TUTELA

BeNeLux

State of Mobile Experience

Analysts

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Annual Report

DECEMBER 2020

www.tutela.com

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Introduction

The Benelux region has traditionally had some of the best wireless networks in the world, and in 2020, that hasn't changed. Belgium, the Netherlands and Luxembourg all finished in the top five countries for overall mobile experience (Excellent Consistent Quality) in Tutela's 2020 global mobile experience report(1).

However, this does not mean that the state of wireless networking is identical between the countries, especially as we look ahead to next-generation wireless technologies.

Operators in the Netherlands were able to purchase some 5G spectrum this year(2), whilst delays in Belgium(3) have seen the auction pushed to next year.

Several operators in Luxembourg have 5G networks deployed and available to the public(4), although the networks expect it will be several years until coverage — especially with new, high-band spectrum — is widespread.

(1)Tutela, Global Mobile Experience Report 2020
https://www.tutela.com/blog/global-mobile-experience-2020

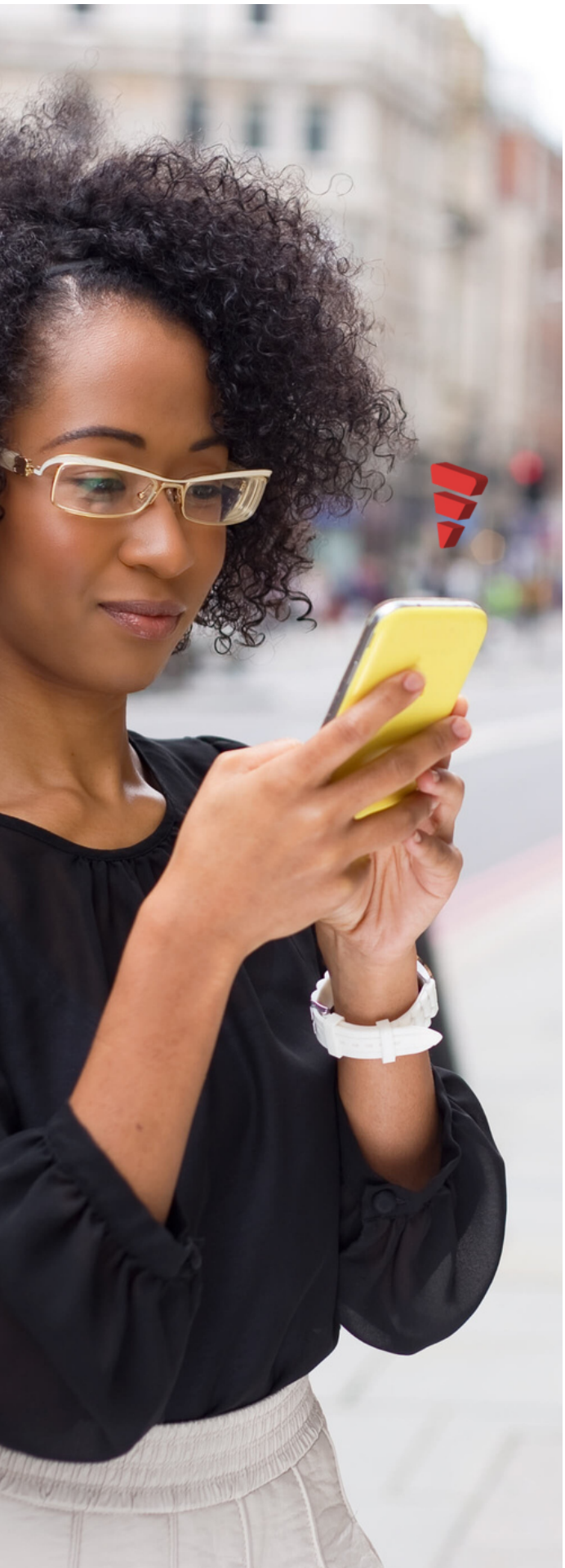
(2)Telecoms.com, Netherlands kicks off 5G auction
https://telecoms.com/505256/netherlands-kicks-off-5g-auction/

(3) Brusselstimes.com, Government: Another year until 5G frequencies are auctioned
https://www.brusselstimes.com/news/business/141512/government-another-year-until-5g-frequencies-are-auctioned/

(4) Luxtimes.com, POST to launch 5G in capital city next week
https://luxtimes.lu/luxembourg/41964-post-to-launch-5g-in-capital-city-next-week

Once fully deployed across a wide range of spectrum, 5G promises to offer significant improvements to user experience, including lower latency, more capacity, and higher throughputs. This report suggests that in the last six months, users across Benelux have experienced a relatively similar — and generally excellent -- mobile experience. With the coming shifts to network technology and mobile use-cases thanks to 5G, it will be interesting to see if this remains to be the case going forwards.

Tutela has analyzed over 2.8 billion total records taken from real-world smartphone users, including more than 4.7 million speed and latency tests, taken between May 1st and October 31th 2020.



Key findings

- A dominant operator emerged in both the Netherlands and Luxembourg, with Vodafone and POST respectively winning five out of the six categories in their country. In Belgium, Proximus took home the crown for mobile experience and coverage, but lost to BASE and Orange on download throughput and latency respectively.

- Users in the Netherlands benefitted from the best mobile experience (90.6% Excellent Consistent Quality average) and fastest download throughput (33.7 Mbps), largely thanks to the particularly strong performances from the top operators. Specifically, Vodafone had the fastest median download throughput — 43.8 Mbps — of any operator in the region by a considerable margin — although it's worth noting that its substantial win for download speed didn't translate to an equally outsized difference in mobile experience.

- In both Belgium and Luxembourg, there was a significant difference in area covered between the best and last-placed operator, with a nealy 25% decreased in observed coverage footprint from best to worst operator. In the Netherlands, the coverage footprint of all three operators was much closer, with less differentiation between networks in terms of the observed coverage footprint.

Results overview

TUTELA

Mobile experience results

Belgium, December 2020

	Proximus	BASE	orange
Excellent Consistent Quality	★ Winner		
Core Consistent Quality	★ Winner		
Download throughput		★ Winner	
Upload throughput	★ Winner		
Latency			★ Winner
Coverage	★ Winner		

Results from over 5 billion total records taken from real-world smartphone users, including more than 4.7 million speed and latency tests, taken between May 1st and October 31st 2020.

"Proximus delivered the highest percentage of Excellent Consistent Quality in Tutela's tests"

TUTELA
Best Mobile Network Experience
DECEMBER 2020

Based on the highest Excellent Consistent Quality in Common Coverage Areas.

Results overview

TUTELA

Mobile experience results

Netherlands, December 2020

	vodafone	T-Mobile	kpn
Excellent Consistent Quality	★ Winner		
Core Consistent Quality	★ Winner		
Download throughput	★ Winner		
Upload throughput			★ Winner
Latency	★ Winner		
Coverage	★ Winner		

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Results overview

TUTELA

Mobile experience results

Luxembourg, December 2020

	POST	tango	orange
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Coverage			

Results from over 5 billion total records taken from real-world smartphone users, including more than 4.7 million speed and latency tests, taken between May 1st and October 31st 2020.

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Understanding this report

Tutela uses two key methodological components to best compare user experience across operators: Consistent Quality and Common Coverage Areas. Consistent Quality is a set of metrics that Tutela has developed to objectively evaluate when connections networks are (and are not) enabling users to do almost everything that they want to do on their smartphones.

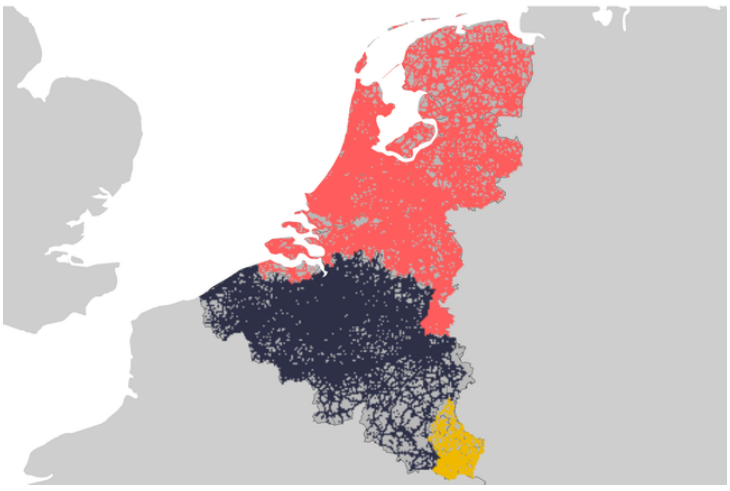
To best serve Tutela's goal to accurately measure and represent the real-world, end-to-end experience of actual users, our methodology is subject to ongoing improvements, which allow us to update the methodology in line with changes in network technology, measurement capabilities, and the realities of how people use their smartphones. As of this report, the methodology includes an updated version of Consistent Quality that better accounts for reliability, an area-based Coverage Score, a more granular Common Coverage Areas definition, and the separation out of users on MVNO or flanker brands. As a result, changes in the numeric values in this report compared to 2019 are not necessarily representative of year-on-year changes in the end-to-end user experience.

The methodology is covered in detail at the end of this report and on our website, but simply put, there are two sets of thresholds, Excellent and Core. A connection that hits the Excellent threshold is sufficient for use-cases like 1080p video streaming or multiplayer gaming, while a Core connection will stream standard-definition video or handle things like web browsing or uploading photos to social media. The percentages you see in this report represent the percentage of tests on a given operator that were above the Excellent or Core thresholds.

Common Coverage Areas are parts of the country where all national operators offer service, either on their own network or through a domestic roaming agreement. Comparing performance within common coverage areas ensures that user experience is being compared in places where networks are competing head-to-head, and ensures that operators with more diverse coverage are not being penalized. In this report, all performance metrics are taken from tests conducted in Common Coverage Areas only.

Measurement locations

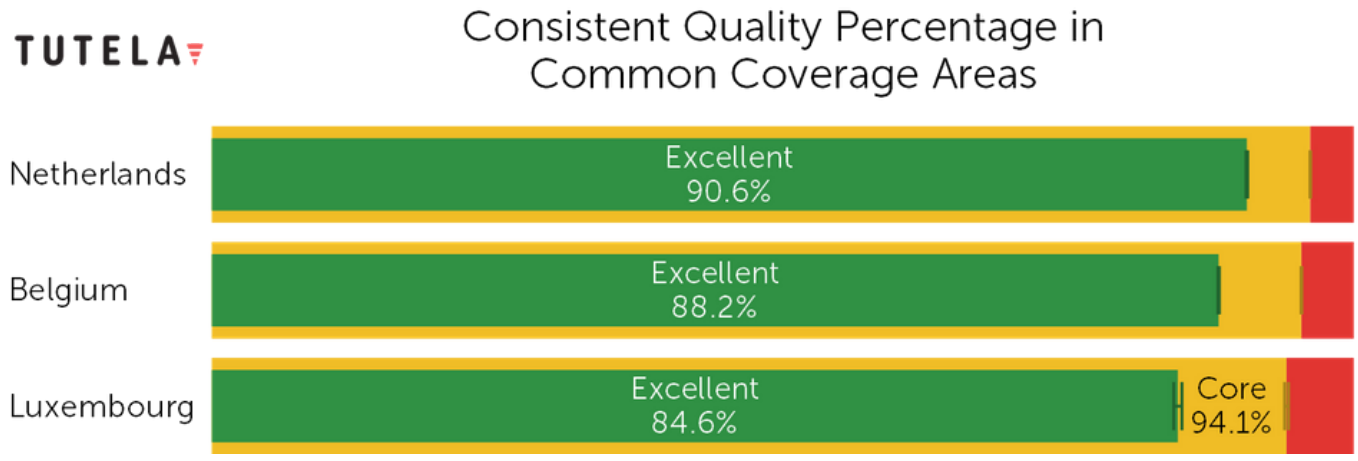
Common Coverage Areas



Consistent Quality

The Netherlands finished joint-second in the world for Excellent Consistent Quality in Tutela's 2020 Global study, so it's no surprise to see the country take first place in the Benelux region in this report. Excellent Consistent Quality is Tutela's metric for measuring user experience, and represents the proportion of tests where a mobile connection is good enough for demanding applications like group HD video calling or mobile gaming.

Belgium was close behind, with 88.2% of tests providing an excellent mobile experience, and even Luxembourg's 84.6% puts it among the best countries in the world for mobile experience. For Core Consistent Quality, the metric for a mobile experience good enough for everyday use-cases like web browsing or social media application, The Netherlands still took the top spot, but the results were much closer.



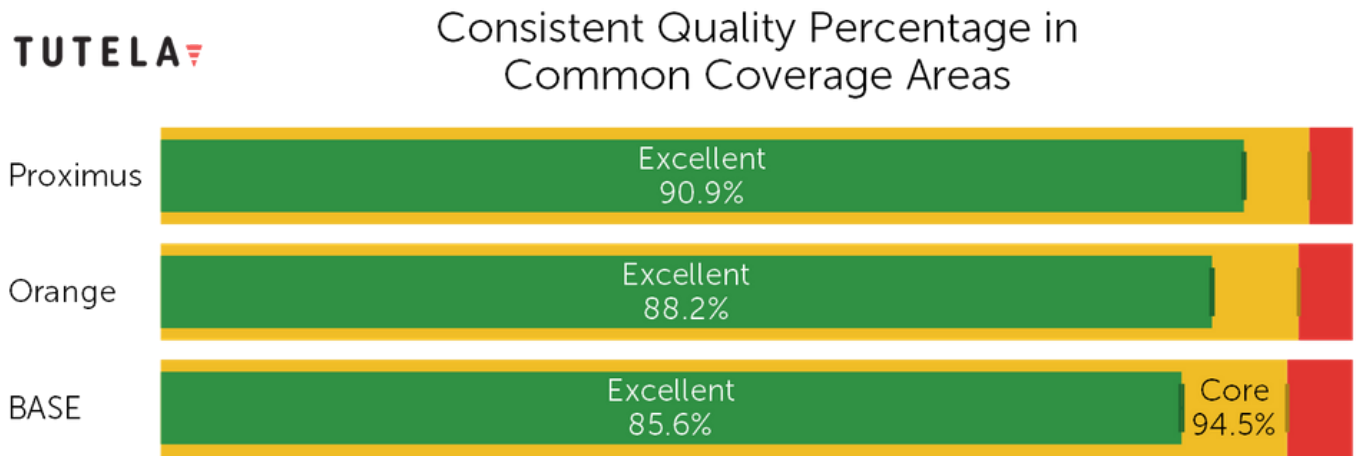
Consistent Quality

BELGIUM

Within Belgium, barely 5% separated first-place Proximus from last-place BASE. All three operators had world-class Excellent Consistent Quality results, but Proximus was the only operator within Belgium to break the 90% threshold. Proximus's result, however, wasn't enough to take the first-place operator in the region for Excellent Consistent Quality, with that honor going to Vodafone in the Netherlands.

The national picture is largely consistent at a regional level. Proxmius took first place for Excellent Consistent Quality across the majority of regions, and had the highest Excellent Consistent Quality of any operator in any region of Belgium, at 92.4%.

For Core Consistent Quality, less than 2% separated first-place Proximus (96.4%) and third-placed BASE (94.5%). For consumers in Common Coverage Areas — that is, places where all three operators offer coverage — that means that there's little difference in the quality of the mobile experience when it comes to everyday use-cases, like streaming standard-definition video or email.

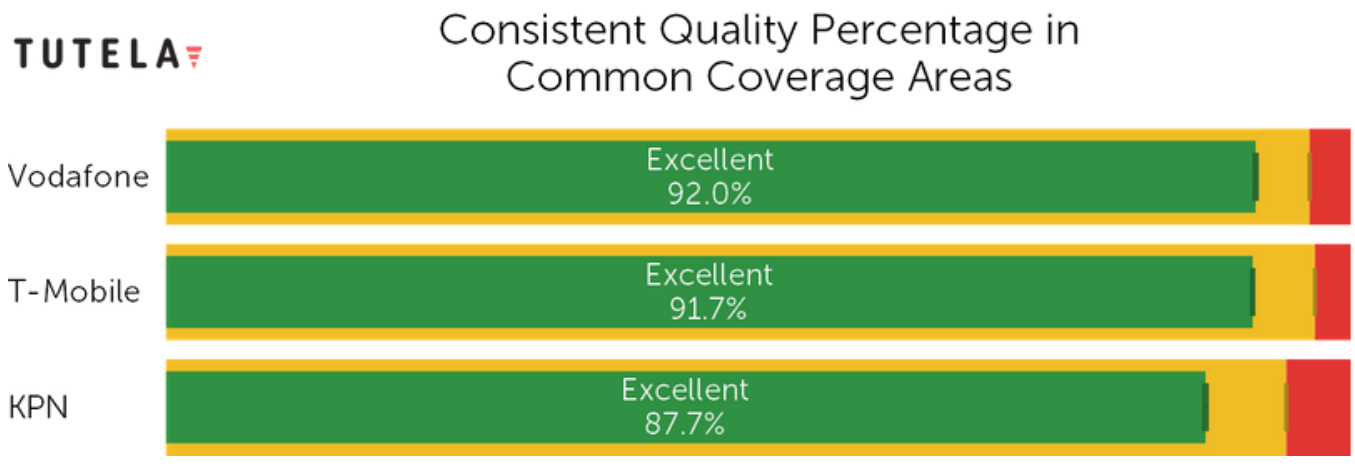


Consistent Quality

NETHERLANDS

It was an extremely close race for which operator provided the best mobile experience in the Netherlands, with less than one percent — barely more than the margin of error — separating T-Mobile from first-placed Vodafone. The battle for the best operator in the Netherlands was also the battle for the best operator in the region, as Vodafone and T-Mobile provided the best and second-best mobile experience (as measured by Excellent Consistent Quality) in Benelux. Outside of the top two operators, there was still minimal difference in mobile experience across networks in the Netherlands, with just 4.7% separating first and last place. For mobile subscribers in the Netherlands, this translates to networks that can do almost anything that they want, at least when they have coverage.

The national parity is also seen at a regional level. While T-Mobile wins in the majority of regions, Vodafone takes first place in both North and South Holland.

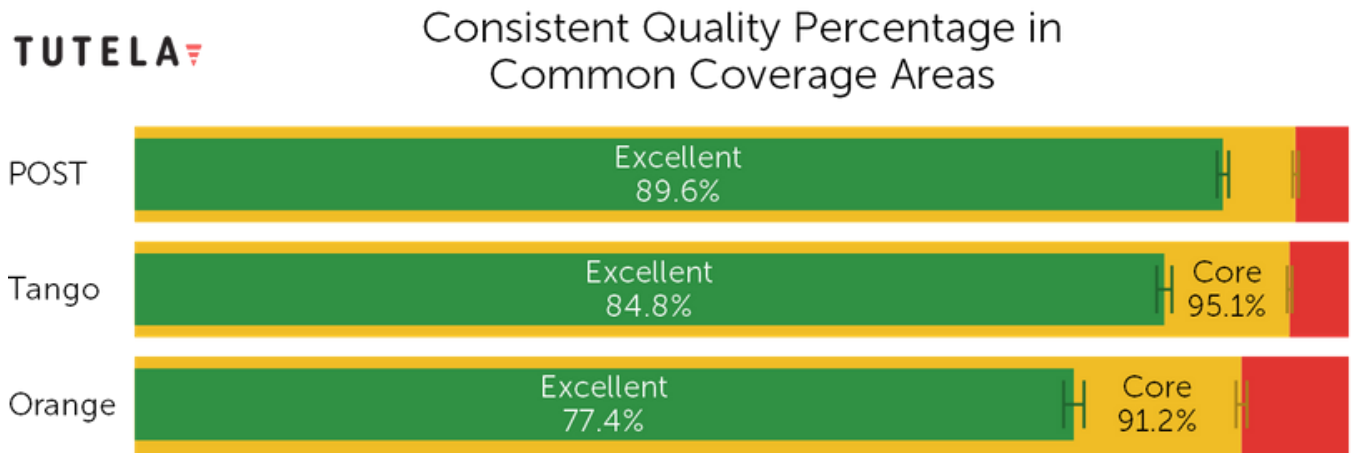


Consistent Quality

LUXEMBOURG

POST provided the best mobile experience to users in Luxembourg, with nearly 90% of tests sufficient for demanding mobile applications like group HD video calling, online multiplayer gaming, or HD video streaming. There was more difference between Luxembourg's operators than in other countries: over 10% separated POST's mobile experience from Orange's, which is enough that it is likely to make a tangible difference to subscribers that use a cellular connection for demanding use-cases.

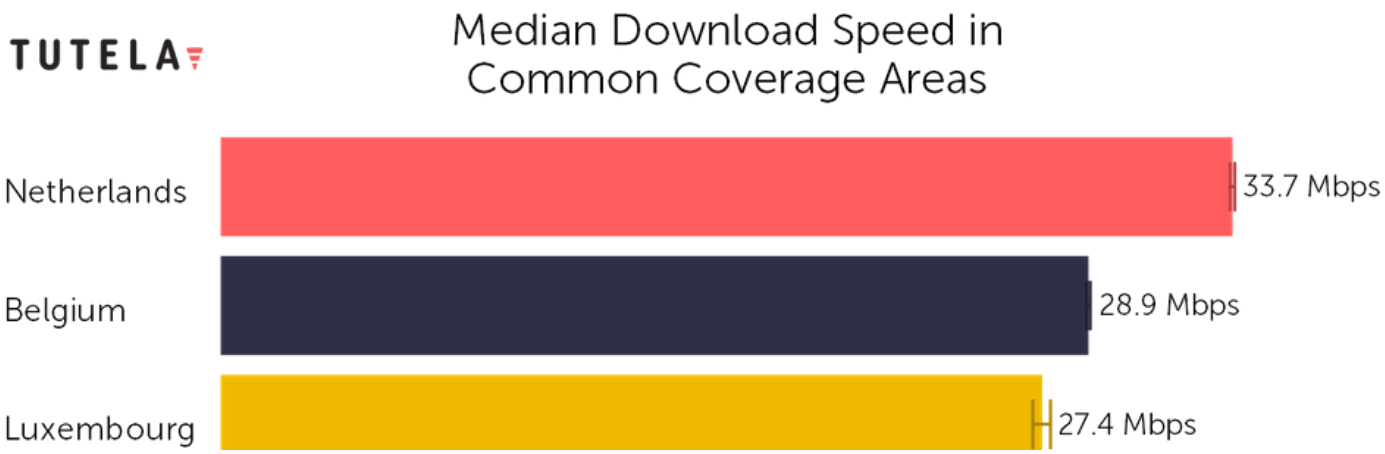
For Core Consistent Quality, Tutela's measure of how often a network connection is sufficient for everyday use-cases, there was still a difference between networks, however it was less pronounced. Although POST still eked out a win over second-placed Tango, the difference was less than 1%, and third-placed Orange still provided a network connection that surpassed the thresholds 91.2% of the time when subscribers were within Common Coverage Areas.



Download throughput

For download throughput, the Netherlands once again came out on top, with a median download throughput of 33.7 Mbps. Unlike for Consistent Quality, however, there was a sizeable gap of over 4 Mbps between the Netherlands and second-place Belgium, with a much smaller difference of 1.5 Mbps back to third-place Luxembourg.

For mobile subscribers, however, this difference in median download speed is unlikely to translate to a tangible difference in mobile experience. The download throughput required for the vast majority of even demanding mobile use-cases, such as group HD video calling, is just 5 Mbps, so the average download throughput in the Benelux region handily exceeds that.

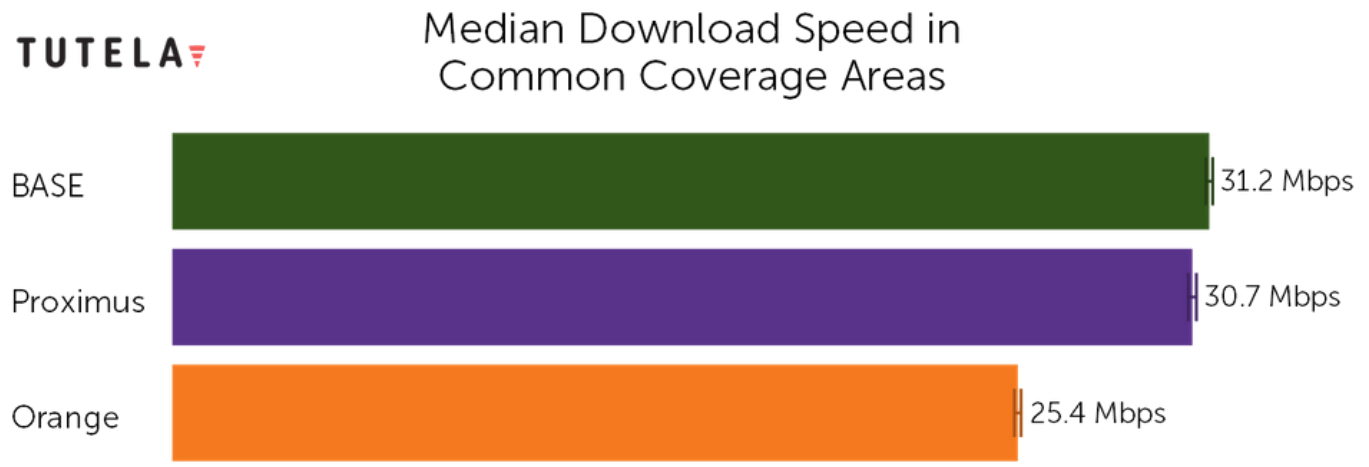


Download throughput

BELGIUM

While Proximus was the best operator for Consistent Quality, it was edged out for first place by BASE for median download throughput in Belgium. There was just 0.5 Mbps between the two operators, however — interesting, since BASE was in third place for both Excellent and Core Consistent Quality.

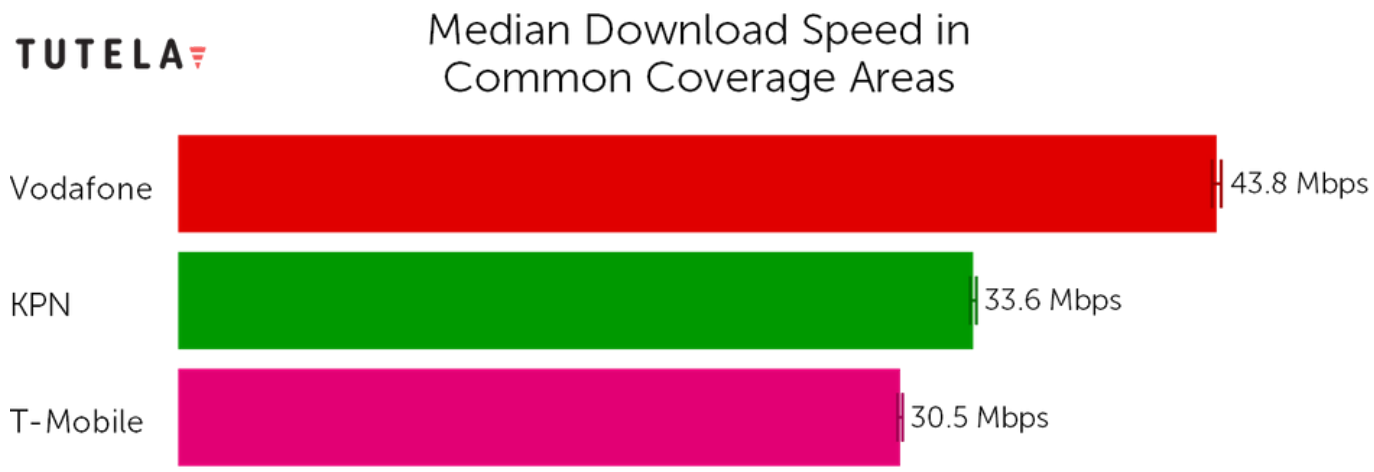
Looking further down the results, however, BASE is in third place for both upload throughput and latency, which shows how having a balanced, responsive network is important for ensuring user experience.



Download throughput

NETHERLANDS

Vodafone has an impressive lead over the competition for first place in download throughput, with a median speed of 43.8 Mbps. That was also fast enough to easily become the fastest operator in the region, with a median download more than 10 Mbps faster than the next-closest operator, which was also from the Netherlands. KPN took second place, with an average throughput of 33.6 Mbps, while T-Mobile's still-fast 30.5 Mbps was only good enough for third.

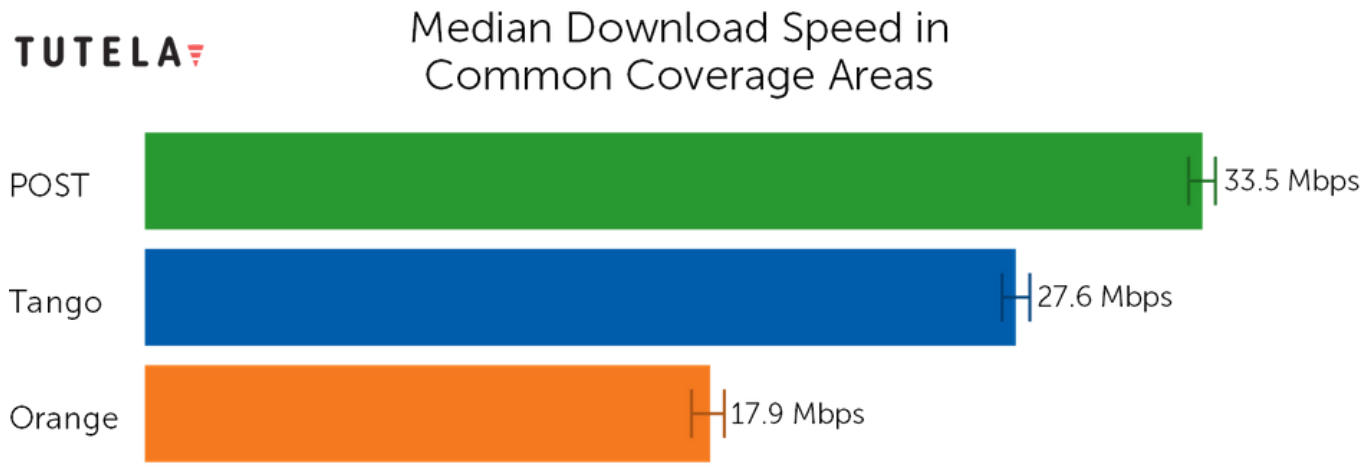


Download throughput

LUXEMBOURG

In Luxembourg, an identical situation played out for median download throughput as for Consistent Quality: POST was easily in first place as the fastest operator in Luxembourg, with a median download throughput of 33.5 Mbps. Tango was in second place, nearly 6 Mbps behind POST, while Orange was in third place, at 17.9 Mbps.

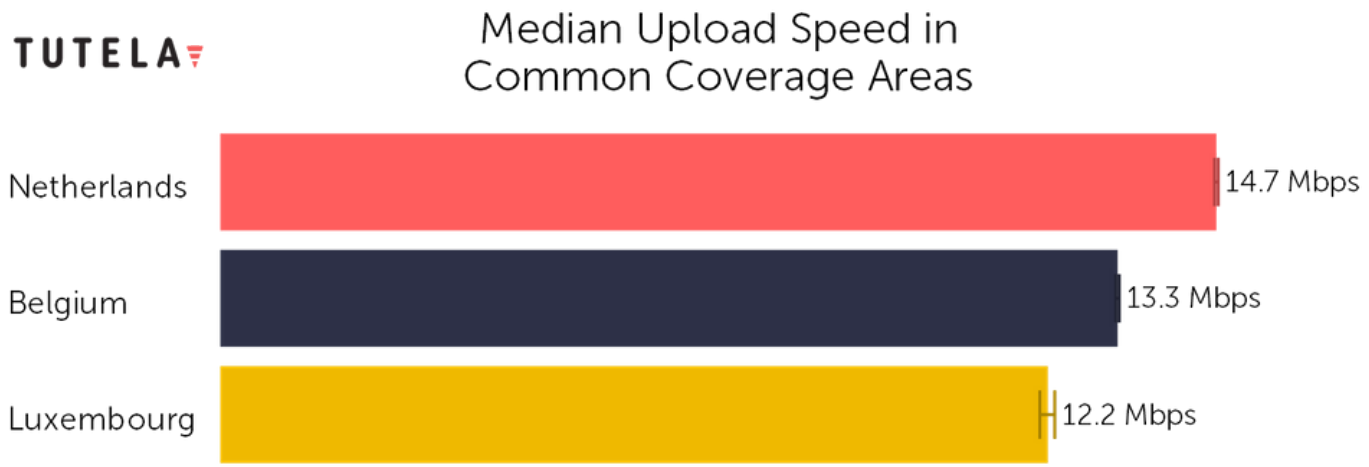
Although all three operators' median throughput comfortably exceeds the 5 Mbps threshold needed for demanding use-cases, it is notable that Orange Luxembourg was the only operator to see its download throughput drop below 20 Mbps, and was also the only operator to have an Excellent Consistent Quality of less than 80%. Although we've shown that for the very best networks, increasing average download speed is no guarantee of improving mobile experience, Orange's results demonstrate that guaranteeing a consistently good-enough download throughput is critical to ensuring a good user experience. A lower median throughput, as Orange shows in this test, indicates that some users are going to be getting a connection that is not fast enough for demanding use-cases.



Upload throughput

A gap of 5 Mbps separated the Netherlands and Luxembourg for download throughput, and although the ranking of the countries is unchanged for upload throughput, the size of the difference isn't quite the same.

Just 2.5 Mbps separated first and last place, a difference that will not be apparent to many mobile subscribers.

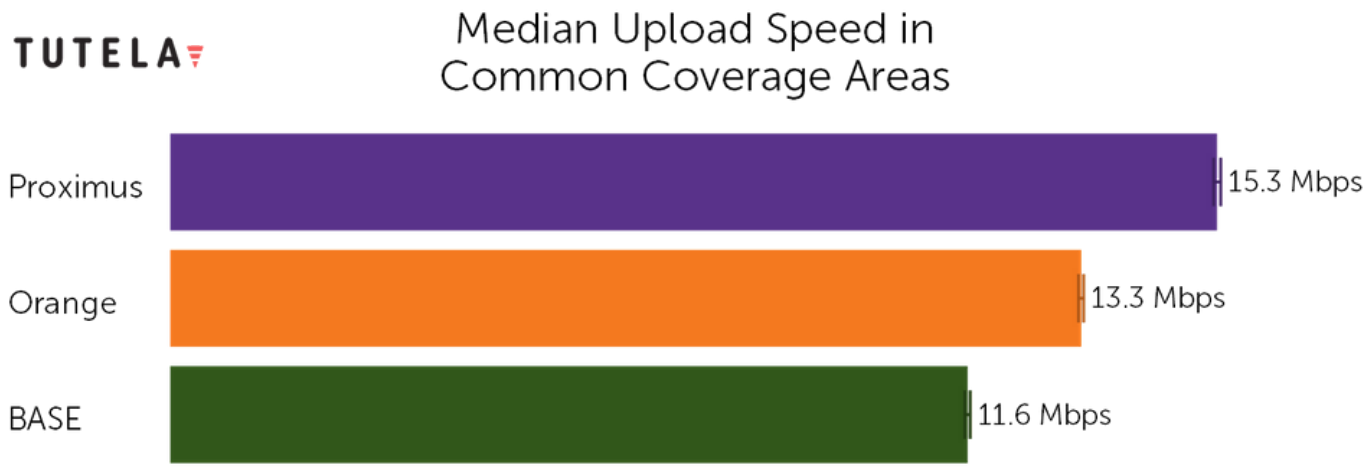


Upload throughput

BELGIUM

Belgium's upload throughput ranking is very different to its download throughput ranking: Proximus is back on top, with Orange in second place, and BASE third.

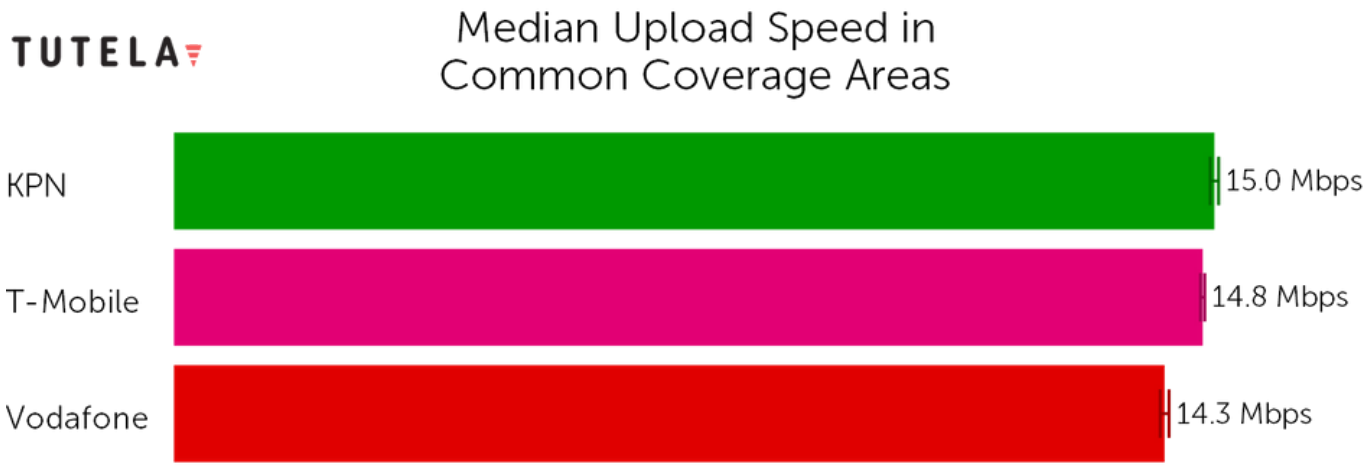
The gap between first and last place is nearly 5 Mbps, and it's interesting to note how the ranking (and, to a lesser extent, the magnitude of the difference between operators) closely mirrors what we see for Excellent Consistent Quality.



Upload throughput

NETHERLANDS

The upload throughput results in the Netherlands are extremely close: there is only 0.7 Mbps of daylight between the three operators, a difference of barely 5%. Compared to download throughput, where Vodafone had an advantage of nearly 50% over the next-closest operator, it's clear that there is little differentiation between operators in the Netherlands based on upload alone.

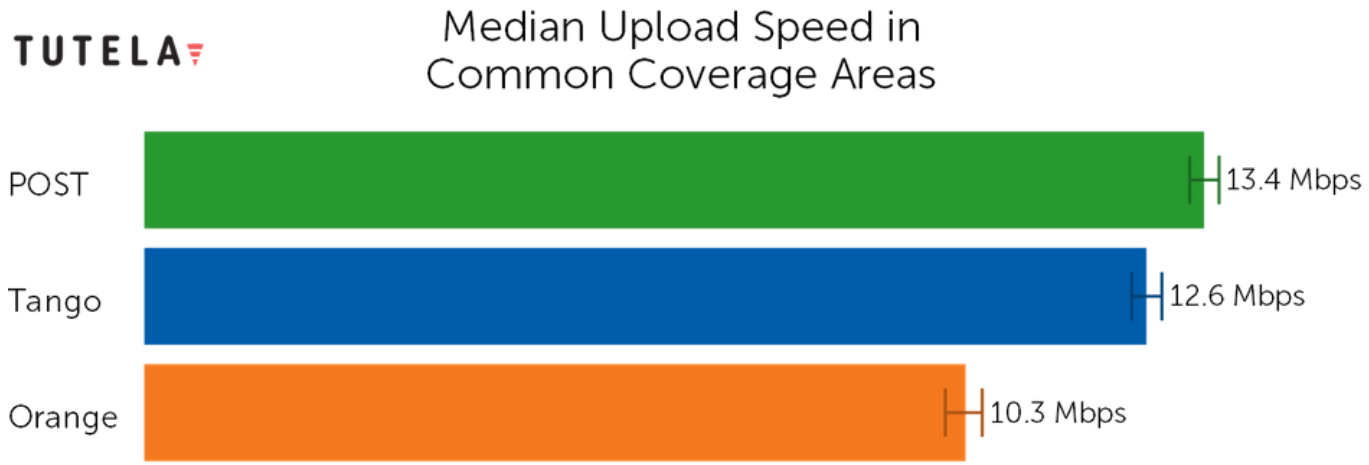


Upload throughput

LUXEMBOURG

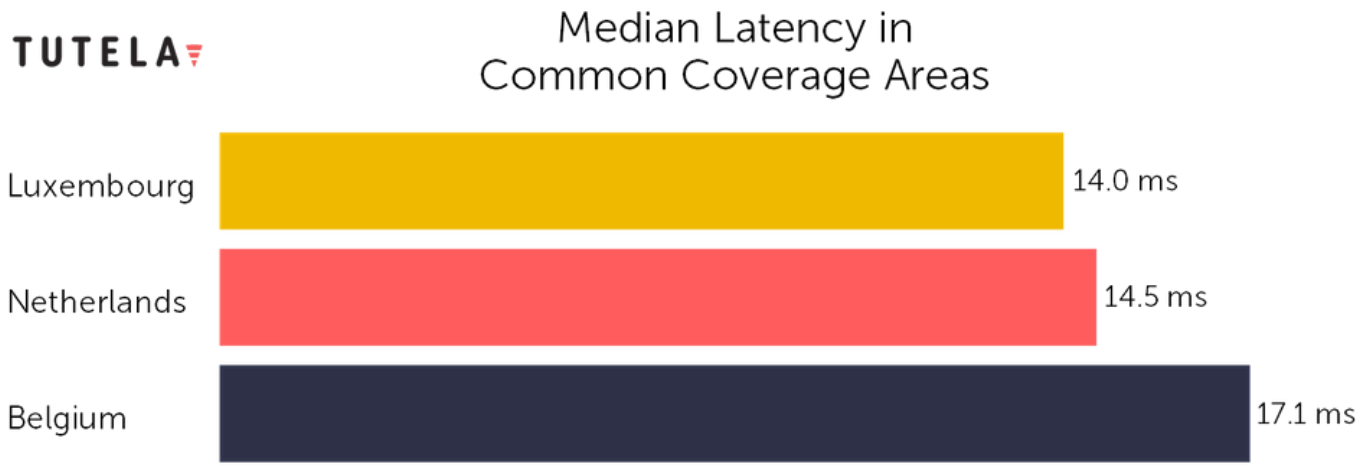
As with Consistent Quality and download throughput POST once again took first place in Luxembourg, with a median upload throughput of 13.4 Mbps. Tango and Orange were again in second and third place respectively.

Although Orange's result was the lowest of any operator in the region, it was still able to exceed 10 Mbps, putting its median upload speed comfortably above what is required in most instances.



Latency

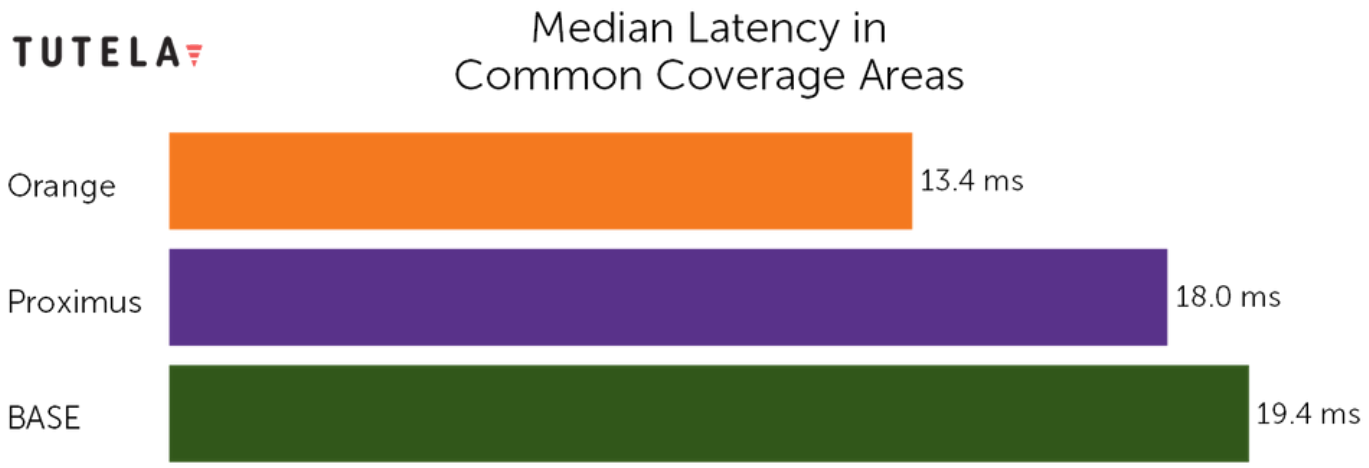
The rankings are flipped when it comes to latency: Luxembourg, which trails its neighbours for consistent quality and throughput, took first place for latency, with a median one-way latency result of just 14.0 ms. The Netherlands was half a millisecond behind, while Belgium's networks were notably less responsive at 17.1 ms.



Latency

BELGIUM

Within Belgium, Orange had the lowest median latency, at 13.4 ms. Latency is a critical metric measuring the responsiveness of a network — how long it takes individual packets to travel from servers to users' phones — and is particularly important for real-time applications like video calling or online gaming. Second-place Proximus was a notable step down at 18.0 ms, with BASE then closer behind at 19.4ms.

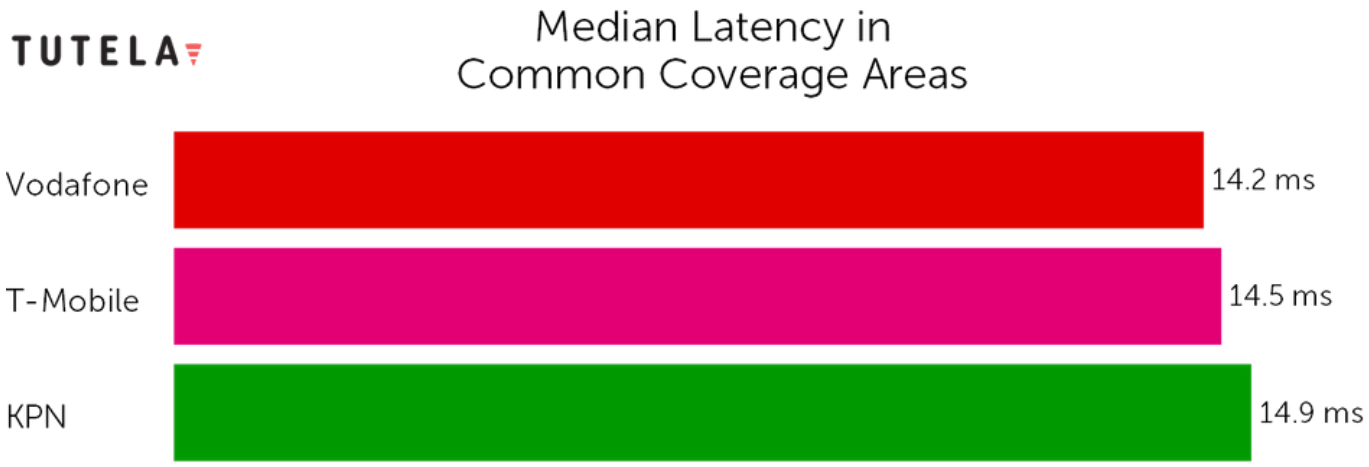


Latency

NETHERLANDS

In the Netherlands, the latency results were virtually indistinguishable between the three operators: just 0.7 ms — about one-half of one thousandth of a second — separated first place from last place.

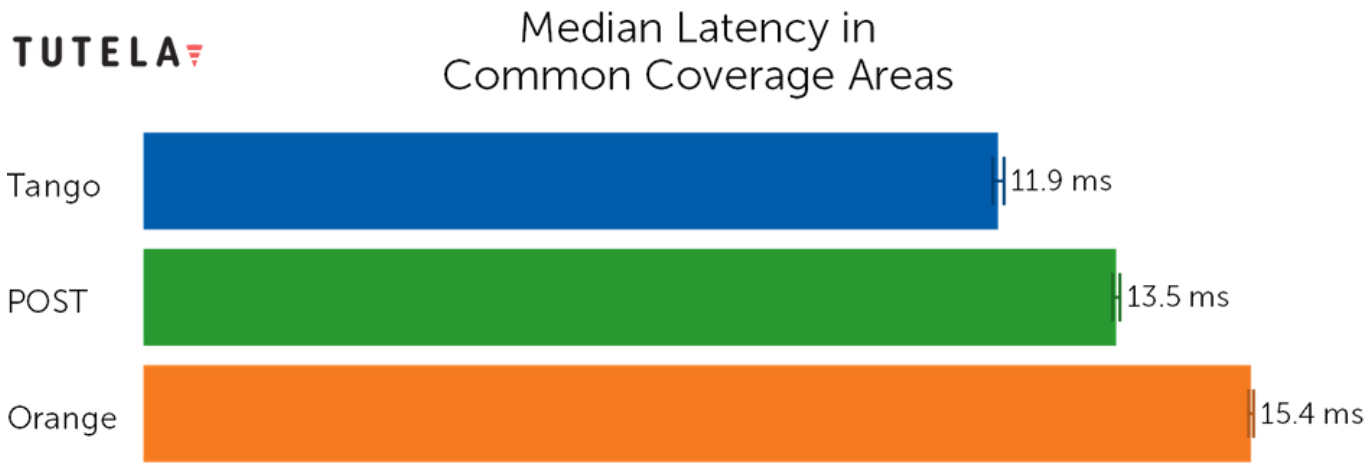
Although enough of a difference exists to statistically differentiate the operators, the functional difference to the average user on the network is likely to be negligible.



Latency

LUXEMBOURG

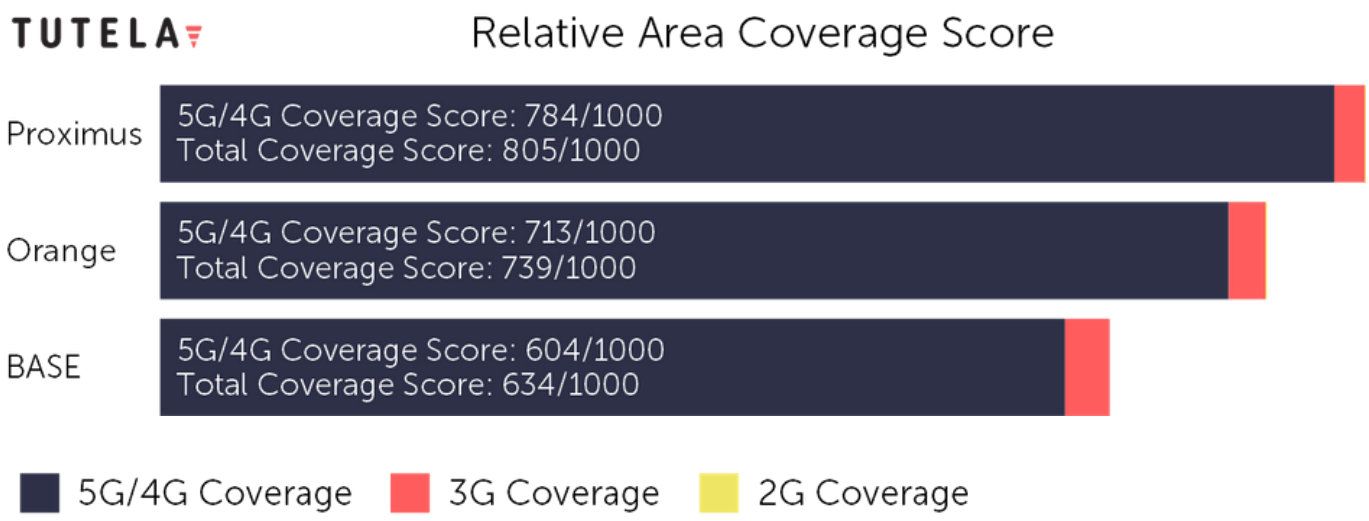
POST's stranglehold on first place was lost in the latency category, as Tango took top honors with a median latency of 11.9 ms. In countries that are geographically small and well-connected to the wider internet, operators frequently return relatively low median latency results, and Luxembourg is no exception, with even third-placed Orange having a median one-way latency of 15.4 ms.



Coverage

BELGIUM

Proximus has a substantial advantage over its competitors when it comes to the geographic area covered, with a coverage score of 805, 65 points more than its next-closest competitor. Orange is in second place for both 5G/4G coverage and total coverage, while BASE is significantly further behind. All three operators have just a small percentage of their total footprint that is only covered by 2G or 3G networks, showing how ubiquitous advanced wireless technology is in Belgium.



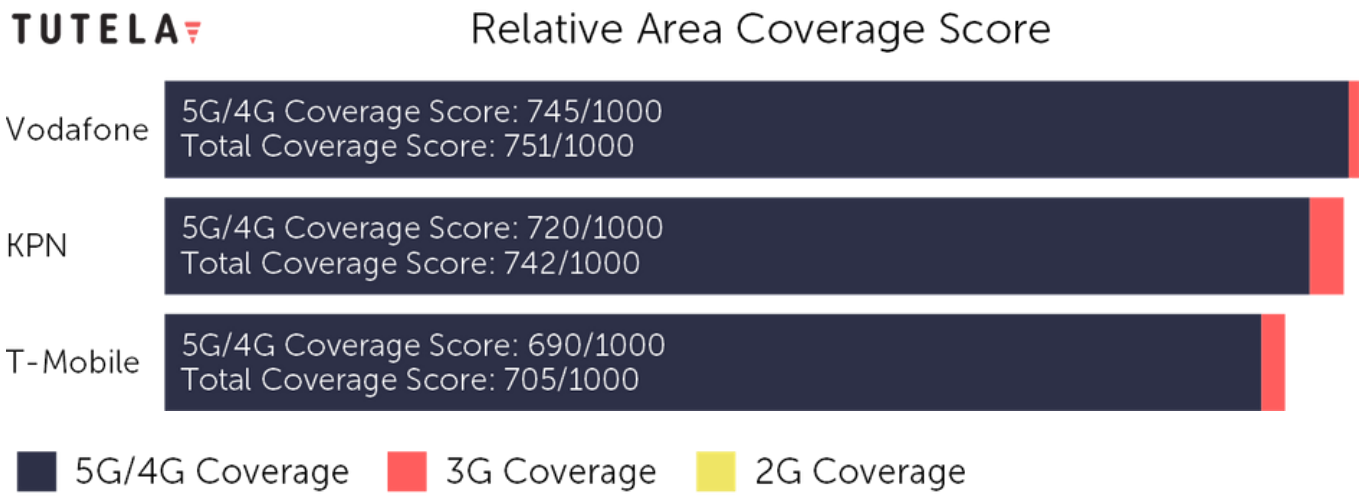
Tutela measures relative coverage between providers in a country by looking at the geographic area that an operator's subscribers have seen coverage, compared to the total area of the country where the subscribers of any operator can get a mobile connection. The geographic area covered by each operator, relative to the total covered area of the country, is presented as a score out of 1,000.

Tutela measures this coverage from the perspective of end users – that is to say, inclusive of times when coverage is provided as part of a domestic roaming agreement or shared infrastructure program. An equal number of representative samples are considered from each operator in a country to determine coverage. Coverage is assessed over the preceding 12 months to ensure any effects of seasonality are appropriately included.

Coverage

NETHERLANDS

There was very little to separate the top two operators for coverage in the Netherlands. Vodafone took first place for both total coverage and 4G/5G coverage, but there was a gap of just nine points — about 1%! — back to KPN in second place. T-Mobile was a little further behind, with a total coverage score of 705,



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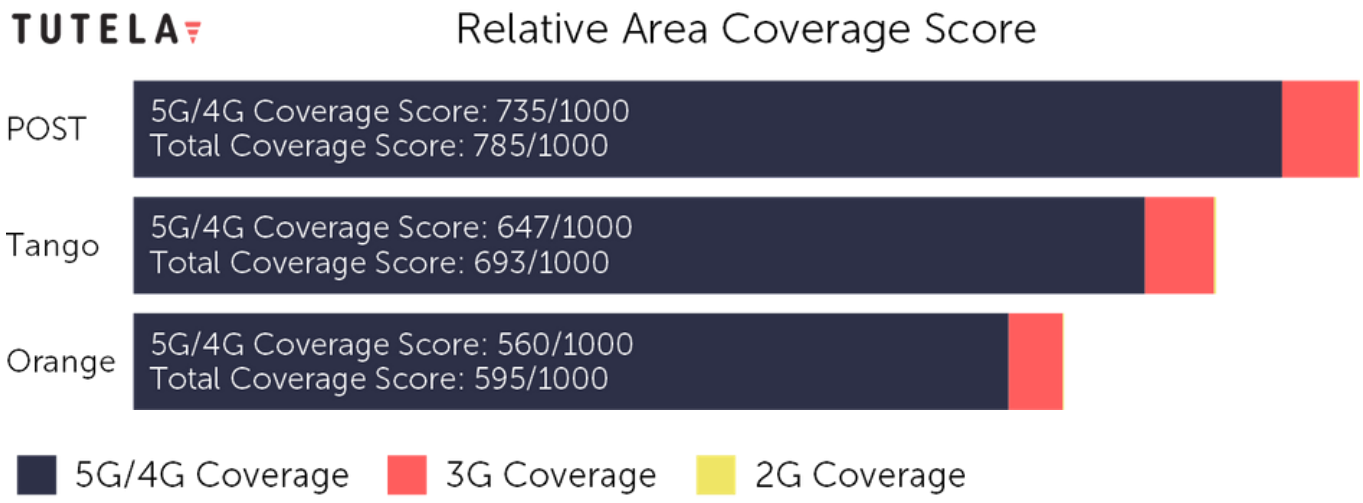
Coverage

LUXEMBOURG

POST had a commanding lead over the other operators for coverage, with a nearly 100-point advantage over second-place Tango for total coverage score. However, POST relies most heavily on 2G and 3G for area coverage, which is reflected in the percentage of time spent connected to 3G or 4G: at 13.8%, POST's users spent nearly 3% more time connected to the older wireless technology.



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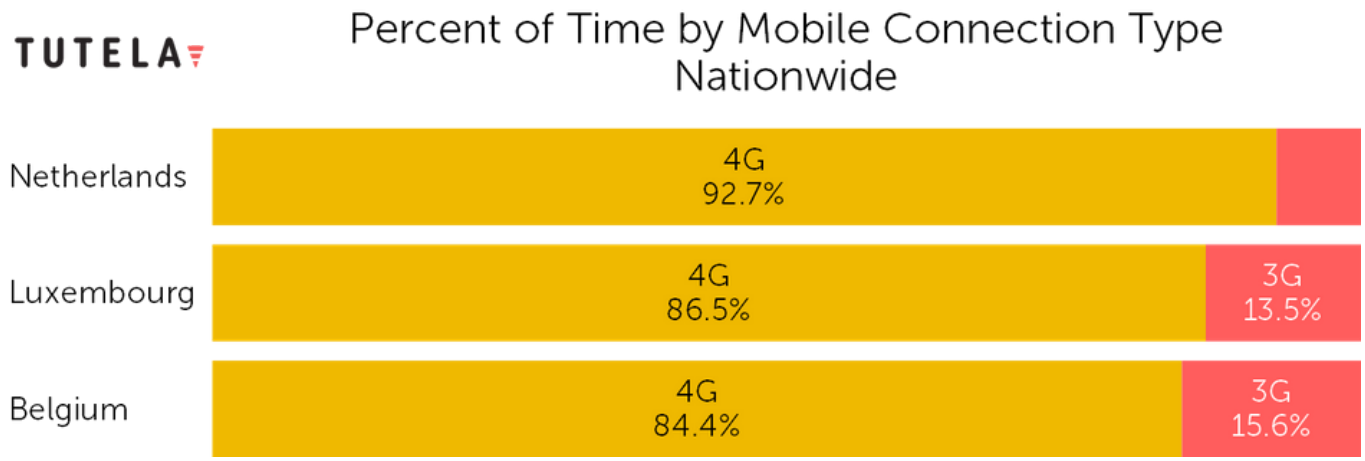
Technology usage

Users in the Netherlands spent the greatest proportion of time connected to 4G, with barely 7% of their time in total spent connected to 3G. 4G and 5G networks perform substantially better than legacy 3G technology, and that likely goes some way to explaining why the Netherlands finished first for Excellent Consistent Quality: it's hard for a users' mobile experience to be good enough to pass the Excellent Consistent Quality thresholds when connected over 3G.



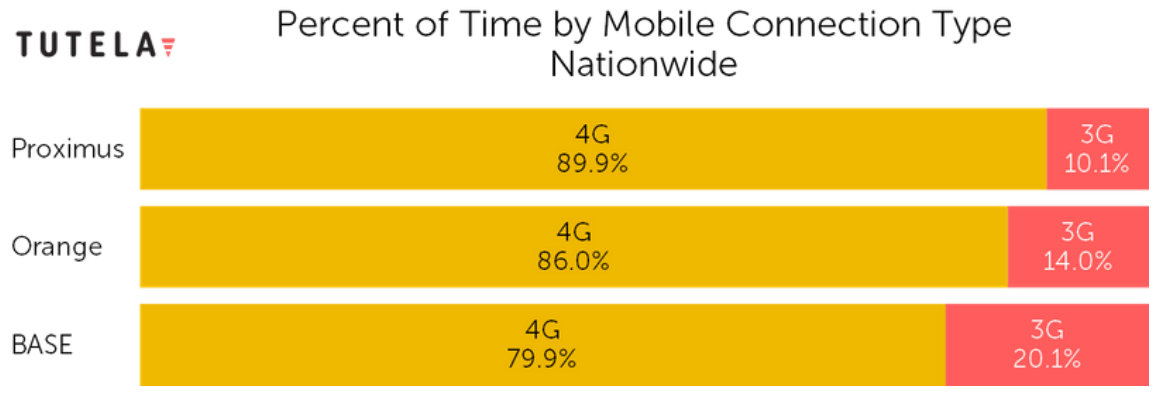
Technology usage

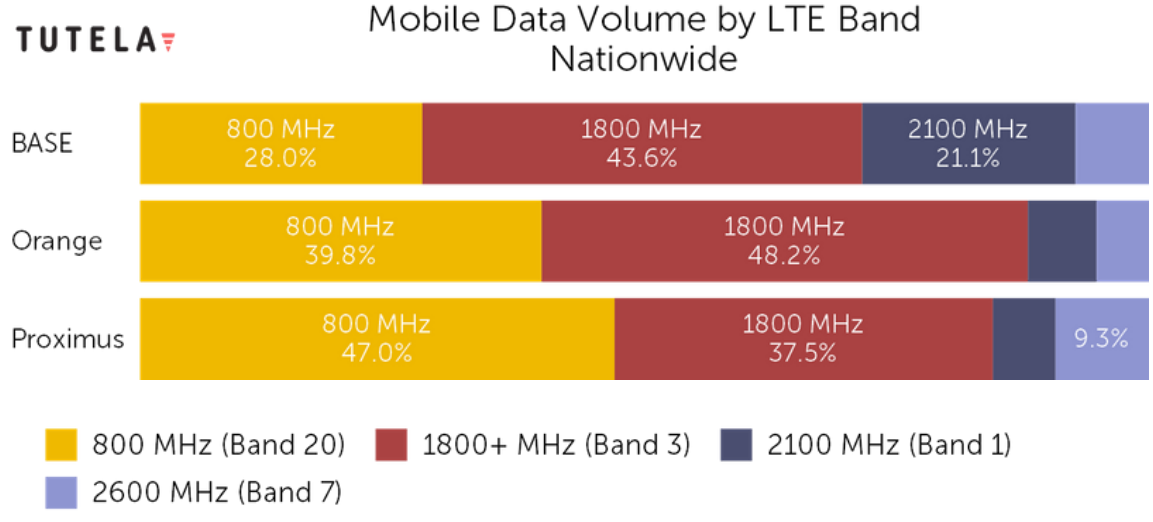
BELGIUM

There was a difference of a full 10% between Proximus and BASE when it came to the proportion of time spent connected to 3G vs 4G: Proximus's users are significantly more likely to have a more modern connection, which is reflected in Proximus's win for Consistent Quality.

When looking at spectrum usage, it's interesting to see the disparity between operators, considering that all three operators own the same amount of 800 MHz and 1800 MHz spectrum.

Proximus uses 800 MHz much more heavily as the primary band for transferring data, whereas the situation is virtually mirrored for BASE. Orange is somewhere between the two operators, although it leans more heavily on the mid-band 1800 MHz spectrum, and uses the least high-band spectrum of any of the operators.

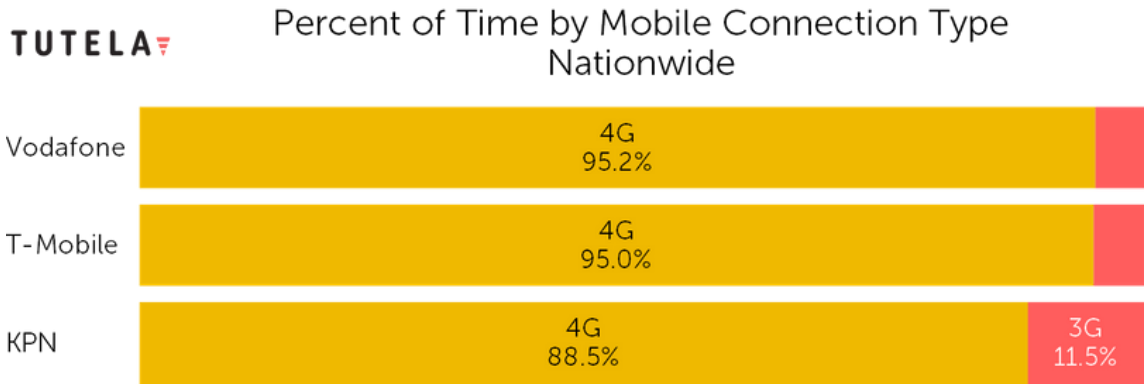


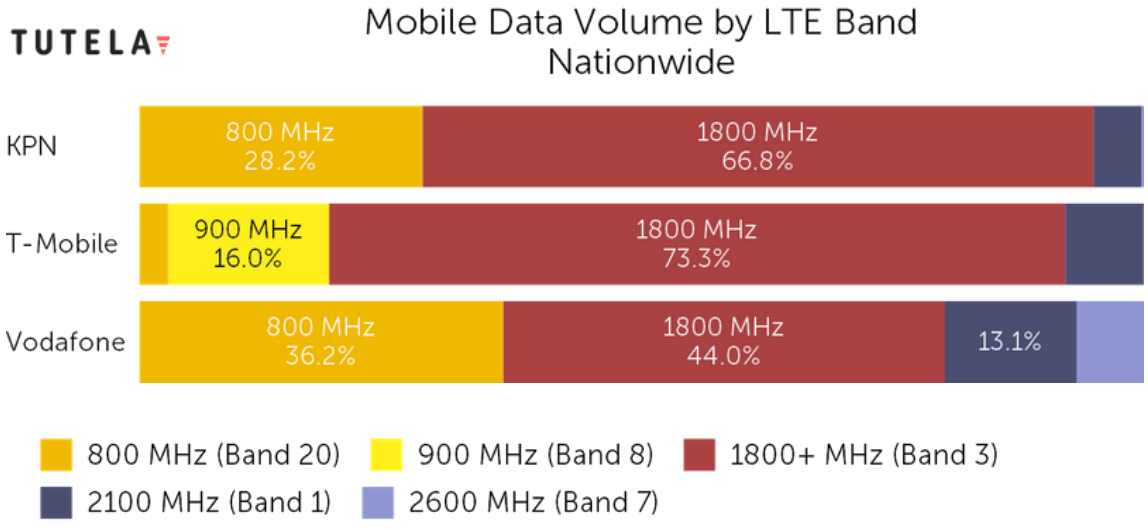


Technology usage

NETHERLANDS

Vodafone and T-Mobile subscribers both spend a similar amount of time connected to 4G, with Vodafone in the lead at 95.2%, and T-Mobile just behind at 95.0%. KPN — which also has the greatest proportion of its coverage footprint 3G or 2G-only — sees its subscribers spend 11.5% of their time connected to the older network technology. The impact of this can particularly be seen in the latency results, where KPN is the least responsive of the three operators. For spectrum usage, the four operators use a similar mix of 800, 1800, 2100, and 2600 MHz spectrum, with the 1800 MHz carrying the bulk of the traffic for all three operators. There's one exception, however — T-Mobile, where refarmed 900 MHz spectrum accounts for the bulk of its low-band data traffic.



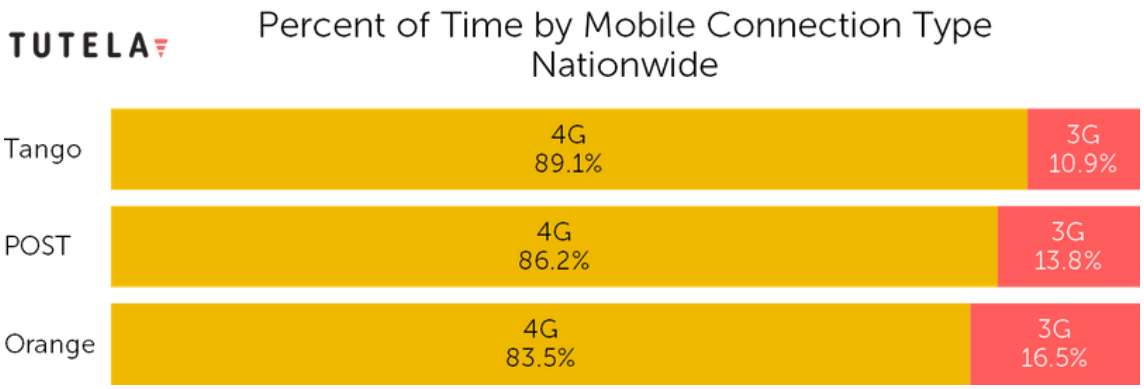


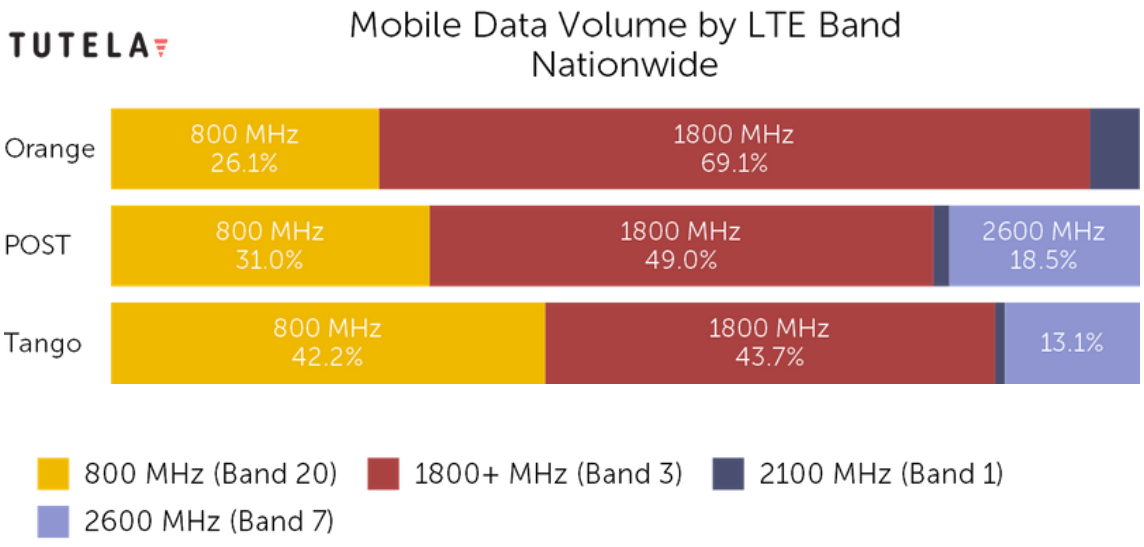
Technology usage

LUXEMBOURG

Tango users spent the highest proportion of time connected to 4G networks — and, possibly not by coincidence, Tango users also sent the highest proportion of their data over the low-band 800 MHz frequency.

Low-band frequency travels further and penetrates buildings better than mid-band or high-band frequencies like 1800 MHz, so the heavy use of 800 MHz spectrum for Tango may help ensure that 4G coverage is particularly ubiquitous.





Methodology

Tutela is an independent crowdsourced data company with a global panel of over 300 million smartphone users. We gather information on mobile infrastructure and test wireless experience, helping organizations in the mobile industry to understand and improve the world's networks. Tutela is a member of the Comlinkdata family.

Tutela collects data and runs network tests via software embedded in a diverse range of consumer applications, which enable the measurement of real-world quality of experience for mobile users, 24/7. For this report, Tutela has collected over 2.8 billion total records between May 1st and October 31st 2020.

Tutela measures mobile experience based on the real-world performance of actual network subscribers for a given brand, inclusive of occasions when a network or tariff may be throttled or congested. Results in this report are based on a testing configuration designed to represent the typical (rather than maximum) performance that users experience. We use a 2 MB file to perform our download testing and a 1 MB file to perform our upload testing. Latency performance in this report reflects one-way UDP latency. Tests are conducted against the same content delivery networks that power many of the world's most popular consumer applications and websites, and as such reflect the end-to-end performance of the network.

Consistent Quality

Download speed is most often used as a proxy for network quality, but while download throughput is important, it's just one of several crucial requirements for a "good" connection.

As operators have upgraded 3G networks through to the latest 5G technology, theoretical (and even real-world) peak throughput speeds have increased to where they vastly outstrip the maximum needed for any current use-case. Real-world speeds above 100 Mbps are now common in parts of the world, and with a 4K video stream — which itself is rarely something smartphone users need — using a fifth of that, average download speed has lost some of its relevance as the dominant statistic used to measure the quality of wireless networks.

At its most basic, a good connection is one that doesn't get in the way of users doing what they want to do. In the real world, smartphone users aren't running speed tests all day — they're browsing the web, using apps, voice calling their friends, streaming Netflix and YouTube, or making video calls. To more objectively evaluate when connections are (and are not) enabling users to do those things, Tutela has developed a standard called Consistent Quality.

Simply put, it's two sets of thresholds, called Excellent and Core. If a connection hits the Excellent standard, it's sufficient for the most demanding mobile use-cases, like HD group video calling or 1080p video streaming. A Core connection is good enough for SD video streaming, web browsing, emails, and VOIP calling, but users are more likely to experience delays or buffering when trying to use more demanding apps. Tutela also considers times when a Consistent Quality style test was attempted, but subsequently failed for distinguishable connectivity issues on the download or server response component, towards the total percentage of "failed" tests against both sets of thresholds. Tutela bases the threshold values on the minimum performance requirements published by popular apps. We most recently updated our Consistent Quality thresholds on September 1st, 2020. Tutela's consistent quality metric, as used in our reports, simply measures the percentage of time that users can hit the thresholds. The higher the number, the more often users have a Core or Excellent quality connection.

Excellent Quality

KPI	Download throughput	Upload throughput	Latency	Jitter	Packet loss	Time to first byte
Minimum acceptable value	5 Mbps	1.5 Mbps	50 ms	30 ms	1%	3.2 s

Core Quality

KPI	Download throughput	Upload throughput	Latency	Jitter	Packet loss	Time to first byte
Minimum acceptable value	1.5 Mbps	500 Kbps	100 ms	50 ms	5%	10.67 s

Discover Tutela Explorer

Tutela Explorer is a powerful cloud-based solution for real-time analysis of crowdsourced data. Using the platform, mobile operators can:

- Create coverage and quality maps
- Benchmark network quality and coverage across all operators
- Drill down to any KPI at city, street or even building level
- Analyse spectrum utilisation, performance and more

Visit www.tutela.com/explorer to learn more

Learn more

Appendix

BELGIUM

TUTELA

Results Overview in Common Coverage Areas

	Download Throughput	Upload Throughput	Latency	Excellent CQ	Core CQ
BASE	31.2 Mbps ± 0.10 Mbps	11.6 Mbps ± 0.04 Mbps	19.4 ms ± 0.011 ms	85.64% ± 0.13%	94.51% ± 0.06%
Orange	25.4 Mbps ± 0.10 Mbps	13.3 Mbps ± 0.04 Mbps	13.4 ms ± 0.010 ms	88.20% ± 0.10%	95.47% ± 0.04%
Proximus	30.7 Mbps ± 0.12 Mbps	15.3 Mbps ± 0.05 Mbps	18.0 ms ± 0.016 ms	90.87% ± 0.10%	96.37% ± 0.04%

TUTELA

Results Overview Nationwide

	Download Throughput	Upload Throughput	Latency	Excellent CQ	Core CQ
BASE	31.0 Mbps ± 0.10 Mbps	11.5 Mbps ± 0.04 Mbps	19.4 ms ± 0.011 ms	85.44% ± 0.13%	94.48% ± 0.06%
Orange	24.9 Mbps ± 0.10 Mbps	13.1 Mbps ± 0.04 Mbps	13.5 ms ± 0.010 ms	87.72% ± 0.10%	95.29% ± 0.04%
Proximus	29.6 Mbps ± 0.11 Mbps	14.9 Mbps ± 0.05 Mbps	17.9 ms ± 0.016 ms	90.10% ± 0.10%	96.21% ± 0.04%

Appendix

NETHERLANDS

TUTELA

Results Overview in Common Coverage Areas

	Download Throughput	Upload Throughput	Latency	Excellent CQ	Core CQ
KPN	33.6 Mbps ± 0.13 Mbps	15.0 Mbps ± 0.06 Mbps	14.9 ms ± 0.016 ms	87.74% ± 0.15%	94.56% ± 0.05%
T-Mobile	30.5 Mbps ± 0.10 Mbps	14.8 Mbps ± 0.03 Mbps	14.5 ms ± 0.013 ms	91.72% ± 0.10%	96.98% ± 0.04%
Vodafone	43.8 Mbps ± 0.19 Mbps	14.3 Mbps ± 0.07 Mbps	14.2 ms ± 0.018 ms	91.97% ± 0.14%	96.52% ± 0.05%

TUTELA

Results Overview Nationwide

	Download Throughput	Upload Throughput	Latency	Excellent CQ	Core CQ
KPN	33.2 Mbps ± 0.13 Mbps	14.6 Mbps ± 0.06 Mbps	14.9 ms ± 0.015 ms	87.09% ± 0.14%	94.37% ± 0.05%
T-Mobile	30.7 Mbps ± 0.10 Mbps	14.7 Mbps ± 0.03 Mbps	14.5 ms ± 0.012 ms	91.46% ± 0.10%	96.89% ± 0.04%
Vodafone	43.0 Mbps ± 0.20 Mbps	14.0 Mbps ± 0.06 Mbps	14.3 ms ± 0.018 ms	91.25% ± 0.14%	96.27% ± 0.05%

Appendix

LUXEMBOURG

TUTELA

Results Overview in Common Coverage Areas

	Download Throughput	Upload Throughput	Latency	Excellent CQ	Core CQ
Orange	17.9 Mbps ± 0.59 Mbps	10.3 Mbps ± 0.26 Mbps	15.4 ms ± 0.037 ms	77.35% ± 0.84%	91.17% ± 0.45%
POST	33.5 Mbps ± 0.44 Mbps	13.4 Mbps ± 0.19 Mbps	13.5 ms ± 0.052 ms	89.63% ± 0.47%	95.62% ± 0.24%
Tango	27.6 Mbps ± 0.44 Mbps	12.6 Mbps ± 0.20 Mbps	11.9 ms ± 0.084 ms	84.81% ± 0.62%	95.13% ± 0.20%

TUTELA

Results Overview Nationwide

	Download Throughput	Upload Throughput	Latency	Excellent CQ	Core CQ
Orange	18.4 Mbps ± 0.53 Mbps	10.2 Mbps ± 0.23 Mbps	15.4 ms ± 0.033 ms	77.52% ± 0.79%	91.19% ± 0.42%
POST	33.4 Mbps ± 0.39 Mbps	13.2 Mbps ± 0.20 Mbps	13.5 ms ± 0.046 ms	89.17% ± 0.44%	95.18% ± 0.22%
Tango	27.3 Mbps ± 0.43 Mbps	12.5 Mbps ± 0.18 Mbps	11.8 ms ± 0.082 ms	84.63% ± 0.58%	94.90% ± 0.19%

About Tutela

Tutela Technologies, Ltd., is an independent crowdsourced data company with a global panel of over 300 million smartphone users. It gathers information on mobile infrastructure and tests wireless experience, helping organizations in the mobile industry to understand and improve the world's networks. Data and insights provided by Tutela are trusted by the engineering teams at mobile network operators and network equipment manufacturers around the world and used to compare operators as well as inform decisions in network and infrastructure planning and optimisation. The organization is headquartered in Victoria, British Columbia.

Tutela does not collect any sensitive personal data and is compliant with international privacy regulations including CCPA and GDPR.

For further information about the methodology, data and tools used to create this report, please contact analysis@tutela.com or visit www.tutela.com.

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