The Evolving Network: DAA and D3.1*Enhanced* Technology Deployments

Customer Name

Mediacom®

Country

United States

Challenges

Access network technologies have evolved at an increasingly rapid pace over the past five years, providing cable operators with significant improvements in network capacities and throughput speeds.

But for networks still operating at 1 GHz bandwidths and lower, many of these new technologies—which include Distributed Access Architectures (DAA), Node PON, virtualized headend operation, and mid-split and high-split DOCSIS® 3.1 operation—are often not viable. Additionally, these new technologies have rendered much of the older equipment in both the headend and the outside plant obsolete. As this older equipment reaches end of life, and aging plants are unable to take full advantage of newer technologies, cable operators in these scenarios are faced with the significant challenge of modernizing and optimizing their networks without disrupting services or incurring excessive capital expenditures.

Overview

Mediacom is a regional telecommunications service provider based in Mediacom Park, New York. A privately held company, Mediacom offers a wide range of broadband and mobile services to over three million households and businesses across 22 states in the U.S. Their current HFC cable access network delivers services to residents and business in smaller U.S. towns and cities, with a large concentration of customers in the Midwest.

Mediacom's legacy HFC cable access network consisted of sub-split plants operating at either 750 MHz or 860 MHz in the downstream and 5-42 MHz in the upstream. Analog video delivery was utilized for cable subscribers.

As part of Mediacom's ongoing commitment to getting the most out of its networks for subscribers, the company initiated a plan to modernize the entirety of its access network. The plan consists of two phases:

- Phase One: Transition from analog to IP video platform to improve operations and reclaim bandwidth to support the Phase 2 initiative; a plant upgrade to support 204/258 MHz high-split operation; the deployment of Remote MACPHY Devices in a DAA network to support 2x1 multi-gigabit per second broadband service tiers (all currently in progress)

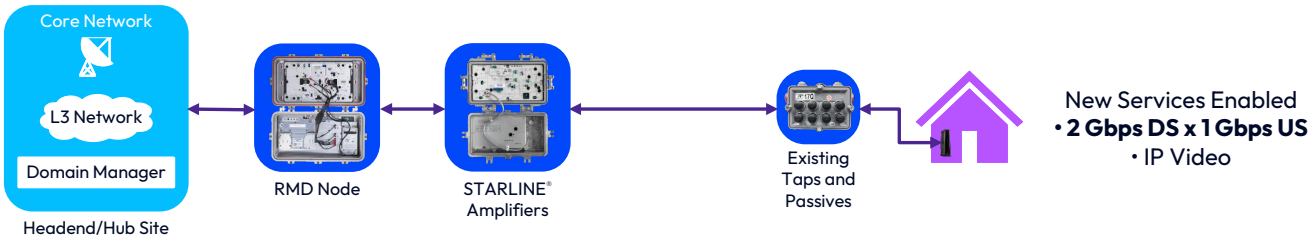

Figure 1. Phase 1 RMD Node and High Split Amplifier Deployment (D3.1 @ 1.2 GHz)

- Phase Two: after completing the DAA deployment, Mediacom will leverage it to incorporate D3.1*Enhanced* (D3.1*E*) technology—which, operating in conjunction with next-generation DOCSIS 4.0 modems, expands the number of OFDM DS channels the network can support—to extend multi-gigabit service beyond 2x1 service tiers

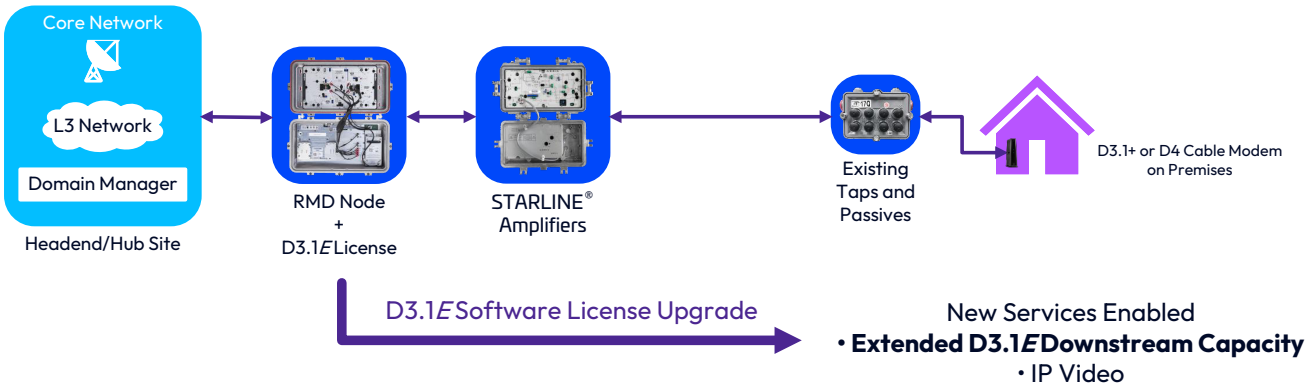

Figure 2. Phase 2 D3.1*E* Deployment @ 1.2 GHz

Additional business goals related to this project include:

- Modernizing Mediacom's current sub-split network to optimize performance, expand bandwidth, and maintain competitive value proposition with subscribers
- Replacing active nodes nearing obsolescence (typically applicable to equipment ≥10 years old) with new RMD-capable nodes to prevent aging nodes from potentially impacting network performance
- Leveraging the plant upgrade and RMD node deployments to expand network speed and capacity beyond the initial 2x1 multi-gigabit per second service tiers to extend the life of these upgrades and maximize ROI

This phased approach will enable Mediacom to completely modernize their legacy network, address concerns over the aging plant and obsolescent equipment, proactively address potential points of failure in the network, reclaim bandwidth to support gigabit service tiers, and significantly improve network speed, capacity, and performance. As a result, Mediacom will remain competitive now and in the future in markets where other operators are offering multi-gigabit services, especially markets in which the competition has deployed FTTH overbuilds.

Why Aurora Networks™?

Mediacom chose Aurora Network's Opti Max® OM4120® nodes with RD2322 Remote MACPHY modules and D3.1*Enhanced* (D3.1*E*) technology for its DAA deployment and gigabit service tier targets. As the only vendor that currently supports I-CCAP, Node PON, and all flavors of DAA technologies—including Remote MACPHY, Remote PHY with a physical MAC core, and Remote PHY with a virtualized CMTS core—Aurora Networks was uniquely positioned to support Mediacom's initial 2x1 upgrade initiative and its plans to extend those service tiers in the future.

In addition to OM4120 RMD nodes and D3.1*E* technology, Mediacom will also deploy select Aurora Networks 1.2 GHz amplifiers to support the plant upgrade initiative and new node deployments.

Scope

Mediacom's network upgrades are an on-going project that will eventually encompass the entire access network. Depending on the size of the community, the upgrade process can take anywhere from six to 15 months. Mediacom expects to continue the upgrades through 2026. The deployment of the Aurora Networks OM4120 RMD nodes in Mediacom's network began about a year and a half ago and is ongoing. D3.1*E* technology deployments will begin in Q1 2026. Aurora Networks will continue to work closely with Mediacom during the upgrade project to ensure a smooth transition from the legacy architectures to the new platforms.

Advantages of the Aurora Networks Solution

By upgrading the legacy sub-split plant and deploying Aurora Networks RMD nodes and D3.1*E* technology, Mediacom is realizing several operational and performance-related improvements across the network. These improvements will benefit both subscribers and the company's internal efficiencies. The more notable improvements are discussed below.

Remote MACPHY DAA Operation

DAA decentralizes and virtualizes headend and network delivery by placing the digital to RF interface at the optical-coax boundary in an access node. The analog links from the headend are also replaced, converting the service group's analog fiber link to digital fiber Ethernet links, which expands bandwidth and helps to improve network performance. By remaking and redeploying the edge of the network and driving digital to analog conversion closer to the home, DAA provides better spectral efficiencies and increases the number of wavelengths supported on each fiber.

These capabilities will enable Mediacom to allocate more bandwidth to homes serviced by OM4120 RMD nodes. Additionally, Mediacom will realize several operating advantages not available in sub-split networks, including higher modulation rates.

OM4120 RMD node operation will also enable Mediacom to move all CMTS operation, including DOCSIS signal generation and processing, from their legacy hardware-based CMTS chassis and into the RD2322 node module. As a result, Mediacom will be able to retire aging and/or legacy headend equipment.

OM4120 RMD node deployments will also help Mediacom integrate these network improvements and bring its new premium multi-gigabit speed tiers to market more quickly than Remote PHY DAA operation by:

> "The combination of Aurora Networks' RMD node support of D3.1*E* technology, along with DOCSIS 4.0 modem deployments, will enable Mediacom to quickly and economically roll out multi-gigabit services to our subscribers by leveraging many of our current network assets. These upgrades are an ideal way for us to maximize ROI while maintaining a competitive advantage in today's challenging broadband marketplace."
>
> **Mike Sobotor**
> **Vice President IP Development, Mediacom**

- Reducing operational complexity by de-centralizing both the MAC and PHY layers; Remote PHY DAA operation only decentralizes the PHY layer, requiring operators to integrate Remote PHY devices with the MAC layer in the headend
- Integrating seamlessly with both legacy and new network assets to simplify the introduction of new and future services
- Reducing the power requirements needed to operate legacy HFC nodes, enabling Mediacom to use the network's power budget more efficiently without having to increase or reallocate powering resources

In addition to these benefits, the Aurora Networks RMD lid upgrade option for the OM4 series (also available for Remote PHY deployments) will also help improve time to market for Mediacom's DAA deployments by enabling Mediacom to upgrade its base of currently deployed OM4120 nodes for RMD operation without having to replace the entire node housing, extending the life of these nodes and limiting network downtime.

By pushing the edge of the network closer to subscribers' homes, Mediacom will be able to reduce the number of amplifiers in cascade from eight, previously used in their sub-split architecture, to four. These smaller cascades will enable Mediacom to reduce the number of homes passed per OM4120 RMD node, freeing up more bandwidth to subscribers and reducing the chances for network outages.

Reclaiming Bandwidth: Transitioning from Analog Video Delivery

To optimize the plant upgrade and fully support multi-gigabit operation, Mediacom is reclaiming and/or augmenting bandwidth in the new plant by eliminating MPEG QAM video

channels and transitioning to IP video operation. IP video enables Mediacom to reclaim set-top box (STB) out-of-band (OOB) channels that would typically prevent high-split operation. Used in conjunction with MPEG-4 compression, which reduces the size of video data streams, IP video is helping Mediacom reassign bandwidth previously used for analog video delivery to OFDM/A channels in the new plant—as much as 6 or 8 MHz per channel in the downstream band (depending on the plant's geographical location and current channel configurations). This additional bandwidth supports a maximum of two OFDM channel blocks in the downstream, enabling maximum throughput speeds of ~3 Gbps. Additionally, the plant's new 5-204 MHz upstream band now supports two 92 MHz OFDMA carriers, enabling maximum throughput speeds of ~1.25 Gbps. Thus, Mediacom will now have the bandwidth to easily support its initial 2x1 multi-gigabit per second premium speed tier target. These premium speed tiers, in fact, are already being offered to subscribers currently serviced by upgraded areas of the network.

Maximizing ROI: D3.1*E* Technology Deployments

Mediacom will leverage their OM4120 RMD deployments and high-split plant upgrades to further enhance their initial 2x1 premium gigabit speed tiers by deploying D3.1*E* technology in Phase 2 of their network upgrade initiative. Mediacom will begin rolling out D3.1*E* technology after the DAA deployments are completed.

D3.1*E* technology leverages next-generation DOCSIS 3.1+ or DOCSIS 4.0 cable modems to expand the number of OFDM channel blocks in the downstream. Legacy DOCSIS 3.1 cable modems are typically limited to a maximum of two OFDM channel blocks. However, by leveraging the new 204/258 MHz high-split spectrum and reassigning bandwidth reclaimed with IPTV operation, Mediacom will be able to deploy a third, fourth, or potentially fifth OFDM channel, depending on their network configuration. These additional OFDM channels represent the extended downstream capacities available with D3.1*E* technology. Mediacom will only need to provide DOCSIS 3.1+ or DOCSIS 4.0 cable modems to subscribers who sign up for the highest service tier.

Mediacom plans to deploy D3.1*E* technology in their new DAA network to extend premium Gigabit speed tiers above and beyond their current 2x1 operating capacity; D3.1*E* technology enables a gain of 3 Gbps in the DS, which Mediacom can leverage to support additional service tiers. Moreover, the deployment of D3.1*E* technology will require minimal capital expenditure—the primary components are software licenses for RD2322 RMDs and targeted deployments of next-generation cable modems—thereby enabling Mediacom to maximize the ROI on its Phase 1 network upgrades and significantly extend their usefulness, while keeping pace with competitors offering similar premium Gigabit speed tiers at a fraction of the costs associated with FTTH overbuilds.

Conclusion

Mediacom's path to 2x1 Gbps speed tiers—and beyond—demonstrates the versatility and value of the deep portfolio of Aurora Networks products and solutions. These include cost-effective options for upgrading aging plants and modernizing access networks with cutting-edge, next-generation technologies, like DAA RMD nodes and D3.1*E* technology, that can extend the life of new network upgrades and technology deployments well into the next decade. As the Mediacom story demonstrates, Aurora Networks is the ideal partner for cable operators who plan to modernize, enhance, and optimize their current network assets to support tomorrow's technologies.

When service providers want innovative, cutting-edge access network solutions to maintain a competitive advantage in today's challenging broadband marketplace, they turn to Aurora Networks. Aurora Networks' end-to-end solutions feature the latest access network technologies while providing a clear path toward tomorrow's symmetrical gigabit deployments. With decades of expertise in developing broadband technologies, Aurora Networks is the ideal partner for service providers planning to enhance, optimize, and refresh their current access network assets. Discover more at vistancenetworks.com.

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