

EUROPE: BROADBAND INVESTMENT GUIDEBOOK

This guidebook helps stakeholders examine the broadband landscape in Europe. It provides analysis on the key challenges facing the broadband sector in the region and offers potential solutions. The guidebook also examines public funding for broadband in Europe including with case studies. It assesses the wholesale broadband access market and how it is likely to evolve. Finally it provides commentary on future opportunities for broadband operators in Europe.

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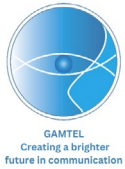
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AUTHORS

Stephen Wilson

Senior Principal Analyst, Broadband Technology, Omdia

Kevin Hasley

VP Strategic Initiatives (Ookla), WBBA Working Group Chair

Longjie Xu

Senior Engineer (China Telecom), WBBA Working Group Chair

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INTRODUCTION

This guidebook is a follow up to the earlier World Broadband Association (WBBA) publication, *Broadband Investment Guidebook: How to Formulate Your Best Broadband Investment Strategy*. It also builds on two subsequent WBBA documents: *North America: Broadband Investment Guidebook (2024)* and *Africa: Broadband Investment Guidebook (2025)*.

This guidebook discusses some of the key challenges facing the broadband sector in Europe and provides an assessment of different solutions. It offers recommendations and guidance for a range of stakeholders, including broadband policymakers and operators. Additionally, it explores the future evolution of broadband operators in Europe and highlights emerging opportunities.

Members of the WBBA can engage in discussions on the topics raised in this guidebook with other member companies, for example, during WBBA-hosted events. In addition, for stakeholders involved in the European broadband sector, WBBA membership offers a platform to share experiences with the broader industry and to highlight opportunities and challenges.

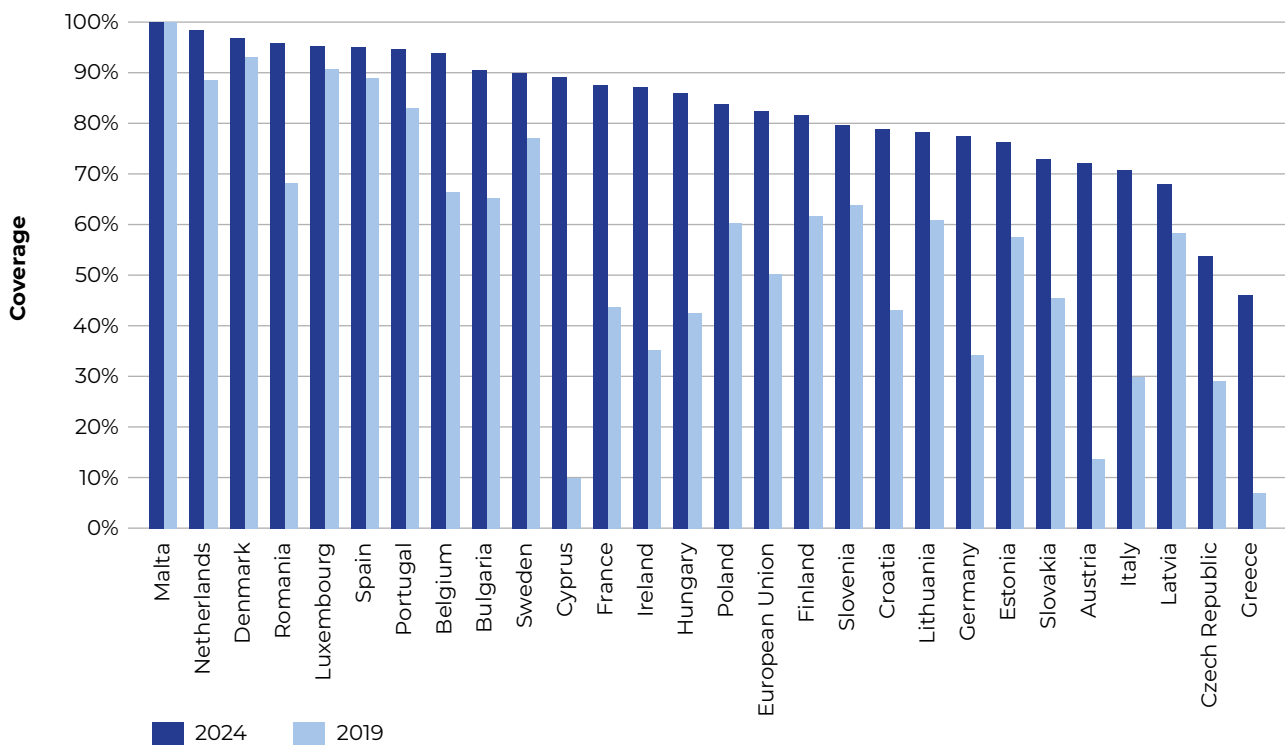
The guidebook comprises the following:

- A section on addressing broadband challenges in Europe. This section discusses challenges related to broadband infrastructure investment, challenges related to broadband subscriber take-up, particularly on next-generation access networks and at higher speeds, and challenges related to improving the broadband subscriber experience.
- A discussion on broadband funding and financing in Europe.
- A section examining the future outlook for wholesale broadband in Europe.
- A discussion on the future outlook and future opportunities for broadband operators in Europe.

OVERCOMING CHALLENGES TO BROADBAND INFRASTRUCTURE INVESTMENT

Substantial progress has been made in expanding the availability of next-generation access infrastructure across Europe (**Figure 1**).

FIGURE 1: FIXED VHCN COVERAGE BY EUROPEAN UNION (EU) COUNTRY, 2019 VS. 2024



SOURCE: OMDIA

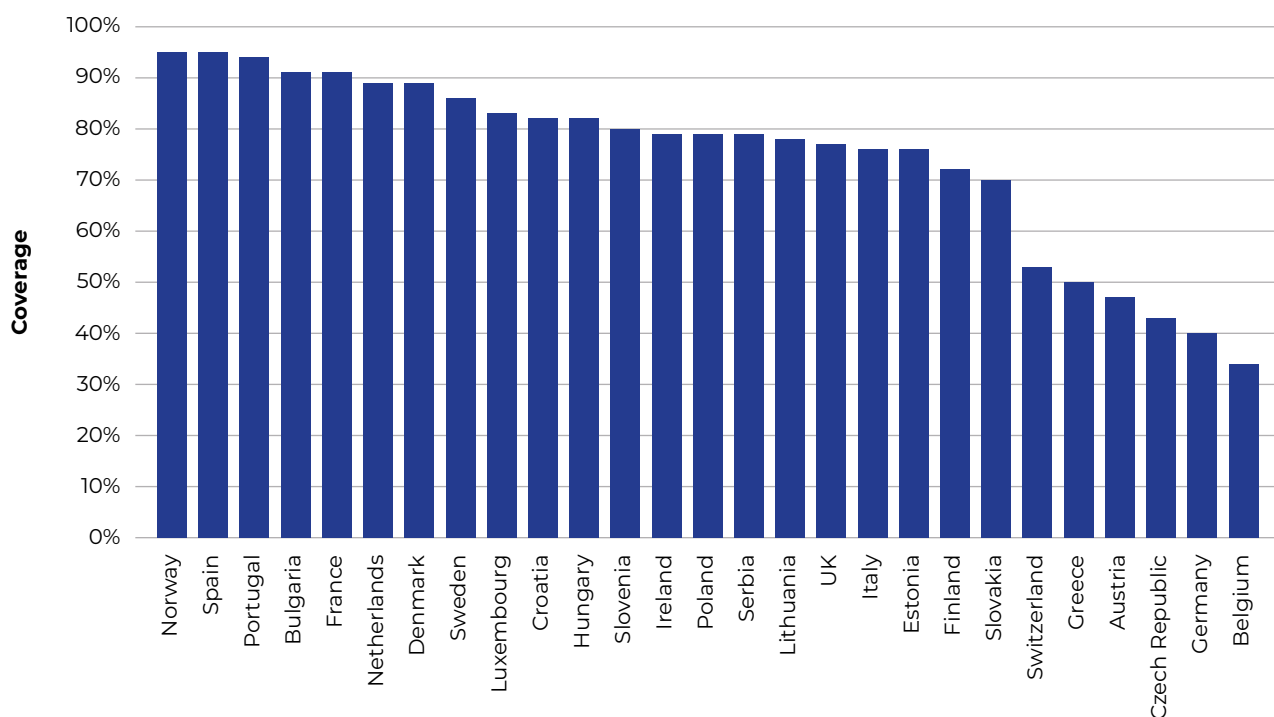
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However, a significant amount of work remains to meet the European Commission's (EC) Digital Decade 2030 goals, such as ensuring that every household has access to an internet connection with download speeds of at least 1Gbps by 2030.

While very high-capacity network (VHCN) coverage has improved significantly in recent years, this progress partly reflects the completion of some of the easier and less costly deployments. For example, some of the recent increases in VHCN coverage are due to upgrades from DOCSIS 3.0 to DOCSIS 3.1, rather than entirely new infrastructure rollouts.

Figure 2 shows data from the WBBA's Fiber Development Index (FDI), which shows exclusively fiber-to-the-premises (FTTP) coverage across various European countries, unlike **Figure 1**, which also includes high-speed cable network coverage. While some leading European countries have achieved FTTP coverage exceeding 90% of total country premises, this does not represent most countries.

FIGURE 2: FTTP COVERAGE OF TOTAL COUNTRY PREMISES IN SELECTED EUROPEAN COUNTRIES, JANUARY 1, 2025



SOURCE: FIBER DEVELOPMENT INDEX (FDI)

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In most cases, FTTP rollouts have focused on areas with greater population density, leaving more costly and challenging rural areas yet to be covered. This means that a considerable amount of funding is still required to deliver gigabit connectivity to all European households using FTTP. For example, in 2023, the EC published a study—with modelling from WIK Consult—that estimated the cost of deploying FTTP to make gigabit connectivity available to all at €114bn.

These costs reflect the significantly higher expense of deploying FTTP per premises passed in rural geotypes compared with urban areas. Even without extending into deep rural geotypes, FTTP costs per premises passed in rural areas can be at least several times higher than in densely populated urban areas. UK fiber operator Gigaclear, which focuses on rural areas, has noted costs of around £1,200–1,300 per premises passed. By way of contrast, incumbent Openreach—whose coverage is largely concentrated in urban areas—has noted FTTP costs per premises passed at the lower end of the £250–350 range.

FTTP COSTS PER PREMISES PASSED ALSO VARY SIGNIFICANTLY BETWEEN EUROPEAN COUNTRIES

When assessing the need for investment in next-generation broadband infrastructure, it is important to recognize the variation in FTTP costs per premises passed across different countries.

In the first instance, when comparing costs per premises passed between different European countries, one very important factor to consider is the ability to reuse existing infrastructure for fiber rollout. In countries such as Spain and the UK, operators have been able to utilize existing ducts and poles for fiber rollout. In some countries, regulated offers have enabled non-incumbent operators to access ducts and poles at cost-oriented rates. This situation contrasts with other markets, such as the Netherlands, Belgium, and Germany, where copper cables have often been buried directly. As a result, operators must build new infrastructure, such as new ducts, to deploy FTTP networks.

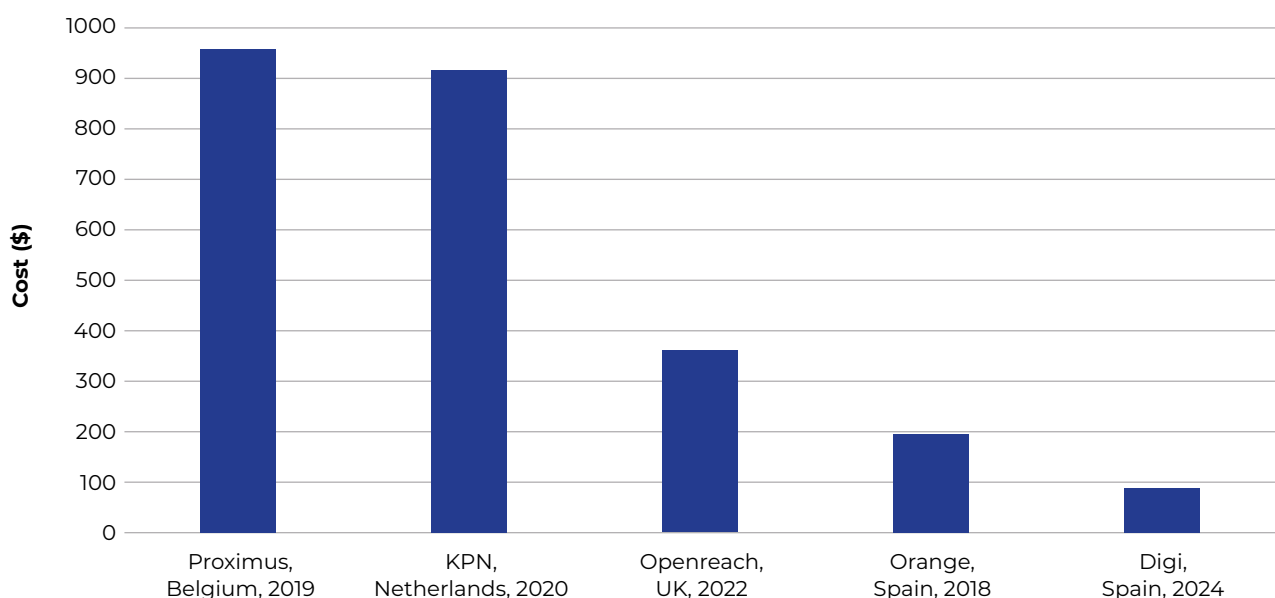
One point worth noting, therefore, is that if there are means to encourage the reuse of existing civil infrastructure for FTTP rollout, then they should be promoted. The EC's Gigabit Infrastructure Act, which entered into force in May 2024, provides the means for better coordination of civil works for FTTP deployment with those being undertaken for water or electricity distribution networks.

New FTTP deployment models can also play an important role in overcoming challenges related to the need for disruptive civil infrastructure work. For example, in Italy, FiberCop is now deploying fiber using microtrenching—a non-invasive process that is likely to be welcomed by municipalities. At the same time, these deployment techniques are also likely to be viewed positively by consumers, as they minimize disruption associated with FTTP rollout and, as a result, offer the potential for higher subscriber take up.

Another important consideration is the share of premises located in multi-dwelling units. A higher percentage of the population living in multi dwelling units can reduce the amount of fiber that must be rolled out, thereby lowering FTTP costs per premises passed. Nevertheless, this can still present challenges, particularly in obtaining permission to roll out fiber within multi-dwelling units, which has been a persistent problem in several countries.

FTTP deployment is also a labor-intensive activity, with labor costs accounting for a significant proportion of total fiber capex. As a result, countries with lower labor costs can enjoy lower FTTP costs per premises passed. Another cost element is optical line terminal (OLT) active equipment. However, in European countries where FTTP cost per premises passed are higher, this equipment typically represents only a small fraction—just a few percent—of the total cost. This is because civil infrastructure work remains the dominant cost driver.

**FIGURE 3: FTTP COSTS PER PREMISES PASSED BY SELECTED EUROPEAN OPERATOR, VARIOUS YEARS
JANUARY 1, 2025**



SOURCE: OMDIA

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In summary, in high-cost European countries, FTTP costs per premises passed—even in urban areas—can make a fully commercial fiber rollout challenging. Overall, however, as demonstrated by the coverage in **Figures 1–2**, operators have often been able to rollout next-generation access networks in urban areas, even in high-cost countries, although this is not universally the case.

In rural areas, costs per premises passed can be high, even in countries where fiber rollout is commercially viable in urban areas. Therefore, the main coverage challenge in Europe is extending gigabit coverage to rural areas, where significant work is still required across most European countries. To address these challenges, there are multiple options that stakeholders should consider.

PUBLIC FUNDING WILL BE NEEDED IN SOME AREAS TO HELP CLOSE THE FUNDING GAP

It is clear from **Figures 1–3** that some areas will remain commercially unviable for the deployment of next-generation broadband access infrastructure without public funding support. The WIK Consult study referenced earlier noted the costs of delivering FTTP-based gigabit connectivity to all at €114bn in 2023, with a public subsidy of €40bn required.

Different funding and financing models for broadband infrastructure rollout are discussed later in this guidebook, in the ***Broadband funding and financing in Europe*** section. Beyond public funding, however, stakeholders must consider several other measures to support deployment.

EFFICIENT DECOMMISSIONING OF LEGACY NETWORKS CAN DRIVE INVESTMENT IN NEW BROADBAND ACCESS INFRASTRUCTURE

Much of the value of the business case for FTTP deployment comes from savings related to shutting down the copper network. When considering timelines for copper network decommissioning, policymakers should recognize the growing urgency. It will become increasingly challenging for operators to maintain their copper networks, because the skilled labor force required is increasingly reaching retirement age. Moreover, chipset vendors are no longer investing in copper-based technologies, meaning that operators will eventually be unable to source new equipment, such as customer premises equipment (CPE), for copper-based networks. At the same time, any decommissioning process must respect consumer rights. The forthcoming Digital Networks Act may set deadlines targeting an 80% copper switch-off by 2028 and full switch-off by 2030, but these timelines are not seen by all stakeholders as workable.

Aside from setting timelines for copper decommissioning, policymakers also have other options available to incentivize migration from copper to fiber. One approach is to set wholesale copper rates higher than fiber wholesale rates. This can encourage access seekers to migrate retail copper customers to fiber, which might otherwise be challenging because such operators do face costs in migrating these subscribers. The potential improved FTTP take-up rates resulting from such incentives can then strengthen the business case for fiber rollout, for instance, as part of a public-private partnership of some form.

On the other hand, some operators reasonably argue that decommissioning should only be mandated in areas where fiber coverage reaches 100% of households. Alternative non-FTTP technologies, such as fixed wireless access (FWA), may have limitations, for instance. Significant subscriber uptake of FTTP networks is also required for the decommissioning process to begin and its complexity reduced. Some operators argue that FTTP subscriber uptake should reach at least 60–70% before decommissioning is initiated.

In addition, if wholesale copper prices remain higher than those for fiber in areas without FTTP rollout, operators may be incentivized to delay fiber investment to preserve fully depreciated legacy infrastructure that continues to generate significant margins. Any public policy to expedite FTTP take-up should take into consideration that, in highly competitive markets with low margins and no retail premium price for FTTP, forcing a rapid migration of existing copper customers to FTTP may be economically unsustainable for operators.

CO-INVESTMENT MODELS CAN HELP REDUCE OPERATORS' INVESTMENT IN NEXT-GENERATION ACCESS INFRASTRUCTURE

The capex burden for extensive FTTP rollout can be substantial, so models that seek to share this cost among multiple parties can deliver value. Operators have opportunities to partner with other entities, such as utilities and cable operators, to deploy fiber networks. This may involve the formation of joint ventures.

One example is SIRO in Ireland, a joint venture in which Vodafone Ireland and the Electricity Supply Board each hold a 50% stake. In Switzerland, Swisscom partners with utilities and cable operators. In one geographical area, Swisscom rolls out a two-fiber network, while in another geographical area, its partner does the same. Each provider then receives an indefeasible right of use (IRU) for the fiber in the area it did not deploy. The party responsible for deploying the fiber infrastructure in the particular area also assumes responsibility for its maintenance. This model allows each party full flexibility to offer their own retail services using their own active equipment, while also enabling both to provide wholesale access.

Fiber carve-outs—where an operator separates its current and/or future FTTP network into a dedicated subsidiary, with ownership often shared between the operator and a third party, such as an infrastructure investor—can help generate funds for additional rollout. Several such fiber carve-outs have been implemented across Europe.

IMPROVING FTTP PERMITTING PROCESSES AND BETTER COORDINATION BETWEEN DIFFERENT ENTITIES CAN SPEED UP FIBER ROLLOUT

While there may be areas that are not commercially viable for FTTP rollout, there are also situations where operators are willing to make their own investment, but such rollouts are impeded by bureaucracy surrounding fiber permitting processes. There is a need for strong coordination between national and municipal authorities—for example, in some cases, municipalities may not follow guidance issued by national-level authorities.

One area that would help operators is ensuring they can work consistently across different municipalities, which is not always the case today. Italy is one example of a country where such challenges still exist.

Nonetheless significant progress is being made in this area. The EC's Gigabit Infrastructure Act simplifies and accelerates the process of obtaining permits for fiber rollout. As part of the Act, public authorities must comply with deadlines for granting permits.

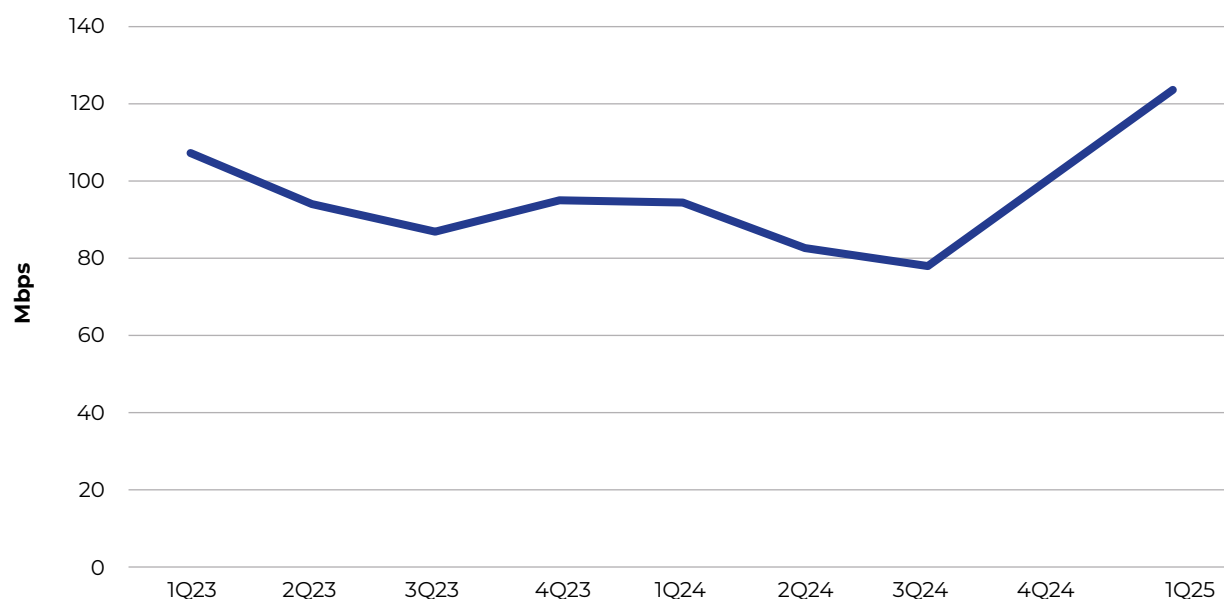
Another way the Gigabit Infrastructure Act can help speed up FTTP rollout is through measures to digitalize information across areas such as planned civil works, existing physical infrastructure, and permit-granting procedures. The Act can also help speed up FTTP coverage expansion because it means new builds and renovated properties will be equipped with fiber or fiber-ready infrastructure.

TECHNOLOGY CHOICE IS A RELEVANT CONSIDERATION FOR REDUCING NEXT-GENERATION BROADBAND ACCESS INFRASTRUCTURE ROLLOUT COSTS

Low Earth Orbit (LEO) satellite broadband has seen rapid subscriber growth. As of July 2025, Starlink had over 6 million subscribers globally, representing approximately 0.4% of total global fixed broadband subscribers. It is important to consider the extent to which newer technologies, such as LEO satellite broadband, can help meet the targets of the Digital Decade 2030.

Evidence from Ookla data suggests that real world performance of LEO satellite broadband remains well below 1Gbps download speeds (**Figure 4**).

FIGURE 4: STARLINK MEDIAN LEO SATELLITE DOWNLOAD SPEEDS, 1Q23–25



SOURCE: OOKLA

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However, there is evidence that LEO satellite broadband can deliver a strong level of service for subscribers. For example, in Ireland, average usage of satellite broadband connections reached 524GB in 1Q25—only 6% lower than for FTTP connections. This suggests that LEO satellite broadband currently places few constraints on subscribers' actual usage. However, capacity constraints may become more apparent as adoption grows beyond the 0.8% market share the technology captured in Ireland at end 1Q25.

LEO satellite broadband capacity and performance will improve over time as more higher-capacity satellites are launched and major players, such as SpaceX and Amazon, continue to invest heavily in the technology. There are already signs of this investment bearing fruit. After a period of decline, median download speeds for Starlink across the 27 EU member states increased quarter-on-quarter (QoQ) in both 4Q24 and 1Q25 (**Figure 4**).

COMPETITION HAS INTENSIFIED, INCLUDING AT THE WHOLESALE LEVEL, LEADING TO CALLS FOR DEREGULATION IN CERTAIN GEOGRAPHICAL AREAS—AN OPTION THAT MERITS CAREFUL CONSIDERATION

Many incumbents have expressed concerns that excessive regulation is hindering their investment in next-generation access infrastructure. Such concerns have also been expressed in *The Draghi report on EU competitiveness*. It should be acknowledged that competition has increased greatly, not just at the retail level but also at the wholesale level. This is evident in the growing importance of wholesale-only operators, as well as formerly closed-network operators who now offer wholesale access. To this end, it is worth questioning whether wholesale regulation is required in areas with high infrastructure competition. At the same time, competitive dynamics can vary significantly within different areas of the same country. As a result of these potentially differing dynamics within countries, sub-national level regulation may be an attractive option.

It is also worth highlighting that potential investors sometimes have concerns about regulation and participating in projects that involve government funding. For example, in FTTP rollouts in rural areas, EC State Aid rules require that ducts must be made available to parties interested in subsequent fiber rollouts. This is an example of a policy strongly focused on promoting competition, but one that may inadvertently lead to increased fiber network overbuild. Such overbuild introduces a significant element of additional risk for private investors, which could, in turn, reduce the willingness of such players to commit higher levels of funding to public-private partnerships.

Europe has a large number of broadband operators, reflecting the number of countries in the region and players offering different technologies, such as FTTP, cable, and FWA. In some countries, FTTP rollouts have been conducted by smaller players operating at sub-national level. Greater consolidation among operators may play a role in driving investment in next-generation access infrastructure.

Increased scale could help reduce costs through more efficient equipment procurement and the sharing of expertise in fiber network rollout. This latter factor is particularly important: evidence shows that operators are reducing their FTTP costs per premises passed over time—even as they expand into areas with lower population density—by leveraging experience and best practices from earlier fiber rollouts. Consolidation can further support this process by enabling operators to achieve stronger scale.

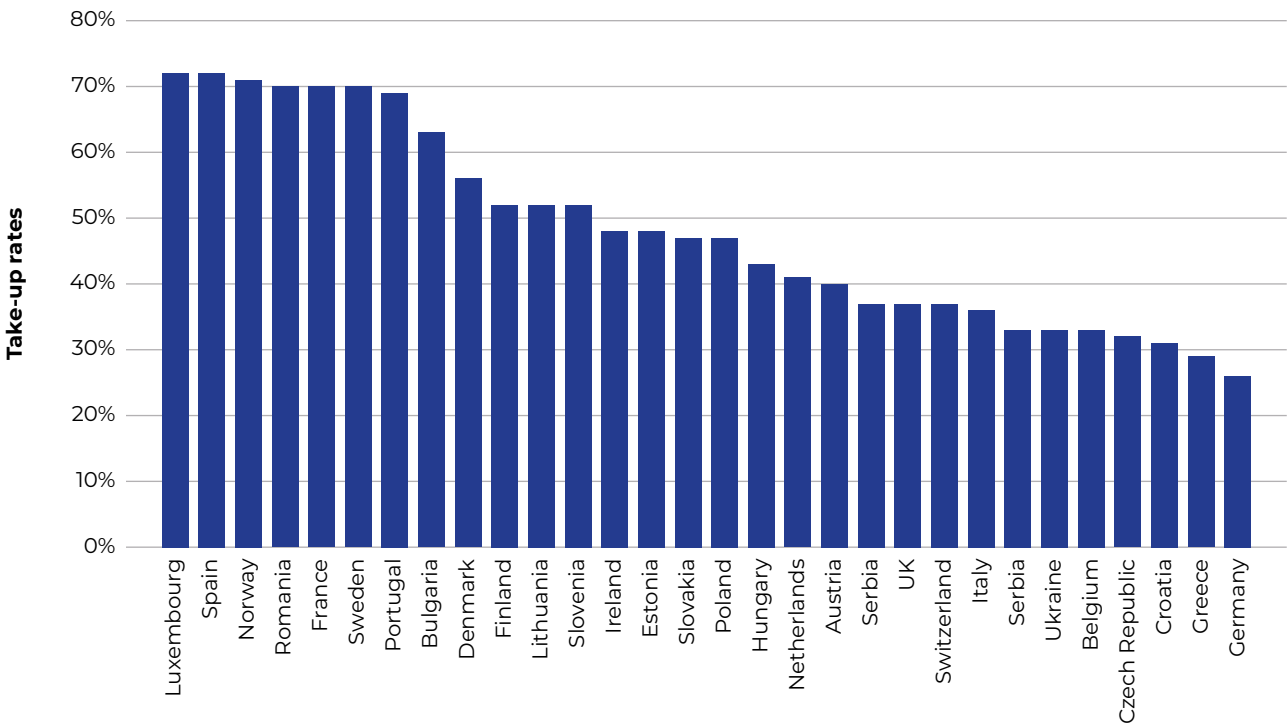
However, as discussed earlier, several factors significantly influence FTTP network rollout costs, such as population density and the availability of existing infrastructure, such as ducts and poles that can be reused for fiber rollout, which may not be affected by greater operator scale.

ADDRESSING BROADBAND DEMAND-RELATED CHALLENGES IN EUROPE

STAKEHOLDERS MUST CONSIDER STRATEGIES TO DRIVE SUBSCRIBER UPTAKE OF NEXT-GENERATION ACCESS INFRASTRUCTURE

Subscriber take-up of next-generation access infrastructure varies considerably across different European countries. While this is partly owing to varying rates of coverage expansion and the inevitable lag before subscribers adopt new FTTP connections, it is clear that some markets face challenges in driving subscriber adoption of new broadband infrastructure. In some cases, one such challenge may be the high proportion of customers already using relatively high-speed advanced copper or cable connections. Although this is not the only factor at play, it is worth noting that the UK, Italy, and Germany—three countries with extensive FTTC-VDSL rollouts—have relatively modest FTTP subscriber take-up rates.

FIGURE 5: FTTP SUBSCRIBER TAKE-UP RATES OF PREMISES PASSED, SELECTED EUROPEAN COUNTRIES, AS OF JANUARY 1, 2025



SOURCE: OMDIA

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Stakeholders have several options to encourage subscriber uptake of next-generation access infrastructure.

COMPETITION CAN HELP INCREASE SUBSCRIBER UPTAKE OF NEXT-GENERATION ACCESS INFRASTRUCTURE

The creation of a healthy competitive environment plays an important role in driving subscriber take-up rates of next-generation access infrastructure. Healthy competition can help eliminate price-related barriers to the adoption of new technologies, while a greater number of providers offering next-generation access increases subscriber choice and makes migration more attractive.

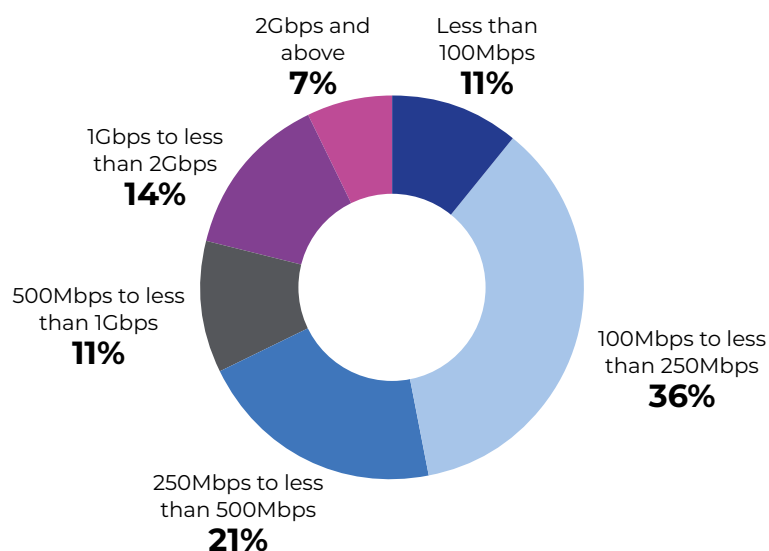
One consideration is the retail pricing premium for next-generation access technologies. This is becoming less relevant, however, because many incumbents no longer sell connections based on older technologies, such as ADSL, after FTTP has been rolled out in a particular area. In some countries, there is also no retail price premium for FTTP compared with other technologies.

At the same time, there is a risk that excessive fragmentation, intense competition, and the presence of retail players leveraging connectivity to support their core businesses in other sectors, such as energy and pay-TV, could equally hinder swift subscriber migration to FTTP. With broadband prices compressed and margins thin, the migration from copper to fiber—which involves significant one-off and recurring costs at the wholesale level—may become economically unsustainable for retail operators.

RETAIL TARIFF DESIGN CAN ALSO PLAY A ROLE IN DRIVING FTTP SUBSCRIBER GROWTH

Operators can ensure that their retail tariffs are designed to encourage FTTP subscriber adoption. One approach is to increase entry-level speeds to differentiate connections using next-generation access networks from those using legacy networks. Raising entry-level FTTP speeds can, in turn, encourage subscriber uptake of next-generation networks. As of July 2025, 22% of European incumbents (across the EU-28) offered entry-level FTTP speeds of 1Gbps and above.

FIGURE 6: ENTRY-LEVEL FTTP SPEEDS BY EUROPEAN INCUMBENT (EU 28), JULY 2025



SOURCE: OMDIA

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MEASURES TO ENCOURAGE SWITCHING BETWEEN OPERATORS

Measures that encourage switching between operators can increase competition and improve subscriber uptake of next-generation access networks. Simplifying the switching process is particularly relevant for driving migration to next-generation access networks capable of delivering higher speeds, especially since not all retail operators offer access to such networks in every location.

In the UK, the so-called one-touch switching (OTS) scheme was introduced in 2024. Prior to its implementation, customers switching to a new network, such as the new FTTP infrastructure of an alternative operator, had to contact both their new and existing operators to coordinate the switching process. Under the new scheme, customers no longer need to pay notice-period charges beyond the switch date, meaning they are not required to pay for the old service once the new one begins.

COPPER SWITCH-OFF TIMELINES AND PREPARATION

Copper switch-off timelines affect subscriber uptake of next-generation access infrastructure. The EC has noted that achieving a copper switch-off for 80% of subscribers in the EU by 2028, and the remaining 20% by 2030, is a reasonable target. However, a report from the Body of European Regulators for Electronic Communications (BEREC) at the end of 2024 indicated that only eight EU member states are currently on a migration and switch-off path likely to meet the 2030 deadline. This highlights that further efforts are needed in this area to ensure these timelines are met.

A key initial step—already been taken by some regulatory authorities—is the introduction of notice periods and the definition of an appropriate alternative wholesale access product. Implementing a notice period allows the conditions for copper switch-off to be met and facilitates voluntary migration. Another important lesson from earlier copper network decommissioning efforts is the need to provide sufficient information to end-users and other alternative operators in the decommissioning process.

As noted earlier in this guidebook, it is also possible to influence the attractiveness of wholesale FTTP offers compared to wholesale copper offers to access seekers. This can be achieved in various ways, for example, by increasing the cost of wholesale copper. Such an approach may be appealing to governments, as it avoids the expenditure associated with other policies, such as retail broadband subsidy models.

On the other hand, some operators view the setting of copper switch-off timelines as unnecessary. One argument is that if copper customers are to be migrated to higher-speed FTTP connections, then cable networks should also be considered for decommissioning over time. Additionally, some retail operators may not favor copper network decommissioning at this stage owing to the costs involved in migrating customers to FTTP. While having more FTTP subscribers could offer benefits—such as improved reliability, which may lead to lower costs—operators will still incur costs during the fiber migration process.

In any case, copper switch-off can only be considered in areas with significant FTTP subscriber take-up. While it may help encourage late adopters, implementing switch-off in areas where 30% or more of the population still relies on legacy technologies would be extremely complex—both financially and operationally.

BROADBAND TECHNOLOGY INFORMATION PROVIDED TO CONSUMERS

Policies on providing clear information about broadband technology can help drive subscriber uptake of next-generation access infrastructure. In some cases, operators have termed hybrid fiber and copper-based or coaxial network cable connections as “fiber,” which may hinder efforts to increase subscriber uptake of FTTP networks.

Some regulators have taken steps to address this issue. In December 2023, UK regulator Ofcom issued guidance stating that hybrid fiber and copper fiber-to-the-cabinet (FTTC) networks should be described as part fiber and that FTTP networks should be described as full fiber. This must be done either before a customer enters a contract for electronic communications services or within the contract itself. One resulting challenge is that such guidance may make it difficult to use the term “fiber” to describe FTTP connections.

Ofcom’s guidance also recommends that providers offer a more detailed explanation of the underlying technology. In Italy, a traffic light labelling system is used: FTTP connections are marked with green labels, FTTC and FWA connections with yellow, and ADSL connections with red.

Terminology used in broadband advertising is also important. Advertising authorities must assess whether using the term “fiber” to describe hybrid fiber and copper connections is misleading.

More broadly, there is more room to educate consumers on the value of moving to FTTP rather than, for example, continuing to rely solely on cellular connectivity. Such educational programs could encompass training through schools and training organized by local municipalities.

RETAIL BROADBAND SUBSIDY SCHEMES

Policymakers could also consider implementing retail broadband subsidy schemes. Several European countries have launched such schemes, although not all are directly aimed at driving subscriber uptake of next-generation access infrastructure. Some schemes, such as those in France and Spain, have focused on providing vouchers to cover connection and activation costs, which may involve the deployment of wireless access technologies. In the UK, vouchers have been used to subsidize the connection and activation costs of higher-speed connections in underserved areas, thereby improving broadband availability and supply.

Several EU member states have also launched schemes offering vouchers and subsidies specifically aimed at driving adoption of already deployed next-generation access infrastructure. Overall, these schemes can be divided into two categories: those targeted at specific social groups—such as individuals on low incomes—and those available to all. Retail broadband subsidy programs have been permitted under the EC State Aid rules, based on the view that low take-up of high-speed broadband represents a market failure.

These types of publicly funded retail broadband subsidy schemes can still be closely tied to coverage expansion. In other words, the subsidies may be used to help increase coverage and are often available only for a limited period after the network has been deployed. As a result, such schemes may not be effective in targeting those most reluctant to upgrade.

Despite potential challenges, various approaches to drive subscriber uptake of next-generation access networks, such as retail broadband subsidies, should at least be considered by European policymakers. Evidence suggests that such schemes have had an impact on the adoption of higher-speed, next-generation access-based connections, although not all schemes have generated positive results.

- The Greek retail broadband subsidy scheme was introduced in 2019 and targeted the general population. Subsidies were available for connections with speeds of 100Mbps and above. The scheme was justified by the relatively high retail prices for FTTP connections in Greece compared with other EU member states, as well as low FTTP subscriber uptake rates. Evidence suggests that these subsidies helped stimulate FTTP adoption: by 2022, around 140,000 vouchers had been used. Building on this, Greece launched a new retail broadband subsidy scheme in November 2024—the Gigabit Connectivity Voucher Program—which provides a €200 subsidy to new and existing customers for acquiring ultra-fast broadband connections of 250 Mbps and above.
- In Cyprus, the retail broadband subsidy scheme began in 2023. Households with existing connections offering download speeds below 100Mbps were eligible to receive subsidies for upgrading to connections with download speeds of at least 200 Mbps. The scheme aimed to benefit 82,000 households by mid-2025. By August 2024, some 50,000 vouchers had been used. As of the end of 2024, some 77% of broadband subscribers in Cyprus had connections with speeds equal to or greater than 100Mbps, representing considerable growth from 47% by the end of 2022. By this metric, Cyprus moved up several places among EU member states and surpassed the overall EU average.
- In Italy, two subsidy schemes were introduced: one for households and one for SMEs. It should be noted that these subsidy schemes were also aimed at bridging the digital divide, rather than solely driving subscriber uptake of next-generation access infrastructure. The household subsidy scheme targeted lower income households with a taxable income of less than €20,000 per year. By the October 2021 deadline, only 53% of the available vouchers had been requested, amounting to around 200,000 households. This low take-up, combined with the inclusion of both VDSL and FTTP plans in the scheme, meant the vouchers had a limited impact on FTTP adoption. One challenge with implementing this policy in Italy is that there has never been a retail price premium for FTTP compared with other broadband access technologies. In other words, retail prices were not a barrier for existing DSL subscribers to voluntarily migrate to FTTP. From the operators' perspective, the major impact of the subsidies was to intensify competition among retail players, driving already below-EU-average prices even lower and further undermining the perceived value of FTTP broadband.

SUBSIDIES FOR RETAIL OPERATORS FOR MIGRATING CUSTOMERS TO FTTP

Another potential policy solution to address the market failure of low high-speed broadband uptake is to provide subsidies to retail operators when customers are migrated to FTTP. In some cases, retail broadband operators may feel insufficiently motivated to migrate DSL customers to FTTP. This may be owing to the costs associated with migrating these customers and higher wholesale FTTP fees compared with the wholesale copper fees they currently pay.

While moving customers to fiber can deliver benefits, such as reduced churn owing to improved broadband quality, these benefits may not be strong enough to incentivize retail operators to migrate copper customers to fiber. This is particularly true in markets where there is no retail price premium for FTTP compared with DSL, and where FTTP retail tariffs lack speed tiering.

To resolve this challenge, retail operators could be offered subsidies for migrating their customers to FTTP. In addition, such measures could be combined with concrete copper decommissioning plans to generate momentum in the FTTP migration process.

DRIVING ADOPTION OF HIGHER-SPEED CONNECTIONS ON NEXT-GENERATION ACCESS INFRASTRUCTURE

The adoption of higher-speed broadband access is another important area for consideration. European policymakers have placed much emphasis on coverage targets for specific broadband speeds. As part of the EC's Digital Decade 2030 strategy, one of the key targets is to ensure that all households are covered by a gigabit network by 2030.

However, it is worth stimulating a discussion on the value of such targets if there are no corresponding objectives for actual subscriber uptake of these speeds. There is limited long-term benefit to the economy and society if investments are made in next-generation access infrastructure, but subscriber take-up rates remain low and broadband speeds do not improve.

Overall median download speeds have increased considerably across Europe in recent years. At the same time, in many cases, operators have seen little ARPU growth, particularly in real terms. This reflects the development of healthy competition, where operators face constraints on raising retail prices and are incentivized to increase speed. Regulation aimed at addressing market failures has played an important role in this regard.

Nevertheless, while median broadband speeds have improved across Europe, they still lag behind those in other comparable markets in some cases. According to data from the EC, the share of total fixed broadband subscriptions with speeds greater than or equal to 1Gbps across all member states was just 22% in 2024, although this marked a considerable improvement from 10% in 2021. In addition, the share of fixed broadband subscriptions with speeds greater than or equal to 100Mbps across all member states was only 72% in 2024.

CHALLENGES IN IMPROVING THE BROADBAND SUBSCRIBER EXPERIENCE: BEYOND ACCESS NETWORK SPEEDS AS A MEASURE OF HIGH-QUALITY BROADBAND ACCESS

STAKEHOLDERS SHOULD CONTINUE TO ASSESS WHAT CONSTITUTES A HIGH-QUALITY BROADBAND CONNECTION FROM THE PERSPECTIVE OF CONSUMERS AND BUSINESSES

Speed remains an important measure of broadband connection quality. However, the value of speeds will change over time, and policymakers must stay informed about these developments. New applications, such as 8K video streaming and AI-powered services, have the potential to require significantly higher bandwidths. To support this, operators must ensure sufficient network capacity.

At the same time, the development of applications that require multi-gigabit speeds will likely accelerate when there is widespread end-user adoption of such speeds. In other words, widespread adoption of multi-gigabit speeds creates strong incentives for application developers to build services that fully leverage those capabilities. Stakeholders should take a long-term view on the value of investing in next-generation broadband access infrastructure and anticipate future growth in bandwidth-intensive applications.

As consumers and enterprises subscribe to higher-speed services, policymakers may also need to look beyond advertised speeds and ensure that operators are delivering those speeds up to the customer's modem. For example, regulators in countries like the Netherlands have introduced rules on how operators market broadband speeds, including requirements to meet certain speed thresholds during peak traffic hours.

While increasing adoption of higher-speed connections should be a priority for policymakers, it also raises the question of which speeds should be considered. Speed delivered to a customer's premises is important, but ultimately, end-user experience depends on the quality of the in-home network. Clearly, even if high-speed connections to subscribers' homes are widely adopted, they offer limited value if those speeds cannot be effectively received on subscribers' devices.

The following are some measures that can be taken to improve in-home network performance:

- Stakeholders should consider the benefits of adopting the latest generations of Wi-Fi technology, particularly Wi-Fi 7. Policymakers may find it worthwhile to promote the provision of accurate information regarding the capabilities of Wi-Fi equipment supplied to subscribers.
- Policymakers must consider measures that could enhanced the performance of in-home Wi-Fi networks. For example, this could include allocating some or all of the 6GHz band for unlicensed use. As broadband traffic continues to grow, the 5GHz band is becoming increasingly congested. With faster speeds being delivered to homes, spectrum in the 6GHz band could become increasingly valuable for Wi-Fi.
- Another way to improve in-home broadband speeds is through the use of fiber-to-the-room (FTTR), where fiber is deployed within the property to individual rooms. Such deployments have grown rapidly in China, for instance, owing to mandates requiring fiber installation in new-build properties. This is an area European policymakers may find worth exploring.

BEYOND SPEED AS THE SOLE MEASURE OF BROADBAND QUALITY

Beyond using speed as the sole measure of broadband quality, it is increasingly evident that subscribers value other aspects of their connection. Generally, while high-speed broadband access is necessary, it is not sufficient on its own. To enhance the subscriber experience, stakeholders must consider a broader range of connectivity metrics, including the following:

- **Reliability** is increasingly important to broadband subscribers. Trends such as a rise in remote working have made dependable connections essential for both consumers and enterprises. A strong indication of this comes from the results of Omdia's *2025 Digital Consumer Insights Survey*. When asked which were the most important features of their broadband connection, the most commonly selected response was "100% reliable service". However, reliability goes beyond whether a service is simply operational—it encompasses other metrics. For example, consumers may view a reliable service as one that can provide guaranteed minimum speeds and low latency especially during peak traffic hours.
- **Resilience** is another key consideration in assessing broadband quality beyond speed. It refers to a connection's ability to recover from failures. Stakeholders should explore solutions such as hybrid CPEs that support both FTTP and backup cellular connections, ensuring continuity in case of fiber network faults. Stakeholders can also consider the value of a battery backup for FTTP CPE.
- **Latency** is increasingly recognized as an important component of broadband quality. It measures the time taken for data to travel from a customer's home to a server on the internet and back. Latency is particularly important for multimodal AI assistants, and keeping it as low as possible is critical for applications such as gaming, video conferencing, and web browsing, where users interact with a screen or other device. As the use of real-time applications like gaming continues to grow, the importance of latency will only increase. It is also worth noting that latency is also not necessarily correlated with higher access speeds, a point that policymakers ought to consider. In addition, some access technologies may incorporate mechanisms within their standards to reduce latency.
- **Low latency, low loss, scalable throughput (L4S)** is a promising technology already deployed commercially, with the potential to reduce latency significantly. The root cause of latency is often insufficient feedback from the network to the application about congestion level in the network. L4S standards specify how network links can implement a new processing function for data packets marked as latency-sensitive, thereby delivering an ultra-low-lag experience for customers. As of mid-2025, 7 million subscribers of the US cable operator Comcast has access to L4S capability. In terms of performance, Comcast has claimed that the technology can reduce working latency by 75%. Another key goal of L4S is to reduce latency variability, or jitter.
- **Security** of a broadband connection is also important. End users are increasingly concerned about the security of all devices connected to their Wi-Fi network. Many providers have launched Wi-Fi network-level security offerings that protect all connected devices. Policymakers should consider whether end users' broadband connections are adequately protected, and operators may find opportunities to offer cybersecurity services that safeguard entire Wi-Fi networks.
- It is also worth noting that some of the technologies described above, such as Wi-Fi 7 and FTTR, not only deliver higher speeds but also improve metrics such as reliability. Therefore, all stakeholders should assess the value of all new technologies based on a broader list of connectivity metrics, rather than focus solely on speed.

It is true that the EC's definition of a VHCN already includes reference to some of these parameters beyond speed. For reliability, it defines IP service availability as greater than or equal to 99.9%, and for round-trip IP packet delay, it sets a threshold of less than or equal to 10ms. Nevertheless, policymakers and regulators should continue to assess how the importance of these metrics evolves over time for end users—driven, for example, by changes in application usage—and adapt these definitions as necessary.

Operators should also recognize that considering connection parameters beyond speed can create opportunities to increase ARPU, attract new subscribers, and reduce churn. A key challenge will be educating end users on the importance of these various aspects of broadband connection quality, especially given that retail broadband marketing has historically focused heavily on speed. One simple example of the communication challenge is that better latency is represented by a lower number, whereas better speeds are represented by higher numbers. Operators and other stakeholders might attempt to simplify the concept of latency by referring to “round trips per minute,” but even this could be confusing for end users.

BROADBAND FUNDING AND FINANCING IN EUROPE: THE IMPORTANCE OF PUBLIC FUNDING

There are several important aspects for government involvement in next-generation broadband access infrastructure. The consumer broadband aspect is important, as are arguments for improved enterprise productivity. In addition, next-generation access infrastructure plays a key role in enabling the delivery of digital government services.

The case for government funding in next-generation access broadband infrastructure rollout has strengthened over time, partly owing to events such as the pandemic, which have highlighted the need for ubiquitous high-speed connectivity. The role of next-generation access infrastructure in helping societies to cope with the impact of climate change may also become more prominent.

At the same time, it is important to acknowledge that governments face competing funding priorities. Areas such as health, education, and increasingly, defense, are often viewed as top priorities. Policymakers will therefore need to grapple with real-world trade-offs when determining the level of funding commitments for next-generation access infrastructure rollout.

While the arguments for government intervention are strong, one important question remains—one that will shape the future direction of broadband in Europe: What level of funding is required to meet the Digital Agenda 2030 targets? As noted earlier in this guidebook, many countries will struggle to meet these targets. A key issue is the amount of funding required to achieve the required coverage levels. Even if only a small proportion of premises in a country remain uncovered, expanding coverage can still be expensive, as FTTP costs per premises passed tend to increase considerably in less densely populated rural geotypes.

The EC itself has acknowledged this challenge, stating that as of early 2023, “additional investment of up to at least €200bn is needed to ensure full gigabit coverage across the EU”. This figure includes investment in both FTTP and 5G networks for mobile connectivity.

This figure underscores the critical role of public funding in improving broadband coverage and quality across Europe. Several national governments have already launched initiatives to help address existing gaps.

THE USE OF GAP FUNDING MODELS IN EUROPE

Gap funding models have been widely used across Europe. Under these models, governments provide funding to bridge the gap between what private operators are willing to contribute and the overall cost of the broadband infrastructure rollout. Governments may launch tenders in which the operator offering the highest private contribution gains the right to deploy, maintain, and operate the resulting broadband network.

This approach—also known as the operator subsidy model or private build-design-operate model—limits the public authority’s role to providing the subsidy. The public authority does not build or operate the network and does not participate in the retail broadband market. From the public authority’s perspective, this model reduces complexity and can accelerate rollout.

However, gap funding models also mean that the financial returns from the project flow to the private operator, limiting public authority’s ability to reinvest those returns into further expanding coverage.

SHARED OWNERSHIP OF THE NETWORK BETWEEN PRIVATE AND PUBLIC AUTHORITIES: JOINT VENTURES

Another model that can be used is the joint venture model, in which the state holds a partial share in the broadband network. Within this model, there are different variations, including public-private partnership that may or may not involve the creation of a special-purpose vehicle.

CONCESSION MODELS

In build–operate–transfer concessions, the private sector funds the initial infrastructure rollout. Once the network is constructed, the private operator maintains the network as part of the concession agreement, while ownership of the passive network infrastructure remains with the public authority. This model has the advantage of limiting financial risks for the public authority.

Once the concession period ends, the government assumes ownership of the active network infrastructure. The model offers flexibility, because public authorities can choose to extend the contract with the private entity, engage a different operator, or operate the network themselves.

One advantage of this model from the perspective of private investors is that it reduces the risk of network overbuild. This model has been used in rural France through the so-called Public Initiative Networks (PINs).

BEST PRACTICE FOR PUBLIC-PRIVATE PARTNERSHIPS

While various public private partnership models for next-generation access broadband rollout are possible, several lessons have been learned from past projects.

One key insight is that trade-offs are inevitable in such projects. For example, governments may choose to fund areas that are currently not commercially viable for rollout. However, this could result in unnecessary commitments if those areas become viable over time—perhaps owing to operators reducing FTTP deployment costs per premises passed through increased expertise and efficiency.

As discussed earlier in this guidebook, there are also trade-offs between rollout costs and technology performance. In some cases, it may be reasonable not to deploy FTTP to extremely isolated locations, where costs per premises passed are significantly higher than in typical rural areas. In such cases, alternatives like FWA or LEO satellite broadband may offer acceptable performance at a lower cost.

A key question for governments is how to ensure sufficient private investor interest in public-private partnership schemes. One important aspect is the careful selection of areas to be included in different types of schemes. Creating clusters that combine premises with lower deployment costs alongside those that are more expensive to cover can improve overall viability and attract private investment.

Closely linked to this is the need for high quality data to produce clusters of premises. This could involve using artificial intelligence (AI) and machine learning (ML) tools to reference the locations of roads or electricity supply.

Governments can also encourage private investment by establishing stable, predictable, and long-term frameworks for investment. One example is Ireland's National Broadband Ireland (NBI) initiative, which operates under a 25-year contract.

To encourage private sector investment, governments can also find ways to create an environment that promotes subscriber uptake of next-generation access infrastructure. Various strategies for this are discussed in the ***Addressing broadband demand-related challenges in Europe*** section of this guidebook.

CASE STUDY: NBI-BRINGING HIGH-SPEED CONNECTIVITY TO RURAL IRELAND

NBI's deployment is a compelling case study, demonstrating a high degree of ambition in deploying FTTP to all—or nearly all—premises across the country. It also highlights what can be achieved when governments and the private sector collaborate effectively.

The Irish Government's National Broadband Plan has a core mission to deliver world-class broadband infrastructure throughout Ireland, with a particular focus on regions previously overlooked by commercial providers owing to economic viability concerns. This targeted approach ensures digital inclusion for all Irish citizens, regardless of geographic location or commercial attractiveness.

The objectives of the National Broadband Plan are particularly important given that Ireland's rural population share is higher than the EU average. As per World Bank data, Ireland's rural population share was 35% in 2024, compared with 24% for the EU as a whole.

The rationale for government investment also extends to the applications enabled by high-speed connectivity. The government has highlighted several key use cases, including flexible and remote working, smart health services such as online GP and nursing consultations and medical monitoring, cloud-based services and connected devices, smart farming opportunities, digital learning, and reliable electronic payments and bookings. To deliver on these objectives, NBI was established specifically to implement the goals of the Irish National Broadband Plan.

NBI represents a sophisticated public-private partnership model. The project originated in 2012, and the contract was awarded in 2019, highlighting the complexity and need for careful planning in such initiatives. This initiative combined Irish government funding with private investment from Granahan McCourt Capital, the successful tender recipient for the National Broadband Plan, along with its consortium of investment partners.

NBI operates as a wholesale-only operator and maintains an open-access fiber infrastructure that enables all retail service providers to utilize the network. This approach promotes market competition and ensures consumer choice across rural Ireland.

The NBI network will cover over 569,000 premises, including new premises built in the rollout area over the next 25 years (from 2019 to 2044) and will reach 23% of the population—approximately 1.1 million people. This rollout is highly ambitious, as it aims to extend connectivity to 100% of the country, with the network predominantly based on FTTP technology.

The original plan was to cover more than 900,000 premises, but this figure was reduced after incumbent operator Eir committed to covering some of these premises using its own funding. This reflects a key trade-off in public-private partnerships: early funding commitments may result in investments in areas that could later become commercially viable for FTTP rollout, as operators reduce deployment costs over time through increased expertise and efficiency.

To ensure premises are covered with high-quality broadband, NBI has deployed an XGS-PON network. This deployment is significant because it helps eliminate the urban-rural digital divide in terms of broadband speeds and supports the growing demand of Irish broadband users.

The NBI deployment is highly significant, as it represents the largest public-private partnership in the history of European telecoms. The ambition of the NBI rollout is further reflected in the financial commitment made by the Irish government. The maximum possible state investment in the project is €2.6bn over a 25-year period, although clawback mechanisms can reduce this amount.

As of early 2022, private investors had committed €175m in funding, with the potential to increase this to €223m. One important element of the contractual arrangement is the inclusion of various public subsidies designed to share risks between public and private partners. For example, at the outset of the project, it may be difficult to determine the final cost per premises passed for FTTP rollout.

To put the Irish government's investment into context, Ireland has approximately 1.85 million households. This translates to a maximum state investment of over €1,400 per premises nationwide, or around €4,569 per premises within the rollout area. These costs are higher than those seen in similar rollouts across other European countries, underscoring the ambition of the project.

The cost level also reflects the geographic and demographic challenges of rural Ireland. The rural areas covered are extensive, and the clustering of premises within rural areas in the coverage area is limited. In rural Ireland, premises are often spread out along roads rather than grouped together, which significantly increases FTTP deployment costs per premises passed.

NBI ROLLOUT RESULTS

The project has delivered strong results in both network rollout and subscriber uptake. As of mid-2025, NBI has successfully extended high-speed broadband to more than 367,000 rural properties across Ireland. Over 130,000 customers are already connected to the network, resulting in an impressive nationwide adoption rate of 35%. In areas where the network has been operational for at least 18 months, this figure rises even further—to over 50%. These statistics demonstrate both the effectiveness of NBI's rollout strategy and the strong demand for reliable, high-speed connectivity among Ireland's rural communities.

Independent evaluations have also highlighted the benefits of the NBI rollout. By the end of 2023, the deployment had covered 955 strategic community points (SCPs), including schools, community halls, libraries, and other public buildings. These connected locations deliver a range of benefits, including improved education, healthcare, and access to government services.

The deployment has also supported enterprises' productivity and benefited sectors like tourism and hospitality. Independent evaluations have noted a positive impact from the NBI deployment on the delivery of key government policies, including the Digital Strategy for Schools, Remote Working Strategy, Digital Connectivity Strategy, Climate Action Plan, National Development Plan, Rural Development Policy, and National Islands Policy.

In terms of the retail broadband market, prices are consistent with those in areas where operators have deployed their own networks without government funding. The number of retail service providers on the NBI network has also grown over time, giving end users greater choice in broadband providers.

CASE STUDY: THE CONNECTING EUROPE BROADBAND FUND – AN INNOVATIVE STRUCTURE USING EU FUNDS

There are opportunities to explore innovative models that pool financing from both public and private sources. In some cases, public entities may take equity stakes in broadband operators. One example worth analyzing is the Connecting Europe Broadband Fund, which demonstrates a novel approach to combining EU funding with private investment.

BACKGROUND

As well as national government-led initiatives, EU-driven schemes are also being used to drive broadband rollout in underserved areas. One such scheme is the Connecting Europe Broadband Fund, launched in 2018 and managed by Cube Infrastructure Managers—an independent mid-market infrastructure investor. The fund receives funding from public investors including the EC, the European Investment Bank (EIB), and National Promotional Banks and Institutions from France, Germany and Italy.

The public investors provide equity or quasi-equity funding—including mezzanine and subordinated debt—to projects that face challenges in securing financing from the banking sector. The core idea behind the Connecting Europe Broadband Fund is that pooling funds from public sources, such as the Connecting Europe Facility and the European Fund for Strategic Investments, helps de-risk investments and maximize the leverage of private funds in projects that support the EU's connectivity objectives.

The Connecting Europe Broadband Fund provides various levels of risk exposure to investors, with the EC assuming the first-loss position. It also employs a unique governance structure that reconciles the interests of different investors by ensuring a balance between public and private investors.

At first closing in 2018, a total of €420m was raised from public and private investors, including €140m from the European Investment Bank and €100m from the EC via the Connecting Europe Facility. At that time, it was anticipated that the fund would unlock additional investments of between €1bn and €1.7bn for broadband rollout in underserved areas.

The Connecting Europe Broadband Fund invests in greenfield projects, defined as investments made by start-up companies or companies whose existing asset base is small relative to the cumulative investments planned for new assets. All networks supported by the fund operate on an open-access basis.

Each project funded by the initiative is subject to a maximum investment limit of €50m. The projects are for areas where no next-generation access infrastructure is currently available, or where only one such network exists or is planned.

ROLLOUT PROGRESS AND RESULTS

The success of the Connecting Europe Broadband Fund is evident in its multiple investments across several EU member states. As of June 2025, deployments funded by the Connecting Europe Broadband Fund have passed over 1 million premises with FTTP across rural and semi-rural areas in Europe, including Slovenia, Croatia, Spain and Italy.

The projects backed by the fund are particularly significant in Slovenia, where they account for 10% of all dwellings connected to broadband. In Croatia, the figure stands at 8.6%. In terms of future development, it is anticipated that fund-supported projects will pass an additional 800,000 premises in the next three to five years.

The importance of these projects is further underscored by the EC's estimate that every €1 invested in broadband in underserved rural and semi-rural areas will generate an additional €8 in private sector investment outside the telecom sector.

BROADBAND BUSINESS MODELS IN EUROPE: THE IMPORTANCE OF WHOLESALE ACCESS AND ITS EVOLUTION

Wholesale access is a key component of the European broadband landscape, encompassing a variety of business models and operator types. Wholesale-only operators have proliferated across many European countries. In addition, more FTTP operators are offering both retail access and wholesale access on a voluntary basis on their networks.

Wholesale also remains an important part of incumbent operators' subscriber bases. In some cases, incumbent operators have structurally separated their retail and network businesses—TIM in Italy is a recent example of this trend.

To this end, it is worth assessing how the wholesale broadband market will continue to evolve in Europe. At the same time, it should also be noted that some operators argue that network ownership—whether through direct roll-out, co-investment, or long term IRU-like contracts—and the ability to control the end-to-end infrastructure and services are crucial for product differentiation, enabling innovation and preventing competition based solely on prices.

OPENING UP CLOSED NETWORKS FOR WHOLESALE ACCESS

For operators that initially launched vertically integrated business models with closed networks, this approach can be effective in attracting high-value retail customers and early adopters of high-speed FTTP. However, in cases such as the UK, it has sometimes proven difficult to gain high subscriber take-up rates using this approach.

Over time, it can be beneficial to open up these fiber networks for wholesale access to broaden the potential pool of subscribers. To facilitate this approach, smaller new entrant FTTP operators can collaborate with wholesale aggregation platforms. This enables the pooling of coverage across a wider range of new entrant FTTP operators.

Such collaboration is important because retail operators may only be interested in using wholesale access across a widespread FTTP footprint.

THE IMPORTANCE OF ATTRACTING LARGE RETAIL SERVICE PROVIDERS AND DIVERSIFICATION IN THE RETAIL MARKET

Attracting large, existing retail broadband service providers to networks offering wholesale access is likely to be a key driver of FTTP subscriber uptake for different fiber operators. This is because these retail service providers typically maintain substantial broadband subscriber bases on legacy technologies, particularly different variants of DSL. Such subscribers represent prime candidates for migration to FTTP connections.

Many large retail service providers have historically relied on, and continue to use, wholesale access from incumbent operators. However, as the number of other operators offering wholesale access has increased, competition to secure these large retail service providers as wholesale customers has intensified. As a result, it is likely that many countries will experience heightened competition in the wholesale broadband market—at least in the short term.

An alternative approach for operators looking to increase their wholesale FTTP subscriber bases is to diversify the retail market by encouraging the entry of new retail service providers. Today, many European mobile network operators (MNOs) already offer fixed broadband, often using own infrastructure or wholesale fiber.

Other potential entrants could include energy companies or pay-TV providers. Another option is to encourage large retail businesses to become retail broadband operators, similar to how some have successfully entered the mobile market as mobile virtual network operators (MVNOs). Large online businesses might also be viable candidates for launching retail broadband services.

While this strategy could increase consumer choice, it also carries the risk of price erosion in the retail market. For example, new entrants such as energy companies may offer broadband primarily to reduce churn in their core energy business. This might mean they offer low retail broadband prices as part of bundles to their subscribers. Such price erosion carries the risk of potentially disincentivizing further investment in FTTP infrastructure.

It is also true that the market structure and business models for FTTP in Europe will continue to evolve, reflecting a long history of change. In Denmark, for example, the retail ISP Waoow was created in 2010 by a group of energy companies that had invested in open-access FTTP networks. However, some of these networks were not generating high subscriber take-up rates, prompting the merger of three ISPs active on those networks to form a larger entity with greater visibility in the retail market. Waoow remains active in the Danish retail broadband market and is now owned by a single utility company.

A further consideration over time is how easy—or difficult—it will be to encourage retail service providers to switch wholesale fiber supplier. The challenge lies in the fact that once end users have migrated to FTTP on a particular infrastructure, it may become more complicated for the retail operator to change wholesale suppliers. This is because doing so would necessitate a second FTTP installation at the end-user premises.

In other words, while competition in the wholesale market may increase as FTTP subscriber numbers grow, wholesalers could gain more bargaining power over time as more end users have migrated to fiber connections.

STRUCTURAL SEPARATION OF INCUMBENT OPERATORS: ITALY AS A RECENT AND PROMINENT EXAMPLE

There continues to be strong interest in the structural separation of incumbent retail businesses and network assets. Several factors are driving this trend, for instance, the potential for higher valuations of the two separate businesses compared with a combined company. Structural separation can also help sharpen the strategic focus of both retail (servco) and network businesses (netco).

The network business could also gain from higher FTTP subscriber take-up rates, as an integrated business model can create a perception that the incumbent's retail arm is favored over third-party retail service providers using wholesale access. Additionally, proceeds from the sale of fixed network assets can be used to reduce debt.

The biggest example of structural separation in Europe is in Italy. In 2024 TIM's fixed network assets were sold into a new company, FiberCop. FiberCop's shareholders are US Infrastructure Fund KKR Infrastructure with a 37.8% stake, Canada CPP Investment with a 17.5% stake, Abu Dhabi sovereign investment fund Adia with a 17.5% stake, the MEF (Ministry of the Economy and Finance of Italy) with a 16% stake and Italian infrastructure fund F2i with an 11.2% stake. One example of the value that structural separation can provide is that it allows the netco to drive an increased focus on network innovation and new technological platforms including edge computing which can play an important role in reducing latency. The operator is also increasing R&D spending and has launched different R&D programs with Italian universities, such as the Polytechnic University of Turin, the Polytechnic University of Milan, and the National Inter-University Consortium for Telecommunications (CNIT), having signed cooperation agreements with the institutions. The areas of collaboration focus on innovative technologies, such as AI and big data, as well as software defined networks amongst others. FiberCop is also focused on investing in quantum technology to provide a very high level of network security.

OTHER OWNERSHIP MODELS ARE ALSO POSSIBLE

In France, the rollout of FTTP has enabled co-investment between multiple operators. The French model typically involves an operator announcing plans to deploy an FTTP network in a specific area. To fund the physical fiber infrastructure, operators have brought in third-party financial investors through fiber carve-outs. Other players can also coinvest in the fiber rollout in exchange for long-term IRUs on the network. Investment in these IRUs has further driven co-investment carve-outs, where operators have worked with infrastructure funds to finance the IRUs.

There are also signs of similar developments in markets like Spain, where operators are increasingly willing to co-invest with one another in fiber network deployments. In 2025, for example, Vodafone Spain—owned by Zegona Communications—formed fiber netcos with both Telefónica and MasOrange. Additionally, in August 2025, Singapore’s sovereign wealth fund GIC agreed to acquire a 25% stake in the fiber netco formed by Vodafone Spain and MasOrange.

At the same time, it is also possible that ownership of previously co-owned fiber infrastructure may eventually consolidate under a single operator. One example is Fiberklaar in Belgium, a joint venture established in 2021 between incumbent Proximus and infrastructure investor EQT Infrastructure to roll out fiber in the Flanders region. However, in July 2024, Proximus agreed to acquire EQT Infrastructure’s 50.3% equity stake in Fiberklaar, bringing the company under its full ownership.

It is worth noting, however, that this move does not necessarily indicate that Proximus now sees greater value in full ownership of FTTP infrastructure than before. This is because the company has also signed a memorandum of understanding (MOU) with another FTTP infrastructure company, WYRE, on the potential sharing of fiber infrastructure to avoid overbuild.

THE EVOLVING NATURE OF WHOLESALE BROADBAND ACCESS

Many wholesale-only operators have focused on offering bitstream access, but such offerings have limitations. Many access seekers (i.e., retail service providers using wholesale broadband offers) would likely prefer models that offer greater control.

Various software-centric forms of wholesale access, such as those using a fixed access network sharing (FANS) model, could represent the next stage in the evolution of wholesale access. FANS enables access seekers to operate a separate slice of network capacity through software-defined networking and virtualization. Crucially, access seekers have full autonomy over their slice of the network.

In this way, FANS and other similar models can better meet access seekers’ requirements for greater control (e.g., over speeds and retail prices) and improved telemetry data (e.g., enabling faster responses to network changes) compared with traditional bitstream-based wholesale offerings.

FANS and other software-centric wholesale models could also benefit wholesalers by reducing operating costs, primarily owing to less direct interaction with retailers. These types of software-centric wholesale models shift more responsibility to the access seeker, reducing the need for wholesalers to actively manage the network. This makes such models particularly attractive for wholesalers that have not traditionally been involved in the FTTP business.

For all stakeholders—whether regulators considering the most appropriate form of regulated access, wholesalers and access seekers themselves, or vendors whose offerings can help bring these new wholesale solutions to market—it will be important to continue monitoring market demand and the adoption of software-centric wholesale models.

An additional consideration is whether operators will engage in reciprocal wholesale access agreements, granting each other access to their respective infrastructure. Such models are not new and have been used, for example, in the Portuguese market, where operators such as incumbent MEO and challenger Vodafone granted each other access to passive fiber infrastructure in different geographical areas.

These models are particularly useful when FTTP coverage remains relatively low, as they offer significant cost-saving opportunities through infrastructure sharing. There are still some European countries that fall into this category of having lower FTTP coverage—Belgium being one example.

In 2024, new FTTP operator WYRE—a joint venture between Fluvius and cable operator Telenet—and Fiberklaar, owned by incumbent Proximus, announced an MOU to provide wholesale access to each other and coordinate fiber rollout in different geographical areas of the Flanders region in Belgium.

FUTURE DIRECTIONS FOR FIXED BROADBAND OPERATORS IN EUROPE

FOR MANY FIXED BROADBAND OPERATORS IN EUROPE, THE CAPEX BURDEN WILL DECLINE, WITH OPEX ALSO LIKELY TO FALL

As discussed earlier in this guidebook, operators in Europe have made considerable progress in improving the availability of next-generation access infrastructure. Over time, areas that remain underserved will also benefit from improved infrastructure coverage. The widespread rollout of FTTP across Europe has been a costly undertaking, and for operators that have completed their fiber deployments, this means a significant amount of capex will be freed up.

At the same time fixed broadband operators can reduce operational costs. For instance, copper decommissioning will eliminate the need to operate copper and fiber networks side-by-side. The migration to FTTP can also reduce opex owing to reduced fault rates, lower maintenance costs, and lower energy consumption.

Furthermore, as discussed later in this section of the guidebook, the use of AI can help fixed broadband operators develop a more efficient operating model. There are also positive prospects on the revenue side. The move to FTTP is likely to offer operators greater pricing flexibility, among other benefits. Overall, the confluence of these trends presents a significant opportunity for fixed broadband operators in Europe.

NEW INVESTMENT OPPORTUNITIES FOR FIXED BROADBAND OPERATORS IN EUROPE

The Draghi report on EU competitiveness highlights several promising avenues for fixed broadband operators. One such area is edge computing, where European fixed broadband operators could host edge computing capabilities within their networks. This could deliver wider benefits across Europe—for example, highly automated manufacturing plants that require low latency and handle large volumes of data could benefit from broadband operators' edge computing infrastructure.

Another future opportunity for fixed broadband operators in Europe lies in application programming interfaces (APIs), where operators could open up their network capabilities to third-party application developers. There is already significant activity in this area. CAMARA, an open-source project from the Linux Foundation, defines, develops, and tests APIs—including for fixed networks.

While much of the discussion around API-related opportunities has focused on mobile networks, similar possibilities exist for fixed broadband operators. These include quality-of-demand (QoD) APIs, where application providers could pay for guaranteed bandwidth or latency for their applications. For instance, CAMARA's Home Devices QoD API enables application developers to dynamically configure and manage the quality of service (QoS) for devices connected to a user's home Wi-Fi network. This enables end users to run applications that require better-than-best-effort Wi-Fi connectivity, such as cloud gaming or virtual reality.

This API could be particularly valuable in remote work environments, where prioritizing connectivity for devices used by home workers is essential. Additionally, authentication and identity APIs could offer secure subscriber verification services to third-party applications, opening up further monetization and service innovation opportunities.

Fixed broadband operators could seek to tap into growing demand for an improved overall broadband experience. One approach involves partnering with third-party application developers to deploy various applications directly on the subscriber's CPE. Operators could experiment with launching applications for areas such as connected home cybersecurity, prioritization of different types of Wi-Fi traffic, and Wi-Fi motion sensing, which has use cases in areas such as assisted living for the elderly.

These applications could be offered as premium services, allowing operators to generate additional revenue and potentially increase ARPU. US cable operator Comcast was a pioneer in this area, having launched multiple applications on its broadband CPE, including those focused on connected home cybersecurity.

To make the vision of running applications on broadband CPE more widespread, it is essential to ensure that applications are decoupled from the underlying firmware. This separation allows updates or changes to applications without requiring firmware modifications. One solution is to use containers to isolate applications from the underlying firmware. While some CPE vendors already offer containers on their devices, it is not yet universal.

CPE vendors can also play an important role in assisting operators in this area—either by developing their own applications (e.g., connected home cybersecurity) or by partnering with a range of third-party application providers to bundle these applications with their CPE.

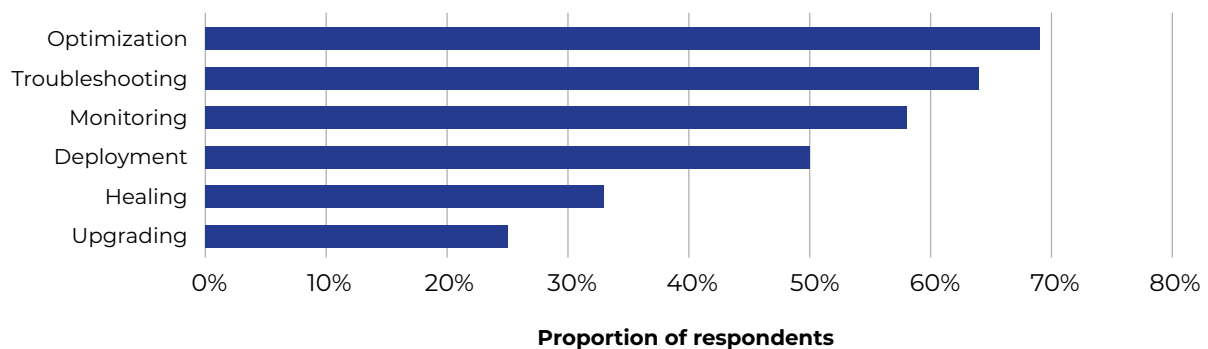
In addition to investing in these specific new and promising areas, operators should take advantage of the opportunities presented by lower capex and opex—as well as potentially increased revenue—by investing more in R&D. There has been a general downward trend in R&D budgets among operators, but the coming years may offer a timely opportunity for fixed broadband operators in Europe to reverse this trend. Renewed investment in R&D could unlock additional growth opportunities in the future.

OPPORTUNITIES FOR FIXED BROADBAND OPERATORS TO ENHANCE THEIR OPERATING MODEL WITH AI

In addition to exciting new revenue opportunities, fixed broadband operators also could make their operating model more efficient—and AI has a significant role to play in this regard. AI applications span the entire fixed broadband lifecycle.

When surveyed about which network processes will AI play a significant role in automating in the next two years, operators identified multiple areas, with network optimization emerging as the top priority.

FIGURE 7: “IN THE NEXT TWO YEARS, WHICH NETWORK PROCESSES WILL AI PLAY A SIGNIFICANT ROLE IN AUTOMATING?”



SOURCE: OMDIA OPERATOR SURVEY 2024

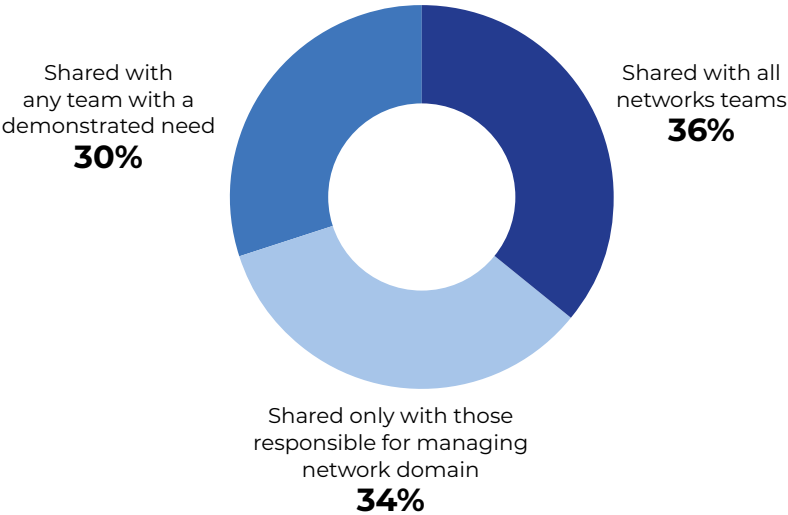
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The widespread potential applications of AI point to an inevitable increase in data processing demand. This means that operators will require infrastructure that offers both scalability and efficient data streaming and collection capabilities.

The effective use of AI depends on a data-centric architecture, where data is continuously analyzed to generate operational benefits. The data-centric architecture must provide high-quality data and enable access across different teams within the operator’s organization to support collaboration and informed decision-making.

Making data available to multiple internal teams is critical, as combining network data with customer care data can improve customer experience. However, Omdia survey results indicate that operators still face challenges in this area. Key barriers to broader data sharing include the additional workload for network operations teams and concerns around privacy.

FIGURE 8: “WHICH BEST DESCRIBES HOW NETWORK ANALYTICS DATA IS SHARED?”



SOURCE: OMDIA OPERATOR SURVEY APRIL 2024

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RECOMMENDATIONS

- **Gigabit connectivity coverage:** Coverage of gigabit connectivity remains a challenge in Europe, although the situation is improving and some countries have made substantial progress. Stakeholders must explore ways to achieve universal gigabit availability. Measures such as accelerating the migration of copper customers to fiber and encouraging shared network infrastructure investment among multiple parties will play a key role.
- **Role of non-FTTP technologies in rural areas:** There should be a legitimate discussion around the role of non-FTTP technologies in delivering higher-speed broadband in rural areas. While FWA and LEO satellite broadband cannot match FTTP speeds, they may offer a sufficient level of service that matches current customer needs. However, policymakers must also bear in mind that these technologies have capacity constraints—and as subscriber numbers increase—this could lead to a deterioration in network performance.
- **Improving subscriber take-up and speed:** It is essential for all stakeholders to focus on increasing subscriber take-up rates for next-generation access infrastructure and improving the speeds delivered to users. Policymakers have several levers to improve demand for next-generation access-based connections, and such measures include retail broadband subsidies, expediting copper decommissioning, and providing clearer information about the technology used by different broadband connections to consumers.
- **Broadening the definition of broadband quality:** Stakeholders—including policymakers and operators—must move beyond defining broadband quality solely by access network speed. It is equally vital to consider actual access network speeds received by subscribers at all times, including peak hours, and the actual in-home speeds delivered to subscribers' devices. Other parameters, such as latency and reliability, must also be monitored.
- **Meeting Digital Decade 2030 targets:** The benefits of deploying next-generation access infrastructure are clear. However, much work remains for different European countries to meet the targets set out in the Digital Decade 2030. One major challenge is the high costs of rollout in many urban areas, which makes purely commercial deployment difficult. To this end, public funding must play a role in ensuring gigabit connectivity is available to all. Leading countries such as Ireland have already committed funding toward this goal.
- **Designing effective public funding projects:** Policymakers must carefully design public funding projects for the rollout of next-generation access infrastructure. Governments can encourage greatest private investment by reducing risks to the private sector—for example, by addressing the risk of fiber overbuild.
- **Innovating broadband business models:** There is still room for innovation in broadband business models in Europe. One promising area is the enhancement of the quality of wholesale broadband access with the use of new software-centric type wholesale models. These can offer access seekers greater flexibility and control, while also enabling cost reductions for wholesalers.
- **Exploring new growth opportunities:** Despite past challenges in achieving strong returns on capital, fixed broadband operators have promising opportunities ahead. As capex and opex decline, operators should explore new areas, such as edge computing, network APIs, and applications deployed on broadband CPE to unlock future growth.



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