Fiber Testing Heats up in the Southwest

At a Glance

Customer:
Arizona State University
City of Phoenix

Industry:
Education
Government

Location:
Phoenix, Arizona USA

Network type:
Campus network

Challenge:
Cabling infrastructure in college campus is constantly being pushed to the limits. New technologies and changes in architecture and applications are pushing high bandwidth links closer to the desktop utilizing fiber networks. Network managers require that each new fiber link is tested, certified and documented to ensure fiber network performance.

Results:
Fluke Networks' OptiFiber OTDR helped ASU define their fiber network capacity, certify links before new service activation and has become a time-saver in every day campus troubleshooting.

Products:
OptiFiber Certifying OTDR

City of Phoenix

Overview

In Phoenix, the nation's sixth largest city, backhoes, cranes and conduits are a mainstay. Two construction hot spots anchoring the city limits are the City of Phoenix's downtown multi-building complex and the sprawling campuses of Arizona State University in the southern tip. In addition to stretching across their domain with new buildings and reconstruction, both the government and educational bodies in this progressive city boast burgeoning upgrades in technology for voice, data and video applications.

Two years ago, the IT department of the City of Phoenix set new cabling and connectivity standards, which at the time called for fiber for the backbone and Category 5e UTP to the desktop for its more than 15,000 government employees. To keep up with the bandwidth requirements put on the network, the City of Phoenix revised their current standard to include fiber in the backbone and to the desktop, as well as Category 6 in the horizontal for voice, data and video. Today, one of their largest construction projects is a new civic center complex that will include more than 6,500 fiber terminations. Arizona State University (ASU), the fourth most populated university in the United States, has 57,000 undergraduate, graduate, and professional students spatially distributed across metropolitan Phoenix in four campuses. Its main 20-acre campus is located in Tempe. Other campuses are located in Glendale, Mesa and a new downtown Phoenix campus. New construction of classrooms and residences and other facilities is a common sight.

"As a Research 1 University, students and staff demand the latest and greatest technology tools and it's our job to stay on the bleeding edge to provide it," states Carl Miller, principal tele-communication specialist with ASU.

With constant expansion, ASU and the City of Phoenix have one goal in common – to provide their 24/7 environment with the latest in telecommunications technology. New technologies and changes in architecture and applications are pushing high-bandwidth links closer to the desktop utilizing fiber networks. In assuring these fiber networks, the network managers require that each new fiber link is tested, certified and documented.

Evolving standards for growing networks

In all new and rebuilt projects, the end user or network manager wants assurance that the cable plant was correctly installed, in accordance with best professional practices. Proof of a proper installation takes the form of a certification report.

The TSB-140 industry testing guidelines, approved by the TR-42 standards body in February, 2004, recommended changes to the way the installer and network owner had been certifying the cable plant. Basically there are two tiers of testing. Tier 1 is based on using a loss/length certification tool that measures optical loss and Tier 2 involves using an OTDR that characterizes the fiber link.

City of Phoenix

According to TSB-140, Tier 1 is required in all fiber optic cabling links and conforms to TIA/EIA-526-14A and TIA/EIA-526-7 (optical power loss measurements of installed multimode and singlemode, respectively). The testing simulates the system by measuring the total loss of the fiber link. This is done by measuring the link's attenuation using a loss/length certification tool. Polarity is also verified with either an optical loss test set or another visible light source, such as a visual fault locator (VFL).

L to R: Craig Trimble, director telecommunication infrastructure IT at ASU, and Tony Janousek of Kearney Electric, one of ASU's contract installers, using the OptiFiber to check the fiber backbone in one of the telecom rooms.

Tier 2 testing with an OTDR is optional, but highly recommended, as a supplement to Tier 1. The OTDR trace is a graphical signature for each individual fiber link. The installer can gain further insight into the quality of the installation and analyze individual events such as cable, connectors, splices, and bends by examining the non-uniformities in the trace. An OTDR does not replace the need for a loss/length certification tool, but is used for additional evaluation of the fiber link.

The importance of two tier testing

"It has become imperative that each fiber link is tested and traced with an OTDR to meet today's emerging standards to assure that the fiber installed meets its specified bandwidth performance prior to turning over the cable plant," states Brian Rhynas, president of CTS, the installation company recently awarded the civic center project. "Where we used to only test with an optical loss test set which would give us a 'pass' or 'fail' result, the end-user is now requiring certification of every event. Therefore, we are using Fluke Networks' OptiFiber OTDR which integrates loss/length certification, auto OTDR analysis and trace, and end-face inspection to give a comprehensive view of the network in one report."

Challenge

On the bleeding edge

Cabling infrastructure in a college campus is constantly being pushed to the limits. College campuses operate 24/7 and students and faculty place high expectations on the networking system as they are constantly pushing bandwidth-intensive applications through it, regardless of its capacity. "A decade ago, students had a pen, calculator and bookbag," states Trimble. "Today, it's a laptop with a Gigabit Ethernet card and it is expected that we provide a hard-wired connection in the classroom and housing," he further explains, "The Internet has opened up a whole new gamut."

Students depend on the reliability of the campus networking system. This is one of the many student computer labs in the Computing Commons Building on ASU's main Tempe Campus

"In a college campus environment, technology requirements are constantly changing and there are many more requirements in the academic world for higher bandwidth applications, such as streaming video, medical imaging and distance learning over the Internet – many of which are not found in the typical corporate premise market," adds Carl Miller, principal telecommunication specialist with ASU. "As a Research 1 University, students and staff demand the latest and greatest technology tools and it's our job to stay on the bleeding edge to provide it," Miller adds.

Educational environments are somewhat different than those of the corporate enterprise. Changes are magnified in an educational environment, both in people and in facilities, which ultimately tax networking needs. "ASU is in constant renovation, rebuilds and new construction," explains Tony Janousek, Kearney Electric, one of the ASU's contract installers. "At any given point in time, there are half a dozen buildings going up or being totally gutted, demanding the newest technology."

At ASU, they are currently building a new inter-campus backbone system that will include 50-micron fiber to expand capacity to 10 Gb/s. In addition to the upgrade in fiber type, they are designing the cable plant to work off of a star layout versus the previous mesh topology. This will provide a more logical pathway system, resulting in better utilization of the backbone, which will ultimately provide better service to the telecom rooms and out to the workstations.

They are planning for gigabit uplinks to the classrooms and 100Base-T to the residence halls. "Technology, combined with high user counts, promotes constant upgrades to hardware, which ultimately challenges the installed cable plant. Basically, our network will always get more demanding and larger, never smaller," notes Trimble.

In addition to more data, voice and video across the campus, there is also a growth of devices and applications using Ethernet attaching themselves to the network. Some of these include HVAC, fire alarm, EMS, BAS, metering and security cameras.

Solution

End-to-end performance

Craig Trimble, Director of Information Technology at ASU, states, "We have gone through several network upgrades and have many flavors of fiber on campus from old ribbon types to today's new 50-micron, laser-optimized fiber products. Our backbone is a fiber mesh ring type of configuration. With 90 buildings on campus running fiber of various makes and models, we needed to standardize the fiber plant and protocols so that we can prepare to install a 10 Gb/s backbone campus wide."

"When the fiber optic cable is installed, we rely on the installer to test each link and provide us with a certification report. However, we also need to constantly identify the end-to-end performance for adding devices to the network, as well as having the ability to immediately troubleshoot on site. Therefore, it is imperative that our IT staff is equipped with the right tools, such as an OTDR for daily use," explains Trimble.

"The installer provides us with the test result for every new fiber link installed. However, we also need to look at the whole picture as it is most likely connected through old fiber cross connects," notes Trimble. Because of the campus mesh topology, the new fiber installed often has to go through existing legacy fibers in one or more of the core mesh buildings, which could include three cross-connects. "Our transition could be from an outside plant fiber to the indoor plenum-rated fiber so it needs to go through a coupler panel. We have to assure that this transition will not degrade the overall link performance. With an OTDR, we can actually see and trace each event," adds Trimble.

Rapid network recovery

In addition to utilizing the OTDR capabilities to define networks and to certify links before each new service activation, this tool has become a time saver in every day campus troubleshooting.

"Whenever a device or even an entire facility goes down, everyone points at the cable," states Trimble. An example of this is when ASU installed an extension of their phone system. One of the buildings utilizing this phone switch and associated new and legacy fiber went "dark" and down. Because there were four connection points between the two end points, the networking department blamed the old fiber cable. Utilizing the OTDR's single-ended testing capabilities, the IT department quickly found out that it was a faulty PC board in the active equipment and not the cable. The OTDR saved hours of troubleshooting time and cut network downtime in half.

The OptiFiber multifunctional OTDR provides installers further insight into the quality of the installation and analyzes individual events such as cable, connectors, splices and bends by examining the non-uniformities in the trace.

Visit our solution center, Ensuring the Health of Tomorrow's Fiber LANs, for additional OTDR resources.

Rapid network recovery is key. Because of the constant demolition and reconstruction, there seems to be a common occurrence of backhoe problems. On many unique occasions at ASU the OptiFiber OTDR has saved time, labor and money, through its troubleshooting features. "In one instance a direct buried legacy cable was sliced by a landscaper. Not knowing what it was, he put a Band-Aid® over it, buried it and continued planting the tree," explains Trimble. "With the OTDR, it pinpointed the break and it was quickly resolved and we were able to remove the Band-Aid and properly splice the cable," he adds. Another instance was when a backhoe pulled out tie cables from a server room, 200 feet away. Because the fiber was in an enclosed cabinet, it was not visible. The OTDR immediately led the IT team to the enclosure. Only an OTDR can pinpoint the precise location of breaks or splices," states Janousek.

Endface inspection is an important troubleshooting capability. "With the 250x or higher 400x camera attachment to the OTDR mainframe, I have found fiber endfaces that might have barely passed inspection, but would certainly hinder bandwidth and headroom capabilities. We can actually view the endface and catch any problems with dust and unclean connector tips or faulty polishes before we install, again saving in installation time and money," adds Janousek.

Results

A tool of all trades

Not only has the OTDR become a daily tool for troubleshooting and defining the network for the end user, it has become a staple in a contractor's tool kit. "Because of the compact size and durability, we only need to carry the OptiFiber when testing long or short lengths of fiber and assuring the link loss budget," states Janousek. OptiFiber allows files to be easily downloaded on to a PC and Fluke Networks' LinkWareTM Software provides customized graphic reports and ensures standards compliance.

By the year 2020, ASU is projected to enroll 90,000 students. And with projections by the U.S. Census Bureau for Arizona to increase their residents to 40% in the next decade, making the "Barbecue Belt" one of the hottest growth spots, the City of Phoenix will constantly be expanding their LAN and WAN infrastructures.

Because fiber cable capabilities in the LAN will continue to place demand on the network and require additional bandwidth to support emerging technologies, cable installers, designers and end users are recognizing the importance of defining their network capacity through more precise cable testing methods. Legacy testing and verification tools will not suffice. In-depth network characterization, as well as troubleshooting, for advanced networks can only be achieved with precise methods, such as the two tiers of TSB-140 to confidently meet the emerging applications. By incorporating the two-tier testing method, installers have the most complete picture of the fiber installation and network owners have proof of a quality installation.