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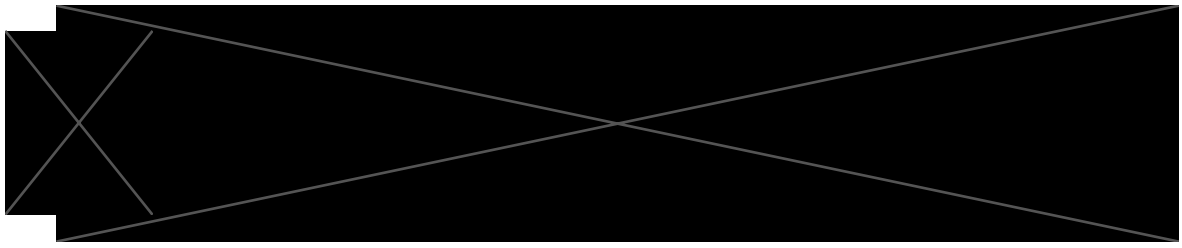
Sep 30, 2021

Cloud Migration / Data Center Modernization Strategy Validation



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Purpose

The executive leadership at the [redacted] retained Samtek Inc. to perform a high-level assessment and validation of the technical approach adopted by the [redacted] Project team for the Cloud Migration or Data Center Modernization Project within the agency. The scope of work as defined in the original Statement of Work included the following:

- Stakeholder Analysis – Identification of key organizational players and roles in Project [redacted]
- Business Objectives Identification – Understand the primary business objectives of the Cloud Migration / Data Center Modernization effort
- Workload Profiling – Identify a sample workload and discuss essential requirements and constraints for its relocation and
- Summary of the Technical Approach adopted for the project

General Approach

The Samtek team followed the AWS Cloud Adoption Framework (CAF) guidance and best practices to perform a Cloud Migration Readiness Assessment (MRA). The AWS CAF is a cloud-agnostic framework to help organizations develop and execute efficient and effective plans for their cloud adoption journey. The validation and readiness assessment focused on the following six perspectives of a typical cloud adoption journey:

1. **Business Perspective**: This covers IT Finance, IT Strategy, Benefits Realization, and Business Risk Management
2. **People Perspective**: This covers Resource Management, Incentive Management, Training Management, and Organizational Change Management
3. **Governance Perspective**: This covers Portfolio Management, Project/Program Management, Business Performance Management, and License Management
4. **Platform Perspective**: This covers System/Solution Architecture, Compute/Network/Storage/Database Provisioning, Application Lifecycle Management
5. **Security Perspective**: This includes Identity, Infrastructure, Data Protection & Incident Response
6. **Operations Perspective**: Service Monitoring, Application Performance Monitoring, Change Management, Business Continuity / Disaster Recovery, Service Catalog, etc.

The team employed a two-fold approach to collect information for the assessment: interviewing key stakeholders from [redacted], business representatives, and technology personnel, and reviewing several project artifacts created by the [redacted] Project Team and previous

vendors. Specifically, the Samtek team conducted the following information-gathering activities:

- Met with executive leadership with the Office of the CIO to understand the current technical challenges, progress, and plans for application relocation
- Met with Project Management for the [redacted] project several times to review the current project plan and to understand the current approach and the progress made against the project plan so far
- Met with the network operations team representatives to understand the current practices regarding day-to-day operations, business continuity, incident, and problem management, etc.
- Met with IT representatives of various business units within the [redacted] to understand application requirements, business continuity and disaster recovery requirements, and other business considerations
- Reviewed various documents created by the Project Team and previous vendors, including:
    - [redacted] - Project Charter
    - [redacted] - Project Management Plan
    - [redacted] - Project Schedule 9-2-21
    - [redacted] - Project Scope Statement
    - [redacted] - WBS
    - [redacted] High Level diagram
    - [redacted]

      [redacted]

      [redacted]
    - DR Equipment Server Inventory
    - DRAP_Remediation Plan
    - Infrastructure_Inventory_12212020
    - [redacted] Infrastructure Modernization_05032021
    - Server Room Migration To Vendor Hosted or Cloud Platform
    - [redacted] Applications

This document summarizes our findings and understanding of the organizational readiness for cloud adoption within [redacted], the current progress, key observations around the current

approach, its challenges, and any gaps within the context of the six perspectives above.

The document has four main sections:

1. **Migration Readiness Assessment Radar Chart --** The Radar Chart visually represents [redacted]'s level of readiness in the six perspectives.

2. **Migration Readiness Assessment Heat Map --** The heat map shows areas of strength/weakness across the organization. Corrective Action Plans must be put in place to improve performance in areas highlighted in yellow or red. This categorization is not a reflection of the current on-premises performance in these areas, but an assessment of readiness for the current project.

3. **Migration Readiness Assessment Scores --** Detailed scoring for various workstreams within each perspective. The level of readiness in each workstream is indicated by a score between 1 and 5, with the following calibration:

    a. **1 –** No work was performed in this workstream, or major rework is required.

    b. **2 –** Significant prep-work or corrective actions may be necessary for the workstream.

    c. **3 –** Some additional work or corrective actions are required for the workstream

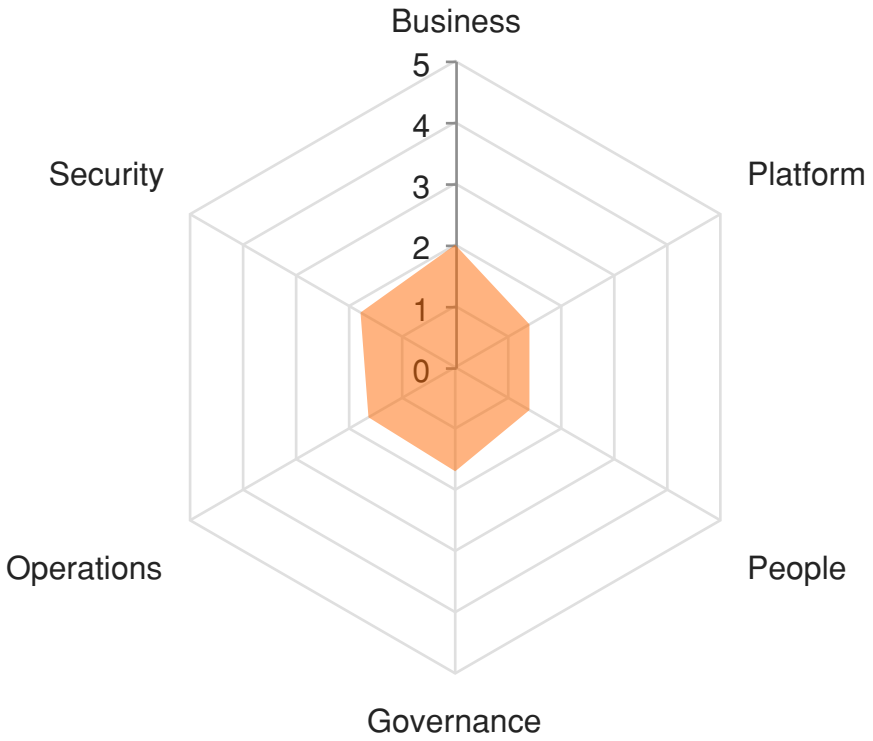
    d. **4 –** Meets the levels of readiness commonly seen in successful cloud migrations

    e. **5 –** No further work needed within the workstream

4. **Migration Readiness Assessment Key Observations Summary –** This summarizes observations, challenges, and gaps in the current approach. Corrective actions may be necessary to address these.

Migration Readiness Assessment Radar Chart

Cloud Adoption Framework Perspectives Radar Chart



Migration Readiness Assessment Heatmap

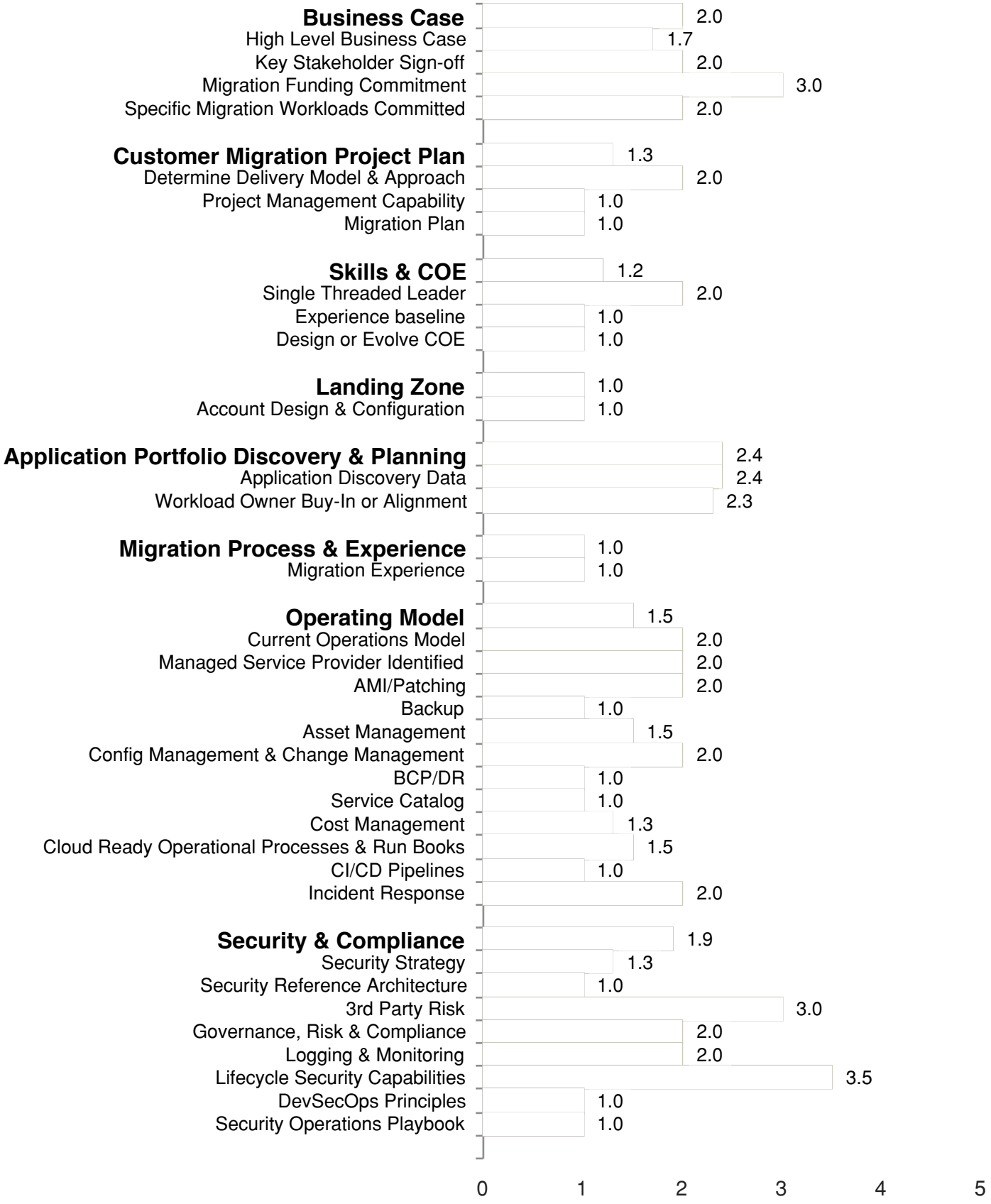
Business Case	Customer Migration Project Plan	Skills & COE
High Level Business Case - Red [Pre-Mobilize]	Determine Delivery Model & Approach - Yellow [Pre-Mobilize]	Single Threaded Leader - Yellow [Pre-Mobilize]
Key Stakeholder Sign-off - Yellow [Pre-Mobilize]	Project Management Capability - Red [Pre-Mobilize]	Experience baseline - Red [Pre-Mobilize]
Migration Funding Commitment - Yellow [Pre-Mobilize]	Migration Plan - Red	Design or Evolve COE - Red
Specific Migration Workloads Committed - Yellow [Pre-Mobilize]		

Landing Zone	Application Portfolio Discovery & Planning	Migration Process & Experience
Account Design & Configuration - Red	Application Discovery Data - Yellow [Pre-Mobilize]	Migration Experience - Red
	Workload Owner Buy-In or Alignment - Yellow [Pre-Mobilize]	

Operating Model	Security & Compliance
Current Operations Model - Yellow [Pre-Mobilize]	Security Strategy - Red
Managed Service Provider Identified - Yellow [Pre-Mobilize]	Security Reference Architecture - Red
AMI/Patching - Yellow	3rd Party Risk - Yellow [Pre-Mobilize]
Backup - Red	Governance, Risk & Compliance - Yellow
Asset Management - Red	Logging & Monitoring - Yellow
Config Management & Change Management - Yellow	Lifecycle Security Capabilities - Yellow
BCP/DR - Red	DevSecOps Principles - Red
Service Catalog - Red	Security Operations Playbook - Red
Cost Management - Red	
Cloud Ready Operational Processes & Run Books - Red	
CI/CD Pipelines - Red	
Incident Response - Yellow	

Migration Readiness Assessment Scores

Cloud Adoption Framework Workstream Scores



Key Observations Summary by Perspective

Business Perspective

Business Case / Value Management

Summary Observations

[redacted] has previously hired a third-party contractor to perform a high-level business case and financial analysis for a data center modernization or public cloud migration effort. The documents created by the third-party contractor were made available to Samtek, Inc. for review. It was not immediately clear how estimates were established, what data points or methodologies were used, or how accurate the data were at the time of the initial evaluation. A solid business, cost analysis, and financial governance strategy are critical to successfully modernizing data center or cloud migration.

Challenges / Gaps

- The project currently lacks a meaningful business case. Developing a "Data Center Modernization / Cloud Migration Business Case" early in the migration journey is essential. This business case should use agent-based infrastructure discovery, look at licensing optimization, and estimate the total cost of ownership (TCO) to create an accurate business case and financial governance model in the target environment. The current project plan partially addresses this via the "Deploy Azure Migration Appliance" task planned in December, but it needs to be earlier and more comprehensive.

- Business owners and technical owners may not share the same vision for data center modernization/cloud migration. The technical team must document and evangelize the strategic vision and value proposition; this will help others in the [redacted] to buy in and help deliver the vision throughout the organization.

- A plan for data center consolidation/exit does not exist. Building a financial and logistical plan for data center consolidation/exit that addresses data center contract terms, decommissioning current assets, etc., can help smooth the transition out of existing data centers.

Migration Funding Commitment

Summary Observations

While a funding plan was not presented to the Samtek team, we understand that executive intent to fund the project is in place. However, it is difficult to assess whether planned funding is appropriate or optimally deployed without a proper business case and TCO estimation.

Challenges / Gaps:

- A TCO analysis in the target environment has not been performed. The current project plan only mentions a monthly cost calculation in December 2021. An early and structured TCO analysis that accounts for hardware acquisition costs, software licensing costs, infrastructure

operations costs, downtime costs, maintenance, and training and support costs would improve the financial predictability of the project and help determine feasibility.

- The current migration timeline and estimated cost are hard to validate since the actual migration of workloads does not start until Q1 2023. Best practices recommend that TCO analyses be followed by early, low-risk migrations into the target environment, so funding and technology validation happens earlier in the journey.

Specific Workloads Committed

Summary Observations

The [redacted] Team has categorized applications into P1, P2, and P3 pools, indicating the order and significance of migration. Specific workloads like the SAS application have been identified as early movers, but a clear migration path has not yet been identified, documented, or communicated. It has also been noted that there might have been a disconnect between the operations team's and the business owner's visions for the migration of this application, underscoring the need for the development and socialization of a shared business value proposition and strategic vision across the organization.

Challenges / Gaps:

- While some "early mover" applications have been identified, business owners and the operations team are not yet fully aligned. Therefore, currently, no migration activities are planned for them in the near- or mid-term. Starting migrations of these non-production environments early while simultaneously conducting other activities can reduce the project's overall delivery timeline.

People Perspective

Skills & COE

Summary Observations

[redacted] has two leaders in charge of the two main workstreams in this project; both leaders report to the CIO. This is against recommended best practices. A single-threaded leader for the Cloud team who directly reports to executive leadership is considered the best leadership model for data center modernization and cloud migration projects.

Challenges / Gaps

- A single-threaded leader for the entire project has not been appointed.

- The team assigned to the project is relatively small and may not have enough internal technical or business owner representation. Ideal cloud migration teams have representation from all impacted lines of business and technology centers.

- Internal technical teams have not yet received adequate cloud training. Training internal teams early in the migration process is a crucial success factor. It allows existing team members with complete business and technical contexts to make and understand critical decisions that are right for the organization and optimized for the target environment.

- Migration team expertise seems restricted to one specific cloud provider. When the target environment is undecided or hybrid, the migration team must have expertise in all possible target areas and a solid understanding of the current on-premises environment and operational processes.

Governance Perspective

Customer Migration Project Plan

Summary Observations

The Samtek team reviewed the current project plan with the executive leadership team. The Project Plan estimates the completion of the migration to the target environment by September 2023.

Challenges/ Gaps

- The current project plan is based on traditional Waterfall SDLC, with prolonged initial discovery, design, documentation tasks. The first deployment in the target environment is planned for Q1 2023, almost 1.75 years after the stated project initiation date. This makes it incredibly difficult to validate any design work and does not provide any opportunity to learn and adapt during the migration. The extended timeframe also risks making much of the documentation obsolete. Reworking the current project plan into an Agile delivery model and setting explicit delivery goals at the sprint or program increment levels can reduce delivery risk on the project significantly.

- Current staff does not have prior experience performing data center modernization or cloud migration projects within an Agile framework. Agile training for staff in Governance Roles could make this and future cloud projects more efficient.

Application Portfolio Discovery & Planning

Summary Observations

The Samtek team was provided manually compiled application and infrastructure inventory and was given an overview of data flow and some internal/external integration points. A more automated discovery is currently planned for Q4 2021 using Azure Migrate. While Samtek did not review any documentation around this, the customer has a good understanding of their licensing agreements and vendor relationships.

Challenges/ Gaps

- No documented data flow, network architecture, or integration documents were shared with Samtek. Conducting a comprehensive discovery of all network traffic flows within the current environment before embarking on a migration project could make the migration effort easier.

Platform Perspective

Technical Strategy

Summary Observations

Most of the applications deployed at the Waterfront server room require network connectivity to

the Office of the Chief Technology Officer (OCTO)-managed network, either for integration/data transfer purposes or because the application itself is primarily exposed via the [redacted]t intranet. This means that any application relocation must account for network connectivity into the [redacted] private network. If the current strategy of exposing applications via the [redacted]ntranet is to continue, additional routing will have to be set up to extend the intranet into the new Data Center or cloud environment (Azure VNET or AWS VPC).

Challenges / Gaps

- The required network connection can only be established with the collaboration of the [redacted]. While initial conversations have happened between the [redacted], there have been no material decisions or progress so far. In the current paradigm, there is no way for the [redacted] to operate in a non-OCTO-managed environment (Data Center or Public Cloud) without this being resolved. Ongoing conversations with OCTO need to be accelerated so a decision can be made about the target environment. Alternative strategies, such as deploying some applications outside the intranet, can be evaluated in parallel.

Cloud-Ready Operational Processes

Summary Observations

Like most enterprises, the Application portfolio within [redacted] comprises a diverse set of applications ranging from custom .Net applications to various commercial off-the-shelf (COTS) applications, ERP systems, telephony infrastructure, and complex database systems running on bare metal infrastructure, etc. A typical data center modernization or cloud migration project involves setting up (and potentially destroying) new environments for each application multiple times across lifecycle environments. Additionally, the elastic nature of the cloud introduces new behaviors at the infrastructure layer; these are best handled via infrastructure automation and require at least minimal application availability and performance monitoring.

Challenges / Gaps

- In our discussions with the team at [redacted], it was noted that while there is centralized logging using Splunk and some infrastructure level monitoring using Solar Winds, the agency does not really have automated, repeatable deployment or functional validation or monitoring. An initial investment in baseline infrastructure automation trusted application delivery pipelines, and application-level monitoring can significantly reduce the risk and effort associated with application migration.

Operations Perspective

Business Continuity Planning & Disaster Recovery

Summary Observations

One of the main drivers for the data center modernization/cloud migration at the [redacted] is improving their application availability and disaster recovery posture.

Challenges / Gaps

- Current RTO/RPO metrics are mostly guesses and not fully understood or accepted by business owners. These numbers must be reviewed and reconciled with available

operational data and business requirements to initiate acceptance conversations with business owners. Designing for application availability in the public cloud without clearly defined objectives can be suboptimal from both a cost and reliability perspective, and it can lead to the realization of various risks at unacceptable levels.

- At least some applications require 24/7 availability yet, network and infrastructure operations are business hours only. A meaningful incident and problem management strategy in line with application availability requirements is a must-have for a modern operations organization.

Managed Service Provider

Summary Observations

In conversation with the Network Operations team and the representatives of various business owners within the [redacted] team, it emerged that there is a strong desire to offload day-to-day operational activities like Operating System patching, Virtual Machine creation, OS upgrades, etc. to a managed service. There is a strong preference for leveraging SaaS offerings where possible (for COTS applications) and creating bandwidth for other critical functions like security within the existing operations team. A strong preference for SaaS offerings or managed services is sometimes the best way to leverage the elasticity and reliability of the cloud without building extensive internal teams/expertise. Early in the migration journey, a good business case exercise can help elaborate the benefits and risks of this approach for the organization.

Challenges / Gaps

- N/A.

Security Perspective

DevSecOps Principles

Summary Observations

[redacted] does not have a standardized CI/CD or DevSecOps framework at the enterprise level. Most applications are not monitored for uptime or functional/transactional performance. Code deployments, application or infrastructure changes require manual testing effort by Business users or their representatives.

Challenges / Gaps

- Current deployment processes are mostly unautomated, and the enterprise does not have a security operations playbook or regularly tested processes. Automating security-related tasks and deployment processes can ensure Security, Risk, and Compliance governance guidance principles are always met when making changes to the applications or the target environments.

- Currently, the organization does not have an internal framework/methodology for evaluating cloud services against the policy, regulation, and performance requirements for various applications/systems. An internal review process that includes activities like Security Impact Assessments, Reliability & Performance Review, and Information Security Risk can

help organizations evaluate their “acceptable risk” and navigate the “shared responsibility model.”

Conclusion / Final Summary

In conclusion, while the [redacted] project team has planned or performed many of the most important first steps in the project, considerable prep work and several corrective actions are needed in many workstreams to achieve efficient and effective migration.

In our assessment, the main areas of opportunity with potential for immediate impact are: “**Customer Migration Project Plan**,” “**Cloud-Ready Operational Processes,**” **“Single-Threaded Leader,**” and “**Migration Process & Experience**.”.

Replanning the project using Agile methodology and establishing an iterative cloud adoption process with intelligent automation and proven industry best practices could significantly improve the project's velocity and outcome.

References

1. AWS Cloud Adoption Framework - https://aws.amazon.com/professional-services/CAF/
2. Cloud Readiness Assessment Tool - https://cloudreadiness.amazonaws.com/
3. Agile Cloud Migrations - https://docs.aws.amazon.com/prescriptive-guidance/latest/migration-program-implementation/welcome.html
4. Microsoft Cloud Adoption Framework - https://docs.microsoft.com/en-us/azure/cloud-adoption-framework/
5. Plan for Cloud Adoption - https://docs.microsoft.com/en-us/azure/cloud-adoption-framework/plan/plan-intro