Distributed Cloud Architecture on Digital Repository for Digital Transformation

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Abstract: *The purpose of this study is to study distributed cloud architecture on digital repository for digital transformation resulting from technological progress, given that efforts should be made to improve the efficiency of the modern education system in terms of the process of teaching and learning and provide accessibility services. Cloud computing services transform the current education system into a more advanced one. There are many tools and services available to make teaching and learning more interesting. In the education system, data flow and basic operations are almost the same. These systems need to be improved to achieve progress and flexibility in what they do. Building the right distributed cloud architecture on digital repository for digital transformation provides all the benefits of the cloud to the user. At the same time, educational institutions also want more secure and detailed information. Therefore, there is a need for securing an on-premises data center along with the cloud infrastructure. This paper proposes distributed cloud architecture on digital repository for digital transformation a flexible and secure to meet the growing demand for education.*

Keywords: distributed cloud, cloud services, digital repository, digital transformation

1. Introduction

Current technology has changed people's way of life by using new information and technology to compete for knowledge**.** With the passage of time during the information age, there has been a rapid change in that modern learning management has increasingly seen the impact of knowledge**.** Therefore, learners need to seek how to access such knowledge and skills in accordance with such changes**.** ICT literacy cooperation organization networks develop the ability to use digital technology**.** Communication and networking tools that are available include access management, integration, evaluation, and data generation**.** These allow users to be able to work in a knowledge society**.**

The level of ICT literacy are users being able to Define, Access, Manage, Integrate, Evaluate, and Communicate (UNESCO, 2008).

Data warehouse system development involves improving a compilation of databases from many sources and periods of time in terms of developing information to make it complete in all forms and recorded as a system. This would consist of a database that is easy to both access and use. Information is stored in a system that ensures efficient use and have a management system Data warehousing in the field of data collection, screening, development and utilization. This involves having a management system incorporating data warehousing to allow data collection, screening, development, and utilization. Digital data collection has the advantage of being able to access such data quickly and efficiently, which helps to promote the learning process (Digitized Thailand, 2015). The technology that has evolved to date is in the form of cloud computing technology. This has the unique feature that it is highly flexible in terms of increasing and decreasing the amount of system resources according to actual needs, while also reducing costs associated with user resource management. It is a technology that uses a computing method based on user needs. The system will allocate resources and services in such a way as to meet the needs of users. The system can be flexible in terms of being able to increase or decrease the number of resources to suit the needs of users at any time (Cheng et al., 2012). Digital storage plays an important role in the use of records in research. This requires the need for the reconciliation of archival documents because long term content is valuable (Kutay, 2014).

Based on the information discussed above, the researchers created the design of a distributed cloud architecture on digital repository for digital transformation which will help the system to ensure a more systematic organization of data storage.

2. Literature review

2.1 Distributed cloud

The distributed cloud refers to the cloud spread across multiple geographic locations, most of which are needed by companies with branches all over the world. The spread in cloud computing means spreading to different systems placed in multiple locations. It also works for customers who operate and access the cloud using a variety of devices and interfaces (Al_barazanchi et al., 2020). System components have access control and access priorities so that parts of the system will not have access to specific components within the system. However, these components can access other points within the cloud space based on the priority and accessibility features provided. Most distributed clouds are used internally connected via the internet. This sometimes also happens infrequently through third-party cloud sources. Most distributed cloud attacks occur through internal system sources or directly via the Internet.

2.2 Cloud services

Cloud hosting offers many types of services. The cloud is organized, and the architecture built, according to the services available, each with its own usage patterns. Such service formats are described below with priorities in mind. Cloud architectures must be built based on the type of services they provide, and the overall system must be sufficient to support the service. (Ghorbel et al., 2021)

Infrastructure as a Service

This model provides infrastructure as a service to customers. Infrastructures may contain high-level APIs for consuming a range of resources within that infrastructure such as hardware resources, data partitioning, storage, computing resources, security, and backup services. With this model, part of the cloud infrastructure can be shared (Narantuya et al., 2018).

Platform as a Service

The model provides a platform for customers for providing data processing, storage, backup, security and for all types of computers. It supports resources and provides storage space to enable customers to use software and remote data from anywhere in the world. (Amit Garg & Rakesh Rathi, 2019).

Software as a Service

This service model contains (Venkateswaran et al., 2019) software as a product or service. This works on a subscription basis, where customers can upload their projects to the cloud and use cloud resources to run the software and work online. Common examples of these include Google Play apps, Rebus Farm, and G suite.

Function as a Service

This service model benefits customers by allowing them to develop, debug, and run application functions without a complex hardware architecture and superior infrastructure **(**Qiu et al., 2022**)**.

2**.**3 Digital transformation

Digital transformation **(DT)** is characterized by planned changes created on the basis of advanced technologies**.** Digital transformation can be described as an organization's shift towards big data, analytics, the cloud, and mobile communications technology**.** Digital transformation includes the sum of many innovations and digital technologies**.** It introduce actors, structures, practices, values, management and beliefs that alter, destroy, replace or complement existing rules of the game within an organization, ecosystem, industry or field **(**AlNuaimi et al., 2022**)**.

2.4 Digital repository

A digital repository is involved in efforts to digitize the collection of intellectual works and scientific materials**.** Accessible online, digital repository also plays a role in giving users access to all their data online in one form or another**.** Digital format to make communities more facilitated with easy access and establishment of venues **(**Rismanto et al., 2021**)**.

With the use of a low-resource digital repository design, it is clearly easier to migrate to other software systems**.** It is not necessarily designed for low-resource environments**.** However, using such a design might be the bad step. This is because it requires collections that are easily preserved and destroys the attributes of simplicity that allow collections to be preserved **(**Frank, 2022**)**.

3. Proposed Cloud Based Education Architecture

3**.**1 System analysis and design

Designing distributed cloud architecture on digital repository for digital transformation shows commitment on the part of the organization with regard to corporate executive use**.** An overview of the proposed architecture is shown in Figure 1**.** It is a distributed cloud environment that includes both an enterprise data center and cloud infrastructure**.** Distributed cloud is built into the cloud infrastructure to maintain the resources needed to manage the education system**.** Creating such a distributed cloud provides better control over resources in a network environment**.** Institutional data centers in the same education domain are connected via the distributed cloud, or through direct connection. Thus, institutional data centers in the cloud can act as a single network, which means that resources in the data center can communicate over private IP addresses.
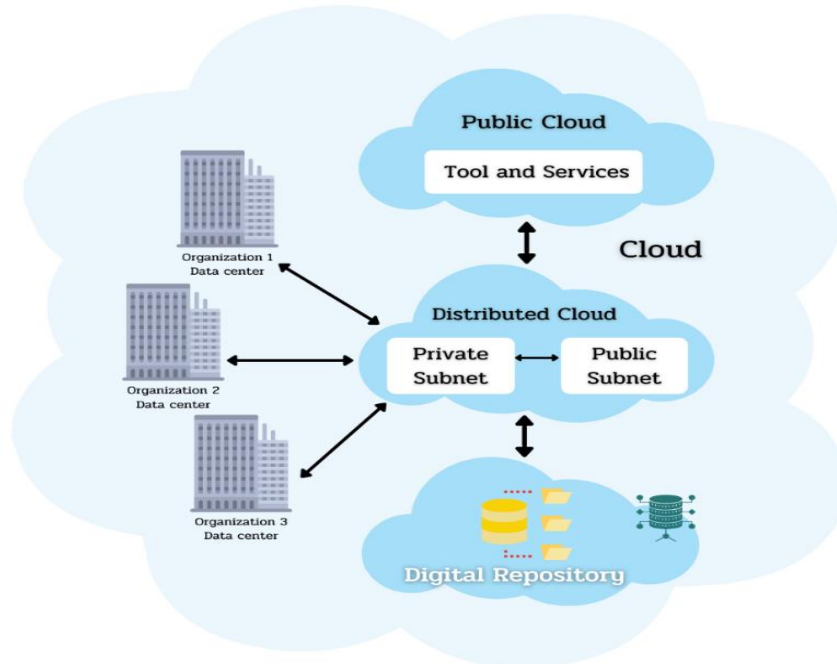

Figure 1. Overview of distributed cloud architecture on digital repository for digital transformation

The detailed functionality of the architecture is shown in Figure 2. An organization's existing on-premises data center is used to manage data and operations on premises. Therefore, workloads that are closely related to the organization are shared by the internal data center. On the other hand, some sensitive data and actions, such as dealing with student assessment details, should be managed within the corporate data center. Cloud infrastructure is managed using resources from cloud service providers. Such an infrastructure can be dynamically scalable by adding resources as needed. First, a distributed cloud was created to maintain the resources of the education system. To control access to the resources used in the distributed cloud which are maintained in a subnet, the web and database servers are in separate subnets. Different access rights are assigned to subnets so that resources have different access levels. Instead of connecting individual resources in the cloud, the distributed cloud allows data center connections to the cloud network. Routers in on-premises data centers connect to the distributed cloud through direct connections. The main elements and functions of the architecture are discussed as follows.
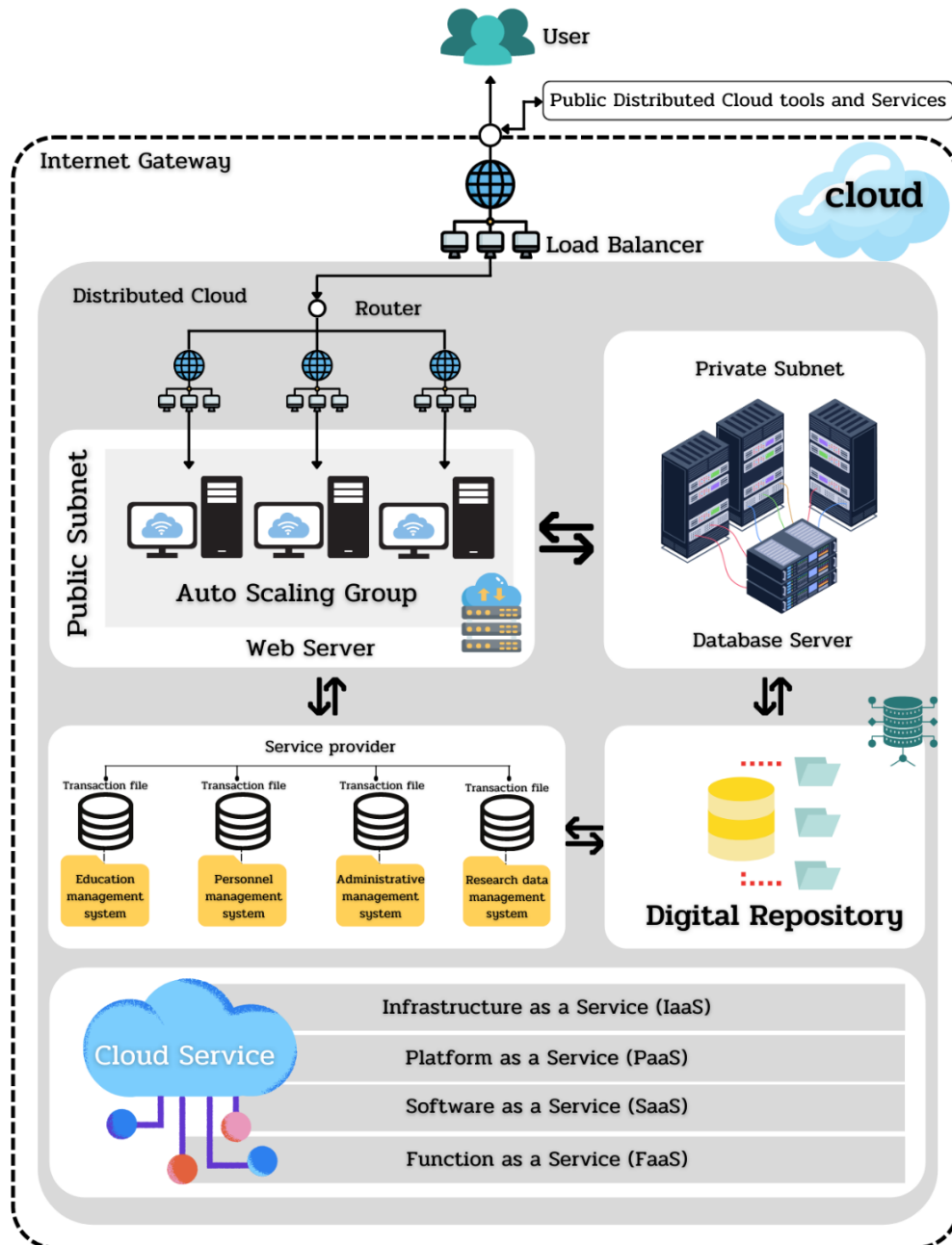

Figure 2. Functionality of distributed cloud architecture on digital repository for digital transformation

Table 1. Synthetic distributed cloud architecture on digital repository for digital transformation

Topic	Concepts	Example of Activities/ /Process/Phase	Reviews
Distributed Cloud	Distributed Cloud is a cloud service distributed in various locations. It will be seen as providing logic, supervision, management services, governance, system development, and supervision, and will be the responsibility of the service provider in terms of solving the latency problem.	- Public-resource Computing - Volunteer Cloud	(Amin et al., 2018; Fitzgerald et al., 2009; Pal et al., 2022; Sheng & Qi, 2022; Yan et al., 2021)
Cloud Services	Cloud services facilitate the flow of user data over the Internet from front-end clients (such as user servers, tablets, desktops, laptops-everything at the end-user) to the service provider's system. Users can access cloud services without a computer operating system and Internet connection or a virtual private network (VPN).	- Infrastructure as a Service (IaaS) - Platform as a Service (PaaS) - Software as a Service (SaaS) - Function as a Service (FaaS)	(Ghorbel et al., 2021; Jensen & Lundström,2021; Li et al., 2021; Marimuthu et al., 2022; Priya & Bhuvaneswaran, 2020; Ramamoorthy et al., 2021; Wang et al., 2021; Ye & Sun, 2021)
Digital Repository	The institution's repository is provided to members in order to manage and distribute the digital media created. Fundamentally, it is the commitment responsibility of the organization to take care of these digital media, including long-term storage as appropriate, as well as accessing or disseminating information.	- Collecting - Classifying - Cataloging - Curating - Preserving - Providing access to digital content	(Bernisca et al., 2020; Donaldson, 2020; Fox et al., 2019; Frank, 2022; Rismanto et al., 2021; Serafin-Prusator & Tarkowski, 2021; Starzynska & Klembalska, 2021; Suleman, 2019)
Digital Transformation	Changes in organizational activities, scope, and goals to take advantage of the opportunities afforded by digital technology.	- Process - Preparation - Price - Potential Risks - Project Timeline - People	(Chen et al., 2021; Feroz et al., 2021; García-Peñalvo, 2021; Hai et al., 2021; Hanelt et al., 2021; Holmström, 2021; Kraus et al., 2021; Llopis-Albert et al., 2021; Nadkarni & Prügl, 2021; Rijswijk et al., 2021; Vaska et al., 2021)

From Table 1, it can be concluded that Distributed Cloud consists of 1) Public-resource Computing 2) Volunteer Cloud. Cloud Services consists of 1) Infrastructure as a Service (IaaS) 2) Platform as a Service (PaaS) 3) Software as a Service (SaaS) 4) Function as a Service (FaaS). Digital Repository consists of 1) Collecting 2) Classifying 3) Cataloging 4) Curating 5) Preserving 6) Providing access to digital content, and Digital Transformation consists of 1) Process 2) Preparation 3) Price 4) Potential Risks 5) Project Timeline 6) People

In terms of document synthesis and related research, distributed cloud, cloud services, digital repository, digital transformation, the relationship network can be shown in Figure 3.
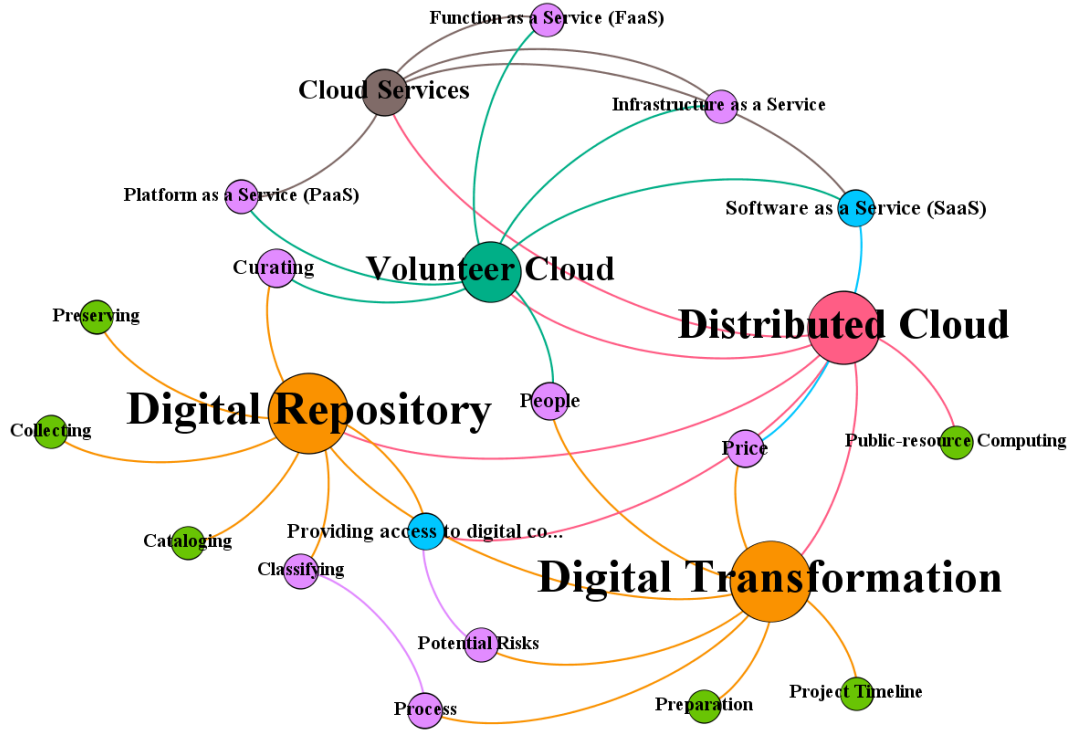
Figure 3: Data association distributed cloud architecture on digital repository for digital transformation

Figure 3 shows that the distributed cloud architecture on digital repository for digital transformation relationship network consists of Distributed Cloud, Cloud Services, Digital Repository, and Digital Transformation. The cloud group is the main component, and there are also subgroups associated with each main group that are related to each other.

5. Discussion

Distributed cloud architecture on digital repository for digital transformation is designed to facilitate the storage needs of various departments. This corresponds to the job (Nookhong & Nilsook, 2017) research on system architecture for green university resource planning (GURP) in terms of cloud computing which found that the working principle of using the cloud takes the form of software-as-a-service. The system architecture represents the sub-modules that work together within the university context and results (Almotiry et al., 2021) from research into hybrid cloud architecture for higher education systems. It has been found that adopting the cloud infrastructure for educational purposes will improve accessibility for users. The adoption of hybrid cloud architecture enables the provision of efficient and reliable services for higher education systems. In addition, educational organizations will be able to control information.

6. Conclusion

This review paper covers many concepts in distributed cloud computing. The main goal of this article is related to preserving the resources needed to manage the education system. Building such a Distributed Cloud in the cloud provides better control over the resources in the network environment.

However, the article mentioned that choosing the right service, the education system is safe and reliable. Leading cloud service providers are always introducing new and advanced services to improve cloud performance, improvements which can meet educational needs. Based on the above information Services can be improved to improve how cloud resources are allocated with more limitations on distributed cloud platforms in the future.

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