

# PARAGON PLANNER

## Product Overview

*Network operators can no longer afford a reactive, overbuilt network to handle traffic growth caused by emerging services. They need an approach that optimizes their existing network assets and ensures that every bit generates revenue. Paragon Planner is a multivendor and multiprotocol traffic management and engineering solution for IP, IP/MPLS, and segment routing networks. It is a planning and simulation tool that provides in-depth network views, health audits, and scenario planning, all without impacting your environment.*

## Product Description

Juniper® Paragon Planner (formerly NorthStar Planner) is a network modeling tool that can be used for offline visualization and detailed architectural planning of any production network. Paragon Planner enables network operators to forecast the impact that changes such as latency, additional traffic, shifts in traffic flows, and new capacity or services will have on their network.

An intuitive graphical interface provides concise and in-depth views into routed networks and helps optimize bandwidth and network resources. Using Paragon Planner's global network topology view, operators can model and visualize dynamic, explicit routing paths, designed to operate within end-user defined constraints.

Paragon Planner can generate a graphical view of a network, enabling the addition, removal, and reconfiguration of network elements. Paragon Planner can analyze models from several sources:

- Models created from scratch in Planner
- Imported models based on collected CLI information
- Automated model builds from Paragon Pathfinder (formerly NorthStar Controller) that leverage the full range of dynamic topology collection and automated CLI/performance metric information

The effects of these changes and other traffic scenarios can be simulated without affecting the production network. Simulations can be run on demand in an interactive mode to assess the network for potential failure scenarios.

## Architecture and Key Components

Paragon Planner is an integrated software package that can be used for network topology design and simulation across multiple network domains using different network elements.

Paragon Planner designs, simulates, and analyzes off-line network models, predicting network performance without affecting the network itself.

- **Design:** Paragon Planner offers the ability to construct network topology maps showing simulated or imported data for nodes, links, and LSP paths. It offers a one-off capability to import or add nodes, links, and LSPs for network modeling, and can also add/stage LSPs for provisioning to the network.
- **Simulate:** Paragon Planner allows you to create or schedule simulation events to analyze the network model based on failure scenarios such as link congestion, broken link, unresponsive node, and more.
- **Analyze:** The Report Manager feature provides extensive reports for simulation and planning. Paragon Planner imports interface data or aggregates archived data to generate historical statistics for querying and chart displays.

Paragon Planner imports network state and topology information from Paragon Pathfinder, an SDN controller that provides granular visibility and control of IP, IP/MPLS, and segment routed flows. This helps simulate live production networks that are controlled by Paragon Pathfinder, and it allows Paragon Planner to run simulation tests offline without affecting the live production network

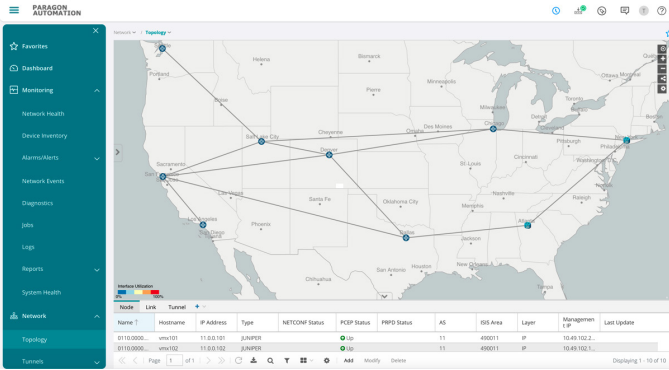


Figure 1: Paragon Pathfinder Topology

The main components of Paragon Planner include the following.

### Main and Topology Window

The main window provides the topology view, configuration wizards, the console, toolbars, and network information. The topology (map) view, which is in the main work area for any network model, is loaded into the system as shown in Figure 3. Multiple links displayed between nodes use “line bending” to avoid hidden trunks in the topology, which incorporates collapsible node aggregation views. Node locations can be viewed with their geographic coordinates on the world map or automatic layouts.

The topology view displays important link and node properties. Links are color-coded based on utilization. Alternatively, links can be viewed by other properties such as media, trunk type, vendor, or domain/area. Nodes are color-coded by symbols, icons, or vendor types. Path analysis, performed in the topology view, 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.

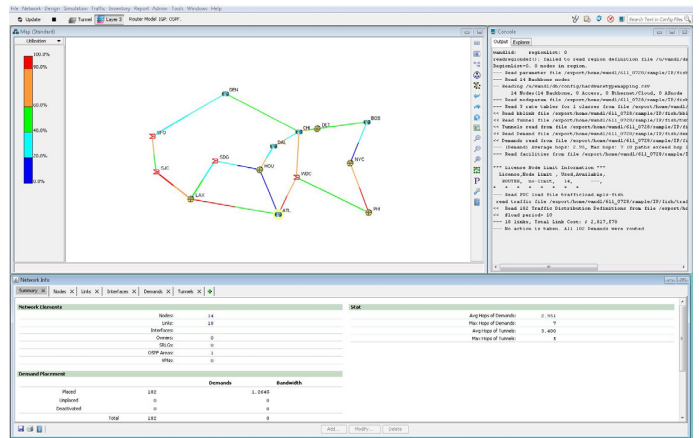


Figure 2: Paragon Planner Main Window with Network Topology View

### Import Network Wizard

The import network wizard allows you to import different types of network configuration data into the software. This process creates a corresponding network project specification file, which is saved into the user-specified output directory and automatically loaded into the program.

### File Menu and File Manager

The file menu option includes browsing options such as Create Network, Open Network Browser, Open File Manager, Import Network Wizard, and more. The File Manager lets you 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.

## Key Capabilities

### Construct Network Topology Automatically

Paragon Planner utilizes data snapshots of live networks from Paragon Pathfinder, leveraging the tight integration between the two tools. Additionally, Paragon Planner can source data from stored network configuration files and other optional data sources, leveraging these data sources to construct accurate network topology views for multivendor networks that are fully aware of protocols, layers, autonomous systems (AS), areas, VPNs, and more.

### Perform Traffic Load Analysis

Paragon Planner users can access, view, and assess current and historical traffic data to pinpoint bottlenecks or underutilized links at a glance from the topology map.

## Perform Capacity Planning

Paragon Planner facilitates decisions about future network expansion by studying the impact of potential changes before they are implemented. The system can be used to determine whether there is sufficient capacity or if more should be added, as well as which links can be pruned without compromising resiliency.

## Ensure Network Resiliency Against Failure

Paragon Planner users can study the impact of extensive node, link, site, card, and Shared Risk Link Group (SRLG) multilayer failure scenarios, analyzing how traffic is rerouted and its effect on network links (e.g., worst-case trunk utilization).

## Identify and Prevent Potential Bottlenecks

Paragon Planner provides insights into why traffic flows or tunnels fail to route, and it identifies which trunks will become congested under certain failure or what-if scenarios.

## Validate Changes Prior to Deployment

Paragon Planner lets you validate day-to-day network changes, or model and simulate network migration, network expansion, or the merging of multiple networks. This allows you to analyze the impact of these changes in a safe, virtual environment while experimenting with changing parameters, protocols, and topologies.

## Design and Simulate MPLS-TE and LSP Routing

With Paragon Planner, users can perform network outage simulations across MPLS and IP layers, automate fast reroute (FRR) backup tunnel design and simulation, automate the design of diverse paths for primary and backup protection tunnels, and optimize paths that have become suboptimal over time.

## Create and Model VPNs

Paragon Planner lets you model a wide variety of VPNs and simulate VPN routing. You can use the system to generate VPN traffic and then simulate a card failure to see if it will bring down the VPN. You can also run VPN-specific integrity checks on the configuration files.

## Analyze CoS to Meet SLAs

To ensure that they are meeting SLAs, network operators can use Paragon Planner to model class of service (CoS) classes and policies, as well as different queuing schemes. They can also define application flows based on CoS, which enables the modeling of voice over IP (VoIP) or video on demand (VOD). Paragon Planner also analyzes packet loss and delay statistics per class of service.

## Simulate Multicast

With Paragon Planner, users can simulate multicast flows based on user-defined multicast groups and demands. They can also simulate the effect of rendezvous point selection on the distribution tree and on link utilization, as well as shortest-path tree (SPT) switchover.

## Model and Analyze BGP

Paragon Planner users can study BGP routing, perform detailed BGP routing analysis and what-if studies involving BGP policy changes or the addition of new BGP peers, and perform detailed BGP neighbor analysis.

## Features and Benefits

Paragon Planner lets network operators import their existing network configuration or build a new network from scratch. Network modeling and simulation capabilities enable you to optimize network bandwidth and latency, as well as network resource management for the most efficient use of network infrastructure.

Paragon Planner also helps network operators effectively manage network costs. An inventory management tool, which facilitates the optimization of network infrastructure, helps design networks based on available resources, collecting and analyzing network data for producing network health audits. For example, Paragon Planner checks whether device configurations are accurate and comply with operator-defined specifications, eliminating the potential for manual network errors.

## Benefits of the Paragon Planner

- **Reduce network costs:** Effective designs can result in lower hardware and maintenance costs. Paragon Planner features tariff-based design, MPLS LSP, and SR traffic engineering for effective utilization of the network, and superior design optimization.
- **Automate for productivity and operational efficiencies:** With Paragon Planner, tasks such as reporting, topology maps, and LSP path generation are automated, as well as tasks such as accommodating traffic growth and optimizing the network topologies.
- **Guard against unnecessary risk:** Assessing the network using planner's resiliency analysis, fiber cut analysis, etc. helps operators avoid problems and mitigate risk.
- **Diagnose performance problems:** Using Paragon Planner's flow analysis, bottleneck detection and analysis, peak utilization analysis, and multicast simulation features helps administrators quickly diagnose performance problems.
- **Validate changes prior to deployment:** Paragon Planner enables designers and administrators to validate new services, equipment, and technologies before they are rolled out.
- **Plan for future growth:** Using Paragon Planner's superior capacity planning and data forecasting helps inform and optimize plans for growing the network to meet business needs.

## Paragon Planner Feature List

Features	Description
<b>Backbone design, demands, TE tunnel, and diverse P2MP tree design</b>	The impact of adding new demands, or traffic, can be analyzed in a network model before they are deployed on the real network. The software determines whether there is sufficient available capacity in the network and recommends 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.
<b>Failure simulation</b>	Exhaustive single-, double-, or triple-element failures, interactive or customizable scripted failure scenarios can be simulated to analyze and evaluate a network's resiliency.
<b>Hardware-specific device library</b>	Hardware-specific device models have been developed through close working relationships with 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.
<b>Path assignments</b>	For an existing backbone network, an optimal layout or path assignment can be determined that satisfies all demand constraints, which 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 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.
<b>Detailed design and analysis reports</b>	As with all modules, detailed reports are generated to help you 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.
<b>Detailed Topology Views</b>	Detailed topology views allow you to view your network nodes and links. These can be organized by geographical location, rearranged by hand, or automatically rearranged in a format that distributes 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 labelled 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.
<b>Traffic load models</b>	Traffic load models are available via LSP traffic loads, or through NetFlow and LDP traffic statistics collected by Paragon Pathfinder.
<b>Traffic load analysis</b>	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 multiperiod load and performance analyses.
<b>Facility feature</b>	Any number of nodes and/or links can be grouped in a facility for failure scenarios and reporting options.
<b>Class of service (CoS) feature</b>	The CoS feature lets you divide traffic into four classes, including strict priority. 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.
<b>Customer rates</b>	The customer rates feature allows you to incorporate a customized rate table, enabling the calculation of cost per link.
<b>Path diversity design</b>	The path diversity design feature allows you to configure demands (or tunnels) on link-disjoint, site-disjoint, or facility-disjoint paths.

## Specifications

### Supported Protocols and Technologies

#### Interior gateway protocol (IGP)

- Modeling of OSPF, IS-IS, and RIP routing protocols
- OSPF two-layer hierarchy (backbone area and areas off the backbone area)
- Routing metric modification by modifying variables like the cost, reference bandwidth, interface bandwidth, and delay, according to each routing protocol's metric calculation formula

#### Equal-cost multipath (ECMP)

- Path analysis displaying ECMP routes between two nodes
- ECMP report listing ECMP routes in the network
- Load balancing by splitting flows into sub flows with equal-cost paths

#### Static routes

- Extraction of static route tables
- What-if studies upon adding or modifying static routes

#### Border Gateway Protocol (BGP)

- Extraction of BGP speakers, autonomous system (AS) numbers, peering points for both IBGP and EBGP, route reflectors, BGP communities, weight, local preference, multi-exit discriminator, AS\_PATH, and BGP next hop from router configuration files
- Key integrity checks such as finding BGP unbalanced neighbors and checking IBGP mesh connectivity
- Implementation of the BGP route selection rules and bottleneck analysis to troubleshoot routing failures
- BGP attribute modification for what-if studies
- BGP map logical view of EBGP and IBGP connections

### Virtual private network (IP VPN)

- Modeling of MPLS VPNs such as L3 VPN, L2 Kompella, L2 Martini, L2 CCC, and virtual private LAN service (VPLS)
- VPN extraction from router configuration files
- VPN topology display and reports
- VPN-related integrity checks

### Class of service (CoS)

- Extract CoS classes and policies from router configuration files
- Create and modify CoS classes and policies and assign policies for link interfaces
- View Link and Demand CoS reports and link load reports by CoS policy

### Multicast

- Create, view, and modify multicast groups
- Create multicast demands and analyze their paths
- Protocol Independent Multicast (PIM) modes including sparse mode, dense mode, bidirectional PIM, and source-specific multicast (SSM)

### OSPF area

- Design the backbone network based on the following settings:
  - Specify which nodes to use as gateways and the areas accessible to this gateway
  - Specify administrative weights to be used for designed links from the Admin Weight feature
- ISIS analysis:
  - Performs OSPF to ISIS migration analysis
  - Performs ISIS LFA analysis

### MPLS tunnels for traffic engineering (TE)

- Path placement
  - Routing of LSP tunnels over physical links
  - Routing of traffic demand flows (forwarding equivalence class [FEC]) over LSP tunnels and links
- Modification
  - Modification of LSP tunnel preferred/explicit routes and media requirements (bandwidth constraints, QoS requirements, priority and preemption, affinity/mask, and include-any/include-all/exclude admin-groups)
  - Addition of secondary/standby routes
- Net grooming
  - Network grooming of tunnel paths configlet generation
  - Configlets created based on added and modified tunnels
  - Templates can be specified
- Path diversity design
  - Design primary and secondary/standby tunnel paths to be link-diverse, site-diverse, or facility-diverse
  - View or tune the resulting paths

### MPLS fast reroute (FRR)

- Specification of tunnels requesting FRR protection and FRR backup tunnels
- Simulation of routing according to FRR during link failure
- Design of FRR backup tunnels for LSP tunnels requesting FRR protection according to site or facility diversity requirements

### Interarea MPLS-TE

- Design LSP tunnels between different OSPF areas for multi-area networks

### Differentiated Services (DiffServ) TE tunnels

- Create and model Juniper Networks single-class and multi-class LSPs
- Configure bandwidth model (RDM, MAM) and bandwidth partitions
- Define scheduler maps (CoS policies) and assign them to links

### Supported Platforms:

- Juniper Networks:
  - Junos® operating system 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:
  - IOS and IOS-XR-based devices such as ASR, NCS, and CRS
  - MPLS/tag switching (MPLS-TE, GB-TE) routers
- Alcatel
  - 7750 Service Router
- Huawei
  - AR Series Routers
  - NE Series Routers

## Juniper Networks Services and Support

Juniper Networks is the leader in performance-enabling services that are designed to accelerate, extend, and optimize your high-performance network. Our services allow you to maximize operational efficiency while reducing costs and minimizing risk, achieving a faster time to value for your network. Juniper Networks ensures operational excellence by optimizing the network to maintain required levels of performance, reliability, and availability. For more details, please visit [www.juniper.net/us/en/products-services](http://www.juniper.net/us/en/products-services).

## Ordering Information

This product adheres to the Juniper Software Advantage pricing model. Please be advised of the following items that constitute an order:

- As this is a virtual appliance/software product, you would not buy any hardware license from Juniper.
- Instead, you would procure the hardware and additional required support for this hardware from a third-party vendor.

For additional information on supported hypervisor(s) and VM requirements and recommended hardware configuration, please refer to the technical documentation for this product on our website ([www.juniper.net](http://www.juniper.net)) under the support section.

Juniper Networks products are sold directly as well as through Juniper partners and resellers. For more information on the Juniper Software Advantage business model, please visit <https://www.juniper.net/us/en/products-services/network-automation/paragon-planner/>.

For information on how to buy, please visit [www.juniper.net/us/en/how-to-buy](http://www.juniper.net/us/en/how-to-buy).

## About Juniper Networks

Juniper Networks brings simplicity to networking with products, solutions and services that connect the world. Through engineering innovation, we remove the constraints and complexities of networking in the cloud era to solve the toughest challenges our customers and partners face daily. At Juniper Networks, we believe that the network is a resource for sharing knowledge and human advancement that changes the world. We are committed to imagining groundbreaking ways to deliver automated, scalable and secure networks to move at the speed of business.

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