

Fixed Line Test 2.0

In its fourteenth year, our test of German fixed-network internet connections uses a completely new methodology. Our focus is now on the quality actually experienced by customers.

Our sophisticated broadband and fixed network has been familiar to connect readers for 14 years. This year, however, there will be a major change: The methodology we used until now was based on selected measurement points. This allowed us to make detailed statements about the so-called core network – in other words, the internal infrastructure of the carriers’ networks. However, this previous approach only provided a limited picture of the performance and quality actually experienced by customers at their connections.

Starting this year, we are using a new methodology. It comes from our test partner umlaut, part of Accenture, which connect readers already know from our mobile network test and many international network test projects. umlaut now also uses its sophisticated crowdsourcing analyses to assess fixed network connections.

On page 77, you can read exactly how this works and what reliable statements we can make on this basis. Another advantage of this approach is that the results of our fixed-network tests are now also more comparable between different countries. In the next issue, we will also be taking a closer look at the fixed networks in Austria and Switzerland in this way.

All new test methodology
However, as the new and old methodologies differ significantly, direct comparisons with the previous year’s results would not be valid or meaningful.

Nevertheless, we are convinced that our new approach provides a more comprehensive picture of the performance of individual fixed-line providers. With this in mind: Raise the curtains for the results of our fixed network test 2.0.

Hannes Rügheimer



“The winner in our fixed network test is the customer, all operators deliver very good service. Congratulations to Deutsche Telekom for winning the nationwide test and to Wilhelm.tel in the regional category. Deutsche Glasfaser also performed outstandingly well. The overall high level of performance is extremely pleasing.”

Hakan Ekmen, Global head of the network division in Telecommunications and at the same time CEO umlaut, part of Accenture

CROWDSOURCING FACTS

338 million samples	411 684 internet lines considered	24 weeks (early January until end of June 2023)
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Nationwide Providers

We rate fixed-network providers that provide their services nationwide and have correspondingly high market shares in a separate category.

In our test, we evaluate providers with a nationwide presence and those with a predominantly regional footprint in two different categories. To be counted among the nationwide providers, a fixed-network operator must meet two criteria:

First, its service must be available in all federal states of Germany. And second, it must reach a market share of at least four percent, based on the whole of Germany, according to the industry-wide recognized market study by the VATM (Association of Telecommunications and Value-Added Service Providers; <https://www.vatm.de/marktstudien>).

The reason for this differentiation is that regionally oriented fixed-network offerings are not fully comparable with nationwide offerings for reasons of fairness – after all, it is easier for a provider to supply only a regionally limited area with its internet lines than to be represented nationwide in smaller communities or in the countryside.

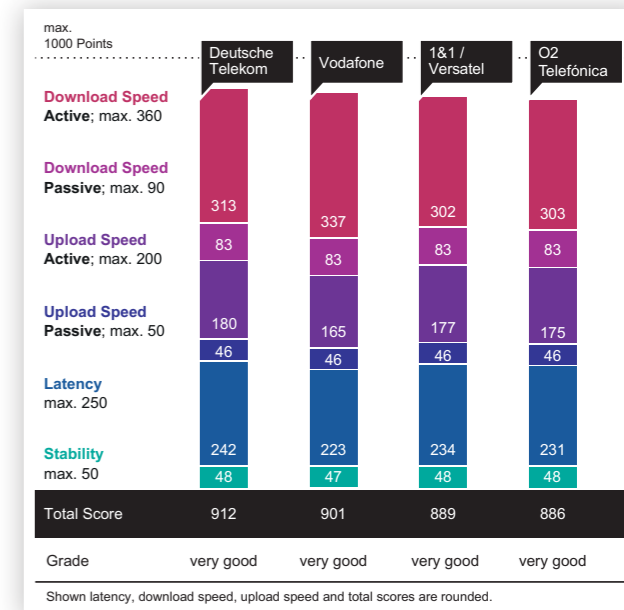
In addition, such nationwide offerings generally mean that the total installed base we consider also includes more of the slower lines, because a roll-out of faster lines is often not profitable in rural regions. Taking this into account is another reason why we distinguish between the two groups.

Check available offers

However, even the providers who are active nationwide cannot supply an internet connection in every location – let alone in the technology preferred by the customer, such as (V)DSL, broadband cable or fiber optics.

Anyone interested in a broadband connection must therefore check which options are actually available at their address. And in addition to this come the rates offered by the providers, which we do not take into account in our purely technical performance assessment.

However, our test results give very good indications of the level of performance customers can expect from a specify provider. It may happen that



customers of one providers typically book a larger proportion of slow lines than the customers of other providers. However, with fixed-line operators that achieve top results in our mix surveyed across the entire market, customers who choose a product from their top offerings can generally expect to also receive a particularly high performance with it.

Four times very good

All four providers operating nationwide scored “very good” in our assessment. Deutsche Telekom is clearly ahead in the nationwide rating.

Telekom

The Bonn-based fixed-network market leader deservedly wins our test with a convincing overall performance.

With 14.8 million fixed-network customers or a market share of 39.8 percent according to the VATM study, Deutsche Telekom is the undisputed market leader in the German fixed network.

DSL and VDSL lines still dominate its customer base, but the Bonn-based company is now stepping on the gas with its fiber-optic roll-out: it can already supply around six million households with FTTH, and this

year and in the following years it plans to add a further 2.5 million households. The actual subscription figures and thus their representation in our database are, of course, significantly lower.

Among the nationwide providers, Deutsche Telekom is ahead in terms of the actively measured upload data rates and, interestingly, also in terms of latency – in the latter category

this also consistently applies in all application classes considered. In the active upload measurements, Telekom leads in the average and P10 values, while Vodafone is just ahead of the Bonn-based provider in the peak-performance-oriented P90 values.

In the passively determined data rates and in the stability rating, all nationwide providers are on a par in the scores

achieved anyway. But Telekom also takes the lead in some cases in the measured values behind it – for example, in the high-speed downloads or the two speed classes considered in the passive upload category.

Overall, Telekom deservedly wins the test with this performance.

connect VERDICT
VERY GOOD (912 Points)

Vodafone

With its gigabit cable lines, Vodafone is particularly convincing in the download discipline – and achieves the second place overall.

10.8 million customers, corresponding to a market share of 29.0 percent according to VATM, make Vodafone the second-largest fixed-network provider in Germany. In principle, the Duesseldorf-based company also offers fiber-optic lines and, primarily via resale, VDSL lines. However, Vodafone supplies the majority of its residential fixed-network customers via broadband (coaxial) cable.

The Group has greatly expanded this portfolio through the takeovers of its former competitors Unitymedia and Kabel Deutschland.

The considerable proportion of cable connections is also reflected in the detailed results. In terms of actively measured download data rates, the operator is clearly ahead. This is not surprising, given that it has a good proportion of gigabit lines

in its customer base. However, cable connections typically only allow lower upload speed. This becomes not so obvious in the average values of the active measurements, but in the wide area (P10), this value of 6.1 Mbps is clearly behind the other nationwide candidates.

The broadband cable technology also takes its toll on the latencies. Vodafone already falls behind somewhat in the high-

end gaming class (latency values of up to 20 ms), and even more so in the demanding ultra-low latency class (maximum latency of 10 ms). However, there is nothing to criticize about the stability of the connections.

Overall, the Duesseldorf-based company achieved a very good second place nationwide with its result.

connect VERDICT
VERY GOOD (901 Points)

1&1 The network operator from Montabaur achieved a very good third place with its portfolio of leased lines and its own fiber-optic connections.

With around 4.2 million customers, 1&1 covers approximately 11.3 percent of the German fixed-network broadband market, making it the third-largest provider. Although 1&1 mostly leases access lines from Telekom, Vodafone and other network operators, it operates its own core network and its own "carrier interconnects" and, since 2014, its own fiber-optic network, which it markets under

the "Versatel" brand. The data basis of the crowdsourcing conducted by umlaut reflects this constellation.

In the actively measured download rates, the average value determined for 1&1 falls slightly behind the other nationwide providers. In the actively measured upload data rates, on the other hand, 1&1 achieved the second-best result in the nationwide category behind overall

winner Telekom. In the passive upload and download measurements, the scores achieved by all four nationwide providers are on a par anyway – in terms of the degree of fulfillment in the UHD video class (at least 20 Mbps) in the download category, 1&1 even exhibits the best measured value.

In terms of latencies, 1&1 is also in second place nationwide and only just behind Telekom.

The provider from Montabaur achieves this above all in the demanding ultra-low latency class (roundtrip times of max. 10 ms).

In terms of stability, 1&1 is on a par with its competitors. Overall, the provider achieves a very good third place nationwide with these convincing performances.

connect VERDICT
VERY GOOD (889 Points)

02 Telefónica's fixed-network offering also performs very well and scores only three points behind the third-place provider 1&1.

O2/Telefónica's fixed-network offering has 2.3 million customers, which according to the VDMA study corresponds to a market share of 6.2 percent and thus fourth place among the major providers active nationwide in Germany.

To realize its customer connections, Telefónica leases lines from national network operators such as Telekom and also from regional providers. This results in

a colorful bouquet of access technologies, behind which the Munich-based provider also operates its own core network. This mix is also taken into account in the data basis of umlaut's assessment.

In the active data rate measurements, the O2 network is roughly on a par with competitor 1&1 – O2 scores one point more in the active downloads and two points less in the uploads. In

both cases, it is primarily the average data rates that explain the difference. In the passively determined data rates, the Munich-based company is on a par with its competitors both in downloads and uploads.

The gap between third (1&1) and fourth (O2) place nationwide in terms of latency is also only slight. In terms of both actively measured uploads and latencies, O2 came third, ahead of

Vodafone – probably due to the fact that the Munich-based company has more (V)DSL lines and fewer broadband cables in its portfolio.

Overall, O2 also performs very well. The fact that the company markets itself primarily as a provider for everyday requirements fits in well with this test result.

connect VERDICT
VERY GOOD (886 Points)

Detailed results nationwide

The comparison of the results in the individual disciplines shows differences in performance, with regard to data throughputs and connection stability required in everyday use, but also similarities.

The methodology of this test is specifically designed so that performance relevant to everyday life makes up the majority of the evaluation.

The upload and download measurements as well as the determination of latencies and stability are primarily intended to show how well the tested networks cope with everyday requirements of their users.

A dedicated look at peak performance beyond this then serves to provide additional differentiation.

Differences not least due to technology

Under these conditions, the results show a distribution that could be expected: In terms of data rates, the average values and the P10 values (90% of all measured values above...) show that there is a relevant number of connections in the analyzed data pool that only deliver comparatively low speeds. Only when it comes to the P90 value (10% of all measured values above...) do the fastest connections in the respective portfolio come into play.

However, it is striking that all four nationwide providers achieve the same score for the data rates determined by passive observation, both for download and upload – their respective performance determined across all sample suppliers is close together and at a high level overall.

The active measurements approach the performance limits closer. Here, the provider Vodafone, which relies heavily on broadband cable, has a clear lead in download data rates over the other candidates, whose portfolio still includes many (V)DSL lines.

However, the picture changes when it comes to the active upload measurements, because broadband cable is at a technological disadvantage here, especially compared with VDSL.

The same applies to the observed latencies, where Deutsche Telekom with its mix of (V)DSL and fiber lines stands out from the rest of the test field, while Vodafone with its high cable share falls somewhat behind.

KPI Values	Deutsche Telekom	Vodafone	1&1/ Versatel	O2 Telefónica
Download Speed Active [Mbps]				
Ø Datarate	74.0	121.6	65.2	67.9
P10 Datarate	23.8	23.5	22.9	21.5
P90 Datarate	120.5	287.4	106.7	105.8
Download Speed Passive [%]				
UHD Video Class	45.9	45.6	47.5	46.0
Bulk Download	12.3	11.6	12.1	11.6
Upload Speed Active [Mbps]				
Ø Datarate	28.8	26.2	23.6	21.7
P10 Datarate	11.2	6.1	9.8	10.4
P90 Datarate	45.4	52.5	42.9	44.3
Upload Speed Passive [%]				
HD Video Class	46.1	44.5	42.6	44.2
UHD Video Class	35.8	33.9	32.6	32.8
Latency [%]				
Standard Gaming Class	98.5	97.6	98.1	97.0
Highend Gaming Class	86.0	71.5	79.1	77.0
ULL Class	45.5	14.6	32.6	33.5
Stability [%]				
Transaction Success	98.6	98.5	98.6	98.7

Percentages are rounded to one decimal place and points rounded to integer numbers. For the calculation of points and totals, the accurate, unrounded values were used.

Differences at the top

In terms of stability, the four nationwide candidates are again almost on a par, and at a high level. In terms of internet transaction success rates, therefore, none of their customers need worry.

The differences are small in the passively determined data rates, but they become more obvious in the performance-oriented measurements.

Reliability

After Telekom, also 1&1 and O2/Telefónica perform particularly well when it comes to separating the mandatory from the performance-related KPIs.

The "Reliability" section is not based on additional test points, but is rather a different look at the results of the various test categories. The analysis is based on the fact that umlaut distinguishes between "Qualifier KPIs" (the mandatory, so to speak) and "Differentiator KPIs" ("freestyle") for all KPIs – also see page 77.

Providers who perform well in the mandatory part deliver reliable services, regardless of any top performance in the "freestyle" or performance-related evaluation. In the mandatory part, all four nationwide providers do very well. 1&1 even manages to close the gap to Telekom to within two points, while O2/Telefónica follows with only a small gap here as well.

Reliability	max.	Deutsche Telekom	Vodafone	1&1/ Versatel	O2 Telefónica
Active Download data rates	198.0	185.8	185.6	185.3	184.4
Passive Download data rates	49.5	45.7	45.6	46.2	45.8
Active Upload data rates	110.0	100.0	84.2	99.6	99.8
Passive Upload data rates	27.5	25.1	25.0	24.8	25.0
Latency	137.5	134.7	132.9	133.9	131.9
Stability	50.0	47.7	47.4	47.7	47.8
Total	573P.	539	521	537	535

Percentages are rounded to one decimal place and points to whole numbers. The exact, unrounded values were used to calculate points and totals.

Regional Providers

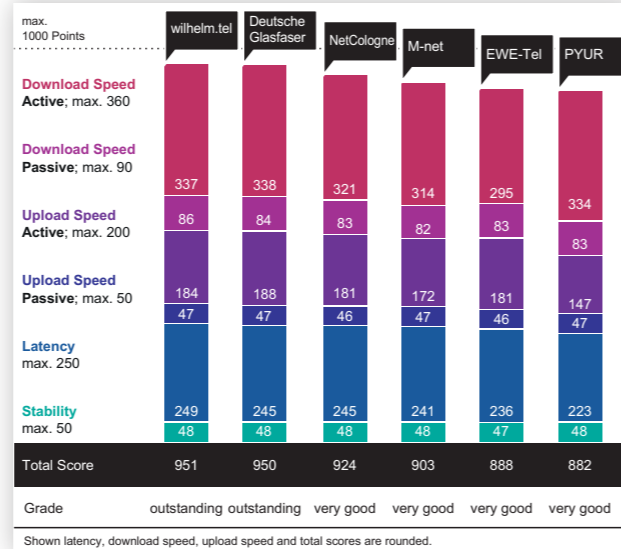
Among the regional providers, we were able to attest two of them the seldom-awarded grade of “outstanding” – and that with a gap of just one point at the top.

As already explained on page 71, the separate analysis of nationwide and regional providers is not least a matter of fairness. Even if a provider is represented in almost all of Germany’s federal states, it does not necessarily roll out its network across the entire country, but may concentrate on individual hotspots such as areas of new construction or dedicated network expansion. This is why the market share achieved is also an important criterion.

Different Footprints

In the crowdsourcing conducted by umlaut, the regional distribution of the samples and the “case numbers” there can be clearly seen. For example, we see users of

Wilhelm.tel in Lower Saxony, North Rhine-Westphalia and Schleswig-Holstein in addition to Hamburg. Deutsche Glasfaser can be found in all federal states except Berlin, but in some cases with only small numbers of users. For NetCologne, we see samples from NRW and Rhineland-Palatinate. M-net has its main focus in Bavaria, but is also represented with a relevant number of sample suppliers from Baden-Württemberg, and Hesse. EWE-Tel shows users in Baden-Wuerttemberg, Brandenburg, Bremen, Hamburg, Hesse, Lower Saxony, NRW, Saxony-Anhalt and Schleswig-Holstein. For Pÿur, we only see no samples from Bremen, but again only low case numbers overall.



High level of performance

Twice the rare mark of “outstanding” at the top is a clear statement. Because regional providers concentrate on smaller roll-out areas, they often achieve higher performance there.

Wilhelm.tel With a one-point lead over Deutsche Glasfaser and an outstanding overall result, the provider from Norderstedt secured the test victory in the regional chapter.

Wilhelm.tel is a brand of Stadtwerke Norderstedt – the town where it also has its headquarters. The provider is also active in Hamburg and parts of Lower Saxony, North Rhine-Westphalia and Schleswig-Holstein. Its – market share is not shown in the VATM study, which means that

it is likely to be one percent or less nationwide. The company also cooperates with local cable providers, but itself relies almost exclusively on optical fiber.

This also provides an explanation for the excellent test results achieved by this provider. Although it falls slightly behind

Deutsche Glasfaser in the active download and upload measurements, it is ahead in the latency discipline and in the passively determined download data rates.

In the passively observed uploads and stability, Wilhelm.tel ranks among the top regional

providers. With a one-point lead over second place and the rare grade of “outstanding,” the provider wins our regional ranking.

connect VERDICT
OUTSTANDING (951 Points)

Deutsche Glasfaser Deutsche Glasfaser also scores “outstanding”. Important for customers: This operator is active in many more places than the regional winner.

Even though Deutsche Glasfaser is represented in almost all German federal states, the VATM study shows it to have 0.6 million customers and a market share of 1.6 percent, making it a regional provider by our standards. The provider aims to connect around 400,000 addi-

tional households annually, and as many as 800,000 households per year from 2025 on. As the name suggests, the company only offers fiber-optic connections, using FTTH technology.

This orientation is also reflected in the test results – in our ranking, Deutsche Glasfaser

scores neck-and-neck with the much smaller Wilhelm.tel.

It is ahead in the active throughput measurements, but loses the overall victory by a slight margin in the discipline of passive download data rates and in the latency rating. Its passively measured upload

data rates and stability are among the top performers.

Scring just one point behind regional winner Wilhelm.tel, Deutsche Glasfaser also receives the rare grade of “outstanding.”

connect VERDICT
OUTSTANDING (950 Points)

NetCologne With strong results in the latency discipline, but a slight lag in the download and upload scores, the Cologne-based company achieves the third place regionally.

NetCologne has 0.4 million customers, giving it a market share of 1.1 percent, according to VATM. The company was founded by RheinEnergie, Sparkasse Koeln/Bonn and Kölner Verkehrsbetriebe (Cologne Transportation Services), and has been a wholly owned

subsidiary of the holding company GEW Koeln AG since 2004. The provider supplies fiber-optic and VDSL lines primarily in the Cologne/Bonn region, but is also represented in Rhineland-Palatinate. The fact that the provider is on a par with Deutsche Glasfaser in the laten-

cy discipline indicates a very high share of fiber lines in its portfolio. In both active and passive download and upload data rates, however, the provider lags behind the top performers in the regional category, which explains its third place in this environment. This is most evident in the P90

values (10 percent of values above...) for the active measurements. In the stability rating, on the other hand, NetCologne is once again in the top group. Overall, the Cologne-based company thus achieved third place regionally.

connect VERDICT
VERY GOOD (924 Points)

M-net The Munich-based provider delivers very good services to its customers and frequently frequent fiber-optic connections, but falls a little behind the top trio.

With half a million fixed-network customers and a market share of 1.4 percent, M-net is also a typical regional provider. It is backed by Stadtwerke (Municipal utilities) Munich and Augsburg, Allgaeuer Ueberlandwerk and other shareholders. In the greater Munich, Augsburg, Ulm

and Erlangen areas, many other regions in Bavaria and in the Main-Kinzig district of Hesse, M-net offers fiber optics, but also VDSL connections. In larger residential complexes, the provider also relies on the forwarding of FTTB lines via G.fast.

This technology mix also offers an explanation why this provider falls a bit behind its higher-rated competitors, especially in the active download and upload measurements, but also in the latency discipline. In the passively observed data rates as well as in the stability rating, M-net is

on the same high level as the other regional providers. Overall, this results in the fourth place in the regional ranking, but still with the grade “very good”.

connect VERDICT
VERY GOOD (903 Points)

EWE-Tel “Energieversorgung Weser-Ems“ achieved a very good result. The share of fiber-optic lines, which can probably still be enhanced, is likely to prevent an even better ranking.

According to the VATM Market Analysis 2022, the EWE Group has 0.7 million customers and thus a market share of 1.9 percent. The provider is primarily active in northwestern Germany – between the Ems and Elbe rivers, in Bremen, parts of Brandenburg, Lower Saxony and

North Rhine-Westphalia, and on the island ofueRügen, it offers both VDSL and fiber-optic lines . Together with Deutsche Telekom, the company intends to offer fiber-optic connections to up to 1.5 million households in the near future. At present, however, VDSL and/or slower

FTTH connections probably still dominate its portfolio – at least this is what our active download measurements and the latency rating suggest.

In the passively observed downloads as well as in the upload disciplines, the provider is on par with most of its peers.

In the stability score, EWE-Tel ranks one point behind the rest of the regional test field.

Overall, this provider’s results are also very good.

connect VERDICT
VERY GOOD (888 Points)

Pÿur/Tele Columbus The Berlin-based provider Tele Columbus, brand name Pÿur, scores very good, but shows some potential for improvement.

This provider was created from the merger of several regional cable providers. With 0.6 million broadband customers, it currently has a market share of 1.6 percent and is thus classified by us as a regional provider – even though its lines based on broadband cable and, in some

cases, fiber optics are already present in many federal states of Germany.

Typical for cable connections in particular, the results of the active download measurements are quite high, while we see potential for improvement in the results of the active upload

measurements and especially in the more demanding classes of the latency rating.

If Pÿur manages to improve in this area, a higher ranking would also be well within reach for this operator. The stability rating, on the other hand, gives no cause for complaint. Even though we

still identified some potential for improvement based on the test results, this provider also deserves the grade very good in the overall rating.

connect VERDICT
VERY GOOD (882 Points)

Detailed results regional

As a rule, the higher the fiber share, the better the performance. This is particularly evident at the top of our regional category.

The test result also emphasizes the superiority of fiber-optic access technology: The two providers at the top both achieve the seldomly awarded grade of "outstanding" and are only one score point apart. Both provide their customers entirely or at least predominantly with FTTH connections (fiber to the home, i.e., optical fiber all the way to the customer's premises). But the providers who are following on the next positions of our regional ranking also have high proportions of fiber-optic lines in their product ranges.

Performance also reflects the Technology Mix of the Operators

This can be clearly seen in the active throughput measurements – iwhen our test procedure pushes the data rates to their technically possible limits, a high share of fast connections naturally brings a clear advantage.

The more the mix spans other connection technologies besides fiber optics (which includes (V)DSL, coaxial cable, but also, for example,

the forwarding of fiber optic connections via copper twisted pairs using standards such as G.fast), the more clearly the determined data rates fall behind. In the download direction, broadband cable connections can still keep up quite well, as can be seen in particular from Pÿur's good result in this discipline. At the same time, however, the comparatively lower achievable upload speed clearly has an impact on providers with a high coax share.

The passively observed throughput measurements correlate with these effects, but show them less pronouncedly. Particularly in the passively recorded upload speeds, the regionally active candidates also converge more clearly.

The latencies determined in the analysis largely follow this trend – here, too, high proportions of fiber-optic lines deliver better results than those customer and line portfolios which contain a high number of broadband (coax) cable lines. This is again more pronounced particularly with the provider Pÿur.

KPI Values	wilhelm.tel	Deutsche Glasfaser	Net Cologne	M-net	EWE-Tel	PYUR
Download Speed Active [Mbps]						
Ø Datarate	99.5	124.2	76.5	68.0	60.1	116.1
P10 Datarate	28.7	23.3	26.2	23.0	19.6	22.1
P90 Datarate	234.2	324.1	140.8	139.7	103.5	221.5
Download Speed Passive [%]						
UHD Video Class	49.4	45.5	46.6	44.4	46.3	44.8
Bulk Download	15.2	13.2	11.6	11.7	12.0	12.7
Upload Speed Active [Mbps]						
Ø Datarate	41.0	88.7	29.9	27.1	28.4	19.1
P10 Datarate	16.3	18.2	9.8	6.9	9.0	5.0
P90 Datarate	57.0	204.4	48.9	61.4	54.7	43.6
Upload Speed Passive [%]						
HD Video Class	49.4	47.2	44.0	49.1	44.4	44.2
UHD Video Class	37.9	42.4	37.5	38.7	31.2	41.6
Latency [%]						
Standard Gaming Class	99.3	98.8	99.0	98.9	98.1	97.5
Highend Gaming Class	95.7	89.9	89.9	86.0	77.4	69.8
ULL Class	82.8	63.5	54.6	41.0	40.1	18.3
Stability [%]						
Transaction Success	99.0	98.6	98.8	98.7	98.4	98.7

Percentages are rounded to one decimal place and points rounded to integer numbers. For the calculation of points and totals, the accurate, unrounded values were used.

In the stability category, the six regional providers are again largely on a par. Success rates of around 99% are an indication that the fixed-network lines mostly provide stable connections despite all differences in performance.

Our test results show that customers of the regional fixed-network providers can also rely on this.

Strengths and weaknesses

Download data rates are high for providers that predominantly rely on coaxial cable connections, while there are limitations in uploads and latencies. Candidates with predominantly fiber-optic lines are showing top results in all three disciplines.

Reliability

Our reliability ranking shows a high level of performance for all regional providers.

Wilhelm.tel also leads the field in the analysis focusing on basic services – or the mandatory program respectively (see also page 73). However, Deutsche Glasfaser and NetCologne are moving closer together here. EWE-Tel and M-net are also closing the gap by a comparatively small margin. Overall, this view shows that the regional operators in particular provide their customers with an overall reliable and high level of service. If you only have basic requirements for an Internet connection, you can rest easy with all the providers considered here.

Reliability	max.	wilhelm.tel	Deutsche Glasfaser	Net Cologne	M-net	EWE-Tel	PYUR
Active Download data rates	198.0	188.6	185.5	187.2	185.3	183.3	184.8
Passive Download data rates	49.5	46.7	45.6	45.9	45.3	45.8	45.4
Active Upload data rates	110.0	101.8	102.5	99.5	90.2	99.3	75.3
Passive Upload data rates	27.5	25.4	25.2	25.0	25.4	25.0	25.0
Latency	137.5	136.2	135.3	135.7	135.4	133.9	132.7
Stability	50.0	48.4	47.7	48.1	47.8	47.4	47.8
Total	573 P.	547	542	541	529	535	511

Percentages are rounded to one decimal place and points to whole numbers. The exact, unrounded values were used to calculate points and totals.

Methodology

With its crowdsourcing methodology, already familiar from our mobile network tests, umlaut, part of Accenture, can also analyze performance KPIs of fixed network services.

The results of this test are based on a comprehensive analysis of crowdsourcing data conducted by umlaut, based in Aachen and part of Accenture.

Fixed Line Crowdsourcing

The data basis for the analyses is gathered on smartphones and tablets. When thousands of popular apps are used on them, the parameters described below are collected in the background – provided that the user has consented to completely anonymous data gathering. Samples are generated at specific intervals (from one second to 15 minutes) and sent daily to umlaut's cloud servers, where the data is further processed.

By filtering the network access technology for samples collected during a Wi-Fi connection (as opposed to mobile network connections) and identifying the network operator, the samples can be limited to fixed network connections. A complex set of rules and extensive checks then ensure the validity of the evaluations. For example, conspicuously slow connections are filtered out – the threshold value is derived from the average performance of all lines observed in a country.

The analysis of Wi-fi connections takes into account the fact that most Internet connections today take place this way. Since the Wi-Fi speeds achievable with current smartphones are also usually significantly higher than the observed overall data rates, the influence of the Wi-Fi link speed on the measurement results is negligible.

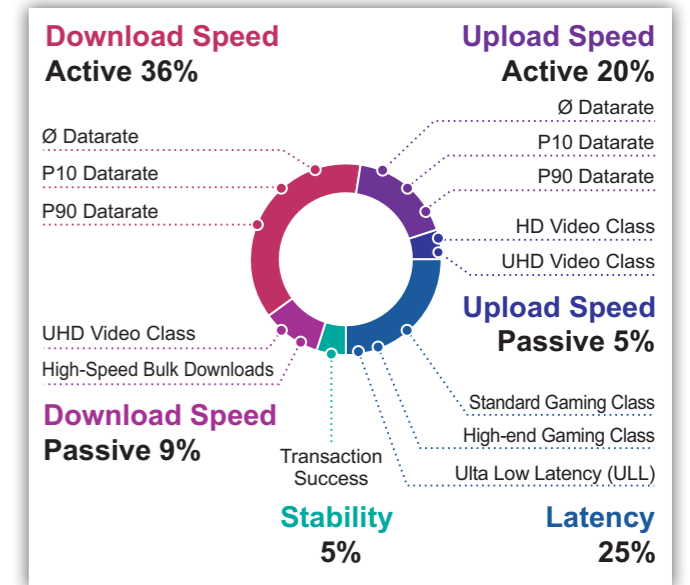
Passive Data Rates

The passive collection of data rates for downloads and uploads takes place in the background while the user is using everyday applications such as web browsing, streaming or gaming on their device.

In order to classify the observed data rates, umlaut has defined application-related speed classes: *UHD Video* requires 20 Mbps and *High Speed Bulk Downloads* require 50 Mbps. In contrast, for the typically slower uploads, the speed classes *HD Video* (min. 5 Mbps) and *UHD Video* (min. 20 Mbps) are considered. *Passively observed download speeds* account for 9% of the overall result, while the according *upload speeds* contribute 5%.

Active Data Rates

In addition to the passively observations of the data rates requested by apps, *active measurements of the upload and download data rates* also take place once a month. They determine the amount of data that can be transferred in 3.5 seconds and derive the data rate from this. Our scoring considers the *average data rate*, the *P10 value* (90% of the values are above the specified threshold, a good approximation of the typical minimum speed) and the *P90 value* (10% of the values are above this threshold, a look at the peak values) for the determined measurements. The determined active download speeds account for 36% of the overall result, and the active upload tests contribute 20% to it.



Balanced requirements

The recorded key performance indicators (KPIs) take into account both day-to-day basic requirements as well as peak values focused on higher performance.

Latencies

Latency measurements are taken every 15 minutes – for this purpose, "pings" are performed directly after the connection tests. The first "hop", which is affected by Wifi, is corrected. umlaut also assigns the results of the latency determinations to an application-related class: Roundtrip times of less than 50 ms qualify a sample for *standard gaming* and less than 20 ms for *high-end gaming*. If the latency is shorter than 10 ms, the sample is counted as *Ultra Low Latency (ULL)*, which is sufficient for near-real-time applications. Our tables show the percentage of connections that reached the required thresholds in the mentioned classes or performed better. The latency score accounts for 25% of the result.

Stability

Based on the determined data rates and additional browsing and connection tests, umlaut also examines when a broadband connection is available at all. The averaged and weighted results define the percentage of the Internet transaction success rate and account for 5% of the total score.

Reliability

umlaut divides all measured values into basic requirements ("Qualifier KPIs") and values related to peak performance ("Differentiator KPIs"). The presentation of reliability takes only the "Qualifier KPIs" into account and thus allows a statement to be made about how well a provider's network meets the purely basic requirements.

Nationwide

Overall Results	max.	Deutsche Telekom	Vodafone	1&1/ Versatel	O2 Telefónica
Download Speed Active	360.00	313	337	302	303
Ø Datarate	90.00	75.0	83.9	69.2	71.0
P10 Datarate	198.00	185.8	185.6	185.3	184.4
P90 Datarate	72.00	51.8	67.4	47.4	47.2
Download Speed Passive	90.00	83	83	83	83
UHD Video Class	49.50	45.7	45.6	46.2	45.8
Bulk Download	40.50	37.4	37.0	37.3	37.0
Upload Speed Active	200.00	180	165	177	175
Ø Datarate	50.00	45.1	45.0	43.1	40.9
P10 Datarate	110.00	100.0	84.2	99.6	99.8
P90 Datarate	40.00	35.2	36.1	33.9	34.6
Upload Speed Passive	50.00	46	46	46	46
HD Video Class	27.50	25.1	25.0	24.8	25.0
UHD Video Class	22.50	21.2	21.1	21.0	21.0
Latency	250.00	242	223	234	231
Standard Gaming Class	92.50	134.7	132.9	133.9	131.9
Highend Gaming Class	20.00	89.2	83.8	86.6	85.8
ULL Class	137.50	18.0	5.8	13.1	13.4
Stability	50.00	48	47	48	48
Transaction Success	50.00	47.7	47.4	47.7	47.8
Total	1000P	912	901	889	886

Percentages are rounded to one decimal place and points rounded to integer numbers. For the calculation of points and totals, the accurate, unrounded values were used.



Hannes Ruegheimer
connect author

The new crowdsourcing-based methodology of our broadband and fixed-network test delivers interesting findings. In the nationwide category, it deservedly rewards operators who are committed to rolling out fast internet lines across the board. Congratulations to Deutsche Telekom for the overall nationwide victory! Vodafone is also rightly reaping the rewards of its gigabit rollout in its cable networks.

And even if 1&1 and O2/Telefónica do not participate at the very top, they are still performing very well and offering their customers stable often high-performance internet connections.

In the regional rankings, the operator Wilhelm.tel won the category in a neck-and-neck race. The Hamburg-based operators finished with a razor-thin lead of just one point over Deutsche Glasfaser. Both candidates impress with an outstanding result. NetCologne, M-net and EWE-Tel also perform very well and deserve the same grade for this. Finally, this also applies to Pÿur, even though our test identifies the most potential for improvement with this provider.

For readers and all those interested in a stationary internet connection, our test provides a good guide, from which provider they can expect the highest performance. Of course, our ranking still has to be compared with local availability and the rates offered – after all, our ranking is based solely on the technical aspects and therefore makes no statement about the price-performance ratio of the respective offers.

Regional

Overall Results	max.	wilhelm.tel	Deutsche Glasfaser	Net Cologne	M-net	EWE-Tel	PYUR
Download Speed Active	360.00	337	338	321	314	295	334
Ø Datarate	90.00	82.2	84.1	76.6	71.1	65.6	83.5
P10 Datarate	198.00	188.6	185.5	187.2	185.3	183.3	184.8
P90 Datarate	72.00	66.2	68.2	57.6	57.3	46.4	65.9
Download Speed Passive	90.00	86	84	83	82	83	83
UHD Video Class	49.50	46.7	45.6	45.9	45.3	45.8	45.4
Bulk Download	40.50	39.3	38.0	37.0	37.1	37.2	37.7
Upload Speed Active	200.00	184	188	181	172	181	147
Ø Datarate	50.00	45.6	47.5	45.2	45.1	45.1	37.5
P10 Datarate	110.00	101.8	102.5	99.5	90.2	99.3	75.3
P90 Datarate	40.00	36.2	38.5	36.0	36.2	36.1	34.3
Upload Speed Passive	50.00	47	47	46	47	46	47
HD Video Class	27.50	25.4	25.2	25.0	25.4	25.0	25.0
UHD Video Class	22.50	21.4	21.8	21.4	21.5	20.8	21.7
Latency	250.00	249	245	245	241	236	223
Standard Gaming Class	92.50	136.2	135.3	135.7	135.4	133.9	132.7
Highend Gaming Class	20.00	92.5	90.6	90.6	89.2	86.0	82.9
ULL Class	137.50	20.0	19.2	18.6	16.4	16.0	7.3
Stability	50.00	48	48	48	48	47	48
Transaction Success	50.00	48.4	47.7	48.1	47.8	47.4	47.8
Total	1000P	951	950	924	903	888	882

Percentages are rounded to one decimal place and points rounded to integer numbers. For the calculation of points and totals, the accurate, unrounded values were used.