Fiber to the Campus: The Challenge of Providing Broadband to the University Setting

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By: Scot Bohaychyk
Clearfield Market Manager and Smart Guy

One of the biggest challenges facing fiber deployments on a campus is the lack of easy access to structures. The design and layout of a college campus (or any campus for that matter) with dorms, arenas, stadiums etc. present significant challenges to the provider. The college campus, with its makeup of both students and staff, is one of the most data hungry environments in today's world.

We know by the makeup of a university's population that there is a hunger for broadband services for classroom activities, campus wide notifications, and for internet access in every venue from the dorm to the classroom to the arenas and stadiums. This is one of the most data intense populations in the country. Students expect to have instant access to all of their data (whether it is a favorite TV show, a YouTube video, an online lesson or just where to get a pizza) at all times.

The challenge of delivering fiber to meet this hunger for broadband has been looked at by engineers and telecommunications professionals with some angst. The good news is that with advancements in placing methods and materials, we can now tackle this problem more economically than ever before.

While getting the fiber as close to the end user as possible is very important --- managing and protecting that fiber is equally as important --- if we want to ensure the longevity and integrity of the network.

This whitepaper will outline how microduct can be used all the way from the football stadium to the dorm room to manage and protect the fiber while ensuring a cost-effective broadband installation.

First, a primer on Microduct and an introduction to FieldShield

One of the lesser known advancements is in the area of Micro-conduit or Microduct. Microducts are really just smaller versions of HDPE conduits that have been used for decades in the Telecom and Power markets. The challenge in creating a microduct is the same as with larger ducts: striking a balance between strength, crush resistance and flexibility.

Clearfield has managed to strike that balance with our FieldShield microduct. Now a 10mm microduct can be bent in a circle as small as a coffee mug without kinking, but with enough strength to drive a tank over it.....(it's true, I have pictures!)

FieldShield comes in a number of ways including: Direct buried, direct buried with an integrated locate wire, Plenum, and aerial so you simply pick the microduct for your application. Keep in mind that all of the microducts can be coupled together with an air and watertight coupler. With that in mind, the installer can move from a buried environment, to an aerial and on to an indoor plenum environment if needed all while using the same FieldShield fiber. This helps to eliminate connection locations whether it is a splice or cross connect box.

Microduct in the Outside Plant

Instead of cutting the parking lot, sidewalk, or other hard surface and digging a trench with an excavator, due to the small size of the microduct, micro-trenching is a new and viable option. With micro-trenching, we now have the ability to make a one-inch wide saw cut about nine to twelve inches deep and place microducts into the trench and backfill it. The advantage of this method is that since the trench is only an inch wide, it can be done almost anywhere, even using existing expansion joints in a concrete walkway or sidewalk. This is done by simply widening the expansion joint using the micro-trencher, laying in one or more microducts and backfilling the joint with a hot polymer, epoxy or grout. After the backfill is complete, it is not unusual for the trench to be virtually invisible. An additional benefit of the very small trench is that traffic disruptions, both vehicular and pedestrian, are almost non-existent. There is no need for steel plates covering a trench to accommodate traffic. It is even possible to trench across one lane and then allow traffic to cross over the trench while the other lane of traffic is cut. Traffic is only held up long enough to lay the microduct in the trench. Additionally, with most backfill options, it's possible to let traffic drive on it minutes after it's placed. After we gain access to the building, the microduct can then be routed to an economical wall box from the FieldSmart product set. These indoor or outdoor boxes can be configured to accept the microduct directly, and fitted with as many Clearview cassettes as needed. This allows the fiber to be protected all the way into the facility, easily broken out for distribution and gives the technicians access to the connectors without risk of damage to the fiber.

Microduct in the Riser

Another use of Microduct is to place it in occupied conduit systems. Most campus buildings have a conduit structure feeding into them. The problem is that most are nearly full. This is an environment where microduct can be considered a viable solution. Because of the design of the microduct, it lends itself to be pushed into an occupied conduit in much the same manner as a fish tape. It is rigid enough to be pushed, yet flexible enough to navigate bends and turns. An example of this was a building where 24 fibers were needed to service a site on the 10th floor. The only access was a 1 inch metal conduit with a 25 pair copper cable and four Cat5 wires already in place. We used the microduct as a fish tape and pushed two microduct conduits down through the existing conduit from the 10th floor to a utility room in the basement. This now gave not only a primary pathway, but a secondary one for future growth. After the microducts were placed, we simply pulled the fiber in. It was estimated that this job would require forty hours to build using traditional methods and time considerations. Actual time to place the microduct and fiber…….8 hours. As with the earlier deployment method, the duct and fiber were terminated in a rack mounted FieldSmart panel configured with two cassettes. The splices were made in the cassette and then placed into the panel to complete the job. The final installation looked very clean, but more importantly; the fiber was completely protected from the splice in the manhole some 900 feet away all the way to the connector face.

Gigabit to the Dorm Room

Another challenge facing network operators dealing with the campus environment is that of the housing areas. Dorms are a lot like the traditional MDU environment and can come in a number of configurations. Most dorms are very closely related to the tower type MDU. With this type of build and the space restrictions in the risers of these structures, the FieldShield Plenum microduct is uniquely suited and can save both space and headaches for the installer. The 10mm footprint, coupled with the rugged nature of the product, allows it to be placed in the riser space without concern of incurring damage during the installation process, or more importantly, after the fiber is installed and turned up. Also, since the microduct can be terminated in the FieldSmart boxes on any or all floors, it allows the designer to place access points easily and only where they are needed. The boxes allow for a "pass-through" installation or a point-to-point installation, whichever is desired. Only as many cassettes as needed are installed while allowing for additional cassettes to be placed at a later date.

After the backbone is installed, additional microducts can be run to each suite/dorm room or common area. These horizontal runs can then house one to 24 fibers each, depending on the requirements. Normally we see that a box is placed in a wire closet on the floor, fiber is run to the box (a duct from each floor or pass through) then the fiber is broken out into one or more cassettes. At this point, one splice can be done in the basement, lighting up the entire building. At each access point, microducts are run to each room, and a fiber is placed to a faceplate, modem, ONT, and now to a Clearview xPAK. The xPAK is an economical way to both break out and protect up to six fibers. In those areas that don't require the capabilities of the Clearview cassette, the xPAK is a good way to house smaller counts while giving the same level of protection to the fibers. These small footprint housings allow them to be placed in areas that typically were not available before: closets, baseboards, under desks just to name a few. Keep in mind that the ultimate goal is to deliver the fiber in a way that makes it convenient to use, but with a superior level of protection.

With the introduction of the FieldShield pushable fiber, no splicing is needed on the floor. The technician simply pushes or pulls the pre-connectorized fiber to the desired room through the microduct, takes off the protective cover and slides on the connector housing. This allows for the more experienced splicer to spend their time on splicing while the installation of services can be done by lesser experienced personnel. Another advantage of this type of installation is that the fiber does not need to be installed until there is an actual need for service. Then when requested, it can be installed without any need for special tools or a splicer.

Microduct to the Stadium

Last, but certainly not least, the most challenging venue on a campus is that of the sporting venues. Football stadiums, basketball arenas, soccer fields, baseball fields all have unique and challenging issues brought about by a high concentration of people all expecting to access the network just as if they were in their rooms, as well as the added broadband demands from television trucks, broadcast needs and special event requirements. While they are all different, we can concentrate on the similarities of each and by varying the components that were discussed earlier, provide unparalleled services -- without breaking the bank.

A football stadium is usually the most difficult because of the construction of the stadium, the capacity and sheer size. DAS (Distributed Antenna Systems) is a fast growing technology that is ideally suited to mate with ruggedized microducts, pushable fibers and all of the associated housing we talked about earlier - especially the xPAK. While providing fiber to the stadium facility is much the same as the other areas, distribution of the fiber throughout the facility is where the microduct really outshines other options. Because of the construction of stadiums (primarily concrete and steel), most deployments have to be in exposed areas. Building conduit runs can be extremely expensive, but the need to protect and manage the fiber is paramount. DAS systems allow for multiple antennas to be fed from a radio unit, greatly minimizing the cost of deployment, but because of the amount of data that will be running through these systems, fiber is the only media that is really suited for them. If you imagine a football game opening ceremony, nearly every person wants a picture and then wants to be able to post it to Facebook, email it or text it to a friend. This all puts enormous stress on the macro-networks. DAS, by design, relieves this stress by providing an additional route for this data through an alternate fiber path.

The challenge is getting fiber to the RU and being able to terminate it in a way that protects and allows for ease of connection as well as expansion if needed. By placing a microduct to the RU, the network operator can install a multi-fiber pre-terminated in an xPAK by pulling the un-terminated tail back to the splice point. With multiple RU's deployed around the stadium, the installer needs to do only one setup, splicing all the tails at one location and subsequently turning up all the RU's. If one of the routes is later damaged, the conduits can be coupled using the air-tight couplers we discussed earlier, and pulling a new tail back to the splice location. If only one or two fibers are needed to each of the RU's, a pre-connectorized solution is the most economical.

In Summary

By taking advantage of the unique properties of microducts, connectorized fibers and cassettes, specifically those with ruggedized properties, the problems associated with campus environment placements can often be easily solved. Design engineers and campus administration can have peace of mind knowing they can get fiber to the various venues without causing undo disruptions or spending large amounts of operating capital.