TUTELA

Southeast Asia

State of Mobile Networks

Analysts

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Annual Report

FEBRUARY 2020

www.tutela.com

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Introduction

Whilst Southeast Asia might not be as notoriously smartphone-loving as regional neighbours like South Korea, countries in the region are experiencing a rate of mobile traffic growth virtually unprecedented around the world. In Indonesia, for example, Netflix says that subscribers consume streaming video at twice the rate of the global average(1) — and above-board streaming services only make up a portion of the mobile video traffic that networks have to handle(2). In response, operators are continuing to invest in network capacity.

Some operators, like Telkomsel in Indonesia, deployed tens of thousands of new 4G base stations in 2019(3), whilst others look to the future with 5G deployments(4).

To measure how wireless networks are performing under this growing data usage load, Tutela has analyzed over 48 billion total records from over 14 million Android and iOS smartphones, including over 330 million speed tests and 3.7 billion latency measurements, collected from July 1st to December 31st 2019.

(1) Telecompaper, Netflix launches Mobile Plan in Indonesia
https://www.telecompaper.com/news/netflix-launches-mobile-plan-in-indonesia--1319673
Retrieved 28 January 2020

(2) Telecompaper, Nearly 63% of online Indonesian consumers access pirate streaming websites
https://www.telecompaper.com/news/nearly-63-of-online-indonesian-consumers-access-pirate-streaming-websites--1321046
Retrieved 28 January 2020

(3) Telecompaper, Telkom's 9-month revenue climbs 3.5% on data, internet, IT business growth
https://www.telecompaper.com/news/telkoms-9-month-revenue-climbs-35-on-data-internet-it-business-growth--1314477
Retrieved 28 January 2020

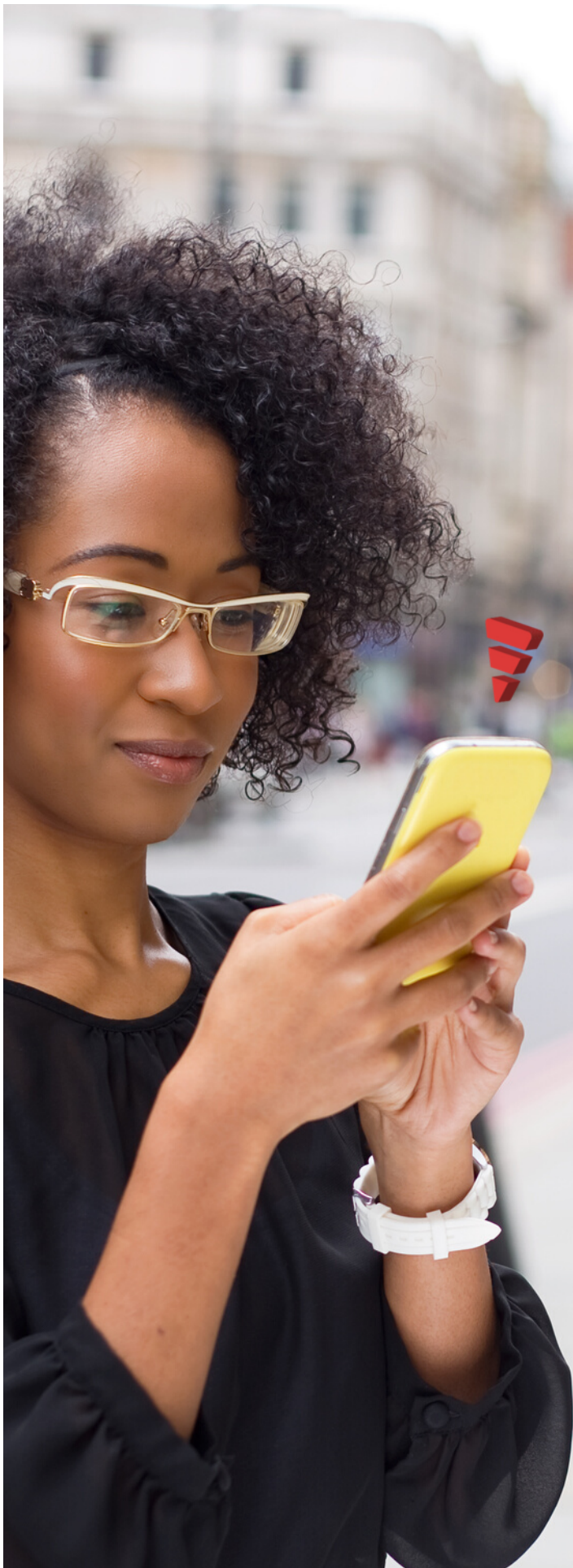
(4) Telecompaper, Viettel, Nokia launch 5G in Ho Chi Minh City
https://www.telecompaper.com/news/viettel-nokia-launch-5g-in-ho-chi-minh-city--1309255
Retrieved 28 January 2020

Key findings

- Although Indonesian networks are middle of the pack for the region overall, Telkomsel is individually one of the best-performing operators in this report, and significantly outperforms all other Indonesian operators on virtually every metric.

- Vietnamese networks are the best overall, thanks to strong competition between the top three operators in the country, all of which provide above-average performance compared to the rest of the region. However, all operators in the country still have work left to do to convert more of their networks to 4G.

- In Thailand, smartphone subscribers' mobile experience depends greatly on what kind of things they do with their smartphones. DTAC and TrueMove have virtually identical Core Consistent Quality percentages, indicating that their networks are on par for common use-cases like streaming SD video or browsing the internet. For Excellent Consistent Quality, a test geared more towards demanding use-cases like multiplayer online gaming, DTAC pulled significantly ahead.



Results overview

TUTELA

Mobile experience results

Indonesia, February 2020

	TELKOMSEL	Indosat Ooredoo	XL	3	smartfren
Excellent Consistent Quality	★ Winner				
Core Consistent Quality	★ Winner				
Download throughput	★ Winner				
Upload throughput	★ Winner				
Latency	★ Winner				

Results from over 14 million Android and iOS smartphones, including over 330 million speed tests and 3.7 billion latency measurements, taken in Common Coverage Areas across Southeast Asia between July 1st to December 31st 2019.

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

TUTELA
Best Mobile Network Experience
FEBRUARY 2020

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

Results overview

TUTELA

Mobile experience results

Malaysia, February 2020

	maxis	digi	celcom	U mobile
Excellent Consistent Quality	★ Winner			
Core Consistent Quality	★ Winner			
Download throughput	★ Winner			
Upload throughput	★ Winner			
Latency	★ Winner			

Results from over 14 million Android and iOS smartphones, including over 330 million speed tests and 3.7 billion latency measurements, taken in Common Coverage Areas across Southeast Asia between July 1st to December 31st 2019.

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Results overview

TUTELA

Mobile experience results

Philippines, February 2020

	Smart	Globe
Excellent Consistent Quality	★ Winner	
Core Consistent Quality		★ Winner
Download throughput	★ Winner	
Upload throughput	★ Winner	
Latency		★ Winner

Results from over 14 million Android and iOS smartphones, including over 330 million speed tests and 3.7 billion latency measurements, taken in Common Coverage Areas across Southeast Asia between July 1st to December 31st 2019.

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

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Results overview

TUTELA

Mobile experience results

Thailand, February 2020

	dtac	AIS	truemove H
Excellent Consistent Quality	★ Winner		
Core Consistent Quality	★ Winner		
Download throughput	★ Winner		
Upload throughput			★ Winner
Latency		★ Winner	

Results from over 14 million Android and iOS smartphones, including over 330 million speed tests and 3.7 billion latency measurements, taken in Common Coverage Areas across Southeast Asia between July 1st to December 31st 2019.

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Results overview

TUTELA

Mobile experience results

Vietnam, February 2020

	Viettel	vinaphone	mobifone	vietnamobile
Excellent Consistent Quality	★ Winner			
Core Consistent Quality	★ Winner			
Download throughput	★ Winner			
Upload throughput	★ Winner			
Latency	★ Winner			

Results from over 14 million Android and iOS smartphones, including over 330 million speed tests and 3.7 billion latency measurements, taken in Common Coverage Areas across Southeast Asia between July 1st to December 31st 2019.

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

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

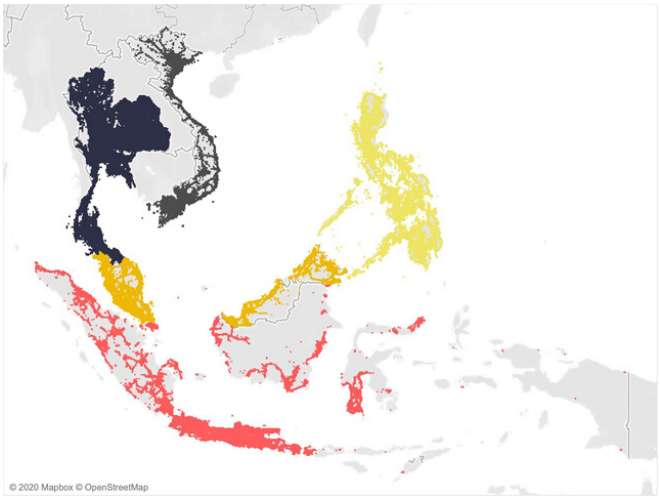
Understanding this report

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.

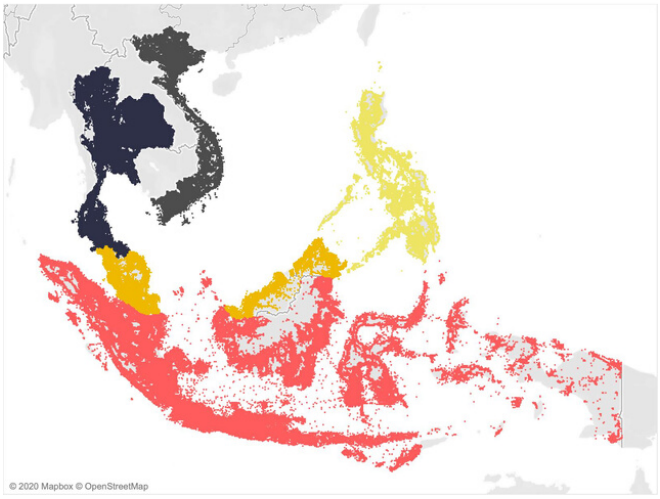
The methodology is covered in detail at the end of this report and on our website, but simply put, there are two sets of thresholds, Excellent and Core. A connection that hits the Excellent threshold is sufficient for use-cases like 1080p video streaming or multiplayer gaming, while a Core connection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

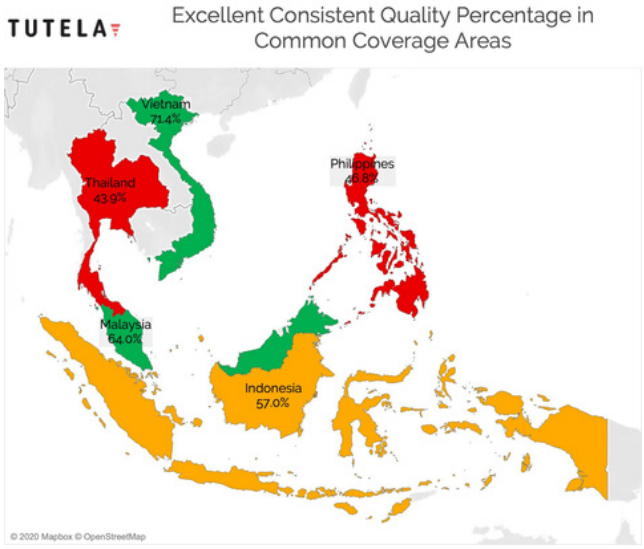


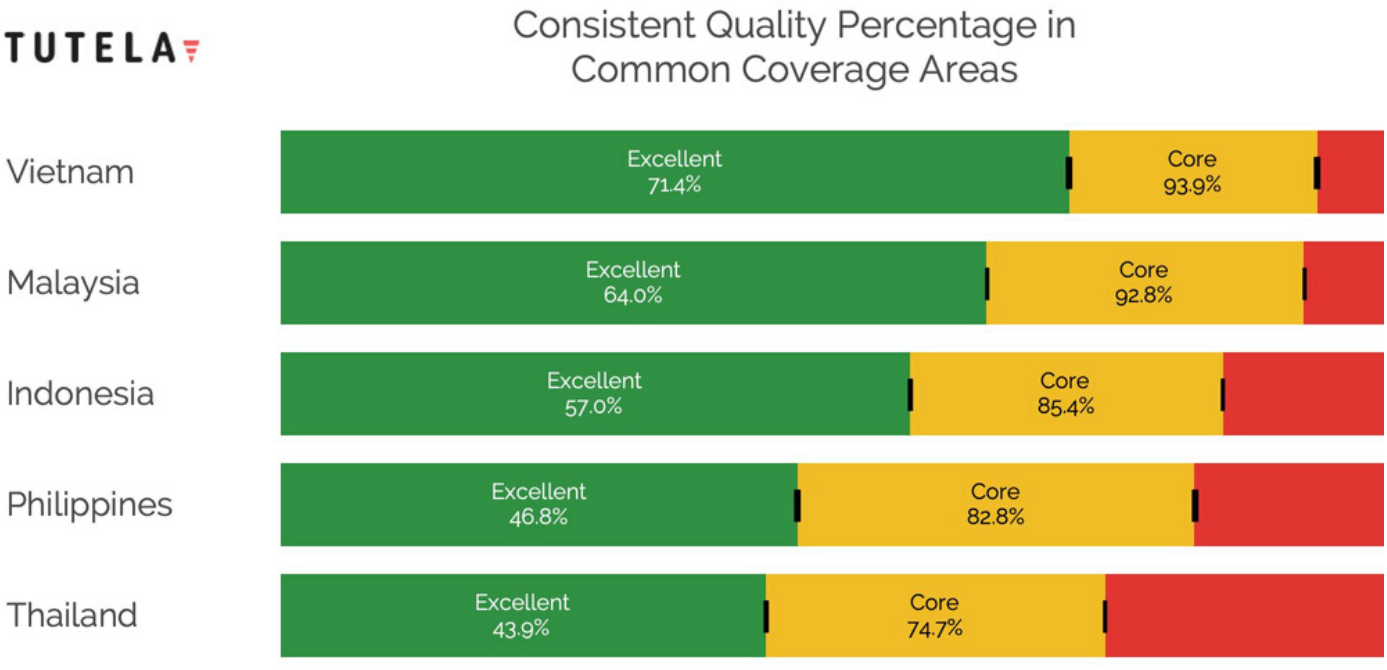
Consistent Quality

Country comparison

Vietnam leads all countries in the region for both Excellent and Core Consistent Quality, Tutela's two metrics for measuring user experience for more demanding and everyday use-cases respectively. Although it took first place for both metrics, its lead was far more significant on Excellent Consistent Quality, with a gap of 7.4% to second-place Malaysia.

The results show that even though subscribers across networks in all countries can expect a decent mobile experience the majority of the time, there is a noticeable difference in mobile experience for the most demanding use-cases between countries. A user in Vietnam has a significantly higher chance of having a mobile connection sufficient for the most demanding use-cases, compared to a subscriber in Thailand.





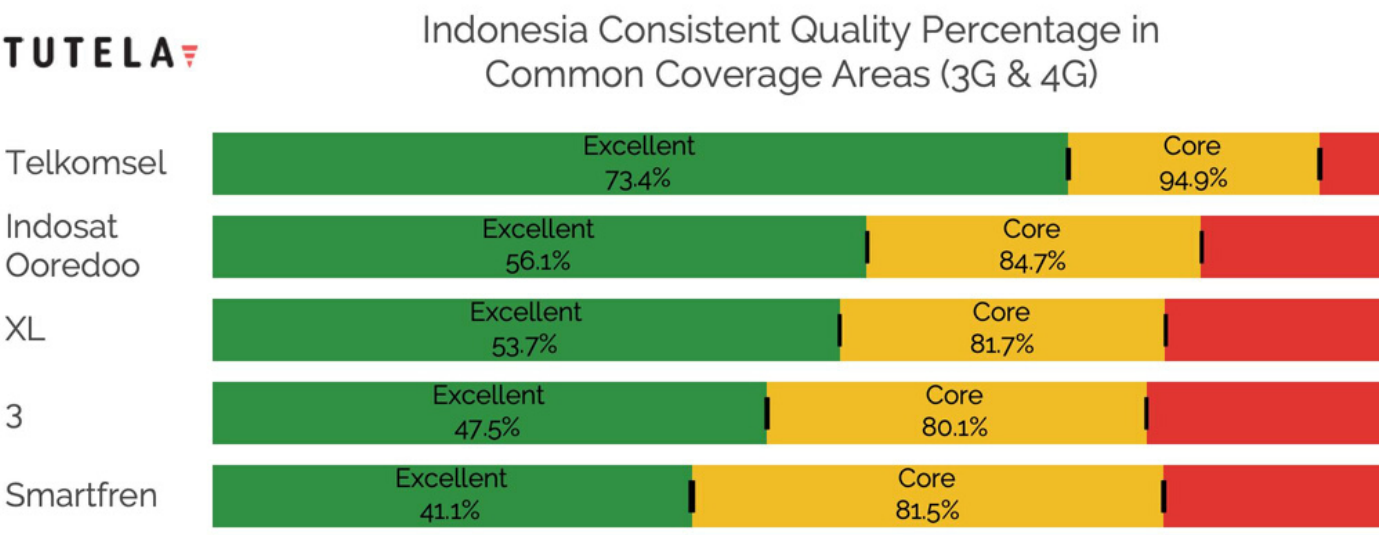
Consistent Quality

Indonesia Common Coverage Areas (CCAs)

Telkomsel was head and shoulders above other operators in Indonesia, with an Excellent Consistent Quality Score over 17% better than Ooredoo, the next-best operator. Excellent Consistent Quality is Tutela's metric for whether a network connection is sufficient for the most demanding use-cases, such as cloud gaming or streaming HD video, and Telkomsel's commanding lead indicates that its users are able to do those more demanding use-cases far more frequently.

Although the other four operators are closer in terms of Excellent Consistent Quality, there is still a substantial difference between operators — for example, the 15% difference between Ooredoo and last-place Smartfren is nearly as big as the difference between Telkomsel and Ooredoo.

For Core Consistent Quality, all five operators managed a percentage of 80% or better. That means that when a user has signal, four out of five tests (in Common Coverage Areas) are good enough for everyday use-cases, like streaming SD video and web browsing. Just as for Excellent Consistent Quality, however, Telkomsel has a substantial lead over other operators — it was a full 10% better on Core Consistent Quality than second-place Ooredoo.

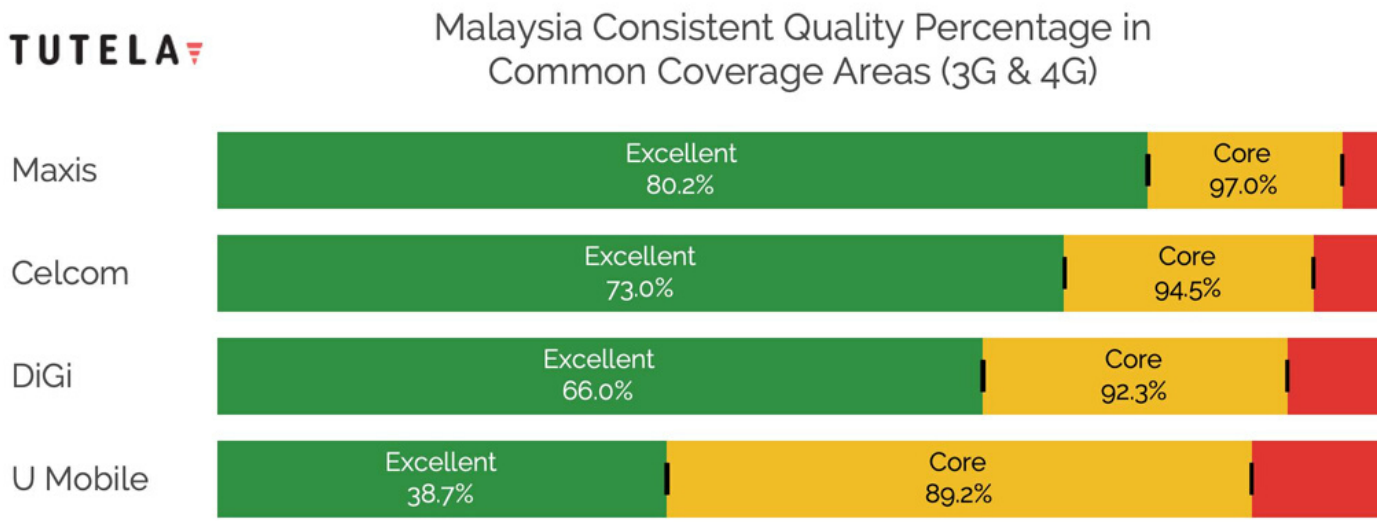


Consistent Quality

Malaysia Common Coverage Areas (CCAs)

Maxis was the only operator in this report to record an Excellent Consistent Quality percentage better than 80%, indicating that four out of five times, when a Maxis user has signal, their connection is good enough for virtually anything they want to do on their phone. Notably, it's also better than the Core Consistent Quality percentage for some operators in other countries. Celcom and DiGi came in second and third place respectively for Excellent Consistent Quality relatively close to Maxis. U Mobile's Excellent Consistent Quality was just 38.7%, putting it firmly in fourth place.

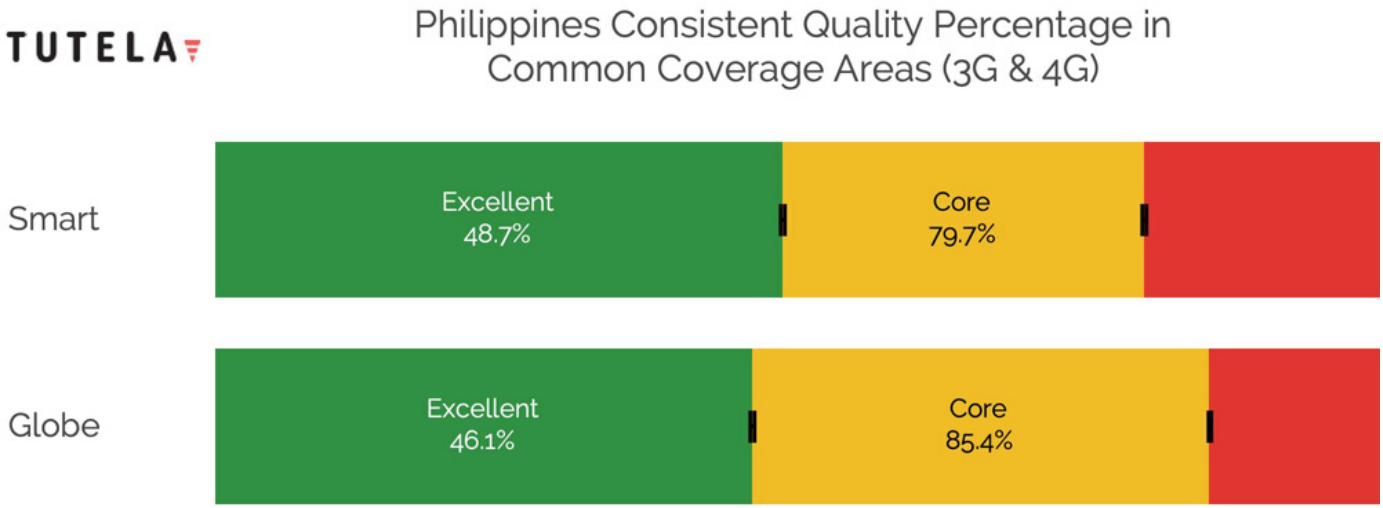
The results were much closer for Core Consistent Quality, with Maxis once again taking first place, but the gap from first to last place (U Mobile once again) was less than 10%.



Consistent Quality

Philippines Common Coverage Areas (CCAs)

Both operators in the Philippines posted similar Excellent Consistent Quality results, with Smart taking first place by just 2.6%. Globe was ahead on Core Consistent Quality, however, with over 85% of tests from its users passing the thresholds for day-to-day uses like streaming SD video.



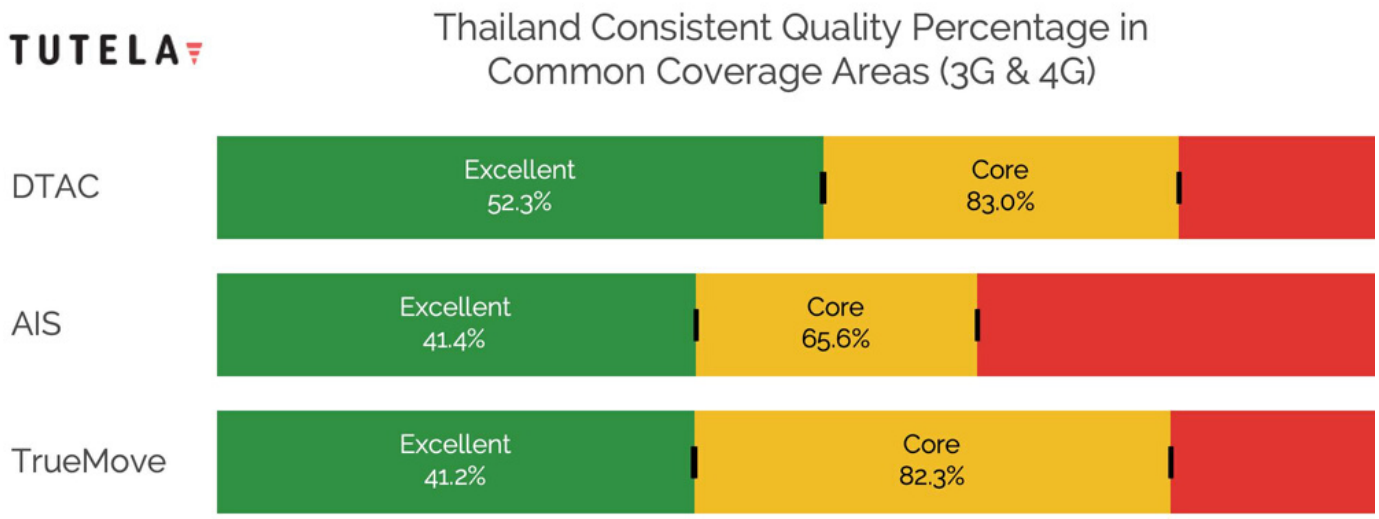
Consistent Quality

Thailand Common Coverage Areas (CCAs)

On average, Thailand's networks recorded the worst Excellent Consistent Quality of any in the region — but there is not complete parity between operators. DTAC's Excellent Consistent Quality was 10 percentage points higher than AIS and TrueMove — a substantial difference, given that all three operators were around the 40-50% range.

TrueMove saw some redemption for Core Consistent Quality, where it was barely behind DTAC. AIS, which tied for Excellent Consistent Quality with TrueMove, was in last place for Core Consistent Quality by 17%.

"DTAC's Excellent Consistent Quality was 10 percentage points higher than AIS and TrueMove"

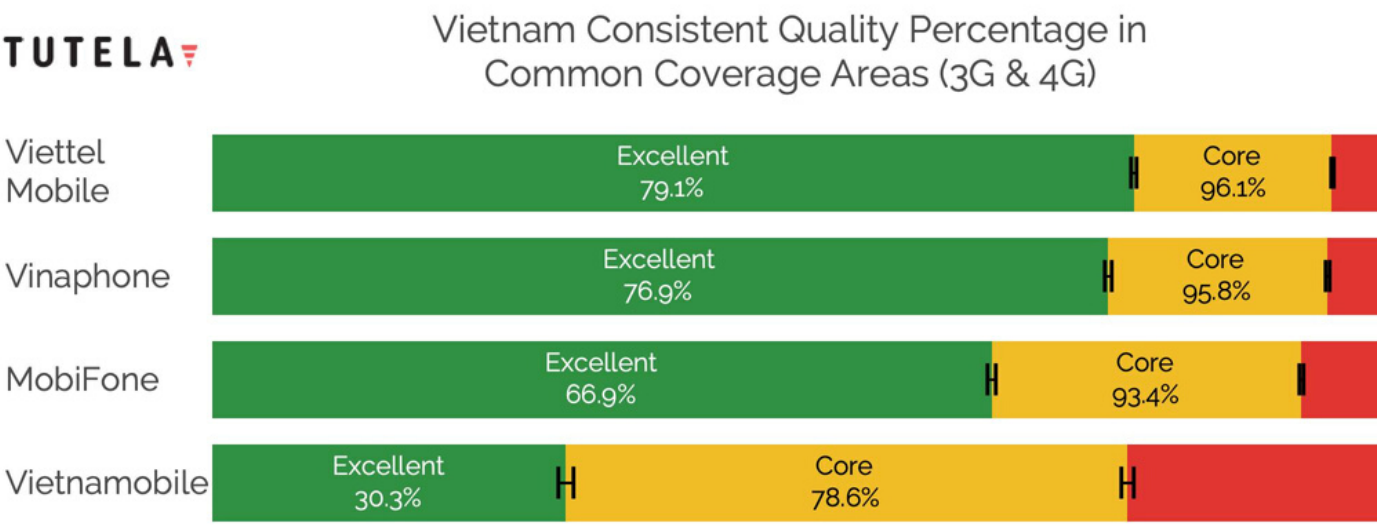


Consistent Quality

Vietnam Common Coverage Areas (CCAs)

Vietnam mobile subscribers have the best mobile experience of any country in the region, but the performance across different operators has some differences. Viettel Mobile takes first place for Excellent Consistent Quality, but Vinaphone is less than 3% behind, much closer in performance than MobiFone or Vietnamobile. In particular, Vietnamobile's Excellent Consistent Quality percentage of just 30.3 was less than half of any other operator, and the lowest Excellent Consistent Quality of any operator in this report.

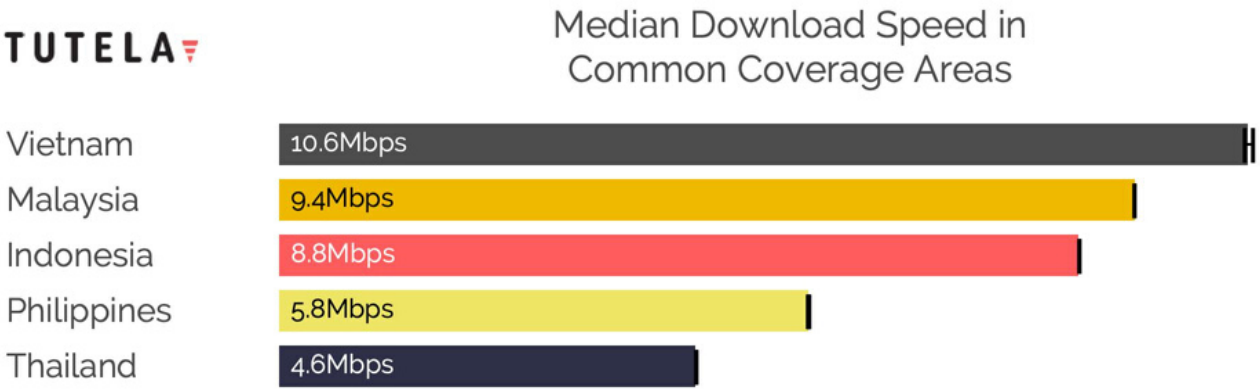
Viettel Mobile eked out first place in Core Consistent Quality as well, but the gap to Vinaphone was even smaller than in Excellent Consistent Quality — just 0.3%. Although the difference is statistically significant, it is unlikely to translate to a noticeable practical difference in everyday data usage for subscribers.



Download throughput

Country comparison

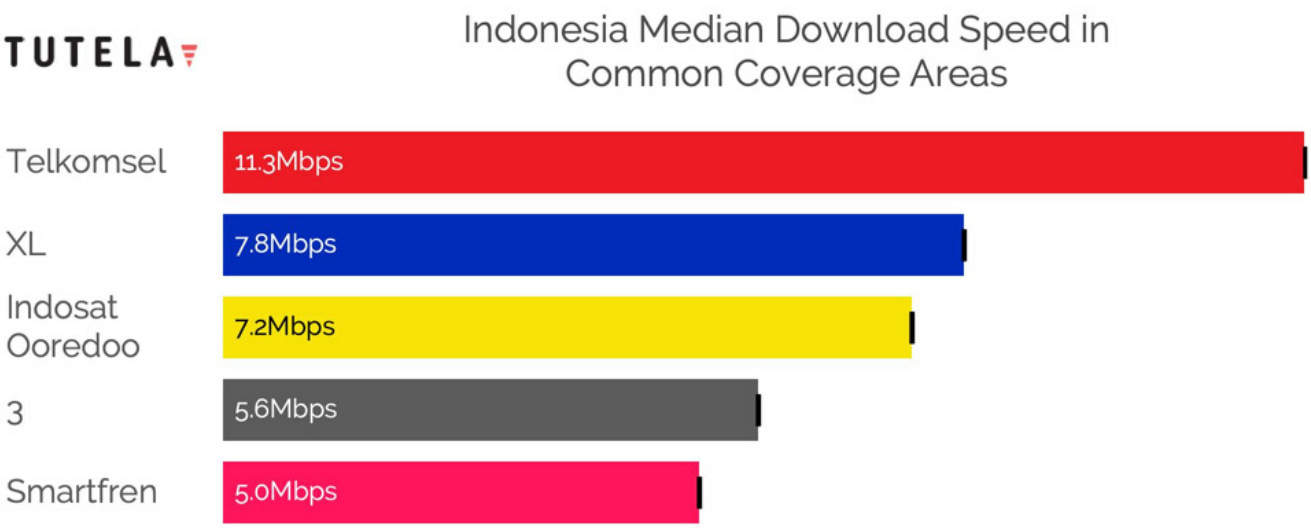
The country rankings based on download speed are the same as they are for Consistent Quality: Vietnam is on top, closely followed by Malaysia, Indonesia, the Philippines, and then Thailand. Malaysia is home to the fastest individual operator (Maxis), but once again the consistency of performance across the majority of Vietnamese operators saw it come in first place.



Download throughput

Indonesia Common Coverage Areas (CCAs)

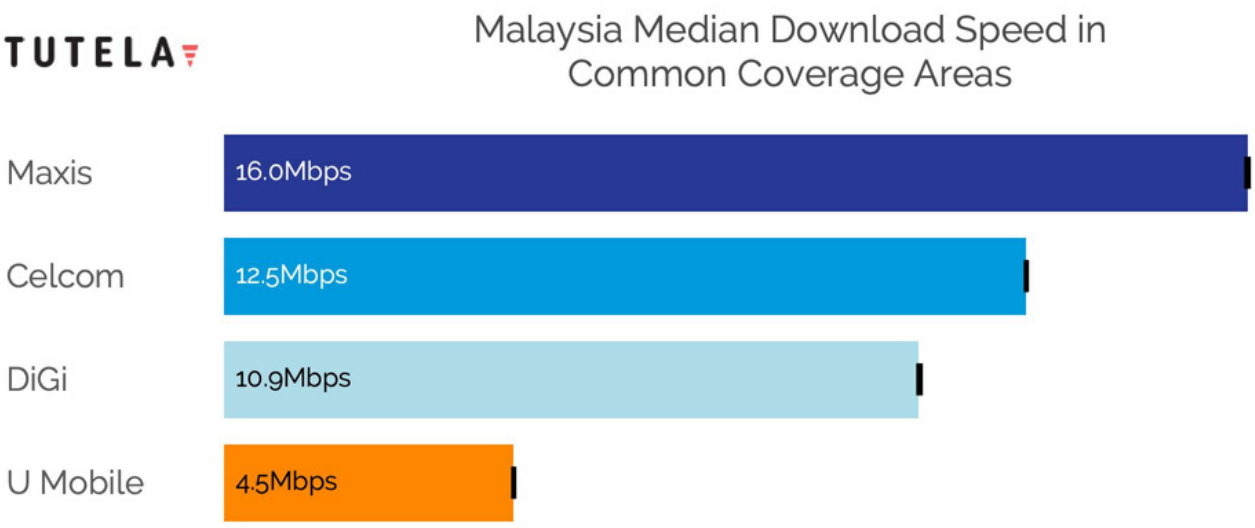
Once again, Telkomsel took an emphatic lead over other Indonesian operators, and was the only network in the country to record a median download speed greater than 10 Mbps. Whilst Ooredoo was in second place for both Core and Excellent Consistent Quality, it was in third place behind XL for download throughput. That shows that whilst download speed is important, it's not the only metric that matters when it comes to delivering a consistent quality of user experience.



Download throughput

Malaysia Common Coverage Areas (CCAs)

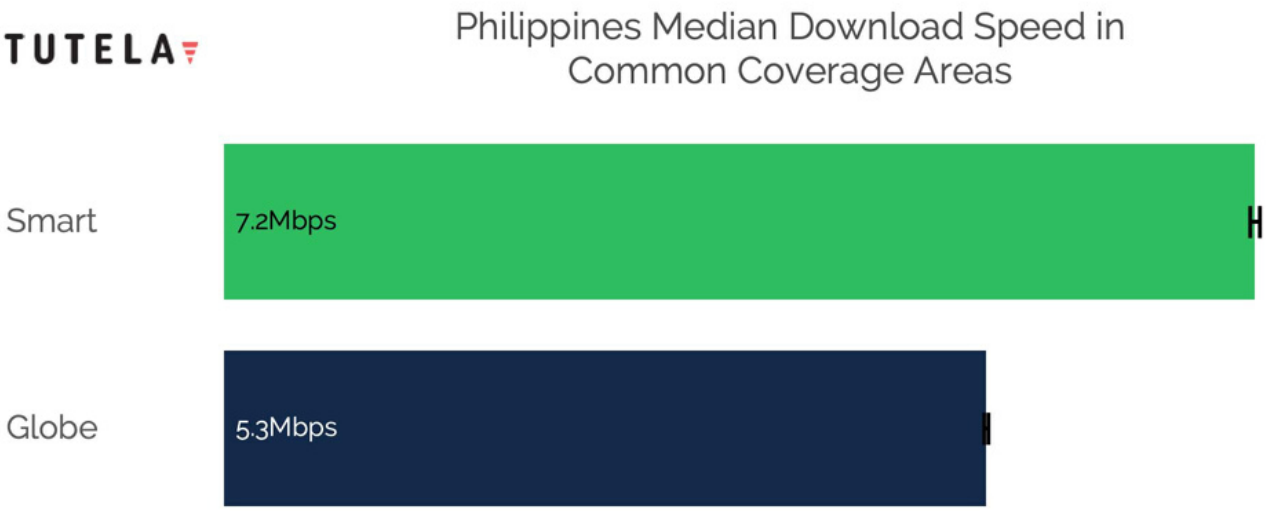
Maxis recorded the fastest median download speed, not just in Malaysia, but across the entire region. Celcom was in second place, and DiGi was in a relatively close third place, with a median of 10.9 Mbps. Only fourth-place U Mobile failed to record a median download throughput greater than 10 Mbps, and its median of 4.5 Mbps was below Tutela's threshold for Excellent Consistent Quality, indicating that users may experience difficulties when streaming HD video.



Download throughput

Philippines Common Coverage Areas (CCAs)

Smart recorded the fastest median download throughput out of the two operators, at 7.2 Mbps. Globe was relatively close behind, and its median download speed of 5.3 Mbps was just above Tutela's Excellent Consistent Quality threshold, indicating that the majority of tests from Globe users have a download throughput fast enough for demanding use-cases like streaming HD video.



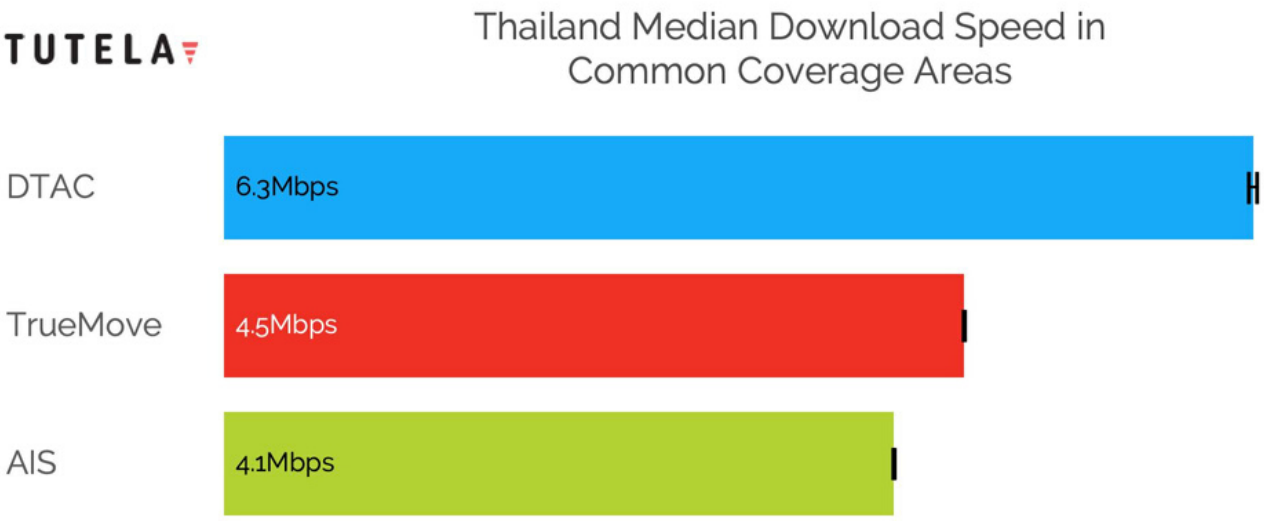
Download throughput

Thailand Common Coverage Areas (CCAs)

In Thailand, DTAC was the fastest operator in terms of download speed, and the only operator to have a majority of tests pass the 5 Mbps threshold. TrueMove was in second place, with a median of 4.5 Mbps, and AIS was just behind, on 4.1 Mbps.

Using the median download throughput rather than the mean exposes an interesting difference between the three operators. Using mean download throughput, last year Tutela found TrueMove had the fastest average download speed, with a mean of 7.5 Mbps. This year, its mean download throughput would have been 8.9 Mbps, although it still would have placed second behind DTAC. Why is there such a difference between the means and medians in this case? Although both providers presented a peak (99th percentile) performance between 38 and 45 Mbps, it seems that a large number of lower-speed tests draws the median down significantly.

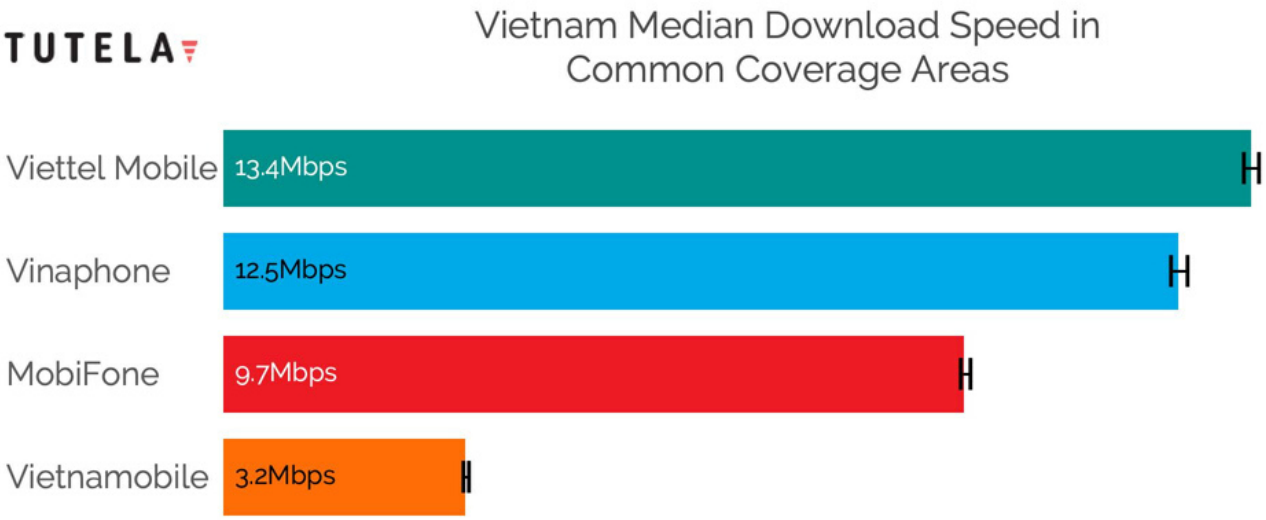
Tutela's data shows two distinct clusters of download speed results, one just under 1 Mbps, and one at approximately 4-5 Mbps for both DTAC and TrueMove, which bring their median results down. This is likely in part due to the composition of plans on both networks – TrueMove, for example, offers a pre-paid SIM as well as a bundle add-on with internet speeds capped at 1 Mbps for social media use. Other contributing factors could include network congestion during peak hours, or other traffic management processes.



Download throughput

Vietnam Common Coverage Areas (CCAs)

Vietnam saw the greatest spread of download speeds in the region. Viettel Mobile was the second-fastest operator in the region, with a median of 13.4 Mbps, and Vinaphone was tied for third-fastest in the report at 12.5 Mbps. At the other end of the scale, Vietnamobile had the slowest median download throughput in the report, at 3.2 Mbps. The difference in results suggests that Vietnamese mobile subscribers will have a radically different experience when using their phones for download-intensive uses, depending on which operator they're subscribed to.

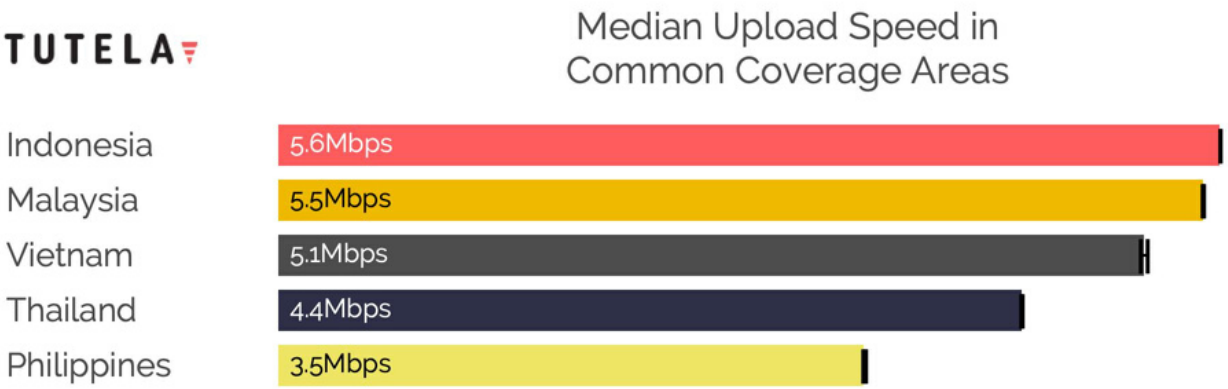


Upload throughput

Country comparison

Whilst download speed and Consistent Quality saw some major differences in results between countries, the performance difference for upload speed between countries was much smaller. Indonesia finished at the top of the pack, with a median upload throughput of 5.6 Mbps. However, Malaysia was just 0.1 Mbps behind, and Vietnam also recorded a median upload speed greater than 5 Mbps. Thailand and the Philippines were slightly further behind, and 4.4 Mbps respectively.

However, it's notable that even the Philippines' median of 3.5 Mbps is well in excess of the upload speed needed for most mobile applications, such as an HD video chat or uploading videos to social media.

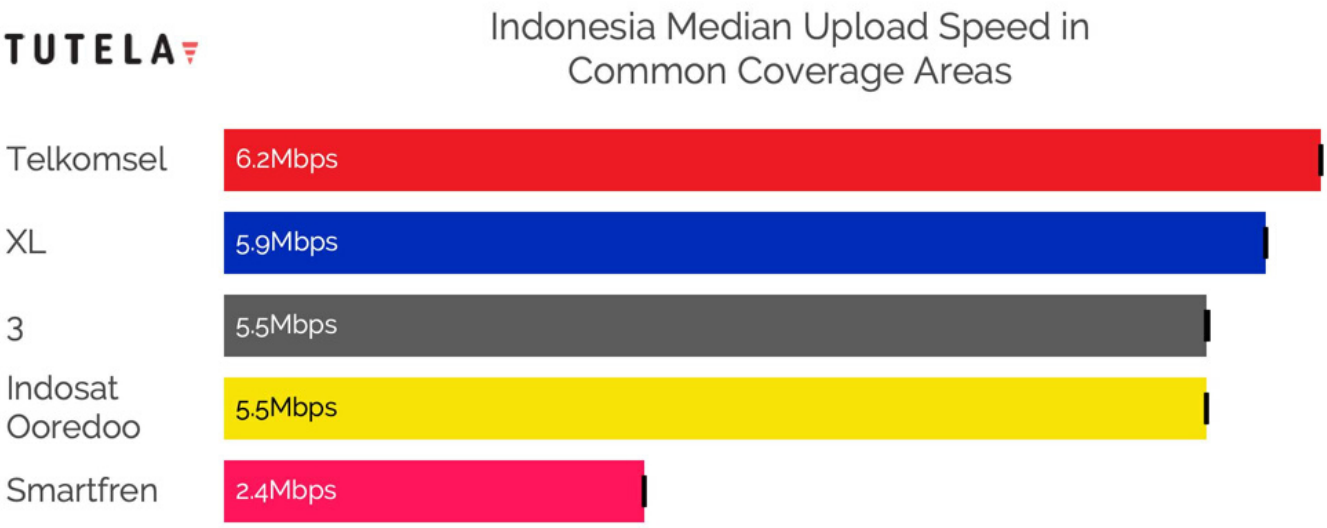


Upload throughput

Indonesia Common Coverage Areas (CCAs)

Four of the five operators in Indonesia finished within 0.7 Mbps of each other for median upload throughput, showing that there's little differentiation between most operators for upload performance.

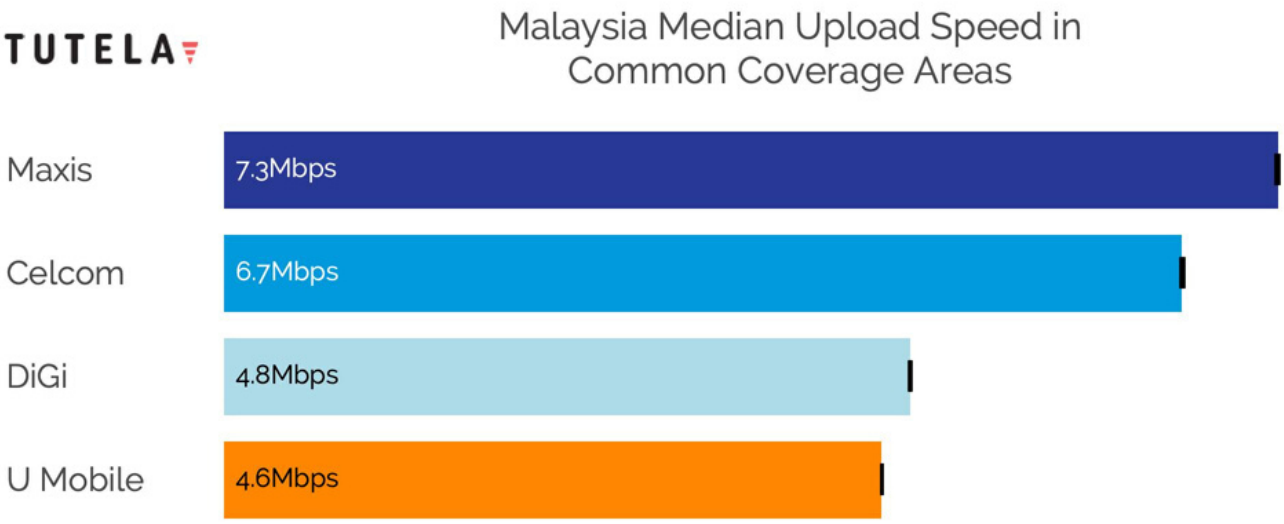
Smartfren was the only significant outlier, and its median upload speed of 2.4 Mbps was less than half the median speed of Ooredoo, the next-closest operator.



Upload throughput

Malaysia Common Coverage Areas (CCAs)

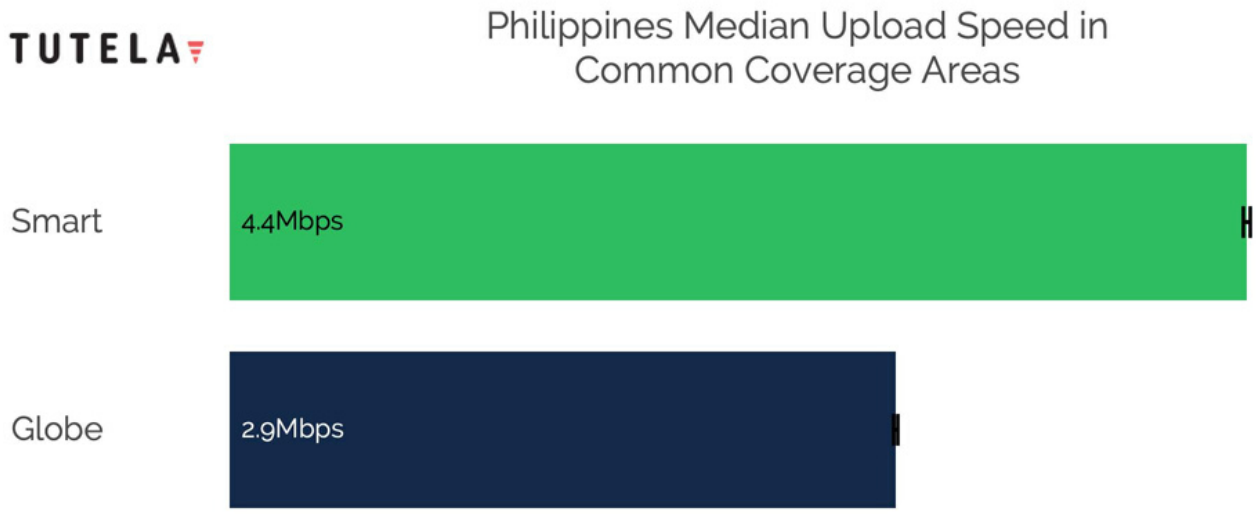
There were two clear groupings of operators for upload performance: Maxis and Celcom were in first and second place respectively, separated by just 0.6 Mbps. DiGi and U Mobile fought for third place, but DiGi's 4.8 Mbps median upload speed was just in excess of U Mobile's 4.6 Mbps.



Upload throughput

Philippines Common Coverage Areas (CCAs)

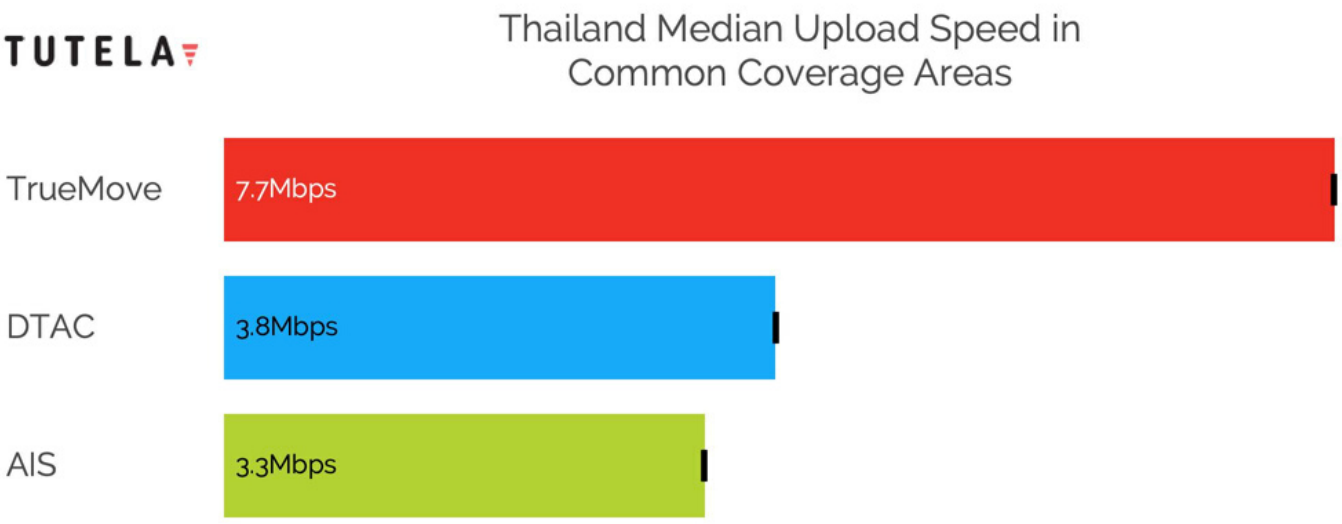
Smart was the clear winner for upload throughput in the Philippines — although, compared to operators in other countries, Smart's 4.4 Mbps is still on the slower end of results. However, Smart still comfortably outperformed Globe, whose median upload speed of 2.9 Mbps was one of the lowest in the report.



Upload throughput

Thailand Common Coverage Areas (CCAs)

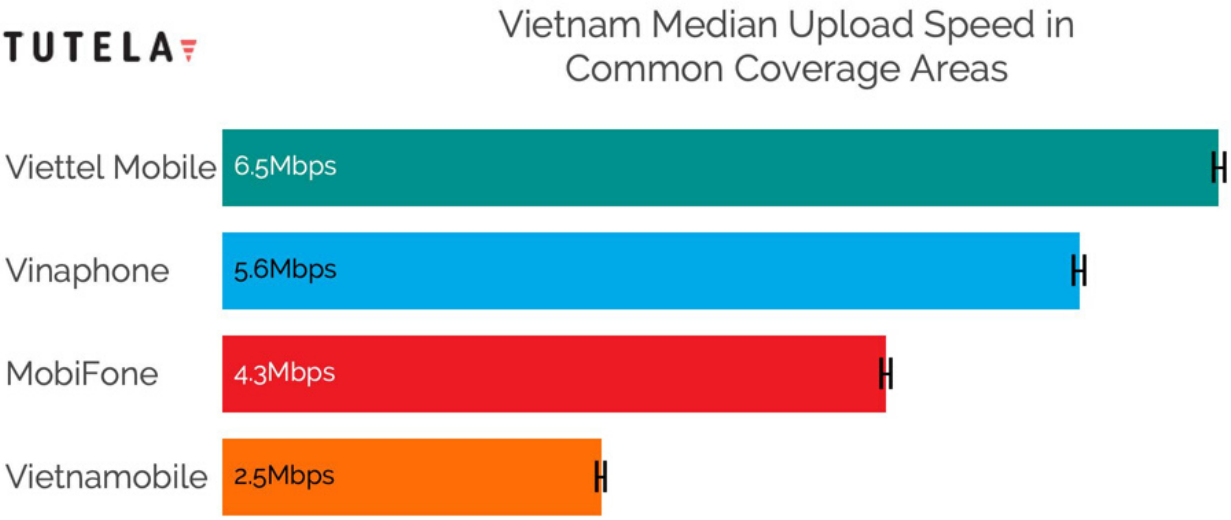
In a reversal of the download throughput results, TrueMove took an emphatic first place for upload speed. Its median upload of 7.7 Mbps was the fastest of any operator in the report, and was also faster than TrueMove's median upload throughput. This is likely due to the plan metering on download throughput mentioned before – often operators apply such metering or traffic management just to download throughputs, meaning upload remains relatively unaffected.



Upload throughput

Vietnam Common Coverage Areas (CCAs)

Viettel Mobile continued its winning streak, taking first place for upload throughput with a median of 6.5 Mbps. Vinaphone was in second place, with a median of 5.6 Mbps, while MobiFone and Vietnamobile rounded out the results. With the exception of Vietnamobile, all the operators were well in excess of the 1.5 Mbps minimum upload throughput required to pass the Excellent Consistent Quality thresholds, and even Vietnamobile's 2.5 Mbps median indicates that a strong majority of its users have a sufficient upload speed for most common applications.

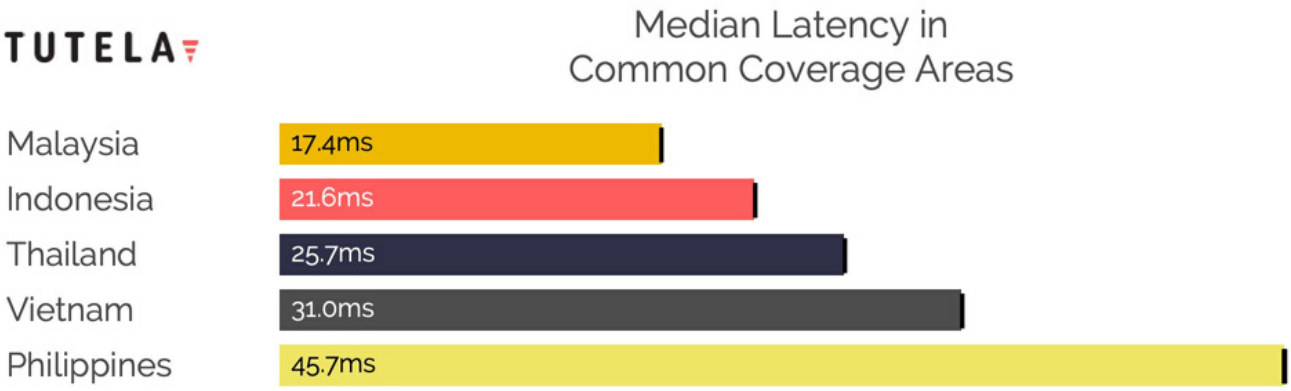


Latency

Country comparison

Latency is an often-overlooked but crucial measure of wireless network quality. Latency measures the responsiveness of a network — specifically, how long it takes for an individual transmission to travel from the user's device to the server the user is trying to communicate with. Latency is particularly crucial for real-time applications, such as VOIP and video calls, or multiplayer online gaming.

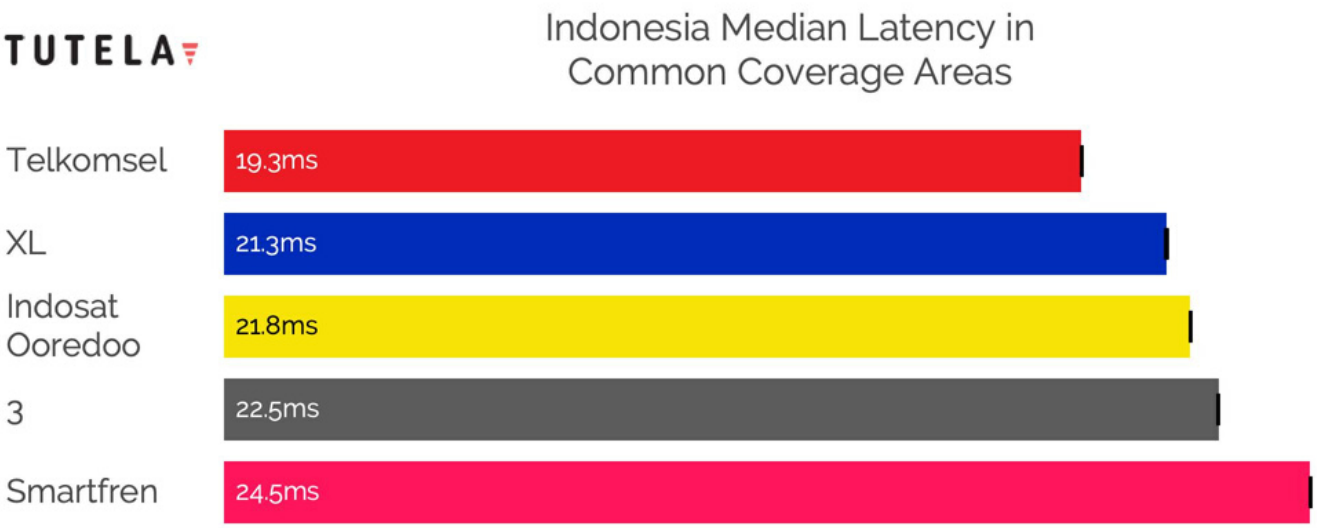
The median latency for all five countries was below the 50ms threshold that Tutela uses for Excellent Consistent Quality — a threshold selected as it's the minimum required for those latency-sensitive applications like gaming and real-time communications. The Philippines is the only country in the test where users are likely frequently experiencing latency-related problems.



Latency

Indonesia Common Coverage Areas (CCAs)

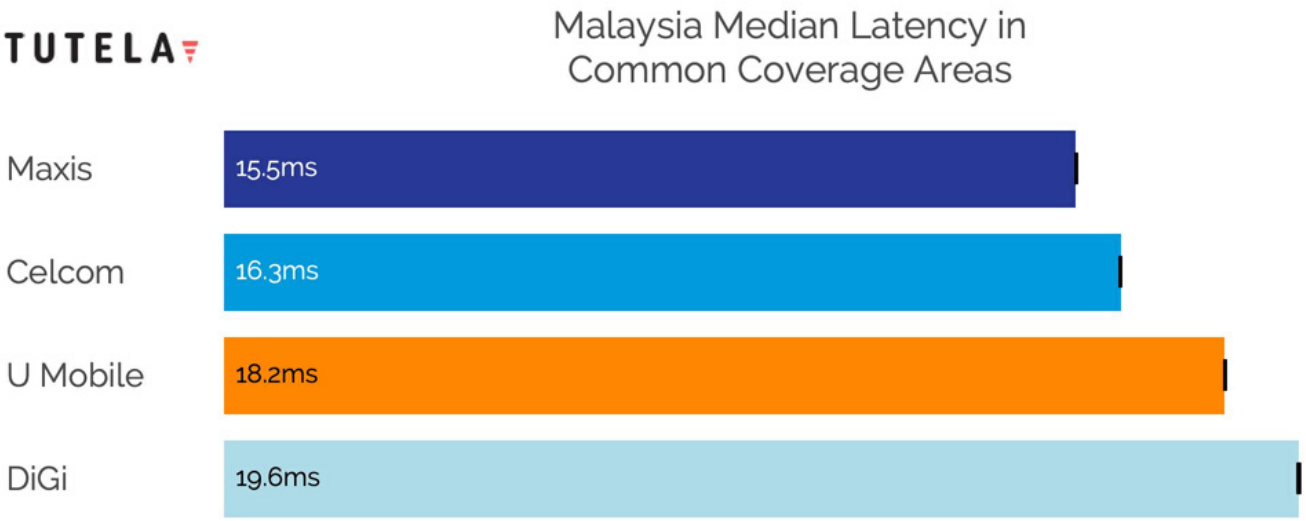
All five operators recorded a median latency within 5.2 milliseconds of each other, indicating that there's little performance difference between networks when it comes to responsiveness. However, it is notable that Telkomsel was able to sneak in with a median latency under 20 milliseconds — the only operator outside of Malaysia to do so.



Latency

Malaysia Common Coverage Areas (CCAs)

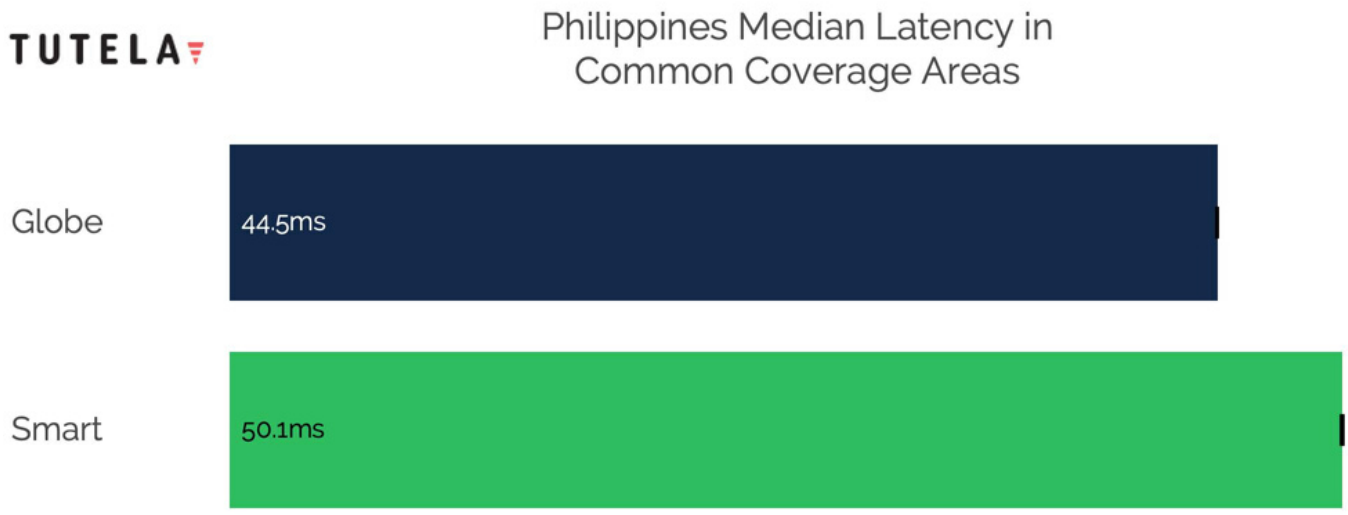
Maxis continued its winning streak, with a median latency of 15.5 milliseconds – good enough for first place in Malaysia, as well as the crown for most responsive operator in the report. However, all the operators in Malaysia demonstrated responsive networks, with median latencies of less than 20 milliseconds across the board.



Latency

Philippines Common Coverage Areas (CCAs)

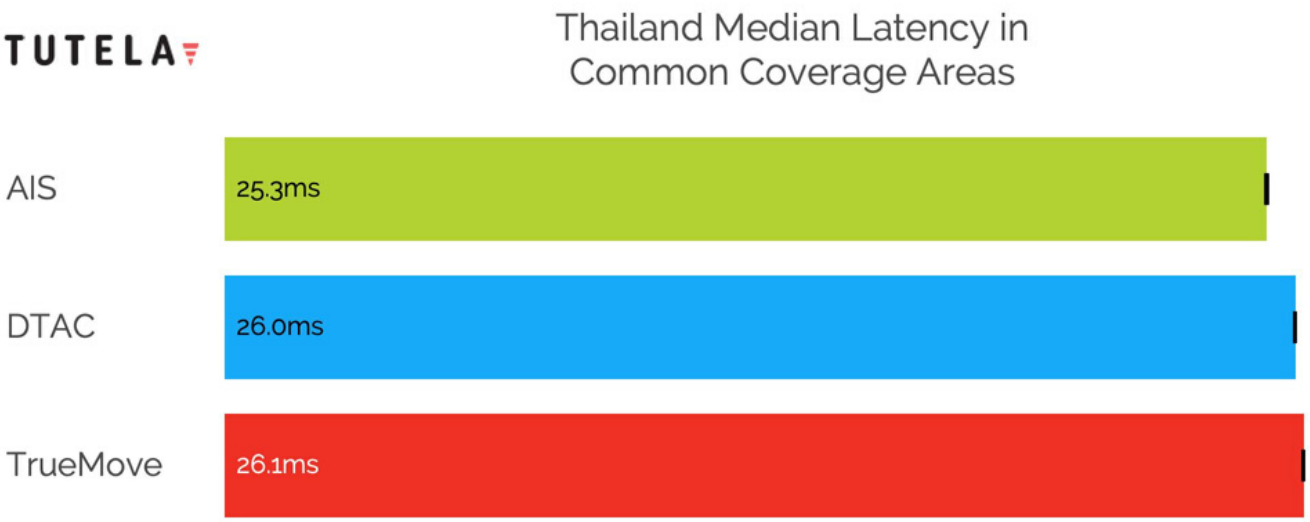
Globe took the crown for the lowest-latency operator in the Philippines, with a median latency more than 5 milliseconds faster than Smart — a significant difference, considering the small time intervals at work. Smart was also the only operator in the test to cross the 50 millisecond barrier, indicating that its users are more likely to experience issues with real-time applications.



Latency

Thailand Common Coverage Areas (CCAs)

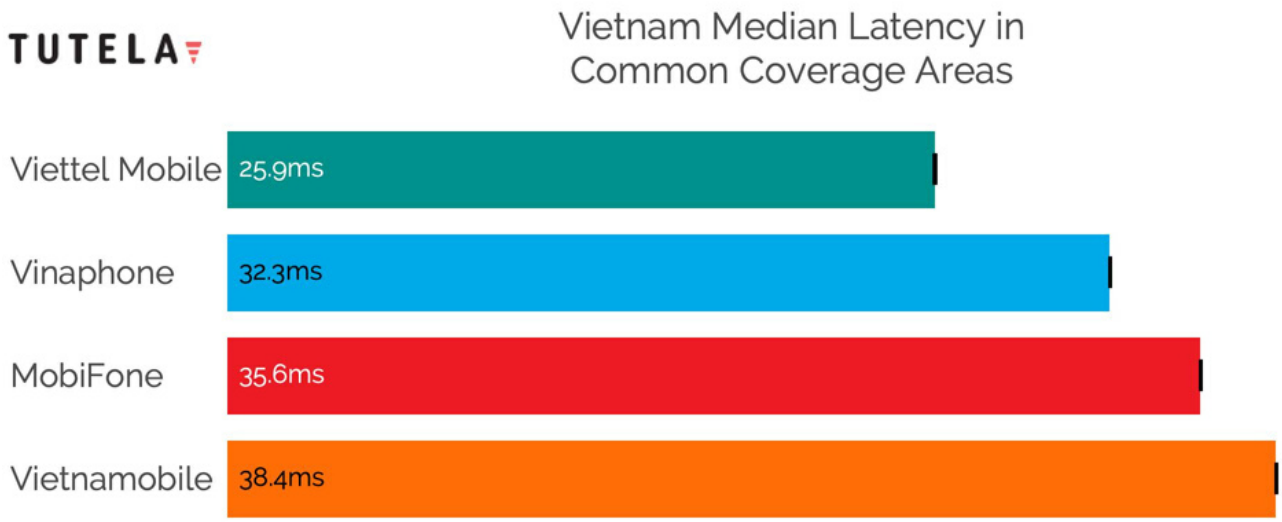
There was virtually no difference in latency performance in Thailand, with the median latency for all three operators within 0.8 milliseconds. AIS was in first place by a statistically significant margin, but in practice, there appears to be little functional difference when it comes to the responsiveness of all operators in Thailand.



Latency

Vietnam Common Coverage Areas (CCAs)

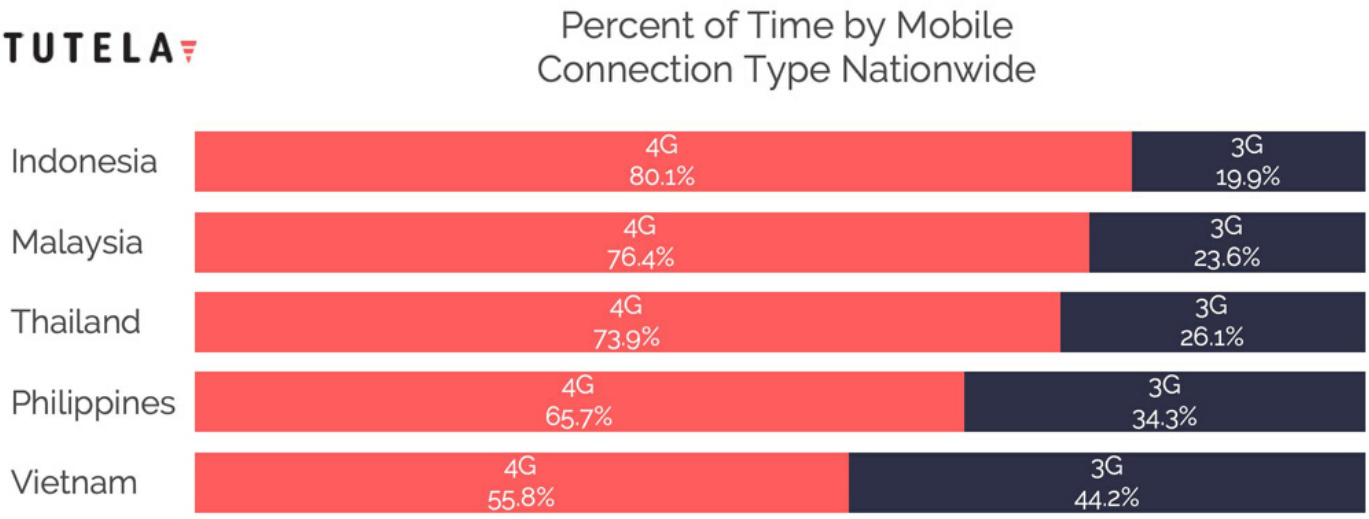
The gap between first-place Viettel and last-place Vientamobile was 12.5 milliseconds, the greatest difference between operators in one country for latency. Viettel again had a clear lead at 25.9 ms, although all operators comfortably outperformed the 50 ms threshold used in Tutela's Consistent Quality metric.



Radio technology usage

Country comparison

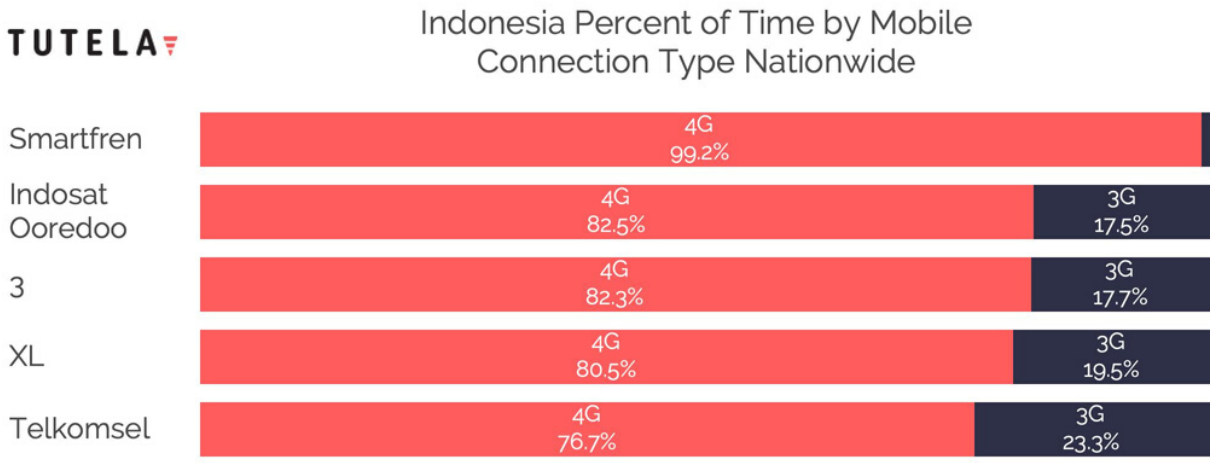
In general, there is a strong correlation between a higher percentage of time spent on 4G and a better mobile experience. 4G networks allow for a much faster download and upload speed, along with a significantly lower latency, meaning that it's much easier for the network to ensure a satisfactory connection. Although there is some link between better mobile networks and a higher 4G time percentage in these results, there are some surprising outliers. Vietnam, which recorded the best Excellent and Core Consistent Quality, has the lowest percentage of time spent on a 4G network. Indonesia, which was middle of the pack for Consistent Quality, records the best 4G percentage of any country.

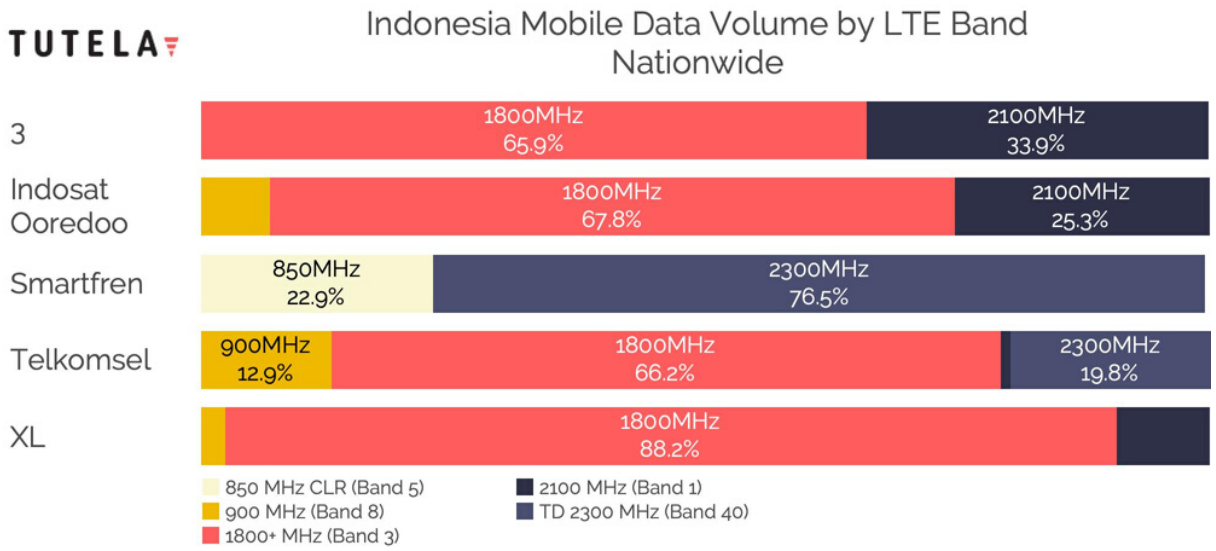


Radio technology usage

Indonesia nationwide

Given the fact that Smartfren only operates a 4G LTE network, it's no surprise to see that its users lead the way in terms of time spent on 4G (with the sliver of 3G likely due to emergency-call-only time spent on other networks). Ooredoo, 3, and XL all saw their users spend similar amounts of time on 4G, at around 80%, whilst Telkomsel — which has the most geographic coverage of any network by far — relies a little more on its 3G network. In terms of spectrum usage, mid to high-band spectrum like 1800 MHz and 2100 MHz dominates. Smartfren is the only particular outlier — it uses the highest proportion of low-band spectrum, with 22.9% of data sent over the 850 MHz band. However, its heavy usage of the 2300 MHz TDD band stands out as being unique.

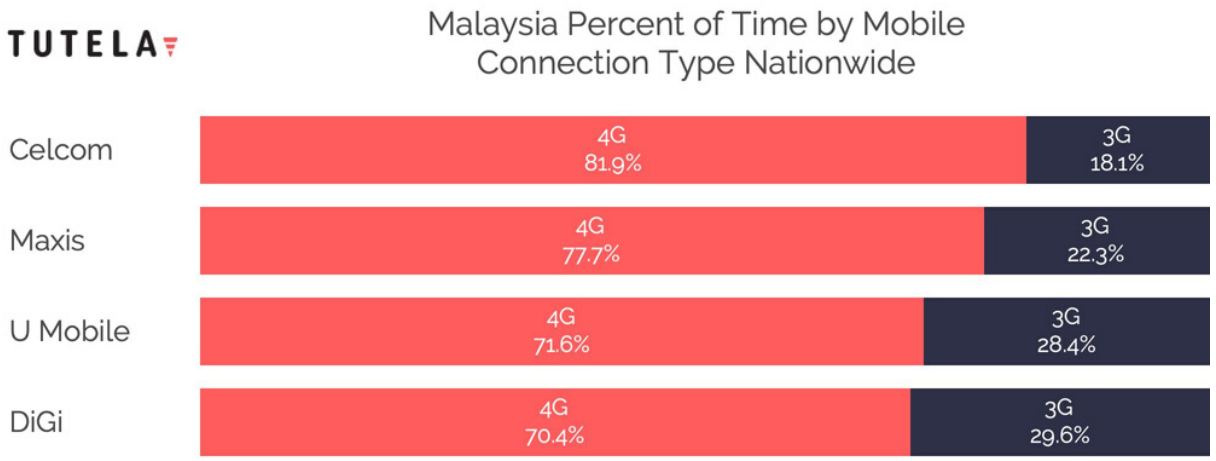


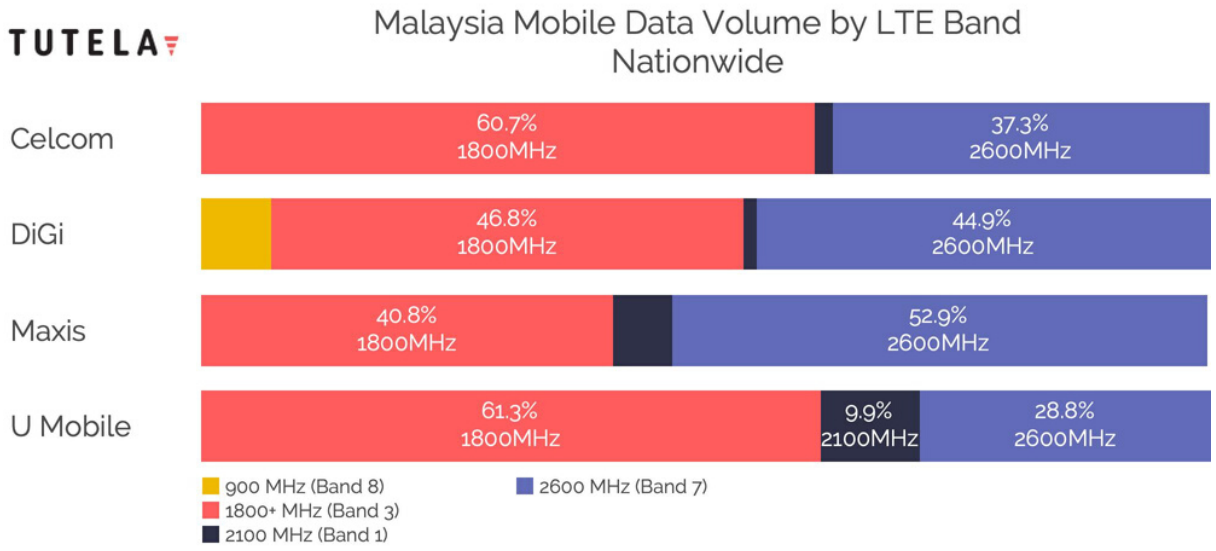


Radio technology usage

Malaysia nationwide

Celcom and Maxis, which dominate in terms of performance metrics, also saw their users stay on 4G for the greatest proportion of time. All four operators rely primarily on 1800 MHz and 2600 MHz for the bulk of their network capacity, with only U Mobile and Maxis using any significant amount of 2100 MHz for additional capacity. DiGi is also unique in being the only operator to use low-band spectrum for LTE, which could give it a coverage advantage in hard-to-reach places such as inside buildings or more rural locations.

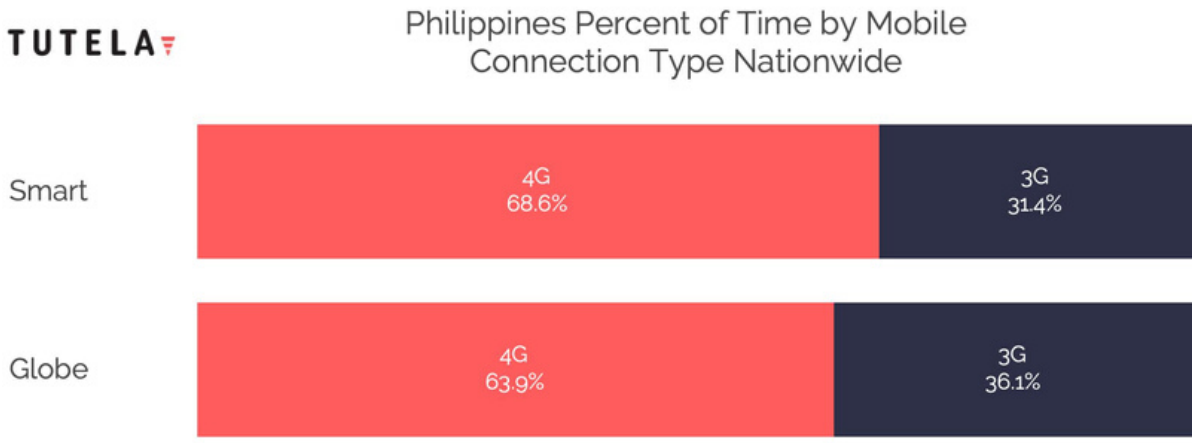


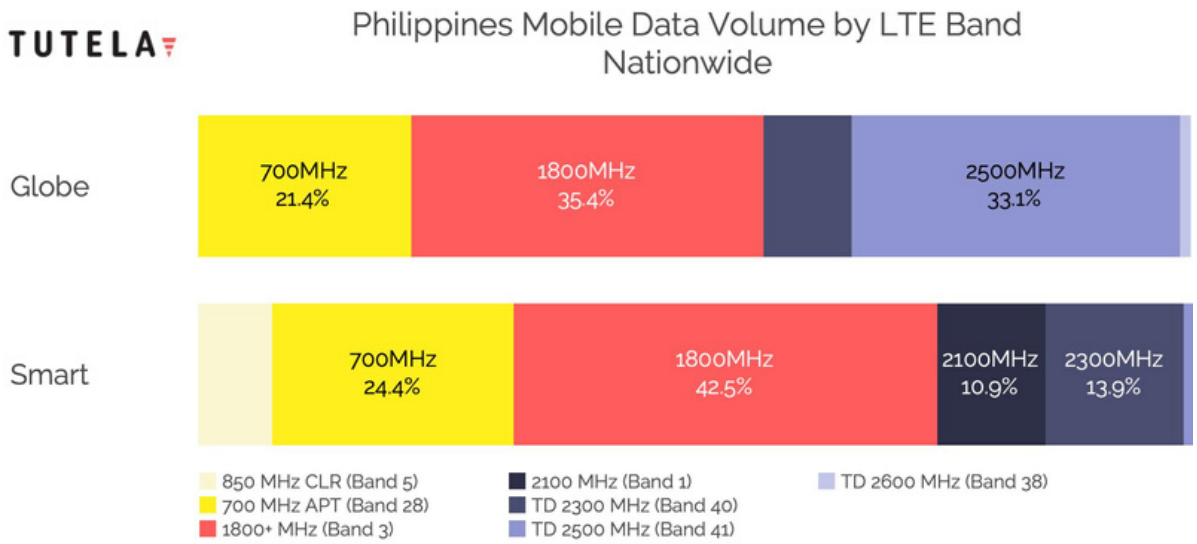


Radio technology usage

Philippines nationwide

Smart, which came first in the majority of performance metrics, also has the edge on Globe for the proportion of time spent on a 4G network. However, when it comes to spectrum deployment, the two networks are very similar: a mix of low, mid, and high-band spectrum is used to carry traffic in nearly-equal proportions.

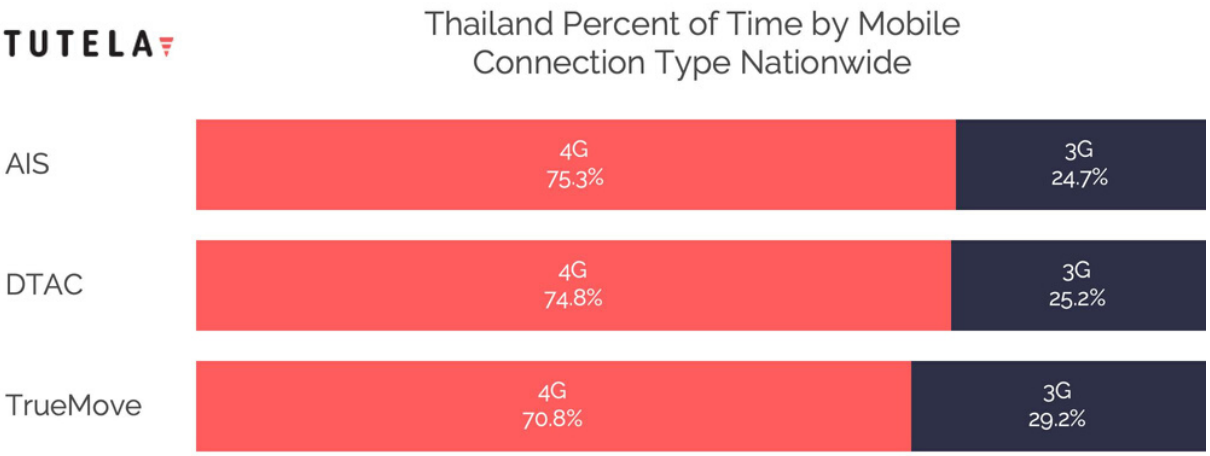


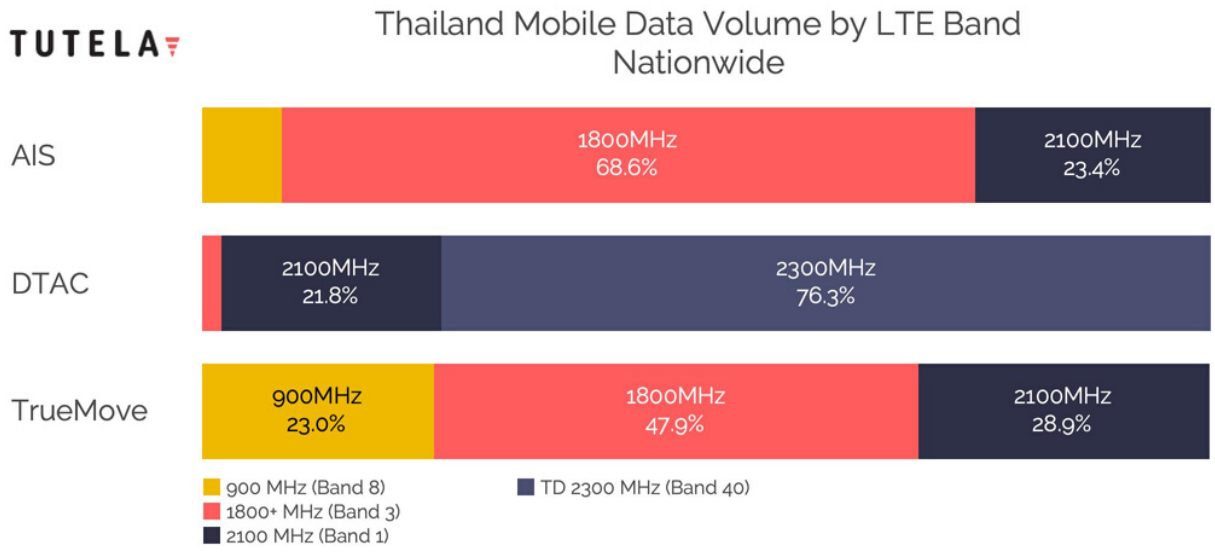


Radio technology usage

Thailand nationwide

AIS and TrueMove employ similar spectrum strategies, with both relying on 1800 and 2100 MHz bands for the majority of data transmission. However, TrueMove stands out for its employment of low-band 900 MHz spectrum for 23% of its data traffic. Low-band spectrum travels further and penetrates obstacles better than mid or high-band spectrum like 1800 or 2100 MHz, which could give TrueMove (and, to a lesser extent, AIS) an advantage in coverage. DTAC relies almost exclusively on high-band spectrum for its LTE data traffic — an advantage in terms of capacity and bandwidth, but a strategy that requires adding more cell towers to achieve full coverage.

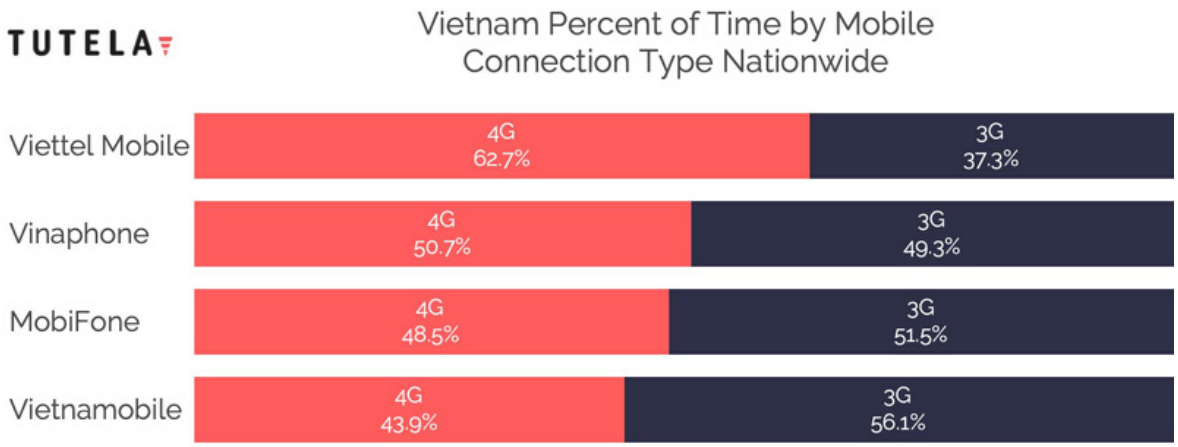


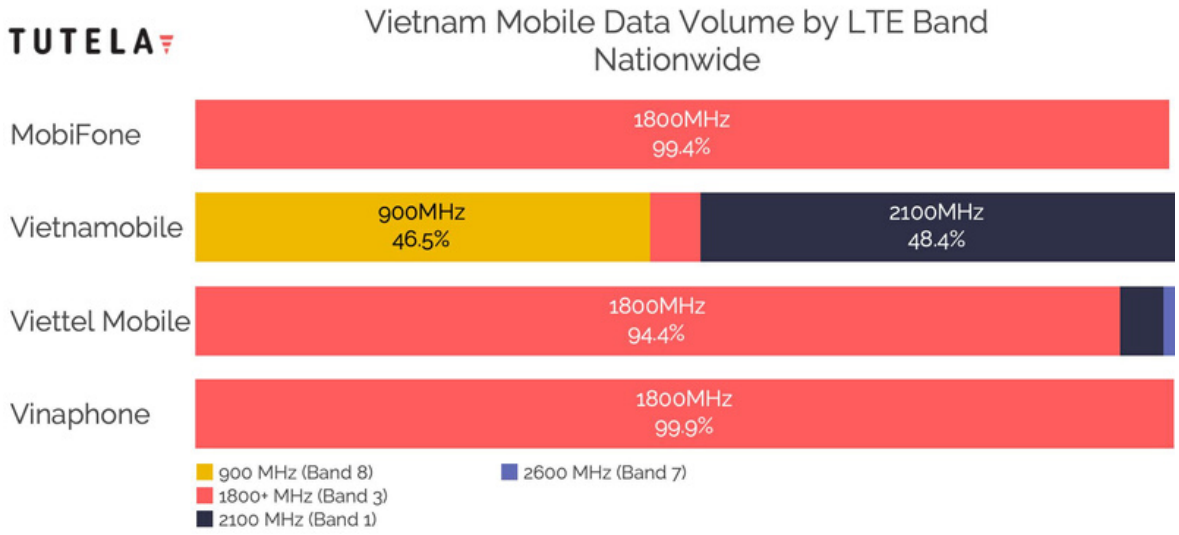


Radio technology usage

Vietnam nationwide

The relatively low proportion of time spent on 4G stands out for the Vietnamese operators. Viettel Mobile was the only operator to see its users spend more than 60% of their time on a 4G connection. When it comes to spectrum usage, 1800 MHz dominates as the primary (or sole) band for three of the four operators. Vietnamobile was the only exception, eschewing 1800 MHz in favour of 900 MHz and 2100 MHz for the majority of its 4G data traffic.





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, we gathered 48 billion records, including over 330 million speed tests and 3.7 billion latency measurements, from over 14 million devices (iOS and Android smartphones) between July 1st and December 31st 2019.

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.

Consistent Quality

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%

Meet Tutela at MWC

Tutela invites executives from telecoms operators to meet with our management team for an executive briefing where you can:

- Learn how Tutela's crowdsourced data solutions can be applied to Benchmarking, Planning, Quality Assurance and Optimisation
- Discover our latest new features and developments for 2020
- See a live demonstration for your markets
- Discuss your objectives and requirements

Visit www.tutela.com/meet-at-mwc-exec-2020 to learn more and schedule a meeting.

Schedule a meeting

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 (%)
Indonesia	3	5.6	0.01	5.5	0.00	22.5	0.00	47.5	±0.05	80.1	±0.04
	Indosat Ooredoo	7.2	0.01	5.5	0.00	21.8	0.00	56.1	±0.04	84.7	±0.03
	Smartfren	5.0	0.01	2.4	0.00	24.5	0.00	41.1	±0.08	81.5	±0.06
	Telkomsel	11.3	0.01	6.2	0.00	19.3	0.00	73.4	±0.04	94.9	±0.02
	XL	7.8	0.01	5.9	0.00	21.3	0.00	53.7	±0.04	81.7	±0.03
Malaysia	Celcom	12.5	0.01	6.7	0.01	16.3	0.00	73.0	±0.04	94.5	±0.02
	DiGi	10.9	0.02	4.8	0.01	19.6	0.00	66.0	±0.06	92.3	±0.03
	Maxis	16.0	0.02	7.3	0.01	15.5	0.00	80.2	±0.05	97.0	±0.02
	U Mobile	4.5	0.00	4.6	0.00	18.2	0.00	38.7	±0.06	89.2	±0.04
Philippines	Globe	5.3	0.01	2.9	0.01	44.5	0.01	46.1	±0.14	85.4	±0.10
	Smart	7.2	0.04	4.4	0.01	50.1	0.04	48.7	±0.18	79.7	±0.14
Thailand	AIS	4.1	0.01	3.3	0.01	25.3	0.00	41.4	±0.06	65.6	±0.06
	DTAC	6.3	0.02	3.8	0.01	26.0	0.00	52.3	±0.08	83.0	±0.06
	TrueMove	4.5	0.00	7.7	0.01	26.1	0.00	41.2	±0.07	82.3	±0.06
Vietnam	MobiFone	9.7	0.07	4.3	0.03	35.6	0.01	66.9	±0.34	93.4	±0.18
	Vietnamobile	3.2	0.04	2.5	0.02	38.4	0.02	30.3	±0.61	78.6	±0.55
	Viettel Mobile	13.4	0.10	6.5	0.04	25.9	0.00	79.1	±0.23	96.1	±0.11
	Vinaphone	12.5	0.12	5.6	0.04	32.3	0.01	76.9	±0.35	95.8	±0.17

Appendix

TUTELA

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 (%)
Indonesia	3	5.6	0.01	5.5	0.00	22.5	0.00	47.54	±0.05	80.0	±0.04
	Indosat Ooredoo	7.2	0.01	5.5	0.00	22.0	0.00	55.85	±0.04	84.6	±0.03
	Smartfren	5.0	0.01	2.4	0.00	24.6	0.00	40.98	±0.08	81.4	±0.06
	Telkomsel	11.0	0.01	5.9	0.00	19.9	0.00	72.64	±0.04	94.6	±0.02
	XL	7.7	0.01	5.8	0.00	21.4	0.00	53.47	±0.04	81.5	±0.03
Malaysia	Celcom	12.5	0.02	6.6	0.01	16.4	0.00	72.94	±0.04	94.5	±0.02
	DiGi	10.8	0.02	4.7	0.01	19.6	0.00	65.89	±0.06	92.2	±0.03
	Maxis	16.0	0.02	7.3	0.01	15.5	0.00	80.19	±0.05	97.0	±0.02
	U Mobile	4.5	0.00	4.6	0.00	18.2	0.00	38.68	±0.06	89.2	±0.04
Philippines	Globe	5.3	0.01	2.9	0.01	44.5	0.01	46.07	±0.14	85.4	±0.10
	Smart	7.2	0.04	4.4	0.02	50.1	0.04	48.65	±0.18	79.7	±0.14
Thailand	AIS	4.0	0.01	3.2	0.01	25.3	0.00	41.03	±0.06	65.3	±0.05
	DTAC	6.2	0.02	3.8	0.01	26.0	0.00	52.16	±0.08	83.0	±0.06
	TrueMove	4.5	0.00	7.7	0.01	26.2	0.00	40.97	±0.07	82.2	±0.06
Vietnam	MobiFone	9.4	0.07	4.1	0.03	36.0	0.01	65.82	±0.33	93.0	±0.18
	Vietnamobile	3.2	0.04	2.4	0.02	38.7	0.02	30.40	±0.58	78.3	±0.52
	Viettel Mobile	13.1	0.09	6.2	0.03	26.5	0.00	77.97	±0.20	95.9	±0.10
	Vinaphone	11.6	0.10	5.2	0.04	33.1	0.01	74.31	±0.33	95.0	±0.16

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 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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