MPLS LSP tunnel preemption

Agilent Technologies RouterTester Application Note

Multiprotocol Label Switching (MPLS) is an emerging set of protocols and technologies. Recently, there has been a tremendous amount of interest among the Internet Service Providers (ISPs) in these technologies. One of the key features customers are looking for is the reliability and scalability for their mission critical applications. Service providers not only have to support their customer demands but also need to have the ability to support a wide range of services and to unify offering these services.

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Multiprotocol Label Switching "Preemption" feature

The Internet is evolving very rapidly to become the next public network infrastructure for real-time and delay sensitive services such as voice and multimedia, and value-added applications such as financial transactions. However, the successful delivery of these services is dependent upon the ability to provide reliable, predictable, and class-aware IP transport.

Traffic patterns are constantly changing in the network, creating the need for 'new' LSP establishment for network optimization. When a lack of bandwidth occurs, an attempt to establish an LSP might fail. The MPLS preemption feature provides a way to define the relative importance of LSPs such as high-priority and low-priority LSPs. This feature thus allows the preemption of low-priority tunnels in favor of higher-priority LSPs.

Whether an LSP can be preempted is determined by two properties associated with the LSP:

Setup priority--Determines whether a new LSP that preempts an existing LSP can be established. For preemption to occur, the setup priority of the new LSP must be higher than that of the existing LSP. Also, the act of preempting the existing LSP must produce sufficient bandwidth to support the new LSP. That is, preemption occurs only if the new LSP can be successfully established. Hold priority--Determines the degree to which an LSP holds onto its session reservation after the LSP has been set up successfully. When the hold priority is high, the existing LSP is less likely to give up its reservation and hence it is unlikely that the LSP can be preempted.

As shown in figure 1, if the ingress LSR isn't able to establish a high-priority LSP - due to lack of bandwidth; the ingress LSR preempts the lower-priority LSP in favor of establishing the high-priority LSP.

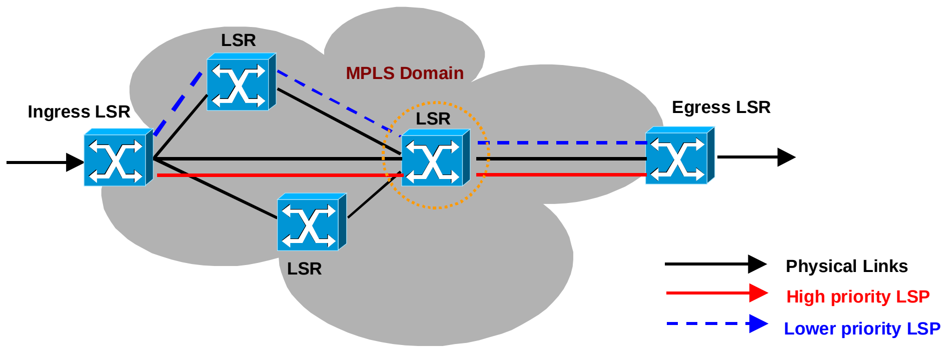


Figure 1: High-priority LSP preempts low-priority LSP.

Test Challenges

Based on the complexity of the preemption feature, a number of test challenges come to light. When there is insufficient bandwidth to establish a high-priority LSP, routers should tear down an existing (lower priority) LSPs to free up bandwidth. High-priority LSP is said to ’preempt’ the existing LSP. During this LSP establishment, it is important that routers don’t loose any of the data traffic traversing the high-priority LSP.

Measuring the effectiveness of a gigabit/terabit router’s preemption process requires a tester that can generate and support MPLS signaling protocol (RSVP-TE and CR-LDP) to establish LSPs. A tester must have the ability to establish different priority LSPs, generate wire-speed labeled traffic, and be capable of advertising bandwidth attributes.

The operation of MPLS protocols such as RSVP-TE and CR-LDP relies on the internal gateway routing protocol (IGP). Bandwidth availability is one of the attributes being distributed and exchanged by IGP traffic engineering protocol extensions. Hence, support for at least one of the IGP protocols, - such as Open Shortest Path First (OSPF), or intermediate-system-to-intermediate-system (IS-IS), and the ability to accurately simulate IGP topology is necessary in order to effectively test the MPLS capabilities and features of high performance gigabit/terabit routers.

IGP topology simulation is the ability to emulate a complete network behind the SUT to create ’multi-hop’ LSP tunnels (see figure 2), which places more stress on the router than a single-hop LSP tunnel.

LSP tunnel preemption test

The Agilent Technologies RouterTester generates RSVP-TE signaling messages that support the establishment of different priority LSP tunnels.

RouterTester also simulates a complete OSPF network topology behind the SUT.

In the following section we will examine how RouterTester measures the performance of the SUT during the LSP tunnel preemption process.

Procedure: Port 1A signals the establishment of an LSP to one of the simulated routers behind RouterTester port 1B, as shown in figure 2. Port 1A forwards data traffic to port 1B to exercise the operation of the LSP tunnel. Port 1A signals the establishment of a high-priority LSP tunnel with bandwidth requirements exceeding the link's current capacity. The SUT preempts the low-priority LSP and establishes the high-priority LSP tunnel. RouterTester verifies the preemption process and measures the packet loss, if any, on the high-priority LSP tunnel.

Easy steps to achieve preemption test

1. An OSPF topology is simulated behind RouterTester port 1B (refer to figure 3), and as shown in figure 2, a low-priority LSP is established between port 1A and 1B. The setup priority value for the LSP is 7 and the hold priority value is 7. The bandwidth attribute for this LSP is 60% of the total link bandwidth. Figure 4 shows how to define the different LSP attributes.

2. Port 1A forwards data traffic to port 1B exercising the LSP tunnel operation, port 1B verifies receiving the packets with the correct label value.

3. Port 1A signals the establishments of a high-priority LSP tunnel to port 1B. For this LSP, the setup priority value is o and the hold priority value is o respectively. The bandwidth attribute for this LSP is also 60% of the total link bandwidth.

4. Due to the LSP attributes requirements, the SUT preempts the lower priority LSP tunnel in favor of establishment of the higher-priority LSP tunnel. Port 1B verifies the establishment of the higher priority LSP.

A sample configuration for Cisco and Juniper routers that accommodates the test is shown in figure 5.

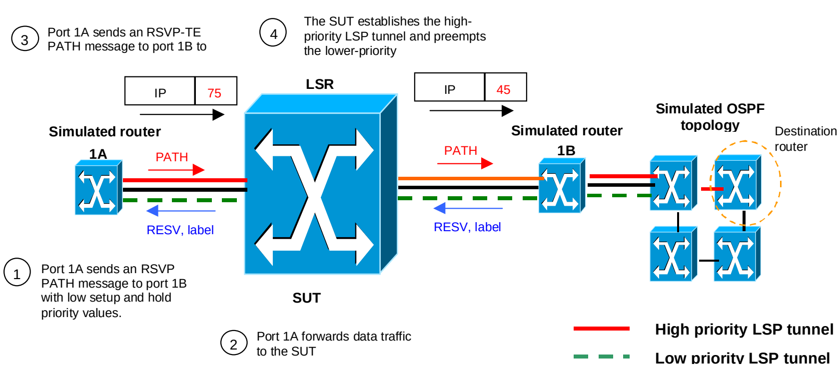


Figure 2: Preemption test scenario

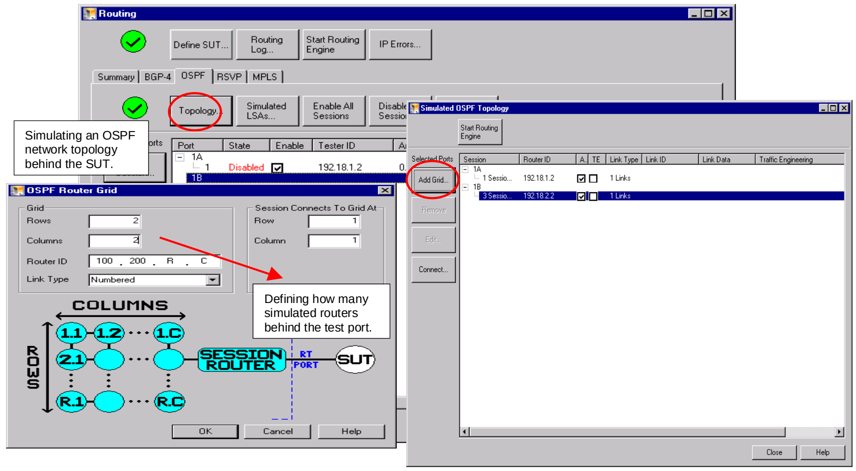
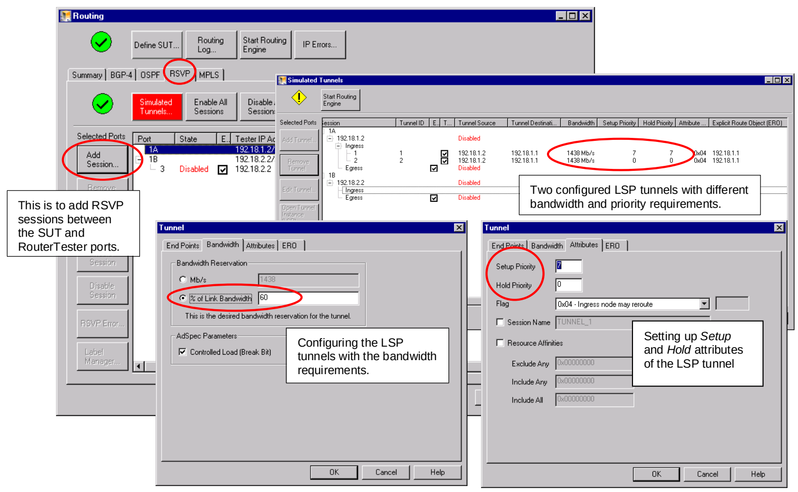


Figure 3: How to add the simulated OSPF topology




```
Interfaces{
      so-0/0/0{
            unit 0{
                  family mpls;
            }
      }
}
protocols{
      rsvp{
            interface all;
      }
      mpls{
            interface all:
```

```
!
nterface POS0/1
 ip address 192.18.1.1 255.255.255.0
 mpls traffic-eng tunnels
 ip rsvp bandwidth 466500 466500
!

router ospf 1
 router-id 120.120.120.120
 network 192.18.1.0 0.0.0.255 area 0.0.0.0
 mpls traffic-eng router-id Loopback0
 mpls traffic-eng area 0
```

Figure 5: Sample configuration for Cisco and Juniper routers

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Agilent IP Routing Test Solution

Agilent's IP Routing Test Solution product family includes Agilent QA Robot and Agilent RouterTester and the test software that runs on these platforms. The QA Robot provides all basic IP routing test capabilities, plus conformance, stress and functional testing. The RouterTester is enhanced with wire-speed traffic generation that enables comprehensive performance metrics and integrated routing protocol support..

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