



Next Gen NETWORKS

Addressing profitability challenges in
Advanced Fibre Management
for FTTP networks



Advanced fibre management systems incorporate the latest techniques for optimising access networks for accessibility and time required to reconfigure, perform maintenance, or troubleshoot problems. Successful fibre management plays an increasingly important role in eliminating potential problem areas that can become both costly and time consuming over the life of the network.

The fibre management experts at ADC KRONE have spent many years developing these techniques and providing solutions that match the ever-evolving fibre-to-the-premise (FTTP) network architectures. This paper will address the latest challenges facing service providers and present practical solutions for dealing with them – solutions that will save both time and operational expense over the long term.

Passive optical network (PON) architectures are designed with no redundant paths, therefore, there is no network protection. Normally, any maintenance requirement within the PON requires taking the network out of service until the problem is resolved. With that in mind, providers need the fastest possible access to quickly isolate and repair problems, while minimising outages.

Electronic gear at each end of the PON, basically the optical line terminal (OLT) and the optical network terminals (ONTs), can communicate with each other. If the OLT loses contact with a single ONT, it's logical to assume the problem is between the splitter output and that ONT. If the OLT loses contact with all the ONTs of one splitter, the problem is between the central office (CO) and the splitter. However, the electronics at the ends of the PON cannot identify the exact location of the problem.

The only way to determine the exact location of the problem is to get onto the fibre itself and perform an optical time-domain reflectometer (OTDR) trace. The need for quick and easy access to the fibres in a traditional fibre management system is critical – and although there have been many advances in terms of management, density, and ease of access, the requirement for a technician to gain access for adds, moves, and testing is still necessary in many FTTP architectures. Let's look at some of the challenges this access still poses.

The challenges

As service providers face increasing pressure to be profitable, traditional cable management is often not enough, particularly in the area of the optical distribution frame (ODF). Increasing revenues requires decreasing operational costs, and this means reducing technician errors, achieving faster service turn-up time, lowering overall maintenance expenses, and resolving customer issues promptly.

Many network outages can be traced back to technician error, and a lot of those errors are attributed to poor record keeping. Contrary to popular belief, record keeping in our industry is often a neglected area. For instance, knowing where every patch cord

is routed requires routing records that are only as good as the last person who touched them. How important is it to know which patch cord to disconnect for troubleshooting a fibre? Ask the customer who lost service when the wrong connection was broken.

Technicians must also deal with cable congestion issues. A 144-port panel has 144 terminations in a very small footprint, so unless the means are in place for easy identification – and record keeping is accurate – there will always be potential for human error.

Of course, if the technician cannot easily access the panel, then it becomes even more difficult to locate the proper connector, increasing the likelihood of errors. It's easy to see how much time might be spent just locating the proper connection for service turn-up, maintenance, or troubleshooting. Withdrawing the wrong connector only adds time, expense, and aggravation. Therefore, the optimal solution for preventing the possibility of technician error is one that minimises the need for technicians to access the network.

Reducing overall operational expenses will require a reduction in the work actually performed at the ODF location. With many traditional systems, the amount of labour required for identifying and accessing a particular connector is significant. Cable congestion following a recent push for higher density systems, coupled with decommissioned patch cords (unused and left in place) and an inexperienced technician can further compound the problem.

Once a problem has been identified and isolated, a truck roll – with all the required test equipment and technicians on board – must be dispatched. This may be the most significant operational cost incurred by FTTP networks. These truck rolls are not only required following fault isolation, but also to keep pace with network requirements through the demands of the end customer.

To address these challenges, ADC KRONE has developed advanced ODF solutions that incorporate additional functionality in their cable management solutions that traditional systems may be lacking. Service providers who take initial steps to address challenges in today's ODF systems will increase profitability, save maintenance costs, and provide top-notch customer service for the future.

Out with the old

Traditional ODF solutions are basically configured with a demarcation/interface point between the OSP fibres and the network elements, basically a crossconnect patch cord. These systems have a lot of inherent value. Purchasing and deploying the OSP fibre is a significant investment for any carrier; so they need to get the most possible value out of that investment.

With that in mind, the core functions of the ODF include allowing both easy access to the fibre network for customer churn (adds, moves, changes) and centralised test points for troubleshooting.

With the traditional ODF, service providers have a permanent location for accessing their fibre. The same is true of each network element – enabling them to connect any equipment to any OSP with the crossconnect fibre. This is also where the aforementioned record keeping challenges become apparent.

The ODF solution, as it is today, is an extremely valuable part of the network, providing equipment location, easy access, and permanent port locations. In fact, a service providers' fibre frame solution is probably one of the most reliable entities within the network. Once the connectors are plugged in and the fibres are routed, system failures are rare in the absence of any external forces.

But as good as today's ODF systems perform, ADC KRONE has developed several improvements that will address the new challenges to higher profitability from the network. While still maintaining the core value of the ODF, service providers can increase the functionality and find ways to reduce the cost of operations while improving the test access capability.

In with the new

One way to improve the ODF functionality is to incorporate optical splitters. The optical splitter is used for many purposes, such as combining signals and multicasting. Within the ODF, these devices provide a "window" onto the fibre for testing and troubleshooting.

Basically, the splitter provides a non-intrusive tap onto the fibre itself, enabling technicians to run signals through their test equipment.

With a splitter module, technicians avoid taking a signal out of service by pulling the patch cord off the frame to plug in an OTDR. Instead, they can actually plug into the network via the splitter to monitor the signal without interrupting service.

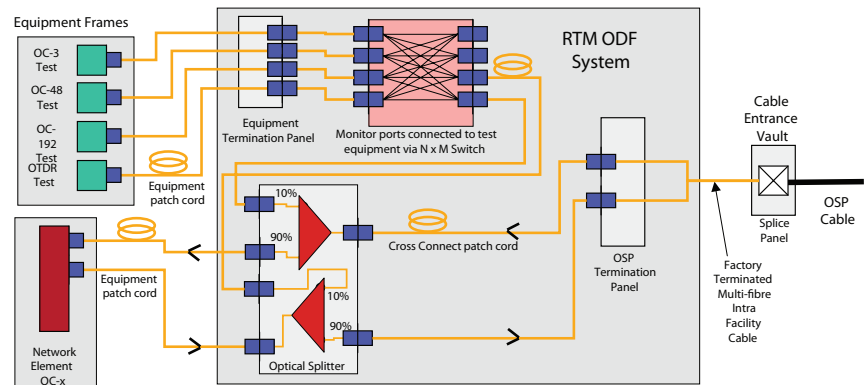
Additionally, test signals can be launched into the network by using the optical splitter in reverse as a combiner. However, when putting these value-added modules (VAMs) into the ODF system to provide easier fibre access, a technician is still required to go to the frame, locate the port, set up equipment, and run the tests. So even though the VAM provides that critical window into the fibre network, the solution still requires a lot of time and work for the technician. There is still an even better way.

Taking the same monitoring window provided by the splitter VAM, the test equipment is mounted permanently on racks within the central office (CO). The test equipment is then connected to an optical switch. All of the monitor ports are also connected to the switch. With this configuration, a technician can connect any window port to any piece of test equipment from a computer in the CO or network operation centre (NOC).

The switch makes the desired connection and the technician runs his OTDR trace, analyses it, and determines if additional tests are required. With this remote testing concept, it's easy to see dramatic time savings in fault isolation – from hours to minutes. Not only is troubleshooting time reduced, but customer service is improved. Instead of being sent into the field to troubleshoot a problem – requiring a truck roll and lots of remote equipment – the technician is now sent out to actually fix the problem. The troubleshooting phase is already completed.

Advanced ODF applications

These advanced ODF solutions have several vital applications. One is in traditional network monitoring, such as monitoring a hand-off or keeping track of critical circuits. For example, a service provider may have several high-value customers with service level agreements (SLAs) that guarantee 99.999 reliability. Providing this high reliability requires the provider to identify any network issues before they become network outages.



With monitoring ports and test equipment permanently set up and connected to the switch, these circuits can be cycled through a testing scenario on a regular basis. For instance, an OTDR trace can be gathered at regular intervals and compared with an original trace to determine any potential issues.

Another example might be an area of the network known to have poor cable management or excessive fibre bending. This area could be regularly monitored to ensure that attenuation levels remain constant. The bottom line is that potential problems can be identified early and dealt with before the customer's service is affected.

This could potentially be a service that the provider could actually sell, adding new revenue streams. With the remote test and monitoring ODF solution, it now becomes easier to provide more value-added reliability and monitoring capability services to customers.

Another application addresses the challenge of testing PON networks. Even though the electronics can diagnose many of their own issues, if there is a fibre break in the network, neither the

OLT nor the ONT can tell you where the break occurs. Basically, the electronics can only narrow it down to before or after the splitter in the OSP. Beyond that, a truck roll is usually required to find the exact problem location.

A truck, loaded with all the necessary test equipment, must go to the fibre distribution hub (FDH) or splitter cabinet. At the cabinet, the technician will set up the OTDRs, power meters, and other necessary equipment to test the individual fibres. Provided the technician is skilled enough to use and read the test equipment, or even has the necessary equipment on the truck, this is going to be a high-cost procedure that will likely take hours to restore subscriber services.

A better solution can be adapted within the CO for fault isolation in the PON portion of the network. It would involve designating a spare fibre between the CO and FDH as a test fibre with a dedicated port in the cabinet. In the FDH or splitter cabinet, there are multiple splitters – each serving up to 32 subscribers. However, when the carrier runs the fibre from the CO to that cabinet, there are generally several spare fibres. Dedicating one of those fibres for testing purposes enables technicians to have a port on the fibre frame that is a designated test fibre for that particular cabinet.

Now, when a problem occurs between the FDH and a subscriber, the technician still responds to the cabinet. Only now, it can be a less-skilled technician who doesn't need to bring all that test equipment. The technician will simply route a temporary patch cord to connect the maintenance port to each subscriber fibre. Back at the CO, a more highly-trained technician, using the permanently mounted test equipment, runs all the tests, identifies the problem, and relays the "fix" back to the technician at the cabinet.

In this scenario, one highly-trained technician can perform any test from the CO, decreasing the cost of truck rolls. In fact, test equipment costs are greatly reduced since the need for equipment in every truck is eliminated.

Another benefit of this configuration is in service turn-up. A technician simply hooks up the ONT at the subscriber premise, then plugs into the maintenance link

at the FDH to perform initial testing without having to be on the live network. Once the link is tested and verified from the CO, the FDH connection can simply be swapped from the maintenance port to the optical splitter – turning up service much faster.

Finally, this solution also provides easier fault isolation when the problem is determined to be between the CO and the FDH cabinet and somewhere on the feeder fibre. Traditionally, the process was to send a technician to the frame, locate the patch panel and port, pull the patch cord, and hook up the appropriate test equipment. As stated before, this process can be problematic for many reasons, including technician errors, poor record keeping, or cable congestion – and it also takes time.

However, by taking advantage of the same monitor functionality and using the splitter in reverse as a combiner, an OTDR trace can be launched onto the feeder fibre without actually going into the CO and rerouting patch cords. Instead, a quick OTDR trace is performed, fault isolation accomplished, and a technician is dispatched to fix the problem.

Using a maintenance fibre in the FDH cabinet, a test link is established between every subscriber and the CO. However, the key is the optical switch. By permanently linking test equipment to the maintenance fibres, easy access is achieved and testing is accomplished faster – equating to less operational cost and higher profitability.

In summary, there are many access network challenges facing service providers today.

Optimising the access network for accessibility and decreasing the time required to reconfigure, perform maintenance, or troubleshoot problems can significantly increase the overall flexibility and functionality of the network. A well planned advanced fibre management system plays a very important role in eliminating potential problem areas that can become both costly and time consuming over the life of the network. The techniques presented in this paper will save both time and operational expense over the long term.



www.adckrone.com/au

AUSTRALIA 2 Hereford Street, Berkeley Vale NSW 2261
Mailing Address: PO Box 335, Wyong NSW 2259, Australia
TECH SUPPORT 1800 801 298 helpdesk.au@adckrone.com

www.adckrone.com/nz

NEW ZEALAND 2 Nevis Street, Petone, Wellington
Mailing Address: PO Box 38-177, Wellington Mail Centre 6008, New Zealand

ADC Telecommunications, Inc., P.O. Box 1101, Minneapolis, Minnesota USA 55440-1101

Specifications published here are current as of the date of publication of this document. Because we are continuously improving our products, ADC reserves the right to change specifications without prior notice. At any time, you may verify product specifications by contacting your local ADC KRONE office. ADC Telecommunications, Inc. views its patent portfolio as an important corporate asset and vigorously enforces its patents. Products or features contained herein may be covered by one or more U.S. or foreign patents. An Equal Opportunity Employer.

400625_AU 04/08 © 2008 ADC Telecommunications, Inc. All Rights Reserved.