VIAVI Solutions

White Paper

Troubleshoot Network Route Flapping Errors With VIAVI ONMSi Flash Fiber Monitoring

Detect and locate the short duration, transient "flash" fiber optic faults that cause intermittent network link flapping burst error conditions using VIAVI ONMSi Flash Fiber Monitoring. For use in xWDM, FTTX, PON, 4G/5G networks.

Background

Comprehensive physical layer network performance can be continuously evaluated and trended to minimize latency, errors, and Mean Time to Repair (MTTR), while maximizing availability and bandwidth. Physical layer monitoring can locate the root cause of many network errors. Intermittent network link flapping is a challenging problem to solve and causes a burst of errors in IP packetized networks when brief link failures cause communications links to alternate between up and down states. Identifying the root cause is mandatory to maintain quality high-speed, high-volume communications such as required for data center applications or core or metro high speed links that provide high reliability services. Distinguishing brief events due to intermittent physical fiber link discontinuities from other causes like device and power failures requires ultra-fast, automated fiber monitoring systems. Line flapping detection systems detect the up down link state change but cannot characterize a potential intermittent physical layer root cause. The VIAVI Flash Fiber Monitoring feature is designed for this rapid response link flapping diagnostics use case and is 100 to 300 times faster than traditional monitoring without sacrificing location diagnostic accuracy.

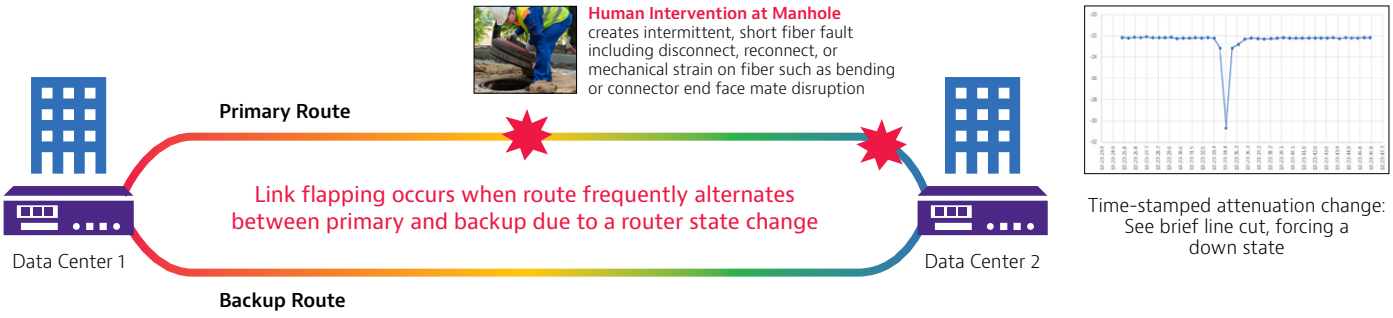
The Need for Ultra-Fast Detection of ISDF

Fiber optic monitoring systems typically monitor link power loss using Optical Time Domain Reflectometers (OTDR) that use Rayleigh Backscattering and Fresnel reflection signals to capture physical layer events. The low level of the Rayleigh signal requires accumulating and averaging multiple OTDR acquisitions over 10-30 seconds to obtain an acceptable signal-to-noise ratio to accurately detect, locate, and characterize faults along a line. The measurement time of this technology has been too slow to detect and locate transient intermittent short duration faults (ISDF) of 1 second or milliseconds that can cause a brief link failure flapping event.

Overview of Solution and Use Cases

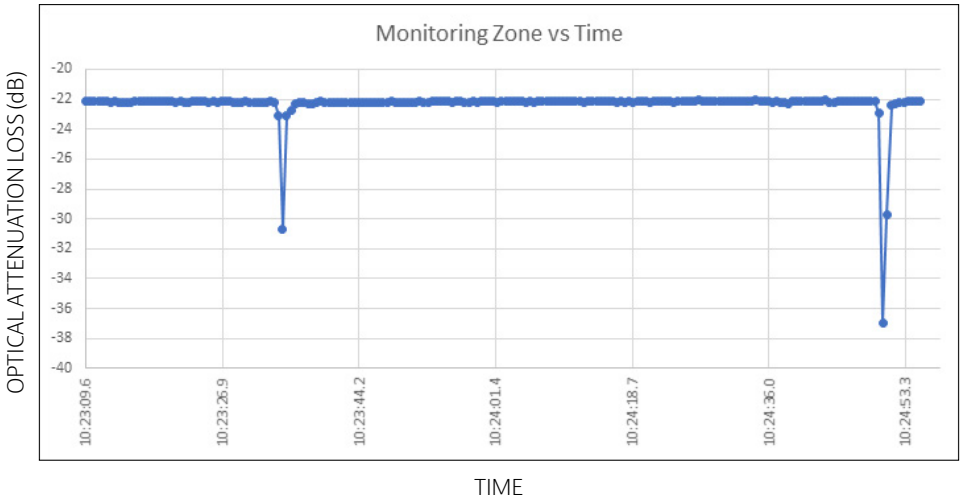
The patented invention under U.S. patent number 8682158 devises a system for detecting and localizing transient ISDF in an optical transmission system, using wavelength division multiplexing with a U band monitoring wavelength (1625nm-1675nm) that differs from the traffic wavelength. The invention is optimized to detect and locate ultra-short duration fiber link loss transients by combining short duration, real time OTDR trace acquisition technique and a high-speed local level analysis to first detect a link budget loss near the end of the line. Upon detection, fault location analysis utilizes the full OTDR data set. Use cases include identifying:

1. Human intervention causing a route flap such as disconnects/reconnects or short bending at a splice enclosure
2. Connector end face mate misalignment due to intermittent mechanical cable pulling
3. Intermittent cable bending that is severe enough to block light transmission
4. Potentially faulty elements or laser power levels



1. Apply Flash Fiber Monitoring 100 to 300x faster to detect and locate the transient fiber events causing errors.
2. Receive instantaneous notification with time-stamped attenuation change and loss metric.
3. Address physical root cause of fiber flapping events to improve service SLA to over five 9s.
4. Select best, most competitive service provider for reliability and obtain compensation from the responsible party.

Figure 1: Flash Fiber Monitoring System Detection in a Network



VIAVI ONMSi Flash Fiber Monitoring Innovation

A reference trace to obtain a full OTDR data set is taken to baseline the line optical budget performance and loss events, including splice loss, connector loss, reflectance, slope loss and bends. Next the Ultra-Fast Monitoring routine commences to detect a transient ISDF loss. Figure. 2 below represents the implementation of the innovative high-speed algorithm 00. The first part 01 describes the real time measurement and detection of power loss in the area taken as a reference. The process begins with the acquisition of the OTDR data points in real time mode limited to a few hundred microsecond duration 02 followed by the calculation of the filtered reference level around the reference point 03. The process continues with a new acquisition 02 if the threshold is not crossed. In the case of crossing the detection threshold 05 the full OTDR data acquisition is stored and used to locate distance of event 06.

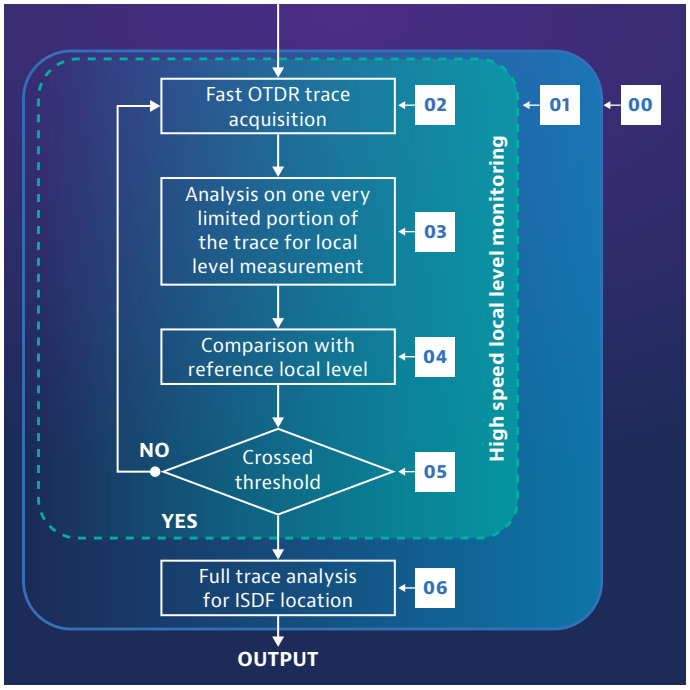


Figure 2: Flash High Speed Fiber Monitoring Algorithm

Impact and Conclusion

Flash Fiber monitoring is 100 to 300 times faster than traditional monitoring without sacrificing location diagnostic accuracy for this use case that necessitates a rapid response to diagnose an intermittent, physical root cause of link flapping. This system and algorithm innovation accelerates the detection window for a transient ISDF loss event by using the continuous, real time acquisition time to focus detection on a few data points. Upon discovery of a transient loss, accurate location analysis utilizes a full OTDR data set. Successful troubleshooting of intermittent physical fiber faults causing network route flapping will transform your troubleshooting process and eliminate a significant cause of burst error conditions that lead to faulty communications and frustrated customers.

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