2018-22
POWERLINK QUEENSLAND REVISED REVENUE PROPOSAL

APPENDIX 4.03 – PUBLIC

Future Wide Area Network Implementation Strategy

Delivering better value

MPLS Future State - Implementation Strategy

Division responsible: **Investment and Planning**

Contents

Introduction

This document outlines the strategy for further development of the MPLS Wide Area Network (WAN) to meet operational services requirements in the medium to long term.

Current State

The MPLS network provides a cost effective, flexible and scalable platform for modern IP services, including but not limited to:

- Metering over IP;
- Voice over IP (VOIP);
- SCADA over IP;
- Monitoring and management of the transmission network, for example, power quality and high speed monitoring (currently provided by the OpsWAN network);
- Substation monitoring and security; and
- Remote access to corporate applications from substations.

The rollout of the MPLS WAN to date has covered approximately 80 sites (70 of which were included under the Stage 1 MPLS rollout, with the remainder under Secondary System refurbishment projects). The sites in the Stage 1 deployment were selected as they provided the minimum protected ring architecture needed to meet the availability requirements of the services listed above. The rollout was timed to ensure the network was fully operational prior to the replacement of the Operational Telephone Network (OTN) with a VOIP solution. Specifically, having the network in place has allowed –

- The OTN replacement project to proceed, mitigating significant obsolescence issues with the existing telephony technology. This project will also remove of the reliance on Telstra and the NBN at the substation.
- The migration of SCADA to IP, included with Secondary System reinvestment projects.

Additionally, the end-of-life strategy for the PDH network is to perform a progressive migration onto the MPLS and SDH networks. Over the next 5-7 years, approximately 30 sites that currently contain PDH multiplex equipment will undergo a Secondary System replacement. The MPLS network established under Stage 1 will allow the gradual fulfilment of this strategy, reducing the need for a full scale PDH network replacement.

Future Network Development

Early plans for further MPLS network development included a full rollout to all remaining sites, with the trigger for deployment being the establishment of the VOIP network. Continuing with this approach would result in a significant infrastructure build (additional buildings and DC supplies) due the limited rack space availability at many of the remaining sites. The cost for such a project was previously estimated at approximately $10M.

This direction has since changed in light of the following -

- A solution has been found for the deployment of VOIP using existing equipment at sites that

are not part of the core MPLS network. This has removed the VOIP network as a trigger for further MPLS deployment.
- As many of the sites yet to obtain MPLS are relatively small and not part of the core network, a full MPLS implementation is no longer considered necessary.

This new position pushes out the timing of the MPLS network expansion and significantly reduces the project scope. The timing is now determined by one of the following conditions being reached –

- OpsWAN router replacement due to obsolescence
- Move to SCADA over IP due to EMS upgrade
- Move to Metering over IP

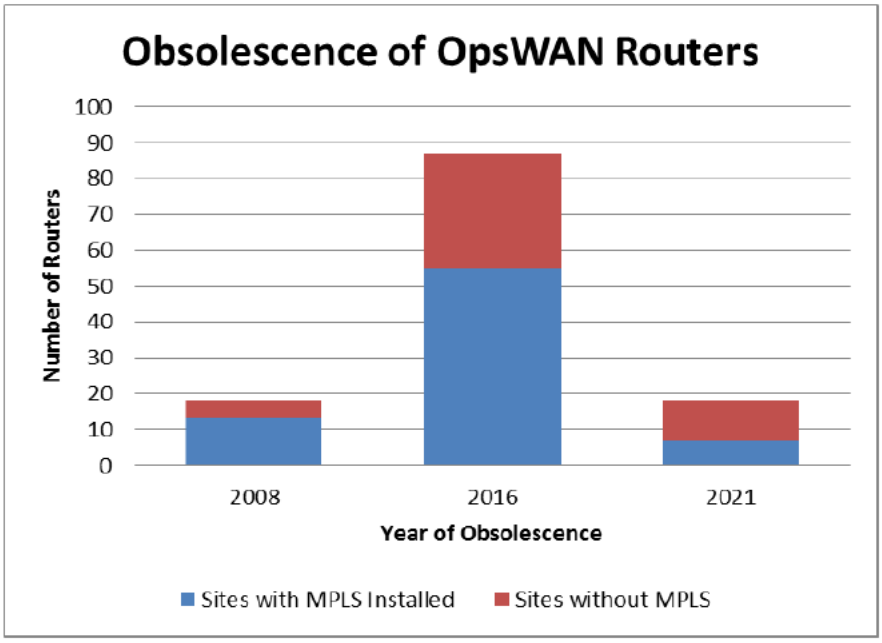
The timing for full migration to Metering and SCADA over IP will be in the next 3 – 6 years, but is dependent on external factors and vendor interoperability. As such, the short to medium term focus for further MPLS deployment will be centred on OpsWAN replacement, and is discussed below.

OpsWAN equipment obsolescence

Powerlink's Digital Asset Management Framework highlights four distinct change vectors that must be considered and monitored during the asset life cycle in order to perform prudent asset management of digital assets. One of these change vectors is obsolescence. From the Digital Asset Management Framework -

> "Obsolescence is the inability to support a product, system, or service for ongoing use despite it being in reasonable working order. While life extension is possible, an unsupported product has a significantly increased risk profile as a lack of spares and expertise increase the consequences of failure. Additionally lack of cyber security mitigations also increases both likelihood and consequences of risks associated with legacy digital assets. Obsolescence differs in its asset management treatment in that it is typically addressed via a 'fleet-wide' replacement decision where the organisation will strategically divest all instances, rather than targeted at individual assets."

Obsolescence is typically defined by vendors as the last date to receive service and support for the product, including patches for firmware faults or security vulnerabilities. With respect to the OpsWAN network, the following table shows the number of installed routers that are obsolete for the corresponding year.



The obsolescence date is as per the manufacturer end of life statements. Sites with MPLS have been distinguished from sites without.

Cutting over OpsWAN to existing MPLS equipment is already included in planned future projects. Accordingly, the immediate interest for further MPLS development is in the sites with OpsWAN routers that have either already, or are about to, reach obsolescence and where MPLS is not already installed. These sites are presented in the table below.

Site	OpsWAN Obsolescence Date	Comment
H004	2016	MPLS being installed as part of approved secondary systems replacement project
H016	2016	MPLS being installed as part of approved secondary systems replacement project
H021	2016	MPLS to be installed as part of planned secondary systems replacement project
H031	2016	
H038	2008	
H039	2016	MPLS to be installed as part of planned secondary systems replacement project
R004	2016	
S003	2016	
T026	2016	
T054	2008	
T065	2016	
T092	2008	MPLS to be installed as part of planned secondary systems replacement project
T094	2016	
T101	2016	MPLS to be installed as part of planned secondary systems replacement project
T129	2016	

T136	2016	MPLS to be installed as part of planned secondary systems replacement project
T140	2016	
T143	2016	
T146	2016	
T147	2016	MPLS to be installed as part of planned secondary systems replacement project
T150	2016	
T153	2016	MPLS to be installed as part of planned secondary systems replacement project
T155	2016	
T157	2016	
T160	2008	
T161	2008	
T172	2016	
T175	2016	
T178	2016	
T182	2016	
T189	2016	
T192	2016	
T199	2016	
T209	2016	
T210	2016	
T211	2016	
T212	2016	
T215	2016	

Of the sites listed above, 29 require the obsolescence issue to be specifically addressed. Valid options for progressing are –

1. Do nothing
2. Like for like replacement
3. Roll out MPLS and cut over OpsWAN

Detail for each of these options is presented below.

Option 1 – Do nothing

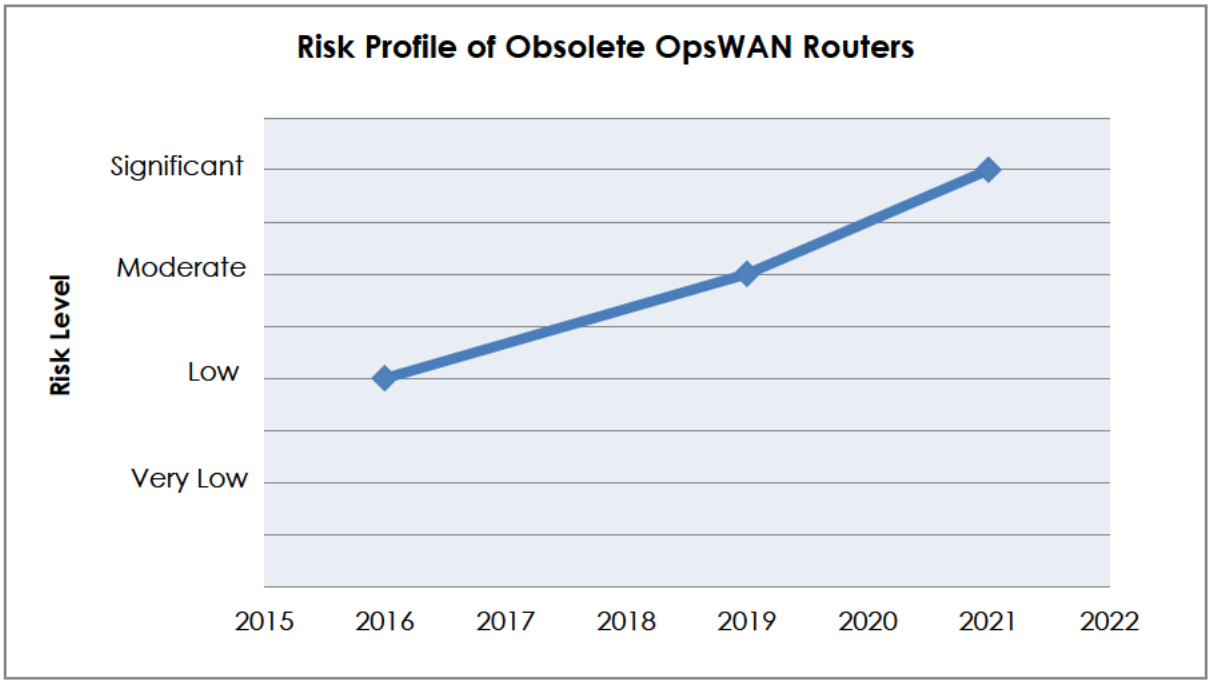
The do nothing option results in the OpsWAN routers being replaced on fail. A lack of accurate fault information makes it difficult to carry out analysis on the expected life of the installed equipment and the expected internal support period made possible through the existing spares holding. Regardless, equipment failures can be managed through design modification using alternative equipment. Under this scenario, failure of a router module will require a complete router replacement and reconfiguration at additional operational expense.

The configuration of the network would remain as per the existing unduplicated architecture. As such, the network will not be able to carry services that require the availability of a redundant network, such as –

- Metering over IP;
- Voice over IP (VOIP);
- SCADA over IP; and
- Substation monitoring and security.

Once one of the triggers for migration of Metering or SCADA to IP is reached in the next 3-6 years, the MPLS network will need to be expanded to provide the necessary service availability. This will result in additional capital expenditure, equivalent to Option 3.

[redacted]



Unmitigated Risks - 2016

	Likelihood	Consequence	Risk
[redacted]	[redacted]	[redacted]	**Low**

Unmitigated Risks – 2019

	Likelihood	Consequence	Risk
[redacted]	[redacted]	[redacted]	**Moderate**

Unmitigated Risks – 2021

	Likelihood	Consequence	Risk
[redacted]	[redacted]	[redacted]	**Significant**

The cost of this option is not quantifiable due to the uncertainties around the expected life of the equipment. However, as the unmitigated risk at 2021 is at a level that must be addressed, this option is not considered appropriate.

Option 2 – Like for like replacement

A like for like replacement would see the OpsWAN routers being replaced by the year 2021 with the latest supported router. As per the "Do Nothing" option, proceeding with this option will result in additional capital expenditure, equivalent to Option 3, once high availability IP services are required in the next 3-6 years. The anticipated timing of these additional services ultimately render this option a wasted investment, as the MPLS network will need to be rolled out during the same timeframe.

The cost for a like for like replacement is estimated at $2.0M. This option would mitigate the security risk identified in Option 1.

Option 3 – Roll out MPLS and cut over OpsWAN services

This option will involve MPLS being rolled out to all 29 sites, with OpsWAN services being cut over and the OpsWAN router decommissioned. As many of the sites are small and on the edges of the Telecommunications network, a full MPLS implementation is not considered necessary. This will reduce the requirement for establishing additional buildings at sites that do not require higher bandwidth.

A major benefit of this option is that it delivers a scalable platform that is capable of carrying high availability services without additional expenditure.

The cost for implementing this option is estimated at approximately $5.5M (Attachment 1). This option would mitigate the security risk identified in Option 1.

Option Comparison

Option	Cost	Risk	Additional future spend (3-6 years)
1 – Do nothing	Uncertain	Significant	$5.5M
2 – Like for like	$2.0M	Mitigated	$5.5M
3 – MPLS roll out	$5.5M	Mitigated	Nil

Note: Option 1 is not viable due to unacceptable risks posed by obsolescence after 2021

As the trigger to move to MPLS is expected to be around the same time as the when risk from OpsWAN Router obsolescence becomes significant, option 3 is the lowest cost option that mitigates the identified risks.

Recommendation

It is recommended to proceed with an MPLS rollout, as per Option 3, for the replacement of OpsWAN routers. Timing of this solution would have the obsolete equipment removed from the network by 2021. Some benefits of this solution include –

- It provides the lowest total cost of ownership for Powerlink.
- Enables the end-of-life strategy for the PDH network to be fulfilled through progressive migration onto the MPLS and SDH networks.
- Mitigates the security risk associated with obsolescence of the OpsWAN routers.
- Establishes the highly available IP network so that future services can be easily deployed, as required to meet the demand for regulated transmission services.

ATTACHMENT 1 – ID&TS - Reset 2017/18-2021/22 Project Proposal for CP.02553 Wide Area Network Deployment Stage 2

ID&TS - Reset 2017/18-2021/22 Project Proposal for CP.02553 Wide Area Network Deployment Stage 2

Document Approval		
	Name	Position
Prepared by		Project Manager
Reviewed by		Team Leader Projects
Approved by		Group Manager Infrastructure Delivery

Contents

1. Executive Summary

The telecommunications network is a critical supporting system for the transmission network, providing protection signalling, control and monitoring functionality and other data and voice communications.

Developments in both the transmission and telecommunications networks are imposing changes that require Powerlink to adapt to emerging technologies. As the system monitoring and control functions evolve to an IP based delivery model, then it is necessary for Powerlink to position itself to ensure its capabilities can continue to meet the demands of the future. Consequently, Powerlink commenced implementation of an MPLS (Multi Protocol Label Switching) network in 2012 to provide for these requirements both in the short and long term.

The objective of this project is to extend the MPLS capability to a further 29 sites across the network by October 2021.

2. Project Definition

2.1 Project Scope

The following scope presents a functional overview of the desired outcomes of the project. The proposed solution presented in the estimate has been developed with reference to all sections of this Project Scope Report, including *Section 1.7 Matters to Consider*.

Briefly, the project consists of providing MPLS capability at a further 29 sites across the network, details as follows:

- Design, procure, install and commission a fully diverse and equipment redundant MPLS WAN at the following twenty nine (29) sites:

Functional Location	Site	Functional Location	Site
H031	Molendinar	T160	Sumner
H038	Goodna	T161	Algester
R004	Millmerran Switch Yard	T172	QR Mindi
S003	Greenbank	T175	QR Bolingbroke
T026	Biloela	T178	Stony Creek
T054	Barron Gorge PS	T182	QAL South
T065	Alligator Creek	T189	Oakey
T094	Townsville East	T192	QR Mackay Ports
T129	Edmonton	T199	Yarwun
T140	Townsville Zinc	T209	Bluff
T143	Stuart GT	T210	Duaringa
T146	Oakey GT PS	T211	Wycarbah
T150	Alan Sherriff	T212	Goonyella Riverside
T155	West Darra	T215	Eagle Downs
T157	Ingham South		

- as most of the sites above are relatively small and on the edges of the Telecommunications and Power Networks, a full MPLS implementation may not be necessary and a minimal installation is to be deployed where appropriate.

- ensure that common hardware is utilised across the network;

- MPLS is to be installed direct over fibre where distance permits. Alternatively, the MPLS WAN shall be built on the Powerlink private SDH and DWDM infrastructure which is to provide 1Gbps Ethernet access to the MPLS nodes in the substation;

- throughput of the core routers to the substation LAN is to be a minimum of 100Mbs with the availability to achieve 1Gbps;

- where necessary, install a new telecommunications demountable building to accommodate the additional equipment;

  Note: for the purposes of this estimate assume two (2) sites will require new buildings and that there is sufficient space available the remainder of sites in the existing comms or control rooms;

  Note: it is assumed that installed DC systems are adequate, and no allowance is to be made for their upgrading under this project; and

- update all documentation and drawings, including [redacted], neXus and SAP, etc. to cater for new equipment.

2.1.1 Transmission Line Works

Not applicable.

2.2 Major Scope Assumptions

It has been assumed that:

- procurement agreements will be in place for the supply of MPLS equipment at commencement of the project;
- the existing Network Management System is suitable for management of the new MPLS equipment; and
- sufficient DC capacity is available at all sites.
- FAT testing will be done in Brisbane or on site and excludes any string testing.

2.3 Scope Exclusions

Network Management System licencing costs have been excluded.

3. Project Execution

3.1 Project Dependencies & Interactions

Large telecommunication projects in execution during the execution of this project could affect the cost and duration to complete this project.

Project No.	Project Description	Planned Comm Date	Comment
Pre-requisite Projects			
	Nil		
Co-requisite Projects			
	Nil		
Other Related Projects			
	None identified at time of Project Proposal development.		

3.2 Site Specific Issues

The project involves work at multiple sites. Individual site assessments will be required to identify issues prior to commencing work.

3.3 Project Delivery Strategy

It is expected that civil works and buildings installation will be completed by a SPA contractor.

Design of all telecommunications equipment will be done by Powerlink, constructed by a PanTel contractor and tested and commissioned by the Maintenance Service Providers.

Project Delivery Strategy Matrix		
Design	Earthworks Design	N/A
	Civil Design	Powerlink / SPA Contractor
	Electrical Design (Primary)	N/A
	Electrical Design (Secondary) – Protection	N/A
	Electrical Design (Secondary) – Automation	Powerlink

	Transmission Line Design	N/A
	Telecommunication Design	Powerlink
Construction	Earthworks Construction	N/A
	Civil Construction (Buildings)	SPA Contractor
	Construction (Panels)	PanTel Contractor
	Electrical Construction / Installation	N/A
	Transmission Line Construction	N/A
Testing	Substation Testing – FAT	N/A
	Substation Testing – SAT	N/A
	Substation Testing – Cut-Over	N/A
	Telecommunication FAT Testing	Ergon and Powerlink (O&FS)

3.4 Proposed Sequence of Works

3.4.1 Project Schedule

Multiple staging would allow design, construction and commissioning activities to run concurrently, reducing the overall project duration. Based on this approach, to meet the required commissioning date of October 2021 full project approval will be required by September 2019.

High Level Schedule

- Project Approval : September 2019
- Design Complete : June 2020
- Telecom Buildings Commissioned : February 2021
- MPLS Equipment Constructed : June 2021
- MPLS Equipment Commissioned : October 2021
- Project Completion : 31st October 2021

3.4.2 Project Staging

Major project stages are considered to be:

Stage	Description/Tasks
1	Design
2	Procurement of Buildings.
3	Procurement of Equipment
3	Building construction on site
4	Building commissioning on site
5	MPLS equipment construction on site
5	Commissioning of MPLS equipment.

3.4.3 Network Impacts and Outage Planning

No primary plant outages will be required. Impacts will be limited to operational and commercial telecommunications circuits only and will be managed and planned through the AFW process.

3.5 Project Health & Safety

The implications of relevant workplace health & safety legislation in delivering the proposed solution have been considered in preparing this estimate. In particular, this estimate includes an allowance for typical safety related activities required in the delivery phase of the project.

3.6 Project Environmental Management

Environmental management implications for the delivery of this project will need to be assessed on a site by site basis depending on the specific site requirements.

4. Project Risk Management

Some allowances have been included in the estimate. Please see estimate for details.
Please refer to the assumptions and exclusion as these items have implications for the overall project risk.

5. Project Estimate

5.1 Estimate Summary

Quote Summary :CP.02553 - Wide Area Network Deployment Stage 2

The quotation at current cost levels and escalated for completion by end 2021 at 2.5% per year, plus labour rate revisions.

OR.02553 Quotation in $,000 AUD	Base Cost Levels	Escalated to Compln.	Comment (Costs @ Base Cost Levels)
Telecommunications - Wide Area Network Deployment Stage 2	[redacted]	[redacted]	**CP.02553 - Wide Area Network Deployment Stage 2 - 29 sites**
	[redacted]	[redacted]	Telecommunication Design
	[redacted]	[redacted]	Telecommunications Procurement
	[redacted]	[redacted]	Telecommunications- New Buildings (2 Sites)
	[redacted]	[redacted]	Telecommunications Construction
	[redacted]	[redacted]	Telecommunications Commissioning (MSP)
	[redacted]	[redacted]	Safety and Environmental Compliance
	[redacted]	[redacted]	Project Concept/Investment & Planning, Statutory Costs, Project Management and O&FS -Network Ops
TOTAL QUOTE (EXCL RISKS & Offsets)	**5,311**	**6,058**	
Offsets	**0**	**0**	
Risk Estimate	**321**	**321**	
Climate	[redacted]	[redacted]	
Construction	[redacted]	[redacted]	
Design	[redacted]	[redacted]	
TOTAL QUOTE (INCL RISKS)	**5,633**	**6,379**	

5.2 Asset Disposal Table

No assets have been identified for recovery or disposal for this project.

6. References

Document name and hyperlink (as entered into Objective)	Version	Date
Project Scope Report	2	27/10/16
Estimate Detail	5	27/10/16