Stofa Goes Live with Arris R-PHY Solution

A Market Impact Report

August 2018

EXECUTIVE SUMMARY

Stofa, a major cable operator in Denmark, recently selected the Remote-PHY version of the Distributed Access Architecture to upgrade its network to DOCSIS 3.1. ARRIS supplied most of the solution, including the CCAP Core, RPD and R-PHY nodes. The solution went live in March 2018.

Stofa followed a deliberate and comprehensive process to identify its requirements, which drove the selection of the vendor and the solution. However, the extensive selection process was only the beginning. What followed were intensive workshops and walk throughs, which helped to evolve the solution to meet the needs of Stofa.

The migration to DAA has far reaching implications for an operator's network and operating environment, for example, the analog network that connected the integrated CCAP to the fiber node is now replaced by a digital network, connecting a multitude of CCAP cores to multi-thousand RPDs. Such a network is complex to manage and requires a new skillset. The monitoring tools no longer work in the new environment, and the RF alignment processes need to be revisited. Careful consideration should be given to power consumption in the nodes and to their form factor.

Careful planning and extensive testing ensured a successful, smooth go live for the solution. By migrating to Remote-PHY, Stofa was able to reap significant savings in space, cooling and overall power consumptions in the headends; furthermore, with a new solution powering its DOCSIS 3.1 network and 1.2GHz upgrades, the company can compete much more effectively with the incumbent operator in Denmark.

KEY FINDINGS

- Stofa recently went live with a Remote-PHY solution from Arris to power its DOCSIS 3.1 deployments.
- Extensive analysis of its requirements drove vendor and solution selection. Next came a long journey of deep engagement with the vendor and internal stake holders to address network and operational issues.
- Some of the issues Stofa had to address:
  - Management of RPDs and of the network connecting them to CCAP cores
  - Changes in RF network alignment process
  - Power consumption and cooling in the node, as well as form factor
- Stofa's careful planning ensured a successful market introduction, and the operator is reaping the benefits of the new solution to be more competitive.

INTRODUCTION

Faced with significant competition from the incumbent operator TDC, Stofa, a major cable operator in Denmark, decided to upgrade its network to meet the increasing demand for bandwidth by its subscribers. In 2016, Stofa started the RFI process to upgrade its headends to DOCSIS 3.1 and support capacity expansion to 1.2 GHz. The highly contested RFI/RFQ process ended with the selection of the Remote-PHY solution by Arris in May 2017. In March 2018, the Arris solution went live in the Stofa network.

This report highlights the key criteria that led to the selection of the Arris solution and the process that the cable operator and Arris went through to go live with the new solution.

THE SOLUTION SELECTION PROCESS

Denmark, much like the rest of Scandinavia, has a high fiber penetration and a very competitive market environment. Stofa, one of the major players, was operating a legacy network that was not DOCSIS 3.1 capable and was limited in its ability to offer the gigabit speeds the market is increasingly demanding.

About 60% of Stofa's footprint is rural, but there is a strong concentration of MDUs in Denmark's major cities. As is typical in most of Europe, cable runs are buried rather than aerial (as is largely the case in the US outside urban areas).

The selection process was long, multi-staged and extensive; it included multiple walk throughs at several customers' field sites, as well as numerous architectural design workshops. The key drivers and criteria that guided the selection process were:

- Support for DOCSIS 3.1 to enable network capacity expansion.
- Consolidate the hubsites, particularly as Stofa did not have the real-estate capacity to accommodate the additional hardware associated with capacity expansions in the head-ends. Stofa wanted to transition the use of their existing fibers from analog fibers to digital ones. This transition was designed to allow them to send more wavelengths (lambdas) from the headends to the nodes location. In addition, Stofa were looking to simplify the operation of those fibers, by moving to a digital transmission. Therefore, Stofa needed to push the PHY layer to the access network and digitize its network.
- Support for all its existing services and planned services.
- Compliance with CableLabs specifications.
- Alignment with its planned expansion to 1.2GHz, from 860MHz.
- A stable vendor with proven expertise and track record, strong field support capabilities, and solid financial resources.
- A solution that fits within the parameters of its access network. For example, due to the relatively small size of the cabinets that host the optical nodes in its network, the size of the nodes was a factor in the solution selection. Unlike the US where in most cases the nodes are mounted on poles, in Europe, the nodes are housed in cabinets. Replacing cabinets to accommodate larger nodes would have added significantly to the operation and capital expenses and project timeline given that it would have required new permits.

Stofa started the RFI process in 2016, at a time when the Distributed Access Architecture was still a nascent technology with many vendor solutions still being finalized. A thorough RFI/RFQ process culminated with the selection of the Arris Remote-PHY solution, the Arris E6000 Core and the NC2000 Remote-PHY optical nodes. Stofa was keeping an N+5 configuration and selected Teleste for the upgrade of the amplifiers and other components south of the node.

The selection process was long, multi-staged and extensive; it included multiple walk throughs at several customers' field sites, as well as numerous architectural design workshops. Because R-PHY solutions were still being optimized, Arris had the opportunity to evolve its solution with a better understanding of the operator's requirements.

KEY CONSIDERATIONS FOR DAA REMOTE PHY MIGRATION

The migration to DAA has profound implications for service provider networks and operating environments.

Management of RPDs

Because the PHY layer is separated from the MAC in Remote PHY, what used to be an analog node has been replaced by a digital node that hosts the RPD; the new node becomes an intelligent network element that needs to be managed. With R-PHY, there will be multiples of thousands of nodes across the network that will need to be managed. Therefore, the operator should consider implementing a DAA device orchestration and management layer to automate functions such as software control, inventory, and configuration management of the RPDs. Furthermore, the operator needs the capability to monitor the RPDs and to automatically activate them to speed up the deployment.

Management of Network Connecting CCAP Cores to RPDs

With the migration to R-PHY, the link between the CCAP core (which remains in the head-end) and the fiber node becomes a digital one. Although there are substantial benefits for substituting a digital link to the traditional analog one, the digital connectivity implies that there is now a complex network of CCAP cores and a significantly large number of nodes that host the RPDs that are connected via 10 Gigabit Ethernet links in spine leaf configurations. The industry refers to such a network as Converged Interconnect Network. The operator should carefully consider the design, implementation and management of this network and plan to retrain its employees and acquire new talent with the right skillset. The good news is that while the analog network was somewhat esoteric, the new network is in line with the broader communications industry, thus making it easier to find the talent and the vendors to support it.

Changes in RF Network Alignment Process

Because the analog links are replaced with digital ones, the legacy analog sweep systems and field tools no longer work. The operator needs new tools for RF network alignment and for upstream quality assessment. One solution, which Arris developed, consists of a software tool that connects remotely to the RPD and provides US RF spectrum plot readings in real time (like a spectrum RF analyzer) through which the US path can be aligned and which can be used for periodic or reactive RF network monitoring

and maintenance. The operator must be ready to acquire new tools and to train technicians on using them.

Power Consumption in the Node

With the PHY layer moving to the node and if the amplifier cascade south of the node is maintained (as is the case with Stofa), the power needs may need to be augmented, leading to the need to replace the existing power supplies. It is essential that an operator evaluates the powering requirements of the solution it is implementing to optimize the need to replace power supplies and power consumption in the access network.

Form Factor and Cooling Requirements of the Node

In some parts of the world, as is the case in Europe, the node is hosted in a street cabinet that has limited space. A larger node footprint necessitates the replacement of the street cabinet enclosure, which is costly and may require a long permitting process. Cooling of the node is an important factor, particularly in the case when the node is enclosed in a cabinet. It is not recommended that operators use forced air cooling within the cabinets because it adds to power, noise and requires significant maintenance. Therefore, in areas where the node is enclosed, the operator should carefully consider the size and heat dissipation parameters of the node, because this choice will have an impact on operation expense and on long-term reliability.

OVERVIEW OF THE STOFA SOLUTION

The Stofa solution consists of the E6000 core in the head-end and the NC2000 optical node in a remote PHY configuration. Unlike most US operators that are pursuing an N+0 fiber deep solution, Stofa, as it typical in Europe, is maintaining a cascade of amplifiers between the nodes and the subscribers in an N+5 configuration in most cases. Each node serves approximately 512 homes passed.

A key part of the solution is a migration from analog connectivity between the headends/hubs, to the access nodes, to Ethernet connectivity. This migration is now possible because the PHY layer is moved to the optical node. The migration to Ethernet is one of the benefits of DAA, because it is easier to manage, and the talent needed to manage it is widely available, unlike analog/RF links that required specialized expertise.

Stofa's network upgrade also underpins its upgrade from 860MHz spectrum to 1.2 GHz. Therefore, the passives and actives south of the nodes were also upgraded.

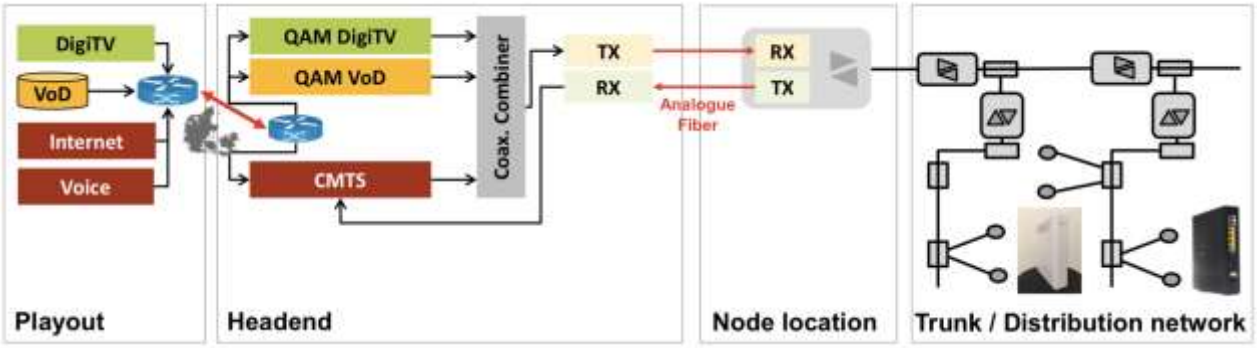

Figure 1. Pre-Upgrade DOCSIS 3.0 Architecture (Source: Stofa)

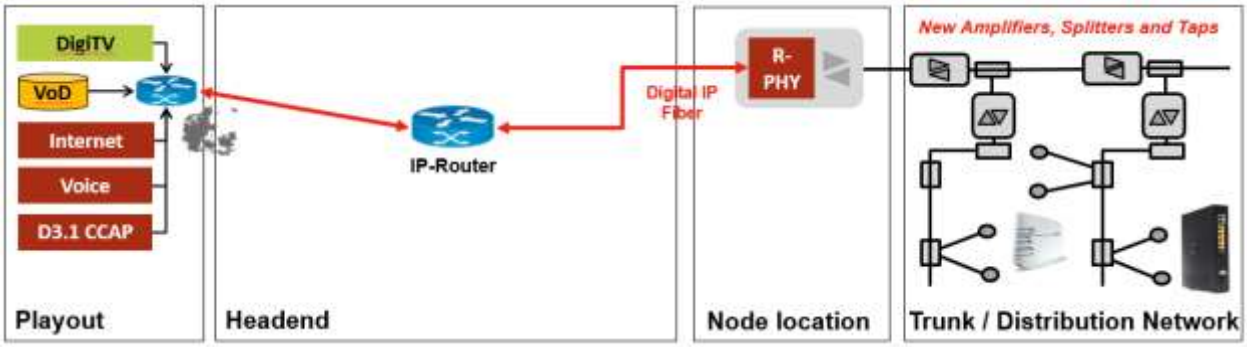

Figure 2. New DOCSIS 3.1 Architecture (Source: Stofa)

For automation and DAA element management capability, Stofa decided to also deploy a new software solution from Arris called vManager, a centralized, cloud-based management capability for RPD and CCAP core and includes device orchestration. The vManager is designed to meet the CableLabs specifications, supports scalability and soon also multi-vendor interoperability.

THE ROAD TO FIELD LAUNCH

Given the relative immaturity of the Remote-PHY solution that Stofa was deploying because of both CableLabs standards and the state of the technology at that time, extensive lab testing was required. The solution had to also be evolved to address the specific needs of the operator's network and operating environment. Stofa had to also modify its methods and procedures to retrain its staff and to hire new staff to support the new solution.

The solution was in Stofa's lab for six to nine months undergoing extensive testing and tweaking. Lab testing was followed by a two-months field trial with very specific KPIs defined and measured.

KEY TAKEAWAYS

- Stofa transitioned from an analog network to a digital one. Initially this process turned out to be more complicated than originally anticipated. Although this migration is essential in modernizing the network, it is important for an operator to understand its complexity, allocate the right resources, provide the right training, and allow sufficient time so that the migration is successful.

- The transition to DAA is far reaching in its impact on the network and operations. Therefore, comprehensive upfront planning that includes not only network architectures, but also operations, product development and other relevant parts of the organization is essential.
- DAA implies a departure from analog networks, which means retraining the existing workforce, and supplementing with new talent; it also means rethinking methods and procedures and other operating processes, as well as tools and capabilities.
- No two operators are alike, and even within one operator there can be significant variability between various locations. Therefore, the operator needs to carefully consider its needs, current and future, in deciding on the right solution.
- DAA is a new technology. Therefore, careful planning, selecting the right vendor and partnering with the vendor or vendors throughout the process is essential.

With the right solution and appropriate planning, operators will be successful in migrating to DAA and will be able to reap the significant benefits of the new architecture.

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