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Canada

State of Mobile Experience

Analysts
Chris Mills
Fi Armstrong

Annual Report

www.tutela.com

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Introduction

COVID-19 has driven an unprecedented change for Canada's telecoms operators: millions of people switched from a commute-to-the-office, travel-for-weekends approach, driving near-overnight changes in network usage. Planned 5G investment has been delayed[1], while mobile networks in some areas — suburbs that have had to handle a surge in working from home, for example — have been under strain in a way they were never designed for.

Nonetheless, Canada has retained its status as a world leader in mobile network performance. In Tutela's 2020 Global Mobile Experience report, Canada ranked fourth for median download speed – just behind Switzerland, Singapore and the Netherlands. However, that is not to say that the landscape is without its challenges. While Canada did well in Tutela's mobile experience comparisons (ranking 26th for Excellent Consistent Quality, and joint 23rd for Core Consistent Quality), there is still room for improvement when it comes to user experience.

In order to benchmark mobile experience over the last six months, Tutela has evaluated nearly 900,000 speed and latency tests, conducted on the smartphones of real-world users of national mobile operators within Common Coverage Areas, between September 1st 2020 and February 28th, 2021.

[1] CBC, Ottawa delays 5G spectrum auction because of COVID-19
https://www.cbc.ca/news/business/5g-spectrum-auction-1.5600474
Retrieved 12/03/21

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Key findings

- Canada's status as a nation with high-performing wireless networks was once again on display, as all operators reported performance results — particularly download throughput — well above the average in many other countries.

- Telus led for mobile experience, both for demanding and day-to-day applications (Excellent and Core Consistent Quality), as well as tying for fastest median download speed with Bell

- Rogers and Bell both also managed to win one distinct category apiece, with Rogers taking the lead for the fastest median upload speed, and Bell demonstrating the most responsive connections with the best median latency

- With additional spectrum yet to be deployed for 5G, Canada's status as a frontrunner for network performance will require further investment in the short-to-medium run. The spectrum auctions coming up this year[2] — and how quickly operators are able to deploy new spectrum — will be critical for Canada's wireless future, at least on the global stage.

[2] RCR Wireless, Canada postpones 3.5GHz spectrum auction due to COVID-19 https://www.rcrwireless.com/20200609/5g/canada-postpones-spectrum-auction-covid-19 Retrieved 12/03/21

Results overview

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Mobile experience results

Canada, March 2021

	TELUS	Bell	ROGERS
Excellent Consistent Quality	⭐ Winner		
Core Consistent Quality	⭐ Winner		
Download throughput	★ Draw	★ Draw	
Upload throughput			⭐ Winner
Latency		⭐ Winner	
Coverage	★ Draw	★ Draw	

Results from nearly 900,000 speed and latency tests, conducted on the smartphones of real-world users of national mobile operators within Common Coverage Areas, between September 1st 2020 and February 28th, 2021.

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

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Best Mobile Network Experience

MARCH 2021

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
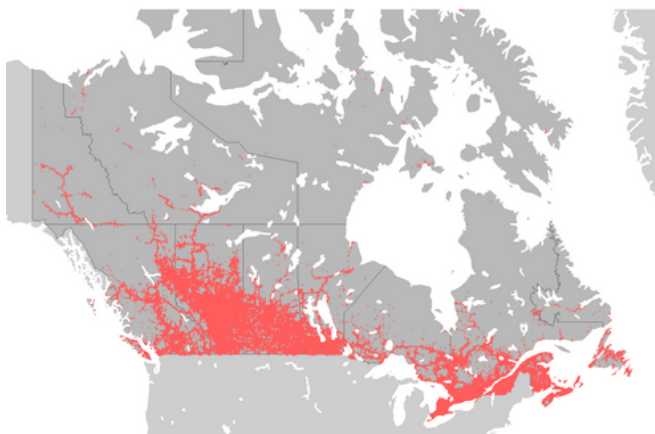
Common Coverage Areas
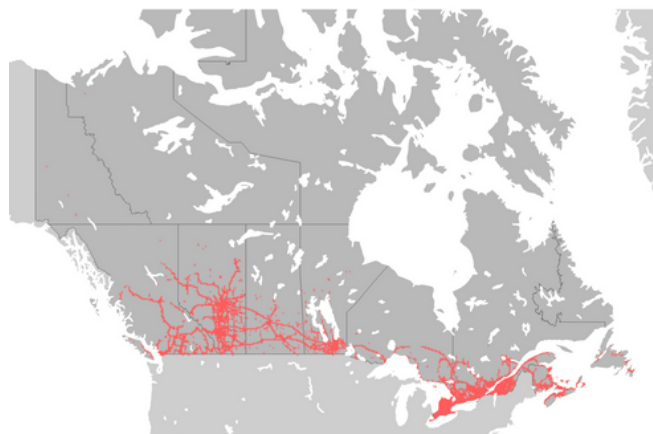
Consistent Quality

Telus was the clear winner for mobile network experience in Canada, taking home the top spot for both Excellent Consistent Quality (88.4%) and Core Consistent Quality (95.2%) – two sets of thresholds that Tutela used to represent how often a connection is good enough to support a range of popular application types.

Excellent Consistent Quality is Tutela's metric that represents how often connections are good enough for demanding applications like 1080p video streaming, HD group video calling and real-time mobile gaming. Meanwhile, Core

Consistent Quality represents how often consumers can access applications like SD video streaming, social media sharing or web browsing.

Rogers placed second for Excellent Consistent Quality at 82.7%; however, it was beaten by Bell for second place for Core Consistent Quality, with Bell scoring 92.9% on this metric. This means subscribers to Rogers' services may get a better experience more often for HD video and similar applications, but subscribers on Bell may be able to stream SD video or browse social media more regularly than those on Rogers.

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Consistent Quality Percentage in Common Coverage Areas

Telus	Excellent 88.4%	
Rogers	Excellent 82.7%	
Bell	Excellent 82.0%	Core 92.9%
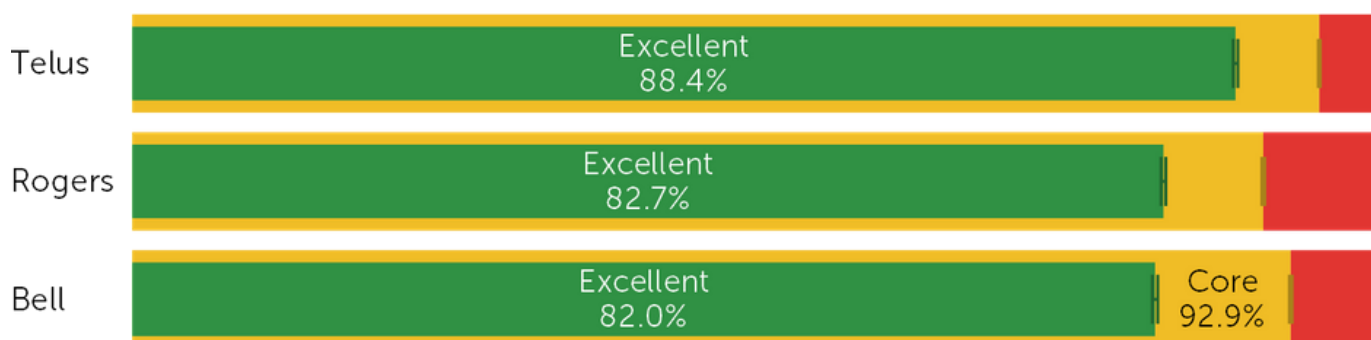
Download throughput

Bell and Telus tied for the fastest median download throughput, delivering speeds in excess of 40 Mbps on average. Rogers was then a small step behind, at 37.4 Mbps. For subscribers on all three major operators, the median speed was far in excess of the requirements for many mobile services –

Netflix, for example, only recommends 25 Mbps for its Ultra HD services[3]. This, coupled with the fact that just 5 Mbps separated first and third place, means that for speed-critical applications, Canadian subscribers get among the best experiences in the world[4].

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Median Download Speed in Common Coverage Areas

Operator	Speed
Bell	42.4 Mbps
Telus	42.2 Mbps
Rogers	37.4 Mbps

[3] Netlfix, Internet Connection Speed Recommendations
https://help.netflix.com/en/node/306
Retrieved 12/03/21

[4] Tutela, Global Mobile Experience Report 2020
https://www.tutela.com/hubfs/Blog%20Images/Global%20report%202020/Global%20Mobile%20Experience%20Report%202020.pdf
Retrieved 12/03/21

Upload throughput

For median upload speed, the results were remarkably close, with just 1 Mbps separating the operators. However, Rogers inched out a win in this category with a median speed of 15.8 Mbps. Once again, Bell and Telus tied when taking error margins into consideration, this time for second place.

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Median Upload Speed in Common Coverage Areas

Operator	Speed
Rogers	15.8 Mbps
Telus	15.0 Mbps
Bell	14.8 Mbps

Latency

For median one-way latency, Bell took the top spot, with a result of 17.1 ms. Telus placed second at 17.8 ms, while Rogers was third at 19.1 ms. All three were well below the 50 ms threshold on average that Tutela uses as part of Excellent Consistent Quality metric, suggesting that the vast majority of the time, subscribers' connections should be able to handle latency-sensitive applications like group video calling or realtime gaming – where lags in connection can become a significant irritation.

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Median Latency in Common Coverage Areas

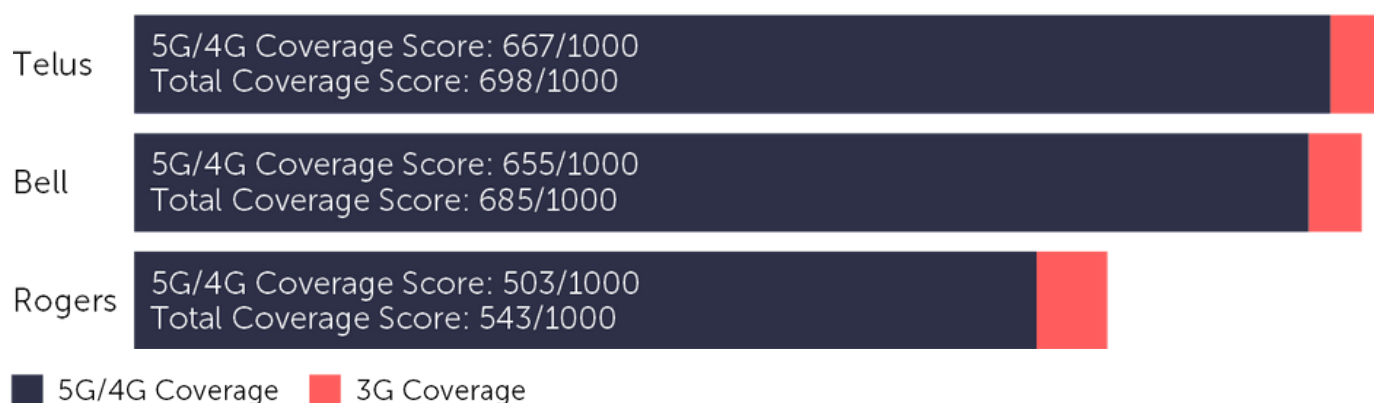| Carrier	Latency
Bell	17.1 ms
Telus	17.8 ms
Rogers	19.1 ms
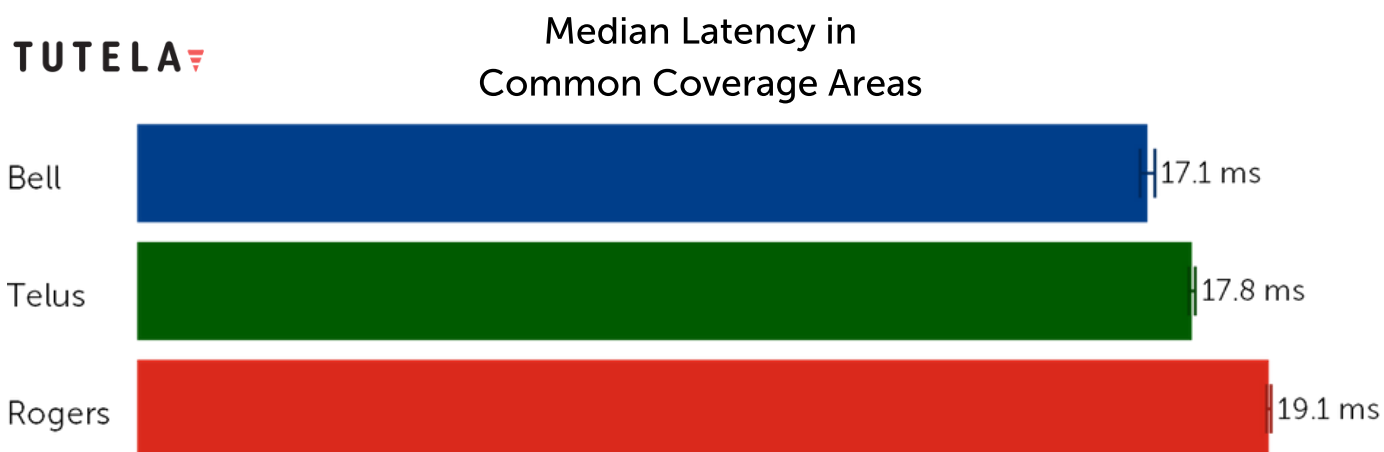
Coverage

Bell and Telus have virtually identical relative area coverage scores — unsurprising, since Bell and Telus share radio infrastructure. The incredibly close scores between the two operators are within the uncertainty of the coverage score (which is approximately 1%), resulting in a tie between the two operators for first place in both 5G/4G and Total

Coverage. Rogers, meanwhile, lags behind Bell and Telus for both total and 5G/4G coverage. All three operators have a similar (relatively small) proportion of their network covered by only 3G technology, which is reflected in the relatively similar proportion of time that subscribers for all three networks spend connected to 3G.

TUTELA Relative Area Coverage Score

Telus
5G/4G Coverage Score: 667/1000
Total Coverage Score: 698/1000

Bell
5G/4G Coverage Score: 655/1000
Total Coverage Score: 685/1000

Rogers
5G/4G Coverage Score: 503/1000
Total Coverage Score: 543/1000

■ 5G/4G Coverage   ■ 3G Coverage

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.
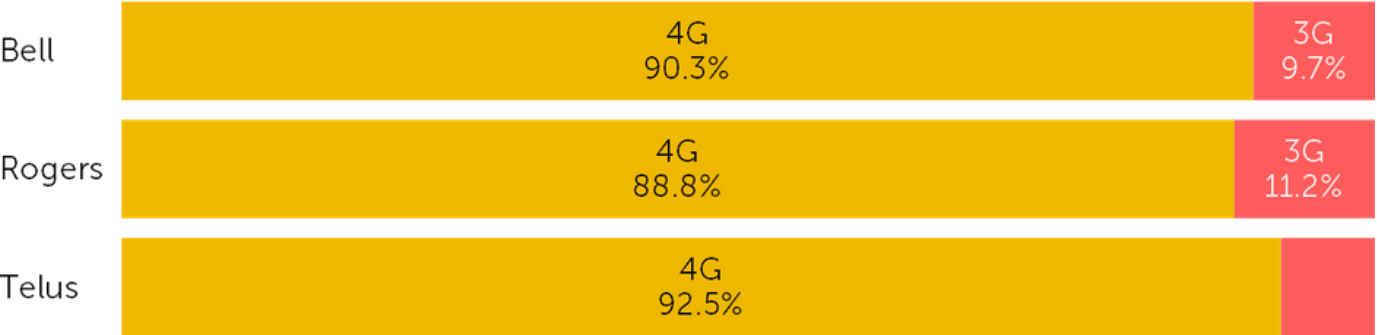
Technology usage

All three operators use a similar mixture of spectrum. Although there is a diverse mix of bands used on paper — largely due to the fragmentation of 700 MHz spectrum into a number of different bands — the formula for all three operators is relatively similar: 20-30% of data traffic uses low-band spectrum as the primary band, mid-band 1700 MHz and 1900 MHz carries the bulk of the traffic, and the 2600 MHz band serves as supplemental capacity. The only major difference is the proportion of traffic that uses low-band spectrum, which is around 5% higher for Bell and Telus compared to Rogers.

For the proportion of time spent on 3G vs 4G, all three operators are again relatively similar. Telus users spend the greatest proportion of their time on 4G, with Bell in the middle. Rogers was the only operator to see users spend over 10% of their time connected to the older mobile technology.
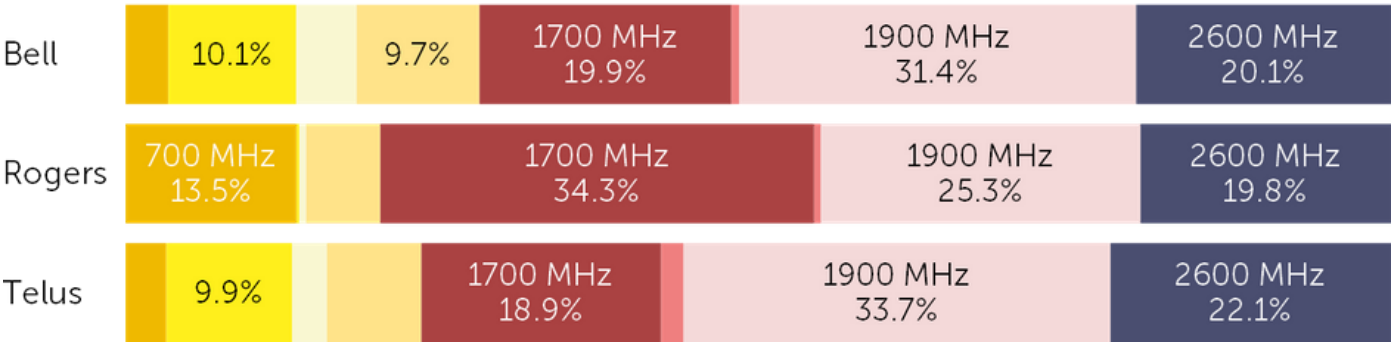
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Percent of Time by Mobile Connection Type Nationwide

Bell	4G 90.3%	3G 9.7%
Rogers	4G 88.8%	3G 11.2%
Telus	4G 92.5%	

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Mobile Data Volume by LTE Band Nationwide

Bell	10.1%	9.7%	1700 MHz 19.9%	1900 MHz 31.4%	2600 MHz 20.1%
Rogers	700 MHz 13.5%		1700 MHz 34.3%	1900 MHz 25.3%	2600 MHz 19.8%
Telus	9.9%		1700 MHz 18.9%	1900 MHz 33.7%	2600 MHz 22.1%

- 700 MHz AC (Band 12)
- 700 MHz C (Band 13)
- 700 MHz BC (Band 17)
- 700 MHz APT (Band 28)
- 850 MHz CLR (Band 5)
- 1700 MHz AWS-1 (Band 4)
- 1700 MHz Extended AWS (Band 66)
- 1900 MHz (Band 2)
- 2600 MHz (Band 7)

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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 nearly 900,000 speed and latency tests, between September 1st 2020 and February 28th, 2021.

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

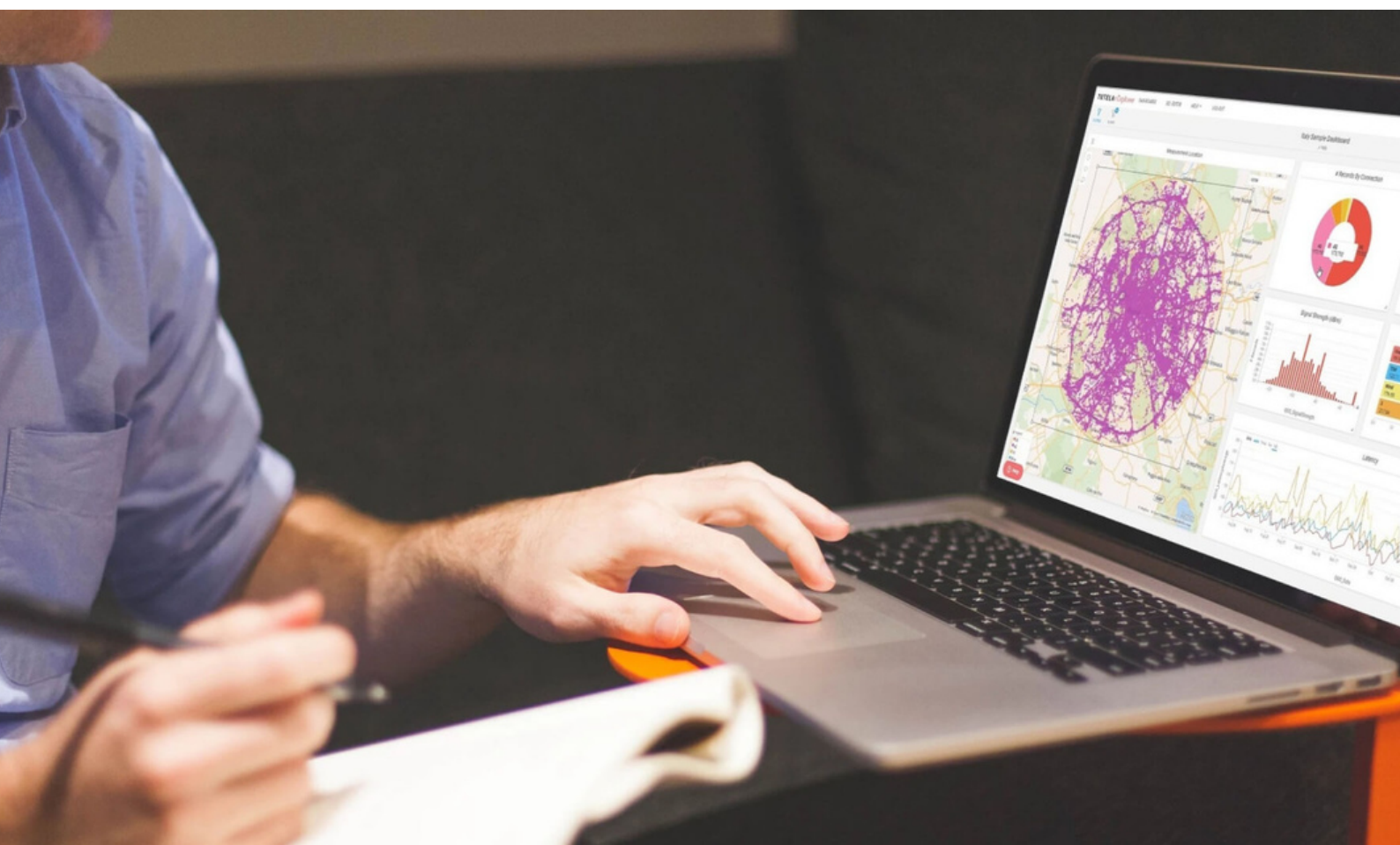| KPI	Download throughput	Upload throughput	Latency	Jitter	Packet loss	Time to first byte
Minimum acceptable value	1.5 Mbps	500 Kbps	100 ms	50 ms	5%	10.67 s

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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

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Results Overview in Common Coverage Areas

	Download Throughput	Upload Throughput	Latency	Excellent CQ	Core CQ
Bell	42.4 Mbps ± 0.23 Mbps	14.8 Mbps ± 0.09 Mbps	17.1 ms ± 0.126 ms	82.00% ± 0.22%	92.88% ± 0.11%
Rogers	37.4 Mbps ± 0.16 Mbps	15.8 Mbps ± 0.09 Mbps	19.1 ms ± 0.040 ms	82.67% ± 0.19%	90.67% ± 0.11%
Telus	42.2 Mbps ± 0.23 Mbps	15.0 Mbps ± 0.12 Mbps	17.8 ms ± 0.055 ms	88.45% ± 0.19%	95.17% ± 0.08%

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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