Cisco IP Solution Center Traffic Engineering Management Version 4.2

Product Overview

Cisco® IP Solution Center (ISC) Traffic Engineering Management is a unique planning and provisioning application for networks including Multiprotocol Label Switching (MPLS) Traffic Engineering-enabled routers. It generates the paths for primary and backup tunnels to overcome network constraints, including limited bandwidth, DiffServ-Aware Traffic Engineering pool, affinity, delay, and connectivity and bandwidth protection, using world-class hybrid optimization techniques to drastically improve network utilization. It automatically discovers, audits, optimizes, and deploys MPLS Traffic Engineering tunnels. Graphical and table-based displays of MPLS Traffic Engineering tunnels and MPLS Traffic Engineering-enabled devices and interfaces give users full access to all MPLS Traffic Engineering configurations.

MPLS has rapidly become an important technology for provisioning and managing core networks, largely because of its ability to support network convergence, allowing delay- and jitter-sensitive traffic (voice, for example) to be carried over the cost-effective IP network infrastructure. MPLS Traffic Engineering provides a way to meet bandwidth and delay requirements and to address connectivity and bandwidth protection in failure scenarios. It helps significantly improve network protection and utilization by providing mechanisms for tracking bandwidth utilization and for avoiding congestion in one portion of the network and underutilization in another.

Managing MPLS Traffic Engineering in converged networks requires the support of a Traffic Engineering management tool. Determining the path for a given tunnel may depend on many other tunnels and MPLS Traffic Engineering configurations in the network. Sophisticated routing algorithms are required to manage potential conflicting constraint requirements (such as bandwidth and delay), generate a globally optimized layout of tunnels, and generate an efficient bandwidth-protection solution using MPLS Traffic Engineering Fast Reroute (FRR) technology.

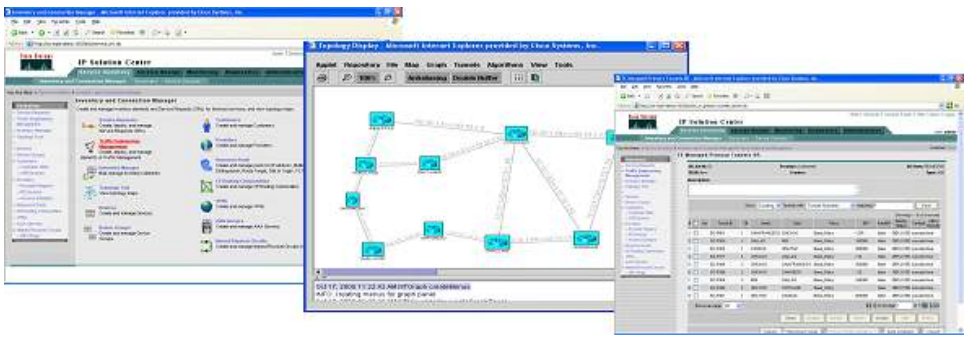
Cisco ISC Traffic Engineering Management is part of the Cisco IP Solution Center family of intelligent network management applications that help reduce overall administration, management, and operational costs by providing automated resource management and rapid profile-based planning and provisioning capabilities that accelerate deployment of MPLS and Metro Ethernet technologies. The applications can operate as a suite or as standalone products, with capabilities that include provisioning of Layer 3 and Layer 2 VPNs, Any Transport over MPLS (AToM), Layer 2 Tunneling Protocol Version 3 (L2TPv3), Metro Ethernet services, and planning and provisioning of MPLS Traffic Engineering. The Cisco ISC also helps reduce network operational costs by providing automated workflow-based troubleshooting and diagnostic capabilities for MPLS VPNs by working with Cisco MPLS Diagnostics Expert. For more information about Cisco MPLS Diagnostics Expert, please visit http://www.cisco.com/go/mde.

Cisco IP Solution Center delivers complete lifecycle management, from creating the IP service to real-time VPN and MPLS Traffic Engineering tunnel provisioning, activation, troubleshooting, and diagnostics. The Cisco ISC provides the provisioning, planning, and autodiagnostics tools that accelerate deployment and time to market of IP services. Simultaneously, it simplifies management of multiple technologies by providing an integrated management product (Figure 1).

Figure 1. Intelligent Management Applications for MPLS and Metro Ethernet Networks

Cisco ISC Traffic Engineering Management is a Web-based, graphical application (Figure 2) that simplifies visualization, configuration, deployment, and operational management of MPLS Traffic Engineering tunnels on a network. It integrates Cisco MPLS Traffic Engineering features (Autoroute Announce, Auto-Bandwidth, DiffServ-Aware Traffic Engineering, and FRR) into a single management tool. Uniquely, it also provides the ability to compute and configure primary tunnels to meet user-specified constraints and to compute FRR bypass tunnels for network-element protection (node, links, or shared-risk link groups), helping to ensure bandwidth availability during normal and element-failure conditions.

Figure 2. Cisco ISC Traffic Engineering Management Web-Based GUI



Cisco ISC Traffic Engineering Management discovers MPLS Traffic Engineering information from the network and presents it in a consolidated view using graphics and tables. It helps users manipulate interface and tunnel characteristics and provides facilities for automated network protection and optimization. Cisco ISC Traffic Engineering Management:

- Provides topology visualization in a graphical view that can be stored and altered
- Provides visualization and editing of primary and FRR bypass tunnels in graphical and tabular views

- Calculates required FRR bypass tunnels and paths to protect bandwidth against network-element failures
- Audits the protection status of the network against element failures
- Calculates required primary tunnels and paths to support defined tunnel requirements, including bandwidth and delay
- Audits the current layout of primary tunnels in the network to determine if they correctly support the tunnel requirements specified; this compares the tunnel requirements with the current routing and highlights inconsistencies
- Provides robust provisioning of primary and backup tunnels into the network, and provides support for schedulable provisioning actions

The following case study was conducted in 2004 using a simulated international Tier 1 Service Provider network (175 nodes, 380 links). Cisco ISC Traffic Engineering Management has been shown to significantly improve traffic management, compared to Interior Gateway Protocol (IGP) and unmanaged solutions. Figure 3 shows network upgrade requirements when using the Cisco solution. The graphs are based on Constraint-Based Shortest Path First (CSPF) metrics. Table 1 provides further details on the number of required link and bandwidth upgrades, and Table 2 shows the results of the case study.

Figure 3. Cisco ISC Traffic Engineering Management (TEM) and Network Requirements Analysis

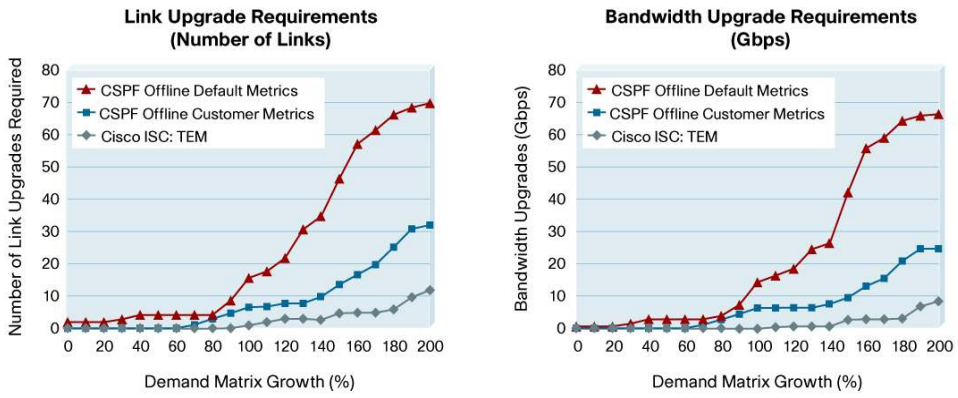


Table 1. Required Network Upgrades

Required network upgrades for each algorithm	100% demand growth		200% demand growth	
	Number of Links	Bandwidth Gbps	Number of Links	Bandwidth Gbps
Cisco ISC Traffic Engineering Management	1	2	12	75
CSPF offline, customer metrics	7	55	32	219
CSPF offline, default metrics	16	134	70	586

Table 2. Case Study Notes

Tier 1 International Network	
Nodes, links (approximately)	175,380
Upgrade a link when primary utilization is greater than	70%
When upgrading, multiply link capacity by	2
Use edge-to-edge as constraint?	No

Key Features and Benefits

Table 3 lists the features and benefits of the Cisco ISC Traffic Engineering Management application.

Table 3. Features and Benefits

Feature	Description	Benefit
Autodiscovery of MPLS Traffic Engineering network and tunnels	Imports existing network into Cisco ISC Traffic Engineering Management device and service repository • Identifies inconsistent configurations • Reconciles live network versus service model • Provides reconciliation reports	Cisco ISC Traffic Engineering Management can discover all tunnels on a given network, together with MPLS Traffic Engineering-enabled routers and links. Existing networks can be uploaded directly into the application. Differences between router configurations and the Cisco ISC Traffic Engineering Management repository can be quickly identified and resolved, minimizing effort to address discrepancies.
Support of Cisco devices in multivendor networks	Cisco ISC Traffic Engineering Management can configure and plan MPLS Traffic Engineering tunnels in Cisco devices that reside in a multivendor environment: • Third-party devices can be discovered and visualized in the network. • The network is completely visible; tunnels are overlaid on topology that includes third-party devices. • Tunnels can be optimally routed through third-party devices and the paths can be fully visualized in the network topology viewer.	This cost-effective solution allows the user to configure the MPLS Traffic Engineering tunnels across a multivendor environment.
FRR tunnel management and bandwidth protection planning	Identifies placement of FRR backup tunnels to protect critical network elements: • Installation of backup tunnels protects against link, node, or shared-risk link group (SRLG) failures. • Interactive GUI allows user to evaluate hypothetical changes and fix protection problems. • Auditing (a method of analyzing the layout of FRR bypass tunnels to determine protection status) allows network operators to determine where protected and unprotected elements reside in the network.	This cost-effective alternative to lower-layer protection supports stringent service-level agreements (SLAs) for voice and video traffic. The highly interactive GUI allows the operator to determine the level of protection and to evaluate the generated tunnels before deployment. Supports link, router, and SRLG protection; alternative lower-layer protection schemes typically offer link protection only. Highly efficient use of bandwidth allows more traffic to be supported on the network, reducing the cost of supporting stringent SLAs. Protection tunnels are automatically generated and can be deployed in one touch.
DiffServ-Aware Traffic Engineering tunnel placement and repair	Generates tunnel paths that meet user-specified constraints, including: • Bandwidth • Bandwidth pool • Affinity • Delay • Traffic Engineering metrics • Protection level (none, best-effort, next-hop [NHOP], next-next hop [NNHOP]) Proposes fixes to meet user-specified constraints for new tunnel demands: • Existing tunnels may need to be moved, minimizing the number of changes. • Resources may need to be added • Constraints may need to be relaxed	Provides major network cost savings through more efficient traffic management and capacity planning. Saves significant time; the user is required only to specify the high-level tunnel requirements for a set of tunnels. Dramatically reduces the skill set required to manage a Traffic Engineering network. The system determines the paths in a way that meets tunnel requirements and optimizes network utilization. Any rerouting of existing tunnels is minimized to avoid disruption to existing services. The user may elect to make certain tunnels unmovable to reflect the importance of supported traffic.

Network grooming	Global reoptimization of primary tunnel placements improves network utilization. As the operator admits new tunnels and alters existing tunnels to reflect changing requirements, network efficiency may be affected.	Periodic global reoptimization can release critical bandwidth for future services. In experimental studies, Cisco ISC Traffic Engineering Management was used to optimize the placement of traffic demands on the network topologies of several major carriers. Results showed that as demands grow, fewer link upgrades are needed, compared with Interior Gateway Protocol (IGP) routing or with conventional MPLS Traffic Engineering. Cisco ISC Traffic Engineering Management showed delayed or reduced bandwidth upgrade costs of 60–90%.
MPLS Traffic Engineering resource modification planning	Identifies impact of changes to network resources (bandwidth pools, link attributes, administrative shutdowns), including: • Disconnection of existing tunnel paths • Violation of existing tunnel constraints (bandwidth, delay, protection) • Loss of element protection Proposes fixes to identified problems with attempted changes, minimizing the number of changes. Existing tunnels may require rerouting.	Supports efficient operational management of network resources. Modifications to the available bandwidth that result in bandwidth oversubscription can be identified. Violations to tunnels can be addressed with minimum disruption to existing tunnel layout. Addresses both primary and FRR bypass tunnel layouts; FRR tunnel layouts are audited with respect to the protection requirements.
Performance collection	Provides reports on the following: • MPLS Traffic Engineering interface performance • Tunnel performance If a link load exceeds predicted levels, users may first determine which tunnels cross this link and then analyze which of these tunnels is carrying more traffic than predicted.	Helps operators to respond efficiently to changes in traffic flows. Users can then alter the tunnel requirements and use the Tunnel Repair feature to address network congestion.
Schedulable tunnel admission	Configures and deploys: • Static routes into tunnels • Autoroute announce All tunnel admission deployments can be scheduled to occur at user-specified times.	Allows scheduling of tunnel admission in operational “windows” and gives full management control to the operator. This enables a controlled migration of traffic onto tunnels and supports rollback.
Provisioning based on current network	Provisioning process helps users: • Upload current configurations • Generate the configlets (the set of CLI commands) required to migrate current configurations to support planned changes • Deploy configlets • Audit deployment to help ensure consistency	Supports operational security by synchronizing with current network configuration. There is always a possibility that the network configuration could have changed since the last “snapshot.” By uploading the configuration prior to applying it, Cisco ISC Traffic Engineering Management helps ensure that the tunnel planning and provisioning configuration will be successfully applied and will not collide with the existing configuration.
Distributed architecture	Four-tiered system consists of client, interface, control, and distribution tiers	Offers a scalable and reliable architecture for large-scale operations.
Role-based access control (RBAC)	RBAC implementation provides detailed access privileges to users. Users can be given read-only access to MPLS Traffic Engineering information or can be restricted in the ability to change the layout of tunnels or MPLS Traffic Engineering parameters on the network.	RBAC provides access control to service providers that want to implement strict operational processes. The RBAC feature also logs user actions, allowing administrators to audit and monitor technical operators and all other types of users.

Product Specifications

Table 4 lists the platforms that support Cisco ISC Traffic Engineering Management.

Table 4. Supporting Platforms

Description	Specification
Product compatibility	Cisco CRS-1 Series carrier routing systems Cisco 7200 Series Routers Cisco 7500 Series Routers Cisco 7600 Series Routers Cisco 10000 (ESR) Series Routers Cisco 12000 Series Routers
Software compatibility	Cisco IOS® Software Release 12.0(32)S and later (Cisco 7200 and 7500 Series) Cisco IOS Software Release 12.2(18)SXF (Cisco 7600 Series) Cisco IOS Software Release 12.0.(30)S3 (Cisco 10000 Series) Cisco IOS Software Release 12.0(32)S and later, and Cisco IOS XR Software 3.2 (Cisco 12000 Series) Cisco IOS XR Software 3.2 (Cisco CRS-1 Series)

System Requirements

The server, client, and Web browser system requirements for Cisco ISC Traffic Engineering Management can be found in the Installation Guide at http://www.cisco.com/go/isc under Technical Documentation and Tools. Please refer to this and the Product Documentation Guide for more detailed information on setting up and configuring this product.

Ordering Information

The Cisco ISC Traffic Engineering Management application is available for purchase through regular Cisco sales and distribution channels worldwide. To place an order, visit the Cisco Ordering Home Page.

Cisco ISC Traffic Engineering Management ordering and licensing options are described in the Cisco IP Solution Center 4.2 product bulletin, available at: http://www.cisco.com/en/US/products/sw/netmgtsw/ps4748/prod_bulletins_list.html.

Cisco offers a wide range of services programs to accelerate customer success. These innovative services programs are delivered through a unique combination of people, processes, tools, and partners, resulting in high levels of customer satisfaction. Cisco services help you to protect your network investment, optimize network operations, and prepare the network for new applications to extend network intelligence and the power of your business. For more information about Cisco services, see Cisco Technical Support Services or Cisco Advanced Services.

Service and Support

Using the Cisco Lifecycle Services approach, Cisco and its partners provide a broad portfolio of end-to-end services and support that can help increase your network's business value and return on investment. This approach defines the minimum set of activities needed, by technology and by network complexity, to help you successfully deploy and operate Cisco technologies and optimize their performance throughout the lifecycle of your network.

For More Information

For more information about Cisco IP Solution Center Traffic Engineering Management, contact your local account representative or visit http://www.cisco.com/en/US/products/ps6163/index.html or http://www.cisco.com/go/isc.

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