Ensuring Reliable Ethernet Forwarding in Switched Networks

By Joe Gomez

The Challenges of Ensuring Ethernet

As communications networks become increasingly complex, service providers who do not own 100 percent of their networks need to prove Ethernet forwarding transparency from end to end to ensure the proper functioning of their equipment. Likewise, providers who lease bandwidth over their networks must have the capability to offer an Ethernet service that does not modify, filter, or change the Ethernet traffic. By default, most Ethernet equipment is not transparent and instead exchanges or filters control plane traffic such as spanning tree; so when configuring a connection, technicians must be able to prove their configuration creates an end-to-end transparent circuit.

Today, Business Service technicians and Central Office technicians who perform end-to-end circuit installation and provisioning must use an external analyzer or a PC running an analysis program to troubleshoot control plane forwarding across all network elements, end to end.

Troubleshooting an end-to-end circuit installation that cannot transparently pass control frames often requires at least one junior technician with an analyzer at one end and a senior technician with another analyzer at a central office. The senior technician must guide the junior technician through the testing process while the senior technician analyzes the results. This process is repeated until all segments of the network with active Ethernet forwarding equipment have been tested, from the circuit endpoint to the central office. The process also may involve numerous teams of technicians as a circuit is traced across multiple central offices, sometimes across a very large geographic area. Deploying technicians locally can be costly, but deploying numerous teams of technicians in different parts of the country can prove prohibitively time consuming and costly for network owners.

Verifying Ethernet from End to End

Testing Layer 2 Ethernet control plane forwarding across networks, network elements, and third-party-provided network segments verifies end-to-end Ethernet forwarding in one easy step and avoids potentially expensive and protracted troubleshooting. Unlike sending Ethernet over dark fiber when Ethernet passes over switched networks, improperly configured network elements such as routers and switches can filter or even drop control plane messages, multicast, and broadcast traffic, which can cause hours of troubleshooting and installation delays.

Offering network owners a tool that empowers their junior technicians with the ability to prove Ethernet forwarding transparency during circuit installation reduces operating expenses significantly. Even in troubleshooting situations that do require sending a technician to a remote site, having a tool that can prove Ethernet forwarding transparency saves time and may avoid the need to use a senior technician instead. The ability to pre-test Ethernet circuits for transparency likewise speeds up the installation process by avoiding re-visiting a site to correct a problem.

JDSU T-BERD® 6000A and 8000 Test Platforms

The JDSU T-BERD 6000A and 8000 platforms are the only tools on the market today that offer proof for both network owners and service providers that their network is transparently forwarding Ethernet. JDSU J-Proof is a test option that verifies transparent end-to-end Ethernet forwarding through switched Ethernet networks, which is useful during circuit installation to eliminate finger-pointing later. With its J-Proof test capabilities, the T-BERD test platforms provide semi-automated test setups that configure and test for most parameters critical to the application. When combined, the test features enable T-BERD 6000A and 8000 users to simultaneously check the VLAN Priority bit (P-bit) settings additionally confirming control messages are not dropped due to protocol time-out. Both the T-BERD 6000A and 8000 offer robust graphical user interfaces (GUIs) with easy-to-read Pass/Fail results that—when combined with the semi-automated test setup—offer simple, repetitious tests with powerful customization.

Having the ability to test transparency over virtual local area networks (VLANs) can help verify the transparency of a specific customer to their SLA, which lets providers fine tune their troubleshooting to the specific VLAN or service that is experiencing the problem. Testing proprietary Cisco VLAN Trunk Protocol (VTP) and Cisco Discovery Protocol (CDP) using non-standard Ethernet frames can provide proof of end-to-end transparency even through networks that use Cisco equipment. Testing transparency of registration and topology protocols such as Generic Attributes Registration Protocol (GARP), GARP for multicast (GMRP), Generic VLAN Registration Protocol (GVRP), Spanning Tree Protocol (STP), Rapid STP (RSTP), and Multiple STP (MSTP) ensures that user bridges and switches can exchange messages needed to change topologies and register multicast based services such as video.

Uses for the J-Proof Ethernet Transparency Test with the T-BERD Platforms

The T-BERD 6000A and 8000 test platforms can be used in a myriad of scenarios to turn up and troubleshoot Ethernet circuits. Here we will describe three typical use cases.

Ethernet Element Test during Circuit Turn-up

Figure 1 shows a typical test scenario to test Ethernet elements during circuit installation, which can be performed using two junior technicians using two T-BERD 6000As or a 6000A and a T-BERD 8000.

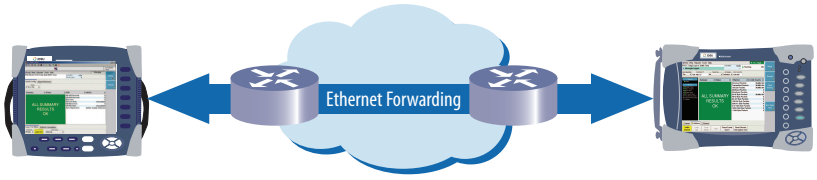

Figure 1. Ethernet element test during circuit turn-up

Provisioning point-to-point Ethernet circuits requires a typical procedure that includes a sequential set of tests. An Ethernet connectivity test first verifies the presence of a signal and that a link has been acquired. An Ethernet bit error rate test (BERT) follows the connectivity test to confirm proper configuration of the SLA. Finally, an RFC 2544 test automates the process of confirming throughput, latency, and frame loss at different traffic rates with varying packet sizes. Adding a J-Proof Ethernet Transparency Test Using the test can confirm the transparent forwarding of Ethernet traffic between endpoints. This additional test helps network owners avoid customer calls and trouble tickets when users of their network space are later unable to pass Cisco CDP/VTP traffic, STP traffic, or the GARP family of topology discovering Ethernet traffic.

The second scenario shown in Figure 2 illustrates Ethernet service turn-up for the last mile.

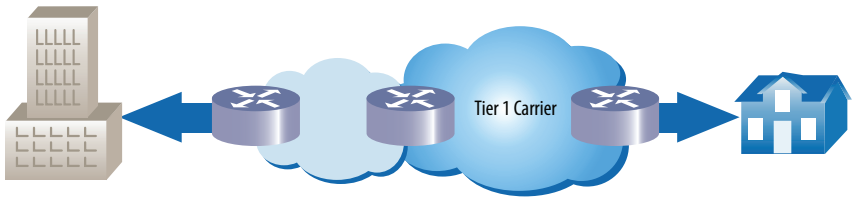

Figure 2. Last mile Ethernet Service Turn-up

Facilities-based service providers have several options for delivering Ethernet service to customers outside the normal coverage area. One option involves leasing an unbundled network element (UNE) and installing a collocated access concentrator such as a Digital Subscriber Line Access Multiplexer (DSLAM) or Optical Line Termination (OLT). A more cost-effective approach is to use the infrastructure of the owner of the copper or fiber and confirm the SLA and Ethernet circuitry transparency during service turn-up. In this second scenario, the facilities-based service provider tests the Ethernet circuit for transparency to ensure that control plane traffic used to manage the CPE transparently traverses the owner's access network.

The third scenario shown in Figure 3 illustrates Ethernet circuit backhaul where the service provider owns a portion of the network in two separate regions but not the portion in between.

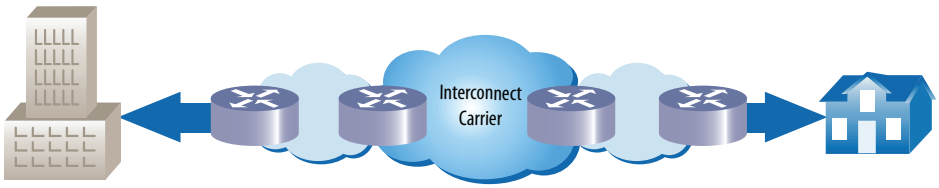

Figure 3. Ethernet circuit backhaul

Delivering Ethernet services across a broad geographical area sometimes forces service providers to lease an interconnect facility to attain the required connectivity. Best practice test procedures include performing Ethernet connectivity tests, Ethernet BERT, and frequently an RFC 2544 test to establish that the circuit conforms to the purchased SLA. The RFC 2544 test specifically verifies throughput, latency, and frame loss. Adding the J-Proof test lets service providers confirm provision of transparent Ethernet forwarding so that the required control plane messaging passes through properly to manage and configure remotely located elements.

Conclusion

Ethernet transparency testing is necessary to eliminate finger-pointing when issues arise while deploying Carrier Ethernet networks that are not completely owned by the network operator or shared with other service providers. Transparency testing can often be labor intensive and time consuming, which is costly for network owners and service providers who must ensure that circuits conform to SLAs. Network operators and service providers both need testing tools that can prove that their networks are turned up properly and ensure connectivity for the services they provide their customers.

JDSU offers the only testing solution on the market that can provide network operators, service providers, and other enterprises with a comprehensive tool that proves control plane transparency of an Ethernet circuit as well as confirms throughput, latency, and frame loss. Only the J-Proof test option for the T-BERD 6000A or 8000 can ensure that Cisco, Spanning Tree and GARP Ethernet messages will not be dropped or filtered out, making it the ideal tool for network owners, service providers, and enterprises that must prove Ethernet transparency for circuit turn-up and troubleshooting. The J-Proof testing option is a powerful and cost-effective solution for any network owner or service provider who must ensure their network meets Ethernet SLAs or who wants to reduce their operating expenses related to turning up circuits or troubleshooting Ethernet network issues.

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