

# Chapter 6

## Configure Static LSPs

To configure static LSPs, configure the ingress router and each router along the path up to and including the egress router.

For the ingress router, configure which packets to tag (based on the packet's IP destination address), the next router in the LSP, and the tag to apply to the packet. Manually assigned labels can have values in the range 16 through 1023. Optionally, you can apply preference and CoS values to the packets.

For the intermediate routers in the path, configure the next router in the path and the tag to apply to the packet. Again, you can optionally apply preference and CoS values to the packets.

For the egress router, you generally just remove the label and continue forwarding the packet to the next hop. However, if the previous router removed the label, the egress router examines the packet's IP header and forwards the packet toward its IP destination.

To configure static MPLS, perform the following tasks:

Configure the Ingress Router for Static MPLS on page 69

Configure the Intermediate and Egress Routers for Static MPLS on page 72

### Configure the Ingress Router for Static MPLS

The ingress router checks the IP address in the incoming packet's destination address field and, if it finds a match in the routing table, applies the label associated with that address to the packets. The label has forwarding information associated with it, including the address of the next-hop router, and the route preference and CoS values.

To configure static LSPs on the ingress router, include the `static-path` statement at the [edit protocols mpls] hierarchy level:

```
[edit protocols mpls]
static-path inet {
  prefix {
    nexthop (address | interface-name | address/interface-name) # required
    push out-label; # required
    class-of-service value; # optional
    preference preference; # optional
  }
}
```

Each static-path statement consists of the following parts:

Criteria to use to analyze an incoming packet:

The *inet* option creates an LSP that handles IPv4 packets. All static MPLS routes created using the *inet* option are installed in the default IPv4 routing table (*inet.0*) and the creating protocol is identified as *static*. This is no different than creating static IPv4 routes at the [*edit routing-options static*] hierarchy level.

In the *prefix* option, you configure the IP destination address to check when analyzing incoming packets. If the address matches, the specified label, *out-label*, is assigned to the packet and the packet enters an LSP. Each *prefix* that you specify is installed as a static route in the routing table. You can specify one or more *prefix* statements at the [*edit protocols mpls static-path*] hierarchy level.

The *nexthop* statement supplies the IP address of the next hop to the destination. You can specify this as the IP address of the next hop, the interface name (for point-to-point interfaces only), or as *address/interface-name* to specify an IP address on an operational interface. When the next hop is on a directly attached interface, the route is installed in the routing table. You cannot configure a LAN or point-to-multipoint (NMBA) interface as a next-hop interface.

Label properties applied to the packet in the LSP:

Label to apply to the packet (push *out-label*)—The label is a 20-bit integer, so it can be a number in the range 0 through 1048575 ( $2^{20} - 1$ ). Dynamic MPLS assigns the labels 1024 through 1048575, so if your network uses both static and dynamic MPLS, we recommend that you use labels 16 through 1023 only for static MPLS. (Labels 0 through 15 are reserved.)

Preference of this route (preference *preference*).

CoS value to apply to the packet (class-of-service *cos-value*).

To determine whether a static ingress route is installed, use the command `show route table inet.0 protocol static`. The following is a sample output. The *push* keyword identifies that a label is to be added in front of IP packet.

```
10.0.0.0/8          *[Static/5] 00:01:48
                    > to 11.1.1.1 via so-0/0/0, push 123
```

## Example: Configure the Ingress Router

Configure the ingress router for a static LSP that consists of three routers (see Figure 16). For packets addressed to 10.0.0.0/8, assign label 123 and transmit them to the next-hop router at 11.1.1.1:

```

interfaces {
  so-0/0/0 {
    unit 0 {
      family mpls;
    }
  }
}
protocols {
  mpls {
    static-path inet {
      10.0.0.0/8 {
        nexthop 11.1.1.1;
        push 123;
      }
    }
  }
  interface so-0/0/0;
}

```

To determine whether the static ingress route is installed, use the following command:

```
user@host> show route table inet.0 protocol static
```

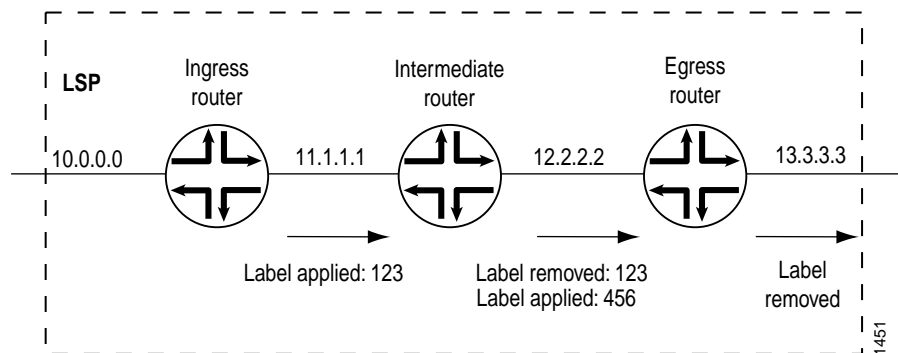
The following is a sample of the output. The push 0000123 keyword identifies the route.

```

10.0.0.0/8          *[Static/5] 00:01:48
                    > to 11.1.1.1 via so-0/0/0, push 123

```

Figure 16: Static MPLS Configuration



## Configure the Intermediate and Egress Routers for Static MPLS

Intermediate and egress routers both perform similar functions—they modify the label that has been applied to a packet. An intermediate router can change the label. An egress router removes the label (if the packet still contains a label) and continues forwarding the packet to its destination.

To configure static MPLS on intermediate and egress routers, include the interface statement at the [edit protocols mpls] hierarchy level:

```
[edit protocols mpls]
interface interface-name {
  label-map in-label {
    (nexthop <address; interface-name>) | (reject | discard); # Required
    (pop | (swap <out-label>)); # Required
    class-of-service value; # Optional
    preference preference; # Optional
    type type; # Optional
  }
}
```

Each statement within the interface statement consists of the following parts:

Criteria to use to analyze the labeled packet. Two criteria are used: the interface on which the packet was received (specified in the opening interface statement itself) and the packet's label (specified in the label-map statement).

The `nexthop` statement supplies the IP address of the next hop to the destination, specified as the IP address of the next hop, or the interface name (for point-to-point interfaces only), or `address/interface-name` to specify an IP address on an operational interface. When the specified next hop is on a directly attached interface, this route is installed in the routing table. You cannot configure a LAN or point-to-multipoint (NBMA) interface as a nexthop interface operation to perform on the labeled packet:

For egress routers, remove the packet's label altogether (`pop`).

For intermediate routers only, exchange the label for another label (`swap out-label`).

Discard the packet, sending an ICMP unreachable message to the packet's originator (`reject`).

Discard the packet without sending an ICMP unreachable message to the packet's originator (`discard`).

Label properties to apply to the packet, all of which are optional:

Type of traffic in the LSP. Currently, the type can be IPv4 only (type `inet`), which is the default.

Preference value for this route (preference `preference`).

For intermediate routers only, the CoS value to apply to the packet (class-of-service `cos-value`).

You can specify any number of label-map statements at the [edit protocols mpls interface `interface-name`] hierarchy level.

The static routes are installed in the default MPLS routing table, mpls.0, and the creating protocol is identified as static. To verify a static route is properly installed, use the command `show route table mpls.0 protocol static`. The following is an example of the output:

```
123                               *[Static/5] 00:00:38
                                   > to 12.2.2.2 via so-5/0/0.0, swap 456
```

### **Example: Configure an Intermediate Router**

For packets labeled 123 arriving on interface so-0/0/0, assign the label 456 and transmit them to the next-hop router at 12.2.2.2:

```
[edit]
interfaces {
  so-0/0/0 {
    unit 0 {
      family mpls;
    }
  }
}
protocols {
  mpls {
    interface so-0/0/0 {
      label-map 123 {
        nexthop 12.2.2.2;
        swap 456;
      }
    }
  }
}
```

To determine whether the static intermediate route is installed, use the following command:

```
user@host> show route table mpls.0 protocol static
```

The following is a sample of the output. The swap 000456 keyword identifies the route.

```
123                               *[Static/5] 00:01:48
                                   > to 12.2.2.2 via so-0/0/0, swap 456
```

**Example: Configure an Egress Router**

For packets labeled 456 arriving on interface so-0/0/0, remove the label and transmit the packets to the next-hop router at 13.3.3.3:

```
[edit]
interfaces {
  so-0/0/0 {
    unit 0 {
      family mpls;
    }
  }
}
protocols {
  mpls {
    interface so-0/0/0 {
      label-map 456 {
        nexthop 13.3.3.3;
        pop;
      }
    }
  }
}
```

To determine whether the static egress route is installed, use the following command:

```
user@host> show route table mpls.0 protocol static
```

The following is a sample of the output. The pop keyword identifies the egress route.

```
456                               *[Static/5] 00:01:48
                                   > to 13.3.3.3 via so-0/0/0, pop
```