Measuring Broadband

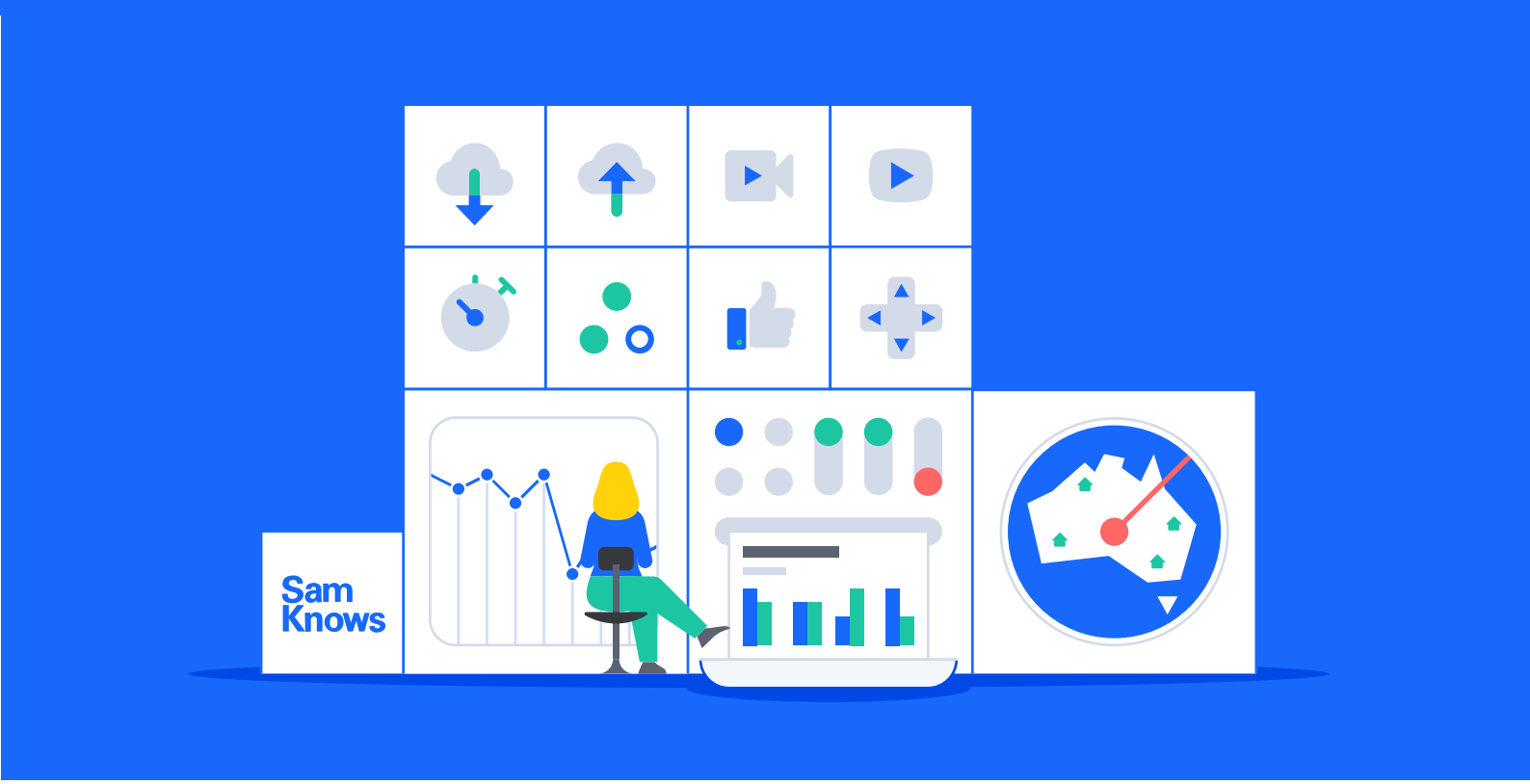
AUSTRALIA

Video Streaming & Video Conferencing

This report is the first in a series of three reports to track the performance of NBN broadband services in providing access to streaming and video conferencing applications.

This report shows performance in the month of May 2020, when various mitigations were in place to manage the potential impact of Covid-19 on network and application performance.

The principal mitigations were: NBN Co's temporary provision of an additional 40 per cent connectivity virtual circuit (CVC) capacity for RSPs and a reduction in video quality by key video streaming and conferencing services.



Methodology Review

The presented charts are based on test data that was recorded by SamKnows Whiteboxes hosted by Measuring Broadband Australia volunteers. Data was collected during May 2020, with baseline data drawn from February 2020. All collected data concerns test communications that were initiated by the Whitebox, which does not involve monitoring or logging user activity.

Results are presented using a number of splits including by RSP, access technology, state and plan speed and for video conferencing whether the servers are hosted domestically or internationally. Results were recorded across all hours of the day.

All charts use a consistent set of Whiteboxes across the entire test period relevant to the chart. For example, if a Whitebox is included on day 1, this means it generated results for every day in the relevant time range. Conversely, if a Whitebox was offline for one day, then it is excluded for the entire period. Additionally, if a Whitebox changed RSP during the period, it is excluded.

All Whiteboxes that met this requirement were included in the study, including any that are connected to impaired NBN broadband services. These are services that do not record download speeds that are at or close to the top speed of the broadband plan.

For this report NBN broadband service performance has been tested to a sample of applications to cover a range of use cases, and to illustrate important drivers of the results obtained where possible. The remaining reports in this series will look to expand the testing further.

In re-issuing this report, we have changed the way in which we present the latency measures that we obtained when testing to international video conferencing servers. These data are presented as the latency that was observed to the server location and are no longer attributed to the performance of a particular video conference application. We have made this change as the measures obtained when testing to the nominated international servers are not representative of the performance of those applications when conferences are hosted from other locations. Relatedly, Cisco and Zoom have advised us that they maintain domestic servers for their respective video conference applications to use.

Whilst we carry out further testing and analysis in advance of publishing an updated and more comprehensive study, this re-issued report focuses on general performance, rather than specific application behaviour. Therefore, it should be noted that whether a video conference is hosted from a domestic or international server can depend on a number of factors which could include where the account is created, whether it is a basic or premium (paid) account, and the overall demand at the time, depending upon the application.

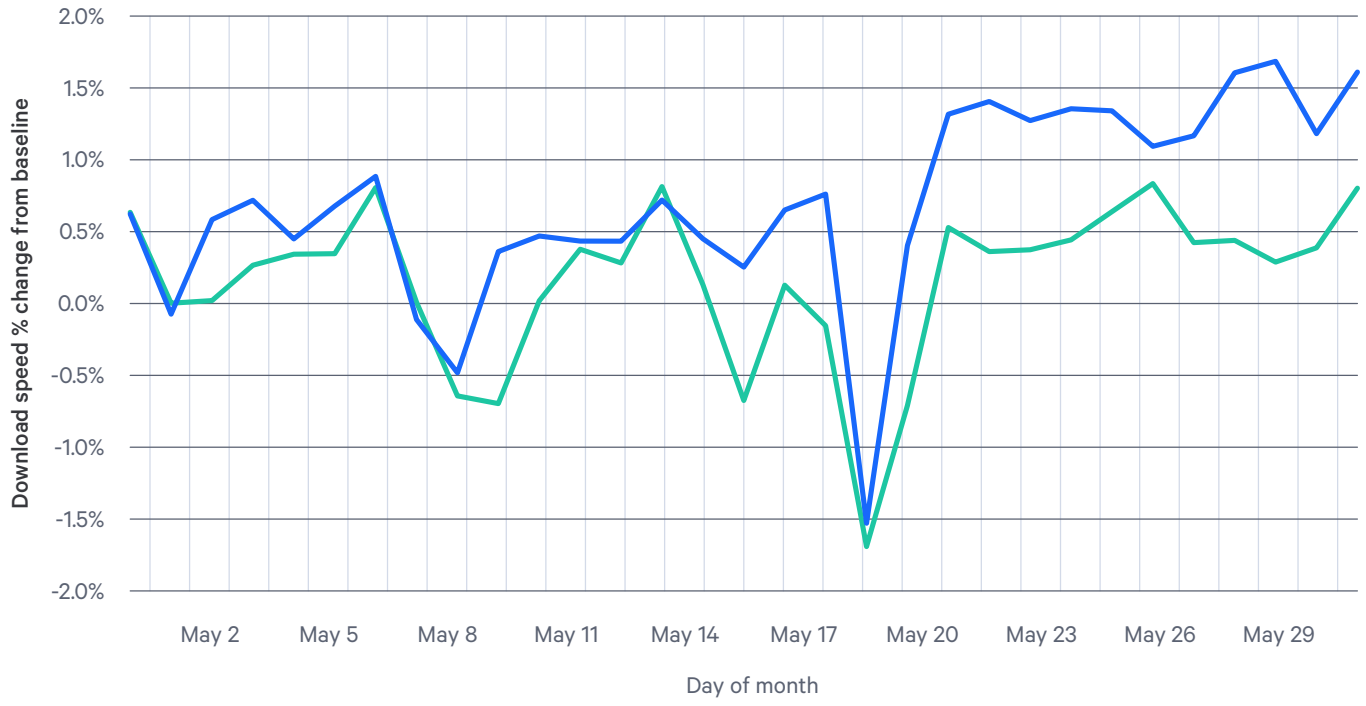
SamKnows is working with a number of video conferencing application providers to better understand the subtleties and how they impact customer experience.

Video Streaming services

- Streaming service performance is presented for Netflix and YouTube using download speed (Mbps).
- Download throughput is the most appropriate metric to assess video streaming performance. This is because video streaming services typically download data in large batches, and buffer video in advance (to allow for erratic or unstable internet connections). It is therefore also important to download from the real video content servers, which is precisely what the Whiteboxes do.
- All results here show the percentage change in performance compared to a baseline of February 2020.
- Data is provided from 1st May to 31st May.
- Average daily figures and hourly figures are presented.
- Results from MyRepublic are excluded from all video streaming charts except on page 7.

Video Streaming overall

Percentage change in download speed from February 2020. Higher values are better. Results from all hours of the day are used (not just busy hours).

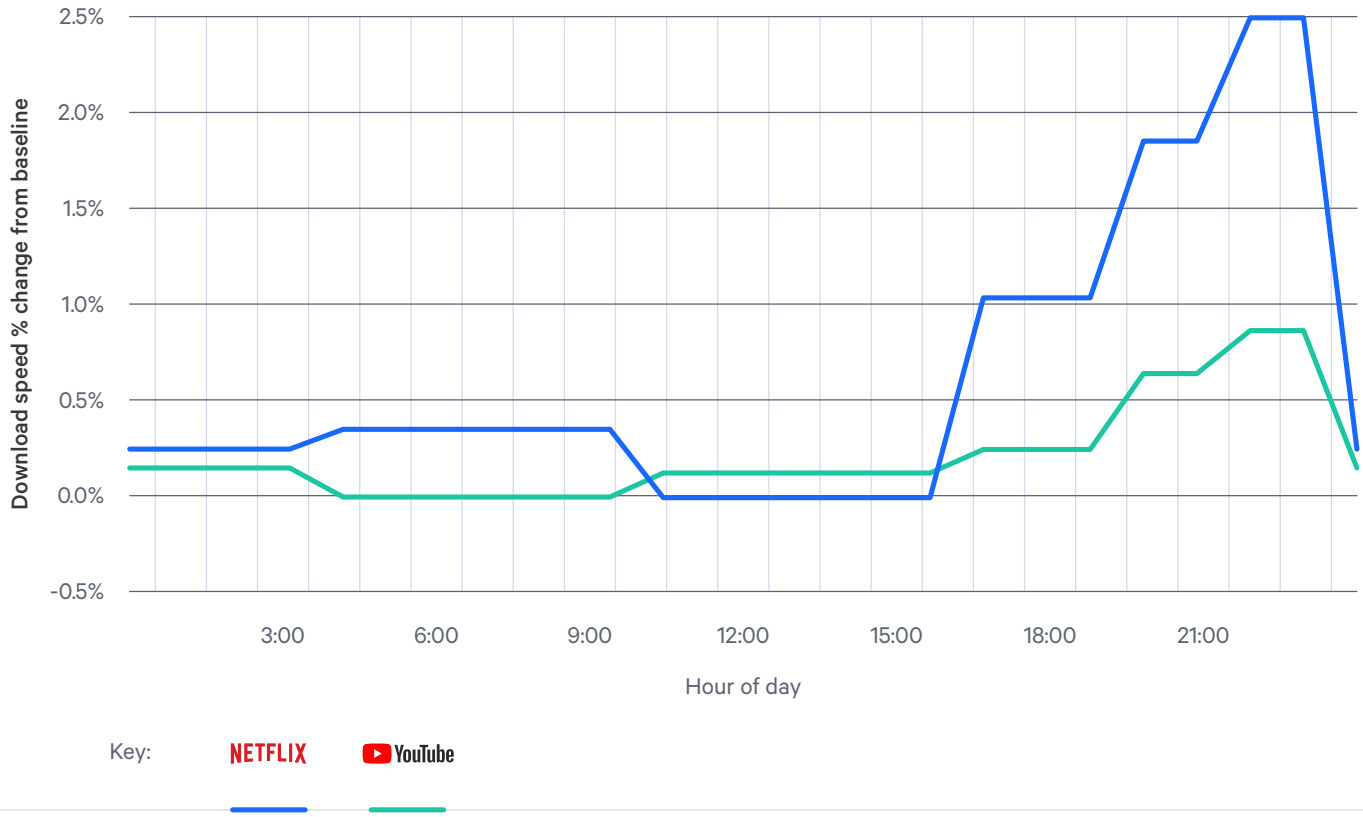


Key observations

- Both streaming services show a similar pattern of performance of daily variation.
- Netflix is consistently above its February baseline figure and ends the month over 1% higher. This is most likely due to measures implemented to offset the impact of Covid-19, specifically NBN Co permitting RSPs to acquire up to 40% additional network capacity at no additional charge and a reduction in Netflix's streaming rate of its video titles, which reduces aggregate traffic to Netflix servers. This suggests there could be potential to improve this aspect of performance in more regular periods.
- YouTube also broadly performs above its February baseline although the increase in performance is less pronounced than for Netflix. This suggests that YouTube's Covid-19 mitigation methods have not had as large an impact as those of Netflix.
- The significant drop on the 19th of May is likely due to the release of an update for one or more video games for which updates were scheduled around that date.
- The differences in performance are unlikely to be so significant that users would notice a discernible change in service quality.

Video Streaming by hour

Percentage change in download speed from February 2020. Higher values are better. Results from all hours of the day are used (not just busy hours).

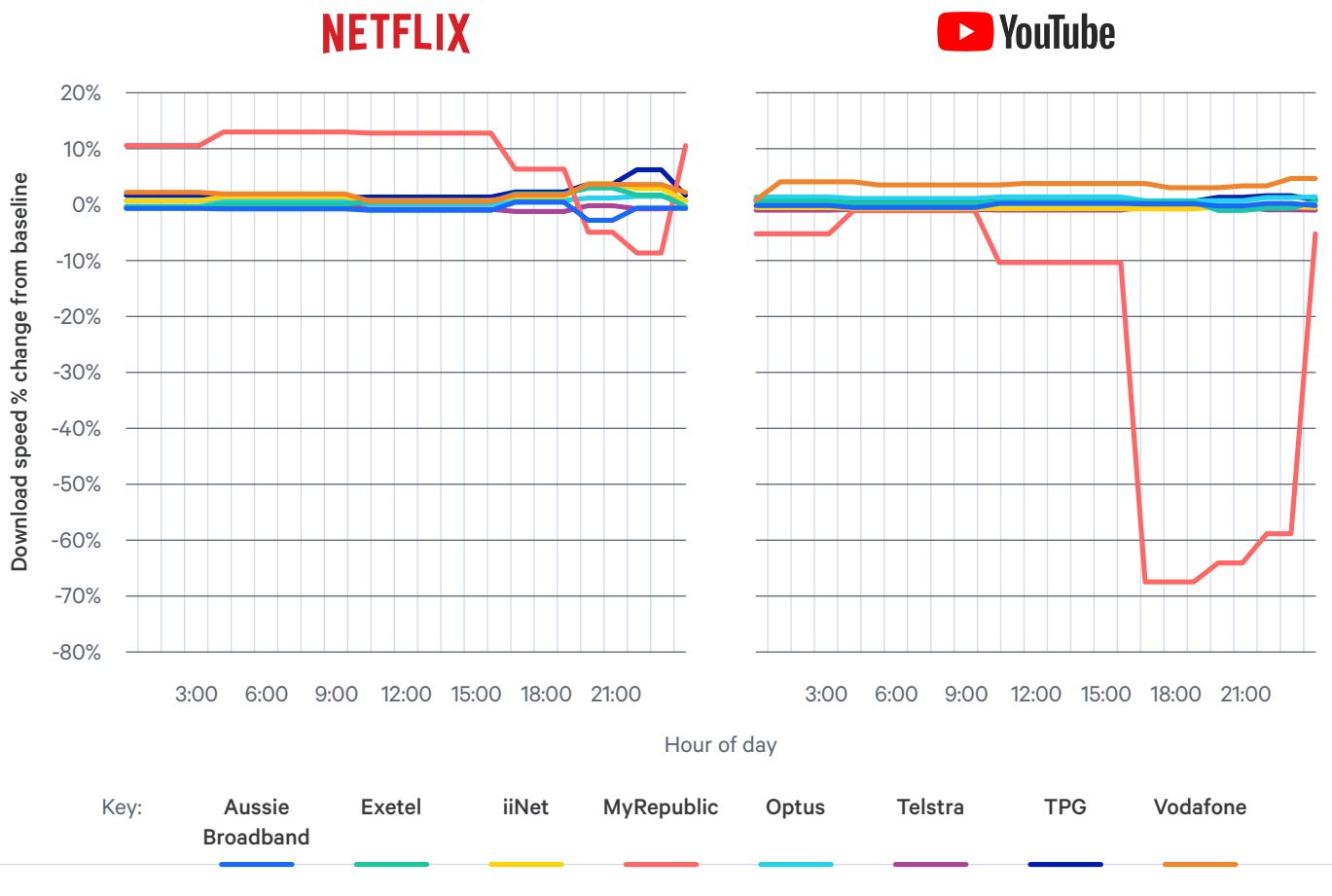


Key observations

- The impact of performance compared to baseline is starker when viewed on an hourly basis.
- Netflix matches or outperforms at all hours but its largest performance improvement is during busy hours.
- YouTube displays a similar pattern but the impact during busy hours is less pronounced.
- The mitigation measures both services have employed may have improved performance more during busy hours. This may be due to the busy hour period being more often at capacity during February and thus having more potential for improvement given the increased network capacity made available.
- Netflix's larger increase in relative performance during busy hours is likely due to a mix of its mitigation measure being more effective and it enduring more challenging circumstances during busy hours in February.

Video Streaming by RSP

Percentage change in download speed from February 2020. Positive results indicate improvement from baseline. Results from all hours of the day are used (not just busy hours). Each RSP's performance is compared to its own baseline performance.

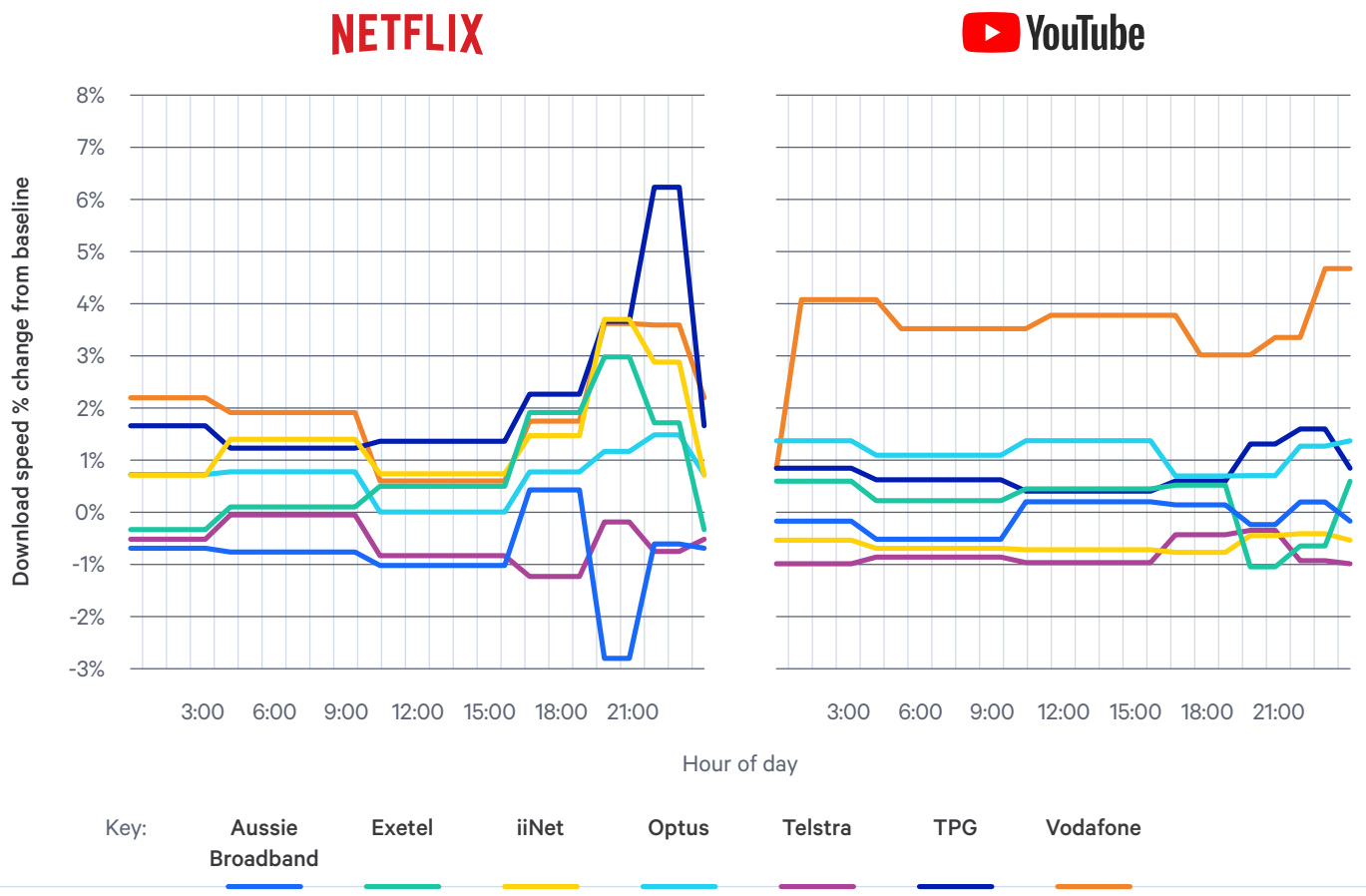


Key observations

- Most NBN RSPs have provided consistent download speeds to video streaming services in May and the baseline month of February.
- MyRepublic displays particularly extreme performance, especially in the case of YouTube.
- The servers which host the video are consistent between the two periods which suggests the issue likely relates to the MyRepublic network or its access to YouTube servers during the testing period.
- YouTube traffic for MyRepublic is served from Google's central (off-net) YouTube servers in one city - Sydney. Other RSPs, host YouTube servers within their own network and in multiple locations too.
- We have removed the units with these outlier results due to their large impact on results.

Video Streaming by RSP

Percentage change in download speed from February 2020. Positive results indicate improvement from baseline. Results from all hours of the day are used (not just busy hours).

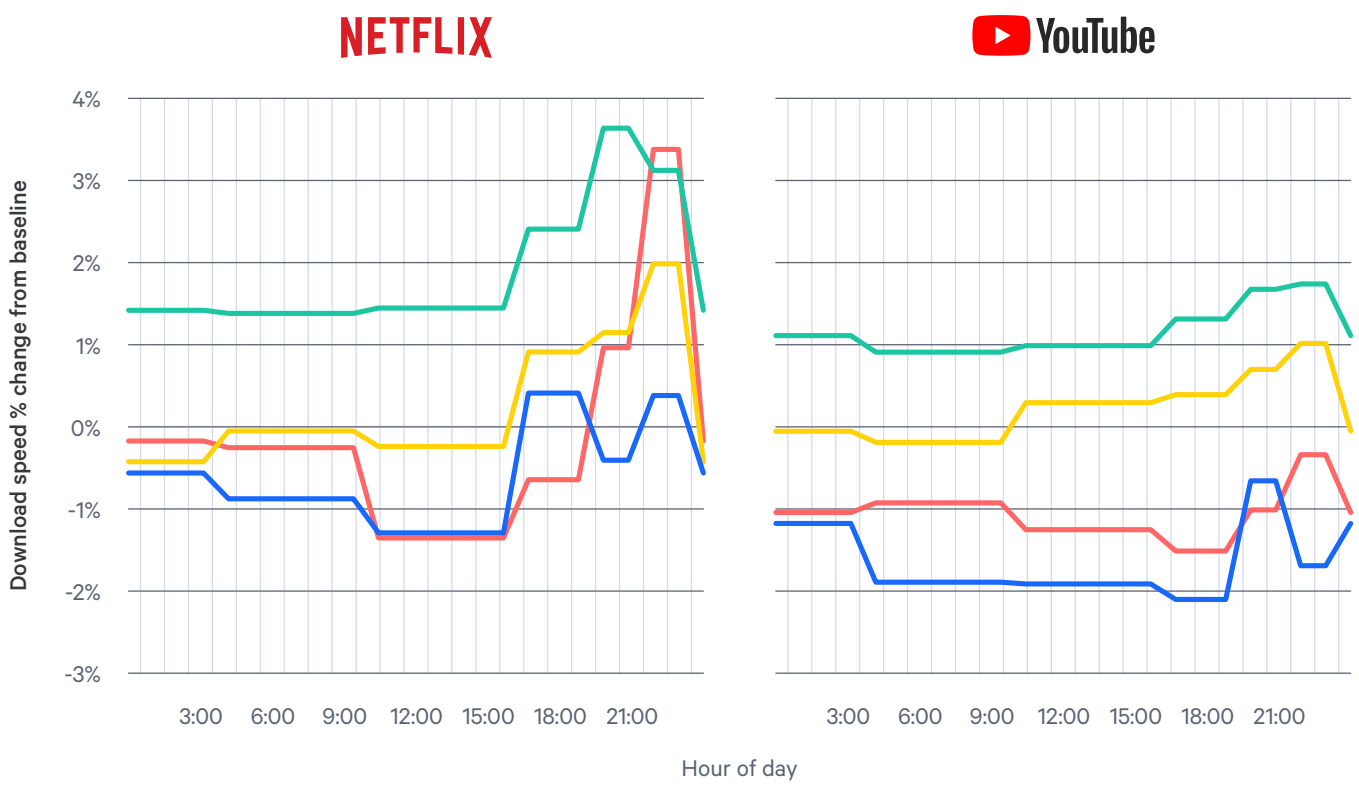


Key observations

- The performance of seven of the RSPs is further presented in the above chart at a scale that better illustrates their change from the February baseline.
- The chart shows changes in RSP performance between the test period (May 2020) and the baseline period (February 2020). The charts do not show RSP performance in absolute terms or relative to other RSPs.
- For Netflix, most RSPs are performing above their February baselines and the effect is most pronounced during busy hours. Some RSPs do have slightly lower performance than when compared to February.
- For YouTube, the majority of RSPs also outperform but without the clear change during busy hours.
- Vodafone displays a significant improvement (3-4%) in its download speed for YouTube compared to its February baseline. The servers which host the video are consistent between the two periods. This could indicate that since February there has been an improvement in Vodafone's network performance.

Video Streaming by access technology

Percentage change in download speed from February 2020. Higher values are better. Results from all hours of the day are used (not just busy hours).

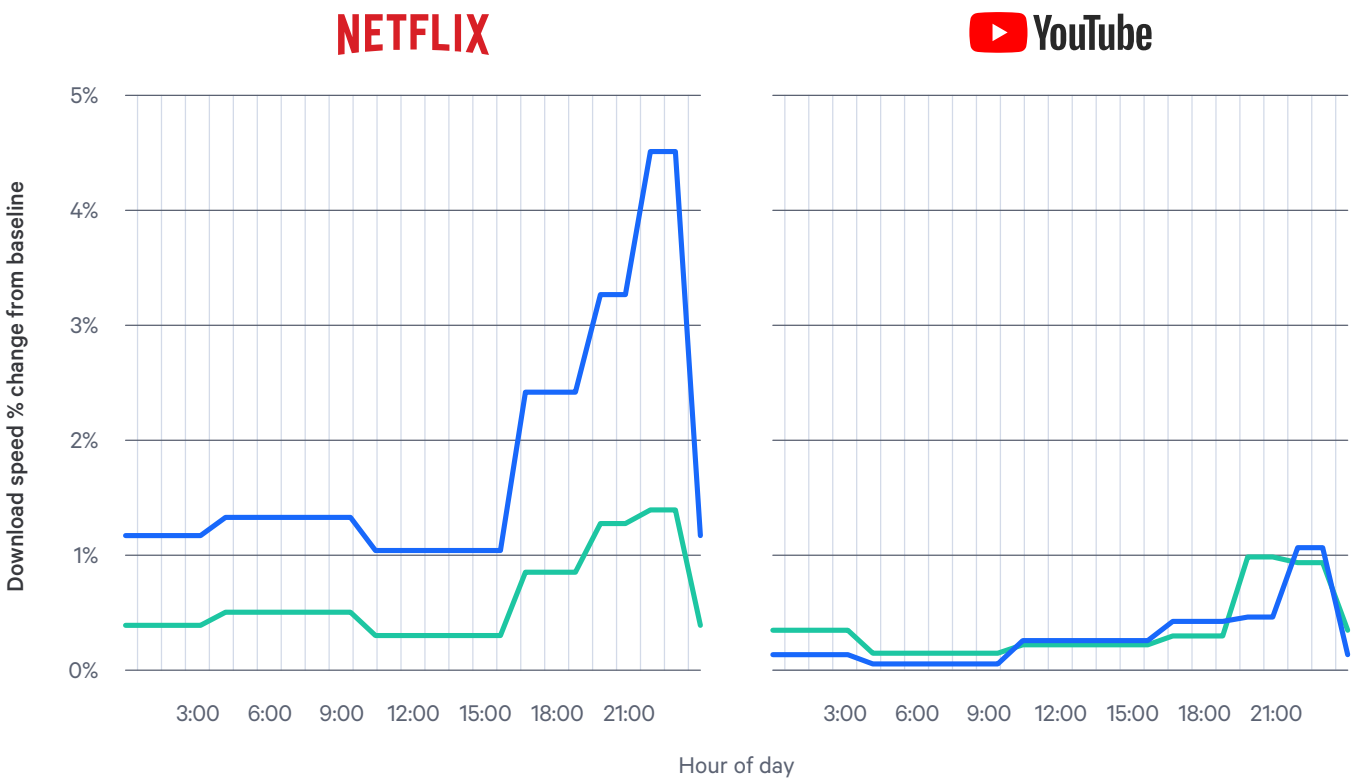


Key observations

- The different access technologies broadly follow the same pattern as overall for both streaming services.
- The differences in change in performance from baseline for both Netflix and YouTube are small.
- These differences are very small and could be caused by differences in the number and composition of units sampled between access technologies.

Video Streaming by NBN plan

Percentage change in download speed from February 2020. Higher values are better. Results from all hours of the day are used (not just busy hours).

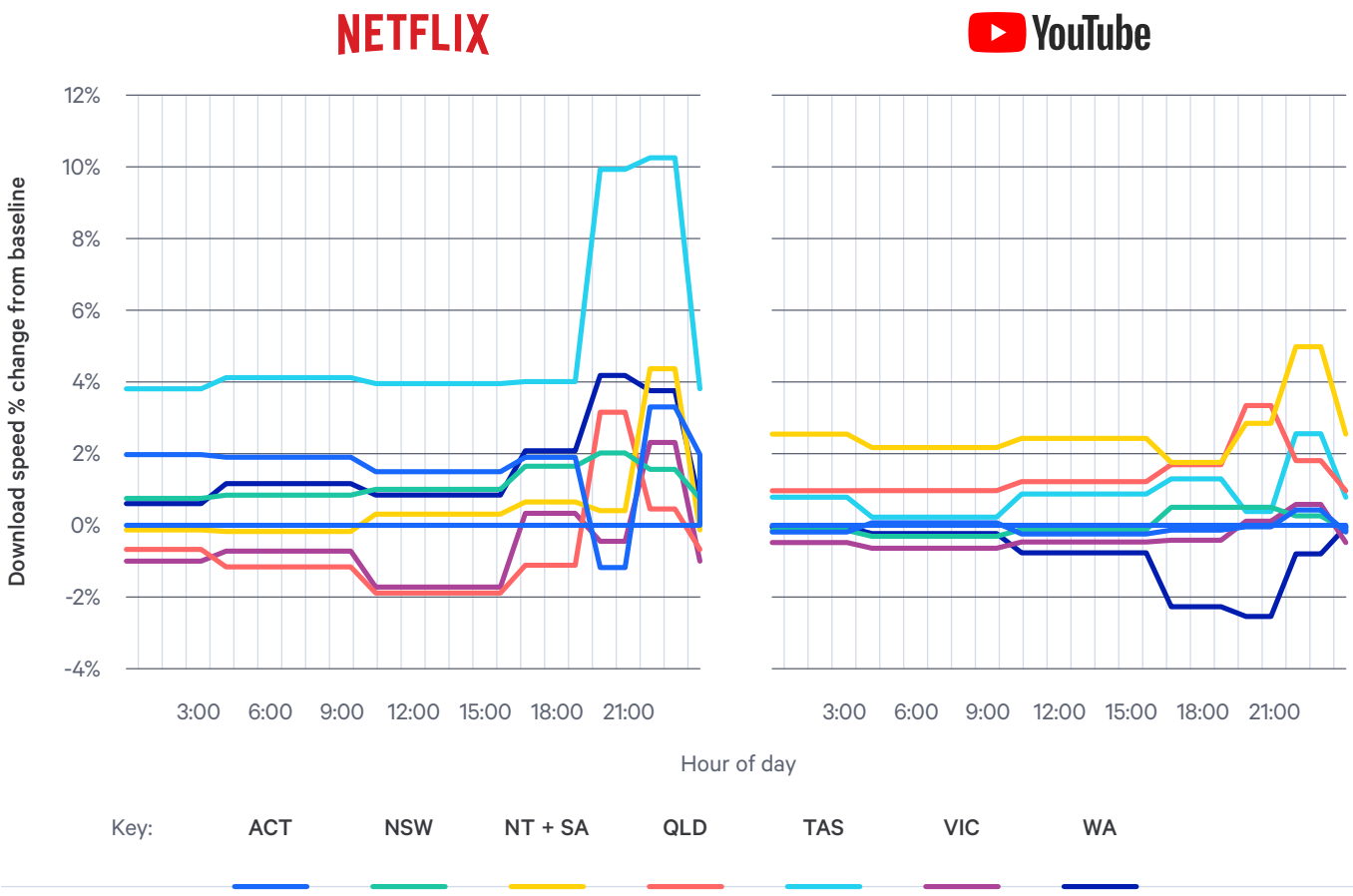


Key observations

- For the NBN plans shown here download speeds for both Netflix and YouTube were above their February baseline for all hours of the day.
- For Netflix, the 100/40 Mbps plan showed a larger improvement against the baseline compared to the 50/20 Mbps plan. The effect of this was largest during busy hours.
- For YouTube, both plans showed similar improvements when compared to their February baselines.
- Given Netflix do not cap download speeds, it is likely that their measures implemented due to Covid-19 have allowed those on higher speed plans to experience a higher download speed due to increased network capacity.

Video Streaming by state

Percentage change in download speed from February 2020. Positive results indicate improvement from baseline. Results from all hours of the day are used (not just busy hours).



Key observations

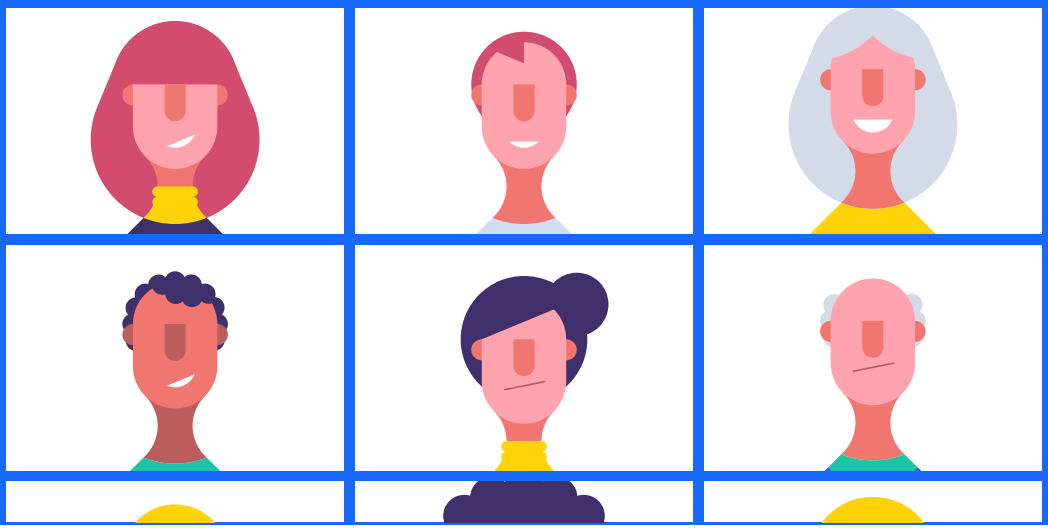
- There is some variation in states performance against baseline for Netflix and YouTube.
- For Netflix, as expected, most states show improved performance against baseline with the most significant improvement during busy hours.
- For YouTube, all states except Western Australia recorded a consistent or improved performance.
- The Netflix results for Tasmania show the largest improvement against its February baseline.

NBN Whiteboxes for streaming services

	Netflix	YouTube
Tier		
100/40 Mbps	310	309
50/20 Mbps	476	459
Access Tech		
FTTC	45	46
FTTN	357	348
FTTP	253	248
HFC	138	133
State		
ACT	38	36
NSW	270	262
NT + SA	47	44
QLD	113	109
TAS	40	39
VIC	210	209
WA	75	76
RSP		
Aussie Broadband	110	110
Exetel	57	51
iiNet	119	117
MyRepublic*	44	42
Optus	97	98
Telstra	157	154
TPG	108	105
Vodafone	50	49

The total number of Whiteboxes included for different splits vary as certain subgroups were excluded for containing insufficient Whiteboxes. The number of Whiteboxes varies between different services due to a different number of tests being completed and the subsequent impact of exclusion criteria. *Whiteboxes for MyRepublic are included only in page 7.

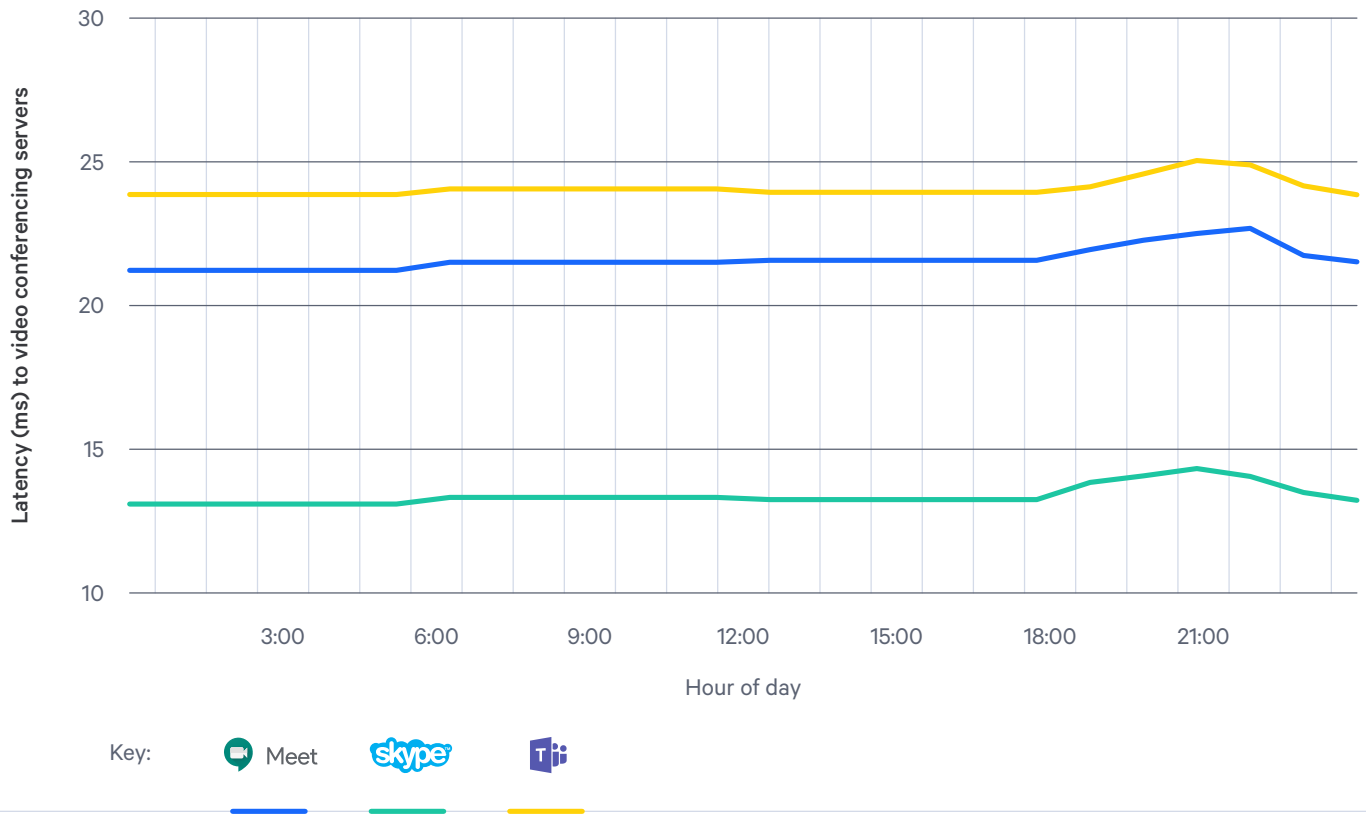
Video Conferencing applications



- Performance measures presented in this report for access to video conferencing applications are for free accounts held with a sample of application providers. Separate performance measures are presented in the case of video conferences hosted domestically, and those that are hosted on international servers.
- Performance measures for access to domestic video conferences are split by the three video conference applications that were included in this testing: Google Meet, Skype and Microsoft Teams.
- Performance measures for access to video conferences that are hosted on international servers are split by the location of the server: Europe, Singapore or USA. The applications used in this testing have not been named as the results do not reflect the performance of NBN services in providing access to those applications in all cases, including where those applications use domestic servers.
- The video conferencing test measures round trip latency. Latency is a suitable metric for assessing video conferencing performance. This is because video conferencing is inherently a realtime application. Latency to the video conferencing server will be the dominant factor in how responsive the call feels (e.g. is there lag or delay). Note that it is important to measure latency to the real conferencing servers of the various providers, and that's exactly what the Whiteboxes do. Performance is measured using latency (ms). In addition to latency, there are other characteristics of video conference applications that consumers may take into consideration, such as security.
- As this is the first period where results have been collected for these tests, all results show absolute latency to give an impression of the differences between services. Domestic and international results are presented to show the impact of location on performance.
- Data is provided from 8th May to 31st May.
- Given the wide variation in latencies attributed to different video conferencing hosted locations, the charts use different scales to ease visibility of results.
- The three services chosen for inclusion in this report are not exhaustive of video conferencing services which use domestically hosted servers. There is an intention to expand the number of services covered in subsequent reports.
- The initial study (Critical Services Report: Video Streaming and Video Conferencing) identified some subtleties in the way that popular video conferencing services handle location identification, as well as differences in the performance of free accounts vs. paid accounts. SamKnows is working with video conferencing application providers to better understand these subtleties and how they impact customer experience.

Domestic Video Conferencing applications by hour

Latency to the video conferencing application's servers, split by hour of day. Lower values are better. Results from all hours of the day are used (not just busy hours).

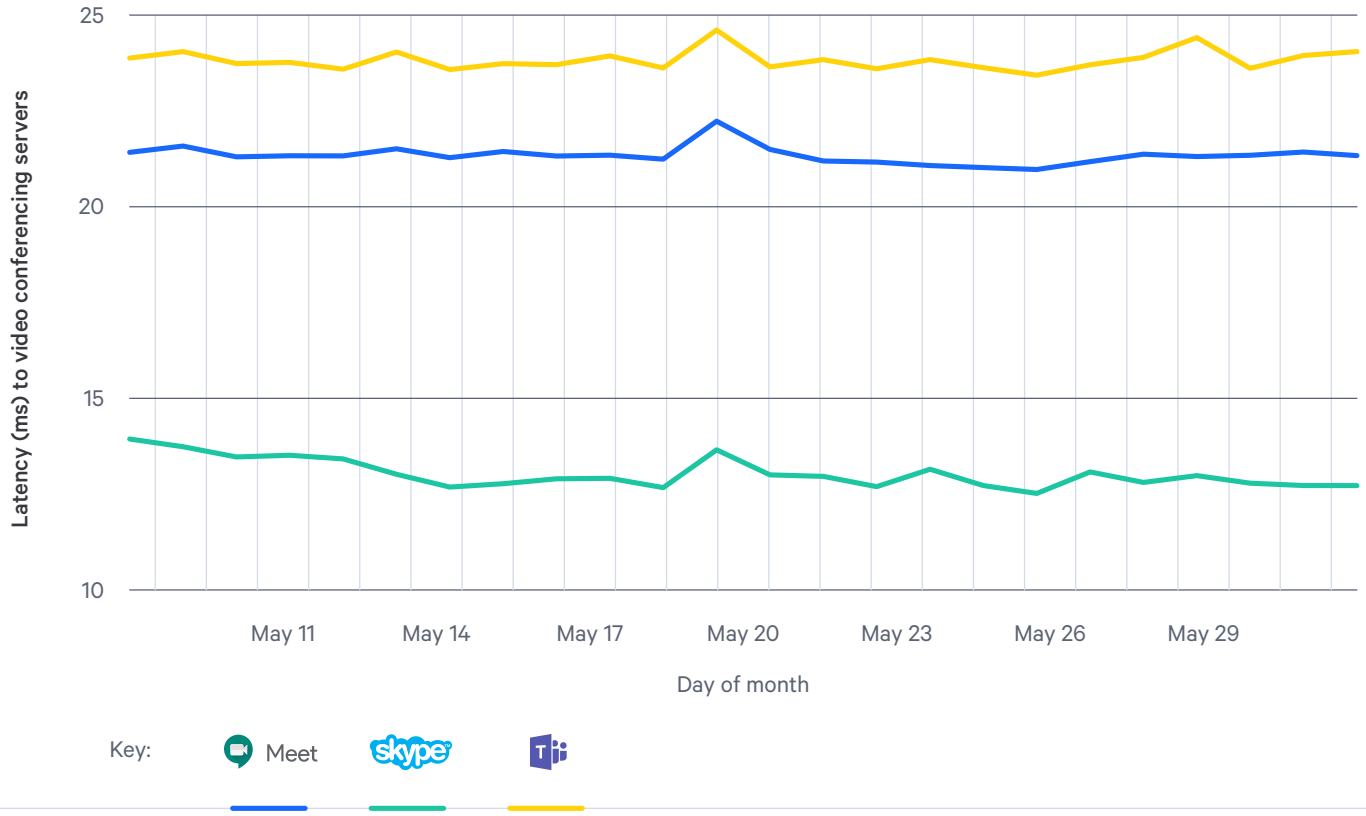


Key observations

- The most significant driver of latency is distance to the end server. Therefore, as expected, observed latencies are low for video conferences that are hosted on domestic servers.
- The low latency observations indicate that good quality access was available to the video conferencing applications hosted on domestic servers.
- Skype consistently displays the lowest latency of the applications that were tested for reporting on video conferences hosted on domestic servers. That said, all services have low latency and the differences would not be noticeable.
- All of the applications exhibited here show marginally higher latency during busy hours. The increase is very slight and not sufficient to impact on end user experience.

Domestic Video Conferencing applications by day

Latency to the video conferencing application's servers, split by hour of day. Lower values are better. Results from all hours of the day are used (not just busy hours).

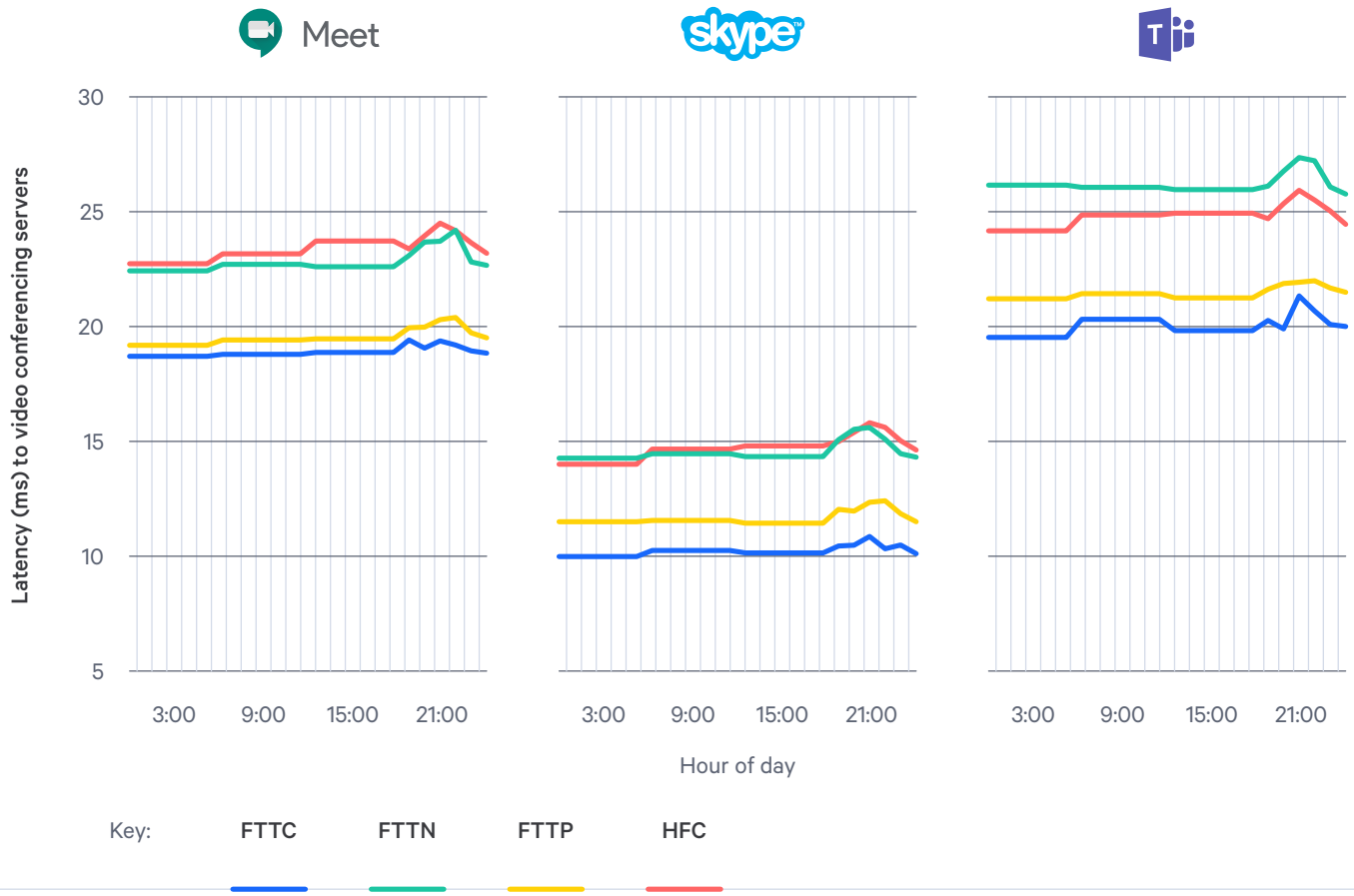


Key observations

- The majority of applications show consistent daily average latency during the measurement period.
- A small increase in latency was observed for all applications on 19th May.

Domestic Video Conferencing applications by access technology

Latency to the video conferencing application's servers, split by hour of day and week. Lower values are better. Results from all hours of the day are used (not just busy hours).



Key observations

- Access technology has a small impact for video conferences that use domestic servers.

Domestic Video Conferencing applications by NBN plan

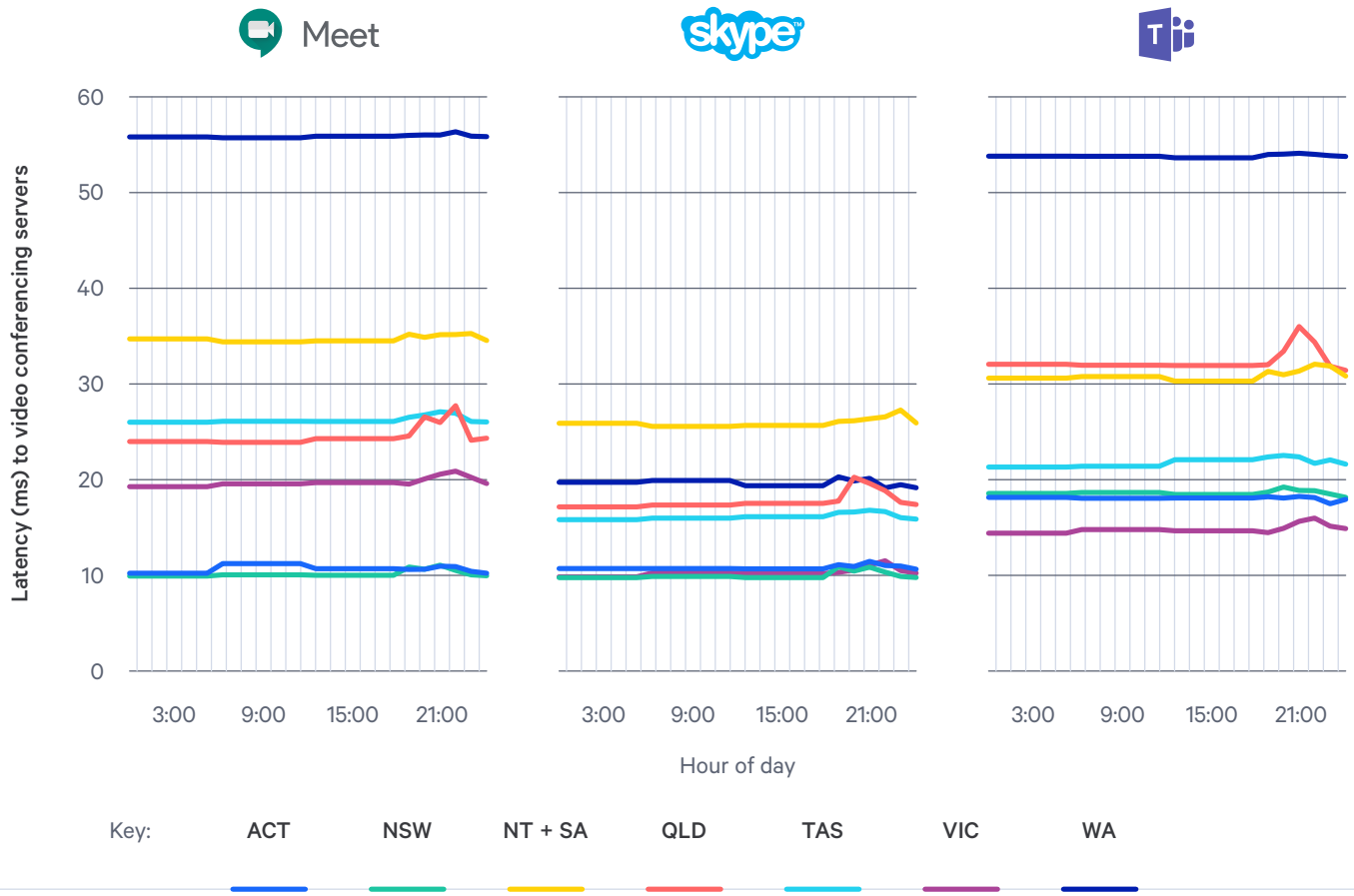
Latency to the video conferencing application's servers, split by hour of day. Lower values are better. Results from all hours of the day are used (not just busy hours).

Key observations

- The choice between NBN 100/40 and NBN 50/20 plans does not have a material impact on latency to video conferencing applications.

Domestic Video Conferencing applications by state

Latency to the video conferencing application's servers, split by hour of day and week. Lower values are better. Results from all hours of the day are used (not just busy hours).

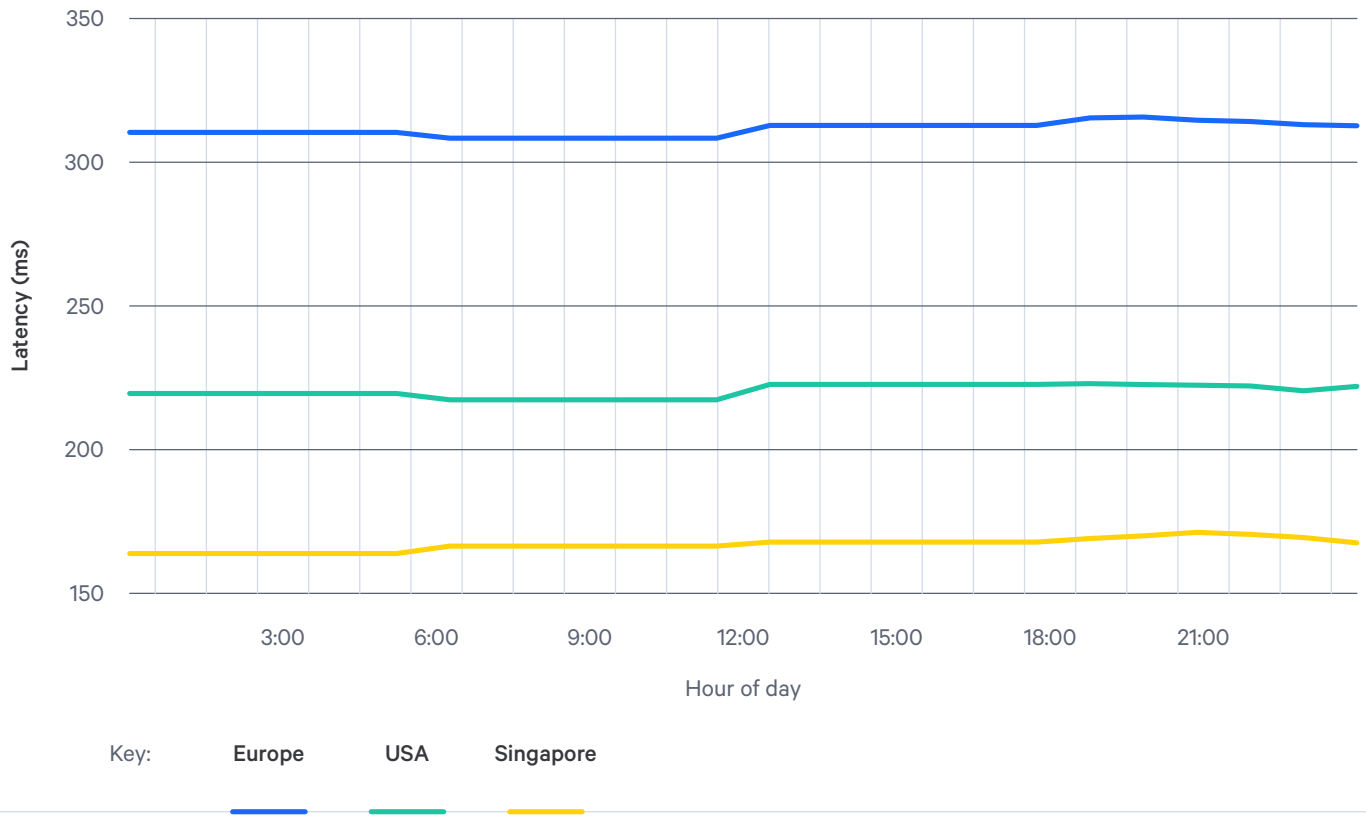


Key observations

- With physical distance having the bulk of the impact on these latency scores it is unsurprising to see variation between states.
- The exact breakdown of which state has lower latency for which application will be determined by the exact routing used by the particular application.
- The charts show that Western Australia has the highest latency for Google Meet and Teams which suggests that traffic is being directed to servers on the East coast of Australia.
- This is not the case for Skype with this platform making use of alternative servers.

International Video Conferencing by hour

Latency to the international servers used by video conferencing applications, split by hour of day and week. Lower values are better. Results from all hours of the day are used (not just busy hours).

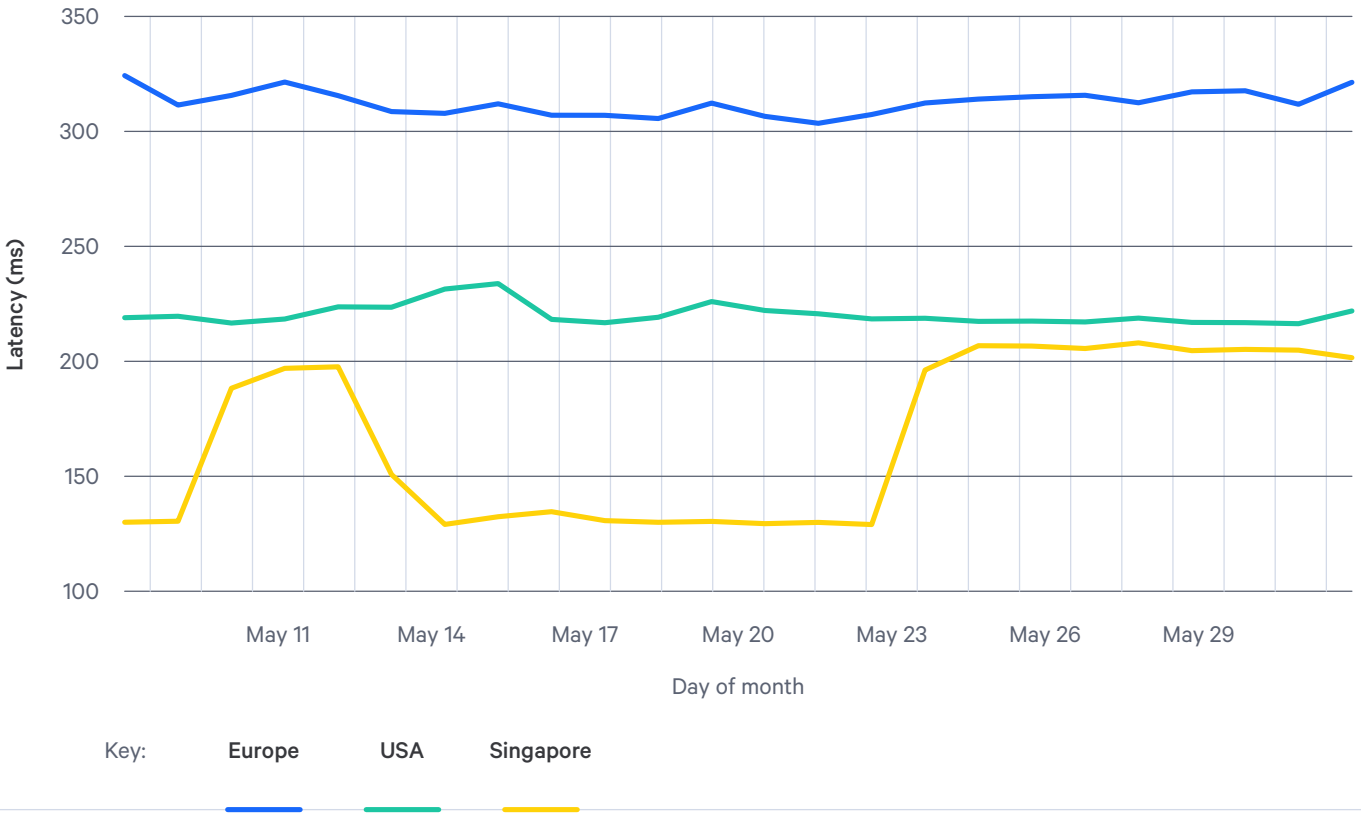


Key observations

- International servers are included in this report as they can potentially be used by video conferencing applications in some cases even where the conference and user are located in Australia.
- Video conferences that use international servers have much higher latency due to the large return distances involved.
- There is a wider disparity in latency figures for the international video conferencing using international servers.
- The observed latencies follow expectations with latency increasing with distance from Australia.
- All of the locations exhibited here show marginally higher latency during busy hours. The increase is very slight and not sufficient to impact on end user experience.
- While users would still be unlikely to notice a significant difference in performance for a video conference hosted on an international server, the increased latencies would produce a small lag that may lead to people accidentally talking over one another.
- Results are not representative of performance to a specific video conference application.

International Video Conferencing by day

Latency to the video conferencing application's servers, split by hour of day and week. Lower values are better. Results from all hours of the day are used (not busy hours).

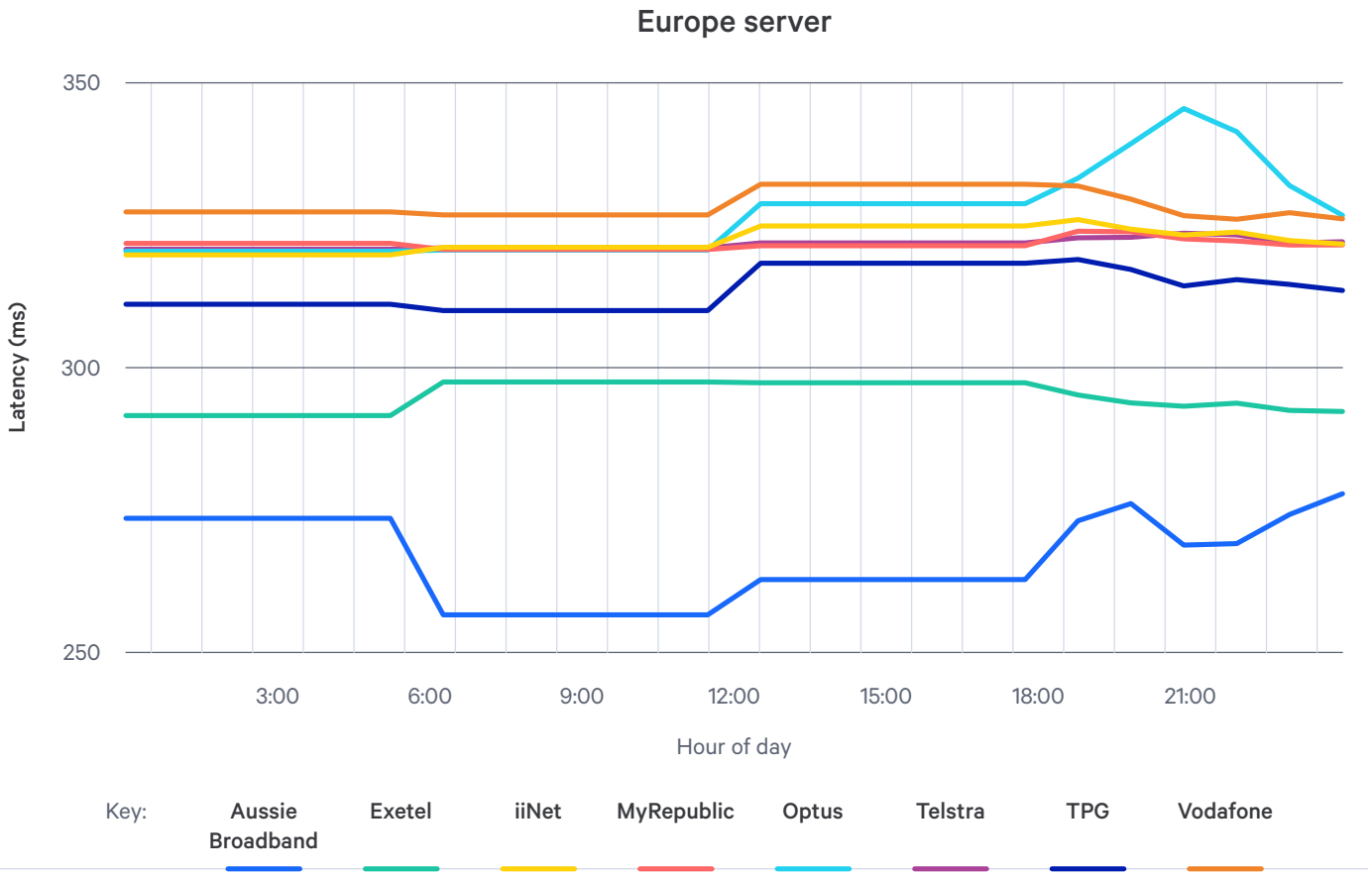


Key observations

- The majority of locations show consistent daily average latency during the measurement period.
- Video conferences using the server located in Singapore are the exception to this and display considerable variation. This is almost certainly due to routing changes on this path occurring during the measurement period.
- Results are not representative of performance to a specific video conference application.

Hourly performance to European server by RSP

Latency to the video conferencing application's servers, split by hour of day and week. Lower values are better. Results from all hours of the day are used (not busy hours).

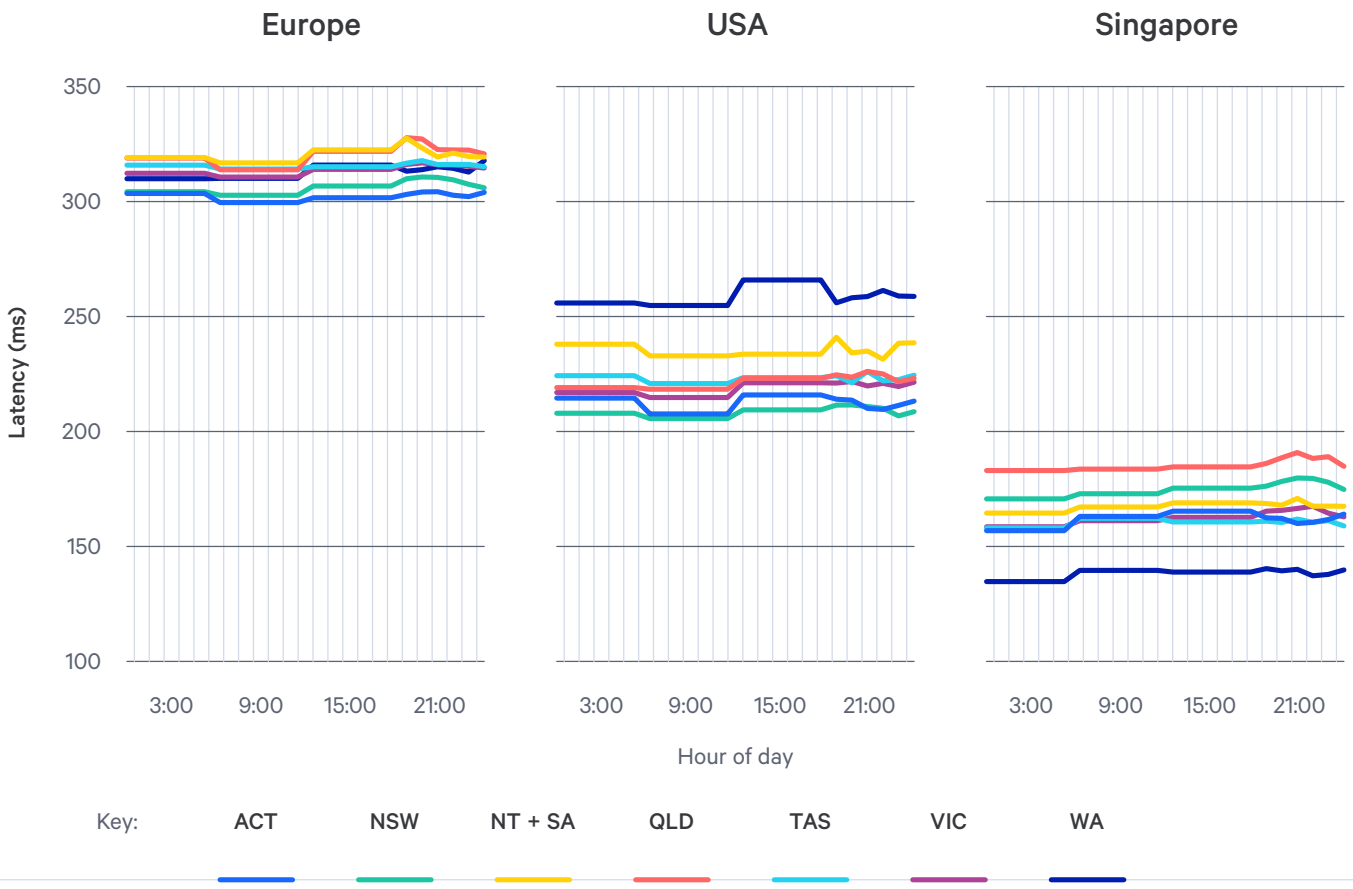


Key observations

- The European server had the highest overall latency of the international server locations tested. This situation should be considered an edge case that would not often be encountered in practice.
- On a split by RSP it is clear that different RSPs connect to the location in diverse ways and this leads to variation in latency.
- Aussie Broadband had the lowest hourly latency at all time points, and record latencies around 50ms lower than some other RSPs.
- The variation by RSP is relatively minor as a percentage of total latency and serves to demonstrate distance to end server is the ultimate driver of performance for these services.
- Results are not representative of performance to a specific video conference application.

International Video Conferencing by state

Latency to the video conferencing application's servers, split by hour of day and week. Lower values are better. Results from all hours of the day are used (not busy hours).



Key observations

- For video conferences that use international servers, the difference in latency reflects that return path distance between the State and the server location
- When Singapore is the server location, Western Australia has lowest latency.
- The converse is true when the server is located in the United States. Here the East Coast states have lower latencies than Western Australia.
- Results are not representative of performance to a specific video conference application.

NBN Whiteboxes for video conferencing applications

	Europe	USA	Singapore
Tier			
100/40 Mbps	345	346	319
50/20 Mbps	508	512	461
Access Tech			
FTTC	47	47	45
FTTN	386	390	353
FTTP	280	280	261
HFC	147	148	128
State			
ACT	42	42	39
NSW	288	289	262
NT + SA	51	51	47
QLD	120	122	110
TAS	42	41	39
VIC	229	231	207
WA	88	89	83
RSP			
Aussie Broadband	126	129	125
Exetel	62	62	60
iiNet	127	127	125
MyRepublic*	49	48	11
Optus	108	108	107
Telstra	165	167	163
TPG	115	116	104
Vodafone	53	53	53

The total number of whiteboxes included for different splits vary as certain subgroups were excluded for containing insufficient Whiteboxes. The number of Whiteboxes varies between different services due to a different number of tests being completed and the subsequent impact of exclusion criteria.