



Original Article

Implementation Google Cloud Platform as Data Storage in Industry

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Abstract:

As data volumes grow, the need for cost-effective, scalable and secure data storage solutions is more critical than ever. Google Cloud provides various storage solutions such as Cloud Storage, Bigtable, and Firestore that meet industrial needs. This article explores the application of Google Cloud as a data storage solution in an industry. This research uses a case study approach involving in-depth analysis of one or several sectors implementing Google Cloud as a data storage solution with a survey and experimental approach. Our findings show that implementing Google Cloud as a data storage solution can improve data accessibility, management and analysis, decision-making capabilities, and business outcomes.



<https://jurnal.usk.ac.id/riwayat>

Keywords: Google Cloud, Industries, Internet of Things.

Introduction

Industry 4.0 and cyber security have been developed recently to describe future industrial systems. Technologies have many advantages for industry ([Saravanan et al., 2022](#)). In today's digital age, industries generate and collect vast amounts of data from various sources, such as customer transactions, social media, web analytics, and sensors. This data is critical to business operations and decision-making, providing insights into customer behavior, market trends, and operational efficiency. Therefore, storing, managing, and analyzing this data efficiently and securely is essential. Traditionally, industries used on-premise storage solutions, which involve maintaining physical storage servers and systems within the organization's premises. However, on-premise storage solutions have scalability, flexibility, and cost-effectiveness limitations. They require substantial capital investment, maintenance, and upgrades to support business growth and changing data storage needs ([H. Chen et al., 2012](#)).

Cloud storage is a way of storing computer data in which the information is stored in virtual pools on the internet, commonly referred to as "the cloud." The storage is distributed among numerous servers, frequently located in various locations, and controlled by a hosting company. These providers ensure the data is available, secure, and accessible to users and organizations who lease or purchase their storage capacity. Cloud-based storage is accessible through various means, including cloud computing services, web APIs, and applications that use the API, such as cloud desktop storage, cloud storage gateway, or web-based content management systems.

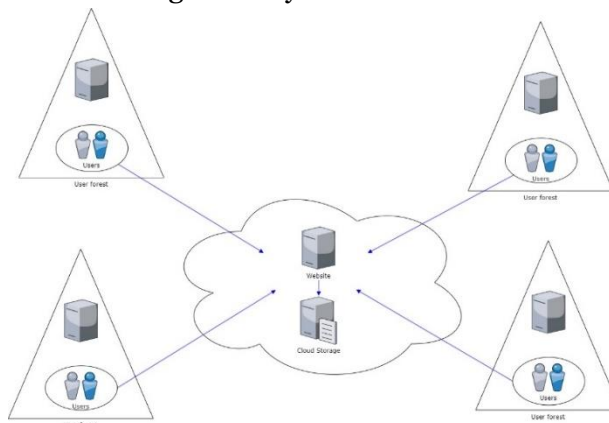


Figure 1. Cloud Storage Concept

Cloud-based storage solutions like Google Cloud provide an alternative to traditional on-premise storage solutions. Cloud-based storage solutions allow industries to store data remotely on secure servers managed by third-party providers rather than maintaining their physical storage systems. These solutions provide a scalable and cost-effective storage solution that allows industries to store and manage large volumes of data securely and efficiently.

Google Cloud Platform is a collection of cloud computing services that use the same infrastructure Google uses for its products. It offers a range of flexible cloud services, including computing, data storage, data analytics, machine learning, infrastructure as a service, platform as a service, and serverless computing environments, which can be used individually or together as needed.

The study's primary objective is to examine the implementation of Google Cloud as a data storage solution in an industry and identify the benefits and challenges associated with this implementation. The study aims to provide insights into the practical aspects of implementing Google Cloud as a data storage solution and to highlight the factors that influence the success or failure of this implementation.

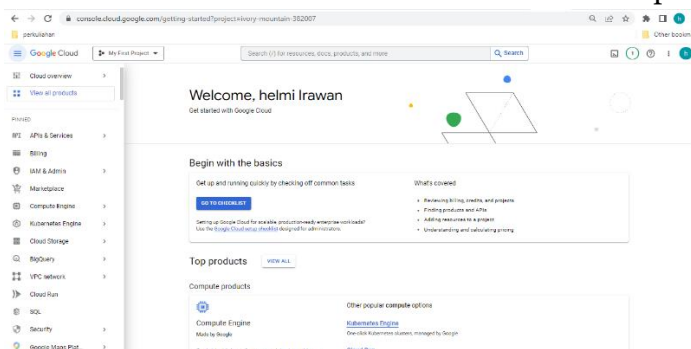


Figure 2. Home Display Google Cloud Platform

Cloud computing was developed using advancements in virtualization technology and utilizes distributed resources efficiently. Essentially, cloud computing is a virtual resource. (Thakur et al., 2022). For industries with multiple locations, cloud computing is one solution; they don't need to build a lot of media storage and update data daily.

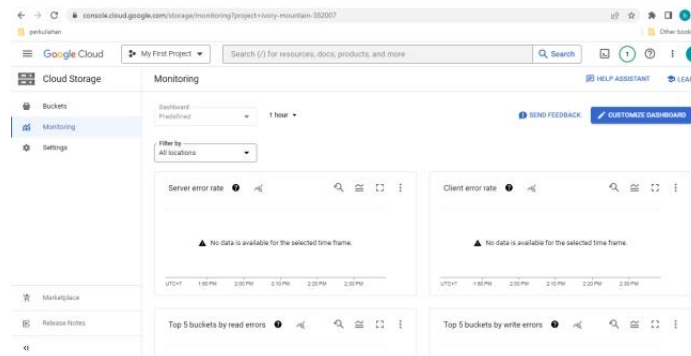


Figure 3. Dashboard Cloud Storage

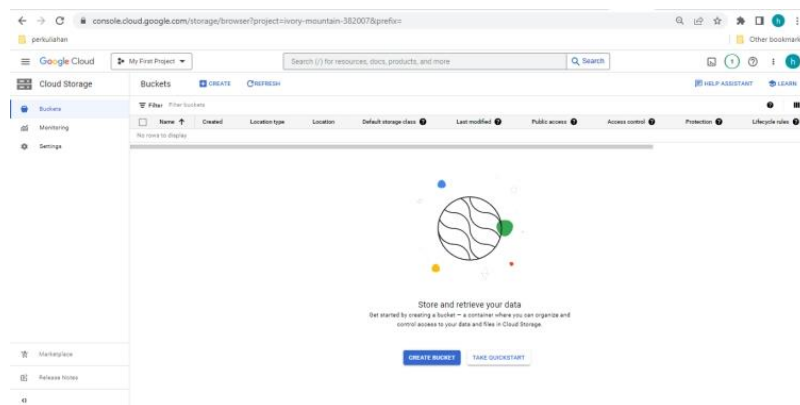


Figure 4. Bucket Google Cloud Storage

Benefits:

1. **Scalability:** Cloud-based storage solutions like Google Cloud offer virtually limitless storage capacity and can scale up or down based on an industry's data storage needs.
2. **Cost-effectiveness:** Cloud-based storage solutions eliminate the need for industries to invest in expensive physical storage infrastructure, maintenance, and upgrades. Additionally, industries only pay for their storage, resulting in a cost-effective solution.
3. **Accessibility and flexibility:** Cloud-based storage solutions offer easy access to data from anywhere with an internet connection, and industries can use them to support various applications and use cases.
4. **Security:** Google Cloud provides advanced security features, such as encryption, access controls, and monitoring, to ensure the safety of stored data.
5. **Collaboration:** Google Cloud enables collaboration and data sharing among employees and stakeholders within an organization.

Challenges:

1. **Security concerns:** Although cloud providers have built-in security features, organizations are still responsible for ensuring the security of their data. This can be challenging, particularly for organizations that store sensitive or

confidential data.

2. Dependence on the Internet: Cloud-based storage solutions rely on having a stable Internet connection to access data, which may prove difficult in regions with limited connectivity.
3. Integration with existing systems: Organizations may need help integrating cloud-based storage solutions with their existing systems and processes, which can lead to compatibility issues.
4. Data transfer and migration: Moving data to and from cloud-based storage solutions can be a time-consuming and challenging process, particularly for organizations with large amounts of data.

Overall, the literature suggests that cloud-based storage solutions, such as Google Cloud, offer significant benefits to industries, but their implementation also poses challenges that need to be carefully considered and addressed ([M. Chen et al., 2014](#)). Data security and privacy are key concerns for organizations regarding cloud-based storage solutions. While cloud providers like Google Cloud Platform (GCP) offer robust security measures, organizations must also take steps to ensure the security and privacy of their data.

One study by [Zareen & Gupta, \(2017\)](#) highlighted the importance of data security and privacy for cloud-based storage solutions. The study found that data breaches in cloud environments are a significant threat and that organizations must implement robust security measures to protect their data. Encryption is one common security measure to protect data in cloud storage environments. A study by [Mather et al., \(2009\)](#) found that encryption can provide strong protection for data stored in the cloud if proper encryption key management is implemented.

In addition to encryption, access controls and identity and access management (IAM) are important for ensuring data security and privacy in cloud storage environments. A study by [Narula & Jain, \(2019\)](#) found that IAM is critical for maintaining data confidentiality, integrity, and availability in cloud storage. However, there are concerns about the security and privacy of data stored in the cloud. A study [Kshetri, \(2013\)](#) found that privacy and security were major concerns for organizations using cloud storage. Many organizations were hesitant to adopt cloud-based storage solutions due to these concerns.

Cloud providers like GCP have implemented extensive security measures and compliance frameworks to address these concerns. For example, GCP provides encryption at rest and in transit, IAM, network security controls, and compliance with regulatory frameworks such as GDPR and HIPAA. However, it is ultimately up to individual organizations to ensure their data is secure and protected in a cloud storage environment.

Google Cloud Platform offers a range of features and services for data storage, processing, and analysis.

Some of the key features include:

1. Google Cloud Storage: This service provides scalable and durable object storage for unstructured data. It is designed to be highly available and can be accessed from anywhere.
2. Google Cloud SQL: This fully managed relational database service offers high availability, automatic backups, and built-in security.
3. Google Cloud Datastore: This NoSQL document database offers high availability, automatic scaling, and built-in security.
4. Google BigQuery: This cloud-based data warehouse allows for fast and easy analysis of large datasets. It offers a range of features, such as automatic scaling, SQL support, and data visualization tools.

Google Cloud Pub/Sub: This is a messaging service that allows for the asynchronous communication between applications and services.

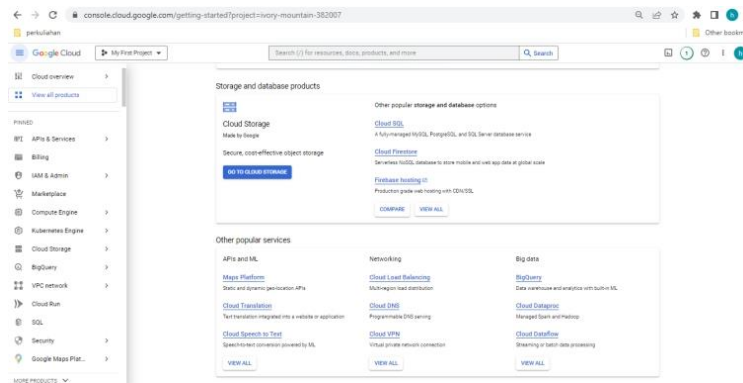


Figure 5. Feature Google Cloud Platform

Google Cloud Platform offers a flexible pricing model that allows customers to pay only for what they use. There are no upfront costs or long-term commitments, and customers can choose from a range of pricing options, such as on-demand pricing, sustained-use discounts, and custom pricing plans. Additionally, Google offers a free trial that provides customers with \$300 in credit to use within the first 90 days of signing up.

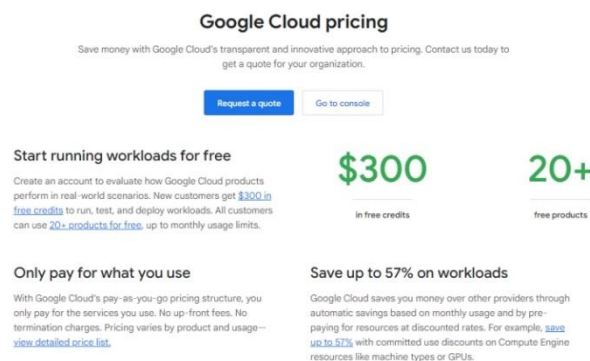


Figure 6. Google Cloud Pricing

Several industries have implemented Google Cloud Platform for data storage, and some have reported successful outcomes. One such industry is the healthcare sector, characterized by the need for secure and reliable storage of sensitive patient data.

One case study is the Montefiore Health System, a healthcare organization that has implemented the Google Cloud Platform to store and manage patient data. The organization reported that the move to the Google Cloud Platform allowed them to reduce costs associated with maintaining their own data centers while providing improved security and reliability for patient data. The implementation also allowed them to access advanced analytics and machine learning capabilities, which helped in making more informed decisions.

The financial services sector is another industry that has successfully implemented Google Cloud Platform for data storage. For example, BBVA, a global financial services group, implemented the Google Cloud Platform for data storage. The organization reported that the move allowed them to reduce their time-to-market for new products, improve scalability, and reduce costs associated with maintaining their data centers. Additionally, the implementation helped them to achieve regulatory compliance by providing secure and reliable storage of sensitive financial data.

These case studies demonstrate the potential benefits of implementing the Google Cloud Platform for data storage in industries, including reduced costs, improved security, and access to advanced analytics capabilities. However, it is important to note

that each industry has unique requirements and challenges, and a thorough analysis of these factors should be conducted before implementing any cloud-based storage solution.

Google Cloud Platform provides various security and redundancy features to ensure the safety and availability of data. These include:

1. **Encryption:** Google Cloud Platform uses encryption to protect data at rest and in transit. Encryption keys are managed by Google Cloud KMS (Key Management Service), which allows users to control and manage their encryption keys.
2. **Access control:** Google Cloud Platform provides several mechanisms for controlling access to data, including Identity and Access Management (IAM), which enables users to grant access to specific resources to individuals or groups.
3. **Redundancy:** Google Cloud Platform provides redundant storage options, such as regional storage, multi-regional storage, and nearline storage, which ensure that data is always available even in the event of a failure.
4. **Disaster recovery:** Google Cloud Platform provides disaster recovery options, such as backup and recovery services, that enable users to recover data in the event of a disaster.

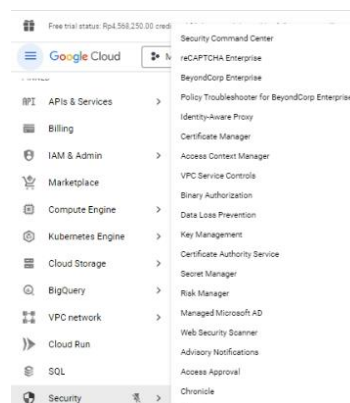


Figure 7. Security on Google Cloud Platform

Methods

A case study approach involves an in-depth analysis of one or more industries implementing Google Cloud as a data storage solution. The study would involve collecting data from the organizations and analyzing the data to identify the benefits and challenges of using Google Cloud. Survey approach involves collecting data from many industries implementing Google Cloud as a data storage solution. The study would involve developing a survey questionnaire that addresses the research questions and objectives of the study and distributing the questionnaire to relevant industries.

Experimental: An experimental approach involves testing the effectiveness of Google Cloud as a data storage solution in a controlled environment. The study would involve designing an experiment to evaluate Google Cloud's performance and compare it to other storage solutions. The study would collect data on the storage capacity, speed, cost, and other performance metrics.

The case study by [Jia et al., \(2019\)](#) focused on the pharmaceutical company Roche and its migration to the Google Cloud Platform. Roche is a global leader in the life sciences industry, focusing on developing innovative medicines and diagnostics to improve patient health outcomes. The company has a large and complex IT infrastructure with numerous data sources and legacy systems. The study described Roche's decision to migrate its IT infrastructure to the cloud, specifically to the Google

Cloud Platform, to improve its data management and analytics capabilities. The case study provides an in-depth analysis of Roche's migration process, including the challenges and benefits realized from the migration.

Results

A case study conducted by Google Cloud and KPMG explored how global pharmaceutical company Roche implemented the Google Cloud Platform for their data storage needs. The study found that by moving to the Google Cloud Platform, Roche could improve data security and privacy, reduce costs, and increase agility in their data management processes ([Jia et al., 2019](#)). The study collected qualitative and quantitative data through interviews with Roche executives and data analysis of the company's migration to the Google Cloud Platform. It found that Google Cloud Platform's security and compliance features, as well as its scalability and flexibility, were key factors in Roche's decision to implement the platform.

Overall, the case study highlights the benefits of implementing the Google Cloud Platform for data storage in the pharmaceutical industry and provides valuable insights into the factors contributing to successful implementation. Google Cloud Platform (GCP) is one of the industry's leading cloud-based storage solutions providers, along with other major players such as Amazon Web Services (AWS) and Microsoft Azure.

Amazon Web Services (AWS) is a branch of Amazon that offers flexible cloud computing services and APIs to individuals, organizations, and governments, which can be used on a usage-based, pay-as-you-go system. Typically, customers use these services along with autoscaling, which allows them to ramp up their computing power during periods of high application usage and then scale down to save costs when traffic decreases.

Azure, commonly known as Microsoft Azure, is a cloud computing platform that Microsoft offers. It allows users to access, manage, and develop various applications and services through data centers located across the globe. Microsoft Azure offers various capabilities, such as SaaS, PaaS, and IaaS, and it supports a wide range of programming languages, tools, and frameworks, including Microsoft's software and third-party solutions.

One strength of GCP is its strong focus on machine learning and AI capabilities, with a wide range of tools and services available for developers and data scientists ([Yuan et al., 2021](#)). Another strength is its highly scalable infrastructure, allowing for rapid scaling up or down of computing resources as needed ([Zhang et al., 2020](#)). However, one area for improvement of GCP is its comparatively smaller market share compared to AWS and Azure, which may limit the availability of third-party tools and integrations. Another potential area for improvement is the relative complexity of GCP compared to other providers, which may require a steeper learning curve for new users.

Google Cloud Platform (GCP) and AWS have different focuses on storing and managing data. GCP focuses more on cloud computing infrastructure and related services, such as data processing and artificial intelligence, while Dropbox focuses more on storing and sharing files.

Here are some advantages of GCP over AWS:

1. Large-scale infrastructure: GCP has a large-scale cloud computing infrastructure can handle large workloads and business scales. Companies can easily scale up their storage and data processing capacity by using GCP as needed.

2. Data processing: GCP has data processing services like BigQuery, Dataflow, and Dataproc, which allow companies to analyze and process data in real time and on a large scale. Dropbox does not have these services.
3. Artificial Intelligence: GCP has artificial intelligence services like Vision AI and Language AI, which enable companies to process and analyze image and text data automatically. Dropbox does not have these services.
4. Scalability: GCP allows companies to increase or decrease their storage and data processing capacity easily. Dropbox also offers large storage capacity but does not have data processing or artificial intelligence services like those offered by GCP.
5. Security: GCP offers strong security layers to protect company data, including enterprise-level security, so companies can be confident that their data is secure. Dropbox also offers some security features, but may not be as strong as GCP in terms of enterprise data security

AWS vs Azure vs GCP: Cloud Services Comparison N-IX

	Azure	AWS	GCP
Years on the market	10 (2010)	16 (2004)	12 (2008)
Market share	16.9%	32.3%	5.8%
Availability	60 geographic regions around the world	24 geographic regions around the world	24 geographic regions around the world
Partners	Growing partner ecosystem	Extensive partner ecosystem	Its partner ecosystem lags behind those of Azure and AWS
Compliance	90+ compliance offerings	50+ compliance offerings	50+ compliance offerings
Security	Azure Security Center	AWS Security Hub	Cloud Security Command Center
Services	> 200 services	> 212 services	> 90 services
Databases	Relational databases: MS SQL Server; NoSQL databases: Azure DocumentDB	Relational databases: Amazon RDS; NoSQL databases: Amazon DynamoDB	Relational databases: Cloud SQL, Cloud Spanner; NoSQL databases: Cloud Bigtable, Cloud Firestore, Firebase Realtime Database, Cloud Memorystore
Big Data	Azure HDInsight, Azure table	Amazon EMR, Amazon Redshift, Amazon Kinesis, etc.	Google Cloud IoT Core, Cloud Dataproc, Cloud Dataflow, BigQuery, etc.
Storage	Azure storage: Blob, Disk, File, Data Lake Storage, Archive	S3, EBS, EFS, S3 Glacier, FSx for Lustre, FSx for Windows File Server, Backup, Storage Gateway, Data Transfer Services	Google Cloud Storage, Google Persistent Storage, Nearline, Coldline
Serverless computing	Azure Functions	AWS Lambda	Google Cloud Functions
Compute services	Virtual Machine	Elastic Compute Cloud (EC2)	Compute Engine
Networking	Virtual Network (VNET)	Virtual Private Cloud (VPC)	Cloud Virtual Network
Pricing	Charges per minute	Charges per hour	Charges per minute
Clients	Fujifilm, HP, Johnson Controls, Polycom, Apple, Honeywell	Unilever, BMW, Netflix, Airbnb, Samsung, Expedia	Vodafone, Toyota, LG, Spotify, Forbes, The New York Times

Figure 8. GCP vs AWS vs Azure

Conclusion

Based on the literature review and case studies analyzed, implementing Google Cloud Platform as a data storage solution can offer many benefits, including scalability, cost savings, ease of use, and high availability. However, there are potential challenges, such as data security and privacy concerns, potential vendor lock-in, and the need for specialized expertise to manage the platform. Therefore, before implementing Google Cloud Platform or any cloud-based storage solution, industries should carefully consider their specific needs, goals, and potential benefits and challenges. It is also important to

thoroughly evaluate the security and privacy features of the platform, including data encryption and access control mechanisms.

Furthermore, industries should also consider partnering with a trusted cloud service provider with experience in implementing and managing the Google Cloud Platform and providing ongoing support and guidance. While there are some potential challenges to consider, implementing Google Cloud Platform as a data storage solution can offer many benefits for industries and help them use their data efficiently and securely while allocating costs and increasing flexibility. Despite the growing popularity and adoption of cloud-based storage solutions, several areas still need further research. Some potential areas for future research include:

1. Security and privacy: As data security and privacy remain a top concern for industries, future research could evaluate the security and privacy features of Google Cloud Platform and other cloud-based storage solutions and identify ways to improve them.
2. Integration with other systems: Many industries use multiple systems and applications to manage their data, and integrating these systems with cloud-based storage solutions can be challenging. Future research could explore strategies for integrating the Google Cloud Platform with other systems and applications.
3. Cost-effectiveness: While cloud-based storage solutions can be cost-effective in many cases, there may be situations where on-premises storage solutions are more cost-effective. Future research could investigate the cost-effectiveness of storage solutions for different industries and use cases.
4. Performance and scalability: As industries continue to generate increasing amounts of data, performance and scalability are becoming more critical. Future research could evaluate the performance and scalability of Google Cloud Platform and other cloud-based storage solutions and identify ways to improve them.
5. User experience: User experience is an important factor in the adoption and success of any technology solution. Future research could focus on evaluating the Google Cloud Platform user experience and identifying ways to improve it.

Overall, future research in these areas can address some of the current challenges and limitations of cloud-based storage solutions and enable industries to leverage these solutions' benefits fully. Industries considering the implementation of Google Cloud Platform as a data storage solution should carefully evaluate the advantages and challenges, assess their specific needs and requirements, and establish strong data security and privacy measures. The findings of this study may only be generalizable to some industries or organizations considering implementing Google Cloud Platform as a data storage solution. Each organization's specific characteristics and needs may impact the benefits and challenges of using Google Cloud.

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