



Cloud Based Web Applications

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Abstract—Internet Cloud-based web applications refer to web applications that are hosted on cloud computing platforms. These platforms offer a range of benefits such as scalability, cost-effectiveness, and high availability.

Cloud-based web applications allow users to access the application from any device with an internet connection. This makes them highly convenient and accessible to users, as they don't need to install any software on their local devices. This also means that the web application can be updated and maintained remotely by the application provider, without any intervention from the user.

Cloud-based web applications can also be highly scalable, as the underlying cloud infrastructure can be easily scaled up or down based on the application's usage patterns. This means that the application can handle large spikes in traffic without any disruption to the user experience.

Another advantage of cloud-based web applications is that they are generally more cost-effective than traditional on-premises applications. The cloud provider handles the infrastructure, maintenance, and upgrades, which reduces the cost and complexity of managing an application.

Overall, cloud-based web applications offer a range of benefits that make them highly attractive to both users and application providers. As such, they are becoming increasingly popular and are likely to play an even bigger role in the future of web applications.

Keywords—web, cloud, Paas , Saas , Tenancy , Iaas

I. INTRODUCTION

Cloud-based web applications are a popular choice for modern businesses that require scalable and cost-effective solutions to serve their customers' needs. This technology allows organizations to leverage the power of the cloud to build, host, and manage web applications, providing users with a seamless experience across multiple devices [1].

In this article, we will provide an overview of cloud-based web applications, including their benefits, key features, and how they work.

What are Cloud-Based Web Applications?

Cloud-based web applications are applications that are hosted on a cloud infrastructure and accessed through the internet. These applications are built using web development technologies like HTML, CSS, JavaScript, and other programming languages, and they can be accessed through a web browser or mobile device [2].

The cloud infrastructure provides the application with the necessary resources, such as processing power, storage, and bandwidth, to run efficiently and reliably. These resources are

shared across multiple customers, allowing for a more cost-effective solution compared to traditional on-premises hosting .

Benefits of Cloud-Based Web Applications

There are several benefits of cloud-based web applications that make them a popular choice for businesses of all sizes. Some of these benefits include:

Scalability: Cloud-based web applications can easily scale as per changing business. It taken to make any sudden spikes in traffic without incurring significant costs.

Cost-Effectiveness: Hosting web applications on the cloud is more cost-effective than traditional on-premises hosting, as businesses only pay for the resources they use. This eliminates the need for expensive hardware and maintenance costs.

Accessibility: Cloud-based web applications can be accessed from anywhere in the world, as long as there is an internet connection. This makes it easy for businesses to serve customers globally.

Security: Cloud-based web applications offer robust security features, such as data encryption, firewall protection, and regular data backups, that are designed to protect businesses from cyber threats [3].

Key Features of Cloud-Based Web Applications

Cloud-based web applications come with several key features that set them apart from traditional web applications. Some of these features include:

Multi-Tenancy: Cloud-based web applications can serve multiple customers on the same infrastructure, making it a more efficient solution for businesses of all sizes.

Resource Pooling: Cloud-based web applications share resources, such as processing power and storage, across multiple customers. This ensures that resources are utilized efficiently and reduces costs.

Rapid Provisioning: Cloud-based web applications can be provisioned quickly, allowing businesses to deploy applications faster and respond to changing market needs.

Self-Service: Cloud-based web applications allow customers to self-provision resources, such as storage and computing power, as needed, reducing the need for manual intervention [4].

How Cloud-Based Web Applications Work

The cloud infrastructure that hosts cloud-based web applications is controlled by a different vendor, including the cloud provider Amazon Web Services (AWS), Microsoft Azure, or Google Cloud Platform. The web application can be operated using the computational power, storage, and networking capabilities that the cloud infrastructure offers.

When a user accesses a cloud-based web application, the request is sent to the cloud infrastructure, which processes the request and sends the response back to the user. This process happens in real-time and is facilitated by the use of a load balancer that distributes requests across multiple servers to ensure that the application runs smoothly.

Cloud-based web applications can be built using a variety of programming languages and web development technologies, including JavaScript, Ruby on Rails, Python, and PHP. Several methods, such as the Platform as a Service or Infrastructure as a Service models, may be used to deploy these applications [5].

Also two factors that hinder organizations from migrating their applications to the cloud. The first factor is the lack of standardization among cloud providers, which leads to a lock-in effect when an organization adopts a single cloud provider. A number of frameworks have been put up to address this problem, allowing apps to switch between different cloud providers and therefore becoming multi-cloud. Safety is the key reason because businesses are hesitant to transfer sensitive data to the cloud and hand over control to unreliable third parties. Due to the fact that consumers exchange physical servers in the form of computer machines, virtualization also raises security issues. As a result, these hosts are more vulnerable to network attacks and attacks from unauthorized attackers, which could result in the leakage of sensitive data during transmission or an excessive workload of applications.



Working of Web application on the cloud typically involves a few key steps:

Choose a cloud provider from the many available options, including Microsoft Azure, the cloud provider Amazon Web Services (AWS), and Google Cloud Platform (GCP). To choose the one that is most appropriate for your application, compare the features and costs of each.

Select a deployment method: There are several ways to deploy a web application on the cloud, including using containers, virtual machines, and serverless computing. Choose the deployment method that best suits your application's needs.

Set up the infrastructure: This involves setting up the necessary infrastructure, such as virtual machines, storage, and networking. This can often be done using the cloud provider's console or command-line interface.

Deploy the application: This involves actually deploying the code for your web application to the cloud. This can be done using a variety of tools, including Git, FTP, or the cloud provider's deployment tools.

Once the program is installed, it is crucial to properly test it and keep an eye out for performance and security concerns. Setting up automated testing, utilizing the cloud provider's features and functionality, or creating your own analysis tools are all possible options [6].

Overall, deploying a web application to the cloud can be a challenging process, but it is manageable with adequate planning and close monitoring of every detail..

II. DEVELOPING A WEB APPLICATION

- A. *Web application development* is the process of building web-based programmes utilising server-side programming languages and frameworks including HTML, CSS, and JavaScript. This is a concise list of the main procedures and factors to be taken into account when developing web applications : *Planning*: Define the purpose, scope, and requirements of the web application. Identify the target audience, key features, and functionality needed.
- B. *Design*: Create wireframes and visual designs for the user interface and design the database schema and application architecture.
- C. *Development*: Write code using a chosen programming language and framework, and integrate third-party APIs and libraries as needed.
- D. *Testing*: Perform unit, integration, and system testing to ensure the application functions as expected.
- E. *Deployment*: Deploy the application to a web server, either on-premises or in the cloud.
- F. *Upkeep*: Keep an eye out for bugs, security holes, and performance problems with the application and update it as necessary.
- G. It's crucial to follow best practises for security and scalability throughout the development process, as well as to consider user experience and accessibility. Also, it's critical to stay current with web application development trends and technologies and to keep learning and developing your skills. [7].

III. ARCHITECTURE OF DATABASES

A database architecture is a diagram that shows how a database management system is designed (DBMS). It aids in the creation, development, implementation, and upkeep of the DBMS. The split of the database system into independent components that can be changed, replaced, or altered individually is made possible by a DBMS architecture. Understanding the different parts of a database is also beneficial.

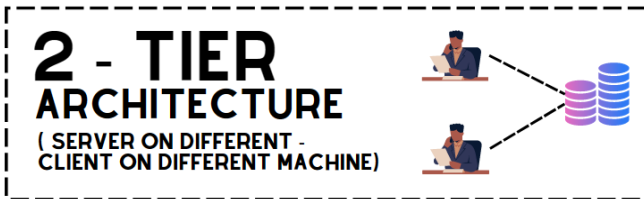
The correct selection of a DBMS architecture is essential for easy and efficient data management. Hence, selecting the right architecture is crucial for data security and efficient data retrieval. With the help of a well-designed database architecture, the system can be scaled up or down easily, allowing the efficient management of data growth [8].

A.1 - Layered Architecture



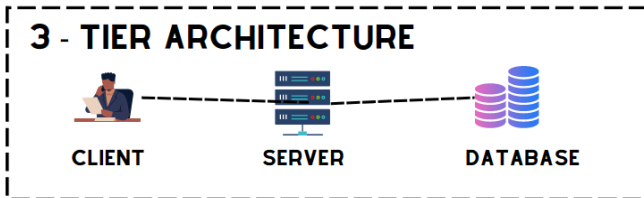
The simplest architecture in DBMS is known as the "1 Layered" architecture, which places the client, server, and database on the same machine. One easy way to build up this architecture would be to install a database on your computer and use it to practise SQL queries. However, due to potential performance and security difficulties, this architecture is rarely utilised in practise. [8].

B.2 - Layered Architecture



2 The simplest architecture in DBMS is known as the "1 Layered" architecture, which places the client, server, and database on the same machine. One easy way to build up this architecture would be to install a database on your computer and use it to practise SQL queries. However, due to potential performance and security difficulties, this architecture is rarely utilised in practise. [8].

C.3 - Layered Architecture



A client-server architecture known as the "3 Layered Architecture" divides the application into three logical layers: display, application, and data storage. The data storage layer is in charge of administering the database, while the application layer handles user requests and interacts with the data storage layer. The presentation layer handles user interface and interaction. As comparison to the two-layered architecture, this architecture offers superior scalability, flexibility, and maintainability because one layer may be modified more easily without affecting the others. Also, it makes it simpler to distribute the programme across a number of servers, improving availability and speed. Yet, it could make the design, development, and deployment of the application more difficult. [8].

IV. WORKING ON UI/UX

Building a web application's frontend is a crucial undertaking that needs careful planning, design, and implementation. The user-facing portion of the application, or frontend, allows users to engage with the system by inputting data, selecting options, and seeing data. The following are the main steps in creating a web application's frontend : Plan and

define the requirements: The first step is to plan and define the requirements for the frontend. This includes understanding the purpose, target audience, and key features of the application. Identify the data that needs to be collected, displayed, or manipulated and the user interface (UI) elements required to perform these tasks.

Design the UI: Once the requirements are defined, the next step is to design the UI. This includes creating wireframes, mockups, and prototypes of the user interface. Consider the layout, color scheme, typography, and other visual design elements to create a consistent and user-friendly UI.

Develop the frontend: After the UI design is approved, the development process can begin. This includes writing HTML, CSS, and JavaScript code to create the UI and adding functionality to handle user interactions. Consider using a frontend framework, such as React or Angular, to simplify the development process and ensure compatibility across different devices and browsers.

Test the frontend: To make sure the frontend is user-friendly and operates as intended, it is crucial to extensively test it. To find and resolve any flaws, issues, or compatibility difficulties, do usability testing, functional testing, and cross-browser testing.

Deploy the frontend: Once the testing is completed, the frontend can be deployed to the web server. This involves uploading the HTML, CSS, and JavaScript files to the server and ensuring that the application is accessible and functional.

After it has been deployed, the frontend needs to be maintained to make sure it is working properly and continues to offer a positive user experience. This entails keeping an eye out for bugs, mistakes, and security flaws while also implementing updates and enhancements as necessary.



In conclusion, building a web application's frontend requires careful planning, design, and development to provide a user-friendly and functioning user interface (UI) that satisfies the needs of the programme. To guarantee that the frontend functions as planned and offers a great user experience, testing, deployment, and maintenance are also essential. These procedures can be used by developers to produce top-notch web applications that cater to both user and corporate needs. [9].

V. ENHANCING THE FEATURES

Any effective web application must have a strong user interface (UI) and user experience (UX). While the UX refers to the overall experience and usability of the programme, the UI relates to the visual design and layout of the application. The following are some methods for improving UI/UX in online applications:

Simplify the UI: One of the best ways to improve the UX of an application is to simplify the UI. This involves removing unnecessary elements, reducing clutter, and making the most

important elements easy to find and use. Consider using a minimalist design with simple color schemes, typography, and layout to make the UI less overwhelming and easier to navigate.

Employ consistent design elements: Good UI/UX depends on consistency. Make sure that the application has the same colour scheme, font, and layout throughout. Users can navigate the programme more easily as a result of the familiarity this establishes..

Employ responsive design to make sure the application is usable on a range of screens and devices. This entails utilising adaptable layouts, text sizes, and screen-responsive pictures. You may enhance the entire UX by making sure the application is usable and available on mobile devices, tablets, and desktops.

Use animation and micro-interactions: Animation and micro-interactions can enhance the UX by providing visual feedback and creating a sense of engagement. For example, animations can be used to show the progress of a task, while micro-interactions can be used to provide feedback when the user interacts with an element.

Use accessibility features: Making the application accessible to all users is essential to good UX. This involves using features like alt tags for images, keyboard navigation, and screen readers. By ensuring that the application is accessible to users with disabilities, you can improve the overall UX and reach a wider audience.

Utilize A/B testing: A/B testing entails comparing the performance of various iterations of the application. In order to find out what appeals to customers the most, this can be used to evaluate various design, copy, and other aspects. You can continuously enhance the application's UX over time by employing A/B testing. [10].



VI. DATA MANIPULATING FOR CLEAN PROCESSING

The act of identifying and eliminating erroneous, incomplete, or corrupt records from a dataset is known as data cleaning. Because the quality of the data used in AI and ML directly affects how effective these technologies are, it is an essential part of data preparation. Here are a few significant AI and ML data cleansing components. [11].



A. Data Validation

Data validation involves checking the consistency, accuracy, and completeness of the data. This process can involve running automated tests to detect errors, such as duplicate

records, missing values, or invalid data types. Validation can also involve manual checks by domain experts to ensure that the data is accurate and complete.

B. Data Transformaton

Data transformation entails putting the data in a format that the AI or ML algorithms can understand. This can involve normalising numerical data, encoding categorical variables, and transforming text data into a numerical format. These adjustments can make the algorithms more accurate and aid in finding patterns in the data.

C. Data Standardization

Making sure the data is consistent across the full dataset is known as data standardisation. Standardizing date formats, addresses, and other data types may be necessary for this. The algorithms' accuracy can be increased and errors can be decreased with the help of standardisation.

D. Outlier Detection

Finding and deleting data points that differ considerably from the rest of the dataset is known as outlier identification. Outliers can seriously affect the accuracy of the algorithms and can be brought on by measurement errors or other irregularities. The algorithms can concentrate on the most important data points and increase their accuracy by deleting these outliers.

E. Adding Up Missing Data

A number of factors, such as measurement errors, data entry problems, or a lack of information, might result in missing data. Imputation is the process of utilising statistical techniques or other algorithms to fill in the missing data. This can ensure that the algorithms are using the maximum amount of data, improving their accuracy.

F. Data Integration

This can be a complex process that involves resolving inconsistencies, standardizing data types, and identifying duplicates. Integration can help to create a complete and more accurate dataset, which can improve the accuracy of the algorithms.

G. Data Reduction

Data reduction involves reducing the size of the dataset while preserving as much relevant information as possible. This can be done using methods such as principal component analysis or feature selection. Data reduction can help to reduce the computational cost of the algorithms and improve their accuracy by focusing on the most relevant data points [12].

VII. CONFIGURATION OF DATABASE ON CLOUD

Integrating a database in the cloud involves the process of migrating a database from a local server to a cloud-based service provider. This can bring several advantages such as increased scalability, higher availability, and improved security. In this Part, we will discuss some of the key steps involved in integrating a database in the cloud.

A Cloud Service Provider to Use The selection of a cloud service provider is the first stage in integrating a database in

the cloud. Google Cloud, Amazon Web Services (AWS), and Microsoft Azure are a few well-known suppliers of cloud services. It's crucial to select a supplier that fulfills your unique needs because each of these providers has unique features and advantages.

Selection of a Database After deciding on a cloud service provider, you must pick a database that works with that provider. Relational databases, NoSQL databases, and graph databases are just a few of the various types of databases available. The type of database you select depends on your application's needs and the data you'll be using.

Creating a Cloud Database Instance The next step is to create a cloud database instance. This involves setting up a virtual machine in the cloud that will host your database. You will need to specify the size and configuration of the instance, as well as any security settings that are required.

Migrating Data to the Cloud Once you have created a cloud database instance, you need to migrate your data to the cloud. This can be done using a variety of tools and techniques, including database backup and restore, database replication, and data transfer services. It's important to ensure that your data is transferred securely and that there is no loss or corruption of data during the migration process.

Configuring Database Access After you have migrated your data to the cloud, you need to configure database access. This involves setting up user accounts and permissions, as well as network settings and firewalls to ensure that your database is secure and accessible only to authorized users.

Evaluation and Improvement You must test your database to make sure it is operating as expected after it is up and running in the cloud. To find any bottlenecks or problems, this entails executing performance tests, load tests, and other sorts of tests. To make sure that your database is operating well, you might also need to adjust its performance settings and setup.

Monitoring and Maintenance Finally, it's important to monitor your cloud database regularly and perform routine maintenance tasks to ensure that it is running smoothly. This includes tasks such as backups, updates, and security patches. It's also important to have a plan in place for disaster recovery and business continuity in case of any unexpected downtime or data loss [13].



VIII. INTEGRATING BOTH ENDS

Integrating the front-end and back-end of a web application is an essential step in creating a fully functional and responsive web application. The front-end is the user interface that users interact with, while the back end handles the business logic and data storage.

The integration process requires a clear understanding of the technologies used for both the front-end and back-end. The front-end is typically built using HTML, CSS, and JavaScript, while the back end can be built using a variety of languages such as Python, Ruby, or Java. One common approach to integrating the front-end and back-end is through the use of an API.

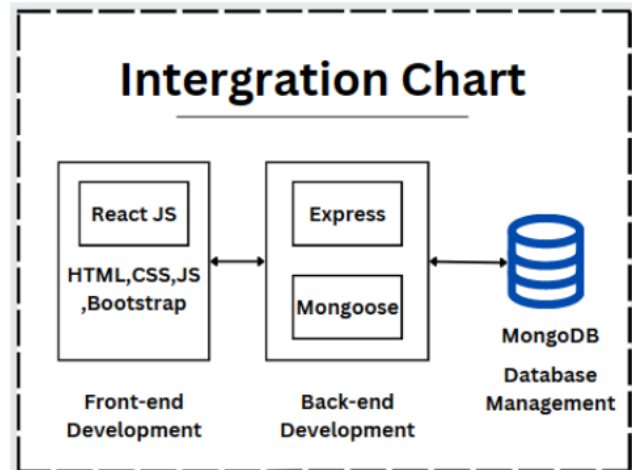


Fig 1 - Integration Chart

Application programming interfaces, or APIs, are a collection of standards, tools, and protocols used in the development of software and applications. It enables data interchange and communication between various software components. Creating the back-end first and then creating the front-end to interact with it is a usual strategy for integrating the front-end and back-end using an API.

Once the back end is built, the API can be developed to allow the front-end to communicate with the back-end. The API defines the endpoints, or URLs, that the front-end can use to interact with the back-end. These endpoints can be used to create, read, update, or delete data stored in the back-end.

It's crucial to make sure that both the front-end and back-end are constructed using the same set of standards and conventions when linking the two through an API. This will make it more likely that the front end and back end can communicate effectively with one another.

Other considerations when integrating the front-end and back-end include security and scalability. It's important to ensure that the API is secure and that user data is protected. Scalability is also important, as the application may need to handle a large number of users and requests.

In conclusion, using an API to enable communication between the front-end and back-end of a website entails designing the front-end and back-end of the web application in accordance with a shared set of standards and conventions. This approach necessitates a thorough understanding of the front-end and back-end technologies, and it's crucial to take security and scalability into account while connecting the two parts. With proper design and execution, connecting the front-end and back-end can result in a smooth and responsive web service [14].

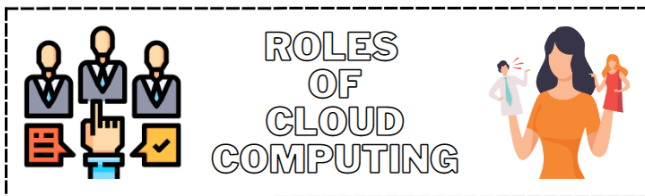
IX. ROLE OF CLOUD INFRASTRUCTURES

Cloud infrastructures are a collection of resources such as computing power, storage, and networking that are delivered

as a service over the internet. They provide a flexible and scalable environment for managing web applications, allowing developers to easily adjust resources based on demand.

One of the key benefits of cloud infrastructures is their scalability. With cloud infrastructures, developers can easily increase or decrease resources based on demand. This means that web applications can scale up or down quickly and easily without the need for significant infrastructure changes. This scalability ensures that web applications can handle sudden spikes in traffic, such as during peak shopping seasons or major news events.

In addition to scalability, cloud infrastructures also provide flexibility. With cloud infrastructures, developers can easily test and deploy web applications across multiple environments without the need for significant infrastructure changes. This means that web applications can be deployed quickly and easily to new regions, allowing businesses to expand their reach to new markets [15].



The affordability of cloud infrastructures is another advantage. Businesses using cloud infrastructures only pay for the resources they actually utilise. Because of this, companies won't have to pay any up-front expenses for creating and maintaining their own infrastructure. Moreover, pay-as-you-go models are frequently available in cloud infrastructures, enabling organisations to only pay for the services they really use.

Comparing cloud infrastructures to conventional infrastructure models, they also offer better availability and reliability. Cloud infrastructures ensure that online applications are accessible even in the case of hardware failure or a natural disaster by distributing resources across numerous data centres. Furthermore, cloud infrastructures frequently provide built-in backup and recovery options, guaranteeing that data is secure and is simple to recover in case of a catastrophe.

Finally, cloud infrastructures offer improved security compared to traditional infrastructure models. With cloud infrastructures, security is often built into the platform, allowing businesses to leverage the expertise of cloud providers. Additionally, cloud providers typically have robust security practices and are able to respond quickly to security threats.

Cloud infrastructures offer a flexible, scalable, and cost-effective solution for managing web applications. They offer improved reliability, availability, and security compared to traditional infrastructure models. With the ability to quickly and easily adjust resources based on demand, businesses can ensure that their web applications can handle sudden spikes in traffic and rapidly expand to new markets. As more businesses adopt cloud infrastructures for web application management, it is likely that they will become the norm for web application management in the years to come [16].

X. ADDITIONAL CLOUD SERVICES

Cloud services have become an essential part of modern businesses, providing a range of benefits such as scalability, flexibility, and cost-effectiveness. While many people are familiar with the popular cloud services like computing, storage, and networking, there are many additional cloud services that businesses may not be aware of. Lets explore some of the additional cloud services that are available.

Cloud service providers like Google Cloud, Amazon Web Services, and Microsoft Azure provide machine learning and artificial intelligence (AI) services, allowing organisations to take advantage of the strength of machine learning algorithms and predictive analytics to discover patterns in their data. [17].

Internet of Things (IoT): Cloud providers offer IoT services that enable businesses to manage their IoT devices and data in the cloud. With IoT services, businesses can easily collect, store, and analyze data from their devices and gain insights that can help them improve their operations.

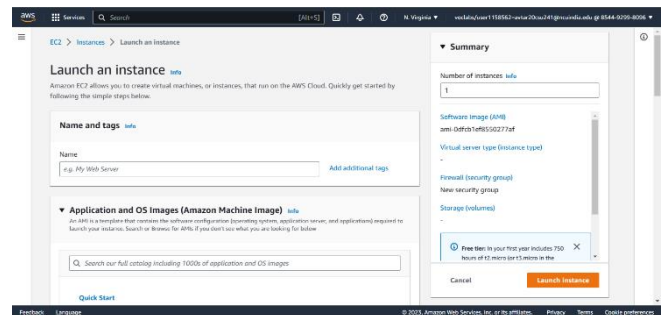


Fig 2 - AWS Console

Blockchain: Cloud providers offer blockchain services that enable businesses to leverage the power of blockchain technology without the need to set up and manage their own blockchain infrastructure. With blockchain services, businesses can securely and transparently store data and transactions, reducing the risk of fraud and improving trust in their operations [18].

Content Delivery Network (CDN): Cloud providers offer CDN services that enable businesses to deliver content to users quickly and efficiently. CDN services use a network of Users receive material from nearby servers, lowering latency and enhancing the user experience. These servers are dispersed throughout the world.

Database as a Service (DBaaS): Cloud providers offer DBaaS, which allows businesses to store and manage their data in the cloud without the need to set up and manage their own database infrastructure. DBaaS services can be easily scaled up or down based on demand, making it a flexible and cost-effective solution for managing data.

Identity and access management, threat detection and response, and compliance management are just a few of the security and compliance services that cloud providers provide. These services assist businesses in defending against cyberthreats, ensuring their operations are compliant with industry standards, and safeguarding their data. [19].

XI. ANALYZING YOUR WEB APPLICATIONS

Analyzing web applications on the cloud offers several benefits for businesses, including performance monitoring, scalability, security, predictive analytics, and cost optimization. Cloud-based application monitoring tools provide real-time insights into an application's performance, allowing businesses to quickly detect and resolve issues that could impact user experience. These tools help monitor key performance metrics, such as response time, page load times, and server uptime, and identify any anomalies. Additionally, cloud-based analytics tools enable businesses to scale their applications in response to changing demand. By monitoring usage patterns and adjusting resources accordingly, businesses can ensure that the application can handle sudden spikes in traffic [20,21].

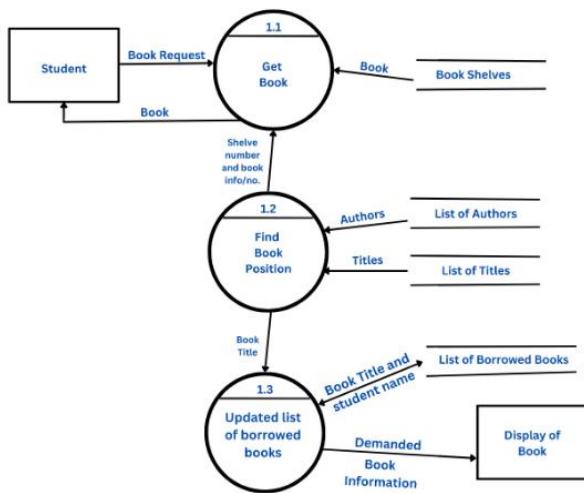


Fig 3 - DataFlow Diagram for LMS

Furthermore, cloud-based analytics tools provide businesses with real-time visibility into their application's security posture, allowing them to identify potential vulnerabilities and threats and quickly respond to any security incidents. With predictive analytics, businesses can identify potential issues before they occur and take proactive steps to address them. Finally, analyzing web applications on the cloud can help businesses optimize their costs. By monitoring resource usage, businesses can identify areas where they can reduce costs, ensuring that they only pay for the resources they need. Overall, analyzing web applications on the cloud is essential for businesses to ensure their application's performance, scalability, and security, while also optimizing costs and making data-driven decisions[22].

XII. CONCLUSION

In conclusion, cloud-based web applications offer several benefits for businesses, including scalability, reliability, security, and cost optimization. By leveraging the power of the cloud, businesses can deploy their web applications more quickly and cost-effectively, while also ensuring that they can handle sudden spikes in traffic. Cloud-based web applications also provide businesses with real-time insights into their application's performance, enabling them to

identify and resolve issues quickly and optimize their performance.

Additionally, cloud-based web applications offer enhanced security features, such as identity and access management, data encryption, and network security controls. These features help businesses protect their applications and data from cyber threats and ensure that they comply with industry regulations and best practices. Moreover, cloud-based web applications enable businesses to scale their resources up or down as needed, reducing costs and increasing efficiency. This is particularly beneficial for businesses that experience seasonal or sporadic spikes in demand, as they can adjust their resources in real-time to meet changing requirements. Businesses have more flexibility and agility thanks to cloud-based web applications, which enables them to quickly adjust to shifting market conditions and client needs. Businesses can respond to shifting demands and develop more quickly with cloud-based solutions because they may scale resources up or down as necessary. Additionally, cloud-based web apps give companies the chance to work more productively and efficiently with teams and stakeholders located all over the world.

But, there are significant difficulties with cloud-based web apps as well, including issues with data security and privacy, vendor lock-in, and potential downtime. Businesses must carefully choose their cloud service provider and put in place the right security and risk management procedures to reduce these risks. They must also make sure that their web applications are optimised for the particular cloud platform they are using and developed for the cloud.

Ultimately, the advantages of web applications that use the cloud outweigh any potential hazards and difficulties. Businesses can deploy their online applications more rapidly and economically while also guaranteeing its security, dependability, and scalability by utilising the power of the cloud. Cloud-based web apps will become more prevalent as businesses continue to embrace digital transformation and the move to the cloud.

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