Over 80% CAPEX Savings with Comtech’s Hybrid DAA Solution

DAA and FTTB modernization for cable networks

Cable network operators are under growing pressure to deliver higher bandwidths. At the same time, modernization must remain economical and make the best possible use of existing infrastructure. Comtech’s Remote-PHY / Remote-MACPHY architecture demonstrates how these requirements can be combined.

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Today’s competitive and marketing environment is increasingly forcing cable TV network operators to offer higher bandwidths in order to remain competitive. This applies even when the desire for higher speeds is often not driven by technical necessity. Sooner or later, operators will therefore be compelled to modernize even well-developed networks.

DAA as the most economically viable development path

Of the available upgrade paths, operators should select the solution that causes the least disruption to subscribers, enables the greatest possible reuse of existing infrastructure and expertise, and at the same time offers the best balance of performance and cost. The rational choice is therefore to retain DOCSIS technology in its most advanced form as a DAA network, using either a Remote-PHY or Remote-MACPHY architecture.

For small and medium-sized cable network operators, RF bandwidths of 1.2 GHz downstream and 204 MHz upstream are realistically achievable. These can accommodate:

- In the downstream direction, two OFDM DOCSIS 3.1 channels with 4096-QAM, plus 32 SC-QAM DOCSIS 3.0 channels.
- In the upstream direction, one OFDMA DOCSIS 3.1 channel with 1024–2048-QAM, plus four to eight SC-QAM DOCSIS 3.0 channels.

This results in a transmission capacity of approximately 5.4 Gbit/s downstream and 1.5 Gbit/s upstream.

Assuming peak-hour downstream usage of 20 Mbit/s per subscriber, or 30 Mbit/s for premium customers, the downstream capacity of a single DAA node can serve approximately 180 to 270 households. On the upstream side, assuming 20 Teams/Zoom calls, 10 CCTV streams and 10 cloud backups per 100 subscribers, together with other traffic (NAS synchronization, gaming, browsing, etc.) amounting to 50 Mbit/s, the requirement is approximately 250 Mbit/s. Even at the stated number of households, utilization remains below 70% with a usable upstream capacity of 1 Gbit/s. This can be improved further by reducing upstream service-group size, for example through 1×2 segmentation.

Even in densely populated cities, this number of subscribers is spread over a relatively large area. There are therefore two options: operate lightly loaded DAA equipment in each individual apartment building, or distribute the output spectrum through a distribution network to buildings farther away.

The modulation error ratio (MER) of more than 42 dB required for the modulation described can also be reliably achieved in analog optical networks, provided that high-quality 1550 nm laser transmitters are used. Even without an EDFA, i.e. without additional optical amplification, transmission over distances of 5 to 15 kilometers can be ensured.

FTTB as a logical extension downstream of the DAA device

An obvious approach is therefore to build an FTTB access network downstream of the DAA device. The existing in-building coaxial distribution can remain unchanged; only the building amplifier is replaced by an FTTB node with identical dimensions and RF output parameters. An inverse node containing the 1550 nm transmitter and the return-path receiver (MDR) is connected to the RF output of the DAA device.

Our measurements, published in the May 2022 issue of Cable!vision (“How fiber can reach buildings cost-effectively”), show that the required return-path MER can be maintained even when combining up to 64 FTTB nodes at an optical modulation index (OMI) setting of 7%. Such a high split ratio will hardly ever be necessary.

With 10 to 30 residential units per building and the traffic assumptions above, a single DAA device can serve a maximum of 9 to 27 nodes for typical customers, or 6 to 18 nodes for premium customers. Taking these values and the available components into account, we developed an inverse-node product family that scales flexibly from 4×4 to 1×16 nodes, covering all economically sensible network architectures.

The greatest advantage of the hybrid DAA+FTTB solution is that, with 1:16 segmentation, the purchase cost of the required active components is less than 18% of the cost of a DAA installation in every building, while customer satisfaction remains unchanged. Further benefits include lower energy consumption and the ability to reuse the fiber installed for FTTB in a future PON network.

Solution development in a customer project

The required network components were developed together with a Scandinavian partner for a specific customer project. The operator had already begun building a Remote-MACPHY network using Vecima components but had been forced to accept several compromises. There was no mechanical design suitable for rack environments, so the die-cast housing, power supply and mounting brackets occupied unnecessarily large amounts of space. In addition, the device produced sufficiently high levels even without amplifier stages, but these stages could not be switched off, causing unnecessary power consumption and increased heat generation.

The first component of the system presented here was developed in response: the Stratum CorX RMV, based on the Vecima RMD. Housed in a rack enclosure with −48 V DC power and integrated cooling, it operates as a high-quality signal source without unnecessary power consumers and requires only 2 rack units (2U). It retains all functions of the original solution while requiring 60% less space and 50 W less power.

Integrating the analog optical transmitter and MDR into the DAA device enclosure was also examined, but ultimately rejected because it would have reduced flexibility. The Stratum LinX RF-R1 inverse node was therefore developed as a complement to the RMV1. Connected to the RMV1 by a short coaxial cable, it can transmit DOCSIS signals over a single-fiber analog optical network to as many as 16 sites. Its design corresponds to the Vecima RMD’s 1×2 segmentation; the connected mini-nodes can operate in two independent groups of eight units each. Comtech’s MDO1201 nodes, which replace the existing

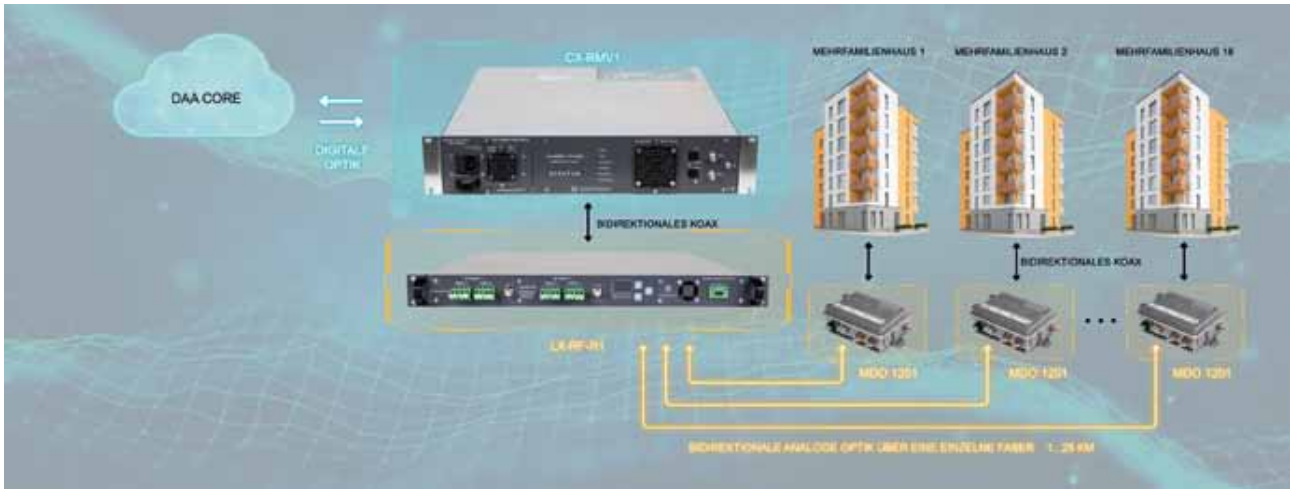
building amplifiers, are specifically optimized for this application.

Modular assemblies for individual requirements

The project’s most important finding is that introducing new solutions of this kind often requires compromises, especially for smaller network operators. Considering the matrix of DAA technology, core vendor, mechanical format and electrical parameters such as power supply and monitoring protocols, it quickly becomes clear how unlikely it is to find a standard solution that fits an existing network exactly.

Our company has therefore developed modular assemblies that make it possible to supply Remote-PHY or Remote-MACPHY nodes based on Vecima, Harmonic, Aurora or Sumavision, with low minimum order quantities and development times of only a few months. These can be provided in die-cast, rack-mounted or BK2000 formats, together with the appropriate RF or optical access-network components. This allows municipal utilities and even the smallest network operators to introduce DAA technology cost-effectively, using components optimally matched to their infrastructure.

System architecture



Efficient building distribution: one RMV1 feeds the RFR1, which transmits signals via analog single-fiber optics to MDO1201 nodes in up to 16 apartment buildings. Original Comtech illustration; embedded labels remain as published.

Source: Cable!Vision 4/2026, pp. 18–19. English translation of the supplied German article. Technical product names and numerical specifications retained.