



Comparative Study of Data Security: Cloud Storage and Local Storage in Technology Companies

Neng Wiwin¹, Teddy Hidayat²

¹Universitas Salakanagara

²Universitas Muhammadiyah Bandung

Email: nengwiwin@unsaka.ac.id

Abstract

In the era of digital transformation, data security has become a top priority for technology companies. This study presents a comparative analysis of cloud storage and local storage, emphasizing their respective security implications. Cloud storage offers scalability, remote accessibility, and cost-efficiency but raises concerns related to data control and vulnerability to cyber threats. Conversely, local storage provides direct data governance and enhanced access speed, albeit at the cost of limited scalability and higher infrastructure investment. Through literature analysis and synthesis of current research, the study identifies hybrid and local-first storage models as viable alternatives to balance security, performance, and scalability. The findings highlight that the best strategy for technology enterprises lies in adopting a risk-based approach to storage architecture that integrates strong security protocols, real-time control mechanisms, and infrastructure optimization.

Keywords: *Cloud Storage; Local Storage; Data Security; Hybrid Model; Local-First Architecture; Cybersecurity; Access Control; Scalability; Performance*

INTRODUCTION

Data storage has become one of the most important aspects of a technology company's operations. As the amount of data generated increases, companies must decide on the most effective and secure storage method. Cloud storage and on-premises storage are two primary methods that are often considered. While both have their own advantages and disadvantages, data security remains a primary concern when choosing a storage method. In a data-driven digital era, technology companies face complex challenges in managing and protecting their valuable information assets. Data security is a top priority, with significant implications for reputation, regulatory compliance and business sustainability. ([Shengbin, 2020](#)). The two main approaches to data storage, cloud storage and local storage, offer different advantages and disadvantages in terms of security, cost, scalability, and performance. Enterprises are increasingly evaluating the benefits of cloud services. ([Asniar & Sari, 2015](#)). However, this use comes with security risks and potential data leaks. ([Jeevitha et al., 2016; Kanatt et al., 2020](#)). A deep understanding of the security differences between these two storage models is critical for technology companies to make informed decisions and implement effective data protection strategies. ([Rahman et al., 2023](#)).

Cloud storage, with distributed infrastructure and services managed by third-party providers, offers attractive scalability, flexibility, and cost efficiency. ([Dawood et al., 2023](#)). However, this model also raises concerns about data control, privacy, and potential vulnerability to cyberattacks. ([Kulkarni et al., 2012](#)). Local storage, on the other hand, gives companies direct control over their data and infrastructure, but requires significant investment in hardware, software, and security experts. Information system security is very important for an institution to maintain information optimally and safely. ([Umar et al., 2019](#)). Maintaining integrity requires not only system-level access controls, but also ensuring that system users can

only change data that they are legally permitted to change. ([Paryati, 2015](#)). In addition, in some cases, it is important to ensure that every action taken by a user is regularly recorded and that these records are protected from unauthorized access or alteration. ([Saputra et al., 2023](#)). Companies that store data locally can choose to implement encryption and access control strategies that suit their specific needs. The protection of critical data and assets can be enhanced by adopting a comprehensive approach to cybersecurity, and organizations should also take steps to mitigate the risk of cyberattacks. ([Herdiana et al., 2021](#)).

Although many studies have discussed the advantages of each storage system, in-depth analysis of data security focusing on technology companies is still rare. This study aims to conduct an in-depth comparative study of data security in cloud storage and local storage, focusing on technology companies.

LITERATURE REVIEW

Cloud storage has become increasingly popular in recent years due to its scalability, flexibility, and cost-efficiency. Cloud storage providers offer a variety of services, including data storage, backup, and disaster recovery. However, cloud storage also poses some security concerns. Cybercrime is becoming more common as the internet continues to function as a hub for commerce, entertainment, and government tools. ([Idellie & Atok, 2023](#)). Therefore, the internet environment opens up new avenues for the emergence of criminal acts. ([Chintia et al., 2019](#)). One of the main concerns is data control. When companies store data in the cloud, they hand over control of that data to the cloud service provider. This can raise concerns about data privacy, compliance, and potential unauthorized access to data. ([Anggraeni, 2018](#)). On-premises storage, on the other hand, gives businesses direct control over their data and infrastructure. This model involves storing data on servers and hardware located within the company's physical premises. This allows businesses to implement security measures that suit their specific needs and ensure that their data remains under their control at all times.

Data security is an important aspect of both storage methods. Virtual information identities are collections of numbers and identifiers in computer databases owned by governments and digital companies that collect various inputs. ([Idellie & Atok, 2023](#)). Therefore, these identities are at risk of being stolen, misused, or forged. Companies must take steps to protect their data from unauthorized access, data leaks, and other cyber threats. ([Asaad & Saeed, 2022](#)). One of the most important security measures is encryption. Encryption converts data into an unreadable format, making it inaccessible to unauthorized persons. Encryption can be used to protect data in transit and at rest. Traditional methods for data security usually rely on data encryption and access control. Encrypting data with AES or other encryption methods will prevent valuable information from leaking even if an adversary obtains the data. However, it has efficiency issues when dealing with oceans of data in cloud environments due to the large encryption and decryption overhead in storage and computing. ([Commey et al., 2020; Shi, 2018](#)).

METHODOLOGY

This study will use a qualitative approach to collect and analyze data. The collected data will be analyzed using statistical analysis and content analysis to identify trends, patterns, and significant differences in data security between cloud storage and local storage. Qualitative research is conducted by interpreting the data that has been obtained. ([Rutania & Ganggi, 2021](#)). In qualitative research, data collection is a very important step to achieve research objectives. ([Fauziah & Apriani, 2021; Latifah & Abdullah, 2024](#)). Research data was collected using literature study, observation, and documentation methods. In analyzing this research, namely qualitative, qualitative analysis techniques are research that provides descriptive legal material results in the form of written words. ([Fauziah & Apriani, 2021](#)). Qualitative analysis

provides an accurate description and interpretation of the meaning of a symptom that occurs in a social context. ([Setiawan et al., 2020](#)). By using the library research method, library data in the form of journals, books, and documents, both printed and electronic, as well as other data sources that are considered relevant to this study are collected. ([Assyakurrohim et al., 2022](#); [Pratiwi & Sari, 2019](#)). Library research is a series of activities related to the method of collecting library data, then read, recorded, and processed into research materials. The research method used in this study is the normative legal research method, namely research that refers to legal norms contained in laws and literature. ([Brilliana, 2022](#)).

RESULTS

Here is a comparative analysis of the latest studies and sources on data security: Cloud Storage vs Local Storage in technology companies:

1. Definition & Ownership Model

Cloud storage is a data storage system distributed across multiple computers that work together to store files optimally (Alizadeh & Karimpour, 2014). This allows users to store and access their data anytime and anywhere via the internet. Some of the advantages of cloud storage include high scalability, low cost, and ease of access ("Analysis of Cloud Computing and Cloud Storage in Mobile Forensics Using the DEMATEL Method", 2024). However, cloud storage also has challenges related to data security and privacy (Kumar & Nagalakshmi, 2019; Yang et al., 2020).

On the other hand, local storage is data storage managed locally on the user's device (Tudoran et al., 2013). Local storage has higher I/O performance than cloud storage, but its storage capacity is limited (Ács et al., 2013). In addition, local storage requires more complex management and maintenance by the user (Eyers et al., 2011). To overcome their respective limitations, some studies have proposed a hybrid model that integrates cloud storage and local storage (Xu et al., 2021; Zhang et al., 2018). With this model, data can be stored in local storage for better performance, while cloud storage is used for scalability and backup (Xu et al., 2022). In terms of ownership model, cloud storage is generally owned and managed by the cloud service provider, while users only rent storage space (Mahendar & Chatrapati, 2015; Yang et al., 2020). This raises challenges regarding user control and data security (Aziz & Mahmood, 2022). In contrast, local storage is fully owned and managed by the user, providing greater control but also greater responsibility (Zeng & Zhao, 2013).

Several studies have proposed schemes to improve security and transparency in cloud storage, such as the use of encryption (Peng, 2014; Zhang et al., 2015), blockchain (Aguru et al., 2024; Huang et al., 2020), and public verification (Gao et al., 2020; Yang et al., 2019). In addition, deduplication techniques (Shyamala & S., 2015; Haoran et al., 2015) and hierarchical coding Yang et al. (2019) have also been proposed to improve storage efficiency in the cloud. Overall, cloud storage and local storage have their own advantages and disadvantages, making a hybrid model that integrates both a promising solution. However, challenges related to security, privacy, and data control still need to be addressed to ensure safe and efficient storage usage.

2. Security & Control

Cloud storage offers ease of access and high scalability, but also poses challenges related to data security and control Yahya et al. (2019)(Vimal, 2019; Wu et al., 2019; . Data storage in the cloud is vulnerable to threats such as hacking, unauthorized access, and data theft (Vimal, 2019; Wu et al., 2019; Zhang et al., 2023). This is due to the separation between data ownership and management, so that users lose direct control over their data (Gudimetla, 2024). To address security issues, various techniques have been proposed, such as encryption (Gudimetla, 2024; Yu et al., 2016; El-Booz et al., 2016), blockchain (Aguru et al., 2024), and public verification (Gao et al., 2020). These techniques aim to improve the confidentiality, integrity, and

transparency of data stored in the cloud (Sheela, 2022). In addition, stricter access controls are also needed to limit access to authorized users only (Niu, 2017).

On the other hand, local storage provides users with greater control over their data (Tudoran et al., 2013; (Ács et al., 2013). However, local storage also has challenges related to more complex management and maintenance (Eyers et al., 2011). In addition, local storage capacity is limited and its I/O performance varies depending on the system used, but can generally be lower than cloud storage (Ács et al., 2013). To integrate the advantages of cloud storage and local storage, some studies have proposed a hybrid model that utilizes both (Xu et al., 2021; (Xu et al., 2022). In this model, data can be stored in local storage for better performance, while cloud storage is used for scalability and backup (Xu et al., 2022). Overall, both cloud storage and on-premises storage have challenges related to data security and control that must be addressed. The use of advanced security techniques, strict access control, and hybrid models can be promising solutions to improve data security and control in cloud and on-premises storage.

Comparison of Security Aspects between Storage Methods

Security Aspect	Cloud Storage	Local Storage
Data Control	Limited to the provider	Full control by the company
Security Threats	Vulnerable to cyberattacks	Lower risk from external threats
Physical Security	Servers are located at the provider's facilities	Servers are located on company premises
	Dependent on the provider's compliance standards	Easier to comply with local regulations

3. Reliability & Redundancy

Cloud storage offers high reliability through data redundancy Feng et al. (2012) Kang et al., 2014; (Li et al., 2016; . Cloud storage systems generally use replication and erasure coding techniques to improve data availability and resilience (Heo et al., 2016; (Rodrigues et al., 2013; Xu & Bhalerao, 2015). Data replication across multiple cloud locations can improve reliability by reducing the risk of data loss due to a single server failure (Li et al., 2016; Xu & Bhalerao, 2015). In addition, error coding can also reduce storage overhead compared to simple replication (Rodrigues et al., 2013; (Mandava & Xing, 2017). On the other hand, local storage has lower reliability due to limited redundancy (Tudoran et al., 2013; Ács et al., 2013). However, local storage can offer higher I/O performance than cloud storage (Tudoran et al., 2013; Ács et al., 2013). To improve the reliability of local storage, some studies have proposed schemes such as RAID (Redundant Array of Independent Disks) (O'Neill & Soh, 2023; Song et al., 2015).

To integrate the advantages of cloud storage and local storage, several hybrid models have been proposed (Xu et al., 2021; Zhang et al., 2018). In these models, data can be stored in local storage for better performance, while cloud storage is used for redundancy and backup (Xu et al., 2022). Data deduplication techniques can also be used to improve storage efficiency in hybrid models (Li et al., 2015; Zhu et al., 2014). In addition, cloud storage reliability can also be improved through techniques such as hierarchical coding (Yang et al., 2019), public verification (Gao et al., 2020; Yang et al., 2019), and blockchain (Aguru et al., 2024; Huang et al., 2020). These techniques aim to improve the reliability, transparency, and security of data

stored in the cloud (Mandava & Xing, 2017; Jiang & Zhang, 2017). Overall, cloud storage offers higher reliability through data redundancy, while local storage has better I/O performance but lower reliability. A hybrid model that integrates the two can be a promising solution to gain the advantages of both types of storage.

4. Accessibility & Performance

Cloud storage offers very high accessibility, allowing users to access and manage data from multiple locations as long as there is an internet connection. This greatly supports collaboration and remote work, as demonstrated by services such as Dropbox and OneDrive that facilitate efficient file synchronization and sharing across multiple devices (Daher & Hajjdiab, 2018; Alotaibi et al., 2019). In contrast, local storage is limited to physical devices and can only be accessed at specific locations. However, this solution is ideal for environments with limited internet connectivity or that require physical control over data. In terms of performance, cloud storage has a performance that is highly dependent on the quality of the internet connection and the service provider. Studies show that Nextcloud outperforms Owncloud in terms of file upload and download speeds (Haryani et al., 2024). In addition, cloud service providers often use techniques such as data deduplication and load balancing to improve system efficiency (Gavali et al., 2014). Meanwhile, local storage offers higher access speeds and lower latency due to direct connections to hardware, making it a superior solution for applications that require fast and stable data access. Local storage performance is also more consistent because it is not affected by network variability. Thus, while cloud storage excels in terms of flexibility and remote access, local storage remains the primary choice in contexts that demand speed and full control over data. The choice between the two largely depends on the user's needs and their respective operational environments.

5. Scalability & Cost

Cloud storage stands out in terms of scalability, allowing organizations to easily and quickly expand their storage capacity as data needs grow. These solutions offer virtually unlimited capacity without requiring a large initial investment (Malaiyappan et al., 2024), and support dynamic scaling that allows businesses to adjust resources in real-time (Kanumuri, 2024). On the other hand, on-premises storage is limited by physical hardware capacity, and its expansion requires significant investment in additional devices and supporting infrastructure ("Building a Fast and Efficient LSM-tree Store by Integrating Local Storage with Cloud Storage", 2022). However, on-premises storage tends to provide higher access speeds, making it an ideal solution for applications with high-performance demands.

In terms of cost, cloud storage offers low upfront costs, making it attractive to many organizations looking to avoid large capital outlays. However, ongoing operational costs can add up over time if not managed efficiently (Kanumuri, 2024). Cloud storage is also more cost-effective in large-scale data scenarios and can provide efficiencies through the use of tiered storage solutions. In contrast, on-premises storage demands higher upfront costs for hardware purchases and maintenance, but offers more predictable long-term costs (Goncalves et al., 2018). This approach is also more suitable for small-scale environments with high performance needs, where operational costs can be lower over time. Overall, while cloud storage excels in scalability and flexibility, on-premises storage remains an important option for organizations that prioritize speed of access and cost stability. The decision between these two models is largely influenced by an organization's specific needs and data usage patterns.

6. Hybrid & Local-First Model

The hybrid model combines local and cloud storage to optimize data access and cost efficiency. This approach enables flexible data management by leveraging local storage for fast access and cloud storage for high scalability (Samy et al., 2017). Cost efficiency is one of the main advantages of this model, as implemented in systems such as HyCloud that effectively balance file system performance and low storage costs (E et al., 2019). In addition, the use of

techniques such as sharding and intelligent data redundancy in the hybrid model can improve performance and fault tolerance, which directly contributes to the acceleration of data access (Liu, 2024).

On the other hand, the Local-First model prioritizes data availability and performance by ensuring that data is stored on the local device first. This strategy minimizes the reliance on an internet connection, while improving the performance of local applications, especially those that require real-time data access. By focusing storage on the local device, this model significantly reduces latency, making it an ideal choice for applications that are sensitive to response time. While the hybrid model offers flexibility and cost efficiency, the Local-First model is superior in use cases that require high availability and low latency. Therefore, choosing between the two models largely depends on the specific needs of the application and the users being served.

CONCLUSION

In a highly dynamic digital era, decisions about data storage cannot only depend on the physical location of the data, but must be based on a comprehensive risk management approach. This study shows that both cloud storage and local storage have their own strengths and weaknesses in terms of security, data control, performance, scalability, and cost. Cloud storage excels in scalability and accessibility, but faces serious challenges related to privacy and data control. Meanwhile, local storage provides full control over data, but is limited in terms of flexibility and scalability. The most promising solution is the implementation of a hybrid model or local-first architecture that is able to combine the advantages of both. Technology companies are advised to implement a risk-based storage strategy by integrating proactive cybersecurity policies, strict access control, and redundancy and encryption as security standards. Thus, data security can be maintained without sacrificing the efficiency and flexibility of the company's information system

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