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Cloud vs Traditional Disaster Recovery Techniques: A Comparative Analysis

Oluwasanmi Richard Arogundade

Cloud Computing, Campbellsville University, Louisville, United State

Abstract: This study investigates the function of cloud computing in disaster recovery and contrasts on-premises disaster recovery strategies with cloud-based ones. Organizations must have a disaster recovery strategy in place since natural disasters, cyberattacks, and other disruptive events can have disastrous impacts on them. Traditional disaster recoveries techniques like hot and cold sites, clustering, and backup and recovery have drawbacks such as being costly, time-consuming, and difficult to execute. Disaster recovery solutions based on the cloud and entail storing data and applications in a remote server provide numerous advantages such as expandability, reduced expenses, and adaptability. The report provides an overview of disaster recovery techniques and discusses the importance of disaster recovery for organizations. The report then compares traditional disaster recovery methods with cloud-based solutions and concludes with recommendations for organizations considering cloud-based disaster recovery solutions.

Keywords: Traditional disaster recovery, cyber-attacks, cloud computing, cost, failover, Scalability

I. INTRODUCTION

A disaster is an unpredictable nature of events, it can be natural or man-made disasters. regardless of how it occurred, or the organization's size involved, disaster may be devastating for companies. Not forgetting cyber intrusions, and other forms of disruptive incidents. catastrophes like natural catastrophes, cyber invasions, and other disruptive situations may have disastrous effects on organizations of any size. Additionally, these occurrences may have a number of detrimental effects on companies' profiles, including financial loss, reputation harm, the loss of crucial data, or even the incapacity to go on with corporate activities.

A contingency plan is most for Companies that want to lessen the effects of such events. Traditional disaster recovery methods have been widely used for many years to restore normal business operations following a disruptive event. Backup and recovery methods involve creating a backup copy of an organization's data and applications and storing them off-site. If a disruptive event occurs, this duplicate can be utilized to reinstate the system to its prior condition. Hot and cold sites involve setting up a replica of an organization's IT infrastructure at a secondary location. In the event of a disruptive event, the secondary site can be used to restore business operations. Clustering involves grouping together multiple servers to create a highly available and fault-tolerant system. Although these approaches may be efficient, they possess certain constraints. To begin with, conventional disaster recovery techniques can be costly, particularly for small and medium-sized businesses, as they typically necessitate substantial investments in tangible infrastructure and equipment. Secondly, setting up and maintaining conventional disaster recovery procedures can take a lot of time, placing heavy pressure on IT workers. Finally, standard disaster recovery techniques may not be appropriate for all companies since they might be difficult to adopt.

Recently, cloud disaster recovery has become more and more popular as a viable option to cloud computing. this is because most companies now stored business data and apps in the cloud as part of cloud-based disaster recovery solutions, making them accessible from any place with an internet connection. if we compare this strategy to conventional traditional disaster recovery techniques, the cloud strategy has various advantages, including scalability, cost-effectiveness, and flexibility. Cloud-based disaster recovery alternatives provide various benefits over conventional approaches.

Firstly, they are exceptionally flexible, enabling them to effortlessly adjust to an organization's evolving requirements. This scalability is especially important for businesses that experience sudden and unpredictable growth. Additionally, cloud-based solutions can offer cost savings since organizations do not need to invest in physical infrastructure or hardware. cloud-based solutions are highly flexible since data and applications can be accessed from any location with an internet connection.

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II. PURPOSE AND SCOPE OF THE REPORT

This study compares traditional disaster recovery techniques with cloud-based disaster recovery to determine how cloud computing could help in disaster recovery. The paper will begin by providing an overview of disaster recovery techniques and discussing the importance of disaster recovery for organizations. I will also discuss the role of cloud computing in disaster recovery solutions and compare it with traditional disaster recovery methods. I will conclude with recommendations for organizations considering cloud-based disaster recovery solutions.

III. LITERATURE REVIEW

According to the literature study, the scalability, affordability, and flexibility of cloud-based disaster recovery make it an increasingly appealing replacement for traditional disaster recovery methods. According to Alshammari et al. (2016), enterprises may instantly scale their resources up or down as needed with cloud-based disaster recovery, which can minimize the time and expense associated with recovering from a disaster. According to Kongara et al. (2018), cloud-based disaster recovery has a lot of advantages over traditional disaster recovery. Because cloud-based disaster recovery solutions can be accessed from any place with an internet connection more dependable, scalability, and accessibility.

However, the literature also highlights some potential concerns with cloud-based disaster recovery, particularly related to security and privacy. Subramanian and Jeyaraj (2018) noted that cloud-based disaster recovery may expose organizations to new security threats, such as unauthorized access to data, data breaches, and cyber-attacks. Kumar and Goyal (2019) also noted that cloud-based disaster recovery may introduce new vulnerabilities that can be exploited by attackers. Although cloud-based disaster recovery solutions seem to provide more benefits than conventional disaster recovery, it is still crucial for organizations of all sizes that want to use the cloud needs to carefully consider the risks and benefits of each option and put the appropriate security measures in place to minimize any dangers.

IV. RELATED WORK

Many studies on different methodologies and strategies for cloud disaster recovery have been conducted. A couple of their techniques are highlighted in this article:

Alshammari, Mohammad & Alwan, Ali & Alshaikhli, Imad. (2016). Data recovery and business continuity in Cloud computing: A Review of the Research Literature. International Journal of Advancements in Computing Technology. Val.8. 80.

Alshammari et al. (2016) conducted a review of the research literature on data recovery and business continuity in cloud computing. The authors analyzed various disaster recovery techniques, including backup and replication, and evaluated their effectiveness in terms of recovery time, data loss, and cost.

Bhardwaj, Prajwal & Lohani, Kaustubh & Tomar, Ravi & Srivastava, Rohit. (2022). Comparative Analysis of Traditional and Cloud-Based Disaster Recovery Methods. 10.1007/978-981-19-0252-9_11.

Bhardwaj et al. (2022) conducted a comparative analysis of traditional and cloud-based disaster recovery methods. The study examined the two methods based on recovery time, cost, scalability, and reliability, according to the authors, cloud-based disaster recovery is more affordable, scalable, and dependable than conventional disaster recovery.

Gu, Yu & Wang, Dongsheng & Liu, Chuanyi. (2014). DR-Cloud: Multi-Cloud Based Disaster Recovery Service. Tsinghua Science and Technology. 19. 13-23. 10.1109/TST.2014.6733204.

Gu et al. (2014) proposed a multi-cloud-based disaster recovery service that leverages multiple cloud providers to ensure business continuity. The solution provides a high level of redundancy and fault tolerance, enabling organizations to recover quickly from disasters. According to the authors, multi-cloud disaster recovery is more reliable and economical than conventional disaster recovery methods.

Kongara, Ravindranath & Raghupriya, Nekkalapu & Vamsi, P. & Kumar, D.. (2018). Study on Disaster Recovery in Cloud Environment. International Journal of Engineering and Technology (UAE). 7. 100-103. 10.14419/ijet.v7i2.32.13537

Kongara et al. (2018) conducted a study on disaster recovery in a cloud environment. The authors compared different disaster recovery techniques, including replication, backup, and snapshot, and evaluated their effectiveness in terms of recovery time and data loss. According to the study's findings, data loss prevention and recovery times are two areas where cloud-based disaster recovery outperforms conventional disaster recovery methods.

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Niu, Feifei. (2022). Cloud Technology Dual Data Center Information System Based on Disaster Recovery Platform. 10.1007/978-3-030-89508-2_110.
Niu (2022) proposed a cloud-based disaster recovery solution that integrates dual data centers to enhance business continuity. The system is designed to switch automatically to the secondary data center in the event of a disaster, thus minimizing downtime. The suggested solution makes use of the scalability, dependability, and affordability of the cloud to deliver a productive and adaptable disaster recovery platform.

Waoo, Akhilesh & Rao, B.. (2020). Analysis of the Technique for Disaster Recovery in Cloud Computing Environment. International Journal of Science and Research (IJSR). 9. 1606 - 1612. 10.21275/SR20329175431.
Waoo and Rao (2020) analyzed disaster recovery techniques in a cloud computing environment. The research emphasized the value of planning for disaster recovery and the requirement for a strong disaster recovery strategy. The authors noted that cloud-based disaster recovery provides a more efficient and flexible solution, particularly in terms of cost and scalability.

V. TECHNIQUES REVIEW: TRADITIONAL DISASTER RECOVERY

Disasters can affect the availability and reliability of IT infrastructure, making disaster recovery planning crucial for businesses. Backup and recovery processes involve copying data to a secondary location and storing it for future recovery in case of data loss or corruption. These processes could be accomplished through periodic backups and restoration of data through storage media, this technique involves copying data to tape storage and storing it offsite, providing a basic level of backup and recovery capabilities. Traditional disaster recovery techniques include Tape backups, Hot and cold sites, Replication, and Server clustering.

5.1.1 Tape backups
This type of data backup provides a basic level of backup and recovery capabilities while being dependable and affordable. Regularly carried to an offsite location for storage, tape backups are typically carried out on a daily, weekly, or monthly basis. Tape backups are often transported to an offsite location for storage; they are commonly done every day, every week, or every month. You may retrieve the cassettes and utilize them to restore your data.

5.1.2. Hot and cold sites
Hot and cold sites are another traditional disaster recovery technique. Hot sites are fully functioning backup data centers that have all of the hardware, software, and infrastructure needed to take over primary operations in the case of a disaster. They are typically located in a different geographic location from the primary data center to ensure that they are not affected by the same disaster. Cold sites, on the other hand, are secondary data centers that require equipment and data restoration before they can become operational. They are typically less expensive than hot sites but require longer recovery times.

5.1.3. Replication
Replication is a disaster recovery approach that includes producing real-time or near real-time copies of data and programs and storing them in a secondary site. This strategy helps ensures that the secondary site location always has an up-to-date copy of the data and applications, which provides a high level of redundancy and resilience for data and applications.

5.1.4. Server clustering
Server clustering is a disaster recovery technique that involves using multiple servers to provide redundancy and failover capabilities. in a cluster environment, multiple servers collaborate together to deliver a single service or application to your customer, and if one server fails, another server in the cluster immediately takes over the task. This technique ensures that applications and data remain available even if one server fails, providing a high level of resilience and availability.

BACKUP AND RECOVERY PROCESSES
Alshammari, Alwan, and Alshaikhli (2016) found that traditional disaster recoveries techniques, such as tape backups, hot and cold sites, and server clustering, have several limitations and challenges that can impact their effectiveness in disaster recovery scenarios. Some of the issues or problems they identified are:

5.2.1. High costs
Particularly for small and medium-sized enterprises that might lack the means to invest in alternative data centers, replication technology, or server clustering, traditional disaster recovery approaches can be expensive to establish and maintain.

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5.2.2. Time-consuming recovery

Businesses may have extended downtime and lost production as a result of some classic disaster recovery strategies, such as cold sites, which might take a while to become operational.

5.2.3. Complexity

Traditional disaster recovery techniques can be complex to set up and manage, requiring specialized skills and knowledge.

5.2.4. Limited scalability

Traditional disaster recovery techniques may not be scalable enough to accommodate the growing data volumes and increasing demands of modern business applications.

5.2.5. Inadequate testing

Some businesses could neglect to test their disaster recovery plans and processes on a regular basis, which might result in gaps in their readiness and make them more susceptible to unforeseeable calamities. According to Alshammari, Alwan, and Alshaikhli (2016), cloud-based disaster recovery strategies can improve data recovery and business continuity in disaster-prone areas while also overcoming some of the drawbacks and difficulties of conventional disaster recovery strategies. These strategies make use of offsite storage and virtualization technologies.

VI. TECHNIQUES REVIEW: STRENGTHS AND WEAKNESSES OF TRADITIONAL (DR) APPROACHES

The traditional methods of disaster recovery have a long history of usage and are shown to be effective. IT professionals are familiar with these techniques, which include tape backups, hot and cold sites, replication, and server clustering. These methods have been tested in various disaster scenarios and have been shown to be successful in restoring data and systems. One of the main strengths of traditional disaster recovery techniques is their reliability. Businesses have relied on it and utilized these techniques to recover from disasters for a long time. However, traditional disaster recovery techniques also have several weaknesses.

The requirement for physical intervention is one of the key drawbacks. For example, tape backups require someone to physically transport the tapes to a secure offsite location, which can be time-consuming and prone to human error. In addition, traditional disaster recovery techniques can have slow recovery times, which can result in prolonged downtime and lost productivity. This is especially true for cold sites, which require equipment and data restoration before they can become operational. Another weakness of traditional approaches is the high costs associated with maintaining and testing the disaster recovery plan.

Traditional disaster recovery techniques can be expensive to implement and maintain, requiring significant investments in secondary data centers, replication technologies, and server clustering. They also need to test the recovery site, based disaster recovery plan. Although testing the disaster recovery plan is crucial, it may be expensive and time-consuming, because it requires specialized knowledge, resources, and expertise which most size companies do not have.

VII. TECHNIQUES REVIEW: CLOUD DISASTER RECOVERY

Due to the advantages, they provide for businesses, cloud-based disaster recovery (DR) approaches are growing in popularity. Organizations may effectively secure their data and applications from future calamities by using cloud-based disaster recovery (DR) strategies. One of the main advantages of cloud-based DR is its scalability, which allows organizations to adjust their DR capabilities to meet their changing needs (Kongara et al., 2018). Another advantage is the flexibility it offers in terms of data recovery options, allowing for both full and partial recoveries based on specific needs (Bhardwaj et al., 2022).

These services are provided by cloud service providers, which also include cloud backup and recovery options, disaster recovery as a service (DRaaS), and virtual disaster recovery. The market for cloud-based DR services has grown in recent years, and Alshammari et al. (2016) predict that it will expand considerably over the next several years.

6. 1. Disaster Recovery as a Service (DRaaS)

For businesses without the resources to create and maintain their disaster recovery infrastructure, DRaaS offers an affordable option. Additionally, DRaaS provides organizations with several benefits, including improved recovery time objectives (RTOs), reduced costs, and increased flexibility. Additionally, DRaaS gives businesses the chance to test their

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disaster recovery strategies on a regular basis, guaranteeing that their systems would work properly in the case of a catastrophe (Bhardwaj et al., 2022). DRaaS is a fully managed DR solution offered by a third-party provider like AWS, or Microsoft Azure. Google Cloud etc.

6.2. Cloud backup and recovery solutions

Cloud backup and recovery solutions are another cloud-based DR technique that provides organizations with an offsite backup and recovery option, it gives organizations a cost-effective way to protect their critical data by backing it up to the cloud. This solution offers faster recovery times, as it allows for immediate data restoration from the cloud (Alshammari et al., 2016). According to Kongara et al. (2018), cloud backup solutions offer several benefits, including scalability, accessibility, and reduced costs. Additionally, cloud backup solutions offer offsite data protection, ensuring that data is protected from disasters that may occur on-premises.

6.3. Virtual disaster recovery

Virtual disaster recovery is another cloud-based DR technique approach that enables organizations to replicate their systems and data in the cloud. This strategy offers businesses an affordable option to guarantee that their data and systems will be accessible in the case of a catastrophe. This solution allows organizations to create and test virtual replicas of their production environments, enabling them to recover from a disaster quickly (Kongara et al., 2018). Niu (2022) suggests that virtual disaster recovery offers several benefits, including reduced RTOs, increased scalability, and improved availability.

VIII. TECHNIQUES REVIEW: BENEFITS AND DRAWBACKS OF CLOUD-BASED APPROACHES

The key benefits of cloud-based methods range widely, including:

7.1. Scalability

Cloud-based solutions have unmatched scalability since they can easily ramp up or down to suit changing company needs without additional hardware or software expenditure. Doing this type of scaling on on-premises infrastructure will be costly and requires a lot of experts.

7.2. Cost-effectiveness

As opposed to conventional on-premises solutions, cloud-based solutions have the distinct benefit of avoiding the astronomical expenses of hardware and software expenditures. you only pay for what you used. And you can even go with managed services like serverless computing to reduce costs the more

7.3. Accessibility

The cloud-based solutions' accessibility is their standout feature, as they can be accessed from any location with an internet connection, making remote collaboration seamless. on the other hand, the traditional data center requires you to be present to carry out some activities, and you have a limited amount of automation when it comes to remote access

7.4. Flexibility

The flexibility of cloud-based solutions is unmatched, as they can be personalized and smoothly integrated with other systems, rendering businesses highly adaptive to constantly evolving requirements. Since it offers a broad range of customization and integration capabilities that are tailored to meet particular business needs, flexibility is a key benefit of cloud-based solutions that is challenging to match. This gives companies the option to choose the services that best meet their needs, guaranteeing that their cloud expenditures will be profitable.

7.5. Security

Cloud-based solutions offer better data protection and security features since they include dependable backup systems, disaster recovery capabilities, and cutting-edge encryption technology. This is outstanding in all respects. It is entirely plausible that in our conventional data center setup, the backup and primary data may be stored in the same physical location, so, when Disaster occurs, everything is gone.

7.6. Reliability

Cloud-based solutions are notoriously dependable, with rare instances of downtime and consistently excellent performance levels. The dependability of cloud-based services is frequently greater than on-premise options. To achieve optimum uptime and availability, cloud providers frequently deploy multiple infrastructure and backup systems, whereas on-premise solutions could only have minimal redundancy and rely on a single point of failure.

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Furthermore, cloud service providers frequently have a number of data centers spread across various regions, enabling seamless failover in the event of an outage. with this type of geographic diversity and redundancy, cloud-based solutions are more dependable and resilient than their on-premise counterparts.

7.7. Reduced IT complexity

Cloud-based solutions typically entail minimal IT resources and maintenance compared to on-premise solutions, liberating IT staff to tackle other critical tasks. This remarkable characteristic can significantly reduce the overhead required for maintaining and managing IT infrastructure, thus liberating IT staff to concentrate on more critical tasks such as innovation, development, and strategic planning. Cloud providers often provide managed services that take on many of the routine maintenance and support tasks that would otherwise consume the organization's IT staff.

While cloud-based disaster recovery techniques offer several benefits, they also have some drawbacks. Waoo and Rao (2020) suggest that one of the main drawbacks of cloud-based disaster recovery is the potential for network latency, which can cause delays in accessing data during a disaster. Data loss is a risk when adopting cloud-based disaster recovery strategies, particularly if the service provider lacks effective backup and recovery procedures. Therefore, the service provider must formulate meticulous backup and recovery protocols to guarantee the safeguarding and accessibility of data in the wake of a disaster. Without such procedures, organizations may face data loss or even data theft during the recovery process. Cloud-based approaches for disaster recovery are widely adopted due to their numerous benefits.

Despite these challenges, cloud-based disaster recovery techniques also offer several benefits. For instance, because cloud-based solutions are scalable and adaptable, businesses can change with the demands of their customers. compared to conventional disaster recovery techniques, such as maintaining an on-site recovery facility, cloud-based disaster recovery has a substantially lower cost. The benefits and drawbacks of cloud-based disaster recovery methods must be carefully considered by enterprises before selecting a solution. While network latency and data loss are potential drawbacks, the benefits of scalability, flexibility, and cost reduction make cloud-based disaster recovery an attractive option for many organizations.

IX. COMPARATIVE ANALYSIS

The comparative analysis examines and compares traditional and cloud-based disaster recovery techniques. The analysis will include cost, recovery time, scalability, reliability, and deployment simplicity. which makes us understand the advantages and disadvantages of each strategy. Factors to consider in the analysis. One significant factor to consider when comparing traditional disaster recovery techniques and cloud-based disaster recovery techniques is the cost. Traditional disaster recovery techniques require companies to purchase and maintain their disaster recovery equipment, which can be costly. On the other hand, cloud-based disaster recovery techniques are less expensive, as companies only pay for the resources they use (Bhardwaj et al., 2022).

Pay-as-you-go models used by the cloud eliminate the need for the business to invest in and maintain costly equipment, making disaster recovery through the cloud more affordable. When evaluating the two approaches, the rate of recovery should also be considered. It is well-known fact that traditional disaster recovery methods take a long time. The distance in kilometers between the backup location and the primary site determines how long recovery will take. In contrast, cloud-based disaster recovery is known to be fast, as recovery can be done almost instantly (Waoo & Rao, 2020). Businesses must consider recovery times carefully since the longer it takes to recover after a crisis, the more money the firm will lose.

A Detailed Assessment of Each Approach

Scalability is another factor that companies need to consider when choosing a disaster recovery technique. Traditional disaster recovery techniques require companies to invest in additional hardware as their data storage needs grow. However, with cloud-based disaster recovery, businesses can quickly scale their storage needs as the cloud provides unlimited storage capacity (Kongara et al., 2018). The ability to scale the system is essential because businesses need to ensure that their disaster recovery system can handle their growing data needs. Reliability is also an important factor when choosing a disaster recovery system. Traditional disaster recovery techniques are prone to failure due to human errors, equipment malfunctions, or software bugs. Cloud-based disaster recovery techniques have a higher level of reliability as cloud service providers have sophisticated systems that guarantee high uptime and disaster recovery capabilities (Alshammari et al., 2016).

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Ease of implementation is another critical factor to consider when selecting a disaster recovery system. Traditional disaster recovery systems require a significant investment in hardware and software, as well as skilled professionals to set up and maintain the system, which most small businesses cannot afford. On the other hand, cloud-based disaster recovery is easy to set up and maintain, as service providers handle most of the work (Tamimi et al., 2019). Enterprises of modest sizes, such as small and medium-sized companies, can effortlessly establish a disaster recovery system with frugal expenses, rendering it an ideal solution. Small and medium-sized businesses, for example, can easily set up a disaster recovery system on a small budget, making it a perfect choice for such businesses. The detailed assessment of each approach shows that traditional disaster recovery techniques have their strengths, but cloud-based disaster recovery techniques are more advantageous in most scenarios.

The strengths of traditional disaster recovery techniques include their ability to store data on-premises, giving businesses greater control over their data, and their ability to perform complex recovery operations. However, the weaknesses of traditional disaster recovery techniques include high costs, slow recovery times, and lack of scalability. On the other hand, cloud-based disaster recovery techniques have several strengths, including low cost, fast recovery times, high scalability, and reliability. The weaknesses of cloud-based disaster recovery techniques include concerns about data security and the possibility of vendor lock-in. However, companies can mitigate these weaknesses by choosing a reputable cloud service provider and implementing data encryption and backup policies.

Summary of the comparative analysis

In summary, the comparative analysis shows that cloud-based disaster recovery techniques have several advantages over traditional disaster recovery techniques. Companies looking for a cost-effective, fast, scalable, and reliable disaster recovery system should consider cloud-based disaster recovery techniques. However, the choice of disaster recovery technique depends on the company's specific needs and the type of data and applications being protected. A thorough evaluation of the company's needs and a careful consideration of the pros and cons of each approach should be done before making a final decision. It's also important to choose a reputable cloud service provider that can guarantee the security and confidentiality of the data being backed up or recovered.

Table 1: Understanding the Key Difference Between Cloud DR and Traditional DR

Traditional DR	Cloud DR
Setting up a data center/secondary site requires large upfront investments for data center space, connectivity, servers, manpower, site maintenance, etc.	Cloud DR is inexpensive since it is not dependent on hardware.
The processes involved in making a physical DR site live requires manual intervention, is time-consuming, and could lead to data loss and impact business continuity.	Cloud DR sites are automated and can be brought online within a few seconds or minutes, which minimizes downtime and the risks associated with data loss.
In circumstances when connectivity is unavailable with the physical disaster recovery setup, manual procedures are required to restart the site's operations.	A cloud-based DR process can be triggered using just a laptop or any device connected to the internet.
Since traditional DR is a hardware-focused approach, any hardware damage will mean replacing it with a new one, which translates into costly downtime.	Since cloud DR is based on virtualization, the virtual servers can be securely moved across multiple data centers.
Upgrading a conventional DR site is tedious, time-consuming and costly.	Cloud-based DR offers clients the flexibility to scale up depending on their needs.
Traditional DR requires a dedicated IT team to manage and maintain the disaster recovery infrastructure, which can be a burden for smaller businesses.	Cloud DR eliminates the need for a dedicated IT team, as the cloud provider takes care of maintenance and upgrades.
in the event of disaster, traditional DR requires periodic testing to ensure the site can be brought up quickly in the event of a disaster, which can be time-consuming and costly.	Cloud DR allows for easier testing and validation of disaster recovery plans, as the cloud provider can spin up test environments quickly and efficiently.
Traditional DR may require businesses to store redundant data in multiple physical locations, which can be costly and difficult to manage.	Cloud DR allows for the easy replication and storage of data across multiple regions and data centers, without the need for additional hardware or physical locations.

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X. CONCLUSION AND RECOMMENDATIONS

Effectiveness of traditional vs. cloud-based approaches

This study investigated the effectiveness of traditional and cloud-based disaster recovery approaches in organizations. The results of this study showed that both traditional and cloud-based disaster recovery approaches have their benefits and limitations. Traditional approaches require a significant amount of time and resources to implement and may result in significant downtime. Cloud-based approaches, on the other hand, can provide faster recovery times, cost savings, and scalability. However, they may not be suitable for organizations with limited internet connectivity, concerns about data privacy, or limited financial resources.

Disaster recovery strategy recommendations

Businesses can use a variety of cloud-based disaster recovery strategies.

9.1. Backup and Restore

This approach involves periodically backing up data to a cloud-based backup service or storage platform. The data can be restored from the backup in the case of a disaster. This approach is straightforward and affordable, but if the backup is out-of-date, data loss might occur. For example, a small online retailer might use backup and restore as their disaster recovery strategy. They could periodically back up their website and customer data to a cloud storage service, such as Amazon S3. In the event of a disaster, they could restore their website and data from the most recent backup.

9.2. Pilot Light Approach

The pilot light approach involves setting up a minimal version of the production environment in the cloud, with key services and applications running in a dormant state. In the event of a disaster, additional resources can be quickly provisioned to bring the pilot light environment up to full production capacity. For example, a healthcare provider might use the pilot light approach for their disaster recovery plan. They could set up a pilot light environment in the cloud, with critical applications and data in a dormant state. In the event of a disaster, additional resources could be quickly provisioned to bring the pilot light environment up to full production capacity, ensuring continuity of care for patients.

9.3. Warm Standby

Warm standby involves running a duplicate copy of the production environment in the cloud, with the duplicate actively receiving updates and changes from the production environment. In the event of a disaster, the warm standby environment can be quickly activated to take over for the production environment. For example, a financial services company might use warm standby as their disaster recovery strategy. They could run a duplicate copy of their trading platform and related applications in the cloud, with the duplicate actively receiving updates and changes from the production environment. In the event of a disaster, the warm standby environment could be quickly activated to ensure the continuity of trading operations.

9.4. Full Replication in the Cloud

Full replication involves running an exact copy of the production environment in the cloud, with the duplicate actively receiving updates and changes from the production environment. In the event of a disaster, the duplicate environment can take over the production environment seamlessly.

For example, a large e-commerce company might use full replication as its disaster recovery strategy. They could run an exact copy of their website and customer data in the cloud, with the duplicate actively receiving updates and changes from the production environment. In the event of a disaster, the duplicate environment could take over the production environment seamlessly, ensuring the continuity of business operations.

9.5. Multi-Cloud Option

The multi-cloud option involves using more than one cloud provider for disaster recovery, providing redundancy and added protection against service disruptions or outages. For example, a transportation logistics company might use the multi-cloud option for its disaster recovery plan. They could use multiple cloud providers to replicate their key applications and data, ensuring redundancy and added protection against service disruptions or outages. As one can discern, there exists a plethora of cloud-based disaster recovery techniques, each one exhibiting a unique set of merits and demerits. Businesses should carefully evaluate their needs and resources to select the most appropriate approach for their disaster recovery and business continuity plan.

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After conducting a comprehensive study on disaster recovery strategies, it is recommended that organizations implement a hybrid disaster recovery approach that combines both traditional and cloud-based approaches. This will enable organizations to take advantage of the benefits offered by both approaches while minimizing their limitations. By leveraging traditional methods, such as backup and recovery, hot and cold sites, and clustering, organizations can ensure a secure and reliable recovery process for their critical systems and data. Simultaneously, cloud-based disaster recovery solutions offer scalability, flexibility, and cost savings, making them an attractive option for organizations looking to enhance their disaster recovery capabilities.

In addition to adopting a hybrid approach, organizations should conduct a thorough risk assessment to identify potential threats and prioritize the recovery of critical systems and data. This assessment should consider the potential impact of natural disasters, cyber-attacks, and other disruptive events on the organization's operations, including financial loss, reputational damage, and the loss of critical data. Based on this assessment, the organization should develop a comprehensive disaster recovery plan that outlines the recovery process for each system and data type. Moreover, it is essential to ensure that the disaster recovery plan is regularly updated and tested to ensure its effectiveness in the event of a disaster. Regular testing allows organizations to identify any gaps or weaknesses in the plan and make necessary adjustments. It is also recommended that organizations provide disaster recovery training to their employees to ensure that they understand their roles and responsibilities in the recovery process. By implementing a hybrid disaster recovery approach, conducting a thorough risk assessment, and regularly testing the disaster recovery plan, organizations can enhance their disaster recovery capabilities and minimize the impact of disruptive events on their operations.

Limitations of the study

While this comparison offers valuable insights into the dissimilarities between traditional and cloud disaster recovery approaches, it has its limitations. The findings of the study may not be applicable to other scenarios as it only focuses on analyzing and inspecting a specific set of disaster recovery techniques and cloud providers, thus having a limited scope. It is imperative to note that disaster recovery techniques may vary depending on the source of information and data used in this research. This difference may impact the reliability of any analysis conducted.

When weighing the pros and cons of cloud-based disaster recovery versus traditional methods, there are certain aspects that may require a subjective evaluation. Factors like affordability, dependability, and ability to expand may be subjective. This study has limitations, as disaster recovery techniques are a constantly evolving field. Staying updated with the latest technological advancements is a challenging task. The analysis results might also be affected by certain viewpoints or methods used in choosing peer-reviewed papers. This study did not examine how disasters affect community infrastructure and disaster response efforts. Future research could investigate how cloud-based disaster recovery methods can help strengthen community resilience and response efforts during disasters.

Suggestions for future research

There are several areas of research that could build on the findings of this study. Firstly, exploring the role of emerging technologies, such as the Internet of Things (IoT) and Artificial Intelligence (AI), in disaster recovery efforts could be a fruitful avenue for future research. The potential of IoT to provide real-time data and insights on disaster situations could be leveraged to develop more effective disaster recovery strategies. Similarly, AI and ML could be used to automate disaster response and recovery processes, potentially reducing the time and resources required for disaster recovery efforts.

Automating key disaster recovery processes, such as damage assessment, resource allocation, and evacuation planning, is possible using machine learning and artificial intelligence. These technologies can also aid in the likelihood and severity of potential disasters, allowing for the proactive mitigation of their effects after they occurred.

Damage assessment usually involves sending teams of specialists to the impacted areas to evaluate the damage, which is a labour- and time-intensive operation. We can use Artificial intelligence (AI) and machine learning (ML) to potentially automate this procedure, allowing for a speedier and more accurate evaluation of damage when a disaster occurred. Machine learning and AI might be beneficial when it comes to planning evacuations. These technologies can assist in determining the most efficient evacuation routes and methods by accessing data like as weather trends, traffic patterns, and population density.

Secondly, hybrid disaster recovery approaches that leverage multiple cloud providers could be investigated in more detail. This could include exploring how multiple cloud providers could be used to improve scalability, resiliency, and cost-effectiveness in disaster recovery efforts. For example, an organization could use multiple cloud providers to ensure that their critical systems and data are redundantly stored across different geographic locations, improving their ability to withstand and recover from disruptive events.

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Finally, more research is needed to explore the ethical and legal considerations associated with the use of cloud-based disaster recovery approaches. This could include examining the potential risks and benefits of cloud-based disaster recovery approaches in relation to data privacy and security, as well as exploring potential legal and regulatory frameworks for managing the use of cloud-based disaster recovery solutions. As organizations increasingly rely on cloud-based solutions for disaster recovery, it is important to understand this trend's ethical and legal implications.

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