

Example: Building a VPLS From Router 1 to Router 3

This example illustrates how VPLS label blocks are allocated for a specific configuration. It is organized in the following sections:

- Requirements on page 1
- Overview and Topology on page 1
- Configuration on page 2

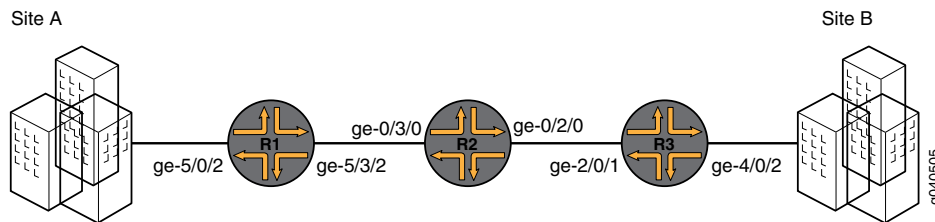
Requirements

This configuration example requires three Juniper Networks routers.

Overview and Topology

In the network shown in Figure 1 Router 1 is establishing a pseudowire to Router 3

Figure 1: Router 1 to Router 3 Topology



Each PE filters the VPLS NLRI contained in the BGP update messages based on route target communities. Those VPLS NLRI instances that match the route target (in this case 8717:2000:2:1) are imported for further processing. The NLRI for Router 1 and Router 3 is shown in Table 1.

Table 1: NLRI Exchange Between for Router 1 and Router 3

Router 1 NLRI Advertisement to Router 3	Router 3 NLRI Advertisement to Router 1
RD - 8717:1000	RD - 8717:1000
VE ID - 1	VE ID - 2
VE Block Offset - 1	VE Block Offset - 1
VE Block Size - 8	VE Block Size - 8
Label Base - 262161	Label Base - 262153

To set up a pseudowire to Router 3, Router 1 must select a label to use to send traffic to Router 3 and also select a label that it expects Router 3 to use to send traffic to itself. The site ID contained in the VPLS NLRI from Router 3 is 2.

Router 1 learns of the existence of site ID 2 in the same VPLS domain. Using the equation $VBO \leq \text{Local Site ID} < (VBO + VBS)$, Router 1 checks if the route advertised by site ID 2 fits in the label block and block offset that it previously advertised to Router 3. In this example it does fit, so the site ID 2 is mapped by the VPLS NLRI advertised by Router 1, and Router 1 is ready to set up a pseudowire to Router 3.

To select the label to reach Router 3, Router 1 looks at the label block advertised by Router 3 and performs a calculation. The calculation a PE router uses to check if its site ID is mapped in the label block from the remote peer is $VBO \leq \text{Local Site ID} < (VBO + VBS)$. So, Router 1 selects label $(262153 + (1 - 1)) = 262153$ to send traffic to Router 3. Using the same equation, Router 1 looks at its own label block that it advertised and selects label $(262161 + (2 - 1)) = 262162$ to receive traffic from Router 3. Router 1 programs its forwarding state such that any traffic destined to Router 3 carries the pseudowire label 262153 and any traffic coming from Router 3 is expected to have the pseudowire label 262162. This completes the operations on the VPLS NLRI received from Router 3. Router 1 now has a pseudowire set up to Router 3.

Router 3 operation is very similar to the Router 1 operation. Since the Router 3 site ID of 2 fits in the label block and block offset advertised by Router 1, Router 3 selects label $(262161 + (2 - 1)) = 262162$ to send traffic to Router 1. Router 3 looks at its own label block that it advertised and selects label $(262153 + (1 - 1)) = 262153$ to receive traffic from Router 1. This completes the creation of a pseudowire to Router 1.

By default, for VPLS operation JUNOS Software uses a virtual tunnel (VT) loopback interface to represent a pseudowire. This example uses a label-switched interface (LSI) instead of a VT interface because there is no change in the VPLS control plane operation. Thus, for an MX platform, if there is a tunnel physical interface card (PIC) configured, it is mandatory to include the `no-tunnel-services` statement at the `[edit routing-instances routing-instance-name protocols vpls]` hierarchy level.

Configuration

The following sections present the steps to configure and verify the example in Figure 1.

- Configuring Router 1 on page 2
- Configuring Router 3 on page 3
- Verifying the VPLS Label Allocations on page 4

Configuring Router 1

Step-by-Step Procedure

1. Configure Router 1. Create the `edut` routing instance. Specify the `vpls` instance type. Configure the route distinguisher and specify the value `8717:1000`. Configure the route target and specify the value `8717:100` Configure the VPLS

protocol. Specify 10 as the site range. Specify 1 as the site ID. Include the `no-tunnel-services` statement.

```
[edit routing-instances]
edut {
  instance-type vpls;
  interface ge-5/0/2.0;
  route-distinguisher 8717:1000;
  vrf-target target:8717:100;
  protocols {
    vpls {
      site-range 10;
      no-tunnel-services;
      site router-1 {
        site-identifier 1;
      }
    }
  }
}
```

Configuring Router 3

- Step-by-Step Procedure**
1. Configure Router 3. Create the `edut` routing instance. Specify the `vpls` instance type. Configure the route distinguisher and specify the value `8717:2000`. Configure the route target and specify the value `8717:200`. Configure the VPLS protocol. Specify 10 as the site range. Specify 2 as the site ID. Include the `no-tunnel-services` statement.

```
[edit routing-instances]
edut {
  instance-type vpls;
  interface ge-4/0/2.0;
  route-distinguisher 8717:2000;
  vrf-target target:8717:100;
  protocols {
    vpls {
      site-range 10;
      no-tunnel-services;
      site router-3 {
        site-identifier 2;
      }
    }
  }
}
```

Verifying the VPLS Label Allocations

- Step-by-Step Procedure**
1. As shown in the figure and the configuration, Site A is attached to Router 1. Site A is assigned a site ID of 1. Before Router 1 can announce its membership to VPLS edut using a BGP update message, Router 1 needs to allocate a default label block. In this example, the label base of the label block allocated by Router 1 is 262161. Since Router 1's site ID is 1, Router 1 associates the assigned label block with block offset of 1. The following messages are sent from Router 1 to Router 3 and displayed using the `monitor traffic interface interface-name` command:

```
user@Router1> monitor traffic interface ge-5/3/2

Jun 14 12:26:31.280818 BGP SEND 10.10.10.1+179 -> 10.10.10.3+53950
Jun 14 12:26:31.280824 BGP SEND message type 2 (Update) length 88
Jun 14 12:26:31.280828 BGP SEND flags 0x40 code Origin(1): IGP
Jun 14 12:26:31.280833 BGP SEND flags 0x40 code ASPath(2) length 0: <null>
Jun 14 12:26:31.280837 BGP SEND flags 0x40 code LocalPref(5): 100
Jun 14 12:26:31.280844 BGP SEND flags 0xc0 code Extended Communities(16):
  2:8717:100 800a:19:0:0
Jun 14 12:26:31.280848 BGP SEND flags 0x90 code MP_reach(14): AFI/SAFI
  25/65
Jun 14 12:26:31.280853 BGP SEND          nhop 10.10.10.1 len 4
Jun 14 12:26:31.280862 BGP SEND          8717:1000:1:1 (label base : 262161
  range : 8, ce id: 1, offset: 1)
Jun 14 12:26:31.405067 BGP RECV 10.10.10.3+53950 -> 10.10.10.1+179
Jun 14 12:26:31.405074 BGP RECV message type 2 (Update) length 88
Jun 14 12:26:31.405080 BGP RECV flags 0x40 code Origin(1): IGP
Jun 14 12:26:31.405085 BGP RECV flags 0x40 code ASPath(2) length 0: <null>
Jun 14 12:26:31.405089 BGP RECV flags 0x40 code LocalPref(5): 100
Jun 14 12:26:31.405096 BGP RECV flags 0xc0 code Extended Communities(16):
  2:8717:100 800a:19:0:0
Jun 14 12:26:31.405101 BGP RECV flags 0x90 code MP_reach(14): AFI/SAFI
  25/65
Jun 14 12:26:31.405106 BGP RECV          nhop 10.10.10.3 len 4
Jun 14 12:26:31.405116 BGP RECV          8717:2000:2:1 (label base : 262153
  range : 8, ce id: 2, offset: 1)
```

2. As shown in the figure and the configuration, Site B is attached to Router 3. Site B is assigned a site ID of 2. Before Router 3 can announce its membership to VPLS edut using a BGP update message, Router 3 assigns a default label block with the label base of 262153. The block offset for this label block is 1 because its own site ID of 2 fits in the block being advertised. The following messages are sent from Router 3 to Router 1 and displayed using the `monitor traffic interface interface-name` command:

```
user@Router3> monitor traffic interface ge-2/0/1

Jun 14 12:26:31.282008 BGP SEND 10.10.10.3+53950 -> 10.10.10.1+179
Jun 14 12:26:31.282018 BGP SEND message type 2 (Update) length 88
Jun 14 12:26:31.282026 BGP SEND flags 0x40 code Origin(1): IGP
Jun 14 12:26:31.282034 BGP SEND flags 0x40 code ASPath(2) length 0: <null>
Jun 14 12:26:31.282041 BGP SEND flags 0x40 code LocalPref(5): 100
Jun 14 12:26:31.282052 BGP SEND flags 0xc0 code Extended Communities(16):
  2:8717:100 800a:19:0:0
Jun 14 12:26:31.282078 BGP SEND flags 0x90 code MP_reach(14): AFI/SAFI
```

```

25/65
Jun 14 12:26:31.282088 BGP SEND          nhop 10.10.10.3 len 4
Jun 14 12:26:31.282102 BGP SEND          8717:2000:2:1 (Label base : 262153
range : 8, ce id: 2, offset: 1)

Jun 14 12:26:31.283395 BGP RECV 10.10.10.1+179 -> 10.10.10.3+53950
Jun 14 12:26:31.283405 BGP RECV message type 2 (Update) length 88
Jun 14 12:26:31.283412 BGP RECV flags 0x40 code Origin(1): IGP
Jun 14 12:26:31.283419 BGP RECV flags 0x40 code ASPath(2) length 0: <null>
Jun 14 12:26:31.283426 BGP RECV flags 0x40 code LocalPref(5): 100
Jun 14 12:26:31.283435 BGP RECV flags 0xc0 code Extended Communities(16):
2:8717:100 800a:19:0:0
Jun 14 12:26:31.283443 BGP RECV flags 0x90 code MP_reach(14): AFI/SAFI
25/65
Jun 14 12:26:31.283471 BGP RECV          nhop 10.10.10.1 len 4
Jun 14 12:26:31.283486 BGP RECV          8717:1000:1:1 (Label base : 262161
range : 8, ce id: 1, offset: 1)

```

- Verify the connection status messages for Router 1 using the `show vpls connections` command. Notice the base label is **262161**, the incoming label from Router 3 is **262162**, and the outgoing label to Router 3 is **262153**.

```

user@Router1> show vpls connections instance edut extensive

Instance: edut
  Local site: router-1 (1)
    Number of local interfaces: 1
    Number of local interfaces up: 1
    IRB interface present: no
    ge-5/0/2.0
    lsi.1049600          2          Intf - vpls edut local site 1 remote
site 2
  Label-base          Offset      Range      Preference
  262161              1          8          100
  connection-site          Type St      Time last up          # Up
trans
  2                      rmt Up      Jun 14 12:26:31 2009
  1
  Remote PE: 10.10.10.3, Negotiated control-word: No
  Incoming label: 262162, Outgoing label: 262153
  Local interface: lsi.1049600, Status: Up, Encapsulation: VPLS
  Description: Intf - vpls edut local site 1 remote site 2
  Connection History:
    Jun 14 12:26:31 2009 status update timer
    Jun 14 12:26:31 2009 loc intf up                      lsi.1049600
    Jun 14 12:26:31 2009 PE route changed
    Jun 14 12:26:31 2009 Out lbl Update                      262153
    Jun 14 12:26:31 2009 In lbl Update                      262162
    Jun 14 12:26:31 2009 loc intf down

```

Layer-2 VPN connections:

```

Legend for connection status (St)
EI -- encapsulation invalid      NC -- interface encapsulation not
CCC/TCC/VPLS
EM -- encapsulation mismatch     WE -- interface and instance encaps not
same
VC-Dn -- Virtual circuit down    NP -- interface hardware not present
CM -- control-word mismatch      <- -- only outbound connection is up
CN -- circuit not provisioned    >- -- only inbound connection is up

```

```

OR -- out of range                Up -- operational
OL -- no outgoing label           Dn -- down
LD -- local site signaled down    CF -- call admission control failure

RD -- remote site signaled down   SC -- local and remote site ID collision
LN -- local site not designated   LM -- local site ID not minimum designated
RN -- remote site not designated  RM -- remote site ID not minimum
designated
XX -- unknown connection status   IL -- no incoming label
MM -- MTU mismatch                MI -- Mesh-Group ID not available
BK -- Backup connection           ST -- Standby connection
PF -- Profile parse failure        PB -- Profile busy

Legend for interface status
Up -- operational
Dn -- down

```

- Verify the connection status messages for Router 3 using the `show vpls connections` command. Notice the base label is 262153, the incoming label from Router 1 is 262153, and the outgoing label to Router 1 is 262162.

```

user@Router3> show vpls connections instance edut extensive

Instance: edut
  Local site: router-3 (2)
    Number of local interfaces: 1
    Number of local interfaces up: 1
    IRB interface present: no
    ge-4/0/2.0
    lsi.1050368      1      Intf - vpls edut local site 2 remote
site 1
  Label-base      Offset      Range      Preference
  262153          1          8          100
  connection-site      Type      St      Time last up      # Up
trans
  1          rmt      Up      Jun 14 12:26:31 2009
  1
  Remote PE: 10.10.10.1, Negotiated control-word: No
  Incoming label: 262153, Outgoing label: 262162
  Local interface: lsi.1050368, Status: Up, Encapsulation: VPLS
  Description: Intf - vpls edut local site 2 remote site 1
  Connection History:
    Jun 14 12:26:31 2009 status update timer
    Jun 14 12:26:31 2009 loc intf up      lsi.1050368
    Jun 14 12:26:31 2009 PE route changed
    Jun 14 12:26:31 2009 Out lbl Update      262162
    Jun 14 12:26:31 2009 In lbl Update      262153
    Jun 14 12:26:31 2009 loc intf down

```

Layer-2 VPN connections:

```

Legend for connection status (St)
EI -- encapsulation invalid      NC -- interface encapsulation not
CCC/TCC/VPLS
EM -- encapsulation mismatch     WE -- interface and instance encaps not
same
VC-Dn -- Virtual circuit down    NP -- interface hardware not present
CM -- control-word mismatch      <- -- only outbound connection is up
CN -- circuit not provisioned    >- -- only inbound connection is up
OR -- out of range              Up -- operational

```

OL -- no outgoing label Dn -- down
LD -- local site signaled down CF -- call admission control failure

RD -- remote site signaled down SC -- local and remote site ID collision
LN -- local site not designated LM -- local site ID not minimum designated
RN -- remote site not designated RM -- remote site ID not minimum
designated

XX -- unknown connection status IL -- no incoming label
MM -- MTU mismatch MI -- Mesh-Group ID not available
BK -- Backup connection ST -- Standby connection
PF -- Profile parse failure PB -- Profile busy

Legend for interface status
Up -- operational
Dn -- down

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