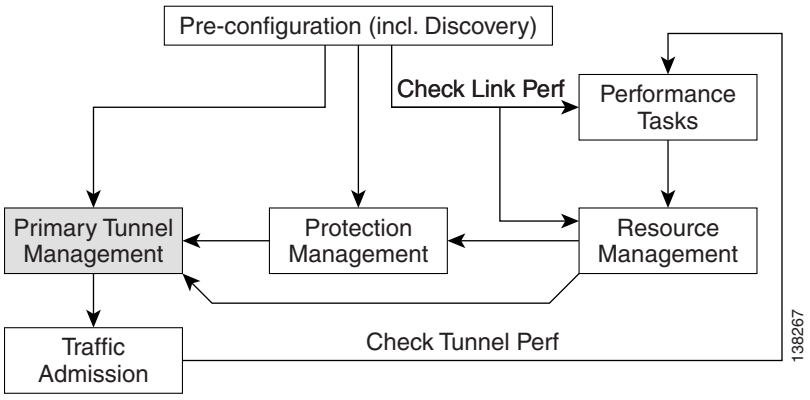
Basic Tunnel Management



This chapter describes the processes involved in creating primary and backup tunnels with ISC TEM. To create a tunnel, certain steps must first be performed as described in previous chapters.

This chapter includes the following sections:

Overview

Primary tunnels are characterized by carrying traffic during normal operation. They have a prioritized list of possible paths, by which traffic can be routed. At any one time, the highest priority path available will be used to route traffic. If this fails, traffic will normally be re-routed via the next available path until a higher priority path becomes available again.

Prior to setting up the tunnel, a TE policy governing the traffic must be defined. An explicit path is created to establish the route and, in the case of a primary tunnel, it is created as either a managed or an unmanaged tunnel.

The purpose of a backup tunnel is to carry FRR protected traffic around a failed element until the routing in the network has reconverged. It is intended to protect traffic travelling along primary tunnels. There can be many backup tunnels protecting the same traffic through the use of load balancing.

If the network fails to reconverge, the backup tunnel will remain in place.

The difference between managed and unmanaged tunnels is described in Managed/Unmanaged Primary Tunnels, page 1-3.

The concept of bandwidth pools from which tunnels reserve bandwidth is important to understand. This is described in Bandwidth Pools, page 1-5.

Create TE Policy

To create a primary tunnel, each primary tunnel must be associated with a policy. A policy can be used by multiple tunnels.

For backup tunnels, this step is not necessary. In this case, proceed to Create Explicit Path, page 5-4.

For other TE policy management operations, see TE Policies, page 9-2.

The TE policy is a set of rules governing the TE network and defines the Class-of-Service (for example, gold, silver, bronze) for primary tunnel traffic.

ISC TEM has a notion of **Managed** and **Unmanaged** policies. **Managed** policies have setup/hold priorities of 0/0 and can have additional pathing constraints such as protection level and max delay. Tunnels with **Unmanaged** policies are provisioned by the system, but the system only tracks the deployment, not the operation of the tunnel. **Unmanaged** policies cannot have a setup/hold priority of zero.

Policies are managed under **Policy Manager** in **Service Design**. For a more detailed explanation of the **Policy Manager** GUI, see TE Policies, page 9-2.

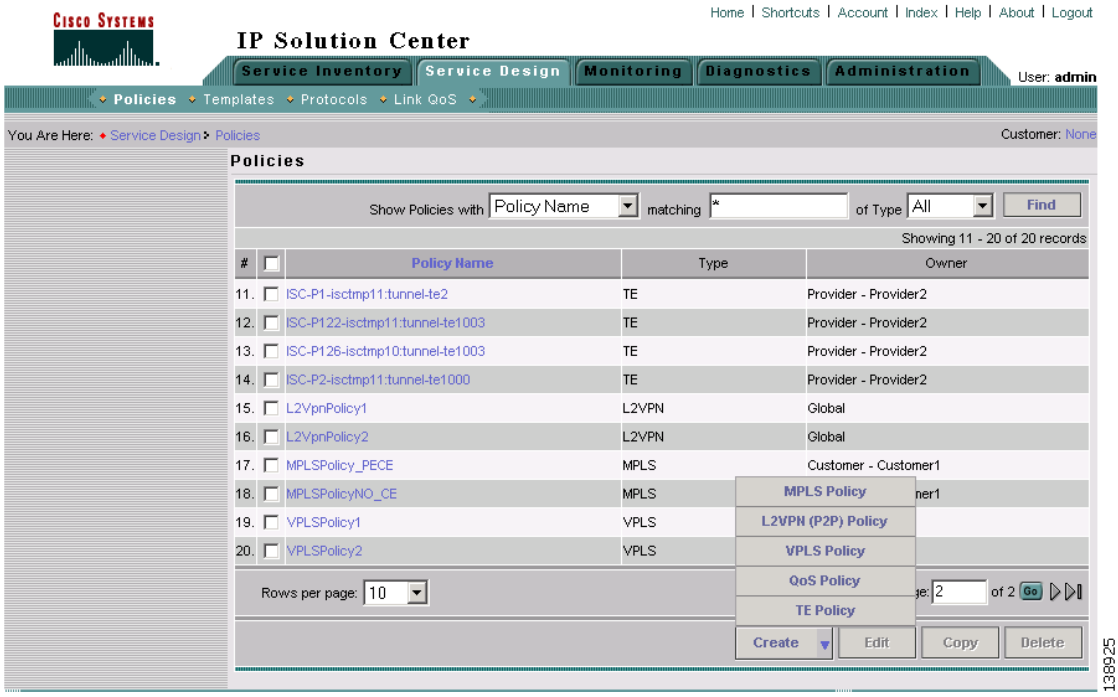
To create a TE policy, use the following steps:

Step 1 Navigate to **Service Design > Policy Manager**.

Step 2 Click the **Policy Manager** icon.

The Policies window in Figure 5-1 appears.

Figure 5-1 Policies Window

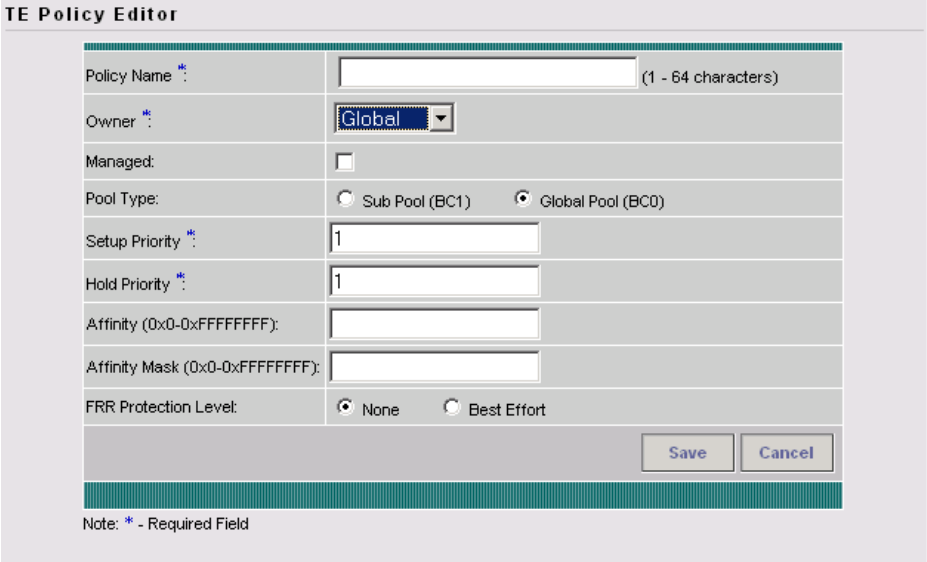


Step 3 Click **Create** and select **TE Policy** to set up a new TE policy.

To edit an existing policy, select the policy that you want to modify and click **Edit**. The TE Policy Editor window in Figure 5-2 appears.

Note A policy that is being used by a tunnel cannot be modified.

Figure 5-2 TE Policy Editor



For an explanation of the various window elements, see TE Policies, page 9-2.

Step 4 Fill in the required fields marked with an asterisk (*) and any optional fields.

If you intend to use the TE policy for managed tunnels, make sure to check the **Managed** check box. When setting up a policy for a managed tunnel, the **Setup** and **Hold** priorities are automatically set to zero (highest priority). In the case of a policy for an unmanaged tunnel, you can specify the desired **Setup** and **Hold** priority settings.

Step 5 Click **Save**.

Create Explicit Path

This section describes how to create a TE explicit path. For other TE explicit path operations, see TE Explicit Paths, page A-33.

Paths are defined between source and destination routers, possibly with one or more hops in between. Paths are used for primary and backup tunnels in the explicit path option(s).

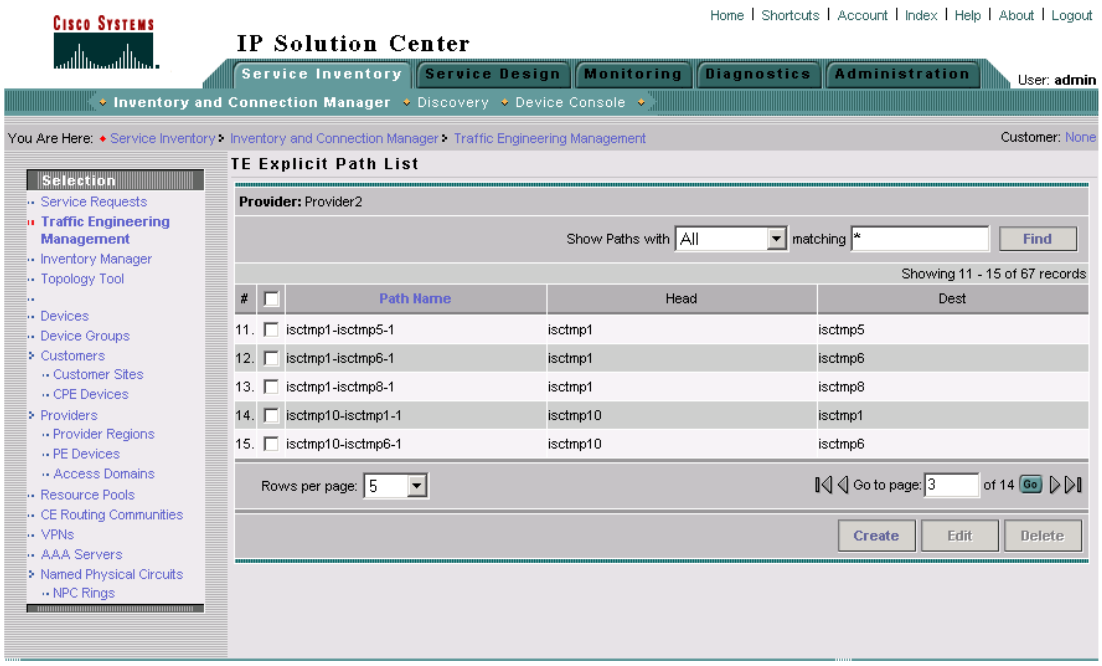
If you intend to create an explicit path for managed tunnels, the path should not contain any non-TE enabled interfaces. Paths with non-TE enabled interfaces will be filtered out by the tunnel path chooser of the tunnel editor for managed tunnels and backup tunnels (not unmanaged tunnels).

To create or edit an explicit path, use the following steps:

Step 1 Navigate to **Service Inventory > Inventory and Connection Manager > Traffic Engineering Management**.

Step 2 Click **TE Explicit Paths**. The TE Explicit Path List window appears. (see Figure 5-3)

Figure 5-3 TE Explicit Path List



For an explanation of the various window elements, see Create/Edit Explicit Path, page A-34.

Step 3 To create an explicit path in the **TE Explicit Path List**, click **Create**. The New TE Explicit Path window in Figure 5-4 appears.

To edit an explicit path in the explicit path list, select the explicit path that you want to modify and click **Edit**. The TE Explicit Path Editor window in Figure 5-5 appears.

Note An explicit path that is being used by a tunnel cannot be modified. However, use Edit to view the path.

Figure 5-4 New TE Explicit Path

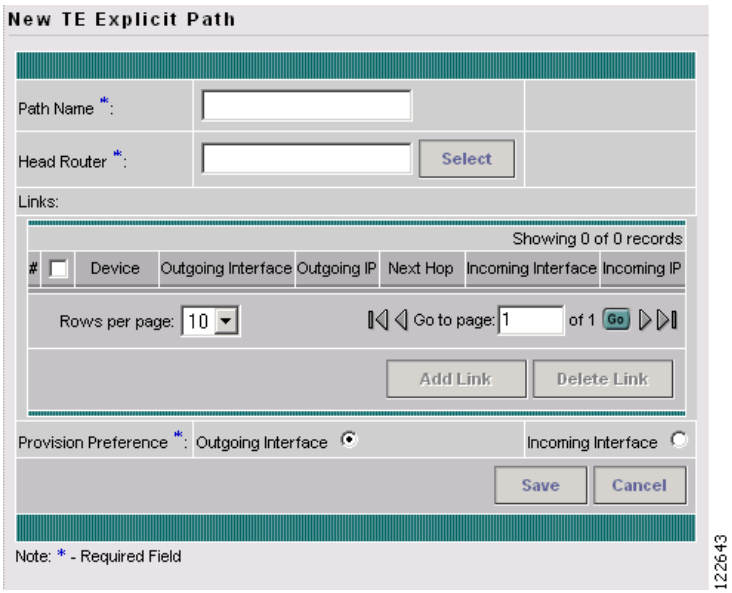
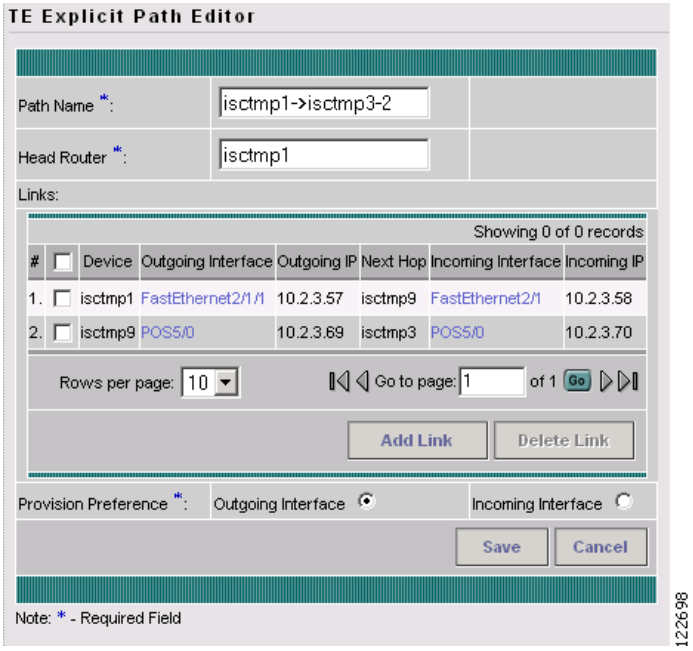


Figure 5-5 TE Explicit Path Editor



For an explanation of the various window elements, see Create/Edit Explicit Path, page A-34 and Edit TE SR (Primary or Backup), page A-52.

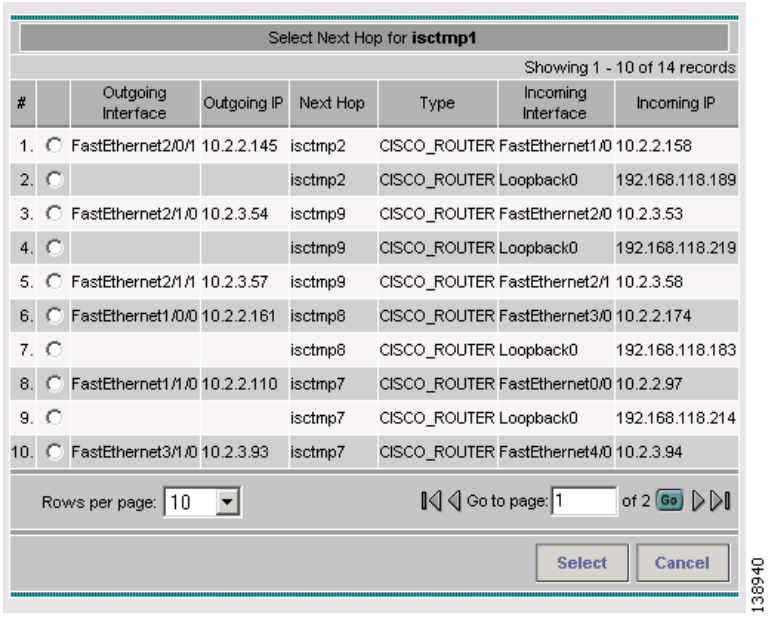
Note If a path is used by any tunnel, no modifications are possible. The **Outgoing Interface** and **Incoming Interface** links are not selectable and the Provision Preference line and the **Add Link**, **Delete Link**, and **Save** buttons disappear.

Step 4 Specify a path name and select a head router.

Step 5 Click **Add Link**. A blank line is added to the hop list table.

Step 6 Now an outgoing or an incoming interface must be selected for the head router. Under **Incoming Interface** or **Outgoing Interface**, click **Add Interface**. The Select Next Hop window in Figure 5-6 appears.

Figure 5-6 Select Next Hop



The next hop list contains all the possible next hops of the router, excluding the ones already included in the explicit paths (to avoid path loops).

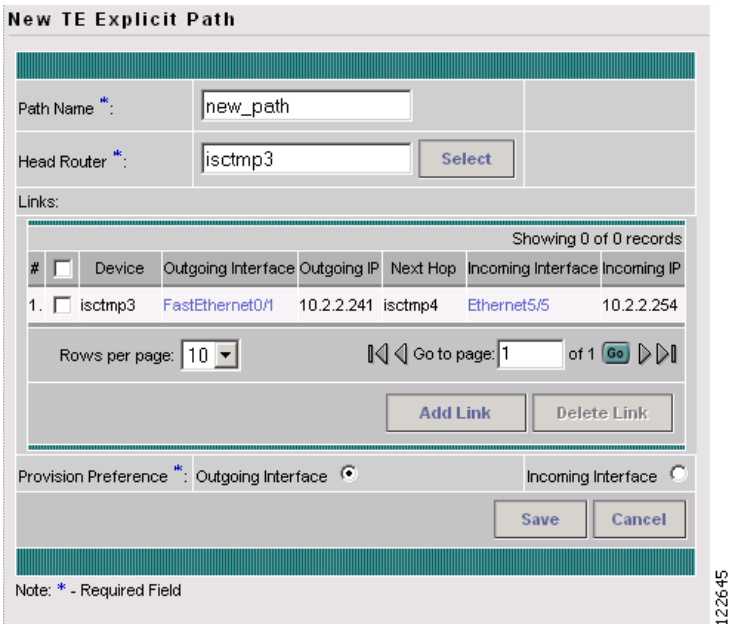
The next hop list contains TE interfaces and at most one non-TE interface for each router (if the loopback interface is used as the MPLS TE ID of the device). For TE interfaces, the **Outgoing Interface** and **Outgoing IP** columns are populated by the application.

Note If a non-TE interface is selected, **Provision Preference** (Figure 5-4) is set to **Incoming Interface**. The provision preference cannot be set manually.

Step 7 Select an interface and click **Select**. The corresponding link information is added to the new explicit path in the **Links** table as shown in Figure 5-7.

The incoming interface field is automatically populated.

Figure 5-7 New Link for TE Explicit Path



Step 8 To add another link, click **Add Link** again.

Step 9 To modify an existing link, click the link in the **Outgoing Interface** or the **Incoming Interface** columns, make the desired changes, and click **Select**.

Step 10 Optionally, select **Provision Preference** by clicking either the **Outgoing Interface** or the **Incoming Interface** radio button.

Note If you try to select the **Provision Preference** before adding a link when non-TE interfaces are present, the **Add Link** process overrides the **Provision Preference** and sets it to incoming.

Step 11 Click **Save** to keep the created TE explicit path or click **Cancel** to quit without saving.

Primary Tunnel Operations

ISC TEM allows you to perform a number of primary tunnel operations, which are described in the following.

Create Primary Tunnel

After a TE Policy and an explicit path have been set up, a primary tunnel can be created. There are two types of primary tunnels:

- Managed Primary Tunnels
- Unmanaged Primary Tunnels

Below, the GUI flow is described for creating unmanaged primary tunnels. It is very similar for managed primary tunnels and the few differences that exist are described in Managed/Unmanaged Primary Tunnels, page 1-3 and Create Unmanaged TE Tunnel, page A-59.

To create a managed or an unmanaged primary tunnel, use the following steps:

Step 1 Navigate to **Service Inventory > Inventory and Connection Manager > Traffic Engineering Management**.

Step 2 Click **Create Managed TE Tunnel**. The TE Managed Primary Tunnels SR window in Figure 5-8 appears.

or

Click **Create Unmanaged TE Tunnel**. The TE Unmanaged Primary Tunnels SR window in Figure 5-9 appears.

Figure 5-8 TE Managed Primary Tunnels SR

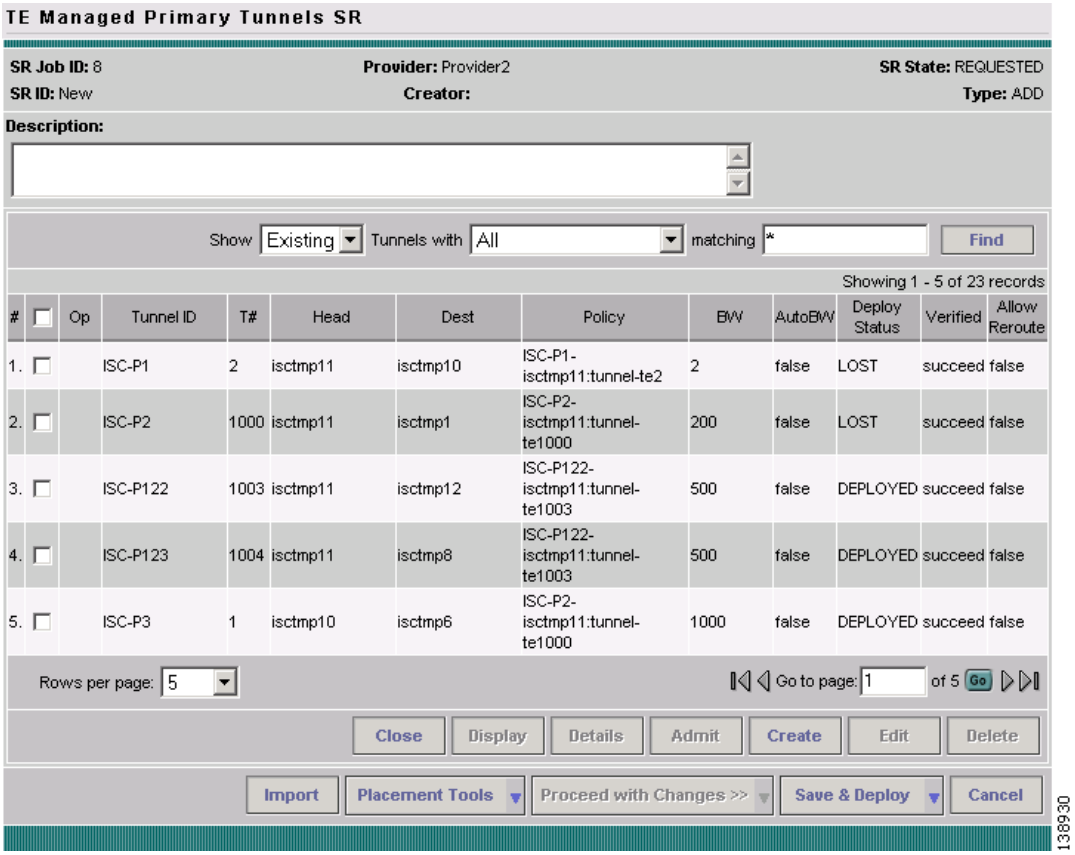
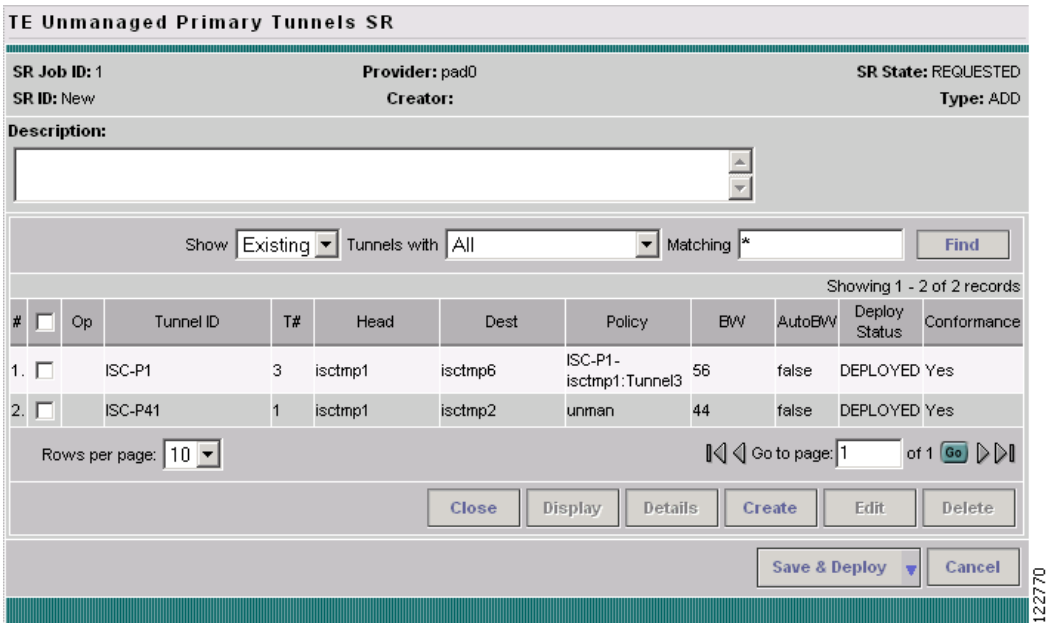


Figure 5-9 TE Unmanaged Primary Tunnels SR



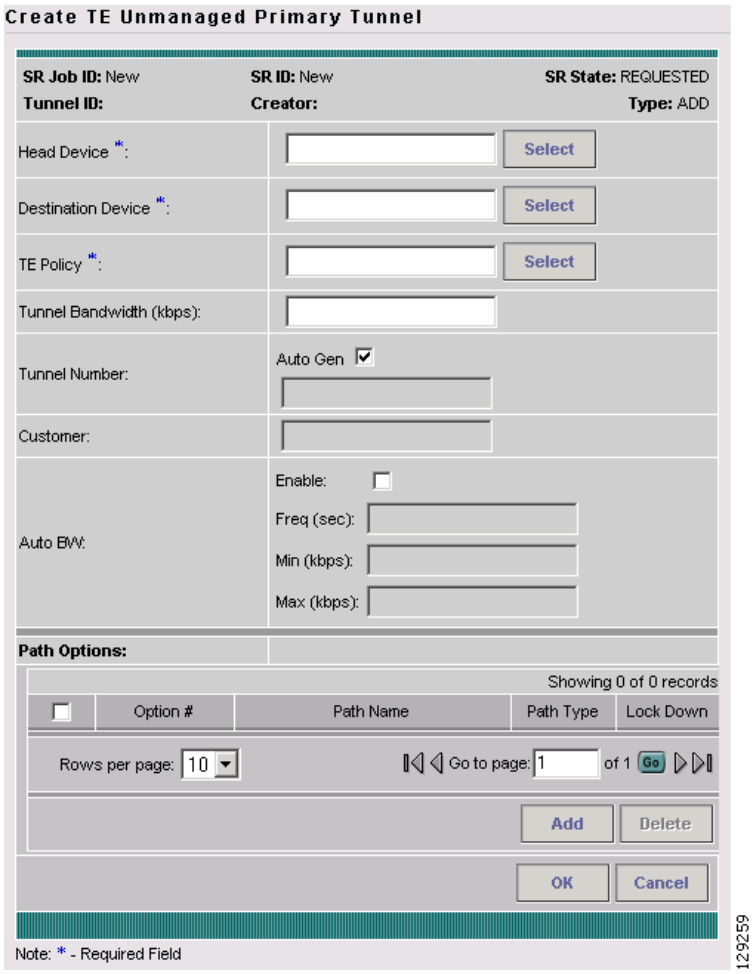
For an explanation of the various window elements, see Create Managed TE Tunnel, page A-41.

Note that for the unmanaged tunnels list, the last two columns in the managed tunnels list in Figure 5-8 (Verified and Allow Reroute) are replaced by the Conformance column.

In this example, we will create an unmanaged tunnel.

Step 3 Click **Create**. The Create TE Unmanaged Primary Tunnel window in Figure 5-10 appears.

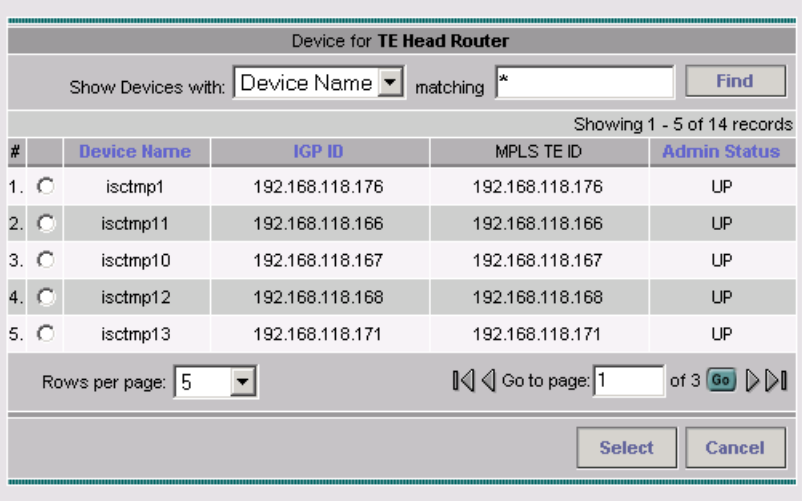
Figure 5-10 Create TE Unmanaged Primary Tunnel



For an explanation of the various window elements, see Create Managed TE Tunnel, page A-41 and Create Unmanaged TE Tunnel, page A-59.

Step 4 To select a **Head Device** in the Create TE Unmanaged Primary Tunnel window, click the corresponding **Select** button to open the Select Device for TE Head Router window shown in Figure 5-11.

Figure 5-11 Select Device for TE Head Router

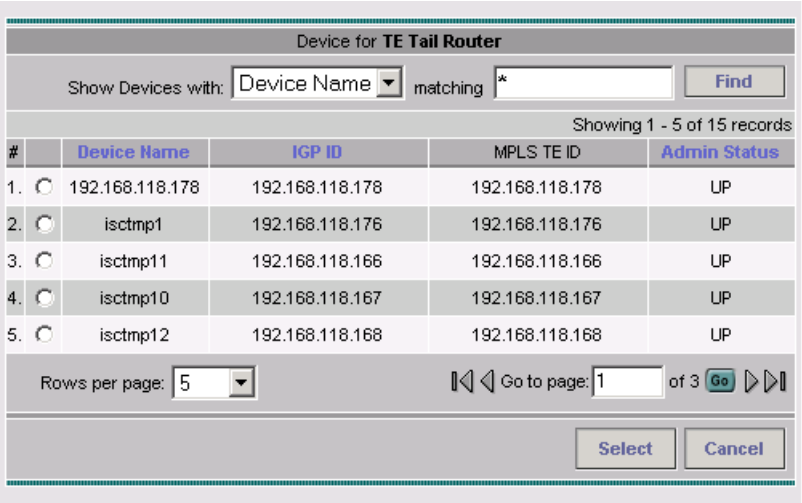


For an explanation of the various window elements, see Create Managed TE Tunnel, page A-41 and Create Unmanaged TE Tunnel, page A-59.

Step 5 Select a device name and click **Select**. The Select Device for TE Head Router window closes and the prompt returns to the Create TE Unmanaged Primary Tunnel window.

Step 6 To select a **Destination Device** in the Create TE Unmanaged Primary Tunnel window, click the corresponding **Select** button to open the Select Device for TE Tail Router window shown in Figure 5-12.

Figure 5-12 Select Device for TE Tail Router



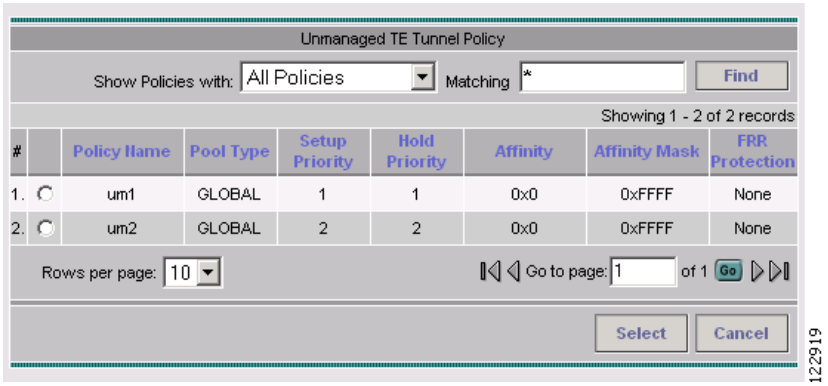
For an explanation of the various window elements, see Create Managed TE Tunnel, page A-41 and Create Unmanaged TE Tunnel, page A-59.

Step 7 Select a device name and click **Select**. The Select Device for TE Tail Router window closes and the prompt returns to the Create TE Unmanaged Primary Tunnel window.

Step 8 To select a **Tunnel Policy** in the Create TE Unmanaged Primary Tunnel window, click the corresponding **Select** button to open the Select Unmanaged TE Tunnel Policy window shown in Figure 5-13.

Note To create a managed tunnel, make sure that one or more managed tunnel policies are available. If that is not the case, go to **Policy Manager** (see Create TE Policy, page 5-2) and make sure to check the **Managed** check box.

Figure 5-13 Select Unmanaged TE Tunnel Policy



For an explanation of the various window elements, see Create Managed TE Tunnel, page A-41 and Create Unmanaged TE Tunnel, page A-59.

Step 9 Select a policy and click the **Select** button. This brings you back to the tunnel editor.

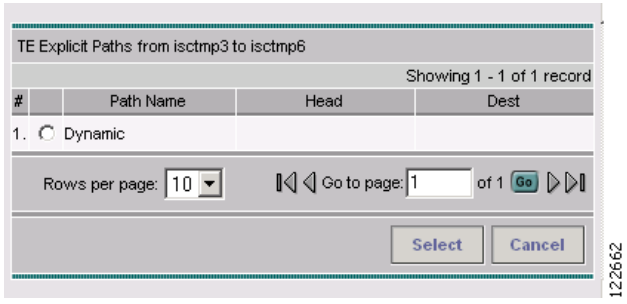
Step 10 Click **Add** to set up path options for the tunnel. The Select TE Explicit Path window in Figure 5-14 appears.

The **Path Options** section provides two path types, **Explicit Path** and **Dynamic Path**.

An **Explicit Path** is a fixed path from a specific head to a specific destination device.

A **Dynamic Path** is provisioned by allowing the head router to find a path. The **dynamic** keyword is provisioned to the routers.

Figure 5-14 Select TE Explicit Path



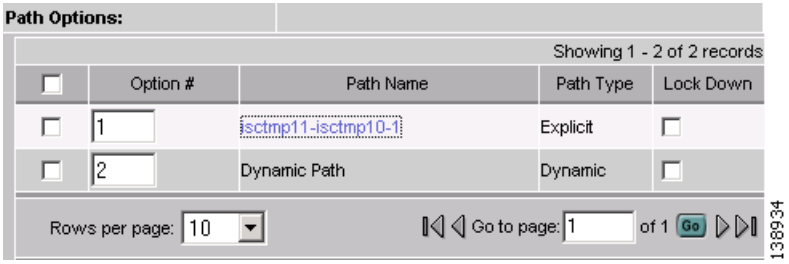
For unmanaged tunnels, paths can be either explicit or dynamic.

Step 11 Select the desired TE Explicit Path unless you prefer dynamic path only. If none is available, you can set one up first. To do so, see Create Explicit Path, page 5-4.

Click **Select**.

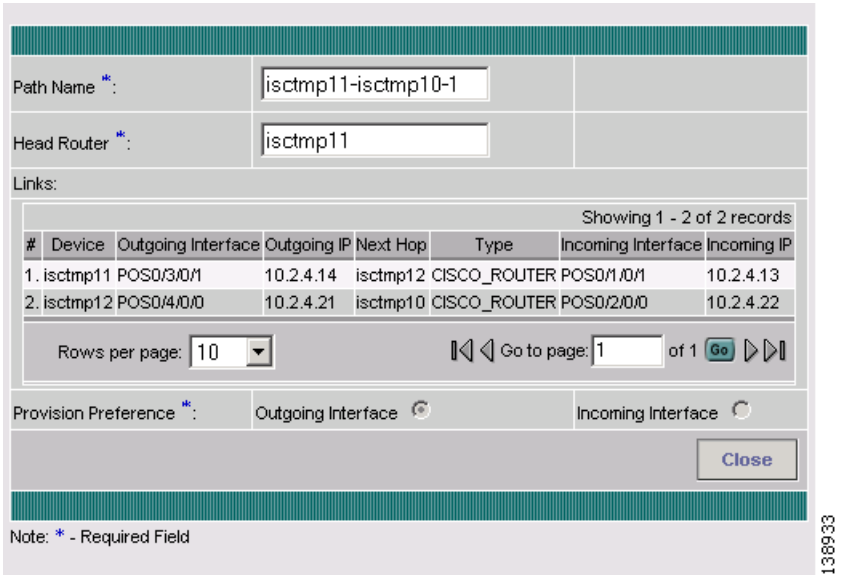
The selected path appears in the **Path Options** section of the create window as shown in Figure 5-15.

Figure 5-15 Path Options



For explicit paths (<head_device>-<destination_device>), you can click the path name to open the non-editable Explicit Path Viewer as shown in Figure 5-16.

Figure 5-16 TE Explicit Path Viewer



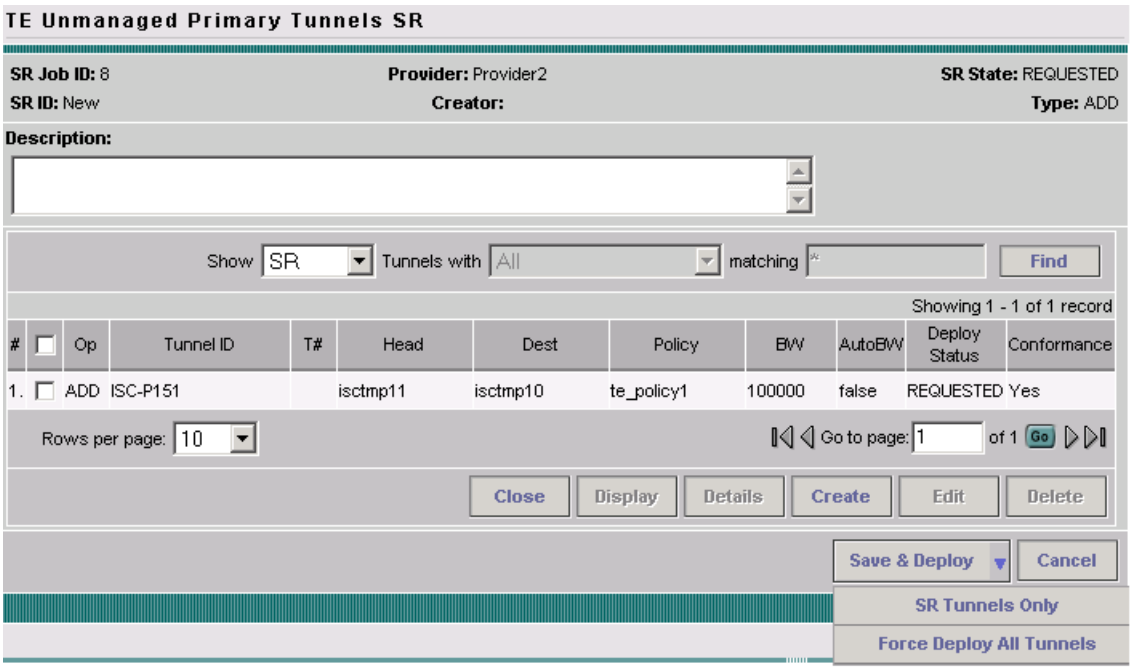
For an explanation of the various window elements, see Create/Edit Explicit Path, page A-34.

Step 12 In the Create TE Unmanaged Tunnel window, click **OK** to accept the entered tunnel information or click **Cancel** to quit and return to the TE Unmanaged Primary Tunnels SR window.

Step 13 The TE Unmanaged Primary Tunnel SR window appears with the newly created SR (Figure 5-17) with the Op field set to ADD.

Note The added tunnel can be reverted from the ADD state to its original state by selecting it and clicking **Delete**. The tunnel is removed from the tunnel list.

Figure 5-17 Service Requests - Unmanaged Tunnels



Step 14 In the TE Unmanaged Primary Tunnel window, click **Save & Deploy** (see Note on page 15) to either deploy the new tunnel SR to the network or force deploy all tunnels, or you can create or edit more primary tunnels and then save and deploy all changes.

When you click Save & Deploy, a background process is started. To avoid a potential conflict with another deployment, wait until the SR has completed the Requested and Pending states before deploying another SR with Save & Deploy. To see the state of deployment, go to the Service Requests window at **Inventory and Connection Manager > Service Requests** or open **Monitoring > Task Manager**.

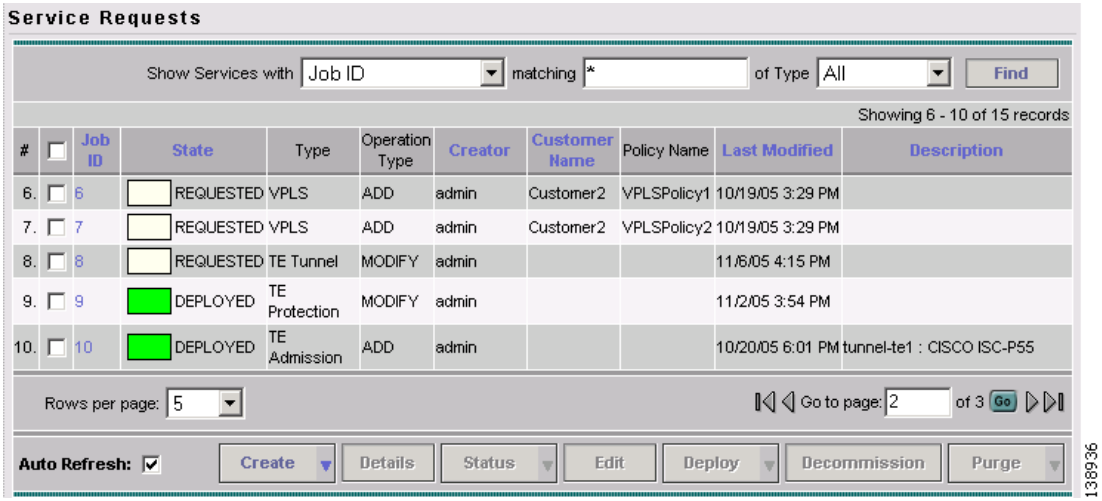
For a further description of save and deploy options, see Create Managed TE Tunnel, page A-41.

Note For managed tunnels, you cannot deploy the service request until you have used the **Proceed with Changes >>** button to perform either Tunnel Placement, Tunnel Audit, or Tunnel Repair (see Chapter 6, "Advanced Primary Tunnel Management").

Note With the exception of TE Traffic Admission SRs, TE SRs are always deployed immediately from the specific TE SR window, not from **Inventory and Connection Manager > Service Requests**.

Step 15 The Service Requests window (**Service Inventory > Inventory and Connection Manager > Service Requests)** appears (see Figure 5-18) and displays the state of the deployed SR (first REQUESTED, then PENDING, then DEPLOYED, if successful).

Figure 5-18 Service Requests - Unmanaged Tunnels



For more information on working with service requests, see Appendix B, "Managing Service Requests."

If the SR does not go to the **Deployed** state, go to the Task Logs window to see the deployment log (**Monitoring > Task Manager > Logs**) as described in SR Deployment Logs, page 10-1.

To edit the service request from the **Service Requests** window, go back to the TE Managed Primary Tunnels SR or the TE Unmanaged Primary Tunnels SR window as described in Edit Primary Tunnel, page 5-16.

Edit Primary Tunnel

Primary tunnel attributes can be modified in the primary tunnel editor

There are two ways to access the primary tunnel editor:

- from the managed or unmanaged primary tunnels SR window or
- from the Service Requests window.

Access from Primary Tunnel SR Window

To access the primary tunnel editor from the primary tunnel SR window (TE Managed Primary Tunnels SR or TE Unmanaged Primary Tunnels SR window) and edit a managed or an unmanaged primary tunnel, use the following steps:

Step 1 Navigate to **Service Inventory > Inventory and Connection Manager > Traffic Engineering Management**.

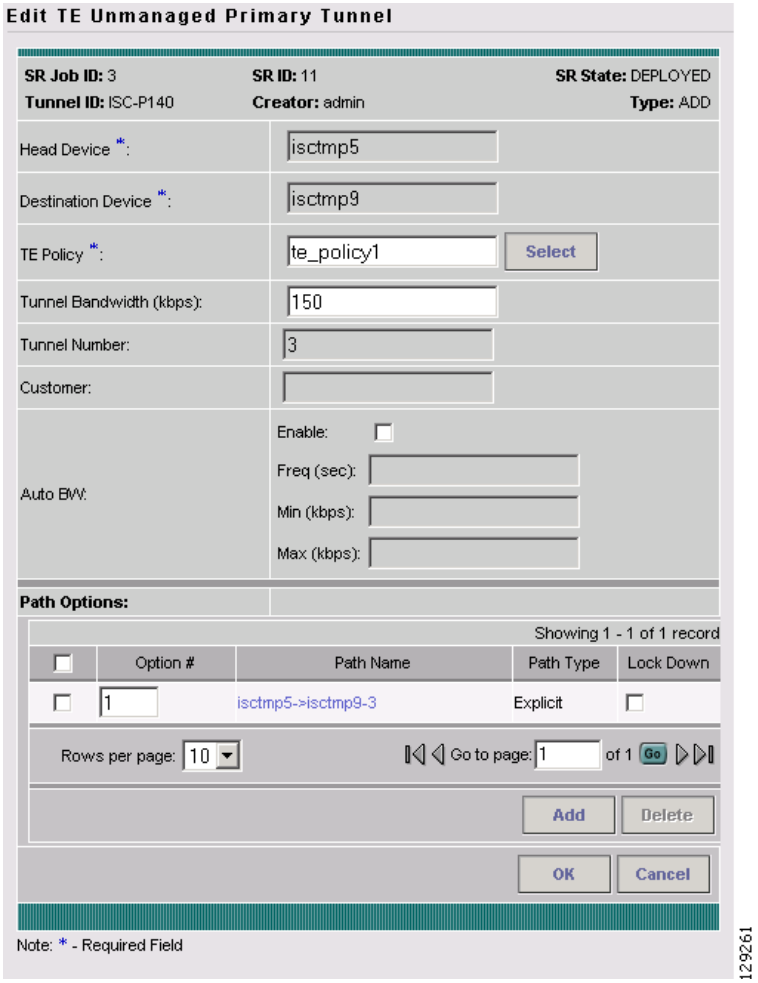
Step 2 Click **Create Managed TE Tunnel**. The TE Managed Primary Tunnels SR window appears .

or

Click **Create Unmanaged TE Tunnel**. The TE Unmanaged Primary Tunnels SR window in Figure 5-9 appears.

Step 3 To edit a tunnel SR, select the desired SR and click **Edit**. The Edit TE Managed Primary Tunnel or the Edit TE Unmanaged Primary Tunnel window in Figure 5-19 appears.

Figure 5-19 Edit TE Unmanaged Primary Tunnel



The primary tunnel editor is identical to that of the create primary tunnel GUI. For an explanation of the various window elements, see Create Managed TE Tunnel, page A-41 and Create Unmanaged TE Tunnel, page A-59.

Step 4 Make the desired changes and click **OK** or **Cancel** to discard the changes.

Step 5 In the TE Unmanaged Primary Tunnel SR window, the Op field changes to MODIFY.

Note The modified tunnel can be reverted to its original state by selecting it and clicking **Delete**. The MODIFY flag in the Op column disappears.

Click **Save & Deploy** (see Note on page 15) to either deploy the new tunnel SR to the network or force deploy all tunnels, or you can create or edit more primary tunnels and then save and deploy all changes.

Step 6 The Service Requests window (**Service Inventory > Inventory and Connection Manager > Service Requests**) appears (see Figure 5-18) and displays the state of the deployed SR.

For more information on working with service requests, see Appendix B, "Managing Service Requests."

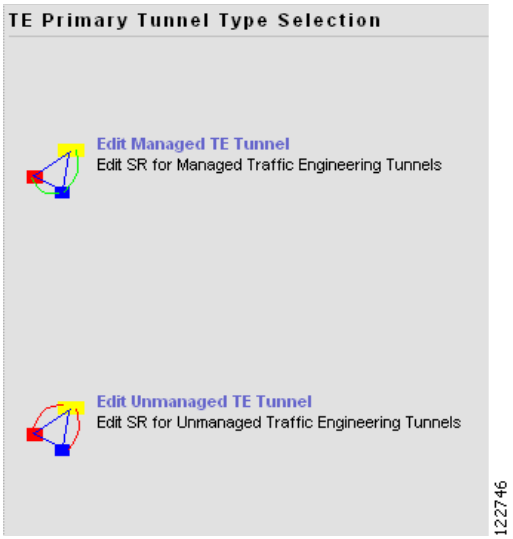
Access from Service Requests Window

To access the primary tunnel editor from the Service Requests window, assuming that the SR has been created, use the following steps:

Step 1 Navigate to **Service Inventory > Inventory and Connection Manager > Service Requests**.

Step 2 To edit the desired tunnel SR, select the SR in question and click **Edit**. The TE Primary Tunnel Type Selection window in Figure 5-20 appears.

Figure 5-20 TE Primary Tunnel Type Selection



Step 3 Specify the type of tunnel, managed or unmanaged. The TE Managed Primary Tunnel SR or the TE Unmanaged Primary Tunnel SR window appears displaying the SR selected in the Service Requests window. An example of the TE Unmanaged Primary Tunnel SR window is shown in Figure 5-9.

Step 4 Select the tunnel SR and click **Edit**. The Edit TE Unmanaged Primary Tunnel window in Figure 5-19 appears.

Go to Access from Primary Tunnel SR Window, page 5-16 and continue the process from Step 4.

Delete Primary Tunnel

To delete a managed or an unmanaged primary tunnel from the primary tunnel SR window (TE Managed Primary Tunnels SR or TE Unmanaged Primary Tunnels SR window), use the following steps:

Step 1 Navigate to **Service Inventory > Inventory and Connection Manager > Traffic Engineering Management**.

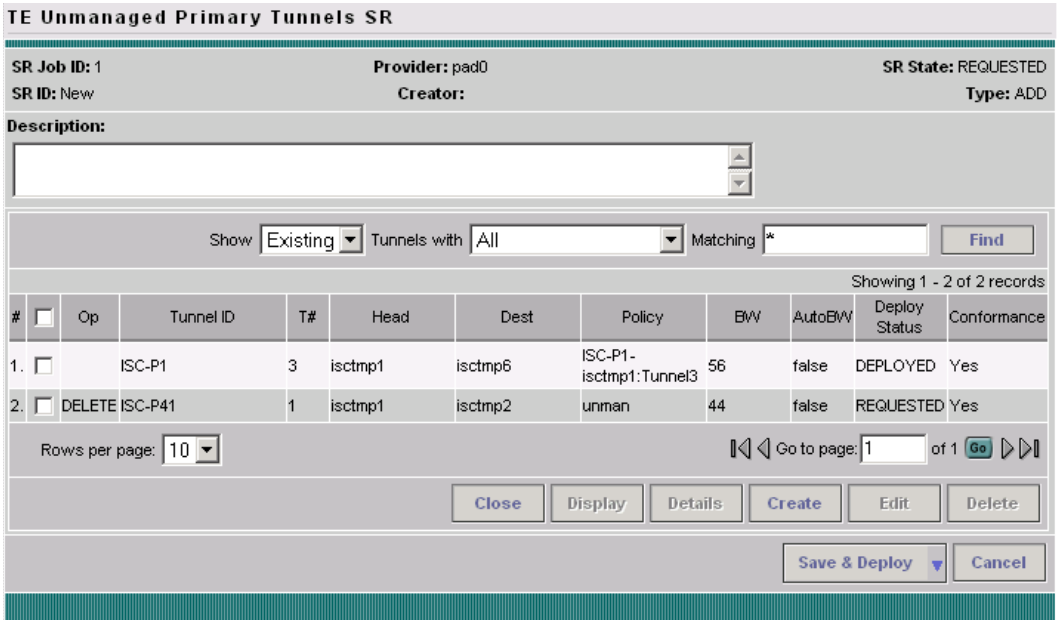
Step 2 Click **Create Managed TE Tunnel**. The TE Managed Primary Tunnels SR window appears .

or

Click **Create Unmanaged TE Tunnel**. The TE Unmanaged Primary Tunnels SR window in Figure 5-9 appears.

Step 3 To delete a tunnel, select the desired tunnel(s) and click **Delete**. The **Op** field status changes to **DELETE** as shown in Figure 5-21.

Figure 5-21 TE Unmanaged Primary Tunnels SR - Delete Requested



For an explanation of the various window elements, see Create Managed TE Tunnel, page A-41 and Create Unmanaged TE Tunnel, page A-59.

Note The deleted tunnel can be reverted to its original state by selecting it and clicking **Delete**. The DELETE flag in the Op column disappears.

Click **Save & Deploy** to either deploy the new tunnel SR to the network or force deploy all tunnels, or you can create or edit more primary tunnels and then save and deploy all changes.

Step 4 The Service Requests window (**Service Inventory > Inventory and Connection Manager > Service Requests**) appears (see Figure 5-18) and displays the state of the deployed SR.

For more information on working with service requests, see Appendix B, "Managing Service Requests."

Backup Tunnel Operations

ISC TEM allows you to perform a number of backup tunnel operations, which are described in this section.

Note Non-POS interfaces cannot be FRR protected on IOS-XR devices.

Create Backup Tunnel

Backup tunnels are created in much the same way as primary tunnels. In both cases, building an explicit path is not required when an existing path already traverses the desired routers. A path can be used for any number of tunnels within its bandwidth capacity.

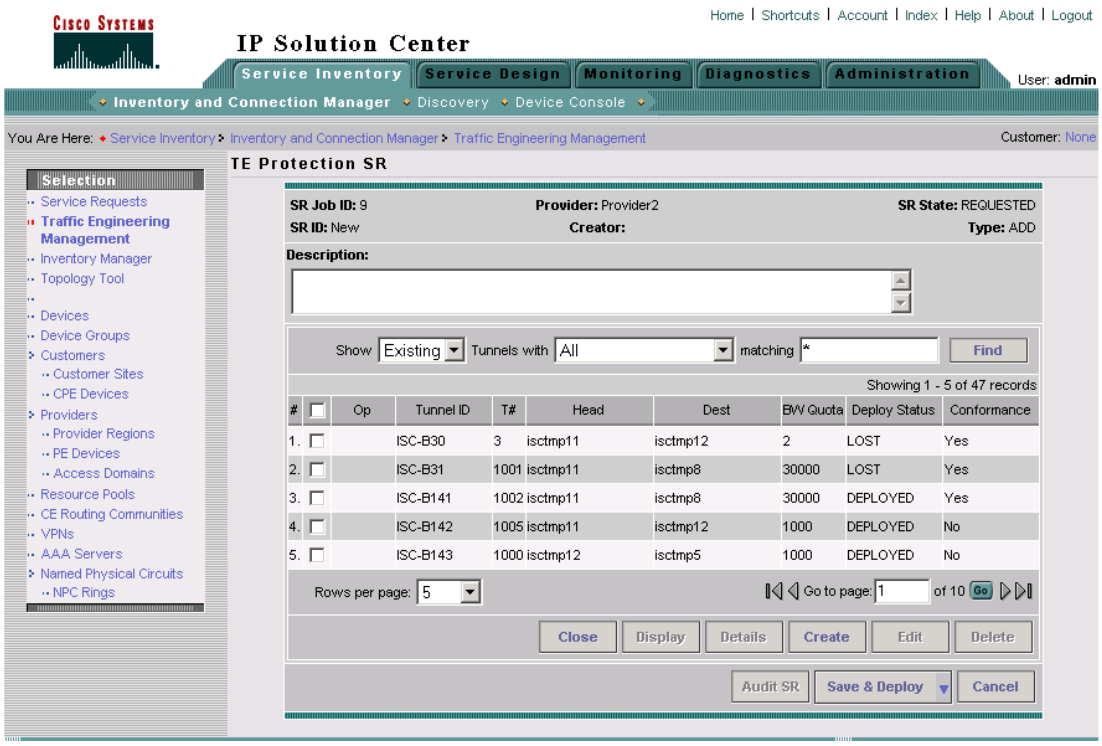
A precondition for creating a backup tunnel is the presence of an explicit path. To create an explicit path, see Create Explicit Path, page 5-4.

To create a backup tunnel, use the following steps:

Step 1 Navigate to **Service Inventory > Inventory and Connection Manager > Traffic Engineering Management**.

Step 2 Click **Create TE Backup Tunnel**. The TE Protection SR window in Figure 5-22 appears.

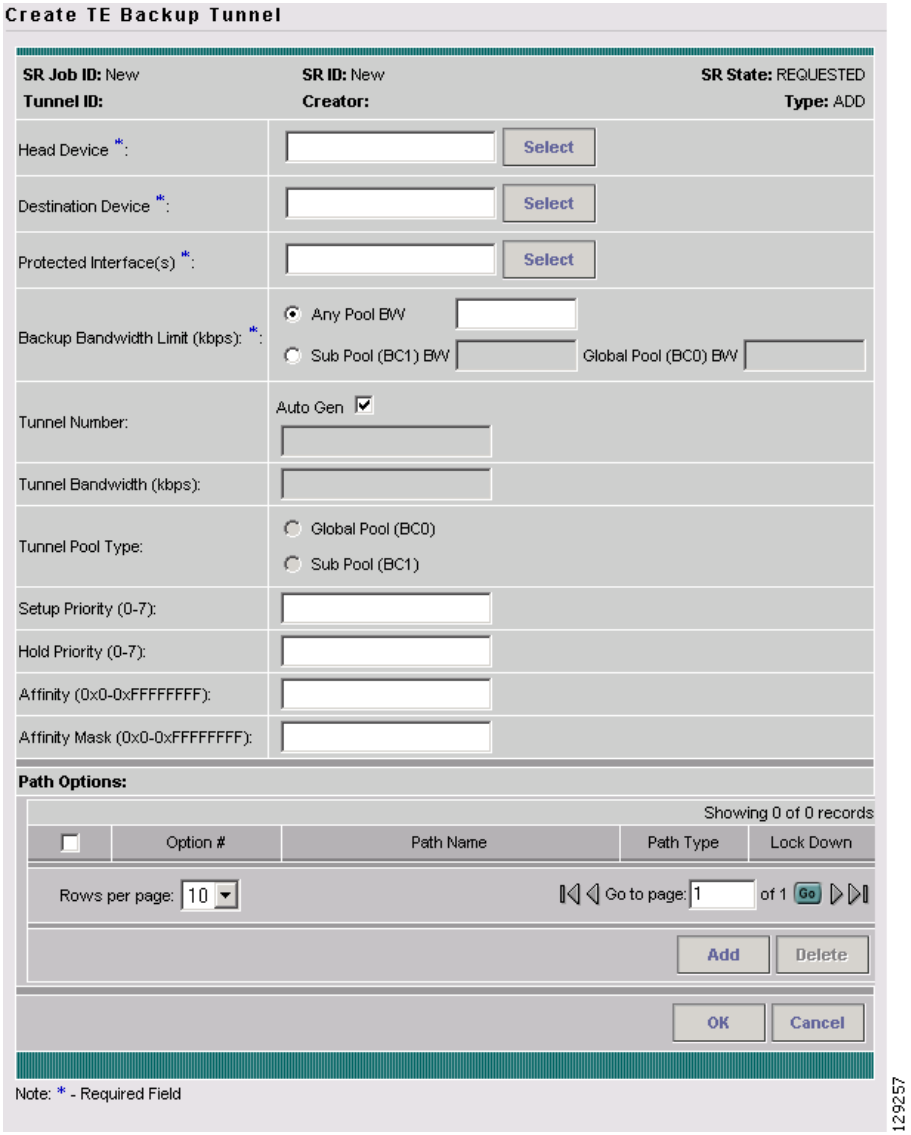
Figure 5-22 TE Protection SR



For an explanation of the various window elements, see Create TE Backup Tunnel, page A-59.

Step 3 Click **Create**. The Create TE Backup Tunnel window in Figure 5-23 appears.

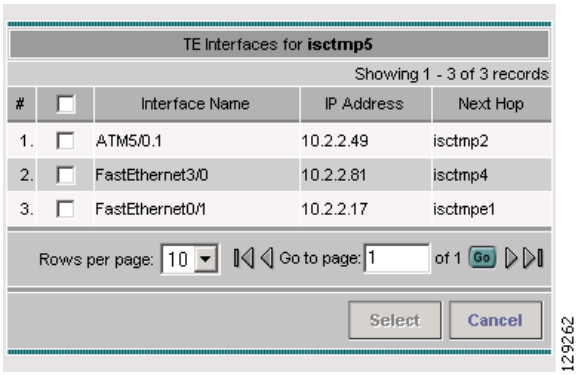
Figure 5-23 Create TE Backup Tunnel



For an explanation of the various window elements, see Create TE Backup Tunnel, page A-59.

Step 4 Select, at a minimum, a **Head Device**, a **Destination Device**, and a **Protected Interface**. Also, specify a **Backup Bandwidth Limit** greater than zero. Add other tunnel information as desired.

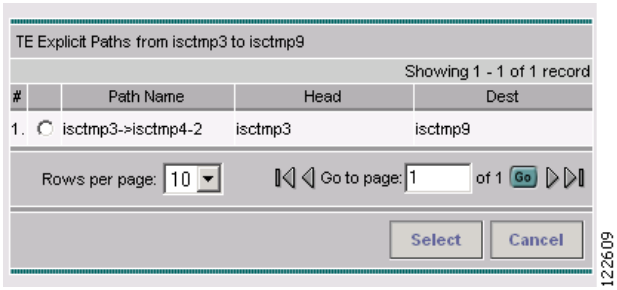
Figure 5-24 Select TE Protected Interface



For an explanation of the various window elements, see Select TE Protected Interface, page A-63.

Step 5 Click **Add** to add just one path. The Select TE Explicit Path window in Figure 5-25 appears.

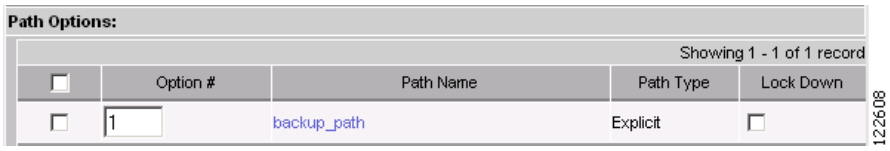
Figure 5-25 Select TE Explicit Path



Step 6 Select an explicit path. It must match the head and destination of an existing path. If none is available, you first must set one up. To do so, see Create Explicit Path, page 5-4.

Step 7 Click **Select**. The selected path appears in the **Path Options** section of the page as shown in the Select TE Explicit Path window in Figure 5-26.

Figure 5-26 Path Options



For explicit paths, you can click the path name to open the Explicit Path Viewer as shown in Figure 5-16.

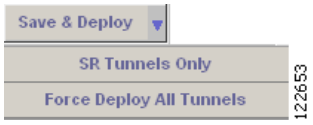
Step 8 In the Create TE Backup Tunnel window, click **OK** to accept the entered tunnel information or click **Cancel** to quit the window without saving it. The window closes.

Step 9 In the TE Protection SR window, a new backup tunnel is added in the tunnel list with the Op field set to ADD.

Note The added tunnel can be reverted to its original state by selecting it and clicking **Delete**. The tunnel is removed from the tunnel list.

Step 10 Click **Save & Deploy** to either deploy the new tunnel SR to the network or force deploy all tunnels, or you can create or edit more backup tunnels and then save and deploy all changes.

Figure 5-27 Save & Deploy Tunnels



The **Save & Deploy** button provides two options:

- **SR Tunnels Only**—Deploy all tunnel changes that does not impact tunnel placement, or if no changes were made to the SR, use this to re-deploy the SR that was in **Requested** or **Invalid** state.
- **Force Deploy All Tunnels**—Force deployment of all tunnels in this SR. This could be useful when previous provisioning of the SR has failed, so that it is necessary to force through the deployment of all tunnels in the SR.

When you click Save & Deploy, a background process is started. To avoid a potential conflict with another deployment, wait until the SR has completed the Requested and Pending states before deploying another SR with Save & Deploy. To see the state of deployment, go to the Service Request window under Inventory and Connection Manager or open the Task Manager under Monitoring.

Note With the exception of TE Traffic Admission SRs, TE SRs are always deployed immediately from the specific TE SR window, not from the Service Requests page in **Inventory and Connection Manager**.

Step 11 The Service Requests window (**Service Inventory > Inventory and Connection Manager > Service Requests**) appears and displays the state of the deployed SR.

For more information on working with service requests, see Appendix B, "Managing Service Requests."

If the SR does not go to the **Deployed** state, go to the Task Logs window to see the deployment log (**Monitoring > Task Manager > Logs**) as described in SR Deployment Logs, page 10-1.

Edit Backup Tunnel

Backup tunnel attributes can be modified in the backup tunnel editor.

There are two ways to access the backup tunnel editor:

- from the Protection SR window or
- from the Service Requests window.

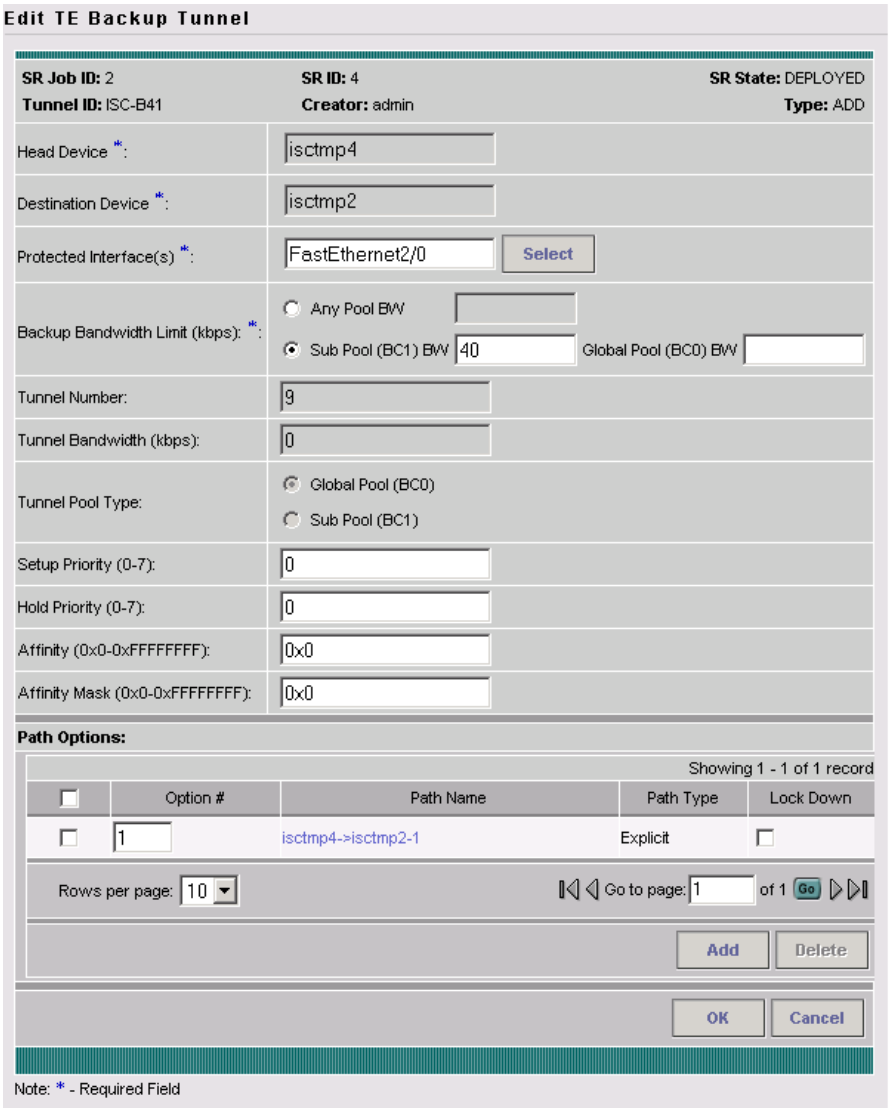
From the Protection SR Window

To access the Protection SR window to edit a backup tunnel, use the following steps:

Step 1 Navigate to **Service Inventory > Inventory and Connection Manager > Traffic Engineering Management > Create TE Backup Tunnel**. The TE Protection SR window appears.

Step 2 To edit a tunnel SR, select the desired SR and click **Edit**. The Edit TE Backup Tunnel window in Figure 5-28 appears.

Figure 5-28 Edit TE Backup Tunnel



The backup tunnel editor is identical to that of the create backup tunnel GUI. For an explanation of the various window elements, see Create TE Backup Tunnel, page A-59.

Step 3 Make the desired changes and click **OK**.

Step 4 In the TE Protection window, the Op field changes to MODIFY.

Note The modified tunnel can be reverted to its original state by selecting it and clicking **Delete**. The MODIFY flag in the Op column disappears.

Step 5 In the TE Protection SR window, click **Save & Deploy** to either deploy the new tunnel SR to the network or force deploy all tunnels, or you can create or edit more backup tunnels and then save and deploy all changes.

The **Save & Deploy** button options are discussed in Create Managed TE Tunnel, page A-41.

Step 6 The Service Requests window (**Service Inventory > Inventory and Connection Manager > Service Requests)** appears (see Figure 5-18) and displays the state of the deployed SR.

For more information on working with service requests, see Appendix B, "Managing Service Requests."

From the Service Requests Window

To edit a backup tunnel from the **Service Requests** window, assuming that the SR has been created use the following steps:

Step 1 Navigate to **Service Inventory > Inventory and Connection Manager > Service Requests**.

Step 2 To edit the desired tunnel SR, select the SR in question and click **Edit**. The TE Protection SR window appears displaying the SR selected in the Service Requests window. An example of the TE Protection SR window is shown in Figure 5-22.

Step 3 Select the tunnel SR and click **Edit**. The Edit TE Backup Tunnel window in Figure 5-28 appears.

Go to From the Protection SR Window, page 5-25 and continue the process from Step 3.

Delete Backup Tunnel

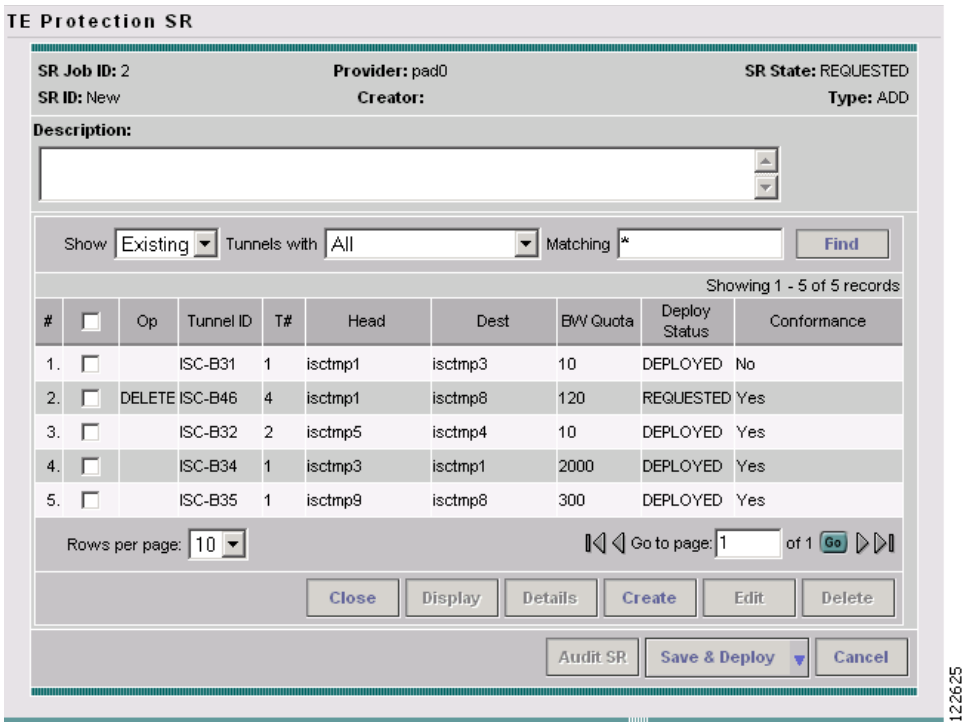
To delete a backup tunnel from the TE Protection SR window, use the following steps:

Step 1 Navigate to **Service Inventory > Inventory and Connection Manager > Traffic Engineering Management > Create TE Backup Tunnel**.

The TE Protection SR window in Figure 5-22 appears.

Step 2 To delete a tunnel SR, select the desired SR and click **Delete**. The **Op** field status changes to **DELETE** as shown in Figure 5-29.

Figure 5-29 TE Protection SR - Delete Requested



For an explanation of the various window elements, see Create TE Backup Tunnel, page A-59.

Note The deleted tunnel can be reverted to its original state by selecting it and clicking **Delete**. The DELETE flag in the Op column disappears.

Click **Save & Deploy** to either deploy the new tunnel SR to the network or force deploy all tunnels, or you can create or edit more primary tunnels and then save and deploy all changes.

Step 3 The Service Requests window (**Service Inventory > Inventory and Connection Manager > Service Requests**) appears (see Figure 5-18) and displays the state of the deployed SR.

For more information on working with service requests, see Appendix B, "Managing Service Requests."