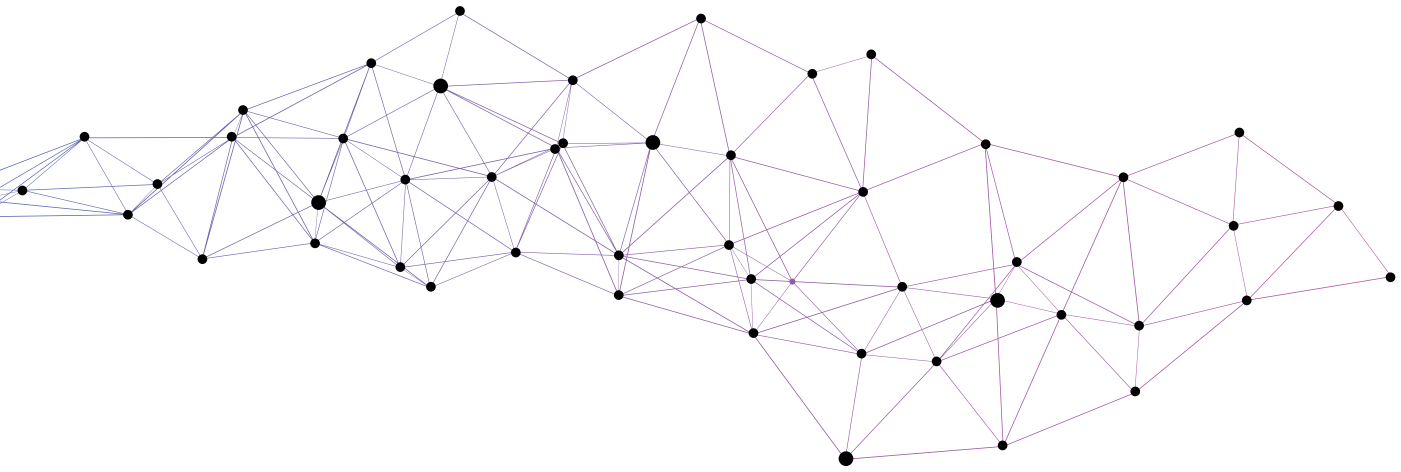
High performance connectivity for all

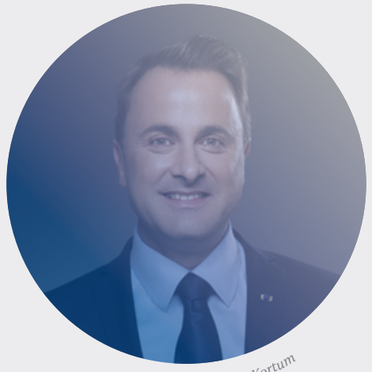
Luxembourg's ultra-high-speed broadband strategy 2021-2025



digital luxembourg
innovative initiatives.

THE GOVERNMENT
OF THE GRAND DUCHY OF LUXEMBOURG
Ministry of State

Department of Media, Telecommunications
and Digital Policy



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Ladies & Gentlemen,

You are holding in your hands the all-new edition of Luxembourg's ultra-high-speed Broadband Strategy. Luxembourg's existing broadband coverage and first-class digital infrastructure seem to say mission accomplished. So, you may be wondering why this strategy is necessary at all.

Yes, we have developed excellent infrastructure on a national level, while maintaining a surplus of resources and spare capacity for continued enhancements.

However, a small percentage of the country remains without ultra-high-speed coverage. This percentage is the most critical, and also the most expensive and difficult to cover. More importantly, it represents the final gap between those who have broadband coverage and those who do not. For me, this is not a technology question, but a social one.

The digital divide is increasingly becoming a social divide that we have to address seriously. The acceleration and omnipresence of digitalization makes broadband coverage indispensable to our everyday lives: remote work, home schooling, social contacts, access to media and information, culture, health services, shops or entertainment. We have all seen it for ourselves during the lockdown.

Connectivity plays a fundamental role in today's nations. That is why I have decided to put this topic on the agenda and tackle it with this ultra-high-speed broadband strategy. We want everyone to benefit from Luxembourg's digital transformation, and we simply cannot achieve that without closing the digital divide.

The second focus of this strategy is the performance of our telecommunications ecosystem. Its competitiveness hinges on innovation, which in turn relies on diversity and competition. We must ensure the diversity of service providers and a balanced amount of competition in our fast-growing market.

With this strategy, we are laying the foundation for the internet of 2025 and beyond.

Xavier Bettel
Prime Minister
Ministre des Communications et des Médias

background

In 2010, Luxembourg published its national strategy for ultra-high-speed networks. Anticipating the country's connectivity needs, the strategy outlined ambitious objectives for the nationwide deployment of next-generation telecommunications networks.

Since then, the digital services offered to consumers have diversified and multiplied – as has digital content, which is available anywhere, at any time, on nearly any device. Simultaneously, new business applications have emerged, compelling connectivity services to adapt in order to meet a new array of business needs. For example, technologies such as machine-to-machine (M2M) communication – in the context of the Internet of Things (IoT), Industry 4.0, artificial intelligence applications, cloud computing and high-performance computing (HPC) – rely entirely on telecommunications networks. As a result, the volume of data transmitted via the networks has grown exponentially in recent years – an accelerating trend with no end in sight.

Thanks to an ambitious, pioneering strategy, the country has developed modern and efficient telecommunications infrastructure, making Luxembourg one of the best-connected countries in the world, according to international benchmarks.

The COVID-19 pandemic has further highlighted the importance of high-quality telecommunications infrastructure. Thanks to the efforts and investments made over the past decade by both public and private stakeholders, Luxembourg's state-of-the-art infrastructure has enabled society – residents and businesses alike – to seamlessly transition to unprecedented reliance on virtual operations: teleworking, home schooling, online medical consultations, etc. As a result, the pandemic triggered extraordinary growth in bandwidth demand. Since the first weeks of lockdown, the regulator, operators and ministries concerned have closely monitored the effects on telecommunication networks. Luxembourg's robust infrastructure has consistently performed throughout the pandemic.

The challenge now is to continue investing in telecommunications networks in order to avoid surpassing current network capacities when faced with future emergencies or changing needs. This edition of Luxembourg's broadband strategy aims to keep us among the best-connected countries in the world. The 2021-2025 vision features the deployment of inclusive, sustainable, state-of-the-art infrastructure that is accessible to all residents, and an ecosystem that supports Luxembourg's economic ambitions.

Prioritizing the digital divide & telecoms ecosystem

This strategy aligns with Luxembourg's plans for sustainable, secure and efficient digital infrastructure – a response to the European Commission's A digital compass for 2030: Europe's way to the digital decade[1]. For all businesses and residents to fully participate in society we need high-quality connectivity for everyone in Europe. It is, therefore, essential to achieve gigabit connectivity by 2030.

This national strategy is Luxembourg's first step towards implementation of the digital compass by 2030. By the end of the decade, new forms of digital communication, such as high-precision holographic media and digital sensory experiences, could lead to a digital-based society with greater connectivity demands, underlining the need for long-term gigabit connectivity.

[1] *https://digital-strategy.ec.europa.eu/en/policies/digital-compass*

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background

Luxembourg's new national strategy for ultra-high-speed broadband networks begins with a solid base: the vast majority of households now have access to high-quality, scalable fixed telecommunications infrastructure[2]. Therefore, attention will now be focused on those households and residents that currently lack such access. As the pandemic and resulting lockdown have demonstrated, a high-quality, secure and efficient broadband internet connection[3] is a prerequisite for full participation in society, whether for work (e.g. teleworking, online conferencing), education (e.g. home schooling), certain health care services, culture, commerce and leisure activities.

[2] *Fibre-optic backbone and a local access network using fibre-optic, CATV, 5G FWA or satellite connection*

[3] *Minimum 100 Mbps downstream and 20 Mbps upstream service*

The strategy prioritizes two main actions:

Reduce the digital divide in Luxembourg society and ensure that no resident is at a disadvantage due to his geographical location or financial situation limiting access to electronic communications.

Foster dynamism and competitiveness within the telecommunications ecosystem. Since the Luxembourg market is small, healthy competition and transparency are essential to quality service for both private end users and professionals. To attract investors in the service economy and industrial sector, Luxembourg relies on certain key factors: diverse providers; high standards of quality and **availability** of networks; and its connectivity to international networks.

To achieve Luxembourg's 2021-2025 vision and tackle the network's existing deficiencies, this strategy outlines five objectives. It touches upon financing, legislation, regulation and coordination and assumes close collaboration with operators and actors in the field.

The goal of this strategy is connectivity in the broadest sense: access to high-capacity networks for all residents and businesses. This access depends on open innovation, infrastructure built on fair and effective competition, and regulations that protect the individual. This initiative falls under the Connectivity Toolbox, adopted by EU Member States in early 2021. The toolbox shares best practices regarding the deployment of very-high-capacity fixed and mobile networks. It includes an exemption from authorization for certain civil works; a single online portal for information on permits, civil works and infrastructure; and financial incentives to encourage network investments. These best practices create the right conditions for investment and help operators reduce the cost of gigabit broadband rollout.

Luxembourg's broadband strategy reflects the Government's larger objective of creating a digital society that benefits all residents. It complements and enables other recent Government strategies: the Cybersecurity Strategy, the Cyber Defense Strategy, the Artificial Intelligence Strategic Vision, the Data-Driven Economy Strategy, the Digital and Sustainable Economy Strategy and the e-Governance Strategy, as well as policies and programs that promote safe internet use and digital-oriented education. Additionally, it addresses fixed services and complements the 5G next-generation mobile services strategy: 5G mobile networks require a fiber-optic antenna connection and 5G fixed wireless access (FWA) technology[4] supports the deployment of fixed networks.

[4] *Fixed Wireless Access: technology that allows the use of the mobile network with a fixed access point*

The Ministry of State's Department of Media, Telecommunications and Digital Policy (SMC) will coordinate the actions and follow-up steps that arise from this strategy and its strategic initiatives with the help of the Luxembourg Regulatory Institute (ILR) and relevant ministries and administrations. The detailed action plan for implementation will be drawn up in the second half of 2021 as outlined at the end of this document.

main objectives of the strategy

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objective 1

make connectivity accessible to all

Digitalization's acceleration and pervasiveness make a reliable, secure and efficient ultra-high-speed internet connection essential for everyday life: teleworking, home schooling, socializing, access to information, culture, certain healthcare services, shopping and leisure. Since the average household has multiple people using digital services in parallel, it is estimated that every household should have a minimum connection speed of at least 100 Mbps downstream and 20 Mbps upstream in order to fully participate in modern society. Therefore, by 2025, every household, regardless of its financial situation, should have access to an internet service that delivers that minimum.

objective 2

accelerate the transition of households and businesses to more efficient and sustainable technologies

Luxembourg's infrastructure already allows a large part of the population to access a fixed connection service of at least 100 Mbps. Currently, over 40%[5] of households still subscribe to a lower speed service or do not have fixed internet access at all, which limits the number and quality of digital applications accessible to each user within the home. The same can be said for businesses, where an adequate connection is essential in order to benefit from digital opportunities, including cloud services. It is essential to make households and businesses aware of the importance of a reliable, secure, high-performance connection that meets their needs.

[5] *Based on the ILR's "Electronic communications scoreboard for the second half of 2020" and the number of households in 2019 as published by Statec in "Luxembourg in figures 2020", adjusted for population growth in 2020*

objective 3

accelerate the deployment of future-proof infrastructure, while respecting technological neutrality

The networks currently deployed in Luxembourg capable of providing speeds of at least 1 Gbps cover approximately 95%6 of the population. The remaining 5% of households are more expensive to connect, especially in the short term. This strategy embraces the principle of technological neutrality in order to accelerate the rate of coverage and meet the current and future needs of all households, regardless of their geographical location. Eventually, the migration of all households to scalable futureproof technologies[7] will optimize the energy efficiency of networks by progressively disconnecting the old fixed network.

[6] *Luxembourg Telecommunications Statistical Report for the year 2020*

[7] *Fibre-optic backbone and a local access network using a fibre-optic, CATV, 5G FWA or satellite connection*

02

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main objectives

of the strategy

objective 4

improve transparency and strengthen consumer protection

In order to choose a subscription adapted to consumer needs, greater transparency is essential, particularly with regard to service offers, contractual clauses, quality of service and price. This strategy aims to further improve the consumers' options.

objective 5

develop Luxembourg as the launchpad of choice for ICT service providers of today and tomorrow

A high-performance, secure and redundant national network and international connectivity support Luxembourg's digitalization and its ability to attract cutting-edge digital services, particularly in the context of 5G pilot projects, supercomputers (HPC), cloud computing and quantum communication (LuxQCI project). Luxembourg is able to offer state-of-the-art connectivity services to economic actors by establishing a diversified and competitive market of leading national and international operators.

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detailed objectives
of the strategy

objective 1

make connectivity available to all

context

The digitalization of the economy, and society as a whole, creates a link between residents' level of connectivity and their quality of life. More and more sectors are reducing their physical footprint to offer their services primarily, or even exclusively, online. Examples include basic activities of daily life: banking, remote working, home schooling, access to information, culture and commerce. A reliable, fast and secure high-speed internet connection is essential for residents of all ages who wish to benefit from these services, as well as for the businesses that offer them.

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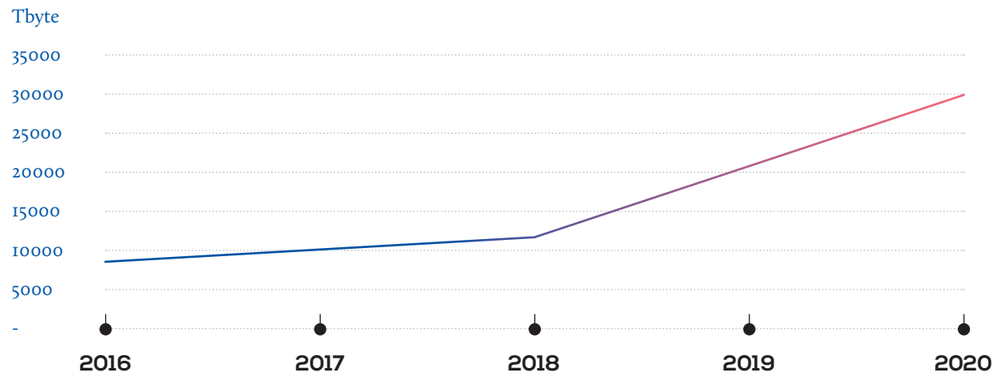
mobile data volume,
retail market.

Fig1: Development of mobile data volume, based on the ILR's "Electronic communications scoreboard for the second half of 2020"



Digitalization creates a link between connectivity & quality of life

The volume of data transmitted over telecommunications networks has increased significantly in recent years, mainly due to the transmission of high-quality video content[8]. Additionally, since the types of connected personal communication devices (tablets, smart phones, etc.) have multiplied, members of the same household often consume digital content at the same time. This trend is expected to grow in the coming years as an increasing number of smart devices[9] and systems (household appliances, home automation, etc.) connect simultaneously.

For this reason, speeds of at least 100 Mbps downstream and 20 Mbps upstream (ultra-high speed connection service) per household are now to be considered as the minimum standard for simultaneous, reliable multi-device access to digital services.[10]

The most disadvantaged households are most at risk of having their employment and education prospects, as well as their participation in society, curtailed by a lack of ultra-high-speed internet connection.

[8-9-10] *Cisco Annual internet Report (2018–2023)*

02

detailed objectives

of the strategy

current situation

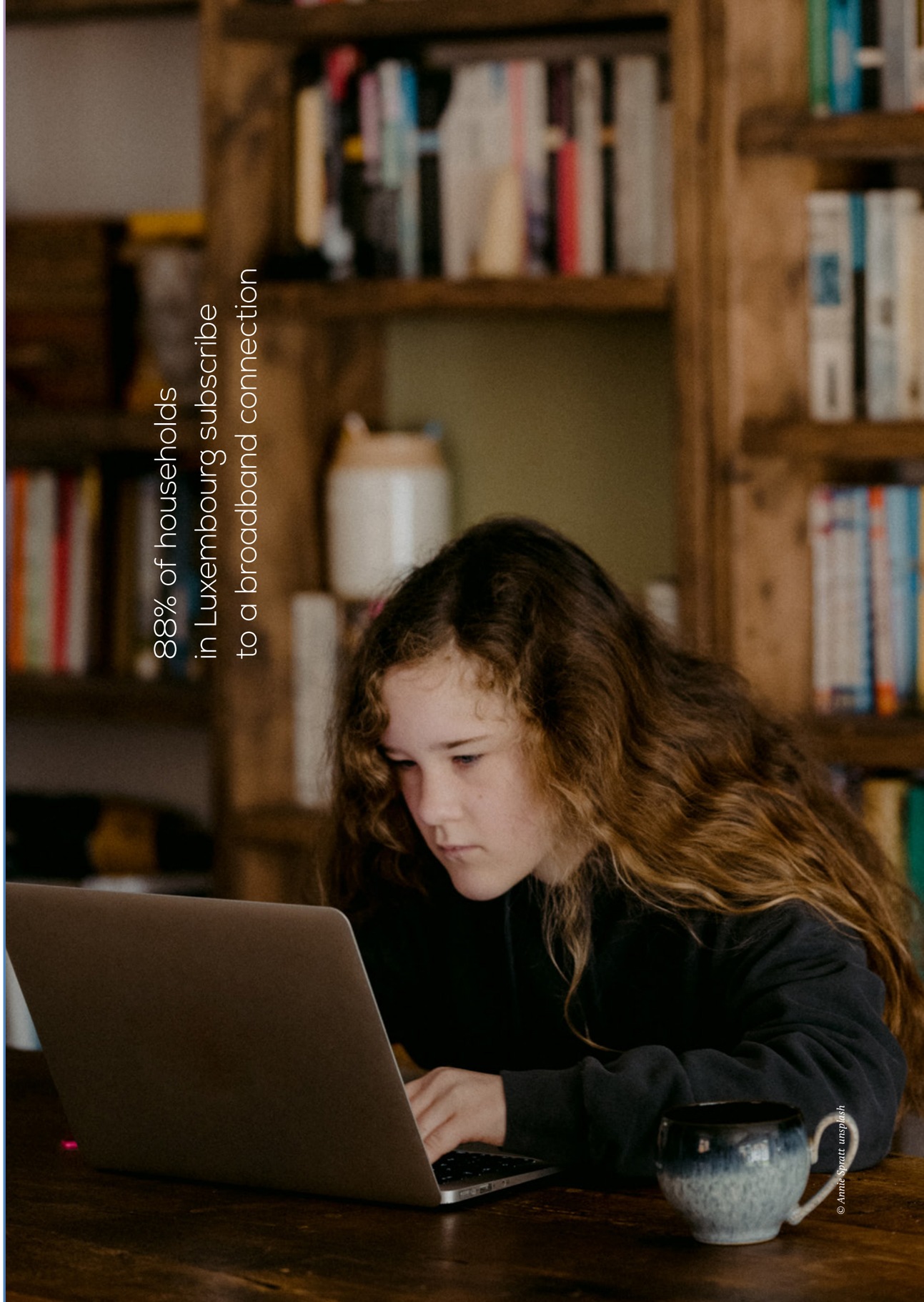
About 88% of households in Luxembourg subscribe to a broadband connection[11], the importance of which was underscored by the COVID-19 pandemic. The remaining 12% of households do not yet feel the need for ultra-high-speed internet connection or struggle to afford it.

Mobile services are often perceived by the general public as being more important than the fixed access offered by various fixed-access network technologies (fiber, CATV). However, mobile connectivity often provides only limited data volumes and/or guaranteed speed. Despite this, many households still have a fixed connection based on a legacy contract with an old-generation physical connection. They, therefore, face a substantial cost premium to upgrade to the higher speed offered by modern technologies.

[11] *Based on ILR's "Electronic communications scoreboard for the second half of 2020" and the number of households in 2019 as published by Statec in "Luxembourg in figures 2020", adjusted for 2020 population growth – includes any type of DSL, cable or fiber-optic service*

measures

To prevent a digital divide from arising in our society, it is essential to ensure that everyone has access to an affordable basic high-speed internet connection. In order to provide this service to the most disadvantaged households, targeted measures will be assessed and implemented.



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objective 2

accelerate the transition of households and businesses to more efficient and sustainable technologies

context

Luxembourg ranks among the best-connected countries in Europe in terms of deployed infrastructure[12] and benefits from state-of-the-art connectivity infrastructure throughout the country. Currently, its infrastructure is mainly based on a fiber-to-the-home (FTTH) access network and a coaxial cable network (largely consolidated by one operator since 2020 and DOCSIS 3.x standard), both capable of speeds in excess of 1 Gbps. However, the country falls in the middle of the rankings for consumer use of digital services and in the bottom half of the rankings for business digitization and e-commerce. Therefore, this strategy encourages residents and businesses to adopt next-generation networks and utilize the services and opportunities they unlock.

[12] *DESI 2020 study*

current situation

On the business side, all commercial and small business zones are connected to the fiber-optic network and have the possibility of connecting at customized speeds, depending on their requirements. For households, 95%[13] can access a network capable of delivering at least 100 Mbps. However, by the end of 2020, only 57.6% [14] of households had subscribed to a service with a downstream speed of at least 100 Mbps, i.e. well below the capacity of the infrastructure already deployed. While the pandemic has accelerated the migration to higher speed services, there are a number of barriers that are slowing down the adoption of scalable fixed connectivity technology by households. These barriers may be technical (vertical cabling constraints within a multi-household building) or financial (possible connection fees or higher service costs after switching technologies).

[13-14] *Luxembourg Telecommunications Statistical Report for the year 2020*

≥100 Mbps' internet access percentage

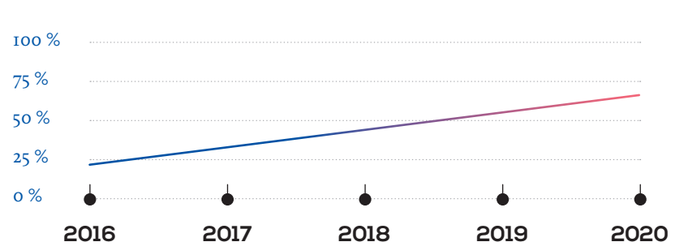

Fig. 2: Number of Internet accesses by downstream speed, based on ILR's "Electronic communications scoreboard for the second half of 2020"

measures

By 2025, the strategy aims to have 100% of residential users adopt a basic ultra-high-speed internet service of at least 100 Mbps downstream and 20 Mbps upstream, using a next generation network. This requires a migration rate similar to that seen in 2020. For businesses, it is important to procure ultra-high-speed internet connection services that meet their needs, while anticipating possible security risks. This will involve an awareness campaign that encourages consumers and businesses to subscribe to a scalable, fixed network service that meets their specific needs.

Additional measures will be proposed to facilitate the deployment of vertical cabling within multihousehold buildings, taking into account the differing interests of the parties involved, e.g. tenants and owners.

objective 3

accelerate the deployment of scalable infrastructure

context

In order to access speeds beyond the basic 100 Mbps service, a fiber-optic backbone and a local access network using a fiber-optic, CATV, 5G FWA or satellite connection are required. The main objective of the 2010 strategy was to promote the rapid and widespread deployment of these scalable, next-generation networks[15] (i.e. networks capable of adapting their capacities to future needs). This objective has largely been achieved, but as a result, the remote locations that do not yet have them remain at a disadvantage, with speeds of little more than 30 Mbps. Once next-generation infrastructure is fully deployed, the previous legacy network will become redundant and can be gradually disconnected, increasing energy efficiency and reducing operating costs. 5G FWA technologies and satellite internet are maturing, potentially becoming an alternative to connecting otherwise hard-to-reach households (although likely at a higher operational cost compared to fixed connections). Technological neutrality is very important in maintaining a diverse and competitive market, leaving operators and consumers to choose the most efficient solutions.

[15] *Very high-capacity network (VHCN): 1 Gbps downstream and 200 Mbps upstream in fixed network and 150 Mbps downstream and 50 Mbps in mobile network (5G, satellite), BEREC Guidelines on Very High Capacity Networks*

current situation

With 95% [16] of households able to access a VHCN15 network, the vast majority of households in Luxembourg are already connected to futureproof networks. The remaining households are often isolated and scattered, significantly increasing the cost of each new connection and making deployment economically prohibitive. The difficulties encountered today mainly relate to the coordination efforts and cost of laying underground cables and ducts.

[16] *ILR study "Market analysis, Markets 3a/2014 and 3b/2014", published in 2018*

measures

This strategy's ambition is to ensure that every housing unit has access to at least one VHCN network. While network operators continue with their expansion plans, this strategy prioritizes households in remote areas that are not connected by a VHCN network. Connecting remote, rural homes is costly and not necessarily worth the investment for private companies. In these cases, public support may be considered. Any such aid is subject to European state aid rules and is not intended to hamper competition or to reduce, replace or render obsolete private investment in the market. 5G FWA or satellite technologies can significantly reduce the need for civil works or avoid them entirely.

We need appropriate incentives for investment in new, very high-capacity networks that will encourage the innovation of content-rich internet services and enhance competitiveness. Such networks have enormous potential to deliver benefits to residents and businesses. It is crucial to encourage sustainable investment in the development of these new networks while (1) preserving competition – as infrastructure bottlenecks and barriers to entry remain – and (2) stimulating consumer choice through regulatory predictability and consistency.

objective 4

improve transparency and strengthen consumer protection

context

Over the past decade, the ultra-high-speed internet market has grown significantly from 160,000 subscriptions to 235,000[17], due to the large-scale market penetration of internet services. Consumer expectations regarding transparency and customer service have risen, as connectivity continues to play a growing role in their daily lives.

[17] *Données publiés par l'ILR: «Rapport statistique secteur télécommunications année 2009 & 2020»*

current situation

Though Luxembourg's telecommunications market was once dominated by the incumbent operator, it has become significantly more dynamic, with a number of alternative operators entering the market. This has inevitably led to more diverse offers aimed at new customers, focusing mainly on price and speed. However, contracts are difficult for users to compare due to the different types of connections, performance (e.g. speed, latency), quality of service (e.g. available ports, video streaming), minimum contract duration, termination periods and more. With the advent of next-generation connectivity linked directly to the home, the internal network is often unable to relay incoming speeds to the end devices. A Wi-Fi type wireless network may be too weak, especially when devices are spread over several floors or when buildings attenuate the signal or nearby Wi-Fi networks interfere with it.

measures

Customer contract play the essential role of delivering transparent information and legal certainty to end users. In addition to the measures provided for in the law transposing the Electronic Communications Code, existing consumer protection requirements in the field of contracts apply.

The specificities of the electronic communications sector bring additional obligations. End users must be informed of the quality of service levels offered, the conditions related to sign-up offers and termination of contracts, the applicable pricing plans and the prices for services subject to special pricing conditions, to name a few.

To enable the end user to make informed decisions, the relevant information must be provided prior to the conclusion of the contract in clear and comprehensible terms and in a durable format, e.g. as a document that is easy to download, open and consult on devices commonly used by consumers. To facilitate comparison, suppliers should also provide a summary of the essential terms of the contract.

The ultimate goal is improved transparency and informed decision-making before and after the signing of any ultra-high-speed service contract[18], for example, by providing customers with detailed performance information for their address and, if possible, at the housing unit level (taking into account vertical cabling). In a competitive market, consumers must be able to compare different service providers and their offers by reviewing easily accessible information, such as pricing.

[18] *The provisions of the Electronic Communications Code will also apply to voice and mobile Internet contracts*

In addition, the existing process for switching providers will be reviewed. The draft law transposing the European Electronic Communications Code into national law addresses these points, while the ILR is responsible for ensuring the implementation of these provisions. As a first step, a list of the available fixed connectivity services at the address level will be made available to households by the ILR, thus facilitating an informed decision.

To improve in-home connectivity, operators are encouraged to offer solutions that optimize customers' internal networks (Wi-Fi network, fixed cabling), which must manage an increasing number of devices across multiple living spaces in spite of interference and other obstacles. Such solutions may also be offered by other service providers, not associated with operators.

objective 5

develop Luxembourg as the launchpad of choice for ICT service providers of today and tomorrow

context

Luxembourg has worked hard to develop a leading ICT ecosystem that, combined with a dynamic financial sector and advanced communications infrastructure, has attracted multiple market leaders to the country. Progress continues, accompanied by key public initiatives, such as calls for 5G projects, the installation of a high-performance computer (HPC) and the quantum communication project (LuxQCI). The trend towards international cloud services will likely impact Luxembourg's ultra-high-speed infrastructure, the backbone of its ICT sector. Cloud services depend on sufficient supplies of dark fiber[19], efficient and redundant international connectivity and a diverse market of local B2B operators – criteria essential to maintaining the country's attractiveness.

[19] *So-called dark optical fiber is deployed in the ground but not used, and therefore constitutes segregated spare capacity*

Luxembourg's telecommunications network requires nonstop development due to the continuous increase in data consumption per user and continuous growth of the resident population and number of cross-border commuters.

current situation

Historically, the financial sector drove the development of sophisticated connectivity solutions, attracting a large number of leading international service providers. Luxembourg's current network has considerable capacity available at both national and international levels. Operators have made significant investments to improve redundancy and decouple networks from the retail market and from the mobile network. Public structures have been put in place to complement and optimize the available commercial infrastructures.

measures

A dynamic B2B market supports Luxembourg's ICT appeal and economic digitalization. Our objective is to maintain and develop a competitive framework for connectivity services. At the same time, we want to maintain a state-of-the-art network able to provide the capacity and backups required by the growing digital economy. Efficient access to cloud computing services provides flexibility that is important to the service sector, for example, which often has multiple locations across different countries.

Initially, implementation involves monitoring the ecosystem in order to react quickly if gaps arise or market competitiveness decreases. Additional measures will be proposed to attract innovative ICT service providers.

03

summary of next steps

A detailed, actionable implementation plan for these five strategic objectives will be deployed once it has been evaluated and validated by relevant stakeholders. The plan will address both the legal basis and financial requirements. A first outline of potential actions includes the following:

Serve as a central contact point offering advice and assistance to stakeholders (project owners, municipalities, operators, etc.) in order to help coordinate worksites and optimize investments

01 National mapping of available communication technologies and classification of connection types to establish priorities and an action plan that will facilitate the implementation of viable solutions.

02 Revising, improving or replacing the register of works to optimize the actions needed for an effective deployment of communication networks.

03 Analysis of authorization procedures to update or deploy new networks in a more efficient way.

04 Assessment and implementation of a programme of targeted measures ensuring connection to the most disadvantaged households.

05 Assessment of the current situation and study of legal provisions to facilitate the installation of vertical cabling in multi-family residences.

06 Implementation of measures to strengthen consumer protection and as well as in-depth market monitoring.

07 Establishment of a dedicated team to support the strategy. Its main task will be to support the implementation of the above measures.

glossary

Scalable fixed telecommunication infrastructure	Futureproof infrastructre Fiber-optic backbone and a local access network using fiber, CATV, 5G FWA or satellite connection
Basic ultra-high-speed internet connection service	Minimum 100 Mbps downstream and 20 Mbps upstream service
VHCN	Very-high-capacity network (VHCN): — 1 Gbps downstream and 200 Mbps upstream in a fixed network — 150 Mbps downstream and 50 Mbps in a mobile network (5G, satellite), *BEREC Guidelines on Very High Capacity Networks* / in line with the definition of "very-high-capacity network" of the Electronic Communications Code

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let's talk!

your ideas are welcome here.

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www.gouvernement.lu/smc 09/2021