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Rethinking Drop Fiber

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Fiber to the X – that's a term you should be familiar with if you are anywhere near the telecom industry. Any potential recipient is thrilled at the prospect of having a dedicated fiber delivered to the X. Greater bandwidth, future-proofed for whatever technologies may come our way, is the way everything should be going. This is the easy part – agreeing that fiber to the X is a great concept. Now let's talk about the hard part.

Early adopters of FTTx established that the technology worked, with varying degrees of profitability, positive in most cases but negative in some. The ROI on FTTx investment continues to improve as technologies, equipment, acceptance, construction knowledge and practices continue to improve.

Standardization on PON (as opposed to point-to-point networks) and subsequent revisions to advanced point-to-multipoint fiber reduced the amount of fiber needed to deploy a network. The Full Service Access Network working group drew on IEEE, ITU and SCTE standards to specify how optical line terminals (OLTs) and optical network terminals (ONTs) would communicate in PON networks.

Considering the magnitude of the effort, the evolution of PON was accomplished in relatively short order as APON (ATM-PON)and BPON (Broadband PON) gave way to the more efficient, cost-effective G984 Gigabit PON (GPON) standard as the popular choice for FTTx networks.

Equipment costs continue to decline even as vendors develop new twists on technologies to meet more advanced and bandwidth-heavy delivery demands . Materials costs between the OLT in the central office and the fiber distribution hub (where the bulk of fiber consolidation and distribution occurs) are becoming streamlined as technologies allow for more feeder fiber to be delivered inside smaller and smaller footprints. Delivery and pathway methods continue to improve with microduct technologies that use blown fiber or pushable fiber from hubs into the access network along with more traditional outside-plant (OSP) cables.

Labor, however, continues to dominate the cost structure of building FTTx networks, and labor costs become more evident and challenging closer to the final destination. Why? *Because methods and procedures that are appropriate for large-count fibers are being used across the entire network.*

Continuing to lower costs in the access network requires addressing the methods used to protect a single fiber and introducing new technologies to meet this challenge – or challenges. Delivering a single fiber (or two fibers) to a single-family unit, a multiple-dwelling unit, an office park or a single-business unit (just to name a few) each has its own unique set of challenges.

Can a single product address them all? Simply, no. Do not let anyone tell you different. These application environments have an enormous range of variability outside a service provider's control, as opposed to a central office, where everything down to the color of paint can be predetermined.

Fiber in the Last Mile

In its simplest terms, the objective of the last mile is to get a fiber from an access point to a customer in the most efficient and cost-effective way. The simplest method (I hope nobody does this) is to lay a bare fiber on top of the ground. Though it is quick and uses the least material, and the fiber can be replaced quickly and inexpensively, such a method would soon result in a damaged, cut or destroyed fiber and an unhappy customer – and, eventually, no customer.

Back to the drawing board. The fiber needs to be a little tougher so it can hold up to harsh environments and placement considerations. The traditional method, and the method most commonly used today, is to bury a flat drop cable of a very rugged construction. That meets the goal!

Or does it? Stiff drop cables are never made to exact length. A technician or a planning engineer needs to be short on the length only once to realize how much time and money the shortfall cost the company – not to mention that the customer is not getting his football channels the day you told him he would.

So what happens? The engineer orders a longer length of cable, "to be safe," and a new problem arises: Where to the put the slack? The coil size of such a stiff cable, because of its construction, prevents it from being stored in the fiber management device at its end. Now an additional slack storage box is required or the extra coil length must be hung somewhere on the dwelling – neither of which is aesthetically pleasing.

If the fiber is damaged or cut, the only restoration process is to dig up the customer's yard and retrench another drop cable. If the flat drop is buried within duct, there is a pathway for restoration with minimal disruption to the environment, but because of the size of the flat drop cable and corresponding connector, the duct is large and disruptive when buried.

And we come full circle – the cable is meant to be direct buried. Burying duct adds material costs to use a product in a way it was not designed for!

A Better Way

When my product development team and I sit down to design a fiber management product to meet a particular need, we give major consideration to slack storage. We often must allocate 20 percent or more of the footprint just for storing slack if we are going to design the product correctly considering current deployment methods and fiber management basics. This is true for products that range from high-density panels in the central office to cabinets in the field.

Fiber management does three things: It consolidates, distributes and protects fiber. Drop cable in FTTx environments performs these same jobs for a single fiber. Most drop cables today are constructed with a tremendous amount of protection around the single fiber. Fiberglass strength members, central tubes, heavy and rugged polymers add to the dimensions of the cable, resulting in a product that must either be made to exact length or allow for slack. Slack storage boxes specifically for cable, larger designs or blunt-end splicing of connectors drive up the material and labor cost of installations.

Why not take advantage of one of fiber's inherent advantages – its small size? Fiber must be protected in a fiber management device and then must be protected through the route path to the next fiber management device. *Separating the two cases – that is, protecting a small fiber through every route path and fiber management device in separate and different ways – takes advantage of a fiber's small footprint, reduces the space requirement for storing slack and still fully protects the investment.*

First, consider the access point – the final fiber consolidation point in the network before the final drop to the customer premises.At an access point, as at a fiber panel or frame, a metal or plastic fiber management device that consolidates and distributes the fiber provides physical fiber protection. Why store a cable meant for direct burial in this device? It only increases the size of the footprint and cost.

When the fiber leaves the fiber management device, a pathway can protect it. Advances in connector size and hardened connector deployment allow microduct of 10 millimeters or smaller to be used rather than large conduit that requires significant earth-moving equipment for installation.

As the drop reaches the customer premises and connects to a test access point or demarcation point, the physical protection can be traded from the microduct to the housing that the drop is entering. The drop leaves the microduct as it enters the device.

What type of fiber can allow the separation of fiber management responsibilities?

The fiber would have to handle very small slack storage requirements, so it makes sense to use bend-insensitive fiber. Minimizing storage requirements also demands a small fiber, but how small is too small for handling by fiber's worst enemy – human fingers? Handling 250um fiber usually requires highly skilled technicians who are performing splicing operations – but that increases the cost of labor to deploy. In addition, because so many fiber-to-the-X deployments are underway, highly skilled technicians will have to be dedicated to the high-fiber-count environments that require their training and experience. Last-mile fiber will have to be handled by lower-skilled laborers. Is 900um a possibility?

It's All in the Jacket

In Minnesota, where temperatures often get down to 20 below zero, we've learned how important it is to dress in layers. A warm, large jacket is a requirement for personal physical protection outdoors.

Once inside, I don't need that heavy protection anymore, and the jacket is too big and bulky for indoors. I take the jacket off – but I still leave on my sweatshirt for that first layer of protection. When I leave the house, I put that outer jacket back on.

In the same way, as a fiber leaves the access point, it must be protected as it travels to the demarcation point at the customer premises. This is where microduct made of a material with high crush resistance and direct bury capability (like a good Carhartt jacket) provides the physical fiber protection that any traditional OSP or flat-drop cable can.

Microduct can be installed using the same methods used for any direct buried cable, and it provides the additional benefits of future proofing for more bandwidth and restoration. If a backhoe cuts the duct, or if Grandpa runs into it when digging holes for trees, the microduct can be quickly restored at only the cut point. The cut fiber is pulled out and a new fiber is pulled in, all in a fraction of the time and cost it takes to splice or plow/trench a new direct-buried cable. This reduces total cost of ownership. Additionally, in the future, when a single fiber is no longer enough to address bandwidth, parallel networks or extension requirements, the fiber count can quickly be upgraded at minimal cost.

Don't Forget the Sweatshirt

When the thermostat is set to 65 in the winter, wearing a T-shirt doesn't make any more sense than pulling a bare fiber through conduit. An optical fiber that has been jacketed must have a tensile rating to handle installation methods that require little to no specialized equipment, and it must be OSP-rated for thermal diversity. A bend-insensitive, 900um, OSP-rated loose-tube cable with high tensile strength is a solution that can be deployed in nonconditioned environments, has great bend radius protection and can pulled by a lower-skilled technician with minimal chance of breaking.

This allows for a more forgiving engineering experience. With 900um drop cable, 5, 10, 25 or even 50 feet of excess fiber can be slack stored in a 4-inch space. Think about an extra 50 feet of flat drop – it requires a much larger footprint to store.

Service providers are calling on engineering firms and labor contractors for a guaranteed price per home connected at a guaranteed schedule – lofty goals! Innovations in OSP-rated 900um cable, which we call StrongFiber at Clearfield, create a more forgiving environment for engineers and a less labor-intensive environment for contractors. Deployment tools, including a one-sized fiber management device for 100- to 300-foot drop lengths from a customer premises to an access point (the reverse of most deployment methods) provide inventory advantages of fewer SKUs, reduced material cost, smaller footprint and shorter installation time.

FTTx single-family units, multiple dwelling units and business premises are application environments where Clearfield's Fieldshield Microducts and 900um StrongFiber combine to provide a pathway solution that minimizes the fiber management footprint on both ends of the drop. Even more than plug-and-play connectivity, this product is "labor lite" from craft requirements to labor savings to material and space saving. Promise.

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