



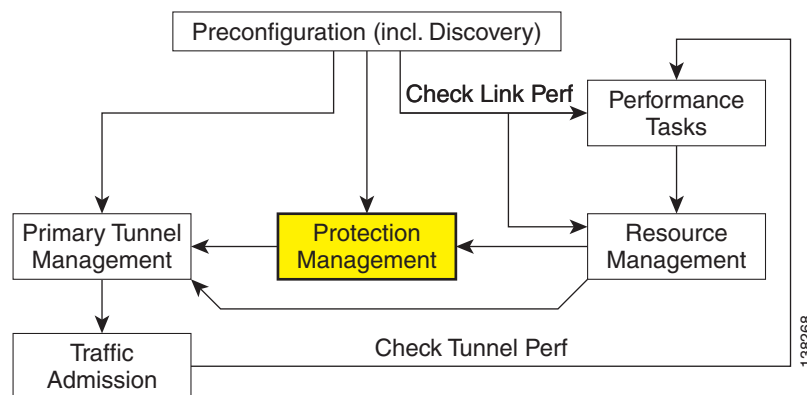
# CHAPTER 6

## Protection Planning

This chapter describes the process of creating and managing the protection of network elements using automated protection tools. See [Chapter 4, “Basic Tunnel Management”](#) for a description of the process using the basic tools.

The highlighted box in [Figure 6-1](#) shows where in TEM protection management occurs.

**Figure 6-1** TEM Process Diagram - Protection Management



This chapter includes the following sections:

- [Figure 6-1 Overview](#), page 6-2
- [SRLG Operations](#), page 6-3
  - [Create SRLG](#), page 6-3
  - [Edit SRLG](#), page 6-4
  - [Delete SRLG](#), page 6-4
- [Configure Element Protection](#), page 6-5
- [Protection Tools](#), page 6-5
  - [Compute Backup](#), page 6-6
  - [Audit Protection](#), page 6-9
  - [Audit SR](#), page 6-10.

# Overview

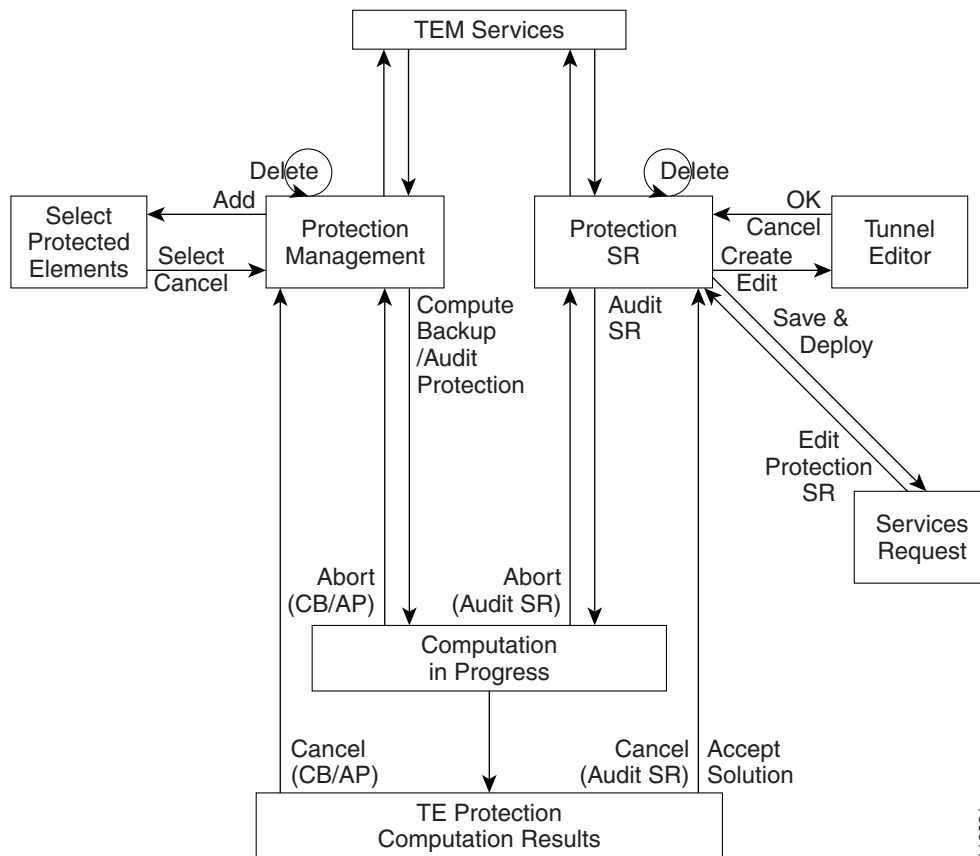
The purpose of protection planning is to protect selected elements in the network (links, routers, or SRLGs) against failure.

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 you 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 6-2](#).

**Figure 6-2** Protection Management Processes



# 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.

## 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** Choose **Service Inventory > Inventory and Connection Manager > Traffic Engineering Management**.

**Step 2** Click **TE SRLGs**. The TE SRLG List window appears.

For an explanation of the elements in this window, see [Create/Edit TE SRLG, page B-29](#).

**Step 3** To create an SRLG in the **TE SRLG List**, click **Create**.

The TE SRLG Editor window in [Figure 6-3](#) appears.

**Figure 6-3** TE SRLG Editor

TE SRLG Editor

Provider Name \*: Provider2

SRLG Name \*: srlg1

Links :

#	<input type="checkbox"/>	Device From	Label	Device To
1.	<input type="checkbox"/>	isctmp8	10.2.2.126<->10.2.2.113	isctmp7
2.	<input type="checkbox"/>	isctmp1	10.2.3.85<->10.2.3.86	isctmp2
3.	<input type="checkbox"/>	isctmp1	10.2.3.89<->10.2.3.90	isctmp3
4.	<input type="checkbox"/>	isctmp1	10.2.2.129<->10.2.2.142	isctmp3
5.	<input type="checkbox"/>	isctmp1	10.2.3.93<->10.2.3.94	isctmp7

Showing 1 - 5 of 9 records

Rows per page: 5

Go to page: 1 of 2 Go

Add Link Remove Link

Save Cancel

For an explanation of the various window elements, see [Create/Edit TE SRLG, page B-29](#).

**Step 4** Specify an **SRLG Name**.

**Step 5** Click **Add Link**.

The Links associated with SRLG window appears. For an explanation of the various window elements , see [Create/Edit TE SRLG, page B-29](#).

**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.

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## Edit SRLG

To edit an SRLG, use the following steps:

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**Step 1** Choose **Service Inventory > Inventory and Connection Manager > Traffic Engineering Management**.**Step 2** Click **TE SRLGs**. The TE SRLG List window 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 6-3](#) 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:

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**Step 1** Choose **Service Inventory > Inventory and Connection Manager > Traffic Engineering Management**.**Step 2** Click **TE SRLGs**. The TE SRLG List window 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.

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# Configure Element Protection

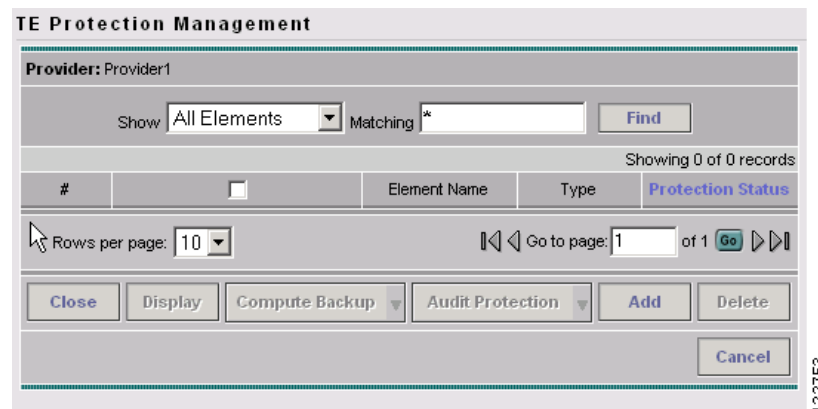
Before a protection computation can be performed, it is necessary to configure the network element protection.

To do so, use the following steps:

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

The TE Protection Management window in [Figure 6-4](#) appears.

**Figure 6-4** TE Protection Management



For an explanation of the various window elements, see [Protection Management, page B-34](#).

- 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 appears.

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.

For an explanation of the various window elements, see [Protection Management, page B-34](#).

- 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 4, “Basic Tunnel Management”](#) has its limitations, not just for larger and more complicated networks.

The protection tools available in 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 results window.

## Compute Backup

Compute Backup is used to let TEM automatically compute the necessary backup tunnels to protect specified network elements. The manual process is described in [Chapter 4, “Basic Tunnel Management.”](#)

To run Compute Backup, use the following steps:

- Step 1** Choose **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 6-5.](#)
- 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 appears.

- Step 4** The TE Protection Computation Results window in [Figure 6-5](#) appears.

**Figure 6-5** TE Protection Computation Results

#	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.	isctmpe4	Node		ValidTunnels

122749

For an explanation of the various window elements, see [Compute Backup, page B-35.](#)

**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 results 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 6-6](#).

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

**Figure 6-6 TE Protection Computation Results with Backup Tunnels**

**TE Protection Computation Results**

**Element:**

Show  with name matching

Showing 1 - 10 of 19 records

#	<input type="checkbox"/>	Element Name	Type	Report	Status
1.	<input type="checkbox"/>	isctmp7	Node		NoSolutionExists
2.	<input checked="" type="checkbox"/>	isctmp7	Node	violationNoBackupTunnels	NoSolutionExists
3.	<input type="checkbox"/>	isctmp7	Node	violationNoBackupTunnels	NoSolutionExists
4.	<input type="checkbox"/>	isctmp7	Node	violationNoBackupTunnels	NoSolutionExists
5.	<input type="checkbox"/>	isctmp7	Node	violationNoBackupTunnels	NoSolutionExists
6.	<input type="checkbox"/>	isctmp7	Node	violationNoBackupTunnels	NoSolutionExists
7.	<input type="checkbox"/>	isctmp6	Node		NoSolutionExists
8.	<input type="checkbox"/>	isctmp6	Node	violationNoBackupTunnels	NoSolutionExists
9.	<input type="checkbox"/>	isctmp6	Node	violationNoBackupTunnels	NoSolutionExists
10.	<input type="checkbox"/>	isctmp6	Node	violationNoBackupTunnels	NoSolutionExists

Rows per page:  Go to page:  of 2

**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	isctmp63	NNHOP

**Backup Tunnels:**

Op	Tunnel ID	Head	Dest	T#	BW	Path	Protection Type	Report
ADD	ISC-B330	isctmp1	isctmp8		200	<a href="#">Computed Path</a>	Protection	
ADD	ISC-B328	isctmp8	isctmp1		550	<a href="#">Computed Path</a>	Protection	
ADD	ISC-B329	isctmp8	isctmp1		1000	<a href="#">Computed Path</a>	Protection	
DELETE	ISC-B42	isctmp1	isctmp6	4	200	<a href="#">Bug-test2</a>	Activating	
DELETE	ISC-B48	isctmp8	isctmp64	3	1550	<a href="#">isctmp8-&gt;isctmp64-1</a>	Activating	

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For an explanation of the various window elements, see [Compute Backup, page B-35](#).

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** If the proposed protection solution is acceptable, click **Accept Solution**.

The TE Protection SR window in [Figure 6-7](#) appears with all tunnel additions and deletions computed by the system.

Figure 6-7 TE Protection SR - Computed Path

**TE Protection SR**

SR Job ID: 10      TE Provider: cisco      SR State: REQUESTED  
 SR ID: New      Creator:      Type: ADD

Description :

Show Existing Tunnels with All matching \* Find

Showing 21 - 25 of 30 records

#	<input type="checkbox"/>	Op	Tunnel ID	T#	Head	Dest	B/W Quota	Deploy Status	Conformance	Backup Type	Head Region	Tail Region
21.	<input checked="" type="checkbox"/>		ISC-B273	1013	isctmp6	isctmp14	0	DEPLOYED	No	CSPF	scotland	scotland
22.	<input type="checkbox"/>		ISC-B274	1014	isctmp6	isctmp14	0	DEPLOYED	No	CSPF	scotland	scotland
23.	<input type="checkbox"/>		ISC-B275	1000	isctmp3	isctmp2	60000	DEPLOYED	Yes	B/W Protected	scotland	scotland
24.	<input type="checkbox"/>		ISC-B276	1002	isctmp3	isctmp1	30006	DEPLOYED	Yes	B/W Protected	scotland	scotland
25.	<input type="checkbox"/>		ISC-B277	1003	isctmp3	isctmp1	30000	DEPLOYED	Yes	B/W Protected	scotland	scotland

Rows per page: 5      Go to page: 5 of 6 Go

Close   Display   Details   Create   Edit   Delete

Audit SR   Update Tunnel ID   Save & Deploy   Cancel

For an explanation of the various window elements, see [Create TE Backup Tunnel, page B-57](#).

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 6-10](#)).

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

When you click **Save & Deploy**, TEM locks the TE routers effected, which will block any subsequent SRs which use that TE router until the SRs are finished. It is safe to try and deploy other SRs in the system. If there is any conflict with the SR currently being processed, TEM will simply ask you to wait until it is complete. To see the state of deployment, go to the Service Requests 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**.

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 C, “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 9-1](#).

## Audit Protection

As opposed to the Compute Backup tool described on page 6, 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 results page as for Compute Backup. When you return from the computation results 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:

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

The TE Protection Management window in [Figure 6-4](#) 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 appears.

Then the TE Protection Computation Results window appears.

For an explanation of the various window elements, see [Compute Backup, page B-35](#).



**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 results 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 6-8](#) appears.

Figure 6-8 TE Protection Computation Results with Backup Tunnels

**TE Protection Computation Results**

Element: Show  with name matching

Showing 1 - 10 of 10 records

#	<input type="checkbox"/>	Element Name	Type	Report	Status
1.	<input type="checkbox"/>	isctmp7	Node		InvalidTunnels
2.	<input checked="" type="checkbox"/>	isctmp7	Node	violationBadBackupTunnel	InvalidTunnels
3.	<input type="checkbox"/>	isctmp7	Node	violationNoBackupTunnels	InvalidTunnels
4.	<input type="checkbox"/>	isctmp7	Node	violationNoBackupTunnels	InvalidTunnels
5.	<input type="checkbox"/>	isctmp7	Node	violationNoBackupTunnels	InvalidTunnels
6.	<input type="checkbox"/>	isctmp7	Node	violationNoBackupTunnels	InvalidTunnels
7.	<input type="checkbox"/>	isctmp7	Node	violationNoBackupTunnels	InvalidTunnels
8.	<input type="checkbox"/>	isctmp7	Node	violationNoBackupTunnels	InvalidTunnels
9.	<input type="checkbox"/>	isctmp7	Node	violationNoBackupTunnels	InvalidTunnels
10.	<input type="checkbox"/>	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

For an explanation of the various window elements, see [Compute Backup, page B-35](#).

- 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 6-6](#).

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 D, “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** Choose **Service Inventory > Inventory and Connection Manager > Traffic Engineering Management**.

**Step 2** Click **Create TE Backup Tunnel**.

The **TE Protection SR** window in [Figure 6-7](#) appears. For an explanation of the various window elements, see [Create TE Backup Tunnel, page B-57](#).

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

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**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).

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The FRR Audit process begins and the TE Protection Computation Results window appears.

See [Audit Protection, page 6-9](#) for a description of the rest of the process. Detail and report windows are identical in these two processes.

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