FTTX NETWORKS

REALIZING MORE PROFIT IN THE OUTSIDE PLANT

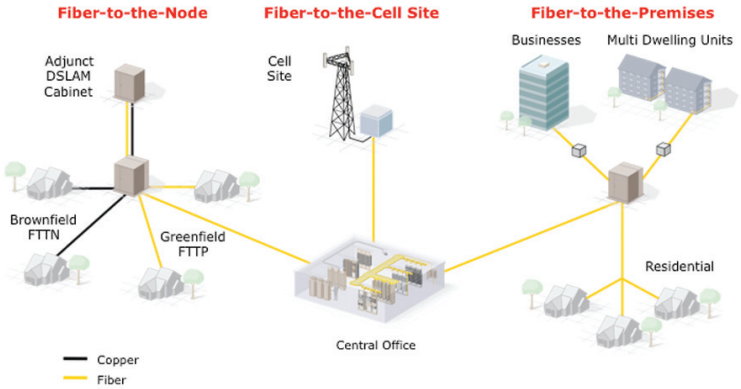
INTRODUCTION

As service providers upgrade their networks to bring fiber closer to their customers, these often are the first major network upgrades the providers have made in a decade or more. In deploying these networks, service providers are seeking to gain a competitive edge while also obtaining as much efficiency as possible without compromising quality. Additionally, the carriers want to make sure the networks are deployed in a way that will minimize the complexity of future upgrades.

The design process begins in the central office (CO) and moves through the optical distribution network or outside plant (OSP) and terminates at or near the customer premises. In this article, we will focus on the OSP part of the process and how service providers can best meet their goals of minimizing costs, ensuring ongoing network quality and making the FTTX networks as future-proof as possible. We also will look at how fiber cable and components that use miniaturized connectors pre-installed at the factory—as well as a new universal drop cable--can help in meeting those goals.

CONNECTORIZATION AND MINIATURIZATION

The outside plant that underlies FTTX installations is comprised of three separate sections:



All of these solutions have various benefits when looking at bandwidth requirements that are needed today as well as the next-generation applications of the future, all provided by the capabilities of fiber.

- The feeder network between the central office and a distribution point in the neighborhood
- The distribution network between the neighborhood distribution point and a service terminal located closer to the end user—on a pole, in a hand-hole or other location
- The customer drop from the service terminal located to the customer premises

At the junction points between each of these network segments, service providers have the option of either splicing fibers or using fiber that has connectors pre-installed at the factory. Spliced connections are fused together during the installation process by specially trained technicians using dedicated equipment. A connectorized approach uses multi-terminal connections that can be easily snapped together without the need for special tools or specially trained technicians. This, in turn, saves time and installation costs, making connectorized fiber the preferred choice throughout much of the OSP.

Service providers can gain additional benefits by selecting the latest-generation of connectorized fiber, which uses smaller connectors than earlier generation products. The latest-generation of miniaturized connectors is designed for use with miniaturized service terminals, which also are considerably smaller than earlier-generation equipment.

Miniaturizated components can fit in smaller spaces, helping service providers save initial installation costs by enabling them to maximize use of pre-existing conduit and hand holes. When new conduit is required, its size can be minimized, helping to reduce costs. A connectorized multiport service terminal (MST) also elim-

inates the need for splice cases at the service terminal, further minimizing the space required at the hand-holes or pedestals that store the service terminals.

Moving forward, it is likely that the OSP architecture will need to include some type of open access networks—for instance, metro Ethernet and wireless backhaul systems. To plan for this eventuality, service providers should consider installing extra fiber to support these potential additional connectivity requirements.

An approach based on connectorized fiber can make it faster and easier for technicians to add the necessary connections when the network is expanded. And the need for specialized splicing technicians and equipment is minimized or eliminated. Trevor Smith, director of carrier solutions for ADC, suggests "Without connectorized fiber, they would have to break a splice or even go into a case with a lot of splices already made—and that's a recipe for disaster. With a connectorized approach, it's safer and easier to make a change."

Miniaturized components can further facilitate future upgrades by enabling service providers to leave ample room on poles and in hand-holes so that technicians can obtain quick access to connectors for making changes, additions or drops.

Using fiber and components with miniaturized connectors also can simplify the process of upgrading FTTX networks to support higher bandwidth, which typically involves upgrading equipment in the CO and at the customer premises, and sometimes at a neighborhood node as well. Additionally, testing and troubleshooting fiber connections is easier with a connectorized approach, eliminating the need to take apart splices to obtain fiber performance measurements.

Service providers can use ADC products with the confidence that they are using products built to high quality standards from a supplier with decades of experience supporting service providers worldwide.

Next we will look at each segment of the OSP underlying FTTX networks in more detail.

THE FEEDER NETWORK

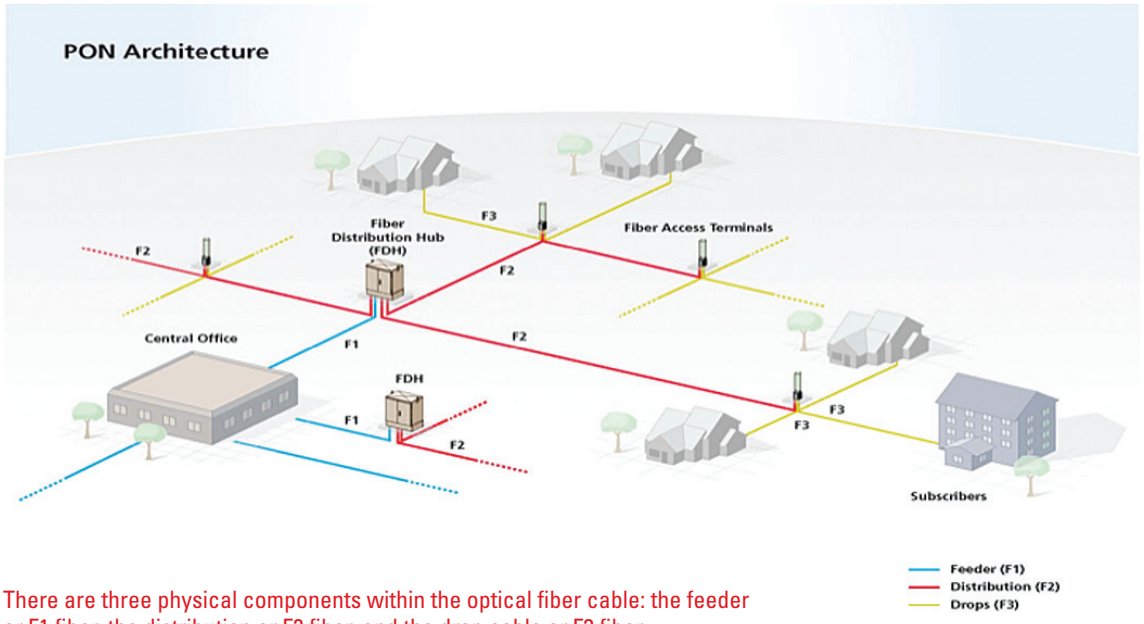
The majority of FTTX networks deployed today are based on a passive optical network (PON) technology in which a single fiber from the central office is delivered to a neighborhood node, where a splitter is used to divide the signal from the fiber into separate feeds for individual customers. In a typical architecture, the signal is split onto 32 separate fibers.

As an alternative to a PON design, some service providers are using an active Ethernet approach, which does not use splitters but instead dedicates an individual fiber path from the central office to each customer, an approach also known as a point-to-point architecture. A third approach uses PON technology but puts the splitter in the CO, also using point-to-point fiber.

ADC estimates that about 30% of new FTTX installations use a point-to-point architecture because some service providers view it as a more future-proof approach. "If the service provider deploys PON and later wants to increase the bandwidth, they can serve fewer homes per splitter or even switch to active Ethernet by doing all upgrades at the CO or at the home," explains Smith. "However, some optical network terminal (ONT) manufacturers also provide auto-sensing ONT's that will allow either PON or active Ethernet without hardware change-out.

But despite these advantages, a point-to-point architecture also creates a unique installation challenge because the number of fiber cables in the OSP increases dramatically with a point-to-point approach, making it increasingly impractical to use loose-tube cable types. "Rather than bringing small-count fiber to the neighborhood and splitting the signal onto multiple fibers in the neighborhood, you're bringing up to 32 times as much fiber from the CO because all of these fibers must appear in the CO as well, increasing the floor space required," Smith notes.

Ribbonized cable is well suit-



There are three physical components within the optical fiber cable: the feeder or F1 fiber, the distribution or F2 fiber, and the drop cable or F3 fiber.

ed to installations using this approach because it is more compact than loose tube cable, particularly in high-fiber count cables, and after cables have been spliced. Service providers can often see an eight- to ten-fold savings in space requirements using ribbon cable.

Using ribbonized cable in the feeder network also brings speed to the installation process, providing quicker and more efficient service turn-up. Technicians can splice 12 fibers at a time using mass fusion technology, rather than individually splicing.

THE DISTRIBUTION NETWORK

In a traditional FTTP architecture, construction places a large distribution cable containing anywhere from 48 to 216 individual fibers from a fiber distribution hub in the neighborhood to the service terminal, which can be a splice case, a pedestal, a handhole or a pole-mounted terminal. A service terminal typically can serve between two and 12 homes.

From the first service terminal, unused fibers are run to the next service terminal, where the appropriate number of fibers (2-12) are connected via splices to the service terminal, with the remainder looped through to the next service terminal, and so on. Specialized technicians (those capable of doing splices) are required to create the loop-throughs at each service terminal.

With the connectorized approach, smaller cables (up to 12 fibers each) are used in place of the large distribution cables. One end of each fiber cable is connected to a miniaturized service terminal located on a pole, hand hole or other location. The other end of each cable is brought to a distribution hub in the network that also feeds several other service terminals. This approach eliminates the need for loop-throughs and minimizes the number of locations at which splices must be made, enabling more efficient use of specially trained technicians.

Using connectorized fiber cable and MSTs in the distribution network saves on fiber cable, cable placement and splicing costs, making the connectorized approach about 20% less expensive than the traditional approach, according to ADC.

THE CUSTOMER DROP

To make the final connection between the service terminal and each customer home, new drop cables

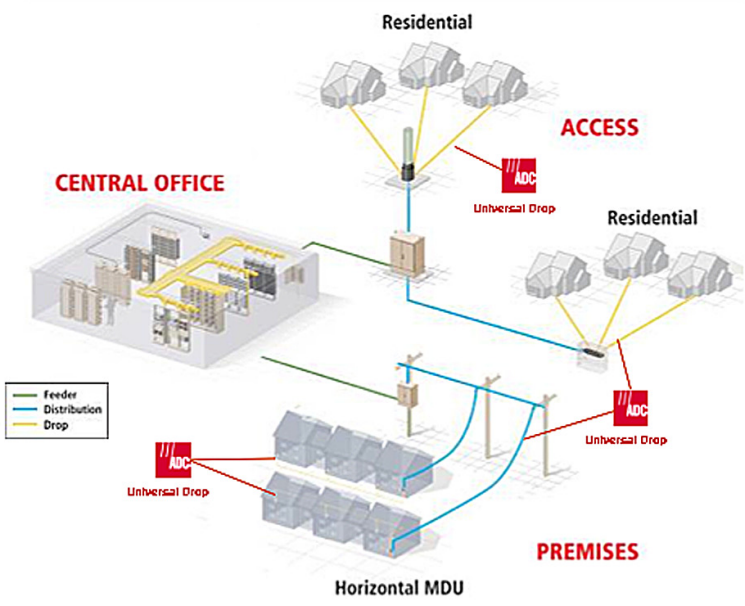
are available that use connectors instead of splices, have reduced bend radius and are designed for indoor or outdoor use. Because of their versatility, they are known as universal drop cables.

The ability to work indoors or outdoors is achieved by embedding an indoor cable within an outdoor sheath. At the time of installation, technicians remove the outdoor-service sheath as needed to create an appropriate length of cable for indoor use, leaving the outdoor sheath intact on the remainder of the cable. This approach eliminates the need to use two separate cables for each customer drop (one for indoor and one for outdoor use), and also eliminates the need for a demarcation device on the side of the building where the two different types of fiber would traditionally be connected.

The indoor cable often uses reduced bend radius fiber (RBRF), enabling it to withstand tighter bends without creating signal loss. This makes it well suited for indoor installation, where as many as seven 90-degree bends may be required. Installers have to use a bend radius limiter when installing traditional cable under these circumstances, but that is not required for the RBRF fiber. In addition, cables do not need to be measured so precisely because the RBRF capability allows slack cable to be easily coiled and stored.

The end of the outdoor cable has a miniaturized connector designed for easy connection to miniaturized service terminals at the time of service turn-up to the customer. This is considerably more efficient than the traditional approach to service turn-up, which requires a technician to go to the terminal, cut off the appropriate length of drop cable from a large spool, place the cable from the terminal to the home and splice both ends. The traditional approach often requires two sets of workers: a drop-placing crew and splice technicians. The connectorized approach eliminates the need for two separate sets of workers, as well as eliminating the need for specially trained technicians to do the splices.

ADC estimates that by eliminating the need for a demarcation box, minimizing labor costs and eliminating the need to inventory two different types of cable, universal drop cables can reduce the cost of bringing service to each home by $40 to $45.



The Universal Drop Cable is a flexible, safe, single-source solution for indoor or outdoor cable applications. It is a pre-connectorized cable assembly solution that promotes rapid, cost-effective connections throughout the subscriber network.

THE ADC SOLUTION

Although connectorized fiber is available from multiple manufacturers, ADC is the manufacturer with the greatest level of miniaturization, Smith says. "No one else makes a connector as small for the OSP." In addition, the universal drop cable with indoor-outdoor capability and RBRF is also unique to ADC.

Based on decades of experience supporting service providers worldwide, ADC delivers products and solutions built to high quality standards that customers have come to rely on. ■