TUTELA

Brazil

State of Mobile Networks

Analysts

Montana Jennings

Annual Report

JUNE 2020

www.tutela.com

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Introduction

Industries across the world are assessing the risk and reward on how to safely open up business again; and in the telecom industry, where strong internet services quickly became a necessity during this pandemic, the assessment lies around whether it is a good time to invest in technologies again, whether it is wise to acquire or merge new business, and whether operators had met or fallen short of its financial targets.

These questions are noticeable in Brazil as operators pivot any initial plans to improve mobile offerings by focusing on whether fixed broadband needs more work instead(1). Telecom Italia (TIM) and Telefonica have also broached the idea of jointly buying out cash-strapped Oi as a way of stamping out more of the competition in Brazil but to continue as independent entities(2). Many 5G deployment plans and auctions in 2020 have also been put on hold across the world, however for Brazil these auctions were already delayed well before the pandemic hit due to the countries allegiance to the USA and the pressure to not pursue help from Huawei with technology deployment(3).

In this report, Tutela has evaluated 21 billion records in Common Coverage Areas across Brazil, including more than 220 million speed tests and 2.8 billion latency tests, collected between November 1, 2019 and April 30, 2020.

(1) BNAmericas, Telcos in the post-pandemic economy: uncertainty reigns
https://www.bnamericas.com/en/features/telcos-in-the-post-pandemic-economy-uncertainty-reigns
Retrieved 01 June 2020

(2) Telecoms.com, Telefonica and TIM circling bankrupt Oi for Brazil expansion
https://telecoms.com/503034/telefonica-and-tim-circling-bankrupt-oi-for-brazil-expansion/
Retrieved 01 June 2020

(3) Reuters, Huawei warns Brazil further delays in 5G auction could hurt competitiveness
https://www.reuters.com/article/us-huawei-5g-brazil/huawei-warns-brazil-further-delays-in-5g-auction-could-hurt-competitiveness-idUSKBN2002F9
Retrieved 01 June 2020

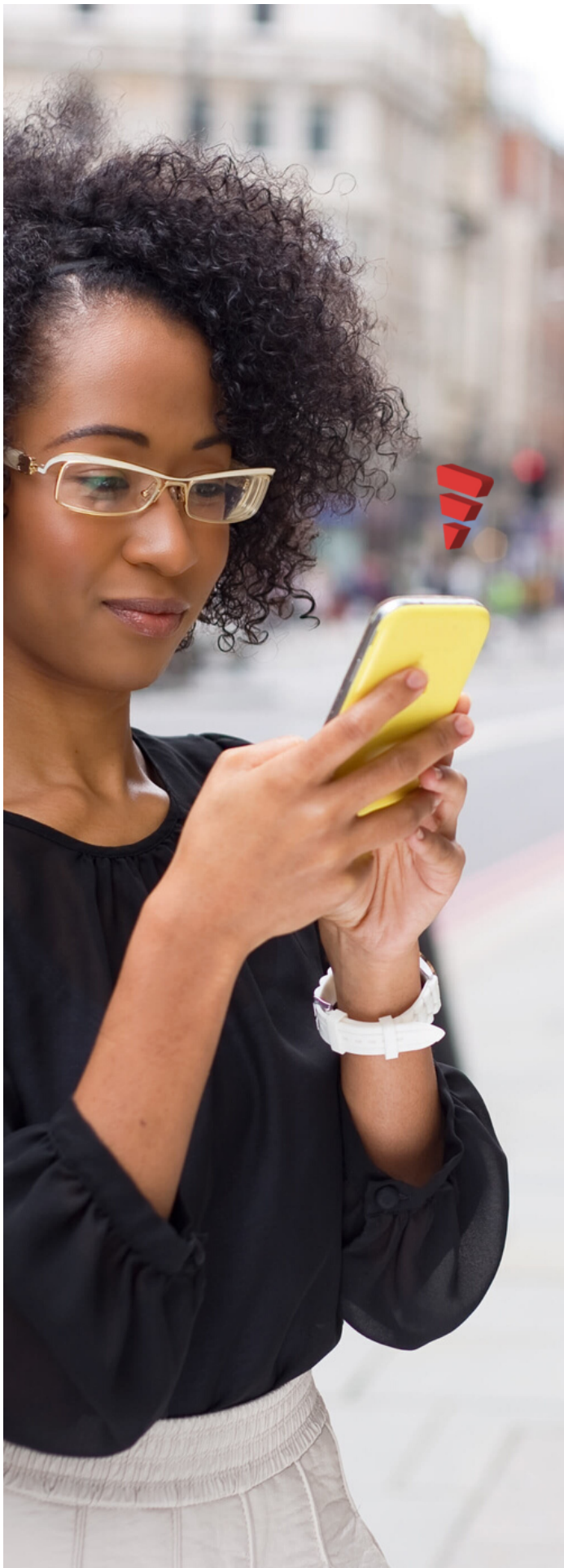
Key findings

- Claro dominated in four of the five metrics in Common Coverage Areas of Brazil, including having the highest Excellent Consistent Quality percentage at 72.2%.

- TIM had the best latency in Brazil with a one-way result of 19.2 ms, and the second best upload speed, with only 1.1 Mbps separating the operator from first place Claro.

- The 1800 Mhz and 2600 Mhz LTE bands are both widely used by all four operators in Brazil, with Oi being the unique operator with an almost 50/50 split of the spectrum.

- Oi may not have won any awards this time, but the operator was not far behind on the Core Consistent Quality metric by only 6% behind Claro and 2.5 Mbps behind Claro on the upload speed metric, showing it can step up to the plate for its users on the simpler tasks of internet usage.



Results overview

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Mobile experience results

Brazil, June 2020

	Claro	vivo	TIM	oi
Excellent Consistent Quality	★ Winner			
Core Consistent Quality	★ Winner			
Download throughput	★ Winner			
Upload throughput	★ Winner			
Latency			★ Winner	

Results from over 21 billion records in Common Coverage Areas across Brazil, including more than 220 million speed tests and 2.8 billion latency tests, collected between November 1, 2019 and April 30, 2020.

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

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Best Mobile Network Experience
JUNE 2020

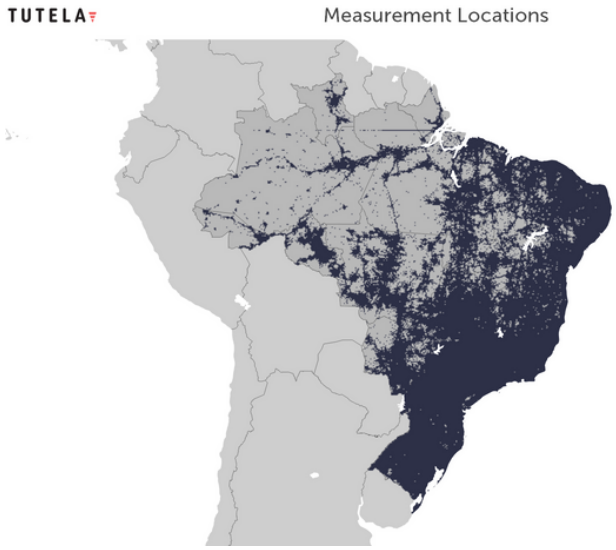
Based on the highest Excellent Consistent Quality in Common Coverage Areas.

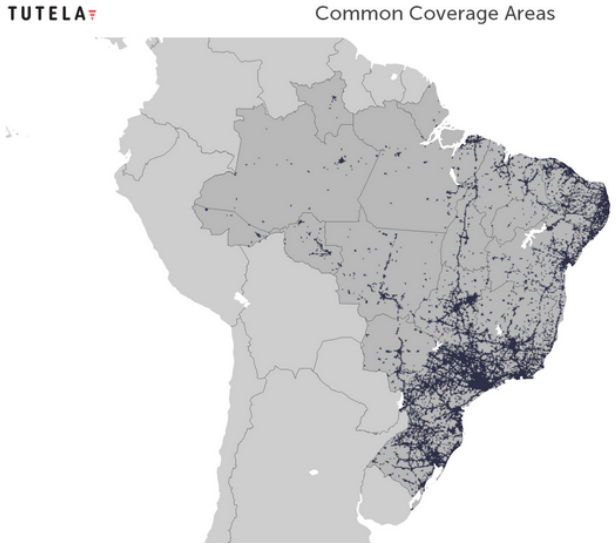
Understanding this report

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 networks are (and are not) enabling users to do almost everything that they want to do on their smartphones.

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. These were most recently re-assessed and updated September 1st, 2019.

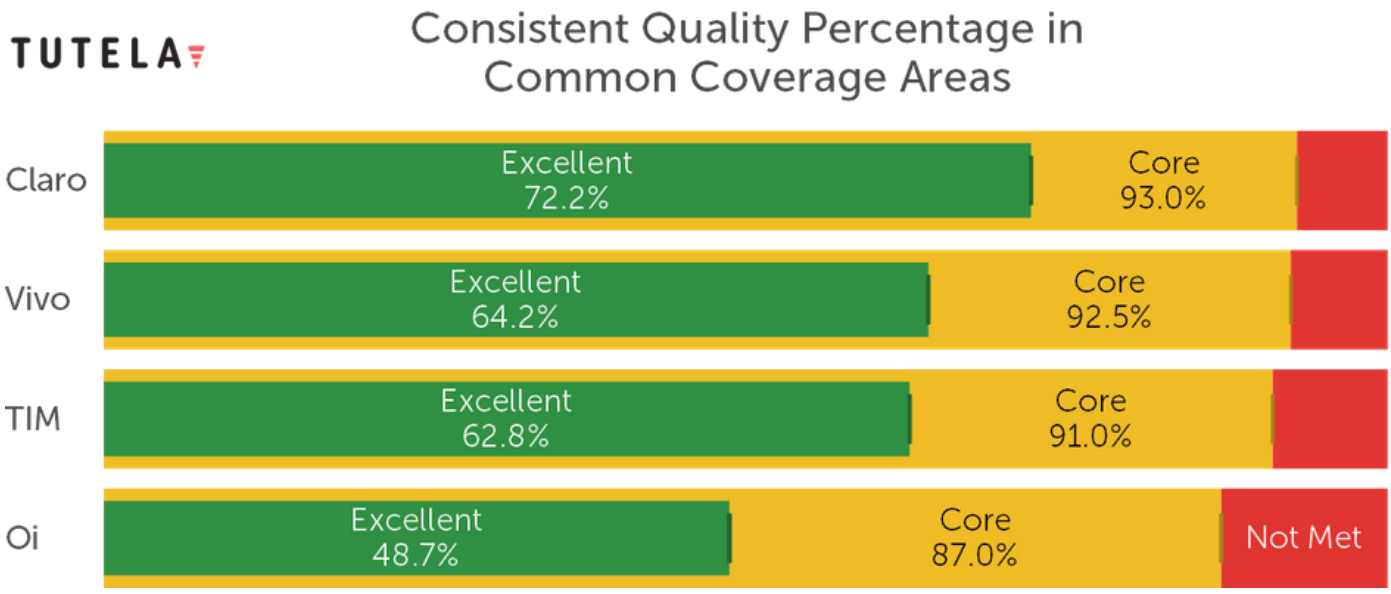
Common Coverage Areas are parts of the country where the majority of operators offer service. In this report, we present results nationally and from Common Coverage Areas, which helps present both a full national picture, as well as highlighting network conditions wherever operators are directly in competition.





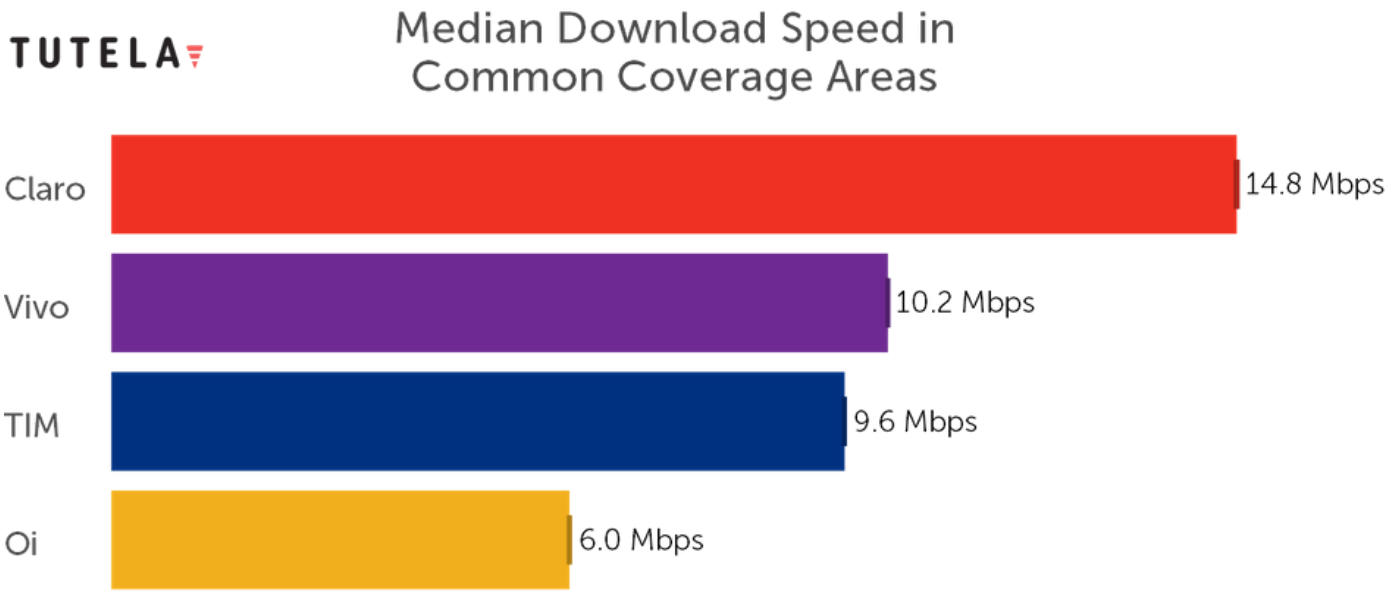
Consistent Quality

Claro had the highest Excellent Consistent Quality percentage in Common Coverage Areas of Brazil, with 72.2% of tests good enough for applications like HD video calling, movie streaming, or mobile gaming. With a difference of 8% in performance, Vivo falls in second place for an Excellent Consistent Quality percentage of 64.2%. The difference in performance in regards to Core Consistent Quality is smaller for Vivo, with only 0.5% between the operator and first place Claro. In third place, TIM had an Excellent Consistent Quality percentage of 62.8% and a Core percentage of 91.0%. And rounding out the top four, Oi had an Excellent Consistent Quality percentage of 48.7%, 23.5% behind Claro, and a Core percentage of 87.0% narrowly missing out on meeting the 90% threshold.



Download throughput

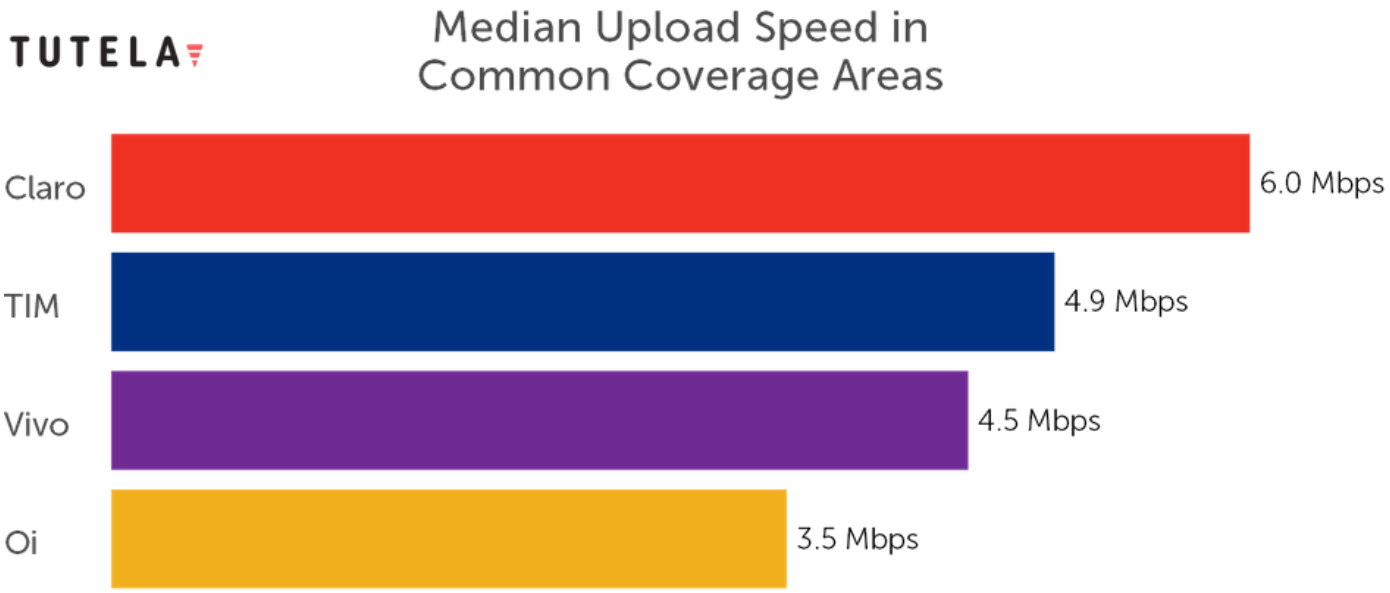
In the Common Coverage Areas of Brazil, Claro had the fastest median download speed at 14.8 Mbps, 4.6 Mbps faster than second place Vivo, 5.2 Mbps faster than TIM, and 8.6 Mbps faster than last place Oi. In similar fashion to the Consistent Quality metric, Vivo and TIM continue to stick close to its main competitor Claro, however Oi continues to fall short with a median download speed of only 6.0 Mbps.



Upload throughput

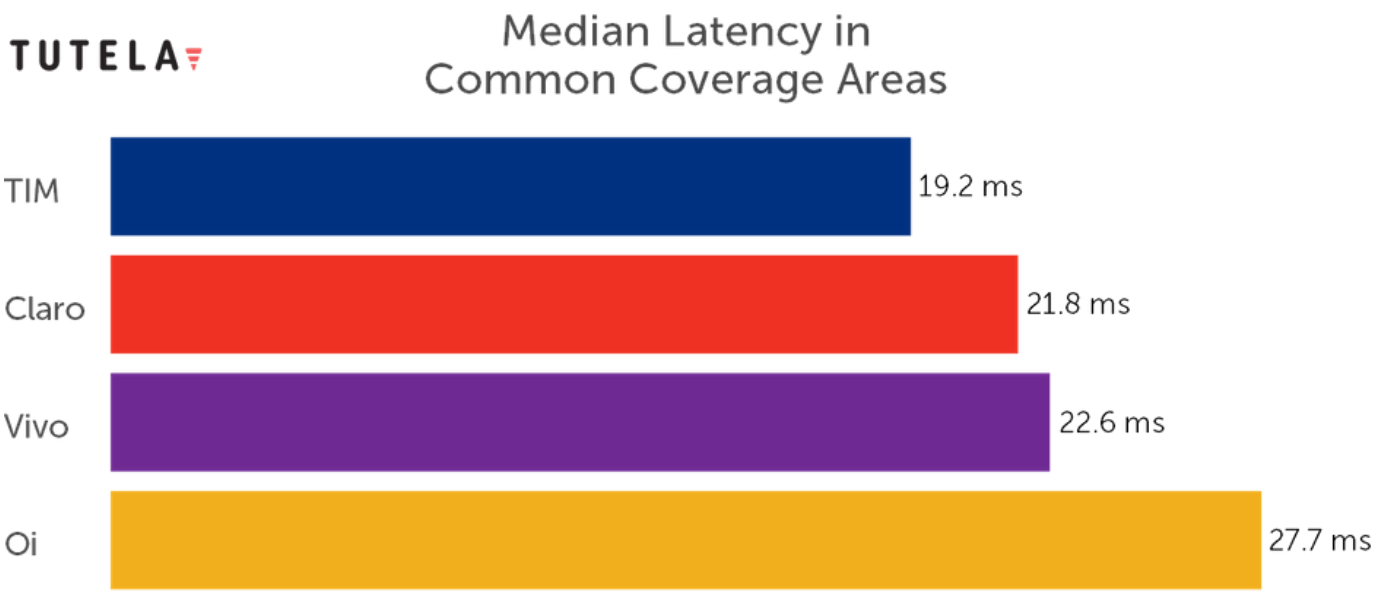
For upload speeds, there is a change in rankings from what had been shown in the Consistent Quality and download speeds: TIM dethroned Vivo from its usual second place spot by 0.4 Mbps, to have the second fastest median download speed at 4.9 Mbps.

Claro had the fastest upload speed at 6.0 Mbps, and we can see that the differences in performance are much smaller with Vivo at 4.5 Mbps and Oi only 2.5 Mbps behind Claro.



Latency

Latency also showed us changes in the rankings, with TIM taking out the top spot for the first time with a median one-way latency of 19.2 ms in Common Coverage Areas of Brazil. This is a positive result for the operator that it is more responsive to those use-cases where responsiveness matters, such as video calling or mobile gaming, than its download speed of 9.6 Mbps might have first suggested. Claro was close behind by only 2.6 ms for a result of 21.8 ms, and Vivo came in third with a one-way latency result of 22.6 ms. The main difference is the performance of Oi with a result of 27.7 ms, 8.5 ms higher than first place TIM.



Technology usage

All four operators in Brazil utilize the 4G network most heavily, with TIM and Claro users nationwide spending over 70% of the time on this connection type. For Vivo, users nationwide are spending over 60% of the time on 4G, whereas Oi users may notice a near 50/50 split between 4G and 3G.

All four operators in Brazil rely on the 2600 MHz (Band 7) and 1800 MHz (Band 3) spectrum the most, although Oi is the only operator to rely almost exclusively on the mid-band and high-band spectrum . TIM and Oi utilize the 1800 Mhz spectrum the most, with 44.4% of 4G data going over the mid-band spectrum, while Claro and Vivo are nearly tied for the heaviest usage in 2600 Mhz. Interestingly, the low-band 700 Mhz is still well used in Brazil for three of the four operators, giving the likes of TIM, which uses low-band for 26% of its data traffic, a nice balance of coverage for its users.

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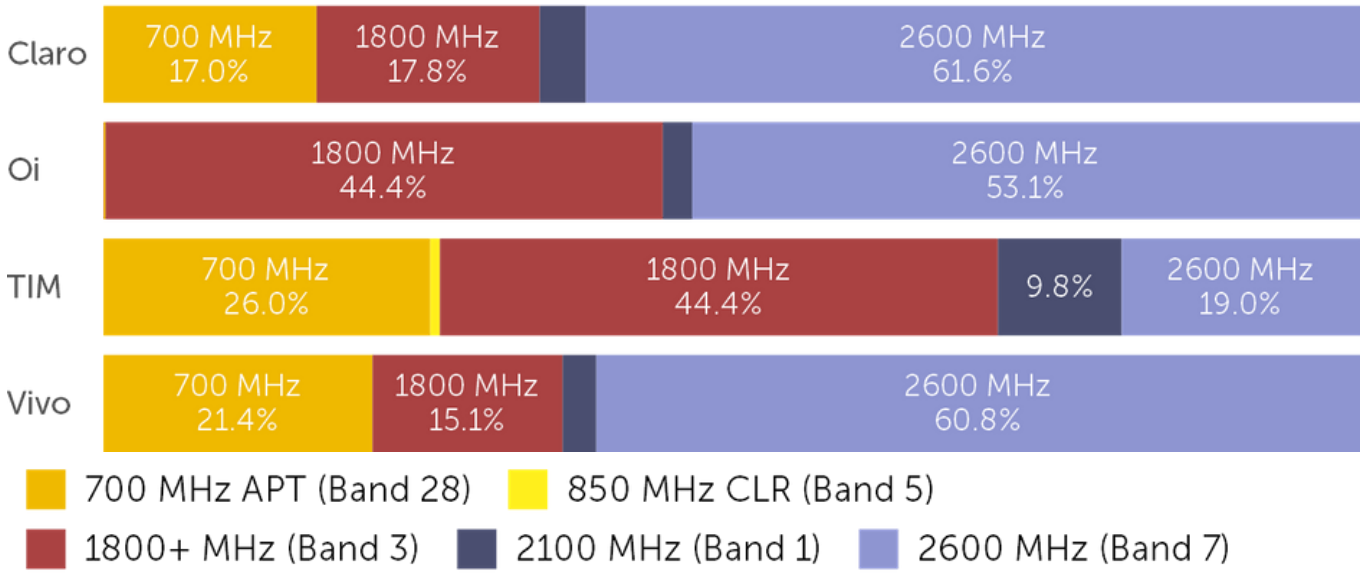
Mobile Data Volume by LTE Band Nationwide



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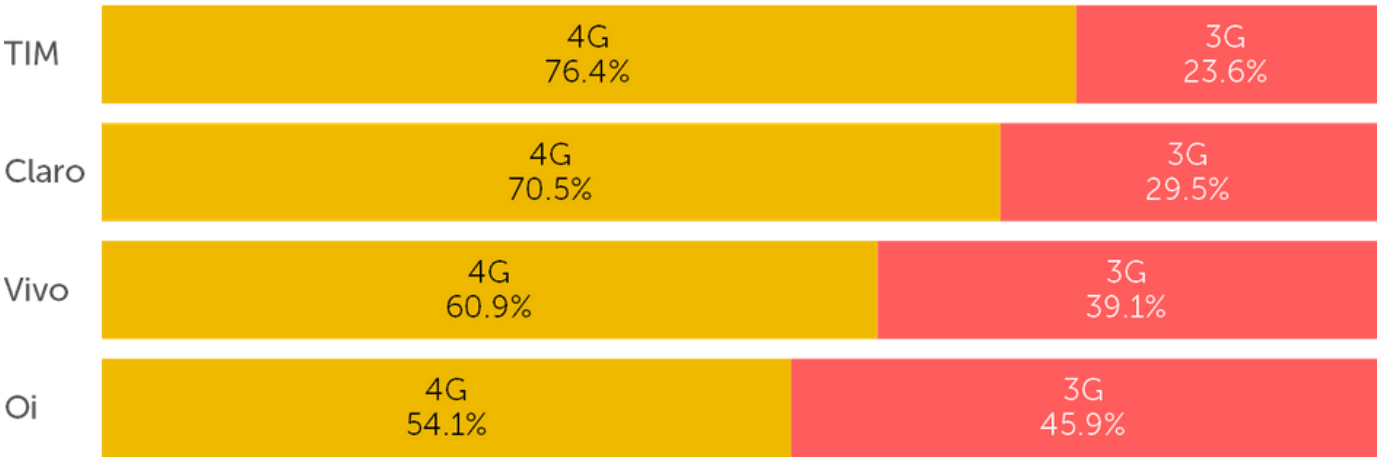
Percent of Time by Mobile Connection Type Nationwide



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 organisations in the mobile industry to understand and improve the world's networks.

Tutela collects data and runs network tests via software embedded in a diverse range of over 3000 consumer applications, which enable the measurement of real-world quality of experience for mobile users, 24/7. For this report, Tutela has collected over 21 billion records in Common Coverage Areas, between November 1, 2019 and April 30, 2020.

Tutela measures network quality based on the real-world performance of actual network subscribers, inclusive of occasions when a network or tariff may be throttled or congested, and of users on the flanker sub-brands of operators. 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 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 to LTE-Advanced 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 networks 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 bases the threshold values on the minimum performance requirements published by popular apps. We most recently updated our Consistent Quality thresholds on September 1st, 2019.

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
Minimum acceptable value	5 Mbps	1.5 Mbps	50 ms	30 ms	1%

Core Quality

KPI	Download throughput	Upload throughput	Latency	Jitter	Packet loss
Minimum acceptable value	1.5 Mbps	500 Kbps	100 ms	50 ms	5%

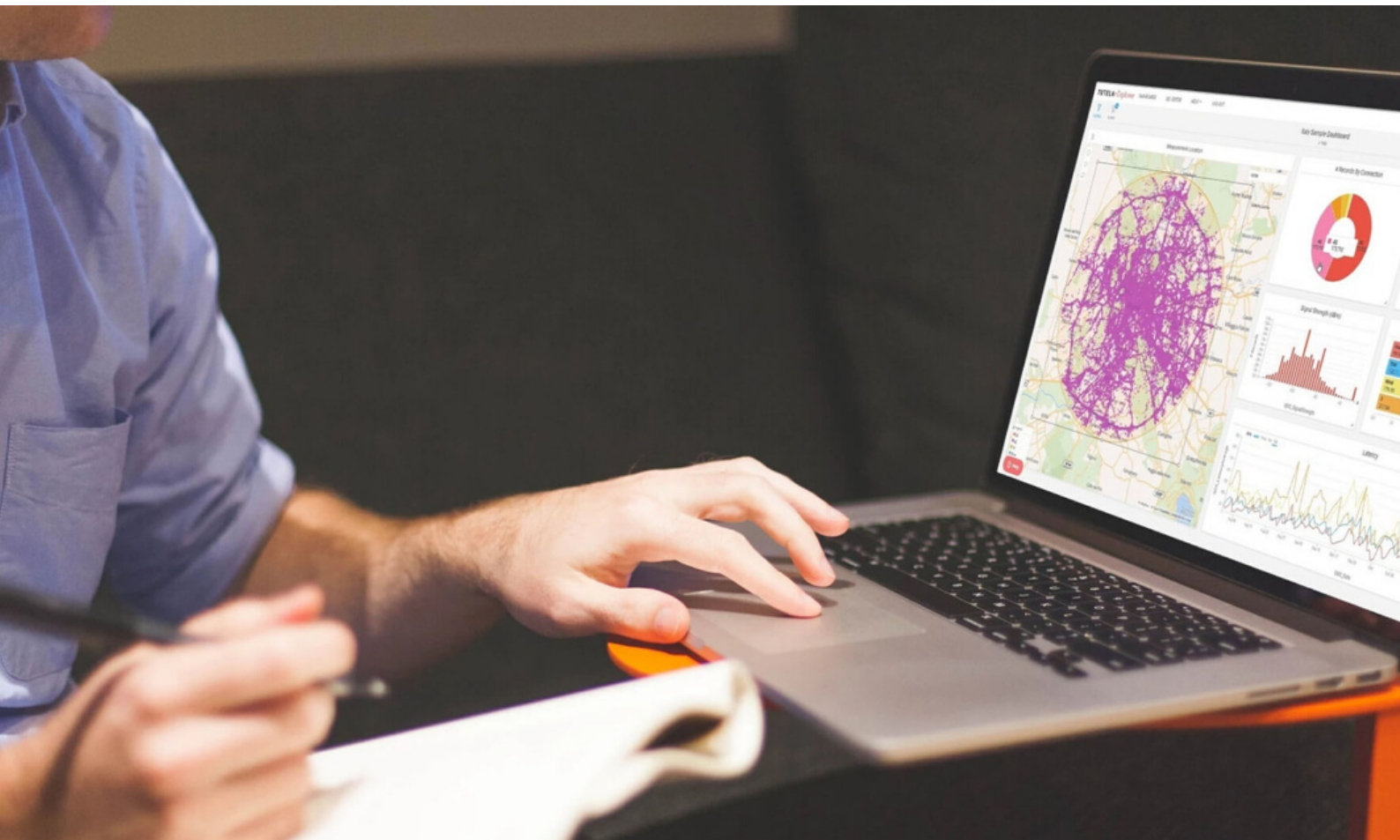
Discover Tutela Explorer

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

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Results Overview Nationwide

	Download Throughput	Upload Throughput	Latency	Excellent CQ	Core CQ
Claro	14.5 Mbps ± 0.02 Mbps	5.9 Mbps ± 0.01 Mbps	22.1 ms ± 0.003 ms	71.71% ± 0.04%	92.71% ± 0.02%
Oi	6.0 Mbps ± 0.02 Mbps	3.5 Mbps ± 0.01 Mbps	28.0 ms ± 0.008 ms	48.54% ± 0.07%	86.93% ± 0.05%
TIM	9.6 Mbps ± 0.01 Mbps	4.9 Mbps ± 0.01 Mbps	19.4 ms ± 0.003 ms	62.49% ± 0.05%	90.91% ± 0.03%
Vivo	9.8 Mbps ± 0.01 Mbps	4.3 Mbps ± 0.00 Mbps	23.2 ms ± 0.003 ms	63.08% ± 0.04%	91.91% ± 0.02%

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Results Overview in Common Coverage Areas

	Download Throughput	Upload Throughput	Latency	Excellent CQ	Core CQ
Claro	14.8 Mbps ± 0.02 Mbps	6.0 Mbps ± 0.01 Mbps	21.8 ms ± 0.003 ms	72.23% ± 0.04%	92.95% ± 0.02%
Oi	6.0 Mbps ± 0.01 Mbps	3.5 Mbps ± 0.01 Mbps	27.7 ms ± 0.007 ms	48.73% ± 0.07%	87.05% ± 0.05%
TIM	9.6 Mbps ± 0.01 Mbps	4.9 Mbps ± 0.01 Mbps	19.2 ms ± 0.003 ms	62.77% ± 0.05%	91.05% ± 0.03%
Vivo	10.2 Mbps ± 0.01 Mbps	4.5 Mbps ± 0.00 Mbps	22.6 ms ± 0.003 ms	64.23% ± 0.04%	92.47% ± 0.02%

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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