Installation, Commissioning, and Maintenance of Metro Ethernet Networks

Using T-BERD/MTS 8000 and NetComplete (QT-600) Metro Ethernet Service Solution

Introduction

Service providers face significant challenges in bringing carrier grade Ethernet products and services to market. Challenges during deployment include the need to reduce installation times, Mean time to repair (MTTR), and decrease the overall technology learning curve. Challenges during network maintenance include ability to remotely isolate network and service level faults in order to dispatch personnel to fix, not find problems.

With the dramatically increasing demand for Metro Ethernet services to support businesses, coupled with the start of the migration of residential users to IP-based applications such as IPTV and VoIP offerings, providers now need to be able to install, commission, and maintain these carrier grade Ethernet networks.

Additionally, the management tasks for this network have been further complicated by the introduction of service level agreements (SLAs) that specify stringent quality of service guarantees. These guarantees, called quality of service or quality of experience, will come under greater scrutiny as IPTV gains traction with consumers because poor-quality video/TV increases customer churn.

The increasing adoption of triple play services over a converged IP infrastructure has created new testing requirements, namely:

- The ability to rapidly install new connections

- The need to minimize future repair costs

- The need for a reliable method to maintain networks with minimal technician dispatches

JDSU addresses these three key features with a cost-effective and flexible testing solution that combines JDSU's Ethernet field test set T-BERD/MTS 8000 (TB/MTS 8000) with JDSU's NetComplete Metro Ethernet Service Assurance Solution, which is comprised of a rack mountable QT-600 Ethernet IP testhead and the centralized NetAnalyst Test OSS.

TB/MTS 8000 Capabilities

The TB/MTS 8000 is a dual port field Ethernet/IP test set. It offers an extensive range of capabilities, including:

- Layer 1 testing to verify end-to-end physical connection, ensuring that the physical layer can sustain 10^{-12} BER

- Layer 2 testing for installation, commissioning, and maintenance of Ethernet services, including RFC2544

- Layer 3 testing for installation, commissioning, and maintenance of IP services, including RFC2544

- Easy to setup filtering capability to view specific customer traffic, and verify its performance

- Ease of use, including industry accepted user interface and web-based remote control capability

NetComplete Metro Ethernet Service Assurance Solution

NetComplete combines the QT-600, an Ethernet testhead that can be distributed at key aggregation points in the network, including central offices and points of presence, with NetAnalyst, a centralized test OSS responsible for testhead management, test creation, and results presentations.

NetComplete for Metro Ethernet's key strengths include:

- Continuous quality of service and service availability testing, monitoring, and analysis

- On-demand and scheduled testing

- Service turn-up verification (including RFC2544)

- Rapid fault isolation and troubleshooting (Ping, Traceroute, network monitoring, loopback)

- Full line rate capture with capabilities to filter data using extensive triggers and filter criteria

- QT-600 multi-interface support for 10/100/1000 Mbps interfaces

- Single solution for triple play services (voice, IPTV, and data)

The TB/MTS 8000 and NetComplete Solution have been designed to be interoperable, therefore dramatically expanding the testing capabilities of the service provider. As shown in the following examples, leveraging this interoperability reduces the travel time and increases the efficiency of the network support teams.

Metro Ethernet Applications

Metro Ethernet Installation & Commissioning

When installing and commissioning Ethernet services, it is important to verify the SLA per the customer contract. This includes verification of connectivity, throughput, frame loss, and latency. This type of testing serves two main purposes: first to provide a record/certificate to the customer that the link meets the SLA requirements; second to serve as a benchmark to the service provider to help manage the overall network and use as a reference for possible future maintenance issues. When completed correctly, this process also has the added benefit of reducing the number of later dispatches to rectify initial incorrect installations. Finally, due to the TB/MTS 8000's test setups, this whole process can be standardized with repeatable methods for achieving consistent results.

The Ping capability of the TB/MTS 8000 and QT-600 enables the field technician to go to an end-customer site and use the TB/MTS 8000 to verify end-to-end connectivity between the end-customer site and any QT-600 deployed in the network (edge, core, access). Additionally, by using NetAnalyst from a centralized network operations center (NOC), the QT-600 can issue a mesh of Pings to TB/MTS 8000s and other QT-600s in the network to determine connectivity to multiple sites/locations at the same time. Once the link connectivity has been verified, the actual SLA benchmarks can be tested by performing a loop-up test either from the TB/MTS 8000 towards the QT-600, or vice-versa. Following this, a RFC2544 test can be carried out to provide clear SLA benchmark test verification.

Because the QT-600 can support multiple connections, installation and commissioning can be done in parallel, which can reduce time to complete this work and increase efficiency. Additionally, this process can be automated from a centralized location using NetAnalyst. This can offer significant cost savings by allowing multiple technicians to work simultaneously when a new high density location is being activated.
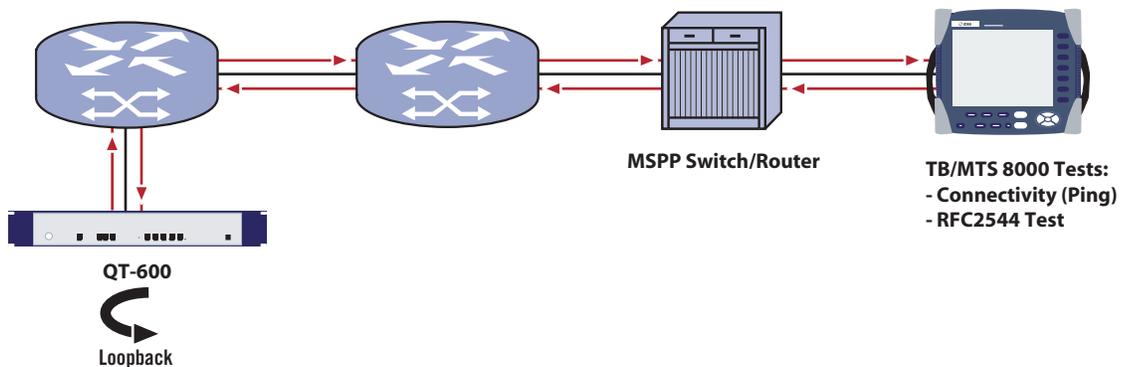

MSPP Switch/Router

TB/MTS 8000 Tests:
- Connectivity (Ping)
- RFC2544 Test

QT-600

Loopback

Figure 1 – Metro Ethernet Service Installation

Troubleshooting - Customer Complaint Resolution

The end-customers typically require some form of SLA in order to accept the service from a provider. In the event of a customer complaint, a TB/MTS 8000 can be used to replace the customer equipment when the customer equipment cannot be looped back. The QT-600 can be used to sectionalize the network from a centralized NOC using NetAnalyst by automatically looping up the TB/MTS 8000 and other QT-600s distributed throughout the network. The QT-600 can then use its extensive range of analysis capability to evaluate the link and identify problems.

MSPP Switch/Router

TB/MTS 8000 Tests:
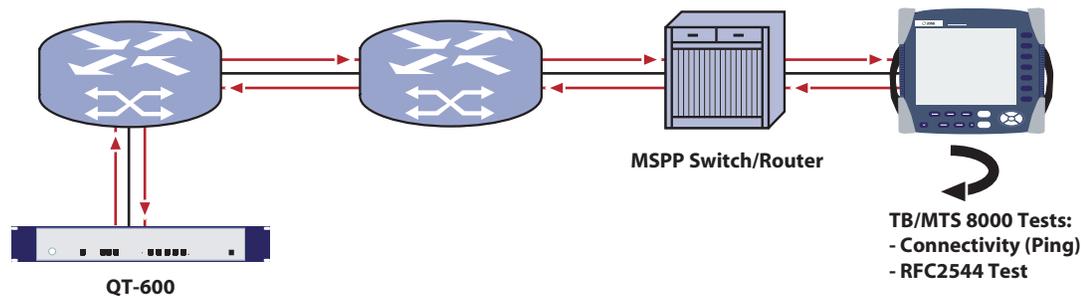**- Connectivity (Ping)**
- RFC2544 Test

QT-600

Figure 2 – Service troubleshooting with the TB/MTS 8000 and QT-600

For IPTV applications, it is important to note that prior to dispatching the technician, the QT-600 can be used to perform a detailed analysis of the link from the head end to the DSLAM by looping up the DSLAM. This helps better identify the fault location and, again, reduces unnecessary dispatches of support staff. Some modification to the DSLAM operating code may be required to fully facilitate the ability of the QT-600 to loop up the DSLAM.
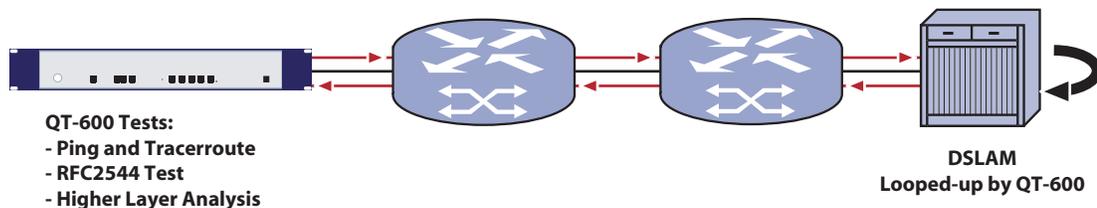
QT-600 Tests:
- Ping and Tracerroute
- RFC2544 Test
- Higher Layer Analysis

DSLAM
Looped-up by QT-600

Figure 3 - QT-600 performing loop-up at the DSLAM

End-to-end Service Verification

With businesses often distributed across many locations, it is essential that the service provider can verify end-to-end service for all end-customers. Using two TB/MTS 8000s, located at two of the customer sites, service providers can prove full end-to-end connectivity as well as perform detailed fault finding in both directions of the service – at all layers of the service. Easy to setup filtering capability allows providers to filter on specific customer traffic, and verify its performance, including VLAN, TOS/DSCP prioritization of traffic.
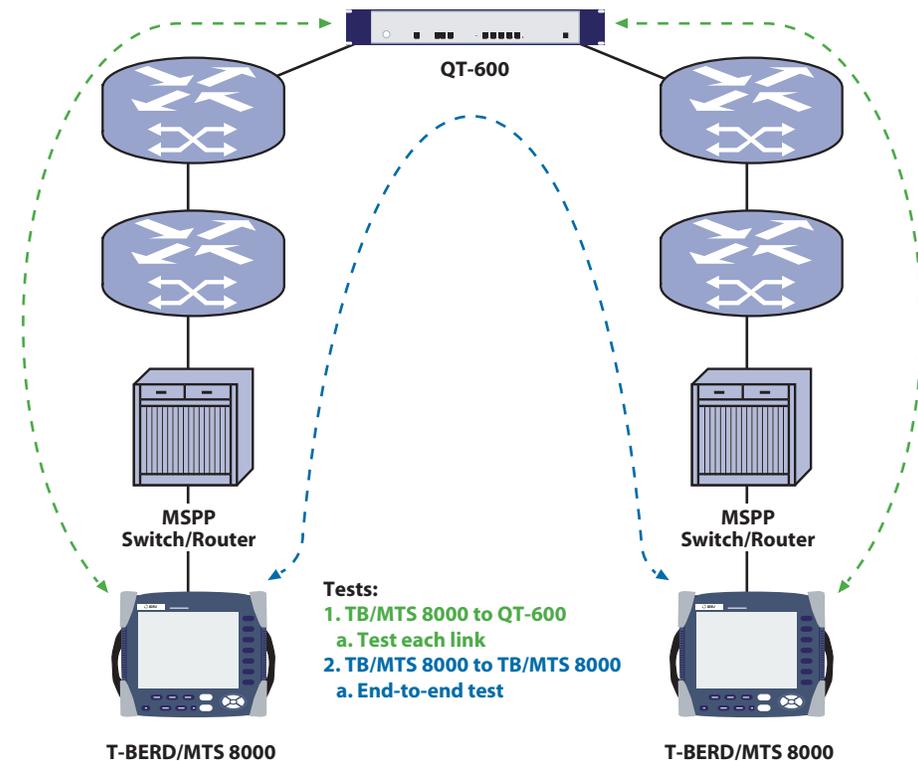

QT-600

MSPP Switch/Router

MSPP Switch/Router

Tests:
1. TB/MTS 8000 to QT-600
  a. Test each link
2. TB/MTS 8000 to TB/MTS 8000
  a. End-to-end test

T-BERD/MTS 8000

T-BERD/MTS 8000

Figure 4 - End-to-end service troubleshooting and verification

Additionally, the QT-600 offers the ability to perform full line rate capture of live traffic and automatically transfers the capture file to the NetAnalyst server, where the full seven-layer decode analysis can be performed using the JDSU Examine software program. The QT-600 supports sophisticated filters and triggers to drill down and limit the amount of data captured to facilitate troubleshooting. The capture function can be used in conjunction with the QT-600 network monitor capability, referred to as Netmon, which provides analysis of live traffic by displaying bandwidth utilization trending graphs, frame distribution statistics, and Top N analysis (VLANs, IP/MAC pairs, talkers, Listerners, Conversations,Vlan Priorities and top applications). For real-time traffic analysis, providers also can use the JDSU DA-3400 product which can be placed in the same location as the QT-600.

Conclusion

As Metro networks evolve, IP-based applications and deployment are soaring, new testing applications have become increasingly more complex and varied. However, the major goals of service providers to reduce mean-time-to-repair (MTTR), limit errors in the field, decrease technology learning curve, and reduce technicians' dispatches have remained the same. JDSU offers the most complete testing methods to support Metro Ethernet offerings, including installation and verification of IPTV networks.

The TB/MTS 8000 allows technicians to first check the physical connection (layer 1) using the BERT capability, then verify the ability of the link to carry traffic using extensive layer 2 (Ethernet) tests, and then complete the layer 3 (IP) evaluation before releasing the link to full service. Easy to setup filtering capability allows providers to filter on specific customer traffic, and verify its performance, including various traffic prioritizations.

This provides a comprehensive and robust installation to minimize future problems. Using the combination of TB/MTS 8000s and distributed QT-600s, centrally controlled via NetAnalyst, will reduce the traveling time required to perform this installation.

The compatibility of the QT-600 and TB/MTS 8000 provides an extremely powerful evaluation solution for maintenance and trouble identification and isolation, while minimizing the amount of travel time taken to locate and resolve field problems. All this helps to cost effectively manage the ever increasingly complex Metro Ethernet networks.

The final set of features that offer significant benefits for in-depth trouble analysis include: the QT-600's data-capture capability with filters and triggers; full seven-layer decode by JDSU Examine software; and the QT-600's trending analysis along with network monitoring (Netmon) application.This combination of test equipment and software facilitates the analysis of the full seven layers of Metro Ethernet service offerings.

JDSU's Metro Ethernet portfolio encompasses a comprehensive suite of instruments and solutions covering the entire network and service deployment lifecycle of the Metro Ethernet offerings.

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