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Innovative Library Service Models in the Modern Era of Cloud Computing: A Study

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ABSTRACT

Cloud computing is a new trend today. The entire library system depends on cloud computing, which also benefits libraries in this era. Cloud computing requires a variety of abilities and offered brand new service models for both fundamental and IT-related tasks around the internet. (Rakesh, 2017) *It is the most important item for library users and also plays a crucial function in the key area of libraries & library professionals. I have concentrated on new library service models in the current cloud computing era in this post.* (Nagalakshmi et al., 2013) *being a new technology, it has generated a lot of interest in library service models, collections, and systems that will be moved into the cloud.* (Maitra & Mudholkar, 2011) *Many libraries are turning more and more to cloud computing. It also explains the merits and demerits. The goal of this study may be useful in identifying and creating ideas for future cloud computing deployment in library and library service models in the contemporary period.* (Kaushik et al., 2013)

Keywords: Activities at the library, cloud computing benefits and drawbacks, service models, deployment strategies.

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1. INTRODUCTION

(Jamal, 2020) In the contemporary day, cloud computing has grown in significance and is now the most prevalent technology for doing tough and crucial computing. Due to its benefits, including cost savings, availability at any time and from any location, as well as flexibility and plasticity, cloud computing offers greater possibility and is developing quickly. Cloud computing is a well-established, cost-effective green technology designed for small to large businesses. It is also the newest method used in electronic academic and research. Many domains, including libraries, knowledge centers, virtual library services, and apps, may now benefit greatly from cloud computing. The newest model for supporting and creating library service models, software, and data maintenance online for e-learning activities at higher education institutions, and particularly in the library, is cloud computing. Due to innovative library service

models, library functions can be managed and control loads effectively and make processing task easier with the help of cloud computing.

2. MEANING OF CLOUD COMPUTING

The National Institute of Technology and Standards (NIST) states that "cloud computing is a model for enabling convenient on-demand network access to a shared pool of configurable computing resources (Ex. networks, server, storage, applications, and services) that can be rapidly provisioned and related with little management effort or service provider interaction."

3. THE ESSENTIALS OF A CHARACTERISTICS

(Jamal, 2020) **&** (Dastagiri & Kumar, 2017)

Five essentials characteristics in cloud computing

- **Broad network access**: Resources are continuously accessible over the internet in the cloud, and users can access them from anywhere in the globe using their devices (Mobile laptop, desktop**).**

- **On Demand Self Service:** The resources of computing, such as server time, CPU, apps, and storage, may be accessed by end users without interacting with a human or a cloud service provider.

- **Rapid Elasticity:** Elasticity is the efficiency of computer resources that may be quickly increased or decreased. The demands of computers are made on consumers. Although resources may be involved, the service provider may scale up or down quickly as needed by the user.

- **Resource pooling:** Multi-tenant cloud service architecture pools contributors to serve all users, and in response to user requests, physical and virtual systems are enthusiastically allocated and redistributed to meet demand. As an illustration, consider storage, access rights, memory, connection, Virtual machines and network bandwidth.

- **Measured Service:** Cloud system services are offering a pay-per-use model, and they are scrutinized and created to be managed by users and service providers for consumed services.

4. CLOUD COMPUTIG SERVICE MODELS :** (Jamal, 2020)

1. **Software as a Service (SaaS):** Software delivery model is the actual name for SaaS. Users of cloud computing are granted a license for software applications. Internet-connected gadgets

may access software programs. Gmail, Yahoo, Face book, and other applications do not need users to install or maintain them.

2. **Platform as a Service (PaaS):** This concept is typically utilized by developers to create their apps on a monthly leasing basis on cloud computing platforms. Online operating environments, programming language implementation, online data bases, and online messaging are just a few of the services and goods that cloud companies provide. Hardware and software layers do not need to be purchased and managed by the consumer. providers of the most significant cloud computing services, like Google, Amazon, Microsoft, etc. Think about Google App Engine.

3. **Infrastructure as a service (IaaS):** Cloud computing platform is on the internet, It is suggested essential server, storage network, hardware and operating system. Cloud users can install operating systems & application software. Manage the memory, CPU and processing of the system by Cloud supplier. Users pay only for consumed resources. Ex. Amazon web services & Amazon Elastic Compute Cloud (EC2).

4. **Function as a Service (FaaS):** Server less computing is another name for function as a service (FaaS). This architecture provides web-based events services for the particular point to be conducted in the cloud management process response.

5. **Mobile "backend" as a Service (BaaS):** In the mobile backend service model also known as Backend as a Service (BaaS) Mobile app and Web app developers are given service on cloud storage. Cloud computing services are APIs- Application Programming Interface and SDKs- Software Development Kits it includes user management, push notifications, integration with social networking services and more.

1. **Monitoring as a Service (MaaS):** Every feature of services and applications, software, networks, systems, and any other component that is deployed for customers within the cloud are included in this model. Users of state monitoring at various levels of cloud service or online service can take advantage of this capability.

2. **Communication as a Service (CaaS):** The communication may include voice over IP, video conferencing, instant messaging, and apps for fixed and mobile device cooperation. All hardware and software operations are the exclusive responsibility of the CAAS creator. Additionally, CAAS offers QoS-Assured Service Quality.

3. **Network as a Service (NaaS)**: The newest cloud computing approach, known as NaaS, allows users to access computer resources via a switch and router. It includes a versatile and

expansive VPN (Virtual Private Network), bandwidth-on-demand, a security firewall, content monitoring, filtering, and antivirus.

4. **Storage as a service (STaaS):** (Nagalakshmi et al., 2013) A managed service known as STaaS gives the client access to a platform for data storage. Organizations using STaaS will often use a public cloud for storage and backup purposes rather than keeping data on-premises. These storage techniques include block storage, SSD storage, object storage, backup and restore, disaster recovery, and bulk data transmission. In the event of data loss, backup and restore refers to the process of backing up data to the cloud. Data replication and protection against virtual computers might be considered a form of disaster recovery (VMs).

5. **Security as a service (SECaaS):** In essence, it is a business model in which companies must purchase on-demand security in order to protect their data, apps, and systems while utilizing the advantages that cloud computing provides.

6. **Data as a service (DaaS):** Cloud computing is being used by almost all businesses. Data integration, administration, storage, and analytics as a service (DaaS) are all solutions that are gaining popularity. The DaaS Provider automatically manages and keeps updated the tools and services on DaaS platforms, so end users are not required to handle the tools themselves.

7. **Database as a service (DBaaS):** In addition to managed database service, **DBaaS** is also known as. is a cloud computing service that enables customers to access and utilize a cloud database system without having to buy, set up, and manage the database themselves. Upgrades, backups, making sure the database system is available, and 24-hour security are all handled by the cloud provider.

8. **Test environment as a service (TEaaS):** Test Environment as a Service is available through a cloud-based, on-demand testing platform that uses a subscription-based, pay-as-you-go business model. In order to justify the expense of the physical infrastructure, testing tools, and IT maintenance staff security, TEaas offers consumers a profit. These include test management & development, test environment setup, test execution, and integration with CI servers.

5. CLOUD COMPUTING DEPLOYMENT MODEL

(Maitra & Mudholkar, 2011)There are nine different versions of this paradigm, which refers to where and how the cloud infrastructure is organized. These include private, public, hybrid, communal, and other models

❖ **Private Cloud deployment model:**

• Infrastructure available on demand, owned by specific users that administer and control the apps
• A great option for organizations dealing with data protection and service level challenges.
• The organization buys tangible resources and makes them available to users.

For examples: Ubuntu Enterprise Cloud (UEC) utilizing eucalyptus
Virtual Private Cloud by Amazon
Center for Microsoft ECI data
Cloud Infrastructure Suite by VMware

❖ **Public Cloud deployment model:**

- Public access to infrastructure is provided.
- Services are either free or pay per usage.
- (Gosavi & Dhakulkar, 2012) owned by a company that sells cloud services

For example: **>** Google App Engine
> Amazon EC2
> IBM Smart Cloud
> Microsoft Window Azure.

❖ **Community cloud deployment model:**

• Cloud infrastructure may be shared by several businesses.
• A third party or organization may administer this.
• In comparison to private clouds, end user costs will be higher.

For example; > (Gosavi & Dhakulkar, 2012) **Government-focused Google Apps Public cloud Service from Microsoft.**

❖ **Hybrid Cloud Deployment model:**

• A group of two or more clouds (Private, public or community)
• Integrated with standardized or proprietary expertise that permits data and application

For Example: **>** Azure's Window
> Microsoft vCloud

A distributed group of computers are joined together in a cloud computing platform using the distributed cloud deployment approach. The hub service or a single system from several locations is involved. Distributed clouds come in two varieties;

Distributed cloud computing for public resources: This type of cloud computing is regarded as a subclass of computing. Mainly because they have more to do with distributed computing than cloud computing.

Volunteer cloud: This term refers to the fusion of public-resource computing with cloud computing, where a cloud computing infrastructure is executed utilizing volunteer resources and a business model is provided to reward assistance with cash compensation. It is also known as a peer-to-peer cloud or an ad-hoc cloud.

- **Multi cloud deployment model:** Multi-cloud deployment model: This is distinct from hybrid cloud and refers to various cloud services as opposed to various deployment strategies. A single heterogeneous system was created to maximize flexibility, minimize dependency on a single provider, and defend against disaster.

- **Poly cloud deployment model:** It is utilizing many public clouds with the intention of affecting certain services. It differs from multi-cloud in that it is used to help a company do more than it could with a single provider rather than to boost flexibility or improve against failures.

- **Big data cloud deployment model:** According to this model, the transfer of enormous amounts of data to the cloud and the subsequent need for data security prevented the use of the cloud for big data in the past. However, today, thanks to the development of bare metal servers, this quantity of data starts off in the cloud.

- **HPC cloud deployment model:** High Performance Computing (HPC) is the practice of running HPC applications using cloud computing infrastructure and services. These programs are typically run on computer clusters since they require a lot of processing power and memory.

6. **ACTIVITIES AT LIBRARY WITH CLOUD COMPUTING** (Radha, 2013)

Automation of library operations using LMS.

- Library Access 24*7.
- Digital library has to create link by using IP for online databases. Such as Institutional repository, an e-learning and training material, question papers, free resources and uploading archives.
- To create Library portal requesting for new book, queries, feedback, newsletter, PO/ PR using internal software.
- The collective e-mails has to make for the client or user (through the web mail)

- OPACs (Online Public Access Catalogues) must be developed for online bookings, renewals, and searches.
- Cloud computing allows for the storage of more documents on a public server.
- To utilize Current Awareness Service to notify the user's community about impending events based on SDI, as well as to create and submit newsletters, new arrivals, and other relevant information.

7. BENEFITS OF CLOUD COMPUTING (Maitra & Mudholkar, 2011)

- **Cost Efficiency:** One of the most crucial strategies in cloud computing is cost effectiveness. Cost-effectiveness is incredibly simple to maintain, use, and update.

- **Unlimited storage:** Cloud computing offers limitless storage space.

- **Recovery & Backup:** Compared to the conventional method of data storage, the entire backup and recovery procedure is quite simple. The providers of cloud-based services often handle data backup & recovery.

- **Easy to access:** Information is readily accessible under the notion of cloud computing. Individuals who have registered with the cloud may access the information whenever and whenever they choose, whereas unregistered users are unable to do so.

- **Location and Devices:** In the cloud, it is possible to establish location and device freedom, allowing users to access systems from any place and any device.

- **Create and collaborate:** In addition to interacting with other library services, cloud libraries can also create their own library services.

- **Resource File Sharing:** Cloud computing is beneficial for A group of libraries may work together and save all of their resource papers and data in one location. Several resources allow them to provide access to their final users.

- **User centric:** Cloud computing is particularly beneficial in this circumstance. The customers of the libraries are always put first while delivering services to them.

8. DROWBACKS OF CLOUD COMPUTING

- **Security & Privacy:** It is cloud computing biggest disadvantage. Since the storage of data and information is neither secure nor private, particularly when it comes to sensitive data, data

saved in the cloud is vulnerable to theft, viruses, and other threats. It is also possible for data to be lost owing to inadequate backup procedures and system failure

- **Network connectivity & bandwidth:** This is one of the biggest online drawbacks of cloud computing. Organizations may experience a loss of data connectivity until it is set up. Cloud computing services may be discontinued due to network issues or any problems with the server if internet access is down. The broadband connection won't work over slow internet.

- **Dependency:** The fundamental problem of the cloud platform is hidden dependencies, and vendor lock-in is another negative of cloud computing.

- **Limited Control & flexibility:** The cloud computing paradigm will result in the creation of a monopolistic service provider by a third party, placing restrictions on control and flexibility for service seekers.

- **Segregated:** One of the problems with cloud computing is segregation. The data in this model is not divided. It is dispersed over the cloud network, and the issue arises when particular data has to be separated.

9. CONCLUSION

Cloud-based apps and their service models are provided in this study's well-organized library with the aim of development. Cloud computing service models and ideas are also discussed. Certain libraries are transitioning to cloud computing technologies at this time. Cloud computing has enabled the development of digital libraries and archives. social networking has seen a number of improvements, but several difficulties relating to security, privacy, and legal matters have not yet been entirely handled. So, before combining library services, a library ought to give it some serious thought. (Maitra & Mudholkar, 2011) Libraries can employ cloud computing tools and techniques to improve the quality of service models and resource utilization, as well as to expand the use of cloud computing for professional work. Cloud-based technologies offer dependable and quick service models to end users. Additionally, all library service models are now relatively simple to implement thanks to cloud computing. In addition, cloud computing is becoming increasingly applicable in the present period due to Financial Crunch and a lack of even basic competence.

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