



# CHAPTER 1

## Overview

---



**Note**

---

Cisco MetroPlanner has been renamed as Cisco TransportPlanner starting with release 8.5.

---

Cisco TransportPlanner Software R8.5 provides a way to model and test wavelength division multiplexing (WDM) optical networks in a graphical environment. The primary purpose of Cisco TransportPlanner is to help sales engineers (SEs) design and validate networks of Cisco Optical Networking System (ONS) 15454 Multi-Service Transport Platforms (MSTP). Using Cisco TransportPlanner Software R8.5, an SE can create multiple instances of a network to modify different parameters in each instance for comparison. Cisco TransportPlanner generates a shelf view of all the sites deployed in the optical network and provides a complete bill of materials (BOM) for the network and the differences between instances of a network.

This chapter describes how you use Cisco TransportPlanner to design, analyze, and optimize new or existing Cisco optical networks and contains the following sections:

- [1.1 Cisco TransportPlanner Features, page 1-1](#)
- [1.2 Network Design Process, page 1-2](#)
- [1.3 Cisco TransportPlanner Process Flow, page 1-5](#)
- [1.4 Planning Traffic in Cisco TransportPlanner, page 1-7](#)
- [1.5 Cisco TransportPlanner Traffic in the Project Explorer Pane, page 1-8](#)
- [1.6 Auto, Forced, and Locked Parameters, page 1-11](#)

## 1.1 Cisco TransportPlanner Features

Cisco TransportPlanner Software R8.5 provides a simple tool set for designing optical networks with Cisco ONS 15454 MSTP products. You can enter all of the network parameters or minimal information, such as site distance, and Cisco TransportPlanner will model the network you need to build and generate a detailed BOM with ordering information. Designing optical networks requires the verification of multiple constraints such as optical budget limitations and platform architectural restrictions. One Cisco TransportPlanner project can contain multiple copies of a network. This allows you to change parameters in one network copy, then analyze and compare to another network copy to determine the differences. In addition to this capability, Cisco TransportPlanner Software R8.5 provides the following new features:

- Network upgrade to implement forecasted channels
- Slot preprovisioning (by importing the NE Update file into the Cisco Transport Controller [CTC])

- User-defined equipment lists in the parts database
- Fiber separation allowing a user to manage certain parameters (such as loss) for each strand in a fiber pair
- Forced equipment settings (user-defined parameters instead of Cisco TransportPlanner automatic settings)
- Power consumption calculation
- L-band design
- C-band enhanced booster
- C-band plus L-band/50-GHz scalable design
- Multishelf management
- New DWDM client interfaces
- Meshed reconfigurable optical add/drop multiplexing (ROADM)
- Capability to select the type of maintenance contract desired to appear in the BOM
- Support for OPT-AMP-C amplifier
- Support for GE and 10GE Xponder
- Support for 10G ADM blade

## 1.2 Network Design Process

To generate a network design, the SE enters the following parameters:

- The topology of the network—ring, linear, or meshed
- The type of equipment used at each site
- The distance separating the sites
- The type of fiber connecting the sites
- Service demands, including the service type, the protection type, and the number of channels between nodes
- The number of network sites

When the network parameters are entered, Cisco TransportPlanner finds the best routing, defines the required add/drop filters, and places optical amplifiers and dispersion compensation units (DCUs) to fit the user traffic demands at the minimum cost. Optimization is performed to meet the boundary conditions. The optimization includes attenuation and amplification.

Finally, Cisco TransportPlanner generates a BOM, which includes the product codes, the quantities, and pricing information. In addition, it creates other reports, such as a shelf-level view of the configuration, which can be printed. This helps the SE understand how the shelf is built and helps to avoid confusion and errors during the actual deployment. Within the BOM is the total network cost, which allows a quick comparison of various design options. The total network cost is the cost of the equipment for all of the sites in the designed network.

## 1.2.1 Network Design Constraints

Cisco TransportPlanner searches for the best solution to a designed network using an optimization algorithm.

A network design must meet the optical budget and receiver overload criteria to operate efficiently. An analysis of optical budget and receiver overload evaluates the strength of the signal traversing the ring. If a design solution satisfies the constraints, it is a valid design. The Cisco TransportPlanner Software R8.5 optimization algorithms generate multiple solutions and verifies the constraints against those solutions. If the constraints are satisfied, the solution with the lowest cost-to-utilization ratio is selected as the optimal solution.

If the network design solution fails to satisfy all the constraints, Cisco TransportPlanner Software R8.5 makes adjustments to parameters such as signal attenuation and amplification. Amplification is achieved by using an erbium-doped fiber amplifier (EDFA). Attenuation is achieved by using variable optical attenuator (VOA) modules integrated into the platform. Cisco TransportPlanner Software R8.5 corrects the optical budget using an algorithm that includes automatic placement of EDFAs and VOA regulation.

For each internodal demand, Cisco TransportPlanner Software R8.5 performs an optical budget and receiver overload analysis and displays the results in various reports in the Graphical User Interface (GUI). If the network design algorithms are not able to provide a solution, then you can modify the input data (for example, by relaxing some user constraints) and run the analysis again.

## 1.2.2 Platform Support

Cisco TransportPlanner Software R8.5 supports the Cisco ONS 15454 DWDM optical platform Software Releases 4.7, 5.0.x, 7.0.x, and 8.x.

## 1.2.3 Topology Support

Cisco TransportPlanner 8.5 supports the following network topologies:

- Bus (single span, point-to-point, and linear)
- Open (or hubbed) ring
- Closed (or meshed) ring
- Any-to-any ring (ROADM)
- Meshed network

Cisco TransportPlanner Software R8.5 allows you to design flexible networks with up to 100 site locations. A flexible network is a network that, using ROADM nodes, allows traffic modification/reconfiguration as traffic requirements change.

For Cisco TransportPlanner Software R8.5, the maximum number of locations where the optical service channel (OSC) is terminated is 40. The maximum number of add/drop locations is 40.

## 1.2.4 Protection Scheme Support

Cisco TransportPlanner Software R8.5 designs support the following protection schemes:

- Y-cable protected—In Y-cable protection, one transponder card is designated as active and the other as standby. The standby transponder card has the client-side laser turned off to avoid corrupting the signal transmitted back to the client. The active transponder monitors the signal from the trunk side and in the event of loss or signal failure, the system switches to the standby path.
- Client-based 1+1—Two client signals are transmitted to separated line cards or transponder cards instead of using a Y-cable to split one client signal into two line cards or transponder cards. In client 1+1 protection, the failure and switchover is controlled by the client system.
- Fiber-switched protection—The single client signal is injected into the client receive (Rx) port. It is then split into two separate signals on the two trunk transmit (Tx) ports. The two signals are transmitted over diverse paths. The far-end card chooses one of the two trunk Rx port signals and injects it into the Tx client port.
- Unprotected—Protection is not used.
- External card switch—Protection not used.

## 1.2.5 Service Support

Cisco TransportPlanner Software R8.5 can support any subset of the following services:

- Alien (third-party DWDM interface)
- Cisco ONS 15530 2.5 Gbps Aggregated
- ONS 15530 10 Gbps Aggregated
- ONS 15530 Multirate (MR) Transport
- ONS 15530 Data Multiplexer (MXP)
- 2R Any Rate
- Gigabit Ethernet
- 10GE—10 Gigabit Ethernet (LAN and WAN)
- D1 Video
- DVB-ASI—Digital Video Broadcast-Asynchronous Serial Interface
- DV-6000
- ESCON—Enterprise System Connection
- Fast Ethernet
- Fibre Channel 1G
- Fibre Channel 2G
- Fibre Channel 4G
- Fibre Channel 10G
- FICON—Fiber Connection 1G
- FICON Express 2G
- FICON 4G
- High Definition Television (HDTV)
- ISC-3 Peer (1G)
- ISC-3 Peer (2G)

- ISC-3 Peer (2R)
- ISC-Compat (ISC-3 Compatibility Mode)
- OC-3
- OC-12
- OC-48
- OC-192
- OC-768
- SDI—Serial Data Input
- STM-1
- STM-4
- STM-16
- STM-64
- STM-256
- Sysplex CLO—control link oscillator
- Sysplex ETR—external throughput rate

**Note**

The Sysplex CLO and Sysplex ETR services are supported only on the following topologies:

- Single span—Two terminal sites with 32MUX-O and 32DMX-O cards, 40MUX-O and 40DMX-O cards, 40WSS and 40DMX, or 32WSS and 32DMX or 32DMX-O cards installed and no intermediate sites in between.
- Point-to-Point—Two terminal sites with 32MUX-O and 32DMX-O cards, 40MUX-O and 40DMX-O cards, 40WSS and 40DMX, or 32WSS and 32DMX or 32DMX-O cards installed. Line amplifiers can be installed between the terminal sites, but intermediate (traffic terminating) sites cannot be installed.
- Two hubs—Two hub nodes in a ring with 32MUX-O, 32DMX-O, 32WSS, 40MUX-O, 40DMX, 40DMX-O, 40WSS, and 32DMX cards or 32DMX-O cards installed. Line amplifiers can be installed between the hubs.

Refer to the *Cisco ONS 15454 DWDM Reference Manual* for more information about the supported topologies for the ETR and CLO services.

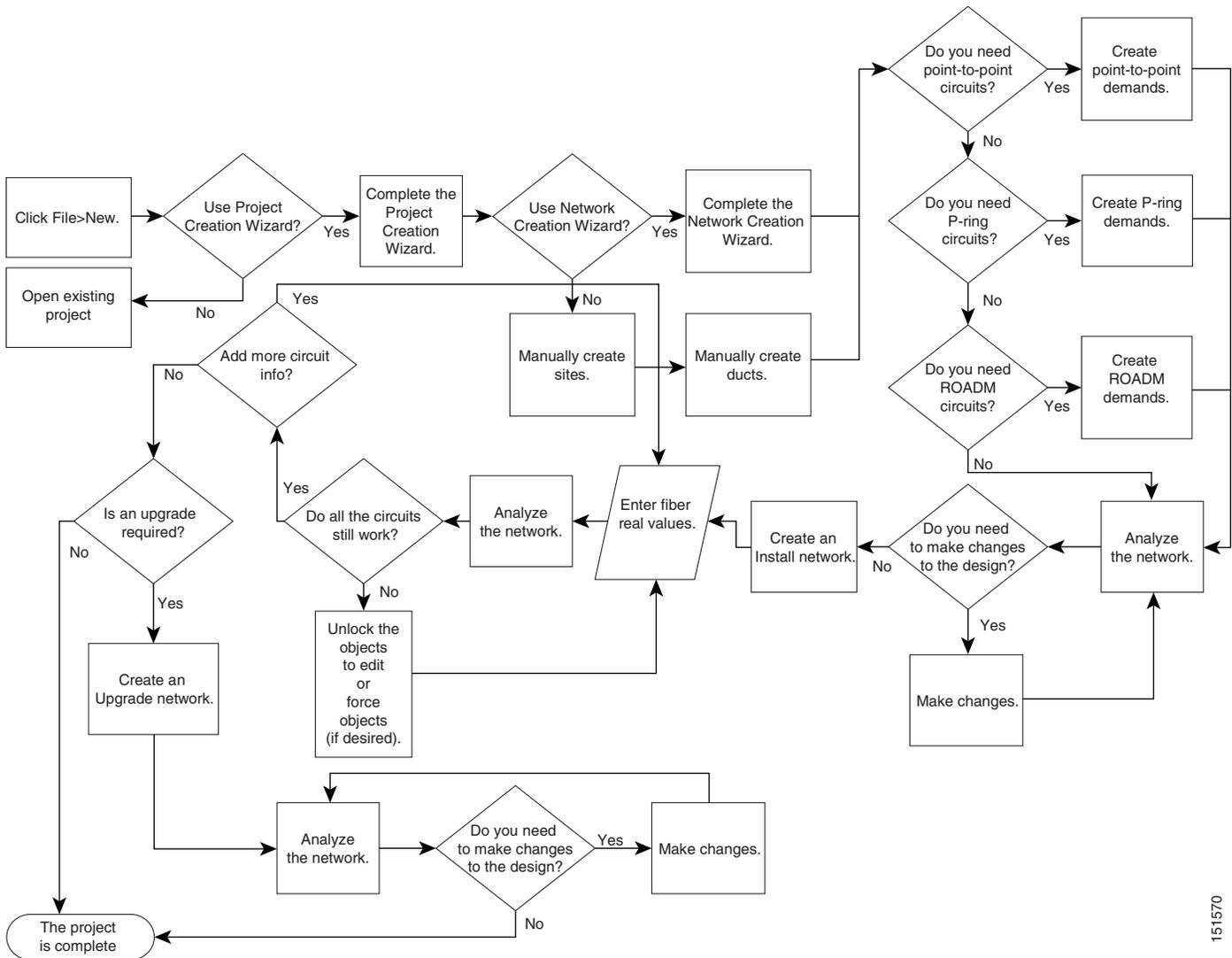
## 1.3 Cisco TransportPlanner Process Flow

The following stages are used to complete a network design. See [Figure 1-1](#) for the process flow.

1. Create a project using the Project Creation wizard.
2. Create a network using the Create Network wizard. The Create Network wizards adds sites and places the fiber spans between the sites. A span represents a pair of fibers.
3. Create a point-to-point, AggregatedEthernet, TDM Aggregated, protected ring (P-ring), and/or ROADM service demand.
4. Analyze the network design.

5. If you would like to force automatic tool choices, adjust the design and repeat the analysis until you have reached the desired configuration.
6. Create an Install copy of the network and update the parameters with real data from the field.
7. Analyze the Install network.
8. Create an upgrade copy of the network, as needed, to add forecasted channels.

Figure 1-1 Cisco TransportPlanner Process Flow



151570

## 1.4 Planning Traffic in Cisco TransportPlanner

Traffic in Cisco TransportPlanner is defined as an optical path for each pair of nodes requiring a service demand. An optical path is the combined channels between the two nodes. The following list gives definitions for some basic traffic items:

- **Circuit**—A single channel between a pair of source and destination nodes. In addition to the source and destination nodes and all the attributes that are common to the service containing the circuit, a circuit has the following attributes:
  - Present/forecast indication
  - Routing direction for unprotected service
  - ITU channel
  - Optical bypass indication
- **Demand**—A set of circuits with common characteristics, such as:
  - Service demand label
  - Number of existing circuits
  - Number of forecasted circuits
  - Client service type
  - Protection type
  - Optical bypass (number of channels and/or sites)
  - WDM interface type (TXT or ITU-LC)
  - WDM card type
  - Source client interface (SR, IR, or LR)
  - Destination client interface (SR, IR, or LR)
- **Traffic demand**—All traffic between the same set of nodes. Both L-band and C-band are supported. The following traffic demands are supported: P-ring, Fixed (point-to-point), and Any-to-any (ROADM).

In P-ring traffic demands, all the demands are used to support traffic topologies similar to bidirectional line switched rings (BLSRs) or multiplex section-shared protection rings (MS-SPRings). Each P-ring demand is between a pair of added/dropped nodes where BLSR-like (or MS-SPRing-like) traffic must exist. The number of circuits is the same for each demand, and is user-specified (from 1 to 40).

In fixed (point-to-point) traffic demands, the set of nodes is restricted to two sites. The number of circuits is user-specified (from 1 to 40).

In any-to-any (ROADM) traffic demands, a minimum of two nodes and a maximum of 40 ROADM nodes are supported. An any-to-any traffic demand allows each node to establish one or more circuits with the other nodes, either as a hub or meshed configuration. In a meshed configuration, each node defined in the set is connected to each other node. This is the most common traffic type. In a hub configuration, the user-defined hub node is connected to each of the other nodes. ROADM circuits have the same protection types and services. The number of circuits is not user-specified and can vary from 0 to 40.

A ROADM demand can have multiple client service types and supports multiple DWDM card interfaces for each client service type. A ROADM demand supports the following routing strategies:

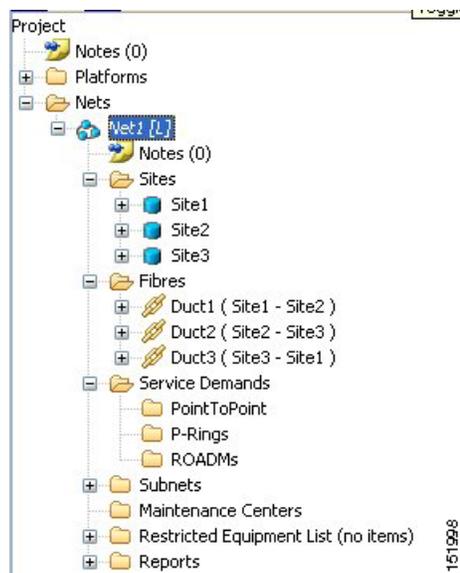
- **Protected (Default)**—Each node pair in the traffic demand is connected using two connections.

- Unprotected optimum optical path—Each node pair is connected using one connection. The unprotected optimum optical path minimizes the number of required optical amplifiers, but also restricts the number of channels that can be deployed among the nodes of the traffic demand (maximum of 40 channels between each node pair) in the installed network.
- Unprotected minimum hop count—Each node pair in the traffic demand is connected by one connection. The unprotected minimum hop count maximizes the number of channels (for unprotected traffic types only) that can be deployed among the nodes of the traffic demand, but can require a higher number of optical amplifiers on the unprotected optimum optical path (maximum of 40 channels between each node pair) in the installed network.
- Unprotected subnet—Each node pair in the traffic demand is connected using one connection. You can manually force connections on only one branch of the ring. For unprotected subnets, you must manually select one starting node of the branch and the direction the ring must be traversed to define the subnet, starting from the initial site. The branch direction is specified by defining the outgoing side first, referred to as the starting node. This routing strategy option allows you to exclude some critical paths and (with ROADMs traffic demands containing two sites) to force each ROADM connection clockwise or counterclockwise.

## 1.5 Cisco TransportPlanner Traffic in the Project Explorer Pane

Cisco TransportPlanner Software R8.5 represents all of the user-defined traffic services as a tree view within the Project Explorer pane. The Project Explorer shows all of the open project information, including the networks, the network dependencies, sites, fibers, services, etc. (Figure 1-2).

**Figure 1-2** Project Explorer View



After you analyze a network design, the colors of tree view change according to the error/warning condition of the network design. The icons display as red if there are errors in the network design; orange if there are warnings but no errors; and green if there are no warnings or errors. The icon shows the color of the most severe condition. For more information about analyzing the network, see the “2.5 Analyzing the Network” section on page 2-52.

Right-clicking on certain items in the Project Explorer tree allows you to edit the parameters. Refer to [Chapter 2, “Designing Networks with Cisco TransportPlanner”](#) for more information about optical results, the traffic matrix, and editing.

## 1.5.1 Point-to-Point Traffic Demands

Point-to-point traffic demands appear in the Service Demands > PointToPoint folder in the Project Explorer pane. Each point-to-point traffic demand is categorized by its source and destination site names. All of the point-to-point services between the two sites appear under the designated demand name ([Figure 1-3](#)).

**Figure 1-3** Point-to-Point Traffic Demand in the Project Explorer



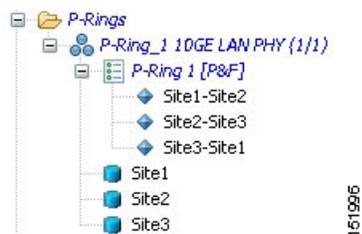
A point-to-point traffic demand includes the following information:

- Client service type
- Site# – Site# (source and destination site labels for this demand)

## 1.5.2 P-Ring Traffic Demands

Each protected ring (P-ring) traffic demand appears in the Project Explorer pane under the Service Demands > P-Rings folder. [Figure 1-4](#) shows an example of a P-ring traffic demand in the Project Explorer.

**Figure 1-4** P-Ring Traffic Demand in the Project Explorer



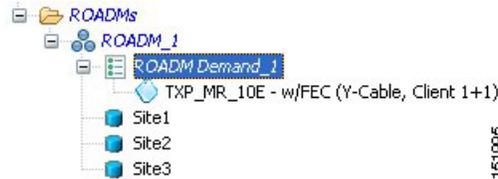
All the P-ring channels between each site pair are listed under each P-ring traffic demand. Each demand is labeled with the following information:

- P-ring number
- Client service type
- Site# – Site# (source and destination site labels for this demand)

## 1.5.3 ROADM Traffic Demands

Each ROADM traffic demand appears in the Project Explorer under the Service Demands > ROADMs folder. The ROADM folder contains each defined ROADM demand. You can define more demands for the same ROADM for the same set of nodes. [Figure 1-5](#) shows an example of a ROADM traffic demand.

**Figure 1-5** *ROADM Traffic Demand in the Project Explorer*

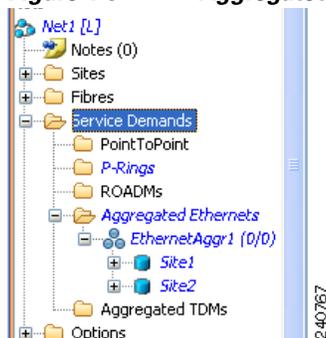


In the Project Explorer, each ROADM includes the ROADM demand name and a list of DWDM card types that support the client service types. Protection types appear in parentheses.

## 1.5.4 Aggregated Ethernet Demand

Each aggregated ethernet traffic demand appears in the Project Explorer under the Service Demands > Aggregated Ethernet folder. The Aggregated Ethernet folder contains each defined aggregated ethernet demand. Aggregated Ethernet demands are supported on ring and linear traffic subnets. [Figure 1-6](#) shows an example of a aggregated ethernet traffic demand.

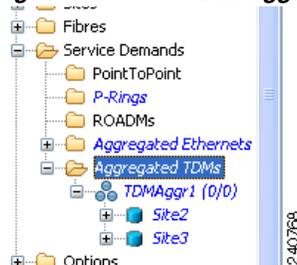
**Figure 1-6** *Aggregated Ethernet Demand in Project Explorer*



## 1.5.5 TDM Aggregated Demand

Each TDM aggregated demand appears in the Project Explorer pane under the Service Demands > Aggregated TDMs folder. [Figure 1-7](#) shows an example of a TDM aggregated traffic demand in the Project Explorer.

**Figure 1-7** *TDM Aggregated Demand in Project Explorer*



TDM aggregated demands are supported only on a ring traffic subnet.

## 1.6 Auto, Forced, and Locked Parameters

Parameters in Cisco TransportPlanner can be in one of three states:

- Auto— This allows the highest degree of flexibility to the Cisco TransportPlanner in designing a network. When a user selects Auto, Cisco TransportPlanner chooses the parameter value during network analysis.
- Forced—When a user sets a specific parameter value, other than Auto, Cisco TransportPlanner designs the network using these constraints. When a setting is forced, the item appears in blue italics in the Project Explorer pane.
- Locked—The state of a parameter after network analysis. The next time the analyzer is run, Cisco TransportPlanner cannot change the value when in the Locked state. A user can unlock an item using the Unlock command. For more information, see the “[2.8.4 Unlocking Parameters in the Network Design](#)” section on page 2-123. [Figure 1-8](#) shows an example of sites in a locked state.

**Figure 1-8**      *Locked Sites in the Project Explorer View*



Depending on the initial state, the network analyzer will:

- Move the parameter into the Locked state when the unit or parameter was set to Auto.
- Leave the parameter in the same state if the user forced a specific value for the unit or parameter.

