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FUTURE NETWORKS

"What choice for digital technologies": viewing telco networks through the lens of digital practices

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1 Foreword

In this era of non-stop innovation in technologies, practices and business models, the common goods that are the networks are being continually subject to change, if not profound upheaval. Every network, be it telecoms, fixed or mobile, internet access or electronic communications, whether postal or press distribution, is thus having to grapple with transformations in their operating models, and this at a time when environmental issues are moving front and centre.

This is why in October 2023, Arcep, which regulates the players that operate these networks, backed by a new Scientific committee, began a cycle of inquiry to deepen its understanding of how networks are likely to evolve over the next five to ten years. This new cycle follows through on the initial work carried out in 2018. Arcep and its Scientific committee identified the topic of "What choice for digital technologies: viewing telco networks through the lens of digital practices" as among the germane issues to be addressed.

The documentary research work and the interviews conducted with a range of stakeholders (local authorities, academics, businesses, associations…) revealed that this topic of "What choice for digital technologies" was likely to encompass a host of issues tied to the role that digital technology plays in society, as widespread digitalisation has gone hand in hand with signs that people's relationship with that technology is gradually changing. In keeping with the objectives of the "Future networks" initiative, this briefing note will focus its reflections specifically on people's expectations of digital networks and infrastructures.

To this end, the note will begin with an inventory of major network rollouts over the past several years, both fixed and mobile, their take-up by users and the factors of reciprocal influence between technology deployment, people's expectations and how practices develop. This assessment will also be an opportunity to analyse those instances in which particular sensitivities, if not controversies, have arisen around network rollouts and the central challenges they elicit – without claiming to be exhaustive.

Drawing on these observations, the note will then adopt a forward-looking posture to examine the ways and means to reconcile these issues and concerns with the development of information and communication technologies (ICT) and electronic communications networks that serve the general interest, against a backdrop of disparate views on the role of ICT in our society. Although the development of digital technology is part of a global dynamic, this forward-looking exercise will focus on the situation in France and its specificities in terms of connectivity needs.

2 "What choice for digital technologies" in an era of changing relationships with ICT

2.1 The pervasive digitalisation of our societies

The past two decades have demonstrated that digital technology is a powerful driving force in societal change, be it economic, social or our daily lives. Information and communication technologies (ICT) now shape our access to knowledge and education, to entertainment, leisure, democratic life, how economic activities are organised and how innovations develop. The innovations ushered in by ICT have spurred very rapid growth trajectories on both an individual (device adoption rates, digitisation of practices, etc.) and global (traffic growth and increased scaling of infrastructure) scale.

This rapid penetration of digital devices has gone hand in hand with a fundamental shift in our lifestyles and individual behaviours: the internet and connectivity now play a dominant role in French people's lives. This can be seen on a large scale, for instance through the ongoing growth of mobile data traffic

(around +20% a year for the past three years in France)[1]. According to the Digital Market Barometer, the number of people who had bought something online over the previous 12 months grew from 11% in 2003 to 77% in 2024[2]. The use of social media (regardless of purpose) has also skyrocketed over the past ten years. The percentage of people in France who had visited a social media site over the previous 12 months went from 23% in 2009 to 62% in 2022.

The Covid crisis was a contributing factor to the accelerated pace of society's digitalisation in recent years, in addition to having a lasting effect on the adoption of certain digital practices. The lockdowns and the periods of forced remote work accelerated the take-up of videoconferencing amongst certain sections of the population. The videoconferencing solutions that were introduced drove a lasting shift in remote working practices, which had been little used before Covid, in every organisation. Other digital practices also experienced massive growth in 2020, including e-commerce (76% of those polled said they had shopped online at least once) and telemedicine (26% of the people polled had consulted a doctor online during lockdown)[3].

2.2 Signs of people's changing relationships with digital technology

As digital technology has played an increasingly large role in our society, there have been signs in recent years of people's changing relationship with that technology. While ICT is being adopted more and more and becoming an integral part of our daily lives, the benefits and opportunities it proffers are being increasingly set against certain inherent risks.

Screen time and screen addiction, mental health issues affecting young people, online bullying, environmental sustainability, privacy protection, disinformation and challenges to democracy, the influence of artificial intelligence: ICT's development is giving rise to a host of concerns and forcing us to examine our relationship with those technologies.

Multiple recent examples serve to illustrate this situation. In 2024, 55% of internet users said they cannot stay offline for a day without missing the internet (+39 points compared to 2011)[4]. This figure rises to 71% amongst young people between the ages of 12 and 17. In addition, the Digital Market Barometer reveals that, in 2024, people ages 12 and up spend an average of four hours a day on their devices, or a quarter of their waking lives[5]. When queried about the role that devices play in their lives and their screen time, close to half of respondents felt that they spent too much time on them. In 2023, 12% of people ages 12 and up said that they had experienced online bullying over the past twelve months[6]. This figure rises to 40% amongst 18 to 24-year-olds. When questioned in 2024 about their main concerns regarding digital technology, 28% of the population said they were worried that their personal data would be used either inappropriately or without their consent.

The advent of generative AI with the launch of ChatGPT in November 2022 also kicked off a host of debates about the economic, societal and environmental issues surrounding the technology, which were addressed during the AI Action Summit in February 2025 in Paris. While artificial intelligence tools are already being used by one third of the population[7], most people still have concerns about them: 62% view artificial intelligence as a threat to jobs, for instance, and 48% see it as an environmental threat.

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[1] Arcep, Electronic communications market observatory.

[2] Arcep, Arcom, CGE, ANCT, Digital Market Barometer, 2025 edition.

[3] Arcep, CGE, ANCT, Digital Market Barometer, 2021.

[4] Arcep, Arcom, CGE, ANCT, Digital Market Barometer, 2025 edition.

[5] Arcep, Arcom, CGE, ANCT, Digital Market Barometer, 2025 edition.

[6] Arcep, Arcom, CGE, ANCT, Digital Market Barometer, 2023.

[7] *Ibid.*

Parallel observations can be made regarding electronic communications network deployments. On the one hand, there is a growing demand for connectivity and nationwide coverage; on the other hand, concerns are being expressed about the harmful effects of 5G on health and the environment, for instance. In response to these specific concerns, elected officials called for a moratorium on 5G development in 2020, as the first frequency auctions got underway, and associations filed several lawsuits.

These parallel and sometimes contradictory trends, between digitalisation, increasing use and growing concerns, call for an investigation into how networks are evolving and the conditions for ensuring that they align with societal expectations and assuage end users' concerns.

To this end, based on feedback on fixed and mobile deployments over the past several years (Part 3), the note will explore expectations with respect to "Future networks" and the ways in which they can be or are already being factored in by the different stakeholders (Part 4).

3 Feedback on networks' evolution: what deployments for what use cases?

This part explores feedback on fixed (3.1) and mobile (3.2) deployments over the past several years, how end users have reacted to them and the practices that have resulted from them, to analyse the factors of reciprocal influence between ICT deployments and how practices develop (3.3). This part will also focus in particular on certain critical issues that have emerged during these deployments and technological shifts, by endeavouring to uncover their sources and their implications (3.4).

3.1 Feedback on fixed network deployment and use

3.1.1 Deployment

In 2025 in France, some fifteen years after the first fibre to the home (FttH) deployments, 90% of the country's premises are able to subscribe to an FttH[8] plan, putting it amongst Europe's leaders in this area. As fibre access has steadily become more widely available and destined to eventually replace the legacy copper network, it would be worth looking at how deployments have unfolded, and to take stock of users' acceptance and appropriation of this new technology.

Fibre to the home deployment in France is the fruit of the combination of an industrial momentum driven by operators, and public policies to support this drive, with the goal of achieving rapid and widespread coverage of the entire country. In the 1990s and 2000s, as electronic communications markets in Europe were being liberalised, ART (*Autorité de régulation des télécoms*, Arcep's predecessor) required incumbent operator France Télécom (now Orange) to unbundle the copper local loop, in accordance with European laws. The successful operation of local loop unbundling (LLU) enabled several solid alternative operators to emerge. In the mid-2000s, several fixed network operators (both incumbent and alternative) announced their desire to deploy a new fixed technology, namely optical fibre, across the entire country.

Public powers took hold of the innovation and technical solutions available at the time to establish a deployment framework for infrastructures across France, to satisfy multiple public policy objectives: digitalising the economy, regional digital development, closing the digital divide, economic development and innovation, etc. The rollout of a new, more efficient fixed electronic communications network, and one designed to eventually replace the ageing copper network, was organised in the late 2000s, before its widespread dissemination.

[8] Arcep, Fixed ultrafast broadband market, 2024.

To this end, Article L. 34-8-3 of the French Postal and Electronic Communications Code (CPCE) enshrined the principle of FttH network sharing, and entrusted Arcep with implementing it. In 2009, Arcep published a first Decision[9] establishing the founding principles of optical fibre deployment, including the introduction of so-called symmetrical regulation, which applies equally to every operator deploying FttH in France. This symmetrical framework was supplemented by a second Decision[10] setting out several arrangements, notably for more sparsely populated areas.

The following year, the Government launched the *Programme National Très Haut Débit* (PNTHD), which would become the *Plan France Très Haut Débit* (PFTHD) two years later, i.e. the national ultrafast broadband rollout programme that until today, has been structuring and organising deployment management and financing in France, relying on stakeholders from both the private (operators) and public (starting with local authorities: departments and regions) sector, and confirming operators' choice of technology: fibre to the home. The PFTHD set ambitious nationwide coverage targets, broken down into several stages that were steadily elevated: good broadband for all (> 8 Mbit/s) in 2020, ultrafast broadband (UFBB) for all (> 30 Mbit/s) in 2022, and virtually ubiquitous fibre access nationwide in 2025. These targets gradually aligned with the fixed connectivity targets set by the European Union, including the Gigabit Society (or ultrafast broadband: > 100 Mbit/s) in 2030, leading to a similar dynamic of massive high-speed then ultrafast broadband rollouts across the EU.

The PFTHD is undergirded by an overall investment of 36 Bn€[11], including both private and public initiatives and investments, while ensuring they are properly coordinated to avoid inefficient spending, e.g. on redundant or overlapping deployments. Total financing includes 3.5 Bn€ in State subsidies for local authorities' projects, or 25% of all public funding, which represents around a third of total financing.

Now that the vast majority of the country is covered by FttH, these networks will have to replace the legacy copper network, which is owned by France's incumbent operator, Orange, which has in fact announced that the old network would be switched off by 2030. As much for economic as technical reasons, it does not make sense to keep and maintain two complete, parallel infrastructures. FttH networks are thus, ultimately, destined to replace the legacy copper network. This trend of switching off copper networks can be observed across the EU, in fact, albeit with varying timetables and switchoff processes.

With FttH, France was thus able to undertake the deployment of a new, more efficient fixed network in a relatively short period of time: less than ten years passed between the onset of the massive expansion of FttH rollouts in 2015/2016, and the widespread availability of the FttH network, now the main source of ultrafast access in France (see graph below). FttH is now widely available nationwide, including in rural areas, and the FttH network today is the main very high speed and ultrafast broadband technology available in France.

[9] Arcep Decision No. 2009-1106 of 22 December 2009 specifying, pursuant to Articles L. 34-8 and L. 34-8-3 of the French Postal and Electronic Communications Code, the arrangements for accessing ultrafast optical fibre electronic communications lines, and the instances in which the shared access point can be located on private property.

[10] Arcep Decision No. 2010-1312 of 14 December 2010 stipulating the arrangements for accessing ultrafast optical fibre electronic communications lines nationwide except in very high-density areas.

[11] Report "Infrastructures numériques et aménagement du territoire | Impacts économiques et sociaux du Plan France très haut débit", (Digital infrastructures and regional development | The economic and social effects of the national ultrafast rollout scheme), France Stratégie, January 2023.

Progression of FttH eligibility in France between 2015 and 2024

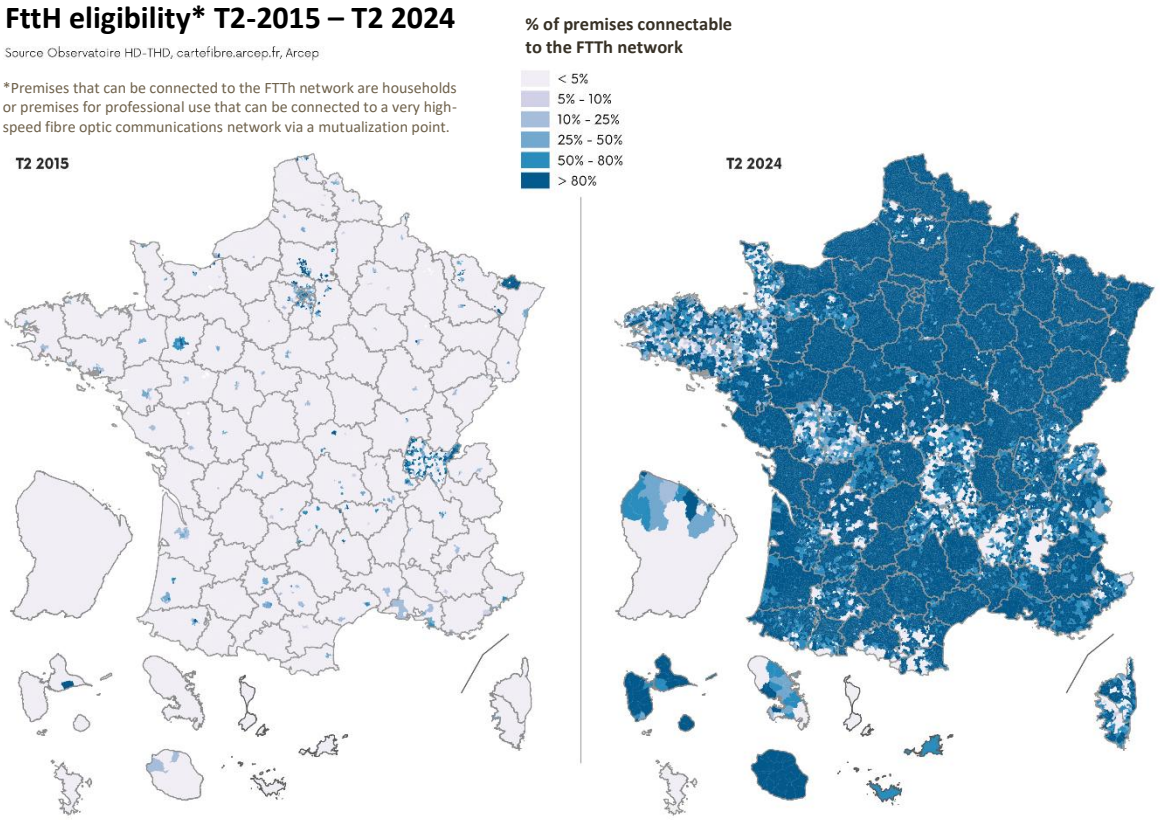

Figure 1 - Source: BB-UFBB Observatory, cartefibre.arcep.fr, Arcep

3.1.2 Network usage

Unlike copper, fibre access provides similar speeds and services everywhere. At the end of 2024, 75% of internet subscriptions in France were to an FttH plan. The success of fibre access in France can be attributed to its rapid deployment across the country, but also to its popularity with consumers who quickly switched to FttH plans. While the first FttH rollouts were in densely populated urban areas, which operators viewed as more lucrative since less expensive to deploy, the PFTHD scheme's "public-initiative network" component, carried by departments and/or regions in France's rural areas, paved the way for FttH rollouts in rural areas at the same time and, in some cases, even before urban areas. As a result, as soon as FttH became available, users in rural areas in particular massively switched over to this network. This appetite for FttH can be explained not by any new use case or killer app that only fibre can deliver, but rather by especially strong expectations, at a time when minimum connectivity requirements were growing (remote working, online classes, etc.), and FttH would provide a smoother, more user-friendly experience with existing services. A study from 2024 also revealed the built-in premium on the price of homes with fibre access[12].

The symmetrical regulatory framework that Arcep established back from 2009-2010 was geared to making it easier for all commercial operators (aka internet service providers, or ISPs) to access the FttH networks built and/or operated by infrastructure operators (who are in charge of operating the networks). As a result, ISPs all gradually started offering their services onto the different FttH networks,

[12] Guiffard, Jean-Baptiste. "Valuing the virtual: The impact of fibre to the home on property prices in France." *Telecommunications Policy* 48, no. 4 (2024): 102732.

whether operated by private companies or local authorities. This can be seen today in the very high rate of network sharing, regardless of the type of network (private or public): at least two ISPs are present on 99% of deployed FttH lines, and at least four ISPs are present on 90% of these lines[13]. In addition to being able to subscribe to an FttH plan, consumers thus have a choice of ISP, and benefit from strong retail market competition, as was the case with copper (ADSL) network access.

The growing availability of fibre access across the country made it possible for more people to work from home, which was further accelerated during Covid. During lockdown, 33% of people ages 18 and up worked from home. Three quarters of them said they did so without encountering any real issues[14]. By the same token, this good quality fibre connectivity facilitated the adoption of the digital version of a range of daily tasks (accessing government services, booking appointments, online shopping, etc.), as well as the development of video on-demand (VOD) platforms and the explosion of video viewing in every part of the country, both urban and rural. By way of example, between 2016 and 2022, the percentage of the population that subscribes to a VOD service increased almost threefold, going from 20% to 55% in only six years[15]. Being a fibre subscriber also contributed to increasing people's digital skills, and so to eradicating the digital divide. A study carried out in Brittany on the role that fibre access plays in digital practices in rural revitalisation zones revealed that, in 2024, "*having fibre at home also drove the development of digital skills and, by extension, digital autonomy*". "*The people queried who had a fibre plan tended to feel more able to figure out a tech issue on their own (10%) and were less likely to ask for help from a friend, a family member, a neighbour or a work colleague (-9%)*"[16].

With the switchoff of the copper network announced for 2030, FttH networks are set to become the infrastructure of reference. Although fibre has been very widely adopted, and the first stages of the copper switchoff have begun, it nevertheless appears that some consumers are still reluctant to switch to this new technology. Continuing to ensure that every citizen remains connected will therefore be an issue during the final stage of the copper network switchoff (cf. section 3.4.1).

3.2 Feedback on mobile network deployment and use

3.2.1 Deployment

In the 1980s, first generation mobile networks only provided the ability to make phone calls in analogue mode. In the 1990s, fully digital second generation (2G) networks brought progress in terms of capacity and security. They also introduced a major innovation for users: the ability to send text messages (SMS) in addition to calling. The 2000s were marked by the launch of third generation (3G) systems that gave users the ability to surf the web on their mobile phones. Some ten years later, fourth generation (4G) networks emerged, with a commercial launch in France in late 2012. They ushered in significant advances in mobile communications, notably with reduced latency and much faster connections. The surge of smartphones and an ecosystem of smartphone app developers opened up access to a plethora of services such as video streaming, video calling, online gaming and digital tools such as e-banking and e-government services.

Fifth generation (5G) mobile systems are the most recent addition, with pioneer rollouts in France in late 2020. This new generation stands out for its even more powerful performance, an increased capacity to respond to ever growing data traffic, as well as infrastructure adapted to the proliferation of connected objects, and to manufacturing and other businesses' dedicated use cases.

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[13] Arcep, Broadband and superfast broadband market observatory: subscriptions and rollouts (Q3 2024), 2024.

[14] Arcep, CGE, ANCT, Digital Market Barometer, 2021.

[15] Arcep, Arcom, CGE, ANCT, Digital Market Barometer, 2022.

[16] Marsouin Study: "Les usages numériques en Zones de Revitalisation Rurales : le rôle de la fibre" (Digital practices in rural revitalisation areas: the role of fibre), June 2024.

Some of these technological developments have radically transformed users' habits, rendering access to mobile networks a now essential service for society.

In the mid-2010s, while smartphones and smartphone use were becoming increasingly commonplace, a growing divide was being felt in the more sparsely populated areas, between users' needs and the mobile coverage being provided by operators, not only in 4G, but 3G and 2G as well. A great many citizens in rural areas complained of being left behind: a confirmation code sent by SMS during a banking transaction never received, self-employed workers (liberal professions) without a connection when travelling to their customers/patients, etc. Associations of local authorities mobilised and lobbied the Government and operators to address this growing sense of exclusion amongst rural populations.

Confronted with this reality, public and private sectors players worked to guarantee high quality mobile coverage across the country. Several programmes were launched ("800 strategic cell sites[17]" counter) or relaunched (*Zone blanche – centre bourgs* dedicated to improve coverage on the town centre of small villages[18]) to this end, but their range was intrinsically limited. Upcoming frequency band assignments were therefore used to improve mobile connectivity nationwide significantly. With the Government's authorisation, Arcep thus wrote coverage obligations into the terms of the licences awarded to the four mobile operators in 2018. The aim of this "New Deal for Mobile"[19] was to achieve ubiquitous, high quality mobile coverage for everybody in France.

The New Deal for Mobile set out a number of obligations: widespread 4G access on operators' mobile networks, ensuring "good coverage" of all populated areas, covering the country's main roads and railway lines (notably those used for daily commutes). It also includes a "targeted coverage scheme" established with input from local authorities on which white areas telecom mobile operators needed to cover. As of 30 September 2024, 99.8% of operators' masts/towers were 4G-enabled, there was 4G coverage on 99.4% of priority transport corridors, and 3,231 new operational multi-operator 4G cells sites were deployed by operators under the targeted coverage scheme[20]. By way of illustration, the image below shows the progression of 4G coverage[21] in France between 2015 and 2024.

[17] French General Secretariat for Investment (SGPI), 800 sites mobiles stratégiques (800 strategic cell sites), 2016.

[18] French General Secretariat for Investment (SGPI), Zones blanches – centres bourgs THD (Town centre – not spot programme), 2016.

[19] Arcep, "New Deal for Mobile" Dossier, 2022.

[20] Arcep, Monitoring the "New Deal for Mobile", 2024.

[21] Arcep publishes coverage data from every mobile operator, with data on every generation network, on the Mon Réseau Mobile website.

Progression of 4G coverage in France between 2015 and 2024

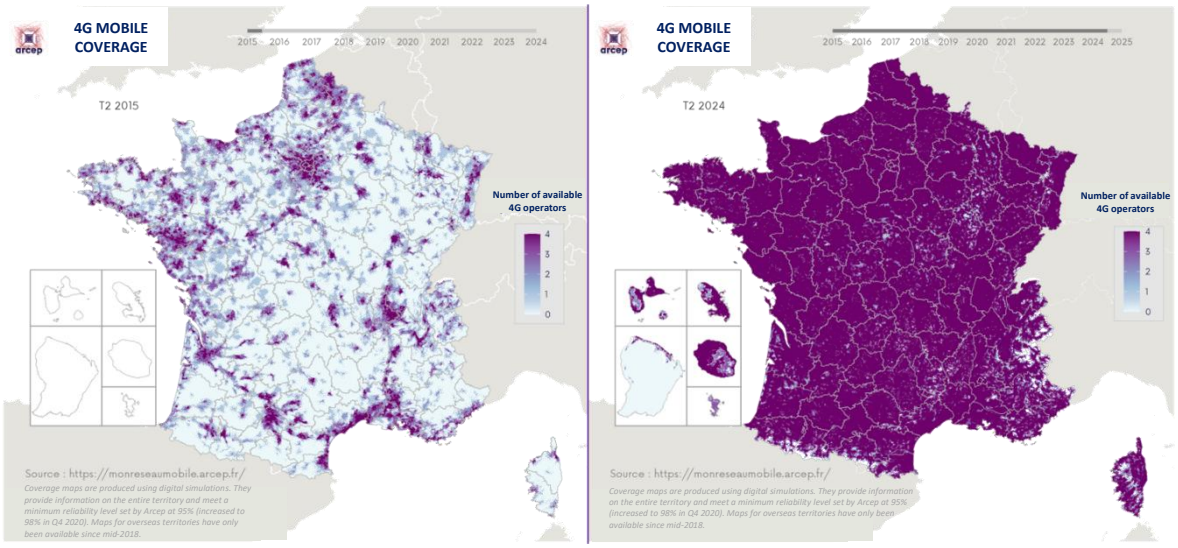

Figure 2 - Source: Arcep

To ensure that the population can continue to enjoy high quality coverage as mobile networks evolve, licences to use new frequency bands, which enabled the launch of 5G, have also incorporated regional digital communications infrastructure development obligations. These obligations include specific targets regarding network performance, geographical coverage and connectivity on the main transport corridors. The 5G network nationwide rollout has been ongoing since being launched commercially in late 2020.

How a new generation mobile network emerges

Two international organisations play a leading role in the emergence of a new generation mobile network: the ITU and 3GPP.

The International Telecommunication Union (ITU) is the United Nations specialised agency for information and communication technologies (ICT), whose chief purpose is to facilitate international cooperation over electronic communications, and to ensure that communication networks and services are available and accessible to everyone, in a fair and efficient manner. The ITU plays an essential role in the development and implementation of new generations of mobile telephony, such as 4G and 5G, notably through the publication of standards and recommendations for the sector.

3GPP (3rd Generation Partnership Project) is an international collaboration of standardisation bodies to establish technical specifications for mobile telecommunications technologies. Created in 1998, 3GPP covers the evolution of cellular network standards, notably 3G (UMTS), 4G (LTE), 5G and beyond. It gathers together the sector's key stakeholders, such as operators, equipment suppliers and researchers.

For the latest known generations of mobile network, ITU published recommendations defining a framework and overall objectives for their development. Its recommendation on IMT-2000 in 1997 was the starting point for 3G, in the same way as IMT-Advanced was for 4G in 2003 and IMT-2020 for 5G in 2015. These guidelines were then taken up by technical bodies that draft a set of standards and principles which are submitted to ITU experts for assessment. These experts verify that the standards

meet the recommended objectives set out in ITU recommendations. If they are validated, they become the standards for the new generation of mobile networks.

Since 3G, it has been 3GPP that develops the technical standards for new generation mobile networks. As an international standardisation project, 3GPP creates a synergy between ITU recommendations and its own technical work. This collaboration ensures the development of new radio interface technologies, and helps regulation keep pace with these developments. By way of example, the recommendation on IMT-2030 published in 2023 is already part of the 3GPP roadmap for the development of 6G, whose principles will be submitted for ITU approval in 2027.

A new generation assembles a set of technological developments covering every network component, and designed to improve each one's performance. Before reaching the standardisation stage, a crucial research stage is carried out on key technologies, followed by their integration into the system along with extensive testing. Although the public often views the advent of a new generation as a sudden change that takes place every ten years, these changes are in fact the culmination of ongoing work: 3GPP publishes a new version of its standards for the current generation roughly every two years. These versions enable a steady improvement in network performances and functionalities, apace with advances in research. The initial version of 5G in 2020 has already evolved and will continue to improve, until coming close to the performances expected for 6G. It is worth noting that in France, as in other countries, the choice was for the 5G rollout to occur in two stages: an initial transitional stage based on the existing 4G network (5G Non-standalone or 5G NSA), then a second stage during which 5G is meant to be deployed in a standalone fashion (5G SA). This is therefore an ongoing process that incorporates connectivity needs and technological advances to improve the functioning of mobile networks.

3.2.2 Digital practices

The development of practices and use cases enabled by 4G and 5G have each followed a particular trajectory. 4G opened the way for new practices for individuals, putting smartphones at the heart of the digital landscape. Thanks to this technology, smartphones have become indispensable tools for listening to music, watching videos, interacting on social media, online gaming, accessing emails and messages, banking, shopping… to name but a few, thanks to a host of available applications. According to the Digital Market Barometer[22], more than 40% of people say their smartphone is their device of choice for connecting to the internet. The following graph shows that, in 2024, 89% of users employed their smartphone to surf the Web, while also making extensive use of its other features[23].

[22] Arcep, Arcom, CGE, ANCT, Digital Market Barometer, 2023.

[23] Arcep, Arcom, CGE, ANCT, Digital Market Barometer, 2025 edition.

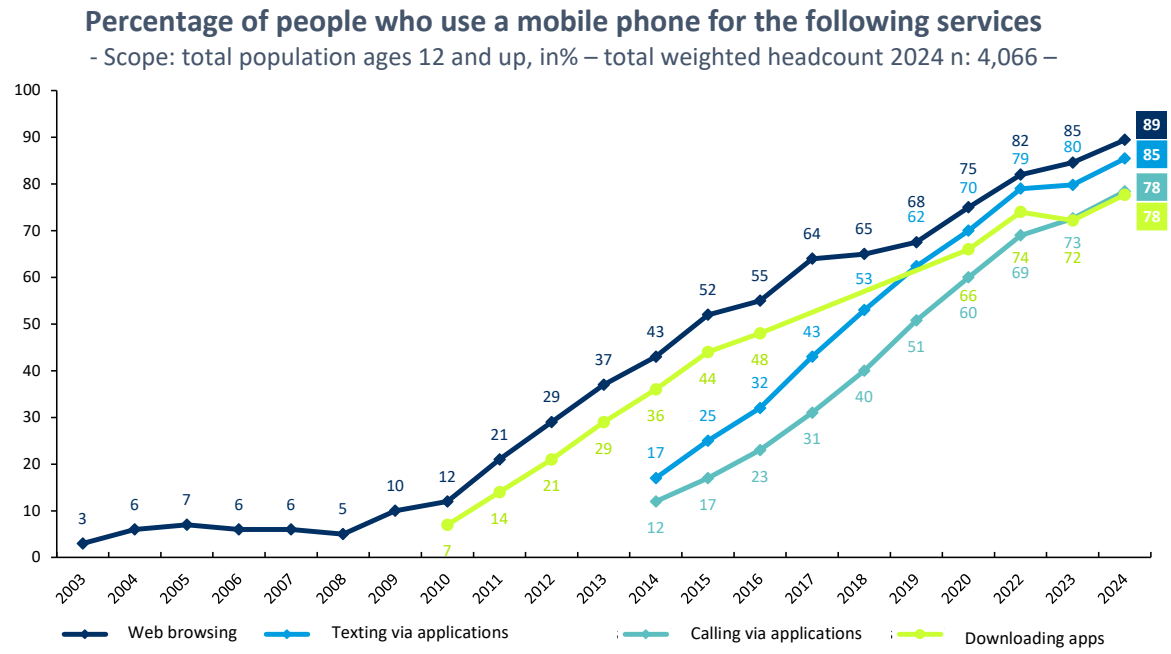

Figure 3 - Source: Digital Market Barometer, 2025 edition

In addition, a still small but growing percentage of the population (9%) uses only a mobile connection for accessing the internet[24]. This is especially true amongst young people: 19% of those between the ages of 18 and 24 (+7 points YoY) and 15% of 25 to 39-year olds (+5 points) only use a mobile connection. This trend can be attributed to the improved quality of mobile networks and the development of 5G.

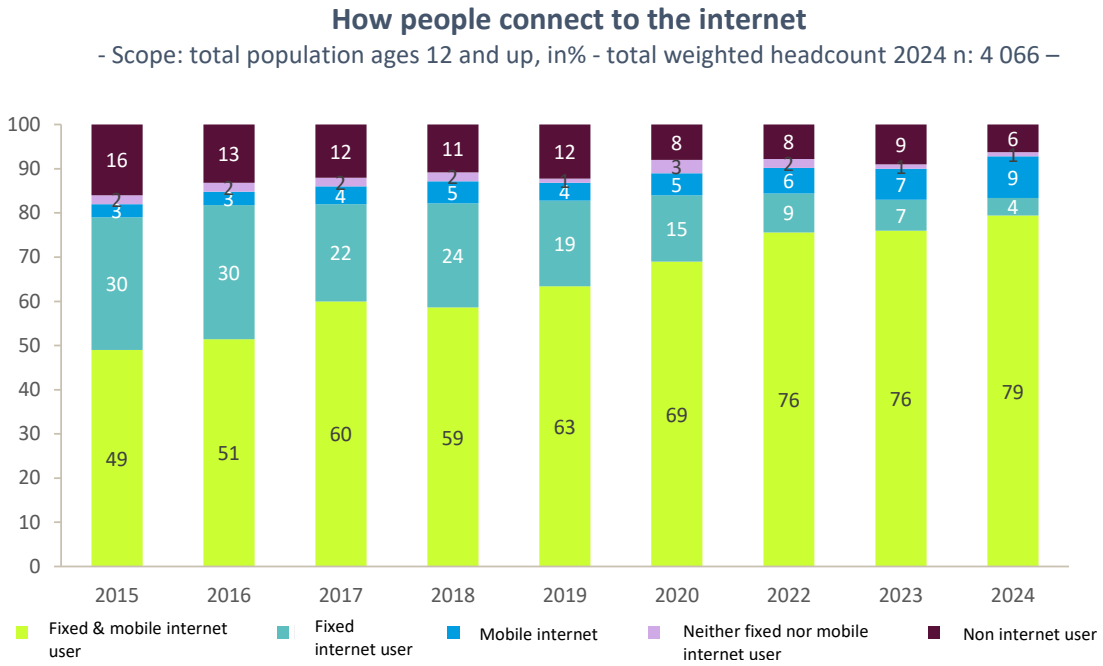

Figure 4 - Source: Digital Market Barometer, 2025 edition

[24] *Ibid*

As mobile practices began to explode in the mid-2010s thanks to 4G, a portion of users were *de facto* excluded from, or limited in their ability to access, these applications due to poor or non-existent 4G coverage in their area, or along the transport corridors they travelled. By guaranteeing widespread 4G access, the New Deal for Mobile guaranteed the nationwide deployment of a network that users were waiting for, and thereby helped to amplify the surge in mobile practices in France, notably via smartphones, from the late 2010s onwards.

Smartphones launched during the 3G era revealed their full potential thanks to advances enabled by 4G. This technological revolution, made possible by fourth generation systems, set high expectations for 5G. These expectations nevertheless gave way to a certain frustration at times, due to a perceived lack of comparably innovative new use cases being unleashed by the advent of 5G.

5G was in fact designed primarily to satisfy the need for more reliable and more powerful connectivity than 4G, while paving the way for innovative use cases, notably for manufacturing and businesses. Events such as the 2024 summer Olympic and Paralympic Games demonstrated 5G's utility for the special events and media sectors[25]. At this stage, the main advantage of 5G when it comes to consumer practices resides chiefly in mobile networks' increased capacity, thanks to the use of an additional frequency band, creating the ability to support ever increasing traffic without diminishing quality of service.

According to data published in January 2025 in Arcep's Digital Market Observatory, there were 22.1 million SIM cards connected to 5G networks in Q3 2024, marking a new annual growth record of close to 10 million since the introduction of 5G in France in 2020. This surge in the number of active cards on 5G networks (+ 4.1 million during the quarter) is tied to the fact that France hosted the summer Olympics in Paris last year. Some operators that differentiated their 4G and 5G plans actually opened up their 5G network to all of their customers during the Games. As a result, the percentage of active cards on 5G networks climbed to 26% in Q3 2024 (+ 12 points YoY). The increased popularity of 5G after the Olympic Games in summer 2024 aligns with the analysis of another study[26] which concluded that users assign a great deal of importance to network performance in critical locations, such as airports, sporting arenas and concert venues. Although this very recent dynamic reveals a revival of growth in 5G take-up after getting off to a slow start, there remains a gap in the comparative pace of 4G vs. 5G adoption in the first years after their respective launches. It will therefore be interesting to monitor 5G's growth trajectory in the coming years, to see if the boost from the Olympic Games proves transitory or whether it kicked off a lasting momentum.

[25] Business Insider, How 5G connectivity has evolved at the Olympic Games, 2024 ; Le Monde, Orange compte faire fructifier héritage des Jeux olympiques (Orange plans to capitalise on the legacy of the Olympic Games), 2024.

[26] Ericsson, "5G value: Turning performance into loyalty", 2023.

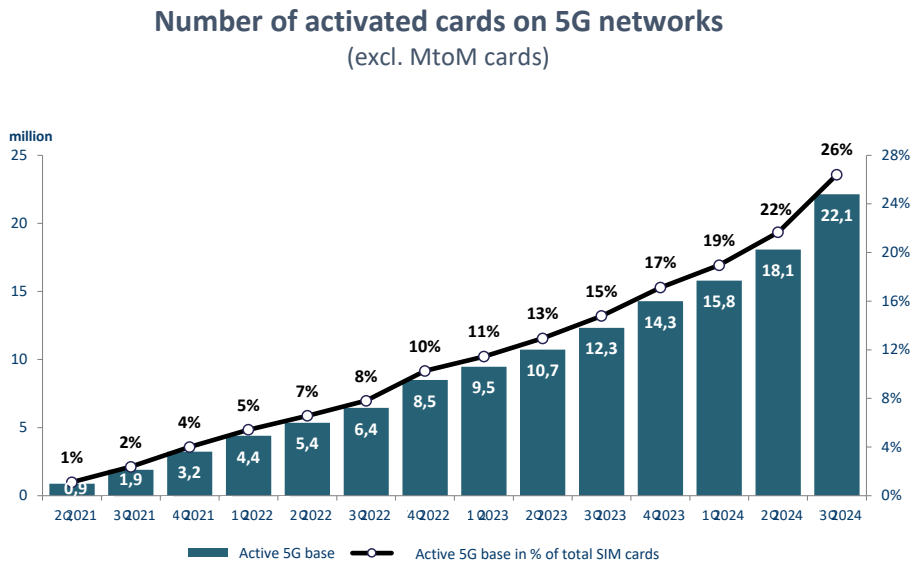

Figure 5 - Source: Observatory of electronic communications markets 16/01/2025

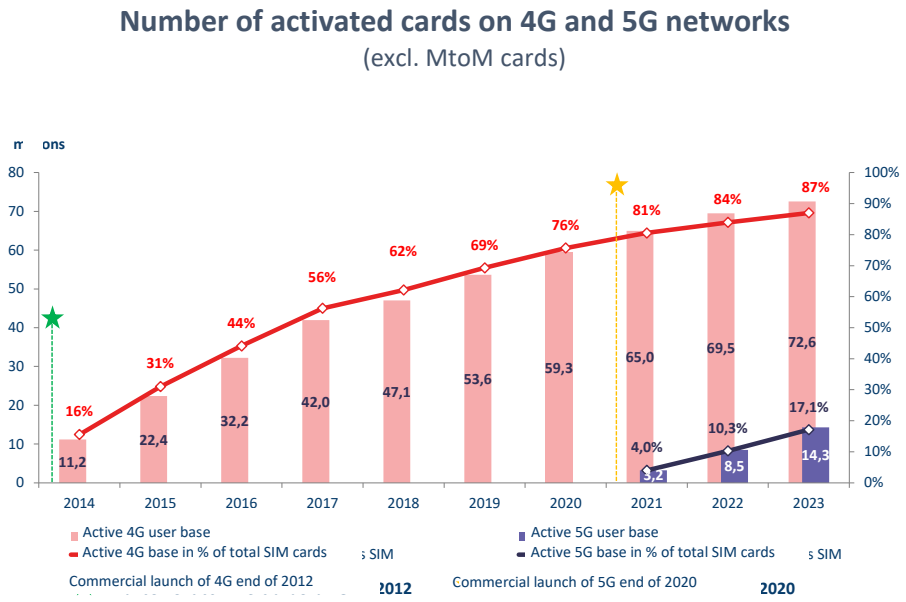

Figure 6 - Source: Observatory of electronic communications markets 30/05/2024

Mobile data traffic continues to climb. Average traffic per user increased from 0.5 Gb a month in 2014 to 15 Gb a month in 2023. 4G thus enabled the democratisation of mobile data services, as illustrated by the massive annual growth rates for data traffic post launch, of around 90%. With the advent of 5G in late 2020, mobile traffic growth remained high, standing at around 25% a year up to 2023. Annual growth in 2024 is expected to be lower, but still well in excess of 10% and synonymous with a steady increase in traffic.

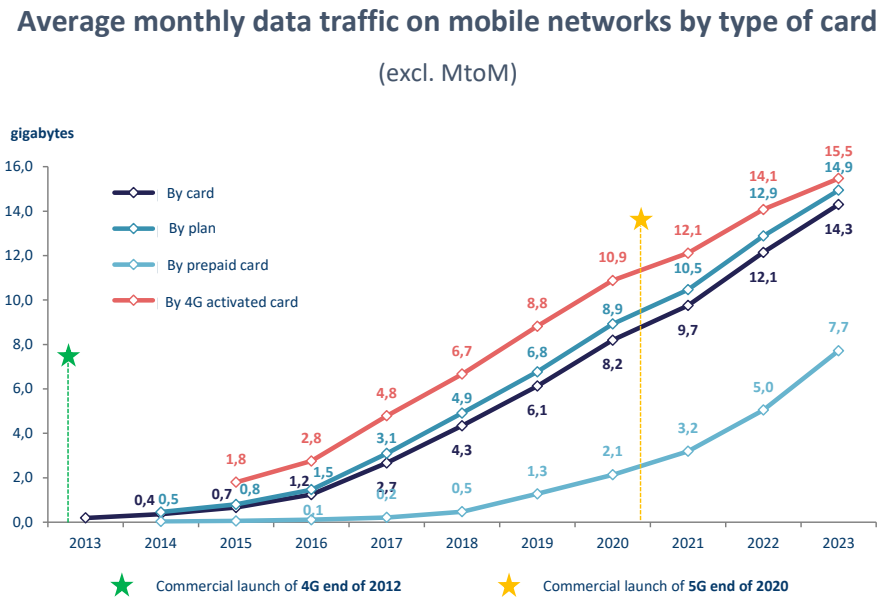

Figure 7 - Source: Observatory of electronic communications markets 30/05/2024

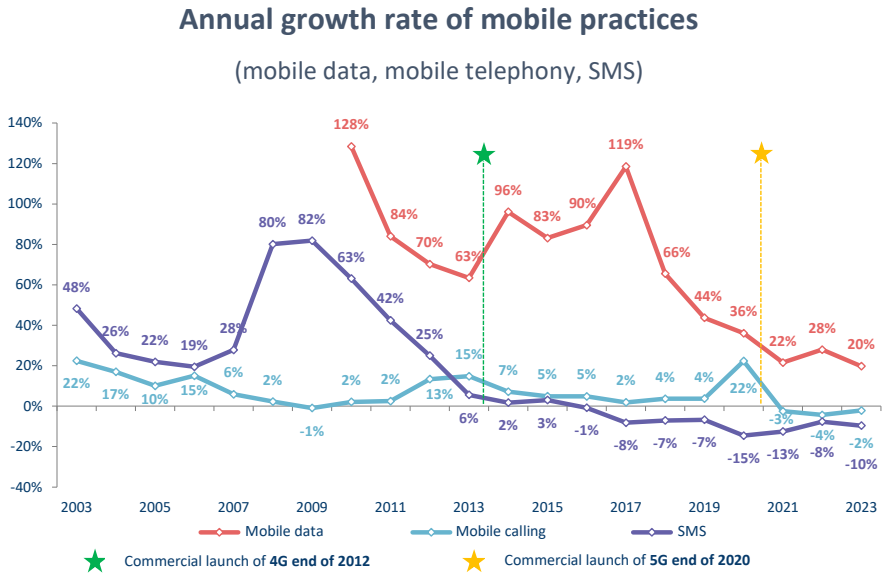

Figure 8 - Source: Observatory of electronic communications markets 30/05/2024

3.3 Factors of reciprocal influence between technology deployments and the development of practices

Feedback on the different technology deployments outlined above reveals tremendous disparities between the factors that influence the development of digital practices. These past examples create the ability to investigate the links between the supply of connectivity and demand for digital services. In other words, are technology deployments a response to users' expression of their expectations and needs, or do the practices emerge on their own, based on the technological and commercial solutions available at given moment in time? One general observation is that end users appear to adopt the available technical solution without it necessarily having been crafted based on proven and previously expressed expectations.

Taking an example from the realm of fixed access, although fibre provides users with a better-quality experience than the legacy copper network, it did not usher in any killer app that only fibre could deliver. If this better user experience did help accelerate fibre take-up, the technology's massive adoption can be attributed mainly to a proactive rollout policy and at very competitive prices. This momentum was driven by the commitment to achieve multiple public policy objectives such as regional digital development, the digitalisation of the economy and reducing the digital divide. Here, the deployment, accessibility and competitiveness of fibre plans were bolstered by a regulatory and financing framework, implemented to facilitate stakeholders' investments, efficient rollouts and the development of competition for the benefit of end users.

In the mobile realm as well, the successive deployment of several generations of mobile network reveals people's varying enthusiasm depending on the technology and, from there, industrial success stories that could be small or large. The main promises made by 2G, for instance, the first generation of a fully digital network, were greater capacity and better security, without having anticipated the ground-breaking success of texting, which proved wildly successful with end users. 3G promised innovative use cases by enabling users to surf the Web on their phones, but the technology did not encounter the success that 4G enjoyed when it was introduced. Here again, regardless of the technologies themselves, the context surrounding their deployment has a decisive influence. The technical and commercial offering is not limited to the network technology. The introduction of smartphones and their steadily massive adoption is also a profoundly influential factor in the differing fortunes of 4G and 3G. It is indeed the combination of the offer of connectivity and complementary devices that led to the massive adoption of 4G and an explosion in mobile data traffic. 5G has not enjoyed the same success as 4G. Even though it delivers superior performances, consumers still do not view it as having unleashed innovations over existing practices. Looking ahead, reflections over 6G therefore include questions about the use cases that could be associated with it, and whether they can reflect people's expectations (cf. inset: "What new use cases can we expect to see with the advent of 6G?", section 4.1.4).

Identifying people's expectations and, from there, the expected success or failure of a new type of network prior to its deployment does indeed appear to be a complex exercise. The context surrounding a connectivity offering in particular appears to heavily influence the characteristics of the technical and commercial offering that might attract users. As explained earlier, this offering is not limited to the networks. Practices are supported in part by the networks, but device suppliers and digital service developers play a major role in shaping the technical and commercial offering that will be available, and can accelerate (or not) the adoption of a network technology.

To summarise, uncertainties surrounding future key technologies and use cases make it difficult to define the networks that are tailored to them. Although processes that result in the emergence of network technologies span several years (cf. inset "How a new generation mobile network emerges", section 3.2.1), it is hard to anticipate behavioural trends. If all of the investments made and innovations developed do not always generate practices that penetrate the market in a significant way, a portion of these new technology rollouts will nevertheless translate into new digital practices.

Faced with the question of whether supply creates demand or, on the contrary, supply only satisfies demand, it should be noted most of the experts questioned during the interviews conducted for this note (including economic stakeholders) expressed the view that digital practices are defined more by the technical and commercial offering than by end users' expectations. If, up to now, our digital habits and practices appear to have been forged by the available services or technologies, rather than the opposite, some believe that this is also a dynamic that has been largely under-investigated. The interviews conducted revealed that some operators today are proposing to adopt a view that is less performance-centric and seek rather to satisfy individuals' expectations by creating value for those customers, notably through tracking the value rather than performance metrics of a technological and commercial offering (cf. part 4). Moreover, the emergence of technology-related controversies in

recent years, which will be explored in the next section, only increase the benefits of a forward-looking approach.

3.4 Controversies surrounding the development of practices and networks

The context in which a technology is deployed is especially important at a time when distrust in technological innovations is becoming an increasingly prevalent issue in public debates, and driving a change in our relationship with digital technology, as mentioned in Section 2. This distrust is all the much greater for a technological development or innovation viewed or experienced as having been thrust upon an individual. Although this does not apply solely to the electronic communications industry, debates over the networks have come to the fore over the past several years, including over the legacy copper network switchoff (3.4.1) and 5G deployment (3.4.2).

3.4.1 Copper network switchoff: how to shepherd the phasing out of an obsolete but widely used technology

As mentioned earlier, FttH network development and growing subscriber numbers reveal that a massive percentage of the French population has adopted fibre technology. This momentum must nevertheless also be understood within the context of the announced switchoff of the Orange legacy copper network by 2030. Which will make FttH the *de facto* infrastructure of reference for fixed ultrafast broadband access.

If, up until now, consumers have opted to subscribe to a fibre plan (or not), they will eventually be obliged to switch over, as they will no longer have a choice. Some users view switching technologies as burdensome, as it requires them to change their plan, service, hardware (modem, etc.) which can be a nuisance. Some users have never felt the need to switch to FttH as it did not deliver any real added benefit. This is especially true with classic landline telephone service users, for which the copper network still delivers good service overall. This remains particularly true as ISPs today offer very few landline-only plans over FttH. Lastly, unlike the copper network, FttH is not an electricity conductor. Which means that it relies on the electrical grid to function: if there is a blackout, e.g. due to a major weather event, the FttH network stops working and the services it provides (calling, remote support, remote alarm systems, etc.) do as well. This can be especially incapacitating for the users of these services who are suddenly cut off.

These concerns were incorporated into the regulatory framework that Arcep established in 2020 then in 2023, and so into the copper network switchoff plan established by Orange. The regulatory framework thus requires, and Orange has since set forth in its plan, a guarantee that every end user, whether consumer or business, has access to a connectivity solution tailored to their needs on another technology before their copper line is technically switched off. In its plan, Orange provides for a gradual switchoff, organised by annual batches whose boundaries must be announced at least three years in advance. Before the plan entered into its industrial phase, Orange provided for a transitional phase during which multiple small-scale trials were conducted on a commercial then technical switchoff, and even on a full decommissioning of the copper lines. A study was also carried out on how users perceived the quality of this process. These trials made it possible to better identify the challenges and concrete obstacles encountered, and so to remedy them. One of the principles that Orange applied to creating batches was to use municipalities as the main operational mesh unit for the network switchoff, having concluded that this geographical mesh made communication with consumers and businesses easier to understand, and helped galvanise the support and involvement of local authorities.

Arcep, meanwhile, is supervising and supporting the switchover from copper to fibre. It is especially mindful of ensuring that the copper network switchoff takes place in a way that upholds fair and

effective competition between operators, and for the benefit of end users. To this end, the Authority imposed a set of regulatory obligations on Orange: transparency over the switchoff procedure, establishing the terms of the switchoff in sync with the fibre rollout timetable, sharing information with the other stakeholders involved. Arcep pays particularly close attention to properly involving local authorities in the process, as multiple players have identified them as having a vital role in the copper network switchoff. In practice, Arcep oversight takes the form of monthly monitoring of the switchoff process through working groups that it hosts with all of the affected infrastructure and commercial operators. Other public entities are also involved in this process, such as the Directorate General for Enterprise (DGE).

Lastly, although the switchoff of the legacy copper network was initiated by Orange, the involvement and cooperation of every stakeholder is crucial to its successful completion. Switching off this copper network involves a wide range of players in every part of the country. One of the keys to the success of this large-scale undertaking therefore lies in Orange implementing a system of governance that involves all of the stakeholders: operators (Orange, the local infrastructure operator, commercial operators/ISPs) and local authorities – which is something that public authorities, and Arcep in particular, are working to ensure. Orange regional delegates thus meet on a regular basis with elected officials for status update meetings to relay information about the plan's implementation in the municipalities. By the same token, departmental coordination committees are also involved in monitoring the copper switchoff on a larger scale.

The mobilisation of every stakeholder, from both the private and public sector, and the gradual and well regimented nature of the switchoff plan, also creates the ability to respond to any issues that arise and especially to end users' concerns.

3.4.2 5G: how to coordinate a technology deployment with end users' need for information and explanations

A number of the stakeholders interviewed, notably sociologists but also local authorities, cited the launch of 5G in France in 2019 as a landmark event where, for the first time, citizens came forward and their voices were heard as they challenged, if not fully opposed, what had previously been considered "mere" technological progress, and not a topic for political debate.

The 5G controversy took several forms, with associations and local representatives taking a stance. Individual actions, such as acts of sabotage, were also observed. The controversy was driven by various and disparate claims, although tied chiefly to health (namely the health effects of exposure to 5G radiofrequencies) and environmental (environmental considerations surrounding the deployment of a new technology) issues, while the main argument for some was that 5G did not offer any advantages over 4G.

The polemics surrounding 5G deployment and development could also be attributed to the perceived lack of democratic debate and public consultation on the matter. So the controversy over this issue was in fact multidimensional [27], encompassing:

- economic controversy, tied to the relatively heavy investments made in deploying 5G;
- environmental, and especially energy-related, controversy;
- controversy tied to occupation of the landscape and the challenges involved in installing or upgrading cell towers (and their visual impact);
- health-related controversy tied to radiofrequency exposure concerns;
- controversy over the benefits of new 5G use cases that earlier technologies could not deliver;

[27] Gauthier Roussilhe, La controverse de la 5G (The 5G controversy), 2020.

- geopolitical controversy (coinciding with questions about the safety of the equipment used to deploy 5G).

These objections of a varying scale developed locally, even though the 5G rollout had proceeded much like previous technological advances (cf. inset "How a new generation mobile network emerges", Section 3.2.1), and was part of a global momentum, which only further entrenched people's feeling of being subjected to decisions without having a say.

For some sociologists, debates over 5G echo similar situations in the past, when the deployment of a technology was felt as being thrust upon people and raised concerns: smart meters[28] and RFID technology[29] being two recent examples in France. In the case of 5G, it was observed, for instance, that a portion of the population expressed a need for information and turned first to local elected representatives. Often at a loss, these turned to public authorities. If a number of educational tools were put into place by government services nationwide[30], some stakeholders nevertheless felt that these tools came too late, and only partially satisfied the need for information and explanations (cf. inset, "Health concerns surrounding 5G" below).

The controversy over 5G began to heat up in September 2020 with protests in Lyon and an op-ed, supported by local elected representatives, calling for a moratorium on 5G deployment. These debates were also fuelled by think tanks.

The momentum of the debates that took place in the city of Grenoble help illustrate how complex this controversy was: long recognised as a champion of technological innovation, this city exemplified the tension that can exist between public policies supporting technological progress and the wishes expressed by local residents. The city had been opposed to 5G deployment since 2014, while retaining its status of technological hub, reflecting local authorities' efforts to reconcile public policy objectives and citizen demands, while seeking to achieve a harmonious marriage of innovation and sustainable governance. In addition to the Grenoble example, debates over 5G triggered the implementation of local citizen action initiatives, some of which continue to this day, along with other community platforms that appear to be forums for fruitful and constructive debate[31].

The varying responses of French municipalities – from the demand for a moratorium in Lille to the technology's adoption in Marseille – demonstrate the challenge of striking a balance between national technological priorities and local concerns.

It should also be noted that France is by no means an isolated case, as other countries have also had to deal with this type of controversy, notably Italy (where there were clashes between local plans and more national infrastructure projects) and Switzerland (demonstrating how well-established democratic mechanisms and systems of governance can adapt to citizens' concerns, while maintaining technological development goals).

[28] Draetta, L. & Tavner, B. (2019). De la "fronde anti-Linky" à la justification écologique du smart metering: retour sur la genèse d'un projet controversé (From the anti-Linky fringe to the ecological argument for smart metering: a look back at the genesis of a controversial project). Lien social et Politiques, (82), 52–77.

[29] Radio frequency identification, a method used to memorise and transmit data, e.g. a public transport or credit card.

[30] The Directorate General for Enterprise (DGE) published a brochure on "What to know about 5G" ("L'essentiel sur la 5G") aimed at mayors and produced with Arcep, ANFR, Anses, ANCT, and the Ministry of Health and Solidarity, the Ministry responsible for the Ecological Transition, and with the participation of local authorities associations. Arcep published information and an FAQ on its website, hosted a "Connected Territories" technical workshop for elected officials in November 2020, and in December 2020 began publishing an observatory providing progress reports on 5G rollouts across the country, which is now updated on a quarterly basis.

[31] E.g. the Observatoire parisien de la téléphonie mobile (Parisian Observatory of mobile telephony), created by the City of Paris, is one example of monitoring, dialogue and cooperation for the controlled development of mobile digital technology.

Health concerns surrounding 5G

In response to 5G deployment, France's National Agency for Food, Environmental and Occupational Health (Anses) received an appeal on 9 January 2019 from the Ministers responsible for health, environment and the economy to perform an expert evaluation on exposure to electromagnetic fields and the associated health effects.

Anses produced a preliminary report in January 2020 containing the initial conclusions of a review of existing knowledge on the health effects of exposure to electromagnetic fields in the 3.5 GHz and 26 GHz frequency bands. A second expert's report was produced in April 2021 by the Anses "5G Technologies" experts group, devoted to assessing the health effects of 5G deployment.

Given the interest surrounding the topic and to gather possible supplementary data, the Agency submitted the conclusions of its report to public consultation[32]. It received more than 200 contributions from associations, citizens and industry stakeholders, reflecting the need for clarification and additional details on this complex subject. The report and associated Opinion were completed or amended as a result, in February 2022[33].

The conclusions of this Opinion uphold the initial conclusions of the expert evaluation, in other words that the overall exposure to frequencies (in the bands examined) are comparable to or slightly higher than those of existing technologies. Anses states that "*it is unlikely that this deployment will create new health-related risks, compared to the results of expert assessments on previous generation mobile telephony systems,"* and that "*it is necessary to continue to produce data, particularly to monitor the progression of the population's exposure as the base of cell towers expands, and 5G network use increases".*

From a more general perspective, the Opinion delivers a reminder that acquiring new knowledge, notably on the ties between exposure and health effects, remains crucial. Although successive Anses work on radiofrequencies indicate that, to date, there is no proof of negative health effects tied to the use of existing digital technology, this Opinion reiterates that it continues to investigate other effects such as developing cancer, altered mental status and fertility.

Here, Anses recently published an Opinion to share its expertise on the updates to guidelines performed by the International Commission for Non-ionising Radiation Protection (ICNIRP)[34].

Technology deployments thus give rise to broader questions about democratic participation and the levels of governance in technology-related decision-making.

At the same time, some sociologists point out that citizens seem less and less inclined to become involved in citizen action mechanisms as they no longer believe that their opinions are actually taken

[32] Consultation publique de l'Anses sur l'avis et le rapport d'expertise relatif aux "Expositions aux champs électromagnétiques liées au déploiement de la technologie de communication "5G" et effets sanitaires éventuels associés" | Anses - Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail (Anses public consultation on the opinion and expert report on "Exposure to electromagnetic fields tied to the deployment of 5G communication technology and possible resulting health-related effects" | Anses – France's National Agency for Food, Environmental and Occupational Health).

[33] Anses, 5G : des travaux actualisés suite à la consultation publique | Anses - Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail, (5G: updated work following the public consultation), 2022.

[34] Avis de Anses portant relatif aux lignes directrices visant à limiter exposition des personnes aux champs électromagnétiques (100 kHz – 300 GHz) (Anses Opinion on the guidelines for limiting people's exposure to electromagnetic fields (100 KHz – 300 GHz)), 25 July 2023.

into account. When it comes to technological choices, this perception can be reinforced by the fact that these choices induce technical-economic considerations, hatched in small, closed circles and on a global scale (cf. inset "How a new generation mobile network emerges", Section 3.2.1), and cannot be revised during the deployment stage, which is when, typically local, citizen action mechanisms come into play. Incorporating the issue of people's expectations during the technology's design stage could, on the other hand, help make those technologies more acceptable during the deployment stage. This approach would require a forward-looking approach and the adoption of forward thinking about future technology deployments.

4 Which digital technologies and networks will power our future society?

After examining the feedback gathered on the networks' evolution, this section takes a more forward-looking approach to thinking about future networks and how they align with people's expectations. Even though identifying future digital practices is a complex exercise, the different players along the value chain do nevertheless attempt to identify them and to design connectivity needs accordingly, to support these practices (4.1). In addition to anticipating the development of new use cases, given these signs of a changing relationship with digital technology and the recent controversies, it is worth trying to understand how industry players already or might incorporate user expectations to a greater degree, without allowing it to undermine innovation, to ensure that their technologies are socially acceptable (4.2).

4.1 What new digital practices can we expect, and how will they influence future networks?

As part of their ongoing commitment to innovation, the ICT ecosystem's players seek to anticipate and develop future technologies and the use cases they could enable, and which would be widely adopted. Faced with the uncertain success of new technologies and the benefits of their own positioning, players along the value chain can develop a differing strategy to what are expected to be the key use cases (or killer apps), and the network infrastructures that will underpin them. These disparate views were made clear during the interviews that were conducted. It is therefore worth examining how industry players anticipate future technologies and practices and especially if, and how, these visions seek to satisfy people's (perceived or already identified) expectations. In this section, certain examples of technologies that some of the players interviewed view as "promising" will be analysed, as they relate to future networks: the Internet of Things (4.1.1), the virtual worlds (4.1.2) and artificial intelligence (4.1.3).

4.1.1 The Internet of Things (IoT)

Active device numbers for the Internet of Things (IoT) have been growing steadily (by more 10% for several years), and current forecasts up to 2030 expect this trend to continue. IoT devices already outnumber non-IoT devices, and projections[35] suggest growth will continue to be strong, both for the number of active devices in 2030 and the size of the market. This growth will be driven by IoT's expansion potential in both consumer apps and business apps for a wide range of industries (such as traffic optimisation, logistics and transportation, stock management and task automation for industries such as electronic communications, retail, construction, heavy industry, manufacturing, etc.). IoT's cross-sector dimension naturally opens up a large economic area for the future. In particular, synergies with artificial intelligence (AI), whose training can be fuelled by the data collection

[35] If, because of a degree of uncertainty, forecast average annual growth rates may vary, they all converge on double-digit annual growth. Sources such as Statista, for instance, forecast annual growth in excess of de 11% for the coming decade.

and monitoring functions enabled by IoT, suggest that IoT's development will have a positive influence on AI development, and vice-versa.

The number of machine-to-machine (M2M) connections and the traffic that future networks will need to support are thus also likely to continue their steady increase. Putting it simply, IoT devices can be classified according to two main criteria, including connectivity[36]. Depending on the application, then, IoT devices will not rely on the same form of connectivity to communicate (mobile or fixed, with or without low latency requirements, etc.), which means that networks used will not be the same, and IoT's influence on networks' development can be seen, on a case-by-case basis, more in the industrial world that employs connectivity solutions tailored to heterogeneous needs (private networks) than in public networks.

Regardless of the specific influence that IoT will have on future networks, however, the growth observed over the past several years, along with the cross-sectoral economic area (smart-home, smart-city, smart-industry, etc.), are leading the ICT ecosystem to believe that IoT will continue to sustain this momentum over the next ten years[37].

4.1.2 The virtual worlds

As concerns virtual worlds, aka the metaverse, some of the players queried believe that this technology could undergo massive development in the coming years, while not yet being driven by an evident high demand amongst consumers. Industrial success today appears to fall short of what was projected in 2021, at the time of Meta's first announcements. In 2023, according to IDC[38], shipments for augmented and virtual reality (AR/VR) headsets stood at around 8.1 million units (i.e. an 8.3% decrease compared to 2022). For 2024, IDC nevertheless notes a 12.8% surge in headset sales in Q3, driven largely by the competitively-priced Meta Quest 3[39] (around €500). These estimated sales of €9.6 million in 2024[40] nonetheless fall well below this industry's initial projections[41].

On the demand side of the equation, according to IDC, so-called mixed reality (AR + VR) products are far more popular than augmented reality or virtual reality ones. But the deck could be reshuffled by the integration of AI in smart glasses: AI could reboot the AR/VR headset market, and especially the smart glasses market by delivering a better user experience.

As to how this will affect the networks, the identified consequences include an increased load on mobile networks that will need to support mobile use of the metaverse, and its need for low latency and ultrahigh speeds. This consequence is likely to be felt far less on fixed networks.

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[36] As explained in the "Scope of IoT devices with respect to information and communication technologies (ICT)" report from the Arcep – ADEME Technical Experts Committee, IoT can be classified from an architectural standpoint according to its processing and connectivity capabilities. By correlating these two capacities, the International Telecommunication Union (ITU) identifies the following IoT device classifications: i) Low processing and low connectivity, or LPLC, device; ii) Low processing and high connectivity, or LPHC, device (e.g. smart appliance apps); iii) High processing and high connectivity, or HPHC, device (e.g. AI-powered CCTV camera).

[37] Statista, "Internet of things (IoT) total annual revenue worldwide from 2020 to 2033".

[38] IDC Market Glance: Web3 and Metaverse, 2Q23.

[39] ITRNews, Casques AR/VR: vers une baisse de 8,3% des ventes en 2023, avant une embellie en 2024, (AR/VR headsets: a forecast 8.3% drop in sales in 2023, before an upswing in 2024), 2023.

[40] TrendForce, Apple's Vision Pro Reshapes the VR/MR Landscape, Driving Applications from Entertainment to Productivity Tools, Says TrendForce, 2024.

[41] CCS Insights projected 11 million units sold in 2023, 19 million in 2024 and 67 million in 2026.

4.1.3 Artificial intelligence (AI)

AI elicits high expectations amongst industry players, further bolstered by existing practices. The new uses of AI have mushroomed thanks to new possibilities for accessing a massive trove of data and computing power. The launch of free content-generating services, such as open AI's ChatGPT, and Midjourney, shone a spotlight on generative AI's capacity to produce new content (text, images, video etc.). In just two months, ChatGPT attracted more than 100 million users worldwide[42]. This surge in popularity has in turn spurred the sector's development. Some forecasts predict that the AI market could be worth more than 500 billion dollars by 2028[43]. There has also been a recent spate of announcements of massive investments (e.g. 500 billion dollars over four years for the Stargate[44] project in the US, 200 billion euros mobilised to make Europe "one of the leading AI continents"[45], and 109 billion euros earmarked in France[46]).

On the supply side, according to an Ipsos survey[47] conducted in the run-up to the AI Action Summit in Paris in February 2025, 88% of respondents said they had already heard of generative AI and 39% said that they use it for personal applications and at work. 18 to 24-year-olds use generative AI to do research (48% of them), to help draft letters/emails (38%), for translation (36%) and to generate ideas (35%). Running alongside this very high take-up momentum is a range of questions and concerns over the (social, ethical, environmental…) risks surrounding the development of AI.

Regarding the impact on networks – even if, according to the players who were queried, a great many uncertainties remain – it is nevertheless certain that AI models' training phase relies on large-scale computing power and communication between high quality training nodes (speed, latency, etc.) that is greater than for average ICT uses. The Statista website estimates that, in 2023, Azure provided 1600 Gbit/s of bandwidth for compute instances' AI needs.

During the inference phase, AI applications, and particularly the generation of data-intensive content (notably video generation), could account for an increasing proportion of internet traffic, depending on the growth of requests. There nevertheless remain a host of questions over the distribution of computing: it can be performed in a centralised or decentralised fashion, each of which would require the network to be scaled differently, depending on the case[48].

AI can also play a role in optimising networks' energy consumption. Another briefing note[49] in the "Future Networks" cycle, devoted to the specific topic of AI in electronic communications networks, explores the surrounding issues in more detail.

Lastly, AI's place in the internet's infrastructure, both upstream and downstream, is likely to lead to the creation of new infrastructures. This includes servers and data centres – both crucial for training models and providing services – as well as network equipment.

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[42] Reuters, "ChatGPT sets record for fastest-growing user base", 2023.

[43] Statista, Le marché mondial de l'IA pourrait dépasser les 500 milliards de dollars d'ici 2028 (The AI market could be worth more than 500 billion dollars by 2028), 2025.

[44] France Info, "Ce que l'on sait de Stargate, le projet à 500 milliards de dollars de Donald Trump dans l'intelligence artificielle" (What we know about Stargate, Donald Trump's 500 billion dollar AI project), 2025.

[45] Le Monde, Intelligence artificielle : Ursula von der Leyen annonce 200 milliards d'euros d'investissements en Europe (AI: Ursula von der Leyen announces 200 billion euros mobilised in Europe), 2025.

[46] Public Sénat, IA : ce que l'on sait des 109 milliards d'investissements privés, annoncés par Emmanuel Macron (AI: What we know about the 109 billion in private investment announced by Emmanuel Macron), 2025.

[47] Ipsos, Intelligence artificielle : quels sont les usages des Français ? (How do people in France use AI?), 2025.

[48] (Decentralised) computing can, for instance, be performed by a smartphone talking to AR glasses, but it is also possible for data to be relayed over the network so that computing be performed in a data centre.

[49] Arcep, AI and electronic communications networks, June 2024.

4.1.4 Decisive choices at different levels for future digital infrastructure

Operating along a complex value chain, ICT industry players design their products and services by factoring in existing and planned future networks' available capacities and properties. Since the deployment of 5G, nascent use cases do not systematically require higher speeds or lower latency and do not appear constrained by network capacities, according to the digital service providers interviewed. Certain more bandwidth-hungry use cases (such as autonomous vehicles) could, however, influence network development more directly. On the flipside, other nascent trends are seeing their development optimised depending on the existing infrastructures: offloading some computing for AI to devices, choosing better encoding for video streams with increasingly high definition, or steering users towards more energy-efficient practices, are some of the methods used for adapting to the networks while delivering a better user experience and reducing the environmental impact. Lastly, as mentioned earlier, the influence that certain digital practices have on infrastructure needs must not be viewed solely from a network perspective. The development of AI, for instance, could translate into an increased need for data centres and, from there, their deployment in different parts of the country.

Anticipating and planning network development and, more broadly, digital infrastructure tailored to future practices, requires coordination between the different economic actors.

Outstanding questions include the new possibilities of future generation mobile systems, such as 6G, and give rise to debates over the (existing and new) use cases they could enable (cf. inset).

What new use cases can we expect to see with the advent of 6G?

It is complicated, and merely speculative to some extent, to make predictions about the use cases that will rely on mobile networks after 2030, the year when 6G is expected to become available. Although this is a somewhat distant future, stakeholders involved in discussions over this new mobile generation, in accordance with IMT-2030 recommendations, have already begun exploring this crucial question, as it will directly influence 6G technical specifications.

Research alliances representing views from North America, Europe, China, South Korea, India and Japan shared their ideas on planned use cases[50]. A consensus appears to be emerging: that 6G must enable fixed and mobile networks to continue to evolve in a lasting, energy-efficient and cost-efficient manner, to satisfy the exponential growth in demand for data. A number of the use cases identified for 6G nevertheless overlap with those already being offered by 5G and 5G-Advanced.

Among the use cases being discussed, several seek to meet the needs of enterprises, manufacturers and other business users, such as the development of collaborative robots (or cobots), real time digital twins and integrated network detection and response capabilities. They will help further optimise logistics, precision farming, smart cities and future industry. Planned practices that could benefit individual users include immersive communications, including holographic communication and telepresence, which could have industrial applications, but could also benefit immersive education and immersive cultural and entertainment experiences. Other use cases are being planned in the areas of health, for instance remote health care that capitalises on improved functionalities in terms of network security and reliability, and monitoring vulnerable people, whether they are in hospital, in a healthcare establishment or at home. The convergence of mobile and satellite networks, which is expected to increase in the 6G era, could also drive connectivity that is extended to every corner of the planet. The

[50] These visions of 6G use cases were shared during the "3GPP Stage-1 Workshop on IMT2030 Use Cases" that took place in May 2024. Its presentations can be accessed here.

advanced features of 6G would also create the ability to satisfy technical connectivity requirements to develop smart transport systems.

Another illustrative example of debates between stakeholders over different expected use cases and networks that are adapted accordingly is the assignment of the future 6 GHz frequency band (cf. inset above).

Spotlight on use of the upper 6 GHz band: different views for different use cases?

Some players have differing views on the use of new frequency bands. Debates over the use of the upper 6 GHz frequency band are a prime example of potentially opposing views on the networks, and on governance for how they are ultimately used.

Some players are calling for this frequency band to be allocated to mobile applications that continue to develop, while others, notably Big Tech companies, want to see these frequency bands allocated to Wi-Fi to enable the emergence of certain augmented and virtual reality applications. To make certain VR devices (especially headsets and glasses) lighter, manufacturers are offloading some computation to classic devices (computers and smartphones): this means that an ultrafast connection between these two types of device is required, and use of the new frequency bands could help open up new, wider channels to carry these links, especially in more densely populated environments (in the workplace or at school/university, at hotspots).

The prospect of seeing some existing mobile networks saturated in certain areas, and the scarcity of spectrum resources (in the medium term) are driving other players to push for these new frequency bands to be allocated to mobile applications (5G or 6G[51]).

The possibility of having these two allocations cohabitate has become the focus of technical studies on sharing the band. The CEPT (European Conference of Postal and Telecommunications Administrations) has been mandated by the European Commission to produce a report on the technical feasibility of this shared use. Moreover, the RSPG (Radio Spectrum Policy Group) is working on policy and strategy recommendations for the future of the band. The European Commission will take this work into account before issuing a harmonisation decision.

EU Member States and regulatory authorities are working on scenario choices, and their contributions are guided by multiple objectives, including network quality of service, nationwide coverage, industrial uses and mobility. This governance of spectrum regulation offers the ability to take different competing viewpoints into consideration.

These discussions are taking place chiefly between experts, public institutions and the economic actors affected by the assignment of a frequency band. It is therefore worth looking at how people's expectations can be taken into account. This will be examined in the next section, to understand the concerns of individuals, and the way in which they are incorporated into discussions at different levels.

[51] The mobile ecosystem is promoting 6 GHz as the pioneer 6G band, in the way the 3.4 – 3.8 GHz band was for 5G.

4.2 A range of existing initiatives to factor in people's concerns and allow them to better choose digital technologies

4.2.1 Growing prevalence of ICT-specific concerns

Although ICT is a purveyor of innovation and economic prospects, concerns surrounding the development of digital infrastructure are front and centre in current public discussions. Alongside a technophile and optimistic view of ICT lives a more technophobe attitude that is worried about the effects of digital technology on our society. These social and environmental concerns encompass a range of topics whose effects can be local or extend to the whole of France, depending on the issue.

From an environmental standpoint, the rapid development of ICT is now giving way to a great deal of talk about sustainability and the lack of transparency within an ecosystem composed of a complex value chain. ICT's growing impact on the environment has thus become a source of concern for the public at large, who are increasingly sensitive to the materiality of digital infrastructures, extending beyond the emblematic smartphone to networks and data centres. Although measuring the environmental impact of digital technology is a relatively new and steadily evolving subject, existing works (see next section) are often cited by the media and echoed by stakeholders, testifying to the growing interest in this issue, and to the desire to develop expertise in these topics (e.g. amongst local authorities for crafting their sustainable ICT strategy).

This growing awareness of the environmental impact of ICT is translating into concerns over the sustainability of its development[52]. The current pace of development does indeed seem to be synonymous with increasing impacts, which are incompatible with Paris Agreement targets, and the environmental sustainability of the economy as a whole. Moreover, in addition to the greenhouse gases (GHG) generated by ICT, these technologies are also responsible for the depletion of the metal and mineral resources needed to produce hardware. These resources are extracted overseas under oft-criticised conditions, such as child labour, in addition to raising supply issues. The geopolitical situation and the distribution of critical resources on the planet are fuelling deep concerns about a dependence on the supply of strategic resources located largely outside of Europe.

Lastly, the explosive development of generative AI over the past two years is acting as a catalyst for both digital development and concerns over the sustainability of this pathway over the coming years.

On a global scale, the source of these concerns includes recent growth projections for the energy consumption of future data centres that support the development of artificial intelligence. This development attracts ever-increasing levels of spending and large-scale projects[53], leading the International Energy Agency (IEA) to take a detailed look at data centres' electricity consumption. According to IEA estimates[54], data centres' global power consumption could double between 2022 and 2026. The fallout of these projections includes the electrical grid's ability to sustain this pace of digital infrastructure deployment, while continuing to satisfy other uses, and is the focus of a great many discussions between stakeholders from the energy and ICT industries (e.g. during a global conference

[52] In France, the forward-looking work conducted jointly by ADEME and Arcep on the environmental impacts of digital technology, estimate a potential tripling of ICT's carbon footprint between 2020 and 2050, and a challenge over the availability of the resources needed to manufacture hardware.

[53] The largest data centre projects to date, located in the US, are equal to the electrical power of a nuclear unit.

[54] IEA, Electricity 2024, analysis and forecast to 2026, 2024.

on Energy and AI hosted by IEA[55]). In addition to these questions are concerns over the potential greenhouse gas emissions resulting from the massive surge in demand for electricity[56].

Alongside these global and national challenges, local concerns are also emerging in places where digital infrastructure is set to be deployed. The city of Marseille, for instance – which has become very attractive to data centres because of the many submarine cables that land there – has also become the stage for a growing opposition to projects that can be contentious due to the amount of power they require[57] or their use of available land. Concerned by a lack of transparency, collectives have been formed[58] to weigh in on the discussions and ensure that citizens' voices are heard in local planning and development decisions, and in guiding objectives. A look at neighbouring territories reveals another growing source of concern: pressure on water resources. Spain, which is home to the same investment momentum as in France, is seeing growing local protests and warnings about the impact of this development of water resources, at a time when extreme weather events, such as droughts, are increasingly common and increasingly severe[59]. The recent forward-looking work of *France Stratégie*[60] on global demand for water reveals that some problems can be local, hence the need to listen to these concerns, to take them into account when planning industrial and economic development in France, and the crucial need for cooperation between stakeholders and civil society.

These concerns being expressed at different levels of society are not confined to environmental issues, but also extend to the social effects of digitalisation and how it influences our way of life.

On a more individual scale this time, digitalisation is a source of anxiety with respect to the youngest users. In response to possible abuses and the misuse of digital technology, such as online bullying, disinformation (and the issues created by AI in this area), screen addiction and overexposure to screens and to online violence, child protection associations have, for instance, asked that helping parents and children be made one of the major areas of focus in France's strategy in the fight against violence towards children[61]. These citizen alerts are echoed in the political agenda. The impact of screen time is an especially pressing issue, and was the subject of recent ministerial announcements. Following up on a report from the Commission of Experts on the effects of screen time on young people, submitted to the President of France in April 2024, which recommended prohibiting screen time for children under the age of three, mobile phones for children under 11 and social media for children under the age of 15[62], in February 2025 the Government announced plans to conduct an investigation into

[55] Global Conference on Energy & AI - Event - IEA.

[56] For technical and economic reasons, electricity production assets do not have the same construction and commissioning timelines. In cases where demand for electricity is increasing rapidly, we can observe instances where, to meet this demand, fossil fuel (carbon or gas) powered plants can be put back into service (or constructed), thereby generating greenhouse gases and contravening the long-term goal of decarbonisation of the electrical grid, just to satisfy short-term needs.

[57] In Marseille, the manager of the electrical grid (Enedis) must therefore manage the port's Green transition with the electrification of the ships, of public transport, demographic development and the sizeable local development of data centres, due to the city's attractive conditions.

[58] Since 2023, for instance, the "*Le nuage était sous nos pieds* (The cloud was at our feet)" collective has been investigating, analysing and battling against the social and ecological effects of these digital infrastructures.

[59] Depending on existing cooling systems, a data centre can require water when the outside temperature is too hot to single-handedly cool the servers. In Spain, we are seeing growing opposition from citizens, including the "Your cloud is drying up my river" collective, drawing attention to the fact that cloud computing depletes water resources.

[60] France Stratégie, La demande en eau - Prospective territorialisée à l'horizon 2050 | France stratégie, 2025 (Demand for water – national outlook up to 2050).

[61] In late 2024, the Safe Child ON! coalition of associations submitted a request to Agnès Canayer that support for parents and children in handling the risks of screen time and online violence become part of the main workstreams in the efforts to fight against violence towards children.

[62] Report from the Commission of Experts on the effects of screen time on young people, April 2024.

possibly forbidding screens for children under three[63]. More recently, an Order dated 27 June 2025 banned screen time for infants between the ages of 0 and 3 in all childcare facilities[64].

The interviews conducted also revealed a more overarching issue of controlling ICT and our addiction to it. The steady digitalisation of society creates an issue of dependency on digital infrastructures that are an increasingly vital component in the functioning of our society[65]. At the same time, concerns over digital skills and the ability to choose digital technologies are an ongoing part of the discussions. With the digitalisation of everyday practices (e.g. using government services or making a booking), in some cases to the exclusion of other options, some local authorities who were queried noted that ICT can be seen as exacerbating inequalities, as varying levels of digital skills can influence the sense of being subjected to these technologies. On both a global and individual level, the issues of control over one's data and online privacy are also part of these societal concerns. The interviews also made it possible to ascertain that these concerns can be heightened by the lack of transparency over how digital services (e.g. social media platforms) use these data, and how they are protected from being transferred to other countries.

These reflections underscore the importance of having a holistic view when it comes to choosing one's tech, which cannot be viewed solely through the lens of the innovations and economic opportunities it creates, but must also address the knowledge and skills that it can deliver, to ensure a healthy and reasonable use of it, and one that benefits everyone. Some of the experts interviewed noted that the complex value chain that involves global entities and choices (some of which are mentioned earlier, cf. inset "How a new generation mobile network emerges", Section 3.2.1) can make it hard to get a read on the directions being taken, and how they influence the daily lives of the general public. They also underscored how important it is to foster awareness and cooperation with citizens, to listen to their concerns and enable necessarily collective decision-making about their digital future.

It therefore seems worthwhile to explore the ways in which stakeholders take all of these concerns into account, and how they incorporate these concerns into their own reflections, and this for both private companies and public authorities.

4.2.2 How these concerns are factored into the deliberations taking place at different levels

The ICT ecosystem stakeholders who were interviewed are well aware of the concerns explored above, be they environmental, social or tied more broadly to the ability to choose digital technologies and protect oneself against abuses. In addition to this overall understanding, it is worth investigating whether and, if applicable, how players along the value chain already or may in future incorporate the concerns of individuals, to ensure that innovations are socially acceptable.

Regarding environmental concerns, a growing number of stakeholders, in both the public and private spheres, are paying attention to these issues that have been raised by civil society, notably as 5G was being rolled out. Multiple initiatives are backed by all electronic communications operators (including the Hexa-X-II project as part of preparations for 6G, which is examined below) and, more widely, by stakeholders along the value chain in concert with civil society (e.g. the 6G4Society project). The different interviews conducted helped confirm that digital technology's environmental footprint is now seen as a major issue. A great many players, from across the spectrum, are exploring ways to

[63] France Inter, Interview with Catherine Vautrin, February 2025.

[64] Protection de la petite enfance : publication de l'arrêté interdisant l'exposition des enfants de moins de 3 ans aux écrans dans les lieux d'accueil du jeune enfant (Protecting infancy: publication of an Order banning screen time for children under three in childcare facilities hosting infants).

[65] Here, network resilience is another topic addressed by Arcep's "Future Networks" cycle of inquiry.

reconcile connectivity and sustainable ICT, two goals that can be viewed as contradictory, especially by local authorities.

Actors from the public sector and civil society have produced a number of works on the environmental impact of digital technology, including reports by ADEME and Arcep published in 2022[66], and by associations and think tanks such as Green IT[67] and The Shift Project[68]. These works revealed that it is crucial to consider the entire value chain. There is a clear interdependence between ICT's three tiers (devices, electronic communications networks and data centres) and the digital services that these three links in this chain underpin. The growth momentum of practices therefore affects all digital infrastructures and hardware. If energy efficiency and ecodesign can attenuate some effects, this interdependence means the sustainability of increased usage is an issue that cannot be ignored. Looking ahead, if nothing is done to curtail it, the French digital carbon footprint could triple by 2050, and its energy consumption, which currently accounts for 10% of total electricity consumption in France, could double. The studies and modelling conducted, notably with ADEME and Arcom, also helped to identify several levers for action: extending the life of devices, developing the ecodesign of digital hardware and services, and disseminating best practices for the design and use of ICT. They revealed that only a combination of sustainability and ecodesign measures can lead to a meaningful reduction in the environmental impact of digital technology.

Meanwhile, more and more local authorities are investigating the responsible and sustainable use of ICT. Towns with a population of more than 50,000 were required to establish a sustainable ICT strategy by 1 January 2025, in accordance with Article 35[69] of the Law on Reducing the Environmental Impact of ICT of 2021. Institutions such as France's National Agency for Territorial Cohesion (*Agence Nationale de la Cohésion des Territoires*) and local authority associations such as "Les Interconnectés," have produced tools to help local authorities craft their strategy. Some local authorities are also engaged in broader regional discussions, one prime example being the Région Grand Est in partnership with ADEME Grand Est[70].

On the manufacturing side of the equation, work on the environmental aspects of networks had already begun before the Covid crisis within international organisations such as ITU, ETSI[71] and 3GPP, whose results were incorporated into 5G standards. In 2019, the first summit on 6G, hosted by Finland's "6G Flagship" initiative, argued that UN sustainable development goals should guide the design of 6G[72], by viewing it as a technology in service to societal ambitions. In 2023, ITU published the framework for the development of future mobile network technologies, with sustainability as one of its pillars[73]. Lastly, in 2024, the 6G4Society[74] project was launched by six partners with backgrounds in human and social sciences (including CyberSocialLab and Public Safety Communication Europe) and industrials (including NOVA and eBOS), with the aim "*to ensure that societal and sustainable values are properly embedded in the development of 6G technology, bringing a sociological perspective to*

[66] Study produced with ADEME on the digital environmental footprint in France in 2020, 2030 and 2050.

[67] Green IT, Empreinte environnementale du numérique mondiale (ICT's global environmental footprint), 2025.

[68] The Shift Project, Lean ICT, Pour une sobriété numérique, 2018.

[69] Law No. 2021-1485 of 15 November 2021 on reducing ICT's environmental footprint in France.

[70] Climaxion, Numérique responsable en Région Grand Est (Sustainable tech in the Grand Est Region), consulted in March 2025.

[71] As its name suggests, the "European Telecommunications Standards Institute" is responsible for developing and testing technical standards that apply to information and communication technologies (ICT) systems, applications and services. This independent body was created in 1988 at the behest of the European Commission.

[72] White Paper on 6G Drivers and the UN SDGs.

[73] ITU, Recommendation ITU-R M.2160-0 (11/2023) - Framework and overall objectives of the future development of IMT for 2030 and beyond, 2023.

[74] 6G4Society, Consulted in March 2025.

technological development". One central tenet of this project is to involve civil society in public debates.

Thanks to this impetus, the industry appears to be mobilised to take environmental issues into account. The world's leading mobile operators, for instance, came together within the *Next Generation Mobile Networks* (NGMN) alliance whose goal is to steer the ecosystem towards innovative, sustainable and affordable mobile telecommunication services[75]. The European 6G AI association, which represents European industry views, is exploring how technology development driven by social values can completement a performance-driven perspective[76]. The industry is also working to establish key value indicators (KVI)[77] that incorporate economic, social and environmental impacts into ICT development. This values analysis provides the foundation for shifting from a one-dimensional view of the search for performance to a multi-dimensional one that places value-creation at the heart of the design of new technologies and services.

In Europe, stakeholders working on the Hexa-X-II[78] project, whose goal is to lay the groundwork for the development of 6G, have emphasised the need to create value for users and to develop technologies with KVIs in mind. To achieve these objectives, current research[79] suggests an approach built around societal dialogue to better understand society's expectations and perceptions, and to identify the best mechanisms for gathering these insights and creating a relationship of trust. This inclusive and collaborative dialogue between the different stakeholders should be preceded by an instructional phase to create a co-construction process for the development of new technologies.

This evolution of the mobile telecommunications ecosystem marks a shift in how technology is designed, and testifies to an awareness of environmental concerns. The impact of these efforts does not, however, seem significant enough to incorporate the fundamental issue of planetary limits, and particularly of climate change, as certain Big Tech companies (such as Google and Microsoft) have admitted that they are unable to meet their climate targets, not least because of the growth of AI[80].

Certain alternative operators have introduced "eco-friendly" data plans with low data allowances, sold at a basic flat rate plus billing per GB of traffic. But these are few and far between. Other classic telcos are also designing offers that encourage customers to be more "green" via dedicated plans (e.g. not using their entire data allowance and donating their remaining allowance to a charity or association). Meanwhile, other operators report relying on KVIs to go beyond Key Performance Indicators (KPI) and take socio-environmental issues into account.

The topic of sovereignty often arises when discussing ICT, and AI in particular. Some of the stakeholders interviewed stressed the need for digital services to be hosted in France, and not depend on large supranational conglomerates. Institutions have seized on this subject to fuel public discussions. Back in 2019, France's Economic, Social and Environmental Council (CESE) came out in favour[81] of a policy of digital sovereignty for Europe, and the development of European AI. More recently, in 2024, CESE published an Opinion[82] on the environmental threats and opportunities that AI represents,

[75] NGMN, Vision & Mission - NGMN, consulted in March 2025.

[76] 6G Infrastructure Association, What societal values will 6G address?, 2025.

[77] Wikström et al, Key value indicators: A framework for values-driven next-generation ICT solutions, 2024.

[78] Hexa-X-II - European level 6G Flagship project, consulted in March 2025.

[79] This work is described in the deliverable: "Environmental and social view on 6G". French carrier Orange is part of the Hexa-X-II project and also shared this vision in its white paper on the evolution of mobile networks beyond 2030.

[80] The Guardian, 2024.

[81] Conseil Economique Social et Environnemental (France's Economic, Social and Environmental Council), Artificial intelligence on the CESE agenda, consulted in March 2025.

[82] Conseil Economique Social et Environnemental, Impacts de l'IA : risques et opportunités pour l'environnement (Impacts of AI: threats and opportunities for the environment), 2024.

recommending that sovereignty issues be reconciled with the environmental issues surrounding the deployment of local data centres, notably to meet the target of "Zero net artificialisation". CESE believes that it is vital to develop AI "that serves the public interest" [83] and can meet the challenges of these multiple issues: fundamental rights, individual freedoms, equality for all, economic imperatives, complying with planetary limits and social progress.

There are also several initiatives focused on the influence of ICT and addiction issues. Following the report on the impact of screen time on young people in April 2025, which was submitted to the President of the Republic, multiple deliberations are underway on possible legislative measures. A committee of inquiry is currently being formed to investigate the effects that certain social media platforms, such as TikTok, have on young people. This work echoes academic work on the attention economy[84], to identify relevant regulatory tools. There are also institutional initiatives, such as the General Policy Framework on the Ecodesign of Digital Services (RGESN) – produced by Arcep and Arcom, in collaboration with ADEME, DINUM, CNIL and Inria – that delivers a list of ecodesign criteria, some of which target attention-grabbing tactics. The purpose of this document is to help solutions developers engage with these issues and with a more sustainable approach to design. On the manufacturing side, some of the players interviewed recognised that digital practices are geared to capturing users' attention to then resell it. Some telcos have launched plans for teenagers that seek to "*encourage healthy digital practices"* such as "*limiting screen time"* and "*enjoying unplugged time".* A targeted awareness-raising campaign about these issues ran in cinemas and on TV.

In light of the issues raised in public debates, whether environmental, tied to sovereignty or public health amongst young people, the topic of ICT governance that creates the ability to define technological directions needs to be addressed. The controversial topics that have arisen over the past several years (e.g.: 5G, Generative AI and video-surveillance) all raise the question of citizen involvement and the governance methods used to make collective choices about digital technology[85].

A number of the stakeholders queried said there is a lack of knowledge about certain issues, which are not properly taken into account when deploying digital technologies, such as their environmental impact, democracy, social impact, sovereignty, accessibility, public health, etc.

Some academics underscore the need to adapt consultation bodies and are calling for the ability to truly choose digital technologies and, on a broader scale, to be able to participate in technology-related choices outside of election periods. Regarding environmental issues in general, questions about the methods used to create a dialogue with citizens are not new[86] but nevertheless need to be looked at specifically with respect to ICT.

[83] Conseil Économique Social et Environnemental, La contribution de la société civile au Sommet pour l'action sur l'intelligence artificielle (Civil society's contribution to the AI Action Summit), consulted in March 2025.

[84] See, for instance, Dominique Boullier, *Comment sortir de l'emprise des réseaux sociaux* (How to break free from social media), 2020 / Dominique Boullier, *Les industries de l'attention: fidélisation, alerte ou immersion* (Attention industries: retention, warning or immersion), 2009.

[85] Grumbach, S. (2020). Gouvernance numérique et changement climatique (Digital governance and climate change). Hérodote, NO. 177-178(2), 17-31.; Valérie Deruelle and Jean-Luc Metzger, "Quelle gouvernance pour un numérique sobre? (Governance to ensure sustainable ICT)", SociologieS [Online], Théories et recherches, posted on 20 March 2024, consulted on 19 January 2025.

[86] François Allard-Huver, Marieke Stein. Introduction to the 2022 supplement: *La concertation citoyenne en environnement* (Citizen cooperation on environment). *Les Enjeux de l'information et de la communication* (ICT issues), 2022, *La concertation citoyenne en environnement*, 23 (2), pp.5-14.

Spotlight on local authorities' citizen action mechanisms

The controversy surrounding 5G (cf. Section 3.4.2) drove a number of local authorities to include citizens more in ICT-related decision-making, and to create forums for public debate. We are seeing this type of initiative especially within those local authorities that are the most fully engaged with the digital transition, with sizeable dedicated departments and that have been working on it for a long time. These initiatives take various forms and tackle an increasingly wide array of topics, as digital technology becomes increasingly omnipresent in citizens' daily lives.

The Rennes Métropole intercommunal structure, for instance, created a Citizen advisory board on sustainable ICT in 2022, a permanent body whose members are all residents of metropolitan Rennes, and chosen by lot. The Board has published several opinions (on e-government solutions, on how ICT affects young people's mental health and on the role of AI in daily life)[87]. The City of Poitiers hosted Citizens' summits on sustainable ICT (*Convention citoyenne pour le numérique responsable*) that brought together elected officials, residents, researchers and businesses, in 2021 and 2022.[88] More recently, Metropolitan Montpellier hosted a Citizens' summit on artificial intelligence[89].

It is worth noting that an (albeit small but) growing number of local authorities are engaging in this type of initiative, in a variety of formats, and that they are taking root, testifying to the role they play in fostering citizens' involvement in local public policy debates.

Particularly with respect to the recent drive to deploy data centres across the country, which can be seen through AI Summit announcements of large-scale projects, and developments in Marseille (cf. Section 4.2.1), it appears worthwhile to maintain these initiatives and to entrench this citizen involvement in order to achieve an industrial ICT infrastructure development policy, which includes data centres, that serves the public interest.

[87] Rennes Métropole, Le Conseil citoyen du numérique responsable (Citizens' summit on sustainable ICT), consulted in March 2025.

[88] City of Poitiers, Convention citoyenne pour le numérique responsable (Citizens' summit on sustainable ICT), consulted in March 2025.

[89] France's National Digital Council (Conseil National du Numérique), Retour sur la convention citoyenne sur AI organisée à Montpellier (Remarks on the Citizens' summit on AI held in Montpellier), 2024.

5 Conclusion

In this briefing note, Arcep has examined people's hopes and expectations for digital network and infrastructures, in this era of rapid digitalisation of our societies, which has gone hand in hand with a foundational shift in our ways of life and individual behaviours. While this digitalisation ushers in a great many benefits and opportunities, there are signs of a changing relationship with information and communication technologies (ICT), whose positive aspects are sometimes offset by certain risks, be they social, environmental, or relating to sovereignty or democratic values.

Nationwide feedback on the evolution of fixed and mobile networks served to highlight the tremendous heterogeneity of factors that influence the development of digital practices. On the whole, the deployment of new networks appears to have been based, up to now, on a supply-side logic – supply of connectivity but also of digital devices and services – which then determines demand in terms of digital practices. End users were required to adopt available technical and commercial solutions whose design did not factor in users' proven or previously expressed expectations.

But there are signs that this dynamic has begun to be challenged. The various controversies surrounding the deployment of new generation networks (not least during 5G rollouts), and the development of digital practices, have raised questions and concerns amongst end users. These situations have underscored a desire amongst a portion of civil society to be more involved in deliberations over the future of digital networks and practices, to choose digital technologies by factoring in the many pressing issues, such as these technologies' impact on health and the environment, regional planning and development, protecting minors and digital sovereignty.

New digital practices are likely to have an impact on future infrastructures and networks. The ICT policies adopted are nevertheless determined in part by the investment choices of international conglomerates and by global standardisation work. Because of this supply-driven logic and the way that global digital ecosystems function, it remains difficult for end users to choose digital technologies and influence the future direction of mainstream digital practices. These investment choices nevertheless remain driven by a desire for profitability, which requires supply to meet demand. It is therefore in economic actors' interest to listen to what end users want. These end users and the demand they represent can play a pivotal role, if their needs and expectations can be more easily expressed, and heard by stakeholders from both the public and private sector.

For several years now, and since the emergence of controversies that have driven members of the public to express their expectations and concerns more overtly, multiple initiatives designed to take fuller account of these expectations and concerns have begun to appear. An analysis of these initiatives reveals that all of the digital ecosystem's stakeholders and public authorities are tending to engage in a growing number of consultations, in various formats, with civil society to take citizens' concerns into account, whether before or after technology deployments. This process must be encouraged, at every level, to include end users more. To this end, it is vital that these users have access to reliable and transparent information, to enable informed, neutral and objective personal reflection and, from there, a useful and constructive contribution to public debates.

This process also naturally raises the question of ICT governance and the role that public authorities play in factoring in the issues raised by civil society as a whole, as digital technology-related choices cannot be based solely on private voluntary initiatives.

While this questioning is a complex process as it requires deliberations to take place on multiple levels, from global choices made by expert bodies that are often little known to the general public, to national and highly local discussions, it is worth wondering what role the national regulator can play. In an ever-changing international and geopolitical environment, Arcep's Ambition for 2030[90] is to ensure that the

[90] Key issue: Arcep's "Ambition 2030" | Arcep.

country is equipped with digital infrastructures that are accessible everywhere, to everyone and for a long time to come, notably by offering up its work to inform public debate. To this end, because of its special ability to access information and its capacity to produce a reliable distillation of that information that anyone can access, Arcep is committed to contributing to the public debate, and to alerting the population and decision-makers to new issues, to continue safeguarding the conditions for making digital an instrument for good.

Annexe 1 : Interviews conducted

Fifteen interviews were conducted with experts to obtain a plurality of viewpoints and profiles, and to help identify the central themes and concepts to shape and inform this briefing note:

- Economic actors (Ericsson, Télécoop, Google, Meta, Orange…),
- Academics (Christian Licoppe, Clément Marquet, Jean-Samuel Beuscart, Nicolas Julien and Soazig Lalancette…),
- Local authorities (Nantes Métropole, Rennes Métropole) and local authority associations (Association of Rural Mayors in France (AMRF), Les Interconnectés).