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6. An Efficacy of Cloud Computing and Its Application in Libraries

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ABSTRACT

In this digital age, library users are becoming more hi-tech and techno-savvy regarding acquiring knowledge and information sharing. Thus, technological advancement became the need of libraries and information centres to provide 27x7 uninterrupted technology-based library services to users at minimum cost. Cloud computing is one of the new and advanced Information Communication Technology (ICT) technologies. It has many potential benefits that other technology does not have, such as cost reduction, anywhere-anytime access, on-demand self-service, resource pooling, flexibility, and many more. Cloud computing provides several opportunities to link library services to the cloud. This paper clearly explains cloud computing, Essential characteristics of the cloud, Cloud Infrastructure, Cloud Deployment Models, Cloud Service Models, Cloud Security & Privacy, advantages & limitations of cloud computing, and the application of cloud computing technology in libraries.

KEYWORDS:

Cloud Applications; Cloud Deployment Models; Cloud Service Models; Cloud Library Services; Digital Library, Smart Library Services.

1. Introduction:

Cloud computing is a web-based computing technology where virtual shared servers provide infrastructure devices, platforms, software, and other resources as a service and hosting to customers on a pay-per-use basis. In Information Technology (IT) sector, Cloud computing is a rapidly evolving technology seen as the third revolution following the Personal Computer (PC) and the Internet. (Sahu 2015). The term "cloud computing" refers to a modernized and improved version of concepts like "Parallel," "Distributed," "Grid," and "Utility Computing". These are the technologies that came before cloud computing. (Gosavi, Shinde, and Dhakulkar 2012). Although it is not a new concept, we have been using this technology for a long time. But nowadays, this technology is emerging with a new concept and dimension. Cloud computing is one of the latest technologies available at a low cost. This technology is inexpensive compared to others, but it is also quite simple to implement. It is often referred to as "service on demand" for short. A cloud service provider is responsible for facilitating and managing all services in a cloud computing environment. Services are made available via the Internet and hosted by the cloud service provider; end-users, typically businesses, use these services to meet their requirements and compensate the provider accordingly. The society of today is an Information Society. Information Technology (IT) is critical in managing information and library resources, including collection, organization, processing, storage, and distribution. For libraries and information centers, cloud computing is a novel technology. It gives users access to e-books, e-journals, online databases, and digital library collections, among other things. There are numerous options and benefits of using cloud computing in libraries, such as lower technological costs, software and hardware independence, increased capacity reliability and performance, and so on.

2. Review of Related Literature:

The application of cloud computing in Library and Information Services (LIS) is the recent trend in the domain. Much research on cloud computing technology has already been conducted in different parts of the world and has explored its possible applications in different key areas of LIS. Some of such studies (researches) are discussed as follows to provide a background idea of the present study, its need, significance and what it adds to the existing literature:

Srivastava (2018) examined the significance of cloud computing technology in e-governance and information centers. He also briefly described the various government projects available online using cloud services. **Wada** (2018), in his paper, concluded that integrating cloud computing technology into libraries would transform libraries into smart libraries and enhance library services. All libraries must revive and build modernized information infrastructure that facilitates research, learning, and teaching. The cloud-based library is becoming the eSmart library worldwide. **McManus** (2016) explained that cloud computing services could cover library management services, including acquisition, circulation, storage, metadata linking, and dissemination of information and library resources. Cloud computing implementation in libraries and information centers may be demonstrated by OCLC WorldCat Service very well, where one can understand the role of cloud computing in research libraries. He also states that implementing cloud computing can cut the cost of libraries because the cloud may provide high-performance computational

services at cheaper rates. **Sandeep** (2015) Discussed the DS and e-Granthalaya, two cloud-based digital library management systems, were examples of how the world's information might be gathered and shared with an international audience. **Grant** (2013) Cloud computing is the latest discovery of Internet development that enables the execution of all programs and activities as the network does. Due to technological advancement, the practice of librarianship is facing new challenges.

Therefore, the emergence of this technology and its application in libraries has made the role of librarians more practical and meaningful to the services & resources they offer to their users on a day-to-day basis. In his survey of libraries of central universities in India, **Yuvaraj** (2013) Found that librarians are particularly interested and excited about using cloud computing for cloud-based library services. He also investigated the cloud computing tools and techniques used in their regular library services and discovered that librarians rely substantially on cloud computing solutions.

The majority of librarians employ a variety of tools to improve the quality of library and information services. However, they are concerned about the security implications of this technology. **Romero** (2012) explained cloud computing features and their utilization in the library and dissemination of information services.

He also found that cloud computing is a highly scalable technology, which is useful for load balancing and helps in easy and quick access to information and library resources. **Shivalingaiah and Sheshadri** (2012) Conducted a study to determine the factors a specific library or information center should evaluate before migrating to cloud-based library services.

3. What Is Cloud Computing?

Cloud computing is defined by the National Institute of Standards and Technology (NIST) of the United States Department of Commerce as- "*a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction"* (NIST, 2011).

Cloud computing, according to Forrester, is *"a pool of abstracted, highly scalable, and managed to compute infrastructure capable of hosting end-user applications and paid by use."*

In its simplest definition, cloud computing is a type of high-tech data storage and application management that uses the world wide web and remote servers. With cloud computing, users can access software without physically downloading and installing it on their own computers and servers. Users can view their information from any computer anytime, as long as they have an active Internet connection.

Figure 1 shows the secure access of various types of data and applications via different computing devices in a cloud-based system.

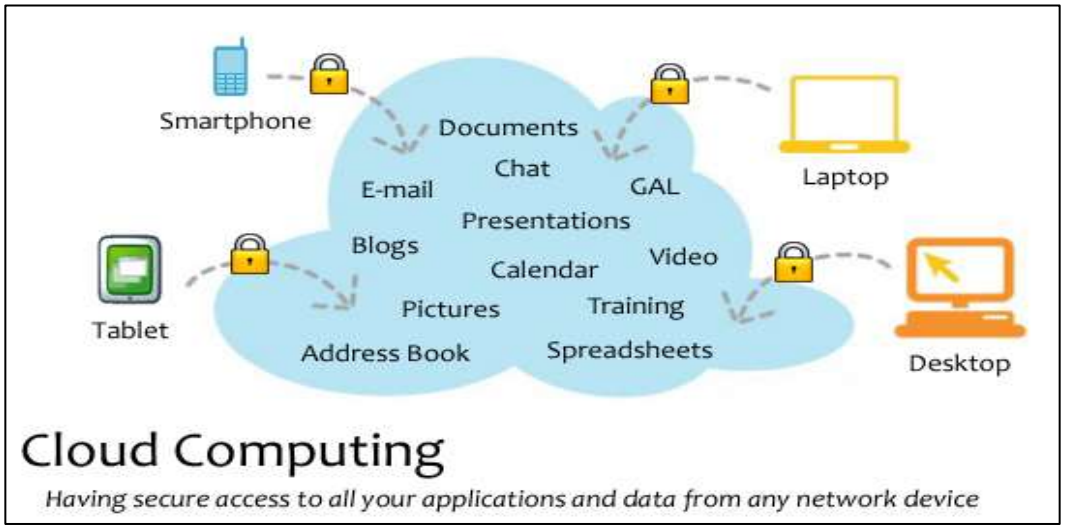


Figure 1: Application of cloud computing
https://commons.wikimedia.org/wiki/File:Cloud_applications.jpg

3.1 Why Cloud Computing?

Cloud Computing is pure *"service on demand"* and saves the user time, money, material, and workforce. The service provider is a third party in cloud computing, so a cloud customer need not worry about maintenance costs and hardware installation. A user of this technology has to pay only the service charges they used. The user or customer need not worry about the software update, antivirus installation, backups, data security and increasing cost of maintenance of the system (Maurya 2016).

4. Essential Characteristics of Cloud:

The National Institute of Standards and Technology (NIST) of the United States of America (U.S.A.) has proposed five essential criteria for cloud computing, which are as follows:

4.1 On-Demand Self-Service: As needed, consumers can unilaterally and automatically provide computer capabilities, such as cloud storage and server time, without needing human interaction with each service provider.

4.2 Measured Service: Cloud systems automatically track and control how resources are used (usually on a charge-per-use or pay-per-use basis) at a level of abstraction that makes sense for the type of service (storage, bandwidth, processing, active user accounts, etc.). Users can track, control, and report how resources are being used, which is evident to the service provider and the people using the service.

4.3 Broad Network Access: Cloud features are accessible via the network using conventional mechanisms that support heterogeneous thin or thick client platforms such as workstations, desktops, laptops, smartphones, tablets, and so on.

4.4 Resource Pooling: The provider's computing resources are shared among several users in a multi-tenant architecture. Consumer demand drives vigorous competition for the allocation and reallocation of physical and virtual resources. There is a common lack of transparency and customer control over the physical location of deployed resources. As a result, individuals have the impression that they are not tied to a particular spot. At the same time, the information may be referring to a more (country, state, data center, etc.). Examples of resources include data storage, processing power, RAM, CPU cycles, network throughput, and virtual machines.

4.5 Rapid elasticity: In order to scale out or scale in quickly, dependent on demand, features can be delivered and published with a high degree of flexibility and, in some situations, automatically. Consumers may incorrectly assume that they have an infinite number and variety of delivery alternatives to choose from at any given time.

5. Cloud Infrastructure:

The combination of hardware and software known as cloud infrastructure makes it possible to use the five core features mentioned above of cloud computing. The physical and abstract layers are both present in the cloud infrastructure.

5.1 Physical Layer: The hardware resources required to support and offer cloud services make up the physical layer of cloud infrastructure. The system consists of a server, a storage device, and a network. The cloud's physical layer is the behind-the-scenes machinery that makes the user interface possible.

5.2 Abstraction Layer: This layer is made up of the software that is given by a physical layer and tells essential things about the cloud. Regarding ideas, the abstraction layer is on top of the physical layer. It is the layer of cloud infrastructure we see when we access our email on Gmail or Hotmail, our social media accounts, etc. On the front end of cloud infrastructure, the software runs.

6. Cloud Deployment Models:

A cloud deployment model describes a specific cloud environment, defined primarily by ownership, scale, and access. Each deployment model has its own set of characteristics. The deployment type chosen determines how much data a consumer wishes to retain and who has access to the infrastructure. The four basic deployment options are private, public, community, and hybrid cloud.

6.1 Private Cloud: Private cloud infrastructure is owned and used solely by one enterprise. An organization uses cloud computing technology to gain centralized access to Information Technology (IT) resources in the private cloud from various components, locations, departments, or units. It is operated, managed, and controlled by the organisation, a third party, or a mix of the two, and it can be located on or off campus. This strategy for cloud deployment is believed to be more secure than others. This deployment approach, however, demands continual maintenance.

6.2 Public Cloud: A public cloud is a cloud infrastructure that is open to the public and can be used by anyone. It is owned, managed, and run by a cloud provider from the outside. They could be business, academic, or government groups, or they could be both. It lives on the cloud provider's property. Google Compute Engine, Amazon Web Services (AWS), Microsoft Azure, etc., are all examples of public clouds. This model can be used on a pay-per-use basis with a small investment. It does not need a professional team to set up the hardware and manage the infrastructure. It is perfect for businesses and companies that need quick and cheap access to resources. However, data security and privacy are the most important things about this model.

6.3 Community Cloud: There is no difference between the public cloud and the community cloud. The most notable distinction is that it is only made available to a select group of cloud customers from companies or enterprises with similar concerns (such as mission, policy, goals, and objectives). Because the cost of a community cloud is split among community members, it is substantially less expensive than private and public clouds. It can exist on or off-premises, and because it is a newer concept, it is not as popular as others.

6.4 Hybrid Cloud: The hybrid cloud is a cloud that consists of two or more distinct cloud architectures, i.e. private, public, or community cloud. Each entity in a hybrid cloud functions differently. Although they are bound together by proprietary or standardized technology, they remain unique entities that enable the portability of data and applications (e.g., *cloud bursting* for load-balancing between clouds). A brief comparison between the above Private, Public, Community, and Hybrid Clouds is also shown in Table 1.

Hybrid cloud decreases the overall cost compared to other models, and data security & privacy is high because it uses the cloud bursting technology by which data is segmented correctly. It stores critical or more sensitive data on the private cloud, while less sensitive data or information is stored on the public cloud.

In addition, there are more cloud deployment models, such as Multi-cloud, Distributed cloud, Inter-cloud, Big Data cloud, and High-Performance Computing (HPC) cloud.

Table 1: A comparison of Cloud Deployment Models

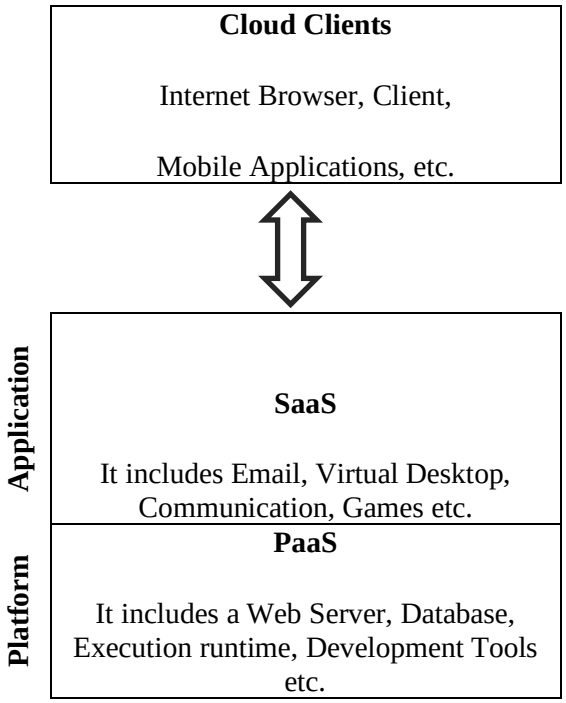
Sr. No.	Important Features	Private Cloud	Public Cloud	Community Cloud	Hybrid Cloud
01.	Setup & Ease of Use	Require IT Professionals	Easy	Require IT Professionals	Require IT Professionals
02.	Data Security & Privacy	High	Low	Very High	High
03.	Scalability & Flexibility	High	High	Fixed Requirements	High
	Cost-Effectiveness	Most-Expensive	Most Affordable	Cost distributed	Cheaper than Private Cloud

Sr. No.	Important Features	Private Cloud	Public Cloud	Community Cloud	Hybrid Cloud
04.				among members	but Expensive than Public Cloud
05.	Reliability	High	Low	Higher	High
06.	Infrastructure Management	Organization or Third-Party	By Third-Party Provider	Third-Party Provider	Both Organization & Third-Party Provider

7. Cloud Service Models:

There are mainly three types of service options available in the cloud computing model that one can get from a service provider. Figure 2 shows these three service models of cloud with their applications:

i. Infrastructure as a Service (IaaS)
ii. Platform-as-a-Service (PaaS)
iii. Software-as-a-Service (SaaS)



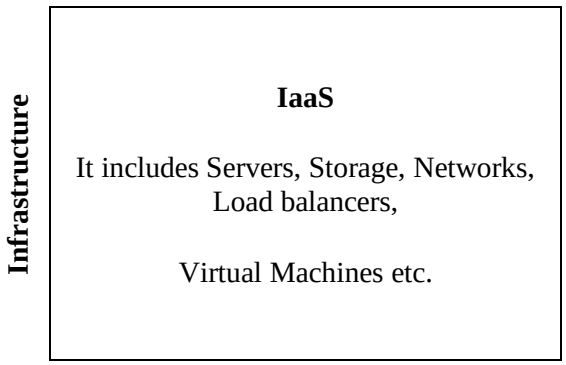


Figure 2: Different service models of cloud computing

7.1 Infrastructure-as-a-Service (IaaS):

Hardware as a Service (HaaS) is another name for Infrastructure as a Service (IaaS/HaaS). It is a service offered by a cloud computing company. Storage, hardware, servers, networking components, and other equipment required to support operations are outsourced by an organization or institution. The service provider offers the tools on an "as needed" and "as paid for" basis. The service provider must also manage the infrastructure and keep it clean and operational. The customer is responsible for the operating system, storage, and applications but not for the underlying cloud infrastructure. The IaaS concept includes features like automated administrative duties, Policy-based services, internet connectivity, hosted storage, hosted hardware, and hosted networks. This can be seen in Google Cloud, Amazon Cloud Service, Microsoft Azure, Rackspace Technology, GoGrid, 3Tera, etc.

7.2 Platform-as-a-Service (PaaS):

On many depictions of cloud architecture, the Platform as a Service (PaaS) layer can be shown sitting between the Infrastructure as a Service (IaaS) and Software as a Service (SaaS) levels. The PaaS layer operates between the IaaS and SaaS tiers. A spinoff of software as a service. Customers may deploy apps they have developed or purchased to the cloud infrastructure using the provided programming languages and tools.

The user under this model does not have to worry about the servers, OSes, storage, or networks that make up the cloud. However, with platforms like Heroku, Google App Engine, Amazon Elastic Beanstalk, Salesforce, etc., the user can still make specific changes to the deployed applications and their configuration settings.

7.3 Software-as-a-Service (SaaS):

Software as a service (SaaS) is another type of cloud computing service model in which service providers outsource applications. In the SaaS model, users do not have to buy or download or install the application on their own computers. Users also do not need to do anything to manage or control the networks, servers, operating systems, and storage that make up the cloud infrastructure. One service instance runs in the cloud and serves many end users.

Applications are accessible from various client devices. Users only need a browser and network access to connect to the application hosted by the service provider or vendor and use it remotely. So, the old way of getting computer software was to buy and install it (Jose, 2018, pp. 223-246). A brief comparison between traditional software and the SaaS model is also shown below in Table 2.

The advantages of the SaaS model include easier administration, such as automated updates and patch management, which eliminates the need to acquire, test, and install various programs on administrative computer systems.

Compatibility means that all users will have the same version of the program or application and global accessibility, which means that users may access it from anywhere in the world—examples: Google Docs, Prezi.com, Microsoft Office 365, and so on. Companies such as Google, Microsoft, Zoho, Salesforce, and others now provide Software as a Service (SaaS).

Table 2: Comparison of Traditional Software with SaaS

Sr. No.	Traditional Software	SaaS
01.	User install, manage & maintain	Users use it over the Internet
02.	It runs on individual organizations on dedicated computers.	It runs on multiple customers simultaneously.
03.	Version updates are less frequent & updates are purchased separately.	Version updates are more frequent for enhanced user satisfaction.
04.	Separate costs are required for updates.	No separate cost is required for updates.
05.	Cross-platform support is required.	No concerns for cross-platform support
06.	Vulnerable to software piracy.	Less vulnerable to software piracy.

8. Cloud Security and Privacy:

Security and privacy are significant concerns with cloud computing. Cloud computing raises several severe security and privacy problems, making it unsuitable for use in sensitive contexts. It comprises data loss, account seizing, service traffic disruption, susceptible application program interfaces, and so forth. The answer to cloud security is to provide security policies that safeguard data from theft, leakage, and destruction.

The three components of cloud security are identity, information, and infrastructure security. Whether it is a private or public cloud, and whether the cloud service paradigm is IaaS, PaaS, or SaaS, the basic architecture of the cloud must be intrinsically secure. Cloud infrastructure security is examined, analyzed, and applied at three levels: network, host, and application (Jose, 2018, pp. 223-246).

8.1 Network-Level Security:

Both public and private clouds provide unique networking security challenges, yet they are fundamentally different. Private clouds and public clouds both have their security flaws. Security teams often do not have to worry about novel threats or flaws when protecting data in the private cloud.

However, in the public cloud, where the on-premises network interacts with the one maintained by the cloud service provider, the network architecture must adapt to meet the evolving security needs of the system.

Data confidentiality, availability, and integrity are the three pillars of network security risk. Hypertext Transfer Protocol (HTTP) is insecure compared to HTTPS (Hypertext Transfer Protocol Secure). Hence users should always use HTTPS instead.

8.2 Host-Level Security:

For PaaS and SaaS to be secure, the host operating system must be invisible to users. Security duties in PaaS and SaaS service models are handed over to the cloud service provider, as is the case with host-level security. In IaaS, consumers have the primary duty of protecting the security of their cloud-based hosts.

8.3 Application-Level Security:

The security of applications or software is a critical component of the cloud security system. Application-level security is in charge of controlling the security of cloud service models such as IaaS, PaaS, and SaaS application security, end-user security, and so on. It ranges from simple single-user apps to complicated multiuser e-commerce programs utilized by several users at the same time.

9. Advantages of Cloud Computing:

There are several advantages of cloud computing, but some significant advantages are as follows:

9.1 Cost Saving: Cost saving is one of the most significant advantages of cloud computing. It helps the customers save the capital cost as it does not require any hardware investment and does not need trained staff to maintain the hardware system. The cloud service providers do buy and maintenance of hardware equipment. It is a pay-per-use model.

9.2 Accessibility & Mobility: Clouds allow quick and easy access to stored data from anywhere in the world, anytime, via any computer or smartphone using an Internet connection.

9.3 Unlimited Storage: Cloud provides unlimited storage capacity to its users. Users can store almost all data types in the cloud-like documents, eBooks, music, video, photographs, applications, etc.

9.4 Backup and Restore Data: It is a vital component of cloud computing that saves data automatically and avoids data loss or erasure. It is considerably easier to acquire a backup and recover data when data is stored in the cloud.

9.5 Enhanced Collaboration: Cloud allows multiple users to work on the same document simultaneously or in real time from various geographical locations. Especially in group projects, it allows people to easily and quickly share information and ideas in the cloud via shared storage. This feature is beneficial in teaching and group projects. Because contents are available online, it is easy to collaborate online and save time and resources in printing lengthy documents like lesson plans, HomeWorks, assignments, projects, study notes, etc.

9.6 Security: This technology improves the security level of data. Many people claim improved data security after switching their businesses to the cloud. Cloud computing also offers data security in case of sensitive data loss. Users can remotely erase the data from lost laptops or smartphones. Thus, it prevents the data from getting into the wrong hands.

9.7 Disaster Recovery: Cloud-based services allow speedy data recovery in emergency or disaster circumstances, such as natural catastrophes or power outages.

9.8 Automatic Software Updates: In cloud computing, the platforms and applications are updated and refreshed automatically. For that reason, it helps the company save time, money, and manpower.

9.9 Quick Deployment: Cloud computing has the benefit of being easy to set up. The system can run in just a few minutes if a user decides to use cloud services for work or business. How long deployment takes depends on what kind of technology their business uses.

9.10 Other Advantages: Cloud computing is an on-demand self-service. It provides fast & effective visualization, web-based control, and an interface. Cloud services are location & device-independent and offer advanced online security of data. This technology can automatically scale up and down to adjust as per demand.

10. Limitations of Cloud Computing:

In addition to the benefits mentioned above of cloud computing, this technology has several disadvantages, some of which are as follows:

10.1 Possible Downtime: Cloud computing makes an organization's Internet connection indispensable. When a business or firm goes offline, it becomes offline. Thus, even the most dependable suppliers of cloud computing services occasionally have server failures.

10.2 Data Security & Privacy: Data security and privacy are currently the most pressing problems in the Information Technology (IT) environment. Data is saved in the cloud in many storage devices located all over the world. During data access, customers have no idea where their data is stored, whose machines are processing it, or how safe their data is. Many companies and organizations, including libraries and data centers, are still hesitant to go to

the cloud because of these issues. Despite this, most cloud service providers say that data kept on servers is secure against intrusion and theft.

10.3 Internet Dependence: In a cloud computing setup, having access to the Internet is required. The cloud service provider makes all these services possible and manages them. Without Internet connectivity, clients cannot use the significant functions of the cloud, i.e. computing and data storage. Google, Microsoft, Rackspace Technology, etc., are the global cloud service provider through the Internet.

10.4 Lack of Support: Some cloud hosts have a poor track record of customer service. Today, customers want faster and more responsive support services across all customer support channels. Any minor problem in the cloud may hamper the cloud services immediately; Thus, customers need to resolve and fix this as soon as possible by the service provider. Any delay may ruin the brand name and customers' trust in it.

10.5 Prone to Attack: As we all know, nothing on the Internet is completely safe. Storing data in the cloud may expose organizations or corporations to internal and external threats (Lata, 2016). Internal attacks leverage current privileges to gain access to third parties to execute confidentiality, integrity, and data availability within cloud systems. External attacks use technological and operational flaws to target cloud services, affecting the entire system. As a result, there is always the danger of sensitive data being stolen through the cloud. To avoid this, cloud computing services provide password security, operate on highly secure servers, and employ data encryption technologies.

11. Application of Cloud Computing in Libraries:

Modern libraries better use cutting-edge IT infrastructure and services, such as AI, cloud computing, and blockchain technology, to serve their communities (Suman & Patel, 2021). The advent of cloud computing has opened up exciting new avenues for delivering high-quality library services to patrons. It offers various services that libraries may use to save money on technology, improve their records and organizational structure, increase productivity and efficiency, and streamline automated processes. The following are examples of how libraries and other information centers are making use of cloud computing:

11.1 Library Automation: Most libraries in the modern day are implementing some automation in order to streamline their routine tasks. Historically, library automation was handled on a locally hosted server utilizing a wide variety of Integrated Library Management Software, either commercial or free source (ILMS). A big part of the library budget is invested in software licensing, hardware purchasing, annual maintenance charges, etc. The entire system is directed by library staff or in-house IT professionals. But, nowadays, several vendors and cloud service providers are providing to host all these services on the cloud. Thus, libraries are free from spending on hardware, software licensing, maintenance and data backup, etc. Cloud OPAC and cloud ILMS are some examples of cloud-based library automation. Cloud-based library automation software is also available as Ex-libris and Polaris services.

11.2 Digital Library and Repository: Cloud-based digital libraries and repositories are emerging trends in the library field. Data is stored on cloud servers, and users may easily

access it from anywhere and anytime through the Internet without requiring large numbers of human resources and space. Every well-established library creates a digital library by utilising any digital library software to digitise its resources, services, and information and give end-users real-time access to library resources. Cloud-based digital library technologies such as Dspace and Fedora are commonly used to create digital libraries and Institutional Repositories (IR) with standard interfaces and services. By using such technology, libraries swiftly transition from traditional to digital formats. The digital library's ultimate objective is to provide suitable, comprehensive, and multi-level services to its customers cheaply, and this technology may help it achieve that goal.

11.3 Digital preservation/Archive Service: The time-consuming process of digitization can be consolidated to reduce unnecessary repetition. A library's digital collection can be archived for future generations.DuraCloud, created by software firm DuraSpace, is open-source software that offers cloud-based digital preservation support services.DuraCloud aids libraries in migrating their information to the cloud, where it may be safely stored across several service providers. In addition to archiving and preserving data, cloud solutions allow for online backup, media access, and online sharing**.** (Dutt 2015).

11.4 Searching Scholarly Literature: The cloud is a data storage facility from which users may retrieve any files at any time. Therefore, the research community's great advantage is that information finding and searching the academic literature have grown much simpler. Through DSpace and Fedora Commons, two open-source repositories, Duraspace helps libraries facilitate the sharing of intellectual material. Similarly, Knimbus is a cloud-based research platform that lets individuals learn from and contribute to studying academic literature. Using Knimbus, researchers and subject-matter experts have a common ground upon which to conduct research and exchange information. This facilitates the labelling and sharing and contains discussions of millions of eBooks, journal articles, patents, and other documents among the research community's users**.** (Fakir, Bhakar & Waghchoure, 2020).

11.5 Storage Service: Library professionals and staff can use cloud storage services to keep and store library documents, records, and files in digital form on the cloud. It is the safest way to keep records safe from physical loss and damage. We don’t need to worry about storage space for hard drives and flash drives to store library documents and records. We have an unlimited cloud storage at the lowest cost and can access it anytime, anywhere, using the Internet. Google Drive, Microsoft OneDrive, Dropbox, etc., are some giant cloud storage services.

11.6 Website Hosting: Hosting is crucial to the operation of any digital or web-based resources. Both web hosting and cloud hosting are used extensively to accommodate our clients' needs for website hosting. Hosting your website in the cloud and hosting it on your server are two different animals. The company or organization hosting the website must pay more money to have a set quantity of space on the server. When using cloud hosting, data is kept in cyberspace. Customers should not be charged for a predetermined amount of storage space on the servers but rather for the resources they employ (Osborne, 2020). As a result, many institutions, libraries included, are contemplating hosting their websites outside the library server so editors from different parts of the world can access the site. When a website becomes as famous and highly regarded as some of the most popular ones, its resource needs might grow as quickly as a library (Tyagi, Passi & Baberwal 2015).

11.7 Building Community Strength: Cloud computing can also help build up the strength of a community. It allows libraries to build their network by connecting LIS professionals and people looking for information worldwide. It creates an open and collaborative platform where libraries can share their resources, services, problems, new ideas, and intellectual discussions with the library community on cloud-based global platforms like Facebook, Twitter, WhatsApp, etc.

11.8 Searching Library Data: OCLC WorldCat service is one of the most popular services for searching library data available on the cloud. It gives more visibility to libraries and their collection on the web. OCLC (Online Computer Library Center) provides various cloud-based library management services through WorldShare Management Services (WMS). WorldShare Management Service assimilates libraries' all print and electronic resources management workflows, including selection, acquisition, circulation, cataloguing, serials control, remote database search, etc.

11.9 Cloud OPAC: The majority of the world's libraries have an online catalogue. These catalogues are available on the local server of the libraries. It will be more convenient for users to find out the availability of resources and their retrieval if the library catalogue is available via the cloud.

Cloud computing has been widely used in the library and information science area, with noteworthy examples being Scribd, Ex-Libris, Cybrarian, Library Thing, OCLC WorldCat, OCLC's Webscale, Google Documents, Duraspace's DuraCloud, etc.

12. Conclusion:

This study explains what cloud computing is, how it works, and what cloud-based applications and services mean for the library field. Libraries are now using this technology and cloud-based services, especially in automation, digital libraries, long-term storage, quick information retrieval, and social networking. The main benefit of cloud computing is that it cuts down on the cost of buying hardware, software, and licenses. However, there are still some big problems with data privacy, security, and trustworthiness. Still, Web 2.0 and social networking are used by so many people. More and more people use it.

Personal and bank information is the most sensitive information you can have, but it is stored on servers that do not have a domain name or an owner. So, this technology has many uses in libraries and information centers if it is used carefully and its limits are known.

In today's world, everyone is short on time, and no one likes to wait in line. In this context, the usage of library resources and services, as well as their time availability to all, is a significant concern for library professionals; thus, cloud computing is the appropriate and best approach to address such challenges in the current and near future.

During this information explosion period, it is also possible for the user to obtain a vast pool of information resources that are easily accessible, scalable, and cost-effective. As a result, now is the moment to investigate the cloud and uncover discoveries and library applications to develop high-quality, low-cost library services.

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