhost:~$ ping 2001:9999:2000::1
PING 2001:9999:2000::1 (2001:9999:2000::1): 56 data bytes
64 bytes from 2001:9999:2000::1: seq=0 ttl=61 time=13.318 ms
64 bytes from 2001:9999:2000::1: seq=1 ttl=61 time=13.008 ms
64 bytes from 2001:9999:2000::1: seq=2 ttl=61 time=15.762 ms
64 bytes from 2001:9999:2000::1: seq=3 ttl=61 time=11.775 ms
64 bytes from 2001:9999:2000::1: seq=10 ttl=61 time=37.407 ms
64 bytes from 2001:9999:2000::1: seq=11 ttl=61 time=14.863 ms
64 bytes from 2001:9999:2000::1: seq=12 ttl=61 time=11.216 ms
64 bytes from 2001:9999:2000::1: seq=13 ttl=61 time=12.995 ms
```

Figure 27: IPv6 STP Convergence

OSPFv3 - took 5s

```
64 bytes from 2.0.0.1: seq=5 ttl=42 time=12.438 ms
64 bytes from 2.0.0.1: seq=6 ttl=42 time=10.133 ms
64 bytes from 2.0.0.1: seq=7 ttl=42 time=17.241 ms
64 bytes from 2.0.0.1: seq=8 ttl=42 time=14.576 ms
64 bytes from 2.0.0.1: seq=9 ttl=42 time=12.428 ms
64 bytes from 2.0.0.1: seq=10 ttl=42 time=12.211 ms
64 bytes from 2.0.0.1: seq=16 ttl=42 time=12.899 ms
64 bytes from 2.0.0.1: seq=17 ttl=42 time=20.203 ms
64 bytes from 2.0.0.1: seq=18 ttl=42 time=12.350 ms
64 bytes from 2.0.0.1: seq=19 ttl=42 time=21.667 ms
64 bytes from 2.0.0.1: seq=20 ttl=42 time=12.085 ms
```

Figure 28: IPv4 OSPFv3 convergence

```
64 bytes from 2001:9999:2000::1: seq=3 ttl=61 time=9.863 ms
64 bytes from 2001:9999:2000::1: seq=4 ttl=61 time=9.815 ms
64 bytes from 2001:9999:2000::1: seq=5 ttl=61 time=13.206 ms
64 bytes from 2001:9999:2000::1: seq=6 ttl=61 time=8.706 ms
64 bytes from 2001:9999:2000::1: seq=7 ttl=61 time=11.633 ms
64 bytes from 2001:9999:2000::1: seq=8 ttl=61 time=20.986 ms
64 bytes from 2001:9999:2000::1: seq=9 ttl=61 time=9.508 ms
64 bytes from 2001:9999:2000::1: seq=15 ttl=61 time=9.437 ms
64 bytes from 2001:9999:2000::1: seq=16 ttl=61 time=8.076 ms
64 bytes from 2001:9999:2000::1: seq=17 ttl=61 time=12.409 ms
64 bytes from 2001:9999:2000::1: seq=18 ttl=61 time=15.159 ms
64 bytes from 2001:9999:2000::1: seq=19 ttl=61 time=8.720 ms
```

Figure 29: IPv6 OSPFv3 convergence

BGP - took 180s

```
localhost:~$ ping 2.0.0.1
PING 2.0.0.1 (2.0.0.1): 56 data bytes
64 bytes from 2.0.0.1: seq=0 ttl=42 time=14.237 ms
64 bytes from 2.0.0.1: seq=1 ttl=42 time=7.253 ms
64 bytes from 2.0.0.1: seq=2 ttl=42 time=13.846 ms
64 bytes from 2.0.0.1: seq=3 ttl=42 time=17.837 ms
64 bytes from 2.0.0.1: seq=4 ttl=42 time=13.004 ms
64 bytes from 2.0.0.1: seq=177 ttl=42 time=11.615 ms
64 bytes from 2.0.0.1: seq=178 ttl=42 time=15.483 ms
64 bytes from 2.0.0.1: seq=179 ttl=42 time=9.397 ms
```

Figure 30: IPv4 BGP convergence

```
localhost:~$ ping 2001:9999:2000::1
PING 2001:9999:2000::1 (2001:9999:2000::1): 56 data bytes
64 bytes from 2001:9999:2000::1: seq=0 ttl=61 time=16.014 ms
64 bytes from 2001:9999:2000::1: seq=1 ttl=61 time=11.571 ms
64 bytes from 2001:9999:2000::1: seq=2 ttl=61 time=20.598 ms
64 bytes from 2001:9999:2000::1: seq=3 ttl=61 time=12.705 ms
64 bytes from 2001:9999:2000::1: seq=4 ttl=61 time=11.743 ms
64 bytes from 2001:9999:2000::1: seq=184 ttl=61 time=34.593 ms
64 bytes from 2001:9999:2000::1: seq=185 ttl=61 time=14.818 ms
64 bytes from 2001:9999:2000::1: seq=186 ttl=61 time=24.508 ms
64 bytes from 2001:9999:2000::1: seq=187 ttl=61 time=11.104 ms
```

Figure 31: IPv6 BGP convergence

5 FHRP

5.1 Implementation

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

Figure 32: 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

Figure 33: 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)

```

Figure 34: 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)

```

Figure 35: 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)

```

Figure 36: 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)

```

Figure 37: 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)

```

Figure 38: 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)

```

Figure 39: 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)

```

Figure 40: 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)

```

Figure 41: 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)

```

Figure 42: 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)

```

Figure 43: 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)
```

Figure 44: 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)
```

Figure 45: 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

```

Figure 46: 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

```

Figure 47: R2 Tracking

6 BGP & Aggregation

do sh ip bgp

	Network	Next Hop	Metric	LocPrf	Weight	Path
*>i	1.0.0.0	44.9.254.6	0	120	0	100 i
*		44.9.248.11	0		0	100 i
*>	2.0.0.0/16	44.9.248.11			0	100 i
s>	44.9.0.0/25	44.9.248.4	11		32768	?
* i	44.9.0.0/17	44.9.254.6	0	100	0	i
*>		0.0.0.0			32768	i
s>	44.9.0.128/26	44.9.248.4	11		32768	?
s>	44.9.0.192/28	44.9.248.4	11		32768	?
* i	44.9.240.0/21	44.9.254.6	0	100	0	i
*>		0.0.0.0			32768	i
s>	44.9.247.0/25	44.9.248.4	11		32768	?
s>	44.9.247.128/26	44.9.248.4	11		32768	?
s>	44.9.247.192/28	44.9.248.4	11		32768	?

Figure 48: WAN1 IPv4 BGP

	Network	Next Hop	Metric	LocPrf	Weight	Path
*>	1.0.0.0	44.9.248.13			0	100 i
*	2.0.0.0/16	44.9.248.13	0		0	100 i
*>i		44.9.254.5	0	120	0	100 i
s>	44.9.0.0/25	44.9.248.8	12		32768	?
*>	44.9.0.0/17	0.0.0.0			32768	i
* i		44.9.254.5	0	100	0	i
s>	44.9.0.128/26	44.9.248.8	12		32768	?
s>	44.9.0.192/28	44.9.248.8	12		32768	?
*>	44.9.240.0/21	0.0.0.0			32768	i
* i		44.9.254.5	0	100	0	i
s>	44.9.247.0/25	44.9.248.8	12		32768	?
s>	44.9.247.128/26	44.9.248.8	12		32768	?
s>	44.9.247.192/28	44.9.248.8	12		32768	?

Figure 49: WAN2 IPv4 BGP

	Network	Next Hop	Metric	LocPrf	Weight	Path
*>	1.0.0.0	0.0.0.0	0		32768	i
*>i	2.0.0.0/16	44.9.254.8	0	100	0	i
*>i	44.9.0.0/17	44.9.254.8	0	100	0	9 i
*		44.9.248.10	0		0	9 9 i
*>	44.9.240.0/21	44.9.248.10	0		0	9 i

Figure 50: ISP1 IPv4 BGP

	Network	Next Hop	Metric	LocPrf	Weight	Path
*>i	1.0.0.0	44.9.254.7	0	100	0	i
*>	2.0.0.0/16	0.0.0.0	0		32768	i
*>	44.9.0.0/17	44.9.248.12	0		0	9 i
*	44.9.240.0/21	44.9.248.12	0		0	9 9 i
*>i		44.9.254.7	0	100	0	9 i

Figure 51: ISP2 IPv4 BGP

do sh bgp ipv6 unicast

	Network	Next Hop	Metric	LocPrf	Weight	Path
s>	2001:9999:1::/64	FE80::5054:FF:FE1B:7390	11		32768	?
* i	2001:9999:1::/48	2001:9999::406	0	100	0	i
*>		::			32768	i
s>	2001:9999:1:1::/64	FE80::5054:FF:FE1B:7390	11		32768	?
s>	2001:9999:1:2::/64	FE80::5054:FF:FE1B:7390	11		32768	?
s>	2001:9999:2::/64	FE80::5054:FF:FE1B:7390	11		32768	?
* i	2001:9999:2::/48	2001:9999::406	0	100	0	i
*>		::			32768	i

Figure 52: WAN1 IPv6 BGP 1/2

	Network	Next Hop	Metric	LocPrf	Weight	Path
s>	2001:9999:2:1::/64	FE80::5054:FF:FE1B:E376	12		32768	?
s>	2001:9999:2:2::/64	FE80::5054:FF:FE1B:E376	12		32768	?
*>i	2001:9999:1000::/48	2001:9999::405	0	122	0	100 i
*		2001:9999::C			0	100 i
* i	2001:9999:2000::/56	2001:9999::405	0	100	0	100 i
*>		2001:9999::C	0		0	100 i

Figure 53: WAN2 IPv6 BGP 2/2

	Network	Next Hop	Metric	LocPrf	Weight	Path
s>	2001:9999:1::/64	FE80::5054:FF:FE1B:7390	11		32768	?
* i	2001:9999:1::/48	2001:9999::406	0	100	0	i
*>		::			32768	i
s>	2001:9999:1:1::/64	FE80::5054:FF:FE1B:7390	11		32768	?
s>	2001:9999:1:2::/64	FE80::5054:FF:FE1B:7390	11		32768	?
s>	2001:9999:2::/64	FE80::5054:FF:FE1B:7390	11		32768	?
* i	2001:9999:2::/48	2001:9999::406	0	100	0	i
*>		::			32768	i

Figure 54: WAN1 IPv6 BGP 1/2

	Network	Next Hop	Metric	LocPrf	Weight	Path
s>	2001:9999:2:1::/64	FE80::5054:FF:FE1B:E376	12		32768	?
s>	2001:9999:2:2::/64	FE80::5054:FF:FE1B:E376	12		32768	?
*>i	2001:9999:1000::/48	2001:9999::405	0	122	0	100 i
*		2001:9999::C			0	100 i
* i	2001:9999:2000::/56	2001:9999::405	0	100	0	100 i
*>		2001:9999::C	0		0	100 i

Figure 55: WAN2 IPv6 BGP 2/2

	Network	Next Hop	Metric	LocPrf	Weight	Path
*>i	2001:9999:1::/48	2001:9999::408	0	100	0	9 i
*		2001:9999::B	0		0	9 9 i
*>	2001:9999:2::/48	2001:9999::B	0		0	9 i
*>	2001:9999:1000::/48	::	0		32768	i
*>i	2001:9999:2000::/56	2001:9999::408	0	100	0	i

Figure 56: ISP1 IPv6 BGP

	Network	Next Hop	Metric	LocPrf	Weight	Path
*>	2001:9999:1::/48	2001:9999::D	0		0	9 i
*	2001:9999:2::/48	2001:9999::D	0		0	9 9 i
*>i		2001:9999::407	0	100	0	9 i
*>i	2001:9999:1000::/48		0			
		2001:9999::407	0	100	0	i
*>	2001:9999:2000::/56	::	0		32768	i

Figure 57: ISP2 IPv6 BGP

prefixy

7 Management

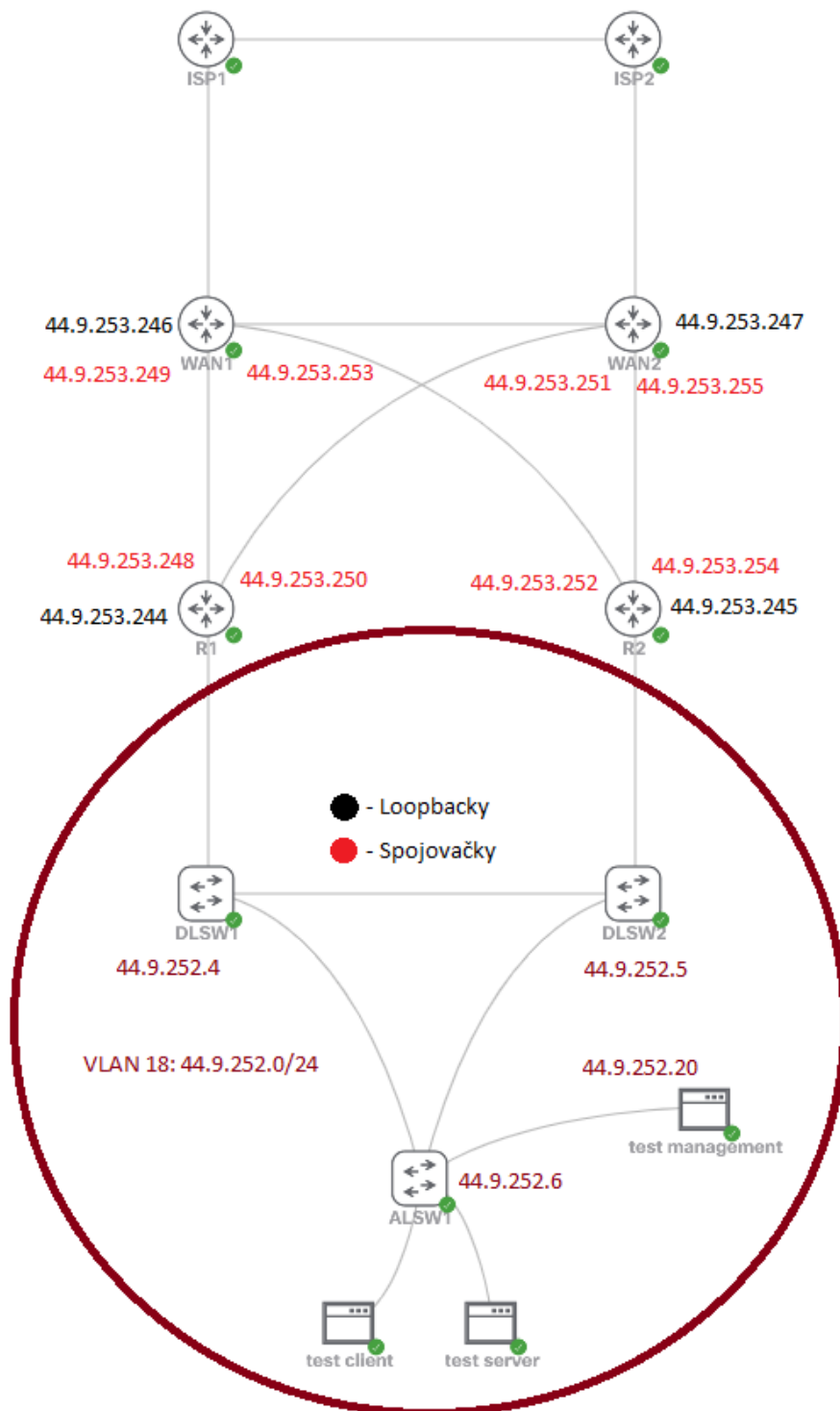


Figure 58: IPv4 management addressing

```
do sh eigrp address-family ipv4 vrf MGMT int
```

```
R1(config-if)#do sh eigrp address-family ipv4 vrf MGMT int
EIGRP-IPv4 Interfaces for AS(1) VRF(MGMT)
```

Interface	Peers	Xmit Queue Un/Reliable	PeerQ Un/Reliable	Mean SRTT	Pacing Time Un/Reliable	Multicast Flow Timer	Pending Routes
Gi0/1.18	1	0/0	0/0	10	0/0	50	0
Gi0/2.91	1	0/0	0/0	3	0/0	50	0
Gi0/3.91	1	0/0	0/0	1590	0/0	7948	0
Lo1	0	0/0	0/0	0	0/0	0	0

Figure 59: R1 VRF EIGRP

```
R2(config)#do sh eigrp address-family ipv4 vrf MGMT int
EIGRP-IPv4 Interfaces for AS(1) VRF(MGMT)
```

Interface	Peers	Xmit Queue Un/Reliable	PeerQ Un/Reliable	Mean SRTT	Pacing Time Un/Reliable	Multicast Flow Timer	Pending Routes
Gi0/1.18	1	0/0	0/0	10	0/0	50	0
Gi0/2.91	1	0/0	0/0	173	0/0	864	0
Gi0/3.91	1	0/0	0/0	5	0/0	50	0
Lo1	0	0/0	0/0	0	0/0	0	0

Figure 60: R2 VRF EIGRP

```
WAN1(config-if)#do sh eigrp address-family ipv4 vrf MGMT int
EIGRP-IPv4 Interfaces for AS(1) VRF(MGMT)
```

Interface	Peers	Xmit Queue Un/Reliable	PeerQ Un/Reliable	Mean SRTT	Pacing Time Un/Reliable	Multicast Flow Timer	Pending Routes
Gi0/3.91	1	0/0	0/0	9	0/0	50	0
Gi0/4.91	1	0/0	0/0	3	0/0	50	0
Lo1	0	0/0	0/0	0	0/0	0	0

Figure 61: WAN1 VRF EIGRP

```
WAN2(config-router)#do sh eigrp address-family ipv4 vrf MGMT int
EIGRP-IPv4 Interfaces for AS(1) VRF(MGMT)
```

Interface	Peers	Xmit Queue Un/Reliable	PeerQ Un/Reliable	Mean SRTT	Pacing Time Un/Reliable	Multicast Flow Timer	Pending Routes
Gi0/3.91	1	0/0	0/0	3	0/0	50	0
Gi0/4.91	1	0/0	0/0	3	0/0	50	0
Lo1	0	0/0	0/0	0	0/0	0	0

Figure 62: WAN2 VRF EIGRP

7.1 IPv4 VRRP

```
R1(config-if)#do sh vrrp
GigabitEthernet0/1.18 - Group 18
  State is Backup
  Virtual IP address is 44.9.252.1
  Virtual MAC address is 0000.5e00.0112
  Advertisement interval is 1.000 sec
  Preemption enabled
  Priority is 120
  Master Router is 44.9.252.3, priority is 120
  Master Advertisement interval is 1.000 sec
  Master Down interval is 3.531 sec (expires in 3.173 sec)
```

Figure 63: R1 IPv4 VRRP

```
R2(config)#do sh vrrp
GigabitEthernet0/1.18 - Group 18
  State is Master
  Virtual IP address is 44.9.252.1
  Virtual MAC address is 0000.5e00.0112
  Advertisement interval is 1.000 sec
  Preemption enabled
  Priority is 120
  Master Router is 44.9.252.3 (local), priority is 120
  Master Advertisement interval is 1.000 sec
  Master Down interval is 3.531 sec
```

Figure 64: R2 IPv4 VRRP

7.2 IPv4

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

Figure 65: 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

Figure 66: 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

Figure 67: 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

Figure 68: 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

Figure 69: 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

Figure 70: 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

Figure 71: 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

Figure 72: 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

Figure 73: ALSW1 IPv4 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

```

Figure 74: 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

```

Figure 75: 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

```

Figure 76: 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

```

Figure 77: 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

```

Figure 78: 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

```

Figure 79: R2 IPv4 routes

do sh ospfv3 ipv4 int br

```

R1(config-if)#do sh ospfv3 ipv4 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    BDR   1/1
Gi0/1.303  1    1     ipv4    1     DR    0/0
Gi0/1.302  1    1     ipv4    1     DR    0/0
Gi0/1.301  1    1     ipv4    1     DR    0/0
Gi0/1.103  1    1     ipv4    1     DR    0/0
Gi0/1.102  1    1     ipv4    1     DR    0/0
Gi0/1.101  1    1     ipv4    1     DR    0/0

```

Figure 80: R1 OSPFv3 Brief

```

R2(config)#do sh ospfv3 ipv4 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    BDR   1/1
Gi0/1.303  1    1     ipv4    1     DR    0/0
Gi0/1.302  1    1     ipv4    1     DR    0/0
Gi0/1.301  1    1     ipv4    1     DR    0/0
Gi0/1.103  1    1     ipv4    1     DR    0/0
Gi0/1.102  1    1     ipv4    1     DR    0/0
Gi0/1.101  1    1     ipv4    1     DR    0/0

```

Figure 81: R2 OSPFv3 Brief

```

WAN1(config-if)#do sh ospfv3 ipv4 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    DR    1/1
Gi0/3.9    1    0     ipv4    10    BDR   1/1
Gi0/1      1    0     ipv4    1     BDR   1/1

```

Figure 82: WAN1 OSPFv3 Brief

```

WAN2(config-router)#do sh ospfv3 ipv4 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    DR    1/1
Gi0/3.9    1    0     ipv4    50    DR    1/1
Gi0/1      1    0     ipv4    1     DR    1/1

```


Figure 83: WAN2 OSPFv3 Brief

7.3 IPv6

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
```

Figure 84: 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
```

Figure 85: 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

```

Figure 86: WAN1 IPv6 interface brief

```

WAN2(config)#do sh ipv6 int br
GigabitEthernet0/0      [administratively down/down]
    unassigned
GigabitEthernet0/1      [up/up]
    FE80::5054:FF:FE1C:3953
    2001:9999::9
GigabitEthernet0/2      [up/up]
    FE80::5054:FF:FE02:DE55
    2001:9999::D
GigabitEthernet0/3      [up/up]
    unassigned
GigabitEthernet0/3.9    [up/up]
    FE80::5054:FF:FE11:C5A
    2001:9999::6
GigabitEthernet0/3.91   [up/up]
    unassigned
GigabitEthernet0/4      [up/up]
    unassigned
GigabitEthernet0/4.9    [up/up]
    FE80::5054:FF:FE0D:9884
    2001:9999::2
GigabitEthernet0/4.91   [up/up]
    unassigned
Loopback0               [up/up]
    FE80::5054:FF:FE1D:FB56
    2001:9999::408
Loopback1               [up/up]
    unassigned

```

Figure 87: 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]
```

Figure 88: 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
```

Figure 89: 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]
```

Figure 90: R2 IPv6 interface brief 1/2

```
FE80::5054:FF:FE02:4B2E
2001:9999::7
GigabitEthernet0/3.91    [up/up]
    unassigned
Loopback0                [up/up]
    FE80::5054:FF:FE11:7D40
    2001:9999::404
Loopback1                [up/up]
    unassigned
```

Figure 91: R2 IPv6 interface brief 1/2

```
DLSW1(config)#do sh ipv6 int br
GigabitEthernet0/0      [up/up]
    unassigned
GigabitEthernet0/1      [up/up]
    unassigned
GigabitEthernet0/1.101  [deleted/down]
    unassigned
GigabitEthernet0/2      [up/up]
    unassigned
GigabitEthernet0/3      [up/down]
    unassigned
GigabitEthernet1/0      [up/up]
    unassigned
Loopback0               [up/up]
    FE80::5054:FF:FE00:6E45
    2001:9999::400
Port-channel1           [up/up]
    unassigned
Vlan18                  [up/up]
    unassigned
```

Figure 92: DLSW1 IPv6 interface brief

```

GigabitEthernet0/0      [up/up]
    unassigned
GigabitEthernet0/1      [up/up]
    unassigned
GigabitEthernet0/2      [up/up]
    unassigned
GigabitEthernet0/3      [up/down]
    unassigned
GigabitEthernet1/0      [up/up]
    unassigned
Loopback0               [up/up]
    FE80::5054:FF:FE01:6758
    2001:9999::401
Port-channel1           [up/up]
    unassigned
Vlan18                  [up/up]
    unassigned

```

Figure 93: 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
```


Figure 94: ALSW1 IPv6 interface brief

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
```

Figure 95: 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
```

Figure 96: 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

```

Figure 97: 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

```

Figure 98: 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

```

Figure 99: 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::1/128 [0/0]
   via GigabitEthernet0/1.301, receive
L 2001:9999:2:1::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::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::1/128 [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

```

Figure 100: 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

```

Figure 101: 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

```

Figure 102: R2 IPv6 routes 2/2

do sh ospfv3 ipv6 int br

```

R1(config-if)#do sh ospfv3 ipv6 int br

```

Interface	PID	Area	AF	Cost	State	Nbrs	F/C
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	BDR	1/1	
Gi0/1.303	2	2	ipv6	1	DR	0/0	
Gi0/1.302	2	2	ipv6	1	DR	0/0	
Gi0/1.301	2	2	ipv6	1	DR	0/0	
Gi0/1.103	2	2	ipv6	1	DR	0/0	
Gi0/1.102	2	2	ipv6	1	DR	0/0	
Gi0/1.101	2	2	ipv6	1	DR	0/0	

Figure 103: R1 OSPFv3 Brief

```

R2(config)#do sh ospfv3 ipv6 int br

```

Interface	PID	Area	AF	Cost	State	Nbrs	F/C
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	BDR	1/1	
Gi0/1.303	2	2	ipv6	1	DR	0/0	
Gi0/1.302	2	2	ipv6	1	DR	0/0	
Gi0/1.301	2	2	ipv6	1	DR	0/0	
Gi0/1.103	2	2	ipv6	1	DR	0/0	
Gi0/1.102	2	2	ipv6	1	DR	0/0	
Gi0/1.101	2	2	ipv6	1	DR	0/0	

Figure 104: R2 OSPFv3 Brief

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

Figure 105: WAN1 OSPFv3 Brief

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

Figure 106: WAN2 OSPFv3 Brief

8 IPv4 Connectivity

8.1 Ping

ping from client to each VLAN's interface on ALSW1

```
localhost:~$ ping 44.9.0.126 -c 6
PING 44.9.0.126 (44.9.0.126): 56 data bytes
64 bytes from 44.9.0.126: seq=0 ttl=42 time=5.984 ms
64 bytes from 44.9.0.126: seq=1 ttl=42 time=1.768 ms
64 bytes from 44.9.0.126: seq=2 ttl=42 time=1.844 ms
64 bytes from 44.9.0.126: seq=3 ttl=42 time=1.691 ms
64 bytes from 44.9.0.126: seq=4 ttl=42 time=5.123 ms
64 bytes from 44.9.0.126: seq=5 ttl=42 time=2.710 ms

--- 44.9.0.126 ping statistics ---
6 packets transmitted, 6 packets received, 0% packet loss
round-trip min/avg/max = 1.691/3.186/5.984 ms
```

Figure 107: Client IPv4 ping to VLAN 101

```
localhost:~$ ping 44.9.0.190 -c 6
PING 44.9.0.190 (44.9.0.190): 56 data bytes
64 bytes from 44.9.0.190: seq=0 ttl=42 time=8.275 ms
64 bytes from 44.9.0.190: seq=1 ttl=42 time=7.656 ms
64 bytes from 44.9.0.190: seq=2 ttl=42 time=13.678 ms
64 bytes from 44.9.0.190: seq=3 ttl=42 time=6.059 ms
64 bytes from 44.9.0.190: seq=4 ttl=42 time=7.608 ms
64 bytes from 44.9.0.190: seq=5 ttl=42 time=13.962 ms

--- 44.9.0.190 ping statistics ---
6 packets transmitted, 6 packets received, 0% packet loss
round-trip min/avg/max = 6.059/9.539/13.962 ms
```

Figure 108: Client IPv4 ping to VLAN 102

```
localhost:~$ ping 44.9.0.206 -c 6
PING 44.9.0.206 (44.9.0.206): 56 data bytes
64 bytes from 44.9.0.206: seq=0 ttl=42 time=8.807 ms
64 bytes from 44.9.0.206: seq=1 ttl=42 time=12.009 ms
64 bytes from 44.9.0.206: seq=2 ttl=42 time=9.204 ms
64 bytes from 44.9.0.206: seq=3 ttl=42 time=5.437 ms
64 bytes from 44.9.0.206: seq=4 ttl=42 time=8.735 ms
64 bytes from 44.9.0.206: seq=5 ttl=42 time=11.581 ms

--- 44.9.0.206 ping statistics ---
6 packets transmitted, 6 packets received, 0% packet loss
round-trip min/avg/max = 5.437/9.295/12.009 ms
```

Figure 109: Client IPv4 ping to VLAN 103

```

PING 44.9.247.126 (44.9.247.126): 56 data bytes
64 bytes from 44.9.247.126: seq=0 ttl=42 time=8.407 ms
64 bytes from 44.9.247.126: seq=1 ttl=42 time=7.017 ms
64 bytes from 44.9.247.126: seq=2 ttl=42 time=9.098 ms
64 bytes from 44.9.247.126: seq=3 ttl=42 time=5.806 ms
64 bytes from 44.9.247.126: seq=4 ttl=42 time=6.719 ms
64 bytes from 44.9.247.126: seq=5 ttl=42 time=7.909 ms

--- 44.9.247.126 ping statistics ---
6 packets transmitted, 6 packets received, 0% packet loss
round-trip min/avg/max = 5.806/7.492/9.098 ms

```

Figure 110: Client IPv4 ping to VLAN 301

```

localhost:~$ ping 44.9.247.190 -c 6
PING 44.9.247.190 (44.9.247.190): 56 data bytes
64 bytes from 44.9.247.190: seq=0 ttl=42 time=5.708 ms
64 bytes from 44.9.247.190: seq=1 ttl=42 time=6.956 ms
64 bytes from 44.9.247.190: seq=2 ttl=42 time=9.191 ms
64 bytes from 44.9.247.190: seq=3 ttl=42 time=8.626 ms
64 bytes from 44.9.247.190: seq=4 ttl=42 time=8.247 ms
64 bytes from 44.9.247.190: seq=5 ttl=42 time=6.442 ms

--- 44.9.247.190 ping statistics ---
6 packets transmitted, 6 packets received, 0% packet loss
round-trip min/avg/max = 5.708/7.528/9.191 ms

```

Figure 111: Client IPv4 ping to VLAN 302

```

localhost:~$ ping 44.9.247.206 -c 6
PING 44.9.247.206 (44.9.247.206): 56 data bytes
64 bytes from 44.9.247.206: seq=0 ttl=42 time=7.468 ms
64 bytes from 44.9.247.206: seq=1 ttl=42 time=5.680 ms
64 bytes from 44.9.247.206: seq=2 ttl=42 time=7.970 ms
64 bytes from 44.9.247.206: seq=3 ttl=42 time=9.421 ms
64 bytes from 44.9.247.206: seq=4 ttl=42 time=6.777 ms
64 bytes from 44.9.247.206: seq=5 ttl=42 time=10.669 ms

--- 44.9.247.206 ping statistics ---
6 packets transmitted, 6 packets received, 0% packet loss
round-trip min/avg/max = 5.680/7.997/10.669 ms

```

Figure 112: Client IPv4 ping to VLAN 303

ping from server to each VLAN's interface on ALSW1


```
localhost:~$ ping 44.9.0.126 -c 6
PING 44.9.0.126 (44.9.0.126): 56 data bytes
64 bytes from 44.9.0.126: seq=0 ttl=42 time=15.132 ms
64 bytes from 44.9.0.126: seq=1 ttl=42 time=8.440 ms
64 bytes from 44.9.0.126: seq=2 ttl=42 time=6.681 ms
64 bytes from 44.9.0.126: seq=3 ttl=42 time=5.240 ms
64 bytes from 44.9.0.126: seq=4 ttl=42 time=6.177 ms
64 bytes from 44.9.0.126: seq=5 ttl=42 time=8.495 ms

--- 44.9.0.126 ping statistics ---
6 packets transmitted, 6 packets received, 0% packet loss
round-trip min/avg/max = 5.240/8.360/15.132 ms
```

Figure 113: Server IPv4 ping to VLAN 101

```
localhost:~$ ping 44.9.0.190 -c 6
PING 44.9.0.190 (44.9.0.190): 56 data bytes
64 bytes from 44.9.0.190: seq=0 ttl=42 time=7.424 ms
64 bytes from 44.9.0.190: seq=1 ttl=42 time=8.519 ms
64 bytes from 44.9.0.190: seq=2 ttl=42 time=11.426 ms
64 bytes from 44.9.0.190: seq=3 ttl=42 time=8.494 ms
64 bytes from 44.9.0.190: seq=4 ttl=42 time=5.952 ms
64 bytes from 44.9.0.190: seq=5 ttl=42 time=7.751 ms

--- 44.9.0.190 ping statistics ---
6 packets transmitted, 6 packets received, 0% packet loss
round-trip min/avg/max = 5.952/8.261/11.426 ms
```

Figure 114: Server IPv4 ping to VLAN 102

```
localhost:~$ ping 44.9.0.206 -c 6
PING 44.9.0.206 (44.9.0.206): 56 data bytes
64 bytes from 44.9.0.206: seq=0 ttl=42 time=6.452 ms
64 bytes from 44.9.0.206: seq=1 ttl=42 time=7.299 ms
64 bytes from 44.9.0.206: seq=2 ttl=42 time=8.874 ms
64 bytes from 44.9.0.206: seq=3 ttl=42 time=5.993 ms
64 bytes from 44.9.0.206: seq=4 ttl=42 time=6.402 ms
64 bytes from 44.9.0.206: seq=5 ttl=42 time=6.256 ms

--- 44.9.0.206 ping statistics ---
6 packets transmitted, 6 packets received, 0% packet loss
round-trip min/avg/max = 5.993/6.879/8.874 ms
```

Figure 115: Server IPv4 ping to VLAN 103

```
localhost:~$ ping 44.9.247.126 -c 6
PING 44.9.247.126 (44.9.247.126): 56 data bytes
64 bytes from 44.9.247.126: seq=0 ttl=42 time=3.913 ms
64 bytes from 44.9.247.126: seq=1 ttl=42 time=1.774 ms
64 bytes from 44.9.247.126: seq=2 ttl=42 time=1.850 ms
64 bytes from 44.9.247.126: seq=3 ttl=42 time=2.011 ms
64 bytes from 44.9.247.126: seq=4 ttl=42 time=3.505 ms
64 bytes from 44.9.247.126: seq=5 ttl=42 time=1.753 ms

--- 44.9.247.126 ping statistics ---
6 packets transmitted, 6 packets received, 0% packet loss
round-trip min/avg/max = 1.753/2.467/3.913 ms
```

Figure 116: Server IPv4 ping to VLAN 301

```
localhost:~$ ping 44.9.247.190 -c 6
PING 44.9.247.190 (44.9.247.190): 56 data bytes
64 bytes from 44.9.247.190: seq=0 ttl=42 time=7.305 ms
64 bytes from 44.9.247.190: seq=1 ttl=42 time=9.293 ms
64 bytes from 44.9.247.190: seq=2 ttl=42 time=5.441 ms
64 bytes from 44.9.247.190: seq=3 ttl=42 time=5.850 ms
64 bytes from 44.9.247.190: seq=4 ttl=42 time=5.852 ms
64 bytes from 44.9.247.190: seq=5 ttl=42 time=5.151 ms

--- 44.9.247.190 ping statistics ---
6 packets transmitted, 6 packets received, 0% packet loss
round-trip min/avg/max = 5.151/6.482/9.293 ms
```

Figure 117: Server IPv4 ping to VLAN 302

```
localhost:~$ ping 44.9.247.206 -c 6
PING 44.9.247.206 (44.9.247.206): 56 data bytes
64 bytes from 44.9.247.206: seq=0 ttl=42 time=5.224 ms
64 bytes from 44.9.247.206: seq=1 ttl=42 time=4.747 ms
64 bytes from 44.9.247.206: seq=2 ttl=42 time=7.978 ms
64 bytes from 44.9.247.206: seq=3 ttl=42 time=6.313 ms
64 bytes from 44.9.247.206: seq=4 ttl=42 time=4.881 ms
64 bytes from 44.9.247.206: seq=5 ttl=42 time=10.847 ms

--- 44.9.247.206 ping statistics ---
6 packets transmitted, 6 packets received, 0% packet loss
round-trip min/avg/max = 4.747/6.665/10.847 ms
```

Figure 118: Server IPv4 ping to VLAN 303

8.2 Telnet

connection to VRF Telnet

```

localhost:~$ telnet 44.9.253.249
Connected to 44.9.253.249

Entering character mode
Escape character is '^]'.

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User Access Verification

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*****
WAN1>en
Password:
WAN1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
WAN1(config)#

```

Figure 119: WAN1 IPv4 Telnet

```

localhost:~$ telnet 44.9.253.255
Connected to 44.9.253.255

Entering character mode
Escape character is '^]'.

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WAN2>en
Password:
WAN2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
WAN2(config)#

```

Figure 120: WAN2 IPv4 Telnet

```

localhost:~$ telnet 44.9.252.2
Connected to 44.9.252.2

Entering character mode
Escape character is '^]'.

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Password:
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*****

R1>en
Password:
R1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#

```

Figure 121: R1 IPv4 Telnet

```

localhost:~$ telnet 44.9.252.3
Connected to 44.9.252.3

Entering character mode
Escape character is '^]'.

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User Access Verification

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Password:
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R2>en
Password:
R2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R2(config)#

```

Figure 122: R2 IPv4 Telnet

```

localhost:~$ telnet 44.9.252.4
Connected to 44.9.252.4

Entering character mode
Escape character is '^]'.

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User Access Verification

Username: grp9
Password:
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*****
DLSW1>en
Password:
DLSW1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
DLSW1(config)#

```

Figure 123: DLSW1 IPv4 Telnet

```

localhost:~$ telnet 44.9.252.5
Connected to 44.9.252.5

Entering character mode
Escape character is '^]'.

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Username: grp9
Password:
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DLSW2>en
Password:
DLSW2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
DLSW2(config)#

```

Figure 124: DLSW2 IPv4 Telnet

```

localhost:~$ telnet 44.9.252.6
Connected to 44.9.252.6

Entering character mode
Escape character is '^]'.

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User Access Verification

Username: grp9
Password:
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*****
ALSW1>en
Password:
ALSW1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
ALSW1(config)#

```

Figure 125: ALSW1 IPv4 Telnet

8.3 SSH

connection to VRF SSH

```

localhost:~$ ssh -l grp9 -oKexAlgorithms=+diffie-hellman-group14-sha1 44.9.253.249
49
The authenticity of host '44.9.253.249 (44.9.253.249)' can't be established.
RSA key fingerprint is SHA256:9R0FmgVL6jKYDrjE5TQncggUbHGKlBwJZppZsbKZK7c.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '44.9.253.249' (RSA) to the list of known hosts.

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Password: *****

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*****
WAN1>en
Password:
WAN1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
WAN1(config)#

```

Figure 126: WAN1 IPv4 SSH


```

localhost:~$ ssh -l grp9 -oKexAlgorithms=+diffie-hellman-group14-sha1 44.9.253.2
55
The authenticity of host '44.9.253.255 (44.9.253.255)' can't be established.
RSA key fingerprint is SHA256:SUBujsd7ru9/PZ5xzJHKuMr5m9oHH9TOVbc0aHmyWEU.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '44.9.253.255' (RSA) to the list of known hosts.

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Password: *****

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*****
WAN2>en
Password:
WAN2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
WAN2(config)#

```

Figure 127: WAN2 IPv4 SSH

```

localhost:~$ ssh -l grp9 -oKexAlgorithms=+diffie-hellman-group14-sha1 44.9.252.2
The authenticity of host '44.9.252.2 (44.9.252.2)' can't be established.
RSA key fingerprint is SHA256:1x7zXfDNf88oKjwinsGUjTfp5RRgA0c8xWW5ojsW3n4.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '44.9.252.2' (RSA) to the list of known hosts.

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Password: *****

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*****
R1>en
Password:
R1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#

```

Figure 128: R1 IPv4 SSH

```

localhost:~$ ssh -l grp9 -oKexAlgorithms=+diffie-hellman-group14-sha1 44.9.252.3
The authenticity of host '44.9.252.3 (44.9.252.3)' can't be established.
RSA key fingerprint is SHA256:tnU189Bq8JG9ujyl8PkUQ6V0TI6y42rF2AJHsbliqBs.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '44.9.252.3' (RSA) to the list of known hosts.

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Password: *****

*****
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* purposes is expressly prohibited except as otherwise authorized by *
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*****
R2>en
Password:
R2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R2(config)#

```

Figure 129: R2 IPv4 SSH

```

localhost:~$ ssh -l grp9 -oKexAlgorithms=+diffie-hellman-group1-sha1 44.9.252.4

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Password: *****

*****
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*****DLSW1>en
Password:
DLSW1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
DLSW1(config)#

```

Figure 130: DLSW1 IPv4 SSH


```

localhost:~$ ssh -l grp9 -oKexAlgorithms=+diffie-hellman-group1-sha1 44.9.252.5
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grp9@44.9.252.5's password: *****
*****
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*****DLSW2>en
Password:
DLSW2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
DLSW2(config)#

```

Figure 131: DLSW2 IPv4 SSH

```

localhost:~$ ssh -l grp9 -oKexAlgorithms=+diffie-hellman-group1-sha1 44.9.252.6
ssh: connect to host 44.9.252.6 port 22: Connection refused
localhost:~$ ssh -l grp9 -oKexAlgorithms=+diffie-hellman-group1-sha1 44.9.252.6
The authenticity of host '44.9.252.6 (44.9.252.6)' can't be established.
RSA key fingerprint is SHA256:bC7G8FLGMxDXiEXcVa2roXQs/O5AKDltRLasRAEyNdU.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '44.9.252.6' (RSA) to the list of known hosts.
*****
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* Cisco in writing. *
Password: *****
*****
* IOSv is strictly limited to use for evaluation, demonstration and IOS *
* education. IOSv is provided as-is and is not supported by Cisco's *
* Technical Advisory Center. Any use or disclosure, in whole or in part, *
* of the IOSv Software or Documentation to any third party for any *
* purposes is expressly prohibited except as otherwise authorized by *
* Cisco in writing. *
*****ALSW1>en
Password:
ALSW1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
ALSW1(config)#

```

Figure 132: ALSW1 IPv4 SSH

8.4 Traceroute

```

localhost:~$ traceroute 1.0.0.1
traceroute to 1.0.0.1 (1.0.0.1), 30 hops max, 46 byte packets
 1 44.9.0.3 (44.9.0.3) 7.643 ms 10.313 ms 11.425 ms
 2 44.9.248.5 (44.9.248.5) 9.397 ms 11.266 ms 10.333 ms
 3 44.9.248.9 (44.9.248.9) 11.207 ms 12.989 ms 19.560 ms
 4 44.9.248.13 (44.9.248.13) 13.155 ms 17.580 ms 17.030 ms
 5 44.9.248.14 (44.9.248.14) 19.394 ms 13.530 ms *

```

Figure 133: Client route to internet 1.0.0.1

```

localhost:~$ traceroute 2.0.0.1
traceroute to 2.0.0.1 (2.0.0.1), 30 hops max, 46 byte packets
 1 44.9.0.3 (44.9.0.3) 7.677 ms 10.347 ms 10.656 ms
 2 44.9.248.5 (44.9.248.5) 16.304 ms 12.334 ms 9.017 ms
 3 44.9.248.11 (44.9.248.11) 16.574 ms 20.946 ms 14.896 ms
 4 44.9.248.15 (44.9.248.15) 14.899 ms 13.734 ms *

```

Figure 134: Client route to internet 2.0.0.1

```
localhost:~$ traceroute 1.0.0.1
traceroute to 1.0.0.1 (1.0.0.1), 30 hops max, 46 byte packets
 1 44.9.247.2 (44.9.247.2)  6.245 ms  9.697 ms  9.242 ms
 2 44.9.248.1 (44.9.248.1)  13.936 ms  16.836 ms  10.272 ms
 3 44.9.248.9 (44.9.248.9)  16.982 ms  13.976 ms  10.646 ms
 4 44.9.248.13 (44.9.248.13)  18.790 ms  22.699 ms  64.268 ms
 5 44.9.248.14 (44.9.248.14)  22.280 ms  12.199 ms  *
```

Figure 135: Server route to internet 1.0.0.1

```
localhost:~$ traceroute 2.0.0.1
traceroute to 2.0.0.1 (2.0.0.1), 30 hops max, 46 byte packets
 1 44.9.247.2 (44.9.247.2)  10.927 ms  8.777 ms  11.112 ms
 2 44.9.248.1 (44.9.248.1)  11.981 ms  11.583 ms  16.831 ms
 3 44.9.248.11 (44.9.248.11)  15.761 ms  12.445 ms  14.966 ms
 4 44.9.248.15 (44.9.248.15)  21.966 ms  17.218 ms  *
```

Figure 136: Server route to internet 2.0.0.1

9 IPv6 Connectivity

9.1 Ping

ping from client to each VLAN's interface on ALSW1

```
localhost:~$ ping 2001:9999:1:0::3 -c 4
PING 2001:9999:1:0::3 (2001:9999:1::3): 56 data bytes
64 bytes from 2001:9999:1::3: seq=0 ttl=64 time=4.959 ms
64 bytes from 2001:9999:1::3: seq=1 ttl=64 time=4.969 ms
64 bytes from 2001:9999:1::3: seq=2 ttl=64 time=2.175 ms
64 bytes from 2001:9999:1::3: seq=3 ttl=64 time=3.652 ms

--- 2001:9999:1:0::3 ping statistics ---
4 packets transmitted, 4 packets received, 0% packet loss
```

Figure 137: Client IPv4 ping to VLAN 101

```
localhost:~$ ping 2001:9999:1:1::3 -c 4
PING 2001:9999:1:1::3 (2001:9999:1:1::3): 56 data bytes
64 bytes from 2001:9999:1:1::3: seq=0 ttl=64 time=24.359 ms
64 bytes from 2001:9999:1:1::3: seq=1 ttl=64 time=8.252 ms
64 bytes from 2001:9999:1:1::3: seq=2 ttl=64 time=6.330 ms
64 bytes from 2001:9999:1:1::3: seq=3 ttl=64 time=6.072 ms

--- 2001:9999:1:1::3 ping statistics ---
4 packets transmitted, 4 packets received, 0% packet loss
```

Figure 138: Client IPv4 ping to VLAN 102

```
localhost:~$ ping 2001:9999:1:2::3 -c 4
PING 2001:9999:1:2::3 (2001:9999:1:2::3): 56 data bytes
64 bytes from 2001:9999:1:2::3: seq=0 ttl=64 time=16.636 ms
64 bytes from 2001:9999:1:2::3: seq=1 ttl=64 time=6.627 ms
64 bytes from 2001:9999:1:2::3: seq=2 ttl=64 time=11.517 ms
64 bytes from 2001:9999:1:2::3: seq=3 ttl=64 time=8.132 ms

--- 2001:9999:1:2::3 ping statistics ---
4 packets transmitted, 4 packets received, 0% packet loss
```

Figure 139: Client IPv4 ping to VLAN 103

```
localhost:~$ ping 2001:9999:2:0::3 -c 4
PING 2001:9999:2:0::3 (2001:9999:2::3): 56 data bytes
64 bytes from 2001:9999:2::3: seq=0 ttl=64 time=12.127 ms
64 bytes from 2001:9999:2::3: seq=1 ttl=64 time=16.016 ms
64 bytes from 2001:9999:2::3: seq=2 ttl=64 time=9.521 ms
64 bytes from 2001:9999:2::3: seq=3 ttl=64 time=7.308 ms

--- 2001:9999:2:0::3 ping statistics ---
4 packets transmitted, 4 packets received, 0% packet loss
```

Figure 140: Client IPv4 ping to VLAN 301

```
localhost:~$ ping 2001:9999:2:1::3 -c 4
PING 2001:9999:2:1::3 (2001:9999:2:1::3): 56 data bytes
64 bytes from 2001:9999:2:1::3: seq=0 ttl=64 time=23.302 ms
64 bytes from 2001:9999:2:1::3: seq=1 ttl=64 time=6.977 ms
64 bytes from 2001:9999:2:1::3: seq=2 ttl=64 time=10.409 ms
64 bytes from 2001:9999:2:1::3: seq=3 ttl=64 time=7.283 ms

--- 2001:9999:2:1::3 ping statistics ---
4 packets transmitted, 4 packets received, 0% packet loss
```

Figure 141: Client IPv4 ping to VLAN 302

```
localhost:~$ ping 2001:9999:2:2::3 -c 4
PING 2001:9999:2:2::3 (2001:9999:2:2::3): 56 data bytes
64 bytes from 2001:9999:2:2::3: seq=0 ttl=64 time=23.059 ms
64 bytes from 2001:9999:2:2::3: seq=1 ttl=64 time=10.486 ms
64 bytes from 2001:9999:2:2::3: seq=2 ttl=64 time=7.121 ms
64 bytes from 2001:9999:2:2::3: seq=3 ttl=64 time=6.967 ms

--- 2001:9999:2:2::3 ping statistics ---
4 packets transmitted, 4 packets received, 0% packet loss
```

Figure 142: Client IPv4 ping to VLAN 303

ping from server to each VLAN's interface on ALSW1

```
localhost:~$ ping 2001:9999:1:0::3 -c 4
PING 2001:9999:1:0::3 (2001:9999:1:0::3): 56 data bytes
64 bytes from 2001:9999:1:0::3: seq=0 ttl=64 time=11.069 ms
64 bytes from 2001:9999:1:0::3: seq=1 ttl=64 time=11.637 ms
64 bytes from 2001:9999:1:0::3: seq=2 ttl=64 time=8.622 ms
64 bytes from 2001:9999:1:0::3: seq=3 ttl=64 time=7.925 ms

--- 2001:9999:1:0::3 ping statistics ---
4 packets transmitted, 4 packets received, 0% packet loss
```

Figure 143: Server IPv4 ping to VLAN 101

```
localhost:~$ ping 2001:9999:1:1::3 -c 4
PING 2001:9999:1:1::3 (2001:9999:1:1::3): 56 data bytes
64 bytes from 2001:9999:1:1::3: seq=0 ttl=64 time=25.470 ms
64 bytes from 2001:9999:1:1::3: seq=1 ttl=64 time=5.677 ms
64 bytes from 2001:9999:1:1::3: seq=2 ttl=64 time=7.493 ms
64 bytes from 2001:9999:1:1::3: seq=3 ttl=64 time=11.621 ms

--- 2001:9999:1:1::3 ping statistics ---
4 packets transmitted, 4 packets received, 0% packet loss
```

Figure 144: Server IPv4 ping to VLAN 102

```
localhost:~$ ping 2001:9999:1:2::3 -c 4
PING 2001:9999:1:2::3 (2001:9999:1:2::3): 56 data bytes
64 bytes from 2001:9999:1:2::3: seq=0 ttl=64 time=6.409 ms
64 bytes from 2001:9999:1:2::3: seq=1 ttl=64 time=8.133 ms
64 bytes from 2001:9999:1:2::3: seq=2 ttl=64 time=13.037 ms
64 bytes from 2001:9999:1:2::3: seq=3 ttl=64 time=11.521 ms

--- 2001:9999:1:2::3 ping statistics ---
4 packets transmitted, 4 packets received, 0% packet loss
```

Figure 145: Server IPv4 ping to VLAN 103

```
localhost:~$ ping 2001:9999:2:0::3 -c 4
PING 2001:9999:2:0::3 (2001:9999:2::3): 56 data bytes
64 bytes from 2001:9999:2::3: seq=0 ttl=64 time=2.254 ms
64 bytes from 2001:9999:2::3: seq=1 ttl=64 time=4.361 ms
64 bytes from 2001:9999:2::3: seq=2 ttl=64 time=3.196 ms
64 bytes from 2001:9999:2::3: seq=3 ttl=64 time=3.199 ms

--- 2001:9999:2:0::3 ping statistics ---
4 packets transmitted, 4 packets received, 0% packet loss
```

Figure 146: Server IPv4 ping to VLAN 301

```
localhost:~$ ping 2001:9999:2:1::3 -c 4
PING 2001:9999:2:1::3 (2001:9999:2:1::3): 56 data bytes
64 bytes from 2001:9999:2:1::3: seq=0 ttl=64 time=18.125 ms
64 bytes from 2001:9999:2:1::3: seq=1 ttl=64 time=7.053 ms
64 bytes from 2001:9999:2:1::3: seq=2 ttl=64 time=6.937 ms
64 bytes from 2001:9999:2:1::3: seq=3 ttl=64 time=6.444 ms

--- 2001:9999:2:1::3 ping statistics ---
4 packets transmitted, 4 packets received, 0% packet loss
```

Figure 147: Server IPv4 ping to VLAN 302

```
localhost:~$ ping 2001:9999:2:2::3 -c 4
PING 2001:9999:2:2::3 (2001:9999:2:2::3): 56 data bytes
64 bytes from 2001:9999:2:2::3: seq=0 ttl=64 time=16.811 ms
64 bytes from 2001:9999:2:2::3: seq=1 ttl=64 time=10.266 ms
64 bytes from 2001:9999:2:2::3: seq=2 ttl=64 time=7.513 ms
64 bytes from 2001:9999:2:2::3: seq=3 ttl=64 time=15.038 ms

--- 2001:9999:2:2::3 ping statistics ---
4 packets transmitted, 4 packets received, 0% packet loss
```

Figure 148: Server IPv4 ping to VLAN 303

9.2 Traceroute

```
traceroute to 2001:9999:1000::1 (2001:9999:1000::1), 30 hops max, 72 byte packets
 1 2001:9999:1::2 (2001:9999:1::2)  5.653 ms  5.830 ms  14.064 ms
 2 2001:9999::4 (2001:9999::4)    10.023 ms 10.538 ms 10.546 ms
 3 2001:9999::a (2001:9999::a)    13.050 ms 20.381 ms 11.738 ms
```

Figure 149: Client route to internet 2001:9999:1000::1

```
traceroute to 2001:9999:2000::1 (2001:9999:2000::1), 30 hops max, 72 byte packets
 1 2001:9999:1::2 (2001:9999:1::2) 10.344 ms 7.617 ms 6.762 ms
 2 2001:9999::4 (2001:9999::4)    9.515 ms 6.817 ms 8.391 ms
 3 2001:9999::a (2001:9999::a)    8.309 ms 16.658 ms 12.941 ms
 4 2001:9999::f (2001:9999::f)   11.030 ms 11.437 ms 13.332 ms
```

Figure 150: Client route to internet 2001:9999:2000::1

```
traceroute to 2001:9999:1000::1 (2001:9999:1000::1), 30 hops max, 72 byte packets
 1 2001:9999:2::1 (2001:9999:2::1) 14.638 ms 6.395 ms 8.058 ms
 2 2001:9999:: (2001:9999::)    11.040 ms 25.764 ms 6.466 ms
 3 2001:9999::a (2001:9999::a)   13.818 ms 16.713 ms 11.937 ms
```

Figure 151: Server route to internet 2001:9999:1000::1

```
traceroute to 2001:9999:2000::1 (2001:9999:2000::1), 30 hops max, 72 byte packets
 1  2001:9999:2::1 (2001:9999:2::1)  7.144 ms  7.844 ms  4.442 ms
 2  2001:9999:: (2001:9999::)  9.192 ms  10.995 ms  18.474 ms
 3  2001:9999::a (2001:9999::a)  12.244 ms  14.404 ms  16.732 ms
 4  2001:9999::f (2001:9999::f)  16.971 ms  15.599 ms  10.566 ms
```

Figure 152: Server route to internet 2001:9999:2000::1

[illegible]

```

interface GigabitEthernet0/0
description ALSW1-Servery
switchport access vlan 301
switchport mode access
negotiation auto
spanning-tree portfast edge
spanning-tree bpduguard enable
!
interface GigabitEthernet0/1
description ALSW1-DLSW1
switchport trunk allowed vlan 18,101-103,301-303,999
switchport trunk encapsulation dot1q
switchport trunk native vlan 999
switchport mode trunk
negotiation auto
spanning-tree vlan 101-103 cost 20
spanning-tree vlan 301-303 cost 5
!
interface GigabitEthernet0/2
description ALSW1-DLSW2
switchport trunk allowed vlan 18,101-103,301-303,999
switchport trunk encapsulation dot1q
switchport trunk native vlan 999
switchport mode trunk
negotiation auto
spanning-tree vlan 101-103 cost 5
spanning-tree vlan 301-303 cost 20
!
interface GigabitEthernet0/3
description ALSW1-Klienty
switchport access vlan 101
switchport mode access
negotiation auto
spanning-tree portfast edge
spanning-tree bpduguard enable
!
interface GigabitEthernet1/0
description ALSW1-VRF-Test
switchport access vlan 18
switchport mode access
negotiation auto
!
interface GigabitEthernet1/1
switchport trunk allowed vlan 998
switchport trunk encapsulation dot1q
switchport trunk native vlan 999
switchport mode trunk
negotiation auto
!
interface GigabitEthernet1/2
switchport trunk allowed vlan 998
switchport trunk encapsulation dot1q
switchport trunk native vlan 999
switchport mode trunk
negotiation auto
!
interface GigabitEthernet1/3
switchport trunk allowed vlan 998
switchport trunk encapsulation dot1q
switchport trunk native vlan 999
switchport mode trunk
negotiation auto
!
interface Vlan18
description VRF-MGMT
vrf forwarding MGMT
ip address 44.9.252.6 255.255.255.0
!
interface Vlan101

```



```

ip address 44.9.0.126 255.255.255.128
ipv6 address 2001:9999:1::3/64
!
interface Vlan102
ip address 44.9.0.190 255.255.255.192
ipv6 address 2001:9999:1:1::3/64
!
interface Vlan103
ip address 44.9.0.206 255.255.255.240
ipv6 address 2001:9999:1:2::3/64
!
interface Vlan301
ip address 44.9.247.126 255.255.255.128
ipv6 address 2001:9999:2::3/64
!
interface Vlan302
ip address 44.9.247.190 255.255.255.192
ipv6 address 2001:9999:2:1::3/64
!
interface Vlan303
ip address 44.9.247.206 255.255.255.240
ipv6 address 2001:9999:2:2::3/64
!
ip forward-protocol nd
!
ip http server
ip http secure-server
!
ip ssh server algorithm encryption aes128-ctr aes192-ctr aes256-ctr
ip ssh client algorithm encryption aes128-ctr aes192-ctr aes256-ctr
!
access-list 1 permit any
!
!
!
control-plane
!
banner exec ^C
*****
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* education. IOSv is provided as-is and is not supported by Cisco's *
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* of the IOSv Software or Documentation to any third party for any *
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*****^C
banner incoming ^C
*****
* IOSv is strictly limited to use for evaluation, demonstration and IOS *
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* of the IOSv Software or Documentation to any third party for any *
* purposes is expressly prohibited except as otherwise authorized by *
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*****^C
banner login ^C
*****
* IOSv is strictly limited to use for evaluation, demonstration and IOS *
* education. IOSv is provided as-is and is not supported by Cisco's *
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* of the IOSv Software or Documentation to any third party for any *
* purposes is expressly prohibited except as otherwise authorized by *
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*****^C
!
line con 0
exec-timeout 0 0
logging synchronous
line aux 0

```

```
line vty 0 4
  access-class 1 in vrf-also
  password cisco
  login local
  transport input telnet ssh
!
end
```

Listing 1: ALSW1 run config


```

description DLSW1-DLSW2
switchport trunk allowed vlan 18,101-103,301-303,999
switchport trunk encapsulation dot1q
switchport trunk native vlan 999
switchport mode trunk
!
interface GigabitEthernet0/0
switchport trunk allowed vlan 998
switchport trunk encapsulation dot1q
switchport trunk native vlan 999
switchport mode trunk
negotiation auto
!
interface GigabitEthernet0/1
description DLSW1-R1
switchport trunk allowed vlan 18,101-103,301-303,999
switchport trunk encapsulation dot1q
switchport trunk native vlan 999
switchport mode trunk
negotiation auto
!
interface GigabitEthernet0/2
switchport trunk allowed vlan 18,101-103,301-303,999
switchport trunk encapsulation dot1q
switchport trunk native vlan 999
switchport mode trunk
negotiation auto
channel-group 1 mode active
!
interface GigabitEthernet0/3
switchport trunk allowed vlan 18,101-103,301-303,999
switchport trunk encapsulation dot1q
switchport trunk native vlan 999
switchport mode trunk
negotiation auto
channel-group 1 mode active
!
interface GigabitEthernet1/0
description DLSW1-ALSW1
switchport trunk allowed vlan 18,101-103,301-303,999
switchport trunk encapsulation dot1q
switchport trunk native vlan 999
switchport mode trunk
negotiation auto
spanning-tree vlan 101-103 cost 20
spanning-tree vlan 301-303 cost 5
!
interface Vlan18
description VRF-MGMT
vrf forwarding MGMT
ip address 44.9.252.4 255.255.255.0
!
ip forward-protocol nd
!
ip http server
ip http secure-server
!
ip ssh server algorithm encryption aes128-ctr aes192-ctr aes256-ctr
ip ssh client algorithm encryption aes128-ctr aes192-ctr aes256-ctr
!
!
access-list 1 permit any
!
!
!
control-plane
!
banner exec ^C
*****

```

```

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* of the IOSv Software or Documentation to any third party for any *
* purposes is expressly prohibited except as otherwise authorized by *
* Cisco in writing.
*****^C
banner incoming ^C
*****
* IOSv is strictly limited to use for evaluation, demonstration and IOS *
* education. IOSv is provided as-is and is not supported by Cisco's *
* Technical Advisory Center. Any use or disclosure, in whole or in part, *
* of the IOSv Software or Documentation to any third party for any *
* purposes is expressly prohibited except as otherwise authorized by *
* Cisco in writing.
*****^C
banner login ^C
*****
* IOSv is strictly limited to use for evaluation, demonstration and IOS *
* education. IOSv is provided as-is and is not supported by Cisco's *
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* of the IOSv Software or Documentation to any third party for any *
* purposes is expressly prohibited except as otherwise authorized by *
* Cisco in writing.
*****^C
!
line con 0
exec-timeout 0 0
logging synchronous
line aux 0
line vty 0 4
access-class 1 in vrf-also
password cisco
login local
transport input telnet ssh
!
!
end

```

Listing 2: DLSW1 run config


```

description DLSW2-DLSW1
switchport trunk allowed vlan 18,101-103,301-303,999
switchport trunk encapsulation dot1q
switchport trunk native vlan 999
switchport mode trunk
!
interface GigabitEthernet0/0
switchport trunk allowed vlan 998
switchport trunk encapsulation dot1q
switchport trunk native vlan 999
switchport mode trunk
negotiation auto
!
interface GigabitEthernet0/1
description DLSW2-R2
switchport trunk allowed vlan 18,101-103,301-303,999
switchport trunk encapsulation dot1q
switchport trunk native vlan 999
switchport mode trunk
negotiation auto
!
interface GigabitEthernet0/2
switchport trunk allowed vlan 18,101-103,301-303,999
switchport trunk encapsulation dot1q
switchport trunk native vlan 999
switchport mode trunk
negotiation auto
channel-group 1 mode active
!
interface GigabitEthernet0/3
switchport trunk allowed vlan 18,101-103,301-303,999
switchport trunk encapsulation dot1q
switchport trunk native vlan 999
switchport mode trunk
negotiation auto
channel-group 1 mode active
!
interface GigabitEthernet1/0
description DLSW2-ALSW1
switchport trunk allowed vlan 18,101-103,301-303,999
switchport trunk encapsulation dot1q
switchport trunk native vlan 999
switchport mode trunk
negotiation auto
spanning-tree vlan 101-103 cost 5
spanning-tree vlan 301-303 cost 20
!
interface Vlan18
description VRF-MGMT
vrf forwarding MGMT
ip address 44.9.252.5 255.255.255.0
!
ip forward-protocol nd
!
ip http server
ip http secure-server
!
ip ssh server algorithm encryption aes128-ctr aes192-ctr aes256-ctr
ip ssh client algorithm encryption aes128-ctr aes192-ctr aes256-ctr
!
!
access-list 1 permit any
!
!
!
control-plane
!
banner exec ^C
*****

```

```

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banner login ^C
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*****^C
!
line con 0
exec-timeout 0 0
logging synchronous
line aux 0
line vty 0 4
access-class 1 in vrf-also
password cisco
login local
transport input telnet ssh
!
!
end

```

Listing 3: DLSW2 run config

Building configuration...

Current configuration : 7945 bytes

! Last configuration change at 13:37:26 UTC Wed Feb 3 2021

! version 15.9

service timestamps debug datetime msec

service timestamps log datetime msec

no service password-encryption

! hostname R1

! boot-start-marker

boot-end-marker

! vrf definition MGMT

! address-family ipv4

exit-address-family

! address-family ipv6

exit-address-family

! no logging console

enable password cisco

! no aaa new-model

! mmi polling-interval 60

no mmi auto-configure

no mmi pvc

mmi snmp-timeout 180

! no ip domain lookup

ip domain name sps.local

ip cef

ipv6 unicast-routing

ipv6 cef

! multilink bundle-name authenticated

! username grp9 password 0 cisco

! redundancy

! track 31 ipv6 route 2001:9999:2::/64 reachability

! track 32 ipv6 route 2001:9999:2:1::/64 reachability

! track 33 ipv6 route 2001:9999:2:2::/64 reachability

! track 301 ip route 44.9.247.0 255.255.255.128 reachability


```

ip address 44.9.0.130 255.255.255.192
standby version 2
standby 12 ipv6 2001:9999:1:1::/64
standby 12 priority 120
standby 12 preempt
standby 102 ip 44.9.0.129
standby 102 priority 120
standby 102 preempt
ipv6 address 2001:9999:1:1::1/64
ospfv3 2 ipv6 area 2
ospfv3 1 ipv4 area 1
!
interface GigabitEthernet0/1.103
description VLAN-Klient-103
encapsulation dot1Q 103
ip address 44.9.0.194 255.255.255.240
standby version 2
standby 13 ipv6 2001:9999:1:2::/64
standby 13 priority 120
standby 13 preempt
standby 103 ip 44.9.0.193
standby 103 priority 120
standby 103 preempt
ipv6 address 2001:9999:1:2::1/64
ospfv3 2 ipv6 area 2
ospfv3 1 ipv4 area 1
!
interface GigabitEthernet0/1.301
description VLAN-Server-301
encapsulation dot1Q 301
ip address 44.9.247.2 255.255.255.128
standby version 2
standby 1 ip 44.9.247.1
standby 1 priority 150
standby 1 preempt
standby 1 track 301 decrement 30
standby 21 ipv6 2001:9999:2::/64
standby 21 priority 150
standby 21 preempt
standby 21 track 31 decrement 30
ipv6 address 2001:9999:2::1/64
ospfv3 2 ipv6 area 2
ospfv3 1 ipv4 area 1
!
interface GigabitEthernet0/1.302
description VLAN-Server-302
encapsulation dot1Q 302
ip address 44.9.247.130 255.255.255.192
standby version 2
standby 2 ip 44.9.247.129
standby 2 priority 150
standby 2 preempt
standby 2 track 302 decrement 30
standby 22 ipv6 2001:9999:2:1::/64
standby 22 priority 150
standby 22 preempt
standby 22 track 32 decrement 30
ipv6 address 2001:9999:2:1::1/64
ospfv3 2 ipv6 area 2
ospfv3 1 ipv4 area 1
!
interface GigabitEthernet0/1.303
description VLAN-Server-303
encapsulation dot1Q 303
ip address 44.9.247.194 255.255.255.240
standby version 2
standby 3 ip 44.9.247.193
standby 3 priority 150

```

```

standby 3 preempt
standby 3 track 303 decrement 30
standby 23 ipv6 2001:9999:2:2::/64
standby 23 priority 150
standby 23 preempt
standby 23 track 33 decrement 30
ipv6 address 2001:9999:2:2::1/64
ospfv3 2 ipv6 area 2
ospfv3 1 ipv4 area 1
!
interface GigabitEthernet0/2
no ip address
duplex auto
speed auto
media-type rj45
!
interface GigabitEthernet0/2.9
description R1-WAN2
encapsulation dot1Q 9
ip address 44.9.248.2 255.255.255.254
ipv6 address 2001:9999::3/127
ospfv3 2 ipv6 area 0
ospfv3 2 ipv6 cost 50
ospfv3 1 ipv4 area 0
ospfv3 1 ipv4 cost 50
!
interface GigabitEthernet0/2.91
description VLAN-M-91
encapsulation dot1Q 91
vrf forwarding MGMT
ip address 44.9.253.250 255.255.255.254
!
interface GigabitEthernet0/3
no ip address
duplex auto
speed auto
media-type rj45
!
interface GigabitEthernet0/3.9
description R1-WAN1
encapsulation dot1Q 9
ip address 44.9.248.0 255.255.255.254
ipv6 address 2001:9999::1/127
ospfv3 2 ipv6 area 0
ospfv3 2 ipv6 cost 10
ospfv3 1 ipv4 area 0
ospfv3 1 ipv4 cost 10
!
interface GigabitEthernet0/3.91
description VLAN-M-91
encapsulation dot1Q 91
vrf forwarding MGMT
ip address 44.9.253.248 255.255.255.254
!
!
router eigrp 1
!
address-family ipv4 vrf MGMT
network 44.9.252.0 0.0.0.255
network 44.9.253.244 0.0.0.0
network 44.9.253.248 0.0.0.1
network 44.9.253.250 0.0.0.1
autonomous-system 1
exit-address-family
!
router ospfv3 1
router-id 44.9.254.3
!
address-family ipv4 unicast

```

```

    passive-interface default
    no passive-interface GigabitEthernet0/2.9
    no passive-interface GigabitEthernet0/3.9
    exit-address-family
!
router ospfv3 2
router-id 44.9.254.3
!
address-family ipv6 unicast
    passive-interface default
    no passive-interface GigabitEthernet0/2.9
    no passive-interface GigabitEthernet0/3.9
    exit-address-family
!
ip forward-protocol nd
!
!
no ip http server
no ip http secure-server
!
ipv6 ioam timestamp
!
!
access-list 1 permit any
!
control-plane
!
banner exec ^C
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banner login ^C
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*****^C
!
line con 0
exec-timeout 0 0
logging synchronous
line aux 0
line vty 0 4
access-class 1 in vrf-also
password cisco
login local
transport input telnet ssh
!
no scheduler allocate
!
end

```

Listing 4: R1 run config

Building configuration...

Current configuration : 7945 bytes

! Last configuration change at 13:37:30 UTC Wed Feb 3 2021

! version 15.9

service timestamps debug datetime msec

service timestamps log datetime msec

no service password-encryption

! hostname R2

! boot-start-marker

boot-end-marker

! vrf definition MGMT

! address-family ipv4

exit-address-family

! address-family ipv6

exit-address-family

! no logging console

enable password cisco

! no aaa new-model

! mmi polling-interval 60

no mmi auto-configure

no mmi pvc

mmi snmp-timeout 180

! no ip domain lookup

ip domain name sps.local

ip cef

ipv6 unicast-routing

ipv6 cef

! multilink bundle-name authenticated

! username grp9 password 0 cisco

! redundancy

! track 11 ipv6 route 2001:9999:1::/64 reachability

! track 12 ipv6 route 2001:9999:1:1::/64 reachability

! track 13 ipv6 route 2001:9999:1:2::/64 reachability

! track 101 ip route 44.9.0.0 255.255.255.128 reachability

```

!
track 102 ip route 44.9.0.128 255.255.255.192 reachability
track 103 ip route 44.9.0.192 255.255.255.240 reachability
!
!
!
!
!
!
!
!
!
!
interface Loopback0
description loopback
ip address 44.9.254.4 255.255.255.255
ipv6 address 2001:9999::404/128
ospfv3 2 ipv6 area 0
ospfv3 1 ipv4 area 0
!
interface Loopback1
description VRF-Loopback
vrf forwarding MGMT
ip address 44.9.253.245 255.255.255.255
!
interface GigabitEthernet0/0
no ip address
shutdown
duplex auto
speed auto
media-type rj45
!
interface GigabitEthernet0/1
description R2-DLSW2
no ip address
duplex auto
speed auto
media-type rj45
!
interface GigabitEthernet0/1.18
description VLAN-MA-18
encapsulation dot1Q 18
vrf forwarding MGMT
ip address 44.9.252.3 255.255.255.0
vrrp 18 ip 44.9.252.1
vrrp 18 priority 120
!
interface GigabitEthernet0/1.101
description VLAN-Klient-101
encapsulation dot1Q 101
ip address 44.9.0.3 255.255.255.128
standby version 2
standby 11 ipv6 2001:9999:1::/64
standby 11 priority 150
standby 11 preempt
standby 11 track 11 decrement 30
standby 101 ip 44.9.0.1
standby 101 priority 150
standby 101 preempt
standby 101 track 101 decrement 30
ipv6 address 2001:9999:1::2/64
ospfv3 2 ipv6 area 2
ospfv3 1 ipv4 area 1
!
interface GigabitEthernet0/1.102

```

```

description VLAN-Klient-102
encapsulation dot1Q 102
ip address 44.9.0.131 255.255.255.192
standby version 2
standby 12 ipv6 2001:9999:1:1::/64
standby 12 priority 150
standby 12 preempt
standby 12 track 12 decrement 30
standby 102 ip 44.9.0.129
standby 102 priority 150
standby 102 preempt
standby 102 track 102 decrement 30
ipv6 address 2001:9999:1:1::2/64
ospfv3 2 ipv6 area 2
ospfv3 1 ipv4 area 1
!
interface GigabitEthernet0/1.103
description VLAN-Klient-103
encapsulation dot1Q 103
ip address 44.9.0.195 255.255.255.240
standby version 2
standby 13 ipv6 2001:9999:1:2::/64
standby 13 priority 150
standby 13 preempt
standby 13 track 13 decrement 30
standby 103 ip 44.9.0.193
standby 103 priority 150
standby 103 preempt
standby 103 track 103 decrement 30
ipv6 address 2001:9999:1:2::2/64
ospfv3 2 ipv6 area 2
ospfv3 1 ipv4 area 1
!
interface GigabitEthernet0/1.301
description VLAN-Server-301
encapsulation dot1Q 301
ip address 44.9.247.3 255.255.255.128
standby version 2
standby 1 ip 44.9.247.1
standby 1 priority 120
standby 1 preempt
standby 21 ipv6 2001:9999:2::/64
standby 21 priority 120
standby 21 preempt
ipv6 address 2001:9999:2::2/64
ospfv3 2 ipv6 area 2
ospfv3 1 ipv4 area 1
!
interface GigabitEthernet0/1.302
description VLAN-Server-302
encapsulation dot1Q 302
ip address 44.9.247.131 255.255.255.192
standby version 2
standby 2 ip 44.9.247.129
standby 2 priority 120
standby 2 preempt
standby 22 ipv6 2001:9999:2:1::/64
standby 22 priority 120
standby 22 preempt
ipv6 address 2001:9999:2:1::2/64
ospfv3 2 ipv6 area 2
ospfv3 1 ipv4 area 1
!
interface GigabitEthernet0/1.303
description VLAN-Server-303
encapsulation dot1Q 303
ip address 44.9.247.195 255.255.255.240
standby version 2

```



```

standby 3 ip 44.9.247.193
standby 3 priority 120
standby 3 preempt
standby 23 ipv6 2001:9999:2:2::/64
standby 23 priority 120
standby 23 preempt
ipv6 address 2001:9999:2:2::2/64
ospfv3 2 ipv6 area 2
ospfv3 1 ipv4 area 1
!
interface GigabitEthernet0/2
no ip address
duplex auto
speed auto
media-type rj45
!
interface GigabitEthernet0/2.9
description R2-WAN1
encapsulation dot1Q 9
ip address 44.9.248.4 255.255.255.254
ipv6 address 2001:9999::5/127
ospfv3 2 ipv6 area 0
ospfv3 2 ipv6 cost 10
ospfv3 1 ipv4 area 0
ospfv3 1 ipv4 cost 10
!
interface GigabitEthernet0/2.91
description VLAN-M-91
encapsulation dot1Q 91
vrf forwarding MGMT
ip address 44.9.253.252 255.255.255.254
!
interface GigabitEthernet0/3
no ip address
duplex auto
speed auto
media-type rj45
!
interface GigabitEthernet0/3.9
description R2-WAN2
encapsulation dot1Q 9
ip address 44.9.248.6 255.255.255.254
ipv6 address 2001:9999::7/127
ospfv3 2 ipv6 area 0
ospfv3 2 ipv6 cost 50
ospfv3 1 ipv4 area 0
ospfv3 1 ipv4 cost 50
!
interface GigabitEthernet0/3.91
description VLAN-M-91
encapsulation dot1Q 91
vrf forwarding MGMT
ip address 44.9.253.254 255.255.255.254
!
!
router eigrp 1
!
address-family ipv4 vrf MGMT
network 44.9.252.0 0.0.0.255
network 44.9.253.245 0.0.0.0
network 44.9.253.252 0.0.0.1
network 44.9.253.254 0.0.0.1
autonomous-system 1
exit-address-family
!
router ospfv3 1
router-id 44.9.254.4
!
address-family ipv4 unicast

```

```

    passive-interface default
    no passive-interface GigabitEthernet0/2.9
    no passive-interface GigabitEthernet0/3.9
    exit-address-family
!
router ospfv3 2
router-id 44.9.254.4
!
address-family ipv6 unicast
    passive-interface default
    no passive-interface GigabitEthernet0/2.9
    no passive-interface GigabitEthernet0/3.9
    exit-address-family
!
ip forward-protocol nd
!
!
no ip http server
no ip http secure-server
!
ipv6 ioam timestamp
!
!
access-list 1 permit any
!
control-plane
!
banner exec ^C
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*****^C
!
line con 0
exec-timeout 0 0
logging synchronous
line aux 0
line vty 0 4
access-class 1 in vrf-also
password cisco
login local
transport input telnet ssh
!
no scheduler allocate
!
end

```

Listing 5: R2 run config


```

!
!
!
interface Loopback0
description loopback
ip address 44.9.254.5 255.255.255.255
ipv6 address 2001:9999::405/128
ospfv3 2 ipv6 area 0
ospfv3 1 ipv4 area 0
!
interface Loopback1
description VRF-Loopback
vrf forwarding MGMT
ip address 44.9.253.246 255.255.255.255
!
interface GigabitEthernet0/0
no ip address
shutdown
duplex auto
speed auto
media-type rj45
!
interface GigabitEthernet0/1
description WAN1-WAN2
ip address 44.9.248.8 255.255.255.254
duplex auto
speed auto
media-type rj45
ipv6 address 2001:9999::8/127
ospfv3 2 ipv6 area 0
ospfv3 2 ipv6 cost 10
ospfv3 1 ipv4 area 0
ospfv3 1 ipv4 cost 10
!
interface GigabitEthernet0/2
description WAN1-ISP1
ip address 44.9.248.10 255.255.255.254
duplex auto
speed auto
media-type rj45
ipv6 address 2001:9999::B/127
!
interface GigabitEthernet0/3
no ip address
duplex auto
speed auto
media-type rj45
!
interface GigabitEthernet0/3.9
description WAN1-R1
encapsulation dot1Q 9
ip address 44.9.248.1 255.255.255.254
ipv6 address 2001:9999::/127
ospfv3 2 ipv6 area 0
ospfv3 2 ipv6 cost 10
ospfv3 1 ipv4 area 0
ospfv3 1 ipv4 cost 10
!
interface GigabitEthernet0/3.91
description VLAN-M-91
encapsulation dot1Q 91
vrf forwarding MGMT
ip address 44.9.253.249 255.255.255.254
!
interface GigabitEthernet0/4
no ip address
duplex auto

```

```

speed auto
media-type rj45
!
interface GigabitEthernet0/4.9
description WAN1-R2
encapsulation dot1Q 9
ip address 44.9.248.5 255.255.255.254
ipv6 address 2001:9999::4/127
ospfv3 2 ipv6 area 0
ospfv3 2 ipv6 cost 10
ospfv3 1 ipv4 area 0
ospfv3 1 ipv4 cost 10
!
interface GigabitEthernet0/4.91
description VLAN-M-91
encapsulation dot1Q 91
vrf forwarding MGMT
ip address 44.9.253.253 255.255.255.254
!
!
router eigrp 1
!
address-family ipv4 vrf MGMT
network 44.9.253.246 0.0.0.0
network 44.9.253.248 0.0.0.1
network 44.9.253.252 0.0.0.1
autonomous-system 1
exit-address-family
!
router ospfv3 1
router-id 44.9.254.5
!
address-family ipv4 unicast
passive-interface default
no passive-interface GigabitEthernet0/1
no passive-interface GigabitEthernet0/3.9
no passive-interface GigabitEthernet0/4.9
default-information originate always route-map RM_DEFAULT
exit-address-family
!
router ospfv3 2
router-id 44.9.254.5
!
address-family ipv6 unicast
passive-interface default
no passive-interface GigabitEthernet0/1
no passive-interface GigabitEthernet0/3.9
no passive-interface GigabitEthernet0/4.9
default-information originate always
exit-address-family
!
router bgp 9
bgp log-neighbor-changes
neighbor 2001:9999::A remote-as 100
neighbor 2001:9999::406 remote-as 9
neighbor 2001:9999::406 update-source Loopback0
neighbor 44.9.248.11 remote-as 100
neighbor 44.9.254.6 remote-as 9
neighbor 44.9.254.6 update-source Loopback0
!
address-family ipv4
aggregate-address 44.9.240.0 255.255.248.0 summary-only
aggregate-address 44.9.224.0 255.255.240.0 summary-only
aggregate-address 44.9.192.0 255.255.224.0 summary-only
aggregate-address 44.9.128.0 255.255.192.0 summary-only
aggregate-address 44.9.0.0 255.255.128.0 summary-only
redistribute ospfv3 1 route-map RM_REDISTRIBUTE_IPV4
no neighbor 2001:9999::A activate
no neighbor 2001:9999::406 activate

```

```

neighbor 44.9.248.11 activate
neighbor 44.9.248.11 route-map RM_INTERNETOUT4 out
neighbor 44.9.254.6 activate
neighbor 44.9.254.6 next-hop-self
neighbor 44.9.254.6 route-map RM_NEIGHBOROUT4 out
exit-address-family
!
address-family ipv6
redistribute ospf 2 route-map RM_REDISTRIBUTE_IPV6
aggregate-address 2001:9999:2::/48 summary-only
aggregate-address 2001:9999:1::/48 summary-only
neighbor 2001:9999::A activate
neighbor 2001:9999::A route-map RM_INTERNETOUT6 out
neighbor 2001:9999::406 activate
neighbor 2001:9999::406 next-hop-self
neighbor 2001:9999::406 route-map RM_NEIGHBOROUT6 out
exit-address-family
!
ip forward-protocol nd
!
no ip http server
no ip http secure-server
!
ip access-list standard REDISTRIBUTE_IPV4
deny 44.9.248.0 0.0.7.255
permit 44.9.0.0 0.0.255.255
!
!
ip prefix-list PL_DEFAULT seq 10 permit 44.9.248.10/31
!
ip prefix-list PL_KLIENT4 seq 10 permit 44.9.0.0/17
!
ip prefix-list PL_SERVER4 seq 10 permit 44.9.240.0/21
ipv6 ioam timestamp
!
!
ipv6 prefix-list PL_KLIENT6 seq 10 permit 2001:9999:1::/48
!
ipv6 prefix-list PL_NEIGHBOROUT6 seq 10 permit 2001:9999:1000::/48
!
ipv6 prefix-list PL_SERVER6 seq 10 permit 2001:9999:2::/48
route-map RM_DEFAULT permit 10
match ip address prefix-list PL_DEFAULT
!
route-map RM_INTERNETOUT4 permit 10
match ip address prefix-list PL_KLIENT4
set as-path prepend 9
!
route-map RM_INTERNETOUT4 permit 20
match ip address prefix-list PL_SERVER4
!
route-map RM_INTERNETOUT6 permit 10
match ipv6 address prefix-list PL_KLIENT6
set as-path prepend 9
!
route-map RM_INTERNETOUT6 permit 20
match ipv6 address prefix-list PL_SERVER6
!
route-map RM_NEIGHBOROUT4 permit 10
match ip address 2
set local-preference 120
!
route-map RM_NEIGHBOROUT4 permit 20
!
route-map RM_NEIGHBOROUT6 permit 10
match ipv6 address prefix-list PL_NEIGHBOROUT6
set local-preference 120
!
route-map RM_NEIGHBOROUT6 permit 20

```

```

!
route-map RM_REDISTRIBUTE_IPV4 permit 10
match ip address REDISTRIBUTE_IPV4
!
route-map RM_REDISTRIBUTE_IPV6 permit 10
match ipv6 address REDISTRIBUTE_IPV6
!
!
access-list 2 permit 2.0.0.0 0.0.255.255
!
ipv6 access-list REDISTRIBUTE_IPV6
permit ipv6 2001:9999:1::/48 any
permit ipv6 2001:9999:2::/48 any
!
control-plane
!
banner exec ^C
*****
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*****^C
banner incoming ^C
*****
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*****^C
banner login ^C
*****
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*****^C
!
line con 0
exec-timeout 0 0
logging synchronous
line aux 0
line vty 0 4
access-class 1 in vrf-also
password cisco
login local
transport input telnet ssh
!
no scheduler allocate
!
end

```

Listing 6: WAN1 run config


```

!
!
!
interface Loopback0
description loopback
ip address 44.9.254.6 255.255.255.255
ipv6 address 2001:9999::408/128
ospfv3 2 ipv6 area 0
ospfv3 1 ipv4 area 0
!
interface Loopback1
description VRF-Loopback
vrf forwarding MGMT
ip address 44.9.253.247 255.255.255.255
!
interface GigabitEthernet0/0
no ip address
shutdown
duplex auto
speed auto
media-type rj45
!
interface GigabitEthernet0/1
description WAN1-WAN2
ip address 44.9.248.9 255.255.255.254
duplex auto
speed auto
media-type rj45
ipv6 address 2001:9999::9/127
ospfv3 2 ipv6 area 0
ospfv3 2 ipv6 cost 10
ospfv3 1 ipv4 area 0
ospfv3 1 ipv4 cost 10
!
interface GigabitEthernet0/2
description WAN2-ISP2
ip address 44.9.248.12 255.255.255.254
duplex auto
speed auto
media-type rj45
ipv6 address 2001:9999::D/127
!
interface GigabitEthernet0/3
no ip address
duplex auto
speed auto
media-type rj45
!
interface GigabitEthernet0/3.9
description WAN2-R2
encapsulation dot1Q 9
ip address 44.9.248.7 255.255.255.254
ipv6 address 2001:9999::6/127
ospfv3 2 ipv6 area 0
ospfv3 2 ipv6 cost 50
ospfv3 1 ipv4 area 0
ospfv3 1 ipv4 cost 50
!
interface GigabitEthernet0/3.91
description VLAN-M-91
encapsulation dot1Q 91
vrf forwarding MGMT
ip address 44.9.253.255 255.255.255.254
!
interface GigabitEthernet0/4
no ip address
duplex auto

```

```

speed auto
media-type rj45
!
interface GigabitEthernet0/4.9
description WAN2-R1
encapsulation dot1Q 9
ip address 44.9.248.3 255.255.255.254
ipv6 address 2001:9999::2/127
ospfv3 2 ipv6 area 0
ospfv3 2 ipv6 cost 50
ospfv3 1 ipv4 area 0
ospfv3 1 ipv4 cost 50
!
interface GigabitEthernet0/4.91
description VLAN-M-91
encapsulation dot1Q 91
vrf forwarding MGMT
ip address 44.9.253.251 255.255.255.254
!
!
router eigrp 1
!
address-family ipv4 vrf MGMT
network 44.9.253.247 0.0.0.0
network 44.9.253.250 0.0.0.1
network 44.9.253.254 0.0.0.1
autonomous-system 1
exit-address-family
!
router ospfv3 1
router-id 44.9.254.6
!
address-family ipv4 unicast
passive-interface default
no passive-interface GigabitEthernet0/1
no passive-interface GigabitEthernet0/3.9
no passive-interface GigabitEthernet0/4.9
default-information originate always route-map RM_DEFAULT
exit-address-family
!
router ospfv3 2
router-id 44.9.254.6
!
address-family ipv6 unicast
passive-interface default
no passive-interface GigabitEthernet0/1
no passive-interface GigabitEthernet0/3.9
no passive-interface GigabitEthernet0/4.9
default-information originate always
exit-address-family
!
router bgp 9
bgp log-neighbor-changes
neighbor 2001:9999::C remote-as 100
neighbor 2001:9999::405 remote-as 9
neighbor 2001:9999::405 update-source Loopback0
neighbor 44.9.248.13 remote-as 100
neighbor 44.9.254.5 remote-as 9
neighbor 44.9.254.5 update-source Loopback0
!
address-family ipv4
aggregate-address 44.9.240.0 255.255.248.0 summary-only
aggregate-address 44.9.224.0 255.255.240.0 summary-only
aggregate-address 44.9.192.0 255.255.224.0 summary-only
aggregate-address 44.9.128.0 255.255.192.0 summary-only
aggregate-address 44.9.0.0 255.255.128.0 summary-only
redistribute ospfv3 1 route-map RM_REDISTRIBUTE_IPV4
no neighbor 2001:9999::C activate
no neighbor 2001:9999::405 activate

```

```

neighbor 44.9.248.13 activate
neighbor 44.9.248.13 route-map RM_INTERNETOUT4 out
neighbor 44.9.254.5 activate
neighbor 44.9.254.5 next-hop-self
neighbor 44.9.254.5 route-map RM_NEIGHBOROUT4 out
exit-address-family
!
address-family ipv6
redistribute ospf 2 route-map RM_REDISTRIBUTE_IPV6
aggregate-address 2001:9999:2::/48 summary-only
aggregate-address 2001:9999:1::/48 summary-only
neighbor 2001:9999::C activate
neighbor 2001:9999::C route-map RM_INTERNETOUT6 out
neighbor 2001:9999::405 activate
neighbor 2001:9999::405 next-hop-self
neighbor 2001:9999::405 route-map RM_NEIGHBOROUT6 out
exit-address-family
!
ip forward-protocol nd
!
no ip http server
no ip http secure-server
!
ip access-list standard REDISTRIBUTE_IPV4
deny 44.9.248.0 0.0.7.255
permit 44.9.0.0 0.0.255.255
!
!
ip prefix-list PL_DEFAULT seq 10 permit 44.9.248.12/31
!
ip prefix-list PL_KLIENT4 seq 10 permit 44.9.0.0/17
!
ip prefix-list PL_SERVER4 seq 10 permit 44.9.240.0/21
ipv6 ioam timestamp
!
!
ipv6 prefix-list PL_KLIENT6 seq 10 permit 2001:9999:1::/48
!
ipv6 prefix-list PL_NEIGHBOROUT6 seq 10 permit 2001:9999:2000::/48
!
ipv6 prefix-list PL_SERVER6 seq 10 permit 2001:9999:2::/48
route-map RM_DEFAULT permit 10
match ip address prefix-list PL_DEFAULT
!
route-map RM_INTERNETOUT4 permit 10
match ip address prefix-list PL_SERVER4
set as-path prepend 9
!
route-map RM_INTERNETOUT4 permit 20
match ip address prefix-list PL_KLIENT4
!
route-map RM_INTERNETOUT6 permit 10
match ipv6 address prefix-list PL_SERVER6
set as-path prepend 9
!
route-map RM_INTERNETOUT6 permit 20
match ipv6 address prefix-list PL_KLIENT6
!
route-map RM_NEIGHBOROUT4 permit 10
match ip address 1
set local-preference 120
!
route-map RM_NEIGHBOROUT4 permit 20
!
route-map RM_NEIGHBOROUT6 permit 10
match ipv6 address prefix-list PL_NEIGHBOROUT6
set local-preference 120
!
route-map RM_NEIGHBOROUT6 permit 20

```

```

!
route-map RM_REDISTRIBUTE_IPV4 permit 10
match ip address REDISTRIBUTE_IPV4
!
route-map RM_REDISTRIBUTE_IPV6 permit 10
match ipv6 address REDISTRIBUTE_IPV6
!
!
access-list 1 permit 1.0.0.0 0.0.0.255
!
ipv6 access-list REDISTRIBUTE_IPV6
permit ipv6 2001:9999:1::/48 any
permit ipv6 2001:9999:2::/48 any
!
control-plane
!
banner exec ^C
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*****^C
banner login ^C
*****
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*****^C
!
line con 0
exec-timeout 0 0
logging synchronous
line aux 0
line vty 0 4
access-class 1 in vrf-also
password cisco
login local
transport input telnet ssh
!
no scheduler allocate
!
end

```

Listing 7: WAN2 run config


```

description ToJsouTyInternety
ip address 1.0.0.1 255.0.0.0
ipv6 address 2001:9999:1000::1/48
!
interface GigabitEthernet0/0
no ip address
shutdown
duplex auto
speed auto
media-type rj45
!
interface GigabitEthernet0/1
description ISP1-ISP2
ip address 44.9.248.14 255.255.255.254
duplex auto
speed auto
media-type rj45
ipv6 address 2001:9999::E/127
!
interface GigabitEthernet0/2
description ISP1-WAN1
ip address 44.9.248.11 255.255.255.254
duplex auto
speed auto
media-type rj45
ipv6 address 2001:9999::A/127
!
interface GigabitEthernet0/3
no ip address
shutdown
duplex auto
speed auto
media-type rj45
!
router bgp 100
bgp log-neighbor-changes
neighbor 2001:9999::B remote-as 9
neighbor 2001:9999::408 remote-as 100
neighbor 2001:9999::408 update-source Loopback0
neighbor 44.9.248.10 remote-as 9
neighbor 44.9.254.8 remote-as 100
neighbor 44.9.254.8 update-source Loopback0
!
address-family ipv4
network 1.0.0.0
no neighbor 2001:9999::B activate
no neighbor 2001:9999::408 activate
neighbor 44.9.248.10 activate
neighbor 44.9.254.8 activate
neighbor 44.9.254.8 next-hop-self
exit-address-family
!
address-family ipv6
network 2001:9999:1000::/48
neighbor 2001:9999::B activate
neighbor 2001:9999::408 activate
neighbor 2001:9999::408 next-hop-self
exit-address-family
!
ip forward-protocol nd
!
!
no ip http server
no ip http secure-server
ip route 44.9.254.8 255.255.255.255 44.9.248.15
!
ipv6 route 2001:9999::408/128 2001:9999::F
ipv6 ioam timestamp
!

```

```

!
!
control-plane
!
banner exec ^C
*****
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*****^C
banner incoming ^C
*****
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*****^C
banner login ^C
*****
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*****^C
!
line con 0
  exec-timeout 0 0
  logging synchronous
line aux 0
line vty 0 4
  login
  transport input none
!
no scheduler allocate
!
end

```

Listing 8: ISP1 run config


```

description ToJsouTyInternety
ip address 2.0.0.1 255.255.0.0
ipv6 address 2001:9999:2000::1/56
!
interface GigabitEthernet0/0
no ip address
shutdown
duplex auto
speed auto
media-type rj45
!
interface GigabitEthernet0/1
description ISP2-ISP1
ip address 44.9.248.15 255.255.255.254
duplex auto
speed auto
media-type rj45
ipv6 address 2001:9999::F/127
!
interface GigabitEthernet0/2
description ISP2-WAN2
ip address 44.9.248.13 255.255.255.254
duplex auto
speed auto
media-type rj45
ipv6 address 2001:9999::C/127
!
interface GigabitEthernet0/3
no ip address
shutdown
duplex auto
speed auto
media-type rj45
!
router bgp 100
bgp log-neighbor-changes
neighbor 2001:9999::D remote-as 9
neighbor 2001:9999::407 remote-as 100
neighbor 2001:9999::407 update-source Loopback0
neighbor 44.9.248.12 remote-as 9
neighbor 44.9.254.7 remote-as 100
neighbor 44.9.254.7 update-source Loopback0
!
address-family ipv4
network 2.0.0.0 mask 255.255.0.0
no neighbor 2001:9999::D activate
no neighbor 2001:9999::407 activate
neighbor 44.9.248.12 activate
neighbor 44.9.254.7 activate
neighbor 44.9.254.7 next-hop-self
exit-address-family
!
address-family ipv6
network 2001:9999:2000::/56
neighbor 2001:9999::D activate
neighbor 2001:9999::407 activate
neighbor 2001:9999::407 next-hop-self
exit-address-family
!
ip forward-protocol nd
!
!
no ip http server
no ip http secure-server
ip route 44.9.254.7 255.255.255.255 44.9.248.14
!
ipv6 route 2001:9999::407/128 2001:9999::E
ipv6 ioam timestamp
!

```

```

!
!
control-plane
!
banner exec ^C
*****
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*****^C
banner incoming ^C
*****
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*****^C
banner login ^C
*****
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* of the IOSv Software or Documentation to any third party for any *
* purposes is expressly prohibited except as otherwise authorized by *
* Cisco in writing.
*****^C
!
line con 0
  exec-timeout 0 0
  logging synchronous
line aux 0
line vty 0 4
  login
  transport input none
!
no scheduler allocate
!
end

```

Listing 9: ISP2 run config