VIAVI Solutions

Case Study

Remote Fiber Test System – Metro Fiber Flapping Case Study

The Flash Fiber Monitoring capabilities of the VIAVI ONMSi RFTS led to the rapid characterization and correction of network link flapping induced by nearby infrastructure in a highly developed urban setting.

Background

A high-profile customer providing a cloud based social media platform was utilizing rented and leased fibers to provide primary and redundant Data Center Interconnects (DCI) between key points of presence in a densely populated area of Shanghai.

One of their DCI fibers, carrying a 200G service and supporting hundreds of thousands of users, began experiencing intermittent alarms that coincided with switchovers to a redundant fiber link, a phenomenon known as fiber flapping.

The potential business impact of the issues included loss of subscribers and loss of advertising revenue, and subscribers themselves loosing revenue from loss of views, likes, and click-through business.

What is Fiber Flapping

The term “flapping” refers not to the presence of the fault itself but to the periodic rerouting of data streams from the primary to backup link. These disruptions cause the link to repeatedly transition between an “up” and “down” state. The reasons for such behavior can vary, including issues with hardware, power, or even software glitches.

The thing that can be overlooked is the fiber links themselves. While fiber optic cables are designed to be robust, environmental factors like temperature fluctuations or physical disturbances, such as technicians working in shared facilities or rodents, can introduce minute movements in the cables, causing any weak connectors or splices to induce attenuation or intermittent continuity and therefore loss of connection, leading to link instability. Conventional flapping detection solutions can assess the up/down state of a link, but not always the root cause.

Initial Investigations

The customer investigated by checking the optical transmitter for any wavelength offset or drift and any transmit power fluctuations, and no issues were found. OTDR testing of the suspect fiber link also revealed no obvious issues such as bends or bad splices.

Obviously, a manual and visual inspection of the fiber is not practical, it's impractical to get physical access to inspect the entire fiber link end-to-end.

Investigations via their transmission and network management tools did not provide any further significant information other than intermittent and changing link status from up to down and back had caused the switch.

Further Diagnostics and Tools Utilized

Remote fiber test systems (RFTS) in the modern era have evolved into centralized monitoring systems with strategically placed fiber test heads (FTH) in key network locations. Optical time domain reflectometry (OTDR) continually sweeps dark or lit fibers to detect breaks or degradations, comparing baseline traces to actual conditions to facilitate early warnings and outage alarms. The best RFTS systems combine continuous monitoring with additional on-demand test capabilities for troubleshooting. In this case, the ultra-fast flash fiber monitoring capabilities developed by VIAVI, with a sampling rate 100 to 300 times faster than conventional OTDR monitoring, was used to perform real time OTDR trace acquisition. And, critically for this scenario, utilizing dense wavelength division multiplexing over a U-band wavelength (1625-1675 nm) enables trace acquisition on the active lit fiber without interrupting or interfering with the live traffic wavelength.

For this 37 km data center interconnect, a VIAVI rack mounted standalone RFTS was used to baseline the link performance and characterize any losses from connection points, splices, and fiber bends.

VIAVI Remote Fiber Test System (RFTS) Fiber Test Head (FTH) for dark and lit fiber monitoring

The customer had performed first stage integration with a VIAVI FTH-5000 rack-mounted fiber test head so that alarm messages were delivered to their alarm server with the corresponding OTDR trace file (.SOR) retrievable from the RFTS/FTH after each event.

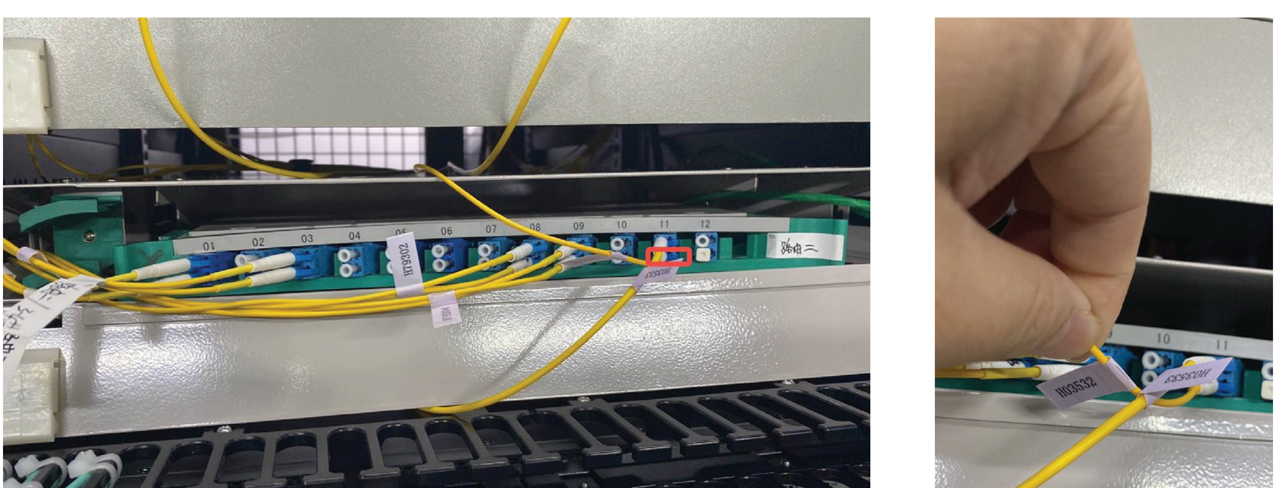


Figure 1: Connecting to the FTH Flash Fiber test port

The Flash Fiber Monitoring feature was then utilized to establish a more granular data set, with a sampling rate 100 to 300 times faster than conventional OTDR methods. As shown in the initial trace below the fiber link was verified at approximately 37 km in length with normal (or designed for) losses and end of trace characteristics. This trace was then used as baseline (or reference) for future measurements.

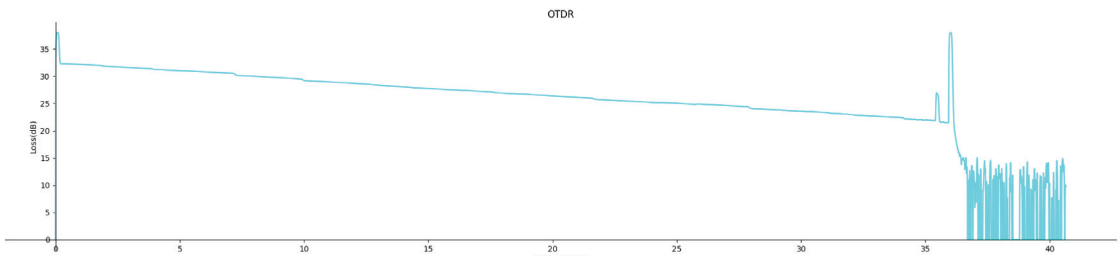


Figure 2: Normal baseline (.SOR trace)

Left to run continuous acquisitions, an alarm was generated immediately an excess loss event was detected which was correlated to a flapping event, it identified the precise loss location approximately 26 km from the link origin, as shown in the subsequent .SOR trace below.

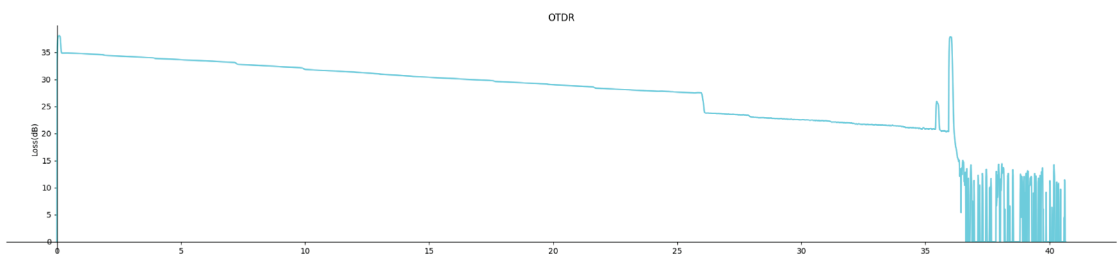


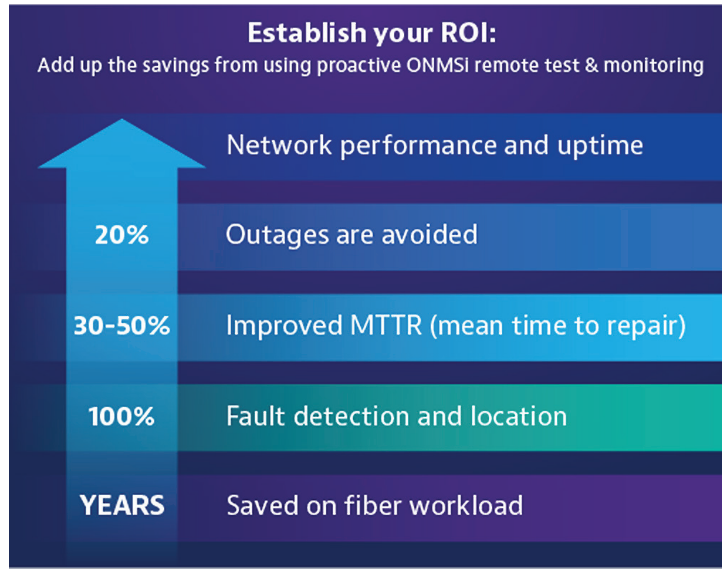
Figure 3: Transient loss event captured (.SOR trace)

Further investigation, with the aid of integrated route maps (.KML integration) and link design documents, pointed to a single patch panel connection, the proximity of this patch panel to a subway line offered additional clues. Vibration from passing trains had gradually degraded the connection, leading to brief outages each time a train passed.

Impact and Conclusion

Although system alarms were triggered each time the flapping occurred, the presence of a viable redundant path meant no end customers were immediately impacted. Indeed, the network maintenance team confirmed that link flapping was typically the precursor to a more serious outage, being able to detect and confirm that a physical layer fiber link related issue was the cause enabled them to perform proactive network maintenance to avert a full outage. If left uncorrected, the faulty patch panel connection could have eventually led to service interruptions and potential revenue losses/SLA penalties.

Some might argue that if the link is stable while using the redundant fiber then leave it as it is. While that is the simplest solution, it’s not the best operational solution or best for the business; you have simply made an unreliable primary fiber link into an unreliable redundant link.



Only VIAVI offers an RFTS solution, with fiber flash troubleshooting for sub-second data acquisition rates, capable of routinely detecting and definitively determining root cause of intermittent fiber issues. Diagnosing and addressing the root cause of flapping events improves service SLA conformance and mean time to repair (MTTR), while informing future network designers of the impact of nearby infrastructure

VIAVI RFTS solutions establish an ideal platform for the ongoing assurance of fiber health, on-demand troubleshooting of intermittent issues, and post-repair verification after a fiber break. Remote monitoring of multiple fibers using the VIAVI ONMSi and FTH increases productivity by automatically detecting areas of degradation and alerting operators and managers. Flash Fiber Monitoring capabilities add granular fiber visibility to reveal intermittent fault root cause that cannot by captured through conventional OTDR. Remote fiber monitoring also provides a greener alternative by minimizing the need for human operators and truck rolls while allowing for more flexible data center geographies.

VIAVI is Redefining RFTS

As the reach and bandwidth of fiber optic cabling continues to expand, so does the need for automated 24/7 monitoring coupled with advanced diagnostic tools. VIAVI has risen to these challenges with RFTS solutions capable of addressing every fiber network lifecycle phase and condition. Fiber network testing and monitoring improve efficiency, scalability, and schedule performance. Comprehensive pre-deployment fiber testing and automated monitoring and troubleshooting are important elements of this holistic strategy. By incorporating new capabilities like Flash Fiber Monitoring, VIAVI is redefining RFTS.

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