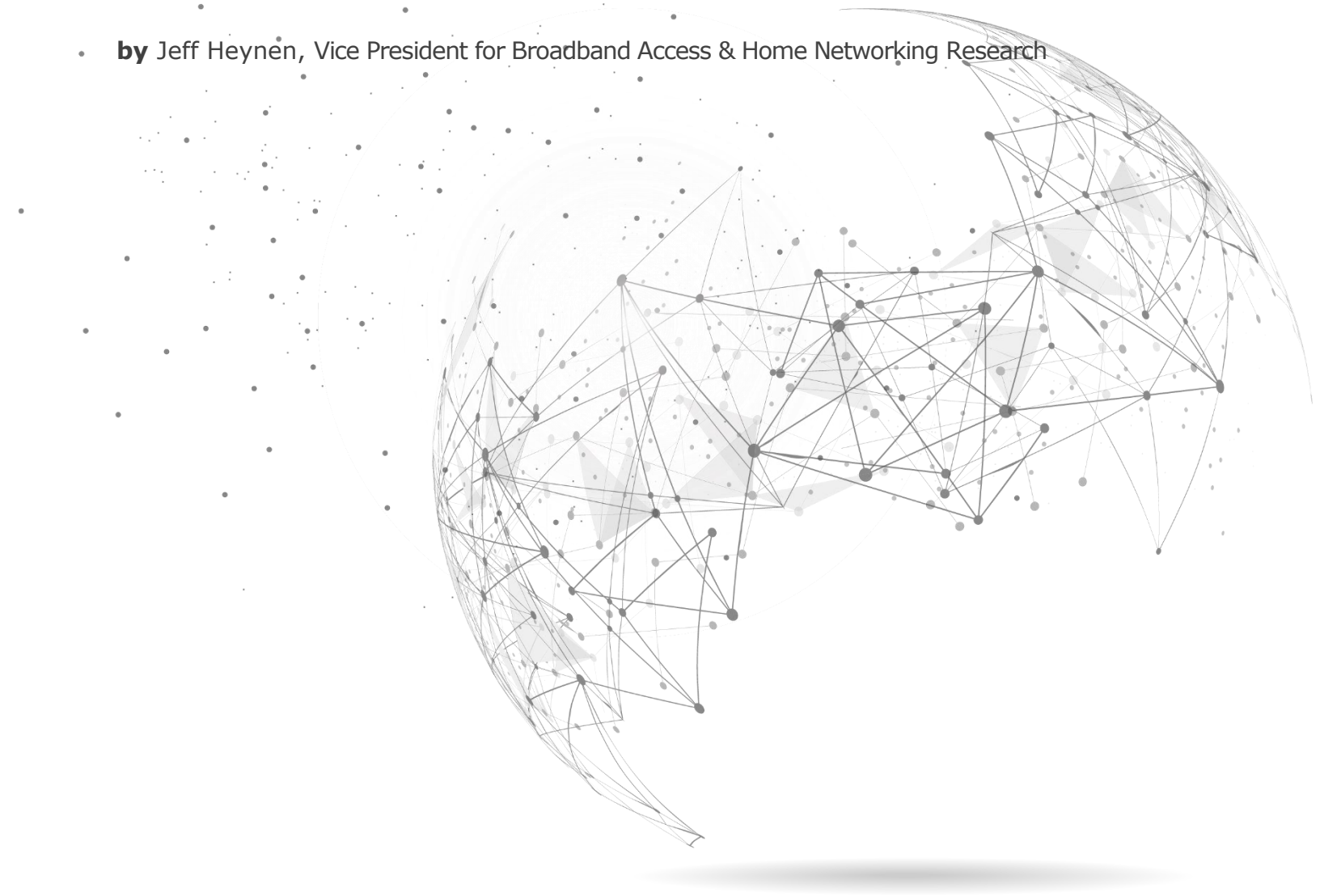
DELL'ORO GROUP

SURVEY REPORT | **November 2022**

# MAPPING THE FUTURE OF CABLE VIRTUALIZATION

**by** Jeff Heynen, Vice President for Broadband Access & Home Networking Research



# EXECUTIVE SUMMARY

A survey of 50 global cable operators reveals a commitment to migrating towards virtual CMTS (vCMTS) platforms as part of distributed access architecture (DAA) deployments to help expand their broadband capacity, improve signal quality in their access networks, and move to a more virtualized architecture that allows for the end-to-end automation of broadband services. By 2025, 66% of respondents expect to deliver average downstream bandwidth of 500Mbps-1Gbps to over 1Gbps, a substantial increase from the 24% who offer those average speeds today.

To help accomplish these speed objectives, operators plan to continue their node splitting activity to reduce service group sizes while also migrating to either remote PHY (RPDs) or remote MACPHY devices (RMDs) within the next couple of years. In fact, all 50 operator respondents plan to have either remote PHY or remote MACPHY devices in their networks by 2024, with 70% of respondents saying they will have remote PHY devices and an additional 54% saying they will have remote MACPHY devices.

The acceleration of DAA deployments—particularly remote PHY devices—also means an increase in the use of vCMTS platforms to provide MAC layer control of RPDs currently, evolving to deliver MAC Manager functions in upcoming Flexible MAC Architecture (FMA) deployments, which are expected to coincide with DOCSIS 4.0 rollouts. In fact, 52% of respondents plan to deploy some of the platforms defined in the FMA specification within the next two years, with an additional 32% saying they will deploy beyond two years.

Our survey results clearly show that today's vCMTS platforms are just the first step in the longer process of virtualizing cable broadband networks and providing far more flexibility in provisioning and delivering new services. Additionally, the migration to vCMTS platforms is driven largely by cable operators' desire to have better performance metrics and telemetry that have been heretofore difficult to collect from traditional, integrated CCAP platforms. 70% of respondents said that network virtualization is a priority for their organizations. vCMTS platforms and DAA are just the first steps in a longer evolution towards that goal.

# CONTENT



# INTRODUCTION

Most cable operators have experienced a dramatic shift in the competitive landscape in just the last year. In general, cable operators successfully navigated the COVID-19 pandemic by means of an aggressive mix of node splitting, service group size reduction, and upstream and downstream bandwidth increases. However, they now face the problem of the concerted and well-funded overbuilding efforts of fiber operators. Net cable subscriber additions throughout 2020 and the first half of 2021 reflect cable's success at adding new broadband homes and stealing away DSL subscribers from their telco competition. However, a slowdown in net cable additions in the fourth quarter of 2021 and the first quarter of 2022 suggests that the pool of available DSL subscribers who are ready to switch has been tapped out.

Additionally and less publicly, as cable operators face competition from fiber overbuilders offering symmetric 1Gig services, they are also seeing their own churn rates increase, as subscribers increasingly value increased upstream bandwidth to support ongoing videoconferencing, gaming, and other low-latency application requirements.

Cable operators are not standing idly by as fiber competitors eat away at their footprint and subscriber base advantage. They continue to invest in next-generation platforms, which support their long-term transition to distributed and virtualized architectures. Cable operators continue to modernize their networks to push fiber deeper, reduce MERs (Modulation Error Rates), and reduce the overall costs of operating their broadband access and outside plant networks.

In the near term, cable operators will push forward with a number of key strategic initiatives through 2026:

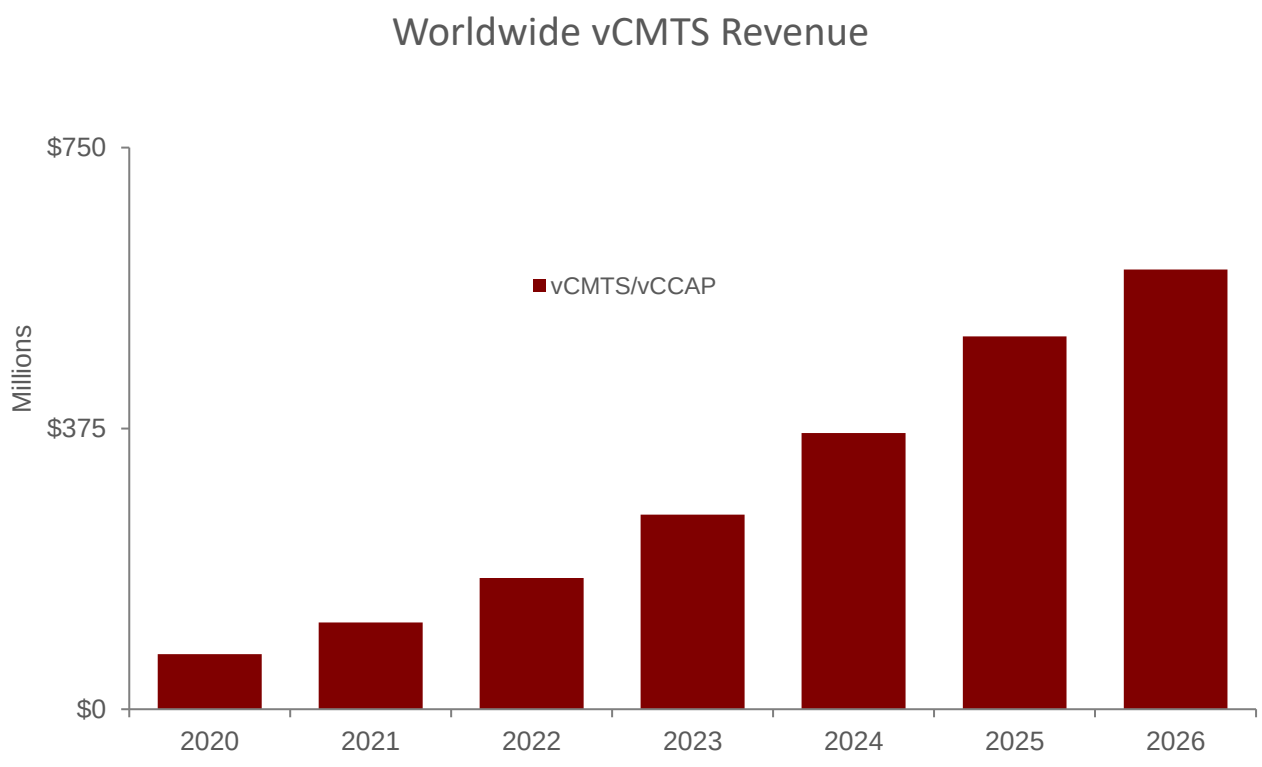
- Quickly improving upstream capacity through mid-split and high-split upgrades, resulting in positive Y/Y increases in upstream channel license purchases through 2026
- Replacing legacy optical nodes that have reached maximum segmentation with DAA nodes, including remote PHY and remote MACPHY devices
- Replacing aging amplifiers, taps, and other passives to begin the process of preparing networks for DOCSIS 4.0
- Migrating to virtualized CMTS platforms for remote PHY deployments and to cap and grow traditional centralized CCAP platforms

Each of these upgrades is being deployed to prepare DOCSIS networks for the transition to DOCSIS 4.0 by the end of this decade, and many of the initiatives listed above will be completed by extending and improving current DOCSIS 3.1 implementations. Accomplishing these initiatives is the fastest way for cable operators to improve their competitive positioning relative to fiber overbuilders, while simultaneously achieving the incremental steps necessary for the ultimate transition to either full-duplex DOCSIS (FDX) at 1.2GHz or extended spectrum DOCSIS (ESD) at 1.8GHz.

Throughout this extended upgrade cycle, virtual CMTS (vCMTS) platforms will serve a key function; namely, giving operators the flexibility to choose their approach and to determine which part of the outside plant will be impacted in a given upgrade wave. When new capacity is required, whether downstream or upstream, new vCMTS servers can be quickly added in any location, and/or existing software resources can be re-allocated to any service groups that are undergoing capacity upgrades. In many cases, these resources can be added much more quickly with a vCMTS platform than with a centralized CCAP platform, which (the latter) would require at least a linecard upgrade to support increased capacity.

Spending on virtual CMTS platforms is expected to increase from $112 M in 2021 to $591 M in 2026, largely based on the continued expansion of distributed access architectures using remote PHY, remote MACPHY, or, in the case of greenfield FTTH buildouts, remote OLTs.




Dell'Oro Group Broadband Access & Home Networking 5-Year Forecast Report January 2022

We saw spending on all DAA platforms increase in 2021 due to a number of important factors:

### 1. Maturity of the solutions, including interoperability

Many operators remained on the sidelines, out of concerns regarding the maturity of the proposed solutions and interoperability between virtual CCAP and CCAP core vendors and RPD suppliers. These initial concerns likely have been allayed, as multiple large-scale deployments running live traffic using multiple vendors' equipment have proven successful. Ensuring the correct functioning of equipment requires constant maintenance in any scenario, but there are now proven blueprints for anticipating the standard issues that normally arise.

### 2. Upstream Relief as a Driver

In the immediate aftermath of COVID lockdowns, cable operators saw an incredible jump in the demand for upstream bandwidth, which forced them to respond with software tweaks to their DOCSIS 3.1 services. They also saw a significant jump in node splits to reduce service group sizes and increase upstream bandwidth. These trends continue today— particularly the node splitting activity—which is causing the pulling forward of mid- and high-split architectures, which provide significant increases in upstream bandwidth. The growing number of operators that are pursuing node splitting efforts are doing so in conjunction with upgrading to remote PHY or remote MACPHY to capitalize on the additional signal improvements. The same is true for operators that are moving to 1.2GHz in the outside plant.

### 3. Second Generation Chips

One of the main concerns with first-generation equipment has been heating dissipation, particularly with remote MACPHY equipment. The second-generation chips that have been integrated into RPDs and RMDs reduce heat dissipation to acceptable levels for all operators (i.e., globally, not just for North American operators). This opens the door for large-scale remote MACPHY deployments and improves the efficiency of remote PHY equipment.

### 4. DOCSIS 4.0 Consensus

The publication of the DOCSIS 4.0 specification in 2020—which included Extended Spectrum DOCSIS (ESD) and Full-Duplex DOCSIS (FDX)—has provided a roadmap for operators for their post-3.1 efforts. Each operator must choose which architectural path to choose, but now there is consensus that both paths will rely heavily on DAA technologies. However, it will be several years before DOCSIS 4.0 has a significant impact on DAA deployments. We expect operators to begin replacing their taps throughout this year, amplifiers beginning next year, and then nodes beginning in late 2023 and 2024.

vCMTS platform adoption will be particularly impacted by the long-term roadmap designed for these platforms in the context of Flexible MAC Architecture (FMA). In September 2020, CableLabs released

the specifications for FMA. FMA defines the disaggregation of the CCAP and virtual CMTS into separate management, control, and data planes. Essentially, this disaggregation is the next step in the evolution that was started years ago with M-CMTS architectures, followed by the move to DAA and Remote PHY, specifically. FMA expands the disaggregation of a traditional integrated CCAP and today's virtual CMTS platforms into a combination of DAA, SDN, and NFV.

More importantly, FMA gives cable operators the flexibility they need as they navigate how to prioritize current capacity upgrades through traditional node splits, mid- and high-splits, upcoming outside plant upgrades to 1.2Ghz and 1.8GHz, and the determination of whether their future access network will rely on DOCSIS 4.0, fiber-to-the-home, or a combination of the two. FMA gives cable operators the flexibility to deliver Low Latency DOCSIS (LLD) and Mobile xHaul over DOCSIS, as well as far more flexibility in how they design their CINs (Converged Interconnect Networks) with external switching elements that allow them to scale their interconnect networks more easily than ever before. For DAA specifically, FMA gives operators a blueprint for pursuing access networks that incorporate multiple physical layer technologies, from remote PHY to remote MACPHY, FTTP, and even fixed wireless.

Finally, FMA opens the door to the true virtualization of cable access networks, supporting any number of use cases and any number of physical layer connections through the same disaggregated network functions, which can be placed in any physical location—node, hub site, headend, super headend, or data center. When cable operators faced a significant ramp in upstream bandwidth consumption in the early weeks of the COVID-19 pandemic, some struggled to support that growth without the traditional tools of node splitting and/or increasing DOCSIS channels through the addition of CCAP line cards or new CCAP chassis in instances in which the existing CCAP platforms were already maxed out. With FMA, operators have the ability to scale far more quickly, adding CPU cycles quickly to match the increase in service groups and bandwidth.

At the same time that virtualization efforts appear to be increasing among cable operators, some incumbent vendors have reduced or entirely eliminated their vCMTS platform developments. They are opting instead to continue relying on their existing centralized CCAP and CCAP core products, while also skipping ahead to developing platforms that are more aligned with the FMA specifications, including the MAC Manager, DOCSIS Controller, and SDN Controller elements, among others.

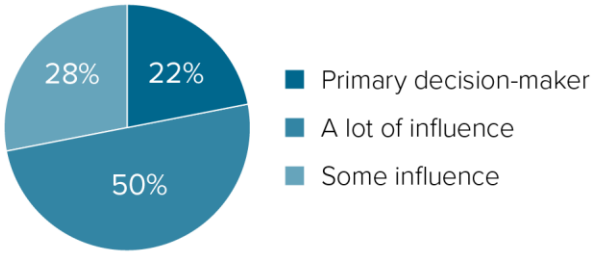
These market and strategy shifts have introduced some confusion to the overall cable marketplace and left some operators and vendors wondering whether the vendor ecosystem for tomorrow's virtualized infrastructure will be robust enough to support their upcoming architectural shifts.

Balancing investment in new technology with spending to combat competitive pressure has always been a challenge for operators of all kinds, but particularly for cable operators. Their challenges weigh heavily on their current and future technology suppliers, who are also trying to determine purchasing trends that will guide their product development and timing.

In an effort to add clarity to the discussion, Dell'Oro Group conducted an online and telephone survey of 50 global cable operators with broadband networks that provide residential broadband services. The survey was intended to gain a better understanding of the current state of cable operators' broadband networks, of which technologies they plan to use in the future, and of how quickly they plan to deploy these new technologies, particularly virtual CMTS and distributed access architectures.

## Survey participants demographics

Level of influence in planning and making purchase decisions for CCAP, Virtual CMTS, and DOCSIS access infrastructure at the company

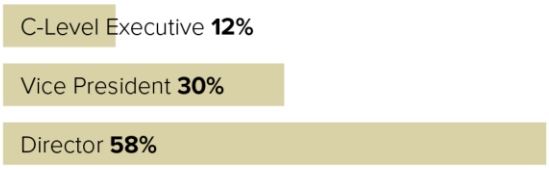



**Q:** How would you describe your level of influence in ... ?
**Q:** Do you have detailed knowledge of ... ?
**Q:** What is your job title at the organization?

**100%**

have detailed knowledge of Virtual CMTS, CCAP, or other DOCSIS infrastructure platforms for the company

**Job titles:**




*For more details on the survey methodology and respondent demographics, please see the methodology section at the conclusion of this paper.*

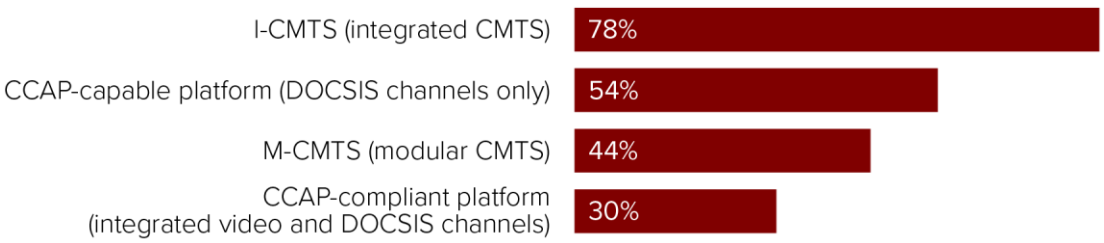

 

# SURVEY FINDINGS

## Operators Currently Relying on a Mix of DOCSIS Platforms

At the outset, we wanted to understand which types of DOCSIS headend equipment cable operators currently have installed in their networks or have used in their networks in the past. The platforms they have installed today might provide insight into how quickly they will transition to vCMTS and DAA platforms in the future.

**CMTS or CCAP equipment installed today or used in the past**




Q: Which of the following CMTS or CCAP equipment do you have installed today or have you used in your network in the past?

Our results showed that operators are relying on a mix of platforms, with 78% using an I-CMTS (integrated CMTS) platform and 44% using an M-CMTS (Modular CMTS) platform.

These two platforms were the backbones of DOCSIS networks for decades, only evolving to denser CCAP platforms in 2013 and 2014. CCAP platforms were designed to support both DOCSIS data and QAM-based video channels in a single chassis, thereby eliminating the need for external edge QAM platforms. Although the potential of the CCAP's collapsed architecture made perfect sense to operators, only a fraction of the world's cable operators actually used the full capabilities of a CCAP to collapse both DOCSIS data and QAM-based video traffic. Most CCAP deployments were used simply to support more service groups and data throughput in a single chassis.

The results of our survey reflect these realities, with 54% of respondents reporting that they used a CCAP-capable platform to support only DOCSIS channels, though they are aware of the capability of upgrading to support QAM video in the future. Meanwhile, 30% of all respondents are using or have used a CCAP-compliant platform, supporting both QAM video and DOCSIS data from a single chassis.

We do not expect these results to change significantly in the next couple of years, as operators continue to move more of their video traffic to IP, and video subscriber numbers are declining at most operators.

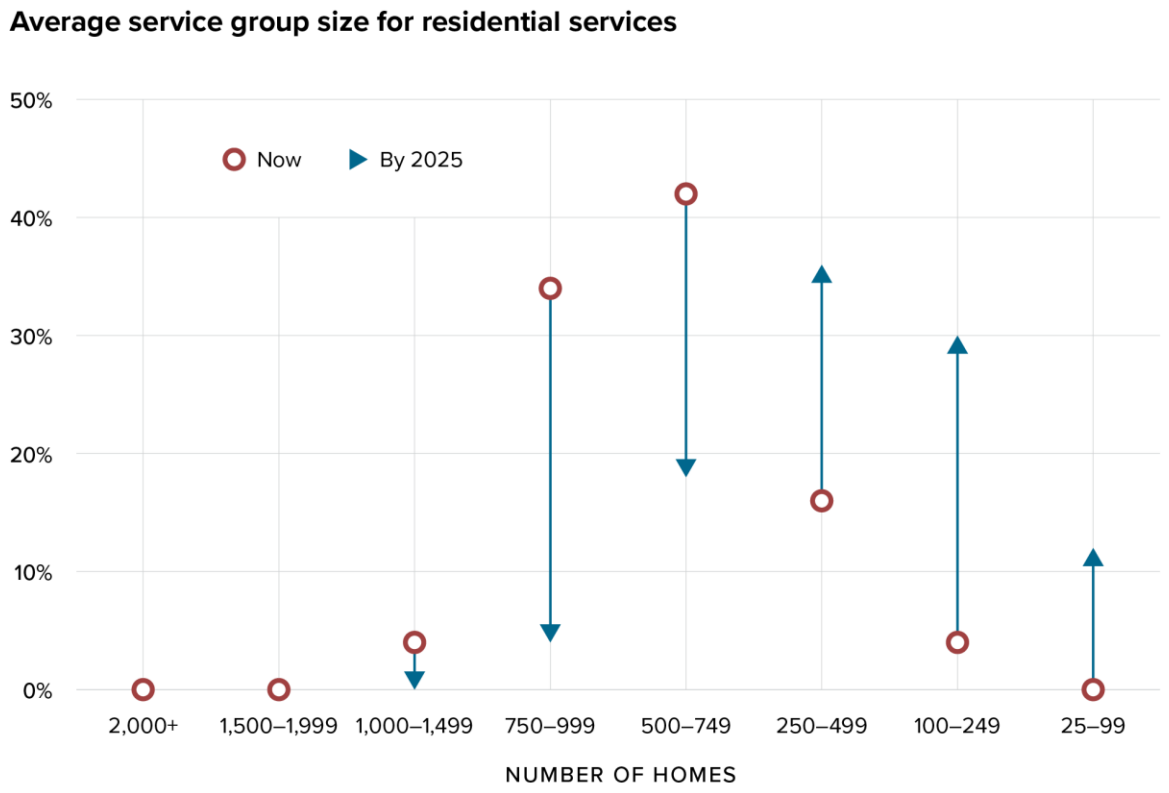

 

## Respondents Continuing to Reduce Service Group Sizes

In addition to inquiring which DOCSIS platforms operators have in place in their networks, we wanted to understand the average size of operators' service groups today—in terms of residential subscribers—and what operators expect the average sizes to be by 2025. Reducing service group size is a critical tool for increasing the amount of bandwidth available to each subscriber in a service group. In the early days of the COVID-19 pandemic, when lockdowns became the norm and teleworking and online education proliferated, operators saw a dramatic increase in both upstream and downstream bandwidth utilization. In response, operators began splitting nodes to reduce service group sizes and allocate more capacity to individual service groups.

As expected, the majority of respondents (42%) said they average between 500-749 homes per service group today, followed by 34% averaging service group sizes of anywhere from 750-999 homes. 16% of respondents average between 250-499 homes, which is becoming more typical in the North American market.

By 2025, 36% of respondents expect to have average service group sizes of 250-499 homes, with an additional 30% planning to average 100-249 homes. Even more interesting than these figures is the fact that 12% of respondents plan to average between 25-99 homes per service group by 2025. Clearly, nearly all respondents see service group size reductions via node splitting as the key to delivering additional bandwidth and capacity to their residential subscriber base.



The expected increase in the total number of service groups, as well as the total capacity delivered to each service group, will drive significant growth in distributed access architectures, including virtual CMTS platforms that can scale quickly to support this additional capacity growth. In the short-term, operators are looking to deliver 1Gbs downstream with anywhere from 35Mbps-100Mbps upstream as their primary residential service offering. With ongoing upgrades to the outside plant to support 1.2GHz spectrum ranges, operators can increase their upstream offerings even before they make the move to DOCSIS 4.0, which is expected sometime later this decade.

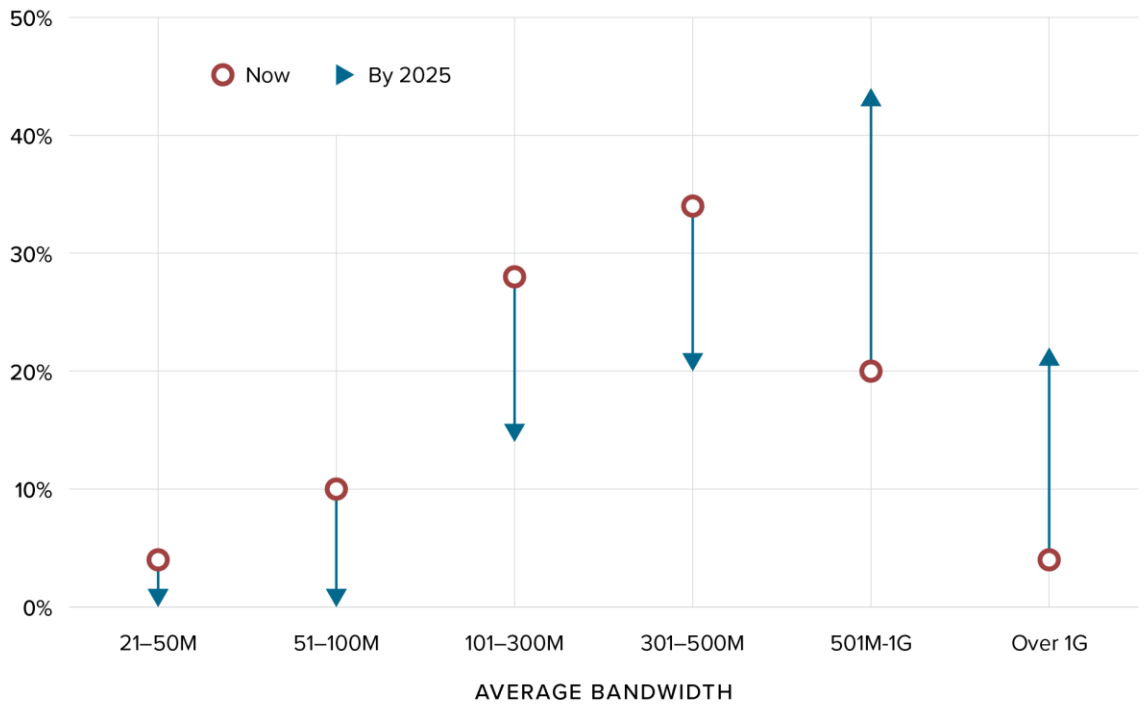
## More Bandwidth The Driver for Reducing Service Group Sizes

The primary driver for reducing service group sizes is to increase the bandwidth available to all subscribers within a particular service group. The smaller the number of subscribers sharing that capacity, the greater the amount of bandwidth available to each of them. Therefore, in addition to determining the average service group sizes both today and expected by 2025, we wanted to know what any changes should mean in terms of downstream bandwidth (from the network to the subscriber). The downstream bandwidth is the advertised speed that customers generally consider when deciding which service provider to use. It is a critical number and one that must continue to increase, especially in the face of increasing competition from fiber providers who, in some regions, already offer multi-gigabit downstream services to differentiate themselves from incumbent cable broadband providers.

34% of respondents provide an average of 301-500Mbps of downstream bandwidth for their residential service offerings. 28% offer 101-300Mbps, and 20% offer 501Mbps-1Gbps. Today, only 4% of respondents offer more than 1Gbps of downstream bandwidth on average.

By 2025, 22% of respondents expect to offer more than 1Gbps of downstream bandwidth, while 44% plan to offer 501Mbps-1Gbps, and 20% plan to offer 301-500Mbps. Clearly, our respondents are moving aggressively in the direction of offering significantly more bandwidth to their residential subscribers.

**Average downstream bandwidth for residential services**




When considering these numbers, please note that we inquired about the average downstream rate offered, which is an estimate of the speeds that subscribers will purchase across a wide range of offerings. By 2025, we expect that most operators will offer a premium service tier of 2Gbps+ downstream, with 1Gbps being the service tier that most subscribers will purchase. Nevertheless, there was still a high percentage of subscribers that prefer a more budget-friendly broadband option that provides them with an average of 500Mbps of downstream bandwidth. This tier will compete against the growing array of fixed wireless and satellite broadband offerings, as well as against any remaining DSL services.

## Distributed Access Architecture Deployments Still in Early Days

The idea of distributing headend or hub site network elements closer to subscribers has been around for many years. Beginning with the M-CMTS architecture as defined by CableLabs in 2005, the separation of the MAC and PHY elements of a CMTS was proposed, ostensibly to reduce the overall system cost and provide cable operators with architectural flexibility in terms of the location of their network elements. Now, with cable operators looking at ways to improve the efficiency and performance of their HFC networks while also increasing the bandwidth they can provide through

node splitting, moving to DAA is becoming a critical tool for improving the overall efficiency and longevity of the HFC plant.

Regardless of the proposed technology, the primary goal of moving to a distributed access architecture is to move the signal from the headend or hub site from analog to digital. Historically, the forward path (downstream) in HFC networks has used analog optics, while the reverse path (upstream) has used a mix of analog and digital optics. Moving to digital optics becomes part of the equation when cable operators are weighing the costs of segmenting or splitting their optical nodes. Most HFC architectures in use today are node +3 to node +5, meaning that the parent node is followed by anything from a 3-5 trunk amplifier, along with 15-25 line extender amplifiers. As noted earlier, operators are continuing to split their nodes to reduce service group sizes while providing significantly more bandwidth, meaning they are likely to move to node +1 or node +2 architectures.

However, with each new node split comes the added cost of new physical nodes, fiber strands, additional optical lasers and receivers in the headend, and more DOCSIS channels at the CCAP. For a growing number of operators, a transition to digital optics and distributed access makes more sense than continuing down the path of node splitting and remaining reliant on analog optics. DAA, which involves placing the PHY or MAC and PHY access layer functions into the optical node or a shelf unit, can provide the following benefits as compared to traditional node splitting:

- Lower-cost digital optics using Ethernet
- Ability to support longer-distance fiber spans
- Ability to support more wavelengths per span
- Higher throughput for DOCSIS 3.1 and 4.0 services

By distributing either the PHY or MAC and PHY functions and pushing RF modulation further downstream, cable operators can:

- Support higher modulation schemes due to higher SNRs (Signal-to-Noise Ratios)
- Reduce the total cost of the HFC plant by moving to digital transport in the fiber portion
- Reduce the operational costs of provisioning Ethernet-based transport links
- More flexibly support the DOCSIS channels by allocating them based on consumption at the node, instead of at the headend

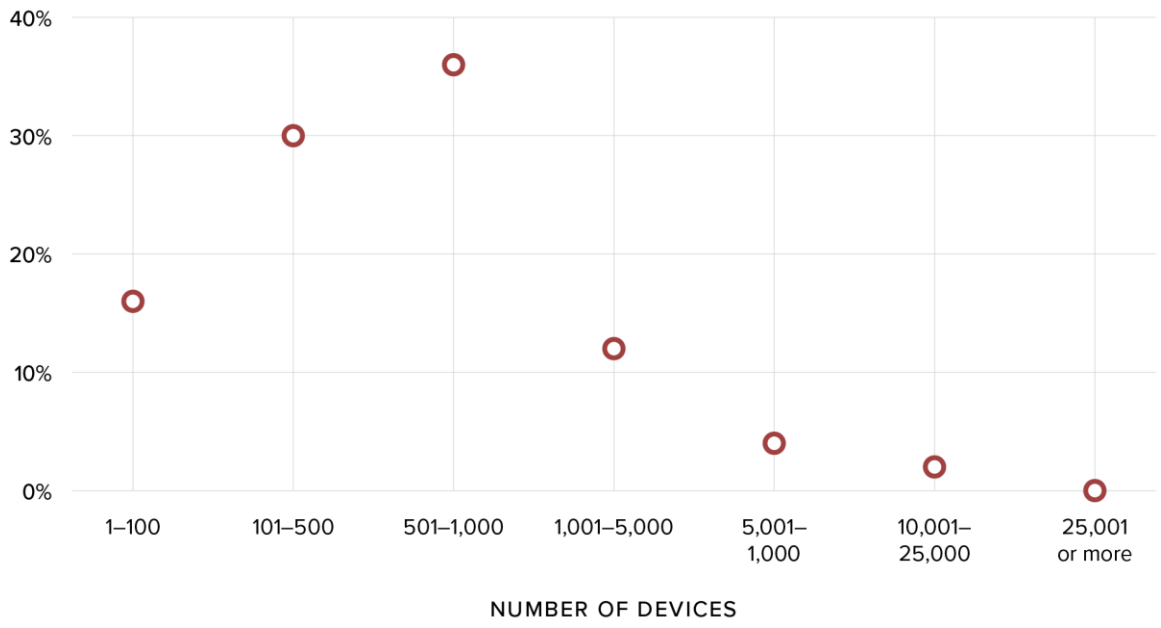
A few years ago, distributed access architectures were expected to be a major portion of cable operator capex spending on their broadband access networks by 2022, replacing the spending on building traditional CCAP platforms and distributing that functionality to node locations in the outside plant. The global pandemic, which shifted operators' priorities to shoring up their upstream

bandwidth on their existing platforms using node splits, put large-scale DAA deployments on hold or, among those operators who remained committed to DAA during the pandemic, slowed the rollouts.

However, we are seeing an increase in spending on DAA platforms of all flavors, and we expect deployments to continue to increase as more operators see the success of large-scale deployments that involve vendor interoperability. Proof that DAA solutions have matured is critical to these technologies being more widely deployed.

We asked respondents how many DAA devices (Remote PHY devices or Remote MACPHY devices) they have deployed in their networks to date. 36% of respondents said they had deployed anywhere from 501-1000 total units in their networks, with an additional 30% saying they had deployed 101-500 units. Further, 16% of respondents said they had anywhere from 1-100 RPD or RMD units in their networks at this time. Only 6% of respondents have 5,000-25,000 DAA nodes in their network today.

**Number of DAA devices (RPDs or RMDs) deployed to date**



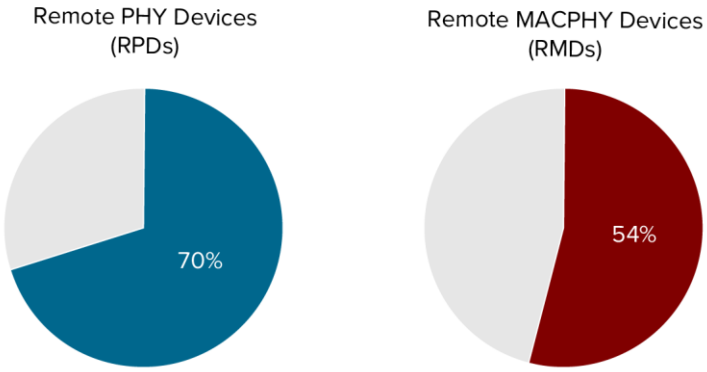

These responses show that DAA deployments are still in their early stages, and there is a significant path for growth for DAA deployments of all flavors, particularly with a growing commitment to DOCSIS 3.1 high-split architectures and, longer term, to DOCSIS 4.0, either in the form of Full Duplex DOCSIS or Extended Spectrum DOCSIS.

As a follow-up question, we asked which DAA technology operators plan to use in their networks by March 2024. We specified that date because we wanted to get a snapshot of what operators expect

to be used principally for their DOCSIS 3.1 networks, as opposed to what they will use in the future for DOCSIS 4.0—we expect to see early deployments of this technology beginning in late 2024 or 2025.

As expected, 70% of operators have or expect to have Remote PHY devices (RPDs) in their networks by March 2024, with 54% expecting to have Remote MACPHY devices (RMDs) in their networks in that time frame.

**Which of the following distributed access (DAA) technologies do you plan to use in your network by March 2024?**




We allowed respondents to select both options because we understand that some operators will use both technologies in their networks, depending on the types of services being deployed, latency requirements, span lengths, MERs (Modulation Error Ratios), and other factors. We are aware of some operators that began their DAA deployments using RPDs but expect to transition to RMDs as product availability and maturity improves. A second-generation chipset is on the horizon for RMDs, which will provide the processing speed and DOCSIS 4.0 support required for installation in operator networks.

## Bandwidth for DAA Node Aggregation Expected to Increase

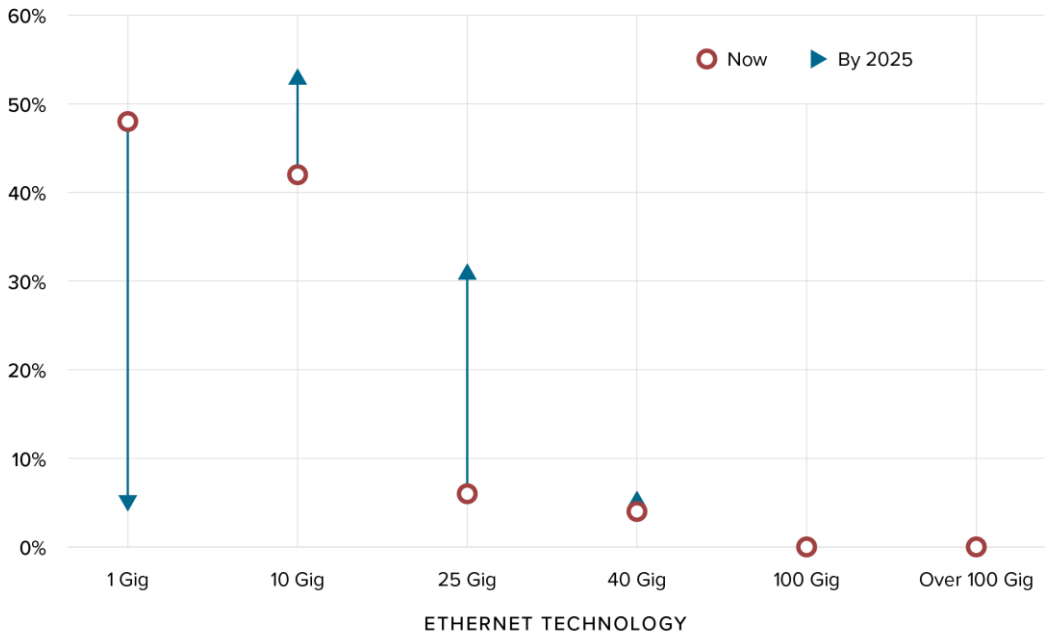
With DAA nodes expected to support an ever-increasing amount of bandwidth, especially as operators use these platforms as part of their DOCSIS 3.1 high-split architectures and their DOCSIS 4.0 deployments, operators will need to upgrade the connections from the headend or hub site. As operators roll out more DAA nodes and move to digital forward and return, we expect them to also move to higher-speed links for the aggregation and transport of data traffic from these nodes.

We asked operators to provide us with the average connection speed in use for the DAA nodes they have deployed today and which average connection speed they will likely average by 2025. Not surprisingly, there was a clear trend toward increasing connection speeds over the course of the next few years.

Today, nearly half of all respondents average 1Gbps Ethernet connections to their DAA nodes, with an additional 42% averaging 10Gbps Ethernet speeds. 6% of operators said they average 25Gbps Ethernet connections, which seems a bit high for an average across an entire node base. However, there is always the possibility that an operator has upgraded those links in anticipation of significant short-term capacity growth at those particular node locations.

By 2025, 54% of respondents expect to average 10Gbps Ethernet connections to their DAA nodes, followed by 32% averaging 25Gbps Ethernet. Only 4% of respondents expect to average 1Gbps Ethernet, meaning that 20 of the 50 respondents expect to transition away from 1Gbps Ethernet as their average connection speed.

**Average network connection technology in use for DAA nodes**

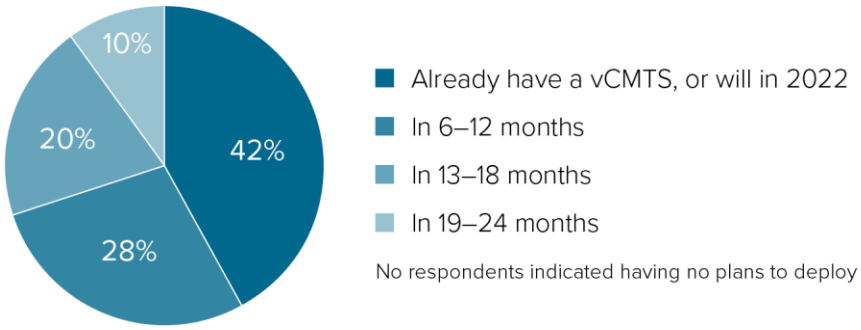


That is a significant shift, which indicates a belief that bandwidth requirements per service group will rise significantly, and that latency requirements will also need to improve. Essentially, significant oversubscription on 1Gbps connections will not suffice, especially when operators move to 204MHz in the upstream spectrum, easily pushing bandwidth to 100Mbps or more.

## All Respondents Expect to Move to a Virtual CMTS (vCMTS)

In a somewhat surprising set of results, all operator respondents said they have already deployed or plan to deploy a virtual CMTS platform within the next 24 months. 42% of respondents said they already have deployed a vCMTS platform in their network, with an additional 28% saying they will deploy a vCMTS platform within the next 6-12 months, and a further 20% saying they will deploy one in the next 13-18 months.

**When do you expect to deploy a virtual CMTS (vCMTS) platform?**




Because of the surprising results generated by this particular question, we decided to follow up with the 15 respondents who said they will be using a vCMTS platform within 13-24 months. We focused on this group of respondents because of the current turmoil in the market and because of the large number of unknowns regarding product availability due to the current supply chain and component constraints.

In a series of prompted responses, we asked the 15 respondents to provide their definition of a vCMTS platform. We provided a prompted list of vCMTS platform options, including:

- A remote PHY device connected to a legacy CMTS for DOCSIS MAC processing
- A remote PHY device connected to a vCMTS, defined as a software-based virtual CMTS running on a server
- A Remote MACPHY device
- Analog nodes pulling RF signals back to cable combining equipment that is served by a remote PHY shelf connected to servers running vCMTS software
- vCore card in a  legacy CMTS served by a remote PHY device
- Other, which was left open for a written response

73% of respondents (11 of 15 respondents) said that they define a vCMTS as a remote PHY device connected to a vCMTS, defined as a software-based virtual CMTS running on a server. This particular definition and architecture are the most common today, so it is not surprising that the vast majority of respondents can be assumed to be following this technological path, as well.

20% of respondents (3 of 15 respondents) define a vCMTS as a remote MACPHY device, which combines DOCSIS MAC and PHY processing remotely in the outside plant. This architecture is gradually becoming more prevalent among cable operators, though product availability remains a concern.

Finally, one respondent defined a vCMTS as a remote PHY device connected to a legacy CMTS for DOCSIS MAC processing. For some operators who had some spare capacity on their existing CMTS/CCAP platforms but also needed to split nodes or replace legacy analog nodes, this option provided a solution without having to migrate immediately to a server-based vCMTS platform.

We also asked the three respondents who defined a vCMTS as a remote MACPHY device about their top concern with the remote PHY architecture, as well as about their top reasoning for wanting to run MAC processing in the node. In both questions, we provided a series of prompts. For the first question regarding the top concern with the remote PHY architecture, the prompts were:

- Cost
- Scalability
- Feature/Functionality
- Operational Complexity
- Latency

All three respondents identified latency as their top concern. This has indeed been a common argument against the remote PHY architecture, primarily due to the need to backhaul signaling and traffic from the remote PHY device to the vCMTS for MAC processing. In some cases, the physical distance between both platforms can be multiple kilometers. So, for some operators who see the

increasing need to support latency-sensitive applications as critical to their overall broadband business, any additional latency introduced into the network is not acceptable.

For the second follow-up question asking these three respondents about their top reasoning for wanting to run MAC processing in the node, the prompted choices were:

- Better capex economics that remote PHY
- Better opex economics than remote PHY
- Easier to manage and operate DOCSIS MAC processing in the node than on servers in the headend
- Better scalability than remote PHY
- Better latency degradation

Very much in line with their previous responses, all three respondents said that their top reasoning for wanting to run MAC processing in the node was because architecture mitigates latency degradation better than remote PHY. Clearly, reducing latency is a top priority for these respondents and is the primary reason for moving forward with remote MACPHY instead of remote PHY.

## Improving the Service Experience for Subscribers Leads vCMTS Business Drivers

As a follow-up question to the timing of vCMTS deployments, we asked respondents to rate a series of prompted business drivers in migrating from a traditional CMTS or CCAP platform to a vCMTS platform. As expected, a few drivers stood out from the others: the goal of providing a better service experience for subscribers was rated a strong driver by 38 of 50 respondents (76%). Along these same lines, providing real-time analytics for better service management and simplifying the provisioning of new services were rated as strong drivers by 68% and 60% of respondents, respectively.

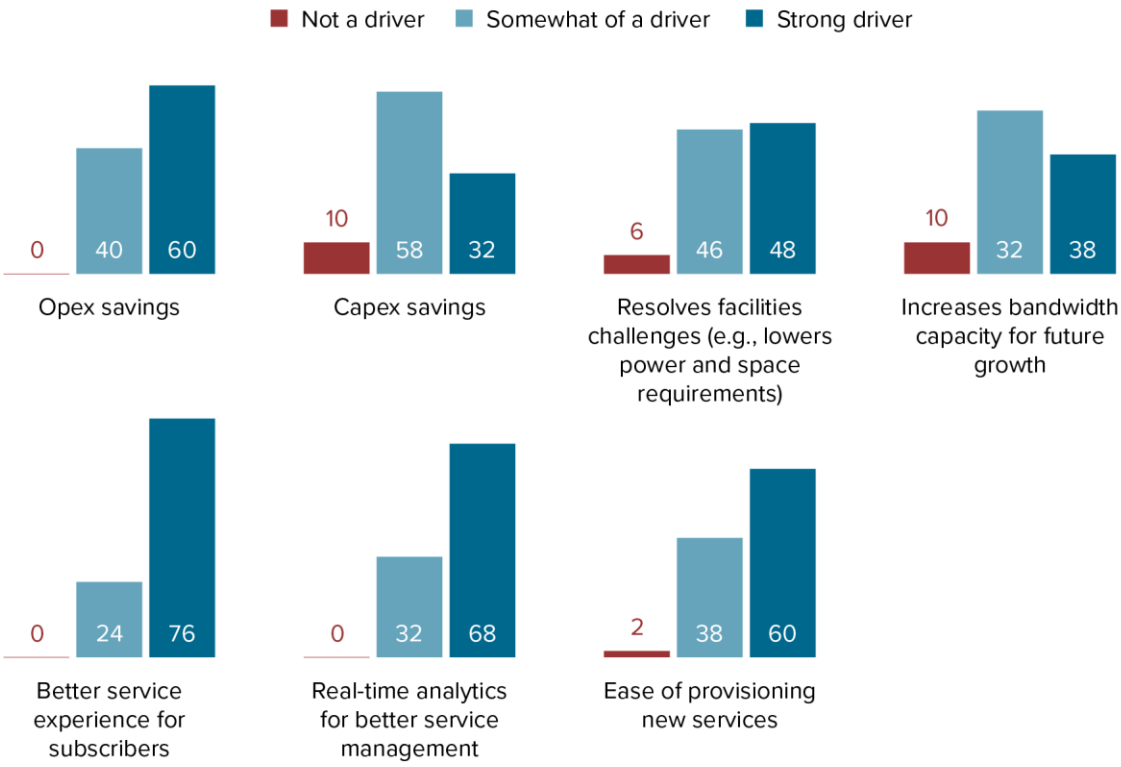
It is well-known in the industry that traditional, integrated CMTS and CCAP platforms have tightly-coupled hardware and software. Though these platforms are stable and reliable, gathering performance data and other telemetry to help understand the impact of traffic flow changes and new service introductions remain a proprietary process.

As cable operators face more competition from fiber overbuilders, and as subscribers' bandwidth consumption and latency requirements change (sometimes on a daily basis), they need to have platforms in place that allow them to quickly respond to network and usage changes. Though vCMTS platforms were initially designed to solve more opex-related issues—such as space constraints in headend locations, reducing power consumption, and eliminating forklift upgrades for integrated platforms that have maxed out backplane or switch fabric capacity—they have evolved to provide

service automation and telemetry functions. Therefore, cable operators need to provide a better overall broadband experience to their subscribers.

The opex-savings driver remains near the top of the list for our respondents, with 60% agreeing that is a strong business driver for their migration. However, it is clear that improving the reliability and responsiveness of broadband service for subscribers is even more important.

**Business drivers in decision to migrate from a traditional CMTS or CCAP to a vCMTS Platform, %**




Q: Please rate the following business drivers in your decision to migrate from a traditional CMTS or CCAP platform to a vCMTS platform (Ratings of 1 through 7 were consolidated; 1+2 = Not a driver; 3+4+5 = Somewhat of a driver; 6+7 = Strong driver).

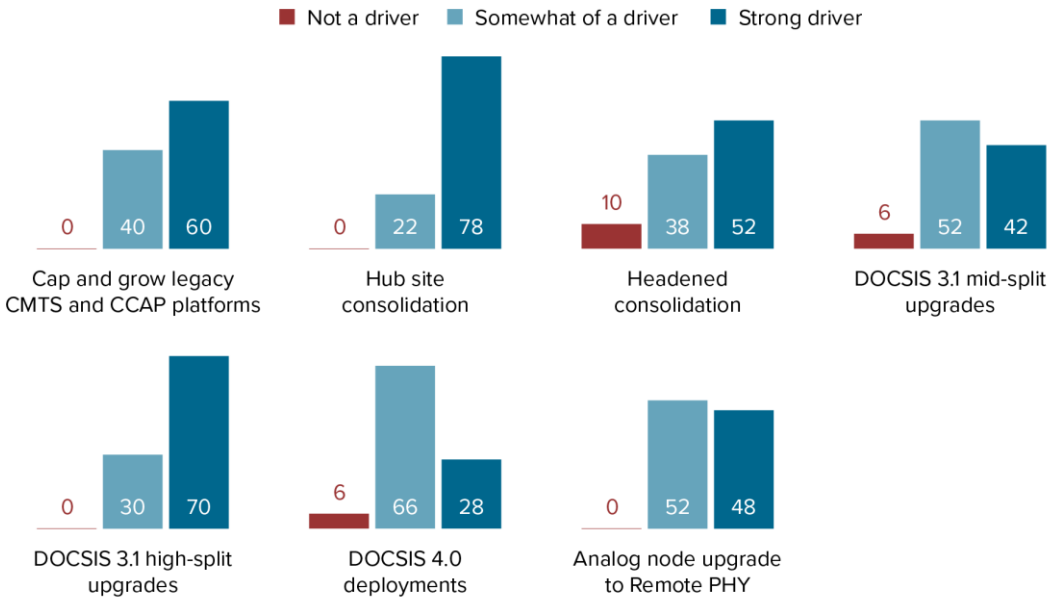

 

## Hub Site Consolidation and DOCSIS3.1 High Splits Lead vCMTS Technical Drivers

Following our question regarding the business drivers for migrating to a vCMTS platform, we wanted to query the specific technical drivers for migrating to a vCMTS platform. Through a series of prompted technical drivers, two responses stood head and shoulders above the others. 78% of respondents said that hub site consolidation was a strong technical driver behind migration to a vCMTS platform, while 70% said that DOCSIS 3.1 high-split upgrading was a strong driver.

Cable operators have been looking to reduce the number of hub sites and secondary headends in their networks to reduce overall real estate costs and simplify and flatten their networks. By moving to a distributed access architecture using a vCMTS platform located in a consolidated headend or data center, combined with remote PHY nodes, cable operators can move control and data plane processing away from the hub sites and secondary headends in which traditional CMTS and CCAP platforms have typically been located. By pushing fiber deeper into their access networks to provide digital forward and return capabilities to DAA nodes, operators can extend spans without losing signal quality, all while bypassing traditional hub site locations. Along these lines, 52% of respondents mentioned that headend consolidation was a strong driver for migrating to a vCMTS platform. We assume in this context that these responses refer to secondary headends, as we did not specify which type of headend in the survey.

**Technical drivers in decision to migrate from a traditional CMTS or CCAP to a vCMTS Platform, %**




Q: Please rate the following technical drivers in your decision to migrate from a traditional CMTS or CCAP platform to a vCMTS platform (Ratings of 1 through 7 were consolidated; 1+2 = Not a driver; 3+4+5 = Somewhat of a driver; 6+7 = Strong driver).

DOCSIS 3.1 high-split upgrade projects are already underway or are planned at dozens of major operators in the North American and Western European markets. These projects, which extend the upstream split from 42MHz to 204MHz, add significant upstream capacity to better compete with fiber operators' symmetric service offerings. In conjunction with the transition to high-split, many operators are upgrading their amplifiers to support up to 1.2GHz of the spectrum, which adds more available capacity.

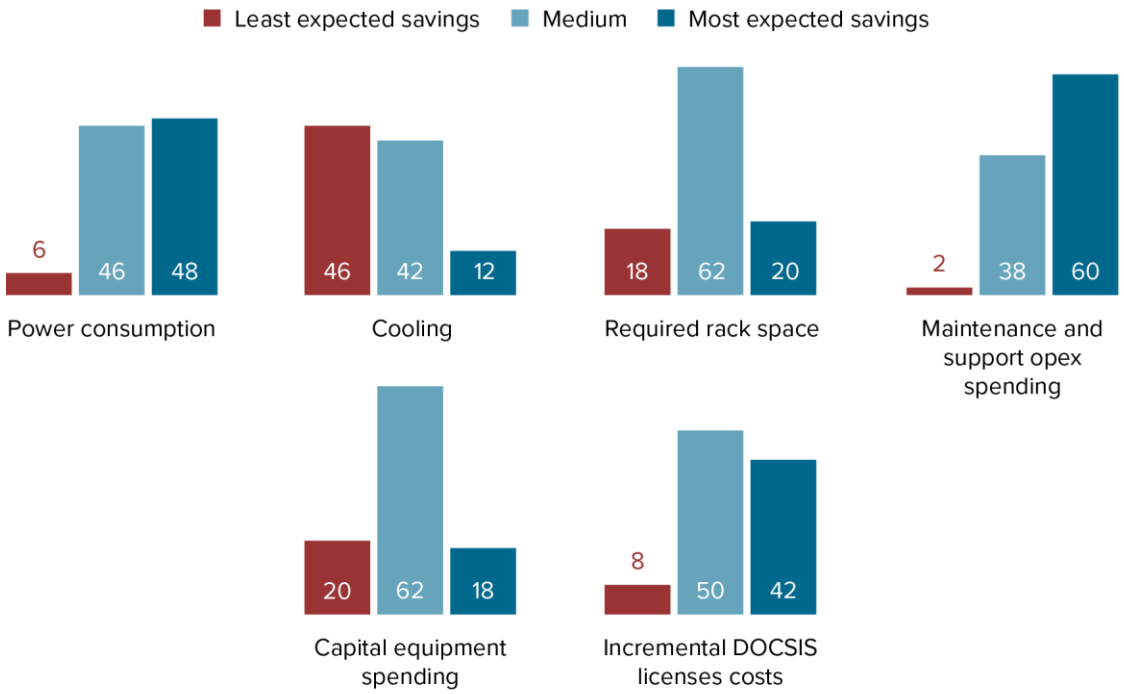
To reap the full benefits of these upgrades, operators are swapping out their legacy HFC nodes with remote PHY devices to improve MERs and signal-to-noise ratio (SNR). In some cases, operators are adding in RPDs in existing amplifier stations and reducing their total amplifier numbers and network architectures from node +5 to node +4. With a vCMTS platform in place, operators can quickly add new RPDs without having to worry about scaling service groups and/or capacity per service group.

## Less Consensus on Expected Cost Saving from vCMTS Platforms

While there was a consensus among our respondents on the business and technical drivers behind migrating to a vCMTS platform, when asked about the cost savings expected from migrating to a vCMTS platform, there was less consensus about where operators expected to reap the biggest savings. In a series of prompted responses, we asked operators to rank from 1 to 7—with 1 being the most expected cost savings and 7 being the least expected cost savings—the factors they expected would contribute to cost savings achieved by migrating to a vCMTS platform.

60% of respondents said they expected to see the most cost savings in maintenance and support opex spending. Traditional integrated CMTS and CCAP platforms, like most hardware-based networking platforms, have always carried with them costly service and support contracts that were required as part of the product's initial purchase. This cost is the major reason that network operators are keen to move to server-based platforms. These virtualized platforms also require maintenance and support contracts; however, the pricing is often considerably less than traditional, integrated CCAP platforms, because the hardware on which they are based is not proprietary.

**Expected cost savings when migrating to a vCMTS platform**




Q: Please rank from 1 to 7 the following areas of expected cost savings when migrating to a vCMTS platform.
(Rankings of 1 through 7 were consolidated: 1+2 = most expected cost savings; 3+4+5 = medium; 6+7 = least expected cost savings).

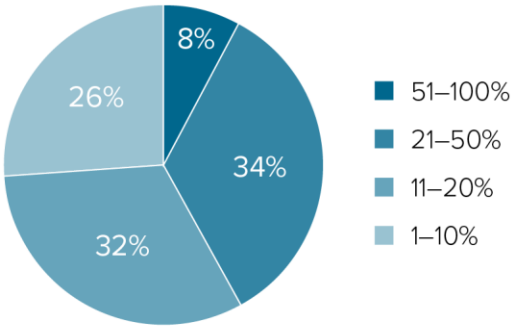
Along those lines, 52% of respondents said they expect to see the most cost savings from incremental DOCSIS license costs. This has been a contentious subject for cable operators and their CMTS and CCAP vendors. Historically, operators would have to pay up-front for new DOCSIS licenses when they split nodes and increased service groups. The operator assumed all the risk by having to purchase the capacity and any associated maintenance agreements before they had any indication of taking rates, and, ultimately, realizing ROI on their investment.

Cisco eventually alleviated this issue by offering its customers a more flexible licensing model (IBU, or Infinite Broadband Unlocked) based on bandwidth used by subscribers, measured on a quarterly basis. However, not every CMTS/CCAP vendor followed suit equally.

vCMTS platform DOCSIS licensing follows a similar model: cable operators purchase capacity based on the number of service groups supported (with each RPD roughly equivalent to a single service group), with the initial purchase plus a total amount of capacity that is available within the initial server configuration, which the operator pays for only when additional service groups turn up. So, technically, additional DOCSIS license costs are tied only to the bandwidth being used, not based on forwarding projections of bandwidth utilization.

In a follow-up question to cost savings expectations, we asked operators to quantify the total cost savings of a vCMTS platform versus a traditional CMTS or CCAP platform over similar product life spans. Admittedly, this is a difficult question to answer, as it requires considering a number of factors and projecting those factors over the course of 5-7 years, the typical lifespan of these platforms. Because of this, it was not unusual to see that our respondents were conservative in their estimations of total cost savings, with 34% saying they would expect cost savings of anywhere from 21-50%, with 32% saying 11-20%, and 26% saying just 1-10%.

**Over similar product lifespans, how much cost savings is possible when migrating from a legacy CMTS or CCAP to a vCMTS?**




Finally, in a follow-up question to cost savings expectations, we asked the 16 respondents who said they expected to see only an 11-20% cost savings from moving from a legacy CMTS to a vCMTS platform what their biggest concerns are that might prevent greater cost savings. We provided the following response options to each of the 16 cable operator respondents and asked them to identify their biggest concerns:

- Software capital cost
- Software maintenance cost
- Server capital cost
- Labor costs to operate and manage software running on servers
- Migration costs

31% of the 16 respondents said that the software capital costs are the biggest concern and the biggest reason for their belief that vCMTS cost savings would be limited. For decades, traditional CMTS and CCAP vendors charged for DOCSIS licenses both up-front and then as new capacity was added on those platforms. In many cases, operators felt like they were being double-charged simply to add new capacity. Over time, licensing models changed to focus solely on capacity as it was added, not paid up-front. Nevertheless, there clearly remains some concern that vCMTS licensing models won't be any different. Along those lines, an additional 13% of respondents said that the software maintenance costs were their biggest concern. So, that means that nearly half of the 16 respondents

said their biggest concern was overall software costs, whether in the initial capital outlay or ongoing maintenance costs.

25% of respondents said that migration costs are their biggest concern. This result is not surprising as the switch from one platform to another always involves risks—both known and unknown. This is especially true among cable operators, who have historically relied on the same platforms and the same vendors for decades.

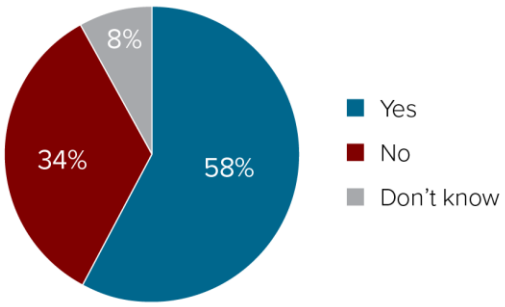
Finally, 19% of respondents said that the capital costs for vCMTS servers were their biggest concern. Again, cable operators are familiar with the cost of the traditional CMTS and CCAP platforms they have relied on for years. Servers, though generally always less expensive than proprietary hardware, are still relatively novel in the area of broadband access. In many cases, operators are still familiarizing themselves with the number of servers required to support an average number of service groups. Thus, there are likely cases where respondents just don't know if they will require 5 or 25 servers.

## vCMTS Platforms Compare Favorably to Legacy Platforms, But Still Have Room to Improve

In addition to the business and technical drivers for migrating to a vCMTS platform, we wanted to hear from respondents whether current vCMTS solutions, from a features perspective, are equal to traditional CMTS and CCAP platforms. If so, in which areas do these platforms excel?

In an unprompted question, we asked whether the vCMTS solutions available on the market today have reached parity in terms of features with legacy CMTS and CCAP platforms. 58% of respondents agreed that vCMTS platforms have reached parity, while 34% said they have not yet reached parity. Four respondents said they did not know or were not comfortable making a determination.

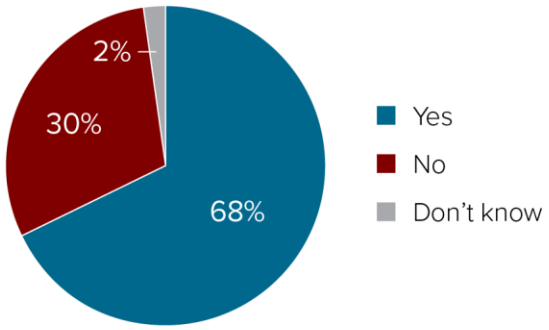
**Do you believe that vCMTS solutions available on the market today have reached parity in terms of features with legacy CMTS and CCAP platforms?**



Though we did not ask in which areas vCMTS platforms fall short, we assume that some carrier-class functions, including redundancy and failover, remain a work in progress for these platforms. These capabilities are often a concern among operators in the early stages of moving to server-based platforms and away from highly-integrated hardware and software platforms.

As a follow-up, we did ask whether operators believe that a vCMTS platform provides more granular analysis of, and more control over, their DOCSIS service delivery platform than a legacy CMTS or CCAP platform. 68% of respondents said that vCMTS platforms provide for more granular analysis, while 30% said these platforms do not necessarily provide a more granular analysis. These results correspond with our earlier findings regarding business drivers for migrating, as 68% of respondents said that the advanced telemetry capabilities offered by vCMTS platforms were a strong business driver for migrating.

**Do you believe that a vCMTS platform provides more granular analysis of, and more control over DOCSIS service delivery platform than a legacy CMTS or CCAP platform?**

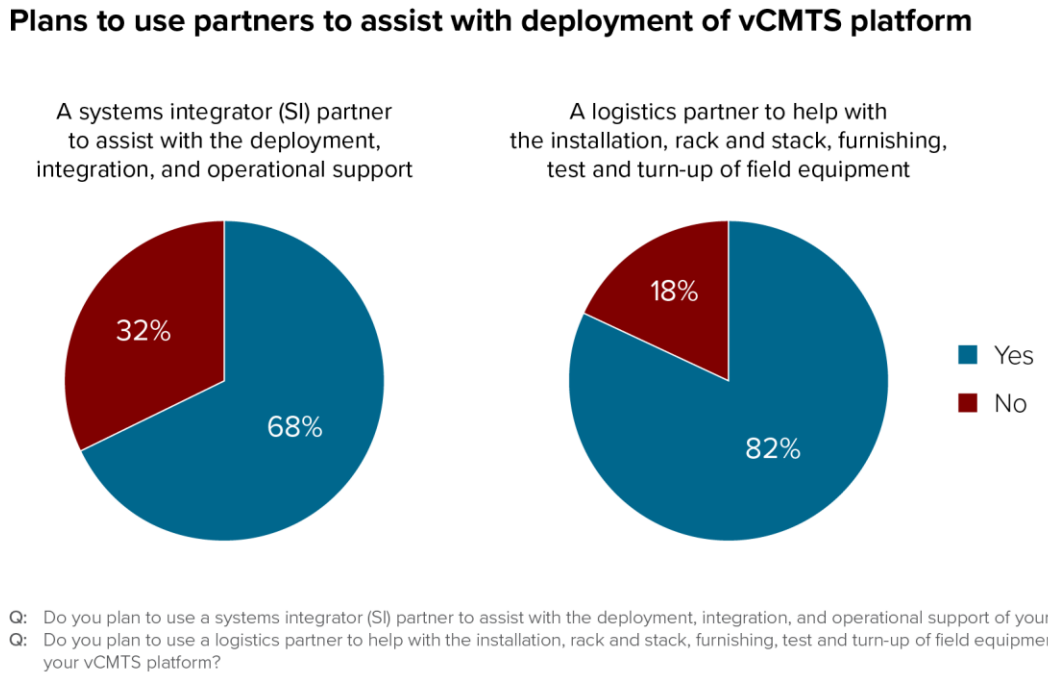



## Operators Planning to Use SI and Logistics Partners for vCMTS and DAA Deployments

Given that the deployment of vCMTS, RPDs, and RMDs involves new procedures and processes beyond the traditional method of adding capacity by splitting nodes and purchasing CMTS DOCSIS licenses, we wanted to understand how many operators were planning to work with systems integrators or other logistics partners to facilitate the deployment of these new platforms.

68% of respondents said they are using, or plan to use, a systems integrator (SI) partner to assist with the deployment, integration, and operational support of their vCMTS platform. Historically, operators have relied heavily on vendor partners for systems integration support, so these results

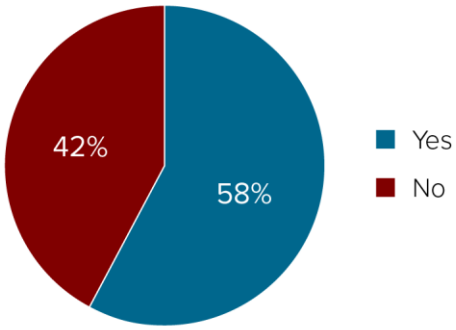
are not surprising. We see this trend reflected in the steady increase in service revenue reported by Harmonic and other vendors supplying cable operators with DOCSIS equipment.




82% of respondents said they plan to work with a logistics partner to help with the installation, rack and stack, furnishing, test, and turn-up of field equipment associated with their vCMTS platforms. We assume here that filed equipment includes any RPDs that are deployed in node housings or headends as shelf units. Again, these results are not surprising, especially given the current constraints on labor, and the need for cable operators to address capacity issues quickly in the face of new competition from fiber overbuilders.

Finally, we asked operators if they felt that vendor support solutions for vCMTS platforms have reached parity with those associated with legacy CMTS or CCAP platforms. Understandably, given that most operators are still in the early stages of their vCMTS platform rollouts, there is less consensus on whether vendor support is the same as that experienced for platforms that have been in networks for decades. Best practices are still being developed for vCMTS installations and configurations, while those for legacy CMTS and CCAP platforms have been documented for years now. 58% of respondents said that vCMTS support had reached parity, while 42% said such support had yet to reach parity. Should we conduct this survey again next year, the results would undoubtedly move in the direction of reaching parity. The development of best practices is simply a matter of time.

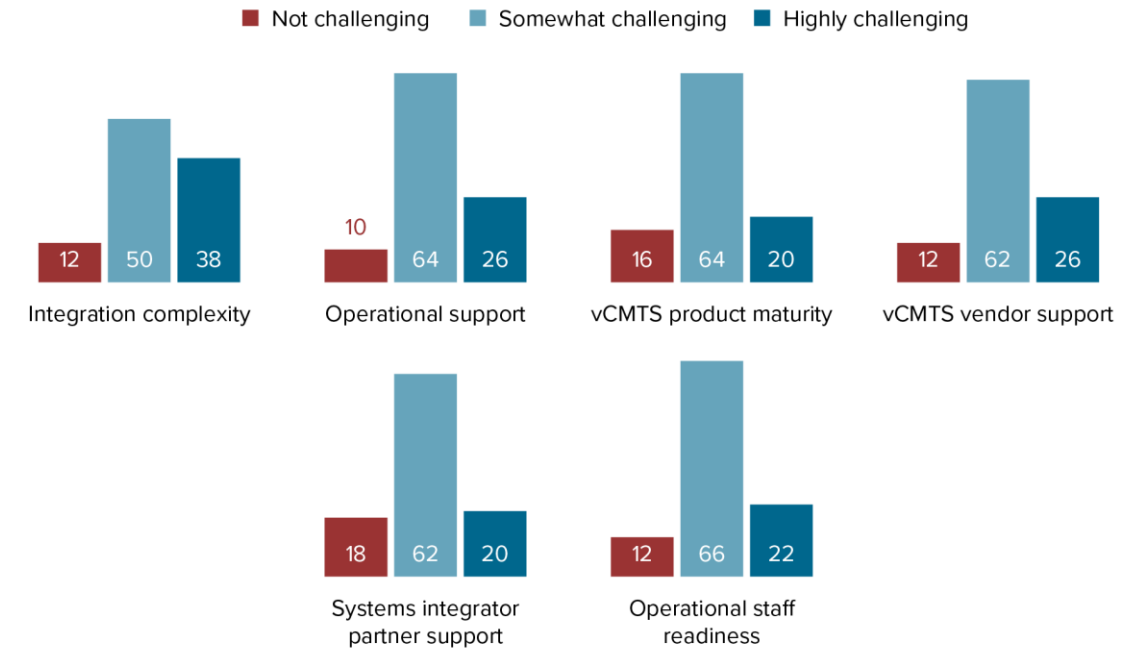
**Have the vendor support solutions for vCMTS platforms reached parity with those associated with legacy CMTS or CCAP platforms?**




## vCMTS Platform Integration Leads Migration Concerns

Because vCMTS platforms are relatively new when compared with legacy CMTS and CCAP platforms, operators are naturally inclined to have some concerns about how to integrate these platforms into their networks without disrupting their present mode of operations. In a prompted question, we asked respondents to rate a series of challenges they have had, or foresee having, when migrating from a traditional CMTS or CCAP platform to a vCMTS platform.

**Challenges in migrating from a traditional CMTS or CCAP to a vCMTS platform, %**




Q: Please rate the following challenges in migrating from a traditional CMTS or CCAP platform to a vCMTS platform. (Ratings of 1 through 7 were consolidated: 1+2 = not challenging; 3+4+5 = somewhat challenging; 6+7 = highly challenging).

There was not consensus on any of the options being a strong driver. Concerns about integration complexity led to the responses, with 38% of operators saying it is highly challenging. Along these lines, operational support was rated as highly challenging by 26% of respondents. Similar to responses regarding vendor support solutions and whether vCMTS support solutions had reached parity with traditional CMTS and CCAP platforms, the development of best practices for vCMTS platforms is clearly still a work in progress. Some operators have already widely deployed vCMTS platforms; however, it will take time for their experiences to proliferate throughout the industry and result in a clear set of best practices for others to follow.

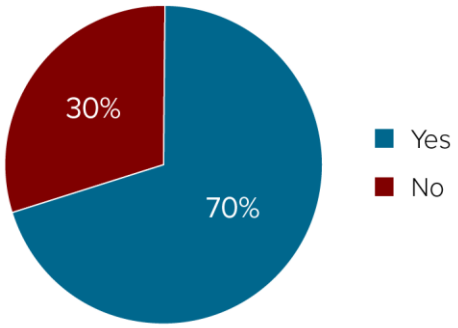
## Majority of Respondents Prioritizing Network Virtualization

For many cable operators, migrating to a vCMTS platform is one of the first steps in a larger process of evolving their overall networks to include more virtualization. The benefits of vCMTS platforms in terms of improving the overall subscriber experience, and improving telemetry and service automation, can ultimately be incorporated throughout their networks. But for some operators, migrating to a vCMTS platform addresses immediate operational concerns, including headend and hub site space constraints.

We asked operators whether overall network virtualization is a priority for their organizations, or whether the deployment of a vCMTS was more about addressing immediate operational needs, with virtualization being a more distant goal.

According to 70% of our respondents, network virtualization is a priority for their organizations and executive teams. For the remaining 30%, virtualization is not a priority.

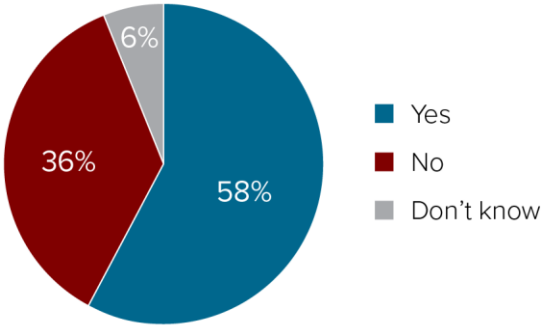
**Is network virtualization a priority for your organization and executive team?**



These results match our expectations, though we expected the implementation of virtualization to be less clear. Cable operators have historically evolved their networks gradually and incrementally. A wholesale shift to virtualization is a significant change in direction, involving both technological change and cultural change within the organizations. The important takeaway here is that operators do intend to prioritize virtualization, even though the implementation might be more challenging.

As a follow-up question, we asked operators whether their organizations are comfortable with network virtualization, SDN, and NFV in the context of broadband services. Somewhat corroborating the point we established above regarding the implementation of virtualization, 58% of respondents said their organizations are comfortable with the key elements of virtualization. So, there is some discrepancy between prioritization and implementation.

**Is your organization, including the engineering and operations staff, comfortable with network virtualization, software-defined networking (SDN) and network functions visualization (NFV) in the context of broadband services?**




## Respondents Planning to Work with a Cloud Service Provider Partner

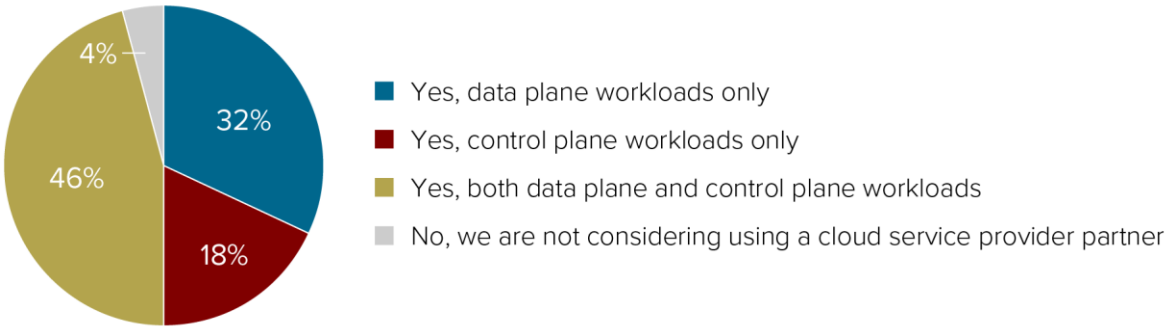
For some operators, one of the benefits of network virtualization is the ability to partner with hyperscalers or cloud providers to offload some combination of the control and data plane workloads. These providers specialize in scaling their networks to support increasing workloads originating from their network operator partners, to enable those organizations to focus on ensuring the performance of their outside plant, underlying transport networks, and device and subscriber management.

Such partnerships are not possible for every operator, as some would like to maintain control over all control and data plane workloads. Some operators will conduct overall migration to network virtualization that involves the complete transformation of their headends into data centers, with

systems integrator partners handling any outside plant work. There are many options available for network operators, but each starts with the virtualization of some key parts of their networks.

We asked operators whether they are considering using a cloud service provider partner for hosting their vCMTS data plane and/or control plane workloads. 46% of respondents said they plan to partner with a cloud service provider to offload both control and data plane workloads. 32% of respondents said they will offload data plane workloads only, while 18% said they plan to offload control plane workloads only. Out of 50 operator respondents, only 2 said they currently have no plans to partner with a cloud service provider.

**Are you considering using a cloud service provider partner for hosting your vCMTS data plane and/or control plane workloads?**

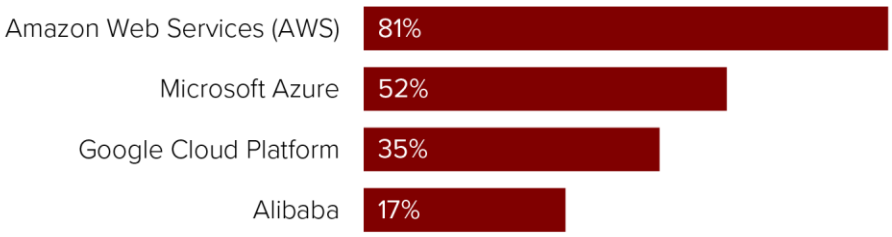



We found these results interesting, as we did not expect such a high percentage of operators to be considering working with cloud service providers. We expected a more even split between those partnering and those not choosing to do so, as our conversations with operators have typically been split between those who see partnering as a key aspect of their overall virtualization strategy and those who don't. We note, however, that makes sense that smaller cable operators would offload vCMTS functions to a cloud partner, especially in recent times when labor shortages remain a constant challenge.

As a follow-up question, we asked operators to share which cloud partner providers they would consider working with to host their vCMTS workloads by selecting from a prompted list of providers.

AWS (Amazon Web Services) was selected by 81% of operators, followed by Microsoft Azure with 52%, and GCP (Google Cloud Platform) with 35%. These results were expected, as AWS has been aggressively courting both cable operators and vCMTS platform providers to host their workloads. AWS has expanded its service provider organization significantly, and the effort has resulted in AWS' clear leadership among our respondents.

**Which cloud service provider partners are you considering to host vCMTS workload?**




## Respondents Planning to Evolve to FMA (Flexible MAC Architecture)

As defined in the CableLabs Flexible MAC Architecture (FMA) specification, the traditional CCAP and current vCMTS platforms are standardized and further disaggregated into separate elements providing for management, control, and data plane functions. This disaggregation and standardization allow for vendor interoperability across all of the back-office elements and network platforms that an operator might deploy. One of the primary goals of FMA—beyond the further disaggregation of the tightly-integrated CCAP—is to provide a network architecture that can be configured through APIs, and can deliver telemetry based on RESTCONF/YANG interfaces, and can provide more feature and service automation through SDN and NFV.

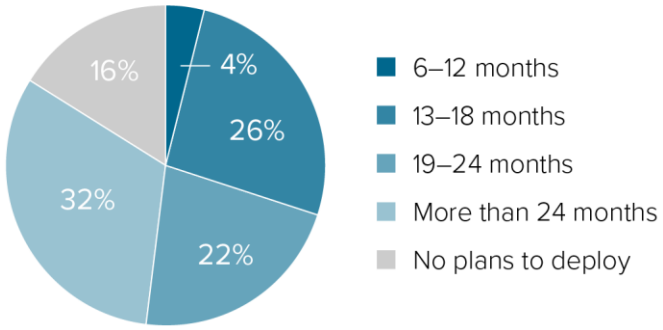
The core components of FMA are the MAC Manager, the PacketCable Aggregator, Video Cores, OOB (Out-of-Band) Cores, Core Timing Devices, and Core Access Devices. Each of these elements could become containerized functions of a single vendor's existing vCMTS platform, or they could be provided by multiple vendors in a best-of-breed approach, since the functions and interfaces are all intended to be standardized.

Arguably the most important component of FMA is the MAC Manager. The MAC Manager aggregates MAC NEs (Network Elements), which could be remote PHY devices, remote MACPHY devices, or remote OLTs. The MAC Manager makes those collective elements look like an integrated CCAP device to the northbound OSS and other control plane elements. The MAC Manager collects all information from the southbound network elements, including state configuration and telemetry data. The southbound interfaces are based on RESTCONF and YANG, while NETCONF is defined as the primary northbound interface.

Since today's vCMTS platforms are likely to be the first to be disaggregated into the various FMA elements mentioned above, we wanted to understand operators' expectations regarding when they plan to deploy any of these FMA components. Understandably, this is a highly speculative question, since the components are still being defined and implemented, so timing is difficult to predict.

Nevertheless, 32% of respondents said they expected to deploy a MAC Manager, DOCSIS Controller, or any of the other FMA components in 24 months or more. Given our understanding of the current availability of other DOCSIS 4.0 components, this estimate seems the most accurate, though an estimate of two years to something beyond two years could range anywhere from 2 to 5+ years.

**When do you expect to begin deploying a DOCSIS Controller, SDN Controller, MAC Manager or PacketCable Aggregator solution as part of a Flexible MAC Architecture (FMA)**

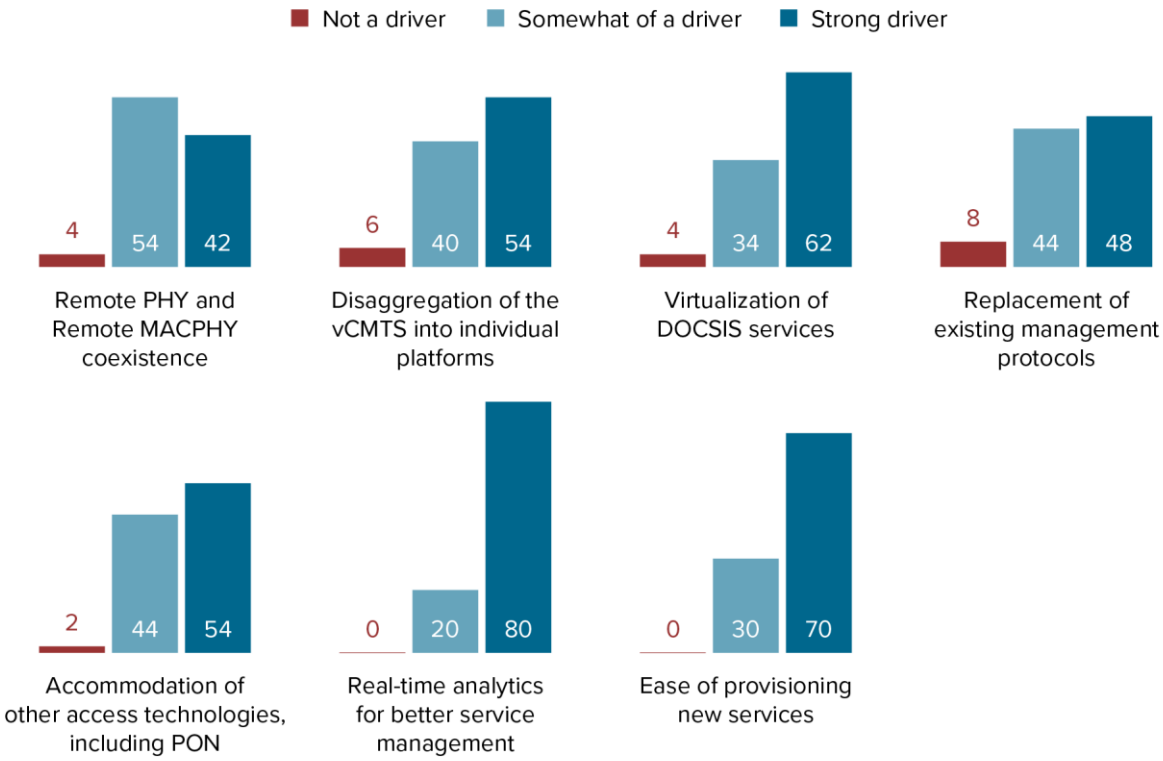



52% of respondents said they would deploy one of the FMA components within the next two years. These responses also seem reasonable, especially if the operators have had vCMTS platforms in place for some time. The phased introduction of FMA components seems likely, as operators begin the long-term transition to DOCSIS 4.0. The FMA buildout does not depend on DOCSIS 4.0, so the process can begin when the components become available.

Finally, 16% of respondents said they had no plans to deploy any of the FMA components. For these operators, either the timing or the utility of FMA remains unclear at the moment, so additional definition and clarification around the benefits must occur.

As a follow-up to our question regarding FMA component timing, we also wanted to understand why operators were considering moving to FMA. Consistent with their responses regarding drivers for migrating to vCMTS platforms, 80% of respondents said that the addition of real-time analytics for better service management is a strong driver for them to migrate to FMA. This is followed closely by the ease of provisioning new services, which was rated a strong driver by 70% of respondents, and the virtualization of DOCSIS services, which was rated a strong driver by 62% of respondents.

**Technical drivers in the decision to migrate to a Flexible MAC Architecture, %**




Again, the key theme in the migration away from tightly-coupled, integrated network platforms to distributed, virtualized platforms is the positive impact that such a move is expected to have on operators' ability to deliver new services and respond more quickly to subscribers' needs based on enhanced programmability, telemetry, and data collection functions.

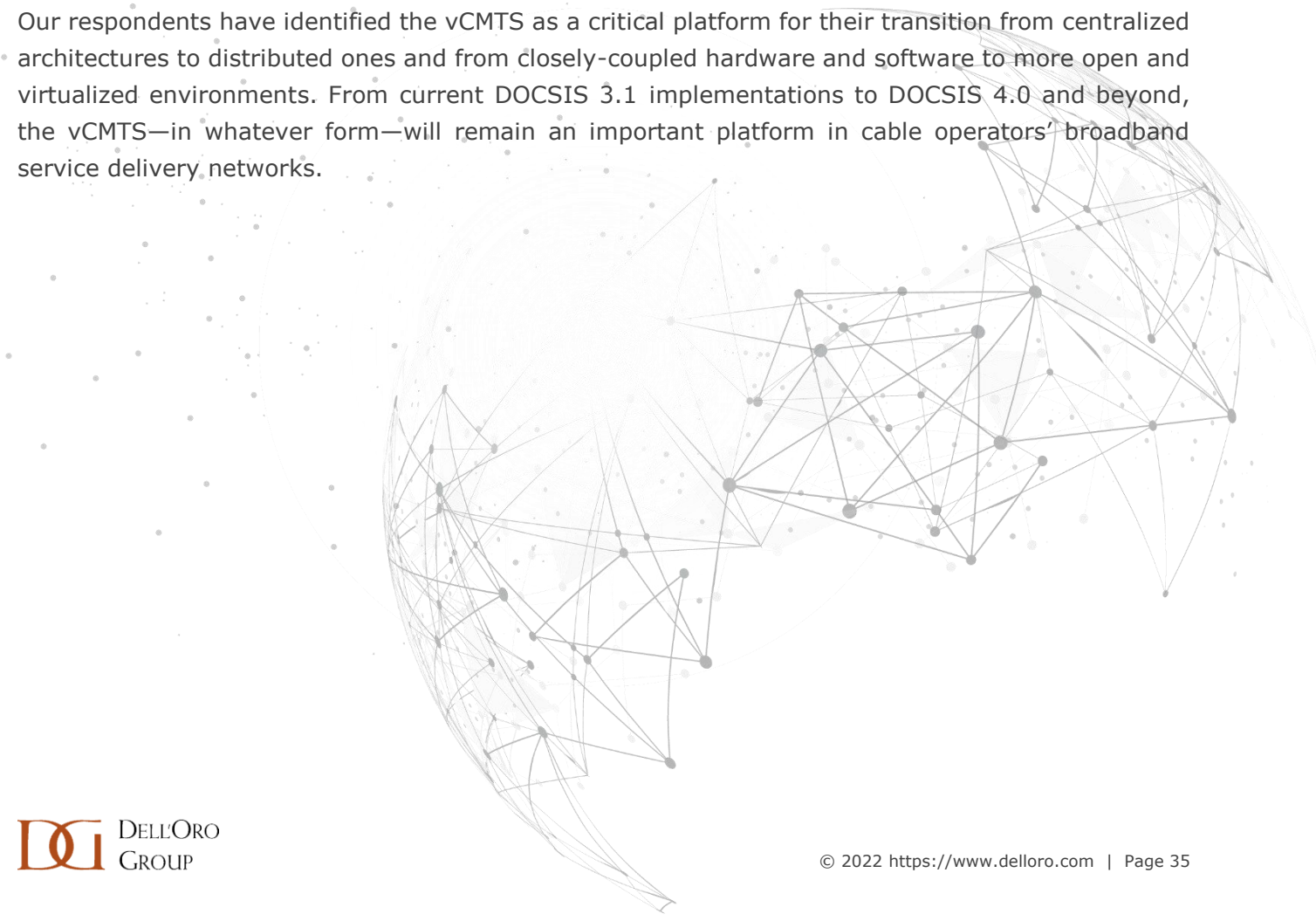
## Conclusion

As global cable operators continue to increase their broadband speeds and services by distributing more intelligence throughout their access networks, they are also moving down the path towards network virtualization. Their long-term goal is to have broadband networks that can adapt to application and service requirements in real-time, while also anticipating network outages and minimizing their impact on subscribers. At the center of this transformation is the vCMTS, both in its current form and its own evolution into modular, containerized functions, including the MAC Manager, PacketCable Aggregator, and other elements.

Today's vCMTS helped operators solve their current challenge of expanding bandwidth by reducing service group sizes and scaling the control and user planes to support that expansion. Tomorrow's vCMTS will continue to help able operators scale not only across their HFC plant, but also their Greenfield fiber networks, giving them far more flexibility than they have had in the past.

Additionally, cable operators are benefiting from the increased telemetry functions of vCMTS platforms, giving them far more insight into the performance of their platforms and their access networks. Ultimately, broadband speed offerings will decline in importance, giving way to other KPIs, such as network uptime and latency, as critical reference points for subscribers choosing between multiple ISPs.

Our respondents have identified the vCMTS as a critical platform for their transition from centralized architectures to distributed ones and from closely-coupled hardware and software to more open and virtualized environments. From current DOCSIS 3.1 implementations to DOCSIS 4.0 and beyond, the vCMTS—in whatever form—will remain an important platform in cable operators' broadband service delivery networks.



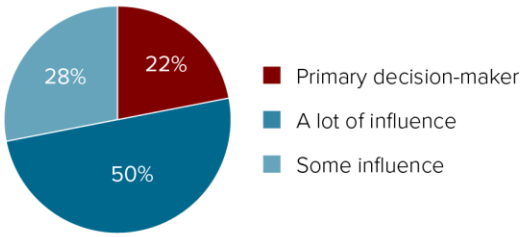
## Methodology

From January to March 2022, Dell'Oro Group conducted an online and telephone survey of 50 global cable operators that have broadband networks and provide residential broadband services.

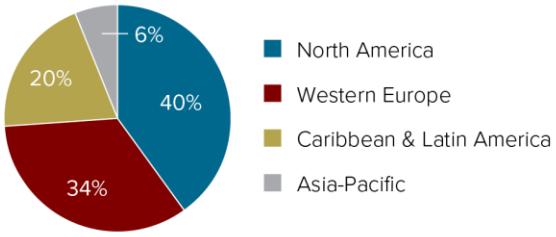
The survey focused on cable reporters around the world, with a heavier weighting given to operators in the North American and Western European markets. On average, these operators have the largest residential broadband subscriber bases, and their scale and size typically determine the technology direction of the entire cable industry. However, our survey also captured respondents from outside these regions, with respondents from the Asia-Pacific and Caribbean and Latin American markets. The regional distribution of respondents for the survey was 40% from North America, 34% from Western Europe, 20% from the Caribbean and Latin America, and 6% from Asia-Pacific. When surveying operators' specific plans for technology selection and adoption, regional distribution is critical to understanding the different competitive, regulatory, and service revenue expectations that drive the timing and adoption of particular technologies.

**Survey participants demographics**

Level of influence in planning and making purchase decisions for CCAP, Virtual CMTS, and DOCSIS access infrastructure at the company




Regional distribution of respondents




**100%**

have detailed knowledge of Virtual CMTS, CCAP, or other DOCSIS infrastructure platforms for the company

**Job titles:**

C-Level Executive **12%**

Vice President **30%**

Director **58%**

**Q:** How would you describe your level of influence in ... ?
**Q:** Do you have detailed knowledge of ... ?
**Q:** What is your job title at the organization?

The influence of individual respondents on their companies' technology and business strategies is just as important as the regional distribution of these companies. 100% of the specific individual respondents in our survey have some level of influence in the planning and purchase decision process

for the CCAP, Virtual CMTS, and DOCSIS access infrastructure for their companies. 22% are the primary decision-makers, and 50% have a significant influence on the purchasing process. 100% of the survey respondents are at the director level or above, with 30% serving as VP-level executives and 12% serving as C-level executives. In other words, 100% of the survey respondents have detailed knowledge of the strategies related to the CCAP, virtual CMTS, or other DOCSIS infrastructure platforms at their respective companies.

The integrity of these metrics is critical to ensuring that the respondent base for our survey includes the individuals who have the ability to directly influence and impact their companies' broadband network technology strategies.

## About Author

**Jeff Heynen** Jeff Heynen joined Dell'Oro Group in 2018, and is responsible for the Broadband Access and Home Networking market, Fixed Wireless Infrastructure and CPE market research programs. Mr. Heynen has expanded the Broadband Access and Home Networking areas to include fixed wireless CPE, virtual CCAP, Remote PHY, remote MACPHY, and DOCSIS 4.0 infrastructure. Mr. Heynen has written articles and white papers, and his research and analysis have been widely cited in leading trade and business publications. Mr. Heynen is a frequent expert judge and invited speaker at industry conferences and events

Email: jeff@delloro.com

## About Dell'Oro Group

Founded in 1995 with headquarters in the heart of Silicon Valley, Dell'Oro Group is an independent market research firm that specializes in strategic competitive analysis in the telecommunications, networks, and data center infrastructure markets. Our firm provides world-class market information with in-depth quantitative data and qualitative analysis to facilitate critical, fact-based business decisions. Visit us at www.delloro.com.

## About Dell'Oro Group Research

To effectively make strategic decisions about the future of your firm, you need more than a qualitative discussion – you also need data that accurately shows the direction of market movement. As such, Dell'Oro Group provides detailed quantitative information on revenues, port and/or unit shipments, and average selling prices – in-depth market information to enable you to keep abreast of current market conditions and take advantage of future market trends. Visit us at www.delloro.com/market-research.

**Dell'Oro Group**
230 Redwood Shores Parkway
Redwood City, CA 94605 USA
Tel: +1 650.622.9400
Email: dgsales@delloro.com
www.delloro.com