White Paper

# FTTH Solutions for MDUs

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## Introduction

Services that demand high quality such as IPTV, HDTV, video-on-demand, content-on-demand (YouTube, picture sharing, on-line gaming ...), video telephony and video conferencing are gaining in popularity and require ever higher bandwidths and faster download and upload speeds. Old technologies are reaching the limits of their performance, so new solutions are needed and network infrastructures must adapt to meet these growing demands. In the outside plant network, this means that fiber optic cables are gradually replacing copper cabling deeper in the access network.

Multi Dwelling Units (MDUs) play a central role in these developments. The high density of end users in such buildings makes them potentially profitable for any service provider. Strategies to connect an MDU to the network depend on many things. Tapping the MDU market requires detailed knowledge of local conditions, including regulatory issues. Diverse communication structures have developed over time in each EU country, and there are numerous regulations and prerequisites that must be observed.

A service provider's decisions for deployment in a particular neighborhood or for connecting to any particular building depends, too, on whether an existing infrastructure is to be updated, or whether the building and its neighborhood are newly built. To anticipate and respond to the multitude of connection scenarios, flexible and adaptable solutions are essential – solutions that can be easily adjusted to the requirements of a specific environment. For the EMEA region, small size and a high level of installation flexibility is required as the construction/building variation is great.

In Europe, major service providers most commonly deploy P2MP (Point-to-Multi-Point) fiber optic networks. When take rates increase, often splitters are added to connect customers, and so-called "plug-and-play" solutions based on fiber optic connectors are used to provision services.

Municipalities and smaller city carriers tend to favor P2P (Point-to-Point) networks, often with permanent splice structures. Due to the diverse requirements of different connection scenarios, there is no "best" option; rather, both technologies, splicing and connectorization, must complement each other in a flexible, complete solution that fits the project in question.

## MDUs are of vital interest for FTTH carriers

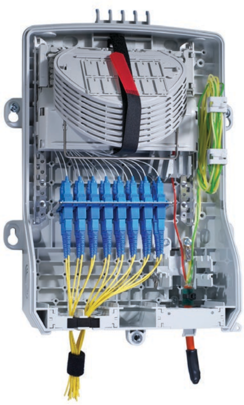
More people live in MDUs than in any other type of home, with more than 35% worldwide being apartment homes. In Europe, this number is even higher (about 50%) and in larger European cities more than 70% of the people live in MDUs. In dense residential areas, MDUs with three to eight stories constitute the majority of the buildings. On average, a building consists of 24 living units per block. Commercial areas are often situated alongside or among blocks of flats, while detached and semi-detached houses are sometimes neighbored with small/mid-sized companies.

Broadband service providers can supply a large number of end customers within a small area. As the living density is high in MDU environments, the relative cost to deploy FTTH in MDUs is lower compared to individual residences although the cost is strongly dependent on the building circumstances. A density increase from 4000 people/km² to 8000 people/km² reduces the cost of civil engineering and cable installation cost by 30% (iDATE). However, to implement a fiber optic solution, a coherent and complete concept which can be adapted to various connection scenarios is required.

## The access area

MDUs are linked from the exchange (central office, CO) either directly using a dedicated fiber for each customer (P2P) or using splitters in enclosures in the field or building (P2MP). The latter seems to get more traction as incumbent operators move into the deployment phase.

The structure of the fiber optic network generally follows that of the existing copper infrastructure. In the route to the MDU, the gas and water supply channels running beneath the pavement are often nearing full capacity. Feeding in additional cables for the FTTH infrastructure may be difficult and often requires costly excavation work. If empty conduits or ducts are available, fiber optic cables can be blown into them over several hundred meters (using blown-fiber injection technique). Open-air cabling to the building is not usually considered, although this is commonplace in many countries.



## Distributor design

The way in which the fiber optic cables are laid, terminated and stored has a direct influence on the performance, lifespan and economic efficiency of a network. Cable management is accordingly of great importance and determines the network's flexibility to adapt to future requirements.

Depending on priorities, a network operator can decide to use a connectorized/factory pre-terminated approach, splicing or a combination of both. Connectors and optical splitter solutions guarantee faster provisioning and network upgrades (e.g. splitter PON to WDM PON). Splicing is used for example if a connection is difficult to reach or if a lack of space prevents the use of a cabinet with a cross-connect function. The trend in Europe is to go for a hybrid solution, because most brownfield MDUs have a congested building infrastructure. This means that fiber optic cables are pre-terminated or connectorized at one end and spliced at the other: the least accessible or difficult end is pre-terminated and the other side is spliced in the field.

## Different building architectures

A typical European MDU comprises three to eight stories, each of which has two to four units. The ground floor is often used for commercial purposes, for example, a shop, restaurant or bank. The units in the remaining stories function as flats or business spaces which may be used as a doctor's surgery, offices, or law practice, etc.

MDUs represent a huge challenge for fiber optic cabling and necessitate an individual design to ensure that the FTTH network is able to scale the individual floors efficiently and reliably. Also of consideration is whether the individual units have been bought or whether they are being rented (and therefore potentially subject to higher tenant turnover).

With MDUs in particular, it may be advantageous for the network operator to migrate from the FTTB concept to FTTH. In FTTB deployments, the fiber optic cables reach only as far as the building. In this case the operator must switch to the existing, mainly copper-based infrastructure while avoiding connection gaps. FTTH requires fiber cable be run to each unit. The effort required to recable an MDU is technically laborious and demands that a number of legal issues be addressed. Directly supplying each unit with fiber optics depends on cable laying options available as well as unit ownership structures. The necessary agreements must be reached, something that may take some time and effort.

These buildings sometimes have vertical and horizontal cable ducts, which already contain coaxial cables for cable networks or other supply lines like UTP cabling. Fiber optic cables may be fed through the cable ducts; due to their physical properties, they can also be laid together with power supply cables. If there are no suitable cable ducts available, network engineers are confronted with the challenge of feeding the cabling into the separate floors without exorbitant cost and without leaving any visible traces of the installation behind. Disused chimney stacks are often employed for this purpose. In some older buildings, it may not be possible to lay fiber optic cables retroactively – this depends on the state of the respective building. Network operators should discuss the relevant options and procedures with the owner of the MDU at an early stage of the planning process. It is clear that for the above reasons a flexible and dense cabling solution is a must for comfortably deploying FTTH in MDU environments.

Another common type of MDU is that of residential facilities (student or group housing, retirement facilities, etc.). These are mostly two to four stories high and comprise several apartments on each floor. In older residential facilities, relevant provisions for installing any new cabling, including fiber optic cables, are missing. This means that they present a great challenge to network engineers.

Due to their complex layouts, supplying the individual buildings is often tricky. Also, excavation is often required outdoors. Such installations are costly and demand a great deal of time and effort.

## Fiber optic connection of MDUs

Project planning and logistics are two of the greatest challenges when connecting a building. Foresighted project planning helps to keep time and logistics expenditure as low as possible, thereby reducing overall costs. During the conceptualization of an MDU connection, the following questions should first be addressed:

1. Type and age: is it a listed building (e.g. subject to protection for historical monuments)? If so, it is very likely that special regulations apply.
2. What is the state of the building? Has it been recently renovated, or is a renovation planned?
3. Use: Is the building used solely for living purposes, it is an office/commercial building, or is it a mixed-use building?
4. Ownership structures: Is the building comprised of purchased or rented units?
5. Access: Where is the cable access point? Is it possible to use cable lines? Is access available for servicing?
6. Infrastructure: Is the existing infrastructure in the building a pure copper network? How old is the indoor copper piping? Are there any useable cable ducts available? What are the ownership structures for the piping and ducts?
7. Competition: Are other service providers already active in the building? It may be possible to use an empty pipe belonging to a cable television provider for laying fiber optic cables in the residential/office units.

Technicians are given access to the building by appointment only. It is thus essential to clarify the ownership structures and responsible persons in the building before beginning installation. To minimize the number of permits that must be obtained, the cross-connect points should be placed in public areas such as in an unlocked basement foyer, for example. This ensures that there will be no access problems for any future service work.

The connection is usually carried out in two stages: first, the fiber optic cables that are fed into the building from outside are terminated in the basement and the vertical riser cable going up to the different floors is installed. Here, the transmission medium is then switched to the existing copper network.

The direct connection of an end customer via a fiber optic cable is usually carried out later, at which point there are further issues to consider. In contrast to in the USA, in Europe, cables or piping are rarely fed freely through the building or in on-wall cable ducts. Technicians must therefore find other ways to reach the end customers on each floor, for example through disused chimney stacks. In this case, it is particularly important that the applicable fire prevention regulations and architectural requirements are observed.

With indoor cabling, the type of optical fiber and the quality of the cable are important factors; fiber optic cables work differently to copper cables and react to mechanical strain accordingly – with increased signal attenuation values. New developments in the area such as robust cables that employ singlemode fiber with a reduced bend radius would thus play a key role in this scenario.

## Connector or splice?

There is no simple answer to this question. A mix of the two connection methods is usually employed. Connectors are often used in P2P networks in the central office and at the customer's premises. Connectors may also be found in the outside plant area of P2MP networks – for example in distributors with optical splitters – where they are used for a fast and flexible access for testing and monitoring the network and for switching, upgrading or turning-up services to subscribers. Choosing the suitable method also depends on whether, and to what extent, an infrastructure already exists and how the subject of collocation – that is, network access for alternative providers – is dealt with. To guarantee the successful and economic implementation of different scenarios, flexible, easily adaptable solutions are required. Essential here is finding the optimal combination of pre-configured standard components, individual adaptation, splice connections and connectors during the planning and installation stages.

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## CommScope is the right partner

CommScope offers an extensive and comprehensive range of infrastructure products for fiber optic networks that allow you to meet all the requirements of an FTTH network – from the exchange and outdoor plant network through to the subscriber connection. CommScope has developed the Home Enlighten product range specifically for MDUs.

Owing to many years of activity in the global market, CommScope boasts a wealth of knowledge and experience when it comes to meeting national requirements in Europe and the rest of the world. The combination of expertise and cooperation with customers has allowed CommScope to develop flexible fiber optic system solutions which are tailored precisely to the respective market requirements.

In-depth knowledge of the numerous regulations and approval procedures that differ from country to country, complemented by an accordingly extensive system portfolio, means that CommScope is well equipped to support its customers through the planning stages and ensure that any problems are resolved before the project has even begun. Moreover, providers can supply their services faster, thereby gaining an edge over their competitors.

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Sam Leeman is FTTH Business Development Manager at CommScope. He has over 15 years of experience in tele- and datacommunications for telecom and enterprise networks.
Sam Leeman held several positions in R&D and Product Management. Since 2006, he is Product Manager for FTTH and specialized in the MDU market.

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