

Application Note

# Deploying MPLS Traffic Engineering

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You can deploy an MPLS traffic engineering solution in a limited manner and immediately notice improved performance for traffic taking the LSP route. In addition, traffic not taking the LSP route benefits from the extra capacity freed by shifting traffic to the LSP. By monitoring traffic patterns, you can determine additional ways to thereafter deploy MPLS to improve performance and service reliability.

Following are high-level steps you can take to deploy an MPLS traffic engineering solution in a controlled manner that does not require a forklift upgrade to your network. These steps are a general guide for easing this solution into your network. For detailed analyses, instructions, and consultation for deploying MPLS, contact our Professional Services consultants at <http://www.juniper.net>.

<b>Identify the Problem</b>
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1. Identify the primary problem you are having or hope to avoid and the end result you want to achieve. For example, your goal might be any of the following.
  - Manage expenses by deferring a circuit upgrade
  - Utilize excess bandwidth as it becomes available
  - Manage large volumes of bandwidth from a single source
  - Eliminate congestion on a specific circuit
  - Improve customer service in rapidly growing regions

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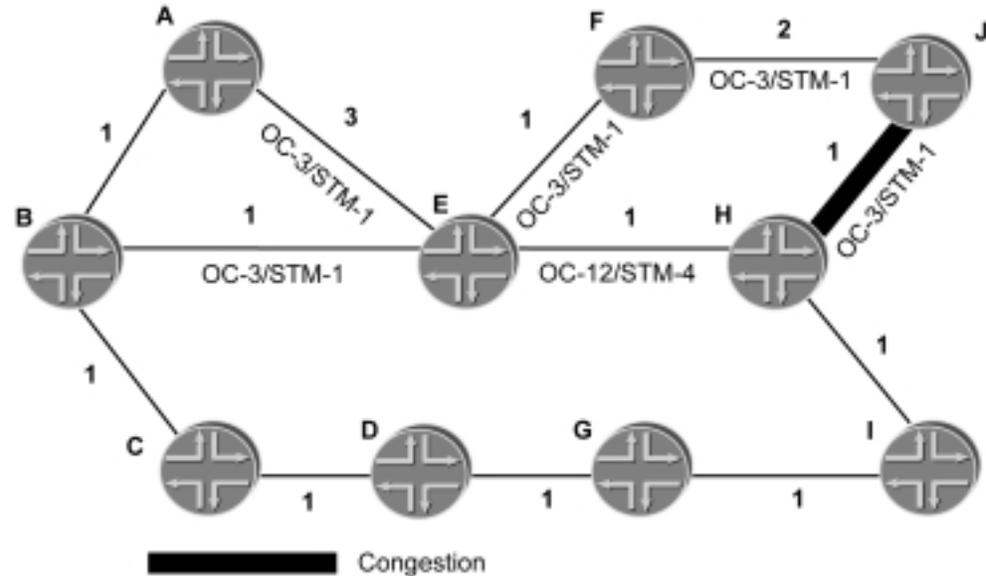
**NOTE** Since how you deploy MPLS differs depending on your goals, the remainder of this paper uses the example goal of eliminating congestion on a particular circuit. This example is specific to creating an explicitly-routed LSP and configuring routers to enable RSVP to reroute the traffic accordingly.

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Refer to figure 1 for a diagram of the network used in this example. Due to the IGP metrics (shown as numbers in the figure), traffic patterns are as follows.

- All traffic from A to J takes the path A - B - E - H - J.
- All traffic from B to J takes the path B - E - H - J.
- All traffic from C to J takes the path C - B - E - H - J.

Other traffic moves across the H-J circuit as well, including traffic from D, G, and I. The result is congestion on the circuit between routers H and J, which has a capacity of only 155 Mb.

**Figure 1: Example Network with Congestion on the H-J Circuit**

**Gain Lab Experience**

2. Gain experience configuring and managing LSPs by working in a lab. Doing so eases you into the learning process and enables you to configure and manage LSPs in a safe environment.
  - A. Create an environment that simulates the portion of your network having the problem (figure 1).
  - B. Recreate the problem. For example, force traffic congestion onto a specific circuit.
  - C. Create LSPs that simply follow the IGP path by enabling RSVP signaling without constraint-based routing (i.e., without CSPF). The traffic flow on the LSP follows the same shortest-path IGP route.
  - D. Monitor the traffic on each of the LSPs.
  - E. Based on the monitoring results, decide which LSP traffic you want to divert.
  - F. Determine an alternate path for the traffic you want to divert.
  - G. Use an explicit route to modify the LSP identified in step 2E to take the new path determined in step 2F. The traffic will now flow over the explicit route, rather than over the shortest-path IGP route.
  - H. Experiment with SNMP to query MPLS MIBs. For example, you can monitor LSP statistics, which routes the LSPs are going over, and the number of active paths.
  - I. Experiment with the `show` commands to view more details about LSP behavior. For example, you can monitor the LSPs' history and which interfaces have MPLS enabled.
  - J. Experiment with more advanced MPLS features.
    - a. Configure IGP traffic engineering extensions and CSPF to experiment with automatic path selection based on constraints.
    - b. Create standby secondary LSPs and force a failure to see how the routers react to failure.
    - c. Enable MPLS Fast Reroute on an LSP to activate additional traffic protection.

**Test LSPs in Live Network**

3. Test the LSP configuration on a portion of your production network that is not carrying customer traffic.
  - A. Configure an LSP.
  - B. Send only test data across this LSP.
  - C. Monitor the traffic going across the LSP.

**Deploy LSPs Along IGP Paths**

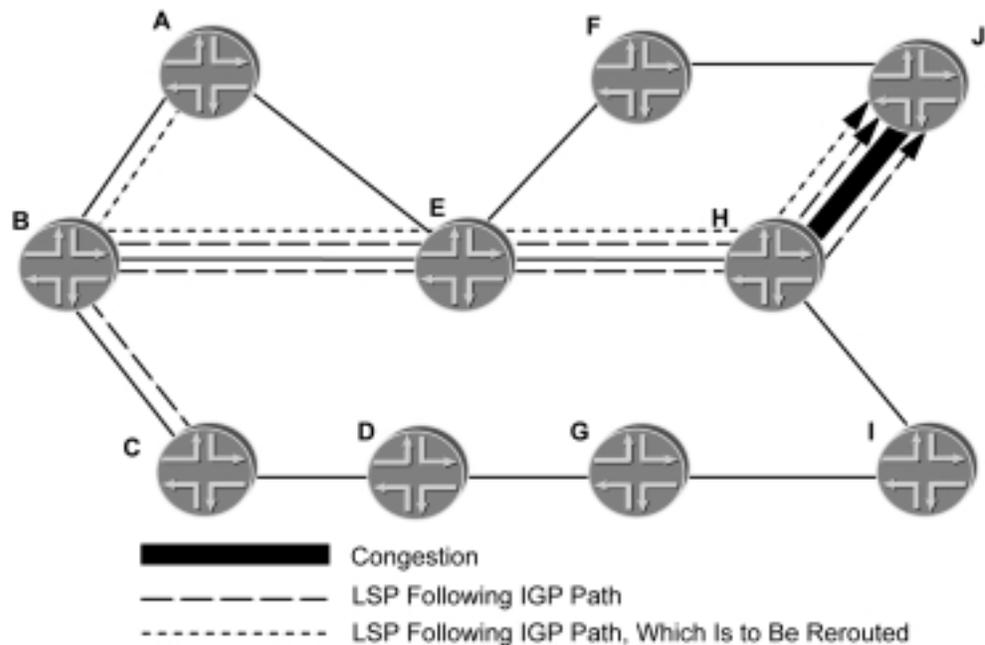
4. In a live production network, create LSPs that follow the IGP path by enabling RSVP signaling without constraint-based routing (figure 2).
  - A. Create LSPs for paths A-J, B-J, and C-J.

By not defining any constraints, RSVP establishes the LSP along the shortest-path IGP route. As such, traffic continues to flow across the same routes as before, so you are not affecting the network load or bandwidth utilization.

- B. Measure the traffic on the newly created LSPs to determine which circuits have the highest bandwidth utilization. For this example, the statistics show the following bandwidth utilization.
  - ▶ Traffic from A to J is using 70 Mb.
  - ▶ Traffic from B to J is using 20 Mb.
  - ▶ Traffic from C to J is using 30 Mb.

The total traffic utilization from these three sources is 120. Remember, the H-J circuit has a capacity of 155 Mb and other traffic is moving across it as well. Hence, the H-J circuit is congested.

**Figure 2: Creating LSPs that Follow the IGP Path**

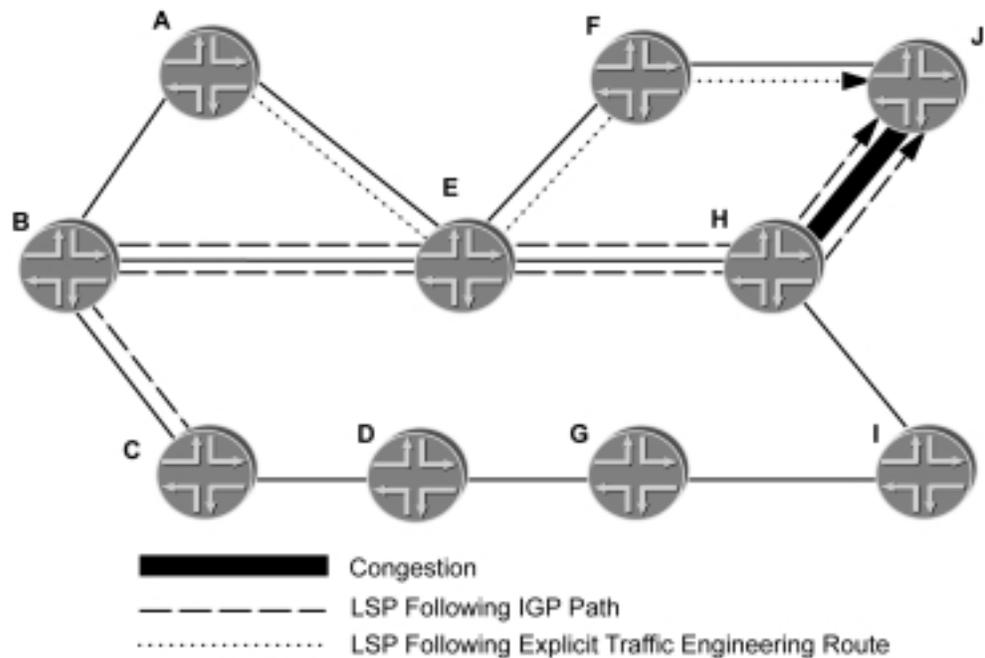


**Reroute LSP to Explicit Path**

5. In the same live production network, alleviate the H-J congestion (figure 3).
  - A. Based on the statistics collected in step 4B, select the LSP with the highest measured bandwidth utilization.
  - B. Select an alternate path that eliminates the H-J congested circuit. In this example, select A-E-F-J as the preferred path.
  - C. Configure the LSP with the explicit route of A-E-F-J. RSVP now signals the LSP along this strictly defined path.

**Monitor Results**

6. Monitor the results.
  - A. Verify that the H-J circuit is no longer congested by inspecting interface statistics.
  - B. Monitor the entire network to ensure traffic continues to flow smoothly and to ensure MPLS traffic engineering is working as intended. If it is not, validate whether the LSP is correctly configured.

**Figure 3: MPLS Traffic Engineering Alleviates H-J Congestion**


Now that you are comfortable with manually engineering paths and enabling RSVP to reroute the traffic accordingly, continue creating and monitoring LSPs as needed. Take advantage of the rich set of advanced MPLS features and experiment with how they can increase your bandwidth efficiency, performance, and service reliability. For instance, you can enable constraint-based routing to automate path selection. To optimize all paths in the network, you can perform a global analysis using network modeling tools.

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## Acronyms

<b>CSPF</b>	Constrained Shortest Path First
<b>IGP</b>	Interior Gateway Protocol
<b>LSP</b>	Label switched path
<b>MPLS</b>	Multiprotocol Label Switching
<b>RSVP</b>	Resource Reservation Protocol

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