Final report

Sandalwood Feedlot

Project code:	P.PSH.1052 Sandalwood Feedlot–WAN and Wide Area Wi-Fi
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Abstract

The telecommunications network upgrade to the Sandalwood feedlot was undertaken to improve Wide Area Network (WAN) connectivity and wireless access at the site. MarchNet constructed a 30Mbps/30Mbps Fixed Wireless Wide Area Network (WAN) link to connect their well-established feedlot site at Irvingdale to high speed, reliable carrier grade internet. To maximise their investment Sandalwood Feedlot requested the design of a MarchNet Wide Area Wi-Fi (WAWIFI) solution, broadcasting the high-speed internet service ~10kms and 360 degrees from the Mill Tower beyond the expansive feedlot, grazing/farming operation, 8 homesteads and into neighbouring properties. A Managed Wi-Fi and Voice over Wi-Fi (VoWi-Fi) network was installed around the site, to enable roaming Wi-Fi and access to the Telstra mobile network.

The key findings that arose over the 3-year project monitoring period are detailed below.

- An increase in speed and reliability of the network
- Enabled remote monitoring of livestock and operational systems
- Enabled remote access to the Sandalwood private network
- Delivers real time, reliable information to help make smarter, faster decisions
- Enabled video surveillance and recording
- Enabled cloud computing and facilitated scalable technology choices
- Helped to improve staff hiring, satisfaction and retention

These results are expected to be replicable for other regional and remote Red Meat producers as well as the wider industry across the country. MarchNet's smarter telecommunications solutions have proven to provide these results and numerous benefits to producers and their staff.

Executive summary

Background

The purpose of this research is to determine if the network upgrades undertaken at the Sandalwood Feedlot meet the below project objectives.

Objectives

- greater efficiency in day-to-day operations
- better connect staff to family and friends
- assist with effective livestock control and decisions
- enable more effective management through real time information and feedback, and
- improve maintenance procedures.
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Methodology

- Install a Wide Area Network (WAN) connection of 30 Mbps symmetrical to the site.
- Install a Managed Wi-Fi and VoWi-Fi network around the site.
- Install a WAWIFI connection to the homesteads via Point to Multipoint microwave and Wi-Fi mesh.

Results/key findings

- An increase in speed and reliability of the network
- Enabled remote monitoring of livestock and operational systems
- Enabled remote access to the private network
- Delivers real time, reliable information to help make smarter, faster decisions
- Enabled video surveillance and recording
- Enabled cloud computing and facilitated scalable technology choices
- Helped to improve staff hiring, satisfaction and retention

Benefits to industry

The industry operates in similar rural and remote locations. Access to high speed, reliable telecommunications can produce similar results for other industry participants.

Future research and recommendations

MarchNet will look to perform similar studies with other industry participants in the future to confirm the findings of this report are repeatable.

This project provides evidence that deployments of a similar design will deliver improved operational efficiencies and benefits for the Red Meat industry.

It is the recommendation of MarchNet that similar deployments are rolled out across other feedlots and sites in the Red Meat Industry.

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1. Background

MarchNet is an established communications provider dedicated to creating value by connecting people and operating exclusively in regional and remote environments. Sandalwood approached MarchNet in 2018 to help with a telecommunications upgrade at their Irvingdale feedlot. Before the upgrade of the network, Sandalwood was running on Telstra's 3G network from Dalby, which was oversubscribed and delivering an unsatisfactory internet service to the office and staff.

Due to increased bandwidth demand at the site and the planned feedlot expansion, Sandalwood required an extensive network upgrade. MarchNet was awarded the contract to design, build and operate the upgraded telecommunications infrastructure.

The results of the research undertaken throughout this project will demonstrate the advantages of faster connectivity, network availability and reliability, and increased wireless network footprint to the Red Meat Industry.

Figure 1 – Sandalwood Feedlot

2. Objectives

The project aimed to improve staff connectivity around the site and to the outside world. This would allow for:

- • greater efficiency in day-to-day operations,
- • connecting staff to family and friends,
- • more effective livestock control and decisions,
- • smarter management through real time information and feedback, and
- • improved maintenance procedures.

The project would literally connect the paddock to the homestead and office.

3. Methodology

To meet the objectives set out by Sandalwood, MarchNet designed a state-of-the-art network solution for the Sandalwood feedlot. This solution did not only provide Layer 2 connectivity,

Internet, Managed Wi-Fi and VoWi-Fi services across the offices and feedlot, but also provided owners and stakeholders with reliable high-speed internet services to the homestead.

The below outlines the technologies used at each location to meet the project objectives.

1. **Office –** Point-to-Point connection back to the MarchNet Dalby Point of Presence, delivering a dedicated 30 Mbps Internet Connection. Managed Wi-Fi at the office, includes provisioning and performance monitoring of the Wireless Access Points, SSID management and per user rate limiting (based on client requirements). MarchNet provides access to the Telstra Mobile Phone network at the office by utilising VoWi-Fi calling.

2. **Feedlot & Homesteads -** The Managed Wi-Fi solution broadcasts the high-speed Internet service ~10kms and 360 degrees from the Mill Tower using a Point-To-Multi-Point (PTMP) network beyond the expansive feedlot, grazing/farming operation, 8 homesteads and into neighbouring properties. MarchNet also monitors the performance of the Wireless Access Points, performs SSID management and per user rate limiting (based on client requirements). MarchNet provides access to the Telstra Mobile Phone network at the feedlot by utilising VoWi-Fi calling.

Using rate limiting on the homesteads, a 30 Mbps symmetrical service is always available at the office. In addition, through connecting the homestead to the private network and creating an extension of the office network, MarchNet enabled remote monitoring and control of the feedlot control systems from the manager's property, or any other authorised location.

Figure 2 – Wireless Network Paths

4. Results

Every month a bandwidth usage report is generated and sent to Sandalwood highlighting the total data consumed for the month including upload and download volumes. The usage for the services is recorded against the current bandwidth being supplied to ensure the current plan is meeting the client's expectations. The last three years of bandwidth usage highlights that the 30Mbps upload / 30 Mbps download service is meeting the client's requirements.

The below findings are from MarchNet's active monitoring platform and outline the typical monitoring outputs over the past three years. The areas monitored are:

1. Bandwidth Usage - **Daily**
2. Bandwidth Usage **– Quarterly**
3. Content Usage - **Quarterly**
4. Data Usage **– Quarterly**
5. Service Availability and Latency **– Quarterly**

Bandwidth Usage – Daily
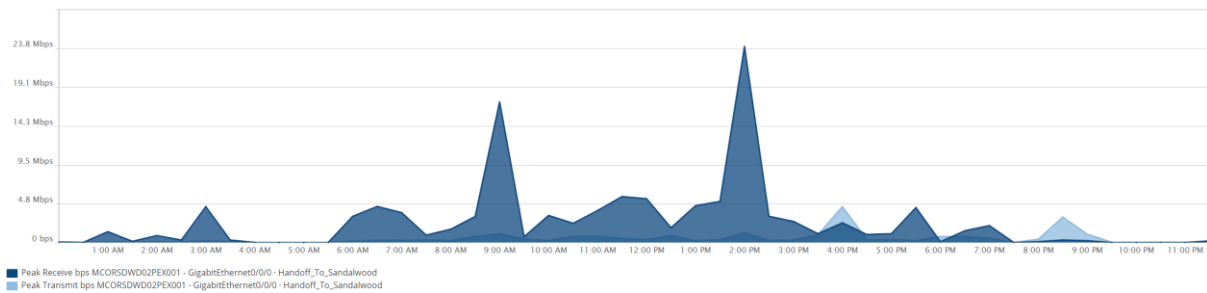
Figure 3- Typical Daily Bandwidth Usage

This graph highlights the bandwidth usage as an example of a typical day during the period. This indicates the service is being utilised well. The graph shows a peak in the morning when operations begin with usage peaking around midday and continue into the afternoon through to the evening.

Bandwidth Usage - Quarterly
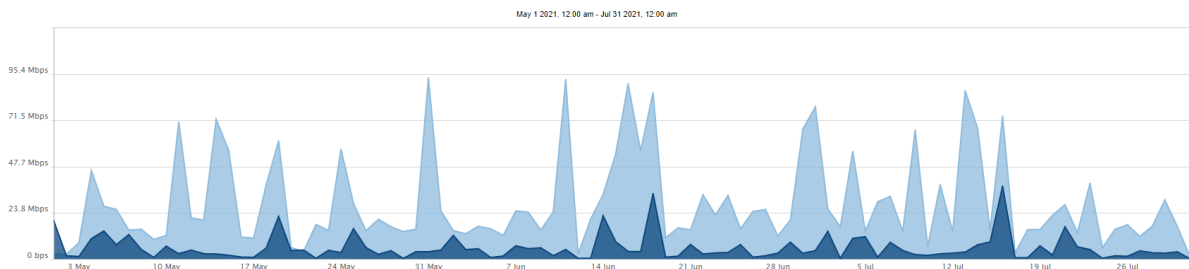
Figure 4 – Typical Quarterly Bandwidth Usage

Sandalwood's bandwidth usage during an average reporting period shows consistent download and upload usage throughout the reporting period. This graph demonstrates that the service is being well utilised and the speed profiles are adequate for Sandalwood's current requirements.

Content Usage – Quarterly

Top 20 Applications
INGRESS AND EGRESS, 1/08/2021 10:00 AM TO 31/10/2021 11:45 PM

NetFlow ∨   EDIT HELP

HP Virtual Room S... (0.03%)
DNS query-respons... (0.03%)
commplex-link TCP... (0.04%)
HTTP Alternate (s... (0.05%)
Domain Name Serve... (0.08%)
RTP UDP (0.09%)
imap4 protocol ov... (0.59%)
Unmonitored traff... (1.81%)
World Wide Web H... (40.81%)

http protocol ov... (56.39%)

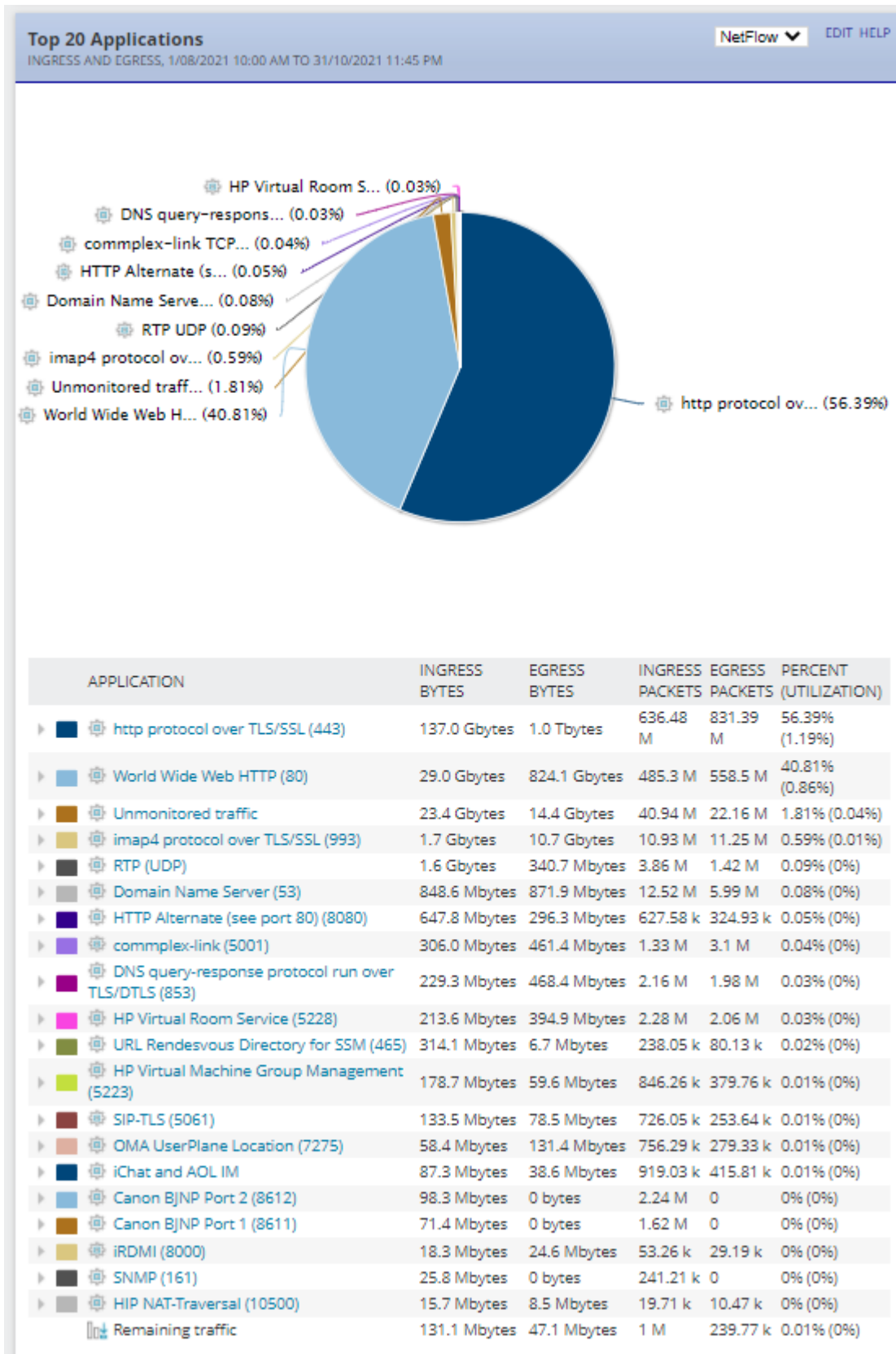|	APPLICATION	INGRESS BYTES	EGRESS BYTES	INGRESS PACKETS	EGRESS PACKETS	PERCENT (UTILIZATION)
▶	http protocol over TLS/SSL (443)	137.0 Gbytes	1.0 Tbytes	636.48 M	831.39 M	56.39% (1.19%)
▶	World Wide Web HTTP (80)	29.0 Gbytes	824.1 Gbytes	485.3 M	558.5 M	40.81% (0.86%)
▶	Unmonitored traffic	23.4 Gbytes	14.4 Gbytes	40.94 M	22.16 M	1.81% (0.04%)
▶	imap4 protocol over TLS/SSL (993)	1.7 Gbytes	10.7 Gbytes	10.93 M	11.25 M	0.59% (0.01%)
▶	RTP (UDP)	1.6 Gbytes	340.7 Mbytes	3.86 M	1.42 M	0.09% (0%)
▶	Domain Name Server (53)	848.6 Mbytes	871.9 Mbytes	12.52 M	5.99 M	0.08% (0%)
▶	HTTP Alternate (see port 80) (8080)	647.8 Mbytes	296.3 Mbytes	627.58 k	324.93 k	0.05% (0%)
▶	commplex-link (5001)	306.0 Mbytes	461.4 Mbytes	1.33 M	3.1 M	0.04% (0%)
▶	DNS query-response protocol run over TLS/DTLS (853)	229.3 Mbytes	468.4 Mbytes	2.16 M	1.98 M	0.03% (0%)
▶	HP Virtual Room Service (5228)	213.6 Mbytes	394.9 Mbytes	2.28 M	2.06 M	0.03% (0%)
▶	URL Rendesvous Directory for SSM (465)	314.1 Mbytes	6.7 Mbytes	238.05 k	80.13 k	0.02% (0%)
▶	HP Virtual Machine Group Management (5223)	178.7 Mbytes	59.6 Mbytes	846.26 k	379.76 k	0.01% (0%)
▶	SIP-TLS (5061)	133.5 Mbytes	78.5 Mbytes	726.05 k	253.64 k	0.01% (0%)
▶	OMA UserPlane Location (7275)	58.4 Mbytes	131.4 Mbytes	756.29 k	279.33 k	0.01% (0%)
▶	iChat and AOL IM	87.3 Mbytes	38.6 Mbytes	919.03 k	415.81 k	0.01% (0%)
▶	Canon BJNP Port 2 (8612)	98.3 Mbytes	0 bytes	2.24 M	0	0% (0%)
▶	Canon BJNP Port 1 (8611)	71.4 Mbytes	0 bytes	1.62 M	0	0% (0%)
▶	iRDMI (8000)	18.3 Mbytes	24.6 Mbytes	53.26 k	29.19 k	0% (0%)
▶	SNMP (161)	25.8 Mbytes	0 bytes	241.21 k	0	0% (0%)
▶	HIP NAT-Traversal (10500)	15.7 Mbytes	8.5 Mbytes	19.71 k	10.47 k	0% (0%)
	Remaining traffic	131.1 Mbytes	47.1 Mbytes	1 M	239.77 k	0.01% (0%)

Figure 5 – Typical Quarterly Content Usage

The content access graph highlights the top 20 applications utilised by Sandalwood during this reporting period. The statistics highlight that 56.39% and 40.81% of usage is web-based traffic across both secured and unsecured content respectively.
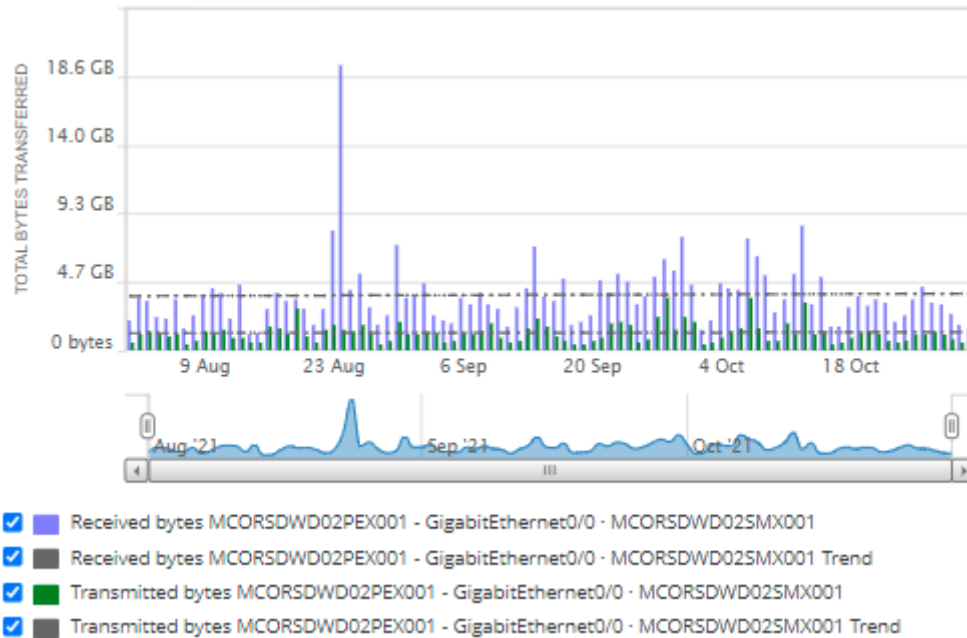
Data Usage - Quarterly

Figure 6 – Typical Quarterly Data Usage

The data usage graph shows both download usage in purple and upload usage in green. The data usage graph shows that there are steady downloads throughout a typical reporting period. The upload data, while quite consistent, does see several days across the period that are higher than the average.

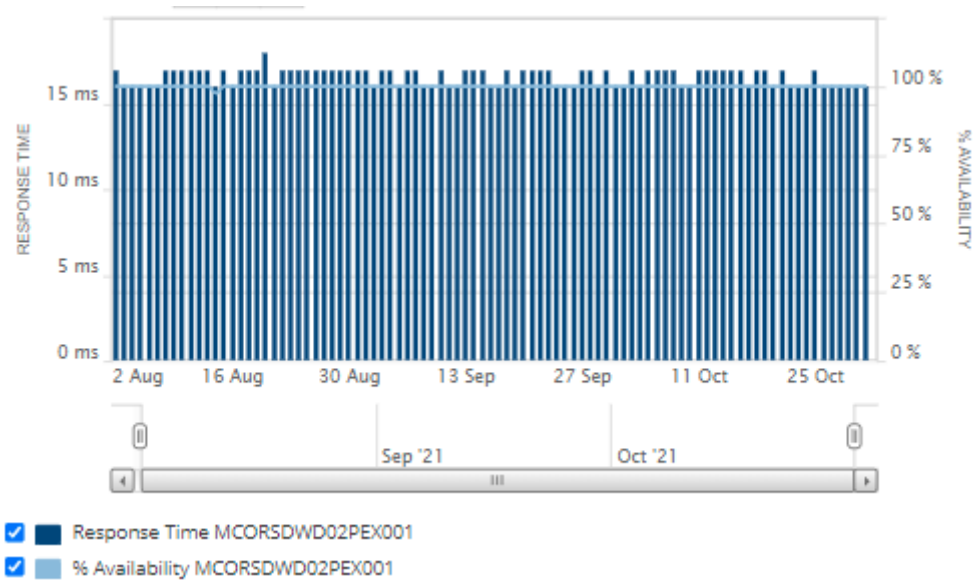**Service Availability and Latency – Quarterly**

Figure 7 – Typical Quarterly Service Availability and Latency

Latency is the delay before a transfer of data begins. The latency for Sandalwood's service was recorded at a consistent 16 milliseconds across the three-month period, which results in an excellent experience for users. This is the typical latency experienced over the three-year period. As a comparison, NBN Skymuster Satellite services operate with 600-1,000ms of latency.

The MarchNet service delivered to Sandalwood was designed and built to meet the MarchNet Service Level Agreement of 99.9%. The service availability and capacity for the three-month reporting period performed at 100%, which represents the typical performance over the three-year period.

5. Conclusion

5.1   Key Findings

The below provides an overview of the key findings throughout this project, which is a combination of Sandalwood's feedback and MarchNet's observations through its active monitoring throughout the project.

5.1.1   System Performance

The last three years of bandwidth usage highlights that the 30Mbps upload / 30 Mbps download service is meeting the client's requirements.

Service availability of the service over the three-year period exceeded the MarchNet Service Level Agreement of 99.9%.

Latency over the three-year period was below 20ms, which translates to an excellent, responsive experience for users. As a comparison, NBN Skymuster Satellite services operate with 600-1,000ms latency.

5.1.2 Feedback from Sandalwood Feedlot

Feedback from Sandalwood Feedlot around remote access to private networks has been very positive, with Sandalwood staff noting increases in efficiency and staff productivity.

5.1.3 Use Cases Enabled

There were a range of Use Cases enabled by the project which are outlined below.

Connectivity across the property:

- Enabled deployment of a number of tablets at key locations throughout the property, which staff are able to log in and log off when they start and finish work using a unique pin code to track this data.
- Sandalwood advised staff can work from homesteads throughout the property
- Sandalwood established additional remote data collection sites throughout the Feedlot
- Collect data as it happens, rather than manually entered periodically
- Access collected data anywhere onsite

Allflex HF tag trial:

Sandalwood engaged in a trial of Allflex HF tags. The coverage established across the feedlot by the MarchNet solution enabled the trial of Allflex HF tags for monitoring various parameters relating to the livestock. The outcomes of the trial were separate to the connectivity project and were not captured under this project.

Remote access:

- Sandalwood enabled remote access to Mill operations, specifically their programmable logic controller (PLC) login. This enables Sandalwood to operate mill facility outside of normal business hours through remote access; reduce the need for staff to be onsite; increased mill efficiency; power savings from the ability to operate the mill during hours of off-peak electricity
- Sandalwood implemented remote access for IT Support, and reported improvement in service levels and reduction in costs
- Sandalwood reported that staff from Korea, Brisbane and Toowoomba are able to login

Cloud-based applications deployed:

- Sandalwood implemented off-site data backup
- Sandalwood implemented a cloud-based Accounting system

- While email is still hosted locally, Sandalwood advised they were planning to move to Office365 for cloud-based email, which the coverage solution has enabled
- Sandalwood advised the implementation of a cloud-based Drafting system is planned, which the coverage solution will enable

Real-time collection of data:

Sandalwood implemented real-time collection of data by pen-riders on mobile devices, collecting information relating to cattle backgrounding, breeder cattle and progeny identification.

Sandalwood advised that remote Walk-Over-Weighing (WOW) is planned to be deployed, which the coverage solution will enable.

Multi-user access to the Internet:

Sandalwood installed Citrix, a high-speed terminal server system, allowing up to 20 users to access the high-speed internet service simultaneously.

Deployment of a CCTV system:

- Sandalwood reported the CCTV system provides managers and supervisors the ability to monitor operations more efficiently and delivered a significant improvement in the recording of on-site incidents
- The CCTV system contributes towards the safety and security of staff working and living on-site
- The time required to effectively investigate safety incidents is reduced where there is now CCTV footage readily available
- Additional benefits of greater visibility afforded include assisting in Sandalwood's Biosecurity monitoring systems

5.1.4   Benefits to the Business

The following benefits to the business were reported:

- Cost savings:
  - o Sandalwood reported remote access for IT support has eliminated 1,000 hours of additional overtime labour, which they advised equates to approximately $50,000 every year cost saving
  - o Sandalwood reported remote access for IT support largely eliminated the need for IT support staff to travel to/from site, which they estimated to be a $100,000 cost saving in IT support
  - o Sandalwood reported the ability to remotely modify and update the software that pen-riders utilise throughout their feedlot operations has assisted in reducing the labour costs of pen-riders to the equivalent of 1 full time staff, estimated as a cost saving of $55,000 every year

- o Sandalwood indicated the ability to capture and collate data remotely is estimated to have reduced labour costs by the equivalent of two full-time staff, valued at $110,000 every year
- Staff Safety:
  - o Remote access to Mill operations reduces the need for staff onsite
  - o CCTV provided benefits to incident monitoring and investigation of safety incidents
- Sandalwood found that remote access by IT Support has enabled faster resolution of issues and reduced system down time.
- Sandalwood found that connectivity across the property enabled increases in efficiency and staff productivity
- Reduced errors in data collection as a result of remote access to services
- Better and faster operational decisions resulting from access to accurate, real-time data
- Enabled the implementation of an off-site, remote backup service, increasing resiliency and data security.
- Sandalwood established additional remote data collection sites throughout the Feedlot enabling the ability to capture data throughout multiple farms and farm sites with significantly lower labour cost.

5.2 Benefits to Industry

The wider industry operates in similar rural and remote locations as Sandalwood Feedlot. Access to high speed, reliable telecommunications can produce similar results in improvements to operational efficiency, staff productivity and cost-saving for other industry participants.

6. Future Research and Recommendations

Through their investment in the latest technology, Sandalwood has committed to their future through innovation. Using new technology such as VoWi-Fi, mobile coverage is extended across the property and delivering a platform for improved asset management, livestock control and condition monitoring.

The below objectives of this project were set from the outset:

- greater efficiency in day-to-day operations,
- connecting staff to family and friends,
- more effective livestock control and decisions,
- smarter management through real time information and feedback, and
- improved maintenance procedures.

Through client feedback and active monitoring over a 3-year period the following benefits and positive outcomes were attributed to the Sandalwood network upgrade:

- An increase in speed and reliability of the network
- Enabled remote monitoring of livestock and operational systems
- Enabled remote access to the private network
- Delivers real time, reliable information to help make smarter, faster decisions
- Enabled video surveillance and recording
- Enabled cloud computing and facilitated scalable technology choices
- Helped to improve staff hiring, satisfaction and retention

Sandalwood will continue to rollout new systems and processes that are now available to them via their new network. Sandalwood will continue to conduct research and development of their own to work on operational efficiencies and potential productivity increases.

The MarchNet solution is demonstrating that it is fit for purpose and MarchNet is providing concrete evidence that future deployments of a similar design will deliver the required results for future projects within the same industry.

There are several benefits that an appropriate telecommunications infrastructure can deliver for any Red Meat producer. Considerable cost savings can be attributed towards making better business decisions with access to live data. Remote monitoring and remote controls provide the ability to watch and respond to situations are they are required, providing a huge benefit in productivity and improvement in response times.

Access to high-speed Internet services also provide other producers with the ability to adopt cloud-based services. These can have major economic benefits through the elimination of onsite infrastructure such as servers for backups.

Regional and remote Red Meat producers have the opportunity to provide major social benefits to their staff by providing a reliable telecommunications infrastructure. The ability to connect with friends and family who do not live with them is a huge benefit. Staff and their families can also afford to relocate to a remote or rural property with good communications, because it provides greater access to educational platforms for their children to complete schooling.

This project provides evidence to ensure deployments of a similar design will deliver the required results for the Red Meat industry. It is the recommendation of MarchNet that similar deployments are rolled out across other feedlots and sites in the Red Meat Industry.