

Cisco Prisma D-PON: Your DOCSIS-Based Fiber-to-the-Home Solution

Introduction

Today's consumers live in a brave new world of media technology. They channel surf program guides, not channels; they pause, rewind, and fast forward live television; they digitally record their favorite shows to view at their leisure. Today's consumers not only download their favorite songs, they download on-demand programming and high-definition (HD) movies, and watch them on their personal computers and even their phones. They take pictures and videos and post them on the web for the entire world to view, within seconds.

Today's consumers have moved beyond the "Video 1.0" world of traditional broadcast television based on programmers' schedules into the "Video 2.0" world, where they have more content, more choice, and more control than ever before. This new generation of digital consumers expects rich, high-quality media experiences. They want access to more personal, more social, and more interactive content across more devices and screens than ever before. The expected interactivity, personalization, mobility, and control lead to the "Connected Life."

In today's cable environments, bandwidth-intensive content combined with these advanced video, voice, and data services consume the great majority of bandwidth in most broadband networks. To support the consumer appetite for speed, content and control, and the continued bandwidth growth that accompanies it, cable operators need innovative design solutions based on proven technologies that alleviate the need for costly overbuilds, support rapid service velocity, and allow for flexible and scalable networks. With the emergence of applications like session shifting, network personal video recording (PVR), consumer telepresence, and video-on-demand (VoD) libraries delivered from on-net and off-net content in HD, service providers have to help ensure that their networks will be capable of delivering the expected a seamless consumer experience. These types of applications are at the heart of what medianet aspires to deliver by helping ensure that networks are ready and optimized for rich and interactive services.

DOCSIS® 3.0 is a medianet solution that is more than just a platform for faster speeds and new consumer services. The extra capacity and efficiency are opening up opportunities for not only enhanced consumer services but also new business services like Cisco TelePresence™, Cisco WebEx™ and Unified Communications to enable new service markets. DOCSIS 3.0 enables cable operators to address current network speed limitations through channel bonding for an increase in downstream and upstream speeds to 160 Mbps and 100 Mbps, respectively. DOCSIS 3.0 also gives operators greater bandwidth to improve the overall service of their existing subscribers. But possibly even more important, DOCSIS 3.0 enables cable operators to move beyond foundation offerings, such as high-speed data, to layering new advanced services and creating new innovative opportunities.

As services continue to expand and consumer demand continues to grow, cable operators are being challenged to deliver cable-centric/cable-friendly fiber-to-the-home (FTTH) technology that does not require the significant changes to back office and network infrastructure necessary with earlier FTTH cable architectures.

The Cisco® Prisma D-PON solution is a radio frequency over glass (RfOG)-compliant, FTTH product line specifically designed for DOCSIS-based service providers to enable them to provide FTTH solutions being requested by master planned communities (MPCs) and new network extensions. D-PON is a medianet solution complementary to other bandwidth optimization solutions offered by Cisco and is a core component of the cable access network that extends the features of DOCSIS 3.0 over an FTTH infrastructure. This paper reviews the advantages of and reasons for choosing the Cisco Prisma D-PON solution.

Challenges for Cable Operators

Challenge 1: Establishing Scalable Network

Cable operators are challenged to deliver cable-centric/cable-friendly FTTH technology that does not require the significant changes to back office and network infrastructure necessary with earlier FTTH cable architectures.

Solution: Prisma D-PON

The Cisco D-PON solution allows for incremental FTTH growth, on a future-flexible, low-maintenance architecture, while leveraging the existing back office infrastructure.

Challenge 2: Delivering Future-Proof FTTH solution

The main challenge that operators face in enabling FTTH solution is that anything that gets deployed today has to be based on standards that enable the solution to evolve in the future.

Solution: Prisma D-PON

The Cisco Prisma D-PON solution not only enables FTTH solutions in a cable environment, but it is also built using standards-based, RfOG technology that will enable the service provider to upgrade the network to future fiber-based technologies with minimal capital expenditures (Capex) and operating expenses (Opex).

Challenge 3: Delivering Higher Bandwidth

The main challenge that operators face to provide a Connected Life experience is lack of available bandwidth. Operators need to deliver more downstream and upstream bandwidth to provide adequate capacity to and from the home.

Solution: DOCSIS 3.0 over Prisma D-PON

DOCSIS 3.0 addresses the bandwidth challenge in both the upstream and downstream directions. The Cisco Prisma D-PON solution is the only FTTH solution available today that will enable the delivery of DOCSIS 3.0 bonding in both the upstream and downstream direction to provide bidirectional bandwidth in excess of 100 Mbps. It is RfOG+.

Cisco Prisma D-PON

The Cisco Prisma D-PON products are an FTTH solution specifically designed for DOCSIS-based service providers. The solution provides the benefits of an FTTH PON while maintaining the existing hybrid fiber-coaxial (HFC) back office systems, such as the billing support system (BSS), operations support system (OSS), broadcast video, narrowcast video, switched digital video (SDV), video-on-demand (VoD), DOCSIS data, DOCSIS voice over IP (VoIP), and video over DOCSIS (VDOC).

The Cisco D-PON solution is the ideal union of ubiquitous HFC systems and the powerful potential of an all-fiber network. More importantly, the D-PON solution allows for incremental FTTH growth on a future-flexible, low-maintenance architecture while continuing to leverage the existing back office infrastructure.

Our D-PON solution is specifically designed to provide cable operators with the ability to cost effectively deploy a DOCSIS-controlled PON solution with DOCSIS 3.0 data rates. Although the Cisco D-PON solution is compliant with the RFoG standard, the solution has overcome the bandwidth and distance limitations that plague existing RFoG solutions. The Cisco D-PON solution is RFoG+.

Advantages of the Cisco D-PON Solution

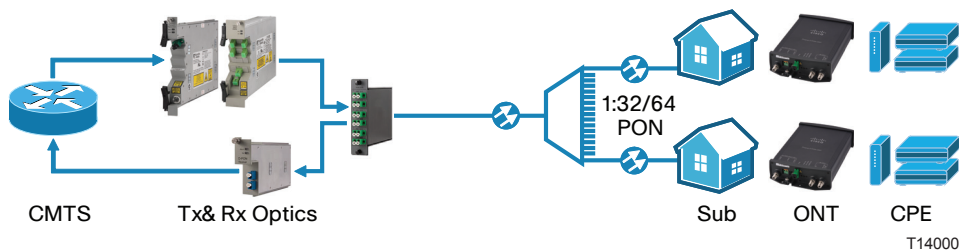
The Cisco Prisma D-PON solution gives cable operators the best of both worlds. D-PON was designed to share the same outside plant (OSP) architecture as existing and planned ITU and IEEE PON solutions and enables delivery of a full suite of DOCSIS 3.0 services over either HFC or fiber-based infrastructure.

The Cisco D-PON design:

- Helps ensure D-PON matches the same footprint as xPON in the event that an MPC requires an ITU- or IEEE-compatible architecture.
- Enables service providers to overlay another type of xPON or point-to-point architecture over the D-PON solution with the same design considerations and without disrupting service on the PON.
- Leverages existing OSP cost reductions based on a common industry standard.
- Allows service providers to pursue any OSP vendor and the lowest-cost OSP solution because the architecture is nonproprietary.

Cisco Prisma D-PON Components

The Cisco D-PON solution consists of three system components: the headend opto-electronics, optical passives, and the optical network terminal (ONT).



Prisma II Chassis with D-PON Modules

The Prisma II chassis with D-PON modules introduces two new purpose-built modules for the existing Prisma II family of products: the D-PON transmitter and the D-PON fiber amplifier (EDFA) module.

High-Density Receiver Modules

The Cisco D-PON solution has two receiver options available depending on the capabilities required by the service provider. The first receiver option is the Wideband Receiver Module. The wideband receiver is required for DOCSIS 3.0 data rates and to achieve the full 20 km, 1:32 PON architecture.

The second receiver option is the standard RFoG analog receiver module. This receiver option utilizes low-noise diodes to maximize the performance over similar competing RFoG solutions, and is best suited for very short links.

Triple WDM LGX Modules

The Cisco D-PON solution has two triple wavelength-division multiplexing (WDM) LGX modules available for a standard four rack-unit chassis. Standard or xPON overlay port options can be chosen to best meet network needs.

D-PON ONT

The Cisco Prisma D-PON optical network terminal (ONT) provides:

- 1310 or 1610 nm return path options
- 28 dB link budget at 1310 nm
- Robust 1 GHz spectrum to support 78 analog channels and 75 quadrature amplitude modulations (QAMs)
- Full 4-channel DOCSIS 3.0 upstream bonding
- Industry-leading throughput and distance performance

Key Benefits of the D-PON Solution

The Cisco D-PON solution provides the benefits of a PON architecture while leveraging the existing HFC back office systems. Broadband cable operators can experience the following features and benefits:

- Ideal Low-Cost Solution for MPC and Greenfield Growth
 - Downstream 1550 nm forward path, cost-effective optics
 - Seamless operating transition from HFC networks to FTTH while maintaining existing OSS and BSS systems
 - Better scalability than GPON or EPON for incremental growth
- No Back Office Change Required
 - Leverages existing DOCSIS control; can share same cable modem termination system (CMTS) shelf with existing HFC plant
 - Does not require modification of video delivery infrastructure
 - Service is provisioned just like HFC

- Future Flexible Network
 - Implement bandwidth upgrades without a service call
 - Incrementally reduce service group sizes from 512 to 256 to 128 homes in headend without having to make any changes or upgrades to the OSP
 - ITU and IEEE comparable 1:32, 20 km PON OSP architecture allows low-cost future upgrade path to any industry standard FTTH solution (architecture not proprietary)
 - Clean plant helps ensure simple upgrade to DOCSIS 2.0, 3.0, and/or VoIP services
- Robust Bandwidth
 - 1 GHz downstream (supports standard CATV 78 Analog / 75 QAMs); capable of supporting DOCSIS 3.0 data rates and 48 carrier-to-noise ratio (CNR) at the home
- Industry-Leading Reverse Path Performance
 - Patent Pending Reverse path technology provides 28 dB of link budget
 - DOCSIS 3.0 channel bonding of four 64 QAM channels for 160/100 Mb data throughput performance
 - True PON architecture reduces operating expense and ingress concerns

Conclusion

The Cisco Prisma D-PON solution is part of the Cisco IP Next-Generation Network (IP NGN) layer that enhances medianets. The architecture provides a truly passive FTTH solution using standards-based technology. The Cisco D-PON is especially beneficial for broadband operators who need to deliver FTTH service for greenfield developments at minimal cost.

In today's highly competitive broadband environment, where higher and higher bandwidths are offered at ever-decreasing prices, differentiation becomes critical. The Cisco D-PON solution enables DOCSIS 3.0 channel bonding for more available bandwidth in the network, support of more bandwidth-intensive services and increased data speed rates, fulfilling the consumer appetite for advanced feature-rich entertainment and communications.

Cisco offers an end-to-end D-PON solution, from headend components and our Prisma II Chassis with D-PON modules, to our transmission and high-density receiver modules. This comprehensive solution can help you protect your investment while providing the potential for a migration path to even more advanced services for consumers.

The Cisco D-PON architecture is a valuable and cost-effective solution as cable operators respond to the fiber-to-the-premise requirements that most residential and commercial developers are defining for new planned communities and multiuse facilities.

Although there are RFoG solutions that claim they can provide a DOCSIS 3.0 FTTH solution in cable, the Cisco Prisma D-PON solution is the only FTTH solution that has overcome the bandwidth and distance limitations that plague existing RFoG solutions to deliver full DOCSIS 3.0 data rate support. It's RFoG+.






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