Singapore

State of Mobile Networks
February 2019

Analysis of Tutela crowdsourced data from over
130 million mobile network measurements.

TUTELA

Executive Summary

Singapore has historically been a world leader in wireless communications but, in 2019, the country's operators are facing change at a nearly unprecedented rate. The industry, which has already been disrupted by the recent entry of cheaper MVNO challengers, will have to contend with the launch of a fourth mobile network operator, a growing appetite for data-hungry streaming media, and -- last but not least -- the deployment of 5G networks.

Tutela, a crowdsourced network data company, has evaluated over 130 million records, including 234,077 download speed tests, collected between the 19th October 2018 and 16th January 2019, to produce its 2019 report on the state of Singapore's network. Tutela collects network and device data from millions of mobile device owners every day. This is used to analyze which carriers reliably provide fast enough speeds to perform routine mobile tasks, like streaming a video on YouTube or using Google Maps.

Key findings

- SingTel had the fastest network overall, with the best 4G download and upload speeds.

- StarHub had the best consistent quality of any network tested, with 88.2% of tests meeting Tutela's standards for demanding network use-cases such as HD video streaming or video calling.

- Latency, particularly over 4G networks, was consistently low among all providers, giving users an unparalleled network experience.

- The performance of the recent MVNO entrants to the market was variable: although Circles and MyRepublic provided a connection equal to that of the host network, Zero1's subscribers routinely saw lower speeds -- although this may be due to the plans offered.

Measuring network quality

TUTELA Best performing networks – Singapore 2019

Operator	Consistent Quality	Avg. Download speed	Avg. Upload speed	Latency	Packet Loss	Jitter
Singtel		🏆	🏆		🏆	
StarHub	🏆					
m1				🏆	🏆	🏆

Glossary - breaking down the jargon

Latency: Any delay in data communication over a network, counted in milliseconds.

Jitter: A variance in time delay between data packets sent over a network, which can result in data packets failing to arrive in the order they were sent. Also counted in milliseconds.

Packet loss: When a packet of data traveling through a network fails to reach its destination, either resulting in an extra delay, or missing audio or video on a video call.
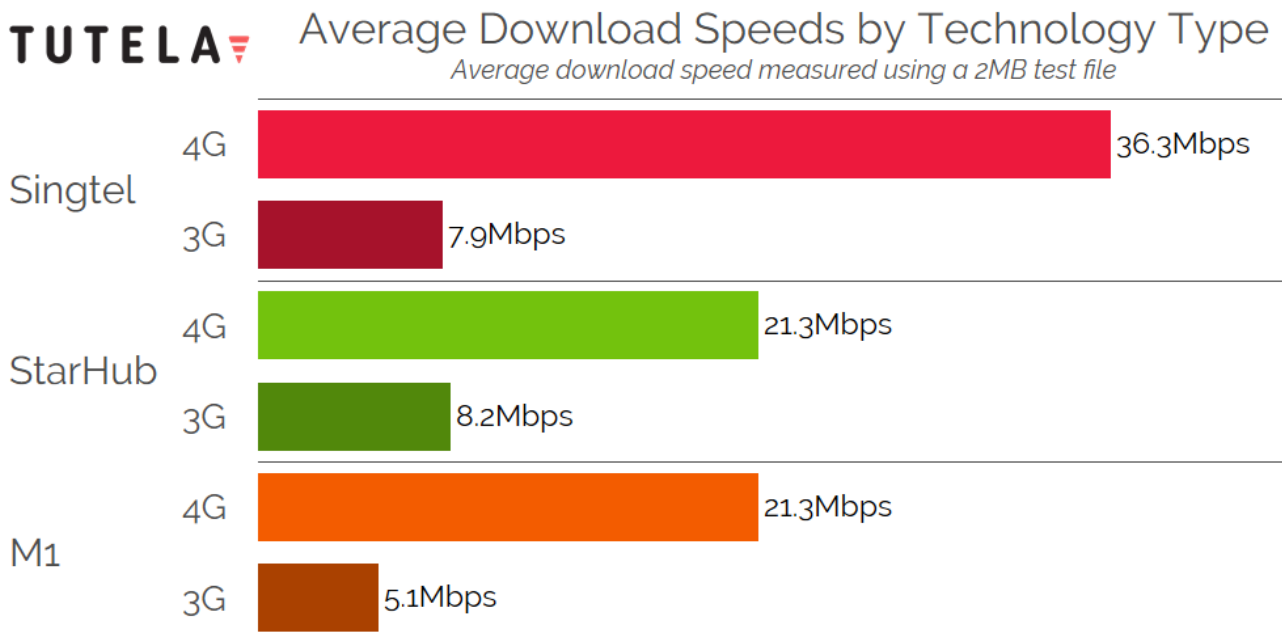
MVNO: Mobile Virtual Network Operator. A wireless reseller that purchases wholesale service from a mobile network operator and provides service, without owning physical network infrastructure..

Download throughput

SingTel ran away with the 4G download throughput test results, delivering average speeds of 36 Mbps, nearly double the performance of its competitors. StarHub and M1 had an identical average of 21.3 Mbps -- lower than SingTel's result, but still more than adequate for most users.

When it comes to 3G results, the networks were much closer. SingTel and StarHub delivered similar results of around 8 Mbps, while M1's 3G network achieved average download speeds of 5 Mbps.

Download throughput is the most-quoted number when it comes to network quality, and although it's not a perfect corollary for network quality, it is important. No matter what, a 128 Kbps connection won't work for most subscriber use-cases.

TUTELA Average Download Speeds by Technology Type
Average download speed measured using a 2MB test file

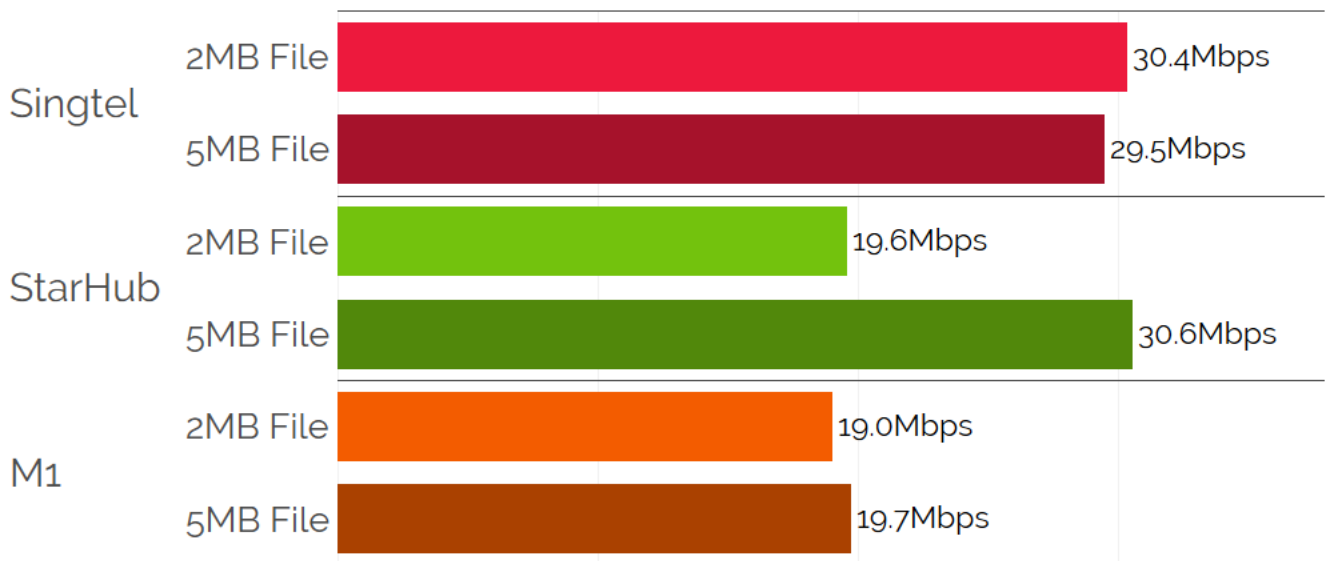| Singtel | 4G | 36.3Mbps |
	3G	7.9Mbps
StarHub	4G	21.3Mbps
	3G	8.2Mbps
M1	4G	21.3Mbps
	3G	5.1Mbps

Download throughput

To test download throughput, Tutela primarily tests using a 2MB file size. Although smaller than the packets typically used for maximum-speed tests, a 2MB file is the most representative of the kind of use that smartphones drive. Web browsing, app usage, and video streaming -- the bulk of mobile data usage -- deals with small data packets. When downloading a much larger file, networks have the time to ramp up, delivering the headline-grabbing top speeds, but it's not a use case that consumers regularly encounter.

SingTel's stellar performance with a 2MB file size indicates that the network has worked to optimize the initial stages of a connection, which in turn will pay dividends for users' Quality of Experience when using most common apps. When testing with a 5MB file size -- which will provide an average speed closer to the maximum achievable -- StarHub closed the gap to SingTel.

Average Download Speeds by Test File Size
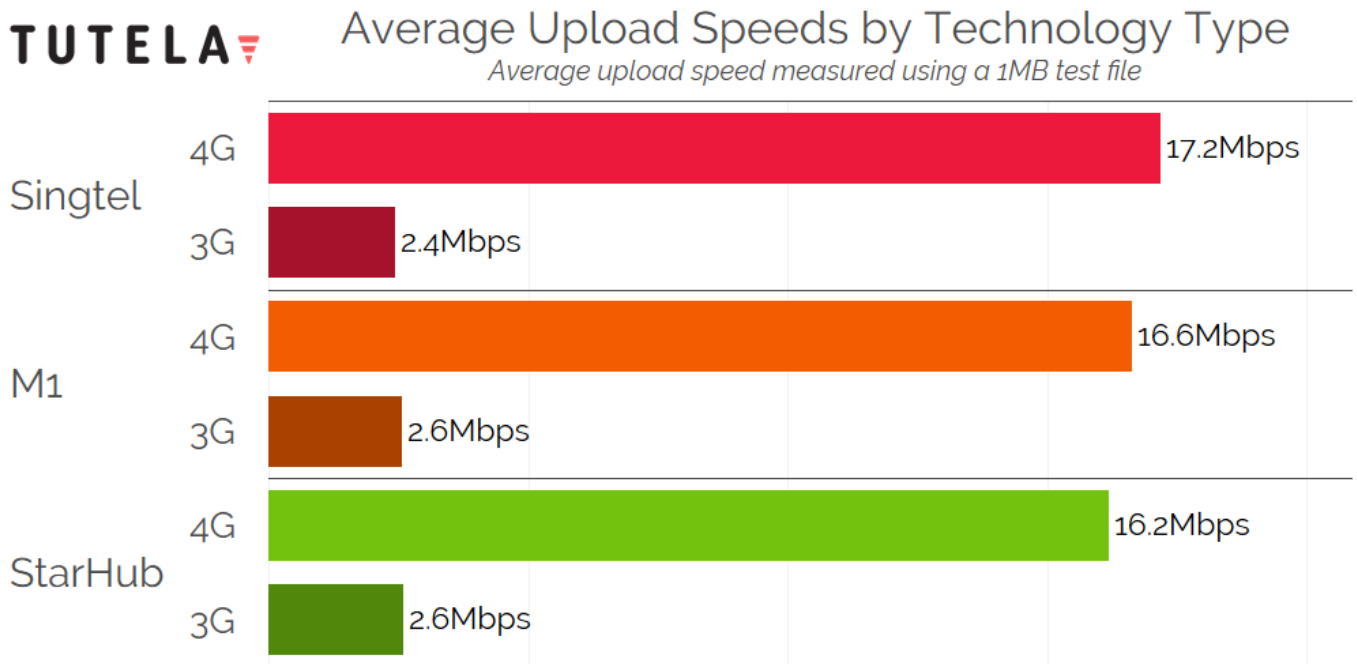### Average download speed measured using a 2MB or 5MB test file

Singtel	2MB File	30.4Mbps
	5MB File	29.5Mbps
StarHub	2MB File	19.6Mbps
	5MB File	30.6Mbps
M1	2MB File	19.0Mbps
	5MB File	19.7Mbps

Upload throughput

Results are much closer for upload throughput. Although SingTel still had the best network, the results were much closer. M1 was in second place, with average upload speeds of 16.6 Mbps, and StarHub was close behind with an average of 16.2 Mbps.

The results over a 3G connection were similarly close. All three providers were within 1 Mbps of each other, with M1 and StarHub jointly taking home the honours.

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Average Upload Speeds by Technology Type
Average upload speed measured using a 1MB test file

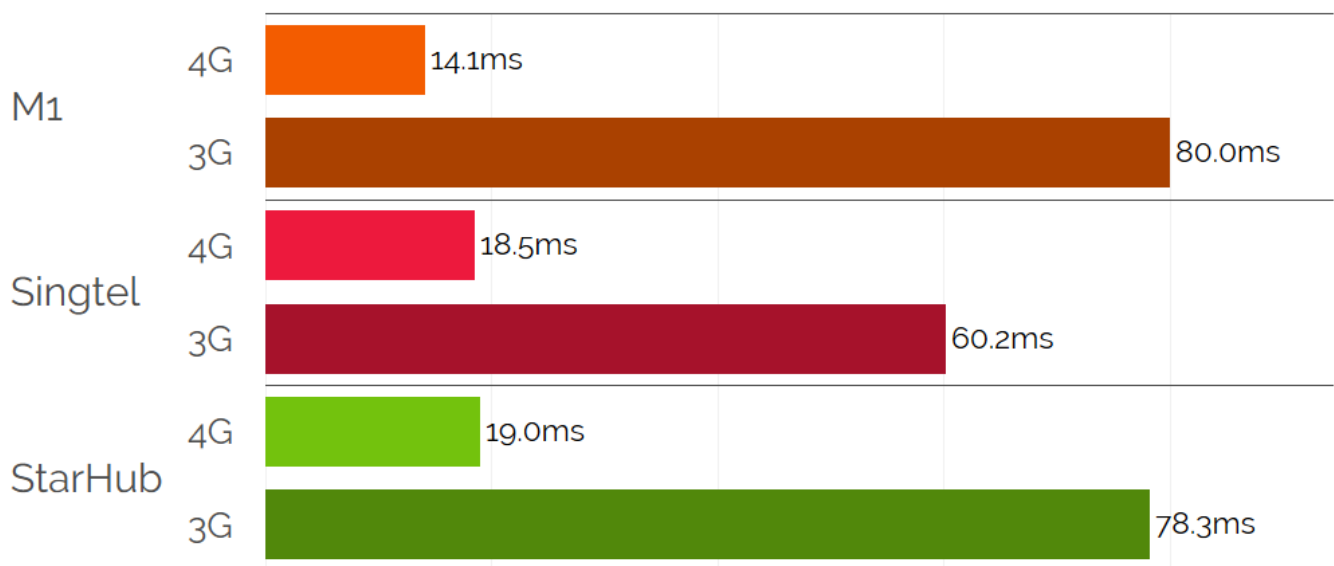|		
Singtel	4G	17.2Mbps
	3G	2.4Mbps
M1	4G	16.6Mbps
	3G	2.6Mbps
StarHub	4G	16.2Mbps
	3G	2.6Mbps

Latency

The latency results are most notable for their conspicuous excellence across all three providers. Although M1 performed the best overall, all three operators are within five ms, and the averages were all low when compared to the typical LTE operator in other countries. This may reflect Singapore's relatively small size and position as a popular location to host servers: data packets don't have far to travel, either geographically or through a network, which goes some way to explaining the low latency.

TUTELA — Average Latency by Technology Type

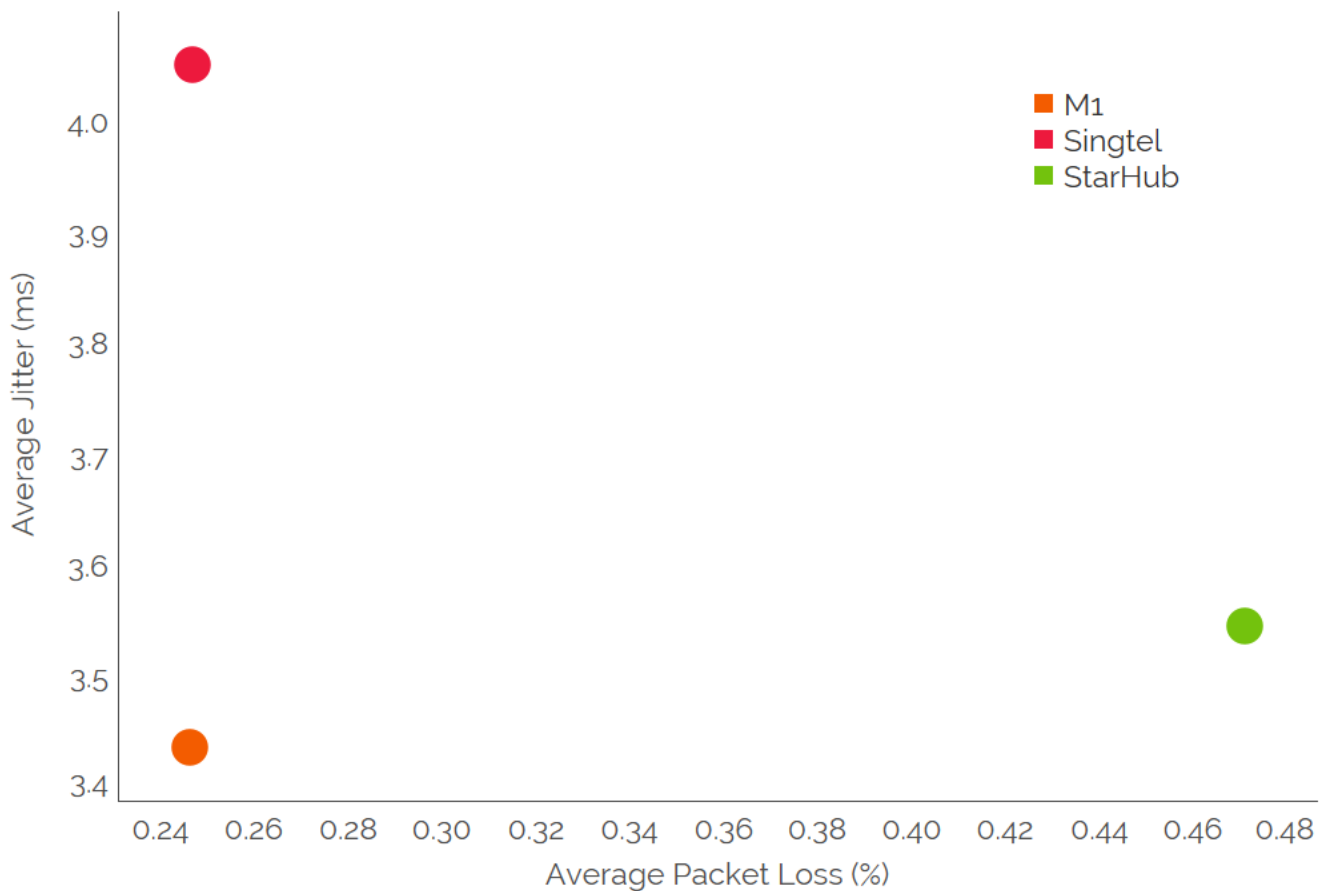| Provider	Technology	Latency
M1	4G	14.1ms
M1	3G	80.0ms
Singtel	4G	18.5ms
Singtel	3G	60.2ms
StarHub	4G	19.0ms
StarHub	3G	78.3ms

Network stability

Jitter and packet loss are both measures of network stability, and once again, all three networks provided a more-than-adequate connection stability to their users. The highest packet loss is recorded by StarHub, at 0.47%; at that level, even users conducting real-time use-cases like HD video calling or multiplayer online gaming will not experience any degradation in performance.

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Average Mobile Jitter and Packet Loss

Legend:
- M1 (orange)
- Singtel (red)
- StarHub (green)

Y-axis: Average Jitter (ms), from 3.4 to 4.0
X-axis: Average Packet Loss (%), from 0.24 to 0.48

Consistent Quality

What is Consistent Quality?

When users are on their phones, the chances are that they're using some of the most popular apps in the country. That means games like PUBG Mobile or Fortnite, messaging apps such as WhatsApp or Messenger, and increasingly, streaming services like YouTube.

Having a good experience on those apps isn't just a matter of speed; in fact, studies have shown that even when streaming video, any increase in speed over just 1.5 Mbps creates barely any increase in user satisfaction.

However, other network factors like latency or packet loss can make or break a user's experience even with a blazing-fast connection.

With that in mind, Tutela has produced a set of five key performance indicators that show the minimum network requirements needed to run the most popular apps at a satisfactory level of operation.

Our key performance indicators

"Excellent" quality
Download speeds > 4 Mbps
Upload speeds > 2 Mbps
Latency < 50 ms
Jitter < 30 ms
Packet loss ~ 0%

Tutela's consistent quality score simply measures the percentage of time that users -- whether for one operator or a whole country -- can hit the thresholds. The higher the number, the more often users have a basic or excellent connection.

In other words, it's a network quality threshold. Any mobile connection performing at or above this level provides consumers with all they need to go about their daily digital routines. Anything below, and consumers face slow-downs, freezes, and loading issues.

Consistent Quality

StarHub, the network that came in second place overall for the fastest speeds, takes first place for consistent quality -- demonstrating, once again, that speed isn't everything. 88% of connections -- including those over 3G -- met Tutela's standard for consistent quality, meaning that StarHub users can do everything they need or want to do on their phone, unimpeded by network connection, 88% of the time.

SingTel was in second place, with a still-impressive consistent quality score of 83%. M1 was in third place, with a consistent quality of 82%. When removing results taken on a 3G network -- which struggles in particular to meet the latency threshold -- the percentages are even higher, at nearly 90% for all operators.

TUTELA   Consistent Quality (Excellent) by Operator

Operator	Score
StarHub	88.4%
Singtel	83.2%
M1	82.3%

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

https://www.tutela.com/explorer

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MVNOs

The MVNO market has exploded in Singapore in recent years, with all three mobile operators partnering with at least one MVNO to provide cheaper prepaid services on their network. The effect was immediate: All three operators saw a modest decline in postpaid subscribers in 2018, showing that the MVNOs are succeeding in taking customers from the established networks.
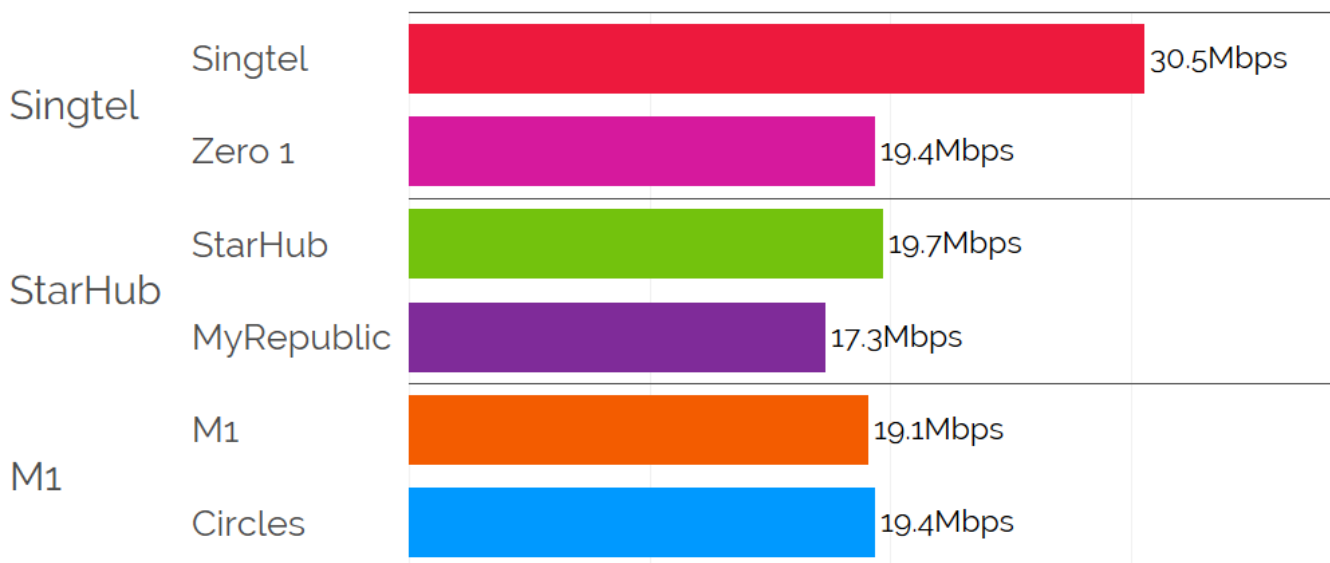
MVNOs resell capacity from their host networks to their subscribers, but MVNO and MNO subscribers don't always experience the network in the same way. The average download speed for Zero1 customers -- who use Singtel's network -- is two thirds that of Singtel's own subscribers.

However, the slowdown doesn't appear to be related to network quality; rather, it's the type of plans that Zero1 offers. Zero1's plans all include a set bucket of "full-speed" LTE data, and once that is used up, customers are throttled. Zero1 doesn't specify a speed for throttled customers, but suggests not trying to stream 720p video, which indicates the throttled speed will be less than 1 Mbps.

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MNO vs. MVNO Download Speed
Average download speed measured using a 2MB test file

Singtel
- Singtel — 30.5Mbps
- Zero 1 — 19.4Mbps

StarHub
- StarHub — 19.7Mbps
- MyRepublic — 17.3Mbps

M1
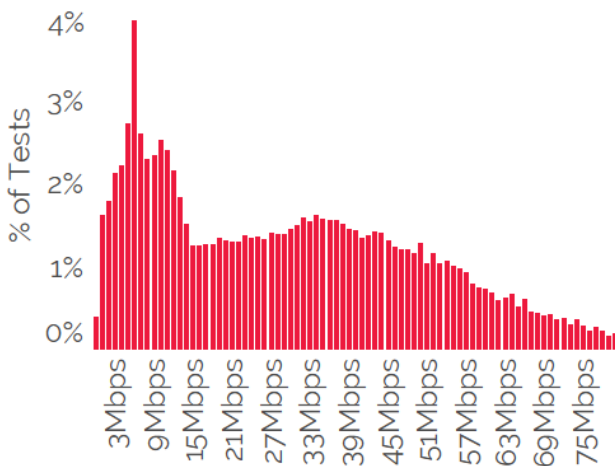- M1 — 19.1Mbps
- Circles — 19.4Mbps

MVNOs

Tutela's data suggests that Zero1 subscribers were often hitting their data limits. Many of the download tests from Zero1 customers were around that 1MB speed, which would indicate throttling or deprioritization.
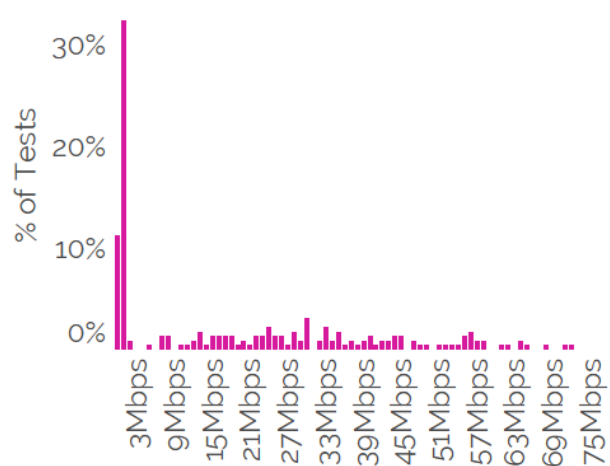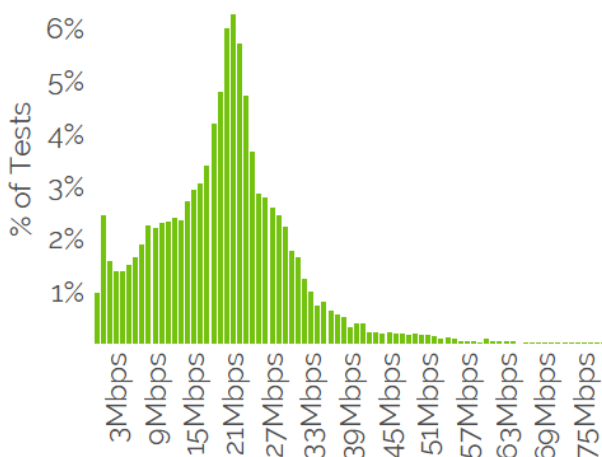

A similar phenomenon can be observed for MyRepublic and Starhub customers, although it is less dramatic. Very few speed tests for StarHub postpaid subscribers are below 5 Mbps, but for MyRepublic customers, it's the opposite.
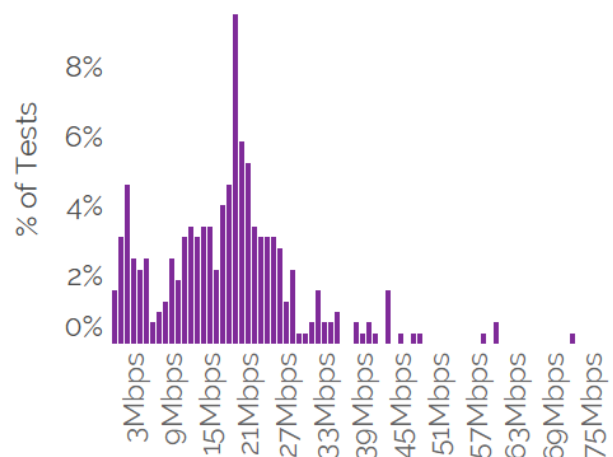
MVNOs

For M1 and its MVNO Circles, the distribution of results is extremely similar. Rather than offering unlimited data plans with an LTE data bucket and throttled data thereafter, Circles offers affordable plans with hard data caps, meaning that customers are either getting full-speed LTE data, or no data at all.
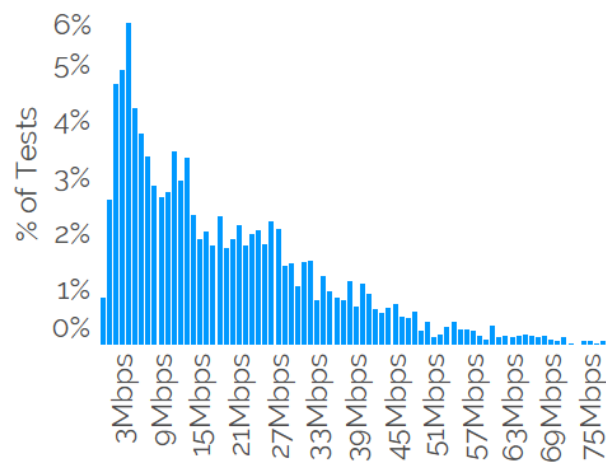

TUTELA MNO vs. MVNO Download Speed Histogram
*Download speed measured using a 2MB test file*
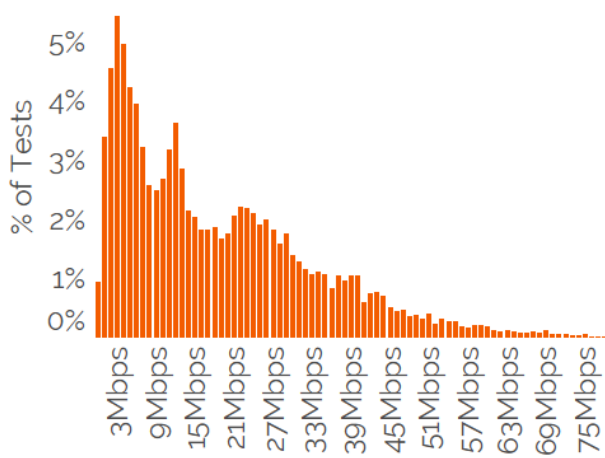
Methodology

Tutela measures network quality based on the real-world performance experienced by users in the field. Results in this report are based on a testing configuration to represent typical (not maximum) performance for users. We used a 2MB file to perform our download testing and a 1MB file to perform our upload testing. Tutela employs software installed on more than 3,000 partner apps to complete frequent, lightweight tests of around 2MB.

Our results differ from other network testing companies which measure the peak performance of networks under ideal conditions (such as downloading a 500MB file).

In total, Tutela's software operates on over 250 million Android and iPhone devices globally, collecting over 10 billion mobile data measurements every day. Our data scientists analyze results for each country every month, and our analytics platform, Tutela Explorer, lets operators chart, map, and filter over 80 key performance indicators into customized dashboards to help them better understand industry performance and benchmark against competitors.

Report facts

The information in this report was taken from our crowdsourced data between 19th October 2018 and 16th January 2019
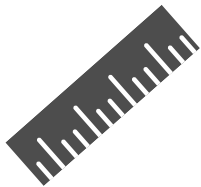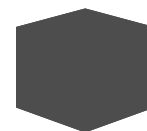
130 million	234 thousand	240 thousand
Measurements	Download tests	Upload tests

6 million	6 million	6 million
Latency tests	Jitter tests	Packet loss tests

Meet us at Mobile World Congress

Mobile World Congress is just around the corner, and we're back for another exciting event to showcase our latest crowdsourced solutions for the mobile industry.

Schedule a meeting with us where you can:

- See a live demonstration of Tutela's data and tools for your markets
- Discover our products and roadmap and learn how Tutela's data and insights can help your business
- Start a free trial of our tools and data for your evaluation purposes
- Meet with our team

Find out more: https://tute.la/MWC2019

About
Tutela

Tutela is a mobile data and analytics company serving the mobile and telecommunications industry with software is embedded in over 3000 diverse mobile applications installed on over 250 million mobile Android and iOS handsets. Tutela continuously monitors network quality of experience all across the world. We collect more than 10 billion measurements every single day, and through our interactive toolset, enable our customers to turn those numbers into actionable intelligence for their businesses.

For more information, visit www.tutela.com or contact us at info@tutela.com