Future-Proofing Broadband: The Strategic Imperative of FTTH for Cable Operators

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Introduction

Multiple system operators (MSOs) have long relied on hybrid fiber-coaxial (HFC) networks using DOCSIS technology to deliver broadband. Since the first DOCSIS standard in 1997, cable operators and vendors have steadily enhanced HFC capabilities to meet evolving consumer demand. Today, however, fiber-to-the-home (FTTH) networks are emerging as the standard for long-term competitiveness. As bandwidth needs continue to grow and competitive FTTH deployments accelerate, cable operators are evaluating whether DOCSIS 4.0 and its upgrade paths will be sufficient, or whether the time has come to pivot more decisively toward fiber.

On nearly every metric of network performance including speed, symmetry, scalability, latency, reliability, and even cost over time, a passive optical network (PON)-based FTTH architecture outperforms DOCSIS-based HFC. These technical advantages are well known, yet many operators still wrestle with how and when to transition their networks. In greenfield areas, the choice is straightforward: FTTH is the default. In brownfield markets, the decision is more complex, often entangled in capital constraints, legacy plant considerations, and organizational alignment.

One of the most significant and often underexamined factors influencing this decision is the dynamic between technology and finance leadership. Even when the long-term benefits of FTTH are acknowledged, moving forward requires consensus between CTOs focused on feasibility and design, and CFOs focused on cost, valuation, and risk. This paper addresses not only the performance and economic advantages of FTTH, but also how MSOs can bridge internal gaps to build alignment around a fiber strategy. The goal is to help decision-makers across both network and financial leadership frame the conversation, quantify trade-offs, and move toward a unified roadmap.

The sections that follow examine the comparative performance of FTTH and DOCSIS 4.0 networks, the long-term capital and operating economics of each path, and the organizational strategies that can help MSOs overcome internal friction and accelerate their transition to fiber.

Technological Comparison: FTTH/PON vs. HFC/DOCSIS

While often discussed, it's worth briefly touching on the core technology differences between passive optical networks (PON) deployed in fiber-to-the-home (FTTH) configurations and hybrid fiber coax (HFC) networks.

Fiber networks offer substantially more headroom in terms of bandwidth, both downstream and upstream. Today's deployed HFC systems, typically running DOCSIS 3.1, can deliver up to 1 Gbps downstream and 100 Mbps upstream, though these numbers fall well short of theoretical limits. DOCSIS 4.0 promises higher speeds, but its rollout is still limited. In contrast, modern PON systems such as XGS-PON support symmetric 10 Gbps, with 25G PON commercially available today and 50G PON imminent. The result is a fiber plant with far more capacity and an upgrade roadmap that doesn't require overhauling the physical infrastructure.

Bandwidth symmetry and reliability also stand out as major differentiators. Fiber networks are inherently symmetrical, which aligns better with rising upstream demands driven by video conferencing, cloud gaming, video surveillance, and other two-way applications. FTTH systems also rely on a passive outside plant, meaning fewer active components in the field, lower power requirements, and far fewer potential failure points compared to coaxial systems loaded with powered amplifiers and nodes. This translates to fewer truck rolls, higher customer satisfaction, and reduced operating costs.

Finally, the performance characteristics of fiber, especially around latency and jitter, are better suited to real-time and high-reliability applications. Whereas HFC networks contend with RF noise and signal degradation, fiber's immunity to electromagnetic interference and use of time-division multiplexing allows for more consistent, lower-latency service. These qualities matter increasingly in a world of cloud gaming, remote work, and 5G backhaul, where perceived responsiveness is a competitive differentiator.

Bridging the CTO–CFO Divide: Making the Case for Fiber Internally

Building Internal Alignment Around a Long-Term Vision

Many MSOs recognize the long-term advantages of transitioning to FTTH, but getting there often requires internal alignment across roles with very different priorities, perspectives, and success metrics. Engineering teams tend to focus on network feasibility, operational constraints, and upgrade sequencing, while Finance and Executive leadership are more focused on capital allocation, risk management, and long-term enterprise value. In practice, the right decision for the company often lies at the intersection of these viewpoints. But in many cases, FTTH plans stall or proceed unevenly not because of technical limitations or

lack of capital, but because the two sides of the leadership table aren't speaking the same language. This section explores how each side of the organization, both CTOs and CFOs, can better frame the fiber migration conversation to move toward aligned, strategic decision-making.

How CTOs and Engineering Leaders Can Make the Case for Fiber

For the CTO or Vice President of Engineering who believe fiber is the inevitable endgame, the challenge is not always technical centered but rather how to be persuasive. Financial and strategic leadership teams don't always resist fiber outright, but they need to hear the case in business terms: value, risk, return, and timing. Engineering teams can gain traction by reframing FTTH not as a cost or rebuild project, but as a long-term asset upgrade with enterprise-wide implications.

That framing starts with operational expense (OpEx). FTTH significantly reduces the volume of truck rolls, maintenance, and field service escalations, particularly in territories with challenging environmental conditions or aging coax. These savings, when quantified over 5 to 10 years, often rival the perceived capital expense (CapEx) delta between HFC upgrades and full fiber. These operating cost reductions can also be linked directly to churn mitigation and customer satisfaction which is another area where finance tracks long-term margin.

Another lever is network reliability. Engineering leaders can walk their peers in Finance through the physical differences: a passive FTTH plant has far fewer points of failure than an HFC plant filled with powered amplifiers and aging taps. Fewer failures mean less subscriber churn, lower SLA penalties in B2B accounts, and fewer reputational risks, all of which directly tie into revenue protection and brand equity.

CTOs can also broaden the argument by emphasizing flexibility. A fiber network is not just a broadband delivery platform; it becomes an enabler for new revenue streams. FTTH doesn't just serve residential subscribers better; it opens the door to new service classes with stronger margin profiles such as 5G xHaul, enterprise services, cloud connectivity, and even wholesale. That kind of monetization potential is especially relevant to CFOs and investors. Many MSOs will already be familiar with these services, so the emphasis is on the ability to broaden the reach of these services.

Finally, Engineering leadership should not hesitate to translate these arguments into valuation terms. A $500 to $1,000 per home passed FTTH investment may seem high in isolation, but when paired with examples of higher EBITDA multiples or increased investor interest in all-fiber assets, the conversation becomes about enterprise value, not just network design.

How CFOs and Executive Leadership Can Guide Toward Fiber

From the other side of the table, Finance and Strategy leaders who are convinced of fiber's long-term advantage often face cultural and organizational inertia from the technical side. Engineering teams may be cautious for valid reasons: concerns about disruption, skills alignment, workforce readiness, or timeline feasibility. But the CFO or CEO can help by anchoring the conversation not on whether to go to fiber, but on when and how.

One useful approach is to frame fiber migration as an exercise in capital discipline. HFC plant upgrades may appear cheaper in the short term, but they are rarely final. Each DOCSIS generation adds another layer of complexity and plant modifications; a pattern that leads to periodic rework. Fiber, in contrast, is a one-time infrastructure investment with a 50-year lifespan. That's the kind of long-lived capital asset that CTOs routinely prefer.

Leadership can also ease the path by supporting phased deployments. Engineering teams may feel overwhelmed by the idea of an all-fiber future, but pilot builds in select markets or competitive overbuild zones can build confidence and internal learning. The goal isn't to flip a switch but rather to build momentum. With each successful FTTH launch, the internal resistance often fades.

It's also important for executives to contextualize fiber in broader strategic terms. This isn't just a question of keeping up with bandwidth demand; it's about staying relevant in a market increasingly dominated by symmetrical, all-fiber offerings. Falling behind can impact market share, pricing power, and even investor perception. The network is not just a cost center; it's a competitive bulwark.

Strategic Imperatives for FTTH Transition

Capital Expense Considerations

Deploying FTTH at scale does require significant capital investment, and MSOs must weigh this against the costs of upgrading their existing HFC plant. However, when comparing CapEx scenarios, FTTH often comes out more favorable than one might assume, especially when looking at long-term value and the costs to achieve equivalent performance.

- Greenfield Builds. In new build areas, the cost parity of fiber and coax deployment is now well recognized. The most expensive part of any access build is the physical construction (trenching, ducts, poles), and modern HFC networks already bring fiber very deep into neighborhoods, often within a few hundred yards/meters of homes. This means that choosing FTTH instead of HFC in new builds does not radically change the construction cost; operators are simply swapping coaxial drop cables for fiber drop cables. Given fiber's advantages in capacity and futureproofing, virtually all operators today opt for full fiber in greenfield situations, since the upfront cost is similar, but the

long-term payoff is far greater. In fact, Nokia's analysis indicates there is "not a great deal of difference" in cost between a new HFC network and a new FTTH network, so the smart money is on building fiber from day one.

- Brownfield Upgrades. For existing HFC networks, the calculus can be a bit more complex. Upgrading an HFC system incrementally such as moving to DOCSIS 3.1 with a mid-split can achieve near-term gigabit speeds at lower CapEx than a full fiber overbuild. Many cable operators will take this path to extend the life of their plant initially. However, these coax upgrades have limits. They might get the network to ~1 Gbps service, but they don't provide a long-term multi-gigabit solution. To truly compete in the multi-gig era, the HFC plant would need a DOCSIS 4.0 upgrade, which, as discussed, entails extensive node replacements, amplifier upgrades, new taps, possibly new coax runs, expanded or reconfigured power infrastructure, and new modems, which often require a truck roll and professional installation.

  By the time an operator finishes a DOCSIS 4.0 overhaul of a dense network, the capital spent can be comparable to an FTTH rebuild, and in some cases, more. Some industry analysts suggest that the cost of upgrading to DOCSIS 4.0, including node changes and amplifier replacements, can range $150 to $300 per home passed. When scaled across a service provider's footprint and combined with prior investments to be "DOCSIS 4.0-ready," the cumulative costs may approach or even exceed those of FTTH deployment in similar environments. This means that for many brownfield situations, investing those funds directly into FTTH might yield a better long-term asset. Indeed, we see a trend of operators leaping directly to fiber in higher-value or high-competition areas, rather than pouring capital into squeezing the last drops out of coax. Every network and market is different, but the tipping point is fast arriving where overbuilding fiber makes as much financial sense as upgrading HFC, especially when you consider what comes next.

- Total Cost of Ownership and Future ROI. Capital costs must be viewed alongside total cost of ownership (TCO) over the network's life. Even if a full fiber overlay requires higher upfront CapEx in some brownfield cases, the substantially lower OpEx of fiber networks can offset that difference within a few years. A 2020 study by the Fiber Broadband Association and Cartesian found that FTTH operating costs were roughly half those of HFC on a per-home basis. Over time, these savings often make the combined cost of fiber lower than that of an upgraded HFC network. In contrast to coax, which often requires recurring upgrades, fiber infrastructure typically entails a one-time deployment that can last for decades. FTTH also improves strategic flexibility, enabling revenue from residential broadband, enterprise services, mobile backhaul, and more, all on a single platform. Just as important, all-fiber networks are increasingly viewed as higher-quality assets, often attracting stronger M&A interest and higher valuation multiples due to their efficiency and long-term scalability. For operators backed by private equity or considering a strategic exit, this can be a defining factor. Taken together, the financial and strategic advantages of FTTH make a strong case for prioritizing fiber as a long-term asset.

OpEx Savings

A key operational advantage of migrating to FTTH is the dramatic reduction in ongoing maintenance and support costs. Unlike HFC networks, which rely on powered nodes, amplifiers, and other active components scattered throughout the outside plant, FTTH networks use a passive optical architecture with far fewer points of failure. This translates to fewer outages, fewer truck rolls, and simpler field operations. At the same time, fiber access networks deliver substantial gains in energy efficiency, consuming far less power than coax per bit delivered. These combined improvements, greater reliability and lower energy use, enable MSOs to operate leaner, more automated networks with improved customer satisfaction and reduced churn.

The energy savings in particular can be quantified clearly. The table below compares estimated power usage and annual electricity costs for representative headend and field equipment configurations in typical DOCSIS 4.0 and XGS-PON deployments. On the fiber side, an XGS-PON architecture with two fully populated OLT chassis supports tens of thousands of subscribers at a draw of just 3.8 kW. In contrast, the DOCSIS 4.0 configuration includes not only power-hungry CMTS and QAM chassis at the headend, but also dozens of kilowatts consumed by the active coax infrastructure in the field. These field actives alone contribute over 30 kW of continuous load, dwarfing the centralized equipment and accounting for the vast majority of the system's power consumption. In total, the DOCSIS 4.0 system in this scenario exceeds $39,000 in annual electricity costs, ten times the corresponding cost for XGS-PON. These figures underscore just one area of recurring OpEx where FTTH offers a compelling and measurable long-term advantage.

Component	Quantity	Power Usage	Annual Energy Use	Annual Power Cost (@ $0.12/kWh)
Nokia Lightspan FX-4 OLT	2 fully loaded	3.8 kW	33,288 kWh	$ 3,994
Total - XGS-PON	**-**	**3.8 kW**	**33,288 kWh**	**$ 3,994**
DOCSIS 4.0 CMTS	1 high-capacity unit	5.0–6.0 kW	47,450 kWh	$ 5,694
QAM Modulators (Video)	3–5 chassis	1.5 kW	13,140 kWh	$ 1,577
Field Actives (Amps/Nodes)	Still required	30.4 kW	266,304 kWh	$ 31,956
Total - DOCSIS 4.0	**-**	**~37 kW**	**326,894 kWh**	**$ 39,227**
Annual Energy Savings	**-**	**-**	**310,250 kWh**	**$ 37,230**

Upstream Demand Growth: Planning for Emerging Use Cases

While today's broadband usage patterns still tilt heavily toward downstream traffic, there are growing signals that upstream demand may rise meaningfully over the next decade. For now, upstream-heavy applications like video conferencing and cloud backups have settled into a stable baseline. But newer use cases are emerging that could shift this balance, especially as AI technologies start to dominate the consumer space.

One scenario is AI-enabled home video surveillance. As smart cameras evolve beyond simple motion detection into real-time object recognition and behavioral analysis, they will require higher fidelity video uploads to centralized cloud AI engines. This trend may mirror how home security shifted from DVR/NAS storage to streaming services over the past decade. Similarly, if large language models become integrated into smart home devices, these could rely on near-constant upstream connectivity for context-aware processing. These are speculative, but credible shifts.

Cloud gaming and remote work are also potential drivers. Cloud gaming models stream both video down and gameplay actions up; latency and reliability become critical. If consumer adoption continues to climb, it could further strain upstream capacity. In enterprise settings, remote work has normalized video calls, VPNs, and cloud-hosted engineering tools, all contributing to modest but sustained uplink usage.

Customer Experience with Sustained vs. Peak Performance Broadband

Since the advent of gigabit broadband, operator marketing and benchmarking have emphasized sustained throughput based on average transfer rates over time, validated by speed tests. But today's applications, especially those driven by the cloud, increasingly depend on peak or burst capacity: the ability to deliver large amounts of data instantly, not gradually. This shift is reshaping user expectations. Whether it's opening a cloud-hosted file that feels as fast as accessing a local drive, downloading a 38 GB game patch in under two minutes, or streaming 8K video without buffering, customers now equate performance with immediacy.

Fiber networks are uniquely suited to meet this demand. Next-generation technologies such as 25G and 50G PON deliver immense peak capacity without the latency or shared spectrum constraints of legacy HFC. These capabilities enable fiber operators to offer differentiated service tiers focused on real-world responsiveness, not just theoretical speeds. As applications evolve, so too must the access layer. Here, fiber is the only architecture with enough headroom and low-latency characteristics to deliver on both sustained and instantaneous performance at scale.

Competitive Pressure and the Growing Risk of Overbuild

The case for migrating to FTTH isn't purely about technical merit or cost structure; it is increasingly about competitive survival. Fiber overbuilds have accelerated dramatically in recent years, driven by both incumbent telcos upgrading their legacy DSL footprints and a wave of new entrants supported by private equity or public subsidies. Forecasts suggest that fiber will reach over 70% of U.S. households by 2030. In some markets, that saturation is already visible; in others, aggressive expansion plans are rapidly closing the gap.

For cable operators, the implications are clear. FTTH competition brings not just symmetrical speeds but also a perception of modernity, reliability, and future-proofing. This

perception can erode share even before performance differences are evident. More critically, operators that delay fiber investments may find themselves boxed out of long-term growth areas or forced into reactive overbuilds under less favorable conditions.

Importantly, the cost of inaction isn't just customer churn. It's also valuation risk. Investors are increasingly discounting operators who remain too dependent on aging HFC infrastructure, especially when surrounded by fiber-rich competitors. The urgency, then, is not just technical or operational; it is also strategic. The risk isn't about losing new markets; it's about losing existing ones. As fiber competition becomes ubiquitous across their own service areas, cable operators who delay fiber migration may find themselves on the defensive, forced into price discounting, higher churn, and accelerated promotional costs to retain customers they already serve.

Real-World Operator Transitions & Technology Coexistence

Several U.S.-based Tier 2 and Tier 3 cable operators have already begun migrating legacy HFC networks to FTTH in a brownfield context. One Midwest-based operator is in the process of decommissioning its HFC footprint after overbuilding more than 70 percent of its service area with PON. This transition has reached a point where some of the coaxial plant is being physically removed, and customers are being moved to fiber-based service; one example of true brownfield fiber migration happening at scale in North America. In these cases, the decisive factor was not just bandwidth but operational simplicity and long-term cost avoidance.

Several operators, including Google Fiber and Hong Kong Broadband, have also begun implementing 25G PON alongside existing XGS-PON deployments. Nokia's approach to multi-wavelength coexistence has enabled transitions without the need for a forklift upgrade, allowing operators to deploy 25G-capable ONTs selectively and defer activation until demand materializes. This capability allows operators to pre-deploy 25G-ready ONTs, even in areas still served by XGS-PON, avoiding future truck rolls when the service layer eventually shifts.

Conclusion

As the broadband landscape accelerates toward a fiber-first future, cable operators face a narrowing window of opportunity to chart their next-generation access strategy. Across nearly every dimension, including network performance, operational efficiency, upgrade flexibility, and long-term financial return, FTTH with PON presents a more sustainable and scalable path than DOCSIS 4.0 over HFC. The case for fiber is no longer purely theoretical. It is now backed by real-world operator transitions, mounting competitive pressure, and the clear economics of reduced energy use, fewer truck rolls, and simplified network operations.

Beyond technical superiority, the shift to FTTH is increasingly about financial and strategic alignment. The most effective MSOs are those that can bridge internal silos, especially between Engineering and Finance, to quantify trade-offs and recognize FTTH not as a cost, but as a long-term asset upgrade. That upgrade not only reduces OpEx and unlocks new service potential, but also positions the operator more favorably with investors, who increasingly value fiber-rich networks over coax-dependent ones.

Meanwhile, speculative but credible drivers such as AI-enabled video surveillance, cloud gaming, and remote collaboration hint at a future where upstream demand will only increase. Coax networks, constrained by asymmetry and legacy complexity, are poorly positioned for that evolution. In contrast, fiber systems with support for XGS-PON and 25G coexistence offer operators a graceful upgrade runway that matches both near and long-term demand scenarios.

The strategic imperative is clear. FTTH is not just about keeping up, it's about staying ahead. In greenfield cases, the choice is already made. In brownfield cases, hesitation may come at a cost. Operators who wait risk falling behind not only in technical capability, but in customer retention, cost structure, and asset value. Those who act now, aligning leadership and investing in fiber, stand to lead in the markets of tomorrow.

About the author: Jay Rolls is the CTO of BSP. He was the SVP and Chief Technology Officer at Charter Communications from 2011 to 2019. During that time, he and his team had responsibility for engineering and architecture across all aspects of Charter's wireline business. Previously, Mr. Rolls served in a variety of roles during 13 years at Cox Communications including SVP of Technology. Mr. Rolls received a B.S. in Electrical Engineering from the University of Virginia and an M.S. in Systems Management from the University of Southern California.

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