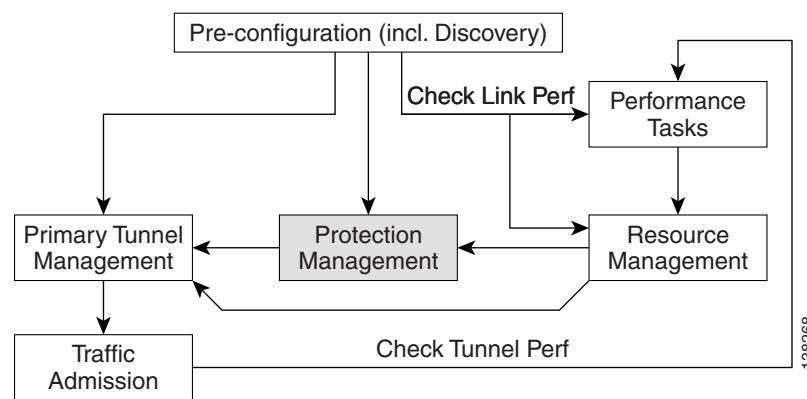




Protection Planning



This chapter describes the process of creating and managing the protection of network elements using automated protection tools. See [Chapter 5, “Basic Tunnel Management”](#) for a description of the process using the basic tools.

This chapter includes the following sections:

- [Overview, page 7-2](#)
- [SRLG Operations, page 7-3](#)
 - [Create SRLG, page 7-3](#)
 - [Edit SRLG, page 7-5](#)
 - [Delete SRLG, page 7-5](#)
- [Configure Element Protection, page 7-5](#)
- [Protection Tools, page 7-7](#)
 - [Compute Backup, page 7-7](#)
 - [Audit Protection, page 7-12](#)
 - [Audit SR, page 7-14](#)

Overview

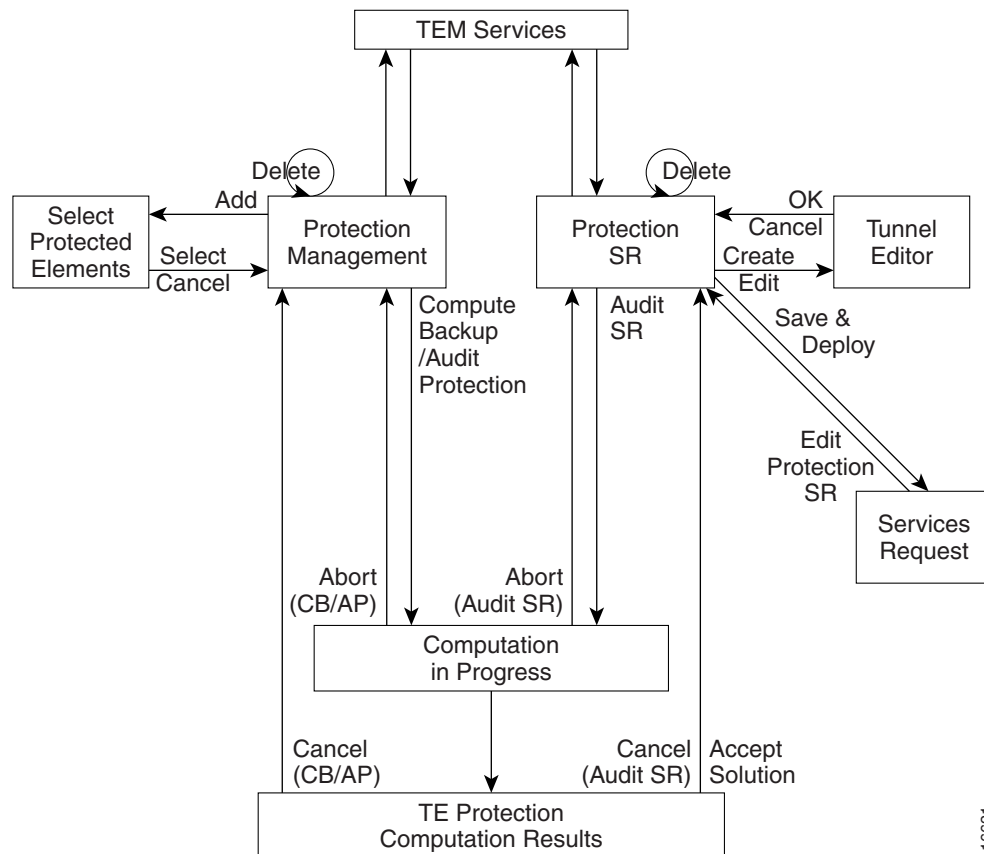
The purpose of protection planning is to protect selected elements in the network (links, routers, or SRLGs) against failure.

The first step is to identify the elements that must be protected and then invoke the protection tools to compute the protected tunnels. From the computation, the system responds for each element with either a set of tunnels that protect the element or a set of violations and warnings that help the user to determine why it could not be protected.

For successfully protected elements the tunnels can be deployed on the network. For elements that could not be protected, the protection is either ignored or the constraints are altered on the protection case. More specifically, this can involve changing the TE bandwidth settings of the links associated to the element and then rerunning the protection computation on the altered network.

An overview of the protection management processes is provided in [Figure 7-1](#).

Figure 7-1 Protection Management Processes



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SRLG Operations

It is not uncommon for links to have identical physical characteristics, such as being physically located in the same conduit, or being connected to the same hardware. As a result, they could fail as a group during a single failure event. A Shared-Risk Link Group (SRLG) addresses this problem by identifying links that could fail together.

After SRLG modifications (create, edit, delete), use the protection planning functions in the **TE Protection Management** window to ensure that adequate protection is available on the network.



Note

If you include a non-POS interface of an IOS-XR device in an SRLG, the SRLG cannot be protected.

Create SRLG

Creating an SRLG is only necessary if a shared risk link group has been identified and it must be protected.

To create an SRLG, use the following steps:

- Step 1** Navigate to **Service Inventory > Inventory and Connection Manager > Traffic Engineering Management**.
- Step 2** Click **TE SRLGs**. The TE SRLG List window in [Figure 7-2](#) appears.

Figure 7-2 *TE SRLG List*

#	SRLG Name
1.	srlg1
2.	srlg2

For an explanation of the various window elements, see [Create/Edit TE SRLG, page A-31](#).

- Step 3** To create an SRLG in the **TE SRLG List**, click **Create**. The TE SRLG Editor window in [Figure 7-3](#) appears.

Figure 7-3 *TE SRLG Editor*

TE SRLG Editor

Provider Name *:

SRLG Name *:

Links :

Showing 1 - 5 of 9 records			
#	☐	Device From	Device To
1.	☐	isctmp8	isctmp7
2.	☐	isctmp1	isctmp2
3.	☐	isctmp1	isctmp3
4.	☐	isctmp1	isctmp3
5.	☐	isctmp1	isctmp7

Rows per page: Go to page: of 2

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For an explanation of the various window elements , see [Create/Edit TE SRLG, page A-31](#).

Step 4 Specify an **SRLG Name**.

Step 5 Click **Add Link**. The Links associated with SRLG window in [Figure 7-4](#) appears.

Figure 7-4 *Links associated with SRLG*

Links associated with SRLG

Show Links with: Matching

Showing 1 - 10 of 32 records			
#	☐	From Device	To Device
1.	☐	isctmp4	isctmp9
2.	☐	isctmp7	isctmpe3
3.	☐	isctmp4	isctmp9
4.	☐	isctmp4	isctmp3
5.	☐	isctmp4	isctmp3
6.	☐	isctmp4	isctmp9
7.	☐	isctmp5	isctmp4
8.	☐	isctmp6	isctmp5
9.	☐	isctmp6	isctmp4
10.	☐	isctmp2	isctmp5

Rows per page: Go to page: of 4

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For an explanation of the various window elements , see [Create/Edit TE SRLG, page A-31](#).

- Step 6** Select one or more links and click **Select**. The corresponding link information is added to the link list and the Select window closes and returns to the SRLG editor.
- Step 7** Click **Save** to save the SRLG. This closes the SRLG editor and brings back the TE SRLG List as the active window, where the newly created SRLG is listed.
-

Edit SRLG

To edit an SRLG, use the following steps:

- Step 1** Navigate to **Service Inventory > Inventory and Connection Manager > Traffic Engineering Management**.
- Step 2** Click **TE SRLGs**. The TE SRLG List window in [Figure 7-2](#) appears.
- Step 3** To edit an SRLG in the TE SRLG List, from the TE SRLG List window select the SRLG that you want to modify and click **Edit**. The TE SRLG Editor window in [Figure 7-3](#) appears.
- Step 4** Use **Add Link** and **Remove Link** to adjust to the desired set of links for the selected SRLG.
- Step 5** Click **Save** to save the changes.
-

Delete SRLG

To delete an SRLG, use the following steps:

- Step 1** Navigate to **Service Inventory > Inventory and Connection Manager > Traffic Engineering Management**.
- Step 2** Click **TE SRLGs**. The TE SRLG List window in [Figure 7-2](#) appears.
- Step 3** To delete an SRLG in the TE SRLG List, from the TE SRLG List window select the SRLG(s) that you want to delete and click **Delete**. The Delete Confirm window appears.
- Step 4** Click **Delete** to confirm. The Delete Confirm window closes. After the TE SRLG List window has been updated, the deleted SRLG no longer appears in the SRLG list.
-

Configure Element Protection

Before a protection computation can be performed, it is necessary to configure the network element protection.

To do so, use the following steps:

- Step 1** Navigate **Service Inventory > Inventory and Connection Manager > Traffic Engineering Management > TE Protected Elements**.

The TE Protection Management window in [Figure 7-5](#) appears.

Figure 7-5 TE Protection Management

TE Protection Management

Provider: Provider1

Show: All Elements Matching: * Find

Showing 0 of 0 records

#	☐	Element Name	Type	Protection Status
---	--------------------------	--------------	------	-------------------

Rows per page: 10 Go to page: 1 of 1 Go

Close Display Compute Backup Audit Protection Add Delete Cancel

For an explanation of the various window elements, see [Protection Management, page A-35](#).

Step 2 First, decide which network elements must be protected.

In the TE Protection Management window, click **Add** to add a protection element (link, node, or SRLG). The Select Protection Elements window in [Figure 7-6](#) appears.



Note

If a link, node or SRLG contains a non-POS interface on an IOS-XR device, the element is selectable as a protected element and backup tunnels will be generated, but the deployment will fail due to a restriction in IOS-XR 3.2. For nodes, all nodes connected to an IOS-XR device must have POS interfaces. If even one node in an SRLG has a non-POS interface, that SRLG cannot be protected.

Links that are connected to non-Cisco devices cannot be protected and will, therefore, not show in the Select protection elements window. Likewise, non-Cisco devices and SRLGs that contain links to non-Cisco devices cannot be protected and are excluded from the selection.

Figure 7-6 **Select Protection Elements**

Protection Elements for **Provider1**

Show: Matching:

Showing 1 - 10 of 45 records

#	☐	Element Name	Type
1.	☐	10.2.3.117<->10.2.3.118	Link
2.	☐	10.2.2.81<->10.2.2.94	Link
3.	☐	10.2.3.78<->10.2.3.77	Link
4.	☐	10.2.2.254<->10.2.2.241	Link
5.	☐	10.2.3.106<->10.2.3.105	Link
6.	☐	10.2.3.82<->10.2.3.81	Link
7.	☐	10.2.2.33<->10.2.2.46	Link
8.	☐	10.2.3.70<->10.2.3.69	Link
9.	☐	10.2.3.74<->10.2.3.73	Link
10.	☐	isctmp1	Node

Rows per page: Go to page: of 5

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For an explanation of the various window elements, see [Protection Management, page A-35](#).

- Step 3** Select one or more elements to be protected and click **Select**. The Select Protection Element window closes and the TE Protection Management window reappears.

Next, decide which protection tools should be applied.

Protection Tools

Relying on manual creation of backup tunnels as described in [Chapter 5, “Basic Tunnel Management”](#) has its limitations, not just for larger and more complicated networks.

The protection tools available in ISC TEM provide a number of tools that automatically compute and verify protection of specified network elements.



Note

Certain attributes, such as Description, that do not impact the computation carried out by these tools and updates to these are, therefore, not displayed in the Computation Result Window.

Compute Backup

Compute Backup is used to let ISC TEM automatically compute the necessary backup tunnels to protect specified network elements. The manual process is described in [Chapter 5, “Basic Tunnel Management.”](#)

To run Compute Backup, use the following steps:

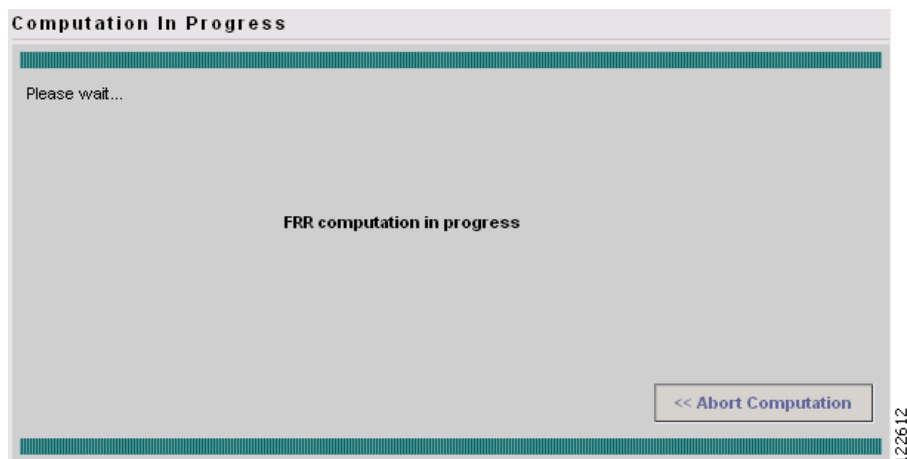
- Step 1** Navigate **Service Inventory > Inventory and Connection Manager > Traffic Engineering Management > TE Protected Elements**.
- Step 2** Configure the necessary protection elements as described in [Configure Element Protection, page 7-5](#).
- Step 3** If you only want to perform Compute Backup on selected elements, select one or more elements on which to calculate a backup path.

Click **Compute Backup** and select one of the following:

- All Elements
- Selected Elements

The Computation In Progress window shown in [Figure 7-7](#) appears.

Figure 7-7 FRR Computation In Progress - Compute Backup



To abort the computation and return to the previous window, click **<< Abort Computation**.

- Step 4** The TE Protection Computation window in [Figure 7-8](#) appears.

Figure 7-8 TE Protection Computation Results

TE Protection Computation Results

Element:

Show with name matching

Showing 1 - 4 of 4 records

#	☐	Element Name	Type	Report	Status
1.	☐	10.2.2.33<->10.2.2.46	Link		NoSolutionExists
2.	☐	10.2.2.33<->10.2.2.46	Link	violationNoBackupTunnels	NoSolutionExists
3.	☐	10.2.2.33<->10.2.2.46	Link	violationNoBackupTunnels	NoSolutionExists
4.	☐	iscrmpe4	Node		ValidTunnels

Rows per page:

Backup Tunnels:

Op	Tunnel ID	Head	Dest	T#	BVW	Path	Protection Type	Report
Accept Solution Cancel								

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For an explanation of the various window elements, see [Compute Backup, page A-37](#).

**Note**

Certain attributes, such as Description, that do not impact the computation carried out by the protection tools and updates to these are not displayed in the Computation Result Window.

Step 5

Select a row corresponding to a specific warning or violation and click **Detail** to display a detailed description in the right pane and backup tunnels associated with the selected item in the bottom pane as shown in [Figure 7-9](#).

For a description of warnings and violations, see [Appendix C, “Warnings and Violations.”](#)

Figure 7-9 TE Protection Computation Results with Backup Tunnels

TE Protection Computation Results

Element:

Show All Elements with name matching * Find

Showing 1 - 10 of 19 records

#	☐	Element Name	Type	Report	Status
1.	☐	isctmp7	Node		NoSolutionExists
2.	☒	isctmp7	Node	violationNoBackupTunnels	NoSolutionExists
3.	☐	isctmp7	Node	violationNoBackupTunnels	NoSolutionExists
4.	☐	isctmp7	Node	violationNoBackupTunnels	NoSolutionExists
5.	☐	isctmp7	Node	violationNoBackupTunnels	NoSolutionExists
6.	☐	isctmp7	Node	violationNoBackupTunnels	NoSolutionExists
7.	☐	isctmp6	Node		NoSolutionExists
8.	☐	isctmp6	Node	violationNoBackupTunnels	NoSolutionExists
9.	☐	isctmp6	Node	violationNoBackupTunnels	NoSolutionExists
10.	☐	isctmp6	Node	violationNoBackupTunnels	NoSolutionExists

Rows per page: 10 Go to page: 1 of 2 Go

Close Display Details

Violation and Warning:

Report Type: violationNoBackupTunnels

Description: There are no backup tunnels protecting this flow through the element

Flow:

Maximum Bandwidth	Head Links	Through Router	Tail Router	Type
550	isctmp8/10.2.3.50	isctmp7	isctmpe3	NNHOP

Backup Tunnels:

Op	Tunnel ID	Head	Dest	T#	BW	Path	Protection Type	Report
ADD	ISC-B330	isctmp1	isctmp8		200	Computed Path	Protection	
ADD	ISC-B328	isctmp8	isctmp1		550	Computed Path	Protection	
ADD	ISC-B329	isctmp8	isctmp1		1000	Computed Path	Protection	
DELETE	ISC-B42	isctmp1	isctmp6	4	200	Bug-test2	Activating	
DELETE	ISC-B48	isctmp8	isctmpe4	3	1550	isctmp8->isctmpe4-1	Activating	

Accept Solution Cancel

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For an explanation of the various window elements, see [Compute Backup](#), page A-37.

The **Backup Tunnel** table displays which new protection tunnels are required and any existing tunnels that should be kept or deleted for each element.

Step 6 In the TE Protection Computation Results window, check whether the proposed protection solution is acceptable. If so, click **Accept Solution**. The TE Protection SR window in [Figure 7-10](#) appears with all tunnel additions and deletions computed by the system.

Figure 7-10 TE Protection SR - Computed Path

TE Protection SR

SR Job ID: 2 Provider: p0 SR State: REQUESTED
 SR ID: New Creator: Type: ADD

Description:

Show Tunnels with Matching

Showing 1 - 10 of 20 records

#	☐	Op	Tunnel ID	T#	Head	Dest	Protects	BW Quota	Deploy Status	Conformance
1.	☐	ADD	ISC-B316		isctmp6	isctmp5		2000	REQUESTED	Yes
2.	☐	ADD	ISC-B317		isctmp4	isctmp2	isctmp5	2000	REQUESTED	Yes
3.	☐	ADD	ISC-B318		isctmp6	isctmp2	isctmp5	2000	REQUESTED	Yes
4.	☐	ADD	ISC-B319		isctmp6	isctmp4	isctmp5	1000	REQUESTED	Yes
5.	☐	ADD	ISC-B320		isctmp2	isctmp4	isctmp5	1000	REQUESTED	Yes
6.	☐	ADD	ISC-B321		isctmp4	isctmp8	isctmp6	100	REQUESTED	Yes
7.	☐	ADD	ISC-B322		isctmp4	isctmp2	isctmp6	500	REQUESTED	Yes
8.	☐	ADD	ISC-B323		isctmp4	isctmp5	isctmp6	500	REQUESTED	Yes
9.	☐	ADD	ISC-B324		isctmp2	isctmp8	isctmp6	50	REQUESTED	Yes
10.	☐	ADD	ISC-B325		isctmp2	isctmp5	isctmp6	50	REQUESTED	Yes

Rows per page: Go to page: of 2

For an explanation of the various window elements, see [Create TE Backup Tunnel, page A-59](#).

Optionally, you can make tunnel changes here and then run **Audit SR** to ensure that you have the desired level of protection before you deploy (see [Audit SR, page 7-14](#)).

Step 7 Click **Save & Deploy** to deploy the new tunnel SR to the network.



Note

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 screen, not from the **Service Requests** page in **Inventory and Connection Manager**.

Step 8 The Service Requests window (**Service Inventory > Inventory and Connection Manager > Service Requests**) opens 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 screen to see the deployment log (**Monitoring > Task Manager > Logs**) as described in [SR Deployment Logs, page 10-1](#).

Audit Protection

As opposed to the Compute Backup tool described on page 7, Audit Protection does not attempt to create a backup solution. It seeks to verify protection of specified network elements with the current set of backup tunnels and reports any warnings or violations that are discovered. It is recommended that any time a change has been committed on the TE topology such as resources on TE links or SRLG membership, a protection audit be run to verify the protection status on all elements.

The computation will display the same computation result page as for Compute Backup. When you return from computation result page, the Protection Status column in the TE Protection Management window is updated to show the level of protection for each element.

This section describes the necessary steps to perform Audit Protection on one or more network elements.

To run Audit Protection, use the following steps:

Step 1 Navigate **Service Inventory > Inventory and Connection Manager > Traffic Engineering Management > TE Protected Elements**.

The TE Protection Management window in [Figure 7-5](#) appears.

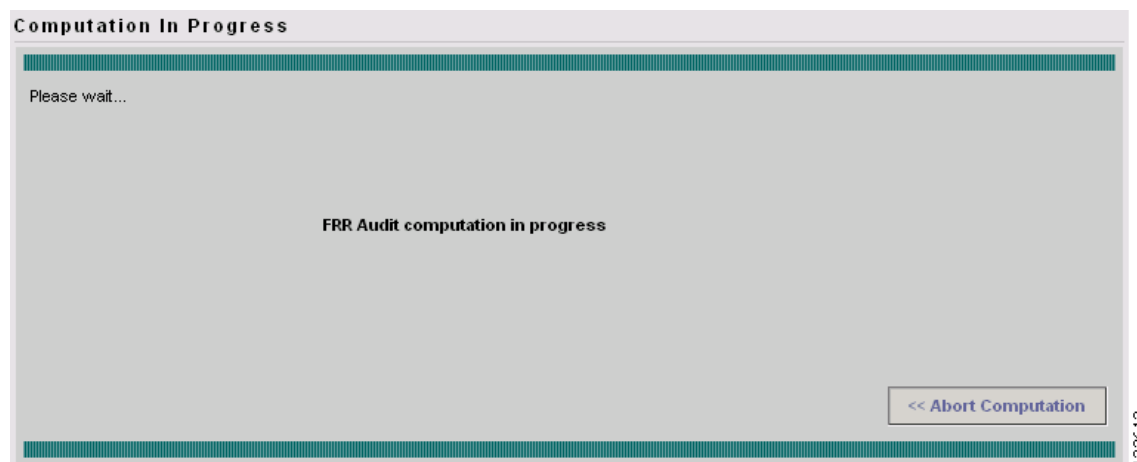
Step 2 If you only want to perform Audit Protection on selected elements, select one or more tunnels on which to calculate a backup path.

Click **Audit Protection** and select one of the following:

- All Elements
- Selected Elements

The Computation In Progress window shown in [Figure 7-7](#) appears.

Figure 7-11 FRR Audit Computation in Progress - Audit Protection



To abort the computation and return to the previous window, click **<< Abort Computation**.

The TE Protection Computation Results window in [Figure 7-12](#) appears.

Figure 7-12 TE Protection Computation Results

TE Protection Computation Results

Element:

Show with name matching

Showing 1 - 10 of 37 records

#	☐	Element Name	Type	Report	Status
1.	☐	isctmp7	Node		InvalidTunnels
2.	☒	isctmp7	Node	violationBadBackupTunnel	InvalidTunnels
3.	☐	isctmp7	Node	violationBadBackupTunnel	InvalidTunnels
4.	☐	isctmp7	Node	violationNoBackupTunnels	InvalidTunnels
5.	☐	isctmp7	Node	violationNoBackupTunnels	InvalidTunnels
6.	☐	isctmp7	Node	violationNoBackupTunnels	InvalidTunnels
7.	☐	isctmp7	Node	violationNoBackupTunnels	InvalidTunnels
8.	☐	isctmp7	Node	violationNoBackupTunnels	InvalidTunnels
9.	☐	isctmp7	Node	violationNoBackupTunnels	InvalidTunnels
10.	☐	isctmp7	Node	violationNoBackupTunnels	InvalidTunnels

Rows per page: Go to page: of 4

Violation and Warning:

Backup Tunnels:

Op	Tunnel ID	Head	Dest	T#	B/W	Path	Protection Type	Report

For an explanation of the various window elements, see [Compute Backup, page A-37](#).

**Note**

Certain attributes, such as Description, that do not impact the computation carried out by the protection tools and updates to these are not displayed in the Computation Result Window.

- Step 3** To view the backup tunnels for a particular element, select the element and click **Details**. The TE Protection Computation Results window in [Figure 7-13](#) appears.

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Figure 7-13 TE Protection Computation Results with Backup Tunnels

TE Protection Computation Results

Element:

Show with name matching

Showing 1 - 10 of 10 records

#	☐	Element Name	Type	Report	Status
1.	☐	isctmp7	Node		InvalidTunnels
2.	☒	isctmp7	Node	violationBadBackupTunnel	InvalidTunnels
3.	☐	isctmp7	Node	violationNoBackupTunnels	InvalidTunnels
4.	☐	isctmp7	Node	violationNoBackupTunnels	InvalidTunnels
5.	☐	isctmp7	Node	violationNoBackupTunnels	InvalidTunnels
6.	☐	isctmp7	Node	violationNoBackupTunnels	InvalidTunnels
7.	☐	isctmp7	Node	violationNoBackupTunnels	InvalidTunnels
8.	☐	isctmp7	Node	violationNoBackupTunnels	InvalidTunnels
9.	☐	isctmp7	Node	violationNoBackupTunnels	InvalidTunnels
10.	☐	isctmp7	Node	violationNoBackupTunnels	InvalidTunnels

Rows per page: Go to page: of 1

Violation and Warning:

Report Type: violationBadBackupTunnel
Description: The tunnel does not protect a flow over this element

Backup Tunnels:

Op	Tunnel ID	Head	Dest	T#	BW	Path	Protection Type	Report
	ISC-B42	isctmp8	isctmp9	4	30000	isctmp8-isctmp9-3	Activating	yes

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For an explanation of the various window elements, see [Compute Backup, page A-37](#).

- Step 4** Select a row corresponding to a specific warning or violation and click **Details** to display a detailed description in the right pane and backup tunnels associated with the selected item in the bottom pane as shown in [Figure 7-9](#).

Tunnels associated with a warning or violation are flagged in the **Report** column in the **Backup Tunnels** table in the bottom pane.

The **Accept Solution** button is greyed out because the audit does not provide a solution but rather an evaluation.

For a description of warnings and violations, see [Appendix C, “Warnings and Violations.”](#)

- Step 5** Click **Cancel** to return to the TE Protection Management window. The protection status is updated in the Protection Status column.

Audit SR

Audit SR audits protection of all elements in the **TE Protection Management** window against backup tunnels in the TE Protection SR window.

This feature can be used to audit the protection for manually added, modified, and deleted tunnels in the TE Protection SR window before deploying them.

To audit a TE backup tunnel SR, 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 7-14](#) appears.

Figure 7-14 TE Protection SR

TE Protection SR

SR Job ID: 9 Provider: Provider2 SR State: REQUESTED
 SR ID: New Creator: Type: ADD

Description:

Show Existing Tunnels with All matching * Find

Showing 1 - 5 of 47 records

#	Op	Tunnel ID	T#	Head	Dest	BW Quota	Deploy Status	Conformance
1.	☐	ISC-B30	3	isctmp11	isctmp12	2	LOST	Yes
2.	☐	ISC-B31	1001	isctmp11	isctmp8	30000	LOST	Yes
3.	☐	ISC-B141	1002	isctmp11	isctmp8	30000	DEPLOYED	Yes
4.	☐	ISC-B142	1005	isctmp11	isctmp12	1000	DEPLOYED	No
5.	☐	ISC-B143	1000	isctmp12	isctmp5	1000	DEPLOYED	No

Rows per page: 5 Go to page: 1 of 10 Go

Close Display Details Create Edit Delete

Audit SR Save & Deploy Cancel

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For an explanation of the various window elements, see [Create TE Backup Tunnel, page A-59](#).

Step 3 To audit the protection SR, click **Audit SR**.



Note Audit SR will only be enabled if there are elements in the TE Protection Management window. If this is not the case, the **Audit SR** button will be disabled (grayed out).

The FRR Audit process begins and the TE Protection Computation Results window in [Figure 7-12](#) appears.

See [Audit Protection, page 7-12](#) for a description of the rest of the process. Detail and report windows are identical in these two processes.

