Measuring Broadband New Zealand

Autumn Report, June 2023

The Measuring Broadband New Zealand programme measures the quality of New Zealand's fixed line internet. The aim of the programme is to independently measure and report on the actual in-home broadband performance so consumers can assess 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.

The report has a new layout highlighting the results for common social media, video streaming, and gaming applications. Please refer to Page 18 for speed test results. The report also includes summary tables at the back that show the results for easy reference.

In late 2022 the Commerce Commission and SamKnows launched the next phase of the programme. The programme is expanding to cover more providers, particularly those who offer Fixed Wireless (including 5G) and satellite technologies, and into rural areas that do not have access to Fibre broadband services.

This report provides an overview of the findings from data collected between 1st April and 30th April 2023.

Contents

Overview

This report presents the key indicators of consumer internet performance in New Zealand from testing during April 2023.

Highlights include:

1. Reporting on application performance for LEO Satellite plans, including gaming, video conferencing, video streaming and social media. This is the first time that the programme and SamKnows has reported quality of experience metrics for LEO Satellite plans.
2. Reporting application performance by plan, including video conferencing and social media, for the first time.
3. Continuing to benchmark LEO Satellite performance against ADSL, VDSL, 4G Fixed Wireless, Fibre 300, Fibre Max and HFC Max plans.

This is the second report in the next phase of the Measuring Broadband New Zealand programme, which will cover more providers and technologies, and expands analysis into rural areas that do not have access to Fibre broadband services. Previous reports released by the Measuring Broadband New Zealand (MBNZ) programme can be found here[1].

This report draws on testing from a wider range of providers including Contact Energy, Inspire Net, Starlink, Unifone and Wireless Nation. There are a range of other RSPs to choose from who are not currently included in the testing, and we encourage Kiwis to shop around.

The MBNZ project has a code of conduct 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 the signatories is included in the code, including the Commission and SamKnows. The current code of conduct is undergoing a review and remains in place until the updated code is and published in the coming months. All tested RSPs complied with the code of conduct, including validation of the data used in 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

[1] https://comcom.govt.nz/regulated-industries/telecommunications/monitoring-the-telecommunications-market/monitoring-new-zealands-broadband/Reports-from-Measuring-Broadband-New-Zealand

Executive Summary

Application Performance

1. Results for LEO Satellite application performance (online gaming, Netflix etc) are included in this report for the first time.

2. Over 99% of Fibre 300, Fibre Max and HFC Max plans were able to support 4 simultaneous UHD Netflix streams. LEO Satellite is close behind with 95% able to support 4 streams, significantly more than VDSL and 4G Fixed Wireless (21% and 20% respectively). Only 37% of ADSL plans were able to support 1 UHD stream.

3. Online gaming shows consistent results for the games included in the previous report, with LEO Satellite results sitting between VDSL and 4G Fixed Wireless. The three games testing to servers in North America showed much higher latencies across all technologies compared to games with gaming servers located in Australia, at a level which would impact user experience.

Benchmarking

1. Satellite findings are now fully reported for download, upload, and latency, instead of being only indicatively reported in the previous report.

2. 4G Fixed Wireless plans are now reported split by Fibre and non-Fibre areas, with both areas seeing slower download speeds during peak hours. Distributions of download speeds show Fibre areas having fewer test results below 25 Mbps than non-Fibre areas.

3. ADSL, VDSL and Fibre plans see stable upload and download results compared to the previous reporting month.

4. MyRepublic continues to see lower average download results for Fibre Max compared to other RSPs and are working with SamKnows to understand the drop in performance seen in the previous measurement period. MyRepublic are also assisting the Commission to recruit more Fibre Max volunteers for the programme.

Broadband Plan Comparison

This report includes broadband plans across a range of technologies and areas, with performance comparison split across areas where Fibre broadband is available (urban areas), and where Fibre is not an option (rural areas). This comparison refines and expands our previous urban and rural view to better allow consumers to see how different technologies such as 4G Fixed Wireless perform in different areas. Areas with access to Fibre plans (Specified Fibre Areas) are the locations where Chorus will eventually be able to stop providing copper-based internet services (ADSL & VDSL plans), because Fibre is available. These are typically in more urban areas of New Zealand. More information on the withdrawal of copper-based internet services is available on the Commerce Commission website here[1].

ADSL - Remains suitable for traditional services like web browsing, email, and basic video streaming, particularly when there is 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 some lines will achieve speeds comparable with Fibre 30, 50 and even Fibre 100 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 300 - Easily supports latency-sensitive applications such as online gaming. Fibre 300 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 300 will cover most users' requirements.

Fibre Max[2] - Higher download and upload speeds than Fibre 300. The latency to internet applications, such as online games, through a Fibre Max line is the same as through any other Fibre plan. Performance varies somewhat depending on the RSP. Fibre 300 will support modern

[1] https://comcom.govt.nz/regulated-industries/telecommunications/regulated-services/consumer-protections-for-copper-withdrawal
[2] All references to Fibre Max in this report encompass broadband plans derived from 'gigabit' wholesale products, in particular: 2degrees' Ultimate, MyRepubic's Fibre Pro/Gamer Pro, Orcon and Slingshot's Gigantic Fibre, Spark's Fibre Max, Trustpower's Fibre Max, and One New Zealand's Fibre Max plans.

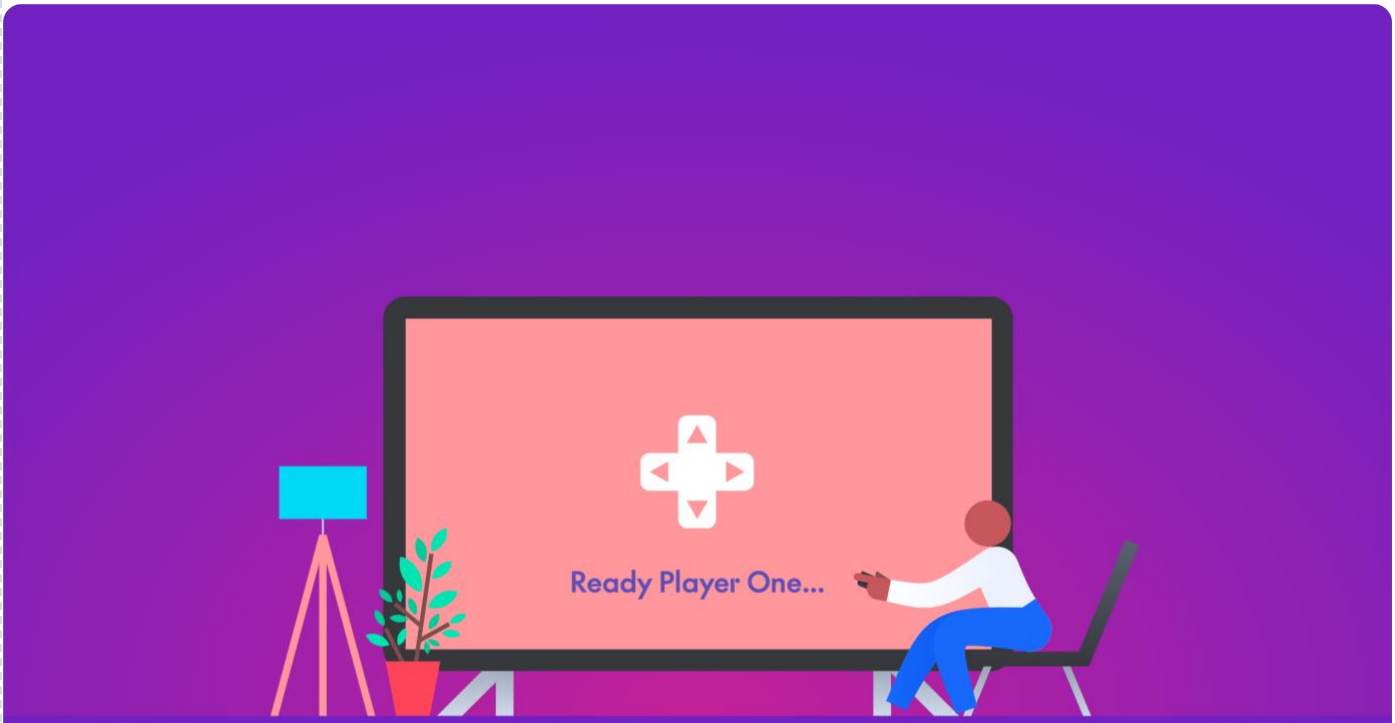
internet applications and most multi-user households, so Fibre Max is still only recommended in cases where there is a genuine need for more bandwidth e.g. frequently uploading or downloading large files.

Cable (HFC) - Available in some areas (Wellington, Upper & Lower Hutt, the Kapiti Coast, and parts of Christchurch). Cable is also referred to as HFC and DOCSIS. One New Zealand (previously Vodafone NZ) 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 does not collect enough data to report on the performance of the UltraFast HFC 200 plan.

4G Fixed Wireless - Can offer higher download speeds than ADSL, but on average slower speeds than VDSL. Users also experience higher latencies due to the cellular technology underlying these plans. 4G Fixed Wireless has the highest latency of all technologies, and also delivers lower download/upload speeds and more frequent dropouts than Fibre. This range of performance factors means 4G Fixed Wireless should not necessarily be preferred to Fibre on performance grounds, however in some areas 4G Fixed Wireless is the only option for consumers, and even in areas where Fibre is available there are other reasons consumers might choose this option (ease of installation for example).

LEO Satellite - Available in both rural and urban areas and is transmitted wirelessly using a satellite and ground based satellite dish. Typically higher download speeds than 100 Mbps, but can vary with location. While speeds can be expected to handle most applications, including video conferencing and streaming, it is not as consistent as fixed line broadband.

Other Broadband Plans - There are other plans available that are not currently reported on by MBNZ. Fibre 30, 50, 100 and 200 plans should be broadly consistent with results measured for Fibre 300 and Fibre Max for latency and reliability metrics. HFC 200 results should also be broadly consistent with HFC Max results for latency and reliability metrics. The main differences for these lower speed Fibre and HFC (Cable) plans would be lower download and upload speeds, meaning it would take longer to download and upload larger files, and they would be able to support fewer users at the same time when using video streaming services. For WISP and 5G Fixed Wireless plans it is not possible to give any firm advice around their suitability for different applications at this stage.



Application Performance

In this section we report on the performance of a number of common applications that consumers in New Zealand use on a regular basis. This is the first time some of these results for application performance are included in this report.

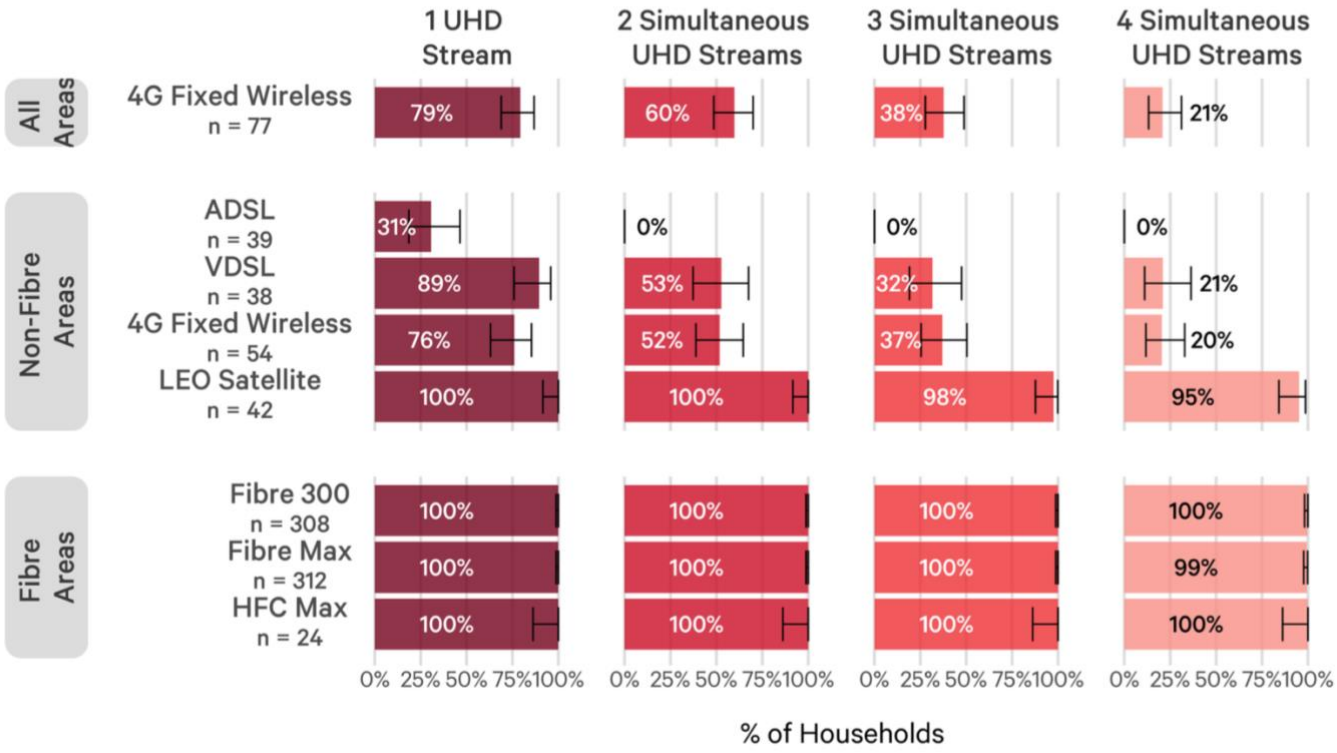
Results in this section are shown with error bars representing the 95% confidence interval for each plan. If we had repeated our measurements 100 times, we would expect the result to have fallen within the black bands in at least 95 cases.

Netflix

Video streaming is a good example of an application where the quality of a user's experience is more affected by bandwidth (capacity) than by latency (lag). Since higher quality video takes up more data than lower resolution video, higher bandwidth plans such as Fibre 300, HFC Max, LEO Satellite and Fibre Max can reliably stream from Netflix in Ultra High Definition more of the time.

Figure 1: The proportion of households able to stream 1, 2, 3 or 4 simultaneous Ultra High Definition videos from Netflix.

Based on the average download speed to Netflix servers for each household.
The number of Whiteboxes contributing to each result is shown under each plan name (eg n = 77).
Error bars show 95% confidence intervals.



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Key Observations

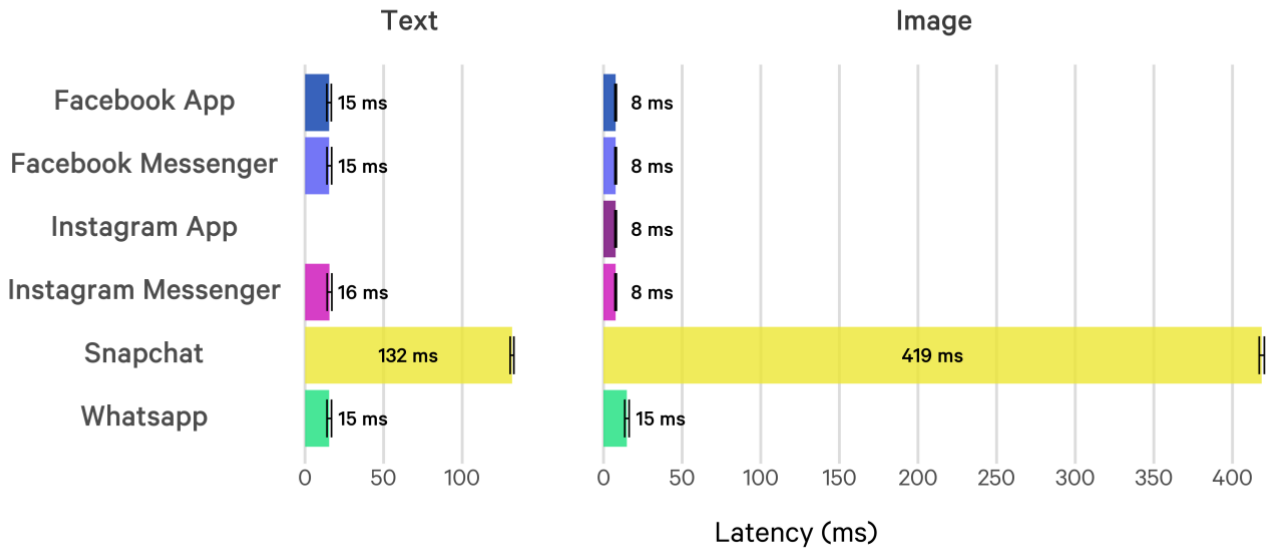
- 99% of households on Fibre 300, Fibre Max or HFC Max plans were able to support 4 simultaneous UHD Netflix streams.
- 95% of LEO Satellite plans were able to stream 4 simultaneous UHD Netflix streams.
- 79% of households on Fixed Wireless across all areas of New Zealand were able to support a single stream, compared to 75% in non-Fibre areas. 89% of households on VDSL plans and 30% of households on ADSL plans were able to support a single UHD stream in non-Fibre areas.

Social Media

Social media applications generally involve fetching a large number of relatively small pieces of information (single images, short pieces of text, and so on). Applications such as Facebook serve different types of content from different servers - for example, an image will come from one server while its caption will come from a different server. Due to this, latency to the server is a big factor in how responsive social media applications will be, however there are other factors that can also influence performance.

Figure 2: The latency to servers of different social media platforms.

Average of household average latency to content servers. Fibre plans only.



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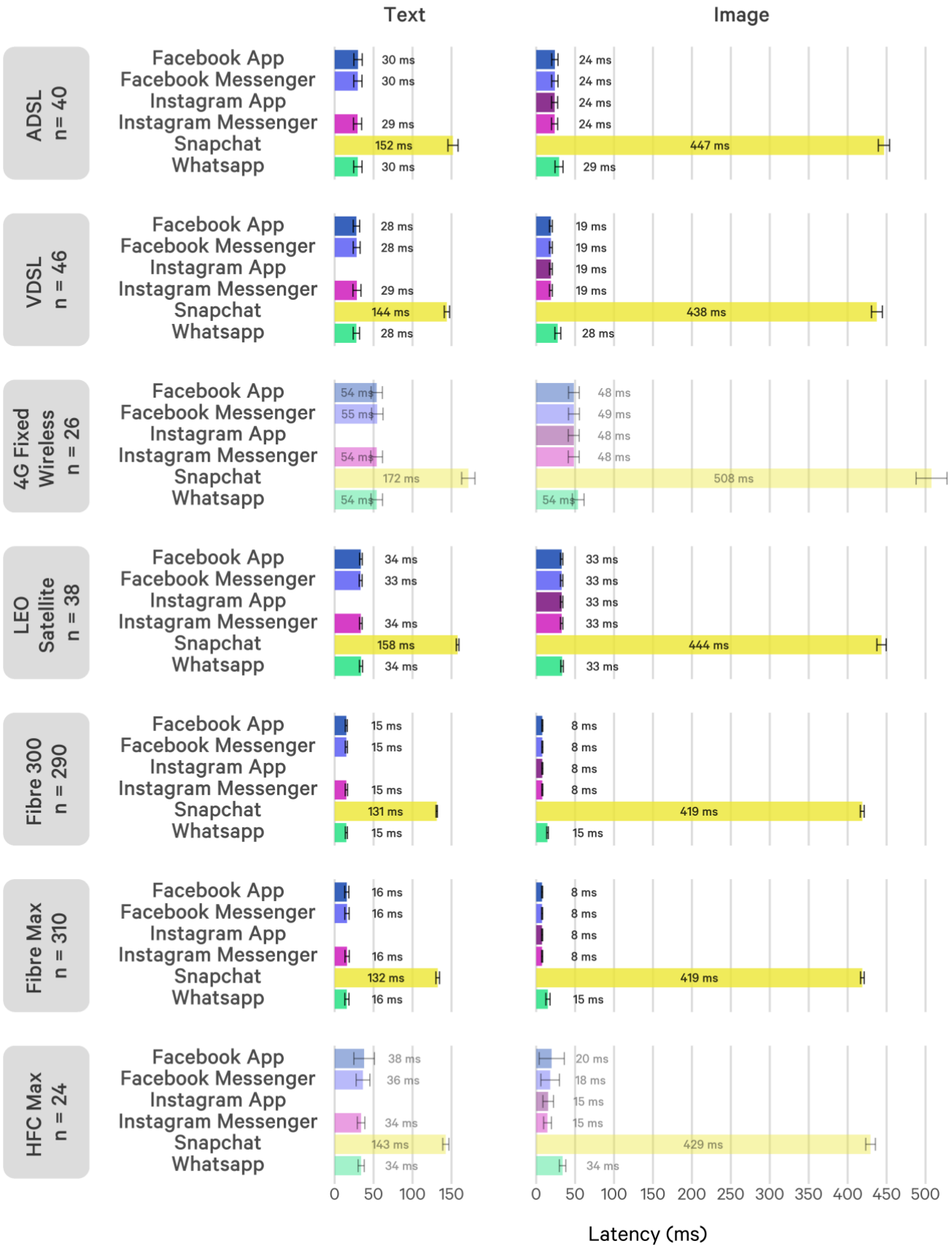
Key Observations

- Latency values for all social media services remained consistent for Fibre plans compared to the previous report. Low latencies are better, although differences of 20-30ms are unlikely to affect user experience for social media applications.
- Snapchat latencies remain higher than all other social media platforms tested for both Image and Text downlink.
- Latency results are shown for Fibre plans only. Results for social media split by individual plans can be seen in the figure below, and results for all RSPs can be seen in Table 3.

Figure 3: The latency to servers of different social media platforms by Plan.

Average of household average latency to content servers.

The number of Whiteboxes contributing to each result is shown under each plan name (eg n = 40).



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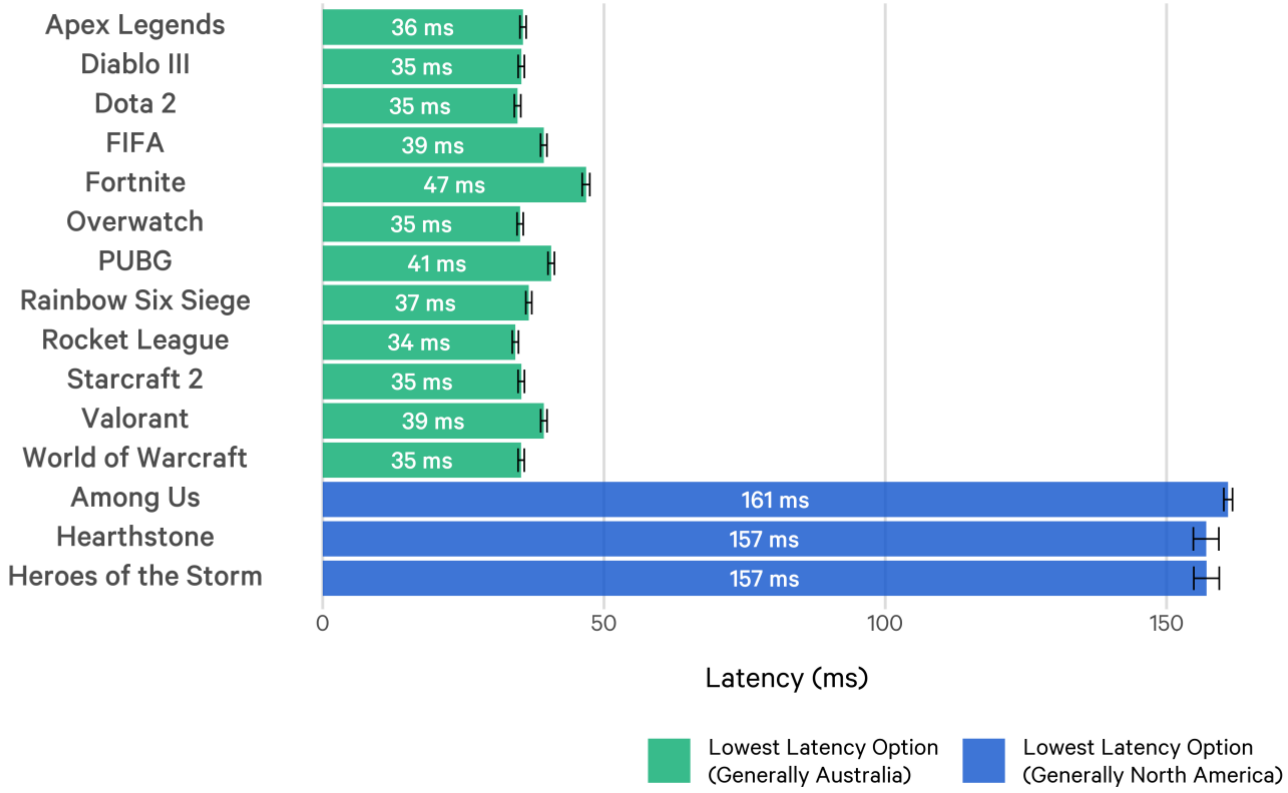
Online Gaming

Online gaming applications require low latency between users' machines and the central host server. If it takes a long time to pass messages between the gamers device and the server where the game is hosted, then disruptive stuttering or lag will result. This is usually when latency increases beyond 50 or 100ms – some game servers will simply refuse to admit players who have triple-figure latency I.e., this will ruin the game for everyone else.

Figure 4: The latency to various online gaming servers. Lower is better.

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



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Key Observations

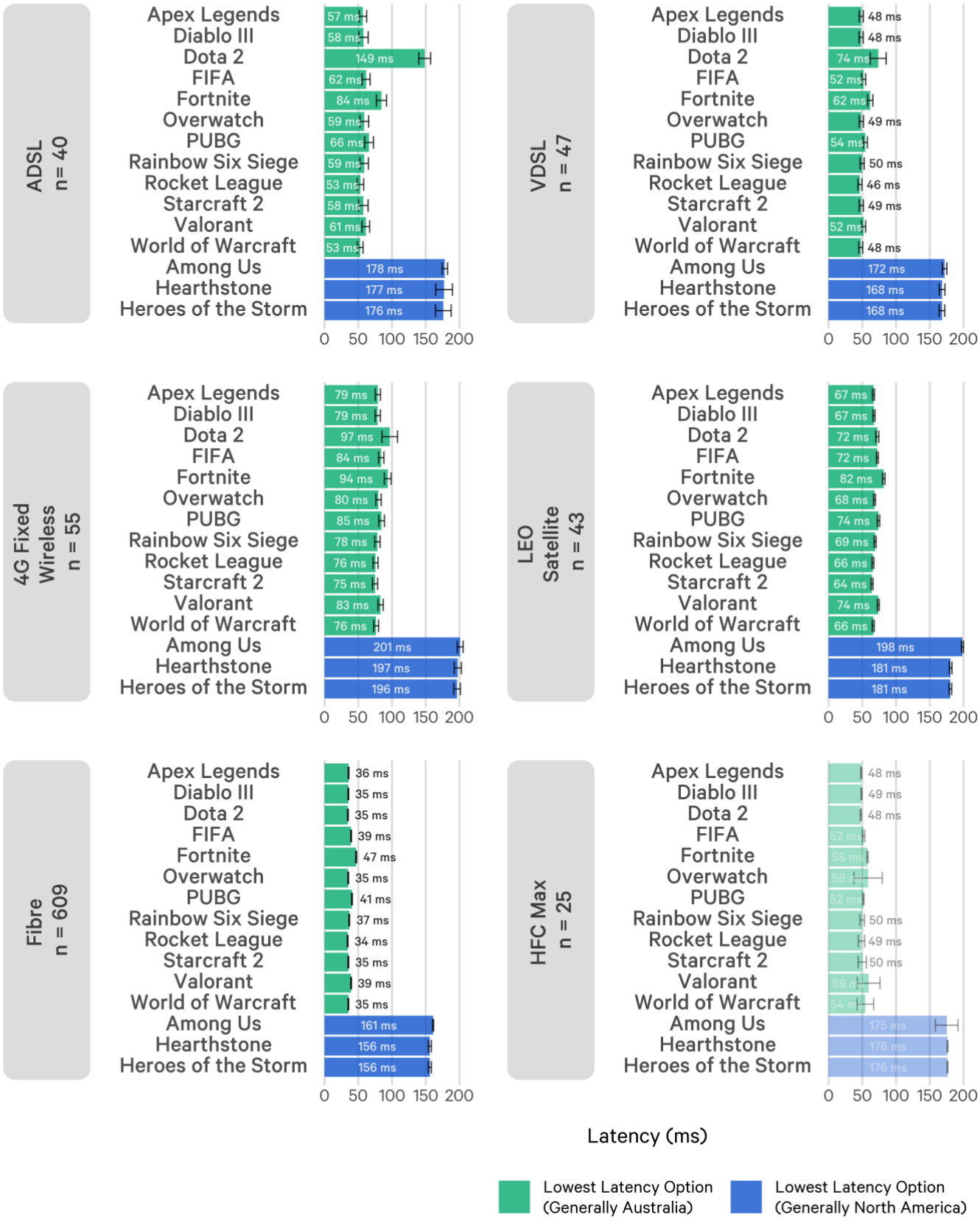
- Among Us, Hearthstone and Heroes of the Storm all tested to servers in North America. These games show average latencies above 150 ms, much higher than the remaining games which tested to servers located in Australia.
- Latency results are shown for Fibre plans only. Results for latency split by plans can be seen in the figure below, and results for all RSPs can be seen in Table 4.

Figure 5: The latency to various online gaming servers by Plan. Lower is better.

Average of household average latency to gaming servers.

The number of Whiteboxes contributing to each result is shown under each plan name (eg n = 40).

Lower latency means that lag is less likely.



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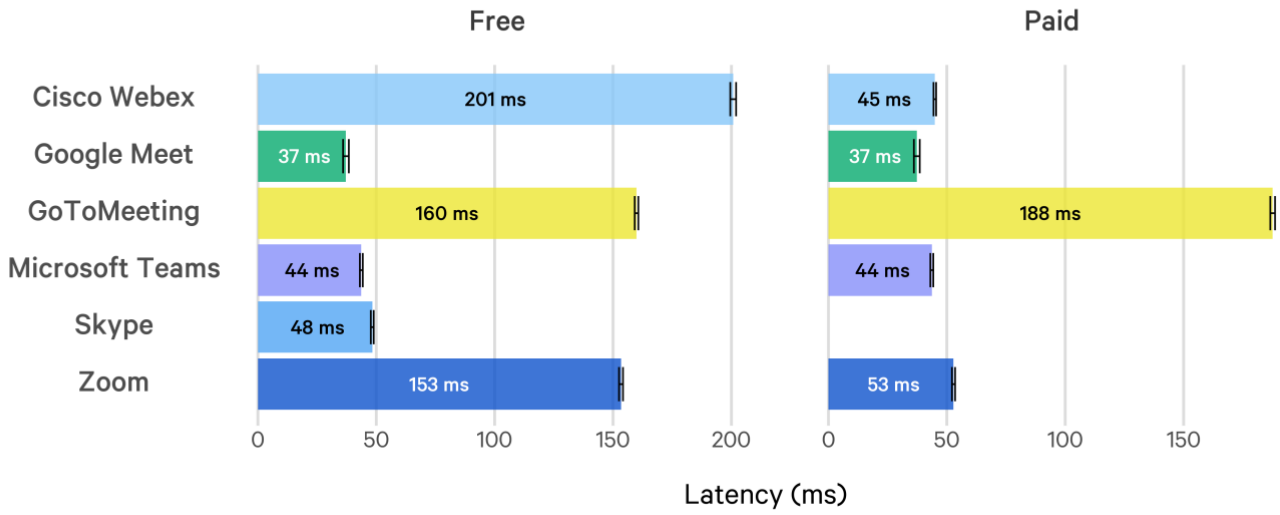
Video Conferencing

Latency is not the only factor impacting on the quality of a video call. Packet loss and jitter can result in stuttering and dropouts, and these are not captured in the round trip times measured here. Application specific attributes such as audio/video encoding and proprietary communication protocols can lead to different performance characteristics for different services.

Figure 6: The latency to servers of different video conferencing services using free and paid accounts.

Average of household average latency, lower is better. Fibre plans only.



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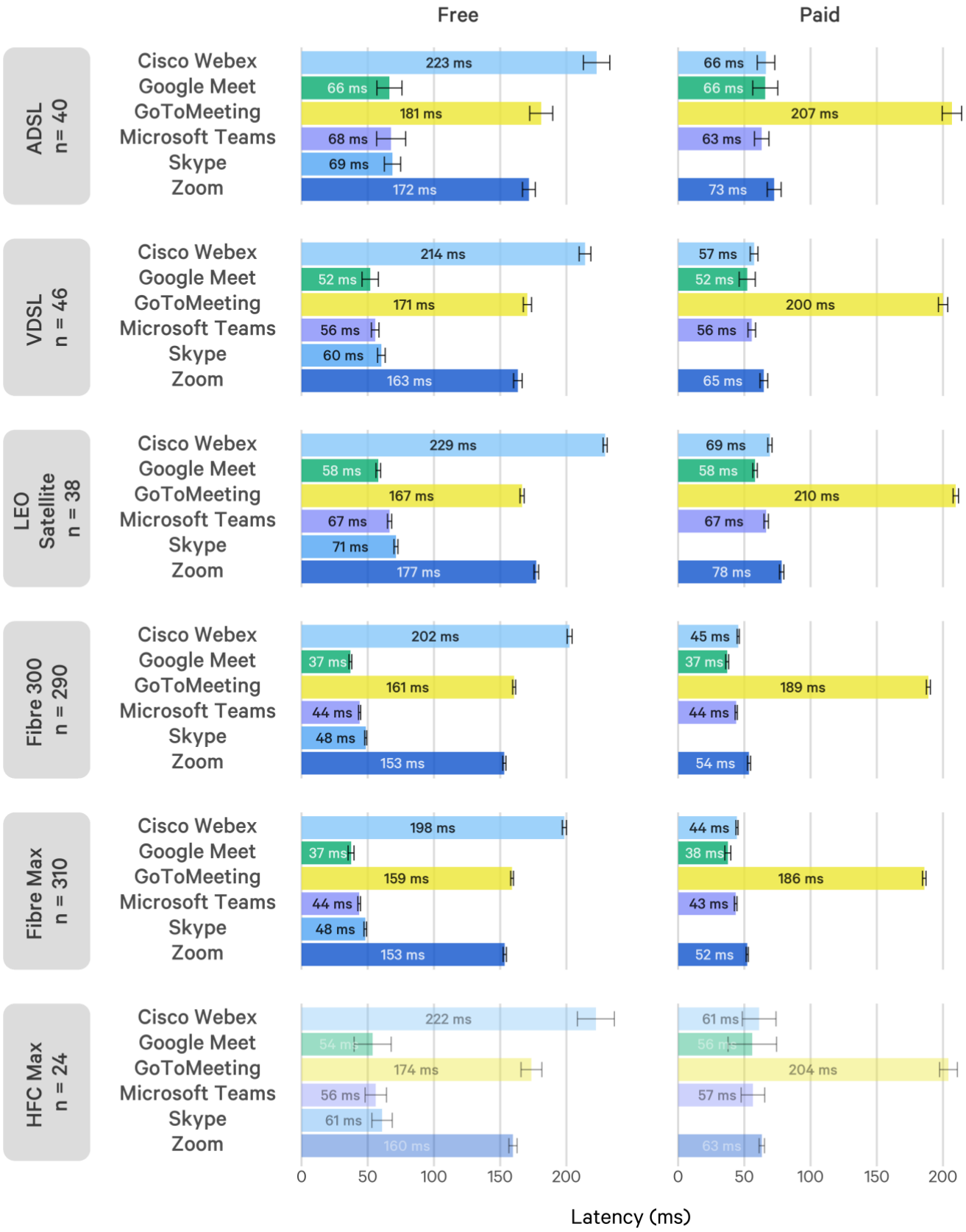
Key Observations

- Zoom and Cisco Webex both provide paid subscribers with geographically nearer servers than unpaid subscribers resulting in lower latency for paid subscribers. Although a significant difference is shown in the chart, both paid and unpaid subscribers of Zoom and Webex would likely experience similar performance when on a video conference call, assuming normal network conditions. These small differences may account for things such as users talking over one another more frequently when using these unpaid services.
- Latency is only one factor that affects video conferencing quality of experience. Other differences between free and paid accounts such as holding longer meetings or inviting more participants aren't included here.
- Latency results are shown for Fibre plans only. Results for all video conferencing split by individual plans can be seen in the figure below, and results for all RSPs can be seen in Table 5.

Figure 7: The latency to servers of different video conferencing services using free and paid accounts by Plan.

Average of household average latency, lower is better.

The number of Whiteboxes contributing to each result is shown under each plan name (eg n = 40).



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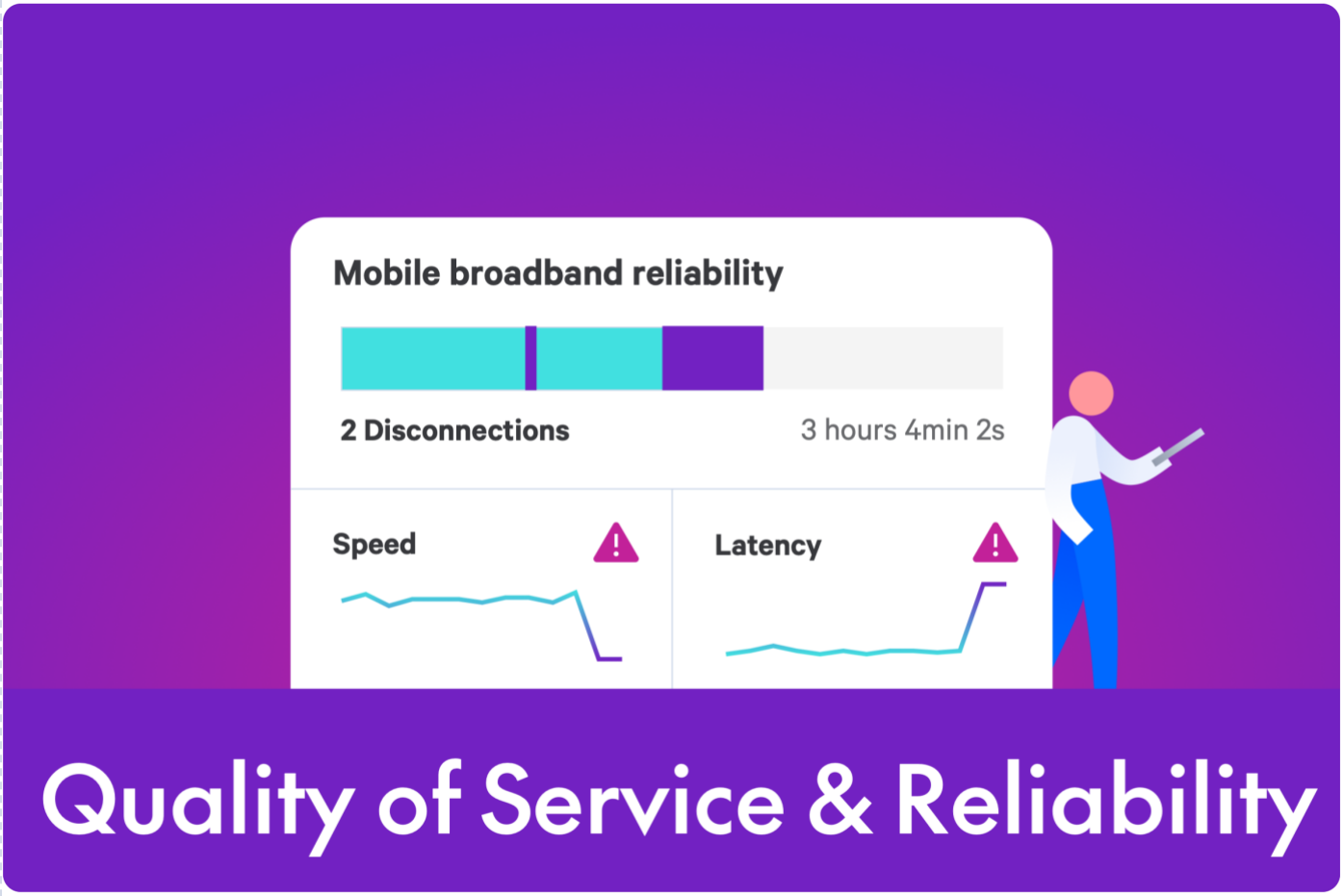


Quality of Service & Reliability

Disconnections

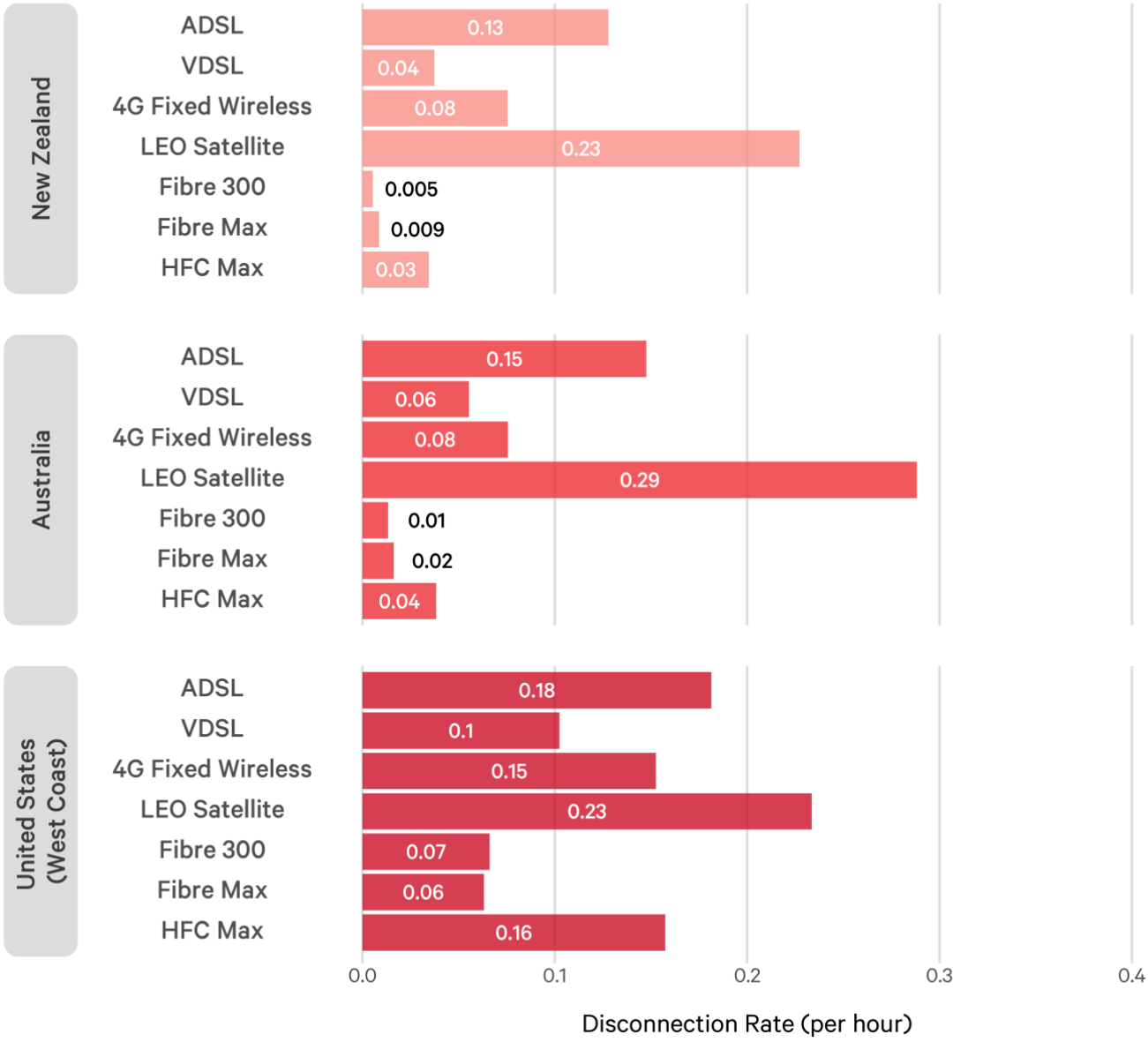
Realtime applications like video calls rely on a consistent connection between the home router and the target server. If the connection drops, even for a few seconds, the application will exhibit some form of stuttering. In the worst instance, a user might be disconnected and have to reconnect or wait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

A brief disconnection very rarely means that, for example, a physical cable has been cut. Instead, the main reasons for network dropouts relate to congestion and the configuration of network equipment. The following graph compares disconnection rates across plans.

This graph shows medians across households. Taking Fixed Wireless as an example, 50% of households will experience no more than 0.1 disconnections 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 disconnection 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 0.1 disconnection per hour when connected to a New Zealand server will not be consistent throughout all hours of the day.

Figure 8: 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.



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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 four undersea cable networks which carry traffic to and from New Zealand across the Tasman Sea and the Pacific.

Key Observations

- The results for disconnections have increased for all technologies when compared to the previous report, especially disconnection to the United States. In spite of these changes, the level of disconnections is still at a level whereby user experience will not be unduly affected.
- Satellite experiences a considerably higher rate of disconnections than most VDSL, Fixed Wireless, Fibre, and Cable connections. Disconnections for Fibre plans remain low.
- Most households see a very low rate of disconnections, at least while the line is idle.
- Traffic going overseas is more likely to be lost than traffic remaining within New Zealand. Disconnections have decreased this report for all technologies for traffic testing overseas however these are not likely to notably impact user experience.

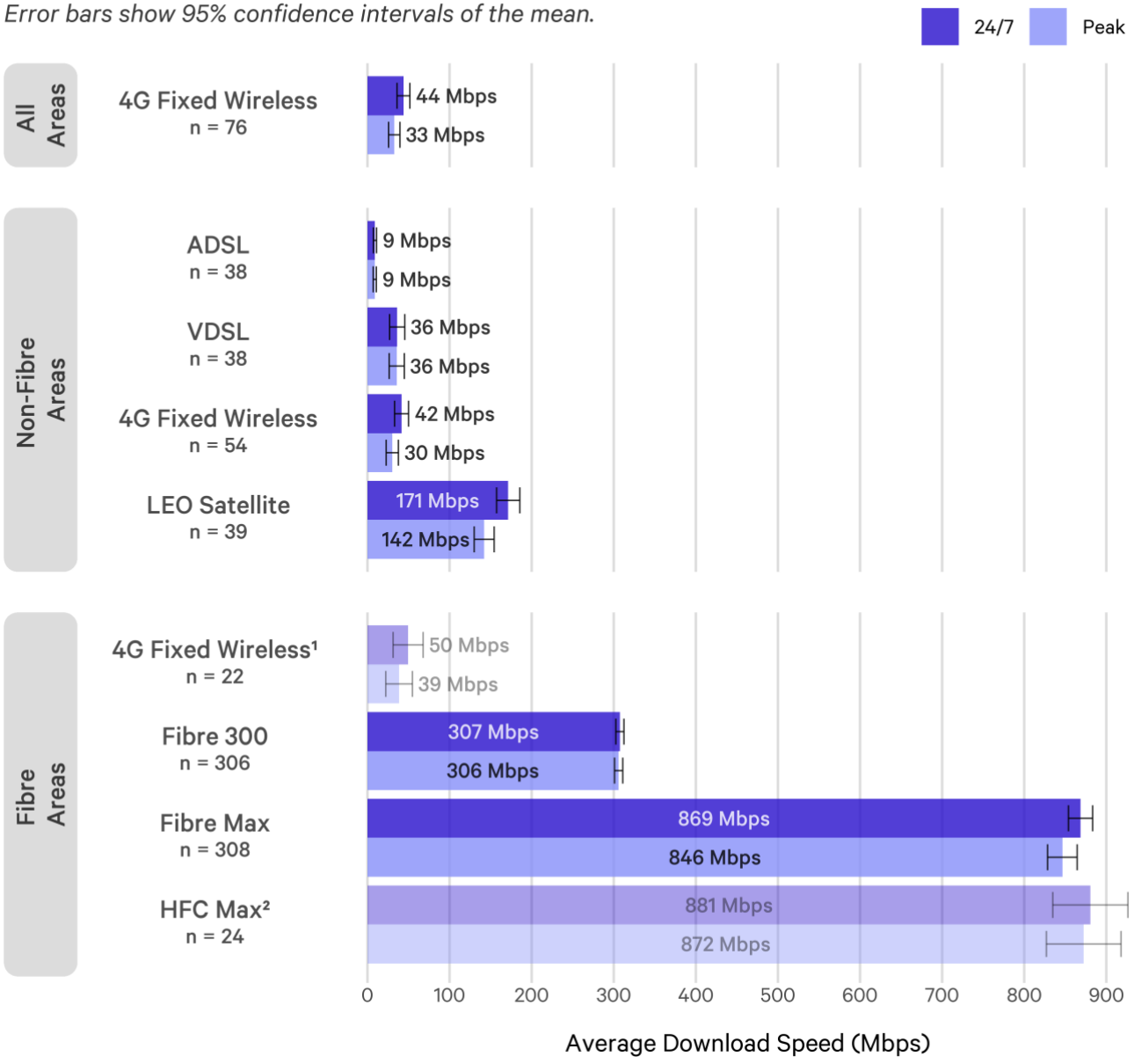
Speed Tests - Download

Figures 8 and 12 give an overview of download and upload speed across the country. These are included in every report to provide a benchmark that can be tracked over time and the figures are also contained in Table 1 on page 40. These results are split across Fibre areas, where Fibre is available to consumers and non-Fibre areas where Fibre is not yet rolled out. There were not enough Whiteboxes to report ADSL and VDSL results in Fibre areas.

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

Figure 9: Average Download Speeds by Plan

Average of monthly household weighted averages. Peak hours are Monday - Friday, 7pm - 11pm. The number of Whiteboxes contributing to each result is shown under each plan name (eg n = 76). Error bars show 95% confidence intervals of the mean.



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These results are shown with error bars representing the 95% confidence interval for each plan's average speed. If we had repeated our measurements 100 times, we would expect average speeds to have fallen within the black bands in at least 95 cases. Other graphs throughout the report display similar confidence intervals, which carry the same interpretation.

Key Observations

- 4G Fixed Wireless results in Fibre areas[1] and HFC Max[2] results are based on a smaller sample size than we would typically include within reporting but are sufficient to indicate performance while we add more Whiteboxes to enable more definite reporting. This accounts for the larger confidence intervals for these plans, and we caveat that consumers should be careful when comparing these plans with others directly, as there is more uncertainty around the average speeds for these plans, and they should take the error bars into account when making comparisons.
- LEO Satellite is now fully reported with peak and 24/7 speeds very similar to the indicative speeds reported in our last report.
- ADSL and VDSL results are consistent with those seen in the previous report, showing similar results during peak hours. Fixed Wireless average download speeds are similar to VDSL but show a lower average during peak hours in non-Fibre areas.
- Fibre 300 and Fibre Max results are also broadly similar to the previous report, with Fibre 300 seeing average speeds above 300 Mbps, including during peak hours. Fibre Max average download speeds are consistent with previous results. Removing MyRepublic from the Fibre Max average download speeds increases the average download speed results to 892 Mbps for 24/7 and 886 Mbps during peak hours.
- MyRepublic continue to work with SamKnows to understand the drop in performance seen in the previous measurement period. RSP specific results for Fibre Max can be found in Figure 15.

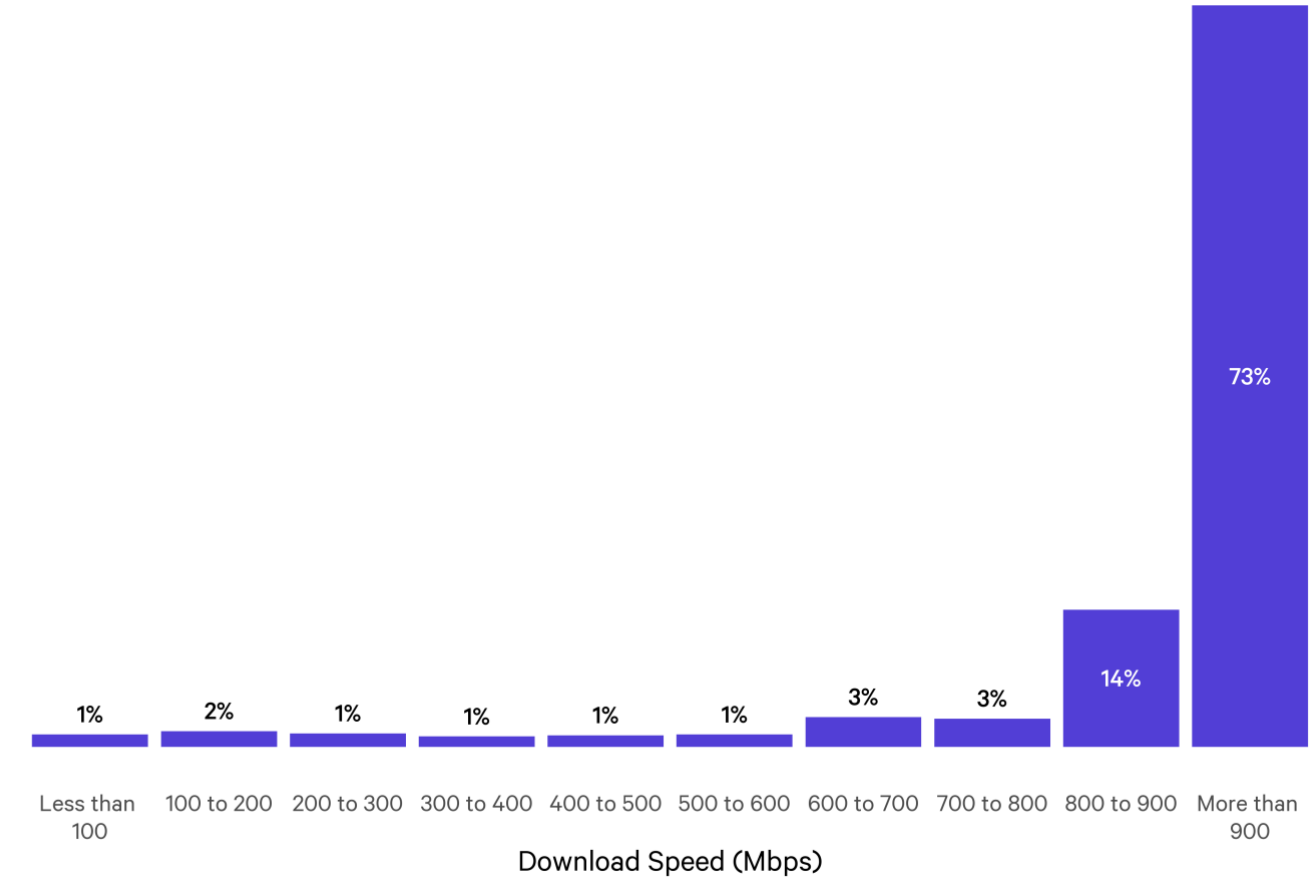
[1] Results for 4G Fixed Wireless are based on a sample size of 21 Whiteboxes in Fibre areas. The lower sample size can be attributed to Fixed Wireless being a new area of focus for the MBNZ programme and we hope to increase this number for the Autumn Report

[2] Results for HFC Max are based on a sample size of 22 Whiteboxes. The low sample size can be attributed to the relatively small coverage area of One New Zealand's Cable network and the competing influence of Copper, Fibre and Fixed Wireless in those areas.

Distribution of Fibre Max Results

Figure 10: Download speeds on Fibre Max plans.

Distribution of test results. Average (24/7) download speeds for Fibre Max plans is 869 Mbps; this varies by RSP and over time.



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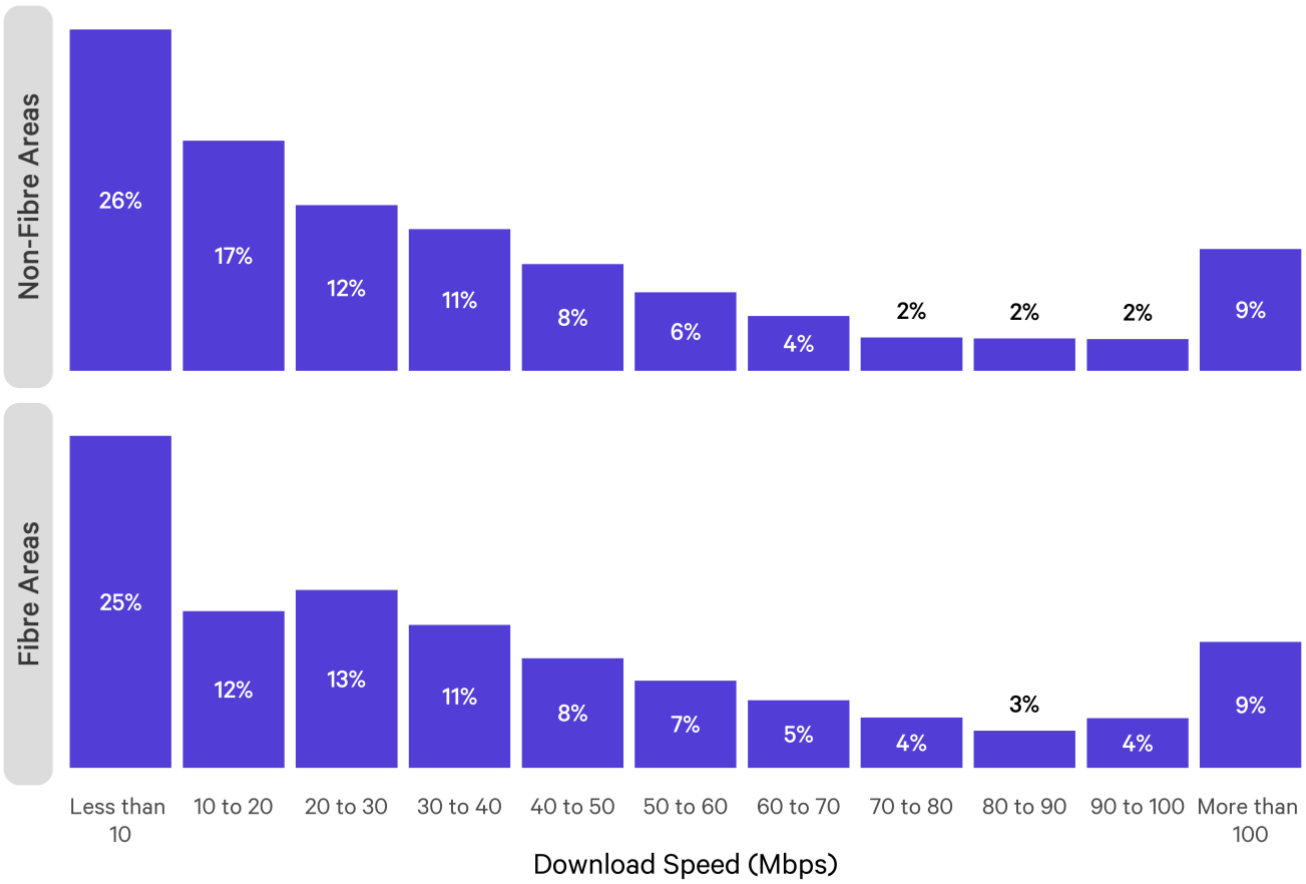
Key Observations

- 73% of speed tests run over Fibre Max lines achieved download speeds above 900 Mbps, consistent with the previous report.

Distribution of 4G Fixed Wireless Results

Figure 11: Download speeds on 4G Fixed Wireless plans.

Distribution of test results. Average (24/7) download speeds for 4G Fixed Wireless plans is 42 Mbps in non-Fibre areas and 50 Mbps in Fibre areas; this varies by RSP and over time.



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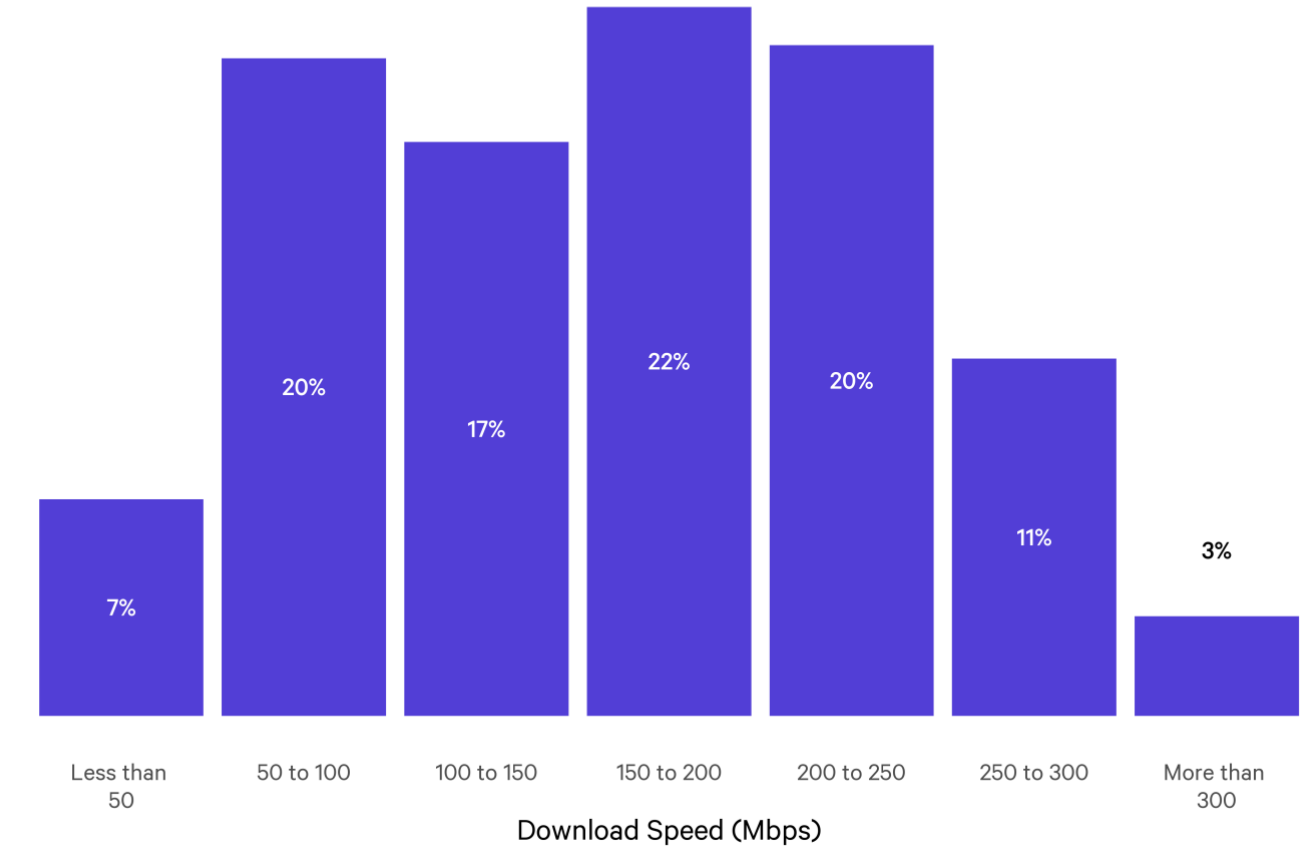
Key Observations

- 43% of speed tests run over Fixed Wireless lines achieve download speeds of less than 20 Mbps in non-fibre areas, compared to 37% in Fibre areas.
- 9% of download speed tests in Fibre areas achieved speeds of 100 Mbps or higher.
- The distribution here shows that performance can vary significantly. This will be caused by a combination of factors, including distance from the cell tower, how many users are served by the cell tower and where the modem may have been placed by the consumer.

Distribution of LEO Satellite Results

Figure 12: Download speeds on LEO Satellite plans.

Distribution of test results. Average (24/7) download speeds for LEO Satellite plans is 171 Mbps in non-Fibre areas; this varies over time.



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Key Observations

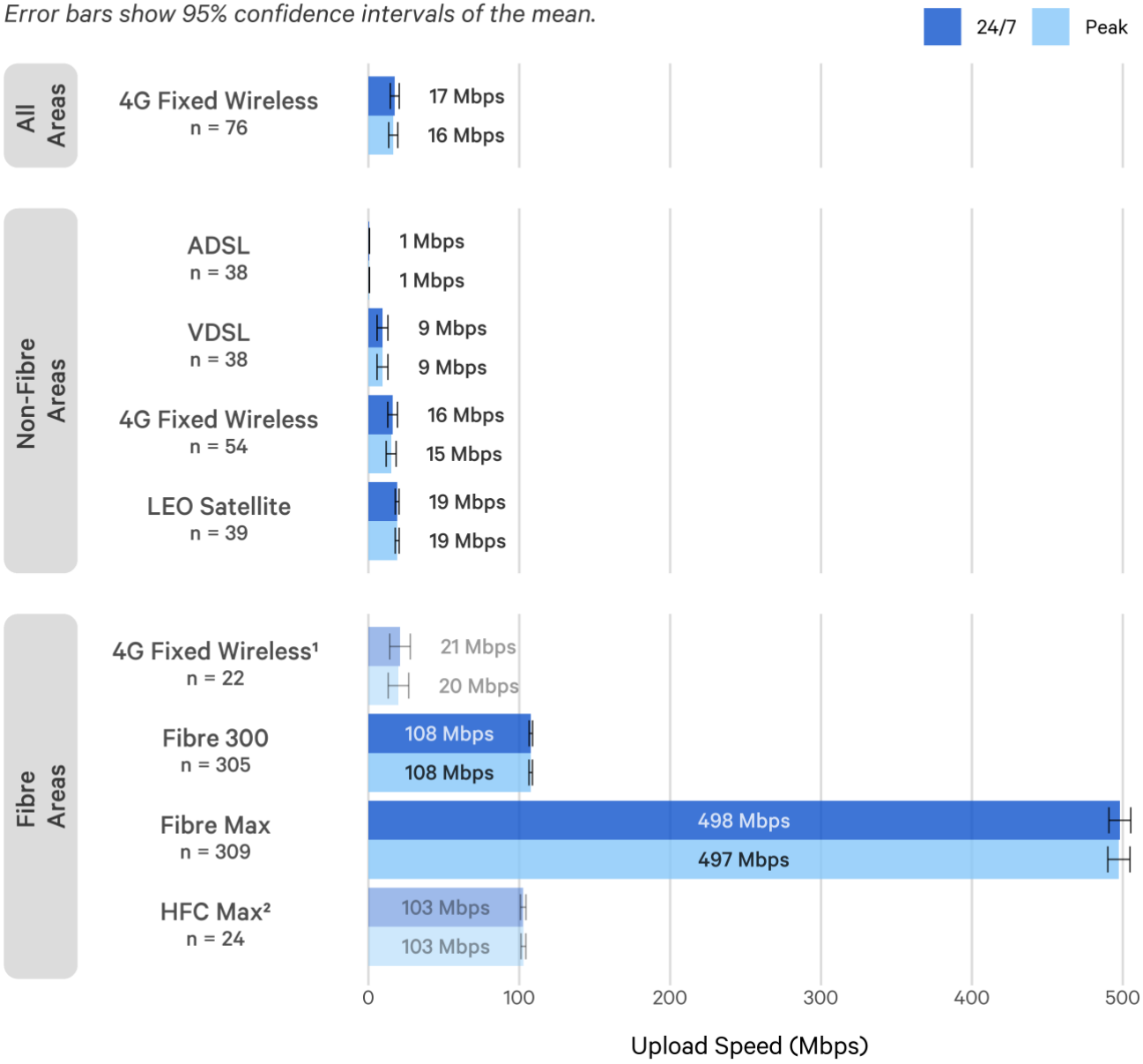
- Only 7% of speed tests run over Satellite lines achieve download speeds of less than 50 Mbps in non-fibre areas. This compares with 74% of non-Fibre 4G Fixed wireless achieving download speeds of less than 50 Mbps.
- 34% of download speed tests in non-Fibre areas achieved speeds of 200 Mbps or higher.

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 video conferencing. For example, a lower upload speed will mean that it takes longer for files to sync or email attachments to be applied.

Figure 13: Average Upload Speeds by Plan

Average (24/7) of monthly household weighted averages. Peak hours are Monday - Friday, 7pm - 11pm. The number of Whiteboxes contributing to each result is shown under each plan name (eg n = 76). Error bars show 95% confidence intervals of the mean.



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Key Observations

- The average upload speeds are consistent with those seen in the previous report, with all technologies seeing very little decrease in average upload speeds during peak hours.
- 4G Fixed Wireless results in Fibre areas[1] and HFC Max[2] results are based on a smaller sample size than we would typically include within reporting but are sufficient to indicate performance while we add more Whiteboxes to enable more definite reporting. This accounts for the larger confidence intervals for these plans. We should caveat that consumers should be careful when comparing these plans with others directly, as there is more uncertainty around the average speeds for these plans, and they should factor in the error bars into their comparison.

[1] Results for 4G Fixed Wireless are based on a sample size of 21 Whiteboxes in Fibre areas. The lower sample size can be attributed to Fixed Wireless being a new area of focus for the MBNZ programme and we hope to increase this number for the Autumn Report

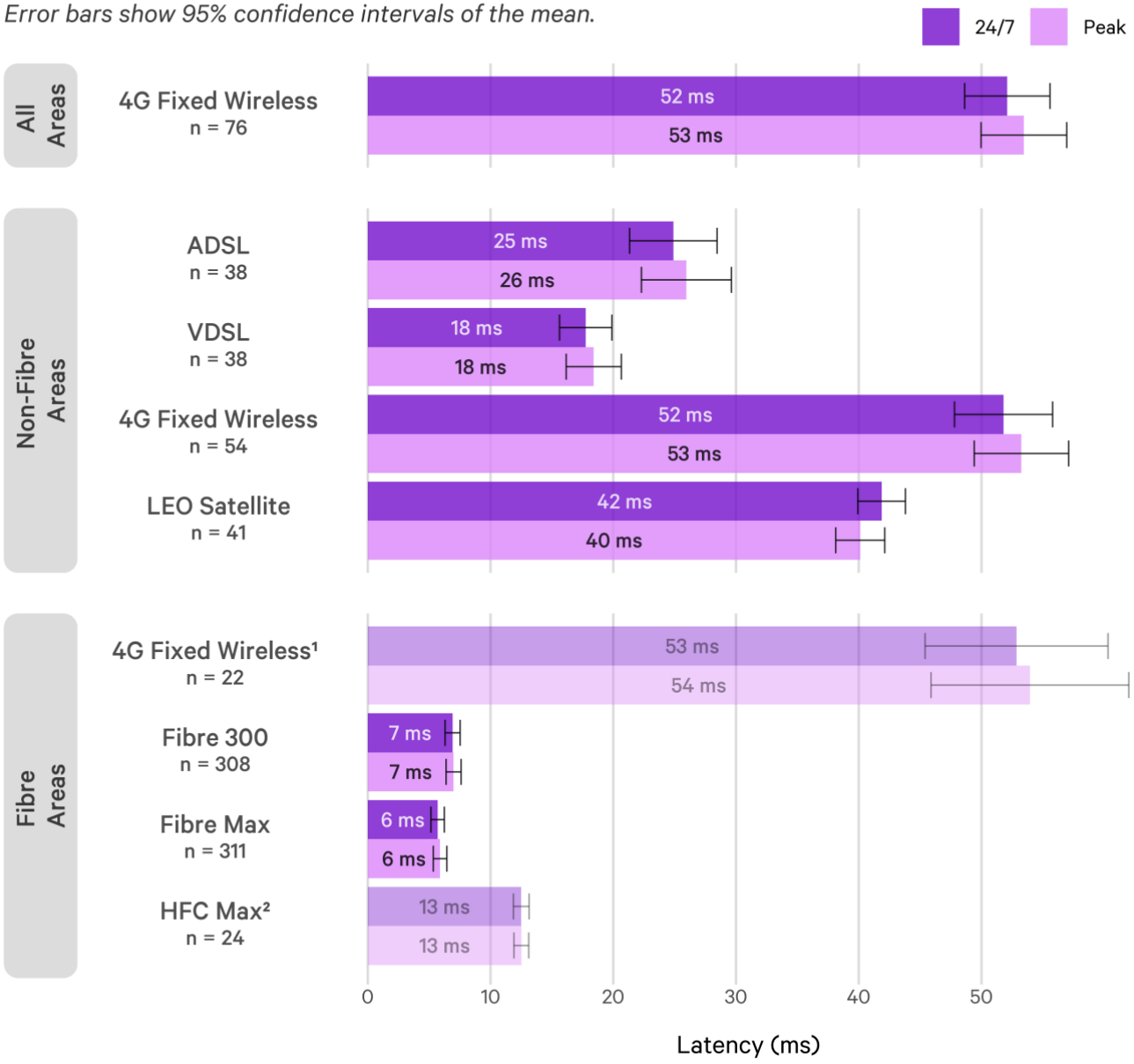
[2] Results for HFC Max are based on a sample size of 22 Whiteboxes. The low sample size can be attributed to the relatively small coverage area of One New Zealand's Cable network and the competing influence of Copper, Fibre and Fixed Wireless in those areas.

Latency

Latency is another key factor that should be considered when assessing broadband performance. The time it takes to transmit and receive messages between households and servers 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 13 only includes results relating to servers hosted in New Zealand.

Figure 14: Average Latency to Test Servers by Plan. Lower is better.

Average of monthly household weighted averages. Peak hours are Monday - Friday, 7pm - 11pm. The number of Whiteboxes contributing to each result is shown under each plan name (eg n = 76). Error bars show 95% confidence intervals of the mean.



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Some plans show a wider variation of latency than others: latency across a Fixed Wireless connection will generally be more variable than over a Fibre line. The impact of latency on user experience relating to specific applications is investigated elsewhere in the report.

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 the more recent infrastructure that underpins the Fibre network.
- Satellite connections have higher latencies than Copper (ADSL, VDSL) but lower latency than 4G Fixed Wireless plans.
- Cable connections have a higher latency than Fibre on average.
- There is no material 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 300 plan.
- 4G Fixed Wireless results in Fibre areas[1] and HFC Max[2] results are based on a smaller sample size than we would typically include within reporting but are sufficient to indicate performance while we add more Whiteboxes to enable more definite reporting. This accounts for the larger confidence intervals for these plans. We should caveat that consumers should be careful when comparing these plans with others directly, as there is more uncertainty around the average speeds for these plans, and they should factor in the error bars into their comparison.

[1] Results for 4G Fixed Wireless are based on a sample size of 21 Whiteboxes in Fibre areas. The lower sample size can be attributed to Fixed Wireless being a new area of focus for the MBNZ programme and we hope to increase this number for the Autumn Report

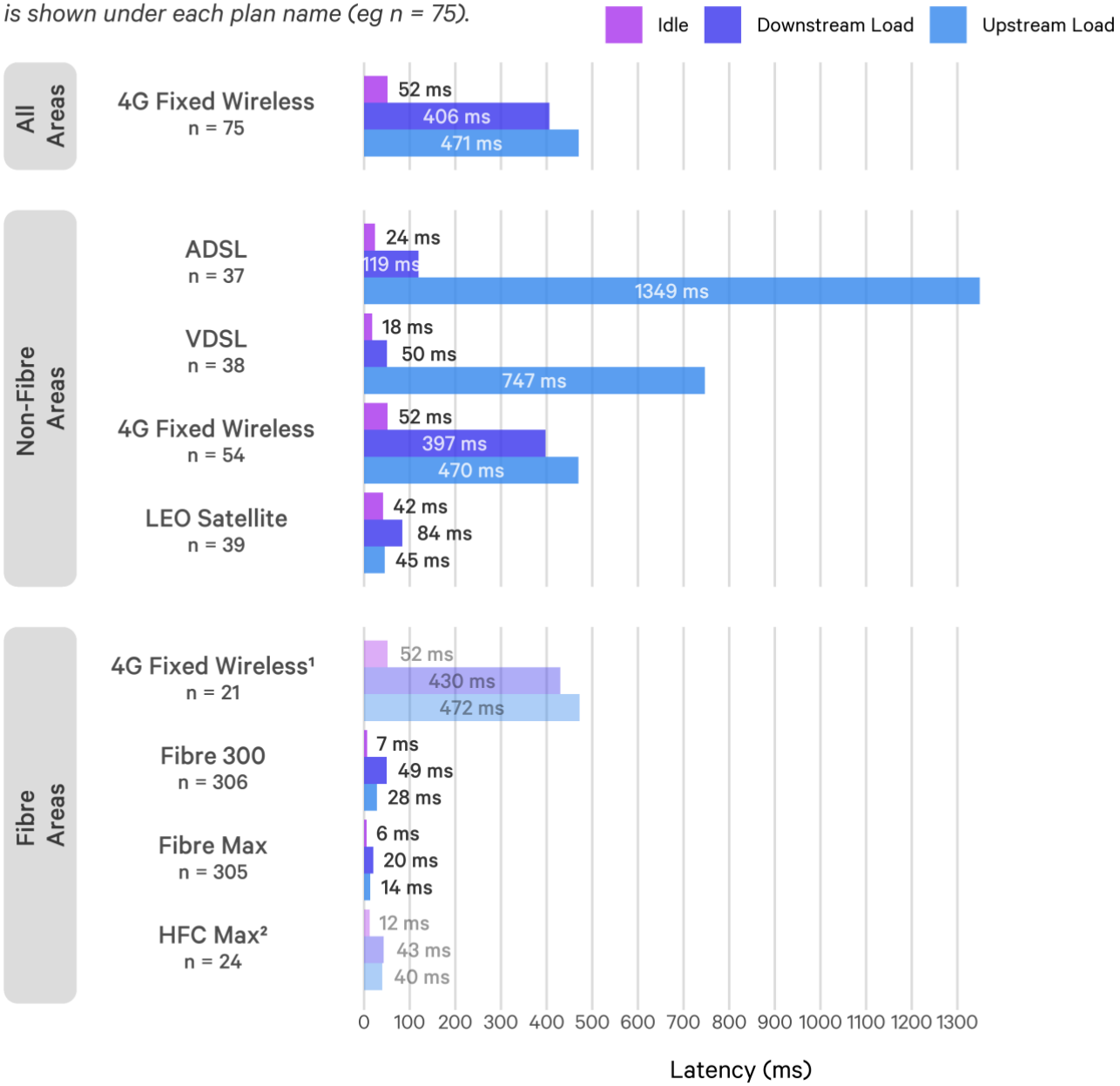
[2] Results for HFC Max are based on a sample size of 22 Whiteboxes. The low sample size can be attributed to the relatively small coverage area of One New Zealand's Cable network and the competing influence of Copper, Fibre and Fixed Wireless in those areas.

Latency Under Load

The latency under load test measures the latency whilst the broadband connection is heavily utilised (by the way of a speed test run in parallel). This is more representative of user experience than latency when the line is idle, as it shows the impact of downloading or uploading data to the internet (e.g. watching Netflix or uploading a file) on latency (e.g. how long a webpage takes to load). The results are particularly illustrative of real-world experience for people who are using latency sensitive applications like video conferencing.

Figure 15: Average Latency Under Load to Test Servers by Plan. Lower is better

Averages of monthly household averages.The number of Whiteboxes contributing to each result is shown under each plan name (eg n = 75).



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The graph shows latency values while the connection is idle, compared with latency values while the connection under either downstream or upstream load. The latency under load test is performed while the download (or upload) speed tests are running, and this is compared to the idle latency measurement which is calculated when the line is idle. Differences in access technology and router models will result in different results for the user.

It is expected that the router model will be a factor in any latency rise, as the test is measuring what is known as bufferbloat, which is where the router or other network devices on the path are buffering large amounts of data. As such, differences in technology and router models will result in different results for the user.

Key Observations

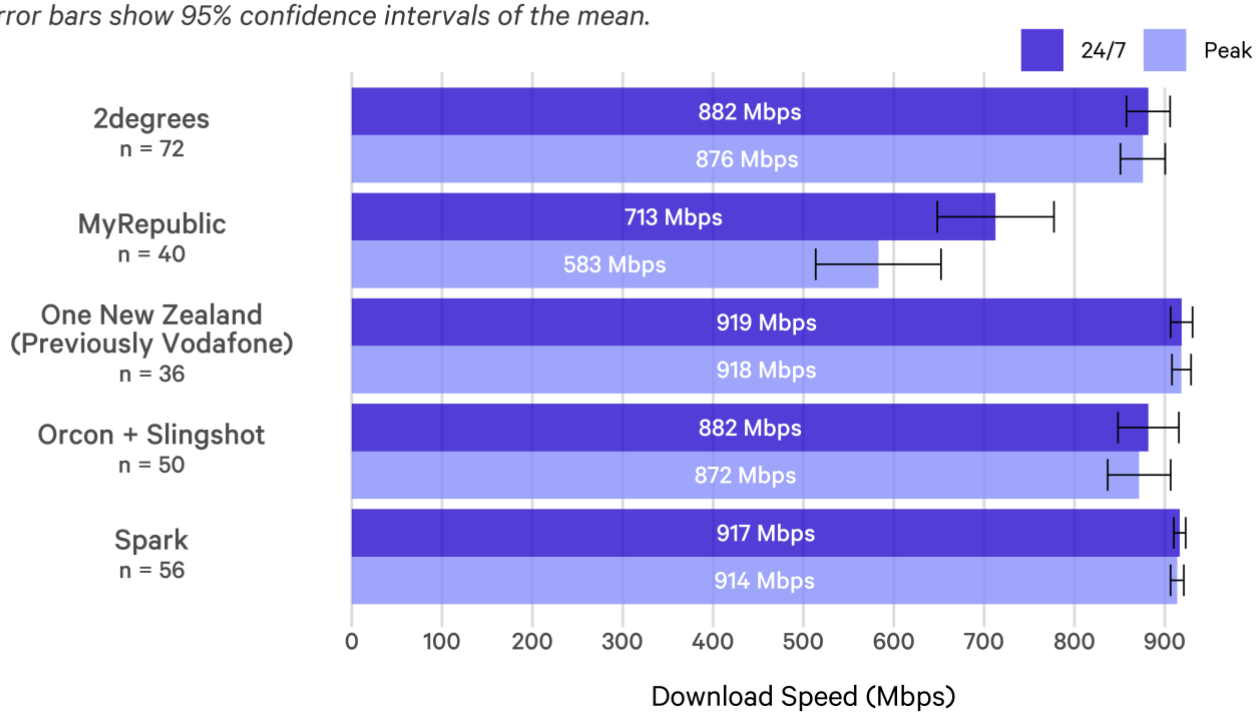
- All plans see latency increase when the line is running upload or download tests compared to when the line is idle.
- ADSL and Fixed Wireless plans see a large increase in latency under load while both download and upload tests are running. VDSL shows a high latency when upload tests are running. These latency values are high enough to be noticeable to the user if multiple devices are used simultaneously, with one device heavily using the connection.
- Satellite plans see a small increase in latency under load when download tests are run.
- The impacts of latency on specific application performance are discussed elsewhere in the report (Social Media, Online Games, Netflix).

Fibre Max Breakdown by RSP

Fibre Max plans are derived from 'gigabit' wholesale products but, since around 6% of the data in HTTP traffic is given over to protocol overhead (IP packet headers etc), the highest speed test result that can theoretically be achieved by a Fibre Max line is around 940 Mbps.

Figure 16: Average Fibre Max Download Speed by RSP

Average of monthly household averages. Peak hours are Monday - Friday, 7pm - 11pm.
The number of Whiteboxes contributing to each result is shown under each plan name (eg n = 72).
Error bars show 95% confidence intervals of the mean.



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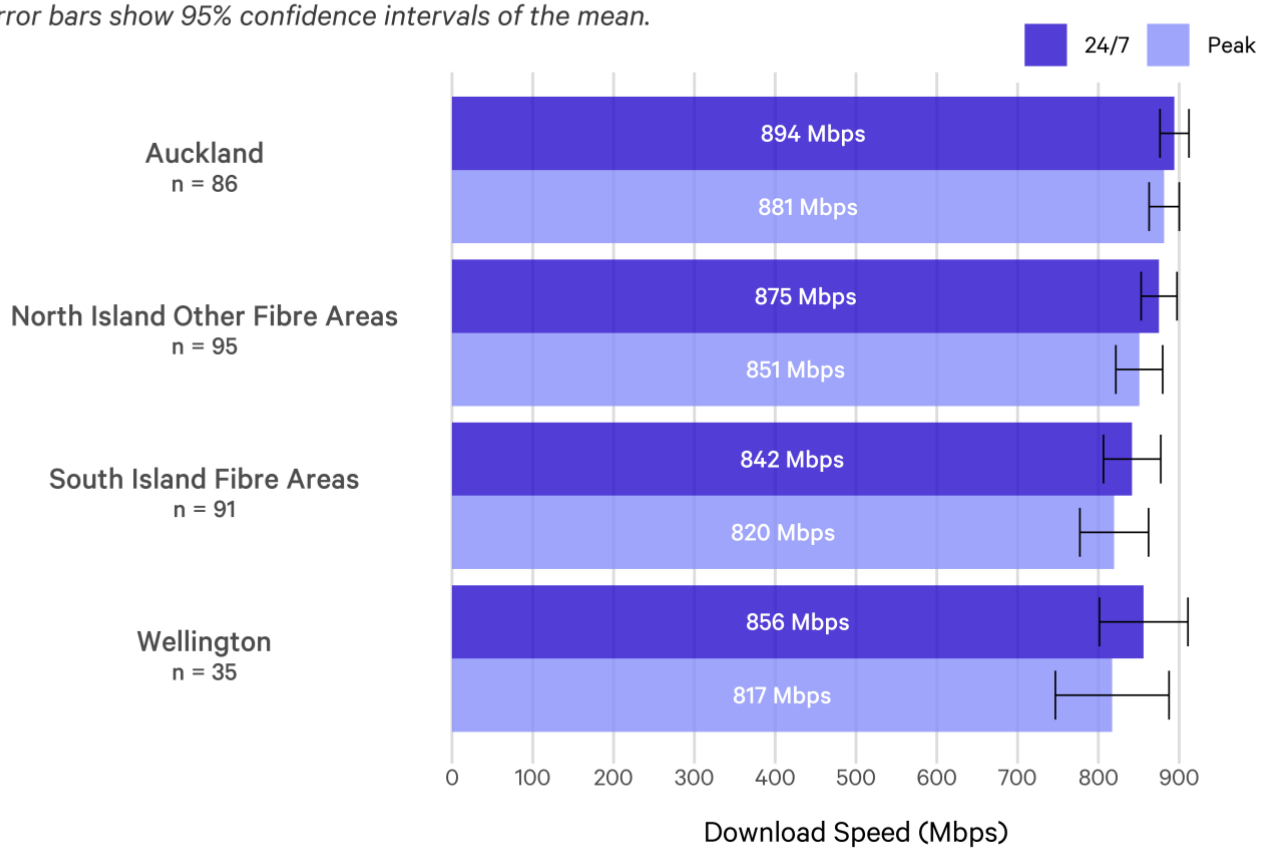
Key Observations

- For MyRepublic, average download speeds have increased compared to the previous report, but remain lower than other RSPs, especially during peak hours. MyRepublic continue to work with SamKnows to understand the drop in performance seen in the previous measurement period. MyRepublic are also assisting the Commission to recruit more Fibre Max volunteers for the programme.
- For all other RSPs, the results are broadly in line with those seen in the previous report, showing similar average download speeds across all hours and peak hours.
- There were not enough Fibre Max volunteers connected to Contact Energy, Inspire Net or Trustpower during the measurement period to report results for these RSP. All tested RSPs are included in the overall Fibre Max results shown in Figures 1-3.

Fibre Max Breakdown by Region

Figure 17: Average Fibre Max Download Speed by Region

Average of monthly household averages. Peak hours are Monday - Friday, 7pm - 11pm.
The number of Whiteboxes contributing to each result is shown under each geographical area (eg n = 86)
Error bars show 95% confidence intervals of the mean.



MBNZ Autumn Report, 2023

Key Observations

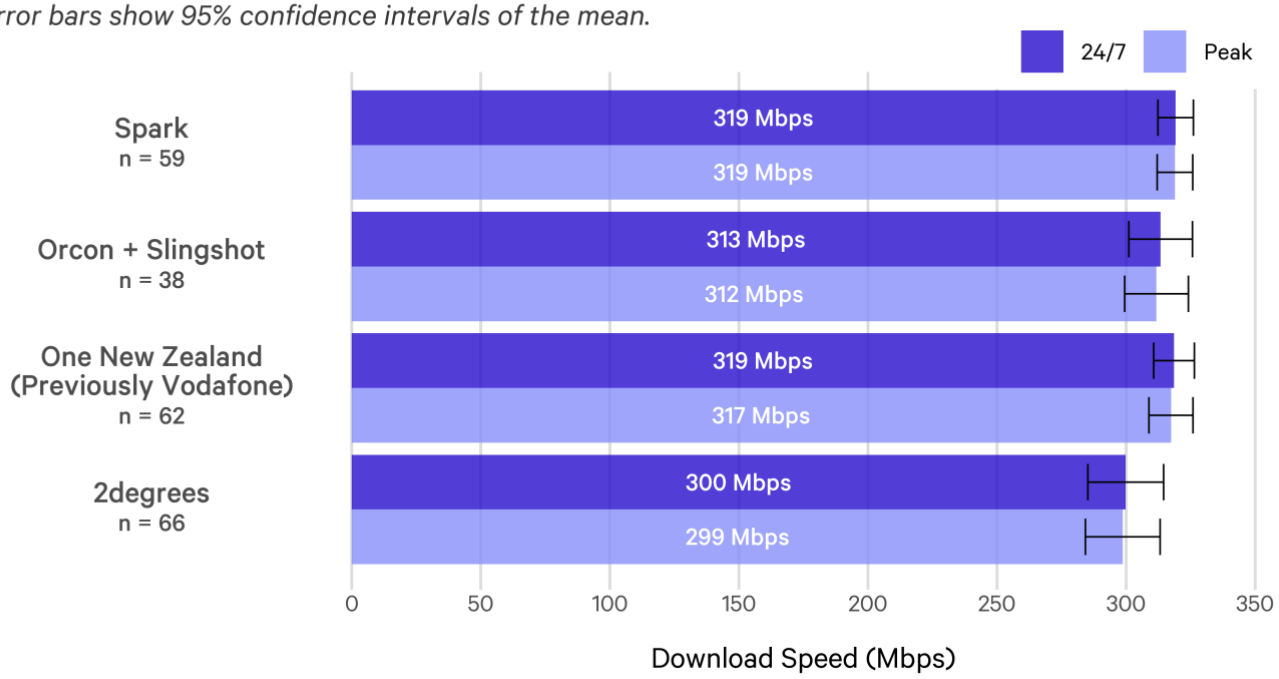
- There remains a small difference in performance between the two main islands, as has been noted in previous reports, but the difference is at a level which is unlikely to be noticed by end users.

Fibre 300 Breakdown by RSP

The speeds under which Fibre 300 is advertised to consumers are 300 Mbps download and 100 Mbps upload. In practice, since the provisioned speed is set slightly higher to allow for extra bandwidth used up by the network protocol overhead, it is quite common to see measured speeds close to or slightly above 300 Mbps.

Figure 18: Comparison of average Fibre 300 download speeds across RSPs.

Average of monthly household averages. Peak hours are Monday - Friday, 7pm - 11pm.
The number of Whiteboxes contributing to each result is shown under each plan name (eg n = 59)
Error bars show 95% confidence intervals of the mean.



MBNZ Autumn Report, 2023

Key Observations

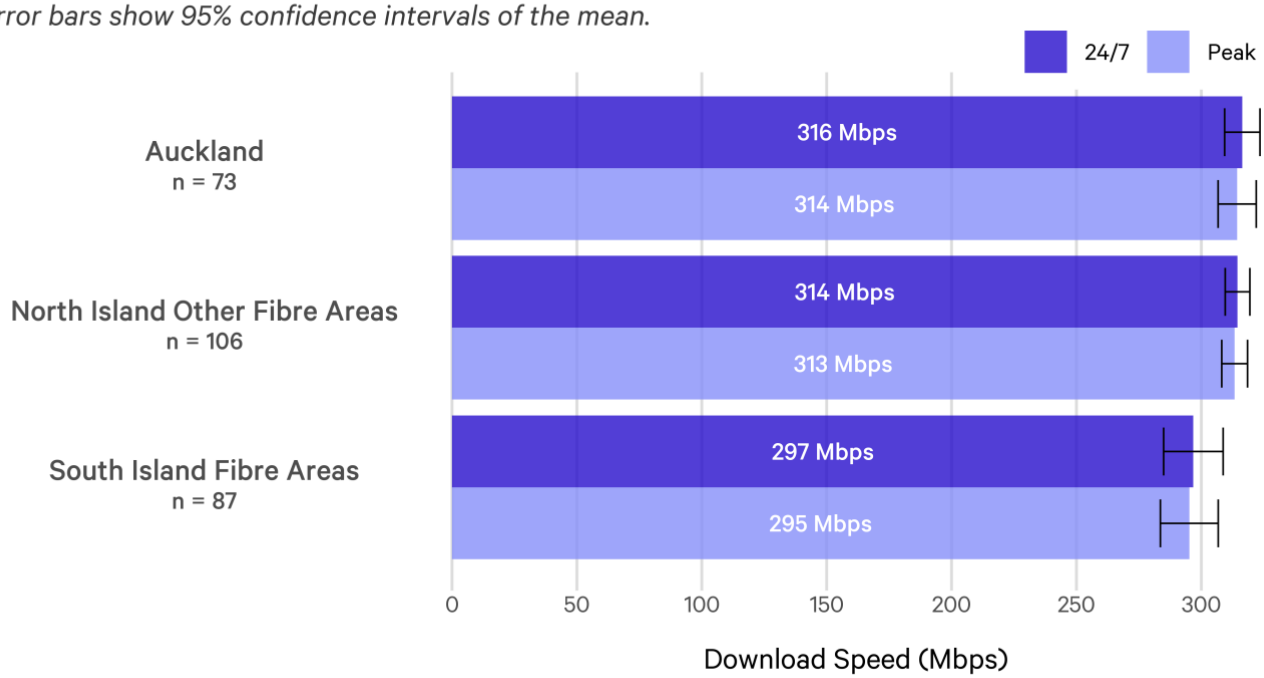
- All RSPs continued to perform consistently in February. All RSPs shown in the chart achieved average download speeds above 300 Mbps.[1]
- There were not enough volunteers connected to Contact Energy, MyRepublic, Trustpower, Unifone or Wireless Nation to report results. All tested RSPs are included in the overall Fibre 300 results shown in Figures 1-3.

[1] Orcon + Slingshot results are based on a sample size of 38 Whiteboxes

Fibre 300 Breakdown by Region

Figure 19: Average Fibre 300 download speeds by Region.

Average of monthly household averages. Peak hours are Monday - Friday, 7pm - 11pm.
The number of Whiteboxes contributing to each result is shown under each geographical area (eg n = 73)
Error bars show 95% confidence intervals of the mean.



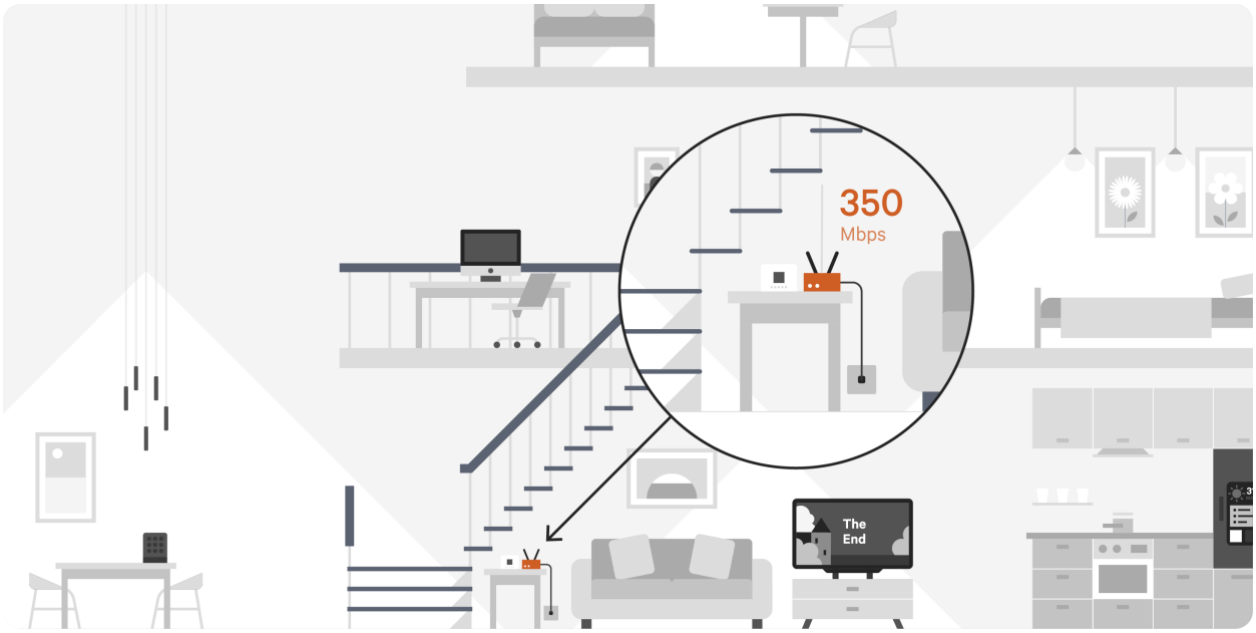
MBNZ Autumn Report, 2023

Key Observations

- There is a small difference in performance between the main islands, but the difference is at a level which is unlikely to be noticed by end users.
- All urban areas of New Zealand that we can provide results for see comparable download speeds through Fibre 300 plans, which are in line with the 300 Mbps headline download speed.[1]

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

How we test



Measuring home broadband across New Zealand

- The SamKnows Whitebox is a purpose-built testing agent that connects to your router.
- It runs regular, automated performance tests to record the quality and performance of your internet connection without interfering with your network.
- The Whitebox does not record any personal information or browsing history.

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.
https://www.measuringbroadbandnewzealand.com/sign-up

Our tests

	Test	Definition
	Download	The speed at which data can be transferred from the SamKnows test server to your device, measured in megabits per second (Mbps).
	Upload	The speed at which information is transferred from your device 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.
	Latency Under Load	How long it takes a data packet to go from your device to our test server and back to your device while a download/upload test is running, 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 do not make it to their destination, measured as a percentage of packets lost out of all packets sent.
	Disconnection	A disconnection means that two or more latency measurement packets in a row were lost. Measured as the median of household hourly rates.
	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 as game distribution platforms.
	Video Streaming	Measures the highest bitrate, 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.

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”, as opposed to historical dial-up internet.
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.
HFC	Hybrid Fibre-Coaxial. A broadband connection that uses coaxial cables to send data.
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.
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.
Latency under load	The time it takes for a data packet to travel from your router to our test server and back while a download/upload speed test is running. Measured in milliseconds (ms); lower is better.
LEO Satellite	Low Earth Orbit Satellite. A broadband connection that is transmitted wirelessly using a satellite and ground based satellite dish.
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.
RSP	Retail Service Provider. A company that provides consumers with access to the internet.
Upload speed	The speed that data travels from your router to our test server. Measured in Mbps (megabits per second); higher is better.
VDSL	Very high speed digital subscriber line. A broadband connection that allows higher speeds than ADSL technologies.

Summary Tables

Table 1: Download, Upload and Latency Performance by Plan

Plan	SFA Area	Peak or Off-Peak	Number of Units	Average Download (Mbps)	Average Upload (Mbps)	Average Latency (ms)
ADSL	Non-Fibre Areas	24/7	38	9 Mbps	1 Mbps	25 ms
		Peak	38	9 Mbps	1 Mbps	26 ms
VDSL		24/7	38	36 Mbps	9 Mbps	18 ms
		Peak	38	36 Mbps	9 Mbps	18 ms
LEO Satellite		24/7	39	171 Mbps	19 Mbps	42 ms
		Peak	39	142 Mbps	19 Mbps	40 ms
4G Fixed Wireless	All Areas	24/7	76	44 Mbps	17 Mbps	52 ms
		Peak	76	33 Mbps	16 Mbps	53 ms
	Fibre Areas	*24/7*	*22*	*50 Mbps*	*21 Mbps*	*53 ms*
		Peak	*22*	*39 Mbps*	*20 Mbps*	*54 ms*
	Non-Fibre Areas	24/7	54	42 Mbps	16 Mbps	52 ms
		Peak	54	30 Mbps	15 Mbps	53 ms
Fibre 300	Fibre Areas	24/7	305	307 Mbps	108 Mbps	7 ms
		Peak	305	306 Mbps	108 Mbps	7 ms
Fibre 300 (Excluding MyRepublic)		24/7	288	311 Mbps		
		Peak	288	310 Mbps		
Fibre Max		24/7	308	869 Mbps	498 Mbps	6 ms
		Peak	308	846 Mbps	497 Mbps	6 ms
Fibre Max (Excluding MyRepublic)		24/7	269	892 Mbps		
		Peak	269	886 Mbps		
HFC Max		*24/7*	*24*	*881 Mbps*	*103 Mbps*	*13 ms*
		Peak	*24*	*872 Mbps*	*103 Mbps*	*13 ms*
5G Fixed Wireless	All Areas		*9*			
Fixed Wireless WISP			*4*			

Table 2: Fibre 300 and Fibre Max Download Speed Summary by RSP

Plan	RSP	Number of Units	Average Download (Mbps)
Fibre 300	2degrees	66	300 Mbps
	One New Zealand (Previously Vodafone)	62	319 Mbps
	Orcon + Slingshot	38	313 Mbps
	Spark	59	319 Mbps
Fibre Max	2degrees	72	882 Mbps
	MyRepublic	40	713 Mbps
	One New Zealand (Previously Vodafone)	36	919 Mbps
	Orcon + Slingshot	50	882 Mbps
	Spark	56	917 Mbps

Table 3: Downlink Latency to Popular Social Media Platforms by RSP

Social Media Platform	Media Type	RSP	Number of Units	Average Latency
Instagram App	Image	Trustpower	41	10 ms
		Starlink	38	33 ms
		Spark	147	14 ms
		Orcon + Slingshot	110	9 ms
		One New Zealand (Previously Vodafone)	179	11 ms
		MyRepublic	60	10 ms
		2degrees	164	12 ms
Instagram Messenger	Text	Trustpower	41	13 ms
		Starlink	38	34 ms
		Spark	147	23 ms
		Orcon + Slingshot	110	14 ms
		One New Zealand (Previously Vodafone)	179	29 ms
		MyRepublic	60	12 ms

Social Media Platform	Media Type	RSP	Number of Units	Average Latency
		2degrees	164	15 ms
	Image	Trustpower	41	10 ms
		Starlink	38	33 ms
		Spark	147	14 ms
		Orcon + Slingshot	110	9 ms
		One New Zealand (Previously Vodafone)	179	11 ms
		MyRepublic	60	10 ms
		2degrees	164	12 ms
Facebook App	Text	Trustpower	41	13 ms
		Starlink	38	34 ms
		Spark	147	22 ms
		Orcon + Slingshot	110	14 ms
		One New Zealand (Previously Vodafone)	179	30 ms
		MyRepublic	60	11 ms
		2degrees	164	15 ms
	Image	Trustpower	41	10 ms
		Starlink	38	33 ms
		Spark	147	14 ms
		Orcon + Slingshot	110	9 ms
		One New Zealand (Previously Vodafone)	179	12 ms
		MyRepublic	60	10 ms
		2degrees	164	12 ms
Facebook Messenger	Text	Trustpower	41	13 ms
		Starlink	38	33 ms
		Spark	147	22 ms
		Orcon + Slingshot	110	14 ms
		One New Zealand (Previously Vodafone)	179	30 ms

Social Media Platform	Media Type	RSP	Number of Units	Average Latency
		MyRepublic	60	12 ms
		2degrees	164	15 ms
	Image	Trustpower	41	10 ms
		Starlink	38	33 ms
		Spark	147	14 ms
		Orcon + Slingshot	110	9 ms
		One New Zealand (Previously Vodafone)	179	11 ms
		MyRepublic	60	10 ms
		2degrees	164	12 ms
Snapchat	Text	Trustpower	39	129 ms
		Starlink	37	158 ms
		Spark	143	140 ms
		Orcon + Slingshot	107	131 ms
		One New Zealand (Previously Vodafone)	170	137 ms
		MyRepublic	58	144 ms
		2degrees	158	132 ms
	Image	Trustpower	41	418 ms
		Starlink	38	444 ms
		Spark	147	435 ms
		Orcon + Slingshot	110	420 ms
		One New Zealand (Previously Vodafone)	178	425 ms
		MyRepublic	60	418 ms
		2degrees	163	425 ms
WhatsApp	Text	Trustpower	41	13 ms
		Starlink	38	34 ms
		Spark	147	22 ms
		Orcon + Slingshot	110	14 ms

Social Media Platform	Media Type	RSP	Number of Units	Average Latency
		One New Zealand (Previously Vodafone)	179	29 ms
		MyRepublic	60	12 ms
		2degrees	164	15 ms
	Image	Trustpower	41	13 ms
		Starlink	38	33 ms
		Spark	147	22 ms
		Orcon + Slingshot	110	13 ms
		One New Zealand (Previously Vodafone)	179	29 ms
		MyRepublic	60	11 ms
		2degrees	164	14 ms

Table 4: Latency to Various Online Gaming Servers by RSP

Game	RSP	Number of Units	Average Latency
Among Us	Trustpower	41	160 ms
	Starlink	44	198 ms
	Spark	171	167 ms
	Orcon + Slingshot	110	166 ms
	One New Zealand (Previously Vodafone)	185	163 ms
	MyRepublic	60	163 ms
	2degrees	172	169 ms
Apex Legends	Trustpower	39	35 ms
	Starlink	43	67 ms
	Spark	170	48 ms
	Orcon + Slingshot	108	37 ms
	One New Zealand (Previously Vodafone)	185	43 ms
	MyRepublic	60	35 ms
	2degrees	167	39 ms
Diablo III	Trustpower	41	34 ms
	Starlink	43	67 ms
	Spark	170	48 ms
	Orcon + Slingshot	110	36 ms
	One New Zealand (Previously Vodafone)	185	43 ms
	MyRepublic	60	35 ms
	2degrees	171	38 ms
Dota 2	Trustpower	39	36 ms
	Starlink	43	72 ms
	Spark	170	61 ms
	Orcon + Slingshot	108	46 ms
	One New Zealand (Previously Vodafone)	185	52 ms
	MyRepublic	60	36 ms
	2degrees	167	43 ms
FIFA	Trustpower	41	38 ms

Game	RSP	Number of Units	Average Latency
	Starlink	44	72 ms
	Spark	170	53 ms
	Orcon + Slingshot	110	39 ms
	One New Zealand (Previously Vodafone)	185	46 ms
	MyRepublic	60	40 ms
	2degrees	171	44 ms
Fortnite	Trustpower	39	44 ms
	Starlink	43	82 ms
	Spark	170	63 ms
	Orcon + Slingshot	108	48 ms
	One New Zealand (Previously Vodafone)	185	54 ms
	MyRepublic	60	49 ms
	2degrees	167	52 ms
Hearthstone	Trustpower	39	167 ms
	Starlink	43	181 ms
	Spark	170	157 ms
	Orcon + Slingshot	110	153 ms
	One New Zealand (Previously Vodafone)	185	171 ms
	MyRepublic	60	149 ms
	2degrees	167	158 ms
Heroes of the Storm	Trustpower	41	167 ms
	Starlink	43	181 ms
	Spark	170	157 ms
	Orcon + Slingshot	109	153 ms
	One New Zealand (Previously Vodafone)	185	171 ms
	MyRepublic	60	149 ms
	2degrees	168	157 ms
Overwatch	Trustpower	41	34 ms
	Starlink	44	68 ms
	Spark	171	48 ms

Game	RSP	Number of Units	Average Latency
	Orcon + Slingshot	110	36 ms
	One New Zealand (Previously Vodafone)	185	45 ms
	MyRepublic	60	35 ms
	2degrees	172	38 ms
PUBG	Trustpower	41	39 ms
	Starlink	43	74 ms
	Spark	170	55 ms
	Orcon + Slingshot	110	41 ms
	One New Zealand (Previously Vodafone)	185	47 ms
	MyRepublic	60	42 ms
	2degrees	171	45 ms
Rainbow Six Siege	Trustpower	41	36 ms
	Starlink	44	69 ms
	Spark	171	50 ms
	Orcon + Slingshot	110	38 ms
	One New Zealand (Previously Vodafone)	185	44 ms
	MyRepublic	60	36 ms
	2degrees	171	40 ms
Rocket League	Trustpower	41	34 ms
	Starlink	44	66 ms
	Spark	171	46 ms
	Orcon + Slingshot	110	35 ms
	One New Zealand (Previously Vodafone)	185	42 ms
	MyRepublic	60	34 ms
	2degrees	172	38 ms
Starcraft 2	Trustpower	41	33 ms
	Starlink	44	64 ms
	Spark	171	47 ms
	Orcon + Slingshot	110	39 ms
	One New Zealand (Previously Vodafone)	185	43 ms

Game	RSP	Number of Units	Average Latency
	MyRepublic	60	34 ms
	2degrees	172	38 ms
Valorant	Trustpower	41	38 ms
	Starlink	44	74 ms
	Spark	171	53 ms
	Orcon + Slingshot	110	39 ms
	One New Zealand (Previously Vodafone)	185	47 ms
	MyRepublic	60	40 ms
	2degrees	172	44 ms
World of Warcraft	Trustpower	41	34 ms
	Starlink	44	66 ms
	Spark	171	47 ms
	Orcon + Slingshot	110	36 ms
	One New Zealand (Previously Vodafone)	185	44 ms
	MyRepublic	60	35 ms
	2degrees	172	38 ms

Table 5: Latency to Various Video Conferencing Services by RSP

Video Conferencing Service	Free or Paid	RSP	Number of Units	Average Latency
Cisco Webex	Free	Trustpower	41	220 ms
		Starlink	38	229 ms
		Spark	139	213 ms
		Orcon + Slingshot	109	193 ms
		One New Zealand (Previously Vodafone)	172	210 ms
		MyRepublic	60	191 ms
		2degrees	161	194 ms
	Paid	Trustpower	41	44 ms
		Starlink	38	69 ms
		Spark	139	52 ms
		Orcon + Slingshot	110	46 ms
		One New Zealand (Previously Vodafone)	174	51 ms
		MyRepublic	60	45 ms
		2degrees	161	46 ms
GoToMeeting	Free	Trustpower	41	144 ms
		Starlink	38	167 ms
		Spark	139	168 ms
		Orcon + Slingshot	110	161 ms
		One New Zealand (Previously Vodafone)	174	166 ms
		MyRepublic	60	159 ms
		2degrees	161	162 ms
	Paid	Trustpower	41	196 ms
		Starlink	38	210 ms
		Spark	139	198 ms
		Orcon + Slingshot	110	183 ms
		One New Zealand (Previously Vodafone)	173	195 ms

Video Conferencing Service	Free or Paid	RSP	Number of Units	Average Latency
		MyRepublic	60	181 ms
		2degrees	161	184 ms
Google Meet	Free	Trustpower	41	34 ms
		Starlink	38	58 ms
		Spark	139	45 ms
		Orcon + Slingshot	110	36 ms
		One New Zealand (Previously Vodafone)	174	45 ms
		MyRepublic	60	48 ms
		2degrees	161	38 ms
	Paid	Trustpower	41	34 ms
		Starlink	38	58 ms
		Spark	139	45 ms
		Orcon + Slingshot	110	36 ms
		One New Zealand (Previously Vodafone)	174	46 ms
		MyRepublic	60	48 ms
		2degrees	161	38 ms
Microsoft Teams	Free	Trustpower	41	43 ms
		Starlink	38	67 ms
		Spark	139	51 ms
		Orcon + Slingshot	110	44 ms
		One New Zealand (Previously Vodafone)	174	48 ms
		MyRepublic	60	45 ms
		2degrees	161	45 ms
	Paid	Trustpower	41	43 ms
		Starlink	38	67 ms
		Spark	139	51 ms
		Orcon + Slingshot	110	44 ms

Video Conferencing Service	Free or Paid	RSP	Number of Units	Average Latency
		One New Zealand (Previously Vodafone)	174	48 ms
		MyRepublic	60	45 ms
		2degrees	161	45 ms
Skype	Free	Trustpower	41	47 ms
		Starlink	38	71 ms
		Spark	139	56 ms
		Orcon + Slingshot	110	49 ms
		One New Zealand (Previously Vodafone)	174	53 ms
		MyRepublic	60	50 ms
		2degrees	161	50 ms
Zoom		Trustpower	41	142 ms
		Starlink	36	177 ms
		Spark	138	153 ms
		Orcon + Slingshot	110	160 ms
		One New Zealand (Previously Vodafone)	171	154 ms
		MyRepublic	60	158 ms
		2degrees	160	161 ms
	Paid	Trustpower	41	52 ms
		Starlink	37	78 ms
		Spark	139	60 ms
		Orcon + Slingshot	110	54 ms
		One New Zealand (Previously Vodafone)	173	57 ms
		MyRepublic	60	52 ms
		2degrees	160	55 ms