

arcep

autorité de régulation
des communications électroniques,
des postes et de la distribution de la presse

FRENCH REPUBLIC

ANNUAL BAROMETER OF THE TRANSITION TO IPv6 IN FRANCE

29 NOVEMBER 2021



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ISSN No. 2258-3106

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1. Accelerating the transition to IPv6: a major issue for competitiveness and innovation¹

IPv4, which stands for Internet Protocol version 4, has been used since 1983 to allow the Internet to function: each device or machine that is connected to the Internet (computer, phone, server, etc.) has an IPv4 address. The protocol is technically limited to 4.3 billion addresses. However, the Internet's success, coupled with the diversity of uses and the growing number of connected objects has resulted in a **steady decrease in the number of available IPv4 addresses**, with some parts of the world being more heavily affected than others. The top operators in France (Bouygues Telecom, Orange and SFR)² had already **assigned between roughly 93% and 98% of their IPv4 addresses**, as of end of June 2021³.

IPv6 specifications were finalised in 1998. They incorporate functions for increasing security by default and optimising routing. Above all, IPv6 delivers almost an infinite number of IP addresses: **667 million IPv6 for each square millimetre of the earth's surface**.

But the complexity of today's Internet makes it impossible to achieve the transition from IPv4 to IPv6 in one fell swoop, overnight (i.e. flag-day). It must therefore take place gradually, starting with a period of cohabitation with IPv4. Once every player has migrated to the new protocol, IPv6 will fully replace IPv4 (switch-off phase).

The transition to the IPv6 protocol began in 2003. Despite which, in 2021, **the Internet is still only at the cohabitation stage. IPv4 and IPv6 protocols will coexist as long as IPv6 is not widespread in all parts of the Internet value chain**.

On 25 November 2019, RIPE NCC (the regional Internet registry which is tasked with allocating IP addresses in Europe and the Middle East) announced that **it had run out of IPv4 addresses**, after having made the final /22 IPv4 allocation (i.e. 1024 addresses) from the last remaining addresses in their pool⁴.

¹ ARCEP specifies that the observations and work mentioned in this document concern only the Internet and do not apply to the private interconnection between two actors, in particular the interconnection of the networks of two operators for the termination for voice calls in IP mode.

² Free did not provide the number of IPv4 addresses already assigned.

³ Data collected from ISPs by Arcep, in accordance with Decision No. 2021-0375.

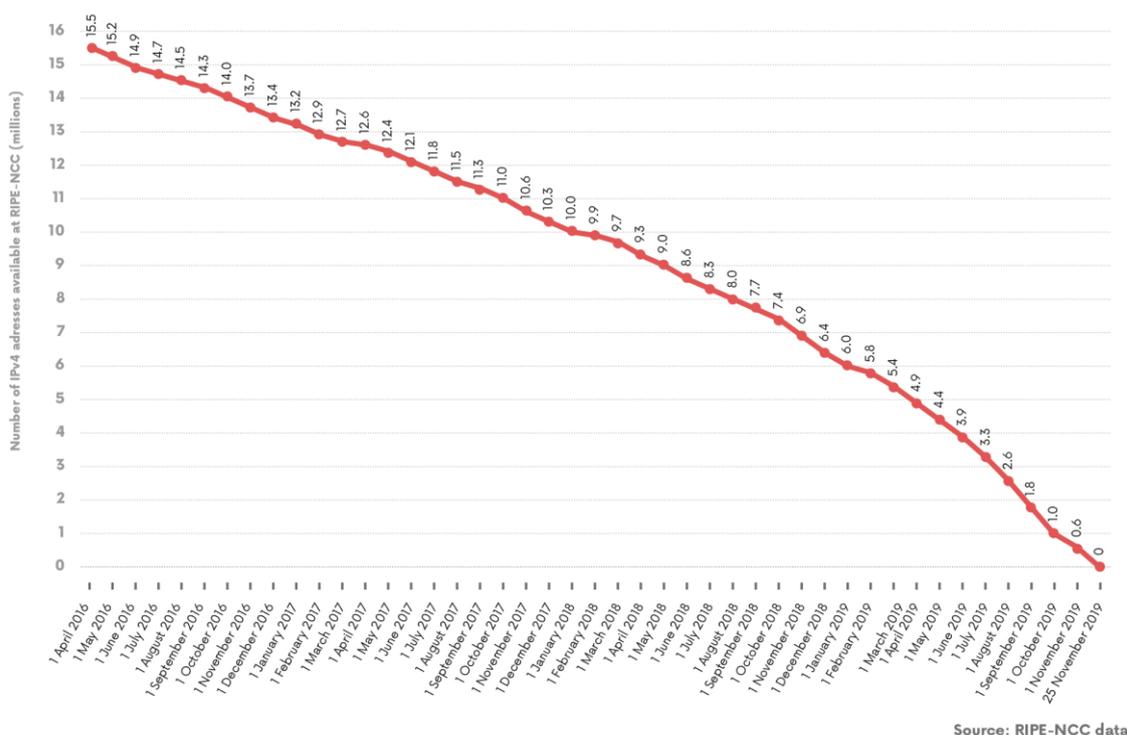
⁴ There is a waiting list for IPv4 addresses that come back to the RIPE NCC, even though few of them do. RIPE NCC explains that these necessarily rare allocations will not be able to meet networks' current IPv4 address needs.

If continuing to have the Internet operate in IPv4 will not prevent it from functioning, it will prevent it from growing, because of the risks inherent in solutions that enable the Internet to continue to function in IPv4 despite the lack of addresses:

- Having several customers share IPv4 addresses could **cause malfunctions on certain categories of Internet services** (smart home control systems, network gaming, etc.). Added to which, these sharing mechanisms increase the risk to users of being denied access to a service, e.g. when an IP address they share has been put on a blacklist due to fraudulent behaviour by another user of that same IPv4 address. Another collateral effect of IPv4 sharing is the increased difficulty in identifying a suspect in a criminal investigation based on their IP address, in some instances requiring law enforcement agencies to investigate people whose only "crime" is sharing an IP address with the suspect.
- It is possible to buy IPv4 addresses on a secondary market, but **the prices charged are likely to create a sizeable barrier to entry for newcomers to the market**. Indeed, the selling price of IPv4 addresses on the secondary market, which was around 25 dollars per IP in mid-2020, would now reach as high as 60 dollars per IP. Added to which, IPv4 address bought on the secondary market can block access to certain banking and video on demand services if the address's geolocation has not been updated.

Because of this shortage and the risks it entails, **making the transition to this new Internet protocol has become a key to ensuring competitiveness and innovation.**

TIMELINE OF IPv4 ADDRESS EXHAUSTION

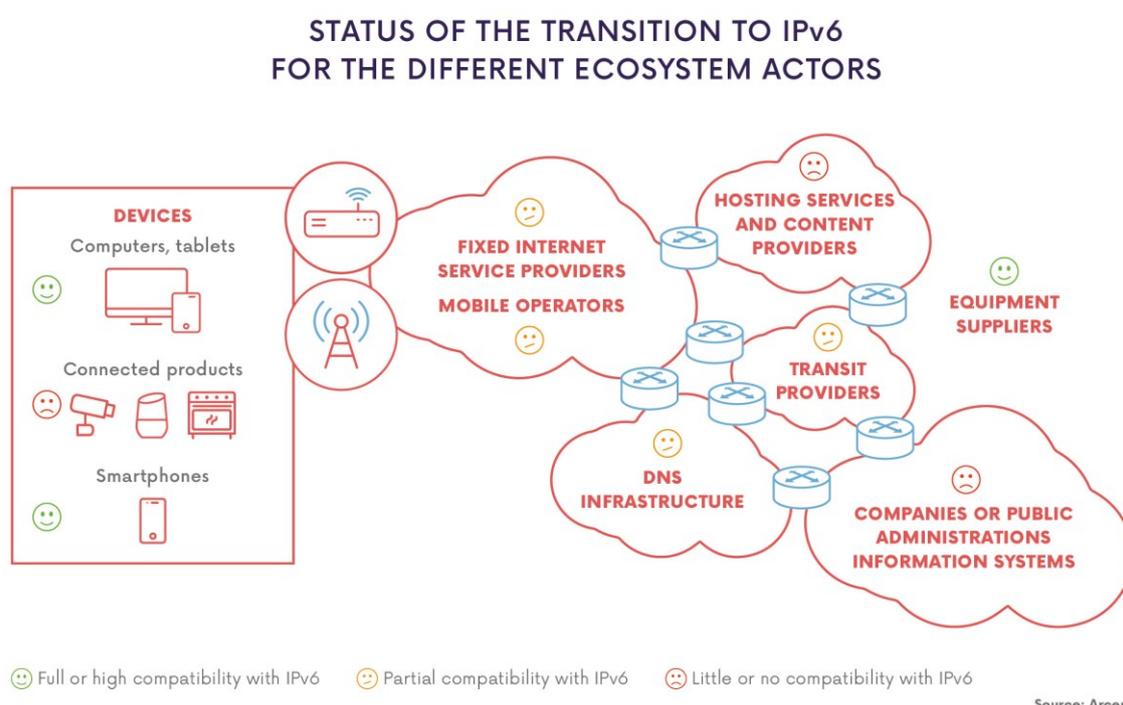


2. Different players at different stages in the transition

To ensure IPv6 protocol functions from end to end, migration needs to cover all of the links along the Internet value chain simultaneously.

Arcep has employed several indicators in order to evaluate the status of IPv6 deployment in France for the various stakeholders involved in the transition. These indicators are calculated using data collected by Arcep in accordance with Decision No 2021-0375, as well as third-party data⁵, for the Internet ecosystem's different stakeholders.

These indicators make it possible to have an overview of the status of IPv6 deployment. Which, today, is as follows:



⁵ Cf. exact source in the sections devoted to each type of player.

3. Fixed Internet service providers

Four conditions need to be met for a fixed line to be able to transmit and receive traffic in IPv6:

- the **fixed network** used must be IPv6-compatible;
- the hardware of the **box** being used must be IPv6-compatible, and its firmware must be capable of managing the protocol. If most of operators' boxes in 2021 are IPv6-compatible, some have not yet upgraded their firmware to be able to handle IPv6.

When both the network and the box are IPv6-compatible, a customer is said to be IPv6-ready (cf. table below).

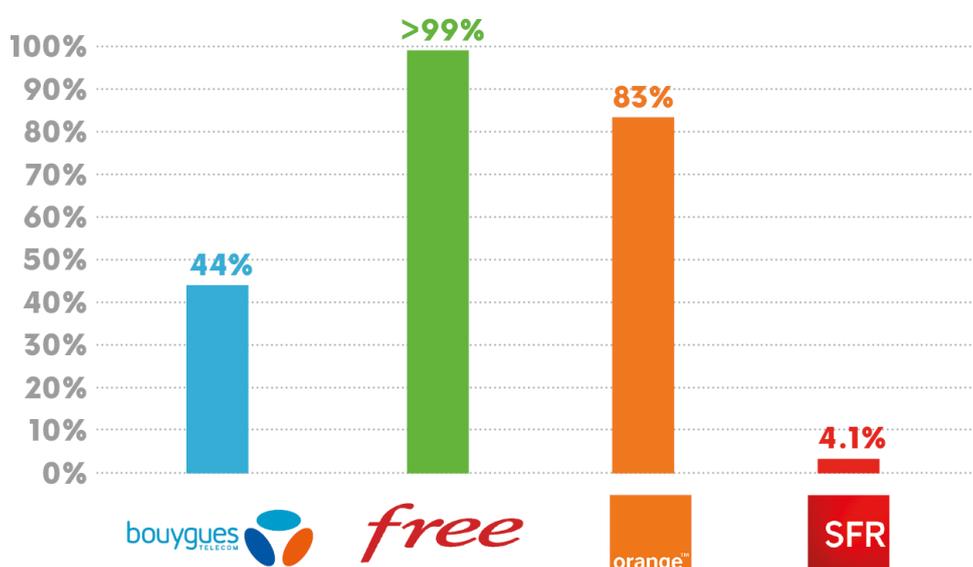
- The operator needs to **remotely configure the customer's box** for it to be IPv6-enabled (cf. table below). If the customer is IPv6-ready but the operator has not enabled IPv6, the customer can configure his/her own box manually for it to be IPv6-enabled. Nevertheless, because the vast majority of users don't take the initiative to do so, it is the action taken by ISPs that will drive the transition.
- The **device's operating system** must be IPv6-compatible and enabled (cf. section on Devices below).

Thus:

- **a customer is said to be "IPv6-ready"** if they are able to activate IPv6 themselves on their own box (both the network and the box are IPv6-compatible);
- **A customer is said to be "IPv6-enabled"** if their box actually sends and receives IPv6 traffic, either through manual activation performed by the customer themselves, or through activation performed by the operator.

3.1. Operators with over 3 million customers on fixed networks

FIXED NETWORK: PERCENTAGE OF IPv6-ENABLED CUSTOMERS



Source: data as of the end of June 2021, collected by Arcep from operators.

FIXED NETWORK: PERCENTAGE OF IPv6-READY AND IPv6-ENABLED CUSTOMERS

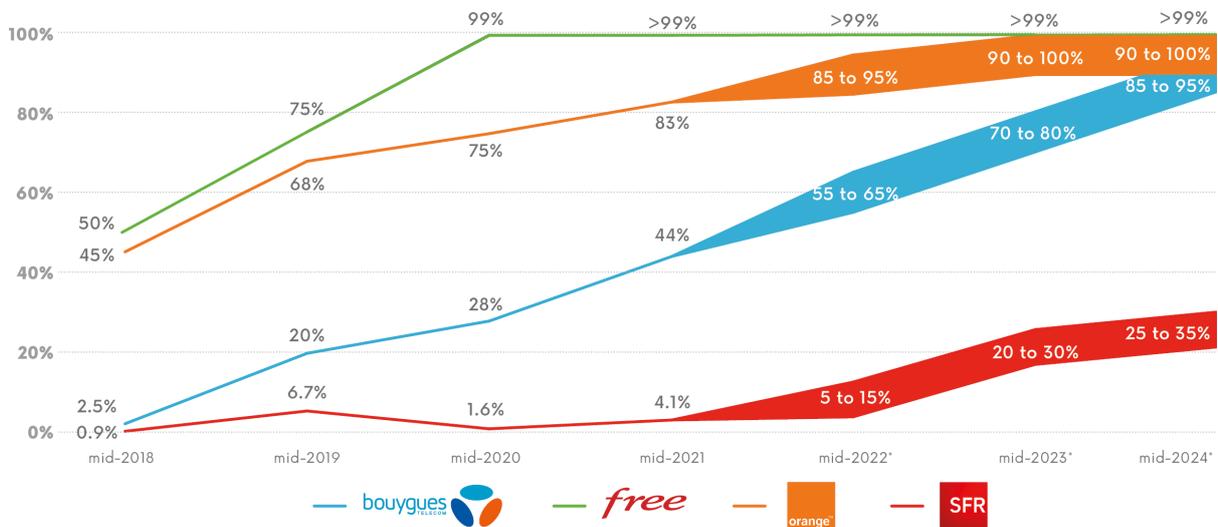
		bouygues TELECOM		free		orange		SFR	
		IPv6-ready	IPv6-enabled	IPv6-ready	IPv6-enabled	IPv6-ready	IPv6-enabled	IPv6-ready	IPv6-enabled
xDSL	Own network	52%	52%	100%	100%	74%	72%	100%	1%
	Backhaul network	0%	0%	0%	0%	N/A		0%	0%
Cable		N/A		N/A		N/A		0%	0%
FttH		55%	55%	100%	100%	100%	98%	42%	11%
4G fixed wireless		0%	0%	0%	0%	0%	0%	100%	30%
Whole network		44%	44%	>99%	>99%	85%	83%	52%	4.1%

Source: data as of the end of June 2021, collected by Arcep from operators.

The disparities between the percentage of customers who are IPv6-ready and the percentage of customers who are actually IPv6-enabled (transmitting and receiving IPv6 traffic) can be explained by the main operators' different IPv6 activation policies.

The four main operators have also provided forecasts for the percentage of customers that will be IPv6-ready and IPv6-enabled one year and three years from now (cf. annex for more details).

FIXED NETWORK: PERCENTAGE OF IPv6-ENABLED CUSTOMERS EVOLUTION



* Figures subject to change

Source: data as of the end of June 2021, collected by Arcep from operators.

Operators have provided details on their IPv4 sharing and IPv6 activation practices (cf. annex).

The four operators all have different IPv4 address sharing practices depending on their fixed network technologies:

- The majority of Free fixed network customers (75% in xDSL and 85% in FttH) as well as a small proportion of Bouygues Telecom customers (5% in xDSL and 2% in FttH) have a shared IPv4 address. However, these ISPs offer a dedicated IPv4 address free of charge on request.
- As of this year, some SFR customers also have a shared IPv4 address (8% in FttH) and this operator does not offer a dedicated IPv4 address on request for these customers.
- With regard to fixed 4G access, while Bouygues Telecom and SFR customers have a dedicated IPv4, Free and Orange customers have a shared IPv4 address. These two ISPs do not offer dedicated IPv4 for fixed 4G.
- This sharing of IPv4 between several customers could become generalized in the coming years to face the shortage of IPv4.

In addition, IPv6 is activated by default, when the client is IPv6-ready, at Bouygues Telecom, Free and Orange. More specifically, it is not possible to deactivate IPv6 on boxes from Bouygues Telecom, Free and SFR (in FttH), which constitutes a best practice. For the rest of SFR xDSL customers, they must activate IPv6 themselves, by configuring their box.

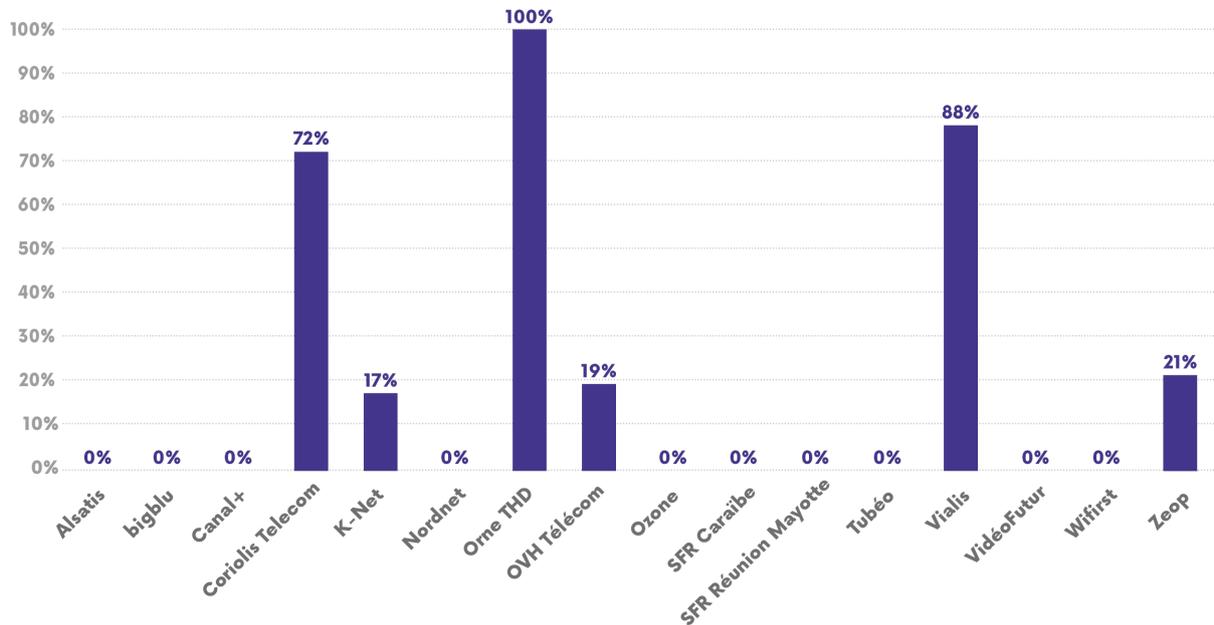
Bouygues Telecom, Orange and SFR have adopted the best practice of installing an IPv6 firewall by default for their customers, which can be configured. Free only offers a firewall as a non-configurable option.

On the fixed networks, Arcep notes significant disparities between the main telecom operators in the transition to IPv6:

- The percentage of IPv6-enabled SFR customers, all technologies combined, rose from 1.6% by mid-2020 to 4.1% by mid-2021. As upcoming activations also remain insufficient (between 20% and 30% by mid-2023 and between 25% and 35% by mid-2023), SFR is invited to highly accelerate its transition to IPv6 on its fixed network, in particular on FttH, and start this transition on cable. Because the vast majority of users will not take the initiative to enable IPv6 manually, Arcep is encouraging SFR to systematically perform this configuration by default.
- Although deployment efforts have been observed (around 44% of customers activated by mid-2021 compared to 28% by mid-2020), Bouygues Telecom is once again being urged to continue and to step up deployment efforts on its fixed network.
- On the fixed networks, the current percentage of Free and Orange customers who are IPv6-enabled is relatively high (approximately above 99% and 83% respectively) and have increased. The projections for mid-2024 for Orange are encouraging (between 90% and 100%).
- Bouygues Telecom, Free and Orange are being urged to begin the transition on 4G fixed wireless as soon as possible. SFR in particular, whose 4G fixed wireless customers are all IPv6-ready, is being encouraged to perform IPv6 activation by default on this technology.

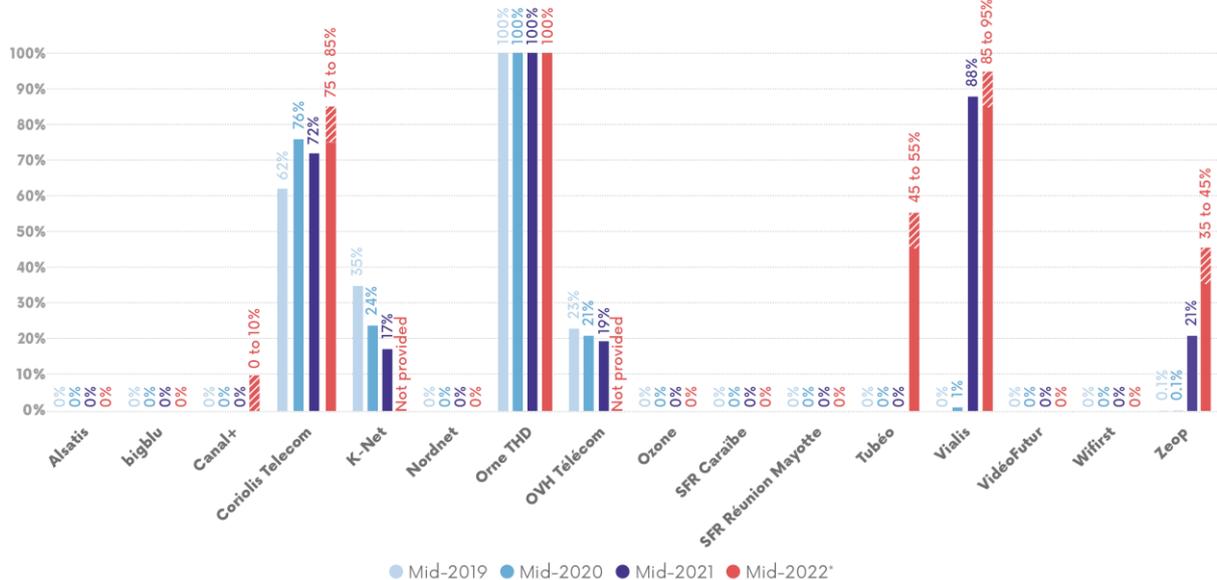
3.2. Operators with between 5,000 and 3 million customers on fixed networks

FIXED NETWORK: PERCENTAGE OF IPv6-ENABLED CUSTOMERS



Source: data as of the end of June 2021, collected by Arcep from operators.

FIXED NETWORK: PERCENTAGE OF IPv6-ENABLED CUSTOMERS EVOLUTION



* Figures subject to change

Source: data as of the end of June 2021, collected by Arcep from operators.

Several operators' initiatives are encouraging, notably Orne THD which has already migrated all of its customers since 2019 and Vialis which started its transition last year (1% by mid-2020) and has already activated IPv6 for 88 % of its customers. Zeop meanwhile went from 0.1% by mid-2020 to 21% by mid-2021. The percentage of IPv6-enabled customers at Coriolis (72%), K-Net (17%) and OVH Télécom (19%) have decreased compared to last year, which seems worrying.

On the contrary, Alsatis, bigblu, Nordnet, Ozone, SFR Caribbean, SFR Réunion Mayotte, VidéoFutur and Wifirst have not initiated their transition to IPv6 and do not yet plan to do so. K-Net and OVH Télécom were unable to provide their deployment forecasts. Even if several operators plan to accelerate their transition in 2021 (Coriolis Telecom, Vialis and Zeop) and that two additional operators (Canal + and Tubéo) plan to start their transition next year, the deployment still seems insufficient to face the shortage of IPv4.

For information, the data from Orange Caraïbe and Orange Réunion Mayotte for the fixed network are already included in the Orange data presented in section 3.1 and therefore do not appear in the two diagrams above. Orange Caraïbe and Orange Réunion thus respectively have 90% and 95% of their customers IPv6-enabled on the fixed line.

The operators have also supplied details on their IPv4 sharing and IPv6 activation practices (cf. annex).

Canal +, Coriolis Telecom, K-Net, Nordnet, OVH Télécom and Zeop, for instance, offer a dedicated IPv4 to every customer, whereas Alsatis, bigblu, OrneTHD, Ozone, Tubéo, Vialis, VidéoFutur and Wifirst use IPv4 address sharing for either a small percentage or all of their customers.

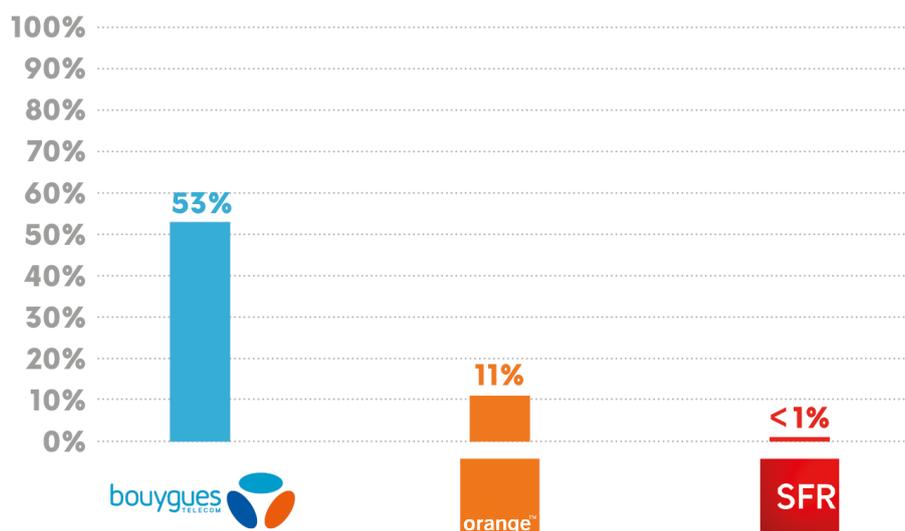
It should be noted that Coriolis Telecom, Orne THD and Vialis have adopted the best practice which consists of activating IPv6 by default, and making it impossible to deactivate it.

Despite the efforts of some operators to accelerate their transition, the forecasts of most operators with between 5,000 and 3 million customers are still largely insufficient in terms of target and pace.

3.3. Operators providing "Pro" plans on their fixed networks

Following reports received on its "J'alerte l'Arcep" platform regarding the difficulties that some businesses were experiencing in obtaining IPv6 solutions from their operators, Arcep expanded its information gathering to include operators that market solutions designed for business customers – aka "Pro" plans – on their fixed network.

FIXED NETWORK "PRO" OFFERS: PERCENTAGE OF IPv6-ENABLED CUSTOMERS



Source: data as of the end of June 2021, collected by Arcep from operators.

FIXED NETWORK "PRO" OFFERS: PERCENTAGE OF IPv6-READY AND IPv6-ENABLED CUSTOMERS EVOLUTION

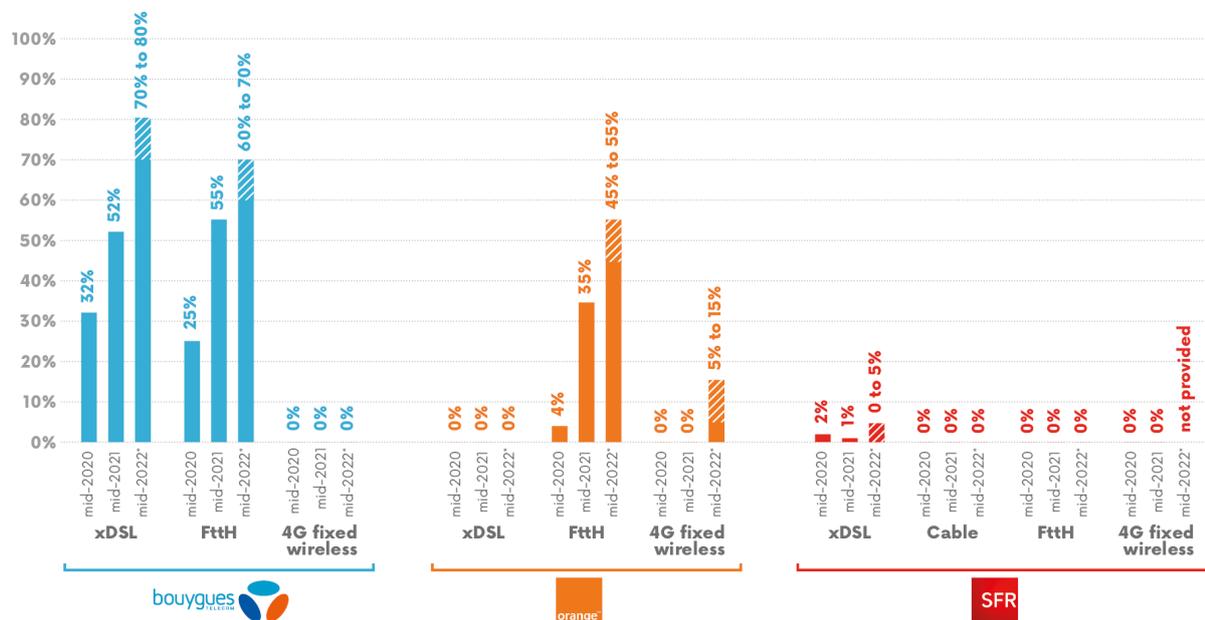
		bouygues TELECOM		orange		SFR	
		IPv6-ready	IPv6-enabled	IPv6-ready	IPv6-enabled	IPv6-ready	IPv6-enabled
xDSL	Mid-2020	32%	32%	0%	0%	100%	1.8%
	Mid-2021	52%	52%	0%	0%	100%	1%
	Mid-2022*	35-45%	35-45%	0%	0%	100%	0-5%
Cable	Mid-2020	0%	0%	N/A		0%	0%
	Mid-2021	N/A		N/A		0%	0%
	Mid-2022*	N/A		N/A		0%	0%
FttH	Mid-2020	25%	25%	4%	4%	0%	0%
	Mid-2021	55%	55%	36%	35%	0%	0%
	Mid-2022*	30-40%	30-40%	45-55%	45-55%	0%	0%
4G fixed wireless	Mid-2020	0%	0%	0%	0%	0%	0%
	Mid-2021	0%	0%	0%	0%	0%	0%
	Mid-2022*	0%	0%	100%	5-15%	N/A	
Whole network	Mid-2020	30%	30%	0.9%	0.9%	51%	0.9%
	Mid-2021	53%	53%	12%	11%	54%	< 1%
	Mid-2022*	65-75%	65-75%	15-25%	15-25%	45-55%	0-5%

* Figures subject to change

Source: data as of the end of June 2021, collected by Arcep from operators.

The three operators have also provided their one-year forecasts for IPv6-ready and IPv6-enabled fixed network customers (cf. annex for details).

FIXED NETWORK "PRO" OFFERS: PERCENTAGE OF IPv6-ENABLED CUSTOMERS EVOLUTION



* Figures subject to change

Source: data as of the end of June 2021, collected by Arcep from operators.

Regarding "Pro" plans on the fixed network, Arcep notes that the deployment of IPv6 is still insufficient and urge operators to include IPv6 in their plans for businesses:

- Arcep notes Bouygues Telecom's efforts to deploy IPv6 on its "Pro" plans and the progress compared to last year (53% by mid-2021 compared to 30% by mid-2020). Bouygues Telecom, already activating IPv6 by default, is encouraged to continue efforts to further increase the number of IPv6-ready customers.
- 100% of business customers on the SFR xDSL technology are IPv6-ready, but only 1% are IPv6-enabled (compared to 1.8% by mid-2020). SFR is once again invited to perform IPv6 activation by default and to initiate the transition of the "Pro" FttH and cable plans, which are not yet compatible with IPv6.
- Although progress is being observed in the transition of its "Pro" plans on FttH technology (35% of customers activated in mid-2021, compared to 4% in mid-2020), Orange is also invited to further accelerate the pace on FttH and to start this transition on xDSL.
- Bouygues Telecom, Orange and SFR are invited to start and accelerate the transition on 4G fixed wireless for "Pro" plans.

4. Mobile operators

Four conditions need to be met for a mobile line to be able to transmit and receive traffic in IPv6:

- The **mobile network** used must be IPv6-compatible, in other words the Access Point Name (APN) must be capable of managing the IPv6 protocol (cf. table below). When the APN is IPv6-compatible, the customer is said to be "IPv6-ready". It should be noted that some operators have an APN for tethering which is different from the APN used for the terminal's internet access. In which case, it is possible that only one of the two APN is IPv6-ready;
- The **device's operating system** must be IPv6-compatible (cf. section on Devices below). If this is already the case for almost all recent smartphones (Android 5 and more recent, iOS 12 and more recent), a substantial number of 4G routers being sold in 2019 are still not IPv6-compatible. Among those routers that are IPv6-compatible, the lack of support for some IPv6 standards could cause some applications to malfunction with an "IPv6-only" APN⁶;
- The operator must **remotely enable the mobile device** before it can use IPv6. With Android, the APN can be configured manually to be made IPv6-compatible. However, because the vast majority of users will not take the initiative of activating IPv6 themselves, it is actions taken by ISPs that will drive the transition. This could require an upgrade by the mobile device's manufacturer. iPhone users cannot enable IPv6 manually.

Thus:

- **a customer is said to be "IPv6-ready"** if they are able to activate IPv6 themselves on their own device (the network is IPv6-compatible);
- **A customer is said to be "IPv6-enabled" if their device** actually sends and receives IPv6 traffic, either through manual activation performed by the customer themselves, or through activation performed by the operator.

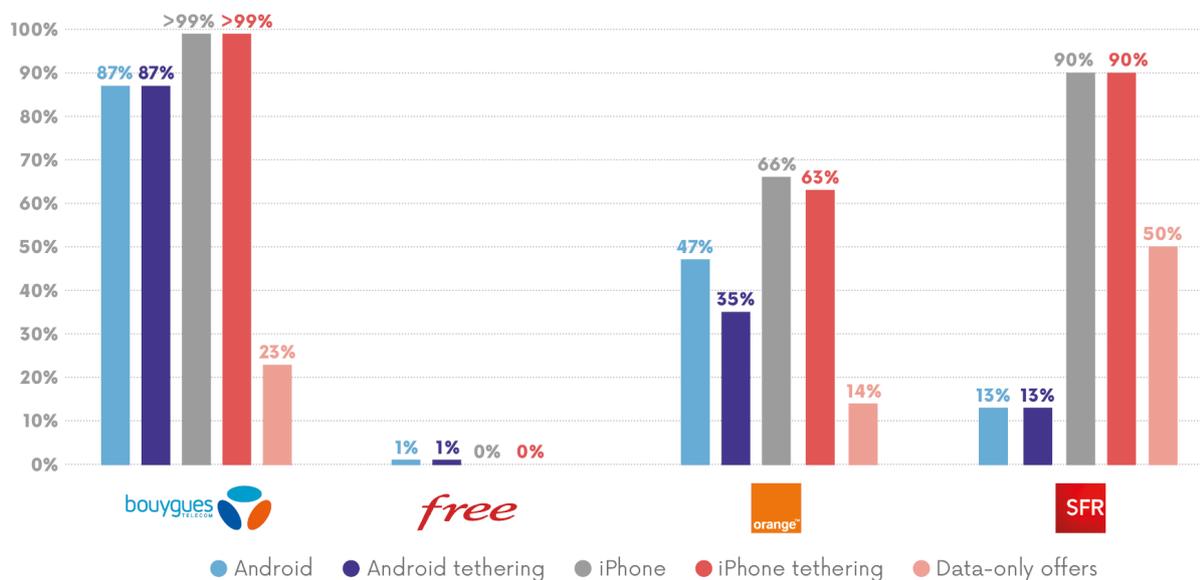
⁶ Three types of connection are possible on a mobile device:

- *IPv4-only*: The device is connected to the network only by an IPv4 address. Such is the case with IPv4-only plans;
- *IPv4/IPv6*: The device is both IPv4 and IPv6-enabled. This is the most common by type of connection on fixed networks with IPv6;
- *IPv6-only*: The device is connected to the network only by an IPv6 address. This is the most common type of connection for smartphones. Mechanisms such as NAT64, DNS64 and 464XLAT are put into place to ensure that the handset can the IPv4-only, internet using an IPv6 device.

4.1. Operators with over 3 million customers on mobile networks

As a reminder, Arcep has introduced, for operators who has been awarded a licence to use 5G frequencies in the 3.4 – 3.8 GHz band in Metropolitan France⁷, an obligation to make their mobile network compatible with IPv6 before 31 December 2020.

MOBILE NETWORK: PERCENTAGE OF IPv6-ENABLED CUSTOMERS



Source: data as of the end of June 2021, collected by Arcep from operators.

The disparity between the percentage of customers who are IPv6-ready and the percentage of customers who are actually IPv6-enabled (transmitting and receiving IPv6 traffic) can be explained by the main operators' different IPv6 activation policies.

⁷ [Arcep Decision on the terms and conditions for awarding licences to use frequencies in the 3.4 – 3.8 GHz band.](#)

Operators are changing the APN configuration, to make their “IPv6-ready” customers “IPv6-enabled” ones, which typically takes the form of an update by the mobile device’s manufacturer. These are the devices to have undergone IPv6 activation in their latest software update:

MOBILE NETWORK: IPv6 ACTIVATION POLICY

				
IPv6 enabled by default in Android	Samsung: S7 and newer Other manufacturers: new products from March 2018	No (double activation of IPv6 by the customer required: on their Free customer area and on their Android device)	Samsung from Android 9 (all models) Other manufacturers: new products from May 2020	Samsung: S21 and newer Other manufacturers: new products from March 2021
IPv6 enabled by default in Android tethering	Samsung: S7 and newer Other manufacturers: new products from March 2018	No (double activation of IPv6 by the customer required: on their Free customer area and on their Android device)	Samsung from Android 10 (all models) and some under Android 9 models Other manufacturers: new products from January 2021	Samsung: S21 and newer Other manufacturers: new products from March 2021
IPv6 enabled by default in iPhone	iPhone 5s and newer with iOS 12.2 or higher	No (IPv6 not available) Free plans to offer IPv6 at the end of 2021	iPhone 7 and newer with iOS 13.0 or higher	iPhone 6S and newer with iOS 14.3 or higher
IPv6 enabled by default in iPhone tethering	iPhone 5s and newer with iOS 12.2 or higher	No (IPv6 not available) Free plans to offer IPv6 at the end of 2021	iPhone 7 and newer with iOS 13.0 or higher	iPhone 6S and newer with iOS 14.3 or higher
IPv6 enabled by default in data-only offers	Progressive update of compatible devices	N/A	New products from January 2021	New products from March 2021

Source: data as of the end of June 2021, collected by Arcep from operators.

Arcep offers a tutorial (in French) on [its site](#) explaining how to activate IPv6 on Android smartphones, operator by operator. iPhones do not currently allow users to change the APN protocol themselves.

MOBILE NETWORK: PERCENTAGE OF IPv6-READY AND IPv6-ENABLED CUSTOMERS EVOLUTION

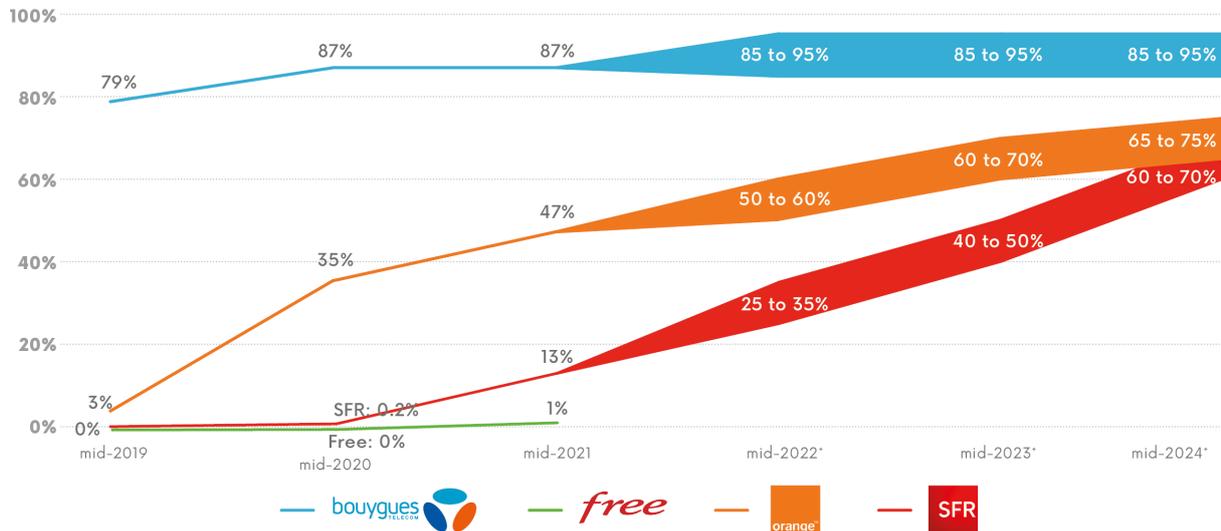
		bouygues telecom		free		orange		SFR	
		IPv6-ready	IPv6-enabled	IPv6-ready	IPv6-enabled	IPv6-ready	IPv6-enabled	IPv6-ready	IPv6-enabled
Android	Mid-2019	100%	79%	0%	0%	100%	3%	0%	0%
	Mid-2020	100%	87%	0%	0%	100%	35%	2%	0.2%
	Mid-2021	100%	87%	100%	1%	100%	47%	100%	13%
	Mid-2022*	100%	85-95%	100%	not provided	100%	50-60%	100%	25-35%
	Mid-2023*	100%	85-95%	100%	not provided	100%	60-70%	100%	40-50%
	Mid-2024*	100%	85-95%	100%	not provided	100%	65-75%	100%	60-70%
Android tethering	Mid-2019	100%	79%	0%	0%	0%	0%	0%	0%
	Mid-2020	100%	87%	0%	0%	100%	15%	2%	0.2%
	Mid-2021	100%	87%	100%	1%	100%	35%	100%	13%
	Mid-2022*	100%	85-95%	100%	not provided	100%	40-50%	100%	25-35%
	Mid-2023*	100%	85-95%	100%	not provided	100%	50-60%	100%	40-50%
	Mid-2024*	100%	85-95%	100%	not provided	100%	60-70%	100%	60-70%
iPhone	Mid-2019	100%	0%	0%	0%	100%	0%	0%	0%
	Mid-2020	100%	98%	0%	0%	100%	60%	2%	0%
	Mid-2021	100%	>99%	100%	0%	100%	66%	100%	90%
	Mid-2022*	100%	>99%	100%	not provided	100%	80-90%	100%	90-100%
	Mid-2023*	100%	>99%	100%	not provided	100%	85-95%	100%	97%
	Mid-2024*	100%	>99%	100%	not provided	100%	90-100%	100%	>99%
iPhone tethering	Mid-2019	100%	0%	0%	0%	0%	0%	0%	0%
	Mid-2020	100%	98%	0%	0%	100%	0%	2%	0%
	Mid-2021	100%	>99%	100%	0%	100%	63%	100%	90%
	Mid-2022*	100%	>99%	100%	not provided	100%	80-90%	100%	90-100%
	Mid-2023*	100%	>99%	100%	not provided	100%	85-95%	100%	97%
	Mid-2024*	100%	>99%	100%	not provided	100%	90-100%	100%	>99%
Data-only offers (4G dongles, tablets, computers, etc.)	Mid-2019	0%	0%	N/A	N/A	0%	0%	0%	0%
	Mid-2020	100%	23%	N/A	N/A	100%	0%	2%	0%
	Mid-2021	100%	22%	N/A	N/A	100%	14%	100%	50%
	Mid-2022*	100%	25-35%	N/A	N/A	100%	25-35%	100%	55-65%
	Mid-2023*	100%	25-35%	N/A	N/A	100%	35-45%	100%	70-80%
	Mid-2024*	100%	35-45%	N/A	N/A	100%	45-55%	100%	80-90%

* Figures subject to change

Source: data as of the end of June 2021, collected by Arcep from operators.

Regarding the different operators' plans for upgrading their mobile network to IPv6 one year and three years from now on Android and iPhone⁸:

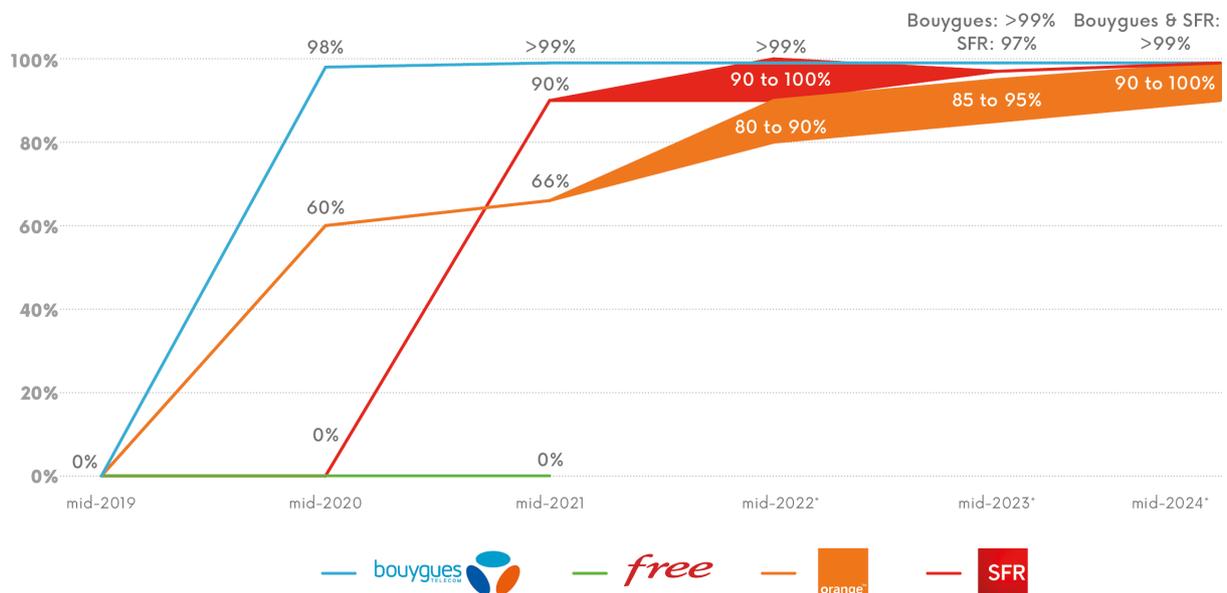
ANDROID: PERCENTAGE OF IPv6-ENABLED CUSTOMERS EVOLUTION



* Figures subject to change

Source: data as of the end of June 2021, collected by Arcep from operators.

iPHONE: PERCENTAGE OF IPv6-ENABLED CUSTOMERS EVOLUTION



* Figures subject to change

Source: data as of the end of June 2021, collected by Arcep from operators.

⁸ Data collected in 2018 were aggregated and can therefore not be compared by 2019 data by individual device category.

Arcep notes significant progress in the deployment of IPv6 on mobile networks but invites operators to continue their efforts to accelerate the activation of IPv6 in their various plans:

- Bouygues Telecom has achieved a noteworthy deployment on mobile networks, with 87% of Android customers and more than 99% of iPhone customers IPv6 enabled in mid-2021.
- IPv6 on the Orange mobile network is also worth noting (47% of Android customers and 66% of iPhone customers IPv6 enabled). Orange is invited to continue its IPv6 activation of mobile devices.
- SFR has carried out a remarkable deployment of IPv6 for its iPhone customers. The rate of iPhone IPv6-enabled customers has increased from 0% by mid-2020 to 90% by mid-2021. Android IPv6-enabled customers by mid-2021 (13%) as well as the deployment forecasts on Android appearing to be insufficient to cope with the IPv4 shortage, SFR is encouraged to step up the pace of Android device IPv6 activation.
- It is particularly regrettable that Free Mobile does not activate IPv6 by default for its mobile network clients, which results in a very low percentage of IPv6-enabled clients (1% for Android and 0% for iPhone) and was unable to provide forecasts for upcoming activations.
- Operators are all being called on to accelerate the pace of IPv6 deployment on their "data only" plans⁹.

4.2. Operators with between 5,000 and 3 million customers on mobile networks

In order to have a better monitoring of the transition to IPv6 of the various mobile operators in France, in addition to the full-MVNOs¹⁰ already present in the previous editions of this barometer, Arcep has broadened its collection of information to include the light-MVNOs¹¹.

The percentages displayed relate to the entire fleet of mobile operators, without distinction between Android or iOS devices¹².

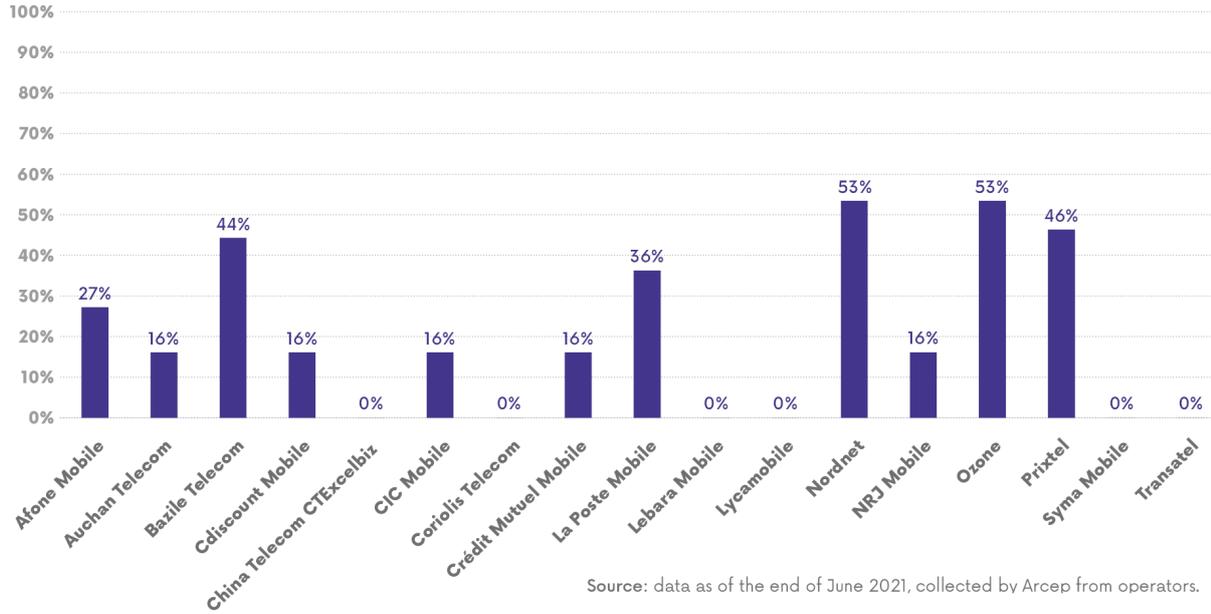
⁹ Plans not including voice transport.

¹⁰ Full-MVNO: MVNO which manages its addressing plan and which takes control of the core network and service platforms, while leasing radio capacity from host operators.

¹¹ Light-MVNO: MVNO which entrusts their host operator with the operational management of the network.

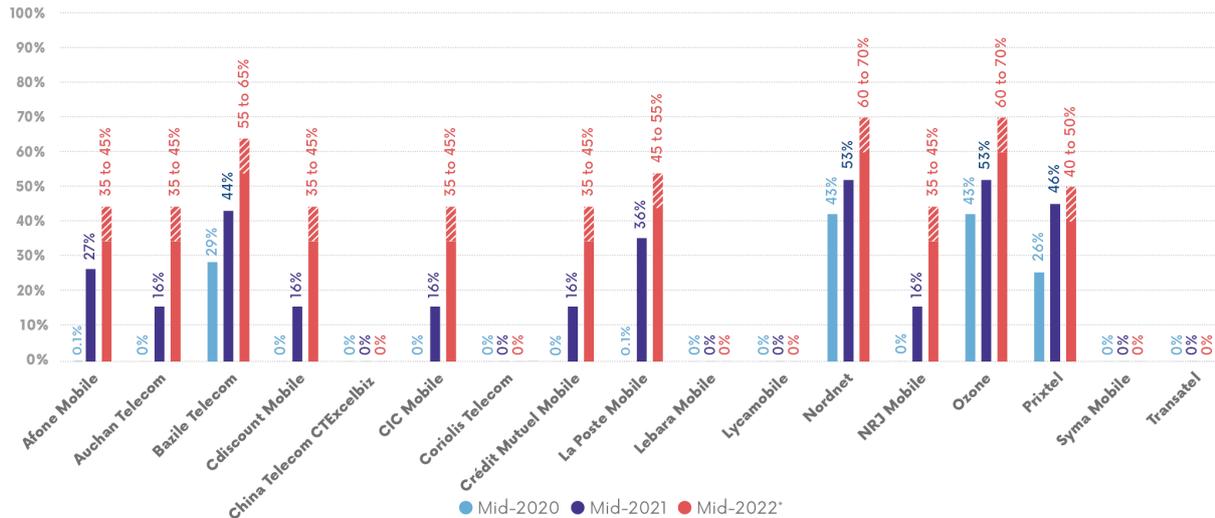
¹² The market share data used in this barometer is 70% for Android and 30% for iOS. [Statcounter data for France](#).

MOBILE NETWORK: PERCENTAGE OF IPv6-ENABLED CUSTOMERS



Source: data as of the end of June 2021, collected by Arcep from operators.

MOBILE NETWORK: PERCENTAGE OF IPv6-ENABLED CUSTOMERS EVOLUTION

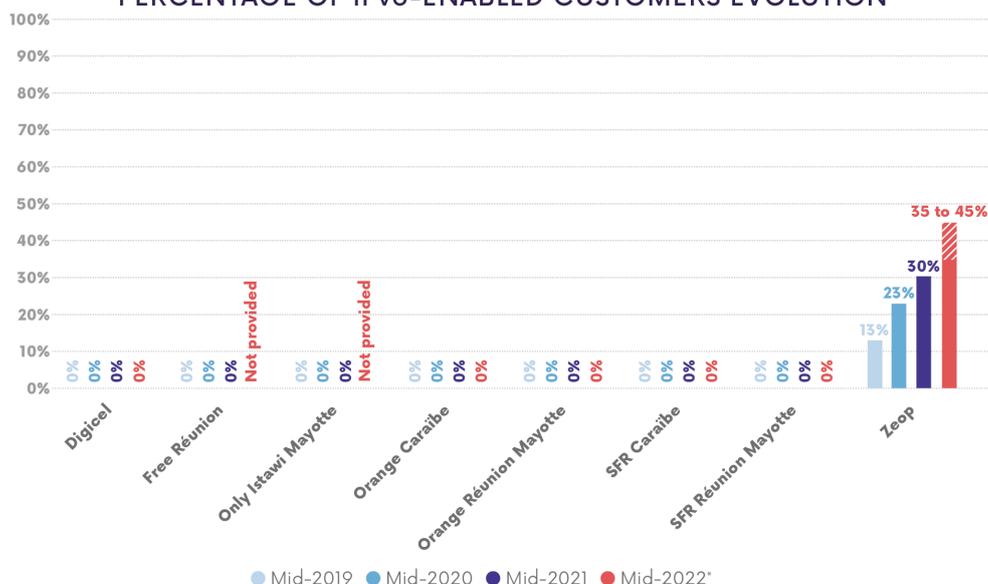


* Figures subject to change

Source: data as of the end of June 2021, collected by Arcep from operators.

In Metropolitan France, thanks to the deployment of IPv6 within the networks of the main operators in France, mobile operators with between 5,000 and 3 million customers that directly operate the APNs of these operators can provide IPv6 to their customers. However, some that have their own APNs (China Telecom CTEExcelbiz, Coriolis Telecom, Lebara Mobile, Lycamobile, Syma Mobile and Transatel) have not yet started their transition and are not considering doing so.

MOBILE NETWORK: PERCENTAGE OF IPv6-ENABLED CUSTOMERS EVOLUTION



* Figures subject to change

Source: data as of the end of June 2021, collected by Arcep from operators.

In overseas departments and regions (DROM), Zeop is the only mobile operator with between 5,000 and 3 million customers that has begun to enable IPv6 on its network (30% in mid-2021) and has a target of between 35 and 45% of customers IPv6 enabled by mid-2022. The remaining operators do not plan to have deployed IPv6 by mid-2022.

Operators with between 5,000 and 3 million mobile network customers, especially those that manage their own APNs, are encouraged to quickly begin and accelerate the transition to IPv6.

4.3. Operators marketing “Pro” plans on their mobile network

To improve its monitoring of the transition to IPv6, Arcep has expanded since 2020 its information gathering to include operators that market solutions designed for business customers – aka “Pro” plans – on their mobile network.

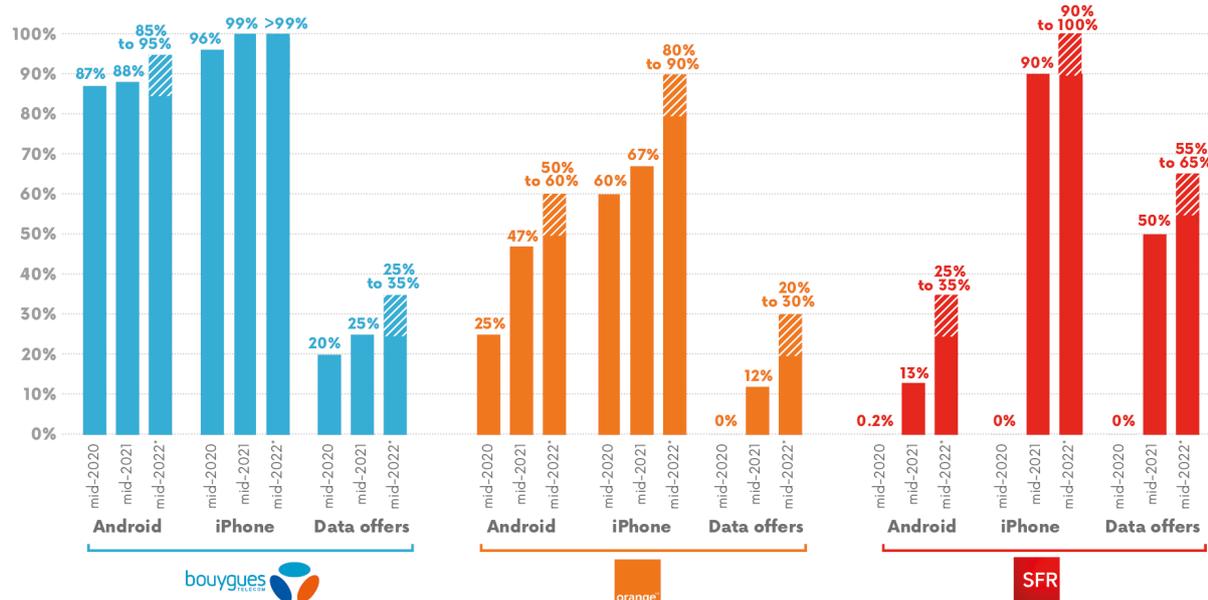
MOBILE NETWORK “PRO” OFFERS: PERCENTAGE OF IPv6-READY AND IPv6-ENABLED CUSTOMERS EVOLUTION

		bouygues TELECOM		orange		SFR	
		IPv6-ready	IPv6-enabled	IPv6-ready	IPv6-enabled	IPv6-ready	IPv6-enabled
Android	Mid-2020	100%	87%	100%	25%	2%	0.2%
	Mid-2021	100%	88%	100%	47%	100%	13%
	Mid-2022*	100%	85-95%	100%	50-60%	100%	25-35%
iPhone	Mid-2020	100%	96%	100%	60%	2%	0%
	Mid-2021	100%	>99%	100%	67%	100%	90%
	Mid-2022*	100%	>99%	100%	80-90%	100%	90-100%
Data-only offers (4G dongles, tablets, computers, etc.)	Mid-2020	100%	20%	30%	0%	2%	0%
	Mid-2021	100%	20%	100%	12%	100%	50%
	Mid-2022*	100%	25-35%	100%	20-30%	100%	55-65%

* Figures subject to change

Source: data as of the end of June 2021, collected by Arcep from operators.

MOBILE NETWORK "PRO" OFFERS: PERCENTAGE OF IPv6-ENABLED CUSTOMERS EVOLUTION



* Figures subject to change

Source: data as of the end of June 2021, collected by Arcep from operators.

The main operators' IPv6 activation policies explain the difference between the percentage of customers that are IPv6-ready and the percentage that are actually IPv6-enabled (i.e. who transmit and receive IPv6 traffic).

There are sizeable disparities between operators when it comes to IPv6 deployment on their mobile network "Pro" plans:

- As it has with mobile plans for consumers, Bouygues Telecom has achieved a remarkable deployment, activating most "Pro" plans' Android (88%) and iOS (99%) devices.
- SFR went from 0% in mid-2020 to 90% in mid-2021 of iPhone IPv6-enabled devices. However, the current percentage of Android IPv6-enabled devices for SFR remains low (13%) and projections on the same indicator remain insufficient (25 to 35% by mid-2022). SFR is also invited to increase the number of Android devices used by "Pro" plans that are IPv6-enabled and to finalize the activation on iPhone devices.
- On its "Pro" mobile plans, Orange has deployed IPv6 on 47% of Android devices and 67% of iPhone devices. Orange is invited to speed up activation, in particular on Android devices.
- Operators are invited to accelerate IPv6 deployment on all of their "Pro" plans.

5. Hosting services, content providers and DNS infrastructure

Five conditions need to be met for a hosting service to be able to transmit and receive in IPv6:

- The **hosting service network** must be IPv6-compatible;
- The **server's operating system** must be IPv6-compatible and its IPv6 stack enabled. It is the case for all currently used servers' operating systems;
- The hosting service must **preconfigure the server**, to use IPv6 addressing.

Once these three conditions have been met, the hosting service can then enable IPv6 at the server level (cf. see diagram in Part 1).

- The content provider must use **server applications** (web, mail, etc.) that can manage the IPv6 protocol. It is almost already the case by default.
- The content provider must **configure the DNS** by adding an IPv6 record, so that the domain name points towards an IPv6 address.

Once all of these conditions are met, the hosted service can be IPv6-enabled.

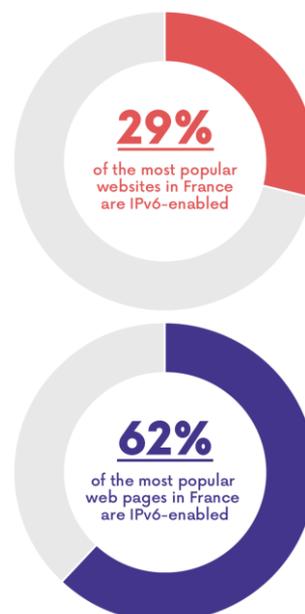
Thus, unlike an ISP that can enable IPv6 remotely, without requiring any action from its customers (i.e. end users), a hosting service's customer (i.e. content provider) must take several steps before IPv6 can be used end-to-end.

In the next part of this section, we take a look at three types of applications: web, mail and DNS infrastructure.

5.1. Web hosting

Web hosting services continue to constitute **one of the main bottlenecks** in the migration to IPv6: of the most popular websites in France according to Alexa rankings, only 29% are IPv6-enabled¹³ (compared to 26% in October 2020). A site is considered IPv6-enabled if its domain name is mapped as being IPv6 (AAAA) in the DNS server record.

Note that the percentage of web pages that are IPv6-enabled (IPv6 content) is significantly higher than that (62%¹⁴). The reason is that many of the smaller content providers operate websites (generally small number of pages viewed) that are not IPv6-compatible.



Source: Cisco 6lab as of 31/10/2021 (6lab.cisco.com).
Data of the top 730 websites in France as ranked by Alexa (www.alexa.com/topsites/countries)

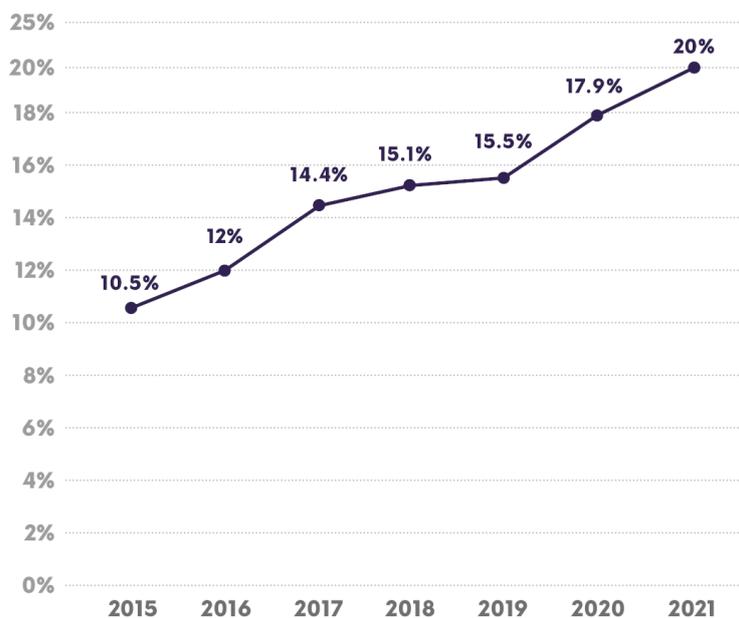
¹³ Cisco 6lab as of 31/10/2021. Data on the top 731 websites in France, [Alexa rankings](#).

¹⁴ *Ibidem*.

The percentage of IPv6-enabled sites stands at a mere 20% when looking at the 3.52 million .fr, .re, .pm, .yt, .tf, and .wf¹⁵ websites. This percentage has been increasing since 2015, but **the pace of this increase appears far from fast enough to enable a complete transition in the next few years.**

EVOLUTION OF IPv6-ENABLED WEBSITES

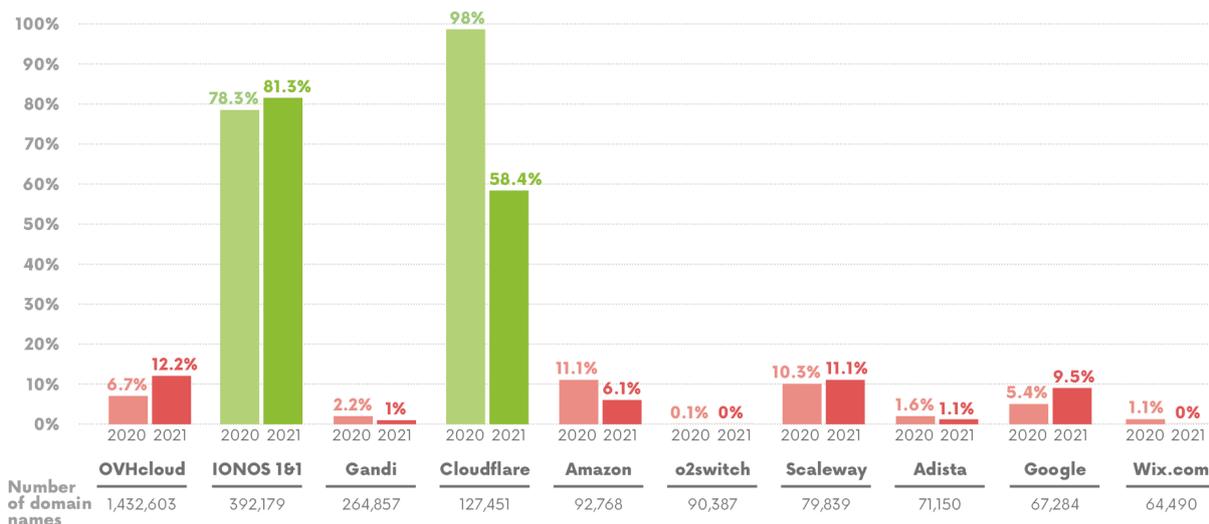
on .fr, .re, .pm, .yt, .tf and .wf domain names



Source: Afnic data, August 2021.

PERCENTAGE OF IPv6-ENABLED WEBSITES

on .fr, .re, .pm, .yt, .tf and .wf domain names

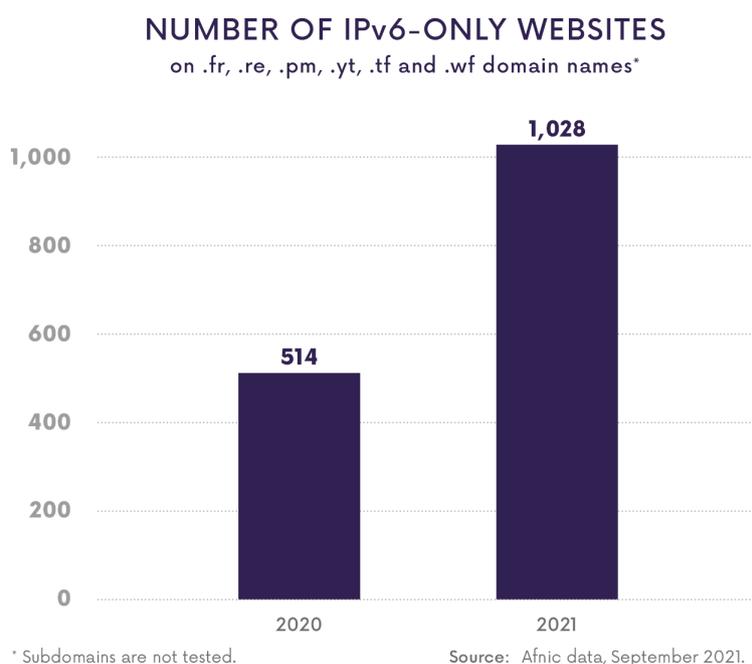


Source: Afnic data, August 2021.

¹⁵ Afnic data, August 2021. This data is based on DNS zone information and analysis of A, AAAA, MX, and NS records configured on a domain name. The analyses of the DNS zones were carried out with the [Zonemaster](#) tool from an Afnic server. For each IP retrieved, MaxMind database was used to find out the AS announcing this IP.

Even if the vast majority of websites accessible in IPv6 are also accessible in IPv4 (the servers are configured in dual-stack with IPv4 + IPv6), a sharp increase in the number of websites accessible in IPv6-only can be noted. Some hosts do indeed offer IPv6-only offers for which IPv4 is a chargeable option. The sites hosted on these IPv6-only servers are then not accessible to clients of IPv4-only operators. This situation illustrates the need to switch to IPv6 to avoid the development of an internet split in two, IPv4 on one side and IPv6 on the other.

In September 2021, there were 1,028 domain names in .fr, .re, .pm, .yt, .tf and .wf accessible only in IPv6¹⁶. This number has doubled compared to 2020 (514 domain names), but remains very limited.



Even if several hosting services include IPv6 in their solutions, **the percentage of websites accessible in IPv6 is very low** for all of the Top 10 web hosting services (in number of domain names) as it is **not activated by default**. Among that Top 10, only IONOS 1&1 has more than three quarters of its sites IPv6-enabled and Cloudflare¹⁷ has more than half of its sites IPv6-enabled, which make them examples to follow.

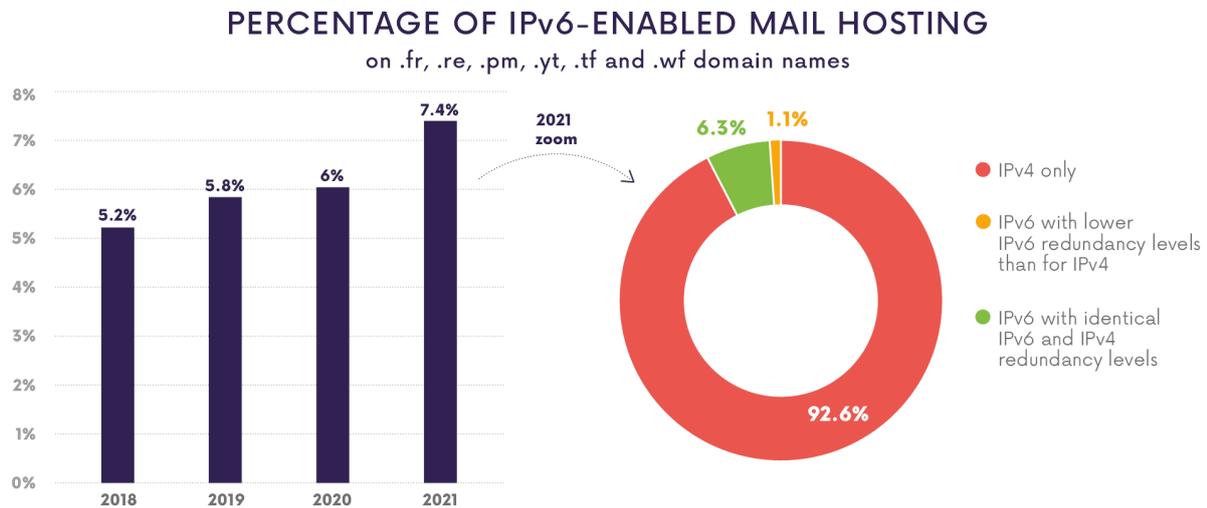
Further details on the Top 50 hosting services are available in annex.

¹⁶ This analysis is limited to the root domain: a subdomain accessible in IPv6-only will not be counted if the root domain is available in IPv4.

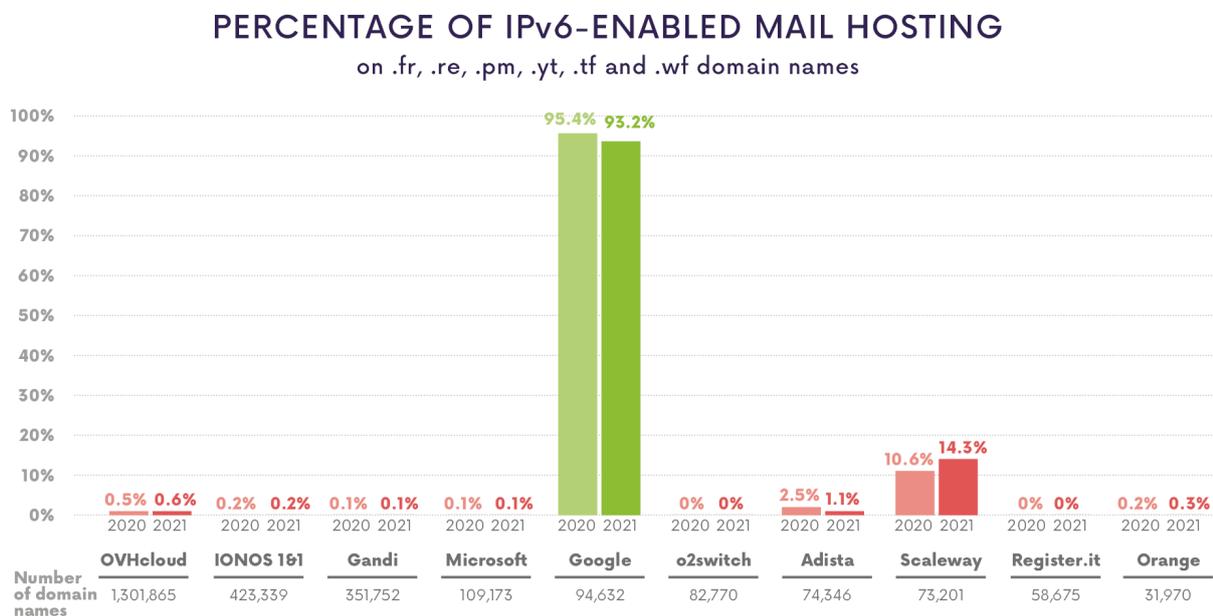
¹⁷ The percentage of IPv6-enabled websites at Cloudflare has fallen sharply (98% in mid-2020 compared to 58% in mid-2021). This is explained by the partnership between Cloudflare and Shopify which brings Cloudflare to advertise Shopify IPs which are only IPv4.

5.2. Mail hosting

The transition of the main mail hosting services is also proving **very slow**: only 7.4% of mail servers on .fr, .re, .pm, .yt, .tf and .wf domain names are currently IPv6-enabled (compared to 6% by mid-2020). It should also be noted that on a number of them, there is an IPv6 redundancy level that is below the one provided for IPv4, which is likely to create resilience issues¹⁸.



Source: Afnic data, August 2021.



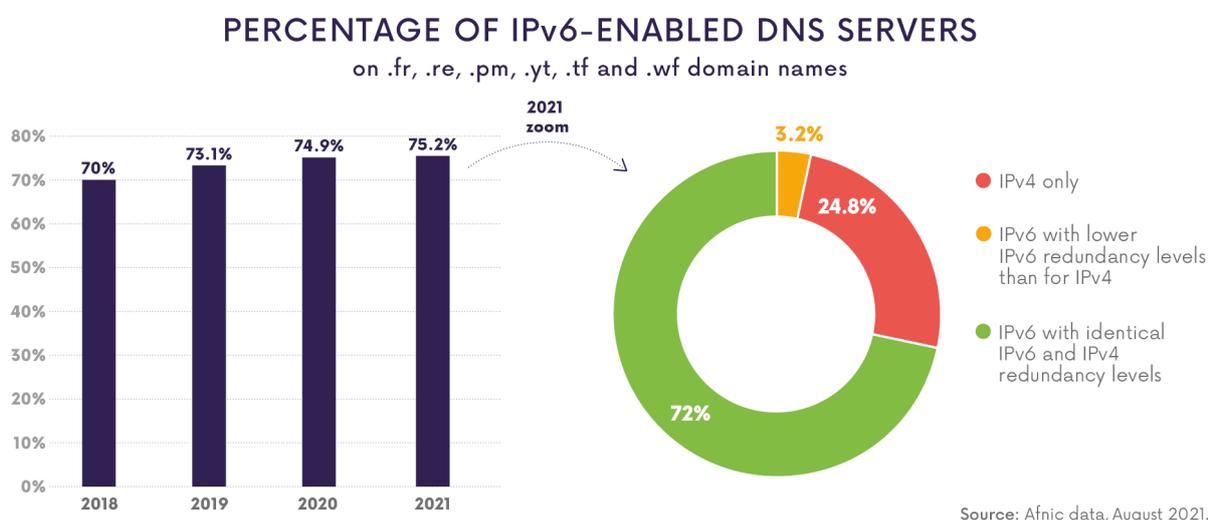
Source: Afnic data, August 2021.

Once again this year, the situation is similar to that of last year: the lack of IPv6-readiness amongst mail hosting services is alarming. If it is not remedied in the next few years, the protracted lag on this link in the internet value chain could force IPv4 to be kept for longer than planned, with all the resulting costs. Only Google stands out here, with more than 93% of domain names for mail using IPv6 (cf. annex for more details on the Top 50).

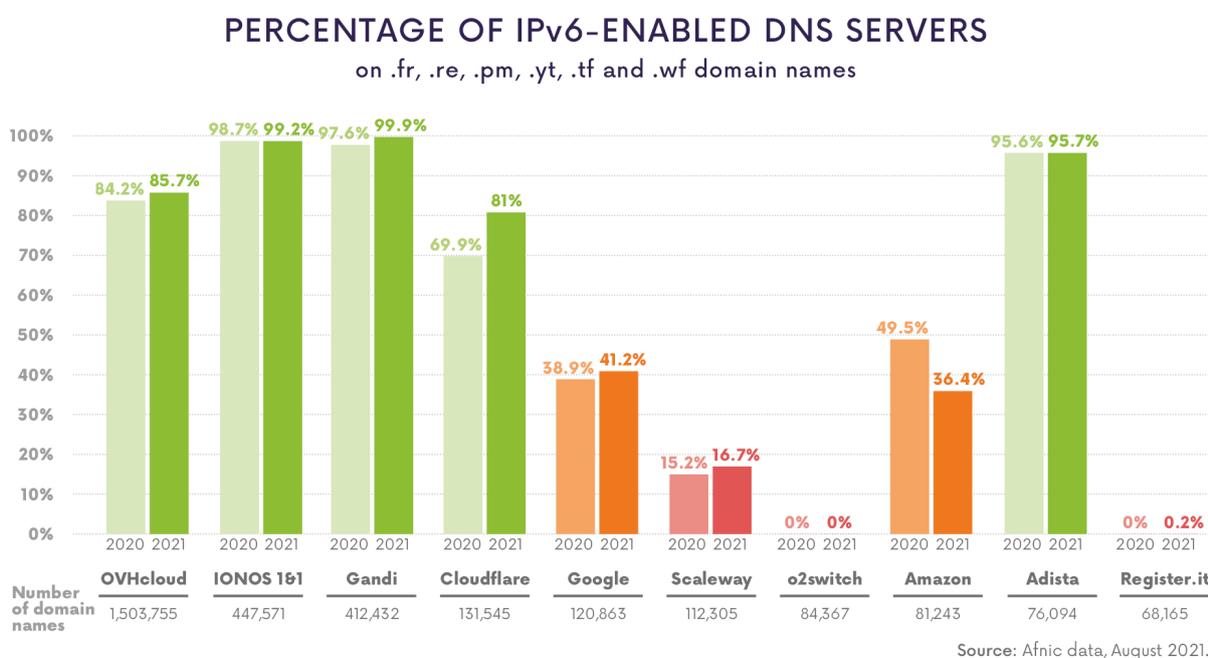
¹⁸ Afnic data, August 2021.

5.3. DNS infrastructure

DNS infrastructure makes it possible to translate a domain name, e.g. www.arcep.fr, into an IP address. This is currently **the sector that is the most advanced in the transition to IPv6**, with around 75% of authoritative name servers¹⁹ supporting IPv6. Around 72%²⁰ of DNS servers guarantee an IPv6 resilience equivalent to IPv4 (identical redundancy levels).



It is worth noting the ongoing tremendous disparity in the Top 10 hosting company rankings, with five players (OVHcloud, IONOS 1&1, Gandi, Amazon et Adista) which have more than 80% of DNS servers IPv6-enabled (cf. annex for details on the Top 50).



¹⁹ An authoritative DNS (domain name server) is the primary DNS server for a domain, in other words the one that holds the domain name resolution information.

²⁰ Afnic data, August 2021.

5.4. Government websites and online services (.gouv.fr)

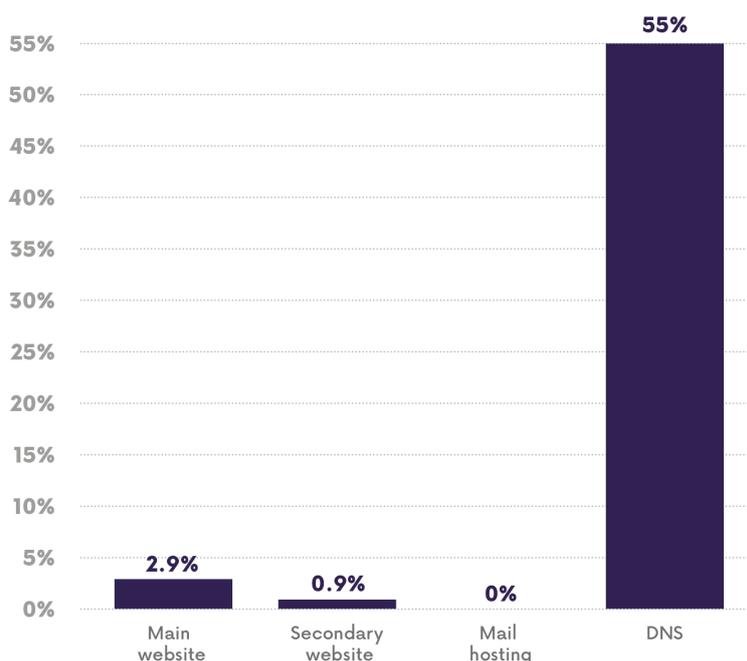
Since having the government lead by example is one of the most important paths to an accelerated transition, this year the barometer has been enhanced with indicators on the progression of this transition to IPv6 by French government websites and online services. The current study pertains to the 243²¹ sites with the .gouv.fr suffix and available in HTTPS²².

DNS servers' transition to IPv6 is relatively well advanced and has progressed since last year, with 55% of them being IPv6-enabled, linked in particular to the IPv6 switchover of DNS hosting managed by Orange and Cegedim.cloud. Mail hosting, on the other hand, is still entirely in IPv4 and the percentage of government websites using IPv6 stands at only 2.9% for the main websites²³ and 0.9% for secondary ones²⁴.

Even if some sites are available in IPv6, it is regrettable that the vast majority are still using only IPv4 and that the progress is very limited compared to last year. Once again this year, the level of IPv6 deployment on government websites and online services remains very inadequate, particularly given the goal of leading the transition to IPv6 by example. More attention could be paid to IPv6 compatibility when upgrading existing websites and when drafting specs for calls to tender to create new online services.

RATE OF IPv6 ADOPTION ON GOVERNMENT WEBSITES AND ONLINE SERVICES

(.gouv.fr and available in HTTPS)



Source: tests performed by Arcep on November 2021, based on Afnic data.

²¹ An error was present in the 2020 edition of IPv6 barometer: only 145 sites (domain names starting with the letter "a" to the letter "l") had been taken into account.

²² Of the 1,009 existing domain names ending with .gouv.fr in August 2020, only the 243 whose HTTPS response has a valid TLS certificate were taken into account, and so excluding from the analysis domain names that are not being maintained or that are not attached to a website.

²³ Main site: the site suggested/linked to by default by a search engine.

²⁴ Secondary site: site that redirects to the main site (if the main site has the "www" prefix, the secondary site does not, and vice-versa).

6. Equipment suppliers, transit providers and devices

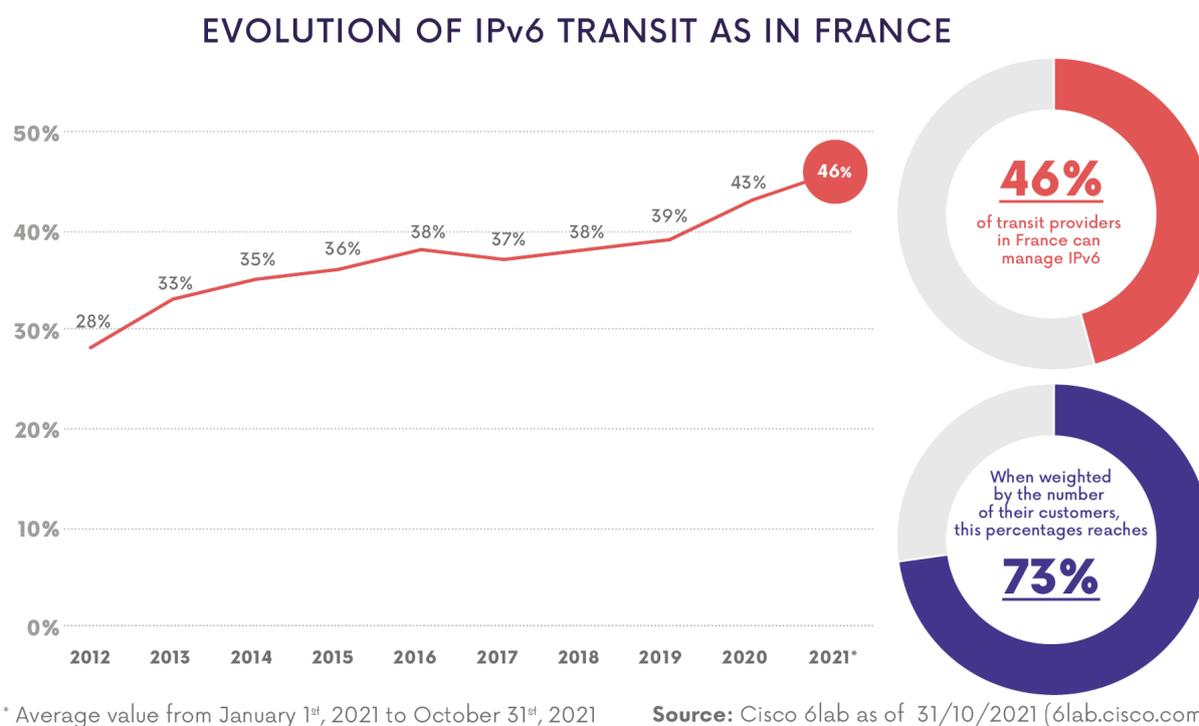
6.1. Equipment suppliers

All of the major equipment suppliers (Cisco, Juniper and Nokia) have indicated that all the network solutions they sell (routers, etc.) are **systematically made IPv6-compatible**²⁵.

This compatibility does not necessarily guarantee that traffic will be routed in IPv6, as this would require each player (ISPs, hosting services, transit providers, etc.) to have configured IPv6 routes at the router level.

6.2. Transit providers²⁶

The percentage of transit providers that manage IPv6 in France has increased by more than 18 points over the past 9 years.



Today, 46% of the transit providers operating in France (88 of the 190 transit providers) can manage IPv6 traffic, compared to 45% at the end of October 2020.

When weighted by the number of transit providers' customers, this percentage climbs to around 73% at the end of October 2021. This means that several of the larger transit providers are better equipped to manage IPv6²⁷.

²⁵ Arcep 2016 questionnaire.

²⁶ The methodology employed by Cisco's ólab stipulates that "all AS that appear on an AS path of BGP table (and that are not the origin AS or the destination) are considered Transit AS.

²⁷ Cisco ólab as of 31/10/2021.

6.3. Devices

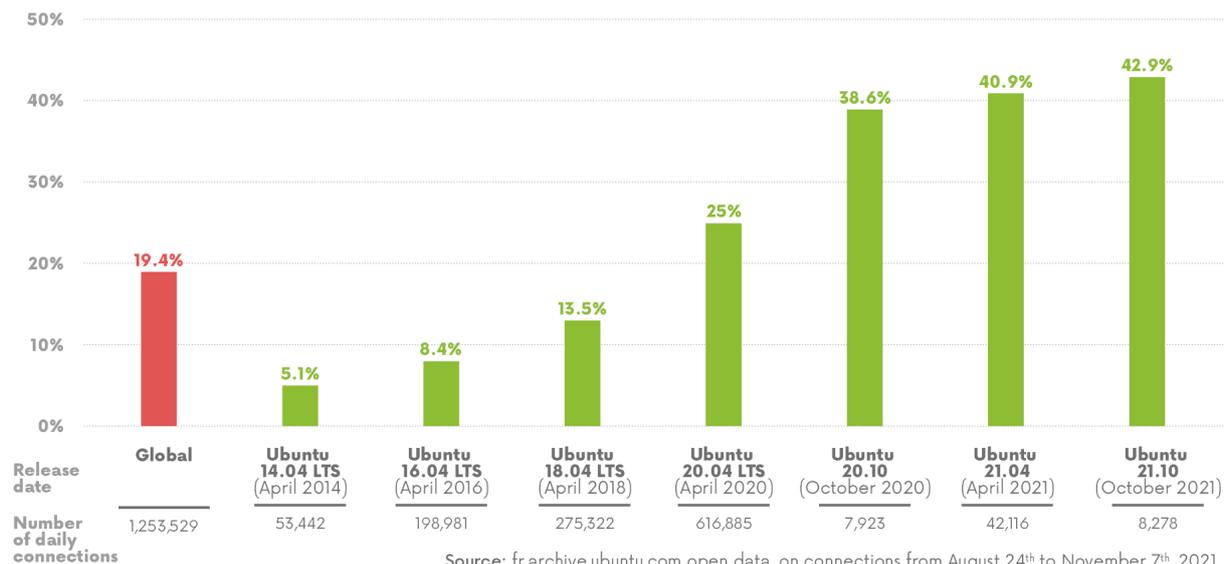
For a device to be able to transmit and receive IPv6 traffic, the operating system (OS) must be IPv6-compatible, and IPv6 must be enabled by default.

In the many connected objects (alarm systems, televisions, etc.), IPv6 is integrated into the OS but has not been enabled by the connected object's manufacturer.

All of these operating systems are compatible with IPv6, which has been enabled by default for several years now (for instance, IPv6 has been enabled by default in Windows since Windows Vista in 2007). However, some OS cannot work properly in IPv6 without an IPv4 address (i.e. when IPv6 is the only protocol available) as they do not include support for the [RFC 8106 Neighbor Discovery Protocol RDNSS](#).

If the operating systems are activated by default in IPv6 when auto-configuring IP addresses, many servers are only provisioned in IPv4, because the tool that will configure the server will only do it in IPv4. IPv6 may be available, but only if the server is manually configured (assuming the host offers IPv6, some hosts do not yet offer IPv6). Disparities in terms of IPv6 activation across different versions of the Ubuntu Linux distribution can be observed.

PERCENTAGE OF UBUNTU OS CONFIGURED WITH AN IPv6 CONNECTIVITY IN FRANCE



Even though the overall percentage of Ubuntu OS (and its versions) that have IPv6 connectivity is only 19.4%, we see that new installations have a much higher percentage of IPv6 enabled than older versions.

7. Where does France stand?

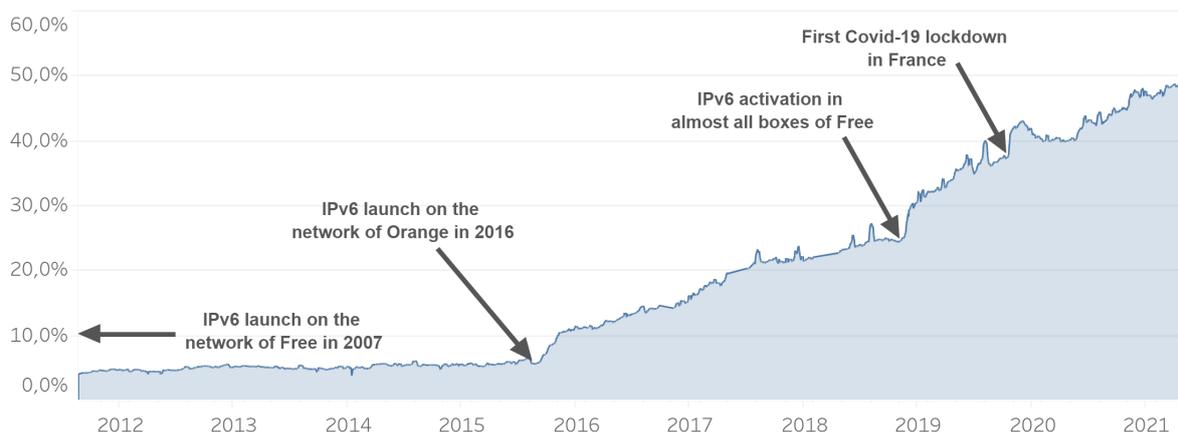
The **IPv6 adoption rate** represents the percentage of users measured at a hosting service level (service proposing already IPv6). This therefore gives an idea of the status of the transition amongst devices, ISPs and mobile operators, and by other technical intermediaries when the hosting service in question makes use of transit providers.

As measured by Google, this rate currently stands almost at 50% in France.

It is worth noting that, during the first lockdown in France due to the Covid-19 pandemic, the rate of IPv6 use rose from around 37% to 43% between mid-March and the end of April 2020. This rate dropped slightly after the lockdown, which can be attributed in particular to the surge in residential internet traffic during the lockdown, which is more widely IPv6-enabled than business internet access.

Evolution of IPv6 adoption in France, as measured by Google

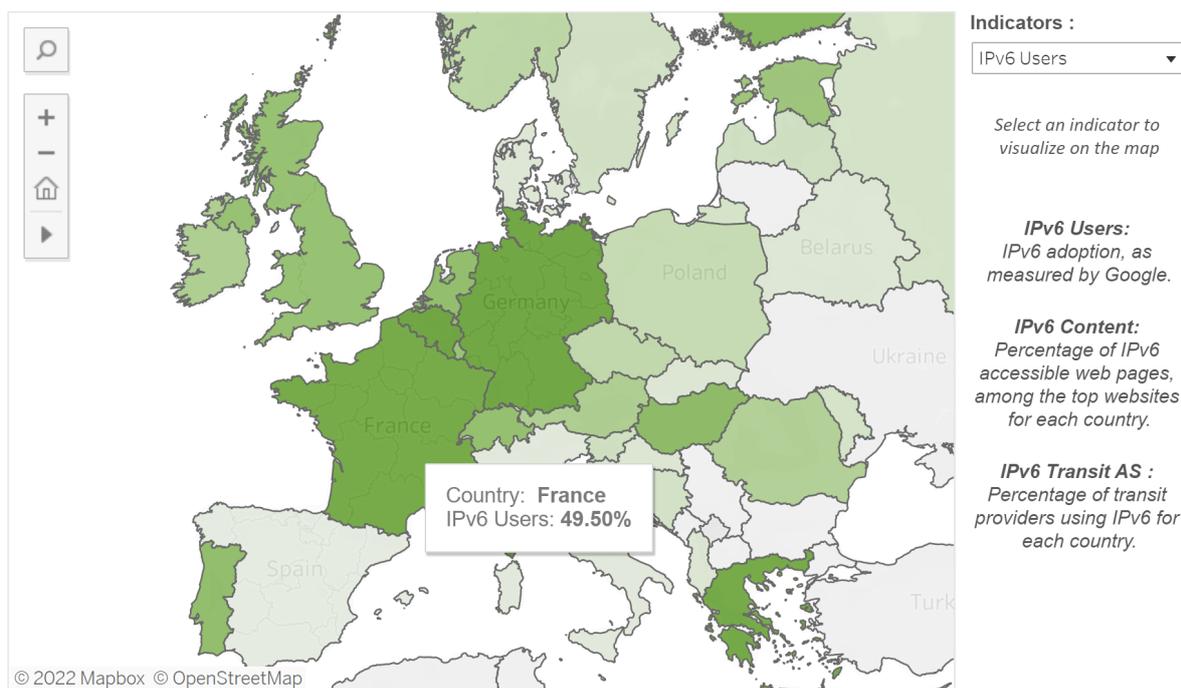
Source : Cisco - 6Lab



Because Google servers are typically located close to end users, this indicator gives an only partial view of the actual situation (the **percentage of transit providers that have adopted IPv6** has a direct influence on the number of IPv6-initiated Internet connections in France, but is marginally taken into account by this indicator). It is also important to know how many web hosts are actually able to provide IPv6, by measuring the **percentage of web pages that are accessible through IPv6 (or content)**. The following map provides a comparison of the different countries around the world for the three indicators listed above.

State of the transition to IPv6 in the world as of 31/10/2021

Source: Cisco - 6Lab

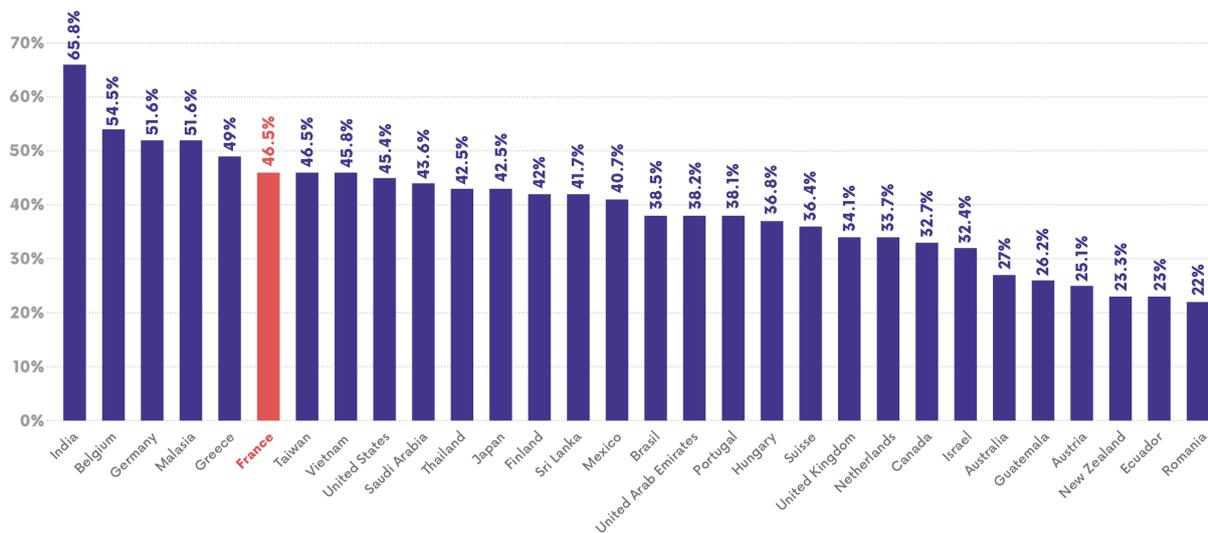


Globally, France went from tenth place at the end of 2020 to **sixth place today in terms of IPv6 use rate** according to the four main sources of publicly available data employed to assess IPv6 adoption (Google, Akamai, Facebook and Apnic)²⁸. There is a significant increase in IPv6 adoption in several countries in one year, notably: Saudi Arabia which is up by 24 points; Israel by 19 points; Guatemala by 13 points; Sri Lanka by 12 points; Thailand, United Arab Emirates, Hungary and Austria by 9 points.

France ranks **fourth in Europe**, behind Belgium, Germany and Greece.

²⁸ Based on the median of [Google IPv6 adoption](#)", "[Akamai IPv6 adoption](#)", "[Facebook IPv6 adoption](#)", "[Apnic IPv6 preferred](#)" data-bbox="113 866 884 926"> data from October 2021. Aggregation of national data is prorated based on the number of internet users (source: Wikipedia, data as of 09/08/2021). The median of the four sources is calculated country by country, before being aggregated on a pro-rated basis, according to the number of internet users in each region.

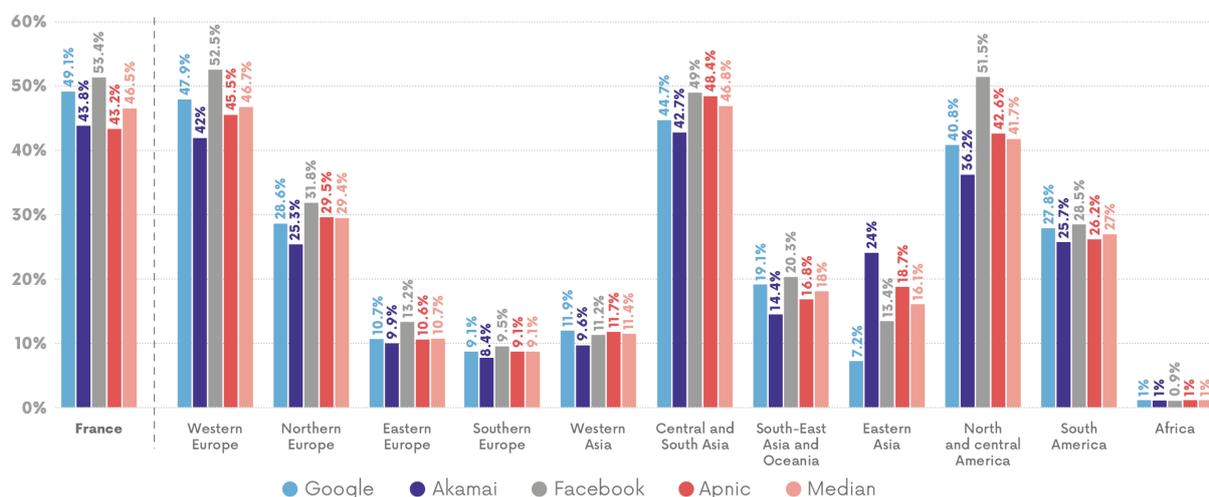
TOP 30 COUNTRIES IN TERMS OF IPv6 ADOPTION



Source: median of "Google IPv6 adoption", "Akamai IPv6 adoption", "Apnic IPv6 preferred" data from October 2021. Pertains only to the 100 countries with the most internet users.

IPv6 deployment levels vary considerably from region to region. The three regions with the most advanced transition to IPv6 are Central and South Asia and Western Europe (47% IPv6 use), as well as North and Central America (42%). The regions that lag the furthest behind in IPv6 deployment are Western Asia (11%), Eastern Europe (11%), Southern Europe (9%) and Africa (1%).

REGIONAL IPv6 ADOPTION LEVELS



Source: "Google IPv6 adoption", "Akamai IPv6 adoption", "Facebook IPv6 adoption" and "Apnic IPv6 preferred" data from October 2021. Aggregation of national data is prorated based on the number of internet users. The median of the four sources is calculated country by country, before being aggregated on a pro-rated basis, according to the number of Internet users in each region.

Annex: more information on the transition to IPv6

3. Fixed Internet service providers

3.1 Operators with over 3 million customers on fixed networks

FIXED NETWORK: PERCENTAGE OF IPV6-READY AND IPV6-ENABLED CUSTOMERS EVOLUTION

		bouygues		free		orange		SFR	
		IPv6-ready	IPv6-enabled	IPv6-ready	IPv6-enabled	IPv6-ready	IPv6-enabled	IPv6-ready	IPv6-enabled
xDSL own network	Mid-2018	2.5%	2.5%	99%	Not provided	40%	39%	100%	1%
	Mid-2019	25%	25%	99%	69%	60%	59%	100%	2%
	Mid-2020	32%	32%	99%	99%	67%	66%	100%	2%
	Mid-2021	52%	52%	100%	100%	74%	72%	100%	1%
	Mid-2022*	70-80%	70-80%	100%	100%	75-85%	70-80%	100%	0-5%
	Mid-2023*	85-95%	85-95%	100%	100%	80-90%	80-90%	100%	0-5%
	Mid-2024*	90-100%	90-100%	100%	100%	90-100%	85-95%	100%	0-5%
xDSL backhaul network	Mid-2018	0%	0%	0%	0%	N/A	N/A	0%	0%
	Mid-2019	0%	0%	0%	0%	N/A	N/A	0%	0%
	Mid-2020	0%	0%	0%	0%	N/A	N/A	0%	0%
	Mid-2021	0%	0%	0%	0%	N/A	N/A	0%	0%
	Mid-2022*	0%	0%	0%	0%	N/A	N/A	45-55%	0-5%
	Mid-2023*	0%	0%	0%	0%	N/A	N/A	100%	0-5%
	Mid-2024*	0%	0%	0%	0%	N/A	N/A	100%	0-5%
Cable	Mid-2018	0%	0%	N/A	N/A	N/A	N/A	0%	0%
	Mid-2019	0%	0%	N/A	N/A	N/A	N/A	0%	0%
	Mid-2020	0%	0%	N/A	N/A	N/A	N/A	0%	0%
	Mid-2021	N/A	N/A	N/A	N/A	N/A	N/A	0%	0%
	Mid-2022*	N/A	N/A	N/A	N/A	N/A	N/A	0%	0%
	Mid-2023*	N/A	N/A	N/A	N/A	N/A	N/A	0%	0%
	Mid-2024*	N/A	N/A	N/A	N/A	N/A	N/A	0%	0%
FtH	Mid-2018	1%	1%	100%	99%	90%	87%	60%	1.5%
	Mid-2019	2%	2%	100%	99%	100%	97%	60%	38%
	Mid-2020	25%	25%	100%	100%	100%	97%	10%	3.5%
	Mid-2021	55%	55%	100%	100%	100%	98%	42%	11%
	Mid-2022*	60-70%	60-70%	100%	100%	100%	98%	65-75%	25-35%
	Mid-2023*	80-90%	80-90%	100%	100%	100%	98%	>99%	75-85%
	Mid-2024*	90-100%	90-100%	100%	100%	100%	98%	>99%	85-95%
4G fixed wireless	Mid-2018	0%	0%	N/A	N/A	0%	0%	0%	0%
	Mid-2019	0%	0%	N/A	N/A	0%	0%	0%	0%
	Mid-2020	0%	0%	0%	0%	0%	0%	0%	0%
	Mid-2021	0%	0%	0%	0%	0%	0%	100%	30%
	Mid-2022*	100%	20-30%	Not provided	Not provided	100%	5-10%	100%	55-65%
	Mid-2023*	100%	25-35%	Not provided	Not provided	100%	15-25%	100%	70-80%
	Mid-2024*	100%	35-45%	Not provided	Not provided	100%	25-35%	100%	70-80%
Wholenetwork	Mid-2018	2.5%	2.5%	99%	50%	46%	45%	64%	0.9%
	Mid-2019	20%	20%	99%	75%	70%	68%	64%	6.7%
	Mid-2020	28%	28%	99%	99%	77%	75%	50%	1.6%
	Mid-2021*	44%	44%	>99%	>99%	85%	83%	52%	4.1%
	Mid-2022*	55-65%	55-65%	>99%	>99%	85-95%	85-95%	60-70%	5-15%
	Mid-2023*	75-85%	70-80%	>99%	>99%	90-100%	90-100%	70-80%	20-30%
	Mid-2024*	85-95%	85-95%	>99%	>99%	90-100%	90-100%	70-80%	25-35%

* Figures subject to change

Source: data as of the end of June 2021, collected by Arcep from operators.

FIXED NETWORK: IPv4 SHARING PRACTICES AND IPv6 PREFIX

		Technologies				
IPv4	Percentage of customers with a dedicated IPv4 address	xDSL	95%	25%	100%	100%
		Cable	N/A	N/A	N/A	100%
		FttH	98%	15%	100%	92%
		4G fixed wireless	100%	0%	0%	100%
	If shared, cost of a dedicated IPv4 address	xDSL, cable, FttH	Free option	Free option	Dedicated IPv4 per default	Dedicated IPv4 not provided
		4G fixed wireless	Dedicated IPv4 per default	Dedicated IPv4 not provided	Dedicated IPv4 not provided	Dedicated IPv4 per default
	Periodicity of the public IPv4 address <i>(subject to modifications on the access or backhaul network)</i>	xDSL, cable	Fixed	Fixed	Dynamic	Dynamic
		FttH	Fixed	Fixed	Change in case of a disconnection from the box > 7 days	Fixed
		4G fixed wireless	Dynamic	Dynamic	Dynamic	Dynamic
Frequency of IPv6 prefix update <i>(subject to change on the access or backhaul network)</i>	xDSL	Fixed	Fixed	Dynamic	Dynamic	
	FttH	Fixed	Fixed	Dynamic	Fixed	
	4G fixed wireless	Dynamic	No IPv6	Dynamic	Dynamic	
Size of IPv6 prefix assigned by default to IPv6 customers	xDSL, FttH	60 bits	61 bits	56 bits	56 bits	
	4G fixed wireless	64 bits	No IPv6	64 bits	64 bits	
IPv6 enabled by default <i>(subject to eligibility)</i>	xDSL	Yes	Yes	Yes	No	
	FttH	Yes	Yes	Yes	Depending on the firmware	
	4G fixed wireless	Yes	No IPv6	Yes	Yes	
Impossibility for the customer to disable IPv6 in the box	xDSL	Yes	Yes	No	No	
	FttH	Yes	Yes	No	Depending on the firmware	
	4G fixed wireless	No	No IPv6	Yes	No	
IPv6 firewall enabled by default (unsolicited inbound IPv6 flows blocked by default)	xDSL, FttH	Yes	No	Yes	Yes	
	4G fixed wireless	Yes	No IPv6	Yes	Yes	
IPv6 firewall: possibility to open the unsolicited inbound IPv6 flows	xDSL, FttH	Manually of via uPnP	The optional firewall cannot be configured	Manually of via uPnP	Manually of via uPnP	
	4G fixed wireless	No to date, possible in the future	No IPv6	The firewall cannot be configured	Manually of via uPnP	

Source: data as of the end of June 2021, collected by Arcep from operators.

3.2 Operators with between 5,000 and 3 million customers on fixed networks

FIXED NETWORK:
PERCENTAGE OF IPv6-READY AND IPv6 ENABLED CUSTOMERS EVOLUTION

		Mid-2018		Mid-2019		Mid-2020		Mid-2021		Mid-2022*	
		IPv6-ready	IPv6-enabled	IPv6-ready	IPv6-enabled	IPv6-ready	IPv6-enabled	IPv6-ready	IPv6-enabled	IPv6-ready	IPv6-enabled
Alsatis	FttH	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Radio**	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Whole network	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
bigblu	Satellite	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Canal+	FttH	0%	0%	0%	0%	0%	0%	30%	0%	45-55%	0-10%
	xDSL	0%	0%	0%	0%	0%	0%	20%	0%	15-25%	0-5%
	Whole network	0%	0%	0%	0%	0%	0%	19%	0%	30-40%	0-10%
Coriolis Telecom	FttH	82%	82%	62%	62%	76%	76%	72%	72%	75-85%	75-85%
K-Net	FttH	73%	26%	82%	35%	84%	24%	84%	17%	90-100%	not provided
Nordnet	FttH	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	xDSL	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Satellite	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Radio**	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Whole network	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Orne THD	Cable	0%	0%	100%	100%	100%	100%	100%	100%	100%	100%
OVH Télécom	FttH	100%	not provided	100%	3.5%	100%	3.9%	100%	4%	100%	not provided
	xDSL	100%	not provided	100%	23%	100%	21%	100%	20%	100%	not provided
	Whole network	100%	not provided	100%	23%	100%	21%	100%	19%	100%	not provided
Ozone	FttH	0%	0%	0%	0%	0%	0%	0%	0%	5-15%	0%
	Radio**	0%	0%	0%	0%	0%	0%	0%	0%	10-20%	0%
	Whole network	0%	0%	0%	0%	0%	0%	0%	0%	5-15%	0%
SFR Caraïbe	FttH	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Cable	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	xDSL	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Radio**	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Whole network	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
SFR Réunion Mayotte	FttH	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	xDSL	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Radio**	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Whole network	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tubéo	FttH	0%	0%	0%	0%	0%	0%	0%	0%	45-55%	45-55%
Vialis	FttH	0%	0%	0%	0%	1%	1%	100%	100%	100%	100%
	Cable	0%	0%	0%	0%	1%	1%	80%	80%	80-90%	80-90%
	Whole network	0%	0%	0%	0%	1%	1%	88%	88%	85-95%	85-95%
VidéoFutur	FttH	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Cable	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Whole network	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Wifirst	Radio**	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Zeop	FttH	0%	0%	0%	0%	0%	0%	3.5%	3.5%	25-35%	25-35%
	Cable	not provided	0.3%	75%	0.3%	90%	0.3%	85%	85%	85-95%	85-95%
	Whole network	not provided	0.1%	18%	0.1%	22%	0.1%	21%	21%	35-45%	35-45%

* Figures subject to change ** Radio technologies: 4G Fixed wireless / Wi-Fi / WiMAX

Source: data as of the end of June 2021, collected by Arcep from operators.

FIXED NETWORK: IPV4 SHARING PRACTICES AND IPV6 PREFIX

	Technologies	IPv4			IPv6					
		Percentages of customers with a dedicated IPv4 address	If shared, cost of a dedicated IPv4 address	Periodicity of the public IPv4 address (subject to modifications on the access or backhaul network)	Size of IPv6 prefix assigned by default to IPv6 customers	Frequency of IPv6 prefix update*	IPv6 enabled by default (subject to eligibility)	IPv6 firewall: possibility to open the unsolicited inbound IPv6 flows	IPv6 firewall enabled by default (unsolicited inbound IPv6 flows blocked by default)	IPv6 firewall: possibility to open the unsolicited inbound IPv6 flows
Alsatis	FTTH	0%	Dedicated IPv4 not offered	Dynamic	N/A	N/A	N/A	N/A	N/A	N/A
	Radio**	50%	6€ / month	Depending on the access network	N/A	N/A	N/A	N/A	N/A	N/A
bigblu	Satellite	20%	Free option	Dynamic	N/A	N/A	N/A	N/A	N/A	N/A
Canal+	FTTH	100%	Dedicated IPv4 by default	Fixed	/56	Fixed	New client	No	Yes	Yes
	xDSL	100%	Dedicated IPv4 by default	Fixed	/56	Fixed	New client	No	Yes	Yes
Coriolis Telecom	FTTH	100%	Dedicated IPv4 by default	Fixed	/56	Fixed	Yes	Yes	Yes	Yes
K-Net	FTTH	100%	Dedicated IPv4 by default	Fixed	/56	Fixed	New client	No	Yes	Yes
Nordnet	FTTH	100%	Dedicated IPv4 by default	Dynamic	N/A	N/A	N/A	N/A	N/A	N/A
	xDSL	100%	Dedicated IPv4 by default	Dynamic	N/A	N/A	N/A	N/A	N/A	N/A
	Satellite	100%	Dedicated IPv4 by default	Dynamic	N/A	N/A	N/A	N/A	N/A	N/A
	Radio**	100%	Dedicated IPv4 by default	Dynamic	N/A	N/A	N/A	N/A	N/A	N/A
Orne THD	Cable	98%	5€ / month	Fixed	/56	Fixed	Yes	Yes	Yes	Yes
OVH Télécom	FTTH	100%	Dedicated IPv4 by default	Fixed	/56	Fixed	No	No	Yes	Yes
	xDSL	100%	Dedicated IPv4 by default	Fixed	/56	Fixed	No	No	Yes	Yes
Ozone	FTTH	27%	8€ / month	Dynamic	N/A	N/A	N/A	N/A	N/A	N/A
	Radio**	73%	8€ / month	Dynamic	N/A	N/A	N/A	N/A	N/A	N/A
SFR Caraïbe	FTTH	100%	Dedicated IPv4 by default	Dynamic	N/A	N/A	N/A	N/A	N/A	N/A
	Cable	100%	Dedicated IPv4 by default	Dynamic	N/A	N/A	N/A	N/A	N/A	N/A
	xDSL	100%	Dedicated IPv4 by default	Dynamic	N/A	N/A	N/A	N/A	N/A	N/A
	Radio**	0%	Dedicated IPv4 not offered	Dynamic	N/A	N/A	N/A	N/A	N/A	N/A
SFR Réunion Mayotte	FTTH	100%	Dedicated IPv4 by default	Dynamic	N/A	N/A	N/A	N/A	N/A	N/A
	xDSL	100%	Dedicated IPv4 by default	Dynamic	N/A	N/A	N/A	N/A	N/A	N/A
	Radio**	1%	10€ / month	Fixed	N/A	N/A	N/A	N/A	N/A	N/A
Tubéo	FTTH	0%	Dedicated IPv4 not offered	Dynamic	N/A	N/A	N/A	N/A	N/A	N/A
Vialis	FTTH	15%	Free option	Dynamic	/56	Dynamic	Yes	Yes	Yes	Yes
	Cable	55%	Free option	Dynamic	/56	Dynamic	Yes	Yes	Yes	Yes
VidéoFutur	FTTH	3%	20€ à la mise en service	Dynamic	N/A	N/A	N/A	N/A	N/A	N/A
	Cable	100%	Dedicated IPv4 by default	Dynamic	N/A	N/A	N/A	N/A	N/A	N/A
Wifirst	Radio**	0%	Dedicated IPv4 not offered	Fixed	N/A	N/A	N/A	N/A	N/A	N/A
Zeop	FTTH	100%	Dedicated IPv4 by default	Dynamic (30 days)	/56	Dynamic (30 days)	Yes	No	Yes	Yes
	Cable	100%	Dedicated IPv4 by default	Dynamic (30 days)	/56	Dynamic (30 days)	Yes	No	Yes	Yes

* Subject to change on the access or backhaul network. ** Radio technologies: 4G Fixed wireless / Wi-Fi / WIMAX

Source: data as of the end of June 2021, collected by Arcep from operators.

4. Mobile operators

4.1 Operators with over 3 million customers on mobile networks

MOBILE NETWORK: IPv6 PROPOSED TYPE AND THE POSSIBILITY TO CONFIGURE IPv6 FIRWALL

				
Size of default IPv6 prefix	64 bits	64 bits	64 bits	64 bits
Frequency of IPv6 prefix update	Dynamic	Dynamic	Dynamic	Dynamic
IPv6 type for smartphones	IPv6-only + DNS64 and 464XLAT	IPv6-only + 464XLAT (no DNS64)	IPv6-only + DNS64 and 464XLAT	Dual-Stack (private IPv4+IPv6)
IPv6 type for data-only offers	IPv6-only + DNS64 and 464XLAT	IPv6-only + 464XLAT (no DNS64)	IPv6-only + DNS64 and 464XLAT	Dual-Stack (private IPv4+IPv6)
IPv6 firewall enabled per default	Yes	Yes	Yes	Yes
IPv6 firewall: possibility to open the unsolicited inbound IPv6 flows via uPnP	No	No	No	No
IPv6 firewall: possibility to open the unsolicited inbound IPv6 flows in the customer area	No	No	No	No

Source: data as of the end of June 2021, collected by Arcep from operators.

4.2 Operators with between 5,000 and 3 million customers on mobile networks

MOBILE NETWORK: PERCENTAGE OF IPv6-READY AND IPv6-ENABLED CUSTOMERS EVOLUTION

	Mid-2020		Mid-2021		Mid-2022*	
	IPv6-ready	IPv6-enabled	IPv6-ready	IPv6-enabled	IPv6-ready	IPv6-enabled
Afone Mobile	2%	0.1%	75%	27%	75-85%	35-45%
Auchan Telecom	0%	0%	80%	16%	85-95%	35-45%
Bazile Telecom	68%	29%	84%	44%	90-100%	55-65%
Cdiscount Mobile	0%	0%	80%	16%	85-95%	35-45%
China Telecom CTEExcelbiz	0%	0%	0%	0%	0%	0%
CIC Mobile	0%	0%	80%	16%	85-95%	35-45%
Coriolis Telecom	0%	0%	0%	0%	0%	0%
Crédit Mutuel Mobile	0%	0%	80%	16%	85-95%	35-45%
La Poste Mobile	2%	0.1%	100%	36%	100%	45-55%
Lebara Mobile	0%	0%	0%	0%	0%	0%
Lycamobile	0%	0%	0%	0%	0%	0%
Nordnet	100%	43%	100%	53%	100%	60-70%
NRJ Mobile	0%	0%	80%	16%	85-95%	35-45%
Ozone	100%	43%	100%	53%	100%	60-70%
Prixtel	63%	26%	100%	46%	100%	40-50%
Syma Mobile	0%	0%	0%	0%	0%	0%
Transatel	0%	0%	0%	0%	0%	0%

* Figures subject to change

Source: data as of the end of June 2021, collected by Arcep from operators.

MOBILE NETWORK: PERCENTAGE OF IPV4-READY AND IPV4-ENABLED CUSTOMERS EVOLUTION

	Mid-2019		Mid-2020		Mid-2021		Mid-2022*	
	IPv6-ready	IPv6-enabled	IPv6-ready	IPv6-enabled	IPv6-ready	IPv6-enabled	IPv6-ready	IPv6-enabled
Digicel	0%	0%	0%	0%	0%	0%	0%	0%
Free Réunion	0%	0%	0%	0%	0%	0%	Not provided	Not provided
Only Istawi Mayotte	0%	0%	0%	0%	0%	0%	Not provided	Not provided
Orange Caraïbe	0%	0%	0%	0%	0%	0%	0%	0%
Orange Réunion Mayotte	0%	0%	0%	0%	0%	0%	0%	0%
SFR Caraïbe	0%	0%	0%	0%	0%	0%	0%	0%
SFR Réunion Mayotte	0%	0%	0%	0%	0%	0%	0%	0%
Zeop Réunion	100%	13%	100%	23%	100%	30%	100%	35-45%

* Figures subject to change

Source: data as of the end of June 2021, collected by Arcep from operators.

5. Hosting services, content providers and DNS infrastructure

PERCENTAGE OF IPv6-ENABLED WEBSITES, MAIL HOSTING AND DNS SERVERS
on .fr, .re, .pm, .yt, .tf and .wf domain names

Hosting service	AS number	Websites				Mail hosting				DNS servers			
		2019	2020	2021		2019	2020	2021		2019	2020	2021	
Name	AS number	Percentage of IPv6	Percentage of IPv6	Number of domain names	Percentage of IPv6	Percentage of IPv6	Percentage of IPv6	Number of domain names	Percentage of IPv6	Percentage of IPv6	Percentage of IPv6	Number of domain names	Percentage of IPv6
Entire .fr .re .pm .yt .tf .wf		15.5%	17.9%	3,520,528	20%	5.8%	6%	3,188,164	7.4%	73.1%	74.9%	3,712,927	75.2%
OVHcloud	AS 16276	4.9%	6.7%	1,432,603	12.2%	0.6%	0.5%	1,301,865	0.6%	82.3%	84.2%	1,503,755	85.7%
IONOS 1&I	AS 8560	75.6%	78.3%	392,179	81.3%	0.2%	0.2%	423,339	0.2%	98.7%	98.7%	447,571	99.2%
Gandi AS29169	AS 29169	2.1%	2.2%	264,857	1%	0.1%	0.1%	351,752	0.1%	97.5%	97.6%	4,192	66.5%
Cloudflare	AS 13335	97.2%	98%	127,451	58.4%	96.2%	5.3%	419	26.7%	69.6%	69.9%	131,545	81%
Amazon AWS AS16509	AS 16509	3.5%	11.1%	92,768	6.1%	0.1%	0.2%	23,336	0.4%	62.8%	49.5%	81,243	36.4%
o2switch	AS 50474	0.1%	0.1%	90,387	0%	0%	0%	82,770	0%	0%	0%	84,367	0%
Scaleway	AS 12876	9.5%	10.3%	79,839	11.1%	9.9%	10.6%	73,201	14.3%	12.5%	15.2%	112,305	16.7%
Adista	AS 16347	1.8%	1.6%	71,150	1.1%	2.4%	2.5%	74,346	1.1%	95.8%	95.6%	76,094	95.7%
Google AS15169	AS 15169	3.8%	5.4%	67,284	9.5%	95.8%	95.4%	94,632	93.2%	34.5%	38.9%	120,863	41.2%
Wix.com	AS 58182	6.1%	1.1%	64,490	0%	0%	0%	23	0%	0%	0%	2,163	0%
Registrarit AS39729	AS 39729	0%	0%	51,587	0%	0%	0%	58,675	0%	0%	0%	68,165	0.2%
NordNet	AS 8362	0%	0%	37,351	0%	0%	0%	18,951	0%	0%	0%	41,335	0%
Infomaniak	AS 29222	24.1%	23.6%	36,840	63.9%	96.5%	99%	24,932	99.4%	99.6%	99.7%	43,722	99.7%
CSC Global	AS 19574	0%	0%	27,826	0%	0%	0%	75	0%	0%	0%	0	N/A
PlanetHoster	AS 53589	0.1%	0.1%	26,984	0%	0%	0%	23,372	0%	0%	0%	24,355	0%
Magic OnLine	AS 35393	0.1%	0.1%	25,931	0%	0%	0%	25,234	0%	27.6%	0.1%	30,409	0.1%
WordPress.com	AS 2635	0.1%	0.1%	25,887	0%	0.7%	1%	2,426	0.4%	100%	100%	25,146	99.9%
Sedo	AS 47846	0%	0%	25,004	0%	0%	0%	30	0%	0%	0%	22,219	0%
TransIP	AS 20857	57.3%	63.1%	24,263	77.2%	28.1%	43.6%	4,494	81.1%	96.7%	96.8%	28,561	22.5%
Free	AS 12322	64.3%	63.3%	20,888	60.6%	61.1%	61.9%	7,245	58.7%	95.8%	95.6%	27,871	96.7%
Solocal	AS 13034	0%	0%	20,062	0%	0%	0%	1	0%	0%	0%	38	0%
Nameshield	AS 20756	0.7%	1%	15,665	1.6%	0.2%	0.2%	17,137	0.1%	52.8%	53.9%	23,945	98.2%
Microsoft	AS 8075	0.7%	0.6%	11,475	0.1%	0.1%	0.1%	109,173	0.1%	90.1%	90.2%	8,897	85.6%
Orange France	AS 3215	1.8%	1.9%	11,401	1.7%	0.1%	0.2%	31,970	0.3%	73.9%	75.1%	22,983	78.4%
One.com	AS 51468	86.4%	81%	10,987	70.7%	0.1%	0.1%	11,244	0%	100%	100%	11,734	98.9%
Hetzner Online	AS 24940	15.3%	15.9%	10,373	17.7%	31.9%	18.3%	7,860	39.2%	79.3%	82.5%	56,618	52.7%
Hostinger	AS 47583	0.6%	0.5%	10,312	19.2%	94.6%	97.7%	11,245	99%	14%	11.6%	475	26.7%
alwaysdata	AS 60362	41.9%	35.8%	9,984	30.7%	99.9%	99.8%	9,053	99.9%	100%	100%	0	N/A
Ikoula	AS 21409	8.9%	12.8%	9,788	14.4%	12.4%	16.2%	5,435	24.5%	8.4%	7.7%	7,050	6.9%
Gandi AS203476	AS 203476	45.5%	54.5%	9,767	57.2%	4.2%	4.2%	964	2.5%	9.2%	8.3%	4,311	0.2%
SafeBrands	AS 34173	0%	0%	9,405	0%	0%	0%	16,620	0%	99.6%	99.6%	12,674	99.8%
DigitalOcean	AS 14061	6%	5.9%	9,106	15.3%	0.8%	3.6%	26,838	0.8%	21%	22.2%	17,433	44.1%
Team Internet AG	AS 61969	0%	0%	8,567	0%	0%	0%	10	0%	0%	0%	0	N/A
Jaguar Network	AS 30781	0.4%	0.4%	8,493	0.2%	0.3%	0.2%	4,618	0.4%	74.9%	79.5%	16,266	80.4%
IP Exchange	AS 15598	0%	0.1%	7,691	0%	0%	0%	7,876	0%	66.7%	68.7%	150	77.3%
ASP Serveur	AS 34235	0.2%	0.1%	7,629	0%	0%	0%	7,326	0%	0%	0%	1,067	0%
GoDaddy	AS 26496	0.1%	0.2%	7,515	0%	0%	0%	7,958	0%	5.6%	5.1%	9	0%
Strato	AS 6724	93.8%	93.4%	7,207	92.8%	96.9%	97.2%	7,129	96.3%	92.3%	95.8%	972	67.1%
Calionat	AS 31178	0.1%	0%	6,862	0%	0%	0%	3,526	0%	0%	0%	3,786	0%
Amazon AS14618	AS 14618	0.8%	1.8%	5,898	0.3%	0.1%	0.1%	1,697	0.1%	1.8%	1.9%	5,020	1.5%
Combell	AS 34762	0.4%	0.4%	5,793	7.1%	1.2%	0.9%	5,743	1%	47.4%	49%	7,346	91.5%
Cogent	AS 174	2.7%	2.5%	5,423	1.9%	8.4%	5.4%	5,607	24.3%	24.6%	22.7%	7,568	14.7%
SFR	AS 15557	1.5%	1.3%	4,995	1.1%	0.1%	0.1%	10,257	0.2%	0.1%	0.1%	9,771	0.1%
Hosteur.com	AS 204818	N/A	N/A	4,989	0%	N/A	N/A	4,599	0%	N/A	N/A	7	0%
Datacenter Luxembourg	AS 24611	0.1%	0.1%	4,827	0%	0.5%	0.5%	3,202	0%	0%	0%	6	0%
Fastly	AS 54113	4.6%	4%	4,457	3%	7.1%	4.2%	32	0%	0%	0%	0	N/A

Source: Afnic data, August 2021.

A more complete list of the rates of websites, content providers and DNS infrastructures accessible in IPv6 is available in the formats: [PDF](#), [OpenDocument](#) and [raw data CSV](#).