COMMSCOPE®

EXECUTIVE BRIEF

Successful Deployment of Remote PHY

Evolving the Network to Increase Bandwidth and Reduce Power and Space Requirements

To deal with rapid growth in bandwidth demand, Operators must embrace new technologies and architectures that supply the desired capacity, as well as deliver higher data speeds and operational cost savings. Many are adopting DOCSIS 3.1 and Distributed Access Architectures to update their network infrastructure. However, they all need to determine which combination of adjustments will best meet their subscriber demand over the next five to 10 years. As one pioneering Danish Cable Operator has discovered, Remote PHY (R-PHY) can be a key ingredient in the transformation required to build a more efficient, scalable, cost-effective network.

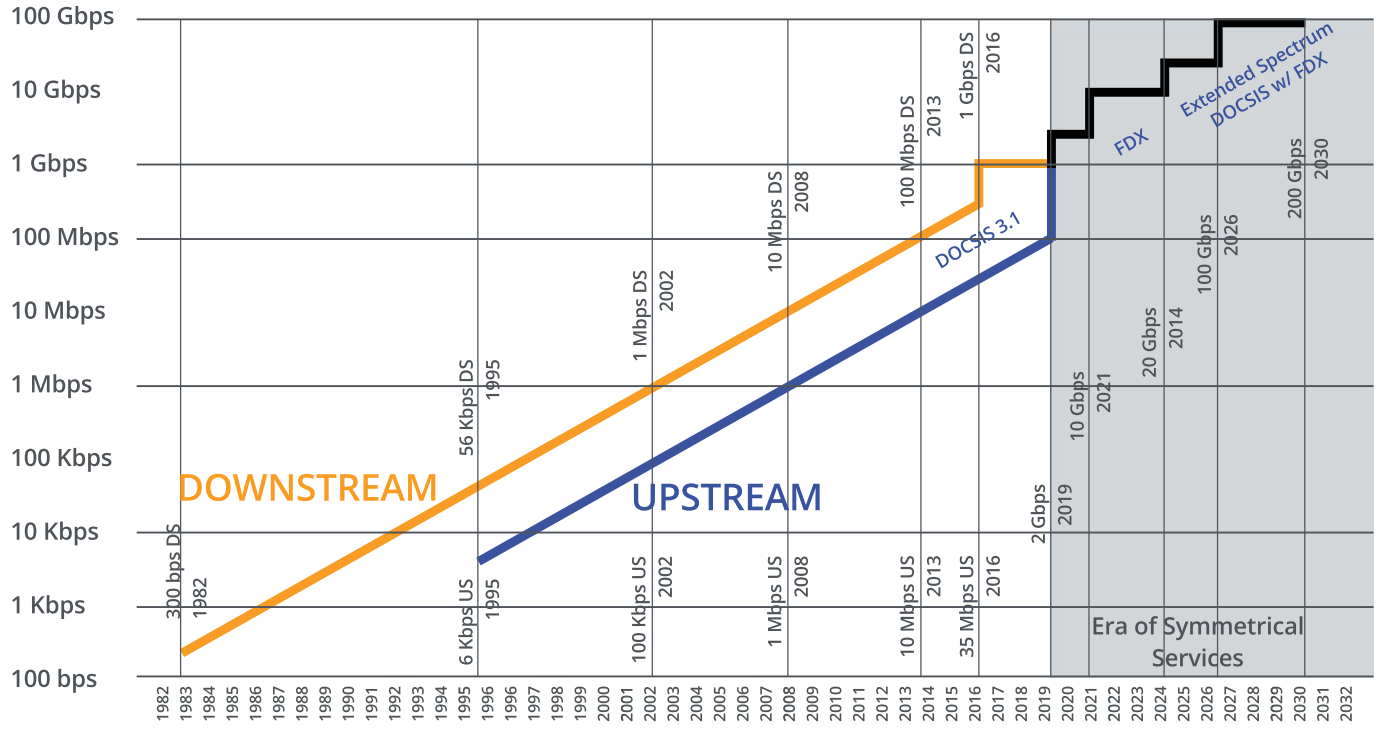
Why Remote PHY?

Distributed Access Architecture (DAA) is an evolutionary step in extending high-performance fiber connections closer to the subscriber home. R-PHY is a technique for separating the QAM modulation/demodulation portion of the traditional integrated CMTS or CCAP and moving it to the end of the network. Shifting these components to the node structure, closer to the subscriber, dramatically boosts signal performance and reduces space and power requirements at the headend. By upgrading to a Remote PHY network, while leveraging DAA and DOCSIS 3.1, which delivers better spectral efficiencies and wider channels for both the downstream and upstream, Operators can increase bandwidth supply and improve cost-efficiency.

More bandwidth, smaller space, less power

The advantages of Remote PHY start with transitioning from analog signals to digital optics on the fiber network. Digital fibers do not require frequent tuning and adjustments, and digital transmission produces more bandwidth from an existing fiber network. Moving RF signal processing from the headend to the node eliminates signal degradation inherent in transmission over AM fiber, thus boosting

Nielson's Law of Internet Bandwidth (Growth Rate = 50% /Year)



the signal-to-noise ratio for better signal quality at the end-of-line. The improved SNR allows DOCSIS 3.1 to push more data through the same amount of RF spectrum, and without changing "last mile" wiring. Bandwidth capacity on existing hybrid fiber coax (HFC) networks jumps from 0.1 Gbps to 1.0-2.0 Gbps in the upstream direction and from 1 Gbps to 10 Gbps going downstream.

By moving functionality out, R-PHY networks also greatly reduce headend and hub space, as well as power requirements, generating substantial savings on facility maintenance. Also, because R-PHY digital fibers have fewer distance limitations, the headend/hub can be more remote from the node and subscriber, opening up opportunities for hub consolidation. Centralizing MAC core functionality in data centers can dramatically simplify operations by reducing the number of devices to be managed, and by adding automation.

Stofa's groundbreaking journey to efficiently deliver more bandwidth

One of the first Remote PHY deployments in the world was performed by Stofa, Denmark's second-biggest provider of television, broadband and telephony. The Danish Operator delivers broadband to more than 500,000 households, with services including high-speed data, voice and QAM video. In 2016, Stofa launched a project to plan a network upgrade that would allow it to stay ahead of its forecasted subscriber bandwidth demand curve. Stofa chose ARRIS as a partner for technology, planning, network design and product deployment.

Prior to the network upgrade project, Stofa's modular architecture placed CMTS in the headend and the associated EQAMs at the antenna facilities location. Benefits of the upgrade included:

- Leveraging DOCSIS 3.1 to increase capacity in both the upstream and the downstream directions. Transitioning to digital fiber would drive better utilization by multiplexing many nodes onto the same existing fiber.
- Using the IP protocol on top of digital fiber to enable dynamic sharing of traffic across fibers. Reaching a higher modulation order would increase the amount of spectrum available for services.
- Easing space and power requirements at hub and headend locations.
- Enabling Stofa to proactively manage network functions.

Getting the network architecture just right using Remote PHY

After it was decided to converge all DOCSIS, VOD and broadcast customer services onto one platform, the team's focus shifted to crafting a design that would bring the benefits of Remote PHY to the network. All services would be processed by the MAC core and transmitted over digital fiber to the R-PHY node. Convergence would create operational simplicity based on a unified data path for all services.

After initial testing, the team launched a limited field trial to learn more about its ability to converge DOCSIS and VOD video services over the Remote PHY architecture. Using pre-production software, the lab and field trials encountered very few issues, while giving the engineering and operations teams valuable experience with services configuration, monitoring and debugging.

Anatomy of a successful R-PHY deployment

Stofa captured RF signal data before and after the deployment. Upstream noise data collected at the R-PHY node showed an average 2.5dB improvement in SNR—with up to 8.2dB improvement in some areas. This result clears the way for Stofa to go to higher DOCSIS 3.1 modulations in the future, which will provide increased upstream capacity to subscribers for faster upload speeds.

Aside from increasing capacity, the R-PHY deployment enabled Stofa to recognize space and power savings in the headend with the potential for facilities consolidation in the future. Stofa's before-and-after comparison of 96 service groups revealed that moving PHY processing out of the headend reduced the number of rack units required by about two thirds, from 64 in the legacy architecture to 19. Power demand decreased by two times, dropping from 7,950W in the legacy architecture to 3,485W for Remote PHY.

Centralized management made the operation of the new architecture significantly easier compared to Stofa's previous network. The number of managed headend devices needed to support 200 service groups dropped from eight to four (one MAC core, two timing servers and one aggregation router), radically simplifying operations. A single provisioning interface for the MAC core now allows administrators to easily perform changes in the provisioning system and back office tools. There are fewer interoperability issues and, with fewer IP addresses needed, the Stofa team can keep a smaller inventory to deal with outages.

R-PHY has created a path toward virtualizing functions and centralizing them in data centers. Future expansion of Stofa's network can be accomplished by adding licenses as part of regular network upgrade cycles and by performing configuration changes remotely rather than sending technicians to the field.

Major takeaways from Stofa's experience

The Stofa deployment offers several valuable best practices when upgrading to R-PHY:

Start testing early. Become familiar with the product and architecture as early as possible.

Plan ahead. Establishing the lab and field qualification process early gives technicians and network engineers time to figure out their needs to support the effort. Laying out the deployment phases helps uncover migration challenges and operational issues before they can impede the rollout.

Dedicate resources to CIN network and timing architecture. Assign resources that have the right experience and skill sets to plan these aspects of the network.

Start slowly. Aim for a gradual migration that allocates sufficient time for capturing process glitches and technical issues. Start your field deployment with one node, then gradually increase the scale to full deployment.

Automate. Making significant changes to the network infrastructure presents an opportunity to automate more processes and make the deployment team as well as the maintenance and support teams more productive in the long term.

Make it a partnership. Be transparent with your equipment vendor. Weekly meetings between integration teams will allow everyone to react quickly when roadblocks are encountered and create effective workarounds together.

Conclusion

Evolving the network with a Remote PHY approach can provide immediate value by increasing bandwidth capacity, while reducing costs associated with operations, power and cooling. Operators can more efficiently meet subscriber demand for more bandwidth, as well as be in a position to easily expand the services they deliver in the future.

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