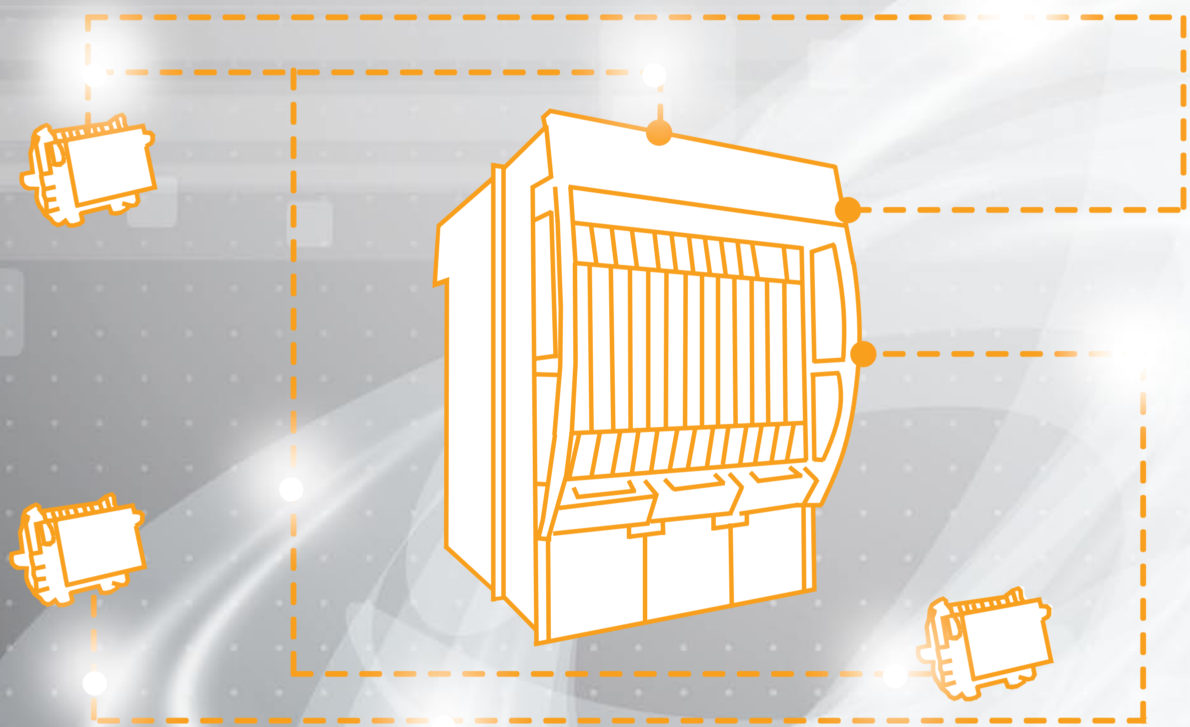
DISTRIBUTED ACCESS ARCHITECTURES:

A NETWORK EVOLUTION PATH TO EXTEND VIDEO AND DATA SERVICES



ARRIS®

Distributed Access Architectures:
A Network Evolution Path to Extend Video and Data Services

Bandwidth usage continues to grow year after year, mainly driven by consumer video consumption. Advanced applications and services have given subscribers new and easy ways to share experiences and stay connected using the devices of their choice. But keeping up with today's capacity demands can be a challenge for Service Providers who are trying to leverage aging technology and overflowing head-ends.

The key for Service Providers is to add capacity to their hybrid fiber-coaxial (HFC) networks in a cost-efficient manner, while maintaining the highest quality of service for subscribers. As such, Service Providers need to establish a network evolution path for enhancing head-end bandwidth capacity that utilizes their integrated CCAP platforms but adds the capability to scale services as they grow. This requires an understanding of the practical constraints in their network operations including physical space, power consumption and cooling in head-end locations.

There is more than one path to network evolution

While some Service Providers will likely be able to support new video and HSD services using traditional head-end-based integrated CCAP (I-CCAP) platforms, others may be considering alternate architectural approaches. There may be other constraints, such as available power and rack-space that prohibit adding more I-CCAP hardware. However, alternate approaches such as Distributed Access Architecture (DAA) or Fiber to the Home (FTTH) help Service Providers add the capacity they need using the footprint and some of the resources they already have.

DAA builds on the existing HFC infrastructure, migrating from analog signaling over fiber to using digital signaling and extending the reach of the fiber closer to the subscriber. This approach decentralizes the infrastructure towards a software-defined network that virtualizes key head-end and network functions. It also extends the digital portion of the head-end or hub domain out to the fiber optic node and places the digital to RF interface at the optical-coax boundary within the node. Replacing the analog optics from the head-end with a digital optics and a fiber Ethernet link increases the available bandwidth and improves fiber efficiencies with regard to both wavelengths and distance. In doing so, Service Providers can enhance directional alignment with network function virtualization (NFV), transition to software-defined networks and provide an evolution path to the FTTx systems of the future.

For Service Providers, the resources to run additional fiber, implement node splits and upgrade head-end facilities can require significant investment. But with DAA, these investments can be made gradually as part of normal plant servicing or demand driven upgrades with minimal disruption to existing services. Additional benefits of DAA include:

Network efficiency

- Increased network capacity and simpler outside plant maintenance
- Node evolution with Remote PHY, Remote MAC-PHY and Remote 10G EPON OLT
- Better end-of-line signal quality, higher modulation rates, higher bit-rates
- Better spectral efficiency, more wavelengths per fiber

Operational and capital expenditure benefits

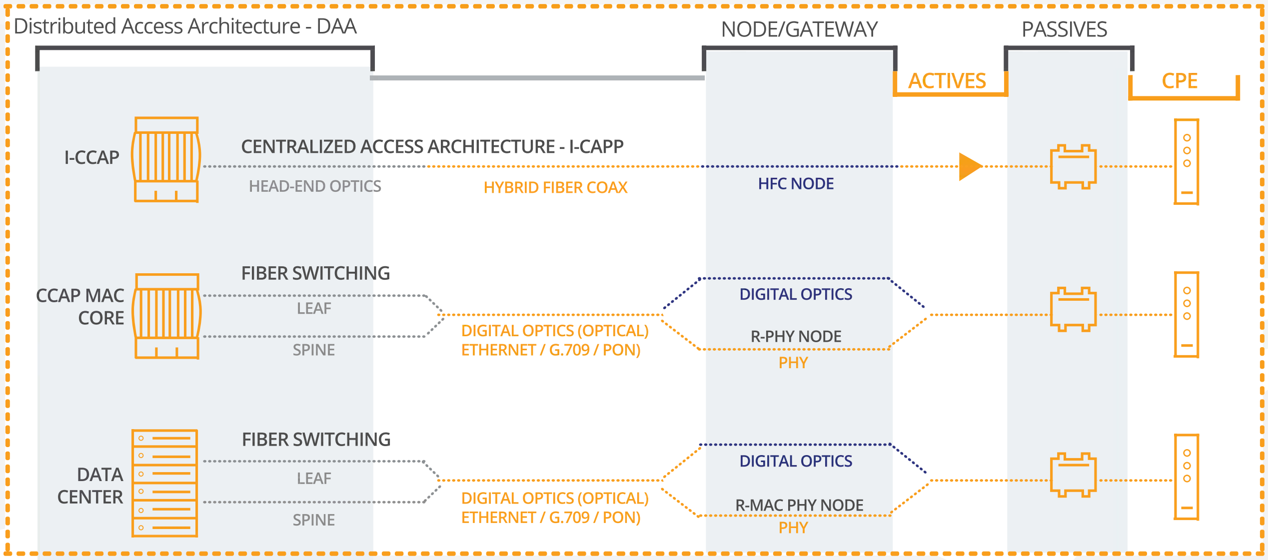
- Reduced head-end power, space and cooling requirements
- Hub consolidation
- Adding QAMs without changing the RF combining network

IP convergence

- Extended IP network to the node
- Alignment with FTTx build-out
- Ability to leverage standards-based interconnectivity and economies of scale

Another fork in the road

There are several approaches to DAA being proposed for use by Service Providers, and each has its own set of advantages and disadvantages. Let's take a brief look at three of the most common architectures.



Remote PHY (R-PHY)

This approach separates the PHY (upstream and downstream RF) from the head-end and places the full PHY layer at the fiber node. It's slightly disruptive, as it requires pieces of head-end equipment to be modified. However, Remote PHY helps with the nonlinear optical noise problem by using digital optics instead of analog, it addresses the head-end power and rack-space challenge and offers investment protection because it allows the re-use of head-end-based CCAPs.

Remote MAC/PHY (R-MACPHY)

This approach places all of the CMTS, Edge QAM and CCAP functions into the fiber node and only requires switches or routers to remain in the head-end, so it is disruptive, requiring replacement of head-end equipment and parts of the node platforms. R-MACPHY also helps with the nonlinear optical noise problem and maximizes power and rack-space savings within the head-end.

Remote PHY with virtual core (vCore)

An extension of the R-PHY approach, the MAC core functionality is virtualized and run on commercial off-the-shelf compute platforms. This architecture typically requires more head-end space than dedicated hardware, but by decoupling the hardware from the software functionality, each can be updated independently. The virtual platform can be shared with other applications and can be easily scaled up and down to meet demand. This allows the hardware to be scaled back when not needed for added power savings.

Our framework for network evolution

The ARRIS Access Network Evolution Framework allows Service Providers to start with common core elements in each of the major system areas, such as video delivery, broadband data services and the access infrastructure. With a flexible approach, Service Providers can evolve their network infrastructure at a pace that aligns with service demands, and apply the necessary resources that will ensure quality of service and experience for subscribers into the future.

For more information, please visit arris.com.