final report

Project code: P.PSH.1056

Prepared by: Daniel Meehan
Meehan Agribusiness Solutions

Date published: 8 December 2019

PUBLISHED BY
Meat and Livestock Australia Limited
Locked Bag 1961
NORTH SYDNEY NSW 2059

Evaluation of Connectivity and Digital Solutions for Vertically Integrated Beef Operations – Stages 1 and 2

This is an MLA Donor Company funded project.

Meat & Livestock Australia acknowledges the matching funds provided by the Australian Government to support the research and development detailed in this publication.

Executive summary

A vertically integrated beef production/processing operation reviewed their connectivity capability and capacity options and alignment with data transfer needs. Deficiencies were identified with the business's ability to efficiently capture and transfer agribusiness data between its properties, feedlots and to a central head office location for processing, analysis and reporting. Data movements amongst the properties and feedlots were extremely expensive and however, due to the limited connectivity experienced in rural and regional areas there were no assurances of reliable service. Telco companies were unable to provide the business with reliable cost-effective solutions across their properties and feedlots. The ability to capture, and efficiently and accurately transfer data to central areas such as the business's head offices are critical for the integrity and compliance of the data and making timely and accurate business decisions. Lack of connectivity across properties also represented a significant safety issue for property workers as well as difficulty in sourcing and retaining staff in regional or remote areas. The challenges experienced by the business of inefficient, expensive and unreliable data transfer and often prone to system failure are common across the red meat supply chains. This project aims to demonstrate working solutions that resolve these data integration challenges.

The primary objective of this work was to evaluate the feasibility and commercial options of data transfer across the businesses. This involved:

- Investigating feasibility and commercial evaluation by independent assessment of connectivity and capability in data movement across the business.
- Design, build and implement alternative connection and data transfer options including Riverbed and March IT demonstration solutions.
- Evaluating options through Proof-of-Concept demonstrations
- Roll-out of production systems across the group.

Solutions evaluated and implemented involved a combination of:

- Riverbed WAN Optimisation
- Implement IP cloud to all properties
- Conversion from Satellite to NextG with multiple relay stations where applicable.

Solutions evaluated but not implemented long term due to alternative and more economical alternatives becoming available were:

- March IT WAN Optimisation
- Iterra Dedicated Satellite
- NBN Shared Dedicated Satellite

The benefits to the business by having enhanced connectivity and data transfer capability and capacity are numerous including: more effective and cost-effective reporting and decision making; live dashboarding; more timely reconciliation and business transactions; and improved staff amenity and safety.

The project approach proved successful in achieving project objectives while adapting to the challenges presented during the project period. Key messages from the project include:

a) Significant direct returns on investment can be achieved from successfully implementing connectivity and digital solutions.
b) Connectivity and digital solutions are "Enabling Technologies" providing a platform for the implementation of other innovative technologies and solutions.
c) Detailed planning and the ability to adapt in an environment of extremely rapid rates of development and commercialisation of new telecommunication technologies was critical to the success of the project including innovative solutions.

d) Viable options (private NextG towers) were identified to support connectivity (data and voice) to clusters of properties to assist with defraying capital costs. Collaboration between property owners/managers is required for this to be successful.
e) Effective communications infrastructure is critical for attracting and retention of personnel and reducing training requirements. This results in improved personnel continuity and stability on properties.
f) No single solution to addressing data connectivity and communications can be recommended. All sites need to be surveyed and solutions developed on a site-by-site basis to account for individual site needs and environments.

Table of contents

1 Background

A vertically integrated beef production/processing operation reviewed their connectivity capability and capacity options and alignment with data transfer needs. Deficiencies were identified with the business's ability to efficiently capture and transfer agribusiness data between its properties, feedlots and to a central head office location for processing. Data movements amongst the properties and feedlots are extremely expensive and however, due to the limited connectivity experienced in rural and regional areas there were no assurances of reliable service. Telco companies were unable to provide the business with reliable cost-effective solutions across their properties and feedlots. The ability to capture, and efficiently and accurately transfer data to central areas such as the business's head offices are critical for the integrity and compliance of the data and making timely and accurate business decisions. Lack of connectivity across properties also represented a significant safety issue for property workers as well as difficulty in sourcing and retaining staff in regional or remote areas.

The challenges experienced the business of inefficient, expensive and unreliable data transfer and often prone to system failure are common across the red meat supply chains. This project aims to demonstrate working solutions that resolve these data integration challenges.

2 Project objectives

The primary objective of this work was to evaluate the feasibility and commercial options of transfer data across the businesses.

Specific objectives of stage 1 feasibility and commercial evaluation:

- Independent assessment of connectivity and capability in data movement across the business's properties.
- Design, build and implement alternative connection and data transfer options including Riverbed and March IT demonstration solutions.
- Report on the outcomes of the project to the business's senior management and to the wider industry demonstrating how to test and build reliable and cost-effective solutions for rural Australian Agribusinesses.

The outcome will be a detailed feasibility report of connectivity and data movement options that will be shared to the wider industry. The benefits to the business by having enhanced connectivity and data transfer capability and capacity are numerous: in more effective and cost-effective reporting; live dashboarding; more timely reconciliation and business transactions:

- More timely and accurate costings.
- Reliable animal transaction data (including NLIS) and payments
- Staff safety.

The outcome of the project will report to the wider industry (i.e. industry final report) on:

- Details of the technology assessment process
- Describe the solutions chosen
- An evaluation of performance - both a methodology and results

3 Methodology

This project was divided into two major stages with a Go/No-Go decision point after Stage 1 (Milestones 1-4). Stage 1 involves a preliminary third-party evaluation of potential solutions including pilot trials and Stage 2 involves implementation and detailed evaluation of proposed solutions. Progression with the balance of the project (Stage 2) is dependent on the recommendations from Stage 1. This approach was taken in order to manage and mitigate the risk to project stakeholders considering the significant investments involved, with progression to Stage 2 only proceeding after concepts/technology had been proved and a high chance of success considered for the overall project. The relevant approaches to achieve these activities/milestones are outlined below. Note that due to the modular nature of the project milestones, Milestones 3 and 4 occurred concurrently as well as Milestones 5 to 9 with the business's resourcing being the primary limiting factor.

The proposed solution by the business to service connectivity and data movement capability and capacity through properties' WAN and network structure is outlined in Appendix I.

3.1 Stage 1

3.1.1 Milestone 1 – Project Working Group formed and detailed schedule and trial design approved.

The assigned project manager facilitated the development of work schedule and agreed work plan. A project work group was assigned for overseeing the project and activities. The preliminary report on the detailed specifications of connectivity and data transfer options and trial schedule brief was submitted to the business and MLA and approved by project working group.

3.1.2 Milestone 2 - Evaluation of connectivity and data movement capability across the business's properties and feedlots by independent service provider (Telstra)

An independent test and evaluation of all properties was undertaken by alternative providers (at least 2 providers). The outcome was a report on current connectivity and data transfer capability and capacity at every property and feedlot across the agribusinesses. Recommendations for potential solutions were provided for the business/MLA project review group to review and consider. Providers were selected based on the performance of available technologies, position in the marketplace, and cost effectiveness of solutions. Where relevant, reliability of service was investigated through utilisation of complementary service providers. Outcome and potential solutions were incorporated and further refined in detailed project scope and work plan.

3.1.3 Milestone 3 - Build and implement Telstra demonstration project (Module 1a – Riverbed Proof of Concept WAN Optimisation)

With assistance from provider (Telstra), the business built and implemented Telstra Demonstration project (Module 1a), a pilot Riverbed trial at its headquarters as source site and two remote feedlot sites. Test, evaluate and report findings and recommendations on the Telstra Riverbed module to the project work group for approval. Outcomes were considered as part of the Go / No-Go point (after MS 4).

3.1.4 Milestone 4 - Build and implement March IT demonstration module (Module 2) at the Feedlot 1.

With assistance from provider, the business built and implemented a demonstration module (Module 2), a pilot March IT trial at a remote feedlot site. Test, evaluate and report findings and recommendations on the March IT module to the project work group for approval. Outcomes were considered as part of the Go / No-Go point (after MS 4).

3.1.5 Go/No-Go Decision to proceed dependant on the recommendations from Stage 1 (Milestones 1-4).

The decision to proceed was made with the business and MLA and was based on the review and sign off the results and findings of demonstration modules 1 and 2 by alternative providers.

3.2 Stage 2:

3.2.1 Milestone 5 - Implement pilot Riverbed Project (Module 1b) across all sites including head office and properties

Implement pilot Riverbed Project (Module 1b) across all sites including head office and all properties. Test and evaluate. The milestone report on evaluation and product testing including data and findings on pilot trial. A summary of results submitted to the business and MLA project technical group was approved by project group.

3.2.2 Milestone 6 - Implement IP cloud including to all properties (Module 3)

Implement IP cloud including to all properties (Module 3). Solution includes Fibre Internet, IP Cloud N7896151R and Internet N7007205R. Test and evaluate. The milestone report on evaluation and product testing including data and findings on pilot trial. A summary of results submitted to the business and MLA project technical group and approved by project group.

3.2.3 Milestone 7 - Convert Property 1 from Satellite to NextG (Module 4)

Convert Property 1 from Satellite to NextG (Module 4). Test and evaluate. The milestone report on evaluation and product testing including data and findings on pilot trial. A summary of results submitted to the business and MLA project technical group and approved by project group.

3.2.4 Milestone 8 - Establish Iterra dedicated Satellite (Module 5)

Establish Iterra Dedicated Satellite (Module 5). Test and evaluate. The milestone report on evaluation and product testing including data and findings on pilot trial. A summary of results submitted to the business and MLA project technical group and approved by project group.

3.2.5 Milestone 9 - Establish NBN shared dedicated Satellite (Module 6).

Establish NBN Shared Dedicated Satellite (Module 6). Test and evaluate. The milestone report on evaluation and product testing including data and findings on pilot trial. A summary of results submitted to the business and MLA project technical group and approved by project group.

3.2.6 Milestone 10 – Final Report and presentation of outcomes and recommendations to the business .

Final report and presentation of outcomes and recommendations to the business. Provider assisted the business in preparing a company report and presentation to the business . Final report submitted to the business and MLA project technical group for approval. Final report to include:

- Capability across all the business properties by independent service provider (Telstra)
- Findings and outcomes of Riverbed trial
- Findings and outcomes of implementation of data transfer options across the business.

The provider also provided an industry report approved by the business to include general description of business case and commercial considerations connectivity and data transfer options.

4 Results

4.1 Stage 1

4.1.1 Evaluation of connectivity and data movement capability across the business's properties and feedlots by independent service provider (Telstra)

Telstra, as an independent service provider, completed a survey of connectivity and data movement capability across the business's properties and feedlots. A summary of results is outlined in Table 1 below.

Table 1 Summary of results of Telstra evaluation of connectivity of facilities.

Facility	Connection Type for Site	No. of users per Site	No. Office 365 Licenses per site	No. Virtual Servers / Physical Servers per site	Coverage Type	Typical Download Speed (Estimated at location)	Access	Nearest Tower	Comment
1. Property 1	N7734677R / N2100652Z Iterra Satellite	25	0	1 Physical	4GX & 3G – No mobile coverage in area, recommend satellite phone.			19.49 km	No Fibre path
2. Property 2	Next G	25	2	1 Physical	3G	1.1-20Mbps	Ext. Antenna	29.64 km	
3. Property 3	Broadband Satellite	2	0	1 Physical				9.24 km	No Fibre path
4. Property 4	To be determined	25	1	1 Physical	3G – No mobile coverage in area, recommend satellite phone.			10.53 km	No Fibre path
5. Property 5	Next G	3	0	None				21.86 km	No Fibre path
6. Property 6	To be determined	5	1	1 Physical	4GX & 3G – No mobile coverage in area, recommend satellite phone.			56.76 km	No Fibre path
7. Property 7	N7734688R / N2100653Z Iterra Satellite	10	0	1 Physical	4G – No mobile coverage in area, recommend satellite phone.			29.02 km	No Fibre path
8. Property 8	N7734679R / N7885777Z Iterra Satellite	10	0	1 Physical	4GX – No mobile coverage in area, recommend satellite phone.			12.86 km	No Fibre path
9. Feedlot 1	Next G – x2	25	0	2 Physical	3G	1.1-20Mbps	Ext. Antenna	6.81 km	

Facility	Connection Type for Site	No. of users per Site	No. Office 365 Licenses per site	No. Virtual Servers / Physical Servers per site	Coverage Type	Typical Download Speed (Estimated at location)	Access	Nearest Tower	Comment
10. Feedlot 2	Next G – x1	10		2 Physical	4GX 3G	2-75Mbps 1.1-20Mbps	Ext. Antenna Device Only	6.44 km	Fibre path in vicinity
11. Feedlot 3	Next G	25 Total	0	2 Physical	4G – No mobile coverage in area, recommend satellite phone.			6.58 km	No fibre access available

In consideration of the survey results above and knowledge of other properties, a summary of the recommended connectivity options are outlined in Table 2 below.

Table 2 Recommended Connectivity Options

Communication Option	Facility
A. Telstra Riverbed Data Compression System	1. Property 2 2. Property 5 3. Property 9 4. Property 10 5. Property 11 6. Property 12 7. Property 13 8. Property 14 9. Feedlot 1 10. Feedlot 2 11. Feedlot 3
B. Telstra Iterra Dedicated Satellite	1. Property 1 2. Property 7 3. Property 8
C. NBN Shared Commercial Satellite	1. Property 3 2. Property 4 3. Property 6

A Proof-of-Concept (POC) of Riverbed WAN Optimisation was proposed at Feedlots 2 and 3 to evaluate effectiveness prior to a decision to implement this solution at further sites. This proof-of-concept evaluation was conducted and the results outlined in Section 4.1.2 below.

4.1.2 Build and implement Telstra demonstration project (Module 1a – Riverbed Proof of Concept WAN Optimisation)

The Proof of Concept was conducted as the initial step to enable the business and Telstra to confirm, measure and demonstrate the real impact WAN Optimisation has on the existing user environment prior to moving into a production solution. During the development of project requirements, the business expressed interest in the Telstra Riverbed SteelHead technology to gain the following benefits:

- To significantly boost application response times to enhance user productivity
- Optimise the user experience of the existing application, file access and web browser environments
- To reduce the volume of data traversing the WAN associated with application traffic and supporting services
- Increase operational simplicity of assets, processes and resources
- Improving IT operations efficiency by optimising application access and gaining insight to flows traversing the WAN
- To reduce the volume of data traversing the WAN in an effort to fix or maintain bandwidth costs, or to free up bandwidth to allow the business to make use of additional technologies

Performance was baselined prior to and post enabling WAN Optimisation to understand the impact on performance.

The scope the Steelhead Optimisation POC was to test any benefits realised by applying WAN Optimisation when accessing and utilising existing corporate based applications and associated services (i.e.: printing, file access, web browsing etc.) from the Head office environment and identified branch site locations. A summary of POC site details are outlined in Table 3 below.

Table 3 Summary of Riverbed Steelhead POC sites

Site	No. of Users	WAN Link	App Servers
1. Head Office – Core	50	10M	Y
2. Feedlot 2	10	Next G	Y
3. Feedlot 3 (Installation 1)	25	Next G	Y
4. Feedlot 3 (Installation 2)		Next G	N

The equipment tested is outlined in Table 4 below.

Table 4 Riverbed Appliances Evaluated

Site	Appliance	WAN Link
1. Head Office – Core	CX 770-L	20M Outbound Optimised WAN traffic/1000 concurrent TCP/UDP flows
2. Feedlot 2	CX 255-H	6M Outbound Optimised WAN traffic/230 concurrent TCP/UDP flows
3. Feedlot 3 (Installation 1)	CX 570-L	10M Outbound Optimised WAN traffic/275 concurrent TCP/UDP flows
4. Feedlot 3 (Installation 2)	CX 255-H	6M Outbound Optimised WAN traffic/230 concurrent TCP/UDP flows

The key success criteria for the business's WAN optimisation POC was to observe successful reduction of data traversing the WAN, in particular services shared centrally from servers located in the data centre environment.

4.1.2.1 Riverbed Proof of Concept outcomes

As reported by Telstra regarding overall performance, two optimised protocols of the top five web traffic showed an effective overall reduction of 53% and 27% over a period of month. An analysis of web proxy traffic over a period of a week demonstrated regular peaks of data reduction of 90% or better, and an overall effective bandwidth increase by a factor of 2X. It was also noted that similar results could be expected from outer high volume protocols on the WAN that are not currently being optimised.

Observations of performance at Feedlot 3 over a period of one week indicated optimised bandwidth achieved for web proxy traffic demonstrated an effective 2.1X increase in available bandwidth. Peaks during the business day achieve significantly higher levels of reduction in the order of 70% or more.

Telstra's conclusions included that the successful results for optimisation of two of the top five protocols in the business's network environment indicated that a full deployment with advanced configuration would provide ongoing benefit to the business in terms of improving user performance,

maximising return on investment in WAN carriage, and future proofing architecture changes such as centralisation/document management projects both on premises and/or in the cloud.

4.1.3 Build and implement March IT Demonstration module (Module 2) at Feedlot 1.

4.1.3.1 Test and evaluation of March IT demonstration module

The March IT demonstration module was built, implemented, tested and evaluated at Feedlot1. The objective of the demonstration was to:

- Deliver reliable internet connection to the site
- Provide 100Mbps remote internet to the feedlot office
- Provide a Wide Area Wi-Fi network for distribution of internet services to various locations at the site including:
    - Staff residences
    - Workers' camp and kitchen

The outcomes of the demonstration were:

- A 100Mbps remote internet service was provided to the Feedlot 1 office. This was achieved by utilising a fixed wireless link with an existing March IT telecommunications tower.
- A Wide Area Wi-Fi network was established providing internet connectivity to various locations including:
    - four staff houses
    - workers camp and kitchen
    - induction facilities
    - mill office
    - hospital
    - outdoor coverage across the feedlot.

Reliability was adequate to Feedlot 1's business requirements with three outage occurrences during the 8-month trial period with no significant impact on business operations. No congestion of internet traffic was observed.

4.1.3.2 Costs of March IT remote internet services and solution performance

The relative costs of 20Mbps and 100Mbps remote internet services provided by March IT are displayed in Table 5 below.

Table 5 Summary of cost (excl. GST) of March IT remote internet services

Data Capacity	Cost per Month	Cost per Annum
1. 20Mbps/20Mbps	$2,500.00	$30,000
2. 100Mbps/100Mbps	$6,500.00	$78,000

Due to the prohibitive cost of the 100Mbps remote internet service, the business elected at the conclusion of the trial at Feedlot 1 to downgrade to March IT's 20Mbps product saving $4,000 (excl. GST) per month (annualised saving of $48,000). Infrastructure providing 100Mps capacity has been retained for future upgrade if costs of this product become viable.

The reduction from a 100Mbps to 20Mbps remote internet service at Feedlot 1 was not detrimental to overall internet connectivity performance. This is due to the business proposing to utilise a

combination of solutions including the successful demonstration Telstra's Riverbed Proof of Concept WAN Optimisation (Milestone 3 (Module 1a) of this project) at Feedlot 1.

Since the completion of Riverbed Proof-of-Concept WAN Optimisation (Milestones 3) and March IT Demonstration (Milestone 4 (Module 2)), a more economical solution was successfully tested for sites with NextG coverage. When used in combination with Riverbed compression, the use of two NextG modems provide adequate capacity at a total monthly cost of $400. This solution will be considered on a site-by-site basis.

4.1.4 Go/No-Go Decision to proceed dependant on the recommendations from Stage 1 (Milestones 1-4).

The Project Management Group (PMG) met in August 2018 to consider the outcomes of Stage 1 (Milestones 1 to 4). Based on successful Riverbed WAN Optimisation Proof of Concept (Milestone 3) and March IT demonstration of remote internet service and Wide Area Wi-Fi network (Milestone 4), the PMG recommended progressing to Stage 2 of the project including implementation of Riverbed to all sites including head office and properties/feedlots.

4.2 Stage 2:

4.2.1 Implement pilot Riverbed Project (Module 1b) across all sites including head office and all properties

The Riverbed Project (Module 1b) pilot was implemented across all sites including head office and all properties/feedlots. Table 6 below provides a summary of the sites, numbers of users and application and remote administration status.

Table 6 Summary of Riverbed sites

Site	No. of Users	Remote Administration
1. Head Office – Core	50	Y
2. Feedlot 1	30	Y
3. Feedlot 2	10	Y
4. Feedlot 3	30	Y
5. Property 1	25	Y
6. Property 2	20	Y
7. Property 3	2	Y
8. Property 4	10	Y
9. Property 5	2	Y
10. Property 7	10	Y
11. Property 8	5	Y
12. Property 9	5	Y
13. Property 10	2	Y
14. Property 11	3	Y
15. Property 12	5	Y
16. Property 13	3	Y
17. Property 14	2	Y

4.2.1.1 Riverbed Implementation outcomes

As reported by Telstra (Milestone 3 (Module 1a)) regarding overall performance, two optimised protocols of the top five web traffic showed an effective overall reduction of 53% and 27%. An analysis of web proxy traffic over a period of a week demonstrated regular peaks of data reduction of 90% or better, and an overall effective bandwidth increase by a factor of 2X.

Observations of performance indicated optimised bandwidth achieved for web proxy traffic demonstrated an effective 2.1X increase in available bandwidth. Peaks during the business day achieve significantly higher levels of reduction in the order of 70% or more.

The successful results for optimisation of two of the top five protocols in the business's network environment indicated that with advanced configuration, the business would continue to achieve ongoing benefits in terms of improved user performance, maximising return on investment in WAN carriage, and future proofing architecture changes such as centralisation/document management projects both on premises and/or in the cloud.

4.2.2 Implement IP cloud including to all properties (Module 3)

An IP cloud was implemented to all properties including Fibre Internet, IP Cloud N7896151R & Internet N7007205R was successfully achieved.

Performance levels achieved are:

- 100% uptime (24/7)
- Speed:
    - NextG:- average 5Mbps
    - Satellite:- average 1Mbps
- Unlimited capacity

Refer to Module 3 in Appendix I - Proposed Service Connectivity and Data Movement Solution for Evaluation across the Business demonstrating the IP Cloud's interaction with the business's overall connectivity strategy.

4.2.2.1 IP cloud implementation outcomes

While business use of the IP cloud is optimised for operation late at night, the cloud operated at capacity. This impedes user experiences (slow internet connections) leading to lower staff moral as they were unable to experience internet connectivity performance taken for granted in urban areas. Providing adequate communications infrastructure is important in attracting and retaining staff in rural and remote areas.

4.2.3 Convert Property 1 from Satellite to NextG (Module 4)

Property 1 was converted from Satellite to NextG (Module 4), tested and evaluated. As part of the initial process of upgrading Property 1 from satellite to NextG, a survey was undertaken by a technology provider specialising in high quality and high-speed wireless telecommunications systems in rural and remote regions. NextG coverage at Property 1 is outside Telstra's guaranteed coverage

footprint and is intermittent. Bandwidth is 3-5mbps when coverage is available. The objective was to confirm NextG signal strength in at different locations on the property in relation to Property 1's needs. Due to the relatively close proximity of Property 1 to Property 3, coverage was also surveyed at Property 3 at the same time.

The outcomes of the survey were:

1. Property 1:
    a. Telstra 3G (NextG) only was received at an Above Ground Level (AGL) of 8m, approximately 1.8kms East of the homestead.
    b. This can be relayed back to the main homestead providing minimal data speeds but predominately for servicing voice calls.
    c. Telstra 4GX was believed to be unavailable to site.
2. Property 3:
    a. At 10m AGL a marginal Telstra 3G and 4GX signal was received.
    b. At 20m AGL, a Telstra 4GX signal with an average speed of 15-20 Mbps Download & 10-15 Mbps Upload was achieved.

Based on these survey results, it was recommended that:

1. A 21m relay tower be installed on a mountain (owned by a third party) to receive Telstra 4GX broadband data.
2. Transfer the 4GX broadband data from the tower to the Property 3 homestead via a 5Ghz microwave point to point link.
3. Repeat Telstra 3G for mobile voice calls to the Property 5 homestead via a CelFi Go.

Due to the results of the NextG survey, the original NextG implementation as proposed under Milestone 7 (Module 4) was not feasible. An alternative solution has been developed for providing both data connectivity and voice communications to Property 1 as detailed in Section 4.2.3.1 below.

4.2.3.1 Alternative solution to Property 1 data connectivity and voice communications

Due to 4GX being unavailable at Property 1 and the proximity of Property 1 to the proposed relay tower and Property 3, an alternative solution is currently being implemented. This solution involves:

1. A relatively small tower being installed at Property 1 with direct line-of-sight 50mbps from the relay tower.
2. A 5m tower at Property 1 relaying NextG locally to support Property 3.

The outcomes of this new solution are bandwidth increasing from 3-5Mbps (intermittently) to 50mbps and including voice communications. However, significant capital costs have been incurred (approximately $60,000) to date with a much higher risk profile.

Due to the results of the NextG survey, the original NextG implementation as proposed under Milestone 7 (Module 4) was not feasible. An alternative solution was developed for providing both data connectivity and voice communications to Property 3. Ultimate performance was significantly better than originally proposed, however significant capital has been invested and with a significantly higher risk profile.

4.2.4 Establish Iterra dedicated Satellite (Module 5)

The initial Project Plan proposed that a Telstra Iterra dedicated satellite be implemented to provide connectivity to Property 1, Property 7 and Property 8. While this solution was identified as being

extremely expensive, it was deemed the only viable option for the three remote properties at the time the project was proposed. The total annual costs of Iterra was approximately $150k or approximately $50k per site proposed per annum.

4.2.4.1 Alternative solution to Iterra dedicated satellite

During the period since project commencement, alternative technologies become readily available as well as changes to pricing/performance plans and regulations. In addition, the Iterra satellite service was expected to become redundant within 24 months. Further investigations resulted in the identification of alternative solutions including NextG utilising several relay stations. This solution requires significant capital investment, however it provides the benefits of telephone communications as well as data/internet. In addition, the bandwidth of Iterra is 100th that of 4G.

The outcomes of these investigations include:

- Iterra's performance has been superseded by alternative options and is significantly below the business's business requirements
- Alternative options (e.g. NextG with multiple relay stations) while requiring significant capital investment to transfer from Iterra to NextG, the significantly lower ongoing costs make these options viable with the additional benefit of supplying phone as well as internet.

Due to the more viable option of NextG utilising multiple relay stations becoming available, the original Iterra satellite implementation as proposed under Milestone 8 (Module 5) was not feasible on an ongoing basis. An alternative solution was developed for providing both data connectivity and voice communications to Property 1, Property 7 and Property 8. A higher risk profile for this solution was also recognised.

4.2.5 Establish NBN Shared dedicated Satellite (Module 6).

The initial Project Plan proposed that shared dedicated NBN satellite be implemented to provide connectivity to Property 3 and Property 4. However, as part of the initial process of upgrading Property 1 from satellite to NextG (Refer Milestone 7 - Convert Property 1 from Satellite to NextG (Module 4)), a survey was undertaken by a technology provider specialising in high quality and high-speed wireless telecommunications systems in rural and remote regions. Due to the relatively close proximity of Property 1 to Property 3, coverage was also surveyed at Property 3 at the same time.

The outcomes of the survey in relation to Property 3 were:

1. At 10m AGL a marginal Telstra 3G and 4GX signal was received.
2. At 20m AGL, a Telstra 4GX signal with an average speed of 15-20 Mbps Download & 10-15 Mbps Upload was achieved.

Based on these survey results, it was recommended that:

1. A 21m relay tower be installed on a mountain (owned by a third party) to receive Telstra 4GX broadband data.
2. Transfer the 4GX broadband data from the tower to the Property 3 homestead via a 5Ghz microwave point to point link.
3. Repeat Telstra 3G for mobile voice calls to the Property 3 homestead via a CelFi Go.

Due to the ongoing annual cost of approximately $3,500 for the NBN service to Property 3, limit of 20Gb per month and limited bandwidth and no voice communication, a decision was made to

implement the alternative solution utilising 4GX relayed from tower on mountain on a neighbour's property.

The commercial NBN satellite delivers Property 4 15-20Mbps download and 5-10Mbps upload however capacity is limited to 100GB. Uncertainty exists over download limits with limits varying from 40Gb to 20Gb to 100Gb within a 12 month period.

Due to the opportunity to provide an improved solution for Property 3 , NBN satellite implementation as proposed under Milestone 9 (Module 6) was implemented at both sites. NBN was implemented at Property 4 while a better performing solution utilising 4GX and relay stations is in the process of being implemented at Property 3. Both sites were provided connectivity.

4.2.6 Current status of property connectivity

All properties have NextG coverage except:

1. Property 3 was on commercial NBN however the service became obsolete in December 2018. The business designed and installed its own repeater station. In addition to Property 3 having 25MBps data available via NextG, it also has mobile phone access.
2. Property 1 now has 25Mbps NextG available and phase two will provide mobile phone access.
3. Planning is in place for Property 7and Property 8 to convert from Iterra to NextG with the aim of providing both mobile accesses and data. Once this is complete, the business will not have any Iterra Satellite installation remaining saving significant costs.

5 Discussion

5.1 Benefits to the business

The benefits to the business by having enhanced connectivity and data transfer capability and capacity are numerous including:

- More efficient and cost-effective reporting; live dashboarding; more timely reconciliation and business transactions;
- More timely and accurate costings;
- Reliable animal transaction data (including NLIS) and payments;
- Improved staff amenity in rural and remote locations leading to better staff availability and retention rates; and
- Importantly staff safety.

The return on investment for the installation of the NextG tower where appropriate to enable unlimited downloads is 0.56 years when compared to leasing satellite capacity. The annual benefit when the cost of identifying the NextG tower's location is annualised over 10 years is $48,011. The main constraint with this system is that the service provides will not guarantee the service availability prior to system.

5.2 Connectivity and data transfer an "Enabling Technology"

Improved connectivity solutions identified in this project have been shown to provide significant direct cost savings. However, improved connectivity per. se. in some locations may not necessarily provide direct benefits over and above coverage, reliability and performance improvements and potential cost reductions. Connectivity does however provide an "enabling" platform facilitating the implementation and harvesting of benefits from more accessible and better designed and performing decision support systems.

An example of improved connectivity and data transfer as an "Enabling Technology" is the new connectivity and data transfer framework underpinning the business successfully implementing an Integrated Livestock Management System. Analysis of benefits to the business's value chain from this project include:

1. Identify the different benefits the new data collection system will provide the business and their supplier partners.
2. Evaluate the value the business will receive in terms of financial benefit per head.
3. Increase supplier commitment in data collection to increase efficiency and quality of livestock supply.
4. Provide recommendations that will help the business capitalise on their data collection and maximise the value it delivers to across their supply chains.

A conservative analysis of the value changing benefits of implementing a best practice system indicated that the overall benefit per head just from Pregnancy Tested In-calf (PTIC) and dentition to be $8.28, and the total cost per head to be $0.42, resulting in a rounded net benefit per head of $7.86. At a projected throughput of 45,000 head per annum, this results in an annual net benefit for of $353,763. The anticipated payback period for the project is 0.50 years.

5.3 Staged project approach and adaptability

The success of the project was largely due to the business's investment in:

- Planning and engaging independent third-party providers to objectively survey connectivity and data movement capability across all the business properties and feedlots;
- Undertaking a Proof-of-Concept prior to implementation; and
- Continuing to monitor improvements in technologies along with relative performance/costs and consider if new alternatives if they offer improved value to the business.

5.3.1 Planning and engaging independent third party providers to objectively survey connectivity and data movement capability

Telstra was engaged as an independent service provider to survey connectivity and data movement capability across the business's properties and feedlots. In addition, as part of the initial process of upgrading Property 1 from satellite to NextG (Refer Milestone 7 - Convert Property 1 from Satellite to NextG (Module 4)) a survey was undertaken by a technology provider specialising in high quality and high-speed wireless telecommunications systems in rural and remote regions. Due to the relatively close proximity of Property 1 to Property 3, coverage was also surveyed at Property 3 at the same time. The results of these surveys contributed to the development of a proposed solution to providing connectivity and data movement services across the business including implementing an alternative solution utilising 4GX relayed from a tower on a mountain on a neighbour's property. Due to the opportunity to provide an improved solution for Property 3, NBN satellite implementation as proposed under Milestone 9 (Module 6) was implemented both sites. NBN was implemented at Property 4 while a better performing solution utilising 4GX and relay stations is in the process of being implemented at Property 3. Both sites will be provided connectivity. This demonstrates the importance of adapting solutions based on survey performance results and advances in technology even within the period of the project.

An important outcome from this project is that no single solution to addressing data connectivity and communications can be recommended. All sites need to be surveyed and solutions developed on a site-by-site basis to account for individual site needs and environments.

5.3.2 Undertaking a Proof-of-Concept prior to implementation

A significant aspect in managing the technical risks of this project was undertaking "Proof-of-Concept" (POC) to evaluate the suitability of proposed solutions prior to committing to the significant investment of implementing solutions across the business. An example of this was conducting the Riverbed SteelHead technology POC as the initial step to enable the business and Telstra to confirm, measure and demonstrate the real impact WAN Optimisation had on the existing user environment prior to moving into a production solution. The scope of the POC was to test any benefits realised by applying WAN Optimisation when accessing and utilising existing corporate based applications and associated services (i.e. printing, file access, web browsing etc.) from the business's head office environment and identified branch site locations. Performance was baselined prior to and post enabling WAN Optimisation to understand the impact on performance.

The independent Providers conclusions from the POC included that observations of performance indicated optimised bandwidth achieved for web proxy traffic demonstrated an effective 2.1 times increase in available bandwidth. Peaks during the business day achieve significantly higher levels of reduction in the order of 70% or more. It was also noted that results indicated that a full deployment

with advanced configuration would provide ongoing benefit to the business in terms of improving user performance, maximising return on investment in WAN carriage, and future proofing architecture changes such as centralisation/document management projects both on premises and/or in the cloud. The results of the POC gave the business confidence in investing in the roll-out of the technology across all sites.

5.3.3 Continual monitoring of improvements in technologies and relative performance/costs

During the course of the project, extremely rapid rates of development and commercialisation of new telecommunication technologies were observed. In any decision making in relation to the implementation of new technologies, it is important that businesses continue to monitor improvements in technologies along with relative performance/costs and consider if new alternatives if they offer improved value to the business.

Examples of the need to continually review performance costs include:

a) The pilot of utilising a fixed wireless link with an existing March IT telecommunications tower delivered a 100Mbps remote internet service to the Feedlot 1 office and a Wide Area Wi-Fi network was established providing internet connectivity to various locations across the site. Reliability and performance were adequate to Feedlot 1's business requirements. However, monthly service costs were analysed and due to the prohibitive cost of the 100Mbps remote internet service, the business elected to downgrade to March IT's 20Mbps product at the conclusion of the trial. Savings of $4,000 (excl. GST) per month were realised, with an annualised potential saving of $48,000. Reduction to the 20Mbps service was not detrimental to overall internet connectivity performance due to the business proposing to utilise a combination of solutions. This includes Telstra's Riverbed Proof of Concept WAN Optimisation successfully demonstrated at Feedlot 1. Furthermore, since the completion of the pilot of the March IT solution, a more economical solution was successfully tested for sites with NextG coverage. When used in combination with Riverbed compression, the use of two NextG modems provide adequate capacity at a total monthly cost of $400. This solution was considered on a site-by-site basis.

b) The initial project plan proposed a Telstra Iterra dedicated satellite be implemented to provide connectivity to Properties 1, 7 and 8. While this solution was identified as being extremely expensive, it was deemed the only viable option for the three remote properties at the time the project was commenced. The total annual costs of Iterra was approximately $150,000 or approximately $50,000 per site proposed per annum.

   During the period since project commencement, alternative technologies became readily available as well as changes to pricing/performance plans and regulations. In addition, the Iterra satellite service was expected to become redundant within 24 months. The identification of alternative solutions were identified including NextG utilising several relay stations. This solution requires significant capital investment, however it provides the benefits of telephone communications as well as data/internet significantly lower ongoing costs. In addition, the bandwidth of Iterra is approximately 100th that of 4G.

A further example of the need to continually the relative performance/costs of connectivity solutions includes the implementation of an IP cloud to all properties including Fibre Internet, IP Cloud N7896151R & Internet N7007205R. While internet performance improved (including 100% uptime) and even with business use of the IP cloud optimised to operate late at night, the cloud is operating at capacity. This impedes user experiences (slow internet connections) leading to lower staff moral as they are unable to experience internet connectivity performance taken for granted in urban areas.

Providing adequate communications infrastructure is important in attracting and retaining staff in rural and remote areas. Due to the extremely rapid rate of development and commercialisation of new telecommunication technologies, that businesses continue to monitor improvements in technologies along with relative performance/costs and consider if new alternatives if they offer improved value to the business. For example, it is recommended that the business continue to investigate options to improve IP Cloud performance and user experiences.

5.4 Benefits and implications for industry

The benefits to the business by having enhanced connectivity and data transfer capability and capacity have application by having enhanced connectivity and data transfer capability and capacity can be applied to the broader red meat industry. These are numerous including:

- More efficient and cost-effective reporting; live dashboarding; more timely reconciliation and business transactions;
- More timely and accurate costings;
- Reliable animal transaction data (including NLIS) and payments;
- Improved staff amenity in rural and remote locations leading to better staff availability and retention rates; and
- Importantly staff safety.

The process to achieving this as demonstrated in this project primarily involved:

- Detailed planning and engaging independent third party providers to objectively survey connectivity and data movement capability across all facets of the business;
- Undertaking a Proof-of-Concept prior to implementation to evaluate performance and mitigate risks; and
- Continuing to monitor improvements in technologies along with relative performance/costs and consider if new alternatives if they offer improved value to the business.

In addition, NextG technology utilised has shown to provide a viable option to enable connectivity of properties in remote Australia. The only constraint is the cost of identifying the tower location and installing the system without a guarantee that it will work. A suggested approach to this risk is to manage it as a Research and Development Project along with the appropriate evaluation of risk, costs and success. Where suitable locations are identified, the solution may suit a cluster of properties assisting in defraying capital costs. Collaboration between property owners/managers is required to facilitate the main tower to be located in a suitable location.

6 Conclusions/recommendations

The project approach proved successful in achieving project objectives while adapting to the challenges presented during the project period.

a) Significant direct returns on investment can be achieved from successfully implementing connectivity and digital solutions for vertically integrated beef operations.
b) Undertaking Proof-of-Concepts trials gave the business confidence in investing in the roll-out of the technology across all sites.
c) Connectivity and digital solutions are “Enabling Technologies” providing a platform for the implementation of other innovative technologies and solutions.
d) Detailed planning and the ability to adapt in an environment of extremely rapid rates of development and commercialisation of new telecommunication technologies was critical to the success of the project including innovative solutions.
e) It is critical that businesses continue to monitor improvements in technologies along with relative performance/costs and consider if new alternatives offer improved value to the business.
f) Viable options (private NextG towers) were identified to support connectivity (data and voice) to clusters of properties to assist with defraying capital costs. However, risks to success need to be seriously considered. Collaboration between property owners/managers is required to facilitate the main tower to be located in a suitable location.
g) Effective communications infrastructure is critical for attracting and the retention of personnel and reducing training requirements. This results in improved personnel continuity and stability on properties.
h) No single solution to addressing data connectivity and communications can be recommended. All sites need to be surveyed and solutions developed on a site-by-site basis to account for individual site needs and environments.
i) Benefits to Industry can be gained by sharing learnings.

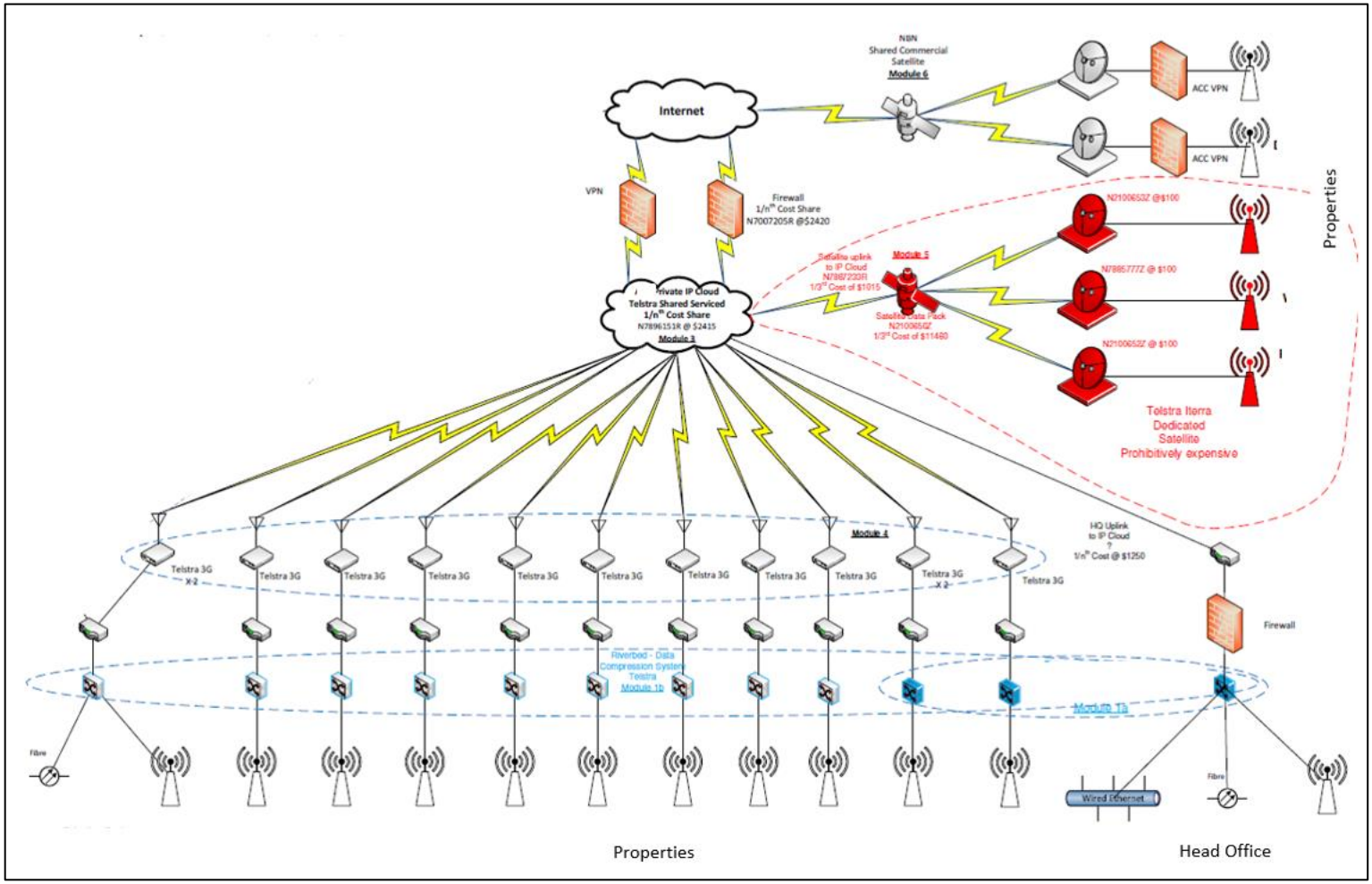
7 Key messages

Key messages from this project include:

a) Significant direct returns on investment can be achieved from successfully implementing connectivity and digital solutions for vertically integrated beef operations.
b) Connectivity and digital solutions are “Enabling Technologies” providing a platform for the implementation of other innovative technologies and solutions.
c) Detailed planning and the ability to adapt in an environment of extremely rapid rates of development and commercialisation of new telecommunication technologies was critical to the success of the project including innovative solutions.
d) It is critical that businesses continue to monitor improvements in technologies along with relative performance/costs and consider if new alternatives offer improved value to the business.
e) Viable options (private NextG towers) were identified to support connectivity (data and voice) to clusters of properties to assist with defraying capital costs. However, risks to success need to be seriously considered. Collaboration between property owners/managers is required to facilitate the main tower to be located in a suitable location.
f) Effective communications infrastructure is critical for attracting and retention of personnel and reducing training requirements. This results in improved personnel continuity and stability on properties.
g) No single solution to addressing data connectivity and communications can be recommended. All sites need to be surveyed and solutions developed on a site-by-site basis to account for individual site needs and environments.
h) Benefits to Industry can be gained by sharing learnings.

8 Appendix

8.1 Appendix I - Proposed Service Connectivity and Data Movement Solution for Evaluation across the Business



8.2 Appendix III - Riverbed proof of concept WAN Optimisation report

riverbed

The Application Performance Company™

Riverbed Proof of Concept
WAN Optimisation

Prepared for:

Prepared by:

Riverbed Technology, Inc.
680 Folsom Street, 6th Floor
San Francisco, CA 94107
Main 415.247.8800
Fax 415.247.8801
www.riverbed.com

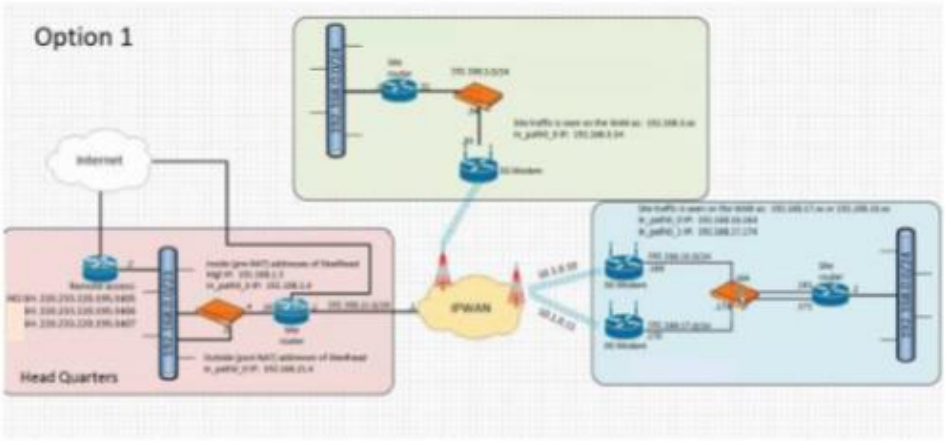
Table of Contents

2 Overview

is one of the largest vertically integrated supply chain organisations in the world. The business is dedicated to the best practice supply of high quality meat products and is the principal supplier to major retail supermarkets.

have identified a need for greater network/application performance, and a trial of Riverbed WAN optimization appliances has been implemented to demonstrate their capabilities.

The network consists of a head office in connected to remote sites via a Telstra IPWAN carriage. A high-level diagram of the environment is shown below (with SteelHeads installed):

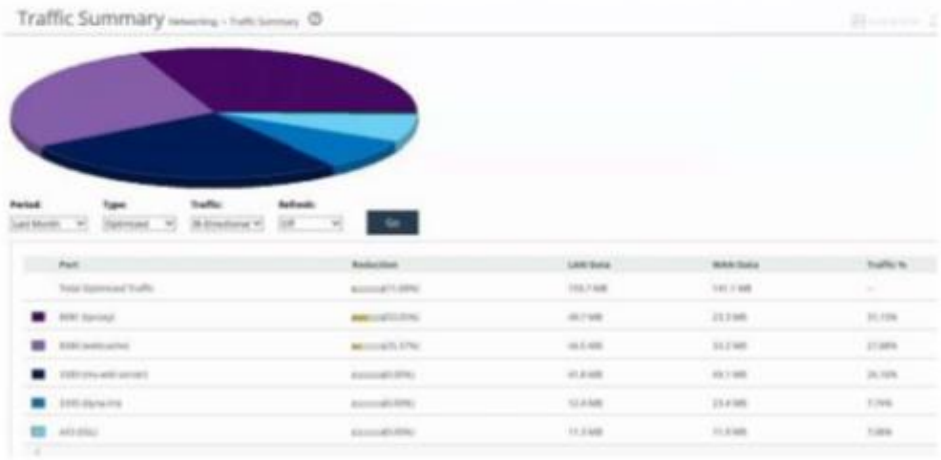


The key success criteria for the WAN optimisation POC was to observe successful reduction of data traversing the WAN, in particular, services shared centrally from servers located in the datacenter environment.

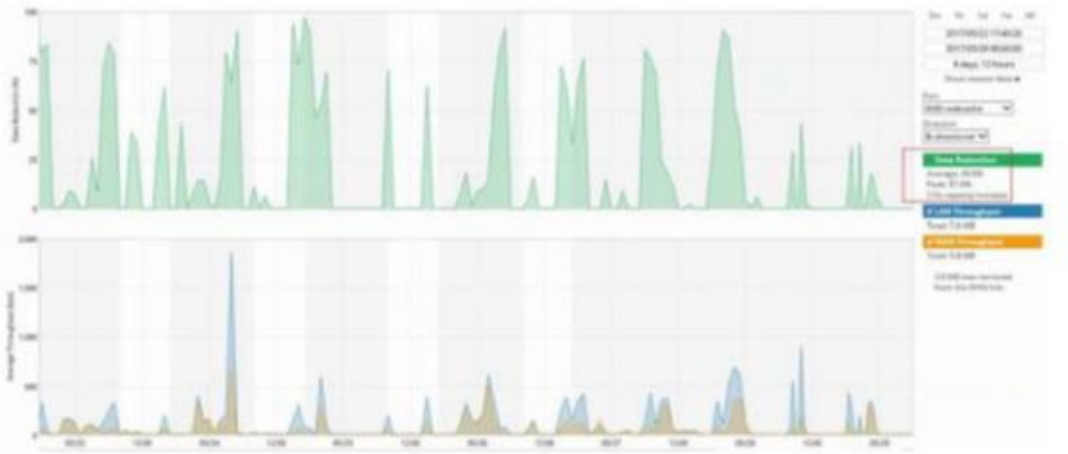
2.1 Optimisation Statistics

2.1.1 Overall

A summary of the key protocols that have received optimization benefit is shown below:



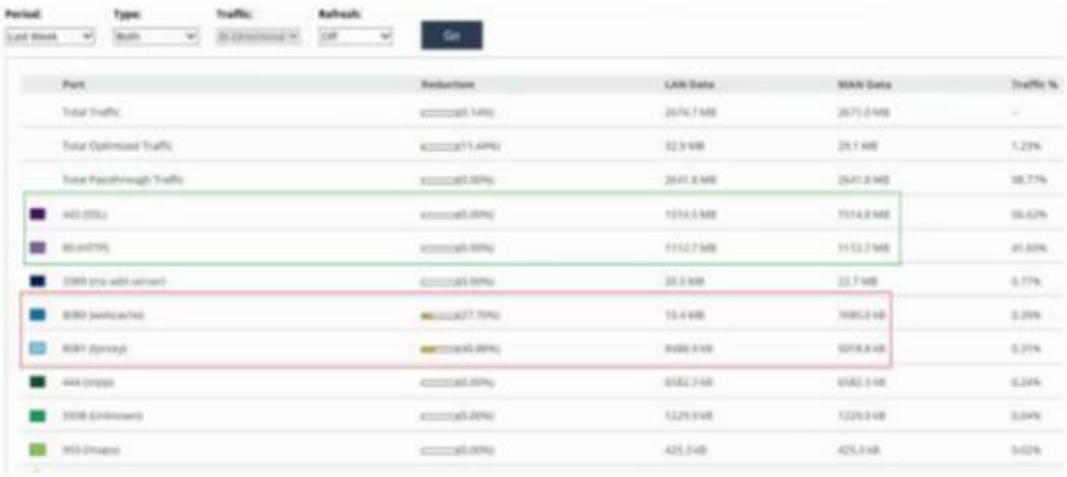
The two optimized protocols in the top 5 include proxied web traffic on TCP 8080 and 8081. The traffic has shown effective overall reduction of 53% and 27% respectively. An analysis of the effective bandwidth being realized for this traffic is shown below:



The above report shows web proxy traffic over the past week, demonstrating regular peaks of data reduction to 90% or better, and an overall effective bandwidth increase by a factor of 2X. It should be noted that similar results could be expected from other high volume protocols on the WAN that are presently not being optimized.

2.1.2 Branch Site -

The report below summarizes the overall traffic as seen from the site:



SSL services and direct Web traffic (non-proxied) were the top two traffic types traversing the network – these were not optimized for the POC as the traffic flow for these traffic types does not traverse between two SteelHeads, however, it should be noted that both of these traffic flows can be highly optimized with more advanced SSL and single-ended configuration post-POC.

Optimised protocols include the proxied traffic between sites, again achieving decent bandwidth reduction percentages.

The optimized bandwidth achieved for web proxy traffic over the past week is shown above, with an effective 2.1X increase in available bandwidth for this traffic. Note again, that peaks during the business day achieve far higher levels of reduction in the order of 70% or greater.

2.2 SaaS Optimisation

A brief analysis of the SSL traffic showed it to be primarily O365 SaaS services, which can be optimized very effectively through the Riverbed SaaS optimization option – this is enabled via a subscription key entered onto the SteelHead appliance.

Riverbed's SaaS optimization capability provides true end-to-end optimization of O365 from the end user desktop all the way to the Akamai point of presence closest to the SaaS tenancy geo-location. The diagram below illustrates this:

As shown above, the user's SaaS request is identified via layer-7 DPI, geo-DNS determines the tenancy location and a cloud SteelHead is automatically spun up at the closest point to the SaaS services, ensuring maximum performance irrespective of the user or the SaaS location. The Akamai SRIP (Sure-Route IP) network is also leveraged to ensure the most efficient path to the tenancy.

Comprehensive visibility/reporting of SaaS usage on a per-SaaS-app and per user basis for O365 is available in RiOS v9.5 onwards, and can be extended to integrate fully with Riverbed's SteelCentral Network Performance Management (NPM) visibility platform if highly detailed monitoring and pro-active application performance baselining/alerting is desired.

3 Next Steps

The successful results for optimisation of two of the top 5 protocols in the network environment indicate that a full deployment with advanced configuration would provide ongoing benefit to the business in terms of improving end user performance, maximising return on investment in WAN carriage, and future-proofing architecture changes such as centralisation/document management projects both on premise and/or in the cloud.

It is recommended that implementation of SteelHead appliances be performed in conjunction with enablement of the single-ended proxy and SaaS subscription capabilities to maximize the performance potential from the deployment.