Multiple System Operators and Their Journey from Hybrid Fibre Coax (HFC) to Fibre to the Home (FTTH)

CORNING

Authors:
Vanesa Diaz, Market Development Manager
Alvaro Muñoz, Application Engineer
Corning Optical Communications GmbH & Co. KG

Overview

The race is on for multiple system operators (MSOs) to deliver increased bandwidth and fibre, particularly to the home. MSOs must consider multiple factors in their quest to deliver fibre to the home (FTTH) and the new generation of services enabled by it. Thought should be given to determining which network technologies to deploy as they upgrade their networks, and to selecting the optimal network components for creating the new infrastructure. Factors such as upgradability, capital spending (CapEx), and operational expenditure (OpEx) need to be evaluated. This white paper explores these technology choices and investigates each component's role in optimising the network architecture.

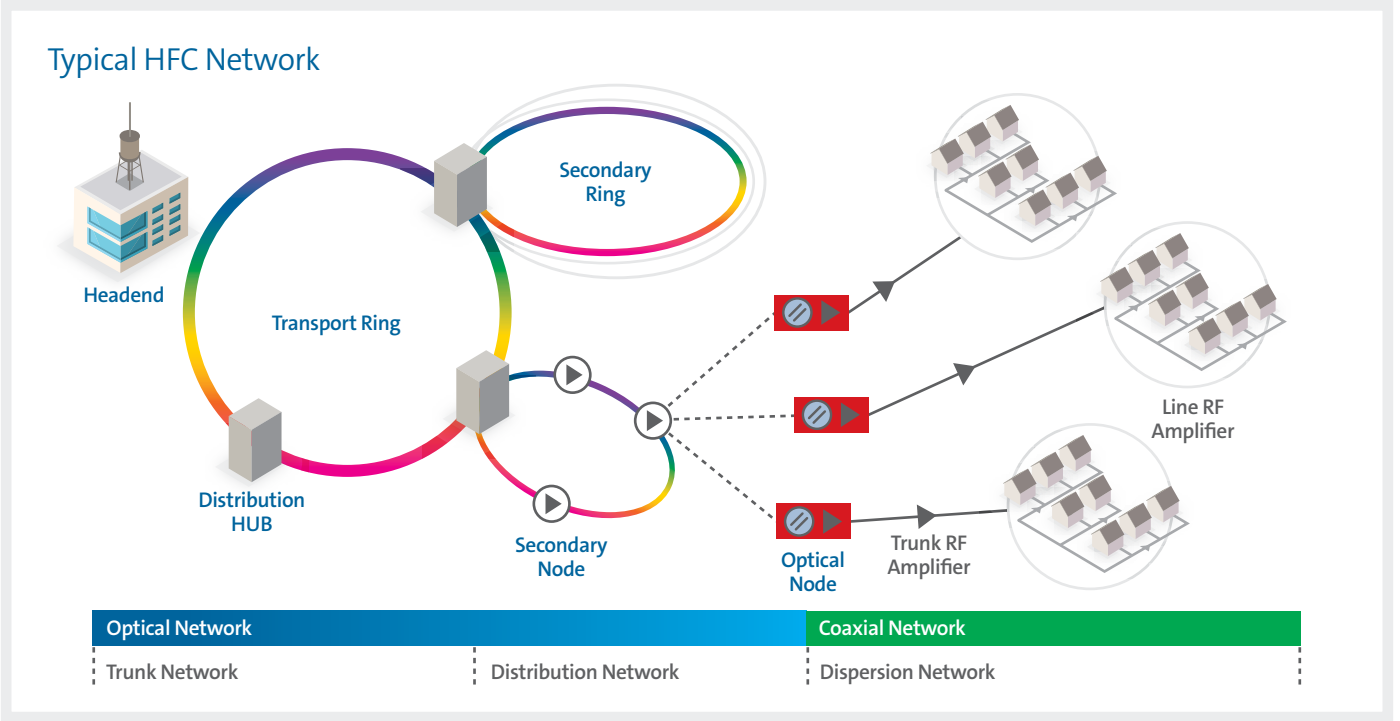
Introduction

MSOs are faced with a great number of opportunities in today's multi-device and multimedia world, but challenges also exist. Growing residential and business demand for applications and services from HDTV to video-rich unified communications point to the same fundamental requirements: high-bandwidth connectivity, real-time interactivity, and increased capacity. The question is, can MSOs deliver them?

Looking at the Service Delivery Network

Since the early 1990s, MSOs and cable television operators have commonly deployed hybrid fibre coaxial (HFC) networks to deliver services and satisfy customer demand. The fibre optic network extends from the cable operator's headend, out to a neighbourhood´s hub site, and finally to an HFC node where the conversion from optical to coaxial cable occurs (a fibre-to-the-node network architecture). The coaxial portion of the network connects between 25 to 2,000 homes (typically around 500) depending on capacity and bandwidth needs, within a tree-and-branch deployment configuration from the node. This design, in combination with the data over cable service interface specifications (DOCSIS), enables the HFC network to carry a variety of services, including digital TV, video on demand, telephony, and high-speed data. Services are carried on radio frequency (RF) signals in the 5 to 1000 MHz frequency band.

These HFC networks, originally designed for broadcast transmission of analogue TV signals, have been constantly upgraded to deliver more services with increased bandwidth and two-way communications. At the same time, the fibre used in MSO networks has steadily increased, with the demarcation point between the fibre and the coax (often referred to as deep fibre) coming closer to the customer premises to address bandwidth, performance, and operational concerns.



This process has led MSOs around the world to explore and try new technologies, even rolling out new all-fibre networks to boost their competitive market position while addressing opportunities among business customers and traditional residential markets. Many MSOs are also being driven to evaluate new technologies to avoid loss of customers due to the competition from incumbent telecom operators that have started to deploy FTTH. In some cases, this competition has come from municipalities, utilities, and other internet service providers (ISPs) that are pushing fibre deeper into the access network to deliver more media-rich services.

Technology Approaches

HFC DOCSIS and Node Upgrades

In brownfield deployments where bandwidth competition is low, cable operators have relied on numerous techniques that help optimise bandwidth so that they can continue working over their current HFC infrastructure. These techniques include node segmentation, recovering capacity from deleted analogue channels, channel bonding, and MPEG-4 video compression. They may find that running these networks using DOCSIS 3.1 technology is enough to provide current network capacity and meet end-user bandwidth/broadband speed requirements.

However, in areas where competition is fierce and/or there is strong demand for higher-capacity and higher-bandwidth service, MSOs are upgrading their networks with new technology.

Radio Frequency over Glass (RFoG)

The development of services using RFoG technology is one option for operators leveraging their existing HFC investment. With traditional HFC systems, digital cable channels are encoded and transmitted using quadrature amplitude modulation (QAM) over RF and delivered via coaxial cable from the node to the customer. RFoG allows these native RF/QAM services to be delivered over a standard passive optical network (PON) with optical cable feeds, splitters, and fibre drops.

Both traditional HFC and RFoG can concurrently operate out of the same headend/hub, making RFoG a good solution for splitting nodes and capacity increases on an existing network. However, while RFoG provides some of the benefits of FTTH, it still requires the infrastructure investments of a traditional HFC/DOCSIS system (e.g., additional transmitters in the distribution hub for capacity and more ports on the CMTS). This solution is also constrained by DOCSIS evolution to offer symmetrical and high-bandwidth-demanding services.

Migration to FTTH Passive Optical Network (PON)

Some operators with HFC networks are starting to deploy xPON FTTH networks for greenfield developments, while others are migrating entirely from an HFC network (FTTN) to FTTH. These particular operators have found that significant additional cost savings can be achieved by no longer maintaining active equipment in the field, especially where harsh environmental challenges exist. When deploying an FTTH architecture, the MSO needs to evaluate which technology (xPON or RFoG) will be used according to the particular requirements and availability of vendors' solutions.

Mixed Approaches

In some scenarios where MSOs are under competitive pressure from FTTH providers, the RFoG approach has been partly applied due to the lack of a production-level IPTV solution. Here, RFoG deployments have been focused on mid-rise buildings and apartment complexes, while elsewhere the existing HFC network is maintained until new services can be delivered via FTTH. This is a pragmatic approach where RFoG is deployed as an interim step toward full xPON deployment where it makes sense. This architecture also allows the operator to expand services to support xPON technologies such as GPON and EPON, either coexisting in parallel or as a future upgrade path.

Maintaining market share, avoiding churn, addressing subscribers' needs, and addressing growth opportunities all require a fast deployment solution.

Optimising the Physical Network Architecture

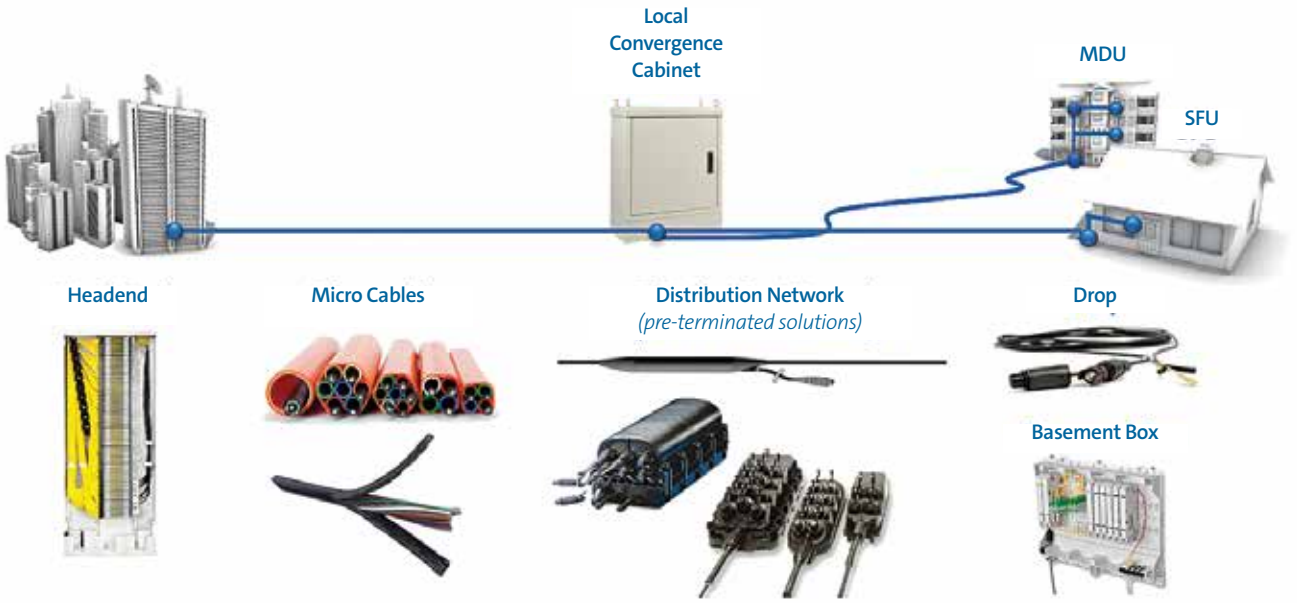
MSOs have long understood the investment model that requires diligent high-quality design and engineering of its critical asset — the network — in order to safeguard it for the long term. Maintaining market share, avoiding churn, addressing subscribers' needs, and addressing growth opportunities all require a fast deployment solution. Whether the underlying technology is HFC, RFoG, or xPON, the network has to sustain the requirements of rapid project construction and a low-cost, low-skill installation, yet also deliver reliability and performance far beyond its projected lifetime.

Fibre Deployment Goals

Deploy an infrastructure that scores high on upgradability and as low as possible in capital and operational expenditures. This means:

- Upgradability of cable and hardware equipment needs to ensure a fast transition to DOCSIS 3.1/RFoG or xPON FTTH technology
- Easy-to-install equipment that enables faster and less-costly deployment, while offering a modular pay-as-you-grow approach to reduce the initial capital expenditure and construction costs
- Reliable and robust components that can minimise truck rolls and network components that can be reutilised in different parts of the network to make a significant difference in terms of operational expenditure

Solution Components for the Optimised Network



Headend Equipment

In fibre-rich application spaces such as headends, high-density fibre management systems with optimised cable and patch cord management are needed to manage an ever-increasing amount of fibre to handle the demand and rollout of high-speed broadband services. Good jumper management and easy access is critical: optimised routing paths for cables and jumpers can reduce the risk of pileup or entanglement, while easy access prevents disturbing adjacent in-use fibres, minimising maintenance costs.

Optical Cable Plant

Operator business models around the world are addressing the need for faster broadband services and deep-fibre rollout while addressing the challenge of shrinking infrastructure space and congested ducts. The latest micro cable technology can help operators to plan a rapid deployment of fibre at a low cost, while ensuring that future demand can be met with minimal disruption to their existing duct space.

Micro cables are designed for installation in microduct systems using air-assisted installation methods, and they offer increased fibre density when compared to standard loose tube cables in a small cable diameter. This cable technology is becoming more and more popular for its pay-as-you-grow approach, its capacity to reutilise blocked or congested ducts, and for enabling new deployment techniques like micro trenching that can reduce civil costs up to 70 percent.

More recent versions of these cables eliminate the use of binders, waterblocking yarns, and tapes for much faster mid-span access and reduced risk of buffer tube damage. A flame-retardant design enables seamless transition from the headend to the outside plant, eliminating the need for expensive transition points.

Local Convergence Point

Modularity is the best tool for fast customer configuration and to enable grow-as-needed connectivity. Modular street cabinets can save up to 75 percent vs. fully configured alternatives. Cabinets should include prestubbed feeder and distribution cables, and modular field-installable cassette platforms with on-board splicing. Intuitive fibre routing with no need for access tools is also important in field terminations and reconfigurations, so a highly skilled labour force is not required. In addition, when the same manufacturer supplies the local convergence points and headend equipment, the same components can be used for both network elements, simplifying construction and reducing training and inventory complexity.

Modular street cabinets can save up to

75%

vs. fully configured alternatives.

Distribution Network

The distribution network needs to provide a deep spread of network connectivity points so customers can be easily connected as service is requested. This is a labour-intensive and costly process, and pre-connectorised solutions have been widely proven to offer significant speed and cost savings in this part of the network. The time to deploy is a key challenge, particularly in situations where competitive operators are deploying infrastructure in the same territory, impacting the availability of skilled labour. In these cases, pre-connectorised systems are best suited to ensure fast provisioning with fewer installation teams, shortening time to revenue and minimising network disruption.

With fully pre-connectorised systems, homes can be passed three to four times faster when compared with traditional spliced solutions. In addition, connectorised products can increase capital deferment opportunities, as connection ports and splitters only need to be added as needed.

Multi-Dwelling Units (MDUs)

As part of a cable network transformation, distribution boxes are needed at the basement and often floor level. MDU deployments require modular housings that can adapt to various building configurations while being easy to configure and add to when increasing capacity. Modularity reduces the impact of any failure and protects work areas. Most importantly, it ensures the housing is versatile enough to allow technology upgrades by simply replacing or adding components. Optimised cable routing is again essential, as is the flexibility to accommodate splitters, splicing, and patching applications.

Customer Drop

The customer drop portion of the network may seem like a simple last step, but in fact has the highest degree of complexity of all parts of the network. For example, drop cables must be suitable for a wide range of installation environments such as aerial, duct, façade, or direct buried, but must also be suitable for installation inside the personal space of the customer's living room. This application requires novel drop cable designs with fast access features and multipurpose capability. It is in the drop where the use of pre-connectorised solutions can provide the biggest benefit. Here it is most important to reduce the time, cost, and skill level of the installers. These products have been shown to double the productivity of drop installers vs. conventional spliced solutions.

Other Considerations

Each MSO may have a unique set of challenges for each type of location and the market being addressed. This might involve customers living in MDUs, single-family units (SFUs), high-rise buildings, and office campuses (to name but a few). MSOs operating in locations where there are harsh environmental conditions, such as sunny climates with high temperatures and high humidity, look for ways to reduce their maintenance costs. Cabling older towns and buildings can be challenging due to poor ducting, or the excess of local permissions and planning regulations that affect the installation of street cabinets or positioning of closures on building façades. These all require flexible cabling solutions that can easily address a wide variety of scenarios to enable easily deployable optical fibre to the end user.

Conclusions: Taking the Journey

MSOs can look back on a successful long-term business model, which has leveraged their initial infrastructure investments. Today, MSOs have the luxury of several more technology options to choose from when upgrading their networks to keep pace with growing capacity needs and demand for new services. Whether an MSO chooses to use an HFC RFoG approach, or migrate to an xPON FTTH design, choosing the optimal network components — for every aspect of an optical fibre infrastructure — dramatically impacts the cost and ease of future upgrades.

Modular pre-connectorised fibre solutions provide installers with a fast, simple, and low-cost installation process for the new fibre connectivity to deliver low deployment costs and rapid rollout. The modularity and simplicity of this type of fibre cabling distribution system provides best-in-class methods for accelerating customer coverage with minimal capital investment. Specifically it can reduce installation time by a factor of 50 percent or more per network access point and allow CapEx deferment in relation to service take-up so that MSOs can adopt a pay-as-you-grow business model for service delivery.

Pre-Connectorised Network Access Point

Corning, MSOs, and FTTH

Corning Optical Communications is an industry-leading supplier of FTTH products, with more than 27 million homes passed over the last 10 years using our pioneering, innovative, field-proven FTTH solutions. Corning's extensive portfolio of products and network expertise ensures our ability to provide solutions that address challenges such as speed of deployment, labour costs, performance and quality cost deferment, network future readiness, and much more!

Our engineering teams have worked with many MSO HFC network migration projects, from consultations and strategy to design and implementation in order to build the best cable network design for each MSO and their installers/contractors.

Further Reading

We invite you to take a further look at the Corning advantage:

- Explore our FTTH solutions on the web.
- Take a look at the approach taken by Spanish operator, Alma. Download our case study.

Are You Corning Connected?

www.corning.com/emea/catv

CORNING

Corning Optical Communications GmbH & Co. KG • Leipziger Strasse 121 • 10117 Berlin, GERMANY
+00 800 2676 4641 • FAX: +49 30 5303 2335 • www.corning.com/opcomm/emea

Corning Optical Communications reserves the right to improve, enhance, and modify the features and specifications of Corning Optical Communications products without prior notification. A complete listing of the trademarks of Corning Optical Communications is available at www.corning.com/opcomm/trademarks. All other trademarks are the properties of their respective owners. Corning Optical Communications is ISO 9001 certified. © 2017 Corning Optical Communications. All rights reserved. CRR-625-A4-BEN / January 2017