# Moonv6 Test Suite

*MPLS Provider Edge Router (6PE)*
*Interoperablility Test Suite*

**Technical Document**

Revision 0.1


***IPv6 Consortium***
***InterOperability Laboratory***
***Research Computing Center***
***University of New Hampshire***

***121 Technology Drive, Suite 2***
***Durham, NH 03824-3525***
***Phone: (603) 862-3941***
***Fax: (603) 862-1761***

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# MODIFICATION RECORD

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# ACKNOWLEDGEMENTS

**The University of New Hampshire would like to acknowledge the efforts of the following individuals in the development of this test suite. This test suite belongs to the University of New Hampshire InterOperability Lab and is a collaborative effort of those listed below and the participants of Moonv6. Special thanks to France Telecom for the base test items.**

| | |
|---|---|
| Yann Adam | France Telecom |
| Sergio Catanzariti | France Telecom |
| Henry He | University of New Hampshire |
| Cathy Rhoades | University of New Hampshire |
| Benjamin Schultz | University of New Hampshire |
| Erica Williamsen | University of New Hampshire |

# INTRODUCTION

## Overview

The University of New Hampshire's InterOperability Laboratory (IOL) is an institution designed to improve the interoperability of standards-based products by providing an environment where a product can be tested against other implementations of a standard. This suite of tests has been developed to help implementers evaluate the functioning of their Internet Protocol, version 6 MPLS Provider Edge IPv6 capable products. The tests do not determine if a product conforms to the IPv6 or MPLS specifications, nor are they purely interoperability tests. Rather, they provide one method to isolate problems within a device. Successful completion of all tests contained in this suite does not guarantee that the tested device will interoperate with other IPv6 devices. However, combined with satisfactory operation in the IOL's semi-production environment, these tests provide a reasonable level of confidence that the Device Under Test will function well in many multi-vendor IPv6 environments.

## Acronyms

**RUT: R**outer **U**nder **T**est **TR: T**esting **R**outer **G:** Traffic **G**enerator
**RT: R**oute **T**arget **RD: R**oute **D**istinguisher

When several entities of the same type are present in a test configuration, a number is appended to the acronym to yield a label for each entity. For example, if there were three testing routers in the test configuration, they would be labeled G1, G2 and G3.

**Test Configurations**

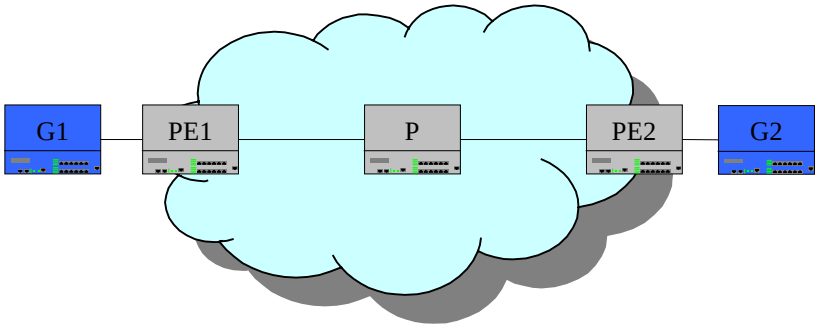


Figure 1: Basic Test Setup

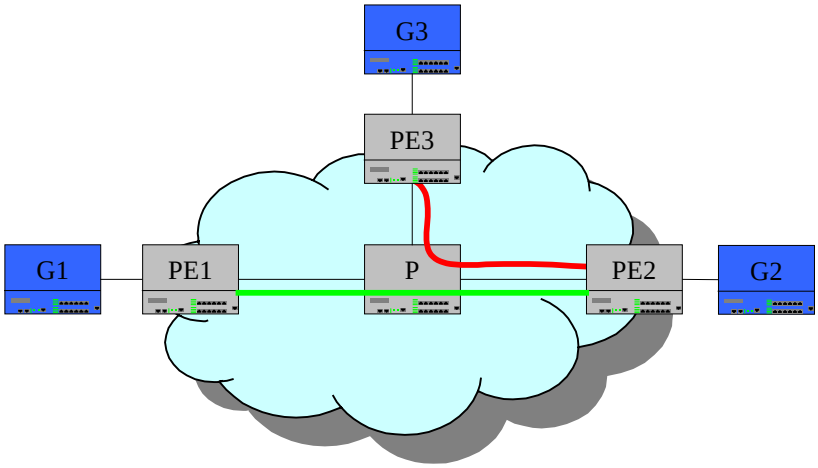


Figure 2: Advanced Test Setup. Different colors represent IPv4 and IPv6 LSPs respectively.

# TEST ORGANIZATION

This document organizes tests by group based on related test methodology or goals. Each group begins with a brief set of comments pertaining to all tests within that group. This is followed by a series of description blocks; each block describes a single test. The format of the description block is as follows:

| | |
|---|---|
| Test Label: | The test label and title comprise the first line of the test block. The test label is composed by concatenating the short test suite name, the group number, and the test number within the group, separated by periods. The Test Number is the group and test number, also separated by a period. So, test label 6PE.1.2 refers to the second test of the first test group in the Provider Edge test suite. The test number is 1.2. |
| Purpose: | The Purpose is a short statement describing what the test attempts to achieve. It is usually phrased as a simple assertion of the feature or capability to be tested. |
| References: | The References section lists cross-references to the specifications and documentation that might be helpful in understanding and evaluating the test and results. |
| Resource Requirements: | The Resource Requirements section specifies the software, hardware, and test equipment that will be needed to perform the test. |
| Discussion: | The Discussion is a general discussion of the test and relevant section of the specification, including any assumptions made in the design or implementation of the test as well as known limitations. |
| Test Setup: | The Test Setup section describes the configuration of all devices prior to the start of the test. Different parts of the procedure may involve configuration steps that deviate from what is given in the test setup. If a value is not provided for a protocol parameter, then the protocol's default is used for that parameter. |
| Procedure: | This section of the test description contains the step-by-step instructions for carrying out the test. These steps include such things as enabling interfaces, unplugging devices from the network, or sending packet from a test station. The test procedure also cues the tester to make observations, which are interpreted in accordance with the observable results given for that test part. |
| Observable Results: | This section lists observable results that can be examined by the tester to verify that the RUT is operating properly. When multiple observable results are possible, this section provides a short discussion on how to interpret them. The determination of a pass or fail for each test is usually based on how the RUT's behavior compares to the results described in this section. |
| Possible Problems: | This section contains a description of known issues with the test procedure, which may affect test results in certain situations. |

## REFERENCES

The following documents are referenced in this text:


[IPv6-SPEC] Hinden, R., S. Deering, Internet Protocol, Version 6 (IPv6) Specification, RFC 2460, December 1998.

[LDP] L. Andersson, et. al. LDP Specification, RFC 3036, January 2001.

[BGPVPN] E. Rosen and Y. Rekhter. BGP/MPLS VPNs. RFC 2547, March 1999.

[2547bis] Rosen et al., BGP/MPLS VPNs. draft-ietf-l3vpn-rfc2547bis-01.txt, September 2003. Work in progress

[6PE] Jeremy De Clercq et. al., BGP-MPLS VPN extension for IPv6 VPN, draft-ietf-l3vpn-bgp-ipv6-01.txt, August 2003. Work in progress.

## Test 6PE.1.1: Basic LDP connectivity and BGP-VPN Functionality

**Purpose:** To verify that a basic BGP-VPN end-to-end connectivity.

**References**: LDP

**Resource Requirements:**

- Monitor to capture packets

**Last Modification**: February 20, 2004

**Discussion**: The basic operation of a MPLS network is the label exchange process and passing traffic end-to-end.

**Test Setup:** Please refer to Figure 1: Basic Test Setup. Connect all routers and traffic generators. Configure IPv4 addressing between the P and PE routers. Enable the IGP (OSPF or IS-IS) and ensure all routers are stable.

**Procedure**:

*Part A: Basic LDP Connectivity*

1. Enable LDP on P, PE1 and PE2.
2. Wait for the labels to be exchanged and the LSP to be established, LSP 1 forming between PE1 and PE2.
3. From G1 and G2, transmit IPv4 traffic in a bi-directional manner.
4. Observe the packets received on G1 and G2.

*Part B: Basic BGP-VPN Connectivity*

5. Configure PE1 and PE2.
6. Wait for the labels to be exchanged and the LSP to be established, LSP 1 forming between PE1 and PE2.
7. Configure VRF, RD, and RT on the PE1 as follows:
    a. VPN1_IP4_G1
        - RD=100:110
        - RT=100:1100 (both import and export)
8. Configure VRF, RD, and RT on the PE2 as follows:
    a. VPN1_IP4_G2
        - RD=100:110
        - RT=100:1100 (both import and export)
9. From G1 and G2, transmit IPv4 traffic in a bi-directional manner.
10. Observe the packets received on G1 and G2.

**Observable Results**:

- In Part A, LSP 1 is established between PE routers and traffic is properly passed between G1 and G2.
- In Part B, PE1 should have in its VRF table an entry to G2 with PE2 as the next hop, and forward all traffic from G1 destined for G2 via LSP 1, and the traffic from G2 destined for G1 to G1. PE2 should have in its VRF table an entry to G1 with PE1 as the next hop, and forward all traffic from G2 destined for G1 via LSP 1, and the traffic from G1 destined for G2 to G2.

**Possible Problems**: None.

## Test 6PE.1.2: IPv6 BGP-VPN Functionality

**Purpose:** To verify IPv6 BGP-VPN connectivity.

**References**: LDP

**Resource Requirements:**

- Monitor to capture packets

**Last Modification**: February 20, 2004

**Discussion**: The basic operation of a MPLS network is the label exchange process and passing traffic end-to-end.

**Test Setup:** Please refer to Figure 1: Basic Test Setup. Connect all routers and traffic generators. Configure IPv4 addressing between the P and PE routers. Enable the IGP (OSPF or IS-IS) and ensure all routers are stable.

**Procedure**:

1. Configure PE1 and PE2.
2. Wait for the labels to be exchanged and the LSP to be established, LSP 1 forming between PE1 and PE2.
3. Configure and IPv6 VRF, RD, and RT on the PE1 as follows:
    b. VPN1_IP6_G1
        - RD=100:110
        - RT=100:1100 (both import and export)
4. Configure an IPv6 VRF, RD, and RT on the PE2 as follows:
    b. VPN1_IP6_G2
        - RD=100:110
        - RT=100:1100 (both import and export)
5. From G1 and G2, transmit IPv6 traffic in a bi-directional manner.
6. Observe the packets transmitted by the RUT on G2.

**Observable Results**:

- PE1 should have in its VRF table an entry to G2 with PE2 as the next hop, and forward all traffic from G1 destined for G2 via LSP 1, and the traffic from G2 destined for G1 to G1. PE2 should have in its VRF table an entry to G1 with PE1 as the next hop, and forward all traffic from G2 destined for G1 via LSP 1, and the traffic from G1 destined for G2 to G2.

**Possible Problems**: None.

### Test 6PE.1.3: IPv6 and IPv4 BGP-VPN Functionality

**Purpose:** To verify simultaneous IPv4 and IPv6 BGP-VPN connectivity.

**References**: LDP

**Resource Requirements:**

- Monitor to capture packets

**Last Modification**: February 20, 2004

**Discussion**: The basic operation of a MPLS network is the label exchange process and passing traffic end-to-end.

**Test Setup:** Please refer to Figure 1: Basic Test Setup. Connect all routers and traffic generators. Configure IPv4 addressing between the P and PE routers. Enable the IGP (OSPF or IS-IS) and ensure all routers are stable.

**Procedure**:

1. Configure PE1 and PE2.
2. Wait for the labels to be exchanged and the LSP to be established, LSP 1 forming between PE1 and PE2 and LSP 2 forming between PE1 and PE2.
3. Configure and IPv6 VRF, RD, and RT on the PE1 as follows:
    a. VPN1_IP6_G1
        - RD=100:110
        - RT=100:1100 (both import and export)
    b. VPN2_IP4_G1
        - RD=100:120
        - RT=100:1200 (both import and export)
4. Configure an IPv6 VRF, RD, and RT on the PE2 as follows:
    a. VPN1_IP6_G2
        - RD=100:110
        - RT=100:1100 (both import and export)
    b. VPN2_IP4_G1
        - RD=100:120
        - RT=100:1200 (both import and export)
5. From G1 and G2, transmit IPv6 traffic in a bi-directional manner.
6. Observe the packets transmitted by the RUT on G2.

**Observable Results**:

- PE1 should have in its VRF table an entry to G2 with PE2 as the next hop, and forward all traffic from G1 destined for G2 via LSP 1, and the traffic from G2 destined for G1 to G1. PE2 should have in its VRF table an entry to G1 with PE1 as the next hop, and forward all traffic from G2 destined for G1 via LSP 1, and the traffic from G1 destined for G2 to G2.

**Possible Problems**: Some devices may have issues forming 2 parallel LSPs simultaneously. Use the topology for Figure 2: Advanced Test Setup if this is encountered.