See how to prevent costly fiber problems – before they begin

According to a recent study by HTI Martin Technical Research, 89% of all fiber problems are caused by dirt and contamination. The tighter the technical requirements for attenuation become, the more problematic dirt and contamination become – and the more time, money and problems can be saved simply by inspecting and cleaning fiber on a regular basis. Here's how.

The old saying "an ounce of prevention is worth a pound of cure" is true when it comes to optimizing the performance of today's fiber optics. And it's especially relevant as the role of fiber optics has moved beyond long-distance data transmission and into the premise environment. Although fiber optics has not replaced traditional copper cabling from the telecommunications room to the work area, it is now widely employed in data centers for switch-to-switch, switch-to-router, switch-to-server and storage area networks (SANs). At the same time, as data speeds have increased, the technical requirements for fiber optics were changed accordingly – with allowances for attenuation becoming much more stringent.

In fiber optics, attenuation is defined as the loss of signal strength from the transmitter to the receiver. Based on the history of technologies that have used fiber, the amount of attenuation allowed has substantially decreased as the speed of the technology has increased.

Attenuation can be caused by a variety of events, including a source that is not transmitting sufficient signal strength, macro and micro bends, density changes, glass impurities, bubbles in the glass, bending of the fiber, and coupling losses.

The area that concerns many network engineers and technicians is the loss at the coupling point.

This loss can be caused by poorly terminated connectors (misalignment, etc.), dirt, surface scratches, and other contaminants. A recent study by HTI Martin Technical Research found that 89% of all fiber problems are caused by dirt and contamination. These are elusive problems that can come and go. Fibers that have been cleaned at one time can have dirt and contaminants migrate into the core of the fiber, blocking signals and causing attenuation.

New technologies and standards; new problems

Such blockages may not have seemed a problem when standards allowed for higher amounts of attenuation. But for current technologies, such as 1000Base LX and 10 GBase, the same blockage can cause serious transmission problems.

For example, current ANSI/EIA/TIA 568-B.3 standards afford approximately 1.5 dB for loss on singlemode systems that use such technologies as 1000Base LX. Even a

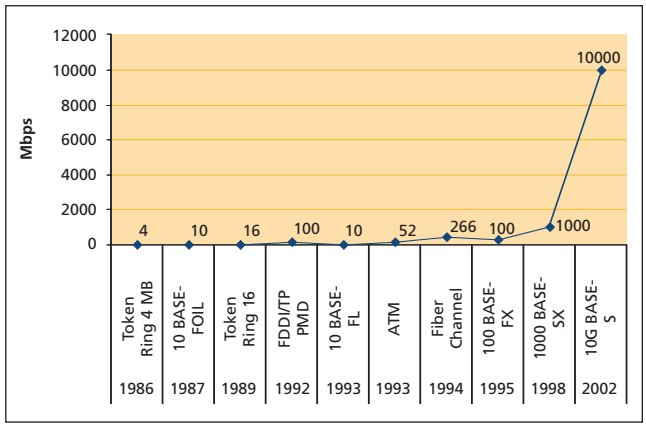

Figure 1: Fiber optic technologies vs. data rates

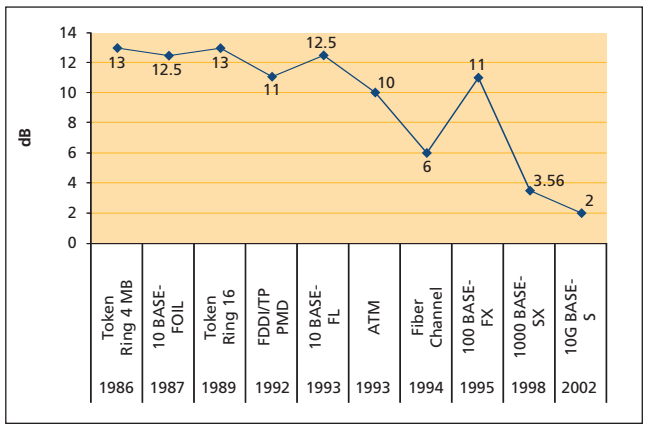

Figure 2: Fiber optic technologies vs. optical loss

particle of dust will block portions of, or the entire, signal. In an experiment conducted at Fluke Networks, a fiber endface that contained dust particles caused an additional 0.3 to 0.5 dB loss in comparison to a cleaned fiber. Considering the 1.5 dB allowance given for singlemode fiber (1550 µm), these particles can constitute approximately 20-33% of the allowed attenuation. These results are from just one connection; if the other fibers are contaminated, the problem is compounded.

The high cost of hit-or-miss troubleshooting

Because dirt and contamination are migratory, their effects may not be not experienced immediately. In the history of a typical device using fiber optics, the fiber optics are installed into the data center/ telecommunications room, an active device that uses fiber is installed into the equipment racks, and fiber patch cables are plugged into the switch(es) or the fiber infrastructure. Since the equipment is relatively new, dirt, contaminants and damaged endfaces are usually not considered problems. When initially installed, every component in the system works to its desired performance. But dirt and contaminants can migrate at any time from the outer perimeter of the fiber endface towards the center and into the core. Due to the critical nature of these devices, network technicians take action at the first sign of problems. These problems typically show up in the form of transmission errors that have been detected and registered by the active device and/or a network monitoring/management system.

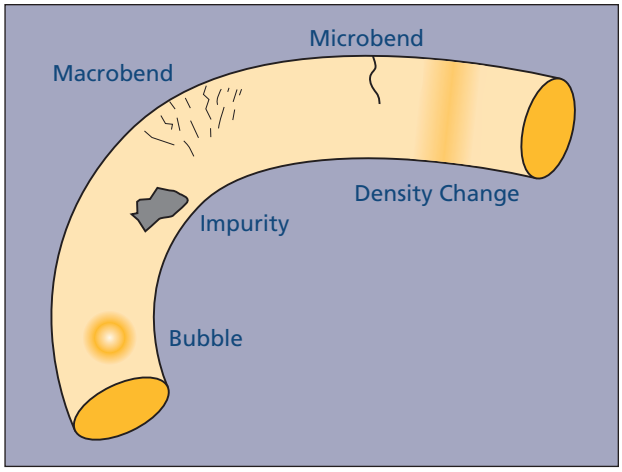

Figure 3: Different causes of attenuation in a fiber optic cable

When dirt and contamination are the cause of a poorly performing fiber optic port, the problem can occur in two different places: the patch cables or within the active component (i.e.: GBIC) itself. For many years, the typical troubleshooting methodology has been to replace and hope for the best.

For example, a Gigabit Ethernet switch port connecting a server to an infrastructure may begin to experience retransmissions and errors. Since this server is critical to the operation of an entire organization, it is imperative to solve the problem quickly. The typical first move is to swap the patch cables. This might prove effective if there is damage or contamination on one of the patch cables connected within the channel. But dirt and contamination can spread from a dirty GBIC, or even introduce further contamination from the new patch cord. If the problem persists, the network technician tries additional patch cables until he gets better results. This method is extremely time-consuming, because the technician must remove the questionable cable and analyze the traffic to determine whether the patch cable swap solved the problem. It can be especially costly if multiple patch cables are swapped multiple times in order to address the problem.

In the case of a switch connecting to the fiber infrastructure, if swapping the patch cable doesn't solve the problem, the technician may connect the switch and end device to another horizontal fiber. If changing the horizontal fiber "solves" the problem, the technician will understandably

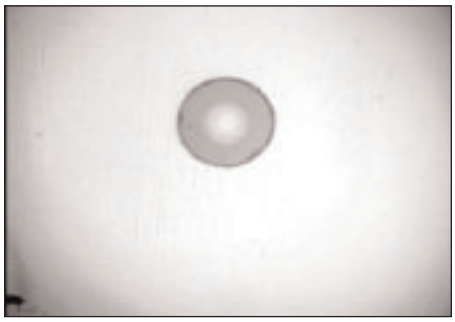

Figure 4: Good/clean fiber endface

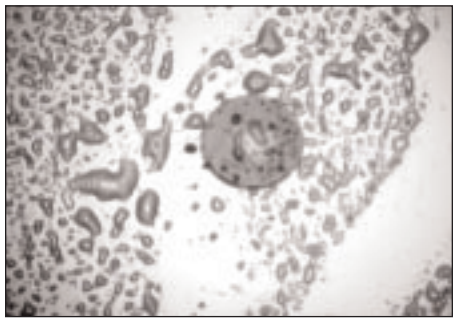

Figure 5: Endface with finger oil

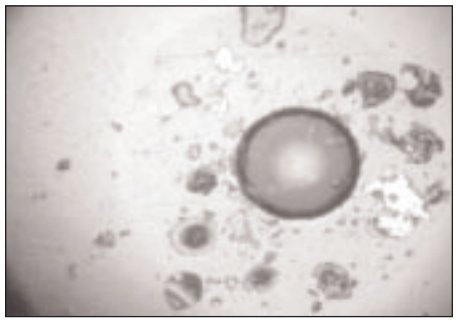

Figure 6: Endface with dirt

label the previous fiber as unusable. When a new switch or device requires another fiber pair, because the only remaining pair is the "faulty pair," the technician might further test with an OTDR or even replace the fiber itself. Meanwhile, contaminants from the GBIC or patch cables may still reside in the channel and wreak their havoc.

When a GBIC is suspected of being contaminated, a common troubleshooting option has been to replace the GBIC itself. The current technology of active devices makes this easy to do. But it can quickly become time- and cost-intensive if the procedure must be repeated on a regular basis. In some cases, the GBIC is not even the problem; it's the cables themselves.

Prevention pays

Prevention is a much simpler, more cost- and time-efficient approach to the problems of dirt and contamination. Regular fiber inspection and component cleaning can be done with a fiber microscope, a device designed to inspect fiber endfaces and bulk head connector interfaces. A fiber microscope literally lets you see what you've been missing – even before it causes a problem.

Fiber microscopes are available as small standalone units that are primarily designed to inspect fiber patch cables. Other microscopes, such as the Fluke Networks FT600 FiberInspector Pro, combine a portable video screen with a probe to inspect the fiber endface. This video/probe combination has two advantages: it inspects the bulkhead connectors directly without having to go to the back of the rack and find the fiber to inspect and a safety filter protects the eyes from damaging optical signals.

Using a fiber microscope, technicians can investigate a faulty component, such as a GBIC, to determine whether there are any contaminants and/or damage. If so, the problem can be quickly addressed with a fiber optic cleaning kit. This same method can be used with patch cords and bulkhead connectors. Using a fiber microscope and cleaning kit save a dramatic amount of time and money compared to the hassles of removing all of the components.

With dirty or contaminated fibers causing nearly 89% of all problems related to fiber optical systems, adopting a better approach to dealing with them will deliver huge cost and time savings on a continuous basis. Fiber inspection and cleaning make the old approach of changing patch cables, horizontal fiber or active components such as GBICs or interface cards seem not only outmoded, but also very costly in comparison. Using quick, simple fiber inspection products, such as the Fluke Networks FiberInspector Pro Series and Optical Cleaning Kit, should be the first action whenever an optical networking problem comes up – or, even better, before a problem occurs in the first place.

Inspect fiber connections quickly and safely with Fluke Networks' FiberInspector™ Pro.