Engineering Simplicity

Paragon Planner Desktop Application User Guide

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The information in this document is current as of the date on the title page.

YEAR 2000 NOTICE

Juniper Networks hardware and software products are Year 2000 compliant. Junos OS has no known time-related limitations through the year 2038. However, the NTP application is known to have some difficulty in the year 2036.

END USER LICENSE AGREEMENT

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About This Guide

Use this guide to access information about the NPAT (Network Planning and Analysis Tools) and Paragon Planner desktop application user interface. See the *Paragon Planner User Guide* for details about router-specific features such as MPLS, BGP, VPN.

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CHAPTER

Introduction

Access Paragon Planner Desktop Application

The Paragon Planner desktop application helps you simulate the effect of changes in a network without affecting the actual network. The following is a high level list of tasks you can perform using the Paragon Planner desktop application:

- Design, simulate, and analyze a network offline.
- A network topology map shows simulated or imported data for nodes, links, and LSP paths.
- Network information table shows simulated or imported data for nodes, links, and LSPs.
- Import or add nodes, links, and LSPs for network modeling.
- Add and stage LSPs for provisioning to the network.
- Create or schedule simulation events to analyze the network model from failure scenarios.
- Report manager provides extensive reports for simulation and planning.
- Import interface data or aggregate archived data to generate historical statistics for querying and chart displays.

You can access the Paragon Planner desktop application by using the Java Network Launch Protocol (JNLP) file, which you can download from the Paragon Automation web UI. JNLP files are used to launch applications hosted on a web server or a remote computer.

NOTE: Ensure that the client PC from which you access the Paragon Planner desktop application has the following software installed:

- Java Runtime Environment (JRE): Depending on the OS of the client PC, you can must install a JRE or equivalent. For example, Azul Zulu (https://www.azul.com/downloads/?package=jdk) offers builds of OpenJDK (Open Java Development Kit) for both Windows and Mac OS.
- Web Start: You can use Open Web Start (https://openwebstart.com/) as a replacement for Java Web Start. Alternatively, you can use Iced Tea on Windows (https://adoptopenjdk.net/icedtea-web.html).

To download and launch the Paragon Planner desktop application:

1. From the Paragon Automation web UI, select **Planning** > **Paragon Planner Desktop**.
2. In the Paragon Planner Desktop page, enter the memory you want to allocate, and click **OK**. The default value is 512 MB.
3. Click **Save File** when prompted.

A Java Network Launch Protocol (JNLP) file is downloaded to your computer.

4. Double-click the JNLP file to launch Paragon Planner desktop application.
5. Log in using the credentials for Paragon Planner.

   Paragon Planner desktop application opens.

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Key Paragon Planner Features

Paragon Planner is an integrated software package that addresses backbone topological design and simulation, as well as maintenance issues using TDM multiplexers, Routers, Frame Relay switches and ATM switches. Several hardware devices are currently modeled.

Feature	Description
Capacity Planning Backbone Design, and Diversity Design	• The impact of adding new demands, or traffic, can be analyzed in a network model before they are placed onto the real network. The software determines whether there is sufficient available capacity in the network and recommend places where capacity should be added. • A network can be automatically designed based on end-to-end traffic requirements, starting from an existing set of backbone trunks (“Incremental Design”) or from scratch (“Green-field Design”). Using powerful heuristic algorithms, Paragon Planner can evaluate whether trunks can be pruned from the network without compromising diversity constraints. Trunks can be optimally added to ensure all traffic is placed under any single element failure (“Diversity Design”). Potential bottlenecks are also easily detected. Further analysis capabilities include load balancing and end-to-end delay and loss calculations.
Failure Simulation	Exhaustive single, double, or triple element failures, interactive or customizable scripted failure scenarios can be simulated to analyze and evaluate a networks' resiliency.

(Continued)

Feature	Description
Hardware-Specific Device Library	• Hardware-specific device models have been developed by through close working relationships with the major device vendors. This ensures the accuracy and precision of the model, as well as the support of many device-specific features. • Paragon Planner includes various data extraction tools to convert network data (for example, router configuration files) into a format readable by Paragon Planner.
Path Assignments	For an existing backbone network, the optimal layout or path assignment can be determined which satisfies all demand constraints. Demand constraints may include media preferences, diverse paths, hardware bandwidth overhead calculations, and delay/hop constraints. In the case of routers, tunnel constraints may include link attributes/colors and capacity. Available paths can be found even when the actual hardware fails to find a path. If the hardware switch supports user-specified paths, then paths found using the model can be downloaded to the real network.
Tariffs	Paragon Planner can help reduce private line leasing costs (monthly recurring and non-recurring components) by producing designs that satisfy user requirements and constraints while maintaining a minimal cost. You can specify your own pricing tables which are then integrated into Paragon Planner suite to price out lines. This is used extensively in the program's heuristic least-cost design algorithms. The savings reaped normally translate to a quick return on investment.
Detailed Design and Analysis Reports	As with all modules, detailed reports are generated to help you to quickly assess and summarize network-related data. These reports include trunk pricing, trunk utilization, and demand paths. Reports can be generated in text format, CSV (comma separated) format, or web-friendly HTML.

(Continued)

Detailed Topology Views	Detailed topology views allow you to view your network nodes and links. These can be placed by geographical location, rearranged by hand, or automatically rearranged in a format that distributes the points to make the network easier to view. Panned utilization, link vendors and other attributes can be viewed by color; hardware devices are represented by various icons. Links can be labeled by a number of attributes including link metrics. From the topology map, popup menus can be accessed by right-clicking on nodes or links, providing quick targeted access to information about the selected network element.

Paragon Planner Power Features

Feature	Description
Discrete Event Simulation	Packet-by-packet simulation is available for Frame Relay and Router device models, giving statistics on queuing delays and packet loss ratios.
Domain/Structured Networks	Partitioned or structured networks, including PNNI, are supported by Paragon Planner. Device-specific support of domains is also correctly modeled.
Traffic Load Analysis	Analysis of real traffic load per demand can be loaded into the software model to obtain a more accurate link utilization for failure simulations. Paragon Planner can do multi-period load and performance analyses.
Facility Feature	Any number of nodes and/or links can be grouped together in a facility for failure scenarios and reporting options.
Class of Service (CoS) Feature	The class of service feature allows you to classify traffic into four classes, including the strict priority class. With this feature, the accuracy of the Paragon Planner's Design and Discrete Event Simulation modules are greatly improved, as the software takes into account all the details of class-based weighted fair queueing (CBWFQ) in its routing process.
Customer Tariff	The customer tariff feature allows you to specify various tariff classes and their rates for the network. Each node is associated with a particular tariff class. All links would then be priced according to its service and the classes of the nodes it connects.
Path Diversity Design	The path diversity design feature allows you to configure demands (or tunnels) on link-disjoint, site-disjoint, or facility-disjoint paths.

Supported Hardware

IN THIS SECTION

Juniper Networks

- Routers: Junos OS and JunosE-based devices such as Juniper Networks® MX Series 5G Universal Routing Platforms, J Series, PTX Series Packet Transport Routers, M Series and T Series routers

Cisco Systems

- Routers: IOS and IOS-XR-based devices such as ASR, NCS, and CRS
- MPLS/Tag Switching (MPLS-TE, GB-TE)

Alcatel

- 7750 Service Router

Huawei

- AR Series Routers
- NE Series Routers

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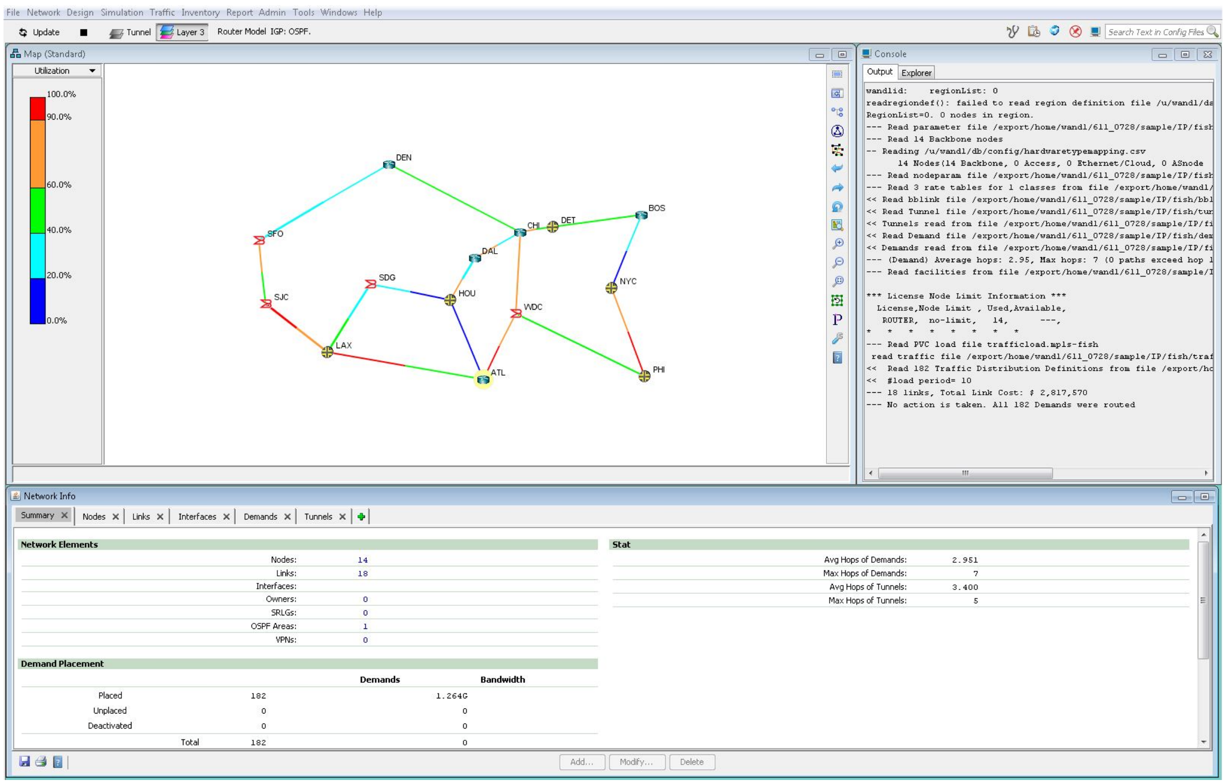
CHAPTER

Main Window

Main Window Overview

This topic explains the functions of the main window, the workspace from which all Paragon Planner windows are launched or opened. In addition, it discusses the File menu of the menu bar. Figure 1 on page 8 shows the main window, displayed when a network is launched.

Figure 1: The Main Window



The main window consists of the following elements: Menu, Toolbar, Topology, Console, and Network Info window. Note that many functions and features do not become available until a network is loaded. This includes some of the menus as well as the topology window.

Menu options may vary depending on your user permissions, or modules.

Table 1: Main Window Drop-down Menus

File	The File menu contains network file functions such as creating, opening, saving, loading files, and closing the network.	"File Menu Functions" on page 98

Network	The Network menu provides comprehensive details on network elements, such as nodes, links, interfaces, demands, and tunnels. Detailed information on services, protocols, and paths. Alternative Maps such as BGP.	"Network Menu Overview" on page 119
Design	The Design menu provides options to design the network's backbone through new or incremental designs for the backbone links. Design also enables functions such as path placement, path diversity design, and tuning.	"Design Menu Overview" on page 193
Simulation	The Simulation menu provides options to run scripted and interactive failure scenarios for nodes, links, sites, and facilities, to test the network's resiliency and discover worst-case scenarios.	"Simulation Menu Overview" on page 214
Traffic	The Traffic menu is used to access traffic-related features such as Traffic Load, Trending, Growth, and Traffic Aggregation.	"Traffic Menu Overview" on page 226
Inventory	The Inventory menu is used to access hardware inventory reports and hardware equipment cost tables.	"Inventory Menu Overview" on page 258
Report	The Report menu is used to access the Report Manager which contains detailed network, tunnel, simulation, configuration, and user customized reports.	"Report Manager Window Overview" on page 309
Admin	The Admin menu is used to access the Task Manager, Device Library, and User Administration. These functions are normally used by network administrators or Paragon Planner administrators.	"Accessing the User Administration Window" on page 387
Tools	The Tools menu contains settings and tools: VPN Traffic Generation, and Options.	"Tools Menu Overview" on page 394
Windows	The Windows menu lists all sub-windows currently open in Paragon Planner.	
Help	The Help menu contains a link to help documentation, information about the system, and the Message of the Day.	

Figure 2: Main Window Toolbar (options may vary)

The toolbar contains the following items:

- Update button to update the status and routing on the network after you have made changes to the network.
- Stop button to cancel simulation runs or T-Solve processing.
- Two network layer buttons for MPLS-enabled router networks: Tunnel, Layer 3
- Description of the network model
- Integrity Checks shortcut
- Task Manager shortcut
- Provisioning Manager shortcut
- Console shortcut
- Configuration File search bar to search for text in the configuration files of the currently opened network.

Topology Map

The topology map, or Map (Standard), is the main work area in Paragon Planner and displays important link and node properties. Links are color-coded according to a specified link property such as media type, trunk type, or vendor. By default, the links are displayed by link utilization. Nodes are color-coded by icons and symbols.

For more information on how to select and move nodes, label nodes, and access network information properties through right-click popup menus, refer to "Topology Window Overview" on page 52.

Figure 3: Topology Map

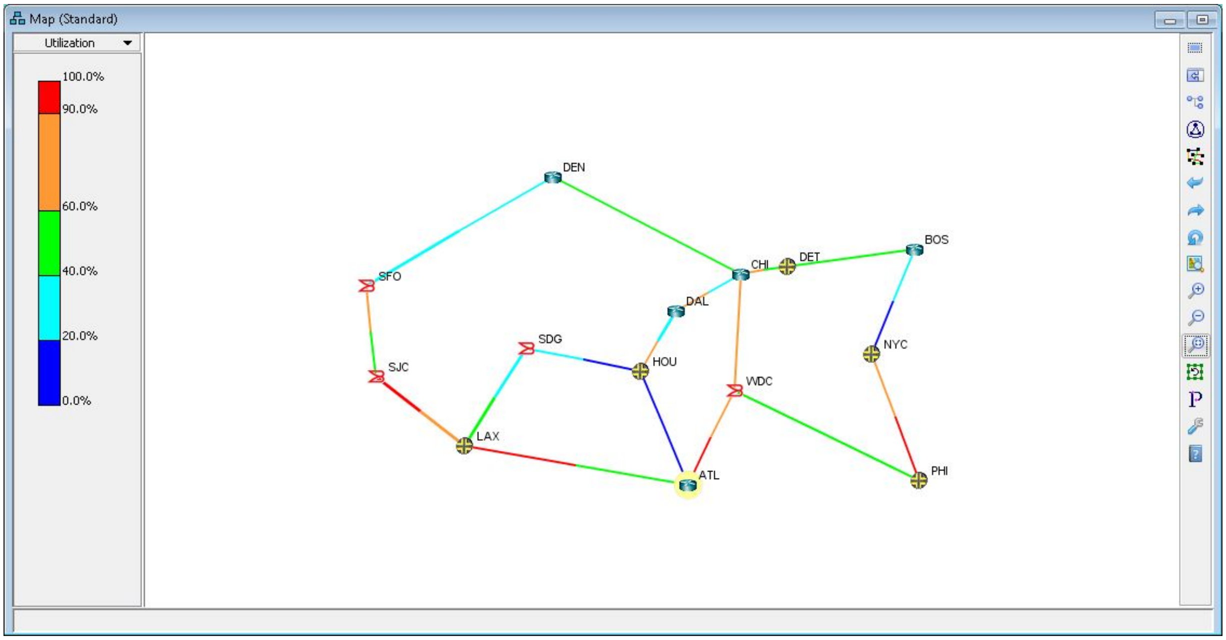


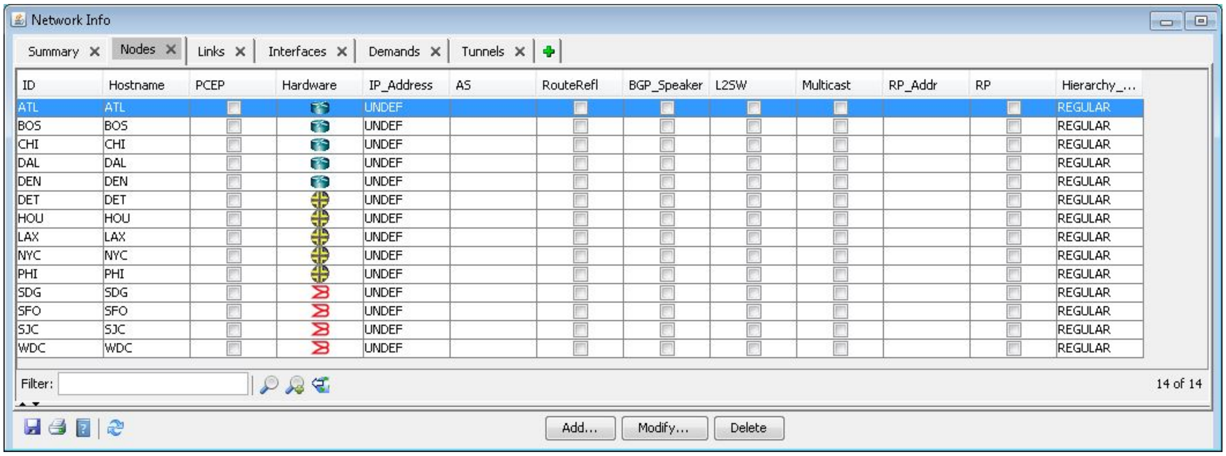
Figure 4: Main Window Console

The console displays additional information when loading the network, reading files, running failure simulation, generating reports, performing path trace, creating designs, and various other functions. The console can be used to trace through information in more detail.

Right-click in the console window to access further functions such as copying text, searching for text in the console, saving the output, or creating a trace file of the console output.

The Network Info window contains network summary information and detailed information on nodes, links, interfaces, demands, and tunnels. Within each element tab, the element information can be searched, filtered, or modified for network *what if* studies. Additional elements may be available in this window depending on the network model.

Figure 5: Main Window Network Information



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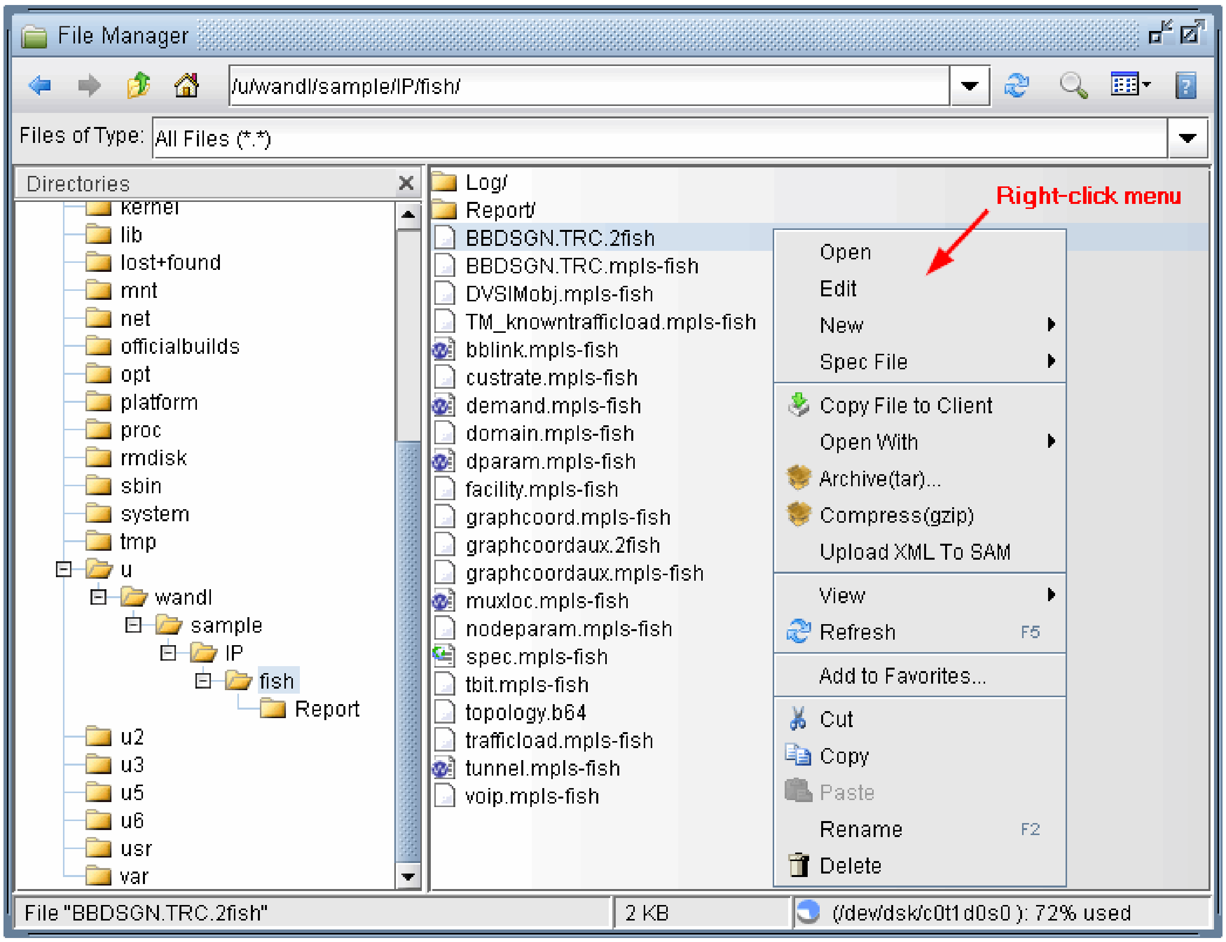
CHAPTER

File Manager

The File Manager Window

The File Manager is the window where you can easily navigate through directories to find and load network projects (specification files), open and edit files, and create new files in Paragon Planner file format. You can also perform basic file functions such as cut, copy, paste, delete, and directory creation. Figure 6 on page 15 shows the File Manager window.

Figure 6: The File Manager



The File Manager is split into two panes: the left pane is a tree view of the directory structure on the server, and the right pane displays the directory contents. Some files and directories may belong to other users and have restricted access. Thus, those files and directories cannot be opened, deleted, or moved because of file permissions.

File Manager Toolbar

The toolbar located across the top of the File Manager window contains buttons useful for directory navigation, file manipulation, and configuring the view.

Figure 7: The File Manager Toolbar

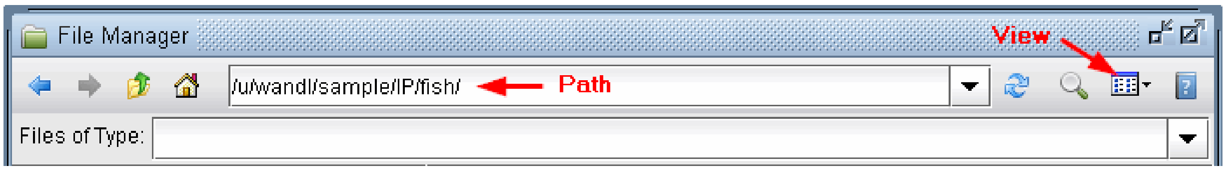


Table 2: File Manager Toolbar Functions

Function	Description
Back	Displays the contents of a previous directory accessed.
Forward	Allows you to go forward on the history list.
Up	Changes the directory to the parent of the current directory.
Home	Goes to the server’s home directory.
Path	Displays the directory path.
Refresh	Refreshes the directory view.
Search	Search text inside the files of the current directory.
View	This drop-down selection allows you to customize the display.
Help	Opens the online-help webpage for more detailed information.

Table 2: File Manager Toolbar Functions *(Continued)*

Function	Description
Files of Types	This field filters for file names or extensions.

The file type drop-down filter options include the following Paragon Planner-specific files:

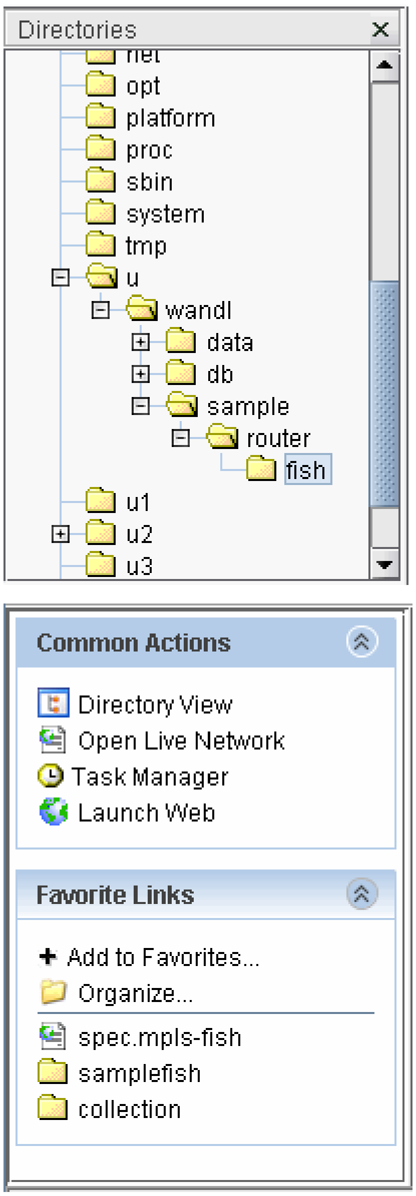
- **All Files (*.*):** Displays all file types in a directory in the right pane of the File Manager.
- **Spec Files (spec.*):** Displays only the specification files in a directory. The specification file is used by the program to determine which input directories and files to load for the network.
- **Dparam Files (dparam.*):** Allows you to display only the *dparam* files in a directory. The dparam file contains default parameter values for the network, such as hardware type, link bandwidth and overhead, size and performance tuning, and miscellaneous parameters.
- **MuxLoc Files (muxloc.*):** Displays only *muxloc* files in the directory. This file contains the node ID and name of each node in the network.
- **BBlink Files (bblink.*):** Displays only *bblink* files. This file contains the location, quantity, vendor, and attributes of the links found in the network.
- **Demand Files (demand.*):** Displays only *demand* files. This file contains information regarding the end-to-end demands, circuits, or flows, and path specifications needed for the network.

  You can enter in a custom filter string using the wildcards “*” and “?” and press <Enter>.

- **‘*’ (Asterisk):** Represents any string of characters. One advantage is that files can be filtered by runcode. For example, you can type in the filter `*.mpls-fish` to filter the files to show only files with the runcode mpls-fish.
- **‘?’ (Question Mark):** Represents any one character. For example, the `bblink.mpls?` string can be used to fetch files named **bblink.mpls1** and **bblink.mpls2** but not **bblink.mpls-fish**.

File Manager Left Pane

Figure 8: Directory View and Common Actions/Favorite Links View



In the left pane of the File Manager, clicking the X in the upper-right corner of the Directory view opens the Common Actions and Favorite Links view. The Common Actions section contains shortcuts to various options. Click on Directory View to switch back to the directory tree view.

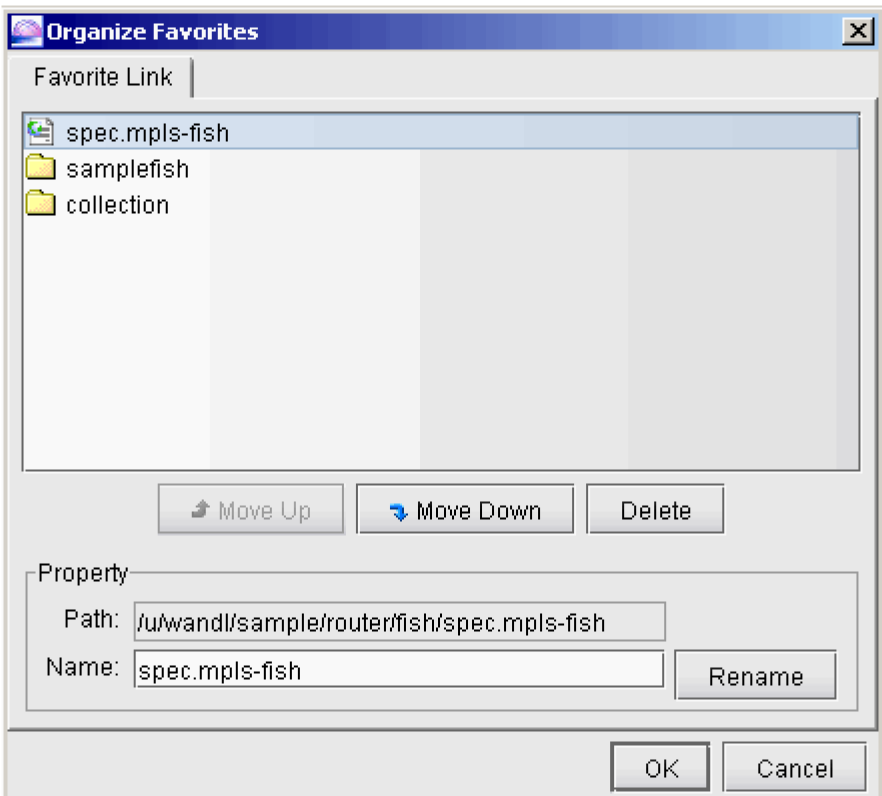
Favorite Links to Directories or Files

Under Favorite Links you can store links to commonly used directories or files. To add a link, right-click the file or directory from the right pane and select **Add to Favorites**. You can specify the name of the link in the subsequent dialog box.

Once the link has been added under the Favorite Links section, clicking on a link to a directory opens that directory in the right pane. Clicking a link to a file performs the Open command for that file.

To rearrange, delete, or rename favorite links, click **Organize...** To rearrange the order, select an item and click **Move Up** or **Move Down**. To rename a link, type in a new name and then click **Rename**.

Figure 9: Organize Favorites



File Manager Right-Click Menu

Right-clicking in the right pane of the File Manager displays the functions listed in Table 3 on page 20

Table 3: File Manager Right-Click Menu Functions

Function	Description
Open	This menu is equivalent to double-clicking a file. This option allows you to open a highlighted directory or file. The actions are different for directories, specification files, and non-specification files: • *A directory*: Displays the contents of the directory in the right pane. • *A specification file*: Loads the specification file into the program and opens up the network model. • *A (non-spec) file*: Launches the Text Editor where you may edit the file.
Edit	Opens the file in Paragon Planner's text editor to allow you to directly edit the file. Refer to "Text Editor" on page 38.
New	Allows you to create new directories and text files in the current path. Refer to *File Manager New Command*.
Spec File	Contains all functions related to the Paragon Planner specification file (spec). From this submenu, you can choose options to load, modify, or create new specification files. Refer to "File Manager Spec File" on page 22.
Copy File to Client	Allows you to copy the selected file(s) from the server to the local client.
Open With Report Viewer	Enables you to view certain files in a table-like format. Refer to *Open With Report Viewer* .
Open With Report Master	Enables you to view multiple reports in one window where the left pane includes the report name and the right pane includes the report contents. Refer to *Open With Report Master* .
Open With Report Editor	Enables you to edit entries in the reports.
Archive (tar)	Zips files or directories into a tar file.

Table 3: File Manager Right-Click Menu Functions *(Continued)*

Function	Description
Compress (gzip)	Compress and zips files into a gz file.
View	Allows you to change the view of the file listing in the right pane of the File Manager. Most of these selections can also be found in the view icon's drop-down selection menu of the toolbar. Refer to *File Manager View*.
Refresh	Updates the directory and file listing
Add to Favorites	Adds file or directory to the Favorite Links list.
Cut	Stores the selected file(s)/folder(s) in memory until you paste the files in a different location. Once you paste them in a different location, the selected file(s) are deleted.
Copy	Copies files and/or folders highlighted in the File Manager window.
Paste	Places files or folders that were last cut or copied into the directory currently open in the File Manager.
Rename	Renames the highlighted file or directory.
Delete	Removes highlighted files or directories.

The New command allows you to create new directories and text files in the current path. Note that when creating new files or directories, the you must have write permission to create files in that directory.

Table 4: File Manager New Command Functions

Function	Description
Directory	This creates a new directory. When selected, you are prompted to enter the name of the directory to be created.

Table 4: File Manager New Command Functions *(Continued)*

Function	Description
Plain File	This creates a new plain text file in the current directory. When selected, Paragon Planner prompts you for a file name. Once the name of the file is entered, the program brings up the text editor for editing the new text file.
Table	This creates a file with tables using comma separated format. It's recommended to save the file extension as .csv.
Backbone data	This creates a template for backbone data files: **muxloc, bblink, demand, nodeparam, site, group, graphcoord, owner**.
Cost files	This creates a template for a tariff file. Tariff files include: **usercost, usercountrycost**.
Control files	This creates templates for the following Paragon Planner files: **fixlink, linkdist, nodeweight, rsvbwfile**.
Report Files	This creates templates for new report files. You can add five types of report files: Paragon Planner report master, main only, main and row detail, main and column detail, and main and cell detail. The Paragon Planner report master is similar to the Report Manager in that it allows you to view more than one report in an organized structure. Main only report files show only the main table, while the other reports show both the main table and detailed information of each row, column, or cell.

File Manager Spec File

The Spec File submenu contains all functions related to the specification files. From this submenu, you can choose options to load, modify, or create new specification files. The following selections are available:

Spec File > New Spec
: Allows you to create a new specification file. This basically means you are creating a new network from scratch. To use this option, first close any the currently open specification files.

Spec File > Load Spec

Loads the currently highlighted specification file into the system. Once a specification file is loaded, the network topology window also appears.

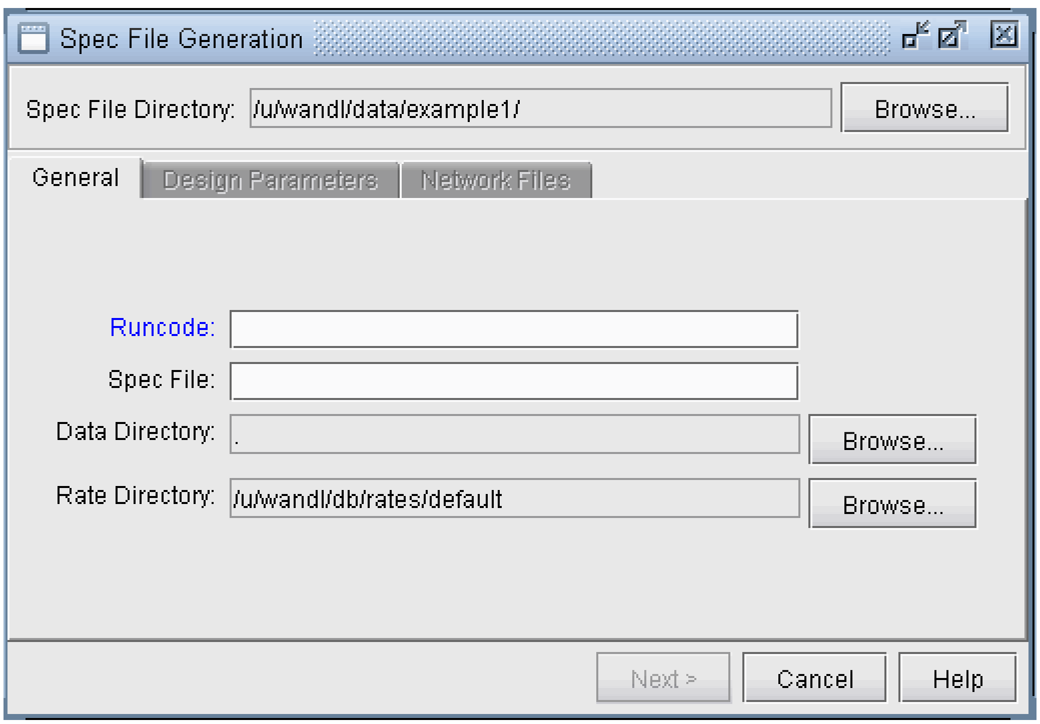
Spec File > Modify Spec

Allows you to change the runcode, data directory, rate directory, and network files of the specification file. After modifying the options and clicking **Finish**, you can load the network.

Spec File Generation Window

Once you select the New Spec or Modify Spec option, the specification file generation window appears. From this window you can specify properties for the specification file, dparam file, and various other specific input files necessary for a network to be properly loaded and displayed.

Figure 10: Spec File Generation Window General Tab



The specification file is a text file that specifies all the network input files to be loaded for the active session as well as the runcode (extension), data directory *datadir*, and rate directory *ratedir*.

Table 5: Spec File Generation Window General Tab Fields

Fields	Description
Runcode	This is the file extension used to distinguish different networks and different sessions. Output files and reports are appended with the specified *runcode* file extension. Runcodes may consist of any combination of alphanumeric characters. This field is saved with the keyword **runcode** in the specification file.
Spec File	Specifies the name of the specification file. By default this is spec.<runcode> where <runcode> is replaced by the network file extension.
Data Directory	The data directory *datadir* represents the path to the default directory in which your data files are searched for. If a particular file is located in the specified data directory, its absolute path need not be provided when defining that file. For example, if the data directory for a design run is specified as **/user/test** and the file **muxloc.test** is located in that directory, you can simply specify **muxloc.test**, rather than **/user/test/muxloc.test**, when prompted for the location of the **muxloc** file. To specify the specification file directory as the data directory, the character "." (period) can be used as a shortcut. This field is saved with the keyword **datadir** in the specification file.
Rate Directory	The rate directory is used to specify the path of the directory where the tariff database files are read. In most cases, the default path **/u/wandl/db/rates/default** does not need to be changed. If you want to use you own tariffs, reference them from a directory other than **/u/wandl/db/rates/default**. This field is saved with the keyword **ratedir** in the specification file.

The **dparam** file specifies design and simulation parameters, hardware vendor, link bandwidth/overhead, size and various other network parameters.

Figure 11: Spec File Generation Window Design Parameters Tab

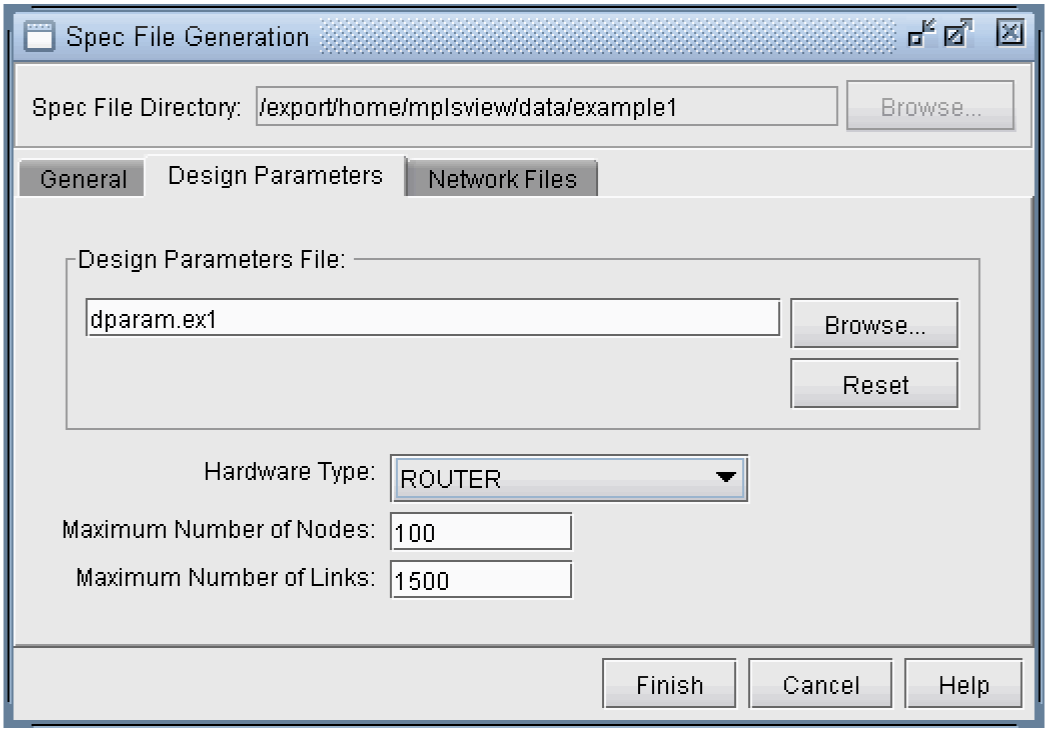


Table 6: Spec File Generation Window Design Parameters Tab Fields

Fields	Description
Design Parameters File	Specifies the file name of the dparam file.
Hardware Type	Allows you to choose the hardware type of the network. This field is saved with the keyword **hwvendor** in the dparam file.
Maximum Number of Nodes	The Maximum Number of Nodes helps the program decide how much memory to allocate and can only be modified when the network is closed: The Maximum Number of Nodes (saved as maxnodenumber in the dparam file) represents the maximum number of nodes that may be entered for a particular network. The number entered should be no smaller than the number of nodes planned and no larger than the node_limit in your license file. The default value is 100.

Table 6: Spec File Generation Window Design Parameters Tab Fields *(Continued)*

Fields	Description
Maximum Number of Links	The Maximum Number of Links helps the program decide how much memory to allocate and can only be modified when the network is closed: The Maximum Number of Links (saved as maxlink in the dparam file) represents the maximum number of links for a particular network. Once the limit is reached during a design, the program does not continue to add links. The number entered should be no smaller than the number of links planned. The default value is 1500.

The default link bandwidth, link overhead and per circuit bandwidth overhead calculations vary for different vendors. Because of device-specific characteristics (routing algorithm, rerouting, buffer size, queuing, etc.) the same network data may yield different results when comparing switch models.

The Network Files tab contains references to data files that should be loaded in. Each reference are saved in the specification file with a separate entry.

You can read in files from the Network Files tab. The files in this tab are categorized as described in Table 7 on page 26.

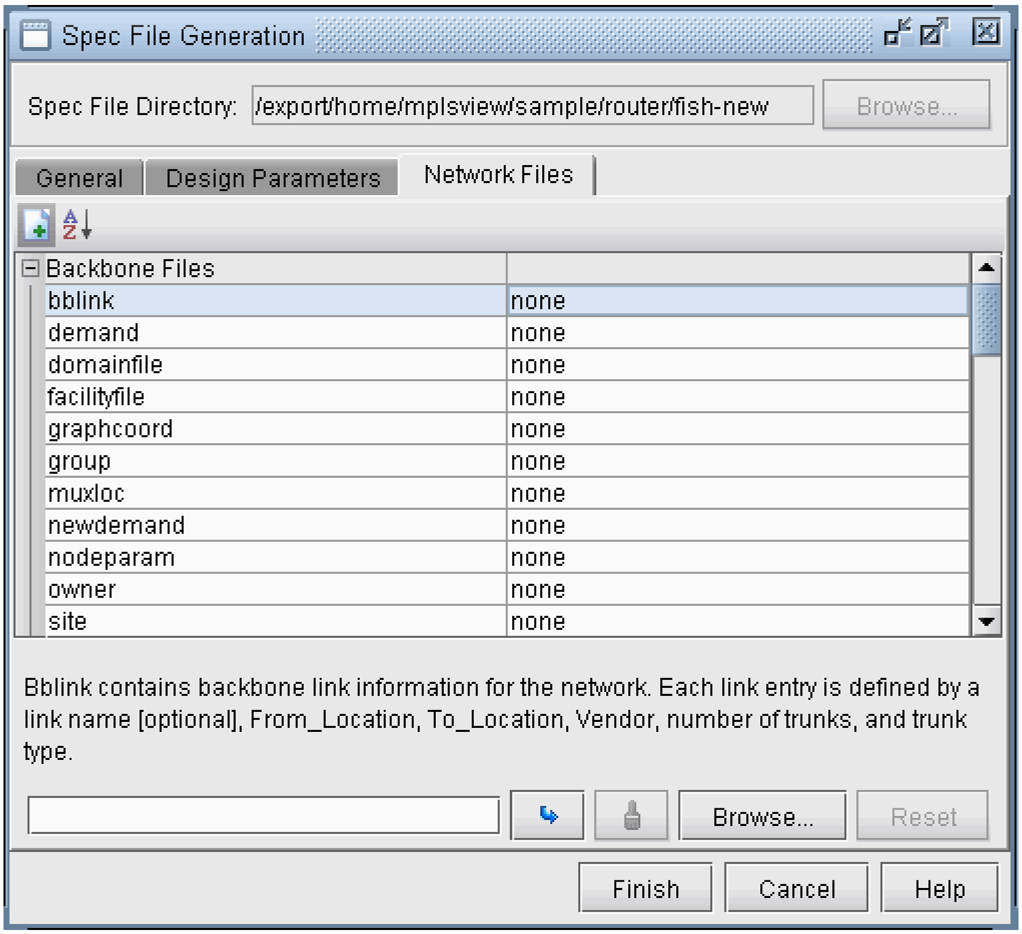
Table 7: Spec File Generation Window Network File Categories

Type of File	File Names
Backbone Files	bblink, demand, domainfile, facility, graphcoord, group, muxloc, newdemand, nodeparam, owner, site, srvcprofile, srvctype
Cost Files	custrate, usercost
Control Files	admincost, fixlink, linkdist, nodeweight, rsvbwfile
Traffic Files	devicedir, egress, ingress, t_trafficload, trafdir, trafficload, tunneltrafdir
Access Design Files	chanbank, offckt, offgraphcoord, offloc, offsitek
Discrete Event simulation	tfxdata, tfxpattern

Table 7: Spec File Generation Window Network File Categories *(Continued)*

Type of File	File Names
Device-Specific Files	aclist, bgplink, bgpnode, bgpobj, intfmap, junospolicy, policymap, route, tbit, tunnel, vpn

Figure 12: Spec File Generation Window Network Files Tab



Network backbone files specify how the network is represented. Backbone files include the **bblink, demand, domainfile, facilityfile, graphcoord, group, muxloc, newdemand, nodeparam, owner, site, srvcprofile,** and **srvctype** files.

Table 8: Spec File Generation Window Network Files List

File	Description
bblink	The **bblink** file contains backbone link information for the network. Each link entry is defined by a link name [optional], From_Location, To_Location, Vendor, number of trunks, and trunk type. The vendor may be specified as DEF (default) if it is not known. See *BBLINK (bblink=filename)* in "Backbone Data" on page 415.
demand	The **demand** file contains user traffic requirements. A demand is defined by an ID, From_Location, To_Location, Bandwidth, Type, Priority, and Preempt Priority. See *DEMAND (demand=filename)*.
domainfile	The **domainfile** contains the definitions for domain elements. Domain elements are defined by ID, name, and color to be used in the Map window. If OSPF is present in the network, this file is used to define OSPF areas. See *DOMAIN (domain=filename)*.
facility	A facility is a set of nodes and links likely to fail together. The **facility** file defines the links and/or nodes associated with a facility. In this file, the first field defines the facility name. The subsequent fields specify the node IDs or link names associated with that facility, delimited by tabs, spaces, or commas. All elements associated with a facility should be specified on the same line. Whenever more than one line is needed to specify the elements, a backslash, '\', must be used to indicate that the element list is continued on the next line. The facility feature does not check the validity of the nodes and/or links listed in the facility file. Duplicate links and/or nodes are also duplicated in the facility. Nodes may be specified either by their node ID or node name. If both are used in the same facility, then that node is duplicated. Nodes which are not in the **mux** file and links not in the **bblink** file are ignored. See *FACILITY (facility=filename)*.
graphcoord	The **graphcoord** file is used to position nodes at coordinates different from their true geographic location. This is often times helpful when multiple nodes have the same NPANXX location or are located in close proximity to each other. Nodes may be moved by first selecting them and then dragging them to the new location. Note that pricing information is not changed since only the graphical representation has been modified rather than the geographical. See *FACILITY (facility=filename)* .
group	The **group** file defines the grouping of nodes in the network topology. Discs are painted on the Standard map around grouped nodes. See *GROUP (group=filename)*.

Table 8: Spec File Generation Window Network Files List *(Continued)*

File	Description
muxloc	Muxloc specifies the file containing switch information such as name, ID, NPA, NXX, latitude, longitude, vertical, or horizontal. This information is used to determine location placement in the map window as well as for link pricing. See *MUXLOC (muxloc=filename)*.
newdemand	The **newdemand** file allows you to specify an additional file containing user traffic requirements besides the demand file. The purpose is to reduce your effort in manually modifying the existing demand file, and/or having multiple versions. In addition, the **newdemand** file is often used in theoretical "What if..." situations in determining capacity planning for the current network state. See *DEMAND (demand=filename)*.
nodeparam	The **nodeparam** file allows you to define specific information on a per-node basis such as the hardware type, vendor, or model. See *NODEPARAM (nodeparam=filename)*.
owner	The **owner** file facilitates identifying the ownership of nodes and demands. Ownership should be specified in either the muxloc or demand files. See *OWNER (ownerfile=filename)*.
site	The **site** file specifies site information. The **site** file is used to define nodes in the same physical location such as a building or campus.
service profile	The **service profile** file lists the service types and the percentage that are in each service profile..
service type	The **service type** file lists service types (for example, FTP, TELNET) and their descriptions (for example, owner, min. and max. bandwidth, type, pri, pre).

Cost and control files are used to assign tariffs and implement link controls. Examples of cost and control files are: **custrate, usercost, admincost, fixlink, linkdist, nodeweight,** and **rsvbwfile**.

Table 9: Cost and Control Files

File	Description
custrate	The **custrate** file is used to assign tariffs for links used in the network to approximate the total cost of the network. You can specify the parameters from which these tariffs are calculated using the modify custom rate and custom rate class windows. See *CUSTRATE (custrate=filename)*.

Table 9: Cost and Control Files *(Continued)*

File	Description
usercost	The **usercost** file is used to define the cost for links according to the end nodes, vendor, and trunk type. See *USERCOST (usercost=filename)*.
admincost	The **admincost** file contains rules to set each link default admin weight/metric according to attributes such as trunk type, mileage, and the hardware type and sites of the endpoints.
fixlink	The **fixlink** file specifies information for links that cannot be removed from the backbone topology. For varying reasons, a customer might have a group of links in the backbone that cannot be removed (even if it is optimal to do so). In this case, during the optimization phase of the design, links from the **fixlink** file are not modified. Note that the **bblink** file might be used for the **fixlink** file if the current topology cannot be changed. See *FIXLINK (fixlink=filename)*.
linkdist	The **linkdist** file is used to define link distance values on a node pair basis. Link distances can be used to bias path routing by assigning either a higher or lower weight to a node pair. If a **linkdist** file is not specified or a particular link's metric is not defined, and the Admin Weight routing method is specified in the design options of the Path Placement tab, the default link distance value is assigned. See *LINKDIST (linkdist=filename)*.
nodeweight	The **nodeweight** file is used to restrict the creation of links at particular nodes during design by assigning to the node a penalty for adding links or the maximum bandwidth capacity for links. This file can also be used to restrict the transit demand bandwidth at a node if the hardware model supports path configuration for demands. Every entry in the **nodeweight** file consists of four fields: node ID or name, node weight (link penalty for design), maximum bandwidth capacity (to carry links), and transit demand bandwidth limit. Fields are separated by spaces or tabs. A node weight is required if maximum link bandwidth capacity is to be specified. See *NODEWEIGHT (nodeweight=filename)*.

Table 9: Cost and Control Files *(Continued)*

File	Description
rsvbwfile	The **rsvbwfile** is used to define reserved bandwidth for links between specific node pairs. Reserved bandwidth is specified as a fixed bandwidth (fixfat) plus a percentage of the link bandwidth (fatpct). See *RSVBWFILE (rsvbwfile=filename)* for the file format. • For node pairs not defined in this file, reserved bandwidth specification is derived from the fixfat and fatpct global parameters defined by selecting **Tools > Options > Design** in the Reserved Bandwidth options pane. • Reserved bandwidth is not used by during path assignment and backbone design if the hardware supports path configuration. The reservation constraints, however, are ignored by the simulation and failure analysis routines.

NOTE: In Table 9 on page 29, an asterisk (*) specifies files used for a feature that is license dependent.

For more information regarding these files, refer to the *Design Menu* chapter.

Access Design Files

Examples of access design files include: **chanbank, offckt, offgraphcoord, offloc,** and **offsite**.

Examples of traffic files include: **devicedir, egress, ingress, t_trafficload, trafdir, trafficload,** and **tunneltrafdir**.

Table 10: Traffic Files

File	Description
egress	The **egress** file contains egress traffic of the network interfaces load. Egress traffic specifies traffic that is going out of the network interfaces. This data is used for calculating link utilization and load.
ingress	The **ingress** file contains ingress traffic of the network interfaces load. Ingress traffic specifies traffic that is going into the network interfaces. This data is used for calculating link utilization and load.

Table 10: Traffic Files *(Continued)*

File	Description
trafdir, tunneltrafdir	The **trafdir** file identifies the location of the interface traffic daily directories repository. The **tunneltrafdir** file identifies the location of the tunnel traffic daily directories repository.
trafficload, t_trafficload	The **trafficload** file allows you to import measured bandwidth utilizations based on data collected from the network. Traffic loads for each PVC can be specified over the time intervals for which the data was collected. The t_trafficload file (IP/MPLS only) is similar to the trafficload file, but for LSP tunnels (layer 2 instead of layer 3)

Examples of the discrete event simulation files include: tfxdata, tfxpattern

Table 11: Discrete Event Simulation

File	Description
tfxdata	For discrete event simulation only. The **trafficdata** file allows you to define each demand by specifying multiple packets and packet sizes. Although this requires you to have a reasonable knowledge of the traffic, more accurate network simulation results can be obtained in this manner. Refer to *TRAFFICDATA (TRAFFICDATA=filename*) for further details.
tfxpattern	For discrete event simulation only. The **trafficpattern** file allows you to define several class types based on traffic characteristics. Each traffic type may be specified in terms of four parameters: number of messages, duration (seconds), message size (bits), and frame size (bytes). Refer to *TRAFFICPATTERN (TRAFFICPATTERN=filename)* for further details.

Device specific files contain the definitions for various types of devices. Examples of device specific files include: **aclist, bgplink**, **bgpnode**, **bgpobj**, **intfmap**, **policymap**, **tbit**, **tunnel**, and **vpn**.

Table 12: Device-Specific Files

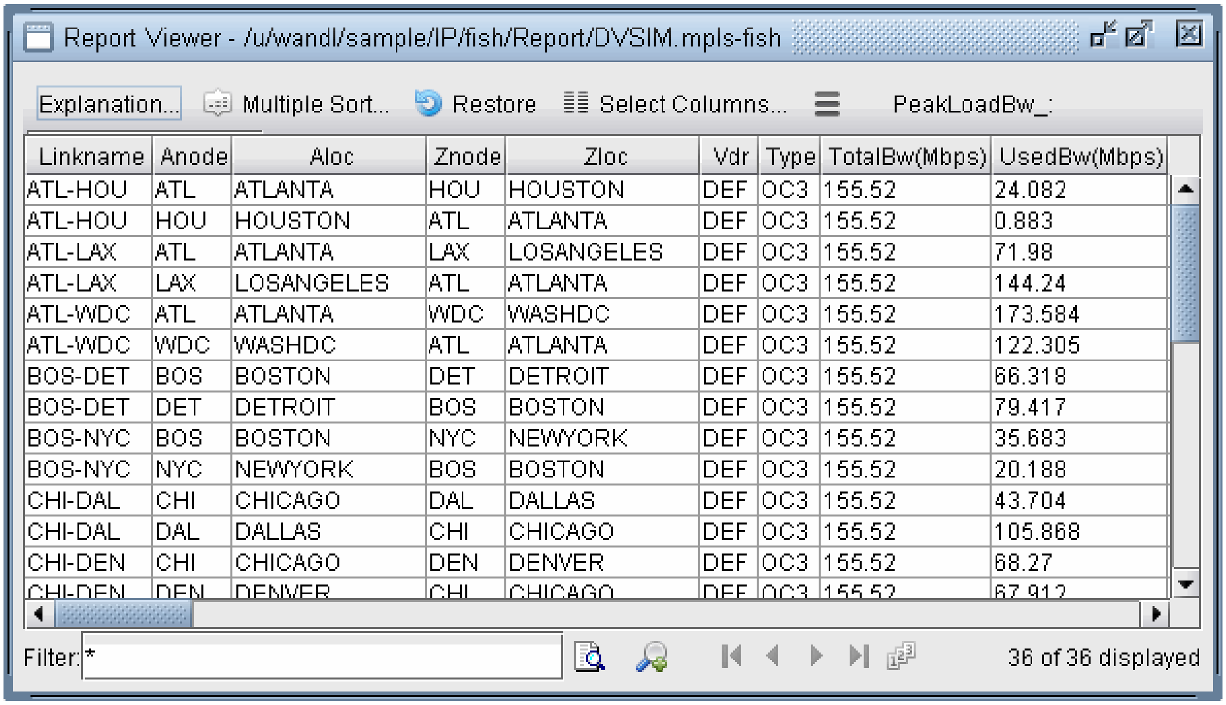
File	Description
aclist	The **aclist** file (Router only) contains information about access rules such as access lists, distribute lists, and filter lists.

Table 12: Device-Specific Files *(Continued)*

File	Description
bgplink	The **bgplink** file (Router only) contains the definitions for BGP neighbors. See note for bgpobj. See note for bgpobj.
bgpnode	The **bgpnode** file (Router only) contains the definitions for BGP speakers. See note for bgpobj.
bgpobj	The **bgpobj** file (Router only)contains information about BGP neighbors and is stored in binary format to speed up performance. Note: If you want to manually edit bgpnode and bgplink, comment out this entry before reloading the network.
intfmap	The **intfmap** file (Router only) contains information about router interfaces, including the node, interface, IP address, status, bandwidth, VPN-list, and other details.
policymap	The **policymap** file (Router only) contains information about CoS Policies on each router
tbit	The **tbit** file (Router only) stores names for the tunnel attributes (otherwise referred to as admin group for Juniper Networks).
tunnel	The **tunnel** file (Router only) contains information about LSP tunnels.
vpn	The vpn file (Router only) contains information about Virtual Private Network details such as vrf, route distinguisher, route target, and protocols.
rtd	The routing table descriptor (rtd) file (ATM/PNNI only) is used for PNNI networks to read routing table descriptor information. This file is generated by Paragon Planner after you saved the network's RTDs.
hpnni	The hpnni file (ATM/PNNI only) is used for PNNI networks to describe PNNI information for nodes and logical group nodes in the network. It also contains hierarchical information which allows Paragon Planner to group the network's nodes accordingly.

The Report Viewer allows you to view reports that are generated by the system. The report viewer provides quick access and a uniformed and organized way of viewing these reports. To view a report, you must select a file that is in Paragon Planner report format. To customize the columns displayed, right-click on the column header and select the **Select Columns...** option.

Figure 13: Report Viewer Window



Linkname	Anode	Aloc	Znode	Zloc	Vdr	Type	TotalBw(Mbps)	UsedBw(Mbps)
ATL-HOU	ATL	ATLANTA	HOU	HOUSTON	DEF	OC3	155.52	24.082
ATL-HOU	HOU	HOUSTON	ATL	ATLANTA	DEF	OC3	155.52	0.883
ATL-LAX	ATL	ATLANTA	LAX	LOSANGELES	DEF	OC3	155.52	71.98
ATL-LAX	LAX	LOSANGELES	ATL	ATLANTA	DEF	OC3	155.52	144.24
ATL-WDC	ATL	ATLANTA	WDC	WASHDC	DEF	OC3	155.52	173.584
ATL-WDC	WDC	WASHDC	ATL	ATLANTA	DEF	OC3	155.52	122.305
BOS-DET	BOS	BOSTON	DET	DETROIT	DEF	OC3	155.52	66.318
BOS-DET	DET	DETROIT	BOS	BOSTON	DEF	OC3	155.52	79.417
BOS-NYC	BOS	BOSTON	NYC	NEWYORK	DEF	OC3	155.52	35.683
BOS-NYC	NYC	NEWYORK	BOS	BOSTON	DEF	OC3	155.52	20.188
CHI-DAL	CHI	CHICAGO	DAL	DALLAS	DEF	OC3	155.52	43.704
CHI-DAL	DAL	DALLAS	CHI	CHICAGO	DEF	OC3	155.52	105.868
CHI-DEN	CHI	CHICAGO	DEN	DENVER	DEF	OC3	155.52	68.27
CHI-DEN	DEN	DENVER	CHI	CHICAGO	DEF	OC3	155.52	67.912

Due to the length of some reports, the Report Viewer only displays a portion of the report in the viewer window. You may set how many lines to display in the Page Setup. With the jump-to buttons, you can jump to the beginning and end of the report. You can also move forward or back. Clicking the **Search** button searches the current table for the queried text. Clicking the **Advanced Search** button opens a new window for more complex searches. The query is entered in the text field at the top of the window. The panels on the bottom are provided for convenience in selecting keys, relations, and boolean operators.

Figure 14: Report Viewer Toolbar

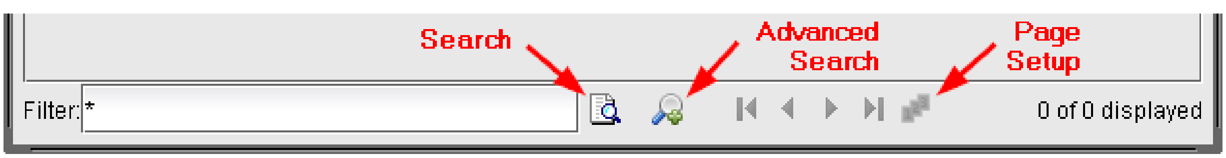
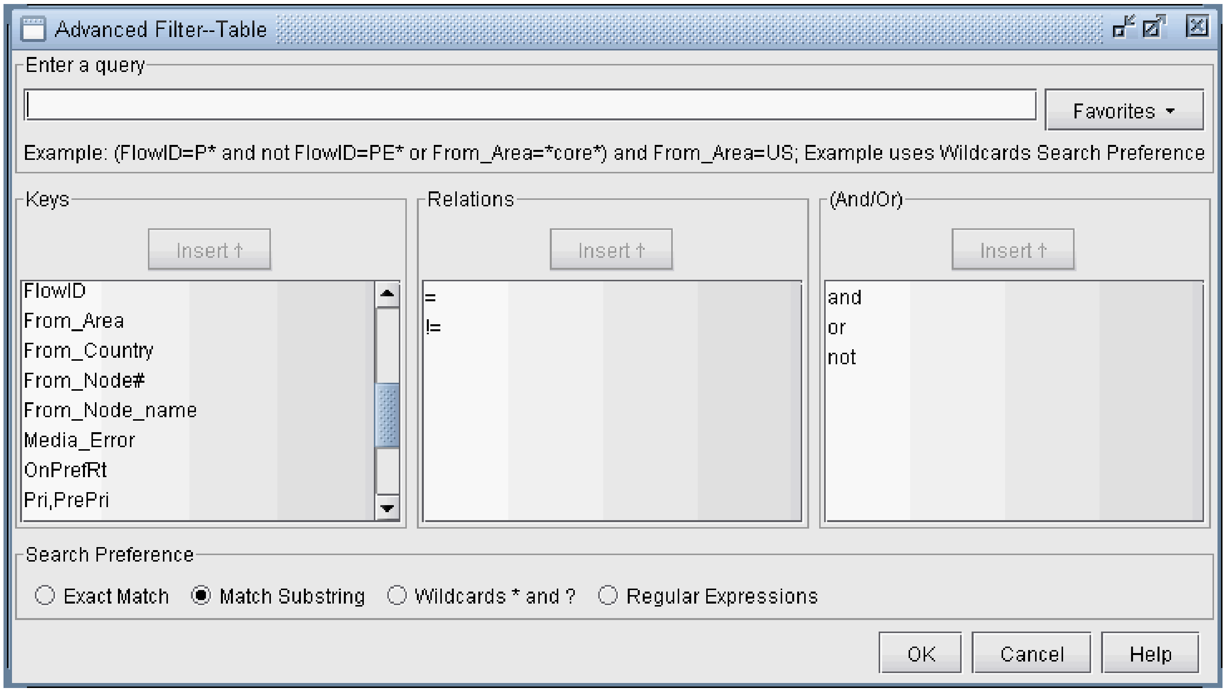
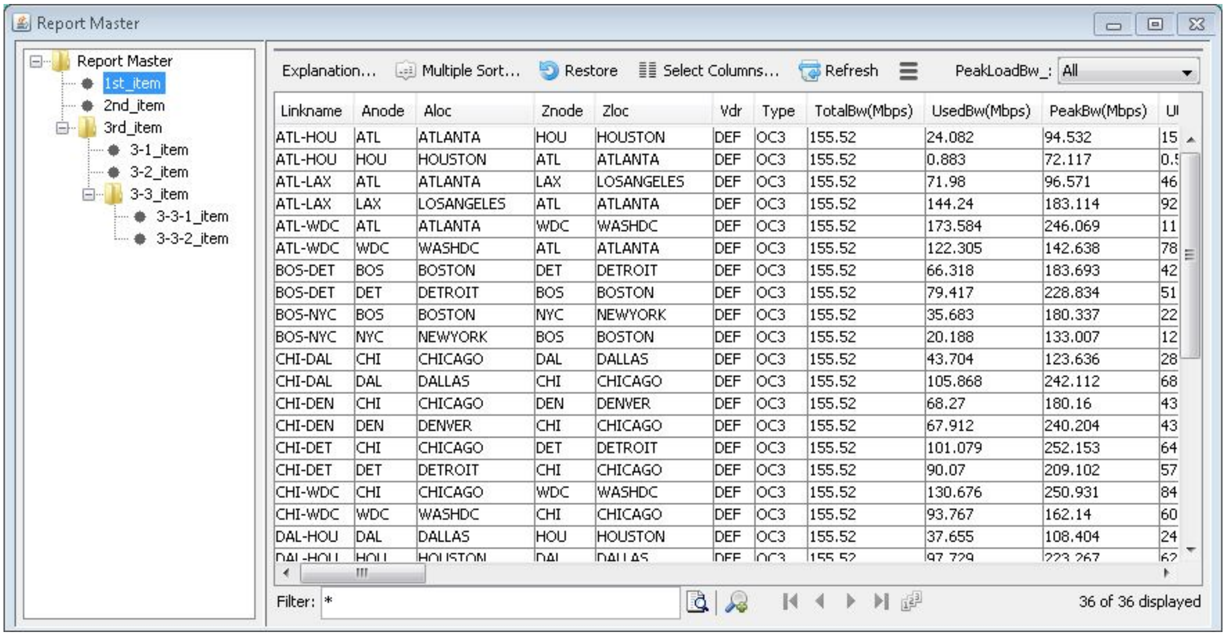


Figure 15: Advanced Filter Window



The Report Master allows you to view multiple reports in the Report Master window. The Report Master is similar to the Report Manager which provides quick access and a uniformed and organized way of viewing multiple reports without having to open a network first. To open a report master, you must select a file that is in report master format.

Figure 16: Report Master Window



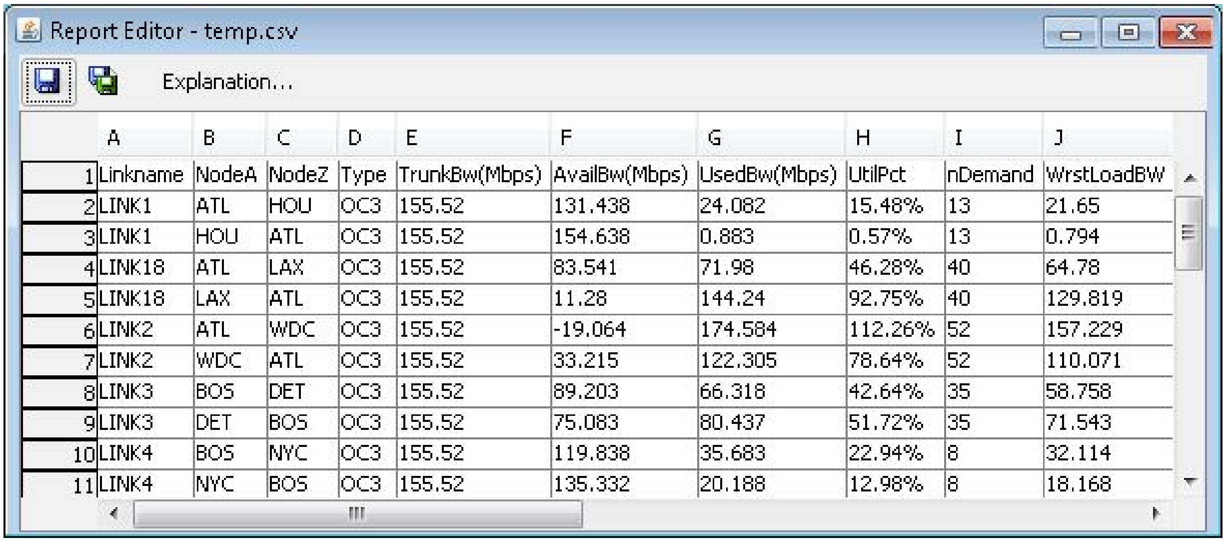
The Report Master files do not contain any actual reports. Instead, the Report Master files reference existing reports and place them into an organized tree structure. The format of a Report Master file is described below.

```
# Paragon Planner Report Master
1st_item First.report
2nd_item ../../other_path/2nd.report
```

```
3rd_item {
    3-1_item /export/home/data/3-1.report
    3-2_item 3-2.report
    3-3_item {
        3-3-1_item 3-3-1.report
        3-3-2_item 3-3-2.report
    }
}
```

The Report Editor allows you to perform basic editing functionality on csv files. Click on a cell to edit the value. Right-click on a cell to for more options to edit rows and columns.

Figure 17: Report Editor Window



	A	B	C	D	E	F	G	H	I	J
1	Linkname	NodeA	NodeZ	Type	TrunkBw(Mbps)	AvailBw(Mbps)	UsedBw(Mbps)	UtilPct	nDemand	WrstLoadBW
2	LINK1	ATL	HOU	OC3	155.52	131.438	24.082	15.48%	13	21.65
3	LINK1	HOU	ATL	OC3	155.52	154.638	0.883	0.57%	13	0.794
4	LINK18	ATL	LAX	OC3	155.52	83.541	71.98	46.28%	40	64.78
5	LINK18	LAX	ATL	OC3	155.52	11.28	144.24	92.75%	40	129.819
6	LINK2	ATL	WDC	OC3	155.52	-19.064	174.584	112.26%	52	157.229
7	LINK2	WDC	ATL	OC3	155.52	33.215	122.305	78.64%	52	110.071
8	LINK3	BOS	DET	OC3	155.52	89.203	66.318	42.64%	35	58.758
9	LINK3	DET	BOS	OC3	155.52	75.083	80.437	51.72%	35	71.543
10	LINK4	BOS	NYC	OC3	155.52	119.838	35.683	22.94%	8	32.114
11	LINK4	NYC	BOS	OC3	155.52	135.332	20.188	12.98%	8	18.168

Table 13: Report Editor Window File Manager View

Show Hidden Files	This option displays all hidden files in the directory
Large Icons	This option displays files and directories listed in the File Manager's right pane as large icons in columns.
Small Icons	This option displays files and directories listed in the File Manager's as small icons in columns.
List	This option displays files and directories listed in the File Manager's in list form.
Details	This option gives a detailed view of the files displayed in File Manager including information such as file permission, file owner, file size, and last modified date. (Note: Each column can be sorted by clicking on the column header.)
Directory View	This toggles the left pane between the Directories view and Common Actions / Favorite Link view.

Text Editor

The text editor allows you to edit any text file found on the system via a graphical interface. When a file such as a log file or Paragon Planner network file is double-clicked, the text editor is launched. When a text file is opened in the text editor, the file name is displayed across the top.

Figure 18: The Text Editor

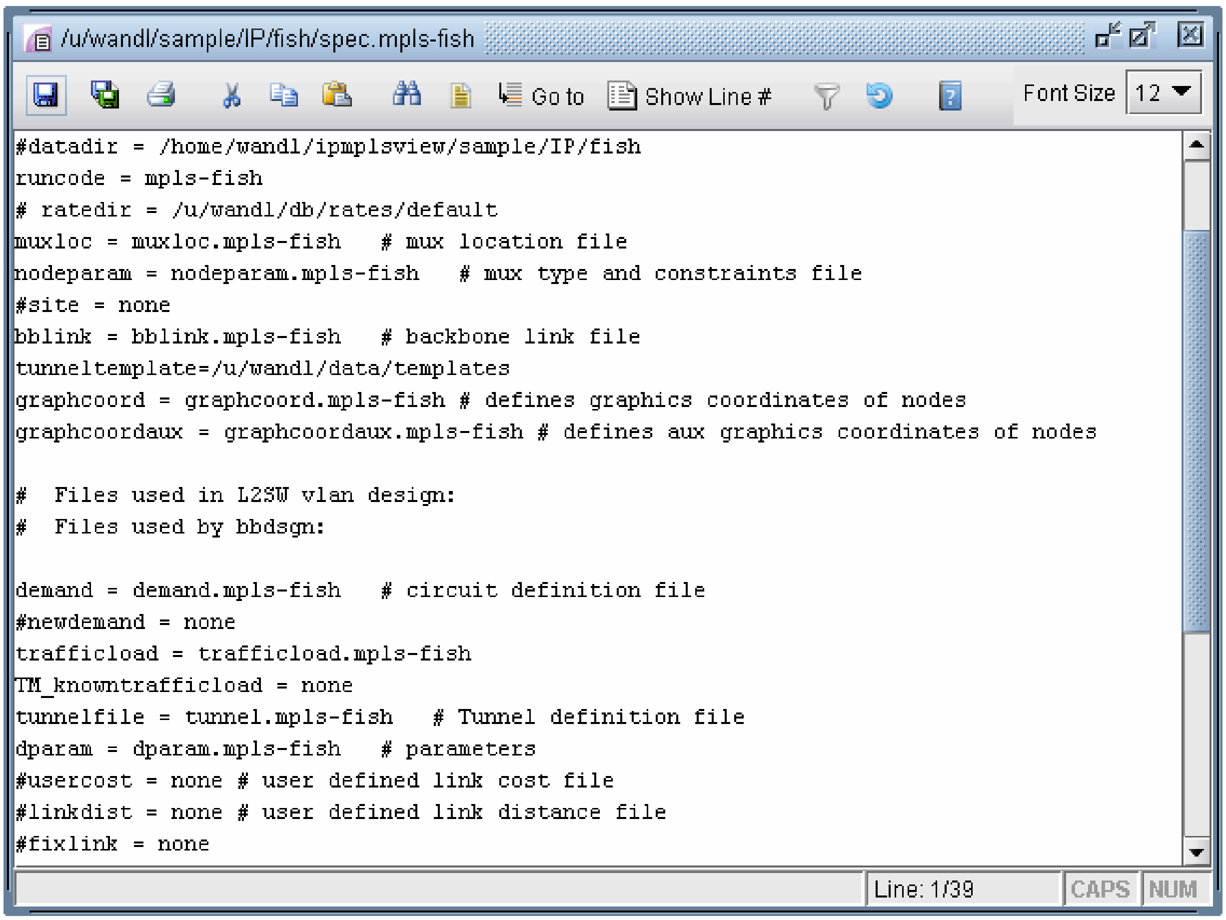


Table 14: Text Editor Window Functions

Function	Description
Save	Save the file.

Table 14: Text Editor Window Functions *(Continued)*

Function	Description
Save As	Save the file under a different name and/or directory.
Print	Print the current file to a printer.
Cut	Cuts the selected text being edited.
Copy	Copies the selected text being edited.
Paste	Pastes any cut or copied text.
Find/Replace	Search for or replace a specified string.
Select All	Select and highlight all the text.
Go To	Jump to a certain line in the file.
Show/Hide Line#	Toggles displaying the line numbers.
Filter Line	Displays only the lines with a text match. Supports regular expression. The filter is case sensitive.
Restore to Original Text	Removes any filters and displays the original text.
Font Size	Change the text font size.

Figure 19: The Find and Replace Dialog Box

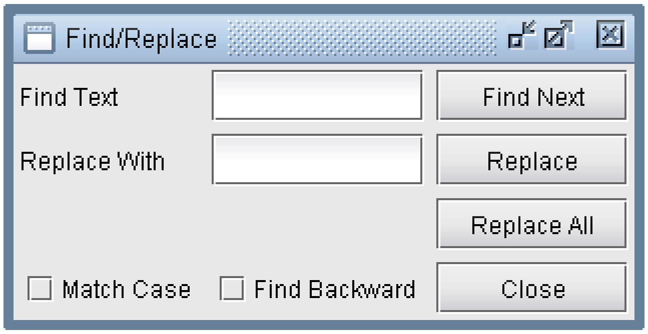


Table 15: Text Editor Window Find and Replace Functions

Function	Description
Find Text	Specify the text to be searched.
Replace With	Specify the replacement text.
Find Next	Click this button to search for the next occurrence of the text.
Replace	Click this button to replace the highlighted text.
Replace All	Click this button to replace all occurrences of the text.
Match Case	Toggles the text search to be case sensitive or insensitive.
Find Backward	Sets the Find/Replace function to search for the text in reverse order toward the beginning of the file.

NOTE: If you open a file that is larger than 4 MB in size, then Paragon Planner will launch the text editor in read-only mode. This is to prevent memory over-usage for the system.

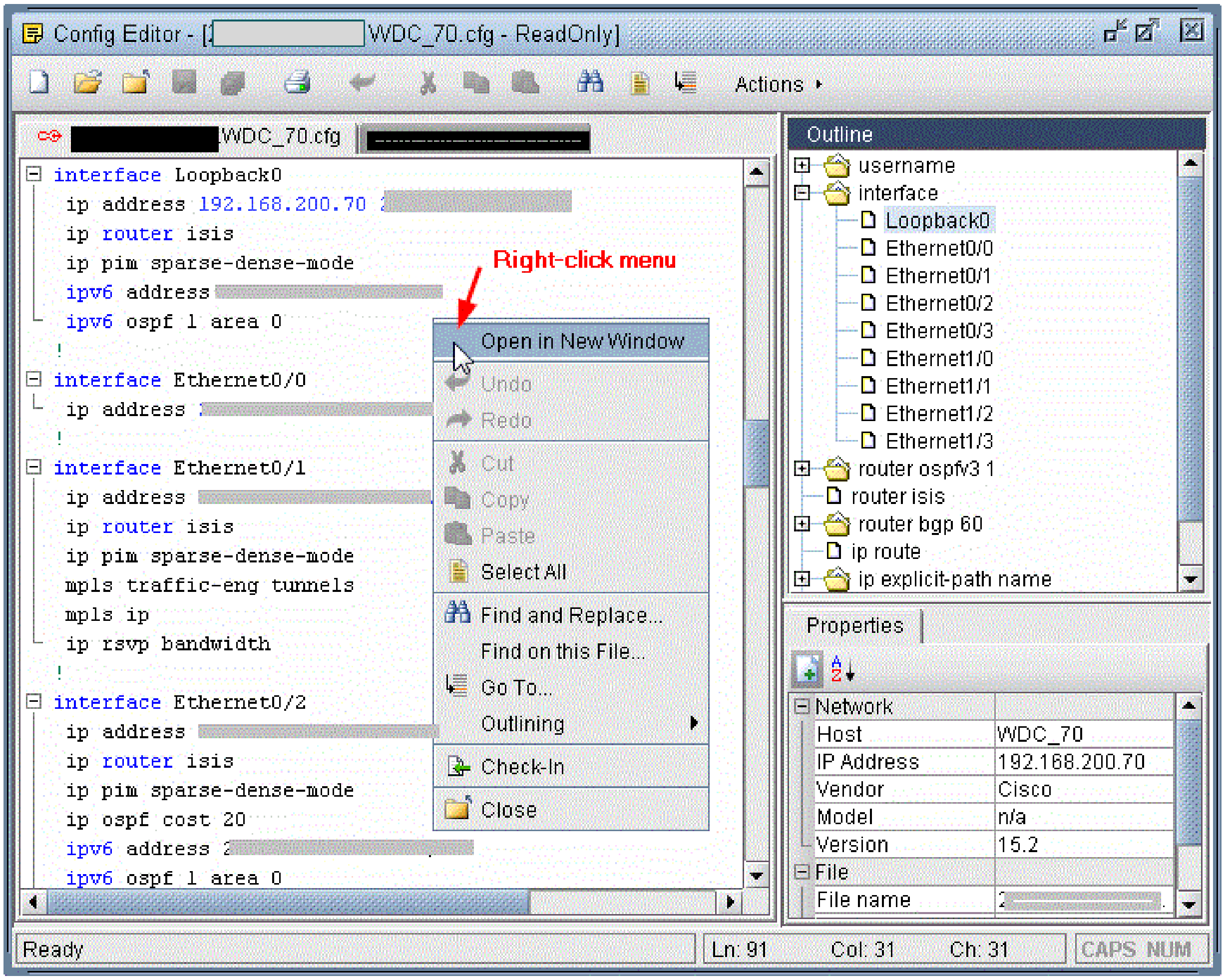
Config Editor (Router and Switch)

Paragon Planner provides a convenient and easy-to-use config editor for editing router configuration files. This editor functions similarly to other text editors, but contains some special operations and built-in recognition of configuration file keywords to facilitate the editing of config files. Supported router configs include Cisco (IOS, XR, CatOS, Nexus), Foundry, Juniper Networks (Junos OS, EX, ERX), Riverstone (RapidOS, ROS-X), Tellabs, Alcatel, Extreme, Huawei, Redback, Starent, and Zyxel.

To access, simply double-click on a configuration file within the File Manager. Alternatively, if your network model was built up from config files via File > Import Network Wizard, you can also right-click on the router in the Map window or the Network Info window Nodes view and select **Show Config File**. This will open up your config file in the Config Editor as shown in Figure 20 on page 42.

> **NOTE**: For those using the Online module of Paragon Planner, if you have opened the Live network, right-clicked on a node in the Map, and selected **Show Config File**, the config editor will only allow you to view the configs, and not edit them. This is because they represent the actual state of the configurations in the network.

Figure 20: Config Editor Window



To edit, simply modify by inserting or deleting characters in the text area. Then, press the Save icon. To close a file, select **Actions** > **File** > **Close**. To open a config file from your local machine rather than the server, select **Actions** > **File** > **Open Local**. Editing tools can be found in the toolbar, in the right-click menu that appears in the left pane, and in the Actions menu.

Most of the editor functionality is self-explanatory or standard. The following lists some specific capabilities of the Config Editor:

- *Config Editor Open Multiple Files*
- *Compare Two Files*
- *Keep Track of Revisions Made to a File*
- *Navigate the Config File Quickly With the Outline*
- *Find and Replace* , including ability to search globally within all configuration files in your current network model

- *Collect and Refresh Configuration Files (Paragon Planner Online Module Only)*
- *Insert an Entire Text File*
- *Set Color-Coding and Other Options*

To open a config file located on the server, press the **Open**icon on the toolbar. Or select **Actions > File > Open**. To open a config file located on your local machine, select **Actions > File > Open Local**.

A new tab is created in the left pane of the Config Editor for each file that is opened.

You can perform side by side comparison of config files by opening a config file in a new window. To do so, first select the tab of the desired config file. Right-click somewhere over the config's pane and select **Open in New Window**. A new instance of the Config Editor will appear and the selected config is moved from the original window over to the new window.

Compare Two Files

To compare two files, select **Actions > Tools > Compare > Two Files**. You are prompted to specify two files located on the server machine, as shown in Figure 21 on page 43. Use the "Browse" buttons to navigate to the desired file. Then, press "OK". The File Diff window will appear showing the side-by-side results of the "diff".

Note that these same comparison capabilities are also available via the Revision Manager. You can access the Revision Manager directly through the Config Editor via Actions > Tools > Revision Manager. If you have already set up revision information for the current network, you can compare two files using Actions > Tools > Compare > With Revision.

Figure 21: Select Two Files for Comparison

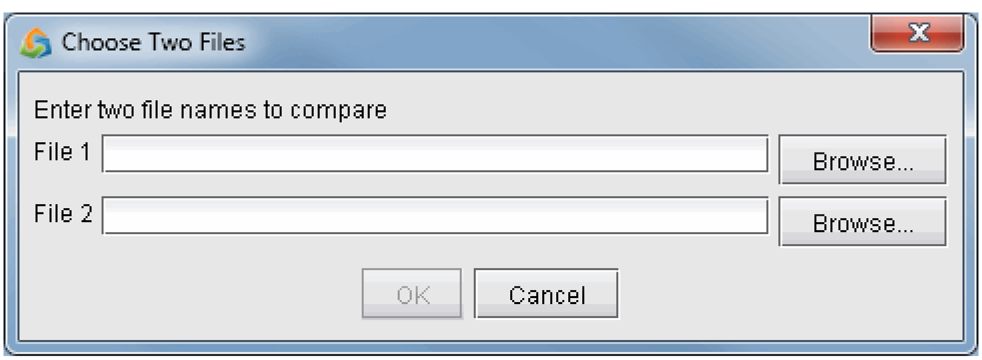
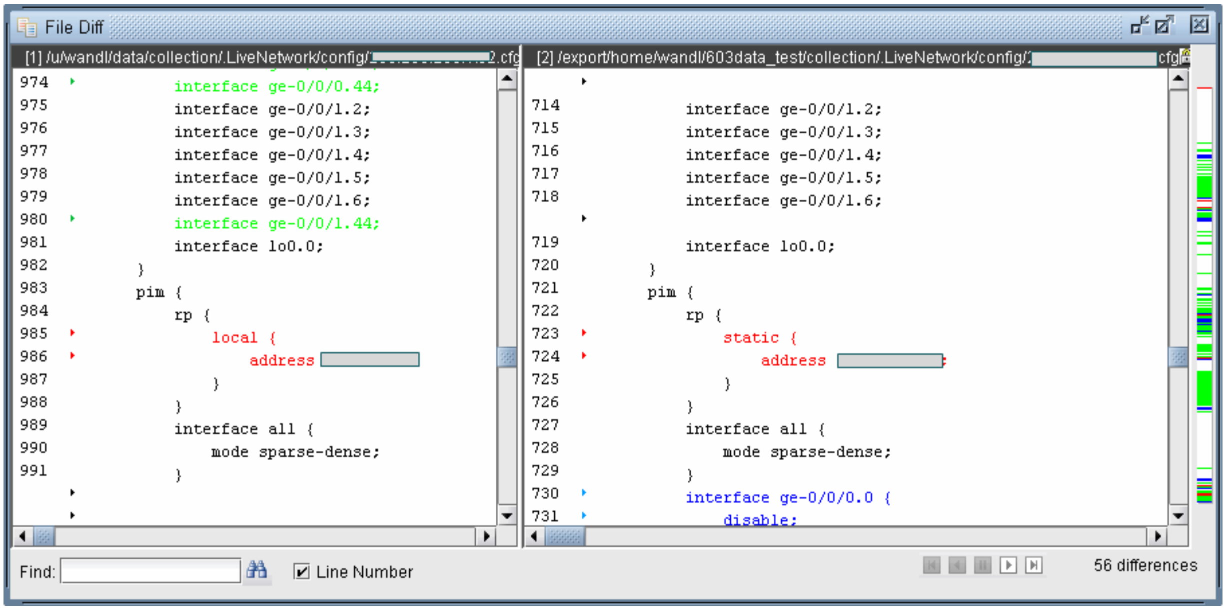


Figure 22: File Diff Side-by-Side Comparison



Entries in GREEN indicate that a line was added. BLUE indicates a line was removed. RED indicates the line has changed. The green, blue, and red markers on the right bar of the window can help you quickly scroll to the points where differences have been detected.

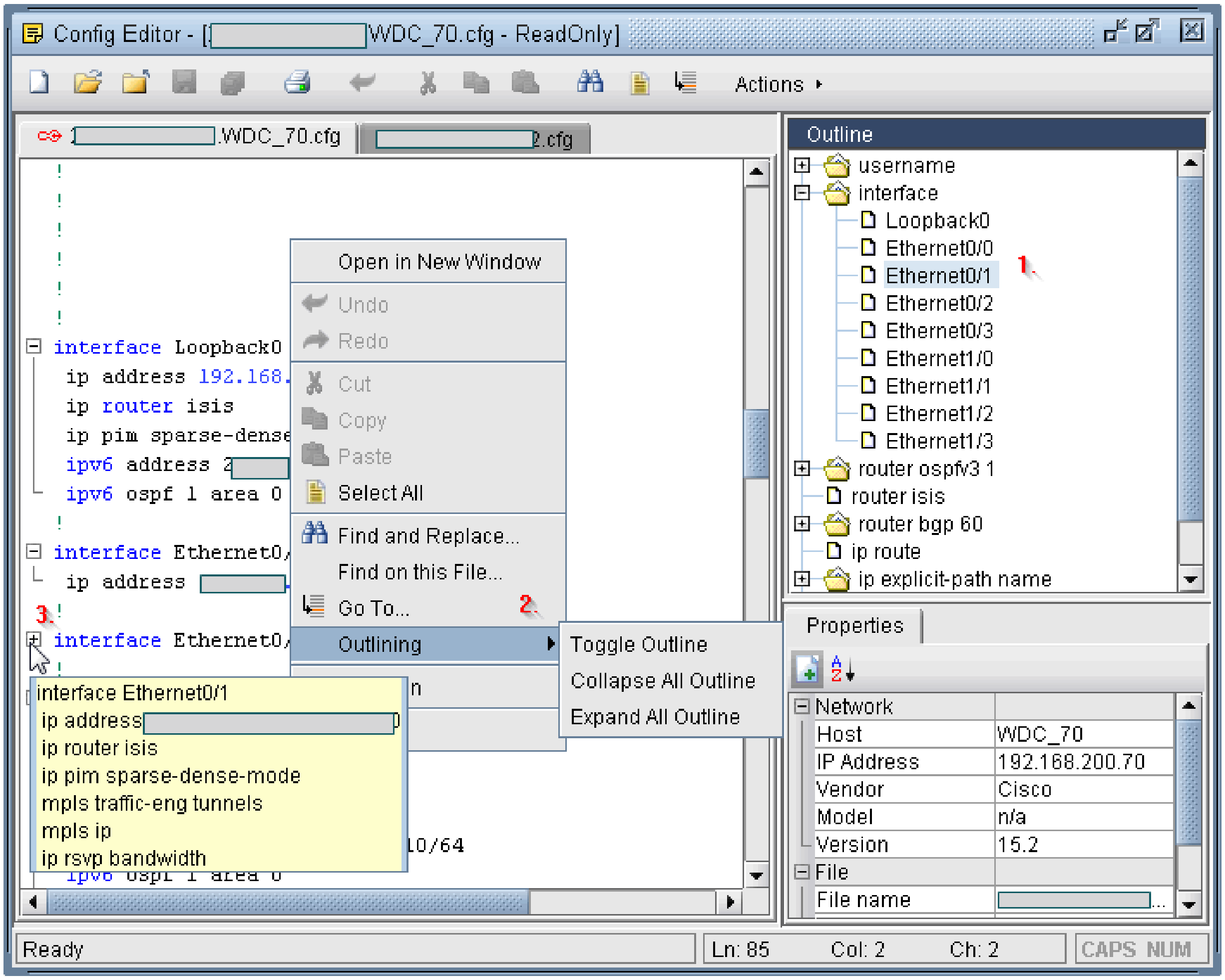
Keep Track of Revisions Made to a File

You can use track changes made to a file, using Actions > Tools > Revision Manager. After the initial setup of the revision system, you can “Check In” your config file to create a new revision/version number.

Navigate the Config File Quickly With the Outline

The Config Editor divides each router configuration file into blocks. In Junos OS, for example, blocks are clearly defined by brackets. For other hardware, the Config Editor divides blocks based on certain major commands. The Outline section of the Config Editor, located in the upper right hand side of the window, lists a high-level “outline” of these major commands. Click on any point in the outline to immediately jump to that section of the config file. Press the “+” and “-” boxes to the left of an entry to expand and collapse the entry, respectively. You can also hide or show the Outline Pane using the toggling menu options Actions > Hide Outline Pane and Actions > Show Outline Pane.

Figure 23: How to Use the Outline



- Clicking on an entry in the Outline pane will cause the Config Editor to jump to that section of the config file, highlight the first line of that section, and expand that block. In Figure 22, Tunnel7 is expanded in the left pane.

- Right-clicking within the left pane reveals three Outlining options. If your mouse cursor is placed somewhere in the config file text in the left pane, and you select **Toggle Outline**, then the section containing the cursor will expand if currently collapsed, or collapse if currently expanded. You can accomplish the same thing by clicking directly on the “+” and “-” boxes to the left of each config section. “Collapse All Outline” and “Expand All Outline” will collapse or expand all sections, or blocks, in the current config file view. Note that these operations are also available via the Config Editor’s Actions menu on the window’s top menu bar.

- Holding your mouse cursor over a “+” box to the left of a collapsed block in the config file will pop up a tooltip showing the contents of that section.

Find and Replace

The Actions > Search submenu contains the following features:

- **Find and Replace:** This is a standard Find and Replace editor function.
- **Find on this File:** This opens the Find function in the Config Editor toolbar.
- **Find in Configuration Files:** This function allows you to perform a global search on all config files associated with the currently opened network model, not just the config files that are opened in the Config Editor. Results are displayed in a table, as shown in Figure 24. Within this table, you can double-click on an entry or press the “Show in Editor” button. The corresponding config file is displayed in the Config Editor (or opened if you have not yet opened it) and the occurrence of the word is highlighted.
- **Go To:** Jump to a specific line in the file.

Figure 24: Find in Configuration Files

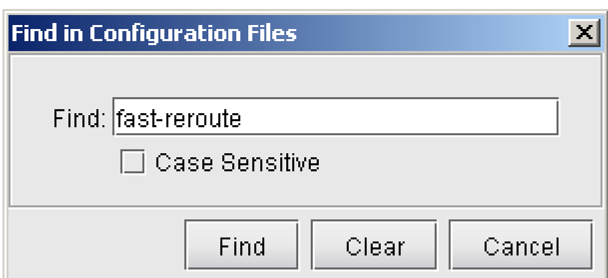
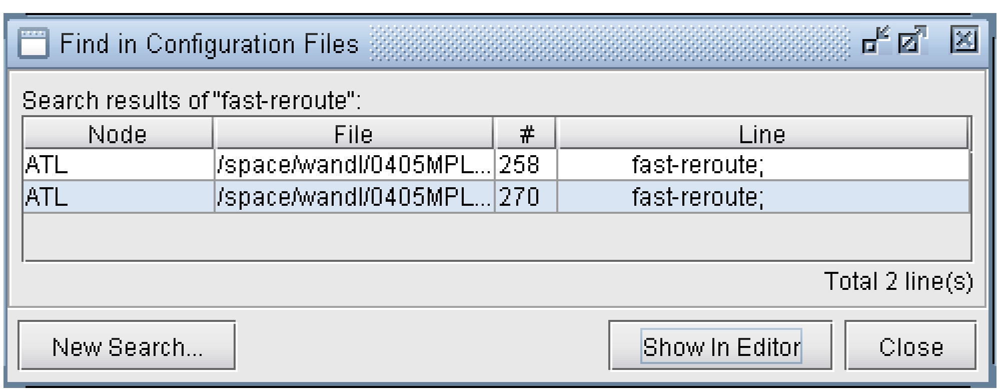


Figure 25: Find in Configuration Files Results



Collect and Refresh Configuration Files (Paragon Planner Online Module Only)

This feature is located in Actions > Tools > Collect and Refresh Configuration. It is available for Paragon Planner only, and accessible only if you are in online, or live, mode (select **File > Open Live Network**). This option applies to just the config that is currently being viewed in the Config Editor. It allows you retrieve the router's configuration file from the live network and update your copy within the Config Editor.

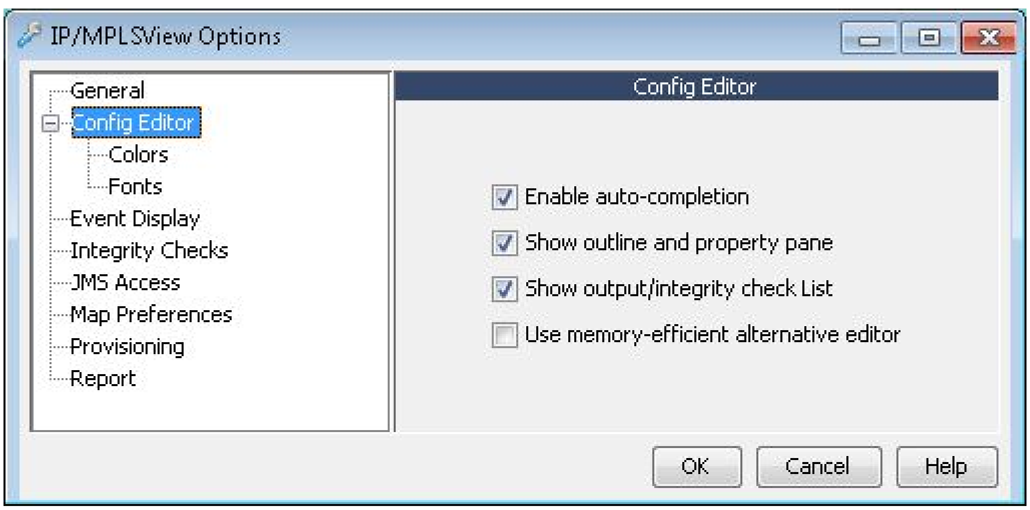
Insert an Entire Text File

If you have config file statements in another file that you wish to insert at a particular point of the current config file, select **Actions > Edit > Insert Text File**. Browse for a text file that is located on the server. If your text file is located on your local machine, select **Actions > Edit > Insert Local Text File** instead.

Set Color-Coding and Other Options

You can set Config Editor color coding, font, and general preferences via Actions > Options. Note that you can also access these preferences by selecting **Tools > Options > General** from the software's main menu bar. In the Options window, click on **Config Editor**.

Figure 26: General Config Editor Options



Function	Description
Enable auto-completion	If this is enabled, then as you type within the Config Editor, Auto-completion will suggest the complete word based on its database of keywords for the particular hardware. Only major keywords for certain hardware models are supported.
Show outline and property pane	If this is unchecked, then the Outline and Property panes of the Config Editor is hidden, providing more room for the main config editing panel.

(Continued)

Function	Description
Show output/integrity check list	If this is enabled, then the Config Editor displays a list of items found from Integrity Checks report.
Use memory-efficient alternative editor	If you click this option, then the next time you open a config file, it is opened in Paragon Planner's standard editor. That is, the configuration file will not be outlined in blocks, there is no color-coding of keywords, auto-completion, etc.

Figure 27: Config Editor Color Options Example

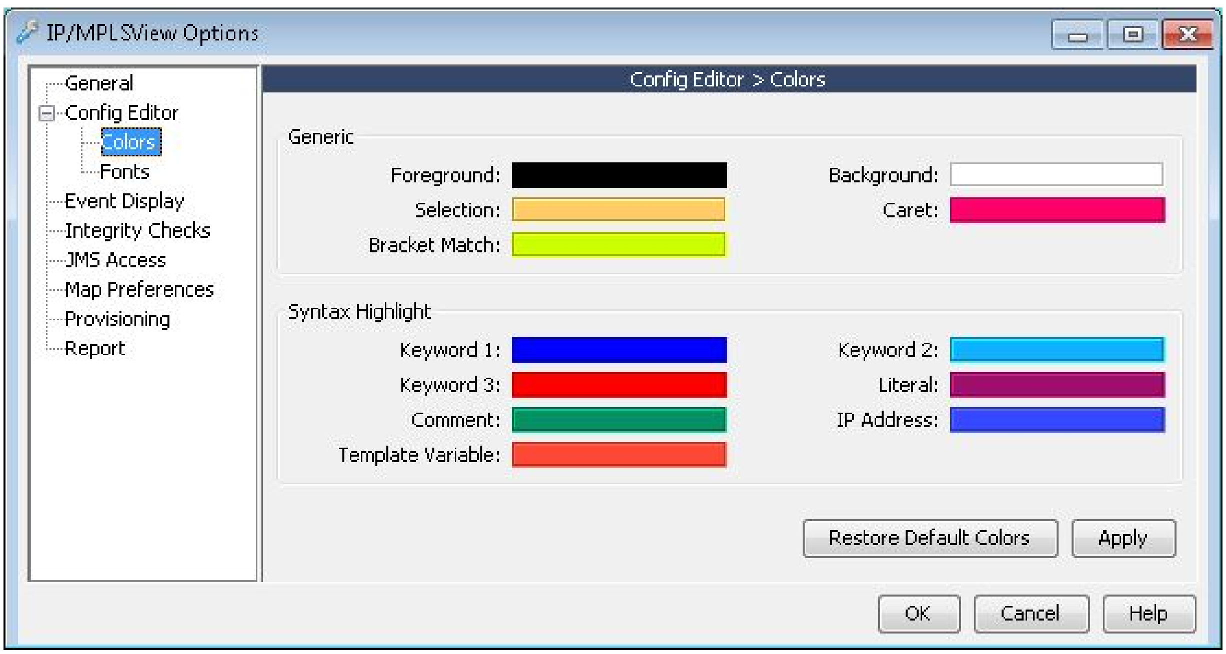
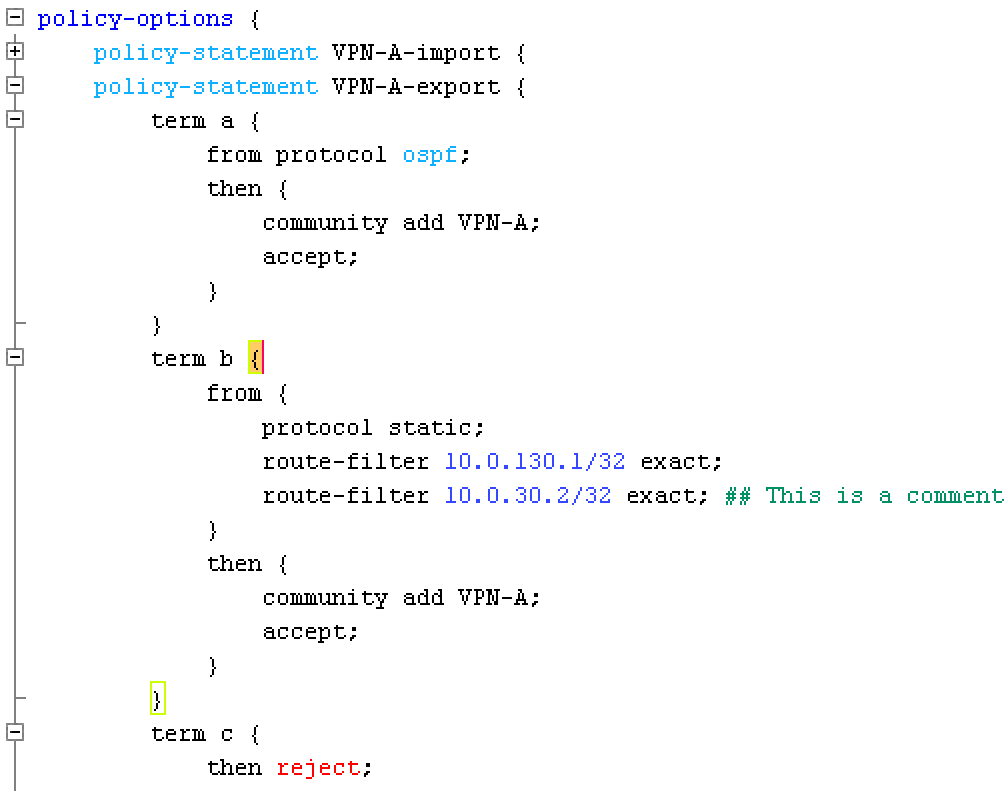


Figure 28: Config Color Options



Item	Description
Foreground, Background	Foreground is the text color. Background is the color of the page.
Selection	Whatever text that is selected is highlighted in this color. Select text by dragging the mouse.
Caret	The cursor
Bracket Match	For config files that use brackets, when you select an open bracket ('{'), the matching close bracket ('}') will also be highlighted.

(Continued)

Item	Description
Keyword 1,2,3	These are colors assigned to different levels of config file keywords. These keywords are pre-defined by the Config Editor, and selected based on both importance and how well they facilitate readability of the file. In general, Keyword 1 = major commands, Keyword 2 = sub-major commands, Keyword 3 = commands with “negative” meaning (for example, “shutdown”, “disable”, “inactive”, etc.). • Note: In a future release, these will also be editable.
Literal	Any user-specified string, such as an interface description, often in double quotes.
Comment	Comments
IP Address	All instances of IP addresses

4

CHAPTER

Topology Window

Topology Window Overview

The topology (map) window is the main work area for any network model you load into the system. Multiple links displayed between nodes uses “line bending" to avoid hidden trunks in the topology. The topology incorporates node aggregation collapsible views. You can also view node locations via their geographic coordinates on the world map, NPA/NXX, or automatic layouts.

The topology window displays important link and node properties. Links are color-coded according to utilization. Alternatively, you can view links by other properties such as media, trunk type, vendor or domain/area. Nodes are color-coded by symbols, icons, or vendor types.

Path analysis can be performed in the topology window. The path function displays detailed path information between any two nodes found in the network based on factors such as routing method used, reserved and actual bandwidth allocation, link distance, or oversubscription.

The topology window is divided into three areas: Left Pane Legend for changing the setting of the topology view; Center Pane Map displaying the network; and Right Pane Toolbar. Right clicking on the map opens a pop-up menu for more functions. Move the map by holding the left mouse button and dragging. Zoom in and out by using the mouse scroll wheel. Figure 29 on page 52 shows the topology window.

Figure 29: The Topology View Window

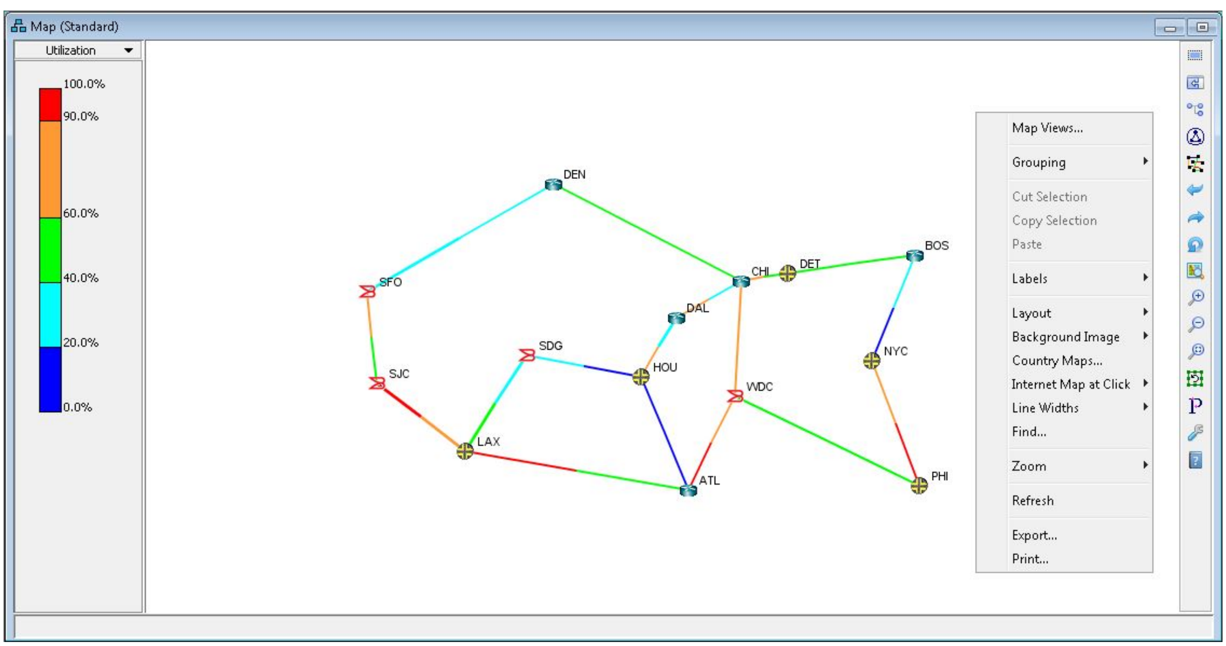


Table 16: Topology Map Pane Areas

Area	Description	Reference
Center Pane Map	The Topology Map Area is the middle portion of the Topology Map. In this area, you can select and move nodes around on the map.	See "Center Pane Map" on page 53
Left Pane Legend	The left pane of the topology window contains drop-down boxes for the following functions: Filters, Network Elements, Utilization Legends, and Subviews.	See "Left Pane Legend" on page 55
Right Pane Toolbar	The toolbar at the right of the topology window provides shortcuts to functions in the Popup Menu.	See "Right Pane Toolbar" on page 74
Pop-Up Menu	The popup menu is accessed by right-clicking within the Topology Map Area. Right-clicking over a node, link, or group results in a popup menu for that element.	See "Map Popup Menus" on page 79

Center Pane Map

The topology map is a graphical representation of the baseline network. Paragon Planner can display the topology in several views depending on the network: BGP, LSP tunnels, Layer 3. You can select these views from the Network menu in the Main Window.

Features

- When the cursor is positioned over a network element in topology window, a description of the network element appears in the description bar at the bottom of the topology window. That description can be customized from the popup menu. Right-click on the map and select **Labels > Bottom Bar** menu.
- Double-click to get full detailed information about the element.
- Right-click on an element to view more options for that element.
- Hold the left mouse button to drag the map around.
- Use the mouse scroll wheel to zoom in and out on the map.

Selecting Multiple Nodes and Links

You can select nodes and links in the topology map in the following ways:

- Use the Selection Tool and drag a rectangle around the nodes and links you want to select.
- <Ctrl>-click or <Shift>-click on nodes and links.
- Right-click on a node and use Select options.
- Right-click on a link and use Select options.

Moving Nodes

When moving nodes in the map area, you are changing the graphical coordinates rather than the geographical coordinates. Graphical coordinates are the positions of the nodes in the topology window. Geographical coordinates are positions of the nodes according to actual physical locations (for example, latitude and longitude). To set the current positions as geographical positions, right-click over the map area and select **Layout > Set Lat/Lon from Map**.

Saving Map Settings

Topology information that gets saved to each client include the following:

- Map Preferences Settings See "Right Pane Toolbar" on page 74.

Topology information that gets saved to each network includes the following:

- **group file:** Groupings of network devices are saved in the group file.
- **graphcoord file:** Graphical coordinates of network devices are saved in the graphcoord file.
- **graphcoordaux file:** Auxiliary map settings below.

The graphcoordaux file stores the following map settings data:

- **Legends:** Node and link color settings, link utilization color bar settings, line styles, most checkboxes in **Subviews > Protocols**, checkboxes in **Filters > Type**.
- **Labels:** Which node/link labels were turned on, labeling preferences for the bottom bar.
- **Background Image:** See "Map Popup Menus" on page 79.
- **Country Maps:** See "Map Popup Menus" on page 79.
- **Groups:** Which groups were collapsed and which groups were expanded.

Multiple map views can be saved for the same network using the Map Views feature. Each view is saved on the server in a userSettings directory consisting of group (grouping), graphcoord (graphical coordinates), and graphcoordaux files. For more information, see "Map Popup Menus" on page 79

Left Pane Legend

Filters

For these items, see "Map Filters" on page 58 for more information.

Table 17: Left Pane Legend

Item	Description
Protocols	Allows you to view your network by different categories such as by protocol.
Types	Allows you to show or label certain categories of nodes (for example, by hardware type) and links (for example, by trunk type)
Routing Instances	Displays routing instances/OSPF process IDs associated with each link/interface by the color in the legend, which can be customized using Set Color... in the right-click popup menu. Refer to the *Paragon Planner User Guide* chapter titled *Routing Instances* for more details.
Advanced	Includes options to hide certain elements such as nodes (AS's) or links (low utilization links)

Network Elements

For these items, see "Map Elements" on page 64 for more information.

Item	Description
Nodes	Includes a list of the nodes in your network. Clicking on a node will highlight it on the map.
Links	Includes a list of links for the selected subview. Clicking on a link will highlight it on the map.
Facilities	Includes a list of facilities in the network. A facility is a set of nodes and links likely to fail together.

Utilization Legends

For these items, see "Utilization Legends" on page 67 for more information.

Item	Description
Utilization	Displays the planned link utilization using colors of the color bar. Planned utilization is the percentage of the link used by the demands you input into the network.
Peak Util	The Peak Util display feature is used after running a failure simulation script to view the highest (or worst case) link utilization loading experienced by each link, depending on the rerouting of demand/flow traffic after any single failure.
Planned Node Load	Displays the planned traffic on a node by a color bar. For further information.
Measured Node Load	Displays the measured interface traffic on a node by a color bar.
Measured Link Util	Displays the measured interface traffic load by CoS, as an alternative to Traffic > Traffic Load, Interface.
Demand CoS Util	Displays the normal and peak utilization calculated based on demand routing, as an alternative to Traffic > Traffic Load.

Subviews

Item	Description
AS	Displays Autonomous Systems (AS's) by color. Each respective AS and their colors are shown in the left pane as a legend. The color can be customized using Set Color... in the right-click popup menu.
Access/Domain	Displays the domain or area (for example, OSPF area) by color. Each respective area and its colors are shown in the left pane legend. The color can be customized using Set Color... in the right-click popup menu.

(Continued)

Item	Description
Attributes/AdminGroup	(MPLS-TE module). View links by logical combinations of RSVP resource colors (Cisco attribute or Juniper Networks admin group). The logical combinations available include all, any, and not. See the *Paragon Planner User Guide* for more information.
Link Status	(Router module). Displays operational statuses of links and virtual trunks using colors or line styles. Operational Statuses for links include Down, Passive, and Other. Operational statuses for virtual trunks include VT (for an operational virtual trunk) and VT Down for a non-operational virtual trunk. .
Media	Displays link media types using colors or line styles. Valid link media attributes include: TERRES (terrestrial), SAT (satellite), MCWAVE (microwave), FIBER, and ENCRYPT (encrypted). These media descriptors are used in route biasing of demands using criteria such as preferred, preferred not, and required. The color and style of these links can be customized by right-clicking on the icon in the left pane and selecting Set Color or Set Line Style.
Multicast Tree	Includes multicast groups in the network. Selecting one will highlight the distribution tree on the map.
OSPF Area	The OSPF Areas list assigns a color, for purposes of representation on the topology map, for each OSPF area configured in the network. NONE shows the color assigned to routers with no OSPF area configured.
P2MP	Displays a list of configured P2MP groups. Clicking on a group in the list shows the relevant tunnels in the topology map.
Protocols	Allows you to view your network by different categories such as by protocol. See "Map Filters" on page 58.

(Continued)

Item	Description
Routing Instances	Displays routing instances/OSPF process IDs associated with each link/interface by the color in the legend, which can be customized using Set Color... in the right-click popup menu. This is the same view you see when you select Filters > Routing Instances. See "Map Filters" on page 58. Refer to the *Paragon Pathfinder User Guide* for additional details.
Types	Displays types of nodes (for example, by hardware vendor) and links (for example, by trunk type). See "Subviews > Types" on page 70 for display customization options.
Vendors	Displays link vendors using colors or line styles. Possible values for vendors include those that are specific to a certain country or region, and are listed in the tariff database. If a vendor is not specified, the vendor is set to the default DEF. To represent in-house fiber links with zero cost, the vendor should be set to NET. The color and style of these links can be customized by right-clicking on the icon in the left pane and selecting Set Color or Set Line Style.

Map Filters

IN THIS SECTION

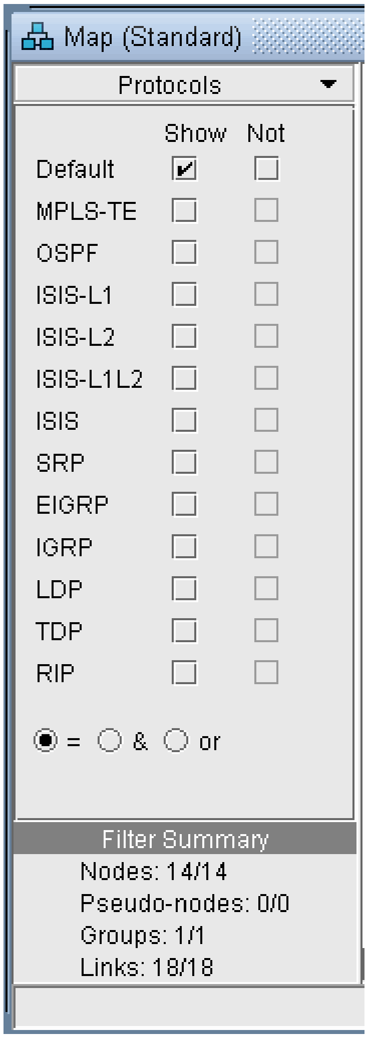
Using the options in the left pane, you can modify your view of the network based on the protocols in the network, the types of nodes and links, or routing instances. There are also advanced options available from the left pane that enable custom filtering of network elements in the topology map.

Filters > Protocols

The Filters > Protocols pane offers the ability to display subsets of the available network routing protocols in the network using logical operations like AND, OR, NOT, and EQUAL. The selections available will vary according to the protocols in the open network

The bottom of the pane contains the number of nodes, pseudo-nodes, groups, and links that are currently displayed out of the total number. The number displayed is less than the total when objects are hidden due to selections either in this pane or other Filters panes.

Figure 30: Filters > Protocols View



Show, Not

Selecting **Show** by itself for a protocol displays all network elements supporting the protocol. Selecting **Show** and **Not** together for a protocol displays all network elements that do not support the protocol.

Logical Operations (=, &, and or)

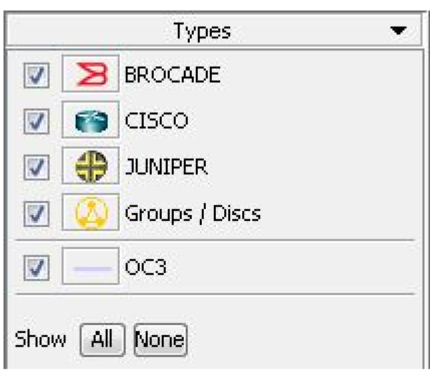
You can perform logical operations on the protocol list selections. The equal operation (=) specifies that only the currently selected subview is shown. Only one selection is allowed for this operation. The AND operation (&) specifies that the intersection of the protocol subviews is displayed. The OR operation (or) specifies that the union of the protocol subviews is displayed. lists the logical operations.

Logical Op	Protocols	Interpretation
=	OSPF	Filters the display to show OSPF enabled links.
&	OSPF: “Show” MPLS-TE: “Show Not”	Filters the display to show all links with OSPF enabled but without MPLS enabled
or	OSPF: “Show” ISIS: “Show”	Filters the display to show all links with either OSPF or ISIS enabled.

Filters > Types

With the Types function, you can choose to display or hide network element symbols in the topology map depending on the type of node or link (for example, hardware vendor, or trunk type) by selecting or deselecting the corresponding check box. Use Show All or None to toggle on or off the display of all element types.

Figure 31: Types

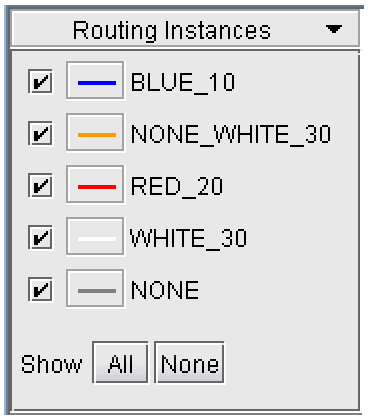


This is the same display you see when you select Subviews > Types. See "Subviews > Types" on page 70 for display customization options.

Filters > Routing Instances

With the Routing Instances filter function, you can choose to display or hide links depending upon the routing instance or OSPF process ID it belongs to by selecting or deselecting the corresponding check box. Use Show All or None to toggle on or off the display of all routing instances.

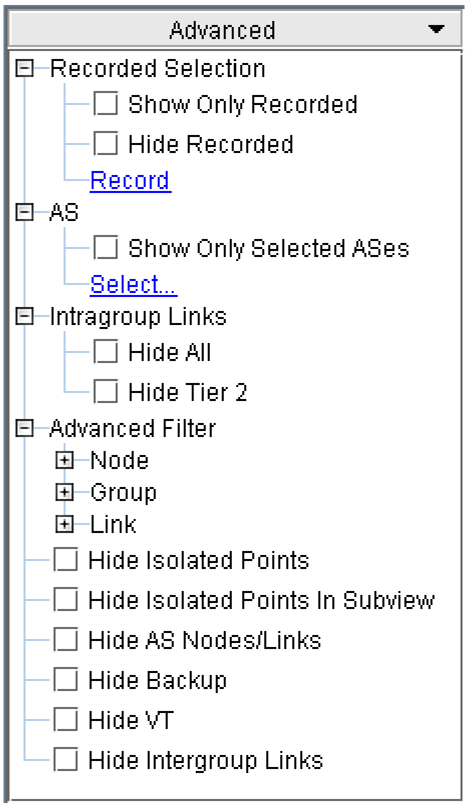
Figure 32: Routing Instances



Click a color box to change the legend color. Alternatively, right-click a box and select **Set Color**. Right-click on the color box and select **Highlight**. These Items to highlight links of this routing instance.

Filters > Advanced

Figure 33: Advanced Filter



Option	Description
Recorded Selection > Show Only Recorded	You can select some nodes/links on the map and then click **Record** to take a snapshot of the selection. After the recording is made, selecting the checkbox shows only the recorded selection.
Recorded Selection > Hide Recorded	You can select some nodes/links on the map and then click **Record** to take a snapshot of the selection. After the recording is made, selecting the checkbox hides the recorded selection from the map.
AS > Show Only Selected ASs	Allows you to show only selected autonomous systems (ASs) in the topology map. Click **Select** to specify which ASs to show.

(Continued)

Option	Description
Intragroup Links > Hide All Intragroup Links > Hide Tier 2	Intragroup Links connect nodes within a group. If there are several layers of groups, selecting **Intragroup Links > Hide All** hides all links within the top-level groups and selecting **Intragroup Links > Hide Tier 2** hides all links within groups that are two group levels down.
Advanced Filter	Click **Set...** for one of the three categories (Node, Group, or Link) to create an advanced filter statement. Then click the checkbox to turn the filter on or off.
Hide Isolated Points	Hides nodes and groups that are disconnected from all other nodes and groups in every subview in the map.
Hide Isolated Points in Subview	Hides nodes and groups that are disconnected from all other nodes and groups in the current subview.
Hide AS Nodes/Links	Hides ASNODE(s) and the link(s) and/or LANs that connect the ASNODE(s) to the rest of the network. (ASNODES represent ASs outside the network with EBGP peering relationships with BGP speakers of the network.)
Hide Backup	Hides back-up routes in the topology
Hide VT	Hides virtual trunks in the topology.
Hide Intergroup Links	Hides intergroup links connecting different groups.

Map Elements

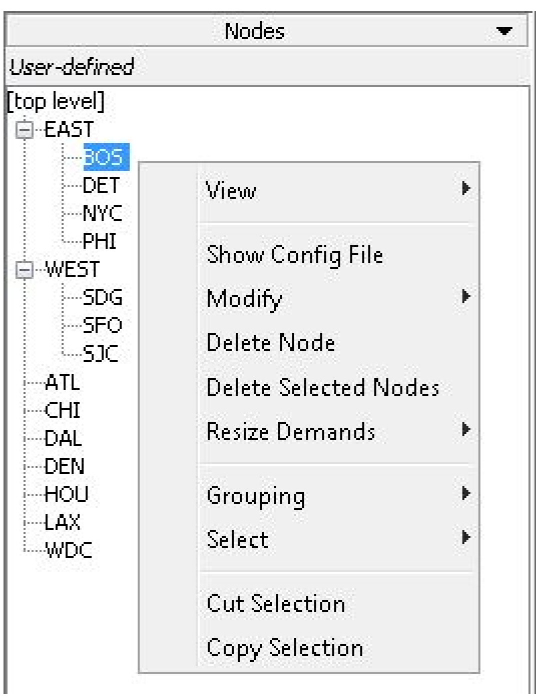
IN THIS SECTION

The network elements you can view on the topology map and customize in the left pane include nodes/groups, links, and facilities. Nodes and links you click in the left pane are highlighted in the topology map. Facilities are sets of nodes and links that are likely to fail together.

Network Elements > Nodes

When this option is selected, the groups/nodes in the network are displayed in a tree view in the left pane. Selecting a node or collapsed group in the list highlights it on the map display. The groups, if defined in the network, are displayed with group elements indented underneath. To expand or collapse a group, click on the hinge icon to the left of it. You can add an element into a group by selecting the element name, dragging it and dropping it over the group's name. Figure 34 on page 65 shows the nodes/groups.

Figure 34: Network Elements > Nodes List with Pop-up Menu

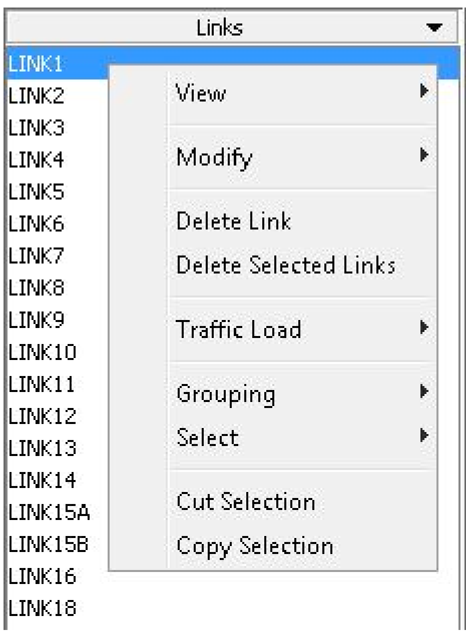


Network Elements > Links

When selected from the drop-down menu, this function displays all links associated with the protocol selected in the **Subviews > Protocols** menu. For example, if you select Frame-Relay protocol in the **Subviews > Protocols** menus, then the Links list displays only the links associate with Frame Relay.

The link names are displayed in a list view in the left pane. Selecting a link name in the list highlights it in the topology window. Clicking on the links on the topology map highlights them on the links list. Figure 35 on page 66 shows an example of the links list.

Figure 35: Links List with Pop-up Menu

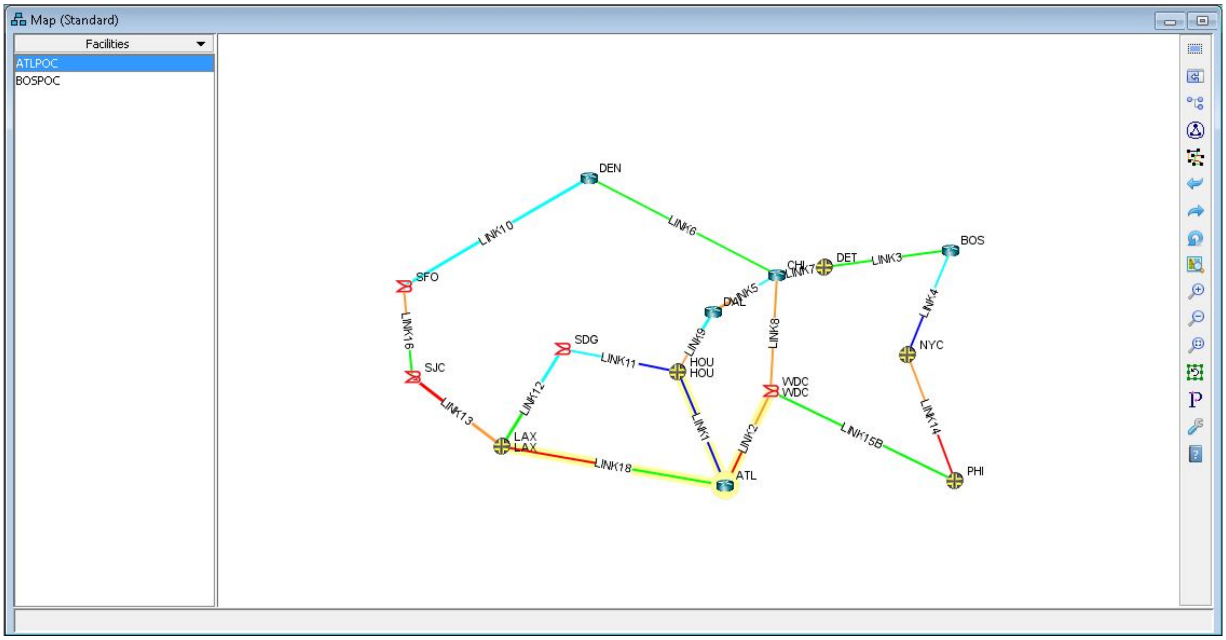


Network Elements > Facilities

A facility is a group of links and/or nodes that are likely to fail together. It is used in failure simulations where accurate modeling requires the simultaneous failure of specific links and/or nodes. For instance, if several links travel over the same fiber, a fiber cut will break all of them at once. In this case, one can define a facility to represent the SRLG (Shared Risk Link Group) containing those links. Another example is the set of switches on one floor of a large data center, together with all the links going into or out of that floor.

Figure 36 on page 67 shows an example of a facilities list in the left pane.

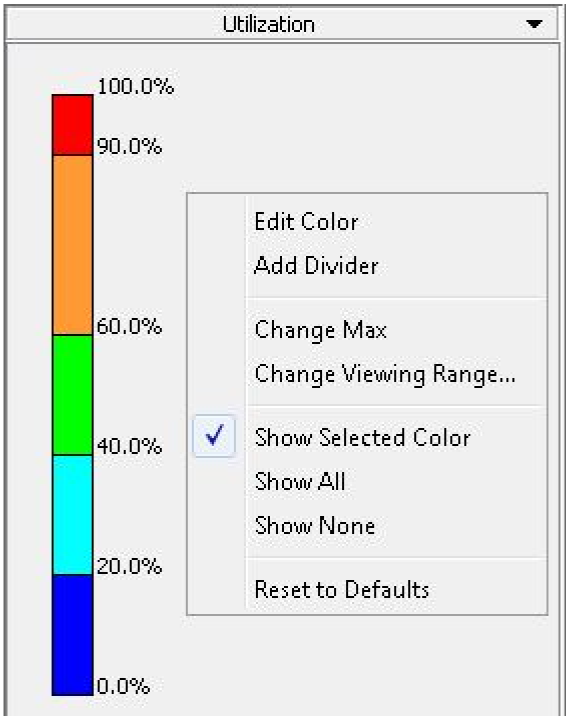
Figure 36: Facility List



Utilization Legends

- The Utilization displays the planned utilization rate of links resulting from the demands in the network model.
- The Peak Util displays the links according to the peak utilization reached on that link in a failure simulation.
- The Measured Link Util displays the measured link utilization, up to 24 periods. A slider bar can be used to check the utilization at different periods. The data comes from the ingress (interfaceLoad_in) or egress (interfaceLoad_out) files. For the live network this is named Interface CoS Util and uses the /u/wandl/data/.network/interface.traffic and interfacei.traffic files.
- The Demand CoS Util displays the normal and peak utilization per CoS calculated based on demand routing. In this case, it is based off of both the demand and trafficload file. The trafficload file is used to display up to 24 periods. A slider bar can be used to check the utilization at different periods.

Figure 37: Utilization Legend



Popup Menu

Menu Item	Description
Edit Color	This will open a color palette that allows you to choose a color for the section selected on the color slider.
Add Divider	This will add a new divider on the color bar at the location of the right-mouse-click.
Change Max	This will change the maximum utilization percentage on the color slider to the specified value in the New Max window.
Change Viewing Range	Use this to zoom into a particular percentage range, for example, 0.00-10.00% for greater granularity.
Show Selected Color	Selecting this option shows links that have the selected color. Note that when deselecting a color, a link is hidden only if the colors of both of its interfaces are deselected.

(Continued)

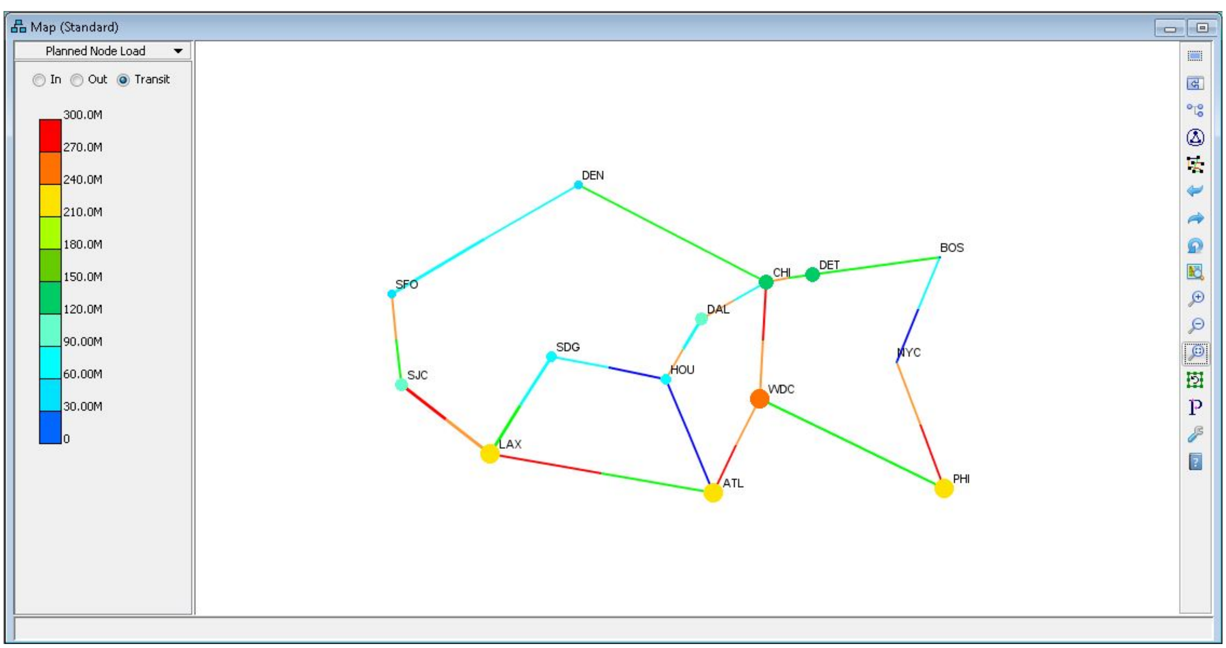
Menu Item	Description
Show All	Shows links of any colors.
Show None	Hides all links.
Reset to Defaults	This will reset the Prov Util color bar to the original default setting of dividers and colors.

For the Planned Node Load and Measured Node Load panes, there is a color legend that colors the nodes according to the node load. The colors and divider locations can be modified in this legend.

The Planned Node Load pane allows you to view the planned load on each node based on the bandwidth of demands originating (Out), terminating (In) or passing through (Transit) each node.

The Measured Node Load pane allows you to view the measured load of traffic going in or out of the network. This option shows traffic derived from measurements at the incoming and outgoing interfaces. To use this feature, you should indicate in the specification file the location of the following files that specify the traffic going in/out of the node from interfaces: interfaceLoad_in (ingress), interfaceLoad_out (egress). See the *Paragon Planner User Guide* for more details about these two panes.

Figure 38: Planned Node Load



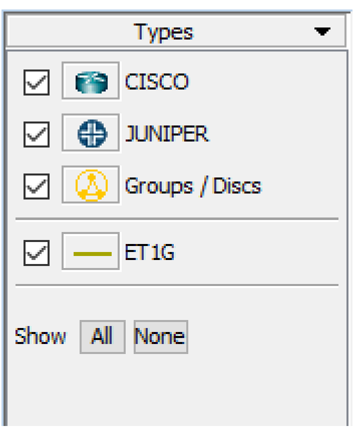
The Node Load legend draws each node as a circle. The bigger the traffic going in/out of the node, the bigger the circle is, so you can easily see which nodes have the most traffic to the outside world. For Measured Node Load, there is also a slider to choose one of up to 24 periods to display.

For MPLS-enabled networks, you will see a different view depending upon whether Layer 2 or Layer 3 is selected from the top menu bar of the main window. Selecting Layer 2 allows you to view the planned load of LSP Tunnels.

Subviews > Types

The Types pane displays categories of devices found in the currently opened network. These devices include routers, types of links, and any user-defined network element groups found in the network. Different types of devices are associated with different icons. When putting the mouse over one of these icons, a tool tip will indicate how many items of the corresponding category are represented on the map.

Figure 39: Types Subview



Customizing Nodes and Links

The right-click popup menu for an icon includes the following options:

- **Set This Icon:** Choose an icon
- **Highlight These Items:** Highlight nodes of this type

The right-click popup menu for a link supports the following options:

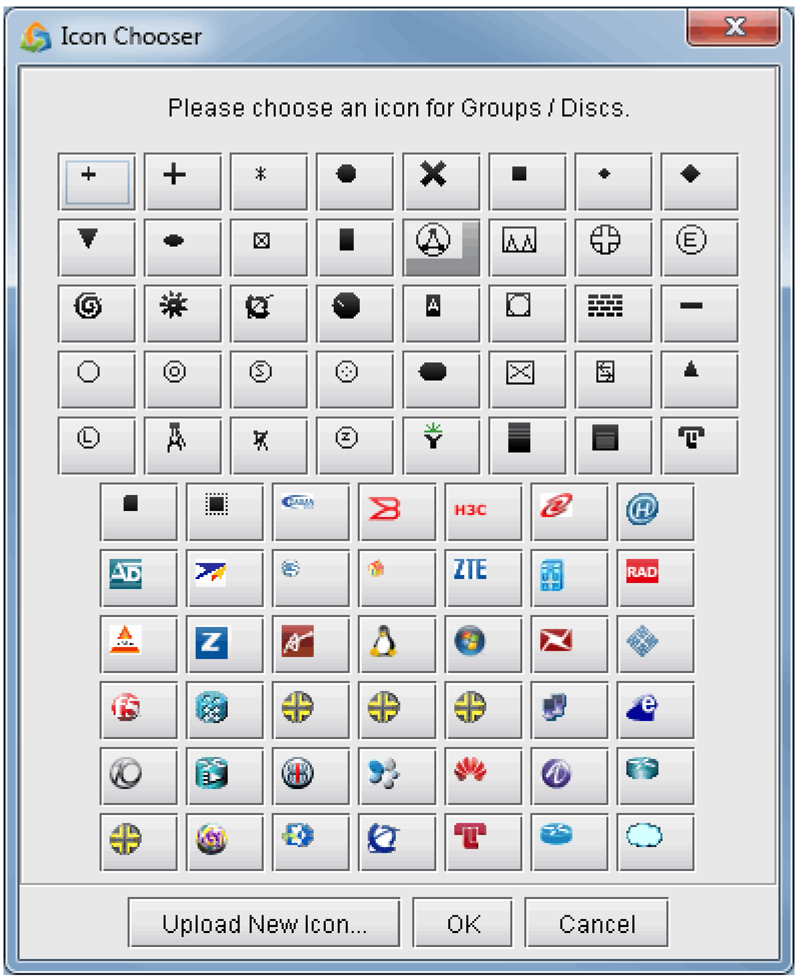
- **Set Color:** Brings up a color chooser to customize the color

- **Set Line Width:** Choose a line width (the larger the number, the thicker the link width)
- **Set Line Style:** Choose a style (for example, dotted lines)
- **Highlight These Items:** Highlight links of this type

Customizing Node Type Icons

You set icons by right clicking on the node type or group and selecting Set This Icon. In the Icon chooser, you may select an icon and press OK to use a preexisting icon. The description of an icon can be found by hovering the pointer over the icon.

Figure 40: Icon Chooser



Alternatively, an icon can be uploaded by selecting **Upload New Icon** and selecting the image file (PNG, JPG, GIF) in the Choose Icon window. Once the image is selected, select the scale and/or width and height in the Icon Sizing Tool window.

Uploaded icons can be deleted by right-clicking on the type and selecting **Set This Icon** and then clicking the **Delete Icon** button. Upon deleting the icon, nodes of that type will revert to the original icon used for that type.

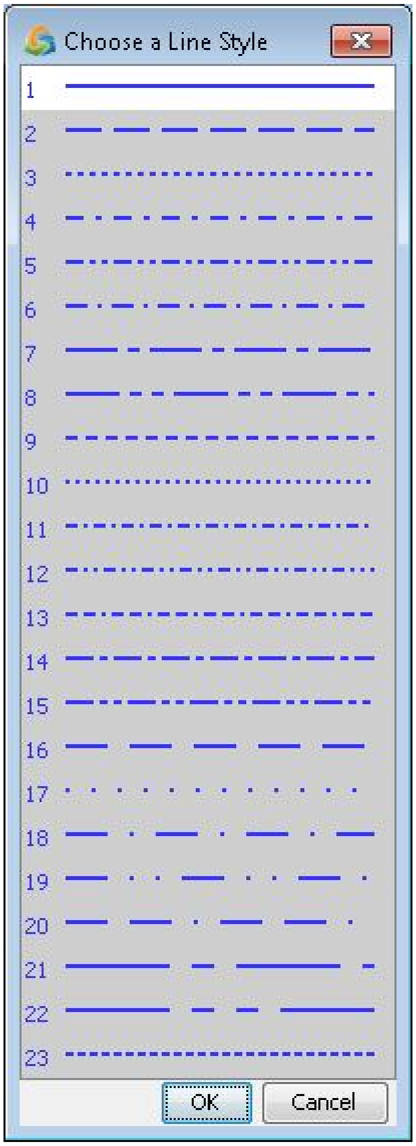
Additional Notes on Icon Import

- Icons uploaded in one session will automatically appear in the "Icon Chooser" window in later sessions.
- Paragon Planner's default icons are flat and two-dimensional, and you can set their colors by clicking on the buttons in the Type Legend. By contrast, it is not possible to change the color of an imported icon.
- Maps with icons cannot be exported to Visio 2002 and earlier (*.csv export). They can be exported to Visio 2003 and later (*.vdx export).
- When a map is exported to SVG, the *.svg file refers to the icons by their names in the local cache directory. Before sharing the SVG files with a second user on another machine, it is necessary to edit the *.svg file to use the icons' names on the second user's machine.

Customizing Line Style

You can modify the line style used to represent specific link types, such as OC3, OC12, STM3, Gigabit Ethernet, etc. Similar to customizing node type icons, to customize link type line styles, right click on the link in the type legend and select one of the menu options.

Figure 41: Link Styles

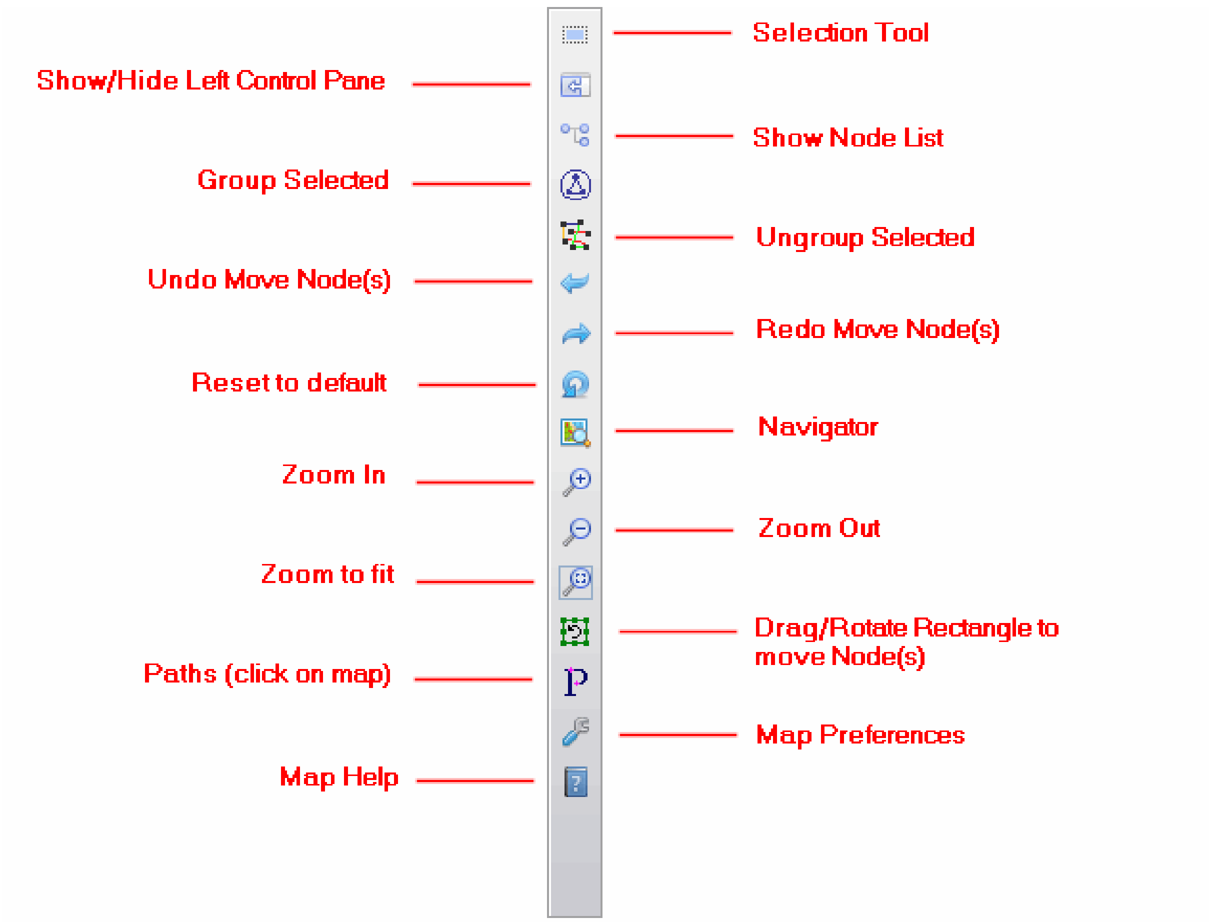


NOTE: The Export to Visio feature supports dotted line styles, as long as the dotted line is limited to one color. Solid lines can be exported in up to two colors (for example, to show the utilization in both directions on a link). However, it is not possible to export a link in two colors to show the utilization, and have it be dotted at the same time.

Right Pane Toolbar

Located on the right side of the topology window is the map toolbar. The toolbar provides quick access to some functions that are also available when right-clicking on the map.

Figure 42: The Topology Toolbar



Item	Description
Selection Tool	Toggles the selection tool to select multiple nodes and links. When ON, holding the left mouse draws a rectangular selection box. When OFF, holding the left mouse drags the map around.

(Continued)

Item	Description
Show/Hide Left Control Pane	Shows or hides the left pane of the map window.
Show Node List	Shows the nodes list in the left pane of the map window.
Group Selected	To create a group, select a set of nodes and/or other groups in the topology map. Then click this button in the toolbar and specify a name for the group. The selected nodes and groups are combined and displayed as a group icon. Multilevel group hierarchies can be created if several groups are organized together into a single higher-level group.
Ungroup Selected	This function will ungroup any group(s) chosen by you. Collapse a group, select it, and click on the Ungroup Selected Groups button. This permanently removes the group from the system.
Undo Move Node(s)	This function allows you to undo up to 10 node movements/re-layouts.
Redo Move Node(s)	This function allows you to redo up to 10 node movements/re-layouts.
Reset to default	Resets the nodes to their initial position on the map.
Navigator	The navigator map provides you with a scaled down version of the topology. After zooming in to the level you prefer, a box will appear in the navigator map that you can move to view other areas at the same zoom level. For further details, refer to *Navigator*.
Zoom In	This function allows you to zoom in on a particular area of the topology map by drawing a box around the target area.
Zoom Out	This function allows you to zoom out of the topology map.
Zoom to Fit	This function allows you to quickly fit the entire network topology into the topology window. The system only fits the network elements that are visible.

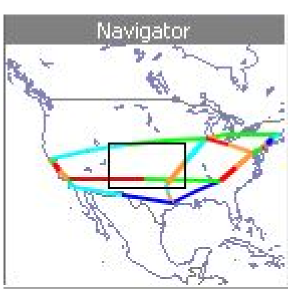
(Continued)

Item	Description
Drag/ Rotate Tool	• You can create a rectangular box on the map by holding down the left mouse button at a point and dragging the mouse to another point and then letting go of the mouse to create a box. • After creating that rectangle, you can stretch and rotate the nodes in that rectangle.
Path	• With the Paths button, you can perform path analysis in the topology window. This is the same Path function found in the Network Elements > Nodes list and in the pop-up menu in the topology map. • The path analysis function displays graphically the path between any two nodes found in the network based on factors such as routing method used, reserved and actual bandwidth allocation, link distance, oversubscription. Paths are displayed as a solid yellow line. Detailed information about the path is displayed in the console window.
Map Preferences	Opens the Tools > Options > Map Preferences window for you to customize the map display (for example, background color, font size, and display of parallel links as curves).
Map Help	Opens the online help.

Navigator

When the Navigator button is clicked, it displays the navigational map with an outlined box inside it showing which part of the map is in the current view. By clicking and dragging this box, you can pan across the topology map. This function is ideal for use when you have zoomed in to one section of the topology, and would like to easily move to other regions at the same zoom level.

Figure 43: Navigator



Drag/Rotate Tool

The purpose of the tool is to choose some nodes or collapsed groups within a rectangular region, and then stretch or shrink the rectangle, move, or rotate it.

To use the tool, press the Drag/Rotate button. Drag a rectangle on the map around nodes/groups that you wish to move. You may hold down the <Shift> key to constrain the rectangle to be a square. If no nodes/groups are selected (highlighted in yellow), the rectangle will remember all the nodes and collapsed groups inside it. Otherwise, if some of the nodes/groups in the rectangle are selected (highlighted in yellow), then the rectangle will remember only the selected nodes/groups in the rectangle. This is useful if you only want to move selected nodes in a rectangle.

When you stop dragging, the rectangle turns green, meaning active. Then you can perform one of the following actions:

- To stretch or shrink the region, drag one of the eight square handles.
- To move the region, put the mouse inside the green rectangle and drag the rectangle to another location.
- To rotate the points inside the green rectangle, rotate the mouse wheel. If you don't have a mouse wheel, hold down <Alt> and click the left mouse button to rotate in one direction. To rotate in the other direction, hold down the <Alt> and <Shift> buttons and left-click. If you have a middle mouse button, click the middle mouse button to rotate them one way, and <Ctrl> or <Shift>-click the middle button to rotate the other way. (The rotation is along ellipses inside the rectangle, so if you want true circular rotation, make sure the rectangle is a square by using shift-drag when you create it.)

There are two ways to end the drag/rotate operation: click outside the green rectangle, or click on the Drag/Rotate button to turn it off.

Paths

This function allows you to view the path between any two nodes in the topology map. To view detailed path information, click the Paths button in the toolbar (or from the drop-down menu). A cross-hair will appear. Then select a starting node and drag the cross-hair to a destination node and click on it. The paths information will appear in the console window giving detailed information about the paths such the route of the path between these two nodes. The following is an example of the detailed path information between two nodes:

```
Bandwidth initialized to 8000
* * * N1(XN1) - N2(XN2): bw= 8.0K * * *
new N1 N2 8.0K R,A2Z 02,02 N1--N2
(Adm_Weight) Route-cost=100. Max_Path_Bw= 40.704M
```

Node Popup Menus

The following options are accessible when right-clicking a node or set of nodes.

- **View > Selected Nodes:** Displays detailed information about the currently selected nodes.
- **View > Nodes under Pointer:** Displays detailed information about the node(s)/switch(es) at the place where you clicked. If there are multiple nodes at the place where you clicked, then all are displayed.
- **View > Demands on/thru Node:** Displays all demands that originate or pass through this node. In the resulting window.
- **View > Equipment View:** Displays node, card, port information.
- **View > SRLGs on Node:** Displays information about the SRLGs at a node.
- **View > Interfaces at Node:** Displays information about the interfaces at a node, including but not limited to IP address, name, bandwidth, and status.
- **View > Links at Node:** Displays detailed information about all links originating from this node.
- **View > Summary at Node:** Displays a summary information window for this selected node. Information such as total number and bandwidth of originating, terminating, transit, and local demands are all displayed in this summary.
- **Modify > Selected Nodes:** Allows modification of selected nodes.
- **Delete Selected Nodes:** Deletes the selected nodes. Connecting links may also be deleted in this process.
- **Resize Demands > At Selected Nodes:** Enter in a percentage by which to multiply the bandwidth of the demands that originate or terminate at the node(s) you right-clicked over. For example, enter in 200% to double the bandwidth of the demands at the nodes right-clicked over.
- **Fail Selected Nodes:** Fails selected (highlighted) nodes. The failure simulation will take place when you click the Run button. This option is available only when the Interactive Simulation window is open.
- **Show Config File:** This option will open the configuration file for the node if available.
- **Show Collected File:** This will open the Run CLI Command windows which lists data collected by the Task Manager. The categories available are: ARP, Equipment CLI, Interface, MPLS Topology, Multicast Path, OAM, OSPF Neighbors, Switch CLI, Transit Tunnel, and Tunnel Path. This option is available only for Live networks.
- **Internet Map at Node:** Brings up a third party map from the Internet using the specified node’s latitude and longitude coordinates.

Link Popup Menus

- **View > Selected Links:** Displays detailed information about the link(s) that were highlighted when you selected this option.
- **View > Links under Pointer:** Displays detailed information about the link(s) at the place where you clicked.
- **View > Demands on/thru Link:** Displays the demand that are going through the link. You can view all of them, all of them in one direction, all that start or end at an endpoint of the link, or all demands that pass through the link that do not start or end at an endpoint of the link.
- **View > SRLGs on Link:** View the SRLGs that this link is part of.
- **View > Interfaces on Link:** View the interfaces on this link.
- **View > Tunnels on/thru Link:** Similar to Demands on/thru Link but for tunnels.
- **Delete Selected Links:** Deletes selected links from the network
- **Fail Selected Links:** Fails highlighted links. The simulation will take place when you click the Run button. This option is available only when the Interactive Simulation window is open.
- **Collapse/Expand Multiple Links:** This will collapse or expand multiple curved links into one drawn between two nodes. When you mouse-over a collapsed multi-link, the bottom information bar displays **1 of x** where 'x' is the number of links collapsed

Map Popup Menus

IN THIS SECTION

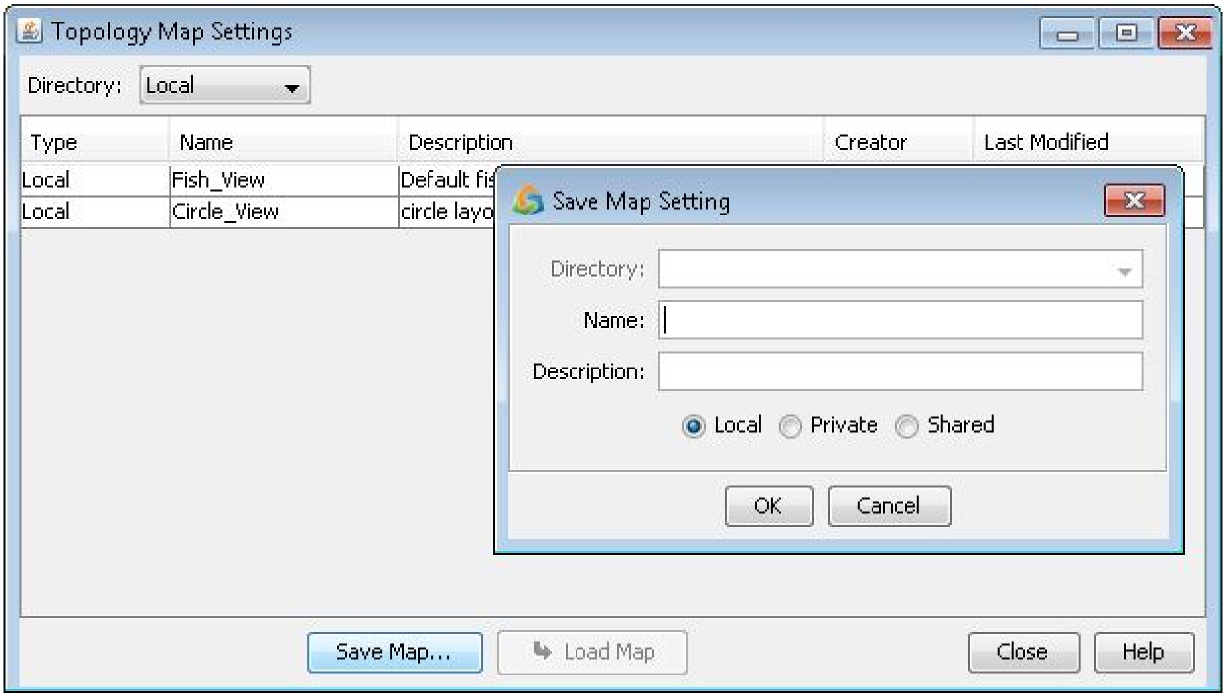
The following menu options are general options available in the map's right-click menu.

Map Views

For each offline network, you can save multiple map views, corresponding to different graphical locations and groupings of network devices. Map settings such as zoom, color legend sliders, and applied filters are also saved. For each map view that is saved, there is a subdirectory which contains map-related files for that view, including graphcoord, group, and graphcoordaux files.

- Click **Save Map** and enter a Name and optional Description to save a new map view. Local is for offline networks. Private and Shared are for Live networks.
  - Local saves map settings to the network spec directory in subdirectory **/userSettings**
  - Private saves map settings to your home directory in subdirectory **/wandlnetworks/livenetwork_output_directory/userSettings/livenetwork/**
  - Shared saves map settings to the Live network directory **/u/wandl/data/userSettings/livenetwork/**
- Select a map view and click **Load Map** to load a previously saved map view.
- To overwrite an existing map view, select an entry, click **Save Map**, and use the same Name.

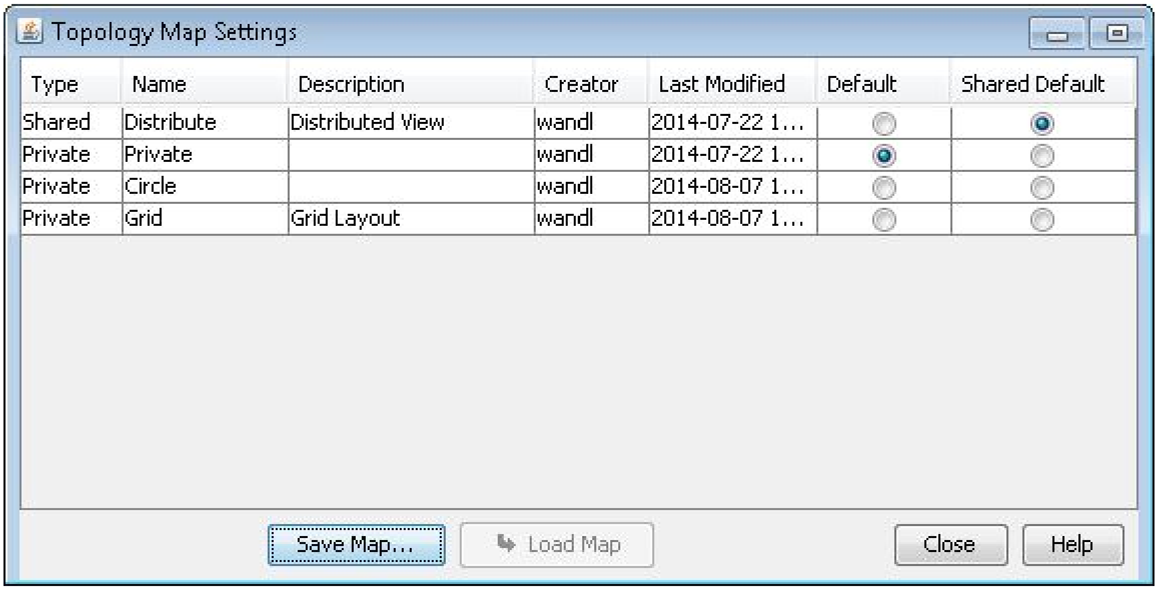
Figure 44: Map Views



For the Live Network (File > Open Live Network), you can specify a default private view. Administrators can create shared views that will appear in everyone's map view list. Administrators can also set one as the default shared view. To set your personal default view, select the radio button under the Default column.

NOTE: Administrators must set one default shared view by selecting the radio button under the Shared Default column. The Shared Default is the view every user will see when opening the Live Network and used by the Web for group reports and features. If you have selected a different Default view, your view has higher priority than the Shared Default and it is loaded when opening the Live Network.

Figure 45: Live Network Map Views



Grouping Popup Menus

The Grouping menu contains functions for creating network elements groups in the topology map. In this menu, you can find options for specifying groups within the topology. These functions are especially helpful when the network is large and contain many devices and elements.

- **Group Selected:** The Group Selected Nodes button merges a set of nodes into a single group on the topology map. This is useful if you want to partition the network into groups or hierarchies.
- **Ungroup Selected:** This function will ungroup any groups you have selected in the topology window. This permanently removes the group from the system. A group must be collapsed and then selected before this function can be accessed.
- **Ungroup All:** This function permanently ungroups all groups in the topology map.
- **Collapse Containing Group:** This function will collapse the group containing the selected node, displaying it as a small group symbol with its contents hidden.
- **Collapse All:** This function will collapse any groups, displaying them as small group symbols with their contents hidden.
- **Expand All:** This function will expand any collapsed group in the topology. The groups are displayed as circular discs and the contents are visible.
- **Expand Selected:** This function will expand selected groups.

- **Modify Parent Group of Selected:** Moves the selected node from one group to another group of your choice.
- **AutoGroup:** This function will allow the program to use its node-grouping algorithm to auto-group nodes. Nodes can be grouped by AS, area, lat/lon, access domain, tree, LAN, hardware type, regular expression, and/or NPA/NXX, depending on what type of network it is. (Options may vary depending upon the hardware type.) You can create more than one grouping levels. If selecting more than one level, the first selection will create the top-most (parent) groups. The second level will subdivide the nodes in a group further into sub-groups, and so forth. For more details, refer to the *AutoGroup* section.
- **Sibling Mesh:** When this option is selected, a fully-meshed set of lines is drawn among the members of each expanded group. Different groups get different colors.

AutoGroup

Select the nodes that you want to autogroup. Next, right-click over the nodes and select **Grouping > AutoGroup** for the following first level groups. Click **AutoGroup only selected instead of all nodes.** if you wish to autogroup only the selected nodes.

To create flexible grouping, the “Regexp” button can be used to group according to a regular expression.

- **Look in the field:** Indicates the field to use for the match criteria (for example, Node ID, Node Name, IP Address)
- **Find the first match for:** Indicates the regular expression that should match in order to form a group.
- **(Optional) Substitute it into:** Specifies a name for the new group(s). To create different groups based on the pattern being matched, you can save a part of the expression being matched for into a buffer by surrounding it in parentheses in the “Find the first match for” textbox. Then in the “Substitute it into” textbox, the buffer number can be accessed by preceding it with the ‘$’ symbol. Note that you can have more than one buffer. To create a buffer, surround the expression with a left and right parenthesis. The first buffer in the expression is accessible using $1, the second is accessible using $2, and so forth.
- **Case-sensitive:** Specifies whether the string to match is case-sensitive

AutoGroup Examples

Suppose you have routers with the following IDs: P1_ATL, P2_ATL, P3_ATL, P1_NYC, P2_NYC, P3_NYC, P1_CHI, P2_CHI, P3_CHI. Entering either of the criteria in the table below would create the following groups: ATL, NYC, and CHI , each containing 3 routers.

Look in the field	Find the first match for	Substitute it into
ID	.*_([A-Z]*)	$1
ID	.._(...)	$1

If you wish to group the devices only by the first two characters of the ID, the following criteria could be used.

Look in the field	Find the first match for	Substitute it into
ID	..	

Note that local area networks (LANs) not matching the criteria is given a group of their own, such as GROUP0. To move these LANs into the same group as their attached router, select **Network Elements > Nodes** in the Standard map. Right-click the GROUP0 containing the LANs, and select **Grouping>Ungroup this Group**. Then right-click the map and select **Grouping>Move LANs to Siblings' Groups**.

Selection Options

- **Select > All Points:** This function will select all network elements on the topology map.
- **Select > Neighbors:** Highlights all neighbors of the node that was right-clicked over.
- **Select > Nodes on Selected Links:** Highlights the two endpoints of every selected link.
- **Select > Single-End Neighbors:** When you right click on a node, there is an option to select single-end neighbors. Selecting this will highlight any peripheral nodes (single-ended nodes, attached to only one link) that are connected to the selected node. The selected node will remain highlighted. Typically, the selected node is a router, and the nodes that are subsequently highlighted are loopbacks and single-ended LANs.
- **Select > Tree:** Available when you right-click on a node, this option will find the largest tree in the network that contains the selected node and highlight all nodes in that tree. A tree is defined as any group of nodes that are connected to each other in such a way that there exists only one available path between any two nodes in the group. (Note: in selecting the tree, this option will stop once it hits a node that belongs to a cycle.)

- **Cut Selection:** This allows you to cut from the network all currently selected nodes and any links that (both) originate and terminate at the selected nodes. This action is reflected in the topology map. The cut elements are stored in the clipboard and can be pasted back into the network (multiple times if desired) at a location specified by you.
- **Copy Selection:** Clicking this when one or more nodes are selected will copy to the clipboard the selected nodes and any links that (both) originate and terminate at the selected nodes.
- **Paste:** This will paste the most recently cut or copied elements onto the topology map. Once pasted onto the map, the elements can be dragged around with the mouse and positioned at an appropriate location. Numerical characters are appended to the names of each pasted element in an ascending order to maintain an unique identity for each element. Any XML router-config data associated with the pasted nodes are carried over as well.

Custom URLs

Custom menu items can be added to the main map's right-click menu that pop up a browser going to a user-defined URL. The URL can be specified as a function of the node, group, or link that is right-clicked over. To create custom menu items, create a server-side file **/u/wandl/data/custom/menuitems.txt**. This file should be saved as Unicode UTF-16 format. Each line should have two comma-separated items:

```
menuItem,URLtoView
```

where menuItem is substituted with the text that you will see in the right-click popup menu and URLtoView is the URL that the browser will request. A specific value can be inserted into the URL depending upon the node, link, or group that is right-clicked over. To specify a node's field, use the syntax ${Node.key}, substituting key with the attribute of interest, which can be found through the node's Advanced Filter. For example, putting ${Node.ID} in a URLtoView will insert the ID field of the node right-clicked over into the URL. Similarly, use the syntax ${Link.key} and ${Group.key} to indicate a link or group attribute, where key is one of the available attributes available through Advanced Filter for links or groups, respectively. The following is an example file:

```
Explain Node Type,http://en.wikipedia.com/wiki/${Node.Type}
Search Link Name,http://www.google.com/search?q=${Link.Name}
JUNIPER,https://www.juniper.net
```

Labels Menu

When selecting one of the menu options below, you are prompted to choose what to label and with what text.

- **Node Labels:** Allows you to turn on or off labels for nodes displayed in the topology map.
- **Group Labels:** Allows you to turn on or off labels for groups displayed in the topology map.
- **Link Labels:** Allows you to turn on or off labels for links displayed in the topology map.

What to Label

Option	Explanation
All	Displays the label for all elements in the given category
None	Removes the label for all elements in the given category
Only Current Selection	Displays the label only for selected elements in the given category, removes labels for nonselected elements
Add Current Selection	Adds label(s) for selected elements in the given category, preserves pre-existing labels of nonselected elements
Remove Current Selection	Removes label(s) for selected elements in the given category, preserves pre-existing labels of nonselected elements

Label Text

A list of typical attributes that are used to label the item are given in the right-hand side of the table. For the node and link labels, you also have the option to customize the label in such a way that it includes other properties or more than one property. This option is available by selecting **Customize...** under the What Text? section and results in **Customizing Labels**.

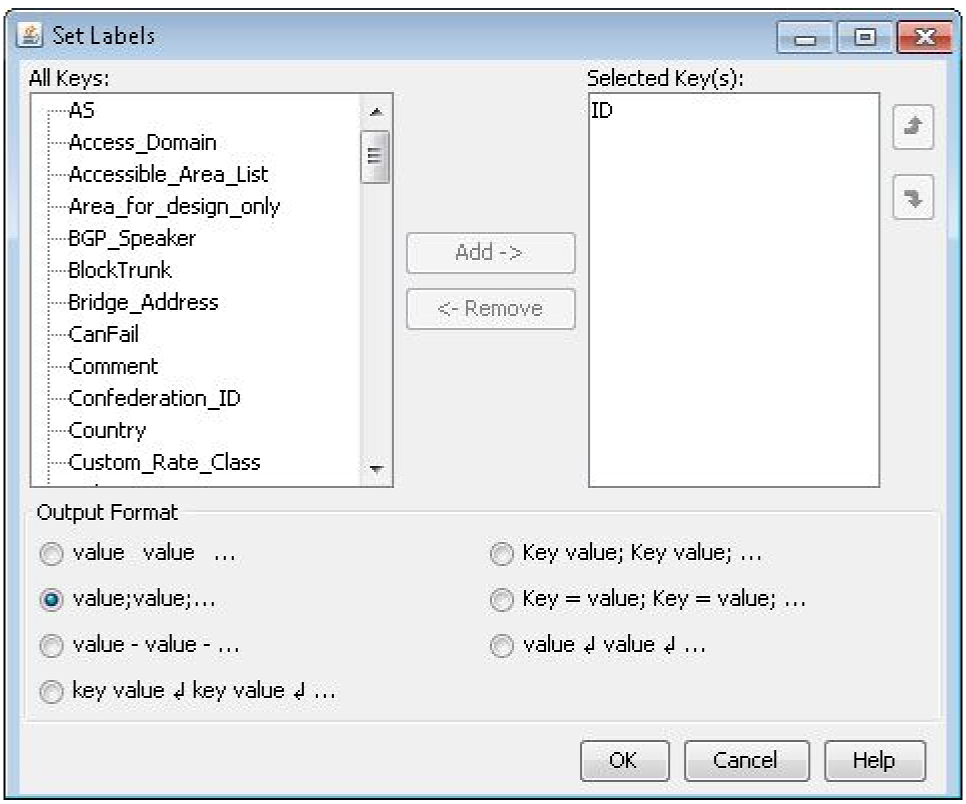
By selecting **Bottom Bar**, you can also customize the map window bottom bar display this is shown when you hover the mouse over a map element such as a node or link.

Bottom Bar	Description

Nodes: Customize...	Allows you to customize the label shown in the bottom bar when the pointer is over a node
Nodes: Reset to Defaults	Resets the node information given in the bottom bar to the default values.
Links: Customize...	Allows you to customize the label shown in the bottom bar when the pointer is over a link
Links: Reset to Defaults	Resets the link information given in the bottom bar to the default values.

Customizing Labels

Figure 46: Set Labels... Window



Options	Description
Add/Remove	Add moves selected key from left hand side to the right hand side list
Up/Down arrows	Moves a selected field up and down to change the field order
Output Format	In the list of Output Formats, the Key is taken from the titles listed in the top panel, and the Value is the specific value for any particular Key. • For example, if you select for link label text the following keys: Name, Used_BW_AZ, and Used_BW_ZA and the following output format: Key=value; Key=value; ..., you could get the following results: • Name=Link2; Used_BW_AZ=84M; Used_BW_ZA=40M • Note that for the link labels, you can select not only link properties to display but also properties of the source and destination nodes by double-clicking on NodeA or NodeZ.

Show/Hide Message

Toggles on or off any messages or text that are displayed in the topology map. Messages that are displayed in the map usually include total link cost.

International Map Labels

Each node, link, and group on the map can have one label in any language, defined in a single server-side file /u/wandl/data/custom/intllabel.txt, which must be saved in Unicode UTF-16 format. Each line of the file should have three items separated by commas:

```
LetterCode,ElementID,intlLabel
```

- LetterCode is either N (for node), G (for group), or L (for link)
- ElementID is either the nodeID field from the muxloc file (first column), link name from the bblink file, or group name from the group file.
- intlLabel is the foreign text in Unicode.

Once this file is created, and the network is reopened, this label can then be displayed on the map by opening the Labels Menu , selecting **Customize...**, and then selecting the **IntlLabel** key. This label can also be displayed in the Network window node and link view panes by right-clicking the table header, selecting **Table Options...** and then adding the **IntlLabel** column. Finally, the IntlLabel attribute can also be used for advanced filters for nodes and links.

Layout

This function allows you to lay out the display of network elements in the topology map.

- **Circle Selected Nodes:** When selected, the cursor becomes a cross hair. You should click once on the map to pick the center of a circle, and click a second time to choose the radius of the circle. All the points that are currently selected (highlighted) are moved onto the circumference of the circle at equally spaced intervals.
- **Distribute Selected Points:** When selected, the cursor becomes a crosshair. You should click once on the map to pick the center of a circle, and click a second time to choose the radius of the circle. All the points that are currently selected (highlighted) are laid out on the map in a way that's easier to see. They are fitted inside the circle that you chose. If any of the points are collapsed groups, the groups are expanded, will have their contents distributed, and are collapsed again, and so on recursively.
- **Distribute Selected Points Within Groups:** This option is available in the Layout menu only after selecting collapsed groups. For each selected group, the points are distributed for that group, and if multiple groups are selected, they are distributed in a way such that there is little overlap between the groups when they are expanded.
- **Straighten Selected Nodes:** This feature is like Circle Nodes, but puts the selected points onto a horizontal line, equally spaced. (Rotate it with the Drag/Rotate tool to align the selected points vertically instead of horizontally.)
- **Flip:** This feature flips the entire layout vertically or horizontally depending on your selection.
- **Stiffen:** When there are multiple links between two nodes but some of the links are hidden from view, the parallel links may be spread apart too wide or unevenly or all to one side. In this case, selecting Stiffen Visible Curves will bring the parallel links closer together and center them. Select **Unstiffen All** to undo this stiffening. Option is only relevant when Draw Multiple Links as Curves is turned on in the Map Preferences.
- **Reset by Lat/Lon:** Selecting this option will reset the network topology to its original geographical layout (provided that the LAT/LON coordinates are used in the network). This function is useful when you want to view the network in its geographical layout according to previously specified Lat/Lon values.

- **Set Lat/Lon From Map:** Selecting this option will assign Lat/Lon values to all selected nodes based on their current location on the Map. This function is useful if you have manually moved nodes on the map to desired locations and wishes to save these locations for future sessions.
- **Quick Layout:** Recomputes the X, Y coordinates of all the points using the program's algorithms to try to lay them out clearly. This is the same algorithm used when a Topology View is opened and no saved coordinates are available. If latitude/longitude coordinates are available, they are used to position the nodes, and nodes with the same Lat/Lon are laid out at the city's location in a small radius around the city center. The full recalculation could take a long time for large networks.
- **Detail Layout:** This topology layout algorithm attempts to distribute the nodes and links as a planar graph. Meaning the topology is drawn in such a way that links intersect only at nodes, or no links cross each other. This layout is useful to create a topology to display a minimal amount of links crossing over each other while keeping node groups together. Various parameters relating to the geographical Lat/Lon position, distance proximity to other nodes, link length, and groups can have their cost weights adjusted. Adjusting these weights will impact the algorithm's topology display.
- **Grid Layout:** This topology layout algorithm lays out nodes on a grid. The "Intersect Weight" field can be used to reduce line crossing-- the higher the value, the lower the number of line crossings. If you would like to rerun the calculation from the previous iteration's layout, select the **Continue from previous layout if possible** checkbox. For Layout, Geographical Group places the groups at the mean lat/long position of the nodes within the group and rearranges the nodes within in a radius determined by the distance to the nearest neighbor. Abstract Group treats the network hierarchically and lays the groups out in a grid as "nodes" - then lays the nodes within the groups out within a radius determined by the distance to the nearest neighbor. "Abstract" will calculate the layout ignoring any group information. "Geographic Group" and "Abstract Group" will consider group information. Search Breadth: With a narrow search breadth, changes that make the solution worse are more likely to be rejected. At the end of the iterations, only changes that make the answer better are accepted. However, at the beginning, you can go backwards -- the probabilities of accepting an answer change as the iteration progresses. For the Iterations, specify the number of iterations to run for the optimization problem, for example, 500.

Internet Map at Click

When you right-click a point on the map and select this option, a third party Internet map opens, displaying the particular latitude/longitude point that you right-clicked.

Line Widths

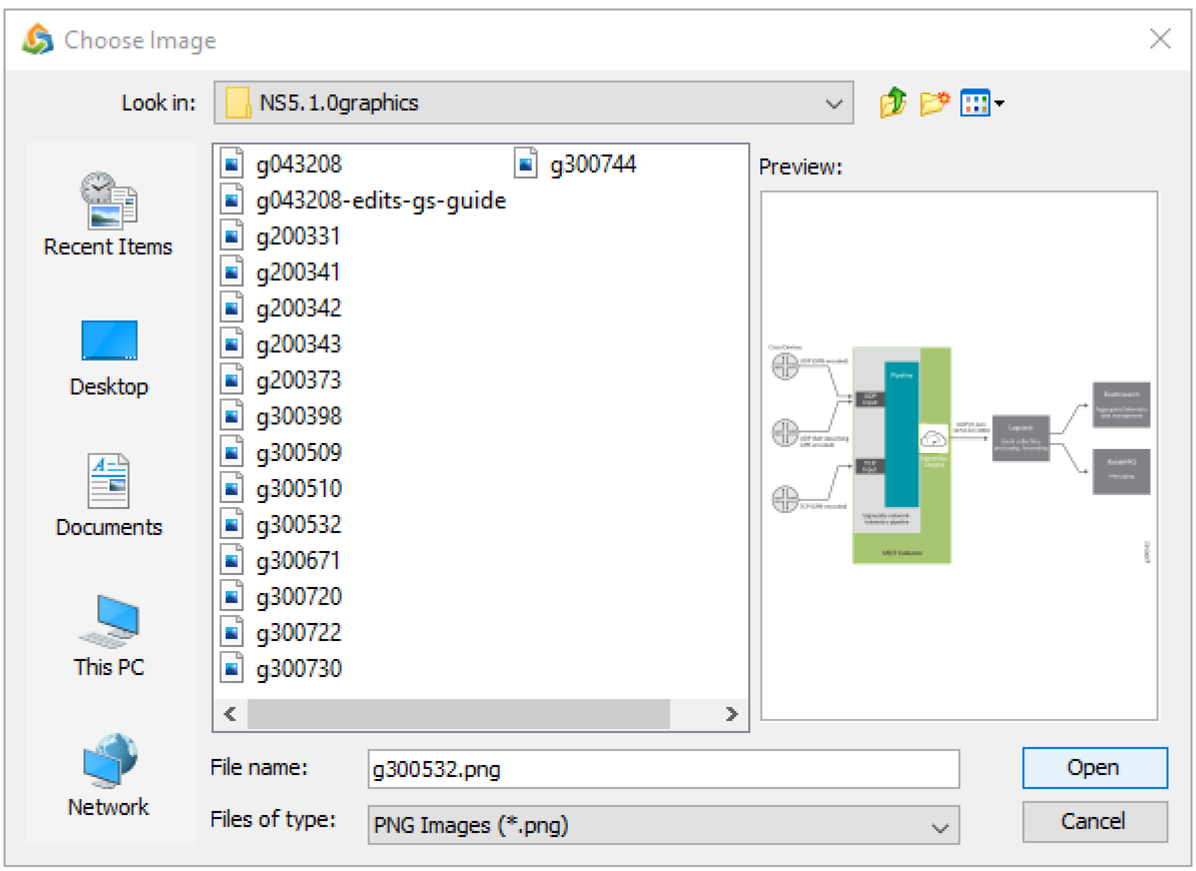
- **Auto-assign Widths:** Assigns widths based on trunk type. For example, a T3 is wider than a T1 and an ET1G is wider than an ET100M.
- **Reset Widths to Default:** Restores widths to the default where all link widths are the same.

Alternatively, to manually set the widths, right-click on the link and select **Set Line Width...** from the Legends menu, Type submenu of the map window's left pane.

Background Image

This allows you to choose a background image from your local or server machine to display on the Map window.

Figure 47: Selecting a Background Image



You can:

- Select the folder where your images are stored (Look in:).
- Select the file type to list (.jpg, .png, and so on).
- Click an image to view a preview in the right pane.

Click **Open** to complete your selection. The image appears in your topology window.

Once you have a background image in place, right-click the image in the topology window and select Background Image to access the following options:

- Load a different image (Load an Image File from Client).
- Clear the background image so there isn't one displayed.
- Select Fixed, Fit Whole Window, Fit Horizontally, or Fit Vertically which specifies how the image is to be displayed in the window.
- Resize Fixed Location, which allows you to resize the image by clicking and dragging the sizing handles that appear.

Country Maps

Figure 48: The Country Maps Menu

When you select this option, a dialog box appears. This option allows you to select the level of map detail to display on the background of the topology window, where the settings are remembered from session to session. For example, using this option, you can select a combination of Continents, Countries, and U.S. states to be displayed.

Find

This function searches for any node, link, or group and highlights the element on the topology.

Figure 49: Find Box

Refresh

When selected, this function removes certain temporary interface labels and addresses, clears all highlighted network elements, and deselects all selected network elements.

Zoom

The Zoom menu contains functions for focusing in on a particular area of the topology map.

- **Zoom In:** This function allows you to zoom in on a particular area of the topology map. To zoom in on the topology, click the Zoom In button and then click and drag a desired area in the topology map. Another method to select the zoom in area is to <Shift>-drag the rectangle. It will always match the aspect ratio of the map.
- **Zoom Out:** This function allows you to zoom out from a particular area of the topology map.
- **Zoom To Fit:** This function allows you to quickly fit the entire network topology in the topology window. Items hidden by the Subview or Label/Show panes are not included.
- **Zoom To Fit Selection:** This makes the map zoom to fit the items that are selected.
- **Zoom to Region:** Allows you to zoom to a specific geographic region in the topology. The regions which you can zoom to include the following: World, United States, Europe, Asia, and China.

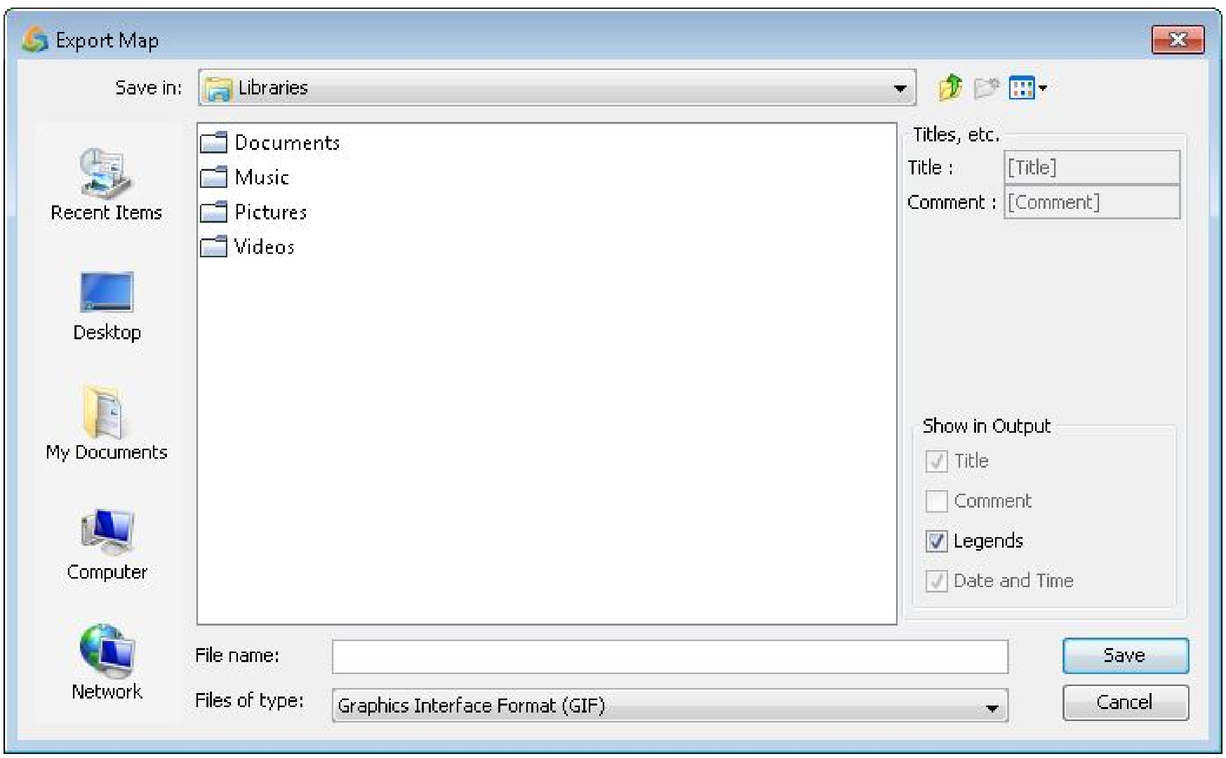
Print

When this function is selected, the program will allow you to print the current on-screen topology. You will first be asked which part to print (the entire topology window (Whole window) or just the topology map (Map only)). Next, you are given printer options.

Export

This function allows you to save the topology window as a graphics file in several formats.

Figure 50: Export Map



For non-Visio file types, selecting the Legends option will export the entire topology window and deselecting it will export only the map.

For Visio file types (VDX, CSV), the customizable Title and Comment fields, as well as the Legends and Date and Time can be included in the resulting Visio file.

Export Map to Visio

In the Export dialog, the last three options can be used to export to a file that can be imported into Visio and then edited or printed from Visio.

- For Visio 2003, it is recommended that you export to a VDX file by selecting **Visio 2003 and Later (VDX)**.
- For Visio 2002 and earlier, it is recommended that you export to a .CSV file by selecting **Visio 2002 and Earlier (CSV)**. After importing the .CSV file into Visio 2002, you can save the resulting Visio file as a Visio drawing (.VSD) file. Note that opening the .CSV format in Visio requires extra steps to put the Paragon Planner stencils where Visio can find it.
- The "Block Diagram for Visio 2003 and later" option is designed to be run after running Layout > Recalculate Grid Layout as described in the *Layout* section earlier in this topic.

Export Map to MapInfo

MapInfo requires two files, myMap.mif with the xy-coordinates, colors, and other graphical info, and myMap.mid with data per node or link for display in mouse-overs, tables, and reports.

After selecting a filename and this export option, you are prompted with a chooser to select a combination of node and link data to put into the mid file. After selecting the data to put into the mid file, click OK to create the .mif and .mid files for import into MapInfo.

Export Map to SVG

SVG can be exported from the map right-click menu item Export, or from File > Export to Web. Note that the exported SVG file depends upon existing settings in the topology map. These settings include whether the world map should be displayed, the boundaries of the world map, and whether node and link labels should be displayed.

When exporting to SVG, the resulting file can be viewed from a web browser such as Mozilla FirefoxTM, Microsoft Edge, or Google Chrome. We recommend that you use the latest version of the web browser to view the SVG file.

Scheduling or Scripting an SVG Export

A CLI version of the SVG export, also used by the Web Report task in the Task Manager, can be found in /u/wandl/util/svg.sh. Since this SVG map may be generated when the network is closed, a configuration file is needed to specify SVG-related parameters. The syntax for calling this script is as follows:

/u/wandl/util/svg.sh <spec_file> <output_svg_file>

To customize the settings of this SVG export, edit the **/u/wandl/util/svg/svg.cfg file.** Variables include:

- **CANVASWIDTH, CANVASHEIGHT:** Width and height of the map
- **TITLE:** The title of the map

- **SHOWSPEC, SHOWDATE, SHOWLEGEND:** Whether to show or hide the specification file path, creation date/time, and node & link legend
- **REMOVEASNODES,REMOVEETHERNETNODES,REMOVEISOLATEDNODES:** Whether or not to hide AS pseudonodes, Ethernet pseudonodes, and/or isolated nodes. This can be used to reduce clutter on the map.
- **CURVEDLINKS:** Whether or not to show links as curved or overlapping on a straight line
- **COLLAPSEGROUP:** Whether or not to collapse groups into a single node
- **NODELABEL:** How to label the node (for example, by NAME and/or IP)
- **LINKLABEL:** How to label the link (for example, by NAME and/or TYPE).
- **INTFLABEL:** How to label the interface (for example, by NAME and/or by UTIL).
- **UTILPERIOD:** Which trafficload period to use to label the interface utilization
- **TITLEFONTSIZE, LEGENDFONTSIZE, NODEFONTSIZE, LINKFONTSIZE, INTFFONTSIZE:** Font sizes
- **TITLEFONTCOLOR,LEGENDFONTCOLOR,NODEFONTCOLOR,LINKFONTCOLOR,INTFFONTCOLOR:** Font colors
- **COLORLINKBY:** Links can be colored by type or utilization
- **UTILCOLOR = <NUMBER> = <COLOR>:** To model the map utilization legend, specify in ascending order the utilization percentages and associated color between that number and the next number.

Upon scheduling the Web Report task, the resulting map(s) can then be viewed from http://serverip:8091/ (substitute *serverip* with your application server's IP address). Select **Reports >Network Reports**. Then click on the link to the desired network, and click on "Standard Topology." Icons are available for zoom in, zoom out, and zoom to fit (reset). Once zooming in, the map can be panned by clicking the map and dragging it in the desired direction. Additionally, link and node details can be seen by hovering the mouse over the link or node.

5

CHAPTER

File Menu

File Menu Functions

Table 18 on page 98 lists the file menu functions.

Table 18: File Menu Functions

Function	Description
Create Network	• The submenu Create Network > From Collected Data allows you to create a new network based on data such as router configuration and interface files. For more information, refer to the *Paragon Planner User Guide*. • The submenu Create Network > Paper Model allows you to create a new network model and specify the Paragon Planner files that define the network, such as the muxloc (node), bblink (backbone links), and demand files.
Open Network Browser	Opens the Network Browser window where you can load previously saved networks, and organize networks by labels and comments. For more information, refer to "File > Open Network Browser" on page 99.
Open File Manager	Opens the File Manager where you can browse through directories and files to create and/or load a network specification file, view files, or perform basic file operations such as cut, copy, paste, and delete. For more information, see "The File Manager Window" on page 15.
Import Network Wizard	Opens the Import Network Wizard, allowing you to import data files that are converted into the Paragon Planner network model. Here, you can specify the import input and output directories and select other options for parsing a set of data files. For more information, see "Import Network Wizard" on page 110.
Load Network Files	Opens the Load Network Files window from which you can read in, or load, various network files into the network. See "File > Load Network Files" on page 101.
Close	Closes the current network that is loaded. After closing the current session, you can open another network model or exit the program.
Save	Saves all files for the current network.

Table 18: File Menu Functions *(Continued)*

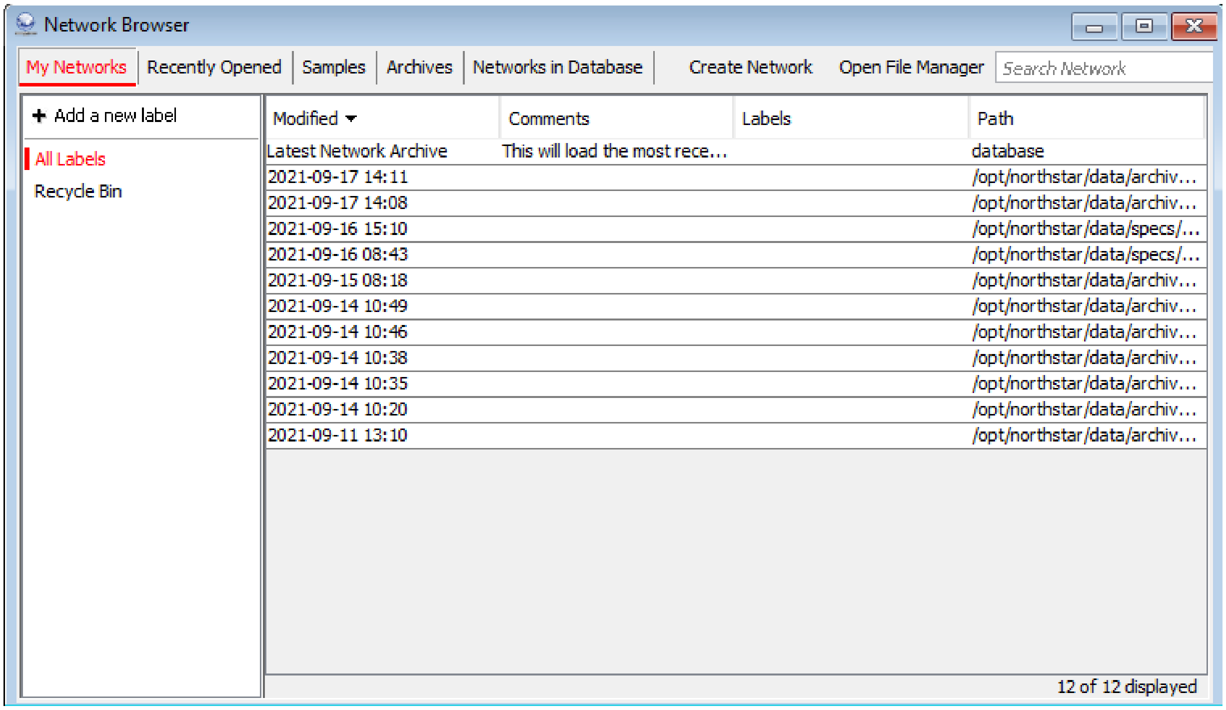
Function	Description
Save As...	Saves all files for the current network into a different directory or as a different runcode. The Save As option also allows you to add Comments or Labels to help describe and categorize the network.
Save Network File	The Save Network option allows you to save the current network. The Save Network File option allows you to save one network file without saving the entire network. See *File > Save Network File* in "Saving a File" on page 103.
Recent Specs Shortcuts	The File menu provides shortcuts for the most recently opened specs. You may also use the mnemonic keys (1-5) to access these specification files.
Exit	This option will close the current network and exit the program. Be sure to save the network environment to avoid losing changes when exiting.

File > Open Network Browser

Each time a network project is saved, it is recorded in the Network Browser window. Each network project is uniquely identified in the **Network Browser** by its Path and `Runcode`. The Network Browser also provides additional details for each network project such as the user, the last modified date/time, descriptive comments about the network, and user-defined labels.

Filter the projects by user-defined labels by selecting a label from the Labels list in the left hand pane, or by typing a custom string in the Filter text box and pressing <Enter> or <Return>. A label is a user-created descriptive tag which can be applied to one or more networks. For example, the label OSPF was created in the example below to tag all networks which have the OSPF protocol.

Figure 51: Network Browser



Action Buttons

- **Open:** To open a network project from the list, double-click an entry from the table.
- **Modify:** To modify the labels of a network project, double-click an entry in the Labels column from the table. Labels can be tagged to the network and comments can be added. Check off the labels you would like to be associated with your network. If the label does not exist, click **Create** and enter a new label. Then make sure to check off the new label and click **Apply**.

Figure 52: Add Comments and Labels

- **Delete:** To delete a network project, right-click an entry from the table and select **Delete**. This will tag the network with the “Recycle Bin” label.

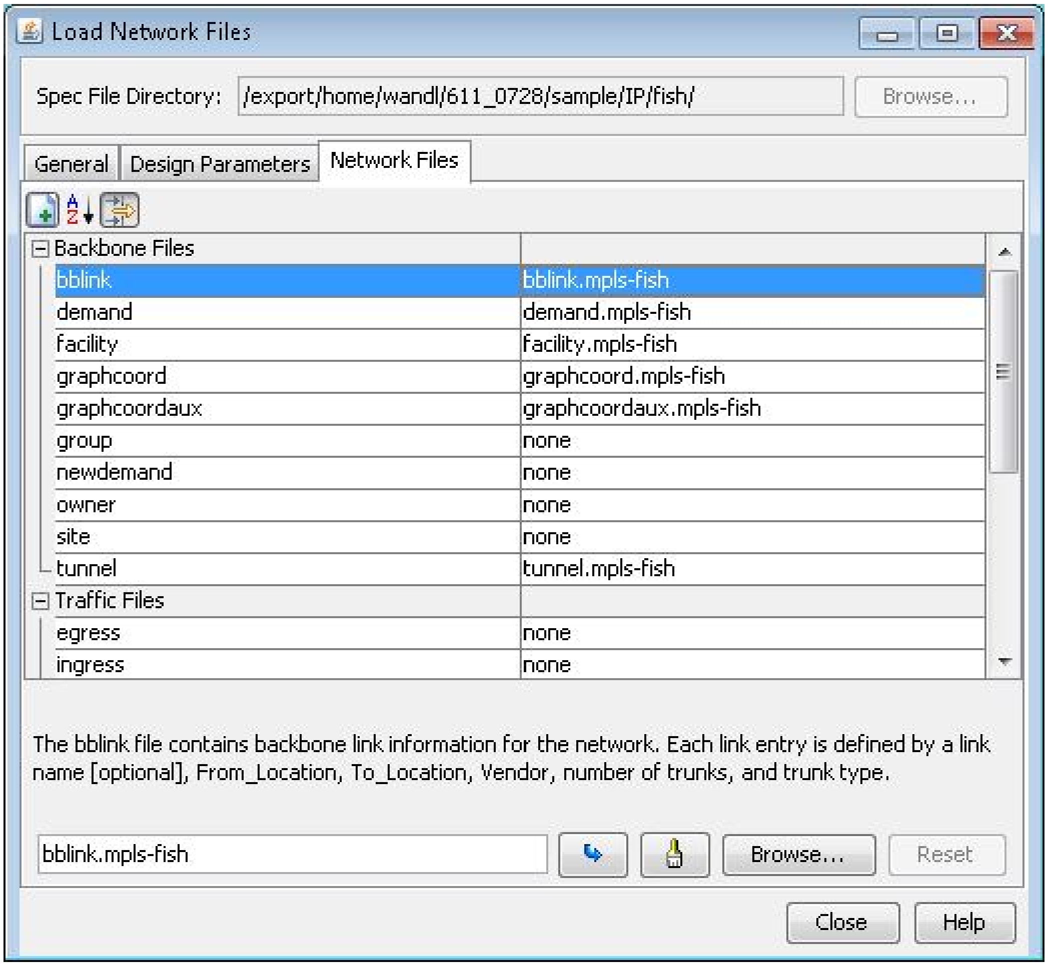
- **Restore:** To restore a network project from the “Recycle Bin” before it is permanently deleted, click the “Recycle Bin” label, right-click an entry from the table and select **Restore**.

- **Permanent Delete:** To delete a network project permanently, click the “Recycle Bin” label, right-click an entry from the table and select **Delete**. This will delete the network project files from the hard disk. A backup copy of the network is zipped and placed in the “trashbin” folder of the network owner.

File > Load Network Files

The Load Network Files window allows you to read in, or load, individual files into the current network project.

Figure 53: Loading Files Window



Locating a File Type

To locate the file type to load, either search by one of the categories above by clicking the **Arrange by Category** button, or search by alphabetical order by clicking the **Sort Alphabetically** button. By default, only the modifiable file types are displayed. To show all file types, select the Filter not modifiable button.

Loading a File

To read in a new file, type in the file location or click **Browse** to choose a file location from the File Chooser window. Then click the Load button to load the file into the current network.

Note that if a file type is not modifiable, the text "[Not Modifiable]" is displayed in red and you will not be able to modify the file path. To edit these fields, close the current network, right click in the File Manager, and select **Spec File > Modify Spec or Edit**.

Removing a File

To unload a file, select **Remove**.

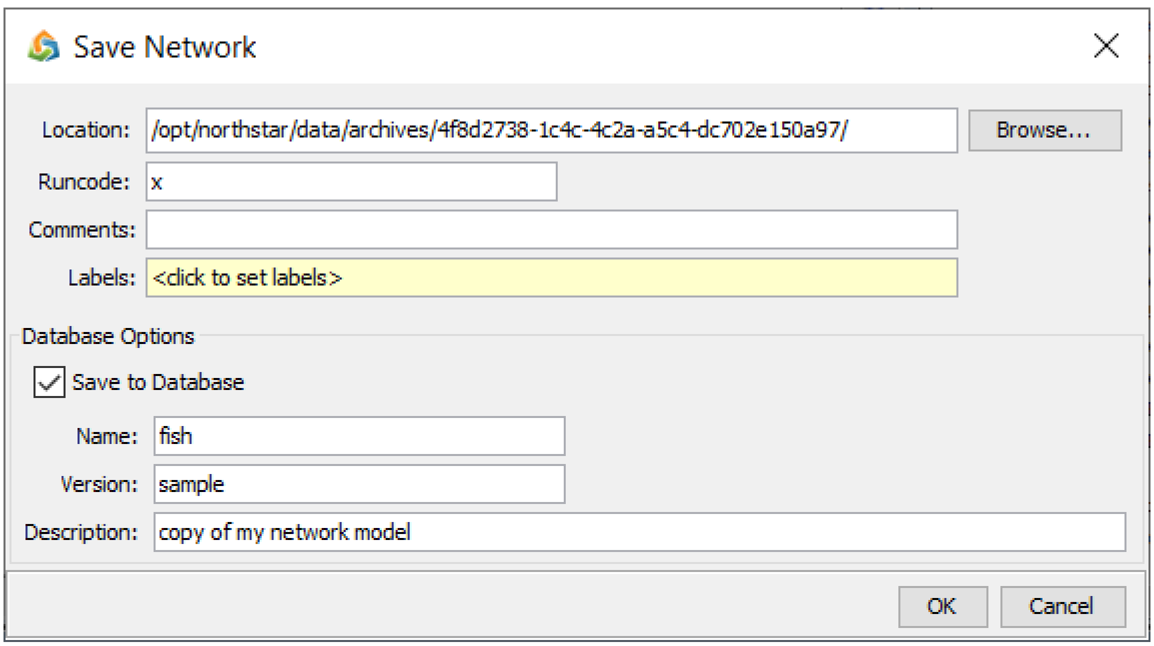
Saving a File

The **File > Save As** option saves the network project and all associated reports and files with it. The files include: **spec, bblink, muxloc,** and **dparam** files.

You can save a network model to the file system or to the Paragon Planner database. Files saved in the archives are read-only. However, you can edit and reuse network models later if you save them in the database. You can access the files thus saved in the database from the **Networks in Database** tab in the **Network Browser** window.

This option opens the following dialog window:

Figure 54: Save Network Dialog



To save the network, select the directory in which to save the network and type in the runcode (file name extension) that will identify the network. Optionally add a descriptive comment and/or labels to organize the networks, as described in "File > Open Network Browser" on page 99. Then click the OK button. The network is saved to a set of files with this runcode, which are organized together by a specification file of the same runcode.

Directory Selection

To select a directory, click Browse... Then type in the directory in the Look In field and press the <Enter> or <Return> key. The contents of that directory will then be shown in list format. The up arrow can be used to navigate to the parent directory and double-clicking a directory from the list will open a directory. The following directory shortcuts are also available from the Look In drop-down list:

- **Spec Dir:** The directory containing the last opened specification file.
- **Output Dir:** The directory where output files (such as trace files or reports) are saved and stored. This directory can only be changed before a network spec is launched. Once a network spec is opened, the Output Path remains fixed for the remainder of the session. By default, the output directory/path is set equivalent to the spec directory. Certain output files are generated and given the runcode extension you have defined in the specification file.
- **Home Dir:** Your Unix administrative home directory

  .
- **Current Path:** The current path in the File Manager

  .

File > Save Network File

This option allows you to save only certain files separately without having to save all the network files. These files can later be read into a network project through **File** > **Load Network Files**. Note that unlike the Save option, saving a single file to a new location will not automatically update the specification file to reflect the new location of the input file.

The available files that can be individually saved include the *demand* file, the *bblink* (links) file, the *graphcoord* (topology coordinates) file, the *graphcoordaux* (topology window settings) file, and the *group* (logical grouping for the topology map) file. If you have moved the network elements around on the map and would like to save their new positions, be sure to save the *graphcoord* file.

RELATED DOCUMENTATION

Save Network Models to the Paragon Planner Database | **105**

Save Network Models to the Paragon Planner Database

IN THIS SECTION

Starting with Paragon Automation Release 21.2, you can securely store network models by saving them in an access-controlled database. Storing network models in the database helps you secure them though attribute-based access control, and retrieve them in case of an accidental data loss. You can access the saved network models from the **Networks in Database** tab in the **Network Browser** window.

Access to the network models stored in the database is controlled through attribute-based access control. The ability to edit or save network models from the **Networks in Database** tab depends on the permissions assigned to you. After you save a network, you can assign edit or view-only permissions to users. From the **Archives** tab, you can access networks that are saved in the database by the network archive tasks, however, you cannot edit network models. That is, the networks listed in the **Archives** tab are read-only. From the **Networks in Database** tab, you can save network models, including those saved in the file system, to the database.

Benefits of Saving Network Models to the Database

- You can retrieve and reuse the stored network models from the database later.
- The database constitutes an additional repository for saving network models. You can retrieve network models from the database in case of data loss on the hard drive where the archive files are stored.
- Unlike files saved in the file system, which are available to all users, files saved in the database are secured through access control.

RELATED DOCUMENTATION

Saving a File | 103

Manage Network Models Stored in the Database

IN THIS SECTION

Starting with Paragon Automation release 21.2, you can store network models in the database, in addition to saving them in the file system. While the network models saved in the file system are accessible to all users, the files saved in the database are access-controlled and more secure. You can access the network models you saved in the database, modify them, or share with other users and assign permissions to the users.

To access network models saved in the database, click **File** > **Open Network Browser** and select the **Networks in Database** tab.

Save a Network Model to the Database

To save a network model to database:

1. Click **File** > **Save As**, when you are ready to save the network model.

   The Save Network window appears.
2. Select the **Save to Database** check box and enter the required information.
3. Click **OK**.

   You receive a confirmation message stating that the file has been saved to the file system.
4. Click **OK**.

   You receive a confirmation message stating that the file has been saved to the database.
5. Click **OK** to finish.

   The network model is now saved to the database.

Open a Network Model from the Database

To open a network model from database:

1. Click **File** > **Open Network Browser**.
2. From the **Network Browser** window, select the **Networks in Database** tab.

   Network Browser displays the networks available in the database.
3. Right-click the network you want to open, and select **Open**. Alternatively, you can double-click the network.

   The network model opens in the **Map (Standard)** window.

Delete a Network Model from the Database

Deleting a network model from the database does not remove the file system. To delete a network model from the database:

1. Click **File** > **Open Network Browser**.
2. From the **Network Browser** window, select the **Networks in Database** tab.

   Network Browser displays the networks available in the database.
3. Right-click the network you want to delete, and select **Delete**.

   The network is deleted from the database.

> **NOTE**: A network model thus deleted is removed only from the database. The file will still be available in the file system.

Share a Network Model with Users

You can share the network models with users by applying attribute-based access control. You can specify which type of users can access the network model files. You can assign the following attributes to the files:

1. Rich-click the network model file and select **Share**.

   The **Share Network** window appears.
2. Specify the type of access you want to provide to the users to access the files.

- View Users: Can open the network but cannot overwrite the original database entry. However, View Users can edit a network model and save it as a new file in the database. Specify the users that you want to provide view-only access.
- Edit Users: Can open the network models and overwrite the original database entry.
- All Other Users: Assign this attribute to users who cannot be explicitly assigned view or edit permissions. You can choose not to share the files with any other users.

 The permissions you assign here apply only to the files that you store in the database.

3. Click **OK**.

SEE ALSO

Save Network Models to the Paragon Planner Database | **105**

Saving a File | **103**

6

CHAPTER

Import Network Wizard

Import Network Wizard

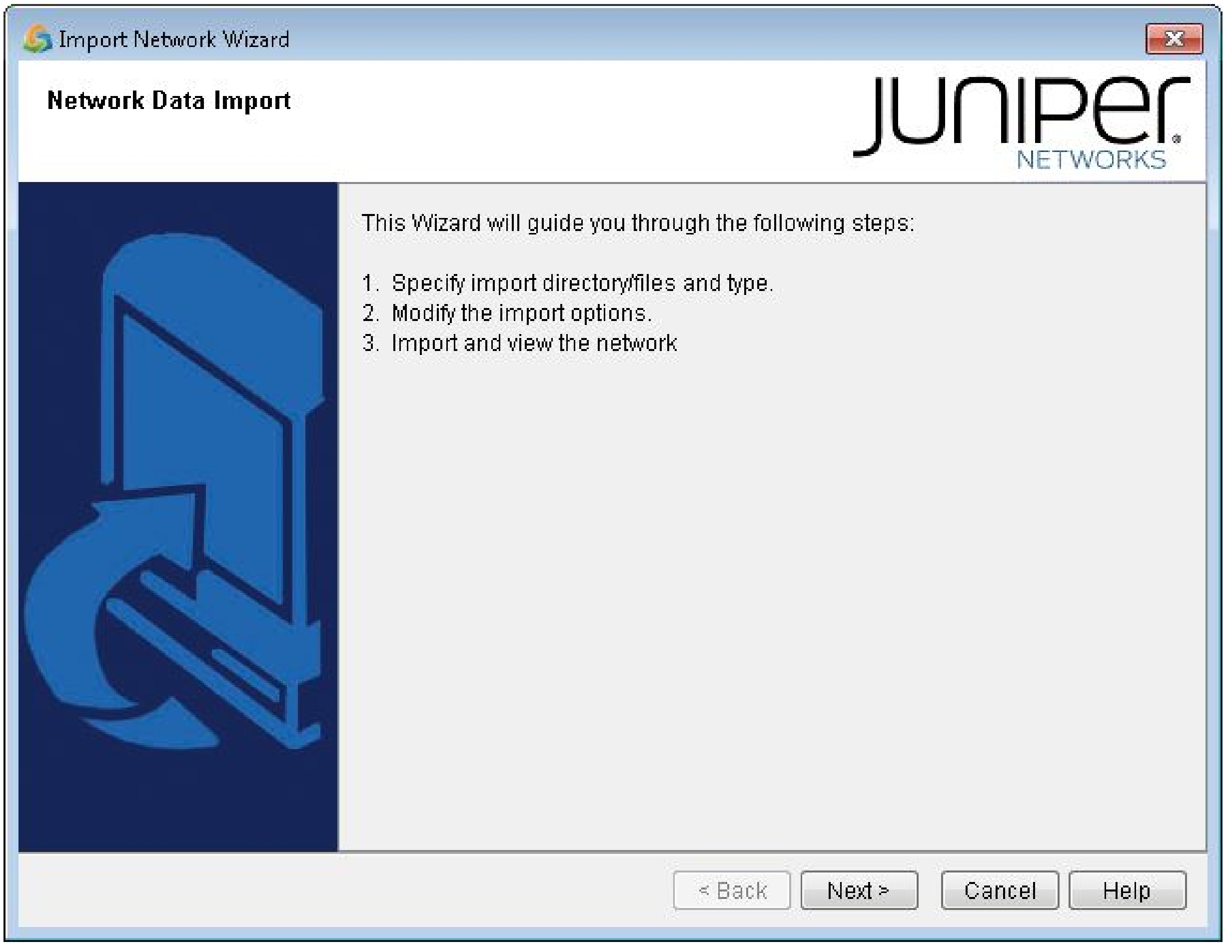
IN THIS SECTION

The Network Data Import Wizard is accessed from the main menu File > Import Network Wizard. This feature allows you to import different types of network configuration data into the software. In the process, a corresponding network project specification file is created, saved into the user-specified output directory and automatically loaded into the program.

Introduction

"Import Network Wizard" on page 110 shows the initial Import Network Wizard window.

Figure 55: Import Network Wizard



The following buttons apply to most pages of the import wizard.

Table 19: Import Network Wizard Functions

Function	Description
< Back	Goes back to the previous page of the wizard.
Next >	Goes to the next page of the wizard.
Cancel	Cancels the import action and closes the wizard without saving.
Help	Accesses the reference page of this window in the help document.

Select the type of the data you want to import and the directory where the data files are stored.

Figure 56: Import Network Wizard Specifying Import Directory and Type

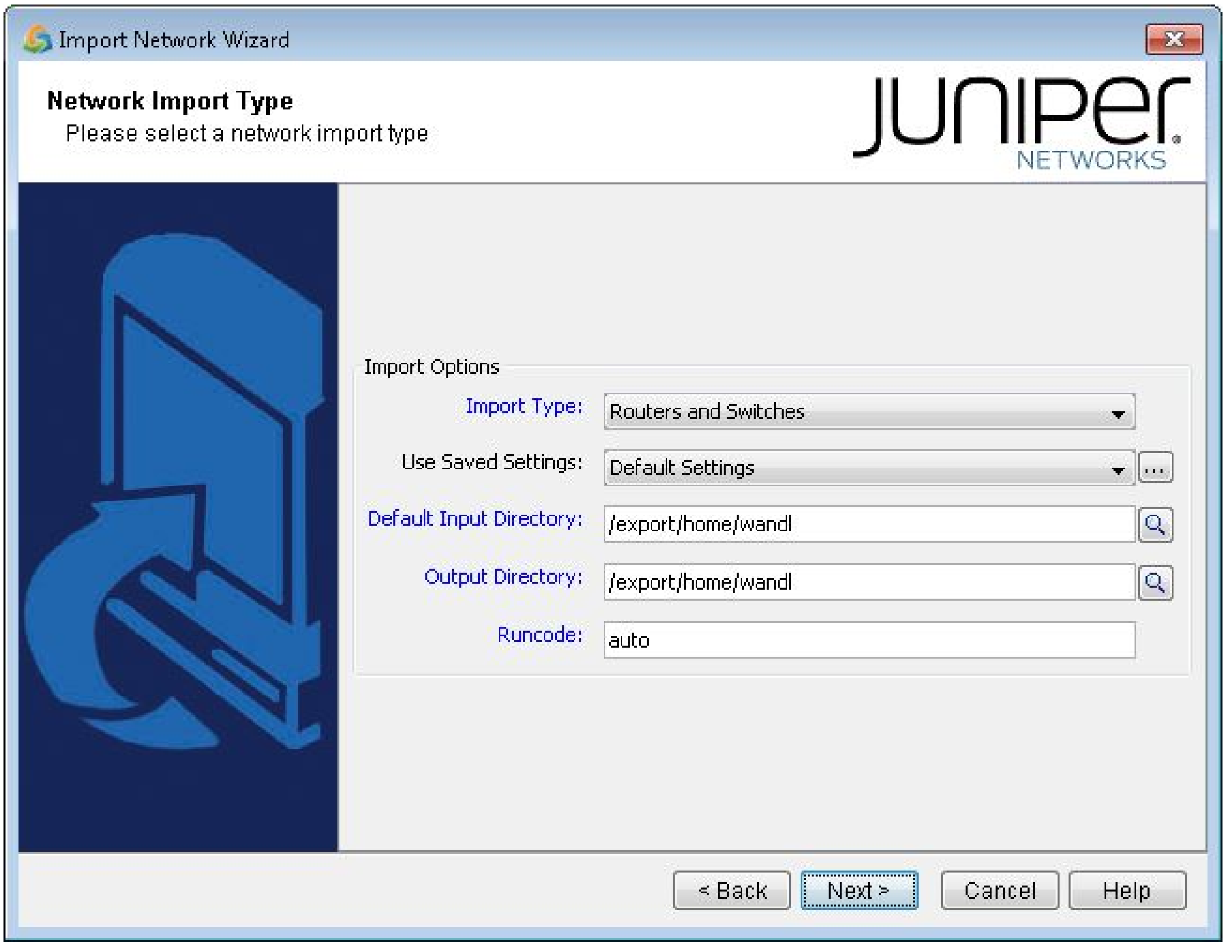


Table 20: Import Network Wizard Import Types and Directories

Function	Description
Import Type	Click to see the drop-down selection box to select the appropriate data type for import and conversion.
Use Saved Settings	This allows user to load an import template to automatically map fields and settings based on previous import runs.

Table 20: Import Network Wizard Import Types and Directories *(Continued)*

Function	Description
Default Input Directory	The directory shown here displays the current import directory source. This field should specify the directory in which data files are stored. For certain import types, this field is used to indicate an import file instead of a directory.
Output Directory	Select where the Paragon Planner specification file are created
Runcode	Specify a file name extension for the specification file and related project files

Depending on which data type is being imported, the next pages of the wizard will guide you through a different set of tabs and required parameters to be entered.

The Data Import feature supports the data file types described in the sections that follow.

Routers and Switches (IP/MPLS only)

This section only provides a high-level summary of the router config import. See the *Paragon Planner User Guide* for details on importing router configuration files.

Default Tab
This tab provides additional import options to the standard Configuration files. You can import Interface, VLAN Discovery, Switch CLI, Tunnel Path, Transit Tunnel, Equipment CLI, and Equipment SNMP files.

Bandwidth Options
This tab provides options for deriving the interface bandwidth. You can specify supplementary sources such as the MPLS Topology file or rules to use to derive the bandwidth.

Network Options
This tab allows you to specify an already-defined network file that should be preserved during the import. Additionally, you can specify VPN and BGP options.

Misc Options
Miscellaneous options are provided here, such as ignoring the private IP address.

Paragon Planner Config File

You may create and import your own user-defined configuration file using Paragon Planner Config file format. Using any text editor, save your file extension as .cfg and follow the syntax example below:

```
## WANDL CONFIG
HOSTNAME=ROUTER01
HWTYPE=JUNIPER
IP=1.2.3.4
INTERFACE=ge-1/0/0.1 IP=1.2.3.4/30 BW=1G
```

The keyword `## WANDL CONFIG` must be in the file to identify it as a Paragon Planner configuration file. Select **Import Type>Routers and Switches** to import these configuration files.

OSPF Database

The OSPF Database import supports Cisco, Juniper Networks, and Alcatel-Lucent and accepts a file with output from the following commands. In case more than one commands are mandatory, combine the outputs in the same file.

Cisco IOS

- `show ip ospf database router` (mandatory)
- `show ip ospf database network` (mandatory)
- `show ip ospf database opaque-area` (optional for RSVP TE information)
- `show ip ospf database summary` (optional to create virtual link between ABR and node in another area -- Only available in text mode using -igpsummary)

Cisco IOS-XR

- `show ospf database router` (mandatory)
- `show ospf database network` (mandatory)
- `show ospf database opaque-area` (optional for RSVP TE information)
- `show ospf database summary` (optional to create virtual link between ABR and node in another area -- Only available in text mode using -igpsummary)

Juniper Networks Junos OS

- `show ospf database extensive` (includes both ospf and TE)

Alcatel-Lucent

- `show router ospf database detail` (mandatory)
- `show router ospf opaque-database detail` (optional for RSVP TE information)

Options

- DNS Lookup or **/etc/hosts** Lookup: Use the text mode -igpdns flag
- Import Multiple Files: Use the text mode -ospfdir flag instead of -ospf
- Only Import Links of Specified Area: -igparea <a.b.c.d> : If specified, only bblink with the specified area are reported, and the igpsummary are disabled.</a.b.c.d>

ISIS Database

ISIS Database import supports Cisco and Juniper Networks and accepts files with output from the following commands:

Cisco IOS and IOS-XR

- `show isis database verbose`

Juniper Networks Junos OS

- `show isis database extensive`

Options

- DNS Lookup or **/etc/hosts** Lookup: Use the text mode -igpdns flag
- Import Multiple Files: Use the text mode -isisdir flag instead of -isis

Marconi CLI

The Default Tab provides the following:

- **Select Output Directory:** Select where the Paragon Planner specification file is created
- **Specify Runcode:** Specify a file name extension for the specification file and related project files

- **Specify Old Runcode:** Specify the runcode of the original specification file, if any

The Advanced Tab provides the following:

Table 21: Marconi CLI Advanced Tab

Option	Description
Select External Link File	This option allows you to select a link file to include in the import to complete the topology. These links are typically WAN links connecting through an external carrier's ATM backbone.
Generate psuedo nodes	If selected, the import will generate pseudo nodes for all unknown link destination addresses.
Match paths	The import program will attempt an ad-hoc virtual path matching algorithm to generate link and demand connectivity. This should only be used in cases where either PNNI info is missing, signaling has been turned off on the ports, or encryptors exist between links.
Suppress logical links	This is another option that should only be used when there are encryptors between links that short-circuit the topology.

Nortel PND

The Default Tab provides the following:

- **Select Output Directory:** Select where the Paragon Planner specification file is created
- **Specify Runcode:** Specify a file name extension for the specification file and related project files
- **Specify Old Runcode:** Specify the runcode of the original specification file, if any

The Advanced Tab provides the following:

- **Select EPIC SPVC Data File:** The PND extracted data does not include SPVC info. This info, along with UNI addresses should be queried and logged via EPIC. This options allows you to specify the file that contains the additional EPIC data.

Nortel Virtual Router

The Nortel Virtual Router import type has the same option tabs as Router Configuration, but it is tailored for importing Nortel passport configuration files to extract virtual router information. As with Router Configuration import, the Nortel VR import uses getipconf on the backend, so it can accept multi-vendor router configs. Refer to the *Paragon Planner User Guide* for more details.

Tunnel Path Extraction

The tunnel path extraction feature shows the exact network view of tunnel paths. It helps to simulate the impact of tunnel set up on IGP routing by taking into account Explicit Tunnel Routing, Affinity and Trunk attributes. This is useful if the LSPs can be dynamic (as opposed to explicit). Paragon Planner displays the current status and routing of the LSP tunnels within the defined network.

The MPLS Tunnel Extraction feature retrieves the actual placement of the tunnel and the status (up or down) of the LSP paths by parsing the output of the following Juniper Networks Junos OS command:

```
show mpls lsp statistics extensive
```

The same is true for the following Cisco IOS command:

```
show mpls traffic-eng tunnels
```

To use this feature, you must have a network open and then specify a directory that contains the output of these commands. There should be one file per router. On the second page of the Import Wizard, select **Tunnel Path** in the Import Type selection box. Then click on the Browse button above to open the Import Directory Chooser window.

Navigate to the directory that contains the files and press **Select**. Click.**Next >** to continue.

This should generate an Paragon Planner format file of the tunnel paths and status called tunnelpath.runcode, where runcode is the file extension used for your network model. This will automatically be loaded into the network model.

7

CHAPTER

Network Menu

Network Menu Overview

The Network menu from the main menu bar provides access to network information for all types of network elements. The most basic of these are nodes, links, and demands. Other types of network information are available depending on the hardware type of your network.

You can also access network information by right-clicking the mouse over a network object in the Map window. For example, to view node information, right-click the mouse over a node and select **View > Node** in the pop-up menu to display the properties for that node.

Table 22 on page 119 shows the network menu options that are available.

Table 22: Network Menu Options

Feature	Reference
Summary	Provides general information about the network under review. The Network Summary window displays statistics about the various network elements in the network, including nodes, links, and demands. The demand statistics indicate the average and maximum hops of demands and the number of placed, unplaced, and deactivated demands. Placed demands are demands that were routed over the network. Unplaced demands were demands that failed to route over the network. Deactivated demands are demands that are not routed over the network, for example, demands from a node to itself.
Maps	Select **Network > Maps** to display additional maps such as the BGP, Events, and IP VPN maps if available. Select **Network > Maps > Copy Map Layout** to take the layout of one of the maps and copy it onto another open map. When the network is saved, the layout of the main map is also saved, but not that of other maps.
Nodes	See "Network Menu: Nodes" on page 128
Links	Displays link information. The number of tabs and type of information displayed in the Link window depend on the hardware type of the network model.
Interfaces	See "Network Menu: Interfaces" on page 144

Table 22: Network Menu Options *(Continued)*

Feature	Reference
Demands	See "Network Menu: Demands" on page 148
Tunnels	See *Tunnels*
Sites	See "Network Menu: Sites" on page 176
SRLGs	See "Network Menu: SRLG" on page 177
Owners	See "Network Menu: Owners" on page 179
Element Templates	See "Network Menu: Templates" on page 179
User Parameters	See "Network Menu: Demands" on page 148.
VPN	See *Virtual Private Networks* in the *Paragon Planner User Guide*.
VLAN	See *Virtual Local Area Networks* in the *Paragon Planner User Guide*.
Access Domains	See *Virtual Local Area Networks* chapter in the *Paragon Planner User Guide*.
BGP	See *Border Gateway Protocol* in the *Paragon Planner User Guide*.
Multicast	See *Multicast* in the *Paragon Planner User Guide*.
OSPF Areas	See "Network Menu: OSPF Areas/Domains" on page 182.
OSPF/ISIS Routing Instance	See *Routing Instances* in the *Paragon Planner User Guide*.
Static Route Table	See *Static Routes* in the *Paragon Planner User Guide*.

Table 22: Network Menu Options *(Continued)*

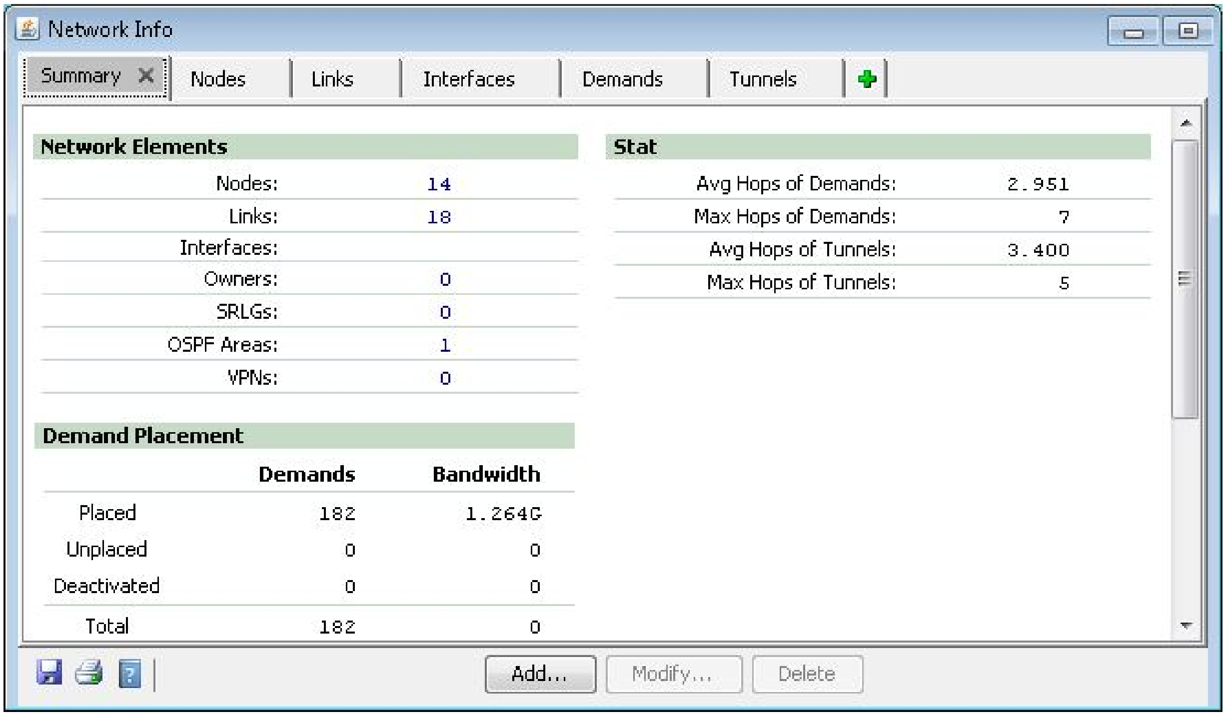
Feature	Reference
QoS Manager	See "Network Menu: QoS Manager" on page 183
Admin Weight	See "Network Menu: Admin Weight" on page 185
Service Type	See "Network Menu: Service Type" on page 184
Path & Capacity	See "Network Menu: Path and Capacity" on page 186

Network Menu: Summary

IN THIS SECTION

To obtain general information about the network under review, select **Summary** from the Network menu. The Network Summary window will appear displaying statistics about the various network elements in the network, including nodes, links, and demands. The demand statistics indicate the average and maximum hops of demands and the number of placed, unplaced, and deactivated demands. Placed demands are demands that were routed over the network. Unplaced demands were demands that failed to route over the network. Deactivated demands are demands that are not routed over the network, for example, demands from a node to itself.

Figure 57: Network Summary Window (Options May Vary)



In some windows such as the Nodes window, you can find a text field labeled Filter and icons labeled Search by Property, Advanced Search, and Filter from Map. These allow you to search for and display a subset of the network elements that match your filter or search criteria. This section uses the Nodes window as an example.

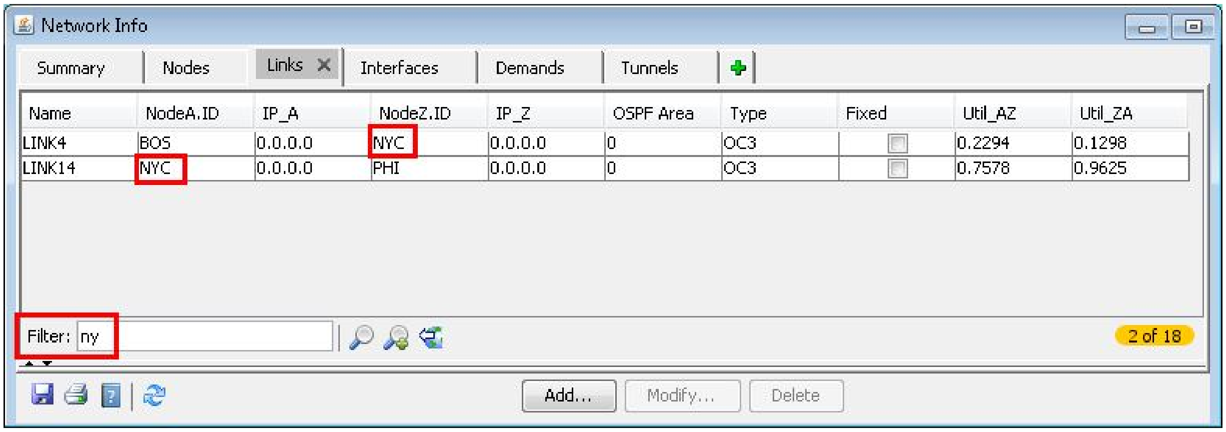
NOTE: The search functionality for the Filter and Advanced Search is not case-sensitive. For example, `ID = abc` also matches `ABC`. The filter searches all entries within the current table.

The following sections provide more information on the options available.

Filter

In the Nodes window, type the text you wish to perform a search on in the Filter box. To reset the list of elements, clear the text field.

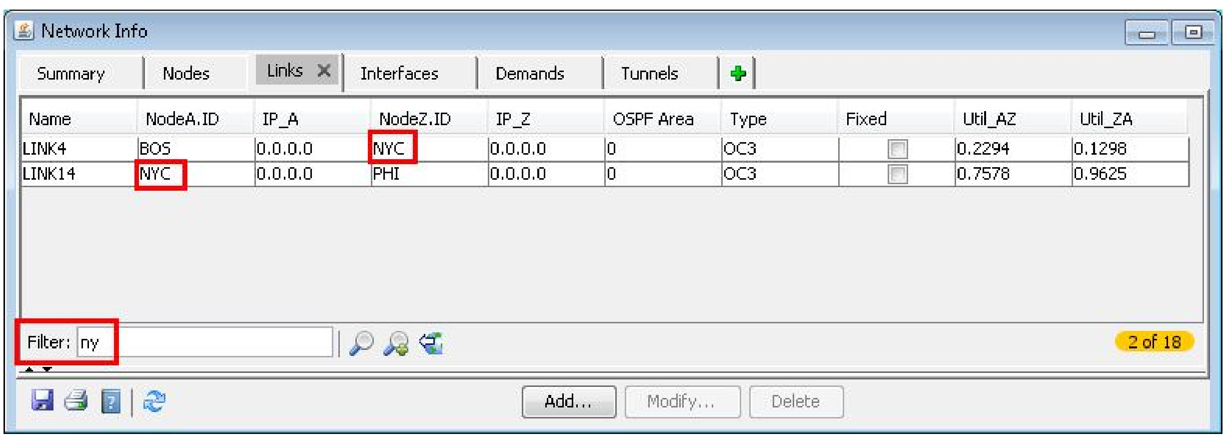
Figure 58: Filter Text Box



Search by Property

In the Nodes window, type the text you wish to perform a search on in the Filter box. To reset the list of elements, clear the text field.

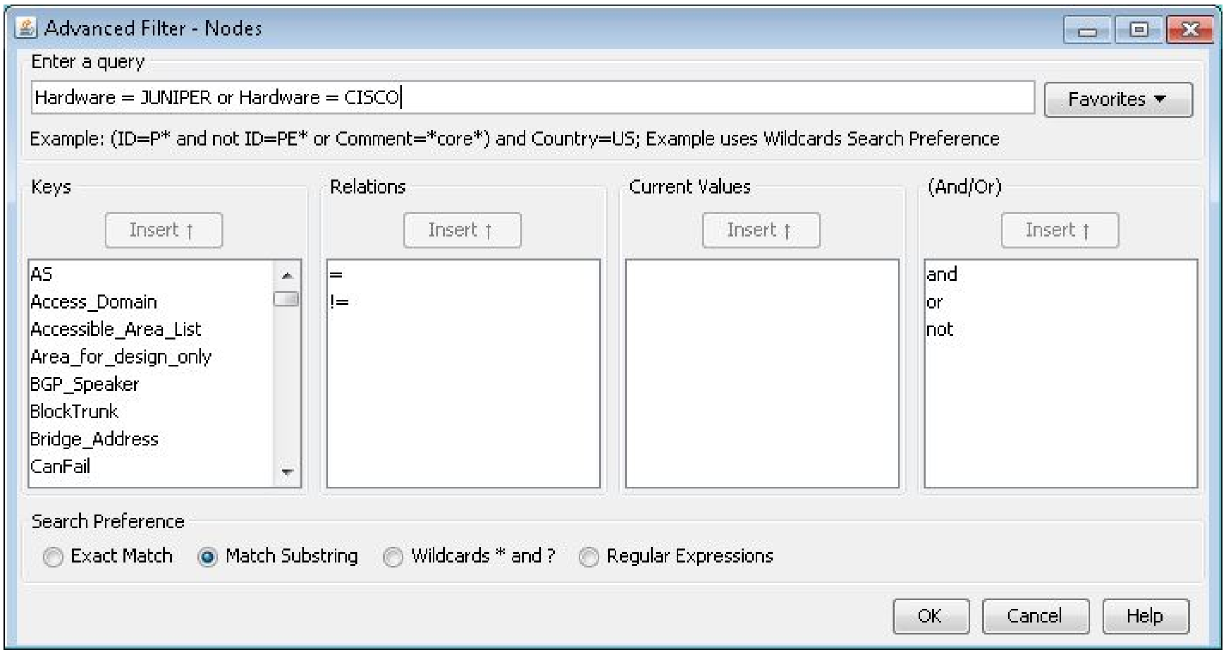
Figure 59: Filter Text Box



Advanced Search

The Advanced Search offers more filtering options. In the Advanced Filter window, a basic query statement consists of a keyword, followed by a relation, and then a value (for example, “Hardware=ETHERNET”). More complicated queries can be formed by joining statements using the and, or, and not conjunctions. Left and right parentheses can be used to override the order of precedence (the “and” operator takes precedence over the “or” operator).

Figure 60: Advanced Filters for Nodes



You can type your query directly in the Enter a query text box. Or use the lists for Keys, Relations, Current Values, and And/Or. To insert text into the query text box from one of the lists, select the desired item from the list, and then click **Insert**. The Current Values list will automatically populate with valid values for the selected Key. You can choose a value from the Current Values list, or simply type in your own. Once you have specified your query in the Enter a query text box, click **OK** to apply the search filter.

Table 23: Advanced Search Preference Options

Option	Description
Exact Match	The query matches a value if the two strings match exactly
Match Substring	(Default) The query matches if it is a substring of the value. For instance, "id = S" matches BOSTON as well as SEATTLE.

Table 23: Advanced Search Preference Options *(Continued)*

Option	Description
Wildcards * and ?	When the "*" character is used in the query, it matches any text. The "?" character matches any one character.
Regular Expressions	Allows regular expressions in the query. This is like regular expressions in Unix.

Here is an advanced filter node example. To find all devices that have an ID beginning with `N1` but not `N11`, together with Ethernet and token ring, all east of the Mississippi River in the U.S., select **Wildcards * and ?** for the search preference and type:

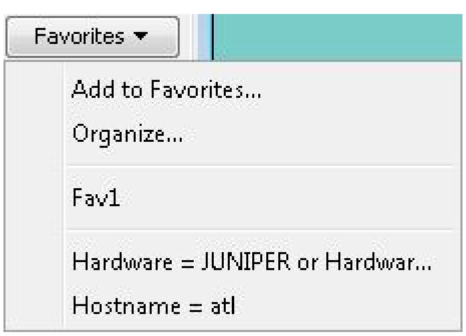
(ID = N1* and not ID = N11* or type=ethernet or type=tokenring) and lon > -90 and lon < -60 and Country = US

Here is an advanced filter link example. To find all OC3 links that either belong to area AREA0 or have an endpoint whose IP address begins with 10.0. but not 10.0.113.1, select **Wildcards * and ?** for the search preference and type:

Trunk = OC3 and (Area = AREA0 or IP_A = 10.0* or IP_Z = 10.0* and not (IP_A = 10.0.113.1 or IP_Z = 10.0.113.1))

To save a query as favorite, select **Favorites > Add to Favorite** and enter in a name for the query. The Favorites menu displays the favorite queries by name, followed by a list of most recent queries. Select **Favorites > Organize** to reorder, rename, or delete queries. Note that the favorites settings are saved on the client machine.

Figure 61: Search Favorites



Navigation Page Setup

For the Interfaces, Demands, and Tunnel tables, the default display is 1000 entries per page and the Filter text box is disabled to enhance performance. Click the **Navigation Page Setup** icon to change these settings.

Figure 62: Navigation Page Setup

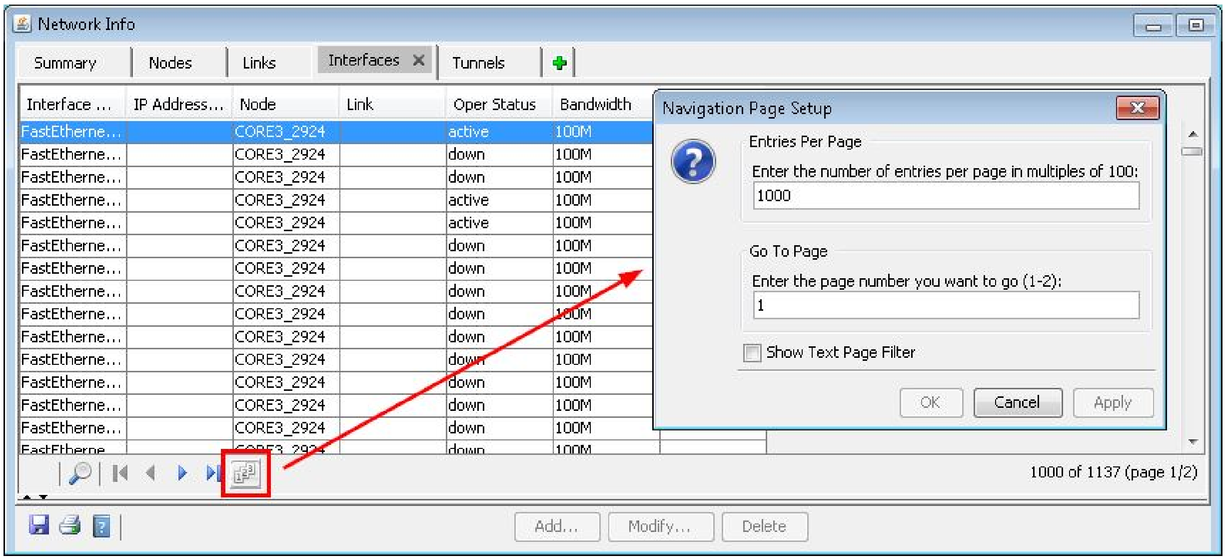


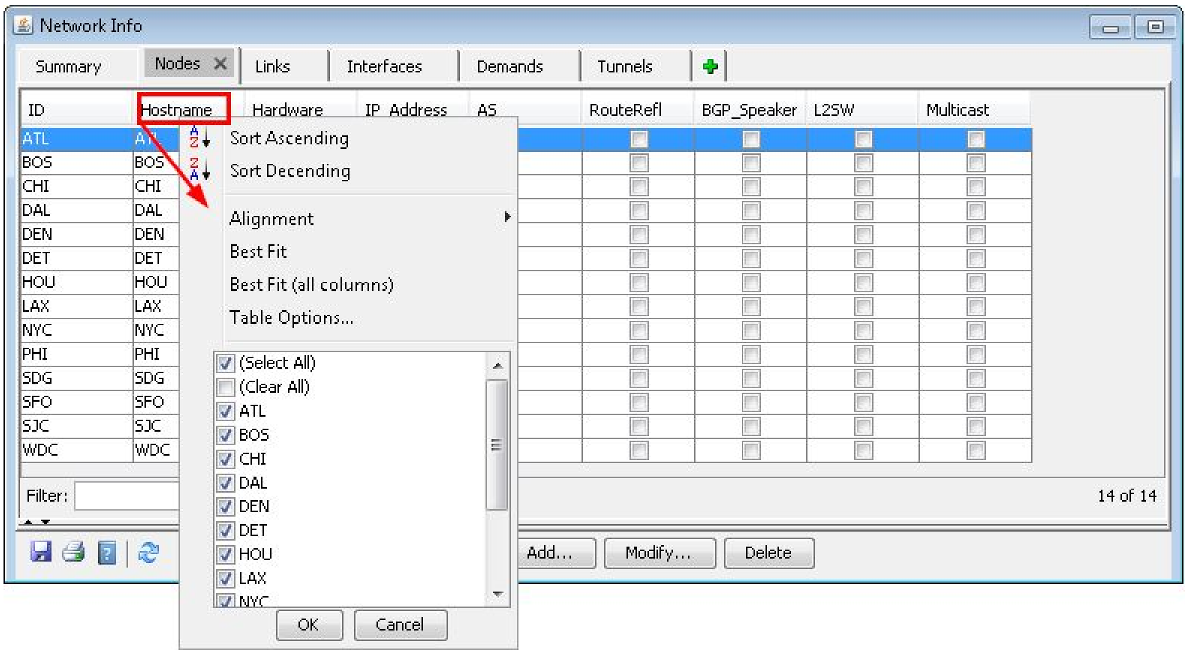
Table Options

Many tables can be customize by right-clicking on a column header in the table. The following options may be available:

- **Sort Ascending/Descending:** Sorts the column entries in ascending or descending order. You can also sort a column directly by left-clicking the respective column header.
- **Alignment Left/Right/Center:** Positions the text within a column on the left side, right side, or center of the cell.
- **Best Fit:** Sizes each column to fit the longest text in each column.
- **Best Fit (all columns):** Sizes all columns to fit the longest text for each column.
- **Filter Checkbox:** Filters the table based on the entry selections of the column. Select All checks all entries and Clear All de-selects all entries

- **Table Options:** Opens a window that allows you to select which columns should be displayed. These settings are saved on the client.

Figure 63: Right-Click Table Columns

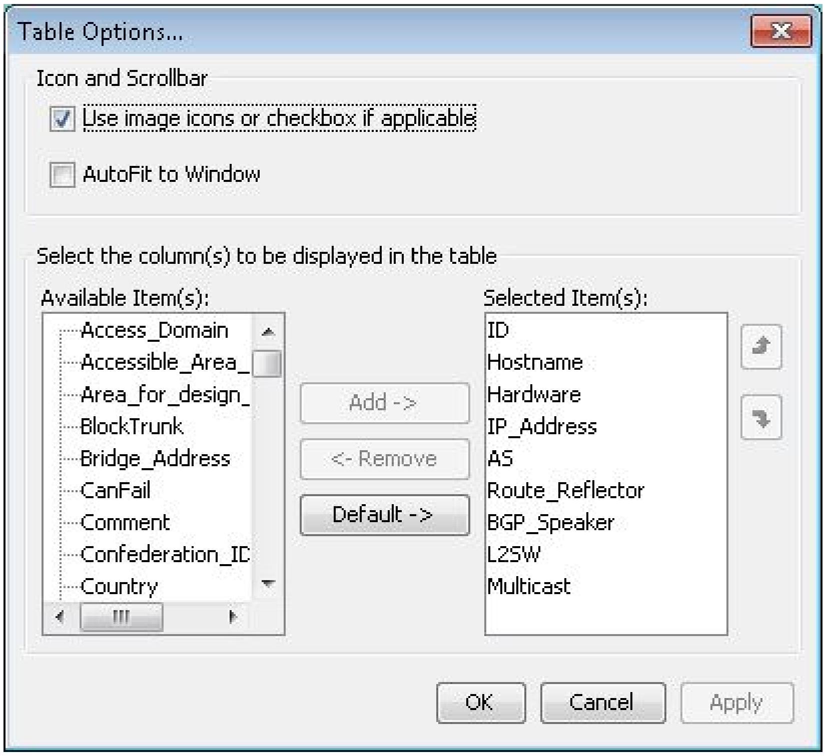


- **Use image icons or a checkbox if applicable:** Some fields can be displayed with an image icon or text (for example, certain hardware types). For these fields, if this checkbox is checked, the image icon is displayed. Otherwise, the corresponding text is displayed.

- **AutoFit to Window:** Adjusts the columns to fit inside the width of the table. Columns are given equal width. This option is useful if there are not too many columns.

- **Selected Item(s):** You can select the desired columns to display in the table by moving them from the Available Item(s) list to the Selected Item(s) list. To do so, select the item in the Available Item(s) list and click **Add**. Select one or more items in the Selected Item(s) list and use the Up / Down Arrows to rearrange the column order. For multiple selection, use <Ctrl >-click or <Shift>-click.</Shift></Ctrl>

Figure 64: Table Options



Network Menu: Nodes

Select **Network** > **Elements** > **Nodes** from the main menu bar to view node information. You can add, modify, or delete nodes in the Nodes window. You can also view and modify node information interactively by:

- Double-clicking on a particular node in the Map window.
- Right-clicking on a specific node in the Map window and selecting **View or Modify** options.

You can filter the nodes that are displayed using the Filter window at the bottom of the Summary section of the display. Enter the search criteria into the Filter field and either press Enter or click the magnifying glass icon. To reset the list of elements, clear the text field.

The number of tabs and type of information displayed in the Node window depend on the hardware type of the network model. Click on the up and down arrow to view the additional tabs.

Figure 65: Nodes Window General Tab

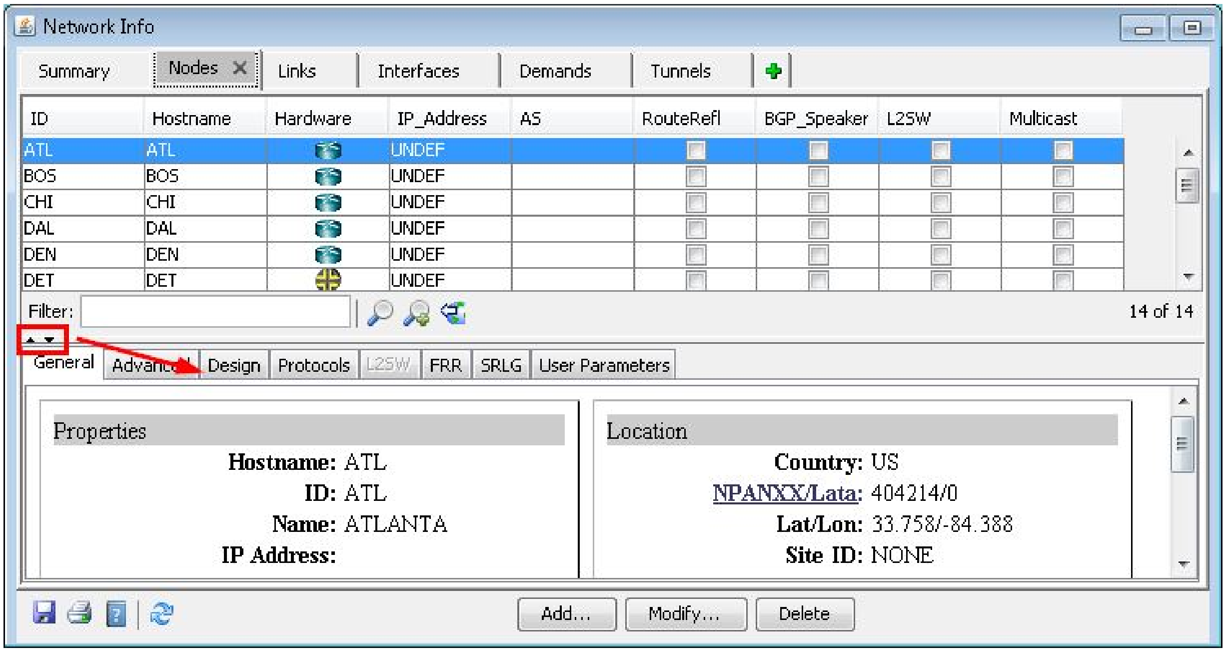


Table 24: Nodes Window General Tab Fields

Field	Description
ID	The user-assigned identifier for a node.
Name	The user-assigned name associated with a node.
IP Address*	The IP address of the node (if applicable). Specified in the nodeparam file: IPADDR=ip_address
Mgmt IP Address	The management IP address is the IP address that was used from the router profile to collect information for this router.
Hardware	Defines the switch hardware being used.
Country	This field specifies the country location of the switch. Country designations are in the form of two letter abbreviations (i.e. UK = United Kingdom)

Table 24: Nodes Window General Tab Fields *(Continued)*

Field	Description
NPA	The number planning area (NPA) code for the node. This field is required for locations in the United States and Canada. Latitude and longitude coordinates are determined from NPA information and are used in graphical display and pricing. For locations elsewhere, the set the NPA field to 999.
NXX	The NXX code for the node. In the North American direct, distance-dialing numbering plan, the NXX code represents either the central office code or a given 10,000-line unit of subscriber lines. This field is required for locations in the United States and Canada. Latitude and longitude coordinates are determined from NXX information and used in graphical display and pricing. For locations elsewhere, set the NXX field to 999.
LATA	The local access transport area (LATA) for the node. This only applies to locations inside the United States.
Latitude	This field specifies the latitude coordinates for a switch location. The latitude can be described using either a floating point number between -90 and 90, or a string in the format ddmmssN or ddmmssS where dd stands for degree, mm stands for minute, and ss stands for seconds. N means North, and S means South. It is required for locations outside of the U.S. and Canada.
Longitude	This field specifies the longitude coordinates for a switch location. The longitude can be described using a floating point number between -180 and 180, a string in the format dddmmssE or dddmmssW. In that latter form, ddd stands for degree, mm stands for minute, ss stands for seconds, E means East, and W means West. It is required for locations outside of the U.S. and Canada.
V and H Coordinates	Vertical and Horizontal projection system used by Telcos and is mapped to LATA and NPA NXX. If NPA NXX is given, V and H coordinates can be calculated.
E and N Coordinates	The UK easting and northing fields only apply when the country is set to "UK". These fields correspond to the UK Ordnance Survey grid and uses a point of origin near Scilly Isles. The field should be specified with 3 digits for each field. Note: For these fields to be saved, the country code should be the UK and the "saveUKENcoord" variable should be set to 1 inside the network model's dparam file.

Table 24: Nodes Window General Tab Fields *(Continued)*

Field	Description
Comment	The comment field can be used to add miscellaneous notes and messages about a node. You should note that comments are not used in any part of the modification, design, or simulation of the program and are merely provided as a convenience.

Table 25: Nodes Window General Advanced Tab Fields

Field	Description
Delay	The delay (in ms) associated with this node.
Site ID	The site with which a particular node is associated. Sites are used to represent node elements that reside in the same room, building, or general area.
Colocation	Allows you to specify whether a particular node is collocated at an IXC POP. The reason for doing this is to save on the local loop (LL) charges, however a collocation rental fee may be charged for the equipment. Note that collocation applies only to U.S. locations.
Hierarchy Level	You may specify whether a node is a core, regular, single-ended, or feeder node in this field. Core nodes are nodes residing in the center of the backbone and that receive the heaviest traffic. Regular nodes are non-core nodes. Single-End nodes only connect to one other node (it is a node with a single neighbor). Feeder nodes only connect to one other node, and only through one link (no parallel links to its single neighbor).
Misc	Miscellaneous fields. For example, *Shortcut* specifies whether the node is enabled for forwarding equivalence class.
CanFail	Indicates if the element can fail during exhaustive failure simulation.

Table 26: Nodes Window General Design Tab Fields

Field	Description
Max. Trunk BW	During a design, a link will not be added to the node if adding the link will exceed the node's capacity for links specified here. The default value is infinity. This value can also be specified from the nodeweight file.
Max. Transit Demand Count	Allows you to specify the number of demands that pass through this node, which does not include any demands originating or terminating at this node.
Node Weight	During a design, the node weight acts as a penalty for purchasing links at a node if the value is <100000. This parameter can also be used to disallow pass-through traffic. If set to PASSTHRU, it is not allowed in the design mode. If set to BLOCK, it is not allowed in the design and simulation modes. The default value is zero.
Block from adding new trunks	During a design, this setting will prevent the program from adding new links from or to this node.
Max. Transit Demand BW	Allows you to specify the maximum total bandwidth of demands that pass through this node, which does not include any demands originating or terminating at this node.
Gateway*	This field allows you to specify whether a node is a gateway. Gateway nodes are used as entry/exit points when using multiple domains. Selecting this will activate the Accessible Area List parameter.
Area/Domain*	This field allows you to specify the area/domain association for the node. Areas/domains allow you to effectively partition the backbone topology into smaller networks for purposes such as facilitating network administration as well as overcoming physical hardware limitations.
Accessible Area List*	Specifies the constraint of areas that this node can become a gateway to. This parameter is used for design purposes. The areas should be separated by commas. The gateway checkbox must be selected in order for this field to be editable.

Fields identified with an * are for device-specific models.

Table 27: Nodes Window General Protocol Tab Fields

Field	Description
OSPF Reference BW	OSPF reference bandwidth value if the default value or metric is not used
OSPF Overload Bit	Identifies if the node has OSPF overload bit set
ISIS Reference BW	IS-IS reference bandwidth value if the default value or metric is not used
ISIS Overload Bit	Identifies if the node is using the overload bit in IS-IS
ISIS Area	The IS-IS area
AS	Autonomous system (AS) number of the node
Confederation ID	BGP Confederation ID of the node
BGP Speaker	Identifies if the node is a BGP speaker
Route Reflector	Identifies if the node is a route reflector
Multicast	Identifies if the node is configured with multicast
SPT Threshold	The shortest path tree switch-over threshold value
RP	Identifies if the node is a rendezvous point
RP Address	The rendezvous point address

Table 28: Nodes Window General BGP Tab Fields

Field	Description
AS	Displays the AS number that this node belongs to.

Table 28: Nodes Window General BGP Tab Fields *(Continued)*

Field	Description
BGP Speaker	Marks whether this node is a BGP speaker. A BGP speaker is a router configured to support BGP.
Router Refl.	Marks whether this node is a route reflector in this AS.
Confederation ID	Displays the confederation ID for this node.

To add a new node, press the **Add** button in the Nodes window. The Add Node window will appear. Specify the properties for the new node and click **Add**. Note that the Add Node window remains open to allow you to continue adding nodes if desired.

> **NOTE**: If you plan to add many nodes with similar properties to your network, the use of templates can speed up the process. Node templates can be defined by selecting **Network > Elements > Templates > Node**. Once defined, templates can be specified via the Apply Template drop-down box in the Add Node window. This will automatically populate many of the fields in the window. For example, the node template also supports autonumbering of the Node ID and Node Name fields.

Specifying Node Location

Based on the location selection method chosen by you, certain parameters in the location tab are activated.

The Add Node window contains the following options for selecting the node location.

- **Mouse:** This method allows the mouse to be used for the specification of the location for a new node. You should first check the box marked Mouse in the Location tab and then move the cursor to the map window. When the cursor is in an area of the map window where a location can be selected, it will change to a white crosshair pointer. Move this pointer to the desired location for the new node and left click. The corresponding latitude and longitude coordinates will automatically appear in the Location tab.

- **City, Country:** This method allows you to specify a node location by country and city. For remote locations not in the database, you may need to either specify a larger city within close proximity to the desired location or use the Mouse method.

  When the City, Country option is selected, the country and city text fields become active. You must first select a valid country from the drop-down combo box labeled 'Country'. A corresponding city name should then be entered in the city text field. City names may also be searched by entering a partial name and clicking on the Search button. Names of cities in the specified country that contain the search string is displayed in the drop-down combo box labeled 'City'.

- **NPANXX:** This method is used to specify a node location using the number planning area or area code (NPA) and the local exchange (NXX). Note that this method can only be used for defining locations in the United States and Canada. When the NPANXX option is selected, the NPANXX field in the Location tab becomes active. You should enter the desired location's NPANXX code and click **Add**. Information in the city, latitude, longitude, vertical, and horizontal text fields will then be updated.

- **Lat/Lon:** This method is used to specify a node location using latitude and longitude coordinates. When this option is selected, the corresponding latitude and longitude fields in the Location tab become active.

  Latitude can be described using either a floating point number between -90 and 90 or a string in the format ddmmssN or ddmmssS where dd, mm, ss, N, and S respectively stand for degree, minute, seconds, North, and South.

  Longitude can be described using a floating point number between -180 and 180 or a string in the format dddmmssE or dddmmssW. In this format, ddd, mm, ss, E, and W stand for degree, minute, seconds, East, and West respectively.

Modify Nodes

To modify one or more nodes, first select or highlight these nodes in the Nodes window. Then, click the Modify button. In the Modify Nodes window, current values can be modified by changing the corresponding text field.

When more than one node is selected for modification, certain fields such as ID and Name are disabled and cannot be modified. If no change is made to a particular field (i.e. the field is left blank), then that property will not be touched or modified for any of the selected nodes.

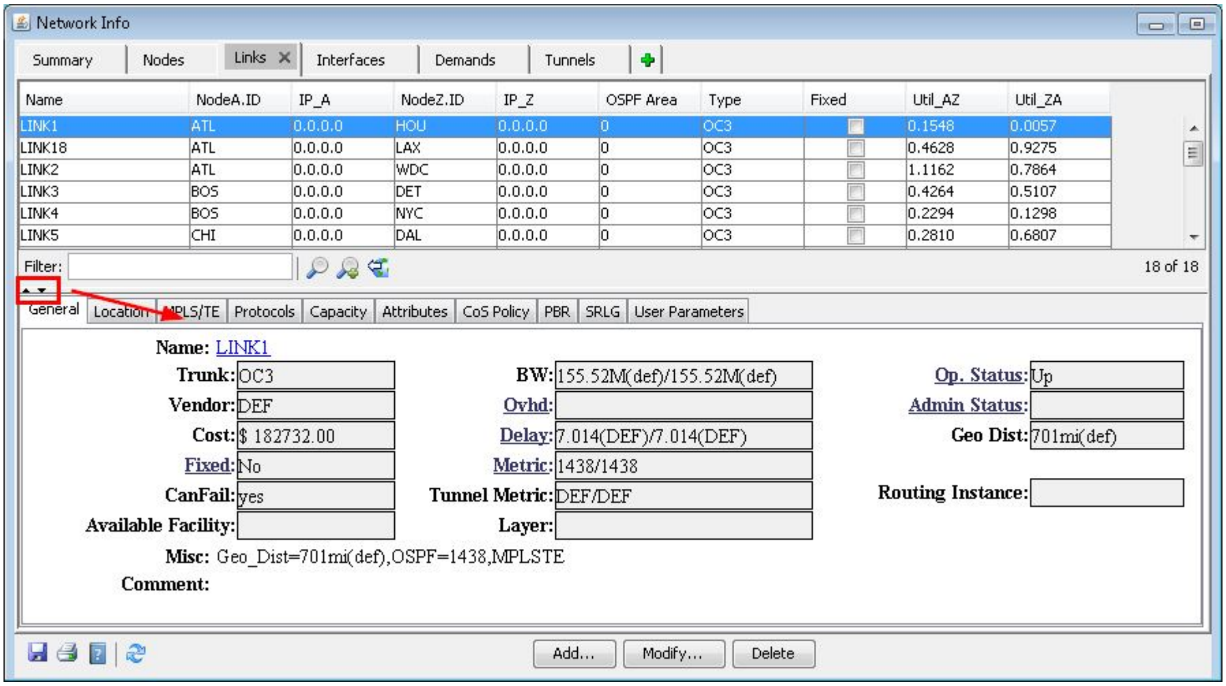
Network Menu: Links

IN THIS SECTION

Link information can be displayed from the main menu by selecting **Network > Elements > Link**. Or select the link(s) from the map and right-click select **View> Selected Links** from the popup menu to open the Links window.

The number of tabs and type of information displayed in the Link window depend on the hardware type of the network model. Click on the up and down arrow to view the additional tabs

Figure 66: Links Window General Tab



The following sections provide additional information about the options available.

Links: General Tab

Field	Description
Name	The user-assigned name for a link. If a name is not assigned, references to that link are made using the node pair representing its origination and termination ends.
Trunk	This field specifies the type of trunk being used. The trunk type is subsequently used in determining link pricing and bandwidth availability.
Vendor	The vendor field allows you to specify the vendor to be associated with the particular link. Possible values for vendors include those that are specific to a certain country or region, and are listed in the tariff database. If a vendor is not specified, the vendor is set to the default DEF. To represent in-house fiber links with zero cost, the vendor should be set to NET.
Cost	This field allows you to specify the cost for a particular link. If this field is specified, the link price is based on this value, rather than one from the tariff database.
Fixed	This field allows you to specify whether a link is to be considered permanent in the backbone topology. If this field is checked, the particular link will not be considered for removal during the optimization phases of design and/or diversity design.
CanFail	Indicates if the element can fail during exhaustive failure simulation.
BW	Defines the bandwidth in each direction if it is different from the default bandwidth.
Ovhd	Defines the bandwidth reserved for signaling. The default value is used if not specified.
Delay	This field is used only if the routing method is set to Delay Metric. When the program performs path placement and is trying to find the best route for a call, delay metrics are examined to determine the desirability/undesirability of a link. Two delay metrics are supported, one for each direction of the trunk. If asymmetric delay metrics are not supported by the hardware, the second delay is marked as '-'. If a delay metric is not defined for a trunk, a default delay is calculated based on propagation delay and serialization delay. Units are in milliseconds.

(Continued)

Field	Description
Metric	When the program performs path placement, link metrics are examined to determine the least cost path. Two metrics are supported, one for each direction of the trunk. If asymmetric metrics are not supported by the hardware, the second metric is marked as '-'. For the metric to be used, an appropriate routing method should be set in the Tools > Options > Design, Path Placement options pane. DIST= *number* DISTA2Z= *number* DISTZ2A= *number*
Tunnel Metric	(IP/MPLS only) Link metric as seen by tunnels. Defaults to IGP metric if not specified. TDIST= *number* TDISTA2Z= *number* TDISTZ2A= *number*
Op Status	Indicates the operating status of the link. This field reflects the current status of the link. Valid status include: Unknown, Install, Live, Active, Order, Planned.
Admin Status	This parameter reflects the current status of the link. Valid states include: Unknown, Install, Active, Live, Order, and Planned.
Service	This field specifies the service type of the trunk. Current service types include ATM and Frame. This field specifies the type of traffic switches support, either frame or cell. If a service type is not explicitly set by you, a default value will automatically be set based on the hardware switch being used.
Media	The media field allows you to assign attributes to a link. Valid media attributes include: TERRES (terrestrial), SAT (satellite), MCWAVE (microwave), FIBER, and ENCRYPT (encrypted). These media descriptors are used in route biasing of calls using criteria such as preferred, preferred not, and required.

(Continued)

Field	Description
Misc	This field is used to display special characteristics of a link. The miscellaneous field contains media and link overhead, distance, cost, delay specifications for links. If more than one specification qualifier is needed for a link in the media type field, these specifications should be separated by commas (,) without any spaces.
Comments	Comments attached to the trunk definition. You should note that comments are not used in any part of the modification, design, or simulation of the program and are merely provided as a convenience.

Links: Location Tab

Field	Description
Area/Domain	The “Area” field will appear only when the OSPF protocol is used. The “Domain” field will appear only for networks with multiple domains.
Node A, Node Z	Displays the source and destination of the link. It is important that you be able to clearly distinguish between Node A and Node Z, especially in defining one-way demands.
Card A, Port A, Shelf A, Card Z, Port Z, Shelf Z	These indicate the card, port, and shelf numbers of the originating and destination nodes. These fields are useful for identifying the source and destination of the link. These fields are only available for certain hardware types.
Interface A, Z	This indicates the interface at node A and node Z that this link comes out of.
IP/Mask A, Z	This indicates the IP address and mask of node A and node Z.

Links: Capacity Tab

In general, the Capacity tab of the Links windows is used to display link utilization information, derived from the bandwidth of demands (for example, PVCs or flows) routed over the link and the link's total bandwidth. The upper half shows summary information and the lower half gives a breakdown by partition.

Field	Description
Dir	The Direction of the link, either "A2Z" or "Z2A".
Total BW	The total bandwidth of the link.
Avail	The amount of bandwidth still available on the link.
Used	The amount of bandwidth used on the link by demands (or tunnels)
Util	The utilization percentage of the link, as calculated from the Used and Total BW values.
Rsv	The amount of reserved bandwidth on the link. This affects routing design. Reserved bandwidth is often used to let you "save" bandwidth for scenarios such as network growth or potential outage. Note that the maximum usable bandwidth for routing is set to Total BW - Rsv. To change the reserved bandwidth value, select **Tools** > **Options** > **Design** and switch to the **Design>Reserved Bandwidth** options pane. For more information, see *Reserved Bandwidth*.

Links: MPLS/TE Tab

Field	Description	File Format
FRR A	no/yes: specifies if there is a fast reroute backup tunnel for the Node A to Node Z direction. If yes, specify the fast reroute backup tunnel.	bblink file FRR_A= *backuptunnel*

(Continued)

Field	Description	File Format
FRR Z	no/yes: specifies if there is a fast reroute backup tunnel for the Node A to Node Z direction. If yes, specify the fast reroute backup tunnel.	bblink file FRR_Z= *backuptunnel*
GLB Pool / RSVP	Tunnels cannot route over a link unless there is available bandwidth in the global pool.	bblink file (for Cisco) GLBPOOL= *bw* GLBPOOLA2Z= *bw* GLBPOOLZ2A= *bw* (for Juniper Networks) RSVP= *bw* RSVPA2Z= *bw* RSVPZ2A= *bw*
SUB Pool / GB	"Guaranteed bandwidth" tunnels cannot route over a link unless there is available bandwidth in the subpool.	bblink file (for Cisco) SUBPOOL= *bw* SUPOOLA2Z= *bw* SUBPOOLZ2A= *bw* (for Juniper Networks) GB= *bw* GBA2Z= *bw* GBZ2A= *bw*

Links: Protocols Tab

The following protocols can be viewed in the Protocol tab: MPLS, OSPF, ISIS, EIGRP, IGRP, RIP, LDP, TDP. The corresponding metric (if applicable) is displayed underneath the A-Z Metric and Z-A Metric columns, such as the tunnel metric for MPLS-TE and the cost for OSPF, ISIS1 and ISIS2. The metric for a given IGP protocol is used for routing the demands if the default routing protocol is set to that protocol.

Note that there are two additional entries, Metric Bandwidth and (E)IGRP delay that can also used to influence the routing metric. The Metric Bandwidth is an informational and routing parameter corresponding to the “bandwidth” statements for Cisco and Juniper Networks interfaces. The (E)IGRP delay corresponds to the “delay” statement for Cisco interfaces.

EIGRP and IGRP metrics can be influenced by changing the Metric Bandwidth or EIGRP Delay fields. To change the K-values from the text file before opening the network, the following line can be added to or edited in the dparam file: IGRP_param1= TOS:0,K1:1,K2:0,K3:1,K4:0,K5:0

For OSPF, the Metric Bandwidth is used to calculate the routing metric only if no cost is specified. The reference bandwidth can be changed by modifying the Node.

Links: Attributes Tab

Tunnels can be prevented from routing over particular links if the link attributes, tunnel mask, and tunnel affinity are set.

Links: CoS Policy Tab

Specify the CoS policy attached to the interface of node A (source) or node Z (destination).

Adding Links

Click the Add button in the Links window to open the Add Link window. The required information (in blue) includes the trunk type (T3, OC3, etc.) and the link’s end nodes (on the Location tab.) The end nodes of the link may be chosen by referencing the Node ID or by using the mouse.

- **By Mouse:** Select **node A and node B** from the display map by using the mouse. When the nodes are selected, the node IDs are displayed in the node A and node B fields of the Location tab.
- **Node ID:** Select **node A and node B** by browsing through the node list by each field.

For router networks the interface and IP address can be specified. To specify an interface, click the search icon to see available choices. Other hardware types may have fields for the card and port number instead of the interface and IP address.

Clicking Add submits the new link to the network model. The Add Link window remains open to allow adding additional links if desired.

Apply Template

This pull-down selection allows you to apply a link template that was created by selecting the "Link Template" window as detailed in *Link Templates*. This can serve as a shortcut to automatically filling in fields that are in common amongst many links.

Auto Add on Mouse Clicks

When this checkbox is selected, you may automatically add new links from the map by choosing node A and node Z. The properties of the new link should be specified on the properties tab of the "Add Link" window before adding the link with the mouse.

Modifying Links

To modify one or more link, first select or highlight these links in the Links window. Then, click the Modify button. In the Modify Links window, current values can be modified by changing the corresponding text field.

When more than one link is selected for modification, certain fields are disabled and cannot be modified. If no change is made to a particular field (i.e. the field is left blank), then that property will not be touched or modified for any of the selected links.

Right-Click Menu Options

- **Traffic Chart:** Traffic charts include the traffic load per period derived from the *trafficload* file and measured interface traffic from the *interfaceLoad_in* (ingress) and *interfaceLoad_out* (egress) files. For router hardware, options vary depending upon the chosen layer (Layer 2 or Layer 3) indicated in the toolbar.

- **Node Detail A, Node Detail Z:** Switches to a view displaying information on the source node (Node A) or destination node (Node Z)

- **Show Config A, Show Config Z:** (Router only). Displays the configuration file for the source node (Node A) or destination node (Node Z)

- **Demands on/thru Link:** Displays a list of demands routed over this link.

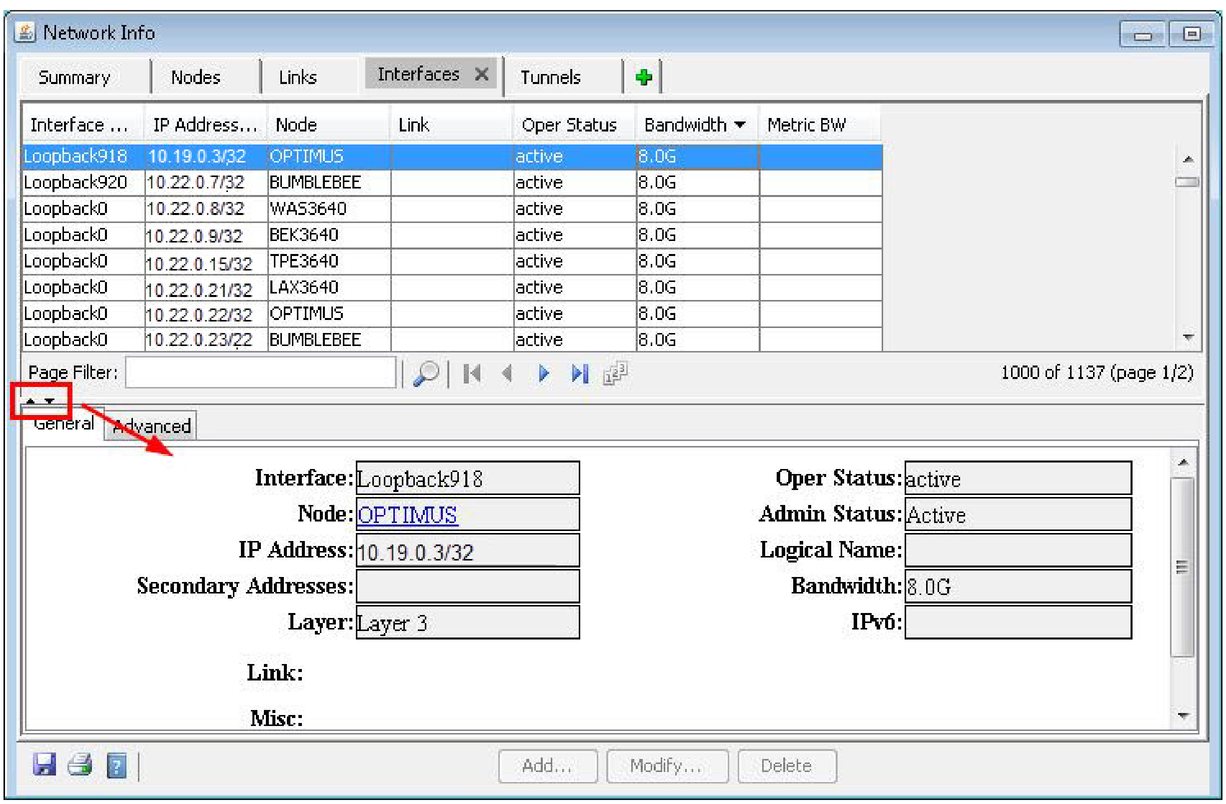
- **SRLGs on Link:** Displays a list of facilities containing the selected link

- **Interfaces on Link:** View the interfaces used for the selected link.
- **Nodes on Link:** Displays NodeA and NodeZ on the link.
- **Tunnels on/thru Link:** Displays a list of tunnels that routes through the link.
- **Tunnel Table on/thru Link:** Displays a list of tunnels that routes through the link in a table.
- **CLI - Show Interfaces:** (Live Network only). Opens the Run CLI window and runs the show interface command on the interfaces of the link.
- **Live Link Status Check:** (Live Network only). Opens the Live Status window and runs queries to check the operation and admin status of the link.

Network Menu: Interfaces

The interface window is available from Network > Elements > Interfaces

Figure 67: Interfaces Window



General Tab

Field	Description
Interface Name	The interface name
IP Address/Mask	The IP address and mask of the interface
Bandwidth	The allocated bandwidth
Layer	Layer 3 (IP) or Layer 2 (switches)
Node	The node which contains the interface
Link	The link which uses the interface
Oper Status	The operational status of the interface (active, passive, planned, down, unknown)
Admin Status	The administration status of the interface (active passive, planned, down)

Advanced Tab - Layer 3

Field	Description
VCI/DLCI	The virtual circuit identifier or the data link connection identifier for ATM frame relay
VPN	The VPN being used on the interface
VRF	The virtual routing and forwarding instance name
VRouter	The virtual router name
HSRP	The hot standby routing protocol

(Continued)

Field	Description
Encapsulation	The interface encapsulation type
Multipoint	The multipoint interface
APS Group	The automatic protection switching group
APS Protected Address	The automatic protection switching address
APS Protected Node	The automatic protection switching node
VLAN ID	The VLAN associated with this interface, if any
Aggregated Interface	The aggregated interface (for example, ae0, ae1 for Juniper Networks) associated with this interface.

To associate an interface with a link, modify the link's Location tab. Click on the search button next to each Interface text box to bring up the Select Interface window. Highlight the interface you wish to associate with that end of the link and click **OK**.

Advanced Tab - Layer 2

Field	Description
Encapsulation	The interface encapsulation type
VLAN ID	The VLAN associated with this interface, if any
Redundant Trunk Group	Redundant trunk groups can be configured on EX-series switches so that when the active link in the group fails, a secondary link will start forwarding data traffic.
Aggregated Interface	The aggregated interface (for example, ae0, ae1 for Juniper Networks) associated with this interface.

(Continued)

Field	Description
Port Mode	Access (SW_ACCESS) or Trunk (SW_TRUNK)
Tagging	Specifies the tagging type (For Juniper Networks, VLAN_TAGGING is for single tagging, STACKED_TAGGING is for double tagging, and FLEX_TAGGING can be configured on the physical interface to support different tagging types on different logical interfaces of the same physical interface).

Right-Click Menu Options

- **Live Interface Load (Live Network only):** Indicates the traffic load collected by Paragon Planner using the Traffic Collection Manager.
- **Show Related Interface(s):** Opens a table of related subinterface(s) of a physical interface, aggregate link (for example, ae link) to which this interface belongs, if applicable, and connected interface(s). The Relation column indicates the nature of the relationship (Physical/Main Interface, Sibling, Connected, Self, Subinterface, etc.) When selecting a link of this table, the bottom pane indicates the relationship. For example, for WAS3640.Ethernet0/1.6, the Physical/Main Interface is WAS3640.Ethernet0/1, a Sibling interface is WAS3640.Ethernet0/1.2, and a Connected interface is J3.ge-0/0/1.6 (there is a link between WAS3640 and J3).

Add Interfaces

To add an interface, click **Add** to open the Add Interface window. Then specify an Interface Name, IP Address/Mask, Bandwidth, and select a Node from the drop-down box.

Modify Interfaces

To modify an interface, select an interface and click **Modify** to make the desired changes.

To associate an interface with a link, go to the Links window and click **Modify**. In the Location tab, click on search button next to each Interface text box to bring up the Select **Interface window**. Highlight the interface you wish to associate with that end of the link and click **“OK”**.

Network Menu: Demands

IN THIS SECTION

From the main menu select **Network > Elements > Demands** to open the Demands window. “Demands” is a generic terminology used in Paragon Planner. It is equivalent to “PVCs” in ATM networks or end to end “flows” in router networks.

Demands: Properties Tab

Figure 68 on page 149 shows the Properties Tab under Demands. Table 29 on page 149 describes the fields in the Properties tab.

Figure 68: Demands Window Properties Tab

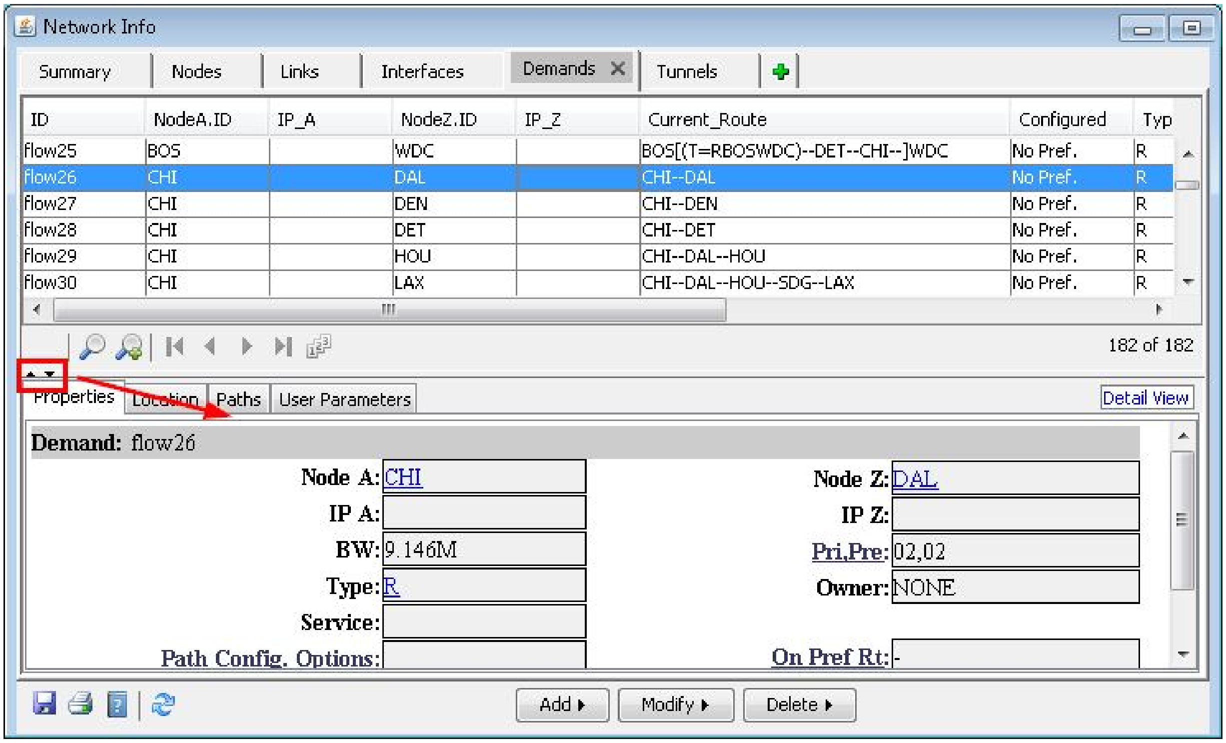


Table 29: Demands: Properties Tab Field Descriptions

Field	Description
Demand	The demand name specified by you when the demand was added.
Node A, Node Z IP A, IPZ IPv6 A, IPv6 Z	Displays the source node (Node A) and termination node (Node Z) of the demand and their IP addresses (router model only).
BW	This is the bandwidth required by the demand. Demand overhead is automatically calculated by the program.
pri,pre	The priority and preempt fields of the demand specification consists of two numbers separated by a comma (,). The first number defines the priority of the demand, and the second number the preempt priority of the demand. The preempt priority should be at the same or lower priority as the priority of the demand. It is assumed that this demand can bump any of the demands with priority lower than the preempt priority.

Table 29: Demands: Properties Tab Field Descriptions *(Continued)*

Field	Description
Type	Indicates the type of the demand, whether it is a data demand or voice demand.
Owner	Displays the name of the owner of this demand. Owner groups can be defined using the Owners section in the Modify menu.
Service	Indicates the user-defined service type of the demand (for example, FTP, VOIP) as described in "Network Menu: Service Type" on page 184.
Path Config Options	For the optical transport model, this will indicate if the demand is a 1+1 demand
On Pref Rt (On Preferred Route)	Indicates whether or not the path is routed on the primary configured route. ‘yes’ means the path is routed on the primary configured route ‘no’ means the path is routed but not on the primary configured route ‘-’ means there is no configured route ‘not routed’ means the path failed to be placed
Comment	User-entered comments

Demands: Paths Tab

Field	Description
Current Route	This is the current route/path of the demand. This path is calculated by the program according to the metric, partitions, etc. as specified by you in the Design options. • The route consists of a sequence of node IDs or names separated by “--”. Different delimiters are used to mark the distance relationship between nodes. A listed configured route for a demand would be something like “ATL--WDC--HOU--NYC”. This means the path of the demand begins at node Atlanta, goes to Washington DC, Houston, and terminates at node New York City. • Use the Report Options window (Tools > Options > Report) to decide whether to display the path using the linkname or only the nodes along the path.

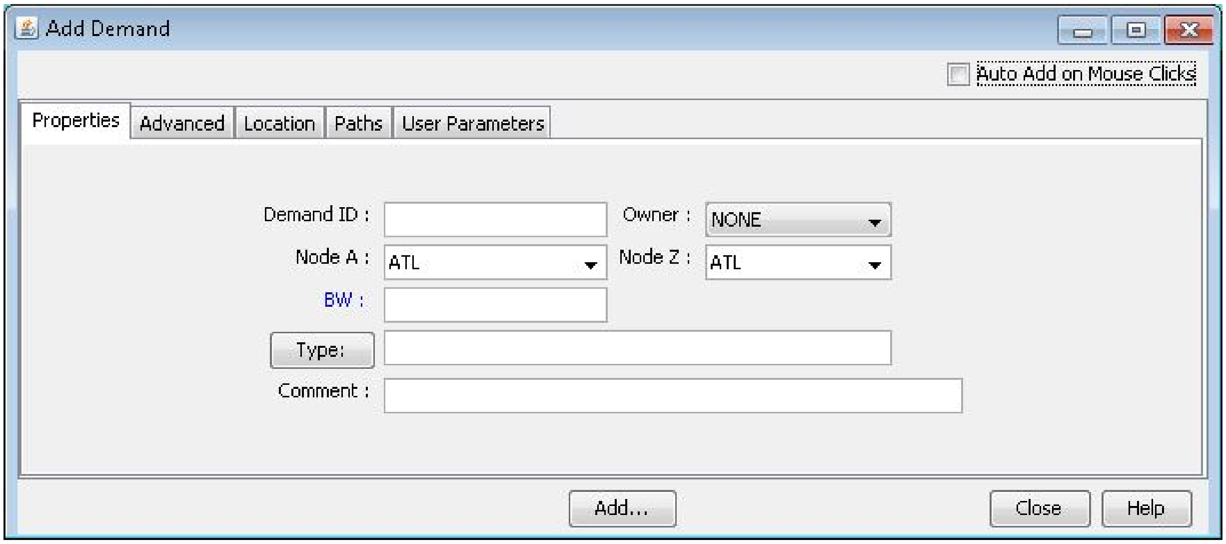
(Continued)

Field	Description
Configured Paths	This field displays the user-configured route/path for this demand. This route is specified by you in the Add/Modify Single Demand window. • The route consists of a sequence of node IDs or names separated by "--". Different delimiters are used to mark the distance relationship between nodes. A listed configured route for a demand would be something like "ATL--WDC--HOU--NYC". This means the path of the demand begins at node Atlanta, goes to Washington DC, Houston, and terminates at node New York City. • Use the Report Options window (Tools > Options > Report) to decide whether to display the path using the linkname or only the nodes along the path.
Secondary	Displays all secondary routes/paths of the demand. Secondary routes are also specified by you in the Add/Modify Single Demand window.

Adding a Single Demand

To add a single demand, click the Add > One demand button. Enter in the source (Node A), destination (Node Z), bandwidth (BW) and a demand identifier (Demand ID). For an explanation of the parameters in this window refer to the table below.

Figure 69: Add Demand Window



Properties

Field	Description
Demand ID	The Demand identifier as specified by you.
Owner/VPN	Displays the name of the owner of this demand. Owner groups can be defined using the Owners section in the Modify menu. In router models, this shows the VPN in which the demand belongs.
Node A	Originating node of the demand.
Node Z	Destination node of the demand.
BW	The bandwidth required by the demand. Overhead is automatically calculated by the program.
Type	Indicates the type of the demand. (varies with different hardware types)
comment	Comments attached to the demand definition. You should note that comments are not used in any part of the modification, design, or simulation of the program and are merely provided as a convenience.

Advanced

Field	Description
pri,pre	The priority and preempt (or holding priority) fields of the demand specification consists of two numbers separated by a comma (,), or a forward-slash (/). The first number defines the call priority of the circuit, and the second number the preempt priority or holding priority of the circuit. The preempt priority or holding priority should be at the same or lower priority as the call priority of the circuit. • Whether the second number is the preempt or holding priority depends on the hardware. Most hardware vendors use holding priority. Note the subtle difference between the two types: A circuit can bump any circuit with call priority lower than the preempt priority. A circuit can only be bumped by a circuit with call priority higher than the holding priority.
Service	Indicates the service type of the demand. The available service types can be found in the Service Type window as detailed in "Network Menu: Service Type" on page 184.
Path Config. Options	Displays the path configuration options used to mark current routes as configured paths or to remove configured paths. Options available are: Config, Div. Sec. and Div. Stdby. • Div. Sec. and Div. Stdby options are applicable only for ATM PVCs and LSP tunnels. When specified, Paragon Planner will create a secondary or standby path entry, respectively, for the PVC/tunnel. • Specifying Config will cause the Configured Route to be set equivalent to the Current Route.

Location

NOTE: An asterisk (*) denotes a hardware specific field.

Field	Description
Node A	Displays the source node of the demand.
IP A*	Displays the IP address of node A.
IPv6 A*	Displays the IPv6 address of node A.

(Continued)

Field	Description
Node Z	Displays the destination node of the demand.
IP B*	Displays the IP address of node B.
IPv6 B*	Displays the IPv6 address of node B.

Paths

Field	Description
Pathname	This is the user-specified name of the route for this demand. This pathname is specified by you in the Add/Modify Single Demand window.
Opt	This field indicates the priority of this path/route in the “Opt” field. In the “Opt” field, the program will select the smallest number to be the primary route. For example, you may specify an Opt 2 for route “Backup1” and Opt 5 for “Backup2”. The program will sort these two routes and select **Backup1** to be the primary route since its Opt is smaller.
Configured Path	This field displays the user-configured route/path for this demand. This route is specified by you in the Add/Modify Single Demand window. • The route consists of a sequence of node IDs or names separated by “--”. Different delimiters are used to mark the distance relationship between nodes. A listed configured route for a demand would be something like “ATL--WDC--HOU--NYC”. This means the path of the demand begins at node Atlanta, goes to Washington DC, Houston, and terminates at node New York City.

Configuring the Demand Path

When adding a demand, you can configure a path or route for the demand.

> **NOTE**: This feature applies for connection-oriented networks like ATM where a path can be preferred or required. (For IP/MPLS networks, configuring the demand path applies only for tunnels, not for demands.)

To configure the path, underneath the “Demands / Paths associated with this demand” section, first double-click the Pathname field to change the pathname so that it is no longer “Dynamic”. There are multiple ways to configure the path through the graphical interface.

- One way is to select **Click links/nodes on map**, then right-click in table next to where it says “To choose paths.” Then, <Ctrl>-click all the links along the path, right-click the relevant row entry in this table, and then select **Use Map Sel’n.**
- Another way is to select **Click consecutive nodes starting at node A** next to where it says “To choose paths.” Then click the nodes from source to destination to automatically populate the Configured Route. Because this method is based on nodes only rather than including the links, this method cannot be used to select a particular link when there are parallel links between two nodes.
- Finally, another method is to right-click an entry and select **Edit Route** to open a window where you are given options for each next hop until the destination is received.

Edit Route

Field	Description
Current Node	Displays the current originating node from which the path of this demand is to be specified.
Circuit ID / Flow ID	Displays the name of the demand as specified by you.
Next Available Hop(s) / Available Nodes	Here, you can select three methods to choose the next hop or path for this demand. The Node ID/Name option allows you to select the next hop by choosing the next node of the path. The Link Name option allows you to select the path of the demand by choosing the links on which the demand will traverse. Lastly, with the Loose Route option, the program displays a list of routes calculated
Add to Path	Clicking on this button will add the highlighted hop or path to the path list.
Delete from Path	Deletes the highlighted path from the current path list.
Show Path	Selecting this button displays the path in the topology map. The path is displayed in a think yellow line.
Clear Selections	This will clear the list of chosen paths from the current paths section of this window.

(Continued)

Field	Description
Hop Disp Opt	Allows you to set the next available hop using the IP address or node ID/name.
Defined Path	As you defines and adds to the path for the demand, this field will progressively display the path as specified by you.

User Parameters

User parameters allow you to define their own parameters for network elements such as nodes, links and demands, and then to associate values to these parameters for the individual network elements.

Demand Type Parameter Generation

Click the Type button in the Add or Modify Demands window to access additional demand settings. Clicking OK causes the Type field to be populated with the corresponding keywords. Note that different parameters will appear for different hardware device models.

Field	Description	File Format
Max Delay	Specify a maximum delay constraint (default in milliseconds).	MAXDELAY=*x* (optional unit ‘s’ or ‘ms’ for seconds and milliseconds)
Max Hop	Specify a maximum hop constraint	Hcnt
Max Cost	Specify a maximum end-to-end cost of the path (for example, sum of the metrics/admin weights)	MAXCOST=*x*
Frame Size	Used to calculate overhead.	BF*size*
Diversity	Specify the name of a group of demands this demand belongs to. When performing diverse path design, the program will try to design the paths of the demands in this group to be diverse.	Ddivgroupname where *divgroupname* is the name of a group of paths

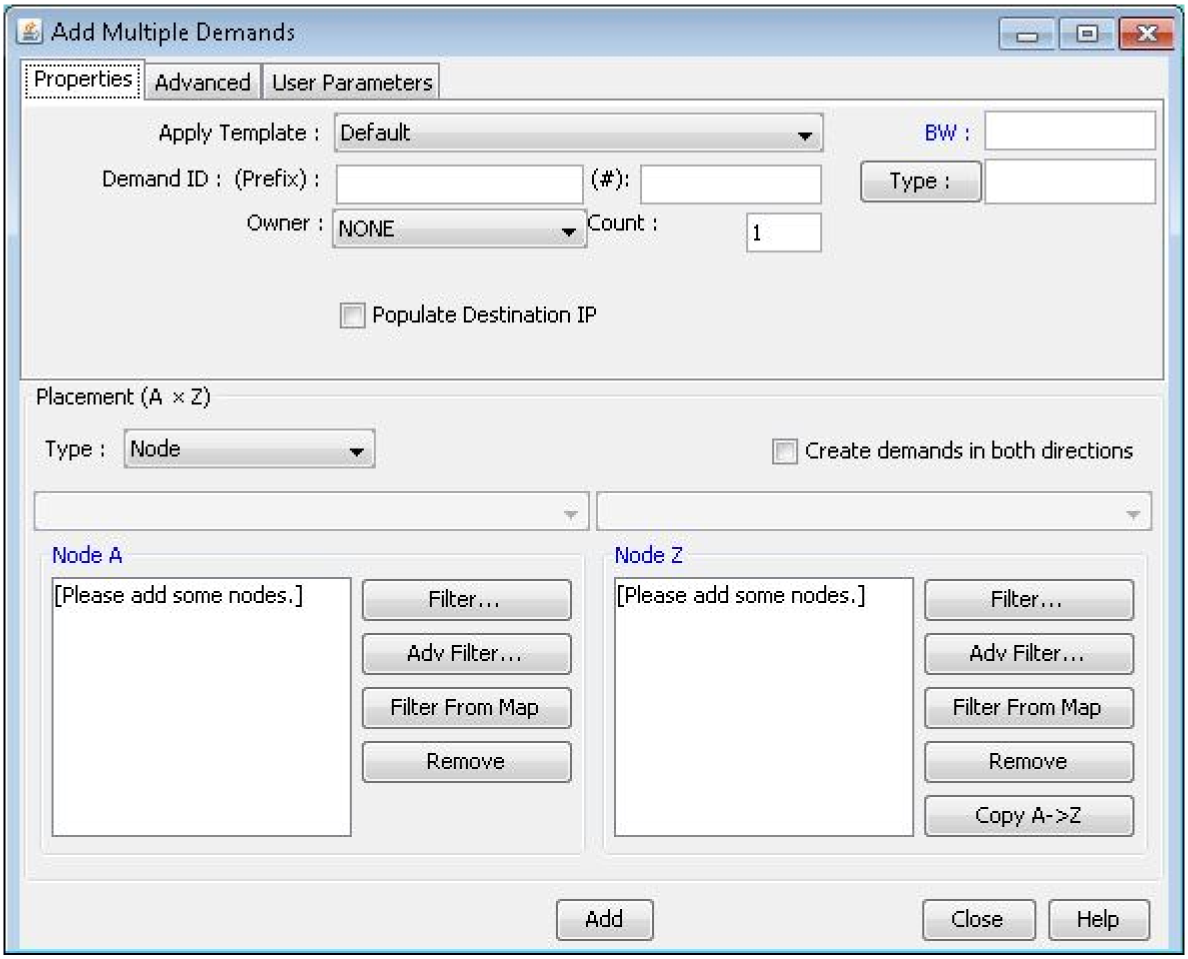
(Continued)

Field	Description	File Format
Guaranteed BW	Specifies that the demand should route over a Guaranteed Bandwidth (for example, subpool) tunnel	GB,
Full Duplex	If this checkbox is selected, the flow is routed along the same route in both directions.	DUPLEX,
Policy Class	CoS Policy	COS=*policyname*, where *policyname* is substituted by the CoS policy name
Multicast	If this checkbox is selected, specify the destination IP in the adjacent select menu.	MCip-*address*, where *ip-address* is substituted by the destination IP address
PIM Mode	The following Protocol Independent Multicast modes can be specified: • PIM-DM (dense mode) PIM-SM (sparse mode) • PIM-SM (sparse mode) • Bidir-PIM • SSM	pim-mode, where *pim-mode* is substituted by the multicast mode (for example, PIM-DM)
Admin Status	These are labels for status classification that can be applied to a demand or tunnel. • LIVE, MOD, NEW, and PLAN labels have no impact on routing and is used for identification purposes. • If SHUTDOWN label is used, the demand becomes unplaced.	LIVE is live MOD is modified NEW is new PLAN is planned SHUTDOWN is shutdown
ECMP	Specify that this demand can be load-balanced to Equal Cost Multiple Paths: specify a number in the adjacent textbox to specify the number of sub-flows that the flow can be broken down into	ECMP= *n*, where *n* is substituted by an integer

Adding Multiple Demands

Select **Add > Multiple Demands** to add multiple demand definitions to the network at one time. A list box is used to indicate the origin (Node A) and destination (Node Z) locations. Meshed demands are created between all locations listed in Node A and Node Z.

Figure 70: The Add Multiple Demands Window



Field	Description
Apply Template	Specifies the circuit identifier assigned by you to the demand.
Demand ID (Prefix and #)	Specifies the demand suffix number assigned for multiple demands. This number will automatically increment.

(Continued)

Field	Description
Owner	Specify the name of the owner of this demand or the VPN in which this demand belongs. Owner groups can be defined using the Owners section in the Modify menu. VPN can be defined using the Add/Modify IP VPN window in the Modify menu.
Count	Specifies the number of demands to be added between node pairs.
BW	This is the bandwidth required by the demand. Demand overhead is automatically calculated by the program.
Type	Indicates the type of the demand, whether it is a data demand or voice demand. This field also indicates parameters for QoS networks. See "Demand Type Parameter Generation" on page 156.
Pri,Pre	The priority and preempt priority (or holding priority) fields of the demand specification consists of two numbers separated by a comma (,), or a forward-slash (/). The first number defines the call priority of the circuit, and the second number the preempt priority (or holding priority) of the circuit. The preempt priority should be at the same or lower priority as the call priority of the circuit.
Service	Indicates the service type of the demand. The available service types can be found in the Service Type window. For more information on service types, see "Network Menu: Service Type" on page 184.
Path Config. Options	Specifies the path configuration option, which can be Config, Div.Stdby, or Div.Sec.
Comment	Displays any comments you may be inclined to enter.
Populate Destination IP	Specifies that the destination IP Address of each new demand should be automatically populated.

- **Filter:** Opens the Find Nodes window in order to add nodes to the Node A and Node Z lists.
- **Filter From Map:** Adds nodes to the Node A and Node Z lists that are highlighted on the topology map.

- **Remove:** Remove the selected node from the Node A or Node Z list.
- **Copy A-> Z:** Copies the nodes that are on the Node A list to the Node Z list.

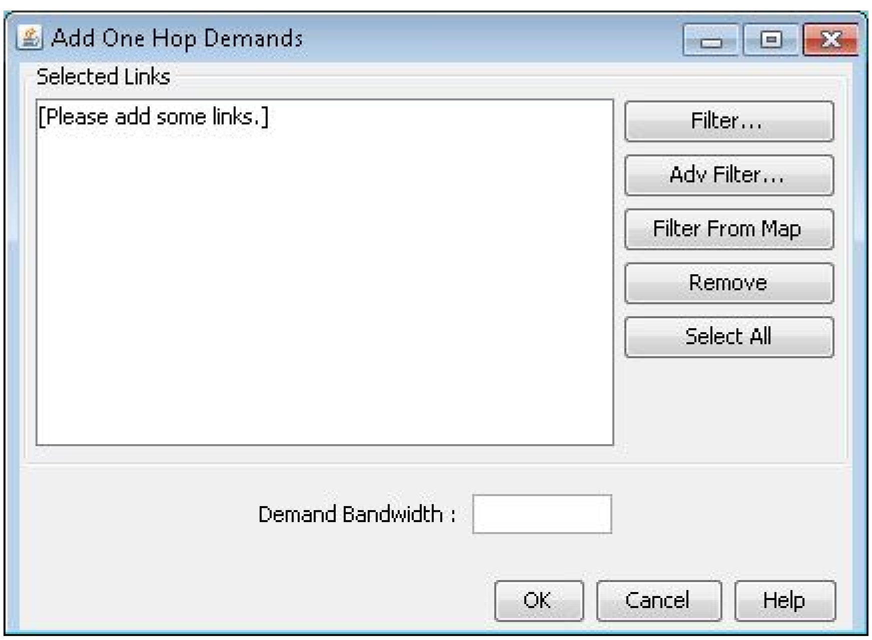
Adding One Hop

The Add > One Hop option allows you to create two demands per link, one in each direction. Because these demands have adjacent source and destination nodes, they are referred here as “one hop demands.” For example, for a link connecting ATL to DAL, the program can create two one-hop demands, one from ATL to DAL and one from DAL to ATL.

The purpose of this feature is to allow you to analyze the network to find out which demands are routed over the direct link and which are routed over a detour path. The detour path may be taken, for example, if the metric of the direct link is higher than that of the detour path. You can then check to see whether the detour path was intended or not.

Upon opening the following window, you should perform a Filter... or Filter From Map to select the links for which to add one-hop demands. Then enter a bandwidth and bandwidth unit for the demands to be added, for example, 1M for 1Mbps, and click **“OK”**.

Figure 71: Add One Hop Demands

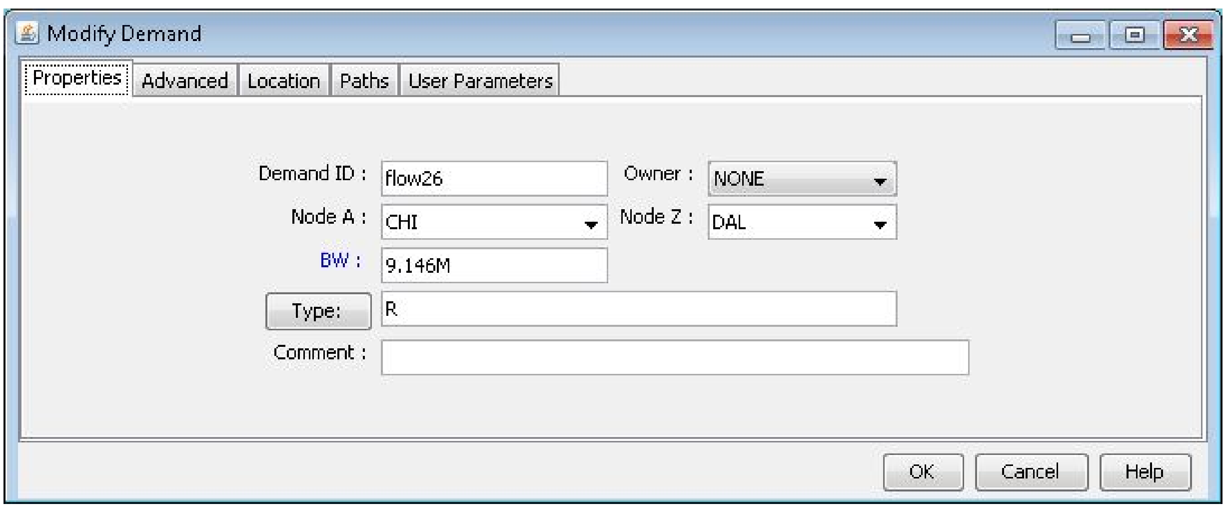


NOTE: For information on the Add One Hop Tunnels feature, see the *Paragon Planner User Guide*. Whereas for demands, the routing is left dynamic in order to allow discovery of multi-hop paths, for tunnels, an explicit tunnel path over the selected link is given to force the tunnel over the direct link. There are also additional options to label the added tunnels with a tunnel user parameter for the tunnel ID group.

Modifying a Single Demand

When you select **Modify > Selected...** for only one entry in the Network Info window Demands view pane, the following window is opened. You must first select a set of demands to modify in the table.

Figure 72: Modifying a Single Demand (Options May Vary)



Paths Tab

- **Path Table:** When selected, a table will appear displaying each configured or calculated path that originates at the source node of this demand. Note that these paths are not necessarily associated with the demand, and are not to be confused with the configured or current path taken by the demand.

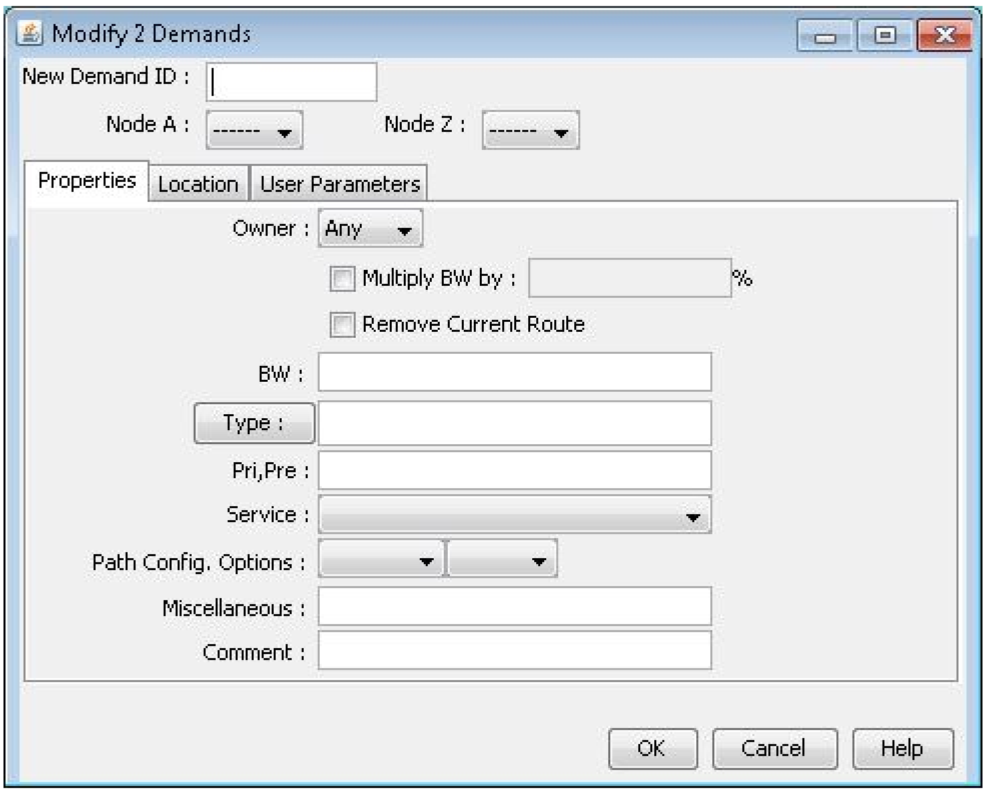
- **Show Route:** When selected, this button displays the highlighted path in the detailed demand information window.

- **Show All Paths:** This option displays all paths listed in the detailed demand information window.

Modifying Multiple Demands

When you select **Modify > Selected...** for multiple entries in the Network Info window's Demands view pane, the following window is displayed.

Figure 73: Modifying Multiple Demands (Options may vary)



Field	Description
New Demand ID	This option can be used to change multiple demands to have the same Demand ID. In most cases Demand IDs are unique and this option will not be needed. However, for certain features, the same demand ID may be used for different demands in order to group them together. These features include multicast demands (ATM or router hardware) and virtual concatenation groups (optical transport only).
Multiply BW by	When this checkbox is selected, the program will perform a bandwidth multiplication by the percentage specified here. The bandwidth of every demand selected for modification is multiplied by this percentage.

(Continued)

Field	Description
Remove Current Route	When this checkbox is selected, the program will remove the current route for the demands being modified. Accordingly, those demands are unplaced and the Current_Route column of the demand window is cleared for those demand entries. • You can then have those demands routed when updating the network state or exiting from modify mode by answering “Yes” to the dialog prompt to update the demand routing tables. Alternatively, you may perform tuning for unplaced paths only from Design > Demands > Route Paths > Unplaced Paths.

Right-Click Menu Options

- **Show Path:** Displays the path of the demand in the topology map, if it is routed. If multiple demands are selected, their paths are highlighted on the topology map, and the demand currently selected in the path window is highlighted with a slightly different color.
- **Highlight All:** Displays on the Standard map the source to destination pairs of all demands listed in this window.
- **Bottlenecks:** Displays the location of the bottleneck in the console when a demand is unplaced.
- **BW_Ovhd:** Displays the bandwidth used by the demand and also the actual bandwidth allocated to the demand. This information is displayed in the console window.
- **All Configured Routes:** This option displays on the map the configured routes for this demand. If the path is dynamic rather than configured, you should use the Show Path option instead.
- **Path Table:** When selected, a table will appear displaying each configured or calculated path that originates at the source node of this demand. Note that these paths are not necessarily associated with the demand, and are not to be confused with the configured or current path taken by the demand.
- **End-to-End Delay:** View a chart of the end-to-end delay per period as described in "End-to-End Delay" on page 166
- Show Traffic Load: View a chart of the traffic load per period in the network as described in "Traffic Load" on page 165"Traffic Load" on page 165.

- **Show Site Demands:** Display site-to-site demands on topology map, with a legend to indicate the load between each site pair. See "Network Menu: Show Site Demands" on page 190 for more information.

- **Aggregate Demands:** View the total bandwidth between each node pair in table format. See "Network Menu: Aggregate Demands/Tunnels" on page 190 for more information.

Notes on Priority and Preemption

The Priority and Preempt Priority (or “pri,pre”) values of a demand (or MPLS LSP tunnel in Router models) influences routing order and placement. Note that although Paragon Planner uses the term “preempt priority” throughout its graphical interface, for a majority of hardware types, if supported, this value actually maps to a demand’s Holding Priority. Paragon Planner will mimic the behavior of the hardware device.

Note that Holding Priority and Preempt Priority differ subtly in meaning. A demand with a holding priority of some value x indicates that “any demand with a priority higher than x can preempt this demand.” A demand with a preempt priority of some value x indicates that “this demand can preempt any demand that has a lower priority.” Net.com Promina hardware, for example, uses “preempt priority”. The majority of supported ATM and router hardware, however, use a “holding priority” implementation (for the routers, this applies to MPLS LSP tunnels, as opposed to demands).

Also, for the majority of supported hardware models, a lower number indicates a higher priority. For a few hardware types, however, it is the reverse. Refer to your hardware’s documentation to check for the proper numbering scheme. Paragon Planner will mimic the hardware’s behavior.

For example, suppose a demand has a pri,pre value of (7,0). Assume the lower value receives a higher priority. So, a “0” holding priority is already the highest priority and indicates that no demand is able to preempt this particular demand. The “7” priority value is used to determine routing order. If demands are placed with higher priority demands first (the default), then this demand will not be routed until after the demands of priorities 0 through 6 are routed.

> **NOTE**: The preempt priority, or holding priority, should always be set to a higher priority than the priority value. To illustrate, assume that we are dealing with holding priorities, as defined earlier, and that the lower value receives a higher priority. Then, a pri,pre value of (7,8) is invalid. To understand why, imagine if you had two such demands with pri,pre values of (7,8). One demand, of holding priority 8, could be preempted by the other demand, whose priority is 7. The preempting demand could then become preempted by the original demand, causing an oscillating scenario.

Demand Statistics View

The statistics view can be obtained by right-clicking a demand and selecting **View > Statistics View**. The tabs are explained below:

Field	Description
General	The General demand information tab displays the total amount of placed and unplaced voice and data demands found in the network in terms of bandwidth.
Pri Load	The Priority Load tab sorts the demands found in the network by their defined priority and displays them in a table form in the demand information window.
BW & Ovhd	The BW & Ovhd tab provides summary information on the bandwidth and overhead of the demands shown in the Demands window. The program calculates the bandwidth of the demands including the overhead calculation and summarizes this data in this tab. Note: This tab is only activated when you are viewing demands on/thru a specific link. (Right-click on a link; select **View > Demands On/Thru Link**.)
N Hop Path	The NHop Path tab categorizes the demands found in a network by the total number of hops in each demand's route.

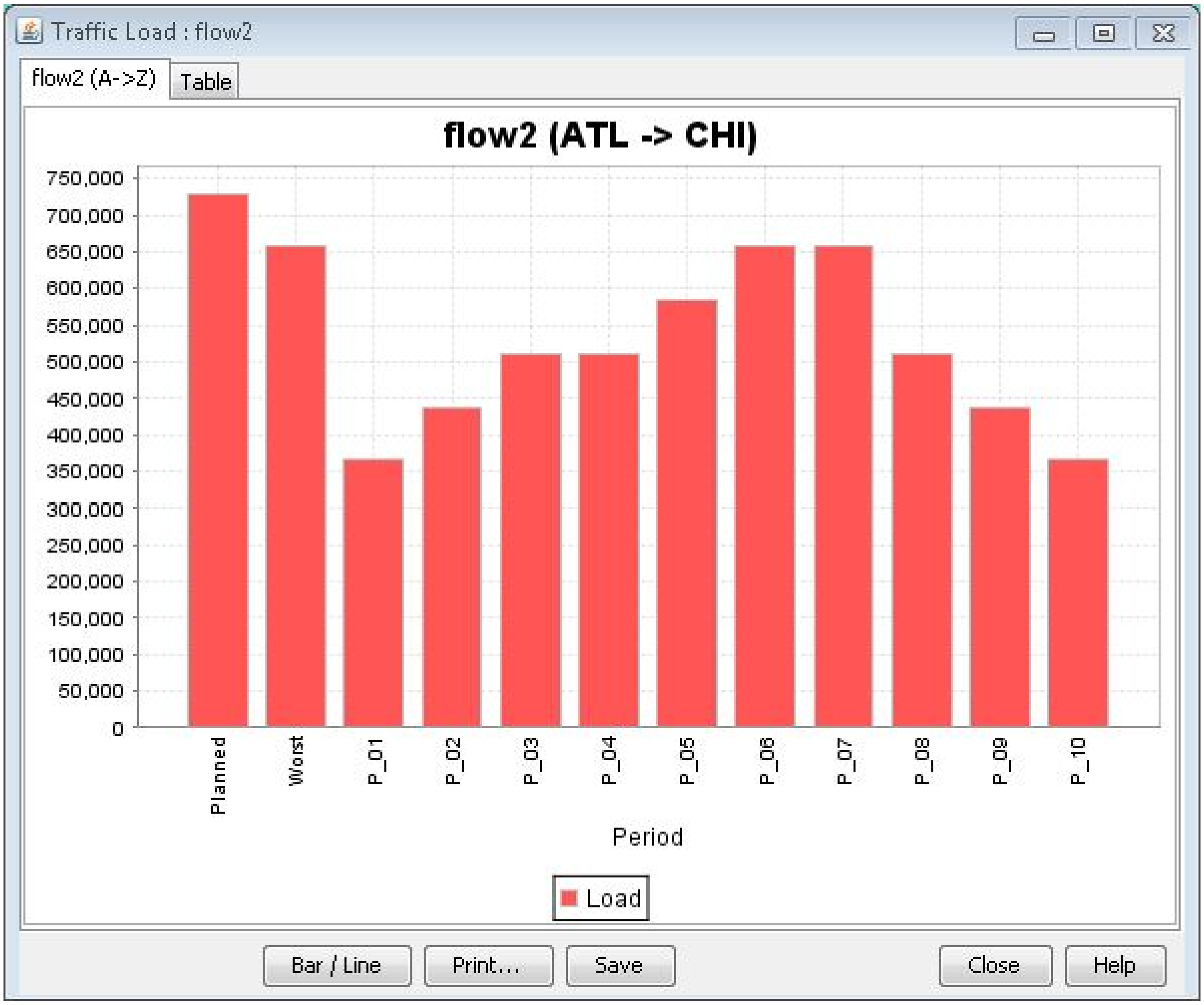
Traffic Load

As a prerequisite, you should load in the trafficload file, which details the period by period bandwidth utilization.

Right-click a demand from the Network Info window’s demand view pane and select **Show Traffic Load** to view the traffic load for a single demand or Show All Traffic Load to view the sum total traffic load for all demands. This displays the Traffic Load window, displaying the traffic load in either barchart or line form.

In the traffic load graph show below, the Y-axis displays the traffic load in megabits per second. One bar is displayed on the barchart for each of up to 24 time periods. The first two bars display the planned or normal bandwidth ("N") and the worst or peak traffic load ("W") which occurred during those periods.

Figure 74: The Traffic Load Graph

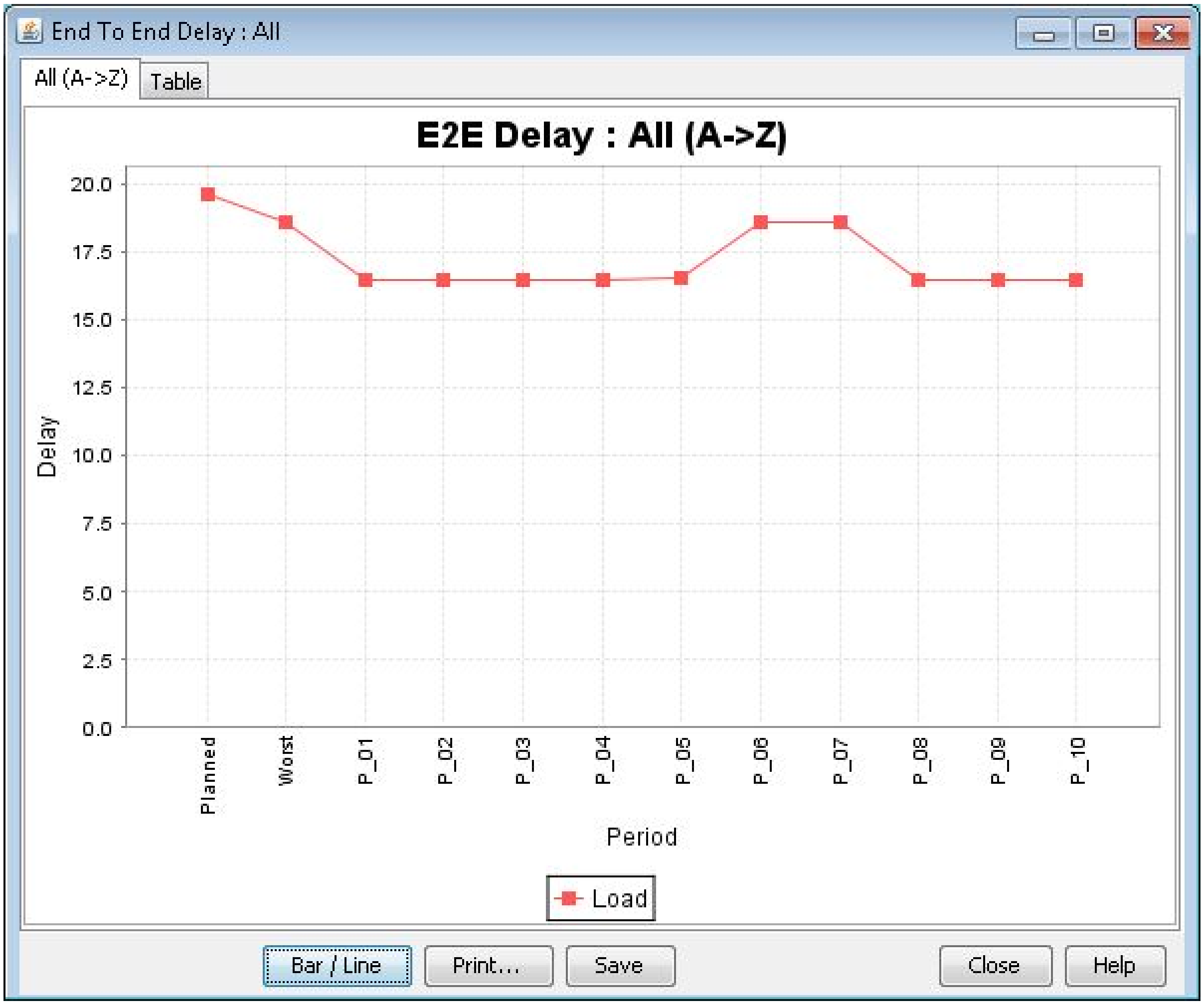


End-to-End Delay

Right-click a demand from the Network Info window's demand view pane and select **End-to-End Delay** to view the period to period end-to-end delay for a single demand or All End-to-End Delay to view the average of the end to end delays for all demands in the networks. This displays the Traffic Load window, displaying the traffic load in either bar chart or line form.

The End-to-End Delay graph displays the delay experienced by the demands in the network. In the graph, the end-to-end delay is shown in milliseconds. The delay found in the planned and peak bandwidths are shown as the first two bars in the graph.

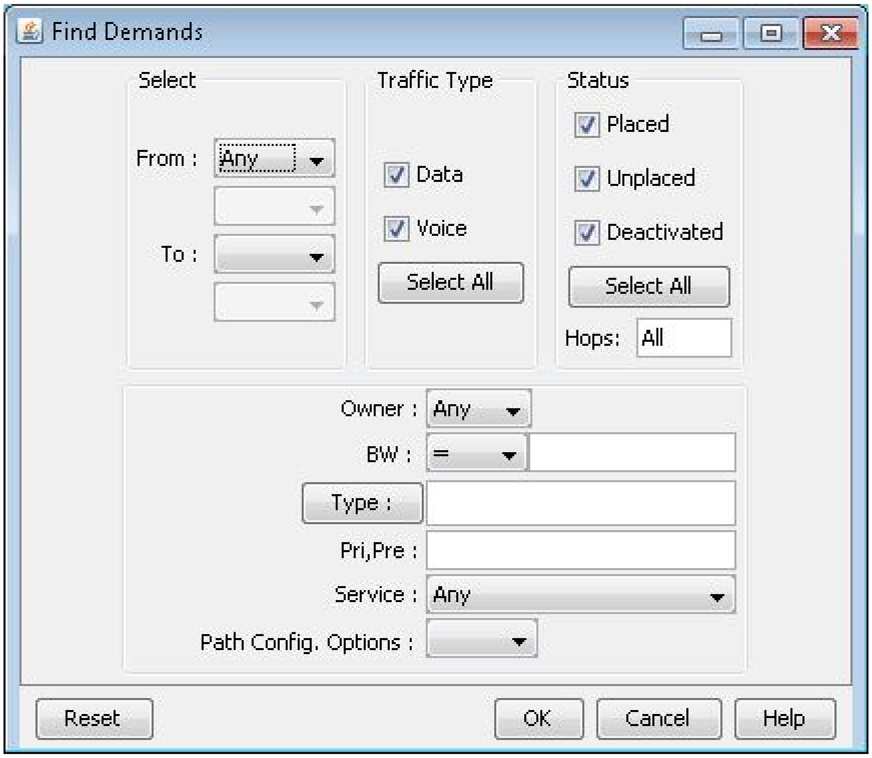
Figure 75: End-to-End Delay



Find Demands Filter

Click the Search by Property button in the Demands window to open the Find Demands window. The Find Demands window is a utility for filtering demands by matching the fields entered. Fields that are left blank are ignored.

Figure 76: Find Demands Window



The From fields indicate the starting Node, Site, Lata, Group, or Area. For example, if you select **Group** this will find all the demands originating at a node in the selected topology group. Select **Flow ID** to indicate a specific demand.

The Status section can be used to narrow down on the demands of a particular status. For example, to view only the Unplaced demands, deselect the checkboxes for Placed and Deactivated.

The Type field is used to hold many specific demand type parameters, separated by commas. Pressing on the Type button will open the Demand Type Parameter Generation window, which can be used to help you automatically populate the Type field.

The Type field is used to hold many specific demand type parameters, separated by commas. Pressing on the Type button will open the Demand Type Parameter Generation window, which can be used to help you automatically populate the Type field.

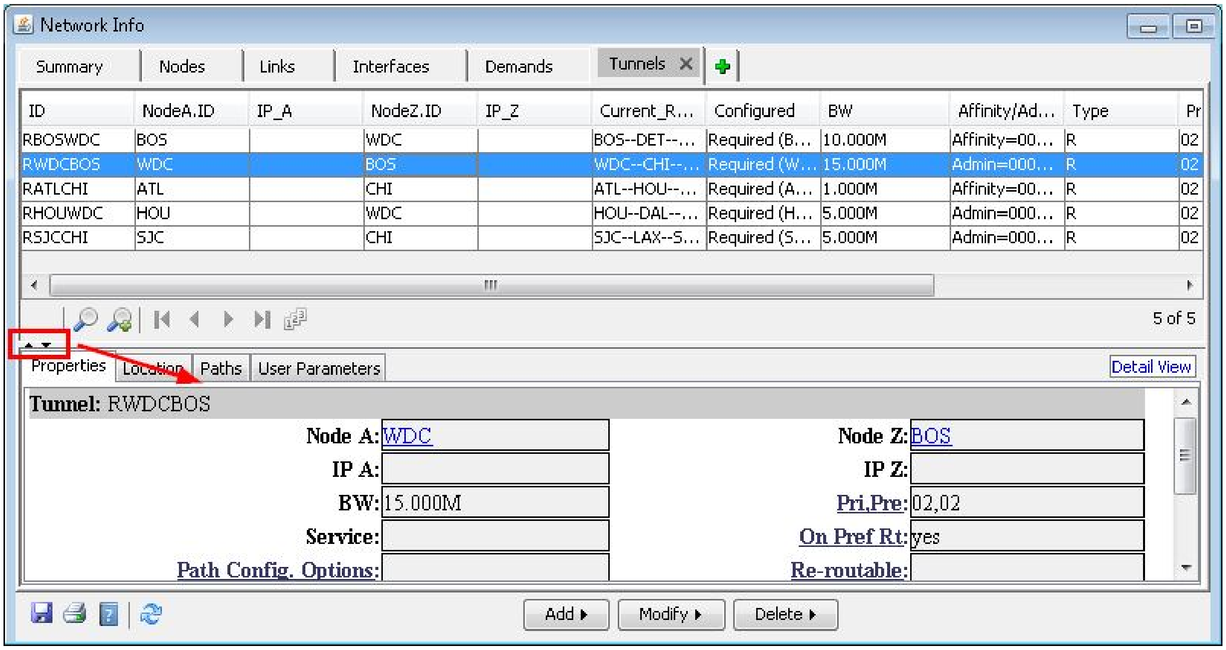
After you have entered any demand properties in the Find Demands window, the program will match the properties entered and return a list of demands matching those properties. For example, if you want to search for all demands that have a bandwidth of 5 megabytes both way, you would enter an “5M” in the A->Z and Z->A fields. Then click on the OK button to retrieve the list of demands.

Network Menu: Tunnels

IN THIS SECTION

From the main menu select **Network** > **Elements** > **Tunnels** to open the Tunnels window.

Figure 77: Tunnels Window Properties Tab



Properties Tab

Table 30 on page 170 describes the fields available in the Properties tab.

Table 30: Properties Tab of the Tunnels Window

Field	Description
BW(J)	This is the bandwidth required by the tunnel.
Type(J)	Indicates the type of the tunnel as specified in the Tunnel Attributes window. You may edit this field by right-clicking on the table and selecting **Edit Type**.
Affinity/Mask (C) IncludeAll/ Exclude/ IncludeAny (J)	Allows you to set the affinity/mask of the tunnel for Cisco, or the include all, exclude, and include-any settings for Juniper Networks admin groups to prohibit particular tunnels from routing on trunks with particular attributes (admin-groups). Trunk attributes effectively color the trunk, whereas a tunnel's affinity/mask or include-all, exclude, and include-any settings determine which color trunks the tunnel is permitted to be placed upon. You may edit this field by right-clicking on the table and selecting **Edit Affinity/Mask** for Cisco or **Edit Include-All/Exclude/Include-Any** for Juniper Networks.
Pri,Pre(J)	The priority field of the circuit specification consists of two numbers separated by a comma (,), or a back-slash (/). The first number defines the setup priority of the circuit, and the second number the holding priority of the circuit. The holding priority should be at the same or lower priority as the setup priority of the tunnel. It is assumed that this tunnel can only be bumped by a tunnel with a setup priority higher than its holding priority.
Comment(J)	Displays any comments you may wish to enter.

Paths Tab

Table 31 on page 171 describes the fields available in the Paths tab.

Table 31: Paths Tab of the Tunnels Window

Field	Description
	This is the user-specified name of the route for this tunnel. If “Dynamic” is specified, the route is chosen dynamically and you should not configure a path in that entry. Otherwise, you can specify a different path.
Opt	This field indicates the priority of this path/route in the “Opt” field. In the “Opt” field, Paragon Planner will select the smallest number to be the primary route. For example, you may specify an Opt 2 for route “Backup1” and Opt 5 for “Backup2”. Paragon Planner will sort these two routes and select **Backup1** to be the primary route since its Opt is smaller.
Configured	This field displays the user-configured route/path for this tunnel. • The route consists of a sequence of node IDs or names separated by “--”. Different delimiters are used to mark the distance relationship between nodes. A listed configured route for a tunnel would be something like “ATL--WDC--HOU--NYC”. This means the path of the tunnel begins at node Atlanta, goes to Washington DC, Houston, and terminates at node New York City.

Right-Click Menu Options in the Tunnels Window

Right-click in the Tunnels window to access the following options:

- **Show Path:** Displays the current route and the defined routes (for example, primary and backup) of the given tunnel in the topology map. If multiple tunnels are selected, their primary paths are highlighted on the topology map, and the tunnel currently selected in the path window is highlighted with a slightly different color.
- **Highlight All:** Displays on the Standard map the source to destination pairs of all tunnels listed in this window.
- **Bottlenecks:** Displays the location of the bottleneck in the console when a tunnel is unplaced.
- **BW_Ovhd:** Displays the bandwidth used by the tunnel and also the actual bandwidth allocated to the tunnel. This information is displayed in the console window.
- **Show Traffic Load:** View a chart of the traffic load per period in the network as described in "Traffic Load" on page 165.

- **Path Table:** When selected, a table will appear displaying each configured or calculated path that originates at the source node of this tunnel. Note that these paths are not necessarily associated with the tunnel, and are not to be confused with the configured or current path taken by the tunnel.
- **All Configured Routes:** This option displays on the map the configured routes for this tunnel. If the path is dynamic rather than configured, you should use the Show Path option instead. If there are multiple paths
- **Aggregate Tunnels:** View the total planned tunnel bandwidth between each node pair in table format. See"Network Menu: Aggregate Demands/Tunnels" on page 190 for more information.

Tunnel Type Parameter Generation

Click **Type** in the Add or Modify Demands window to access additional demand settings. Clicking **OK** causes the Type field to be populated with the corresponding keywords. Note that different parameters appear for different hardware device models. Tables Table 32 on page 172 and Table 33 on page 174 describe the fields displayed in the General and Design tabs, including the file format.

Table 32: Fields in the General Tab

Field	Description	File Format
Tunnel Metric	A tunnel metric (absolute, relative or don't care) used by IGP if Autoroute Announce is checked. **Absolute:** Use tunnel metric as is **Relative:** Set tunnel metric relative to IGP Metric (for example, 10 would mean tunnel metric = IGP metric + 10) **Don't Care:** Tunnel metric defaults to IGP metric.	ABS=*absolute_metric* REL=*relative_metric*
Tunnel Option	Specifies whether the tunnel is primary, secondary, or standby. This option can be configured for a tunnel originating at a Juniper Networks router by selecting Edit Type from the right-click menu of the bottom half of the Add Tunnel or Modify Tunnel window.	

Table 32: Fields in the General Tab *(Continued)*

Field	Description	File Format
Autoroute Announce	Announces the presence of the tunnel by the routing protocol. When Autoroute announce is enabled, the IGP will include the tunnel in its shortest path calculation when the tunnel is up	NOAA (No Autoroute Announce) corresponds to not selecting this checkbox
GRE	Generic Router Encapsulation	GRE
Zero Backup Bandwidth	Cisco feature. During reroute, the tunnel bandwidth is 0. If this is a backup tunnel, then selecting this option would mean that bandwidth will not be reserved from the link(s) for this tunnel.	0BW
Policy Class	If there was a policy class established and applied to this tunnel, it would appear here. You can click on the down arrow and review all policies that apply to the tunnel.	
Guaranteed Bandwidth-TE	GB Tunnels can only be routed on trunks with available bandwidth in the SubPool.	GB
CCC	Circuit cross-connect. This means that this tunnel is cross-connecting between two interfaces using CCC	
No BD	No Border Flag. This is an artificial parameter used for design. When set, routing will not follow OSPF constraints. That is, the whole network is treated like a flat network.	NOBD
No CSPF	Indicates that administrative groups/link attributes are ignored by this tunnel.	NOCSPF
IGP	If checked, the tunnel is routed using the current Interior Gateway Protocol's metric rather than the tunnel metric. The current routing method can be found in the Design Options, Path Placement options pane.	IGP
Auto-Reoptimization	Indicates that the LSP can be automatically reoptimized if the existing path becomes suboptimal.	REOPT

Table 32: Fields in the General Tab *(Continued)*

Field	Description	File Format
Template	Specifies a configlet template in the **$WANDL_HOME/data/templates** or **/u/wandl/data/templates** directory. This option allows you to select a manually-generated template to be used for the configlet generation process. Select the directory in which this template file is saved.	TMLT=*templatename*

Table 33: Fields in the Design Tab

Field	Description	File Format
Max Delay	The maximum delay allowed for this tunnel. The max delay is calculated either from the delay inputted on the links, or else the value set in the Delay Parameters section of the Design Options window (by default, 1ms per 100 miles).	MAXDELAY=<delay>
Max Hop	The maximum number of hops allowed for this tunnel.	H<hopcount>
Max Cost	The maximum total admin cost (sometimes referred to as “distance” or “admin weight”) allowed for this tunnel. That is, the total admin cost of all the links that the tunnel traverses should not exceed this value.	MAXCOST=<value>
Diverse Level	Allows you to specify path diversity requirements for tunnels with standby or secondary paths. Select the desired level of diversity NODEDIV for node disjoint paths LINKDIV for link disjoint paths FACDIV for facility/SRLG disjoint paths	NODEDIV LINKDIV FACDIV
Diversity Group	If SITEDIV is selected, the program will pair tunnels with the same originating and terminating sites. Paired tunnels are routed diversely. • This field can also be used to specify the name of a group of tunnels this tunnel belongs to. When performing diverse path design, the program will try to design the paths of the tunnels in this group to be diverse.	DSITEDIV D*divgroupname* where *divgroupname* is the name of a group of tunnels for which diverse paths is desired

Table 33: Fields in the Design Tab *(Continued)*

Field	Description	File Format
Tertiary Diverse	Indicates that if there is a third path for this tunnel (for example, in the case of one primary plus two secondary paths), that all three paths should be designed to be diverse. You should add an entry for the second and third path and then design the path by selecting **Design>Diverse Path Design** for Paragon Planner to design this path.	3DIV
Symmetric Pair Group	When there are two tunnels with the same end nodes but in opposite directions, the path routing will use the same set of links. Example, Tunnel1 source to destination is NodeA to NodeZ, and Tunnel2 source to destination is NodeZ to NodeA. Selecting Tunnel1-Tunnel2 as a symmetric pair group will place both tunnels along the same set of links. In the tunnel file, the keyword is PAIR=groupname in the type field. Tunnels in the same group are paired based on the source and destination node.	

Virtual Trunk Tab

The Virtual Trunk tab is used to indicate traffic engineering tunnels advertised as links in an IGP network (OSPF or ISIS) and to indicate the corresponding metric assigned. Select the Virtual Trunk checkbox in order to configure the relevant protocol, area, and/or metric for which the virtual trunk will apply.

For Cisco, the corresponding statement would be “show mpls traffic-eng forwarding-adjacency”.

For Juniper Networks, the corresponding statement would be the “label-switched-path *name* metric *metric*” statement under the hierarchy level [edit protocols ospf area area-id] or “label-switched-path name” under the hierarchy level [edit protocols isis].

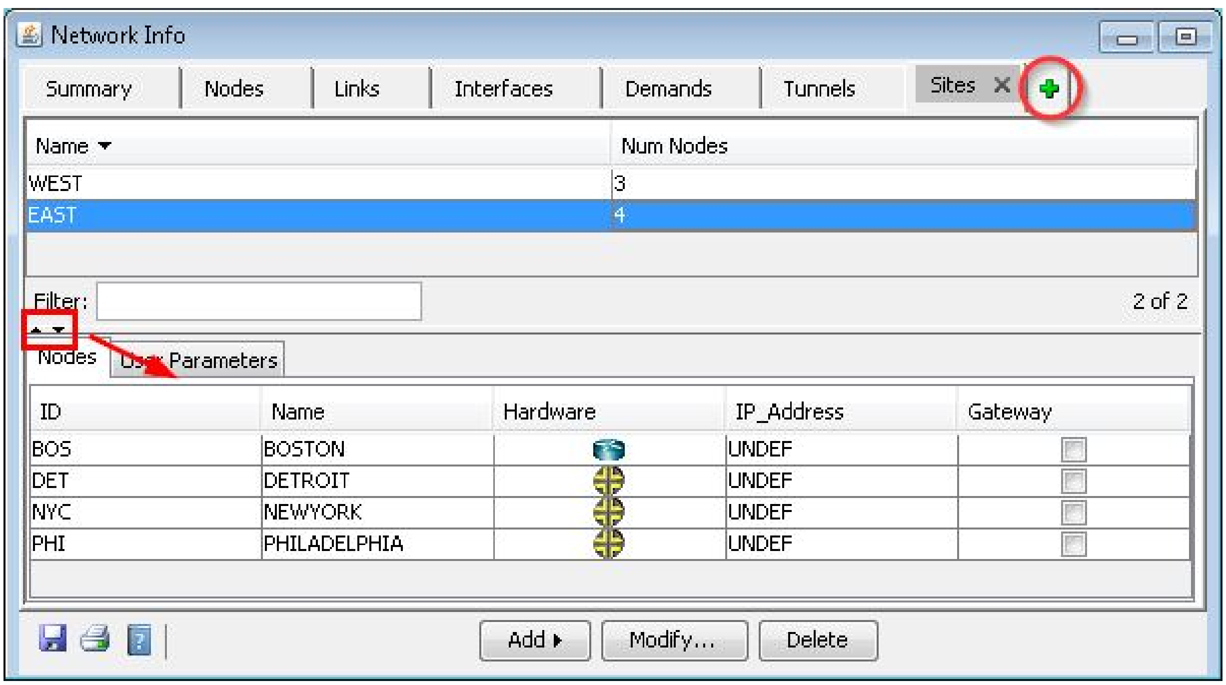
If a tunnel is marked as a virtual trunk, it is known to other routers and its metric and available bandwidth information is broadcast to other routers as if it were a link. Just as a link has interfaces defined on both ends, two tunnels (one in each direction) must be defined as virtual trunks for this setting to take effect. Otherwise, the virtual trunk is perceived as being “down”. The file format is VT or VT_*areanumber*.

This Area option is the OSPF area assigned to the Virtual Trunk. This applies only if Virtual Trunk is selected and the network uses OSPF routing (as opposed to ISIS routing, for example). A tunnel that is marked as a virtual trunk is advertised as a link to other routers. If those routers perform OSPF area routing, they need to know what area this virtual trunk belongs to. Select the area from the pull-down menu.

Network Menu: Sites

The Site window allows you to get more detailed information about currently defined sites in the network. Sites represent node associations. These associations are typically by physical location. If several nodes are located in the same area, such as in a building, small campus, or in the same calling area, you may want to logically group these together by site. This grouping is not necessarily related to the hardware design of a network.

Figure 78: Sites Window



- **Node Details:** Jumps to the Nodes view and displays nodes that belong to the selected site.
- **Create Group:** Creates a group based on the nodes of the selected site. Opens an input name dialog window for the new group.
- **Add:** Opens a Add Site dialog window for inputting the name of the new site, and values of customized site user parameters.
- **Modify:** Modify a site or the site user parameters

- **Delete:** Deletes the selected site from the network.

Assigning Nodes to a Site

Nodes may be added to a site from the Nodes window by using either Add Node or Modify Node functions. In the Add or Modify window, select the site from the Site ID drop down menu.

User Parameters

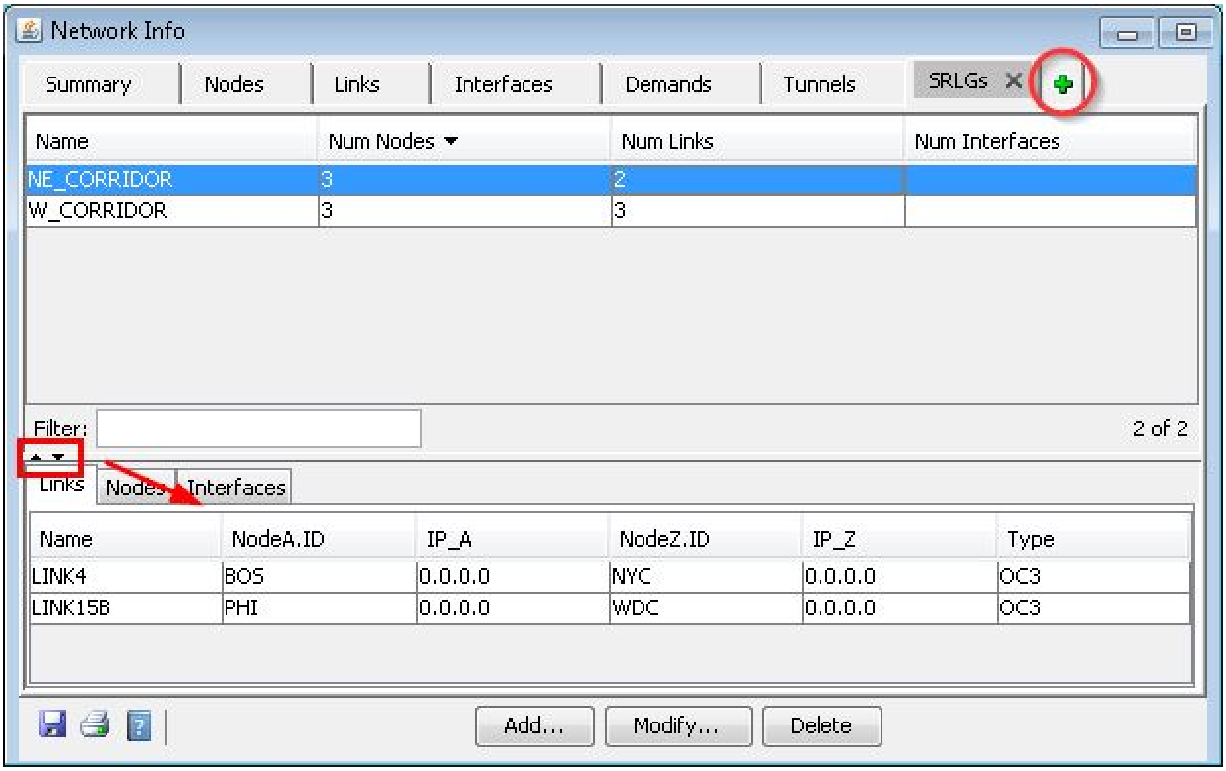
User parameters allow you to define their own parameters for sites. Before entering in values for site user parameters, these parameters must first be created under Modify > User Parameters, in the Site tab.

Network Menu: SRLG

The SRLG window provides a method of grouping links and/or nodes that are likely to fail together if they fail at all. The facility definition is used in failure simulations where accurate modeling requires the simultaneous failure of specific links and/or nodes. It can also be used for diverse path design where primary and backup paths for tunnels (Router model) or 1+1 demands (SONET model) are required to be routed on facility-diverse paths.

Facilities can be used to model SRLGs (shared risk link groups) when only specifying a group of links. If several links travel over the same fiber, so that a fiber cut will break all of them at once, it's good to define a facility containing those links. Facilities can also be used to group together links on the same card. Another example of a facility is the set of switches on one floor of a large data center, together with the links going into or out of that floor.

Figure 79: SRLG Window



- **Add:** Opens the Add Facility window which allows you to add a new facility and select the nodes and links that belong to the facility.

- **Modify:** Opens the Modify Facility window which allows you to modify the facility groupings. Use the mouse to highlight elements you desire to be in the selected facility. Deselect those elements to be removed from the facility. There are multiple ways to select elements. You can select nodes and/or links directly from the list provided. Click the first element and then <Shift>-click the last element to select a range of elements. <Ctrl>-click an element to toggle the selection of a particular element in the facility. Alternatively, to add elements from the map, highlight the nodes and links on the map (for example, selected by <Ctrl>-click or by drawing a box around a group of nodes and links) and then click.**Add from Map**. Another method is to click**Add Links from Filter** and then enter in advanced filtering criteria as described in the section Advanced Search in "Network Menu: Summary" on page 121.

- **Delete:** Deletes the selected facility group.

Network Menu: Owners

The Owners feature accessed by selecting **Network > Elements > Owners** allows you to display detailed circuit information for the currently defined owner groups. By right-clicking an Owner and selecting View Demands, information for the demands associated with the currently selected owner can be displayed.

This feature is useful for link ownership identification. By defining an owner and associating certain demands with that owner, the task of bandwidth reconciliation is simplified. Service providers that carry the traffic of several companies use the owner feature to quickly determine the distribution of traffic in the network. For example, a business owner demands 1.544 megabits/second bandwidth over a network. That business owner owns that 1.544 megabit demand. The Owners information window allows you to see how bandwidth in a network is allocated to all such business owners.

- **View Demands:** Selecting this button displays the View Demands window. This window will appear only if the selected owner group has been assigned to a demand.
- **Add:** Opens the Add Owner dialog box which allows you to specify the name of the new owner.
- **Delete:** Deletes the selected owner group.

Network Menu: Templates

Node Templates

The Node Template window accessed from Network > Elements > Element Templates > Node, allows you to create sets of default values to expedite the addition of nodes. Templates may be created and modified by you and then used while in the Add Node window.

- **Add:** Opens an Add Node Template window that allows you to add a new template.
- **Modify:** Opens the Modify Node Template window that allows you to modify the selected template.

Field	Description
Template Name	The name identifying the template. Template names must be unique.

(Continued)

Field	Description
Auto-Generate node ids	Generate the node ID using the specified prefix and number to create a unique node ID.
Prefix	Defined prefix for generating node IDs.
Start #	Number from which to start numbering generated node IDs. Example: If Prefix is set to "COR" and Start# "1", autogenerate node ID would create node ID "COR1", "COR2", "COR3", etc.
Auto-Generate node names	Generate the node name using the specified prefix and number to create a unique node name.
Prefix	Defined prefix for generating node names.
Start #	Number from which to start numbering generated node names. Example: If Prefix is set to "NODE" and Start# "1", autogenerate node names would create node ID "NODE1", "NODE2", "NODE3", etc.

Link Templates

The Link Templates accessed from Network > Elements > Element Templates > Link, allow you to create sets of default values to aid in the addition or modification of links. Templates may be created and modified by you and then used in the Add Link window. When saving the network environment, link templates are saved into the file linktemplate.*<runcode>*.

- **Add:** Opens an Add Link Template window that allows you to add a new template.
- **Modify:** Opens the Modify Link Template window to allow you to make modifications to the selected template. You should select the desired template for modification from the Template list found on the right of the Link Templates window.

Field	Description
Template Name	The name identifying the template. Template names must be unique.

(Continued)

Field	Description
Auto Generate Link names	Generate the link name using the specified prefix and number to create a unique link name.
Prefix	Defined prefix for generating link names.
Start #	Number from which to start numbering generated link names. Example: If Prefix is set to "LINK" and Start# "1", autogenerate node names would create node ID "LINK1", "LINK2", "LINK3", etc.

Demand Templates

The Demand Templates accessed from Network > Elements > Element Templates > Demand, allows you to create sets of default values to aid in the addition or modification of demands. Templates may be created and modified by you and then used in the Add Multiple Demands windows.

- **Add:** Opens an Add Demand Template window that allows you to add a new template.
- **Modify:** Opens the Modify Demand Template window that allows you to modify the selected template.

Field	Description
Template Name	The name identifying the template. Template names must be unique.
Owner	Select a owner for this demand. Ownership is defined in the Owners option of the Modify menu.
Count	Specifies the count of the demand.
BW	Specify the bandwidth required by the demand. Demand overhead is automatically calculated by the program.
Type	Indicates the type of the demand.

(Continued)

Field	Description
pri,pre	The priority field of the circuit specification consists of two numbers separated by a comma (,), or a forward-slash (/). The first number defines the call priority of the circuit, and the second number the preempt priority of the circuit. The preempt priority should be at the same or lower priority as the call priority of the circuit. It is assumed that this circuit can bump any of the circuit with call priority lower than the preempt priority.
comment	Specify any comments you may wish to enter.

Tunnel Templates

The Tunnel Templates accessed from Network > Elements > Element Templates > Tunnel, allows you to create sets of default values to aid in the addition or modification of tunnels. Templates may be created and modified by you and then used in the Add Multiple Tunnels windows. The tunnel template is similar to the demand template, but includes some tunnel-specific properties in the Type field. Refer to the *Paragon Planner User Guide* for more details on these settings.

Network Menu: OSPF Areas/Domains

The OSPF Areas/Domains option allows you to view existing area or domain definitions. Depending on the hardware type, this option will appear as either “area” or “domain”. They both have the same options, so for the sake of simplicity in this document, we will refer to “area” only. Keep in mind that it also applies to domains.

Areas are network partitions designed to make the network more scalable. Network summary information is exchanged between two areas through gateways.

When you select **Network > Protocols> OSPF Areas**, the Areas information window will appear. The first table displays the current area definitions while the second table lists the nodes and links in the currently selected area.

- **Node Details:** When this menu is selected, the Nodes view will appear and display information regarding the nodes in the selected domain/area.
- **Link Details:** When this menu is selected, the Links view window will appear and display information regarding the links in the selected domain/area.
- **Create Group:** This menu will create a group for the nodes in the selected area.

- **Add:** Opens dialog at the top of the window which allows you to add a new domain/area.
- **Delete:** Deletes the selected area in this window.

Link OSPF Settings

To enable OSPF for a link and to specify an area for a link, modify a link from the Links window by selecting **Modify > Links**. In the Protocols tab, set OSPF to “yes” and select an Area.

Network Menu: QoS Manager

The Quality of Service Manager displays CoS Forwarding Classes, CoS Policies, and Rate Limit Policies in the network. Use the left-panel to navigate through the tree view structure. The Summary view displays the total number of forwarding classes, CoS policies, nodes with CoS policies, rate limit policies, and nodes with rate limit polices. For more details on using Class of Service see the *Paragon Planner User Guide*.

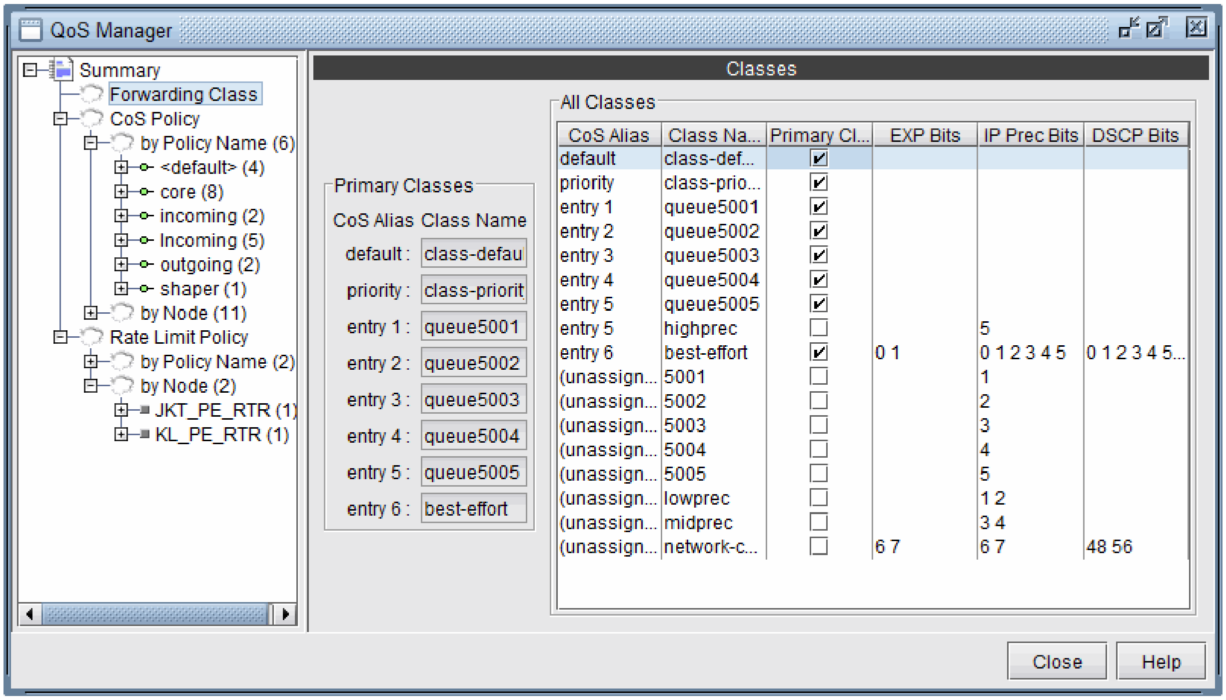
NOTE: The maximum number of supported CoS classes is eight.

The Forwarding Class displays a list of the classes, CoS alias, primary classes, EXP bits, IP Prec bits, and DSCP bits.

The CoS Policy displays a list, grouped by policy name or grouped by node, of the nodes, policy names, policy types, and class mapping status. The Properties tab displays the class weight or bandwidth, PIR, and Queue size of the node. The Interfaces tab displays the interfaces with the polices of the node.

The Rate Limit Policy displays a list, grouped by policy name or grouped by node, of the policy name, node name, classifier, number of interfaces, CIR, BC, PIR, BE, conformed action, exceed action, and violate action. The Interfaces tab displays the interfaces with the policies of the node. The Configlet tab displays the policy statements in the configuration file of the node.

Figure 80: QoS Manager



Network Menu: Service Type

The Service Type window accessed from the main menu Network > More > Service Type displays a list of service types defined by you. Service types are defined by you to be used as a template when demands are created or modified. Once a service type is created, you can select it to populate all the demand parameter fields when creating demands.

- **Add:** Opens the Add Service Type window to create a new service type.
- **Modify:** Opens the Modify Service Type window to modify the selected existing service type.
- **Delete:** Deletes the selected service type from the network model.

Field	Description
Name	Displays the name of the service type. This name is specified by you.

(Continued)

Field	Description
Owner	Displays the owner for this demand. Owners are defined by selecting **Modify > Owners**.
Min, Max BW	These fields are only used with the Demand Generation feature (Traffic > Demand Generation > General), during which newly generated demands of the given service type are ensured to have a bandwidth between Min BW and Max BW. That is, a very large generated demand is split into smaller pieces with a maximum bandwidth of Max BW.
BW	Displays the bandwidth required by the demand. Demand overhead is automatically calculated by the program.
Type	Indicates the type of the demand for this service type.
pri,pre	The priority field of the circuit specification consists of two numbers separated by a comma (,), or a forward-slash (/). The first number defines the call priority of the circuit, and the second number the holding priority of the circuit.
Misc	Miscellaneous information that might be included in the service type file.
Comment	Comments regarding this service type.
Services	This section displays all service types that have been defined by you.

Network Menu: Admin Weight

The Admin Weight window accessed from the main menu Network > More > Admin Weight displays rules that can be used to set the default administrative weight (or link metric) for links to influence routing. Note that the specification of administrative weights in this window is overridden by distances explicitly set in the bblink file or linkdist file.

1. You must first specify criteria to match a desired set of links, such as protocol and end node types.

2. Then, you should specify the values of the weight variables. The fixed and variable weights determine how the link's administrative weight is calculated. The formula is: Admin Weight = Fixed Weight + (Link Mileage * Variable Weight)

   where Link Mileage is calculated by Paragon Planner and is always in miles. Link Mileage is based upon the "airline mileage", or geographical distance between two points. The distance between two nodes is calculated based upon the coordinates in the muxloc file. The coordinates may be derived from the NPA NXX values (for the United States and Canada) or latitude and longitude values.

> **NOTE**: If the muxloc file does not contain any coordinates, this will lead to unpredictable results in the Admin Weight calculations.

- **Add:** Opens the Add Admin Weight window which allows you to add a new administrative weight rule to the network. the selected administrative weight rule(s).
- **Modify:** Opens the Modify Admin Weight window which allows you to modify the selected administrative weight rule(s).
- **Delete:** Deletes the selected administrative weight rule(s) from the network.

Network Menu: Path and Capacity

The Path and Capacity feature allows you to quickly determine whether sufficient bandwidth exists in the network to place additional user demands. The program can determine both straight path placement and diversity path placement for mission-critical traffic. When the Path & Capacity option is selected from the Network menu, the following submenu is displayed.

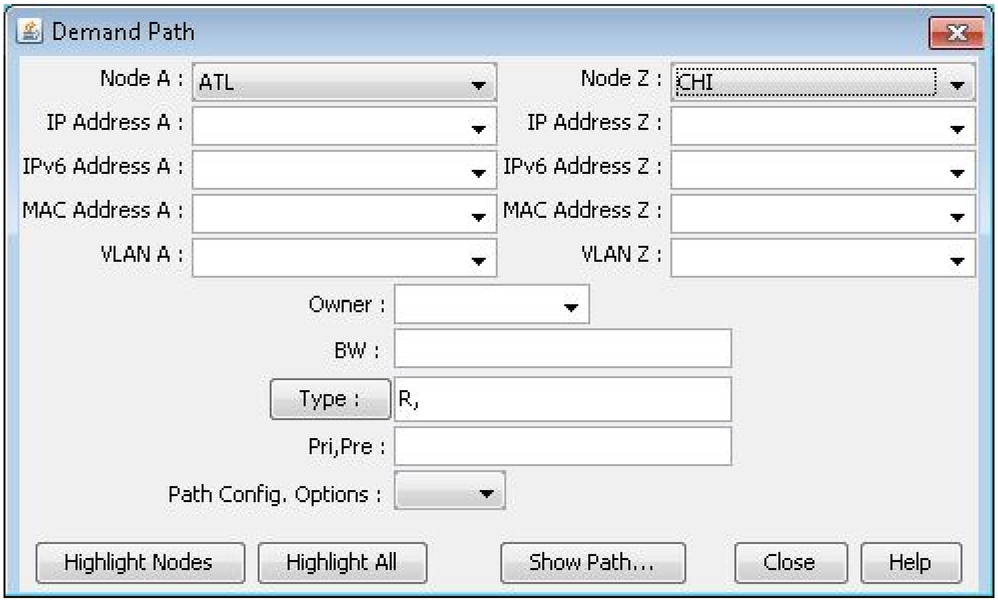
Field	Description
Path	This option is used to determine if there is enough bandwidth for a circuit to be routed between a given pair of nodes. These nodes can be selected by using the drop-down combo boxes in the Demand Path window or by clicking the left mouse button on two nodes in the map window. To see if a path exists, click on the Show Path button. If BW is not specified, then the default BW is 8000

(Continued)

Field	Description
Paths AZ + ZA (Router-only)	This option, available for Router networks, displays a round-trip path between a given pair of nodes. The paths from Node A to Z and from Node Z to A may differ because of asymmetric link costs/metrics, which may or may not be desirable. Select the end nodes by using the drop-down selection boxes in the Demand Paths AZ + ZA window or by clicking the left mouse button on two nodes in the map window. Use the Round Trip Paths window to zoom into a segment of the path in either direction.
Diverse Path	This option is used to find out if there is enough bandwidth to route two circuits in node disjoint paths between a given pair of nodes. These nodes can be selected by using the drop-down combo boxes in the Demand Path window or by clicking the left mouse button on two nodes in the map window. If it cannot find node disjoint paths, the program will look for edge disjoint paths. If it fails to find edge disjoint paths, it will search for paths with a minimum number of common nodes or edges.
Site Path	This option is used to find out if there is sufficient bandwidth to route a path between two selected sites. You will first be prompted to select two nodes. These nodes can be selected by using the drop-down combo boxes in the Demand Path window or by clicking the left mouse button on two nodes in the map window. It will then check to see if there is enough bandwidth to place a path between the sites where the two nodes are located.
Site Diverse Path	This option is used to determine if two node disjoint paths exist between sites.
Equivalent Path	This option sets each virtual circuit, as well as its assigned QoS, bandwidth, and calculated equivalent capacity. This option is only available for router networks.

Selecting any of the Path & Capacity options displays a window similar to the following which will allow you to select two nodes for the program to demand sufficient bandwidth between them.

Figure 81: Window for Viewing Capacity



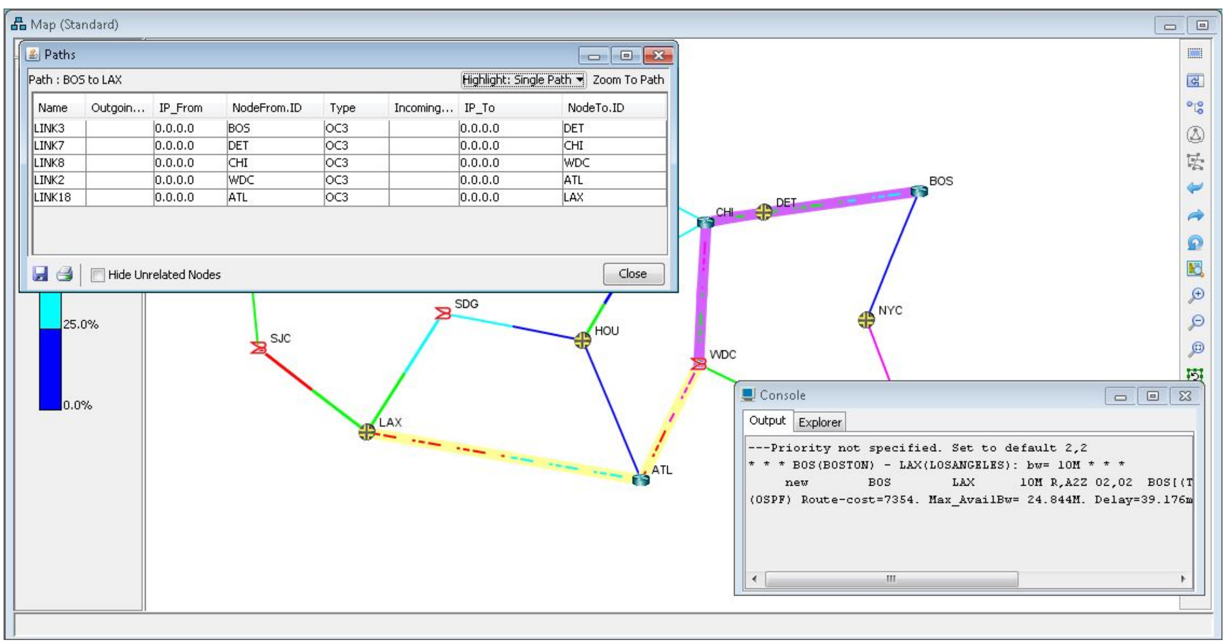
Field	Description
Node A and Z	Source and destination endpoints of the path analysis
IP Address A and Z	Source and destination IPv4 addresses. You should enter an IP address that corresponds to one of the node's IP addresses or its interface's IP addresses
IPv6 Address A and Z*	Source and destination IPv6 addresses.
Owner	Selecting an owner or VPN allows you to limit the nodes that are in the Node A and Node B combo boxes to those with the selected owner/VPN.
BW	Specifies the bandwidth of the demand. The program will check if there is sufficient capacity to route a demand of this size. Note: For ATM networks, the bandwidth should only include the payload (not the overhead).
Type	The type field is a field from the demand file. Clicking the Type button will bring a window to select specific options. Options vary by hardware.

(Continued)

Field	Description
pri,pre	Priority and preempt priority values for the demand
Highlight Nodes	Highlights the selected nodes A and Z on the topology map.
Highlight All	Highlights all of the nodes in the network on the topology map.
Show Path	Checks the path of a demand from node A to node B with the specified demand properties and opens a Path Table showing each hop of the demand's path.

The following window appears after performing a path analysis, indicating details about each step of the path:

Figure 82: Paths Window



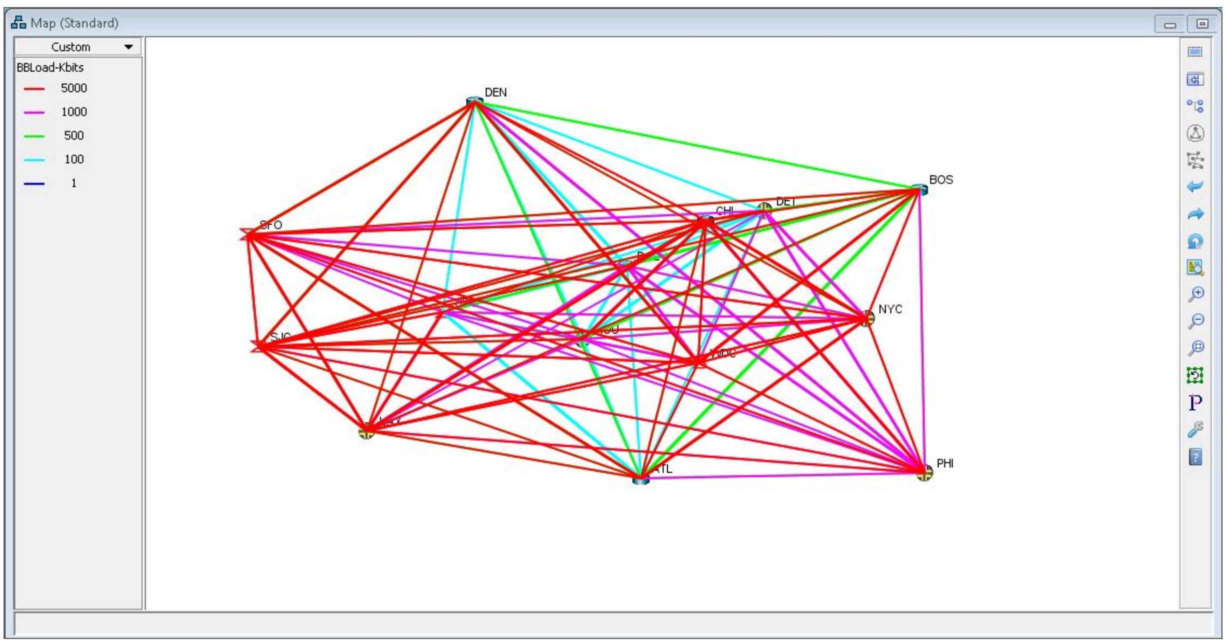
- Select **Hide Unrelated Nodes** to show on the map only those nodes and links along the path.
- Select **Highlight Single Path** and select **Clear Path Highlights** to turn off the path highlight on the map.
- The Console displays information from the path analysis.

- The Map displays the path route.

Network Menu: Show Site Demands

The Show Site Demands option is available from Network > Elements > Demands. Right-click on a demand and select **Show Site Demands** to display the site-to-site demands on the map. The program calculates the total demand between two nodes and draws a line connecting them according to the colors described in the “BBload-Kbits” legend, which is displayed in one of the tab menus in the left pane of the topology window.

Figure 83: Viewing Site Demands



This view of the topology map is useful since it provides the use a visual picture of the demands found in the network. The utilization of each demand in displayed according to the color found in the legend.

Network Menu: Aggregate Demands/Tunnels

The Aggregate Demands feature is accessible through Network > Elements > Demands. Right-click on a demand and select **Aggregate Demands**. For each pair of nodes A and Z in the network, the Aggregate

Demands function adds up the total bandwidth of all the demands starting at originating nodes A and destination nodes Z. Aggregate Demands then presents a table with one row for each node pair, showing A, Z, and the total bandwidth. The demands are sorted by bandwidth, the largest at the top.

NOTE: For MPLS-enabled networks, there is a similar Aggregate Tunnels feature, accessible by selecting **Network > Elements > Tunnels**. Right-click on a tunnel and select **Aggregate Tunnels**. While reading this section, simply replace each occurrence of “demand” with “tunnel”.

Field	Description
Combine A-Z with Z-A	When this option is checked, the row for A-Z includes the demands from Z to A as well as A to Z. If it is not checked, there is one row for A-Z and one for Z-A.
Place demands only	When this option is checked, Aggregate Demands will only add up demands that have been placed by the program in the current network model.
Show at most	A network can have hundreds of thousands of node pairs. This option lets you see a manageable number of the heaviest pairs of nodes.

After specifying the Aggregate Demands parameters, the aggregated demand bandwidth is presented in a table form.

- **Highlight All:** This function highlights all node pairs in this table on the topology map.
- **Report:** This function saves the aggregate demands in a report on the server and client machines.

8

CHAPTER

Design Menu

Design Menu Overview

The Design menu allows you to access functions related to the backbone topology of the network. You can perform demand and tunnel path design, rerouting, sizing; and network resizing, optimization and analysis.

For information about FRR Design, Tunnel Sizing, T-Solve, and Auto Tunnel Design see the *Paragon Planner User Guide*.

Design Menu: Backbone Design

IN THIS SECTION

Resize

The Design > Backbone > Resize option may be used to tune and optimize the current backbone topology. Links can be resized based on normal link utilization or peak link utilization based on failure simulation results. When the resize option is performed, Paragon Planner replaces links in the network based on the Link Type Candidate in the Tools > Options > Resize window.

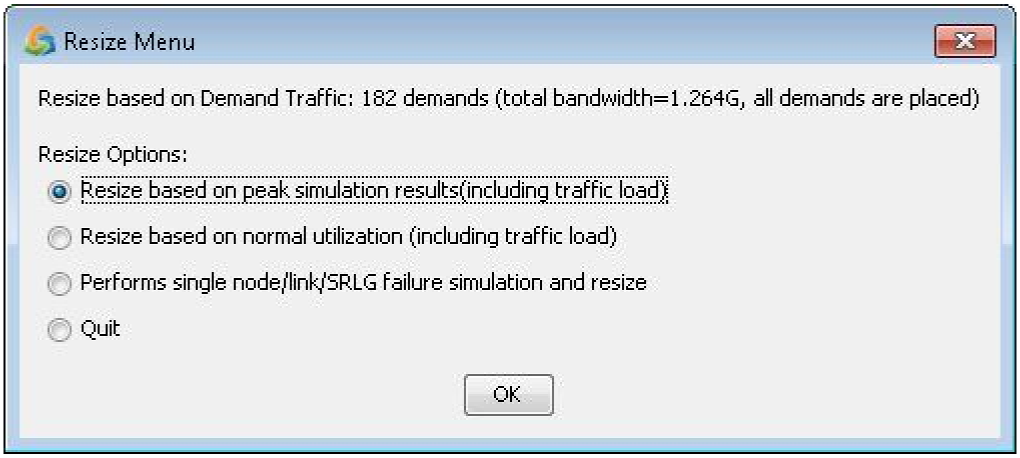
- **Types in Tariff:** Valid link types are taken from the current tariff table
- **AGGR(xGb):** Valid link types are based on multiples of 1G with default set to 10G.

Once you have selected the valid link types for the resize, you can choose to resize based on

- The peak link utilizations of the latest failure simulation performed
- The current link utilization when not under failure

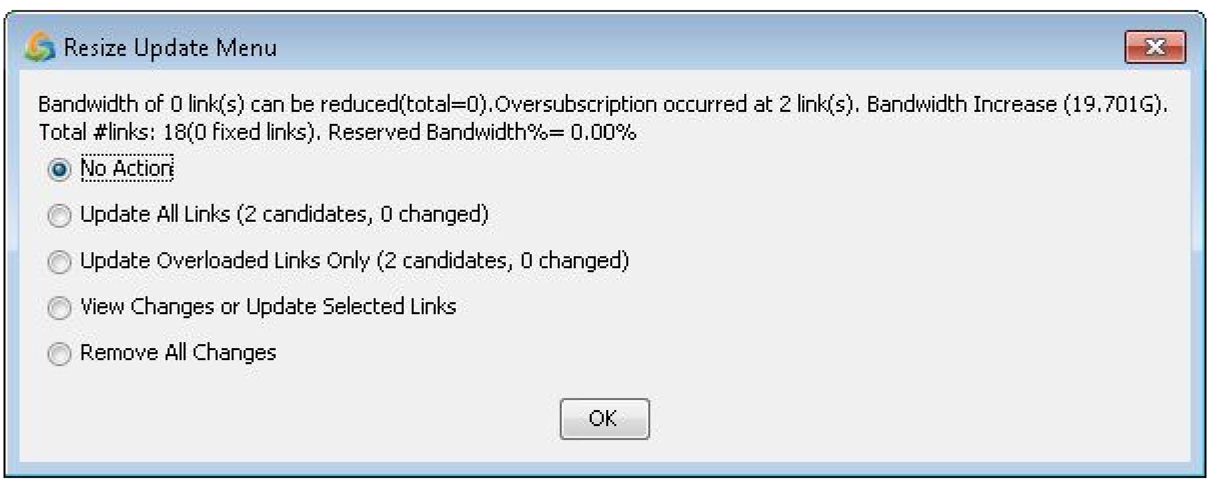
- You can also automatically run exhaustive failure simulation for nodes, links, and SRLGs, and then resize the links accordingly.

Figure 84: Resize Options



Make your selection (or select **Quit** to cancel). Then click the **OK** button. The following window will provide resize recommendations based on the previously selected Resize options.

Figure 85: Resize Recommendations

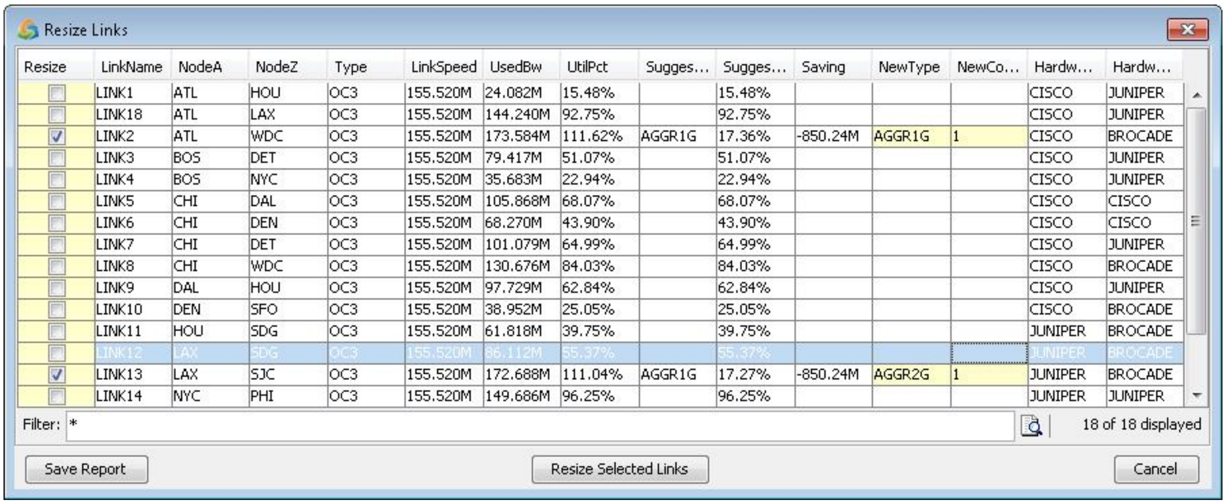


The choices are as follows:

- No Action
- **Update All Links:** Update all links' trunk types based on recommendations

- **Update Overloaded Links Only:** Update only the links' trunk types which have utilization above 100%. In other words, trunk types will only be upgraded to higher bandwidths and not downgraded.
- **View Changes or Update Selected Links:** Manually select which links are to be resized.
- Remove All Changes resets the links trunk types back to their original size.

Figure 86: Resize Links



Resize	LinkName	NodeA	NodeZ	Type	LinkSpeed	UsedBw	UtilPct	Sugges...	Sugges...	Saving	NewType	NewCo...	Hardw...	Hardw...
[ ]	LINK1	ATL	HOU	OC3	155.520M	24.082M	15.48%		15.48%				CISCO	JUNIPER
[ ]	LINK18	ATL	LAX	OC3	155.520M	144.240M	92.75%		92.75%				CISCO	JUNIPER
[x]	LINK2	ATL	WDC	OC3	155.520M	173.584M	111.62%	AGGR1G	17.36%	-850.24M	AGGR1G	1	CISCO	BROCADE
[ ]	LINK3	BOS	DET	OC3	155.520M	79.417M	51.07%		51.07%				CISCO	JUNIPER
[ ]	LINK4	BOS	NYC	OC3	155.520M	35.683M	22.94%		22.94%				CISCO	JUNIPER
[ ]	LINK5	CHI	DAL	OC3	155.520M	105.868M	68.07%		68.07%				CISCO	CISCO
[ ]	LINK6	CHI	DEN	OC3	155.520M	68.270M	43.90%		43.90%				CISCO	CISCO
[ ]	LINK7	CHI	DET	OC3	155.520M	101.079M	64.99%		64.99%				CISCO	JUNIPER
[ ]	LINK8	CHI	WDC	OC3	155.520M	130.676M	84.03%		84.03%				CISCO	BROCADE
[ ]	LINK9	DAL	HOU	OC3	155.520M	97.729M	62.84%		62.84%				CISCO	JUNIPER
[ ]	LINK10	DEN	SFO	OC3	155.520M	38.952M	25.05%		25.05%				CISCO	BROCADE
[ ]	LINK11	HOU	SDG	OC3	155.520M	61.818M	39.75%		39.75%				JUNIPER	BROCADE
[ ]	LINK12	LAX	SDG	OC3	155.520M	86.112M	55.37%		55.37%				JUNIPER	BROCADE
[x]	LINK13	LAX	SJC	OC3	155.520M	172.688M	111.04%	AGGR1G	17.27%	-850.24M	AGGR2G	1	JUNIPER	BROCADE
[ ]	LINK14	NYC	PHI	OC3	155.520M	149.686M	96.25%		96.25%				JUNIPER	JUNIPER

The Resize Links windows allows manually selecting the links to be resized. Once a row is selected, the columns at right are activated so that the trunk type (NewType) and count (NewCount) can be modified if necessary. Then select **Resize Selected Links**. In the subsequent window, click Quit to exit from the main menu. The trunk types of the selected links are then resized.

Route Paths

Route From Scratch

The Design > Demands > Route Paths > Route From Scratch option removes demand path placements from the network and reroutes all the demands from scratch in sequential order. The Design > TE Tunnels > Route Paths > Route From Scratch option works similarly but for TE Tunnels.

Tuning

With the current paths remaining in place, the Tuning option performs a local optimization of path placement on the network. If there is sufficient bandwidth, path placement is performed on the network for the selected paths:

Tune All Paths

The program will try to place unplaced demands and improve on already placed paths.

Tune Unplaced Paths

The program will try to place only unplaced demands.

Restore

Resets the paths of demands as specified in the input demand file.

Remove

Removes all placed demands from the network.

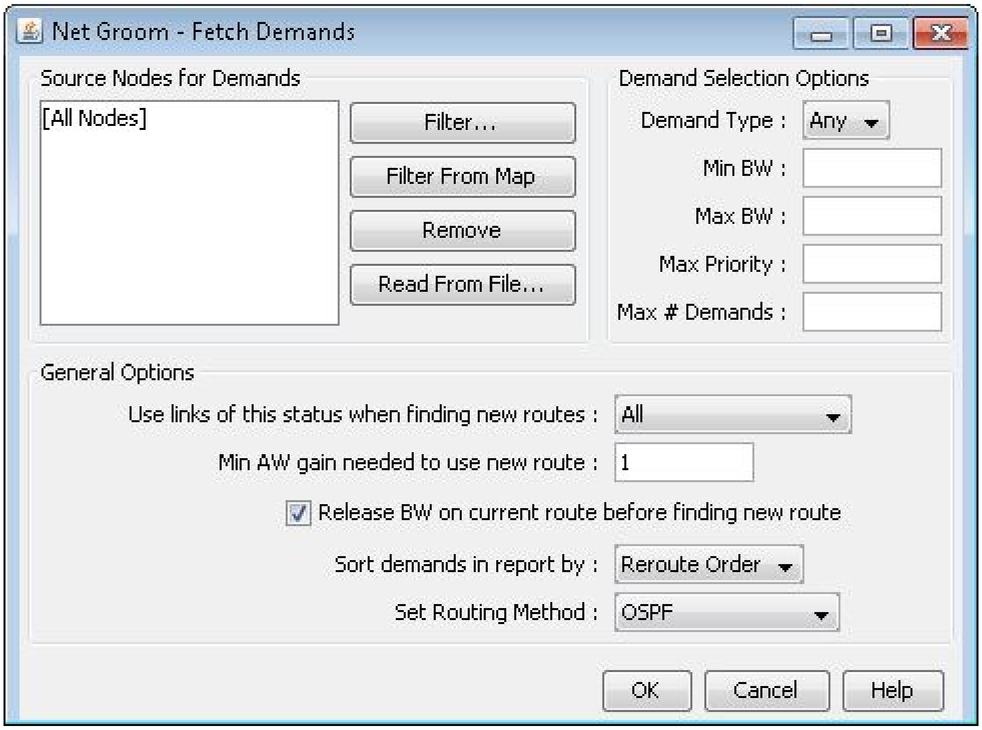
Remove Configured Paths

Removes all configured paths (Path Select, Path Required) and reroutes them dynamically.

Design Menu: Net Groom

Due to the dynamic rerouting of demands/designs during node or link failures, demand placement in the network may gradually become sub-optimal. The Design > Demands > Net Groom and Design > TE Tunnels > Net Groom option finds the best path for each demand (or tunnel) using existing network bandwidth (without preemption) and displays these demands. Net Groom reroutes paths to minimize the distance metric of the paths using available bandwidth in the network.

Figure 87: Net Groom - Fetch Demands Window



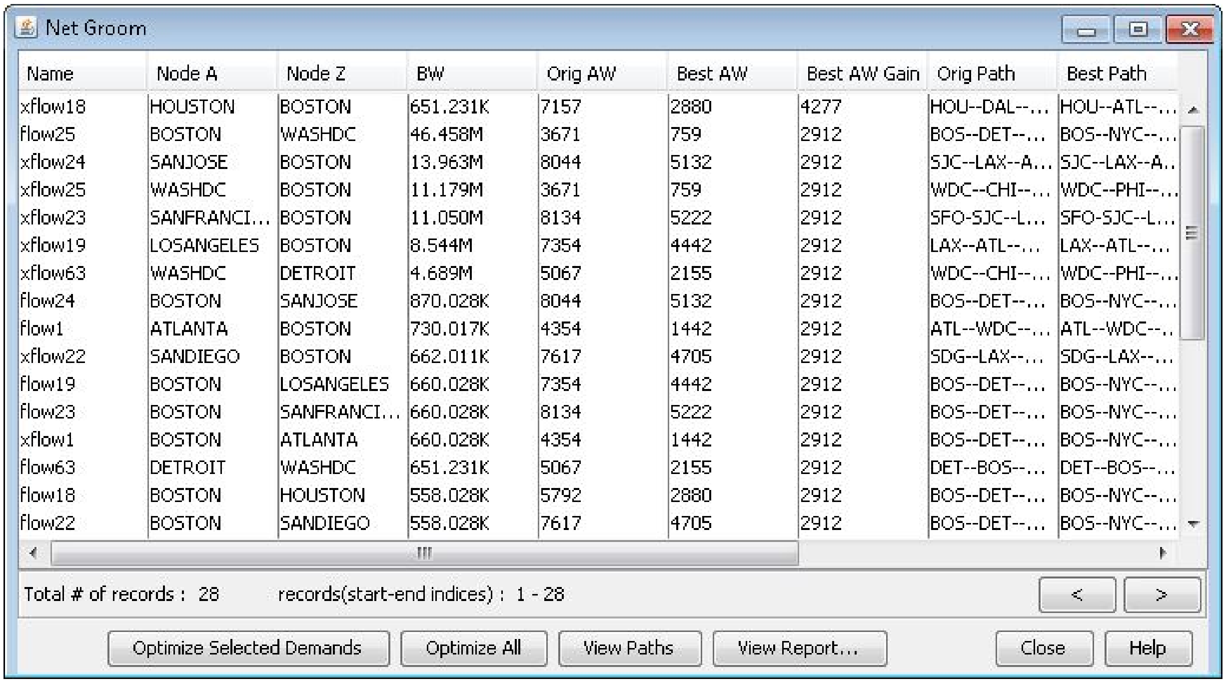
- Filter: Opens the Find Nodes window which allows user to select nodes based on various parameters and add them to the list of nodes for net groom.
- Filter From Map: Adds the selected nodes from the Map window to the list of nodes for net groom.
- Remove: Removes the selected node(s) from the list of nodes for net groom.
- Read From File: Allows user to import a list of source nodes for the demands from a file on the server. The format of this file is simply a list of node IDs - one per line.
- Set Routing Method: Brings up the console and allows you to specify which variables to use when calculating optimal placement of demands.
- OK: Applies the current settings and brings up the Net Groom window.
- Close: Closes the window and discards all settings.
- Help: Directs you to the online help documents for this window.

Field	Description
Demand Type	Specifies the type of demand to optimize

(Continued)

Field	Description
Max BW	Specifies the maximum bandwidth of demands to optimize
Max Priority	Specifies maximum priority of demands to optimize
Use links of this status when finding new routes	Selects which types of links to use when optimizing demands.
Min AW gain needed to use new route	Any demands that will not achieve a gain in admin weight larger than this value when optimized will not be optimized
Release BW on current route before finding new route	Specifies whether or not the original path of the demand being optimized is factored into the network when optimizing a demand
Sort demands in report by	Specifies how the demands are sorted when a report is generated on the optimized demands.

Figure 88: Net Groom Window After Optimization


Net Groom

Name	Node A	Node Z	BW	Orig AW	Best AW	Best AW Gain	Orig Path	Best Path
xflow18	HOUSTON	BOSTON	651.231K	7157	2880	4277	HOU--DAL--...	HOU--ATL--...
flow25	BOSTON	WASHDC	46.458M	3671	759	2912	BOS--DET--...	BOS--NYC--...
xflow24	SANJOSE	BOSTON	13.963M	8044	5132	2912	SJC--LAX--A...	SJC--LAX--A..
xflow25	WASHDC	BOSTON	11.179M	3671	759	2912	WDC--CHI--...	WDC--PHI--...
xflow23	SANFRANCI...	BOSTON	11.050M	8134	5222	2912	SFO-SJC--L...	SFO-SJC--L...
xflow19	LOSANGELES	BOSTON	8.544M	7354	4442	2912	LAX--ATL--...	LAX--ATL--...
xflow63	WASHDC	DETROIT	4.689M	5067	2155	2912	WDC--CHI--...	WDC--PHI--...
flow24	BOSTON	SANJOSE	870.028K	8044	5132	2912	BOS--DET--...	BOS--NYC--...
flow1	ATLANTA	BOSTON	730.017K	4354	1442	2912	ATL--WDC--...	ATL--WDC--..
xflow22	SANDIEGO	BOSTON	662.011K	7617	4705	2912	SDG--LAX--...	SDG--LAX--...
flow19	BOSTON	LOSANGELES	660.028K	7354	4442	2912	BOS--DET--...	BOS--NYC--...
flow23	BOSTON	SANFRANCI...	660.028K	8134	5222	2912	BOS--DET--...	BOS--NYC--...
xflow1	BOSTON	ATLANTA	660.028K	4354	1442	2912	BOS--DET--...	BOS--NYC--...
flow63	DETROIT	WASHDC	651.231K	5067	2155	2912	DET--BOS--...	DET--BOS--...
flow18	BOSTON	HOUSTON	558.028K	5792	2880	2912	BOS--DET--...	BOS--NYC--...
flow22	BOSTON	SANDIEGO	558.028K	7617	4705	2912	BOS--DET--...	BOS--NYC--...

- **Optimize Selected Demands:** Optimizes the selected demands.
- **Optimize All:** Optimizes all demands in the table, including those not shown on the current page.
- **View Paths:** View the original, best, and new (if demand is optimized) paths of the selected demand
- **View Report:** Brings up a report window detailing the optimized demand weights and paths.
- **Close:** Closes the window.
- **Help:** Directs you to the help documents for this window.

Field	Description
Name	The name of the demand
Node A	The source node of the demand
Node Z	The destination node of the demand
BW	Total bandwidth of the demand

(Continued)

Field	Description
Orig AW	The admin weight of the demand prior to optimization
Best AW	The best possible admin weight for the demand if there were no other demands in the network
Best AW Gain	The difference between Orig AW and Best AW
New AW	The optimal admin weight for the demand, taking into account the other demands in the network.
AW Gain	The difference between Orig AW and New AW
Orig Path	The original path of the demand
Best Path	The best possible path of the demand if there were no other demands in the network.
New Path	The optimal path for the demand, taking into account the other demands in the network.

After a Net Groom session has been performed and the network has been saved, the following parameters are added into the network's dparam file:

- netgroom_demandtype
- netgroom_maxpriority
- netgroom_minawgain
- netgroom_linkstatus
- netgroom_releasebw
- netgroom_reportorder

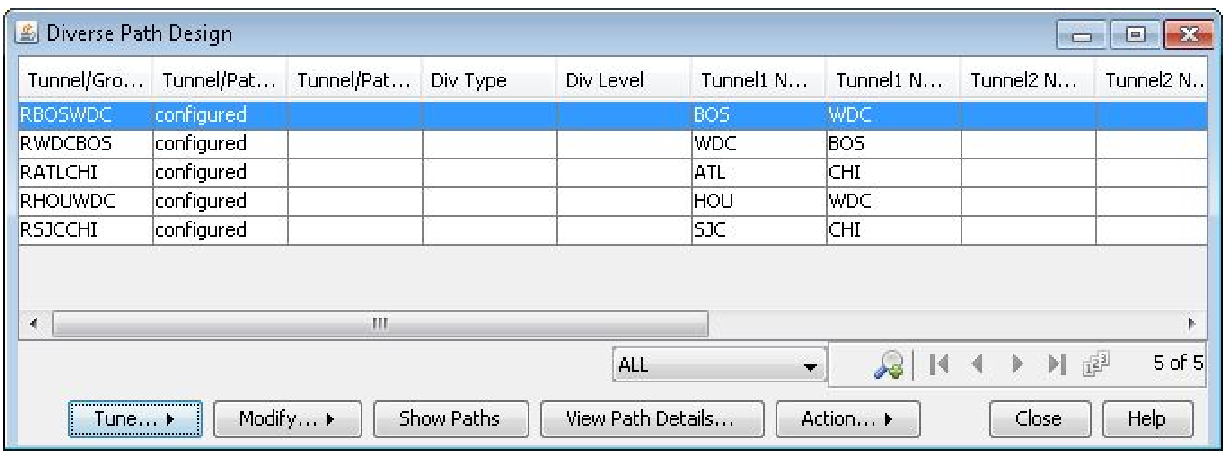
Path Diversity Design

Use Path Diversity Design by selecting **Design > Demands > Path Design** or **Design > TE Tunnels > Path Design** to automatically configure two paths to be on diverse routes. This feature is available for demand paths in ATM networks and Optical Transport networks, as well as LSP tunnel paths in MPLS-enabled networks.

For MPLS-enabled networks, refer to the Path Diversity Design chapter of the *Router Feature Guide for Paragon Planner* for more information on adding diverse standby and secondary paths.

After selecting **Design > Demands > Path Design** or **Design >TE Tunnels > Path Design**, the Diverse Paths window is opened with a list of demands (for ATM/optical networks) or tunnels (for IP/MPLS networks) that have diversity requirements.

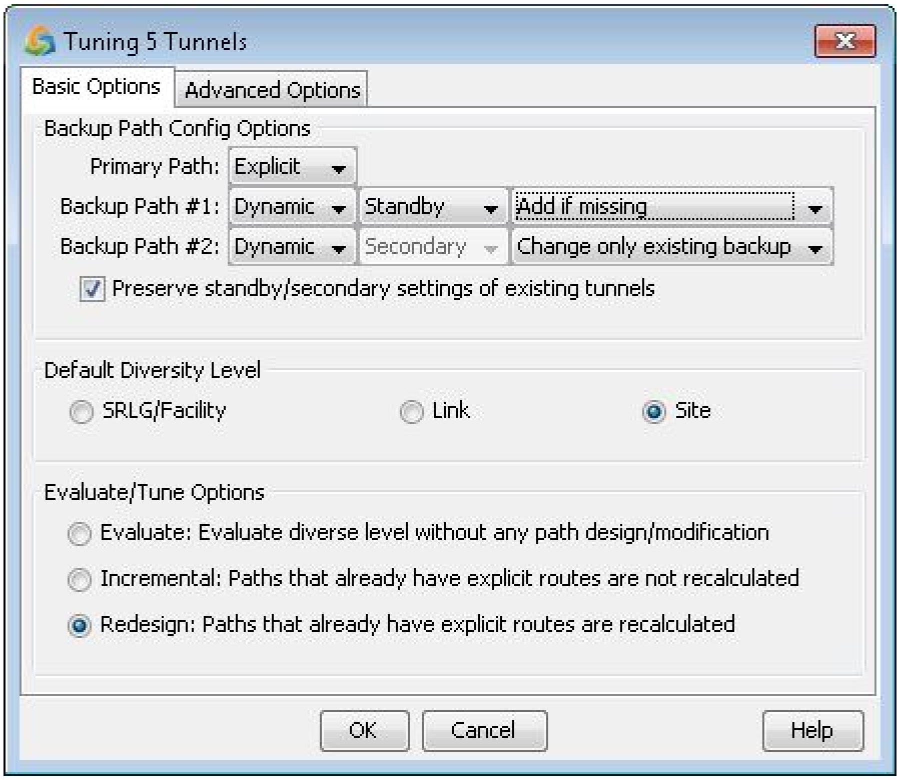
Figure 89: Diverse Paths Window



Tune

- To perform a diversity design, either select **Tune > All Paths** to design on all entries, or **Tune > Selected Paths** to tune the diversity for only selected entries.
- A sort can be performed on the Actual Div Level column to tune only entries that are not at the desired diversity level. A new placement is considered better than an old placement if either of the following conditions is true:
  - The new placement is at a higher diversity level than the old placement, or
  - The new placement is at the same diversity level as the old placement, but the total length of the new path is less than the total length of the old path.

Figure 90: Diverse Path Design Window

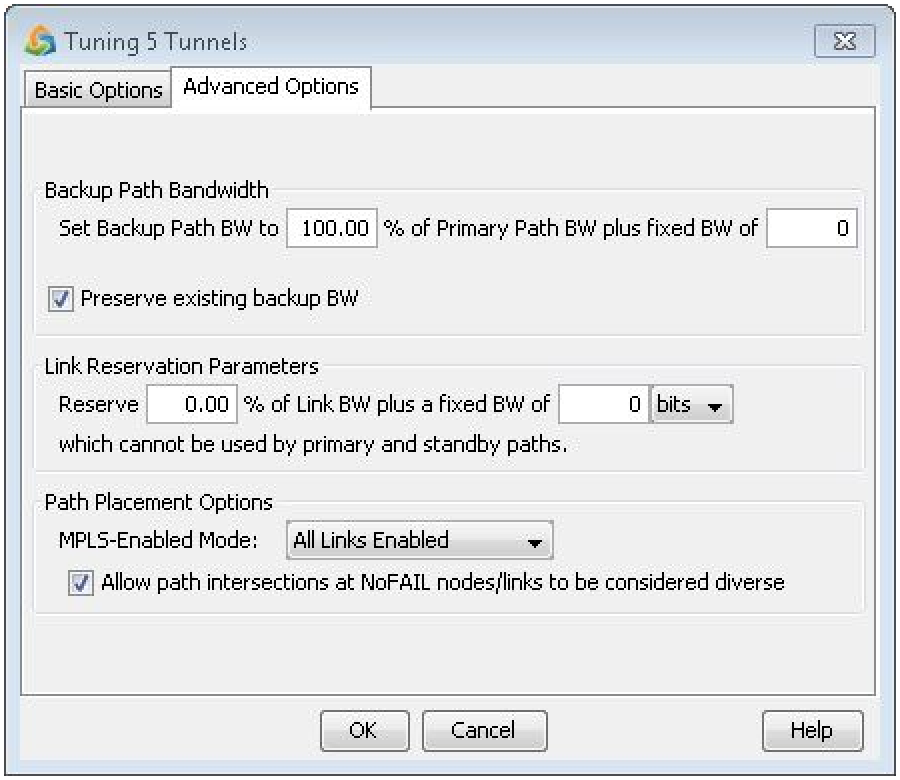


Field	Description
Default Diversity Level	Indicate the default level of path diversity to aim for. Available options include facility, link, or site ("divgrouplevel" in the dparam file). Note: For IP/MPLS networks, the targeted diversity level can be set on a per-tunnel basis by modifying the Tunnel Type Parameter window, Diversity tab, and will override the default for those particular tunnels.

(Continued)

Field	Description
Backup Path Config Options	(Router only) Indicate how many backup paths you want to add by selecting **Add if missing** for the backup paths you would like to add. Additionally, select the type of backup path to add (standby or secondary) and whether it should be Dynamic (loose) or Explicit (strict/nailed-down routing). • Selecting **Add if missing** creates new backup paths and modify existing backup paths. Selecting **Change only existing backup** only modifies existing backup paths. • Select **Preserve secondary/standby settings of existing tunnels** to prevent existing backup paths from changing the backup path type from secondary to standby or from standby to secondary. This option should usually be checked, in which case the backup path type settings only applies to added backup paths. To specify a requirement for tertiary diverse paths, select **Add if missing** and **Explicit** for both Backup Path #1 and Backup Path #2.
Path Config. Options	Options may vary according to hardware type. • Remove configured paths before tuning: Select this in order to allow modification of already existing paths. If a path is set to required, the program will not attempt to find a path satisfying diversity even if that path does not already satisfy diversity. If you change the current paths from Required to Preferred, the program can change the path, if necessary to satisfy diversity. • Mark new paths as configured: After the paths are designed, the resulting path are marked as path required (corresponds to PR flag in the demand type field). Recall that a required path, as opposed to a “preferred” path, will only route on the specified path. If that path is not available, the demand/tunnel is not placed. • Mark new paths as preferred: After the paths are designed, paths are marked as path preferred (corresponds to PS flag in the demand type field). **NOTE**: If you do not mark a secondary path configured or preferred, the current path specification will not be recorded when you save the demand/tunnel file or network environment. If you choose not to mark it configured or preferred at this time, you can still do so afterwards through the Design > TE Tunnels > Route Paths > Interactive Mode menu (option Update Preferred Path Setting, 3. Use current routes as preferred/required routes). (On the contrary, the current path specification with standby paths are recorded even if not configured because they are given separate demand/tunnel entries of their own.)

Figure 91: Advanced Options

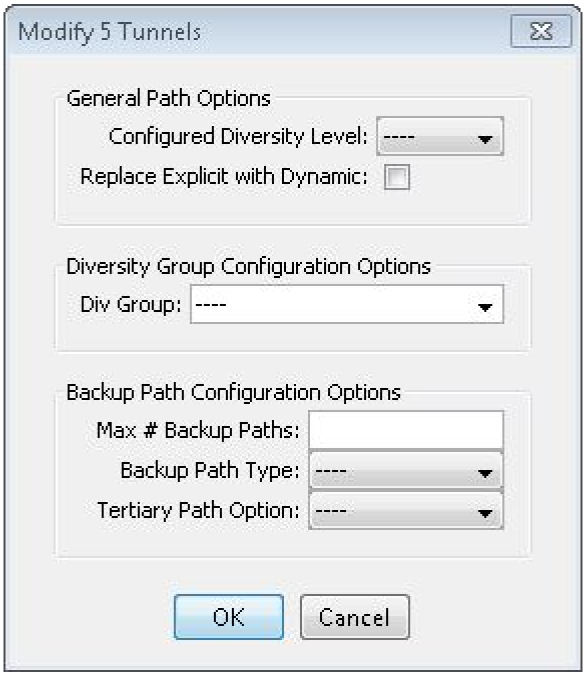


Field	Description
Backup Path Bandwidth	The backup path’s bandwidth can be configured as a percentage of the primary path bandwidth plus a fixed bandwidth,
Link Reservation Parameters	This specifies how much bandwidth is already reserve as a percentage of the link’s bandwidth (fat %) plus a fixed bandwidth (fatpct and fixfat in the dparam file). This information is for reference only. To modify it, select **Tools > Options > Design**, Reserved Bandwidth options pane.
Path Placement Options	MPLS-Enabled Mode sets all links to be mpls enabled or uses the current mpls settings defined on each link. • Option to allow path intersections at No FAIL nodes and links to be considered diverse. The No FAIL flag on nodes and links can be set in Modify mode by setting Fail=0 toTrue.

Modify Options

To modify tunnel backup paths or diversity requirements, select **Modify > All Paths** or **Modify > Selected Paths.**

Figure 92: Path Design: Tunnel Modification



Field	Description
General Path Options	Use the Configured Diversity Level menu to specify per tunnel diversity level requirements. This will override the Default Diversity Level. • Select **Replace Explicit with Dynamic** to change the primary tunnel from an explicit to a dynamic route.
Diversity Group Configuration Options	Demands or tunnels in the same Diversity Group are paired off and then designed for diversity. Select a name for the Div Group. • The special Div Group SITEPAIR is a reserved group. For demands or tunnels in the group SITEPAIR, those sharing the same source and destination sites are paired together.

(Continued)

Field	Description
Backup Path Configuration Options	The “Max # Backup Paths” specifies can be used to limit the number of backup paths. For example, specifying a Max # Backup Paths of 0 will delete all the backup paths for the existing tunnel. • Use the “Backup Path Type” option to specify per tunnel backup path type requirements (for example, Standby vs. Secondary). This will override the Default Backup Type. • Use the “Tertiary Path Option” to specify tertiary diversity requirements (Add 3DIV or Remove 3DIV)

View/Tune Paths Window

After designing or tuning the paths in the Diverse Path Table, click on any of the following buttons to view details regarding the current diversity status for the selected demand (or tunnel):

- **Show Paths:** A Path window will open to highlight in different colors on the map the two diverse paths, if any (or three diverse paths, in the case of 3DIV).
- **View Path Details:** Opens up the Demand or Tunnel window to view details on the selected demand/ tunnel. Select the Paths tab of the first entry to display the details of the diverse paths, if any, including secondary/standby paths.
- **Filter button:** A text filter and advanced filter option are provided to filter out only desired entries of the table based on user-defined criteria. Use the previous or next page to navigate if there are more than 100 entries. Note that when performing a text filter as opposed to the Advanced Filter, each result is a successive filter. Use “*” to refresh the table before performing a new search.
- **Action > Report:** Saves the Diverse Paths table to a comma-separated file.
- **Action > LSP Delta Wizard:** Provides a shortcut to the LSP Delta Wizard to generate LSP delta configlets (offline module) or create a provisioning order (provisioning module only)
- **Action > Import DivPath Definition file:** The DivGroup settings exported by selecting **File > Save Network File > Tunnels** to usertunneldef.runcode can be imported from this option.

The file format is as follows:

```
#NodeName TunnelName DivGroupName
BOS,RBOSWDC,test
WDC,RWDCBOS,test
```

```
ATL,RATLCHI,test
HOU,RHOUWDC,test
```

Additional Notes for the Router Module

When selecting View Path Details, if you designed for standby paths, they are displayed as additional demands/tunnels and STANDBY are listed in the type field of the new demand/tunnel.

If you designed for secondary paths, this information is displayed in the same tunnel entry as the primary path. The Secondary field will give the pathname of the new path. However, a path name may not be created for you. In that case, click on the Details button for a demand/tunnel. Your secondary path are listed in the paths associated with the demand/tunnel. If you enter a path name in modify mode, the name is displayed under the Secondary field. A secondary path's path specification will only be displayed if the path is preferred or required.

You can also see the new paths from the Report Manager. Select **Network Reports > Demand Reports > Demand Path & Diversity** (or **Tunnel Layer Reports > Tunnel Reports > Tunnel Path & Diversity**. In this report, each path has its own entry. The type field will say SECONDARY or STANDBY if present. It will say PR(path_specification) or PS(path_specification) where path_specification is replaced by an actual path specification (nodes separated by dashes), if the path was set to be required or preferred (PR for path required, PS for path select).

Below are the possible columns in this table. Column names may vary depending on the hardware model. If a column name is missing, right-click on the column header, select **Table Options**, and select which columns to display.

Field	Description
Group Name	Name of the group of paths which should be designed to be diverse. For IP/MPLS networks with Standby/Secondary paths, the tunnel name is used for the group name.
Path1 Name Path2 Name Path3 Name	Names up to three paths that form the diverse group, which the program will try to route along diverse paths
Div Type	Indicates the group type. For example, secondary/standby (router only), 1+1, VCAT (transport only), or DivGroup (for a user-defined diverse group)

(Continued)

Field	Description
Div Level Actual Div Level	Indicates current level of diversity satisfied (for example, NO_DIVERSITY, SITE, LINK) or if the path is unplaced. Note that the Actual Div Level considers also access nodes. **NOTE**: Only one type of diversity is listed. If one includes the other, the more inclusive category is listed (for example, site diversity implies link diversity, so it is sufficient to indicate site diversity). In the case where both are satisfied but one does not include the other, still only one is listed. For example, if site and facility diversity are satisfied, only site diversity is listed.
Config Div Level	(IP/MPLS only). Indicates the configured target diversity level if configured on a per tunnel basis, for example, through the Tunnel Type Parameter Generation window, Diverse Level drop-down box.
3Div	Indicates if tertiary diversity is desired. For IP/MPLS networks, to design a tunnel to have one primary and 2 secondary paths that are all diverse, this setting should be set for the tunnel and an entry should be created for each path for the program to configure during the Path Design.
NodeA, NodeZ, Site A, SiteZ, BW, PriPre	For Path1, Path2, and Path3 are indicated the source and destination nodes, sites containing source and destination nodes, primary bandwidth, and priority/preempt setting. Not all of these fields are displayed by default. Right-click the table column header and select **Table Options...** to turn on the display of these columns.
Current Path	The current paths of the demands/tunnels for Path1, Path2, and Path3
Config Path	The configured paths of the two demands/tunnels for Path1, Path2, and Path3

Design Menu: Configlets/Delta

LSP Delta Wizard (IP/MPLS only)

The LSP Delta Wizard is used to compare LSP configurations in the baseline network with LSP configurations in the current network, and to create CSV and XML reports of the differences. Refer to the LSP Delta Wizard chapter of the *Paragon Planner User Guide* for further details.

LSP/VPN/Switch Configlet (IP/MPLS only)

LSP, VPN, and switch configlets can be generated based on modifications made to LSP tunnels, VPNs, and switches in the software. The configlet generation is available in the Design action mode. Refer to the LSP Generation and Virtual Private Networks chapters of the *Paragon Planner User Guide* for further details.

Design Menu: Metric Optimization

NOTE: Metric Optimization is available for router networks.

The Design > Metric Optimization option attempts to optimize the link metrics to remove congestion from the network. Upon selecting this option, a wizard guides you to select the candidate links that can be changed and an algorithm to use for optimizing their metrics. Once the operation is complete, the metric changes are reported in METRICBAL.runcode, where runcode is the file extension used by your network project specification file. The report indicates the number of links whose metrics have been changed, the old and new worst case utilization, and the old and new metric values for modified links. You have the option to review the link changes and rerouted demands and to accept or discard the new metric changes. After accepting the new metric changes, you can save the metrics by saving the entire network or saving only the bblink file using File > Save Network File > Links. If you wish to revert back to your original link metrics, simply read in the original bblink file using the File > Load Network Files window. Click on the “Network Files” tab, and then press the **bblink** button to browse for the original link file.

For further details, refer to the *Paragon Planner User Guide*.

Design Menu: P2MP Tree Design Window

To define a P2MP tree, grouping, and diversity level, perform the following procedure *before* opening the P2MP Tree Design window:

1. Select all the sub-LSPs of a tree in the Network Info window (hold down the Ctrl key to select multiple LSPs).

2. Click **Modify** and select **Selected** to edit all the selected LSPs simultaneously.

The Modify Tunnels window is displayed.

3. In the Properties tab, click **Type**.

   The Tunnel Type Parameter Generation window is displayed.

4. In the General tab, populate the P2MP field with the tree name.

5. In the Design tab, populate the Diversity Group field with the group name.

6. In the Diversity Group field, select the tree diversity using the drop-down menu.

7. Click **OK** to save the settings.

   Confirm that the changes were successfully made for all the selected LSPs.

8. Click **Update** and select **Update Display** to update the network model.

Repeat this procedure for each tree. P2MP tree names must be unique within a diversity group.

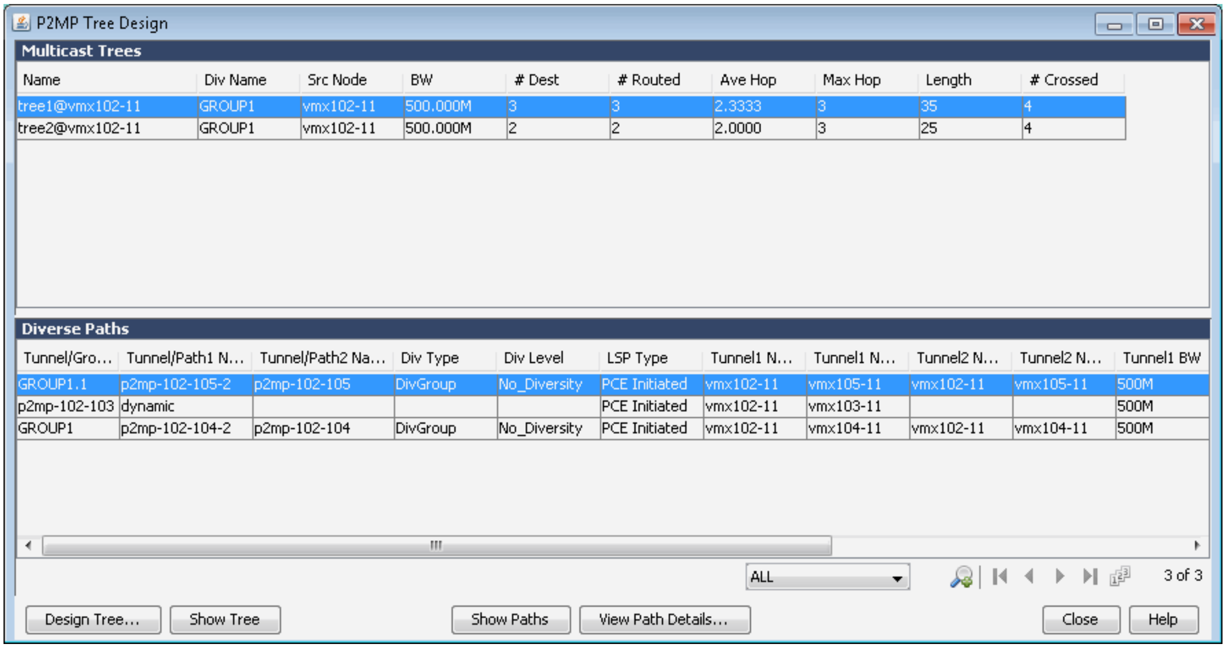
Use the P2MP Tree Design window to design the paths of the sub-LSPs of a tree to minimize the number of shared elements (shown in the # Crossed column) and the total path length (shown in the Length column) to another tree within the same group. The type of shared element is determined by the Diversity Level (site, link, facility) of the sub-LSPs of the tree. The total path length is the path metric of the tree.

To use the P2MP Tree Design feature effectively, there should be at least two trees defined within the same group. A P2MP tree requires that the head ends of all the sub-LSPs begin at the same node and have the same bandwidth value.

Once you define the P2MP trees, you can view them on the topology map. In the topology map window, use the drop-down menu at the top of the left pane (RSVP Util) to select **Subviews>P2MP**. The P2MP window is displayed where you can select one or more trees that you want to see on the topology map.

In the Paragon Planner main window, select **Design > P2MP Tree Design**. The P2MP Tree Design window is displayed as shown in Figure 93 on page 211.

Figure 93: P2MP Tree Design Window



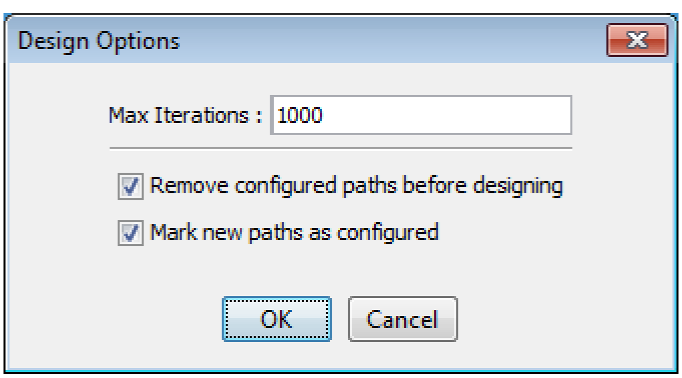
To display a selected tree in the topology map window, click **Show Tree**.

To display a selected sub-LSP path in the topology map window, click **Show Paths**. The paths are highlighted and animated in the topology map window.

To display detailed information about the selected sub-LSP in the Network Info window, click **View Path Details**.

To design a P2MP tree, select a multicast tree and click **Design Tree**. The Design Options window is displayed as shown in Figure 94 on page 211.

Figure 94: Design Options Window for P2MP Trees

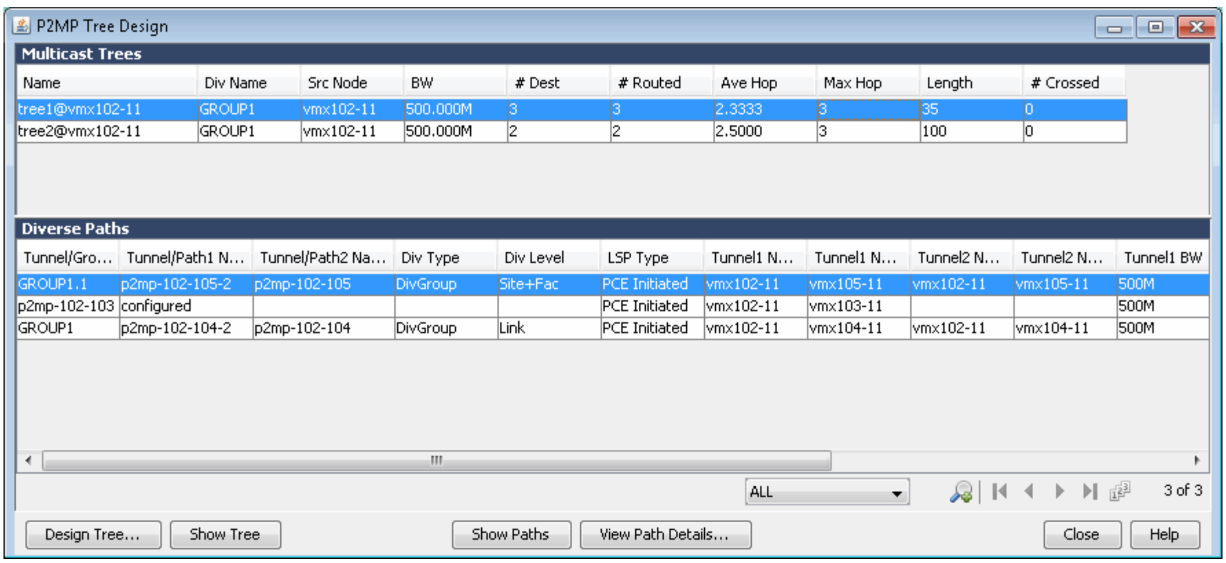


In the Design Options window, enter the number of iterations to run, select whether to remove configured paths before running the design, and select whether to mark the new paths as configured. Click **OK** to run the design.

The results of the design are displayed in the P2MP Tree Design window. Look for improvements to the number of shared elements (# Crossed should be less than or equal after the design) and diversity level of the sub-LSPs (Div Level).

Figure 95 on page 212 shows the design results and improvements. The Length increased for tree2 because improving shared elements and diversity has higher precedence.

Figure 95: P2MP Tree Design Window After Design



9

CHAPTER

Simulation Menu

Simulation Menu Overview

The Simulation menu is used to run various failure scenarios. You can perform simulations on both new and existing designs to determine resiliency in the backbone. By default, Paragon Planner simulation mimics the actual hardware. However, you can also adjust simulation parameters for experimentation and “what-if” purposes.

In Failure Analysis, path provisioning simulates the hardware's implementation of bandwidth allocation and demand routing on the existing topology. You can run interactive simulations or simulation scripts (predefined or user-created). In addition, you can try simulating path placement for several iterations to see what impact demand path placement and demand routing order have on the network.

By default, Paragon Planner failure simulation will mimic the actual hardware (for example, in routing, max hop, etc.). However, you can adjust simulation parameters for experimentation purposes.

These can be accessed by selecting **Tools > Options > Failure Simulation**, and are described in detail in "Tools: Options Menu" on page 394. In addition to Path Placement controls, these options also control certain aspects of the Failure Analysis and Reporting.

Failure analysis reports can be generated for the following cases:

- Single Line Failure Report - simulation report for each single line failure
- Link Failure Report - simulation report for each link failure
- Node Failure Report - simulation report for each single node failure at every site for each vendor
- Random Daily Failure Report - simulation report for randomly generated multi-link or multi-vendor failure scenarios
- Replay Up-Down Sequences Report - simulation report for any link/node/vendor up or down sequence

Simulation Menu: Predefined and Interactive Scenarios

IN THIS SECTION

Scripted simulations are predefined simulation scenarios, which provide a quick and easy way for you to test the network's resiliency to various failures. For each script, a failure report is automatically generated.

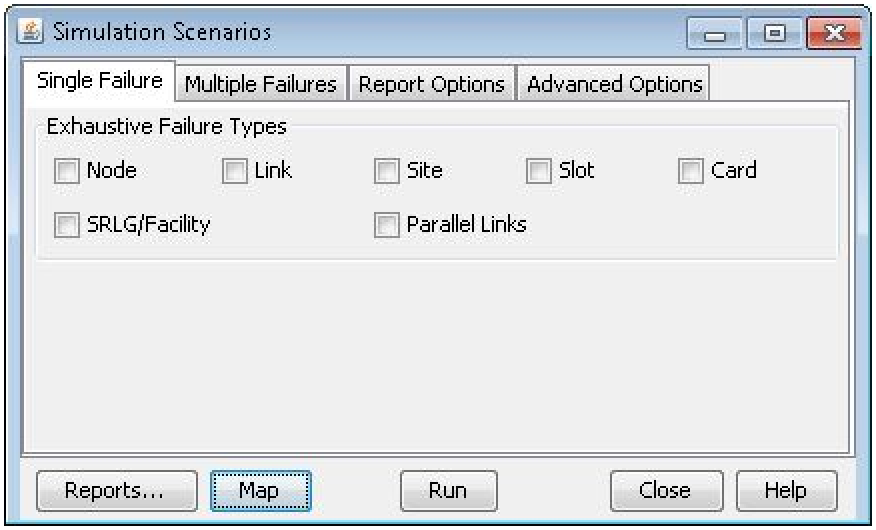
NOTE: Before running a scripted, or batch simulation, be sure to review your failure simulation option settings. These can be accessed by selecting **Tools** > **Options** > **Failure Simulation**, and are described in detail in "Tools: Options Menu" on page 394. By default, an exhaustive failure simulation will fail all elements one for each simulation. To specify not to fail certain nodes or links, first modify the node (Design Properties tab) or link (Properties tab) and set FAIL=0 to true.

Scripts

Exhaustive Single Element Failures

The exhaustive single failure scripts fail all network elements of a given type, one at a time.

Figure 96: Single Failure Simulation Window



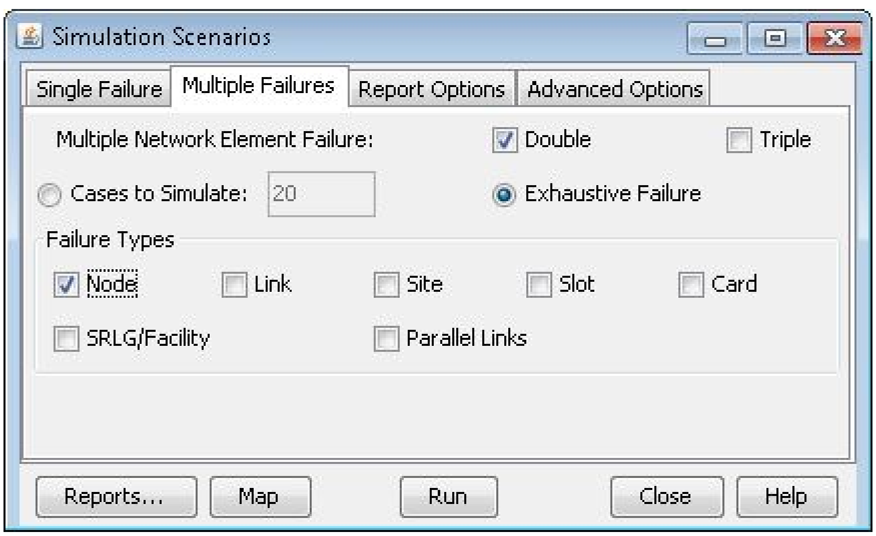
- **Exhaustive Node Failure:** Exhaustively fails every single node in the network.
- **Exhaustive Link Failure:** Exhaustively fails every single trunk in the network.
- **Exhaustive Site Failure:** Exhaustively fails all sites in the network. A site file is required to define nodes within the same site. Nodes that are not grouped within a site are considered sites by themselves.
- **Exhaustive Slot Failure:** Exhaustively fails all slots that are defined in the network (router networks only).
- **Exhaustive Card Failure:** Exhaustively fails all cards that are defined in the network. For all ATM networks, cards can be specified in the definition of links. Go to the Links detail tab and select the **Location** tab. For certain router models, cards can be defined through the Equipment View feature. Select **Inventory > Hardware Inventory**, or right-click on a node and select **View > Equipment View**.
- **Exhaustive SRLG/Facility Failure:** Fails all facilities. A facility file is required to define node and trunk facility associations. Trunks that are not associated with a facility are considered to be facilities by themselves.
- **Exhaustive Parallel Links Failure:** Exhaustively fails all trunks between all node pairs.
- **Exhaustive Voice Trunk Group Failure:** Exhaustively fails all voice trunk groups defined in the network. Select **Network > Voice > Trunk Group** to examine the trunk groups in your network. Addition of trunk groups through the Java user interface is not supported at this time, although modification is supported. To define trunk groups, the trunk group file should be edited through a text editor.

Reports

- The Peak Link Utilization Report (Simulation Reports > Network Statistics > Peak Link Utilization) records the maximum trunk utilization for each trunk during the period of all the selected simulations and the element whose failure triggered this maximum utilization. Peak utilization is reset each time predefined scenarios are run. See "Report Manager: Simulation Reports" on page 379 for details on this report. The resulting peak utilizations can also be viewed graphically on the Standard map by selecting **Utilization Legends > Peak Util**.
- **PeakSimLink:** The PeakSimLink report contains detailed information on oversubscribed links after the exhaustive failure simulation.
- **PeakSimRoute:**The PeakSimRoute report contains detailed information of failed demands or tunnels.
- **PeakSimReroute:** The PeakSimReroute report contains detailed information for rerouted demands or tunnels. To generate this report, select **Generate Detailed Reroute Report** from the Options tab.
- **PeakSimSummary:** The PeakSimSummary report contains a summary of all exhaustive failure simulations performed.

Exhaustive Multiple Element Failures

Figure 97: Multiple Failure Simulation Window

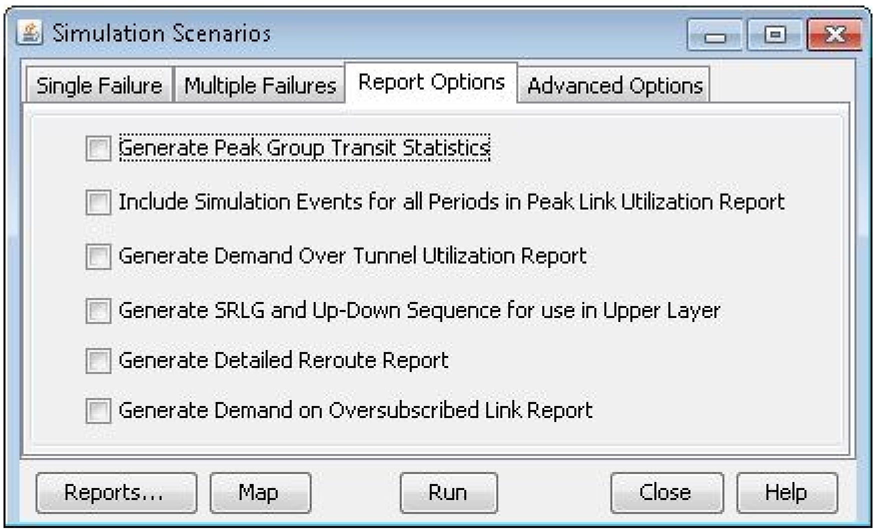


To run an exhaustive failure script for the simultaneous failure of 2 or 3 elements, select the **Multiple Failure** tab. Select the number of elements to be failed together (Double or Triple), select the Exhaustive radio button, and then select the element type to be failed (node, link, etc.) for the Failures Type. For example, selecting Double, Exhaustive Failure, for the Failure Types: Node and Link and then clicking the Run button will result in an exhaustive failure simulation of node & node, node & link, and link & link combinations.

To randomly simulate a specified number of double or triple failures, rather than all possible failure combinations exhaustively, select "**Cases to Simulate**" instead of Exhaustive Failure, and enter the number of cases to simulate.

Report Options

Figure 98: Report Options



- **Include Simulation Events for all Periods:** In the Peak Link Utilization report, information is provided regarding the event triggering the peak link utilization, indicating which failure type triggered the peak link simulation (for example, node, link, or facility) and the name of the element. With this option unchecked, the simulation event is reported only for the planned period (based on the demand file) and worst failure scenario among the periods of the trafficload file. If this option is checked, the simulation event is also displayed for all of the individual periods (up to 24).

- **Generate Demand Over Tunnel Utilization Report:** This option will generate the Demand Traffic on Tunnel report in the Tunnel layer reports.

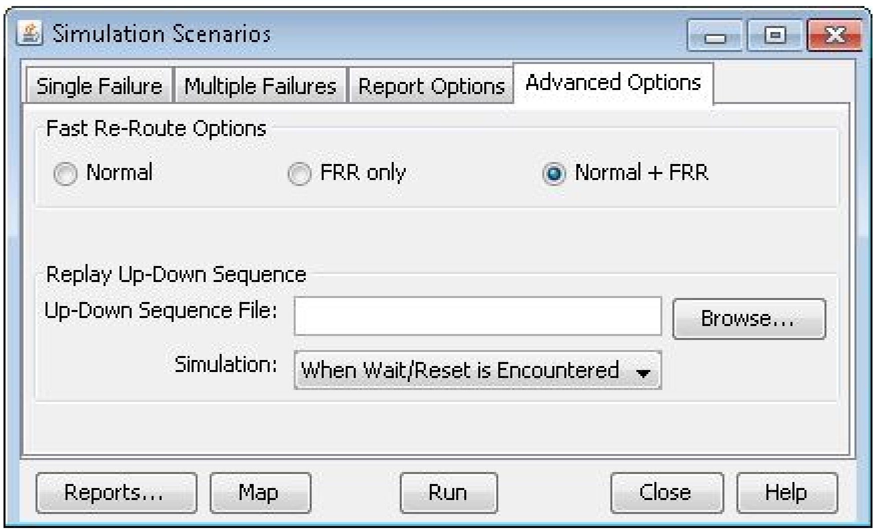
- **Generate Peak Group Transit Statistics:** Records the maximum number and bandwidth of demands transiting through a topology group. This information is displayed in the Group > Group Demand Bandwidth Distribution report of the Report Manager. These statistics can also be turned on by first setting CheckTransitDemandLimit=2 in the dparam file before opening the specification file.

- **Generate SRLG and Up-Down Sequence for Upper Layer:** Selecting this option will generate a report, UPDOWN.runcode, which lists the demands or tunnels that went down during the simulation. This report is often used as an Up-Down Sequence File in an upper layer network in which the demands of the lower layer network are translated into links in the upper layer network. Thus, the demands that are reported as being down in the UPDOWN.runcode report can be read in as downed links in a custom failure simulation script for an upper layer network. Additionally, an SRLG file is created, based on the set of demands of the lower layer (links of the upper layer) which go down together.

- **Generate Detailed Reroute Information:** Report detailed information on demands that rerouted during the failure simulation.

Advanced Options

Figure 99: Advanced Options



Fast Reroute Options

(Router networks only): See the Fast Reroute chapter of the *Paragon Planner User Guide* for more information.

Replay Up-Down Sequence

Use a custom failure simulation script. The file name of the script must be specified. An example of a custom failure simulation script is provided below:

```
Link1 down
Link2 down
RESET
Link3 down
Link4 down
RESET LINK
```

```
Link5 down
Link6 down
WAIT
Node1 down
Node2 down
RESET
```

Before you run an up-down sequence simulation, you must first specify whether to simulate Every Event or to simulate When WAIT/RESET is Encountered. Assuming the latter, in the above example, Link1 and Link2 is brought down first.

At the RESET line, the program will attempt to route all unplaced demands in the network (and generate the appropriate reports), after which all links are brought back up and all demands are placed back in their original paths. The program will then fail Link3 and Link4. Upon seeing the RESET LINK line, the program will again attempt to route all affected and unplaced demands in the network (and append the appropriate reports), after which all links are brought back up.

However, this time, the demands will not be placed back in their original paths; instead, the demands will remain routed according to the paths found while Link3 and Link4 were down. The program will then go on to fail Link5 and Link6. At the WAIT line, the program will attempt to route all unplaced demands (and append the appropriate reports), but will not bring up any links afterwards. Node1 and Node2 are then failed, and at the next RESET line the program will attempt to route all unplaced demands in the network while Link5, Link6, Node1, and Node2 are all down (and append the appropriate reports), after which all links and nodes are brought back up and all demands are assigned to their original paths.

After the program has finished running through the script, you may view the appropriate failure simulation reports for information recorded at each of the RESET, RESET LINK, and WAIT lines.

If you choose to simulate Every Event, then the program will run a simulation after every network failure. In the above example, Link1 is taken down first, and the unplaced demands are rerouted and the appropriate reports generated. Then, Link2 is taken down (Link1 is still down) and the unplaced demands are rerouted. When RESET is encountered, all links are brought back up and all demands are placed back in their original paths.

Interactive Scenarios

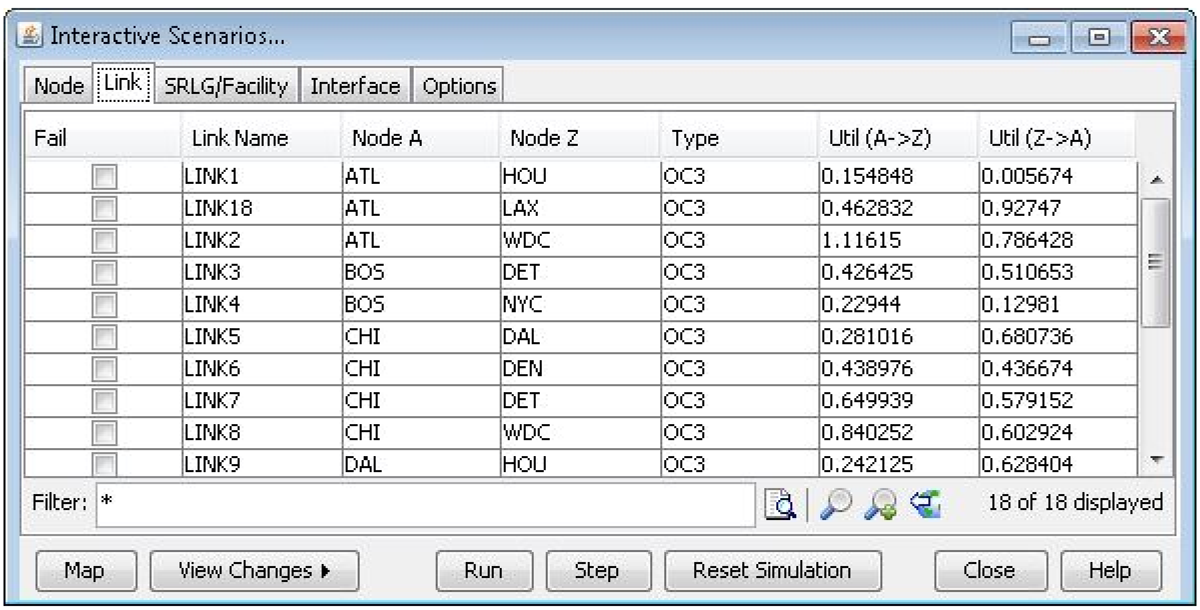
Interactive Simulation allows you to specify the nodes, trunks, and/or facilities that he wants to fail for the simulation run. Subsequent failures can also be performed by continuing the simulation using a different set of failed elements.

NOTE: Before running an interactive simulation, review your failure simulation option settings via Tools > Options > Failure Simulation, and are described in detail in "Tools: Options Menu" on page 394.

Fail Link

Fails selected trunks in the network. In the Fail Links tab, a list of all trunks is displayed. To fail a link, simply select the row for a link. The link is grayed out on the map and marked with a red ‘F’ symbol to indicate its failure. To bring a trunk back up, select the failed trunk. 'Reset All' will bring all failed trunks up. Use the View Changes option to see how the failure impacts link utilization, and demand/tunnel routing.

Figure 100: Fail Links Window



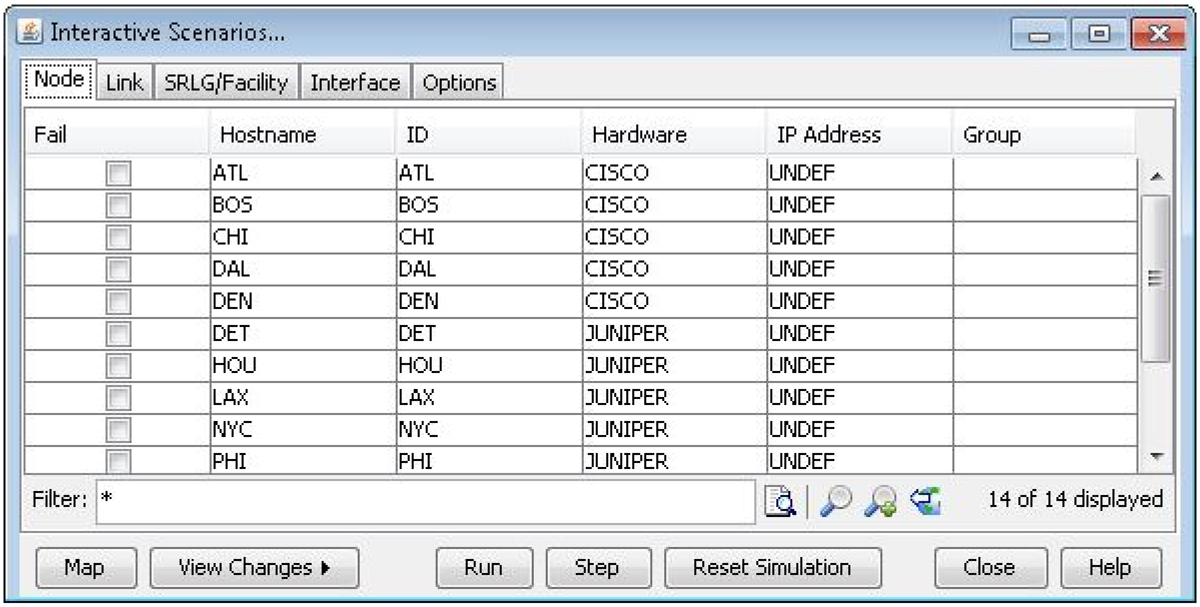
Fail Interface

The purpose of this tab is to study the failure of a physical interface, which can have multiple logical links. For example, failing fe-0/1/2 on router ATL_TEST will cause 3 logical links associated with fe-0/1/2.0, fe-0/1/2.211, fe-0/1/242 to fail. Select the row for a physical interface to bring down or up the physical interface and associated logical links. ‘Reset All’ will bring all failed interfaces up. Use the View Changes option to see how the failure impacts link utilization, and demand/tunnel routing.

Fail Node

Fail selected nodes in the network. Use the View Changes option to see how the failure impacts link utilization, and demand/tunnel routing.

Figure 101: Fail Nodes Window



Fail Facility

Fail selected facilities in the network. A facility file must be defined and loaded in order to use this feature.

Use the View Changes option to see how the failure impacts link utilization, and demand/tunnel routing.

Run, Step, Stop

- Run is used to run a simulation with the given failures.
- Step is used to step through a simulation. A step consists of the rerouting of a single demand. For each step, a Paths window appears indicating the rerouted path (if any) and the disconnected path. This feature is applicable only when a running simulation has been stopped.
- Stop is used to stop a running simulation.

View Changes

The following changes can be viewed after performing the interactive simulation:

- **View Link Changes:** View changes to the link utilization and RSVP utilization
- **View Demand Changes:** View changes to the demand placement, number of hops, and delay (ms)

- **View Tunnel Changes:** View changes to the tunnel placement, number of hops, and delay (ms)

Reset Simulation

Reset the simulation to the initial network state. All trunks and nodes are set to active and all demands are routed according to the state at which the simulation mode was entered.

Simulation Menu: Time-Based Simulation

Time-based simulation is used to simulate bandwidth calendaring. By Scheduling LSPs with specific time windows, you can simulate circumstances in a live network where peak periods of bandwidth utilization are created by LSPs with overlapping start and end times. This allows you to predict whether planned LSPs would actually be placed. You can add exhaustive failure simulation to the scenario as well, and finally, you can generate a report that details the results of the simulation.

The Paragon Planner follows some rules when performing the routing and failure portions of this type of simulation. For the routing simulation:

- Only LSPs that are active during the simulation period are considered and placed into the time line; inactive LSPs are ignored.
- The Paragon Planner advances the time line to route each LSP based on its scheduled start time.

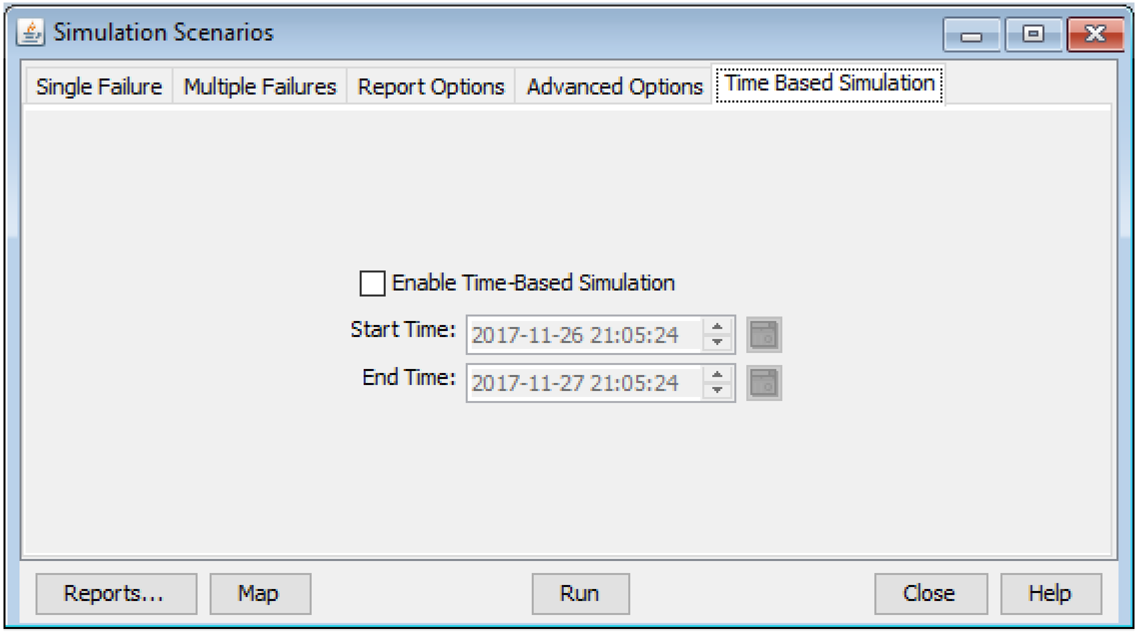
For the failure simulation:

- Outage simulation can be time consuming, so the Paragon Planner performs it only at specific times.
- The times selected are just prior to the time the LSPs are scheduled to disconnect. This is when the highest impact is expected.

To simulate bandwidth calendaring, perform the following procedure.

1. Provision scheduled LSPs in the Paragon Pathfinder UI.
2. Set the network time by navigating to **Tools** > **Options** > **General**.
3. In the Simulation Scenarios window, click **Time Based Simulation** as shown in Figure 102 on page 224.

Figure 102: Simulation Scenarios Window Time Based Simulation



4. Click the check box that enables time-based simulation and select the simulation start and end times.

5. If you also want to include exhaustive failure simulation, click Single Failure in the Simulation Scenarios window and select the type(s) of outage you want to include (link, SRLG, node, and so on).

6. In the Simulation Scenarios window, click **Report Options**. Click the check box corresponding to the type of results report you want to generate. For bandwidth calendaring simulation, the following reports provide very useful information:

   - L2_PeakSimReroute
   - L2_PATHDELAY
   - L2_PeakSimRoute

   These reports provide information about LSPs that are (not_routed) or (time_expired). You can then use the UI to research the exact reason why an LSP is (not_routed). Right-click on an unplaced LSP and select Bottleneck Analysis to learn why the LSP was not placed. One common reason is insufficient RSVP bandwidth.

RELATED DOCUMENTATION

Report Manager: Simulation Reports | 379

Tools: Options Menu | 394

10

CHAPTER

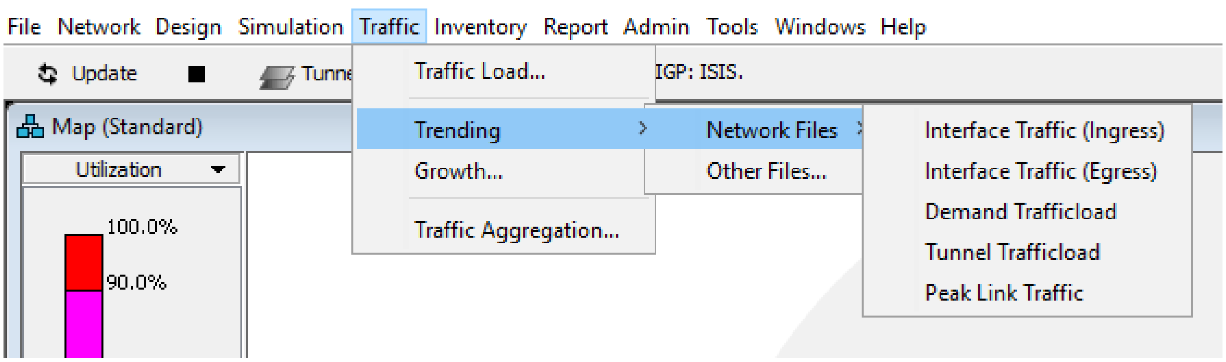
Traffic Menu

Traffic Menu Overview

This chapter explains how to use the various traffic features in the Traffic Menu. The addendum at the end of this chapter also explain how to access and interpret the basic traffic charts available in the Paragon Planner Desktop application.

Figure 103 on page 226 shows the Traffic Menu on the top menu bar.

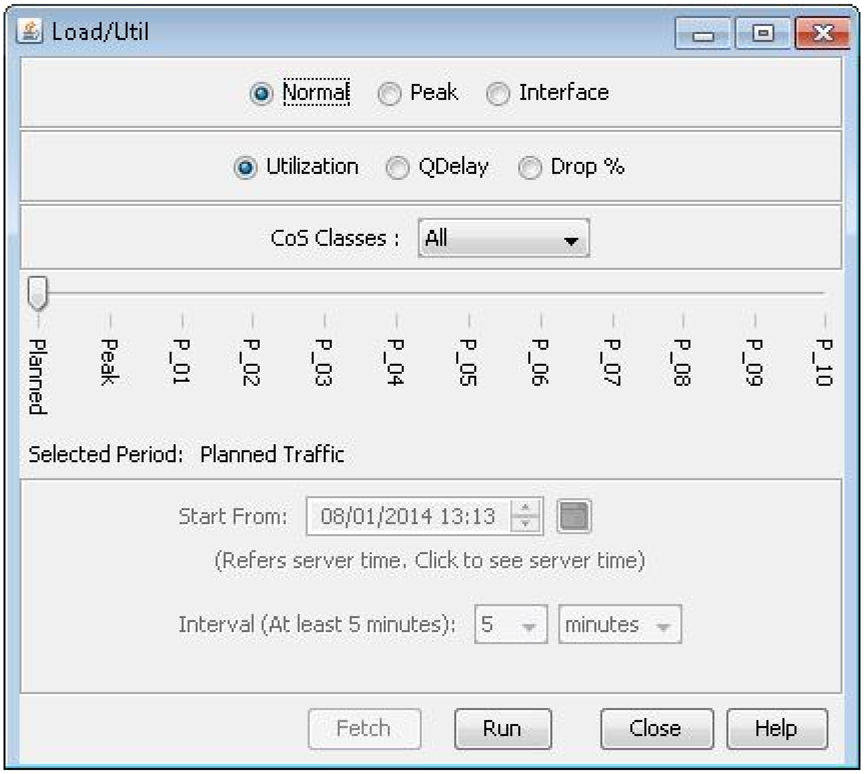
Figure 103: Traffic Menu



Traffic Menu: Traffic Load

Select **Traffic Load** to open the Load/Util window. The window options may vary depending on the hardware type. The most basic window will contain the Normal and Peak radio buttons and the slider bar. Router modules will have an additional option for live interface (for Layer 3) or tunnel (for Layer 2) traffic and the option to fetch historical traffic from the database from a selected starting period and at a selected time interval. The link utilizations on the map will reflect planned traffic, worst-case traffic, or a certain time period of traffic (up to 24) by moving the horizontal slider.

Figure 104: Traffic Load Window (Options May Vary)



- The Planned period reflects the loading based on the bandwidth specified for each demand in the demand file (this can be set to the peak payload per demand for a specified time interval, measured and extracted by the hardware device's management platform).

- The Worst period (for the Normal traffic load option, based on the trafficload file) provides the traffic loading supposing each demand is at its worst period (maximum value) among the 24 periods in the traffic load file, even though these could actually occur at different times. For router modules, with actual measured interface traffic, the Worst period (for the Interface or Tunnel option), will show the highest value of the 24 periods.

- Following the Planned and Worst periods are up to 24 periods based on the “trafficload” file that is referenced to from the specification file.

The program will follow the hardware's implementation of demand routing and bandwidth allocation as in the Path Provisioning mode of simulation. Once the demand path is established, traffic load information for each demand is then loaded onto the network model. By using measured traffic, snapshots of actual trunk utilization can be analyzed and a better understanding of the impacts under failure conditions can be gained.

Field	Description
Normal	Displays link utilizations based upon the routing of specified demand/flow traffic. In the specification file, traffic input is read in from the “trafficload” file. Note: For the Router module with MPLS enabled features, if Layer 2 (tunnel layer) is selected, then selecting Normal in the Load/Util window displays the link utilizations based upon the routing of tunnel traffic that is specified in the “tunnel trafficload”, or “T_trafficload” file in the specification file. This file has a format similar to that of the “trafficload” file.
Peak	This option is only applicable after you have run a failure simulation scenario (and has checked the Include Traffic Load box in the Simulation Script Options). Peak represents the highest (or worst) link utilization loading experienced by each link, depending on the rerouting of the demand/flow traffic after any single failure. If 24 periods of traffic are specified in the “trafficload” file, then the peak utilization will represent the worst loading on that link during each of the 24 periods.
Utilization	Displays the results as link utilization on the topology map. This is the default.
QDelay	Displays the results as queuing delay (in milliseconds) on the topology map according to a custom map legend.
Drop	Displays the results as drop percentage on the topology map according to a custom map legend.
Run	Starts running the animation that is reflected on the topology map. Begins with Planned, Worst, and is followed by the periods of traffic.

Router-Specific options

Field	Description
Interface	This option appears if you are in the Layer 3 (Demand) view and displays link utilization based on traffic actually measured at the interface. This differs from the “Normal” option which displays the utilization based on the routing of traffic associated with end to end flows. Interface traffic can be read from two sources: 1. User-supplied “ingress” or “egress” files, also referred to in the specification file as “interfaceLoad_in” and “interfaceLoad_out”. 2. Traffic saved in a database when performing a traffic collection in the Live Network using the Traffic Collection Manager. After selecting a start date and time interval, click Fetch to fetch the data from the database. Subsequently, you can replay the historical traffic using the Run button or view the traffic in chart format via the Traffic Load > Measured Interface Traffic menu.
Tunnel	This option appears if you are in the Layer 2 (Tunnel) view and displays tunnel traffic at an interface. Tunnel traffic can be read from two sources: 1. Traffic data from a tunnel trafficload file (referred to as “T_trafficload” in the specification file) 2. Traffic saved in a database when performing a traffic collection in the Live Network using the Traffic Collection Manager. After selecting a start date and time interval, click Fetch to fetch the data from the database. Subsequently, you can replay the historical traffic using the Run button or view the traffic in chart format via the Traffic Load > Tunnel Traffic on Link menu.
CoS	By choosing a particular Class of Service (CoS), the traffic statistics associated with that CoS can be displayed. This information is based on demands, as opposed to measured data.
Start From... Interval and Fetch	This panel is only applicable for router modules if you have run traffic data collection live, using the Traffic Collection Manager, which stores the traffic data into a database. You should first select a starting date and then an interval between the periods, and then click ‘Fetch’ to load the summarized traffic data. After the status message says “Traffic Ready,” then, click on ‘Run’ or open the appropriate traffic chart (Traffic Load > Measured Interface Traffic for interface traffic or Traffic Load > Tunnel Traffic on Link for tunnel traffic.

Traffic Menu: Trending

IN THIS SECTION

The Trending feature takes as input several periods of traffic data or other data. It then performs a "trending" by extrapolating future growth of the data based on a number of user-supplied parameters such as the type of regression to use, the number of points to extrapolate, and so on. The Trending data input file can be any one of four different Network Files. Alternatively, you can specify a separate input file by choosing Trending > Other Files. The file formats for all these input files are described briefly below.

Network Files

Interface Traffic (Ingress or Egress)

To use Paragon Planner interface files as the trending input, select **Traffic > Trending > Network Files > Interface Traffic (Ingress)** or **Interface Traffic (Egress)**. These files list period-by-period ingress or egress traffic per interface.

In order to use these files, they must first have been loaded into your network project. To do so, select **File > Load Network Files**, select the Traffic tab, and press the **ingress** or **egress** buttons, respectively. Typically a user only specify one of these.

The file format is as follows:

```
NodeID Interface Direction - Period1 Period2 ... PeriodN
MYNODE1 POS0/1 A2Z 0 100200112 100601536 100400624 100601536
```

An alternative file format for interface traffic is:

```
LinkName Direction - Period1 Period2 ... PeriodN
MYLINK1 A2Z - 100200112 100601536 100400624 100601536
MYLINK1 Z2A - 5003683 5003822 5284499 683344
```

The units for the period data should be in bits per second.

NOTE: The NodeID must match the ID or name of one of the nodes in the muxloc file.

Trafficload (Demand, NCP, ...)

To use Paragon Planner trafficload files as the trending input, select **Traffic** > **Trending** > **Network Files** > **Demand Trafficload**. These files list period-by-period traffic per demand.

In order to use these files, they must first have been loaded into your network project. To do so, select **File** > **Load Network Files**, Traffic tab, and press the “trafficload” button.

The file format is as follows:

```
DemandID Direction - Period1 Period2 etc…
MYDMD A2Z - 100200112 100601536 100400624 100601536

Or, for those with Node-Card-Port (NCP) data:

FromNodeCardPort Direction - Period1 Period2 etc…
ToNodeCardPort Direction - Period1 Period2 etc…
MYNODE.P3C5 A2Z - 100200112 100601536 100400624 100601536
```

Tunnel Trafficload (IP/MPLS only)

To use Paragon Planner tunnel trafficload files as the trending input, select **Traffic** > **Trending** > **Network Files** > **Tunnel Trafficload**. These files list period-by-period traffic per LSP tunnel.

In order to use these files, they must first have been loaded into your network project. To do so, select **File** > **Load Network Files**, Device Specific tab, and press the **trafficload** button.

The file format is as follows:

```
NodeID:TunnelName Direction - Period1 Period2 etc…
MYNODE1:MYTUNNEL290 A2Z - 100200112 100601536 100400624 100601536
```

Peak Link Traffic

To use peak link traffic load files as the trending input, run an exhaustive single element failure from Simulation > Predefined Scenarios on a network with a trafficload file, which contains the period-by-period traffic per demand. For example, the sample fish network (/u/wandl/sample/IP/fish/spec.mpls-fish) could be used to generate a peak link traffic load since the specification file references a trafficload file with the period-by-period traffic per demand. After the failure simulation is complete, a file named PeakLinkLoad.< runcode> is created, which indicates for a particular link and a particular period, what was the worst link load experienced for that link, taking into consideration all of the single element failure simulations that were simulated on the network.

The file format is as follows:

```
Node,Interface,Dir,Peak_1,Peak_2,Peak_3,Peak_4,Peak_5,Peak_6,Peak_7,Peak_8,Peak_9,Peak_10,
ATL,LINK1,A2Z,25952066,31141680,36327296,36327296,41518908,46707684,46707684,36327296,31141680,25
952066,
```

Load the file using Traffic > Trending > Network Files > Peak Link Traffic.

Other Files

You can also load trending input from any file, as long as the file has the proper file format. To load this file, select **Traffic > Trending > Other Files**. You are prompted to specify the location of the trending file. The recommended name for this file is *trending.trending.<runcode>*..The file should contain the <COLUMN>, <START>, and </START> tags and have the following comma-separated format:

```
<COLUMN>
TextColName1,TextColName2,...,TextColNameN,DataColName1,DataColName2,...,DataCol
NameM
<START>
MYDATUM1,Chicago,100200112,100601536,100400624,100601536
MYDATUM2,Jersey,20045634,20135645,22411224,21044335 # This is a comment
</START>
```

NOTE: Files in this comma-separated format can be opened automatically in Report Viewer. Go to the File Manager window, right-click on the file, and choose “Open in Report Viewer” from the drop-down menu. The <COLUMN>, <START>, and </START> tags enable the file to be read by the Report Viewer.

Trending Window

Once the data is read in, Paragon Planner will filter out any entries with too many "Undetermined Values" such as negative numbers. How many undetermined values is too many? In Paragon Planner, for a polynomial of degree k, the data should have no more than k undetermined values. For linear or exponential, the data should have no more than one undetermined value. Otherwise, the data is omitted from the analysis.

NOTE: For traffic files generated by the Paragon Planner, a "-1" is often used for a period lacking traffic data. In Trending, a "0" zero value is also ignored so that the projection from the non-zero values are more accurate.

Figure 105: "Bad" or "Undetermined" Data Points are Discarded

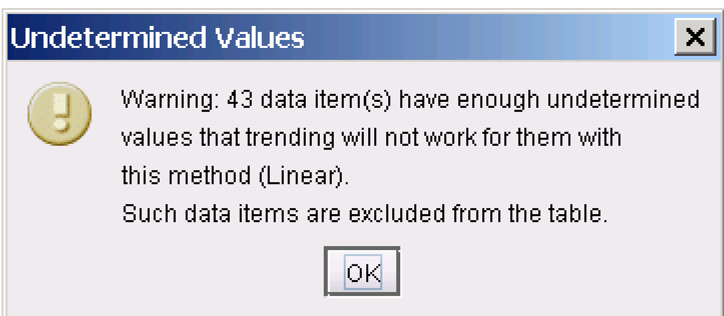
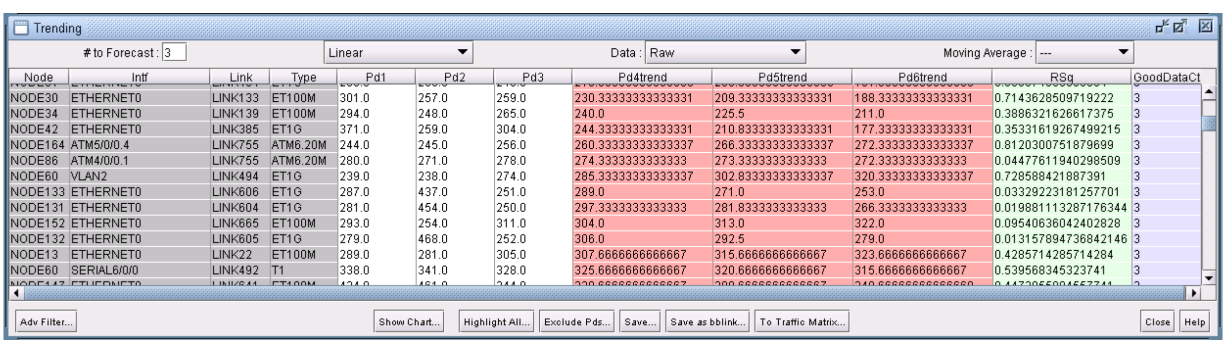
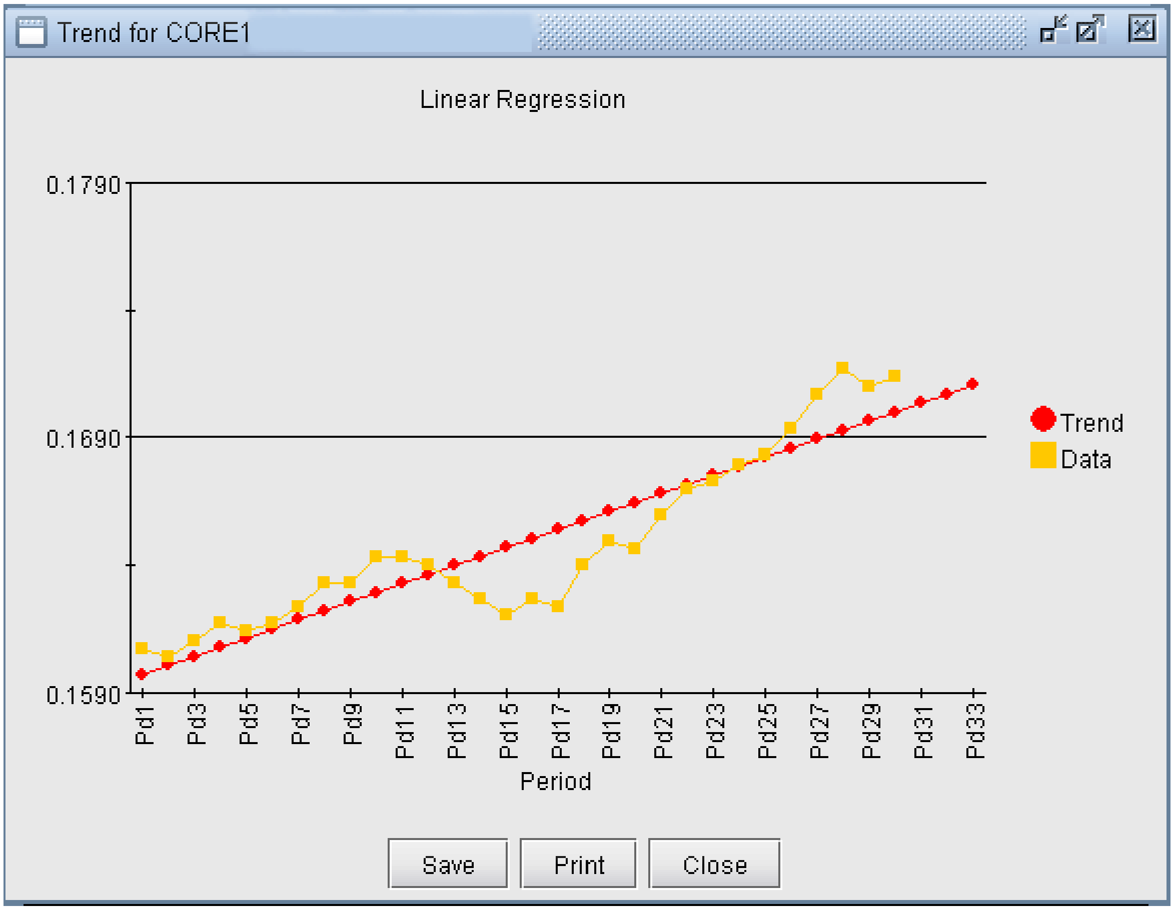


Figure 106: Trending Window



Column	Description
Node, Intf (gray)	The node and interface to which the traffic data points and trending data points in that row correspond. Link indicates the corresponding link name and Type indicates the trunk type. Note that other fields may be present in this gray section, depending on the.input data.
Pdn (white)	These columns contain the period data based on your Paragon Planner data file or trending.<runcode> input file.
Pdntrend (red)	These columns contain the forecasted data. The number of trending data points is based on the specified # to Forecast.
RSq (green)	The coefficient of determination. It is a value between 0 and 1, where 1 indicates that the curve fitting matched the data perfectly.
GoodDataCt (blue)	The number of good data points included in the trending analysis. Bad data points (typically values of ”-1” or “0”) are automatically omitted.

Figure 107: Trending Chart for a Particular Interface



Field	Description
# to Forecast	The number of data points to forecast. Press <Enter> after specifying a value. The trending table will then automatically update.
Linear / Exponential / Polynomial	The type of regression to be performed.
Data	Data can be viewed and processed in two forms: either Raw (raw traffic data numbers) or Util (Raw/BW) (the traffic utilization on each trunk). The Util view is the more useful and interesting.

(Continued)

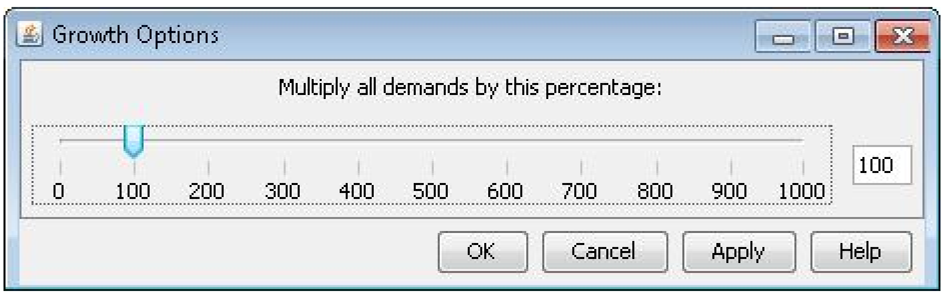
Field	Description
Moving Average	This number is used to "smooth out" any outliers in the data. If the value is set to "3", then each data point is the arithmetic average of the traffic value in the previous, current and next time interval of the original data. If the value is set to "5", then each data point is the average of the values of the two previous, the current, and the two following time intervals in the original data.
Adv Filter	Allows you to display only selected rows in the table. For example, if your Data value is set to `Util (Raw/BW)`, then you might query for `Pd5trend > 1.0` to identify where traffic may exceed trunk capacity five periods in the future.
Show Chart	Displays a line chart of the raw and trending data points corresponding to the selected row in the trending table. See Figure 107 on page 235 .
Highlight All	Highlights all entries on the Map. Highlight all nodes in the table, all nodes and links in the table, or all links in the table along with their end nodes.
Exclude Pds	Allows you to exclude selected periods of data from the regression.
Save	Saves the current table into a *TRENDING.<runcode>* file.
Save as bblink	Creates a link file (in bblink format), called *TRENDING_BBLINK.<runcode>*, from the rows currently displayed in the table.
To Traffic Matrix	Generates the corresponding traffic matrix input file, *TRENDING_TMATRIX.<runcode>*, for the specified trending period. Use this file as an input to the Traffic Matrix feature, accessible via Design > T-Solve in a multitude of traffic engineering studies. For more information on this feature, see "Traffic Menu: Growth" on page 237.

Traffic Menu: Growth

The Growth option in the Traffic menu can be used as a simple way of projecting future network growth. This tool allows you to model the existing network in terms of projected future growth.

This network growth feature is not cumulative; the percentage growth is always applied to the original demand bandwidths. If the growth feature is invoked twice, each time with 200 percent, for example, the result after the second increase is still a doubling, rather than a quadrupling, of the original demand bandwidth.

Figure 108: Adjusting the Network Growth Factor



You can use the slide rule in the Growth Options window to increase the bandwidth of existing demands in the network as a way to project future network growth. Using the slide rule, the current demands in network can be multiplied by a factor anywhere from 0 percent to 1000 percent.

Traffic Menu: Traffic Aggregation

IN THIS SECTION

The Traffic Aggregation function allows extraction of performance data from the analytics database for use in modeling, simulation and trending. You can extract different types of performance traffic into their relative files using a variety of timeframes and traffic statistics.

Make your selections in the Traffic Aggregation window and click **OK**. The traffic aggregation process on the server requests the analytics database to aggregate the performance data according to the selections you provided, and the data are stored to the corresponding traffic files (interface, T_trafficload and trafficload). When complete, the window remains open. You can close it by clicking **Cancel** or via the window actions used by the interface for the operating system.

The information in the following sections should help you define a traffic aggregation that suits your purpose.

Performance Data Indices Used for Aggregated Queries

The analytics database stores performance data in a series of indices. The default index for a measurement contains each measurement to a granularity of 5 minutes. High frequency measurements collected through Telemetry are stored in a special index used mostly for real-time traffic graphs. The high-speed (raw) index is then recorded as an average into the default index. The default index has a configurable retention period which is initially set to 90 days with this setting.

The measurements are then rolled up hourly with average and 90 percentile aggregations, and this rolled-up index is used for more scalable queries on the performance data. In addition to the hourly index, the default index is also rolled up into daily, weekly and monthly indices to support queries over longer time frames. The rollup indices are initially set to 1000 days.

The performance data indices are summarized in Table 34 on page 239.

Table 34: Performance Data Indices

Index	Interval	Purpose	Retention
Raw	Same as collection for high frequency measurements such as Telemetry (30 seconds, for example).	• Temporary storage for traffic graphing • Averaged aggregation over five minute periods into the default index	Hard set to 1 day
Default	Measurement frequency or five minutes, whichever is less.	• Base for rollup indices • Used for extended period traffic graphs	In northstar.cfg: es_log_retention_days = 90
Rollup	Rolled up on an hourly, daily, weekly, and monthly basis.	Produces increased performance and reduced storage needs for traffic reporting and modeling.	In northstar.cfg: es_log_rollups_retention_days = 1000

Generate Options

The generate options are:

- Interface Traffic
- Interface CoS Traffic
- Tunnel Traffic
- Demand and trafficloads

Click the check boxes to select as many of these options as you want, except that Interface Traffic and Interface CoS Traffic are mutually exclusive. They use the same interface traffic files for output, so you can only have one or the other. If selected, Demands only returns values if demands have been collected via Paragon Pathfinder task collection.

Range Options

Click any one of the radio buttons to select that range. Begin Time and End Time formats are a little different, depending on what you choose for the Series:

- If Series = hour of day aggregation, the Begin Time and End Time are specified as just the date because all hours of the specified days are used.
- If Series = time series, the Begin Time and End Time are specified as date and time.

Series Options

Two options are available for Series:

- **Hour of day aggregation**

  In this type of series, all measurements are aggregated by hour of day, potentially across multiple days. For example, by specifying “last week”, you would get the average or 90 percentile traffic for 9 – 10 PM. All measurements between 9 and 10 PM from all seven days would be considered in the calculation of the statistics. This is useful for calculating a typical day across a date range. Each parameter would have 24 values in the resultant traffic file, corresponding to each hour in the typical day. The usefulness of this series type diminishes as the time range becomes longer because the impacts of traffic trend over the time range would skew the statistic to represent either the time range mid-point or end-point for average and 90 percentile statistics, respectively.

- **Time Series**

  This is a typical series which will have a data point for each interval between the selected start and end times. There is a maximum of 168 data points that can be utilized in simulation. For example, you could do hourly statistic calculations for seven days (24 x 7 = 168), but if you were interested in a time series for a month of data, you would need to use a courser interval such as daily or weekly. This should be a consideration if the data is to later be trended as a forward projection, to ensure the projected data does not result in exceeding the maximum of 168 data points per parameter. The system does give you an error message if you enter settings that would result in more than 168 data points.

Statistic Options

Use the drop-down menu to select from the two traffic statistics options offered. The two options enable different objectives in modeling:

- **Average**: Provides a representation of the typical traffic during a period.
- **90 percentile**: Provides a representation of peak traffic during a period.

For recent time ranges (last day or week), there may not be a large difference in these values for hourly interval time series or hour of day aggregation. For daily or larger intervals, 90 percentile might be a better choice for capacity planning and average might be a better choice for trending.

Interval Options

Use the drop-down menu to select an Interval. Based on the Series type, data points will represent the selected interval as shown in Table 35 on page 241.

Table 35: Data Points by Series Type and Interval

Interval	Series Type: Hour of day aggregation	Series Type: Time series
1 hour	√	√
1 day		√
1 week		√
1 month		√

For example, a one-week interval applies to Time series, but not to Hour of day aggregation. Recall that a maximum of 168 values per parameter can be retrieved in a time series. Hourly data must be used for hour of day aggregation.

Output Directory and Output Runcode

The output directory defaults to the directory where the model is stored on the server. Click **Browse** to select an alternate directory.

NOTE: Do not extract traffic aggregations to directories used by the Paragon Pathfinder (**/opt/northstar/data**).

The output runcode defaults to the current model's runcode.

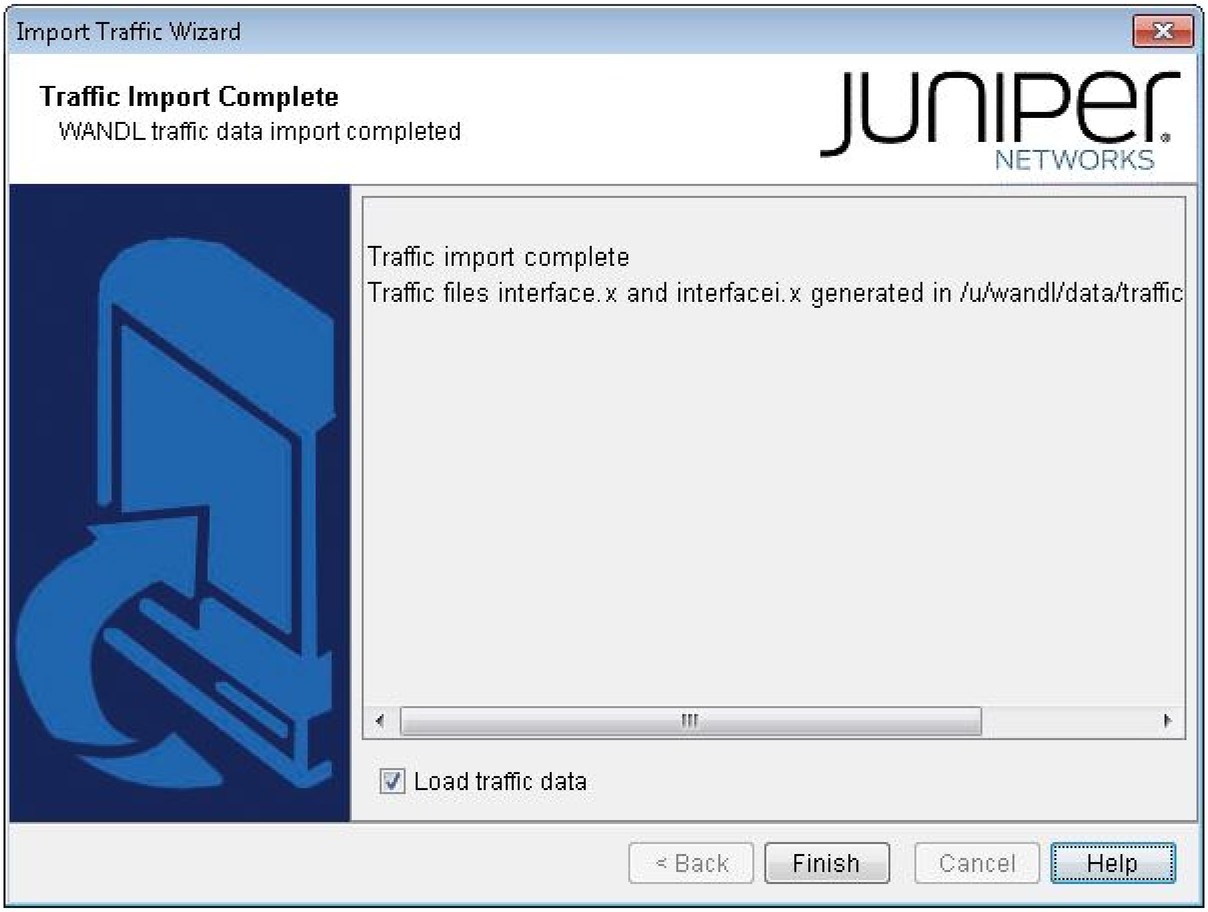
Load New Data

If selected, the extracted performance files are read into the current model.

Using the Generated Trafficload File

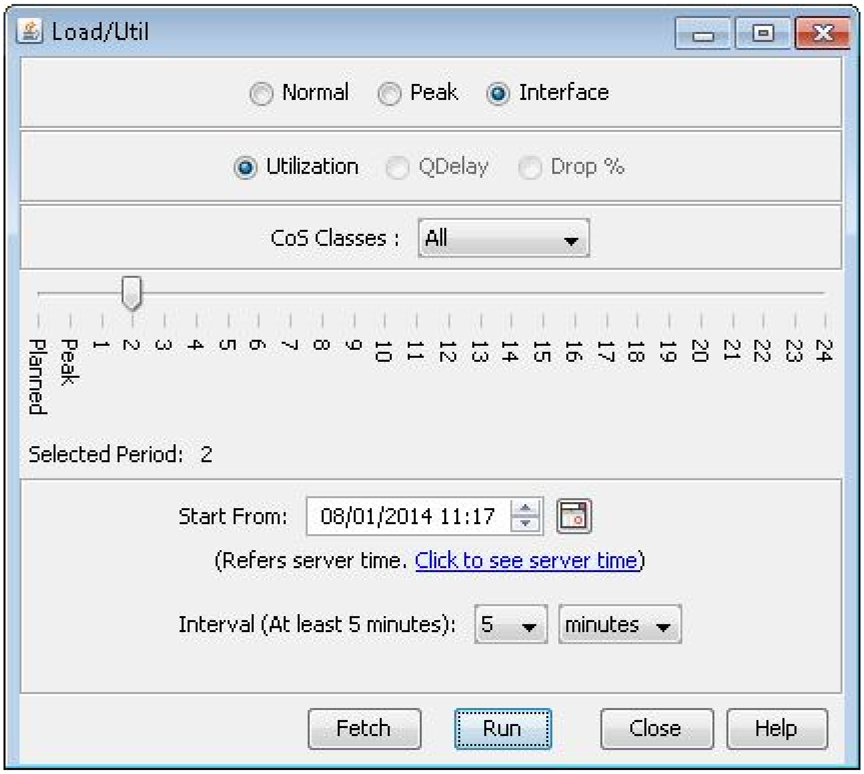
The status window will indicate when the traffic files are successfully processed and aggregated. Generating the interface/tunnel traffic files should be very quick, in a matter of minutes or less. Corresponding Paragon Planner format ingress and egress interface traffic files or tunnel traffic files are generated and loaded into the system if you check the Load traffic data checkbox. Once completed, click on the **Finish** button. Select **Traffic > Traffic Load** to display the Load/Util window. For MPLS-enabled networks, the proper layer (Layer 2 or Layer 3) should be selected.

Figure 109: Interface Traffic Load Files Generated



In the Load/Util window, select the Interface radio button (or Tunnel for tunnel traffic in MPLS-enabled networks). Then, click the **Run** button for an animated 24-period link utilization display. The 24 periods represent 24 hourly values. The slider can also be dragged to a particular period, to view the corresponding link utilization on the topology map. The second “tick” on the slider shows the Peak period. Peak represents the highest value of the 24 periods.

Figure 110: View the Utilization on the Map over 24 Periods

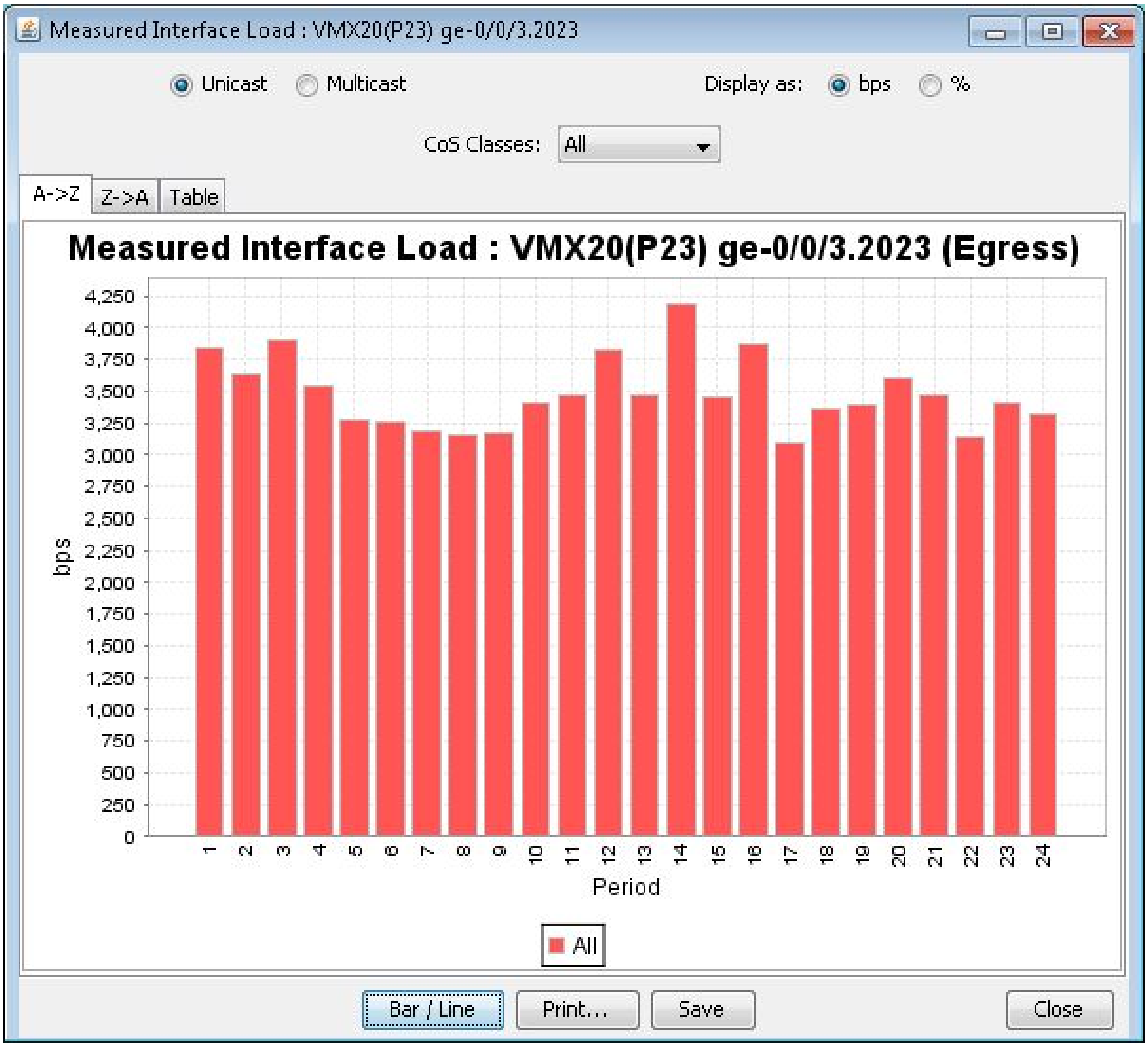


Right-clicking on a link will also display the 24-hour interface traffic bar chart.

- To display the corresponding traffic bar chart for interface traffic, select **Traffic Load > Measured Interface Traffic** from the popup menu.
- To display the corresponding traffic bar chart for tunnel traffic, select **Traffic Load > Tunnel Traffic** on Link from the popup menu.

To display a detailed report of the traffic and utilization for each interface for each 24 hour period, click on **Interface Traffic Reports > Interface Traffic Report** in the Report Manager.

Figure 111: 24-period Aggregate Data on a Link



This section describes how to use the Paragon Planner conversion utilities.

Paragon Planner takes selected types of traffic data as input and converts them into a concise binary format, organized by “daily directories”, that is suitable for rapid aggregation using any of a choice of statistical computation methods. For example, it allows you to "roll-up" a week's worth of data into 24 hourly periods and display the hourly utilization based on the 95th percentile.

The following explains the structure of the daily directories. These directories have names in date format such as:

```
MAR19.01
MAR20.01
```

In each of these daily directories is a number of files- one file per device for which traffic was collected on that particular day.

For example,

```
>ls MAR19.01
ROUTER1 ROUTER2 ROUTER3
```

Thus, if interface traffic for Router1 was collected on all three days, there is a binary file for Router1 under each of the three daily directories.

Related Spec File Parameters

To save the imported traffic from a particular network scenario, select **File > Save As**, for example, to save any new configurations to the specification file.

To view the text version of the spec file in the File Manager, right click on the newly created (or refreshed) specification file and select **Spec File > Modify Spec**, or **Edit** from the popup menu .

The traffic-related specification file parameters are described here.

Interface Traffic Parameters	Description
ingress	24-period incoming, or ingress traffic measured on the interface. This corresponds to the ingress file. When importing traffic, the ingress file is automatically named interfacei.runcode and placed in the trafdir.
egress	24-period outgoing, or egress traffic measured on the interface. This corresponds to the egress file. When importing traffic, the egress file is automatically named interface.runcode and placed in the trafdir.
trafdir	The location of the interface traffic daily directories repository. This is also called trafdir.

Tunnel traffic Parameters	Description
t_trafficload	24-period tunnel traffic file. This corresponds to the tunnel trafficload parameter in the Device Specific tab. When importing traffic, the tunnel traffic file is automatically named tunneltraf.runcode and placed in the tunnelrafdir.

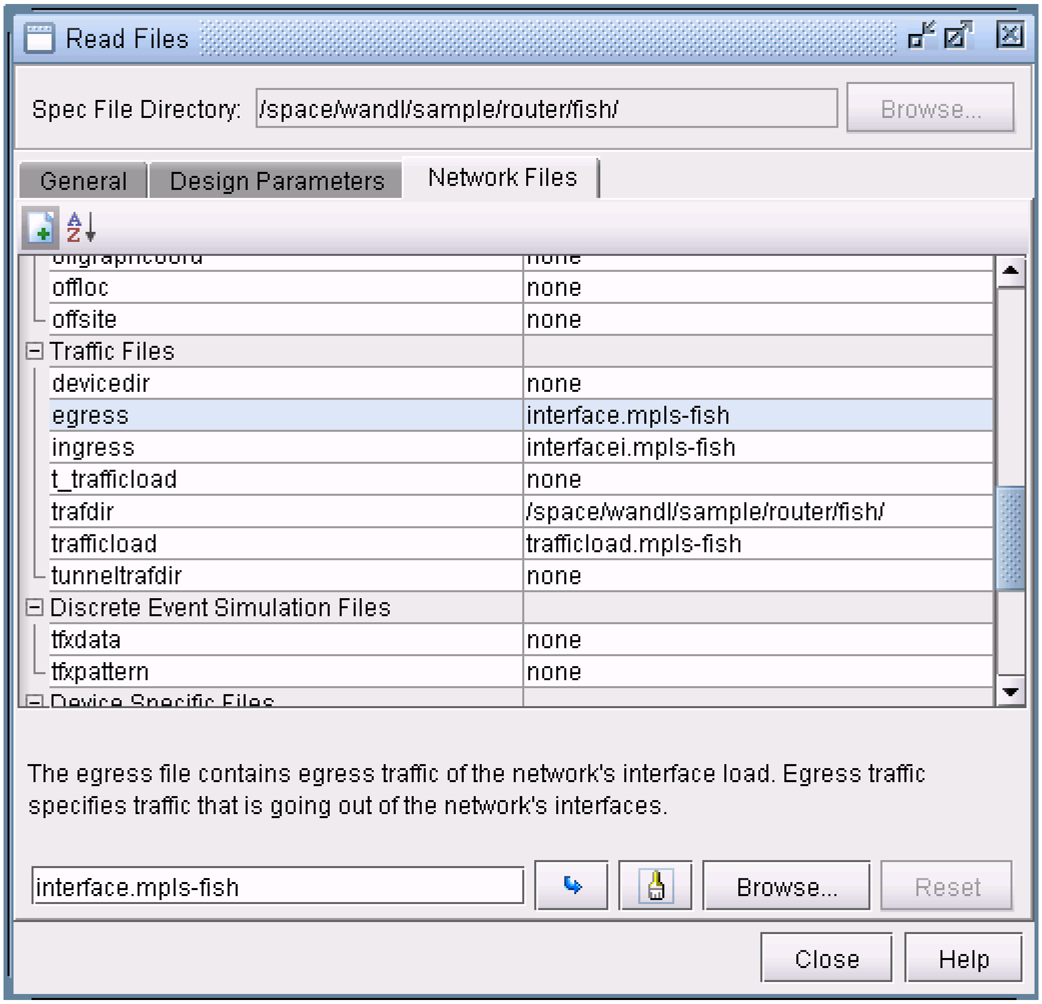
(Continued)

Tunnel traffic Parameters	Description
tunneltrafdir	The location of the tunnel traffic daily directories repository. This corresponds to the tunneltrafdir parameter in the Device Specific tab.

Addendum: Traffic Data Input Files

This section contains information on the traffic-related input files and their format. Many of these files are very similar: each line begins with some element ID, such as that for a demand, tunnel or interface. This is followed by a series of numbers representing the measured or estimated traffic statistics over that network element across many periods (for example, 24 hourly periods of traffic measurements collected on an interface.)

Figure 112: File > Load Network Files Window



Spec File > Load Network Files	dparam equivalent	Description
trafficload	trafficload=	Demand traffic file
trafdir	trafdir=	Location/path of ingress and egress files
ingress	interfaceLoad_in=	Interface traffic file
egress	interfaceLoad_out=	Interface traffic file

Sample Demand Traffic Input ("trafficload" File)

The following shows a sample of a trafficload file containing 24-period traffic load data for a demand with demand ID RNode1toNode3 originating from Node1. Note that the "UNIT=1" line is important because it establishes the unit of all other numbers in the file. In this case, the unit is 1 bit per second. Some may want to change this to "UNIT=8" depending on the data.

```
UNIT = 1 # bit per second
Node1:RNode1toNode3 A2Z - 5.000M 5.5M 5.833M 2.222M 1.0M 300K 400K 2.0M 6.0M 8.0M 11.25M 15.5M
14.054M 9.053M 6.8M 3.1M 2.0M 1.8M 500K 400K 400K 800K 1.9M 3.1M
...
```

The format for each demand entry is:

```
NodeID:DemandID Direction FrameSize P_01 P_02 P_03 P_04 P_05 P_06 P_07 P_08 P_09 P_10 P_11 P_12
P_13
P_14 P_15 P_16 P_17 P_18 P_19 P_20 P_21 P_22 P_23 P_24
```

Sample Interface Traffic Input ("interface" Files)

The following is an example of an interface egress file. The ingress file has the same format.

```
UNIT = 1 # bit per second
LDN2600 Ethernet0/0 A2Z 0 7669 7580 7555 7567 7495 7582 7608 7533 7533 7283 6841 -1 -1 -1 -1 -1
-1 -1 -1
-1 -1 -1 -1 -1
LDN2600 Serial0/0 A2Z 0 58 58 58 58 58 58 61 58 58 58 58 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1
```

The format for each ingress or egress entry is:

```
NodeID Interface Direction Framesize P_01 P_02 P_03 P_04 P_05 P_06 P_07 P_08 P_09 P_10 P_11 P_12
P_13
P_14 P_15 P_16 P_17 P_18 P_19 P_20 P_21 P_22 P_23 P_24
```

Note that a "-1" can be used as a placeholder indicating that no traffic was measured on the interface for that particular period.

Note that special unit characters such as "K" and "M" are not supported in the interface files at this time.

Also note that the Paragon Planner will use egress values if they are available. In situations where there is no egress value for a particular period, the software will check the measured ingress values and use the corresponding value. For example, for a link from Node A -> Node Z, if no value was measured for the egress traffic from Node A on the interface from Node A to Node Z, then the Paragon Planner will check the ingress value at Node Z along the same link and use that as an approximate value.

Addendum: Accessing Traffic Charts

Viewing Traffic on a Link

There are many ways to access traffic charts. To view the traffic on a particular link, you can right-click on the link in the Map window and choose an option from the Traffic Load submenu.

NOTE: For MPLS-enabled networks, there is a very similar Tunnel Traffic menu in Layer 2. The descriptions are identical to those of Demand Traffic; simply replace “Demand” with “Tunnel” in the table below.

Field	Description
Demand Traffic on Link	Brings up chart of Demand Traffic load on this link (takes into account all demands routed on this link)
Demand Traffic Load by CoS (Router only)	Brings up Demand Traffic load chart that partitions the traffic by Class of Service (CoS) for viewing.
Demand Traffic Load/BW Ratio	Brings up the Load/BW Ratio Charts that shows Demand Traffic load over Link BW.
Measured Interface Traffic	Brings up Interface Traffic Load chart for this link.
Interface vs Demand	Brings up chart that compares Interface and Demand Traffic loads on this link.

Alternatively, you can open the Links window by selecting **Network** > **Elements** > **Links**. Right-click a given link. From the popup menu you can then select **Traffic Chart** > **Measured Interface Traffic** or **Demand Traffic Load by CoS** if you have a router network. Otherwise, you can select the Demand Traffic on Link chart.

Viewing Traffic on a Demand

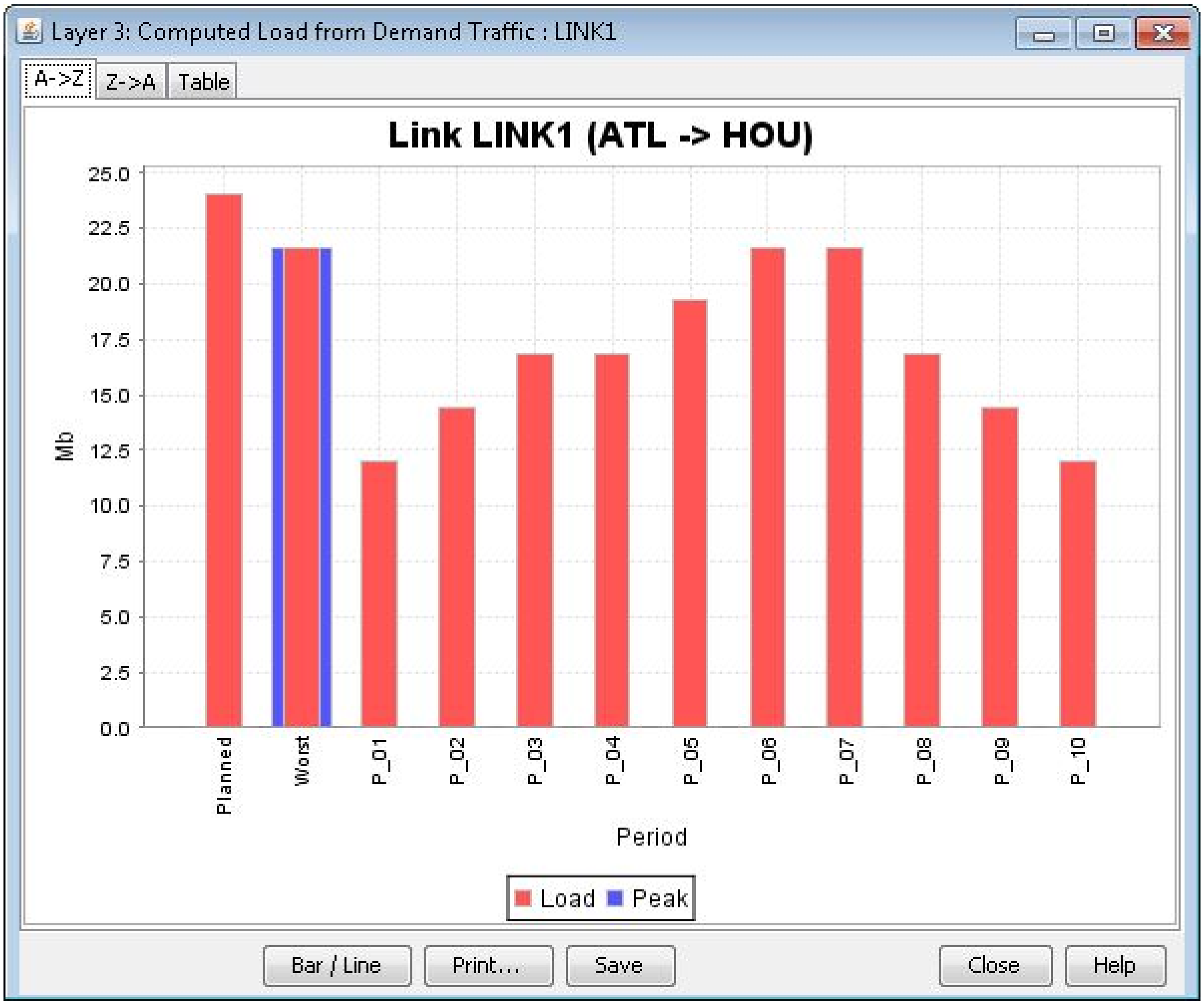
To view the traffic on a demand, select **Network > Elements > Demands**. Select the Demands you wish to view. Right-click and select either **Show Traffic Load** or **End to End Delay**.

Field	Description
Show Traffic Load for Single Demand	Shows the traffic load chart for the selected demand in the Demands window.
Show Traffic Load for All Demands	Shows the sum of the traffic load for all demands for each period.
E2E Delay for Single Demand	Shows the computed end-to-end delay for the selected demand in the Demands window.
E2E Delay for All Demands	Shows the average end-to-end delay for all demands for each period.

Addendum: Interpreting the Traffic Charts

In the Computed Load from Demand Traffic window. the *computed load* is the traffic load on the link determined by the load on the demands that are routed over the link. The load on each demand for each of a number of periods is read from the **trafficload** file. Paragon Planner computes the placement of the demands, and then reads the **trafficload** file to determine the traffic load on any particular link. If there are multiple demands traversing a link, then the Link Traffic Chart displays the sum of the demand loads.

Figure 113: Traffic Load on a Link



- **Planned:** The first column represents the total bandwidth of the demands (from the demand file) that are routed over the link.
- **Worst:** The second column represents the highest link load among the following periods.
- **Load:** Represents the link load (up to 24 periods) based on the information given in the **trafficload** file.
- **Peak:** If failure simulation is performed, peak is the highest link load during failure.

Customizing the Traffic Chart

- The *style* of the chart can be toggled between a Bar chart and a Line chart, by pressing **Bar/Line**.
- The *color* of the traffic chart can be edited by right-clicking on the graph and selecting **Properties**.

- The *period* names at the bottom of the chart (excluding those for the Planned and Worst) can be customized for just the demand traffic charts by editing the optional "FORMAT" line in the original trafficload file. The "FORMAT" line looks similar to the following, and should be placed above the first line of actual traffic data:

```
FORMAT DIR FRAMESIZE Per1 Per2 Hour3 Hour4 5 6
F0001 A2Z - 6852 2083 1372 2749 1183 1242
F0001 Z2A - 18795 11703 4578 5065 4748 6155
```

Understanding Planned Load

The planned value is the sum of the bandwidth allocated on the link for every demand of the demand file. In the router environment, it is the same as the sum of the demand bandwidths. For ATM networks, it is the sum of the CAC. If an overbooking factor is set, the CAC value is modified. Planned bandwidth is the bandwidth from the router's or switch's routing point of view.

Understanding Worst Load

The worst load is simply the worst traffic load experienced on the link over all periods for which traffic load data is supplied.

Understanding Peak Load

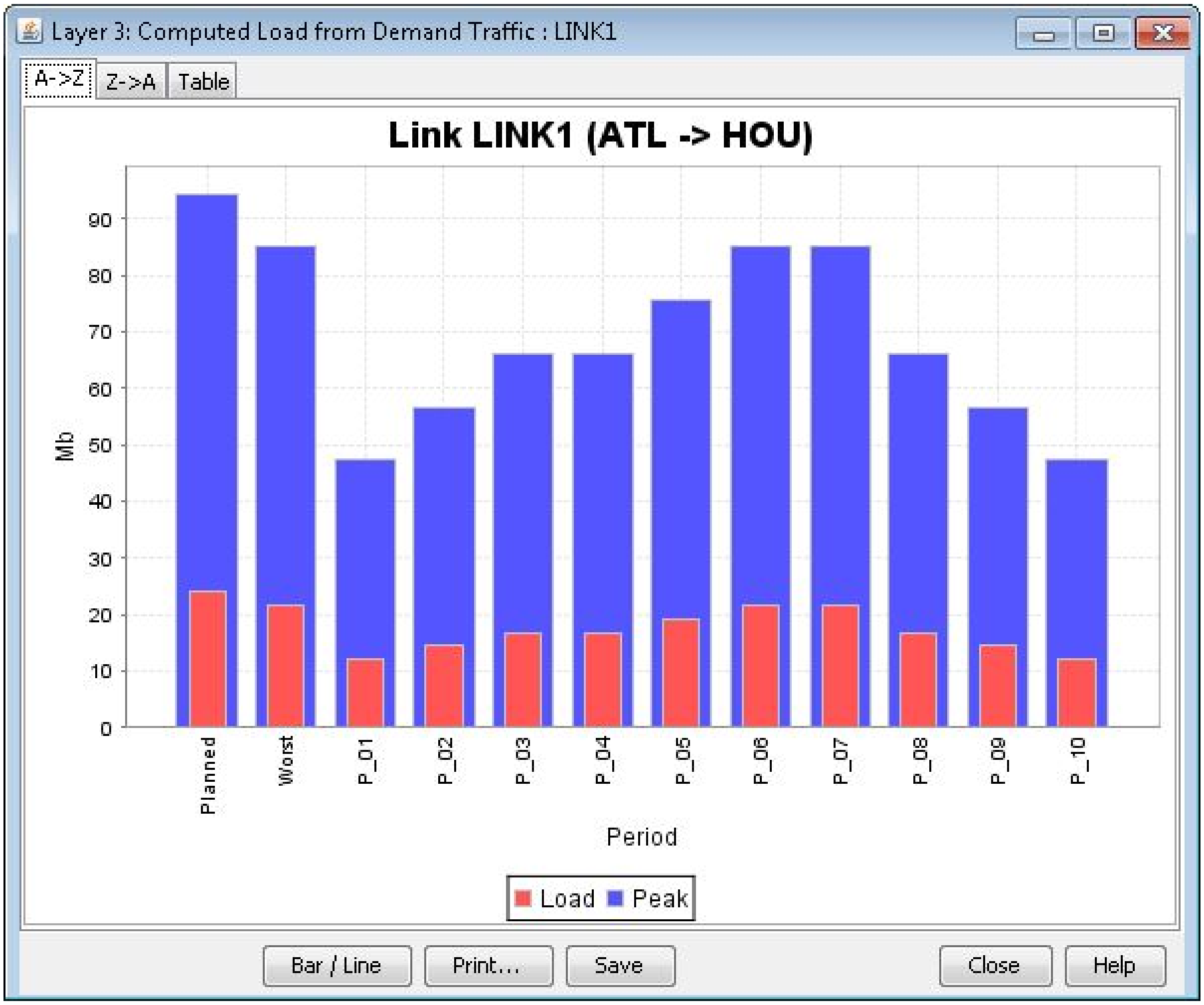
The peak is displayed only after performing a failure simulation. Peak load is based on the maximum utilization of a link resulting from the latest failure scenario.

After running a failure simulation script, Peak load values become available in the traffic charts. Each simulated failure results in the rerouting of demands around that failure. The new routes, carrying each demand's traffic load, are reflected in the peak load values on the links. Paragon Planner will compute the worst-case or peak load experienced on every link over each period over the course of the entire failure simulation sequence.

The Peak load in the Worst (second) column, reflects the value of the period with the highest peak load.

The peak planned load is also higher than the normal planned load because of the additional bandwidth required for demands rerouting over the link.

Figure 114: Traffic Statistics on Link After Running a Failure Simulation



Load/BW Ratio Charts

The Load/BW Ratio chart is accessed by right-clicking on a link and choosing Traffic Load > Demand Traffic Load/BW Ratio from the popup menu.

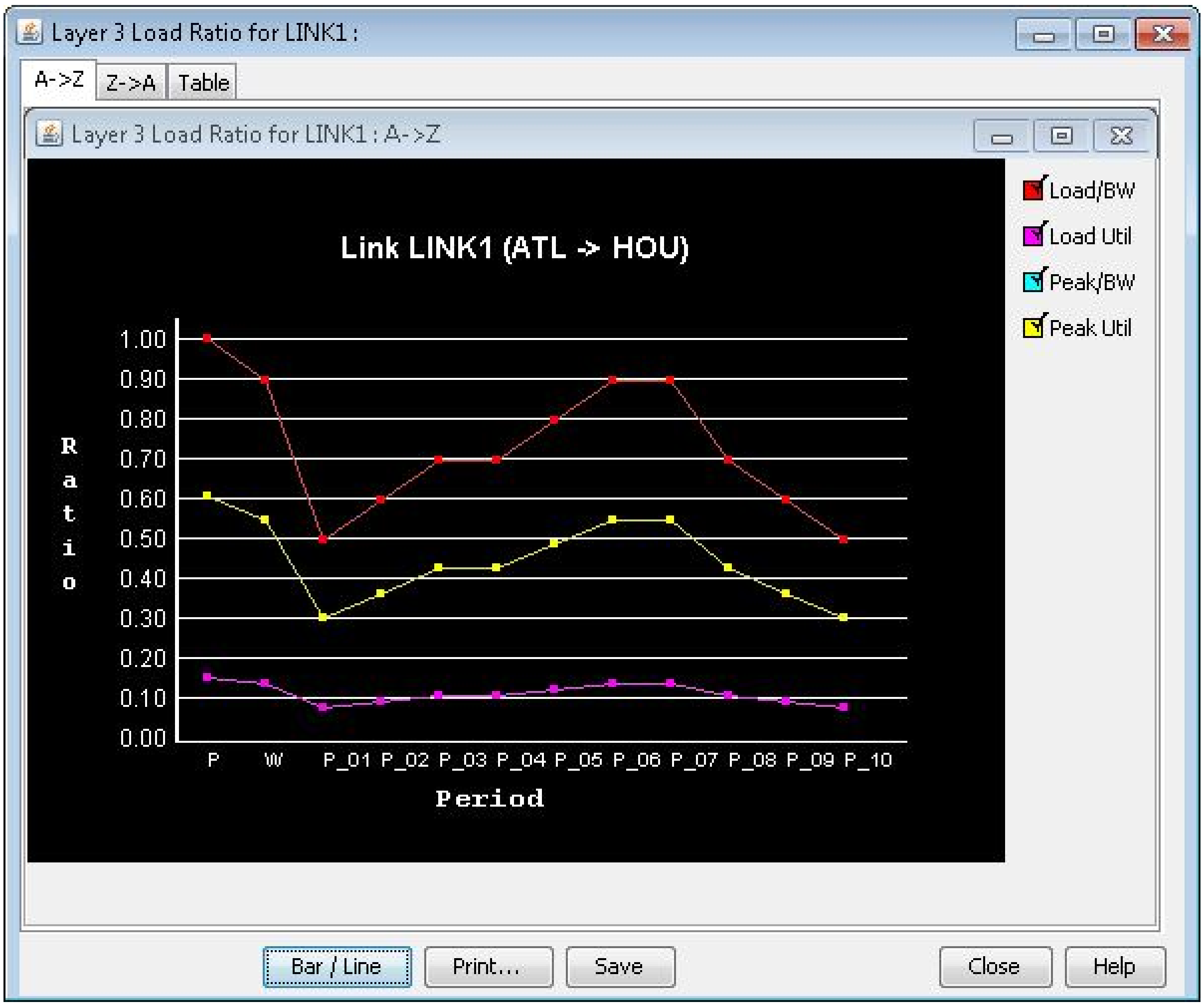
Period (X-Axis)

- P stands for planned and indicates the load based on demand bandwidths, as defined in the *demand* file.
- W represents the load during the worst period based on demand traffic load values from the *trafficload* file.
- Periods represent the load information based on demand traffic load values from the *trafficload* file.

Ratio (Y-Axis)

- **Load/BW:** Normal Load/Total Demand Bandwidth
- **Load Util:** Normal Load/Link Bandwidth; The utilization of the link for a particular period based on the traffic load of those demands routed over it, as given in the trafficload file.
- **Peak/BW:** Peak Load/Total Demand Bandwidth (experienced during Failure Sim)
- **Peak Util:** Peak Load/Link Bandwidth; The peak utilization is the highest bandwidth utilization obtained at the chosen link during the failure simulation. It will only be displayed after running a failure simulation, such as a scripted exhaustive node failure.

Figure 115: Load/BW Ratio Chart After Failure Simulation



Measured Interface Traffic Chart

The Interface Traffic chart can be accessed either by selecting **Traffic Chart > Measured Interface Traffic** from the right-click menu of the NetInfo window Link tab, or by right-clicking on a link in the Map and selecting **Traffic Load > Measured Interface Traffic**.

This chart displays the measured interface load from the *interfaceLoad_in* (ingress) or *interfaceLoad_out* (egress) files. Note that this is different from the traffic load of demands routed over a link, where the load is derived based on the load on the demands routed over the link for a particular period. Rather, it represents the actual load measured at the link interface.

11

CHAPTER

Inventory Menu

Inventory Menu Overview

IN THIS SECTION

The Hardware Model, accessed through Inventory > Hardware Inventory, allows you to view details about the equipment in a network. There are two ways to view Hardware Model information: through the Hardware Inventory window, or through the Equipment Cost window. The Hardware Model feature can be very helpful to the network planner who is concerned about equipment cost and availability. This feature can also be used to keep track of equipment in an existing network, including information such as number of available ports, operating system versions, part numbers, serial numbers, and other inventory related operations. Link and card failure simulations can also be launched.

Components of the Hardware Model

- Hardware Inventory deals with detailed equipment reporting, equipment utilization view, hardware capacity management, and hardware CapEx.
- Hardware Equipment Costs is used to associate costs with specific hardware equipment, and is the major financial input table for the Hardware Inventory Capex report. For information on how to assign costs to hardware, refer to "Hardware Equipment Cost" on page 297.

Collecting Hardware Inventory

Hardware inventory information can be derived from CLI commands, which can be either automated in from the Network Config Data Collection task or Scheduling Live Network Collection task, or collected through a third-party tool.

Importing CLI Output Commands

Hardware information can be imported from text files containing CLI output commands. The following is a partial list of currently supported CLI output commands:

Juniper Networks Junos OS

- show version
- show chassis hardware

Cisco IOS

- show version
- show hardware
- show diag
- show env all
- show idprom backplane

Cisco XR

- show version
- show hardware
- show diag

Cisco Catalyst

- show module

Nortel Passport

- show config

Alcatel SR

- show mda

Riverstone

- show version

Configs Collected by Rancid

- Cisco IOS

- Juniper Networks Junos OS
- Tellabs

Importing and Saving

Hardware information from a live network can also be imported on-demand via real-time SNMP and CLI outputs. Previously saved SNMP, CLI, and CSV data can also be imported for an offline network. To do this, open the Hardware Inventory window by selecting **Inventory > Hardware Inventory**. Then, at the bottom of the window, there is a toolbar with Load and Save buttons.

Clicking on the Load button displays several options.

Field	Description
Collect Inventory	Collect real-time SNMP and CLI data from a live network.
SNMP Output	Load previously saved SNMP output.
CLI Output	Load previously saved CLI output.
Node/Shelf/Card Descriptions	Load previously saved CSV data.

Clicking on the Actions > Save button displays several options.

Field	Description
Current Report	This saves the current report displayed in the right pane. Different reports can be selected via the tree in the left pane.
All Node/Shelf/Card Descriptions	Saves node/shelf/card descriptions for all devices in the network to a CSV file.
All Hardware Information for Comparison	Save the current complete hardware profile for future comparison.

Hardware Inventory File Format

When using CLI to collect the hardware information, the raw data files are saved into directory /u/wandl/data/collection/.LiveNetwork/equipment_cli. The file naming convention is “<Router Profile Name>.equipment_cli”.

When using SNMP to collect the hardware information, the raw data files are saved into directory /u/wandl/data/collection/.LiveNetwork/equipment. The file naming convention is “<IP>.iftable” and “<IP>.snmp”.

From the raw data, hardware inventory files are generated into XML format in directory /u/wandl/data/livenetwork_output_directory/swconf.x. The file naming convention is “<hostname>.xml”. Each collection method may have slightly different raw data values which is dependent on the device vendor. Also, SNMP may not be able to collect certain data fields that CLI can collect and vice versa. If both SNMP and CLI collection methods are used, the combined data collected will compliment each other in the hardware inventory files.

From the hardware inventory files, hardware inventory reports in CSV format can be generated by running Task Manager > Hardware Inventory Reports. The output directory of the reports can be specified along with options to timestamp the file names and save the reports to the Web. The CSV reports created are listed in the table below.

Filename	Description
ROUTER_LIST	Device, IP, Vendor, OS, Chassis, Hardware ID, Boot Image, ROM, Memory, Processor
CARD_LIST	Card ID, Part #, Serial #, Port count
INTF_LIST	Interface, IP, Status, Physical Address
TRANSCEIVER_LIST	Transceiver
MISC_PART_LIST	Miscellaneous parts: power supply, fan, display
HW_CAPEX_REPORT	Cost, Part Type, Component Name grouped by Device
HW_PARTS_REPORT	Cost, Part Type, Component Name grouped by Part Type
HW_DEVICE_USAGE_REPORT	Card Usage, Port Usage grouped by Device

(Continued)

Filename	Description
HW_LINECARD_USAGE_REPORT	Card Usage, Port Usage grouped by Card
HW_IC_REPORT	Integrity Check report for unknown or unsupported data

Inventory Menu: Hardware Inventory

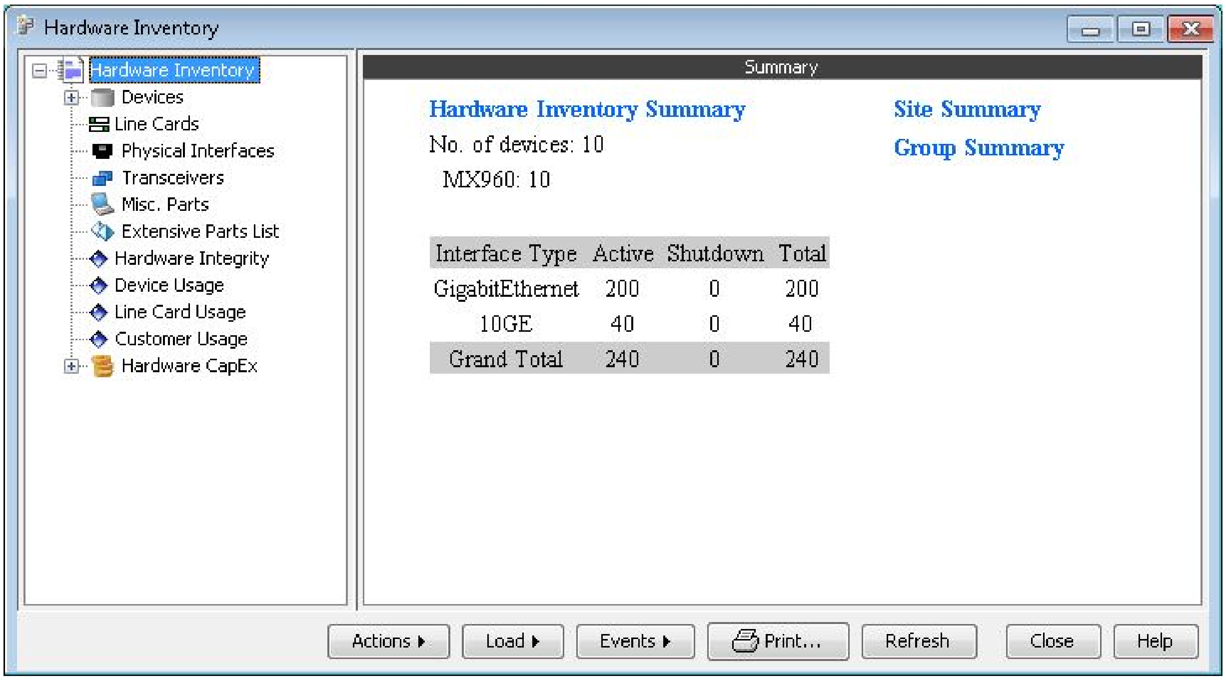
IN THIS SECTION

When a network is loaded, the Hardware Inventory window can be opened by selecting **Inventory > Hardware Inventory**. This window contains reports and information about the hardware at each individual node in the network. When viewing hardware information at a specific node, the Hardware Inventory window is split into two panes. The left pane displays a tree listing all existing hardware (routers) and summary reports. The right pane displays the content of the item selected in the left pane.

Hardware Inventory Summary

When the Hardware Inventory window is opened, the right pane will show a summary of all the equipment in the network. This provides a quick tally of the number and types of devices and interfaces in the entire network.

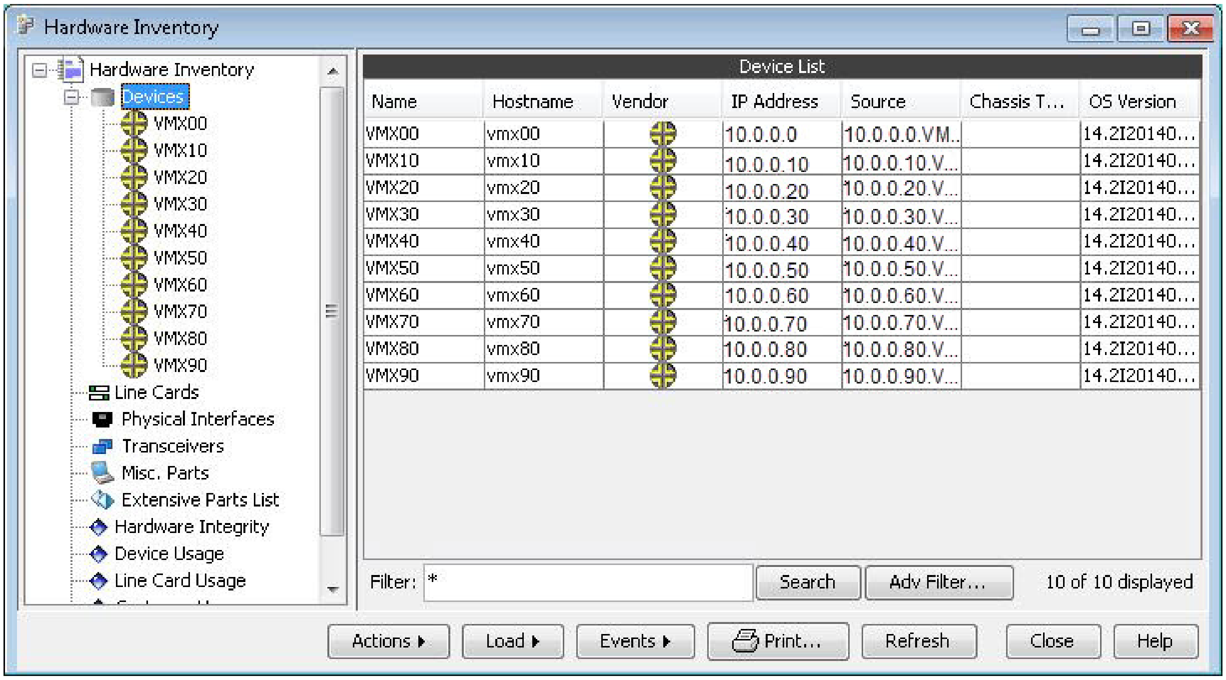
Figure 116: Hardware Inventory Summary



Devices List

Selecting Devices in the left pane displays a Device List report in the right pane. The saved report's filename starts with "ROUTER_LIST." Clicking on the small icon to the left of Devices in the left pane will expand the tree to show a list of routers in the left pane. These devices can then be individually selected to display a detailed Equipment View in the right pane for the selected router. See "Equipment View" on page 283 for more information

Figure 117: Device List

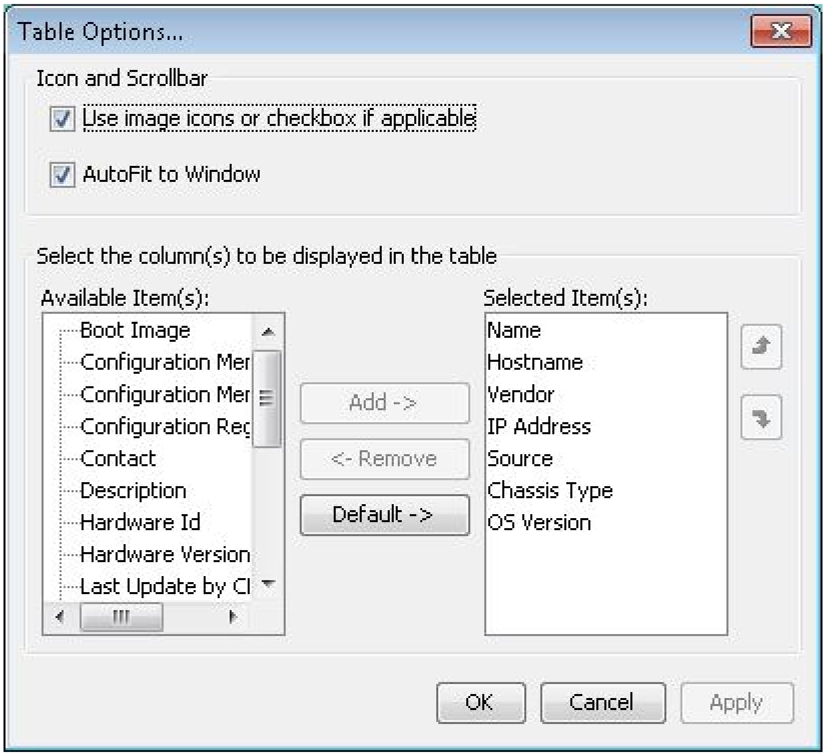


Various actions can be executed by right clicking on a row and selecting an item from the popup menu. The items in this popup menu are available for many reports in the Hardware Inventory window, though not all reports will contain all items.

- **Node Detail:** Brings up a Node window with detailed information about the node in the selected row.
- **Highlight:** Highlights the relevant node in the Map window.
- **Show Config:** Opens the router configuration file for the relevant node if such a file is available.
- **Show Equipment:** This will open the Equipment View window for the relevant node.

The Table Options window can be opened by right clicking on a row in a report and selecting **Table Options**. This is useful for customizing the type of information displayed in the report.

Figure 118: Hardware Inventory Table Options



Selecting Use image icons or checkbox if applicable displays image icons in vendor and status cells that make the reports more visually pleasing and easier to comprehend at a glance. The Autofit to window option will, when selected, automatically resize the column widths to fit the width of the report window. In the bottom half of the Table Options window, specific columns can be either included are excluded from the report.

Columns	Description
Name	Device name converted into Paragon Planner format
Hostname	Device hostname
Vendor	Device vendor (for example, Cisco, Juniper Networks)
IP Address	Loopback IP address of the Device, typically the first one listed
Source	Filename of collected configuration file

(Continued)

Columns	Description
Chassis Type	The type of chassis, for example, WS-C6509-E (similar to SNMP chassisType)
OS Version	Operating System Version, for example, 12.2(53)SE
Contact*	SNMP sysContact
Description	Device description
Location*	SNMP sysLocation
System Name*	SNMP sysName
Boot Image	The boot image, e.g, a string starting with flash:, bootflash:, disk0:
Configuration Memory	Non-volatile configuration memory (bytes)
Configuration Memory in Use*	Non-volatile configuration memory in use (bytes) SNMP nvRAMUsed
Configuration Register*	SNMP configRegister, for the configuration register value
Hardware Id	Equivalent of SNMP chassisId, which defaults to the chassis serial number
Hardware Version	Equivalent of SNMP chassisVersion, which defaults to the chassis hardware revision level
Last Update by CLI	The last time this file was updated by CLI collection
Memory	Equivalent of SNMP processorRam, based on RAM available to CPU (bytes)
Mgmt IP Addr	The Management IP Address is the IP addressed used by Paragon Planner to discover the device.

(Continued)

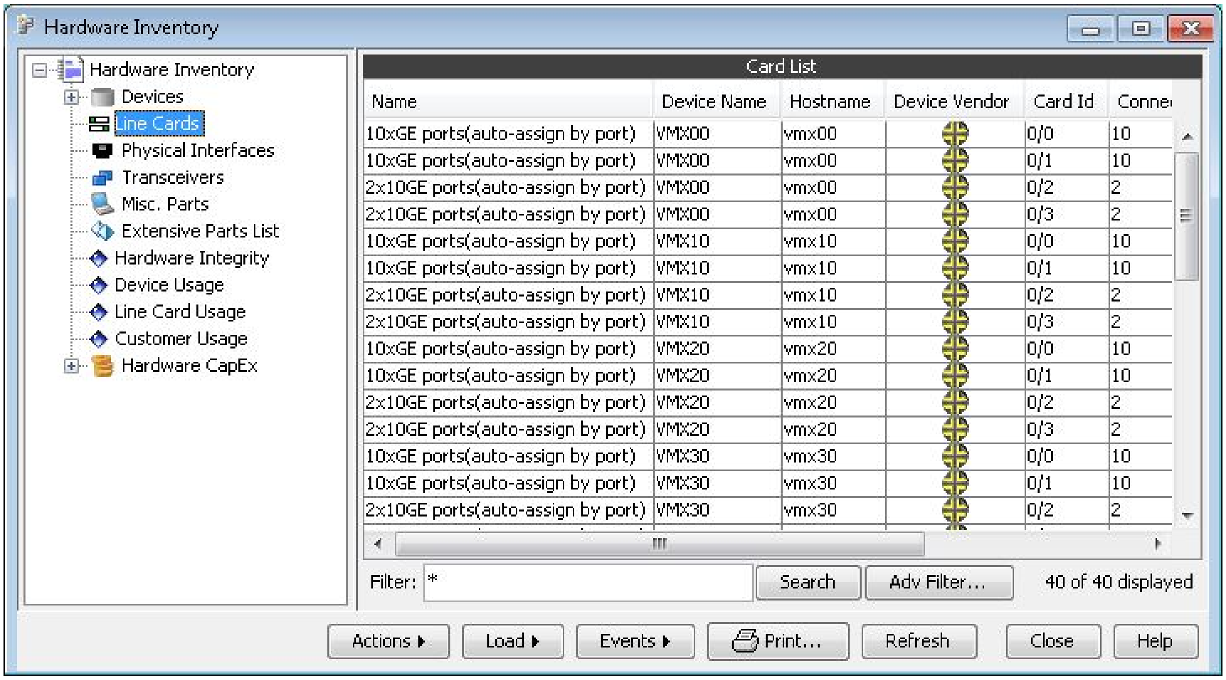
Columns	Description
Model	The Hardware model can provide additional detail not known from the vendor, for example, by distinguishing JUNIPER and JUNIPER_EX
OS Family	The operating system family (for example, IOS, Junos OS)
Processor	The device processor, for example, PowerPC405
ROM System Version*	SNMP romSysVersion, which contains the ROM system software version
ROM Version	SNMP romVersion, which contains the ROM monitor version

NOTE: SNMP fields will not be populated if hardware inventory is collected by CLI.

Line Cards

Selecting **Line Cards** in the left pane displays a Card List with information on all the cards in the network. The saved report name starts with `CARD_LIST`. This list is useful for managing aspects of a network related to card capacity, such as keeping track of how many ports of a specific type are available in the network. The Table Options (right-click a table header for this menu option) can be used to add additional columns such as the Version.

Figure 119: Hardware Inventory: Line Cards



Column	Description
Hostname	Device hostname
Name	Line card name, for example, WS-X6704-10GE
Device Name	Device name converted into Paragon Planner format
Device	Vendor Hardware vendor (Cisco, Juniper Networks)
Card Id	Slot information, for example, S-0/1
Connected	Ports Number of ports that (a) have a corresponding link in the model, (b) are operationally up, or (c) have an IP address defined on the interface
No. of Ports	Number of physical ports

(Continued)

Column	Description
Part	Line Card Part number
S/N	Line Card Serial number
Version	Line Card Version information, for example, rev A0 ver 4
Controller Mem.*	Controller memory (Cisco-specific field)
Cost (Estimated)	Estimated hardware cost
Description	Line Card Description
Device IP Addr.	Loopback IP address of the Device, typically the first one listed
Device Mgmt IP Addr.	The Management IP Address is the IP addressed used by Paragon Planner to discover the device.
FRU Line Card FRU Packet Mem. FRU Route Mem.	Details related to the Field Replacement Unit (Cisco)
L3 Engine L3 Engine Type	Details related to the L3 Engine (Cisco)
Reserved Ports	Number of Reserved ports, based on customizable keywords found in the description.
Shutdown Ports	Ports that have operational or admin status down

(Continued)

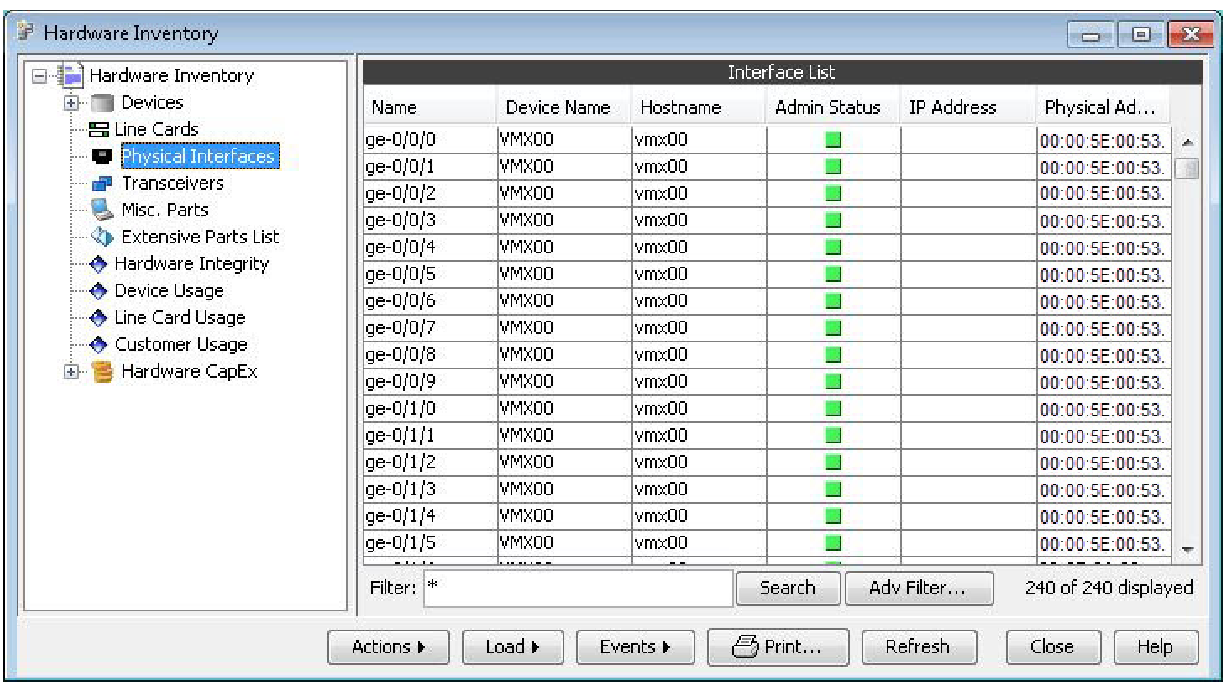
Column	Description
TAN	Top Assembly Number (Cisco ordering number)

NOTE: NMP fields will not be populated if hardware inventory is collected by CLI.

Physical Interfaces

Selecting **Physical Interfaces** in the left pane displays an Interface List report listing all interfaces, their status, and additional information in the right pane. The saved report's filename starts with "INTF_LIST." The rows in the report can be sorted by clicking on the column header for the property to sort by.

Figure 120: Hardware Inventory: Physical Interfaces



Column	Description
Name	Physical Interface Name, for example, TenGigE0/2/0/2
Hostname	Device hostname
Device Name	Device name converted into Paragon Planner format
Device Vendor	Hardware vendor (Cisco, Juniper Networks)
Card Id	Slot information, for example, S-0/1
Description	Physical interface description
IP Address	IP address of physical interface, if assigned
Device IP Addr.	Loopback IP address of the Device, typically the first one listed
Device Mgmt IP Addr.	The Management IP Address is the IP addressed used by Paragon Planner to discover the device.
Admin Status	Interface Administrative status (active, down, or unknown)
Physical Address	The address of the physical interface, based on intfmap Paragon Planner file.
Aggregated Link	Any associated aggregated link, such as PortChannel or Bundle-Ether
Bandwidth T	he physical interface bandwidth, for example, 100.0M
IPv6	IPv6 address information (based on Paragon Planner intfmap file)
MTU	MTU information (based on Paragon Planner intfmap file)

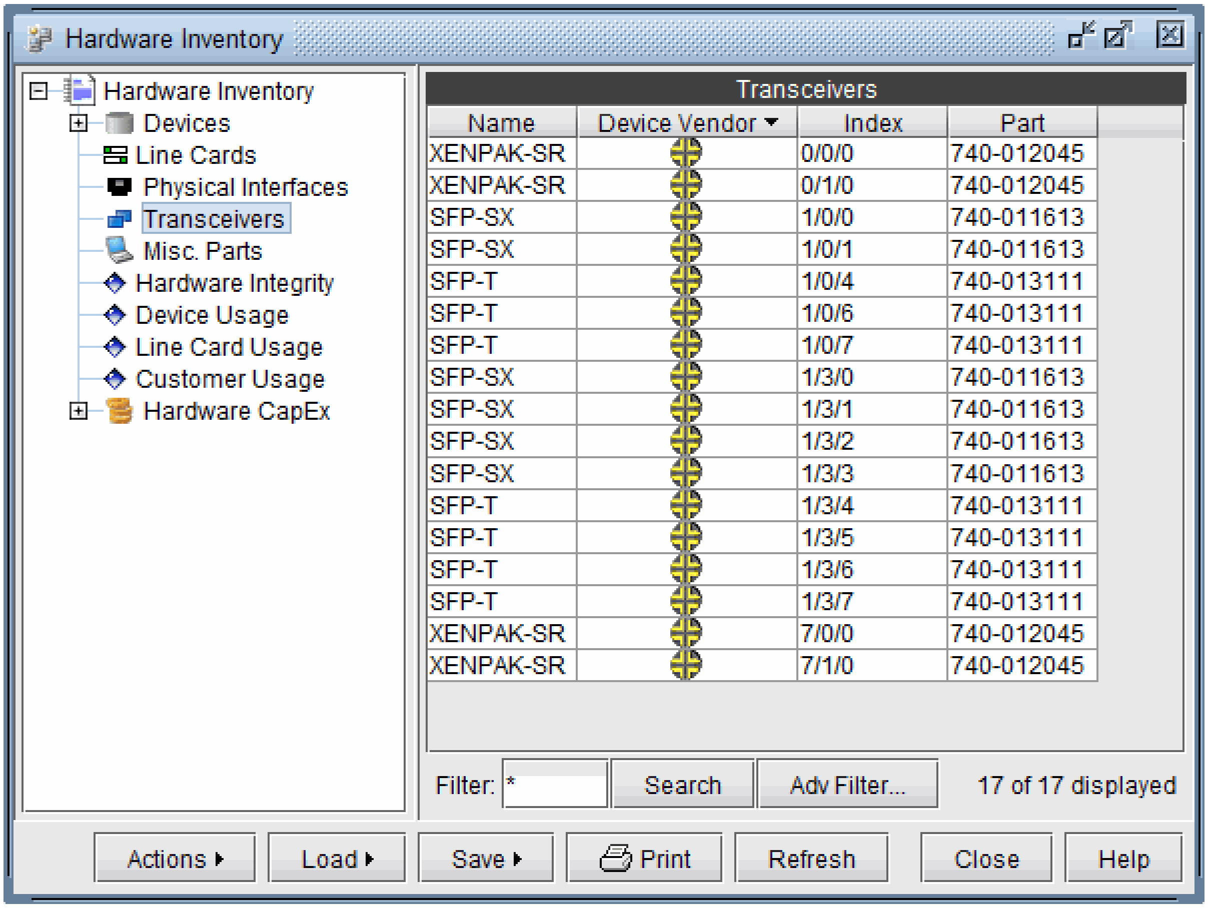
(Continued)

Column	Description
Media Type	The Physical interface media type, for example, `ATM,BRI,BVI,Cable,Channelized E1,DS,E1,Ethernet,FE,GE,OC3/STM1,T1,T3`
Operational Status	Interface Operational Status (active, down, or unknown)
Switchport Mode	Switchport mode for layer 2 interfaces, for example, access or trunk
VLAN	List of VLAN's for this physical interface, for example, "22 100-102 105-108"

Transceivers

Selecting **Transceivers** in the left pane displays a Transceivers List with information on all the transceivers or small form-factor modules of devices in the network. This report can be filtered and sorted by clicking on the appropriate column headers. The saved report's filename starts with `TRANSCEIVER_LIST_LIST`.

Figure 121: Hardware Inventory: Transceivers



Column	Description
Name	Transceiver name, for example, SFP-10GBase-ER
Hostname	Device hostname
Device Name	Device name converted into Paragon Planner format
Device Vendor	Hardware vendor (Cisco, Juniper Networks)
Device IP Addr.	Loopback IP address of the Device, typically the first one listed
Index	Slot information, for example, S-0/1

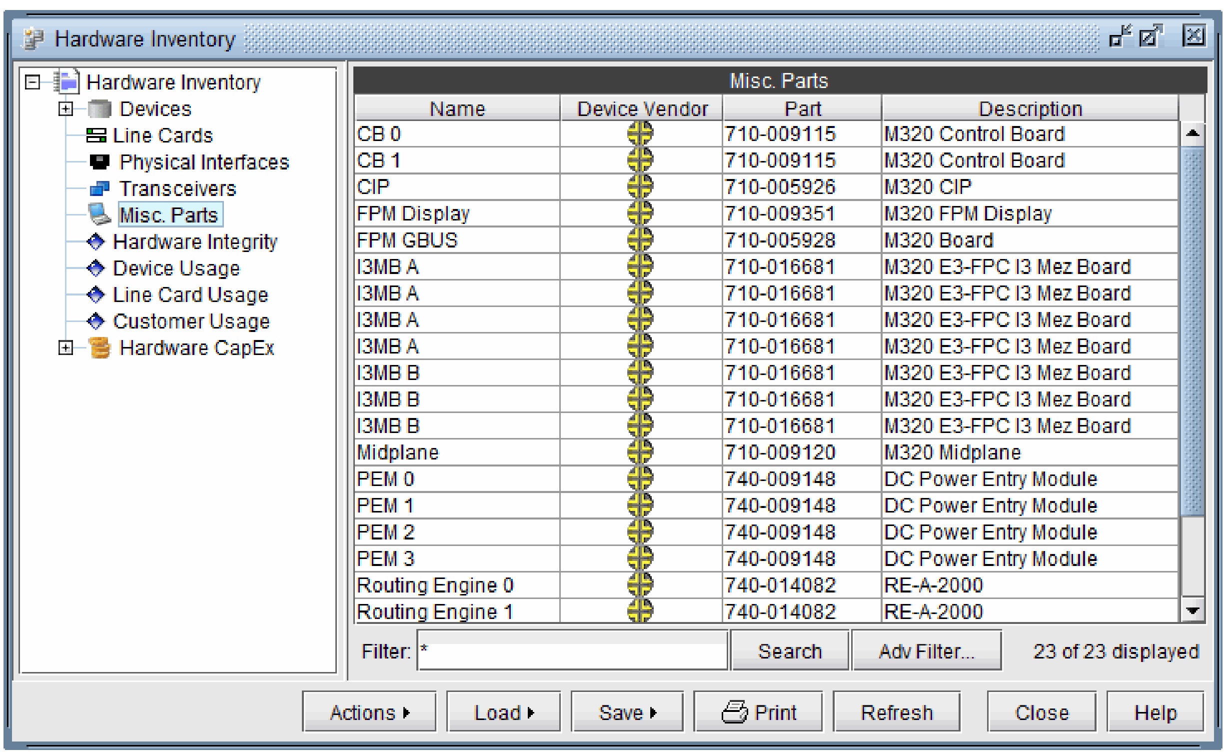
(Continued)

Column	Description
Part	Part number
S/N	Serial number
Cost (Estimated)	Estimated hardware cost

Miscellaneous Parts

Selecting **Misc Parts** in the left pane displays a Miscellaneous Parts List with information on all the power supplies and fans of devices in the network. This report can be filtered and sorted by clicking on the appropriate column headers. The saved report's filename starts with `MISC_PART_LIST`.

Figure 122: Hardware Inventory: Misc Parts

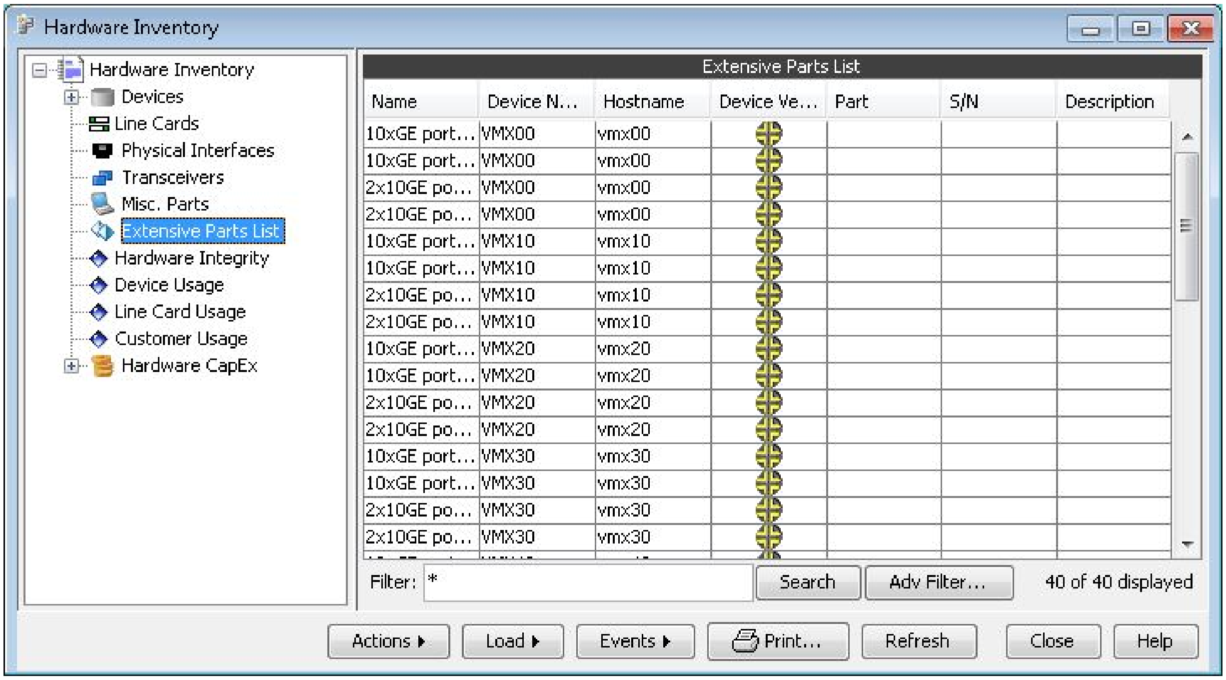


Column	Description
Name	Name of miscellaneous part, for example, “Power Supply 1”
Hostname	Device hostname
Device Name	Device name converted into Paragon Planner format
Device Vendor	Hardware vendor (Cisco, Juniper Networks)
Device IP Addr.	Loopback IP address of the Device, typically the first one listed
Description	Description of miscellaneous part
Part	Part number
S/N	Serial number
Cost (Estimated)	Estimated hardware cost

Extensive Parts List

Selecting **Extensive Parts List** in the left pane displays a report listing all parts along with the part number, serial number, description, and the device it belongs to in the right pane. The rows in the report can be sorted by clicking on the column header for the property to sort by.

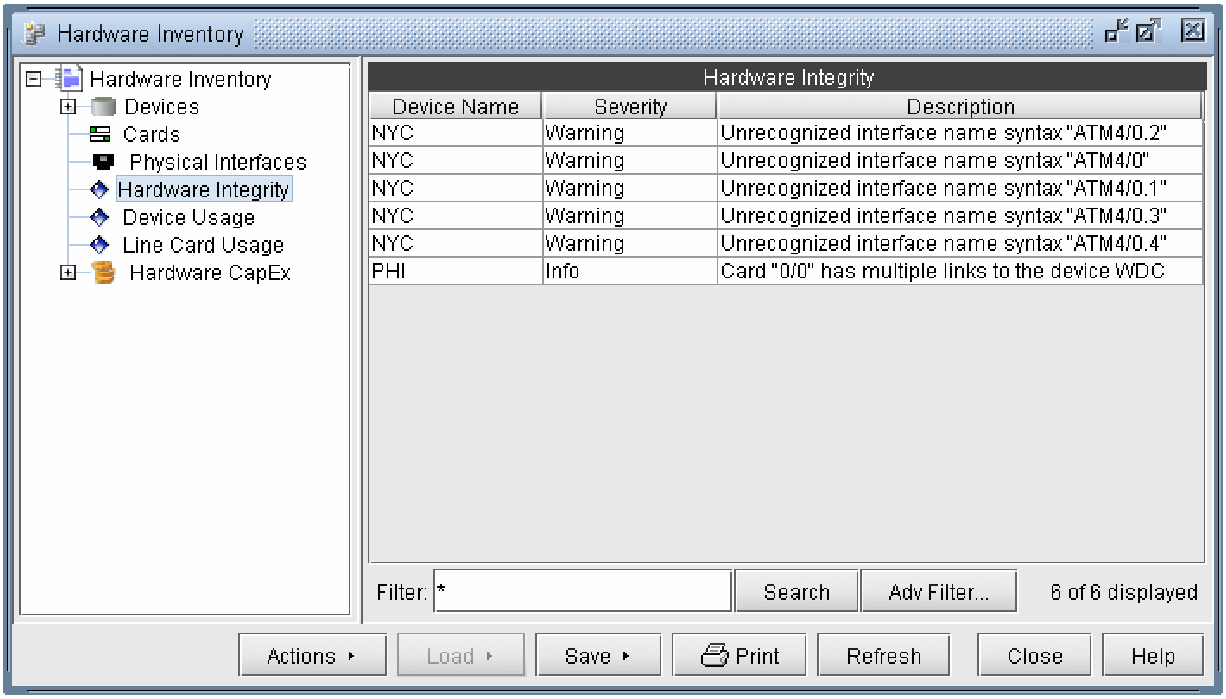
Figure 123: Hardware Inventory: Extensive Parts List



Hardware Integrity

The Hardware Integrity report window provides a summary check of possible errors in the hardware configuration as represented by the Hardware Model. This report can be sorted by clicking on the appropriate column headers. This report is useful when, for example, checking to make sure that all links have connected interfaces. The saved report's filename starts with "HW_IC_REPORT."

Figure 124: Hardware Inventory: Hardware Integrity

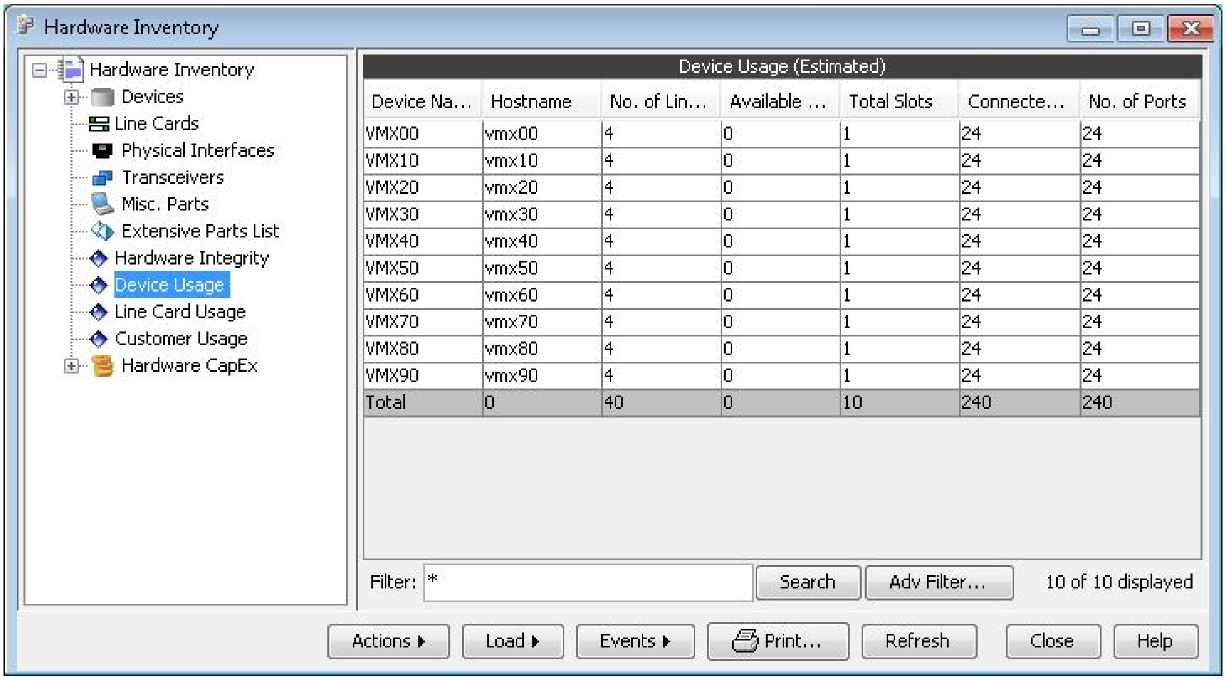


Column	Description
Device Name	Device name converted into Paragon Planner format
Severity	Severity level of integrity check: Info,Severity,Warning
Description	Description of the integrity check finding

Device Usage

The Device Usage report provides an estimate of the degree to which all the cards and ports in the nodes of the network are being utilized. The report lists total numbers of cards and ports side by side with the number of utilized cards and ports, sorted by node, to give you an idea of where the network stands in terms of hardware capacity and usage at each node. You can also choose to show interface usage through the table options window (by right-clicking on the column headers). The saved report's filename starts with "HW_DEVICE_USAGE_REPORT."

Figure 125: Router Inventory Reports: Device Usage



Column	Description
Hostname	Device hostname
Device Name	Device name converted into Paragon Planner format
Occupied Line Cards	Number of line cards which are used
Available Line Cards	Number of line cards which are empty
Total Line Cards	Total number of line cards
Connected Ports	Number of ports that (a) have a corresponding link in the model, (b) are operationally up, or (c) have an IP address defined on the interface
No. of Ports	Total Number of physical ports
Reserved Ports	Number of Reserved ports, based on customizable keywords found in the description.

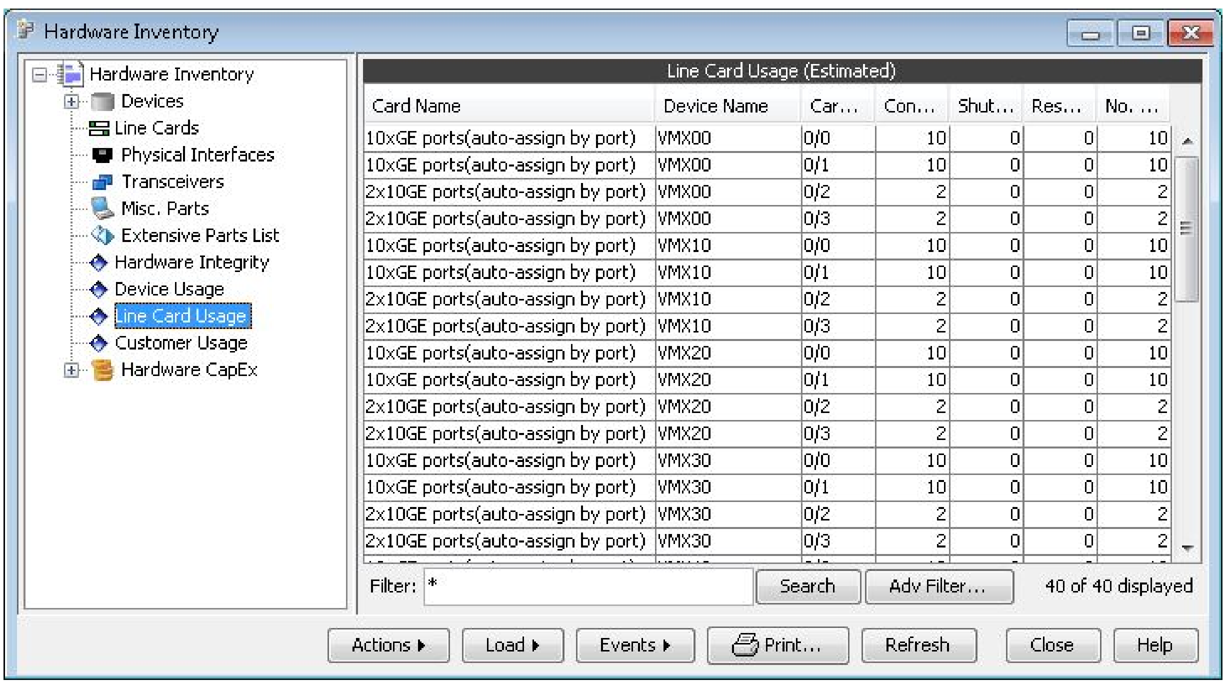
(Continued)

Column	Description
Shutdown Ports	Ports that have operational or admin status down

Line Card Usage

The Line Card Usage report lists all the cards in the network sorted by card type and provides usage information for these cards. This is useful when searching for capacity information, such as the number of port vacancies in a particular type of card in the network. The saved report's filename starts with "HW_LINECARD_USAGE_REPORT."

Figure 126: Hardware Inventory: Line Card Usage



Column	Description
Card Name	Name of line card

(Continued)

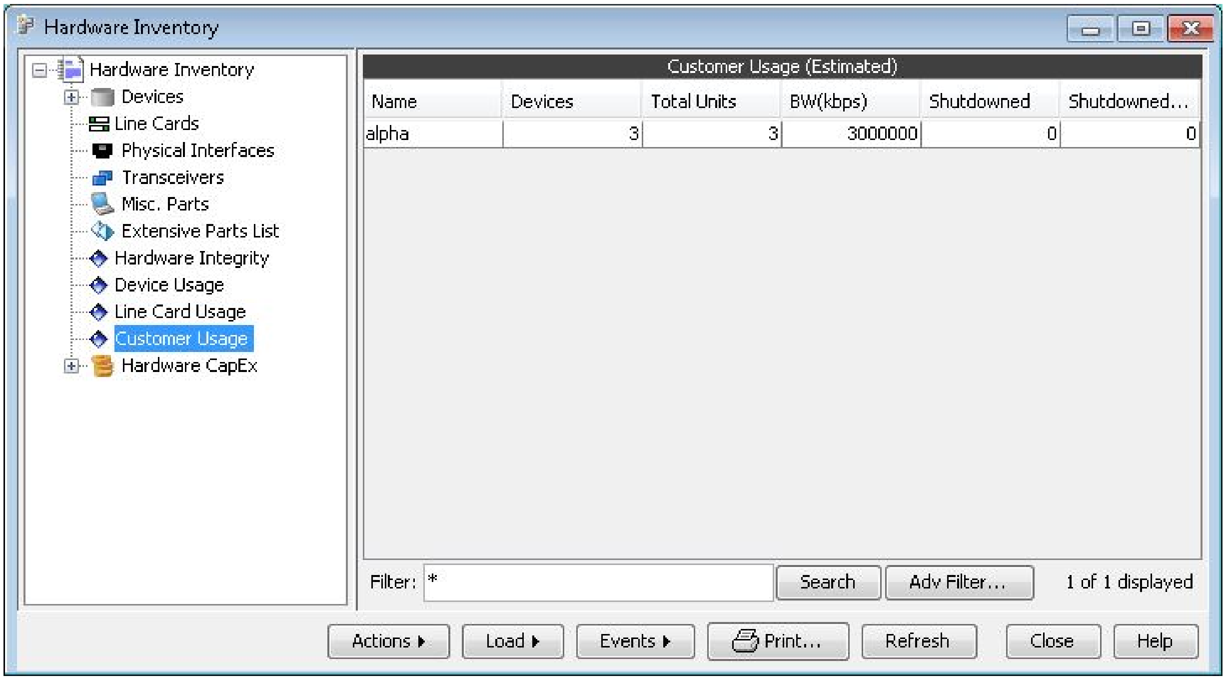
Column	Description
Device Name	Corresponding device name converted into Paragon Planner format
Card Id	Slot information, for example, S-0/1
Connected Ports	Number of ports that (a) have a corresponding link in the model, (b) are operationally up, or (c) have an IP address defined on the interface
No. of Ports	Total Number of physical ports
Reserved Ports	Number of Reserved ports, based on customizable keywords found in the description.
Shutdown Ports	Ports that are operationally or administratively down

Customer Usage

The Customer Usage report displays network usage on a per customer basis. Customer names are parsed from the interface comments in the imported configuration files. The regular expression used to parse the customer names can be customized by selecting a device from the Hardware Inventory window, going to the Logical View panel, selecting **Actions > Options**, and going to the Misc tab. There, you will see a section called Customer Identifier with a field called Use regular-expression in interface description. Enter your custom regular expression here.

The parser looks for customer names within parenthesis. For example, to match a number sequence in interface comments of the format, `cust####...`, use the expression, `cust([0-9]+).*` There is currently no way to define customers other than parsing them from interface comments in the imported configuration files.

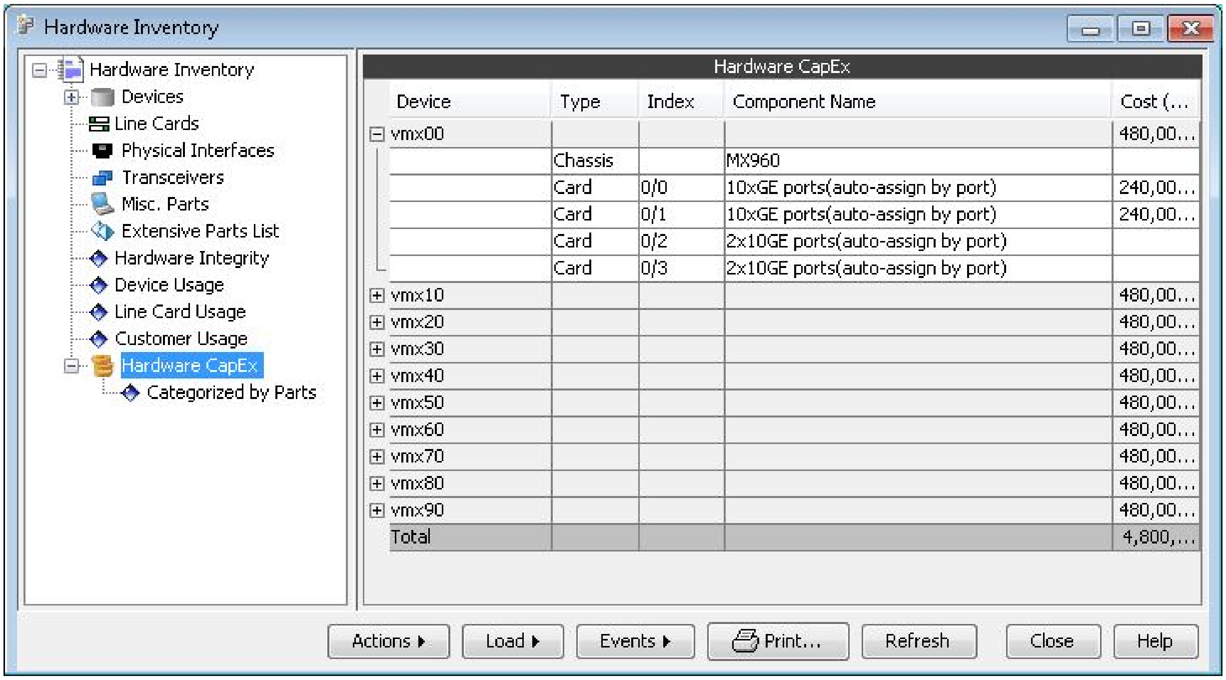
Figure 127: Hardware Inventory: Customer Usage



Hardware Capex

The Hardware Capex report window displays the hardware costs associated with the network grouped by node. A similar cost report grouped by parts is also available, as is explained below. To expand or collapse a group in the Hardware Capex report, click on the small icon to the left of the node name. To expand or collapse all groups in the Hardware Capex report, simply right click anywhere in the report and select **Expand All** or **Collapse All**. The saved report filename starts with `HW_CAPEX_REPORT`.

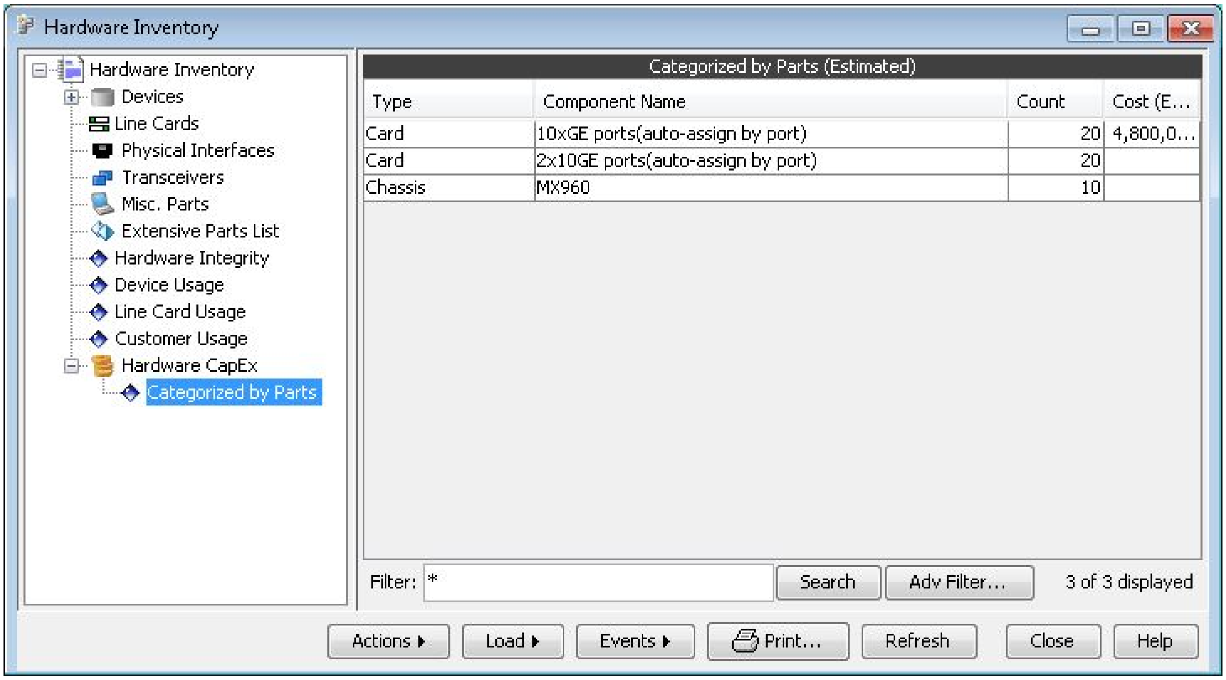
Figure 128: Hardware Cost



Column	Description
Device	Device hostname
Type	Type of component (for example, Chassis, Card, or Scvr)
Index	Slot information, for example, S-0/1
Component Name	Name of the component, for example, 26xGE
Cost (Estimated)	Estimated Cost of component

The information contained in the Categorized by Parts sub-report is related to that of the default Hardware Capex report. However, the grouping of the costs is different, as this report lists costs based on the component type rather than for each node. The saved report's filename starts with `HW_PARTS_REPORT`.

Figure 129: Hardware Inventory: Hardware Costs Categorized by Parts



Column	Description
Type	Type of component (for example, Chassis, Card, or Scvr)
Component Name	Name of the component, for example, 26xGE
Count	Count of such components in the device
Cost (Estimated)	Estimated Cost of component

Equipment View

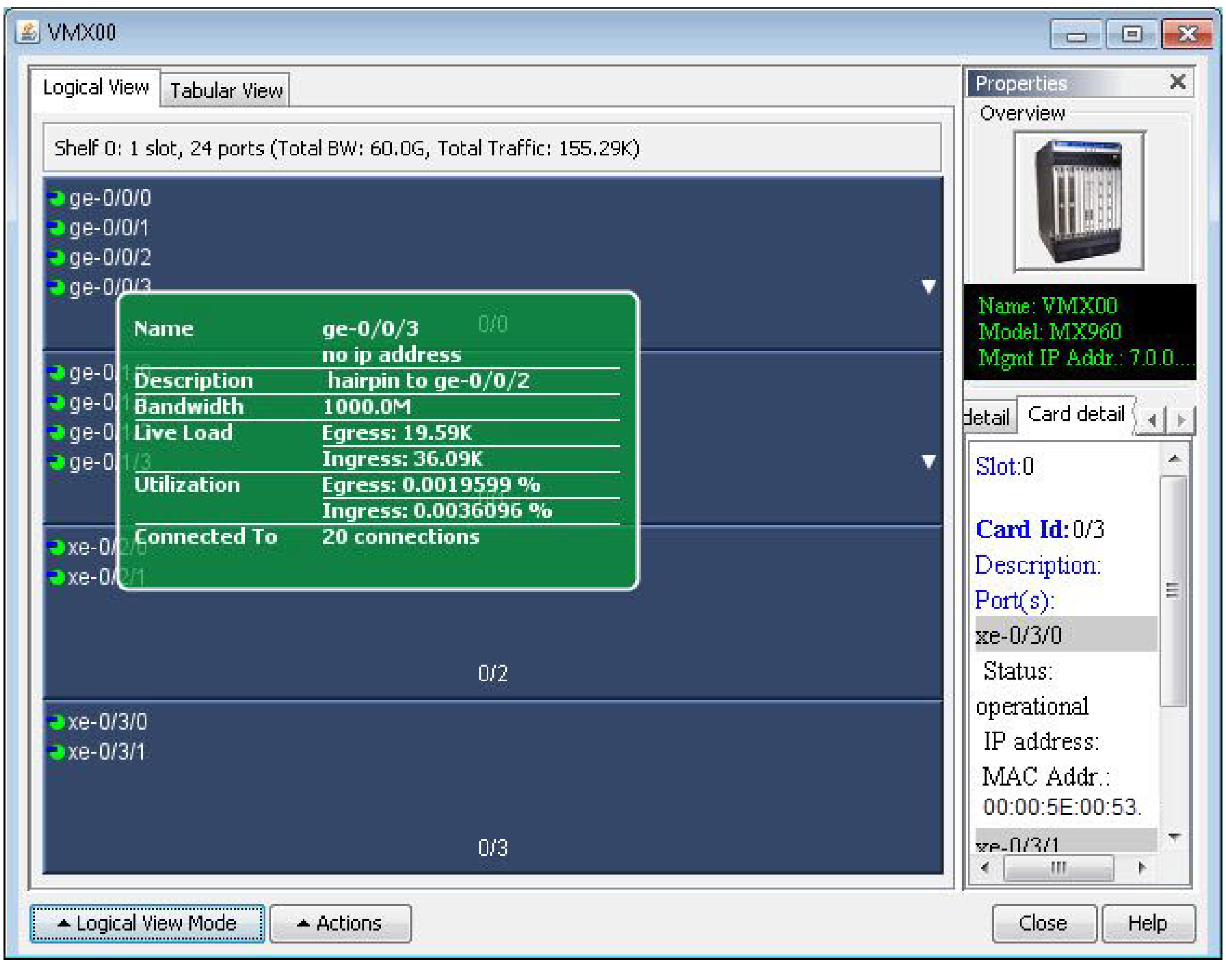
The Equipment View window provides detailed information on the chassis, cards, ports, and interfaces on any given router. It can be accessed by right clicking on a node in the Map window and selecting **View > Equipment View**. There are two types of views in Equipment View, accessible by clicking on the appropriate tabs at the top of the window: Logical View and Tabular View.

Logical View

Logical View provides a schematic representation of the hardware at the node. Empty, occupied, and designated template slots are distinguished by different colors which can be customized as described later in this chapter.

Connected and disconnected ports are distinguished by the symbols next to the port name. Connected ports have a colored bar in the circle, whose color can be customized in the Options window. A port is considered connected here if there is a link in the bblink file associated with this port (Network > Elements > Links). Left clicking on a port will popup a translucent window showing detailed information about the port.

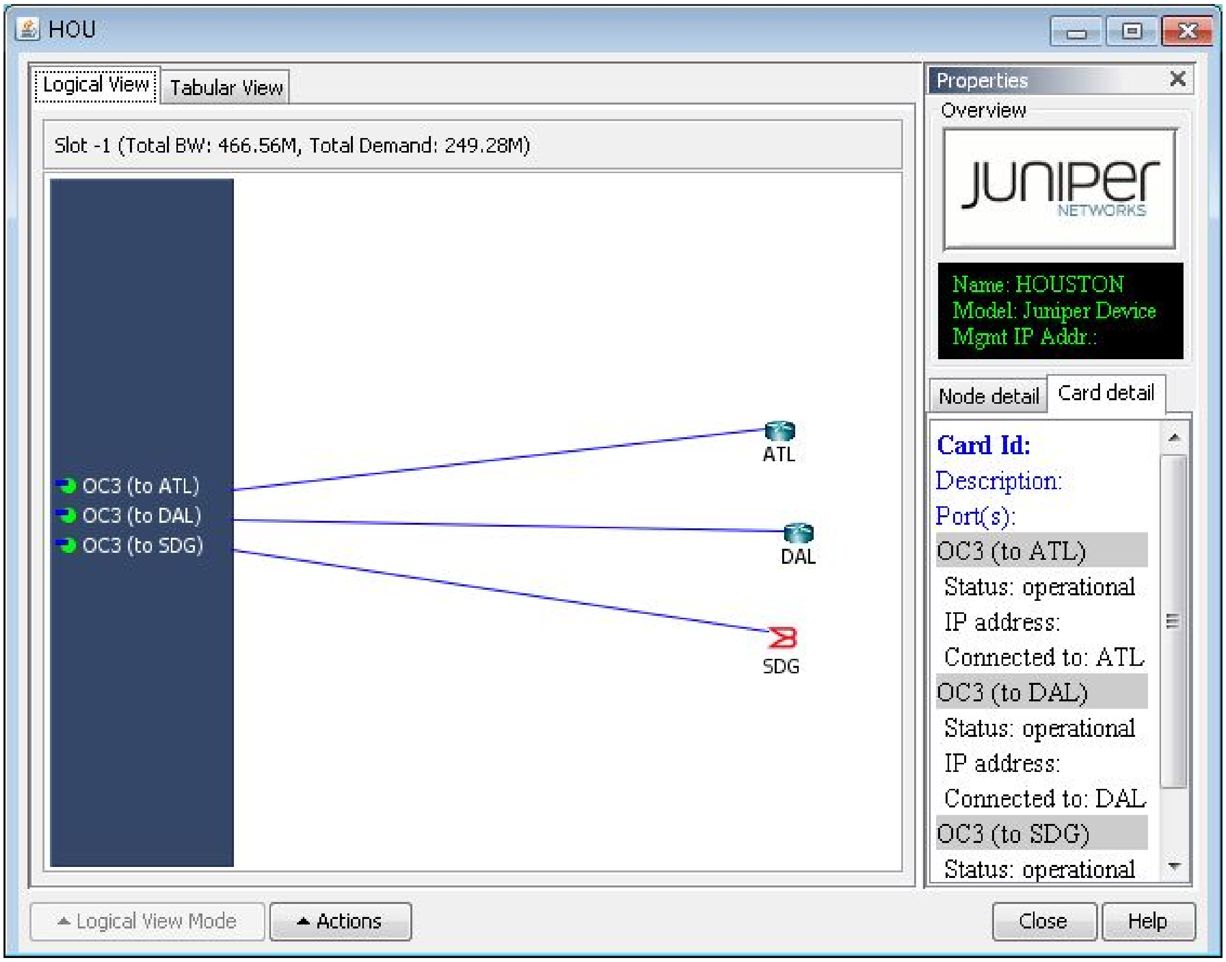
Figure 130: Equipment View for a Specific Router: Logical View



Additional detailed port information can be displayed by right clicking on the port and selecting an option from the table below. The available options may vary depending on the network model:

Field	Description
Show Demand	Selecting this will open the Demands window to display all demands going through the port.
Show Link	Selecting this will open the Links window to display all links connected to the port.
Show Demands in Card	Selecting this will open the Demands window to display all demands going through the card.
Show Links in Card	Selecting this will open the Links window to display all links connected to the card.
Card Connections View	This displays ca view of the card along with all the links attached to the card and the nodes on the other end of those links.
Display Card Details	This displays details about the card in the Properties pane to the right.
Display Port Details	This displays details about the port in the Properties pane to the right.

Figure 131: Card Connections View



Logical View Mode Button

Clicking on the Logical View Mode button will open a menu through which you may customize the window.

Menu Item	Description
Show Color Legend	This displays the color legend used for this window.
Show Fullname	This displays the full names of the ports in each slot
Hide Metrics	This causes only the port name to be displayed next to each port.

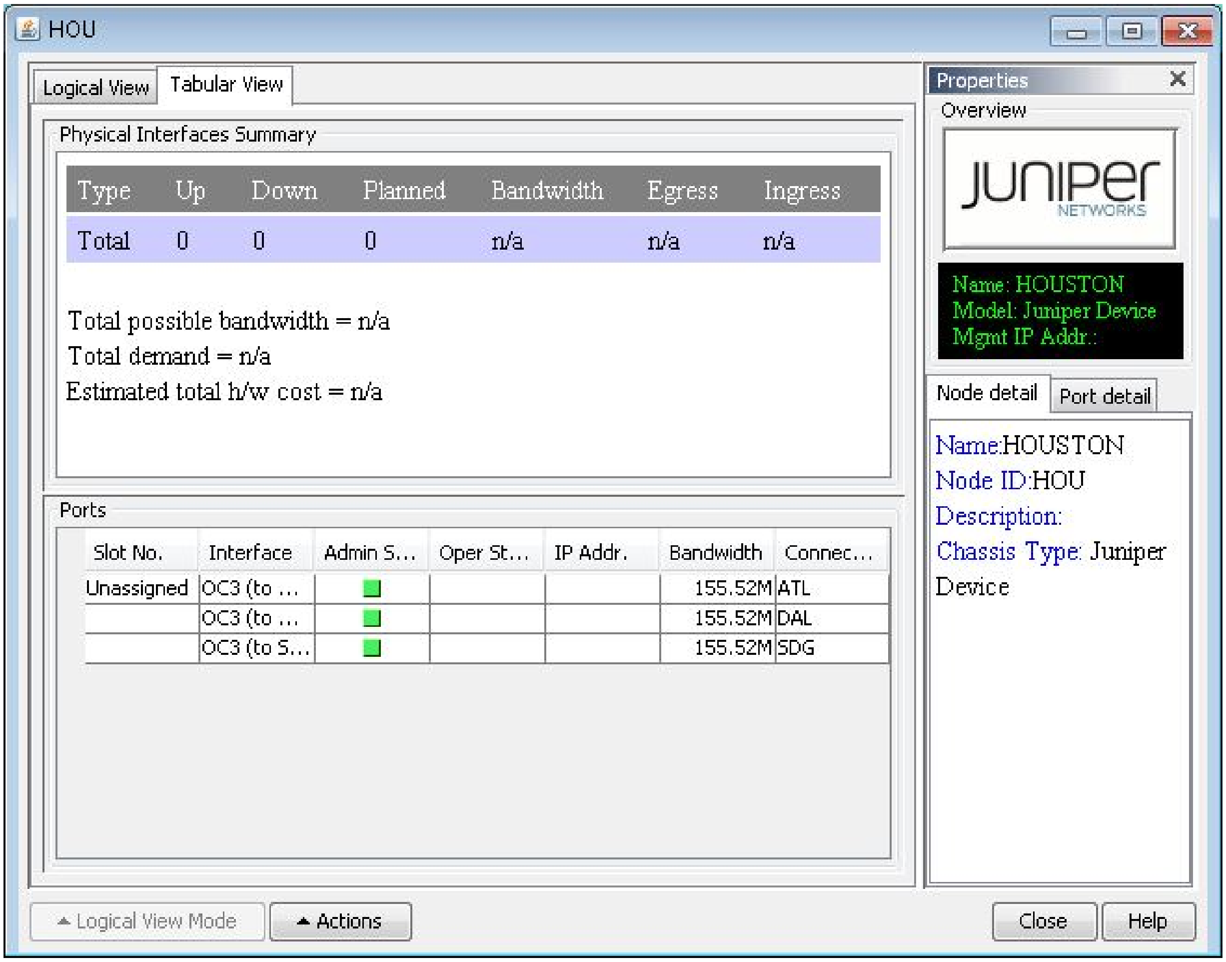
(Continued)

Menu Item	Description
Show Demand Egress, Ingress	This causes the total egress and ingress demand bandwidth to be displayed next to each port.
Show Utilizations	This causes a horizontal bar graph representing total port utilization to be displayed next to each port.
Show Empty Slots	Selecting this displays all unused slots. De-selecting this will hide all unused slots.
Show Pre-planned Slots	If template slots have been defined, selecting this displays these slots.
Slot Orientation	This controls how slots or displayed. Vertical displays slots on top of each other, while Horizontal displays slots side by side.
Slot Ordering	This controls how slots are ordered. Ascending will order slots from lowest index to highest index, while Descending will order slots from highest index to lowest index.
Logical Port Connections	This displays VLANs that are connected to the card.
Highlight VLAN ID	This item is available only if there are VLANs connected to the card, and will highlight the VLANs if they exist.
Highlight VRF Membership	This item is available only if there are VRF Memberships defined on the card, and will highlight the relevant ports.
Highlight VR Membership	This item is available only if there are VR Memberships defined on the card, and will highlight the relevant ports.

Tabular View

Tabular View can be accessed by clicking on the Tabular View tab at the top of the Equipment View window. This displays the Hardware Model information for the node in tabular form. The top pane of Tabular View displays a summary of interface types and bandwidth information. The bottom pane lists all ports and interfaces in a sortable table along with their attributes and related information.

Figure 132: Equipment View for a Specific Router: Tabular View



You can use the Actions button to bring up a menu through which various Hardware Model related actions can be carried out. These actions are useful when you are interested in viewing additional information about the particular node or modifying various properties on the node.

Menu Item	Description
Node Detail	Opens up the standard Node window for the current node to display additional information.
Highlight	Highlights the node in the Map window.
Show Config	Open the config file for the current node in a text editor.

(Continued)

<table>
<tr><th>Menu Item</th><th>Description</th></tr>
<tr><td>Save As Template</td><td>This allows you to save the Hardware Model for the current node as a Template in a client side xml file. This Template can later be imported and applied to additional nodes.</td></tr>
<tr><td>Hardware Template</td><td>Opens the Hardware Modeling Template window through which you may apply an existing template to the current node.</td></tr>
<tr><td>Print</td><td>Prints a report of the current hardware information.</td></tr>
<tr><td>Report</td><td>Saves a text report of the current Hardware Model information for the current node to the client.</td></tr>
<tr><td>Refresh using SNMP</td><td>Refreshes the Hardware Model information of the current node using SNMP data. You must be connected to the device and have the necessary login information to use this option.</td></tr>
<tr><td>Refresh using CLI</td><td>Refreshes the Hardware Model information of the current node using CLI data from Cisco and Juniper Networks hardware. You must be connected to the device and have the necessary login information to use this option. The commands issued during CLI refresh are as follows:

Cisco hardware:

• show version
• show diag
• show env all
• show idprom backplane
• show module

Juniper Networks hardware:

• show chassis hardware
• show version</td></tr>
</table>

(Continued)

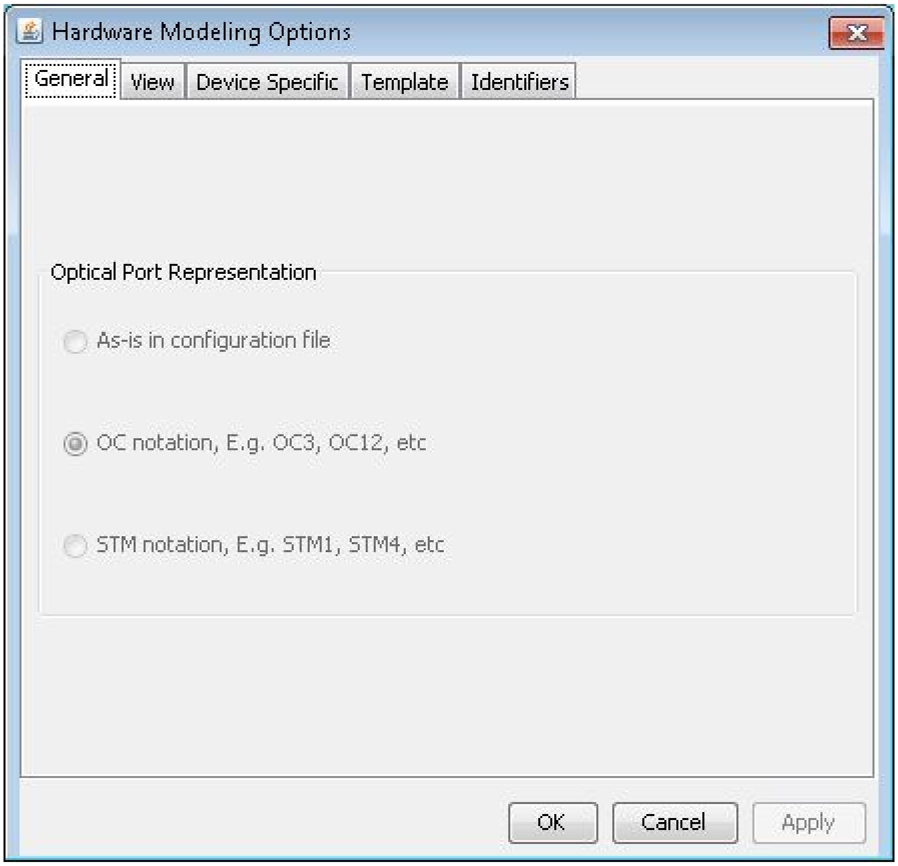
Menu Item	Description
Hide Properties Pane	Hides the Properties Pane normally displayed on the right side of the Equipment View window.
Options	Opens an Options window that allows you to set various options related to how Hardware Model information is visually presented in the Equipment View window.

Various options related to how information is visually displayed in the Equipment View window can be customized in the Hardware Modeling Options window, accessible through the Actions button in the Equipment View window by selecting **Options**.

General Tab

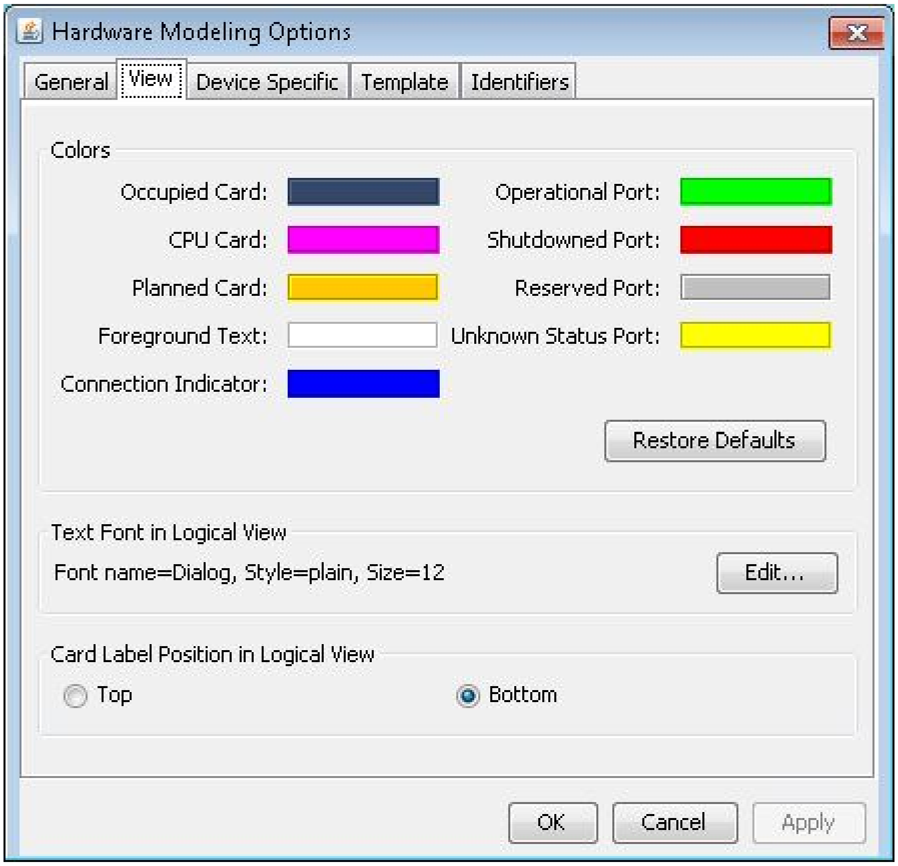
In the General tab of the Hardware Modeling Options window, you may choose how optical ports are represented in the Equipment View by selecting an option in the Optical Port Representation field. In the bottom half of the window, you can customize what type of information is displayed in the bottom table of Tabular View.

Figure 133: Hardware Modeling Options: General



View Tab

Figure 134: Hardware Modeling Options: View



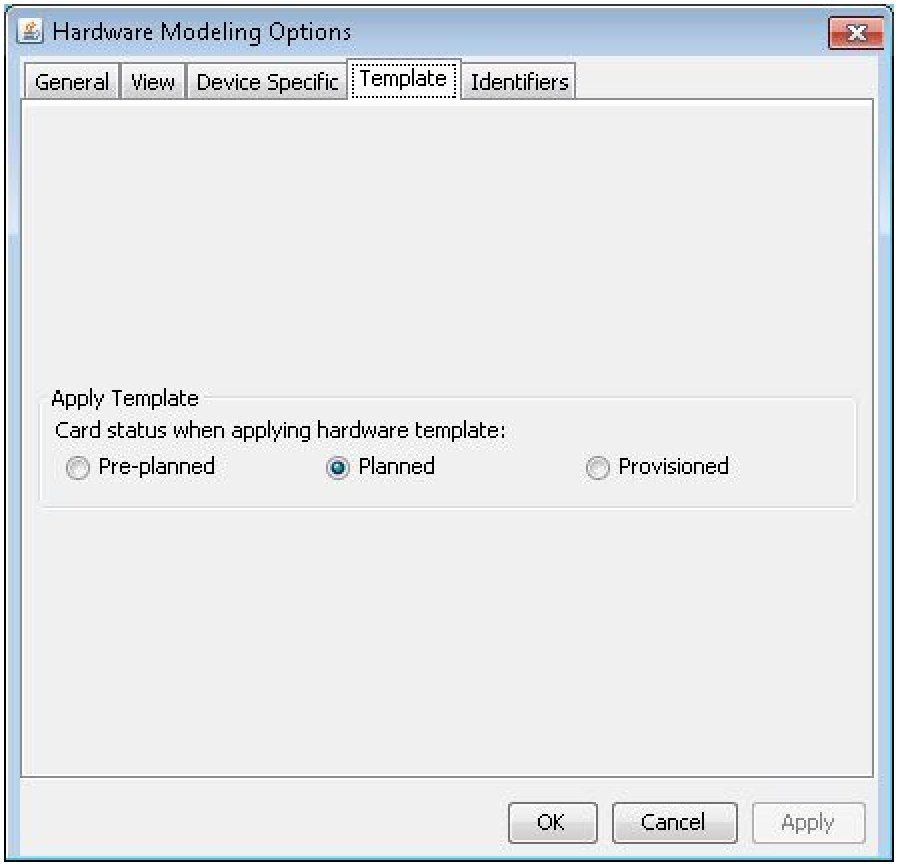
The View tab of the Hardware Modeling Options window allows you to customize various color, font and text position properties in Logical View. To change the color of a property, simply click on the color bar and a new window will pop up from which a new color for property can be chosen. The font used to display information in Logical View can also be changed here by clicking the Edit button. The position of the card label in Logical View can be customized to be shown either on the top or bottom of the card.

Device Specific Tab

Cisco IOS XR, Ignore preconfigured ports in Hardware Model: An interface that does not yet exist may be configured using the “interface preconfigure” command. Those interfaces are included by default with status “planned”. If this Ignore option is selected, those interfaces will not be displayed and the port counts may decrease as a result.

Template Tab

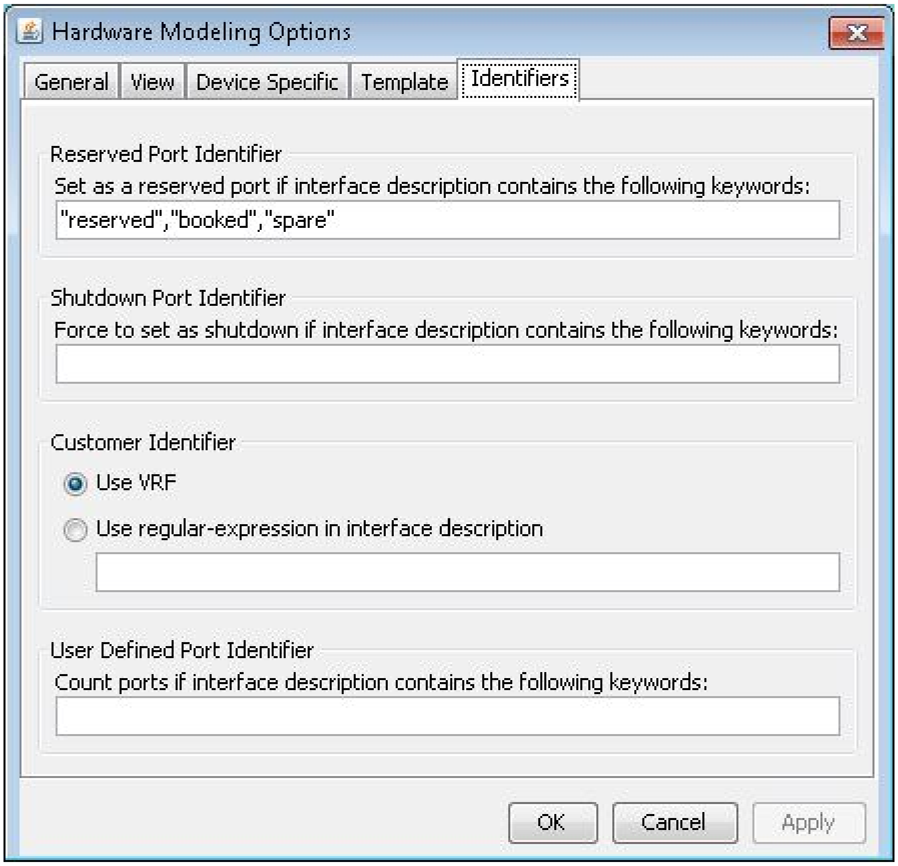
Figure 135: Template Tab



Apply Template: Here you can also specify the default state to be used when applying card templates.

Identifiers Tab

Figure 136: Hardware Modeling Options: Identifiers



- **Reserved Port Identifier:** For the Device Usage Report, if the interface description contains one of the strings in this comma separated list, that interface is interpreted as a reserved port. Note that the Reserved Ports column can be added to the report display by right-clicking the table header and selecting **Table Options**.

- **Reserved Port Identifier:** For the Device Usage Report, if the interface description contains one of the strings in this comma separated list, that interface is interpreted as a reserved port. Note that the Reserved Ports column can be added to the report display by right-clicking the table header and selecting **Table Options**.

- **Customer Identifier:** For the Customer Usage report, interfaces are associated with customers based on the interface description field. For example, to match a number sequence in interface comments of the format, `cust####...`, use the expression, cust([0-9]+).*

- **User Defined Port Identifier:** Suppose you want to count the number of interfaces in a line card containing a particular keyword in its description. Add the desired strings in a comma-separated list, each surrounded by quotations marks, similar to the Reserved Port Identifier format. Select the Line Cards report, right-click the table header, and select **Table Options** to add a column for each keyword, to see the number of interfaces containing that keyword.

The Properties Pane

The Properties Pane is displayed on the right side of the Equipment View window and contains useful information about the card and ports in the chassis. It provides an overview of the hardware, node details, and card details. The Properties Pane can be closed by clicking the [**x**] button on the top right and shown through clicking the **Actions** button and selecting **Show Properties Pane**.

Event View

The Hardware Inventory window is capable of displaying hardware related event counts from the Live Network. This requires opening the Event Map before opening the Hardware Inventory window. Click the Events button and select the desired view. The event count appears in the left panel under Devices.

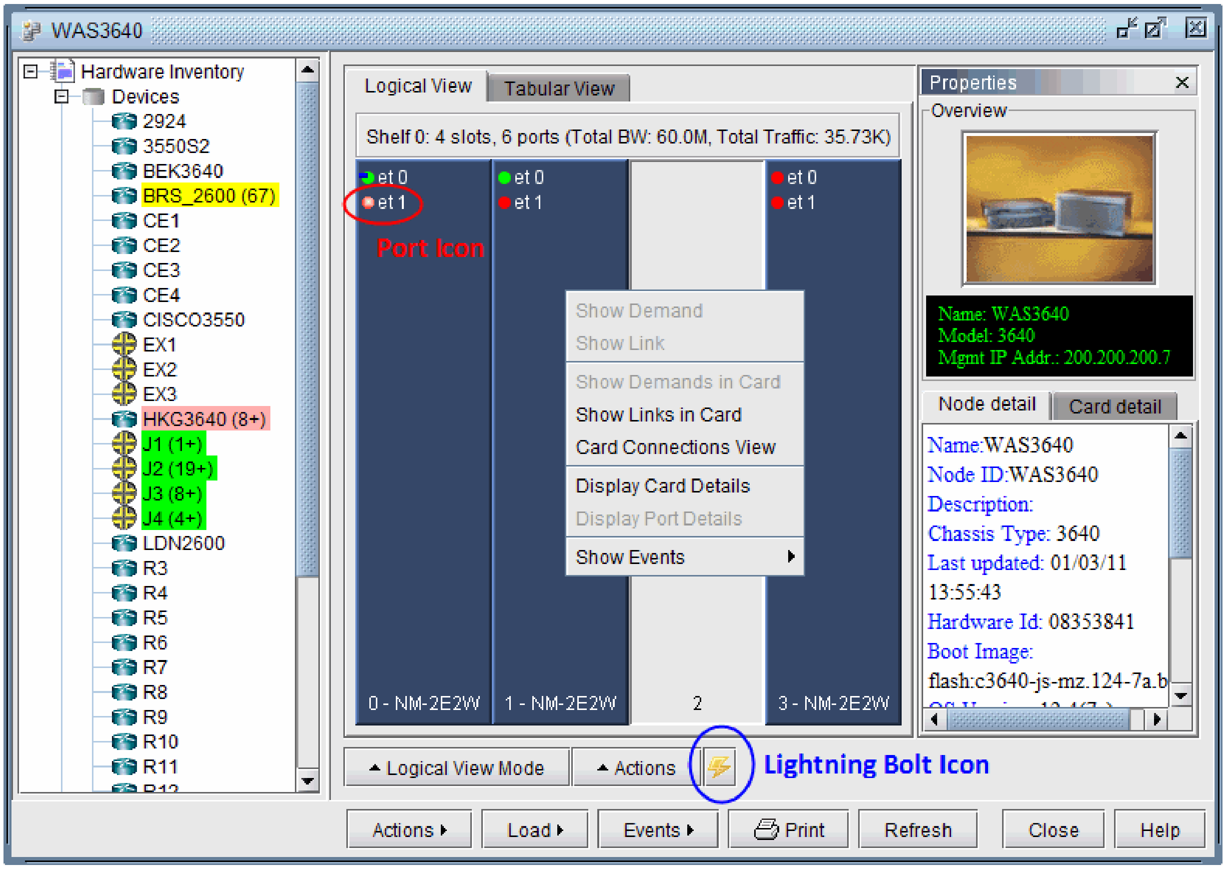
- Show node event count always displays the total number of events.
- Show updated event count only displays the number of new events since refreshing the hardware inventory window. Selecting a device will clear the counter.
- Hide event count hides the event counters.

The number of events on each node are displayed against a background colored according to the Event Map severity legend. Note that some of the event counters are followed by a `+' symbol. In this case, the counter represents the number of events belonging to the worst severity category used for the background color and the `+' symbol indicates that there are additional events of lower severity not factored into this counter.

If a physical port goes down, the port icon will flash.

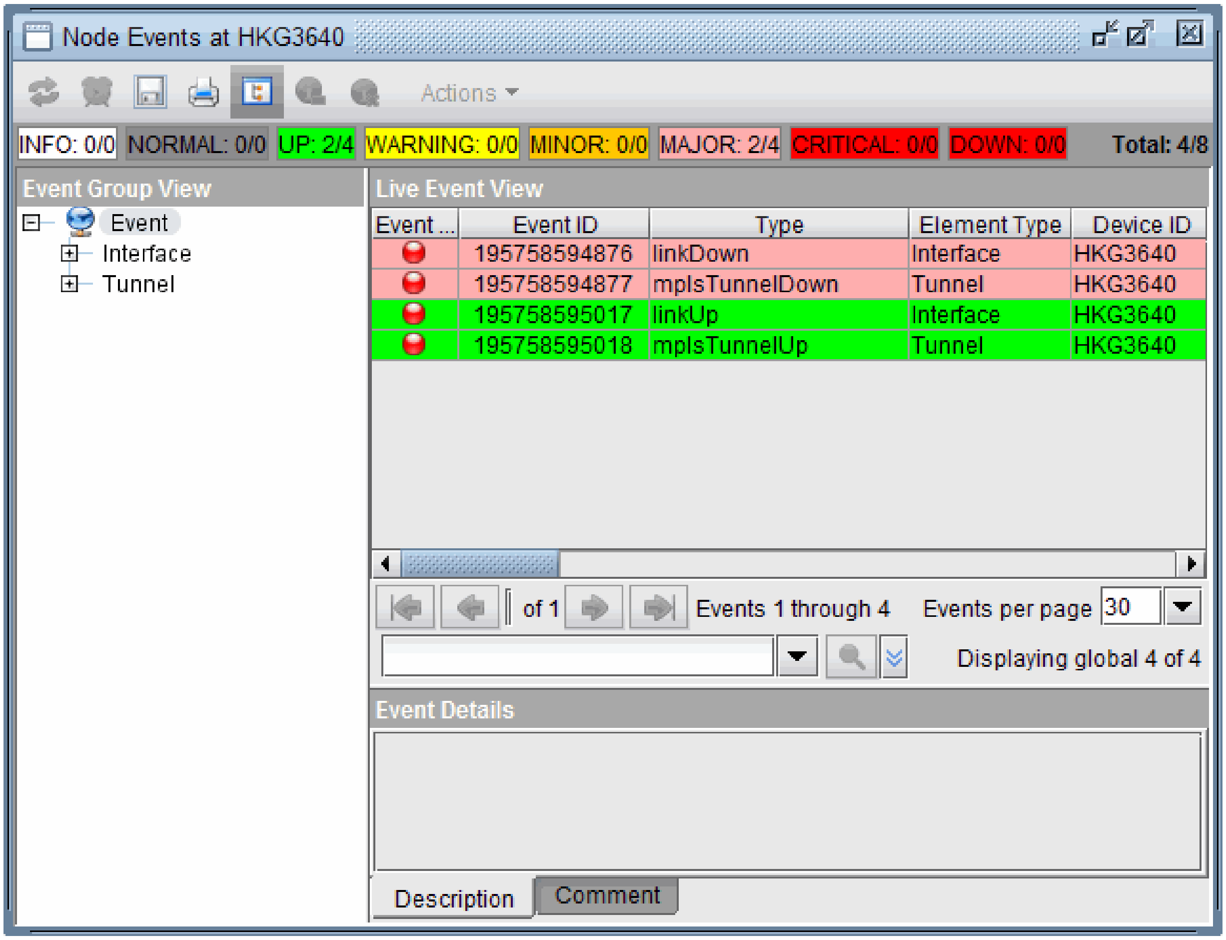
When new events occur, a lightning bolt icon will appear. Clicking on the icon opens a new window similar to Event Browser with the related events.

Figure 137: Hardware Inventory Device Events View



Right-clicking in the Logical View panel opens a pop-up menu to Show Events by node, card, or port. This opens a new window similar to Event Browser with only the events relevant to the device selected.

Figure 138: Hardware Inventory Device Show Events



Hardware Equipment Cost

NOTE: This feature applies to router networks only.

For pricing purposes, you can specify the cost for certain ports, cards or chassis within the Hardware Model. Cost data can be set either:

- Globally, by selecting from the main menu Inventory > Hardware Equipment Costs.
- Individually, per device. In the Equipment View for a particular device, select the **Logical View** tab. Within the Logical View, you may right click on a card and select **Modify Properties > Chassis** or

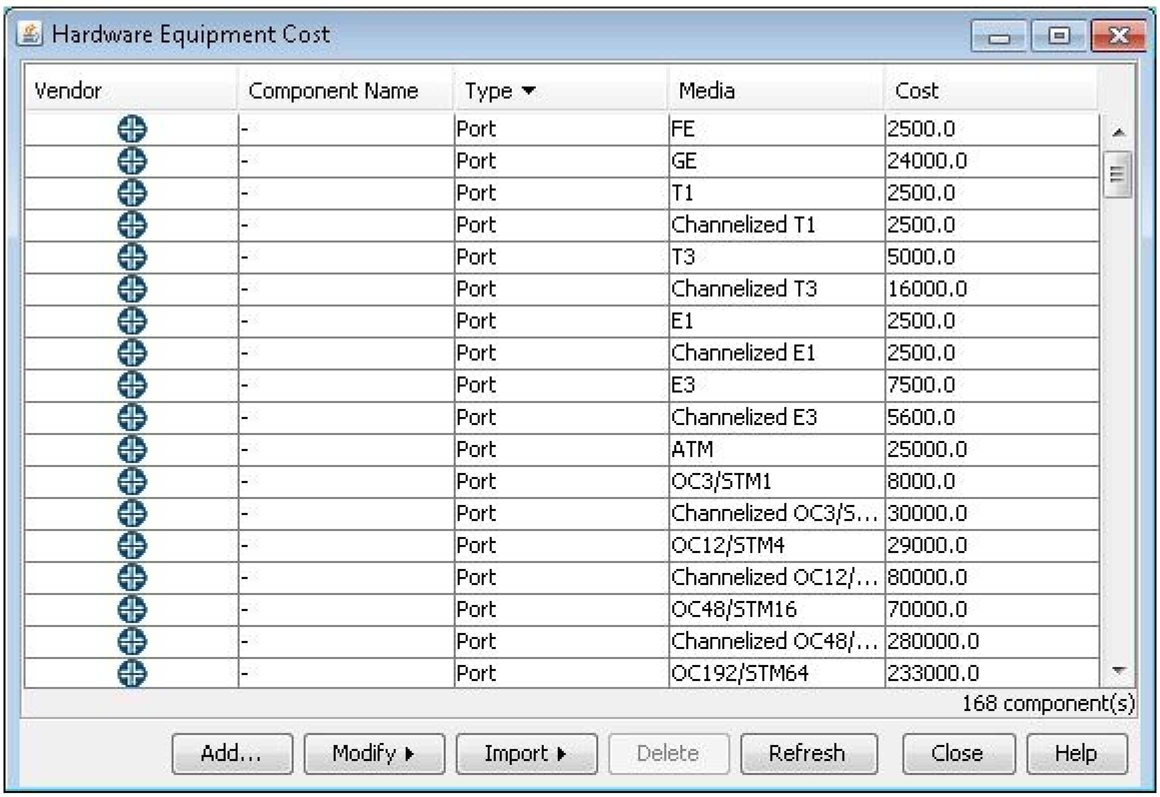
Modify Properties > Card from the popup menu. The price for that specific Chassis or Card can then be entered into the price field.

- By editing the cardcost file as described in *Hardware Equipment Cost File*.

The hardware equipment costs window displays the costs of all equipment that has been defined. It allows you to add, modify and delete cards from its list. This list includes per port costs, which are used when no matching cards can be found, as explained above.

Three sets of equipment costs can be defined using this window. They are chassis, card and port costs. Port costs are also used if a particular card is not defined in the equipment costs table.

Figure 139: Hardware Equipment Cost



Note that the initial costs indicated in the Hardware Equipment Cost window are arbitrary values to help you get started. To add an item to the Hardware Equipment Cost window, simply click the **Add** button, and a new window will popup allowing you to enter the necessary values. To modify an item, select the item and click the **Modify** button. To delete an item, select the item or multiple items and click the Delete button.

Note that the hardware equipment costs are saved on a per-network base. You may import a custom Hardware Equipment Cost list by clicking the Import button and browsing to the appropriate file.

For cards, the Component Name can be substituted with the Part Number of the card. The Hardware CapEx report will associate the cost of the card to the part number. The Part Number can be found in the Hardware Inventory window Devices or Line Card views.

- If no price is specified in the price field in Equipment View, then the program calculates a default price based on the information in the Hardware Equipment Cost window as follows:
- If the name of the card in Equipment View matches a card name in the Hardware Equipment Cost window, the cost of the card in the Hardware Equipment Cost window is used for the card in Equipment View.
- If no exact match can be found based on card name, then the program will search for a match based on the type and number of ports on the card. If an appropriate card can be found in the Hardware Equipment Cost window that matches the specifications of the card in Equipment View, then the price of that card in the Hardware Equipment Cost window is applied to the card in Equipment View.
- If no appropriate card in the Hardware Equipment Cost window can be found that matches the specifications of the card in Equipment View, then a price based on default per port pricing as defined in the Hardware Equipment Cost window is calculated for the card in Equipment View.

Hardware Equipment Cost File

When you modify or add to the Hardware Equipment Cost window and saves the network, a `cardcost.runcode` file is created which contains the Hardware Equipment Cost information for that specific network. The cardcost file is referenced from the specification file using the keyword “cardcost” . The format of this file can be used to create a custom file that can be imported into the Hardware Equipment Cost window as described above. Some sample lines along with field descriptions are provided below.

Specific Card Cost

```
# Vendor, Name, 'card', Cost, Number of Ports, Media, Description
Cisco, LC-4OC3/POS-SM, card, 39000.0, 4, OC3/STM1, "4port OC3/STM1 Card"
```

Generic Port Cost

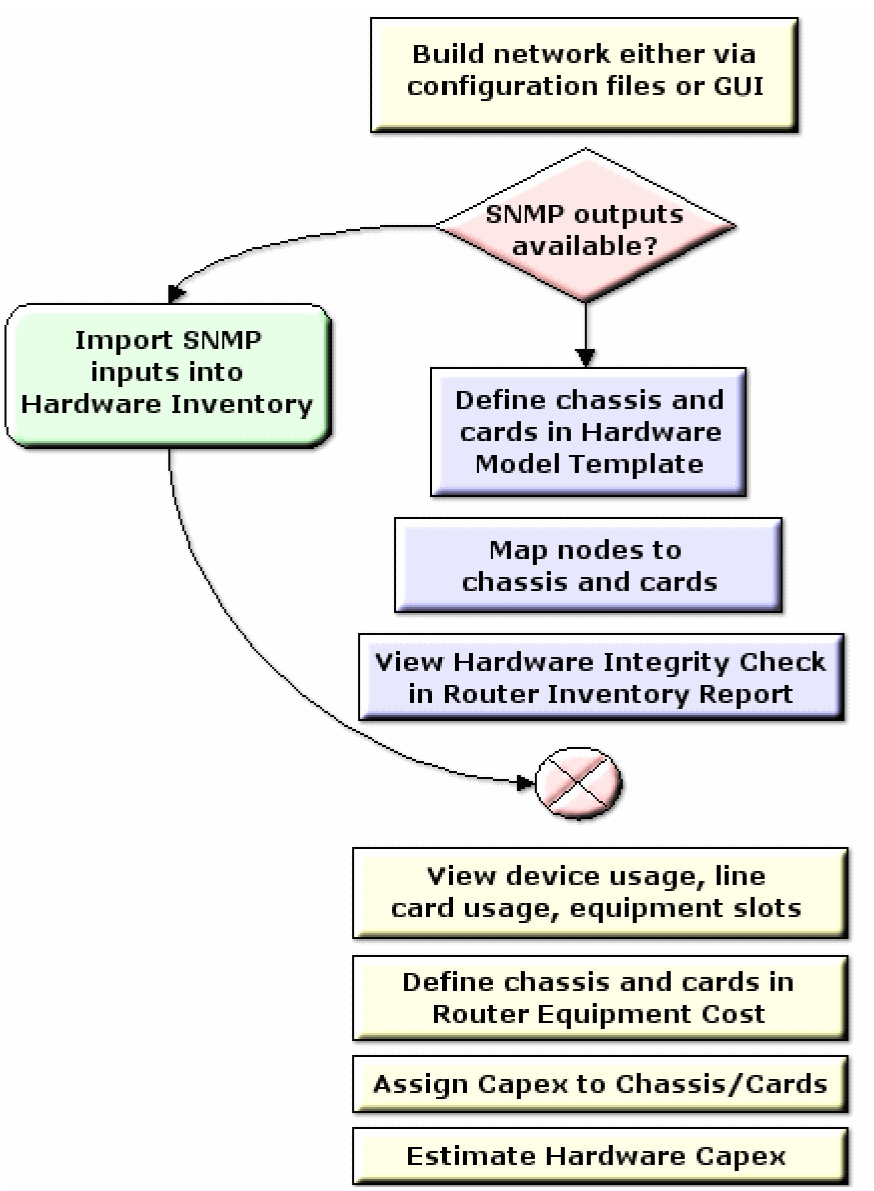
```
# Vendor, Name, Media, Cost per port
Juniper, -, OC12/STM4, 29000.0
```

Depending on the format used, the program will recognize the cost as a specific card cost or a generic port cost.

Templates

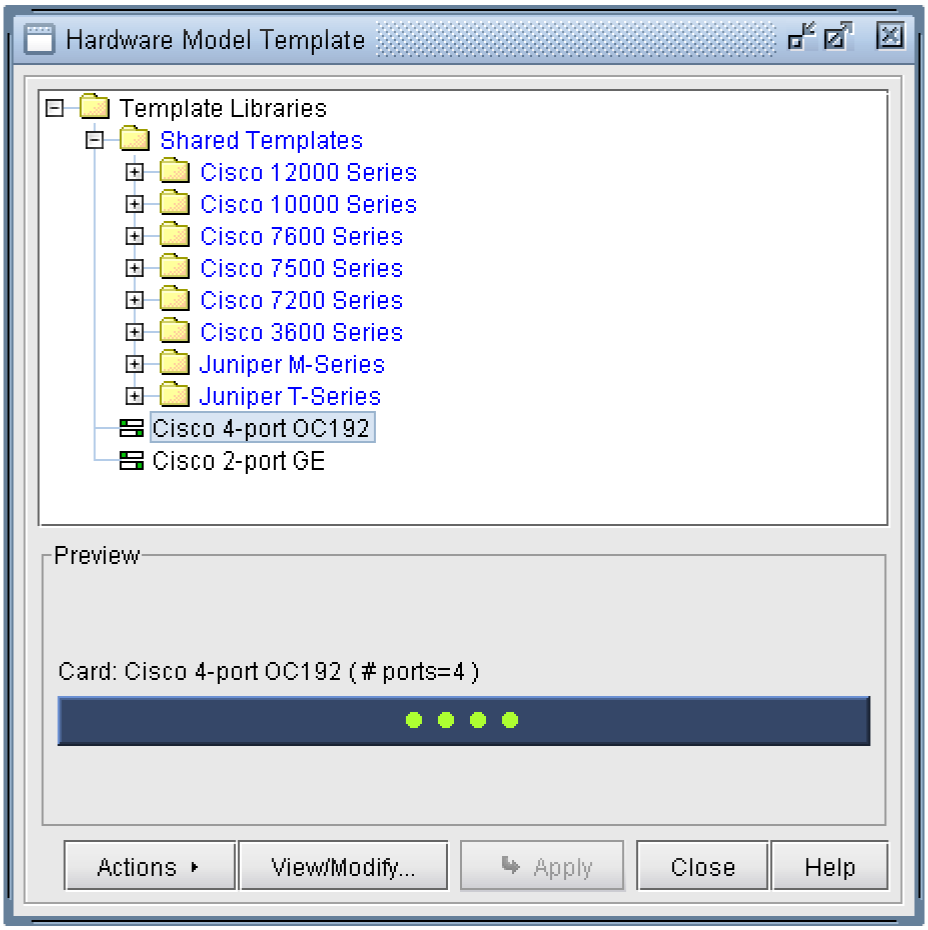
The Templates are an advanced feature used to map individual hardware components with a specific brand and type (for example, Cisco 12816 or Juniper Networks M40).

Figure 140: Hardware Model Workflow



There are two levels of templates in the Hardware Model feature: Chassis and Card. A Chassis Template defines the number of slots on the chassis and can also designate a slot to be occupied by a card template if so desired. A Card Template defines the number of ports on the card as well as the media type of the ports. When a Chassis Template is applied to a node, that node receives all the properties of the Chassis Template. To view the list of available templates, click on the Tools menu and select **Hardware Model Template**.

Figure 141: Hardware Model Templates



Template Actions

When clicking on the Actions button in the templates window, the following options are available:

Action	Description
New Chassis Template	This opens the Chassis Template Builder window, allowing you to create a new chassis template.

(Continued)

Action	Description
New Card Template	This opens the Card Template Builder window, allowing you to create a new chassis template.
Import from Spreadsheet	Import templates from a CSV formatted spreadsheet.
Import from Hardware Equipment Cost	Import templates from the Hardware Equipment Cost window.
Export	Saves the current template information in a CSV formatted spreadsheet file.

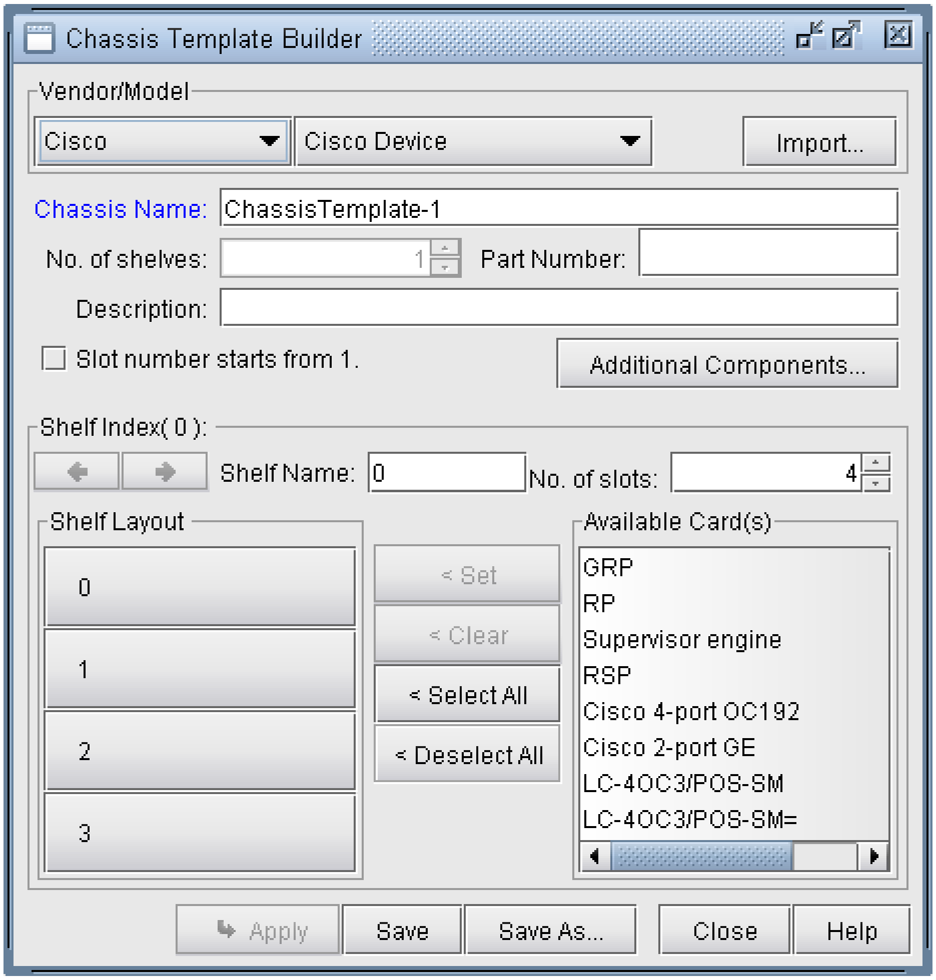
Organizing Templates

When right-clicking in the templates window, the following options are available:

Action	Description
Create Category	Creates a new folder in which to organize templates. Note that templates can be dragged and dropped into this new folder.
Create Alias	Creates an alias for the selected template.
Duplicate	Creates a duplicate of a template.
View/Modify	Opens a template to be viewed and modified
Rename	Renames a template
Apply Selected Template	Opens the Apply Template window, allowing you to select a set of nodes to which the selected template is applied.
Delete	Removes a template from the template library

Chassis Template Builder

Figure 142: Chassis Template Builder



In this window, you can specify the following fields:

- Vendor/model (select a generic vendor if the desired vendor is unspecified)
- Chassis name
- Part number
- **Number of shelves:** Currently, only switches are allowed to have more than one shelf. In the future, the program will support multiple shelves for standard routers as well as switches.
- Description
- **Slot number starts from 1**: This options specifies whether the slot number starts at 1 (or 0).
- Shelf name
- Number of slots

- Shelf layout

Once you select the number of shelves, you can select a particular shelf to specify the shelf layout by using the Shelf Index's previous and next buttons. For a particular shelf name, you can specify the number of slots on that shelf using the up and down arrows next to No. of Slots..

To customize the shelf layout using the available cards, you should select the slot(s) in the shelf layout to which the card is applied. To select a range of shelves, you can click the first shelf and <Shift>-click the last shelf. To select shelves one by one, you can also <Ctrl>-click each additional shelf. Once the shelves have been selected, you should select a card from the Available Card(s) list. If the desired card does not exist, you can create a new card by right clicking in the Available Card(s) list and selecting **New Card Template**. When both the shelves and the card have been selected, clicking the **Set** button will assign the selected card to the selected shelves.

Shelf Layout Options

Action	Description
Set	Moves selected card into selected slots
Clear	Erases the cards in selected slots
Select All	Selects all slots
Deselect All	Deselects all slots

Chassis Template Builder Options

Action	Description
Import	Imports template information from an XML file
Apply	When in modify mode, this option is used to apply the template to specific nodes in the network.
Save	Saves the chassis template information in the template library
Save As	Saves the chassis template information as an XML file on the client machine

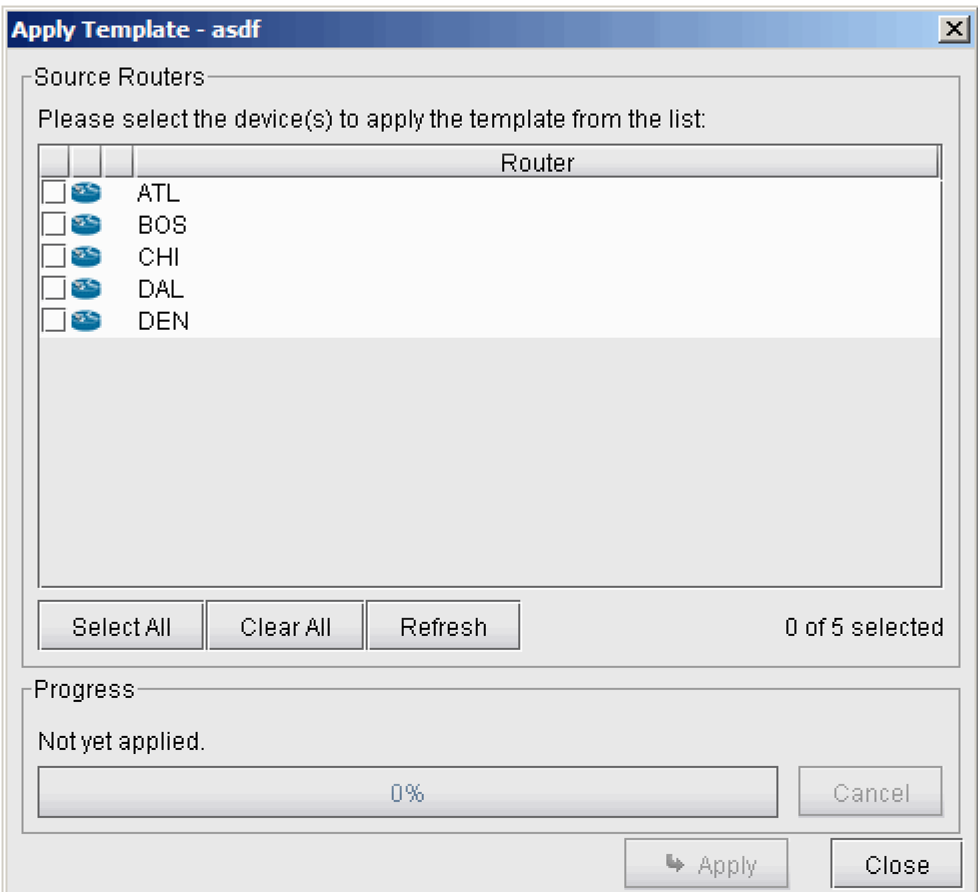
(Continued)

Action	Description
Help	Brings up the online help for the hardware model chapter

Applying the Template

A selected template can be applied to nodes by pressing the **Apply** button.

Figure 143: Apply Template



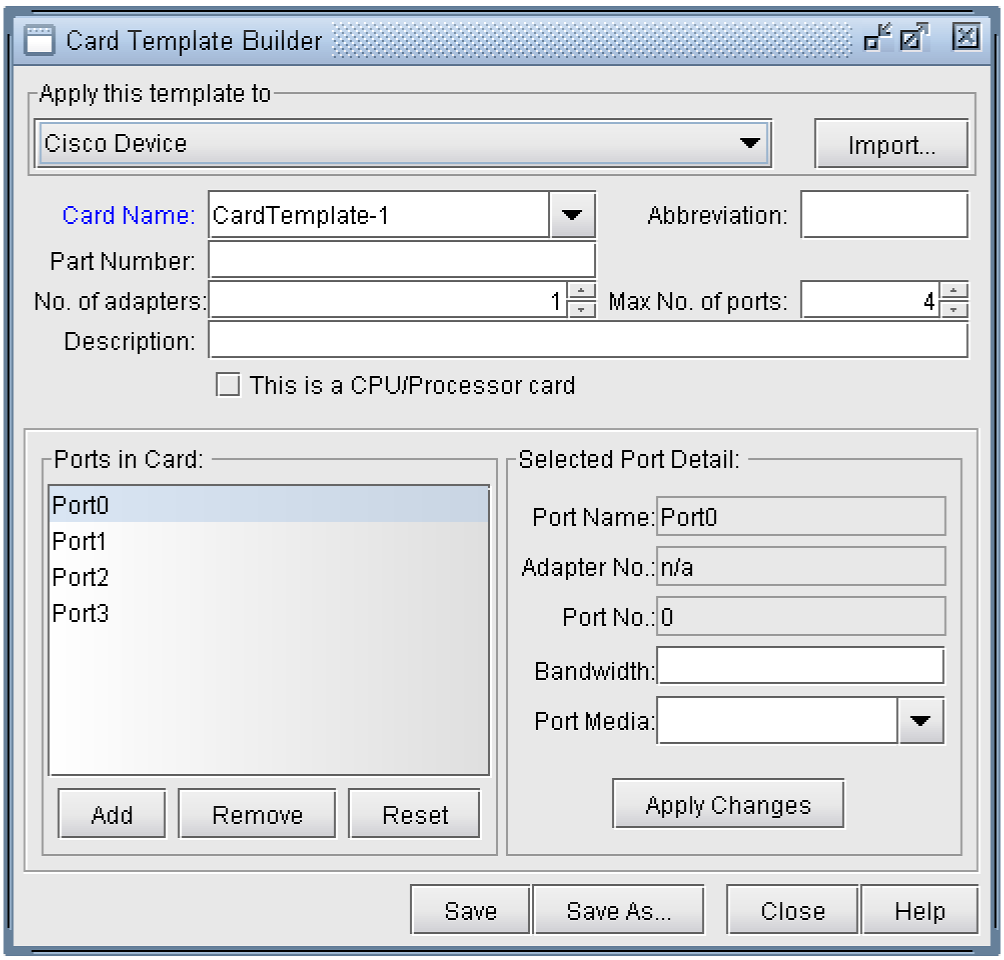
The template is applied to the nodes selected by you in the Router list. To select one at a time, you can click the checkboxes to the left of those nodes. You can also select a range of rows by clicking the first row and shift-clicking the last row. Then you can select or de-select those entries from the right-click menu. Click Apply to have the template applied to selected nodes.

- Select All: Selects all rows

- Mark as Selected: Marks selected rows
- Clear: Clears selected rows
- Clear All: Clears all rows

Card Template Builder

Figure 144: Card Template Builder



You should specify the following fields

- Apply this template to: Select the vendor here □ □ □ □ □ □ □ □
- Card Name: Required field
- Abbreviation
- Part Number

- No. of adapters
- Max No. of Ports
- Description
- CPU/Processor card
- Ports in Card

Modifying Ports

When a new card is created, the ports are all unassigned. It is up to you to assign specific media types to each port. This is done by selecting the desired ports in the box labeled Ports in Card, specifying the proper settings to the right, and clicking the **Change** button to apply the settings to the selected ports. Below is a list of the settings available for a port.

- Port Name
- Adapter No.
- Port No.
- Bandwidth (bps)
- **Port Media:** Selecting the Port Media automatically populates the Bandwidth (bps) field

Card Template Builder Options

Action	Description
Import	Imports template information from an XML file
Save	Saves the slot/card template in the template library
Save As	Saves the template information into an XML file on the client machine for later import.

Vendor Hardware Support for Templates

A specific vendor can be specified during chassis or card template creation. The Hardware Model template module supports the following vendors: Cisco, Juniper Networks, Riverstone, Alcatel, Nortel, Tellabs. For all other vendors, this field can be set to Generic.

12

CHAPTER

Report Manager

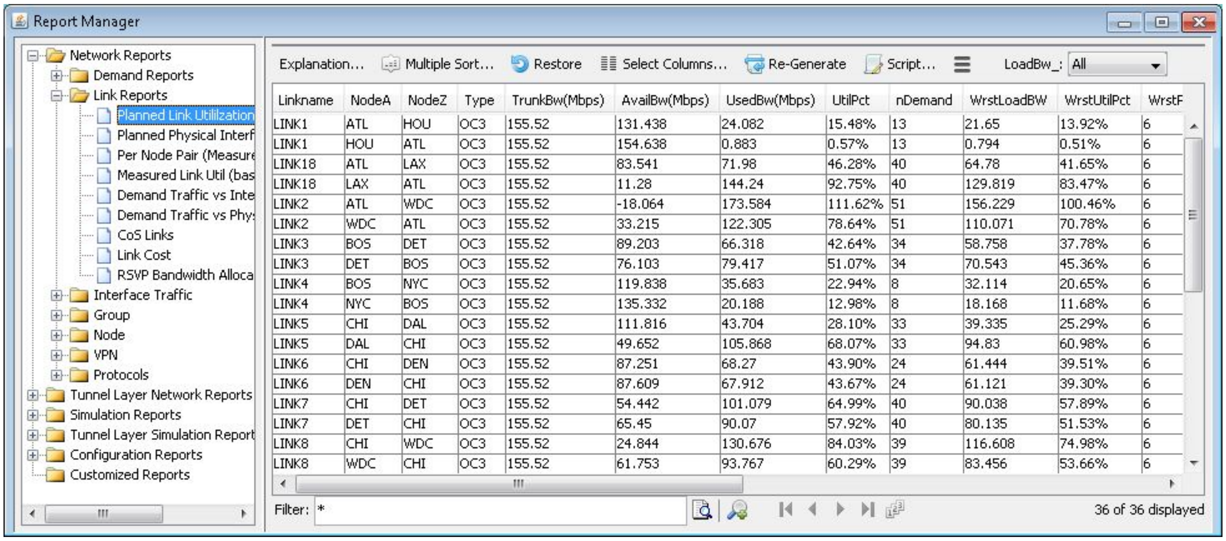
Report Manager Window Overview

IN THIS SECTION

The Report Manager window is split into two panes, where the left pane displays the available reports in a tree view, and the right pane, or Results Pane, displays the contents of the selected report. The reports are categorized into the following categories:

- **Network Reports:** These are the main network reports, including path, utilization, and cost reports. These reports are dynamically generated, meaning the report is always up to date, reflecting the current state of your network model. Each time that the Report Manager is opened, upon the first click of a report, the report is generated and saved to the Report folder of the network model. For all other subsequent clicks on that report, the report is read from the cache unless you close and reopen the Report Manager, or chooses to regenerate the report, an option described in the next page.
- **Tunnel Layer Network Reports:** These are the tunnel layer related network reports, including tunnel path and diversity, tunnel traffic, FRR, and tunnel RSVP BW reports.
- **Simulation Reports:** These reports provide information on the performance of the network after running failure simulation. Certain reports are only available after running specific failure simulations.
- **Tunnel Layer Simulation Reports:** These reports provide information on the performance of the network relating to the tunnel layer after running failure simulation.
- **Configuration Reports (Router only):** These reports are generated when you import network configuration files into your network model (via File > Import Data).
- **Customized Reports:** The customized reports are user-customized reports, where you select **columns of interest** from an existing Node, Link, Interface, Demand, and Tunnel report.

Figure 145: Report Manager Window - Report View



Some report windows contain a filter mechanism which allows you to search for any expression.

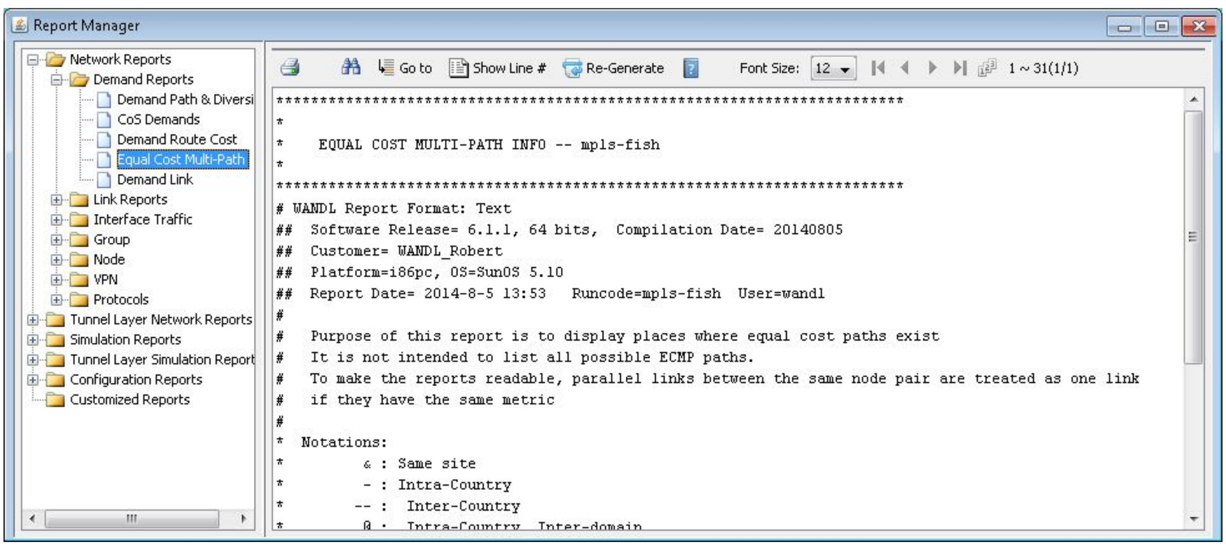
Field	Description
Explanation	Provides an explanation of the currently selected report.
Multiple Sort	Allows two consecutive sorting methods to be applied to the current report.
Restore	Displays the report in its original form prior to any sorting or searching.
Select Columns	Opens a Column Selection window, allowing you to select which columns to display in the report.
Re-Generate	Refreshes the currently selected report.
Script	This creates a file for filtering the report in text mode. The filter is based on the query specified in the Advance Filter window.
Actions drop down	The actions available include setting columns to display, saving the report, and printing.
LoadBw drop down	When there are multiple periods in the report, this allows you to select a specific time period.

(Continued)

Field	Description
Filter	Performs the search as specified in the Filter field.
Advance Filter	Opens an Advanced Filter window, allowing you to search by exact match, substring match, wildcards, and regular expressions.
Go to page	Displays the page entered here. Enter the page number and click **"Go"** or click **<Enter>**.
Lines Per Page	Sets the number of lines that are shown on each page or the viewer. Enter the number of lines to show per page and click **"Set"** or click **<Enter>**.

Some reports are displayed simply as text output without tables.

Figure 146: Report Manager Window - Text View



Additional Report Manager Actions

The following actions can be performed on the column headers in report view in the right pane. Some actions are available by right-clicking on the column header.

- **Sort:** The information displayed in the right pane of the Report Manager can be sorted. Click on the column header to sort in an alphabetical order. To reverse sort, click the header again.

- **Select Columns:** This function will open up a Columns Selection window allowing you to select the columns to display in the report if applicable. The ordering of the column headers can be set in this window or by dragging the column header in the report view.
- **Show All Columns:** Selecting this option displays all available columns for this report in the right-pane.
- **Reset the column order:** If the column order has been changed, selecting this option will reset it to its default order.
- **Auto Fit This Column:** Only the selected column is resized to fit the longest text entry.
- **Auto Fit All Columns:** All columns are resized to fit the longest text entry.
- **Freeze Column:** The column(s) are frozen for horizontal scrolling.

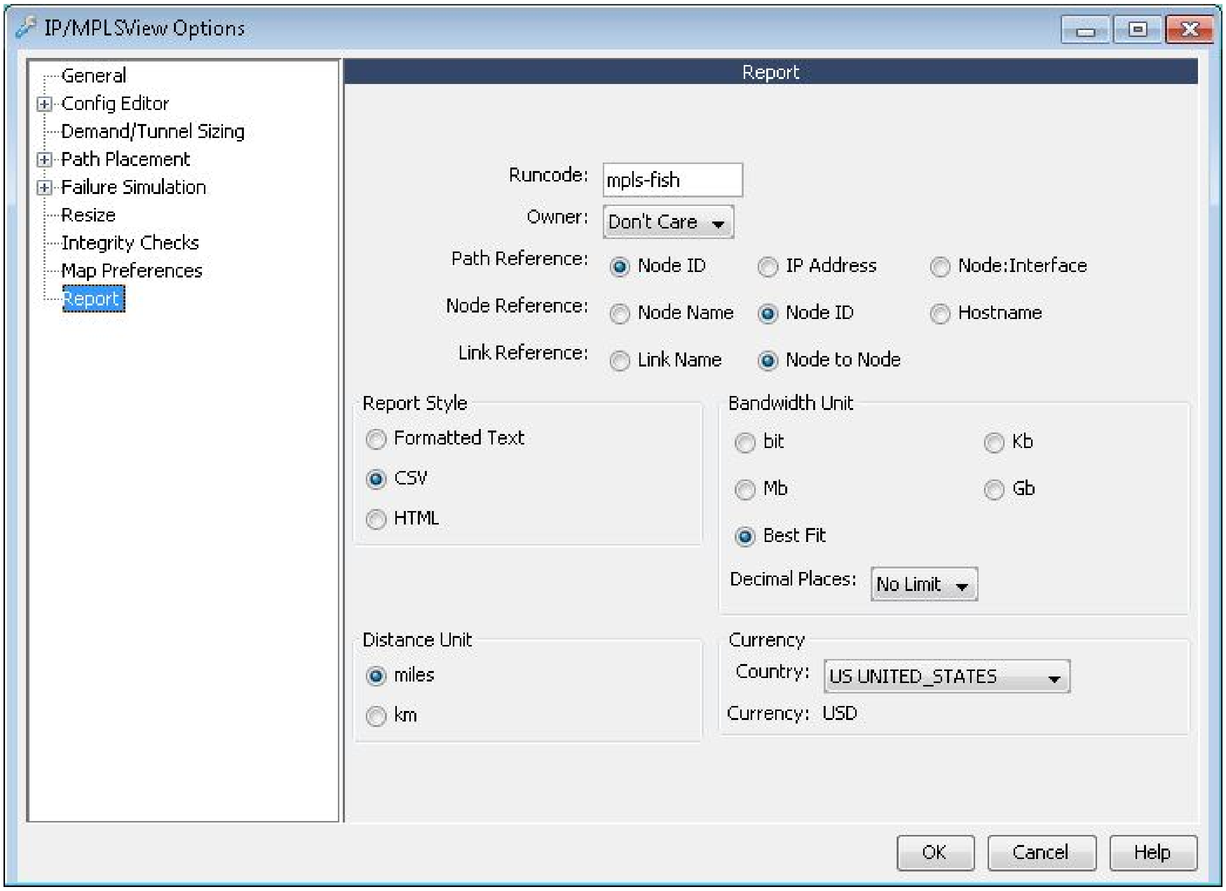
The following actions can be performed by right-clicking on the report entry in the left pane.

- **Re-generate Report:** When this option is selected, the program will regenerate the report and update any fields that might need updating.
- **Save Whole Report to Client:** Any available reports in the Report Manager can be exported to a Comma-Separated Values (CSV) file. Selecting this option will open up a directory chooser window and allow you to save the report to the desired location. This will save the entire report ignoring any filters applied.
- **Save Filtered Report to Client:** If you have used any of the filter functions on the report, then only the filtered results are saved.
- **Convert Report:** Saves the report into the desired format. Choose from XML, Comma-Separated Values (CSV), or Hyper-Text Markup Language (HTML). Indicate an Output File name on the server in which to save the report. The report is saved into the Output Path as indicated in the File Manager window. To change the path, press the “Browse” button and navigate to the desired directory. You can also save a copy of the report to your local client, by marking the “Copy to client” checkbox. Press the “Browse” button to navigate to the desired location on your local machine.
- **Generate Filter Script:** This allows you to generate an advanced filtering shell script in your UNIX server environment. Once created, this script enables you to create customized reports from existing network project reports at a later time, without having to launch the Paragon Planner client. This is useful for the advanced user who may wish to run batch processes for efficiency purposes, especially if he or she always needs to customize the generated reports using specific filters. Filter Scripts are described in detail in *Advanced Filter Script Utility*.

Report Options

Options that influence the output of these reports can be set in the Report Options window of the Tools > Options > Report menu. These settings include node and link references, bandwidth and distance units, and currency.

Figure 147: Report Options Window



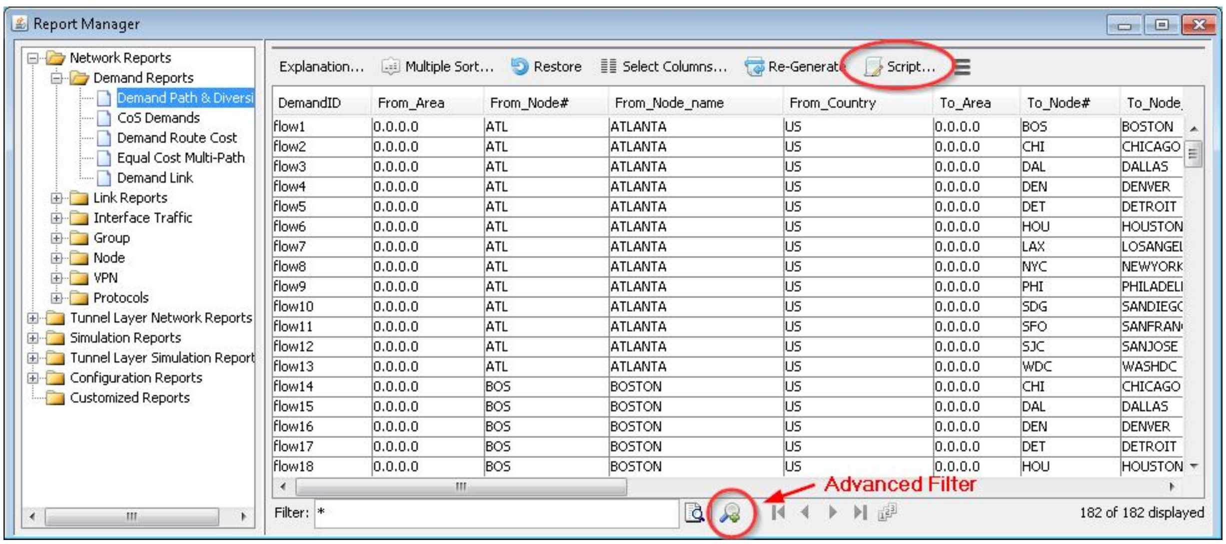
See "Simulation Menu: Predefined and Interactive Scenarios" on page 215 for an explanation of additional items.

Advanced Filter Script Utility

The Advanced Filter Script utility allows you to create and then to apply a filtering shell script in the Unix environment on reports that have been generated by the tool. This is a convenient way to produce filtered reports without the need to launch the client. The shell script can also be called by other scripts that are used for automated daily batch report generation, for instance. The following figure, showing the Report Manager's Path & Diversity Report, is used to illustrate how to use the Advanced Filter Script in the following steps.

NOTE: In the Report Manager, the Script utility is only available for reports that are in Comma Separated Values (CSV) format, a format that is viewable in many programs such as Microsoft Excel. If you do not see the Script button, select **Tools** > **Options** > **Report** and make sure that the Report Style is set to CSV. Once that is done, go back to the Report Manager, right-click on the report file name you are trying to view and select **Re-Generate Report** from the popup menu. If CSV format is supported for the report, it will then be re-displayed in a table format.

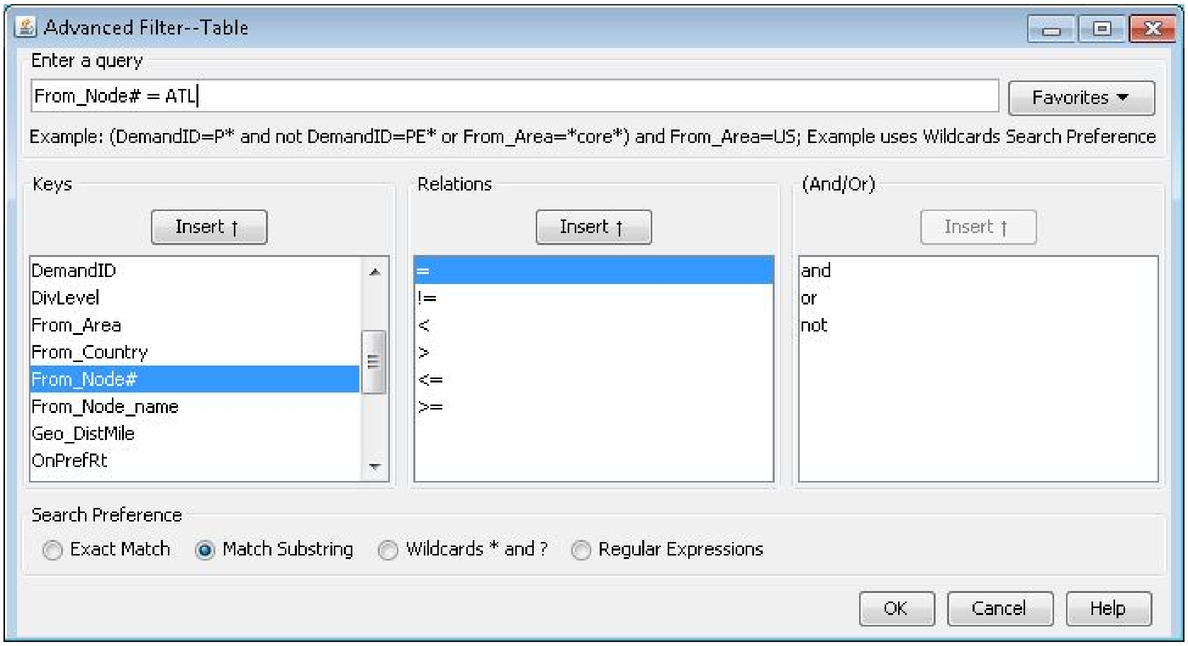
Figure 148: Demand Path and Diversity Report



1. First click on the Advanced Filter button to bring up the Advanced Filter window. Suppose we want to only look at certain demands, such as demands starting from ATL. One way to do this is to use the query, **"From_Node# = ATL"**.

2. Click **OK** to apply the filter.

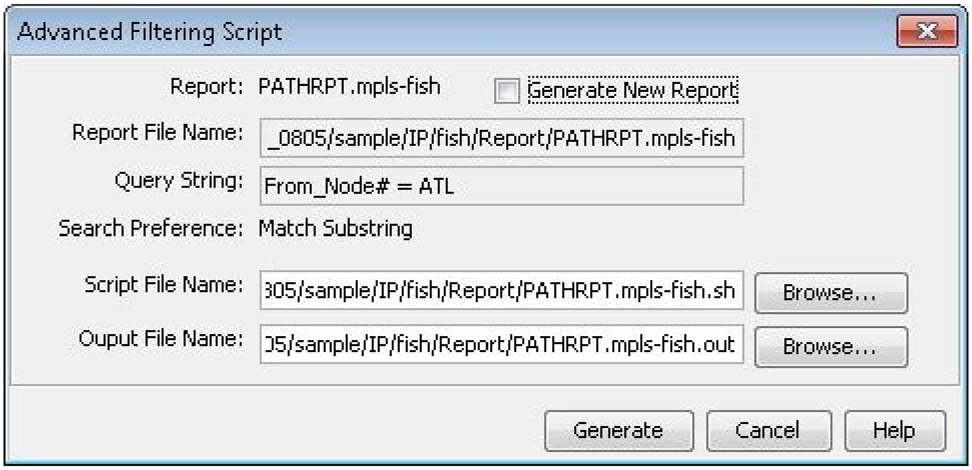
Figure 149: Define a Query in the Advanced Filter Window



3. Next, click on the Script button in the Report Manager to bring up the Advanced Filtering Script window, as shown in the following figure. You may change the script file name or the filtered report output file name by editing the Script File Name and Output File Name text boxes, respectively. You can also choose to regenerate the original report in full (in this case, the Path and Diversity Report) before the filter is performed on it. To do so, mark the Generate New Report checkbox. Once you have finished with any changes, click on the Generate button and a shell script is created in the output path. In this example, PATHRPT.mpls-fish.sh is generated.

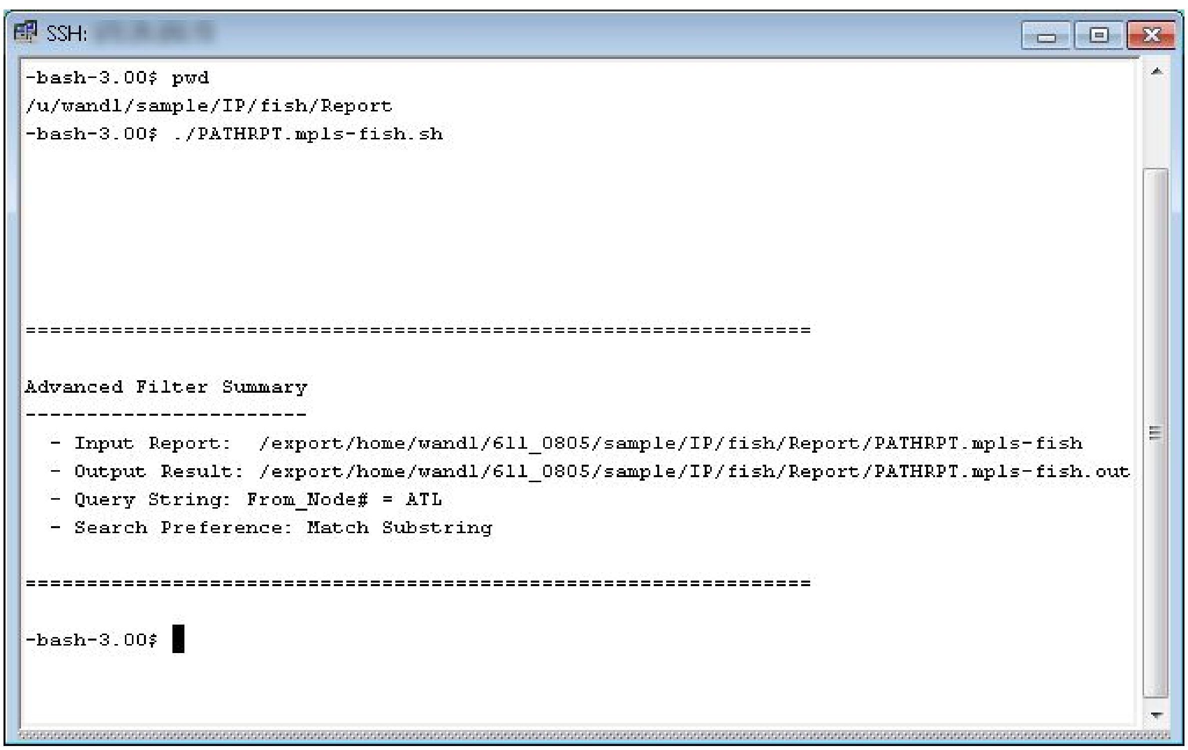
NOTE: The Generate New Report option works for most reports. However, it will not regenerate certain reports, such as Simulation and Configuration (Router-only) reports, which are only created once during the corresponding failure simulation, or configuration import operation, respectively.

Figure 150: Advanced Filtering Script window



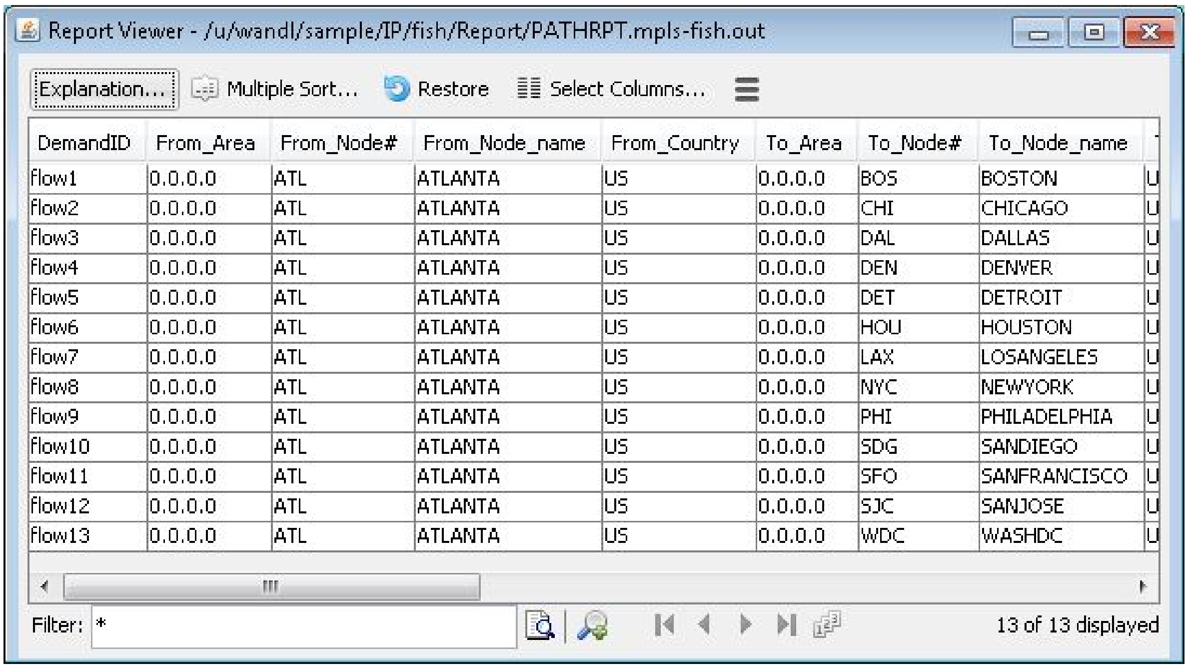
4. Next, log onto your server and navigate to the output directory. (You can do this via Tools > Connect to Server.) Then, to execute the Advanced Filter shell script, simply type the name of the script file at the command prompt, as shown in the following figure.

Figure 151: Run the Advanced Filter shell script



5. Once the shell script has been run, the filtered report is generated, as indicated by the “Output Result” line as shown in the figure above. The following figure shows the filtered report displayed in the Report Viewer (in the File Manager, right click on the file name and select **Open With > Report Viewer**.

Figure 152: Filtered Path and Diversity Report



DemandID	From_Area	From_Node#	From_Node_name	From_Country	To_Area	To_Node#	To_Node_name
flow1	0.0.0.0	ATL	ATLANTA	US	0.0.0.0	BOS	BOSTON
flow2	0.0.0.0	ATL	ATLANTA	US	0.0.0.0	CHI	CHICAGO
flow3	0.0.0.0	ATL	ATLANTA	US	0.0.0.0	DAL	DALLAS
flow4	0.0.0.0	ATL	ATLANTA	US	0.0.0.0	DEN	DENVER
flow5	0.0.0.0	ATL	ATLANTA	US	0.0.0.0	DET	DETROIT
flow6	0.0.0.0	ATL	ATLANTA	US	0.0.0.0	HOU	HOUSTON
flow7	0.0.0.0	ATL	ATLANTA	US	0.0.0.0	LAX	LOSANGELES
flow8	0.0.0.0	ATL	ATLANTA	US	0.0.0.0	NYC	NEWYORK
flow9	0.0.0.0	ATL	ATLANTA	US	0.0.0.0	PHI	PHILADELPHIA
flow10	0.0.0.0	ATL	ATLANTA	US	0.0.0.0	SDG	SANDIEGO
flow11	0.0.0.0	ATL	ATLANTA	US	0.0.0.0	SFO	SANFRANCISCO
flow12	0.0.0.0	ATL	ATLANTA	US	0.0.0.0	SJC	SANJOSE
flow13	0.0.0.0	ATL	ATLANTA	US	0.0.0.0	WDC	WASHDC

List of Network Reports

Depending on the network type, the Report Manager displays a different set of reports. The following table lists the available reports. Reports marked with (Router) are device-specific reports and will only appear for the corresponding network type. All other reports are general and should appear for all networks.

Demand Reports	File	Description
Demand Path & Diversity	PATHRPT	Lists details of all user demand requirements in the network. See "Simulation Menu: Predefined and Interactive Scenarios" on page 215.

(Continued)

Demand Reports	File	Description
CoS Demands (Router)	DEMANDCOS	Displays the worst propagation and queuing delays for each demand. *See CoS Demands Report* .
Demand Route Cost	CKTCOST_RT	Provides utilization costs according to demand routes. See *Demand Route Cost Report* .
Equal Cost Multi-Path (Router)	EQPATHRPT	Lists equal cost multiple paths that exist in the network for nodes in the same AS and same OSPF area, and also for inter-area and inter-VPN demands. See *Equal Cost Multi-Path Report*.
Demand Link	DEMAND_LINK	Displays the demand path through links by interface out and in sequence.

Link Reports	File	Description
Planned Link Utilization	LKUTIL	Provides demand bandwidth utilization information for each link in the network. See "Report Manager: Network Reports" on page 335.
Planned Physical Interface Utilization	PHYUTIL	Provides demand bandwidth utilization information for each physical interface in the network. See *Planned Physical Interface Utilization*.
Per Node Pair (Measured)	MEASUREDLKBWRPT	Shows link utilization by period from the interface ingress and egress traffic files between connecting nodes.
Measured Link Util (based on trafficload)	L3LINKUTIL	Shows the measured traffic by link based on the trafficload file.
Demand Traffic vs Interface Traffic	L3LINKUTILCOMPARE	Shows the comparison between planned and measured traffic. See *Demand Traffic Versus Interface Traffic*.

(Continued)

Link Reports	File	Description
Demand Traffic vs Physical Interface Traffic	L3PHYUTILCOMPARE	Shows the comparison between planed and measured traffic on physical interfaces.
CoS Links* (Router)	LINKCOS, L2_LINKCOS	Displays the worst propagation and queuing delays for each CoS class on each link. See *CoS Links Report*.
Link Cost	LKCOST	Provides detailed link pricing information.
RSVP Bandwidth Allocation (Router)	LKPART	Displays link partitions and their capacity allocation.

Interface Traffic	File	Description
Interface Traffic (Router)	IntfUtil	Displays interface load and utilization information. See *Interface Traffic Report*.
Interface CoS Traffic (Router)	INTFCOS	Displays interface Traffic by Class of Service.
Interface Multicast Traffic (Router)	INTFMULTICAST	Displays interface Multicast Traffic.
AS Traffic (Router)	ASTraffic	Displays traffic information for interfaces at different AS's. See *AS Traffic Report*
Inter-AS Traffic (Router)	InterASTraffic	Displays traffic information between different AS's. See *Inter-AS Traffic Report*.

(Continued)

Interface Traffic	File	Description
Inbound/Outbound Network Traffic (Router)	NWKTRAF	For each node, displays an aggregate outbound and aggregate inbound value, corresponding to the sum of traffic originating and terminating at a node respectively - but only on interfaces that do not correspond to any links in the network model (for example, customer-facing interfaces, PE-CE interfaces when CE configuration files are missing from the network model). This information is derived from the measured traffic on the interfaces (interface “egress” and “ingress” traffic files in the File > Load Network Files window). One purpose for this file is for use in the Traffic Matrix tool, as described in the *Paragon Planner User Guide*.

Group	File	Description
Group Demand Summary by Group Pair	GROUPDEMANDSUMMARY	Shows summarized information for demands that are requested within a group or between two different groups.
Group Demand Detail by Group Pair	GROUPDEMANDDETAIL	Shows detailed information for demands that are requested within a group or between two different groups.
Group Demand Traffic on Link Summary	GROUPLINKSUMMARY	Shows summarized information for links that exist within a group or between two different groups.
Group Demand Traffic on Link Detail	GROUPLINKDETAIL	Shows detailed information for links that exist within a group or between two different groups.
Group Interface Load Summary (Router)	GROUPINTFSUMMARY	Shows summarized information for interface load of links within a group or between two different groups.
Group Interface Load Detail (Router)	GROUPINTFDETAIL	Shows detailed information for interface load of links within a group or between two different groups.

(Continued)

Group	File	Description
Group Demand Bandwidth Distribution	L3GROUPLOAD	Shows traffic statistics for groups such as source, destination, transit, and intra-group traffic.

Node	File	Description
Demand Traffic Per Node	SWITCHCONN	Shows statistical information on demands that originate, pass through or terminate at each node in the network.
Measured Interface Traffic Per Node (Router)	MEASNODELOAD	Displays up to 24 periods of total incoming and outgoing traffic from each node based on the measured interface traffic data. Note that only interfaces corresponding to links in the network model are considered.
Node Link Port	NodeLinkPort	Displays the number of ports on a node by link type.

VPN	File	Description
VPN Interface Traffic (Router)	VPNINTFTRAF	Reports the ingress and egress traffic on VPN interfaces for each traffic load period.
VPN Interface CoS Traffic (Router)	VPNINTFCOS	Reports VPN interface traffic broken down into CoS classes.
VPN Interface Multicast Traffic (Router)	VPNINTFMULTICAST	Reports on the VPN interface multicast traffic load.
VPN Export-Import (Router)	VPNEXPORTIMPORT	Displays the route target export/import relationships that exist between VPNs in the network.
Layer3 (Router)	VPNREPORT_LAYER3	Displays the details of Layer 3 VPN's in the network.

(Continued)

VPN	File	Description
Layer2 Martini (Router)	VPNREPORT_LAYER2	Displays the details of Layer 2 Martini VPN's in the network. See *Layer2 Martini Report* .
Layer2 Kompella* (Router)	VPNREPORT_L2KOMPELLA	Displays the details of Layer 2 Kompella VPN's in the network. See *Layer3/Layer2 Kompella Report*
Layer2 CCC (Router)	VPNREPORT_L2CCC	Displays the details of Layer 2 circuit cross-connect VPN's in the network.
VPLS-LDP	VPNREPORT_VPLS	Shows LDP based VPLS information
VPLS-BGP	VPNREPORT_VPLS_JUNIPER	Shows BGP based VPLS information. Juniper Networks only.

Protocols	File	Description
Route Instance (Router) *	RTINSTRPT	Reports on Routing Instances for OSPF or IS-IS. For more information, see the *Paragon Planner User Guide*, *Routing Instances* chapter.
Subnet (Router) *	SUBNETRPT	Displays all subnets in the network model
BGP > BGP * (Router)	BGPRPT	Also called the BGP Integrity Checks Report. It contains four sections (select **Application** > **Options** > **Report**) including Unbalanced BGP Neighbor Check, IBGP Mesh Connectivity Check, Local/Neighbor AS Specification, and Route Reflector Statistics. See "Report Manager: Network Reports" on page 335
OSPF > Inter Area Load Distribution* (Router)	INTDOMLOAD	Displays the load distribution between areas in the network

(Continued)

Protocols	File	Description
OSPF > Inter Area Paths* (Router)	INTDOMPATH	Displays information regarding paths between two user-specified areas
OSPF > Area Pass through Paths* (Router)	DOMPASSTHRU	Generates information regarding demands passing through an area in the network
OSPF > OSPF Area Summary* (Router)	OSPFSUMMARYRPT	Shows summarized information for each OSPF area See *OSPF Area Summary*
OSPF > OSPF Area Detail* (Router)	OSPFDETAILRPT	Shows detailed information for all routers in each OSPF area. See *OSPF Area Detail Report*
OSPF > ABR Bordering Area* (Router)	ABRBORDERRPT	Displays the bordering areas for each ABR. See *ABR Bordering Area Report.*

List of Tunnel Layer Network Reports

Tunnel Reports	File	Description
Tunnel Path & Diversity	TUNNELRPT	Displays details of all tunnels in the network and their paths. .
Tunnel Route Cost	L2_CKTCOST_RT	Provides utilization costs according to tunnel routes.
Demand Traffic on Tunnel	TUTIL	Displays comprehensive tunnel information in the network. See "Simulation Menu: Predefined and Interactive Scenarios" on page 215.
Tunnel Traffic	TUTRAFRPT	Displays tunnel load and utilization information.

(Continued)

Tunnel Reports	File	Description
Tunnel-Link	TUNNEL_LINK	Displays information for each interface segment of each tunnel's path.

Tunnel Layer Link Reports	File	Description
Tunnel RSVP BW on Link	L2_LKUTIL	Provides tunnel bandwidth utilization information for each link in the network
Tunnel RSVP BW on Node Pair	L2_LKBWRPT	Provides tunnel bandwidth utilization information for grouped links (links that have the same endpoints)
Measured Link Util (based on T_trafficload)	L2_MEASUREDLKUTIL	Shows tunnel traffic on the link by period from the T_trafficload or tunnel.traffic file for Live networks.
Tunnel Layer Per Node Pair (Measured)	L2_MEASUREDLKBWRPT	Shows tunnel traffic between connecting nodes by period from the T_trafficload or tunnel.traffic file for Live networks.
Tunnel Traffic vs Interface Traffic	LINKUTILCOMPARE	Compares aggregate tunnel traffic load versus the measured interface traffic.
RSVP Bandwidth Allocation	L2_LKPART	Displays partitions of the link bandwidth (RSVP and GB=Guaranteed Bandwidth, GlobalPool and SubPool, or CT partitions for DiffServ-TE) and shows the tunnel bandwidth for each partition.

Tunnel Layer Group	File	Description
Group Tunnel Summary by Group Pair	GROUPTUNNELSUMMARY	Shows summarized information for tunnels that are requested within a group or between two different groups.

(Continued)

Tunnel Layer Group	File	Description
Group Tunnel Detail by Group Pair	GROUPTUNNELDETAIL	Shows detailed information for tunnels that are requested within a group or between two different groups.
Group Tunnel Bandwidth Distribution	GROUPLOAD	Shows total ingress, egress, and transit tunnel traffic through the groups.

Node	File	Description
Planned Tunnel RSVP BW Per Node	TUNNELSTAT	Shows statistical information on tunnels that originate, pass through or terminate at each node in the network.
Measured Tunnel Traffic Per Node	L2_MEASNODELOAD	Shows ingress and egress tunnel traffic tunnel traffic through the nodes.

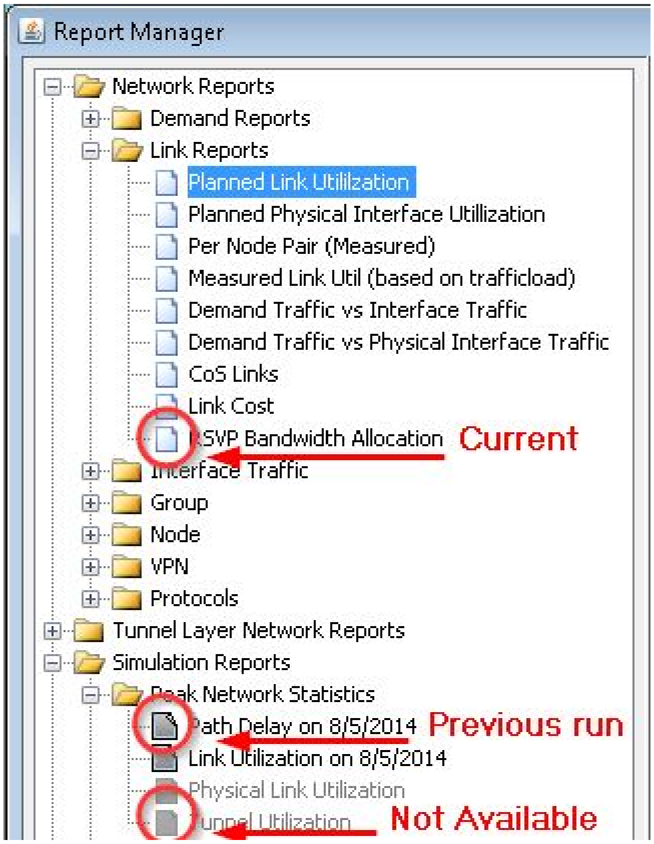
List of Simulation Reports

All simulation reports are pre-generated. That is, they are generated after performing the associated simulation script. The Report Manager provides a quick, organized way of accessing these reports, though the reports can also be opened directly via the File Manager.

Simulation Report Icons

Because the Simulation Reports are pre-generated, at the time a simulation report is viewed, it may not accurately correlate with the current state of the network. For example, in the interim you may have modified the network, adding or removing network elements like nodes, links or demands. Special icons are used to quickly allow you to distinguish newer reports from older reports that may be out of date:

Figure 153: Report Icons



- **Faded Gray:** Indicates that the report is not available. The associated simulation script has not yet been run.
- **White:** Indicates that the report was generated during the current network session. This does not guarantee that the report reflects the current state of the network model. It is just an indicator that the report is relatively new.
- **Dark Gray:** Indicates that the report was generated during a previous network session.

Associated Simulation Scripts

The following table lists the simulation script corresponding to each report. The scripts are accessed from the main menu Simulation > Simulation Scenarios. For more detail about the variety of simulations, see "Report Manager: Simulation Reports" on page 379.

Report	File	Associated Simulation
Peak Link Util	DVSIM	Displays link and bandwidth information under normal and peak conditions obtained from failure simulation runs
Interactive Failure	SIMRPT	Tools > Options > Failure Simulation; In Failure Report Tab, ensure that the “Yes” checkbox for Trace File is marked. Then, perform an interactive failure sequence by failing nodes/links via the map right-click menus or via Simulation > Interactive Scenarios. Run or Step through the simulation. See *Interactive Failure (SIMRPT) Reports*.
Exhaustive Failure	PeakSimSummary PinkSimLink PeakSimRoute	Simulation > Simulation Scenarios
Daily Sequence	DAILYSEQ	This file is generated when a Random Daily Failure simulation is run. To perform this simulation, select **Simulation > Simulation Scenarios**, select **Multiple Failures**, select **Double** or **Triple** failure, and enter in a number of Cases to Simulate. • This file records the random daily failure sequence into an *up-down* sequence file that can be replayed with the Replay Up-Down Sequence simulation.
Path Delay Information	PATHDELAY	This report is generated with almost every simulation script that you run. It indicates the worst path delay experienced by each demand, as well as the failure event that caused the worst-case scenario. Note that the report is overwritten each time.
Up-Down Sequence	UPDOWN	Under Simulation > Simulation Scenarios, select **Generate Up-Down Sequence** for use in Upper Layer option in addition to the simulation script to be run.
Shared Risk Link Groups	SRLG	This file is generated during an Up-Down Sequence simulation, for use in Upper Layer. It basically creates a facility file that groups the failed demands corresponding to each network element failure just simulated in the current layer. These demands correspond to links in a higher network layer, where you can proceed to run an Exhaustive Facility Failure. In this way, you can see the impact of the network failure at a higher network level.

(Continued)

Report	File	Associated Simulation
Replay Up-Down Sequence	REPFAIL	Under Simulation > Simulation Scenarios > Advanced Options, select Replay Up-Down Sequence, then specify the up-down sequence file. The DAILYSEQ file generated from Random Daily Failure can be used here.

List of Configuration Reports (Router Only)

All configuration reports are “pre-generated”. That is, they are generated after you import configuration files into the network model by selecting **File > Import Data**. The Report Manager provides a quick, organized way of accessing these reports, though the reports can also be opened directly from the File Manager.

For more information on configuration import, see the router data extraction chapter of the *Paragon Planner User Guide*.

Report	File	Description
Integrity Checks	configLog	Displays detailed integrity checks. See "Report Manager: Configuration Reports" on page 382.
Integrity Checks Summary	Integrity_Summary_rpt	Displays a summary of the integrity checks. This report can also be accessed directly by pressing the Stethoscope icon on the main menu bar.
ISIS Config	ISISReport	Displays the details of IS-IS configuration. See *ISIS Reports*.
OSPF Config	OSPFReport	Displays the details of OSPF configuration
CoS Config	ConfigCoS	Displays the details of CoS configuration

(Continued)

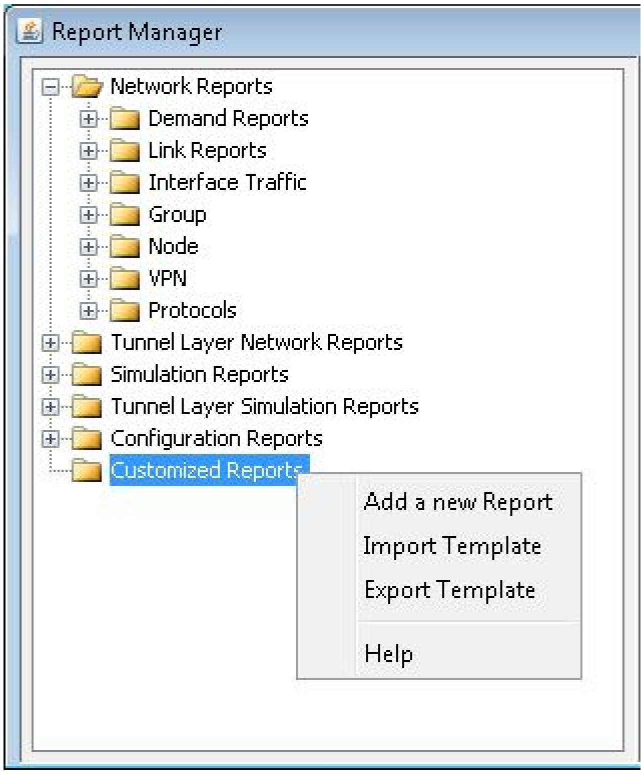
Report	File	Description
Config Files Status	ConfigFileStatus	Displays the file properties of collected configuration files.
VLAN Detail	VLANReport	Displays details of the VLAN's collected from switches via SNMP.
Duplicated IP Address	ConfigDuplicateAddress	Displays duplicate IP address(es) found in the configuration files.
Node Discovery	BridgeVLAN ConfigCoS ConfigElementDiscovery ConfigFileStatus ConfigIntegrityChecks ConfigIntegrityChecksSummary ConfigISIS ConfigOSPF	Displays the names of devices (nodes) added to or removed from the network after completion of a Scheduling Live Data Collection task or Network Config Data Collection task. To generate the Node Discovery report, Paragon Planner compares the device differences between the previous network and the current network, and lists any devices that have been added or removed.

Customized Reports

The customized reports feature allows you to create a customized report by selecting certain columns of interest from an existing Node, Link, Interface, Demand, and Tunnel report.

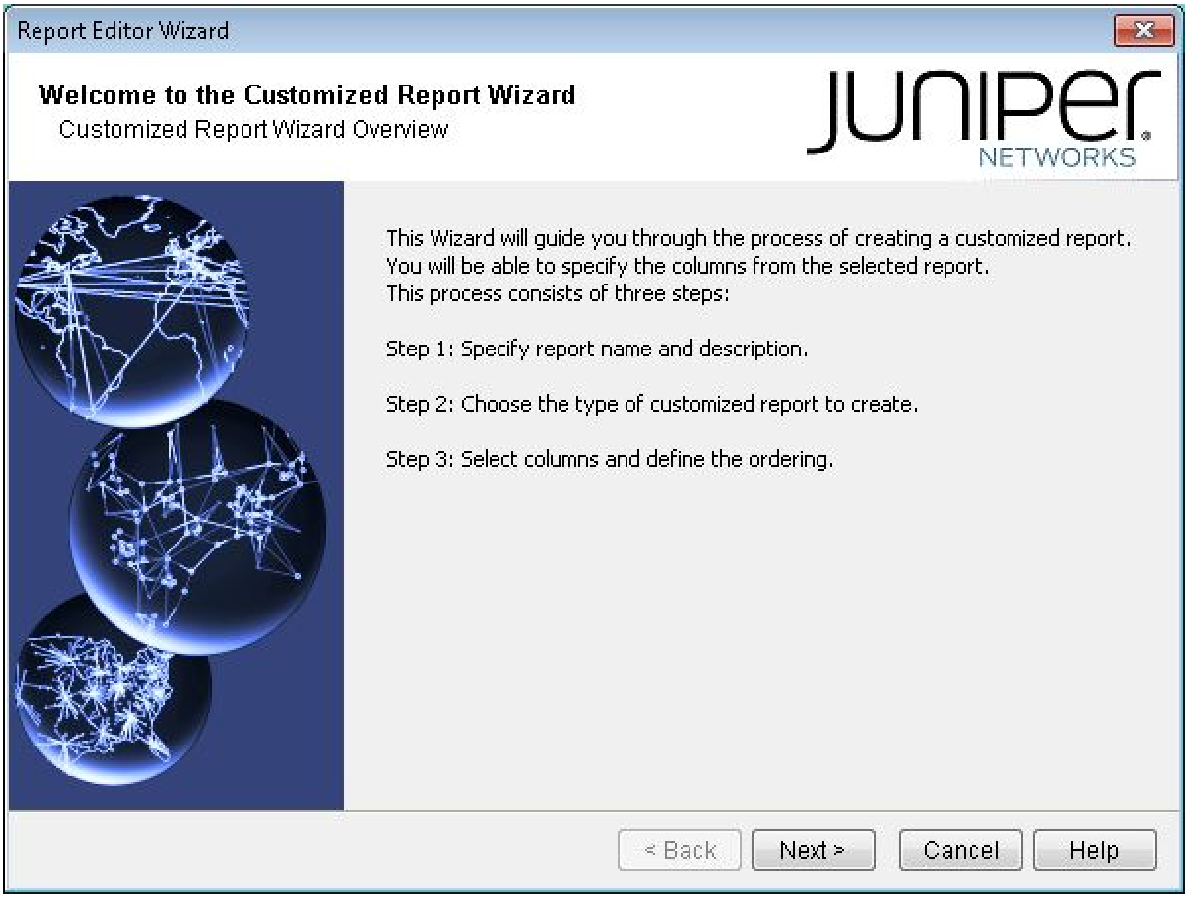
1. To create a customized report, right-click over Customized Reports in the Report Manager and choose **Add a new Report** from the menu.

Figure 154: Adding a New Customized Report



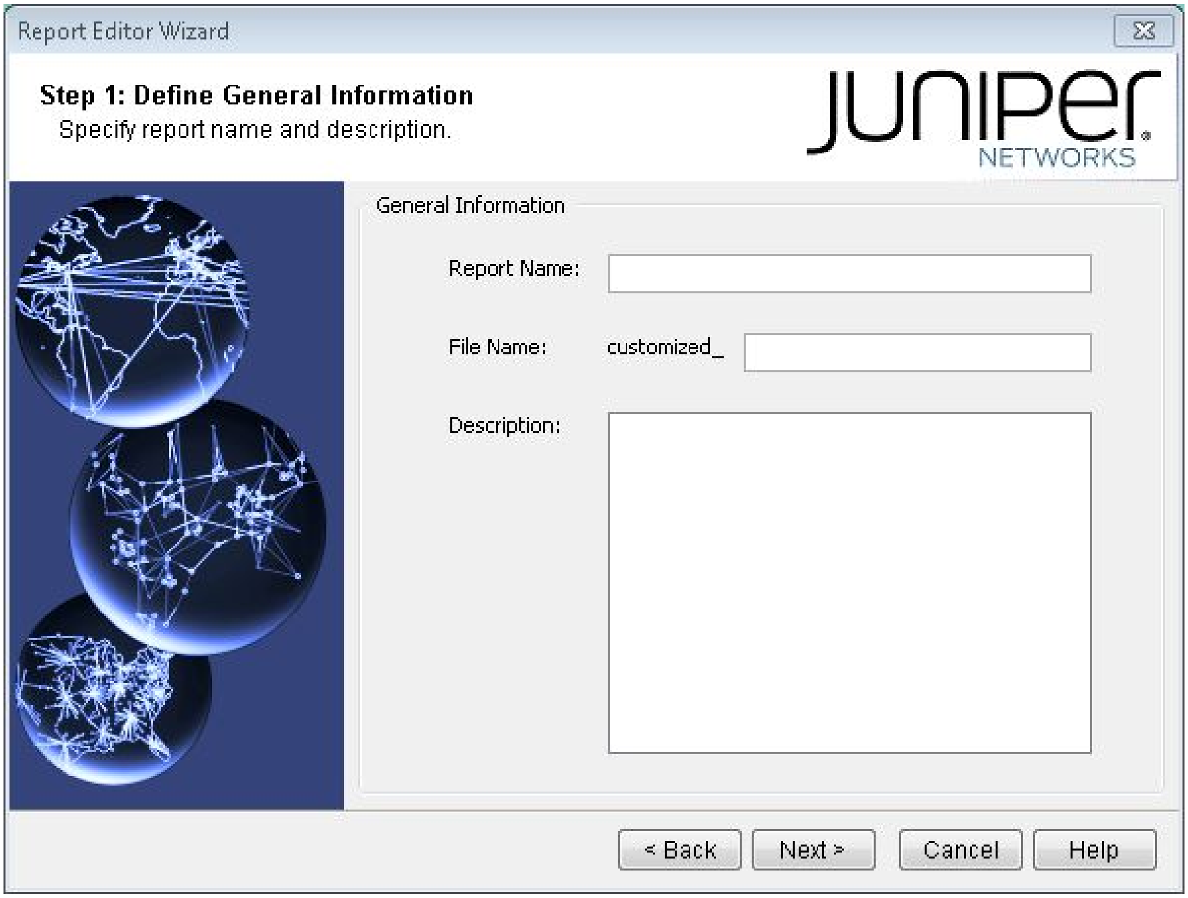
The Customized Report Editor Wizard then appears, as shown in the following figure. Click **Next** to continue.

Figure 155: Customized Report Wizard



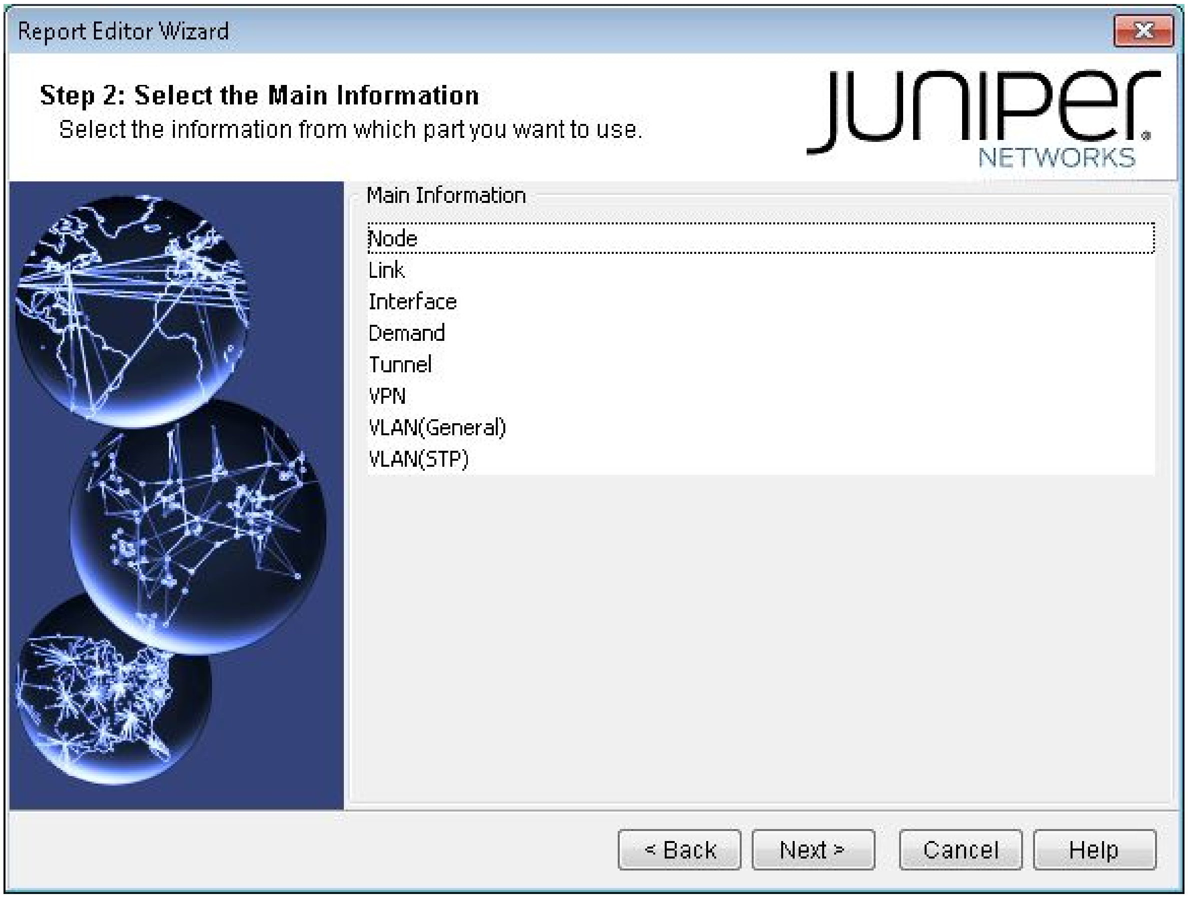
2. Specify the report name, file name, and a description, and click **Next** to continue.

Figure 156: Define Report Name, File Name, and Description



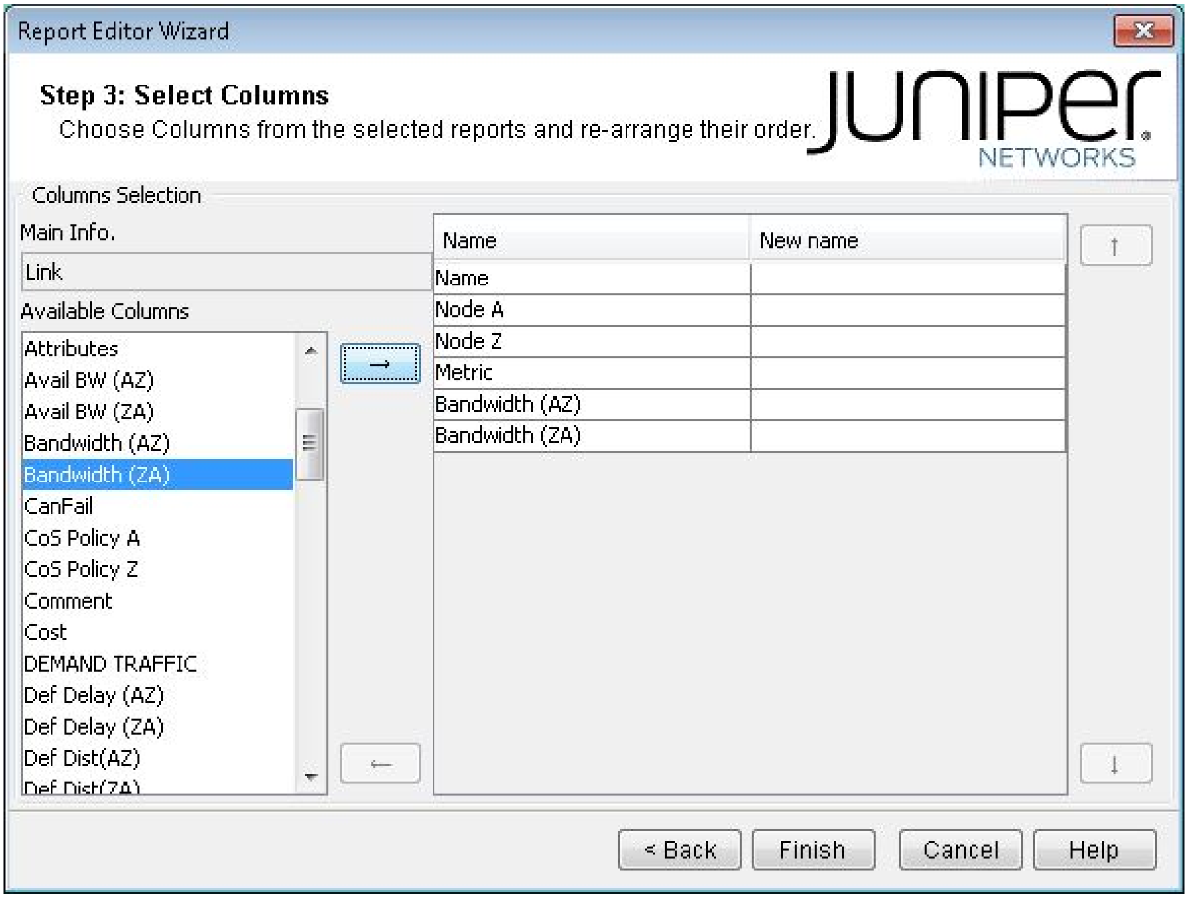
3. Choose the type of report from which to derive a customized report. After choosing the report type, click **Next** to continue.

Figure 157: Choose the Report Type



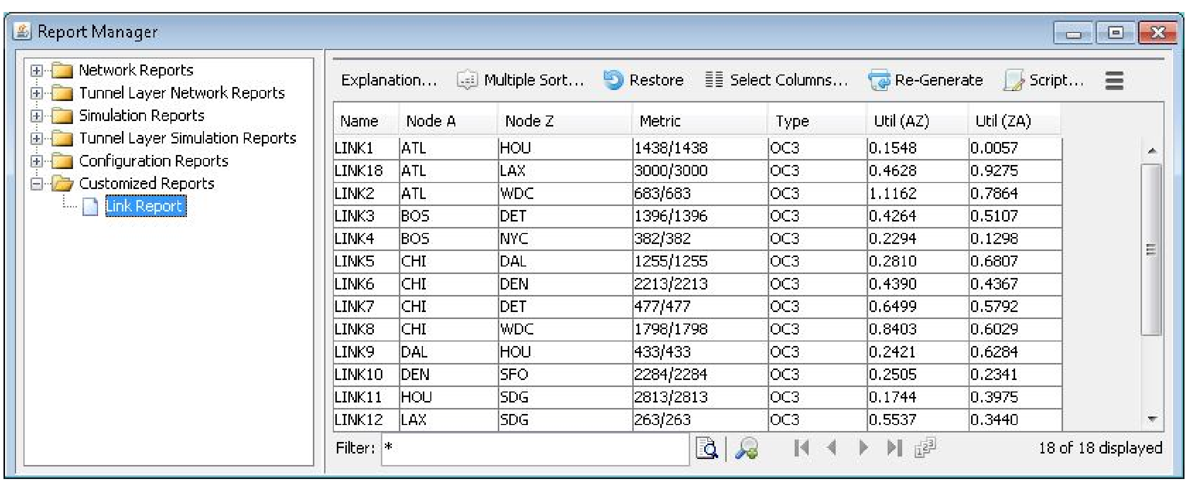
4. Select the columns of interest for the customized report by highlighting rows from the Available Columns list and clicking on the -> button. For each column selected for the customized report, you may choose a new name for an existing column name by clicking on the text box in the New name column and typing in a new string.

Figure 158: Choose Columns of Interest



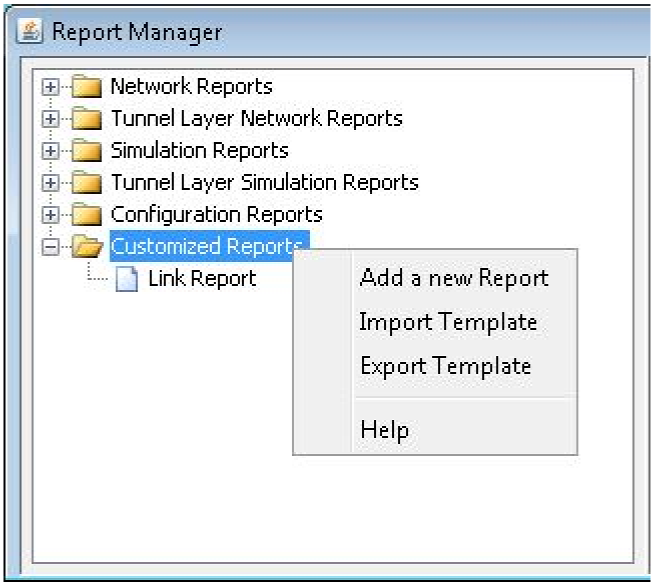
5. Click on Finish to create the customized report, which is placed into the Customized Reports folder.

Figure 159: A Customized Report Derived from the Link Report



6. After a customized report has been created, you may export it as a template. This template may then be imported by a different network spec, and the same customized report could be generated for that network.

Figure 160: Exporting/Importing a Customized Report Template



Report Manager: Network Reports

IN THIS SECTION

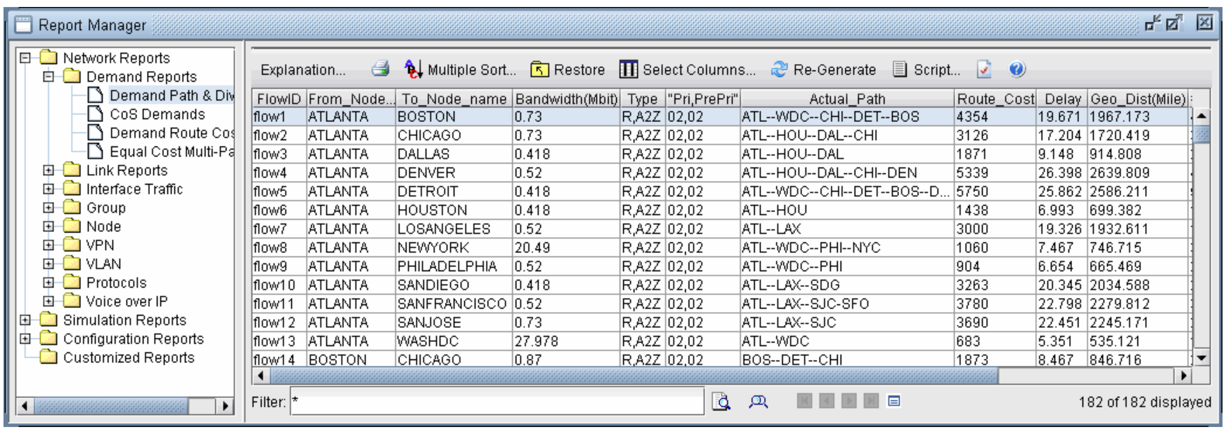
The following sections describe the types of network reports that are available:

Demand Reports

Demand Path & Diversity Report

The Demand Path & Diversity Report lists all user demand requirements in the network, with demand ID, origination, destination, bandwidth, type, priority, preempt priority, path routing, and distance metrics. The output file that is written to the output directory is called “PATHRPT.*runcode*”.

Figure 161: The Path and Diversity Report in a Frame Relay Network



Field	Description
FlowID/PVCID	The ID of the demand. (Column name varies with hardware modules.)
From_Node_Name	The full name of the origination node of the demand.
From_Domain/ From_Area	The domain at which the demand originates, if any.
From_Node#	The ID of the origination node of the demand.
From_Country	The country in which the origination node resides.

(Continued)

Field	Description
Card	The name of the card which the demand is connected to; the card slot position that the demand/flow uses.
Port	The port number of the card which the demand is connected to; the port associated with the card the demand/flow uses
To_Node_Name	The full name of the destination node of the demand.
To_Domain/To_Area	The domain at which the demand is destined for, if any.
To_Node#	The ID of the destination node of the demand.
To_Country	The country in which the destination node resides.
Card	The name of the card which the demand is connected to; the card slot position that the demand/flow uses
Port	The port number of the card which the demand is connected to; the port associated with the card the demand/flow uses
Bandwidth	The amount of bandwidth allocated to the selected demand.
Type	The type of the demand, whether it is a data demand (R) or voice demand (V), and the direction of the demand (A-Z, Z-A).
Terrestrial	The demand's preference for terrestrial media. Valid entries include: Don't Care, Required, Prefer, Prefer Not, and Avoid. Note that this parameter is used in route biasing and may not actually reflect true media characteristics.
Fiber	The demand's preference for fiber media. Valid entries include: Don't Care, Required, Prefer, Prefer Not, and Avoid. Note that this parameter is used in route biasing and may not actually reflect true media characteristics.

(Continued)

Field	Description
Encrypted	The demand's preference for encryption media. Valid entries include: Don't Care, Required, Prefer, Prefer Not, and Avoid. Note that this parameter is used in route biasing and may not actually reflect true media characteristics.
Pri, PrePri	The priority field of the demand specification consists of two numbers separated by a comma (,), or a forward-slash (/). The first number defines the call priority of the demand, and the second number the preempt priority of the demand. The preempt priority should be at the same or lower priority as the call priority of the demand. It is assumed that this demand can bump any of the demand with call priority lower than the preempt priority.
Actual_Path	The current path (routing) of the demand.
Route_Cost	This field displays the sum of the metrics (administrative weights) of the links that the demand traverses. For asymmetric demands, two separate rows are used to show the metric, one for each direction. Note that the default metric of a link depends upon the routing method set in the Tools > Options > Design window, Design>Path Placement options pane.
Delay	When the program performs path placement and is trying to find the best route for a call, delay metrics are examined to determine the desirability/undesirability of a link. Two delay metrics are supported, one for each direction of the trunk. If asymmetric delay metrics are not supported by the hardware, the second delay is marked as '-'. If a delay metric is not defined for a trunk, a default delay is calculated based on propagation delay and serialization delay.
Geo_Dist(Mile)	Specifies the sum of the actual mileage distance of links in the current path.
#Hop	Specifies the total number of hops of the current path.
OnPrefRt/Path_Violation	Specifies if the demand could not be routed on the specified path.
Media_Error	Specifies if the demand could not be routed on the specified media (terrestrial, fiber, encrypted).

(Continued)

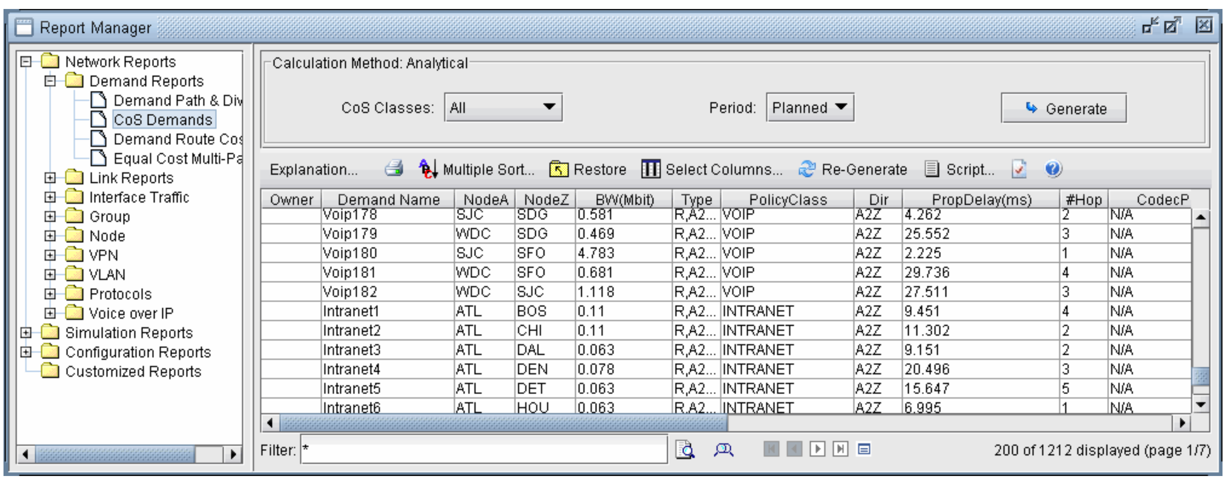
Field	Description
Comment	Any user-specified comments.
DivLevel/DivGroup	Group name for demands that are to be diverse from each other.

CoS Demands Report

The CoS Demands Report provides information on interface load and queuing delays for the demands of the selected CoS class in the network. See the *Paragon Planner User Guide* for details on the Class of Service feature.

The output file that is written to the output directory is called “DEMANDCOS.*runcode*”.

Figure 162: The CoS Demands Report



- **Normal or Peak:** Normal traffic means the network does not experience any failure/outages. Peak means that failure simulation reports are going to be used.

- **CoS Classes:** Select all or one specific class of traffic. Reports can be issued for all classes of traffic or for a particular one (for example, the priority class).

- **Period:** Select planned, worst, all, or a specific time period (from traffic load files). Planned means the report is generated using the interface load calculated based on the demand file values. Worst means that the report is generated using the interface load calculated based on the worst traffic load.

Field	Description
DemandName	The name of the demand.
NodeA	The originating node of the demand.
NodeZ	The terminating node of the demand.
BW	The bandwidth of the demand.
Type	The type of the demand, whether it is a data demand (R) or voice demand (V), and the direction of the demand (A-Z, Z-A).
Policy Class	The policy class to which the demand belongs.
Dir	The direction of the demand: A2Z, Z2A.
PropDelay(ms)	The sum of node delay and link propagation delay for nodes and links in the path. Delay at the first node is not included.
#Hop	Specifies the total number of hops of the current path.
CodecPktDelay	Specifies the Codec Packet Delay
Planned Load	The bandwidth defined in the demand's bandwidth field. The amount of bandwidth planned for this demand.
Planned QDelay(ms)	The queuing delay based on the planned load and CoS policies.
Planned DropBW	The planned drop bandwidth for this demand
Planned Jitter	The jitter as defined by the standard deviation of the total path delay.
Worst Load	The highest bandwidth among the load in all the traffic periods.

(Continued)

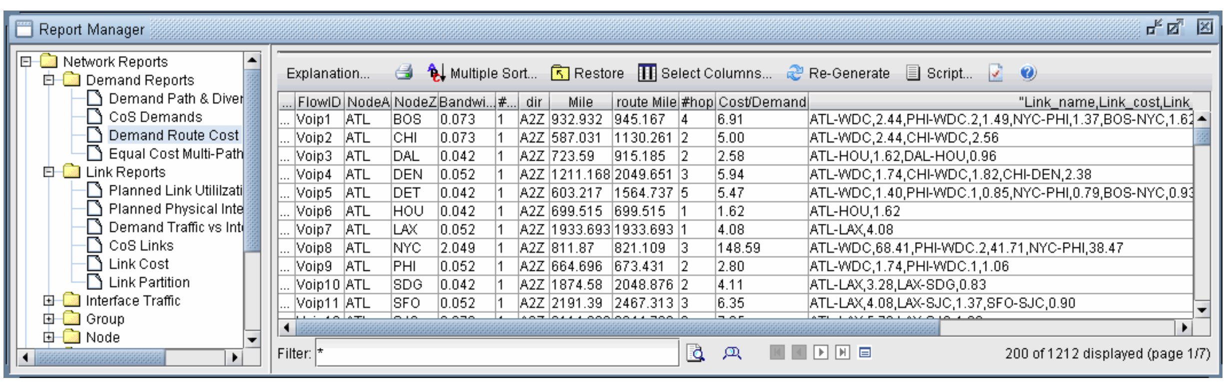
Field	Description
Worst QDelay	The highest queuing delay value among all the traffic periods.
Worst DropBW	The highest dropped bandwidth among all the traffic periods.
1, 2, ... Load	The bandwidth of the demand in the specified time period.
1, 2, ... QDelay	The queuing delay in the specified time period.
1, 2, ... DropBW	The dropped bandwidth in the specified time period.

Demand Route Cost Report

The Demand Route Cost Report provides cost information for each demand based on the demand's route. Each entry is a demand in the network. The report specifies details of each demand, its total cost, and the breakdown of the cost by each link that it passes through.

The output file that is written to the output directory is called "CKTCOST_RT.*runcode*".

Figure 163: The Demand Route Cost Report



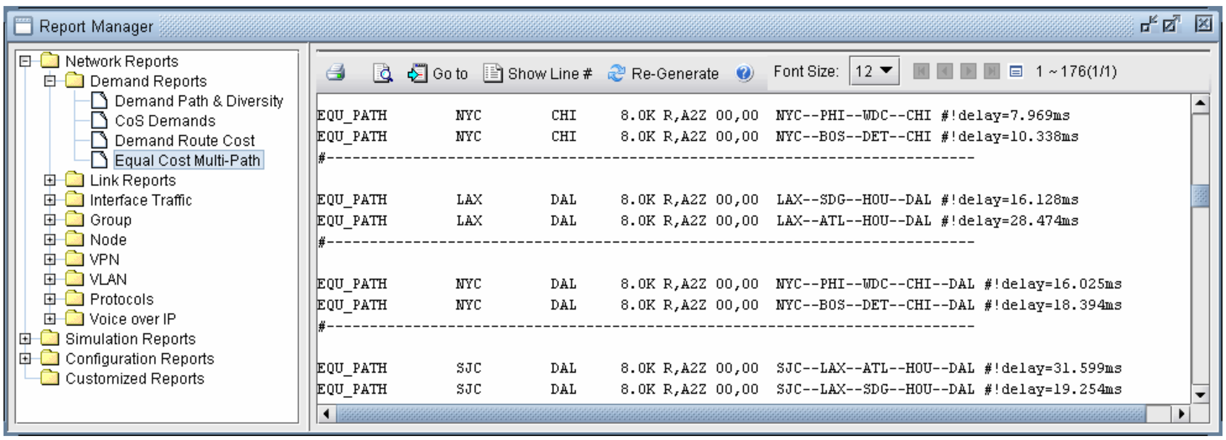
```
################################################################
# COST REPORT FOR DEMANDS File=CKTCOST_RT.x
################################################################
##
# Currency= DL(American Dollar), DistUnit=mile
```

```
Ratedir = /u/wandl/db/rates/default
# Calculation Method: utilization cost according to demand routes
# i.e. Demand cost = Sum of (bandwidth/link_cap)*(link cost)
# for links in the path
#
```

Equal Cost Multi-Path Report

The Equal Cost Multi-Path Report displays all the equal cost multiple-paths in the network. It lists each set of equal cost paths, displaying the originating and destinating nodes, and the hop-by-hop paths. See the *Paragon Planner User Guide* for details on the ECMP feature. The output file that is written to the output directory is called “EQPATHRPT.*runcode*”.

Figure 164: The Equal Cost Multi-Path Report



NOTE: ECMP paths are calculated based on IGP routing, but the actual path placement will also take into consideration MPLS Traffic Engineering Tunnels.

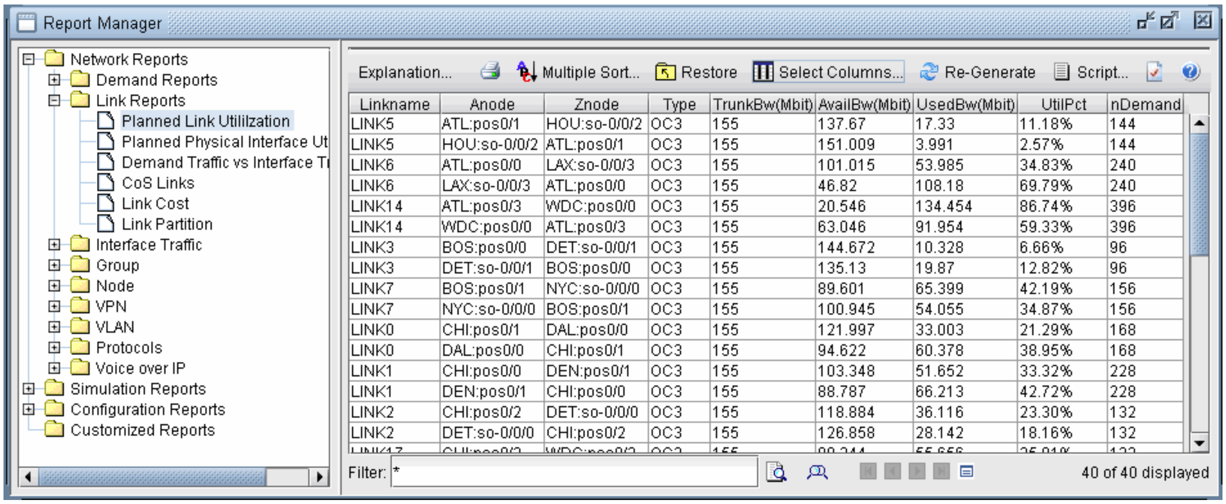
```
* Notations:
* & : Same site
* - : Intra-LATA or Intra-Country
* -- : Inter-LATA or Inter-Country
* = : Intra-LATA or Intra-Country, Second vendor or linktype
* == : Inter-LATA or Inter-Country, Second vendor or linktype.
* @ : Intra-LATA or Intra-Country, Inter-domain
* @@ : Inter-LATA or Inter-country, Inter-domain
* -*- : Link missing or not enough bandwidth
```

Link Reports

Planned Link Utilization Report

The Planned Utilization Report lists comprehensive link and bandwidth information for the network. The output file that is written to the output directory is called “LKUTIL.*runcode*”.

Figure 165: The Planned Link Utilization Report, LKUTIL



Field	Description
Linkname	The name of the link.
dir	The direction of the link.
Anode	The origination node of the link.
Znode	The destination node of the link.
Type	The type of trunk being used. The trunk type is subsequently used in determining link pricing and bandwidth availability.
TrunkBw	The total bandwidth of the link from nodes A to Z. This is also the sum of the AvailBW, UsedBW and Ovhd values.

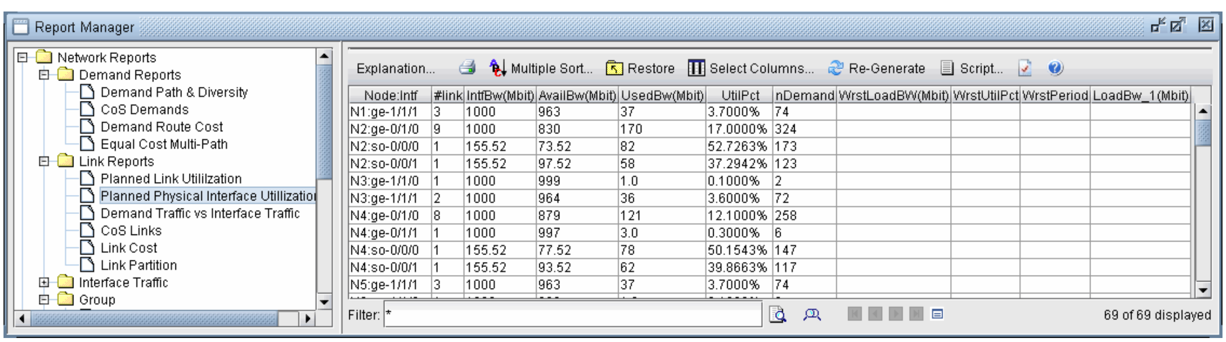
(Continued)

Field	Description
AvailBW	The available amount of unutilized bandwidth between nodes A and Z.
UsedBW	The amount of bandwidth actually used by the demand requirements between nodes A and Z.
Ovhd	The amount of reserved bandwidth for overhead. (TotalBw = AvailBw + UsedBw + Ovhd)
UtilPct	The utilization of this link calculated by (UsedBW+Ovhd)/TotalBW.
nDemand/ncall	The number of demands routed on or through the link.

Planned Physical Interface Utilization

The Planned Physical Interface Utilization Report provides utilization statistics for each physical interface in the network. The output file that is written to the output directory is called "PHYUTIL.*runcode*".

Figure 166: Planned Physical Interface Utilization



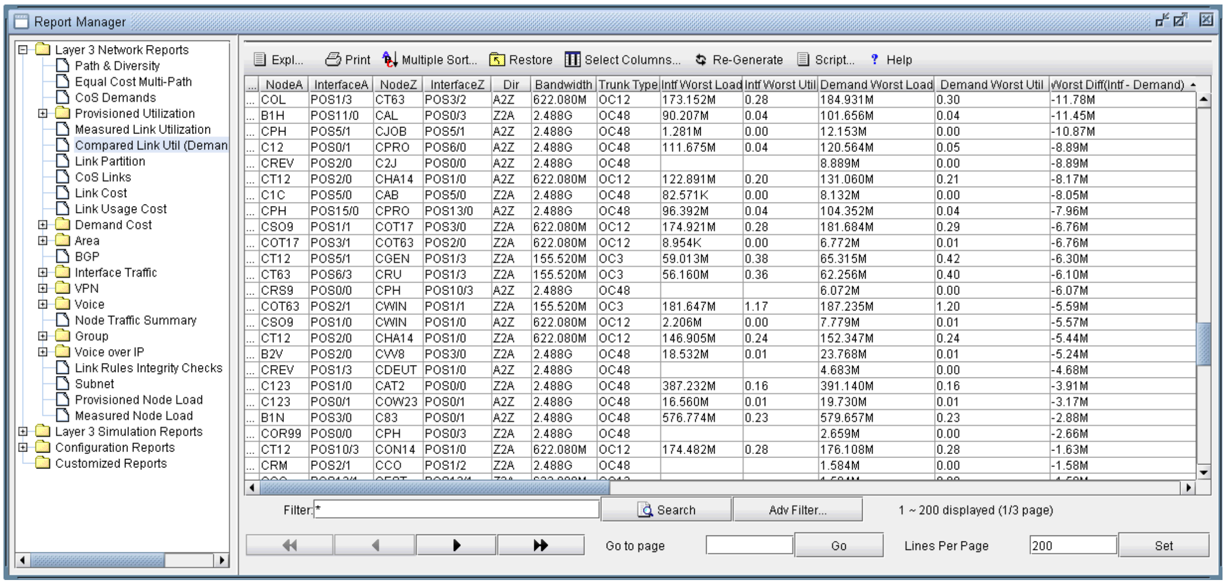
Demand Traffic Versus Interface Traffic

The Demand Traffic vs Interface Traffic report merges together the Measured Link Utilization and the Interface Traffic reports and compares them.

In Layer 3, the Compared Link Utilization report is used to compare the link utilizations computed from the traffic load versus that computed from the interface traffic. For each of the 24 periods, the difference between the link utilization computed from the interface traffic and from the traffic load is calculated and displayed in the Diff (intf - Demand) columns for each period and for the worst period and the average of the periods.

In Layer 2, the Compared Link Utilization report is used to compare the link utilizations computed from the tunnel traffic load versus that computed from the interface traffic.

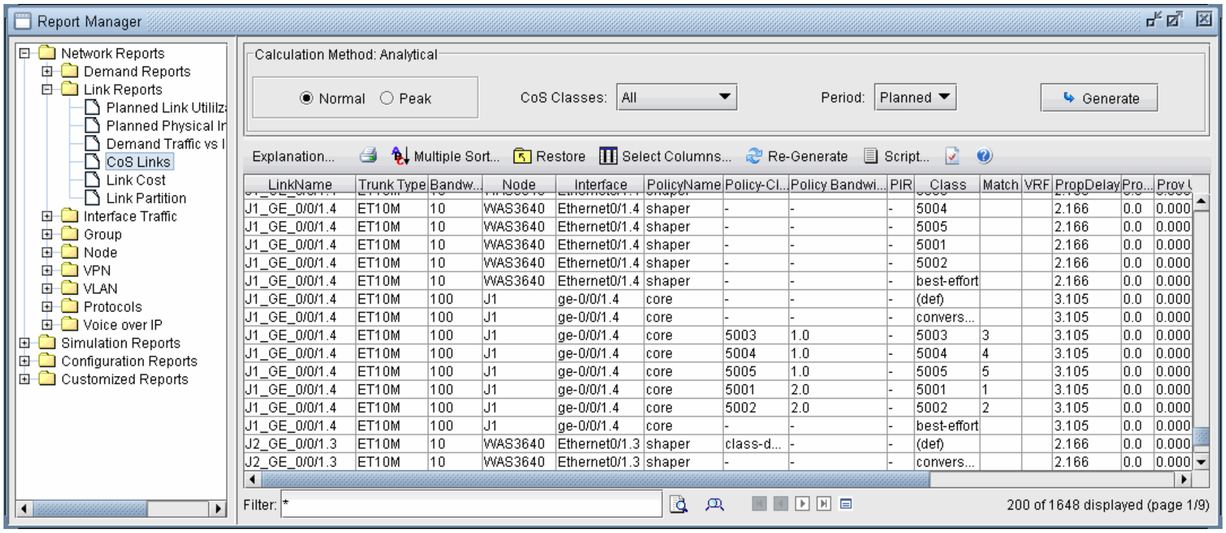
Figure 167: Compared Link Utilization Report



CoS Links Report

The CoS Links Report provides information on interface load and queuing delays for links of the selected CoS class(es). See the *Paragon Planner User Guide* for details on this feature. The output file that is written to the output directory is called “LINKCOS.*runcode*”.

Figure 168: The CoS Links Report



- **Normal or Peak:** Normal traffic means the network does not experience any failure/outages. Peak means that failure simulation reports are going to be used.
- **CoS Classes:** Select all or one specific class of traffic. Reports can be issued for all Classes of Traffic or for a particular one (for example, the Priority class)
- **Period:** Select planned, worst, all, or a specific time period (from interface load files). Planned means the report is generated using the interface load calculated based on the demand file values. Worst means that the report is generated using the interface load calculated based on the worst traffic load.

Field	Description
LinkName	The name of the link.
TrunkType	The type of the link, for example, OC3 or STM1
Bandwidth	The bandwidth of the link.
Node	One of the link's endpoints. This specifies the direction of traffic described in this row.
Interface	The interface on the node that the link is connected to.
Policy Name	The CoS policy specified for the link.

(Continued)

Field	Description
Policy-Class	The CoS class of traffic.
Policy Bandwidth	Bandwidth reserved for the policy class.
PIR	The Peak Information Rate
Class	The class name used in demands' CoS definition.
Match	The "IP precedence" or "MPLS EXP bits" used as matching conditions for the specified class.
PropDelay	The propagation delay on the link.
Planned Load	The amount of bandwidth planned for demands on the link.
Planned Util	Percentage of the trunk bandwidth that is used.
Planned PolicyUtil	Percentage of the bandwidth reserved for the policy class that is used.
Planned QDelay(ms)	The queuing delay on the link.
Planned DropBW	The dropped bandwidth planned on this link.
Planned Jitter	The standard deviation of the total path delay.
Worst Load	The highest bandwidth among the load in all the traffic periods.
Worst QDelay	The highest queuing delay value among all the traffic periods.
Worst DropBW	The highest dropped bandwidth among all the traffic periods.

(Continued)

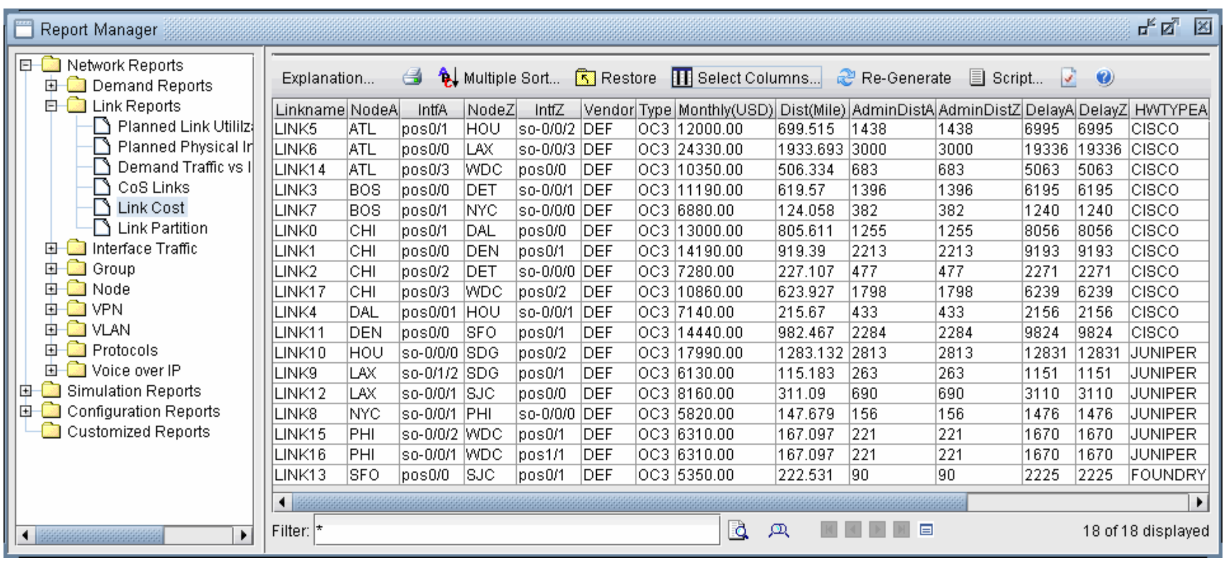
Field	Description
1, 2, ... Load	The load of the link in the specified time period.
1, 2, ... QDelay	The queuing delay in the specified time period.
1, 2, ... DropBW	The dropped bandwidth in the specified time period.

Link Cost Report

The Link Cost Report provides detailed link pricing information. Each link in the network is listed by its source and destination nodes, Vendor, Type, Monthly Cost, and Non-Recurring Charge. Link grouping is done by LEC and IXC vendor.

The output file that is written to the output directory is called "LKCOST.*runcode*".

Figure 169: The Link Cost Report




```
********************************************************************
*
* Backbone Link Configuration and Pricing Report -- runcode=x
*
********************************************************************
```

```
*
Remark 1: vendor/cost marked with * are default specified in usercost file
Remark 2: vendor/cost marked with # are default specified in bblink file
Remark 3: cost marked with @ are calculated from usercountrycost file
Remark 4: cost marked with ^ are estimated from default specified in usercost
file
```

Special characters (such as #, *, @, ^) appended to a vendor or cost value is used to indicate how the pricing was calculated. For example, a vendor or cost value marked with a '#' means that default values specified in the bblink file were used. Press the Exp button in the report window for an explanation.

If the report is saved in CSV format or is viewed through the Paragon Planner client, there are question marks ('??') in the Monthly and NRC columns indicating that pricing for this link cannot be determined. This usually occurs if the service type is not supported in the tariff database. In this case, you can:

- Specify the desired link cost directly in the bblink file, or
- Use the usercost file to define the default vendor and cost for various service types between particular node pairs.
- Use the custrate file to create pricing tables between defined classes of nodes. Note that this the custrate feature is an unbundled add-on feature.

Field	Description
Linkname	Identifier of the link
CntryA/NXX	The NPA/NXX location of where the link originates.
NodeA	The name of the node where the link originates.
CardA	Any information regarding the card found at the origin node of the link.
InterfaceA	The name of the interface at the origin node of the link.
CntryZ/NXX	The NPA/NXX location of the destination of the link.
NodeZ	The name of the destination node where the link terminates.

(Continued)

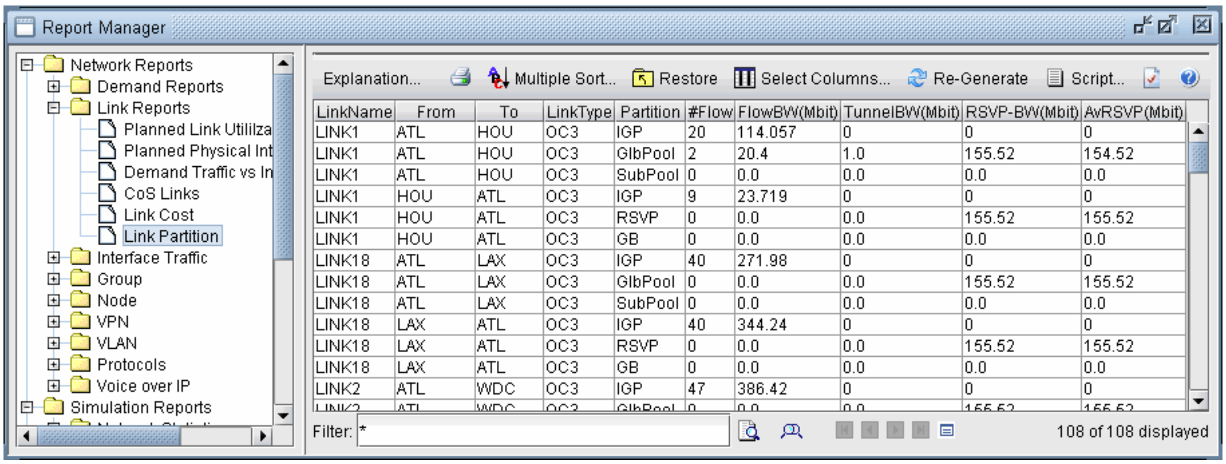
Field	Description
CardZ	Any information regarding the card found at the destination node of the link.
InterfaceZ	The name of the interface at the destination node of the link.
Vendor	The vendor associated with this link. Possible values for vendors include those that are specific to a certain country or region, and are listed in the tariff database. If a vendor is not specified, this value is set to the default value DEF.
#	The number of links from node A to node Z.
Type	The type of link being used. The link type is used in determining link pricing and bandwidth availability.
Monthly	Link/circuit cost expressed a monthly billed amount.
NRC	Non-Recurring Charge also known as installation charge.
Dist (mile)	The distance between the two nodes (in miles).
AdminDist	The administrative weight or distance of the link. AdminDistA for A-Z direction; AdminDistZ for Z-A direction.
Delay	The delay of the link in each direction. DelayA=delay for A-Z; DelayZ=delay for Z-A.
CLASS	The custom rate class that the nodes belong to. CLASSA=class for node A; CLASSZ=class for node Z.
SITE	The site that the nodes belong to. SITEA=site for node A; SITEZ=site for node Z.
HWTYPE	The hardware type of the nodes. HWTYPEA=hw type for node A; HWTYPEZ=hw type for node Z.

RSVP Bandwidth Allocation Report

The RSVP Bandwidth Allocation Report displays detailed link partition information for each link in the network. This report displays the same detailed information in the capacity tab menu of the Links window found in the Network menu.

The output file that is written to the output directory is called “LKPART.*runcode*”.

Figure 170: The Link Partition Report in a Router Network



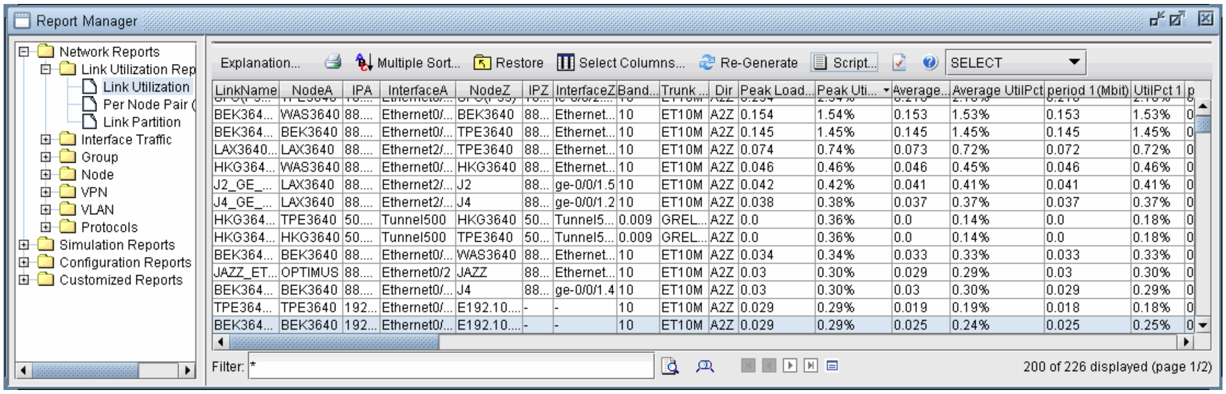
Measured Link Utilization Report

The Measured Link Utilization report displays the computed link utilization based on the routed traffic load in the network. For live network models, this report can be viewed after opening the live network and switching to Offline mode.

In Layer 3, the traffic load could be either the measured end-to-end traffic load, which can be read in as a trafficload file in the Load Network Files window, or the end-to-end demands. If a trafficload file is read in, then up to 24 periods of traffic data could be available. For each period, load and utilization information are displayed in two columns. Worst and average statistics are also shown (for example, Average Load and Average Util columns).

In Layer 2, the link utilization is based on the tunnel traffic load in the network. The tunnel traffic load can be read in as a t_trafficload file in the Load Network Files window.

Figure 171: Measured Link Utilization Report



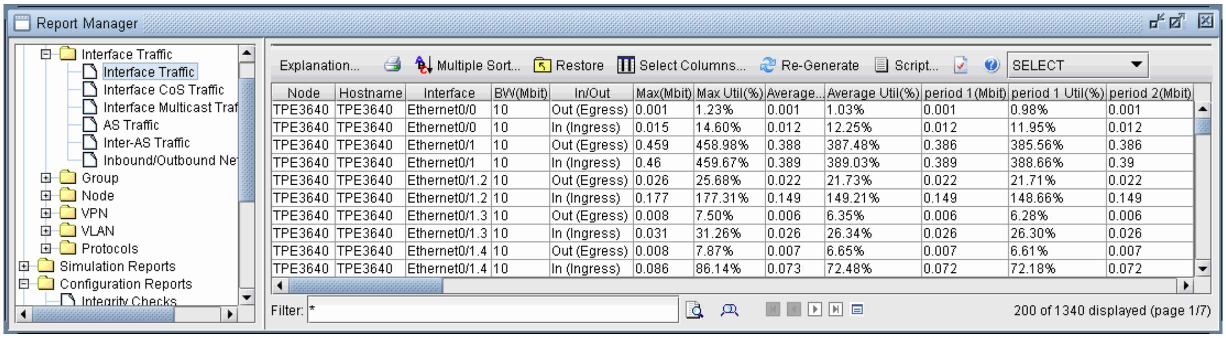
Interface Traffic Reports

The Interface Traffic Reports detail the measured traffic on each link over a set of time periods, if data is provided. In order to access these reports, traffic should have first been collected (either using the offline traffic collection features in Paragon Planner or other traffic sources) and imported into the software using the offline traffic import feature. For more on Offline Traffic Import, see the *Paragon Planner User Guide*.

Processed interface traffic data is saved in a file that is referenced by the specification file in the lines, “interfaceLoad_out” (egress traffic) and “interfaceLoad_in” (ingress traffic). The Interface Traffic Report, AS Traffic Report and Inter-AS Traffic Report are derived from these files. Up to 24 periods of traffic data could be available. For each period, load and utilization information are displayed in two columns. Worst and average statistics are also shown (for example, Average Load and Average Util columns). The report is the same in Layer 3 as in Layer 2.

NOTE: If the outgoing traffic measurements cannot be found (going out from Node A to Node B) in the egress traffic file, then Paragon Planner will use the numbers from the ingress traffic file (going into Node B from Node A) if available.

Figure 172: Interface Traffic Report



Interface Traffic Report

The Interface Traffic Report is generated when you perform an offline traffic import.

Field	Description
LinkName	The name of the link.
NodeA/Z	The source (A) and destination (Z) endpoints of the link.
InterfaceA/Z	The originating (A) and terminating (Z) interfaces on Node A and Z respectively.
Bandwidth	The total bandwidth of the link.
Trunk Type	The link type (for example, T1, OC3, ATM10M)
Worst Load	The worst load experienced over all time periods.*
Worst Util	The link utilization correlating to the Worst Load.
Average Load	The average of the loads experienced over all time periods.*
Average Util	The link utilization correlating to the Average Load.
period1...n	The load experienced during period1, period2, ... periodn.*

(Continued)

Field	Description
Util(%)	The link utilization correlating to the load measured each period. There should be a “Util(%)” column immediately after each “period” column.

To determine the units (for example, Kbps), press the Explanation button at the top of the report.

AS Traffic Report

The Autonomous System (AS) Traffic Report details the traffic measured over links whose endpoints are located in two different ASs.

Field	Description
AS1	The AS number of the source AS for the link.
nodeID1	The node ID of the source node of the link.
interface1	The link interface at the source node.
AS2	The AS number of the destination AS for the link.
nodeID2	The node ID of the destination node of the link.
interface2	The link interface at the destination node.
bandwidth	The bandwidth of the link.
Average-in	The average incoming traffic measured on the link in the AS2->AS1 direction.
Average-out	The average outgoing traffic measured on the link in the AS1->AS2 direction.

Inter-AS Traffic Report

The Inter-AS Traffic Report details the aggregated average traffic measured on all links between two different Autonomous Systems (AS).

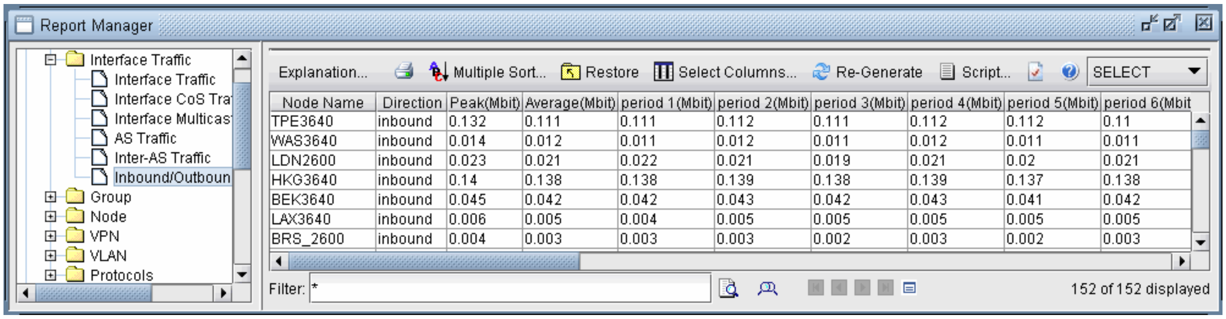
Field	Description
AS1	The AS number of the source AS.
AS2	The AS number of the destination AS.
AS1 Name	The AS name corresponding to AS1. By default, the AS names are derived from the file, $WANDL_HOME/db/misc/ASNames.
AS2 Name	The AS name corresponding to AS2.
Total BW	The Total Bandwidth of all links between these two ASs.
Average-in	The average traffic load measured on all links between AS1 and AS2 in the AS2->AS1 direction.
Average-out	The average traffic load measured on all links between AS1 and AS2 in the AS1->AS2 direction.

Inbound/Outbound Network Traffic

This report displays an aggregate outbound and aggregate inbound value for each node, corresponding to the sum of traffic originating and terminating at a node respectively - but only on interfaces that do not correspond to any links in the network model (for example, customer-facing interfaces, PE-CE interfaces when CE configuration files are missing from the network model). This information is derived from the measured traffic on the interfaces (interface “egress” and “ingress” traffic files in the File > Load Network Files window).

One purpose for this file is for use in the Traffic Matrix tool, as described in the *Paragon Planner User Guide*.

Figure 173: Inbound/Outbound Network Traffic



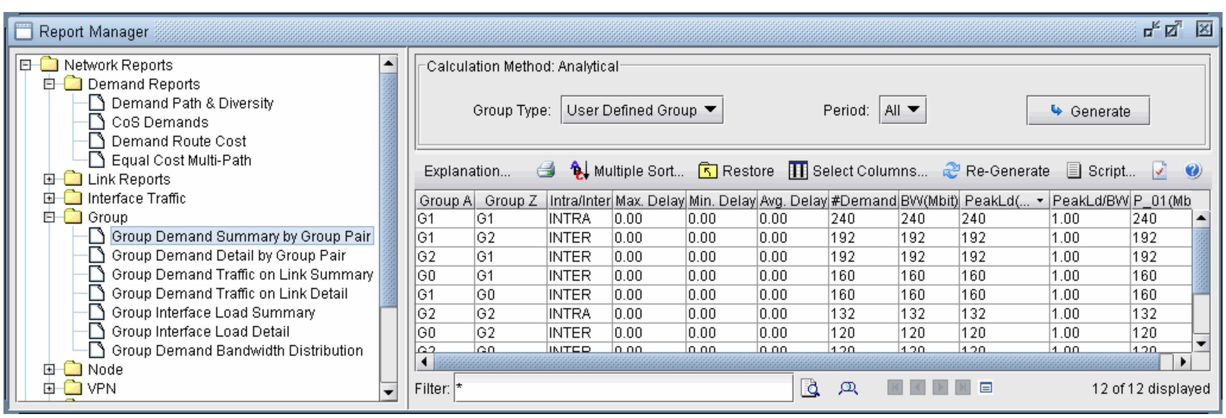
Group Reports

This set of group reports in the Report Manager displays information about groups in the network model. This information includes link and demand summaries and details within and between groups. When you have categorized nodes into groups, these reports show the amount of links and traffic that exists within a certain group or between two different groups. After a failure simulation run, you can also choose to view network group information in peak conditions.

These reports can be generated in Layer 2 of an IP/MPLS network regarding tunnel information between groups, as well as in an ATM network containing PNNI groups. To view information between PNNI groups, select this option in the Group Type selection box.

Group Demand Summary by Group Pair Report

Figure 174: Group Demand Summary Report



The output file that is written to the output directory is called “GROUPDEMANDSUMMARY.*runcode*”.

- **Normal, Peak:** Select **Normal** to display network information under normal conditions. After having run a failure simulation, selecting "Peak" will show peak utilization information.
- **Group Type:** The default selection is user-defined groups. If this network contains PNNI groups, then the selection box will also allow you to choose PNNI groups for viewing.
- **Period:** Based on the traffic load file, the report can display traffic load information in the selected time period(s).

Field	Description
Group A, Z	This row contains summarized information for demands that originate at group A and terminate at group Z.
# Demand	The total number of requested demands (placed and unplaced) from group A to group Z.
BW	The sum of the demands' bandwidth.
WorstLd	The sum of the traffic load for these demands in the worst case out of all the time periods. (Data taken from traffic load file.)
WorstLd/BW	The ratio of worst load and the sum of the demands' bandwidth.
P_01, P_02, ...	The sum of the traffic load for these demands in period 1 (P_01), period 2 (P_02), etc. (Data taken from traffic load file.)

Group Demand Detail by Group Detail Report

The output file that is written to the output directory is called GROUPDEMANDDETAIL.*runcode*.

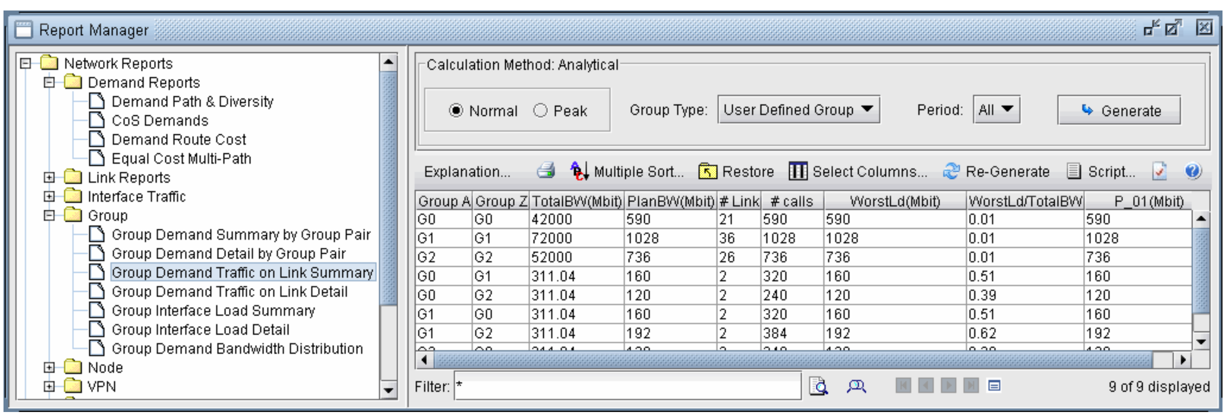
- **Normal, Peak:** Select **Normal** to display network information under normal conditions. After having run a failure simulation, select **Peak** to show peak utilization information.
- **Group Type:** The default selection is user-defined groups. If this network contains PNNI groups, then the selection box also allows you to choose PNNI groups for viewing.
- **Period:** Based on the traffic load file, the report can display traffic load information in the selected time period(s).

Field	Description
Node A, Z	This row describes a demand that originates at node A and terminates at node Z.
Group A, Z	Group A is the group in which node A resides. Group Z is the group in which node Z resides.
BW	The bandwidth of the demand.
WorstLd	The worst load of this demand out of all the time periods. (Data taken from traffic load file.)
WorstLd/BW	The ratio of worst load and the bandwidth of the demand.
P_01, P_02, ...	The load of this demand from node A to node Z in period 1 (P_01), period 2 (P_02), etc. (Data taken from traffic load file.)

Group Demand Traffic on Link Summary Report

The output file that is written to the output directory is called “GROUPLINKSUMMARY.*runcode*”.

Figure 175: Group Demand Traffic on Link Summary Report



- **Normal, Peak:** Select **Normal** to display network information under normal conditions. After having run a failure simulation, select **Peak** to display peak utilization information.

- **Group Type:** The default selection is user-defined groups. If this network contains PNNI groups, then the selection box also allows you to choose PNNI groups for viewing.

- **Period:** Based on the traffic load file, the report can display traffic load information in the selected time period(s).

Field	Description
Group A, Z	This row contains summarized information for links in the network whose first endpoint is in group A and other is in group Z.
TotalBW	The sum of the bandwidth of links between group A and group Z.
ProvBW	The sum of the amount of bandwidth in the links planned for demands that are routed on or pass through the links.
# Link	The number of links between group A and group Z.
# Calls	The number of demands routed on or through the links between group A and group Z.
WorstLd	The sum of the links' traffic load in the worst case out of all the time periods. (Data taken from traffic load file.)
WorstLd/TotalBW	The ratio of worst load and sum of the bandwidth of the links.
P_01, P_02, ...	The sum of the links' traffic load in period 1 (P_01), period 2 (P_02), etc. (Data taken from traffic load file.)

Group Demand Traffic on Link Detail Report

The output file that is written to the output directory is called "GROUPLINKDETAIL.*runcode*".

- **Normal, Peak:** Select **Normal** to display network information under normal conditions. After having run a failure simulation, select **Peak** to displaypeak utilization information.
- **Group Type:** The default selection is user-defined groups. If this network contains PNNI groups, then the selection box will also allow you to choose PNNI groups for viewing.
- **Period:** Based on the traffic load file, the report can display traffic load information in the selected time period(s).

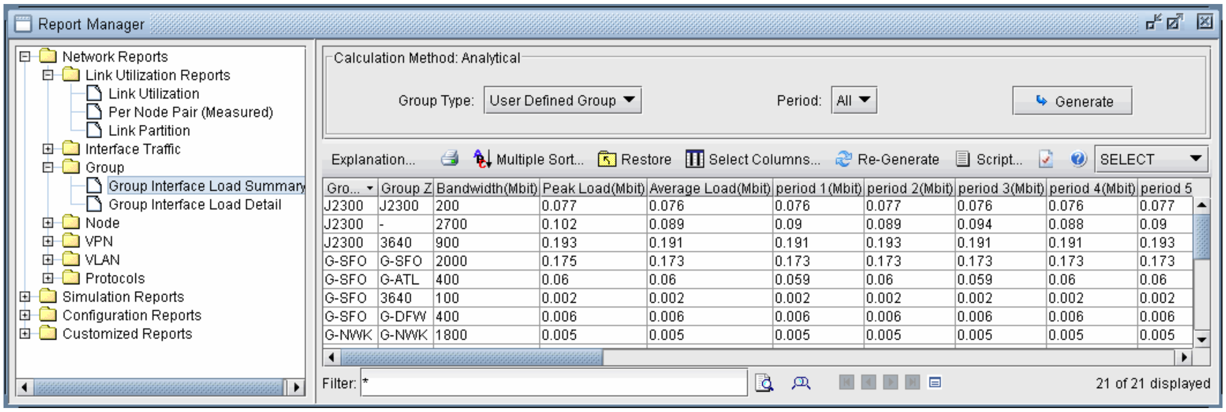
Field	Description
Node A, Z	This row describes a link in the network whose endpoints are at node A and node Z.
Group A, Z	Group A is the group in which node A resides. Group Z is the group in which node Z resides.
TotalBW	The bandwidth of the link.
ProvBW	The amount of bandwidth in the link planned for demands that are routed on the link or pass through the link.
# Calls	The number of demands routed on or through the link. Note: This can be verified by right-clicking on the link in the map and selecting **View > Demands On/Thru Link**.
WorstLd	The link's traffic load in the worst case out of all the time periods. (Data taken from traffic load file.)
WorstLd/TotalBW	The ratio of worst load and the link's bandwidth.
P_01, P_02, ...	The traffic load in the link in period 1 (P_01), period 2 (P_02), etc. (Data taken from traffic load file.)

Group Interface Load Summary Report

The output file that is written to the output directory is called "GROUPINTFSUMMARY.*runcode*".

NOTE: To display interface load information in these reports, the interface load files must first be read into the network model.

Figure 176: Group Interface Summary Report



- **Group Type:** The default selection is user-defined groups. If this network contains PNNI groups, then the selection box will also allow you to choose PNNI groups for viewing.

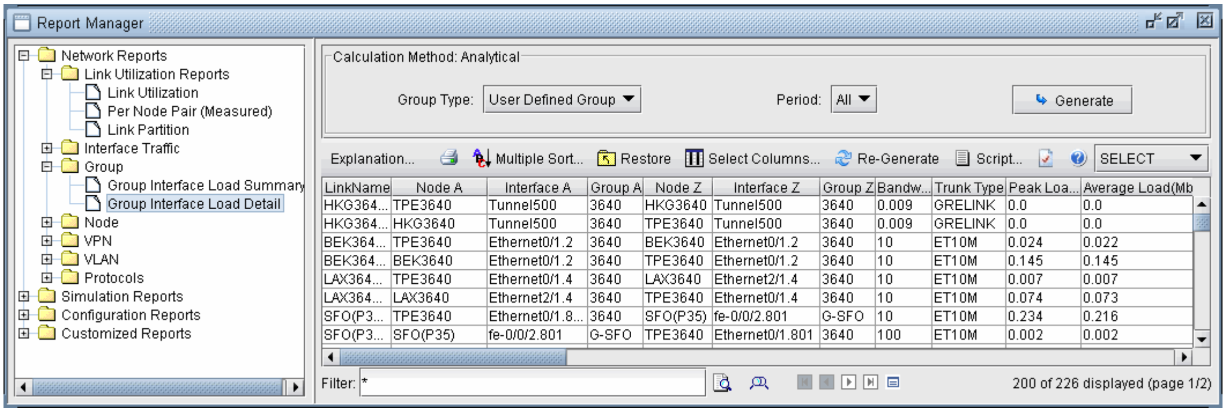
- **Period:** Based on the traffic load file, the report can display traffic load information in the selected time period(s).

Field	Description
Group A, Z	This row contains summarized information for traffic that originate at the interfaces of nodes that belong in group A and terminate at the interfaces of nodes that belong in group Z. Group A is the group in which node A resides. Group Z is the group in which node Z resides.
Bandwidth	The sum of the bandwidth of links between group A and group Z.
WorstLoad	The interface traffic load of the links from group A to group Z in the worst case out of all the time periods. (Data taken from interface traffic load files.)
AverageLoad	The average interface load of the links from group A to group Z in all the time periods. (Data taken from interface traffic load files.)

Group Interface Load Detail Report

The output file that is written to the output directory is called “GROUPINTFDETAIL.*runcode*”.

Figure 177: Group Interface Detail Report



- **Group Type:** The default selection is user-defined groups. If this network contains PNNI groups, then the selection box will also allow you to choose PNNI groups for viewing.

- **Period:** Based on the interface traffic load file, the report can display traffic load information in the selected time period(s).

Field	Description
LinkName	The name of a link whose end points are at node A and node Z. If the link does not have a link name, then it will appear as [nodeA]-[nodeZ].
Node A, Z	This row describes a link in the network whose endpoints are at node A and node Z.
Interface A, Z	This row gives interface A,Z that corresponds to node A,Z.
Group A,Z	The groups that nodes A and Z belong to, respectively.
Bandwidth	This corresponds to the bandwidth of interface A
Trunk Type	The link trunk type.
Worst Load	The interface load of the link from interface A to interface Z in the worst case out of all the time periods. (Data taken from interface load files.)

(Continued)

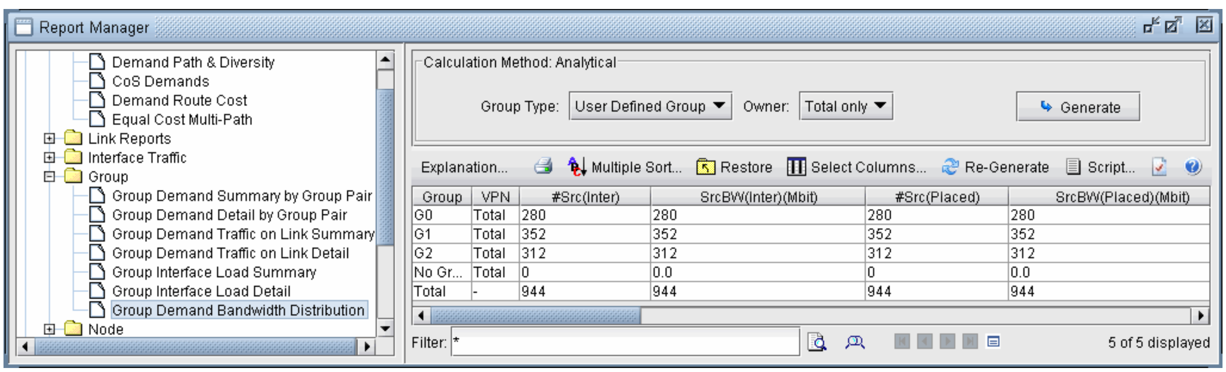
Field	Description
Average Load	The average interface load of the link from interface A to interface Z in all the time periods. (Data taken from interface load files.)

Group Demand Bandwidth Distribution Report

As described in VPN reports section in "Report Manager: Network Reports" on page 335, the Group Demand Bandwidth Distribution Report provides summarized traffic statistics. The output file is saved to the L3GROUPLOAD file. The source, destination, transit, and intra-group traffic is reported for each group, in terms of the number of demands and the bandwidth of those demands. Note that the source and destination traffic for a group do not include intra-group traffic.

Two additional columns #Transit(Max) and TransitBW(Max) may appear after running an exhaustive failure simulation script from Simulation>Scripts with the Generate Peak Group Transit Statistics checkbox selected or by setting CheckTransitDemandLimit=2 in the dparam file.

Figure 178: The Group Bandwidth Distribution Report



Field	Description
Group	The name of the group whose traffic load is being analyzed. For nodes not belonging to any group, they are categorized together as “No Group”

(Continued)

Field	Description
VPN	The VPN, if any, whose traffic is being analyzed. For networks with multiple VPNs, select a specific owner under the Owner dropdownmenu to view only statistics for a particular VPN. Alternatively, select owner “All” to view a breakdown into statistics for each VPN. followed by the sum total. • If Total appears in this column, all traffic at this group is factored in, including traffic for each VPN and traffic not in any VPN. • Traffic that is not using any VPN is categorized under No VPN.

#Src(Inter)
SrcBW(Inter)
	Total number of demands and bandwidth of demands that originate at this group and visit at least one other group.
	Note: This category includes local inter-group traffic but not local intra-group traffic. For the total bandwidth originating at this group, add Src(Inter)+Local(Intra).

#Src(Placed)
SrcBW(Placed)
	Number of routed demands and total bandwidth of routed demands that originate at this group and visit at least one other group. Unlike Src(Inter), Src(Placed) excludes unplaced demands.

#Dest(Inter)
DestBW(Inter)
	Total number of demands and bandwidth of demands that terminate at this group and visit at least one other group
	Note: This category includes local inter-group traffic but not local intra-group traffic. For the total bandwidth terminating at this group, add Dest(Inter)+Local(Intra).

#Dest(Placed)
DestBW(Placed)
	Total number of routed demands and bandwidth of routed demands that terminate at this group after visiting at least one other group. Unlike Dest(Inter), Dest(Placed) excludes unplaced demands.

#Transit TransitBW	Number of demands and total bandwidth of demands that pass through this group without originating or terminating at it Note: If a demand transits through a group more than once, it is counted multiple times.
#Local LocalBW	Total number of demands and bandwidth of demands that originate and terminate at the same group, subdivided below into Local(Intra) and Local(Inter).

(Continued)

Field	Description
#Local(Intra) LocalBW (Intra)	Demands that originate and terminate at the same group which never go outside the group.
#Local(Inter) LocalBW (Inter)	Demands that originate and terminate at the same group but transit through at least one other group. These demands are also counted under Src(Inter) and Dest(Inter).
#Transit(Max) TransitBW(Max)	Max number and bandwidth of transit demands at this group during peak failure simulation

To view the details of the demands included in each category: Src(Inter), Dest(Inter), Transit, and Local(Inter), Local(Intra), access the text mode either from the command line using /u/wandl/bin/bbdsgn followed by the specification file path. Detailed info can be found under the menu item: 3. Network Information > 4.Path > 13.Group. Upon entering the group name, you can select which category of demands to view. For example, the following indicates the demands transiting through Group 1.

```
Enter group name: group1
Group Demands Menu (GROUP1):
1. ALL 2. Src (Inter) 3. Dest (Inter) 4. Transit
5. Local (Intra) 6. Local (Inter)
Select: 4
Demands Passing Through GROUP1:
* Bandwidth Unit = bit
Demand Node Node Bandwidth Type Pri/Pre path
flow10 ATL SDG 418017 R,A2Z 02,02 ATL--LAX--SDG
flow52 DEN SDG 402000 R,A2Z 02,02 DEN--SFO-SJC--LAX--SDG
flow78 NYC SDG 4801220 R,A2Z 02,02
NYC--PHI--WDC--ATL--LAX--SDG
flow82 PHI SDG 1216020 R,A2Z 02,02 PHI--WDC--ATL--LAX--SDG
flow88 SDG WDC 662011 R,A2Z 02,02 SDG--LAX--ATL--WDC
xflow10 SDG ATL 452011 R,A2Z 02,02 SDG--LAX--ATL
xflow52 SDG DEN 452011 R,A2Z 02,02 SDG--LAX--SJC-SFO--DEN
xflow78 SDG NYC 662011 R,A2Z 02,02
SDG--LAX--ATL--WDC--PHI--NYC
xflow82 SDG PHI 452011 R,A2Z 02,02 SDG--LAX--ATL--WDC--PHI
xflow88 WDC SDG 4689230 R,A2Z 02,02 WDC--ATL--LAX--SDG
--- 10 demands, Total bandwidth = 14.207M
```

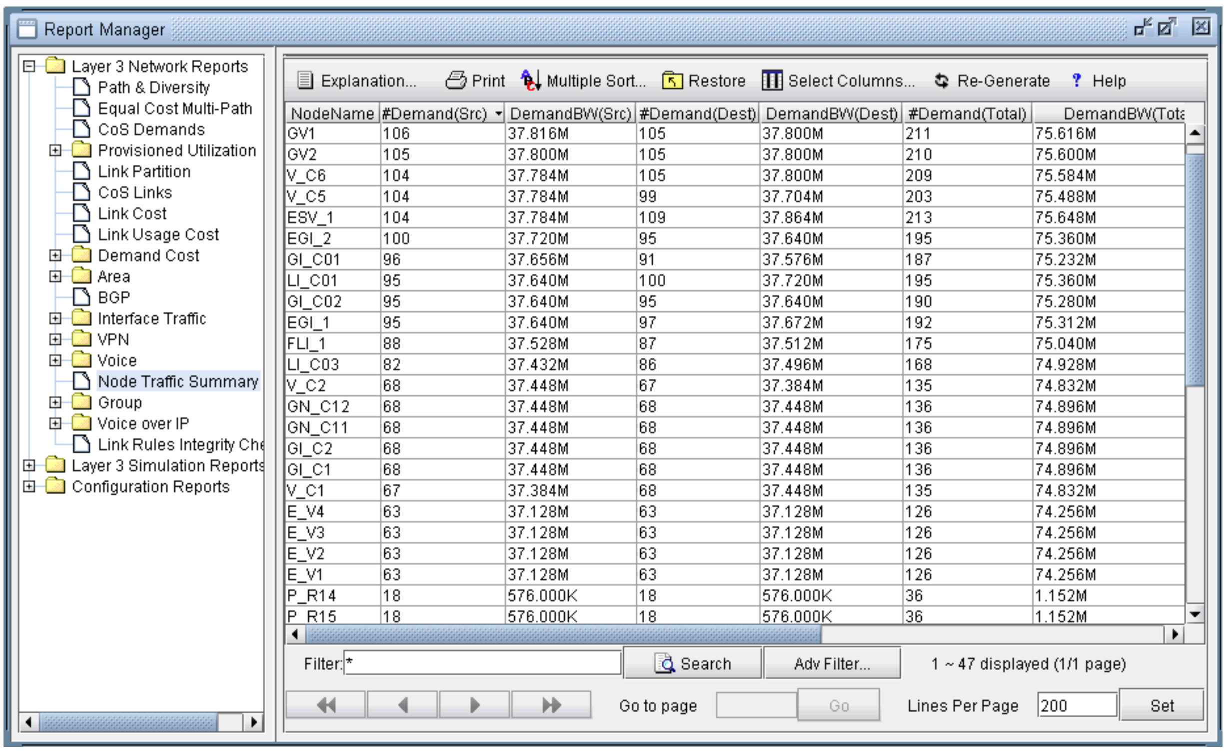
Node Reports

Demand Traffic Per Node Report

The Demand Traffic Per Node Report contains summary traffic statistics for each node, including the amount of source, destination, and transit traffic reported either as a number of demands or as the combined bandwidth of those demands. Note that local demands (demands that originate and end at the same node) are not included in the source or destination traffic statistics.

The output file that is written to the output directory is called “SWITCHCONN.*runcode*”.

Figure 179: The Node Traffic Summary Report



Field	Description
NodeName	The name of the node.

#Demand(Src)
DemandBW(Src)
	Number of demands and total bandwidth of demands that originate at this node and terminate elsewhere (outgoing)

(Continued)

Field	Description
#Demand(Dest) DemandBW(Dest)	Number of demands and total bandwidth of demands that terminate at this node and originate elsewhere (incoming)
#Demand(Total) DemandBW(Total)	#Demand(Total)= #Demand(Src) + #Demand(Dest) DemandBW(Total)=DemandBW(Src) + DemandBW(Dest)
#TransitDemand TransitBW	Number of demands and total bandwidth of demands that pass through this node without originating or terminating at it
#TransitDmd(Max) TransitBW(Max)	Max number and bandwidth of transit demands at this node during peak failure simulation

For ATM models, the headings for the report are shown in the following table.

Field	Description
NodeName	The name of the node.
#LocalDmd	The number of local demands at the node. Local demands are ones that originate and terminate at the node.
LocalBW	The bandwidth of local demands at the node.
#NonLocalDmd(Src)	The number of non-local demands that originate from the node.
NonLocalBW(Src)	The bandwidth of non-local demands that originate from the node.
#NonLocalDmd	Total number of non-local demands originating/terminating at the node.
NonLocalBW	Total bandwidth of non-local demands originating/terminating at the node. For asymmetric demands, the bandwidth of a demand is set to the larger value.

(Continued)

Field	Description
#TransitDmd	The number of transit demands at the node. Transit demands are ones that pass through the node, neither originating or terminating at the node.
#TransitDmd(Max)	The maximum number of transit demands at the node during peak failure simulation.

VPN Reports

The VPN Reports in the Report Manager display information about Layer3/Layer2 Kompella VPNs as well as Layer2 Martini VPNs.

Layer3/Layer2 Kompella Report

Field	Description
Node	The name of the node
VPN Name	The VPN name
VRF	The virtual routing and forwarding instance name
RD	The route distinguisher - used to determine which VPN a route belongs to
Route Target Export	Target VPN community that routes are exported to
Route Target Import	Target VPN community that routes are imported from
Protocols	The VPN protocol used
Interface	The interfaced used by the VPN

(Continued)

Field	Description
IP address	The VPN's IP Address
Bandwidth	The allocated bandwidth

Layer2 Martini Report

Field	Description
VPNName	The name of the VPN
Node A, Z	The end points of the VPN and the nodes at which the circuits reside. Circuit A resides in node A, and circuit Z resides in node Z
VCID	The (unique) virtual circuit identifiers
circuit A, Z	The circuits at nodes A and Z that the VPN is connected to
Encapsulation ID	The interface encapsulation type
BW	The amount of bandwidth allocated to the VPN

Protocols Reports

Inter Area Load Distribution Report

The Inter Domain Load Distribution Report displays information on the load distribution between domains/areas in the network and is saved as “INTDOMLOAD.*runcode*”.

```
Demand Info: --- Total --- --- Placed --- - Not Placed - - Deactivated
- Area -> Area Count Bandwidth Count Bandwidth Count Bandwidth Count Bandwidth
AREA1 ->AREA0 10 4.864M 10 4.864M 0 0 0 0
```

```
 AREA1 ->AREA3 15 3.712M 15 3.712M 0 0 0 0
AREA0 ->AREA1 10 4.864M 10 4.864M 0 0 0 0
AREA0 ->AREA3 20 1.280M 20 1.280M 0 0 0 0
AREA2 ->AREA1 24 32.544M 0 0 24 32.544M 0 0
 AREA2 ->AREA0 16 21.696M 0 0 16 21.696M 0 0
AREA2 ->AREA3 8 10.848M 0 0 8 10.848M 0 0
AREA3 ->AREA1 12 2.176M 12 2.176M 0 0 0 0
AREA3 ->AREA0 20 1.280M 20 1.280M 0 0 0 0
 ------------------------------------------------------------------------------
ALL ->ALL 135 83.264M 87 18.176M 48 65.088M 0 0
--- Inter-Domain Traffic from DOMAIN-EAST to DOMAIN-WEST
Demand1,DOMAIN_EAST,N1,,,XN1,US,DOMAIN_WEST,N2,,,XN2,US,
900000,"R,A2Z,CBR",Don't Care,Don't Care,Don't Care,"00,00",N1@@N2,684,25,no,no,
,

PVC Info: --- Total --- --- Placed --- - Not Placed - - Deactivated-
Domain -> Domain Count Bandwidth Count Bandwidth Count Bandwidth Count Bandwidth
DOMAIN-EAST->DOMAIN-WEST 1 900.000K 1 900.000K 0 0 0
0

--- Inter-Domain Traffic from DOMAIN-EAST to TEST

--- Inter-Domain Traffic from DOMAIN-WEST to NONE

--- Inter-Domain Traffic from DOMAIN-WEST to DOMAIN-EAST
Demand1,DOMAIN_EAST,N1,,,XN1,US,DOMAIN_WEST,N2,,,XN2,US,
900000,"R,Z2A,CBR",Don't Care,Don't Care,Don't Care,"00,00",N1@@N2,684,25,no,no,
,

PVC Info: --- Total --- --- Placed --- - Not Placed - - Deactivated-Domain -> Domain Count
Bandwidth Count Bandwidth Count Bandwidth Count Bandwidth
DOMAIN-WEST->DOMAIN-EAST 1 900.000K 1 900.000K 0 0 0
0

--- Inter-Domain Traffic from DOMAIN-WEST to TEST
Demand2,DOMAIN_WEST,N2,,,XN2,US,TEST,N3,,,XN3,US, 750000,"R,A2Z,CBR",Don't
Care,Don't Care,Don't Care,"00,00",N2@@N3,684,21,no,no, ,

PVC Info: --- Total --- --- Placed --- - Not Placed - - Deactivated-
Domain -> Domain Count Bandwidth Count Bandwidth Count Bandwidth Count Bandwidth
DOMAIN-WEST->TEST 1 750.000K 1 750.000K 0 0 0
0
```

Field	Description
Count	The number of demands/PVCs between the two areas.
Bandwidth	The amount of bandwidth used by the demands/PVCs.
Total	All demands/PVCs between the two areas: placed + not placed + deactivated.
Placed	The demands/PVCs between the areas that are routed.
Not Placed	The demands/PVCs between the areas that are not routed.
Deactivated	The demands/PVCs between the areas that are not activated.

Inter Area Paths Report

The Inter Domain Paths Report displays information regarding paths between two user-specified areas/ domains. The output file that is written to the output directory is called “INTDOMPATH.*runcode*”.

Field	Description
Count	The number of demands/PVCs between the two areas.
Bandwidth	The amount of bandwidth used by the demands/PVCs.
Total	All demands/PVCs between the two areas: placed + not placed + deactivated.
Placed	The demands/PVCs between the areas that are routed.
Not Placed	The demands/PVCs between the areas that are not routed.
Deactivated	The demands/PVCs between the areas that are not activated.

Area Pass Through Paths Report

The Area Pass Through Paths Report, or the Domain Pass Through Paths Report, generates information regarding demands passing through an area or domain in the network. This report is only available for networks defined with multiple areas or domains and demands to and from each domain. The output file that is written to the output directory is called “DOMPASSTHRU.*runcode*”.

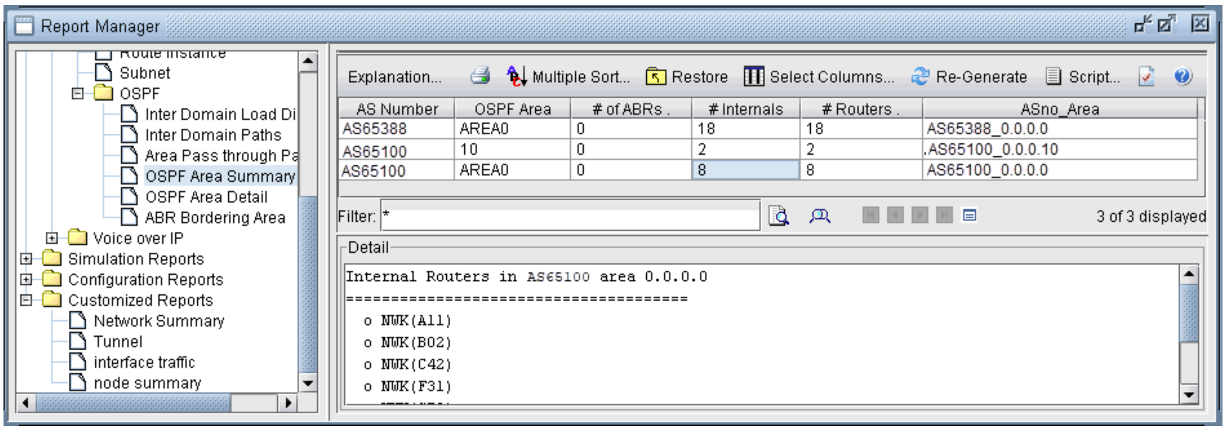
Following is a sample text file of the Domain Pass Through Paths Report from an ATM network:

```
Demands passing through domain AREA0:
RN1N15,0.0.0.3,N1,,,XN1,US,0.0.0.1,N15,,,XN15,US, 768000,"R,BR1.0M,BM768K,BB200K,RT",Don't
Care,Don't
Care,Don't Care,"02,02",N1-N10@@N17--N4--N7@@N8--N15,600,23,no,no, ,
RN1N15,0.0.0.3,N1,,,XN1,US,0.0.0.1,N15,,,XN15,US, 768000,"R,BR1.0M,BM768K,BB200K,RT",Don't
Care,Don't
Care,Don't Care,"02,02",N1-N10@@N5--N6--N7@@N8--N15,600,22,no,no, ,
RN2N3,0.0.0.3,N2,,,XN2,US,0.0.0.1,N3,,,XN3,US, 512000,"R,Z2A,UBR+",Don't Care,Don't Care,Don't
Care,"02,02",N2--N10@@N17--N4@@N3,400,16,no,no, ,
RN2N3,0.0.0.3,N2,,,XN2,US,0.0.0.1,N3,,,XN3,US, 512000,"R,Z2A,UBR+",Don't Care,Don't Care,Don't
Care,"02,02",N2--N10@@N17--N4@@N3,400,16,no,no, ,
RN2N3,0.0.0.3,N2,,,XN2,US,0.0.0.1,N3,,,XN3,US, 512000,"R,Z2A,UBR+",Don't Care,Don't Care,Don't
Care,"02,02",N2--N10@@N17--N4@@N3,400,16,no,no, ,
RN2N13,0.0.0.3,N2,,,XN2,US,0.0.0.1,N13,,,XN13,US, 64000,"R,RT",Don't Care,Don't Care,Don't
Care,"02,02",N2--N10@@N11--N6@@N13,400,13,no,no, ,
RN2N13,0.0.0.3,N2,,,XN2,US,0.0.0.1,N13,,,XN13,US, 64000,"R,RT",Don't Care,Don't Care,Don't
Care,"02,02",N2--N10@@N11--N6@@N13,400,13,no,no, ,
RN2N13,0.0.0.3,N2,,,XN2,US,0.0.0.1,N13,,,XN13,US, 64000,"R,RT",Don't Care,Don't Care,Don't
Care,"02,02",N2--N10@@N11--N6@@N13,400,13,no,no, ,
RN2N13,0.0.0.3,N2,,,XN2,US,0.0.0.1,N13,,,XN13,US, 64000,"R,RT",Don't Care,Don't Care,Don't
Care,"02,02",N2--N10@@N11--N6@@N13,400,13,no,no, ,
RN2N13,0.0.0.3,N2,,,XN2,US,0.0.0.1,N13,,,XN13,US, 64000,"R,RT",Don't Care,Don't Care,Don't
Care,"02,02",N2--N10@@N11--N6@@N13,400,13,no,no, ,
RN2N13,0.0.0.3,N2,,,XN2,US,0.0.0.1,N13,,,XN13,US, 64000,"R,RT",Don't Care,Don't Care,Don't
Care,"02,02",N2--N10@@N5--
N6@@N13,400,12,no,no, ,RN2N13,0.0.0.3,N2,,,XN2,US,0.0.0.1,N13,,,XN13,US, 64000,"R,RT",Don't
Care,Don't Care,Don't
Care,"02,02",N2--N10@@N11--N6@@N13,400,13,no,no, ,
RN2N13,0.0.0.3,N2,,,XN2,US,0.0.0.1,N13,,,XN13,US, 64000,"R,RT",Don't Care,Don't Care,Don't
Care,"02,02",N2--N10@@N5--N6@@N13,400,12,no,no, ,
RN2N13,0.0.0.3,N2,,,XN2,US,0.0.0.1,N13,,,XN13,US, 64000,"R,RT",Don't Care,Don't Care,Don't
Care,"02,02",N2--N10@@N11--N6@@N13,400,13,no,no, ,
RN2N13,0.0.0.3,N2,,,XN2,US,0.0.0.1,N13,,,XN13,US, 64000,"R,RT",Don't Care,Don't Care,Don't
Care,"02,02",N2--N10@@N11--N6@@N13,400,13,no,no, ,
-- 15 PVC(s)(bw=3.712M) pass through domain AREA0
```

OSPF Area Summary Report

The Area Reports in the Report Manager display information about areas in the network model. This section includes a description of the OSPF area summary and detail reports, as well as the ABR border area report.

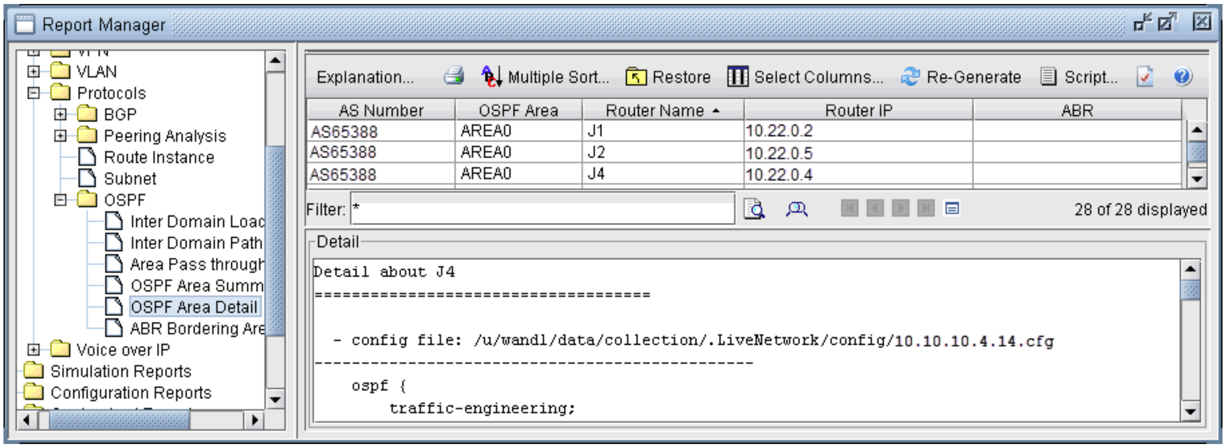
Figure 180: The OSPF Area Summary Report



Field	Description
AS Number	The AS number of the area
OSPF Area	The name of the OSPF area
# of ABRs	The number of nodes that are defined as Area Border Routers (gateway routers)
# Internals	The number of routers in the OSPF area that aren't defined as ABRs
# Routers	The total number of routers in the area (equivalent to # of ABRs + # Internals)
ASno_Area	A unique name created by concatenating the AS number and the area name

OSPF Area Detail Report

Figure 181: The OSPF Area Detail Report



Field	Description
AS Number	The AS number of the OSPF area that the router is located in
OSPF Area	The name of the OSPF area that the router is located in
Router Name	The name of the router
Router IP	The router's IP Address
ABR	Is this router defined as an Area Border Router

ABR Bordering Area Report

Field	Description
AS Number	The AS number of the area that the ABR is located in
ABR	The name of the ABR
Bordering Area(s)	A list of all the areas that the router is bordering

BGP Reports

When the client session is opened for the first time, the BGP Report should be checked to make sure that the network has no obvious BGP configuration errors. The output file that is written to the output directory is called "BGPRPT.*runcode*".

BGP Integrity Check Report:

BGP statistics – This section shows:

- The total number of BGP speakers in the network
- The total number of neighbors
- The total number of policies
- The list of all ASs and the number of their BGP speakers

```
 * BGP Integrity Check Report
******************************************************
-- 17 BGP speakers,89 neighbors,283 members,183 policies
 -- 3 local AS:
ASno 65222: 9 routers
ASno 65111: 7 routers
ASno 65534: 1 routers
```

Neighbor AS Specification Error Check Report

This section shows any errors about ASs that are not specified correctly. For example, router A declares that its neighbor, router B, is in AS65243, but router B is actually in AS65312.

```
* * * * * Neighbor AS Specification Error Check Report
AS Location Nbr_AS Nbr_IP_Addr Nbr-Location ValidAS Comments
65243 X39 65224 10.49.226.34 Q39 65312
*** 1 AS specification errors
```

In the example, the Neighbor AS Specification Error Check Report shows that there is an error in the node (Location) X39.

The neighbor node(Nbr-Location) is Q39 and the neighbor AS (Nbr_AS) is 65224, which should be 65312 as shown in the ValidAS field.

Unbalanced BGP Neighbor Check Report

The BGP protocol requires that if router A declares router B to be its neighbor, then router B also has to declare that router A is its neighbor. If not, then an unbalanced neighbor occurs. This section reports any unbalanced neighbors between BGP speakers within the network.

```
* * * * * Unbalanced BGP Neighbor Check Report
# Unbalanced BGP Neighbor = 2
AS Location Nbr_AS Nbr-Location
65111 S39 65111 X39
65111 W39 65111 X39
```

The Unbalanced BGP Neighbor Check Report shows that there are two unbalanced neighbors. On the first record S39 declares that X39 is its neighbor but X39 does not declare that S39 is its neighbor. The second record shows a similar error.

IBGP Mesh Connectivity Check Report

All IBGP speakers within an AS have to be fully meshed, unless route reflectors or confederation are used. This section shows if any AS is not fully meshed.

A full mesh for both IPV4 and VPNV4 address families are checked.

```
* * * * *
IBGP Mesh Connectivity Check Report
AS65222: #IPV4 IBGP neighbor=0. Check mesh definition for VPNV4 address family
AS 65222: passed mesh connectivity checking
---- VPNV4 AS65111: S39 is not defined as X39's neighbor
IPV4 VPNV4 AS65111: W39 is not defined as X39's neighbor
AS65111: 2 neighbor definition missing
AS65333: IPV4, VPNV4, L2VPN IBGP neighbors are not defined
AS 65534: passed mesh connectivity checking* * * * *
```

The IBGP Mesh Connectivity Check Report shows the following

- AS65222 is fully meshed for the VPNV4 address family but no IBGP neighbors exist for IPV4 address family.
- AS65111 is not fully meshed for IPV4 and VPNV4. For the VPNV4 address family, S39 and W39 are not defined as X39’s neighbors. For the IPV4 address family, W39 is not defined as X39’s neighbor.
- AS65534 passes the mesh connectivity check for both IPV4 and VPNV4.
- AS65333 is missing IBGP neighbors for the IPV4, VPNV4, and L2VPN address families.

IPV4/VPNV4/L2VPN Route Reflector Statistics

These three sections indicate the route reflector statistics, including number of route reflectors, number of route reflector clients, and hierarchical route reflector information. Route reflector clients with only one route reflector are listed as a warning that they do not have redundant route reflectors defined. The following is an example of the IPV4 route reflector statistics:

IPV4 Route Reflector Statistics: 200 BGP Speakers, 8 Route Reflectors, 100 Route
Reflector Clients
Redundant Route Reflectors are not defined at 2 RR Clients
1. WDC1, RR= PHI1
2. WDC2, RR= PHI1

```
#Route Reflector Hierarchy Level= 3
Top Level: 4RR(s)
1. NYC1,
2. NYC2,
3. BOS1,
4. BOS2,
Level 2: 3RR(s)
1. PHI1, RR= NYC1 NYC2
1. PHI2, RR= NYC1 NYC2
2. BOS3, RR= BOS1 BOS2
Level 3: 1RR(s)
1. TRE1, RR= PHI1 PHI2
```

VPNV4 and L2VPN route reflector statistics are similarly provided.

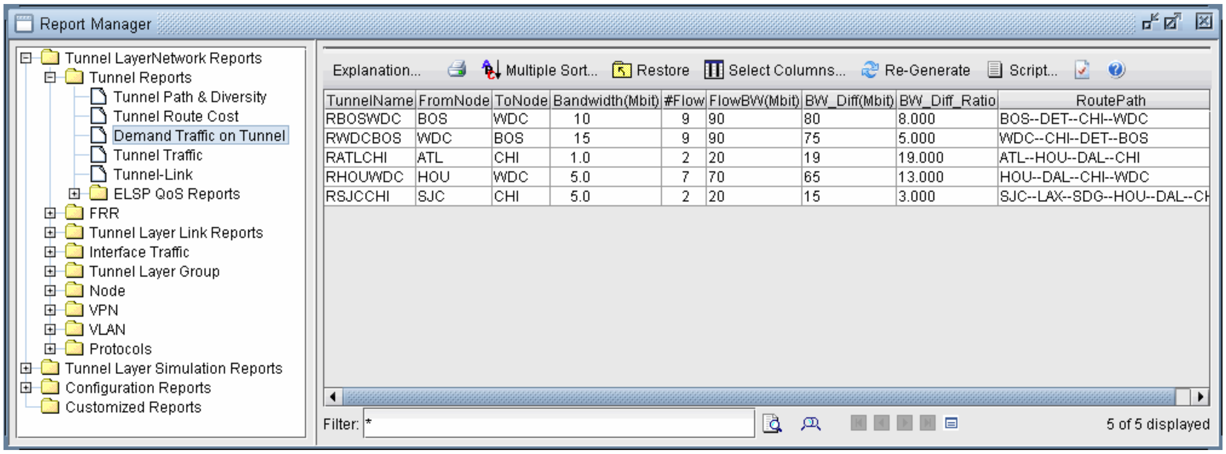
It is recommended that all errors reported in the BGP Report file get fixed before carrying on further analysis. One way to do it is to correct the errors on the configuration files and then run through getipconf again.

Report Manager: Tunnel Reports

Demand Traffic on Tunnel Report

The Demand Traffic on Tunnel provides comprehensive tunnel bandwidth information. Switch to the Tunnel layer before opening the Report Manager to see the tunnel layer reports. See the *Paragon Planner User Guide* for details on viewing and modifying tunnels. The output file that is written to the output directory is called *TUTIL.runcode*".

Figure 182: The Demand Traffic on Tunnel Report



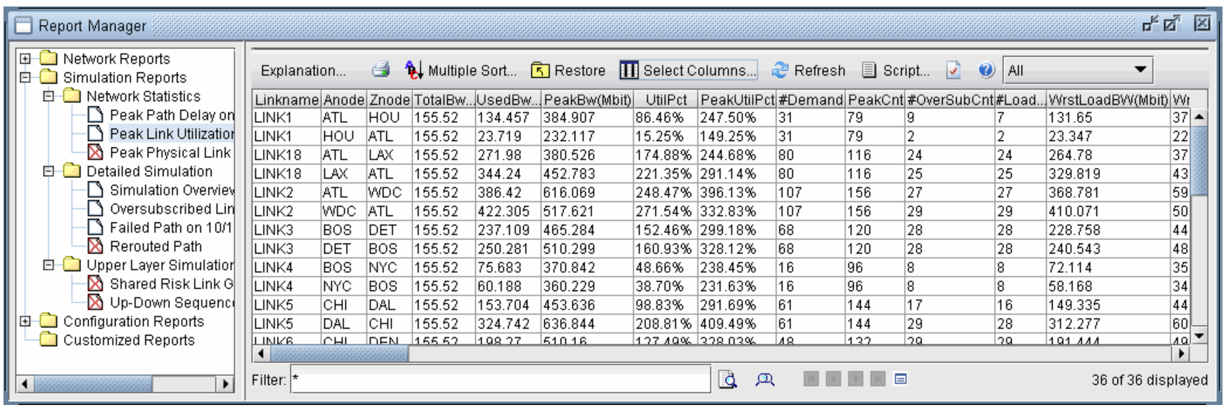
Field	Description
TunnelName	The name of the tunnel.
FromNode	The originating node of the tunnel.
ToNode	The terminating node of the tunnel.
Bandwidth	The total bandwidth of the tunnel.
#Flow	The number of flows or demands that are routed on this tunnel.
FlowBW	The amount of bandwidth used by the demands on the tunnel.
BW_Diff	The difference between the flow bandwidth and the total bandwidth. This value is calculated by FlowBW - Bandwidth.
BW_Diff_Ratio	If the tunnel’s bandwidth is 0, then this value is the FlowBW. If the tunnel’s bandwidth is greater than 0, then this value is calculated by dividing BW_Diff by the total andwidth.
RoutePath	This is the actual routed path of the tunnel.

Report Manager: Simulation Reports

Link Utilization Reports

The Link Utilization Report displays the link and bandwidth information under normal and peak conditions obtained from failure simulation runs. Thus, before opening this report, you must first run a failure simulation script (Simulation > Simulation Scenarios). The results depend on the settings of the failure simulation.

Figure 183: The Link Peak Utilization Report



Field	Description
Linkname	The name of the link.
Anode	The ID of the source node where the link originates.
Aloc	The name of the source node where the link originates.
ACountry	The country where the source node is located.
Znode	The ID of the destination node where the link terminates.
Zloc	The name of the destination node where the link terminates.

(Continued)

Field	Description
ZCountry	The country where the destination node is located.
Vdr	The vendor associated with this link. Possible values for vendors include those that are specific to a certain country or region, and are listed in the tariff database. If a vendor is not specified, this value is set to the default value DEF.
Type	The type of trunk being used. The trunk type is subsequently used in determining link pricing and bandwidth availability.
TotalBw	The total bandwidth of the link from node A to Z.
UsedBw	The amount of bandwidth used on this interface by the demand requirements from the demand file.
PeakBw	The peak (maximum) bandwidth used by the demand requirements between node A and Z during failure simulation.
UtilPct	The percentage of total bandwidth used by demands prior to the failure simulation.
PeakUtilPct	The peak percentage of total bandwidth used during failure simulation. This is calculated as PeakBW divided by TotalBW.
#Demand	The number of demands carried by the link in the normal mode
PeakCnt	The peak number of demands carried by the link during failure simulation.
#OverSubCnt	The number of failures that caused the used bandwidth to exceed (1-fatpct)*TotalBw.
LoadBW_n	The amount of bandwidth used on this interface by the demand requirements during period n of the trafficload file.

(Continued)

Field	Description
PeakLoadBw_n	The peak (maximum) bandwidth used during failure simulation for this period n of the trafficload file.
SimType / SimEvent	The type of simulation event (for example, NDFAIL stands for node failure) that triggered the worst traffic load on either end of the link, and the associated event detail (for example, name of failed network element).
Cnt_SimType / Cnt_SimEvent	The type of simulation event that triggered the worst demand count on the link (for example, NDFAIL stands for node failure), and the associated event detail (for example, name of failed network element).

Interactive Failure (SIMRPT) Reports

The Interactive Failure report is a trace file that records statistics during an interactive failure simulation. To create the report, you must enable the Trace option in the Failure Report tab of the Failure Simulation Options (Tools > Options > Failure Simulation). Then, perform an interactive failure sequence by failing nodes/links via the map right-click menus or via Simulation > Fail Link/Node/Facility. When you run or step through the simulation, results are appended onto the Interactive Failure report.

The Interactive Failure report is typically used for quick analysis. The report is usually used following another failure simulation. For example, you might first perform an Exhaustive Link Failure, during which a few problem links are identified. You may then want to analyze those link failures further by performing an interactive failure simulation in which just those links are brought down and up.

NOTE: If you change any failure simulation options via Tools > Options > Failure Simulation and press **"OK"**, the SIMRPT is overwritten (that is, cleared). Note that for every network session (each time you open a network project or specification file), you will need to set the failure simulation options, as they are not saved.

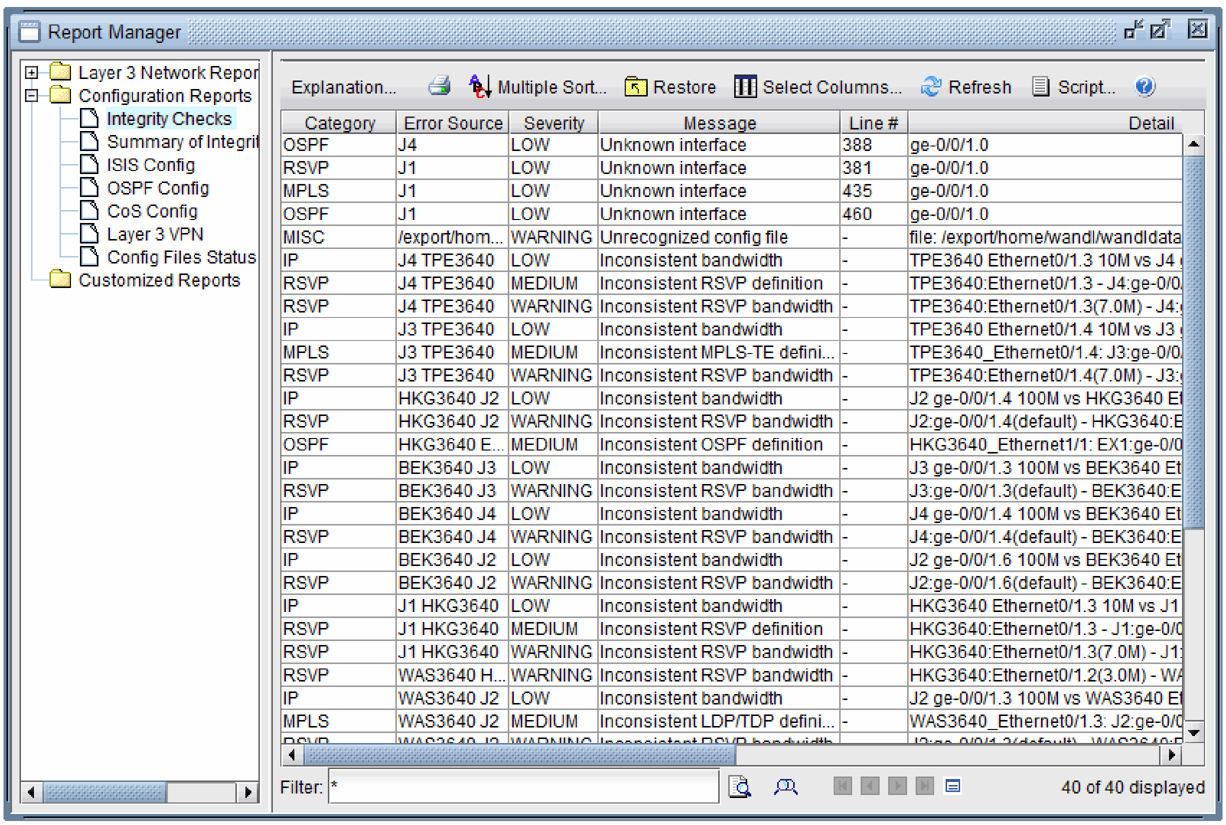
Because this is a running trace file, you should not delete the SIMRPT file during a network session. The results of an interactive failure simulation may not be saved in this event.

Report Manager: Configuration Reports

Integrity Checks Reports

When router configuration files are read into Paragon Planner, a configuration integrity checks report is generated which lists possible errors found by the program while parsing the router configuration files. To access this report, you must first import configurations files using the Import Data Wizard from File > Import Data. Once the configuration files have been imported, you can bring up the Configuration Reports in Report Manager.

Figure 184: Integrity Checks



Field	Description
Error Source	This field indicates the source of the error. This will usually be a configuration file name, or may sometimes be a description when more than one configuration file is involved.

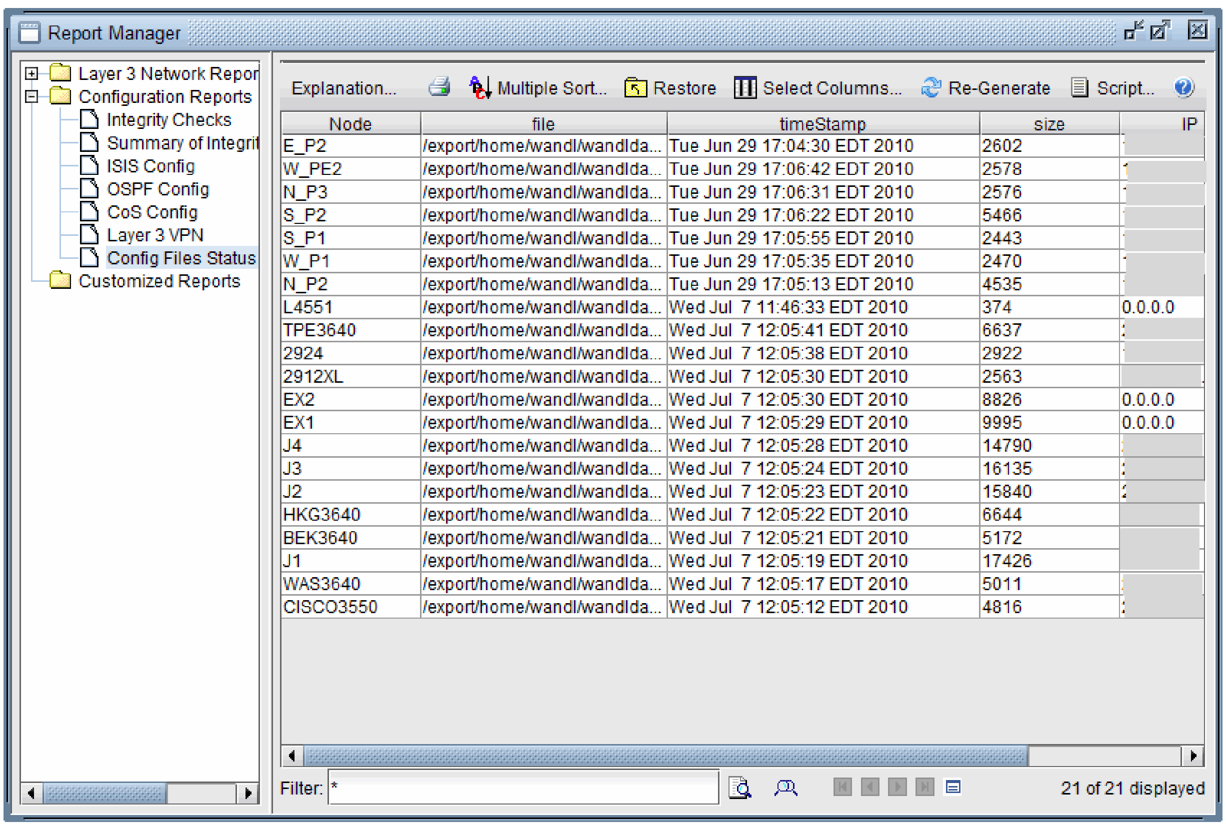
(Continued)

Field	Description
Line	This field gives the line in the configuration file where the error was found.
Severity	This field indicates the severity of the error. The levels include High, Medium, Low, and Warning.
Message	This field provides a description of the error and may contain references to specific configuration files or host names when more than one configuration file is involved.

Config Files Status Reports

This report displays the config files used for the configuration integrity check reports.

Figure 185: Config File Status

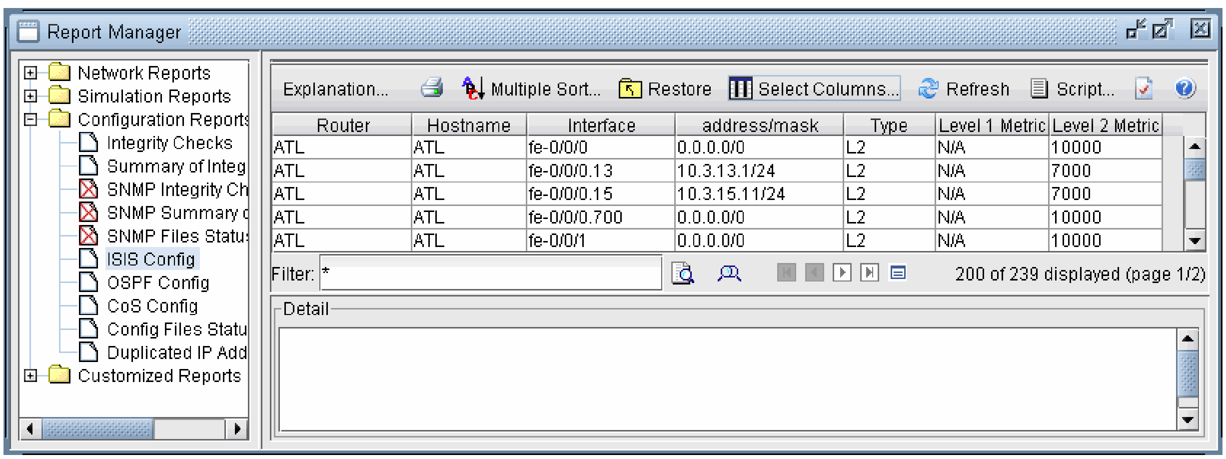


Field	Description
file	This field specifies the directory path and filename of the node's configuration.
timeStamp	This field is the last modified date and time of the config file.
size	This field is the Byte size of the config file.

ISIS Reports

The ISIS Report displays the details of IS-IS configuration as a result of parsing a set of configuration files from a network. Click on a row to see the ISIS attributes associated with the router. The output file that is written to the output directory is called "ISISReport.*runcode*".

Figure 186: The ISIS Report



Field	Description
Router	The router name.
Interface	The interface of the router.
address/mask	The IP address and mask of the interface.

(Continued)

Field	Description
Type	The IS-IS router type.
Level 1 Metric	The IS-IS cost for this interface in level 1.
Level 2 Metric	The IS-IS cost for this interface in level 2.
Detail	A portion of the configuration file that applies to its IS-IS configuration.

13

CHAPTER

Admin Menu

Accessing the User Administration Window

To access the User Administration window, you must log in to the client with the user account used to install the server. Other users will not see the User Administration window.

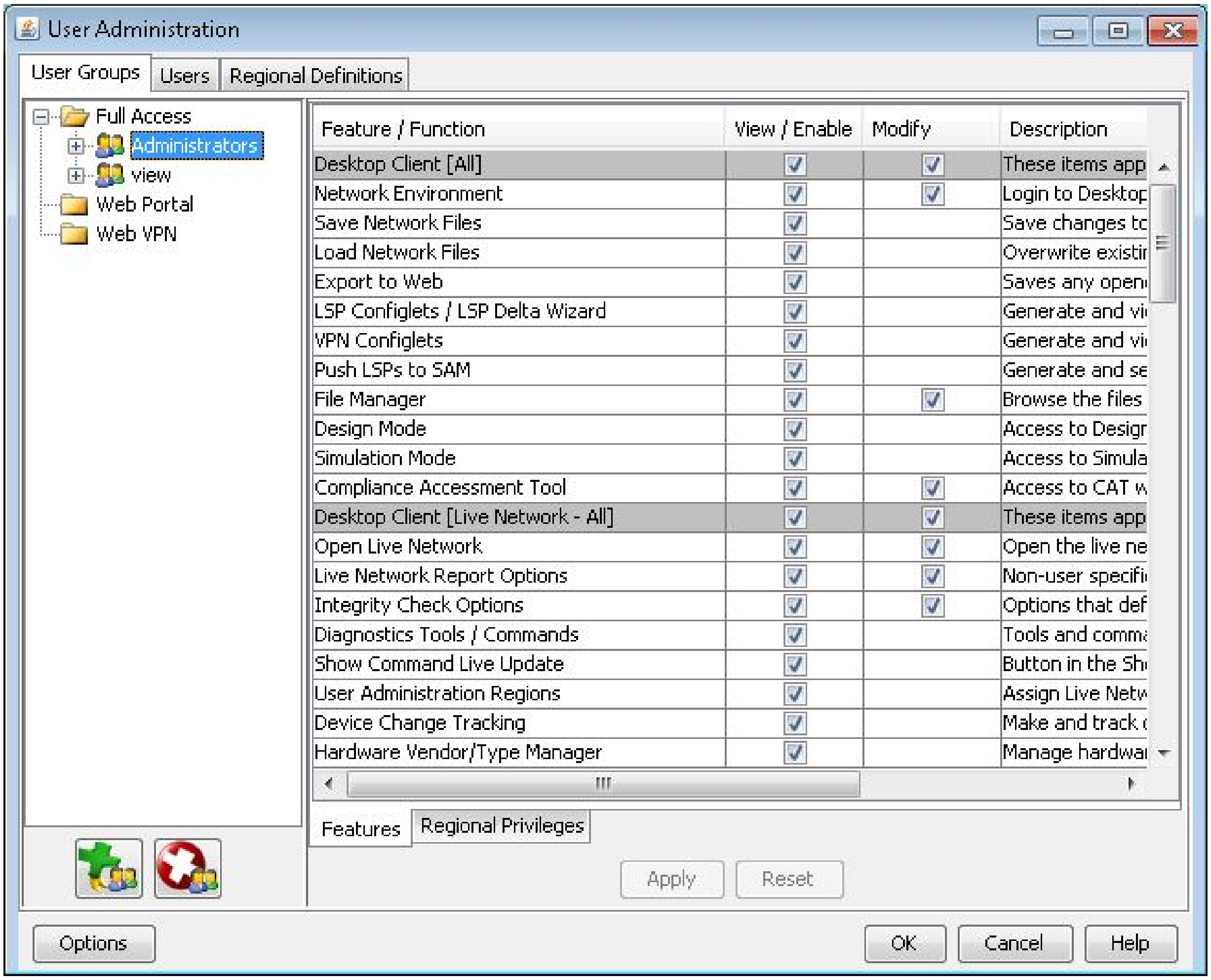
There are three types of users:

- Full Access users who can log into the client and optionally the web, which are mapped to a Unix User. Any Full Access user created through the User Administration window must map to an existing Unix user on the Paragon Planner server. The login name used to log in to Paragon Planner should be the same as the Unix user name. The corresponding password is the same as the password for the corresponding Unix user account. The only exception is the “admin” user which is mapped to the Unix account of the user that installed the application. Authentication is done through an LDAP server that is installed on the same server machine of Paragon Planner.
- Web Portal users who are restricted to the web only.
- Web VPN users who are restricted to the web VPN view. These users can be assigned access to view only certain VPN customers.

Creating User Groups and Permissions

An admin user can create any number of Paragon Planner user groups and assign to each of these group a custom set of permissions. Select the group type and enter in the group name.

Figure 187: User Groups Tab of the User Administration Window



Setting Permissions

Once a user group has been created, you can assign permissions to that user group. Some features allow both View/Enable and Modify permissions, while others are turned completely on or off with just the View/Enable permission.

Note that enabling some features may require additional features to be enabled as well. This is because certain features are dependent on other features to be enabled before they can be accessed. When selecting the check box for such a feature, the checkbox(es) of the additional required feature(s) will automatically be checked as well.

To select all View/Enable or Modify items within a category, check the corresponding checkbox in the gray row indicating a category. Click the gray checkbox again to deselect all items under that category. Individual items within a category can also be turned on and off.

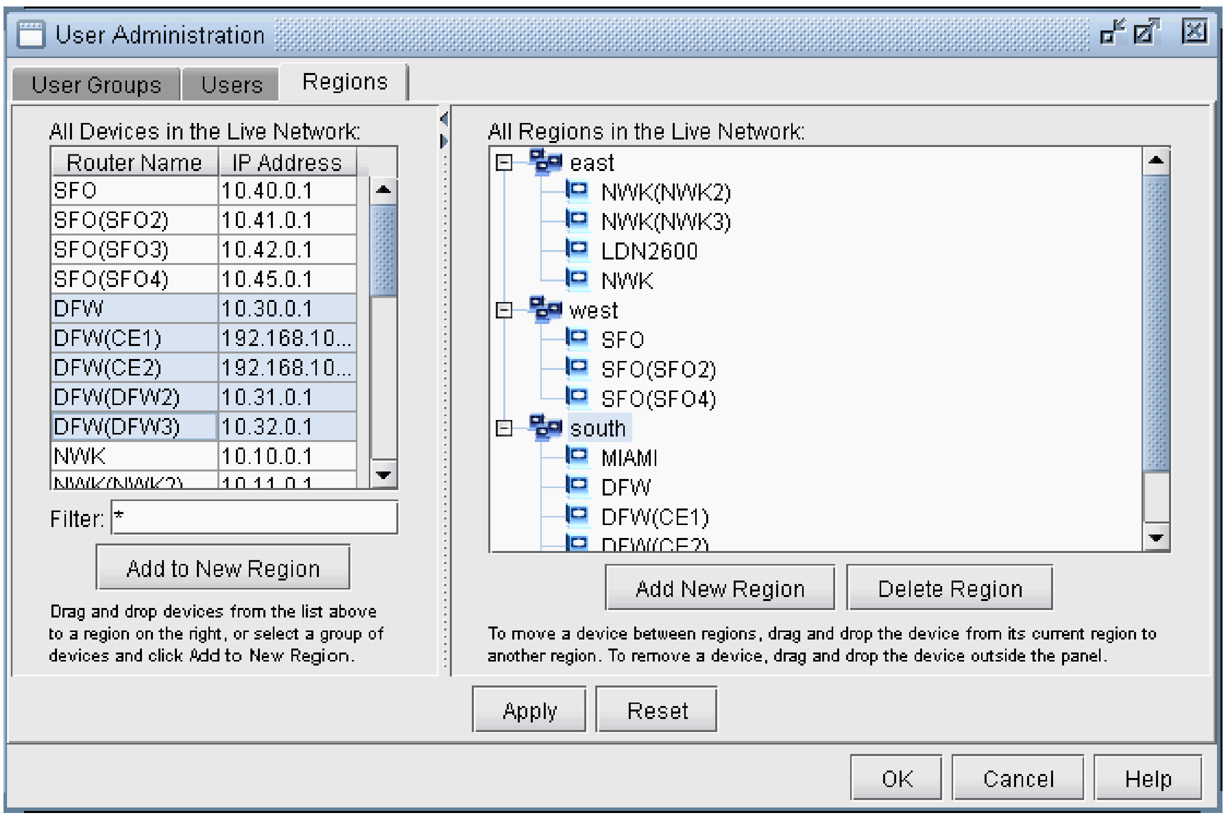
Changes made to a user group's permission checkboxes are saved when clicking "Apply" or "OK."

Regional Permissions

For the live network view, Full Access and Web Portal users can be restricted to being able to directly access the routers only for particular region(s). For devices outside of the permitted regions, which are grouped into the OUTSIDE_REGION group, view-only access is provided, and features such as ping, traceroute, show config, and hardware inventory are disabled. To limit the region(s), first define the regions in the top Regions tab. Note that you need to have run a live network task in order to define regions based on routers collected in the task.

Defining Regions

Figure 188: Defining Network Regions

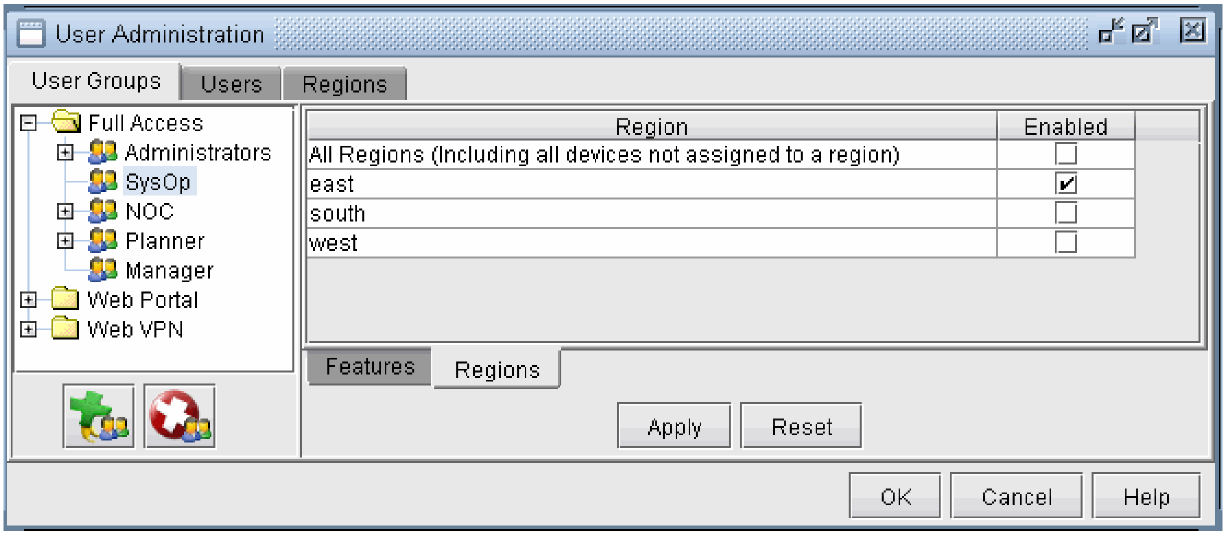


Select the routers to add to a region from the left pane and then click **Add to New Region** to create a new region with these selected routers. Alternatively, click **Add New Region** in the right pane and then select **multiple routers** (using <Shift> and <Ctrl> keys), and drag them from the left pane to the right pane. Note that you must drag them over a group name and not over a group member to add them to a group. To move a router from one group to another, select the router, and drag it to another group. To remove the router from the group, drag it outside of the right pane. Click **Apply** to save your changes.

Setting Regional Permissions

Once the region has been added, select the **User Groups** tab.at the bottom of the right pane and select the **Regions** tab. Here, you can limit the permissions for accessing the router live by unchecking the All Regions checkbox and then checking the corresponding region(s) to which the user can have access.

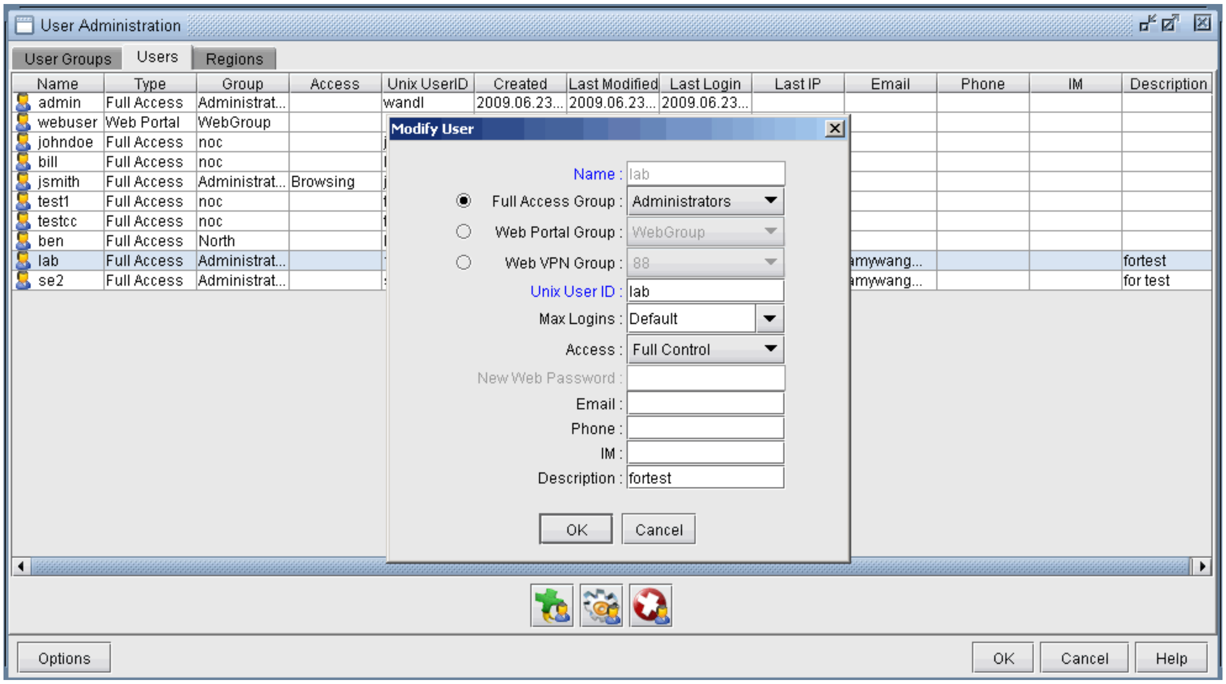
Figure 189: Setting Regional Permissions



Creating Users / Assigning Users to Groups

Once user groups have been setup with the desired permissions, you can create users and assign them to user groups. To create a user, click on Add User icon button on the bottom of the Users tab of the User Administration window.

Figure 190: Users Tab of the User Administration Window



Type a login name next to Name. Next, choose the radio button for the appropriate group type (Full Access, Web Portal, or Web VPN). Then select one of the available groups for that group type.

- For Full Access users, please choose a valid Unix User ID to map the new Paragon Planner user to. This should be the same as the login name. (Note: To add a new user ID, you must access the server via telnet or ssh window, switch to root user, and either run "admintool" (requires display of the desktop) or use the "useradd" command (for example, "**useradd -g staff -d /export/home/wandl wandl**" would add user wandl in group staff with home directory /export/home/wandl). Subsequently, you may create a password for that user using the command "passwd *userid*" substituting *userid* with the Unix User ID. Note that you can similarly modify or delete a Unix user ID as root user using the commands "usermod" and "userdel".)

- For Web Portal and Web VPN users, enter in a password to log in to the web interface.

  Optionally specify additional contact information such as Email, Phone, IM, and a Description for this new user.

  Max Logins can be configured to control the maximum number of times a specific user can be logged into the Paragon Planner server.

  Access level (Full Control, Browsing, Restricted, or Blocked) can be configured to further control the access level of a user.

- **Full Control Access:** The Full Control user can modify, perform design and simulation on the network model in Paragon Planner.

- **Browsing Access:** The Browsing user can only open a network model in Paragon Planner for viewing, but is not allowed to perform any modification, design, or simulation on the network model.
- **Restricted Access:** The Restricted user has Browsing privileges, but with even stricter limitations to view only certain networks, files and directories: Once logged in, the Restricted user can only navigate to the Home Directory and its child directories. Only spec.* and newdemand.* network files are displayed in the File Manager. The user cannot access "Hidden" files. All Report Manager reports are read-only, and are not regenerated before displaying in the Report Manager. Certain menus are disabled.
- **Block Access:** The user is blocked from opening a network model in Paragon Planner. The length of time a user is blocked from accessing the system is defined by the Block Period in the Update GUI Login Policy section.

Once a Paragon Planner user name has been added, that user name will also appear in the User Groups tab of the User Administration window under the group to which it belongs. To modify an existing user, select the user in the Users tab, and click the Modify Icon button at the bottom of the window. To delete an existing user, select the user and click the **Delete Icon** button.

If the user name has been mapped to a valid Unix User ID, the new user should be able to log in to the Paragon Planner client and interface, when assigned the appropriate privileges, using either the user name and the corresponding password for this Unix User ID.

License File Manager

The License File Manager allows you to view the current license installed for Paragon Planner. It contains entries for the modules supported, maximum number of users, and expiration date. The License File Manager also allows you to upload a license file to the server. This will replace any existing license file.

14

CHAPTER

Tools Menu

Tools Menu Overview

The Tools menu contains the following general tools:

- **VPN Traffic Generation**

  You can add demands within the VPNs using the VPN Traffic Generation tool. See the *Paragon Planner User Guide*, *Virtual Private Networks* chapter for more details.

- **Add-ons**

  Any add-ons available to you are listed for your selection.

- **Options**

  See "Tools: Options Menu" on page 394 to learn about the various options that can be configured for Paragon Planner.

Tools: Options Menu

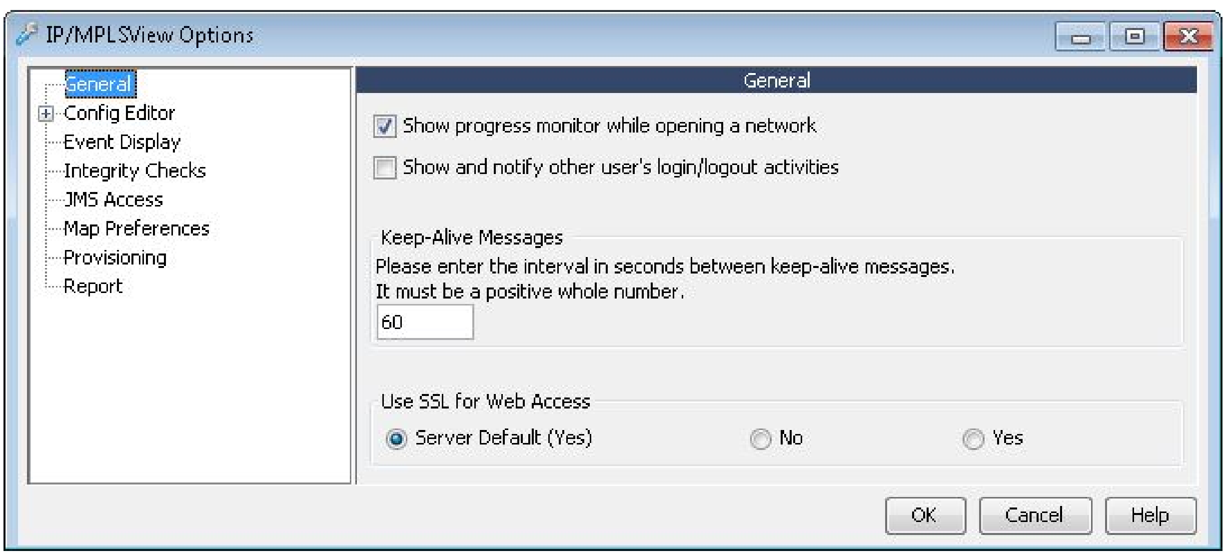
IN THIS SECTION

Depending on the hardware type, the Options windows may look different and contain additional fields than what is described below. For description of hardware-specific fields, see the hardware-specific guides.

General Options

- **Show progress monitor while opening a network:** The progress monitor when opening a network displays the current status, whether it be loading the network or creating the map.
- **Show and notify other user's login/logout activities:** This option can be used to pop up a status message in Paragon Planner when another user has logged into Paragon Planner, including details such as the user name, client PC name and client PC IP address.
- **Keep Alive Message:** The server and client send keep-alive messages to make sure that the connection stays up. This value sets the message interval time in seconds.
- **Use SSL for Web Access:** If this option is selected, then when Paragon Planner redirects users to the Web Portal, it will direct them to a link prefixed with https using port 8443 rather than http on port 8091. By default this is determined by the Server Default setting, USE_SSL, in **/u/wandl/bin/mplsenvsetup.sh.**

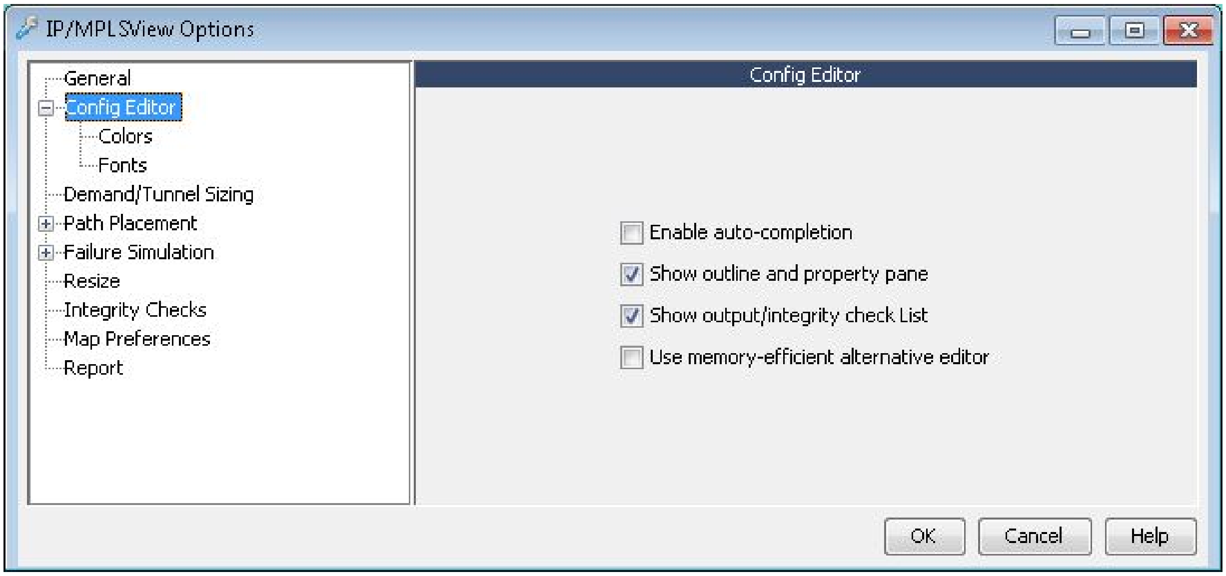
Figure 191: General Options



Config Editor Options

The Config Editor Options window is used to set options for the Configuration Editor, which is a text editor enhanced for configuration files. There are also two sub-options windows which allow you to modify the colors and fonts used in the editor. For information on how to access the Config Editor, see "Config Editor (Router and Switch)" on page 41.

Figure 192: Config Editor Options



- **Enable auto-completion:** Selecting this option enables the intelligent auto-completion of commonly-used configuration commands as you type.

- **Show outline and property pane:** Selecting this option displays two extra panes on the right-hand side of the editor. The Config Editor divides each config file into blocks, based on significant keywords. The outline pane provides an outline view of the config file based on these blocks and allows you to quickly jump to a specific section of the config file. The property pane reveals information regarding the router and associated config file, such as IP address, vendor, version number, as well as the location of the config file.

- **Show output/integrity check list:** Selecting this option displays the results of the integrity checks in a separate pane within the editor.

- **Use memory-efficient alternative editor:** Selecting this option disables the configuration-enhanced text editor and uses the standard text editor when you open a router configuration file.

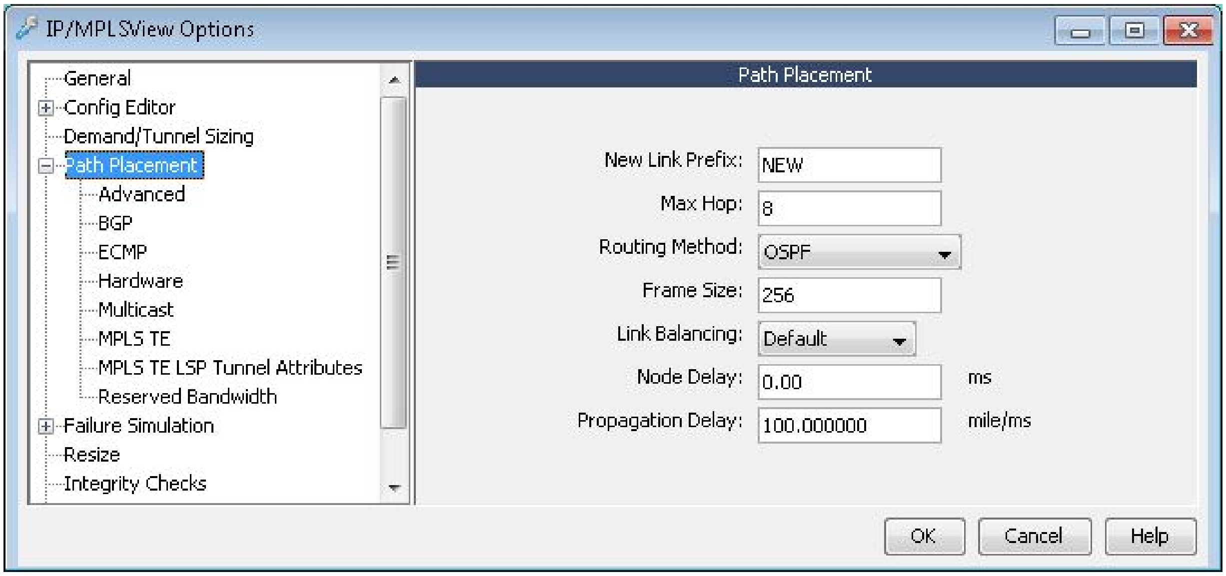
- **Config Editor > Fonts**: select to configure the font used by the config editor.

- **Config Editor > Colors**: select to configure the colors used by the config editor. See *Set Color-Coding and Other Options* for more details.

Path Placement Options

Depending on the hardware type, this option may contain additional fields than what is described below. For a description of those hardware-specific fields, see the hardware-specific guides.

Figure 193: Path Placement Options



Field	Description
New Link Prefix	The link prefix that gets used to generate the link name for newly added links. By default, this is set to “NONE” which means no link name is generated.
Max Hop	The maximum number of hops allowed for a demand path

(Continued)

Field	Description
Routing Method	This specifies the method Paragon Planner will use to determine a demand's path placement: for example, Constant Distance, Actual Mileage, Delay, Admin. Weight, OSPF, ISIS, IGRP, or EIGRP. • Constant Distance: Each link in the network has the same distance metric. When a demand is to be placed, the program finds a minimum distance path. Since each link has the same metric, this effectively translates into finding a shortest hop path. • Actual Mileage: The distance metric for each link in the network is based on its airline mileage. In determining a path, the program will search for a minimum distance path. Note that because of various tariff regulations, the shortest distance path may not always be the least cost as well. • Admin. Weight: This distance metric for each link in the network is assigned by you in the bblink file miscellaneous field. If a metric is not assigned for a particular link, the linkdist file node-to-node distance is used. Otherwise, the linkdistunit parameter in the dparam file is used. The program will attempt to find the minimum distance path. • Delay: The delay metric for each link in the network is used to compute the shortest path, not to exceed the Max Delay value. If the delay metric for a trunk is not assigned in the bblink file, a default value is given based on the propagation delay and serialization delay. • OSPF: The distance metric for each link is based on the OSPF distance formula. For the router module, this may be a configured OSPF metric, a configured OSPF reference bandwidth/trunk bandwidth or 10^8 / trunk bandwidth. In a Frame Relay or ATM environment, it is set to 10^8 / available trunk bandwidth. • ISIS: Uses the ISIS distance metric. • IGRP: Uses the IGRP distance metric. This is a Cisco proprietary protocol. • EIGRP: Uses the enhanced IGRP distance metric. This is also a Cisco proprietary protocol. • CDV: The distance metric is based on the cell delay variation (CDV) for a trunk. The program will find the minimum distance path based on the CDV for each type of trunk.
Frame Size	This defines the average frame size, in bytes, used in overhead calculation for traffic utilization estimation and delay calculation.

(Continued)

Field	Description
Link Balancing	If there are parallel links between two nodes, this option is used to decide which link is used to route a demand/tunnel. The following options are supported: • Best Fit: This is used in layer3/layer2 multi-layer simulation for the router model. If there are multiple tunnels between two nodes, the "bestfit" algorithm is used to select which tunnel to use for traffic between those two nodes. • Default: This uses the default algorithm implemented by the hardware. • First Fit: This selects the first link encountered in the routing algorithm. • Load Balance: This option will try to place the demands proportionally among the equal-cost paths, by selecting the link with minimum traffic load. • Random: This randomly selects a link; this is the default option for routers.
Node Delay	Sets the delay for the node. Delay is in milliseconds (ms).
Propagation Delay	Sets the propagation delay. Propagation delay is determined using the assumption that every 100 miles equals one millisecond of delay.

Advanced

Field	Description
Placement Order	This parameter affects the placement order of demands. Possible values are: • High-Priority First: Input Order: Place high-priority demands before low-priority demands. For demands with the same priority, sort by the order of the demands in the input file. • High-Priority First: Scramble: Place high-priority demands before low-priority demands. For demands with the same priority, sort randomly. This is the default used in Paragon Planner. • High-Priority, High BW Demands First: Input Order: Place high-priority demands before low-priority demands. For demands with the same priority, place high bandwidth demands before low bandwidth demands. For demands with the same priority and bandwidth, sort by the order of the demands in the input file. • High-Priority, High BW Demands First: Scramble: Place high-priority demands before low-priority demands. For demands with the same priority, place high bandwidth demands before low bandwidth demands. For demands with the same priority and bandwidth, sort randomly. • Scramble Randomly: Sort all demands together randomly and place them accordingly. • Low Bandwidth Demands First: Scramble: Place low-bandwidth demands before high-bandwidth demands. Among same-bandwidth demands, sort randomly. If there are multiple links between two nodes, less demands can usually be routed if this option is used. It is provided for worst-case study. • High Bandwidth Demands First: Scramble: Place high-bandwidth demands before low-bandwidth demands. Among same-bandwidth demands, sort randomly. • Input Order: Route demands only by the order in the input file.

(Continued)

Field	Description
Path Selection Method	This parameter influences path selection when more than one shortest path is found to route a demand. Possible values are: • Hardware Implementation: Select among the shortest paths based on the existing hardware's implementation. • Shortest Path Encountered First: (For experimentation) Among the shortest paths, use the first one the program discovers, regardless of whether the hardware would select that path. This feature might be useful in simulating a hardware device that uses a different routing algorithm than the existing hardware. • Select **Randomly Among Best Candidates** :(For experimentation) Randomly choose a path among the paths with the shortest paths, regardless of whether the hardware would select that path. This feature might be useful in simulating a hardware device that uses a different routing algorithm than the existing hardware.
Force PBR Check	When set to True, this forces the program to check demands against Policy Based Routing (PBR) even if there is no destination IP address defined on the demand. When set to false, demands that do not have destination IP address defined are not checked against PBR. Demands that do have destination IP address defined are checked against PBR regardless of how this option is set.
Ignore Multiprocess	Only interfaces of the same OSPF process/routing instance are allowed to exchange routing tables and send traffic to one another. For what-if studies, however, this parameter can be set to true to ignore this requirement and to see how traffic would route if they were in the same OSPF process. For more details, refer to the *Paragon Planner User Guide* chapter, *Routing Instances*.
Ignore Max Delay	If this option is selected, demands are placed even if they exceed the max delay constraint property specified for the demand.
Allow Negative Available Capacity in Layer 3	This selection specifies whether the available bandwidth of trunks will or will not be checked during path placement. When Yes is selected, it is not checked. When No is selected, it is checked. Hardware default selection will depend on the hardware specification.

(Continued)

Field	Description
Include Node's Admin Weight in Path Length Calculation	By default False, any admin weight on the node itself is not included in the path length calculation. If set to True, then the admin weight on the node is added to the path length calculation.

BGP

Field	Description
IGP Override	When both a BGP and IGP path are available between two ASs, by default the BGP protocol is treated as having the higher administrative distance/preference. If this option, IGP Override, is set to true, then the IGP route is used instead of the BGP route. If this option is set to false, the BGP route is used, as is usually the default in most networks. In the dparam file, set this parameter to true by setting IGPoverride=1.
Check IBGP Policy	IBGP Policies may be used to change the BGP next hop info when passing BGP tables from one speaker to another using IBGP neighbor definitions. To turn on IBGP policy checking, set this to true. For performance reasons, you may want to change this flag to false for a network without IBGP policies. In the dparam file, set this parameter to true by setting chkIBGPflag=1 (0 to skip IBGP policy checking).
Use Live BGP Table If Available*	Live BGP routing tables can be used to create a live BGP table object file that can be loaded into the program to route according to the live BGP routing table by specifying the livebgprtblobj file in the specification file. The live BGP routing table may have additional information about the BGP next hop to external IP addresses that is otherwise unavailable through the config files. Select True to route according to the live BGP routing table specified in the specification file. Select **False** to have the program route according to the BGP routing table information generated from the config files and any additional BGP protocol parameters that were entered into the BGP subnet file. In the dparam file, set this parameter to true by setting useliveBGPrtbl=1.

ECMP

Field	Description
Max. ECMP Count	This number specifies the maximum number of ECMP sub-flows that can be split from one original flow.
Min. ECMP Flow BW	This bandwidth value specifies the minimum bandwidth a flow must have in order to split it into sub-flows.

Hardware

This window allows you to specify the bandwidth of each type of trunk in the network, a limit on the length of paths, and the demand priority scheme. The hardware type of the network is displayed for you, but cannot be changed in this particular window.

Field	Description
Hardware Type	The current hardware type may be selected from the Hardware Options window. Note that the available list of device models is based on the switch libraries that have been licensed from Juniper Networks.
Reverse Priority	The reversepri parameter determines which demand priority scheme should be used by Paragon Planner. "No" for larger numbers that have higher priority (1=lowest priority) and "Yes" if smaller numbers have higher priority (1=highest priority).
Physical Hop Limit	This number specifies the hop limit of the actual hardware and is used only in simulation mode, primarily during the Simulate Path Placement function. This parameter is not to be confused with the max hop parameter which is used during design aspects of Paragon Planner.
Bandwidth, Overhead	The bandwidth and overhead fields indicate the trunk values which the program uses, by default, for the selected Hardware Type. If, for any reason, these values are inconsistent with your expected values, this Hardware Options window is the place to modify them. Bandwidth and link overhead are used in the routing and rerouting algorithms when determining demand placement.

Multicast

Field	Description
Enable PIM	This option allows you to enable or disable all links as PIM-enabled.
PIM Mode	This specifies the PIM mode for the multicast feature.

MPLS TE

Field	Description
MPLS-Enabled Mode	This option allows you to enable all links as MPLS-enabled, or have them set as specified per link in the Protocols tab of the Link window.
Tunnel Parameters: Reuse ID of Deleted Tunnels	This specifies whether or not IDs of deleted tunnels should be reused. This applies to Tunnel ID groups that are used to rename tunnel IDs to Cisco's default tunnel ID format. When a tunnel that has been assigned a tunnel ID is deleted, whether or not its ID is reused is determined by this option.
Bandwidth Model	This determines how bandwidth for multiple classes is displayed in the Link window. User can choose between Maximum Allocation Model (MAM) and Russian Doll Model (RDM). Refer to the *Paragon Planner User Guide*, chapter *DiffServ Traffic Engineering Tunnels* for further details on the RAM and MAM bandwidth models.
GlbPool/RSVP	This defines the percentage of bandwidth reserved on a link for global pool / RSVP. This setting is the default global setting for the entire network.
SubPool/GB	This defines the percentage of bandwidth reserved on a link for sub pool / GB (Guaranteed Bandwidth). This setting is the default global setting for the entire network.

MPLS TE LSP Tunnel Attributes

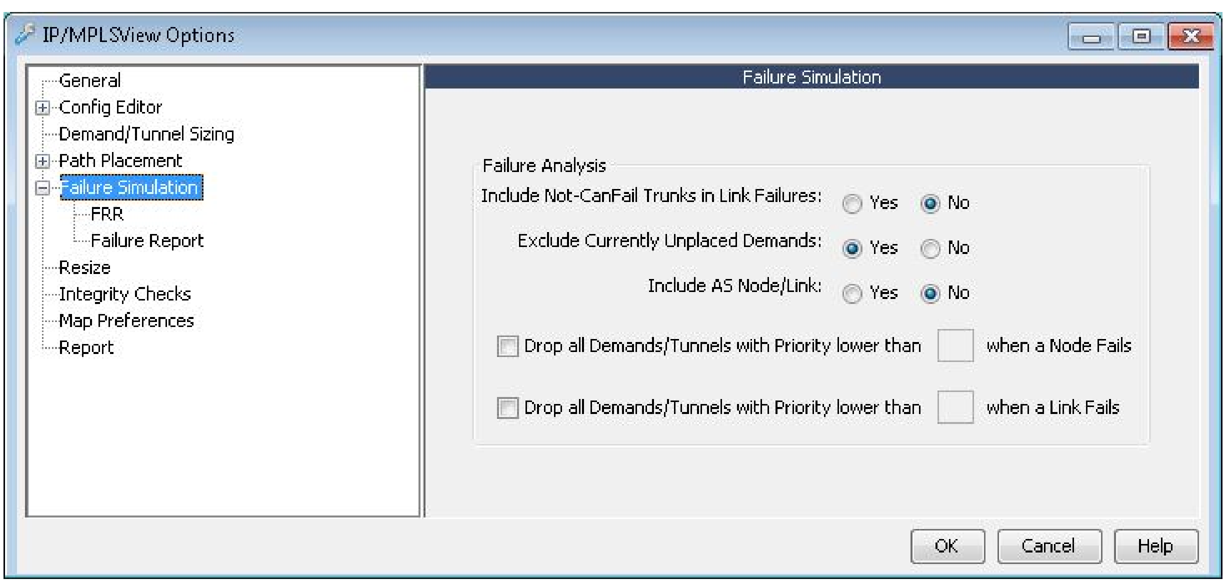
Type over the bitxx to a name you want to be associated with your attributes on the Tunnels and links.

Reserved Bandwidth

Field	Description
Reserve Bandwidth File	The Reserve Bandwidth File field indicates the path of the reserved bandwidth file that is being used, if any. To incorporate the reserved bandwidth file into the network model, you can import it using the File > Read, Network Files tab, Control Files category, rsvbwfile. The file specifies reserved bandwidth information for specific trunks.
Ethernet Fat (%)	Global parameter that indicates the default percentage of bandwidth to be reserved for ethernet trunks. This parameter can be overridden in the rsvbwfile.
Default Fat (%)	Global parameter that indicates the default percentage of bandwidth to be reserved for all trunks. This parameter can be overridden in the rsvbwfile.
Default Fixed Fat	Global parameter that indicates the default amount of bandwidth to be reserved for all trunks. Fixed fat is specified in either bits or kilobits. This parameter can be overridden in the rsvbwfile.

Failure Simulation Options

Figure 194: Failure Simulation Options



Field	Description
Include Never CanFail trunks in failure simulations	This field specifies whether “CanFail = 0” trunks should be included in link failure simulations. A link marked as “CanFail = 0” represents a link that will never fail. A link marked as “CanFail = 1” represents a link that will fail.
Exclude Currently Unplaced Demands	This field specifies whether unplaced demands should be included in the failure simulation. Note that unless specified in this option, unplaced demands are listed along with failed demands in the node, link, and single line failure simulations.
Include AS Node/Link	If set to Yes, AS nodes and AS links are failed in the exhaustive node and link simulations, respectively. To exclude the AS nodes and AS links from the exhaustive simulations, set this option to No.
Drop all Demands/Tunnels with Priority lower than <value> when a Node Fails	During node failure simulation, demands and tunnels that are lower than the defined value are automatically dropped and will not be rerouted in the simulation results.
Drop all Demands/Tunnels with Priority lower than <value> when a Link Fails	During link failure simulation, demands and tunnels that are lower than the defined value are automatically dropped and will not be rerouted in the simulation results.

FRR

This window defines the default FRR mode used during failure simulation batch scripts. If no FRR mode is specified in failure simulation batch scripts, the script will use the FRR mode specified in this window by default. The FRR modes are explained in the table below:

Normal	Simulates the “normal” tunnel reroute. Does not consider the effect of the FRR detours during the simulation. Peak utilization reflects that during the “normal” situation.
FRR only	Simulates only the FRR detour. The resulting link peak utilization report reveals just the peak utilization experienced during the detour.
FRR + Normal	Simulates the FRR detour first followed by the normal primary tunnel reroute as established at the head-end router. The resulting link peak utilization report identifies the worst utilization, or max value of the transient detour and normal modes. **NOTE**: A primary tunnel being detoured is marked down if it cannot be rerouted.

Failure Report

Verbose Mode	Specifies whether output results should be in detailed (verbose) or summary format. When in verbose mode, the program will draw colored lines representing failed and rerouted demands on the topology map during interactive failure simulations. When verbose mode is disabled, no such lines are drawn on the map during interactive failure simulations.
Sequential Mode	This option allows you to sequentially step through a given simulation run. You can advance to the next simulation by clicking the left mouse button. If sequential mode is set to "No", the simulation will automatically run to completion.
Trace File	This option specifies whether a trace file should be used to record simulation output results.
Display Paths at Failed Nodes	Specifies whether paths that originate or terminate at a failed node should be displayed in the simulation output. All such demands will obviously be brought down in a node failure.
Exclude Path Required Demands in Failure Statistics	Specifies whether demands that failed because of path required criteria should be excluded in the simulation. If a demand is defined with a path required field and that path is not available for some reason, the demand will fail. The program will not attempt to reroute the demand on an alternate path.
Report Tunnel Utilization	When running an exhaustive failure simulation in layer 3 and selecting **Generate Peak Utilization Report**, the Tunnel Peak Utilization report generation can be turned off by setting this to No.

Resize Options

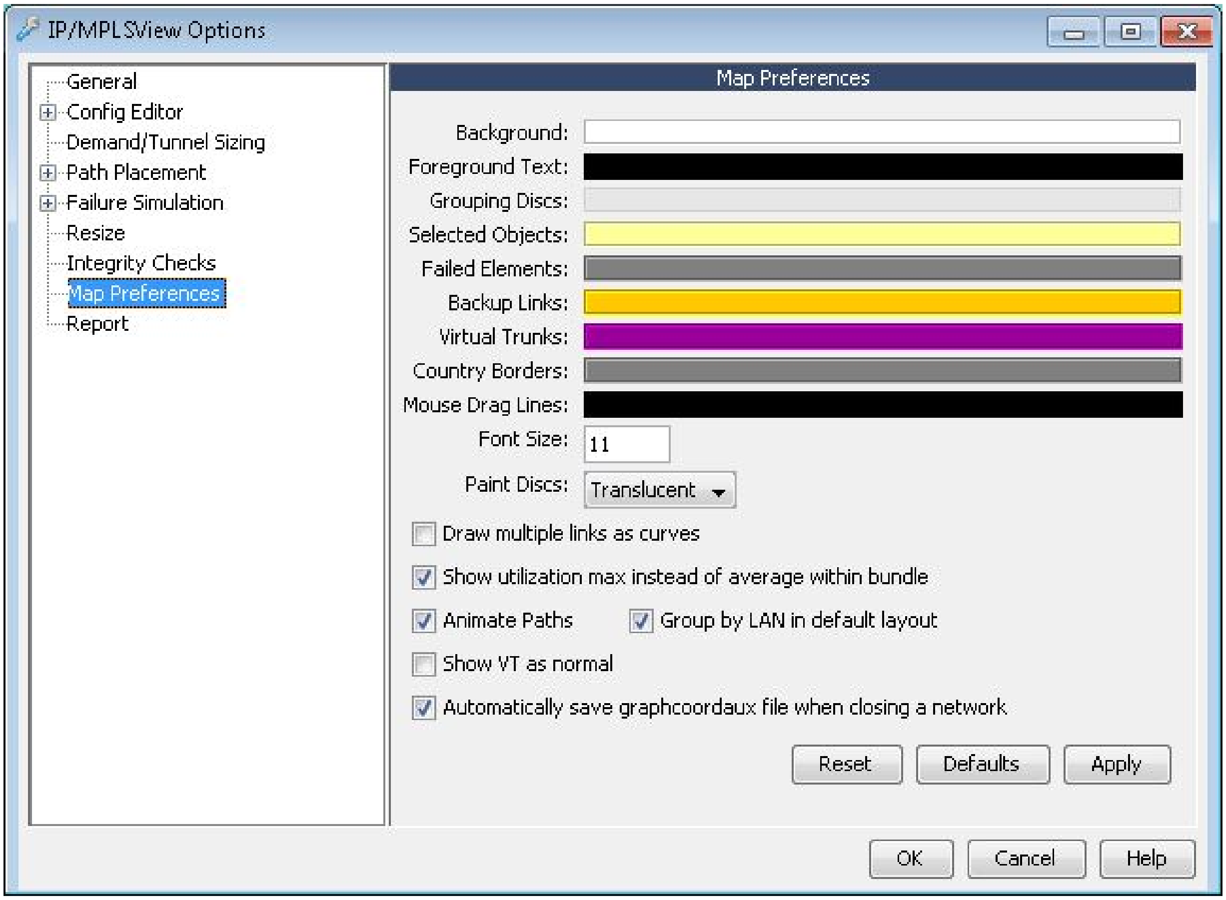
The Resize Options may be used to tune and optimize the current backbone topology. Accessed from Design > Backbone > Resize, this design feature will modify the current link bandwidths to maximize utilization. Three resize options can be chosen: based on the current peak simulation results, based on normal utilization, or based on exhaustive node/link/SRLG failure simulation results. This analysis and modification presume that there might be unnecessary bandwidth in certain links and also take into account the additional bandwidth necessary during demand rerouting. When the resize option is performed, Paragon Planner replaces links in the network in accordance with the Link Type Candidate selected in the Design Options window.

Field	Description
Additional Trunk Penalty	Added penalty during Resize for replacing large trunks with multiple trunks of smaller size.
Types in Tariff	Valid link types are taken from the current tariff table
AGGR	For the aggregate link type, valid link types are based on multiples of a specified unit, for example, if the unit is 10G, then the resize will choose multiples of 10G, for example, AGGR10G, AGGR20G, etc.

Map Preferences

The color scheme and display options of the topology map may be changed in the Map Preferences window. Click on any color to change it. You may also change options related to the display of the network topology.

Figure 195: Map Preferences Window



Field	Description
Background	This selects the color for the background on the topology window.
Foreground Text	This selects the color for text labels and other foreground items.
Grouping Discs	This selects the color for any groups in the topology defined by you. A group is a region that can be set by you.
Selected Objects	This is the color for any user-selected objects in the topology window.
Failed Elements	This is the color for failed elements (links, nodes, facilities, etc.)

(Continued)

Field	Description
Backup Links	Allows you to set the color for back-up links.
Virtual Trunks	Allows you to set the color for virtual trunks.
Country Borders	This selects the color of country borders when the country map is displayed in the Topology window.
Mouse Drag Lines	Specifies the color of the lines shown when you click and drag the mouse in the topology window.
Font Size	You may increase or decrease the font size of text (such as node labels, link labels, etc.) that appear in the Topology window.
Paint Discs	Allows you to select a method for painting discs for groups on the topology map. The choices are: translucent, quick rings, opaque and none. On some machines, choosing quick rings or opaque may improve performance.
Draw multiple links as curves	When checked, the program will draw multiple links between a given node pair as curves for better display of the paths.
Show utilization max instead of average within bundle	If Draw multiple links as curves is not checked, then multiple links are drawn as one bundled link. When Show max is not checked, the utilization displayed from mouse-over in the bottom bar of the map is the Average utilization of the multiple links. When Show max option is checked, the utilization displayed from mouse-over in the bottom bar of the map is the Highest utilization of the multiple links.
Animate Distribute Points	When checked, this option will animate the Distribute Points function in the Topology window. Refer to the Topology chapter for more information.
Animate Paths	This option will animate the path between two points in the topology, showing the direction the path is flowing. Turning off the animation will improve the performance of the system.

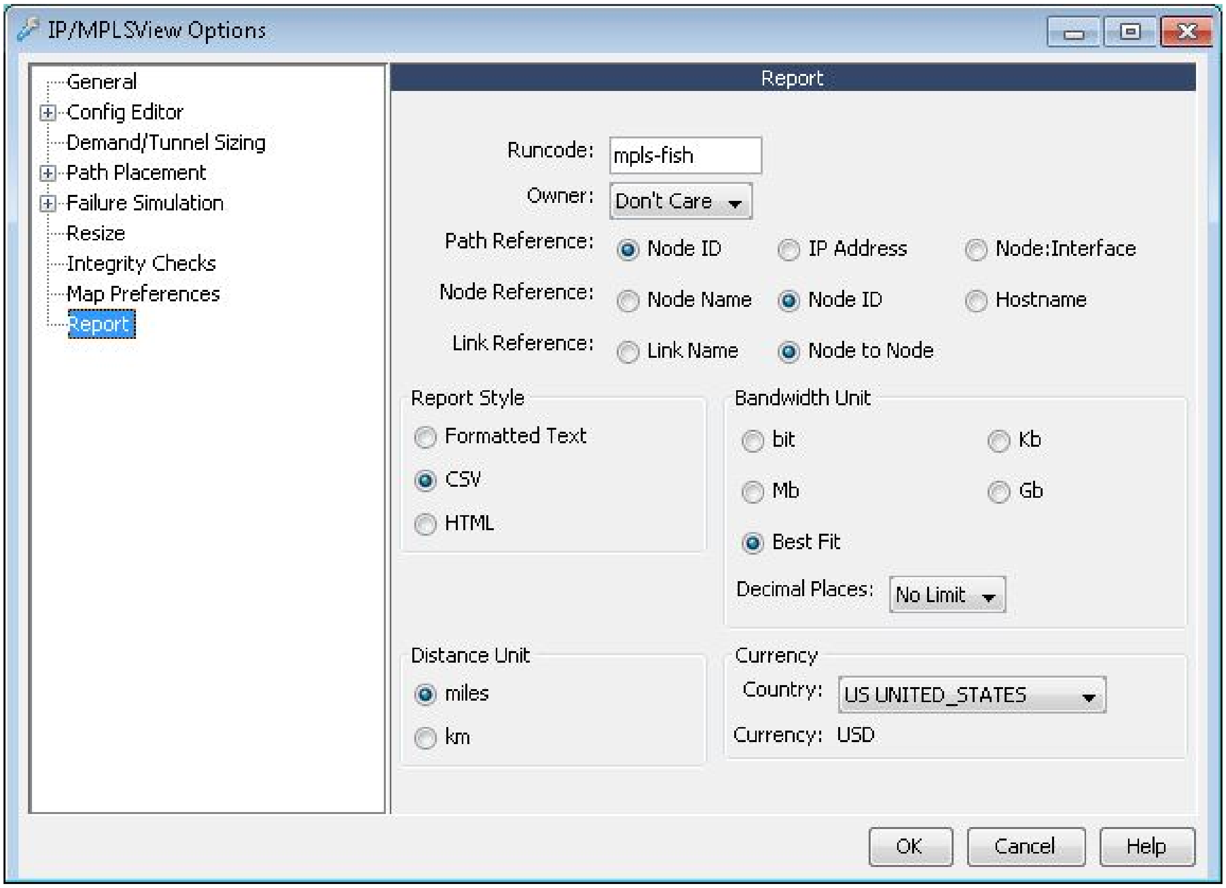
(Continued)

Field	Description
Group by LAN in default layout	Selecting this option will cause the initial layout when opening a network to attempt to layout nodes in such a way that minimizes LAN link lengths as much as possible. Since this only affects the initial layout when opening a network, changes made to this option will not have any effect until a new network is opened. This option should be turned off if nodes connected by ethernet can be separated by longer distances.
Show VT as normal	Displays virtual trunks as regular trunks. When this option is not checked, virtual trunks are always displayed in the color chosen above.
Automatically save graphcoordaux file when closing a network	By default, the graphcoordaux file is automatically saved when closing a network to avoid losing auxiliary changes made to the map, such as map legend settings. Uncheck to disable this feature.
Reset	Resets options to the previous settings.
Defaults	Sets options to the system default settings.
Apply	Applies new settings immediately without closing the Map Preferences window.
OK	Applies new settings and closes the dialog window.
Cancel	Cancels the any changes.
Help	Opens the help documentation.

Report Options

The Report Options window is used to customize the format of reports generated through Paragon Planner.

Figure 196: Report Options



Field	Description
Runcode	The runcode is the filename extension appended to the end of each output file generated in a particular run of Paragon Planner. It allows you to distinguish amongst several sessions using the same data set. To specify a runcode, you should type the desired input in the Runcode text box of the Report Options window. This runcode may consist of a combination of alphanumeric characters. Subsequently, any report files generated is in the format filename.runcode. It is important to use unique runcodes. Otherwise, there is a danger of accidentally overwriting existing files with the same names.
Owner	You can choose to view report data related only to the specified owner(s).
Path Reference	This option sets the display preference for paths in the report.

(Continued)

Field	Description
Node Reference	In report files, nodes may be referred to by either node name, node ID, or hostname.
Link Reference	In report files, links may be referred to by using one of two conventions. The standard method is to represent a link by the node pair that defines it. An alternative method is to associate a user-defined link name with that link. If a link name is not defined for a link, the node pair naming convention is used. To use either method, select the appropriate box in the Link Reference section. Note: This option applies not just to report files, but also to some console messages, for example, those displayed during an Exhaustive Single Line Failure.
Report Style	You may specify the file format of subsequent reports in the Report Options section. Three formats are supported: Formatted Text, CSV, and HTML. Formatted Text is simply standard ASCII output that may be viewed in any text viewer without additional preprocessing. Comma delimited format (CSV) outputs text so that a comma is used as a separator for each distinct field in the report. This is most often used to import report files into spreadsheet applications, and can be viewed using the Report Viewer. Finally, Hypertext Markup Language format (HTML) outputs reports in HTML-compliant format so that the report files can be directly viewed by web page browsers.
Bandwidth Unit	The bandwidth unit used in reports may be selected in the Bandwidth Unit section of the Report Options menu. The Best Fit option can be used when there is a large number of different bandwidth types being used. Reports generated with the Best Fit option may contain Bits, Kilobits, or Megabits depending on the available field space. Note that cells may only be selected for ATM hardware devices. In the ATM case, values entered in bits are converted to the appropriate number of cells using a conversion formula. Decimal Places is the number of digits to the right of the decimal point displayed in reports.
Distance Unit	The distance unit used in report files may be specified in the Report Options menu. To specify a distance unit, go to the Distance Unit section and select an appropriate one. The available options are miles and kilometers (km).
Currency	Sets the currency unit for Paragon Planner. To specify a currency, first go to the Currency section. Then, select a country from the drop-down combo box listing the available countries. Once this is done, the selected country's associated currency unit is used in subsequent monetary values. **NOTE**: For the EURO currency used in various European countries, select **ER EURO** from the country list. The Euro unit is displayed as ER.

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CHAPTER

Appendix A: Input Files Format

Spec File

The specification file contains a list of the files that characterize a network. Each line specifying a file location should be in the format, keyword=filename, where keyword is the file type name and filename is the file path (either absolute or relative to the path specified in the datadir variable). Note that both keyword and filename are case-sensitive. Following are a list of keywords.

Type	Description
Backbone data files	bblink, demand, domain*, facility*, graphcoord, group, muxloc, newdemand, nodeparam, owner*, site
Cost Files	custrate*, intlratespec*, ratespec, usercost, usercountrycost
Control Files	fixlink, linkdist, nodeweight, rsvbwfile

A specification file also includes the following keywords:

- runcode default file extension when saving files
- datadir default input file directory prefix
- ratedir tariff database directory
- dparam file containing design parameters

For keywords for hardware-specific files, please see the appropriate document.

Backbone Data

MUXLOC (muxloc=filename)

Description: Node File

General format (United States and Canada locations):

```
#nodeID name npa nxx[MISC]
N01 NYC(5WTC) 212 392
```

```
General format (International locations):
#nodeID name npa nxx countrycode lat long [MISC]
N33 LEED 999 999 UK 534959N 0013459W
```

BBLINK (bblink=filename)

Description: Link File

```
#[LinkName] NodeA NodeZ Vendor # BwType [Misc]
N2 N6 ATT 3 T3
LINK1 N3 N4 DEF 1 OC3
```

DEMAND (demand=filename)

Description: Demand File

```
#DemandID NodeA NodeZ bw Type_field Pri,Pre [Path]
I000123A N01 N02 256000 R2 12,10 N01-N05-N02
```

To add more demands without modifying the original demand file, use the

```
NEWDEMAND file (newdemand=filename)
```

NODEPARAM (nodeparam=filename)

Description: Node Hardware Type File

```
#nodeID/name hwtype [MISC]
Y36 MUX
```

SITE (site=filename)

Description: Site Definition File (useful for diversity design, simulation, path placement, pricing)

Purpose: The site file is used to define sites as logical groupings of nodes. The site definitions are used for the purpose of failure simulation, diversity design, and diverse path placement. By default, if a node is not included in a user-defined site definition, it is treated as being in a site of its own for these purposes. Site information can also be used to facilitate pricing specifications, as in the usercost file.Purpose: The site file is used to define sites as logical groupings of nodes. The site definitions are used for the purpose of failure simulation, diversity design, and diverse path placement. By default, if a node is not included in a user-defined site definition, it is treated as being in a site of its own for these purposes. Site information can also be used to facilitate pricing specifications, as in the usercost file.

Usage: Each line entry in the site file uses the following syntax to indicate the nodes in a site:

```
#sitename=node1=node2=...=nodeN
mysite01=N08
mysite02=N46=N86 = N71 = N72 \
= N73 = N74
```

A node can be indicated by ID or name. If you need multiple lines to define a site, use a back slash character (\) to continue the entry from one line to the next. Choose site names that differ from node names to avoid potential confusion in the input data.

GROUP (group=filename)

Description: Topology Groups File (useful for visual grouping; unlike the site file, this file does not influence diversity design, simulation, path placement, or pricing)

```
# Group_name Members
GROUPA N1, N2, N3
```

Grouping is a topology feature used to group nodes together. If you save your specification file with groups, the next time you open it up, nodes in a group is grouped together under one group symbol.

GRAPHCOORD (graphcoord=filename)

Description: Topology Window Definition and Node Coordinates (useful for display only; to be distinguished from latitude & longitude coordinates and geographical V & H coordinates)

```
window 1228 158 2114 1515
#first line defines the window size, Only locations and #line segments within
the window coordinates are displayed.
#node npa nxx graph_v graph_h
N001 212 406 4919 1447
N002 212 406 4933 1570
N003 212 406 5154 1394
END
```

Graphics coordinates for backbone nodes may be changed by moving locations around on the topology map and using the Map Views feature. Note that changing the graphical coordinates does not change geographical information which is stored in the muxloc file.

DOMAIN (domain=filename)

Description: Domain File

```
#domain_ID domain_name color
1 REDNET MAGENTA
V2 BLUENET BLUE
TRANSIT=V2
```

This file is needed only for large networks that are to be partitioned into different areas (domains). In it you can specify the ID, name, and color of domain regions. Nodes in different domains may only communicate with each other through gateway nodes. The domain file allows for node/link coloring by domain and for the specification of a transit domain.

For the Domain_ID, the format Dd, where d is a number, is reserved to signify a domain with domain number of d. For domains using this format, leading zeros are ignored, so D5, D05, and D005 are all treated as the same domain identifier.

> **NOTE**: This file can also be used for OSPF areas instead of domains. Depending on the hardware vendor specified in the dparam file (hwvendor=hardware_vendor), the domain file is interpreted to contain domains or OSPF areas.

OWNER (ownerfile=filename)

Description: Owner File

```
#OwnerID Name Color
G1 wandl blue
G5 wandl2 red
```

The purpose of this file is to facilitate the identification of node and demand ownership. By defining an owner and associating certain demands with that owner, service providers that carry traffic of several companies can use the owner feature to quickly determine the distribution of traffic in the network.

To associate a demand with an owner, the type field of the demand's entry in the demand file should include ownerID where ownerID is substituted by the corresponding ownerID in the owner file. To associate a node with an owner, specify OWNER=ownerID in the miscellaneous field of the muxloc file. Owner names defined in the muxloc and/or demand files are automatically added to the owner list if they are not defined in the owner file.

Valid Color Values: Red, Green, Cyan, Blue, White, Magenta, Yellow.

FACILITY (facility=filename)

Description: Facility Definition File (useful for diversity design, simulation)

```
#Facility_name net_element1 [net_element2 ]*
FAC1 L2N2N3 L3N2N3
FAC2 L2N4N5 L3N4N5 L4N4N5 \
L5N4N5
```

The facility file is used to define facilities as logical groupings of nodes and links. The facility definitions are used for the purpose of failure simulation and diversity design.

Each entry of the facility file should be a separate line containing a facility name followed by the associated node ID (or node name) or link name.

The network elements should be delimited by tabs, spaces, or commas. If you need multiple lines to define a facility, use a back slash character (\) to continue the entry from one line to the next.

The facility feature does not check the validity of the nodes and/or links listed in the facility file. Duplicate links and/or nodes will also be duplicated in the facility. If both are used in the same facility, then that node is duplicated. Nodes that are not in the muxloc file and links not in the bblink file are ignored.

TRAFFIC LOAD (trafficload=filename)

Description: Peak Load by Period

```
#Facility_name net_element1
The format for the traffic load file is shown below:
# --Peak load in bits--
#DmdID Dir AvgFrameSize Period1 Period2 etc…
V0001 - 20 12800 12800 12800 12800
F0001 A2Z 87 6852 2083 1372 2749
F0001 Z2A 456 18795 11703 4578 5065
```

For each demand, peak load information can be recorded in this file for various time periods. Data collected from the network or user-defined data can be stored in this file. Upon reading this data, the program can then calculate link bandwidth utilization at different times based on this information. This feature is applicable to ATM, Frame Relay, or Router networks.

- DmdID must correspond to a demand ID defined in the demand file. The direction of the demand may be specified using one of the following three identifiers: "-" for Two-way, "A2Z" for One-way from Origination switch to Destination switch, or "Z2A" for One-way from Destination switch to Origination switch.
- Alternatively, The FromNodeCardPort or ToNodeCardPort can be specified instead of the DemandID.

- AvgFrameSize indicates the average frame size of the demand. It may be specified using a number or a dash. It is assumed that overhead is already included in the interval definition.
- "#_bytes_in_frame": Traffic load specified is adjusted based on whether it is being routed over a frame or cell trunk.
- The remaining columns (Period 1, Period 2, etc.) indicate the traffic load (bits) measured during the corresponding interval. A maximum of 24 intervals may be specified per PVC.
- The field "unit = number" may be placed before the actual traffic data for demands or tunnels. The default unit value is 1 bit. All the traffic data in the traffic load file is interpreted as kilobits if the value of unit is specified as 1000. The data unit is interpreted as byte if unit = 8 is specified.

TRAFFICPATTERN (TRAFFICPATTERN=filename)

NOTE: This file is for discrete event simulation only.

```
#traname #msg Duration Msg size framsize
 # second bits bytes
PATTERN1 1.0 2.0 160000 1500
PATTERN2 3.0 1.0 2000000 256
PATTERN3 4.0 3.0 500000 1000
PATTERN4 1.0 1.0 1000000 1000
```

The traffic pattern file allows you to define several class types based on traffic characteristics. Each traffic type may be specified in terms of four parameters: number of messages, duration (seconds), message size (bits), and frame size (bytes).

In the example above, PATTERN1 is defined as 1 message lasting 2.0 seconds, with a message size of 160,000 bits and a frame size of 1,500 bytes. PATTERN2 is defined as 3 messages lasting 1 second, with a message size of 2,000,000 bits and a frame size of 256 bytes. PATTERN3 is defined as 4 messages with a duration of 3 seconds, a message size of 500,000 bits and a frame size of 1,000 bytes. PATTERN4 is defined as 1 message lasting 1 second, with a message size of 1,000,000 bits and a frame size of 1,000 bytes.

TRAFFICDATA (TRAFFICDATA=filename)

NOTE: This file is for discrete event simulation only.

```
#format = unit unit_size
 #interval = x (number of seconds)
#pvcname direction #unit unit_size #unit2 unit_size2
# format line may be one of the following:
# packet size
# byte size
# bit size
# size packet
# size byte
# size bit
format = packet size
interval = 300
PVC1 A2Z 16,48,30,512,35,256,20,512
PVC1 Z2A 10,48,20,512,30,256
PVC2 A2Z 20,48,50,512
PVC2 Z2A 20,48,50,512
```

The traffic data file allows you to define each demand by specifying multiple packets and packet sizes. Although this requires you to have a reasonable knowledge of the traffic, more accurate simulation results can be obtained in this manner. For each PVC, up to 10 pairs (#unitx and unit_size) may be specified in defining the demand. Note that although the PVC definition entries in the example above are delimited by commas, you may also use spaces and tabs to separate entries.

This file specifies an interval of 300 seconds (5 minutes), and defines a traffic distribution for two PVCs. In this example, the PVCs are full duplex (both A2Z and Z2A directions are defined). To define a simplex PVC, specify either A2Z or Z2A for the direction field. The direction field assumes that a demand from the first node to the second node is marked as A2Z, and the reverse direction as Z2A. During the 5 minute interval, 16 packets of 48 bytes, 30 packets of 512 bytes, 35 packets of 256 bytes, and 20 packets of 512 bytes were sent in the A2Z direction of PVC1. Similarly, 10 packets of 48 bytes, 20 packets of 512 bytes, and 30 packets of 256 bytes were sent in the Z2A direction of PVC1. In PVC2 from the A2Z direction, 20 packets of 48 bytes, and 50 packets of 512 bytes were sent. The identical distribution is present for PVC2 in the Z2A direction because they have identical traffic entries.

Control Files

FIXLINK (fixlink=filename)

The format of the fixlink file is exactly the same as that of the bblink file. This file is used to tell Paragon Planner that the links specified in this file should not be deleted during backbone link design.

LINKDIST (linkdist=filename)

```
#from to dist
N01 N02 5
N01 N03 1
```

This file contains default distances (admin weights) that can be assigned between backbone nodes. If the hopdist design parameter (in the dparam file) is set to Adm_Weight, then the distances in the linkdist file may be used to calculate the lengths of the demand paths during path placement. The only way to override this admin weight is to use the admin weight specified in the miscellaneous field of the bblink file for a particular link between two nodes. In the bblink file, use "DIST=x" (symmetric), "DISTA2Z=x", or "DISTZ2A=x" (asymmetric), where x is substituted by a number.

For a link between a node pair not listed in the linkdist file, the admin weight defaults to the linkdistunit parameter in the dparam file. This parameter can be specified in the "User-Defined Link Distance" function of the "Read Files" menu in the text version of BBDsgn. If linkdistunit is positive, that value is the default admin weight for all links. If linkdistunit is negative, the default admin weight for all links is calculated as the airline distance between each pair of nodes divided by the absolute value of linkdistunit and rounded up to the nearest integer. For example, if linkdistunit=-50, the user-defined distance for links from 1 to 50 miles is 1. Similarly, for links from 51 to 100 miles, the user-defined distance is set to 2.

NODEWEIGHT (nodeweight=filename)

```
#nodeID/name nodeweight trunk-bandwidth-limit transit-bandwidth-limit
N0007 100 500M 1000M
N0011 -1 10808000
N0010 BLOCK
```

- Node weight, or Link Penalty for Design: A penalty at a node for purchasing links at it during a design. Use a number less than 100000. If 100000 or higher, this value has another meaning: no pass-through demands are allowed in design mode.

- Trunk-bandwidth-limit: a maximum trunk bandwidth capacity at a node that gets used during design, and For example, if the trunk-bandwidth-limit is set to 5M (5Mbps) and the link type being designed for is a T1, then only 3 T1s (each ~1.5 Mbps) can be added since 4 T1s would exceed this limit.
- Transit-bandwidth-limit: a maximum transit demand bandwidth capacity for a node that gets used for path placement. For example, specifying a limit of 0 will prevent pass-through demands at a node.

> **NOTE**: A node weight is required if maximum link bandwidth capacity is to be specified. The default Node Weight is 0 and the Default Maximum Link Bandwidth Capacity is infinity.

RSVBWFILE (rsvbwfile=filename)

```
#node1 node2 fixfat fatpct
N01 N02 128000 0.1
N05 N10 256000 0
```

The fixfat and fatpct parameters in the dparam file are used to globally define reserved bandwidth for all links in the network. To define reserved bandwidth for specific node pairs, the rsvbwfile should be used. Reserved bandwidth is calculated based on values in the rsvbwfile. For node pairs not defined in this file, reserved bandwidth is calculated based on the fixfat and fatpct global parameters. To follow the reservation constraints, BBDsgn will avoid using reserved bandwidth during path assignment and backbone design. In failure analysis/failure simulation routines, however, these reservation constraints are ignored.

Cost Files

CUSTRATE (custrate=filename)

Description: Customized Tariff File

```
DIST= MILE #DIST= Unit of measure; KM or mile
 COUNTRY= IT #Specifies the Country Rate
 INCR_DIST=0.1 MILE #Incremental unit:0.1 MILE (default=1 M)
#service class1 class2 NRC [tomile fix rate_per_incdist]*
OC3 ALL ALL 1000 9999 270000 600
T3 CA CB 1000 100 300 30 9999 1000 20
```

The custrate file is used to define tariff rates for links that cannot be priced out using the tariff database.

For any link, the rate depends on the service used and the class of the nodes of the link's endpoints. The service field denotes a trunk type like OC3 or T3. The fields class1 and class2 are logical groupings of nodes. These classes are defined by adding a CLASS=classname in the miscellaneous field of the muxloc file.

The pricing method used is the band method. For a given link, the non-recurring charge is NRC and the recurring charge depends on the mileage band it falls under.

Following the first four fields are a set of three numbers representing the first mileage band. Subsequent triplets represent subsequent mileage bands. The field tomile indicates the end of the mileage band.

The recurring charge is determined using a fixed rate plus a rate per incremental distance. That is:

Recurring charge = fixed_rate+(rate_per_inc_dist/inc_dist)*link_airline_distance

Example: Suppose we have a 200 mile T3 link between a node in class CA and a node in class CB. Using the custrate file specified above, the link would fall within the second mileage band. The non-recurring charge would be 1000. The recurring charge would be 1000+(20/0.1)*200=41000.

USERCOST (usercost=filename)

The usercost file is used to define the cost for links according to the end nodes, vendor, and trunk type. The format of the usercost file is as following:

```
#from to vendor type [cost/mo.]
N01 N02 ATT T1 1000.00
N01 N02 ATT FT56K 300.00
N01 N02 WTG FT56K 250.00
N03 N04 USS T1
site2 site3 USS T1 2000.00
N05 site3 USS T1 2000.00
N05 site3 ATT T1 2200.00
```

The from and to fields should specify a node ID, node name, or site name. If a site name is entered, the assignment applies to all locations in that site. You should ensure that site names are different from node names in order to prevent pricing inconsistencies.

If more than one vendor is assigned to the same type for the same node pair, then the least cost vendor is treated as the default vendor. In the example above, the default vendor for a FT56K link between N01 and N02 is WTG. If ATT is selected as the vendor for a FT56K between N01 and N02, the cost of that link is calculated as $300.

If site names are specified in the from/to fields, then the price and default vendor assignments apply to all the locations in the site specified. The default intra-site cost is 0.

USERCOUNTRYCOST (usercountrycost=filename)

```
#CountryCodeA CountryCodeZ vendor type [cost/mo.]
FR GE DEF FT64K 1000.00
```

The only difference is that the from and to fields are replaced by two-letter country codes rather than node Ids.

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CHAPTER

Appendix B: Search Preferences

Exact Match Strings

This appendix describes the search preferences available in Paragon Planner and examples of how strings are matched. This applies to the Find and Advanced Filter windows of the Paragon Planner client (for example, Find Node, Find Link) and to the AutoGroup by Regular Expression (Regexp) option in the topology map.

String	Matches	Does Not Match
foo	foo	food, Foo
foo	foo, food, afoot	fox, Foo
foo	foo	food, Foo
foo*	foo, food	afoot
foo	foo, food, afoot	
foo?	food	foo, foods
foo	foo, food, afoot	fox, Foo
fo	foo, fox	fo
pa*t	pt, pat, paaat	paa
pa+	pa, paa, paaa	p
pa?t	pt, pat	paat
[NI]pat	Npat, Ipat	Jpat, npat
^pat	pat, patty	ipat

(Continued)

String	Matches	Does Not Match
pat$	pat, ipat	patty
pa{2}	ipaat	pa
pa{2,}	paa, paaa	pa
pa{2,3}t	paat, paaat	pat, paaaat
\d	any digit	
\D	any non-digit	
\s	any white space character	
\S	any non-white space character	
\w	any alphanumeric character	
\W	any non-alphanumeric character	
(pa)+	pa, papa, papapa	
([bn]a)*	banana	