



MEASURING
BROADBAND
AUSTRALIA

Report 2, July 2018

In 2017, the Australian Competition and Consumer Commission (ACCC) appointed SamKnows to launch a project to measure internet performance. The program, named Measuring Broadband Australia, gives internet users in Australia access to SamKnows Whiteboxes to measure quality of experience for fixed-line internet.

The second report in the series builds on the initial findings released in March 2018 and provides more granular analysis on the state of broadband provision across the country. The goal of Measuring Broadband Australia is to increase transparency and encourage greater performance-based competition and better internet performance throughout the country.

The program tests fixed-line services. It does not test fixed wireless and satellite services.

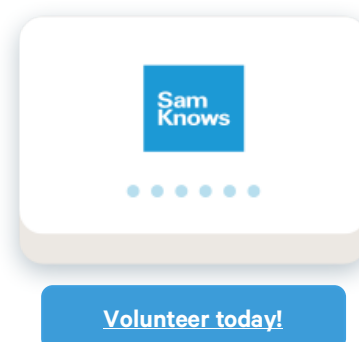
SamKnows One Analytics

- ◆ 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.










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.



Test Packages

We're running a bunch of tests and look to add more in the future. See below to find out more!

Tests	Definitions
 Download	The speed at which data can be transferred from the SamKnows test server to your computer, measured in megabits per second (Mbps). We also measure the percentage of the maximum plan download speed achieved. For example, a busy hour speed measure of 90% means that an RSP with maximum 100Mbps speed Plans is supplying an average speed of around 90Mbps in the evening busy hours. For its 50Mbps plans, it is supplying around 45Mbps, and for 25Mbps plans it is supplying around 22.5Mbps.
 Upload	The speed at which information is transferred from your computer to the SamKnows test server, measured in megabits per second (Mbps).
 Latency	How long it takes a data packet to go from your device to our test server and back to your device. The shorter the latency, the better.
 Jitter	Jitter is the variation in the delay of received packets, essentially it is a measure of the stability of your latency.
 Packet Loss	Packet loss is the number of packets that are sent over a network that don't make it to their destination, measured as a percentage of packets lost out of all packets sent.
 DNS	The Domain Name System (DNS) connects the website address to the actual website.
 Website load	The time it takes for a specific website to fully load. This is a combination test that includes download, latency and DNS in one test that accurately mimics real-world usage.

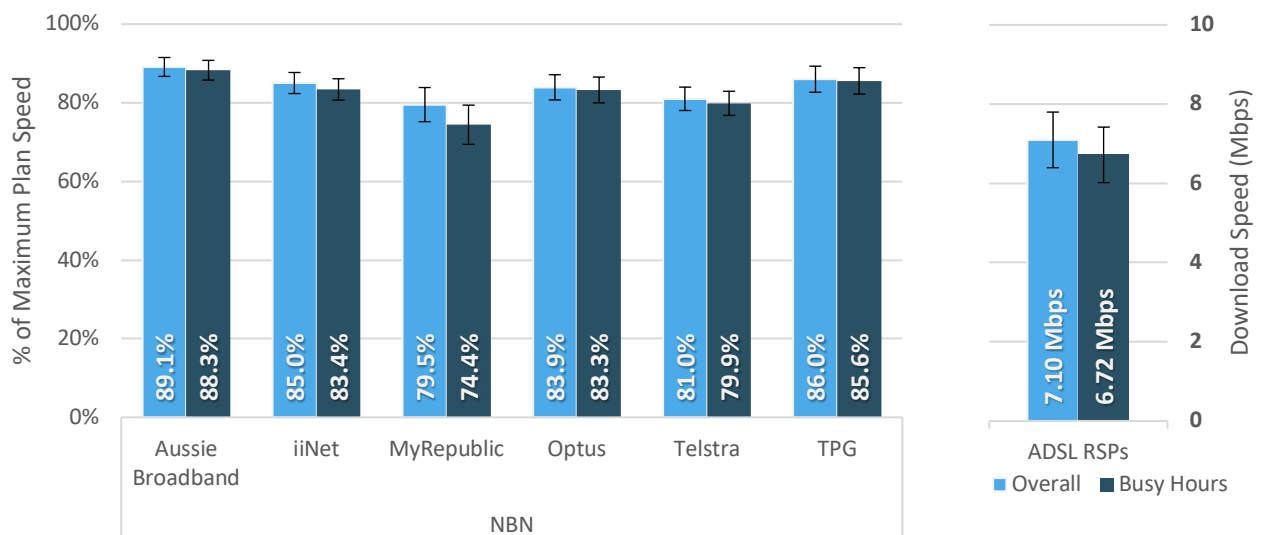
Overview

1 May 2018 – 31 May 2018

In this report, we present speed measures by comparing speeds achieved to maximum plan speeds that are available to consumers as based on the NBN speed tier for fixed-line services. This allows us to report on performance across a range of broadband plans, either at the network (NBN fixed-line or ADSL) level, or at the RSP (Retail Service Provider) level, on a like-for-like basis.

Some but not all RSPs advertise typical busy hour speeds that are below the maximum plan speeds. Hence, for those RSPs, where the report outlines speed measures below 100 percent of maximum plan speeds, this should not be interpreted as the RSP having failed to provide the speed measures that it advertised.

Average download speed



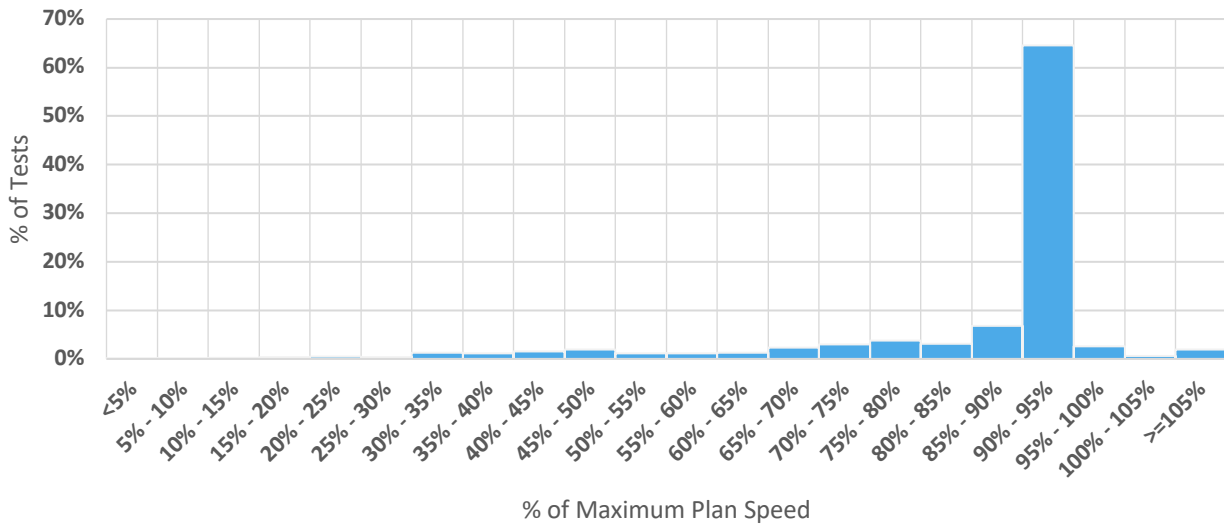
RSPs on NBN fixed-line provided users with overall download speeds ranging from just under 80% of their maximum plan speed and upward to 89%. A measure of 85% means that, for example, a user subscribed to “100Mbps download” plan would receive an average of 85Mbps, or a user subscribed to a “25Mbps download” plan is very likely to experience download speeds of just over 21Mbps.

Network congestion can negatively affect download speeds during the busiest hours of the day (7pm to 11pm), but this congestion effect was generally very limited, with download speeds decreasing by approximately 1 percentage point for most RSPs.

ADSL products delivered an average download speed of 7.1Mbps, but network congestion during busy hours was more pronounced, with speeds decreasing by 5%.

The 95% confidence intervals in the chart – which are determined by the number of Whiteboxes and their individual results – are a measure of how certain we are (in this case, 95% certain) that the true average download speed lies between the upper and lower boundary indicated by the thin black lines. For example, the boundaries for Aussie Broadband are very narrow and we are 95% certain that the average – if we were to repeat our measurements – would lie between 86.7% and 91.5%.

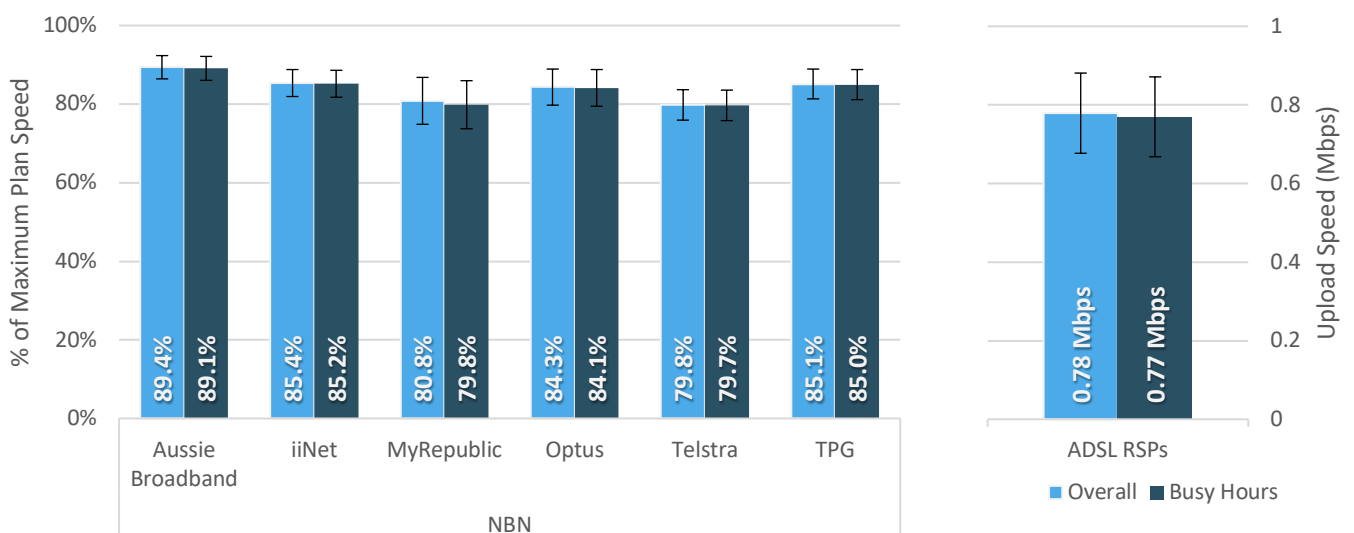
Average NBN download speeds attained during tests



During the month of May, over 145,000 download speed tests were conducted on Whiteboxes connected to fixed-line NBN infrastructure – more than doubling the number of tests performed during March of this year. In 70% of tests, download speeds were at least 90% of the maximum plan speed.

A minority – but nevertheless significant – number of tests (7.4%) failed to achieve 50% of the RSP’s plan speed. These results highlight the negative impact of physical limitations and are further explored in a subsequent section of this report. The physical limitations could take the form of interference that affects communications as they pass over the access network, or potentially even issues affecting the in-premise router (e.g old routers that do not fully support the maximum plan speed).

Average upload speed

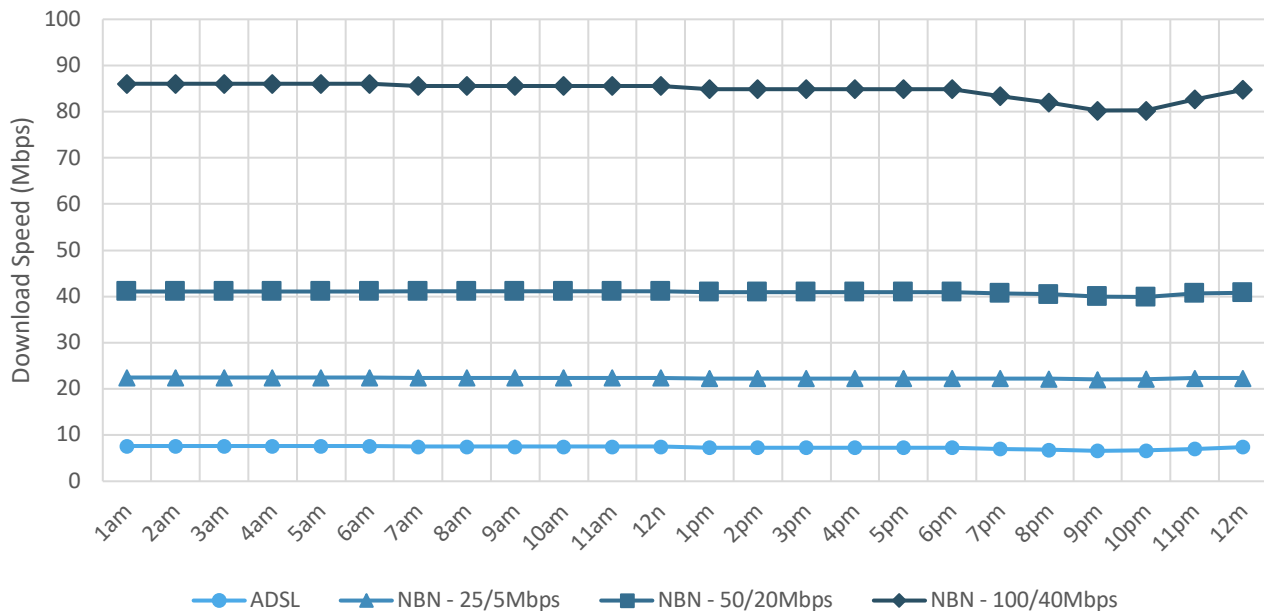


Upload speeds were generally in line with the download speeds tested for each RSP, ranging from an overall average of 80% to close to 90% of maximum plan speed on NBN fixed-line plans with virtually no impact from network congestion during the busiest hours of the day. ADSL products were similarly unimpacted by network congestion, providing users with nearly 0.8Mbps upload speeds on average.

The ranges shown by the 95% confidence interval are slightly larger than for download speeds, and can be interpreted as follows: taking MyRepublic as an example, the overall average upload speed during tests was

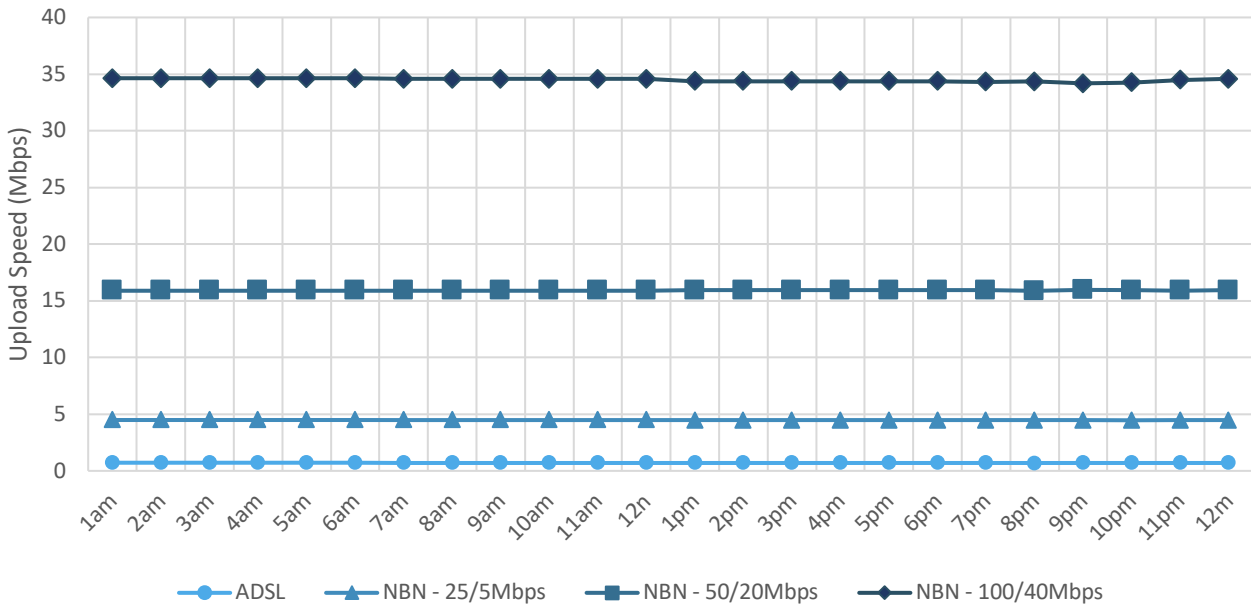
80.8%, with a 95% confidence interval of $\pm 6\%$. This means that if we were to repeat our measurement process, we are 95% certain that the average will be between 74.8% and 86.8%.

Average hourly download speeds – ADSL and NBN plans



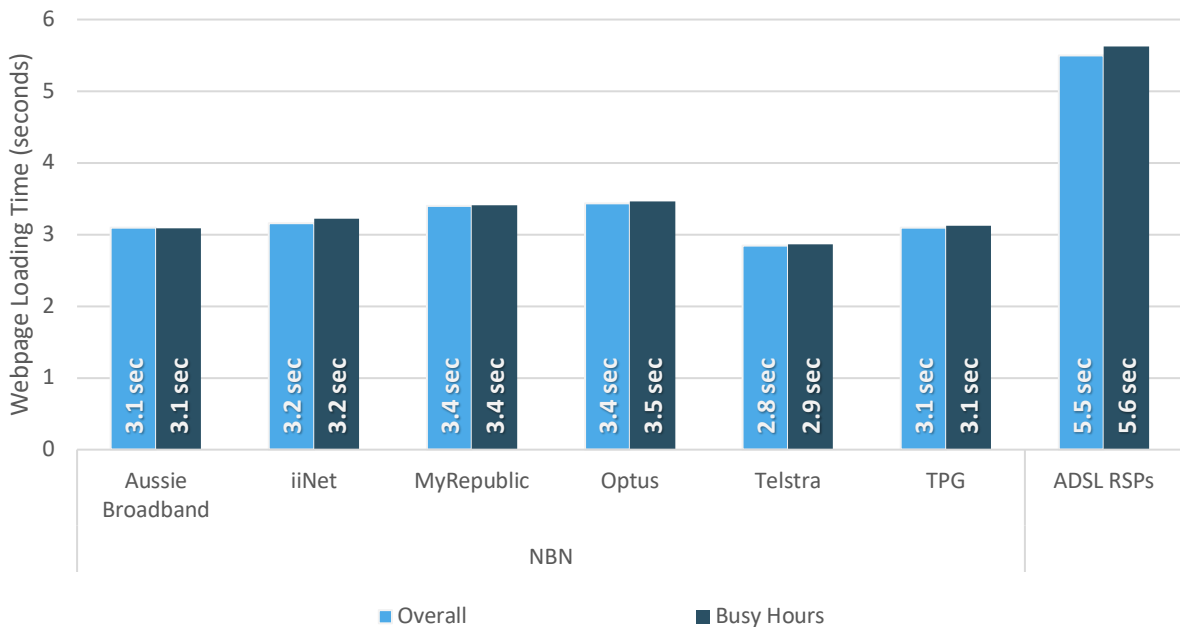
Download speeds were steady throughout most of the day, with the greatest decreases in performance occurring between 9pm and 10pm. ADSL services experienced the strongest decrease due to network congestion, with a difference of 16 percentage points between the highest and the lowest hourly speeds. On NBN fixed-line plans, 100/40Mbps products had the highest performance decrease at 7.2 percentage points, enough for users to notice slight decreases when downloading content from the web or loading websites. 25/5Mbps NBN fixed-line plans were instead the least affected with a mere 1.8 percentage points performance decrease.

Average hourly upload speeds – ADSL and NBN plans



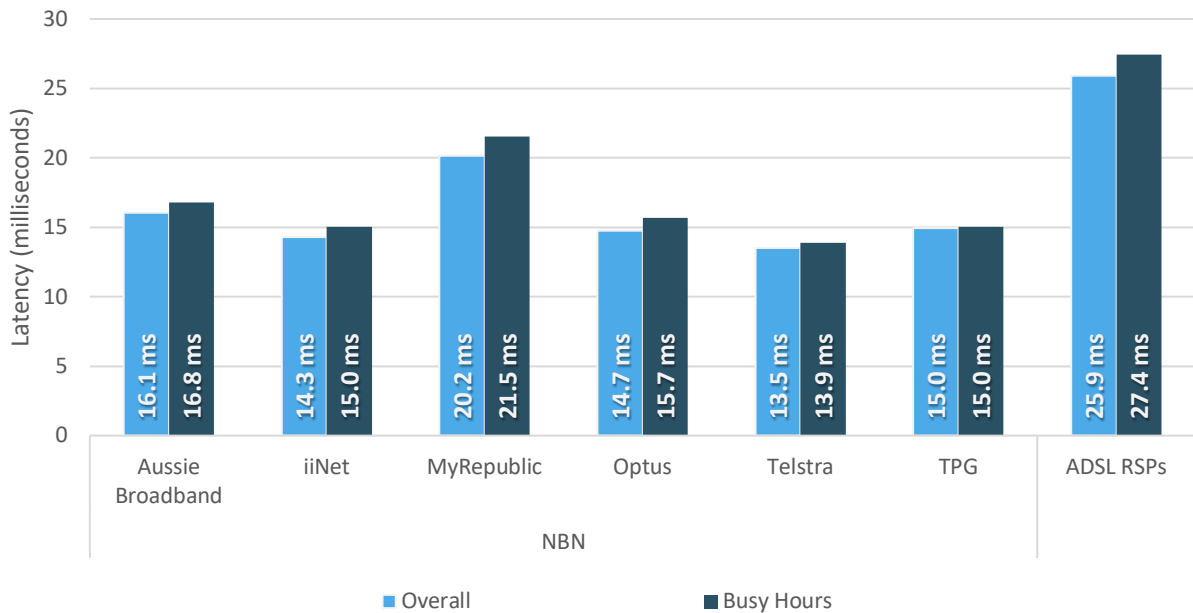
The effect of network congestion was similarly very limited for upload speeds, with a maximum difference between highest and lowest hourly speeds of 1.3 percentage points for users on the 100/40Mbps tiers – a decrease that is very small and of no consequence for most online activities.

Webpage loading time – ADSL and NBN plans



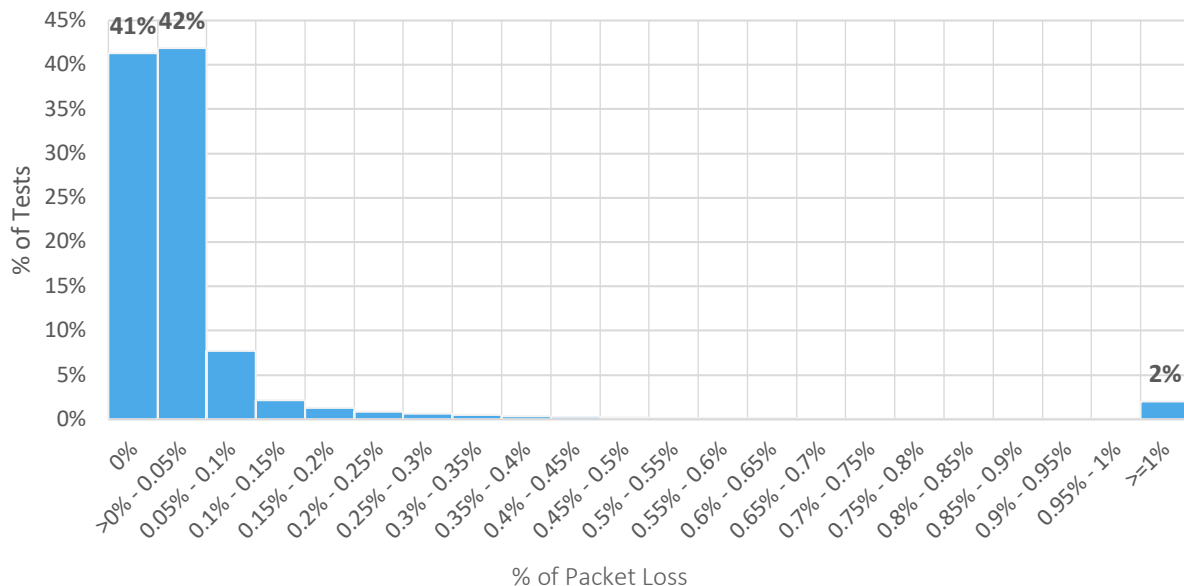
The chart above shows the average time required to load the webpages most frequently visited by Australians, per RSP. In practical terms, the time required was just over 3 seconds for all RSPs on NBN fibre network except Telstra, with no discernible impact occurring during the busiest hours of the day. The time was over 2 seconds higher for ADSL services.

Latency – ADSL and NBN plans



The chart above shows the average round trip latency required to send a packet of data to a nearby test server and back. Users on NBN fixed-line connections would have seen overall latencies ranging from a low of 13.5ms on Telstra to a high of 20.2ms on MyRepublic. Latency on ADSL connections was higher – as expected from the technology itself – at 25.9ms. Network congestion during busy hours had very little impact on latency, and users should see no difference in performance from latency-dependent activities.

Frequency of packet loss – ADSL and NBN plans



The chart above shows the frequency at which certain levels of packet loss occurred during tests. Nearly 900,000 packet loss tests were performed during the month of May, of which 83% registered packet loss under 0.05%, values at which users would experience absolutely no issue with internet services.

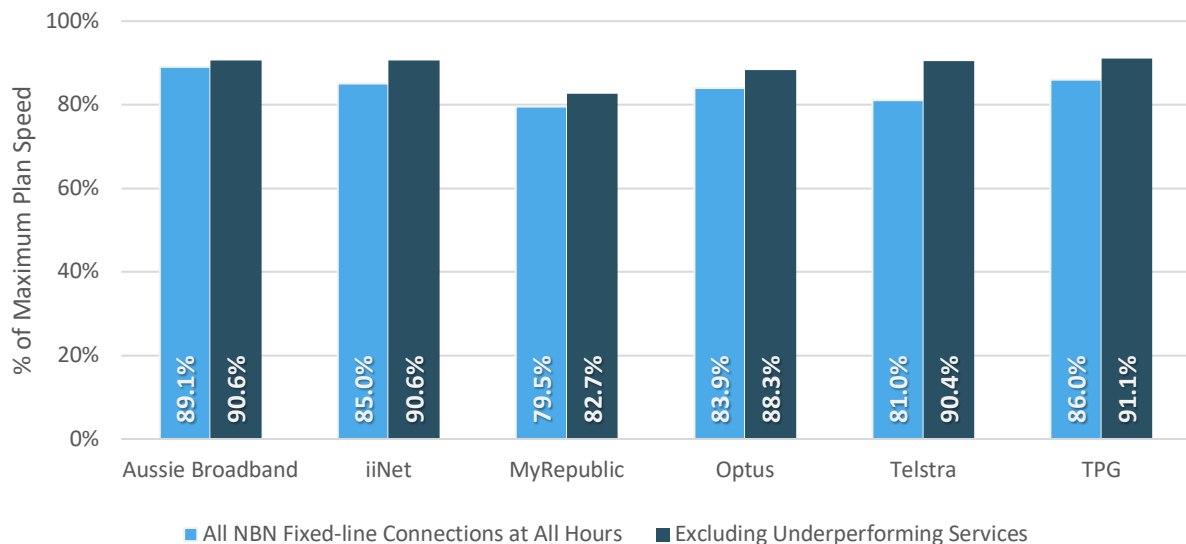
A small number (2%) of tests saw packet losses higher than 1%, the level at which users will start experiencing issues with their internet activities. These higher levels of packet loss were more frequent on ADSL than on NBN plans, at 3.3% vs 1.8%.

Impact of underperforming services on download speed measures

For this report, we are taking a deeper look into the contribution that ‘underperforming services’¹ make to the speed measures. These are services that do not achieve speeds at any time of the day that approach the maximum plan speeds. These are essentially services that the RSP has sold to a consumer with a maximum plan speed that cannot be attained due to specific physical limitations affecting the service.

This allows consumers to better understand the reported download and upload speed measures, as well as provide stronger incentives for service providers to improve service quality for these customers. This would include addressing issues leading to slow speeds, offering different plans until this can be achieved. Somewhat relatedly, it also estimates for RSPs and network operators the improvements that are potentially available if the plans sold to consumers more closely align with the maximum attainable speeds of the consumer’s network connection.

As shown below, underperforming services can make a material contribution to reported download and upload speed metrics. While there are of course other factors that contribute to the level of a speed metric², in some cases underperforming services appear to make the most contribution to the reduction in speed metrics below maximum plan speeds.

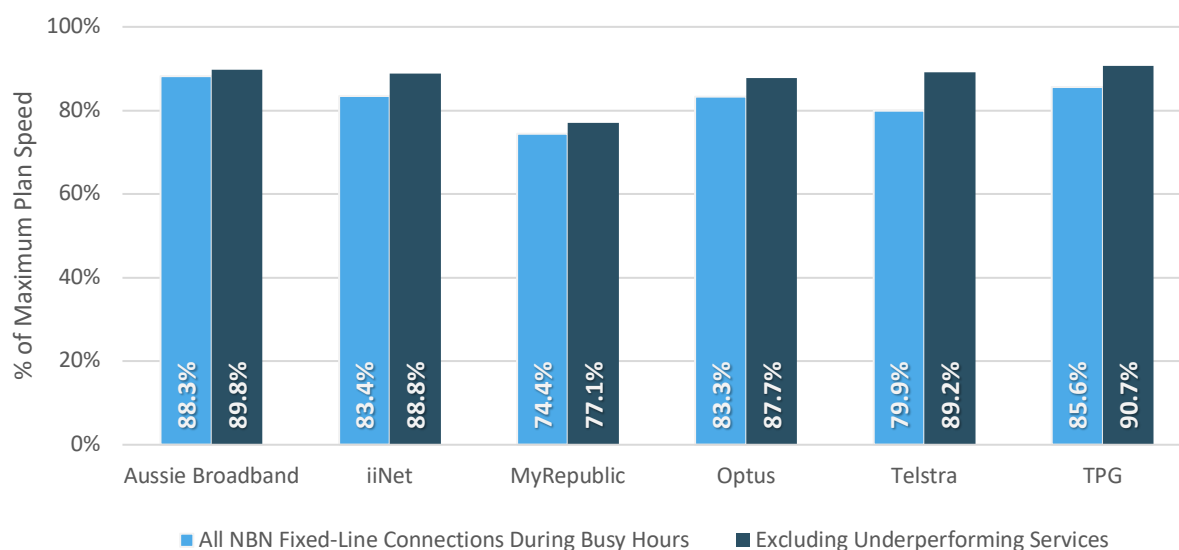


In performing this analysis on download speed metrics, we observe that – as expected – overall download speeds were higher across all RSPs when underperforming services are removed from the average. Overall, underperforming services were found to decrease the average download speed by 5 percentage points, although its effect varies across RSPs: whilst it is minimal for Aussie Broadband (1.5 percentage points), it is instead very significant for Telstra (9.4 percentage points).

¹ For this report we classify a service as ‘underperforming’ if no more than 5 percent of the speed tests that we conducted over the service achieved a speed that was above 75 percent of the maximum plan speed. This test effectively identifies those services with maximum attainable speeds that fall closer to the maximum speed available on a lower speed tier than to the maximum speed of the consumer’s current plan. Saying that, gains are also available from prompting other consumers to consider their service options in light of shortfalls in their maximum plan speeds.

² Other possible contributors are capacity constraints in the busy hours, but this is currently having only a modest impact; network management, i.e. RSPs borrowing some capacity to address Internet protocol traffic for the consumer; and sampling errors, i.e. the true speed metric for a product or RSP being slightly above (or conversely below) the metrics calculated from the sample that we have used.

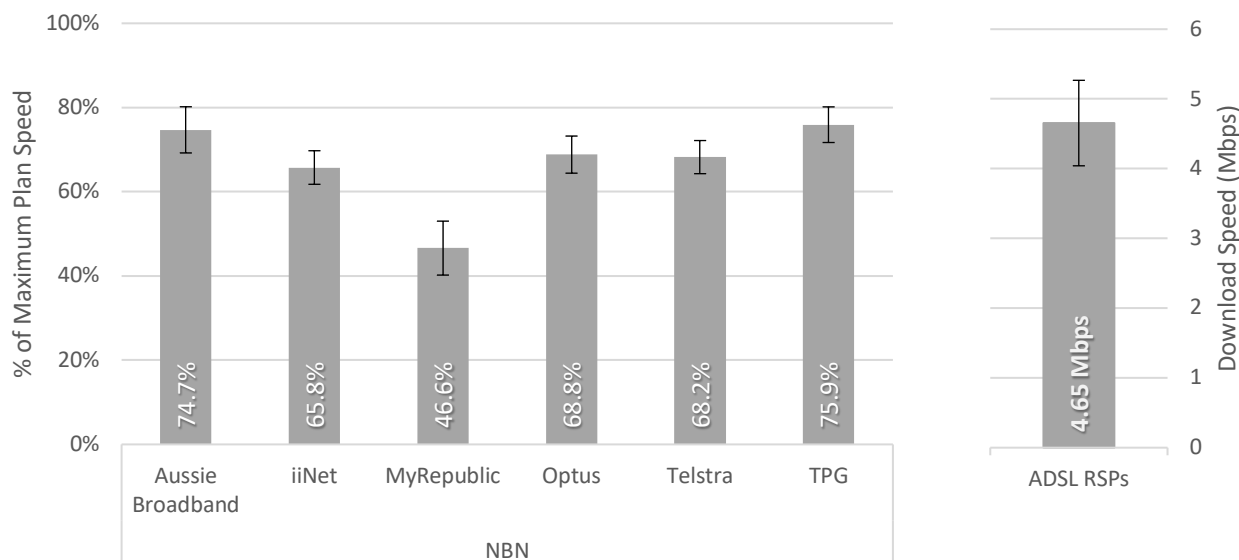
A similar difference is seen when excluding underperforming services when computing the average download speed during the busy hours of the day, once again showing an overall improvement of over 5 percentage points, with Telstra seeing the greatest difference.



As noted above, there is potential for this factor to reduce in importance over time, in part due to the greater awareness of the potential and effect of underperforming services, and as there is improvement in RSP practices, and in network and in-premise hardware. In addition, during the second quarter of 2018, a significant number of NBN fixed-line plans migrated to higher speed plans, and a number of RSPs repositioned to make higher speed plans their default product offer, which would tend to increase the number of underperforming services.

Appendix

Download speed during very busy hours



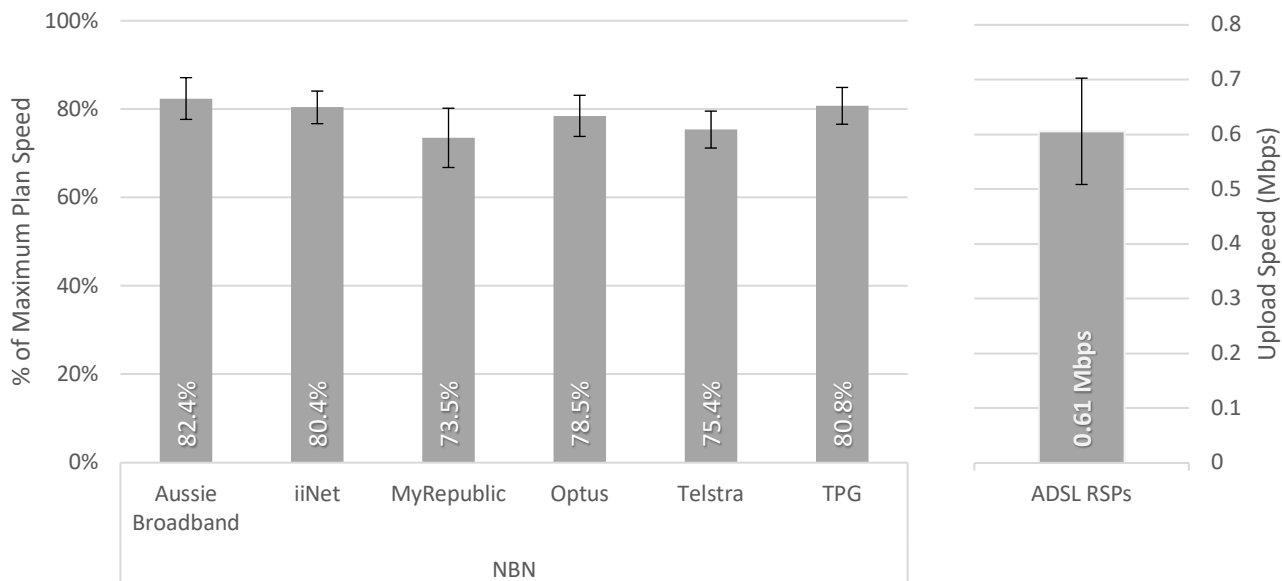
Speeds achieved during the very busy hours provide a further perspective from which to view how well broadband services perform. It can also potentially be used to differentiate between broadband plans that perform similarly when considering average performance across all the busy hours in a test period. This is because this further perspective isolates the performance achieved when the networks are under particularly high stress. We base very busy hour performance on the fifth lowest hourly average speed measure per Whitebox that we observed during the 120 busy hours that fell within the test period. This is quite a high bar. We don't use the very lowest speed measure due to the potential for this view to be distorted by a network or an extraordinary demand event.

Download speeds during very busy hours generally remained reasonably high, with most RSPs still providing download speeds above 60 percent of maximum plan speeds. That said, as expected there was differentiation seen, with RSP measures ranging from 75 percent to 47 percent of maximum plan speeds.

Speeds during very busy hours varied across RSPs providing services on NBN fixed-line, from a minimum of 47% for MyRepublic to a maximum of 75.9% of maximum plan speed for TPG. ADSL users instead saw speeds during very busy hours at just under 4.7Mbps.

There are some points to keep in mind when interpreting these results. While these results show that some RSPs maintain their download speeds better than others, by definition this is over a limited time period and shouldn't be the only perspective that consumers with everyday online usage requirements should use to choose their RSP. As fewer speed tests go into calculating these very busy values, there is also potential for them to be slightly less accurate than the other speed results we have included in this report. For clarity, we have not adjusted for the impact of underperforming services on these particular results.

Upload speed during very busy hours



Upload speeds as a percentage of maximum plan speeds during very busy hours were significantly higher than downloads, with Aussie Broadband, iiNet and TPG close to the 80% mark. ADSL users would have seen speeds just over 0.6Mbps during very busy hours.

NBN RSP tables

The following tables show top-level statistical information on overall download and upload speeds on a per-RSP basis.

The overall speed is the average speed (download or upload) for the RSP, measured as a percentage of the maximum plan speed; the standard deviation is a measure of how widely or narrowly test speeds are distributed in the data set; the 95% confidence interval is a measure in which the “true” average value is estimated to lie and is a function of the sample size (in this case Whiteboxes) and standard deviation.

For example: during testing, we measured an average download speed of 85% of maximum plan speed for iiNet. If we were to repeat our measurement, we would be 95% certain that the average would lie between 82.4% and 87.7%.

RSP	Overall Download % of Maximum Plan Speed	Std. Dev	95% Confidence Interval	Number of Whiteboxes
Aussie Broadband	89.1%	10.8%	86.7% - 91.5%	78
iiNet	85.0%	17.0%	82.4% - 87.7%	154
MyRepublic	79.5%	17.5%	75.2% - 83.9%	62
Optus	83.9%	16.0%	80.7% - 87.1%	95
Telstra	81.0%	19.8%	78.0% - 84.0%	169
TPG	86.0%	16.8%	82.7% - 89.3%	99

RSP	Overall Upload % of Maximum Plan Speed	Std. Dev	95% Confidence Interval	Number of Whiteboxes
Aussie Broadband	89.4%	13.3%	86.4% - 92.3%	78
iiNet	85.4%	21.7%	81.9% - 88.8%	154
MyRepublic	80.8%	24.0%	74.9% - 86.8%	62
Optus	84.3%	22.8%	79.7% - 88.9%	95
Telstra	79.8%	25.7%	75.9% - 83.7%	169
TPG	85.1%	19.3%	81.3% - 88.9%	99

NBN speed tier tables

The following tables show top-level statistical information on overall download and upload speeds on a per-speed tier basis.

The overall speed is the average speed (download or upload) for the RSP, measured as a percentage of the maximum plan speed; the standard deviation is a measure of how widely or narrowly test speeds are distributed in the data set; the 95% confidence interval is a measure in which the “true” average value is estimated to lie and is a function of the sample size (in this case Whiteboxes) and standard deviation.

For example: during testing, we measured an average download speed of 88.4% of maximum plan for users subscribed to 25/5Mbps NBN fixed-line plan. If we were to repeat our measurement, we would be 95% certain that the average would lie between 86.6% and 90.2%.

Speed Tier	Overall Download % of Maximum Plan Speed	Std. Dev	95% Confidence Interval	Number of Whiteboxes
25/5Mbps	88.4%	11.3%	86.6% - 90.2%	146
50/20Mbps	81.0%	18.9%	78.7% - 83.3%	265
100/40Mbps	83.7%	17.1%	81.8% - 85.6%	310

Speed Tier	Overall Upload % of Maximum Plan Speed	Std. Dev	95% Confidence Interval	Number of Whiteboxes
25/5Mbps	88.7%	17.6%	85.8% - 91.5%	146
50/20Mbps	78.9%	25.1%	75.9% - 81.9%	265
100/40Mbps	86.0%	19.8%	83.8% - 88.2%	310