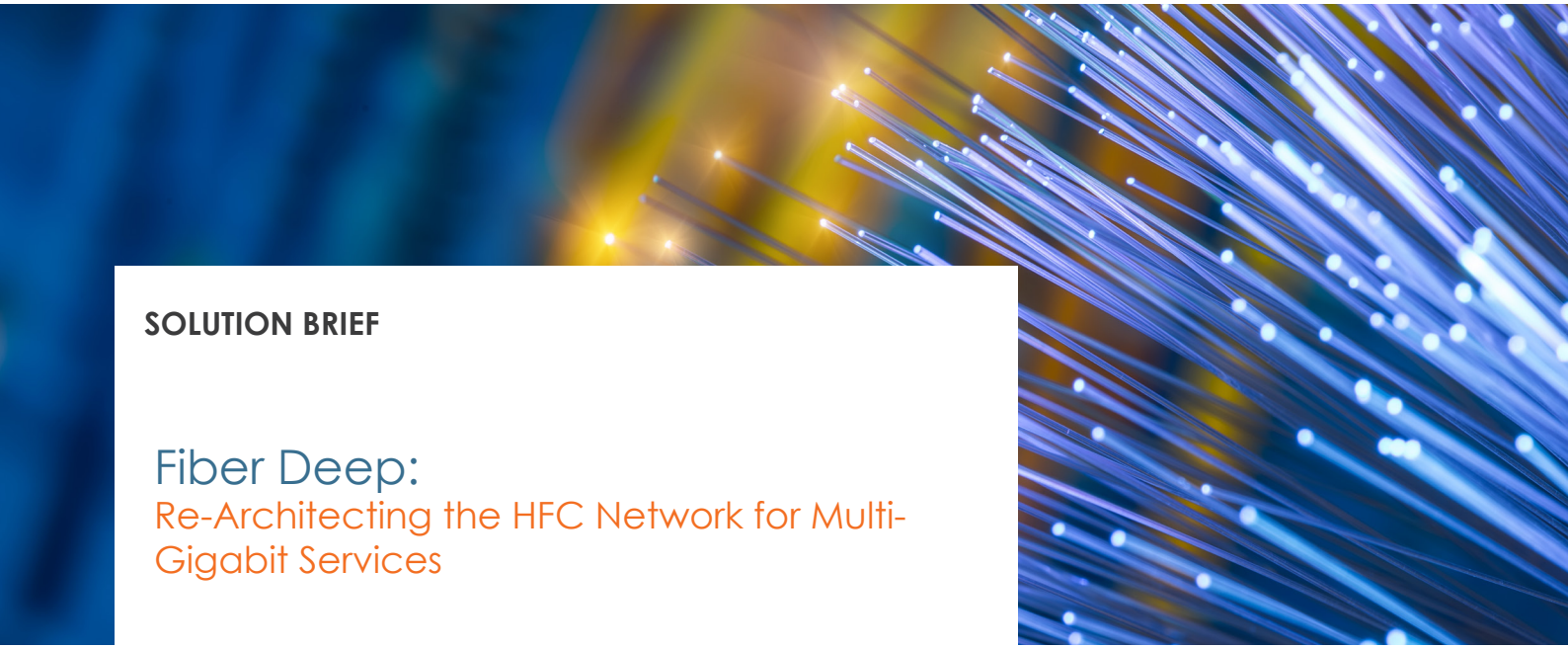

SOLUTION BRIEF

Fiber Deep:
Re-Architecting the HFC Network for Multi-Gigabit Services

Background

Hybrid Fiber Coax, known as "HFC", is the well-established cable access network architecture. As the name suggests, HFC consists of two separate media connecting a cable head end to the subscriber. While most of the focus is on the coax portion that actually connects to the subscriber, the heavy lifting is done by the fiber portion of the network that provides the massive capacity necessary to deliver content from and between cable head ends. In fact, in today's HFC networks, the coax portion can actually be a significant barrier to ultra-high bandwidth connectivity for each customer.

Cable multisystem operators now recognize this and, since 2016, MSOs both large and small have been implementing new technologies such as DOCSIS 3.1 that enable downstream connectivity speeds up to 10 Gbps and 1 Gbps upstream. The advantage DOCSIS 3.1 provides over other approaches such as Fiber-To-The-Home (FTTH) is that it leverages the existing coax network making it a far more economical solution than building out fiber to every subscriber location.

However simply upgrading to DOCSIS 3.1 is not as straightforward as it sounds. Ironically, one of the primary factors preventing its widescale deployment is the architecture of the legacy HFC plant and the presence of radio frequency (RF) amplifiers. Consequently, MSOs are moving to next generation "Fiber Deep"—or "N + 0"—networks that facilitate DOCSIS 3.1 by moving the fiber-to-coax conversion closer to the end user, shortening the length of the coax span required and eliminating the need for RF amplifiers.

With the access architecture opening to high bandwidth connectivity, it is going to put a lot more pressure on the metro core fiber network that connects the fiber nodes and head ends. Legacy 10G networks are no longer adequate to meet the bandwidth demand and lack the scalability required to support high bandwidth services forcing cable operators to undertake an order of magnitude increase in metro backbone capacity.

FlexRate-based optical transport systems from EKINOPS capable of tuning their performance based on service demand provide the most adaptable and economic WDM platform available. By adding a single line card at each end, a MSO can increase the capacity of an existing span up to sixty times and eliminate the time and expense of building a new fiber network.

The Current Coax Challenge

The next generation of cable network architectures are based on a single concept—more bandwidth to each subscriber. With subscriber bandwidth demand rising 20% to 30% upstream and downstream needs increasing up to 50%, advances in cable network technology are required to kick open the door to high speed service delivery. What needs to be understood is that speeding up the coax connection to the home or business is only part of the solution. Without a corresponding capacity increase to the fiber transport network behind it, MSOs are only moving the bandwidth bottleneck from one part of the network to the other.

Today the access portion of the HFC network is based on a Centralized Access Architecture (CAA) in which all of the network functionality is located at the cable head end. In a CAA, each service area consists of hundreds or even thousands of individual subscribers resulting in coax spans that can be up to several kilometers in length from the node to the subscriber location (see Figure 1). Because the analog signal is not strong enough to extend those kinds of distances, radio frequency (RF) amplifiers are needed to boost the signal power.

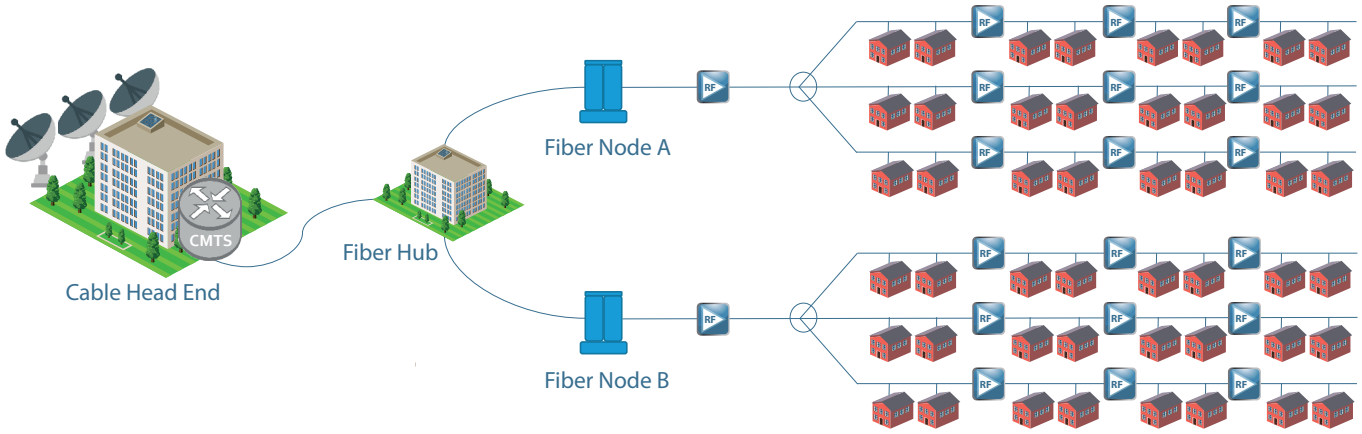

Figure 1 - Centralized Access Architecture

In addition to the significant cost of deploying and maintaining thousands of RF amplifiers throughout the network, it is the design of the RF amplifier itself that limits the amount of bandwidth that can be deployed to each subscriber. RF amplifiers rely on diplex filters that actually prevent symmetrical high speed bandwidth in both directions. For this reason, their presence is a barrier to the deployment of the gigabit level services that DOCSIS 3.1 enables. Removing RF amplifiers results in a passive coax infrastructure on which the MSO can allocate any amount of spectrum as upstream or downstream without changing the outside plant.

The Next Generation MSO Architecture

Without RF amplifiers, MSOs can transition to a next generation "Fiber Deep" architecture in which the fiber-coax demarcation point is moved closer to the end user to increase capacity per subscriber and improve network efficiency (see Figure 2). In this type of architecture, functionality is distributed out to local nodes rather than centralized for better efficiency in processing high speed services. The resultant bandwidth gains can be as high as 500 percent in the downstream path and a 1,000 percent in the upstream path.

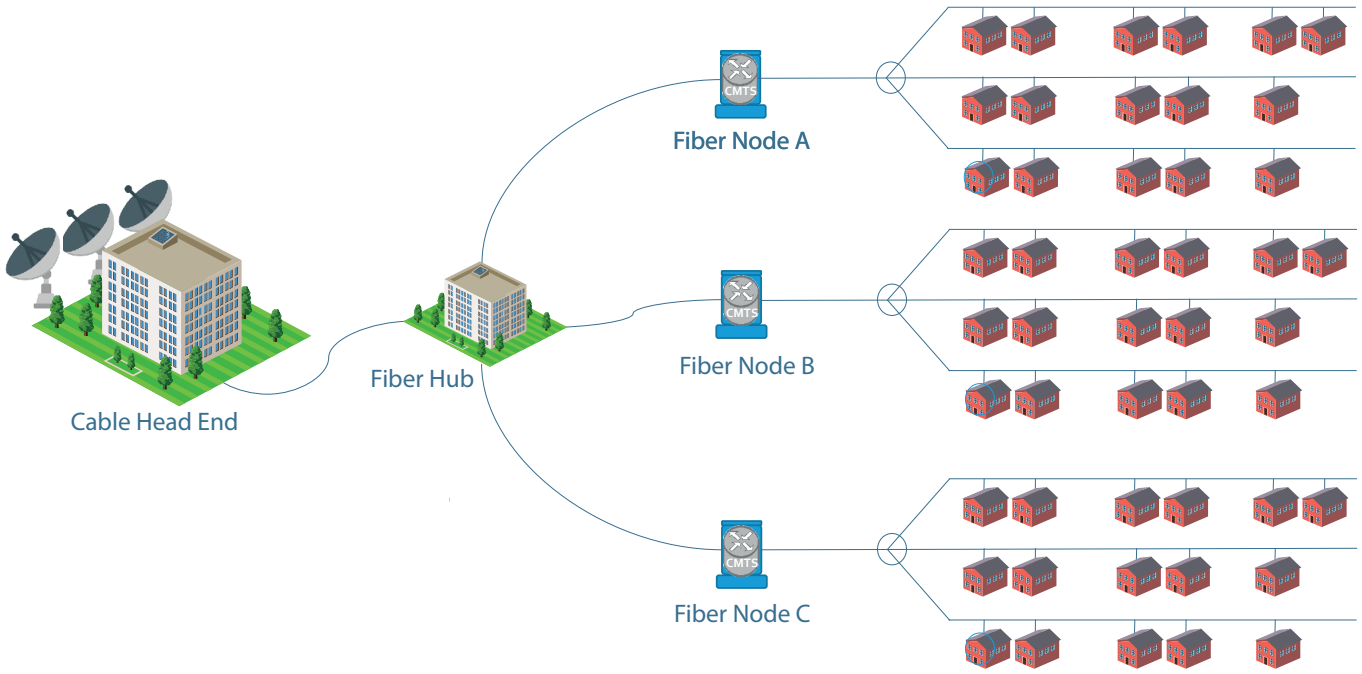

Figure 2 - Distributed Access Architecture - aka "Fiber Deep"

With this amount of capacity now in the coax network, the fiber portion of the network will need to be upgraded to handle the capacity crunch. With more service areas delivering higher capacities from every node, it will put pressure on the metro core network to support the required performance (see Figure 3). The problem is that existing networks built on 10G technology are not up to the task. What the MSOs need is a cost efficient and scalable method for adding capacity across their networks.

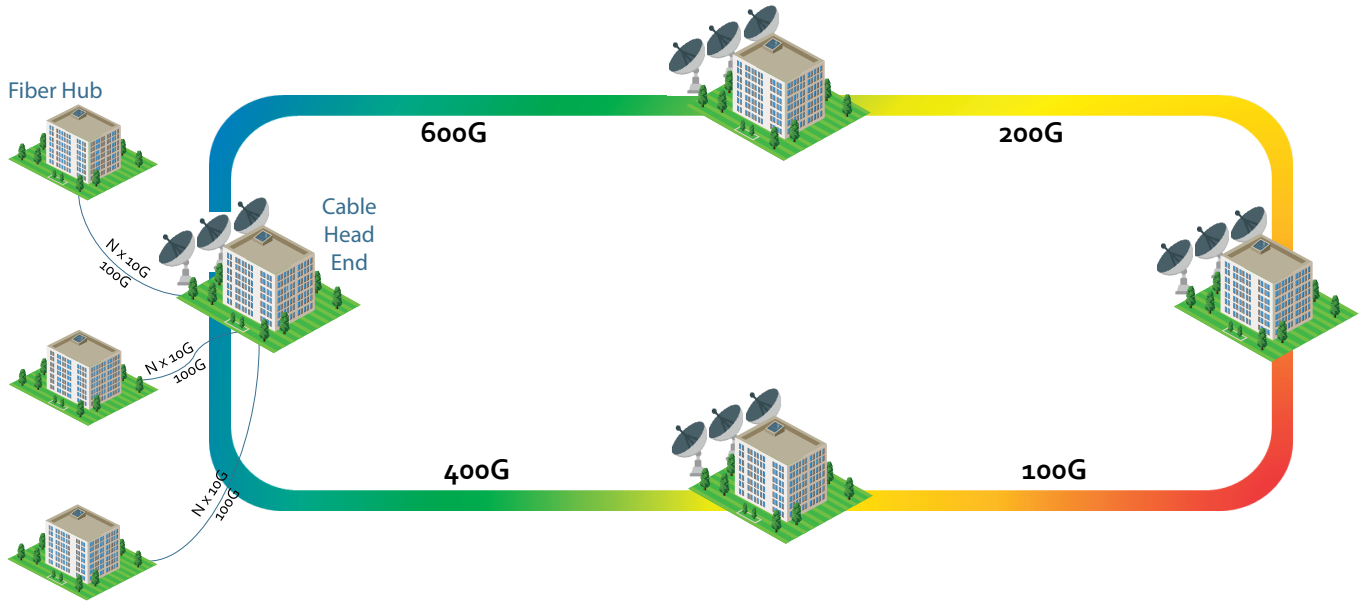

Figure 3 - MSO Metro-Regional Fiber Network

The Ekinops Solution

The ***EKINOPS360***® platform is a dynamic, multireach, multirate, multiprotocol Layer 1 transport system that provides the capability for cable MSOs to handle the deluge of bandwidth resulting from the opening of the access spigots in the coax network. The 360's FlexRate muxponders can adjust their functional parameters—modulation scheme, baud rate, FEC overhead—automatically based on link design allowing MSOs to deploy as much capacity as they need where they need it and deliver optimal performance on any network over any span.

Using EKINOPS PM 200FRS02 and PM 600FRS06, an MSO can deploy anywhere from 100G to 600G of capacity depending on their demand and distance requirements, even over single fiber networks. Ekinops FlexRate technology allows the operator to choose the line rate best suited for each span and from there the module will automatically self-configure to deliver the right OSNR to guarantee performance.

Ekinops FlexRate solutions are highly cost efficient. They can be deployed over an existing third-party line system as an alien wavelength requiring only a single muxponder on either end of the link keeping equipment costs to a minimum. Once installed, they can be upgraded from 100G to 200G or even up to 600G through simple software commands. No license fees or hardware upgrades are required. With FlexRate solutions, you can future-proof your network and eliminate the worry of having to upgrade to meet new demand.

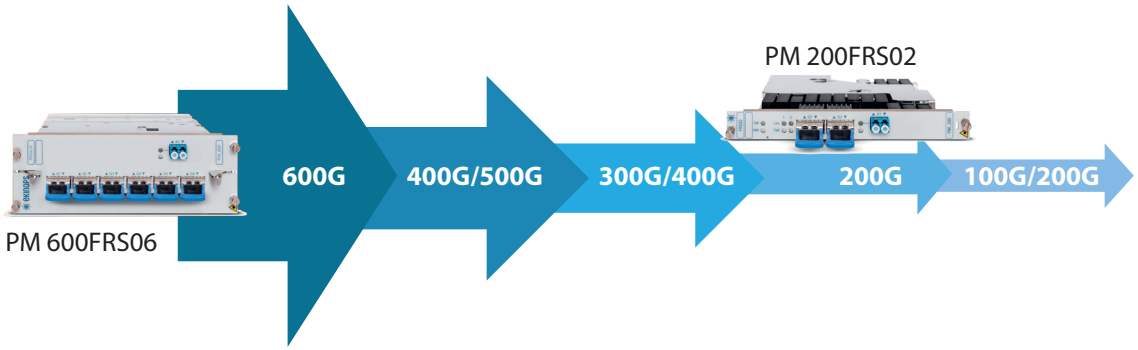

Figure 4 - EKINOPS FlexRate Solutions

Conclusion

In order to wring the most out of your coax network to deliver the next generation of gigabit level services, you also need to support your DOCSIS 3.1 rollout with an adequate fiber network to connect your fiber nodes and cable head ends. Sufficient capacity in the metro transport is necessary to avoid a bandwidth bottleneck. It's critical that both parts of the HFC network support one another to operate efficiently.

FlexRate solutions from Ekinops provide the capacity and economics you need to upgrade the fiber portion of your network. The ability to choose and upgrade your capacity allows you to meet demand today and in the future without incurring additional equipment costs. Whether used for a greenfield network build or deployed over an existing line system, EKINOPS PM 200FRS02 and PM 600FRS06 provide the solution you need to make your Fiber Deep network a success.

About Ekinops

Ekinops is a leading provider of open and fully interoperable Layer 1, 2 and 3 solutions to service providers around the world. Our programmable and highly scalable solutions enable the fast, flexible and cost-effective deployment of new services for both high-speed, high-capacity optical transport networks and virtualization-enabled managed enterprise services

Our product portfolio consists of three highly complementary product and service sets: Ekinops360, OneAccess and Compose.

- Ekinops360 provides optical transport solutions for metro, regional and long-distance networks with WDM for high-capacity point-to-point, ring and optical mesh architectures, and OTN for improved bandwidth utilization and efficient multi-service aggregation.
- OneAccess offers a wide choice of physical and virtualized deployment options for Layer 2 and Layer 3 access network functions.
- Compose supports service providers in making their networks software-defined with a variety of software management tools and services, including the scalable SD-WAN Xpress.

As service providers embrace SDN and NFV deployment models, Ekinops enables future-proofed deployment today, enabling operators to seamlessly migrate to an open, virtualized delivery model at a time of their choosing.

A global organization, with operations in 4 continents; Ekinops (EKI) - a public company traded on the Euronext Paris exchange - is headquartered in Lannion, France, and Ekinops Corp., a wholly-owned subsidiary, is incorporated in the USA.

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