CHAPTER 11

Using Cisco ANA PathTracer to Diagnose Problems

Cisco ANA enables you to view a network path between two network objects using Cisco ANA PathTracer in the following types of networks:

- Circuit-switched network, such as Frame Relay or ATM
- Packet-switched networks, such as Ethernet and IP

In addition, beginning with Cisco ANA 3.7, you can specify either IPv4 or IPv6 addresses for the source or destination of a path trace.

The following topics describe the Cisco ANA PathTracer working environment and the functionality available when using Cisco ANA PathTracer:

User Roles Required to Work with Cisco ANA PathTracer

Table 11-1 identifies the roles that are required to work with Cisco ANA PathTracer. Cisco ANA determines whether you are authorized to perform a task as follows:

- For GUI-based tasks (tasks that do not affect devices), authorization is based on the default permission that is assigned to your user account.
- For device-based tasks (tasks that do affect devices), authorization is based on the default permission that is assigned to your account. That is, whether the device is in one of your assigned scopes and whether you meet the minimum security level for that scope.

For more information on user authorization, see the *Cisco Active Network Abstraction 3.7.1 Administrator Guide*.

Table 11-1 Default Permission/Security Level Required for Working with Cisco ANA PathTracer

Task	Viewer	Operator	OperatorPlus	Configurator	Administrator
Launch a path trace	—	—	—	—	X
View path information	—	—	—	—	X
Save Cisco ANA PathTracer map files	—	—	—	—	X
Save Cisco ANA PathTracer counter values	—	—	—	—	X
Rerun a path and compare results	—	—	—	—	X

Cisco ANA PathTracer Overview

Cisco ANA PathTracer enables end-to-end route tracing to be performed with informative performance information displayed simultaneously for the multiple networking layers. Upon receiving a path's start and endpoint, Cisco ANA PathTracer visually traces the route through the network. For example, in an ATM network environment, Cisco ANA PathTracer identifies all information regarding the connection of a subscriber to a provider, including all ATM PVCs, ATM switching tables, ATM class of service (CoS) definitions, IP-related information, and so on. You can also use Cisco ANA PathTracer to:

- Trace paths using IPv4, IPv6, or both IPv4 and IPv6 addresses for the source and destination.
- Trace a hypothetical Ethernet frame from a VLAN interface to a specified MAC address.
- Trace a hypothetical Ethernet frame from an Ethernet interface to a specified MAC address within a specific VLAN ID.

Cisco ANA PathTracer can also be used for the following MPLS and Carrier Ethernet technologies:

- Path trace across VLANs—Follows the path based on forwarding table, which means the trace follows ports in Forwarding STP state.
- Path trace across Q-in-Q—Creates a single path trace (if the MAC address is learned) or multiple-path (multipath) trace if the MAC address is not in the forwarding table. If the VLAN bridge has not learned a given MAC address, the bridge floods the Ethernet frame to the confines of a given VLAN or switching entity and across those ports that allow the given VLAN ID. A

MAC/VLAN path trace can be conducted from a CE-VLAN interface across an SP-VLAN, that is, across Q-in-Q configurations with the CE-VLAN ID as inner VLAN ID and Cisco ANA PathTracer detecting the outer SP-VLAN ID that encapsulates the CE-VLAN.

- Path trace across pseudowires (also known as EoMPLS) —A MAC/VLAN path trace can be conducted from a VLAN interface across a VLAN attachment to a pseudowire.
- VLAN-VPLS-VLAN path trace—A multi-point MAC/VLAN path trace can be conducted on CE-VLANs across service provider VPLS transport from a VLAN interface that attaches to the VPLS.
- MAC address not reachable— If Cisco ANA PathTracer cannot complete a MAC/VLAN path trace to a specified destination MAC address across an MPLS core, VPLS, or H-VPLS, then Cisco ANA PathTracer displays the portion of the path that Cisco ANA PathTracer was able to trace toward the destination MAC address.
- Simulated Ethernet frame—Cisco ANA PathTracer can trace a simulated Ethernet frame from a VLAN port, across a VLAN (VLAN-based Flow Domain Fragment), VPLS (VPLS-based Flow Domain Fragment), and VLAN, for an end-to-end MAC address trace.

Cisco ANA derives the various paths on the network from its up-to-date knowledge of the network. After a user has selected a source and destination, Cisco ANA PathTracer finds and retrieves the path of a specified service. The retrieved information contains network elements in the path, including all properties at Layer 1, Layer 2, and Layer 3, plus alarm information, counters, and more.

Cisco ANA PathTracer enables you to view multiple paths between the source and the destination in the Cisco ANA PathTracer multipath window, or to view a selected single-path in the Cisco ANA PathTracer single-path window.

Using Cisco ANA PathTracer

Cisco ANA PathTracer can be launched from a bridge, switching entity, Ethernet interface, Ethernet flow point, VLAN interface, ATM VC, DLCI, or IP interface entry point. The virtual route is found according to the cross connect table of each ATM switch or Frame Relay device. The IP routing and path finding process is enabled according to the VRF tables of each router.

To view a specific path, you must specify an initial point, such as a VPI/VCI, DLCI, VLAN, Ethernet port, or IP interface and optionally a destination, such as an IP or MAC address. If you specify VC or DLCI information, which ends in a router, Cisco ANA PathTracer finds the next hop according to the destination IP address. If you do not specify a destination IP or MAC address, Cisco ANA PathTracer uses the default gateway in the router. The business tags that have been referred to the physical or logical entities are also displayed.

Note The path can also be opened if there is a business tag attached to an endpoint that can be used as the starting point for opening the Cisco ANA PathTracer.

The Cisco ANA PathTracer tool provides two windows in which to view the path:

- Cisco ANA PathTracer Multipath Window, page 11-12—Displays all the paths available between the selected source and destination.
- Cisco ANA PathTracer Single-Path Window, page 11-16—Displays a single path available between the selected source and destination, as well as the subscribers and properties.

Cisco ANA PathTracer Right-Click Menu Options

Cisco ANA PathTracer is launched by using right-click menu options. Table 11-2 identifies the launching points for the different types of elements.

Table 11-2 Cisco ANA PathTracer Right-Click Menu Options

Element	Location
Affected Parties	• Inventory window • Ticket Properties window (Affected Parties tab)
Bridge	Inventory window
Business tag	The path can be found using a business tag, which is attached to the VPI/VCI, or using an IP interface by entering its key; it can then be opened from the Find Business Tag dialog box.
Ethernet flow point	Map view (Ethernet Flow Domain Properties window)
IP interface	• Inventory window • Affected entry
Layer 2 MPLS Tunnel	Inventory window
MPLS-TE Tunnel	Inventory window
Port	Inventory window
Site	Map view
Switching entity	Map view
VC Cross Connect Table	Inventory window (Cross Connect dialog box)
VC Table	Inventory window (VC Table dialog box)
VLAN	• Navigation pane • Map view

Starting a Path Trace

You can start a path trace in the following ways:

- From the Map View, page 11-5
- From Logical or Physical Inventory, page 11-7

From the Map View

To start a path trace from the map view:

Step 1 In the Cisco ANA NetworkVision map view, start the path trace in one of the following ways:

- For a VLAN:

  a. In the navigation pane or map pane, select the required network VLAN and then drill down to a switching entity or Ethernet flow point.

  b. Right-click the required item.

  c. Choose **PathTracer > From Here to Destination** or **PathTracer > Start Here**.

- For a VPN:

  a. In the navigation pane or map pane, select the required network VPN and then drill down to the required site.

  b. Right-click the site.

  c. Choose **PathTracer > From Here to Destination** or **PathTracer > Start Here**.

- For an Ethernet flow point:

  a. Choose **Network Inventory > Ethernet Flow Domains**.

  b. In the Ethernet Flow Domain List Properties window, double-click the required domain.

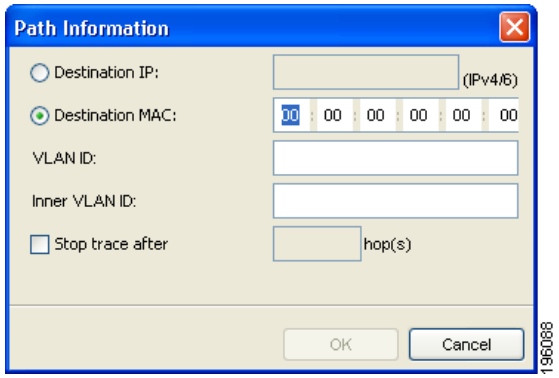
  c. In the Ethernet Flow Domain Properties window, right-click the required element.

  d. Choose **PathTracer > From Here to Destination** or **PathTracer > Start Here**.

The next step depends on your choice in Step 1:

- If you chose **PathTracer > From Here to Destination**, the Path Information dialog box is displayed (Figure 11-1). Continue with Step 2.
- If you chose **PathTracer > Start Here**, continue with Step 3.

Figure 11-1 Path Information Dialog Box



Step 2 To specify a destination:

a. In the Path Information dialog box, enter the required information, as described in Table 11-3.

Note Depending on the launch point, the Path Information dialog box might not contain all of the following fields.

Table 11-3 Cisco ANA PathTracer Path Information Dialog Box

Field	Description
Destination IP	Select this option to specify an IP address as the destination. Enter either an IPv4 or IPv6 address.
Destination MAC	Select this option to specify a MAC address as the destination. Enter the MAC address.
VLAN ID	Enter the required VLAN identifier. You must enter an IP address or a MAC address to use this option.
Inner VLAN ID	Enter the required inner VLAN identifier.
Stop trace after	Check this check box to limit the number of hops that Cisco ANA PathTracer makes in its attempt to reach the destination. Enter the maximum number of hops that you want to allow in the hops field.

b. Click **OK**.

Step 3 If you chose **Start Here**, navigate to the destination interface, port, or bridge, right-click it, and choose **End Here**.

The PathTracer multipath window is displayed showing the paths that were found. For more information about this window, see Cisco ANA PathTracer Multipath Window, page 11-12.

Step 4 If the multipath window displays more than one path, select a path in the Paths pane.

Note If multiple paths are selected in the Paths pane, they will be opened. If nothing is selected in the Paths pane, then all the available paths will be opened automatically, and each one will be displayed in a separate PathTracer single-path window.

Step 5 On the multipath window toolbar, click **Cisco PathTracer**. The PathTracer single-path window is displayed showing the end-to-end path.

For more information about the single-path window, see Cisco ANA PathTracer Single-Path Window, page 11-16.

From Logical or Physical Inventory

To start a path trace from logical or physical inventory:

Step 1 In Cisco ANA NetworkVision, open the inventory window for the required device using one of the following methods:

- Double-click a device or element in the navigation pane or in a map.
- Right-click a device or element in the navigation pane or in a map and choose **Inventory**.

Step 2 Select one of the following launch points in logical or physical inventory:

- IP Interface
- VLAN Bridge
- Port

Step 3 Right-click the selected item and choose one of the following:

- **PathTracer > From Here to Destination**—If you choose this option, continue with Step 2 in From the Map View, page 11-5.

  Note If you select an IP interface as the launch point, the right-click menu displays IPv4 and IPv6 options. These options are enabled or dimmed, depending on whether the IP interface has an IPv4 IP address, an IPv6 address, or both IPv4 and IPv6 addresses. For an example, see Figure 11-3.

- **PathTracer > Start Here**—If you choose this option, continue with Step 3 in From the Map View, page 11-5.

Examples of Launching Cisco ANA PathTracer

The following topics provide examples for launching Cisco ANA PathTracer from different points in Cisco ANA NetworkVision:

- Using an Ethernet Flow Point, page 11-7
- Using an IP Interface, page 11-8
- Using a VLAN Bridge, page 11-10
- Using an Ethernet Port, page 11-11
- Using a Pseudowire, page 11-11

Using an Ethernet Flow Point

A network VLAN is required for you to start a path trace using an Ethernet flow point.

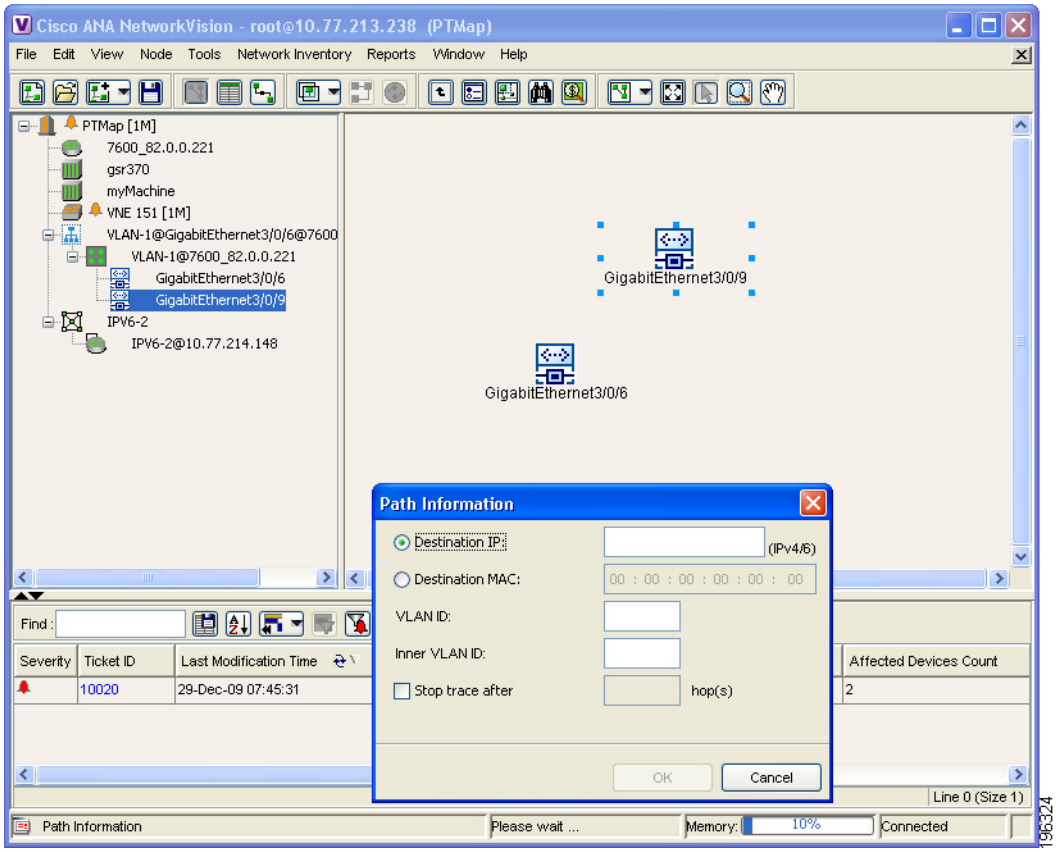
To launch a path trace from an Ethernet flow point:

Step 1 In the Cisco ANA NetworkVision navigation pane or map pane, select the required network VLAN.

Step 2 Navigate down to an Ethernet flow point and right-click it.

Step 3 Choose **PathTracer > From Here to Destination**. The Path Information dialog box is displayed as shown in Figure 11-2.

Figure 11-2 Ethernet Flow Point Path Trace Example



Step 4 Specify the destination and maximum number of hops using the information in Table 11-3.

Step 5 Click **OK**. The Cisco ANA PathTracer window is displayed with the resulting path trace.

Using an IP Interface

Both IPv4 and IPv6 addresses are supported as valid path trace sources and destinations as illustrated in the following procedure.

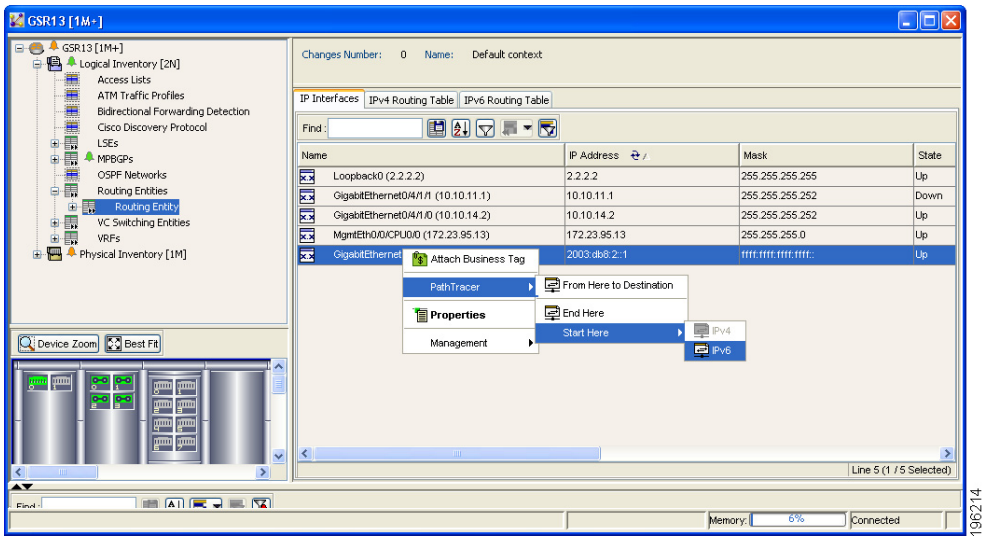
To launch a path trace from an IP interface:

Step 1 In logical inventory, select the required IP interface (**Logical Inventory > Routing Entities > Routing Entity >** *ip-interface*).

Step 2 Right-click the selected interface.

The right-click menu displays IPv4 and IPv6 options. These options are enabled or dimmed, depending on whether the IP interface has an IPv4 address, an IPv6 address, or both IPv4 and IPv6 addresses. See Figure 11-3.

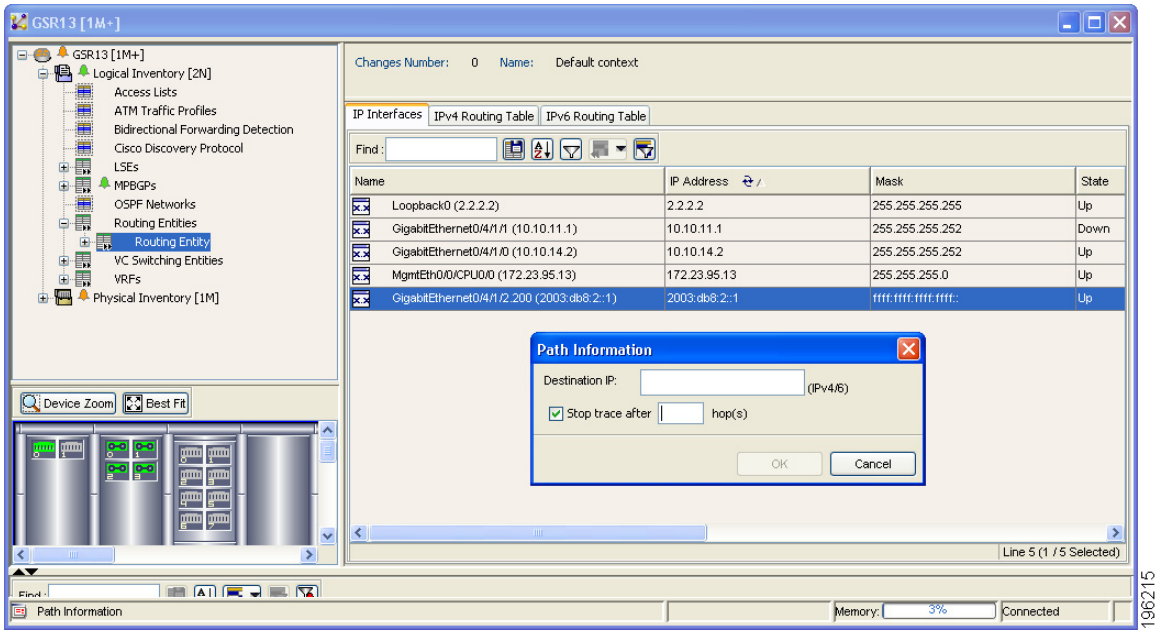
Figure 11-3 IP Interface Path Trace Launch Point



Step 3 Choose **PathTracer > From Here to Destination**.

The Path Information dialog box is displayed as shown in Figure 11-4.

Figure 11-4 IP Interface Path Trace Launch Point Path Information Dialog Box



Step 4 In the Destination IP field, enter the IPv4 or IPv6 address.

Step 5 To limit the number of hops for the path trace, check the *Stop trace after* check box, and enter the maximum number of hops for the path trace.

Step 6 Click **OK**. The Cisco ANA PathTracer window appears, displaying the resulting path trace.

Using a VLAN Bridge

You can launch path traces from VLAN bridges. Additionally, MAC addresses in the VLAN bridge forwarding table can be path trace destinations.

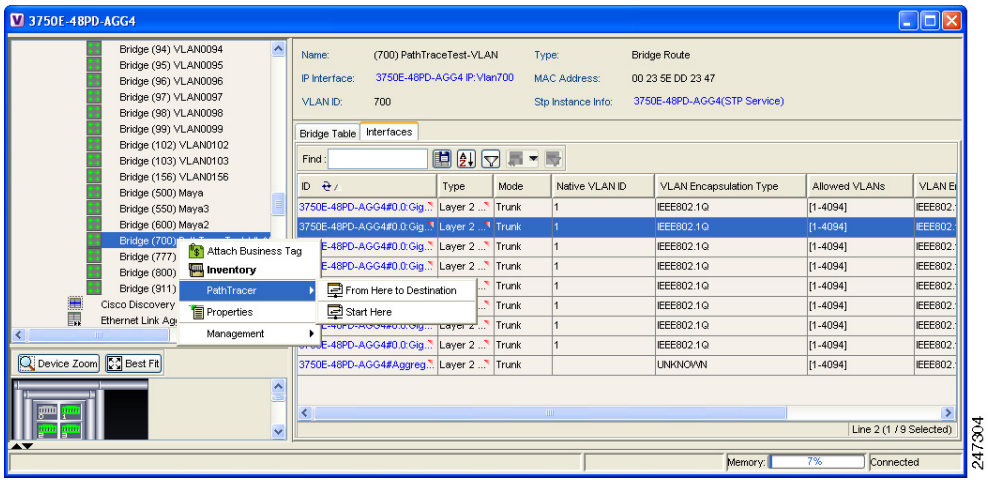
To launch a path trace from a VLAN bridge:

Step 1 In logical inventory, select the required bridge (**Logical Inventory > Bridges >** *bridge*).

Step 2 Right-click the selected bridge, then choose one of the following options as shown in Figure 11-5:

- **PathTracer > From Here to Destination**
- **PathTracer > Start Here**

Figure 11-5 VLAN Bridge Path Trace Launch Point



Step 3 If you chose **From Here to Destination** in Step 2, the Path Information dialog box is displayed. Specify the required destination using the information in Table 11-3.

Step 4 If you chose **Start Here**, navigate to the destination, right-click it, and choose **End Here**. Destination options include:

- IP interface—**Logical Inventory > Routing Entities > Routing Entity >** *IP-interface*
- Bridge—**Logical Inventory > Bridges >** *bridge*
- MAC address—**Logical Inventory > Bridges >** *bridge* **> Bridge Table >** *MAC-address*
- Ethernet port—**Physical Inventory >** *chassis* **>** *slot* **>** *port*

When a destination is selected, the system extracts the relevant IP address from this point and uses it as the destination.

The Cisco ANA PathTracer window is displayed with the resulting path trace.

Using an Ethernet Port

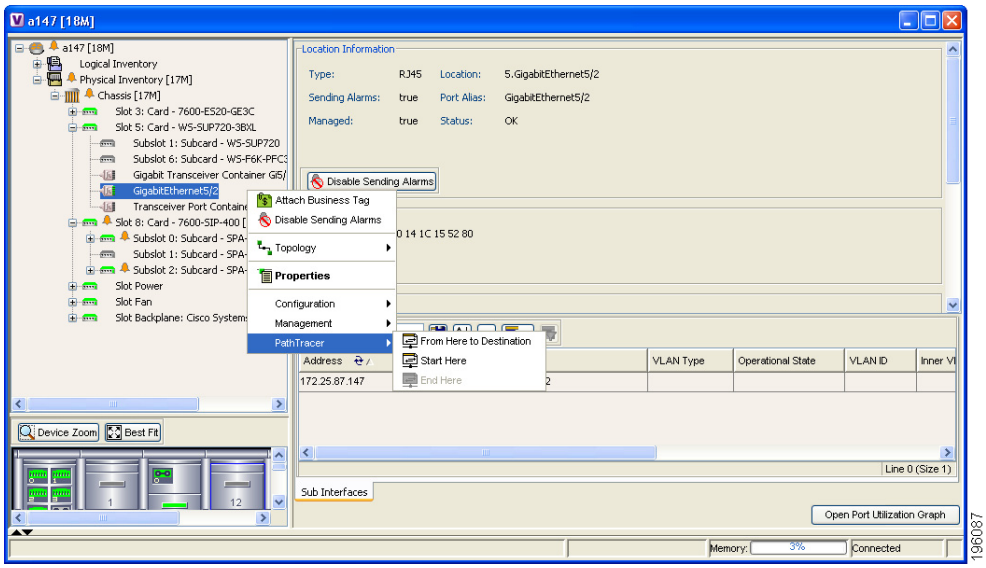
To launch a path trace from an Ethernet port:

Step 1 In physical inventory, select the required port (**Physical Inventory > Chassis >** *slot* **>** *subslot* **>** *port*).

Step 2 Right-click the selected port and choose one of the following as shown in Figure 11-6:

- **PathTracer > From Here to Destination**
- **PathTracer > Start Here**

Figure 11-6 Ethernet Port Path Trace Launch Point



Step 3 Depending on your choice in Step 2, specify the required destination information or select the path trace end point.

The Cisco ANA PathTracer window appears, displaying the resulting path trace.

Using a Pseudowire

To launch a path trace from network pseudowire:

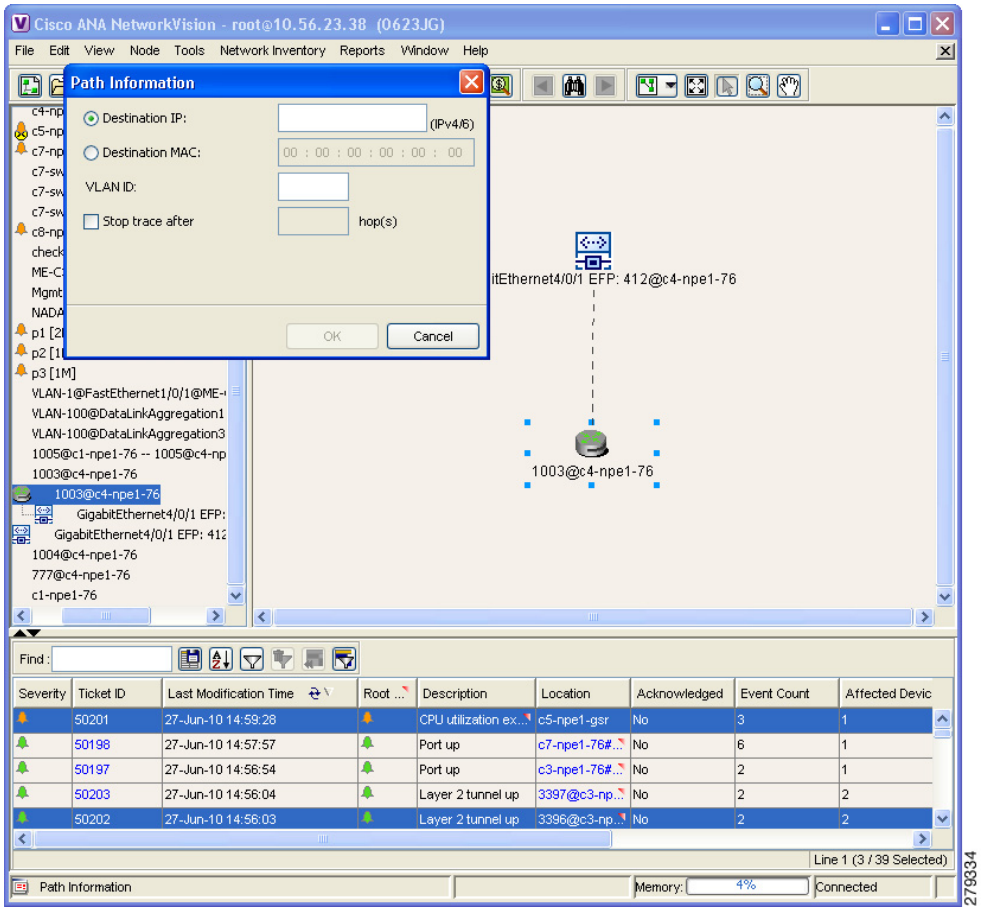
Step 1 In the Cisco ANA NetworkVision navigation pane or map pane, select the required network pseudowire.

Step 2 Navigate down to the required pseudowire endpoint and right-click it.

Step 3 In the right-click menu, choose **PathTracer > From Here to Destination**.

The Path Information dialog box is displayed as shown in Figure 11-7.

Figure 11-7 Path Information Dialog Box



Step 4 Specify the destination using the information in Table 11-3.

The Cisco ANA PathTracer window appears, displaying the resulting path trace.

Cisco ANA PathTracer Multipath Window

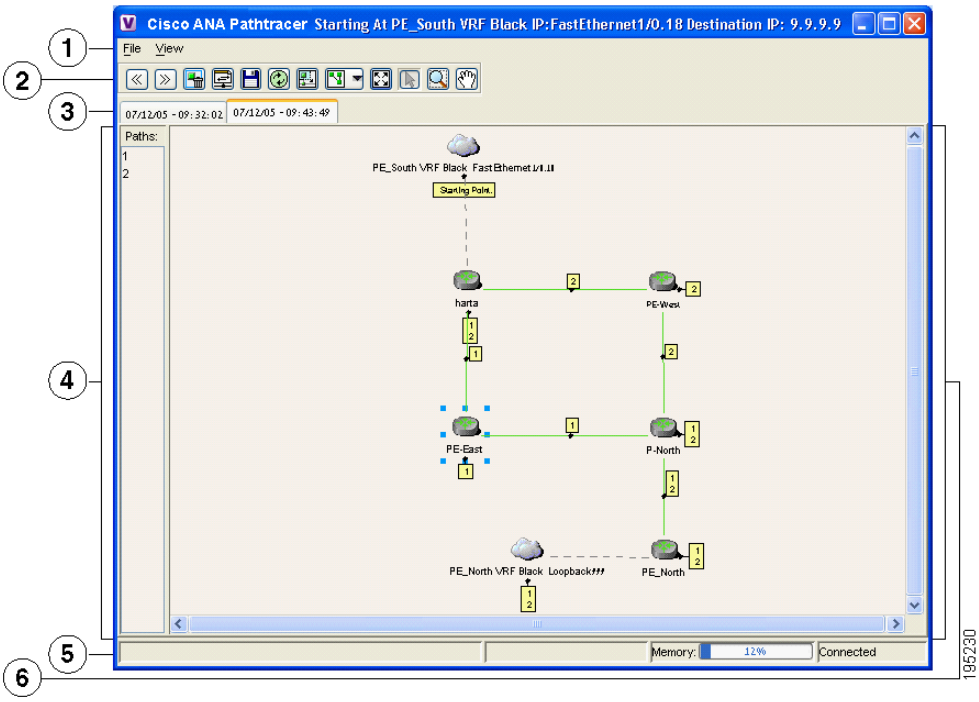
The Cisco ANA PathTracer multipath window displays all the discovered paths for the selected context, including devices and physical links.

The Cisco ANA PathTracer multipath window enables you to:

- View a previous path or view the next path.
- Open the Cisco ANA PathTracer single-path window in order to view a single selected path.
- Save the multipath map to a file.
- Run the Cisco ANA PathTracer again.

An example of the Cisco ANA PathTracer multipath window is displayed in Figure 11-8.

Figure 11-8 Cisco ANA PathTracer Multipath Window



1	Menu bar	**4**	Paths pane
2	Toolbar	**5**	Status bar
3	Map pathtraced at...tabs	**6**	Content pane

The Cisco ANA PathTracer multipath window contains the following elements:

- Menus, page 11-14
- Toolbar, page 11-14
- Tabs, page 11-15
- Paths Pane, page 11-16
- Content Pane, page 11-16

Menus

The menus in the Cisco ANA PathTracer multipath window provide the options described in Table 11-4.

Table 11-4 Cisco ANA PathTracer Window Menu Options

Menu Option	Description
File Menu	
Run Again	Runs the Cisco ANA PathTracer again, using the same source and destination parameters.
Save	Saves the map displayed in the multipath window.
Close	Closes the multipath window.
View Menu	
Layout	Defines the way in which the NEs are arranged in the Cisco ANA PathTracer window: circular, symmetric, tree, or hierarchical.
Overview	Opens a window displaying an overview of the network.
Zoom In	Enables you to zoom in for a closer view of the map.
Zoom Out	Enables you to zoom out for a higher-level view of the map.
Fit in Window	Fits the entire subnetwork or map in the content pane.
Normal Select	Activates the normal selection mode (the button toggles when selected or deselected).
Pan	Activates the pan mode, which enables you to move around in the map by clicking and dragging (the button toggles when selected or deselected).
Zoom Selection	Activates the zoom selection mode, which enables you to select an pane in the map to enlarge by clicking and dragging (the button toggles when selected or deselected).

You can also right-click views and network elements in the multipath window and choose items from a shortcut menu. The shortcut menu is context sensitive depending on the view and the network element selected. For more information about the Device shortcut menu and for a detailed description of the menu options available, see Device Shortcut Menu, page 2-30.

Toolbar

The Cisco ANA PathTracer multipath window contains the following tools:

Button	Function
	Selects the previous path viewed in the content pane.
	Selects the next path viewed in the content pane.

Button	Function
	Clears the path selection made in the content pane.
	Opens the Cisco ANA PathTracer single-path window based on the path selected in the Cisco ANA PathTracer multipath window. A map is displayed for the selected path, including NE details, links, and property information. For more information, see Cisco ANA PathTracer Single-Path Window, page 11-16.
	Saves the multipath map displayed in the content pane. For more information, see Saving and Opening Cisco ANA PathTracer Map Files, page 11-20.
	Defines the way in which the map is displayed in the content pane (circular, symmetric, tree, or hierarchical).
	Opens a window displaying an overview of the network displayed in the content pane.
	Offers the following options for running Cisco ANA PathTracer again for the same source and destination: • Change Hop Count—Enables you to enter a new hop count. • Repeat Last Trace—Runs the previous trace with the same settings. • Run Full Path Trace—Runs the previous trace without a hop count limitation. The new path trace map is displayed in the content pane. A new tab with the up-to-date (or refreshed) path map is created for each run, with each tab representing a run and the tab label indicating the snapshot time.
	Fits the entire subnetwork or map in the content pane.
	Activates the normal selection mode (the button toggles when selected or deselected).
	Activates the zoom selection mode, which enables you to select an pane in the map to enlarge by clicking and dragging (the button toggles when selected or deselected).
	Activates the pan mode, which enables you to move around in the map by clicking and dragging (the button toggles when selected or deselected).

Tabs

The path is initially displayed in the content pane in a tab that displays the date and time when Cisco ANA started the path tracing process (snapshot time).

If you load a saved path from a file or run the displayed path trace again, the opened or refreshed path is displayed in a new tab with a refreshed path map for each run or file. When using a saved path from a file, the source and destination must be the same as the current display for it to appear in the same path trace window. Each tab represents a run or file, and its header displays the snapshot time.

Paths Pane

The Paths pane displays all of the paths available for the selected source and destination. A new path is created for each source and destination pair. The paths are identified by number, such as 1, 2, and 3. Selecting a path in the Paths pane enables you to view each individual path in the content pane of the Cisco ANA PathTracer single-path window, and the selected path is highlighted in the map.

If the path trace was launched with a specific hop count, the paths pane displays First *n* Hops where *n* is the number of hops specified.

Content Pane

The content pane enables you to view a route map of the intermediate network elements. The map displays devices, links, and topological paths.

Icons are used in the content pane to display the network objects and their status. For more information about the icons used, see Chapter 2, "Working with the Cisco ANA NetworkVision Client."

All links and nodes are labeled with the relevant paths numbers. The starting point is labeled with a special Starting Point label. All other edge points are displayed as clouds.

Cisco ANA PathTracer Single-Path Window

The Cisco ANA PathTracer single-path window displays the devices and links of the discovered path, as well as path layer properties and subscriber information.

Note This section refers to single-path view only.

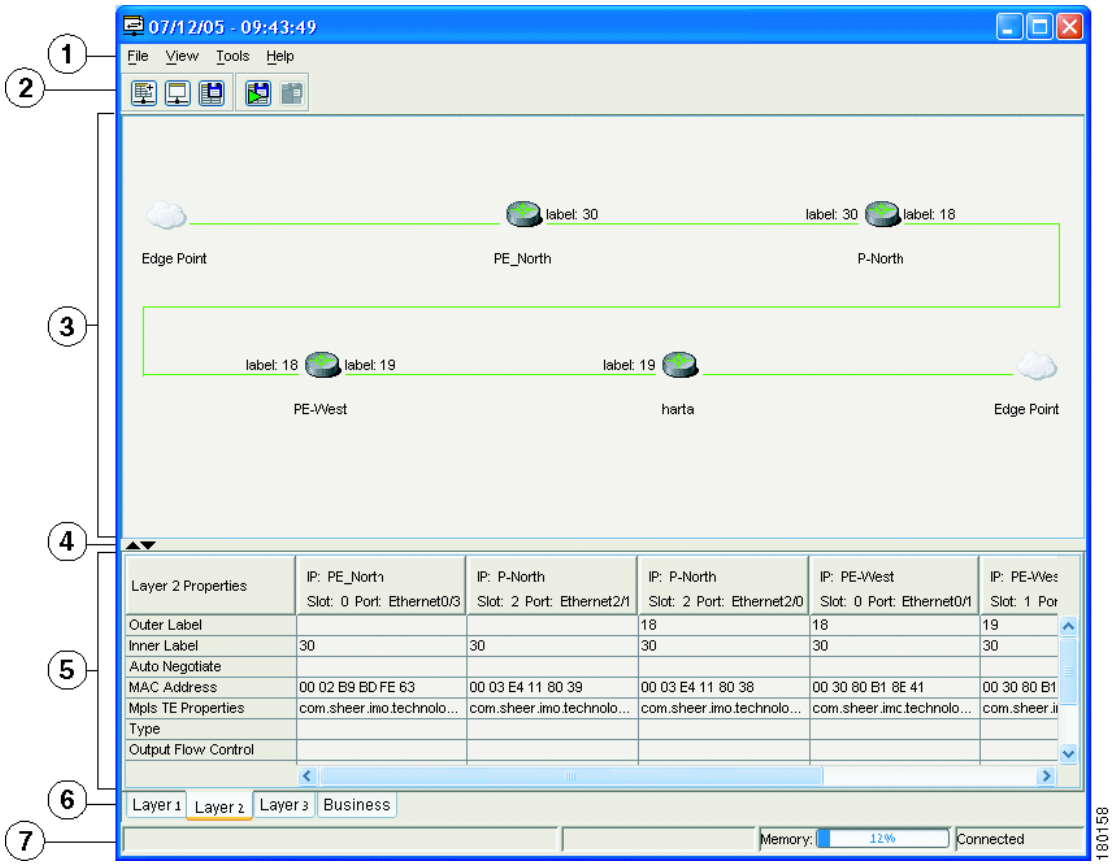
The Cisco ANA PathTracer single-path window enables you to:

- View a map of the intermediate network elements.
- View the following information for each network element:
  - The relevant parameters for each interface on all layers along the path.
  - For each layer, an indication of a mismatch between the parameters of the interfaces on both sides of a link.
  - Traffic statistics along the path.
- Monitor the status and traffic of all links along the path.
- View In and Out port properties.

In addition, right-clicking on an item in Cisco ANA PathTracer enables you to perform certain functions. For example, you can view device information, including device properties, and attach business tags.

Figure 11-9 shows an example of the Cisco ANA PathTracer single-path window.

Figure 11-9 Cisco ANA PathTracer Single-Path Window



1	Menu bar	**5**	Properties table
2	Toolbar	**6**	Layer tabs
3	Content pane	**7**	Status bar
4	Hide/Display Properties table		

The Cisco ANA PathTracer single-path window contains the following items:

- Menus, page 11-18
- Toolbar, page 11-18
- Topological Map, page 11-19
- Properties Table and Layer Tabs, page 11-19

Menus

The following table provides a description of each option available in the Cisco ANA PathTracer single-path window menus.

Menu Name	Options
File	Close—Closes the single-path window.
View	• Show All—Displays all of the information contained in the Properties table. • Hide All—Hides all of the information contained in the Properties table.
Tools	• Export to File—Exports the currently displayed data to a file. • Start Saving to File—Starts exporting the counter values of the path displayed in the Cisco ANA PathTracer single-path window to a CSV file. • Stop Saving to File—Stops exporting the counter values of the path displayed in the Cisco ANA PathTracer single-path window to a CSV file.
Help	• Help Contents—Opens the online help for Cisco ANA NetworkVision and Cisco ANA EventVision. • Help About—Displays application information, such as the version number.

In addition, you can right-click views and network elements in the single-path window and choose items from a shortcut menu. The shortcut menu is context sensitive depending on the view and the network element selected. The following right-click menu options are available only when you select a network element in the single-path window:

- Show ‘In’ Port—In the Properties table, highlights the In Port information of the selected network element.
- Show ‘Out’ Port—In the Properties table, highlights the Out Port information of the selected network element.

Toolbar

The Cisco ANA PathTracer single-path window contains the following tools:

Table 11-5 Cisco ANA PathTracer Single-Path Window Tools

Button	Name	Function
	Show All	Displays all the information in the tabs.
	Hide All	Hides all the information in the tabs.
	Export to File	Exports the currently displayed data to a CSV file.

Table 11-5 Cisco ANA PathTracer Single-Path Window Tools (continued)

Button	Name	Function
	Start Saving to File	Starts exporting the counter values of the path displayed in the Cisco ANA PathTracer single-path window to a CSV file.
	Stop Saving to File	Stops exporting the counter values of the path displayed in the Cisco ANA PathTracer single-path window to a CSV file.

Topological Map

The topological map displays the devices and links that are part of the path. Icons are used in Cisco ANA PathTracer to display the network objects and their status. For more information about the icons used, see Chapter 2, "Working with the Cisco ANA NetworkVision Client."

For more information about the colors used to indicate severities, see Map View, page 2-6.

The same coloring conventions that are used in maps in the Cisco ANA NetworkVision content pane are used to display links in the Cisco ANA PathTracer single-path window. Selecting a device or link on the map automatically highlights the related parameters in the table.

Note The color of a selected link is customizable. The default color is blue.

The status of a network object can be indicated on the topological map in the following ways:

- Severity
- Management state
- New alarms

For more information, see Network Element Status Indicators, page 2-17.

Properties Table and Layer Tabs

The Properties table and tabs display the supported parameters of the specified NE. The Cisco ANA PathTracer single-path window is divided into tabs as shown in the example in Cisco ANA PathTracer Single-Path Window, page 11-16.

The information parameters are displayed in a table, with the ingress and egress ports on the top and the parameters on the left.

Any inconsistencies between the two connected ports are colored to emphasize a discrepancy, such as different admin statuses.

The Cisco ANA PathTracer information parameters are arranged in groups as follows:

- Networking Layers—This group provides information about each network element, including ingress and egress port information. The information is either plain data that was extracted from the device or calculated data such as rates or statistics. This information is displayed in the Layer 1, Layer 2, and Layer 3 tabs.

  If a field has no value on any of the interfaces, the field is not displayed in the table. For example, if none of the interfaces is configured for MTU, the MTU row is not displayed in the table. If at least one of the interfaces is configured for MTU, the MTU row is displayed.

- Business—This area provides the name and key of the business tags that have been attached to the network entities displayed; for example, the port or the entire device (physical entity), VC, VP, DLCI, context (logical entity), or MPLS. This information is displayed in the Business Tag area.

The Cisco ANA PathTracer window is divided into the following tabs; all tabs appear empty when the window opens:

- Layer 1—Displays the Layer 1 information in the selected path and enables you to view the link parameters. The name of each device is displayed, as well as the subslot, slot, and port details.
- Layer 2—Displays the Layer 2 information in the selected path. In addition, it enables you to view the link and connection parameters. For each of the devices, the name and MAC address are displayed, as well as the VPI/VCI in an ATM link or the DLCI in a Frame Relay link. By default, the Cisco ANA PathTracer single-path window is displayed with the Layer 2 tab active.
- Layer 3—Displays the Layer 3 information selected path and enables you to view the link parameters. The name of each device is displayed.
- Business Parameter—Displays the name and the key of the business tags that have been attached to the network entities displayed; for example, the port or the entire device (physical entity), VC, VP, DLCI, IP interface, or context (logical entity).

Viewing Path Information

The Cisco ANA PathTracer tabs display information regarding each network element, including ingress and egress port information. The information is either plain data that was extracted from the device or calculated data such as rates or statistics. This information is displayed in the Layer 1, Layer 2, and Layer 3 tabs of the Cisco ANA PathTracer single-path window.

To view path information, select the required tab, and click **Show All**. The path information is displayed in the active tab of the Cisco ANA PathTracer single-path window.

Note Selecting a device or link on the map automatically highlights the related parameters in the table.

Saving and Opening Cisco ANA PathTracer Map Files

Cisco ANA NetworkVision enables you to export the maps displayed in the Cisco ANA PathTracer multipath window to an .xml file. You can view the data at a later time to assess whether anything has changed.

Saving Cisco ANA PathTracer Map Files

To save Cisco ANA PathTracer Map Files:

Step 1 Open the Cisco ANA PathTracer multipath window as described in Using Cisco ANA PathTracer, page 11-3.

Step 2 Save the map in one of the following ways:

- Click **Save MultiPath** in the multipath window toolbar.
- Choose **File > Save** from the multipath window menu.

Step 3 In the Save dialog box, browse to the directory where you want to save the file.

Step 4 In the File name field, enter a name for the map file.

Step 5 Click **Save**. The map file is saved in the selected directory.

Opening Cisco ANA PathTracer Map Files

Cisco ANA NetworkVision enables you to open saved XML-formatted path-tracing maps.

Note
- When you load a multipath file, Cisco ANA queries the file (not the network), and loads all the persisted information.
- When you load a multipath file that does not contain the same Start Here and End Here destination information, the map is automatically opened in another instance of Cisco ANA PathTracer.

To open Cisco ANA PathTracer Map Files:

Step 1 In Cisco ANA NetworkVision, choose **File > Load PathTracer** from the main menu. The Open dialog box is displayed.

Step 2 Browse to the directory of the saved file and select the file.

Step 3 Click **Open**. The Cisco ANA PathTracer multipath window is displayed with the previously saved map file.

Saving Cisco ANA PathTracer Counter Values

Cisco ANA NetworkVision enables you to export, over a period of time, the counter values of the path displayed in the Cisco ANA PathTracer single-path window to a CSV file. The data can then be viewed at a later stage.

Note This topic applies to the single-path view only.

To save Cisco ANA PathTracer counter values that are generated over a period of time:

Step 1 Open the Cisco ANA PathTracer single-path window as described in Using Cisco ANA PathTracer, page 11-3.

Step 2 Start saving counter values to a file in one of the following ways:
- Click **Start Saving to File** in the single-path window toolbar.
- Choose **Tools > Start Saving to File** from the single-path window main menu.

Step 3 In the Export Table to File dialog box, browse to the directory where you want to save the Cisco ANA PathTracer counter values.

Step 4 In the File name field, enter a name for the file in which to save the counter values.

Step 5 Click **Save**. Cisco ANA PathTracer starts saving the counter values to the specified file.

Step 6 Stop exporting counter values to the file in one of the following ways:

- Click **Stop Saving to File** in the single-path window toolbar.
- Choose **Tools > Stop Saving to File** from the single-path window main menu.

Cisco ANA NetworkVision stops exporting the counter values to the file.

Rerunning a Path and Comparing Results

If you save a path to a file (see Saving and Opening Cisco ANA PathTracer Map Files, page 11-20), you can use the file a later time to rerun the same path automatically with the same source and destination. If required, you can then compare the saved path and the newly run path to determine if the path has changed or to assess a problem.

To rerun a saved path:

Step 1 Load the required map file as described in Saving and Opening Cisco ANA PathTracer Map Files, page 11-20. The Cisco ANA PathTracer multipath window is displayed with the previously saved map file.

Step 2 Rerun the path in the file in one of the following ways:

- Click **Run Again** in the multipath window toolbar.
- Choose **File > Run Again** from the multipath window main menu.

The path runs automatically using the same source and destination as the loaded map file, and a new tab is displayed in the Cisco ANA PathTracer multipath window with the updated map. The tab also displays the updated details of the date and time when the path was rerun.

Step 3 Compare the previous map with the updated one by switching between the tabs in the Cisco ANA PathTracer multipath window.

Note

- If you load a Cisco ANA PathTracer map file that does not contain the same source and destination information as the map that is currently displayed in the window, the map is automatically opened in another instance of the Cisco ANA PathTracer multipath window.
- If you load a Cisco ANA PathTracer map file that contains the same source and destination information as a map that is currently displayed in the window, the map is loaded in a new tab in the same window.

Viewing Q-in-Q Path Information

The Q-in-Q (IEEE 802.1) tagging technology (also known as Dot1q tunneling) allows the nesting of an additional VLAN tag in a packet, in addition to an existing one. Either VLAN tag is considered an 802.1Q header.

Cisco ANA PathTracer uses the VLAN tags of the Ethernet header and the port configuration to trace the path from one interface to another over the network. Among other things, the tool lets you:

- View a Layer 2 path across a LAN domain with all the VLAN tag information.
- For each network element, view the relevant parameters for each interface on all layers along the path.

Q-in-Q and dot1q information is displayed in the Cisco ANA PathTracer windows when a path is traced over Ethernet ports with Dot1q and a Q-in-Q configuration.

As described in Using Cisco ANA PathTracer, page 11-3, to view a specific path, you must specify an initial start point, such as an IP interface, and then an endpoint, such as a destination IP address.

To trace a Q-in-Q path, you start the path from any:

- Router or switch that is part of the Ethernet domain with Dot1q and Q-in-Q configurations.
- IP destination that can be reached from that point of the network.

As soon as you select the endpoint, the Cisco ANA PathTracer Multipath window is displayed. From this window, you can open the Cisco ANA PathTracer Single-Path window, with the appropriate Q-in-Q information displayed in the Layer 2 tab.

The Layer 2 tab can display the following information specific to Q-in-Q and VLAN port configurations:

- VLAN Mode—The work mode for the interface: Unknown, Access, Trunk, or Dot1QTunnel. Trunk mode also refers to multiple tagging.
- Native VLAN ID—The VLAN identifier that is used to tag untagged traffic received on a trunked interface:
  - If VLAN tagging is enabled, the default native VLAN identifier is 1.
  - If VLAN tagging is disabled, the native VLAN identifier is 0 (zero) or ‘no VLAN ID.’
- CE VLAN ID—The customer edge device VLAN identifier.
- SP VLAN ID—The service provider VLAN identifier.

Viewing L2TP Path Information

Cisco ANA uses VC ID encapsulation information to trace the path from one tunnel interface to another over the network. The Cisco ANA PathTracer tool enables you to:

- View a path for the defined Layer 2 Tunneling Protocol (L2TP) session across the network.
- For each network element, view the relevant parameters for each interface on all layers along the path.

Layer 2 and Layer 3 L2TP information is displayed in the Cisco ANA PathTracer windows when a path is traced over L2TP tunnels for Redback devices.

The Layer 3 tab displays the peer name for L2TP tunnels.

Table 11-6 describes the information that is displayed in the Layer 2 tab for L2TP tunnels.

Table 11-6 Layer 2 Tab Information for L2TP Tunnels

Field	Description
Encapsulation Type	The encapsulation type, such as Point-to-Point Protocol over ATM (PPPoA).
Binding Information	The name of the subscriber.

Table 11-6 Layer 2 Tab Information for L2TP Tunnels (continued)

Field	Description
Binding Status	The binding status: bound or unbound.
Tunnel Session Count	The number of current sessions.
Tunnel Remote ID	The remote tunnel identifier.
Tunnel ID	The local tunnel identifier.
Tunnel Name	The name of the subscriber and the tunnel ID.
Session ID	The session identifier.
Traffic > L2TPSessionCounters	The number of traffic packets passing through the L2TP tunnel.
Traffic < L2TPSessionCounters	The number of traffic packets passing through the L2TP tunnel.
Tunnel Ctl Errors	The number of control errors.
Tunnel State	The tunnel state: unknown, idle, connecting, established, or disconnecting.
Session Type	The session type: unknown, LAC, or LNS.
Peer Name	The peer name.
Tunnel Remote IP	The remote IP address of the tunnel.
Last Error Code	The value of the last error code that caused the tunnel disconnection.
Session State	The session state: unknown, idle, connecting, established, or disconnecting.
Remote Session ID	The remote session identifier.

Using Cisco ANA PathTracer in MPLS Networks

You can open and view Cisco ANA PathTracer information between service endpoints, such as an IP interface that is attached to the VRF over an MPLS network. The LSP in the MPLS network is found according to the cross-connect table of each router.

Note The LSP can be traced and displayed by Cisco ANA PathTracer as part of an end-to-end tracing of a service, as well; for example, when viewing a path between one CE device and another. Cisco ANA PathTracer traces the path that goes over circuits or VLANs in the access networks. It also traces the LSPs between the VRFs going through all intermediate devices such as CE devices, aggregation switches, PE routers, and core routers.

To view a specific path, you must specify an initial starting point, such as an IP interface; specifying a destination IP address is optional. If the traced circuit (for example, a VC or VLAN) ends in a router, Cisco ANA PathTracer finds the next hop according to the destination IP address. When you select an endpoint, Cisco ANA extracts the relevant IP address from this point and uses it as the destination.

Cisco ANA PathTracer MPLS Starting Points

You can open Cisco ANA PathTracer by right-clicking a starting point and entering the required destination IP address. Table 11-7 lists the Cisco ANA PathTracer starting points.

Table 11-7 Cisco ANA PathTracer Starting Points

Element	Location	Start Options
IP Interface	• Inventory window. • Affected entity (enabled only if the affected entity has an IP interface).	• From Here to Destination • Start Here
Site	Service view map.	• From Here to Destination • To Subnet Destination • Start Here
Business tag attached to the VPI/VCI or IP interface	The path can be found using a business tag, which is attached to the VPI/VCI or IP interface by entering its key. It can then be opened from the Find Business Tag window.	From Here to Destination
Layer 2 MPLS Tunnel	Inventory window.	From Here to Destination
LCP	Service view map.	• From Here to Destination • Start Here

Cisco ANA PathTracer MPLS Endpoints

If you choose the Start Here option, Table 11-8 lists the endpoints that can be selected as path destinations.

Table 11-8 Cisco ANA PathTracer Endpoints

Element	Location	End Options
IP Interface	• Inventory window • Affected entity (enabled only if the affected entity has an IP interface)	End Here
Site	Service view map	End Here
LCP	Service view map	End Here

The Cisco ANA PathTracer multipath window is displayed. From this window you can open the Cisco ANA PathTracer single-path window with the appropriate VPN information displayed in the Layer 2 and Layer 3 tabs.

Note If multiple paths are selected in the paths pane, or if nothing is selected in the paths pane, all available paths are opened automatically, and each is displayed in a separate Cisco ANA PathTracer single-path window.

Using Cisco ANA PathTracer for Layer 3 VPNs

Cisco ANA PathTracer uses VRF routing and label switching information to trace the path from one VRF interface to another. If you choose a start and endpoint from the right-click menu, you can open the Cisco ANA PathTracer for Layer 3 VPNs. The Cisco ANA PathTracer multipath window shows the VPN topology map. From this window, you can open the Cisco ANA PathTracer single-path window with the appropriate VPN information displayed in the Layer 2 and Layer 3 tabs.

For Layer 3 path information, Cisco ANA uses VRF routing and label switching information to trace the path from one VRF interface to another. Layer 3 Cisco ANA PathTracer information is displayed in the Cisco ANA PathTracer window when the path goes over connections and ends in VRFs.

If a VRF table includes more than one path toward a destination, Cisco ANA PathTracer shows all paths.

To view Layer 3 path information, choose the **Layer 3** tab and choose **Show All** from the View menu. The path information is displayed in the active tab.

Note Selecting a device or link on the map automatically highlights the related parameters in the table.

The Cisco ANA PathTracer single-path window with the Layer 3 tab is displayed. The table displays the Layer 3 VPN information on the device that has a VRF. The following Layer 3 properties displayed in the Layer 3 tab relate specifically to VPNs:

- Name—The name of the site. For example, ATM4/0.100(10.0.0.1) is a combination of the interface name and IP address used to reach the site. Each site belongs to a particular VPN, so the address must be unique within the VPN.
- IP Address—The IP address of the interface.
- Mask—The mask of the specific network.
- State—The state of the interface (up or down).
- VRF Name—The name of the VRF.
- Sending Alarms—Whether or not the interface is configured for sending alarms: True or False.

Cisco ANA PathTracer does not display or trace EXP bits for L3 VPNs that use policy-based tunnel selection (PBTS).

Using Cisco ANA PathTracer for Layer 2 VPNs

Cisco ANA uses VC ID and label switching information to trace the path from one tunnel interface to another over the MPLS network.

The Cisco ANA PathTracer also covers end-to-end Layer 2 VPN service paths from one CE router to another. The path goes over circuits (such as a VC) or VLANs in access networks and over LSP between the Layer 2 tunnel edge.

The Cisco ANA PathTracer multipath window shows the VPN topology map for the relevant devices and links. From this window, you can open the Cisco ANA PathTracer single-path window with the appropriate VPN information displayed in the Layer 2 and Layer 3 tabs.

For Layer 2 path information, Cisco ANA uses VC ID and label switching information to trace the path from one tunnel interface to another. Layer 2 Cisco ANA PathTracer information is displayed in the Cisco ANA PathTracer window when the path goes over pseudowire tunnels.

To view Layer 2 path information, choose the **Layer 2** tab and then **View > Show All**. The path information is displayed in the active tab.

Note Selecting a device or link on the map automatically highlights the related parameters in the table.

Table 11-9 describes the Layer 2 properties that can be displayed in the Layer 2 tab specifically for VPNs.

Table 11-9 Cisco ANA PathTracer Layer 2 Properties for VPNs

Field	Description
Outer Label	The details of the outer MPLS label.
Inner Label	The details of the inner MPLS label.
MAC Address	The MAC address.
Tunnel ID	The tunnel identifier. The identifier and the router IP address of the two tunnel edges identify the pseudowire tunnel
Tunnel Type	The tunnel type: • 0—Unknown • 1—PWE3 • 2—TE
Tunnel Status	The operational state of the tunnel: Up or Down.
Tunnel Local VC Label	The MPLS label that is used by the router to identify or access the tunnel. It is inserted in the MPLS label stack by the local router.
Tunnel Peer VC Label	The MPLS label that is used by the router to identify or access the tunnel. It is inserted in the MPLS label stack by the peer router.
Tunnel Local Router IP	The IP address of the tunnel edge, which is used as the MPLS router identifier.
Tunnel Peer Router IP	The IP address of the peer tunnel edge, which is used as the MPLS router identifier.
Distribution Protocol Type	The protocol used by MPLS to build the tunnel, such as LDP or TDP.
Peer OID	The tunnel identifier and device name.

Using Cisco ANA PathTracer for MPLS TE Tunnels

Cisco ANA Path Tracer uses label switching information to trace the end-to-end path of a TE tunnel path from one PE router to another.

Using MPLS TE technology, Cisco ANA PathTracer enables you to:

- View a path or list of devices.
- View the following information for each network element:
  - The relevant parameters for each interface on all layers along the path.
  - The path for the defined MPLS TE-LSP across the network.

The Cisco ANA PathTracer multipath window is displayed showing the MPLS TE tunnel topology map. From this window, you can open the Cisco ANA PathTracer single-path window with the appropriate MPLS TE tunnel information displayed in the Layer 2 tab.

Note Cisco ANA PathTracer does not display or trace EXP bits for L3 VPNs that use PBTS.

Layer 2 and Layer 3 Cisco ANA PathTracer information is displayed in the Cisco ANA PathTracer window when a path is traced over MPLS TE tunnels. To view Layer 2 path information, choose the **Layer 2** tab and then **View > Show All**. The path information is displayed in the active tab.

Note Selecting a device or link on the map automatically highlights the related parameters in the table.

Table 11-10 describes the Layer 2 properties that can be displayed in the Layer 2 tab specifically for MPLS TE tunnels.

Table 11-10 Cisco ANA PathTracer Layer 2 Properties for MPLS TE Tunnels

Field	Description
MPLS TE Properties	The MPLS TE data set in an MPLS interface, primarily bandwidth allocation levels and signaling protocol.
Tunnel Oper Status	The operational status of the tunnel: Up or Down. If this value is Up, the Tunnel Admin Status must also be Up. See Tunnel Admin Status properties for additional information.
Tunnel Bandwidth Kbps	The configured bandwidth (in Kb/s) for the tunnel.
Tunnel Description	A description of the tunnel.
Tunnel Name	The interface name.
Tunnel Admin Status	The administrative status of the tunnel (Up or Down) with the following caveats: • If the Tunnel Oper Status value is Up, the Tunnel Admin Status value must also be Up. • If the Tunnel Admin Status value is Down, the Tunnel Oper Status value must also be Down.
Tunnel Lockdown	Whether or not the tunnel can be rerouted: • Enabled—The tunnel cannot be rerouted. • Disabled—The tunnel can be rerouted.
Tunnel LSP ID	The LSP identifier.
Tunnel Auto Route	Whether or not destinations behind the tunnel are routed through the tunnel: Enabled or disabled.
Tunnel Hold Priority	The tunnel priority after path setup.
Tunnel Setup Priority	The tunnel's priority upon path setup.

Table 11-10 Cisco ANA PathTracer Layer 2 Properties for MPLS TE Tunnels (continued)

Field	Description
Tunnel Path Option	The tunnel path option: • Dynamic—The tunnel is routed along the ordinary routing decisions after taking into account the tunnel constraints such as attributes, priority, and bandwidth. • Explicit—The route is explicitly mapped with the included and excluded links.
Tunnel Out Label	The TE tunnel MPLS label distinguishing the LSP selection in the adjacent device.
Tunnel Affinity	The tunnel's preferential bits for specific links.
Tunnel Destination Address	The IP address of the device in which the tunnel ends.
Tunnel Peak Rate Kbps	Peak flow specification (in Kb/s) for this tunnel.
Tunnel Out Interface	The interface through which the tunnel exits the device.
Tunnel Burst Kbps	Burst flow specification (in Kb/s) for this tunnel.
Tunnel Average Rate Kbps	The tunnel average rate in Kb/s.
Tunnel Affinity Mask	The tunnel affinity bits that should be compared to the link attribute bits.