TUTELA

Argentina

State of Mobile Experience

Analysts

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Annual Report

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Introction

As the world economy is battling with the effects of the COVID-19 pandemic, some countries are suffering more than others. Argentina's economy was struggling even before the pandemic with a persistent budget deficit of around five percent and a substantial trade deficit(1). This economic struggle, marked by high unemployment and about 35 percent inflation(2), has led the government to categorize telecom related services such as cellular plans, home internet, and TV as 'essential services'(3) and impose a price freeze on them.

(1) FierceWireless, Industry Voices — Entner: Telecommunications are declared a 'public service' in Argentina
https://www.fiercewireless.com/wireless/industry-voices-entner-telecommunications-declared-a-public-service-argentina
Retrieved 30 October 2020

(2) Bloomberg, Creditors Blast Argentina for Post-Restructuring Bond Blowup
https://www.bnnbloomberg.ca/creditors-blast-argentina-for-post-restructuring-bond-blowup-1.1511963.amp.html
Retrieved 30 October 2020

(3) Bloomberg, Argentina Freezes TV, Internet And Mobile Prices Until Year-End
https://www.bloomberg.com/news/articles/2020-08-22/argentina-freezes-tv-internet-and-mobile-prices-until-year-end
Retrieved 30 October 2020

Although a positive move for consumers, price freezes may negatively impact investments in telecom infrastructure - especially the rollout of 5G networks — as operators might be hesitant to invest unless they are confident of a positive return on investment(4). Nonetheless, a report from Ericsson(5) suggests that the first 5G rollouts in South America would take place this year. However, specific details about the timeline for a 5G network deployment, particularly for Argentina, are not yet clear.

Although 5G services are not yet available, there have been improvements in wireless telecoms throughout the year. For example, HISPASAT, the Spanish satellite telecoms operator, signed an agreement with Claro Argentina to expand 3G and 4G connectivity in 250 rural communities providing them internet access "through a cellular backhaul service by satellite"(6). Meanwhile, Camara de Cooperativas de Telecomunicaciones (Catel) is in the process of finalizing an agreement with Telefonica-owned Movistar to use its network for launching MVNO services(7), which can increase market competition.

For this analysis of mobile network experience across Argentina, Tutela has analyzed over 2 billion total records taken from real-world smartphone users, including more than 18 million speed and latency tests, collected between April 1st and September 30th, 2020.

(4) FierceWireless, Industry Voices — Entner: Telecommunications are declared a 'public service' in Argentina
https://www.fiercewireless.com/wireless/industry-voices-entner-telecommunications-declared-a-public-service-argentina
Retrieved 30 October 2020

(5) Ericsson, The Ericsson Mobility Report
https://www.ericsson.com/en/mobility-report
Retrieved 30 October 2020

(6) Hispasat, Hispasat signs an agreement with Claro to bring 3G and 4G connectivity to 250 rural communities in Argentina
https://www.hispasat.com/en/press-room/press-releases/archivo-2020/390/hispasat-signs-an-agreement-with-claro-to-bring-3g-and-4g-connectivity-to-250-rural-communities-in-argentina
Retrieved 30 October 2020

(7) Telefónicawatch, Telefónica Argentina's network to host CATEL MVNO
https://www.telcotitans.com/telefonicawatch/telefonica-argentinas-network-to-host-catel-mvno/1520.article
Retrieved 30 October 2020

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Key findings

- Claro took first place for Excellent Consistent Quality and Core Consistent Quality, despite being the second or third-ranked operator for a majority of the other core metrics included in this report. While Claro's median download throughput was lower than other operators, tests from Claro users were most often fast, responsive, and stable enough for demanding mobile applications like HD video calling or online gaming. This shows that having the fastest download speed isn't everything: providing a consistently usable connection for the use cases that matter most is the key to ensuring a better user experience.

- Personal took the awards for highest download and upload speeds as well as the Relative Coverage Score award for 4G/5G coverage, narrowly beating Claro. However, Claro had the most total coverage (that is, coverage from any network technology, including 2G and 3G). A similar result played out for the percentage of time spent on 3G vs 4G: Personal users spent the greatest percentage of time connected to 4G (86.1%), whilst Claro subscribers use 3G the most of any operator.

- Movistar bagged the prize for lowest one-way latency, beating Personal and Claro by 1.8 and 4.0ms respectively. Also, it was second behind Personal when looking at the technology usage metric, with subscribers spending 77.2% of their time on 4G.

Results overview

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Mobile experience results

Argentina, November 2020	Claro	Personal	movistar
Excellent Consistent Quality	⭐ Winner		
Core Consistent Quality	⭐ Winner		
Download throughput		⭐ Winner	
Upload throughput		⭐ Winner	
Latency			⭐ Winner
Best 4G coverage		⭐ Winner	
Best total coverage	⭐ Winner		

Results from over 2 billion total records taken from real-world smartphone users, including more than 18 million speed and latency tests, collected between April 1st and September 30th, 2020.

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

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Best Mobile Network Experience

NOVEMBER 2020

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

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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.
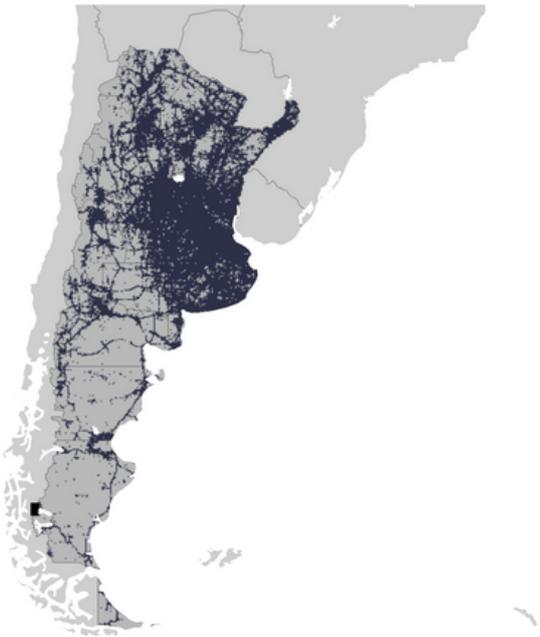
Common Coverage Areas are parts of the country where all national operators offer service, either on their own network or through a domestic roaming agreement. Comparing performance within common coverage areas ensures that user experience is being compared in places where networks are competing head-to-head, 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

Claro ranked first achieving the highest Excellent Consistent Quality of 74.8%, Tutela's metric for user experience against a range of common but high-intensity use cases such as 1080p video streaming, live mobile video broadcasting, online gaming, and HD video calls in Common Coverage Areas in Argentina. Personal placed second at 70.1%, around four percentage points lower than Claro. However, Movistar was placed third at 60.9% over fourteen percentage points below first-place Claro.

For Core Consistent Quality, a metric that measures requirements for use-cases like SD video streaming, social media sharing, and web browsing, results are slightly better than Excellent Consistent Quality. Claro is the winner here as well, with a Core Consistent Quality of 87.5%, approximately seven percent higher than Personal placed second at 80.6%. Movistar is just below Personal with a difference of about two percentage points at 78.9%.

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Consistent Quality percentages in Common Coverage Areas

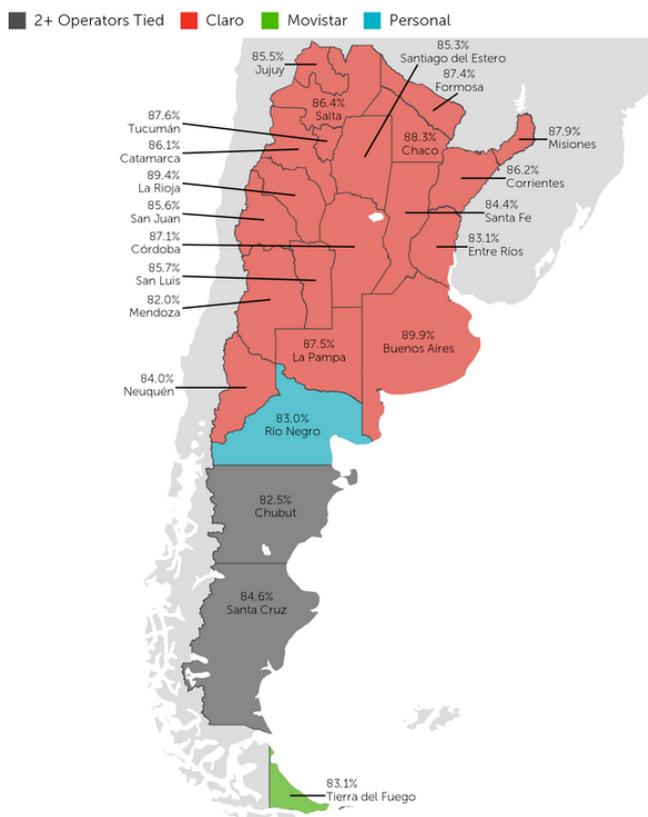|	Excellent	Core	Not Met
Claro	74.8%	87.5%	Not Met
Personal	70.1%	80.6%	Not Met
Movistar	60.9%	78.9%	Not Met

On a regional level, results are slightly different than what we see on a national level. For Excellent Consistent Quality, Claro dominates most of the northern and northeastern part of Argentina, while the northwestern part is dominated by a tie between multiple operators. Personal leads in the southern part of Argentina.

When it comes to Core Consistent Quality, again, Claro dominates in the northern part of Argentina with Personal leading in the region of Rio Negro. While two regions in the South, Chubut and Santa Cruz have two plus operators tied, the Southernmost region of Tierra del Fuego was the only region in the country won by Movistar.
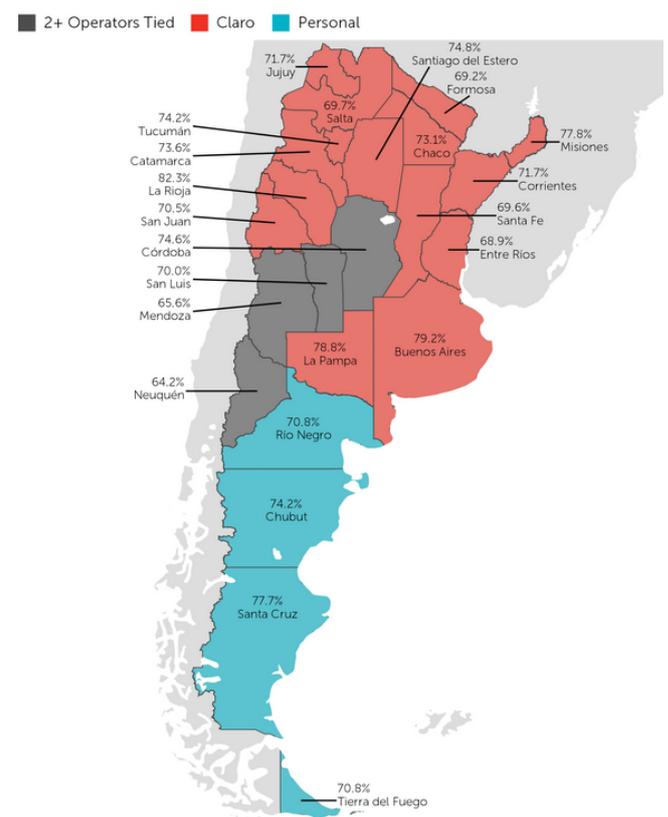
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Core Consistent Quality percentages in Common Coverage Areas

Legend: 2+ Operators Tied | Claro | Movistar | Personal

- 85.5% Jujuy
- 85.3% Santiago del Estero
- 87.4% Formosa
- 86.4% Salta
- 87.6% Tucumán
- 86.1% Catamarca
- 88.3% Chaco
- 87.9% Misiones
- 89.4% La Rioja
- 86.2% Corrientes
- 85.6% San Juan
- 84.4% Santa Fe
- 87.1% Córdoba
- 83.1% Entre Ríos
- 85.7% San Luis
- 82.0% Mendoza
- 87.5% La Pampa
- 89.9% Buenos Aires
- 84.0% Neuquén
- 83.0% Rio Negro
- 82.5% Chubut
- 84.6% Santa Cruz
- 83.1% Tierra del Fuego

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Excellent Consistent Quality percentages in Common Coverage Areas

Legend: 2+ Operators Tied | Claro | Personal

- 71.7% Jujuy
- 74.8% Santiago del Estero
- 69.2% Formosa
- 69.7% Salta
- 74.2% Tucumán
- 73.6% Catamarca
- 73.1% Chaco
- 77.8% Misiones
- 82.3% La Rioja
- 71.7% Corrientes
- 70.5% San Juan
- 69.6% Santa Fe
- 74.6% Córdoba
- 68.9% Entre Ríos
- 70.0% San Luis
- 65.6% Mendoza
- 78.8% La Pampa
- 79.2% Buenos Aires
- 64.2% Neuquén
- 70.8% Rio Negro
- 74.2% Chubut
- 77.7% Santa Cruz
- 70.8% Tierra del Fuego

Download throughput

Personal ranked first in Common Coverage Areas across Argentina with a median download throughput speed of 18.5 Mbps. The gap between second-placed Claro and Personal was around 4 Mbps with Claro achieving a median download speed of 14.4 Mbps. On the other hand, Claro was very closely followed by last-place Movistar, which had a median download speed of 13.7 Mbps — less than one Mbps slower than Claro. An interesting thing to note here is that Personal ranked lower than Claro in Consistent Quality results despite having the highest median download throughput. This indicates that download throughput alone cannot gauge network performance effectively.

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Median download speed in Common Coverage Areas

Personal	18.5 Mbps
Claro	14.4 Mbps
Movistar	13.7 Mbps

Upload throughput

In Common Coverage Areas across Argentina, Personal again is the winner with an upload speed of 8.4 Mbps. There is a minuscule difference of 0.3 Mbps between Personal and its close second Claro that has

an upload speed of 8.1 Mbps. Movistar has an upload throughput of 6.6 Mbps that is 1.8 Mbps and 1.5 Mbps lower than first placed Personal and second-placed Claro respectively.

TUTELA   Median upload speed in Common Coverage Areas

Operator	Median upload speed
Personal	8.4 Mbps
Claro	8.1 Mbps
Movistar	6.6 Mbps

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Latency

Latency, which determines the responsiveness of a user's network connection has now become a critical KPI in measuring network performance as an increasing number of people are engaging in activities like online gaming, video conferencing, etc. Latency results are upended in Common Coverage Areas across

Argentina where the usually last-placed Movistar was ranked first with the lowest latency of 28.4 ms, followed by Personal with a latency of 30.2 ms. Claro ranked third with the highest latency of 32.4 ms which is 4 ms higher than first placed Movistar.

TUTELA Median latency in Common Coverage Areas

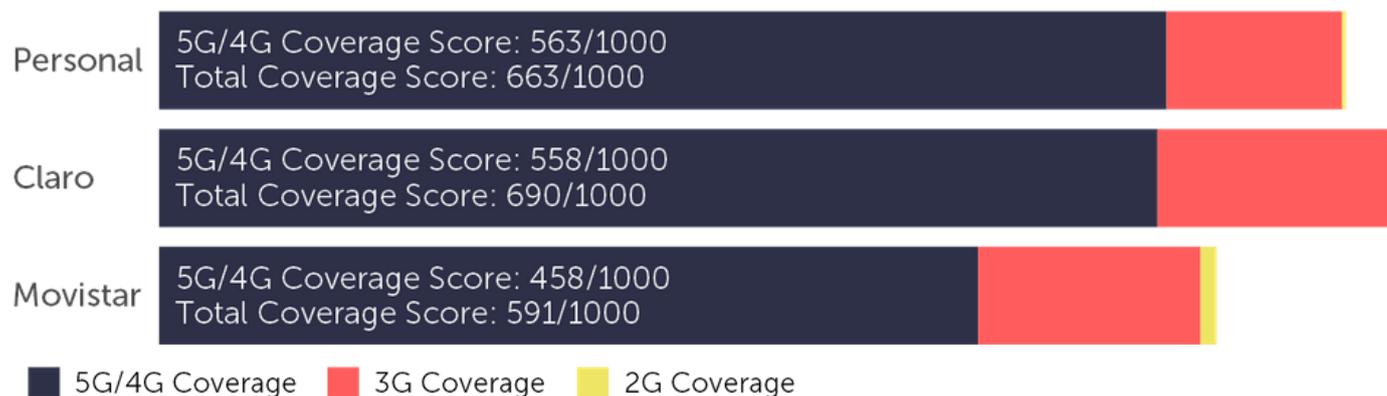|	
Movistar	28.4 ms
Personal	30.2 ms
Claro	32.4 ms

Coverage

Personal had the highest Relative Area Coverage Score of 563 for 4G/5G coverage in Argentina, followed by Claro with a score of 558. There was a notable difference of 100 points between last-placed Movistar with a score of 458 and second-placed Claro.

A different scenario played out in the case of total coverage score, where Claro took the lead with a score of 690 followed by Personal around 27 points behind with a score of 663. The substantial difference between the first and last placed operators was around 100 points in this category as well. Movistar had a total coverage score of 591. It was also observed from coverage score results that operators are still relying heavily on older network technologies, namely 2G and 3G, for a significant proportion of their total coverage footprint. Claro relies most heavily on 2G and 3G — nearly 19% of its coverage footprint is served only by the older technologies, which will be particularly limiting as users increasingly use their phones for things like video calling and online gaming, for which a 4G connection or better is virtually a requirement.

TUTELA Relative Area Coverage Score

Personal
5G/4G Coverage Score: 563/1000
Total Coverage Score: 663/1000

Claro
5G/4G Coverage Score: 558/1000
Total Coverage Score: 690/1000

Movistar
5G/4G Coverage Score: 458/1000
Total Coverage Score: 591/1000

■ 5G/4G Coverage   ■ 3G Coverage   ■ 2G Coverage

Technology usage

When it comes to the percentage of time that subscribers spend on a specific technology, the results are in line with the relative coverage score results. Personal users spent the majority of their time connected to 4G at 86.1% — however, the 13.9% of time that users spend connected to 3G is not insignificant.

The gap between Movistar users connected to 4G and Personal users connected to 4G was also notable with a difference of about 9%. Movistar subscribers used the 4G network 77.2% of the time while they were connected to 3G 22.8% of the time. Claro users spent the largest proportion of time on the older 3G technology at 26.8% as demonstrated in the relative coverage score chart as well, while 73.2% of connections were connected to a 4G network, with a gap of almost 13% between Claro and first ranked Personal.

TUTELA⩤ **Percentage of Time by Mobile Connection Type Nationwide**

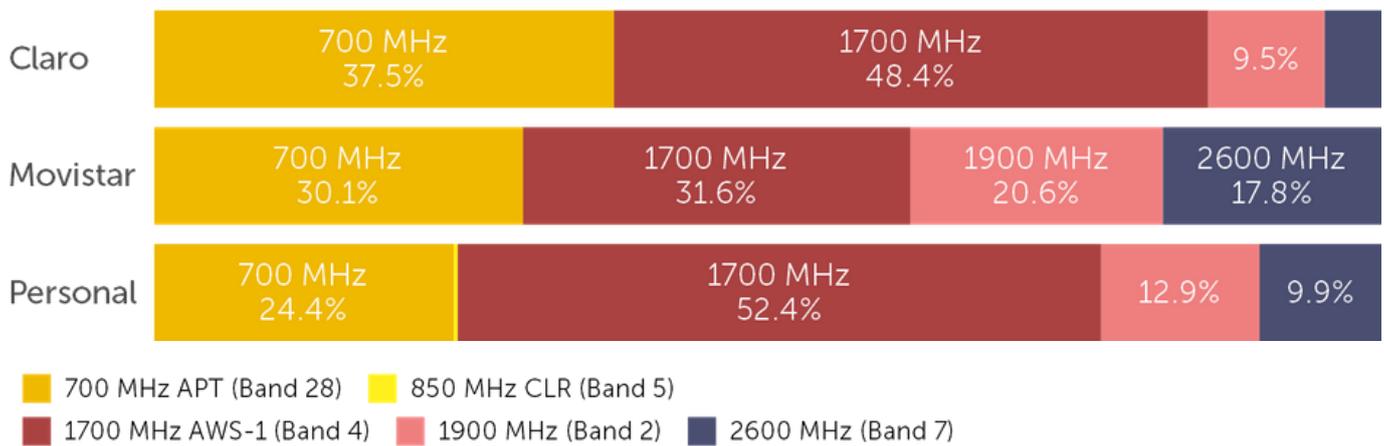|	4G	3G
Personal	4G 86.1%	3G 13.9%
Movistar	4G 77.2%	3G 22.8%
Claro	4G 73.2%	3G 26.8%
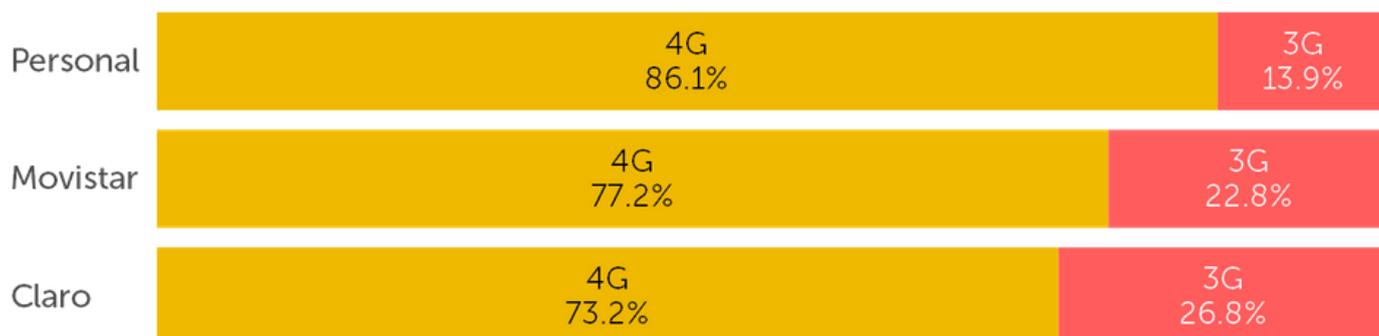
Spectrum optimization in Argentina involves operators using a mix of the low and mid-band spectrum with a small proportion of data traffic being supported on the higher 2600 MHz band. Claro and Personal have a similar spectrum distribution with over 75 percent of data traffic supported by the 700 MHz low-band and 1700MHz mid-band frequency. Claro subscribers had the lowest proportion of data usage on the 1900 MHz and 2600 MHz band at 9.5 percent and less than five percent respectively. Personal has around 22 percent of its LTE traffic being carried on 1900 and 2600 MHz bands. On the other hand, Movistar had a fairly uniform frequency distribution over low and

mid-band frequencies. While it relied on the 1700 and 1900 MHz bands for over 50 percent of its data usage and 700 MHz for about 30 percent of data traffic, it is the only operator that had a considerable volume of traffic on the 2600 MHz high-band spectrum. Movistar's observed coverage footprint is substantially less than the other operators, which may go some way to explaining how the operator is able to use high-band spectrum for more data traffic — high-band spectrum travels less far and covers less total area, which makes it more plausible to use in a smaller coverage footprint.

Mobile Data Volume by LTE Band Nationwide

Operator	700 MHz	1700 MHz	1900 MHz	2600 MHz
Claro	37.5%	48.4%	9.5%	
Movistar	30.1%	31.6%	20.6%	17.8%
Personal	24.4%	52.4%	12.9%	9.9%

Legend:
- 700 MHz APT (Band 28)
- 850 MHz CLR (Band 5)
- 1700 MHz AWS-1 (Band 4)
- 1900 MHz (Band 2)
- 2600 MHz (Band 7)

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 two billion total records between April 1st and September 30th, 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

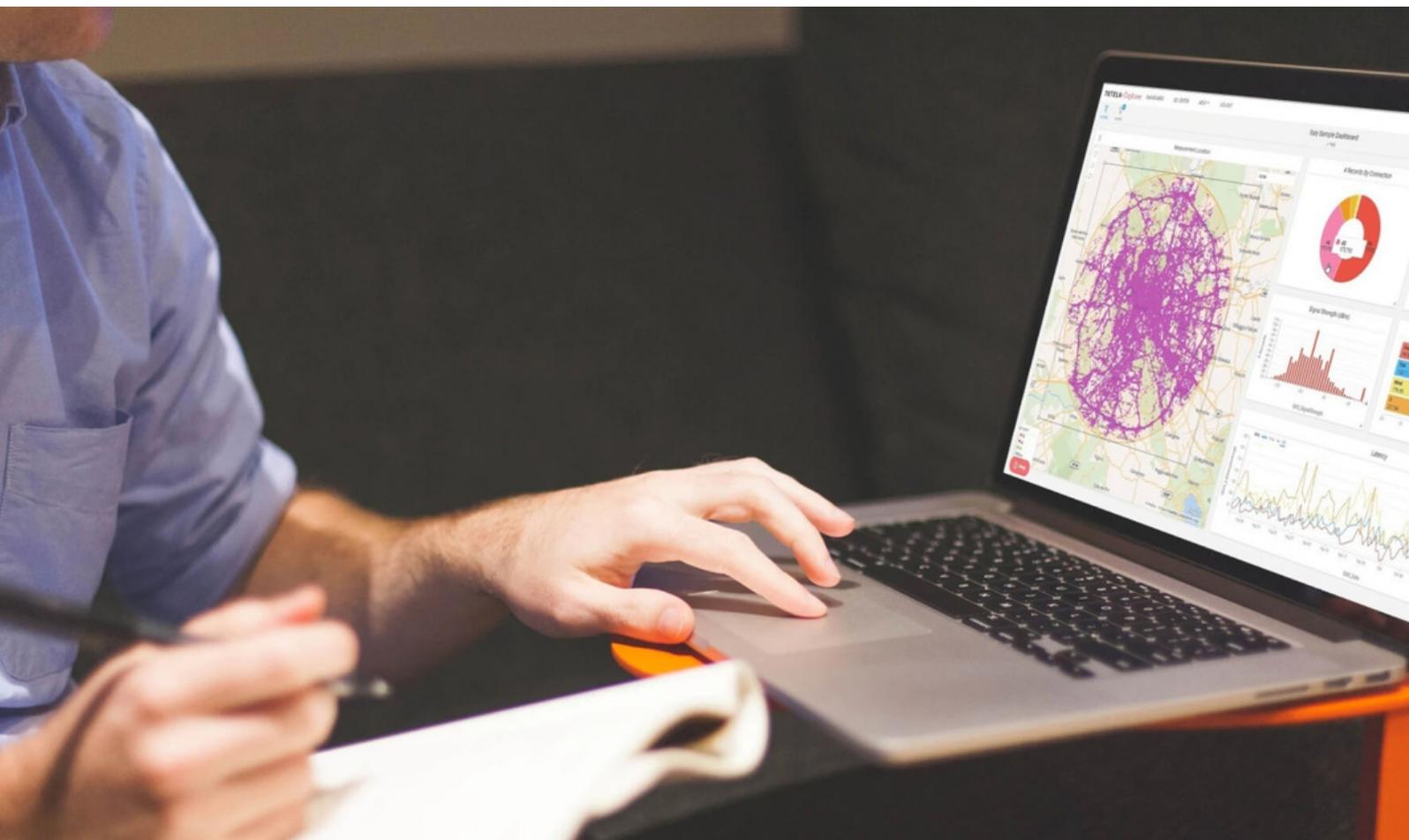| KPI	Download throughput	Upload throughput	Latency	Jitter	Packet loss	Time to first byte
Minimum acceptable value	1.5 Mbps	500 Kbps	100 ms	50 ms	5%	10.67 s

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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

TUTELA Results Overview in Common Coverage Areas

	Download Throughput	Upload Throughput	Latency	Excellent CQ	Core CQ
Claro	14.4 Mbps ± 0.04 Mbps	8.1 Mbps ± 0.02 Mbps	32.4 ms ± 0.040 ms	74.84% ± 0.12%	87.48% ± 0.07%
Movistar	13.7 Mbps ± 0.05 Mbps	6.6 Mbps ± 0.03 Mbps	28.4 ms ± 0.035 ms	60.92% ± 0.16%	78.92% ± 0.08%
Personal	18.5 Mbps ± 0.06 Mbps	8.4 Mbps ± 0.03 Mbps	30.2 ms ± 0.039 ms	70.07% ± 0.12%	80.64% ± 0.06%

TUTELA Results Overview Nationwide

	Download Throughput	Upload Throughput	Latency	Excellent CQ	Core CQ
Claro	14.0 Mbps ± 0.04 Mbps	7.7 Mbps ± 0.02 Mbps	34.0 ms ± 0.031 ms	71.70% ± 0.11%	85.35% ± 0.06%
Movistar	13.3 Mbps ± 0.05 Mbps	6.3 Mbps ± 0.03 Mbps	29.4 ms ± 0.048 ms	58.66% ± 0.15%	77.07% ± 0.08%
Personal	17.8 Mbps ± 0.05 Mbps	8.0 Mbps ± 0.02 Mbps	31.9 ms ± 0.025 ms	64.89% ± 0.11%	76.41% ± 0.06%

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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