Business Ethernet Revisited:
The Testing Imperative

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Table of Contents

1 Introduction .................................................................................................................. 3
2 Market Size .................................................................................................................. 3
3 Ethernet past, present ................................................................................................. 4
4 Testing Ethernet ........................................................................................................... 4
5 Business Case ............................................................................................................... 5

About VeEX ...................................................................................................................... 6
1 Introduction

The business services opportunity for the cable industry still beckons. Ethernet has emerged as a key enabling technology for its speed, low cost and flexibility.

Cable operators have gained a small share of the telco-dominated business services market but are relatively stronger in retail and wholesale Ethernet services. Testing plays a critical role in the installation and maintenance of these services, which typically require adherence to service level agreements (SLAs). Prerequisite to testing is a workforce trained to use test and measurement (T&M) equipment.

2 Market Size

For years, industry observers have talked about the size of the business services opportunity. Multiple system operators (MSOs) have embraced this market to varying extents. Business services account for 11 percent of revenue at Cox, 6 percent at Charter, 5 percent at Time Warner Cable and 2 percent at Comcast.¹

Overall, U.S. MSOs generated an estimated $5 billion in business services in 2010. Yet analysts still point to how small this is as a share of the larger market. While forecasting cumulative revenue of $35.5 billion for cable operators over the next five years, Insight Research notes that those numbers remain “only a tiny fraction of the $130 billion spent annually by businesses on telecommunications services.”²

The industry does better in one growing category. According to the Vertical Systems Group, by the end of 2010, cable had an 18 percent market share of the U.S. business Ethernet market.³ In terms of ports, the overall market grew by 34 percent in 2010. Annually, U.S. businesses spend $3 billion on retail Ethernet services.

Companies spend another $500 million to $1 billion on wholesale Ethernet services. One part of that market, cellular backhaul, has received special attention from MSOs recently. Now serving 5 percent of all U.S. cell towers, MSOs generated an estimated $200 million in 2010, primarily from Verizon, T-Mobile and Sprint.⁴

² “Cable TV Operators, Telecom Services and the Push into the Enterprise 2010-2015,” Bob Rosenberg, Insight Research Corp, released November 9, 2010. Heavy Reading’s Breznick said cable’s current share is “a mere 4 percent of the total.”
3 Ethernet past, present

Codified by the IEEE’s 802.3 subcommittee in the early 1980s, Ethernet benefited as an international standard and became ubiquitous in the local area network (LAN). By the late 1990s, Ethernet had acquired “Fast” and “Gigabit” designations and was migrating into the metro and wide area network (MAN/WAN).

More flexibility emerged in the 2000s as the Metro Ethernet Forum (MEF) advanced service specifications such as Ethernet Private Line (EPL) and Ethernet Virtual Private (EVP)-LAN. In parallel, the IEEE added features such as link-layer operations administration and maintenance (OAM) (IEEE 802.3ah) and service-layer OAM (IEEE 802.1ag, identical to ITU-T Y.1731).

As Ethernet matured, its range of speeds grew from 1 Mbps to 10 Gbps to now 100 Gbps. The emergence of timing solutions also allowed its application to grow in areas once dominated by plesiochronous or synchronous digital hierarchy (PDH, SDH)-based services, such as E1/T1. Cellular backhaul is one of those markets.

Ethernet’s favorable cost structure also helped with its adoption. For two-plus years (roughly since the iPhone’s launch in 2008), the mobile industry has fixated upon the delta between the projected exponential growth of mobile traffic—and related delivery costs—and the linear increase in customer revenues. Ethernet can help mobile operators narrow that gap.

4 Testing Ethernet

Low prices may open doors for Ethernet service providers, but winning and retaining customers requires smart delivery of services. That means everything from identifying circuit IDs to testing services at turn-up to executing SLAs.

The starting point for Ethernet service testing is Internet Engineering Task Force (IETF) Request for Comment (RFC) 2544, “Benchmarking Methodology for Network Interconnect Devices.” Issued in 1999, this 30-page memorandum “defines a specific set of tests that vendors can use to measure and report the performance characteristics of network devices.”

Four of the basic tests covered in that document include:

- **Throughput**—The fastest rate at which the count of test frames transmitted by the device under test (DUT) equals the number of test frames sent to it by the test equipment. A common test method is to send traffic first at maximum speed and then at incrementally reduced speeds until reaching the point at which all traffic is sent with no frames dropped.

- **Latency**—A measurement of time delay in a system, the test involves one time-stamp (A) on a frame sent after one minute and another (B) on the frame looped back to the receiver on the test equipment. Latency for a particular frame size is B minus A. The test is repeated twenty times for each frame size being transmitted.

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5 Current timing solutions are vendor-specific; standardized software (IEEE 1588.v2) and hardware (Sync-E) approaches to Ethernet timing are also in development.

• **Frame loss rate**—The ratio of successful frame receptions to the attempted frame transmissions at the committed information rate (CIR). The test begins at the maximum rate per frame size for a certain number of frames; then repeated at reduced intervals until no frames are lost.

• **Back-to-back frames**—The procedure is to send a burst of frames with minimum inter-frame gaps to the DUT and count the number of frames that the DUT forwards. Then, either the burst is increased or its length is reduced. The value is the number of frames in the longest burst that the DUT will handle without loss of frames.

Two additional RFC 2544 tests include system rest and system recovery. All in all, this set of tests captures most of the Ethernet issues that face operators in the field. But there are others.

Variation in latency, aka jitter, is not defined in RFC 2544 but is critical to services, such as voice over IP (VoIP), that emerged after the document’s release. There are also various ways to measure throughput, for instance: with or without overhead frames. Another issue related to frame size is reduced speed triggered by buffers for transmission control protocol (TCP) acknowledgments (acks). In those cases, file transfer protocol (FTP) tests shed light on actual data rates. Then there is the reality of concurrent service levels.

Today’s Ethernet services could include mobile backhaul, business and wholesale, each carrying voice, video, data, gaming and other applications. RFC 2544, which began life as a way to benchmark devices in a lab environment, alone is insufficient for validating the multi-service SLAs that accompany such complex live offerings. What operators require are additional multi-service test capabilities.\(^7\)

Finally, some advanced MEF service definitions may include stacked VLANs or assume multi-protocol label switching (MPLS) topologies, which call for additional testing functionalities. And the Y.1731 protocol, mentioned above, employs loop-backs, “keep-alive” messaging and other OAM-type tools.

5 **Business Case**

The argument for devices that can test Ethernet in all its varieties is simple: Customers expect it. That requirement will only increase going forward.

MSOs have succeeded with Ethernet in part because it is a fast and inexpensive technology. But even if some business customers are concerned only about uptime and latency, there still remains the need to certify those parameters when the service is turned up. To meet the SLAs of more demanding—and higher paying—customers requires more functionality and possibly even full-service monitoring.

The trend toward incorporating performance-tracking network interface devices (NIDs) into the service provider network and at the customer edge could help satisfy such customers, although it will take several more years to make this approach work industry-wide. Meanwhile, the need for handhelds and paired devices that offer complete tests for Metro Ethernet network installation and maintenance is here and now.

\(^7\) These and other tools and applications are part of VeEX’s RFC 2544 Advance SLA feature.
That need will grow as MSOs attempt the difficult task of capturing a greater share of the overall business services market. Pointing to increasingly stiff competition and tight profit margins, Sanford Bernstein Senior Analyst Craig Moffett told a Light Reading audience in New York City last December that the best opportunities for MSOs in the near term are in transport services and as secondary providers. Ethernet is well suited for both cases.

In meeting those opportunities, MSOs can realize a good return on investment (ROI) not simply from T&M equipment, but also from training. Those with field experience know that this is one of the biggest challenges in Ethernet services today. The training deficit faces technicians working for telcos, MSOs and contractors alike. Rich resources, such as SCTE Live Learning seminars, are readily available to those motivated to learn and grow the Ethernet services market.8

Ultimately, a well-trained technical team using cost-effective and fully functioning test equipment can help MSOs make sales, preserve margins, satisfy customers and gain rightful share of this valuable market segment.

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About VeEX

Located in the heart of Silicon Valley, VeEX provides innovative test and measurement solutions for next-generation communication equipment and networks. Founded in 2006 by test and measurement industry veterans, VeEX builds products that blend advanced technology and vast technical expertise with the discerning measurement needs of customers.

VeEX core expertise and product lines range from DSL, Broadband and Cable TV to Metro and Next Generation Transport Networks. VeEX’s multinational structure consists of several specialized business units operating in different parts of the world. VeEX has shipped more than 10,000 units since volume production began.

Industry consulting firm Frost & Sullivan has benchmarked VeEX against other leading test and measurement companies. As a result, among other awards, VeEX is the proud recipient of the 2009 Global Gigabit Ethernet Test Equipment Price Performance Value of the Year and the 2008 Global Test & Measurement Emerging Company of the Year.

The VeEX team brings simplicity to tomorrow’s networks.