



PON infrastructure monitoring

Adtran's deep PON assurance (DPA) technology

Highlights

- In-service, proactive 24x7 PON infrastructure monitoring
- End-to-end network monitoring from the OLT down to individual ONTs without demarcation reflectors
- Supports all PON generations, protocols and transport speeds
- Detect, identify and localize any fiber break or degradation almost immediately
- Reduces downtime and prevents unnecessary truck rolls reducing opex
- Low maintenance, power and footprint
- Comprehensive management support including geo-location information

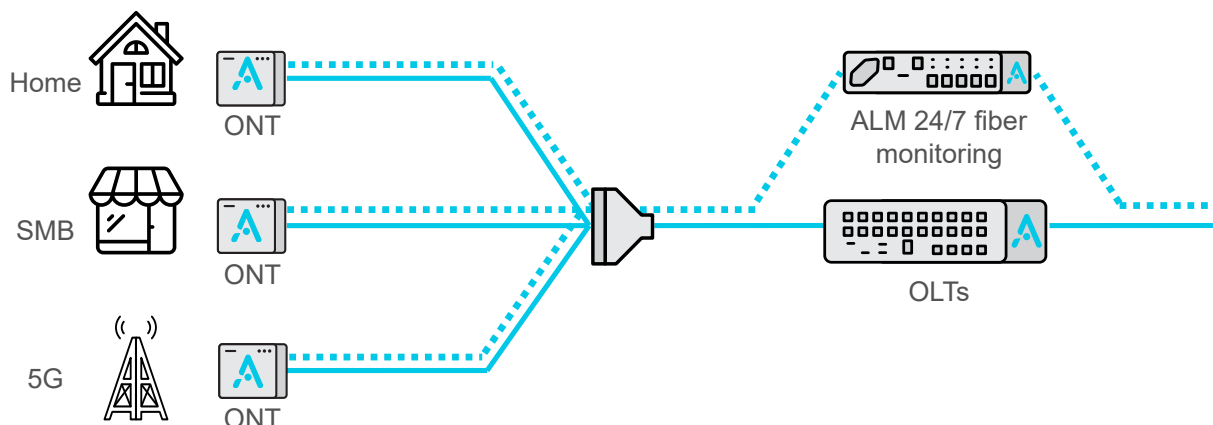
Maximizing PON network availability

Passive optical networks (PON) are critical for delivering high-speed connectivity to millions of homes and businesses. The communication and data services transported over these fiber networks are crucial for our working environments and our social lives. Any disruption due to damaged fibers can pose significant challenges.

With our expertise in both PON and fiber assurance, we've developed a unique solution that provides a simple and cost-efficient way to monitor PON networks even behind splitters. Adtran's ALM advanced fiber monitoring with DPA technology provides precise, simple and cost-efficient fiber fault location and characterization of the complete PON fiber infrastructure.

PON infrastructure monitoring

Pro-active fiber monitoring in PON networks



In-service, OTDR-based monitoring

Monitoring of PON networks is available today via OLT and ONT interaction. While this monitoring provides visibility into the operation of the network, it is based on the electronics in the OLT and ONT being operational. When there is a fiber problem such as a cut, traditional PON monitoring tools are unable to troubleshoot physical fiber plant issues and identify the true root cause and location of the fault. This limitation stems from their reliance on the network being active and operational. With our ALM in-service OTDR-based fiber monitoring solution, this issue is eliminated.

Adtran ALM advanced fiber monitoring solution

A critical component of troubleshooting any network interruption is quick and accurate root cause analysis. The use of in-service fiber monitoring provided by our ALM complements traditional PON management methods by providing direct physical fiber plant information about fiber health, including attenuation as well as fiber cuts. This capability enables network operators to take immediate, targeted action, while also preventing false alarms and unnecessary truck rolls. This shortens the repair cycle, improves the availability of a fiber link and also speeds up installation and commissioning of fiber services.

Benefits beyond live network monitoring

Traditionally, fiber monitoring has been viewed primarily as a tool for “post-network installation,” assisting in troubleshooting and restoring network service. Its primary purpose was to maintain the functionality of an existing, active network. However, the advantages of fiber monitoring extend well beyond addressing common live network issues.

Monitoring and certifying PON physical fiber plant is a challenge for network providers. Given the vast scope and rapid pace of service deployment for potentially thousands of residential subscribers, ensuring proper installation and certification of the fiber is crucial. Many companies use third-party contractors for their installation. However, inconsistencies in installation quality and incomplete documentation frequently arise, leading to issues when turning up services. ALM fiber monitoring is a valuable tool to aid in the construction of PON fiber plants to validate and document the fiber plant from a central location. In addition to monitoring and validating the passive fiber plant including feed-fibers and splitters, our ALM can also aid in the installation of the OLT and ONTs. With our innovative Deep PON assurance technology, our ALM provides visibility down to individual businesses and residences to ensure they are installed properly and seen by the network at turn up, aiding the OLT and associating the ONT with the proper fiber connection and OLT connectivity. Moreover, users can easily identify fiber versus electronics as the root cause of events.

Adtran's deep PON assurance (DPA) technology

Addressing PON monitoring challenges

Historically, managing the physical fiber plant of PON networks has posed challenges for OTDR solutions. This is due to PON's inherent characteristic as a shared medium and the very limited optical dynamic range of its links. Any PON monitoring required the use of a passive reflector device that added loss, required additional stocking of components and significantly increased installation cost.

The need to deploy demarcation reflectors, at each monitored site was cost prohibitive for point-to-multipoint network topologies such as PON. The time and effort required to travel to each site and install the hardware poses a significant opex challenge on top of the pure cost of the reflectors themselves. Based on our analysis, adding reflectors to a PON network to enable monitoring would then add 50–70% of the fiber plant hardware costs, as illustrated in Figure 1.

Adtran's ALM advanced fiber monitoring solution with deep PON assurance (DPA) technology provides visibility in PON networks without the need for reflectors, allowing operators to save significant costs.

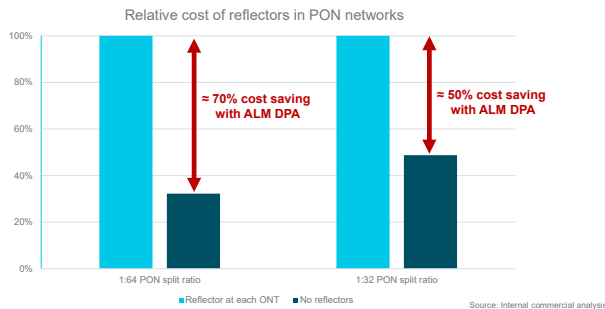


Figure 1

ALM deep PON assurance technology

One of the key parameters of an OTDR measurement and its operation is the pulse width. Longer pulse widths increase the signal-to-noise-ratio (SNR), however dead zones are also increased. This means that it becomes more difficult for the measurement unit to discover multiple consecutive events. As a PON network would have many events displayed in close proximity in an OTDR graph, the pulse widths need to be very short – typically 5–10 nanoseconds.

However, with the reduction of the pulse width, the SNR also decreases, making it more difficult to provide sufficient measurement range. Given the insertion loss from passive splitters in PON networks, there has been a necessity to install demarcation reflectors with 0dB reflectance at every monitoring point. This high reflectance ensures an adequate SNR, enabling effective fiber monitoring within PON networks.

Adtran's ALM advanced fiber monitoring solution with deep PON assurance (DPA) technology eliminates the need for reflectors. This new technology takes advantage of intelligent software algorithms and extensive digital signal processing to better detect events in PON networks, paving the way for affordable fiber monitoring possibilities right down to an individual home or ONT. Figure 2 illustrates an example of how our ALM with DPA technology provides an adequate SNR without reflectors.

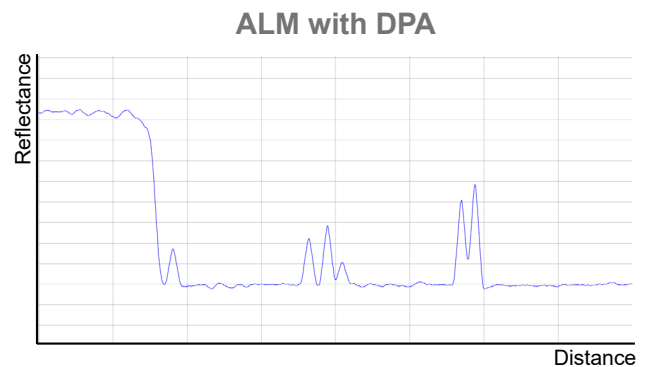
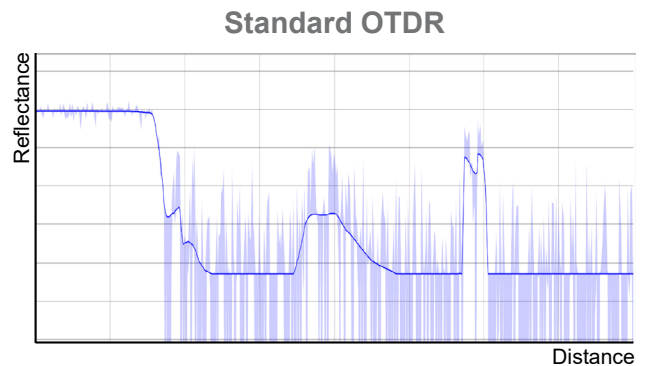


Figure 2

PON infrastructure monitoring

For any type of FTTx infrastructure

Adtran's ALM technology for in-service fiber monitoring can be easily integrated into existing fiber-to-the-home, fiber-to-the-business or any other FTTx network. The non-intrusive, service-agnostic deep PON assurance solution eliminates the need for demarcation reflectors in the field, ensuring compatibility with any existing PON network while reducing operational complexity. Offering valuable insights into passive network quality, it acts like a radar to pinpoint the location of issues.

Real-time insights

Real-time network status information about the type of fiber event as well as the geographic location of events eases troubleshooting, root cause identification and shortens return to service time. With our ALM fiber monitoring solution, users can easily check the status of their PON network through Adtran's web-based GUI, Ensemble Fiber Director (part of our Ensemble Controller network management platform) or a dedicated mobile application for on-the-go access.

Using geographic information system (GIS) tracking, Ensemble Fiber Director precisely pinpoints any faults. Fiber events are visible on real-life geographical maps. Figure 3 shows sample screenshots of a network in normal operation and after a fiber cut has occurred.

Minimize operational costs

With its innovative DPA technology, our ALM enables users to monitor their entire PON infrastructure for any faults or degradation. It provides a simple and cost-efficient way to leverage real-time insight enabling maintenance teams to quickly locate and resolve issues before they affect customers. Our ALM with deep PON assurance technology enables FTTx network operators to dramatically shorten repair cycles, avoid unnecessary truck rolls, and provide a better customer experience. In the event of fiber break, fiber degradation or abnormal attenuation, e.g. due to a tapping attempt, the user is immediately notified about the issue with the exact location of the event. Moreover, with self-calibrating capabilities, fanless operation and a compact, low-power design, our ALM eliminates the need for regular maintenance, bolsters operational efficiency and promotes sustainability.

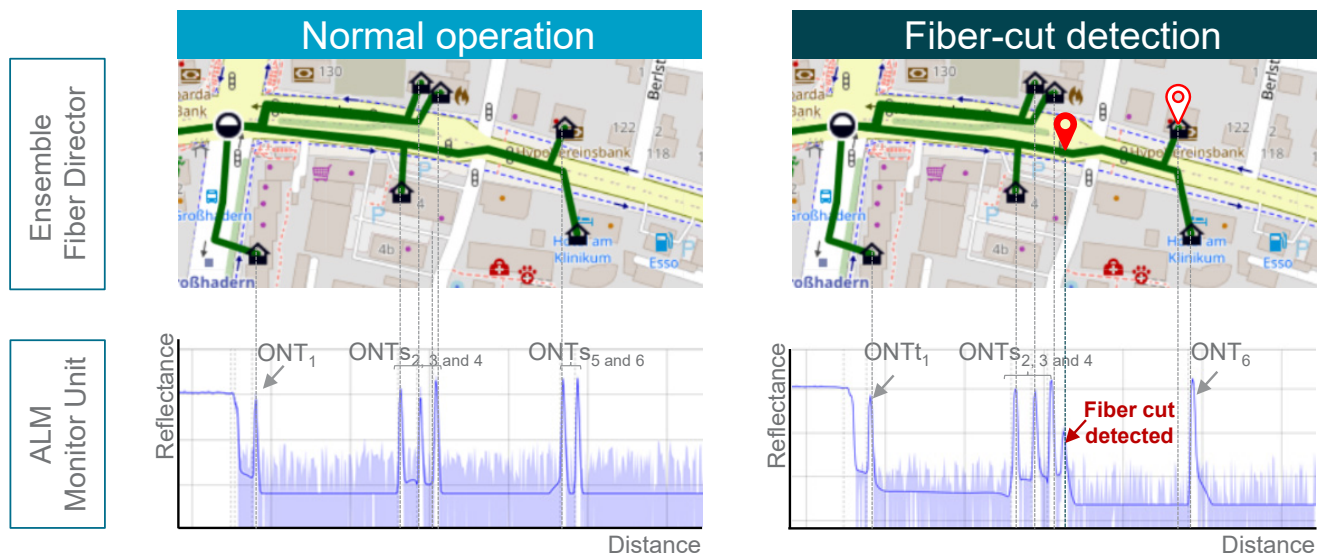


Figure 3

