WORKLOAD MIGRATION TO CLOUD: A COMPREHENSIVE REVIEW AND ANALYSIS

by

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ABSTRACT

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Cloud computing has become a game-changing technology for enterprises with its unparalleled scalability, agility, and cost-effectiveness. Cloud migration has emerged as a strategic necessity for enterprises looking to take advantage of cloud computing's advantages as they work to maximize those benefits. In line with this significance, it is necessary to have a thorough understanding of this concept, including these advantages and disadvantages as well as the strategies or factors that has to be considered to ensure an efficient migration that realizes the full benefits for enterprises. Therefore, the purpose of this critical study is to comprehend the potential and difficulties related to moving workloads to the cloud as well as the most effective techniques for an efficient transition for businesses. As part of its methodology, the study evaluated prior research papers using a qualitative, systematic review approach in order to address the research questions. Content analysis was used to examine the data that was taken out of the chosen articles. The study's findings show that because the cloud computing ecosystem is always changing, both small and large enterprises have embraced cloud migration strategies. This move is beneficial for a number of reasons, including cost-effectiveness, adaptability, and

agility. However, moving to the cloud is not without its difficulties, and managers and company executives in charge of the process should be aware that there are significant risks associated. Notably, while navigating these obstacles, the conversation has revealed important factors that affect how well workloads are moved to the cloud. The results highlight how crucial careful risk assessment, strategic planning, and the incorporation of best practices are to a successful move to enable businesses to maximize their cloud transition initiatives. Future research may focus on dwelling on the challenges of workload migration and providing solutions that companies can adopt to counter the challenges using methodologies such as interviews or questionnaires to get information from cloud providers and companies.

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Chapter 1: Introduction

This first chapter, the introduction, provides the study's background information and defines the topic, rationale, questions, aim, and importance of the research.

1.1 Background to the Study

Cloud computing has changed the game for businesses thanks to its unmatched scalability, agility, and affordability (Boutaba et al., 2023). Cloud computing, according to Madhavaiah et al. (2012) has been a game-changing technology that gives businesses access to unprecedented levels of cost-effectiveness, scalability, and agility. Thus, it has become essential for companies to take advantage of these cloud computing strengths. After much development, cloud computing is now a recognized platform for hosting ICT infrastructure. The Pentagon has stated that it will grant a contract worth USD 10 billion to transfer to the cloud, demonstrating their confidence in the cloud infrastructure. Almost all Fortune 500 companies use the cloud (Ahmad et al., 2020).

According to Boutaba et al. (2023), cloud computing is a computing paradigm that depends less on local computer utilization and more on resource sharing. Unlike traditional server-client configurations, this technology exchanges resources through virtualized devices. This technology is becoming more and more popular because of its various advantages, which include excellent scalability and cheap IT costs (Al-Mahdawi and Ali, 2016). In line with this definition, Madhavaiah et al. (2012)’s assert that cloud migration has become a crucial strategic requirement for businesses seeking to leverage the benefits of cloud computing to the fullest extent possible. Transferring workloads, data, and apps from legacy systems to cloud-based infrastructures is referred to as cloud migration. This is a process that allows businesses to fully leverage cloud services by improving their digital skills, and building their competitiveness in a dynamic market

(Banerjee, 2012). One of the most important factors in cloud acceptance and utilization modernization acceleration efforts is cloud migration. Modern applications are developed entirely in the cloud these days, from conception to completion. In addition to adopting a cloud-first strategy, legacy enterprises can reduce their traditional IT operational expenses by forty to fifty percent on average by moving their own data center premises to a public cloud service provider (Tubre and Rodeghero, 2020).

According to Seenivasan (2021), Workload migration to the cloud is the concept of transferring applications, data, and supporting infrastructure from on-premises settings to cloud service providers' platforms. Programs and applications are moved from one environment to another using this procedure (Chen et al., 2023). Workload migration can also refer to the moving of services or programs from one infrastructure to another. In this case, the virtualized data, databases, software, and systems are accessed via the internet (Zaidan and Kurniawan, 2024). Thorough planning, a compelling business case, a reliable migration strategy, and solid migration frameworks are necessary for cloud migration (Ahmad et al., 2020).

Enterprise workloads, which are characterized by varying degrees of transformation diligence, return on investment, and productivity use cloud delivery choices. Therefore, similar to any other transformation project, cloud migration can be viewed as a progressive shift or journey (Banerjee and Mohapatra, 2013). Workload migration might include moving from one physical infrastructure to another or from one on-premise infrastructure to a cloud environment, according to Demeke and Sharma (2024). By using this approach, companies can make the most of cloud services, develop their digital competencies, and stay competitive in a continuously evolving digital market (Cardoso et al., 2014).

As correctly pointed out by Chen et al. (2023), an increasing number of firms have already migrated to the cloud, and an even larger number are getting ready to do so even if they haven't yet. For a number of reasons, cloud-based workload migration has grown in popularity among small and large enterprises (Chen et al., 2023). The majority of businesses hope that by 2024, $8 of every $10 spent on IT hosting would be utilized in cloud services, such as platform as a service (PaaS), software as a service (SaaS), infrastructure as a service (IaaS), and private cloud (Boutaba et al., 2023).

According to Banerjee (2012), organizations may want to go to the cloud in order to gain cost-effectiveness, scalability, and agility, among other reasons. Moving to cloud solutions, according to Badshah et al. (2021), provides numerous advantages, including better resource usage, enhanced scalability, enhanced flexibility, and potential cost savings. This suggests that businesses can leverage cloud-based services and resources to effectively handle a range of workloads, adapt to evolving business requirements, and shorten the time it takes for their products and services to reach market (Badshah et al., 2021). These advantages and the increased demand for transitioning to the cloud point to the importance of workload migration to the cloud and hence the need to understand the benefits or opportunities it brings, as well as the challenges and strategies that can be used to ensure effective migration to enable organizations or businesses to realize the benefits rather than being brought down by the drawbacks.

1.2 Problem Statement

According to Cardoso et al. (2014), cloud computing is a cutting-edge paradigm in information technology that leverages the Internet to deliver utilities-like services. As businesses look to take advantage of cloud computing's advantages, moving workloads from on-premise locations to the cloud has garnered a lot of attention in the last ten years (Chen et al., 2023). Businesses getting

ready for a sustainable IT landscape can find it attractive to invest in moving workloads to the cloud, according to Cardoso et al. (2014). It provides several advantages over traditional computing platforms, including as increased flexibility, reduced expenses, agility, scalability, fewer end-user IT expenses, and on-demand services. Businesses are moving their current apps to the cloud due to the numerous advantages and long-term benefits of this new technology (Banerjee, 2012). Using an organization's current IT investment and moving it to the cloud environment with the least amount of corporate disruption and expense appears to be the biggest barrier to implementing cloud-based modernization, despite the many benefits of moving to the cloud (Banerjee and Mohapatra, 2013). Notably, a number of challenges and security concerns are impeding the process of cloud adoption by companies (Banerjee, 2012).

Cardoso et al. (2014) go on to say that in order to avoid having a detrimental effect on the institution making the change, it is crucial to carefully transition internal IT services to the cloud computing paradigm. Because the cloud computing paradigm provides a large amount of resources for application design and installation, it is a tool that will play a significant role in the replacement and migration of many services that were previously offered in data centers. Workload migration to the cloud has a number of benefits and drawbacks, so it's important to fully comprehend this idea. These include the benefits and drawbacks as well as the strategies or considerations that need to be made to guarantee an effective migration that maximizes the benefits for businesses. In addition, given the growing requirement for cloud migration, a research agenda for cloud migration needs to be investigated (Jamshidi et al., 2013). On this background, this study is a comprehensive literature review that aims to understand the challenges and opportunities associated with workload migration to the cloud and the best practices for an effective transition.

1.3 Research Aims and Objectives

The present critical review aims to understand the challenges and opportunities associated with workload migration to the cloud and the best practices for an effective transition. In light of that aim, the primary objectives of this concept paper are:

1) To determine the benefits following the transition to the cloud.

2) To understand the challenges of migration to the cloud.

3) To explore the key considerations that determine an effective transition into the cloud

1.4 Research Questions

The study will answer the following questions:

1) What are the benefits following the transition to the cloud?
2) What are the challenges of workload migration to the cloud?
3) Which key considerations should be taken into account to determine an effective transition into the cloud?

1.5 The Significance of the Study

This review is significant in various ways. First and foremost, Boutaba et al. (2023) claim that an increasing number of firms, regardless of size-small, mid-sized, or large are embracing the cloud model for their operations since it offers affordable business solutions. It is a well-known reality that every organization need cloud computing due to the widespread acceptance and popularity of this technology. Organizations can expect significant benefits from cloud computing, particularly on cost-effectiveness, operational efficiency, and creativity. The primary reason why businesses are moving to the cloud is its lower cost. The cloud helps shift large investments into

operating expenses and lowers maintenance, operational, and manpower costs. Due to their limited funding and resources, start-ups and small to medium-sized organizations are especially interested in public clouds (Boutaba et al., 2023). Additionally, Ahmad et al, (2020) note that while some organizations are preparing an initial migration, others have been utilizing clouds for more than ten years and are thinking about switching providers. Because of its size and the significance of the data it holds, the database is frequently the hardest component to move in both scenarios. Therefore, the study will offer recommendations for best practices that will help to successfully migrate and operate on cloud, enabling entities to realize the desired benefits while navigating market challenges more effectively. The analysis of the findings will be beneficial to organizations planning to adopt more cloud computing or to increase the migration of their workload to the cloud.

Also, Academics studying software engineering and cloud computing who are searching for relevant articles to locate and cite will find the study's findings useful. A methodical presentation of research provides a body of knowledge to create theories and solutions, evaluate research outcomes, and define future aspects on the topic of workload transfer to cloud computing. Third, this study may help to ease the transfer of workloads to cloud-based environments for other researchers who are curious about the methods and techniques that are now supported by tools, as well as their limitations and level of maturity. The outcomes will give them a basis of understanding on which to build.

1.6 Limitations, Delimitations, and Assumptions

Limitations

The methodology for this qualitative study design is a literature review. There are certain limitations to this research design that could restrict the research's findings and, thus, its generalizability. For example, there may be inherent bias in the publishing bias and search volume of this methodology. Publication bias, according to Wang et al. (2016), is the intentional publication of study results based only on their conclusions. Positive research results have a higher chance of being published than negative ones. This has an effect on literary reviews' caliber. Restricting a literature review's scope to published studies may lead to an excessive selection of studies and an overestimation of the effects, including the advantages and difficulties of workload migration in this particular situation. Wang et al. (2016) go on to say that publication bias may lead to an underreporting of inconsequential findings or an overestimation of the advantages and difficulties associated with workload relocation.

The bias arising from secondary data and the restricted range of databases that will be examined in order to locate the publications this study will cover are two more constraints. Only anything released between 2010 and 2024 that is fully searchable, publicly available, and written in English will be chosen. Since there is a growing body of research on modularized production in the pharmaceutical business, the article samples included in this study are not exhaustive. Bias is thus another potential study problem because of the possibility that some potentially relevant studies will be missed during the thorough literature search that will be conducted for this investigation in just these databases— Emerald Insight, Wiley Interscience, JSTOR, Elsiver's, EBSCO Host, Google Scholar, ProQuest, Scopus, and Taylor and Francis. Nonetheless, prior publication materials will be used to bolster the conclusions. The generalizability of findings may be negatively impacted by all of these shortcomings.

Delimitations

The study focuses on exploring workload migration into cloud. This study is a comprehensive review and analysis that cut across all industries and business sectors both small and large and both public and private organizations. The study will critically review and analyse the benefits that these organizations derive from workload migration to cloud, the challenges they face when migrating to cloud, and the considerations for effective migration strategies (which include the factors that should be put into considerations to ensure effective migration of workloads to cloud. From the findings, the study will provide recommendations on how organizations can perform successful migration of workloads to cloud.

Assumptions

The study assumes that workload migration to cloud is a seamless process that applies to all organizations depending on the type of migration that an organization decides to use. Thus, the benefits and challenges of workload migration to cloud applies to all organizations across industries whether small or big.

1.7 Definition of Terms

Workload – refers to a computational activity or process and the amount of processing, memory, storage, and network resources needed to complete it. Workload in the context of cloud computing is any service, application, or capacity that uses resources hosted on the cloud. Workloads in this cloud environment include virtual machines, databases, micro services, apps, nodes, and more. Workloads might be as simple as executing a single application or computation or as sophisticated as processing massive amounts of data or managing a network of related apps (Madhavaiah et al., 2012).

Cloud computing - this refers to a model for computing that depends more on resource sharing than on using computers locally. It is the method of storing, managing, and processing data via an internet-hosted network of distant servers as opposed to a local server or personal computer (Boutaba et al., 2023).

Workload migration - involves transferring applications, information, and associated hardware from on-premises settings to cloud service providers' platforms. In this case, the databases, virtualized data, software, and systems are accessed via the internet (Zaidan and Kurniawan, 2024).

1.8 Dissertation Structure

There are five main chapters in this research report. The first chapter, the introduction, provides the study's background information in addition to highlighting the problem statement, highlighting its importance, and outlining the study's goals and objectives. The constraints, boundaries, presumptions, and definitions of terminology are also covered in this chapter. In the second chapter, "literature review," relevant concepts and published academic sources related to workload transfer to cloud are compared and contrasted. It goes over the definition of workload, workload migration, kinds of workload migration, considerations for cloud-based workload migration, and reasons for cloud-based workload migration. The procedures required for the review program, including data analysis, ethical issues, and a summary, are covered in the third chapter, "Research Methodology." The fourth chapter presents, analyzes, and explains the data-gathering operation's findings. The conclusions for each research question and purpose are explained in this chapter, along with the advantages and difficulties of moving workloads to the cloud and suggestions for efficient workload migration and summarization. The results are

presented in the fifth chapter, after which a conclusion is provided with suggestions for further research, applications, and implications.

Chapter 2: Review of Literature

The goal of this critical comprehensive review is to understand the potential and difficulties that come with moving workloads to the cloud as well as the best practices for a seamless transition. This chapter offers a critical evaluation of past scholarly studies that looked at concepts related to the idea of shifting workloads onto clouds. The chapter explains the rationale for the cloud migration as well as the process for transferring workloads. The following section is a review of scholarly articles on the benefits, opportunities, challenges, and strategies to be considered in order to ensure a seamless transition.

2.1 Workload Migration to Cloud

2.1.1 Workload

Workload is defined as the computational task of assessing the processing, storage, memory, and network resources needed to complete a task (Moreno et al., 2014). Workload in relation to cloud computing is any service, application, or capacity that uses resources hosted on the cloud. Workloads in this cloud environment include virtual machines, databases, microservices, apps, nodes, and more (Zhang et al., 2014). According to Masdari and Khoshnevis (2020), the terms "workload" and "application" are frequently used synonymously. Although workloads and applications are essential parts of any IT architecture and are connected to each other (workloads can also be considered apps), their functions are quite distinct. Applications are programs, or collections of programs, made to assist users in doing particular tasks and fulfilling particular business requirement (Masdari and Khoshnevis, 2020). The processing needs of various tasks are referred to as workloads. Put differently, workloads drive applications (or portions of them). It's crucial to remember, though, that a task isn't always limited to one program. Tasks across apps are performed by many workloads (Moreno et al., 2014).

Moreno et al. (2014) affirm that workloads can vary from straightforward tasks like executing a single program or computation to intricate processes like handling massive data analytics or managing a collection of linked apps. Zhang et al. (2014) state that workload management is a crucial component of IT resource optimization that directly affects system stability, cost, performance, and, eventually, the success of business operations. Workload management has grown more difficult as cloud computing and virtualization have spread. Workloads can span platforms and regions by utilizing hybrid cloud, multicloud, and public cloud resources. Each has its own characteristics and management requirements (Zhang et al., 2014).

2.1.1.1 Types of Workload

There are different workloads in organizations. These include transactional workloads, batch workloads, high-performance computing (HPC) workloads, analytical workload, database workload, test and development workloads, real-time workloads and hybrid workloads (Narasayya and Chaudhuri, 2021). They are described below.

Transactional Workloads

Real-time user contact, usually in the form of several quick online transactions, is a component of transactional workloads. Transactional workloads are frequently used by e-commerce sites to handle payments, product searches, and other activities because they demand systems that can manage numerous concurrent users and respond quickly and consistently (Zhang et al., 2014).

Batch Workloads

Jobs that are processed in large quantities, frequently consecutively, are referred to as batch workloads. Batch workloads are prevalent in systems that analyze large volumes of data, such as weather modeling, payroll, and billing, since they demand a significant amount of processing

capacity. In order to avoid interfering with interactive or transactional workloads, these operations are frequently performed during off-peak hours (Elnaffar and Martin, 2002). Parallel processing, in which tasks are broken down into smaller assignments and processed concurrently across numerous servers and processors, is also frequently necessary for these workloads (Zhang et al., 2014).

Analytical Workloads

Analytical workloads are typified by intricate queries that operate on extensive datasets. These workloads do in-depth data analyses—often utilizing machine learning and artificial intelligence—to find trends, linkages, and insights, in contrast to transactional workloads, which entail brief, straightforward transactions. Analytical workloads are frequently utilized for data warehousing and big data analytics due to their high data throughput (Zhang et al., 2017).

Database Workloads

Foundational databases are essential to the operation of most enterprise systems. Apps that use a database will experience bottlenecks if it is not operating at peak efficiency. These problems are addressed by database workloads (Narasayya and Chaudhuri, 2021). Workloads on databases are optimized to speed up and enhance search capabilities for other applications that rely on databases. Additionally, they enable groups to examine data such as CPU and memory use, input/output (I/O) throughput, and query execution rates (Zhang et al., 2017).

High-performance Computing (HPC) Workloads

Complex modeling and mathematical calculations requiring a large amount of processing power are done by HPC workloads. A group studying meteorology might, for instance, simulate how El

Niño affects climate patterns. HPC workloads typically exhibit high levels of parallelism, much as batch workloads (Zhang et al., 2017).

Test and Development Workloads

Teams who are working on software development and testing frequently rely on test and dev workloads, which take care of things like code compilation, unit testing, and load testing. Test and development workloads can be unpredictable, much like the development process itself, and developers may need to swiftly supply and de-provision resources as needed (Elnaffar and Martin, 2002).

Real-time Workloads

These workloads are frequently crucial in IT contexts such as stock trading applications, video streaming services, and sports betting platforms that demand real-time, extremely quick data processing to offer immediate results (Zhang et al., 2014).

Hybrid Workloads

The complexity of IT environments has increased, necessitating the need for resources and tools that can perform a wide range of functions, frequently concurrently. This problem is where hybrid workloads, which blend aspects of various types of workloads, really shine. A real-time analytics app is a prime example of a hybrid workload (Elnaffar and Martin, 2002). The program uses transactional workloads to handle incoming data, analytical workloads to conduct complicated queries on the data, and batch workloads to generate reports. (Zhang et al., 2014).

2.2 Workload Migration to Cloud

The cost of computer resources has been trending downward, partly due to the quick development of information technologies (IT). The technologies that rely on computational resources are become more potent, complex, and widely accessible than ever before, even if the cost of these resources is still falling. Workload migration to the cloud is is usually facilitated by the cloud computing model, which was developed as a result of advancements in network and the internet (Tweneboah-Koduah et al., 2014). This model allows for easy network access to shared computing resources, which include networks, servers, storage, and applications. This also includes services that can be quickly provided without extensive management work or service provider involvement, as explained by the National Institute of Standards and Technology (NIST) (Ahmad et al., 2020).

Many are beginning to switch to cloud services due to the sharp rise in resource consumption. Clouds here refer to a vast collection of virtual resources that comprise of development platforms, hardware, and services. To best utilize available resources, these assets can be proactively reconfigured to adapt to a changing load (Zhao and Zhou, 2014). The virtualized resources state that, there are primarily three services available to use this cloud, i.e. PaaS, IaaS, and SaaS. With SaaS, users only need to use their web browser to access the hardware and software that has already been configured at the data center (Shethwala and Karamta, 2017). Cloud service providers offer platform as a service (PaaS). One platform for creating applications is set up in the cloud, so users may access it directly without having to install it on a physical device. This will increase the benefits of cloud computing and lower the cost of application licenses. Cloud providers offering IaaS make virtual machines available for use (Shethwala and Karamta, 2017).

The process of moving digital assets (such as databases, IT systems, apps, services, and other electronic resources) from a company's servers or appliances into the cloud is known as cloud migration of workload, according to Banerjee (2012). Moving digital assets from one cloud server to another is another use for it (Banerjee, 2012). In the end, cloud migration is about switching to cloud computing and/or storage from hardware or software solutions that are no longer as effective as they should be (Badshah et al., 2021). According to Gholami et al. (2016), cloud migration involves transferring an organization's workload, data, applications, or IT resources from private servers or internal data centers to public cloud architecture. Cloud migration can also entail shifting IT assets across cloud platforms, also referred to as cloud-to-cloud migration (for example, Amazon to Azure, and vice versa). This migration has seen multi-cloud and hybrid solutions grow popular and mainstream (Gholami et al., 2016).

Shethwala and Karamta (2017) add that the process of migrating workloads from one cloud to another or from the local setting to the cloud is known as cloud migration. Virtual machines are available for infrastructure services (Shethwala and Karamta, 2017). It involves moving all IT resources, including operating systems, apps, and data, to a physical server or the cloud (Banerjee, 2012). Furthermore, Alharthi et al. (2017) equally define cloud migration as moving organizational IT infrastructure like computer resources, storage, platform services, and software to the cloud. It frequently entails mixing a hybrid cloud—which may be accessed online for a small fee—with on-site IT equipment (Seenivasan, 2021). In general, cloud migration is the process of moving current on-premise data from a physical server to a cloud server that is under the cloud service provider's supervision and control (Cardoso et al., 2014).

Cloud computing is more than simply a data storage server; it is something that provides a range of internet-based services, including platforms, networks, storage, infrastructure, and many more,

regardless of the physical locations of users and servers. Thus, a CSP (Cloud Service Provider) that is reliable and offers services at a reasonable price can be selected by any company decision-maker (Fahmideh et al., 2017). This introduces the idea of virtual to virtual (V2V) migration, often known as cloud service migration. The transferring of data and other hardware and software components from a single disk partition to another different cloud service provider is defined by the migration model (Boutaba et al., 2023). Here, businesses, government organizations, and private citizens can choose from a range of services provided by cloud service providers, or CSPs. Cloud consumers, also known as users, typically utilize cloud computing for information archiving and sharing, database administration and mining, and web service deployment. These uses might vary from handling large datasets for complex scientific issues to managing and granting access to medical records (Tweneboah-Koduah et al., 2014).

For businesses, switching to cloud resources offers a number of benefits, including cost savings and resource scalability. Productivity software, CRM support systems, enterprise databases, business services, remote desktops, SD-WAN, platforms, web/mobile applications, network administration instruments, Internet of Things, and edge services can all be transferred via cloud migration services. Every firm has unique requirements that are fueled by IT and business requirements that the cloud can readily meet (Al-Mahdawi and Ali, 2016).

2.2.1 Types of Clouds for Workload Migration

There are different types of clouds that organizations adopt for migrating their workloads including public cloud, hybrid cloud, private cloud and community cloud as discussed below.

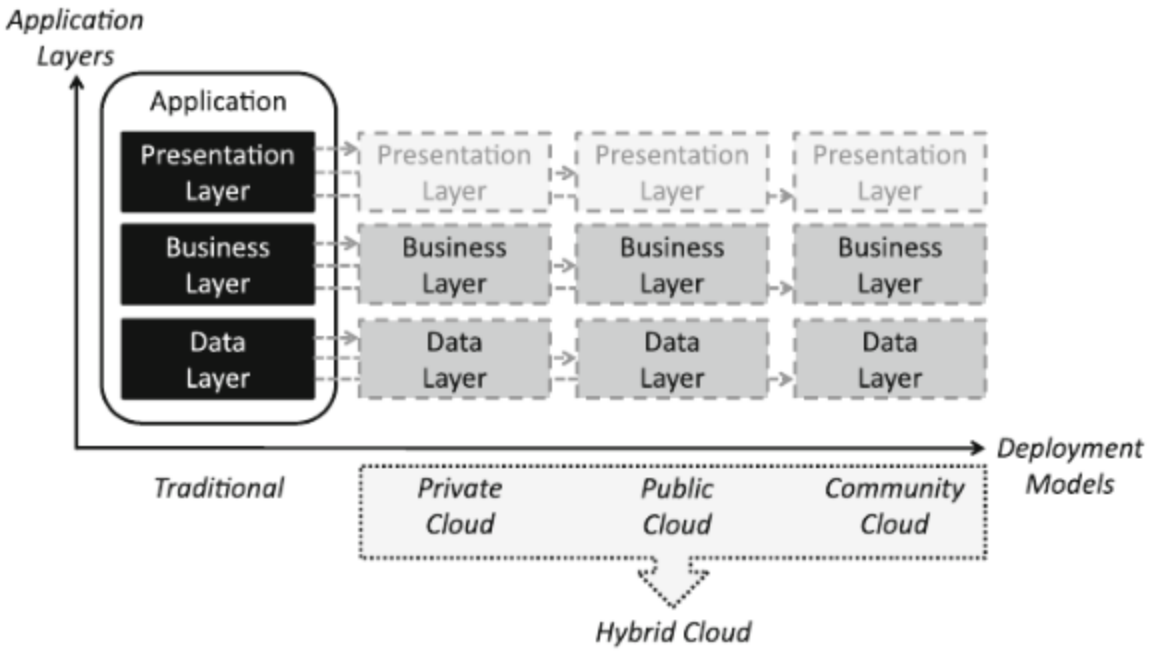


Figure 1: Overview of Cloud deployment models, application layers and possible migrations (Andrikopoulos et al., 2013)

Public Cloud

In this regard, a third-party entity that provides cloud services and owns the cloud infrastructure, which can be utilized by the general public or commercial entities (Huth and Cebula, 2011). Under this arrangement, cloud resources are availed as a service in public cloud platforms for a price that is largely based on the level of utilization. Customers in this case do not have to purchase any hardware to use the service and are able to scale their use as needed (Pathania and Mithani, 2020). Public cloud providers are usually in charge of the infrastructure and have to ensure the available resources can meet customer demand for capacity. In this instance, a public cloud offers a comparable range of features and services and is hosted online, making it accessible to everyone with an internet connection. Users of public clouds are predominantly local residents who access the public internet through an internet service provider (Grossman, 2009). Public cloud vendors such as Google, Amazon, and Microsoft (Amazon AWS,

Salesforce.com, Google Apps, Microsoft BPOS, and Microsoft Office 365) are accessible to the general public (Pathania and Mithani, 2020).

According to Huth and Cebula (2011), Consumer-submitted and produced data is typically stored on the third-party vendor's servers in public clouds. The public cloud offers several benefits, such as constant uptime and data availability, round-the-clock technical support, scalability on demand, low setup costs, and no resource waste. However, there are disadvantages to public cloud computing as well. These include concerns about data security and privacy, the possibility of data loss or corruption, and the uncertainty around data storage and backup procedures. Another issue with public cloud networks is reliability. For example, a two-day Amazon cloud disruption rendered hundreds of significant e-commerce websites inoperable or non-existent (Goyal, 2014). Thus, Jin et al. (2010) claim that enterprises have the responsibility of ensuring that the public cloud computing solution they choose is configured, implemented, and managed in line with their expectations on security, privacy, and other needs. While security is a major challenge limiting the utilization of public cloud computing, the cloud computing still has opportunities for innovation in the provision of security services that enhance the level of information security for businesses. Smaller businesses who lack the manpower in terms of IT administrators and security staff can particularly benefit the most from utilizing public cloud services, as they gain the capacity to take advantage of economies of scale that is mostly available to larger businesses that have invested in large data centers (Goyal, 2014).

In public cloud computing, there are defined non-negotiable service agreements that are set out by the cloud provider. However, there are service agreements that are negotiated between the ISP and the users (Grossman, 2009). By negotiating these agreements, organization ensure that concerns regarding security and privacy details are addressed through interventions like

employee vetting, ownership of data and withdrawal rights, violation alert, separation of tenant apps, encryption of data and discrimination, monitoring and reporting on effectiveness of service, adherence to regulations and laws, and the utilization of verified products fulfilling national or federal standards. Negotiated agreements have some similarities to traditional IT contracts for outsourcing used by agencies (Goyal, 2014).

Hybrid Cloud

Hybrid clouds brings together different clouds aspects that are drawn from private, community, and public cloud options, making them complicated to deploy compared to single types of cloud. Although each member is still distinct from the others, they are connected to one another by means of proprietary or standardized technology that permits data mobility and application between them (Goyal, 2014). Huth and Cebula (2011) define hybrid cloud as a combination of not less than one private cloud and one public cloud. For instance, it can be provided by either a public cloud provider partnering with a vendor who has private cloud platforms, or one who provides private cloud collaborating with a public cloud provider (Huth and Cebula, 2011). Under the hybrid framework, an enterprise manages both internal and external resources that are required for service access. Companies that particularly store their proprietary data in private cloud but host their other systems like CRM and HR data in a public cloud systems like Saleforces.com (Goyal, 2014).

Through the adoption of hybrid method, organizations get to benefit from increased cost-effectiveness and scalability offered by the public cloud computing infrastructure (Grossman, 2009). Additionally, hybrid clouds enable organizations to enjoy the benefit of control and security of private clouds along with the cost and scalability strengths of public clouds (Goyal, 2014). Accordingly, the advantages of implementing hybrid cloud computing include: lowering

the cost of capital relating to the organization's infrastructure by outsourcing needs to public cloud providers; enhancing resource allocation for short-term projects at significantly lower costs due to the utilization of public cloud, which eliminates the need for expenditures to carry out these projects; and assisting in the optimization of infrastructure spending at various phases of the application lifecycle (Jin et al., 2010).

Private cloud is suitable for production, while public cloud in contrast can be used for development and testing. More crucially, retiring applications—which may become unnecessary with the shift to SaaS—can be done far more affordably with public clouds than with dedicated on-premise equipment. Additionally, it provides support for cloud-bursting, gives the controls of a private cloud installation along with the ability to scale quickly using public clouds, and significantly increases organizational agility overall by leveraging public clouds to create new opportunities (Goyal, 2014). The first disadvantage of a hybrid cloud is that, with a portion of its infrastructure controlled by the service provider, it creates a greater surface area for assaults by extending the IT perimeter outside of corporate boundaries (Jin et al., 2010). Second, extending the existing business access and the system for identity management by shifting it to public clouds provides a better way of meeting the identity needs of hybrid clouds. This leads to the concern of how this strategy can impact the enterprise identification and how that will affect the firm’s security. Third, companies have to consider the security ramifications of utilizing management tools, whether built into the cloud platform or purchased separately, when managing complicated hybrid cloud setups. As per Huth and Cebula (2011), the management tool ought to possess the capability to manage identity and maintain security consistently in hybrid cloud systems. Additionally, a hybrid cloud greatly facilitates data transfer from private platforms to public cloud. Since the privacy concerns of public cloud vary widely with those of

private cloud, there are integrity and confidentiality challenges associated with such data migration. Finally, the associated security regulations risks related to the hybrid cloud architecture cover challenges of managing encryption keys of public cloud in relation to using a strictly private cloud framework (Grossman, 2009).

According to Goyal (2014), businesses benefit from hybrid clouds' increased flexibility and options for maintaining security and control. In most cases, hybrid clouds are utilized by enterprises that are prepared to shift a portion of their services to public clouds, especially in projects that need faster implementation more quickly or for cloud-bursting scenarios. There is no universally applicable hybrid cloud solution because of variations in needs of businesses and the implementation structure (Huth and Cebula, 2011). Furthermore, some extra facilities security considerations that are typically associated with public clouds, come into play since hybrid architectures incorporate both physical premises and the services of public cloud providers. The reduction of risks requires companies that seek to implement hybrid clouds to be cognizant of the multiple security requirements, while ensuring adherence to best practices within their industry. After it is secured, a hybrid cloud enables companies to migrate more apps to public clouds, leading to significant cost reductions (Goyal, 2014).

Private Cloud

The infrastructure of the cloud, under the private plan, is entirely managed on behalf of an entity. In some cases, it might be located onsite or offsite, and be operated by the company or another entity (Huth and Cebula, 2011). In this instance, only authorized third parties or members of the organization have access to the private cloud's cloud infrastructure. The intention is to ensure the utilization of cloud services internally while limiting their access to the outside world. In the case of a business that wishes to ensure its various branches have access to relevant customer data, a

private cloud is hosted in a data center that exclusively offers its services to employees of that business. Under private cloud, businesses get to enjoy greater security compared to public clouds and get to save on costs if they effectively use the space available in their data centers. By making these idle capacities available via cloud interfaces, one can benefit from the multiple features of cloud management software, such as taking advantage of the self-service interface, operating optimally through the use of automated resource management, and gaining the ability to extend excess capacity to affiliated businesses, while also using the same tools as when interacting with public clouds (Goyal, 2014). According to a survey released by the Aberdeen group, companies utilizing private clouds make a 12% cost saving over those utilizing public clouds (Jin et al., 2010).

Goyal (2014) further note that an organization can gain higher control over its infrastructure and resources if it uses a private cloud. Despite the technological differences of the various cloud models, they mostly have comparable benefits on data security and privacy, which offer organizations additional advantages for utilizing private clouds over public clouds (Goyal, 2014). Large-scale breach of cloud service have periodically occurred over the past few years, making businesses to start to pay attention to the issue, with some realizing that using a private cloud is less risky. The capacity of private clouds to virtualize services optimizes the use of hardware, hence lowering expenses and complexity (Jin et al., 2010). Since an organization's data and resources are among the most valuable assets, organizations are at risk when they entrust these resources to external parties that as they become targets of attacks time and time again (Grossman, 2009). As a result, private clouds were found to be the most secure and private. The key limitation of private cloud computing is its higher costs arising from the hiring of workers,

the purchase of software, and the burden of maintaining infrastructure. These lead to a rise in the cost of an organization's private cloud in relation to public cloud services (Goyal, 2014).

Community Cloud

To cater for the diverse characteristics of cloud customers, community cloud bridges the gap between public and private clouds by complementing private cloud in certain aspects while ensuring it is accessible to more than one business. Its larger scale of infrastructure and computational horsepower can be utilized by more organizations seeking to address their privacy, security, and regulatory challenges (Huth and Cebula, 2011). In addition to leveraging more of the self-management breakthroughs from autonomic computing, this type of cloud aims to bring together distributed resource provisioning from grid-based computing, distributed management from digital ecosystems, and sustainability from environmentally friendly computing with the use cases of cloud computing. using user computers' unused resources to create a community cloud in place of vendor clouds, where nodes might play the roles of producer, consumer, and—most importantly—coordinator (Goyal, 2014).

One of the benefits of community clouds is that they might be more affordable to set up than individual private clouds because the costs are shared by all users. Secondly, a cloud provider may be hired to handle the community cloud. The benefit here is that, aside from what is required by contract, the provider would be an unbiased third party that is obligated by law and has no favor toward any of the clients involved (Jin et al., 2010). Third, the community cloud's features, which include just-in-time manufacturing and delivery and return tracking, can be utilized to make the most of the data kept to benefit customers and the supply chain (Grossman, 2009). Community cloud offers benefits, but it also has drawbacks. Among these are the greater

costs in comparison to public cloud. and a set quantity of data storage and bandwidth that are shared by all community members (Goyal, 2014).

2.3 Factors Influencing the Migration of Workloads to Cloud

There are various factors that an organization have to consider before the migration of workloads to cloud. Failure to consider these factors may bring challenges to organizations when they migrate their workload to cloud. Costs, institutional preparedness, intricacy, rules, current infrastructure and IT investments, privacy and security of data, network and support, IT skills, availability, and security architecture are a few of these factors. These are discussed below:

Costs

A combination of capital and operating expenses makes up the IT on-hand cost model. Businesses typically budget for peak loads that require larger capital expenditures. Despite their high cost, these expenses are planned for and predictable. Paying for resources according to utilization would be necessary to transition to a cloud-based operational cost model (Morgan and Conboy, 2013). This model suggests erratic operating expenses, particularly for applications where demand for websites with a public face fluctuates. As a result, before shifting their workload to the cloud, businesses should evaluate application consumption and operational costs. Further, before deciding to switch to the cloud, migration expenses must also be recognized and taken into account. Should this not be done, the anticipated cost reductions from Cloud adoption may be nullified. (Rai et al., 2013).

Complexity

Workloads or programs that are simple can be moved to the cloud with ease, and the effort involved in doing so might not be very high. These programs can be easily converted to SaaS

programs that are already offered by different suppliers. Email programs, for example, can be seamlessly transferred to cloud services such as Google Apps, Office365, and Lotus Live. Similarly, it might not take as much work to switch from a basic web server to IaaS platform (Pathania and Mithani, 2020). Complex application transfer, however, requires thorough preparation and testing before going live. The migration of workload to the cloud may be impacted by the need for code modifications for legacy and current enterprise apps in order for them to function on the cloud (Rai et al., 2013)

Institutional Readiness

A few essential services must be operational and prepared for cloud migration. For instance, digital government services, public data centers, and digital services are only a few instances of what the organization does as a public one. Before moving workloads to the cloud in public companies, these services should be taken into account as they facilitate a seamless transition to the cloud (Tweneboah-Koduah et al., 2014). Furthermore, institutional realignment is necessary for cloud migration. It necessitates management, operational, cultural, administrative, and training improvements. These all have an impact on workload transfer to the cloud (Pathania and Mithani, 2020).

Regulations

Before moving to the cloud, geopolitical concerns should be thoroughly considered, particularly for governments and financial institutions. This is particularly important in the Indian context, for example, because the majority of cloud data centers are not situated there. Prior to opting to migrate to the cloud, it is imperative to confirm compliance with pertinent local rules specific to each enterprise (Rai et al., 2013). Organizations must also make sure that standards, laws,

compliance, and audits are followed, according to Pathania and Mithani (2020). A cloud provider's system may fall down, but with minimal effort, an organization can use its data, tools, apps, and virtual images in other cloud-based environments thanks to cloud standards, which are an agreed-upon method of ensuring interoperability. Up until now, cloud computing standards and policies have been a major source of anxiety. The regulatory requirements pertaining to cross-border information movement and cloud adoption provide an equally formidable obstacle (Pathania and Mithani, 2020). Electronic surveillance is another difficult problem associated with the cloud, especially when it crosses international borders. The constitution of the United States protects citizens from arbitrary search and seizure. Usually, in order for the authorities to look through someone's personal computer's data, they need a search warrant. It's unclear if data that is backed up in a cloud data center is safeguarded, especially if that data center is located abroad (Tweneboah-Koduah et al., 2014).

Existing Investments in IT

In undertaking cloud migration, small and medium-sized businesses have higher flexibility than larger firms. This is due to the possibility of a greatly constrained installed IT support SMEs moving straight into the cloud. However, the majority of big businesses have already made large expenditures in their IT infrastructure. Their current IT environment is highly complicated, requiring significant investments in hardware, network, application support, and administration, making a transition away from it challenging (Rai et al., 2013)

Data Security

The security of data and other computing resources is a key concern when thinking about moving to cloud. It would be preferable for workloads containing extremely private and sensitive

information to be protected by the corporate firewall. However, data that can withstand more security threats might be moved to the cloud. The most significant barrier to cloud adoption is still data security, despite ongoing technological advancements in this area (Rai et al., 2013)

IT Skills

Even though Cloud leverages the latest technology, IT staff still need to have up-to-date knowledge of architecture, development, implementation, and operation. Companies that do not utilize the latest technologies find it harder to migrate to cloud. Furthermore, IT teams sometimes believe they are losing control when workloads are moved to the cloud. It would be necessary to address these kinds of cultural issues before deciding to migrate to the cloud (Rai et al., 2013).

Provisioning

Rapid resource provisioning is one of the Cloud's primary features. Cloud computing is best suited for workloads that must be instantly available and scaled up quickly in response to demand. The majority of enterprises have business needs that must be met with rapid IT data provisioning; one example of this would be an organization that is executing a transient internet marketing campaign. A number of applications, such as those related to payroll and HR, are also seasonal in nature and can only be completed during specific times of the year. Applications of this kind can benefit from the Cloud's capacity to deploy resources rapidly (Rai et al., 2013).

Network and Support

There is a genuine chance that the network will collapse as more workloads go to the cloud. Furthermore, it might be necessary to enhance the bandwidth due to the high connection volume to the external Cloud. Organizations would therefore need to make plans for more dependable and superior network connections to the Cloud. This creates the possibility that businesses could

be charged more to enjoy robust network connections. Additionally, telecom providers would need to provide more support to ensure that the possibility of downtimes is kept to a minimum (Rai et al., 2013). Tweneboah-Koduah et al. add that most Cloud deployment services are evaluated over hypertext transfer protocols via the internet. Any company considering cloud adoption needs to make sure that its service users can access the internet with consistency and dependability. In fact, the key to successful cloud adoption and usage is ubiquitous connection (Tweneboah-Koduah et al., 2014).

Existing Infrastructure

The industry's present demands are met by the traditional IT architecture. On the other hand, switching to the cloud would need an alteration to the IT architecture. The delivery of IT to end users would drastically alter as workloads moved to the cloud. The reaction from the cloud service provider would determine some end user assistance. Thus, businesses would need to focus on developing competitive vendor management (Rai et al., 2013)

Security Architecture

To fit into the Cloud ecosystem, security measures for applications and controls would require to be modified. In order to safeguard data both in transit and at rest, new kinds of methods would be needed. For cloud deployments, identity and access management systems would need to be modified. It is also necessary to take into account cloud key management and data encryption techniques (Rai et al., 2013).

Privacy

In a cloud setting, privacy refers to a user's or a company's capacity to manage what personal information they disclose online or to a cloud service provider, as well as who can access that

information (Rai et al., 2013). Regarding user trust and legal compliance, this is a critical issue for cloud computing consumers and, more significantly, the government. Every stage of the design and execution process must take this into account (Tweneboah-Koduah et al., 2014). Because there aren't enough rules to prevent users from disclosing information to cloud providers or other users, the cloud environment is plagued by complicated privacy and confidentiality difficulties (Pathania and Mithani, 2020). For example, when it comes to public organizations like government institutions, the government could not be willing to share her information, but it might already be stored on the cloud, which could have negative effects on their services and occasionally the state as a whole (Tweneboah-Koduah et al., 2014).

Service Level Agreements (SLAs)

Before moving to the cloud, it's important to think about whether cloud service providers can offer the SLAs that the company requires. Considering how little control businesses have over apps in the cloud, this is quite important (Morgan and Conboy, 2013). SLAs must handle issues with application integrity, confidentiality, and availability. It should also explicitly state the obligations of service providers and the consequences of not meeting service levels that have been agreed upon (Rai et al., 2013).

2.4 The Phases and Processes of Cloud Migration

Organizations must follow certain protocols to ensure a successful cloud migration. There are several steps in place to improve migration's efficacy.

Feasibility study: Any preparations for cloud migration must first be completed by completing a feasibility evaluation. This include gathering important data about the workloads, programs, and dependencies that are currently in use, evaluating this data, and identifying potential candidates

for migration. Verifying the server inventory, analyzing server affinity, and tracking server utilization are the primary tasks for this phase (Al-Mahdawi and Ali, 2016). This step often yields the identification of workloads and associated expenses that are appropriate for hosting in a particular cloud environment. Typically, the same is offered as the "Application Report" (Al-Mahdawi and Ali, 2016).

In this stage, a corporation will try to ascertain at this point whether or not migration is feasible from a technical and economic standpoint. To study the existing system and try to understand its behavior, they need to collect data about functioning systems. A company must evaluate the expense of the transfer in light of its needs in order to decide whether or not a migration is feasible (Shethwala and Karamta, 2017). This phase is called the discovery phase because it involves employing both basic configuration management system processes and migration-oriented processes to find the source environment. This phase involves gathering data on both static (such hostname, IP, and OS type) and dynamic (like CPU utilization and workload characterisation) aspects of the source setup. The dynamic workload characteristics may need instrumenting the sources for a period in order to collect the required data prior to transfer (Gholami et al., 2016). This phase helps to determine the costs and technical issues that must be resolved before cloud implementation. To determine if the financial and technological aspects are ideal, a thorough examination must be carried out (Odun-Ayo and Agono, 2018).

Requirement analysis and planning: During the requirement evaluation phase, an organization must ascertain what needs to be moved and any new requirements. During the planning stage, a comprehensive examination of the existing surroundings and the elements that require relocation is necessary. It entails developing microdesigns for certain sources and targets. The whole cost of migration needs to be ascertained once the study is complete (Shethwala and Karamta, 2017). In

other words, the kinds of information and programs that will be transferred to the cloud are taken into account during this phase. At this stage, the operating system, filesystems, middleware, which is users, and other application components are developed, provisioned, and configured along with the target platform(s) infrastructure (Gholami et al., 2016). To ensure that migrating a software program is a sensible step, a cost-benefit analysis is conducted once again (Odun-Ayo and Agono, 2018). The logical design of the cloud applications must be completed after the targeted applications have been inventoried and prioritized. As a prerequisite, this stage entails meticulous planning and design of the target environment, which includes memory, CPU, and disk storage (Al-Mahdawi and Ali, 2016).

In this case, data from the feasibility study is used to choose migration candidates. There are several steps to this process, including workload migration objective planning (high-level objectives), fit for purpose analysis (which examines recommended practices for specific workload categories), and macro design(s) involving financial data for ROI. At this point, a migration plan that has been decided upon in consultation with the customer is produced (Gholami et al., 2016).

Scheduling: The scheduling procedure entails figuring out the migration window of opportunity. This requires an understanding of the activities that take place during a typical business day in order to determine the best time to work, when the least amount of disruption to people and the system occurs. As such, once a time has been established, it can be set for that time (Shethwala and Karamta, 2017).

Migration Execution: At this moment, the migration is actually completed. It depends on the migration plan that is chosen. Actual data is transmitted and moved from one device to another in this step (Shethwala and Karamta, 2017). More complex apps require a more rigorous

deployment process; all easily migrated apps are relocated and evaluated (Odun-Ayo and Agono, 2018). All things considered, once the target has been selected, the operating system installed, and the main middleware packages loaded, the application configuration can be migrated during this phase. This is the step that requires the greatest care and is customized to the target environment for every source component. The set-up migration process must be combined with the copying and adjusting of data that the apps require (Gholami et al., 2016).

Final Testing and Go Live: To guarantee that the migration is successful, final testing must be performed before the system is turned on. If it's data, you should confirm its integrity by examining its checksum to determine whether or not all of the data was transferred successfully. Cross-verification is necessary for data flows during virtual machine migrations. It can go online if everything is verified and the data is accurate (Shethwala and Karamta, 2017). In this case, a parallel approach is suggested whereby the cloud-migrated processes or apps remain available in the on-site data center. However, cloud apps will be tested using internal data, and any discrepancies will be resolved by observation (Odun-Ayo and Agono, 2018).

Pre-Migration: In this step, a migration is simulated and the system is tested to determine whether it is ready for the migration or not. The movement mechanism has to be tested, and any necessary fixes need to be made. Understanding the system's performance during migration would also be beneficial so that any issues may be fixed before the actual shift takes place (Shethwala and Karamta, 2017). Any necessary script modifications for the destination operating system are covered by remedial and testing (Gholami et al., 2016).

***Implementing the Migration*:** Using the best method available, the workloads are transferred to the cloud platform in this step. The method consists of multiple steps, the first of which is setting up the target. An enterprise must therefore have a clear idea of the desired cloud environment at

this point. The target infrastructure preparation is different depending on whether the cloud is a private, public, or hybrid cloud type. The actual migration scenario affects the preparedness level as well. But typically, the standard need is to create a virtual machine instance using one of the target cloud catalog's accessible images (Al-Mahdawi and Ali, 2016). This phase also involves reinstalling the existing workload's software stack on the target cloud platform or migrating/creating images from existing workloads. This is the stage of data migration, whereby data is moved from the target cloud environment to the existing environment (Shethwala and Karamta, 2017). Additionally, standardization is carried out at this point, which entails modifying or standardizing the generated image to make it compatible with the cloud setting's infrastructure management services. 5) Integration: complete integration wherever necessary to guarantee that the transferred workload is connected to data and application services that are dependent on it in the cloud environment (Al-Mahdawi and Ali, 2016)

Monitoring and Maintenance: Monitoring is essential following any system migration. The virtual machine needs to be watched to make sure it isn't running in an anonymous fashion, even after it has been successfully moved and is functioning as planned (Shethwala and Karamta, 2017). After migration, it is often imperative to keep a close check on the process for reliability and other security concerns. Currently, a number of CSPs provide usable cloud monitoring solutions. (Odun-Ayo and Agono, 2018).

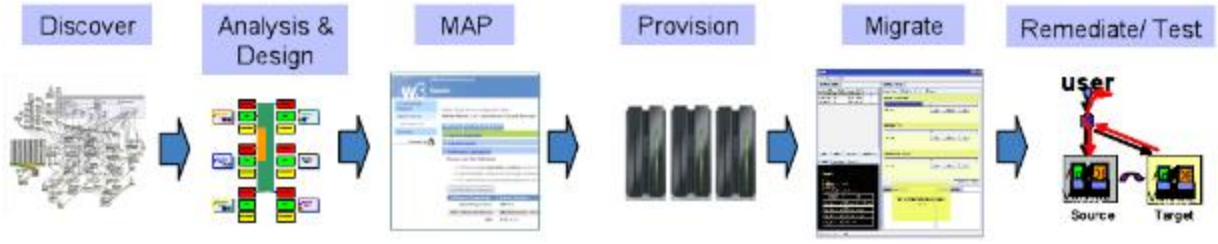


Figure 2: Workload migration through an integrated automated process

2.5 Types of Cloud Migration

There are different types of cloud migration. This includes replacement, whole stack, partial, and cloudify, as discussed.

Replacement: This type of cloud migration involves moving one or more components to the cloud (Andrikopoulos et al., 2013). People dislike this type of cloud migration since it requires reconfiguring alterations from one site to another. Due to the differences in the designs of the two cloud providers, such services must be reconfigured. One illustration would be switching from a local system to a virtual computer hosted by Amazon Web Services (Rai et al., 2015).

Partial: Partially migrated applications have some functionality transferred to the cloud. If people are using two different cloud services to do the same operation, then one or more software layers in the cloud's architecture will be needed to complete the task (Shethwala and Karamta, 2017). According to Rana and Rahman (2018), this approach places a strong emphasis on transferring some of the application to the cloud. Using this approach, the danger of unexpected behavior during the application migration might be reduced by optimizing each moved component separately. In a traditional datacenter, communication between components can be accomplished by building temporary wrappers. Wrappers use well-defined interfaces to encapsulate and conceal an entity's underlying complexity. Wrappers should be made

asynchronous and cloud aware to guarantee that communication is not disrupted by fluctuating internet latencies (Rana and Rahman, 2018). Using Google App Engine and Google Mail in tandem to create an application for a required email service would be a partial migration (Andrikopoulos et al., 2013).

Whole stack: This is an example of cloud migration in the real world. With this type of cloud, all applications must be moved among cloud service providers (Shethwala and Karamta, 2017). No reconfiguration is required because the entire enclosed virtual machine (VM) can be transported to a separate CSP and launched there. People tend to prefer this type of cloud migration when they need infrastructure that is more suited for their business. Changing from OpenStack to Amazon Web Services EC2 is one instance of this (Rai et al., 2015).

Forklift Migration: Applications that are closely connected, self-contained, and stateless are best suited for this migration strategy. Instead of relocating the application system piecemeal over time, the entire system is migrated to the cloud. This significantly lowers the risk associated with making modifications to an existing application's code (Zhao and Zhou, 2014). Rana and Rahman further state that the majority of the adjustments will include moving to relational databases in the cloud, copying your application binaries, building and configuring virtual machine images, configuring elastic IP addresses and security groups, and DNS. Maintaining a backup plan, rollback strategy, and end-to-end testing are critical components of this methodology (Rana and Rahman, 2018).

Cloudify: One way to refer to full cloud adaptation is "cloudify." This kind of migration moves all of an application's functionality to the cloud. One example of cloud computing is building any application using the cloud's architecture, platforms, apps, and software (Shethwala and

Karamta, 2017). Service providers try to develop cloud-native solutions in this type of migration (Andrikopoulos et al., 2013).

Phased Migration: Organizations can transfer their application to the hosting platform gradually by employing this strategy. According to Zhao and Zhou (2014), this migration approach is best suited for businesses who cannot afford to experience extended periods of downtime. Phased migration necessitates a lot of labor and a lengthy time to complete the migration procedure. With the least amount of downtime possible, testing can be done ahead of time by adhering to the customers' standards (Rana and Rahman, 2018).

2.6 Strategies of Cloud Migration

Treating cloud migration as just another IT project is to miss the mark. Cloud migration is a complicated, resource-intensive, time-consuming process that may be simple to understand but difficult to accomplish. Businesses must devote enough effort to developing a cloud migration plan that closes the gap between expected and realized advantages (Zhao and Zhou, 2014).

1. Rehosting

Rehosting, also known as the lift and shift technique, involves the use of infrastructure-as-a-service (IaaS). To utilize the cloud server, a business just needs to redistribute its current data and applications. It involves distributing the business application across the newly created cloud hosting environment. To use the cloud under this technique, a business does not need to change the app's architecture or code. However, organizations that are new to cloud computing and want to take advantage of the deployment speed in less time or money consider rehosting (Fahmideh et al., 2020).

Zhao and Zhou (2014) support that The quickest and most straightforward method for moving legacy apps to the cloud is usually the lift and shift technique. Lift and shift leverages an application's original infrastructure, thus it doesn't require new coding or architecture in a cloud context. The hardware and the application's new cloud environment are the only things that change (Zhao and Zhou, 2014). However, since legacy apps originate from an on-premises environment, there is a specific drawback to employing this technique. This is the reason why legacy apps can handle a certain amount of workload. The workload associated with an application may vary when a company migrates from on-premises to the cloud. The administration and functionality of the application itself are impacted by this. Lift and shift is an excellent technique to get the cloud setting up and running quickly and effortlessly if a corporation does not anticipate any challenges with workload balance and control (Madhavaiah et al., 2012).

2. Re-Platforming

Adopting a re-platforming cloud approach enables a company to modify and enhance applications to enhance its utilization of cloud-based resources. Platform-as-a-service (PaaS) is the model used in this instance (Zhao and Zhou, 2014). But the applications' fundamental architecture hasn't altered (Fahmideh et al., 2020). To prepare an application for cloud use, minor and simple architectural adjustments must be made. For instance, changing how a certain application interacts with databases to enable server-less databases in the cloud could be one example (Madhavaiah et al., 2012).

Zhao and Zhou (2014) assert that replatforming is less risky, faster, and more economical than refactoring. In comparison to rehosting, it also increases automation and boosts application performance, security, and scalability (Zhao and Zhou, 2014). Replatforming offers a solid

balance between the reliability of refactoring and the quickness of lift and shift for anyone wishing to move legacy apps to the cloud. The client end of the apps typically remains unchanged during replatforming. This implies that businesses can go to the cloud without having an impact on their clientele. It is usually the initial step in upgrading an organization's legacy applications and is a significantly faster process than reworking. Problems could come up at any time during the replatforming process. Replatforming, however, can be a beneficial choice if a company's IT staff is knowledgeable and flexible (Madhavaiah et al., 2012).

3. Re-Purchasing

For businesses who are having trouble managing numerous services or apps and have highly customized legacy landscapes, repurchasing is the ideal option. A business using a repurchasing cloud migration plan must replace all of its current apps with a cloud-native, SaaS-based platform, like an in-house CRM integrated with salesforce (Fahmideh et al., 2020). The problem is that the team might not be accustomed to a new platform, therefore a business could need to provide training. However, the development costs are saved (Zhao and Zhou, 2014).

4. Refactoring

Refactoring is a methodical process that reorganizes an existing code base by modifying its internal organization while leaving its exterior behavior unchanged. Refactoring enhances software architecture, facilitates comprehension of the program, speeds up bug detection, and accelerates program execution (Madhavaiah et al., 2012). Refactoring is the process of starting over and rewriting an organization's apps in order to take advantage of cloud-native features like serverless computing and auto-scaling. This approach necessitates starting from scratch when developing the system in this instance. Refactoring calls for a considerable time and resource

commitment, as well as the potential need for large coding modifications. The legacy system is being redeveloped with an emphasis on utilizing the most recent technical advancements that may be incorporated into the system to meet its evolving needs. According to Rana and Rahman (2018), this method explains the "Database First Approach" and the "Database Last Approach" for migrating the database before to and following the migration of source code. Additionally, the IT staff must keep in mind to upgrade any connections to other applications. Most of the time, legacy apps are connected to several apps within the IT architecture of a business. The inability of your staff to use essential software programs could result from not updating all of these integrations.

Refactoring is ultimately the most environmentally friendly way to migrate to the cloud, even though it takes some time. The price is the one drawback, though. Refactoring is effectively rebuilding a legacy application from the ground up, which means it costs money and takes time. It could be necessary to hire an external migration consultant because the process is so complicated. But in the long run, the expense will be justified (Madhavaiah et al., 2012).

5. Retiring/Decommission

Retirement refers to the process of decommissioning or archiving elements of an organization's application that are no longer needed. When the time comes for them to migrate, the savings from delaying them could strengthen your case for application migration (Zhao and Zhou, 2014).

6. Retaining

One cloud migration strategy that can help a company do it skillfully without interfering with corporate operations is retaining or revisiting. By requiring more substantial modifications to the design and code of the systems being migrated to the cloud, revising improves on the earlier

strategies. This is done to allow apps to fully utilize the cloud's capabilities, which can necessitate making significant code modifications. This tactic calls for sophisticated understanding and advance planning (Zhao and Zhou, 2014).

2.7 Motivations for Cloud Migration

Businesses are shifting their workloads to the cloud for a variety of reasons. One of the reasons is that it has a greater reach, to start. This is a result of enterprises shifting from local to cloud settings, allowing customers to access and take advantage of the cloud's elastic nature. In the cloud, processing power and hardware resources have no boundaries (Odun-Ayo and Agono, 2018). Moreover, mobile access is facilitated by cloud computing's independence from platforms and devices. It is accessible from any location, on any device, and with any kind of operating system. Their services can be accessed by clients from any location, including their home office (Shethwala and Karamta, 2017). Tweneboah-Koduah et al. (2014) add that easy access is one of the driving forces behind cloud services. This is because cloud services are web-based and internet-based, which means that a range of internet-enabled devices, including laptops, tablets, cell phones, phablets, and classic PCs, may access them.

The second reason is because of the adaptability and agility of the firm. The flexibility of the cloud allows a business to extend service for a certain number of hours. Additionally, companies can employ cloud computing to expand their service offerings because it provides more flexible administration (Shethwala and Karamta, 2017). The results of Jamshidi et al. (2013), which showed that operational cost savings, flexibility, and scalability are the main drivers of cloud adoption, lend support to this. The results show that a sizable portion of respondents (46 percent in the most recent edition compared to 53 percent in the original version) cite flexibility as the benefit that the cloud offers to the company. Of the participants, 31% voted for flexibility, and

only 28 percent for cost savings. According to reports, the fourth major factor influencing cloud adoption is application scalability. The results unequivocally show that moving applications to the cloud is primarily motivated by cost savings, scalability, effective resource usage, and flexibility (Jamshidi et al., 2013).

Third is the heightened security. Customers can go from the public cloud to the private cloud, which has stronger security, if they would like even more security while using the public cloud. Customers can also save and backup their personal data on the cloud, which enhances security (Rai et al., 2015). IT decision makers (ITDMs) cite recovery from disasters and continuity of operations as their main reasons for investing in the cloud (40 percent), followed by the replacement of on-premise legacy systems (39 percent), according to IDG (2022). Given the overwhelming tendency to use cloud-based services by default for new features and systems, both make sense. According to IDG (2022), nearly one-third of ITDMs also mention reducing total cost of ownership (34%), enhancing worker productivity (33%), and boosting adaptability to changing market conditions (32%).

Fourth, users can benefit from improved responsiveness because cloud computing doesn't involve the installation of hardware or software. It is up to the users to use the services as needed. Many cloud systems are operating on any calculating activity, enhancing the cloud's responsiveness, so it will be done rapidly (Rai et al., 2015). Fifth, better application utilization insights are offered by cloud computing. This is accurate given that cloud computing depends on a resource pool. For analytics applications, cloud computing provides an enormous amount of processing power, storage, and RAM, which makes the process quick and easy for users (Odun-Ayo and Agono, 2018). An additional incentive stems from the enhanced accessibility provided by cloud services' 24/7/365 the availability and cloud service provider management (CSP).

Availability varies based on the CSP and the terms of the Service Level Agreement (SLA) with the CSP (Qazi et al., 2024). But according to Rai et al. (2015), services nowadays are incredibly dependable and rarely experience downtime. Finally, the reason why organizations are moving to the cloud is the reduced and/or redistributed costs. When people adopt cloud infrastructure, their hardware installation expenses decrease because the infrastructure is now managed by CSP. The cost of platform software licenses is reduced by moving to the cloud. This also holds true for software services, which consumers may access directly without needing to set up any kind of software on their PCs (Shethwala and Karamta, 2017).

Timelines and priorities make up the seventh incentive. A corporation is more likely to have any given workload or application in the cloud or be in the process of moving it if it has a greater cloud budget or has more of its IT infrastructure in the cloud. This is understandable considering that a greater dedication to cloud computing is indicated by a larger cloud budget and presence. But compared to companies that are fully on-premises or mostly in the cloud, those that remain mostly on-premises but have migrated some infrastructure to the cloud are noticeably more likely to be considering migrating any given application or workload. This is likely because migrating a few things to the cloud increases pressure to move more (IDG, 2022).

An additional incentive is increased competition. Cloud computing is seen by both startups and well-established IT companies as a clever business strategy to meet objectives and maintain competitiveness. Larger companies are thinking about business continuity strategies in an effort to take advantage of this platform's benefits. Benefit derived from this is the cost-flexibility that makes pay-per-use models preferable to the upfront purchase of an overprovisioned infrastructure. Additionally desired are the cloud environments' interoperability, scalability, and dependability. Many companies continue to use "legacy systems," which are programs that were

developed over the course of an organization's existence using traditional development approaches (Jamshidi et al., 2013). Despite maintainability issues, on-premise legacy systems remain crucial because they support vital business functions that are difficult to replace (Jamshidi et al., 2013).

Covid-19 pandemic is another motivating factors. Gokarna (2021) affirm that for a number of years, the subject of whether to shift workload from on-premises to the cloud has been pertinent. Prior to 2020, as businesses began to feel the consequences of the COVID-19 epidemic, a small number of businesses moved to the cloud annually. The epidemic prompted many businesses to switch from on-premises to cloud-based software in their IT infrastructure (Gokarna, 2021). Jawale (2022) concurs that the COVID-19 epidemic is contributing to the lofty objective by necessitating a rapid pace of organizational digitization. According to research by Synergy Research Group, the COVID-19 pandemic accelerated an industry trend that has been going for ten years toward running enterprise workloads in the cloud rather than on-premises servers or through managed providers. As a result, in 2020, global enterprise spending on cloud infrastructure overtook spending on data center software and hardware for the first time (Jawale, 2022). Prior to the COVID-19 crisis, businesses were adopting the cloud; in fact, most of them planned to move the majority of their IT hosting expenses to the cloud. However, the pandemic increased the necessity of using the cloud (Gokarna, 2021).

Further concurring with this finding is Athambawa et al. (2023) who assert that The necessity for enterprises to transition to cloud computing has only increased in the wake of the Covid-19 outbreak. Systems within organizations can be made more resilient, flexible, adaptable, and scalable by utilizing the elasticity of cloud capabilities. Companies must expedite their cloud migration in light of the post-pandemic environment, which is characterized by a strong need for

remote labor, online commerce, and virtual learning among other major shifts in consumer demand (Athambawa et al., 2023). However, Tubre and Rodeghero (2020) contend that the COVID-19 epidemic has made it more important than ever to include cloud-based technologies into software systems. An impartial survey of 500 IT decision-makers worldwide found that 87 percent of them agreed that the COVID-19 pandemic will cause an acceleration of the cloud migration process. It follows that enterprises will be moving their apps to the cloud, albeit with some difficulties (Tubre and Rodeghero, 2020).

Chapter 3: Methodology

Understanding the potential and difficulties involved in moving workloads to the cloud, as well as the best practices for a smooth transition, is the goal of this study. To address the research topics, the study used a qualitative, systematic evaluation to assess previous research papers. The outcomes of every independent study that were incorporated into the systematic review were narratively synthesized through content analysis. The author followed the six standard procedures for writing a review article: defining the study question and objective, looking through recent literature, screening for inclusion, evaluating the value of the primary study, extracting data, and analyzing data.

3.1 Literature Review

A literature review is a research methodology that evaluates and summarizes the corpus of existing information on a particular topic (Snyder, 2019). According to Lacey et al. (2011), even seasoned scholars might struggle to finish this assessment, especially in the current environment with its pervasive internet use and wealth of potentially relevant materials. Still, the literature is a valuable resource for the investigation. First and foremost, it can give a researcher access to a corpus of material they were not previously familiar with. Additionally, it could provide insight into what was completed effectively and correctly, reducing the amount of time lost—especially when attempting to spin the wheel (Lacey et al. (2011). Conversely, a review of the literature might help researchers pinpoint the limitations of earlier studies. Using this approach, a researcher might discover novel ideas that they can use (Snyder, 2019). According to Lacey et al. (2011), a literature review can help researchers place their survey within a larger framework so they can come up with novel, reliable findings. Most importantly, it can provide the reader with

guidance on a variety of topics, such as lowering childhood malnutrition, and provide solutions to theoretical or real-world nursing issues.

It is interesting to note that there are different types of literature reviews; for this study, we'll employ the systematic literature review. According to Snyder (2019), the scientific process of systematic review is made up of exact procedures and strict guidelines that attest to the impartiality, rigor, responsibility, and openness of the approaches and how they are applied. The methodology includes a methodical strategy to selecting, evaluating, and analyzing the corpus of literature. According to Nightingale (2009), systematic reviews aim to incorporate all currently available evidence on a topic while assessing the quality of this evidence, making them an open and reproducible method of synthesizing scientific data to address a specific research question. By relying on precise, methodical techniques to lessen bias in the selection and inclusion of studies, to evaluate the quality of each included study, and to objectively summarize them, the review approach seeks to lower the risk of bias and improve transparency at every stage of the review process (Nightingale, 2009). A thorough search to find all pertinent published material on a topic, a methodical integration of the search findings, and an evaluation of the quantity, kind, and quality of evidence in relation to the study's topic are usually involved in systematic literature reviews (Snyder, 2019).

This study's systematic literature review section provides a comprehensive examination of the corpus of literature on workload migration to the cloud. It delves deeply into the possibilities and issues of the migration of workloads to the cloud, along with the most effective ways to ensure a seamless transfer. The authors of this study choose to adopt a systematic literature review methodology due to the abundance of literature on workload migration into clouds. This indicates that a substantial body of research has previously been conducted and can serve as the

basis for the analysis in this investigation. This move also highlights how important it is to critically assess the literature regarding the benefits and challenges of migrating workloads to the cloud, as well as the strategies that need to be employed to ensure a successful migration. The author conducted a systematic review of the selected publications using the six generic procedures listed below: creating the study topic and objective, looking up relevant literature, screening candidates for inclusion, assessing the advantages of the original study, extracting data, and analyzing data (Snyder, 2019).

3.1.1 Research Identification

The aim of this study is to understand the challenges and opportunities associated with workload migration to the cloud and the best practices for an effective transition. To do this, the study sets out to pursue several interrelated objectives, which include determining the benefits following the transition to the cloud, understanding the challenges of migration to the cloud, and exploring the key considerations that determine an effective transition into the cloud.

3.1.2 Literature Search (Search Strategy)

To guarantee that the researcher finds papers that are linked to the research issue, the following databases were used for the article search: Emerald Insight, Wiley Interscience, JSTOR, Elsiver's, EBSCO Host, Google Scholar, ProQuest, Scopus, and Taylor and Francis. Millions of scientific articles are added annually to the corpus of research papers in major databases such as JSTOR and Scopus, according to Hristidis et al. (2003). Consequently, researchers find it increasingly difficult to locate the most relevant article for their topic. Using keywords and phrases speeds up the process of searching through millions of articles in a database. In the case of this research, the author used both single words and key phrases “cloud computing,” “workload migration,” “benefits or opportunities of workload migration into the cloud,”

"challenges of workload migration into the cloud," "considerations for effective transition into the cloud," among others, and the combination of these words using Bolean operators "AND" and "OR." The search terms also included these key phrases' synonyms. These key terms and their synonyms are in line with the primary research goal of this study, and numerous combinations were used. The researcher tested out various key word chains to determine which one produces the greatest results without requiring a lot of useless publications. These search phrases were provided by the authors of various relevant articles that were located during the preliminary literature assessment. These terms were then selected for the search. Upon initial project conception, a comprehensive search was conducted across multiple databases to determine what is available. Once the researcher had decided on a research question, another search was done across the previously stated databases.

Table 1: Key search terms

Key Search Words	**Justification**	**Reference**
"Cloud computing"	The term refers to internet-based computing where resources are shared rather than relying on local computing infrastructure. Its inclusion ensures the study focuses on cloud-based workload migration.	Alzide, (2024); Vankayalapati, (2025)
"Workload migration"	This phrase specifically denotes the movement of applications, data, and processes from on-premise infrastructure to the cloud. It is central to understanding the research topic.	(Ward et al., 2010)

"Benefits or opportunities of workload migration into the cloud"	This phrase captures the positive aspects of cloud migration, such as cost efficiency, scalability, and operational agility.	Zhou, (2023)
“Challenges of workload migration into the cloud"	This phrase is crucial to discussing the obstacles organizations face when migrating workloads, such as security risks, latency issues, and data sovereignty concerns.	Fawad (2023); Pushpalatha and Ramesh (2021)
"Considerations for effective transition into the cloud"	This phrase highlights factors such as risk assessment, data security, and compliance that must be evaluated for successful migration.	Martins (2023); Johnson et al., (2024)

3.1.3 Exclusion and Inclusion Criteria

To determine which articles to include in the systematic review, a clear criterion that specifies which papers should be included in the review must be established. One of the aforementioned review questions must be directly addressed by the literature that is to be included in the study. Meline (2016) contends that inclusion and exclusion criteria are essential to secondary research because they allow the researcher to ensure that the selected data sources contribute to the study's validity and reliability while also supporting the study's objectives. These criteria are crucial because they help focus research on reliable sources of data, especially when it comes to the literature search and study selection stages. According to Androcec et al. (2012), inclusion and exclusion criteria are important for five main reasons: they provide consistency, enhance quality control, reduce bias, and maintain researcher concentration. The literature chosen for the study

must directly answer one of the two review questions mentioned above. Thus, search queries should cover subjects like cloud computing, workload migration, opportunities, benefits, issues, and strategy considerations.

The papers that were included for examination in the study were filtered by the author using the inclusion and exclusion criteria. English-language publications that address or resolve the study's findings and were published between 2010 and 2023 were included in the screening criteria. Articles published before 2000 that are not fully available, are not written in English, or do not relate to the study's issues are not taken into consideration. The table below shows the PICOs that was used as a guideline for inclusion and exclusion criteria:

Table 2: PICOS Criteria

PICOS TABLE	
P (Population/problem)	Understand the challenges and opportunities associated with workload migration into cloud
I (Phenomenon of Interest)	Benefits, challenges and strategies for workload migration
Co (Context)	Workload migration into cloud
S (Types of Studies)	Published in English language, full text available and published between 2010-2023

Based on the PICO framework, the researcher addressed the following research question: "*What are the challenges and opportunities associated with workload migration into cloud?*" Meline

(2016) argues that defining the research question explicitly is crucial to assisting the researcher in selecting studies that are both targeted and relevant to the study topic.

3.1.4 Quality Assessment

When assessing the caliber of the included research, factors such as the source's credibility, the writers' credentials, the original study's methodology, and the clarity and coherence of the results will all be taken into account. The findings of this quality assessment will dictate how each study is weighted in the dissertation's overall assessment and conclusions. Understanding the potential and challenges associated with workload migration into the cloud requires an orderly, comprehensive, and objective review of the literature, which is ensured by this dissertation's methodological approach.

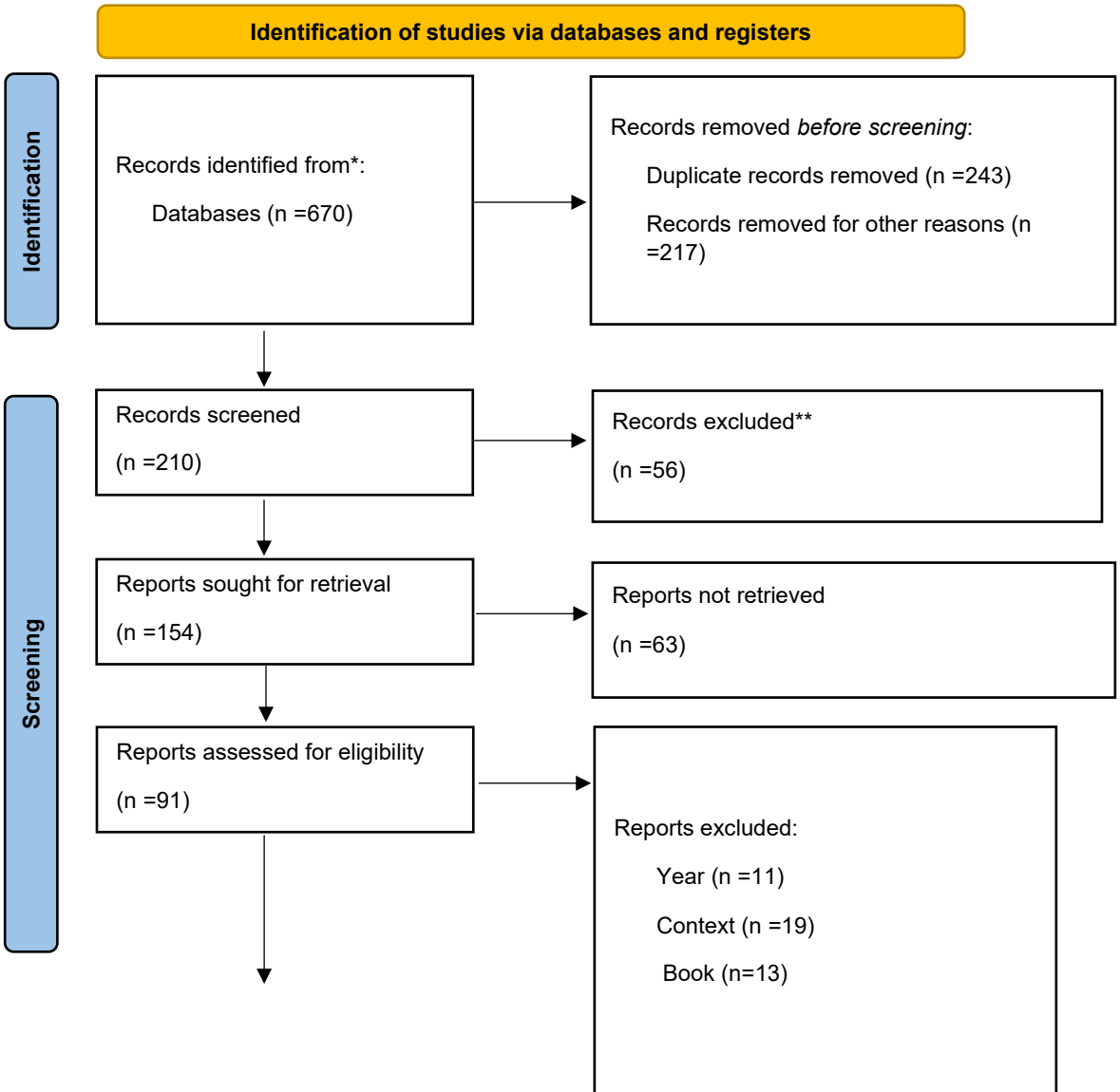
To further minimize bias and ensure the validity of the evaluation process, two researchers will work independently on the search method and selection procedure. To resolve any discrepancies, the author and other impartial researchers will convene. Since they will carefully evaluate each study in light of the quality criteria, researchers are crucial. They will also provide an opportunity to confirm the inclusion and exclusion criteria. Studies that don't fit the criteria for inclusion in the previously specified phases won't be listed among the final publications. As in the previous stage, the articles that are to be omitted will be retained for cross-checking, record-keeping, and repeatability.

Following their retrieval, the articles will go through title and abstract screening, which comprises identifying the study question and topic and eliminating duplicates from many databases. After the duplicates have been eliminated, the complete texts (full text screening) will be retrieved and evaluated to determine whether they meet the inclusion requirements and

pertain to the study topic. Articles that do not meet the inclusion criteria or address the research topic will now be excluded.

3.1.5 Data Extraction

The researcher will extract the relevant information from each study addressing the opportunities and difficulties related to workload transfer to the cloud, after finding pertinent studies, eliminating duplicates, and evaluating the studies. The data extraction strategy will be guided by the study's objectives. The findings or conclusions of any study, along with the approach or methodology employed to attain the desired outcomes determines how much attention is placed on data extraction. The data extraction process for the study is presented below.



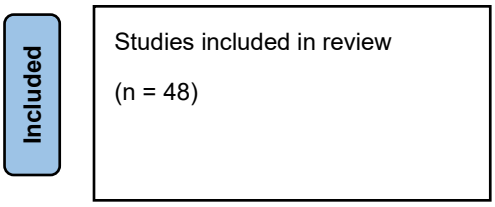


Figure 3: The PRISMA Diagram for reporting systematic reviews

3.1.6 Data Analysis

The final stage will involve qualitative data analysis, which involves searching for themes or patterns within the text of the examined articles. According to Thomas (2016), data analysis is a systematic process for describing, assessing, compressing, and illuminating data. Scholars have discussed a wide range of approaches that can be used to draw conclusions from data collected for a study. The researcher will use qualitative data analysis, sometimes referred to as content analysis, because the majority of the data in this instance will come from secondary research.

Rather than using a deductive approach that involves verifying a particular hypothesis, the researcher used an inductive technique to draw conclusions and patterns directly from the data. In this case, the investigator will start by reviewing the literature sources and analyzing the themes, subjects, and trends that emerged in these information sources. Inductive analysis demands that the researcher begin with a data review and end with overarching concepts (Kyngäs, 2020). The researcher will use the coding technique to subheadings and subjects in order to streamline and organize them. An abstraction technique will be used by the researcher to restrict and organize material in order to make sure they can address the research questions through the three phases of preparation, organization, and reporting (Kyngäs, 2020). The researcher will then review the data to find any unresolved issues. Subthemes and associated content will then be integrated with these and other open codes. Subthemes sharing a common

body of content will coalesce into concepts, which will subsequently be further subdivided into central themes (Thomas, 2016). The findings will be reported using the identified themes as a foundation.

3.2 Ethical Considerations

The study was conducted with ethical considerations in mind and did not use any plagiarized content. According to Mahida (2022), plagiarism is the use of someone else's words or ideas without giving due credit to the original author. The researcher used evidence-based information gathered from scientific sources to guide them as they work on the noteworthy aspect of the selected issue. The researcher clearly stated the study's hypothesis in a comprehensible analysis and data conclusion. This facilitated readers' reading and comprehension of the study's contents, ultimately assisting them in applying newly acquired skills and knowledge.

The main issues with using secondary data are consent returns and potential harm to specific individuals. Different levels of personally identifiable information can be found in secondary data. An extensive assessment by the ethical board is not necessary if the data is appropriately coded so that the researcher cannot read the codes, if it contains no personally identifiable information, or if it lacks any identifying information. The board needs to be guaranteed that information may be made anonymous. The board will thoroughly examine the application if the data includes participant personal information or information that can be used to identify them (Mahida, 2022). However, the researcher anticipates that this study won't include any personally identifiable information, therefore a thorough ethics board evaluation won't be necessary.

Chapter 4. Results and Discussion

This chapter reports the findings of the study. The findings are categorized into three main themes, in which the first section discusses the first theme which entails describing and critically examining the benefits of workload migration to the cloud. The second section presents the second theme that explains and critically assesses the challenges of workload migration to the cloud, while the final part presents the third theme, which describes the key considerations that organizations can take into account to ensure an effective and successful workload migration to the cloud.

4.1 Categorization of Research Findings

Through applying the inductive content analysis, an inductive process and iterative coding was used. As per the inductive process, the codes that are used to label the data are created throughout the coding process. In this case, the researcher finds the codes within the data set itself, or as they "arise" or "emerge" from the data (Vears and Gillam, 2022). The codes used to analyze the data in deductive content analysis, on the other hand, are pre-set and typically derived from prior studies in the topic as well as a conceptual framework or model. In deductive content analysis, the codes are created independently of the data prior to its collection (Vears and Gillam, 2022).

Involving iterative coding means that coding is not done once for every document or transcript; rather, it is modified based on comparisons between papers and transcripts before being repeated. Every document or transcript is coded multiple times in increasingly sophisticated versions (Kyngäs, 2020). This repeated recoding is an essential step to ensure that the recently discovered codes were not "missed" in the previous coding rounds because the procedure is inductive and fresh details or elements continue to be discovered from the data as additional documents or

transcripts are analyzed. Ideas that are found in later transcripts frequently appear in older transcripts, possibly in more subtle forms, but were not recognized when those transcripts were first coded (Kyngäs, 2020).

Thus, during the course of the analysis, the researcher is expanding and modifying the list of codes. This differs from coding using deductive content analysis, where the predetermined set of codes remains constant throughout the study. For the reasons listed below, the coding process, which is followed by grouping, comparing, and subdividing groups of codes, produces content categories and subcategories as opposed to "themes." A "content category" is a general notion or idea that has been used to group several more specialized content codes (Vearsn and Gillam, 2022).

In the context of this current study, the main question focused on understanding the challenges and opportunities associated with workload migration to the cloud and the best practices for an effective transition. The selected articles (48) were designed to elicit discussion of this study's aim, and "workload migration benefits, challenges, and best practices" were the key ideas sought to explore in the selected articles to answer the research questions. The content categories identified were various benefits of workload migration, the challenges associated with workload migration, and the best practices/key considerations that businesses can apply for a successful workload migration. These three content categories formed the "themes" of the study results, which are the broad content categories identified by the analysis.

To identify the expressions, sub-categories, categories, and themes from the 48 selected articles, were reduced and grouped data utilizing the abstraction process in order to use concepts, categories, or topics to address the research questions. The researcher sorted through the data to find open codes after selecting the 48 articles based on inclusion and exclusion criteria. These

codes were then joined with other open codes from other articles that contained related content to create sub-concepts, categories, and themes. This began by going over the information (articles), letting codes appear, and then naming the ideas and codes as they appeared. This was the first attempt at coding (initial coding). After that, the researcher went over the data (articles) in each category identified in the initial coding round once more, coming up with and using codes while also looking for new themes or ideas. In order to find the expressions, codes, categories, and topics, the articles were read numerous times. This is known as iterative coding.

This was followed by assessment of patterns both within and between data sources (original expressions from the selected articles) using a technique known as "pattern coding." In order to chunk the data into fewer analytical concepts, the codes generated during open coding have to be condensed. This enabled me to start compiling the information. These codes and other open codes were combined with the subthemes and related content from the original expressions taken from the articles. Concepts, which were further broken into key themes (main categories), were formed from subthemes that had a common body of content. By memoing and, where possible, further compressing the pattern codes, the researcher was able to extract themes from them. The topics (main categories) were then attempted to be encapsulated in brief words such as "benefits of workload migration" or "challenges of workload migration."

Similar to the last stage, ideas, categories, and themes were created by combining the detected sub-concepts, -categories, and -themes (major categories). The results of the content analysis were reported using the identified concepts, categories, and themes (or primary concepts, categories, and themes).

Table 3: Summary of findings

Original expression	Reduced expression	Sub-category	Main category/theme
Cloud computing allows businesses to swiftly scale up or down while optimizing resource utilization, in contrast to traditional on-premises systems. This built-in functionality ensures that resource updates happen quickly, ensuring that the IT infrastructure may be adjusted to meet the constantly changing needs of the enterprise (Zhou, 2023). Flexibility also comes because workload analysis is made possible by cloud migration, allowing firms to make necessary adjustments based on demand.	Allows swift scaling up and down Workload analysis is made possible to enable easy adjustments	Allow flexibility	**The benefits of workload migration to cloud**
When the expectations of clients (businesses) change, the cloud sets itself apart as a platform that is adaptable and agile. The cloud enables companies to continuously adapt and exceed customer expectations, regardless of the objective—improving reaction times, raising availability, or providing cutting-edge capabilities, for instance (Shethwala and Karamta, 2017). Cloud infrastructure providers are able to aggregate vast numbers of data center resources, often from several geographical areas, and make them available to fulfill customer demand quickly (Shethwala and Karamta, 2017).	Cloud acting as an adaptable and agile platform to align to customer demands Cloud infrastructure in different geographical areas are able to quickly fulfil customer demand	Enable scalability	
A user only has to pay for the services or workload that they actually use while using cloud computing. As they are only required to pay for the resources they use individually under this pay-per-use arrangement. Again, users will save a substantial amount of money that would have gone toward buying the cutting-edge machinery that cloud service providers employ (Demeke and Sharma, 2024). Profitability comes because of the reduced investment costs when moving to the cloud since cloud computing gives enough resources in a way that lets customers use resources on demand as a metered service. This is better than grid computing that offers resources, but they are not sufficient for current needs (Ward et al., 2010). Organizations only pay for the services they really use when they use the pay-as-you-go approach, which leads to predictable and simpler-to-manage operational costs (Ward et al., 2010). Customers merely pay for the resources they utilize in accordance with their demands. Thus, a company's profitability is increased because no more funds are needed to invest in the cloud, which could have a negative impact on the company's earnings (Ward et al., 2010)	Paying for only workload used leads to more saving Increased profitability due to reduced investment costs when moving workload to cloud Simple to manage operational costs Paying for only resources used increases profitability	Increases profitability	
The inherent feature of cloud workloads is their accessibility from any location via a secure network connection to the cloud. This characteristic is what motivates businesses to migrate to the cloud. The ability to access data from any place or device is a crucial component of the digital revolution (Zhou, 2023).	Accessible anywhere at anytime through internet connection	Improved accessibility	

Anyone can access data from anywhere in the world by logging into the cloud via an internet connection. It's perfect for cooperative, distant work settings where data and files must be shared. The entire team can have access to critical analytics like call disposition and conversion rates (Cresswell et al., 2022). Using cloud computing, one may grant anyone, anywhere, at any time, access to their documents. Let's say a business is trying to find a new provider of business call forwarding services. The shortlist might be saved to the cloud for access by the entire team. Each team member can view the short list, provide feedback, and assist you in making a decision (Boutaba et al., 2014).	Easy accessibility by the entire team Easy accessibility anywhere and any time		
Workflow automation, which is made possible by cloud management, helps firms boost productivity when workloads are migrated to the cloud and they effectively implement cloud management and optimization techniques (Zhou, 2023). Cloud service providers (CSPs) facilitate the efficient management of infrastructure complexity, allowing enterprises to concentrate on productivity. Additionally, the majority of cloud solutions' remote accessibility frees up a firm's crew to concentrate on expanding the company (Demeke and Sharma, 2024). Shifting workloads to the cloud improves operational efficiency since cloud services abstract away a large portion of the overhead associated with operations. IT teams might divert their attention from regular maintenance to higher-value projects. To further improve productivity, automation and self-service features are included (Boutaba et al., 2014).	Workflow automation that comes with cloud boost productivity Efficient management is done by cloud providers enabling companies to concentrate on productivity Moving workload to cloud improves operational efficiency	Enhance productivity	
Enterprises can quickly test out machine learning capabilities on the cloud and expand when projects go into manufacturing and demand for such capabilities increases. Furthermore, anyone without sophisticated knowledge of data science or artificial intelligence can access ML capabilities thanks to the cloud (Alzide, 2024). Organizations can use machine learning abilities to solve business challenges without having to handle the technical burden by utilizing public clouds and IaaS services (Hosseini Shirvani et al., 2018). AI and ML-powered cloud computing services offer a scalable and adaptable machine learning platform. Businesses can increase machine learning efforts without spending more money on hardware or infrastructure by utilizing cloud-based services (Alzide, 2024).	Cloud provide capabilities for ML use Possible to use ML to solve business issues when using cloud Cloud can be AI and ML powered unlike on-premise workload storage	Opening Doors for Leveraging New Technologies	
Companies frequently migrate to the cloud in order to reduce their IT expenses. IT managers have an opportunity to save unnecessary spending and easily right-size computer resources based on specific business requirements thanks to the cloud (Ward et al., 2010).	Cloud enables IT managers save on unnecessary spending Lowers IT expenses which would be used to replace legacy systems	Reducing IT costs	

Moving to cloud lowers IT expenses because a firm can avoid investing the time and money it would have needed to replace a legacy system when it eventually malfunctions or loses functionality by migrating to the cloud (Demeke and Sharma, 2024). Transferring workloads to the cloud eliminates the need for physical data centers, allowing for a smaller footprint for data centers. This results in decreased expenses for cooling, power, and real estate (Demeke and Sharma, 2024).	Lead to decreased expenses for power, cooling and real estate		
Cloud providers can provide stronger security than on-premises infrastructure in terms of data loss by acknowledging a shared responsibility paradigm. Cloud workload resilience is increased by the adoption of zero-trust security solutions, which benefit from extremely stringent physical security standards. (Hosseini Shirvani et al., 2018) The best cloud service providers prioritize supporting security and, as a result, offer built-in capabilities like cross-enterprise visibility, security analytics, and periodic updates (Gholami et al., 2017). By moving workloads to the cloud, a company may stay compliant with regulations and avoid data breaches by ensuring that its security features are up-to-date. This enhances security of the data (Gholami et al., 2017).	Cloud is more secure than on-premise infrastructure Cloud have in-build capabilities that enhances security of data stored Cloud ensures that a company complies with security regulations	More secure in terms of data loss and resilience than on-premise infrastructure	
Migration to the cloud has always brought up significant security issues. The core of the concern is the data storage issue. It is believed that there might be issues with integrity and legitimacy. A database loss or an intrusion into a company could result in massive losses (Demeke and Sharma, 2024). Security concerns in cloud-based environments are often categorized into three categories: attack susceptibility, standard security procedures, and compliance with local, state, or federal data-storage regulations pertaining to record-keeping or privacy (Gholami et al., 2017).	Data storage issue Various security concerns attached to cloud	Networking and security concerns	**The challenges of workload migration to cloud**
One of the issues with workload transfer, however, is creating a cost case that provides the user (a corporation) with a respectable return on investment (ROI) within a reasonable time frame (Hosseini Shirvani et al., 2018). Adopting the cloud can incur costs such as creating new technology and redesigning existing security infrastructure that is compatible with the cloud, retraining and training personnel, realigning institutions, developing policies and standards, and paying for cloud services, which are typically unknown until they are used. This makes implementing cloud computing and moving workloads to the cloud difficult for many companies and government organizations (Gholami et al., 2017)	Challenges of creating a cost case Adopting cloud can incur cost	The challenge of cost management and control	
The issue of cloud computing pricing is one that needs to be resolved quickly right now. For example, there's animosity toward chargeback models, which frequently results in conflict. The implementation may be costly due to the chargeback's cost. This methodology is ineffective because business units lack the expertise, transparency, and understanding necessary to comprehend a chargeback (Demeke and Sharma, 2024). The drawback of peak and off-peak consumption periods billing is that customers may be penalized by the cloud service provider if the peak and off-peak hours are changed, or even if there is little traffic during the designated peak time—for example, on holidays or during significant events (Hosseini Shirvani et al., 2018).	Cloud computing pricing is a challenge Issues with billing systems such as peak and off-peak	The issue of charging models	

Among the architectural issues is the problem of virtualization. Multiple cloud users can share resources on a real system thanks to virtualization. A hypervisor oversees the virtualization machine (VM) process. However, virtualization raises a number of security issues. Users can upload and download photos from the repository via virtual machine sharing. Data breaches could result from malware included in the image that is to be posted., making it possible for malevolent users to ascertain the platform's security level (Demeke and Sharma, 2024). Users may also experience virtual machine isolation; however, since cross-VM attacks might result from sharing physical resources in the cloud, computational resources must also be isolated (Gholami et al., 2017)	The problem of virtualization The issue with virtual machine isolation	Architectural challenges	
Load balancing challenges and issues in cloud computing systems are often divided into four main categories: performance, data replication, spatial distribution of the cloud nodes, and point of failure. The method used to oversee the load balancing procedure among all geographically dispersed cloud nodes is the first problem (Boutaba et al., 2014). In cloud-based environments, managing and minimizing failures caused by load balancing algorithms' growing complexity through the use of a controller function is a difficult problem that warrants research attention (Alzide, 2024). The methods used for data replication, which include both complete and partial replication across several nodes is a challenge. This is because full replication necessitates greater storage, while partial replication depends on the complex nature of the load balancing algorithm across different cloud nodes (Hosseini Shirvani et al., 2018)	There are various load balancing challenges Managing and minimizing failures caused by load balancing algorithms' is difficult Methods for data replication is a challenge	Load Balancing challenges	
One of the most difficult problems in providing cloud-based services is the ability to adjust cloud capacity to on-demand services when different workloads (such as static, recurring, once-in-a-lifetime, unanticipated, and continuously changing workloads) occur (Chana and Singh, 2014). Static scaling provisioning of resources begins based on the anticipated workload and ends when the workload reaches its anticipated peak. When the experienced workload exceeds the anticipated demand, this kind of scaling has a serious vulnerability to once-in-a-lifetime and unforeseen workloads and may result in system failure during resource provisioning (Chana and Singh, 2014).	Difficulty adjusting cloud capacity when various workloads occur There are vulnerabilities and unforeseen workloads and may result in system failure during resource provisioning	Issues with scalability and availability	
Workload migration can also lead to interoperability problems, particularly when merging with legacy on-premises or cloud-based systems (Kumar and Garg, 2012). Maintaining system communication and interoperability is essential to maintaining operational continuity. Businesses frequently experience difficulties with data formats, application programming interfaces (APIs), and communication protocols in this fleeting period (Kumar and Garg, 2012).	Interoperability problems when merging with legacy on-premises or cloud-based systems Difficulties with APIs and data formats	Interoperability issues	
Even with cloud-performing applications, stress testing becomes crucial after migration. While some programs might experience latency problems, others might see higher-than-average running costs. Higher CPU usage or fees for utilizing the API and generating reports could be the cause of these costs (Ward et al., 2010).	Stress testing after migration may be costly though essential	Workload migration stress testing	

The process of choosing the right type of cloud instance is one of the main challenges; if done wrong, it could have a ripple impact on the entire migrated workload (Ellison et al., 2018).	Choosing the right type of cloud is a challenge		
A variety of events, such as natural catastrophes, human error, and security breaches, can result in data loss in cloud computing. Client companies may suffer significant financial losses, harm to their reputation, infractions of the law, loss of vital data, and compliance violations in such circumstances (Chana and Singh, 2014). A hostile attack, a natural calamity, or a data cleanse by the cloud service provider could result in the loss of data stored in the cloud. Organizations lacking a recovery plan may face catastrophic consequences in the event of critical information loss (Chana and Singh, 2014).	Various events such as hacking may lead to data loss A natural calamity or data cleanse by providers can cause data loss	Data loss	
Challenge with service level agreements (SLAs) is that cloud users have no or little control over the resources that the CSP offers (Ellison et al., 2018). In the context of cloud computing, SLAs serve as crucial legal frameworks that specify performance requirements and user-provider expectations. Numerous obstacles also face cloud computing SLAs. Issues with resource management arise when millions of consumers receive services through data centers. Managing data processing risks, giving users control over services, putting autonomous resource management into practice, allocating resources in SLAs through virtualization, and gauging service efficacy are some of the issues associated with SLAs (IBM 2025). SLAs are essential for guaranteeing the dependability and quality of services rendered by cloud service providers. But there are certain difficulties involved. The dynamic behavior of the infrastructure is one of them (Ellison et al., 2018)	Little or no control over resources for users Numerous obstacles face SLAs Dynamic behavior of the infrastructure brings a challenge to SLAs	Challenges with service level agreements (SLAS)	
It is critical to take the type of migration into account. Choosing the right migration strategy is an important choice that affects how well the migration trip goes. Making informed decisions requires firms to carefully assess their goals, existing infrastructure, and budgetary constraints when deciding between lift-and-shift, re-platforming, or application rewriting approaches (Zhou, 2023). A company's chosen migration plan is one of the additional considerations, in addition to costs and money Another important consideration when shifting workloads to the cloud is whether the process will be handled internally or by other parties (Microsoft Azure. 2025).	Choose the right migration strategy Determine whether the process is handled internally or through third parties	Selection of migration strategy and process	**Key considerations for effective workload migration to cloud**

It is also advisable to do thorough preparation before moving to the cloud. This means that before proceeding, all the necessary arrangements must be reviewed, including the company's migration goals, the timeline, the budget, and the people overseeing the process (Alzide, 2024).	Doing thorough preparation before moving to cloud	Setting out a comprehensive preparation plan	**Key considerations for effective workload migration to cloud**

Even with the best-laid plans, there is always some risk when moving to the cloud, so management should always be prepared for any unforeseen circumstances (Alzide, 2024).	Prepare for unforeseen events		
The type of cloud that best meets an organization's needs should be considered, such as hybrid solutions that offer both public and private services for different business divisions or public cloud data controlled by public cloud providers (IBM 2025). It is crucial to closely examine the application's trial version, as it can offer insightful details about how easy and quick tasks can be accomplished, as well as useful information regarding the program's usability and interface (Islam et al., 2014).	Consider the type of cloud to adopt Examine trial version of applications	Selection of the type of cloud to use for the migration of workloads	
A company needs to develop a cost management strategy. There variety of solutions that have been created to reduce the expenses related to cloud migration; two such strategies include restructuring and deactivation of unused resources (Mvelase et al., 2016). Using serverless computing, which usually charges by consumption instead of fixed bandwidth, is another strategy employed by companies to provide back-end services on demand (Mvelase et al., 2016).	Develop a cost management strategy Employ cost management tactics	Developing a cost management tactic	
It is important to comprehend the security measures in place in the application and data center, the methods used by cloud providers to secure data from viruses and hackers, and their backup and recovery protocols (Microsoft Azure. 2025). It is vital to comprehend platform compatibility in order to ensure functionality across the range of operating systems and web browsers that the company may use (Mvelase et al., 2016). Businesses should give great consideration to security and compliance issues. Important components of cloud migration include security and compliance. Strong security protocols and encryption are required for data movement and cloud application operations. Ensuring adherence to industry rules and data protection laws is crucial for upholding data privacy and confidentiality in cloud computing environments (IBM 2025).	Understand the security measures in place Understand platform compatibility Consider compliance and security issues	Understand the security levels and compatibility	
Post-migration optimization is an ongoing process that businesses should do to continuously improve the security, performance, and cost of cloud-based workloads and applications. Regular monitoring, adjustments to resource allocation, and cloud cost control are essential post-migration optimization techniques (IBM 2025) Post-migration optimization is important in order to consistently improve the cloud-based workloads' security, performance, and cost-efficiency. A competitive advantage in a changing digital environment and the ability to fully utilize the advantages of cloud computing depend on regular monitoring and optimization of cloud resources (Islam et al., 2014) Businesses should have a look at a few of these cloud optimization tactics to ensure a smooth and successful transition of workloads to the cloud. The first is the governance plan, which has a tight connection to cloud optimization (Islam et al., 2014).	Perform post migration techniques Regular monitoring Cloud optimization tactics such as governance plan	Post-migration optimization	

A well-defined plan of action is aided by efficient preparation. Even though companies and organizations are frequently eager to utilize cloud infrastructure, in order to get the greatest results, it is crucial to approach the procedure with a clear strategy and action plan (Microsoft Azure. 2025). Before starting a cloud migration journey, careful preparation and assessment are crucial. A successful cloud migration requires a well-defined migration plan that is adapted to the unique demands and objectives of the company (Vankayalapati, 2025). After a business has made the decision to embrace cloud computing, success depends on developing a thorough roadmap that outlines the resources and migration process. It is important to think about what needs to be migrated, why, and who will be in charge of each step of the transfer (Alzide, 2024).	Having a well-defined action plan Careful preparation and assessment Develop a thorough roadmap for resources and migration process	Effective planning and assessment	
Careful planning for data migration minimizes the chance of information loss or corruption, ensuring a safe and seamless transfer of data to the cloud (Cresswell et al., 2022) It is important to follow recommended practices in order to ensure that a cloud migration is successful. Thorough preparation and evaluation are necessary in order to select the optimal migration strategy based on organizational goals and the existing infrastructure (Vankayalapati, 2025).	The need for careful data migration planning Follow recommended practices	Considering cloud migration best practices	

4.1.1 The Benefits of Workload Migration to the Cloud

Several scholarly articles have highlighted the benefits of migrating workloads to the cloud. Researchers have identified enhanced flexibility, scalability, and resource efficiency as the main advantages. When everything is considered, moving workloads to the cloud offers businesses several advantages that dramatically boost their performance and output (Attaran and Woods, 2019). These benefits are covered in the section that follows:

Flexibility

One major benefit that cloud computing offers is flexibility, as per the findings. In line with this, Doddavula et al. (2013) emphasize that with cloud computing, businesses can grow and deploy computing resources continuously based on real-time requirements, giving them greater flexibility. These changing needs play a major role in the ability to modify dynamic demands in response to changing workloads. Cloud computing allows businesses to swiftly scale up or down while optimizing resource utilization, in contrast to traditional on-premises systems. This built-in functionality ensures that resource updates happen quickly, ensuring that the IT infrastructure may be adjusted to meet the constantly changing needs of the enterprise (Doddavula et al., 2013).

According to Attaran and Woods (2019), user interest is ever-changing, much like the market. The cloud can foresee traffic changes in businesses, but no one can predict when or how they will occur. This cloud infrastructure is adaptable and has the benefit of quickly handling spikes in any magnitude of traffic by scaling up or down computer capacity (Attaran and Woods, 2019). Banerjee and Mohapatra (2013) add that cloud computing's elasticity and flexibility help businesses become agile quickly. In order to fulfill market demand, resources can be instantly provisioned and stopped with a cloud-based IT architecture. Because of their adaptability,

businesses are able to launch new goods and services and quickly adapt to changing conditions (Banerjee and Mohapatra, 2013).

Flexibility also comes because workload analysis is made possible by cloud migration, allowing firms to make necessary adjustments based on demand. Analysis of workload: Workloads and continuous user experiences can be analyzed thanks to cloud management. An organization employing a private cloud can verify the performance of its cloud infrastructure and provide basic functions such as balancing company workload and capacity planning. Server downtime measures aid in enforcing compliance with the service level agreement provided by public cloud providers in contexts where they are used (Badshah et al., 2021). Businesses can determine how long they want to utilize cloud service providers and when they need to move their workload from public to private clouds by using measuring criteria. According to Odun-Ayo (2018), public cloud service providers utilize sophisticated technologies that align with the demands of the services they offer. Rai et al. (2013) provide additional evidence in favor of this claim, stating that workload migration to the cloud enhances performance by moving a company's data to quick cloud servers, allowing for increased operating flexibility and agility while avoiding bottlenecks.

Scalability

A system's scalability refers to its capacity to grow in response to both internal and external pressures. Because of this, cloud infrastructure providers are able to aggregate vast numbers of data center resources, often from several geographical areas, and make them available to fulfill customer demand quickly (Tweneboah-Koduah et al., 2014). As a result, Battleson et al. (2016) claim that cloud services provide companies with access to a variety of tools and resources that expedite the creation and implementation of new applications. This expeditious technique

expedites the innovation cycle, enabling enterprises to promptly introduce novel products and services and acquire a competitive edge in the process. Scalability guarantees that the infrastructure can easily expand to meet new requirements as resource demands rise, avoiding bottlenecks and maintaining optimal performance. When the expectations of clients (businesses) change, the cloud sets itself apart as a platform that is adaptable and agile. The cloud enables companies to continuously adapt and exceed customer expectations, regardless of the objective—improving reaction times, raising availability, or providing cutting-edge capabilities, for example (Battleson et al., 2016).

Tweneboah-Koduah et al. (2014) add to this finding by stating that as a firm expands, so does the requirement for databases, analytics, and other snowballing workloads. Under such circumstances, the cloud makes it possible to expand within the current infrastructure, giving apps flexibility to develop without compromising performance (Tweneboah-Koduah et al., 2014). The LOTE Agency (LOTE), an Australian multicultural research and communications agency whose work involves compute- and storage-intensive tasks like video editing and marketing artifact generation, is one organization that has profited from workload migration to cloud scalability. LOTE achieved a safe, effective, robust, and scalable infrastructure that can readily scale to meet the agency's demanding demands wherever its personnel are stationed by moving its outdated on-premises systems to Amazon AWS, a sort of cloud (Ahmad et al., 2020).

Reducing IT Costs

The analysis revealed that reducing expenses is still another important advantage of moving to the cloud, and it happens in a few distinct ways. According to Banerjee (2012), companies frequently migrate to the cloud in order to reduce their IT expenses. IT managers have an opportunity to save unnecessary spending and easily right-size computer resources based on

specific business requirements thanks to the cloud. In addition to the projected capacity requirements, businesses have the flexibility to modify resource requirements at any time and get rid of outdated technology or inflexible on-premises assets (Moghaddam et al., 2015). In agreement with this discovery, Tweneboah-Koduah et al. state that service providers rent cloud resources in accordance with their demands since resources in a cloud environment can be quickly allocated and de-allocated. Customers can request resources according to their own needs with this functionality, which prevents unused or underutilized computing resources and significantly reduces IT expenses (Tweneboah-Koduah et al., 2014). Additionally, it lowers IT expenses because a firm can avoid investing the time and money it would have needed to replace a legacy system when it eventually malfunctions or loses functionality by migrating to the cloud (Attaran and Woods, 2019).

Additionally, shifting workloads to the cloud lowers the cost of maintenance and infrastructure. Workload migration to the cloud removes the requirement for hardware on-premises. Physical server purchases, upkeep, and upgrades are no longer necessary. Hardware updates and security fixes are handled by cloud providers as part of their infrastructure maintenance. Each of them lowers the expense of IT. Notably, cloud providers' large-scale operations enable them to spread costs among numerous clients, which contributes to economies of scale that further reduce IT expenses. Businesses can save money by using shared infrastructure instead of operating their own data centers (Rai et al., 2015). According to Bandari (2022), transferring workloads to the cloud eliminates the need for physical data centers, allowing for a smaller footprint for data centers. This results in decreased expenses for cooling, power, and real estate (Bandari, 2022).

Opening Doors for Leveraging New Technologies

Platforms for the cloud provide countless possibilities. Users can benefit from cutting-edge technology like AI and machine learning by moving to the cloud, as maintaining them on-premises is not practical. Data lakes and Kubernetes containers are simply two more instances of how incredibly convenient cloud computing is. Bandari (2022) affirm that cloud platforms assist IT managers in avoiding issues like juggling strict license terms and long-term contracts that need to be kept up-to-date when important gear and software reach the end of their useful lives. Without having to sign any rigid or lengthy contracts, cloud computing provides access to the newest and greatest resources and technology whenever needed (Bandari, 2022).

Mohan (2021) asserts that many companies can use open-source frameworks like Scikit Learn, TensorFlow, or PyTorch to develop machine learning models internally. Though internal teams may be able to develop algorithms, it will frequently be challenging for them to scale models to real-world workloads and deliver them to production, which frequently calls for massive computer clusters. In this instance, integrating machine learning capabilities into enterprise applications is hampered by a number of obstacles. In addition to the expense of personnel, development, and infrastructure, the knowledge and experience needed to create, train, and implement machine learning models necessitate the acquisition and maintenance of specialized hardware. However, cloud computing can solve a lot of these issues. Organizations can use machine learning abilities to solve business challenges without having to handle the technical burden by utilizing public clouds and IaaS services (Mohan, 2021).

One of cloud computing's main advantages for machine learning workloads is its on-demand pricing structures, which allow ML initiatives to be started without requiring a substantial initial expenditure. Without the need to purchase hardware, the cloud offers GPU-level speed and

performance. Additionally, enterprises can quickly test out machine learning capabilities on the cloud and expand when projects go into manufacturing and demand for such capabilities increases. Furthermore, anyone without sophisticated knowledge of data science or artificial intelligence can access ML capabilities thanks to the cloud. In addition to enabling developers to create ML algorithms more quickly, cloud computing increases machine learning's affordability, flexibility, and accessibility (Attaran and Woods, 2019). Ultimately, enterprises may leverage robust machine learning tools and algorithms through cloud-based AI and ML services, which eliminates the need for specific hardware or internal knowledge. This makes ML-driven solutions more affordable and accessible for businesses of all kinds. AI and ML-powered cloud computing services offer a scalable and adaptable machine learning platform. Businesses can increase machine learning efforts without spending more money on hardware or infrastructure by utilizing cloud-based services (Moreno-Vozmediano et al., 2022).

Productivity

Workflow automation, which is made possible by cloud management, helps firms boost productivity when workloads are migrated to the cloud and they effectively implement cloud management and optimization techniques. Workflow automation is made possible by cloud management. Automation increases productivity and efficiency by allowing businesses to convert their business objectives and rules into the actions and procedures needed to generate and manage cloud instances with the least amount of human intervention (Attaran and Woods, 2019). Attaran and Woods (2019) support the idea the idea that workload migrations to the cloud allow for automated management. In this instance, cloud service providers provide managed services that take care of standard duties like monitoring, security upgrades, and backups. IT teams are less burdened by this automation, freeing them up to concentrate on strategic projects

rather than routine maintenance. Consequently, this raises the employees' productivity (Attaran and Woods, 2019). According to Moghaddam et al. (2015), shifting workloads to the cloud improves operational efficiency since cloud services abstract away a large portion of the overhead associated with operations. IT teams might divert their attention from regular maintenance to higher-value projects. To further improve productivity, automation and self-service features are included (Moghaddam et al., 2015).

Apart from functioning in placing, creating, and adjusting intensive cloud processes, automating organizational workflow helps firms achieve the necessary compliance and reporting standards in addition to helping create, place, and alter intensive cloud operations. In the event that an employee attempts to transfer files and activities from a private cloud to a public cloud, for example, cloud management tools can notify a manager. This could result in a breach of the organization's security and compliance policies, potentially drawing regulatory bodies' wrath (Odun-Ayo, 2018).

Finally, cloud migration matters. In comparison to their peers, businesses have benefited from moving workloads—such as CRM, Data Analytics, SAP, and other workloads—to the cloud by increasing staff efficiency, fostering innovation, and opening up new revenue streams. For businesses of all sizes, the opportunities are almost limitless once they are on the cloud (Odun-Ayo, 2018). According to Attaran and Woods (2019), cloud service providers (CSPs) facilitate the efficient management of infrastructure complexity, allowing enterprises to concentrate on productivity. Additionally, the majority of cloud solutions' remote accessibility frees up your crew to concentrate on expanding the company (Attaran and Woods, 2019).

Improved Accessibility

The accessibility of cloud computing is among its biggest advantages. Anyone can access data from anywhere in the world by logging into the cloud via an internet connection. It's perfect for cooperative, distant work settings where data and files must be shared. The entire team can have access to critical analytics like call disposition and conversion rates (Jamshidi et al., 2013). According to Wyld (2009), cloud service providers who serve global financial, governmental, and healthcare clients must uphold stringent security protocols that adhere to various legislative frameworks. On the other hand, the inherent feature of cloud workloads is their accessibility from any location via a secure network connection to the cloud. This characteristic is what motivates businesses to migrate to the cloud. The ability to access data from any place or device is a crucial component of the digital revolution (Wyld, 2009). Cloud-based workloads can be accessed from any location with an internet connection, according to Rai et al. (2015). This makes it possible to collaborate remotely and have easy access to vital apps. When workers are free to work from any location, they can produce higher-quality work.

Long before the COVID-19 pandemic, according to Badshah et al. (2021), sophisticated teams were working remotely and looking for new and improved ways to transmit information. It is annoying to create an email, attach a file, and then click send just to find out that the file size restriction has undoubtedly been exceeded and your message won't even reach your inbox. That is not an issue with cloud computing, though, as workloads can be accessible from the cloud almost anywhere. Employees can provide a URL after uploading their files to the cloud in this scenario. Every member of the team will be able to view the central file they develop. Who can view the file is determined by its creator. Using cloud computing, one may grant anyone, anywhere, at any time, access to their documents. Let's say a business is trying to find a new

provider of business call forwarding services. The shortlist might be saved to the cloud for access by the entire team. Each team member can view the short list, provide feedback, and assist you in making a decision (Badshah et al., 2021).

Profitability

As per the findings, profitability comes because of the reduced investment costs when moving to the cloud. Ranjithprabhu and Sasirega (2014) assert that grid computing offers resources, but they are not sufficient for current needs. This is addressed by the emergence of cloud computing, which gives enough resources in a way that lets customers use resources on demand as a metered service. By adding fresh computing resources to the locally accessible computational power, it increases the computational capacity. The foundation of cloud computing is the Internet. For IT and scientific research, it is a distributed internet computer system. Applications hosted on big data servers are saved in the cloud and can be accessed via the internet. Many data servers housed in one location are utilized to host cloud services and applications. However, the cloud offers a metered service that allows anyone to pay for the use of computer resources, network storage, and other metrics (Ranjithprabhu and Sasirega, 2014).

As a result, according to Odun-Ayo and Agono (2018), a user only has to pay for the services or workload that they actually use while using cloud computing. Businesses will be required to pay for the resources they use individually under this pay-per-use arrangement. Again, customers will save a substantial amount of money that would have gone toward buying the cutting-edge machinery that cloud service providers employ. When necessary, organizations will reduce their needs and make service requests, which will save money (Odun-Ayo and Agono, 2018). Pay-as-you-go cloud computing allows businesses to minimize capital expenditures through the use of cloud services (Zhao and Zhou, 2014).

The realization of cost savings is the primary financial benefit associated with shifting workloads to the cloud, according to Mvelase et al. (2016). Cloud computing embraces the need for significant upfront expenditures in hardware, upkeep, and infrastructure. Organizations only pay for the services they really use when they use the pay-as-you-go approach, which leads to predictable and simpler-to-manage operational costs (Mvelase et al., 2016).

Additionally, every business's goal should be to minimize costs, and the cloud makes this easy to do. Pay-as-you-use models for cloud services are available from cloud providers. In other words, you only pay for the resources that you really utilize. According to Attaran and Woods (2019), there is no longer a need to invest in updating, maintaining, training, or making room for physical servers. The argument that cloud computing functions similarly to traditional utilities and requires no upfront investment is supported by Tweneboah-Koduah et al. (2014). The pricing of cloud services is centered on a pay-as-you-use model. Because of this, businesses using cloud services do not need to make investments in technical infrastructure in order to begin reaping the rewards of cloud computing. Customers merely pay for the resources they utilize in accordance with their demands. Thus, a company's profitability is increased because no more funds are needed to invest in the cloud, which could have a negative impact on the company's earnings (Tweneboah-Koduah et al., 2014).

Provide more Security than On-premise Infrastructure in terms of Data Loss and Resilience

Another benefit is that a company's historical systems and data are preserved when workloads are migrated to the cloud, preventing them from becoming outdated or inoperable as technology advances. As a result, cloud providers can provide stronger security than on-premises infrastructure in terms of data loss by acknowledging a shared responsibility paradigm. Cloud workload resilience is increased by the adoption of zero-trust security solutions, which benefit

from extremely stringent physical security standards (Wyld, 2009). A company can obtain better security with cloud migration than with on-premises data centers, claim Attaran and Woods (2019). This is due to the fact that the best cloud service providers prioritize supporting security and, as a result, offer built-in capabilities like cross-enterprise visibility, security analytics, and periodic updates (Attaran and Woods, 2019). Additionally, by moving workloads to the cloud, a company may stay compliant with regulations and avoid data breaches by ensuring that its security features are up-to-date. However, in order to minimize recovery time objectives (RTO) and recovery point objectives (RPO) in the event of system failures or data loss, cloud-based backup and archiving are crucial for data recovery processes (Mvelase et al., 2016).

4.1.2 The Challenges of Workload Migration to the Cloud

Despite its benefits, workload transfer to the cloud has several disadvantages. Even though cloud computing environments have many advantages, there are several grave worries that have compromised the dependability and effectiveness of this cutting-edge and persistent idea. Cloud computing faces several difficult problems that have garnered public interest (Moghaddam et al., 2015). Remember that even if moving to the cloud might be the best course of action for a company, there will still be difficulties. The types of these barriers vary based on the migration strategy of a company. Whether a company decides to move all of its computing resources to the cloud or only a portion of them, leaving some services and apps on-premises, could have an impact on the migration's result. According to Andrikopoulos et al. (2023), this replatforming can highlight a company's business demands and expose weaknesses.

Androcec et al. (2012) further agree that the paradigm of cloud computing is changing how IT services are delivered and used. To avoid suffering significant losses for the institution making the shift to cloud computing, the migration of in-house IT services to the cloud computing

paradigm must be handled properly (Cardoso et al., 2014). Thus, a crucial factor in determining the success of cloud computing will be the capacity of institutions to handle these difficulties. The use of cloud models must be accompanied by an understanding of the adoption obstacles and methods to address them to avoid unintended technological implications and even more serious issues from the standpoint of government information management (Tweneboah-Koduah et al., 2014).

The Challenge of Cost Management and Control

Key factors for the adoption of clouds have been identified. Cost savings, optimal resource usage, limitless resource scalability, and minimal maintainability are some of the main factors driving the adoption of clouds (Rai et al., 2015). One of the issues with workload transfer, however, is creating a cost case that provides the user (a corporation) with a respectable return on investment (ROI) within a reasonable time frame (Shethwala and Karamta, 2017). Developing and executing strategic cost management plans that optimize the allocation, supervision, and management of monetary resources for cloud services and infrastructure is one of the main issues. According to data from the Flexera State of the Cloud Report, 40 percent of firms struggle to keep cloud costs under control. Understanding cost management strategies is essential when implementing a multi-cloud approach, since more and more clients select multi-cloud solutions (Shethwala and Karamta, 2017). According to Tweneboah-Koduah et al. (2014), adopting the cloud can incur costs such as creating new technology and redesigning existing security infrastructure that is compatible with the cloud, retraining and training personnel, realigning institutions, developing policies and standards, and paying for cloud services, which are typically unknown until they are used. This makes implementing cloud computing and

moving workloads to the cloud difficult for many companies and government organizations (Tweneboah-Koduah et al., 2014).

Networking and Security Concerns

Safeguarding the confidentiality and integrity of stored data is a significant barrier to improved efficiency and reliability in cloud computing systems. Security in cloud computing has become increasingly important and is currently the primary factor influencing its growth in both industry and academic study (Moghaddam et al., 2015). Addressing security issues with the cloud and the migration process, however, has slowed the rate of cloud adoption (Rai et al., 2015). Tweneboah-Koduah et al. (2014) state that security, trust, confidentiality, and data sovereignty are the primary concerns against using public clouds at this time. As a result, the Tweneboah-Koduah study's results demonstrated that the majority of respondents (more than 80 percent) identified privacy and security as their top concerns when it comes to cloud adoption. Furthermore, security, trust, and privacy are mentioned as the main issues for both private and public adoption in the majority of relevant studies. A survey by the EU's Department of Economic and Scientific Policy found that 63 percent of government CIOs believe security and privacy are the biggest obstacles to the use of public clouds. In addition, a KPMG analysis on public cloud adoption in Europe, America, and Asia Pacific revealed that the biggest obstacles to public sector cloud adoption are security and privacy issues (Tweneboah-Koduah et al., 2014).

Migration must be done carefully because cloud adoption may lead to the public exposure of confidential information about a company. It is also possible to look into the business and technical facets of the migration issues, such as implementation ease. Data center upkeep does come with a hefty price tag, though. These costs pay for the resources employed, licenses obtained, and support systems required to maintain these centers' operations. For large

companies, shifting merely a percentage of their on-site resources to the cloud may be adequate (Fahmideh et al., 2017). Fernandes et al. (2014) add that migration to the cloud has always brought up significant security issues. The core of the concern is the data storage issue. It is believed that there might be issues with integrity and legitimacy. A database loss or an intrusion into a company could result in massive losses. Furthermore, the virtualization process might share a physical system thanks to multi-tenancy. Multi-tenancy may pose a security concern if a malevolent user shares facilities with a regular user. Data belonging to regular users might be affected, and issues with reputation might also arise. Moreover, larger migration expenses could arise from the combination of data from several clouds and the usage of that data. (Fernandes et al., 2014).

According to Fernandes et al. (2014) and Kalloniatis et al. (2013), security concerns in cloud-based environments are often categorized into three categories: attack susceptibility, standard security procedures, and compliance with local, state, or federal data-storage regulations pertaining to record-keeping or privacy. Significant worries at several levels (such as infrastructure, service providers, and end-users) emerged as a result of these problems. The most difficult problems in cloud-based systems are those related to user identification and access control procedures, which give rise to significant worries for end users as well as service providers. As a result, a lot of research and studies have been done to enhance the effectiveness and dependability of handling accesses and authentications; however, the outcomes of these studies have not kept up with the swift expansion of cloud computing communications (Rosado et al., 2012). Two popular methods for boosting the authentication process's dependability include implementing an agent-based system of authentication and a multiple-factor verification procedure. Moreover, researchers and service providers take into consideration the difficult

problem of guaranteeing the security of data during transmission processes between suppliers and clients (companies) (Moghaddam et al., 2015). Another crucial security concern is the resilience of cloud-based servers against potential intrusions or unforeseen circumstances. A notable level of resistance could boost the rate of dependability in cloud computing settings and help service providers protect customer data more effectively. Using real-time cryptography methods could be the best course of action for strengthening defenses against potential threats or unforeseen circumstances (Moghaddam et al., 2015).

Concerns about security are present in every aspect of cloud computing. Contractual, architectural, and communication levels are all impacted by security. Standard transmission protocols are used for cloud communication across the Internet to send data between the client who uses the cloud and the cloud infrastructure (Andrikopoulos et al., 2013). The Internet presents security challenges such as denial of service, surveillance, floods caused by IP spoofing, and masquerading. To counter these, security measures such as digital certificates, secure socket layers, and encryption are employed. Virtual networks, security setups, and shared communication infrastructure are all impacted by internal communication security challenges (Odun-Ayo et al., 2018). Virtual machine management is typically allowed to cloud users; however, unscrupulous users may utilize techniques like spoofing and sniffing to conduct attacks. Since the virtualized network is shared and utilized for communication between virtual machines, it may be vulnerable to attacks like service denial, eavesdropping, and sniffing, which could compromise the security of user data (Odun-Ayo et al., 2018).

Data Loss

The use of cloud storage also presents serious security issues because private information is moved and kept on the servers of unaffiliated cloud service providers. In this instance,

safeguarding data stored in the cloud is crucial to preventing data breaches, illegal access, and possible data loss (Ahsan et al., 2019). Notably, a variety of events, such as natural catastrophes, human error, and security breaches, can result in data loss in cloud computing. Client companies may suffer significant financial losses, harm to their reputation, infractions of the law, loss of vital data, and compliance violations in such circumstances (Soewito et al., 2022).

A hostile attack, a natural calamity, or a data cleanse by the cloud service provider could result in the loss of data stored in the cloud. Organizations lacking a recovery plan may face catastrophic consequences in the event of critical information loss. Examining your provider's backup plans with special attention to how they handle physical storage sites, physical access, and physical catastrophes is all that is necessary to secure our personal data. Data validation must be done once the migration is complete to guarantee that all of the data has been moved securely because data might be lost even during the migration process (Kalloniatis et al., 2013).

The issue of Charging Models

Cost analysis is now more difficult due to the elasticity process than it was while computing for static resources. Every aspect of cloud computing needs to be considered in an appropriate pricing strategy. To support multi-tenancy needs, SaaS vendors may have to pay hefty fees to rebuild and relaunch their systems. It is imperative that cloud providers and users employ an optimal billing model (Fahmideh et al., 2017). According to Bai et al. (2011), cloud computing is a growing sector of the IT business. The issue of cloud computing pricing is one that needs to be resolved quickly right now. For example, there's animosity toward chargeback models, which frequently results in conflict. The implementation may be costly due to the chargeback's cost. This methodology is ineffective because business units lack the expertise, transparency, and understanding necessary to comprehend a chargeback (Bai et al., 2011).

Remarkably, Sharkh et al. (2016) note that it entails pricing the resource cost based on the workload pattern, as per peak-level cost allocation. Billing for cloud users will be based on their peak and off-peak consumption periods rather than their average usage. This paradigm is comparable to those used for utility charging, such as electricity. This cost allocation has the benefit of being extremely straightforward. It's comparable to consumption metering. Peak and off-peak are the only two metering levels. The only resource utilization that the IT administrators track and document is peak usage. It is simpler to inform customers when they are consuming more resources than necessary. The drawback is that customers may be penalized by the cloud service provider if the peak and off-peak hours are changed, or even if there is little traffic during the designated peak time—for example, on holidays or during significant events (Sharkh et al., 2016). According to a study by Woitaszek and Tufo (2010), charging for computational time in the cloud may be suitable, but charging for the transmission of data between the supercomputer and the storage and systems in the front-end might only result in a small additional revenue. This finding supports the difficulty of charging models in cloud computing. Similar to this, charging for data storage space at going commercial rates results in inadequate income to cover the cost of purchasing and running the storage (Woitaszek and Tufo, 2010).

Service-level Agreements Challenges

Another challenge with service level agreements is that cloud users have no or little control over the resources that the CSP offers. There must be a mechanism to ensure that service providers keep their end of the bargain with clients. SLAs provide a means of striking this balance, but it's imperative that they're simple to understand and that the providers stand behind the caliber of the services they provide. Because of security concerns, organizations are employing SaaS more

frequently than IaaS. Storage and server use are negligible in comparison to administration and collaborative programs (Odun-Ayo and Agono, 2018).

Chana and Singh (2014) claim that SLAs are essential for guaranteeing the dependability and quality of services rendered by cloud service providers. But there are certain difficulties involved. The dynamic behavior of the infrastructure is one of them. SLA fulfillment is still difficult even though the cloud abstracts the fundamental infrastructure, including physical and logical resources. Depending on system configuration and service demand, suppliers could find it difficult to satisfy customer demands. Since SLAs were formerly separately negotiated between clients and service consumers, standardization and negotiation present the second challenge. But because of the big cloud providers that resemble utilities, most SLAs are now standardized until a client uses cloud services extensively (Chana and Singh, 2014).

Supporting the above finding, Qazi et al. (2024) affirm that in the context of cloud computing, SLAs serve as crucial legal frameworks that specify performance requirements and user-provider expectations. Numerous obstacles also face cloud computing SLAs. Issues with resource management arise when millions of consumers receive services through data centers. Managing data processing risks, giving users control over services, putting autonomous resource management into practice, allocating resources in SLAs through virtualization, and gauging service efficacy are some of the issues associated with SLAs (Qazi et al., 2024).

Issues with Scalability and Availability

One of the most difficult problems in providing cloud-based services is the ability to adjust cloud capacity to on-demand services when different workloads (such as static, recurring, once-in-a-lifetime, unanticipated, and continuously changing workloads) occur (Shuaib et al., 2019). When providing on-demand services, the absence of this capability may result in performance

degradation at the top of the workload or even oversizing at the bottom of the workload (Moghaddam et al., 2015). In order to make provisioning of resources more flexible than static scaling and less dependent on workload projections, elasticity in resource scaling is the best option for handling potential workloads in cloud computing environments (Shuaib et al., 2019).

According to Moghaddam et al. (2015), static scaling provisioning of resources begins based on the anticipated workload and ends when the workload reaches its anticipated peak. When the experienced workload exceeds the anticipated demand, this kind of scaling has a serious vulnerability to once-in-a-lifetime and unforeseen workloads and may result in system failure during resource provisioning. In addition, when an increase is recognized, new resources are provided at short intervals via elastic resource scaling. Furthermore, the provisioning procedure ends even if the workload reaches the anticipated peak. Workloads of any kind can be handled by elastic resource scaling. But the intricacy of elastic resource scaling algorithms could make resource provisioning procedures less effective, particularly when workloads are unexpected (Moghaddam et al., 2015).

Workload Migration Stress Testing

According to Moghaddam et al. (2015), even with cloud-performing applications, stress testing becomes crucial after migration. While some programs might experience latency problems, others might see higher-than-average running costs. Higher CPU usage or fees for utilizing the API and generating reports could be the cause of these costs. Errors committed by users throughout the workload migration process could complicate matters and make the move less successful. The process of choosing the right type of cloud instance is one of the main challenges; if done wrong, it could have a ripple impact on the entire migrated workload (Shuaib et al., 2019).

Interoperability Issues

Workload migration can also lead to interoperability problems, particularly when merging with legacy on-premises or cloud-based systems. Maintaining system communication and interoperability is essential to maintaining operational continuity. Businesses frequently experience difficulties with data formats, application programming interfaces (APIs), and communication protocols in this fleeting period (Andrikopoulos et al., 2023). Effective business continuity and backup plans, however, are essential to sustaining corporate operations since they minimize downtime both during and after workload relocation. To reduce the risk of losing data or service disruptions and sustain continuous business operations, organizations must have strong plans for data backup, restore, and failover procedures (Moghaddam et al., 2015).

Load Balancing Challenges

When it comes to storage usage and download speed in a cloud computing environment, load balancing is crucial. Here, the primary goal is to develop an algorithm that can efficiently distribute tasks among the cloud nodes in accordance with the constraints that are in place (such as high latency and heterogeneity). According to Moghaddam et al. (2015), load balancing challenges and issues in cloud computing systems are often divided into four main categories: performance, data replication, spatial distribution of the cloud nodes, and point of failure. The method used to oversee the load balancing procedure among all geographically dispersed cloud nodes is the first problem. This management should take into account many delays that may occur due to the distance between service nodes, the speed of network connectivity between cloud nodes, and the distance between clients and task processing nodes (Al Nuaimi et al., 2012). The second issue relates to the methods used for data replication, which include both complete and partial replication across several nodes. This is because full replication necessitates greater

storage, while partial replication depends on the complex nature of the load balancing algorithm across different cloud nodes (Moghaddam et al., 2015). The load balancing algorithm's performance is the subject of the following problem: Because load balancing procedures include numerous operations, the algorithm's complexity should be kept to a minimum to prevent errors and delays. The load-balancing algorithms' resilience to frequent or unforeseen failures represents their final obstacle. In cloud-based environments, managing and minimizing failures caused by load balancing algorithms' growing complexity through the use of a controller function is a difficult problem that warrants research attention (Balaji, 2021).

Architectural Challenges

Among the architectural issues is the problem of virtualization. Multiple cloud users can share resources on a real system thanks to virtualization. A hypervisor oversees the virtualization machine (VM) process. However, virtualization raises a number of security issues. Users can upload and download photos from the repository via virtual machine sharing (Odun-Ayo et al., 2017). Data breaches could result from malware included in the image that is to be posted., making it possible for malevolent users to ascertain the platform's security level. Users may also experience virtual machine isolation; however, since cross-VM attacks might result from sharing physical resources in the cloud, computational resources must also be isolated (Krebs et al., 2012). The hypervisor, also known as the virtual machine manager (VMM), is used to manage virtual machines (VMs) and manage resource access. Through a VMM escape, a malevolent user can circumvent the VMM's control and get unauthorized access to computational and storage resources. Krebs et al. (2012) add that virtual machine migration enables the movement of a virtual machine to a different physical computer for load balancing or maintenance. Data leaks could result from an incompetent attacker moving a virtual machine to a different server. When a

virtual machine is rolled back to an earlier state, stored security credentials are enabled, potentially endangering the security of data. The fundamental component of the virtualization procedure is the hypervisor, or VMM. User data may be exposed to the cloud if a malevolent user gains control of the VMM or if the VMM contains faults (Odun-Ayo et al., 2017).

The problem with data storage is the second. This is due to the possibility that data security and privacy may be jeopardized if users have no control over client (or company) data. Managing servers and data for users is the responsibility of the CSP (Krebs et al., 2012). Because of the cloud's multi-tenancy feature and the potential for rogue users to exist, all user data may be accessed without authorization. Assigning recovered data from one user to another is a data recovery vulnerability. This is a byproduct of cloud computing's resource-pooling and elastic features. Data recovery procedures might be utilized by a malevolent user to acquire the data belonging to an earlier user. It is imperative to appropriately dispose of storage devices and safeguard the data backup process against unauthorized access (Odun-Ayo et al., 2017).

4.1.3 Considerations for Effective Workload Migration to the Cloud

In order to successfully migrate workloads to the cloud, businesses need to take certain factors into account. Comparative studies that have assessed the benefits and drawbacks of the major cloud providers have allowed organizations to make educated judgments regarding their cloud strategy. Cardoso et al. (2014) emphasize the need for caution while moving internal IT services to the cloud computing paradigm in order to prevent the institution undertaking the transfer from suffering large losses.

Selection of Migration Strategy and Process

A range of migration strategies, such as re-platforming, lift-and-shift, re-architecting, and hybrid approaches, are documented in the literature, claim Cardoso et al. (2014). Previous data indicates

that lift-and-shift migration is used for at least one application by over 64 percent of businesses. As more clients choose multi-cloud solutions, it is imperative to ascertain the number of firms utilizing a lift-and-shift migration plan as part of their multi-cloud strategy (Cardoso et al., 2014). Madhavaiah et al. (2012) concurs that it's critical to take the type of migration into account. Choosing the right migration strategy is an important choice that affects how well the migration trip goes. Making informed decisions requires firms to carefully assess their goals, existing infrastructure, and budgetary constraints when deciding between lift-and-shift, re-platforming, or application rewriting approaches (Madhavaiah et al., 2012).

Morgan and Conboy (2013) add that a company's chosen migration plan is one of the additional considerations, in addition to costs and money. For established companies that did not start in the cloud, there are usually two important options. Do they move using fix-and-shift or lift-and-shift techniques? The differences between these two strategies depend on the outcomes the company hopes to achieve. The process of moving a currently running database program from the data center to the cloud with the fewest adjustments required is called lift-and-shift, and it may be less expensive. While there are financial advantages to this technique, there may be a number of compatibility problems and data delays that will need to be resolved, which could take some time. The process of repairing the culture and altering the applications and databases during the migration of cloud infrastructure is known as "fix-and-shift," on the other hand. Instead of creating a single, monolithic piece of software, the organization creates hundreds of microservices, each of which can be improved and expanded independently of the others while still working as a unit (Morgan and Conboy, 2013).

Another important consideration when shifting workloads to the cloud is whether the process will be handled internally or by other parties. Occasionally, outside vendors offer a

comprehensive package that may include other services from their partners. This is good since it could provide services that the company needs now but doesn't think it will need in the future. One potential financial disadvantage of this could be that the greatest services may come at a cost that is prohibitive for organizations, especially smaller ones who have less money allocated for this process. On the other hand, in-house migration may occasionally be advantageous since it frees up time and resources by allowing the company to concentrate on the particular needs of its current situation rather than providing a broad range of services (Shethwala and Karamta, 2017).

Setting out a Comprehensive Preparation Plan

It is also advisable to do thorough preparation before moving to the cloud. This means that before proceeding, all the necessary arrangements must be reviewed, including the company's migration goals, the timeline, the budget, and the people overseeing the process. This is an important phase since it would be costlier for the company to start transferring its essential data resources and then become bogged down in the process. Even with the best-laid plans, there is always some risk when moving to the cloud, so management should always be prepared for any unforeseen circumstances (Boutaba et al., 2023). As an illustration, consider Netflix's decision to go to the cloud, which was spurred by the company's rapidly expanding data needs as a result of its rapidly expanding global user base. When Netflix partnered with Amazon Web Services (AWS), it had the goal of completing a full data-center-to-cloud transition at a time when many companies were still unaware of the benefits of cloud migration (Boutaba et al., 2023).

Developing a Cost Management Tactic

Furthermore, studies show that a variety of solutions have been created to reduce the expenses related to cloud migration; two such strategies include restructuring and deactivation of unused

resources (Fisher, 2018). Performance, need, and usage patterns of each instance are analyzed, and when workload demands require overallocation or underallocation, any idle instances are terminated. Using serverless computing, which usually charges by consumption instead of fixed bandwidth, is another strategy employed by companies to provide back-end services on demand (Boutaba et al., 2023).

Selection of the Type of Cloud to use for the Migration of Workloads

An additional tactic to enhance the success of workload migration is to assess the delivery mechanism's adaptability. The type of cloud that best meets an organization's needs should be considered, such as hybrid solutions that offer both public and private services for different business divisions or public cloud data controlled by public cloud providers (Aryotejo et al., 2018). Thus, it is crucial to closely examine the application's trial version, as it can offer insightful details about how easy and quick tasks can be accomplished, as well as useful information regarding the program's usability and interface (Aryotejo et al., 2018).

Understand the Security Levels and Compatibility

Goyal stresses the significance of comprehending the security measures in place in the application and data center, the methods used by cloud providers to secure data from viruses and hackers, and their backup and recovery protocols (Goyal, 2014). Accordingly, it is vital to comprehend platform compatibility in order to ensure functionality across the range of operating systems and web browsers that the company may use (Goyal, 2014). Shethwala and Karamta (2017) bolster this claim by stating that security and compliance concerns are equally important. This is true, as security and compliance are the two main tenets of cloud migration. Studies demonstrate how important it is to use robust security procedures and encryption when transferring data and utilizing cloud-based applications. Ensuring adherence to industry

regulations and data protection laws is crucial for preserving data safety and confidentiality in cloud environments (Shethwala and Karamta, 2017). Madhavaiah et al. (2012) goes on to say that businesses should give great consideration to security and compliance issues. Important components of cloud migration include security and compliance. Strong security protocols and encryption are required for data movement and cloud application operations. Ensuring adherence to industry rules and data protection laws is crucial for upholding data privacy and confidentiality in cloud computing environments (Madhavaiah et al., 2012).

Post-migration Optimization

According to Boutaba et al. (2023), post-migration optimization is another strategy to ensure a seamless changeover. Post-migration optimization is highlighted as an ongoing process that businesses should do to continuously improve the security, performance, and cost of cloud-based workloads and applications. Regular monitoring, adjustments to resource allocation, and cloud cost control are essential post-migration optimization techniques (Boutaba et al., 2023). In a similar spirit, Madhavaiah et al. (2012) highlight the equal importance of post-migration optimization in order to consistently improve the cloud-based workloads' security, performance, and cost-efficiency. A competitive advantage in a changing digital environment and the ability to fully utilize the advantages of cloud computing depend on regular monitoring and optimization of cloud resources (Madhavaiah et al., 2012). Odun-Ayo and Agono (2018) add that improving infrastructure usage efficiency is the goal of cloud management and optimization. Management teams in enterprises understand the need for cloud optimization because of the range of services that cloud computing continuously provides, which is a crucial component of their information technology infrastructure (Odun-Ayo and Agono, 2018). Businesses have discovered that, in addition to implementing cloud services, it is more satisfying to have proper, close monitoring

and evaluation of resources in order to guarantee optimal performance and productivity (Saraswat et al., 2023).

Businesses should have a look at a few of these cloud optimization tactics to ensure a smooth and successful transition of workloads to the cloud. The first is the governance plan, which has a tight connection to cloud optimization. A cloud governance plan establishes the process by which a company uses predetermined rules to assess and manage its cloud solution. In order to ensure the responsible use of resources, cloud governance can efficiently decrease instances of inefficient cloud usage (Odun-Ayo and Agono, 2018). Investing in data analytics in the cloud is the second. A company needs a way to figure out who is utilizing its cloud services, where they are being used, and how. This makes it possible for the cloud services to continue operating at their best (Saraswat et al., 2023). The third approach to optimization management involves scheduling, scalability, and dynamic uptime. Many workstations make up the bulk of the systems utilized in the cloud platform, and these workstations only operate during regular business hours. Except for sometimes doing batch operations, back-end systems are frequently inactive. As a result, in addition to standard batch functions, systems should be examined and arranged according to their uptime requirements, such as 24/7 and weekday only. To make sure they satisfy needs, a system can be scaled according to load or other metrics that are found. Automation of system uptime ought to be done via classification (Odun-Ayo and Agono, 2018).

The fourth strategy is leveraging purchase commitments. Large cloud service providers provide steep discounts in exchange for meeting predetermined milestones over time. It is possible to lower expenses and boost return on investment by using the different expenditure models. Thus, in order to benefit from a suitable model, uptime schedules must be determined (Saraswat et al., 2023). Lift and shift management constitute the sixth strategy: A lot of cloud infrastructure

initiatives begin as lift and shift initiatives, in which the current on-premise infrastructure is transferred, exactly as it is, to the cloud. This strategy could lead to an unwieldy and ineffective system. As a result, the size of each system instance and functionality should be determined by the actual performance requirements. Saving money by using reserved instances and shutting down unused instances has proven to be a worthwhile endeavor (Saraswat et al., 2023). Also, instance sizing ought to be taken into account as an optimization management tactic. Selecting a single instance that satisfies an organization's initial needs is crucial. Size adjustments can be performed on demand if further usage and monitoring show that the needs need to be changed (Odun-Ayo and Agono, 2018). The auto-scaling approach is the last one. Adopting a dynamic environment that adapts to demand is a requirement of using the cloud. Autoscale is a crucial and fundamental cloud functionality that lets users specify their maximum and minimum instance pools in addition to basic scaling parameters like CPU utilization rate (Odun-Ayo and Agono, 2018).

Effective Planning and Assessment

Before starting a cloud migration journey, careful preparation and assessment are crucial (Madhavaiah et al., 2012). A successful cloud migration requires a well-defined migration plan that is adapted to the unique demands and objectives of the company. A crucial component of cloud migration is data migration, and enterprises need to make sure that data is transferred to the cloud environment securely and seamlessly. To choose the best migration method based on organizational objectives and the current infrastructure, thorough planning and evaluation are essential. An efficient and safe transmission of data to the cloud is ensured by careful planning for data migration, which reduces the possibility of data loss or corruption (Madhavaiah et al., 2012). A well-defined plan of action is aided by efficient preparation. Even though companies

and organizations are frequently eager to utilize cloud infrastructure, in order to get the greatest results, it is crucial to approach the procedure with a clear strategy and action plan. A cloud migration strategy should take into account a variety of aspects, such as how to prevent downtime and the overall aims of the move. Additionally, it is crucial to carefully consider which workloads are best suited for the cloud during the planning and assessment process. Avoid choosing to run apps in the cloud that would be more suitable on-premises. This variable varies based on the particular requirements and commercial goals of your organization, the cloud service providers you have selected, and the cloud distribution types you have used (SaaS, PaaS, or IaaS, for example) (Rai et al., 2013).

It should be added that, after a business has made the decision to embrace cloud computing, success depends on developing a thorough roadmap that outlines the resources and migration process. It is important to think about what needs to be migrated, why, and who will be in charge of each step of the transfer. A smoother transition can be achieved by clearly identifying these routines. Along with employing technologies like automation, the plan should take latency, dependencies, and security concerns into account. Aligning the IT complexity during cloud migration is another benefit of efficient planning and assessment (Ahmad et al., 2020). It can be difficult to align an organization's cloud plan with its overall IT strategy, especially if its current IT infrastructure is complex. Developing and implementing an appropriate cloud migration strategy may be more challenging due to IT complexity (Ahmad et al., 2020). In order to avoid introducing a complicated new cloud or hybrid environment, with all of its associated expenses and difficulties, the corporation must thoroughly plan and create a workable vision. To reduce disparities and interoperability issues among various systems, the company should aim to create

an architecture for cloud computing that is compatible with the current internal IT infrastructure (Rai et al., 2013).

Considering Cloud Migration Best Practices

Cloud-based legacy application migration is a significant task. Even though technicians believe they are following all the proper procedures, mistakes might still happen. The literature also emphasizes how important it is to follow recommended practices in order to ensure that a cloud migration is successful. Thorough preparation and evaluation are necessary in order to select the optimal migration strategy based on organizational goals and the existing infrastructure. Careful planning for data migration minimizes the chance of information loss or corruption, ensuring a safe and seamless transfer of data to the cloud (Boutaba et al., 2023).

Here are some recommended practices for cloud migration that can reduce a business's risk of loss, facilitate a trouble-free cloud migration, and prevent any migration issues.

1. SWOT Analysis

In this instance, the migration team within the firm should weigh the benefits and drawbacks of cloud computing. Because a SWOT analysis addresses more ground than simply the technical aspects of the relocation, it is advantageous to apply it for this procedure. The total cost of ownership, required personnel training, legal compliance, and security protocols are all taken into account. An organization can use this overhead perspective to improve its planning procedures and identify any vulnerabilities that its staff should be aware of (Fehling et al., 2013).

A SWOT analysis is crucial because it provides information about the advantages of cloud migration for a firm and highlights important possibilities and strengths that should be capitalized on. It makes sure a business is informed about anything that could jeopardize its

migration project. This evaluation shouldn't be viewed as a one-and-done task in a setting that prioritizes ongoing improvement. Rather, it ought to be maintained as the migration moves along and record any new dangers as well as any possibilities that arise (Fehling et al., 2013).

2. Evaluate the Environment.

An organization must assess its existing IT environment prior to initiating a migration. Luckily, there are resources available to assist with this procedure. The Microsoft Assessment and Planning (MAP) toolbox, which addresses capacity, network design, performance needs, availability, infrastructure, and resilience requirements, is made available to IT professionals by Microsoft. It's crucial to use this tool to examine and record a company's current practices in each area since doing so will make it possible for the business to use the MAP toolkit to identify any additional maintenance processes required in its new cloud environment (Kumar and Garg, 2012).

This should also contain the personnel that a business has on hand and whether any processes will be outsourced. Ultimately, assigning a team of just two IT personnel to a multi-year, company-wide migration effort is ineffective. As a migration project moves forward, an organization aiming to relocate must periodically reevaluate its surroundings. This is especially important if the company has altered the departmental structure, added new software, or made other significant changes that may require the legacy program to interface with them (Fehling et al., 2013).

3. Test First (Conducting a Pilot Study)

Conducting a test or pilot migration prior to starting the real procedure is a smart idea. This enables an organization to test the migration in a secure simulation setting that closely mimics

the real-world circumstances in which the migration will occur. That's essentially the sole investment at this moment, even though executing a pilot migration can take some time. Users can try the apps in a low-risk, safe environment to iron out any kinks or issues before using them in a real-world setting. It's a good investment to work out any issues before the live migration, provided that time is not an obstacle (Boutaba et al., 2023).

A corporation should ideally carry out test migrations in a virtual setting that closely resembles the real migration circumstances. Ask actual end users how they feel about it; they might point out issues that a business missed. A pilot migration is essential, even in an ongoing development framework, as it helps prevent any significant defects from emerging early in your project (Bond, 2015).

4. Migrate your Legacy Application

It is now time for the migration of the legacy application after coming up with a plan and testing the approaches. A more conventional method would entail organizing several stages, possibly spanning several years. Something may be moved, tested, and teams trained on the new cloud solution and the old one decommissioned by the organization. Nonetheless, through an ongoing procedure, users are still able to access the old system through the additional features that integrations provide. This allows you to continue making changes in the background while facilitating a smooth transition between the two. In this instance, an organization can easily construct integration points as needed using automation (Zhao and Zhou, 2014).

5. Managing Cloud Resources

An organization must closely monitor its cloud resources once the migration has started. They nevertheless need to be maintained, even if they are frequently easier to administer than ones

kept on a business's own hardware or software (Banerjee, 2012). In order to ensure that everything is running smoothly, it is necessary to periodically check in with the suppliers. Organizations should also ensure that they are optimally functioning, secure, and updated on a regular basis. Consequently, a company can discover that it needs to grow beyond its initial plans or choose to simultaneously move other apps to the cloud (Ahmad et al., 2018).

Chapter 5: Conclusions, Implications, and Recommendations

This systematic review aimed to explore workload migration to the cloud through a comprehensive analysis. This included investigating the benefits and challenges of migrating to the cloud, as well as factors or strategies that can be taken into consideration to ensure an effective and successful migration of workloads to the cloud. This section discusses the findings of the study by presenting a summary of the findings, relevance and meaning, conclusion, implications and application, and finally future research.

5.1 Summary of the Study Findings

Benefits of Workload Migration to the Cloud

The study revealed that cloud migration of workloads results in various benefits to organizations. However, there are also some challenges encountered that can only be countered by considering the strategies outlined to ensure an effective and successful migration. Accordingly, first, the study's conclusions showed that resource advantage, scalability, and enhanced flexibility are the main advantages of workloads. In terms of adaptability, the results showed that cloud computing offers organizations more adaptability by letting them grow and distribute computing resources on the fly in response to demands. These changing needs play a major role in the ability to modify dynamic expectations in response to changing workloads. Cloud computing allows businesses to swiftly scale up or down while optimizing resource utilization, in contrast to traditional on-premises systems. This built-in functionality ensures that resource updates happen quickly, ensuring that the IT system may be adjusted to meet the constantly changing needs of the enterprise. Using the cloud offers a scalability advantage in that resource demands may be met by the infrastructure without any issues, avoiding bottlenecks and maintaining optimal performance. When the expectations of clients (businesses) change, the cloud sets itself apart as

a platform that is adaptable and agile. Whether the objective is to enhance responsiveness, boost accessibility, or provide innovative functionalities, the cloud enables enterprises to continuously adapt and surpass customer demands.

In addition to these benefits, the research indicates that shifting workloads to the cloud also saves money on IT expenses for a number of reasons, such as the ability to quickly allocate and release resources within a cloud environment and the fact that service providers can rent cloud resources based on their requirements. With this feature, consumers are able to request resources based on their own needs, preventing unwanted or underutilization of computing resources and saving considerably on IT costs. Also, it reduces IT costs because moving to the cloud saves a company the time and money it could have invested when the legacy system inevitably breaks or loses functionality. Other benefits entail opening doors for leveraging new technologies such as AI; increased productivity as workload in the cloud can enable workflow automation through cloud management; improved accessibility of the data (workload) as all employees of a company can log in to the cloud anywhere they are and access data; increased profitability because of the reduced investment costs when moving to the cloud as well as the paying model where companies pay per use; and finally, moving workload to the cloud provides more security than on-premise infrastructure in terms of data loss and resilience. These advantages imply that moving workloads to the cloud is a good investment or decision that companies need to consider in light of the advancement of technology in the digital world. Therefore, it is something that more companies, whether big or small, local or international, should consider as a necessity to enable them to reap the benefits and grow their businesses.

Challenges Encountered when Migrating Workloads to the Cloud

Notably, the study findings also revealed that there are some challenges that businesses may encounter when migrating workloads to the cloud. As per the findings, these challenges include the challenge of cost management and control. To improve the allocation, supervision, and management of the financial resources allocated to cloud services and infrastructure, it is challenging to strategically plan and execute efficient cost management practices. Second, networking and security issues arise from its susceptibility to attacks like sniffing and spoofing, which can result in the disclosure of a company's confidential information. Third, moving workloads to the cloud may result in data loss since there are a number of reasons why data loss can happen in cloud computing, including security breaches, natural disasters, and human error. Client companies may suffer significant financial losses, harm to their reputation, infractions of the law, loss of vital data, and compliance violations in such circumstances. Fourth, there is the matter of charging models. Chargeback models have been the subject of complaints, which frequently result in a dispute. The chargeback's cost may make implementation pricey. This methodology is ineffective since business units lack the knowledge, transparency, and understanding necessary to comprehend a chargeback.

The study's findings state that since cloud users have little control over the resources provided by the CSP, service level agreements pose additional challenges. There must be a mechanism to ensure that service providers keep their end of the bargain with clients. SLAs provide a means of striking this balance, but it might be challenging to comprehend the terms, and the providers do not ensure the caliber of the services they provide. Furthermore, there are issues with availability and scalability because the static scaling provisioning of resources begins based on the anticipated workload and ends when the workload reaches its peak. When the experienced workload exceeds the anticipated demand, this kind of scaling has a serious vulnerability to

once-in-a-lifetime and unforeseen workloads and may result in system failure during resource provisioning. In addition, when an increase is recognized, new resources are allocated at short intervals via elastic resource scaling.

Stress testing for workload migration is especially problematic since human errors committed throughout the process could prevent a seamless transfer and introduce a host of new problems. A significant challenge is choosing the right type of cloud instance, which can have a cascading effect on the entire transferred workload if done wrong. However, there are still more difficulties, such as load balancing, interoperability problems, and architectural difficulties like the virtualization problem.

These results about the difficulties in migrating workloads to the cloud suggest that an important factor in determining the success of cloud computing is the capacity of institutions to handle these difficulties. The use of cloud models must be accompanied by an understanding of the adoption obstacles and methods to address them to avoid unintended technological implications and even more serious issues from the standpoint of government information management.

Considerations for Effective Workload Migration to the Cloud

The results showed that businesses needed to take certain steps to overcome the obstacles in order to successfully migrate workloads to the cloud. Comparative studies that have assessed the benefits and drawbacks of the major cloud providers have allowed organizations to make educated judgments regarding their cloud strategy. Care must be taken while moving internal IT services to the cloud computing paradigm in order to prevent the organization making the change from suffering large losses. In order to make educated judgments, these factors must be carefully considered. These include choosing the migration strategy and process, which includes deciding

whether to use a re-platforming, lift-and-shift, or application rewriting method. Creating a cost-management strategy is the second thing to think about. This means taking into account a variety of cost-management techniques, such as restructuring and deactivation of idle resources, in order to reduce the expenses related to cloud migration. The third step is to comprehend security and compatibility levels. It's critical to know how the application and data center are protected, how cloud providers secure data from viruses and hackers, and how they backup and recover. Post-migration optimization is another crucial element to take into account for a successful workload migration. This strategy aids in ensuring a seamless transition because it is an ongoing procedure that businesses should implement to continuously improve the performance, security, and affordability of cloud-based workloads and apps. Companies may want to think about post-migration optimization techniques such as cloud cost control, resource allocation adjustments, and routine monitoring.

One further thing to think about is efficient planning and evaluation. Prior to starting a cloud migration journey, this strategy should be carefully considered. A successful cloud migration requires a well-defined migration plan that is adapted to the unique demands and objectives of the company. A crucial component of cloud migration is data migration, and enterprises need to make sure that data is transferred to the cloud environment securely and seamlessly. The best migration strategy must be chosen based on organizational objectives and the infrastructure that is already in place, which requires careful planning and assessment. The danger of data loss or corruption is reduced when data migration planning is done properly, ensuring a safe and smooth transfer of data to the cloud environment. The last consideration for a smooth and successful workload migration to the cloud is cloud migration best practices. Cloud-based legacy application migration is a significant task. Even though professionals believe they are following

all the correct procedures, mistakes might still happen. such as doing a pilot study, analyzing the environment, conducting a SWOT analysis, migrating your legacy application, and managing cloud resources to ensure they are safe, updated frequently, and performing at their best.

5.2 Conclusions, Implications, and Applications

When companies start their transformative journey to move from using data centers to the cloud, they are likely to meet a complex terrain of opportunities and problems, according to the systematic review done on the migration of workloads to the cloud. The results of this study demonstrate that both small and large businesses have widely adopted cloud migration tactics due to the ever-evolving nature of the cloud computing ecosystem. This change has several strong reasons, including cost-effectiveness, scalability, and agility. These reasons highlight how strategically important it is for businesses to use cloud-based resources, and as the conversation demonstrates, more and more businesses are prepared to pay for their data and apps to be stored in the cloud. Organizations can benefit from increased flexibility and better resource use after moving to the cloud, in addition to agility and low costs. As a result, more businesses than ever should take advantage of these advantages and move their burden to the cloud, taking into account the best practices and elements for a successful migration and overcoming any obstacles.

But moving to the cloud is not without its difficulties, and managers and company executives in charge of the process should be aware that there are significant risks associated. Identification and comprehension of these obstacles are critical for companies striving for a smooth transition. Security considerations are among the most significant challenges that come with data migration. Another significant barrier that has surfaced is the requirement for a resilient and flexible IT infrastructure. This systematic review has highlighted the importance of thorough planning and comprehensive strategies while also shedding light on potential difficulties that companies may

encounter during the migration process. While navigating these obstacles, the conversation has revealed important factors that affect how well workloads are moved to the cloud. The results highlight how crucial careful risk assessment, strategic planning, and the incorporation of best practices are to a successful move. Therefore, for businesses looking to maximize their cloud transition initiatives, it is imperative that they comprehend the complex interactions among technological, organizational, and environmental aspects as they are highlighted in the literature. In this instance, a comprehensive strategy that takes into account organizational and technical aspects is necessary to ensure a seamless and effective cloud migration. As a result, every company considering a cloud migration for their workload—as well as those that have already done so partially or completely and are thinking about switching to a different kind of cloud, like going from a public to a private workload—should pay close attention to all the factors that have been mentioned as needing to be taken into account. For example, a company's choice of cloud migration strategy and type (public, hybrid, private, or community) are crucial, as are the preparation and assessment steps to guarantee everything is in place for a smooth transition. Similar to this, post-migration optimization is crucial to ensuring that cloud computing is efficient and to identifying the best practices for ensuring cloud data protection.

All things considered, the systematic review of workload migration to the cloud has shed important light on the advantages, difficulties, and important factors related to the transformational process that businesses must go through in order to migrate. It is clear that while new businesses might choose to launch on the cloud, established businesses must devise plans to guarantee a smooth transition from traditional data centers in order to reap the benefits of the cloud.

5.3 Recommendations

The length of the migration, the cost of the move, and the ongoing expenses are three important factors to consider when moving a database to the cloud. An organization can select between cloud providers and various migration techniques (e.g., Internet versus shipping) by having a thorough grasp of each. The demand on a system both now and in the future is not taken into account by existing cloud cost estimates and methods. They depend on the user correctly balancing the promised cloud resources with their workload. As a result, their precision is constrained in practical applications (Ellison et al., 2018).

There are numerous major issues involved in moving large relational databases from physical premises to the cloud, such as selecting the right cloud provider, managing system outages, and selecting appropriate cloud instances. The database may be set up and configured on a virtual machine or put on a database-as-a-service provided by a number of public cloud providers. In either case, understanding the workload and size of the database is necessary to choose the right cloud resources. The source database's infrastructure may have an effect on how long the migration takes; if it has a limited amount of bandwidth or capacity, the data extraction process will take longer. To expedite the migration process, an organization might want to improve the hardware currently used for the database or plan downtime to move the database when it is not in use (Badshah et al., 2021).

Organizations can use models to precisely estimate the cost and length of cloud database migrations in order to address cost challenges. This will facilitate the evaluation of various migration alternatives and criteria, hence aiding in the process of making decisions. For every migration, a cost baseline is generated using the Microsoft Azure pricing calculator and the Amazon Simple Monthly Calculator. These are frequently the first resources a company uses to

plan a cloud migration. However, they have a lot more drawbacks than our method (Ellison et al., 2018).

Organizations making the move to the cloud can take into account security strategies like end-to-end separation, which reduces malware distribution, provides deep visibility into east-west traffic movement over distributed networks, and authorizes the isolation and identification of compromised devices; a robust end-to-end separation technique that includes internal distinct firewalling over data centers; or private cloud segmentation, which isolates applications and data in an increasingly consolidated environment, to address security challenges. Regardless of the physical network topology, an organization could think about micro-segmenting workloads to create a single virtual task (Adun-Ayo et al., 2018).

Smart workload migration: Overutilization is a difficult problem in developing smart device systems because of scarce resources. This leads to poor performance, increased costs, and low prices because service level agreements (SLAs) are broken. Both customers and providers find these factors exceedingly annoying. In order to get over the problems with resource scalability, external resources are engaged; nevertheless, this comes with a higher delay, operation time, and transfer cost (Badshah et al., 2021). An increase in lateness directly translates into higher expenses and increased consumer discontent. Geographic distance and overuse cause an increase in transfer costs and delays. This article proposes a mechanism to search for an optimal data center (DC) where resources can be taken under ideal conditions, hence making effective choices regarding migration to external cloud service providers (CSPs) with the goal of minimizing the delay, operating time, and transfer cost. The suggested framework is simulated by extending the Cloud Analyst (Badshah et al., 2021).

Additionally, companies are using sophisticated solutions to manage workloads across computer environments and workflows. They make use of solutions such as cloud management platforms (including Amazon Web Services (AWS), Google Cloud Platform, IBM Cloud®, and Microsoft Azure), backend APIs, task automation software, and AI-based predictive analytics. Businesses are also using workload placement plans, in which they assess each workload's optimal location according to its lifetime, cost, performance, compliance, and business needs. With this method, each job is guaranteed to be operating in an environment most suited to its unique requirements (Badshah et al., 2021).

5.4 Future Research

This research was limited in its methodology as it was a systematic review. The papers that were included for analysis in this review were restricted to papers published from 2010–2024. This implies that there is a possibility that some pertinent papers were left out, which may have limited the quality of the findings as the recommendations for the factors to consider for effective workload migration may not be all-inclusive. Therefore, future studies focusing on this topic should use other methodologies, such as interviews and case studies, to uncover the true state of workload migration from first-hand information regarding the benefits, challenges, and factors that need to be considered to ensure an effective and successful migration to the cloud.

Also, future research may focus on dwelling on the challenges of workload migration and providing solutions that companies can adopt to counter the challenges using methodologies such as interviews or questionnaires to get information from cloud providers and companies.

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