



TUTELA 

Global Mobile Experience

Country-level comparison

Analysts

Chris Mills

Fiona Armstrong

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Annual Report

www.tutela.com

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Introduction

What constitutes the best mobile networks in the world? In the minds of many, faster is always better. In the race to 5G, we hear stories of gigabit speeds and operators competing to have the fastest 5G on the market. However, the speeds experienced by consumers during every-day mobile usage tend to be significantly lower – and for many of us, our networks seem just fine, most of the time.

This suggests that the best network may be something different – a network that allows us to do the activities we want, when we want to. In practical terms, this means a network which is both reliable and meets the requirements of the applications we use every day. After all, there's not much use in a mobile device that can reach high speeds when you're standing in a specific street corner if you spend most of your time moving around somewhere else. More to the point, infinitely increasing download speeds does not necessarily improve all aspects of network experience.

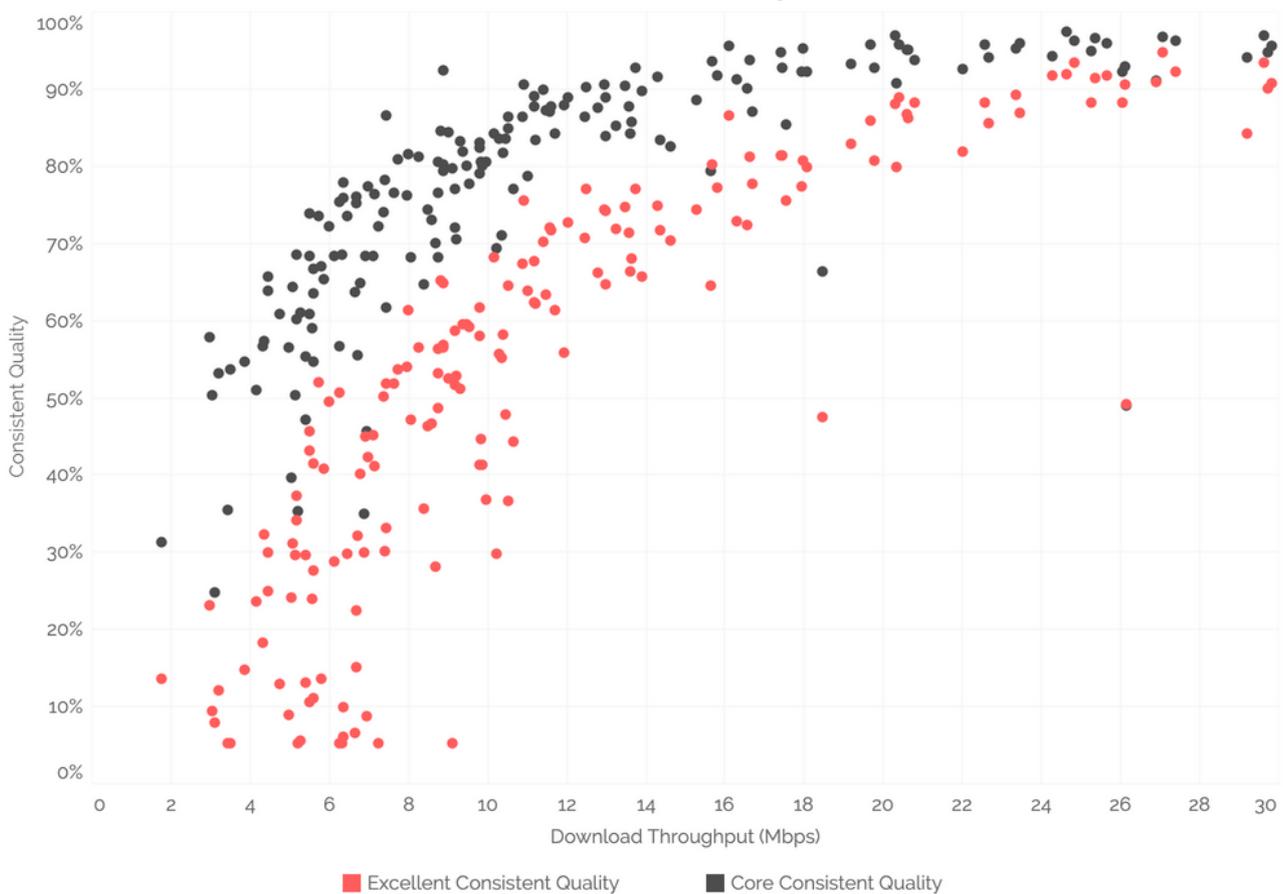
This is where two composite quality metrics – Excellent and Core Consistent Quality – come in. These measure how mobile connections compare to popular use cases to represent how often a mobile experience is good enough for a consumer to do what they want when they want.



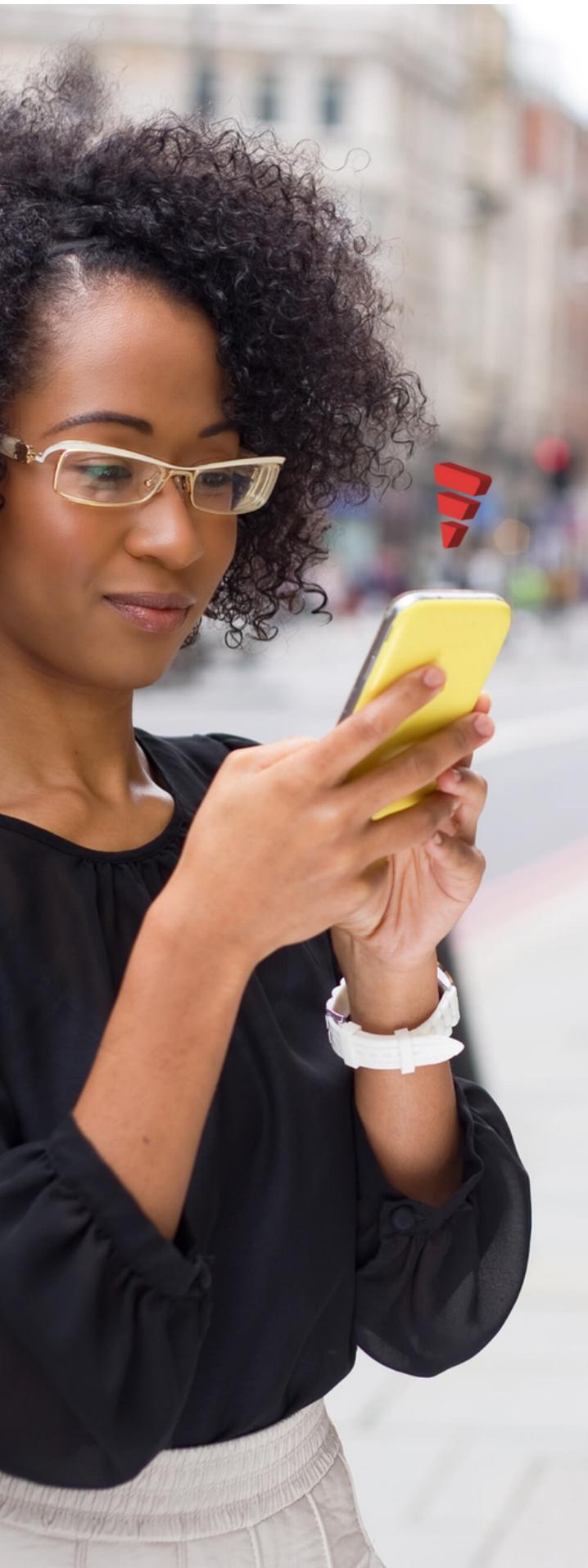
As the below graph demonstrates, above a certain threshold (around 8Mbps), increased average download speeds for users give diminishing returns in this regard - both for higher-intensity use cases and routine ones.

This report uses over 1.4 billion mobile download and latency tests on a 3G, 4G or 5G connection, collected worldwide between 16th August 2019 and 15th August 2020.

TUTELA Comparison of Median Download Throughput and Consistent Quality



Methodology note: Unlike Tutela’s country-level benchmarking reports, the global report includes all records for a given country, including those collected outside of Common Coverage Areas, and users on flanker brands and MVNOs. The reason for this is because this report seeks to represent the overall experience of mobile subscribers in a country, rather than a comparison of subscriber experience between parent-brand operators. Statistical ties are indicated with an “=” in the country rankings. Cases when a country has error bars overlapping one, but not all, of the countries with the next-highest rank are indicated with a “*”.



Key findings

- The Nordic countries frequently outperform any other region, leading the way for mobile experience in both Europe and the wider world. Norway places first for Excellent Consistent Quality, while Denmark and Sweden rank first and second for Core Consistent Quality.
- Individual countries that excelled in their region were Singapore and South Korea in Asia, Australia and New Zealand in Oceania, Canada in North America and Uruguay in South America.
- Despite the marketing hype around faster speeds, above a point faster speeds deliver little in terms of network experience improvement. Switzerland, who had the fastest median download speeds, was ninth when it came to Excellent Consistent Quality – beaten by countries with download speeds that were up to 19% slower.

Excellent Consistent Quality

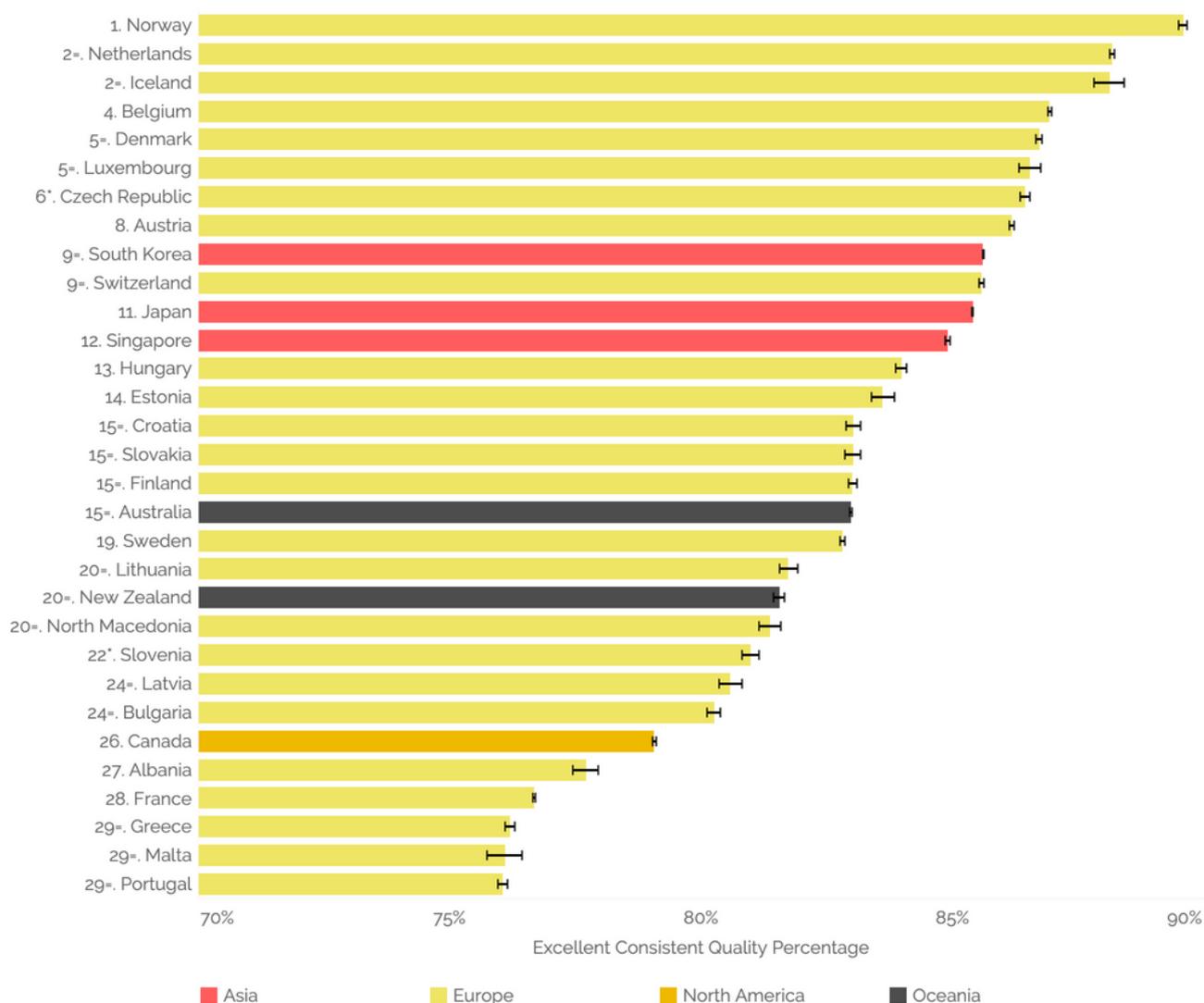
When it comes to Excellent Consistent Quality, European – and in particular Nordic – networks excel. Users in Norway overall have the best mobile experience in the world, with 89.6% of mobile connections on a 3G, 4G or 5G connection being good

enough for high-intensity use cases like 1080p video streaming, group HD video calls or real-time mobile gaming on the go. Iceland draws with the Netherlands for second place, while Denmark ranks fifth, and Finland and Sweden are both in the top 20.

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Excellent Consistent Quality - Top 30 Countries

The % of tests where a mobile connection was good enough for the most demanding popular apps (including HD video group calls and 1080p video streaming)



Full ranking available [here](#).

Outside of Europe, the top-ranked country is South Korea, which placed joint ninth with Switzerland with an Excellent Consistent Quality of 85.6%. While South Korea has one of the most advanced 5G deployments in the world, traffic management and choices in data prioritization and plan structure mean many users do not routinely see the full speed potential of the networks. Japan and Singapore follow closely behind South Korea, ranking at 11th and 12th respectively with Excellent Consistent Quality results of 85.4% and 84.9%.

In Oceania, Australia leads for Excellent Consistent Quality, tying for 15th place globally with a result of 83.0%. New Zealand is close behind, tying for 20th place at 81.6%. Canada leads among North American countries, placing 26th overall with an Excellent Consistent Quality of 79.1%. The US was six places behind at 32nd, with a result of 75.4%.

Morocco was the highest rated country in Africa at joint 42nd, with an Excellent Consistent Quality at 69.2%. South Africa was just a hair behind at joint 47th. South America also entered the ranking at joint 42nd, with Uruguay placing the highest of all South American countries. Argentina was next, ranked at joint 52nd, with an Excellent Consistent Quality of 66.6%.



Core Consistent Quality

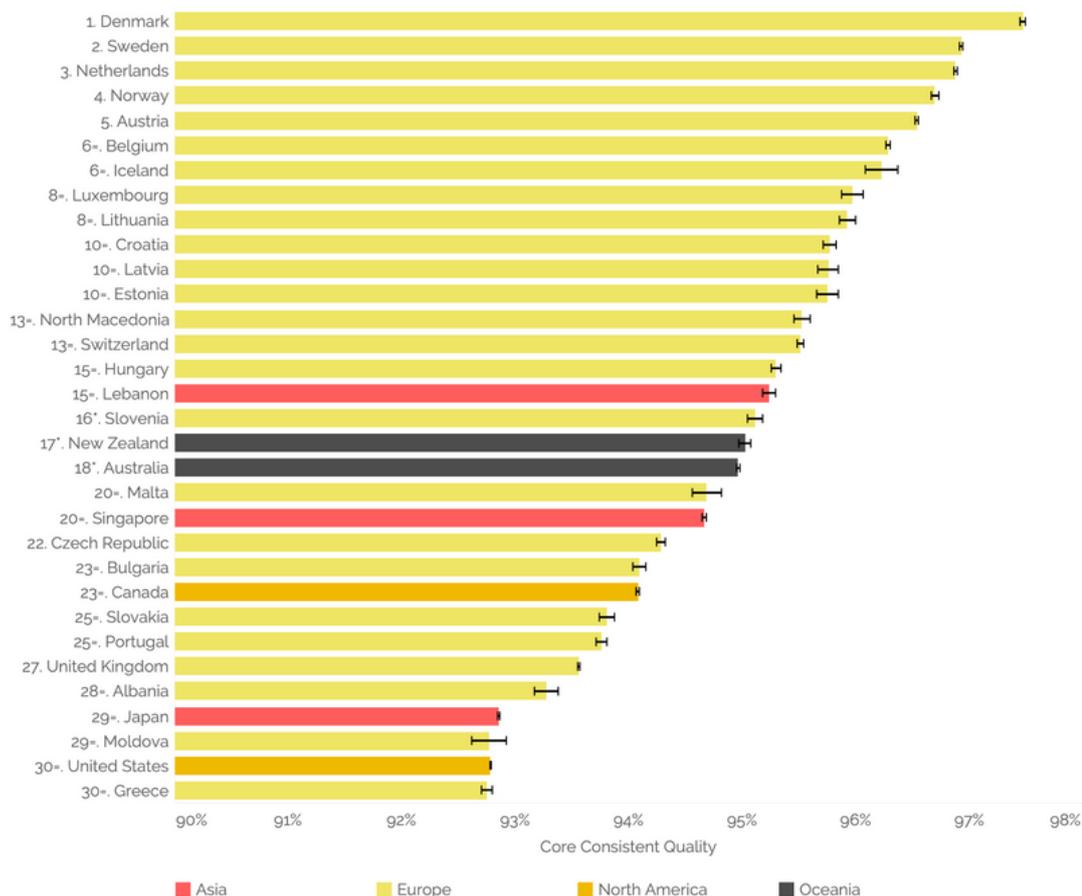
For Core Consistent Quality, we see a similar picture. Again, Europe holds the top of the leader board and accounts for the full top 10 positions. Denmark comes out first overall, with a Core Consistent Quality of 97.5% - 0.5% above second-place Sweden. The Nordics continued to do well, with Norway at 4th and Iceland at 6th, although Finland was a little lower at 34th. The top 30 countries are all extremely close, with less than 5% separating 1st from 30th. Outside of Europe, Lebanon was the highest rated country in

Asia, at joint 15th, with a Core Consistent Quality of 95.2%. Singapore was next among Asian nations, at 20th (94.7%). In Oceania, New Zealand and Australia drew with Core Consistent Quality results of 95.0%. Canada was again top for Core Consistent Quality in North America at 94.1% (ranked joint 23rd overall), with the US next at 92.8% (joint 30th overall). Uruguay placed highest among South American countries at joint 34th (Core Consistent Quality: 91.5%), while Tunisia was top in Africa at 51st (88.9%).

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Core Consistent Quality - Top 30 Countries

The % of tests where a mobile connection was good enough for the daily usage apps (including 420p video streaming, VOIP calls and photo-sharing apps like Snapchat and Instagram)



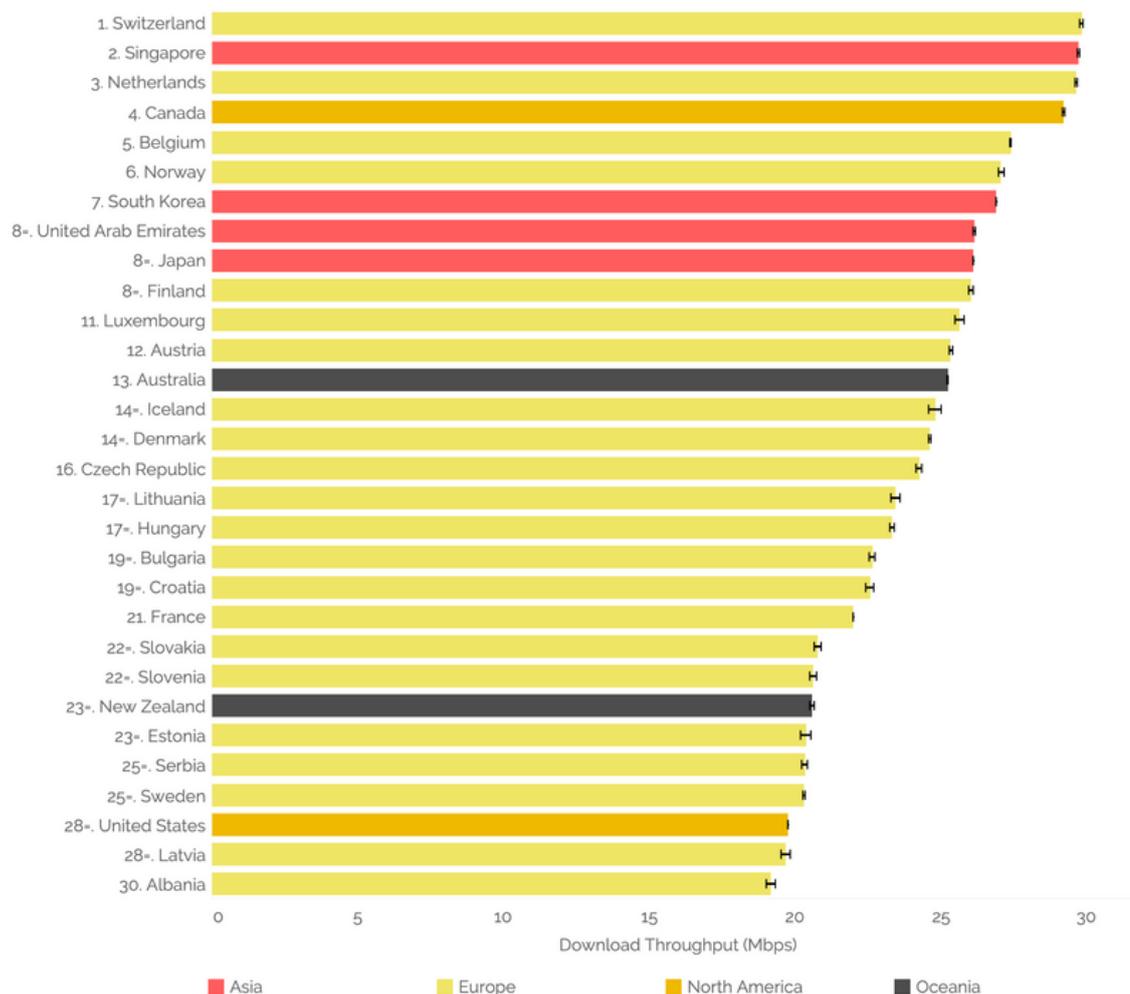
Full ranking available [here](#).

Median download speed

While at Tutela we believe that average (median) download speeds paint only a limited picture of user experience, download speeds have been traditionally used as one of the primary metrics of network superiority. For median download speeds, rankings are much more competitive between regions. Switzerland wins overall, with a median speed experienced by

consumers of 29.8 Mbps. Singapore is second at 29.7 Mbps, Netherlands third at 29.6 Mbps and then Canada fourth at 29.2 Mbps. Australia placed top in Oceania at 25.2 Mbps (13th overall), Morocco was top in Africa at 15.3 Mbps (46th overall), and Uruguay again leads in South America at 14.3 Mbps (joint 48th overall).

TUTELA Median Download Throughput Comparison - Top 30 Countries



Full ranking available [here](#).



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.

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 |

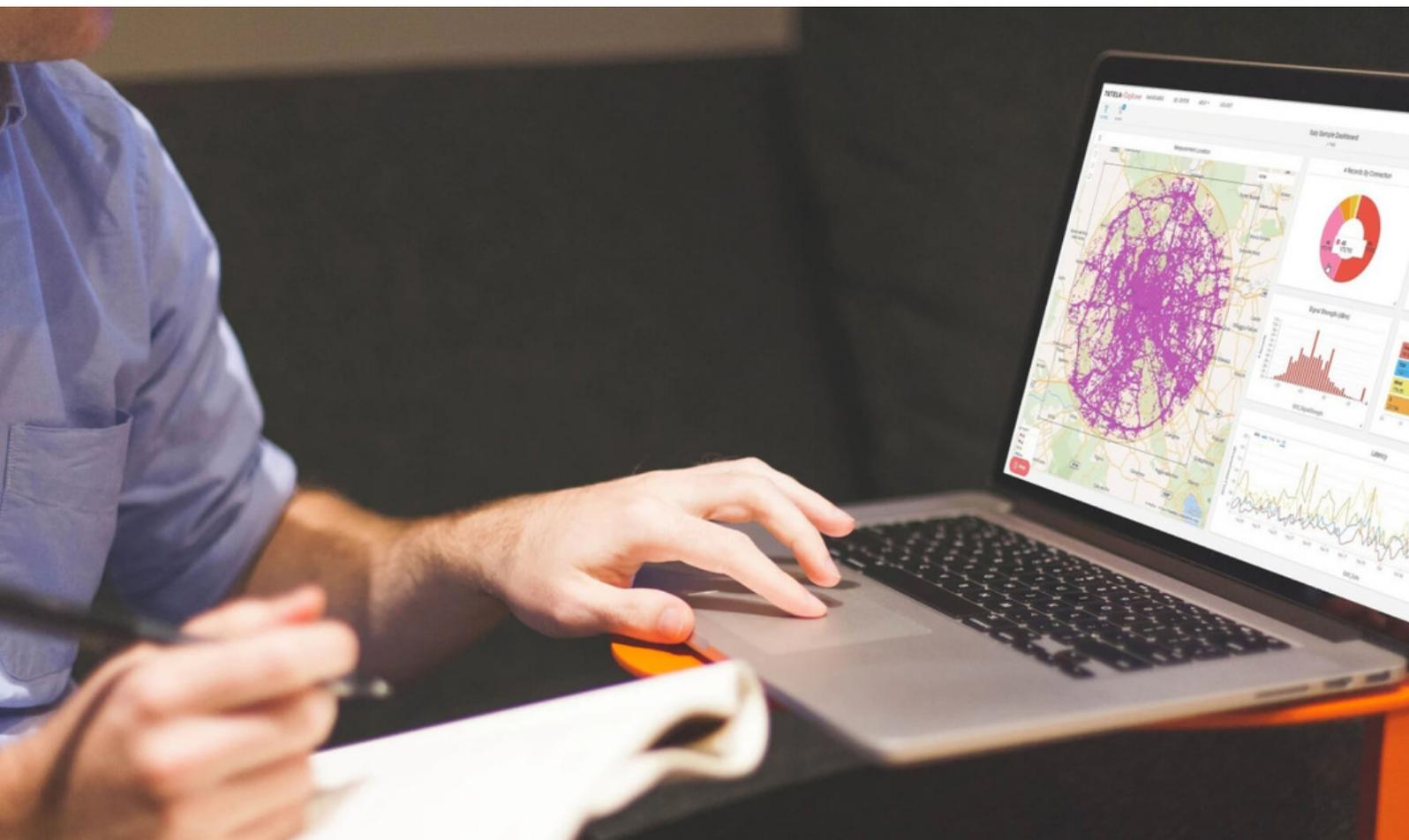
Discover Tutela Explorer

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

Country-level Percentages and Error Margins

| | Excellent Consistent Quality | Excellent Consistent Quality Error Margin |
|--------------------|------------------------------|---|
| 1. Norway | 89.58 | ±0.09 |
| 2=. Netherlands | 88.18 | ±0.04 |
| 2=. Iceland | 88.11 | ±0.30 |
| 4. Belgium | 86.93 | ±0.04 |
| 5=. Denmark | 86.72 | ±0.05 |
| 5=. Luxembourg | 86.54 | ±0.21 |
| 6*. Czech Republic | 86.45 | ±0.10 |
| 8. Austria | 86.19 | ±0.05 |
| 9=. South Korea | 85.61 | ±0.01 |
| 9=. Switzerland | 85.58 | ±0.06 |

To download the full table [click here](#).

| | Core Consistent Quality (%) | Core Consistent Quality Error Margin |
|----------------|-----------------------------|--------------------------------------|
| 1. Denmark | 97.50 | ±0.02 |
| 2. Sweden | 96.90 | ±0.02 |
| 3. Netherlands | 96.90 | ±0.02 |
| 4. Norway | 96.70 | ±0.03 |
| 5. Austria | 96.50 | ±0.02 |
| 6=. Belgium | 96.30 | ±0.02 |
| 6=. Iceland | 96.20 | ±0.14 |
| 8=. Luxembourg | 96.00 | ±0.10 |
| 8=. Lithuania | 95.90 | ±0.07 |
| 10=. Croatia | 95.80 | ±0.06 |

To download the full table [click here](#).

| | Median Download Throughput (Mbps) | Median Download Throughput positive error margin | Median Download Throughput negative error margin |
|--------------------------|--|---|---|
| 1. Switzerland | 29.83 | +0.05 | -0.05 |
| 2. Singapore | 29.71 | +0.04 | -0.04 |
| 3. Netherlands | 29.64 | +0.04 | -0.04 |
| 4. Canada | 29.21 | +0.03 | -0.03 |
| 5. Belgium | 27.39 | +0.03 | -0.03 |
| 6. Norway | 27.08 | +0.09 | -0.09 |
| 7. South Korea | 26.90 | +0.01 | -0.01 |
| 8=. United Arab Emirates | 26.15 | +0.05 | -0.05 |
| 8=. Japan | 26.12 | +0.01 | -0.01 |
| 8=. Finland | 26.04 | +0.07 | -0.08 |

To download the full table [click here](#).

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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