



Simbani Integrated Research
Telehealth, Digital Access, Innovative Remote
Strategy Solutions and Service Development



Draft Report on Sky Muster™ Plus and Telehealth Video Conferencing System: Performance in Darwin Rural Area – Draft for ICPA.

Marianne St Clair & David Murtagh
Simbani Integrated Research

www.simbani.com.au;

+61 427 555 484; marianne@simbani.com.au; dave@simbani.com.au;

Survey Link: <https://www.surveymonkey.com/r/5KXZNNS>

Sky Muster™ Plus performance in Darwin Rural Area.

This research aimed to determine if the NBN™ Sky Muster™ Plus satellite service would be adequate for telehealth in remote areas. Consumer grade Sky Muster™ Plus services were installed at a rural property approximately 35 kms south of Darwin.

The area is subject to severe weather events and cyclones in the wet season. The quality (ping (or latency), download and upload speeds) were monitored during the wet season at different times of the day and night including throughout moderate weather events. The Ookla speed test was used to monitor internet quality.

It is important to note the assured rate for Sky Muster™ Plus is 25 Mbps down and 5 Mbps up. Performance in light weather seemed reasonably consistent with the mean download speed of 29.02 Mbps and the mean upload speed of 8.82 Mbps, with an average ping of 567ms (n = 497).

However, during moderate weather, while outages occurred (2-26 minutes), the system recovered quickly. This internet service was used successfully with a variety of video-conferencing tools. These initial results demonstrated the Sky Muster™ Plus service was adequate for videoconferencing and therefore for video conferencing for telehealth. These preliminary data were provided to Laynhapuy Homelands Health Service (LHS) in January 2020.

Outages due to weather events.

Outages varied in duration from 2 to 26 minutes (St Clair and Murtagh, 2020). There seemed to be a trend for the download and upload speeds to reduce prior to outage, with upload failing more often than download. Light drizzle seemed to have little impact on performance with download speeds varying between 28 and 45 Mbps and upload speeds remaining fairly consistent around 9.8 Mbps. Ping remained fairly consistent between 556 – 570. When heavy weather was approaching, downloads were often possible, but there were up-load errors. Upload error is defined as being unable to connect to the internet.

Outages due to power failures.

There were frequent power failures during the wet season resulting in the Sky Muster™ Plus service failing. Additionally, there were a number of power failures during the dry season – some for extensive periods of time (eg > 5 hrs). Connectivity recovered quickly.

Outages due to NBN System upgrades.

During the 2019-2020 wet season there was one failure on the system due to NBN upgrades. On this occasion a reboot of the NTD was required (the first in 4 months use of the system).

Conclusion.

Testing of the NBN Sky Muster™ Plus satellite internet service in the Darwin Rural area indicates it is adequate for telehealth via video conferencing where small numbers of people are using the service. This is

further supported by the feedback from Laynhapuy Health Services who have been successfully using NBN Sky Muster™ Plus satellite internet for telehealth and community wifi.

Telehealth Video System Update.

A range of equipment and software was tested with a number of devices and software purchased for testing in the Darwin Rural area on the Sky Muster™ Plus service.

Technology requirements for Telehealth

As a general set of principles, the Australian College of Rural and Remote Medicine ([ACRRM](#)) have developed a guide to Telehealth in clinical practice with the following recommendations :

- Where appropriate and available, use technology that is recommended by, or available from your Primary Health Network or health organisation.
- Use technology accessible to, and usable by, the general public and other health organisations.
- Have available adequate network capacity for the technology supplied by your organisation or an internet service provider to operate reliably.
- Have timely access to technical support for detecting, diagnosing and fixing technology problems.
- Take measures to protect the identity of patients when using commercial service providers or social media networks, for instance by only using a dedicated account owned by your practice.
- When using commercial service providers or social media networks to communicate by phone or video with patients, ensure no health information such as chat interactions, documents, images are retained by the commercial service provider or social media network.
- Understand the Office of the Australian Information Commissioner Privacy policies for GPs as they may apply to information and communications technology used for telehealth services.

Zoom

Zoom as a company has seen huge expansion since the start of the pandemic. The software and underlying infrastructure were able to expand with the demand placed upon it. Since significant scrutiny was placed on the program, security features have been increased. A high level former Yahoo security expert was contracted and the purchase of an existing security firm has led to a more secure environment for videoconferencing.

Zoom's call quality has been reported to be better than similar market products. This is a very difficult value to measure but from personal observation over NBN Sky Muster™ Plus - Zoom is the most reliable performer.

Cross-platform integration in Zoom means it can be installed in all mainstream computing environments including IOS, Android, Mac, Linux and Windows.

Zoom has introduced custom backgrounds to create a more private or decorative environment for videoconferencing. If the user has a nice picture they wish to share with patients or the clinic room is not very attractive, a background can be enabled.

Zoom also has created filters to adjust facial blemishes, etc.

Meeting recording and transcripts (not recommended for clinical interactions as video files can be very large and the requirement to retain medical data will soon present issues with storage) is also available. Large video files may also slow down the operation of the database, depending on the clinical record system in use.

Zoom for Healthcare

Zoom has customised a paid version which is specifically designed for telehealth and is compliant with health international standards (e.g. Health Insurance Portability and Accountability Act (HIPAA)), which is the American healthcare standard for technology and devices). It has high-quality video, even in low-bandwidth

environments, on-screen annotations to allow clinicians to explain health issues and can provide a consultation recording (not recommended for long consults as described above).

<https://www.cnet.com/news/zoom-security-issues-zoom-buys-security-company-aims-for-end-to-end-encryption/>

<https://www.businessinsider.com.au/zoom-video-everywhere-google-hangouts-skype-2020-3?r=US&IR=T>

Facetime

Facetime is built into the Apple iPhone, iPad and MAC computers and is only usable between these devices. This system is secure but is also immediately eliminating just over half smartphone users. It could represent an option in the situation where the practice believes it will be an alternate connectivity solution, but this would require a practice mobile number. If using personal phones, patients would possibly have unscheduled access to the owner of the phone.

As Apple shares a dominant position in the smart phone industry, Facetime video calls are now an easy way to transition from a traditional phone call to video. The downsides are the screen is only small and the service is iPhone/iPad/Mac only. There have been a number of Telehealth papers mentioning the use of smart phones to allow remote-end doctors to direct patients to allow closeup views of wounds, skin conditions and other visible problems requiring remote diagnosis. Although these examples have clear benefit, the lack of an Android version of Facetime will always restrict use of this service.

Conclusions/Key Recommendations

From a technical perspective, there are a number of key choices remote health service providers should consider before establishing significant Telehealth infrastructure in software, hardware and Internet Services. The following list outlines key considerations and recommendations in the Australian video conferencing market for Remote Telehealth at the end of 2020. These recommendations will change as new vendors and functionalities are introduced to software, hardware and Internet services.

Beneficial features and functionality of healthcare focused videoconferencing.

Easy scheduling and initiation

Zoom has benefitted greatly from being an easy to use videoconferencing product. Primarily from the fact that the service allows users to setup and start a video conference quickly without too many questions, clicks or technical failures. Zoom also quickly responded to concerns about security maintaining trust as a new organisation to most technology users.

The two Microsoft products: Skype and Teams were both more complex and were not clearly targeted to their market segments (i.e. home and business users). There are a number of Telehealth specific videoconferencing tools that have gained market share by integrating closely into the work practice activities of the clinical environment. Products like Coviu (now part of the Health Direct government supported solution) may not be as easy to use as Zoom.

Easy transition from phone to video.

Facetime phone to video conference transition shows an easy way to change a patient consultation from a phone conversation to a video call. This has been demonstrated to be valuable in gaining a differential diagnosis in the Laynhapuy Homelands of East Arnhem Land in the NT (St Clair and Murtagh, 2020). Clinicians have been able to more accurately assess the severity of injuries, skin conditions and other key diagnostic indicators to help inform on-going treatment and/or the decisions to evacuate the patient. This feature/functionality may be enabled through the generation of an SMS with a link to a video conference so the phone call could become the video call. This would require doctors to understand a new skill/capability/competency from the perspective of both the use of the software and changes to the consultation method.

High quality video rendering over low bandwidth connections.

Zoom also won the videoconference battle by providing more reliable and better-quality video images using a variety of internet services. Remote health services tend to rely on inferior internet services. So, the choice of videoconference software in remote settings must place priority on low bandwidth performance.

Multiple camera/video stream input.

Telehealth is not just videoconferencing. It can take the form of remote monitoring. Video conference software can display multiple video inputs. For example, a dental camera can be added to the videoconference so patients, doctors and the output of the remote monitoring device used to assess a particular condition can be viewed at the same time. As an education process as well as a way to ensure the patient understands the problem and the information being provided to them, this functionality allows better communication between the remote clinician and the local patient.

Remote End Camera Control

There are now a number of remote-control video conferencing cameras. For example, Zoom allows users to grant access to remote doctors to control camera direction and zoom into specific features of a wound or skin condition. The Logitech PTZ Pro camera for example can plug into the computer's USB port and be controlled both locally and remotely. This would allow a remote clinic with limited staffing to be guided by a more experienced and qualified clinician. Here is a You Tube video to explain remote camera control: <https://www.youtube.com/watch?v=8DujozD1fSs> It is worth noting that both users, the user requesting and the user giving control, need to have the far end camera control option turned on in Zoom's advanced settings.

Connectivity

In respect to Internet connectivity, new Internet services are being established and will change the remote connectivity environment in the coming years but the NBN Sky Muster™ Plus service is a viable videoconference platform and therefore all Australian mainland based health services can do Telehealth from the perspective of external connectivity.

The testing done by the project team indicates the Sky Muster™ Plus service is adequate for videoconferencing and telehealth with up to two connections operating concurrently. This is further supported by Laynhapuy Health Service's positive experience with the product and their purchasing of an additional four Sky Muster™ Plus services for their stores and community wifi.

Initial development of a simple, robust and reliable Telehealth Video Conferencing System (TVS).

A range of equipment and software were tested in the first phases of this project. A list of components of the current TVS system which has been tested extensively in the Darwin Rural area is outlined below.

Fundamental TVS principals:

1. Must be very easy to use from the clinician and patient's perspectives.
2. Best case scenario requires alternate internet connectivity for reliable telehealth clinical services.
3. Need enough concurrent bandwidth to access a) Video conferencing session, b) Patient data (ie medical record and My Health Record Data) and c) Other internet resources required by the clinician.
4. It is better to have 2 screens - one for patient data/resources, one for video conferencing.
5. A high quality video camera capable of remote control via remote clinician is required. Camera needs high quality pan tilt and zoom ability so clinician can clearly see specific patient conditions to inform diagnosis.
6. High quality microphone and speaker preferably integrated to eliminate feedback.
7. Video software (Zoom is the current recommended product for small services) but there is a clear use of multiple VC software when interactions with Specialist, other healthcare providers and State and Territory Departments of Health.
8. Network setup should employ multiple routers to isolate any untrusted devices such as security cameras, guest Wi-Fi access, smart medical devices, ECG's, smart door locks, remote blood testing equipment,

etc. This setup is commonly known as the [three router system](#) and deploys a Border Router connected to the internet and two internal network routers, one for secure devices and the other for unsecure and untrusted devices (see figure below).

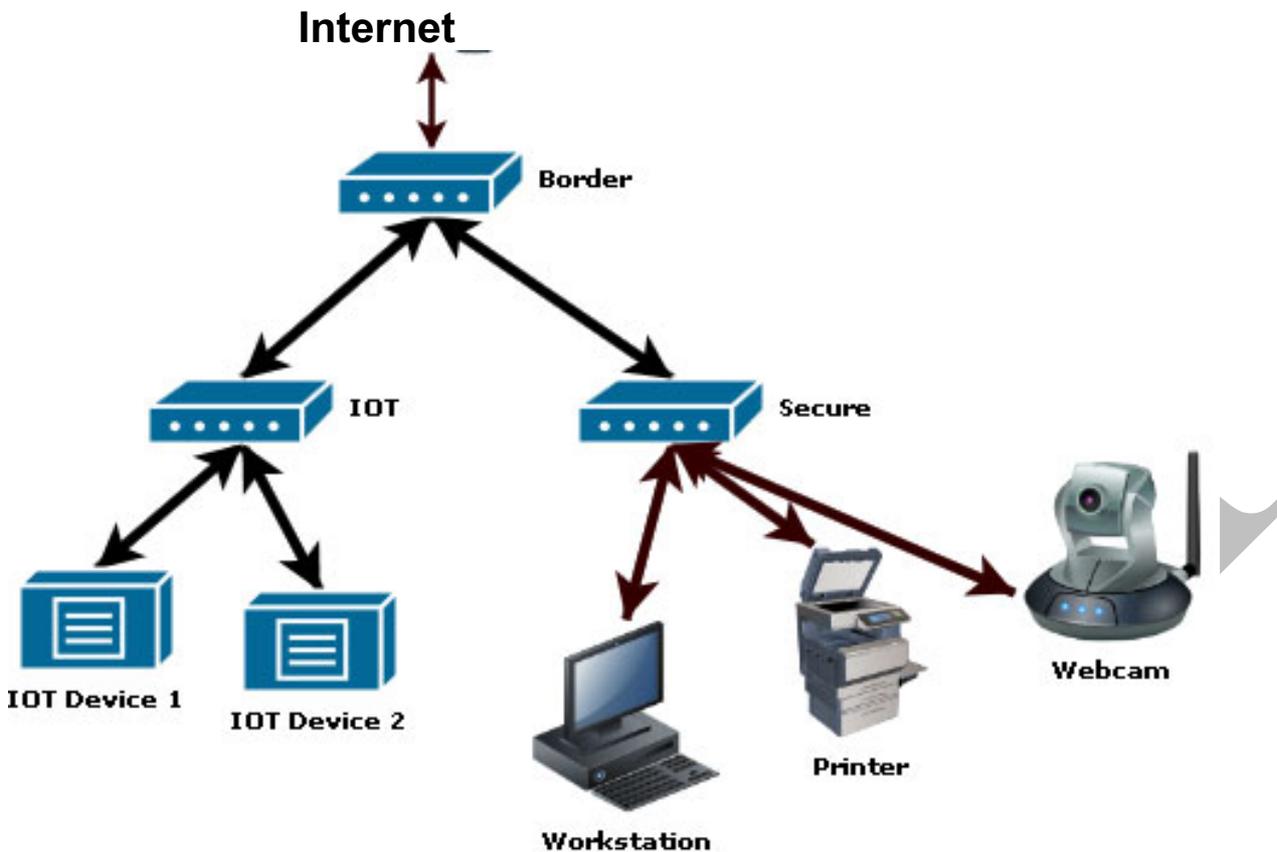


Figure 1 <https://pcper.com/2016/08/steve-gibsons-three-router-solution-to-iot-insecurity/>

Current Telehealth Video Conferencing System (TVS) and indicative costs (please see table below):

Establishment costs: Estimated establishment costs for the current TVS is approximately \$4,400 but when costed out as a per annum cost would be in the range of \$2,500. A number of devices tend to fail in the harsh conditions of remote communities, so a conservative (prophylactic) approach includes replacing some components more frequently than required in an urban setting.

Annual subscription costs: Annual subscription costs are in the order of \$2,530 which includes the costs of the Sky Muster™ Plus Service and Zoom annual subscription.

Access to My Health Record is free for both clinicians and patients. Costs for clinic specific patient data bases have not been included in these costs.

Current TVS and connectivity systems and costs:

#	Item	Indicative cost (\$)		Estimated life	Expected
		pa	Establishment	Expectancy ***	cost pa
1	Zoom Video Conferencing Software	130			
2	Computer – either Mac or PC with integrated camera*		1000	2 years	500
3	Camera – Logitech PTZ Pro		1200	2 years	600
4	Jabra 710 integrated conference microphone and speaker		300	2 years	150
5	NBN Sky Muster™ Plus Plus service (including Satellite Dish and NTD)**	2,400			
6	NighthawkWiFi Access Point		100	1 year	100
7	2 x Router Ubiquiti Unifi Security Gateway @ approximately \$500 each		1000	2 years	500
8	Netgear Prosafe Switch		500	1 year	500
9	Uninterruptible Power Supply (UPS) – eg Power Shield Defender 1600		300	2 years	150
10	Remote access to patient's clinical record (highly recommended) ****	0	0		0
	Totals	2530	4400		2500

NB: Links to devices and software have been included as examples, however, the researchers are not advocating or recommending any particular provider. However, the researchers strongly recommend “shopping around” to get the best deal and shop to support local business if possible. The researchers often negotiate with vendors to get better deals for equipment.

*Devices tested: Mac Book Pro, Mac Book Air, Mac Mini, HP Envy Laptop and HP all in one, ACER Spin Laptop
Range in costs \$400 - \$4,000, a figure of \$1,000 is used as an example with
Minimum specifications: <ul style="list-style-type: none"> • Storage space: 250 GB • CPU: i5 or above • RAM: 8GB minimum • Graphics: Onboard is OK
**The establishment and maintenance costs are borne by NBN Co and not the consumer
NBN Sky Muster™ Plus Service is approximately \$200 per month
*** Estimated life expectancy relates to the anticipated life expectancy in the bush which can be subject to severe weather events, lightning strikes, etc.
This figure is based on the researchers' personal experiences in regional and remote areas as well as ICT support staff in a number of roles over the last 20 years.
**** Patient's records may include My Health Record and/or the clinical database used by that practice. My Health Record is free, other database access costs vary significantly and have not been included in the costs

A number of Telehealth consultations and demonstrations have been done in Darwin Rural successfully using the current TVS and Sky Muster™ Plus service.

It is important to note, the Sky Muster™ Plus service can fail in storms and power failures but recovers quickly when the storm has passed or the power returns. It is recommended to switch power off to all unprotected equipment as the storm approaches to prevent damage to equipment. It is also recommended all networking equipment is connected to the Uninterrupted Power Supply (UPS). Telehealth consults can continue if power and internet are still available on power protected devices (UPSs).