

IT Infrastructure Core Services - Investment Evaluation Summary

Project name:	IT Infrastructure Core Services
Department	F&BS
Investment Category	Information technology (support the business) non-network
Network	Shared
Project ND number / work category:	ITC
Project ZoNe location:	R0000736242 under ITRR19 project zone
Document number:	2422
Version number:	1
Date:	10/10/2017
Project initiation approval reference:	R0000748131

Preferred Option:	Option 1 - Upgrade and replace core IT infrastructure									
Estimate (preferred option – base dollars):	■■■■■ (2019-24 total)									
expenditure profile	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29
Capex	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■

Sign-offs (in support of the recommended option)			
Project Initiator:	■■■■■	Date	16/06/2017
Leader: (Endorsement)	■■■■■	Date	16/06/2017
Leader or General manager noting delegation levels. (Approval) ¹	■■■■■	Date	16/06/2017

¹ Approval based on delegation level.

1. Overview

1.1 Background

The TasNetworks Information Technology (IT) team is responsible for delivering Architecture, Infrastructure and data network services; desktop services and application support; data management and development and project delivery, testing and governance. IT Infrastructure systems are the shared hardware, software, monitoring and administration tools forming the foundation of shared IT capabilities upon which business systems are built.

The high level scope of this document is to describe planned expenditure for the determination period for IT Infrastructure Core Services. These core services are a combination of smaller initiatives that have historically been treated separately. This IES has them grouped due to each being integral components of the larger IT Infrastructure Core Services.

The Core Services consist of:

- **Network**
 - local area and wide area networking equipment;
 - core networks;
 - monitoring and management software for network platforms.
- **Compute**
 - physical servers and hardware appliances;
 - associated system software, including server virtualisation and operating system software;
 - monitoring and management software for compute platforms.
- **Storage**
 - shared storage solutions;
 - enterprise backup system;
 - monitoring and management software for storage and backup platforms.

For each of these areas the following items are considered:

- Maintenance, upgrade, extension and replacement of storage arrays, compute (server) and core network hardware;
- Maintenance, upgrade, extension and replacement of supporting software and management components dedicated to these core components;
- Maintenance, upgrade, extension and replacement of supporting hardware dedicated to the storage arrays and storage access platforms (storage fabric).

The Information Technology team is responsible for the Network, Computer and Storage infrastructure and associated services underpinning delivery of application services used across all business functions. These services provide critical functions such as Network

Operations Control (OT core systems, not SCADA WAN), Outage Management, energy market operation processes and works service delivery.

IT Infrastructure Core Services do not include:

- Protection and Control;
- Telecommunications (external and wide area networks including SCADA WAN).

The goal of maintaining IT Core Services is to ensure prudent and timely investment through annual incremental expansion or refresh as well as scheduled major uplifts (as technology advances are realised or components reach the end of their extendable and supportable life).

The major maintenance categories are:

- capacity and performance extensions/uplifts; and
- major upgrades/technology refreshes.

Typically IT core services infrastructure has a lifecycle of 5-7 years before manufacturers and vendors introduce step changes and cease support of older platforms. TasNetworks IT Infrastructure aims to stagger the major step changes to reduce or smooth any capital expenditure spikes over the investment periods.

Two cycles exist for this equipment. The longer cycle requires a major upgrade as the platform or stack reaches end of life while the shorter cycle has capacity and performance assessed and remedied as required. A pragmatic approach to the timing of the major upgrades has resulted in these being staggered across the type of equipment. This allows a more effective management of resources.

Storage

For the purposes of this document, storage hardware refers specifically to infrastructure installed to provide shared storage for servers and server applications as well as general document storage. Storage hardware includes:

- Storage Area Network (SAN) platforms;
- Network Attached Storage (NAS) infrastructure;
- Fibre Channel switching hardware dedicated to storage access.

This storage has undergone significant consolidation and the corporate environment now operates on two separate arrays. The operational environment also operates on two separate arrays. There are only two models of array from the same vendor over these installations. Storage hardware of this type is typically operated on a 4-5 year life cycle. Annual maintenance and support charges for such arrays are significantly increased during years 5 and 6 to send a strong price signal to customers to upgrade and replace. Current maintenance agreements allow for storage controller uplift to be provided as part of the service every three years. This means that the major performance bottleneck to the platform is refreshed regularly and non-disruptively but also results in some vendor lock in.

TasNetworks' corporate environment currently operates three storage tiers, each scoped to best fit the data and workload they are primarily serving.

1. A primary storage array is hosted at datacentres servicing active data loads.

2. A secondary array is located at [REDACTED] facilities servicing online backup copies of data.
3. The third tier of storage is a tape library located at [REDACTED] facilities. This third tier services long term backups and archive copies of data.

TasNetworks' operational environment data is hosted on an independent set of storage arrays located at two sites. These provide cross-site backup services for the OT data with a tertiary copy being moved to primary corporate arrays.

Compute/Server Hardware

This asset class refers to hardware infrastructure specifically designed for hosting of server applications, primarily (but not necessarily exclusively) in one or more of TasNetworks data centre facilities. Server hardware includes:

- Native Physical Servers: servers running a single operating system instance and one or more applications directly on the physical hardware and without an intervening virtualisation layer;
- Virtualisation Physical Servers: servers running virtualisation software, thereby hosting multiple logical operating system instances on the hardware.

Server hardware includes the physical servers themselves as well as shared server infrastructure, required for blade server installations (including chassis, power supply and interconnect components).

As at mid-2017, TasNetworks operates [REDACTED] virtualisation servers and manages [REDACTED] native physical servers.

Servers are typically operated to a 5-year life cycle, while shared blade server infrastructure components are refreshed less frequently (7-8 years). The nature of the current platform allows staggered generations to co-exist which allows refresh cycles to be likewise staggered and maintain an optimum 20% refresh rate per year.

Corporate compute platforms are primarily housed at the main datacentres. Workloads are largely virtualised (CPU and RAM resources are pooled allowing servers to reserve only what they require).

Security and other constraints have resulted in the location of distinct OT compute stacks located at the [REDACTED] Street and [REDACTED] sites.

Network

The network core is responsible for inter and intra datacentre connections, allowing servers to communicate with clients and the outside world. The operational (OT) network is not considered in this IES and is included in another IES.

Location	Hardware Type	Description/Notes	Typical Lifespan
TasNetworks Data Centres	Core Switch	A high-capacity switch generally positioned within the backbone or physical core of a network. Core switches serve as the final aggregation point for the network.	7-10 years
	Server	Hardware connecting data centre servers to the core	6-8 years

	Switch	switch. Note that many devices (including server chassis interconnects) will connect directly to the core switch infrastructure.	
	Fabric Extender	A fabric extender is a specialised piece of hardware that physically 'extends' a [REDACTED] by providing port capacity in a discrete form factor that is physically detached from the parent switch.	
	Router	A device used to forward data between networks. Typically used to provide access to external networks or remote sites.	6-8 years
Site Locations	Access Switch	Provides physical connectivity to endpoint devices, including workstations, printers and telephony equipment.	6-8 years
	Wireless Access Point	Allows wireless devices to connect to the wired network.	3-5 years
	Wireless LAN Controller	Used to manage multiple wireless access points and regulate wireless access to the network.	5 years
	Router	Used in remote sites to access communications links to TasNetworks data centres.	6-8 years

1.2 Problem definition

IT Infrastructure Core Services provide the key technology foundation for the use of Information Technology at TasNetworks, supporting all business systems servicing the [REDACTED] employees located throughout the state. These services are hosted within [REDACTED] datacentres managed by TasNetworks and are comprised of [REDACTED] compute nodes, [REDACTED] storage nodes, [REDACTED] core network nodes with [REDACTED] supporting network devices providing end user connectivity.

This initiative seeks to address two challenges encountered with IT infrastructure:

1. Asset end of usable life and end of supported life;
2. Need for increased capability, performance and capacity to support the organisation.

If the Information Technology team does not invest in the Storage, Computer and Network infrastructure assets, it is extremely likely (close to certain) that asset failures in one or more of these asset classes will occur each year after asset end of life, leading to a loss of the Information Technology service that supports critical business processes for internal and external customers.

Information Technology takes the following infrastructure objectives into account:

1. Reliable and effective delivery of IT services to the TasNetworks' business and external customers;
2. Compliance with state and federal legislative and regulatory requirements, including:
 - a. Industry-specific requirements
 - b. State and federal privacy legislation

- c. Occupational Health and Safety requirements
 - d. Data privacy and data retention;
3. Efficient, flexible and cost-effective service delivery;
4. Availability of services meets or exceeds IT service level targets through appropriate configuration and procurement of suitable support agreements;
5. Sufficient performance over the period;
6. Sufficient capacity for the following resources in order to meet IT service level requirements through the determination period:
 - a. Production and Development data storage
 - b. Disaster Recovery/Service Continuity data storage
 - c. Growth in existing business services and activities;
7. Anticipated new business services and activities;
8. Support the ability of TasNetworks to access IT business services and data in accordance with TasNetworks' Disaster Recovery/Service Continuity requirements;
9. Ensure services are flexible to cater for changing landscape;
10. Reduce complexity through a compatible and consistent platform for all applications and systems;
11. Ensure that all security facilities are:
 - a. Licensed, and installed in compliance with vendor licence requirements
 - b. Supported by the vendor to a level appropriate to IT service level objectives
 - c. Upgraded or replaced as necessary to meet the requirements above;
12. Ensure replacement of security hardware and software in line with the IT Infrastructure Lifecycle policy to meet the investment needs documented above.

A summary of general lifecycle reviews/dates is discussed in the Infrastructure Asset Management Plan and summarised in the following table.

Asset	Event	Timeframe	Driver
Server	Server replacement	Annual on a rolling basis, server lifespan 4-5 years	To adequately support business and operational IT systems through the provision of reliable and fit for purpose IT infrastructure. Replace equipment within a suitable economic lifespan, maintaining active vendor warranty support to facilitate timely remediation of any hardware faults.
Storage	Storage array replacement. The current agreement	2018, 2022	As above

	with the vendor means we will get a controller replacement at year 4. This allows us to avoid forklift upgrades and potentially extend the lifetime of shelves and disks.		
Network	Data centre network equipment replacement	2017, 2023	As above
Network	Office location network equipment replacement	Semi annual rolling upgrades as equipment reaches end of life	As above
Network	Wireless network equipment replacement	Semi annual rolling upgrades as equipment reaches end of life	As above

These activities will allow TasNetworks to maintain a reliable, efficient and performant capability to effectively host systems.

2. Customer needs and impacts

TasNetworks' IT infrastructure is critical to the reliable, timely and effective delivery of business application and data services to staff and customers. These services are directly related to TasNetworks' ability to deliver efficient and effective services to our internal and external customers. The management of the items in this IES are critical to the operation of these components.

- Storage services focus on providing data holding capabilities that match the systems requirements around cost, performance and availability. TasNetworks maintains several platforms that cater for these variable storage requirements;
- Compute services are mandatory to running any systems within TasNetworks' platforms. The hypervisor allows these compute resources to be pooled and utilised in an efficient and flexible method. It also decouples the running services from hardware allowing non-disruption hardware maintenance and upgrades;
- All servers housed in the datacentre make use of the network core. Therefore maintaining reliable and performant network equipment is a core requirement to the business.

The Corporate IT team is strongly focussed on service delivery to customers. These services are delivered in a manner that aligns with TasNetworks' mission, commitments and values. The customer consultation program for the Infrastructure Program of Work documented in this IES reflects an approach of constant and direct engagement with business customers through:

- Regular direct meetings with management teams from all business units at least every six months. These meetings are broadly scoped and cover all services provided by the Corporate IT team as well as discussing current and emerging requirements from the business;
- A formal project prioritisation process that includes full transparency, extensive customer consultation and business-determined priorities;
- A fully consultative project management methodology that embeds the needs of the Corporate IT team's customers in every stage of the project.

3. Corporate alignment

3.1 Strategic objectives

The following table highlights how the initiative will assist in achieving TasNetworks' Strategy for 2025.

Table 1 Strategic Goals relevant to this project

Strategic Goal	How this initiative will address the strategic goal
Business Productivity – <i>"Optimise our program of work and emergency response capability delivering on our promise"</i>	Storage, Network and Compute provide the Information Technology foundation that supports all business applications that enables critical business processes within TasNetworks. These services are mandatory for all IT based systems. This initiative will maintain these capabilities.
Network Capability – <i>"Our network continues to meet demand and power system security systems requirements while accommodating the changing use of our network"</i>	These services are mandatory for all IT based systems. Supervisory control of the network would be compromised by a widespread core systems failure.
Culture and Capability Program – <i>"Value chain optimisation and change capability"</i>	These services are mandatory for all IT based systems. This initiative will maintain these capabilities.
Voice of the Customer – <i>"Delivering valued services"</i>	Should TasNetworks core services fail, TasNetworks may fail to provide key services to connect, modify connections, re-energise or provide billing reads for our

	customers.
Business Transformation – <i>“Realise our business transformation”</i>	The core systems capability is pivotal to many transformational initiatives. Extending the core services is a prerequisite to providing sufficient capacity to allow transformational projects that rely on information technology.

3.2 Performance objective

This project will help to achieve the customer and business performance objectives in TasNetworks’ Corporate Plan 2017-18 to 2021-22 and aligns with the 2019 to 2024 regulatory period. The relevant performance indicators and measures are presented in table 2.

Table 2 Performance objectives relevant to this project

Performance measure	Measure	Project objective
Zero harm	Number of significant incidents	Provide reliable and timely IT systems in line with performance, availability and retention requirements.
Sustained cost reduction	Efficient operating and capital expenditure.	Provide IT systems in line with performance, availability and retention requirements.
People	Staff turnover.	Provide IT systems in line with performance, availability and retention requirements.
Network service	Transmission loss of supply events	Supervisory control of the network is supported by Storage, Networks and Compute.
Customers	Call answering – Service Centre	The customer and the Integrated Voice Response (IVR) system is a key component to many processes that support our customers. Any failure in this system will lead to an increase in calls to our Service Centre.
Customers		
Customers	Customer satisfaction	Customer systems are supported by core services and are a key component to many processes that support our customers.
Customers	Customer net promoter score	Ensure delivery of services that drive the net promoter score.
Customers	Meter data provision	Customer systems supported by core services

Performance measure	Measure	Project objective
		are central to the processes that provide quality meter data to market participants for [REDACTED] customers. If this system fails or experiences any issues, the business will fail these measures.
Customers	AEMO ; - MDP compliance measures - DNSP/LNSP compliance measures - MPB compliance measures	Customer systems supported by core services is central to the processes that provide quality meter data to market participants. The performance of the MDMS directly affects our ability to meet the AEMO compliance measures.
Shareholder Value	- Profit after tax - Operating cash flow	Any system failure will result in impact to Distribution Monthly Billing, which will in turn affect TasNetworks' revenue targets and cash flow.

3.3 Risk objectives

This initiative addresses Financial, Customer, Network Performance and Compliance risks, of which TasNetworks has [REDACTED] appetite.

Those risks, which will be impacted by this project, are presented in table 3.

Table 3 Risks impacted by this project

Risk #	Risk category	Risk	Impact	Likelihood	Consequence	Risk Rating
ITR-137	Finance	As systems age, the effort involved with maintaining them increases leading to issues with productivity, reliability and capacity.	Although the systems operate in a highly redundant environment, the chances of unmanaged failure increase with age. A complete failure of these services results in all IT/OT systems being unavailable.	Rare	Severe	Medium
ITR-138	Customer	As systems age, the effort involved with maintaining them increases leading to issues with productivity, reliability and capacity.	Although the systems operate in a highly redundant environment, the chances of unmanaged failure increase with age. A complete failure of these services results in all IT/OT systems being	Unlikely	Major	Medium

			unavailable.			
ITR-139	Network Performance	As systems age, the effort involved with maintaining them increases leading to issues with productivity, reliability and capacity.	Although the systems operate in a highly redundant environment, the chances of unmanaged failure increase with age. A complete failure of these services results in all IT/OT systems being unavailable.	Unlikely	Major	Medium
ITR-140	Compliance	The ability to audit events and trace incidents will increasingly become a manual or impossible task as systems responsible for this become overwhelmed or incompatible.	Data may not be available to meet audit or legal requirements.	Unlikely	Major	Medium

4. Project objectives

The primary objective of this initiative is to ensure TasNetworks' has the ongoing ability to deliver prescribed, negotiated and non-prescribed services to customers. This objective is achieved through meeting the following initiative objectives:

1. Provide a platform to meet IT service level requirements through the 2019-2024 determination period and beyond.
2. Provide sufficient performance of the above services over the period
3. Provide sufficient capacity for the following resources in order to meet IT service level requirements through the 2019-2024 determination period and beyond:
 - a. Production and Development data storage
 - b. Disaster Recovery/Service Continuity data storage
4. Provide sufficient capacity over the 2019-2024 determination period and beyond for:
 - a. Growth in existing business services and activities
5. Anticipated new business services and activities
6. Ensure that the availability of services meets or exceeds IT service level targets through appropriate configuration and procurement of suitable support agreements
7. Support the ability of TasNetworks to access IT business services and data in accordance with TasNetworks' Disaster Recovery/Service Continuity requirements
8. Ensure services are flexible to cater for changing landscape
9. Provide a compatible and consistent platform for all applications and systems
10. Ensure that services are operated to meet TasNetworks' compliance requirements for data privacy and data retention
11. Ensure that all security facilities are:
 - a. Licensed, and installed in compliance with vendor licence requirements
 - b. Supported by the vendor to a level appropriate to IT service level objectives
 - c. Upgraded or replaced as necessary to meet the requirements above

12. Ensure replacement of security hardware and software in line with the IT Infrastructure Lifecycle policy to meet the investment needs documented above.

The objectives will be met through the execution of maintenance, upgrade, extension and replacement activities as described.

5. Revenue Determination

N/A

6. Options analysis

Each option has been selected and assessed with regard to the following criteria:

1. **Solution effectiveness:** solution effectiveness is tested against the problem (detailed in section 1.2 titled “Problem Definition”);
2. **Cost** (estimates used on the analysis have a level of accuracy of $\pm 30\%$ and do not include the 20% project contingency normally applied to this type of project);
3. **Business impact:** the selected option will consider the level of change to TasNetworks environment (including during project implementation and post implementation);
4. **Business Strategic alignment:** does the option fulfil the business objectives and current business initiatives (detailed in section titled “Corporate Alignment”);
5. **Information Technology Strategic alignment;**
6. **Project complexity:** solutions have the minimum level of complexity needed to meet the business requirements;
7. **Risk profile:** solutions will be risk averse;
8. **Compliance:** ability to achieve compliance. Solutions will be fully compliant with all regulatory requirements and applicable industry standards;
9. **Time:** solutions will be implemented within a suitable timeframe to ensure compliance (where relevant), minimise disruption to the business and reduce the likelihood of project requirements becoming dated.

The following table compares the options presented with regard to the criteria assessed in the previous chapter.

Table 4 Summary of Drivers

Driver	Option 0 Do Nothing	Option 1 Upgrade and replace core IT infrastructure	Option 2 Delay maintenance of core IT infrastructure
1. Solution effectiveness	Addresses few requirements	Addresses most requirements	Addresses most requirements
2. Cost	High	Low	Medium
3. Business Impact	High	Low	High

4. Business strategic alignment	Poor alignment	Good alignment	Partial alignment
5. IT strategic alignment	Poor alignment	Good alignment	Partial alignment
6. Project complexity	N/A	Low	High
7. Risk profile	High	Low	Medium
8. Compliance	Moderate	Easy	Easy
9. Time	N/A	Easy	Hard

The table below shows the key for each rating.

Table 5 Drivers Rating Key

Driver	Rating 1 - Green	Rating 2 - Yellow	Rating 3 - Red
Solution effectiveness	Addresses most requirements	Addresses some requirements	Addresses few requirements
Cost	Low	Medium	High
Business Impact	Low	Medium	High
Business strategic alignment	Good alignment	Partial alignment	Poor alignment
IT strategic alignment	Good alignment	Partial alignment	Poor alignment
Project complexity	Low	Medium	High
Risk profile	Low	Medium	High
Compliance	Easy	Moderate	Hard
Time	Easy	Moderate	Hard

6.1 Options considered

The following table lists the options considered.

Table 6 Options considered for this project

Option No.	Option description
0	Do Nothing
1	Upgrade and replace core IT infrastructure (preferred option)
2	Defer Upgrading and replacement of core IT Infrastructure. Capacity increases are still maintained.

6.1.1 Option 0: Do Nothing

The option of ‘Do Nothing’ assesses the scenario where this initiative is not approved. It is envisaged that maintenance/support is still maintained over the period while the vendor continues to provide such. Essentially all business services will be heavily impacted as storage and compute capacity is exhausted. Additionally ageing hardware/software will introduce increasing amounts of unrecoverable failures.

Table 7 Option 0 – Scenario Assessment

Criteria	Advantages	Disadvantages
1. Solution effectiveness	NA	Unable to meet growth and availability requirements.
2. Cost	Reduced Capex	If this initiative does not progress and TasNetworks experiences a system failure, operations will be cut to around 20% of full efficiency and manual workarounds for various processes will need to be activated. This will result in increasing reliance on manual processes, leading to increased staff and incremental Opex.
3. Business impact	NA	If core IT infrastructure ceases to function adequately, it will have a significant impact on TasNetworks’ capability to operate. This will ultimately increase process complexity and negatively impact customer service levels. Another impact may also be in increased frequency and duration of IT service outages.
4. Business strategic alignment	NA	Option 0 will not fulfil any of the strategic and performance objectives outlined in Sections 3.1 and 3.2, as: <ul style="list-style-type: none"> • TasNetworks capability to meet network demands and power system security is reduced • There will be disruption or inability to support transformational initiatives as these are reliant on sufficient and reliable core IT infrastructure • A reduction in customer satisfaction as customer systems are supported by core services and are central to the processes that provide quality meter data to market participants
5. IT strategic alignment	NA	Not aligned with the IT Strategy as Option 0 does not fulfil the principle of maintaining systems in a healthy and supported state.
6. Project complexity	NA	Many manual processes will have to be enacted or created.
7. Risk profile	NA	Increased risk of hardware failure and subsequent service interruption.
8. Compliance	NA	If this initiative does not progress, TasNetworks

		will be severely hindered in meeting performance targets for customer service levels, outage restoration and performance obligations imposed by the AER.
9. Time	NA	NA

6.1.2 Option 1: Upgrade and replace core IT infrastructure

The option of ‘**Upgrade and replace with annual increases to capacity**’ is the preferred option and its scenario assessment can be seen below. Further details are available on section 6.8 titled “Preferred option”. It should be noted that the Capex for the period is consistent with expenditure over the past three years.

Table 8 Option 1 – Scenario Assessment

Criteria	Advantages	Disadvantages
1. Solution effectiveness	Option 1 addresses the problems outlined in Section 1.2 by ensuring all core IT services are fully operational in a fit for purpose and healthy state.	
2. Cost	Cost savings will be derived from reduced Opex	Increase in Capex
3. Business impact	Option 1 will: <ul style="list-style-type: none"> • Reduce frequency and duration of IT services outages • Maintain IT core services in a fit for purpose and healthy state to satisfy customer experience levels and ensure optimal performance 	
4. Business strategic alignment	This option fulfils the strategic and performance objectives detailed in Sections 3.1 and 3.2 of this IES. In addition, Option 1 supports the transformational goals to integrate systems, which optimises information flow and enables increased reliance and knowledge of IT capabilities. The initiative will also future proof TasNetworks ability to deliver on IT and transformational initiatives	
5. IT strategic alignment	By implementing this initiative, all systems are adequately supported and the risk of failure is reduced. This option best aligns with the IT	

	Strategy of being fully supported, and as efficient and effective as possible	
6. Project complexity	Low	
7. Risk profile	Decreased risk of service failure and capacity issues. Please also refer to Appendix B – Risk Comparison	
8. Compliance	This Option will ensure all compliance requirements are met.	
9. Time	NA	

6.1.3 Option 2: Defer Upgrade and Replacement

This option of 'Defer upgrading and replacement but maintain annual increases to capacity' is assessed below.

Table 9 Option 2 – Scenario Assessment

Criteria	Advantages	Disadvantages
1. Solution effectiveness	Able to meet capacity requirements in the short term	This option is forecast to not meet future technical capability/performance or requirements and have a higher risk of system failure, affecting network performance and customer satisfaction.
2. Cost	Lower Capex	Higher Opex
3. Business impact	Available capacity for business activities	Increased frequency and duration of IT service outages, resulting in additional human resources required to maintain core IT services. Performance will degrade in a non-linear fashion.
4. Business strategic alignment	This option will support the performance objectives outlined in Section 3.2 but agility and the ability to leverage new technologies will be severely hampered.	Option 2 will not fulfil certain strategic objectives, in particular to 'Realise our business transformation', as it may not be able to meet IT requirements if upgrades are delayed. By delaying upgrades, the ability to support the additional demand from other initiatives may be hindered.
5. IT strategic alignment		Not aligned with the IT Strategy as Option 2 does not fulfil the principle of maintaining systems in a healthy and supported state
6. Project complexity		Similar complexity compared to Option 1 with limitations in play due to increasing numbers of equipment generations. This will lead to silos.
7. Risk profile	Decrease risk of capacity issues. Please also refer to Appendix B –	Increased chance of hardware failure, service interruption, lower agility and technical

	Risk Comparison	capability.
8. Compliance		
9. Time		

6.2 Option estimates

Tables 10 and 11 show the cost estimates for options 1 and 2. Option 0 'Do Nothing' has no capital expenditure.

Table 10 Option 1 – Cost Estimates

Estimate (in nominal dollars) [REDACTED]					
Option 1 expenditure profile	19/20	20/21	21/22	22/23	23/24
Capex	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
Opex					

Table 11 Option 2 – Cost Estimates

Estimate (in nominal dollars) [REDACTED]					
Option 2 expenditure profile	19/20	20/21	21/22	22/23	23/24
Capex	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
Opex	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]

Option 2 : Increases in Opex are the result in increases in maintenance costs, interruption to services and performance degradation. Some Capex due to increases in capacity.

Table 12 Option 0 – Cost Estimates

Estimate (in nominal dollars) [REDACTED]					
Option 0 expenditure profile	19/20	20/21	21/22	22/23	23/24
Capex					
Opex	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]

Option 0 : Large increases in Opex are the result of large and prolonged failure of IT hosted systems within the business.

6.3 Economic analysis

An economic analysis has been undertaken to compare the options considered. The economic analysis was conducted on the options to address detailed project outcomes. Options were evaluated against Option 0. Details of the NPV analysis are included in Appendix A.

The table below details the preferred option in respect to NPV results.

Table 13 NPV Summary Results

Option No.	Option description	NPV	Reason got selection/rejection
0	Do nothing	██████	No business benefit. Leaves significant risk and almost certain operational impact.
1	Upgrade and replace with annual increases to capacity	██████	Provides business benefits and mitigates risks in current system.
2	Defer Upgrading and replacement of core IT Infrastructure. Capacity increases are still maintained	██████	Provides less business benefits. Medium risks are still present resulting in operational inefficiencies.

6.3.1 Sensitivity analysis

NA

6.4 Risk Matrix summary of drivers

This matrix provides a comparison of each option's impact against the company risks identified in section 3.3 titled "Risk objectives". Appendix B contains supporting details of the risk assessment outcomes as summarised in table 13.

The risk review is cognisant of the risk approach and risk management process outlined in TasNetworks' risk management framework document².

Table 12 Risk Matrix summary

Risk ID	Risk Category	Risk Drivers	Option 0 - Do Nothing Gross risk	Option 1 Net risk	Option 2 Net risk
ITR-137	Finance	As systems age the effort involved and vendor support costs increase. Reliability, productivity and	Very High	Low	Medium

² Zone Ref. R0000209885

		capacity decrease.			
ITR-138	Customer	As systems age the effort involved and vendor support costs increase. Reliability, productivity and capacity decrease.	High	Low	Medium
ITR-139	Network Performance	As systems age the effort involved and vendor support costs increase. Reliability, productivity and capacity decrease.	High	Low	Medium
ITR-140	Compliance	As systems age the effort involved and vendor support costs increase. Reliability, productivity and capacity decrease. The ability to audit events and trace incidents will increasingly become a manual or impossible task as systems responsible for this become overwhelmed or incompatible.	High	Low	Medium

6.5 Quantitative risk analysis

N/A

6.6 Benchmarking

N/A

6.7 Expert Findings

N/A

6.8 Preferred option

The preferred option is to replace the storage, network and compute platforms in alignment with the asset management plan. Extra capacity will be purchased and bought online as part of a yearly assessment and procurement cycle. This allows procurement to be staggered and the process to be well refined and practised, minimising disruption to the business and

external customers. Maintaining current generation hardware will ensure optimal capacity, performance, availability and technical capability. Not maintaining this core IT equipment significantly increases the risks of a failure and resulting service interruption. Additionally, support costs will rise exponentially after the manufacturer's nominally rated lifetime.

6.8.1 Scope

The scope of the preferred option includes:

- Replacement of current storage systems;
- Replacement of current compute systems;
- Replacement of current network core;
- Incrementally adding capacity as forecasting dictates.

6.8.2 High Level Implementation Activities

The high level implementation activities of this initiative are:

- Review on a regular interval capacity and performance requirements and trends;
- Procure capacity based on this analysis;
- At the end of the equipment's nominal lifetime review current landscape;
- Procure new stack noting this can be very different architecture;
- Migrate services to new equipment.

7. Investment timing

This investment is part of a rolling upgrade and migration process. End of life is staggered over the period depending on the type of equipment and environment it is servicing (e.g. OT assets have a different start date for the rolling cycle compared to IT. Likewise compute, network and storage have varying cadence and are largely decoupled).

8. Regulatory test

N/A

9. Expected outcomes and benefits

The outcomes and benefits are considered from a TasNetworks' perspective and from an external stakeholder perspective, in this case the customer and retailer. Details of these benefits can be seen in the table below.

The benefits to TasNetworks from implementation of the preferred option will be:

- Critical and ancillary systems will be available to both internal and external customers;
- Critical and ancillary systems will operate in a performant manner;

- Critical and ancillary systems will have sufficient capacity to service changes in business needs;
- Support costs will be minimised;
- Reduced Opex.

Outcomes and benefits have also been segregated into tangible (i.e. measureable) and intangible (not measureable). Tangible benefits are used as part of the NPV calculations in chapter 6.

Table 135 Summary of Expected Benefits

TasNetworks' perspective	Tangible benefits								
	The potential benefits of the preferred option will take the form of lower operational expenditure and productivity gains provided via having systems that are available and performant.								
	<table><tr><th>Benefit Description</th><th>Benefit</th></tr><tr><td>Performance of systems will be maintained or increased. Avoidance of 2% productivity loss.</td><td></td></tr><tr><td>Reduced frequency/duration and scope of service interruptions.</td><td></td></tr><tr><td>Reduction of support costs</td><td></td></tr></table>	Benefit Description	Benefit	Performance of systems will be maintained or increased. Avoidance of 2% productivity loss.		Reduced frequency/duration and scope of service interruptions.		Reduction of support costs	
	Benefit Description	Benefit							
	Performance of systems will be maintained or increased. Avoidance of 2% productivity loss.								
Reduced frequency/duration and scope of service interruptions.									
Reduction of support costs									
Unquantifiable benefits of the options are listed below.									
Intangible benefits									
This project will provide the following benefits:									
<ul style="list-style-type: none">• Maintain compatibility of systems.• Maintain technological feature currency of systems.• Continue to facilitate changing business requirements with regular capacity reviews and adjustments.									
Customer's perspective	<ul style="list-style-type: none">• Maintain high availability of systems.• Maintain sufficient performance of systems.								

10. Assumptions

The table below shows the assumptions used for this IES.

Table 16 Assumptions

ID	Assumption Description
ITA-074	Option 0 'Do Nothing' will still maintain vendor support if available while the equipment is in service.
ITA-081	No major stepwise increase in requirement from initiatives outside of Infrastructure.

ITA-082	Equivalent capacity between similarly priced equipment 5 years apart is 3x (based on existing compute infrastructure compared to the replacement equipment quoted in the detailed costs).
ITA-083	Storage hardware will be required across 4 datacentre locations.
ITA-084	No major changes to Disaster Recovery/Business Continuity service level objectives in the period.
ITA-085	Continue existing requirement for active-active data centres.
ITA-086	This analysis breaks down after 2 years of extension as it is no longer possible to acquire hardware maintenance contracts on equipment of this age. A more practically relevant analysis would require that replacement is unavoidable at year +6 or +7 and those capital costs should be deferred to those years rather than eliminated.
ITA-087	Although some consideration for the increasing alignment of IT/OT has been factored in we have not assumed total merging of assets during this period.
ITA-088	No allocation for big data or analytics has been factored in.
ITA-079	No significant move to externally hosted services (cloud).
ITA-080	Artificial Intelligence based systems will still be considered immature and not widely adopted.
ITA-127	Vendor support costs will increase to 35% at yr6 and 45% at yr7 of initial Capex when available.
ITA-128	Core storage services failure will result in widespread (>70% headcount) severe (>50%) productivity loss for ~4 weeks.
ITA-129	A campus switch failure will impact 20 personnel. Impact = Loss of 4hrs plus small productivity loss for next few days(15% for 35hrs).
ITA-130	A wireless access point will impact 5 people with a similar profile to campus switch productivity loss.
ITA-131	Loss of a compute node will impact 500 personnel. The impact will be 25% productivity loss for 4hrs.

11. Recommendation

At TasNetworks, IT Infrastructure Core Services provide the key technology foundation for the use of Information Technology. Current challenges include assets being at the end of their usable life, and an increasing demand for capability, performance and capacity requirements to support the business and changing cyber threat landscape. Accordingly, TasNetworks will need to continually upgrade components of its IT Infrastructure Core

Services throughout the upcoming regulatory period. In delaying these upgrades, TasNetworks undermines its ability to be efficient and prudent with respect to IT Infrastructure Core Services.

It is recommended that TasNetworks pursue Option 1, which is to perform upgrades and annually increase the capacity available. The business benefits, costs and associated risks outlined for each option support this recommendation.

Appendix A – NPV Analysis

The assumptions used in the NPV analysis are as follows:

- NPV analysis is carried out for a 5-year period (2019-2024).
- WACC of 3.59 per cent is used.
- CPI of 2.45 per cent is used.
- No contingency has been assumed.

	Option 0	Option 1	Option 2
Costs			
NPV Capital Expenditure			
NPV Operational Expenditure			
NPV Costs Only			
Benefits			
NPV Other benefits			
NPV Benefits Only			
NPV Net Benefit			

Appendix B - Risk Comparison

The project options each have a different impact on the future asset risk. The table below provides a qualitative summary of the risk considerations cognisant of the risk approach and the risk management process outlined in TasNetworks’ risk management framework document³ and complement the risks identified in section 3.3 titled “Risk objectives”.

Risk ID	Risk Category	Risk drivers	Option 0 Do Nothing				Option 1 Maintain core				Option 2 Delay core maintenance			
			Likelihood	Consequence	Risk	How does this option mitigate current situation risk?	Likelihood	Consequence	Risk	How does this option mitigate current situation risk?	Likelihood	Consequence	Risk	How does this option mitigate current situation risk?
ITR-137	Finance	As systems age the effort involved and vendor support costs increase. Reliability, productivity and capacity decrease.	Almost certain	Severe	Very High	Does not	Rare	Moderate	Low	Reduced likelihood and scope of risk situation	Rare	Severe	Medium	Capacity issues are addressed. Scope and likelihood of failure still high.
ITR-138	Customer	As systems age the effort involved and vendor support costs increase. Reliability, productivity and capacity decrease.	Likely	Major	High	Does not	Rare	Moderate	Low	Reduced likelihood and scope of risk situation	Unlikely	Major	Medium	Capacity issues are addressed. Scope and likelihood of failure still high.
ITR-139	Network Performance	As systems age the effort involved and vendor support costs increase. Reliability, productivity and capacity decrease.	Likely	Major	High	Does not	Rare	Moderate	Low	Reduced likelihood and scope of risk situation	Unlikely	Major	Medium	Capacity issues are addressed. Scope and likelihood of failure still high.
ITR-140	Compliance	As systems age the effort involved and vendor support costs increase. Reliability, productivity and capacity decrease. The ability to audit events and trace incidents will increasingly become a manual or impossible task as systems responsible for this become overwhelmed or incompatible.	Likely	Moderate	High	Does not	Rare	Moderate	Low	Reduced likelihood and scope of risk situation	Unlikely	Moderate	Medium	Capacity issues are addressed. Scope and likelihood of failure still high.

³ ZoNe ref. R0000238142.