



# The Road to Cisco Infinite Broadband

E-Book





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## About This E-Book

This E-Book was written to help cable business decision-makers who are formulating strategies to evolve their business and networks. In the chapters that follow, we'll show you how you can capitalize on Cisco's new cable access technologies pragmatically, without forklift overhauls, to realize immediate gains and address your most pressing business challenges. Other vendors offer point products or partial solutions. Cisco can help you evolve your cable access network to unlock business transformation and build a foundation for the fully automated, all-IP, cloud-powered cable system of the future.

The goal of this E-Book is to present an overview of Cisco's vision for evolving cable access networks. We take you through a step-by-step evolution path across five key technology areas:

- **Infrastructure:** Use next-generation converged cable access platforms (CCAP), DOCSIS 3.1, and Remote PHY to deliver Gigabit service tiers and drive down operating costs.
- **Virtualization:** Virtualize cable modem termination systems (CMTS), video processing, and other functions so you can scale them elastically and reposition resources to meet changing demand.
- **Network Abstraction:** Decouple services and applications from complex underlying network infrastructures and create a programmable network that can be re-provisioned and reconfigured on the fly.
- **Management and Automation:** Use new tools to monitor network health proactively and automate provisioning end-to-end.
- **Long-term Change:** Build a path to the revolutionary cable technologies of the future, with a platform for full duplex, segment routing, digital fiber to the home (FttH), and more.

Navigating today's fiercely competitive marketplace will require cable operators to focus on very specific goals. We believe that to succeed, you need to drive down network complexity and operating costs. You need to unlock profitable growth by delivering a broader mix of services. And, you need to bring innovative, differentiated new experiences to your customers faster.

## The Road to Cisco Infinite Broadband

Cable business transformation starts by rethinking the network architecture. In the future, every service – linear video, over-the-top content, and broadband Internet – will be decoupled from the network infrastructure. Services will be provisioned as cloud applications – elastically scalable and automated end-to-end. And cable operators will have flexibility to deliver any service, anywhere, much more directly, over any access media, at a much lower cost.

This transformation won't happen overnight. It will be a journey that extends to every area of a cable provider's business. But it begins right now, with the cable access network. Read on to find out how.



## Cable Fast Facts: Sneak Peek into 2020

- Globally, IP video traffic will be 82 percent of all consumer Internet traffic by 2020, up from 70 percent in 2015
- By 2020, there will be 5x more wearable devices
- Virtual-reality traffic will increase 61-fold between 2015 and 2020
- Ultra-high definition will be 20.7 percent of IP VoD traffic in 2020, up from 1.6 percent in 2015

Source: Cisco VNI Complete Forecast, June 2016

# How Did We Get Here? And Where Do We Need to Go?

Cable operators have one huge advantage over other service providers: mature last-mile networks connecting them to millions of residences and businesses. The problem is that those access networks were initially deployed to deliver downstream linear video traffic. Now, cable TV providers are multiple services operators, with millions of customers relying on them for high-speed Internet access, voice services, business networking services, and much more.

Although cable providers have made savvy investments to transform their HFC cable plant into full-service “everything pipes,” the limitations of yesterday’s access technologies are becoming harder to overcome. Let’s take a look at how current access networks are stifling cable innovation and profitability, and what needs to change.

## What’s wrong with cable access networks?

### Complex and siloed

To deliver multiple services – linear video, video-on-demand (VoD), IP traffic, and more – modern cable providers effectively maintain separate overlay networks. Each service requires dedicated equipment, management, and operational expertise. Operations are also now split between applications running in a data center and traditional services that rely on intelligence distributed out to legacy equipment. As the market has consolidated, some cable operators also find themselves managing multiple access networks (HFC, DSL, PON, wireless) at the same time. The result is a hugely complex and unwieldy network environment.

### Expensive to operate

Along those lines, running current cable networks is time-consuming and manual-intensive, requiring massive operational overhead. As cable providers strive to meet growing bandwidth demands and compete with pure fiber-to-the-home (FttH) players, they’re also adding more and more equipment to hub sites. Already-high OpEx is spiking for power, cooling, and maintenance across the access network. And with constant demand for ever-faster services, those costs will continue to grow.

### Hard to change or scale

When services depend on disparate physical networks, scaling or changing is enormously complex. As a result, updating services or rolling out new ones is painfully slow. Adapting access networks to accommodate new business models (managed Wi-Fi, enterprise SD-WAN connectivity, mobile traffic backhaul) becomes a monumental undertaking. And opportunities to generate revenues in new ways come to market too late or not at all.



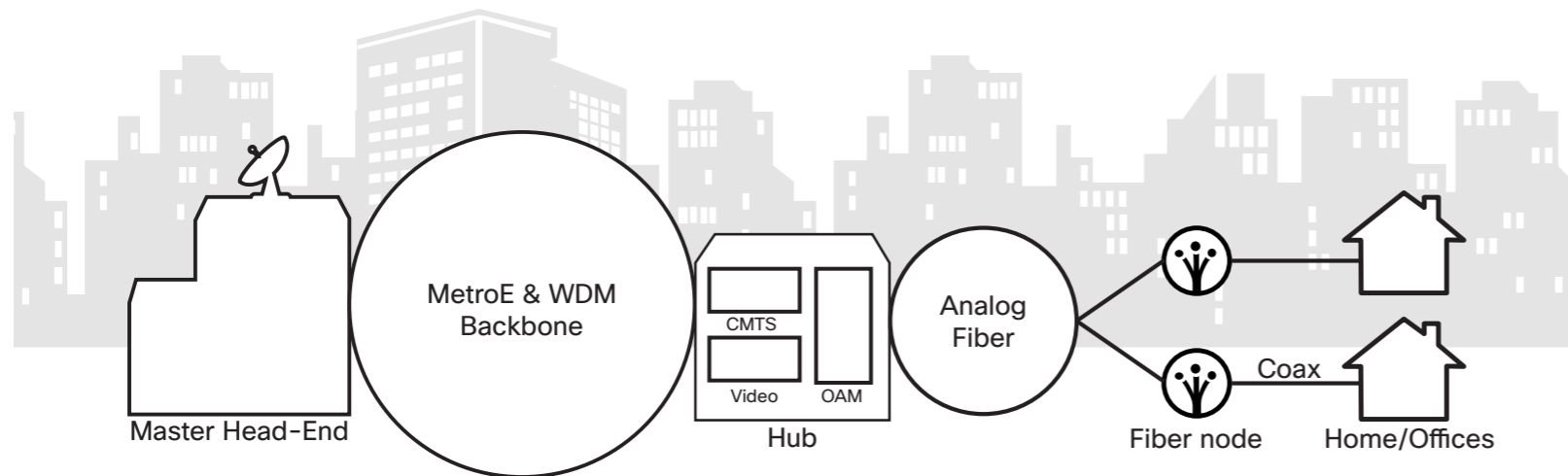


Figure 1. A Typical Data and Video Service Deployment

Let's start by reviewing what a typical access network looks like today. In most cases, it starts with a master head-end connecting hub sites over a digital fiber metro backbone network, typically Ethernet. Each hub site supports equipment for cable modem termination systems (CMTS), video services, and data and video QAMs. Data and video services are converted to run over legacy analog fiber, feeding HFC fiber nodes and, eventually consumer homes and offices.

Today, all of those services and are operated as separate, siloed infrastructures—each with their equipment dependencies and operational processes. This tight coupling of services to specific infrastructures makes it hard to roll out new competitive offerings and makes network changes complex and expensive.

## What will it take to become more competitive?

In the short term, cable providers need to converge infrastructures so that they can provision and scale different types of services over the same network. In the long-term, they need cloud-scale flexibility and economics, with the ability to deliver any service, anywhere, quickly and automatically. To achieve this kind of transformation, cable providers need several new capabilities.

First, they need to simplify their access networks radically. That means consolidating them into a single, standards-based framework so that any service can be delivered over a single infrastructure – ultimately one that's all-IP end-to-end. They need to start virtualizing access network resources so that they can be managed like any other cloud service – scaled up and down elastically and positioned wherever they're required at any time. They need network abstraction so that higher-level services can be decoupled from complex underlying infrastructures, and diverse physical and virtual devices can become programmable network elements. And, they need a management framework that can proactively monitor network health, and empower them to provision new services and devices automatically, in seconds.

## Compete and Grow

To break the cycle of exploding demand and shrinking revenues, cable operators need to change the economics of their business. They need to be able to design differentiated products and bring them to market faster. And they want a network that can do much more, more efficiently. That will require abstracting away complexity, automating previously manual processes, and gaining the ability to run all services with fewer resources.

### Core Capabilities Required

- ✓ Speed to design, deliver, and update services more quickly to compete with OTT video services and emerging cloud competitors.
- ✓ Simplified implementations and operations to drive down costs and complexity.
- ✓ Automation to roll out new services in days instead of months, and make it easy to continually refine and enhance services.
- ✓ Flexibility to deploy and move workloads wherever they are most efficient, anywhere across the network, and scale resources elastically with demand.
- ✓ Agility to support new business models wherever and whenever opportunities arise.

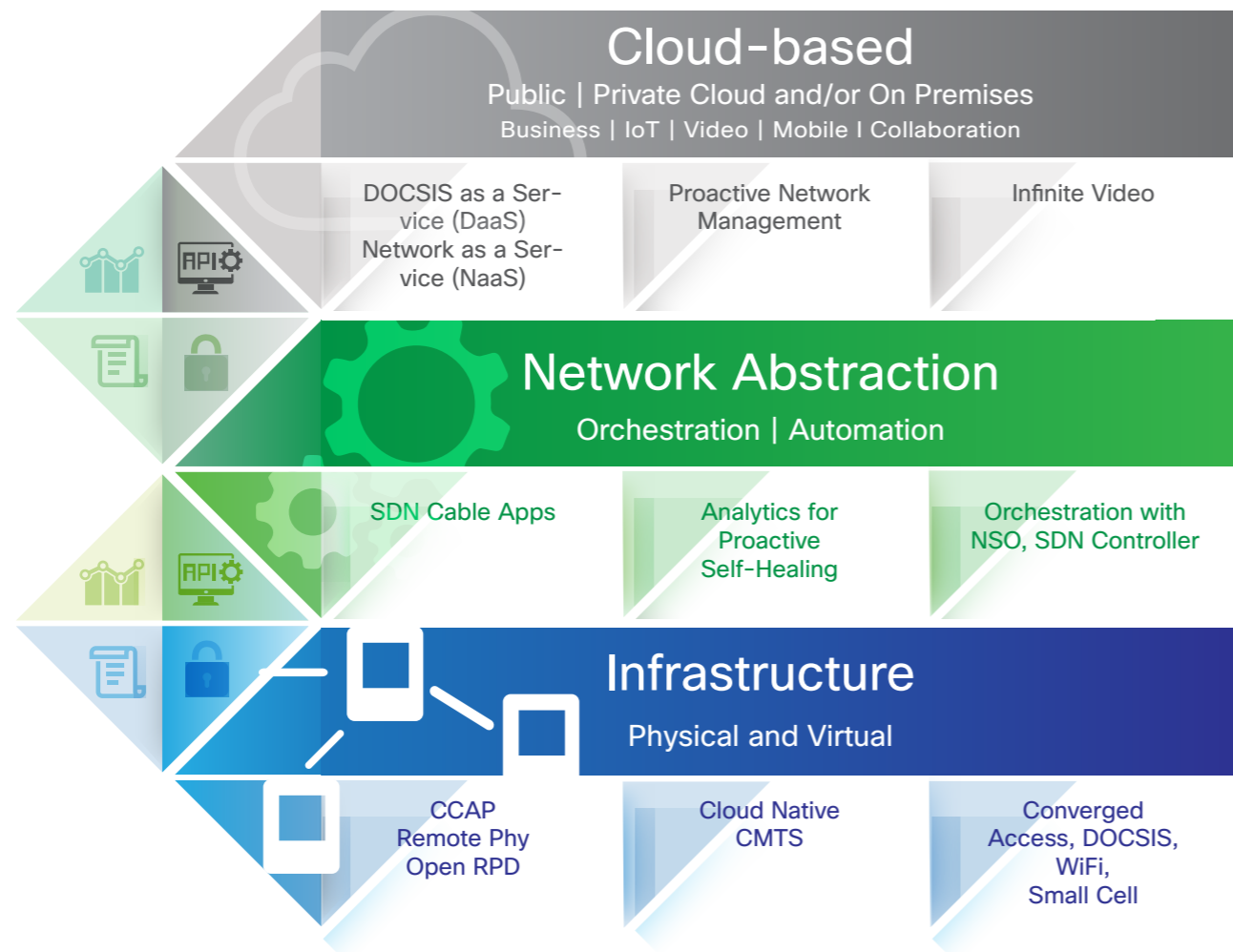


Figure 2. The Cable Network of the Future

## Building the Cable Network of the Future

You're intimately aware of the limitations of current analog access networks. You understand the capabilities you need to become more competitive and profitable. So where do you go from here? The good news is that, in the market for new cable technologies, you have many options from many vendors. The immediate steps in optimizing cable access networks – DOCSIS 3.1, Remote PHY, virtualized CMTS – are well understood. But if your goal is transforming your business, it's essential to recognize that those steps alone aren't enough.

No virtualized CMTS or Remote PHY point product will deliver the overall business agility that cable providers need. Instead, you should be thinking about these new technologies as pieces of a larger puzzle, building a framework that radically simplifies operations and empowers you to deliver any service, anywhere, with flexibility and speed. Let's take a look at what that kind of cable network looks like.

## Envisioning Tomorrow's Cable Platform

**Applications:** In the network of the future, all cable services – linear video, on-demand, broadband, and new services like managed Wi-Fi and mobile backhaul – operate as cloud applications. They can be elastically scaled in response to changing demand. You can embrace new DevOps models to roll out new services and continually refine and repackage existing ones. And your product teams can focus on delivering amazing customer experiences, without worrying about hardware dependencies and underlying network complexity.

**Orchestration:** Now, a network virtualization layer abstracts away all the complexity of the underlying infrastructures. It uses standardized southbound interfaces and SDN programmability to automate the configuration of any physical or virtual device. It integrates with existing OSS, management, and policy systems. The entire network functions as a single infrastructure, allowing you to provision services in the same way over any last-mile network.

**Infrastructure:** This layer includes all the physical and virtual devices in your network – CMTS platforms, Remote PHY devices, and more. State-of-the-art CCAP platforms beef up capacity, allowing you to deliver Gigabit Internet service tiers. Remote PHY devices in hubs and nodes are easily provisioned. And you can add devices to support new services – business WAN connectivity, Wi-Fi, mobile backhaul – over the same all-IP infrastructure.

## Unlock Business Agility

Tomorrow's cable platform allows for an entirely new kind of operational model, innovation, and unprecedented speed. In the same way that mobile app designers can develop new applications without worrying about dependencies across different hardware platforms, cable providers won't have to worry about underlying infrastructures and network elements. All of that complexity is abstracted away, and they can focus on delivering great customer experiences.

Services and applications are now decoupled from the infrastructure delivering them. You'll be able to connect all kinds of services over any last mile network – HFC, fiber, PON – and operate everything as a single infrastructure, with a single point of management and control. And you'll be able to provision a diverse mix of services such as elastic cloud applications, much faster, and at a much lower cost.

All of a sudden, your cable platform is:

**Fast:** Now, your network can deliver Gigabit and even multi-Gigabit speeds comparable to any pure fiber player over existing HFC plant. You can use DOCSIS 3.1 and other cable innovations to preserve and extend existing access investments for years, even decades.

**Simple:** Complexities across different services and network components are now abstracted away. Rather than managing and maintaining separate networks and operations for linear TV, VoD, Internet, and other services, you have a single, all-IP infrastructure to deliver all services in the same way, from a unified management platform.

**Flexible:** Access networks now function as fat IP pipes connecting every household, delivering any service over inexpensive, ubiquitous high-speed Ethernet. You can capitalize on next-generation residential services, enterprise services, mobile backhaul, and other new revenue opportunities wherever they arise.

**Automated:** All of the complexities of disparate underlying network equipment, both physical and virtual, are now abstracted away. You can scale virtualized resources (CMTS, video processing, content delivery networks (CDN)) elastically and reposition them to meet fluctuating demand. And you can bring up new services in minutes, without requiring lengthy manual processes or onsite expertise.

**Standardized:** Technology changes fast, and you don't want to be locked into one vendor's proprietary approach and roadmap. Now, your cable network uses open APIs and open standards (YANG, NETCONF, CableLabs® Open-RPD Remote PHY specification) to afford full business flexibility. Regardless of the underlying network equipment, virtualized resources, or existing OSS/BSS environment, you can operate everything in the same way, as a single system.

## Cable Solution Checklist

As you weigh your different options, make sure the solution you select is part of a larger strategy that can check off all of these boxes.

- Is the solution ready day one for DOCSIS 3.1 and Remote PHY? Is the Remote PHY standards-based? Can you operate physical/virtualized resources from the same management platform?
- Does the solution include a strategy to virtualize all cable applications, not just CMTS – CCAP, video processing, CDN, and more – and deliver them as cloud services?
- Does the solution allow you to decouple services and applications from the infrastructure? Will you be able to treat new access solutions as cloud services that can be scaled and provisioned over any last-mile network?
- Will you be able to automate the provisioning of new Remote PHY devices and other services? Can you monitor the network and proactively detect issues so that you can deliver better customer experiences?
- Does the solution roadmap include next-generation technologies (full duplex, segment routing, support for new services such as Wi-Fi and 5G backhaul) to grow revenues and increase profitability?

## Cisco Cable Access Network Evolution

Cisco offers a comprehensive migration path to evolve today's complex and limited cable access networks into a platform for business transformation. We can help you put in place a long-term, scalable network foundation to support bandwidth growth and multi-Gigabit speeds far into the future. We can push standardization, flexibility, and automation farther out into the cable network. And we can help you take pragmatic steps in the access network today that lay a foundation for the programmable, all-IP, cloud-powered cable networks of tomorrow.

### Cisco's cable access evolution strategy encompasses five key technology areas.

#### Evolving Physical Infrastructure

Our next-generation evolved CCAP converges all broadcast and narrowcast services within a single platform, the Cisco cBR-8. It can unlock over ten times the bandwidth of legacy CMTS platforms with a solution built from the ground up for DOCSIS 3.1, that can operate in your network for the next decade and longer without hardware overhauls.

Cisco Remote PHY solutions boost capacity and lower costs. You can unlock new capabilities and efficiencies by centralizing CCAP core functions, while distributing CMTS physical-layer QAM and ODFM modulation functions out closer to subscribers. There are two basic options:

- **Remote PHY Shelf:** Use the Remote PHY Shelf solution to extend cBR-8 features and capacity from larger hubs to smaller sites. This allows you to remove full-featured CMTS platforms from smaller hubs, freeing up rack space and reducing power and cooling costs. At the same time, you can scale the number of service groups (SGs) those smaller sites can support well beyond existing CMTS capacity.
- **Remote PHY Node:** You can evolve to a fiber-deep architecture by extending digital fiber out closer to subscribers. With Remote PHY Node, you replace analog HFC fiber nodes in the last mile with Remote PHY nodes connected to next-generation CMTS platforms at hub sites. You can now eliminate the analog fiber network connecting hubs to nodes, replacing it with a less-expensive, higher-quality 10-Gbps or 100-Gbps Ethernet network.

#### Cloud-Native CMTS (cCMTS)

Once you take advantage of Remote PHY, your hub sites are much simpler. Now, you can virtualize CMTS functions and run them from a centralized or distributed data center alongside other virtualized services.

Cisco's cCMTS solution is designed to operate in blended environments, where operators mix and match physical and virtual CMTS solutions in different parts of the network. With Cisco, you can bring web-scale reliability, elasticity, scalability, and feature velocity to the cable access network with cCMTS capabilities.

## What We're Hearing from Service Providers

### THEY WANT

- Simplicity for implementation and operations allowing a faster time to market
- Flexibility for workload placement, elastic capacity, and network slicing
- The speed and agility to offer on demand services
- To improve profits by reducing OpEx with operational efficiencies
- Increase profits through new services and CapEx reduction



Speed, Flexibility, and Profitability



## Network Abstraction

Cisco provides industry-leading, standards-based network virtualization capabilities to decouple services from infrastructure dependencies. Using open standards and interfaces, you can design services and applications at a high level, and provision them in the same way – independent of the devices or last-mile networks that will deliver them. Now, you can begin provisioning services that used to be entirely separate infrastructures – CMTS, Metro Ethernet, Wi-Fi, and others – as just different applications running on the same unified network. You can address the entire heterogeneous environment – physical and virtual devices, equipment from multiple vendors – through a single orchestration layer that abstracts away all of the underlying complexity. You can draw on NFV and SDN to make the access network more automated, economical, resilient, and elastically scalable. Elements of the access network that used to require complex dedicated infrastructures become interchangeable cloud resources that can be repositioned and scaled up and down as business needs dictate.

## Next-Generation Management and Automation

Cisco provides tools to give cable operators end-to-end visibility and proactive maintenance capabilities for their networks. Instead of manually running CLI scripts or updating spreadsheets, you can centrally monitor the health, utilization, and capacity of your network from one place. You can collect real-time inventory and telemetry information from across your entire infrastructure using open-source SDN capabilities. And, using new applications that draw on Cisco network abstraction and orchestration capabilities, you can automate the configuration of thousands of Remote PHY devices across your access network, and drive down the time and costs of Remote PHY migration.

## Build a Platform for Long-Term Change

The idea of the “cable operator” is becoming a misnomer. Today, cable providers can operate a range of infrastructures in different markets, including FttH. And they deliver a broad and growing portfolio of services well beyond traditional pay-TV and Internet. With Cisco’s cable evolution path, the access changes you make today lay the foundation for delivering a range of new consumer and business services over a network that’s all-digital, all-IP, end-to-end. Whether providing business WAN connectivity, managed Wi-Fi, mobile backhaul, or other new revenue-generating services, you can provision everything in the same way, over the same IP infrastructure. And, when you partner with Cisco, your network foundation is ready for cable innovations of the future, including full duplex, segment routing, and more.

Read on to learn more about each step in the journey to the agile cable network of the future.

## Cisco Literally Wrote the Book on Remote PHY

**John T. Chapman**  
**CTO Cisco Cable Business Unit**

With so much buzz in the marketplace around Remote PHY, it’s easy to forget how it came about in the first place. But we remember, because the person who invented it, John T. Chapman, is the chief technology officer of our Cable Business Unit.

Chapman played a central role in the creation and ongoing development of the DOCSIS standard and invented the key technologies that are the foundation for DOCSIS 3.0 and DOCSIS 3.1. He was inducted into the Society of Cable Telecommunications Engineers (SCTE) Hall of Fame for this work. And the Remote PHY architecture that’s now standardized by CableLabs®, as well as the open-source Remote PHY Software program, were his creations.

It’s no stretch to say that the reason why standardized Remote PHY solutions are now possible is largely due to Chapman’s work. His commitment to open-source development and industry standards continue to drive Cisco’s efforts to fuel cable industry innovation.

## Evolve Physical Infrastructure: Cisco cBR-8

The Cisco cBR-8 Converged Broadband Router provides a full-spectrum CCAP-compliant platform that's designed from the ground up to support DOCSIS 3.1. It provides the most scalable CMTS platform in the industry, allowing you to offer multi-Gigabit broadband services with a much lower total cost of ownership (TCO) than solutions based on legacy DOCSIS 3.0 designs. And it's built for the future, with a software architecture that's ready for Remote PHY, SDN, and virtualization whenever you choose to implement them.

The Cisco cBR-8 platform provides:

**20x the capacity of ATCA-based access platforms:** cBR-8 can deliver over 96 channels per service group, including more than 6,000 downstream channels of DOCSIS 3.0 with the ability to scale to full DOCSIS 3.1 and video. With a 200 Gbps forwarding capacity and a backplane that is scalable well beyond 1.6 Tbps, The Cisco cBR8 provides ample room to grow and meet future bandwidth demands.

**Economical scaling to DOCSIS 3.1:** The Cisco cBR-8 is designed from the ground up for DOCSIS 3.1, with the ability to deliver full-scale DOCSIS 3.1 capacity for every SG and household, and enable Gigabit and multi-Gigabit service tiers. Unlike other platforms that require hardware upgrades to move to DOCSIS 3.1, you can scale up with a simple software license upgrade – using the same line cards, supervisors, and chassis you deploy today.

**Lower costs:** The cBR-8 delivers much higher density per chassis and line card. With the ability to support 40 percent more SGs per rack unit than ATCA-based platforms, you can substantially reduce power consumption. You can also fully converge all video and data services to radically lower cost per bit. All of which adds up to 40 percent lower TCO than ATCA-based chassis over the next five years.

**High availability:** The cBR8 is designed with full redundancy for line cards, supervisors, power supplies, and fans. It provides hitless failover for all active line cards and modules to support 99.999 percent availability of video and data services.

### Innovative Software Architecture Ready for the Future

Cisco's cBR-8 platform isn't just built for DOCSIS 3.1. Its modular software architecture is designed to enable future services including distributed Remote PHY architectures, SDN, and virtualization.

With modular processes and clearly defined control plane and data plane functions, we can maximize availability in our CMTS platform. We enable a resilient architecture that can recover from failures with zero packet loss, and allow for quick patching and hitless upgrades. And we provide a platform that's ready-made to support Remote PHY and virtualization – because CMTS core and PHY functions already run separately, and can easily be moved to other parts of the network.

## Considering a Solution Built for DOCSIS 3.0?

Cable providers are under pressure to evolve the access network to support converged video services and higher QAM density. A typical large operator can expect its number of service groups per hub to triple over the next five years. Large MSOs can expect bandwidth per SG to increase 6x over the same period.

That kind of scale can be costly – especially when relying on conventional integrated CMTS (I-CMTS) solutions based on ATCA designs. They're limited to a maximum of 32 channels per service group, support a maximum of 10 Gbps per slot, and offer limited video convergence. Instead, they rely on separate platforms for broadcast video and optical distribution.

### Costs and Limitations

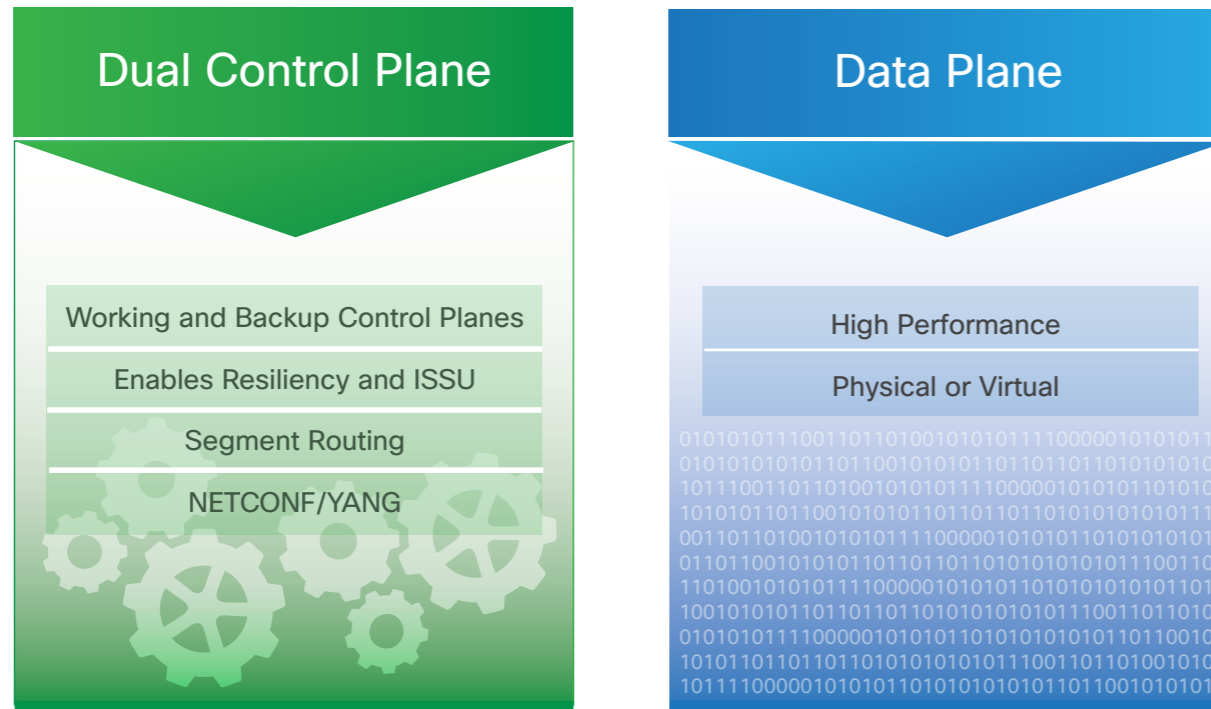
If you try to scale legacy platforms linearly to compete with providers offering Gigabit data rates, you would need to double your CapEx spend, push the limits of the available space at hub sites, and take on power and cooling costs up to 6x higher than today. Even worse, it would only be a temporary solution. The inherent limitations of ATCA-based platforms mean they'll require a forklift upgrade – chassis, line card, and processor – to get you to full-scale DOCSIS 3.1.

## Migrate to DOCSIS 3.1.

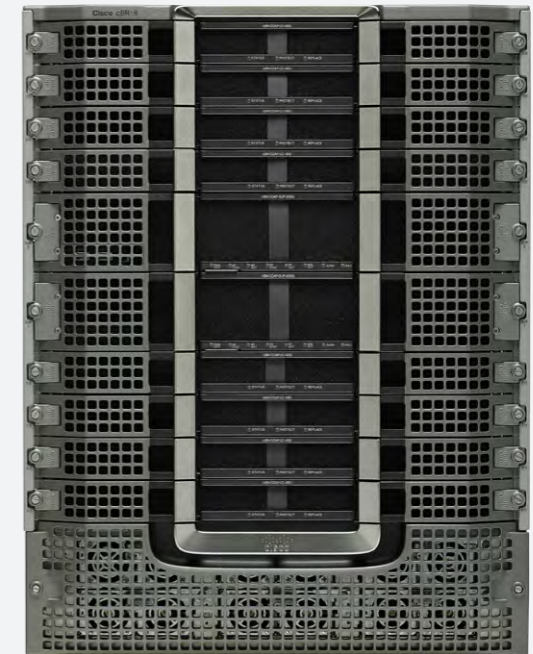
Switch between integrated CMTS services and distributed Remote PHY architectures. Virtualize CMTS functions and redeploy them to a data center. Deploy an orchestration layer to automate CMTS functions, or run virtualized CCAP services as data center applications. You can do any or all of it with the same Cisco platform.

Figure 3. cBR-8 Software Architecture

## Cisco cBR-8 Same OS Physical and Virtual CMTS



## Cisco cBR-8 Platform



## Evolve Physical Infrastructure: Remote PHY and Fiber-Deep Architectures

An extension of DOCSIS 3.1, Remote PHY is the product of cable operators asking the industry to help them overcome the limitations of analog fiber and break through the HFC bottleneck. In its most basic form, Remote PHY unlocks major bandwidth increases in existing access networks. But it also enables “fiber deep” architectures that push digital fiber out much closer to homes. Ultimately, Remote PHY helps cable operators deliver capacity and Gigabit service tiers on par with any pure-fiber competitor, at a fraction of the cost of ripping and replacing the existing HFC plant.

### Decomposing CMTS

Current I-CMTS platforms combine both CCAP core routing functions and physical-layer QAM and ODFM modulation in one box – one fairly sophisticated and expensive box. Remote PHY splits CMTS functions so that CCAP core and physical-layer functions can run separately, in different locations. CCAP core routing can run out of larger hubs (or even vCCAP instances in a data center), while QAM and ODFM modulation get pushed out to Remote PHY Devices (RPDs) located nearer to subscribers.

With Remote PHY, you can deploy fewer sophisticated CCAP routing platforms, connected to many smaller-footprint, less expensive RPDs. You don't have to run a large number of full-featured I-CMTS platforms at every hub, consuming space and power as you scale, and requiring advanced onsite expertise to deploy and maintain. You can consolidate CCAP core functions to larger hubs or data centers and push digital fiber deeper into your access network – in some cases, all the way to the node. You only have to worry about converting to analog HFC for the last few hundred feet to the residence. And you can dramatically boost bandwidth to every home.

### Consolidate CCAP with Remote PHY Shelf

Cisco offers two Remote PHY architectural approaches, Remote PHY Shelf and Remote PHY Node. With the first, you deploy a cBR-8 in a central location feeding Remote PHY Shelf solutions at multiple smaller hub sites. Effectively, Remote PHY Shelf becomes a port extender for a consolidated, centralized CCAP core. You continue to use your existing HFC plant. But by removing full-featured CMTS platforms at smaller sites, you radically reduce space, power, and cooling requirements at those hubs. You can scale bandwidth without having to expand your equipment footprint in the hub. And you lay the foundation to virtualize CMTS routers and run them wherever you choose. Remote PHY Shelf can be an attractive option for cable operators with small hubs serving smaller numbers of service groups, where space is limited and deploying a full cBR-8 would be overkill.



## Embrace Fiber-Deep Architectures with Remote PHY Node

Remote PHY Node represents a more significant evolution of the access architecture. It extends the digital fiber network (typically Ethernet) farther out in the field, all the way to nodes a few hundred feet from the home. And it replaces current HFC nodes with a simplified RPD that connects Ethernet on one side to HFC on the other. Although this approach requires a big step for cable providers, it also brings big benefits.

Remote PHY Node eliminates many of the inefficiencies of analog optics. Today, cable providers need racks of QAMs stacked together, converting digital services for analog optical transmission. Analog optics have limitations. They can't transmit over long distances, and they generate significant "noise" in the network, reducing quality and limiting capacity. When you deploy RPDs close to customers, you can eliminate analog transmitters and receivers, and replace them with digital fiber connections, removing most of the noise from your access network. You can use higher-order modulation schemes to deliver much more bandwidth – scaling from a maximum 256 QAM modulation today to 1,024 or 4,096. Add it up, and you can boost data rates over existing HFC infrastructure by 50 percent, at a fraction of the cost of deploying a full FttH architecture.

## A Path to Virtualization

When you remove PHY functions from CMTS and switch to digital fiber transmission, your CMTS platforms effectively become software processors with Ethernet running in and out. CMTS core functions can be virtualized and run from a data center, where they become more flexible, resilient, and elastically scalable. You no longer have to restrict CMTS routing functions to the number of physical ports on the platform. Instead, you can take advantage of Moore's Law to gain continuous improvements in processing speeds, capacity, and cost-per-bit for CCAP routing, while physical-layer equipment out in neighborhoods becomes simpler and less expensive to operate and maintain.

## Why Cisco for Remote PHY?

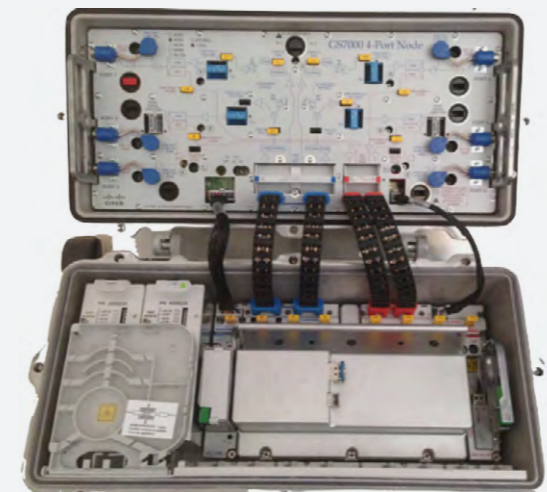
Vendors are racing to bring Remote PHY solutions to market, often promising the same benefits. But as with any new technology, the devil is in the details. Cisco's Remote PHY approach delivers:

**Standards-based, open-source RPDs:** At Cisco, we know that innovation comes when our customers can draw on open standards and open-source development from many vendors. That's why we submitted our Open-RPD software architecture to CableLabs® to become the basis for the new RPD industry standard. With Cisco Remote PHY, you can mix and match standards-based RPDs from multiple vendors, and deploy them as plug-and-play solutions in your nodes.

**Lower CapEx:** Our cBR-8 CCAP platforms are built from the ground up to capitalize on Remote PHY. When you roll out Remote PHY, you'll be able to double the service groups each Cisco CMTS platform supports without adding any new hardware to the chassis.

## Advantages of Cisco Remote PHY Node

- Enables Virtualization CCAP
- Enables Ethernet to the node which increase plant value
- Enables sharing of plants for commercial and residential
- Enable sharing of HFC fiber with FTTH and PON
- Enables hub site consolidation
- HFC becomes a full service IP network



CISCO GS7000 RPD

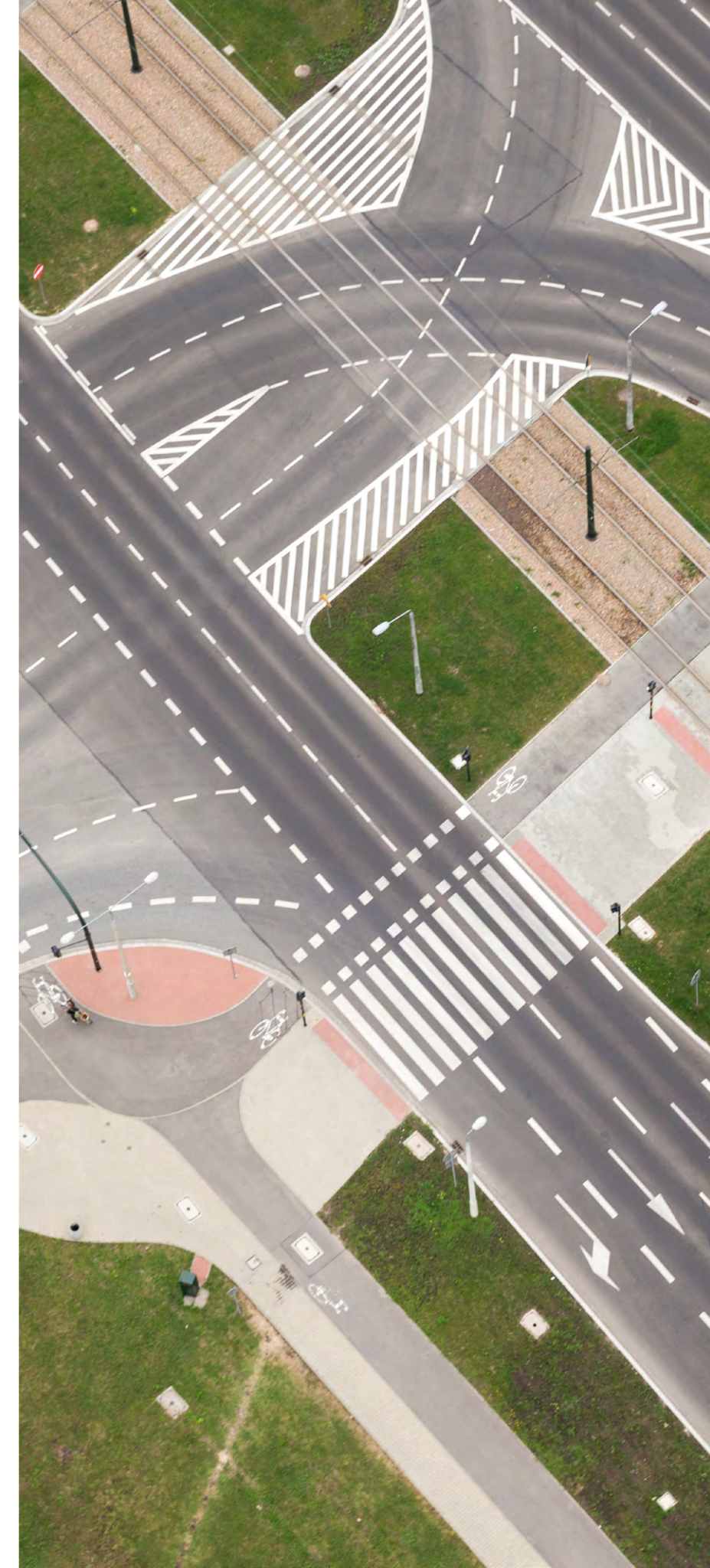
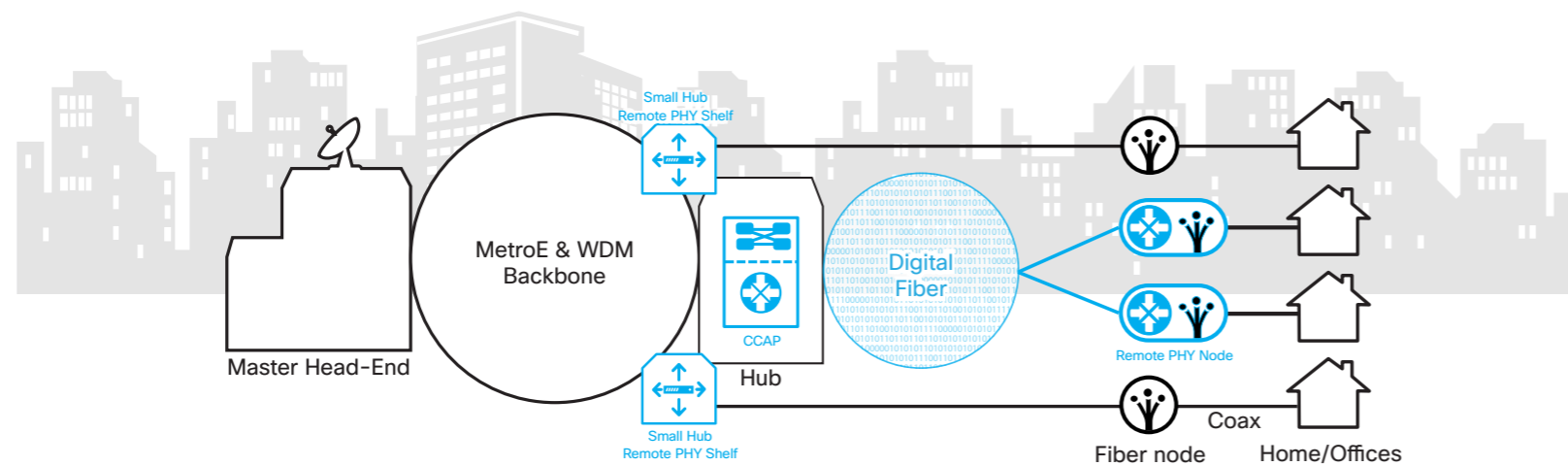
- Lowers plant maintenance costs
- Lowers optics costs (10G)
- Enables simpler fiber design rules
- Supports multiple DOCSIS and Video SG per wavelength
- Enables more wavelengths
- Support Longer reach
- Provides higher bit-rate for DOCSIS 3.1
- Enables higher scaling

**Simple, streamlined migration:** Remote PHY represents a departure from current cable access architectures. With some vendors' solutions, those changes can be extremely disruptive. Cisco's approach lets you migrate your current cBR-8 CCAP platforms to Remote PHY with a simple software upgrade.

**Consolidated complexity, distributed simplicity:** Some alternative approaches to Remote PHY, using Remote PHY-MAC technology, get very complicated. These approaches "miniaturize" CMTS functions and package them in the node, pushing more complexity out into your network. Our RPDs are simple, low-touch/low-maintenance devices that just convert digital services for HFC. Complex functions are pushed back into the network, running on fewer platforms at fewer sites.

**Fast, simple installation:** With thousands of hub sites and tens of thousands of nodes, needing advanced onsite technical expertise to install Remote PHY shelves or nodes gets costly. Our comprehensive orchestration tool makes it easy for field technicians to install Remote PHY. They just scan a QR code, connect the device, and the orchestrator does the rest.

Figure 4. Remote PHY Node



## Remote PHY Orchestration and Automation

Pushing fiber out closer to subscribers delivers significant benefits, but migrating to a distributed Remote PHY architecture can be a massive operational effort. For a large cable operator, the shift to fiber-deep can mean a 10x increase in the number of nodes – often reaching hundreds of thousands – each of which must be deployed, configured, and managed, entailing dozens of manual steps for each new node. As a typical region may include up to 500 RPDs per CMTS instance and hundreds of CMTSs, a deployment may require months of staff hours before it becomes operational.

Cisco makes moving to large-scale Remote PHY and fiber-deep deployments much easier. Whether you're using physical or virtual CMTS, you can automate the configuration of tens or even hundreds of thousands of Remote PHY devices. Our RPD automation tool encompasses:

- **Deployment preparation:** We provide a comprehensive inventory and planning interface that makes it easy to plan out how each CMTS will be configured and utilized, the catalog of services each RPD will deliver, and how new nodes will be assigned to a given service group or CMTS.
- **Configuration:** The RPD automation tool automatically generates and publishes the relevant CLI commands needed to configure the CMTS to support the RPD.
- **Field installation:** Out in the field, you no longer need high-level technicians to install and configure RPDs. Technicians can simply scan a QR code on the device to add new RPDs to the system inventory. Or, you have the option to use GPS to validate when new devices come online. In either case, field technicians can bring up new RPDs in minutes. The system automatically pairs the RPD to the appropriate CMTS and service group, pushes out the configuration, performs validation testing, and activates the new device – all without needing advanced onsite expertise.
- **Ongoing RPD and service monitoring:** Once deployed, you can use simple topology overlay and underlay views to monitor the real-time health of your RPD footprint, showing both the health status of services along with link status and utilization.

Additionally, the RPD orchestration platform provides a framework to automate incremental changes, including the ability to roll back any change to the previous good state – without having to retrace each step manually. And, unlike Remote PHY automation solutions that rely on closed, proprietary technologies, our solution is fully open and standards-based.

## Remote PHY and Open-RPD

Remote PHY is the only Distributed Access Architecture (DAA) standard in the industry. It's the result of an industry-wide initiative chaired by CableLabs® with substantial contributions to the specification from Cisco. This standard allows vendors to build to a common platform, and customers to experience the same level of industry cooperation as with previous DOCSIS specifications.

In addition to the technical advantages of Remote PHY, Cisco and CableLabs® have agreed on an open-source program to further accelerate full interoperability for Remote PHY devices (RPDs), and collaboration among equipment vendors and silicon manufacturers. Called "Open-RPD," the program addresses the time-to-market demands of cable operators by fostering an RPD development ecosystem and, ultimately, adoption of Remote PHY architectures. Open-RPD will drive innovation and interoperability beyond what's possible with a closed, proprietary solution by drawing on the advantages of open-source projects: faster and more broad-based technology improvements, rapid prototyping, and the promotion of a common networking cause among stakeholders across the industry.

To help facilitate better interoperability among different vendors participating in the Open-RPD ecosystem, Cisco has launched a program to allow RPD vendors to test their interoperability with the Cisco cBR8 Remote PHY core. This testing will be conducted at a third-party industry lab and will follow specific acceptance testing plans. Ultimately, this work will accelerate time-to-market of Remote PHY architectures.

## Virtualization: Unlock True Cloud Agility

Unlike other CMTS vendors, Cisco has years of real-world experience with virtualization and the cloud. We offer one of the largest portfolios in the industry of virtualized networking functions, data center, and SDN solutions.

### Why Choose Cisco cCMTS?

**Cloud-native capabilities:** Some virtualized CMTS (vCMTS) solutions are technically “virtualized” in that they’re deployed as software solutions running on commercial servers, rather than dedicated appliances. But if you’re running the same software, in the same way, at the same locations, how much are you benefiting by running it on a server rather than dedicated hardware? Cisco is providing CMTS capabilities that go well beyond basic virtualization. Our cCMTS is designed from the ground up for cloud-based environments – and for cloud portability, scalability, and speed. You can bring web-scale reliability, elasticity, and feature velocity to your access network.

**The ability to build a cost-effective high-availability system from low-availability components:** Cisco’s cCMTS is fundamentally a load-sharing distributed system. As a result, it can provide “Ultra HA” capabilities. If any component fails, its load can be moved to a different place. Also, scale-up/scale-down functions use the same load-sharing and distribution system, so that a failure effectively becomes a “forced scale-down.” Software upgrades use the same distribution and load-sharing Ultra HA capabilities as well. As old software versions are scaled down, new versions can be scaled up, allowing you to upgrade software without interrupting services. The Ultra HA capability also accelerates feature velocity (and competitiveness), because you can phase in software changes more quickly through DevOps and continuous integration/continuous deployment operating models.

**The industry’s most comprehensive virtualized platform:** Some new vCMTS solutions can connect customer modems, but many other legacy service features – set-top gateway management, load balancing, lifeline telephony services, and more – are not part of the solution. Cisco cCMTS will deliver a complete feature set to support all of your existing access services from day one.

**Virtualization flexibility:** The basic premise of virtualization is that CMTS software functions can run on any commercial server. If you start modifying the compute platform for vCMTS, you’re no longer virtualized – you just have a different kind of dedicated appliance. Unfortunately, that’s what some virtualized CMTS products require. Cisco vCMTS can run on any general-purpose hardware.

## Why Virtualize Anyway?

Few technologies have received as much buzz in the marketplace as virtualization, and few have spawned as many misconceptions.

For example, some vendors offer a solution to replace dedicated CMTS hardware in hubs with software running on general-purpose servers – in the same hubs. Technically, your CMTS is now “virtualized.” But from an operational perspective, what’s changed?

The real power of CMTS virtualization comes when CMTS functions run out of a data center with orchestration. It enables you to simplify your network, automate your operations, and accelerate service velocity.

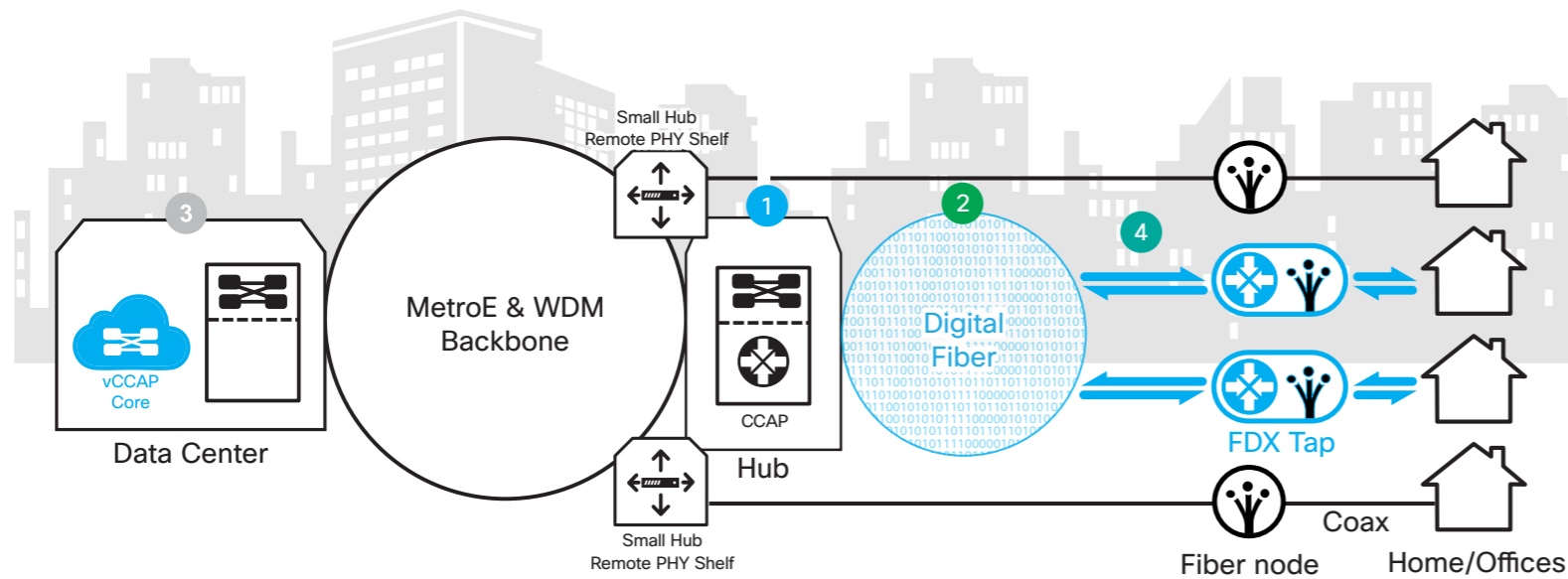
Ultimately CMTS should be just one application among many running in your cloud (video encoding and decoding, security, virtual managed services), all overlaid with a unified orchestration layer. Once you get there, you can scale capacity elastically, load-balance to utilize resources more efficiently, and deploy services with cloud speed and agility.

**But if you’re considering a virtualization solution that’s limited to one function in a hub, you won’t realize those full cloud benefits.**



**Flexible CMTS capacity:** Our physical cBR-8 can service up to 100,000 subscribers, but not all cable providers need to operate at this scale. With our cCMTS, you can use the same feature set for much smaller groups of customers. It gives you the flexibility to right-size CMTS capabilities for any location. And you can also introduce new services on a smaller scale, quickly, and with less risk.

**A pragmatic path to virtualization and the cloud:** Cable providers want cloud flexibility, efficiencies, and speed, and each cable operator has a timeline and migration path to get there. Our cCMTS integrates transparently with your existing access services. You'll retain the flexibility to adopt Remote PHY, fiber-deep architectures, and cloud-based service delivery at your pace. Whenever you do begin your transition, your access solutions will be ready to come along.



- 1 Converge Your Cable Access with the CCAP**  
Achieve higher capacity and reduce operational and capital expenses by integrating the functions of CMTS, QAM, and video with the Cisco cBR-8 to enable DOCSIS 3.1 and begin the evolution to NFV and SDN.
- 2 Build the Foundation for Automation & Virtualization**  
Deploy Remote PHY (Remote PHY shelves & Remote PHY nodes) throughout your infrastructure for distributing DOCSIS PHY and transform your analog fiber into digital fiber.

- 3 Go Cloud Native**  
Transform your head-ends with a data center centric architecture. Enable new capabilities such as elastic capacity, high availability and cost advantages with services no longer being tied to dedicated hardware resources and physical locations.
- 4 The Future – Infinite Broadband**  
Fully utilize the capacity of HFC. Enable symmetrical services with full duplex DOCSIS, automated provisioning, and economical capacity growth.



## Network Abstraction: Unlock Automation

To capitalize on cloud scale and agility and simplify your network, you need one key ingredient: network abstraction. Cisco can help you abstract away all of the complexity across all of the diverse physical and virtual resources in your network. You can automate workflows that used to require extensive manual effort across different infrastructures and equipment interfaces. And you can control all devices and services centrally, with much less operational overhead.

Cisco's orchestration solution for cable networks is based on the same industry-leading platform that service providers worldwide are already using to simplify their networks: Cisco Network Services Orchestrator (NSO) enabled by Tail-f. We provide end-to-end automation to help cable operators design and deliver services faster. You can create and change services using standardized YANG models – without lengthy custom coding efforts or service disruptions. You eliminate the “fat finger” errors caused by human operators accidentally using incorrect CLIs to configure devices – all CLIs are now automatically generated by the orchestrator in a model-driven way. And, you gain an open, standards-based framework to automate the full range of devices in your network – both physical and virtual, from any vendor – and fully integrate them with your existing back-end OSS/BSS environment.

### The Orchestration Advantage

With Cisco cable network abstraction and orchestration capabilities, you can:

**Accelerate service velocity and revenues:** Use automated, on-demand, and even customer-facing self-service provisioning to reduce activation times from months to minutes.

**Increase business agility:** Create, reconfigure, and repurpose services in real time, without disrupting running services or worrying about underlying device dependencies.

**Simplify network operations:** Automate the end-to-end service lifecycle (design, provisioning, ongoing monitoring) and radically reduce the manual steps needed to deliver services.

**Differentiate from the competition:** With a single framework to address any and all devices in your network, automatically activate advanced device features and easily bundle multiple network services to deliver customized experiences.

**Promote nonstop operations:** Gain centralized control over network changes, with the ability to reconfigure devices and services during live production, without disrupting customers.

With these capabilities, you can continually refine and repackage network services at the speed of software. You can drive down costs and complexity in your operations. And you can innovate to deliver new value to your customers.



## Next-Generation Cable Management: Modernizing Access Network Management

In network management, particularly FCAPS (fault, configuration, accounting, performance, security), there has long been a divide between the worlds of telcos and cable operators. Most telco networks, designed to meet strict service-level agreements (SLAs), were built from the ground up to enable in-depth network monitoring and service assurance. Cable networks, originally designed for linear TV, didn't need the same capabilities – and their network devices rarely supported them.

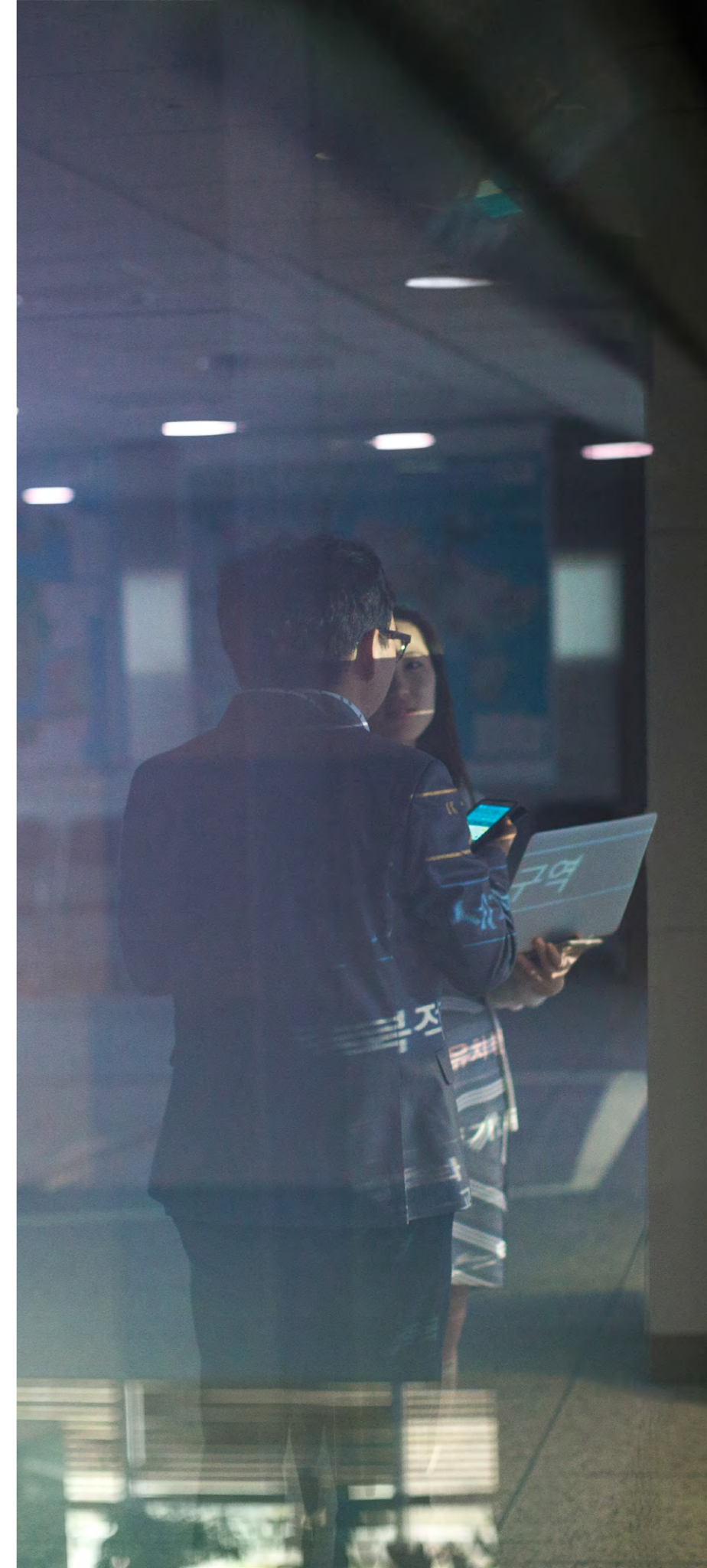
However, as you add new services and compete in new markets, network monitoring, alarming, and fault management – all of the tools needed to assure excellent experiences for end-customers – become much more important. Relying on the homegrown software or static spreadsheets that many cable providers use today can't provide the real-time visibility into network health and performance that you need.

From an operations perspective, cable providers are also looking for ways to simplify and automate network device configurations; this becomes critically important as you look to migrate to Remote PHY architectures and connect thousands or tens of thousands of new devices in the field. Whether or not you're ready to deploy a unified orchestration layer for your entire network, you need to be able to automate and simplify RPD configurations. If you can't, the cost of Remote PHY migration quickly becomes prohibitive.

### Cisco Cable Automation and Orchestration Platform

Cisco provides a suite of next-generation management and orchestration tools designed specifically for cable networks. Using open interfaces, we can give you in-depth visibility and proactive maintenance capabilities across your network, without having to invest in a new, monolithic FCAPS platform. And, we provide CMTS and Remote PHY orchestration tools to enable “zero touch” deployment of new devices, remote reprogramming of devices in the field, and proactive monitoring services.

At its core, the Cisco Cable Automation and Orchestration Platform provides a software infrastructure to collect real-time information from across your network – RPDs, CMTS platforms, and more – and enable a range of next-generation cable management applications. Right now, you can use the platform to automate the deployment of RPDs and accelerate your migration to a Remote PHY architecture. (See the section “Remote PHY Orchestration and Automation” on page 15.) In the future, the platform will support additional management applications – maintenance automation, proactive health, elastic resource management – that drive down operating costs and improve quality and resiliency in your access network.



## Maintenance Automation

The Cisco Cable Automation and Orchestration Platform will support critical capabilities to simplify and automate maintenance in growing networks with tens of thousands of nodes. Many of today's manual operations including method operating procedure [MOP] scripts, pushing out configurations to CMTS platforms and RPDs, software updates/versioning, and node and service group splits, will be automated end to end. You'll be able to easily manage devices across your infrastructure as your footprint grows, without disrupting services.

## Proactive Health

Instead of relying on piecemeal CLI scripts or manually updated spreadsheets, the Cisco Cable Automation and Orchestration Platform provides a framework to collect real-time information from across your network in one place. You'll be able to monitor network health, utilization, and capacity centrally, and troubleshoot problems anywhere in your environment through a single graphical interface. You can maintain an up-to-the-minute inventory of your entire access network – CMTS and RPDs, physical and virtual. And, your network will automatically respond to issues as they are detected, taking immediate actions in response to predefined triggers. For example, if connectivity between a cBR8 and an RPD goes down, the Cisco platform will recognize the problem and automatically re-route the RPD to an alternate cBR8, restoring connectivity in seconds – without anyone having to lift a finger.

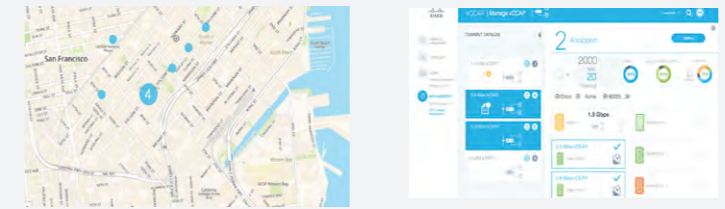
## Elastic Resource Management

As you evolve to cloud-based models for core access network services, the Cisco Cable Automation and Orchestration Platform will make it simple to scale virtualized network resources with demand. You'll be able to automatically scale cCMTS services and apply traffic engineering (network optimization and load balancing) to deliver guaranteed performance under SLAs. The platform will also streamline capacity planning for nodes and service groups. Node and service group splits will become much more common as cable operators adopt fiber deep architectures and look to deliver more bandwidth to residences and businesses. Today, recognizing when a node or service group is reaching capacity – and then deciding what to do about it – is an entirely manual process. With the Cisco platform, you'll be able to shift RPDs to different ports on a CMTS platform, or even to an entirely new cBR8, automatically, in seconds.

## End-to-End Orchestration as Your Network Evolves

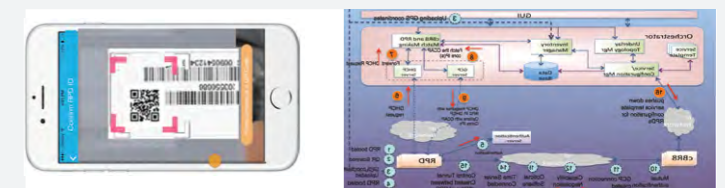
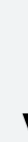
All of these applications, and the Cable Automation and Orchestration Platform itself can function as standalone cloud-based solutions in a network operations center. However, they are all also integrated with Cisco's larger orchestration strategy. As Cisco introduces new capabilities for streaming telemetry, microservices, container frameworks, and more, the platform will allow you to take advantage of them to simplify your network operations. All of these solutions also use open interfaces to collect information from your devices, even from multiple vendors. So you can expand and update your infrastructure to bring up new capabilities from multiple vendors while retaining centralized visibility and control.

## Automation in the RPD Life Cycle



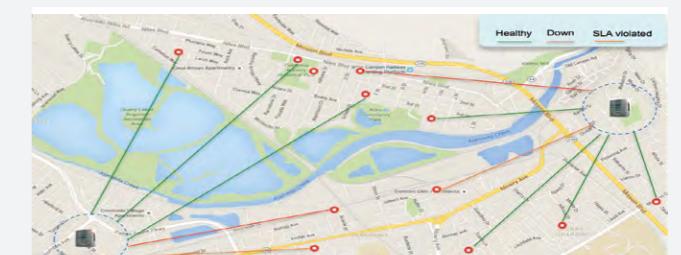
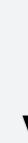
### Process: RPD Deployment Preparation

- RPD Inventory and Planning
- Service Catalog Definition and Assignment



### Process: RPD Install in the Field

- QR Scan for Dynamic RPD Inventory View
- CMTS Service Orchestration for RPDs



### Process: RPD and Service Monitoring

- Overlay and Underlay Topology with Health status

## The Future of Cable Network Management: Intelligent Nodes

Cisco network management tools can dramatically simplify network management and operations right now. And in the near future, you'll have even more powerful capabilities. Cisco is providing intelligent CCAP and Remote PHY nodes that use open standards (NETCONF, YANG) to automatically push out real-time telemetry information to northbound OSS and management systems. You'll have granular, up-to-the-moment information about every device in your environment and the services running across them. You'll be able to set key performance indicators (KPIs) for different services, and automatically detect and correct problems when they arise. And you'll be able to do everything – monitor and troubleshoot your entire network footprint, automatically reconfigure devices as needed – from a single, open standards-based platform.



Figure 5. Cable Network Management

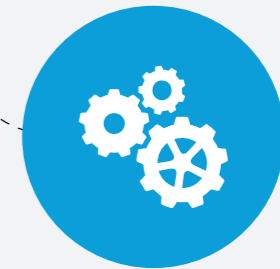
## Cisco Infinite Broadband

### Future Opportunities



### New Services

In Minutes Not Months



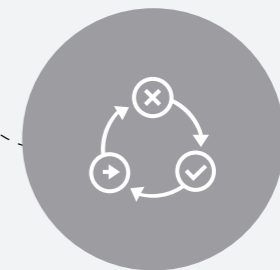
### Automation

Zero Touch Operation



### Profitability

Revenue Growth



### Operational Consistency

Qualification in Days

## Building a Platform for Long-Term Change: New Business Agility with a Multiservice Access Network

Traditionally, cable access networks, and particularly the last-mile HFC plant have been closed, rigid infrastructures. They were purpose-built for consumer TV and Internet services and offered little flexibility to support new services and revenue models. Today, cable operators are supporting a wider range of last-mile networks – fiber, PON, Ethernet, in the future even 5G wireless. And they'd like to use their massive network footprint to expand into new offerings and business models. But if they have to operate each network and service offering as a separate infrastructure, new services will be complex and slow to roll out, making it difficult to compete with pure-fiber and OTT competitors.

Cisco cable innovations in fiber-deep architectures, virtualization, network abstraction, and management all work together to lay a foundation for new revenue-generating services and differentiated customer experiences. As you evolve your access network, each new technology implementation provides an incremental step towards a versatile, all-IP network extending all the way to the home or business. Using standards-based Ethernet, you can scale bandwidth across the access network much more efficiently, and at a much lower cost. Suddenly, many cable operators will now have the largest Ethernet networks in the markets they serve.

### Enabling New Business Models

With your evolved, fully orchestrated cable network, consumer video and DOCSIS processing become just some of the applications your access network supports. The same distributed nodes become flexible points-of-presence (PoPs) for a broad range of technologies and services. If you want to run digital fiber or PON to some neighborhoods, you can do that with the same infrastructure. If you want to expand into new markets by using 5G wireless as a last-mile medium, you can. If you want to use your distributed all-IP architecture to deliver public Wi-Fi, mobile backhaul, enterprise WAN connectivity, or other new revenue-generating services, you can do that too. Everything runs over the same flat, all-IP network.

Once you've consolidated multiple services that used to require separate infrastructures, it's now easy to virtualize them and run them from a cloud or data center infrastructure. Cisco's network abstraction layer and SDN controllers can communicate with all the equipment in your access network – both physical and virtual, from multiple vendors. You can automate the entire lifecycle of a broad range of services, and integrate them easily into your existing OSS/BSS systems. Your access network is now a flexible, automated platform to support a broad range of new business models alongside current data and video services, and unlock new possibilities for profitable growth.

## Segment Routing

The limitations of traditional broadcast video services – where each channel consumes a fixed portion of spectrum going into the home – continues to limit cable network capacity and service agility.

- ✓ New IPv6 Segment Routing technology breaks free of conventional cable TV constraints.
- ✓ Cable providers will be able to deliver all services, including linear video, over IP end-to-end. Using IP multicast techniques, subscribers will receive the same channels, without having to reserve hundreds of MHz of bandwidth on their networks.
- ✓ Cable providers will be able to deliver broadcast video the same way they deliver any other OTT service over the simplified all-IP network. And they can unlock a tremendous amount of currently stranded capacity to support Gigabit services and new consumer experiences.

## A Path to New Capabilities

Some vendors' vision of cable network evolution is limited to DOCSIS 3.1 and Remote PHY. At Cisco, we know that real business transformation goes much farther. We've invested millions into cable R&D, and are working with the cable industry and engineering bodies around the globe right now to deliver tomorrow's revolutionary cable technologies.

## Cisco Is Your Partner for the Future

Today, technologies like these are limited to laboratories and early field trials. But Cisco is playing a central role in their development. That's why our cable evolution path positions short-term technology innovations – DOCSIS 3.1, Remote PHY, cCMTS – within an overarching framework to run any network device or service as a programmable, automated, cloud-scalable application. With our long-term vision for cable network virtualization and orchestration, you'll be able to implement new capabilities like these, without disrupting your current operations or running services. As new cable innovations come to market in the coming years and beyond, you'll be able to turn them into real-world efficiencies, experiences, and revenues much faster.

## Full Duplex DOCSIS Technology

Few cable innovations are generating as much buzz as full duplex DOCSIS (FDX). Using new microprocessors and echo cancellation and signaling techniques, FDX will enable high-capacity, symmetrical services over an existing HFC cable plant – with up to 50 times more upstream capacity than HFC networks can support today.

- ✓ Cable operators will be able to provide fiber-optic performance and multi-Gigabit capacity over coax, eliminating the need to rip and replace HFC networks for years.
- ✓ They'll be able to deliver a new world of experiences – full 4K entertainment and communication services, immersive gaming, virtual reality, and more – over existing access networks.

Cisco is already leading the industry FDX. We played a key role in the development of the Full Duplex DOCSIS specification. We developed a validated reference design for digital echo cancellation. And, like our work on the Open-RPD specification, we submitted this work to the open-source community to help advance cable technology for the industry as a whole.

# Cisco Services

## Unmatched Industry Experience

Implementing new cable access technologies can get complex. Ensuring that you're adding them in a way that will enable the simplified, automated, programmable networks of the future – even more so. Fortunately, you don't have to go it alone.

Cisco Services has decades of professional services experience helping cable providers plan, build, and manage cable network migration projects. We have industry-leading expertise across the full range of CCAP, Remote PHY, cCMTS, and other cable access technologies, as well as next-generation virtualization and orchestration platforms. We can help you capitalize on new cable innovations more quickly and easily, at a lower cost and with less risk.



## Implementation Tailored to Your Business

Cable access evolution paths can be different for each operator. We have the flexibility to understand and help you achieve your specific business goals. Our services can help you evolve your network to support new customer experiences, simpler and less expensive operations, faster time-to-market, and more profitable growth. Cisco Services uniquely deliver innovative solutions, unmatched expertise, and smart service capabilities using a collaborative partner approach.

Our intellectual capital, tools, and experience and expertise set Cisco Services apart from the competition. We have delivered successful plan, build, and manage services to all types of service providers around the world. Trust the success of your network operations to the worldwide leader in networking services and solutions.





## Summary and Benefits

As the competition for consumer mind and wallet heats up, cable operators are reimagining their networks and operating models. To stand out from the crowd, they need new capabilities and customer experiences, and they need to bring them to market fast. They want to drive down the costs and complexity in their networks. And they recognize that speed, flexibility, and operational simplicity will dictate market success.

Cisco provides a cable access evolution path to help you transform your business. Our state-of-the-art CCAP, Remote PHY, and cloud-native solutions unlock new efficiencies and Gigabit capacity over existing HFC access networks. But unlike other vendors, we go far beyond just point products. Our solution brings new access technologies to a programmable, unified network. With Cisco, your access evolution will lay the foundation for a fully virtualized, orchestrated, and cloud-scale operating model. You can pragmatically build towards a future where you can deliver any service, anywhere, over an all-IP network that's automated and end-to-end. With Cisco cable innovation and industry-leading expertise, you can build an access network that is:

**Fast:** Deliver Gigabit and multi-Gigabit speeds to compete with any pure fiber player, and continually drive new capacity and experiences over existing HFC access networks.

**Simple:** Abstract away the complexities of siloed infrastructures and heterogeneous physical and virtual devices. Operate all services and infrastructures in the same way, more easily, and at a much lower cost.

**Flexible:** Create a flat, all-IP access network connecting every household and business customer to introduce new revenue-generating services and expand into new markets easily.

**Automated:** Design innovative new services and experiences without worrying about dependencies on the underlying infrastructure. Provision services as virtualized, elastically scalable applications that can be automatically reconfigured and repositioned on the fly, in response to changing business and customer demands.

**Standardized:** Don't lock yourself into one vendor's vision for your future. Draw on Cisco's commitment to open APIs, open standards, and open-source collaboration to preserve full flexibility to introduce new multivendor innovations in the future.

### Learn More

Ready to take the next step in your cable network evolution? Contact your Cisco account representative or visit <http://www.cisco.com/c/en/us/solutions/service-provider/cable-access-solutions/index.html>.

## Cable Solution Checklist

As you weigh your different options, make sure the solution you select is part of a larger strategy that can check off all of these boxes.

- Is the solution ready day one for DOCSIS 3.1 and Remote PHY? Is the Remote PHY standards-based? Can you operate physical/virtualized resources from the same management platform?
- Does the solution include a strategy to virtualize all cable applications, not just CMTS – CCAP, video processing, CDN, and more – and deliver them as cloud services?
- Does the solution allow you to decouple services and applications from the infrastructure? Will you be able to treat new access solutions as cloud services that can be scaled and provisioned over any last-mile network?
- Will you be able to automate the provisioning of new Remote PHY devices and other services? Can you monitor the network and proactively detect issues so that you can deliver better customer experiences?
- Does the solution roadmap include next-generation technologies (full duplex, segment routing, support for new services such as Wi-Fi and 5G backhaul) to grow revenues and increase profitability?