FTTH network ePlanner overview

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INTRODUCTION

Opportunities such as the Rural Digital Opportunity Fund (RDOF) have enabled tier 2/tier 3 operators, rural electric co-ops and municipal utilities to provide reliable high-speed broadband to their communities. The opportunities are immense—but so are the challenges.

For the RDOF winners and their technology consultants, the next challenge is translating their conceptual plans into detailed designs tailored to their specific use case. Selecting the appropriate network topologies, technologies and product solutions involves dozens, if not hundreds, of difficult decisions. For most smaller rural utilities and co-ops, however, the fiber landscape may be unfamiliar territory.

That's why CommScope has developed the FTTH ePlanner.

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The FTTH ePlanner is an interactive guide that helps network engineers and consultants understand and navigate the multiple decisions that go into transforming their conceptual network vision into a working design.

It takes you step by step through the major infrastructure decisions—from the central office, feeder and distribution network to the inside of the customer’s home.

Each section introduces you to the key topologies, product types and design considerations involved in building your network. Interactive decision trees guide you in configuring a customized broadband network design and understanding the product options to implement your strategy.

The FTTH ePlanner is the product of CommScope’s 40+ years of broadband network design and success. It includes the insights gained from our involvement with the global standards bodies and field experience with service providers of all size. The following is just a sample of the information it includes.

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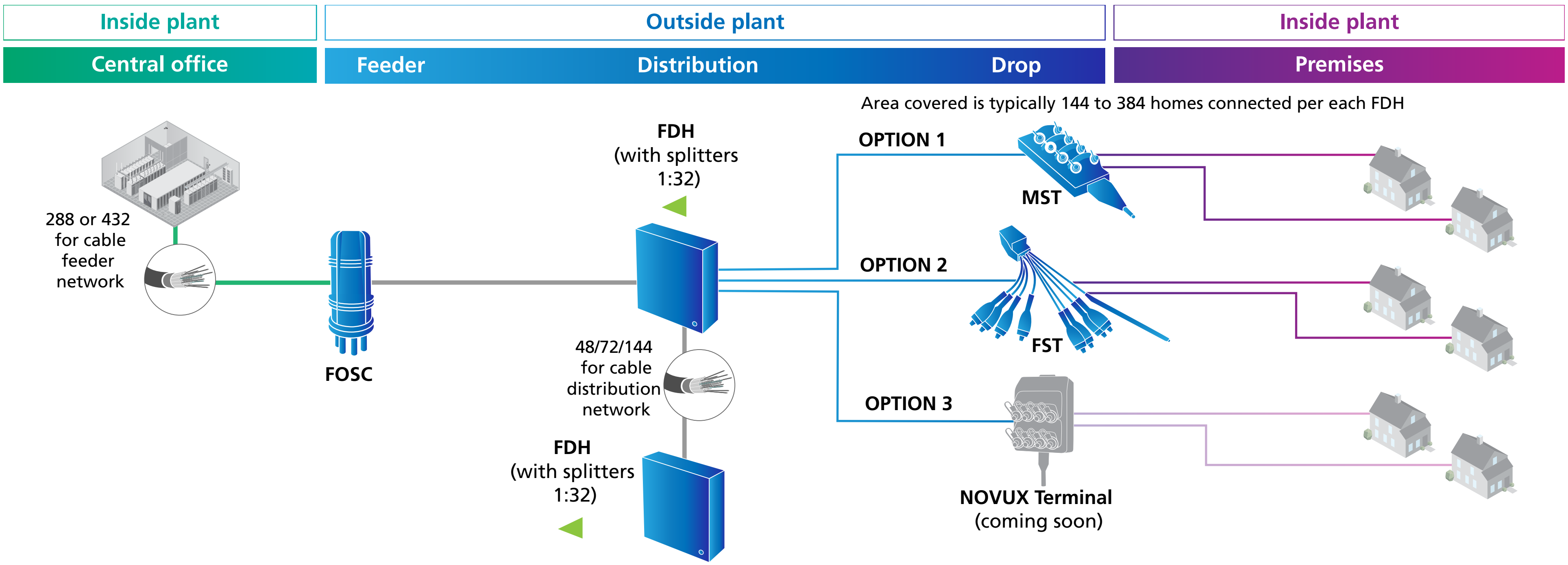
Designing a best-fit broadband network begins by breaking it into its three main parts: central office (CO) cabling and connectivity, the feeder and distribution network, and your on-premises drop strategy for single-family units (SFUs) and multi-dwelling units (MDUs). Of course, all three are interdependent and must be designed within the context of the others. That being said, a number of larger trends are affecting broadband network designs. Here are a few of them:

- There is a strong preference among operators for passive optical networks (PON) to handle residential and business services. This same PON architecture continues to evolve to the point of supporting 5G backhaul.
- Network operators are turning to newer PON technologies that have evolved from GPON. These include XGS-PON and NG-PON2. Two additional technologies, 25G and 50G PON, are now in development and will be ideal for 5G cross-haul.
- Wave division multiplexing (WDM) is enabling operators to get more out of their existing networks. WDM options include passive, active and a mix of semi-active or semi-passive. The widening variety of solutions will enable operators to choose a best-fit solution for their specific applications.
- A growing number of rural providers are considering fixed wireless as a way to answer the ubiquitous demand for faster (read 1 Gbps) broadband.

Keep these trends in the back of your mind as you read the insights and information that follow.



As the number of fibers in the distribution and access portions of the network increases, the ability to manage them in the CO is critical. The key tool for managing high-density fiber connections in the central office is the optical distribution frame (ODF). How your ODF is configured can make a big difference. The FTTH ePlanner will guide you in determining the best CO connectivity solution for your application.

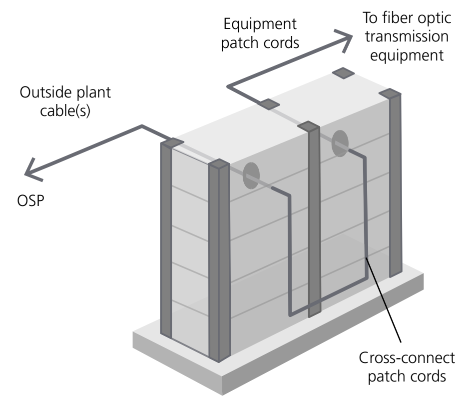
Cross-connect or inter-connect?

When it comes to managing thousands of fibers, there are two cabling topologies: a cross-connect design or an inter-connect design. Both can use an ODF to terminate your outside plant (OSP) and CO equipment, but each is configured differently. An inter-connect can also be supported by a standalone fiber-optic panel for small fiber count applications.

Cross-connect: A cross-connect architecture uses the ODF as a dedicated termination point for both the OSP fibers and the equipment fibers. All fibers connect in the rear of the ODF. The OSP and equipment fibers are connected via a short cross-connect patch cord routed between the two ports on the front of the ODF.

Inter-connect: In an inter-connect configuration, an ODF or fiber-optic panel provides a termination point on the rear for OSP fibers, while the equipment fibers terminate on the front. For each service turn-up or reconfiguration, a long patch cord is routed from the equipment to the ODF or fiber-optic panel inter-connecting equipment to OSP fiber.

Cross-connect ODF configuration



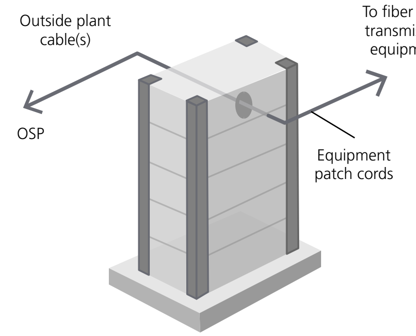
Pros

- Greatest flexibility for network reconfigurations
- OSP and equipment terminations have dedicated terminations
- Reduces the time required to turn-up or restore services

Cons

- More equipment, rack or floor space is required
- Typically is a 35% increase in equipment costs

Fiber Optic Panel configuration



Pros

- Less equipment is required than Cross-connect
- Ideal for small environments such as a hut or cabinet

Cons

- Limited flexibility for network reconfigurations
- OSP and equipment do not have dedicated terminations
- Increases the time required to turn-up or restore services

Your feeder network originates at the central office (CO) with higher count fiber cables that typically terminate at a fiber distribution hub (FDH), located typically within a neighborhood, or in the case of a multi-dwelling unit (MDU) possibly within the building. In a PON architecture, the distribution network starts where the feeder network terminates—at the FDH. Here, smaller count fiber cables connect to terminals located close the individual home or groups of homes to be serviced.

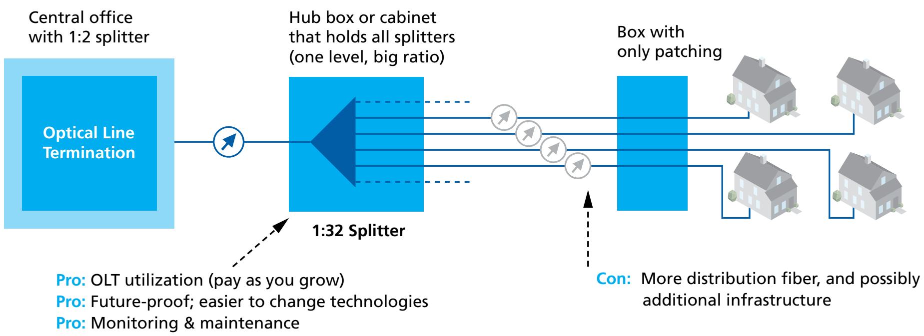
The FTTH ePlanner will guide you in determining the best feeder and distribution architecture and topology solution set for your application. The following are some decisions to consider regarding the feeder and distribution network.

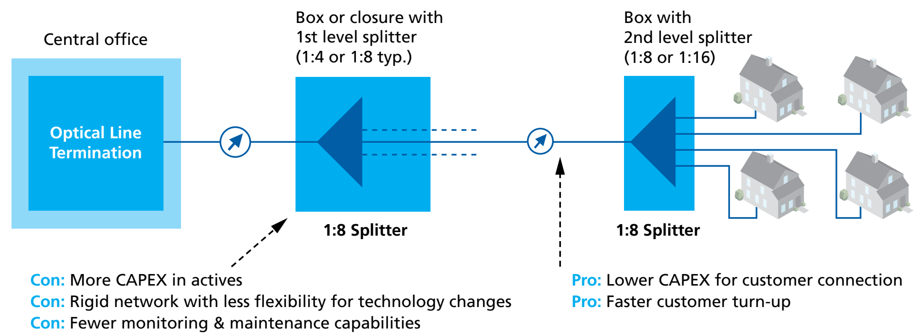
Centralized or distributed split architecture?

Splitting the signal from the central office for delivery to individual homes can be done in one of two ways: a centralized (single-stage) split or distributed (two-stage) split design.

Centralized: A centralized split strategy uses a single layer of splitters, typically 1:32. These splitters are fed by the fibers exiting the optical line terminal (OLT) ports in the CO and distribute individual fibers to each premises. The splitter is typically connectorized and located in an outdoor cabinet or FDH or spliced into an OSP fiber-optic splice closure.

Distributed split: A distributed split approach typically does not use splitters in the central office. Instead, the OLT port in the CO is connected or spliced directly to an outside plant fiber. A first level of splitters (1:4 or 1:8 typically) are either placed in a FDH or spliced into an OSP fiber-optic splice closure. A second level of splitters (1:4 or 1:8) resides in terminal boxes very close to the customer premises, with each splitter covering four to eight homes. These splitters are fed by the fibers from the first-level splitters.





Multiport service terminals

Whether you select a centralized or distributed architecture, the fiber cables from the distribution network must be terminated before you can handoff service to the living units. This is typically done using multiport service terminals (MSTs). An MST provides easy plug-and-play connectivity between the distribution network and home. There are two main types of MST: standard connector terminals and hardened terminals.

For standard connector terminals, the optical connectors or adapters and splices are inside the terminal, and must be re-opened every time a new customer needs to be connected. The hardened connector terminals, however, use outside adapters to access the inside connectors, and require no opening when connecting new customers. The FTTH ePlanner will guide you in determining the best multiport service terminal solution for your application.

Options within a distributed split architecture: cascaded, fiber indexing or tap?

Within the distributed split architecture, there are several options: cascaded, fiber indexing or optical tap.

Cascaded: In a cascaded design, two layers of splitters are used to divide and distribute the signal. In most cases, the first layer of splitters (1:4 or 1:8 typically) are either placed in a FDH or spliced into an OSP fiber-optic splice closure. The second level of splitters (usually 1:4 or 1:8) is located near the customers' homes and is fed from the output fibers in the first level. In a typical two-layer split, each second-layer splitter can serve 32 or 64 homes.

Fiber indexing: Fiber indexing is a novel approach that uses connectorized cables and terminals and allows installers to use a cookie-cutter approach to build out the network. The exact same components are "daisy chained" together, limiting the need for custom cable assemblies or splicing. The basic building block, which is repeated throughout the service area, includes a terminal with a built-in splitter (1:4 or 1:8), hardened connector, 12-fiber inputs and outputs, and four or eight hardened connector drop ports to the homes.

The indexing begins with a 12-fiber cable entering the first terminal. In the terminal, fiber 1 is routed to a splitter for servicing local customers, while the remaining fibers are "indexed" or moved up as they exit the terminal to connect to the next terminal. Indexing means the second fiber entering the terminal will exit as the first fiber to enter the next terminal, and so on in a daisy-chained fashion.

Optical tap: A distributed optical tap architecture is different from a splitter-based architecture. An optical tap architecture uses fiber-optic taps spliced into the distribution network—enabling a portion of the signal to be siphoned off and fed to locally connected customers. Multiple taps can be placed where needed until the optical link budget (or customers per OLT port) is maxed out.

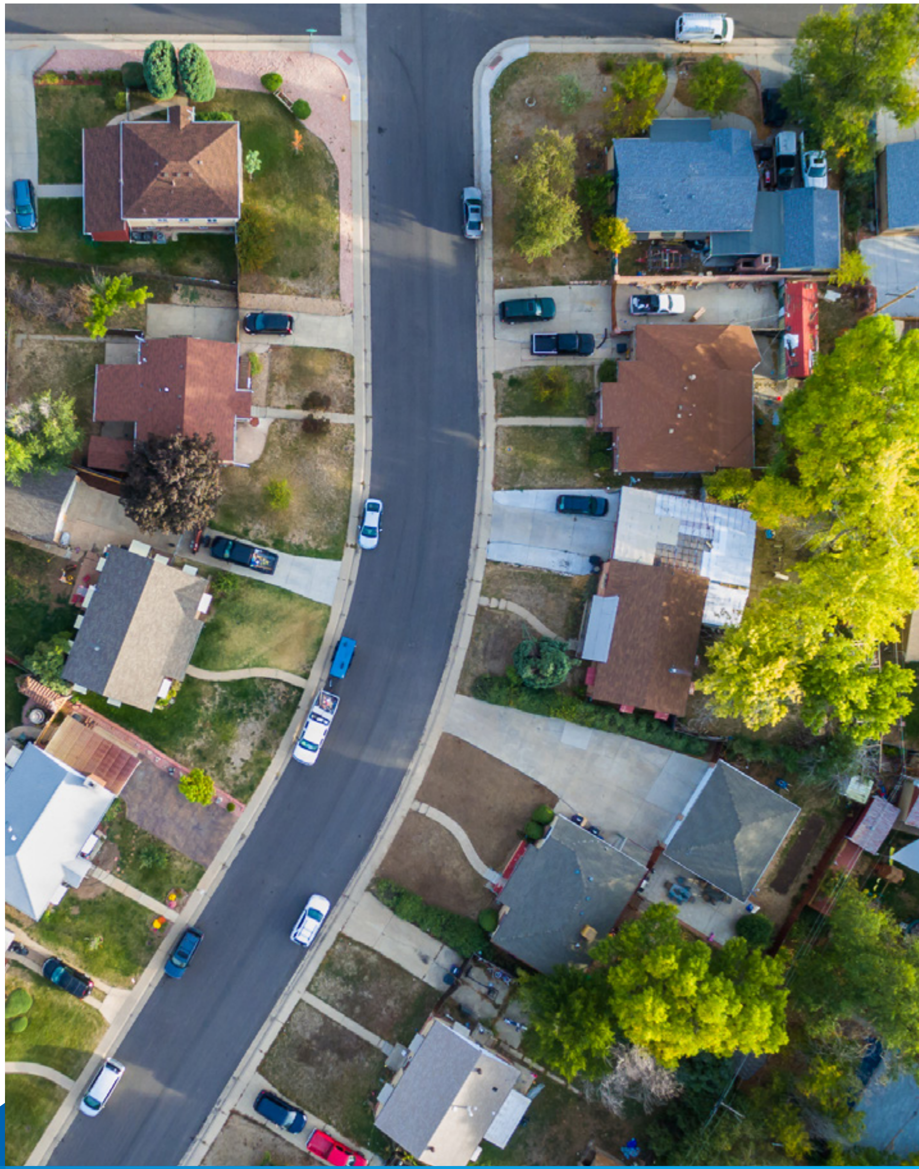
> The FTTH ePlanner will guide you in determining the best multiport service terminal solution.

The fiber drop is the final step in connecting the customer to the network. A typical FTTH deployment will involve a wide variety of connection and application types: aerial installations, underground conduit installations, or even in-ground burial. Network operators need to be prepared for all scenarios and have fiber drop solutions that can withstand the most demanding environmental conditions and mechanical stresses. The structures into which the fiber must be run vary, as well: single-family units, multi-dwelling units, office buildings, etc. Here, too, providers need flexible solutions that offer a wide range of connectivity options.

And, of course, speed of deployment is critical. The faster you can connect new customers, the lower your installation costs and the faster your ROI. Many network providers are turning to equipment solutions that offer a flexible plug-and-play architecture, and connection schemes that minimize or even eliminate the need for fiber cable splicing in the field. The FTTH ePlanner will guide you in determining the best fiber drop solution for your application.

Cabling and termination for single-family units (SFUs) and multi-dwelling units (MDUs)

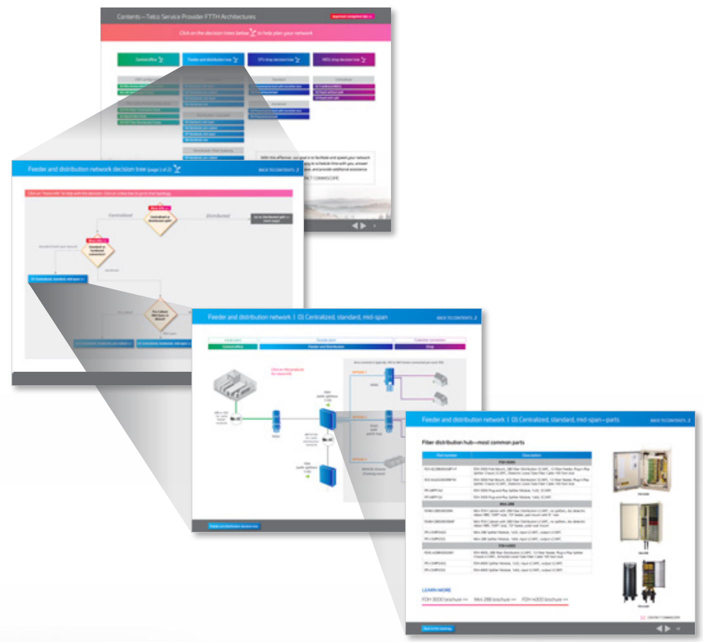
Cabling and terminating fibers within a single-family unit often involves pulling pre-connectorized cables from the optical network terminal (ONT), usually located in the basement or on the outside of the home, to the wall outlet. Cabling an MDU is usually a bit more involved depending on how many floors and living units the building has. Options here include whether or not to use splitters onsite, using a traditional cabling strategy or newer technologies like RapidReel®, which can speed the engineering and installation process. Again, the FTTX ePlanner does an excellent job of explaining these options and guiding you through the decisions.



Now that you have an idea of the key decisions involved in designing your FTTH network, the next step is to begin translating your FTTH concept into a practical design. This is precisely what the CommScope FTTH ePlanner helps you do.

Don’t worry if you don’t have a solid grasp of which options are the best for your design. CommScope created the FTTH ePlanner to help you navigate and understand the broadband landscape. The FTTH ePlanner explains the pros and cons of each architecture strategy and topology solution set, providing helpful resources and product information along the way. It enables you to compare a range of architectures and topology solution sets. Once the FTTH ePlanner has guided you to the architecture and topology solution set that is right for you, you and CommScope can work together to generate the detailed bill of material based on your specific project requirements.

To get started, contact your CommScope representative and request a consultation on utilizing the CommScope FTTH ePlanner. Together, we’re building a brighter, more connected future.



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