Visualize the Network Topology

Network Topology Overview

The Network Topology window presents a graphical, topological map view of devices, the links between them, and the active alarms on elements in the map. In addition, the Network Topology window provides access to map element tools and functions, and allows you to drill-down to get detailed information about map elements.

The Network Topology window is accessed from the left sidebar (**Maps** > **Topology** > **Network Topology**). The content of the Network Topology window is determined by the device group you have selected. To select a device group, use the Device Groups panel on the left. From the Device Groups panel you can access the central device grouping functionality to create new groups, add devices to groups, and so on. See Create Groups of Devices for Easier Management and Configuration for more information.

Each Network Topology map is divided into a left pane that contains alarm and link information, and a right pane that displays the map itself. When the left pane is expanded, additional columns might be added to the tables in the tabs.

- Alarm and Link Information (left pane)—Provides information relevant to the devices and topology shown in the map.

  - Alarm Summary—Shows all the current alarms for the selected group, categorized by alarm severity. In addition to a table showing the number of alarms for each alarm severity, the Alarm Summary tab provides a graphical pie chart view of the current alarms, which is color-coded based on alarm severity. This enables you to see, at a glance, the distribution of alarm severities and the number of alarms of each severity. In both the table and the pie chart you can drill down to see a table listing

the actual alarms of that severity. To see all the alarms for the selected device group, click the Alarms Table link at the bottom of the Alarm Summary tab.

- • Links—Lists the links relevant to the selected device group and shows the highest severity alarm on the link. Selecting a link in the table, highlights the link in the topology map. Clicking the Links Table link at the bottom of the tab launches a separate window with a table of links.

- • Topology map (right pane)—Displays the topology of the selected device group in graphical form. It displays the group's devices and sub-groups (if any) and the links between them (Physical, Ethernet, and technology-specific links). It also displays the active alarms on the devices or links so that you can easily identify problems in the network. You can drill down from the topology map to detailed information about a device or link in order to troubleshoot problems. The topology map can be customized, filtered, and manipulated to show exactly the information you need.
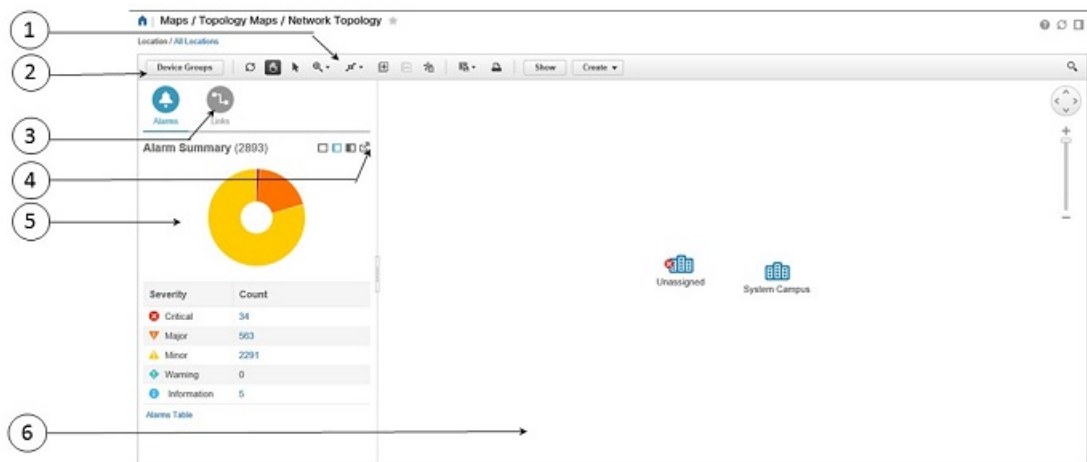
1	Topology toolbar	2	Device Groups pane
3	Links pane	4	Detach icon. Click the icon to open a detail window.
5	Alarm Summary pane. Click **Alarms Table** to display the alarm detail window.	6	Topology Map pane

Datacenter Topology

The data center topology keeps no link idle. The next-generation data center provides the ability to use all links in the LAN topology by taking advantage of technologies such as virtual PortChannels (vPCs). vPCs enable full, cross-sectional bandwidth utilization among LAN switches, as well as between servers and LAN switches.

A port channel bundles up to eight individual interfaces into a group to provide increased bandwidth and redundancy. Port channeling also load balances traffic across these physical interfaces. The port channel stays operational as long as at least one physical interface within the port channel is operational.

A virtual PortChannel (vPC) allows links that are physically connected to two different devices to appear as a single PortChannel to a third device. The third device can be any other networking device. A vPC allows

you to create redundancy by increasing bandwidth, enabling multiple parallel paths between nodes and load-balancing traffic where alternative paths exist.

After you enable the vPC function, you create a peer keepalive link, which sends heartbeat messages between the two vPC peer devices.

Virtual Device Context (VDC) enables the virtualization of a single physical device in one or more logical devices. Each of the provisioned logical devices is configured and managed as if it were a separate physical device.

View Detailed Tables of Alarms and Links in a Network Topology Map

From the Network Topology window, you can access extended tables that list and provide more information about the alarms and links in the selected device group.

To open the extended details tables, click the **Detach** icon in the top right corner of the Alarm Summary (or click the hyperlink at the bottom of Alarm Summary or Links). The window that opens will contain an Alarms tab and a Links tab.

Be aware of the following when working with the extended tables:

- When the extended tables window is open, the left pane of the Network Topology window is disabled. When you close the extended tables window, the tabs in the left pane of the Network Topology window become fully functional again.
- There is synchronization between the extended tables and the information in the left pane in the Network Topology window. For example, if you select a link the extended links table, that link will also be selected in the left pane of the Network Topology window and the circuit/VC overlay will be shown in the topology map. Conversely, if you select a link in the left pane of the Network Topology window and then open the extended table, the same link will be selected in the extended table.
- Alarms in both the Network Topology window and in the extended tables are refreshed based on the user preference settings. See Set Up Your Alarm and Event Display Preferences and Customize the Alarm Summary.
- Click the **Export** icon at the top right of the table to export the data from the table to a file (either PDF or CSV format). Export is available for alarms.

Filter Data in the Detailed Tables

You can also filter the data to find specific alarms or links using a *quick filter* or an *advanced filter* from the **Show** drop-down list. The quick filter narrows the content that is displayed in a column according to the text you enter above the column. The advanced filter allows you to narrow down the data in a table by applying a filter using multiple operators such as Does not contain, Does not equal, Ends with, Is empty, and so on. You can also create a *user defined* filter which, if saved, will be added to the **Show** drop-down menu.

To create and save a user defined filter:

Step 1   From the **Show** drop-down list above the extended tables of alarms and links, choose **Advanced Filter**.

Step 2   In the **Advanced Filter** data popup window, enter the advanced filter criteria, and then click **Save As**.

Step 3   In the **Save Filter** dialog box, enter a name for your filter and click **Save**.

To edit or remove a user defined filter, choose **Manage User Defined Filters** from the **Show** drop-down list.

Determine What is Displayed in the Topology Map

Choose Which Device Group(s) to Display in the Network Topology Map

The topology map enables you to visualize the topology of a device group or multiple device groups. The selected group(s) might cover a specific network segment, a customer network, or any other combination of network elements. Device grouping is hierarchical. There are two top-level parent groups containing multiple sub-groups - Location groups and User Defined groups. You can display multiple groups within the same top-level parent group. For example, you can display multiple Location groups but you cannot display one Location group and one User Defined group.

To determine which devices are displayed in the topology map, click a device group in the Device Groups pane on the left.

After you have displayed the required group(s) in the topology map, you can access additional information about any device or link. See Get More Information About Devices

The topology map only displays devices for which the logged in user has access privileges, based on the virtual domains to which the user has been assigned. For more information, see the section *Create Virtual Domains to Control User Access to Devices* in the chapter User Permissions and Device Access in the Cisco Prime Infrastructure Administrator Guide. .

Note If you encounter topology issues, such as topology components not rendering as expected or component data not being displaying on the map, we recommend that you clear your browser cache and try again.

To display network elements in the topology map:

Step 1 Choose **Maps** > **Topology Maps** > **Network Topology**.

Step 2 Click a device group in the Device Groups pane on the left. The selected device group is displayed above the topology map.

Step 3 Customize the topology map as required by showing specific device/link types, adding manual links, and so on. See the following topics for more information:

- Change Which Link and Device Types are Shown in the Network Topology Map, on page 7

- Manually Add Links to the Topology Map, on page 6

View the Contents of a Sub-Group in the Topology Map

You can expand a sub-group to show its contents within the current context or you can drill down to see the contents of the sub-group independently of the current map context.

Note　When expanding sub-groups, be aware that if a device belongs to more than one group, the device will appear in one of the expanded groups only. It will not appear in all of the groups to which it belongs. If your setup has devices that belong to multiple groups, rather view the groups individually in the topology map by selecting them in the Device Groups pane. This will ensure that you will always see all the devices that belong to a specific group.

To view the contents of a sub-group:

Step 1　Click on a sub-group in the topology map.

Step 2　In the displayed popup, click one of the following:

- Drill down group—Displays the sub-group on its own in the topology map, meaning that the currently displayed group is replaced with the selected sub-group. Note that the sub-group name is selected in the Device Groups pane.

  Note　You can double-click on the sub-group to quickly drill down into the group.

- Expand group—Adds the contents of the sub-group to the current topology map display.

In the figure below, the IL group is expanded.
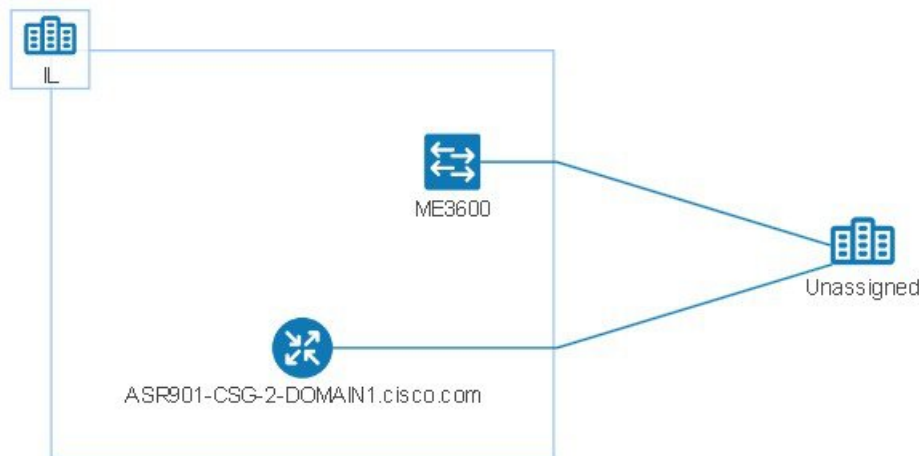
Manually Add Devices and Networks to the Topology Map

You can display devices and networks that are not managed by the system on the topology map and on the geo map by adding them manually.

Step 1 In the topology toolbar, choose **Create > Create Unmanaged Device** or **Create > Create Unmanaged Network**.

Step 2 Click on the map to add the device/network to the map.

Step 3 Click on the newly-added device/network in the map. From the displayed panel, you can add the device/network to a group, rename the device/network, or delete the device/network.

After you have added a device or network to the topology map, it will also be available in the geo map. The unmanaged device will appear in the list of unmapped devices and you can set its location.

Manually Add Links to the Topology Map

If you know that two devices are connected but Prime InfrastructurePrime Infrastructure cannot discover the link and show it on the map, you can add the link manually. After you add this link, it will be shown by default whenever the relevant group is shown on the map.

Following are the most common scenarios in which manual links could be used:

- From the optical/DWDM controller of a trunk port on a Cisco NCS device running IOS-XR (NCS 4000, 9000, 5000, 1000) to an add/drop port pair in NCS 2000 devices.

- From the optical/DWDM controller of a client port on a Cisco NCS device running IOS-XR (NCS 4000, 9000, 5000, 1000) to NCS 2000 transponder client ports (representing connections for 10GE/100GE ports).

- From 10GE/100GE controllers of ports on a Cisco NCS device running IOS-XR (NCS 4000, 9000, 5000,1000) to NCS 2000 transponder client ports (representing connections for 10GE/100GE ports).

- Between two trunk ports on Cisco NCS 2000 series devices with 400-G-XP linecards. This link must be created as a managed OTU link.

- From a Cisco NCS 2000 series device with 400-G-XP linecard and a Cisco NCS 4000 series device with 4H-OPW-QC2 linecards. This link must be created as a managed OTU link.

Manual links can be unmanaged:

- Unmanaged links: For visualization purposes only. If you know that two devices are connected but you do not need full management of the link between them, you can add an unmanaged manual link to the map. The link will appear as a grey dashed line.

Note Prime Infrastructure does not support managed manual links.

To manually add a link between two devices:

Step 1 In the topology toolbar, choose **Create** > **Create Unmanaged Link.**

Step 2 Click and hold down the mouse on the first device in the topology map and drag it to the second device.

Step 3 In the Interface Details dialog, select the source interface on the first device and the target interface on the second device from the drop-down lists of available interfaces, and click **OK**.

The link between the two selected devices will be displayed on the map.

Change Which Link and Device Types are Shown in the Network Topology Map

You can choose to display only certain types of links or devices in the network topology map. Click the **Show** button and select **Links** or **Device Families** to see a full list of link and device types and select the ones you want to display.

Step 1 In the left sidebar, choose **Maps** > **Topology Maps** > **Network Topology**.

Step 2 Select the required device group from the Device Groups panel on the left.

Step 3 Click **Show** in the topology toolbar and choose **Links** or **Device Families**.

Step 4 In the Links dialog:

- Select the types of links you want displayed in the topology map, for example, physical layer links, Ethernet layer links, and so on. The Links dialog only shows link types that exist in your network. If a link type exists in your network but not in the selected device group, it will be disabled.

- If you want to differentiate aggregated links from single links, select the Display Aggregated Links as check box.

- Click **OK**. The topology map will reflect your selections. Only the link types you selected will be displayed.

Step 5 In the Devices dialog:

- Select the device types you want displayed in the topology map, for example, routers, switches and hubs, optical networking, and so on. The Devices dialog only shows device types that exist in your network. If a device type exists in your network but not in the selected device group, it will be disabled.

- Click **OK**. The topology map will reflect your selections. Only the device types you selected will be displayed.

Note If you have selected to display optical networks on the map, by default you will see the devices that serve as optical line amplifiers (if any). Deselect the Display Optical Line Amplifier check box under Device Functions if you do not want these optical line amplifier devices to be displayed on the map. The Display Optical Line Amplifier check box under Device Functions only appears if there are optical devices in setup which support Line Amplifier functionality.

Show/Hide Alarms and Labels in the Topology Map

You can choose to hide the device name labels and you can hide alarms altogether or you can display alarms of specific severities only.

Step 1 In the left sidebar, choose **Maps** > **Topology Maps** > **Network Topology**.

Step 2 Click the **Show** button in the topology toolbar.

Step 3 Select the items you want displayed in the topology map:

- Labels—Labels associated with devices, such as device names.
- Links—Single links between devices.
- Aggregated Links—Links that represent more than one underlying link. They are represented by dotted lines.
- Device Families— Devices that are displayed in the topology map, for example routers and wireless controllers.
- Faults—Deselect the check box to hide fault information altogether. Select the check box to show all alarms or use the slider to show only faults of a certain severity or higher.

Step 4 Close the Show dialog. Your selections are applied to the topology map.

Isolate Specific Sections of a Large Topology Map

In cases where a topology map is displaying thousands of devices, you might want to focus on specific devices or sets of devices. The Overview pane shows you the entire topology map in miniature and lets you select the area you want to display in the large topology map. It also provides an at-a-glance view of the alarm status of the elements in the topology map.

Step 1 Click the Overview icon in the topology toolbar. The Overview pane appears in the at the bottom right of the topology map and displays the following:

- Dot—indicates any network element. The color of the dot indicates the severity of alarms associated with the network element.
- Line—indicates a link. The color of the line indicates the severity of the associated alarm.
- Blue rectangle—indicates the selection area. The area within the rectangle is displayed in the map pane. Handles on the corners enable you to resize the selection area.
- Pan mode cursor—cursor displayed within the selection area. Use this cursor to move the selection area, and thereby view different elements in the map pane.
- Zoom mode cursor—displayed outside the selection area. Use this cursor to define a new selection area or to zoom in on an existing selection area.

Step 2 Draw a rectangle by dragging the mouse over the area you want to see in the topology map.

Step 3 Click the 'x' in the upper right corner to close the Overview pane.

Get More Information About Devices

From the topology map, you can drill down to get more information about a device.

Step 1   Click on the required device in the topology map. A popup appears showing basic device information and alarm information for the device.

Step 2   Click **View 360** to access the Device 360 view for detailed information about the device.

For more information, see, Get Device Details from Device 360° View.

Get More Information About Links

The representation of links in the topology map provides some information about the link:

- A solid line represents any type of discovered link between two elements in the topology map.

- A dotted line represents an unmanaged link that has been manually drawn in the topology map.

- A dot-dash line represents an aggregated link (if Aggregated Links is selected in the Show popup).

- An alarm severity badge indicates the highest severity alarm currently affecting the link.

From the topology map, you can drill down to get more information about a link by clicking on the required link in the topology map.

- For simple links, the displayed popup shows the link type and the A-side and Z-side of the link.

- For aggregated links, the displayed popup shows a table listing all the underlying links.

View Fault Information for Devices and Links

If a device or link has an alarm associated with it, an alarm badge is displayed on the device icon or on the link in the topology map. The color of the alarm badge corresponds with the alarm severity—minor (yellow), major (orange), or critical (red)—and matches the alarms displayed in the Alarm Browser.

For groups, the alarm badge represents the most severe alarm that is currently active for any of the group members.

Link-related alarms, such as Link Down, generate an alarm badge on the relevant link in the topology map. After the link up alarm is received, the link alarms and corresponding badges are cleared.

See Alarm Severity Icons for more information.

Change the Layout of a Network Topology Map

You can specify how the devices and other network elements (such as labels, nodes, and the connections between them) are arranged in the topology map:

- Symmetrical (default)—Maintains the symmetry that is inherent in the topology. This ensures that adjacent nodes are closer to each other and prevents node overlapping.
- Circular—Arranges the network elements in a circular style highlighting the clusters inherent in the network topology.

- Hierarchical—Ensures that the dependencies on the relationships and flows between elements are maintained.
- Incremental—Maintains the relative positions of specific elements while adjusting the positions of newly added elements. Use this layout to re-render nodes/links and to clean up overlaps.

When you choose a map layout, the elements align accordingly. You can also drag and drop elements to change the layout manually. After you have changed the layout, you can save it so that it will be preserved when you next open the Network Topology window. See Save the Layout of a Network Topology Map for Future Web GUI Sessions, on page 10

Step 1 In the left sidebar, choose **Maps > Topology Maps > Network Topology**.

Step 2 Click the **Device Groups** button and select the required device group.

Step 3 Click the **Layout** icon in the topology toolbar and choose the required layout. The topology map display will be adjusted accordingly.

Save the Layout of a Network Topology Map for Future Web GUI Sessions

Prime InfrastructurePrime Infrastructure retains your layout changes and your selections for the current browser session only. Therefore, after you have changed the topology map layout to suit your needs, it is highly recommended that you save the layout so that you do not have to manually rearrange the topology map each time.

Note The layout is saved for the selected device group only.

Choose **Layout** > **Save Manual Layout** from the Topology toolbar. You can reload the layout at any time by choosing **Layout** > **Load Manual Layout**.

If you want to return to the default system layout after you have saved your manual layout, you must delete the manual layout. Choose **Layout** > **Delete Manual Layout**.

Show Clock Synchronization Networks on a Network Topology Map

If Synchronous Ethernet (Sync-E) or Precision Time Protocol (PTP) clock synchronization is configured on the devices in your network, you can visualize the clock synchronization network on the topology map.

- The Sync-E overlay shows the topology and hierarchy of the sync-E network, including the primary clock and the primary and secondary clock inputs for each device. This allows the clock signal to be traced from any Sync-E enabled device to the primary clock or from the primary clock to a Sync-E enabled device.

• The PTP overlay shows the clock synchronization tree topology, the PTP hierarchy, and the clock role of each device in the tree - primary, boundary, subordinate, or transparent.

Step 1   In the left sidebar, choose **Maps** > **Topology Maps** > **Network Topology**.

Step 2   Click on the **Device Groups** button, select the required device group(s), and click **Load**.

Step 3   Click **Show** in the topology toolbar and choose **Technology**. Click the question mark icon for a description of what will be displayed on the map for each technology.

Step 4   Select the required technology and click **OK**.

The clock synchronization network is shown as an overlay over the existing network in the map. The legend at the bottom right explains the notations used in the map for the selected technology.

Note   If you select a different device group, the technology overlay will be removed.

Save the Topology Map as an Image File

You can save the entire topology map or selected objects from the topology map as an image file. This will enable you to store copies of the topology map in a specific state which you can use as a point of reference in the future when multiple changes are made to the topology.

To save the topology map as an image file:

Step 1   Choose **Maps** > **Topology Maps** > **Network Topology**.

Step 2   Click on the **Device Groups** button, select the required device group(s), and click **Load**.

Step 3   Make content and layout changes to the topology map as required.

Step 4   Click the Save Image icon in the topology toolbar.

Step 5   From the **Save Image** drop down list, select the file type of the image being saved.

The image is saved in your local Temp folder.