Chapter 22
Layer 2 Circuit Configuration

To configure a Layer 2 circuit, include statements at the [edit protocols l2circuit] hierarchy level:

```
[edit]
protocols {
    l2circuit {
        neighbor address {
            interface interface-name {
                community community-name;
                (control-word | no-control-word);
                description text;
                virtual-circuit-id identifier;
            }
        }
    traceoptions {
        file filename <replace> <size size> <files number> <nostamp>;
        flag flag <flag-modifier> <disable>;
    }
}
```

The following sections describe how to configure Layer 2 circuits:

Configure the Neighbor and Interface

Each Layer 2 circuit is represented by the logical interface connecting the local PE router to the local CE router. All the Layer 2 circuits using a particular remote PE router designated for remote CE routers are listed under the neighbor statement (neighbor designates the PE router). Each neighbor is identified by its IP address and is usually the end-point destination for the LSP tunnel transporting the Layer 2 circuit.

Configure the Virtual Circuit ID

You configure a virtual circuit ID on each interface. Each virtual circuit ID uniquely identifies the Layer 2 circuit among all the Layer 2 circuits to a specific neighbor. The key to identifying a particular Layer 2 circuit on a PE router is the neighbor address and the virtual circuit ID. An LDP-FEC-to-label binding is associated with a Layer 2 circuit based on the virtual circuit ID in the forwarding equivalence class (FEC) and the neighbor that sent this binding. It enables the dissemination of the VPN label used for sending traffic on that Layer 2 circuit to the remote CE router.

Configure the virtual circuit ID at the [edit protocols l2circuit neighbor *address* interface *interface-name*] hierarchy level:

```
[edit protocols l2circuit neighbor address interface interface-name]
virtual-circuit-id identifier;
```

Configure the Interface Encapsulation Type

Both ends of a Layer 2 circuit must connect using the same Layer 2 encapsulation. The Layer 2 encapsulation type is carried in the LDP FEC. The encapsulation type received from an FEC is matched against the local encapsulation type of the Layer 2 circuit. The Layer 2 circuit will not work if the encapsulation types do not match.

The configuration for the encapsulation type on Layer 2 circuits is identical to the configuration for the CCC encapsulation type. For more information, see the *JUNOS Internet Software Configuration Guide: MPLS Applications*.

To configure the interface encapsulation for a Layer 2 circuit, include statements at the [edit interfaces] hierarchy level:

```
[edit]
interfaces {
   interface-name {
      encapsulation encapsulation-type;
      unit unit-number;
   }
}
```

You can configure ATM2 interfaces for Layer 2 circuits using Layer 2 circuit ATM cell relay mode and Layer 2 circuit AAL5 transport mode. The configuration statements are atm-l2circuit-mode cell and atm-l2circuit-mode aal5. For more information on these statements and configuring ATM2 interfaces, see the *JUNOS Internet Software Configuration Guide: Interfaces and Class of Service*.

The JUNOS implementation of sequence number processing for Layer 2 circuit ATM cell relay mode and Layer 2 circuit AAL5 mode differs from that described in the Internet draft *Frame Relay Encapsulation over Pseudo-Wires* (draft-martini-l2circuit-encap-mpls-04.txt).

The JUNOS implementation has these differences:

1. A packet with a sequence number of 0 is treated as out of sequence.
2. A packet that does not have the next incremental sequence number is considered out of sequence.
3. When out-of-sequence packets arrive, the expected sequence number for the neighbor is set to the sequence number in the Layer 2 circuit control word.

Configure LDP for Layer 2 Circuits

Use LDP as the signaling protocol to advertise ingress labels to the remote PE routers. When configured, LDP examines the Layer 2 circuit configuration and initiates extended neighbor discovery for all the Layer 2 circuit neighbors (for example, remote PEs). This is similar to how LDP works when tunneled over RSVP. You must run LDP on the lo0.0 interface for extended neighbor discovery to function correctly.

For detailed information about how to configure LDP, see the *JUNOS Internet Software Configuration Guide: MPLS Applications*.

Configure Layer 2 Circuit Policies

You can configure JUNOS routing policies to control the flow of packets over Layer 2 circuits. This capability allows you to provide different level of service over a set of equal-cost Layer 2 circuits. For example, you can configure a circuit for high-priority traffic, a circuit for average-priority traffic, and a circuit for low-priority traffic. By configuring Layer 2 circuit policies, you can ensure that higher-value traffic has a greater likelihood of reaching its destination.

To configure Layer 2 circuit policies, complete the steps in the following sections:

Configure the Layer 2 Circuit Community on page 370

Configure the Policy Statement for the Layer 2 Circuit Community on page 371

Verify the Layer 2 Circuit Policy Configuration on page 372

Configure the Layer 2 Circuit Community

To configure a community for Layer 2 circuits, include the community statement at the [edit policy-options] hierarchy level:

```
[edit policy-options]
community name {
   members [ community-ids ];
}
```

name identifies the community or communities.

community-ids identifies the type of community or extended community. A normal community uses the following community ID format:

as-number:*community-value*

as-number is the Autonomous System (AS) number of the community member.

community-value is the identifier of the community member. It can be a number from 0 through 65,535.

An extended community uses the following community ID format:

type:*administrator*:*assigned-number*

type is the type of target community. The target community identifies the route's destination.

administrator is either an AS number or an Internet Protocol Version 4 (IPv4) address prefix, depending on the type of community.

assigned-number identifies the local provider.

You need to associate the communities with the appropriate Layer 2 circuits. To associate a community with a Layer 2 circuit, include the community statement at the [edit protocols l2circuit neighbor *address* interface *interface-name*] hierarchy level:

```
[edit protocols l2circuit neighbor address]
interface interface-name {
   virtual-circuit-id number;
   community community-name;
}
```

Configure the Policy Statement for the Layer 2 Circuit Community

You need to configure a policy to send community traffic over a specific LSP. Include the policy-statement statement at the [edit policy-options] hierarchy level:

```
[edit policy-options]
policy-statement policy-name {
    term term-name {
        from community community-name;
        then {
            install-nexthop [ lsp lsp-name | lsp-regex lsp-regular-expression ];
            accept;
        }
    }
}
```

To assign traffic from a community to a specific LSP, include the install-nexthop statement with the lsp *lsp-name* option at the [edit policy-options *policy-statement* policy-name term *term-name* then] hierarchy level:

```
[edit policy-options policy-statement policy-name term term-name then]
install-nexthop lsp lsp-name;
accept;
```

You can also use a regular expression to select an LSP from a set of similarly named LSPs for the install-nexthop statement. To configure a regular expression, include the install-nexthop statement with the lsp-regex option at the [edit policy-options *policy-statement* policy-name term *term-name* then] hierarchy level:

```
[edit policy-options policy-statement policy-name term term-name then]
install-nexthop lsp-regex lsp-regular-expression;
accept;
```

The following example illustrates how you might configure a regular expression in a Layer 2 circuit policy. You create three LSPs to handle gold-tier traffic from a Layer 2 circuit. The LSPs are named alpha-gold, beta-gold, and delta-gold. You then include the the install-nexthop statement with the lsp-regex option with the LSP regular expression .*-gold at the [edit policy-options *policy-statement* policy-name term *term-name* then] hierarchy level:

```
[edit policy-options]
policy-statement gold-traffic {
    term to-gold-LSPs {
        from community gold;
        then {
            install-nexthop lsp-regex .*-gold;
            accept;
        }
    }
}
```

The community gold Layer 2 circuits can now use any of the -gold LSPs. Given equal utilization across the three -gold LSPs, LSP selection is made at random.

You need to apply the policy to the forwarding table. To apply a policy to the forwarding table, configure the export statement at the [edit routing-options forwarding-table] hierarchy level:

```
[edit routing-options forwarding-table]
export policy-name;
```

Verify the Layer 2 Circuit Policy Configuration

To verify you have configured a policy for the Layer 2 circuit, you can issue the show route table mpls detail command. It should display the community for ingress routes that corresponds to the Layer 2 circuits as shown by the following example:

```
user@host> show route table mpls detail
so-1/0/1.0 (1 entry, 1 announced)
    *L2VPN  Preference: 7
        Next hop: via so-1/0/0.0 weight 1, selected
        Label-switched-path to-community-gold
        Label operation: Push 100000 Offset: -4
        Next hop: via so-1/0/0.0 weight 1
        Label-switched-path to-community-silver
        Label operation: Push 100000 Offset: -4
        Protocol next hop: 10.255.245.45
        Push 100000 Offset: -4
        Indirect next hop: 85333f0 314
        State: <Active Int>
        Local AS:   100
        Age: 22
        Task: Common L2 VC
        Announcement bits (2): 0-KRT 1-Common L2 VC
        AS path: I
        Communities: 100:1
```

For more information on how to configure routing policies, see the *JUNOS Internet Software Configuration Guide: Policy Framework*.

Configure the Control Word for Frame Relay Interfaces

On interfaces with Frame Relay CCC encapsulation, you can configure Frame Relay control bit translation to support Frame Relay services over IP and MPLS backbones using CCC, Layer 2 VPNs, and Layer 2 circuits. When you configure translation of Frame Relay control bits, the bits are mapped into the Layer 2 circuit control word and preserved across the IP or MPLS backbone.

For information on how to configure the control bits, see the *JUNOS Internet Software Configuration Guide: Network Interfaces and Class of Service*.

Disable the Control Word for Layer 2 Circuits

The emulated VC encapsulation for Layer 2 circuits is accomplished by adding a 4-byte control word between the Layer 2 protocol data unit (PDU) being transported and the VC label that is used for demultiplexing. Various networking formats (ATM, Frame Relay, Ethernet, and so on) use the control word in a variety of ways.

The JUNOS software supports the control word for Frame Relay. However, it does not support the control word for any other networking format, meaning that it is not fully compliant with the Internet draft in cases where the control word is mandatory. To be minimally compliant with the Internet draft, JUNOS supports a null control word (a control word of all zeros). If JUNOS receives a packet with a control word attached, the control word is discarded before the packet is forwarded to its destination.

JUNOS can typically determine whether a neighboring router supports the control word or not. However, if you want to explicitly disable its use on a specific interface, include the no-control-word statement at the [edit protocols l2circuit neighbor *address* interface *interface-name*] hierarchy level:

```
[edit protocols l2circuit neighbor address interface interface-name]
no-control-word;
```

This statement might be required for Layer 2 VPN configurations. For more information, see "Disable the Control Word for Layer 2 VPNs" on page 48.

Trace Layer 2 Circuit Creation and Changes

To trace the creation of and changes to Layer 2 circuits, you can specify options in the traceoptions statement at the [edit protocols l2circuit] hierarchy level:

```
[edit protocols l2circuit]
traceoptions {
   file filename <replace> <size size> <files number> <nostamp> <no-world-readable>
<world-readable>;
   flag flag <flag-modifier> <disable>;
}
```

The following tracing flags display the operations associated with Layer 2 circuits:

connections—Layer 2 circuit connections (events and state changes)

error—Error conditions

FEC—Layer 2 circuit advertisements received or sent using LDP

topology—Layer 2 circuit topology changes caused by reconfiguration or advertisements received from other PE routers