

Methodology: Worldwide Broadband Speed League 2021

1. Overview

Cable.co.uk has once again worked with [M-Lab](#) – led by teams based at Code or Science & Society; New America’s Open Technology Institute; Google, Inc; Princeton University’s PlanetLab – to create this annual data set.

Previously, Cable.co.uk has produced internationally cited reports on [global broadband speeds during COVID lockdown periods](#), [global mobile data pricing](#), and [global fixed-line broadband package pricing](#).

To understand the data, one must first understand the methodology and analysis (Cable.co.uk) applied to the source data (M-Lab).

It should be noted that [due to a platform upgrade](#) in January 2020, year-on-year speeds rose considerably during that period. This has to do with the an improved M-Lab measurement platform, and does not reflect a real-world rise in network speeds.

Comparative ranking of countries remains valid, of course, and as ever you are encouraged to view the data as a league table of all countries, rather than an absolute measure of average network speed in any specific country.

1.1 About the M-Lab speed test data

Here are some things to consider when understanding speed test data in general, and some concerning the M-Lab data set in particular.

Speed test data in general

A single speed test (of which there are over 1.1 billion included in this study) is not a direct measure of the maximum speed available to a household router. Rather, it is the speed available to a device via the router. This is an important distinction because...

1. A speed test conducted over wifi, due to local signal

interference and/or the capabilities of the router and/or the capabilities of the device being used to take the measurement, can be significantly slower than the same connection directly over a LAN cable. Speed test data tend to consist partially of measurements made over wifi, reflecting real-world use. This is why the country averages may appear lower than you might expect when compared to first-hand experience or assessment of local markets. However, since every country's average will suffer this flaw – innate to speed tests without compensatory weighting – measurements of changes over time, or comparative average speeds between different countries are sound

2. Speed test data tend to show a negativity bias – people are more likely to measure their speed if there is something wrong or if they aren't getting the speed they need. This also helps to explain why speed test averages are lower than people might expect. To mitigate this, we filter out tests where a fault or problem is evident

Ofcom, the UK telecoms regulator, uses physical equipment to constantly measure the maximum speed available on particular lines across a long period of time, and it is from this it derives its average. This is very different to the way a regular speed test 'snapshot' is captured, and explains why Ofcom's average speeds measured in the UK are likely to be higher than those measured in our tests.

Likewise, some speed test providers such as Ookla, which collects speed test data similarly to our open-source partners M-Lab, use compensatory weighting to offset effects one and two (above). Part of what Ookla does when presenting speed test averages, for example, is to disregard the slowest 30% and the fastest 10% of slices taken in each test. We do not do this.

The M-Lab data, and therefore the national averages presented in this report, should be regarded as a realistic reflection of real-world user experience rather than an absolute measurement of available bandwidth. Moreover, the focus of this study is comparative in nature, not absolute – how countries compare to one another, not how fast or slow a country is in absolute terms. Any measurement of absolute national network speed is beyond the capability of broadband speed test data.

The tests themselves

The download part of Measurement Lab's Network Diagnostic Tool

(NDT) application measures the throughput of a single TCP connection, attempting to transfer as much data as possible for a period of at least ten seconds.

Any tests that have not managed to 'stress' the connection by creating congestion between the client and server machines have been excluded from our analysis. Likewise any tests that ran for less than nine seconds, or lasted over 15 seconds, have been excluded. Any tests that transferred less than 8 KB of data, or that did not properly establish a connection between server and client, were also excluded.

Where multiple tests have been run by a single IP address, the average speed has been used for that address. Here are some further notes on NDT, courtesy of M-Lab:

1. **Off-net vs. on-net measurement:** All of M-Lab's measurement services, including NDT, are hosted on our off-net platform. "On-net" refers to measurement performed on the same network as the network it is measuring, such as an Internet Service Provider (ISP) measuring itself. It only captures one segment of any path that data is likely to be traversing. In contrast, "off-net" measurements extend beyond a user's access provider's network to measure the complete path across the Internet from user to content including interconnections. By definition, on-net measurement can not even detect the effects of any performance limitations at interconnects between ISPs. All of the measurement services hosted by M-Lab inherit the off-net platform methodology for nearly all users (there are a few commercial users on the same networks as M-Lab).

2. **Link capacity vs. bulk transport:** When using NDT tests specifically, Internet users are sometimes confused when their individual results don't confirm the speeds promised by their Internet service provider.

"Speed" is often associated with "link capacity," which is the maximum bitrate of a link; in other words, the best performance possible. However, NDT measures "bulk transport capacity" -- the rate that TCP can deliver data across the end-to-end path; in other words, the reliability of that connection. It is important to note that many link problems (such as low level packet loss and reordering) typically adversely impact both M-Lab measurements and real application performance. These two ways of measuring performance, link capacity and bulk transport capacity, are different and are often

conflated when both concepts are referred to as “Internet speed.” When using NDT data to discuss speed, it is important to clarify these terms to have more effective conversations about Internet speed.

3. **Single-stream vs. multi-stream tests:** NDT measures the single-stream performance of bulk transport capacity. While modern web browsers will use multiple streams of data, testing for multiple streams can compensate for data delivery problems that are exposed by a single stream. A multi-stream test can return measurements closer to link capacity but it would not represent the adverse performance impact of low-level packet loss. By testing for single-stream performance, NDT is an effective baseline for measuring a user’s Internet performance.

Reasons for tests being excluded

- Transmission of < 8 KB of data
- Test duration of < 9 seconds
- Test duration of > 15 seconds
- TCP congestion has not been reported
- TCP three-way handshake has not been completed
- Test has been in a congestion limited state for less than 80% of the test duration
- Congestion has been caused by the client device for more than 20% of the test duration

Reasons for countries being excluded

- Tests have been performed by fewer than 100 unique IP addresses

M-Lab's upgrade to the 2.0 platform

M-Lab upgraded its measurement platform in January of 2020. The upshot of this, when it comes to measuring average speeds, was apparently faster speeds across the globe. As always, then, we

remind you that the focus is on the comparative ranking of each country, rather than absolute speed numbers. It also means this year's figures more closely resemble figures provided by other speed test platforms.

To learn more about M-Lab's 2.0 platform upgrade you can [visit their blog post](#).

2. The data table explained

2.1 Table columns

Here's a brief overview, column by column, of this year's data from the 'Countries' tab. Column headers for the 'Regional' tab are identical.

- A. **Position:** An integer showing the world ranking of the country between 1 and 224, with 1 representing the fastest speed in the world and 224 the lowest

- B. **Country name:** The name of the country in English

- C. **Country code:** The internationally recognised ISO 3166 alpha 2 abbreviation for the country

- D. **Region:** The region the country occupies. You can use the filters in this column to produce regionalised tables, or alternatively click over the 'Regions' tab where this has been done for you

- E. **Mean download speed (Mbps):** The mean average speed of all speed test results from unique IPs in the country

- F. **Unique IPs tested:** Total number of unique speed tests across the entire six-month study period. An IP means a particular internet address, and may be understood in layperson terms as a single household or connection

- G. **Total tests:** Total number of tests across the study period, including repeat tests from the same IP. An IP means a particular internet address, and may be understood in layperson terms as a single household or connection

- H. **How long it takes to download a 5GB movie (HH:MM:SS):** The amount of time in hours, minutes and seconds it would take to download 5GB (gigabytes) of data at the national average speed measured in the study

- K. **Gobal or regional totals:** Here you can find the totals for the

global (countries) data, and regional totals in the 'Regions' tab

3. Should you require further information

3.1 What we will and will not respond to

When we release data of this kind, we tend to receive requests for deeper insight into the situation in both specific countries and across groups of countries, either occupying the same region or related economically.

We invite any organisation or person interested in our data to use it as they please upon release, provided they link to [Cable.co.uk](https://www.cable.co.uk). However, if you require detailed, qualitative insight into a specific country or countries, that is not a service we are able to provide, and ask that you undertake such work yourselves using this data as a foundation or launching point.

Our aim in producing this data (and other such studies) is to offer a big-picture view of the subject matter. For example, last year, our [Global Broadband Pricing](#) data were used:

- As news of the day – many countries and their news agencies were interested to see and report how and where they ranked
- By educational resources – across the year various universities and other educational bodies included the data either for reference or as the main focus of published work
- By government bodies and lobbyists – there were instances where our data were used to demonstrate the need for change
- By NGOs and other international stakeholder bodies – NGOs such as the World Economic Forum wrote both coverage and critique of the research, the latter providing us with useful insights as to how we can add greater value to our data moving forward