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Scalable Cloud Deployment and Automation for E-Commerce Platforms Using AWS, Heroku, and Ruby on Rails

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Abstract: *The rapid expansion of e-commerce has intensified the need for scalable, reliable, and responsive infrastructures to support surges in demand, dynamic content, and real-time user interactions. Cloud computing has revolutionised the e-commerce industry by offering scalable, cost-effective, and efficient solutions to address the growing demands of businesses. This paper explores the deployment and automation strategies for e-commerce platforms, emphasising the use of Amazon Web Services (AWS), Heroku, and Ruby on Rails. The discussion begins with an overview of cloud computing, its deployment models, and the key concepts of scalability and automation. Critical aspects like Infrastructure as Code (IaC), Continuous Integration/Continuous Deployment (CI/CD), auto-scaling, and monitoring are highlighted to demonstrate the efficiency of cloud-based systems. Additionally, the role of cloud platforms in enhancing the operational flexibility, security, and performance of e-commerce platforms is discussed. Examples of popular cloud-supported e-commerce platforms like Shopify, BigCommerce, and Wix are provided to illustrate real-world applications. By leveraging AWS for infrastructure, Heroku for seamless deployment, and Ruby on Rails for robust application development, this paper presents a comprehensive approach to building adaptive and high-performing e-commerce platforms.*

Keywords: Cloud Computing, E-commerce, Heroku, Ruby on Rails, Automation, Continuous Deployment, Scalability, AWS

I. INTRODUCTION

A number of industries, including marketing, have seen shifts as a result of IT advancements. Everyone has a fair chance to promote their wares on the Internet because of the widespread use of information technology in marketing, particularly with the rise of electronic commerce (E-commerce), which eliminates geographical barriers to communication between businesses and their consumers. At the moment, businesses that use e-commerce will incur significant environmental costs, but with the introduction of cloud computing, all issues have been fixed[1]. Consequently, cloud computing is becoming more popular among e-commerce enterprises as a means to gain significant economic value. Hardware components (servers, communication infrastructure, and client computers) and software components (application server, client application, database server) make up the architecture of a distributed eCommerce system [2][3]. The client application could be anything from a regular web browser to a specialised program. A mobile device or desktop PC can stand in for the client hardware. Cloud computing will be utilised by the eCommerce server, allowing for the dynamic adjustment of all necessary resources [4].

The rapid growth of e-commerce has necessitated scalable, reliable, and highly responsive infrastructures capable of accommodating surges in user demand, dynamic content delivery, and real-time interactions[3]. Web computing platforms, especially AWS and Heroku, have become vital tools for deploying, managing, and automating web applications because of their inherent flexibility coupled with a set of automation tools[5][6]. Using these platforms, modern e-commerce systems can reach unlimited uptimes, organised deployment processes, and cheap resource utilisation, which are essential to remain competitive worldwide[7]. The demand for this agility and performance has underscored the need for scalable deployment frameworks tailored for high-demand environments, such as e-commerce, where service availability directly impacts customer experience and business success[8]. Figure 1 shows the cloud-based e-commerce applications.

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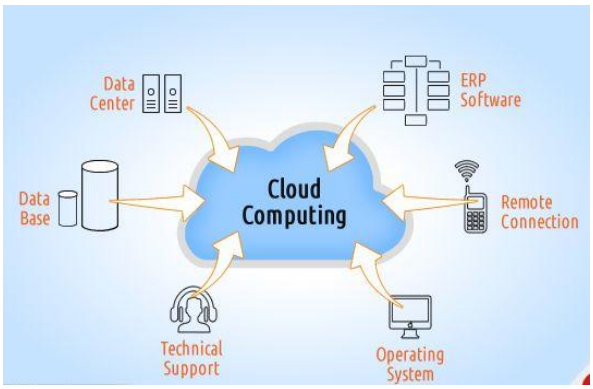

Figure 1: Cloud-Based eCommerce Applications

Ruby on Rails, which has been noted as having a short cycle of development and being inherently maintainable, is now one of the most preferred choices in e-commerce application frameworks. Ruby on Rails, in conjunction with cloud platforms including AWS and Heroku, enables the developers to establish dynamic data-driven applications capable of addressing intricate methodologies of operation inherent in e-commerce. [9]. The use of these platforms enables the distribution of microservices and containerised applications as well as improving modularity and scalability [10]. Additionally, by supporting DevOps practices like CI/CD, these cloud services facilitate automatic testing, deployment, and scaling of applications, minimising manual oversight and improving the efficiency and reliability of updates[11].

A. Organized of this paper

The paper begins with an Introduction to scalable infrastructures in e-commerce, focusing on AWS, Heroku, and Ruby on Rails. Section II provides the overview of Cloud Deployment and Automation, Section III give the aspects of Could in Ecommerce, Section IV discussed the AWS For Scalable E-Commerce Applications, Section V provide the Heroku For Rapid Deployment and Scalability, Section VI discussed the Ruby On Rails for E-Commerce Development, Section VII provide the Literature Work and Section VIII give summary of the paper as Conclusion.

II. OVERVIEW OF CLOUD DEPLOYMENT AND AUTOMATION

The "cloud" in cloud computing refers to the actual phenomenon of clouds gathering water molecules. Whenever needed, the user can access cloud computing features without restrictions. The majority of cloud computing customers would rather work with an intermediary than build their own physical infrastructure [12]. It is only necessary to pay for the services that have been used. The burden on cloud computing can be lessened by redistributing tasks [13]. The local computers do not experience high loading times when applications are run in the cloud since the networks in the cloud handle a huge volume of service [14]. This results in less user-side hardware and software needs. A web browser is essential for accessing the cloud. Using a web browser such as Chrome and cloud computing is all that's required[15]. Here are the main components of cloud computing:

- Resource Pooling and Elasticity
- Self-service and On-Demand Services
- Pricing
- Quality of Service

The world has learnt how to construct scalable architectures for computing, storage, and application services from companies like Amazon, Google, Yahoo!, and others who have constructed enormous systems to support their applications [2]. The anticipated yearly revenue growth for public clouds is projected to exceed USD 40 billion, as shown in Figure 2.

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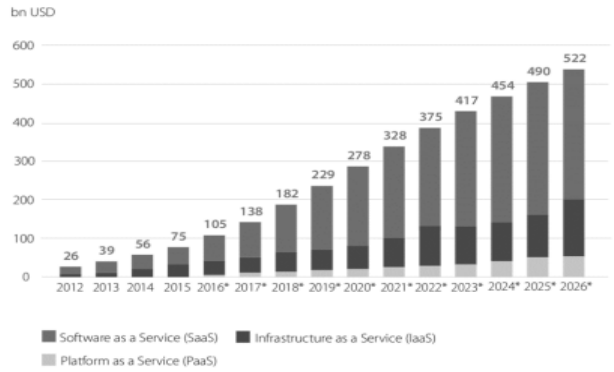

Figure 2: Public cloud revenue worldwide from 2012-2026, segment (in billion U.S. dollars)[4].

- **Amazon Web Services:** The main IaaS on Amazon Web Services that hosts virtual machines is EC2. Among the leading cloud providers, AWS offers the most variety of instance types, including general-purpose ones for virtual machines and instances for computation, memory, and storage. The integration of EC2 with AWS data storage services is done by the clients.
- **Microsoft Azure:** One of the many services that Azure provides to build an instance is Azure Virtual Machines. Azure Storage and Azure Databases are among its offerings.
- **Google Cloud Platform:** As an IaaS provider, Google offers its own cloud computing platform, GCE, which provides both standard and specialised machine kinds.

A. Cloud Deployment Models

The uncertainty around the three possibilities makes it difficult for online businesses to decide whether to invest heavily in private, public, or mixed cloud computing.

- **Public Cloud:** Apps, storage, and other resources can be made publicly accessible by using a service provider. The general public can access public clouds, which are owned, hosted, and operated by third-party service providers. The infrastructure pool is the same for all users, with only slight variations in client dependability, information security[16], and settings[17].
- **Private Cloud:** The term "private cloud" refers to a specific kind of cloud computing architecture in which a single company has exclusive access to a shared pool of computer resources and related IT goods. Internal resources are often responsible for managing a private cloud[18]. Businesses in regulated industries, as well as those with predictable workloads or needs for customisation, may find these advantages particularly helpful.
- **Hybrid Clouds:** Hybrid cloud computing basically combines public and private cloud computing. One of the main ideas behind hybrid clouds is that it is possible to integrate the two major cloud architectures into a single application. Utilising information and resources from many cloud models, the objective is to create a consistent, predictable, and highly efficient computing environment. Leading hybrid cloud providers include Amazon, Microsoft, Google, Cisco, and NetApp.

B. Key Concepts in Scalability and Automation

Cloud computing's underlying principles of scalability and automation facilitate the efficient and dependable expansion of applications [19][20][21].

1. Scalability:

A system's scalability in a cloud setting is defined as its capacity to manage increasing workloads or its flexibility to accommodate expansion. This is accomplished by:

- **Vertical Scaling (Scaling Up):** Increasing resources (CPU, memory) of an existing server or virtual machine.
- **Horizontal Scaling (Scaling Out):** Adding more servers or instances to distribute the workload, typically managed with load balancers to maintain service levels during high traffic.

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- **Elasticity:** This is usually linked with scalability and by changing resources' allocation dynamically to meet current usage needs, applications can increase or decrease resource requirements thus cutting costs and providing better performances.

2. Automation:

Automation is useful when applied in Cloud deployment because it eliminates recurrent tasks, making the process more efficient [22][23][24]. Key automation practices include:

- **Infrastructure as Code (IaC):** Automation that enables the usage of code for controlling the resources and infrastructures on the cloud for consistent deployment. The most common IaC tools include Terraform, Amazon Web Services CloudFormation and Ansible.
- **Continuous Integration and Continuous Deployment (CI/CD):** CI/CD pipelines can help the software to be released much faster and more dependably because of the tested, built and deployed code.
- **Auto-scaling:** This automatically allocates resources depending on specific states (CPU usage, network congestion, etc.) to maximise both efficiency and cost[25].
- **Monitoring and Alerts:** There is CloudWatch, Grafana, for example, which allow controlling and alerting so that one can solve the problem before it becomes critical or perform necessary adjustments to the system.

By leveraging scalability and automation, organisations can deploy resilient and adaptive applications that respond efficiently to fluctuating demands and minimise human intervention, ensuring consistency and reducing operational costs.

III. ASPECTS OF COULD IN E-COMMERCE

Cloud computing is one of several new paradigms in computing that have emerged as a consequence of the vast improvements in internet services and virtualisation techniques made possible by the explosion of innovation in the field of information and communication technologies (ICT) during the past few decades. Globally, a number of large cloud service providers make their products and services available to individuals and organisations via the Internet [26]. Efficient Data Modeling and Storage Solutions with SQL and NoSQL Databases in Web Applications[26]. The outcome is an increase in the demand for cloud services as more companies move their operations online. Businesses have a lot to gain from cloud computing, but there are also certain risks and problems associated with it. By reducing friction in the buying and selling process, cloud computing is enhancing electronic commerce[4].

There are a lot of factors that businesses must think about while deciding on the ideal e-commerce platform [27]. Among the many, here are the excellent examples[28]:

- **Shopify:** a prominent online marketplace. With 20,000 websites, it holds the second-largest proportion of the market[29]. It provides a means to initiate a business and commence sales without delay.
- **Big-commerce:** a leading cloud-based e-commerce brand. Designed for those without extensive knowledge of web design, Large Commerce is a software application that lets you sell both digital and physical goods.
- **WiX:** is an easy-to-use platform that offers both website creation and e-commerce solutions. Simple and well-organized, it lets you sign up with your Facebook or Gmail account.
- **Esty:** another comprehensive online marketplace that specialises in selling one-of-a-kind products created in factories, as well as those that are handcrafted or vintage. The facility is structured similarly to traditional open-air craft fairs.

Table 1: Features Of Cloud Computing in Ecommerce[30]

Features	Explanation
Cost reduction	Cut down on IT spending on things like installing, maintaining, and implementing resources.
Gradation	Cloud computing is adaptable to the needs of different types of businesses, enabling specific services to expand over time.
Convenient	Needs in the business world are dynamic and unpredictable. Cloud computing allows for rapid adaptation of IT to these changes through self-adaptation and dynamic expansion.

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Security	Data was saved and distributed over numerous servers to ensure data stability and to distribute the storage load.
Productivity	Cloud computing is economical since it boosts productivity in the workplace. Compared to a traditional installation, software distribution in the cloud is faster.
Efficiency	I.T. departments are free to concentrate on running their businesses and making money by investing in new research and development.
Accessibility and mobility	The customer can use cell phones to access services and goods from anywhere at any time.
Sustain quality	Ensuring scalability, stability, and flexibility in e-commerce is crucial.
Easy management	Make it easier to maintain infrastructure, software, and hardware.
Optimisation search engine	Improve a website's suitability for high-ranking economic leaders to boost eCommerce store traffic.

A. The Role of Cloud Platforms in E-Commerce.

Cloud platforms play a critical role in modern e-commerce by providing a flexible, secure, and scalable infrastructure to support online retail operations [31][32]. Key contributions of cloud platforms in e-commerce include:

- **Scalability and Performance:** It handle fluctuating traffic, ensuring reliable performance even during high-demand periods[33]v.
- **Global Reach:** Content Delivery Networks (CDNs) deliver content quickly to customers worldwide, enhancing user experience[34] Software Development Life Cycle Models: A Review Of Their Impact On Project Management.
- **Security and Compliance:** Encryption and compliance certifications are built-in security features that meet regulatory criteria while protecting client data [35].
- **Data Analytics:** Customer trends, material resources required, and product setting up in a precise manner augment the decision-making process due to the sophisticated tools [36].
- **AI and Automation:** Sophisticated solutions such as chatbots, recommendation engines, automated back end processes make the engagement of customers alongside the improvement of business performance possible [37].

Thus, utilising these cloud capabilities, e-commerce platforms provide business reliability, security, and ability to manage a significant flow of clients in the global market.

IV. AWS FOR SCALABLE E-COMMERCE APPLICATIONS

AWS (Amazon Web Services) gives e-commerce solutions necessary to build and run sophisticated and profitable applications. Using services like Amazon's EC2 service and AWS Elastic Beanstalk offering, organisations can smoothly adjust their computing resources to meet the demands of a certain period, say sale season traffic. For data storage and management there are services such as Amazon S3 for storage solutions, and databases like Amazon RDS and DynamoDB for storage of customer data, product information and transactions respectively. CloudFront makes content delivery better, increasing content availability to users from around the world, while AWS WAF and AWS Shield provide better security mechanisms for protecting the website from hackers. More so, AWS has a pay-as-you-go service that ensures that e-commerce businesses pay only what they use while offering them high-quality services thus making it ideal for businesses that want to grow and push for innovation in the stiff market. The following application of AWS for scalable e-commerce applications;

A. AWS Infrastructure for E-Commerce

AWS offers the right environment for e-commerce applications, this environment provides flexibility and scalability through EC2, ELB with Auto Scaling and Amazon RDS services.

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1. Elastic Compute Cloud (EC2) for Scalability

Amazon EC2 enables e-commerce organisations to control and proportionally increase or decrease computational power depending on flow. This flexibility guarantees that applications are able to handle peak loads with ease and use only the necessary resources to make the entire process more cost-effective. Another benefit of EC2 is the high availability supported through multi-zone deployment [38].

2. Elastic Load Balancing (ELB) and Auto Scaling

EC2 instances are load-balanced by ELB so that the instances are not overwhelmed by incoming traffic. When used alongside Auto Scaling, it dynamically adjusts the number of instances to the current traffic in order to remain continuously available and optimise for cost when traffic increases.

3. Amazon RDS for Database Management

Amazon RDS offers scalable, managed databases with automated backups and multi-AZ replication for high availability. RDS ensures secure and reliable data management for critical e-commerce information like user data, transactions, and inventory, supporting various database engines for flexibility.

These AWS services provide a solid, scalable foundation for e-commerce applications, enabling seamless user experiences during high-demand periods.

B. AWS Automation Tools

AWS offers a variety of automation tools that streamline the deployment, management, and monitoring of resources, enabling businesses to improve efficiency, reduce manual intervention, and ensure consistent performance across applications.

1. AWS Cloud Formation

Developers and administrators have an easy way to construct, supply, and upgrade relevant resources with the use of Amazon Web Services' CloudFormation tools. Cloud Formation provides example templates, or they can create our own to reflect AWS services, device requirements, and related tools [39][40].

- **Authoring with familiar programming:** Cloud development kits from Amazon Web Services (AWS) make it easy to build apps in popular languages, including Typescript, Python[41], Java, and.NET. Furthermore, it allows us to offer our infrastructure using AWS CloudFormation straight from our IDE.
- **Authoring with JSON/YAML:** It is possible to model a whole network in text using AWS CloudFormation. The resources needed to configure or create AWS can be defined in a YAML or JSON file.
- **Safety Controls:** Secure automation of AWS infrastructure provisioning and updates is provided via AWS CloudFormation. To specify the CloudWatch, you might utilise Rollback Triggers. With Rollback Triggers, they can tell CloudFormation which CloudWatch alarms to watch for when they implement our slack and replace procedures.
- **Dependency Management:** An automatic handling of resource dependencies is performed by AWS CloudFormation during stack management behavior.
- **Managing Cross-region Cross-Account:** Using AWS Stack Sets, they can deliver a suite of AWS tools to several accounts and locations using a single CloudFormation template.

2. Kubernetes

Kubernetes is a software platform that runs and manages itself through a network of machines. Throughout its development, it has been created using techniques that provide high availability, scalability, and predictability for containerised applications and services [42][41]. Figure 3 shows how Kubernetes's platform-composable features and basic interfaces provide you a lot of leeway, power, and assurance when you're defining and managing your application.

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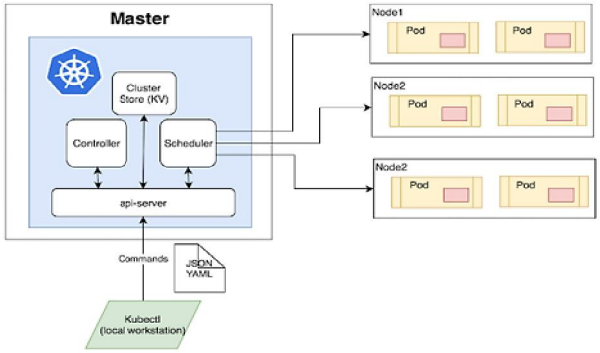

Figure 3: Kubernetes Architecture.

Understanding the high-level structure and organisation of Kubernetes, as well as how it can have certain features, is crucial. Kubernetes is similar to a layer-built network in that any higher-level node can pick up where a lower-level node left off in terms of complexity[8].

- **Master Node:** Kubernetes cluster administration begins with the master node and is an essential component. A central point of entry for all types of administrative operations. To ensure fault tolerance in the cluster, numerous master nodes might be used.
- **Scheduler:** Node functions are executed by the programmer. Records how much of a certain resource each node has used. The workload will be divided amongst the employees.
- **Master/Slave Node:** In order to provide resources to containers that are scheduled, these worker nodes are crucial because they provide the services needed for networking and collaboration among containers. It's also crucial to have worker nodes.

3. Puppet

A free and open-source program for managing cloud configurations; it works with public, private, and hybrid clouds. With Puppet DSL (Domain-specific language), it comes with its own configuration language. Implementing a DSL allows for the definition of system configurations and infrastructure as code. Puppet Enterprise coordinates the management and execution of commands across several devices based on tasks. It gives you a GUI for managing and organising all your cloud machines [43].

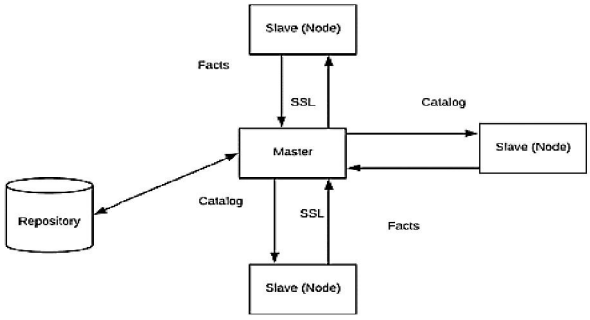

Figure 4: Simple Puppet Architecture

The basic principle of Puppet is the master-slave paradigm. The secure socket layer, seen in Figure 4, connects the client and server. The following elements make up the puppet architecture [44]:

- **Puppet Master:** All processes pertaining to configuration are handled by the Puppet Master, a Linux-based system. The system administrator verifies and validates the SSL certificates.
- **Puppet Slave:** The client uses puppet slaves as functional systems. The slave is managed and cared for by the puppet master. The slave is where the Puppet agent daemon service operates.

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- **Repository:** The configuration files for the nodes and servers are kept in the repository. The official operating system bundle archives are kept by Puppet. The bulk of the software needed for a practical Puppet deployment may be found in Puppet collections.

4. Terraform

Infrastructure as code can be easier with the help of HashiCorp's Terraform technology. The provisioning of data centre infrastructure is accomplished using HashiCorp Configuration Language. Streamlined infrastructure development, versioning, and maintenance using a tool. Through the deployment of bespoke in-house solutions, Terraform manages a large number of existing service providers [43][45].

- **Infrastructure as Code:** The infrastructure can be characterised using high-level, reusable, and flexible languages. Because of this, they can draw up an infrastructure blueprint that can be easily updated.
- **Execution Plans:** When the application is called, Terraform gives the user complete execution details through a phase called the planning step.
- **Resource Graph:** Terraform uses construction graphs to parallelise the creation and modification of resources. As a result, the infrastructure may be built more quickly and efficiently by terraform.
- **Change Automation:** Terraform can make complicated changes by using the execution plan and the resource graph. Therefore, enabling a sophisticated alteration with minimal human participation and error.

V. HEROKU FOR RAPID DEPLOYMENT AND SCALABILITY

- Heroku is a popular PaaS known for simplifying the deployment, scaling, and management of web applications. It is widely adopted by developers and businesses for its ease of use and support for multiple programming languages, including Ruby, Python, Node.js, Java, and more. Leveraging Heroku can lead to rapid deployment cycles and scalable infrastructure, making it ideal for modern web applications that require agility and responsiveness[46][47][10].

A. Ease of Deployment

- Heroku is known for its capability in terms of the deploy of applications that can sometimes take only few commands from the command line. This option of being able to deploy a solution quickly is useful in other agile environments where short iterations and fast rollouts are important for sustaining the edge.
- Through integration with Git such as GitHub developers can push changes directly to Heroku avoiding the laborious process of taking backups and deploying the application.

B. Automatic Scalability

- Since Heroku is a Platform as a Service, it comes with easily configurable scaling that allows the addition or removal of resources depending on the number of users that an application may have. Using Heroku's dynos (micro, isolated, online, insecure processes), applications are easily crafted to scale application horizontally by adding more dynos to meet increasing traffic.
- Using automated scaling is a feature that allows Heroku to automatically scale the number of dynos specific to the application load without necessitating human interference. This auto-scaling feature is very useful for application that receives high variabilities of traffic because it then maintains the best performance while containing costs.

C. Add-Ons for Enhanced Functionality

- Heroku boasts a rich list of add-ons that can be integrated into an application and improve its performance, functionality or security: Heroku Postgres, NoSQL databases, New Relic, caching services, and others. These add-ons require little setup to fit into Heroku applications and provide additional capabilities to applications.
- Add-ons allow the constructed Heroku applications to be altered in certain areas in accordance with respective requirements like using a managed database, analysing the application or incorporating caching layers.

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D. Heroku's Support for Continuous Integration and Delivery (CI/CD)

- Since Heroku provides its native CI/CD capabilities, the integration process is made much easier, and the testing and deployment tasks are executed automatically. Allows developers to first try out the new code updates on dummy servers before make it live, thus preventing many problems and boosting up application efficiency.
- Heroku Pipelines allow to follow the separate environment strategy for several development, staging, and production environments where teams can be sure that new features and fixes are well tested. This capability brings more frequent delivery cycles and better-quality releases.

VI. RUBY ON RAILS FOR E-COMMERCE DEVELOPMENT

Ruby on Rails (RoR) is one of the most progressive Web Application Frameworks for fast development and deployment. Famous for its 'convention over configuration' Rails framework means that development can be efficient and effective with setting up because the frameworks provide much of the boilerplate code. …and given Heroku preeminent native support for rails, Heroku is a perfect platform for generating Rails applications rapidly, since one can count on Heroku to have unerring built-in support for all the dependencies and framework convention of Rails[48]. This compatibility enhances easy prototyping and scaling up of the application without many complex configurations [49].

A. Scalability Features of Ruby on Rails

Rails has instruments and frameworks that make it possible to develop applications that can sustain further growth, including the feature for putting in place optimized database communication and background operations.

1. Active Record for Database Optimization

Active Record is the ORM of Rails that helps in reducing the amount of code required to make a query to a database. It offers optimised Database Queries and caching strategies to support higher Data Availability while Applications from burning out the Database. Active Record also provides database indexing and lazy loading which means it only load the data it needs at a given time in order to enhance the query performance [50].

2. Caching and Background Jobs

Rails has different types of caching that include fragment caching and low-level caching to boost the application speed by helping the server. Also, working with background job they have some gems like Sidekiq and Resque that help Rails to perform tasks asynchronously [51].

B. Ruby on Rails and Cloud Compatibility

The above arrangements are well compatible with cloud platforms such as AWS and Heroku, prominently using cloud services to achieve deployment, scalability and performance.

1. Deployment Best Practices with AWS and Heroku

For scalable, cloud-based deployments, AWS and Heroku complement each other well. Heroku simplifies deployment and scaling, while AWS offers storage, backup, and security features[10]. Best practices include:

- **Decoupling services:** Running database and caching layers on AWS RDS and ElastiCache, while using Heroku for app hosting.
- **Autoscaling:** Using Heroku's dyno scaling capabilities to handle traffic spikes and scale down during low traffic.
- **Environment management:** Utilizing AWS and Heroku's environments to separate development, staging, and production deployments for better testing and version control.

VII. LITERATURE WORK

Existing work in this area primarily relies on statistical methods and basic models to tackle challenges related to automation and deployment.

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This study, Lee, Dewi, and Wajdi (2018) explains how to set up Heroku as a cloud platform and how to secure data on Heroku using AES. Evidence from the performance evaluation supports the usage of AES cryptography for data security. Another interesting finding from the delay calculation of data encryption is that the data delay time for encrypting data grows as the data amount increases[46].

This study, Harzenetter et al. (2018) addresses that matter. With the goal of introducing a pattern-based deployment model meta-model, which allows for the direct incorporation of cloud patterns into deployment models as generic, vendor- and technology-agnostic modeling components. As a result, our method allows us to model solely the abstract notions represented by patterns that must be followed during deployment, rather than defining specific technologies, providers, and their configurations. In addition, they demonstrated an automated process for transforming these models into deployment models that can be executed. They offer a case study and a prototype built on top of the TOSCA standard to prove that our approach is feasible in practice[52].

In, Saraswat and Tripathi (2020, the three leading cloud computing providers—AWS, Azure, and GCP—have their compute, storage space management, and performance offerings examined in this article. In order to assist companies and customers in selecting the appropriate features that will meet their long-term needs, this article will outline and compare the features of AWS, Azure, and GCP [53].

In, Liu (2020) Cloud class APP, an AI-powered TA, has quickly become a crucial pedagogical tool in the development and execution of blended learning. This paper builds a hybrid teaching mode of "Introduction to e-commerce" using the cloud class platform's essential features and drawing on three facets of online and offline classroom instruction, course evaluation and assessment, and instructional practice. It then proposes four areas for further attention[54].

In, Yi (2020) A measurement scale for IT technological capabilities based on cloud computing has been developed through research on e-commerce marketing and enterprise performance on cloud service platforms. The study also examines the business process viewpoint on the realisation of cloud computing's value. They conclude that e-commerce businesses should increase their company size, optimise their capital structure, and boost their financial performance after using factor analysis to assess the sample cloud service e-commerce enterprises' financial performance. In order to draw these conclusions, use a quantile regression model[55].

In, Angui et al. (2022) concentrate on RAN units (also called Cloud-RAN) and automate their deployment in an end-to-end mobile network. Particularly difficult is the automation of the Cloud-RAN because of the need to manage real antennas and the severe latency restrictions anticipated in 6G. They provide a Zero Touch Commissioning (ZTC) model for automating the deployment of a Cloud-RAN chain. This model searches for computing capacity and antennas that are as close to the desired coverage area as possible, doing resource discovery in the process[56].

In, Pushpaleela et al. (2022) the goal of this project is to examine and debate current practices in digital transformation as they pertain to moving on-premises applications to the Amazon Web Services (AWS) cloud. This will involve migrating databases and implementing AWS cloud automation with the help of DevOps tools. Multiple steps will comprise the modernisation strategy. Evaluation and Strategy, Data Migration, Data Extraction and Transformation, Quality Assurance, and Launch/Deployment are the steps involved [57].

Table II provide the Literature review summary of Cloud in E-Commerce platforms

Table 2: Literature review summary of Cloud in E-Commerce platforms

Paper Reference	Objective	Key Findings/Methodology	Technology/Tools	Outcome	Limitations	Future Work
Lee, Dewi, and Wajdi (2018)	Implement Heroku as a cloud platform and AES for data security.	Evaluated performance of AES for data security and encryption delay for different data sizes.	Heroku, AES Cryptography	AES is effective for data security, but encryption delay increases with data size.	Limited analysis on scalability and advanced cryptographic methods.	Explore scalable cryptographic techniques and test on larger datasets.
Saraswat	Compare features	Analysed and	AWS,	Helps	Focused on	Conduct in-depth

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and Tripathi (2020)	of AWS, Azure, and GCP for computing, storage, and performance.	summarised features to guide users in choosing suitable platforms for long-term requirements.	Azure, GCP	organisations/users choose the best cloud platform based on specific needs.	general features without detailed performance benchmarking.	performance evaluations for specific applications and industries.
Harzenetter et al. (2018)	Introduce a meta-model for Pattern-based Deployment Models.	Proposed a vendor-agnostic model enabling abstract pattern-based deployment.	TOSCA standard	Prototype validated practical feasibility with a case study.	Case study validation limited to specific scenarios; lacks real-world implementation.	Apply the model in diverse real-world deployments to evaluate adaptability and efficiency.
Liu (2020)	Construct a hybrid teaching mode for "Introduction to E-commerce" using a cloud class platform.	Developed methods for online and offline teaching, assessments, and evaluations for blended learning.	Cloud Class APP	Created a structured teaching mode with practical recommendations.	Limited to a single course; lacks scalability to other disciplines.	Expand the hybrid teaching model to various courses and subject areas.
Yi (2020)	Study the impact of cloud services on e-commerce marketing and enterprise financial performance.	Measured IT capability, analysed business value of cloud computing, and used regression for financial performance.	Quantile Regression Model	Concluded that optimising company size and capital structure improves financial performance in cloud-based e-commerce.	Focused only on financial performance without exploring non-financial benefits.	Incorporate non-financial metrics such as customer satisfaction and operational efficiency in future studies.
Angui et al. (2022)	Automate deployment of Cloud-RAN units in end-to-end mobile networks.	Introduced Zero Touch Commissioning (ZTC) model for resource discovery and latency management in 6G.	Cloud-RAN, ZTC Model	Automated Cloud-RAN chain instantiation addressing latency and resource constraints for 6G.	Limited to latency and resource management; no evaluation of cost-effectiveness.	Explore cost implications and scalability for large-scale deployment in 6G networks.
Pushpalela et al. (2022)	Study modernisation strategies for digital transformation of on-prem applications to AWS Cloud.	Proposed multi-stage strategies involving planning, data migration, ETL, quality engineering, and Go-Live.	AWS Cloud, DevOps Tools	Developed a comprehensive modernisation approach for application and database migration to AWS.	Lacks exploration of potential risks and mitigation strategies during migration.	Include risk assessment frameworks and develop contingency plans for migration challenges.

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VIII. CONCLUSION

The integration of cloud deployment and automation using platforms such as AWS, Heroku, and Ruby on Rails has emerged as a transformative solution for e-commerce platforms. Cloud computing enables businesses to scale dynamically, optimise costs, and improve operational efficiency while ensuring high performance and security. Deployment models like public, private, and hybrid clouds provide flexibility to address diverse business needs. The adoption of automation tools and techniques, including IaC and CI/CD pipelines, further streamlines processes, reduces human intervention, and enhances reliability. Through this paper, they have demonstrated how leveraging advanced cloud technologies enables e-commerce platforms to handle fluctuating demands, ensure global reach, and enhance customer experience. These findings underscore the critical role of scalable and automated cloud solutions in driving innovation and success in the e-commerce sector.

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