

DACH

State of Mobile Networks

April 2019

Analysis of Tutela crowdsourced data from over 102 billion mobile network measurements.

For further information about the methodology, data and tools used to create this report, please contact analysis@tutela.com.

TUTELA 

Measuring network quality

Key findings

- ▶ Switzerland had the best consistent quality and fastest average download speeds across the region. Swiss operators also took home all the individual awards, with Sunrise winning the best consistent quality, and Swisscom posting the best average download speed.
- ▶ German networks continue to rely heavily on 3G, particularly in rural areas. Germany recorded an average of 33.3% mobile data usage over 3G; those numbers were just 10.4% and 18.0% in Switzerland and Austria respectively.
- ▶ Despite Austria's networks handling some of the highest data usage rates in the world, both 3 and A1 delivered consistent quality on par with operators in other countries. 3 took first place for best excellent consistent quality within the country, while A1's superior rural coverage helped it overtake 3 to deliver the best basic consistent quality.

Key numbers

102 billion measurements
18 million speed tests
217 million latency tests
540 million jitter and
packet loss tests

21st September 2018 -
20th March 2019

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Introduction

2019 has opened with a flurry of spending on 5G spectrum licenses in Germany(1), Austria(2), and Switzerland(3), but while the operators might have their eye on the future, 4G networks remain the reality consumers are living with.

Despite demographic similarities between the countries studied, data shows that consumers' experience with wireless networks varies significantly across the region. Some Austrian networks see data usage 15 times higher than their German counterparts(4), while download

while download speeds in Switzerland are significantly higher than in neighbouring countries, despite stringent limits on EMF exposure(5).

To quantify the difference in customer quality of experience between different countries and operators, Tutela has collected and analyzed more than 18 million speed tests and over 200 million latency tests, collected from 21st September 2018 to 20th March 2019.

(1) Bidding picks up again in Germany's 5G mobile spectrum auction
<https://ca.reuters.com/article/technologyNews/idCAKCN1RG10N-OCATC>
Retrieved 12 April 2019

(2) The Austrian 3.5GHz auction raised 188 million EUR
<http://5gobservatory.eu/the-austrian-3-5ghz-auction-raised-188-million-eur/>
Retrieved 12 April 2019

(3) Swisscom, Sunrise, Salt pay \$380 million for Swiss 5G frequencies
<https://www.reuters.com/article/us-swiss-telecoms-5g/swisscom-sunrise-salt-pay-380-million-for-swiss-5g-frequencies-idUSKCN1PX12W>
Retrieved 12 April 2019

(4) China and India shift to 4th gear – leave many mature markets in the dust
<https://tefficient.com/wp-content/uploads/2019/01/tefficient-industry-analysis-3-2018-mobile-data-usage-and-revenue-1H-2018-per-country-final-17-Jan-2019.pdf>
Retrieved 12 April 2019

(5) Exposure Limits for Radiofrequency Energy: Three Models
https://www.who.int/peh-emf/meetings/day2Varna_Foster.pdf
Retrieved 12 April 2019

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Get started

Consistent quality

Historically, download speeds have been used as the standard for measuring mobile network performance. For years, the logic has gone like this: the faster the download throughput, the better the network experience for subscribers.

However, as networks (and how subscribers have used them) have evolved, the means used to evaluate them have changed. Adequate download speed is just one of several crucial requirements for a “good” connection, and an over-emphasis on download speeds that are well in excess of what’s required for almost all mobile applications has caused other network performance measurements to be overlooked.

To solve this problem, Tutela has developed a metric called consistent quality. It incorporates five network performance measurements: download speed, upload speed, latency, jitter, and packet loss. Every time Tutela collects those measurements on a mobile connection, we compare them against two sets of thresholds,

Excellent quality

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

Basic quality

Download speeds > 512 Kbps
Upload speeds > 128 Kbps
Latency < 100 ms
Jitter < 50 ms
Packet loss < 5%

which were selected using the minimum performance requirements of popular mobile applications. There are two sets of thresholds, excellent and basic. If all the network measurements meet or exceed the standards for excellent consistent quality, we conclude that the user can use services like Netflix, Skype, YouTube, or other real-time or streaming video applications (in 720p HD) with no noticeable problems or hiccups, since these will exceed the minimum network requirements set by these services. Connections that don’t meet the thresholds may still allow users to use those services, but without the same likelihood of a flawless experience.

The basic consistent quality thresholds follow a similar principle, but for less demanding use-cases. A connection that meets the basic consistent quality thresholds will be sufficient for things like web browsing, email, or a VOIP voice call on a service like WhatsApp or Viber. Tutela set these thresholds based on the network requirements set by the applications (where available). You can read more about how Tutela chose these thresholds and what they represent here(6).

In the reports, Tutela represents each operators’ consistent quality with a percentage score; this number represents what percentage of tested network connections met or exceeded the excellent or basic consistent quality thresholds. Every connection that meets the excellent consistent quality threshold also exceeds the requirements for basic consistent quality.

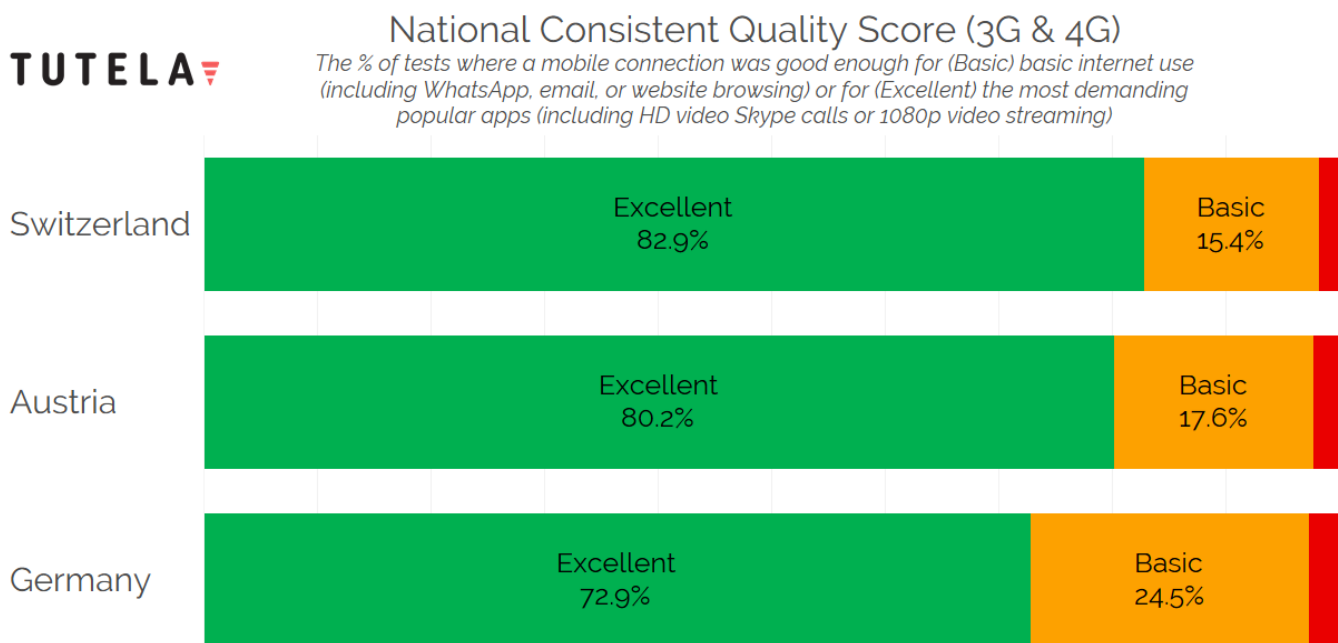
(6) Introducing Consistent Quality - measuring more than just speed
<https://www.tutela.com/blog/introducing-consistent-quality-measuring-more-than-speed>
Retrieved 12 April 2019

Consistent quality

Swiss operators took first place for both excellent and basic consistent quality, although their advantage was most pronounced when it came to excellent quality. The difference in basic quality is minimal: the Swiss average was 98.3%, Austria was second on 97.8%, and Germany was third on 97.4%. With less than one percent separating first and last place, there's little difference in basic consistent quality across the region.

For excellent quality however, the gap between Germany and other countries is more pronounced. Switzerland took first place with a small (but significant) lead over Austria, 82.9% compared to Austria's 80.2%. However, the gap to Germany is much wider, with its excellent consistent quality of 72.9% putting it a ways behind the other countries.

Much of the difference is likely attributable to Germany's greater reliance on 3G: the more demanding requirements of the excellent consistent quality thresholds make it difficult to achieve an excellent connection over 3G.



Consistent quality

Switzerland

Although Switzerland leads the region in excellent consistent quality, there are differences in the quality of connection provided among the network operators. Sunrise took first place for excellent consistent quality, but just one percent separates Sunrise from second-place Swisscom.

Switzerland's largest operator also beat out Sunrise for basic consistent quality, with a score of 98.6% compared to Sunrise's 97.9%. Salt finished in last place for both excellent and basic consistent quality.

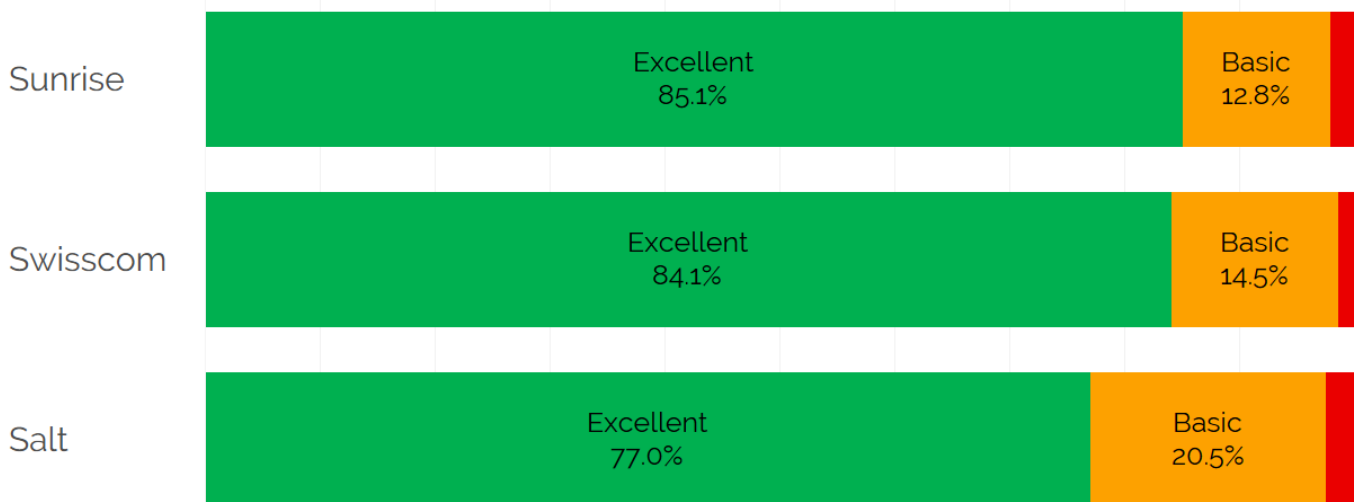
The gap is minimal for basic consistent quality - - Salt is just 0.4% below Sunrise for basic consistent quality -- but over seven percent for excellent consistent quality.

In practice, the difference in consistent quality score should translate to a similar experience for customers of all three networks when it comes to web browsing, checking emails, or placing VOIP calls. For more demanding use-cases, the superior excellent consistent quality scores of Sunrise and Swisscom should translate to a noticeably better experience for subscribers.

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Swiss Consistent Quality Score (3G & 4G)

The % of tests where a mobile connection was good enough for (Basic) basic internet use (including WhatsApp, email, or website browsing) or for (Excellent) the most demanding popular apps (including HD video Skype calls or 1080p video streaming)



Consistent quality

Austria

3 narrowly won the crown for best excellent consistent quality within Austria, a particularly impressive result given that the network has the third-highest data usage (per SIM) of any operator in the world(7), and carries 43% of Austria's mobile data traffic. All else being equal, high data usage tends to correlate to a diminished network performance, thanks to congestion, but 3 appears to be walking the line between efficient network utilization and overcrowding quite accurately.

A1 delivered the highest overall basic consistent quality, at 98.4% compared to 3's 98.1% -- in part due to its larger network coverage compared to other Austrian operators.

In addition, A1 is only behind 3 on excellent consistent quality by 1.7%. Like 3, A1 also has a significant fixed wireless offering, so its strong showing in consistent quality demonstrates again that Austria's mobile subscribers are not suffering as a result of fixed wireless deployment.

T-Mobile is in last place for excellent consistent quality, finishing almost five percent behind first-place 3. T-Mobile is in the middle of the pack for 3G vs 4G utilization, and performs well on latency; however, its last-place finishes for download and upload speed translate to a minor decrease in consistent quality compared to the other operators.

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Austrian Consistent Quality Score (3G & 4G)

The % of tests where a mobile connection was good enough for (Basic) basic internet use (including WhatsApp, email, or website browsing) or for (Excellent) the most demanding popular apps (including HD video Skype calls or 1080p video streaming)



(7) Industry analysis #1 2019

<https://tefficient.com/wp-content/uploads/2019/03/tefficient-industry-analysis-1-2019-mobile-data-usage-and-revenue-FY-2018-per-operator-29-March.pdf>

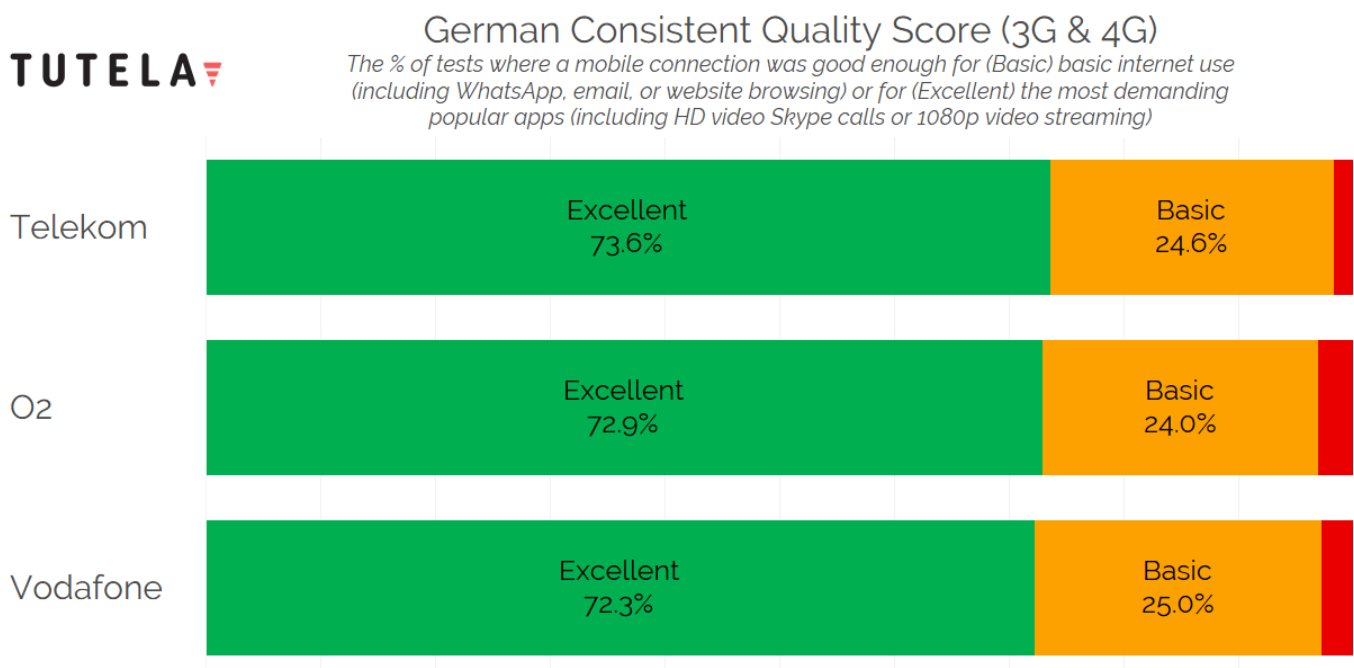
Retrieved 12 April 2019

Consistent quality

Germany

All three German operators are extremely close on consistent quality. Telekom has the edge in both excellent and basic consistent quality, with its 73.6% excellent consistent quality score putting it 0.7% ahead of next-placed O2. Telekom's lead in basic consistent quality is even greater, as it finished 0.9% ahead of next-placed Vodafone for basic consistent quality.

As well as being extremely similarly matched for excellent consistent quality -- just 1.3% separates first and last place -- all three German operators finished behind any of the operators in Austria or Switzerland for excellent consistent quality, highlighting the gap in network quality between the regions.





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Tutela Explorer is a powerful cloud-based solution for real-time analysis of crowdsourced data. Using the platform, mobile operators can:

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- 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

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Learn more

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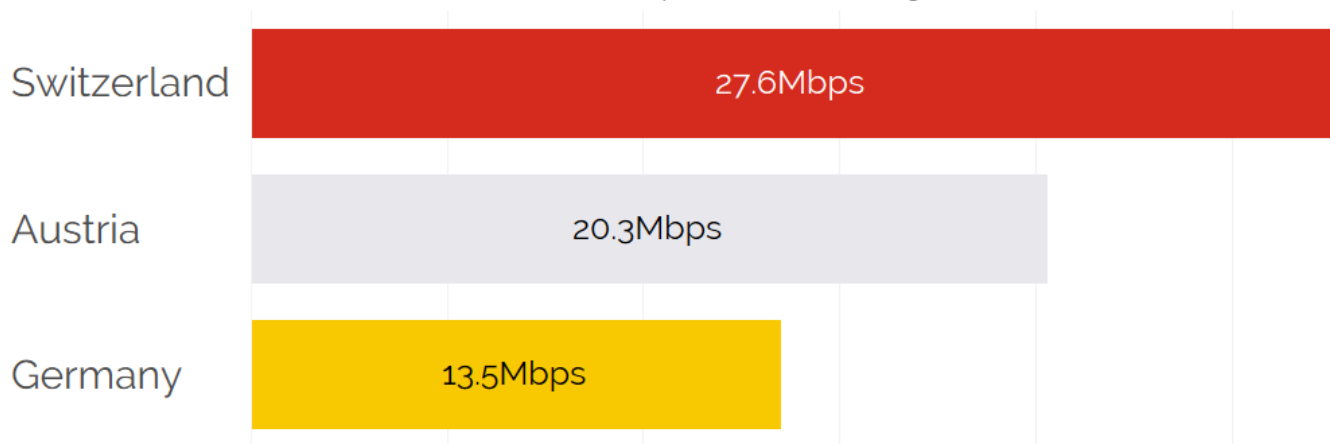
Download speeds

The difference between Switzerland and Germany might be relatively small for excellent consistent quality, but the gulf is much wider when looking at download speeds. Swiss mobile subscribers saw an average download speed of 27.6 Mbps, significantly faster than next-placed Austria, and double the average download speed of Germany. All three nations saw average download speeds well in excess of even the excellent consistent quality thresholds -- hence the more limited difference in consistent quality -- but Switzerland's download performance is impressive nonetheless.

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National Average Download Speed (3G & 4G)

Download speed measured using a 2MB file size



Download speeds

Switzerland

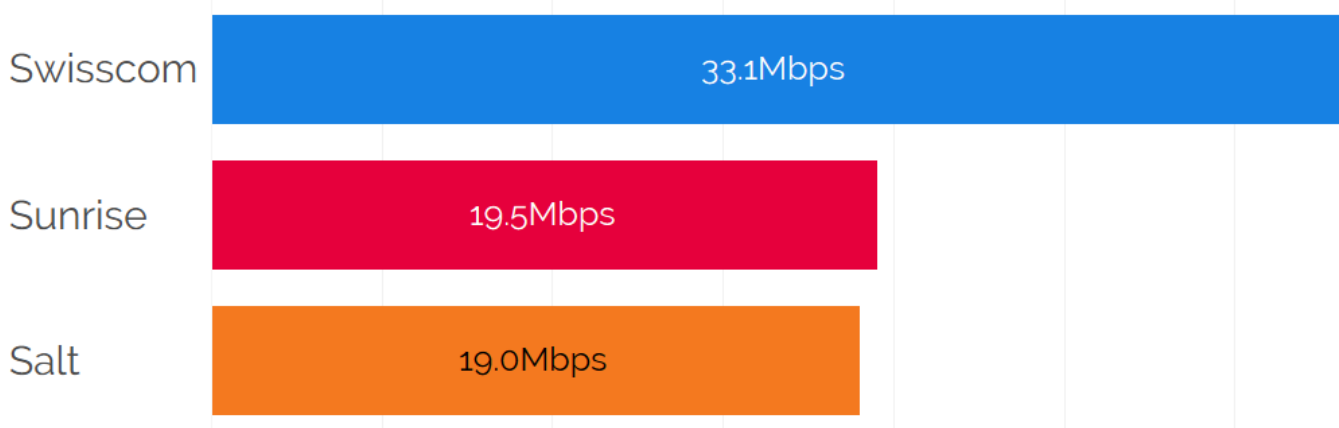
Within Switzerland, there's a clear winner on download speeds. Swisscom saw an average of 33.1 Mbps across 4G and 3G, more than 13 Mbps faster than its next-closest competitor. Previous analysis by Tutela and Rewheel(8) has shown that Swiss operators consistently have the fastest average download speeds of any country in Europe.

Much of the speed is attributable to Switzerland's unique approach to mobile infrastructure: strict limits on EMF exposure in Switzerland cause Swiss operators to have a lower total signal power than operators in other countries. To offset this somewhat, Swiss operators (particularly Swisscom) have deployed multiple LTE bands per tower, and use carrier aggregation to increase performance.

TUTELA

Swiss Average Download Speed (3G & 4G)

Download speed measured using a 2MB file size



(8) Site density is key to LTE network performance – and critical for 5G

http://research.rewheel.fi/downloads/Rewheel_Tutela_LTE_5G_performance_drivers_Europe_17022019_FINAL.pdf

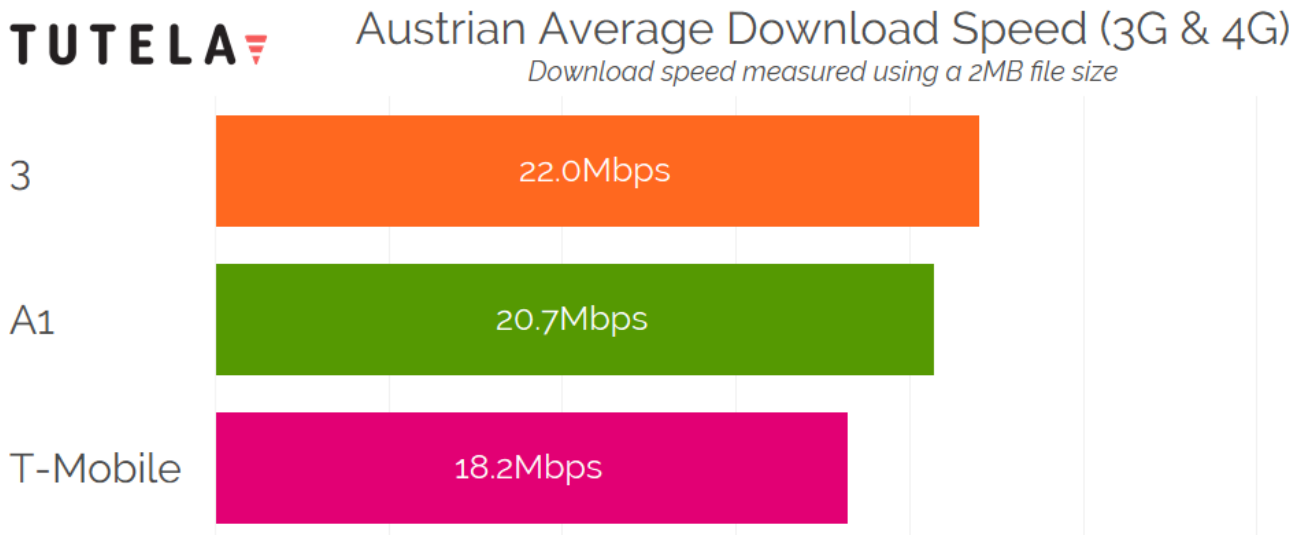
Retrieved 12 April 2019

Download speeds

Austria

3 has the best download speed among Austrian operators, with a small but significant lead of 1.3 Mbps over next-placed A1. 3's impressive download performance is even more so when considering the volume of data traffic its network handles. A1's speeds are also impressive given this number incorporates both rural and urban network deployments, and a higher proportion of A1's users are in rural areas compared to the other operators.

Although none of the Austrian operators can challenge Swisscom's exceptional 33 Mbps average download speed, it's notable that all of Austria's operators are close to the same 20 Mbps average download speed as Switzerland's other operators, suggesting that Switzerland's overall advantage in download speed is attributable to Swisscom's download throughput performance.



Download speeds

Germany

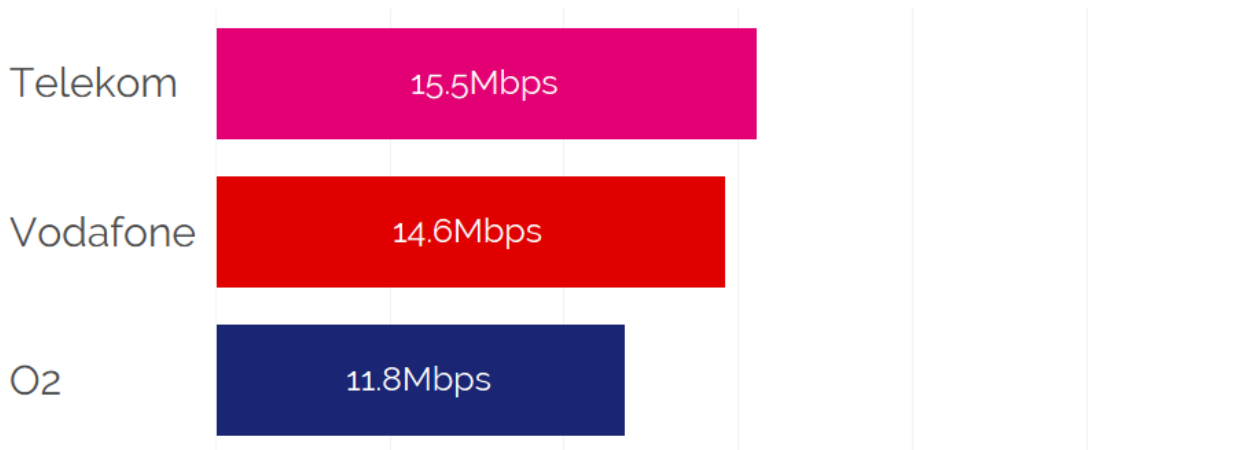
None of the German operators can challenge the download speeds recorded by operators in Austria or Switzerland; Telekom, Germany's best-performing operator for download speed, would be in last place behind all operators in Austria or Switzerland.

Among German operators, Telekom has the best combined 4G and 3G download speeds, 15.5 Mbps in front of next-placed Vodafone. O2 recorded the lowest average download speed of any operator in the test, an average of 11.8 Mbps. However, it's still notable that all three German operators still saw average download speeds well in excess of the requirements for excellent consistent quality.

TUTELA 

German Average Download Speed (3G & 4G)

Download speed measured using a 2MB file size



Upload speeds

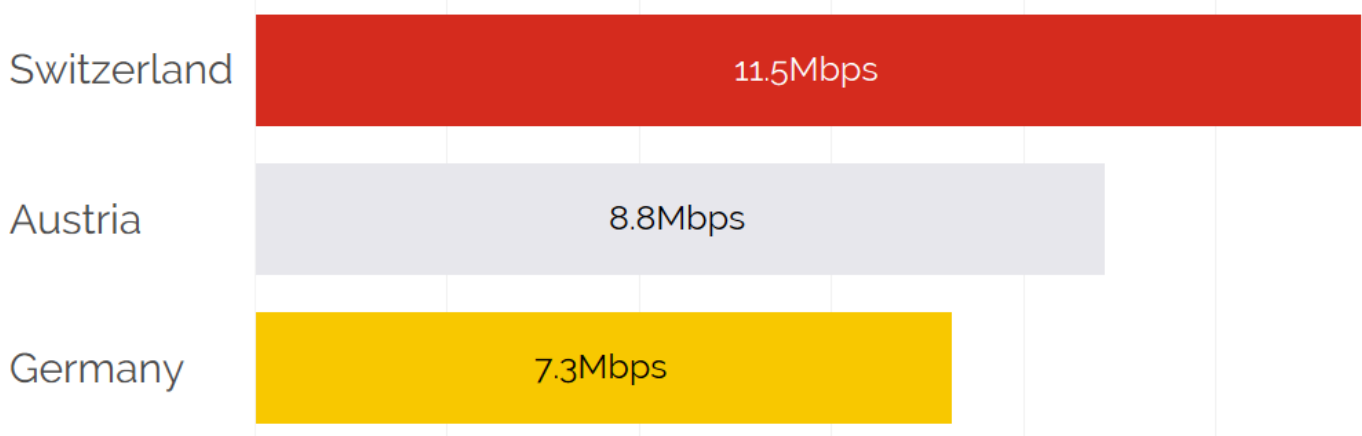
Just as for download speeds, Swiss operators lead the competition by a healthy margin when it comes to upload speeds. The average for all three Swiss operators came to 11.5 Mbps, compared to 8.8 Mbps in Austria, and 7.3 Mbps. Although this proved to be another win for Swiss operators, the gap to Austria and Germany was less pronounced than it is for download speeds.

It's also worth noting that although Switzerland recorded the fastest average upload speed, even the 7.3 Mbps that German operators averaged was nearly four times higher than the 2 Mbps upload necessary to exceed Tutela's excellent consistent quality standard. In other words, upload speed is not the limiting factor for network performance in any of the countries in the region.

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National Average Upload Speed (3G & 4G)

Upload speed measured using a 1MB file size



Upload speeds

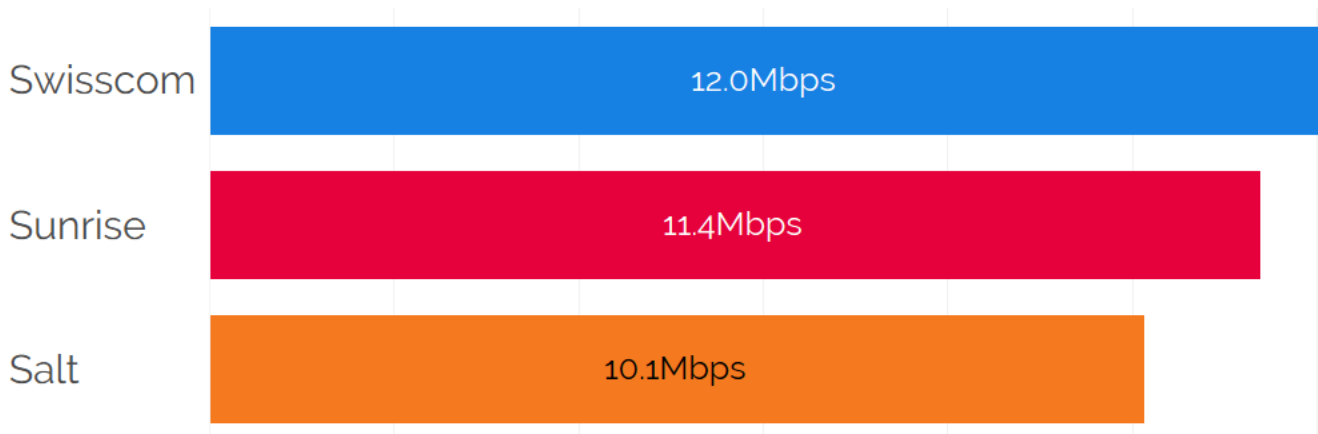
Switzerland

Swisscom once again took first place over its competitors for average upload speed, but unlike download speed, the results are much closer. Swisscom's average upload speed was just 0.6 Mbps ahead of second-place Sunrise, and the gap to third-place Salt was less than 2 Mbps.

TUTELA 

Swiss Average Upload Speed (3G & 4G)

Upload speed measured using a 1MB file size



Upload speeds

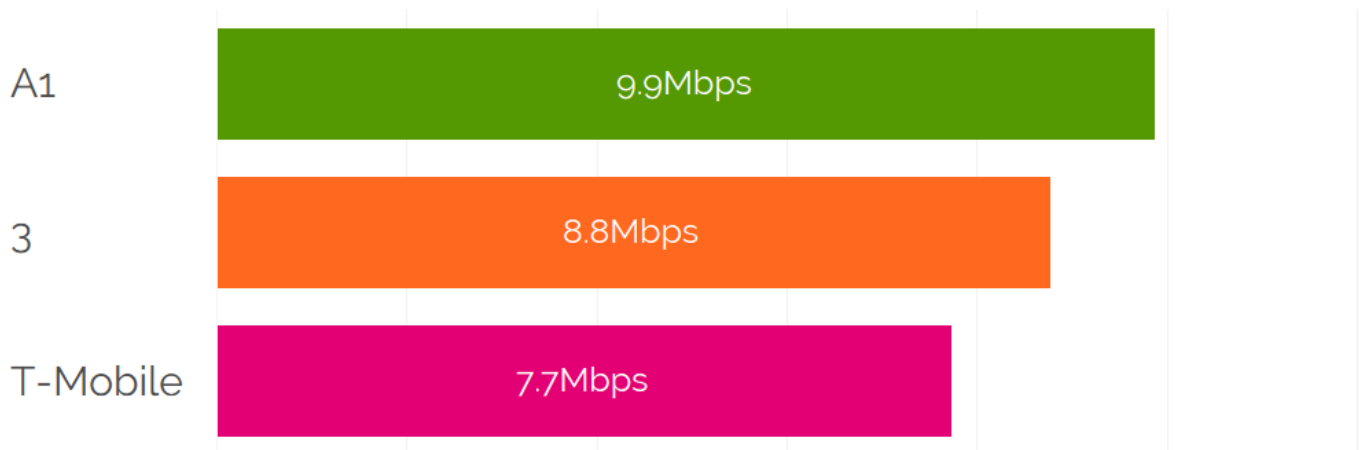
Austria

A1 provided the fastest average upload speed to its subscribers, achieving a mean upload speed of 9.9 Mbps. 3 -- which is top for both download speed and consistent quality -- came in second at 8.8 Mbps, whilst T-Mobile retained its third-place finish with an average of 7.7 Mbps.

TUTELA 

Austrian Average Upload Speed (3G & 4G)

Upload speed measured using a 1MB file size



Upload speeds

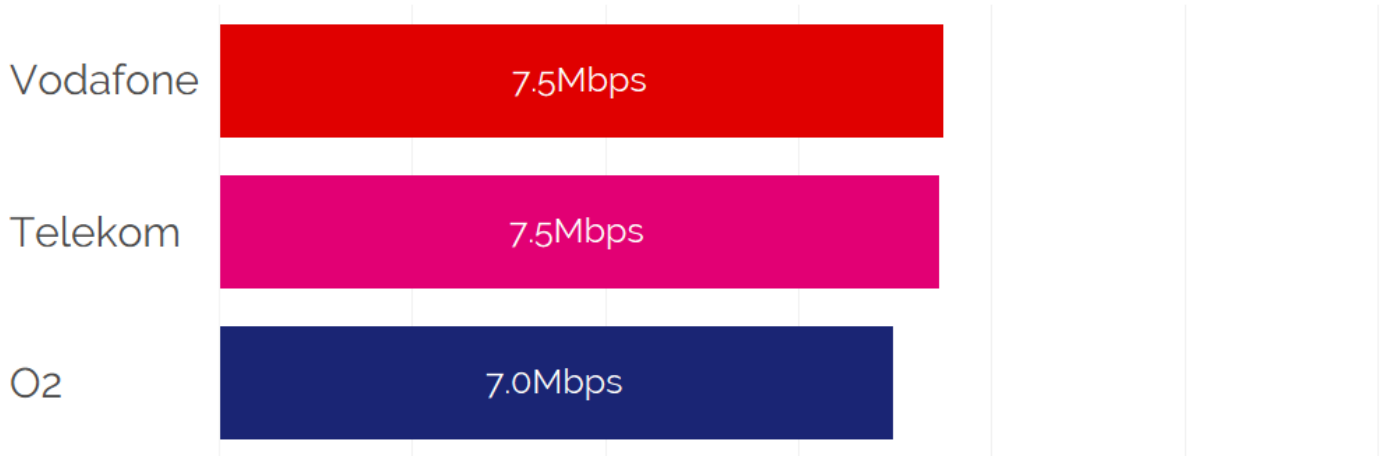
Germany

Vodafone and Telekom tied for average upload speed, at 7.5 Mbps. O2 was just half a megabit behind, with an average upload of 7.0 Mbps. Unlike consistent quality and download speed, where German operators were significantly behind the network providers in Austria and Switzerland, the gap between German operators and the rest is much less pronounced for upload speed.

TUTELA 

German Average Upload Speed (3G & 4G)

Upload speed measured using a 1MB file size

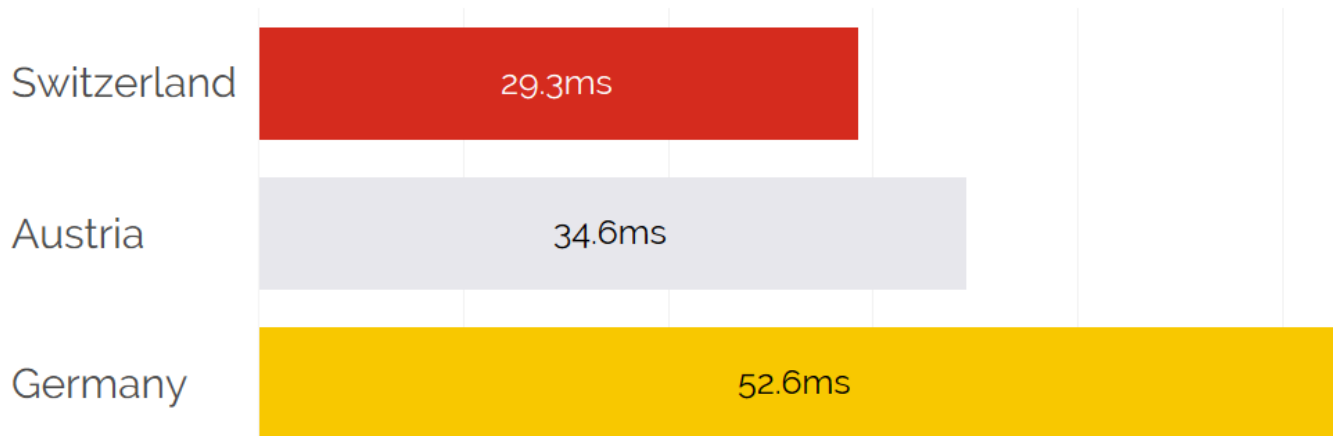


Latency

Once again, Swiss operators beat the competition when it comes to providing a quick connection, sneaking in with an average of 29.3ms. Austrian providers were around 5ms slower on average, at 34.6ms. Germany was in third place once again, over 20ms slower than the average provided by Swiss operators.

The difference between Germany's networks and those of Switzerland and Austria when it comes to latency is likely due to the availability of 3G and 4G networks in the region. German operators use 3G networks much more heavily than their regional counterparts, especially in rural areas. Although healthy upload and download speeds are achievable over a 3G connection, even the best 3G connection will struggle to achieve the 50ms latency needed for demanding use-cases like video calling.

TUTELA National Average Latency (3G & 4G)



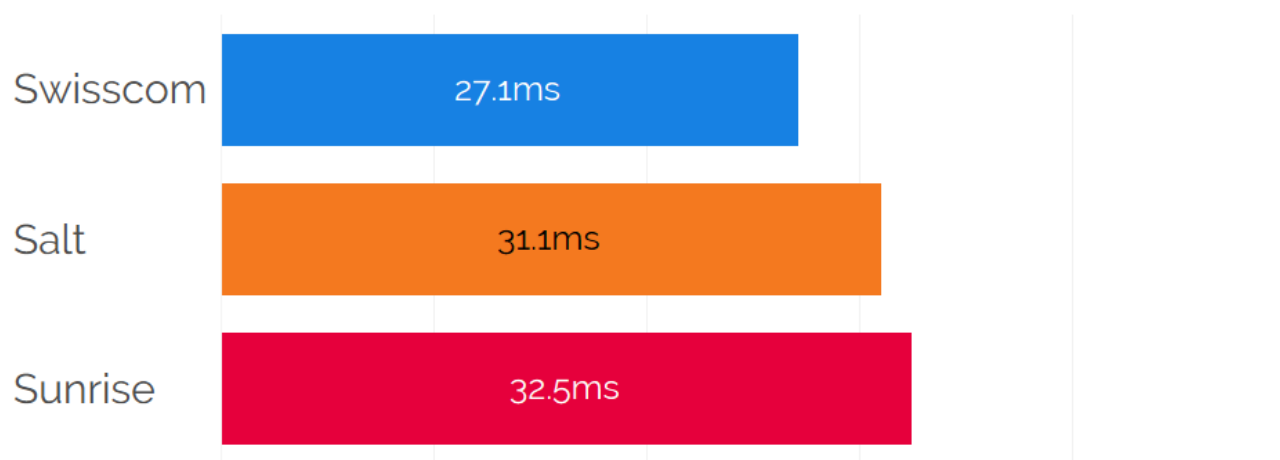
Latency

Switzerland

Swisscom won the latency category, with an average one-way latency of just 27.1ms. However, there wasn't much difference between first and last place: Sunrise, which came in third, had an average latency of 32.5ms, barely 5ms slower than Swisscom. Salt split the difference, with an average latency of 31.1ms.

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Swiss Average Latency (3G & 4G)



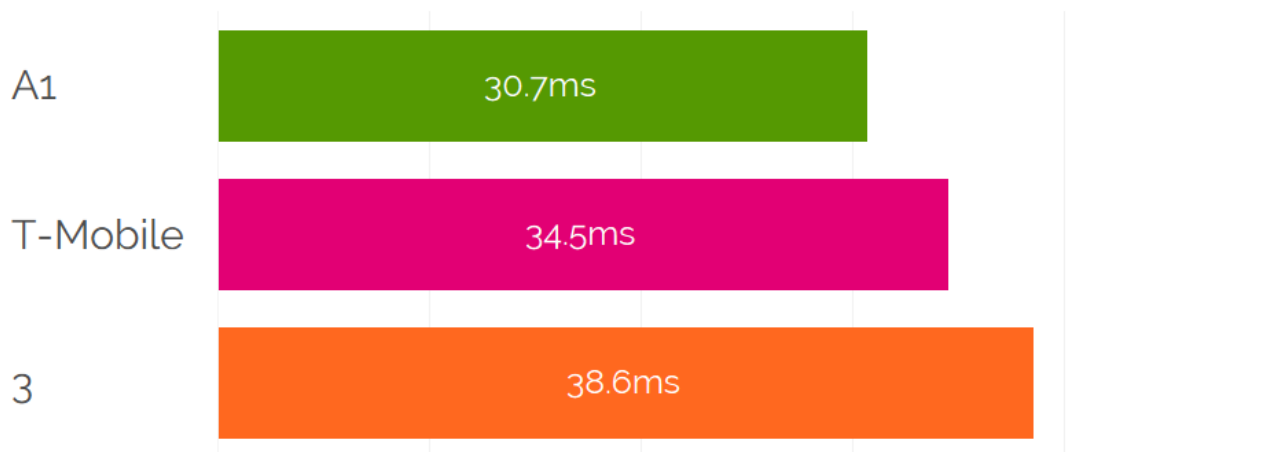
Latency

Austria

The results for latency go against the national trend: 3, which achieved the best consistent quality and download speed, recorded the slowest latency, at an average of 38.6ms. T-Mobile was in second place, with an average of 34.5ms, while A1 took the overall crown with a healthy average of 30.7ms.

TUTELA ▾

Austrian Average Latency (3G & 4G)



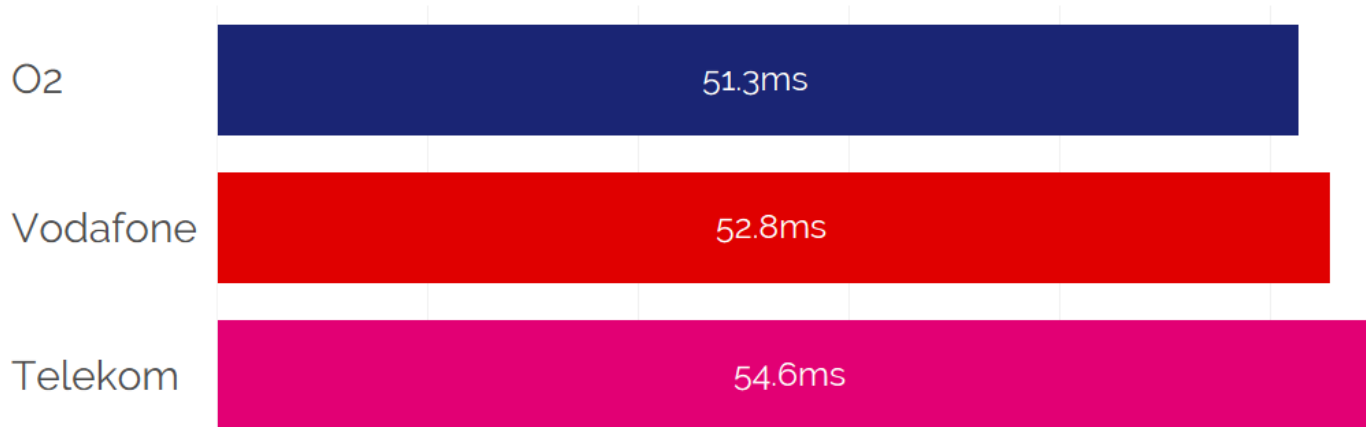
Latency

Germany

Latency was similar across all three German providers, with all three clocking in an average of just over 50ms. O2 took first place among German providers, with an average of 51.3ms. Vodafone was in second, with an average latency of 52.8ms, while Telekom was in third at 54.6ms.

TUTELA 

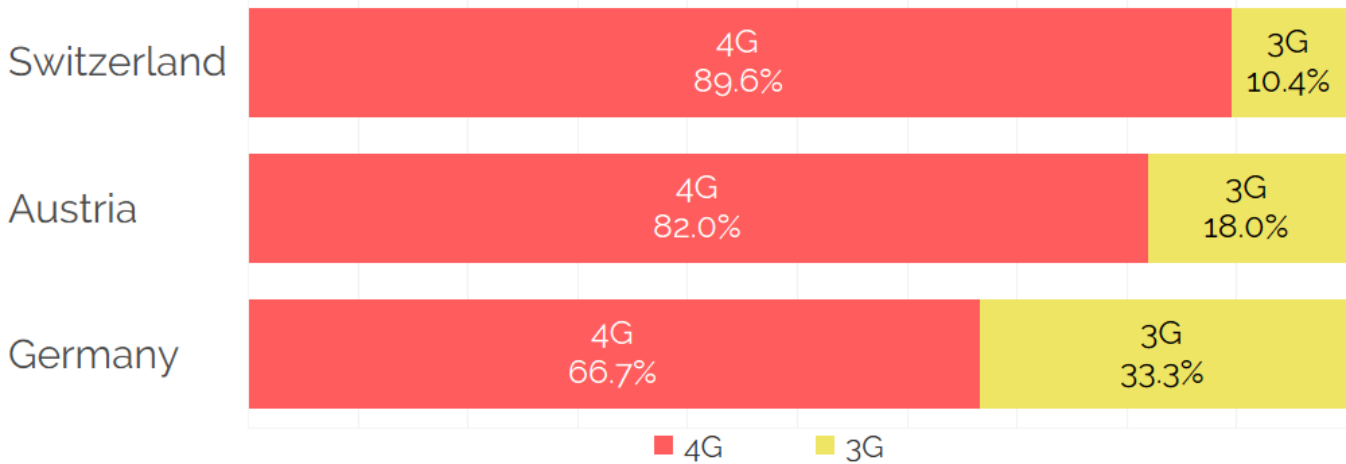
German Average Latency (3G & 4G)



Spectrum & technology usage

Switzerland is the clear winner when it comes to the 4G-3G breakdown, with 89.6% of data usage on Swiss networks using the newer (and faster) technology. Austria is 7.6% behind, with 82.0% of data usage occurring on 4G; as previously mentioned, German operators significantly lag their regional counterparts when it comes to 4G availability, as just 66.7% of data usage was over a 4G connection.

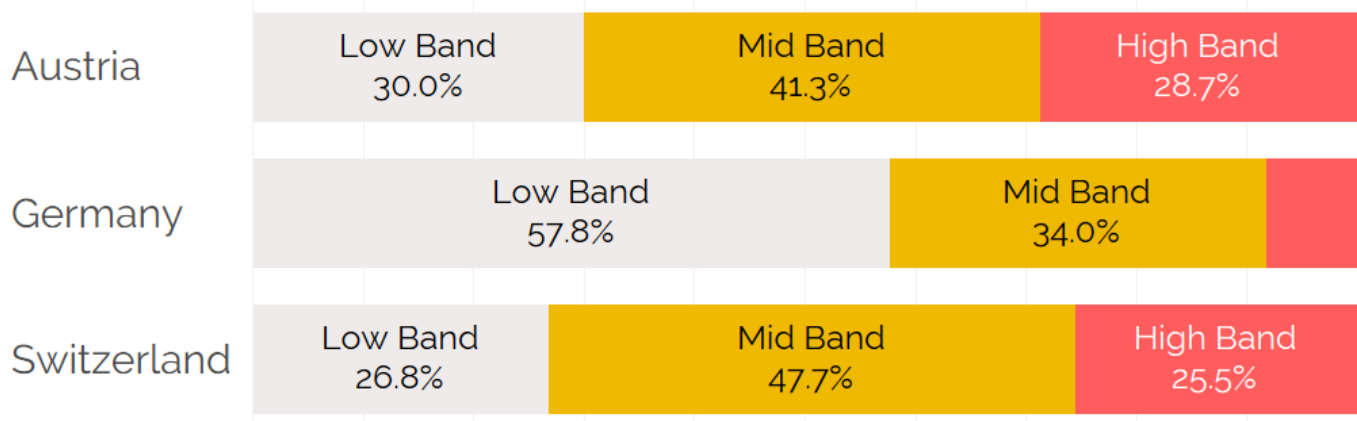
TUTELA National Mobile Data Used by Technology



Examining the spectrum usage, which measure the percentage of 4G data transmitted over a particular band, can be instructive for understanding the underlying infrastructure of the mobile networks. All else being equal, low band spectrum travels further and penetrates buildings better than higher band spectrum, which makes it a better candidate for providing coverage in rural areas or inside buildings. Mid band and high band spectrum, on the other hand, provide valuable capacity that can help deal with congestion and high data usage, especially in urban areas.

Austria and Switzerland have similar spectrum deployments, although Swiss operators lean most heavily on mid-band spectrum, using it for nearly half of all data transmission. Germany is the clear outlier, using low band spectrum for nearly 60% of all LTE data transmission.

TUTELA National Percentage of Data Used by Frequency



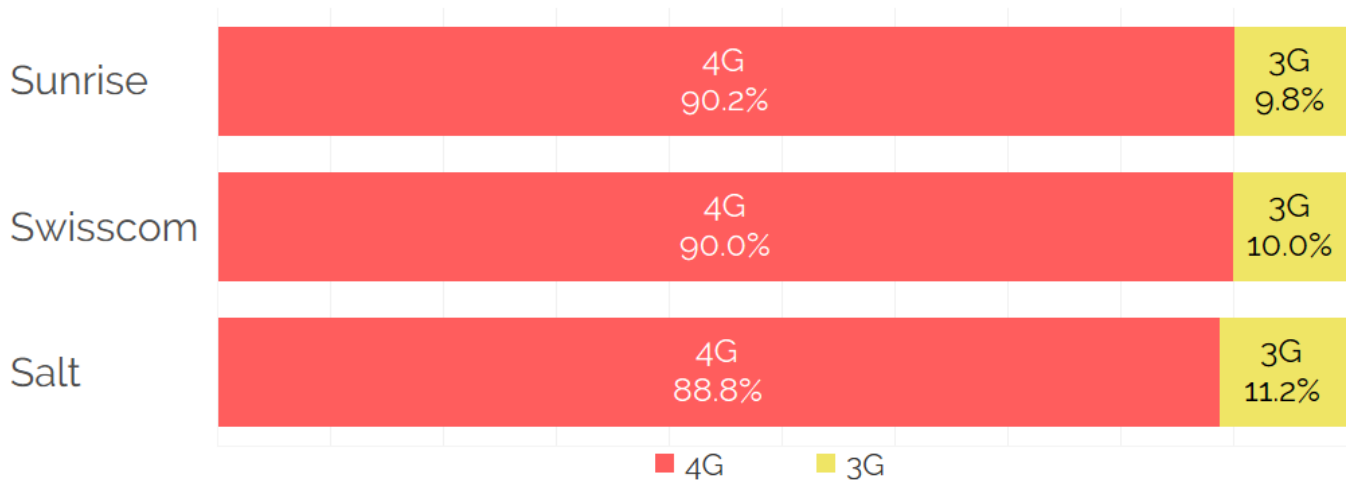
Spectrum & technology usage

Switzerland

Sunrise has the highest proportion of 4G data usage of any operator in this report, with an average of 90.2% of data usage running over a 4G connection. Salt was in third place among the Swiss operators, with an average of 88.8%.

TUTELA 

Swiss Mobile Data Used by Technology



Spectrum & technology usage

Switzerland

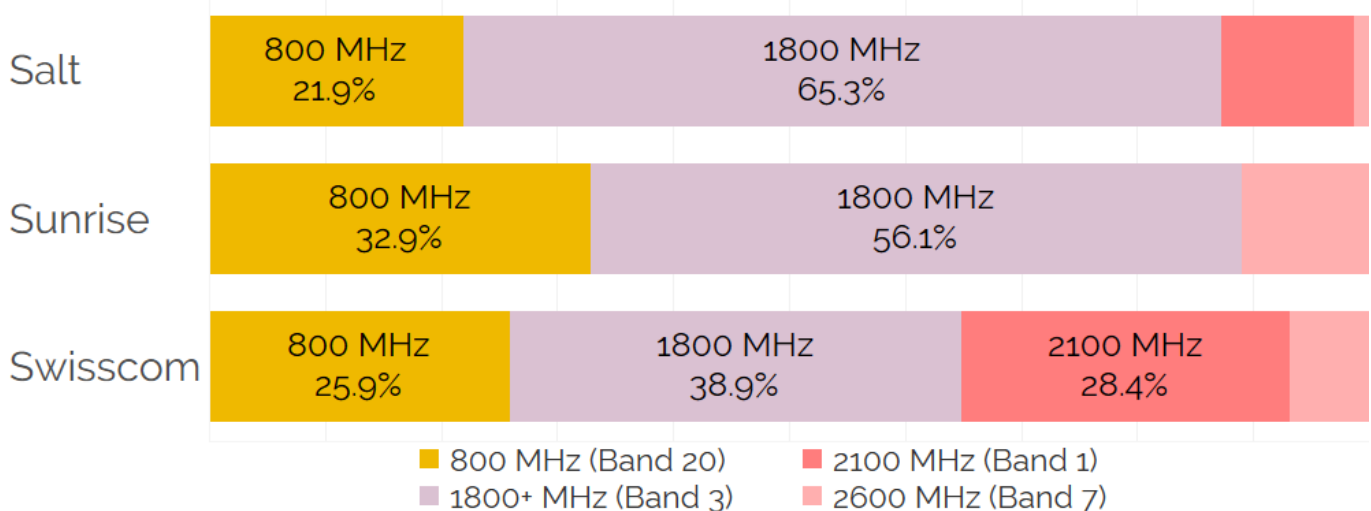
Looking at the spectrum utilization goes some way to explaining how Swisscom manages to deploy a network with the highest average download speeds. It uses low, mid, and high-band spectrum in the most balanced way: 1800 MHz carries the greatest proportion of Swisscom's traffic, but even that band only accounts for 38.9% of total data transmission. Both other operators rely more heavily on 1800 MHz, with the frequency accounting for 56.1% and 65.3% of Sunrise and Salt's data transmission respectively.

The future continues to be bright for Switzerland's mobile spectrum use. A 5G spectrum auction recently finished(9), with the three operators paying a combined US\$379 million for spectrum in the 700 MHz, 1400 MHz, 2.6 GHz and 3.5 GHz range. Swisscom's position at the top of the pack looks solidified, as the operator snapped up 46% of the spectrum on offer.

The US\$379 million paid by the operators is relatively modest compared to the sums demanded for spectrum licenses in other European auctions, which should leave the operators with more resources to spend deploying the spectrum.

TUTELA 

Swiss Percentage of Data Used by Band



(9) Swisscom, Sunrise, Salt pay \$380 million for Swiss 5G frequencies

<https://www.reuters.com/article/us-swiss-telecoms-5g/swisscom-sunrise-salt-pay-380-million-for-swiss-5g-frequencies-idUSKCN1PX12W>

Retrieved 12 April 2019

Spectrum & technology usage

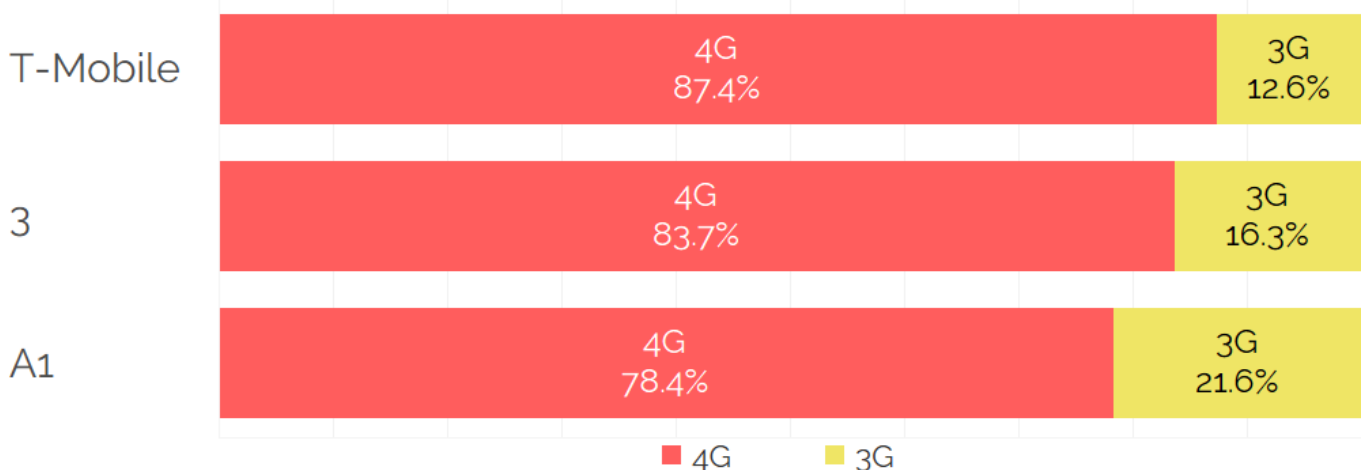
Austria

T-Mobile has the best 4G utilization of the Austrian operators, with an average of 87.4% of smartphone data usage going over 4G. 3 is 3.7% behind, on 83.7%, while A1 is 9% behind T-Mobile's 4G usage with an average of 78.4% of data usage running over its 4G network.

However, the overall network data use rate is likely to be skewed more heavily towards 4G. Tutela's methodology only tests mobile connections that are made directly from a smartphone to the cellular network; since all three operators have a significant number of customers using their mobile network for fixed home broadband (which uses the 4G network), the data utilization is likely to be more heavily skewed towards 4G.

TUTELA

Austrian Mobile Data Used by Technology



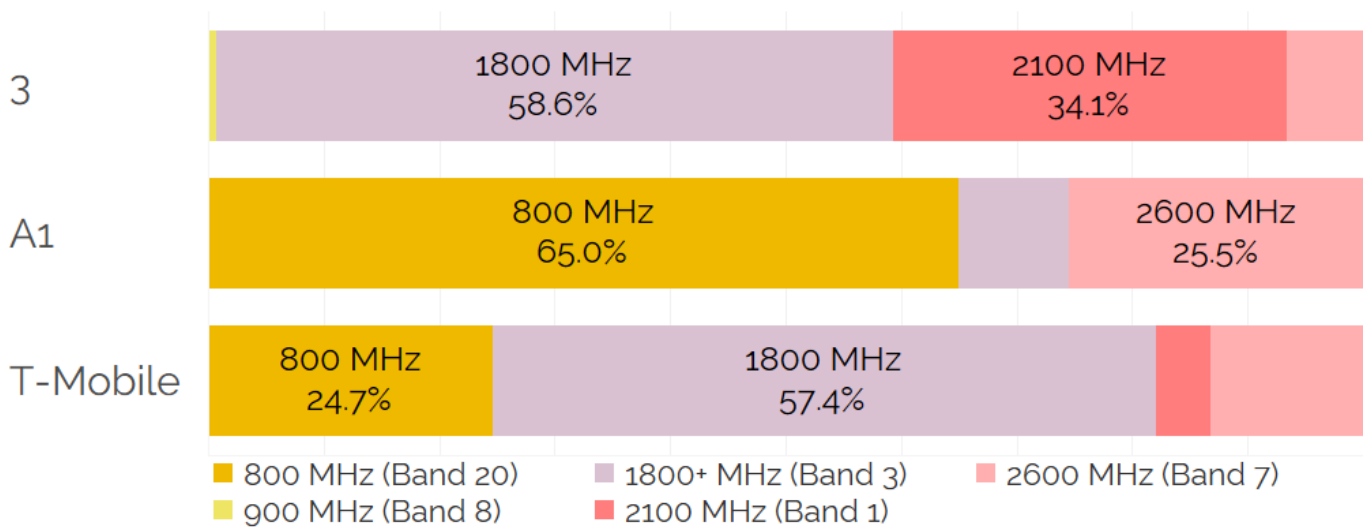
Spectrum & technology usage

Austria

The proportion of data used by band varies significantly between operators. 3, which only has a total of 10 MHz available in the low-band 900 MHz range, uses a combination of 1800, 2100, and 2600 MHz for the majority of its data traffic. A1, which owns 40 MHz of low-band 800 MHz spectrum, uses that for 65% of its mobile network traffic, and uses 1800 MHz and 2600 MHz for the rest. T-Mobile has half the amount of 800 MHz spectrum available as A1, so uses the 1800 MHz spectrum for the bulk of its traffic.

All three operators have bought at least 100 MHz of spectrum in the 3.5 GHz or 3.7 GHz bands(10), which will be used for 5G. T-Mobile has already activated 25 base stations on the 5G spectrum it obtained(11); given Austria's high penetration of fixed wireless access and the sub-6GHz spectrum the operators have bought, 5G will likely emerge as a fixed wireless technology first, with mobile devices to follow.

TUTELA Austrian Percentage of Data Used by Band



(10) The Austrian 3.5GHz auction raised 188 million EUR
<http://5gobservatory.eu/the-austrian-3-5ghz-auction-raised-188-million-eur/>
Retrieved 12 April 2019

(11) T-Mobile Austria launches 5G network with 25 base stations
<https://www.fiercewireless.com/wireless/t-mobile-austria-launches-5g-network-25-base-stations>
Retrieved 12 April 2019

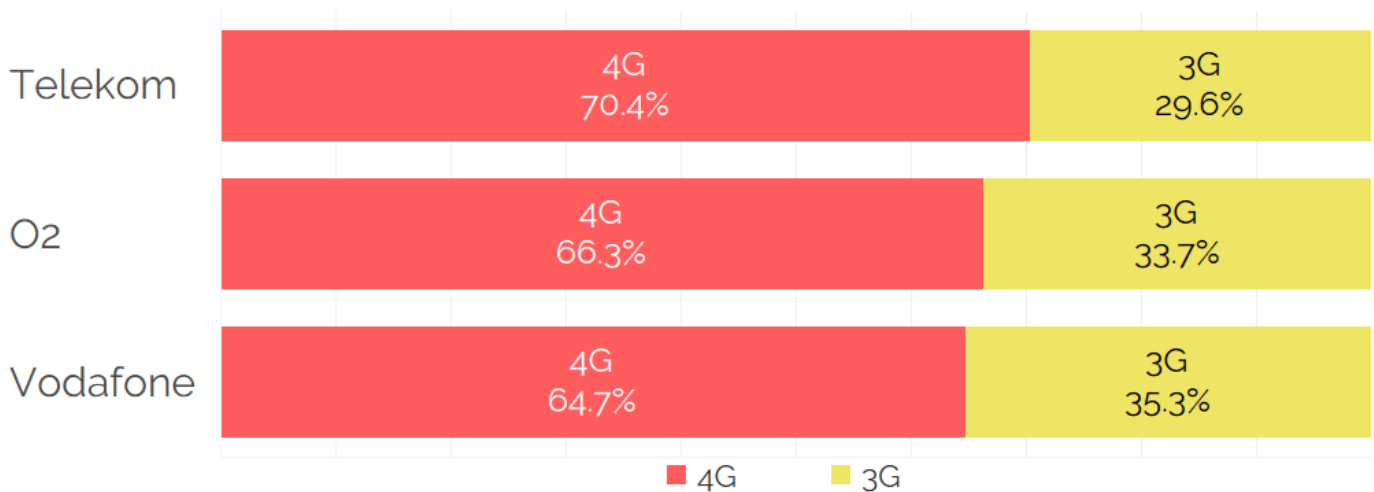
Spectrum & technology usage

Germany

German operators have the lowest penetration of 4G networks in the region; Telekom, which has the greatest proportion of its data usage on 4G, saw just 70.4% of data usage over its 4G network, a result that would put it last in either Switzerland or Austria. O2 was behind Telekom, with an average 66.3% of data usage over 4G, while Vodafone was in last place, with just 64.7% of data usage occurring over a 4G network.

TUTELA ▾

German Mobile Data Used by Technology

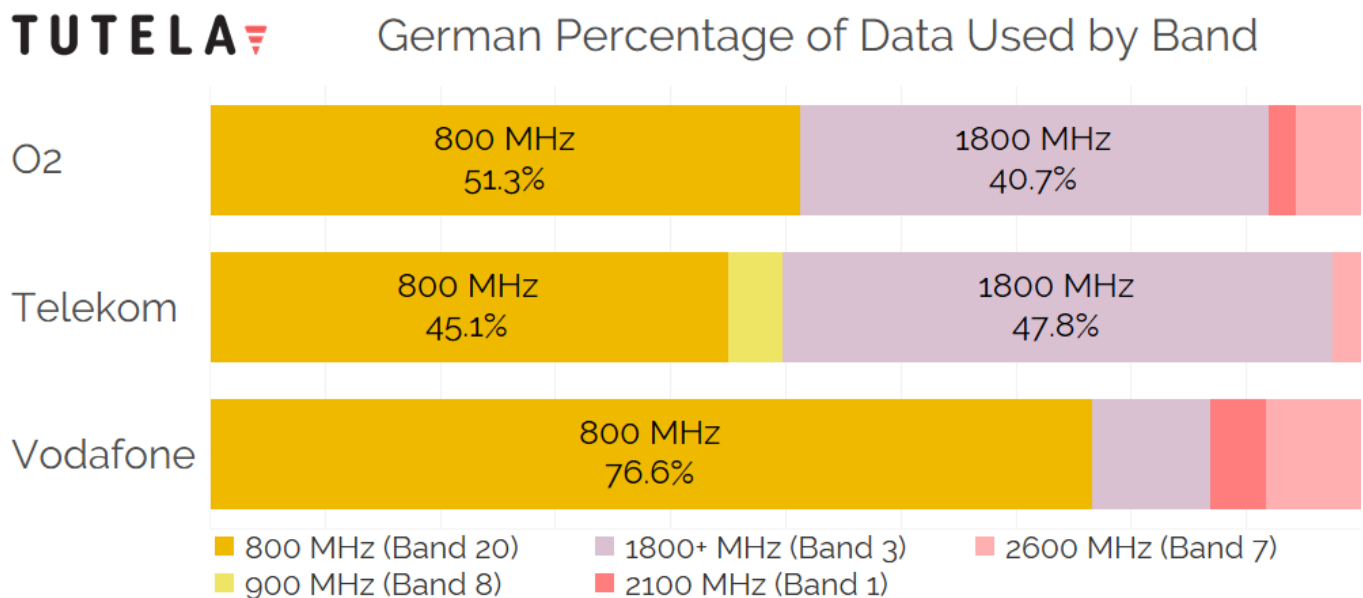


Spectrum & technology usage

Germany

Although German operators own licenses for hundreds of MHz of spectrum ranging from low to high bands, only four bands are widely used for 4G: 800 MHz, 1800 MHz, 2100 MHz, and 2600 MHz. Of those, the high-band 2100 and 2600 MHz spectrum is primarily deployed in urban areas, and 800 MHz -- where all three operators own 20 MHz of spectrum each -- is used for the bulk of the national coverage.

The adoption of 700 MHz for LTE may go some way to boosting 4G proliferation in the country. Telekom recently applied to the regulator to start LTE service on its 700 MHz spectrum this year, and other operators may follow suit.



(10) Telekom applies to use 700MHz spectrum for LTE rollout

<https://www.telegeography.com/products/commsupdate/articles/2019/02/06/telekom-applies-to-use-700mhz-spectrum-for-lte-rollout/>

Retrieved 12 April 2019

Coverage

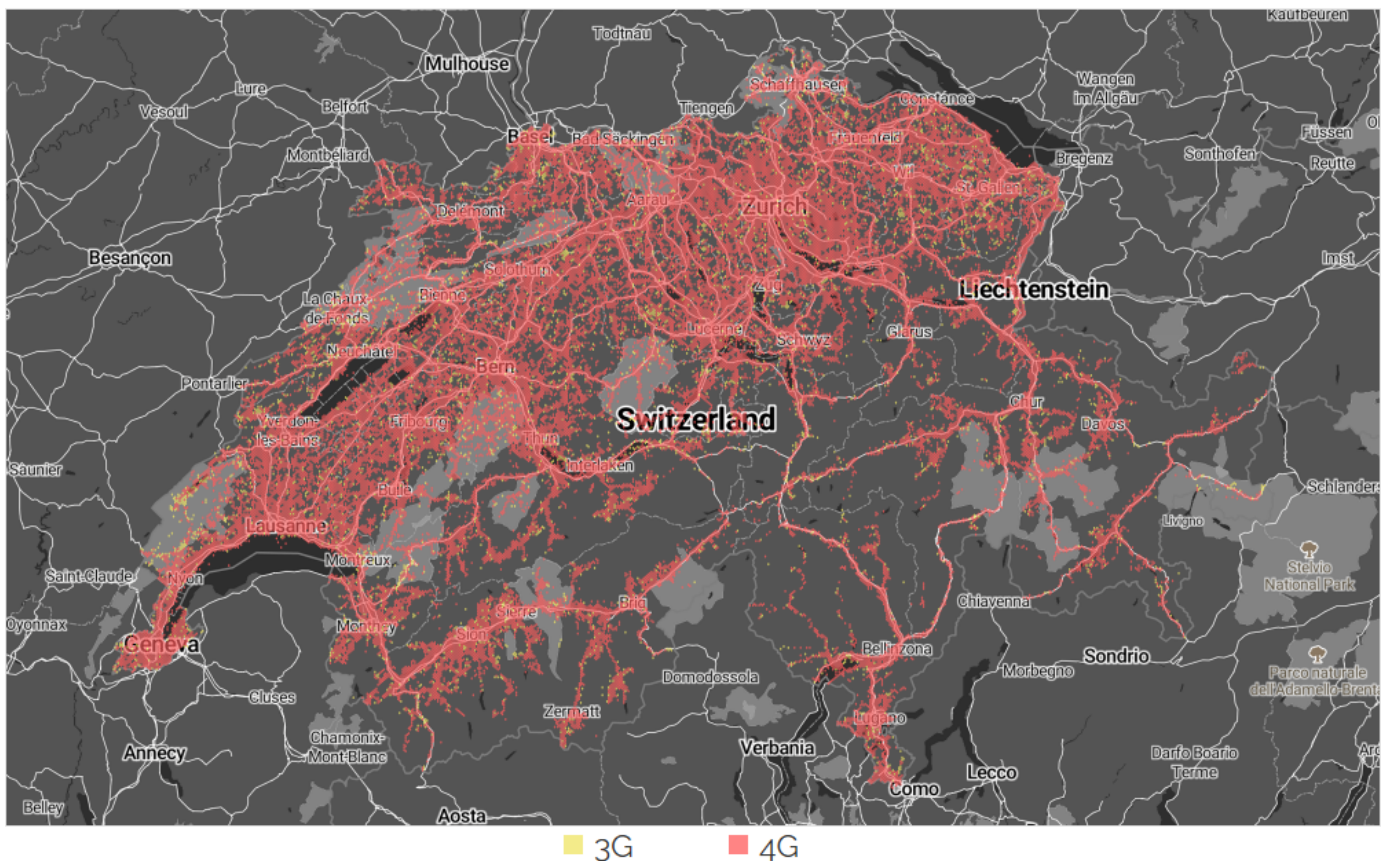
By plotting the locations where users have successfully recorded a test on a particular network, Tutela can establish a baseline for an operator's minimum coverage. The maps produced aren't a definitive record of every square meter of a country that is covered; rather, they serve as a proportionate measure of one operator's coverage relative to another.

Switzerland

Among the Swiss operators, Swisscom appears to have a distinct advantage in coverage. Although all three operators have robust 4G coverage in and around urban areas and roadways, Swisscom's coverage of rural areas and the nearly-ubiquitous 4G coverage are visually evident. Sunrise and Salt appear to have similar levels of coverage overall, but Sunrise's mild advantage in 4G coverage vs 3G coverage, particularly in rural areas, also stands out.

TUTELA 

Swisscom Coverage by Mobile Technology



To see coverage maps for all operators please visit tute.la/DACH



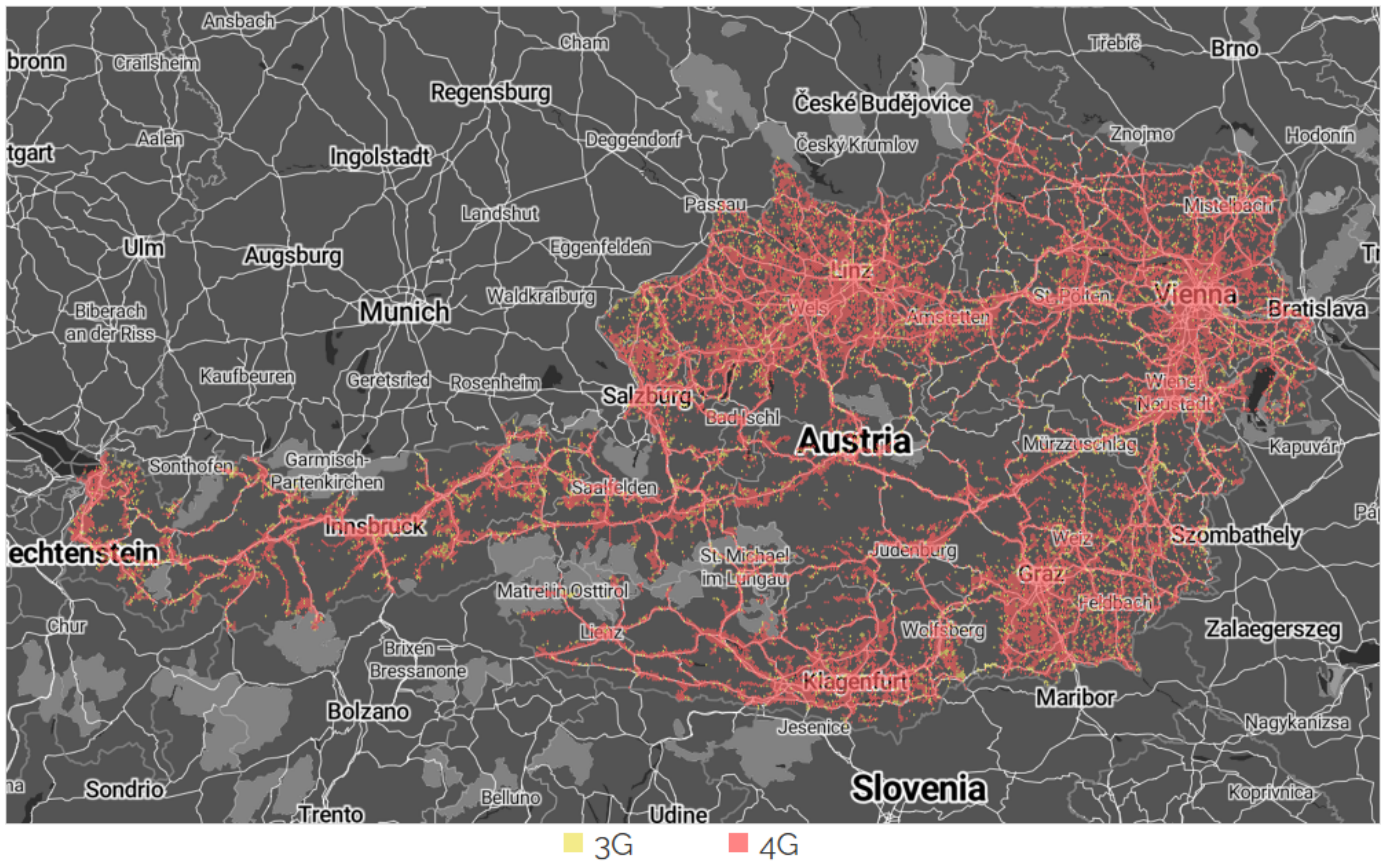
Coverage

Austria

A1 has notably more coverage than the other operators, although a greater proportion of its coverage is with a 3G network. A1's superior coverage is likely due to its minor advantage in the number of cell sites it has deployed, as well as its much more widespread deployment of 800 MHz spectrum. The low-band 800 MHz spectrum propagates better than the mid-band and high-band spectrum favoured by 3 and T-Mobile, which helps explain A1's coverage advantage, as well as its first place in basic consistent quality.

TUTELA 

3 Coverage by Mobile Technology



To see coverage maps for all operators
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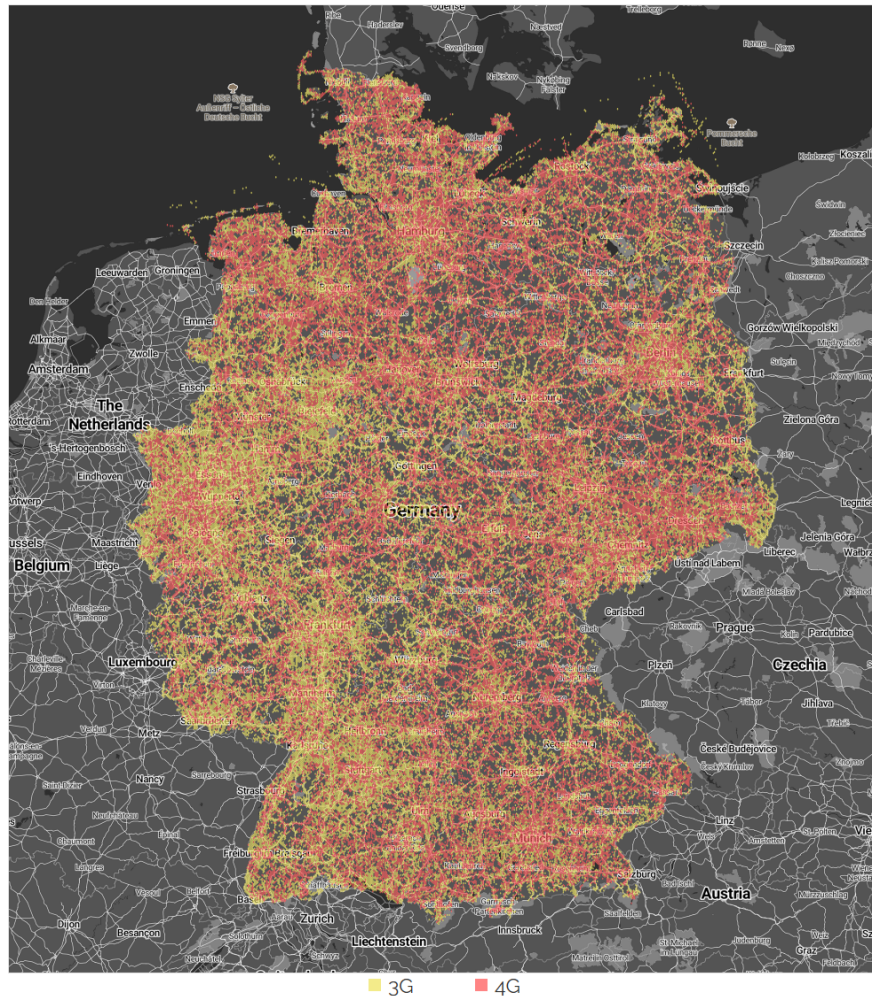
Coverage

Germany

When considering both 3G and 4G, Vodafone appears to have the best coverage of all three operators, with its network particularly strong around Pomerania and Saxony. However, Telekom has the most consistent 4G deployment of any of the operators.

The most surprising coverage is that of O2: despite O2 having the highest percentage of tests run over 4G of any operator, the coverage map shows that O2 has selectively deployed its 4G network only in certain cities and regions. In places where O2 has deployed its 4G network, it utilizes the newer technology for far more of its traffic than Telekom and Vodafone, but the trade-off is that large regions of the country are left without any 4G coverage from O2.

TUTELA  Vodafone Coverage by Mobile Technology



To see coverage maps for all operators please visit tute.la/DACH



Methodology

Tutela measures network quality based on the real-world experience of millions of users. We employ software installed in more than 3,000 partner apps to actively test network performance, conducting download, upload, and server response tests against Tutela-configured servers. The tests are conducted randomly and in the background to avoid sampling bias, with a testing configuration designed to emulate and measure real-world user activity, not maximum network throughput.

At the heart of Tutela's throughput testing is our use of small, lightweight files (2MB for download and 1MB for upload), which are designed to mimic the way that people actually use their devices. The most common smartphone uses include things like web browsing, using weather apps, written communication with friends and colleagues, playing games, or reading the news⁽¹³⁾ -- all of which involve sending and receiving small data packets. How a network performs depends on the size and type of data packets being sent and received, which is why Tutela uses a small, fixed file size to test how the network handles typical traffic -- rather than huge files of several hundred megabytes, which are representative of downloading huge apps, entire movies to watch offline, and little else.

Unlike traditional methods of benchmarking mobile network performance, the crowdsourcing techniques employed by Tutela don't inherently offer a head-to-head comparison of operators in exactly the same location. Crowdsourcing is complementary to drive-test techniques and measures network performance wherever users are actually using the network -- which, if you're seeking to examine the real-world experience of subscribers using their own devices on the network, is exactly what you'd be after.

In addition to working in the background (to eliminate user-initiation bias) and testing using representative packet sizes, Tutela also employs the largest crowdsourced population in the world for mobile network testing. Our software is present on over 250 million Android and iPhone devices globally, and our network collects over 10 billion mobile data measurements every day. Our data scientists analyze results for countries on a monthly basis and tabulate the results into reports. Our custom analytics solution, Tutela Explorer, updates with new measurements on a daily basis, and enables operators to chart, map, and filter over 80 key performance indicators into customized dashboards to help them better understand network performance, enhance customer Quality of Experience, and benchmark their network against competitors.

(13) Why the growth of mobile apps is good news for brands

<https://www.ipsos.com/sites/default/files/2017-08/Google-mobile-apps-report-2017.pdf>

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About Tutela

Tutela is a mobile data and analytics company serving the mobile and telecommunications industry with software 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.

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