



GM HSCP: XXXX

Cloud Strategy

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Executive Summary

Context

The XXX Partnership (XX P) wishes to generate high quality asset registers for each participating organisation across XX, to help it meet its information governance (IG) requirements, to inform organisational information management and technology (IM&T) maturity indices, to identify areas where technology efficiencies could be made, to identify areas where organisations could collaborate, and to improve efficiency, quality or performance.

The XX P also wishes to explore the opportunities presented by an analysis of cloud and hybrid cloud strategies across the XX area.

The XX P has commissioned Shaping Cloud (SC), a XX-based organisation, to deliver this programme to help define the required future state that will envision the next generation of ICT/ IM&T requirements and capability across XX.

SC has been delivering Public Cloud strategy and technology solutions almost exclusively to the UK Public Sector for many years, including recent working with NHS Trusts and local government in the XX region.

SC has been commissioned to undertake an SC: Strategy engagement with each of the participating organisations, which will include the delivery of an Azure Foundation programme and culminate in the production of a strategy document that:

- includes an ICT asset register;
- identifies areas where:
 - technology efficiencies could be made
 - organisations could collaborate to improve efficiency, quality or performance;
- assesses application cloud candidacy;
- proposes a future target operating architecture; and
- develops strategic understanding and justification for change.

In addition to this strategy document that is produced for each client organisation, an overarching XX-wide strategy will be produced that will provide an accurate, thorough, and expertly informed strategy for the consolidation and migration of current on-premise IM&T services to a “public cloud first” future state operating model which will also be justified by a full analysis of costs, benefits, technical feasibility and future governance procedures.

A, B and C are not included within the scope due to recently conducting a SC: Strategy project. However, the outputs from these three previous projects (collectively known as cohort o) will be used to inform the XX-wide strategy, subject to SC gaining approval from the respective organisations.

The strategic approach we have taken can be summarised by the following six steps:

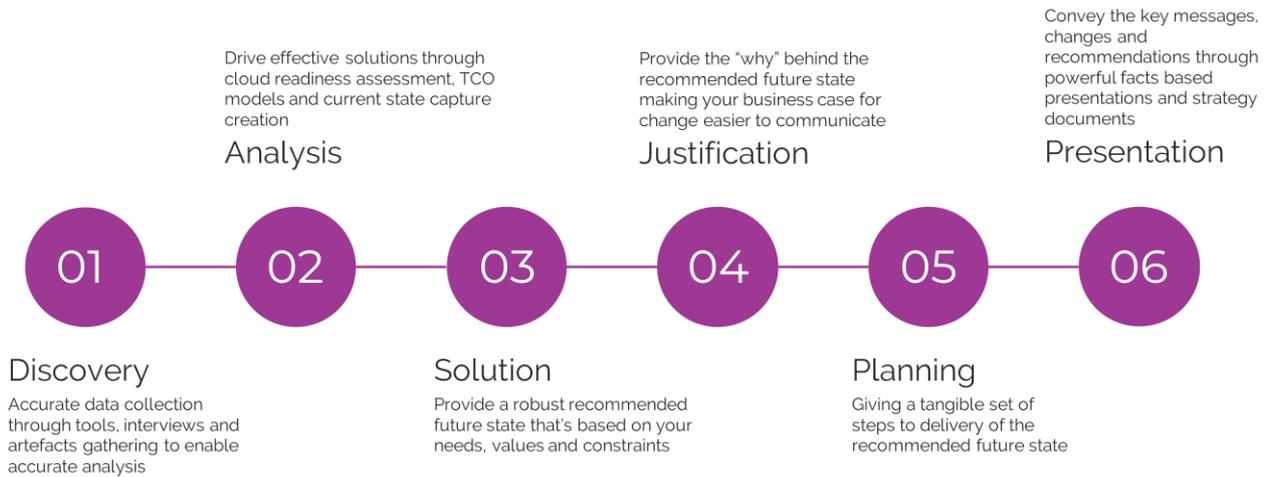


Figure 1 – SC: Strategy approach

This strategy summarises the assessment, general findings, key challenges and benefits, along with SC's key recommendations and next steps.

Strategic Summary

In 2012, YYY (YYY) invested in refreshing its datacentre and data centre hosting infrastructure, during the construction of its main offices, ZZZ. The capacity that investment provided has been used to its fullest extent over the last six years, with minimal capital investment required to expand the hosting infrastructure during that time. This strategy has provided a good value hosting provision for YYY to date and provides a clear benchmark for comparing alternative hosting provision.

Migrating the existing hosting provision on a like for like basis onto a public cloud hosting platform is a cost neutral option. Consideration of other benefits ought to be considered, such as: access to cloud services; speed of provisioning and scaling up infrastructure; ability to realise cost savings as hosting requirements decrease; more accurate prediction and control over costs of business decisions such as storage retention and availability requirements; and reduction in staffing risks with respect to hosting infrastructure.

There are some infrastructure platforms that have been developed in a non-standard way in the past (SharePoint and Dynamics), which may complicate migration and additional support is recommended to avoid this being a barrier to the benefits of cloud services.

YYY has already encountered the Microsoft licensing increase for on premise software and infrastructure in its 2017 Enterprise Agreement (EA) renewal – migrating to the cloud will enable YYY to start benefiting from cloud services that this EA allows. Office 365 brings a number of benefits to the business – see Appendix E for some highlights.

Key challenges:

- Aged and ageing infrastructure (87% six years old).
- Expensive rented hosting provision in second datacentre.
- Limited capacity in the second datacentre – not all systems are designed to be resilient to a major failure at the primary datacentre.

- The business experiences delays in accessing the latest business application versions and features, the latest productivity and collaboration tools, and has described some performance issues.
- There are a lot of in house developed applications that lack comprehensive documentation – thereby limiting the ability to further develop or adequately support due to staff turnover in developers.
- There are non-standard developments of standard platforms, SharePoint and Dynamics, which would likely require some rectification before migration to these cloud platforms is possible.

Key opportunities:

- This year (2018) is a perfect opportunity for YYY to consider its future hosting strategy and set the course for the next five years, due to the age of its on premise infrastructure
- There are some good software as a service (SaaS) options available for the core business applications
- Rationalising the second datacentre would immediately realise revenue savings as a result of it being a monthly rolling contract
- In house applications will benefit from the PaaS environment that cloud offers
- Non-production environments do not need to be available 24/7 and cloud provides the opportunity to only pay for the compute resources as they are required
- YYY have already invested in Office 365 E3 licenses are a part of its recent EA agreement, so maximising the use of these should improve the productivity and collaboration tools available to the business without further investment
- Migrating to cloud will enable a refocus of technical resources on good data, integration between systems and datasets, and cost optimisation

Recommendations

For YYY to maximise benefits from migrating to and using cloud services, the following is recommended:

- Use cloud platforms for disaster recovery, development and test environments, and web application hosting – this will provide much lower cost provision for this type of hosting.
- There will be minimal physical infrastructure refresh required at N1R for systems that cannot/ should not migrate or those that will be a later migration – make a small investment in compute infrastructure on premise as modelled in the TCO.
- Connect backup and storage to cloud storage in order to cope with increased demand during migration.
- Migrate to O365 for at least email and explore the business benefits of the remaining tools, such as Teams, SharePoint, and Flow.
- Rationalise the second datacentre as soon as possible to benefit from reduced hosting costs and design resilient networking elements into the MPLS services provision.
- Redevelop the internal use of SharePoint in order to ready this for SharePoint Online and associated tools and services, or consider redevelopment on SharePoint Online – migrating users to this new environment as they migrate to O365.
- Migrate web applications that work with the internal use of SharePoint and integrate with SharePoint Online provision.

- Ready Dynamics environment for migration to Dynamics 365 or consider redevelopment on Dynamics 365.
- Explore in more depth the options for hosting and management of the XXX external website.
- Assess the maturity and viability of the SaaS platforms for LiquidLogic, MidlandHR, Civica Financials, and Leisure systems.

Though there is not an overwhelming financial business case for YYY to migrate to cloud, migrating now will reduce the capital investment required for the next 12 months and will avoid a further capital investment cost in five to six years time. Additionally, YYY will be one of the earlier (not the first) local authorities to have migrated its infrastructure and start benefiting from the wider non-financial benefits of cloud services.

We hope that you find the output of our engagement informative and thought-provoking. We believe it sets out a clear route for your organisation to take forward. We encourage all feedback, comments and challenges that you may have and would welcome the opportunity to discuss any aspect of this strategy in greater detail.

About Shaping Cloud

Founded in Manchester in 2010, Shaping Cloud was formed to deliver innovative digital solutions by leveraging the then nascent Microsoft Azure platform. We have grown consistently and organically since then and remain a Manchester based company specialising in cloud solutions and strategies. We were named a Microsoft UK Partner of the Year due to our work in transforming Wokingham Borough Council from an outsourced data-centre into a hybrid cloud on Microsoft Azure, bringing control of IT back into the organisation and delivering £0.5m of savings in the first year.

With a clear focus on delivering to the UK Public Sector, we remain highly current on all national and regional strategies, guidance and legislation to ensure we can truly be a strategic partner for our clients; steering delivery to ensure business value, innovation, future compliance, stability, and value for money. It is a time of great change across the sector with the advent of devolution, STPs, and locality plans where public health and wellbeing services must provide better outcomes more efficiently, all whilst minimising disruption during the transition to new service delivery models.

Our commitment to serving our public-sector customers is also reflected in our highly active membership of several techUK boards and working groups: NHS Digital & techUK strategic partnership; the Public Services Board, the Sustainability and Transformation Plan working group, and our CEO, Carlos Oliveira, chairs the Local Public Services Committee. Our reach & influence across these important areas of public sector and IT industry engagement, means that we are able to understand and shape the positive development and impact of new technology for the sector as well as speaking directly to all levels of government to support policy making.

Organisation Overview

Business overview

YYY is a XXX in the area in North West England. It has its main offices in ZZZ, also hosting public spaces and shared office accommodation with other related organisations.

YYY provides the full range of local government services to the XXX residents in the towns of ZZZ, , and surrounding areas. It's vision for the future is described¹ under three priorities of 'Pxx', 'Pxx', and 'Pxx' and it has described that it plans to change and improve performance in these priority areas through five 'corporate enabling work programmes':

1. x
2. x
3. x
4. x, and
5. x

It is within this context that changing or investing in the IT infrastructure must be considered – ensuring best value and enabling integration, improvements, and change.

Business challenges

YYY has had to reduce its budgeted spend considerably over the last few years in response to the changes in local government funding and increases in demand on its services. In its 2018/19 annual budget, YYY has budgeted for a further £XXm savings in 2019/20 and £XXm savings in 2020/21.

Like other local authorities within the XX area, YYY is moving towards a more integrated and joint commissioning model for health and social care services, which requires some significant business and system changes and increased co-operation and collaboration with local health partners, such as the creation of the local care organisation² (LCO) in April 2018, and the restructuring of adult care into localities.

While the health and social care organisations are working more closely together, including being physically collocated, there is no trust relationship or federation between the organisations' IT productivity and collaboration tools. There is also a lack of confidence in the use of SharePoint due to an historical information breach incident, possibly due to incorrect configuration or lack of appropriate controls in place. There is also fear of losing information from shared file stores.

Referrals from social care to acute are still via email and fax and the business would prefer a professional portal to replace email and fax.

YYY continue to be the IT service provider³ to the commissioned local leisure trust, who also deliver some public health contracts. They have expressed a desire to understand its options for alternative hosting of its systems and data, particularly to benefit from options only available to charities and charitable companies.

¹ XXX Corporate Plan 2016-2019

² An 'alliance'

³ Amongst other contracted services to the charitable company

When engaging with the business, IT find that financial pressures are driving decisions and that performance and availability are increasingly important to them.

Business drivers for cloud

During interviews and workshops there was varying awareness of the benefits of public cloud services displayed, depending on the level of management.

The communicated main drivers for adoption of cloud at the most senior level interviewed were:

- Collaboration tools, to enable joint working between health and social care
- Reduced dependency on IT specialist skills, such as database administrators (DBA), virtualisation, and storage engineers, and
- Reduced operating costs

There is not an up to date published IT strategy for YYY, but during interviews IT management communicated a direction towards software as a service (SaaS) / fully managed and hosted business applications and away from in-house bespoke development. The given reasons for this were staff recruitment and retention challenges as well as service and system issues resultant from substantial undocumented in house or non-standard development over the past five years.

Despite these challenges, YYY has benefitted from the 2012/13 rationalisation, simplification and standardisation of its hosting and end user compute platforms and wishes to continue this approach to selecting and designing its replacement now that the physical infrastructure is nearing the end of its life.

IM&T in the Organisation

Information Management, Governance and Technology currently sit within one directorate within the overall organisation

Figure 2 – YYY Information, Customers & Communities Organisation Chart REDCATED

Information Management, Governance and Technology all sit within one IM&T organisational structure, which should enable closely aligned strategies and working.

Links with business change programs

Requirements and changes coming from locality plans go directly to the MIS Portfolio team and are prioritised and assigned to resources from that team. Other requirements and changes from the business are prioritised by a project team within IT. Standard service requests go through the Service Desk.

There are regular (monthly or quarterly depending on business unit preference) account meetings between IT and business units – to review relevant IT expenditure, active projects, and new requirements. The business is often initially unclear as to their needs and IT work with the business to help define requirements to ensure higher likelihood of project success and solutions that meet the needs of the business.

No joined up business and IT strategy group or governance was discovered during the interview process.

Current State

The completion of the current state stage of an SC: Strategy engagement is key to the success of the project, enabling an understanding of the current environment, architectural drivers, constraints and goals of the IT function. Ultimately this stage enables SC to use their knowledge of cloud technologies and cloud operating models to overcome challenges and provide accurate recommendations that meet the needs of your organisation.

The key deliverables produced at this stage are:

- Current state Ao schematic – Provides a high-level architecture diagram of your current IT environment, grouping together data applications and technology
- Current state total cost of ownership (TCO) model – Acting as an accurate baseline for comparison
- Inventory of Assets – a register of all physical and virtual servers and the applications and/ or services running on them

Our data gathering process involved a series of face to face interviews, execution of data analysis tools across the network and gathering of artefacts such as technical documentation, asset lists and service descriptions. In addition, we also collected finance, procurement, service, project, programme and strategy information for analysis.

The Ao diagrammatical output is key to ensuring collaboration and the presentation of this phase. This was presented in a workshop to technical and managerial staff to ensure the data was accurately captured and analysed and was key to ensuring our understanding of the environment, including any constraints.

The aim of this section is to provide an overview of the findings from the Current State stage of the engagement.

Current state overview

Fact	
Number of managed sites	
Number of data centres / large server rooms	
Number of racks self-populated (not rented out)	14 (11 at ZZZ, including CCTV, and 3 at ISP)
Number of racks rented/ lent out	
Number of blade enclosures / rack servers	3 full blade enclosures and 5 rack servers
Virtualisation technology	100% VMWare
Number of virtual servers	
Operating Systems in production	

Number of physical servers and proportion of virtual hosts	
Average age of hardware	
Amount of storage (TB)	
Backup technology	
Backup standard routines	<p>Email: hourly cycle retained for 14 days, weekly for 4 weeks, monthly for 6 months</p> <p>Databases: transaction log hourly, daily increments, weekly retain 2 weeks, monthly backups retained 6 months</p> <p>File servers: daily increments, weekly retained for 1 month, monthly retained for 3 months</p> <p>Application servers & DCs: Daily increments, weekly retained for 4 weeks, monthly retained for 3 months</p>
Databases	
Number of DB servers	
Number server applications (including web/ SaaS)	

Table 1 – Current state key facts

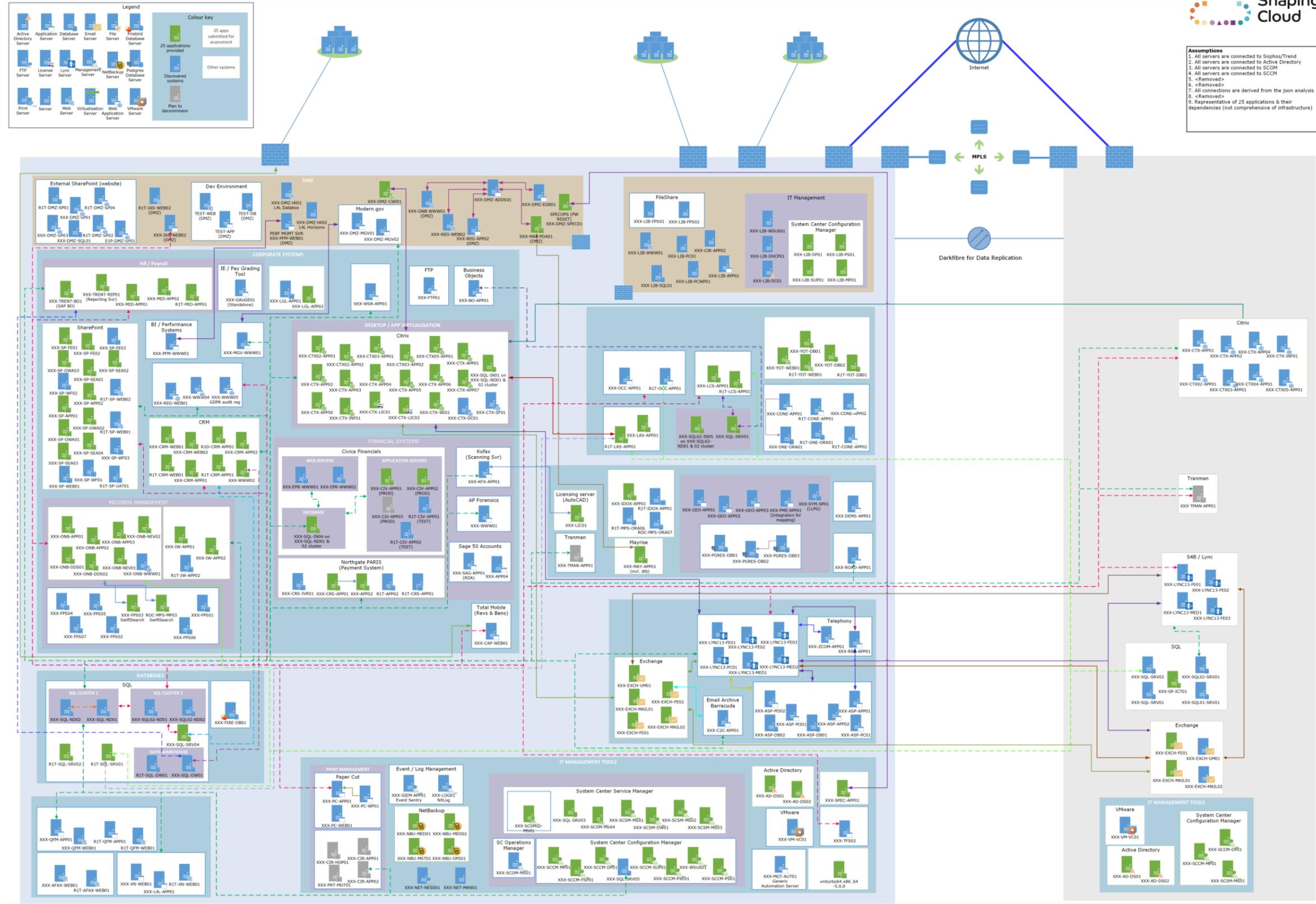


Figure 3 – Current state schematic – version 7

The current state schematic is a simplified representation of YYY's architecture, focusing on the 25 nominated applications and the systems and services they depend, but representing the majority of server-based business applications. Excluded is the schools network and the full extent of the DMZ and libraries network. All other significant applications and databases for YYY are represented. The links represented are those that were discovered as active or open when Shaping Cloud collected the information about the services or have been added as a result of context and information provided by the client during interviews and workshops. The intention of this diagram is to inform the future state design and ensure that inter-relationships between systems are adequately taken into consideration.

Current state technical findings

Hosting context

YYY hosts the majority of its compute and storage requirements in the purpose built N1R secure datacentre. It uses just under 50% of the capacity available in this datacentre; the remaining space being rented to VVV and the UUU, for which there is the requirement for additional security checks and controls to be in place for staff and the physical hosting environment at the N1R location.

YYY also hosts a smaller infrastructure environment in three rented racks within an Internet Service Provider's (ISP) colocation provision. This provides YYY with offsite business continuity (BC) / disaster recovery (DR) facility for a proportion of its systems and services.

Both datacentres have access via the wide area network (WAN) service to independently routed Internet lines, newly replaced and upgraded to 1Gbps bearers. Since the Internet provision and WAN are provided by the same supplier, that also provides standard cloud connectivity services, cloud connectivity options are easily available to YYY: both VPN and private directly routed⁴ services. To optimise costs, the network design for YYY's connection to its cloud hosting and services should change over time, as the migration progresses and considering the data transfer requirements between the on premise network and cloud.

High Level Findings

Through the process of analysing the current state and the creation of the diagrams we uncovered several summary technical findings:

- 87% of the hosting infrastructure is six years old, having been purchased in bulk for a datacentre replacement project in 2012
- Renting server racks (3) at the ISP colocation provider is twice as expensive as the ZZZ hosting provision
- There is daily effort required to keep systems up to date and secure
- The business feels they experience delays in getting access to the latest application features and tools
- The business has recently experienced some performance issues in their business applications and reporting tools
- There are a significant number of in house developed web applications that the business is dependent on, including enabling customer interactions via the external website

⁴ E.g. AWS Direct Connect, MSFT Azure Express Route, and Google Cloud Interconnect.

- There is non-standard development of Microsoft SharePoint and Dynamics (CRM), with developments having been commissioned a number of times from third-parties and an associated lack of documentation
- With the exception of the Contact Centre⁵, telephony has been operating for five years as Lync 2013 (Skype for Business) and is implemented as full Unified Communications with softphone, IM, presence, handset integration and single number reach
- Email is locally hosted as Exchange Server 2010 on eight servers, but XXX has already invested in Microsoft Office 365 E3 licensing for the workforce for 2018/19, with the intention of migrating within 12 months
- There is some SQL licensing rationalisation with the provision of two main SQL clusters

Current state challenges

The large majority of the existing hosting infrastructure is six years old and the spare capacity is low. Therefore any decisions about refresh of on premise equipment vs. migration to cloud / hybrid cloud are urgent. As a result, if deciding to move to a maximum cloud future state, the migration path may need to be steep, which presents its own risks.

There is significant non-standard development in SharePoint and Dynamics, which would likely require redevelopment in order to migrate.

YYY use SharePoint as the platform for both the intranet and the XXX's external website. While SharePoint Online is useful for creating extranets, it is not designed for customer facing transactional websites. Therefore, consideration of the best website platform and service would need to be factored in to the final future state design.

ZZZ has ~1800 HP 4110/ 4120 IP desk phones that work natively with Lync⁶ 2010 and 2013 on premise. Our initial research on behalf of YYY indicates that these phones have been discontinued and therefore may pose issues going forward with respect to updates, support, and continued compatibility with Office365. However, the software on these models is based on snom software, so firmware updates to continue compatibility, for instance with the TLS 1.2 enforcement on October 31 2018, may be possible but would require investigation and testing. YYY is already considering their need for desk phones – opting for headsets and mobiles.

The schools network was excluded by YYY from analysis, but it is understood that the remaining footprint within the datacentre is minimal, with the majority of schools already benefitting from cloud services and plans in place to migrate the remainder.

VVV and UUU infrastructure was excluded from the analysis and calculations for the overheads of the datacentre were adjusted as much as was possible given information provided.

YYY is already considering migration of their Finance system to a SaaS provision, but no costs for this as a comparison were available at the time of analysis.

YYY were negotiating their Microsoft licensing renewal at the time of the analysis. The new enterprise agreement has been used for the purposes of baseline and analysis.

⁵ Aspect Contact Centre solution

⁶ The precursor to Skype for Business

Current state top five risks

The key risks that were captured in the current state infrastructure and services are represented in the following table⁷.

Key Risk	RAG Status	Possible mitigation(s)
Storage capacity runs out of space.	R	Revisit data retention requirements and apply to data stored. Identify data duplication and rationalise. To alleviate the risk of the impact of storage growth, explore connecting to cloud storage or procuring a connected appliance such as StorSimple.
Risk that migration to cloud takes longer than 12 months and requires physical infrastructure replacement or current infrastructure performance issues are experienced by the business during migration due to delays.	R	Plan migration fully at the outset and align with the highest risks in existing infrastructure, e.g. storage capacity. Put in place business continuity plans for business critical systems (e.g. re-use of newer infrastructure, next business day hardware contract, and / or agreement with another organisation).
Migration to cloud / hybrid cloud still requires at least one rack in a second datacentre, which is currently at a high cost	A	Explore option of renting a rack from another XX organisation at lower cost than current.
Lack of availability, RPOs, & RTOs with the business lead to unnecessarily expensive or insufficient service design in the cloud	A	Review availability, RTO, and RPO requirements for business applications and incorporate into future state design. Where this is not possible, use lower rated virtual machines (VMs) and scalesets initially and scale up as necessary. Review availability and scale sets in design.
Lack of documentation and non-standard design of bespoke web apps, SharePoint, and Dynamics prevents YYY from benefitting from the cloud in the area where the benefits tend to be highest.	A	Establish cloud as development platform for any new developments, document that which has been developed, and engage a third party and/or Microsoft ⁸ to provide support for migrating SharePoint and Dynamics.

Table 2 – Current state top five risks

The RAG status is an assessment of the SC consultant based on the information provided during the strategic review covered by this report.

⁷ Not included in this table of risks is the price increase from Microsoft in on premise licensing, as this has already had impact in this years' enterprise agreement.

⁸ Possible to get additional support from Microsoft at no / low cost as a part of Enterprise Agreement and due to their current focus on migrating customers.

Current state opportunities

Timing for decision

Because the majority of the existing infrastructure is aged, YYY is able to benefit from both the cost benefits associated with a single procurement of server and storage equipment for that which will remain on premise, and realising the benefit of not requiring the scale of capital investment otherwise required to fully refreshing the on premise infrastructure.

Software as a Server (SaaS) solutions available

There are some maturing SaaS options available for YYY's core business applications, including Liquid Logic (Case Management), Leisure systems, and MidlandHR (HR and Payroll, aka iTrent). Migrating to these fully hosted services will reduce the resources required to host and manage these large business systems, and enable the business to focus on how they use these systems and the data within them vs. regular decisions on how to host them and keep them up to date.

Reduced need for second datacentre

YYY's second datacentre provision is in a rented colocation space from an ISP, which is twice as expensive as the hosting provision in ZZZ. Reducing the number of racks required in this space will immediately provide a reduction in YYY's running costs.

Use of PaaS/ Web app services for in house developed applications

The public cloud is primarily designed for web applications and deploying web applications on this platform can dramatically reduce hosting costs and complexity, including the hosting of the related databases. Additionally, the tools available for developers on cloud platforms can speed up development and deployments and enhance the functionality and integration possibilities.

Non-production environments can benefit from pay as you go models

Public cloud platforms provide two main charging options for VMs: reserved pricing (increasing discount related to number of years) and pay as you go. Modelling production (live) environments with an appropriately sized VM over a number of years will reap significant savings. Non-production environments that can be shut down when not in use can benefit from automation and pay as you go charging models – only paying for the compute resources when they are in use. When on premise, the physical infrastructure must be sufficiently scaled to always have the capacity to run all non-production environments. On public cloud platforms, when a customer is not using the physical compute resources, these are redirected and therefore not charged.

Already committed to Office365 E3 licenses

Some organisations do not have Microsoft Enterprise Agreements (EA), or they have entered into an EA before changes to the licensing models. YYY have entered into a new EA this year (2018) due to expiry of their old EA and therefore have already been required to make the move to the E3 licenses for their Office suite. For this reason, however, YYY are well placed to maximise their benefit of migration immediately – benefiting from the full Office365 featureset for its workforce and the decommissioning of associated on premise servers, such as Exchange.

Refocus of technical resources

YYY's migration path will need to be steep in order to minimise the need to refresh on premise physical infrastructure. However, once migrated, YYY will benefit from the ability to redirect resources that were managing and maintaining hosting infrastructure to making the most of cloud services, good data management, and improved business intelligence.

Future State

The completion of the future state stage of the SC: Strategy process is the culmination of several inputs; bringing together the analysis of the current state environment, market place trends and innovative technology solutions to provide an easy to understand, yet tangible set of technical options and recommendations.

The key deliverables from this stage are:

- Guiding principles and technology strategy – providing the architectural vision and principles on which the future state is based as well as any recommendations to get the most from the new operating model
- Future state Ao diagram - providing an overview of the recommended solutions, technologies and services, presented on a large Ao poster with solution diagrams and discussed at a future state workshop
- Application candidate assessment – providing our expert assessment of the best hosting approach, prioritisation of migration, and key considerations for each application in scope of assessment

This section provides an overview of the findings from this stage of the engagement. More detailed views can be seen in supporting documentation provided.

Recommended guiding principles

One of the key components in building the future state is to ensure that the guiding principles on which the solutions are chosen are aligned with the vision of the organisation.

The following eight guiding principles have been used⁹ to inform the recommendations made:

1. Public Cloud First

All services must be assessed in line with the UK Government's 2013 'cloud first' policy, the National Information Board's Personalised Health and Care 2020 Framework, and cloud guidelines from the Cabinet Office and the National Cyber Security Centre (NCSC).

2. Map service availability and capacity to business needs

Each service must be designed to at least meet the minimum stated business needs with respect to availability and capacity.

When designing the future state, service availability and capacity must be balanced with the associated costs and ensure best value.

3. Design for simplicity of management

Ensure that the right platform, architecture, and tools are selected in order to ease the long-term management of the future state.

⁹ Where information was available and provided by the organisation to inform findings and recommendations

Use strong automation and orchestration where appropriate.

Consider the redesign / replacement of applications with cloud-optimised solutions where this will ease long term management, deliver additional benefits, and/ or reduce technical debt.

4. Re-use common resources to optimise cost

Ensure the architecture maximises the use of microservices, datasets, interfaces, and platforms in common.

5. Allow for fault tolerance, scalability and elasticity

All technologies must be resilient (no single points of failure) with aligned application support and delivery.

All services must conform to standard SLAs and must be recoverable in line with recovery point and time objectives.

All services must allow for projected scalability and elasticity needs, identified by examining current and projected workload.

6. Reflect all dependencies and risks in design

Technical and business dependencies and risks must be identified for each service and/or system. The mitigation of these must then be designed in the future state solutions, reflecting service availability needs defined by the business.

Identity management should be rationalised where possible and designed for cloud, but take into account a period of hybrid infrastructure.

All services must be compliant with regulatory requirements and established best practice standards.

7. Use the best data store for the data use

Consider existing data stores and keep migration simple.

Public cloud allows for the difference in data storage type and optimises for it (e.g. object storage, shared files, key stores and relational databases): ensure appropriate data storage is used for each data type.

This will maximise cost efficiency and enhance potential business intelligence (BI) and reporting potential.

8. Planning and predictive modelling to be based on reliable information

In order to ensure sound decision making, planning and predictive modelling must be based on the more accurate and up to date information provided by the client and the market.

Where information is missing or incomplete, this should be acknowledged.

Future state Infrastructure as a Service (IaaS) schematic overview

The latest future state Ao diagram is at version 3 and is provided as per figure 4.

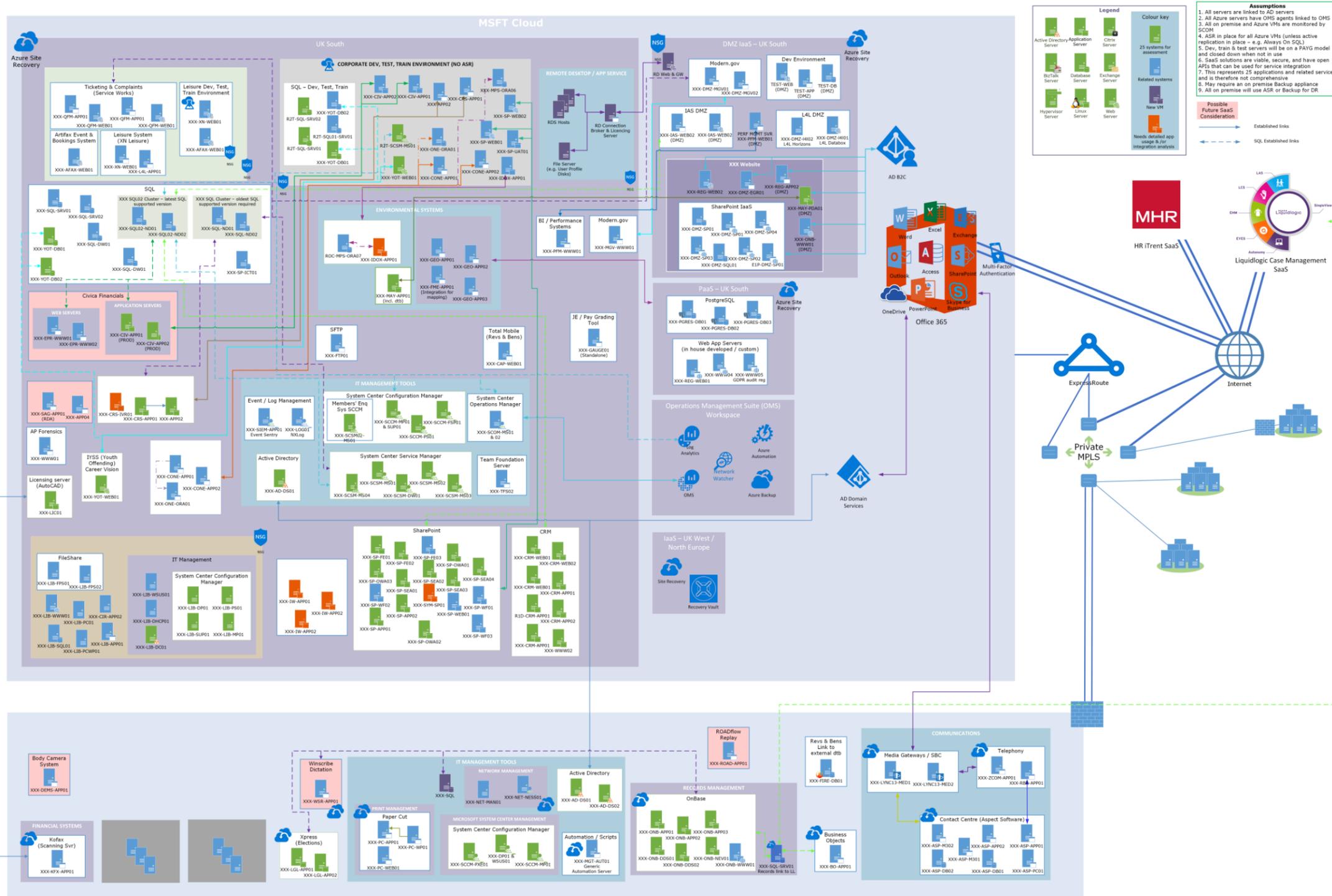


Figure 4 – Future State Schematic – version 3

The future state schematic is a simplified representation of the architecture that hosts the majority of business applications and the systems and services they depend on. The links represented are a replica of those from the current state to show continued interrelationships between systems and services. The intention of this diagram is to provide a high level view of what a realistic maximised cloud architecture could look like for YYY.

Application candidate assessment

YYY provided a list of 25 applications for candidate assessment (see appendix B). This represents approximately 36% of the total number of server-based¹⁰ applications in use. Importance was categorised by:

- Business risk: Impact of unavailability to the organisation and complexity of migration
- Potential value: Financial, non financial benefits and urgency to migrate

Compatibility with cloud

By default, Public Cloud offers several standard server models. Most client servers, both physical and virtual, can be mapped directly to one of these models, but in some cases, this cannot be done. The list of 25 applications provided have been taken through our standard candidacy assessment.

The cloud candidacy assessment summary spreadsheet is provided at appendix B – this is used to capture key information pertinent to the assessment process and evidence where decisions have been made.

Our candidate assessment can be split into 3 key areas:

- Compatibility with key cloud providers – looking at factors such as operating system version, data use, network interfaces, CPU / RAM size etc.
- Complexity to migrate – looking at factors such as dependencies, use of data, accessibility, business impact, security considerations etc.
- Urgency to migrate – looking at factors like end of life hardware, the risk it poses to the operation (i.e. lack of business continuity), capacity and performance etc.

Summary findings

The main findings can be summarised as:

- There is some clustering of SQL databases, which provides cost efficiency with respect to licensing, however this approach is not consistently applied. Modelling a clustered VM environment for databases in the cloud is possible and provides good options with respect to licensing. Alternatively, SQL platform as a service (PaaS) options are available and databases could be suitable for this, depending on the application provider supporting this hosting method.
- There are minimal opportunities for auto-scaling, though this ought to be investigated further with application providers.

¹⁰ Client-based (installed on a desktop / laptop OS only) are out of scope.

- There are SaaS options available for a number of the business applications – further exploration of these options with Liquid Logic, MidlandHR, Leisure systems, and Civica (Financials) is recommended¹¹.
- SharePoint and Dynamics, as previously noted, require some detailed analysis and design and therefore would benefit from Microsoft / Microsoft Partner support¹².
- Current Netbackup server specifications are not supported in standard cloud VM models, however recommendation is to use Netbackup cloud connector in order to make use of access to cheap cloud storage and use cloud native backup tools for all cloud VMs and storage.
- Of the remaining nominated applications, there are no remediations required before migration.
- Based on YYY's usage of Citrix, replacement of this with Microsoft RDS would provide good cost savings and further standardise the overall architecture and ready YYY for using future cloud-native services.
- Eventually, Azure Operations Management Suite (OMS) and associated tools may be able to replace SolarWinds and other local tools, or provide sufficient functionality to reduce the on premise requirement to a free / Open Source network management toolset.

Cloud service compatibility

The following summarises a high level view of which cloud service category each application would be suitable for.

<Removed>

Figure 5 – Application Assessment - YYY

Where an application is listed above as assessed to fit an IaaS model, the database may be suitable for a PaaS service – see more detailed application assessment and cost models for recommended database platform.

Migration prioritisation

By comparing overall risk (including complexity) and potential value (including urgency and benefits) we are also able to determine a recommended migration prioritisation. The following is a summary of that analysis:

<Removed>

Figure 6 – 25 applications prioritisation matrix - YYY

¹¹ Note careful considerations of security, certifications, SLA, service credits, and data ownership / extraction is essential for SaaS services.

¹² Possibility to access this for free – recommend discussion with Microsoft directly.

Financial Findings

The financial findings are split into two distinct areas:

- Total cost of ownership comparison between on premise services and those provisioned in cloud
- Investment case showing an estimated high level financial profile throughout transition and transformation to cloud

The key findings from the engagement are:

- Second datacentre costs twice as much as ZZZ hosting provision.
- 4.2% cost savings over a 5-year period for a realistic hybrid cloud migration, with a return on investment (ROI) of just over 2 years.
- £XX reduced spend over 5-years if maximum migration path selected, with further reductions to running costs possible through re-architecture and rationalisation making the most of the elasticity of cloud services.

Total cost of ownership (TCO)

The total cost of ownership (TCO) comparison is key to understanding the possible savings that cloud may bring. Through our data gathering and discovery phase we bring together many financial artefacts and costs that form the analysis on which the total cost of ownership for the current state is based.

What do the TCO costs include?

The TCO comparison is important as it is the baseline for comparison between the two operating models. For the current state TCO model we look at the following component costs:

- Data Centre / Hosting – All costs of hosting the current environment through operation of data centres, including costs such as electricity, plant maintenance etc
- Physical & Blade Servers – All costs of purchase for physical and blade servers (including blade chassis), including costs such as purchase cost, hardware maintenance etc
- Virtualisation Platform – All costs of with respect to the virtual platform including costs such as virtualisation licensing and windows licenses for virtual machines
- Backup – All costs of providing backup of services including such costs as backup infrastructure (storage, tape backup servers etc), backup licensing etc
- Storage – All costs for the provision of storage for the environment including purchase costs for storage controller devices, disk, storage fabric, hardware maintenance, and effort etc
- Network – All costs with respect to Local Area Networks and Wider Area Networks including capital purchase costs, hardware maintenance, WAN lease costs etc
- Systems Management – All costs with respect to systems management including costs such as the costs of effort required to operate the environment, system management tools etc

TCO summary table

The following table provides a high level unit cost comparison to inform the overall investment case understanding.

Description	Current cost per month	Future cost per month ¹³ (IaaS)
Data centre per 42U rack		
Storage per GB		
Compute equivalent 1 CPU VM with same DR provision		
Backups per GB		

Table 3 - TCO unit costs summary

The above table has been derived by Shaping Cloud based on actual infrastructure, software, and staffing costs as provided as information by the client. The purpose of this is to create a realistic baseline for comparison with cloud services, devoid of fixed costs and according to infrastructure and effort per service. These costs are then compared with future state total cost of ownership to determine realistic comparison and savings for migrating to cloud services.

The following table (4) provides an overall comparison of running costs and capital investment of YYY's hosting infrastructure, with staffing costs and effort omitted.

	Upfront	Year 1 ¹⁴	Year 2	Year 3	Year 4	Year 5	Total 5 Years
On Prem	£1,499,672	£2,153,538	£653,866	£653,866	£659,681	£659,681	£6,350,354
Hybrid	£379,226	£1,193,961	£822,955	£844,417	£860,294	£860,294	£4,581,921
Net difference	-£1,120,446	-£959,577	+£169,089	+£190,511	+£200,612	+£200,612	£198,712

Table 4 – Cost comparison

As can be seen in the above table, the running costs of a maximised hybrid hosting model overall for YYY offers a higher running rate in the long term, but an overall investment saving of just under £200k over a five year period, due to the lack of investment required in the physical infrastructure. If choosing a longer period between physical refresh, the same model can be used with the 'upfront' investment being shown in years one and seven (or later¹⁵). Because YYY has 87% physical infrastructure that is six years old, it is advised to start a migration path soon in order to minimise investment required. The investment case models a realistic estimate of investment in migration vs. running costs over five years.

¹³ When calculating cost per month, the total number of available hours per month that has been used is that used by Microsoft on their calculator for Azure i.e. 730 hours per month. Prices here represent a 3 year reserved rate.

¹⁴ Includes the up front investment costs in infrastructure shown

¹⁵ Stretching physical infrastructure over longer than a six year period carries risks and can introduce additional revenue costs in resources and hardware maintenance

Investment case

The purpose of the investment case is to profile overall spend, old and new operating model TCO, and investment (project) required. We use the costs that have been profiled across both the current and future state TCO, adjusting the timing of when the costs apply and when project spend would be accounted for.

When developing a detailed plan for migration the balance of responsibility ought to be considered. The following is a sample diagram to demonstrate the clarity of responsibilities that would need to be determined.

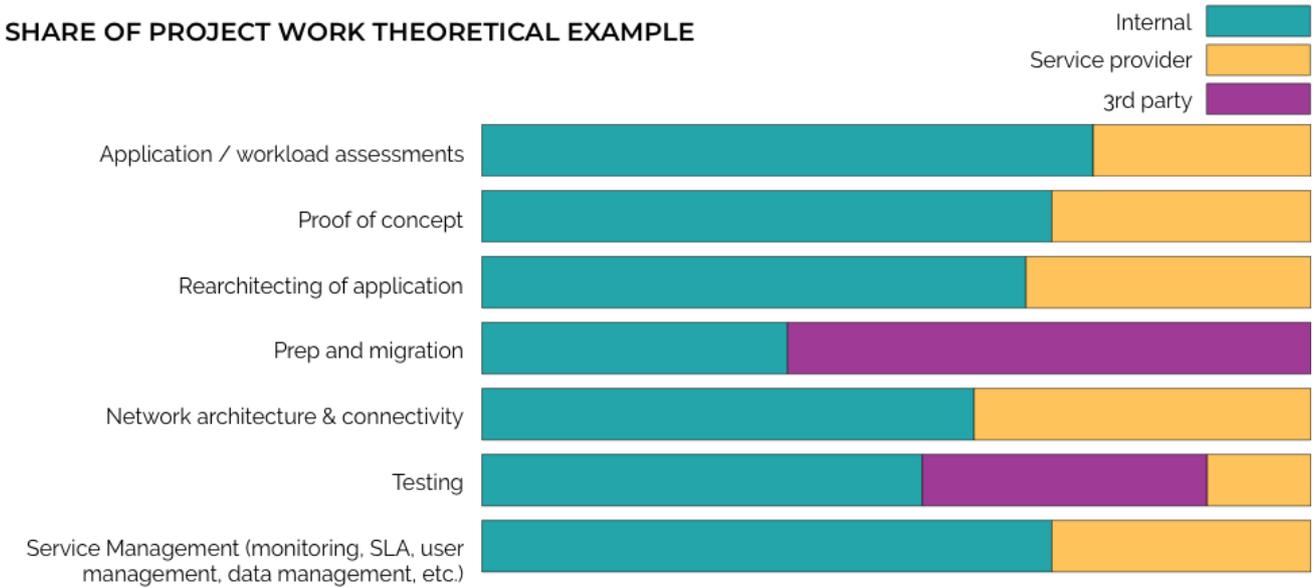


Figure 7 - Migration Project Balance of Work Example

The investment case we have developed for YYY is SC's estimate given certain balance of work assumptions. It is recommended that this be reviewed internally and adjusted to suit your organisation's decisions with respect to time and share of effort.

Investment case profile

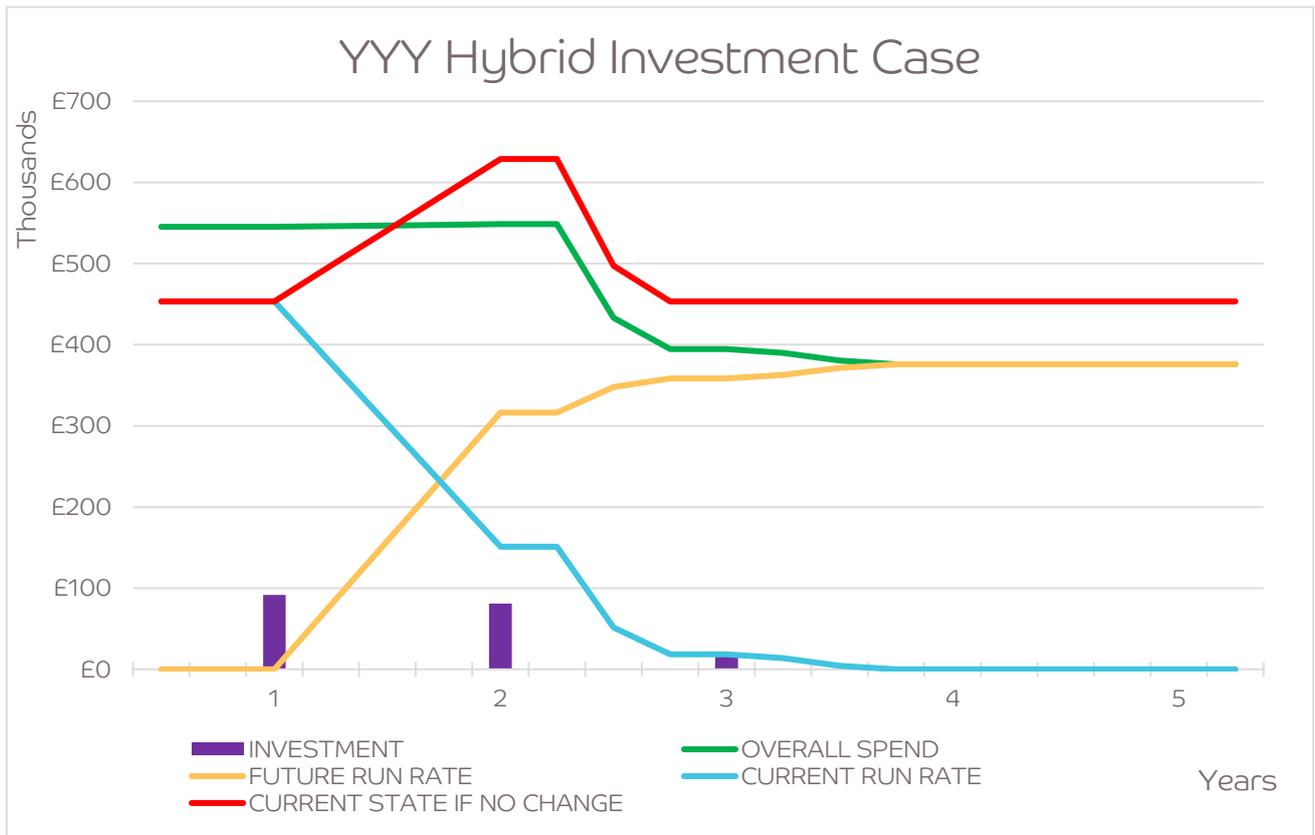


Figure 8 – Investment case profile for nominated applications and dependencies

Figure 8 provides an overview of the financial profile we would expect to see if migrating the nominated applications¹⁶, with figures provided over a 5-year period. Data points in the chart are every quarter, highlighting run rate, with the exception of investment which is modelled as an investment per year. The following provides an overview of the data represented above:

- Red Line - Current run rate if there is no change in investment and hosting approach.
- Blue Line - Current run rate combined during migration – Provides a view of the current run rate, including refresh cycle of physical infrastructure.
- Yellow Line - Future run rate combined during migration – Provides a view of the future run rate when using a hybrid cloud operating model (on basis of findings), with some services provided from on premise or rented location(s), and much of services presented from cloud.
- Purple Bar Charts - Project spend – The bar charts in figure 8 highlight the likely project spend per year.¹⁷
- Green Line - Overall Spend – Shows the overall spend across the quarters, which highlights the overall “hump” of spend as both operating models come together

¹⁶ Excludes those not recommended to migrate

¹⁷ Provided for a high level financial view only. Migration projects would need to be categorised and defined, with detailed cost models worked up taking into account complexities, interdependencies, costs of available resources, and risks.

The above graph is based on the figures in the following table, the calculations of which can be viewed in the separate Investment Case workbook. This represents migrating the recommended proportion of the 25 nominated applications for more detailed analysis. Effort has been calculated using provided internal resource costs (including overheads) – external resources could be higher.

Year	1	2	3	4	5
Current running state with no change					
Current run state during migration					
Future run state during migration					
Investment required					
Overall spend (both run states and investment)					

Table 5 – Investment case profile for nominated applications and dependencies

Further cost savings and financial considerations

There are a number of assumptions that through experience in performing migrations to the cloud can be applied (and should be targeted) to reduce overall costs in the new operating model. Areas of focus to drive maximum cost savings include:

- Reduction in servers in current environment – Migration alone will not reduce on premise or private cloud costs. A decommissioning and resource reduction plan will need to be developed and implemented alongside migration plans to avoid the spare capacity being swallowed up swiftly by other systems and development projects.
- Rationalising environments – We have assumed the same number of environments in the Future State model. However, each environment (Dev, UAT, etc.) uses compute and storage resources. Rationalising or simplifying (e.g. reducing networking needs) environments will maximise cost savings in a Public Cloud model.
- Reduction in service availability – The Future State models have assumed a continuation of existing service availability requirements. However, it may be that reviewing the business use of a service can result in a significant reduction in actual service hours required. In a Public Cloud environment, this can result in significant savings in the new revenue cost model.
- Making use of efficient development operations - Public Cloud uses a pay as you use model, which provides the opportunity to switch off services and save money on any environment not in use. Through auto-scale services it also allows customers to run lean infrastructure services and intelligently scale on demand, therefore reducing cost. This is particularly relevant for non-production environments.
- Re-sizing servers (lower in specification) – Matching server size precisely to specific application and environment (dev / test / etc) will further reduce unnecessary cost in a Public Cloud model.
- The longer the current operating model is in place the higher the TCO of the service will be, since migrating to the public cloud will certain deliver savings.

- Whilst in transition to the new operating model, the costs for systems management personnel will not reduce. The requirement for their skills and capacity will need to be reviewed post-migration to determine savings.

Considerations for Public Cloud

We have included some generic opportunities, challenges, and considerations for any migration to the cloud.

Cloud opportunities

The benefits of an IaaS infrastructure are:

- Reduced server infrastructure costs as there are no future hardware purchases or refresh costs
- Reduced storage infrastructure costs as there are no future storage purchases or refresh costs
- Greater flexibility in meeting future demands of the business
- Control of costs by managing server run time with business use

The benefits of PaaS are:

- All the benefits of IaaS, and
- Reduced costs of maintenance as the cloud provider is responsible for support and maintenance of the OS and middleware, including security

The theoretical benefits of SaaS (heavily dependent on charging model and SLA from provider¹⁸) are:

- All the benefits of PaaS, and
- Quick / immediate access to latest software version,
- Reduced costs of maintenance as the cloud provider is responsible for security, support, maintenance, and change of the application and its dependencies, including the database

Cloud challenges

The adoption of cloud IaaS and PaaS technologies, whilst addressing a number of issues and bringing great benefits, can also introduce other issues as a result of the necessary standardisation. Some of these are as follows:

- There is generally less flexibility in the variance of servers that are available – the closest matched product is selected
- There is less flexibility in the OS and middleware versions that are available

¹⁸ Highly recommend reviewing a SaaS contract carefully to understand provider responsibilities and commitments, along with contractual mechanisms to ensure compliance

- Existing support staff will need additional training and possible redeployment initially
- Unrestricted access to all cloud functionality by all staff, can lead to loss of control and additional costs – this needs to be pre-thought and decisions made early on

The different models represent different opportunities and challenges with respect to responsibilities, risk ownership, and workforce. A summary of the difference in responsibilities for each service model is shown in the following diagram.

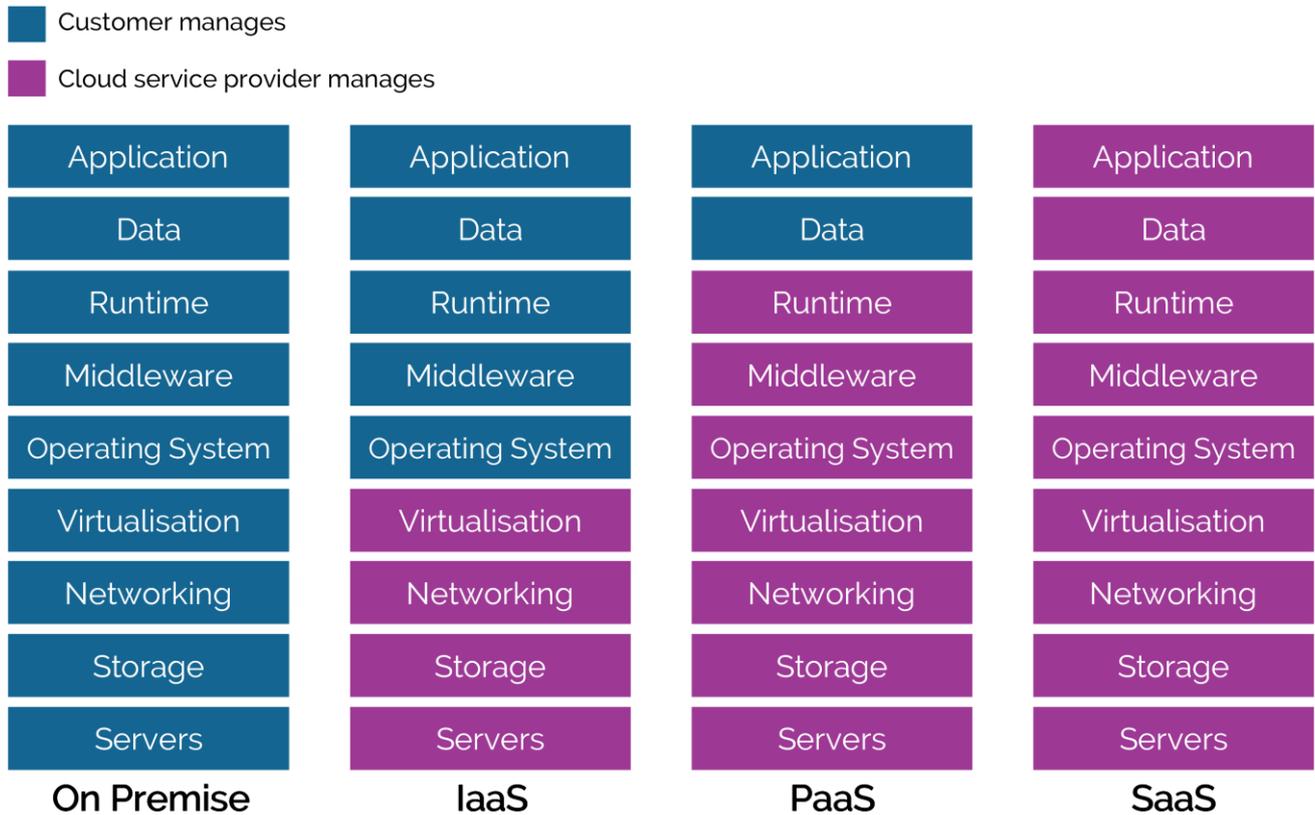


Figure 9 – IT Management Responsibilities

Governance

Governance is important to discuss and agree at the outset and should apply throughout design, migration, and ongoing service management. It is key to ensuring:

- Migrations to cloud services happen in a phased and controlled manner through use of industry standard architecture processes
- Rationalisation through innovation can take place; making full use of public cloud technologies
- Delivery of cloud services continue to be progressed in accordance with the strategy of the organisation and the needs of the end users
- Services are supportable and are operated in an efficient manner to achieve the desired cost savings and efficiencies

- Roles and responsibilities are clearly defined as the transition between operating models takes place
- Risk is well understood and every effort is made to reduce risk to the organisation, with persons held to account for lack of delivery
- Costs are controlled – particularly important in a scalable and elastic hosting environment

It is recommended that YYY consider their existing governance arrangements and ensure they are appropriate for governing migration to the cloud and management of cloud services / infrastructure once migrated.

Considerations for Public Cloud generally

There are number of things that should be considered more generally when assessing whether to migrate an application or service to the public cloud:

1. **Operating System not able to migrate to cloud:** Will the current Operating System migrate to the intended cloud platform, or do we need to migrate / upgrade to a new OS first?
2. **Database software not supported in the cloud:** Is the current database used supported in the cloud? Where it is supported, are all features we depend on supported?
3. **Database software expensive in the cloud:** Will the licencing for the database significantly impact cost? Is there a cheaper alternative that meets the need and is migration possible?
4. **3rd party software cannot run in the cloud:** Many 3rd party software application providers limit the hosting options for their applications due to fears about performance or control. There may also be specific dependency reasons why a 3rd party software provider limits cloud service options. In these circumstances, SaaS options or hosting in private data centres should be considered.
5. **Specific hardware cannot be replicated in the cloud:** For instance reliance on specific graphics cards.
6. **Batch scheduling – work outside core hours may cause increased costs:** Costs are often modelled on the basis of usage by the business. Any batch scheduling that is relied upon in an on premise infrastructure can cause surprise costs in a public cloud infrastructure. This should be identified and modelled in the design stage.
7. **Cloud architecture guiding principles defined:** Have we established clear architectural principles that will shape what is provisioned and developed in our public cloud infrastructure, in order to ensure it is controlled and delivers the anticipated benefits?
8. **3rd party support access may have to be changed:** Most medium to large 3rd party applications have arrangements for remote access by the provider in order to provide support and maintenance to the application. Discussion with any 3rd party providers will need to take place to agree methods of access when the application is hosted in the public cloud.
9. **Setting priorities for migration:** The simplicity and benefits of migrating to the public cloud differs considerably between applications and data types. Assessing infrastructure for migration is necessary to determine an appropriately prioritised roadmap.

10. **Requires deeper understanding of application interaction:** Inherited infrastructure has often grown over many years, sometimes with integration and interaction that is not fully understood. A service or application that is rarely reviewed or discussed can be a critical dependency when migrating services. Comprehensive service and dependency mapping is required to reduce risks and increase likelihood of success.
11. **Server support – no agreed responsibilities in the cloud:** A full change and support model ought to be designed and implemented alongside development in and migration to the public cloud.

SC has taken 1-6 into consideration when assessing YYY's 25 applications and based on the information provided. When preparing for migration, it is recommended that all these factors are reviewed and considered by YYY.

Wider Recommendations

As part of any cloud assessment there are many wider recommendations, hints and tips that Shaping Cloud has experienced throughout migrations and helping customers to migrate to Public Cloud services.

As part of appendix A, we have provided a wider set of recommendations that covers hints and tips for:

- Procurement – decisions made when buying technology or solutions that help to ensure the cloud strategy is at the heart of procurement decisions taken
- Architecture Strategy – having a very clear architecture strategy and a set of technology standards helps to keep your cloud journey on track
- Application Strategy – a set of recommendations around aligning and readying applications for cloud to remove constraints in their migration to cloud services
- Data Strategy – recommendations helping to address common issues that constrain migrations to cloud services
- Infrastructure Strategy – general recommendations on the infrastructure approach and the key things to enable for cloud delivery
- End User Technology – some thoughts and recommendations around the considerations needed to be made for change when adopting cloud services
- People / Business Change – highlighting recommendations on the considerations of business change as the migration to cloud happens
- Security strategy – some considerations around the security approach when adopting cloud

Transformation Blueprint

When thinking of migrating to the cloud, it is important to ensure adequate preparation and thought across a number of disciplines. The first of the following diagrams is provided with the intention of informing YYY's approach to migration and transformation through use of public cloud services. Considering and applying the steps provided will reduce risks and increase the transformation possible through adoption of cloud services.

The second diagram is provided as a suggestion of the order in which YYY might consider migrating their systems, along with the related actions required, the relationships between steps, and the possible benefits associated with each migration.

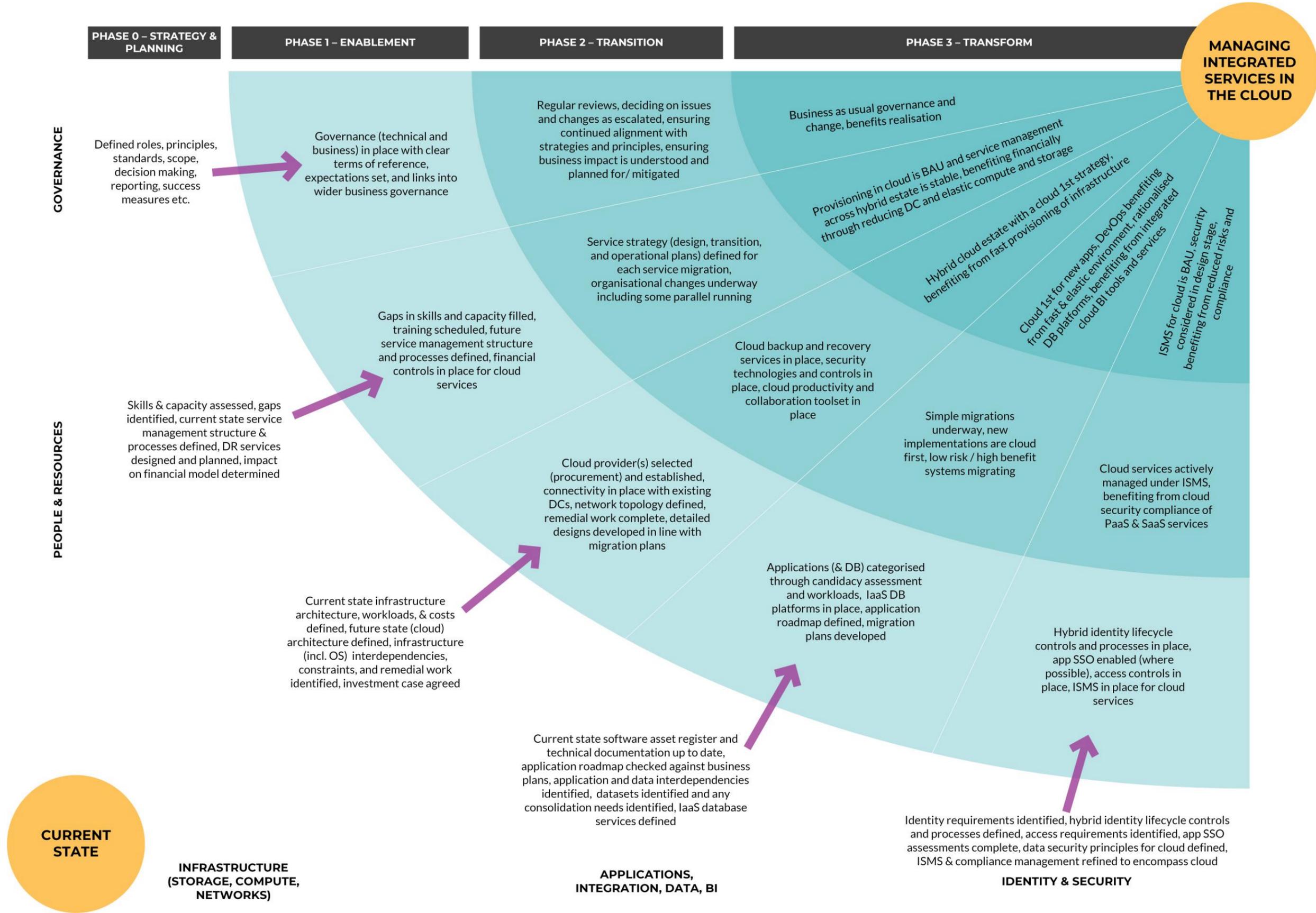
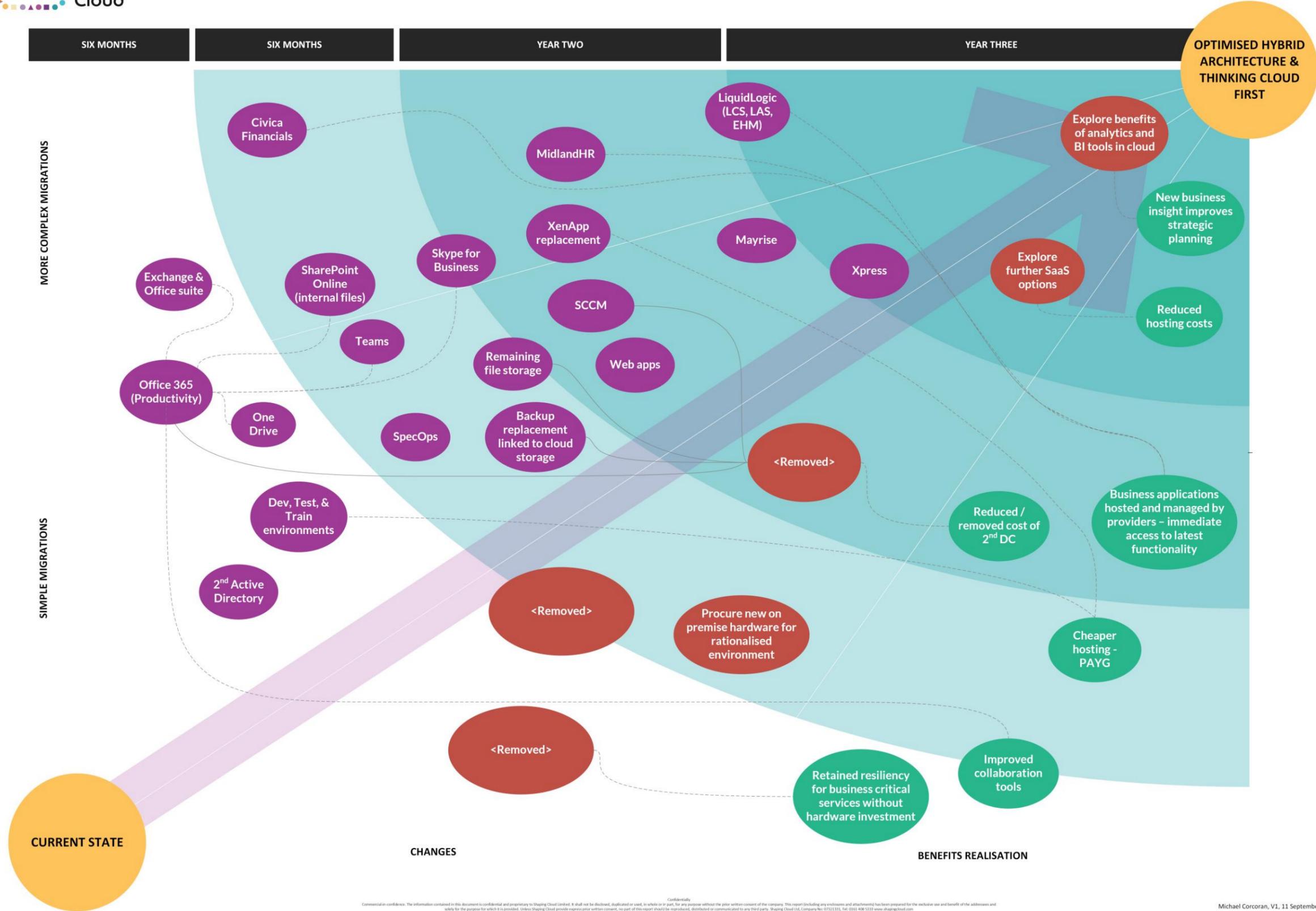


Figure 10 – Transforming with cloud



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Michael Corcoran, V1, 11 September 2018

Figure 11 – Application Transformation Blueprint - YYY

Conclusion and Next Steps

As per the analysis and financial comparison outlined in this document, we feel there is a case for selecting public cloud hosting as a long term replacement for YYY's hosting infrastructure, with particular cost savings with respect to replacing the second rented datacentre space and up front investment. Due to the low cost and efficient way in which YYY has procured and provisioned its' infrastructure over the last five to six years, the cost benefit is primarily limited to the capital investment. However, an immediate change in direction of design for hosting infrastructure should enable YYY to benefit from minimal capital infrastructure investment now, and even less investment required as the XXX moves to a revenue-based model of compute, storage, and service provision.

To achieve this, we have also highlighted:

- Areas where there are risks to migration and the need to address some dependencies to ensure success
- Opportunities outside of migrating the existing environments to maximise cost savings and efficiency

From the analysis that has been done and the options considered, for YYY to maximise benefits and ensure a successful migration to the cloud, the following is recommended:

1. Use cloud platforms for disaster recovery, development and test environments, and web application hosting – this will provide much lower cost provision for this type of hosting.
2. There will be some physical infrastructure refresh required at ZZZ for systems that cannot/ should not migrate (minimal) or those that will be a later migration – make a small investment in compute infrastructure on premise as modelled in the TCO.
3. Connect backup and storage to cloud storage in order to cope with increased demand during migration.
4. Migrate to O365 for at least email and explore the business benefits of the remaining tools, such as Teams, SharePoint, and Flow.
5. Rationalise the second datacentre as soon as possible to benefit from reduced hosting costs and design resilient networking elements into the MPLS services provision.
6. Redevelop the internal use of SharePoint in order to ready this for SharePoint Online and associated tools and services, or consider redevelopment on SharePoint Online – migrating users to this new environment as they migrate to O365.
7. Migrate web applications that work with the internal use of SharePoint and integrate with SharePoint Online provision.
8. Ready Dynamics environment for migration to Dynamics 365 or consider redevelopment on Dynamics 365.
9. Explore in more depth the options for hosting and management of the XXX's external website.
10. Assess the maturity and viability of the SaaS platforms for LiquidLogic, MidlandHR, Civica Financials, and Leisure systems.

The following immediate next steps should help YYY begin this journey to hybrid cloud transformation:

1. Agree what success / benefits look like for your organisation – this will drive the strategy and design.

2. Confirm architectural principles for your hybrid future state – this report contains suggestions that can be adopted or revised to suit YYY.
3. Agree SLAs with the business that can be represented in services provided (availability, RTO, etc.)
4. Consider rationalisation of environments and re-design availability and backup provision, taking into consideration the redundancy and resilience already in place with cloud services.
5. Confirm sizing for on premise infrastructure requirements, in readiness for procurement.
6. Procure on premise core infrastructure refresh.
7. Design and implement enabling services and systems in the cloud, for instance domain controllers, cloud network and storage connectors, etc.
8. Map any missing application and business interdependencies and revise roadmap.
9. Review your migration roadmap as set out within this report in light of local application knowledge and business drivers, and further revise and agree the resultant roadmap.
10. Establish an approach to governance to ensure alignment and success as you progress.
11. Plan a proof of concept for Office 365 to establish configuration preferences and confirm business benefits and engagement requirements to support business through the change.
12. Start to build and migrate, starting with one proof of concept for a non-business critical application.

How Shaping Cloud can assist with your cloud transformation

We believe that public and hybrid cloud provide a unique opportunity for the public sector to re-imagine the way services are delivered and drive better outcomes for staff and citizens alike. Our products and services are designed to inform, advise and guide organisations to transform their IT delivery and continue their cloud transformation journey. The following services are particularly relevant to help an organisation move forward following the completion of this SC: Strategy:

- **SC: Compare:** as public cloud providers continue to invest and develop their platforms it can become increasingly difficult to confidently compare services on a like-for-like basis. SC: Compare leverages the latest services and pricing from all public cloud vendors in order to provide an accurate comparison of platforms.
- **SC: Transform:** guides an organisation on their a journey to cloud, underpinned by real world expertise of cloud technologies, business analysis and detailed planning & design services. Our approach encompasses consultancy, planning and migration services, facilitating live cloud services aligned to your business need. Providing an a-la-carte service, SC: Transform allows you to build a resource profile that meets the needs of your own teams strengths and weaknesses. Our aim is to always enable organisations to manage their own hybrid cloud infrastructure, not to build a dependency on us as an external provider.
- **SC: Office:** Working as your trusted cloud partner, SC: Office provides Enterprise and Technical Architecture alongside Engineering and Project Management resources on a monthly basis. By having resources solely focused on supporting change without the distractions of business as usual



we have seen organisations achieve strategy realisation far quicker than those who attempt to spin both plates at the same time.

Shaping Cloud services can be procured under the G-Cloud 10 framework via the Crown Commercial Services Digital Marketplace. Please visit our Crown Commercial Services supplier site for more information: [Shaping Cloud](#)⁴⁹. Shaping Cloud can also support your cloud transformation journey through introductions to specialists from the main cloud hosting providers.

⁴⁹ <https://www.digitalmarketplace.service.gov.uk/g-cloud/supplier/92518>

Glossary of Terms

Acronym	Acronym Meaning
Ao	Ao diagram used to display our diagrams
Availability	The proportion of time (usually expressed as a percentage) a service or system is required to be available to the end users, e.g. 99.99% uptime or M-F 8-7
BC / BCP	Business Continuity / Business Continuity Plan(s)
BI	Business Intelligence
CPU	Central Processing Unit
DC	Data Centre
DMZ	De Militarized Zone - Logical and Physical Security network using firewalls
DR	Disaster Recovery
ETL	Extract, Transform, and Load – a data transformation task, usually between databases / systems
FTE	Full Time Equivalent
GB	Gigabyte
YYY	YYY
HA	High Availability – two servers running at the same time, configured for physical failure resiliency and / or performance load balancing
IaaS	Infrastructure as a Service
ISP	Internet Service Provider
IT	Information Technology
LAN	Local Area Network
MPLS	Multiprotocol Label Switching
N1R	ZZZ main offices
O365	Microsoft Office 365 productivity suite
Operating Model	The term used to group applications, data, technology and service
OS	Operating System
P2V	Physical to Virtual
PaaS	Platform as a Service

RAG	Red, Amber, Green status used to categorise issues with red as most critical
ROI	Return on Investment
RPO	Recovery Point Objective - maximum targeted period in which data might be lost from an IT service due to a major incident. Generally, lower RPOs = higher cost of service and business makes balanced decision between investment in hosting provision / service and cost of loss of data
RTO	Recovery Time Objective - the targeted duration of time within which a service / system must be restored after a disaster or disruption to service / system access in order to avoid unacceptable consequences associated with a break in business continuity
SaaS	Software as a Service
SLA	Service Level Agreement
SQL	Structured Query Language - Microsoft Database Engine
TB	Terabyte
TCO	Total cost of ownership
UAT	User Acceptance Testing
vCPU	virtual Central Processing Unit
VM	Virtual Machine
WAN	Wide Area Network

Table 6 - Glossary of Terms

Stakeholders

The following list of people were engaged, interviewed, and/or consulted during the process of developing this strategy:

- X YYY, Associate Director Information, Customers, and Communities
- X YYY, MIS Portfolio Manager
- X YYY, Senior ICT Operations Manager
- X YYY, Senior Systems & Network Engineer (DBA)
- X YYY, ICT Business Solutions Manager
- X YYY, Senior Network and Security Engineer
- X YYY, Systems Engineer
- X YYY, Senior Systems and Application Manager
- X YYY, ICT Finance and Contracts Manager
- X YYY, Lead Systems Engineer
- X YYY, Adult Care
- X YYY, Finance
- X Business Analyst and Performance Manager

Appendix A – Hints and Tips

Wider Recommendations

These recommendations, hints and tips are from Shaping Cloud's experience of previous migrations and from helping customers to migrate to cloud services.

This wider set of recommendations covers hints and tips for:

- Procurement – decisions made when buying technology or solutions that help to ensure the cloud strategy is at the heart of procurement decisions taken
- Architecture Strategy – having a very clear architecture strategy and a set of technology standards helps to keep your cloud journey on track
- Application Strategy – a set of recommendations around aligning and readying applications for cloud to remove constraints in their migration to cloud services
- Data Strategy – recommendations helping to address common issues that constrain migrations to cloud services
- Infrastructure Strategy – general recommendations on the infrastructure approach and the key things to enable cloud delivery
- End User Technology – some thoughts and recommendations around the considerations for change when adopting cloud services
- People / Business Change – highlighting considerations for business change as the migration to cloud happens
- Security strategy – some considerations around the security approach when adopting cloud.

The following sections provide the detail and thinking behind this set of recommendations, that hopefully help customers to align thinking across departments as they adopt a cloud services operating model. Some of which will have been captured and included in the proposed solutions through this SC:Strategy engagement.

Procurement

- Start to think about license purchases and what this will mean when that app moves to cloud i.e. can you reduce license costs for 80% of the time but scale on demand for 20% of the time and true up when needed.
- Start to think early about SAAS based service procurement as typically this requires a large amount of business input (i.e. business process, organisation and possibly even benefits in location change).
- Think about what your organisation will be left with once a contract has finished and how this would affect adoption of cloud services - i.e. licensing ownership and delivery through alternative hosting options.

- Think about how platform consolidation for services that applications use is affected, such as database, file, workflow, security services / appliances etc and whether hosting these in a different way could reduce cost.
- For on premise services, think about negotiating pay as you use models or abilities to exit contracts with shorter notice periods so that adoption of cloud can be made in a gradual way and you can realise cost savings immediately rather than depreciating assets over time or having to serve long notice periods.
- When purchasing new services ensure that the technologies in use are not proprietary or would tie you in to an on-premise solution. An example of this is the use of appliances that are managed by the vendor, as these typically are not able to be re-hosted in cloud.

General Architecture & Technology Strategy

- Have a very clear technology strategy that aligns with cloud and make sure that all new services you are thinking of purchasing meet your technology strategy or will meet that technology strategy when you need it i.e. don't allow 3rd party vendors to dictate a certain version of operating system or database version that you know doesn't fit with your cloud strategy. You may not wish to host directly on cloud, but it needs to fit with your organisations plan.

Application Strategy

- Think about high latency applications and bandwidth as well as what rationalisation options, SAAS options or even splitting applications might look like to resolve these issues.
- Understand what business processes / functions the application supports and think about what will happen to that application as the business transforms.
- Understand what dependencies each application service has (both internal and external) and understand what it takes to deliver each application service, forming a portfolio of services aligned to a business function. This may include understanding:
 - End of life dates and end of support dates for given technologies
 - Risk to the business of being without the application service and the SLA's in place to protect the business
 - Understand the roadmap of functionality for each application service from the vendor or internal teams.
- Talk to your application vendors to see whether they could support your applications on cloud and whether there would be any impact in terms of SLA's, cost, functionality, etc.
- Think about application delivery models and the impact this would have at the desktop, such as application re-packaging, etc.

Data Strategy

- Think about data rationalisation, consolidation and archiving as early as possible to reduce the time, effort and cost of moving redundant information or services to a new platform. For example, discreet Microsoft Access databases, SharePoint Applications and Lotus Notes databases that have been created on legacy platforms that don't fit new ways of digital collaboration or data consumption.
- Make sure that all proprietary data platforms are moved to a more portable data type, allowing more easily migratable services between cloud hosting solutions.
- Think about data platform compatibility with cloud vendors and ensure that your database versions are N or N-1 to ensure an easy transition to cloud. This also allows further options to migrate to PAAS rather than IAAS and make more savings.
- Think about how you anticipate your data and reporting platform to fit with any business transformation that is expected as new business functions or improvement to business functions will no doubt mean new KPI's or measures that may be needed from the data platform.
- Understand what data dependencies and flows exist in your organisation to ensure migration to a new platform runs smoothly.

Infrastructure Strategy

- Look to break up hosts that are hosting multiple applications. This typically complicates and adds risk to migration, restricts scaling and can even restrict DR failover and resiliency capabilities. The recommendation is to split these out onto individual servers, remove or combine functionality into one application.
- Ensure your environments are N or N-1 operating systems using a 64-bit architecture. Remove anything that is on the critical path to ensure that you can perform these upgrades such as licensing, 3rd party applications, database versions, etc.
- Depending on suitability, look at moving from a scale up model to a scale out model and re-adjust those servers that appear to be large (CPU, RAM, etc.). Assess the application architecture and determine whether applications can be hosted in the same manner as the cost savings in doing this could be significant, particularly in applications where usage has large peaks of demand.

End User Technology Strategy

- Think about the migration path for centralised / virtualised desktops and application delivery mechanisms. Dual running of large centralised application delivery mechanisms can often be required, when migrating to cloud, to support a phased application approach.
- When increasing user access to applications through web-based services such as Office 365 or other SAAS based applications, network connectivity and all components that form part of that connectivity need to be assessed for capacity and utilisation (i.e. proxies, firewalls, switches, routers etc).

People Change Strategy

- Think about who will be delivering and managing cloud services. Changing to a technology platform that your delivery teams are uncertain of, could unnecessarily stimulate fear of the unknown and therefore create a blocker to cloud. Therefore, it's recommended to:
 - Clearly define roles and responsibilities between new and old operating models
 - Evangelise about the benefits of cloud and stimulate interest in the technology
 - Be clear on the vision, the reasons why cloud is the right approach and communicate this vision effectively
 - Develop awareness and knowledge of the cloud across all relevant staff groups
 - Train staff to deliver their responsibilities in the new operating model.

Security Strategy

- Think about the regulatory security requirements, the way in which your organisation needs to protect data, the types of data you have in your environment and the ways in which cloud can help to achieve security requirements whilst providing a flexible cost-effective hosting platform. Use of DMZ appliances, private connectivity, hybrid authentication mechanisms, data loss prevention technologies (within O365) and the general hosting security capabilities and standards can all help you achieve regulatory compliance and satisfy your auditors.
- Speak to cloud providers about the security standards, pen test reports, managed security services and visit relevant websites to find out more.

Appendix B - Outline Business Case for Cloud Migration

Introduction

This outline business case presents the case for the organisation to migrate some of its existing information systems and IT infrastructure to public cloud hosting, as opposed to hosting these systems in our own data centres. This is to implement the Cloud Strategy¹ that has just been developed by Shaping Cloud, a local consulting company that specialises in cloud services, which was commissioned on our behalf by the XX Partnership (XX P).

Strategic Case

Summary

Cloud computing is revolutionising the way that IT services are provided across government, healthcare and the broader public services. It promises to radically reduce costs and increase flexibility, with some organisations claiming savings of 30%² or more from its adoption.

It is not surprising therefore that most public-sector bodies are moving away from using their own data centres and increasingly sourcing their software and technology needs in the cloud. It is also why the UK Government has had a 'cloud first' policy since 2013³.

Advantages of Cloud

Cloud-based services are not just about savings there are other advantages of moving to cloud-based computing, one important aspect is their flexibility and scalability. Organisations with growing or fluctuating bandwidth demands. It is easy to scale up your cloud capacity, drawing on the service's remote servers and likewise, if you need to scale down again. CIOs and IT Directors rank 'operational agility' as a top driver for cloud adoption.

Organisations should be investing in robust disaster recovery, but for many they lack the required funding and expertise, so this is often more an ideal than the reality. Cloud is now helping more organisations to buck that trend. Cloud-based backup and recovery solutions save time, avoid large up-front investment and roll up third-party expertise as part of the deal.

Cloud Service Providers take care of the servers for you and roll out regular software updates – including security updates – so you don't have to worry about maintaining the servers yourself.

Cloud computing avoids the high upfront cost of hardware and software upon deployment of an application or when you need to refresh your data centre assets. Cloud is a pay as you go subscription-based model.

Teams can access, edit and share documents anytime, from anywhere, they're able to do more together, and do it better. Cloud-based workflow and file sharing apps help them make updates in real time and gives them full visibility of their collaborations. All files are stored centrally and everyone sees one version of the truth. With cloud computing, if you've got an internet connection you can be at work.

Cloud computing is environmentally friendly too. When your cloud needs fluctuate, your server capacity scales up and down to fit. So you only use the energy you need and you don't leave oversized carbon footprints.

Migration Strategy

The XX Partnership want to explore the opportunities of cloud services and have commissioned migration strategy assessments for each public-sector organisation in the partnership.

Our assessment has shown that the majority of our current information systems can move to the cloud and allow us to take advantage of the benefits of cloud services as described above. Some information systems will need to remain in our own data centre and thus a hybrid on-premise/cloud strategy has been devised.

A roadmap has been developed that supports a migration to the cloud over the next three years for YYY. This outline business case makes the case for the investment to transition to cloud services, which will improve the services we provide, will reduce revenue expenditure and avoid the need for capital to refresh some of our data centre assets.

Economic Case

The economic case is about optimising value for money and that is one of the virtues of cloud computing. The flexibility and agility combined with consumption-based subscriptions mean that you only pay for what you use and in some cases only when you are using it. Environments that are used for testing and development can be stood up, when they are needed and taken down afterwards, which allows for cost optimisation that is not achievable with our own data centres.

The main cloud providers are purchasing millions of servers and huge amounts of storage and are doing so at a price point that the public sector can only dream of.

This combination of economies of scale and flexibility are why organisations are reporting savings of 30% or more² compared to their previous on-premise data centre costs.

Options

Two options are being considered in this business case, the 'Do Minimum Option' which retains the current on-premise hosting, in our data centres and the 'Hybrid Cloud Option' which retains some systems in our data centres and moves some information services to be hosted in the public cloud.

A total cost of ownership comparison of our current on-premise costs and a hybrid model utilising the public cloud services has shown:

	Upfront	Year 1	Year 2	Year 3	Year 4	Year 5	Total 5 Years
On Prem							
Hybrid							
Net difference							

The above comparison shows that a 'Hybrid Cloud' Option provides YYY with the most economically advantageous option for the future hosting of its information systems.

Commercial Case

Public Cloud Services are available from a range of Cloud Service Providers, which are typically large corporate suppliers, who are investing billions of pounds into the provision of their cloud platforms. These cloud services have been available for a number of years and there is now a mature marketplace for commercially viable cloud services.

The selection of a cloud provider needs to consider the following areas:

1. Certifications & Standards
2. Technologies & Service Roadmap
3. Data Governance and Security
4. Service Dependencies
5. Contracts, Commercials & SLAs
6. Reliability & Performance
7. Migration Support, Vendor Lock-in & Exit Planning
8. Business Health & Company Profile

These considerations are no different to the selection of suppliers for the provision of equipment and operating systems for your own data centres or when selecting a traditional managed service provider.

Cloud services can be purchased through government procurement frameworks with transparent terms and conditions (e.g. the digital marketplace <https://www.digitalmarketplace.service.gov.uk/>).

In conclusion public cloud services are commercially viable, with a competitive market that ensures the leading providers are very comparable on price and service.

Financial Case

A continued migration to a hybrid public cloud service for hosting of our information systems provides the opportunity for services to be improved (e.g. access to business intelligent tools as a ready-to-use service and swifter deployment of upgrades), for staff to focus on activities that add more value to the organisation (other than keeping the servers running) and also make some savings.

In identifying future costs for the Hybrid Cloud Option a conservative approach has been taken at all times. Further savings could be made by moving systems earlier, moving more systems over time, looking to exploit opportunities for consolidation and by re-imagining the provision of some services by using features and capabilities in the cloud.

The investment case below compares the two options for 14 of our business systems that have been planned in more detail than the overall architecture migration:

Year	1	2	3	4	5
Current running state with no change					

Current run state during migration					
Future run state during migration					
Investment required					
Overall spend (both run states and investment)					

This analysis for both options shows that the Hybrid Cloud Option for these 14 applications saves £XXX pounds of revenue expenditure across a 5 year period and avoids £XXX of capital investment, that would be required to refresh the data centre assets related to these systems in the 'Do Minimum' Option.

The return on the investment required (XXX) is just over 2 years.

In conclusion the preferred option (the Hybrid Cloud Option) is the most cost effective and is cheaper than the 'Do Minimum' Option, saving the organisation £XXX per annum of revenue budget from year three on²⁰, thus making it financially affordable and contributing to the organisation's financial challenges.

Management Case

YYY is relatively new to migrating services to the cloud. It has recently had some further training on a Microsoft Azure (Foundation Course) where the design considerations and selection/configuration considerations have been explained and an instance has been created. It also recommended that specialist support is sought to supplement these new skills to help de-risk the migrations and ensure that the architecture designed is such that it uses the right features, is secure and optimises costs. This will also facilitate a safe migration, in a short timescale, to maximise the benefits to the organisation.

The Cloud Migration Strategy has provided the organisation with the following deliverables:

- Inventory of Assets for the current estate
- Current State Total Cost of Ownership (TCO)
- Current State diagram
- Application Candidacy Assessments - that determine the most appropriate hosting for the organisation's top 25 applications
- Application Cost analyses – showing the costs of hosting these applications in the cloud
- Future State diagram – a high level design of the recommended hosting
- Future State Total Cost of Ownership
- Investment Case
- Strategy Report
- Strategy presentation
- Blueprint and roadmap – showing the recommended high-level migration plan and governance considerations

²⁰ Consideration of possible increased costs elsewhere in the overall architecture ought to be taken into consideration if choosing to migrate the majority of the infrastructure as per total cost of ownership table, before budgeting for revenue savings.

- Microsoft Azure Foundation Training Course.

These deliverables enable YYY to continue their cloud migration journey with confidence that public cloud services are the right hosting for many of their information systems and infrastructure needs.

The organisation will need to establish the recommended governance to support the migrations to public cloud services.

Migration costs in the financial case include additional resources and skills to support the migrations across the proposed roadmap.

Given the above the Board should note that the organisation is in a good place to continue with their cloud journey and the migrations in the plan outlined are achievable.

Conclusion

The detailed work to develop the Cloud Migration Strategy and the options assessed in this business case, make a compelling case for YYY to continue with their cloud journey.

The Board is asked to approve this Outline Business Case on the basis that it is strategically, economically and commercially the best option and is affordable, contributing revenue savings and avoiding future capital expenditure thus contributing towards our financial challenges.

The migration is achievable, with some external specialist support to mitigate the risks, safely transition and keep the migration on track. This external support has been included in the migration costs in this business case.

Adopting cloud hosting as a fundamental part of our ICT and Business Strategy would benefit YYY in terms of being able to improve current services, offer new services and faster, whilst delivering better value and satisfaction to our existing customers. The strategy has made the investment and business case for migrating existing servers to the cloud.

Offering cloud services would be attractive to potential new customers and for new services to existing customers, in terms of shorter lead times, much reduced upfront investment and optimised running costs.

Cloud hosting, in line with government policy, is now actively being adopted by the public sector and to remain competitive in this marketplace YYY needs to be offering cloud hosted services.

Appendix C – Application Candidacy Assessment

Candidate Assessment Process

Service Information

To gain a full understanding of each application Shaping Cloud had to collect both application and server information.

Application Information

Before assessing each application, XXX were asked to provide Shaping Cloud with all the documentation that they had about those applications. From this information, the servers used by each application were identified and this was clarified during the interviews.

During the interview process, there was a discussion as to how the applications were accessed by end users and used by the end users.

Server Information

Most of the information about the servers was taken from the Microsoft Assessment and Planning (MAP) Toolkit. This freely available tool scans the whole IT estate using WMI to gather asset data about every device.

This server information is then merged with the application information to enable the candidate assessment to be completed.

The application candidate assessment analyses each server that is part of the service delivery of the applications. The Azure migration assessment is broken down into three parts:

Compatibility with Azure

By default, Azure offers several standard server models. Most client servers, both physical and virtual, can be mapped directly to one of these models, but in some cases, this cannot be done.

The criteria for Azure compatibility are listed below, with an explanation of what is required.

Criteria	Description
Storage Capacity (GB)	Are the discs too big? The initial limitations on discs in Azure have been raised, but it is still worth assessing the disc storage
IP Addresses	Servers in Azure are created by default with one IP address. More IP addresses can be added, but it will add to the complexity of the migration
Operating System	Azure uses Guest OS Families to define versions of supported O/S. The oldest family (at the time of writing) uses Windows Server 2008 R2, which defines the oldest O/S that will not require an upgrade for migration
Supported Server Performance	Is the on-premise server being assessed, supported by a server in Azure?
Public/Private Access & Security	Is access to the server controlled or is it generally accessible?

Criteria	Description
3rd Party Support	Is 2 nd and 3 rd line support for the application delivered by a 3 rd party, generally the vendor?

Table 6 - Candidate Assessment, Azure Compatibility

Complexity to Migrate

Each server presents a different challenge for migration and this section highlights remediation work from the previous section and the impact on end user and the rest of the IT estate.

Criteria	Description
Compatibility Remediations (IaaS)	A summary of any work that needs to be carried out, prior to migrating to Azure
Data Types (DB)	Database software in use
Application/ Dependencies Technology	What application integrations and technology reliance are there?
Impact of Change on End Users	Low, Medium, High evaluation of impact of migrating end users
IaaS PaaS SaaS	Target Azure service for each server

Table 7 - Candidate Assessment, Migration Complexity

Urgency to Migrate

This section assesses some of the issues that Azure can address at a lower cost and in a robust way. It also considers the impact of service loss to XXX.

Criteria	Description
Infrastructure Age	The estimated age of the server
Criticality of Service	Low, Medium, High evaluation of the criticality of the service to either the IT service or to clinical services
Capacity/ Performance of Current System	If known, an assessment of the current server performance
Current DR Capability	If known, an assessment of the current server performance

Table 8 - Candidate Assessment, Migration Urgency

YYY Candidate Assessment

The following table shows the recommendations for each of the applications that the XXX asked Shaping Cloud to assess.

Application	Assessment	Recommendation
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Exchange	Good ExchangeOnline / O365 candidate	SaaS
Netbackup	IaaS server specs not supported, Suggestion would be to use the NetBackUp Azure cloud connector to enhance on-prem capabilities, allows you to use Azure storage as a backup target. Can be very cheap for archive data. If moving to cloud there are alternative solutions available.	Other
Specops (Password Reset)	Servers compatible, could move to cloud. Based on use case, there may be cloud alternatives	IaaS
XenApp	Citrix is a complex application/environment and needs to be close to the applications / servers it is a gateway to. Careful consideration of when to migrate Citrix users to a cloud alternative needs to be aligned with the application(s) they access and its migration path. If left on-premise, connection with the cloud for elasticity and resiliency would be possible. Recommendation for YYY, based on information provided about use case, is to migrate to a VM cloud installation of RDS and RemoteApp and exploring the new PaaS toolset in public release later this year.	Other
Turbomonic	This is specific to monitoring/managing VMware capacity and performance, cloud alternatives would replace this. More detail required on the server to determine whether this could run in Azure as IaaS.	Other
VPN	This is specific to monitoring/managing VMware capacity and performance, cloud alternatives would replace this. More detail required on the server to determine whether this could run in Azure as IaaS.	Other
SCCM	Servers compatible, could move to cloud - Quite a large deployment of SCCM, which is mostly supported in Azure, with the exception of PXE. It is not possible to run PXE from Azure but you can use on-premise distribution points to respond to boot requests. Recommendation is to use cloud services (Azure OMS for Microsoft cloud) for server management within the cloud network and SCCM on IaaS for end user compute devices on premise, with distribution points as required. Service Manager is an IT Service Desk tool - can run as IaaS or be replaced with a SaaS solution, of which there are many mature options available	IaaS
AD + DNS	Hybrid model likely - Create 2 new DC virtual machines in Azure and add them to the existing farm - Azure AD DS is an option but likely not suitable at this time for YYY's needs. Consider use of AD FS and AD B2C for relevant specific requirements.	IaaS

SharePoint	<p>*Normally a very good O365 candidate, however it has been noted that the current setup is a substantial non-standard build and would therefore be difficult to migrate without redesign.</p> <p>Impact on End Users set at High as used as main Intranet site and any changes would be felt by all end users.</p> <p>External website is also SharePoint but has not been included on the 25 apps register provided by client to review. This would also require redevelopment or consideration of an alternate web platform / CMS.</p>	Other
CRM Dynamics	*There is a cloud solution available in Azure - Dynamics 365. However it has been noted that CRM has been built in a substantial non-standard way and could therefore be difficult to migrate without redesign.	IaaS / SaaS / PaaS
Itrent	Servers compatible, could move to cloud. Supplier also has a mature SaaS product available.	IaaS / SaaS
LAS	Servers compatible, could move to cloud. The supplier also has a SaaS solution available.	IaaS / SaaS / PaaS
LCS	Servers compatible, could move to cloud. The supplier also has a SaaS solution available.	IaaS / SaaS / PaaS
EHM	Servers compatible, could move to cloud. The supplier also has a SaaS solution available.	IaaS / SaaS / PaaS
Information at Work	Servers compatible, could move to cloud. Likely to require confirmation from 3rd party whether they would support this in the cloud.	IaaS / PaaS
OnBase	Servers compatible, could move to cloud, but would require confirmation from 3rd party that they would support this in the cloud and confirmation that it is commercially beneficial to migrate due to storage size. Detailed design required to appropriately size the new SQL PaaS or VM provision due to current shared resource set up - recommend using the provided SQL migration analysis tools for this purpose.	IaaS / PaaS
Autocad	Servers compatible, could move to cloud	IaaS
Xpress	Servers compatible, could move to cloud. But specific security requirements with respect to Elections systems would need to be taken into consideration.	IaaS / PaaS
Swift Search	Not enough data found to make an informed assessment.	IaaS / PaaS

Civica Financials	Servers compatible, could move to cloud. There is also a SaaS solution available for consideration.	IaaS / SaaS / PaaS
Mayrise	Servers compatible, could move to cloud	IaaS
IYSS	Servers compatible, could move to cloud	IaaS / PaaS
Paris Payments	Servers compatible, could move to cloud. However, product recently bought by competitor company and no longer to be supported long term. Alternative SaaS solutions are available.	IaaS / PaaS
Lalpac	Servers compatible, could move to cloud	IaaS / PaaS

Table 9 - Candidate Assessment, Summary Conclusions

Appendix D – Investment Case Model

A detailed total cost of ownership model has been developed for both options, the details can be found in the attached spreadsheet:

REDACTED

Appendix E – Office 365

O365 is always on and always up to date – updating and installing the latest features is the responsibility of Microsoft as a part of the subscription service. Migrating to O365 is a tried and tested path, with guidance and experienced technicians widely available. There are three clear benefits from migrating:

1. Access to new features can be immediate;
2. Scalability – not paying for infrastructure sized for specific user-base as the infrastructure scales with the user base up and down; and
3. One infrastructure engineer (currently managing Exchange on premise) can be redirected to architecting business benefits to be delivered as a consequence of maximising use of the tools available.

Feature development in Exchange varies from version to version, but as an example some key features the business might notice as released in different Exchange versions were:

Feature	Exchange 2010 (YYY Current)	Exchange 2013	Exchange 2016 ²¹ (& O365 current)
Outlook on the web offline	✘	✘	✔
Touch-optimised	✘	✔	✔
Smart Search	✘	✔	✔
Data Loss Prevention ²²	✘	✔	✔
Link preview ²³	✘	✘	✔
Site Mailboxes ²⁴	✘	✔	✔
Built-in Malware Protection	✘	✔	✔

²¹ The differences between Exchange 2013 and 2016 are less than changes between previous versions due to the implementation of O365 compatibility built into Exchange 2016, which is not a change the business would notice or necessarily benefit from.

²² Ability to identify, monitor, and protect sensitive data and inform users about policy violations before emails are sent

²³ Enables users to paste a link into messages, and Outlook on the web automatically generates a rich preview to give recipients a peek into the contents of the destination.

²⁴ Improve collaboration and user productivity by allowing access to both documents in a SharePoint site and email messages in Outlook 2013, using the same client interface.

Compliance Search ²⁵	✘	✘	✔
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Table 10 – Microsoft Exchange email services comparison

Some of the other out of the box unique features of O365 over on premise alternatives that could enable business improvements include:

- “NextGen” SharePoint portals – ready to go intelligent and collaborative portals
- “Delve” – a personal search and discovery tool that starts mapping connections and information relevant to the user’s common activity
- Real-time co-authoring (Word, Excel, PowerPoint)
- Automatic version control and option for version rollback
- Immediate integration with Office Mobile Apps (e.g. on tablets or smartphones)
- “Planner” – simple project or task planning tool without the need for MS Project

Migration of Skype for Business as a telephony solution to simplify management

YYY currently host 8 physical and 12 virtual on-premise servers in order to deliver the Skype for Business (or Teams²⁶) telephony service to the business, including associated upgrades, patches, and backup routines. Skype for Business comes with the standard enterprise “E3” licensing for O365, though this is limited to Skype to Skype calls. For telephone calls into or out of the organisation, a telephony exchange is required – in Office 365 this requires “E5” licenses²⁷ or Phone System add on license²⁸ and a “Calling Plan²⁹” but use of this service removes the need for management and licensing of on-premise PBX (PSTN) / Session Border Controllers (SIP) and PSTN lines / SIP trunks, reducing telephony network engineer workload.

Alternatively, all the features and functionality available in O365 can be consumed while still retaining an on premise break out point to a traditional telecom (PSTN or SIP) provider with minimal infrastructure required – benefit from some simplification but retaining control of telecoms provision and costs. A detailed commercial analysis of these options is recommended to inform a decision for YYY. Our initial calculations show that the Phone System and Call Plans are likely more costly for YYY than the current provision, but negotiation with Microsoft is likely to result in some significant reductions in charges either through discounts to encourage migration or slightly different architecture options.

²⁵ eDiscovery search tool that enables up to 10,000 mailboxes to be searched using a single search – supports audit, complaints, and FOI functions. This is as a result of improved performance in the search architecture of Exchange 2016 over previous versions.

²⁶ Microsoft are merging Skype for Business and Teams - see <https://docs.microsoft.com/en-us/microsoftteams/faq-journey>. Skype for Business was previously known as Lync

²⁷ Consult your Microsoft Licensing Specialist for accurate pricing relevant to your organisation.

²⁸ £6 per user per month

²⁹ £9.10 per user per month for 1200 domestic UK minutes per month (applies to outside org calls only)

References

1. Cloud Strategy, commissioned by the XX Partnership and developed by Shaping Cloud working with the ICT Department from April-August 2018.
2. Accounting for the Cloud, Chartered Institute of Public Finance & Accountancy. March 2017.
<http://www.cipfa.org/policy-and-guidance/reports/accounting-for-the-cloud>
3. Government Cloud First Policy. <https://www.gov.uk/guidance/government-cloud-first-policy>