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

SPS - Semestral project SPS - Semestrální projekt

## Abstrakt

SPS

**Klíčová slova**: SPS, IPv4, IPv6, OSPFv3, BGP, Spanning Tree, STP, BGP, Aggregation, Management, VRF,

### Abstract

SPS

 $\mathbf{Keywords} \colon \mathrm{SPS}$ 

# Contents

1	VLANs plan	4
2	L2 access & distribution	5
	2.1 VLANs implementation	5
	2.2 Trunks	7
	2.3 LACP	9
3	Spanning Tree	11
4	Addressing	22
	4.1 IPv4	22
	4.2 IPv6	
	4.3 Reconvergence	27
5	FHRP	28
	5.1 Implementation	28
	5.2 Tracking	28
6	BGP & Aggregation	37
7	Management	40
	7.1 IPv4 VRRP	41
	7.2 IPv4	42
	7.3 IPv6	47
8	IPv4 Connectivity	62
	8.1 Ping	62
	8.2 Telnet	62
	8.3 SSH	66
	8.4 Traceroute	69
9	IPv6 Connectivity	70
	9.1 Ping	70
	9.2 Telnet	70
	9.3 SSH	70
	9.4 Traceroute	70

# 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

ALSW	ALSW1(config) #do sh vlan									
VLAN	Name				Sta	itus	Ports			
1	defau	 1+				ive				
18	MA	LC				ive	Gi1/0			
101		+101				ive	Gi1/0 Gi0/3			
	klien					ive :ive	G10/3			
	klien					ive				
	serve					ive	Gi0/0			
	serve					ive	G10/0			
	serve					ive				
	unuse					ive				
	native					ive				
		default				/unsup				
		-ring-defau	1+			/unsup				
		et-default				/unsup				
		-default				/unsup				
1000	011100	dordaro			401	, amb ap				
VLAN	Type	SAID	MTU	Parent	RingNo	Bridge	eNo 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
Remo	emote SPAN VLANs									
Prim	ary Sec	condary Type	е		Ports	;				

Figure 1: ALSW1 VLANs

DLSW1(config) #do sh vlan										
VLAN	Name				Stat	tus P	orts			
1	defaul	Lt			act	ive G	i0/3			
18	MA				act	ive				
101	klient	t101			act	ive				
102	klient	102			act	ive				
103	klient	103			act	ive				
301	serve	r301			act	ive				
302	serve	r302			act	ive				
303	serve	r303			act	ive				
998	unused	1			act:	ive				
999	native	9			act:	ive				
1002	fddi-	default			act	/unsup				
1003	token-	-ring-defau	lt		act	/unsup				
1004	fddine	et-default			act	/unsup				
1005	trnet-	-default			act	/unsup				
VLAN	Туре	SAID	MTU	Parent	RingNo	BridgeN	o Stp	BrdgMode	Trans1	Trans2
1	enet	100001	1500						0	0
18	enet	100018	1500						0	0
101	enet	100101	1500						0	0
102		100102	1500						0	0
103	enet	100103	1500						0	0
301		100301	1500						0	0
302	enet	100302	1500						0	0
303		100303	1500						0	0
998		100998	1500						0	0
999		100999	1500						0	0
		101002	1500						0	0
1003		101003	1500						0	0
		101004	1500				ieee		0	0
1005	trnet	101005	1500				ibm		0	0
Remote SPAN VLANS										
Primary Secondary Type Ports										

Figure 2: DLSW1 VLANs

DLSW2	2 (confi	ig) #do sh v	lan							
VLAN	Name				Sta	tus	Ports			
1	defaul	lt.			act	ive	Gi0/3			
18	MA					ive	010/3			
101	klient	:101				ive				
	klient					ive				
103	klient	103			act	ive				
301	serve	r301			act	ive				
302	serve	r302			act	ive				
303	serve	r303			act	ive				
998	unused	i			act	ive				
999					act	ive				
1002	fddi-	default			act	/unsup				
		-ring-defau	lt		act	/unsup				
		et-default			act	/unsup				
1005	trnet-	-default			act	/unsup				
VLAN	Туре	SAID	MTU	Parent	RingNo	Bridge	eNo Stp	BrdgMode	Trans1	Trans2
1	anat	100001	1500	_	_			_	0	0
18		100001	1500						0	0
101		100101	1500		_	_	_	_	0	0
102		100101	1500						0	0
103		100103	1500						0	0
301		100301	1500						0	0
302		100302	1500						0	0
303		100303	1500						0	0
998		100998	1500						0	0
999		100999	1500						0	0
1002	fddi		1500						0	0
1003		101003	1500						0	0
1004	fdnet	101004	1500				ieee		0	0
1005	trnet	101005	1500				ibm		0	0
Remote SPAN VLANs										
Prima	ary Sec	condary Type	В		Ports					

Figure 3: DLSW2 VLANs

# 2.2 Trunks

do sh int trunk

```
ALSW1(config)#do sh int trunk
Port
Gi0/1
Gi0/2
Gi1/1
Gi1/2
Gi1/3
                                          Encapsulation Status 802.1q trunking
                                                                                     Native vlan
                 Mode
                 on
                                                                trunking
                                                                                     999
                                          802.1q
                                                                trunking
                                                                                     999
                 on
                                          802.1q
802.1q
                                                                trunking
                                                                                     999
                 on
                 on
                                                                trunking
                                                                                     999
                                          802.1q
                                                                trunking
                                                                                     999
                 on
Port
Gi0/1
                 Vlans allowed on trunk
                 18,101-103,301-303,999
18,101-103,301-303,999
Gi0/2
Gi1/1
Gi1/2
                 998
                 998
Gi1/3
                 998
Port
Gi0/1
Gi0/2
Gi1/1
Gi1/2
Gi1/3
                 Vlans allowed and active in management domain
                 18,101-103,301-303,999
18,101-103,301-303,999
                 998
                 998
                 998
                 Vlans in spanning tree forwarding state and not pruned 18,301-303,999
Port
Gi0/1
310/1
310/2
311/1
311/2
                 18,101-103,999
                 998
                 998
i1/3
                  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	or ann						
Gi0/1	18,101-103,301-3	03.999						
Gi1/0	18,101-103,301-3							
Po1	18,101-103,301-3							
Port	Vlans allowed an	d active in man	agement domain					
Gi0/0	998							
Gi0/1	18,101-103,301-3	03,999						
Gi1/0	18,101-103,301-3	03,999						
Po1	18,101-103,301-3	03,999						
Port	Vlans in spannin	q tree forwardi	ng state and n	ot pruned				
Gi0/0	998							
Gi0/1	18,101-103,301-3	03,999						
Gi1/0	18,101-103,301-3	03,999						
Po1	18,101-103,301-3	03,999						

Figure 5: DLSW1 Trunks

```
DLSW2(config)#do sh int trunk
                              Encapsulation Status
            Mode
                                                             Native vlan
Port
Gi0/0
                              802.1q
                                                             999
            on
                                              trunking
Gi0/1
                              802.1q
                                              trunking
                                                             999
            on
                              802.1q
Gi1/0
                                              trunking
                                                             999
            on
                                                             999
                              802.1q
                                              trunking
Po1
            on
            Vlans allowed on trunk
Port
Gi0/0
Gi0/1
            998
            18,101-103,301-303,999
Gi1/0
            18,101-103,301-303,999
            18,101-103,301-303,999
Po1
            Vlans allowed and active in management domain
Port
Gi0/0
Gi0/1
            998
            18,101-103,301-303,999
Gi1/0
            18,101-103,301-303,999
Po1
            18,101-103,301-303,999
            Vlans in spanning tree forwarding state and not pruned
Port
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)
                                 S - Layer2
N - not in use, no aggregation
           R - Layer3
           U - in use N - not in use, not f - failed to allocate aggregator
           \mbox{\it M} - not in use, minimum links not met \mbox{\it m} - not in use, port not aggregated due to minimum links not met \mbox{\it 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:
Group
         Port-channel Protocol
                                                Ports
          Po1(SU)
                                 LACP
                                                Gi0/2(P)
                                                                 Gi0/3(s)
```

Figure 7: DLSW1 LACP

Figure 8: DLSW2 LACP

## 3 Spanning Tree

do sh spanning-tree

```
ALSW1(config) #do sh spanning-tree
/LAN0018
  Spanning tree enabled protocol rstp
Root ID Priority 32786
                               32786
5254.0005.5cd0
                Address
                This bridge is the root
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
                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
  Bridge ID Priority
                                                  Prio.Nbr Type
                         Role Sts Cost
Interface
Gi0/1
                         Desg FWD 4
                                                  128.2
                                                              P2p
Gi0/2
Gi1/0
                                                  128.3
128.5
                         Desg FWD 4
                                                              P2p
                         Desg FWD 4
/LAN0101
  Spanning tree enabled protocol rstp
  Root ID
                Priority
                Address
                                5254.0016.6c37
                Cost
                                3 (GigabitEthernet0/2)
2 sec Max Age 20 sec Forward Delay 15 sec
                Port
                Hello Time
                                32869 (priority 32768 sys-id-ext 101) 5254.0005.5cd0
  Bridge ID Priority
                Address
Hello Time
Aging Time
                               2 sec Max Age 20 sec Forward Delay 15 sec 300 sec
                         Role Sts Cost
Interface
                                                  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
                                  28774
5254.0016.6c37
  Root ID
                  Priority
                  Address
                  Cost
                                  3 (GigabitEthernet0/2)
2 sec Max Age 20 sec Forward Delay 15 sec
                  Port
                  Hello Time
                 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
  Bridge ID Priority
                                                       Prio.Nbr Type
Interface
                            Role Sts Cost
Gi0/1
Gi0/2
                                                       128.2
                           Altn BLK 20
Root FWD 5
                                                                    P2p
                                                                    P2p
                                                       128.3
VLAN0103
  Spanning tree enabled protocol rstp
Root ID Priority 28775
Address 5254.0016.6c37
                  Cost
                                   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
                                                                    P2p
P2p
                                                       128.2
Gi0/2
                            Root FWD 5
                                                       128.3
```

Figure 10: ALSW1 STP 2/5

```
VLAN0301
  Spanning tree enabled protocol rstp
Root ID Priority 24877
                                    5254.0016.6c37
                  Address
                  Cost
                                    2 (GigabitEthernet0/1)
                  Port
                                   2 sec Max Age 20 sec Forward Delay 15 sec
                  Hello Time
                  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
  Bridge ID Priority
                                                        Prio.Nbr Type
                            Role Sts Cost
Interface
Gi0/0
Gi0/1
Gi0/2
                            Desg FWD 4
Root FWD 5
Altn BLK 20
                                                        128.1
128.2
128.3
                                                                     P2p Edge
                                                                     P2p
P2p
VLAN0302
  Spanning tree enabled protocol rstp
Root ID Priority 24878
Address 5254.0016.6c37
                  Cost
                                  2 (GigabitEthernet0/1)
2 sec Max Age 20 sec Forward Delay 15 sec
                  Port
                  Hello Time
                                   33070 (priority 32768 sys-id-ext 302) 5254.0005.5cd0
  Bridge ID Priority
                  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
Altn BLK 20
                                                        128.2
                                                                     P2p
                                                                     P2p
Gi0/2
                                                        128.3
```

Figure 11: ALSW1 STP 3/5

```
VLAN0303
  Spanning tree enabled protocol rstp
               Priority
                            24879
5254.0016.6c37
  Root ID
               Address
               Cost
                             2 (GigabitEthernet0/1)
               Port
               Hello Time
                              2 sec Max Age 20 sec Forward Delay 15 sec
 Bridge ID Priority
                             33071 (priority 32768 sys-id-ext 303)
                            5254.0005.5cd0
2 sec Max Age 20 sec Forward Delay 15 sec
               Address
Hello Time
               Aging Time 300 sec
Interface
                       Role Sts Cost
                                             Prio.Nbr Type
Gi0/1
                       Root FWD 5
Altn BLK 20
                                              128.2
Gi0/2
                                             128.3
                                                        P2p
VLAN0998
 Spanning tree enabled protocol rstp
Root ID Priority 33766
               Address 5254.0005.50
This bridge is the root
                             5254.0005.5cd0
               Hello Time
                             2 sec Max Age 20 sec Forward Delay 15 sec
                            33766 (priority 32768 sys-id-ext 998) 5254.0005.5cd0
 Bridge ID Priority
               Address 5254.000
Hello Time 2 sec
Aging Time 300 sec
                            2 sec Max Age 20 sec Forward Delay 15 sec
Interface
                       Role Sts Cost
                                             Prio.Nbr Type
Gi1/1
                       Desg FWD 4
                                              128.6
                                                        P2p
Gi1/2
Gi1/3
                       Desg FWD 4
                                              128.7
128.8
                                                        P2p
                                                        P2p
```

Figure 12: ALSW1 STP 4/5

```
VLAN0999
  Spanning tree enabled protocol rstp
                             33767
5254.0005.5cd0
  Root ID
               Priority
               Address
               This bridge is the root
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
                              33767 (priority 32768 sys-id-ext 999) 5254.0005.5cd0
  Bridge ID Priority
               Address
Hello Time
Aging Time
                             2 sec Max Age 20 sec Forward Delay 15 sec 300 sec
Interface
                        Role Sts Cost
                                                Prio.Nbr Type
                        Desg FWD 4
Desg FWD 4
Gi0/1
                                                128.2
                                                           P2p
Gi0/2
                                                128.3
```

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
                                 32786 (priority 32768 sys-id-ext 18) 5254.0016.6c37
  Bridge ID Priority
                 Address
Hello Time
                 Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec Aging Time 300 sec
                                                     Prio.Nbr Type
Interface
                           Role Sts Cost
Gi0/1
                           Desg FWD 4
                                                     128.2
                                                                  P2p
                           Root FWD 4
                                                     128.5
                                                                  P2p
                           Desg FWD 4
Po1
                                                     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
                                                     Prio.Nbr Type
Interface
                           Role Sts Cost
                           Desg FWD 4
Desg FWD 20
                                                     128.2
128.5
Gi0/1
                                                                  P2p
Gi1/0
                                                                  P2p
                           Desg FWD 4
Po1
                                                     128.65
                                                                  P2p
```

Figure 14: DLSW1 STP 1/5

```
VLAN0102
  Spanning tree enabled protocol rstp
Root ID Priority 28774
                                    28774
5254.0016.6c37
                    Address
                    This bridge is the root
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
                    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
  Bridge ID Priority
                                                               Prio.Nbr Type
Interface
                                Role Sts Cost
                                Desg FWD 4
Desg FWD 20
Desg FWD 4
Gi0/1
                                                               128.2
                                                               128.5
128.65
                                                                              P2p
P2p
Gi1/0
Po1
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
                    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
  Bridge ID Priority
Interface
                                Role Sts Cost
                                                               Prio.Nbr Type
                                Desg FWD 4
Desg FWD 20
Desg FWD 4
                                                               128.2
128.5
128.65
Gi0/1
                                                                              P2p
P2p
Gi1/0
Po1
```

Figure 15: DLSW1 STP 2/5

```
VLAN0301
  Spanning tree enabled protocol rstp
  Root ID
                Priority
                             24877
                               5254.0016.6c37
                Address
                This bridge is the root
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
                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
  Bridge ID Priority
Interface
                         Role Sts Cost
                                                 Prio.Nbr Type
Gi0/1
                                                 128.2
                        Desg FWD 4
                        Desg FWD 5
Desg FWD 4
Gi1/0
                                                 128.5
                                                            P2p
Po1
                                                 128.65
                                                            P2p
VLAN0302
  Spanning tree enabled protocol rstp
Root ID Priority 24878
                               5254.0016.6c37
                Address
                This bridge is the root
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
                              24878 (priority 24576 sys-id-ext 302) 5254.0016.6c37
  Bridge ID Priority
                Address
Hello Time
                               2 sec Max Age 20 sec Forward Delay 15 sec
                Aging Time 300 sec
Interface
                         Role Sts Cost
                                                 Prio.Nbr Type
Gi 0/1
                        Desg FWD 4
                                                 128.2
                                                            P2p
                                                 128.5
Gi1/0
                         Desg FWD 5
                                                            P2p
                                                 128.65
                        Desg FWD 4
Po1
                                                            P2p
```

Figure 16: DLSW1 STP 3/5

```
VLAN0303
 Spanning tree enabled protocol rstp
 Root ID
              Priority
                           24879
                            5254.0016.6c37
              Address
              This bridge is the root
              Hello Time
                           2 sec Max Age 20 sec Forward Delay 15 sec
                           24879 (priority 24576 sys-id-ext 303) 5254.0016.6c37
 Bridge ID Priority
              Address
              Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec Aging Time 300 sec
Interface
                      Role Sts Cost
                                           Prio.Nbr Type
Gi 0 / 1
                     Desg FWD 4
                                           128.2
                                                      P2p
                     Desg FWD 5
Gi1/0
                                           128.5
                                                     P2p
                                           128.65
Po1
                                                     P2p
VLAN0998
 Spanning tree enabled protocol rstp
              Priority
                           33766
 Root ID
              Address 5254.0016.66
This bridge is the root
                           5254.0016.6c37
              Hello Time
                            2 sec Max Age 20 sec Forward Delay 15 sec
                           33766 (priority 32768 sys-id-ext 998)
 Bridge ID Priority
                           33766 (priority)
5254.0016.6c37
2 sec Max Age 20 sec Forward Delay 15 sec
              Address
Hello Time
              Aging Time 300 sec
Interface
                      Role Sts Cost
                                           Prio.Nbr Type
Gi0/0
                                           128.1
                     Desg FWD 4
                                                     P2p
```

Figure 17: DLSW1 STP 4/5

```
VLAN0999
  Spanning tree enabled protocol rstp
  Root ID
               Priority
               Address
                             5254.0005.5cd0
               Cost
                             2 (GigabitEthernet1/0)
2 sec Max Age 20 sec Forward Delay 15 sec
               Port.
               Hello Time
                            33767 (priority 32768 sys-id-ext 999) 5254.0016.6c37
 Bridge ID Priority
              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
                       Root FWD 4
Desg FWD 4
Gi1/0
                                             128.5
                                                        P2p
                                             128.65
Po1
                                                        P2p
```

Figure 18: DLSW1 STP 5/5

```
DLSW2(config)#do sh spanning-tree
VLAN0018
  Spanning tree enabled protocol rstp
                             32786
5254.0005.5cd0
  Root ID
               Priority
               Address
               Cost
                             5 (GigabitEthernet1/0)
               Port
               Hello Time
                             2 sec Max Age 20 sec Forward Delay 15 sec
                             32786 (priority 32768 sys-id-ext 18) 5254.001d.c647
  Bridge ID Priority
               Address 5254.001
Hello Time 2 sec
Aging Time 300 sec
                             2 sec Max Age 20 sec Forward Delay 15 sec
                       Role Sts Cost
Interface
                                              Prio.Nbr Type
Gi0/1
                       Desg FWD 4
                                              128.2
                                                         P2p
                       Root FWD 4
Altn BLK 4
                                              128.5
128.65
                                                         P2p
Po1
                                                         P2p
VLAN0101
  Spanning tree enabled protocol rstp
               Priority
  Root ID
                             28773
                             5254.0016.6c37
               Address
               Cost
               Fort 65 (Port-channel1)
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
                             28773 (priority 28672 sys-id-ext 101) 5254.001d.c647
  Bridge ID Priority
               Address
               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
                                              128.2
                       Desg FWD 4
                                                         P2p
                       Desg FWD 5
Root FWD 4
                                              128.5
128.65
Gi1/0
Po1
                                                         P2p
P2p
```

Figure 19: DLSW2 STP 1/5

```
VLAN0102
  Spanning tree enabled protocol rstp
               Priority
                              28774
  Root ID
                              5254.0016.6c37
               Address
               Cost
                               65 (Port-channel1)
                               2 sec Max Age 20 sec Forward Delay 15 sec
                Hello Time
 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
                        Desg FWD 4
Desg FWD 5
Gi0/1
                                                128.2
                                                           P2p
                                                128.5
                                                           P2p
                        Root FWD 4
201
                                                128.65
VLAN0103
  Spanning tree enabled protocol rstp
                              28775
5254.0016.6c37
               Priority
  Root ID
               Address
                               4
65 (Port-channell)
               Cost
                Port
               Hello Time
                               2 sec Max Age 20 sec Forward Delay 15 sec
                              28775 (priority 28672 sys-id-ext 103) 5254.001d.c647
  Bridge ID Priority
               Address 5254.003
Hello Time 2 sec
Aging Time 300 sec
                              2 sec Max Age 20 sec Forward Delay 15 sec
Interface
                        Role Sts Cost
                                                Prio.Nbr Type
                        Desg FWD 4
Desg FWD 5
Root FWD 4
                                                128.2
128.5
                                                           P2p
P2p
Gi0/1
Gi1/0
                                                128.65
                                                           P2p
```

Figure 20: DLSW2 STP 2/5

```
VLAN0301
  Spanning tree enabled protocol rstp
Root ID Priority 24877
Address 5254.0016.6c37
                                      65 (Port-channel1)
2 sec Max Age 20 sec Forward Delay 15 sec
                    Cost
                   Hello Time
  Bridge ID Priority
                                     24877 (priority 24576 sys-id-ext 301) 5254.001d.c647
                   Address 5254.001d.c647
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec Aging Time 300 sec
                              Role Sts Cost
Interface
                                                            Prio.Nbr Type
Gi0/1
                              Desg FWD 4
Desg FWD 20
Root FWD 4
                                                            128.2
128.5
128.65
                                                                          P2p
Gi1/0
                                                                         P2p
P2p
Po1
VLAN0302
  Spanning tree enabled protocol rstp
Root ID Priority 24878
                   Address
                                      5254.0016.6c37
                    Cost
                   Port 65 (Port-channel1)
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
                   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
  Bridge ID Priority
Interface
                              Role Sts Cost
                                                            Prio.Nbr Type
                              Desg FWD 4
Desg FWD 20
Root FWD 4
                                                            128.2
128.5
128.65
                                                                          P2p
P2p
P2p
Gi0/1
Po1
```

Figure 21: DLSW2 STP 3/5

```
VLAN0303
 Spanning tree enabled protocol rstp
Root ID Priority 24879
               Address
                             5254.0016.6c37
                             4
65 (Port-channel1)
2 sec Max Age 20 sec Forward Delay 15 sec
               Cost
               Port
              Hello Time
                             24879 (priority 24576 sys-id-ext 303) 5254.001d.c647
 Bridge ID Priority
               Address
                            2 sec Max Age 20 sec Forward Delay 15 sec 300 sec
               Hello Time
              Aging Time
                                             Prio.Nbr Type
Interface
                       Role Sts Cost
Gi0/1
                       Desg FWD 4
                                              128.2
                                                        P2p
                       Desg FWD 20
Root FWD 4
Gi1/0
                                              128.5
                                                        P2p
                                              128.65
Po1
                                                        P2p
VLAN0998
 Spanning tree enabled protocol rstp Root ID Priority 33766
              Priority
 Root ID
              Address 5254.001d.c
                             5254.001d.c647
               Hello Time
                             2 sec Max Age 20 sec Forward Delay 15 sec
                             33766 (priority 32768 sys-id-ext 998) 5254.001d.c647
 Bridge ID Priority
              Address
Hello Time
Aging Time
                            2 sec Max Age 20 sec Forward Delay 15 sec 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
               Priority
                              5254.0005.5cd0
               Address
               Cost
                              5 (GigabitEthernet1/0)
                              2 sec Max Age 20 sec Forward Delay 15 sec
               Hello Time
                              33767 (priority 32768 sys-id-ext 999) 5254.001d.c647
 Bridge ID Priority
               Address 5254.001
Hello Time 2 sec
Aging Time 300 sec
                             2 sec Max Age 20 sec Forward Delay 15 sec
Interface
                        Role Sts Cost
                                               Prio.Nbr Type
                       Desg FWD 4
Root FWD 4
                                               128.2
                                                          P2p
P2p
Gi0/1
Gi1/0
                                               128.5
                        Altn BLK 4
                                               128.65
```

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
<b>VLAN 301</b>	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
$\mathrm{TEST}\;\mathrm{PC}$	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

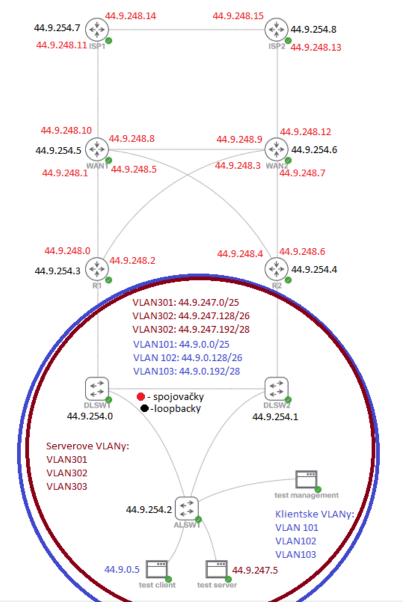


Figure 24: IPv4 addressing

### 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

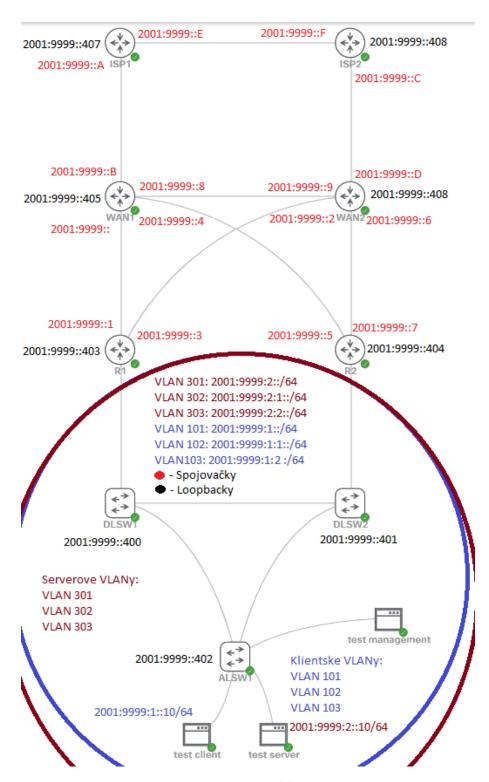


Figure 25: IPv6 addressing

### 4.3 Reconvergence

Routing from client to 2.0.0.1/2001:9999:2000::1 prefers route through R2-WAN1-ISP1-ISP2 STP - took s 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=10 ttl=42 time=12.899 ms
64 bytes from 2.0.0.1: seq=16 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=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=21.085 ms
```

Figure 26: IPv4 reconvergence

```
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=18 ttl=61 time=15.159 ms
```

Figure 27: IPv6 reconvergence

BGP - took s

#### 5 FHRP

#### 5.1 Implementation

do sh standby br

```
R1(config-subif)#do sh standby br
                             P indicates configured to preempt.
                       Pri P State Active Standby
120 P Standby FE80::5054:FF:FE17:C2F3
                                                                                         Virtual IP
Interface
                Grp
Gi0/1.101
                                                                                         FE80::5:73FF:FEA0:B
                                                                  local
Gi0/1.101
Gi0/1.102
                       120 P Standby 44.9.0.3 local
120 P Standby FE80::5054:FF:FE17:C2F3
                                                                                         44.9.0.1
                                                                  local
                                                                                         FE80::5:73FF:FEA0:C
Gi0/1.102
Gi0/1.103
                       120 P Standby 44.9.0.131 local
120 P Standby FE80::5054:FF:FE17:C2F3
                102
                                                                                         44.9.0.129
                                                                                         FE80::5:73FF:FEA0:D
44.9.0.193
44.9.247.1
Gi0/1.103
Gi0/1.301
                       120 P Standby 44.9.0.195
150 P Active local
150 P Active local
                103
                                                                  local
                                                                  44.9.247.3
Gi0/1.301
                                                                  FE80::5054:FF:FE17:C2F3
                                                                                         FE80::5:73FF:FEA0:15
44.9.247.129
Gi0/1.302
                2
22
                                                                  44.9.247.131 44.9.24
FE80::5054:FF:FE17:C2F3
                        150 P Active
                                           local
Gi0/1.302
                       150 P Active
                                           local
                                                                                         FE80::5:73FF:FEA0:16
Gi0/1.303
                3
23
                                                                  44.9.247.195 44.9.24
FE80::5054:FF:FE17:C2F3
                       150 P Active
150 P Active
                                           local
                                                                                        44.9.247.193
Gi0/1.303
                                           local
                                                                                         FE80::5:73FF:FEA0:17
```

Figure 28: R1 FHRP implementace

```
R2(config-subif) #do sh standby br
P indicates configured to preempt.
                                                                        Standby Virtual FE80::5054:FF:FE06:69A1
                          Pri P State
120 P Active
                                                                                                 Virtual IP
Interface
                                               Active
                  Grp
Gi0/1.101
                                                                        FE80::5:73FF:FEA0:B
44.9.0.2 44.9.0.1
FE80::5054:FF:FE06:69A1
Gi0/1.101
Gi0/1.102
                          150 P Active
                                               local
                          150 P Active
                                                                        FE80::5:73FF:FEA0:C
44.9.0.130 44.9.0.129
FE80::5054:FF:FE06:69A1
Gi0/1.102
Gi0/1.103
                          150 P Active
                  102
                                               local
                          150 P Active
                                               local
                                                                                                FE80::5:73FF:FEA0:D
44.9.0.193
44.9.247.1
Gi0/1.103
Gi0/1.301
Gi0/1.301
                          150 P Active local 44.9.0.1
120 P Standby 44.9.247.2 local
120 P Standby FE80::5054:FF:FE06:69A1
                  103
                                                                        44.9.0.194
                                                                                                 FE80::5:73FF:FEA0:15
                                                                        local
                          120 P Standby 44.9.247.130 local
120 P Standby FE80::5054:FF:FE06:69A1
Gi0/1.302
                  2
22
                                                                                                 44.9.247.129
Gi0/1.302
                                                                                                FE80::5:73FF:FEA0:16
44.9.247.193
                                                                        local
                          120 P Standby 44.9.247.194 local
120 P Standby FE80::5054:FF:FE06:69A1
Gi0/1.303
 i0/1.303
                                                                                                 FE80::5:73FF:FEA0:17
```

Figure 29: R2 FHRP implementace

#### 5.2 Tracking

do sh standby

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

```
GigabitEthernetO/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)
GigabitEthernetO/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 31: R1 FHRP detail 2/6

```
gabitEthernet0/1.103 - 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)
igabitEthernet0/1.103 - 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 32: R1 FHRP detail 3/6

```
GigabitEthernet0/1.301 - Group 1 (version 2)
State is Active

4 state changes, last state change 00:05:41
Virtual IP address is 44.9.247.1
Active virtual MAC address is 0000.0c9f.f001
Local virtual MAC address is 0000.0c9f.f001 (v2 default)
Hello time 3 sec, hold time 10 sec
Next hello sent in 0.864 secs
Preemption enabled
Active router is local
Standby router is 44.9.247.3, priority 120 (expires in 10.848 sec)
Priority 150 (configured 150)
Track object 301 state Up decrement 30
Group name is "hsrp-Gi0/1.301-1" (default)
GigabitEthernet0/1.301 - Group 21 (version 2)
State is Active
4 state changes, last state change 00:05:41
Link-Local Virtual IPv6 address is FE80::5:73FF:FEA0:15 (impl auto EUI64)
Virtual IPv6 address is 0005.73a0.0015
Local virtual MAC address is 0005.73a0.0015
Local virtual MAC address is 0005.73a0.0015
Version 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 33: R1 FHRP detail 4/6

```
GigabitEthernetO/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
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)
GigabitEthernetO/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 34: R1 FHRP detail 5/6

```
GigabitEthernet0/1.303 - Group 3 (version 2)
State is Active
4 state changes, last state change 00:05:42
Virtual IP address is 44.9.247.193
Active virtual MAC address is 0000.0c9f.f003
Local virtual MAC address is 0000.0c9f.f003 (v2 default)
Hello time 3 sec, hold time 10 sec
Next hello sent in 1.136 secs
Preemption enabled
Active router is local
Standby router is 44.9.247.195, priority 120 (expires in 9.680 sec)
Priority 150 (configured 150)
Track object 303 state Up decrement 30
Group name is "harp-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 is 0005.73a0.0017
Local virtual MAC address is 0005.73a0.0017
Local 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 35: R1 FHRP detail 6/6

```
R2(config-if) #do sh standby
GigabitEthernet0/1.101 - Group 11 (version 2)
State is Active
2 state changes, last state change 01:54:45
Link-Local Virtual IPv6 address is FE80::5:73FF:FEA0:B (impl auto EUI64)
Virtual IPv6 address is 0005.73a0.000b
Local 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 36: R2 FHRP detail 1/6

```
GigabitEthernet0/1.102 - Group 12 (version 2)
 State is Active
 1 state change, last state change 01:55:07
Link-Local Virtual IPv6 address is FE80::5:73FF:FEA0:C (impl auto EUI64)
Virtual IPv6 address 2001:9999:1:1::/64
 Active virtual MAC address is 0005.73a0.000c
     Local virtual MAC address is 0005.73a0.000c (v2 IPv6 default)
 Hello time 3 sec, hold time 10 sec
Next hello sent in 0.576 secs
 Preemption enabled
 Active router is local Standby router is FE80::5054:FF:FE06:69A1, priority 120 (expires in 9.600 sec)
Priority 150 (configured 150)
Track object 12 state Up decrement 30
Group name is "hsrp-Gi0/1.102-12" (default)
igabitEthernet0/1.102 - 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 16cal
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 37: R2 FHRP detail 2/6

```
GigabitEthernet0/1.103 - Group 13 (version 2)
State is Active

2 state changes, last state change 01:52:38
Link-Local Virtual IPV6 address is FEB0::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 FEB0::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 38: R2 FHRP detail 3/6

```
GigabitEthernet0/1.301 - Group 1 (version 2)
   State is Standby
      4 state changes, last state change 00:17:50
  Virtual IP address is 44.9.247.1
Active virtual MAC address is 0000.0c9f.f001
   Local virtual MAC address is 0000.0c9f.f001 (v2 default)
Hello time 3 sec, hold time 10 sec
Next hello sent in 1.824 secs
   Preemption enabled
  Active router is 44.9.247.2, priority 150 (expires in 10.032 sec)
MAC address is 5254.0006.69a1
   Standby router is local
   Priority 120 (configured 120)
  Group name is "hsrp-Gi0/1.301-1" (default) igabitEthernet0/1.301 - 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 39: R2 FHRP detail 4/6

```
GigabitEthernet0/1.302 - Group 2 (version 2)
State is Standby
4 state changes, last state change 00:17:50
Virtual IP address is 44.9.247.129
Active virtual MAC address is 0000.0c9f.f002
Local virtual MAC address is 0000.0c9f.f002 (v2 default)
Hello time 3 sec, hold time 10 sec
Next hello sent in 1.136 secs
Preemption enabled
Active router is 44.9.247.130, priority 150 (expires in 10.944 sec)
MAC address is 5254.0006.69a1
Standby router is local
Priority 120 (configured 120)
Group name is "hsrp-Gi0/1.302-2" (default)

GigabitEthernet0/1.302 - Group 22 (version 2)
State is Standby
4 state changes, last state change 00:17:50
Link-Local Virtual IPv6 address is FE80::5:73FF:FEA0:16 (impl auto EUI64)
Virtual IPv6 address is 0005.73a0.0016
Local virtual MAC address is 0005.73a0.0016
Local virtual MAC address is 0005.73a0.0016
Local virtual MAC address is 5005.73a0.0016 (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 40: R2 FHRP detail 5/6

```
GigabitEthernetO/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-GiO/1.303-3" (default)

GigabitEthernetO/1.303 - Group 23 (version 2)
State is Standby
4 state changes, last state change 00:17:48
Link-Local Virtual IPv6 address is FEB0::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
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-GiO/1.303-23" (default)
```

Figure 41: R2 FHRP detail 6/6

do sh track

```
R1(config-if)#do sh track
Track 31
  IPv6 route 2001:9999:2::/64 reachability
  Reachability is Up (connected)
  1 change, last change 01:50:00
First-hop interface is GigabitEthernet0/1.301
  Tracked by:
    HSRP GigabitEthernet0/1.301 21
Track 32
 IPv6 route 2001:9999:2:1::/64 reachability
  Reachability is Up (connected)
  1 change, last change 01:50:00
First-hop interface is GigabitEthernet0/1.302
  Tracked by:
    HSRP GigabitEthernet0/1.302 22
Track 33
  IPv6 route 2001:9999:2:2::/64 reachability
  Reachability is Up (connected)

1 change, last change 01:50:00

First-hop interface is GigabitEthernet0/1.303
  Tracked by:
    HSRP GigabitEthernet0/1.303 23
Track 301
  IP route 44.9.247.0 255.255.255.128 reachability
  Reachability is Up (connected) 2 changes, last change 02:19:48
  First-hop interface is GigabitEthernet0/1.301
  Tracked by:
    HSRP GigabitEthernet0/1.301 1
Track 302
 IP route 44.9.247.128 255.255.255.192 reachability
  Reachability is Up (connected)
2 changes, last change 02:19:48
  First-hop interface is GigabitEthernet0/1.302
  Tracked by:
    HSRP GigabitEthernet0/1.302 2
Track 303
 IP route 44.9.247.192 255.255.255.240 reachability
  Reachability is Up (connected)
   2 changes, last change 02:19:48
  First-hop interface is GigabitEthernet0/1.303
  Tracked by:
    HSRP GigabitEthernet0/1.303 3
```

Figure 42: R1 Tracking

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

Figure 43: R2 Tracking

# 6 BGP & Aggregation

do sh ip bgp

	Network	Next Hop	Metric Lo	cPrf W	eight 1	Path	
*>i	1.0.0.0	44.9.254.6	0	120	0	100	i
*		44.9.248.11	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		i	
*>		0.0.0.0			32768	i	
<b>s&gt;</b>	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	?	
<b>s&gt;</b>	44.9.247.128/26	44.9.248.4	11		32768	?	
<b>s&gt;</b>	44.9.247.192/28	44.9.248.4	11		32768	?	

Figure 44: WAN1 IPv4 BGP

	Network	Next Hop	Metric Lo	cPrf W	eight I	Path	
*>	1.0.0.0	44.9.248.13			0	100	i
*	2.0.0.0/16	44.9.248.13	0			100	i
*>i		44.9.254.5	0	120	0	100	i
<b>s&gt;</b>	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	
3>	44.9.0.128/26	44.9.248.8	12		32768	?	
<b>s&gt;</b>	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	
3>	44.9.247.0/25	44.9.248.8	12		32768	?	
3>	44.9.247.128/26	44.9.248.8	12		32768	?	
<b>s&gt;</b>	44.9.247.192/28	44.9.248.8	12		32768	?	

Figure 45: WAN2 IPv4 BGP

	Network	Next Hop	Metric Lo	cPrf W	Teight Pa	th	
*>	1.0.0.0	0.0.0.0	0		32768		
r>i	2.0.0.0/16	44.9.254.8	0	100	0		
*>i	44.9.0.0/17	44.9.254.8	0	100	0 9	i	
*		44.9.248.10	0		0 9	9	6
*>	44.9.240.0/21	44.9.248.10	0		0 9	i	

Figure 46: ISP1 IPv4 BGP

	Network	Next Hop	Metric Lo	cPrf W	eight E	at	h	
r>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			9	9 i	
*>i		44.9.254.7	0	100	0	9	i	

Figure 47: 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 ?

12 2001:9999:1::/48 2001:9999::406 0 100 0 i

32768 i

2001:9999:1:1::/64

FE80::5054:FF:FE1B:7390

11 32768 ?

2001:9999:2::/64 FE80::5054:FF:FE1B:7390

11 32768 ?

12 2001:9999:2::/64 FE80::5054:FF:FE1B:7390

13 32768 ?

14 32768 ?

25 2001:9999:2::/48 2001:9999::406 0 100 0 i

26 32768 i
```

Figure 48: WAN1 IPv6 BGP 1/2

		Next Hop	Metric Loc	Prf W	eight E	ath	
3>	2001:9999:2:1::/	64					
		FE80::5054:FF:FE1	B:E376				
			12		32768	?	
<b>s&gt;</b>	2001:9999:2:2::/	64					
		FE80::5054:FF:FE1	B: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 49: WAN2 IPv6 BGP 2/2

	Network	Next Hop	Metric	Loc	Prf We	eight	Path
<b>s&gt;</b>	2001:9999:1::	/64 FE80::5054:FF:				3	
			1	1		32768	?
* i	2001:9999:1::	/48 2001:9999::406	5	0	100	0	i
*>		::				32768	i
s>	2001:9999:1:1	L::/64					
		FE80::5054:FF:	:FE1B:7390				
			1	1		32768	?
<b>s&gt;</b>	2001:9999:1:2	2::/64					
		FE80::5054:FF:	:FE1B:7390				
			1	1		32768	?
<b>s&gt;</b>	2001:9999:2::	:/64 FE80::5054:FF:	:FE1B:7390				
			1	1		32768	?
* i	2001:9999:2::	:/48 2001:9999::406	5	0	100	0	i
*>		::				32768	i

Figure 50: WAN1 IPv6 BGP 1/2

g>	Network 2001:9999:2:1::	Next Hop	Metric Loc	Prf W	eight 1	Path	
		FE80::5054:FF:FE1	B:E376				
			12		32768	?	
<b>s&gt;</b>	2001:9999:2:2::	/64					
		FE80::5054:FF:FE1	B: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 51: WAN2 IPv6 BGP 2/2

	Network	Next Hop	Metric Lo	cPrf W	eight P	ath	ı
*>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	
*>	2001:9999:100	0::/48					
		::	0		32768	i	
*>i	2001:9999:200	0::/56					
		2001:9999::408	0	100	0	i	

Figure 52: 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 2001:9999:407 0 100 0 i

*> 2001:9999:2000::/56

:: 0 32768 i
```

Figure 53: ISP2 IPv6 BGP

prefixy

# 7 Management

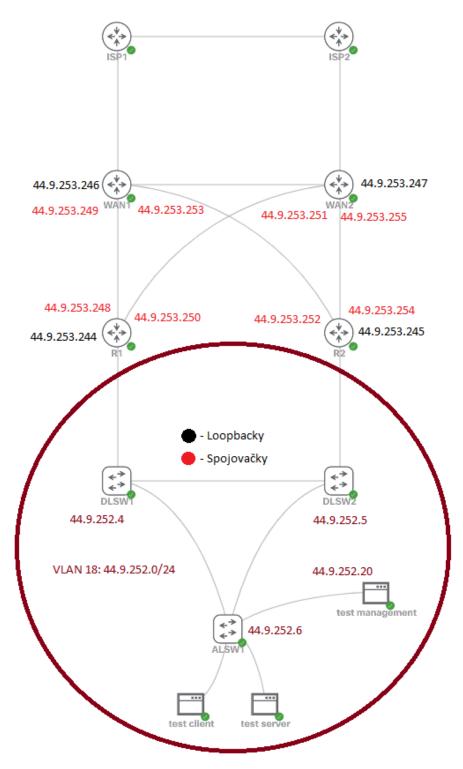


Figure 54: IPv4 management addressing

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					
Gi0/2.91	1	0/0	0/0		0/0	50					
Gi0/3.91		0/0	0/0	1590	0/0	7948					
Lo1		0/0	0/0		0/0						

Figure 55: 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					
Gi0/2.91		0/0	0/0	173	0/0	864					
Gi0/3.91	1	0/0	0/0		0/0	50					
Lo1		0/0	0/0		0/0						

Figure 56: R2 VRF EIGRP

WAN1(config-if) #do sh eigrp address-family ipv4 vrf MGMT int EIGRP-IPv4 Interfaces for AS(1) VRF(MGMT)											
		Xmit Queue	PeerQ	Mean	Pacing Time	Multicast	Pending				
Interface	Peers	Un/Reliable	Un/Reliable	SRTT	Un/Reliable	Flow Timer	Routes				
Gi0/3.91	1	0/0	0/0	9	0/0	50	0				
Gi0/4.91	1	0/0	0/0		0/0	50	0				
Lo1		0/0	0/0		0/0		0				

Figure 57: WAN1 VRF EIGRP

WAN2 (config-route		-	mily ipv4 vrf	MGMT	int		
EIGRP-IPv4 Interf	aces for AS(						
		Xmit Queue	PeerQ	Mean	Pacing Time	Multicast	Pending
Interface	Peers	Un/Reliable	Un/Reliable	SRTT	Un/Reliable	Flow Timer	Routes
Gi0/3.91	1	0/0	0/0		0/0	50	0
Gi0/4.91	1	0/0	0/0		0/0	50	0
Lo1	0	0/0	0/0	0	0/0	0	0

Figure 58: 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 59: 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 60: 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 d	lown	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 d	lown	down
Loopback0	44.9.254.8	YES	manual	up		up
Loopback100	2.0.0.1	YES	manual	up		up

Figure 61: ISP1 IPv4 interface brief

Interface	IP-Address	OK? Me	lethod	Status		Protoco.
GigabitEthernet0/0	unassigned	YES u	nset	administratively	down	down
SigabitEthernet0/1	44.9.248.14	YES ma	anual	up		up
SigabitEthernet0/2	44.9.248.11	YES ma	anual	up		up
SigabitEthernet0/3	unassigned	YES u	nset	administratively	down	down
Loopback0	44.9.254.7	YES ma	anual	up		up
Loopback100	1.0.0.1	YES ma	anual	up		up

Figure 62: 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 63: WAN1 IPv4 interface brief

WAN2(config-router)#do s	n 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 64: 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 65: 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 66: 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 67: DLSW1 IPv4 interface brief

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

Figure 68: 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
${\tt GigabitEthernet0/1}$	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		manual	_	up
Vlan303	44.9.247.206	YES	manual	up	up

Figure 69: ALSW1 IPv4 interface brief

do sh ip route

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

Figure 70: 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
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
44.9.247.0/25 [20/1] via 44.9.248.12, 02:03:24
44.9.247.128/26 [20/1] via 44.9.248.12, 02:03:24
44.9.247.192/28 [20/1] via 44.9.248.12, 02:03:24
44.9.248.12/31 is directly connected, GigabitEthernet0/2
44.9.248.13/32 is directly connected, GigabitEthernet0/2
C 44.9.248.14/31 is directly connected, GigabitEthernet0/1
44.9.248.15/32 is directly connected, GigabitEthernet0/1
44.9.248.15/32 is directly connected, GigabitEthernet0/1
44.9.254.7/32 [1/0] via 44.9.248.14
C 44.9.254.8/32 is directly connected, Loopback0
```

Figure 71: 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
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
0 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, GigabitEthernet0/4.9
[110/1] via 44.9.248.0, 01:33:24, GigabitEthernet0/3.9
0 E2 44.9.0.128/26 [110/1] via 44.9.248.0, 01:33:24, GigabitEthernet0/3.9
0 E2 44.9.0.192/28 [110/1] via 44.9.248.0, 01:33:24, GigabitEthernet0/4.9
[110/1] via 44.9.248.0, 01:33:24, GigabitEthernet0/4.9
[110/1] via 44.9.248.0, 01:33:24, GigabitEthernet0/3.9
0 E2 44.9.247.0/25 [110/1] via 44.9.248.0, 01:33:24, GigabitEthernet0/3.9
0 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
0 E2 44.9.247.192/28
[110/1] via 44.9.248.0, 01:33:24, GigabitEthernet0/3.9
0 E2 44.9.248.0/31 is directly connected, GigabitEthernet0/3.9
0 E4 49.248.0/31 is directly connected, GigabitEthernet0/3.9
0 44.9.248.0/31 is directly connected, GigabitEthernet0/4.9
1 44.9.248.6/31 [110/51] via 44.9.248.9, 01:33:24, GigabitEthernet0/1
0 44.9.248.6/31 [110/51] via 44.9.248.9, 01:33:24, GigabitEthernet0/1.9
0 44.9.248.8/31 is directly connected, GigabitEthernet0/4.9
0 44.9.248.8/31 is directly connected, GigabitEthernet0/4.9
0 44.9.248.8/32 is directly connected, GigabitEthernet0/1.9
0 44.9.248.8/31 is directly connected, GigabitEthernet0/1.9
0 44.9.248.8/32 is directly connected, GigabitEthernet0/1.9
0 44.9.248.8/32 is directly connected, GigabitEthernet0/2.9
0 44.9.248.10/31 is directly connected, GigabitEthernet0/2.9
0 44.9.248.10/32 is directly connected, GigabitEthernet0/2.9
0 44.9.248.10/32 is directly connected, GigabitEthernet0/2.9
0 44.9.254.3/32 [110/10] via 44.9.248.9, 01:33:24, GigabitEthernet0/3.9
0 44.9.254.4/32 [110/10] via 44.9.248.9, 01:33:24, GigabitEthernet0/4.9
0 44.9.254.4/32 [110/10] via 44.9.248.9, 01:33:24, GigabitEthernet0/4.9
```

Figure 72: 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
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
0 E2 44.9.0.0/25 [110/1] via 44.9.248.8, 00:35:29, GigabitEthernet0/1
0 E2 44.9.0.128/26 [110/1] via 44.9.248.8, 00:35:29, GigabitEthernet0/1
0 E2 44.9.0.192/28 [110/1] via 44.9.248.8, 00:35:29, GigabitEthernet0/1
0 E2 44.9.247.0/25 [110/1] via 44.9.248.8, 00:35:29, GigabitEthernet0/1
0 E2 44.9.247.128/26 [110/1] via 44.9.248.8, 00:35:29, GigabitEthernet0/1
0 E2 44.9.247.192/28 [110/1] via 44.9.248.8, 00:35:29, GigabitEthernet0/1
0 E2 44.9.247.192/28 [110/1] via 44.9.248.8, 00:35:29, GigabitEthernet0/1
0 44.9.248.0/31 [110/11] via 44.9.248.8, 01:35:25, GigabitEthernet0/1
0 44.9.248.3/32 is directly connected, GigabitEthernet0/4.9
0 44.9.248.4/31 [110/11] via 44.9.248.8, 00:35:19, GigabitEthernet0/1
0 44.9.248.4/31 is directly connected, GigabitEthernet0/3.9
1 44.9.248.6/31 is directly connected, GigabitEthernet0/3.9
1 44.9.248.7/32 is directly connected, GigabitEthernet0/1
1 44.9.248.9/32 is directly connected, GigabitEthernet0/1
1 44.9.248.9/32 is directly connected, GigabitEthernet0/1
1 44.9.248.12/31 is directly connected, GigabitEthernet0/1
1 44.9.248.12/32 is directly connected, GigabitEthernet0/1
1 44.9.254.3/32 [110/11] via 44.9.248.8, 01:35:25, GigabitEthernet0/1
1 44.9.254.3/32 [110/11] via 44.9.248.8, 01:35:25, GigabitEthernet0/1
1 44.9.254.5/32 [110/11] via 44.9.248.8, 01:35:25, GigabitEthernet0/1
1 44.9.254.6/32 is directly connected, Loopback0
```

Figure 73: WAN2 IPv4 routes

```
0*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
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 44.9.247.0/25 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 44.9.247.194/32 is directly connected, GigabitEthernet0/1.303
C 44.9.248.0/31 is directly connected, GigabitEthernet0/1.303
C 44.9.248.0/32 is directly connected, GigabitEthernet0/2.9
L 44.9.248.2/32 is directly connected, GigabitEthernet0/2.9
C 44.9.248.2/32 is directly connected, GigabitEthernet0/2.9
C 44.9.248.4/31 [110/61] via 44.9.248.1, 00:10:31, GigabitEthernet0/3.9
C 44.9.248.8/31 [110/61] via 44.9.248.1, 01:10:48, GigabitEthernet0/3.9
C 44.9.248.8/32 [110/61] via 44.9.248.1, 01:10:48, GigabitEthernet0/3.9
C 44.9.254.4/32 [110/61] via 44.9.248.1, 00:10:41, GigabitEthernet0/3.9
C 44.9.254.6/32 [110/10] via 44.9.248.1, 01:10:48, GigabitEthernet0/3.9
C 44.9.254.6/32 [110/11] via 44.9.248.1, 01:10:48, GigabitEthernet0/3.9
C 44.9.254.6/32 [110/11] via 44.9.248.1, 01:10:48, GigabitEthernet0/3.9
```

Figure 74: 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 44.9.247.128/26 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
A4.9.247.195/32 is directly connected, GigabitEthernet0/1.303
A4.9.248.0/31 [110/20] via 44.9.248.5, 00:11:11, GigabitEthernet0/2.9
A4.9.248.4/31 is directly connected, GigabitEthernet0/2.9
A4.9.248.4/31 is directly connected, GigabitEthernet0/2.9
A4.9.248.4/32 is directly connected, GigabitEthernet0/2.9
A4.9.248.6/31 is directly connected, GigabitEthernet0/2.9
A4.9.248.6/32 is directly connected, GigabitEthernet0/2.9
A4.9.248.8/31 [110/11] via 44.9.248.5, 00:11:11, GigabitEthernet0/2.9
A4.9.248.8/31 [110/11] via 44.9.248.5, 00:11:11, GigabitEthernet0/2.9
A4.9.254.6/32 is directly connected, Loopback0
A4.9.254.6/32 [110/10] via 44.9.248.5, 00:11:11, GigabitEthernet0/2.9
A4.9.254.6/32 [110/10] via 44.9.248.5, 00:11:11, GigabitEthernet0/2.9
```

Figure 75: R2 IPv4 routes

### 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 76: R1 OSPFv3 Brief

R2(config)#	do sh	ospfv3	pv4 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 77: R2 OSPFv3 Brief

WAN1 (config	-if)#do	sh ospfv3	ipv4 int br			
Interface	PID	Area	AF	Cost	State	Nbrs F/0
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 78: WAN1 OSPFv3 Brief

			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

#### 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 80: 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 81: 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 82: 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 83: WAN2 IPv6 interface brief

```
R1(config)#do sh ipv6 int br
GigabitEthernet0/0
                       [up/up]
    unassigned
GigabitEthernet0/0.9 [deleted/down]
   unassigned
                     [up/up]
GigabitEthernet0/1
   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
                       [up/up]
GigabitEthernet0/3.9
```

Figure 84: R1 IPv6 interface brief 1/2

```
2001:9999::
2001:99999::1

GigabitEthernet0/3.91 [up/up]
unassigned

Loopback0 [up/up]
FE80::5054:FF:FE08:4BB5
2001:9999::403

Loopback1 [up/up]
unassigned
```

Figure 85: 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 86: 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 87: 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 [up/down] GigabitEthernet0/3 unassigned GigabitEthernet1/0 [up/up] unassigned [up/up] Loopback0 FE80::5054:FF:FE00:6E45 2001:9999::400 Port-channel1 [up/up] unassigned Vlan18 [up/up] unassigned

Figure 88: DLSW1 IPv6 interface brief

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

Figure 89: DLSW2 IPv6 interface brief

ALSW1(config)#do sh ip	v6 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	. / 1
Vlan302	[up/up]
unassigned	[/1
Vlan303	[up/up]
unassigned	

Figure 90: ALSW1 IPv6 interface brief

do sh ipv6 route

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

Figure 91: ISP1 IPv6 routes

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

Figure 92: ISP2 IPv6 routes

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

Figure 93: WAN1 IPv6 routes

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

Figure 94: WAN2 IPv6 routes

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

Figure 95: R1 IPv6 routes 1/2

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

Figure 96: R1 IPv6 routes 2/2

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

Figure 97: R2 IPv6 routes 1/2

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

Figure 98: R2 IPv6 routes 2/2

#### 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 99: R1 OSPFv3 Brief

Interface	PID	Area	AF	Cost	State	Nbrs F/C
00	2	0	ipv6	1	LOOP	0/0
i0/3.9	2	0	ipv6	50	BDR	1/1
si0/2.9	2	0	ipv6	10	BDR	1/1
si0/1.303	2	2	ipv6	1	DR	0/0
si0/1.302	2	2	ipv6	1	DR	0/0
i0/1.301	2	2	ipv6	1	DR	0/0
i0/1.103	2	2	ipv6	1	DR	0/0
i0/1.102	2	2	ipv6	1	DR	0/0
i0/1.101	2	2	ipv6	1	DR	0/0

Figure 100: 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 101: WAN1 OSPFv3 Brief

WAN2 (config	-route:	r)#do sh ospf	v3 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		ipv6	50	DR	1/1
Gi0/1	2	0	ipv6	1	DR	1/1

Figure 102: WAN2 OSPFv3 Brief

# 8 IPv4 Connectivity

## 8.1 Ping

ping from client to each VLAN's interface on ALSW1 ping from server to each VLAN's interface on ALSW1

## 8.2 Telnet

```
localhost:~$ telnet 44.9.253.249
 Connected to 44.9.253.249
Entering character mode
Escape character is '^]'.
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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.
                         User Access Verification
Username: grp9
Password:
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 Cisco in writing.
WAN1>en
Password:
WAN1#conf t
Enter configuration commands, one per line. End with CNTL/Z. WAN1(config) #
```

Figure 103: WAN1 IPv4 Telnet

```
localhost:~$ telnet 44.9.253.255
 onnected to 44.9.253.255
Entering character mode
Escape character is '^]'.
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User Access Verification
Username: qrp9
Password:
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 WAN2>en
Password:
WAN2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
WAN2 (config) #
```

Figure 104: 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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User Access Verification
Username: grp9
Password:
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Cisco in writing.
R1>en
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#
```

Figure 105: R1 IPv4 Telnet

```
localhost:~$ telnet 44.9.252.3
 onnected to 44.9.252.3
Entering character mode
Escape character is '^]'.
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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.
User Access Verification
Username: grp9
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
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  Cisco in writing.
R2>en
Password:
R2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R2(config)#
```

Figure 106: 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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 education. IOSv is provided as-is and is not supported by Cisco's
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 Cisco in writing.
User Access Verification
Username: grp9
Password:
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  purposes is expressly prohibited except as otherwise authorized by
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DLSW1>en
DLSW1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
DLSW1 (config) #
```

Figure 107: DLSW1 IPv4 Telnet

```
localhost:~$ telnet 44.9.252.5
onnected to 44.9.252.5
Entering character mode
Escape character is '^]'.
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Jser Access Verification
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 108: 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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 Cisco in writing.
Jser Access Verification
Username: grp9
Password:
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ALSW1>en
ALSW1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
ALSW1(config)#
```

Figure 109: ALSW1 IPv4 Telnet

#### 8.3 SSH

```
.ocalhost:~$ ssh -l grp9 -oKexAlgorithms=+diffie-hellman-group14-sha1 44.9.253.2
The authenticity of host '44.9.253.249 (44.9.253.249)' can't be established.
RSA key fingerprint is SHA256:9R0FmgVL6jKYDrjE5TQNcgqUbHGKlBwJZppZsbKZK7c.
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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 Cisco in writing.
WAN1>en
Password:
WAN1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
WAN1 (config) #
```

Figure 110: WAN1 IPv4 SSH

```
localhost:~$ ssh -1 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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 of the IOSV Software or Documentation to any third party for any purposes is expressly prohibited except as otherwise authorized by
 Cisco in writing.
assword: **
 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.
WAN2>en
Password:
WAN2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
WAN2 (config) #
```

Figure 111: WAN2 IPv4 SSH

Figure 112: R1 IPv4 SSH

Figure 113: R2 IPv4 SSH

Figure 114: DLSW1 IPv4 SSH

Figure 115: DLSW2 IPv4 SSH

Figure 116: ALSW1 IPv4 SSH

#### 8.4 Traceroute

```
localhost:-$ tracercute 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 12.998 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 (44.9.248.13) 13.155 ms 17.580 ms *
```

Figure 117: Client route to internet 1.0.0.1

```
localhost:~S 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 44.9.248.15 (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 118: 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 44.9,248.9 (44.9.248.13) 18.790 ms 22.699 ms 64.268 ms 
5 44.9,248.14 (44.9.248.13) 22.280 ms 12.199 ms *
```

Figure 119: 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 mm 8.777 mm 11.112 mm
2 44.9.248.1 (44.9.248.1) 11.981 mm 11.583 mm 16.831 mm
3 44.9.248.11 (44.9.248.1) 15.761 mm 12.445 mm 14.966 mm
4 44.9.248.15 (44.9.248.15) 1.966 mm 17.218 mm *
```

Figure 120: Server route to internet 2.0.0.1

# 9 IPv6 Connectivity

### 9.1 Ping

ping from client to each VLAN's interface on ALSW1 ping from server to each VLAN's interface on ALSW1

- 9.2 Telnet
- 9.3 SSH
- 9.4 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 121: 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 122: 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 123: 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 124: Server route to internet 2001:9999:2000::1