Measuring Broadband Australia

Report 12, March 2021

In 2017, the Australian Competition and Consumer Commission (ACCC) launched its project to measure internet performance. SamKnows was appointed to supply their Whiteboxes to internet users in Australia to measure the quality of experience for fixed-line internet.

The goal of Measuring Broadband Australia is to increase transparency and encourage greater performance-based competition and better internet performance throughout the country.

Overview

1 December 2020 to 31 December 2020

This is the twelfth report issued as part of the Measuring Broadband Australia project. This reporting period, includes measurements collected over the month of December 2020, a 31 day period.

SamKnows prepares these reports each quarter for publication by the ACCC. The metrics are also presented by the ACCC in a public dashboard at https://www.accc.gov.au/consumers/internet-landline-services/broadband-performance-data. A data release contained underlying summary data for this report can be found through https://data.gov.au/.

The program tests NBN fixed-line services as a main focus. In this report we have also included for the first time a section showing results from NBN fixed wireless services.
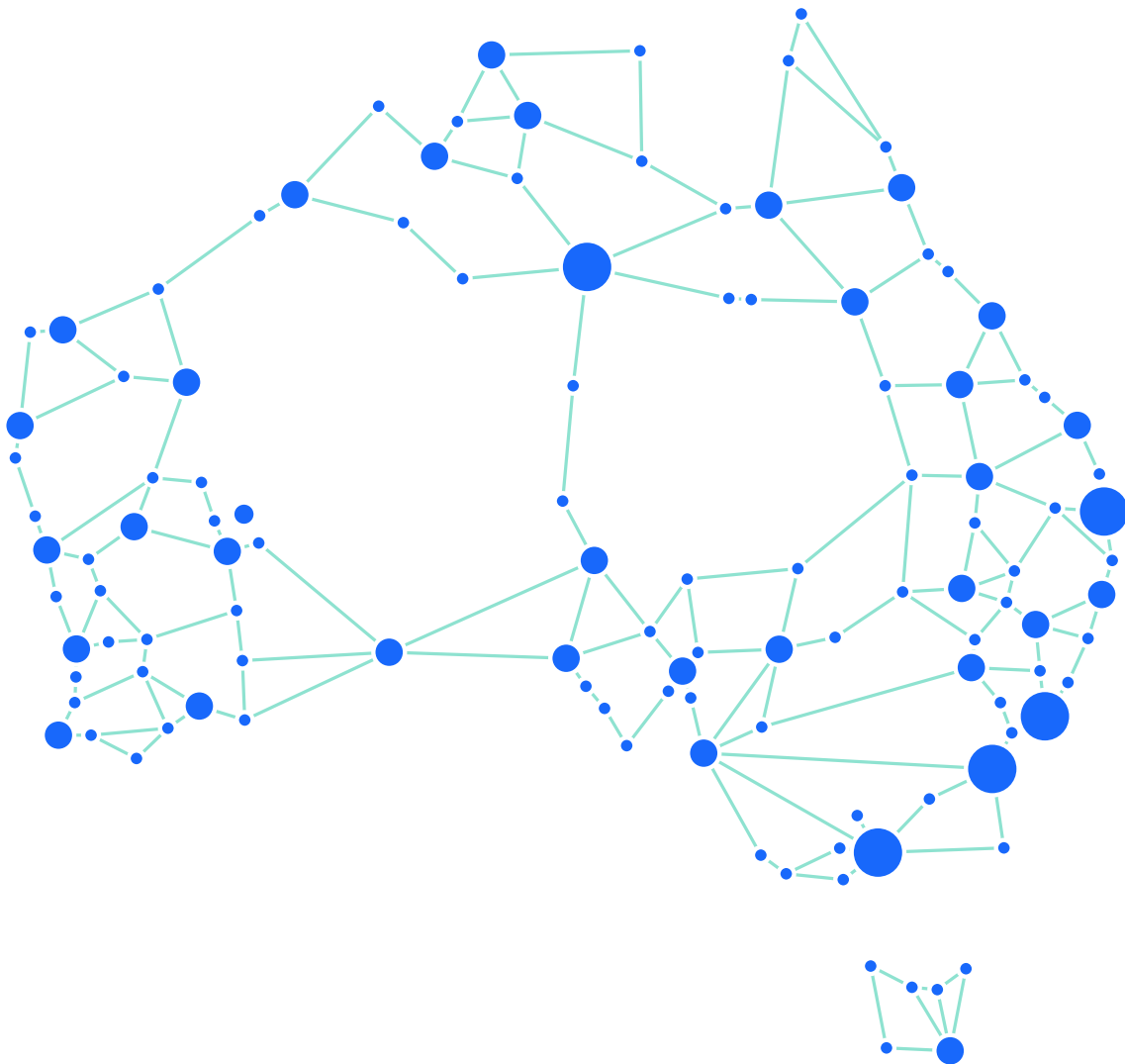
The enduring impact of COVID-19

COVID-19 has led to a major switch in home internet usage patterns. More people are working and learning from home, increasing pressure on telecommunications networks.
As covered in the previous report, NBN Co introduced two measures to respond to the challenges presented by COVID-19. Both measures have caused an uplift in results including in this report and previous reports from September 2020.

NBN Co introduced the following measures:

- provisioned 40 per cent more connectivity virtual circuit (CVC) capacity for retail service providers (RSPs) free of charge; and

- over-provisioned the download component of some NBN speed tiers by around 10 – 15 per cent, where possible.

CVC is one of the essential elements of NBN performance. It is used to aggregate the traffic of an RSP's consumers. Where consumers are doing a lot of things on the internet at once, this will fill up a CVC and cause congestion. If CVC is under-provisioned relative to consumer requirements, then consumers will likely be impacted and speeds will slow, particularly during the busy hours. NBN Co implemented a 40 per cent free CVC boost in late March 2020, and the full amount of this additional capacity was available to RSPs until 30 November 2020.

In December 2020, NBN started to taper the additional CVC capacity. The transition meant that during the December 2020 test period, only 75 per cent of the initial CVC boost was available to RSPs. Despite the reduction in the free CVC boost, the uplift in results in the previous report has persisted for this report. Between June and August 2020 NBN also started to over-provision the download component of some speed tiers by around 10 – 15 per cent, where possible. A certain proportion of a customer's plan speed is given over to protocol overhead, which is key to ensuring that communications are delivered to the right place. The over-provisioning of the download component now means that consumers can more reliably experience speeds that are closer to the maximum set download speed of their chosen retail plan speed.

Netflix upgrades

In the second half of 2020, Netflix rolled out a number of optimisations to its service with the aim of improving user experience. These optimisations focused on allowing users to stream higher quality video at a lower data rate. For this report, the number of concurrent screens of a certain quality level that a plan can stream has improved greatly across all plans. This is a function of it now requiring a lower bitrate to stream at a given quality level.

Inclusion of fixed wireless services

This report also includes a section covering the results of fixed wireless services.
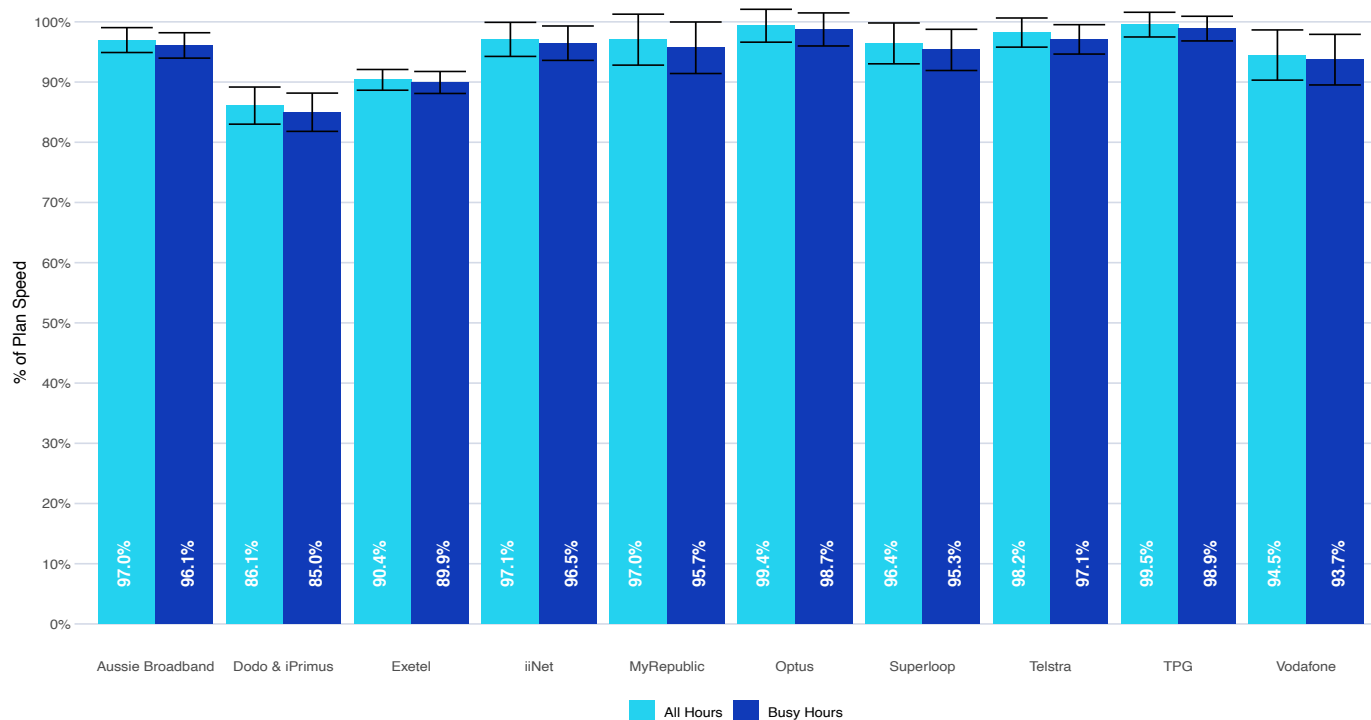
Contents

NBN fixed-line services

Speed Test Results

This report expresses results relating to download and upload speed as a percentage of the service's plan speed[1]. Plan speed is not always the same as the speed advertised for a plan by RSPs. Hence, where the report outlines speed measures below 100 percent of plan speed, this should not be interpreted as the RSP having failed to provide the speed that it advertised.

Figure 1: Average download speed by RSP

Including underperforming services. Error bars indicate 95% confidence intervals of the mean.

	All Hours	Busy Hours
Aussie Broadband	97.0%	96.1%
Dodo & iPrimus	86.1%	85.0%
Exetel	90.4%	89.9%
iiNet	97.1%	96.5%
MyRepublic	97.0%	95.7%
Optus	99.4%	98.7%
Superloop	96.4%	95.3%
Telstra	98.2%	97.1%
TPG	99.5%	98.9%
Vodafone	94.5%	93.7%

1 Plan speed refers to the maximum download or upload speed associated with the relevant retail plan. For example, a 12/1 Mbps retail product has a maximum download speed of approximately 12 Mbps and 1 Mbps upload. A 100/20 Mbps retail product has a maximum download speed of approximately 100 Mbps and 20 Mbps upload. RSPs may advertise a maximum attainable speed and also state a different typical busy period speed that consumers are likely to experience, which may be the same or lower than the maximum attainable speed.

During this period, users on NBN connections attained an average download performance of 96.6% of plan speeds during all hours, decreasing to 95.7% during the busy hours (between 7pm and 11pm) which is when networks experience higher user activity.

These results are in line with those measured in the last (11th) Measuring Broadband Australia report and continue to show the impact that over-provisioning has had on speed results. As explained in the previous report: prior to this change, an NBN100 service would have been provisioned at 100 Mbps plan speed; after protocol overhead, the highest speed test result which we could have measured might have been around 94 Mbps. After the change, the same service might have been provisioned at above 100 Mbps plan speed, meaning that even after protocol overheads we might still measure speeds around or slightly above 100 Mbps. The increase in CVC has meant that there is sufficient capacity for RSPs to deliver speeds that are very close to the maximum set download speed.

The impact is clear in the number of services which have higher average values than their plan speed. In December 2020, 57.0% of NBN services we monitored reported a higher average speed than plan speed.

To give an indication of the impact of this change in provisioning, the set of results in the 10th report for May-June 2020 showed an all hours average download performance of 88.5% of plan speed, decreasing to 86.7% during busy hours. This implies that all-hours download performance in December 2020 has increased by 7.9 percentage points, and busy hour download performance by 8.9 percentage points, since the May-June 2020 test period. Since the 11th report, which had a test period of October 2020, results have increased by 0.7% for both all and busy hours.

As with previous reports, the 95% confidence intervals in figure 1 above, are a measure of how certain we are that the true average download speed lies between the upper and lower boundary indicated by the thin black lines. For example, TPG had an average download performance of 99.5% with a 95% confidence interval of ±2.1%. This means that if we were to repeat our sampling 100 times, we expect that average performance would fall between 97.5% and 101.6% in at least 95 cases.

**Figure 2: Average hourly download speed by plan**

Including underperforming services.
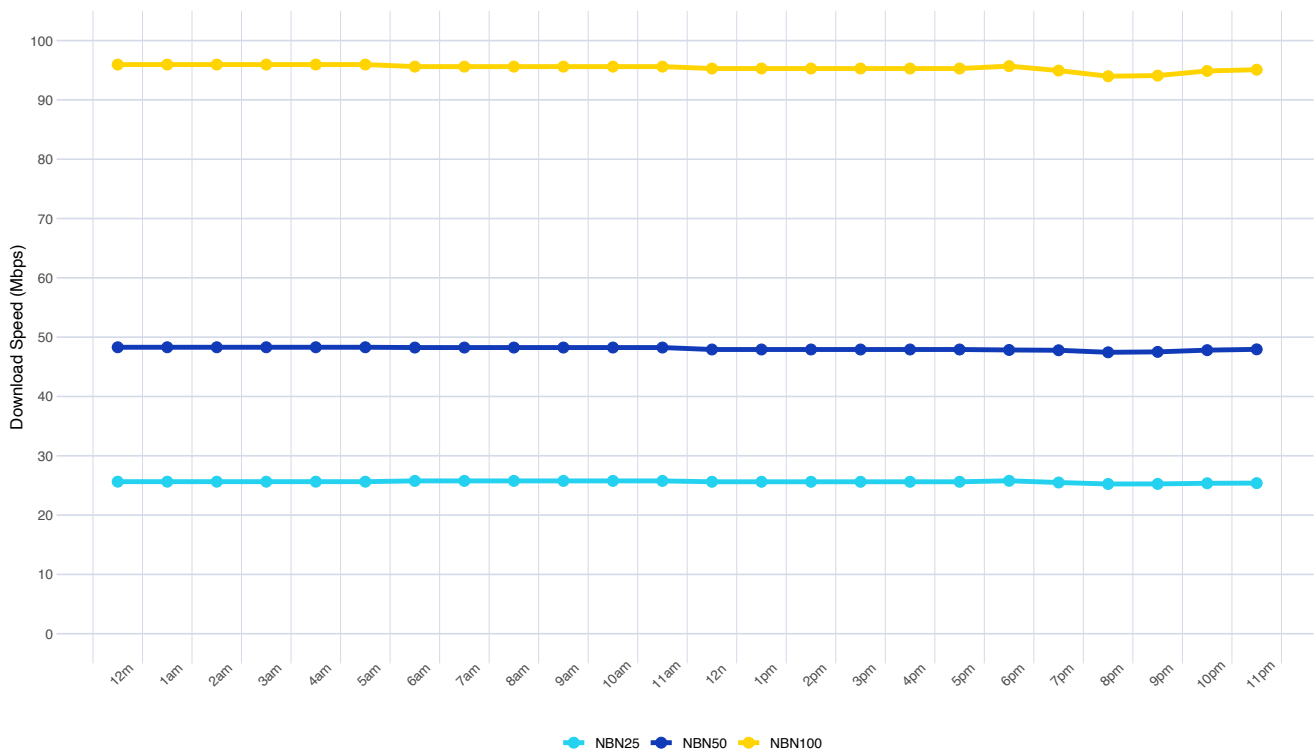
Average download speeds held steady throughout the day for users on most NBN speed tiers. The 100 Mbps NBN tiers remain the most affected by increased user activity in the evening hours: speeds typically started to decrease during the evening, dipping to 2 Mbps below the day's maximum by 8pm, and would recover to higher levels during the night.

Figure 3: Frequency of download speeds attained during tests

All hours. Including underperforming services.
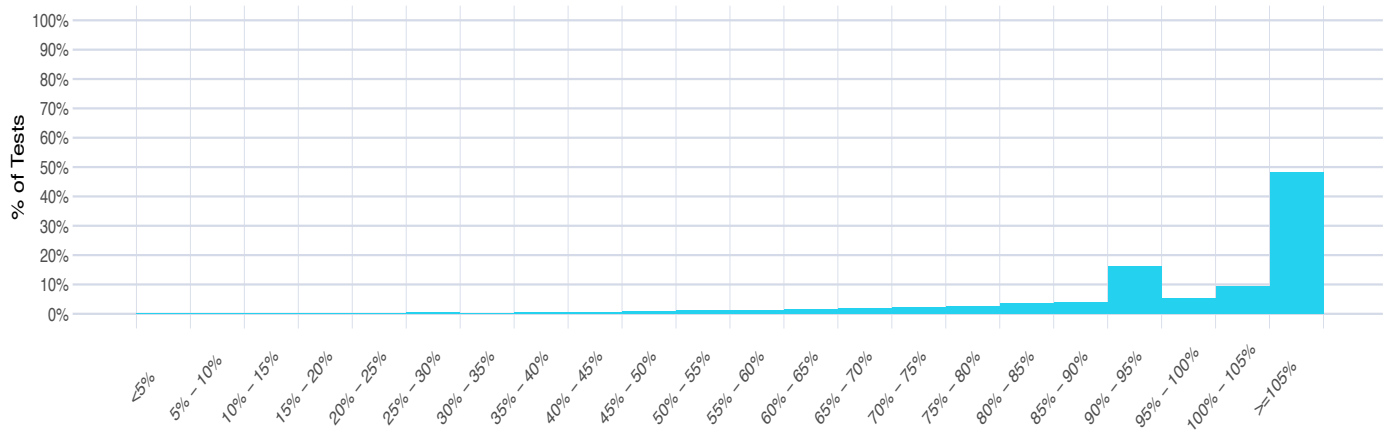
232,568 download speed tests were performed across 1,199 Whiteboxes connected to fixed-line NBN infrastructure during the period. 79.0% of tests conducted achieved a download speed of at least 90% of the plan's download speed – this is an increase from 78.4% in the previous report.

Another impact of the over-provisioning of NBN services and the increase in CVC capacity is the increase in the proportion of tests achieving speeds above 100% of their plan speed. This increase remains the same as the last report, in fact the proportion has further increased, from around 54.7% in report 11 to 57.0% in this reporting period.

There is a spike at the 90%-95% level.

3.0% of tests achieved less than 50% of plan speed; for reference, in the previous report 3.1% of tests also failed to meet the 50% mark.

Figure 4: Average upload speed by RSP

Including underperforming services. Error bars indicate 95% confidence intervals of the mean.
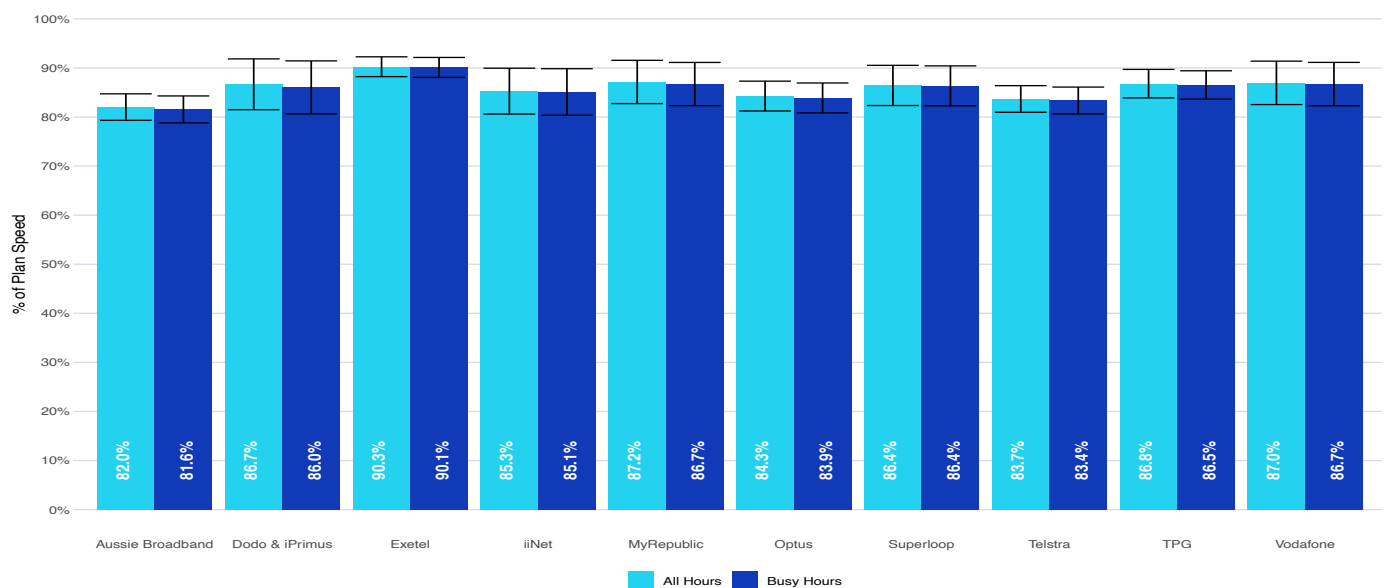
Upload performance was similar when compared to the previous report: NBN services achieved an overall average upload performance of 85.3% during all hours, as against 85.1% in the previous report. In contrast to download speeds, the upstream side of NBN services has not been over-provisioned, and so these upload speed test results do not show a substantial change on previous reports.

Average upload performance ranged between 82.0% and 90.3% during all hours across RSPs as shown in Figure 4.

Figure 5: Average hourly upload speed by plan

Including underperforming services.
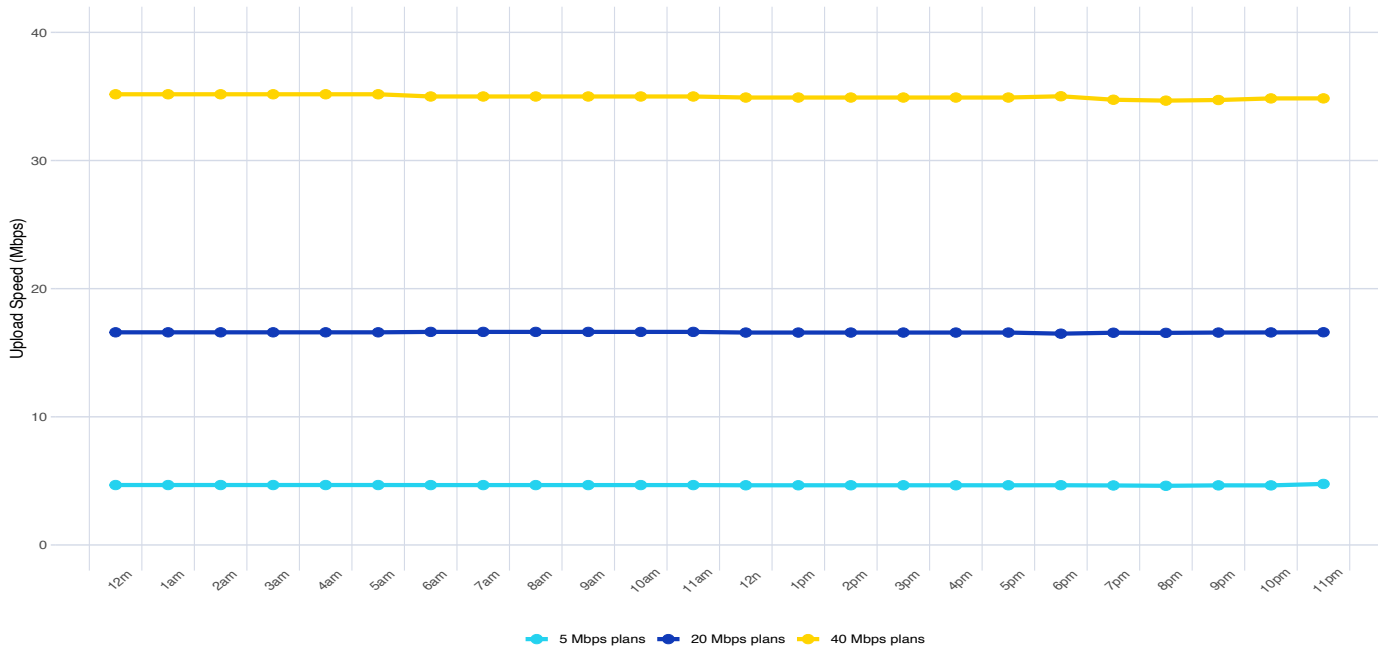
Average hourly upload speeds were steady throughout the day, with negligible change during busy evening hours.

Video Streaming

The following chart shows the proportion of NBN services on the main NBN plans which would be able to reliably stream (without stopping and starting) a varying number of videos at High Definition and Ultra High Definition from Netflix simultaneously. We present results for Netflix as reports indicate that it has the largest volume of traffic over Australian networks and Netflix supports our testing of its services. We welcome interest from other streaming providers if they wish to participate in the program.

In this report, the calculations used to estimate the number of videos which could simultaneously be streamed have been updated to take into account improvements that Netflix have recently made to their service. These improvements aim to allow users to stream videos at lower bitrates than previously. Due to these updates the following results for Netflix performance have increased from the previous report.

Consumers using the popular High Definition video streams from Netflix will see improvements, as a High Definition stream would now take up around 2.2 Mbps (previously 6 Mbps) data rate on average. Even those consumers with premium Ultra High Definition (4K) video stream also see improvements, as a Ultra High Definition stream now takes up 12 Mbps (previously 15.6 Mbps) on average. The actual data rate will vary during video streaming: for example Netflix would use a higher data rate during a fast-paced action scene. It will also depend on how other users are using Netflix. The Whitebox measures the total downstream data rate available from Netflix's servers, and so using multiples of 2.2 Mbps (for High Definition) and 12 Mbps (for Ultra High Definition) allows us to infer whether a service would be able to handle different numbers of streams. This assumes no other use of the connection at the time i.e. that Netflix is the only application running.

Figure 6: Netflix streaming by plan - busy hours

Excluding underperforming and impaired services.
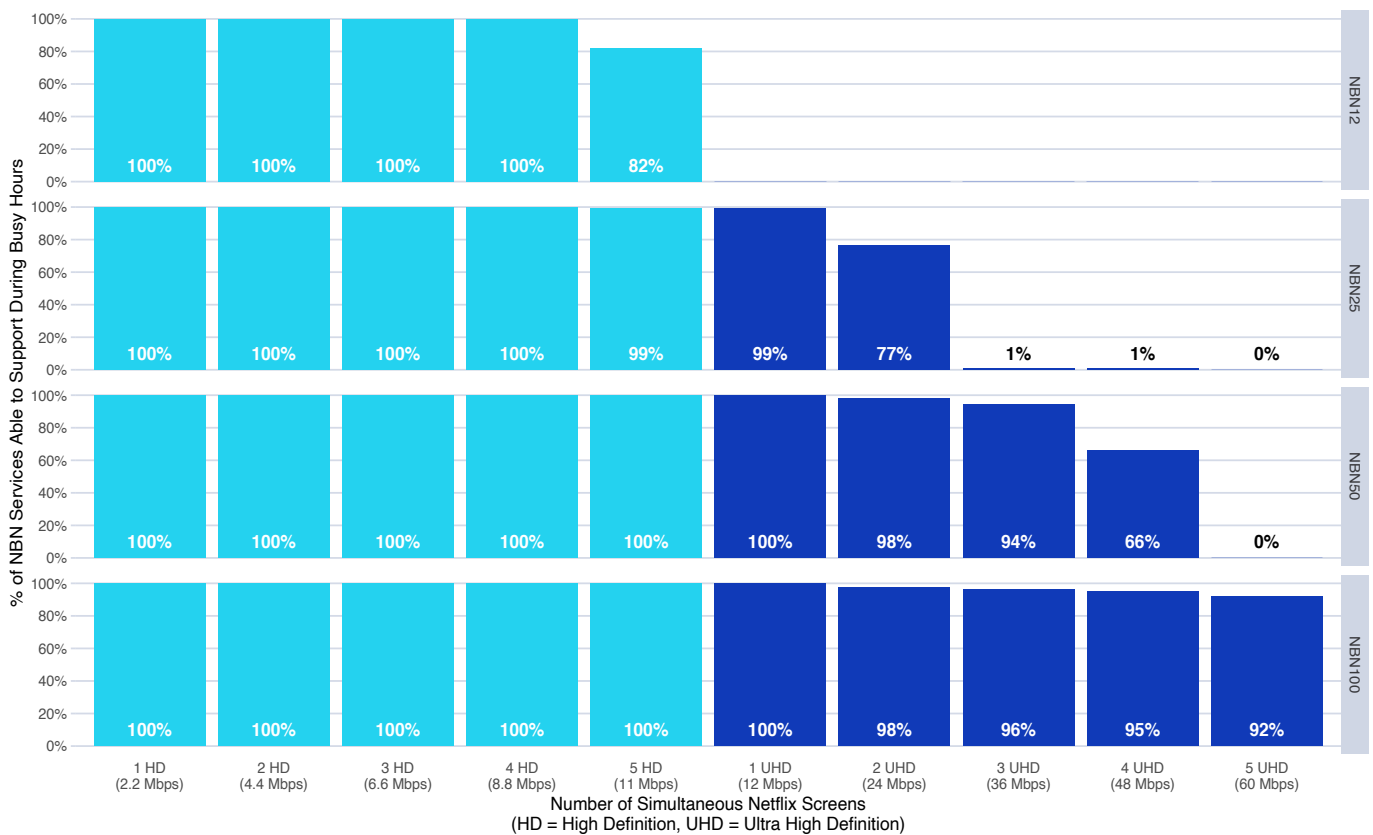
Netflix's upgrades and the subsequent changes to the methodology for calculating the number of theoretical simultaneous screens have had a significant impact on the number of simultaneous screens which can theoretically be streamed.

- All major plan speeds can now theoretically support up to 4 simultaneous High Definition streams.

- Over three quarters of NBN25 services would support two simultaneous Ultra High Definition streams, and almost all can manage a single Ultra High Definition stream.

- Almost all NBN50 plans would be able to handle three Ultra High Definition videos. 66% (up from 0% in the previous report) of NBN50 services can handle four Ultra High Definition streams.

- NBN100 plans will generally allow up to five Netflix videos to be watched with the highest quality settings available, the percentage that can manage 5 simultaneous Ultra High Definition streams has increased to 92% from 76% in the last report.

We have not fully tested NBN12 services for Ultra High Definition Streams.

Similar tests were run to YouTube. Since YouTube caps the data rate at which it serves video, test results could not be used to infer whether a service would be able to handle multiple concurrent streams. Nevertheless, nearly all tests from all NBN plans were able to stream YouTube reliably in Ultra High Definition.

Netflix content is served by 'Open Connect Appliance' content delivery network (CDN) caches embedded within RSPs' networks. Since the endpoints tested for each RSP are different, Netflix performance can vary across RSPs.

The following chart shows the proportion of NBN50 services which would be able to reliably stream two, three, or four simultaneous Netflix videos in Ultra High Definition, split by RSP. Results for Superloop have been excluded due to low sample size.

Figure 7: Netflix streaming by RSP - NBN50 services - busy hours

Excluding underperforming and impaired services.
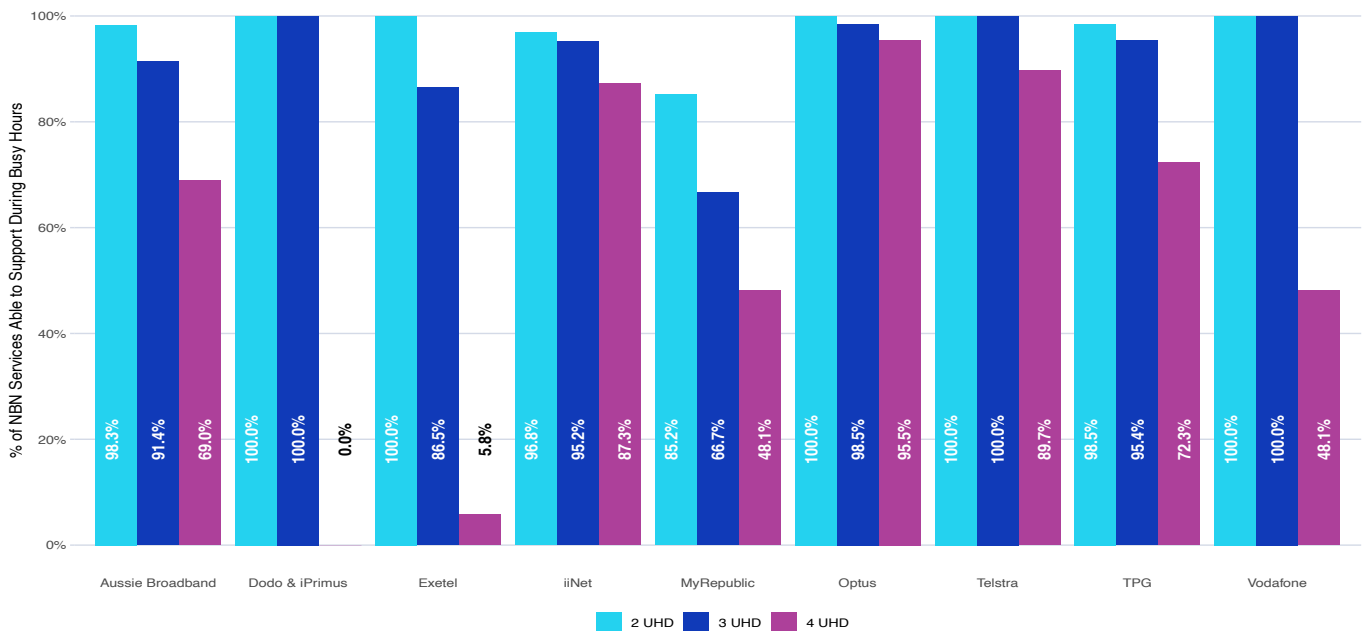
In previous reports, NBN50 performance for High Definition streams has been presented, but given the significant improvements caused by Netflix's bitrate changes, Ultra High Definition has been presented here to be more informative. While most providers are able to stream 2 and 3 simulta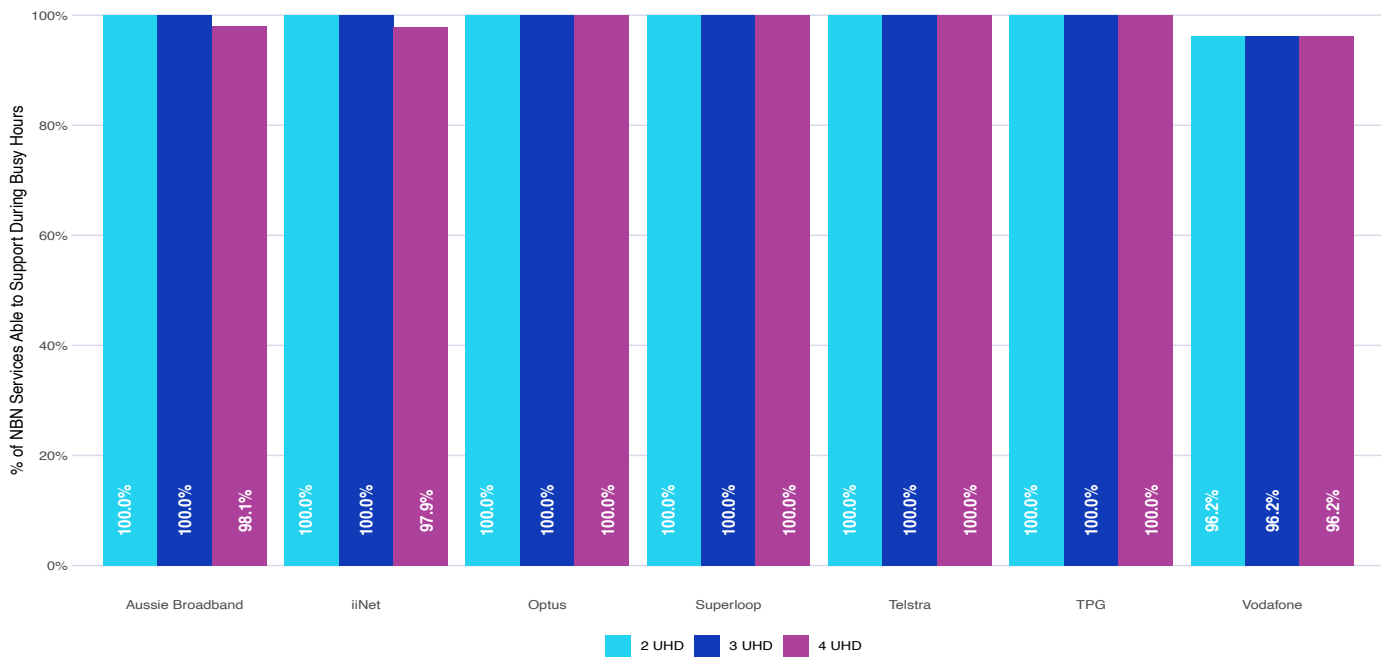neous Ultra High Definition streams, there is more variation in performance for 4 Ultra High Definition streams, which is linked to the RSP's download speed claim. Providers with higher speed claims are linked with a higher proportion of services able to support 4 simultaneous Ultra High Definition streams. It should be noted that the results for Dodo & iPrimus, MyRepublic and Vodafone are based on data from 26, 27 and 27 Whiteboxes respectively, and so the results for those RSPs should be considered as indicative only.

The following chart shows the proportion of NBN100 services which would be able to reliably stream two, three, or four simultaneous Netflix videos in Ultra High Definition, split by RSP. Results from Dodo & iPrimus, Exetel and MyRepublic are excluded due to low sample sizes.

Figure 8: Netflix streaming by RSP - NBN100 services - busy hours

Excluding underperforming and impaired services.

As expected the NBN100 plans do better than the NBN50 plans at being able to support multiple Ultra High Definition streams. In fact, all bar one provider are able to reliably stream 4 simultaneous Ultra High Definition videos. It should be noted that the results for Superloop and Vodafone are based on data from 26 and 27 Whiteboxes respectively, and so the results for those RSPs should be considered as indicative only.

Finally, on video streaming for this report, figure 9 below, presents the impact of access technology on the NBN100 plan.

Figure 9: Netflix streaming by Access Technology - NBN 100 Services - busy hours

Excluding underperforming and impaired services.
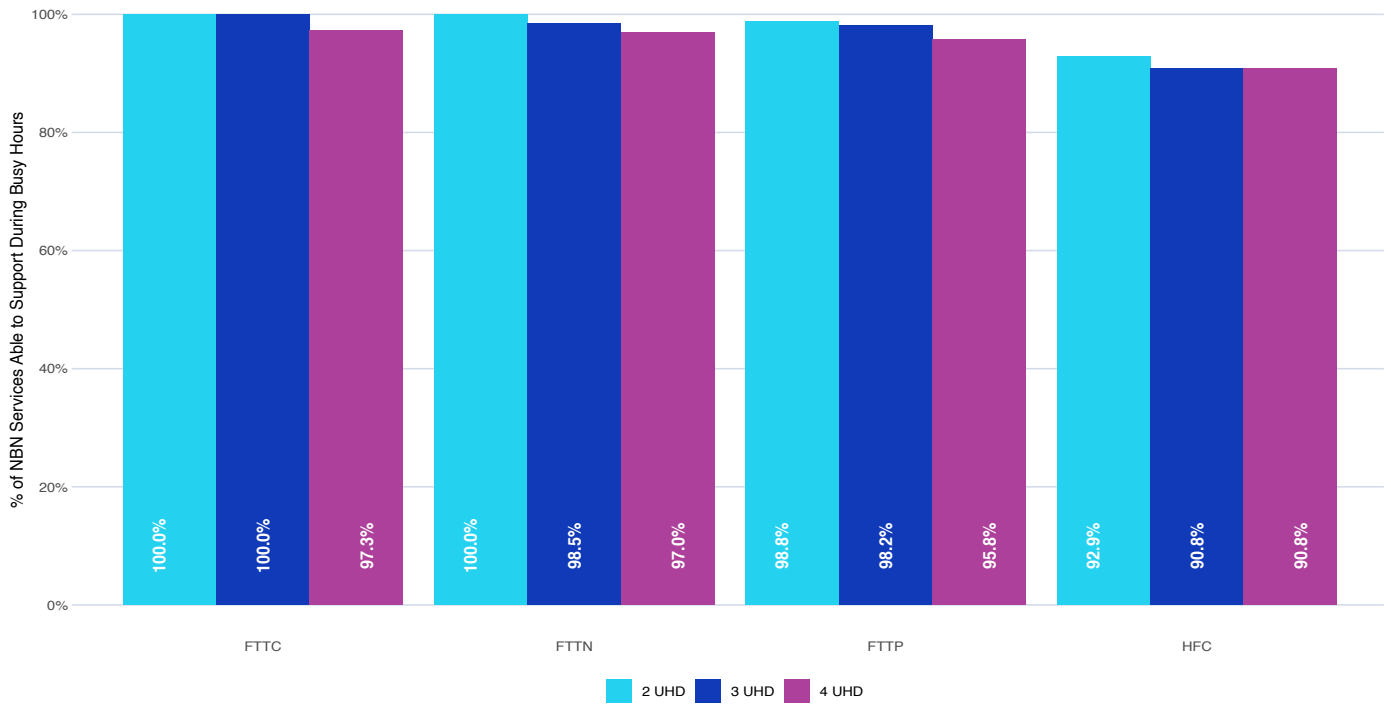
The results show that the majority of units on each different access technology are able to stream multiple simultaneous Ultra High Definition videos, with all technologies having at least 90% of whiteboxes being able to stream 4 simultaneous Ultra High Definition videos.

Impact of underperforming services[2] on download speed

As in previous reports, we present separate measures of download performance exclusive of underperforming services. These are services that do not achieve speeds that approach plan speeds at any time of the day. These are essentially services that the RSP supplies to a consumer with a plan speed that cannot be attained due to specific physical limitations affecting the service.

This information allows consumers to better understand the reported download and upload speed measures by removing the effect of services which, due to physical limitations, would be better assigned to another plan. At the same time, this comparison provides stronger incentives for service providers to improve service quality for customers on underperforming services; a small number of underperforming services can have an appreciable effect on an RSP's overall performance metrics.

Underperforming services represented 7.7% of the 1,199 NBN services that were tested for this report. 97% of underperforming NBN services are fibre to the node connections. 97% of underperforming NBN services are on NBN50 and NBN100 plans. The average download performance once underperforming services are excluded is 100.0% as against the 96.6% figure quoted earlier for all services. This means that if underperforming services had been remediated before the measurements were collected then overall download performance would have been 3.4 percentage points higher than was actually observed during the period.

As in previous reports, all RSPs' performance were impacted to some extent by underperforming services during the period.

Figure 10: Average download speed by RSP - all hours

Inclusive and exclusive of underperforming services. Error bars indicate 95% confidence intervals of the mean.

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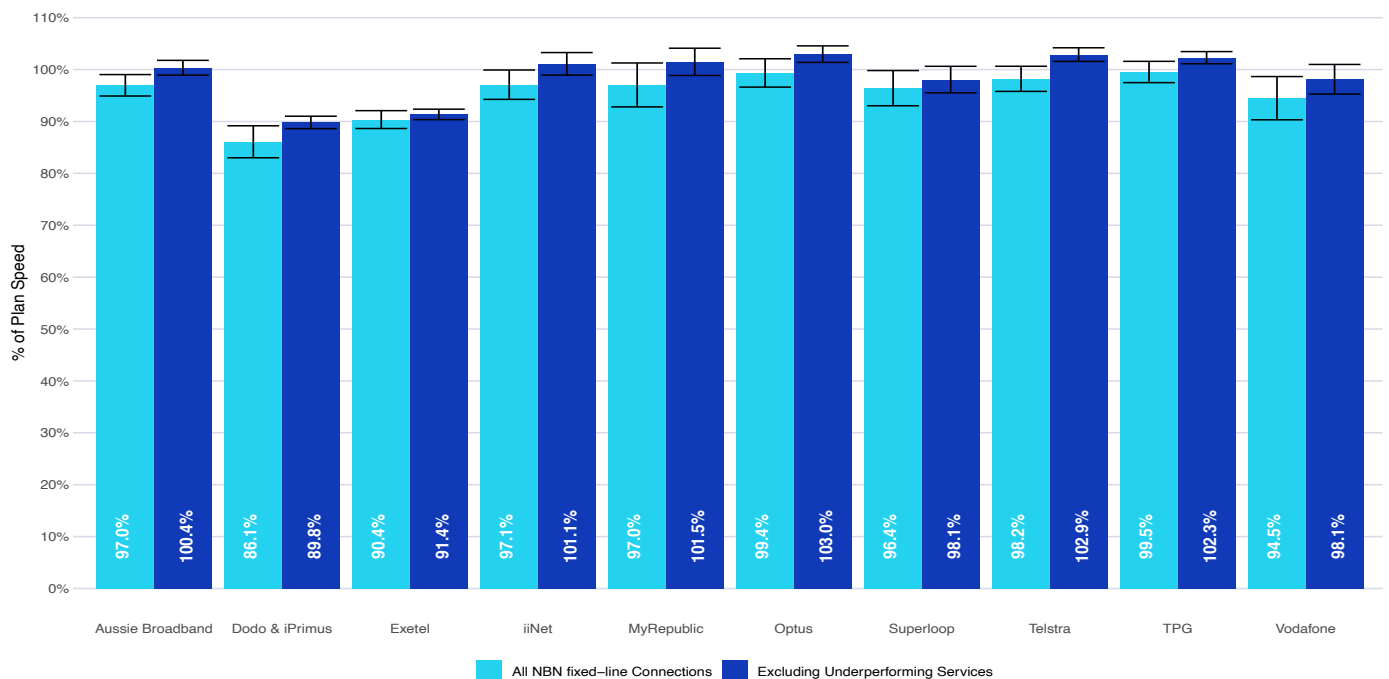
2   We classify a service as 'underperforming' if no more than 5 percent of speed tests that we conducted over the service achieved a speed that was above 75 percent of plan speed. This test effectively identifies those services with maximum attainable speeds that fall closer to the plan speed of a lower speed tier than to the plan speed of the consumer's current tier.

Download Speed by NBN Plan and Access Technology

The following chart shows average download speed for different access technologies for different NBN speed tiers.

Figure 11: Average Download speed by plan and technology.

Including underperforming services. Error bars indicate 95% confidence intervals of the mean.
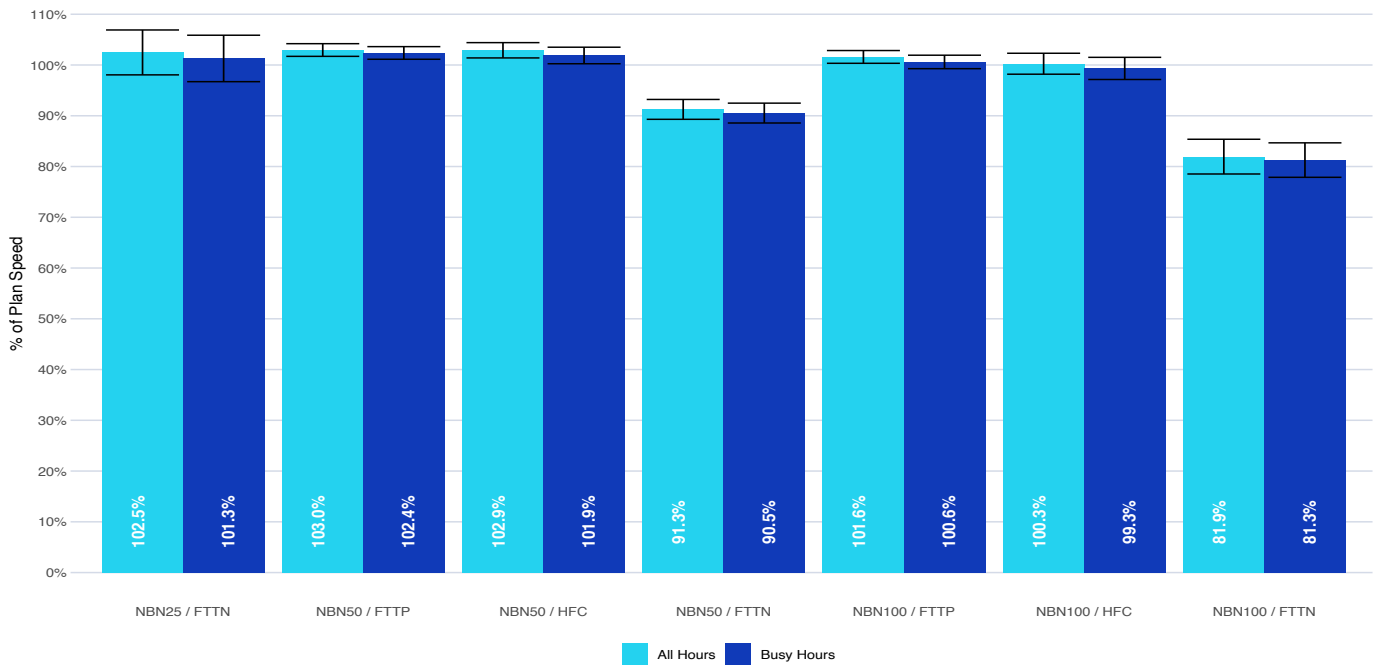
Within the NBN50 speed tier, fibre to the node services had an average download speed around 6 Mbps lower than other technologies, a difference of 12% when comparing in percentage terms as shown in the chart above. Within the NBN100 speed tiers, fibre to the node services had an average download speed around 18 Mbps lower than other technologies.

The pattern of results is similar to that seen in the previous report, with fibre to the node performing significantly below other access technologies for the 50 and 100 plans.

The following chart shows the impact of underperforming services on average download speed across different plans and technologies.

Figure 12: Average download speed by plan and technology - all hours

Inclusive and exclusive of underperforming services. Error bars indicate 95% confidence intervals of the mean.
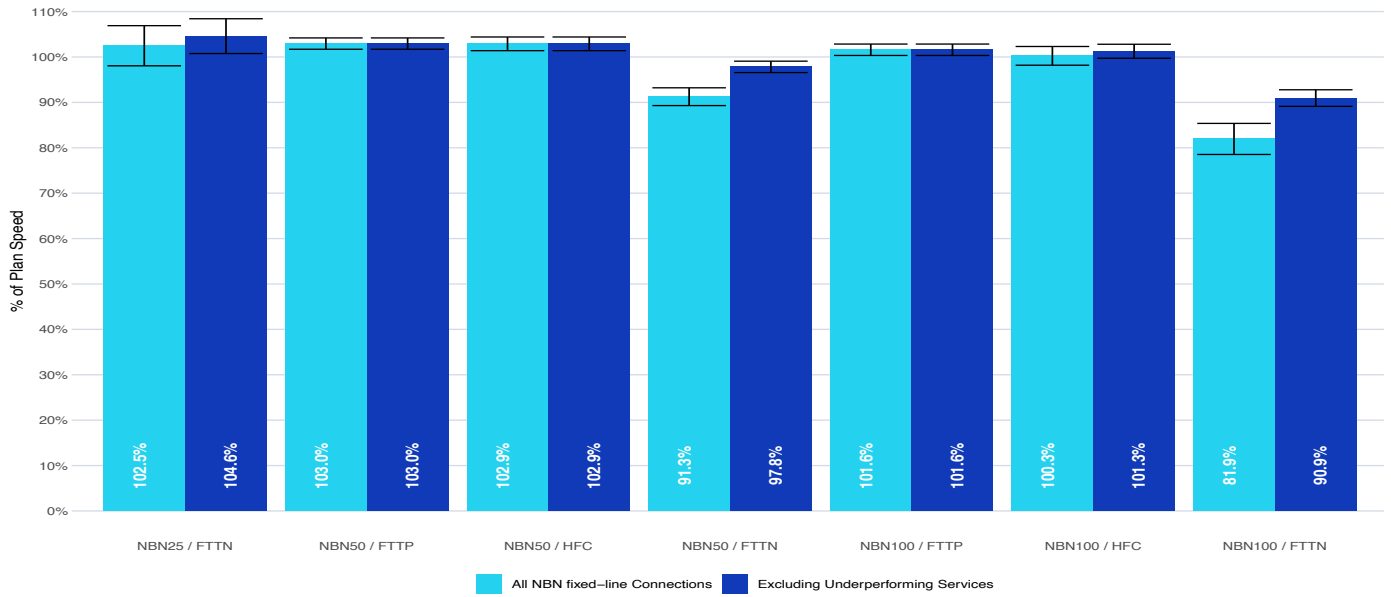
Fibre to the node continues to account for the bulk of the impact from underperforming services across both the NBN50 and NBN100 speed tiers.

Latency, Webpage Loading Time, and Packet Loss by Plan

The following chart shows average round trip latency, which is the average time required to send a packet of data to the test server and back. Lower latency will result in more responsive behaviour from real-time applications such as video conferencing and online gaming.

Figure 13: Average latency by RSP

Including underperforming services. Error bars indicate 95% confidence intervals of the mean.
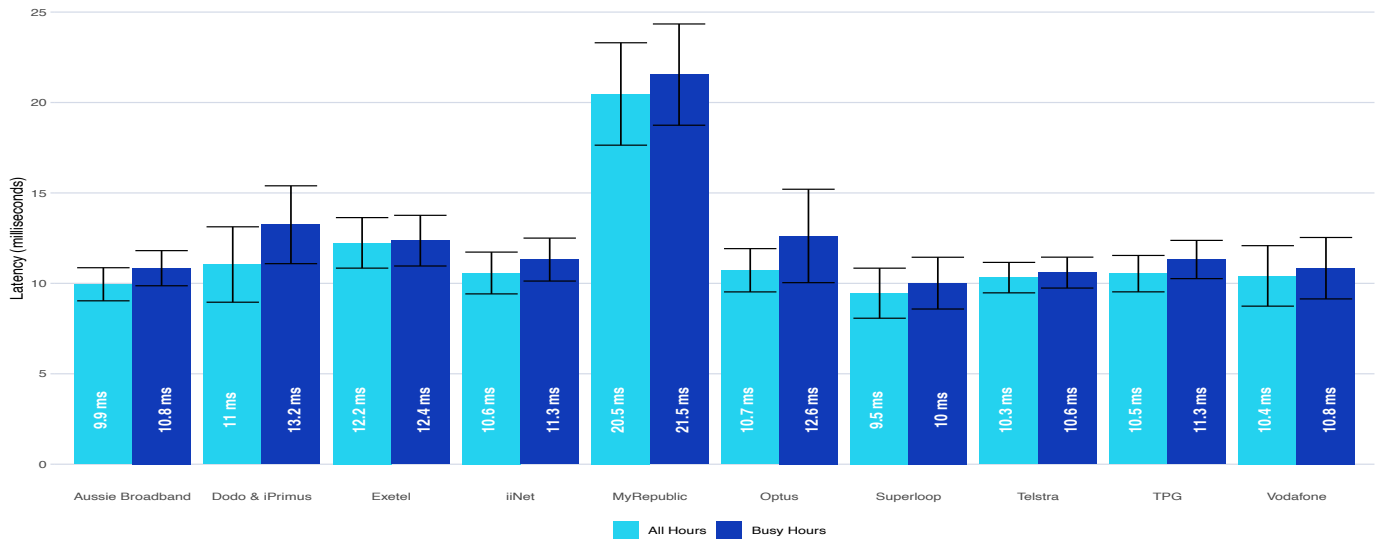
Latency results from this period are in line with the previous report: average latency was generally below 12ms during all hours across RSPs with the exception of MyRepublic.

MyRepublic services had higher average latency than connections served by other RSPs, although MyRepublic's average latency remained at a similar level during busy hours. It should be noted that latency at even 30ms would have a detrimental effect on only the most latency-sensitive applications and would be unlikely to be noticed by an end user.

The following chart shows the average time required to fully load eight popular webpages for Australian users across all NBN speed tiers, per RSP.

Figure 14: Average webpage loading time by RSP

Including underperforming services. Error bars indicate 95% confidence intervals of the mean.
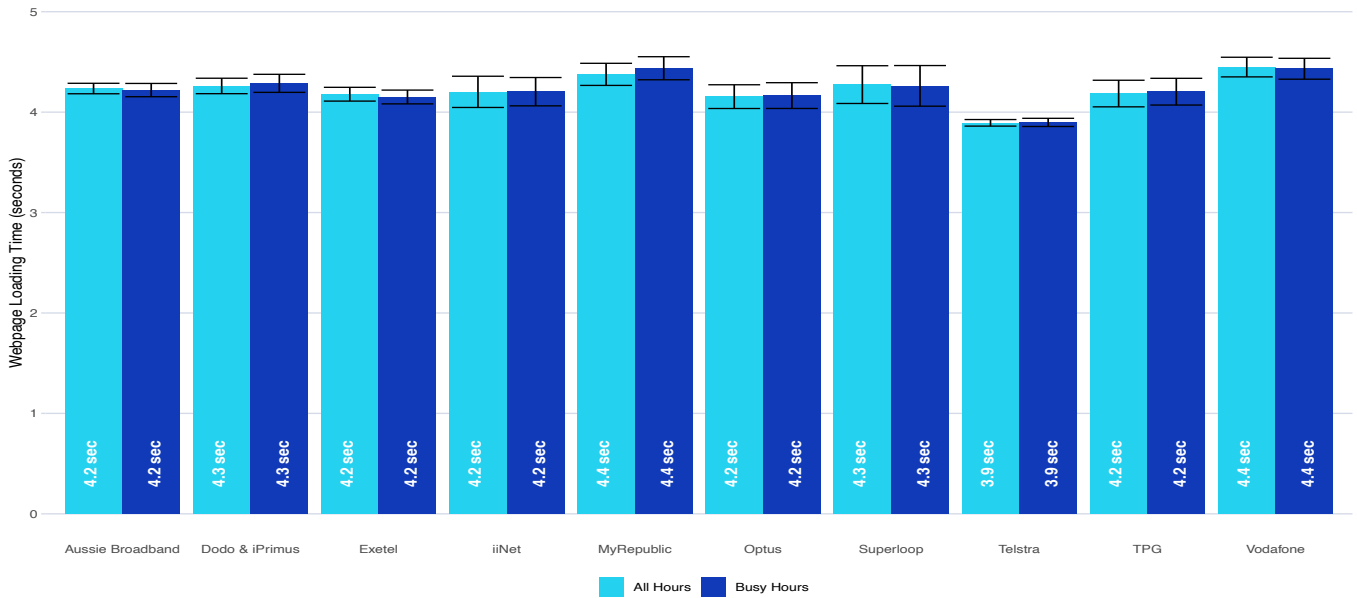
The average time needed to load a website increased since the previous reporting period by approximately 0.6 seconds for each RSP. This is mainly due to the average time to load one monitored website increasing by 60% (to an average of around 13 seconds) since the previous report. This increase affected the webpage loading time metric for all RSPs and so there are no material differences between RSPs by this metric. Even an increase of a few seconds may not have a huge visual impact to an end user. This is because websites are often designed so that the main elements of a page load first as the elements which come through in the final few seconds may not be needed immediately to get a general idea of the page's content.

The following chart shows the frequency at which different levels of packet loss occurred during tests. Packet loss measures the percentage of packets that were lost somewhere between your router and the test server, often due to network congestion. This is measured as a percentage of all packets sent.

Figure 15: Frequency of packet loss rates observed during tests - all hours

Including underperforming services.
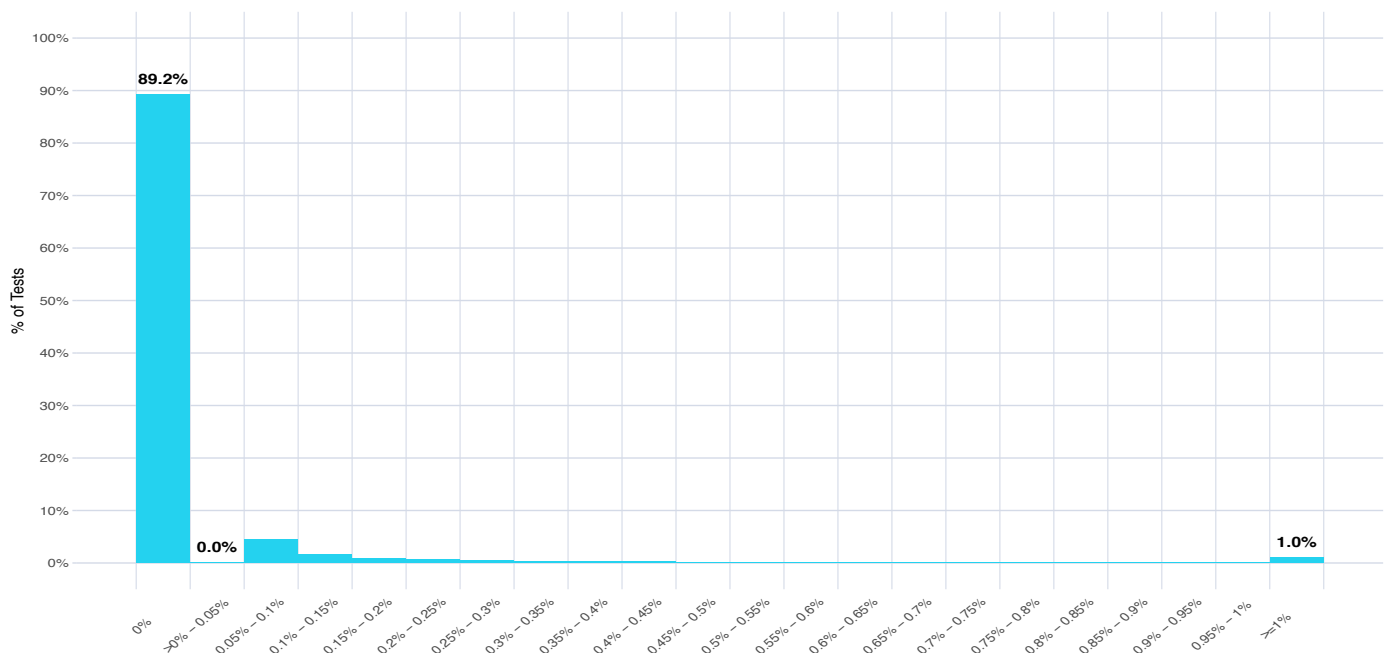
A total of nearly 787,696 packet loss tests were conducted over the measurement period. 89.2% of these tests had packet loss of either zero or less than 0.05%. For reference, in the previous report 81% of tests had packet loss below 0.05%.

At the other end of the scale, 1.0% of tests had packet loss greater than 1% as against 1.2% in the previous report. At levels above 1%, packet loss can cause issues which are detrimental to user experience, such as webpages failing to load.

Outages

Split by RSP, the following charts show:

- the average rate of daily outages for a service, indicating how often outages occurred; and

- the distribution of outage duration, indicating the severity of outages' impact on user experience.

Figure 16: Average daily outages per service lasting over 30 seconds by RSP - all hours
Including underperforming services.
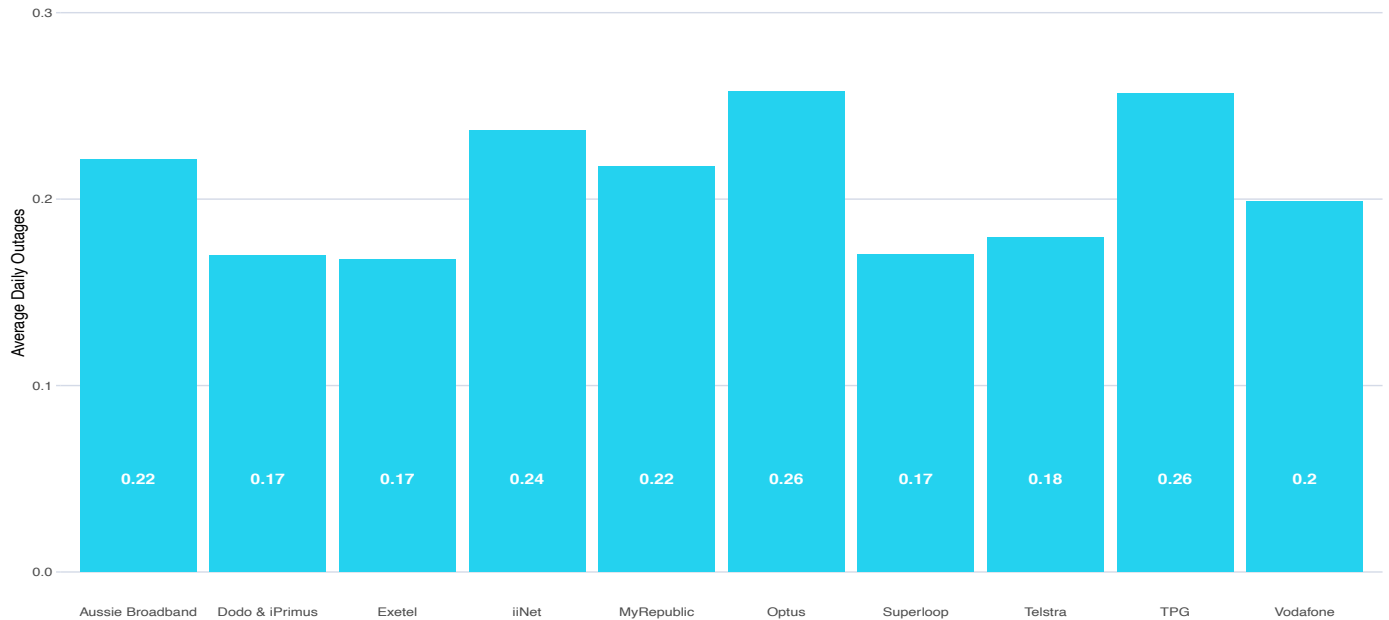
Figure 17: Distribution of outage duration by RSP - all hours
Including underperforming services.
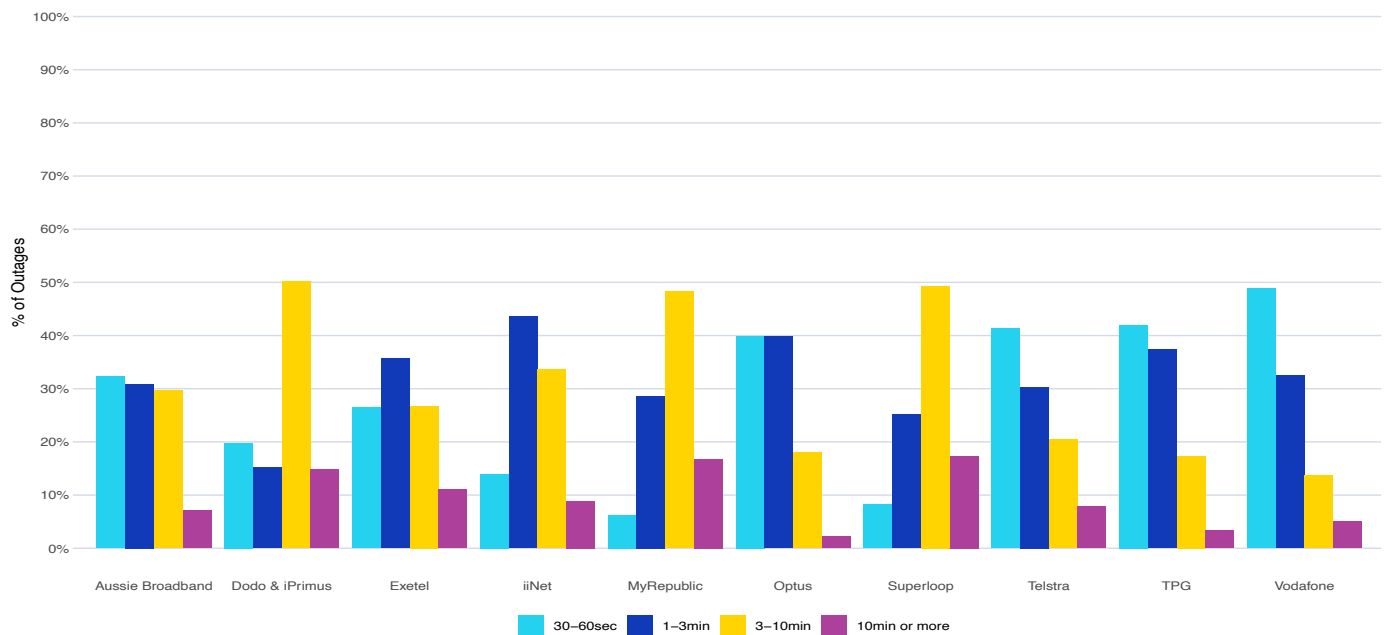
All RSPs' rates of outages were relatively low; no higher than the equivalent of one outage every three days. This, combined with the information that the majority of outages last for no more than 3 minutes, means that outages are likely to have little material impact on end user experience.

Download speed during the busiest hour

In this report, the busiest hour speed is the fifth-lowest average hourly download speed across each busy hour within the month. The measurement period had a total of 31 days with 4 busy hours each, totalling 124 busy hours in the month. For each busy hour, we calculate the average download performance (download speed as a percentage of plan speed) for each RSP. We take each RSP's fifth-lowest hourly download performance as an indicator of performance during the busiest hours when networks are under the highest levels of stress.

The chart below considers NBN50 and NBN100 plans and has three columns for each RSP:

* The first column is a weighted average of the typical busy hour speeds advertised for these plans by each RSP during the measurement period, expressed as a percentage of the maximum speed achievable by the plan. The weights used are the numbers of Whiteboxes online on the NBN50 and NBN100 plans. See the 'NBN50 and NBN100 Advertised Speed Tables' section further in the report for full detail.

* The second column shows download performance during busy hours, expressed as a percentage of plan speed.

* The third column shows download performance during the busiest hour (i.e. the fifth-lowest hourly average as explained above), expressed as a percentage of plan speed.

A result in which the busiest hour speed is relatively close to the average busy hour speed indicates that the plan is relatively unaffected by higher demand especially at busy times. Results in which busiest hour speeds are further below the average busy hour speeds indicates that the plan is more affected by particularly high demand peaks.

During the measurement period, RSPs advertised download speeds for their NBN50 and NBN100 products. These were between 80% and 100% of the maximum achievable by the products, with Exetel and Vodafone advertising the lowest speeds, and Telstra the highest (Telstra advertised a speed of 50 Mbps for its NBN50 plan and 100 Mbps for its NBN100 plan).

Any services which are underperforming (as defined above), or which have an acknowledged impairment which prevents the plan speed from being delivered, have been excluded.

Figure 18: Advertised speeds and average download speeds by RSP

50Mbps and 100Mbps NBN plans. Excluding underperforming and impaired services.
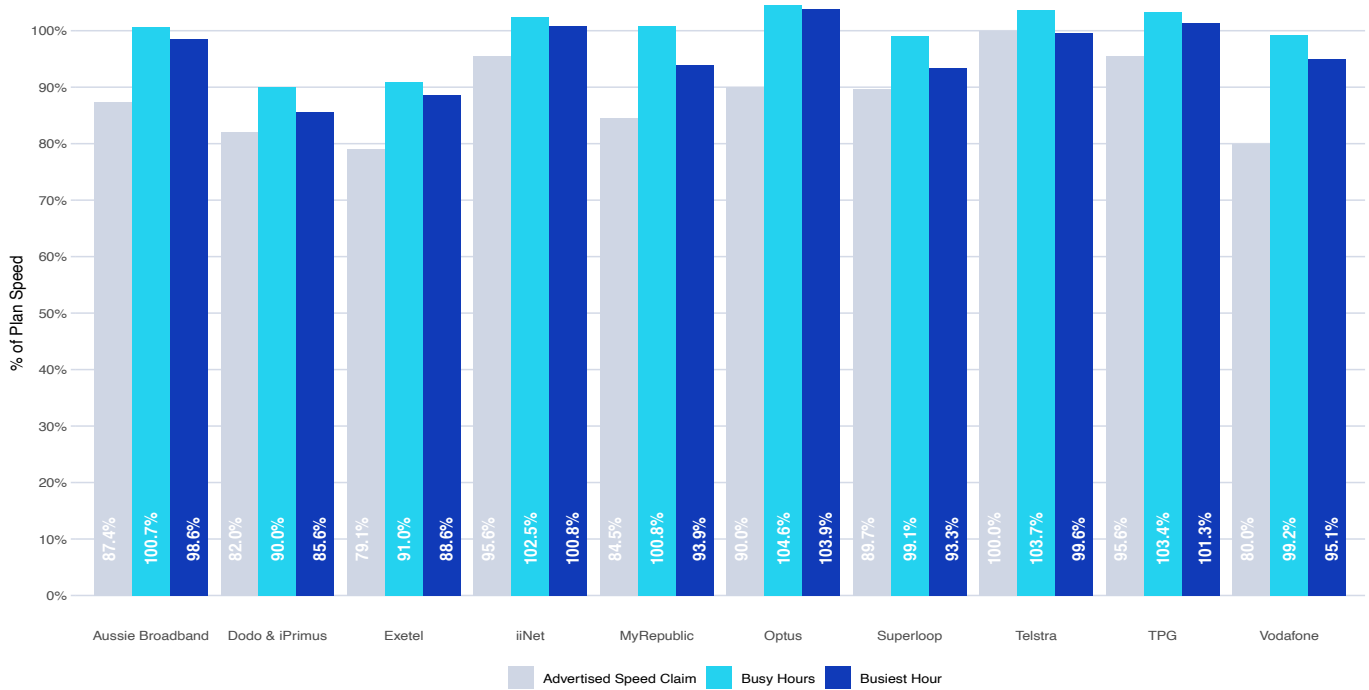
From these results we can see that if all underperforming services and impaired services had been remediated – or moved to a more appropriate plan - then all RSPs bar one would have average speeds that exceeded advertised speed claims during their busiest hour.

The chart below shows the percentage of busy hours during the period in which test speeds for NBN50 and NBN100 products met or exceeded the speeds advertised by RSPs.

Figure 19: Proportion of busy hours where advertised speed was achieved by RSP.

50Mbps and 100Mbps NBN plans. Excluding underperforming and impaired services.
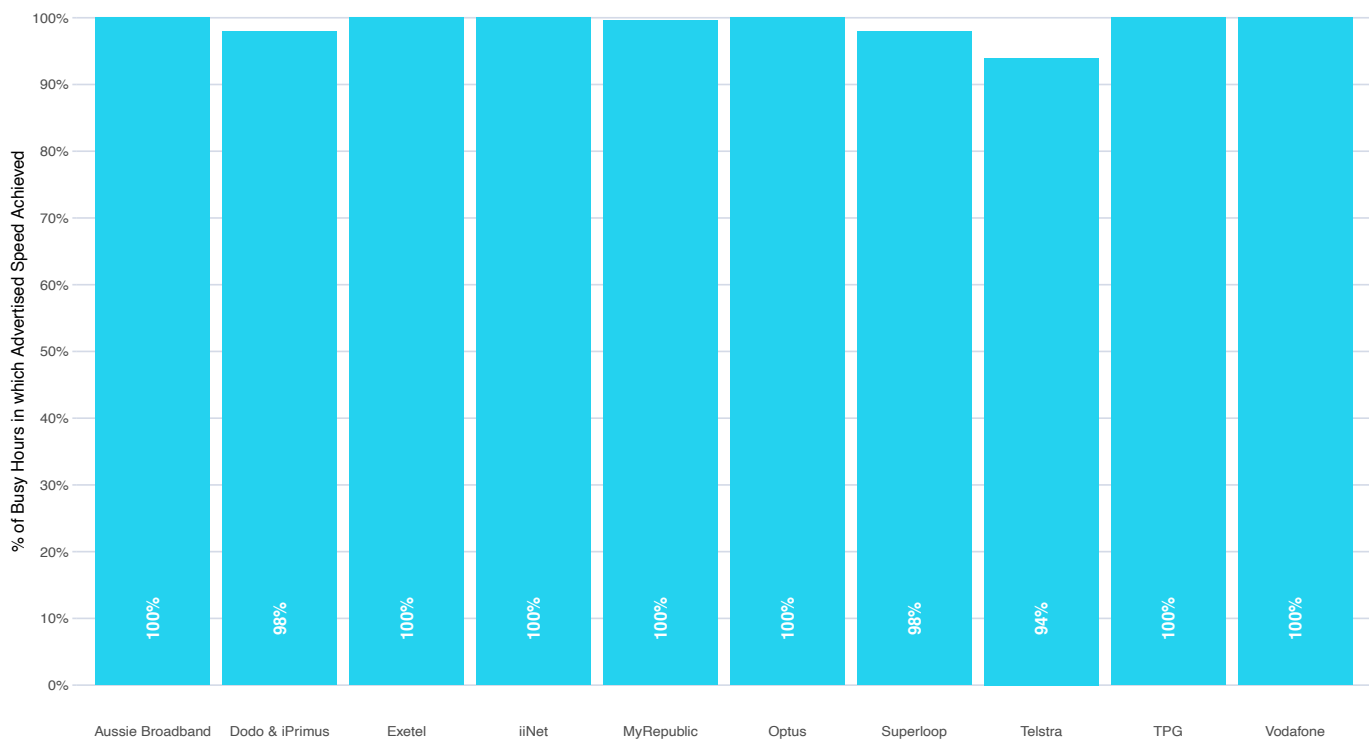
If all underperforming services and impaired services had been remediated – or moved to a more appropriate plan - then the proportion of busy hours when RSPs met their advertised speed claims would have been no lower than 94% for any tested provider.

This is the end of the report on NBN fixed-line services. The NBN fixed-line services tables are found at the end of the report following the subsequent NBN fixed wireless section.

NBN fixed wireless services

Results for NBN fixed wireless services in this section cover the same period, December 2020, as for fixed-line results.

This is the first fixed wireless section in a quarterly report and is designed to increase transparency for users of alternative technologies to fixed-line.

Fixed wireless performance is measured in much the same way as the fixed-line program, with SamKnows supplying its Whiteboxes to NBN fixed wireless internet users in Australia to measure the quality of experience of their internet.

The objective of this report matches that the goal of the wider Measuring Broadband Australia program to increase transparency and encourage greater performance-based competition and better internet performance throughout the country.

The following sections present a brief summary of metrics for the NBN fixed wireless sample, for the 25 Mbps and Fixed Wireless Plus plans.

SamKnows prepares these reports each quarter for publication by the ACCC. The metrics are also presented by the ACCC in a public dashboard at https://www.accc.gov.au/consumers/internet-landline-services/broadband-performance-data.

A data release contained underlying summary data for this report can be found at https://data.gov.au/.

Differences between NBN fixed-line and NBN fixed wireless connections

NBN fixed-line connections and NBN fixed wireless connections utilise different technologies that are not directly comparable in terms of performance. An NBN fixed-line connection utilises a physical line running to the household to connect it to the NBN network. There are a number of fixed-line technologies: fibre to the premises, fibre to the building, fibre to the curb, fibre to the node and hybrid fibre coaxial cable.

An NBN fixed wireless connection transmits data over radio signals to connect a household to the NBN network and uses similar technology to mobile networks. NBN typically uses this type of service in regional and remote areas, where the distance between households can be many kilometres, but outer metropolitan centres may also use NBN fixed wireless. Data travels from a transmission tower to an outdoor antenna fitted at the household. Each fixed wireless tower has one or more 'cells' containing the equipment that transmits signals to a dish or the outdoor antenna at a customer's home or other premise, allowing them to connect to the internet. NBN fixed wireless serves around 4 per cent of NBN consumers.

The quality and maximum speed of a fixed wireless connection is often more variable than fixed-line technology.

The following environmental factors may affect fixed wireless:

*   the distance of the consumer's premises to the fixed wireless tower

*   whether there is a clear line of sight between the antenna on the roof of the premises and the fixed wireless tower, or if there is an obstruction, such as foliage

*   weather conditions such as extreme heat or heavy rain

Another factor that may affect the performance of services provided over fixed wireless network congestion. Each fixed wireless cell has a finite amount of capacity (e.g. a certain number of megabits per second, or Mbps), which is shared between the households connected to that cell. Where more households in an area connect to a particular cell and/or those households increase their usage towards the limits of the cell, this can cause the cell to become congested. The impact of network congestion on the fixed wireless network is typically most noticeable during the busy hours (between 7pm and 11pm).

For further information on using NBN fixed wireless, see https://www.accc.gov.au/consumers/internet-landline-services/broadband-speeds/using-nbn-fixed-wireless.

Speed Test Results

Figure 20: Average download and upload speeds for fixed wireless

NBN fixed wireless plans. Error bars indicate 95% confidence intervals of the mean.
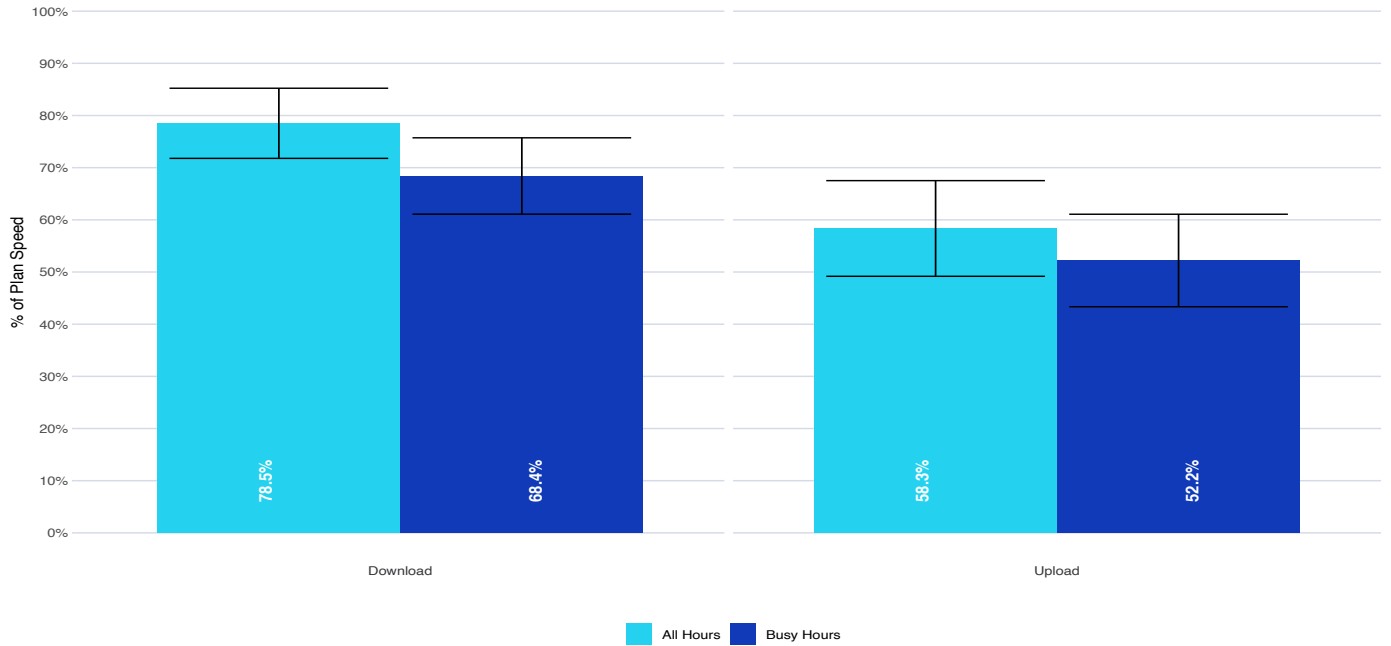
During this period, users on NBN fixed wireless connections attained an average download performance of 78.5% of plan speeds during all hours, significantly decreasing to 68.4% during the busy hours (between 7pm and 11pm) which is when networks experience higher user activity.[3]

NBN fixed wireless connections attained an average upload performance of 58.3% of plan speeds during all hours, decreasing to 52.2% during the busy hours (between 7pm and 11pm).

Figure 21: Average hourly download speed for the Fixed Wireless Plus plan

NBN fixed wireless plans.

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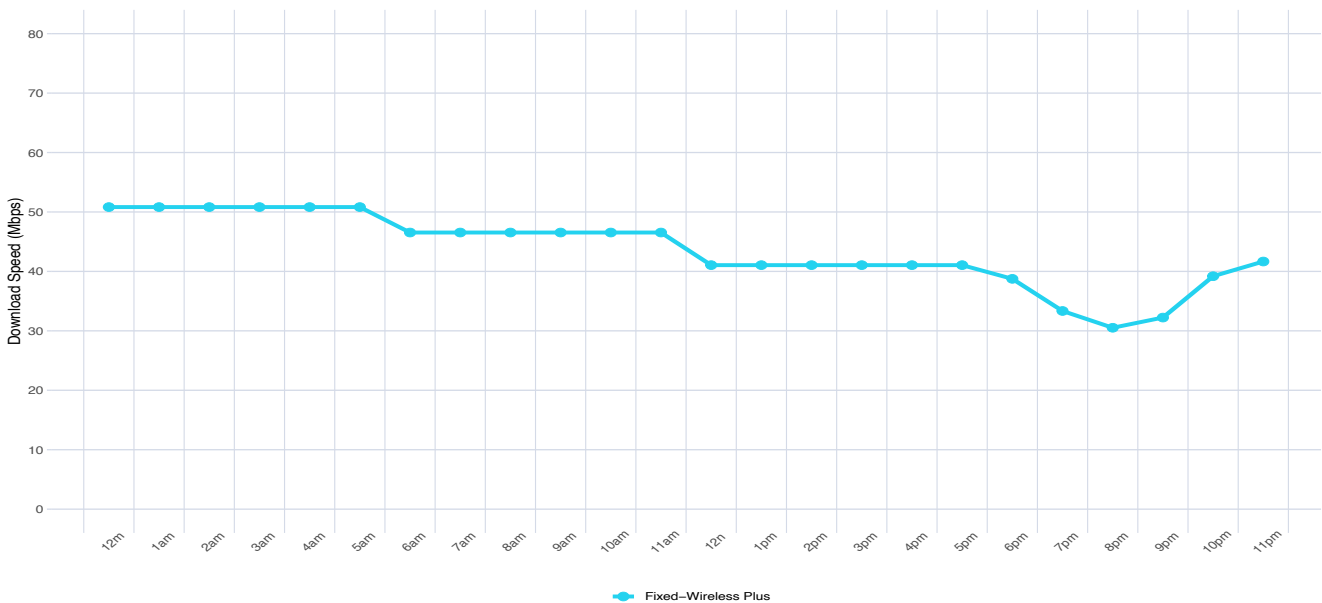
3   Please note, in this metric download speeds for fixed wireless Plus plans have been calculated as a percentage of a 50 Mbps benchmark speed.

Average download speeds showed considerable variation throughout the day for the fixed wireless Plus speed tier: speeds typically started to decrease during the evening, dipping to 20 Mbps below the day's maximum speed by 8pm, and would recover to higher levels later at night. While the significant decrease typically occurs during the busy hours (between 7pm and 11pm), there was also a notable decrease from midday, with speeds dipping to 10 Mbps below the day's maximum speed and remaining at that level during the course of the afternoon.

Uploads speeds showed a similar pattern to download speeds and recorded lower values during busy hours and during the afternoon. Both download and upload speeds show daily variation for fixed wireless products as can be expected with this technology. Network congestion can affect the fixed-wireless network, particularly during the busy hours (between 7pm and 11pm).

Figure 22: Average hourly upload speed for the Fixed Wireless Plus plan

NBN fixed wireless plans.
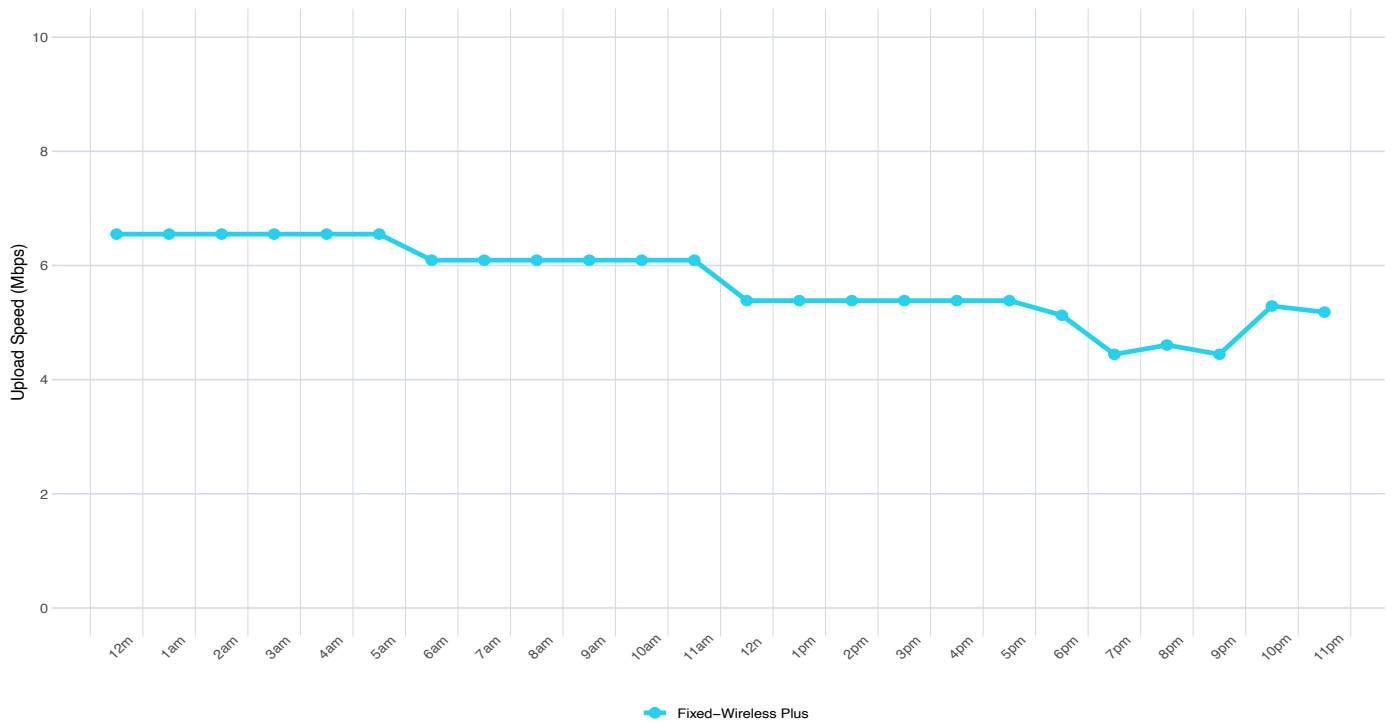
Latency, Packet Loss and Outages

The following section provides a brief overview of latency, packet loss and outages for fixed wireless plans.

Figure 23: Average latency for fixed wireless

NBN fixed wireless plans. Error bars indicate 95% confidence intervals of the mean.
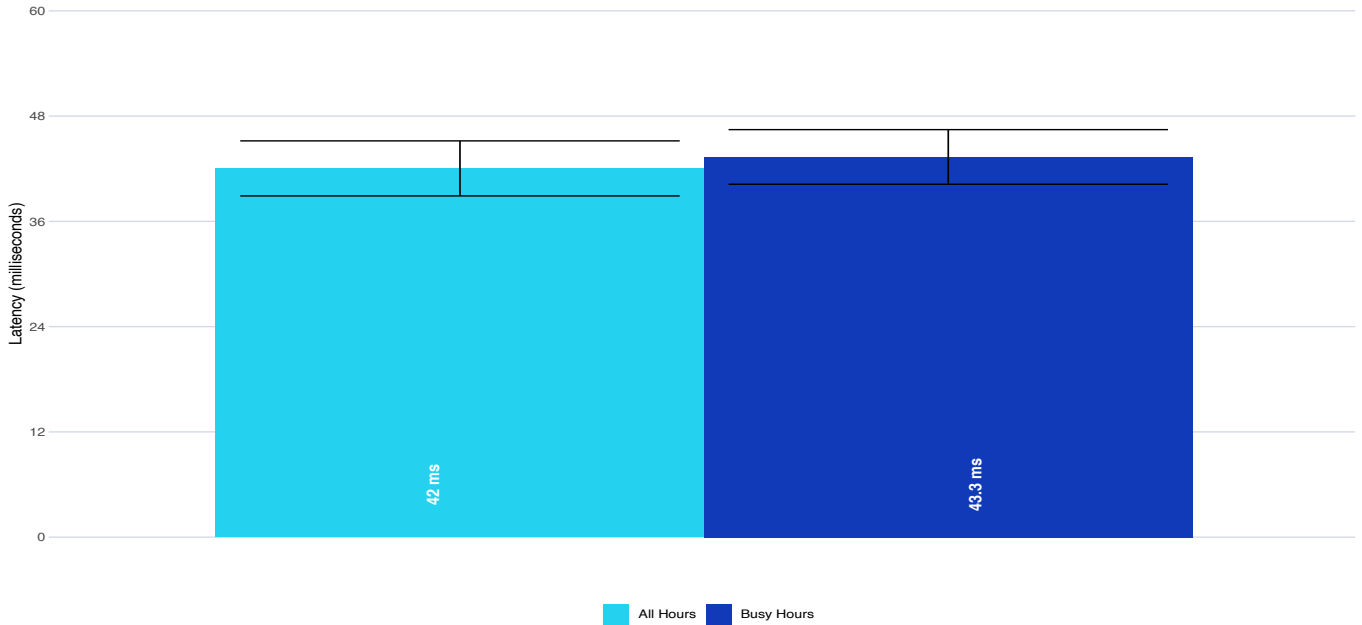
Average latency for fixed wireless plans was recorded as 42.0ms during all hours, rising slightly to 43.3ms during busy hours.

Figure 24: Frequency of packet loss rates observed during tests

NBN fixed wireless. All hours
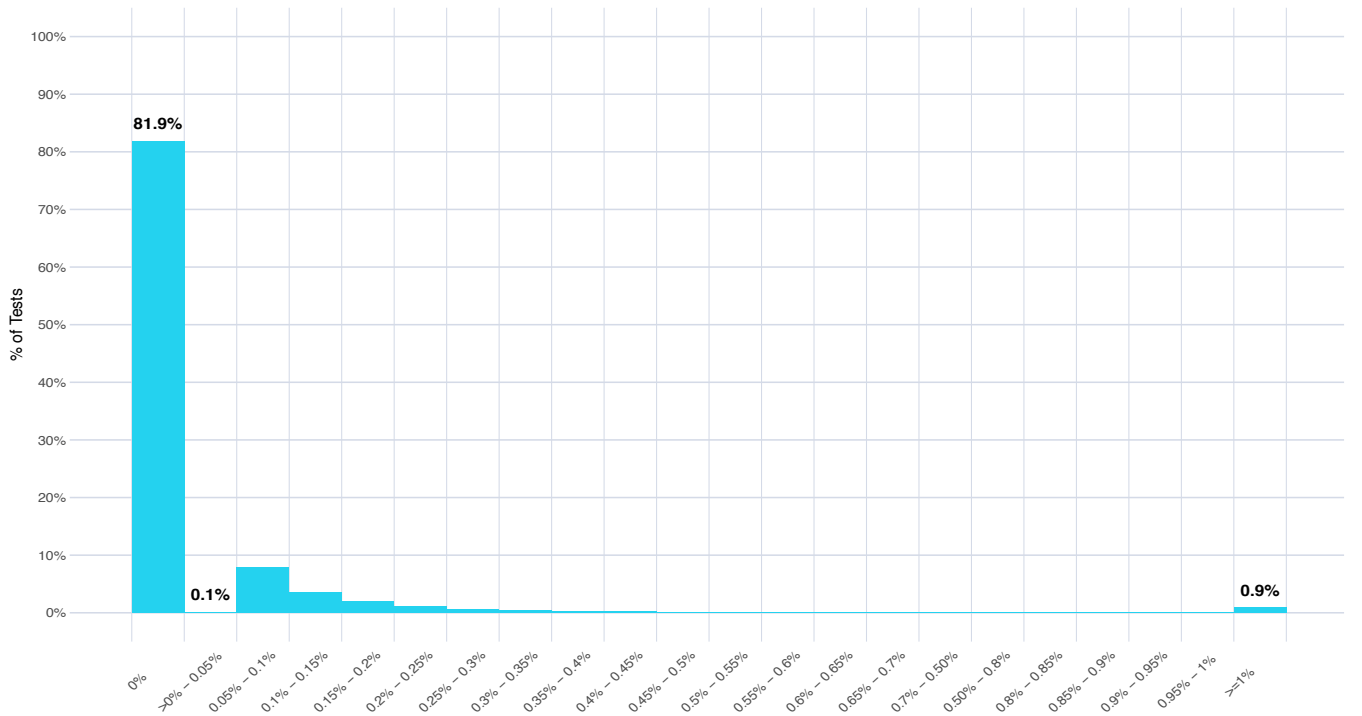
For fixed wireless, 31,213 packet loss tests were conducted over the measurement period. 82.0% of these tests had packet loss of either zero or less than 0.05%.

At the other end of the scale, 0.9% of tests had packet loss greater than 1%. At levels above 1%, packet loss can cause issues which are detrimental to user experience, such as webpages failing to load.
These results are broadly in line with those recorded for fixed-line services.
The following charts show, for fixed wireless services:

• the average rate of daily outages for a service, indicating how often outages occurred; and

• the distribution of outage duration, indicating the severity of outages' impact on user experience.

Figure 25: Average daily outages lasting over 30 seconds for fixed wireless
NBN fixed wireless. All hours. Error bars indicate 95% confidence intervals of the mean
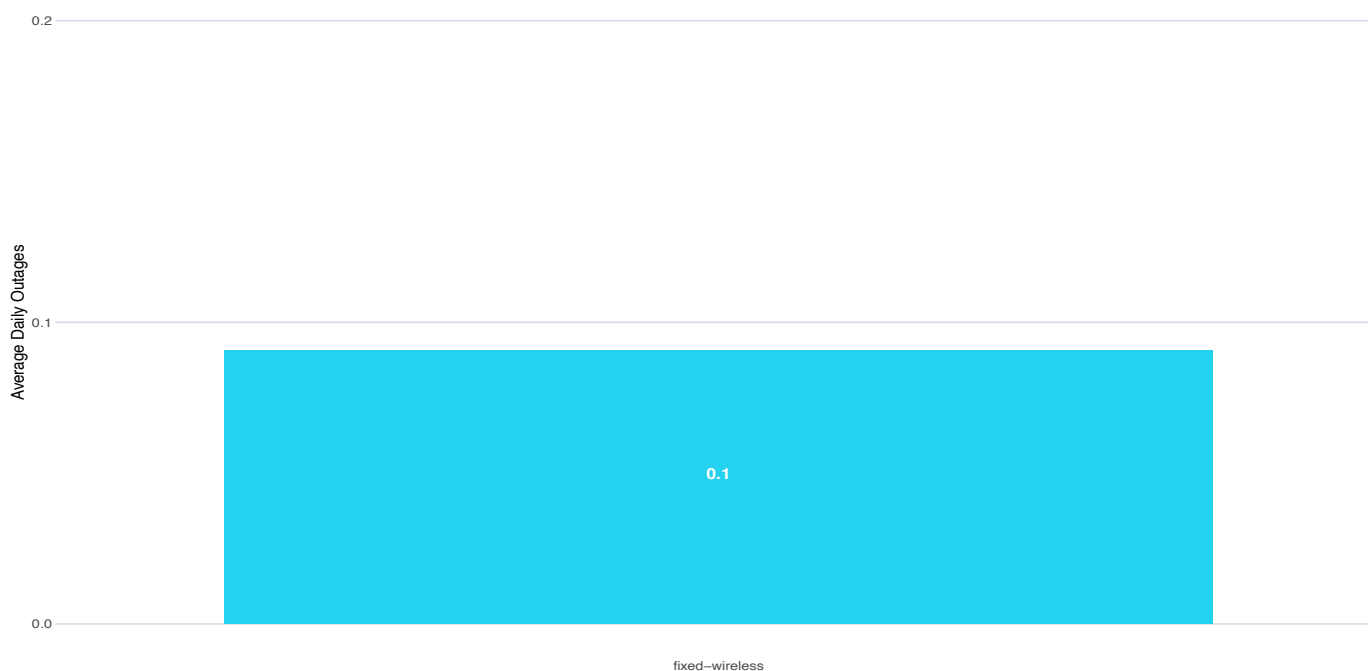
Figure 26: Distribution of outage duration for fixed wireless - all hours

NBN fixed wireless. All hours.
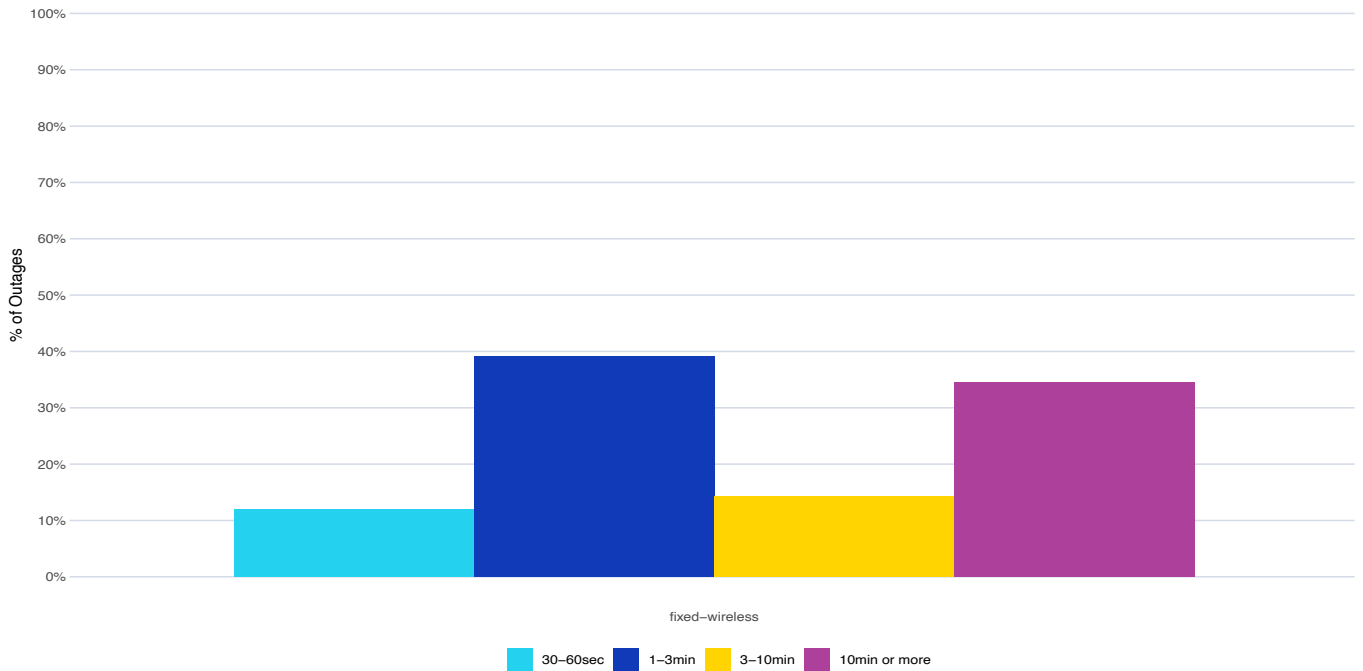
The rate of outages was low and compared favourably even to fixed-line plans, although the fixed wireless sample is small. While more outages for fixed wireless are of the longer variety, these charts give no indication user experience is being materially affected.

NBN fixed-line services tables

NBN RSP tables

The following tables show statistical information on download speeds, upload speeds, and outages for each RSP across all NBN speed tiers, and for individual NBN speed tiers in instances where at least 40 Whiteboxes reported successfully during the test period.

The overall speed is the average speed (download or upload) for the RSP, measured as a percentage of plan speed.
Standard deviation is a measure of how widely or narrowly test speeds are distributed in the data set.

The 95% confidence interval is a range in which the 'true' average value is estimated to lie and is a function of the sample size (i.e. number of Whiteboxes online) and standard deviation.

- If the standard deviation is larger then the confidence interval will be wider, reflecting greater variability in the underlying data. If the sample size is larger then the confidence interval will be narrower, reflecting more certainty in the underlying data.

- For example: during testing, we measured an average download performance of 85.6% of plan speed for Aussie Broadband across all NBN speed tiers with a 95% confidence interval of ±3.3%. If we were to repeat our sampling 100 times, we expect that this average would fall between 82.3% and 88.9% in at least 95 cases.

Period	RSP	Download Average % of Plan Speed (all hours)	Standard Deviation	95% Confidence Interval of the Mean	Panel Size	Number of Tests
All Hours	Aussie Broadband	97.0%	14.1%	94.9% - 99.0%	180	33,784
All Hours	Dodo & iPrimus	86.1%	12.1%	83.0% - 89.2%	59	10,616
All Hours	Exetel	90.4%	8.0%	88.6% - 92.1%	84	15,954
All Hours	iiNet	97.1%	18.3%	94.3% - 99.9%	161	32,250
All Hours	MyRepublic	97.0%	17.1%	92.8% - 101.3%	63	12,501
All Hours	Optus	99.4%	16.7%	96.6% - 102.1%	143	28,484
All Hours	Telstra	98.2%	17.5%	95.8% - 100.6%	200	41,452
All Hours	TPG	99.5%	13.6%	97.5% - 101.6%	169	33,312

Period	RSP					
All Hours	Superloop	96.4%	12.0%	93.0% - 99.8%	48	8,468
All Hours	Vodafone	94.5%	17.3%	90.3% - 98.7%	66	11,410

Period	RSP	Download Average % of Plan Speed (busy hours)	Standard Deviation	95% Confidence Interval of the Mean	Panel Size	Number of Tests
Busy Hours	Aussie Broadband	96.1%	14.4%	94.0% - 98.2%	179	11,353
Busy Hours	Dodo & iPrimus	85.0%	12.2%	81.8% - 88.2%	57	3,497
Busy Hours	Exetel	89.9%	8.5%	88.1% - 91.8%	84	5,396
Busy Hours	iiNet	96.5%	18.4%	93.6% - 99.3%	159	10,885
Busy Hours	MyRepublic	95.7%	17.3%	91.4% - 100.0%	63	3,868
Busy Hours	Optus	98.7%	16.8%	96.0% - 101.5%	143	9,193
Busy Hours	Telstra	97.1%	17.5%	94.6% - 99.5%	198	13,353
Busy Hours	TPG	98.9%	13.6%	96.8% - 100.9%	169	10,886
Busy Hours	Superloop	95.3%	12.1%	91.9% - 98.8%	48	2,923
Busy Hours	Vodafone	93.7%	17.4%	89.5% - 97.9%	66	3,708

Period	RSP	Upload Average % of Plan Speed (all hours)	Standard Deviation	95% Confidence Interval of the Mean	Panel Size	Number of Tests
All Hours	Aussie Broadband	82.0%	18.5%	79.3% - 84.7%	180	33,743
All Hours	Dodo & iPrimus	86.7%	20.3%	81.5% - 91.9%	59	10,643
All Hours	Exetel	90.3%	9.4%	88.2% - 92.3%	83	14,826
All Hours	iiNet	85.3%	30.2%	80.6% - 90.0%	161	32,283
All Hours	MyRepublic	87.2%	17.8%	82.7% - 91.6%	63	12,528
All Hours	Optus	84.3%	18.6%	81.2% - 87.3%	143	28,321
All Hours	Telstra	83.7%	19.6%	81.0% - 86.4%	200	41,505
All Hours	TPG	86.8%	19.2%	83.9% - 89.7%	169	33,206
All Hours	Superloop	86.4%	14.5%	82.3% - 90.5%	48	8,430
All Hours	Vodafone	87.0%	18.3%	82.5% - 91.4%	66	11,388

Period	RSP	Upload Average % of Plan Speed (busy hours)	Standard Deviation	95% Confidence Interval of the Mean	Panel Size	Number of Tests
Busy Hours	Aussie Broadband	81.6%	18.8%	78.8% - 84.3%	179	11,377
Busy Hours	Dodo & iPrimus	86.0%	20.8%	80.6% - 91.4%	57	3,507
Busy Hours	Exetel	90.1%	9.4%	88.1% - 92.1%	83	5,019
Busy Hours	iiNet	85.1%	30.5%	80.4% - 89.9%	159	10,848

Period	RSP						
Busy Hours	MyRepublic	86.7%	17.8%	82.3% - 91.1%	63	3,848
Busy Hours	Optus	83.9%	18.6%	80.8% - 86.9%	143	9,150
Busy Hours	Telstra	83.4%	19.7%	80.6% - 86.1%	198	13,381
Busy Hours	TPG	86.5%	19.2%	83.6% - 89.4%	169	10,851
Busy Hours	Superloop	86.4%	14.4%	82.3% - 90.4%	48	2,898
Busy Hours	Vodafone	86.7%	18.3%	82.3% - 91.1%	66	3,694

Period	RSP	Download Speed Tier	Download Average % of Plan Speed (all hours)	Standard Deviation	95% Confidence Interval of the Mean	Panel Size	Number of Tests
All Hours	Aussie Broadband	50	94.4%	16.1%	90.8% - 98.0%	77	15,152
All Hours	Aussie Broadband	100	97.2%	12.2%	94.2% - 100.2%	62	10,758
All Hours	Exetel	50	90.5%	9.6%	88.0% - 93.1%	56	10,592
All Hours	iiNet	50	94.1%	18.7%	90.2% - 98.0%	88	18,586
All Hours	iiNet	100	97.8%	11.9%	94.7% - 100.9%	55	9,822
All Hours	Optus	50	101.8%	14.3%	98.6% - 104.9%	79	16,462
All Hours	Optus	100	95.3%	19.2%	90.4% - 100.2%	59	10,761
All Hours	Telstra	50	97.5%	18.6%	94.0% - 100.9%	113	23,853
All Hours	Telstra	100	97.1%	15.9%	93.2% - 101.0%	63	11,909
All Hours	TPG	50	99.8%	12.0%	97.1% - 102.4%	79	15,703
All Hours	TPG	100	96.0%	18.7%	90.9% - 101.2%	51	9,543

Period	RSP	Download Speed Tier	Download Average % of Plan Speed (busy hours)	Standard Deviation	95% Confidence Interval of the Mean	Panel Size	Number of Tests
Busy Hours	Aussie Broadband	50	93.8%	16.1%	90.2% - 97.4%	77	5,049
Busy Hours	Aussie Broadband	100	96.5%	12.3%	93.4% - 99.6%	61	3,588
Busy Hours	Exetel	50	90.2%	10.0%	87.5% - 92.8%	56	3,584
Busy Hours	iiNet	50	93.4%	18.7%	89.5% - 97.4%	87	6,175
Busy Hours	iiNet	100	97.2%	11.7%	94.1% - 100.3%	54	3,448
Busy Hours	Optus	50	101.2%	14.4%	98.1% - 104.4%	79	5,147
Busy Hours	Optus	100	94.6%	19.4%	89.6% - 99.5%	59	3,622
Busy Hours	Telstra	50	96.3%	18.5%	92.9% - 99.7%	111	7,603
Busy Hours	Telstra	100	95.9%	16.2%	91.9% - 99.9%	63	3,907

Period	RSP	Upload Speed Tier	Upload Average % of Plan Speed (all hours)	Standard Deviation	95% Confidence Interval of the Mean	Panel Size	Number of Tests
Busy Hours	TPG	50	99.2%	12.0%	96.5% - 101.8%	79	5,053
Busy Hours	TPG	100	95.4%	18.6%	90.3% - 100.5%	51	3,155

Period	RSP	Upload Speed Tier	Upload Average % of Plan Speed (all hours)	Standard Deviation	95% Confidence Interval of the Mean	Panel Size	Number of Tests
All Hours	Aussie Broadband	20	81.0%	19.5%	77.4% - 84.6%	115	22,411
All Hours	Dodo & iPrimus	20	85.8%	23.1%	78.9% - 92.7%	43	7,686
All Hours	Exetel	20	89.2%	11.2%	86.2% - 92.2%	55	10,011
All Hours	iiNet	20	78.2%	23.7%	73.3% - 83.1%	90	19,106
All Hours	iiNet	40	89.0%	9.0%	86.6% - 91.4%	53	9,330
All Hours	Optus	20	84.2%	19.2%	80.0% - 88.4%	82	16,821
All Hours	Optus	40	84.7%	17.8%	80.1% - 89.4%	56	10,245
All Hours	Telstra	20	81.5%	22.0%	77.6% - 85.4%	122	25,726
All Hours	Telstra	40	86.7%	14.0%	83.0% - 90.4%	54	10,104
All Hours	TPG	20	85.1%	20.2%	80.8% - 89.5%	83	16,346
All Hours	TPG	40	84.6%	18.2%	79.4% - 89.8%	47	8,819

Period	RSP	Upload Speed Tier	Upload Average % of Plan Speed (busy hours)	Standard Deviation	95% Confidence Interval of the Mean	Panel Size	Number of Tests
Busy Hours	Aussie Broadband	20	80.8%	19.5%	77.3% - 84.4%	115	7,411
Busy Hours	Dodo & iPrimus	20	85.3%	23.6%	78.2% - 92.4%	42	2,589
Busy Hours	Exetel	20	89.1%	11.2%	86.1% - 92.0%	55	3,385
Busy Hours	iiNet	20	77.9%	23.7%	72.9% - 82.8%	89	6,317
Busy Hours	iiNet	40	88.8%	9.0%	86.3% - 91.2%	52	3,266
Busy Hours	Optus	20	84.0%	19.3%	79.8% - 88.2%	82	5,297
Busy Hours	Optus	40	84.0%	18.0%	79.3% - 88.7%	56	3,429
Busy Hours	Telstra	20	81.2%	22.2%	77.2% - 85.2%	120	8,217
Busy Hours	Telstra	40	86.2%	14.1%	82.4% - 89.9%	54	3,323
Busy Hours	TPG	20	85.0%	20.1%	80.7% - 89.3%	83	5,286
Busy Hours	TPG	40	84.3%	18.2%	79.1% - 89.5%	47	2,901

RSP	Average Daily Outages Lasting Longer than 30 Seconds	Standard Deviation	95% Confidence Interval of the Mean	Panel Size
Aussie Broadband	0.22	0.73	0.11 - 0.33	178

Dodo & iPrimus	0.17	0.23	0.11 - 0.23	59
Exetel	0.17	0.46	0.07 - 0.27	84
iiNet	0.24	1.03	0.08 - 0.40	160
MyRepublic	0.22	0.52	0.09 - 0.35	63
Optus	0.26	0.76	0.13 - 0.38	143
Telstra	0.18	0.85	0.06 - 0.30	199
TPG	0.26	1.33	0.06 - 0.46	168
Superloop	0.17	0.40	0.06 - 0.28	48
Vodafone	0.20	0.40	0.10 - 0.30	65

RSP	Percentage of Outages Lasting 30-60sec	Percentage of Outages Lasting 1-3min	Percentage of Outages Lasting 3-10min	Percentage of Outages Lasting 10min or more
Aussie Broadband	32.3%	30.9%	29.7%	7.1%
Dodo & iPrimus	19.8%	15.2%	50.2%	14.8%
Exetel	26.5%	35.7%	26.8%	11.0%
iiNet	14.0%	43.5%	33.6%	8.8%
MyRepublic	6.2%	28.6%	48.3%	16.8%
Optus	39.9%	39.8%	18.0%	2.2%
Superloop	8.2%	25.1%	49.4%	17.3%
Telstra	41.4%	30.3%	20.5%	7.8%
TPG	41.9%	37.4%	17.4%	3.3%
Vodafone	48.8%	32.4%	13.7%	5.1%

NBN speed tier tables

The following tables show statistical information on download and upload speeds for each NBN speed tier, including all tested RSPs.

The overall speed is the average speed (download or upload) for the particular NBN speed tier, measured as a percentage of plan speed.

Standard deviation is a measure of how widely or narrowly test speeds are distributed in the data set. The 95% confidence interval is a range in which the 'true' average value is estimated to lie.

- For example: during testing, we measured an average download performance of 95.0% of plan speed for users subscribed to 100Mbps NBN fixed-line plans with a 95% confidence interval of ±1.6%. If we were to repeat our sampling 100 times, we expect that this average would fall between 93.4% and 96.6% in at least 95 cases.

For the 12Mbps tier, the sample size is considered low and results are indicative only.

The dataset used for this report includes data from 17 services on 250 Mbps NBN speed tier. These services are implicitly included in the overall, by-RSP, and by-technology results, but the sample size is too low for us to report on results for 250 Mbps tiers separately.

Period	Download Speed Tier	Download Average % of Plan Speed (all hours)	Standard Deviation	95% Confidence Interval of the Mean	Panel Size	Number of Tests
All Hours	12	101.8%	4.6%	100.0% - 103.7%	23	4,799
All Hours	25	102.3%	16.8%	99.2% - 105.5%	110	23,278
All Hours	50	96.1%	16.1%	94.8% - 97.4%	615	122,431
All Hours	100	95.2%	15.4%	93.7% - 96.6%	429	77,965

Period	Download Speed Tier	Download Average % of Plan Speed (busy hours)	Standard Deviation	95% Confidence Interval of the Mean	Panel Size	Number of Tests
Busy Hours	12	101.5%	4.6%	99.6% - 103.4%	22	1,587
Busy Hours	25	101.3%	17.3%	98.0% - 104.5%	110	7,602
Busy Hours	50	95.4%	16.2%	94.1% - 96.6%	611	39,838
Busy Hours	100	94.3%	15.5%	92.8% - 95.8%	427	26,092

Period	Upload Speed Tier	Upload Average % of Plan Speed (all hours)	Standard Deviation	95% Confidence Interval of the Mean	Panel Size	Number of Tests
All Hours	1	98.4%	7.5%	95.3% - 101.4%	23	4,799
All Hours	5	93.1%	34.3%	85.9% - 100.4%	85	18,354
All Hours	20	83.1%	20.6%	81.6% - 84.7%	701	138,301
All Hours	40	87.3%	13.8%	85.8% - 88.7%	347	61,856

Period	Upload Speed Tier	Upload Average % of Plan Speed (busy hours)	Standard Deviation	95% Confidence Interval of the Mean	Panel Size	Number of Tests
Busy Hours	1	98.2%	7.9%	94.9% - 101.5%	22	1,594
Busy Hours	5	92.8%	34.5%	85.5% - 100.2%	85	5,945
Busy Hours	20	82.9%	20.6%	81.4% - 84.4%	697	45,077
Busy Hours	40	86.8%	13.9%	85.4% - 88.3%	345	20,738

NBN technology tables

The following tables show statistical information on download speeds, upload speeds, and outages on a per-technology basis.

The overall speed is the average speed (download or upload) for the technology type, measured as a percentage of the plan speed for each subscriber.

Standard deviation is a measure of how widely or narrowly test speeds are distributed in the data set.
The 95% confidence interval is a range in which the 'true' average value is estimated to lie.

- For example: during testing, we measured an average download performance of 92.6% of plan speed for fibre to the premises NBN fixed-line connections with a 95% confidence interval of ±0.4%. If we were to repeat our sampling 100 times, we expect that this average would fall between 92.2% and 93.1% (rounded to 1 decimal place) in at least 95 cases.

Period	Technology	Download Average % of Plan Speed (all hours)	Standard Deviation	95% Confidence Interval of the Mean	Panel Size	Number of Tests
All Hours	Fibre to the premises - FTTP	102.3%	7.6%	101.4% - 103.1%	321	61,066
All Hours	Fibre to the curb - FTTC	99.4%	8.0%	97.7% - 101.2%	84	15,321
All Hours	Hybrid fibre-coaxial - HFC	101.6%	10.0%	100.3% - 102.8%	228	41,722
All Hours	Fibre to the node - FTTN	90.9%	19.6%	89.3% - 92.5%	566	114,459

Period	Technology	Download Average % of Plan Speed (busy hours)	Standard Deviation	95% Confidence Interval of the Mean	Panel Size	Number of Tests
Busy Hours	Fibre to the premises - FTTP	101.5%	7.9%	100.6% - 102.3%	317	20,138
Busy Hours	Fibre to the curb - FTTC	98.7%	8.2%	97.0% - 100.5%	84	5,050
Busy Hours	Hybrid fibre-coaxial - HFC	100.5%	10.6%	99.2% - 101.9%	227	13,815
Busy Hours	Fibre to the node - FTTN	90.1%	19.6%	88.5% - 91.7%	564	37,558

Period	Technology	Upload Average % of Plan Speed (all hours)	Standard Deviation	95% Confidence Interval of the Mean	Panel Size	Number of Tests
All Hours	Fibre to the premises - FTTP	92.8%	9.9%	91.7% - 93.9%	320	60,619
All Hours	Fibre to the curb - FTTC	91.2%	6.9%	89.7% - 92.6%	84	15,256
All Hours	Hybrid fibre-coaxial - HFC	90.1%	10.0%	88.8% - 91.4%	228	41,269
All Hours	Fibre to the node - FTTN	78.2%	26.0%	76.1% - 80.3%	566	114,066

Period	Technology	Upload Average % of Plan Speed (busy hours)	Standard Deviation	95% Confidence Interval of the Mean	Panel Size	Number of Tests
Busy Hours	Fibre to the premises - FTTP	92.7%	10.1%	91.6% - 93.8%	316	19,968
Busy Hours	Fibre to the curb - FTTC	91.0%	6.9%	89.6% - 92.5%	84	5,018

Busy Hours	Hybrid fibre-coaxial - HFC	89.4%	10.2%	88.1% - 90.7%	227	13,631
Busy Hours	Fibre to the node - FTTN	77.9%	26.1%	75.8% - 80.1%	564	37,450

Technology	Average Daily Outages Lasting Longer than 30 Seconds	Standard Deviation	95% Confidence Interval of the Mean	Panel Size
Fibre to the premises - FTTP	0.14	0.57	0.0775 - 0.20	319
Fibre to the curb - FTTC	0.40	1.89	-0.0076 - 0.80	84
Hybrid fibre-coaxial - HFC	0.16	0.26	0.1224 - 0.19	225
Fibre to the node - FTTN	0.26	0.86	0.1842 - 0.33	564

Technology	Percentage of Outages Lasting 30-60sec	Percentage of Outages Lasting 1-3min	Percentage of Outages Lasting 3-10min	Percentage of Outages Lasting 10min or more
Fibre to the curb - FTTC	49.6%	42.8%	5.0%	2.5%
Fibre to the node - FTTN	25.4%	29.0%	38.0%	7.6%
Fibre to the premises - FTTP	43.1%	35.3%	15.7%	5.8%
Hybrid fibre-coaxial - HFC	21.2%	46.6%	18.9%	13.4%

NBN state tables

This table shows statistical information on download speeds on a per-state basis. In this report, we have been able to draw upon all of the test results from a range of locations.

The overall speed is the average speed (download or upload) for the state, measured as a percentage of the plan speed for each panellist.

Standard deviation is a measure of how widely or narrowly test speeds are distributed in the data set.
The 95% confidence interval is a range in which the 'true' average value is estimated to lie.

• For example: during testing, we measured an average download performance of 93.2% of plan speed for NBN fixed-line services in QLD, with a 95% confidence interval of ±2.8%. If we were to repeat our sampling 100 times, we expect that this average would fall between 90.4% and 95.9% (rounded to 1 decimal place) in at least 95 cases.

Period	State/Territory	Download Average % of Plan Speed (all hours)	Standard Deviation	95% Confidence Interval of the Mean	Panel Size	Number of Tests
All Hours	NSW	97.7%	16.3%	96.1% - 99.4%	378	75,300
All Hours	ACT	94.2%	15.9%	90.1% - 98.2%	58	10,445
All Hours	VIC	97.0%	14.1%	95.4% - 98.5%	330	62,113
All Hours	QLD	94.5%	17.9%	92.0% - 97.0%	196	36,417
All Hours	WA	95.9%	16.3%	92.8% - 98.9%	109	22,629
All Hours	TAS	97.1%	14.1%	93.2% - 100.9%	52	10,604
All Hours	NT + SA	96.9%	14.4%	93.7% - 100.1%	76	15,060

NBN50 and NBN100 Advertised Speed Tables

The figures in the following table are based on the typical evening hour speeds that were advertised by RSPs at the end of the measurement period. The single weighted average speed claim is calculated based on the number of Whiteboxes online for each RSP for each tier (excluding underperforming and impaired services).

RSP	NBN50 Advertised % of Plan Speed	NBN100 Advertised % of Plan Speed	Number of NBN100 Whiteboxes (excluding underperforming and impaired services	Number of NBN50 Whiteboxes (excluding underperforming and impaired services	Weighted Advertised % of Plan Speed
Aussie Broadband	86.0%	89.0%	54	58	87.4%
Dodo & iPrimus	82.0%	82.0%	15	26	82.0%
Exetel	80.0%	77.0%	22	54	79.1%
iiNet	96.0%	95.0%	47	64	95.6%
MyRepublic	86.0%	83.0%	26	27	84.5%
Optus	90.0%	90.0%	48	66	90.0%
Telstra	100.0%	100.0%	42	90	100.0%
TPG	96.0%	95.0%	43	65	95.6%
Superloop	88.8%	90.0%	26	9	89.7%
Vodafone	80.0%	80.0%	27	27	80.0%

Telstra's advertised speed claim of 100 Mbps for its NBN100 plan does not apply to fibre to the node or fibre to the curb services, and so these technologies are excluded from Telstra's counts.

There were 124 busy hours across the 31 day period from 1st October 2020 to 31st October 2020. The following table shows the proportion of busy hours in which each RSP's average speed for each tier met the advertised claims above.

RSP	% of busy hours in which advertised download speed met or exceeded	% of busy hours in which advertised download speed met or exceeded (excluding underperforming and impaired services)
Aussie Broadband	100%	100%
Dodo & iPrimus	83%	98%
Exetel	100%	100%
iiNet	55%	100%
MyRepublic	97%	100%
Optus	100%	100%
Superloop	89%	98%
Telstra	45%	94%
TPG	78%	100%
Vodafone	100%	100%

NBN Whiteboxes connected to underperforming services

The following table shows the number of Whiteboxes on NBN connections for each RSP, alongside the number of Whiteboxes connected to underperforming services.

RSP	NBN White-boxes	NBN Whiteboxes on under-performing services	% NBN Whiteboxes on under-performing services
Aussie Broadband	180	16	9%
Dodo & iPrimus	59	6	10%
Exetel	84	2	2%
iiNet	161	15	9%
MyRepublic	63	6	10%
Optus	143	10	7%
Other RSPs	26	1	4%
Superloop	48	2	4%
Telstra	200	19	10%
TPG	169	10	6%
Vodafone	66	5	8%
Total	1199	92	8%

As highlighted earlier in the report, the majority of underperforming services are connected to fibre to the node infrastructure.

The following table shows the number of Whiteboxes on fibre to the node services for each speed tier, alongside the number of underperforming services.

Technology	Speed Tier	NBN White-boxes	NBN Whiteboxes on underperform-ing services	% NBN Whitebox-es on underper-forming services
Fibre to the node - FTTN	100	122	29	24%
Fibre to the node - FTTN	12	13	0	0%
Fibre to the node - FTTN	25	71	3	4%
Fibre to the node - FTTN	50	356	57	16%
Fibre to the node - FTTN	Other NBN Speed plan_down-load_speeds	4	0	0%
Fibre to the node - FTTN	All NBN Speed Tiers	566	89	16%

How we test

Measuring from homes across Australia

- 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.
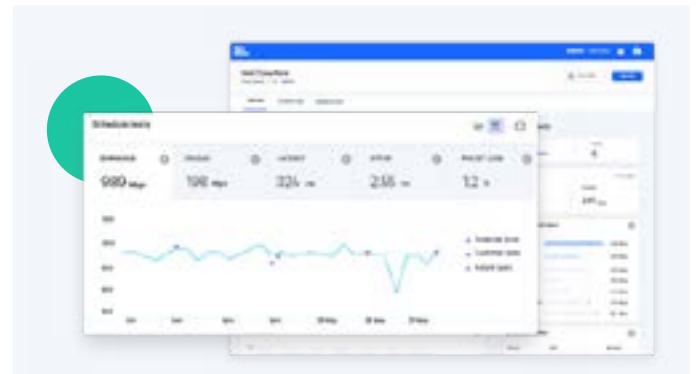
SamKnows One analytics

- 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 Australia in future reports: https://measuringbroadbandaustralia.com.au/signup

Our Tests

Metric		Definition
	Download	The speed data travels from our test server to your device, measured in bits per second.
	Upload	The speed data travels from your device to our test server, measured in bits per second.
	Latency	How long it takes a data packet to go from your device to our test server and back to your device.
	Jitter	Measures the amount of difference between packet delays, or the stability of your latency.
	Packet Loss	When a packet of data becomes lost (does not arrive for two seconds) measured as a percentage of packets lost out of packets sent.
	Outage	The outages metric tracks how many times per day your broadband connection goes offline for at least 20 seconds.
	Video Conferencing	Measures round-trip latency and reachability of a selection of video conferencing services.
	Video streaming	Measures the highest bitrate you can reliably stream for the most popular video in your country.
	Web browsing	Measures how long it takes to fetch the HTML and referenced resources of a popular website.
	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.