TUTELA

India

State of Mobile Networks

Analysts

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Annual Report

MARCH 2020

www.tutela.com

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Introduction

India's telecoms industry has become a fight as much for survival as for network dominance as disputes over revenues subject to tax have lead to potential difficulties for both Airtel(1) and Vodafone Idea(2), while Jio, the youngest national operator in India, has now become the leading operator by both market share and revenue(3). This level of disruption, coupled with the upcoming merger of BSNL and MTNL(4) and the advent of 5G networks potentially at some point in the next year(5) makes it a pivotal moment in the industry as each operator looks to make the most of the current changes, or even just weather the storm.

(1) Quartz Indoa, Despite $5 billion dues and Jio's wrath, Airtel is not hanging up just yet
https://qz.com/india/1789011/airtel-fights-vodafone-idea-slips-in-india-telecom-game-with-jio/
Retrieved 27 February 2020

(2) The Economic Times, If Vodafone Idea disconnects, India picks up the bill
https://economictimes.indiatimes.com/industry/telecom/telecom-news/if-vodafone-idea-disconnects-india-picks-up-the-bill/articleshow/74191481.cms
Retrieved 27 February 2020

(3) Live Mint, Jio is now the largest telecom player in both revenue, market share: Report
https://www.livemint.com/industry/telecom/jio-is-now-the-largest-telecom-player-in-both-revenue-customers-base-report-11580184164761.html
Retrieved 27 February 2020

(4) The Economic Times, BSNL, MTNL to be merged; Cabinet approves four-way revival plan
https://economictimes.indiatimes.com/news/economy/policy/bsnl-mtnl-to-be-merged-cabinet-approves-four-way-revival-plan-for-the-two/articleshow/71721833.cms?from=mdr
Retrieved 27 February 2020

(5) Telecom Regulatory Authority of India, Enabling 5G in India
https://main.trai.gov.in/sites/default/files/White_Paper_22022019_0.pdf
Retrieved 27 February 2020

However, when it comes to the day-to-day experience of subscribers, macro trends like tax policy, mergers and new technology only matter through one lens - will this help me do the things I want to do on my mobile phone, at the time and in the place I want to do them? In Tutela's Global Mobile Experience report, published in September 2019, India ranked 79th globally for Excellent Consistent Quality – Tutela's measure of how often networks are good enough for a range of use cases including HD group video calls and 1080p video streaming – and 90th for Core Consistent Quality, a measure of mobile experience for uses such as social media usage, web browsing or SD video streaming. This indicates there may still be work to do in ensuring that India's networks can compete on a global level despite its unique challenges with managing congestion and ensuring mobile services not only across large geographic areas, but also with the capacity required to ensure reliable services in dense urban areas.

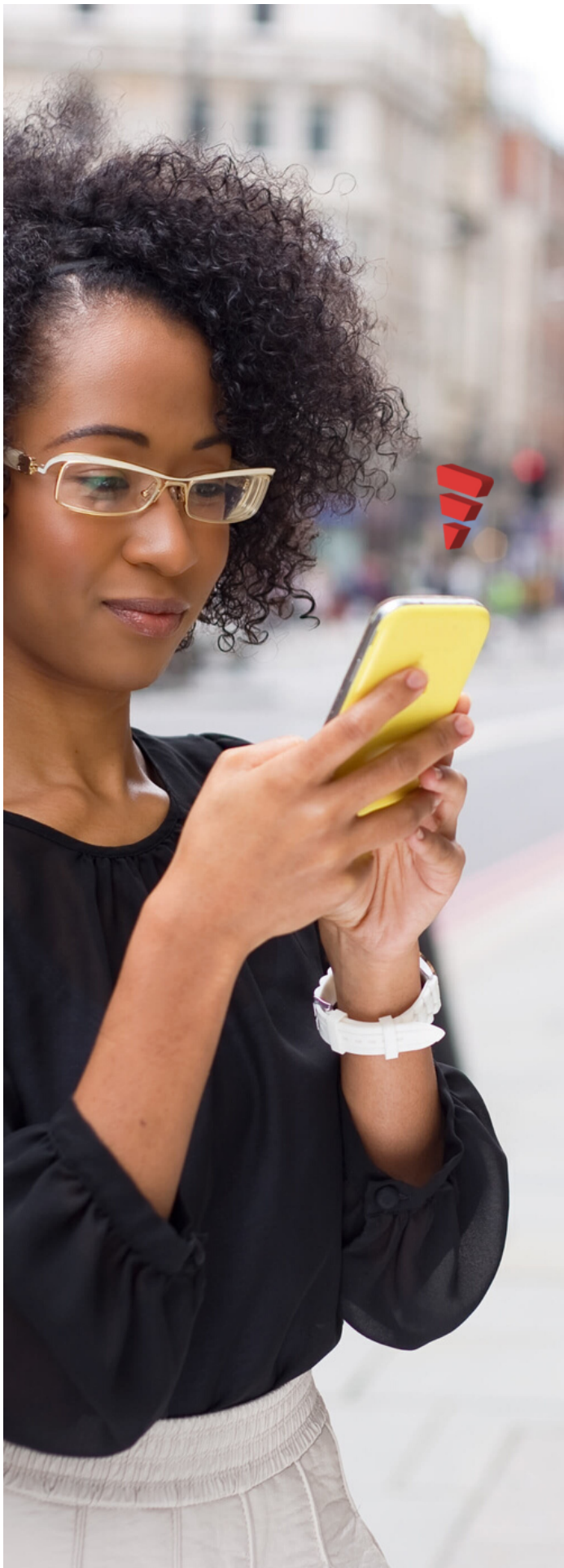
Tutela's report examines the current state of mobile network experience in India, using over 573 billion measurements collected between August 1st, 2019 and January 31st, 2020. This includes over 65 million speed tests, and more than 900 million latency tests.

Key findings

- Airtel was impressive all-round in Tutela's analysis – taking the top spot across four categories including Excellent Consistent Quality (59.2%), median download throughput (7.4 Mbps) and latency (26.2 ms)

- Vodafone Idea and Jio vied for second place across many metrics, coming joint second for Excellent Consistent Quality. However, Vodafone Idea placed top for median upload speed overall at 3.7 Mbps, while Jio was a clear second for Core Consistent Quality at 86.7%

- Unusually, higher rates of 4G penetration do not necessarily lead to better performance. Jio's all-4G network is outperformed by Airtel, where users still spend about 10% of time on 3G, and competes most closely with Vodafone Idea where users are on 3G as much as 27% of the time.



Results overview

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Mobile experience results

India, March 2020

	airtel	vodafone idea	Jio	BSNL
Excellent Consistent Quality	★ Winner			
Core Consistent Quality	★ Winner			
Download throughput	★ Winner			
Upload throughput		★ Winner		
Latency	★ Winner			

Results from over 573 billion measurements collected between August 1st, 2019 and January 31st, 2020 in India.

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

TUTELA
Best Mobile Network Experience
MARCH 2020

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

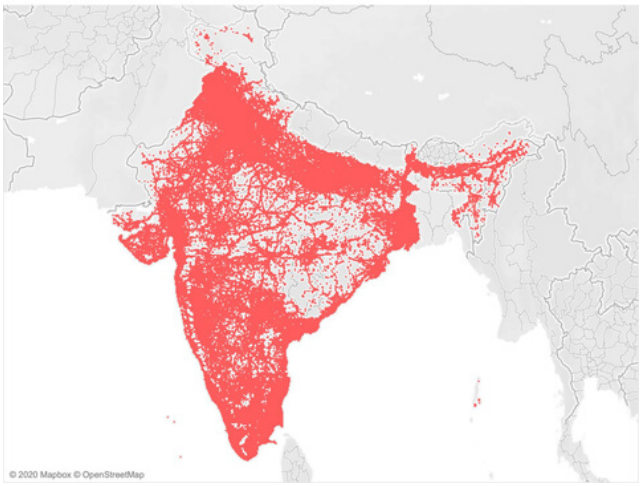
Understanding this report

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.

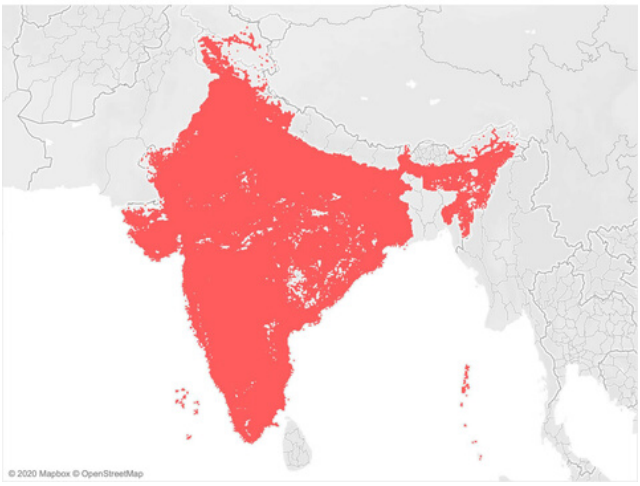
The methodology is covered in detail at the end of this report and on our website, but simply put, there are two sets of thresholds, Excellent and Core. A connection that hits the Excellent threshold is sufficient for use-cases like 1080p video streaming or multiplayer gaming, while a Core connection 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.

TUTELA Common Coverage Areas



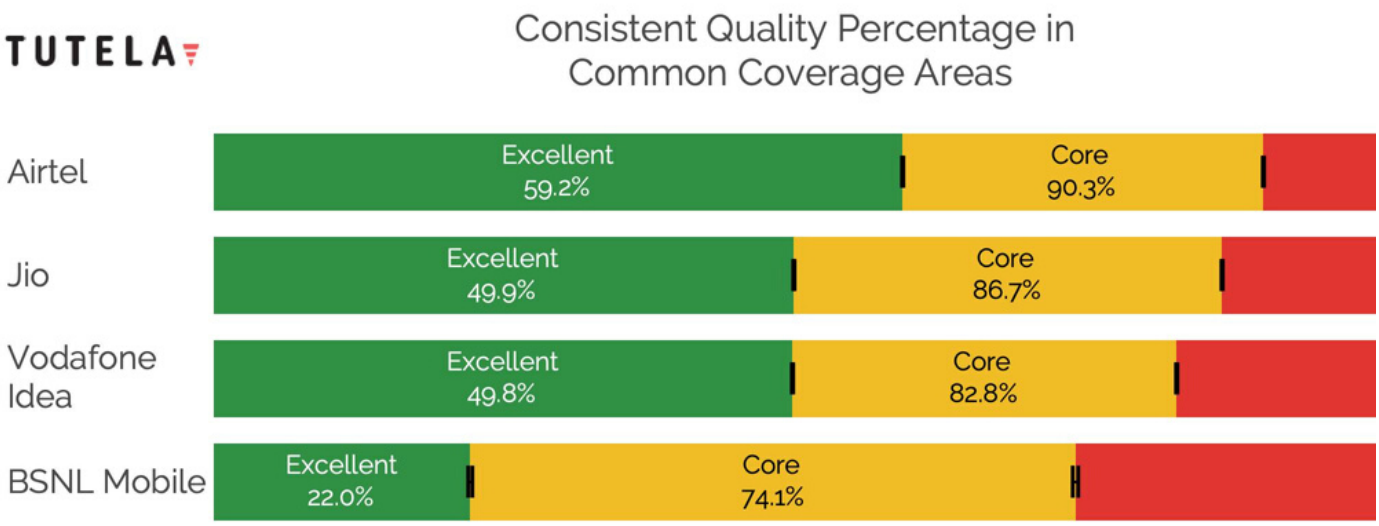
TUTELA Measurement Locations



Consistent Quality

Airtel had a noticeable lead for Excellent Consistent Quality – nearly 10% better than joint second-place Jio and Vodafone Idea. This means that Airtel users have a network connection good enough for a range of use cases including 1080p video streaming, HD group video calls and realtime gaming one in 10 times more often than users on the next-best networks.

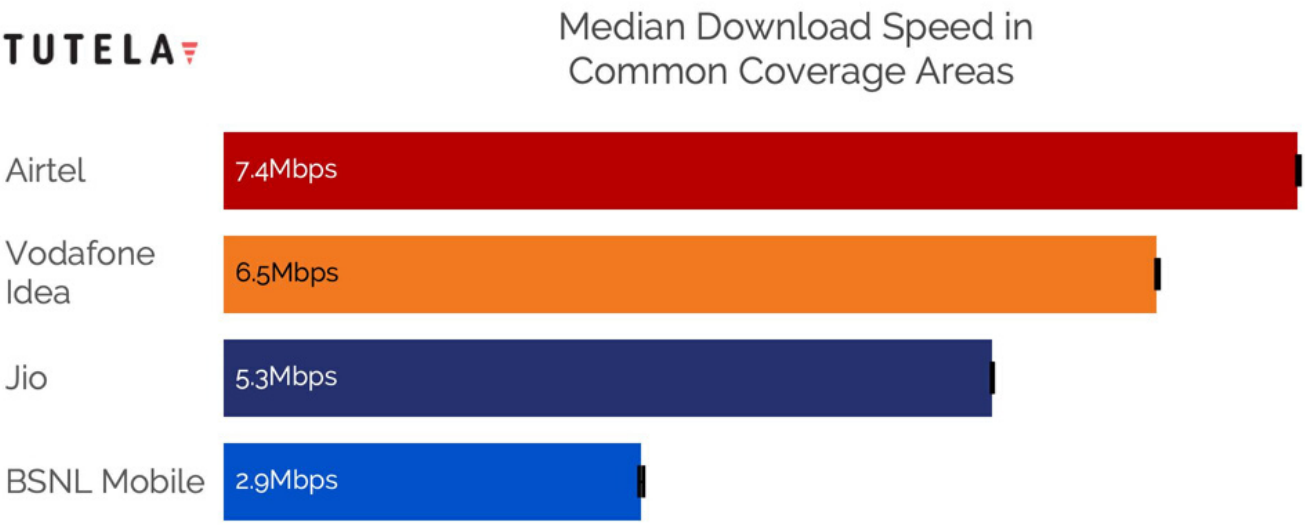
However, the gap for Core Consistent Quality was much less drastic. Although Airtel's Core Consistent Quality was still highest – with Airtel users having a mobile connection good enough for a range of day-to-day use cases such as SD video streaming, web browsing and social media sharing over 90% of the time – Jio was just 3.6% behind.



Download throughput

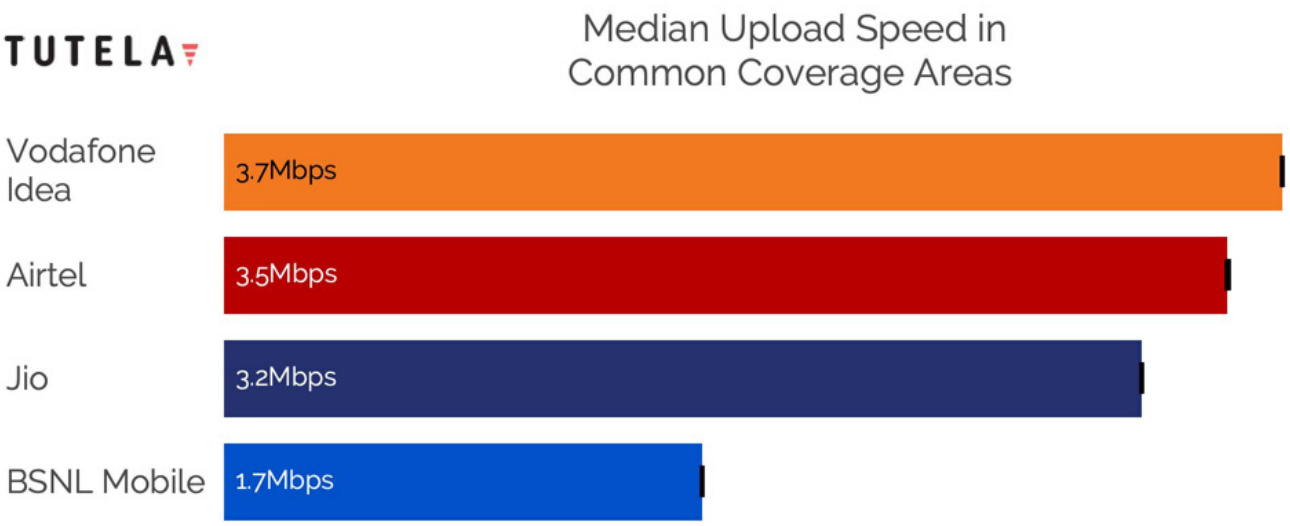
Airtel was also the fastest network, offering its users a median download speed of 7.4 Mbps. However, what is particularly interesting is how Vodafone Idea demonstrates a significantly better median download speed than Jio, with which it drew for Excellent Consistent Quality.

BSNL's low median download speed goes some way to explaining its Excellent Consistent result – its median of 2.9 is well below the 5 Mbps threshold that Tutela uses for Excellent Consistent Quality, meaning that the majority of tests fail on this threshold alone.



Upload throughput

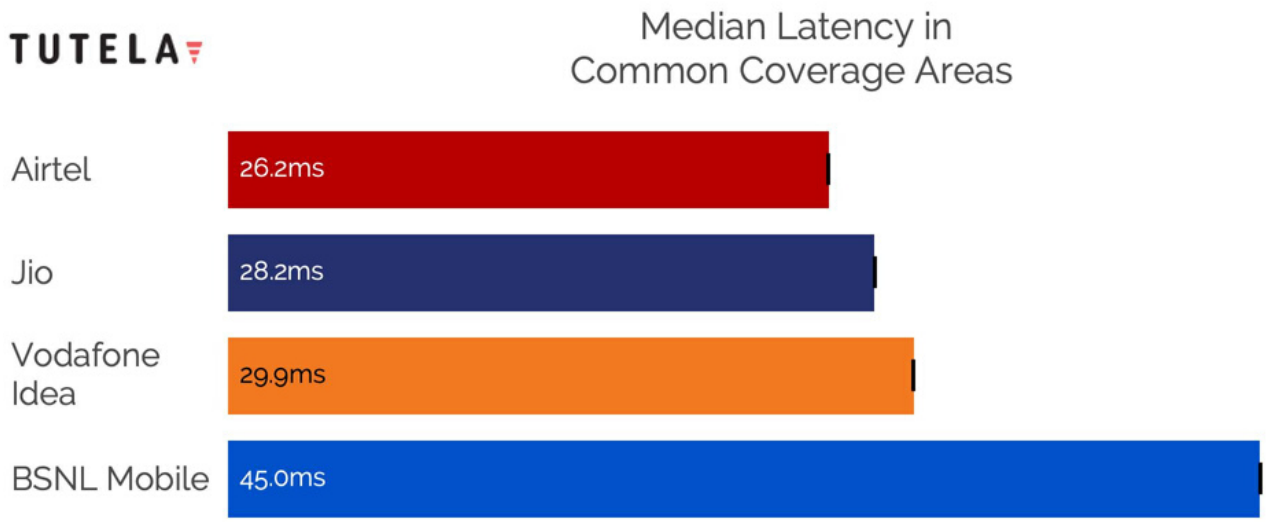
For median upload speed, Vodafone Idea takes the top spot, with a 0.2 Mbps lead over second-place Airtel. Vodafone Idea, Airtel and Jio all finished within 0.5 Mbps of each other, with BSNL noticeably behind. However, even BSNL's median upload speed passed the 1.5 Mbps threshold Tutela uses for Excellent Consistent Quality. Upload throughput is important for uses such as adding photos on social media, as well as real-time two-way connections such as video calls where sending data is just as important as receiving it.



Latency

Airtel topped the rankings for median latency, with a one-way latency of 26.2 ms. Meanwhile, Jio pushed ahead of Vodafone Idea for second place at 28.2 ms. This is likely due to its reliance on 4G network connection technology – which has historically offered dramatically better latency than 3G. It's interesting however that Airtel, who still has about 10.6% of its data traffic run over a 3G connection, managed to beat Jio overall for median latency.

BSNL's latency was notably worse than its competitors, likely a facet of the network being overwhelmingly 3G-based. Although its median one-way latency of 45.0 ms was below the 50 ms threshold Tutela uses for Excellent Consistent Quality, the network likely won't feel as responsive as the others for use-cases that rely on real-time data transfer such as VOIP calls or even just sending and receiving files or playing an online mobile video game.



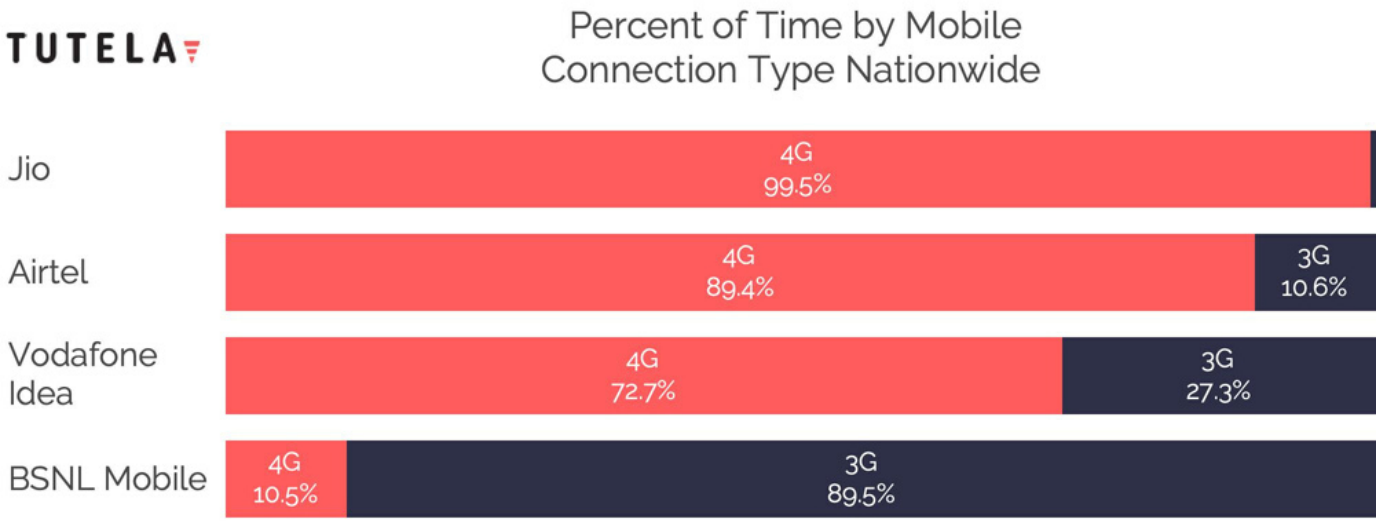
Technology usage

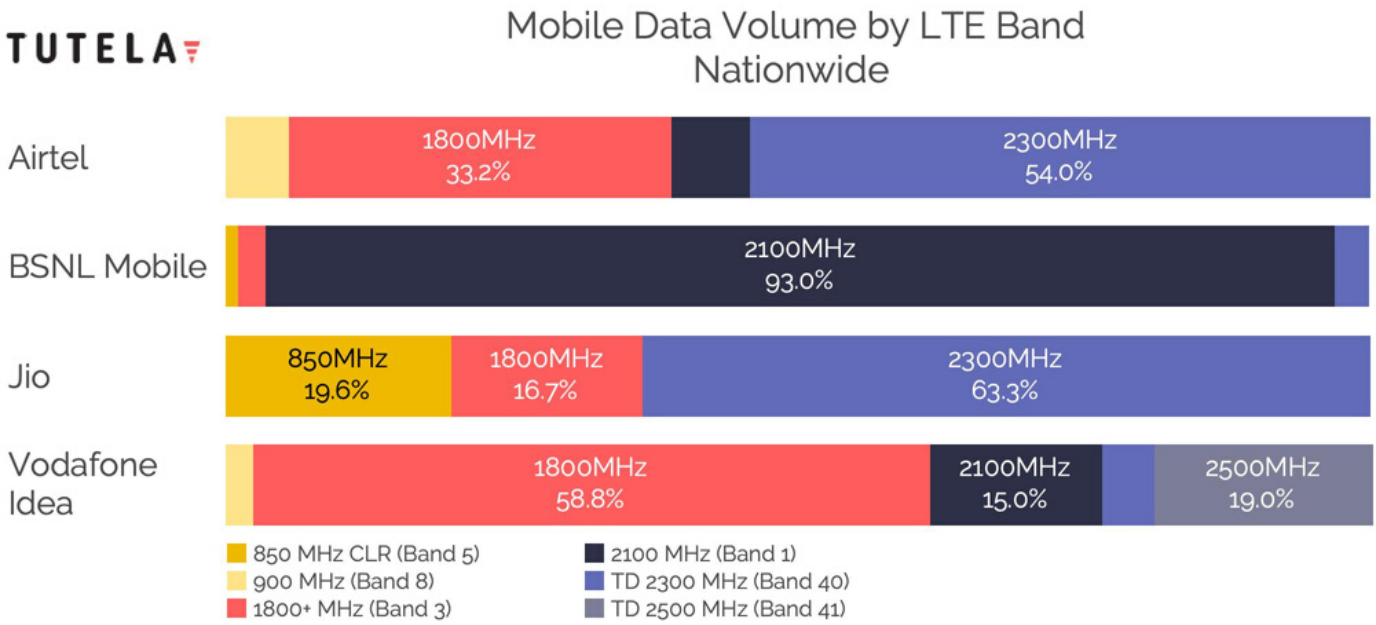
Jio and BSNL's networks are almost polar opposites. Jio users are almost universally on 4G, with a tiny proportion of 3G records likely from when users roamed onto other networks, while BSNL relies predominantly on 3G with limited 4G rollouts in select circles(6). Where BSNL has rolled out 4G, it relies exclusively on 2100 Mhz spectrum – a higher band option that likely offers good capacity but limited reach and in-building performance. The fringe amount of data on other spectrum bands is likely from users roaming onto the Jio network(7).

(6) Gizbot, Bouygues, When Will BSNL Launch Its 4G Services In All Circles? https://www.gizbot.com/telecom/features/when-will-bsnl-launch-its-4g-services-in-all-circles-065767.html
Retrieved 27 February 2020

(7) Bloomberg, Reliance Jio, BSNL In Intra-Circle Roaming Pact For 2G, 4G https://www.bloombergquint.com/business/reliance-jio-bsnl-in-intra-circle-roaming-pact-for-2g-4g
Retrieved 27 February 2020

A tendency towards higher-band spectrum is one shared by both Airtel and Jio - with 54.0% and 63.3% of LTE mobile data traffic respectively using 2300 MHz spectrum, likely with similar limitations to the BSNL spectrum. One interesting difference, however, is Jio's use of lower-band 850 MHz spectrum (accounting for 19.6% of LTE data traffic). Lower band spectrum tends to perform well for covering larger distances such as more rural areas or providing reliable indoor performance in cities. This may be a contributing factor in why, although Jio had a lower median download throughput compared to Vodafone Idea, the two delivered identical Excellent Consistent Quality, while Jio also offered better Core Consistent Quality than Vodafone Idea.





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 used over 573 billion measurements collected between August 1st, 2019 and January 31st, 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. 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%

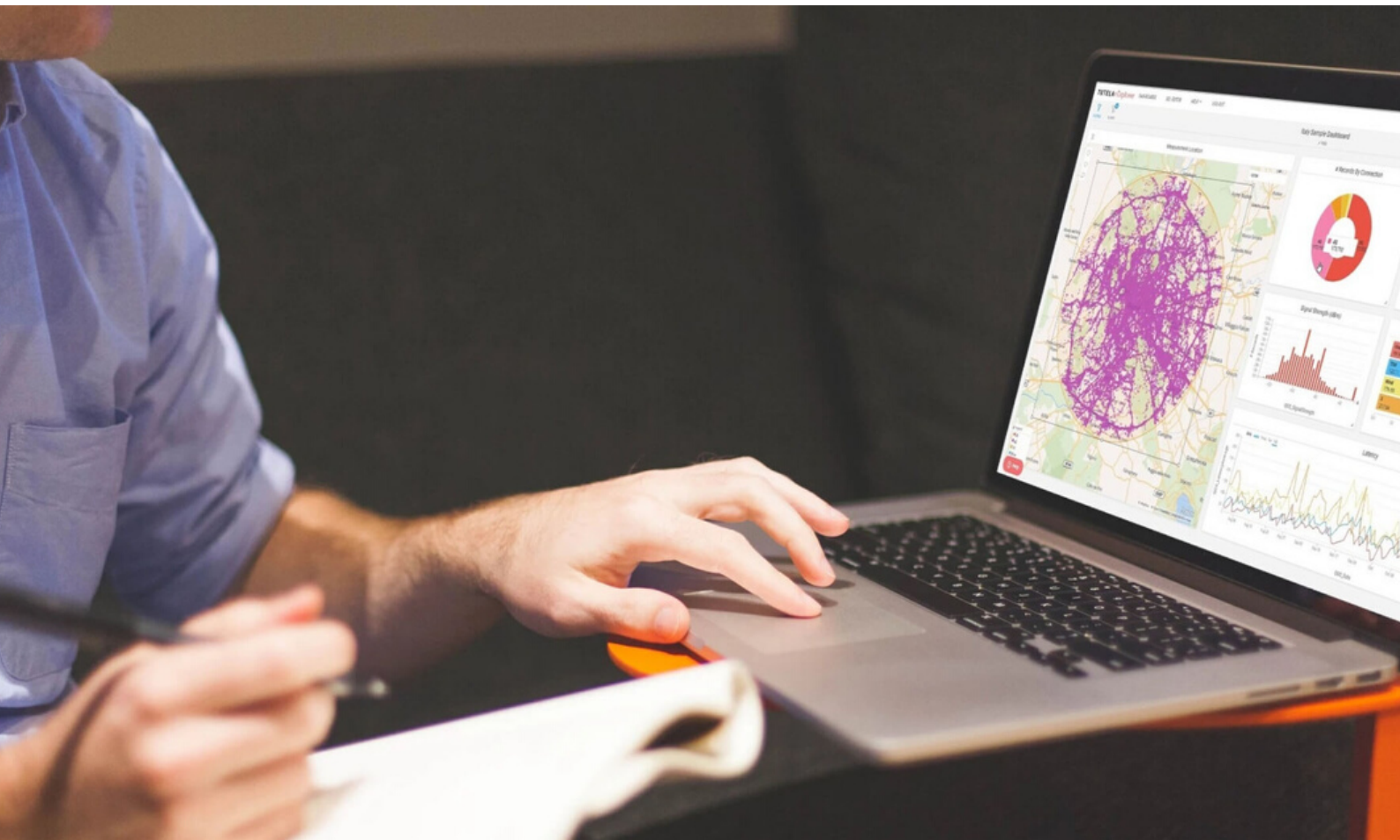
Discover Tutela Explorer

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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Common Coverage Areas Results Overview

	Median Download (Mbps)	Download Error Margin (Mbps)	Median Upload (Mbps)	Upload Error (Mbps)	Median Latency (ms)	Latency Error Margin (ms)	Excellent CQ (%)	Excellent CQ Error Margin (%)	Core CQ (%)	Core CQ Error Margin (%)
Airtel	7.4	0.01	3.5	0.00	26.2	0.00	59.2	±0.05	90.3	±0.03
BSNL Mobile	2.9	0.01	1.7	0.00	45.0	0.01	22.0	±0.19	74.1	±0.20
Jio	5.3	0.00	3.2	0.00	28.2	0.00	49.9	±0.04	86.7	±0.03
Vodafone Idea	6.5	0.01	3.7	0.00	29.9	0.00	49.8	±0.06	82.8	±0.05

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Nationwide Results Overview

	Median Download (Mbps)	Download Error Margin (Mbps)	Median Upload (Mbps)	Upload Error (Mbps)	Median Latency (ms)	Latency Error Margin (ms)	Excellent CQ (%)	Excellent CQ Error Margin (%)	Core CQ (%)	Core CQ Error Margin (%)
Airtel	7.5	0.01	3.5	0.00	26.6	0.00	59.24	±0.05	90.2	±0.03
BSNL Mobile	2.9	0.01	1.7	0.00	45.1	0.01	21.96	±0.18	74.0	±0.19
Jio	5.4	0.01	3.1	0.00	28.5	0.00	50.00	±0.04	86.7	±0.02
Vodafone Idea	6.5	0.01	3.6	0.00	30.0	0.00	49.75	±0.06	82.7	±0.05

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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