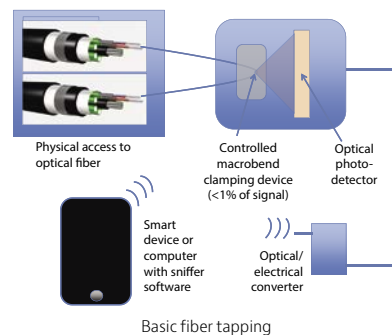# Fiber-Tapping Detection with the ONMSI Optical Network Monitoring System

Fiber networks bring unprecedented speed and bandwidth dimensions to today's electronically-connected world. However, these technological advances also expose data to a wide range of network threats including hackers and corporate/foreign espionage, to name a few. Corporate and government network owners must increasingly mitigate threats of data hijacking on public, private, and secure networks.

The Challenge

One significant threat to data on optical communication networks is fiber tapping. Once someone accesses fibers in a cable or transition/splice point, they can attenuate them by physically bending the fiber strand—and removing and capturing only a small percentage of light can mean significant data theft. The impact on network performance is often negligible and may not disrupt data transmission, so operators may never even be aware of the crime.

Physical access to optical fiber

Controlled macrobend clamping device (<1% of signal)

Optical photo-detector

Smart device or computer with sniffer software

Optical/electrical converter

Basic fiber tapping

The Solution

National Security Agency (NSA) document NSTISSI No.7003 guides protecting wireline and optical fiber protective distribution systems (PDS) to transmit unencrypted, classified national security information (NSI). According to the NSA, operators should implement PDS in three ways:

- Hardened carrier: physical protection (locked enclosure, cable in concrete, etc.)

- Alarmed carrier: protection by monitoring and alarm system

- Continuously viewed carrier: staff monitoring of cable

As an alarmed carrier solution, the ONMSi is widely selected and deployed because it:
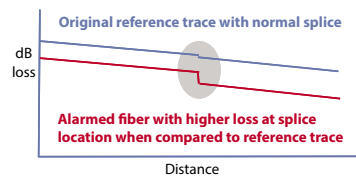
- Accurately detects the physical location of fiber taps in less than one minute

- Is sufficiently simple for non-fiber experts to operate it

ONMSi is an integrated solution that combines the optical monitoring capabilities and performance of an optical time domain reflectometer (OTDR) with a multi-port optical switch and various levels of control software.

Application Note

LASER COMPONENTS

While the OTDR is typically used for fiber construction, acceptance, and troubleshooting, it is also very effective as a fiber-monitoring tool. It provides a dynamic view of each fiber link and can look at events that affect a link with a location reference to each one. This includes monitoring small changes in attenuation along a fiber at different optical wavelengths. This makes it a viable solution for fiber-tapping surveillance, as the OTDR can monitor a fiber at a bend-sensitive wavelength that is away from the transmission region. This ensures transmission is not impacted while monitoring any relative loss changes along the fiber route.
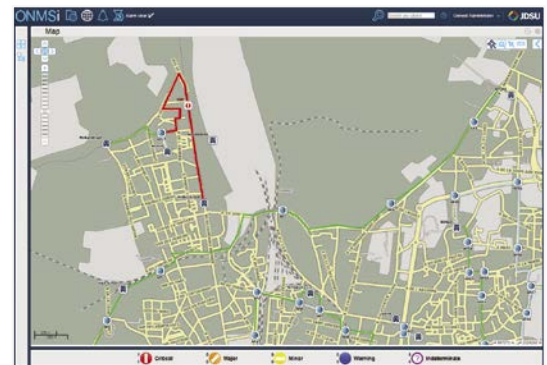
Using an optical switch further enables monitoring multiple fibers from the same OTDR. Comparing each fiber monitor trace to an original reference trace reveals small, relative changes in loss along the fiber. Alarm levels can then be set based on pre-defined loss levels.

Original reference trace with normal splice

dB
loss

Alarmed fiber with higher loss at splice
location when compared to reference trace

Distance

How an OTDR detects a tapped splice location

The Benefits

ONMSi protects networks from fiber tapping with a number of advanced capabilities:

- Continuous monitoring enables threat identification within minutes of incursion, minimizing reaction time
- Sensitive optics ensure that even the smallest loss changes are detected
- Scalability permits flexible deployment expansion as threat risks evolve
- Geospatial mapping software enables more accurate and faster threat response
- Remote location monitoring reveals threats that are difficult to reach by physical inspection

Summary

With the proliferation of data moved to electronic storage in recent years, data security concerns are now part of our daily lives. Fiber tapping to hijack private and government data is increasing as a threat as fiber deployments increase, and even the most sophisticated and secure networks are at risk.

Viavi Solutions™ has shipped hundreds of OMNSi systems globally to network operators, owners, and government agencies with many used specifically for security monitoring. Its speed of detection, accuracy of location, ease of operation, and 15-year history in deployment are why it is a trusted solution for this critical application.

The ONMSi System

ONMSi geo-spatial mapping view

Hardware

- Monitor probe
- Rack-mountable remote testing frame and controller
- OTDR monitoring optics
- Optical switch for multi-fiber monitoring
- Central controller with server

Software

- Access for multiple system users
- LAN- and web-enablement for multiple probe management
- Geospatial mapping to translate an OTDR location to physical reference locations
- SNMP/XML integration with other systems (network operations/security systems)
- Advanced data analysis and reporting
- Alarming and notification (e-mail/txt/LAN)