



Lab Testing Summary Report

November 2005
Report 051120

Product Category:
**MPLS Network
Test/Analysis Tools**

Vendor Tested:
Cisco Systems

Product Tested:
**Cisco MPLS
Diagnostics Expert
(MDE), v1.0**



Key findings and conclusions:

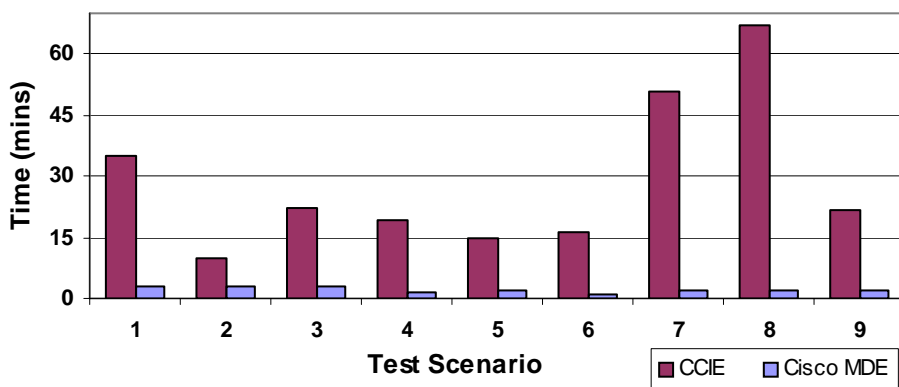
- The Cisco MPLS Diagnostics Expert (MDE) can diagnose network problems more than 10 times faster than a veteran, MPLS-proficient CCIE
- The Cisco MDE can be run by staff with minimal MPLS network-troubleshooting expertise
- The Cisco MDE accelerates handover of problem-diagnostic information to Level-3 support
- The Cisco MDE increases network intelligence and awareness by providing a real-time graphical display of the Label Switched Path (LSP) and MTU (packet size) analysis for VPNs across the MPLS network

Cisco Systems engaged Miercom to independently verify their new MPLS Diagnostics Expert (MDE) v1.0, an MPLS troubleshooting and diagnostic product. The Cisco MDE is an advanced network management product that uses Cisco IOS features to simplify and shorten the process of diagnosing and identifying MPLS network problems on enterprise and service provider networks. The testing was designed to measure the effectiveness of the Cisco MDE in reducing the amount of time to diagnose network problems over that of a manual process.

The test MPLS network had 28 routers. The tests were then created to simulate a variety of problems with a customer's VPN connectivity between end-points. These included a mixture of "access", "edge" and "core" network anomalies.

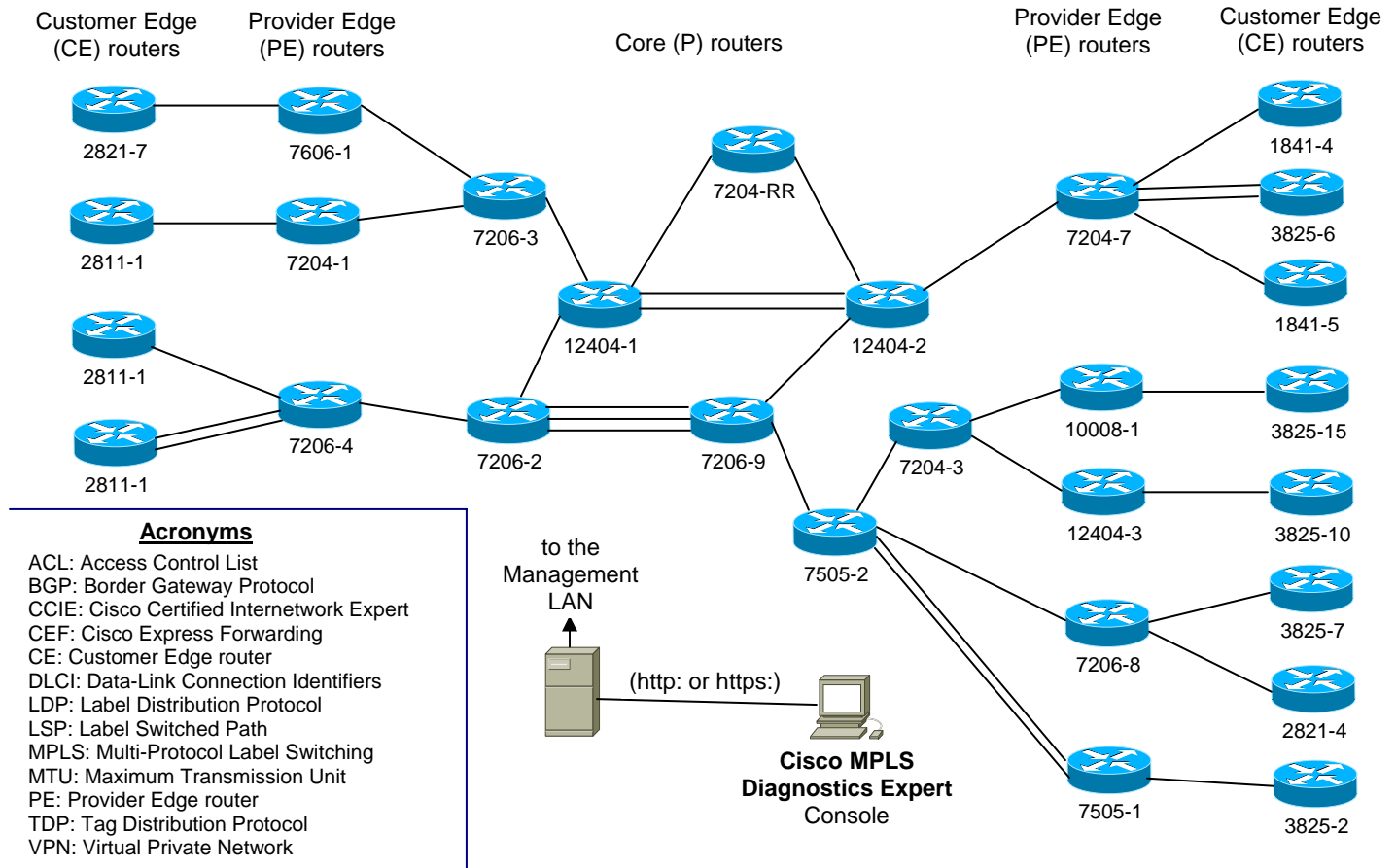
A senior-level CCIE with considerable experience troubleshooting MPLS problems was used for the manual test. The problem end-points were given to the CCIE; and the length of time it took the engineer to identify the source and the cause of the problem was measured. Then the test was replicated using the Cisco MDE product. This time however, instead of using a CCIE, the MDE test was performed by a technician with very limited MPLS or diagnostic experience. In the chart below we compared the results. Observations based on this scenario indicated that the Cisco MDE was easy to use and between 10 and 20 times faster than the manual CCIE-executed diagnostic process.

Manual vs. MDE: How Long to Diagnose Problems?



Comparing diagnosis times between the new Cisco MPLS Diagnostics Expert (MDE) test and analysis product and a Cisco Certified Internet Engineer (CCIE), the Cisco MDE was easy to use and between 10 and 20 times faster than the CCIE diagnosing the same problem.

Test-bed Setup



The tested MPLS network contained 28 routers. Specific failure conditions were created in different routers to test the effectiveness of the diagnostic capabilities of the new Cisco MPLS Diagnostics Expert test and analysis product and the manual CCIE diagnosis. For each test, the problem was defined as a connectivity failure between two end-points (in this case CE routers). The task was to identify which router had the problem and then the cause the problem.

The tested network was comprised of a variety of Cisco router models including 1811, 1841, 2811, 2821, 3825, 7204, 7206, 7505, 7606, 10008, and 12404. The test bed P and PE routers were running Cisco IOS versions 12.0(27)S2, 12.0(30)S1, 12.2(18)SXF, and 12.2(27)SBB. The Cisco MDE makes use of the MPLS OAM (Operations, Administration and Management) functionality (an IETF draft standard) in Cisco IOS® for problem localization.

The Cisco MPLS Diagnostics Expert was connected to the "management" network. The "management" network was configured on a separate LAN from the "production" network. The Cisco MPLS Diagnostics Expert was run on a Sun Ultra 80 workstation running Solaris 2.8 (with a 4 x 450 MHz processor, 4 GB RAM, 2 x 36 GB SCSI disks, with a 100-Mbps network adapter). Although we used an older Sun Ultra 80, the currently recommended server is a SunFire v120, or equivalent. The console was connected to the Cisco MPLS Diagnostics Expert server via a standard web browser. We used Microsoft IE 6.0 (NetScape 7.0 is also supported). A standard http: connection was used for most of the tests, but we also tested using the secure https: protocol.

The CCIE had over 10 years experience in networking – the last year focused on troubleshooting and supporting MPLS networks. However, when using the Cisco MPLS Diagnostics Expert, we observed that a Level-1 support staff person (e.g., a member of the helpdesk) would have been able to do much of the preliminary problem investigation, freeing the CCIE for other network support tasks.

The comparison tests were designed to pit the Cisco MDE product against the expertise and manual testing processes of a CCIE. As soon as the network fault was setup, the details were immediately given to our CCIE, and the clock started. In a typical support organization, the CCIE would normally be part of the Level-3 support team. The resulting times do not include any "handover times" or "escalation times" – which would likely increase the times in a real life scenario. Additionally, with a larger MPLS network, the manual troubleshooting time would increase proportionally with the size of the network (more nodes, larger tables, etc.); while the automated diagnostic processing time would remain relatively consistent.

When debugging multiple problems (as in Test Case #8) the Cisco MPLS Diagnostics Expert product identified each problem individually, as did the manual CCIE process. Therefore, the MDE tool was actually executed three times for this test case; the reported times are cumulative results of these steps. When the problem was fixed, the "Retest" function of the Cisco MDE was used to validate that the connectivity was properly restored.

Diagnostic Scenarios

We concluded that the Cisco MPLS Diagnostics Expert “fits in” well in most support organizations for enterprises and service providers with MPLS networks. The product has two commonly used screens: the first is for the operator to enter the endpoints. A Level-1 or helpdesk staffer capable of reading a network topology map can enter the data, and click “OK” to initiate the diagnostic test.

At this point, one of the most important questions is answered: “Is it our problem or theirs?” If connectivity is confirmed, the Cisco MDE will respond “No loss in connectivity found.” The helpdesk staff can then confidently challenge the caller to go back and check their own network.

The second screen presents the diagnostic results. (See diagram at the right.) Many organizations believe these results can be immediately passed on to Level-2 or Level-3 support staff. To facilitate this process, the operator can export a detailed log which can be appended in the trouble ticket. In our tests, this frequently included a list of 170 commands and the Cisco MDE product made, as well as the CLI output of each command. When the problem is escalated to Level-2, all the diagnostic details can then be reviewed.

The Test Cases

The Miercom tests included nine scenarios. These were selected to simulate some of the more common failures likely to be encountered in MPLS networks. Cisco indicates that over 95 scenarios are handled with v1.0 of the MDE product.

Test Case #1 was an access circuit connectivity problem that resulted from an incorrect DLCI setting at one end of a frame relay circuit. This can occur as a provisioning error when multiple groups do not coordinate the provisioning details. This test case highlights one of the other key uses of the Cisco MDE product – to validate network changes or additions, end to end.

Test Case #2 was caused by the failure to establish a MP-BGP neighbor session (normally the Route Reflector). This can occur if the BGP sessions are not configured properly on the Route Reflector. As with many problems of this type, it’s possible the configuration was changed but not saved, and the router was rebooted later.

Test Case #3 was caused by CEF not being enabled on one of the routers. It’s important that the Cisco MDE product actually checks the running processes in the router, and not just the configurations.

Test Case #4 was an LDP session failure (LDP ID not reachable). This might be due to an incorrect loopback address being used by the router (and the resulting redistribution error). It’s possible this occurred on a router reboot. This was a core router problem.

Results from the Cisco MPLS Diagnostics Expert are presented on a graphical user interface showing the Label Switched Path (LSP) and describing the Possible Causes of the problem and Recommended Actions.

Test Case #5 was a missing “redistribute” statement in an edge router for an address-family IPv4 route. This would likely occur during the provisioning of a new VPN.

Test Case #6 was two adjacent routers running different distribution protocols – one running TDP and the other running LDP. (TDP was the default protocol on some older IOS images.) This could be due to an ACL design that does not allow LDP-related traffic on the link.

Test Case #7 was an LDP session not established due to an incorrect ACL on an edge router. This could be caused by an ACL configuration that does not properly take into account the LDP interactions.

Test Case #8 simulated a multiple-failure scenario that could be created by a limited “maintenance window.” In this case multiple changes are accumulated until they can be applied. This can cause complex diagnostic challenges because one problem can affect the diagnosis of other problems. This test case had two edge-router problems and one core-router problem.

Test Case #9 involved a serial interface configured in loopback mode on an edge router. This might happen if an engineer was performing diagnostic tests, put the interface in loopback mode, and forgot to reset the interface before putting the router back into production.

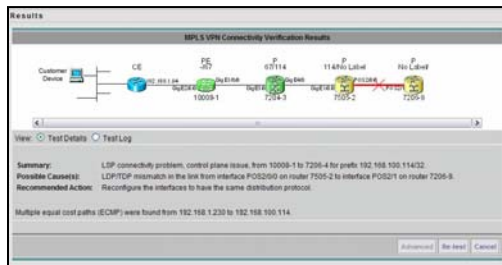
Integration with Cisco IP Solution Center (ISC)

Most of the MDE tests we ran were on VPN sites provisioned manually – that is, not via ISC. We also ran Test Case #6 on a VPN that had been provisioned with ISC and we were able to use some of the integration capabilities of MDE and ISC. The “Populate from VPN” function allows the operator to access the ISC database; select the specific customer’s VPN, and the local and remote sites having the connectivity problem. This reduced the data-input time to the Cisco MDE by more than half, and resulted in fewer input errors.

Miercom Verified Performance

Based on Miercom's lab testing of the Cisco MDE product – and examination of its operation and features, as described herein – Miercom attests to its performance, in particular:

- The Cisco MPLS Diagnostics Expert can diagnose network problems more than 10 times faster than a CCIE using manual processes
- The Cisco MDE can be run by staff with minimal MPLS network troubleshooting expertise
- The Cisco MDE product expedites handover and sharing of troubleshooting diagnostic information to all levels of support staff
- The product simplifies diagnostics by graphically displaying the LSP (Label Switched Path) and an MTU Analysis for VPNs though the network
- Cisco MDE can be run as a stand-alone product, on VPNs that have been provisioned manually, or the Cisco MDE can be used with Cisco's ISC to provide even more advanced level of "ease-of-use" with the integrated access capability to Cisco's ISC MPLS VPN database.



Cisco MPLS Diagnostics Expert



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