



MEASURING
BROADBAND
AUSTRALIA

Report 3, November 2018

In 2017, the Australian Competition and Consumer Commission (ACCC) appointed SamKnows to launch its 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 goal of Measuring Broadband Australia is to increase transparency and encourage greater performance-based competition and better internet performance throughout the country.

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-phone/broadband-performance-data>.

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

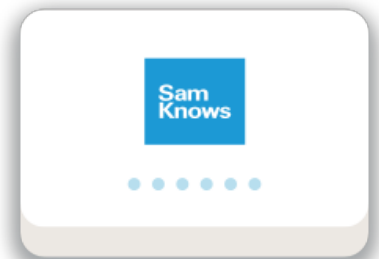
SamKnows One Analytics

- ◆ 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.



[Volunteer today!](#)

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.

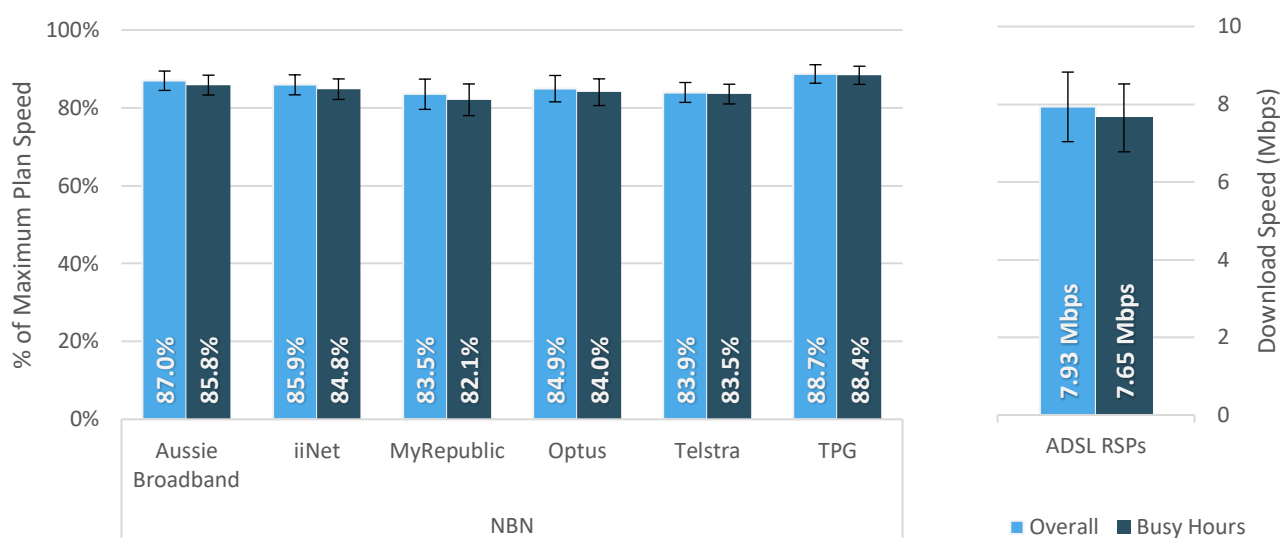
Overview

1 August 2018 – 31 August 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 National Broadband Network's (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

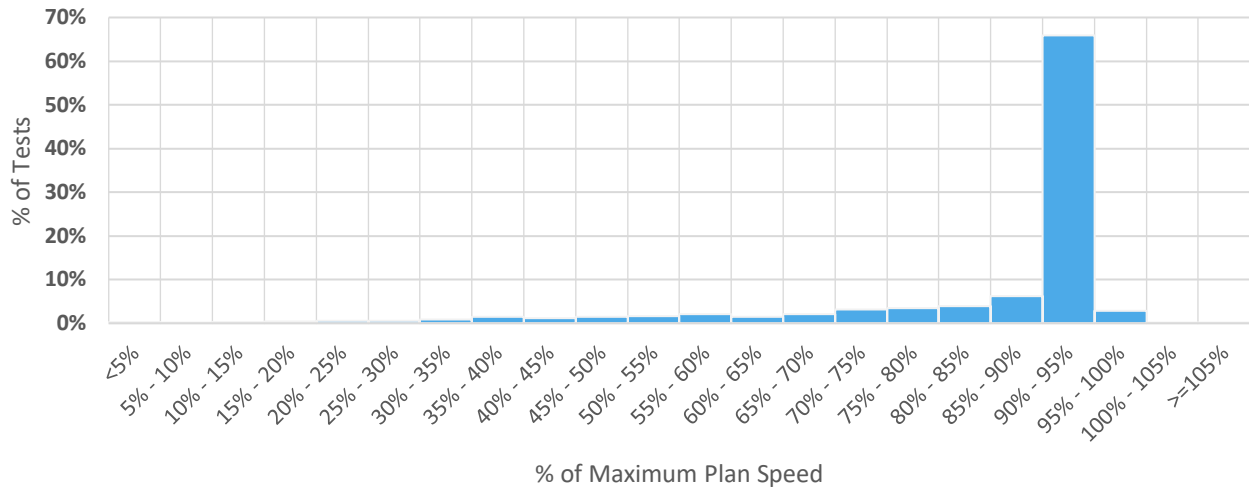


RSPs running on NBN delivered their subscribers with average download speeds ranging from just under 84% to nearly 89% of their maximum plan speeds. This means that a user subscribed to an NBN speed tier of "50Mbps download speed" would likely experience speeds between 42Mbps and 44Mbps depending on their RSP.

Broadband speeds can be negatively affected when there are a high number of users performing online activities - this typically occurs in the evenings. The darker blue columns in the chart show the average download performance during these busy hours (between 7pm and 11pm), and that the effect is quite limited, with a maximum decrease of 1.4 percentage points that is unlikely to have a noticeable effect to most users. The speed decrease was slightly greater for ADSL users, but it was also small enough as to have no real impact. Performance by RSP was largely unchanged compared to May's reporting period, with download speed measures generally changing by less than 3 percentage points. The main exceptions to this were MyRepublic and Telstra, which saw significant increases during busy hour performance of 7.7 and 3.6 percentage points, respectively.

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, Optus has an average download performance of 84.9% with a confidence Interval of $\pm 3.4\%$. This means that if we were to repeat our measurements 100 times, performance would be between 81.5% and 88.3% in 95 of these measurements.

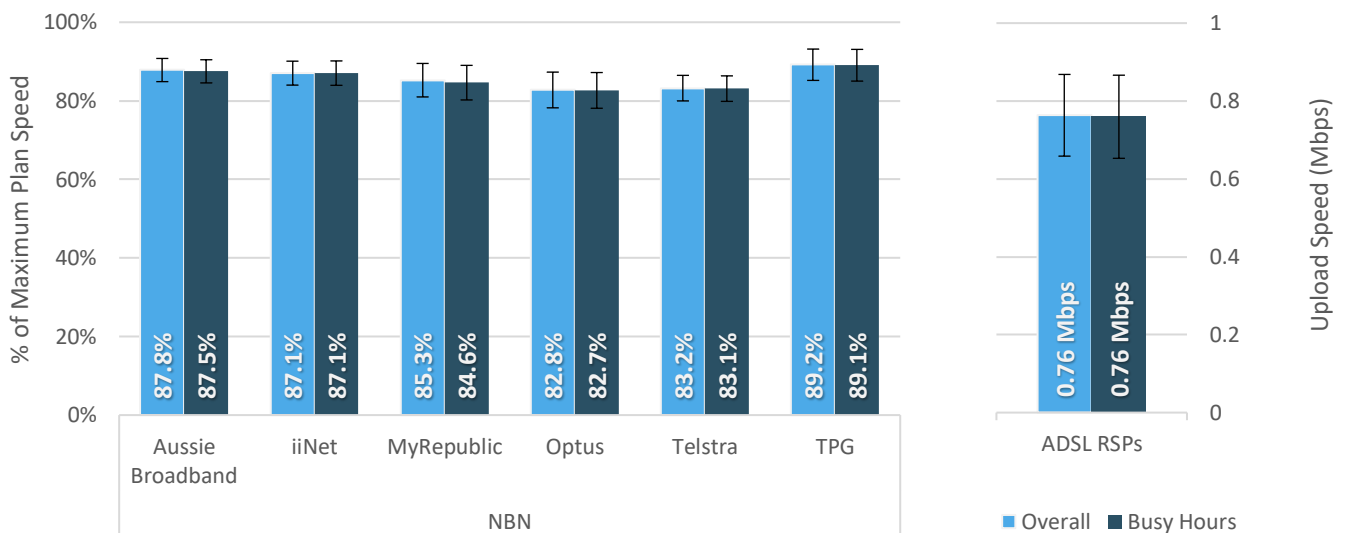
Average NBN download speeds attained during tests



Over 171,000 download speed tests were performed across over 790 Whiteboxes connected to fixed-line NBN infrastructure during the month of August. This number of measurements significantly exceeds the 145,000 during the previous reporting month of May, increasing confidence in the reliability of the findings.

Download performance above 90% of maximum plan speeds was reported during 69% of the tests conducted, keeping in line with May's figure of 70%. Issues with underperforming services, however, persisted as speeds failed to reach even 50% of maximum plan speeds during 7.2% of tests. In a few words: internet download performance is close to the maximum plan speeds offered by RSPs for most Australians, but there is also a minority of users whose speeds are nowhere near those they ought to expect.

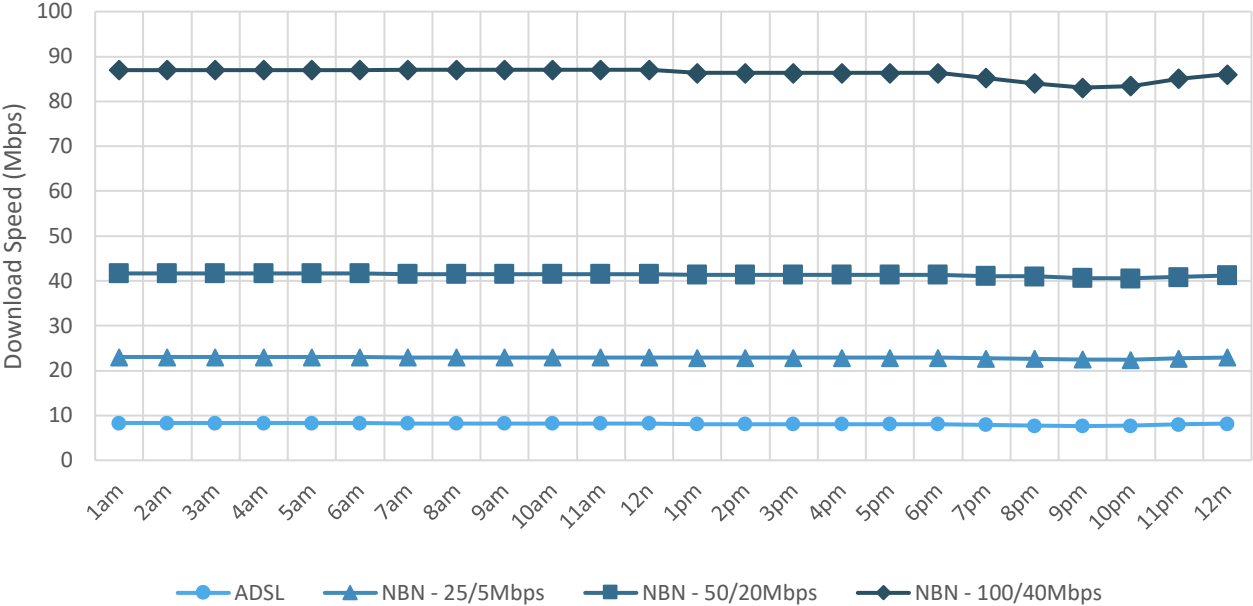
Average upload speed



Upload performance ranged from 83% to 89% of maximum plan speeds, with the majority of NBN RSPs delivering above the 85% mark. Average upload speed was 0.76Mbps for ADSL users. Upload performance decline during busy hours was negligible, and most users would be unlikely to see upload-intensive internet activities affected.

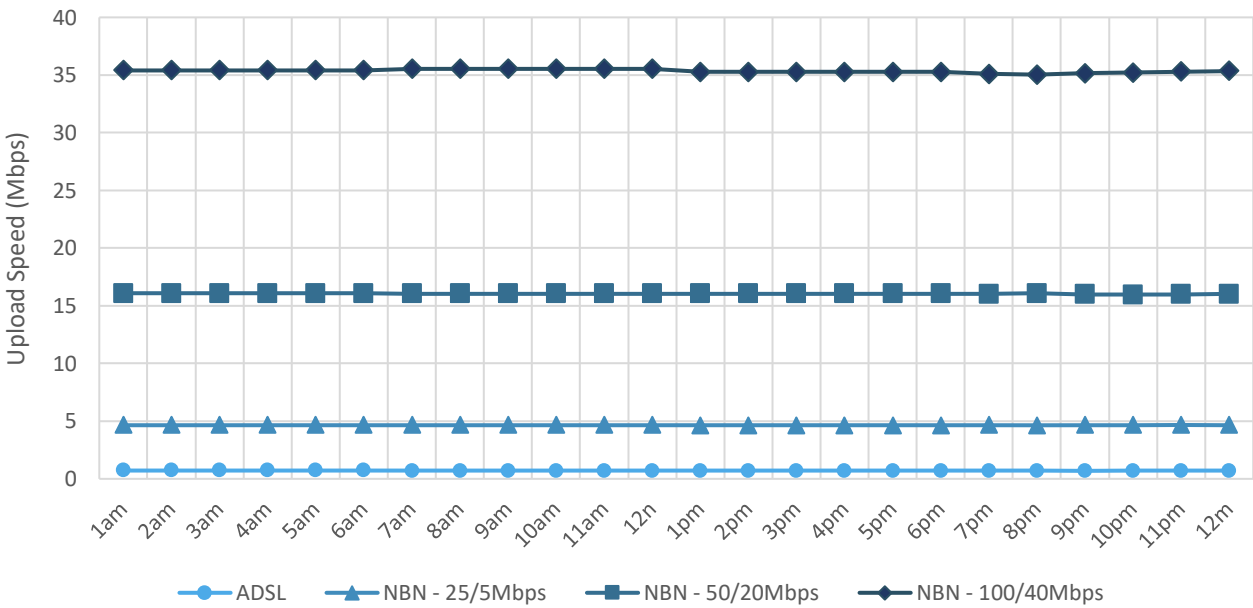
The ranges shown by the 95% confidence interval are in line with those seen across download speeds. Taking TPG as an example, we see an average upload performance of 89.2% with a 95% confidence interval of $\pm 4\%$. This means that we are 95% certain that the true average upload performance for TPG users rests between 85.2% and 93.2%.

Average hourly download speeds – ADSL and NBN plans



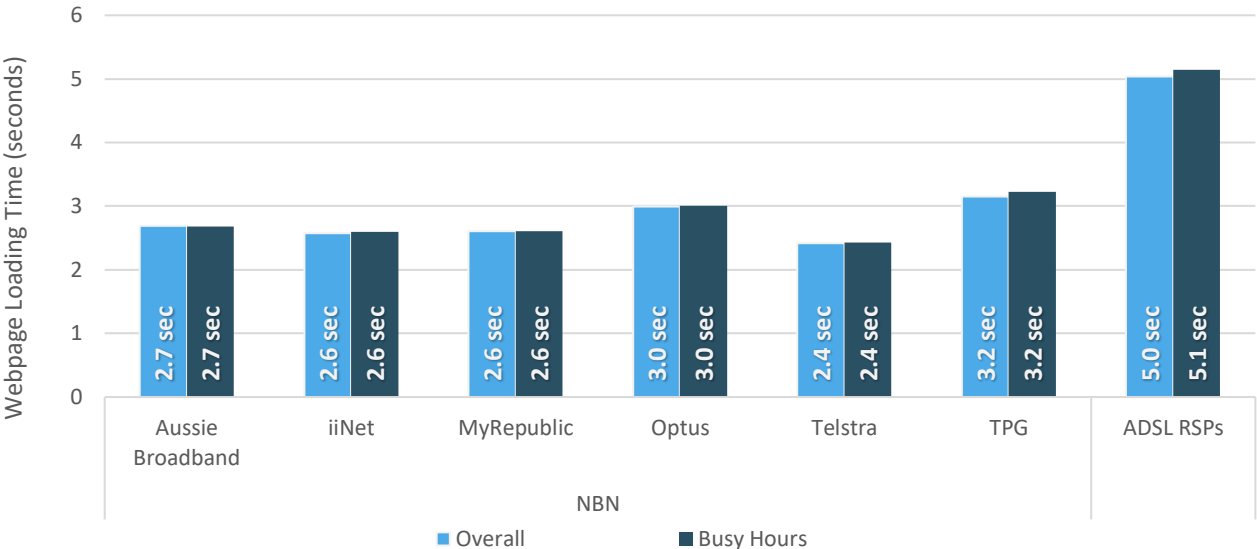
Download speeds were steady throughout the day for users on NBN connections as well as those on ADSL connections. Speeds decreased between 8pm and 10pm - the busiest hours of activity, when networks become congested due to the high number of users performing online activities - but these decreases were generally minor: for comparison, the lowest hourly speed of the day was 2.7% lower than the highest speed of the day for users on NBN 25/5Mbps and 50/20Mbps products, and 4.8% lower for those on 100/40Mbps products. The difference was greatest for ADSL users, who saw a difference of 9.2% between the fastest and slowest hours of the day.

Average hourly upload speeds – ADSL and NBN plans



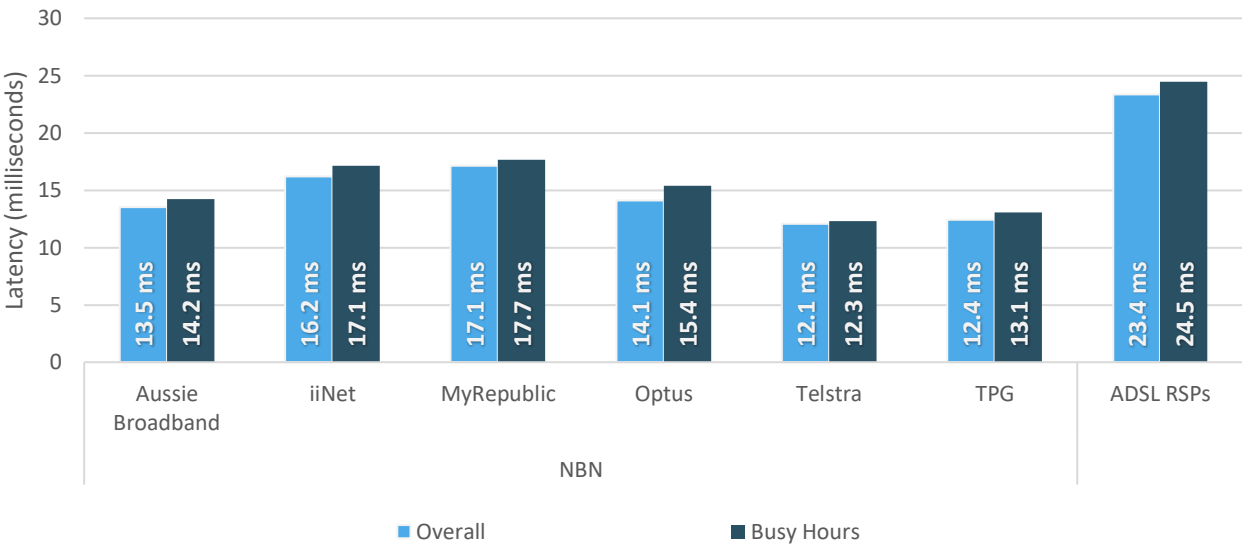
Congestion factors had a very limited effect on upload speeds, which experienced minor declines during the day's busiest hours. To users on NBN products, the effect would have been negligible. Whilst ADSL users saw a difference of 4% between the highest and lowest hourly speeds, it was a small enough difference to have no discernible effect in most online activities.

Webpage loading time – ADSL and NBN plans



The chart above illustrates the average time required to fully load the most popular webpages amongst Australian users, per RSP. The majority of users are able to load webpages in 3 seconds or less across all RSPs except TPG, for which the average time was slightly higher. Webpage loading times are around 5 seconds for users on ADSL services.

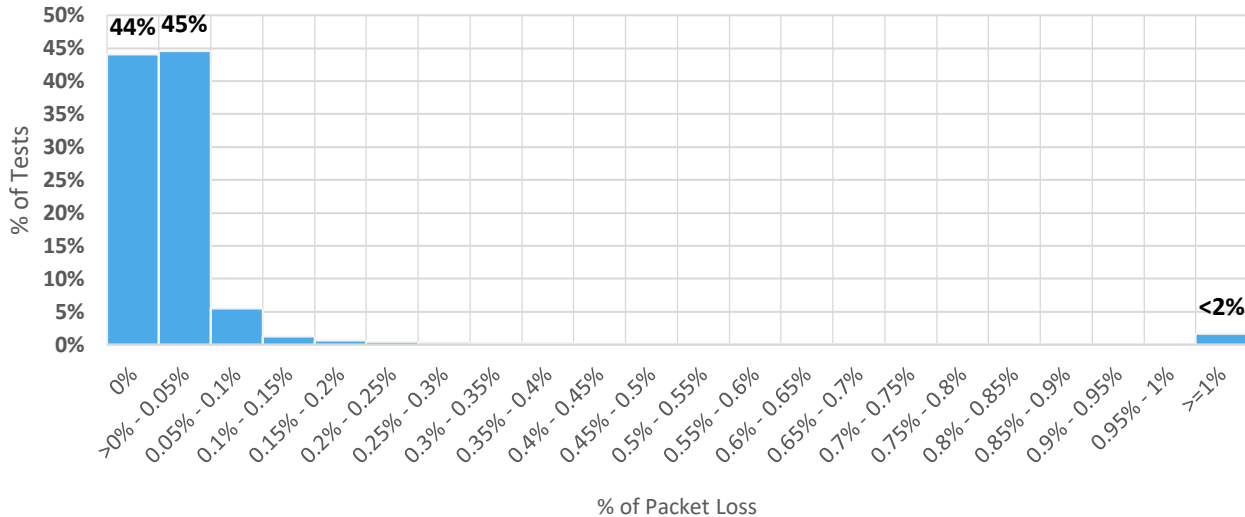
Latency – ADSL and NBN plans



The chart above shows the average round trip latency - the time required to send a packet of data to the test server and back. Latency for users on NBN fixed-line connections was low during August, with average values between 12.1ms on Telstra and 17.1ms on MyRepublic, with very small increases during busy hours that would be of limited effect to latency-dependent activities such as online video gaming

or internet calls (VoIP). Latency was higher for ADSL plans as a result of the copper-based technology, but also low enough as to not have a detrimental effect to users.

Frequency of packet loss – ADSL and NBN plans



The chart above shows the frequency at which certain levels of packet loss occurred during tests. Over 1,130,000 packet loss tests were performed across NBN fixed-line and ADSL products during the month of August, with nearly 89% of these tests showing packet loss under 0.05% - levels at which users can expect a smooth loading of websites and an overall good internet performance.

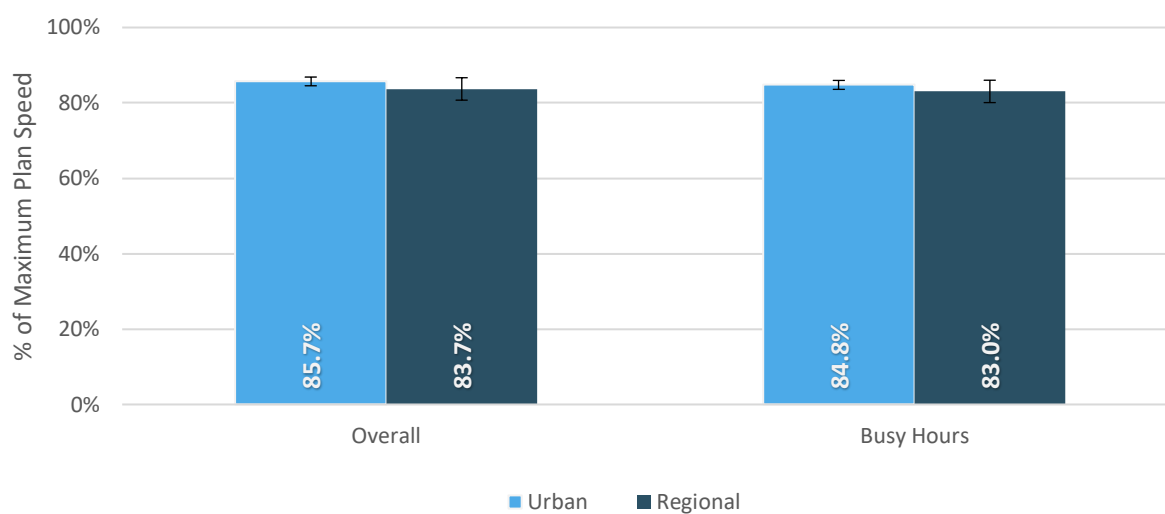
By contrast, a small fraction of tests (under 2%) exhibited packet loss of 1% or higher. At this level, users may experience noticeable issues with their internet activities, such as webpages not loading or internet calls (VoIP) dropping unexpectedly. Packet loss is markedly higher for ADSL users, where 3.6% of tests measured over the 1% mark, whilst the value was lower for NBN fixed-line connections at 1.4%.

Performance across urban and regional areas

In this section, we present a comparative view between urban services and regional services¹. This is to share an additional perspective on the quality of internet performance in Australia over the NBN, and in particular to provide a high-level indicator as to whether there is a disparity in busy hour performance between urban and regional areas.

The results of this analysis are presented at the network level across all RSPs. This is because the factors likely to lead to different busy hour performance between areas are likely to arise from the common network inputs used by all retailers, and due to the small numbers of regional services for each RSP present in the sample.

Average download speed by region



The chart above shows the download speeds tested across NBN fixed-line connections in urban and regional areas of Australia as overall averages, as well as during busy hours. Download speeds in urban areas slightly exceeded those in regional areas. Across the entire day, services in urban areas achieved 85.7%, whilst those in regional areas achieved 83.7% - a difference of 2 percentage points. Whilst there is a difference in performance across urban and regional areas, it is not large enough to indicate a substantial disparity in the services received by respective users.

¹ An urban service is an NBN fixed-line service supplied in a population centre with 10,000 or more residents, while a regional service is an NBN fixed-line service supplied in smaller population centres. That is, the urban footprint is not limited to the metropolitan area of a capital or other large city, but also includes a number of population centres.

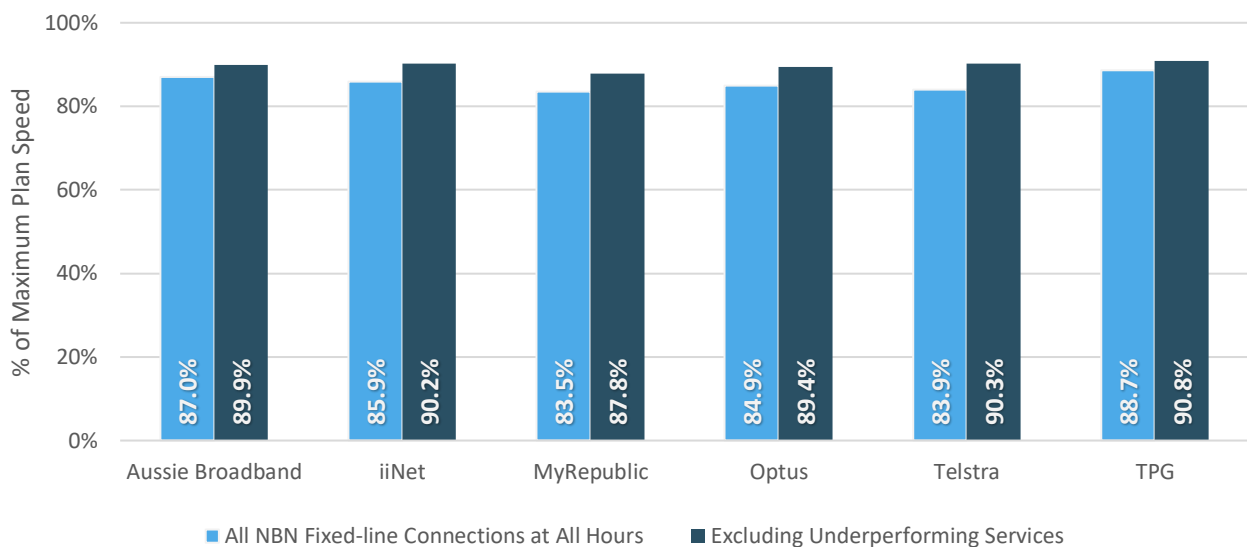
This is a standard grouping used in the communications sector. For present purposes, it can signify a break point between areas where there could be significantly reduced civil infrastructure, or less proximity to technicians to support a high-quality supply of communications services.

Impact of underperforming services on download speed measures

In this report, we continue to take a deeper look into the contribution that ‘underperforming services’² 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. 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.

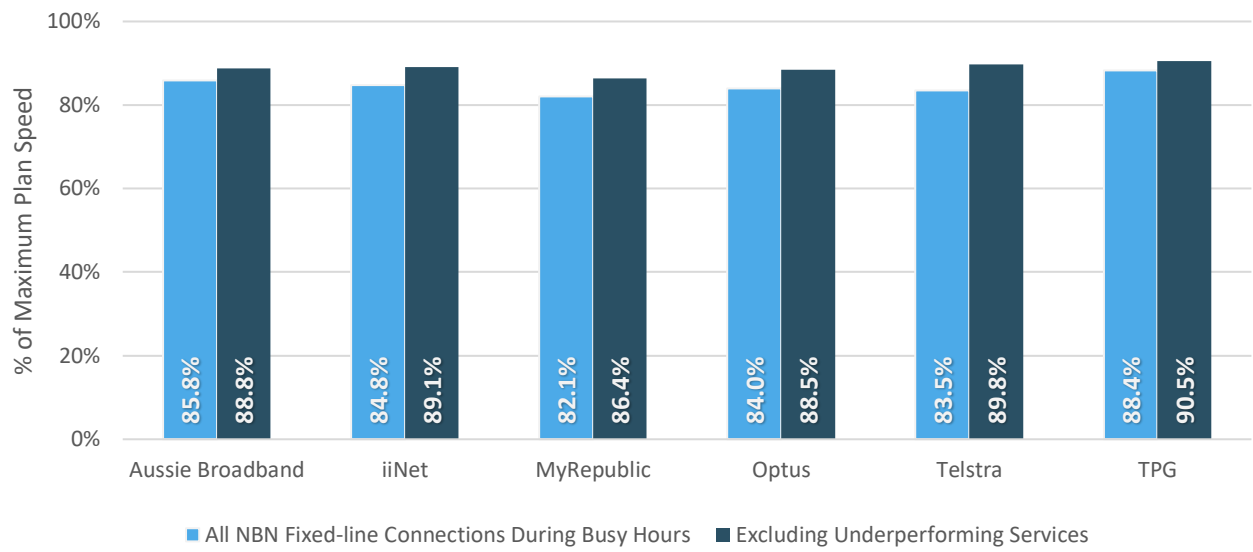
As shown below, underperforming services can make a material contribution to reported download and upload speed metrics. While there are of course other factors that contribute to the level of a speed metric³, in some cases underperforming services appear to make the most contribution to the reduction in speed metrics below maximum plan speeds.



When underperforming services are excluded from the calculations, NBN fixed-line connections were found to perform better by an average of 4.3 percentage points, showing a small improvement from the 5 percentage points seen in May’s reporting period. Most RSPs drew close to the 90% mark when underperforming services were excluded, but the results were varied: the improvement was limited for TPG at 2.1 percentage points - thus indicating that there are fewer Whiteboxes connected to underperforming service - whilst it was significant for Telstra at 6.4 percentage points.

² 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.

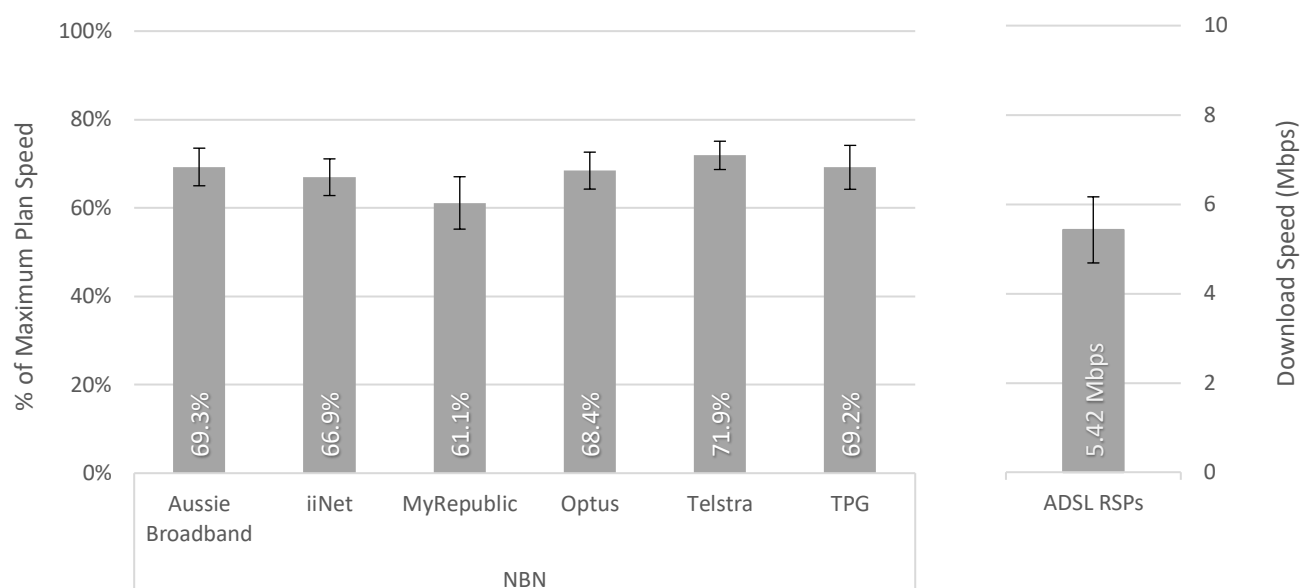
³ Other possible contributors are capacity constraints in the busy hours, but this is currently having only a modest impact; network management, i.e. RSPs borrowing some capacity to address internet protocol traffic for the consumer; and sampling errors, i.e. the true speed metric for a product or RSP being slightly above (or conversely below) the metrics calculated from the sample that we have used.



Similar results were obtained when the underperforming services were excluded during measurements for the average download performance during busy hours, with an average improvement of 4.3 percentage points. As with the overall average performance, these changes vary depending on the RSP. Telstra is the most affected with an improvement of 6.3%.

Appendix

Download speed during very busy hours

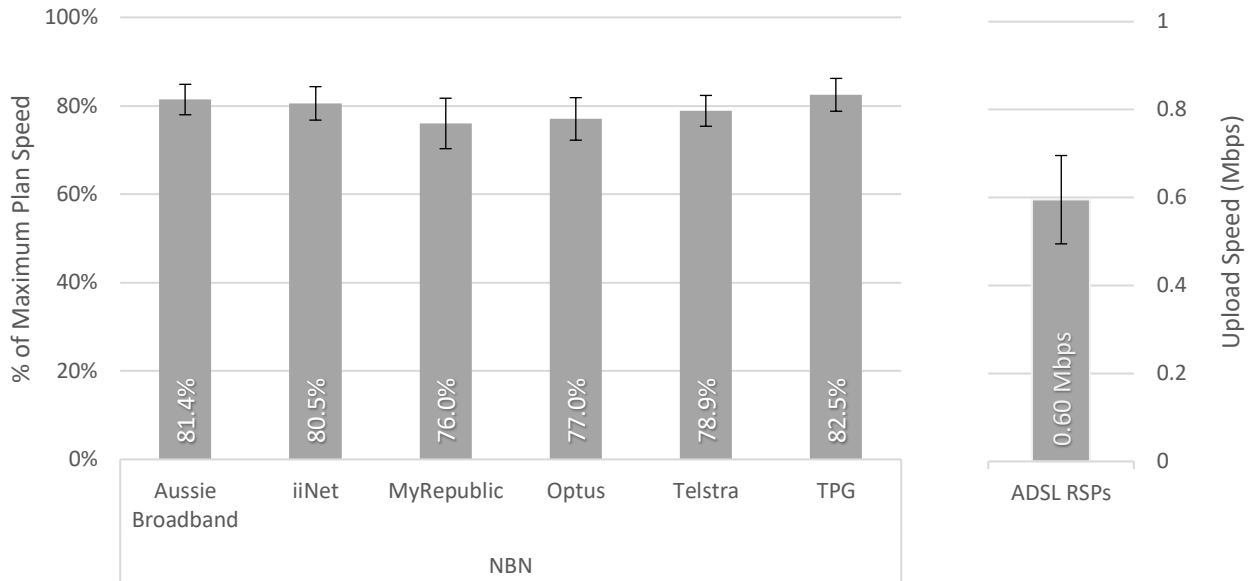


Speeds achieved during the very busy hours provide a further perspective from which to view how well broadband services perform. It can also potentially be used to differentiate between broadband plans that perform similarly when considering average performance across all the busy hours in a test period. 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 across each RSP's Whiteboxes 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 the very busy hours varied across RSPs, from a minimum of just over 61% for MyRepublic to a maximum of nearly 72% for Telstra users, whilst other RSPs performed in the 60 - 70% range. For users on ADSL connections, the average download speed was of 5.4Mbps during the busiest hours.

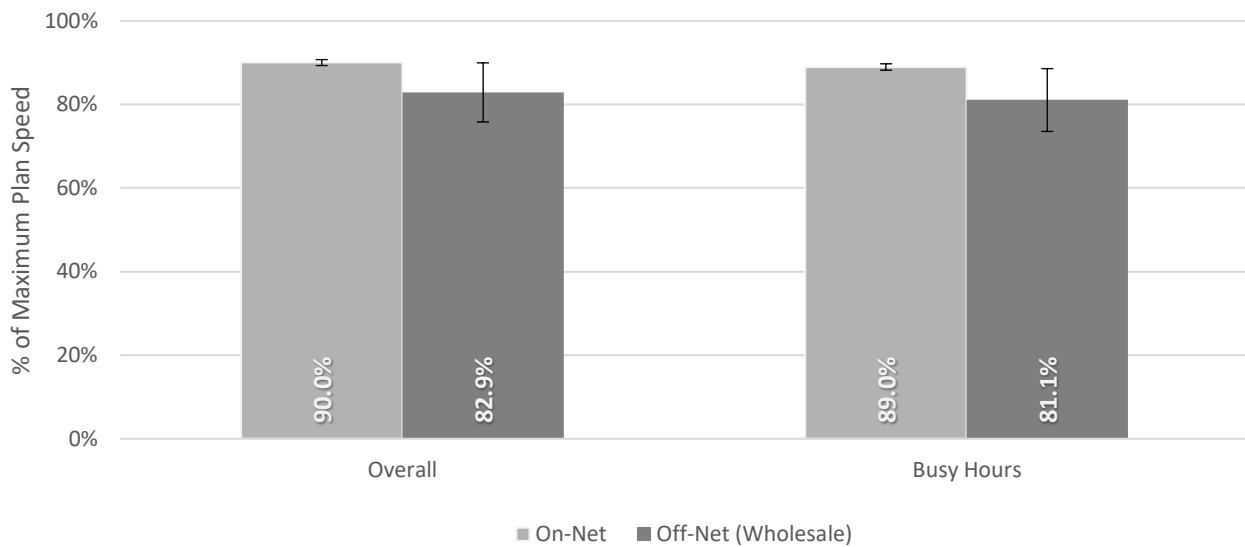
There are some points to keep in mind when interpreting these results. While these results show that some RSPs maintain their download speeds better than others, by definition this is over a limited time period and shouldn't be the only perspective that consumers with everyday online usage requirements 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 performance during very busy hours was markedly better than for download speeds across all NBN fixed-line RSPs. As with download performance, MyRepublic had the lowest result at 76%, closely followed by Optus at 77%, whilst TPG had the highest at 82.5%. ADSL upload speeds during very busy hours was low at 0.6Mbps.

Download speed, on-net vs off-net



In this report, we present a comparative view over the busy hour download speeds of on-net and off-net services⁴. This is to share an additional perspective on the quality of internet performance in Australia over the NBN, and in particular to provide a high-level indicator as to whether there could be disparity in the busy hour provisioning between these groups suggestive of a wholesale market that is not operating efficiently.

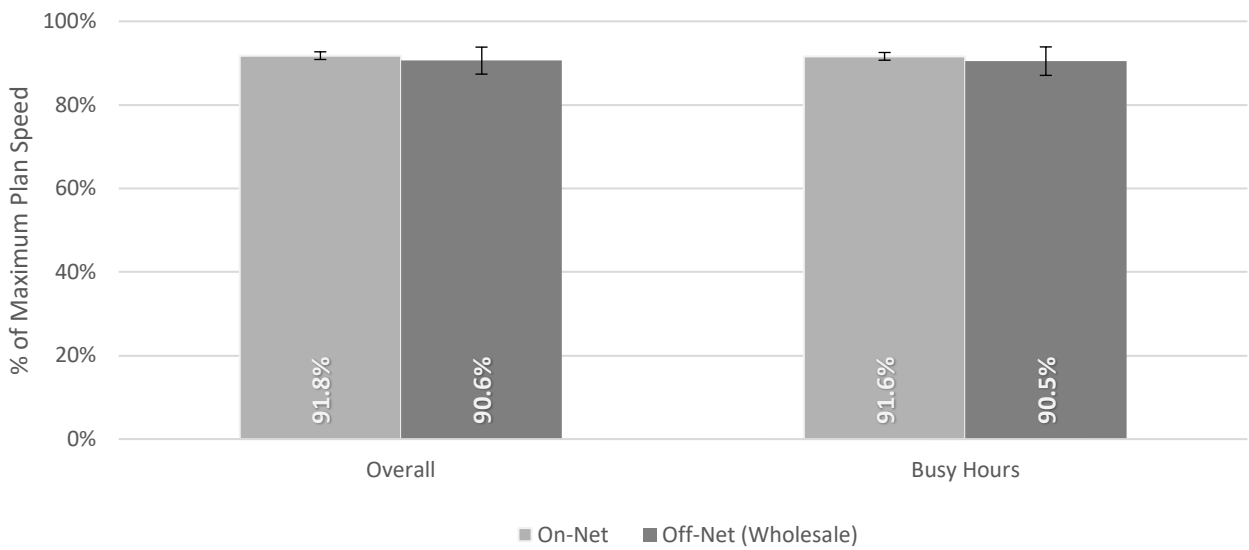
It ought to be noted, however, that the sample size for Whiteboxes connected to off-net services is very limited at 31, and thus these results - whilst interesting - ought to be considered directional in nature and should not be considered to be determinative. In addition, as this indicator concerns the wholesale market, it is not intended to act as recommendations or offer guidance to consumers.

Only connections that could support the full plan speed were included in this analysis. This was to generate an indicator that more precisely focused on the effects of busy hour provisioning, and to avoid connection-specific factors distorting the results given the small sample size involved.

The results show that the off-net services group recorded an average busy hour download speed that is 7.9 percentage points less than the corresponding download speed that the on-net service group recorded. This suggests that there could be a difference in provisioning levels between off-net and on-net services during the test period, with on-net services provisioned with higher network capacity during the busy hours.

⁴ On-net services are services that an RSP supplies over an access product that it has acquired directly from NBN Co, while off-net services are services that an RSP supplies using a wholesale product it has acquired from an NBN access seeker. In both cases the RSP converts the wholesale product into a retail service using other network inputs such as backhaul and switching/routing infrastructure. Some RSPs exclusively supply on-net NBN services, some exclusively use off-net services, and some adopt a hybrid model of supplying on-net services in some locations and off-net services in areas where they are yet to build scale.

Upload speed, on-net vs off-net



Whilst there is a difference in upload speeds between those measured across on-net and off-net services, it is nowhere as significant as that seen in download speed results, at just over 1 percentage point. Whilst it bears reiterating that the number of Whiteboxes connected to off-net services is limited, this minor difference can be attributed more to statistical variability than an outright disparity in the quality of the service itself.

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 performance of 84.9% of maximum plan speed for Optus. If we were to repeat our measurement, we would be 95% certain that the average would lie between 81.5% and 88.3%.

RSP	Overall Download % of Maximum Plan Speed	Std. Dev	95% Confidence Interval	Number of Whiteboxes
Aussie Broadband	87.0%	12.6%	84.5% - 89.5%	98
iiNet	85.9%	16.0%	83.3% - 88.5%	149
MyRepublic	83.5%	15.9%	79.6% - 87.4%	64
Optus	84.9%	17.7%	81.5% - 88.3%	105
Telstra	83.9%	17.3%	81.4% - 86.5%	176
TPG	88.7%	11.8%	86.3% - 91.1%	95

RSP	Overall Upload % of Maximum Plan Speed	Std. Dev	95% Confidence Interval	Number of Whiteboxes
Aussie Broadband	87.8%	14.8%	84.9% - 90.8%	97
iiNet	87.1%	19.0%	84% - 90.1%	149
MyRepublic	85.3%	17.4%	81% - 89.5%	64
Optus	82.8%	23.8%	78.2% - 87.3%	105
Telstra	83.2%	22.0%	80% - 86.5%	176
TPG	89.2%	20.0%	85.2% - 93.2%	96

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 performance of 91.1% of maximum plan speed 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 89.7% and 92.5%.

Speed Tier	Overall Download % of Maximum Plan Speed	Std. Dev	95% Confidence Interval	Number of Whiteboxes
25/5Mbps	91.1%	8.3%	89.7% - 92.5%	140
50/20Mbps	82.4%	18.0%	80.4% - 84.3%	321
100/40Mbps	85.4%	14.7%	83.8% - 87.1%	305

Speed Tier	Overall Upload % of Maximum Plan Speed	Std. Dev	95% Confidence Interval	Number of Whiteboxes
25/5Mbps	93.1%	15.0%	90.6% - 95.6%	140
50/20Mbps	80.3%	24.3%	77.7% - 83%	320
100/40Mbps	88.2%	14.9%	86.5% - 89.8%	305