TECHNICAL MEMORANDUM

Recommendation for a Cloud Service Provider

By: Project Manager (Suliana binti Ibrahim)

&

Research & Development Team (Muhammad Hazriq Akmal bin Zairol, Muhammad Iqmal Hakim bin Ameruddin, Firdhaus bin Md Sidek)

Nexus Sdn. Bhd.
123 Jalan Raja Chulan
50200 Kuala Lumpur
Malaysia
Contact Number: +60 12 345 6789
Email: info@nexus.com

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123 Jalan Raja Chulan
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Contact Number: +60 12 345 6789
Email: info@nexus.com

TECHNICAL MEMORANDUM

TO	Ms. Suliana binti Ibrahim, Head of Project Team
FROM	Mr. Juan Birahman, IT Project Manager
DATE	June 23, 2023
SUBJECT	Recommendation for a Cloud Service Provider

1.0 INTRODUCTION

1.1 Background of Current Situation

In our previous project review meeting, Ms. Suliana, the project team leader, raised a concern about the EmMon employee system for our client, Kludge Sdn. Bhd., a prominent company in Kuala Lumpur engaged in general trading, land, and property investment. Kludge envisions EmMon as a tool for managing business responsibilities and enhancing HR processes.

Commented [N1]: Overview of the situation.

The growth of Kludge Sdn. Bhd. poses challenges for our existing cloud system, Backblaze. With an expanding workforce and data volume, Backblaze's limitations are evident. The recent February security breach has heightened the urgency for a more robust and secure cloud service provider. The EmMon project requires a solution that accommodates growth, ensures data security, and aligns with our evolving needs. Choosing a suitable provider is crucial for overcoming current obstacles and establishing a foundation for future success.

Commented [N2]: Brief statement of the problem.

1.2 Statement of Problem

Kludge's HR department has grown from 200 to 700 employees, increasing data production from 40GB to 200GB per month. Backblaze's 500GB storage plan was initially sufficient, but with Kludge's expansion, it quickly reached 40% of Backblaze's limit. The 1TB plan offers temporary relief, but with Kludge's growth rate, this limit would be reached within 18 months. Backblaze's pay-as-you-go option, capped at 10TB, lacks long-term commitment discounts, making it less attractive for our anticipated high-volume data usage.

Commented [N3]: Cause of the problem.

Since Kludge went global, the need for better availability and redundancy became paramount, and Backblaze's services, with an uptime of only 99.5%, fell short. Furthermore, a

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security breach in February 2023 underscored the need for a more robust and secure cloud service provider.

Considering all options Backblaze provides, and Kludge's willingness to invest in a solution that suits their needs, a change is necessary. This has led to the consideration of a new cloud service provider for a more robust solution for Kludge's EmMon project. The new options being considered will be a long-term investment and standardisation of services that can cater to our expanding clients' diverse needs.

1.3 Purpose of Report, Options, and Points of Comparison

This report compares two cloud-service providers, Microsoft Azure and Amazon Web Services (Azure and AWS), and recommends the best one. They are the top two public cloud providers in 2023, with AWS first and Azure second (Brnakova, 2023). We researched their data storage services for three months, using trials, customer feedback, and sales and support staff. We also consulted companies that use them. This evaluation helps us choose between Azure and AWS based on cost, capacity, availability, and security.

Azure and AWS are leading cloud-based providers with robust data storage solutions. They offer secure and reliable storage with features like data replication, encryption, and enhanced security (SumanthMarigowda et al., 2023). They are strong options for businesses seeking scalable and dependable data storage in the cloud. To recommend a cloud service provider, we consider four key criteria: cost-effectiveness, capacity, availability, and security.

Cost-effectiveness means the provider offers a solution that fits the budget and provides optimal value. For example, Gartner (2016) reported that companies can save up to 30% on cloud spending through cost optimisation. Capacity measures the scalability and storage capabilities of the provider's infrastructure to meet current and future data needs. Katsaliaki et al. (2021) showed that a well-designed cloud storage system can handle up to a 300% increase in data volume. Availability ensures that the data storage service is reliable and accessible, minimising downtime and ensuring uninterrupted access to information (Jacobs & Chase, 2011). Security evaluates the provider's ability to protect data and applications, ensuring the confidentiality, integrity, and availability of data (Microsoft, 2023; AWS, 2023). These four

Commented [N4]: Detailed problem statements.

Commented [N5]: What should be done to solve the problem.

Commented [N6]: How to solve the problem.

Commented [N7]: The purpose of the report.

Commented [N8]: The two final options and why they are picked to solve the problems.

Commented [N9]: More justifications on choosing the options as the two final options.

Commented [N10]: The four points of comparison chosen to help choosing the best option to solve the problems.

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Malaysia
Contact Number: +60 12 345 6789
Email: info@nexus.com

criteria help us make a balanced decision, considering financial, storage, reliability, and security factors to ensure the successful implementation and long-term effectiveness of the chosen cloud service provider (Katsaliaki et al., 2021). A summary table of this evaluation is in Table 1 below:

Commented [N11]: Justifications on choosing the criteria as the four points of comparison.

Table 1 *Comparison of Cloud Service Providers: Cost-Effectiveness*

Options	Points of Comparison/Criteria
Microsoft Azure (Azure) **Amazon Web Services (AWS)**	1. Cost-effectiveness 2. Capacity 3. Availability 4. Integration

2.0 STATEMENT OF REQUIREMENTS

The Executive Committee has set criteria for the cloud service provider. The subscription price should not exceed USD400 per month, aligning with cost-effectiveness principles in IT support (Scott et al., 2022).

Commented [N12]: The statement of requirement with its justification, which is built on high-quality research (in-text citation is provided).

Given the increasing global data volume, the provider should offer a minimum of 4TB storage capacity, with the flexibility to expand as needed. This decision is based on a study by Katsaliaki et al. (2021), suggesting that investing in larger storage now can prepare for future growth.

Commented [N13]: The statement of requirement with its justification, which is built on high-quality research (in-text citation is provided).

The provider must ensure a minimum availability of 99.9% to guarantee uninterrupted access to employee data, emphasising the importance of system availability (Jacobs & Chase, 2011).

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Lastly, the provider should have a robust security framework, including advanced encryption, identity and access management features, and comprehensive monitoring tools, ensuring the protection of sensitive employee data.

Commented [N15]: The statement of requirement with its justification.

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3.0 DISCUSSION

3.1 Cost Effectiveness

Cost-effectiveness is vital in choosing a cloud service provider. It involves comparing the services and prices of different providers to get the best value. The comparison on both two industry leaders considered subscription costs and discounts for long-term commitments, key factors in determining the value proposition.

Both Azure and AWS offer services that match our project requirements, but their pricing models differ. Azure's initial cost for 4TB of storage is USD402, slightly above the USD400 monthly budget limit. However, Azure offers potential cost savings through its Reserved Instances (RI) program, which allows clients to reserve resources for a three-year term and get discounts up to 72%. Our specific service configuration allows for a 66% reduction (Microsoft, 2023).

AWS's pricing for the same storage capacity is USD398 per month, within the budget limit. AWS also offers a 62% discount for a three-year commitment, enhancing its cost-effectiveness (NetApp, 2020).

For the long-term perspective, we recommend a three-year subscription plan. While both Azure and AWS offer discounts, Azure's RI program is more attractive, bringing its projected three-year cost down to USD 4,803.12, $650 less than AWS's USD 5,454.16. This advantage means annual savings of at least $3,000 over the budget ($4,800 annually) and beats Backblaze's pay-as-you-go option. Therefore, Microsoft Azure is the best choice for the EmMon project, thanks to its long-term savings and robust services. Table 2 shows the cost-effectiveness comparison between Azure and AWS.

Table 2 *Comparison of Cloud Service Providers: Cost-Effectiveness*

Criteria	Azure	AWS
Monthly cost	USD135.66	USD151.56
3-year projected cost	(RI programme) USD4,803.12	(Commitment plan) USD5,454.16

Commented [N16]: Brief explanation on the point of comparison which includes the definition and justification.

Commented [N17]: Justification is stated on the unfulfillment of one of the options to the requirement stated in 2.0.

Commented [N18]: Comparison between the two options against the statement of requirements (in 2.0) and problems stated (in 1.2) that are based on research (purposeful in-text citations included) and critical analyses set of information provided where differences are highlighted.

Commented [N19]: Mini conclusion.

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Email: info@nexus.com

Annual projected cost	USD1,601.04	USD1,818.05

3.2 Capacity

One of the criteria for selecting a cloud service provider for data storage is capacity, which refers to the amount of data that can be stored and the ability to adjust the storage size according to the demand. Capacity is important because it determines how well the provider can meet the current and future data storage needs of the employee system. The statement of requirements specifies that the data storage capacity should be at least 4TB, with the flexibility to expand storage capabilities as required. Table 3 compares the capacity of Azure and AWS based on two aspects: storage limit and scalability:

Table 3 *Comparison of Cloud Service Providers: Capacity*

Criteria	Azure	AWS
Storage limit	Unlimited	Unlimited
Scalability	High	High

Both Azure and AWS offer unlimited storage, meaning they can store any amount of data without a maximum cap. This feature ensures the provider can accommodate the growing data volume of the system without compromising performance or reliability.

Azure Blob Storage and AWS S3 are designed to handle large amounts of unstructured data, such as text, images, and videos, making them ideal for data-intensive applications. Both also offer high scalability, allowing them to optimise storage resources and costs according to usage patterns and needs (Katsaliaki et al., 2021).

In conclusion, both Azure and AWS can meet the capacity requirements for the EmMon system. They offer unlimited storage and high scalability, serving as a contingency plan for any unexpected data increase beyond our 4TB projection. Our subscription to a reserved instance plan offers a discounted rate for this fixed storage, ensuring additional costs only if we exceed this capacity.

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3.3 Availability

Regional redundancy refers to the ability to replicate data within the same region or zone to prevent data loss or unavailability due to failures or disasters. This is essential, as it ensures that the employee system can operate smoothly and continuously without interruption. For our client, we have selected Azure's Zone Redundant Storage (ZRS) to be compared with AWS' Availability Zones, which are both ways of replicating data across multiple locations in the cloud. The lower cost option would be Locally Redundant Storage (LRS) that only replicates data within a single physical location and therefore is lower in availability and durability (how long data can survive without being lost or corrupted) (Microsoft, 2021).

Commented [N23]: Brief explanation on the point of comparison which includes the definition and justification.

Azure's ZRS replicates data three times across three Azure availability zones in the primary region to help customers recover from failures. ZRS offers lower cost but lower availability than AWS Availability Zones, which are isolated locations within an AWS region that have independent power, cooling, and networking. Isolation is a desirable feature in cloud computing, as it enhances the security, performance, and reliability of the cloud services (Azure Architecture Center, n.d). Like Azure, AWS replicates data across at least three Availability Zones in each region to ensure high availability and durability, but each region in AWS has at least two availability zones (Amazon Web Services, 2021a). Hence, AWS has a slight edge over Azure in terms of regional redundancy. Nonetheless, it is crucial to note that Azure's Zone Redundant Storage (ZRS) strategy provides a robust framework for failure recovery that ensures a level of redundancy that remains competitive, making it a viable and cost-effective option for our client's consideration.

Availability percentage refers to the probability that data will be accessible at any given time. This is also critical, as it affects the user experience and satisfaction of the employee system. Azure asserted an impressive 99.99999999999999% (16 nines) availability for its ZRS option, translating to data inaccessibility for less than one second in 10 million years (Microsoft, 2021). AWS (2021) claimed to offer up to 99.99% availability for its S3 storage service with availability zones, which means that data will be inaccessible for less than an hour in a year. Hence, Azure has a clear advantage over AWS in this aspect.

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Email: info@nexus.com

In conclusion, both Microsoft Azure and Amazon Web Services (AWS) exhibit commendable offerings, yet nuanced considerations tip the scales. AWS, with its formidable regional redundancy and impressive 99.99% availability, emerges as the preferred choice for ensuring uninterrupted access to employee data. The strategic redundancy across distinct availability zones not only fortifies the system against unforeseen failures but also aligns seamlessly with the EmMon project's global aspirations. In practical terms, AWS's reliability equates to a downtime of less than one hour annually, a statistic mitigated by superior redundancy measures. This ensures that the EmMon project can operate seamlessly, even in the face of unexpected challenges, highlighting the importance of a resilient data storage solution in safeguarding Kludge Sdn. Bhd.'s vital business processes and information integrity. Table 4 presents a detailed comparison of regional redundancy, cross-regional redundancy and availability percentages between AWS and Azure:

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Table 4 *Comparison of Cloud Service Providers: Ability*

Criteria	Azure	AWS
Regional redundancy	Locally Redundant Storage, Zone Redundant and Storage (ZRS)	Availability Zones on S3
Availability percentage	Up to 99.99…% (16 nines)	Up to 99.99%

3.4 Security

Security is crucial for the EmMon project, especially after a recent breach at Kludge Sdn. Bhd. Both Microsoft Azure and Amazon Web Services (AWS) offer robust defenses, but there are differences.

Commented [N26]: Brief justification on the point of comparison.

AWS has an edge in data encryption, using Galois Counter Mode (GCM) for added security. This ensures encrypted data and tamper-resistant verification, protecting against unauthorized access or alterations (SmiKar Software, 2023).

Both Azure and AWS excel in identity and access management, but AWS provides more key management options. This flexibility enhances encryption key security, a critical aspect after a security incident (Microsoft, 2023; AWS, 2023).

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Contact Number: +60 12 345 6789
Email: info@nexus.com

A resilient monitoring system is also vital. Azure Monitor and Amazon CloudWatch allow us to collect, analyse, and respond promptly to data issues, helping detect and mitigate risks swiftly (CloudHealth by VMware, 2020).

Commented [N27]: Comparison between the two options against the statement of requirements (in 2.0) and problems stated (in 1.2) that are based on research (purposeful in-text citations included) and critical analyses set of information provided where differences are highlighted

In conclusion, AWS, with its superior data encryption, key management options, and robust monitoring capabilities, is the strategic choice for navigating the challenges brought by the security incident. This decision ensures immediate security and positions us for long-term resilience and compliance. Table 5 examines AWS and Azure, emphasising their security strengths.

Commented [N28]: Mini conclusion.

Table 5 *Comparison of Cloud Service Providers: Cost-Effectiveness*

Feature	Azure	AWS
Data Encryption	Encryption capabilities (specific method not mentioned)	Galois Counter Mode (GCM)
Identity and Access Management	Strong capabilities	Strong capabilities; More key management options
Monitoring	Azure Monitor	Amazon CloudWatch

4.0 RECOMMENDATION

4.1 Summary

The extensive evaluation of Microsoft Azure and Amazon Web Services (AWS) delves into their capabilities concerning cost-effectiveness, capacity, availability, and security. These facets are crucial in overcoming challenges identified in the EmMon project, triggered by Backblaze's limitations.

Commented [N29]: Restatement of the situation, needs to solve the issues and what have been considered in the resolution of the issues.

For cost-effectiveness, both Azure and AWS present competitive solutions. Azure stands out with potential long-term savings through its Reserved Instances (RI) program, aligning with budget constraints and suggesting it as a viable choice.

In terms of capacity, both Azure and AWS exhibit prowess with unlimited storage limits and high scalability. This assures their ability to accommodate EmMon's growing data volume, ensuring adaptability and optimisation.

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50200 Kuala Lumpur
Malaysia
Contact Number: +60 12 345 6789
Email: info@nexus.com

Availability considerations highlight AWS's edge in regional redundancy, fitting seamlessly with EmMon's global scope. AWS's Availability Zones fortify reliability on a global scale. While Azure boasts a remarkable availability percentage, the emphasis on regional redundancy favors AWS.

In terms of security, AWS emerges as the preference, offering additional data encryption features like Galois Counter Mode (GCM) and more key management options, providing heightened flexibility and control over encryption keys.

Commented [N30]: Summary of all the findings and the justifications.

Table 6

Commented [N31]: Summary table.

Comparison of Cost, Capacity, Availability, and Security Features between Azure and AWS

Criteria	Sub Criteria	Azure	AWS
Cost effectiveness	Subscription cost	✗	✓
	Long-term commitment discount	✓	✗
Capacity	Storage limit	✓	✓
	Scalability	✓	✓
Availability	Regional redundancy	✗	✓
	Availability percentage	✓	✓
Security	Data encryption	✓	✓
	Identity and access management features	✓	✓
	Monitoring tools	✗	✓

4.2 Recommendation

In conclusion, a meticulous evaluation positions Amazon Web Services (AWS) as the preferred choice for Kludge Sdn. Bhd.'s EmMon Employee System. AWS adheres to budget constraints, offering a secure, scalable, and highly available solution. The recommendation is confident, grounded in the comprehensive assessment of both providers and their alignment with the specific needs of the EmMon project. Opting for AWS positions Kludge Sdn. Bhd. for the

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123 Jalan Raja Chulan
50200 Kuala Lumpur
Malaysia
Contact Number: +60 12 345 6789
Email: info@nexus.com

successful implementation, seamless data storage integration, and enduring effectiveness of the EmMon Employee System.

Commented [N32]: Recommendation on which option is the best with the clear and accurate justifications.

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123 Jalan Raja Chulan
50200 Kuala Lumpur
Malaysia
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123 Jalan Raja Chulan
50200 Kuala Lumpur
Malaysia
Contact Number: +60 12 345 6789
Email: info@nexus.com

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