WEB EXTRA: What's Holding Fiber Networks Back?

Providers Should Take a Page From the DSL Playbook on Automating Fiber Networks
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"I want my IPTV. And my video telephony, music downloads, photo and video uploads… with some streaming games thrown in for good measure."

That's the growing (though admittedly not concise) call of the latest generation of broadband service customers. Driven by the explosion in online social and interactive media, the demand for high-bandwidth services is escalating. Research firm Infonetics reports that, in North America alone, the market for residential voice, video and data services will hit $300 billion by 2013.

In turn, awareness of the availability of these services is driving new demand for higher bandwidth connections. According to a report by *eMarketer*, the number of broadband households using technology other than cable or DSL—especially fiber, will more than double by 2012 to a total of 8.6 million.

Putting its own stamp of approval on fiber networks, *PC Magazine* said in its 2009 "ISPs Service and Reliability" survey, "Obviously, if you want the very best experience you can have going online, you want fiber to the home."

The good news is that broadband service providers around the world are heeding the call and have already spent billions of dollars laying new, ultra-high-speed fiber networks to meet the demand. Unfortunately, return on investment remains elusive, making the future of fiber networks, and the services that run on them, uncertain. What's holding fiber networks back?

Deployment Costs Remain High

In spite of gargantuan investments by network operators, the demand for fiber connections, including fiber to the home (FTTH) and point to point/PON networks, along with the services they enable, continues to outstrip the supply. That's because providers are treading cautiously, carefully controlling how these deployments are rolled out to ensure that the new fiber infrastructure and services can deliver the level of experience their customers have come to expect.

One reason is that more quality-sensitive offerings are being introduced into the service mix. While a certain amount of line interference may go unnoticed by broadband customers using their connections to download music or upload photos, new services like VoIP and IPTV require

a higher, more consistent level of quality. In today's world where social media and word-of-mouth marketing can make or break a new service, the customer experience is more vital than ever in determining which services are successful.

To ensure that experience is positive, providers have been rolling out their new fiber networks and services neighborhood by neighborhood, using a capital- and labor-intensive approach that involves expensive equipment, such as remote handhelds, as well as frequent truck rolls to the point of service, topped off with lots of customer handholding. This approach helps ensure early reviews of the services are positive and encourage future customer adoption, but makes it difficult to scale services to large numbers of subscribers.

Further complicating matters, many providers are deploying fiber alongside their existing copper networks. This approach poses its own challenges. For example, the procedures used to test copper connections do not necessarily apply to fiber. While DSL service representatives in the call center can perform remote tests to determine line quality, with fiber, these tests are done in the field, and technicians must interrupt the customer's service in order to take optical signal measurements. The remote testing units currently available for fiber networks require significant capital investment, making them too costly for large-scale deployments.

In addition, faults in a FTTH network, for example, can occur over a fairly wide area and be caused by a variety of different factors, from external events and ambient temperature changes that can result in micro bends, macro bends and crushed fiber, to line damage caused by woodpeckers and squirrels. In the case of PON networks, test head vendors often find it difficult to correlate standalone OTDR trace events with topology, as the measurements can be very complex and ambiguous.

Solution: Automate Key Points in the Customer Lifecycle

As service providers look for ways to scale their fiber deployments to meet the exploding demand for high-bandwidth services, a more sophisticated and automated approach -- one that delivers better operational efficiencies and enhances the customer experience -- is now necessary. In addition, providers must not fall into the trap of focusing on line quality alone.

Fortunately, network operators don't need to look far for answers -- they can take a page from their existing DSL playbooks. While fiber technology is significantly different from DSL, the approach used to scale DSL services to the mass market is one that has proven not only successful, but highly profitable worldwide.

To repeat their success, providers need the ability to automate and remotely manage fiber network operations at 3 key stages of the customer lifecycle:

1. Service Activation
2. Support
3. Proactive Maintenance

This approach will enable providers to accelerate time to market, reduce operating expenses and maximize their capital investments. The ultimate prize, of course, is long-term customer loyalty.

Several key technology capabilities are necessary to achieve this level of remote management, including:

· Leveraging OTM (optical transceiver monitoring) available from network equipment.
· Numerical analysis of OTM measurements to enable accurate fault detection.
· Power budget validation to assess quality of fiber and cross-connect installation.
· Pro-active fault detection and localization of the fiber section (feeder, collector, or drop).
· Ability to assess actual impact of the detected optical faults on the service.
· Ability to identify and analyze long-term degradation trends.
· Optical infrastructure centric database for maintaining long term data consistency.

Stage 1: Automating Fiber Service Activation

Service activation is the first point of contact with the customer, and automating this experience has been one of the key capabilities providers worldwide have leveraged to jump-start widespread customer adoption of broadband services. This technology has greatly reduced the need for expensive truck rolls to the customer site to install service, allowing providers to rapidly grow their subscriber bases while ensuring a positive, consistent user experience.

In the same way, automated and remote fiber service activation will allow providers to scale their new fiber networks and services quickly, without expensive truck rolls and in-home testing. In the short term, on-site technicians can use service activation tools to reduce the time spent at the customer site. Longer-term, customer self-installation and remote activation tools will eliminate the need for the truck roll altogether in many cases.

Step 1: Fiber Verification

Before a subscriber's service is activated, the provider must verify that the customer can be serviced from its existing fiber networks. To complete this step, the provider must understand the optical performance of the candidate access networks, ensuring flawless and smooth fiber activation. Leveraging accumulated data from existing subscribers makes it easier to predict the desired level of network performance for the new installation.

Step 2: Service Verification

To ensure the robustness of fiber networks and protect against future degradations, verifying new installations is key. Once the subscriber is qualified for fiber service, one ore more field technicians are dispatched to complete the fiber cross-connect, drop installation and CPE installation. Providing information to the field technician about the current fiber network performance helps to qualify the handheld readings performed in the process. In addition, automating key steps in the CPE installation and activation process can greatly reduce the time technicians must spend at the site and helps eliminate many potential conflicts and errors that can lead to costly escalations to the support center.

After the service is provisioned, an immediate and automatic verification of the installation against the provider's standards, and the performance of existing fiber links, provides an objective criteria to close activities. This requires the ability to measure and validate the optical signal quality of the new user and verify absence of side-effects on the existing subscribers in network..

Step 3: Coordinated Communication

There are often many different parties, from individual employees in the NOC, support center and back office, to equipment and service partners, involved in delivering fiber service. Coordinating the exchange of information among all of these stakeholders is vital to the provider's success. The ability to verify optical signal integrity allows the provider to confirm the performance of the new service, notify the field technician of ONT installation "success" or "failure", and remotely confirm for the operator that the work order is complete.

Automating the delivery of this information improves relationships among all the parties involved. More importantly, it has a significant positive impact on the customer relationship, as DSL implementations of remote network management tools have proven.

Stage 2: Improved Troubleshooting and Support

Whether it's during service activation or for an existing customer, remote and field service technicians need better tools for diagnosing and resolving support issues. Improved visibility into the network and attached devices can help service technicians resolve problems more efficiently and effectively.

Two main areas where remote management can offer the greatest efficiency gains are fault localization and escalation.

Step 1: Fault Localization

Faults in a FTTH network can be located anywhere within a fairly large area surrounding the point of service. Understanding the nature of the fault and where it resides can significantly reduce the time and expense it takes to repair it. For example, knowing exactly which fiber cable is failing helps providers dispatch the technician to the site with the right tools (e.g., aerial fiber, underground cabling, or cabinet).

In PON networks, an optical time-domain reflectometer (OTDR) provides the distance to the fault, but not to the specific collector branch where the fault resides. Adding the ability to identify end-to-end behavior allows the technician to identify a common point of failure. By collecting in-line data from both views, the exact location of the fault can be determined, reducing time to repair.

Step 2: Fault Escalation

Once a fault has been identified and its location determined, support technicians need to be able to accurately communicate the diagnostic data in order to efficiently escalate the issue to the proper channels. Customer repairable faults can be solved on-site by the field technician, or escalated to customer support. Once escalated, accurate information is key to routing the case to the proper channels for resolution. This reduces support case backlogs, clearing the support desk to work on more complex problems.

Stage 3: Proactive Maintenance

For broadband service providers that have already made huge capital investments in next-generation fiber networks, it doesn't make sense to take a short-term view to reducing costs. In order to recoup investment, providers must not only win new subscribers, they need to nurture

them into loyal, long-term customers. A key factor in that process is the ability to detect network faults before the subscriber's service is affected and perform proactive maintenance.

Knowing when a fault was introduced that degraded performance, and correlating the timing of the fault with fiber maintenance, equipment changes or digging events, can greatly reduce costs and ensure an uninterrupted customer experience.

For a longer-term term view on the performance of the optical infrastructure, measurements can be stored in a fiber-centric database. Initial measurements provide a performance baseline, and the network's evolution and deviations can then be tracked against that baseline to identify locations in the network where the optical margin is small and service interrupts are imminent.

The Rewards of Remote Management

Automated, remote network management tools are vital enablers that network operators have used with great success to scale their broadband services to the mass market. They have proven their value both in reducing costs and opening new revenue opportunities, while improving long-term customer loyalty. Using this proven map to success, providers can once again use these tools to achieve profitable economies of scale. These include:

Reduce Operating Expense

Automated and remote service activation reduces the need for costly truck rolls, while more accurate diagnostic methods reduce or eliminate the need for on-site visits for many common issues. In addition, fast, consistent and accurate fault localization enables operators to resolve problems more quickly. Access to accurate diagnostic information also helps level one support representatives to quickly escalate faults to the proper channels for more efficient resolution.

Reduce Capital Expenditures

By deploying network management solutions that leverage the measurement capabilities native to the equipment that providers already have in place, providers can avoid investing additional capital related to test heads, probes or handheld meters. This makes it more cost-effective to scale service to thousands, even millions, of subscribers.

Reduce Customer Churn

The ability to identify long-term degradation trends and potential faults before they happen allows providers to improve both the perception and the actual quality of their services.

Accelerate Time to Market

Self-service activation is a key factor in scaling broadband services to a wider market, while remote diagnostics enable providers to significantly reduce the time technicians and call center representatives spend resolving issues.

The market for high-speed services enabled by lightning-fast fiber optic networks has so far outpaced the supply. Service providers have made huge strides in laying fiber networks, but manual service activation, diagnostic and support processes are driving up costs and delaying much-needed return on investment. To turn the tide of escalating costs, providers need

automated, remote network management capabilities that allow them to rapidly scale services without putting the customer experience at risk.

Fortunately, providers have been highly successful using these tools in wide-scale DSL deployments, and a roadmap already exists for putting these technologies and processes in place. Now, they must work together with their technology suppliers and vendors to define a similar solution for their fiber networks.

Endnotes

eMarketer: www.emarketer.com
Infonetics Research: www.infonetics.com
PC Magazine: www.pcmag.com

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A leader in fixed, mobile, and converged broadband networking, IP technologies, applications and services, Alcatel-Lucent leverages the technical and scientific expertise of Bell Labs, one of the largest innovation powerhouses in the communications industry. Alcatel-Lucent has operations in more than 130 countries. Alcatel-Lucent achieved revenues of Euro 16.98 billion in 2008 and is incorporated in France, with executive offices located in Paris. For more information, visit www.alcatel-lucent.com.