

Measuring Broadband New Zealand



Winter Report, August 2021

In 2018, the Commerce Commission appointed SamKnows to measure New Zealand's internet performance. The programme, called Measuring Broadband New Zealand, gives internet users in New Zealand access to the SamKnows platform to measure the quality of their fixed-line internet. The aim of the programme is to increase transparency about actual in-home broadband performance and provide consumers with independent information about internet performance across different providers, plans, and technologies, to help them choose the best broadband for their homes. It will also encourage providers to improve and compete on their performance.

This report provides an overview of the findings from data collected between 1st May and 31st May 2021.

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Overview

This report presents the most recent key indicators of consumer internet performance in New Zealand. Highlights include:

- 1. Continued monitoring of the largest providers and plans.**
- 2. The inclusion of a testing server on the South Island (Christchurch) to provide additional insight into regional performance.**

The last report (https://comcom.govt.nz/_data/assets/pdf_file/0030/257952/MBNZ-Autumn-Report-2021-24-June-2021.pdf), published on 24th June 2021, presented an analysis of dropouts on top of continuing to benchmark performance for all the main RSPs and Fibre plans.

Previous reports in this series have examined topics including internet performance during online broadcasts of the Rugby World Cup 2019, internet performance following New Zealand's Level 4 Alert in response to COVID-19, and how many people in a household can watch Netflix at the same time.

Other reports released by the Measuring Broadband New Zealand (MBNZ) programme can be found here: <https://comcom.govt.nz/regulated-industries/telecommunications/monitoring-the-telecommunications-market/monitoring-new-zealands-broadband/Reports-from-Measuring-Broadband-New-Zealand>

The Measuring Broadband New Zealand programme has a code of conduct, the purpose of which is to ensure that parties involved in the MBNZ programme act in good faith and in accordance with principles relating to data validation, 'gaming' of results, and appropriate public usage of the MBNZ results. A list of signatories is included in the code, including the Commission and SamKnows. All tested RSPs complied with the code of conduct, including validation of data for this report. You can see the code of conduct on our website: <https://comcom.govt.nz/regulated-industries/telecommunications/monitoring-the-telecommunications-market/monitoring-new-zealands-broadband>

The MBNZ programme currently tests eight retail service providers (RSPs) (Trustpower, Orcon, Slingshot, MyRepublic, Skinny, 2degrees, Vodafone and Spark) who between them provide broadband services for 95% of the market and pay the Telecommunications Development Levy (TDL). There are a range of other RSPs who are not included in the testing for consumers to choose from and we encourage Kiwis to shop around.

Executive Summary

Benchmarking

1. All main download/upload/latency results are stable against the previous reporting period.
2. A small difference in performance between the two main islands remains, as has been noted in previous reports, but this likely has no impact on South Island consumers.
3. The rate of disconnections increased from the previous report, especially for ADSL and Fixed Wireless, but are still at a level unlikely to impact user experience.

Application Performance

1. Video Streaming, Video Conferencing, and Social Media results were consistent with those seen in previous reports. Charts of the performance of these applications have been omitted from this report but raw results are published alongside this report.
2. Online Gaming results have been included to benchmark performance ahead of tests for new games being introduced, to be included in future reports.

Package Comparison

ADSL Remains suitable for traditional services like web browsing, email, and basic video streaming, particularly when there's only one person using the connection. Due to physical limitations, the highest-performing ADSL lines will never achieve download speeds higher than ~25 Mbps. The distance from house to exchange has a big effect on attainable speeds, with most ADSL lines in New Zealand averaging under 8 Mbps download. The higher latency, more frequent dropouts, and lower upload speeds make ADSL less suitable for video calls and multi-user households.

VDSL There is a range in performance: some lines will achieve download/upload speeds indistinguishable from ADSL, whereas a small proportion of lines will achieve speeds comparable with Fibre 100, and certainly with lower speed Fibre plans. Lower speed lines will be less suitable for applications that use a lot of data, such as video conferencing and Ultra High Definition streaming, whereas higher speed lines will generally support more data-heavy applications.

Fibre 100 Supports latency-sensitive applications such as online gaming. Fibre 100 will also support data-heavy applications such as Ultra High Definition streaming with multiple concurrent users or video conferences with a large number of participants. Fibre 100 will cover most users' requirements.

Fibre Max¹ Higher download and upload speeds than Fibre 100. The latency to internet applications, such as online games, through a Fibre Max line is the same as through any other Fibre package. Performance varies depending on RSP. Fibre 100 will support all modern internet applications and multi-user households, so Fibre Max is still only recommended in cases where there is a genuine need for more bandwidth e.g. frequently uploading or downloading large files.

Cable Available in some areas (Wellington, Upper & Lower Hutt, the Kapiti Coast, and parts of Christchurch). Cable is also referred to as Hybrid Fibre-Coaxial (HFC) and DOCSIS. Vodafone is the only provider operating a Cable network in New Zealand. Two plans are available: UltraFast HFC Max and UltraFast HFC 200. Due to the limited coverage of the Cable network, MBNZ doesn't collect enough data to formally report on the performance of the UltraFast HFC 200 plan.

Fixed Wireless (4G) Can offer higher download speeds than ADSL, but with higher latencies due to the cellular technology underlying these plans. Fixed Wireless has the highest latency of all technologies apart from Satellite (not currently reported on by MBNZ). Fixed Wireless also delivers lower download/upload speeds and more frequent dropouts than Fibre. This range of performance

¹ All references to Fibre Max in this report encompass packages derived from 'gigabit' wholesale products, in particular: 2degrees' Ultimate, MyRepublic's Fibre Pro/Gamer Pro, Orcon and Slingshot's Gigantic Fibre, Spark's Fibre Max, Trustpower's Fibre Max, and Vodafone's Fibre Max packages.

factors means that Fixed Wireless should not be preferred to Fibre on performance grounds. 5G Fixed Wireless plans (not currently reported on by MBNZ) are at present only available in limited areas, but would offer higher bandwidth than existing 4G plans.

Other packages There are other packages available, such as Fibre 30, Fibre 50, Fibre 200, HFC 200, and satellite packages. Since Measuring Broadband New Zealand collects less data on these packages it is not possible to give any firm advice around their suitability for different applications at this stage.

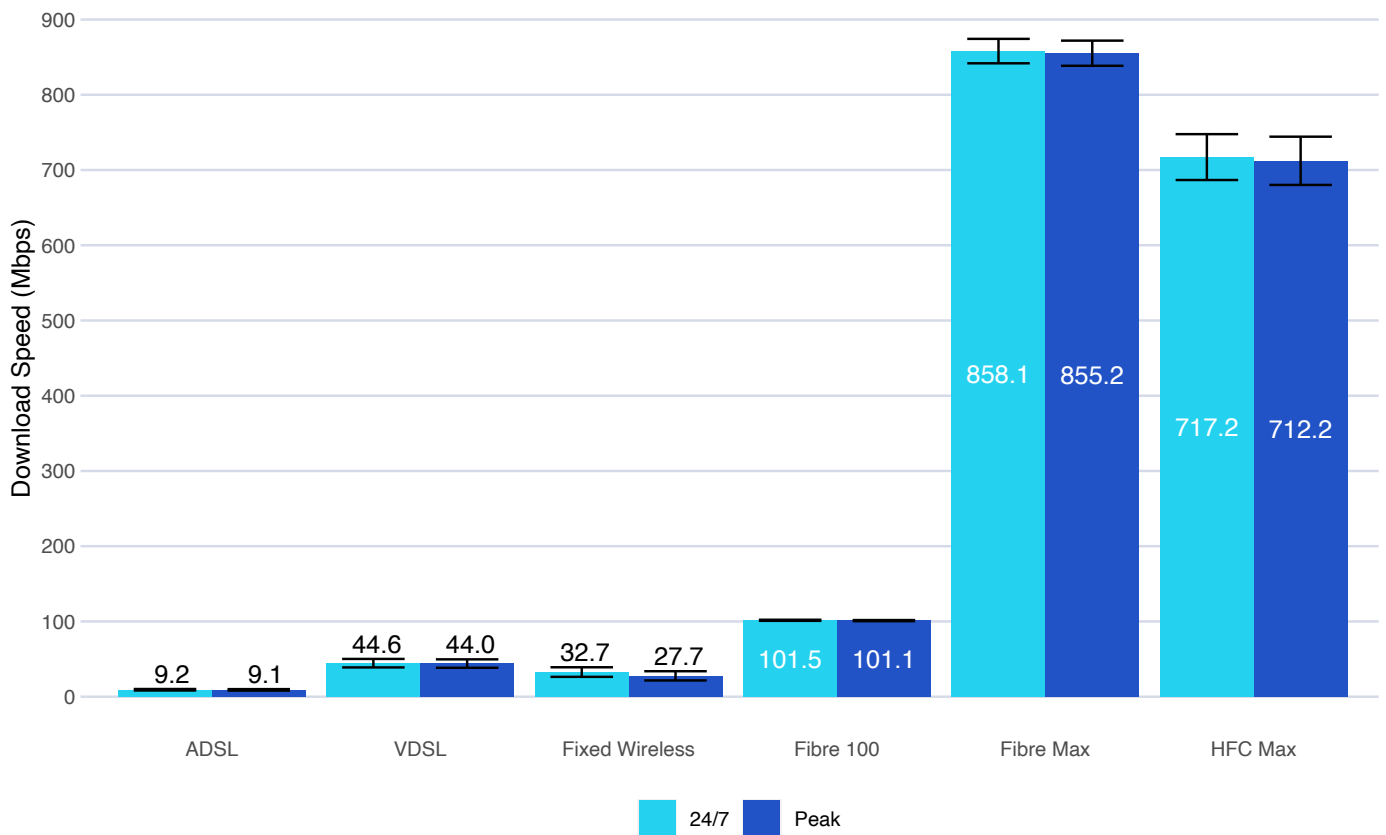
Speed Tests - Download

Figures 1 and 2 give an overview of download and upload speed across the country. These are included in every report in order to provide a benchmark that can be tracked over time.

Peak hours are the times when people typically use the internet; in New Zealand this is 7pm to 11pm on Monday-Friday.

Figure 1: Average Download Speeds by Plan

Average of monthly household averages. Peak hours are Monday - Friday, 7pm - 11pm. Error bars show 95% confidence intervals of the mean.



Key Observations

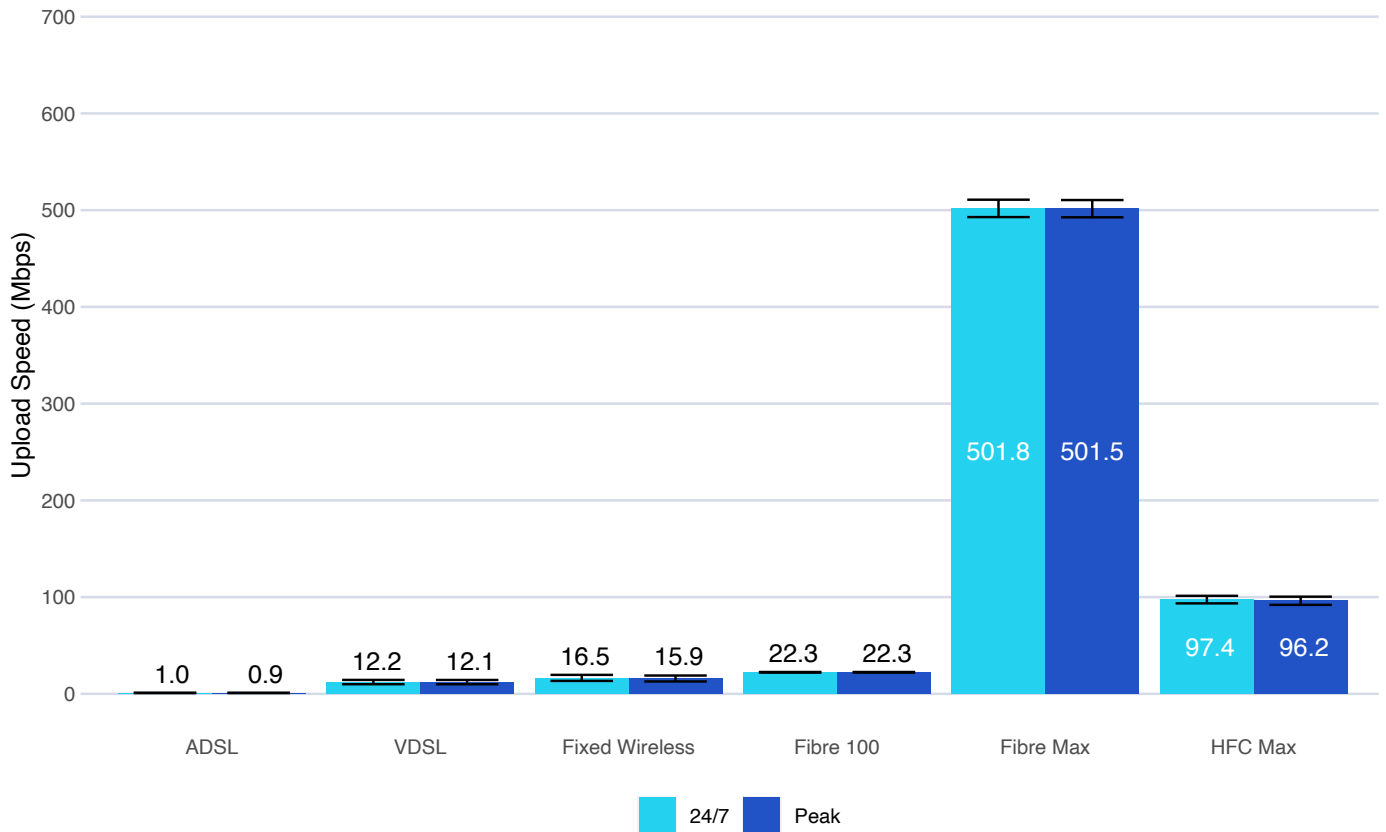
- The average download speeds of HFC saw an increase of 7.5% in performance compared with the previous report. At the end of this reporting period (31st May) Vodafone implemented some network changes affecting their HFC Max customers. We expect these network changes to be reflected in the next MBNZ report.
- Both Fixed Wireless and Fibre Max plans saw small increases in download speed compared to the previous report.

Speed Tests - Upload

Upload speeds should be considered alongside download speeds. The main applications where the impact of upload speed is apparent are file transfers and remote storage. For example, a lower upload speed will mean that it takes longer for files to sync or email attachments to be applied.

Figure 2: Average Upload Speeds by Plan

Average of monthly household averages. Peak hours are Monday - Friday, 7pm - 11pm. Error bars show 95% confidence intervals of the mean.



Key Observations

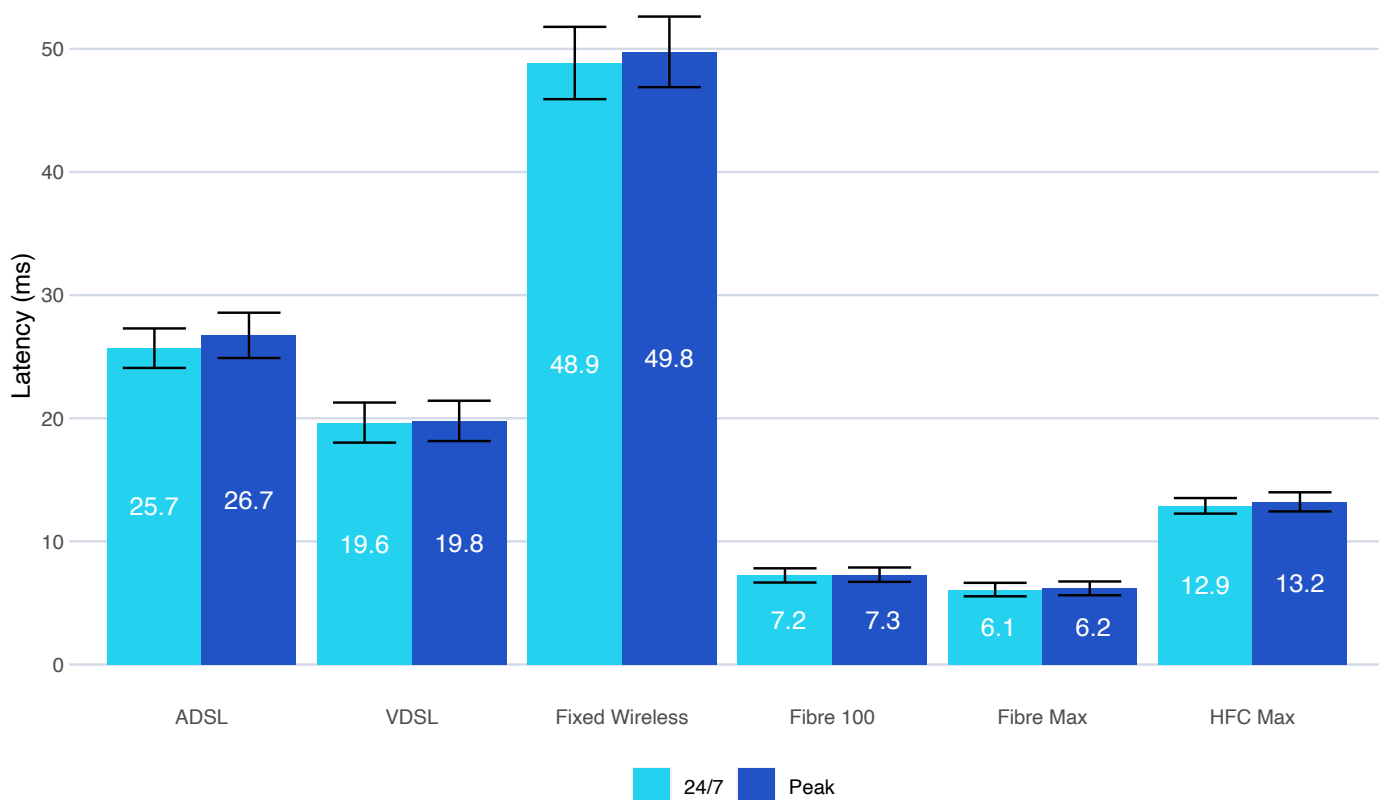
- The average upload speeds of each plan are consistent with those seen in the previous report.

Latency

Latency is another key factor that should be considered when assessing broadband performance. The time it takes to transmit and receive messages between household and server limits the responsiveness of realtime applications such as interactive webpages or video calls. Higher baseline latency makes realtime applications more vulnerable to jitter (also known as packet delay variation) and dropouts.

Figure 3: Average Latency to Test Servers by Plan. Lower is better.

Average of monthly household averages. Peak hours are Monday - Friday, 7pm - 11pm. Error bars show 95% confidence intervals of the mean.



Key Observations

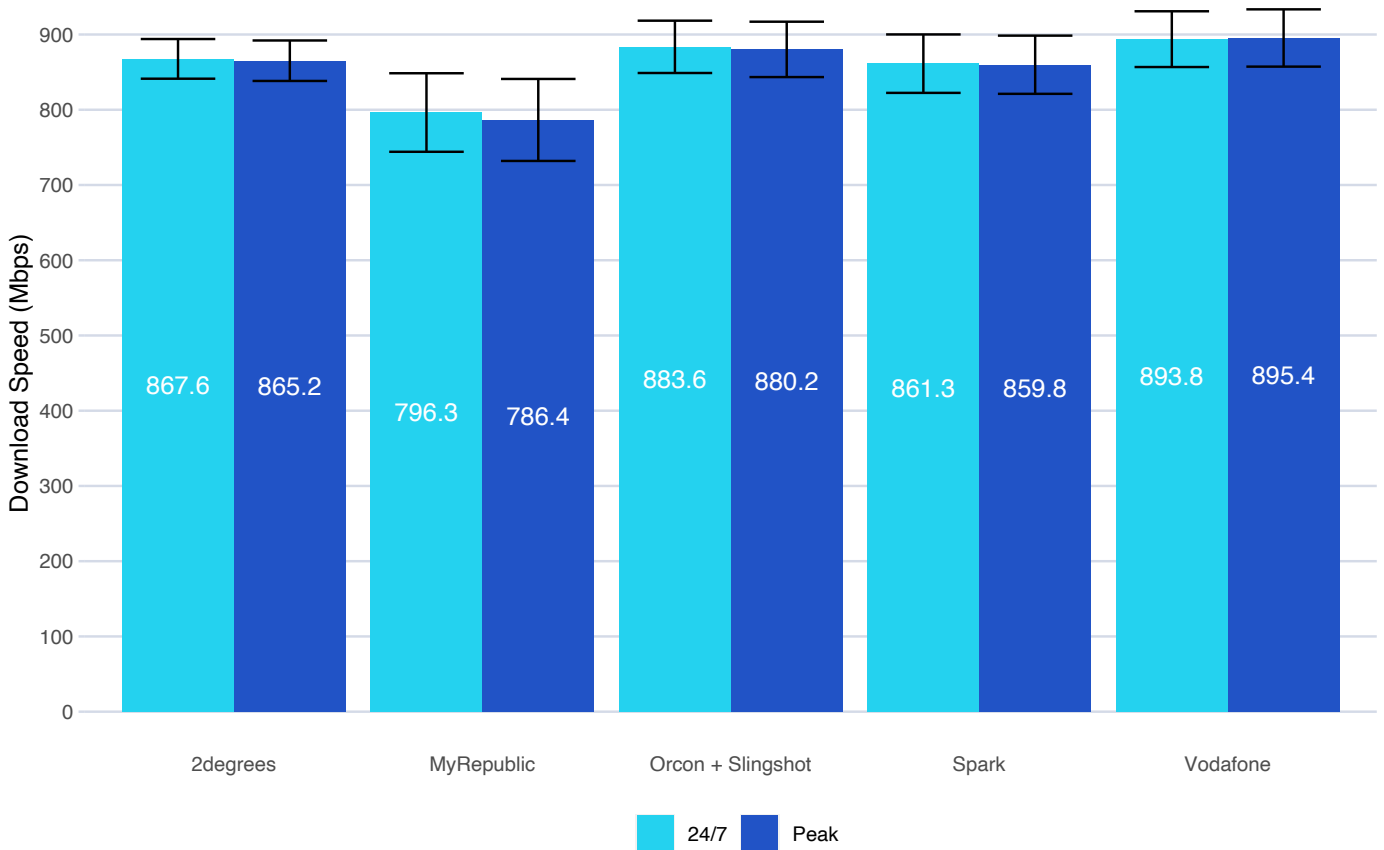
- Latency over Fixed Wireless is higher than over Copper (ADSL VDSL), Cable, or Fibre. Fibre is faster due to both the lower latency over fibre optics and to the more recent infrastructure that underpins the Fibre network.
- Cable connections have a higher latency than Fibre on average, though the difference is not so great as to have an effect on most realtime applications.
- There is no difference in latency across different Fibre plans since latency is independent of bandwidth. A Fibre Max plan will not necessarily result in more responsive performance of interactive applications than a Fibre 100 plan.

Fibre Max Breakdown by RSP

Fibre Max plans are generally advertised to the public with headline download speeds between 750 Mbps and 950 Mbps. Fibre Max plans are derived from ‘gigabit’ wholesale products but, since around 6% of the data in HTTP traffic is given over to network protocol overheads, the highest speed test result that can theoretically be achieved by a Fibre Max line is around 940 Mbps.

Figure 4: Average Fibre Max Download Speed by RSP

Average of monthly household averages. Peak hours are Monday - Friday, 7pm - 11pm. Error bars show 95% confidence intervals of the mean.



Key Observations

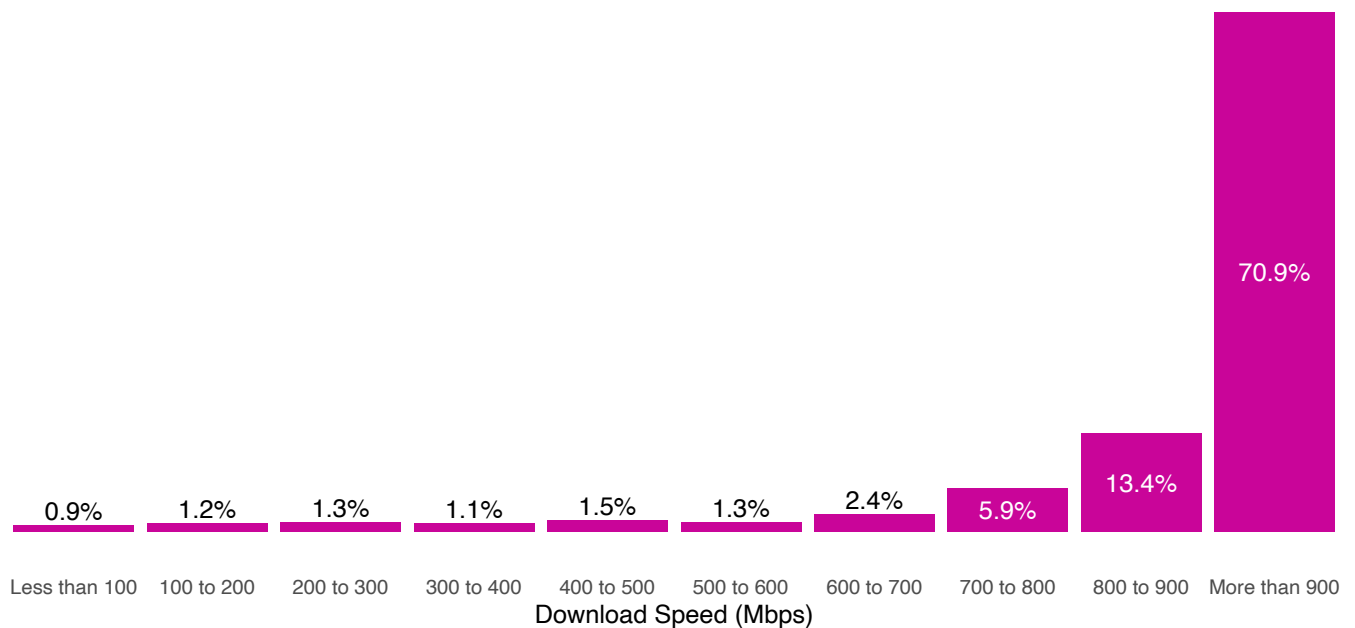
- All RSPs’ results are broadly in line with those seen in the previous report.

There were not enough Fibre Max volunteers connected to Trustpower during the measurement period to report results for those RSPs. All RSPs are included in the overall Fibre Max results shown in Figures 1—3.

Distribution of Fibre Max Results

Figure 5: Download speeds on Fibre Max plans.

Distribution of test results. Advertised average download speeds for Fibre Max plans range between 700Mbps and 950Mbps; this varies by RSP and over time.



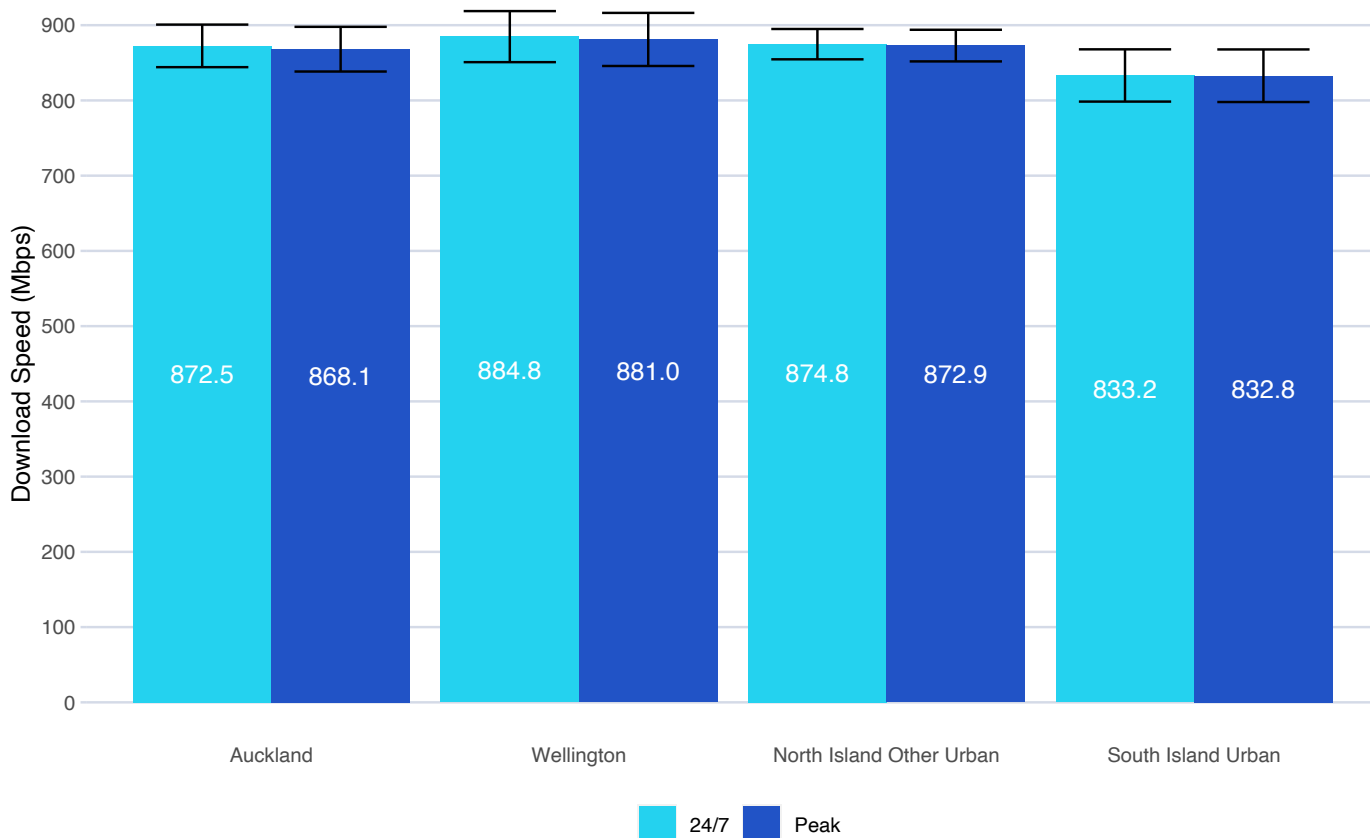
Key Observations

- 71% of speed tests run over Fibre Max lines now achieve download speeds above 900 Mbps, broadly in line with the 69% seen in the previous report.
- Within the range of test results, 83% of tested Fibre Max households had an average download speed higher than 800 Mbps, broadly in line with the 82% seen in the previous report.

Fibre Max Breakdown by Region

Figure 6: Average Fibre Max Download Speed by Region

Average of monthly household averages. Peak hours are Monday - Friday, 7pm - 11pm. Error bars show 95% confidence intervals of the mean.



Key Observations

- There remains a small difference in performance between the two main islands, as has been noted in previous reports, but the difference is at a level which is unlikely to be noticed by end users.²

Before this measurement period a new SamKnows test server was provisioned in Christchurch, in addition to existing ones in Auckland and Wellington, to provide more scope to measure performance on the South Island. Speed tests are run to the nearest server (in latency terms), so tests originating in the South Island would previously most often use the Wellington server.

² The Wellington area contains 36 Whiteboxes on Fibre Max lines.

The inclusion of the Christchurch server has not led to a closing of the speed gap with the North Island. In fact, inclusion of the Christchurch server has confirmed that many RSPs route their South Island traffic via the North Island.

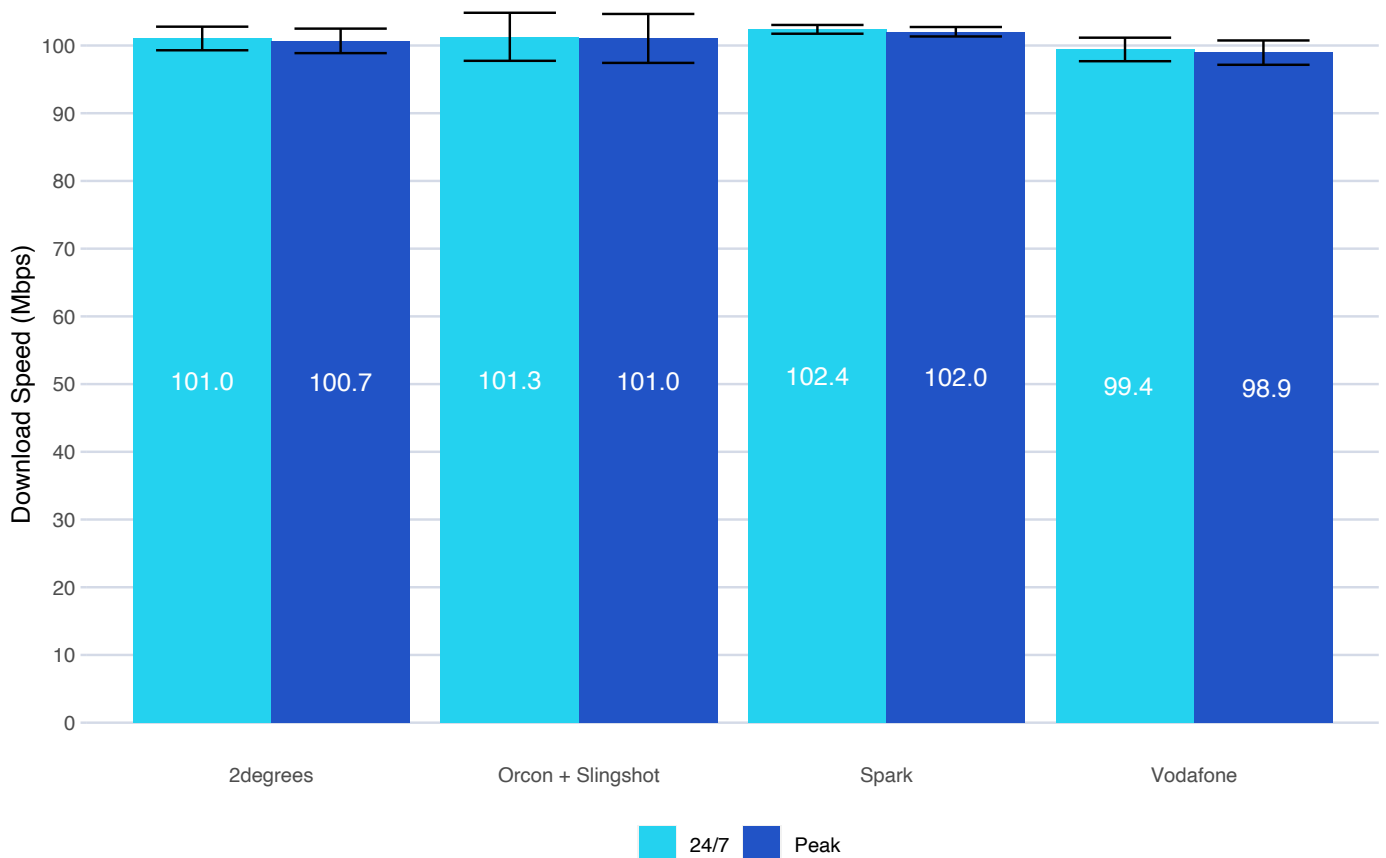
We also compared results between Islands for how long it took for a webpage to load on a site hosted on the South Island. While RSPs who routed via the North Island did record slightly worse figures, the results differential was small and most often content is hosted in the North Island or overseas, meaning the impact on consumers in the South Island is minimal and likely would not be noticed.

Fibre 100 Breakdown by RSP

The speeds under which Fibre 100 is advertised to consumers are 100 Mbps download and 20 Mbps upload. In practice, since the provisioned speed is set slightly higher to allow for extra bandwidth used up by network protocol overhead, it's quite common to see measured speeds close to or slightly above 100 Mbps.

Figure 7: Comparison of average Fibre 100 download speeds across RSPs.

Average of monthly household averages. Peak hours are Monday - Friday, 7pm - 11pm. Error bars show 95% confidence intervals of the mean.



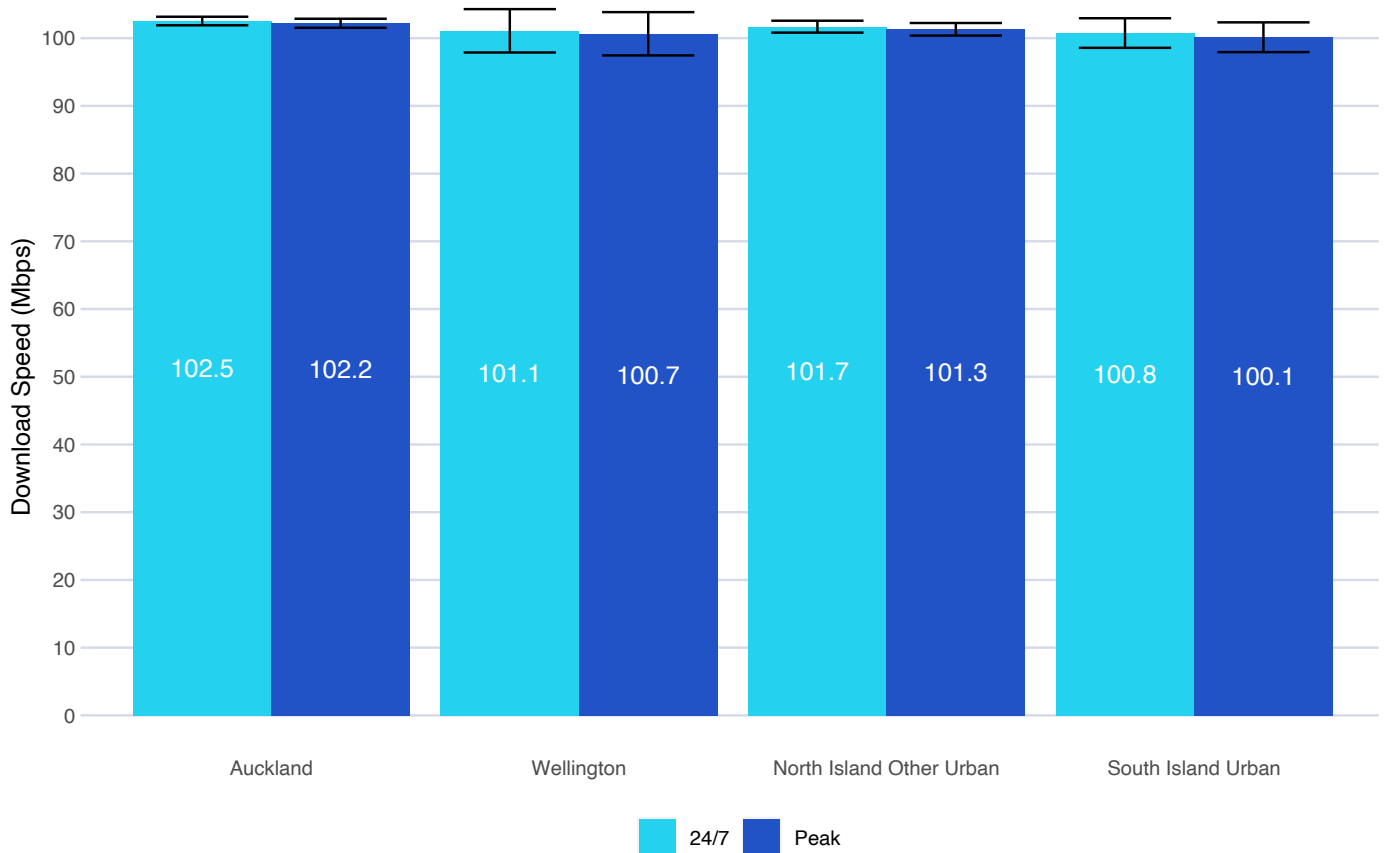
Key Observations

- All RSP average Fibre 100 download speeds are consistent with those seen in the previous report.

There were not enough volunteers connected to MyRepublic or Trustpower to report results for those RSPs. All RSPs are included in the overall Fibre 100 results shown in Figures 1—3.

Fibre 100 Breakdown by Region

Figure 8: Comparison of average Fibre 100 download speeds different parts of New Zealand. Average of monthly household averages. Peak hours are Monday - Friday, 7pm - 11pm. Error bars show 95% confidence intervals of the mean.



Key Observations

- All urban areas of New Zealand that we can provide results for see comparable download speeds through Fibre 100 plans, which are in line with the 100 Mbps headline download speed.³
- Unlike Fibre Max plans, the impact of how traffic is routed from the South Island is not significant for the speed results of Fibre 100 plans.

³ Testing is carried out across the country, but results can only be provided for regions with a sufficient sample of Whiteboxes.

Disconnections

Realtime applications like video calls rely on a persistent connection between the home router and the target server. If the line drops, even for a few seconds, the application will exhibit some form of stuttering. In the worst instance, a user might be disconnected and have to reconnect or wait for their broadband line to come back online.

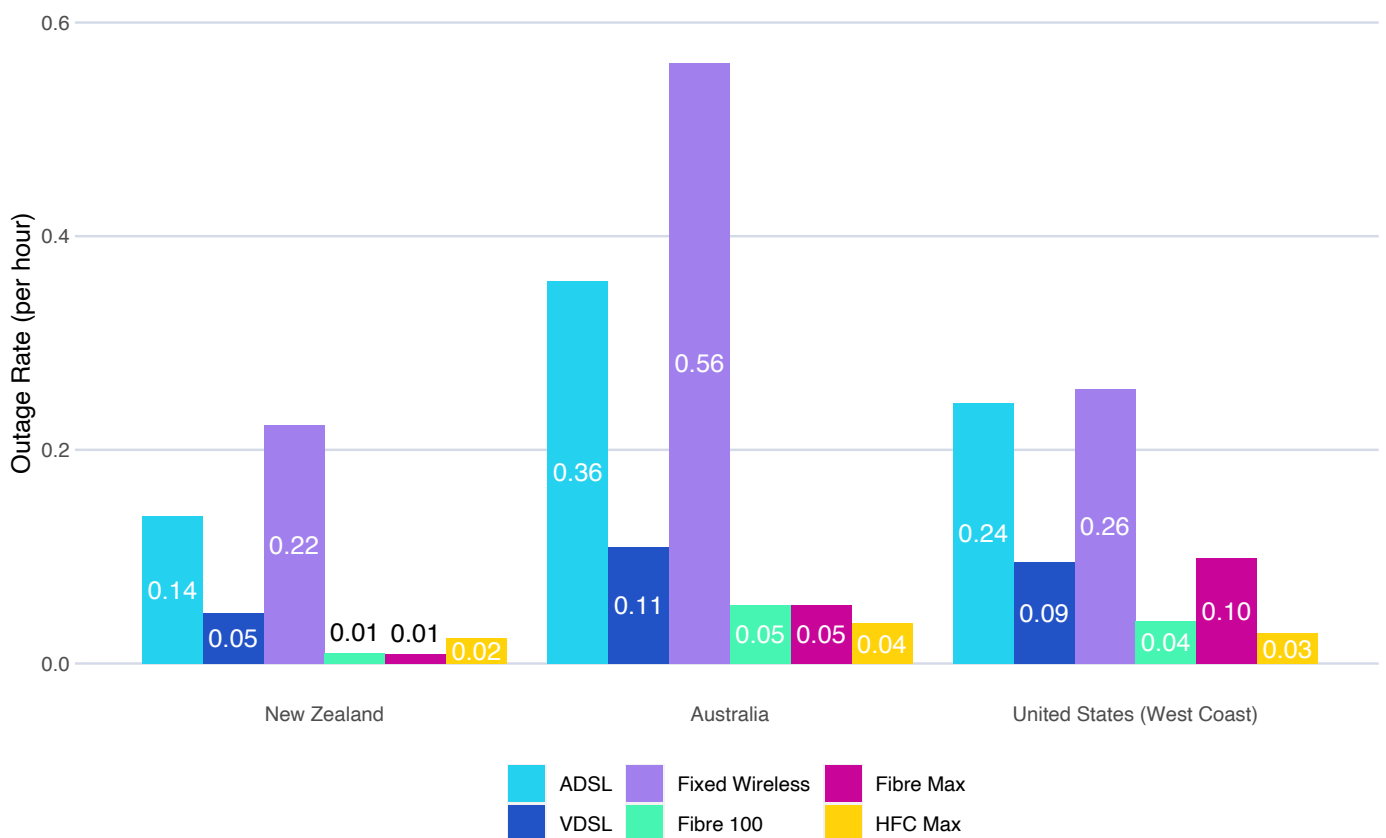
A brief disconnection very rarely means that for example a physical cable has been cut; the main reasons for network dropouts relate to congestion and the configuration of network equipment.

Many common applications, such as video conferencing applications or online gaming used by New Zealanders are served from overseas, mainly Australia, East Asia, and the USA. All New Zealand RSPs share capacity through the limited set of undersea cables which carry traffic across the Tasman and the Pacific.

The following graph compares outage rates across plans.

Figure 9: Median hourly disconnection rates. Lower is better.

Medians of household hourly rates. A disconnection means that two or more packets in a row don't complete a full round trip. Testing only covers periods where the line is idle.



This graph shows medians across households. Taking Fixed Wireless as an example 50% of households will experience no more than 0.2 outages per hour for traffic remaining within New Zealand. This obscures the extremes of performance for each plan: while the median ADSL and Fixed wireless results are comparable, ADSL connections are more likely than others to have outage rates far above the median, whereas Fixed Wireless plans are more likely to have results close to the median. Disconnections vary by hour of the day, so the likelihood of 0.22 disconnection per hour when connected to a New Zealand server will not be consistent throughout all hours of the day.

The results for disconnections have increased for some technologies when compared to the previous report, specifically ADSL and Fixed Wireless. In spite of these increases, the level of outages is still at a level whereby user experience will not be unduly affected.

We will be introducing a new test to the MBNZ program which will be included in reports from the Spring 2021 report onwards. This test, **Latency under Load**, will simulate the connection being in use before running the latency test. This should give an even more accurate picture of end users' experience using applications like video conferencing and online gaming which can be compared with the disconnections tests carried out when the line is idle.

Key Observations

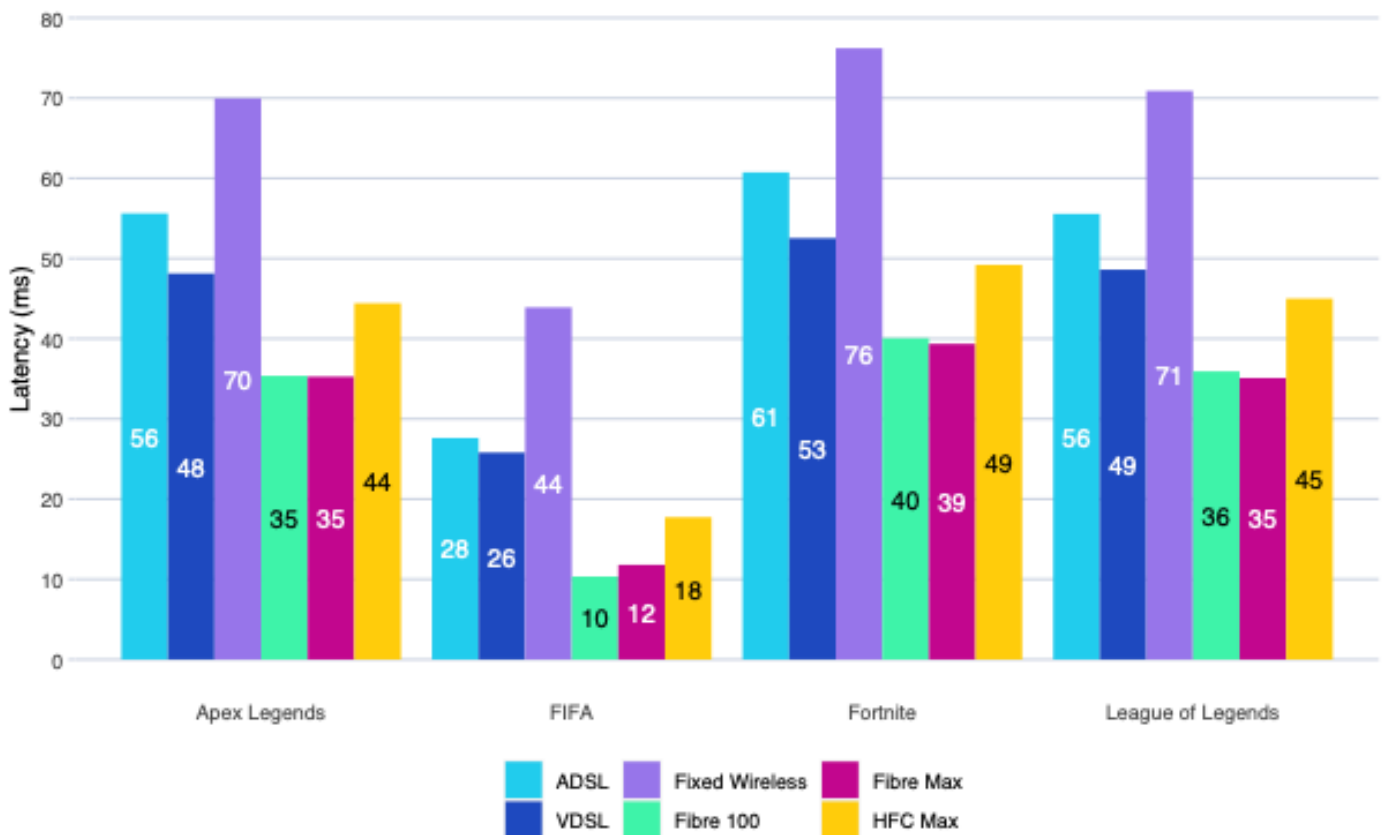
- Most households see a very low rate of disconnections, at least while the line is idle.
- Most ADSL and Fixed Wireless connections experience a higher rate of disconnections than most VDSL, Fibre, and Cable connections.
- Traffic going overseas is more likely to be lost than traffic remaining within New Zealand, though not to such an extent that most households would notice the difference.

Online Gaming

Online gaming applications require low latency between users' machines and the central host server. If it takes a long time to pass messages between client and server then disruptive stuttering or lag will result.

Figure 10: The latency to various online gaming servers. Lower is better.

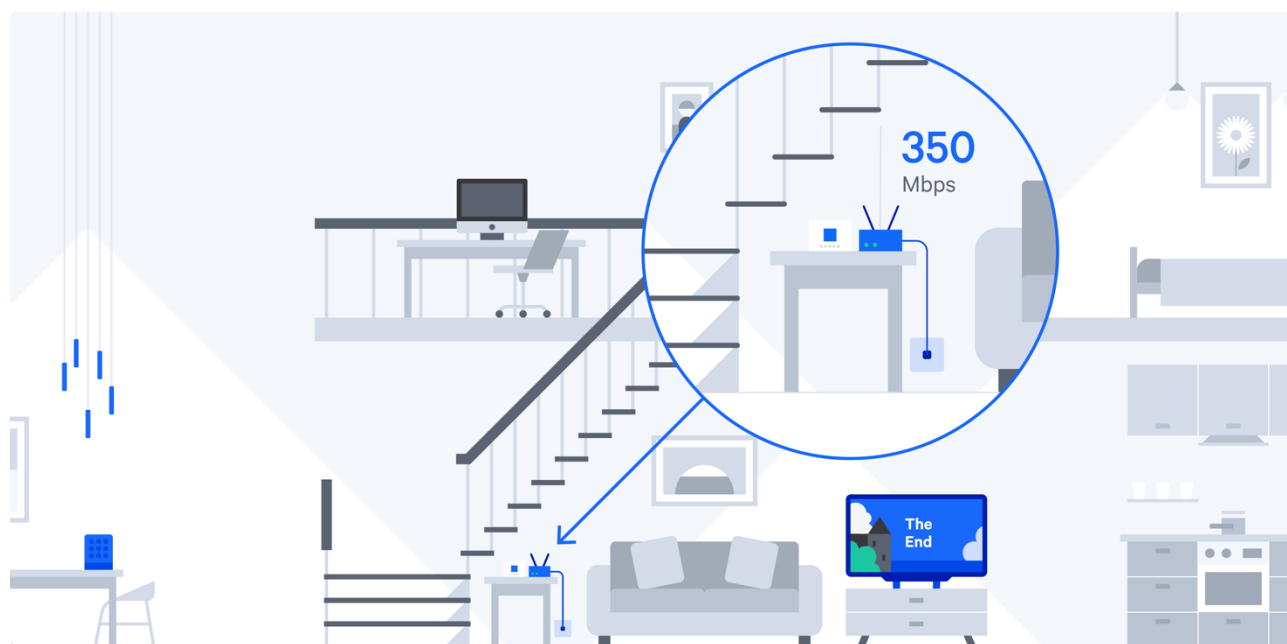
*Average of household average latency to gaming servers.
Lower latency means that lag is less likely.*



Key Observations

- Fibre plans had the lowest latency to each game's servers on average. ADSL, VDSL, and Fixed Wireless plans achieved acceptable latency on average but, due to the variability of performance within these plans, are more likely to experience high latency and lag.
- All games saw broadly consistent performance with the results as previously presented in the 2020 Spring Report.
- Updated gaming tests which cover more games and more accurately measure which geographic server is used for each game will be presented in the next report.

How we test



Measuring home broadband across New Zealand

- The SamKnows Whitebox is a purpose-built testing agent that connects to your router.
- Measures every aspect of your internet service delivered to your home.
- Runs at regular intervals when you're not using the internet.

SamKnows One analytics

- View all your data in one place.
- Create customised charts and save the results that mean the most to you.
- Track changes in your connection over time.

Sign up

Please participate by volunteering to receive a Whitebox. The more volunteers we have, the more information we can provide to consumers in New Zealand in future reports.

www.measuringbroadbandnewzealand.com/signup

Our tests

Test	Definition
Download	The speed at which data can be transferred from the SamKnows test server to your computer, measured in megabits per second (Mbps).
Upload	The speed at which information is transferred from your computer to the SamKnows test server, measured in megabits per second (Mbps).
Latency	How long it takes a data packet to go from your device to our test server and back to your device, measured in milliseconds (ms). The shorter the latency, the better.
Jitter	The variation in the delay of received packets, measured in milliseconds (ms). Essentially it is a measure of the stability of latency.
Packet Loss	Packet loss counts packets that are sent over a network and don't make it to their destination, measured as a percentage of packets lost out of all packets sent.
Video Conferencing	Measures round-trip latency and reachability of a selection of video conferencing services.
Social Media	Measures round-trip latency and reachability of a selection of major social media services.
Online Gaming	Measures performance for a number of major games and supporting services, such a game distribution platforms.
Video Streaming	Measures the highest bitrate (in Mbps), and therefore quality level, you can reliably stream from real content servers.
Webpage Loading Time	The time it takes for a specific webpage to fully load. This is a combination test that includes download, latency and DNS in one test that accurately mimics real-world usage.
CDN Measurements	Measures download performance for the same (or very similar) object from a variety of popular Content Delivery Networks over HTTP.
Voice over IP	Measures the suitability of a broadband connection for VoIP calls.
Outages	The outages metric tracks how many times per day your broadband connection goes offline for at least 30 seconds. Outages between 12am and 6am are excluded from this metric as this is when network maintenance typically occurs.

Glossary

Term	Definition
ADSL	Asymmetric digital subscriber line. A broadband connection that uses existing telephone lines to send data.
Advertised speed	The speed at which broadband services are typically advertised or marketed, usually described in Mbps (megabits per second). On some networks like ADSL or Fixed Wireless, these are not given as a general maximum but vary from line to line as they do not transmit data without depreciation across distance.
Broadband	A network service or connection which is defined as “always on”.
Broadband speed	The speed at which data is transmitted over a broadband connection, usually measured in megabits per second (Mbps).
Disconnection	A disconnection means that two or more latency measurement packets in a row were lost, resulting in stuttering broadband performance.
Download speed	The speed that data travels from our test server to your router. Measured in megabits per second (Mbps); higher is better.
Fibre	A broadband connection that uses fibre-optic cables to send data to and from a property directly. Sometimes referred to as FTTH (Fibre-to-the-home) or FTTP (Fibre-to-the- premises).
Fixed Wireless	A broadband connection that uses radio waves to provide internet access to a premises.
VDSL	Very high speed digital subscriber line. A broadband connection that allows higher speeds than ADSL technologies.
RSP	Retail Service Provider. A company that provides consumers with access to the internet.
Latency	The time it takes for a data packet to travel from your router to our test server and back. Measured in milliseconds (ms); lower is better.
Mbps	Megabits per second. A unit measuring broadband speed. Mbps is the equivalent of 1,000 kilobits per second.
Packet loss	The percentage of packets that were lost somewhere between your router and our test server. Measured as a percentage of all packets sent; lower is better.
Peak hours	The time of day when people are typically using their internet connection, defined in New Zealand as between 7pm and 11pm.
SD	Standard definition. Resolution of video streaming between 640x480 pixels and 858x480 pixels. Often referred to as 480p.
HD	High definition. Resolution of video streaming between 1280x720 pixels and 1920x1080pixels. Often referred to as 720p or 1080p.
UHD	Ultra-high definition. The highest resolution for video streaming, this includes 4K UHD and 8K UHD. Minimum resolution of 3840x2160 pixels.
Upload speed	The speed that data travels from your router to our test server. Measured in Mbps (megabits per second); higher is better.