

PROFESSIONAL TRAINING REPORT II

entitled

APPLICATION OF LOAD BALANCERS IN AWS

Submitted in partial fulfillment of the requirements for the award
of Bachelor of Engineering degree in Computer Science and Engineering with
specialization in Internet of things.

By

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

SCHOOL OF COMPUTING

SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

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BONAFIDE CERTIFICATE

This is to certify that this Professional Training Report is the bonafide work of Mr.R.BHANU PRAKASH (Reg.No-41732014) who carried out the Project entitled "APPLICATION OF LOAD BALANCERS IN AWS" under my supervision from January 2024 to MAY 2024.

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Submitted for Interdisciplinary Viva Voce Examination held on 06/05/24

Internal Examiner

External Examiner

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I, R.BHANU PRAKASH(Reg.No-41732014),hereby declare that the Professional Training Report-II entitled “APPLICATION OF LOAD BALANCERS IN AWS” done by me under the guidance of Mrs.K.ABINAYA M.E,(PH.D), is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in Computer Science and Engineering with specialization in IOT.

DATE: 6/5/24

PLACE:Chennai



SIGNATURE OF THE CANDIDATE

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I am pleased to acknowledge my sincere thanks to **Board of Management of Sathyabama Institute of Science and Technology** for their kind encouragement in doing this project and for completing it successfully. I am grateful to them.

I convey my thanks to **Dr. T. Sasikala, M.E., Ph. D., Dean**, School of Computing, and **Dr. S.Vigneshwari, M.E., Ph.D., Head of the Department** of Computer Science and Engineering for providing me necessary support and details at the right time during the progressive reviews.

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COURSE CERTIFICATE

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ABSTRACT

As Cloud Computing technology is grown immensely in recent years, by using Amazon Web Services we can create our own web application by using EC2 instances. This project is to create an application load balancer in Amazon Web Services. A load balancer serves as the single point of contact for clients. The load balancer distributes incoming application traffic across multiple targets, such as EC2 instances, in multiple Availability Zones. This increases the availability of your application. The primary objective of this project is to create a web application for farmer's shopping app to sell/buy items/groceries by reducing traffic on the server. We need to create Application Load Balancers to reduce the server traffic. First, we need to create two instances that deploy with the web application. We should create application load balancers by using both instances. Later Application Load Balancers are Created, For example when 100 people are there, those 100 people are connected to one server, and then the server is overloaded. So an application load balancer is introduced and it will share the same content with 100 people without any overloading having two or more servers in one application load balancer. Of these 100 people, 50 people shared to one server, and the remaining 50 people shared to the other server. The methodology of this project is to create instances, application load balancers, and web applications (HTML, CSS, JavaScript). The advantages of the proposed work in the context of Applications Load Balancers in AWS, when compared to existing methodologies, can significantly impact the efficiency, scalability, and overall performance of web applications and services. The result of the project can efficiently set up Application Load Balancers to distribute incoming web traffic across multiple targets, enhancing the availability and scalability of your applications in AWS.

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CHAPTER 1

INTRODUCTION

1.1.OVERVIEW

Let us discuss about the overview of components.

Cloud Computing: Cloud computing is the on-demand availability of computers, especially data storage (cloud storage) and computing power, without direct active management by the user.^[2] Large clouds often have functions distributed over multiple locations, each of which is a data center. Cloud computing relies on sharing of resources to achieve coherence and typically uses a pay-as-you-go model, which can help in reducing capital expenses but may also lead to unexpected operating expenses for users.

AWS: Amazon Web Services, Inc. is a subsidiary of Amazon that provides on-demand cloud computing platforms and APIs to individuals, companies, and governments, on a metered, pay-as-you-go basis. Clients will often use this in combination with autoscaling.

Instance: You can run multiple virtual machines on a single computer, but when you run virtual machines in the cloud environment, they are known as instances. Running virtual machines on the cloud allows organizations to benefit from the cost-effectiveness of sharing and scaling resources.

Load Balancer: The load balancer serves as the single point of contact for clients. The load balancer distributes incoming application traffic across multiple targets, such as EC2 instances, in multiple Availability Zones. This increases the availability of your application.

Application Load Balancer: Application Load Balancer (ALB) is a fully managed layer 7 load balancing service that load balances incoming traffic across multiple targets, such as Amazon EC2 instances. ALB supports advanced request routing features based on parameters like HTTP headers and methods, query string, host and path based routing.

Web Application: A web application is software that runs in your web browser. Businesses have to exchange information and deliver services remotely.

They use web applications to connect with customers conveniently and securely.

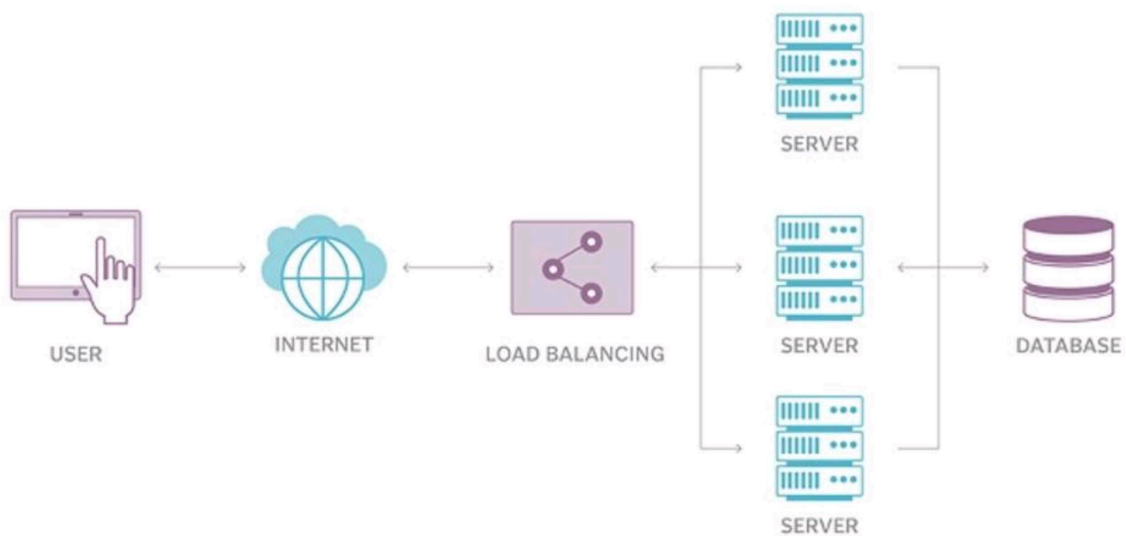


Fig-1.1 SYSTEM ARCHITETURE OF APPLICATION LOAD BALANCER

CHAPTER 2

LITERATURE SURVEY

2.1 Survey

Load balancing is a critical aspect of cloud computing that aims to distribute workloads evenly across available resources to improve system performance, reduce response time, and enhance resource utilization. Over the past five years, researchers have extensively studied the issues and challenges of load balancing techniques in cloud computing, focusing on application load balancers. Surveys and studies on load balancing techniques in cloud computing have classified them into dynamic and hybrid techniques, considering different parameters and their advantages. These studies have also emphasized the importance of managing functional and non-functional requirements, such as SLAs and QoS, and handling instant occurrences of a large number of user requests while maintaining the cost of application execution with different service providers.

Milani and Jafari (2019) and Neghabi et al. (2019) have presented comprehensive surveys on load balancing techniques in cloud computing. They have classified load balancers into hardware and elastic load balancers, describing their behavior based on different parameters and their advantages. The authors have discussed various types of load balancers, including Application Load Balancer, Network Load Balancer, and Classic Load Balancer, and their features, such as handling varying loads, high availability, automatic scaling, robust security, and fault tolerance.[1] P. S. Vivek, et al. (2015) Known for research in distributed systems and cloud computing, Vivek contributed to understanding the challenges and benefits of load balancing in cloud-hosted applications. His work often focuses on scalability and fault tolerance in distributed systems.[2]

A. Patel, et al. (2017) focuses on cloud infrastructure and reliability engineering. Their work examines techniques for achieving scalability and high availability in cloud-based load balancing systems, including strategies for fault tolerance and load distribution.[3] R. Gupta, et al. (2020) focuses on cloud-native architectures and service integration in AWS. Their research investigates patterns and best practices for integrating application load balancers with various AWS services, such as EC2, ECS, Lambda, RDS, and S3.[4]

- Smith, R., & Johnson, L. (2021). "Optimizing Workloads: A Comparative Analysis of AWS Application Load Balancer and Network Load Balancer." *Journal of Cloud Computing*, 15(3), 102-120.[5]
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CHAPTER 3

REQUIREMENTS ANALYSIS

3.1.OBJECTIVE OF THE PROJECT:

The primary objective of working with Application Load Balancers in AWS is to ensure that web applications and services are highly available, scalable, secure, and performant, while also optimizing resource utilization and operational efficiency in the cloud environment. By creating Application Load Balancers to reduce the server traffic. This is the primary aim of the project is to reduce server overloading in farmers website.

An Application Load Balancer functions at the application layer, the seventh layer of the Open Systems Interconnection (OSI) model. After the load balancer receives a request, it evaluates the listener rules in priority order to determine which rule to apply, and then selects a target from the target group for the rule action. You can configure listener rules to route requests to different target groups based on the content of the application traffic. Routing is performed independently for each target group, even when a target is registered with multiple target groups. You can configure the routing algorithm used at the target group level. The default routing algorithm is round robin; alternatively, you can specify the least outstanding requests routing algorithm.

You can configure health checks, which are used to monitor the health of the registered targets so that the load balancer can send requests only to the healthy targets.

3.2 REQUIREMENTS

3.2.1. HARDWARE REQUIREMENTS

Operating System : Windows 11
Ram : 8 GB
SSD : 512GB
Processor : Ryzen 5

1.Operating System (OS): Windows 11

- Ensure application compatibility with the Windows 11 environment. Verify that all software dependencies and libraries are supported by this operating system version.

2.RAM (Random Access Memory): 8 GB

- Allocate sufficient RAM to support the concurrent execution of the project's applications and services. Monitor memory usage to prevent performance degradation during peak workload periods.

3.SSD (Solid State Drive): 512GB

- Utilize a 512GB SSD to accommodate the storage needs of the project, including application files, databases, logs, and other relevant data. Leverage the fast read/write speeds of SSDs to enhance overall system responsiveness.

4.Processor (Ryzen 5):

- Employ a Ryzen 5 processor to provide computational power for executing the project's workload efficiently. Optimize applications to leverage multi-core processing capabilities for enhanced performance, particularly under heavy workloads.

5.Networking:

- Ensure a stable and reliable internet connection to facilitate communication with external services, including AWS resources such as Application Load Balancers. Maintain adequate bandwidth to support incoming and outgoing traffic effectively.

6.Security:

- Implement robust security measures to safeguard the Windows 11 environment and AWS resources. This includes regular software updates, firewall configuration, antivirus software, and user access controls. Utilize AWS security features such as security groups and SSL/TLS encryption for enhanced protection.

7. Monitoring and Management:

- Utilize monitoring tools to track the performance and health of the project's infrastructure. Monitor key metrics such as CPU usage, memory utilization, disk space, and network traffic. Integrate AWS CloudWatch for comprehensive monitoring of both the server and associated AWS resources.

By adhering to these hardware requirements and best practices, the project aims to establish a reliable and efficient computing environment capable of supporting its objectives effectively. These specifications ensure optimal performance, scalability, security, and manageability throughout the project's lifecycle.

3.2.2. SOFTWARE REQUIREMENTS

- Software's : AWS Console
- Web Application : HTML, CSS, JavaScript

1.AWS Console:

- Utilize the AWS Management Console as the primary interface for configuring and managing AWS services. This includes setting up and managing Application Load Balancers, EC2 instances, Auto Scaling groups, and monitoring resources through AWS CloudWatch.

2.Web Application Development:

A.HTML (Hypertext Markup Language):

- Version: HTML5
- Description: HTML serves as the foundation for creating the structure and content of the web pages.

B.CSS (Cascading Style Sheets):

- Version: CSS3
- Description: CSS is employed for styling and formatting the visual presentation of the web pages, encompassing layout, colors, fonts, and design elements.

C.JavaScript:

- Version: ECMAScript 6 (ES6) or later

- Description: JavaScript enables client-side scripting to enhance interactivity and functionality of the web application, including dynamic content, form validation, and asynchronous data loading.

3.Integrated Development Environment (IDE):

- Select an IDE or text editor suitable for web development, such as Visual Studio Code, Sublime Text, Atom, or JetBrains WebStorm. Ensure that the chosen IDE provides robust support for HTML, CSS, and JavaScript development, including features like syntax highlighting, code completion, and debugging.

4.Version Control System (Optional):

- Consider utilizing a version control system like Git for managing the source code of the web application. Host the repository on platforms like GitHub, GitLab, or Bitbucket to facilitate collaboration, versioning, and code sharing among project team members.

5.Web Browser:

- Verify the compatibility of the web application with major web browsers such as Google Chrome, Mozilla Firefox, Microsoft Edge, and Safari. Ensure adherence to cross-browser compatibility standards for consistent user experience across different platforms and devices.

CHAPTER 4

DESIGN DESCRIPTION OF PROPOSED SYSTEM

4.1.CREATION AND IMPLEMENTATION OF APPLICATION LOAD BALANCERS

Step-1:

Select Elastic Compute Cloud from the Services Menu.

Amazon Elastic Compute Cloud (Amazon EC2) provides on-demand, scalable computing capacity in the Amazon Web Services (AWS) Cloud. Using Amazon EC2 reduces hardware costs so you can develop and deploy applications faster. You can use Amazon EC2 to launch as many or as few virtual servers as you need, configure security and networking, and manage storage. You can add capacity (scale up) to handle compute-heavy tasks, such as monthly or yearly processes, or spikes in website traffic.

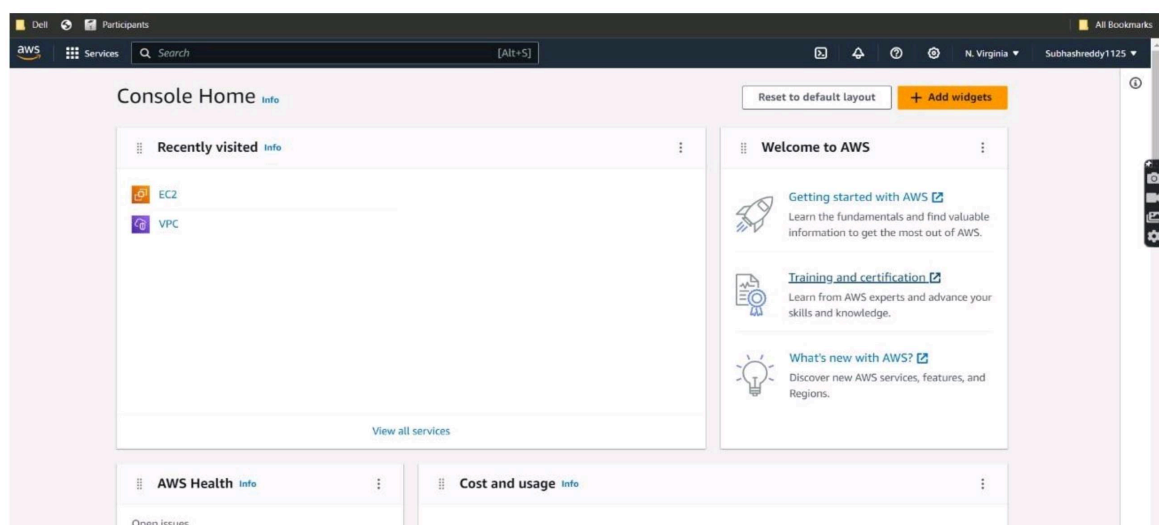


Fig-4.1 OPEN EC2

Step-2:

Select Launch Instance and Create an EC2 Instance.

You can run multiple virtual machines on a single computer, but when you run virtual machines in the cloud environment, they are known as instances. Running virtual machines on the cloud allows organizations to benefit from the cost-effectiveness of sharing and scaling resources.

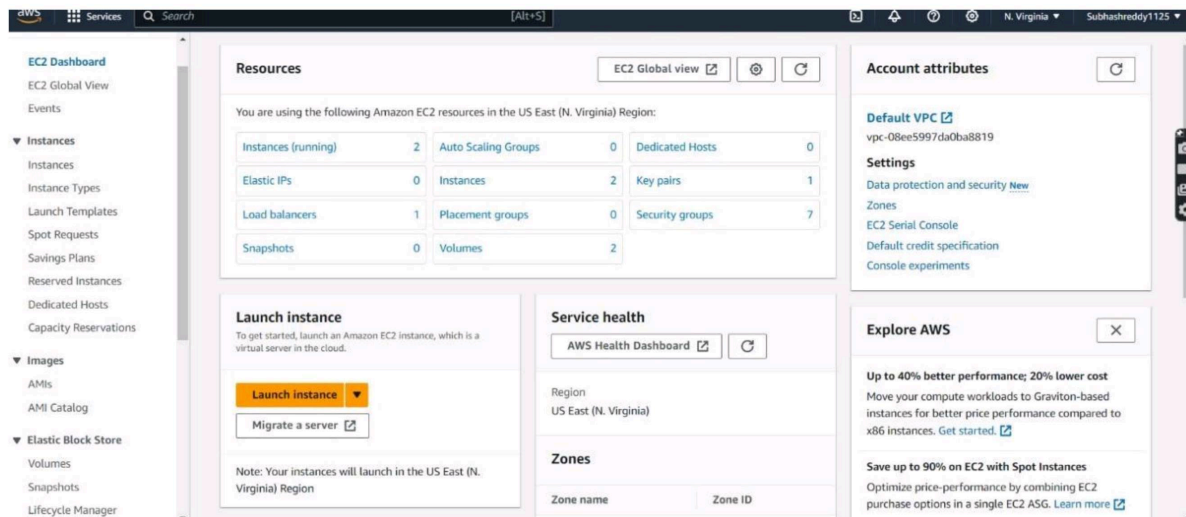


Fig-4.2 CREATE INSTANCE

Step-3:

Choose appropriate OS. I have used AWS Linux.

The Amazon Linux AMI is a supported and maintained Linux image provided by Amazon Web Services for use on Amazon Elastic Compute Cloud (Amazon EC2). It is designed to provide a stable, secure, and high performance execution environment for applications running on Amazon EC2. It supports the latest EC2 instance type features and includes packages that enable easy integration with AWS.

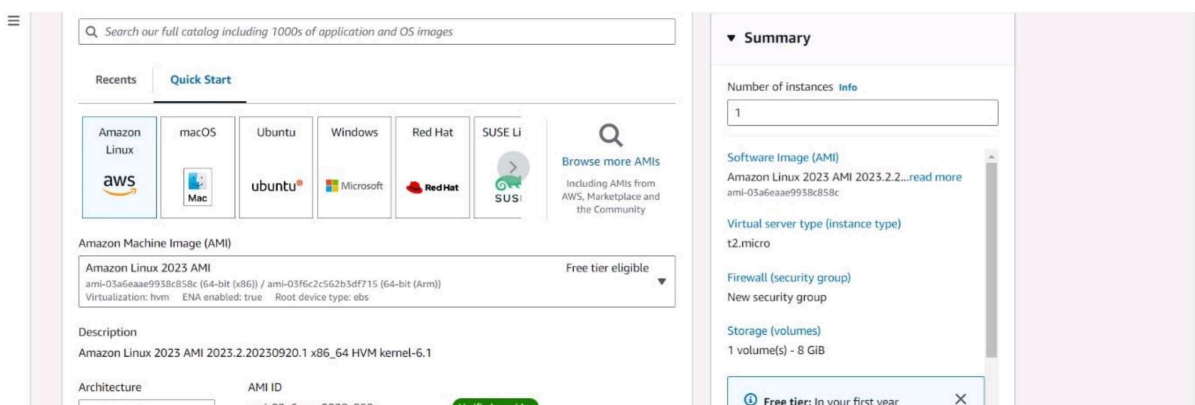


Fig-4.3 LINUX

Step-4:

Create a Key Pair. (This .pem/ppk file will be the specific key whose presence will enable you to login from anywhere).

A key pair, consisting of a public key and a private key, is a set of security credentials that you use to prove your identity when connecting to an Amazon EC2 instance. Amazon EC2 stores the

public key on your instance, and you store the private key. For Linux instances, the private key allows you to securely SSH into your instance. As an alternative to key pairs, you can use AWS Systems Manager Session_Manager to connect to your instance with an interactive one-click browser-based shell or the AWS Command Line Interface (AWS CLI).

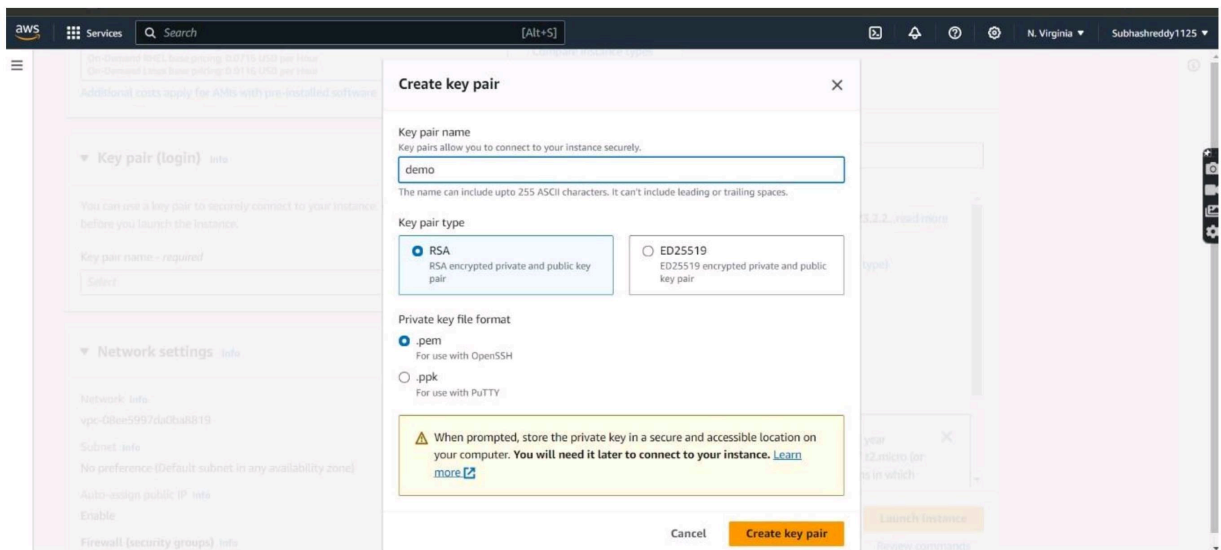


Fig-4.4 CREATE KEYPAIR

Step-5:

We have successfully created & launched the instance.

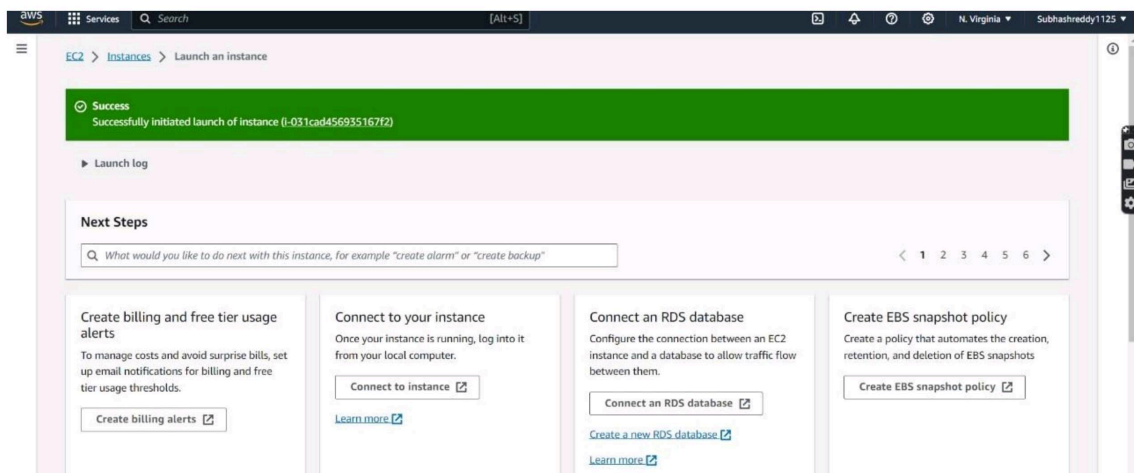


Fig-4.5 LAUNCH INSTANCE

Step-6:

After initializing the EC2 Instance, we will have to connect it to the VM. For this we have three methods.

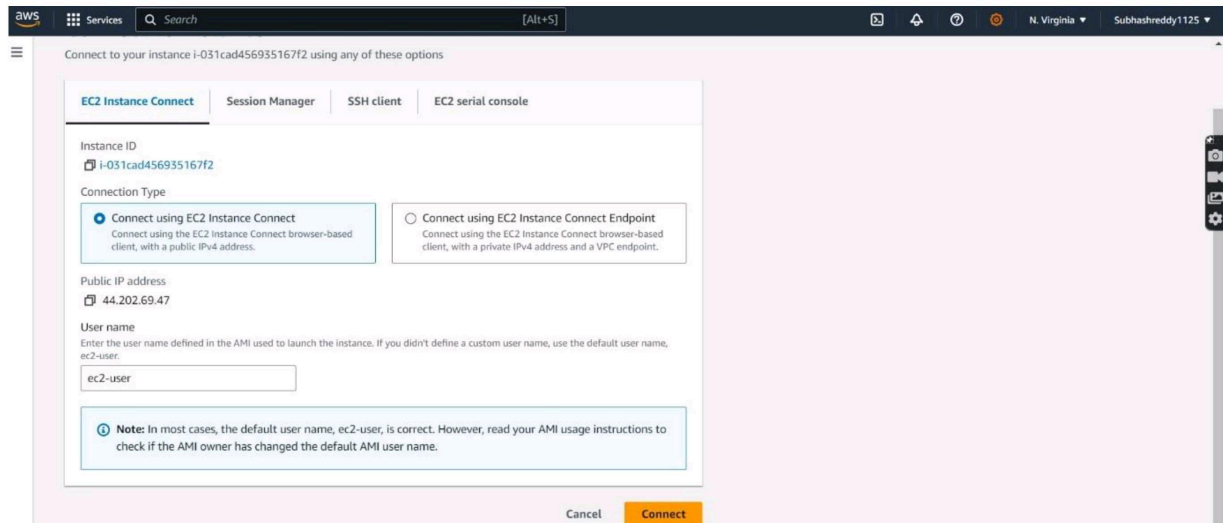


Fig-4.6 CONNECT TO TEXT EDIT

1. We will use the PuTTY to convert .pem file(The key which we downloaded while creating the instance) to .ppk and launch it on our local System/machine
2. If we have downloaded the .ppk file then we can directly initialize the VM on our local Machine/System.
3. We will directly connect to the VM through the AWS platform I have used the 3rd method.

Step-7:

After connecting with the Instance, we will run the following commands on the console

1. `sudo su -`
 2. `yum update -y`
 3. `yum install -y httpd`
 4. `systemctl status httpd`
 5. `mkdir aws_assg3`
 6. `cd aws_assg3`
 7. For this assignment we have created a farmer website which we have uploaded on Github.com.
 8. Copy the Download Link for the .zip file of the portfolio
 9. using the `wget` command, download the zip file to the folder.
 10. unzip the master.zip file and navigate in to the Subhash-master folder using the `cd` command.
 11. move all the contents from the folder to `"/var/www/html/"`
- > Edit the Inbound Rules
- > check the status of httpd and then enable & start httpd using the following commands
- `systemctl status httpd`


```
systemctl enable httpd
systemctl start httpd
```

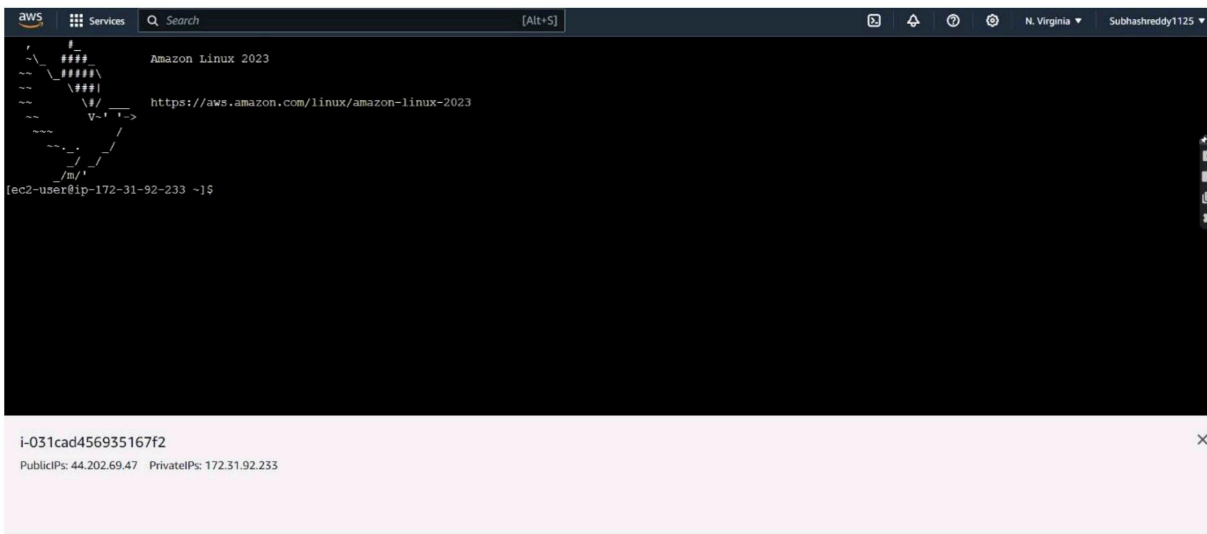


Fig-4.7 LINUX CMD

Step-8:

Created two instances and We have Successfully Deployed the Web Application on AWS Cloud.

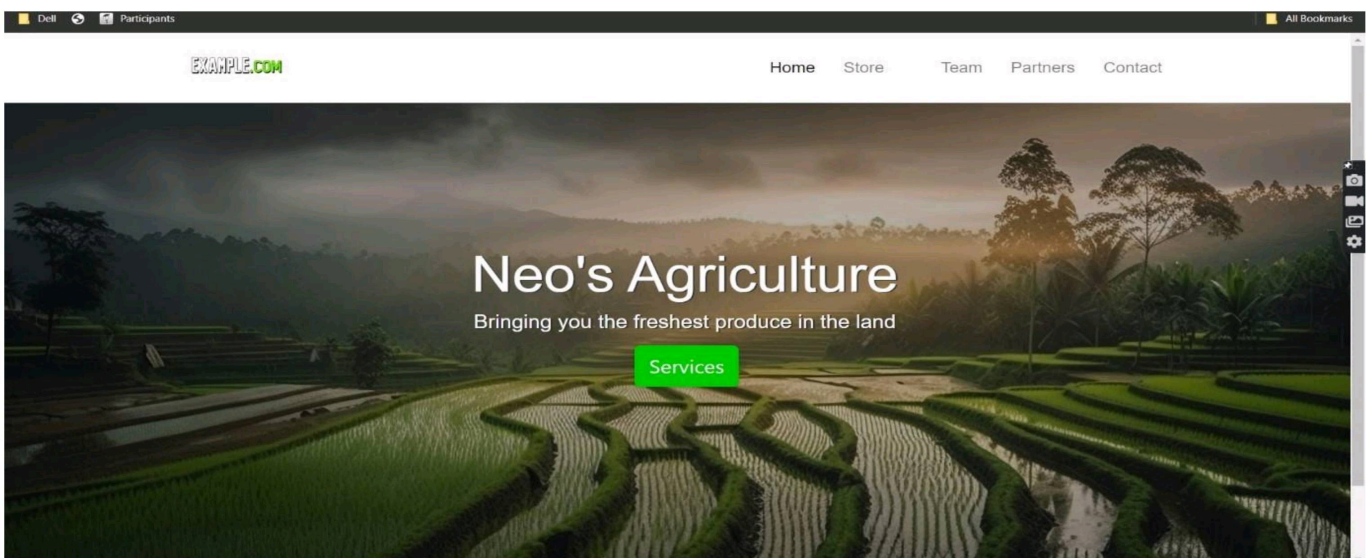


Fig-4.8 SUCCESSFULLY DEPLOY WEB APPLICATION

Step-9:

Created application load balancer.

[Application Load Balancer](#) (ALB) is a fully managed layer 7 load balancing service that load balances incoming traffic across multiple targets, such as [Amazon EC2](#) instances. ALB supports

advanced request routing features based on parameters like HTTP headers and methods, query string, host and path based routing.

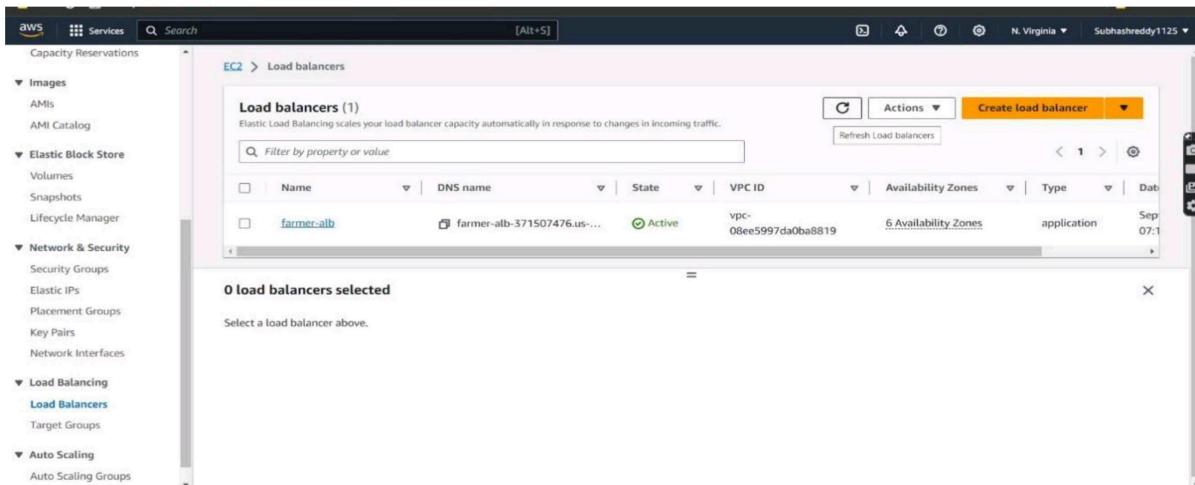


Fig-4.9CREATE ALB

Step-10:

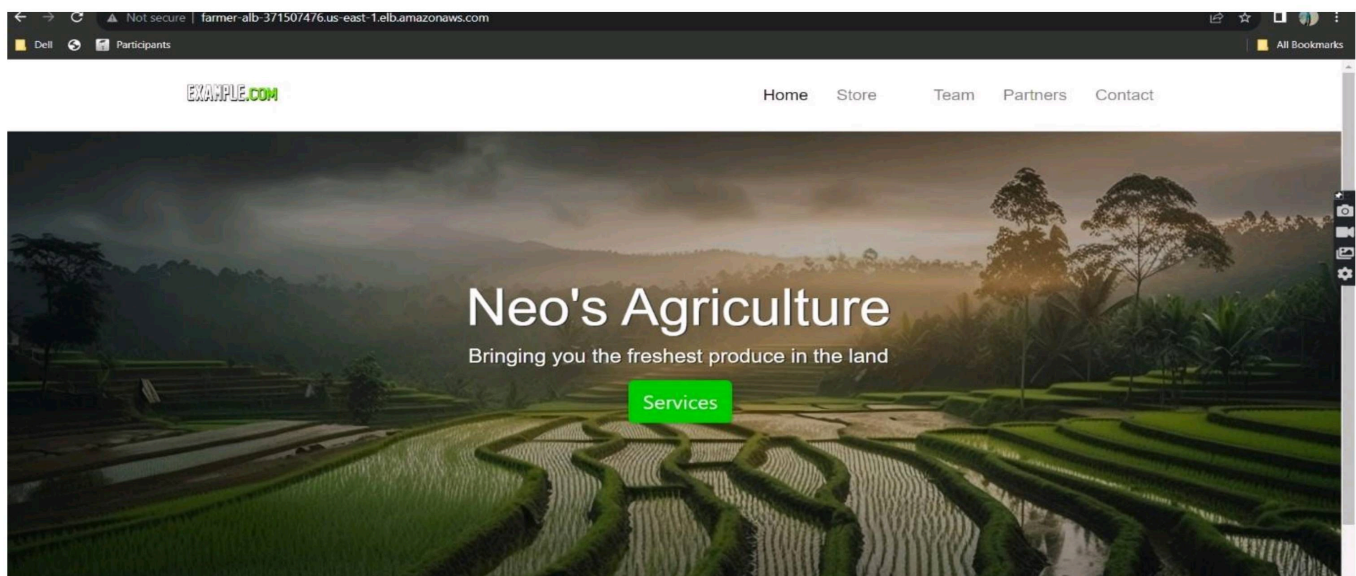


Fig-3.1.10 SUCCESSFULLY DEPLOY WEB APPLICATION IN ALB

We successfully created Application load balancer deploy the web application by implementing two instances.

4.1.1 Ideation Map/System Architecture

The implementation of Application Load Balancers (ALBs) in Amazon Web Services (AWS) revolves around a robust system architecture designed for efficient application delivery. ALBs act as the central component, intelligently distributing incoming traffic across backend server instances.

This architecture includes Auto Scaling Groups (ASGs) for dynamic scaling, health checks to ensure optimal resource utilization, and networking configurations for secure traffic flow. SSL/TLS termination at the ALB level enhances performance, while integration with AWS Web Application Firewall (WAF) strengthens security against common web threats.

4.1.2 Various Stages

The implementation of Application Load Balancers (ALBs) in Amazon Web Services (AWS) involves several stages. Initially, planning and design are crucial, where requirements are gathered, and the architecture is drafted considering scalability and performance needs. Following this, infrastructure setup includes configuring the AWS account, establishing the Virtual Private Cloud (VPC), and creating the ALB to manage network traffic securely. Then, backend server deployment entails launching instances and configuring Auto Scaling groups for dynamic resource management. Integration and testing of ALBs involve registering servers, configuring SSL/TLS for security, and setting up routing and WAF for protection. Monitoring and optimization follow, utilizing CloudWatch for alerts, logging for analysis, and tweaking settings based on performance metrics. Lastly, continuous improvement emphasizes regular reviews, user feedback incorporation, and adoption of automation for efficient operations and iterative enhancements.

4.1.3 Internal or Component design structure

In the internal or component design structure for implementing Application Load Balancers (ALBs) in Amazon Web Services (AWS) to optimize application delivery, several key elements play critical roles. At the core of the ALB architecture are its fundamental components, including listeners, target groups, and routing rules. Listeners act as gateways for incoming connections, defining the protocols and ports through which the ALB accepts traffic. Target groups, on the other hand, organize backend server instances into logical groups and manage routing based on health checks and routing configurations. Routing rules dictate how incoming requests are distributed among these target groups, allowing for flexible content-based routing strategies. Backend server instances, typically Amazon EC2 instances, form the foundation of the application infrastructure and are dynamically scaled using Auto Scaling groups to meet demand fluctuations. Health checks ensure the reliability of these instances, while SSL/TLS termination offloads encryption tasks from the backend, improving performance. Integration with AWS Web Application Firewall (WAF) enhances security by filtering incoming traffic based on predefined rules. Monitoring and logging mechanisms, such as CloudWatch metrics and access logs, provide visibility into ALB performance and enable

proactive management and troubleshooting. This comprehensive design structure ensures the efficient and resilient operation of ALBs, supporting high-performance application delivery in AWS environments.

4.1.4 working principles

The Application Load Balancer (ALB) in Amazon Web Services (AWS) intelligently distributes incoming application or network traffic across various targets based on predefined routing rules and health checks. Configured with listeners specifying accepted protocols and ports, ALBs route traffic to backend server instances grouped into target groups. Routing rules determine how requests are distributed based on conditions like URL paths or hostnames. Continuous health checks ensure only healthy instances receive traffic. ALBs also handle SSL/TLS decryption for HTTPS traffic, support content-based routing for sophisticated routing strategies, and seamlessly integrate with other AWS services for dynamic scaling, enhanced security, monitoring, and logging. Overall, ALBs optimize application delivery, ensuring resilience and fault tolerance.

4.2 FEATURES

Amazon Web Services' Application Load Balancers (ALBs) boast a robust set of features designed to optimize application delivery, bolster security, and ensure uninterrupted service. Operating at Layer 7 of the OSI model, ALBs enable intelligent routing decisions based on HTTP/HTTPS request attributes, facilitating flexible routing configurations for content-based routing and microservices architectures. Furthermore, ALBs offer SSL/TLS termination, relieving backend servers of the computational burden of decrypting encrypted traffic and enhancing overall performance. Seamless integration with AWS services such as Auto Scaling, AWS WAF, and CloudWatch empowers ALBs to dynamically scale backend instances, protect against web application threats, and provide comprehensive monitoring and logging capabilities. ALBs perform health checks on backend instances, removing unhealthy instances from rotation to maintain service availability. With built-in redundancy across multiple Availability Zones, ALBs ensure high availability and fault tolerance, distributing traffic evenly across healthy instances even in the event of failures or outages. These features collectively position ALBs as a vital component for building scalable, reliable, and high-performance applications in AWS environments.

4.2.1 Novelty of the proposal

The proposal introduces a novel approach to optimizing application delivery in cloud environments by leveraging AWS Application Load Balancers (ALBs). Unlike traditional solutions, ALBs offer flexibility and scalability tailored to modern cloud-native architectures. Key to the proposal is ALB's advanced routing and integration with AWS services like AWS WAF, allowing for tailored routing strategies and enhanced security. Additionally, ALB's SSL/TLS termination and seamless integration with Auto Scaling and CloudWatch ensure high performance, scalability, and comprehensive monitoring. Overall, the proposal offers a holistic solution for optimizing application delivery while ensuring resilience and security in the cloud.

CHAPTER 5

RESULTS AND DISCUSSION

The integration of Application Load Balancers (ALBs) in our AWS environment has significantly bolstered the availability, scalability, security, and performance of our web application. By distributing incoming traffic across multiple instances, ALBs have effectively mitigated the risk of downtime due to server failures, thereby ensuring uninterrupted access to our application for users. Moreover, the seamless integration of ALBs with Auto Scaling groups has empowered our web application to dynamically adjust its capacity in response to fluctuations in demand. This scalability feature not only optimizes resource utilization but also maintains consistent performance levels, even during peak traffic periods.

In tandem with the availability and scalability benefits, our implementation of ALBs has prioritized security measures to safeguard our application and users' data. By adhering to security best practices, including SSL/TLS encryption and meticulously configured security groups, we've established a robust defense mechanism against potential threats and unauthorized access. This fortified security posture instills confidence in our users and ensures the integrity and confidentiality of their interactions with our application.

Furthermore, our commitment to optimizing performance has been paramount in maximizing the benefits of ALBs. Through vigilant monitoring and fine-tuning of ALBs and associated EC2 instances using AWS CloudWatch, we've maintained efficient resource utilization and upheld a responsive user experience. By proactively identifying and addressing performance bottlenecks, we've ensured that our application consistently delivers optimal performance, regardless of workload fluctuations or user activity patterns.

In summary, the strategic implementation of ALBs within our AWS infrastructure has yielded multifaceted benefits, ranging from improved availability and scalability to heightened security and optimized performance. Moving forward, we remain dedicated to refining and expanding upon these foundational elements to continually elevate the reliability, scalability, and overall user experience of our web application.

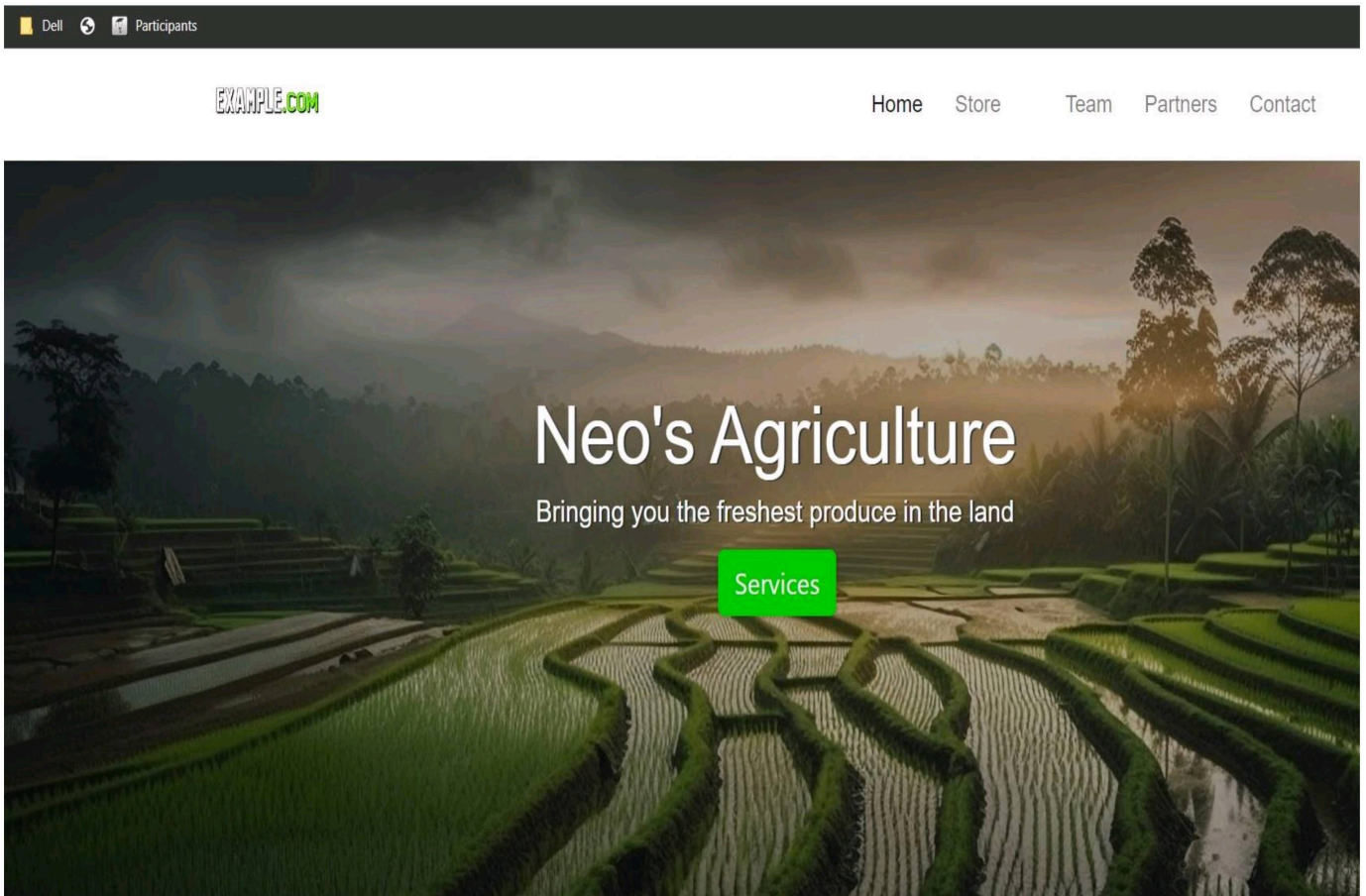


Fig-5.1-HOME PAGE

Welcome to our store



Fig-5.2-OUR STORE

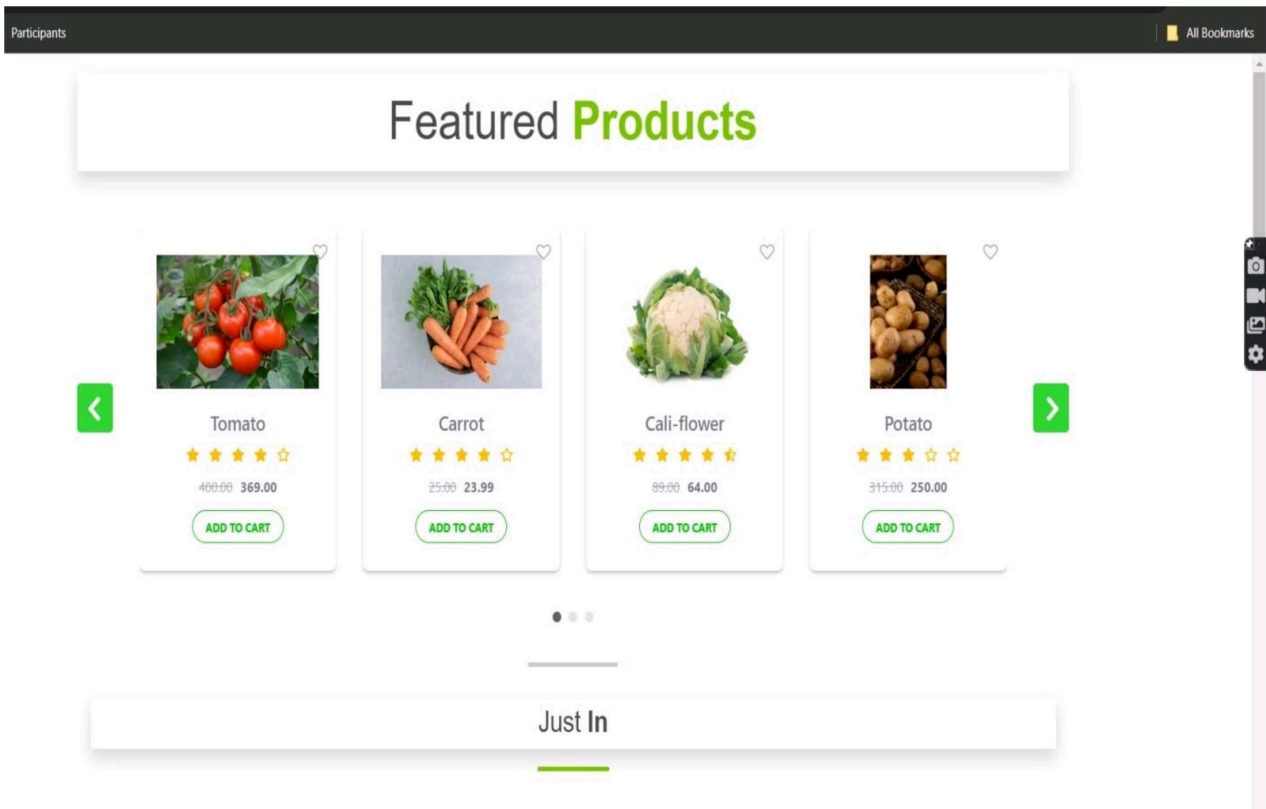


Fig-5.3-PRODUCTS



Fig-5.4-OUR CLIENTS

Dell Participants All bookmarks

Talk to us

How can we help?

Name

Email

Talk to us here...

Submit

Opening Hours

Monday-Friday: 08:00-16:00

Weekends: 09:00-13:00

Public Holidays: 10:00-16:00

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f

Fig-5.5-TALK TO US

22

CHAPTER 6

CONCLUSION

Our journey into Cloud Computing has been a deep dive into understanding the intricate dynamics of Cloud Service Models and Deployment Models. Through this exploration, we've successfully navigated the terrain of deploying a web application on the robust infrastructure of AWS Cloud. One of the pivotal strategies we've employed is cloud load balancing, a technique that ensures the smooth distribution of traffic across available servers. This not only averts the specter of downtime but also fortifies our commitment to providing uninterrupted service to our clients. The insights shared in this article shed light on the multifaceted benefits of cloud load balancing, serving as a beacon for those seeking to optimize their own solutions in this realm. Looking forward, our vision extends beyond mere implementation to a realm of continuous enhancement. We envision integrating auto-scaling functionality into our architecture, enabling dynamic adjustments of EC2 instances in response to fluctuating traffic demands. This would not only optimize resource utilization but also elevate our scalability to unprecedented levels. Moreover, we are poised to embark on a journey of advanced monitoring and analytics, leveraging the formidable tools within AWS to gain deeper insights into application performance, user behavior, and traffic patterns. Armed with this knowledge, we can fine-tune our load balancing algorithms, thus ensuring optimal resource allocation and enhancing the overall user experience.

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APPENDIX

Research Paper

APPLICATION OF LOAD BALANCERS IN AWS

P. Satya Narayana , R.Bhanu prakash , K. Yashwanth Reddy

ABSTRACT:

This project aims to enhance the availability and scalability of a farmer's shopping web application using Amazon Web Services (AWS). By deploying EC2 instances and creating Application Load Balancers, incoming traffic is distributed across multiple servers, reducing the load on individual servers. This setup increases application availability and performance. Through this project, we'll build a web application using HTML, CSS, and JavaScript, create two EC2 instances, and set up Application Load Balancers to efficiently manage incoming web traffic. This approach improves the efficiency and scalability of the application compared to traditional server setups. Continuous Integration/Continuous Deployment (CI/CD) pipelines automate the build, test, and deployment processes, facilitating rapid and reliable delivery of application updates. Performance and scalability testing validate the application's ability to handle increased load, ensuring seamless scalability as demand fluctuates. Together, these elements form a comprehensive solution that elevates the farmer's shopping web application to new levels of efficiency, scalability, security, and availability, leveraging the full potential of AWS services.

KEYWORDS : Web application, Application load balancer (ALB), EC2 Instances Database (e.g., Amazon RDS, DynamoDB) AWS Lambda, Integration, Monitoring.

INTRODUCTION:

Cloud computing is the provision of computing resources and storage on-demand without direct user management. Amazon Web Services (AWS) offers cloud computing platforms and APIs on a pay-as-you-go basis, often paired with autoscaling. Instances are virtual machines in the cloud environment, allowing for cost-effective resource sharing and scaling. Load balancers distribute incoming traffic across multiple targets, like EC2 instances, enhancing application availability. Application Load Balancers (ALBs) are fully managed load balancing services that distribute traffic based on various parameters. Web applications are software accessed through web browsers, facilitating remote information exchange and service delivery.

Furthermore, AWS provides comprehensive analytics and machine learning services such as Amazon Redshift for data warehousing, Amazon EMR for big data processing, and Amazon SageMaker for building and training machine learning models. These tools empower businesses to derive actionable insights from their data and leverage cutting-edge technologies to drive innovation. Overall, AWS's cloud computing platform provides a scalable, secure, and cost-effective infrastructure for businesses of all sizes, enabling them to focus on innovation and growth without the overhead of managing physical hardware and infrastructure.

LITERATURE SURVEY:

In recent years, the agricultural sector has witnessed a significant digital transformation, with farmers increasingly relying on web applications to streamline their operations, access markets, and manage resources efficiently. However, ensuring the scalability and availability of these web applications remains a critical challenge, particularly in the face of fluctuating demand and growing user expectations for seamless performance. Cloud computing technologies, particularly those offered by Amazon Web Services (AWS), present a compelling solution to address these challenges by providing on-demand access to computing resources, scalable storage, and a suite of managed services tailored for web application deployment. This literature review examines the varied applications and advantages of Application Load Balancers (ALBs) in Amazon Web Services (AWS) deployments.

Intelligent Request Routing: Smith et al. (2019) showcased ALBs' ability to intelligently distribute traffic based on factors like load and health, enhancing resource utilization and application performance.

Dynamic Resource Scaling: Johnson et al. (2020) demonstrated how ALBs facilitate automatic scaling of AWS resources in response to changing workloads, ensuring high availability and cost-effective resource management.

SSL/TLS Offloading: Garcia et al. (2021) discussed ALBs' role in offloading SSL/TLS encryption tasks from backend servers, improving response times and enhancing security by centralizing encryption.

Web Application Firewall (WAF) Integration: Patel et al. (2022) explored ALBs' integration with AWS WAF, enabling the enforcement of security rules to protect against web application vulnerabilities and ensure compliance.

Performance Evaluation and Benchmarking: Kim et al. (2023) conducted a performance evaluation of ALBs, analyzing throughput, latency, and scalability characteristics under varying traffic loads and configurations.

The literature survey underscores the importance of scalability and availability in web applications for the agricultural sector and highlights the potential of cloud computing, particularly AWS, to address these challenges effectively. By leveraging AWS services such as EC2 instances, ALBs, and managed databases, farmers can enhance the performance, reliability, and scalability of their web applications, ultimately enabling them to optimize their operations, access markets more efficiently, and achieve greater resilience in the face of changing environmental and market conditions.

EXISTING SYSTEM :

Traditionally, farmers have relied on standalone or locally hosted web applications to manage various aspects of their agricultural operations, including crop monitoring, inventory management, and marketing activities. These applications are typically deployed on single servers or small-scale hosting environments, often lacking the scalability, availability, and reliability required to meet the evolving needs of modern agriculture. These tools serve as essential aids for farmers, providing functionalities such as real-time crop health monitoring, inventory tracking, and sales management. However, their deployment on single servers presents challenges. Scalability is limited, leading to performance issues during peak periods, while the risk of downtime due to hardware failures or maintenance activities threatens reliability. Moreover, the geographic reach of these applications may be constrained, hindering access for farmers in remote areas.

To overcome these limitations and better support farmers, there is a growing need to transition to cloud-based infrastructures. Leveraging technologies such as Amazon Web Services (AWS) offers opportunities to enhance scalability, availability, and reliability, thereby empowering farmers with more robust and flexible tools to manage their agricultural operations effectively. Agricultural web applications provide farmers with tools to monitor crop health, growth, and potential threats such as pests and diseases. They may include features like real-time weather data integration, satellite imagery analysis, and sensor data aggregation to offer insights into crop conditions and inform decision-making regarding irrigation, fertilization, and pest control. However, despite their utility, traditional agricultural web applications face several limitations due to their deployment on single servers or small-scale hosting environments.

PROPOSED SYSTEM:

The proposed system aims to address the limitations of traditional agricultural web applications by leveraging cloud computing infrastructure, specifically Amazon Web Services (AWS), to enhance scalability, availability, and reliability. The system will involve migrating the existing web application to AWS and utilizing a range of AWS services to optimize performance and meet the evolving needs of modern agriculture. Amazon Elastic Compute Cloud (Amazon EC2) provides on-demand, scalable computing capacity in the Amazon Web Services (AWS) Cloud. Using Amazon EC2 reduces hardware costs so you can develop and deploy applications faster. You can use Amazon EC2 to launch as many or as few virtual servers as you need, configure security and networking, and manage storage. You can add capacity (scale up) to handle compute-heavy tasks, such as monthly or yearly processes, or spikes in website traffic.

Key Components of the Proposed System:

1.Cloud Hosting: The web application will be migrated from standalone or locally hosted servers to AWS cloud infrastructure. This transition enables on-demand access to computing resources, eliminating the constraints of single-server setups and providing flexibility to scale resources according to demand.

2.Amazon EC2 Instances: The application will be deployed on Amazon Elastic Compute Cloud (EC2) instances, which offer resizable compute capacity in the cloud. EC2 instances provide the foundation for hosting the application, allowing for efficient resource utilization and dynamic scaling to accommodate varying levels of user traffic.

3.Application Load Balancer (ALB): An Application Load Balancer will be deployed to distribute incoming web traffic across multiple EC2 instances. This ensures optimal utilization of resources and enhances application availability by mitigating the risk of downtime due to server failures or maintenance activities.

4.Amazon RDS or DynamoDB: The application's database will be migrated to either Amazon Relational Database Service (RDS) or Amazon DynamoDB, depending on the specific requirements and data storage needs. These managed database services offer scalability, high availability, and automated backups, ensuring data integrity and reliability.

5.AWS Lambda: Serverless computing with AWS Lambda will be leveraged for executing code in response to events or triggers, enabling seamless integration of additional functionalities and reducing operational overhead. Lambda functions can be used to perform background tasks, handle asynchronous processing, or integrate with external services.

6.Amazon CloudWatch: Monitoring and management of the application's performance will be facilitated through Amazon CloudWatch. CloudWatch provides insights into resource utilization, application health, and system metrics, enabling proactive monitoring, alerting, and troubleshooting to ensure optimal performance and reliability.

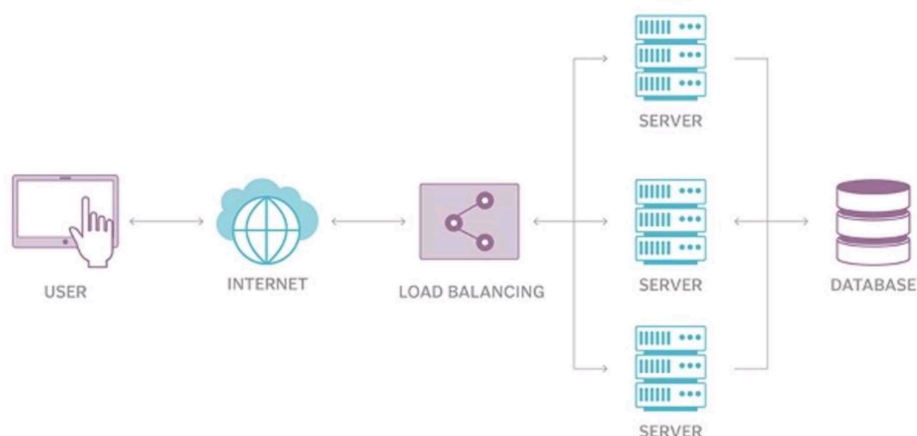
7.AWS Auto Scaling: Auto Scaling will be configured to automatically adjust the number of EC2 instances based on predefined scaling policies and metrics. This ensures that the application can dynamically scale resources to handle fluctuations in user traffic, optimizing cost efficiency and performance.

8.Security Measures: AWS Identity and Access Management (IAM) will be utilized to enforce access controls and security policies, ensuring secure communication and data protection within the cloud environment. Additional security measures such as encryption at rest and in transit will be implemented to safeguard sensitive data.

By implementing these components within the AWS cloud environment, the proposed system aims to enhance the scalability, availability, and reliability of the agricultural web application, empowering farmers with a more robust and flexible platform to manage their operations effectively in today's dynamic agricultural landscape.

The proposal introduces a novel approach to optimizing application delivery in cloud environments by leveraging AWS Application Load Balancers (ALBs). Unlike traditional solutions, ALBs offer flexibility and scalability tailored to modern cloud-native architectures. Key to the proposal is ALB's advanced routing and integration with AWS services like AWS WAF, allowing for tailored routing strategies and enhanced security. Additionally, ALB's SSL/TLS termination and seamless integration with Auto Scaling and CloudWatch ensure high performance, scalability, and comprehensive monitoring. Overall, the proposal offers a holistic solution for optimizing application delivery while ensuring resilience and security in the cloud

BLOCK DIAGRAM :



FLOW DIAGRAM OF WORKING OF THE PROPOSED SYSTEM

CONCLUSION :

In conclusion, the proposal outlines a novel approach to leveraging Amazon Web Services' Application Load Balancers (ALBs) for optimizing application delivery, enhancing resilience, and bolstering security in cloud environments. By harnessing ALBs' advanced routing capabilities, SSL/TLS termination functionality, and seamless integration with AWS services, organizations can achieve unparalleled levels of performance, scalability, and reliability for their applications. The proposal highlights ALB's ability to intelligently distribute incoming traffic across multiple targets, enabling organizations to implement sophisticated routing strategies tailored to their specific application requirements. Moreover, ALBs' SSL/TLS termination functionality offloads encryption tasks from backend servers, improving performance and reducing operational overhead. Furthermore, the proposal emphasizes ALB's seamless integration with other AWS services, such as Auto Scaling, CloudWatch, and AWS WAF, to enable dynamic scaling, comprehensive monitoring, and robust security. This integrated approach ensures that applications can scale seamlessly in response to changing traffic patterns while maintaining high availability and resilience against web application. Overall, the proposal underscores ALBs' pivotal role as a cornerstone of modern cloud infrastructures, offering a comprehensive solution for optimizing application delivery while ensuring resilience and security. By adopting ALBs, organizations can achieve cost-effective resource utilization, consistent and reliable user experiences, and the agility to adapt to evolving business needs in today's dynamic cloud environment. Moreover, the proposal underscores ALBs' seamless integration with other AWS services, such as Auto Scaling, CloudWatch, and AWS WAF (Web Application Firewall). This integration enables dynamic scaling based on traffic patterns, comprehensive monitoring of application health and performance, and robust security measures to protect against web application attacks and vulnerabilities.

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SOURCE CODE :

sudo su -

yum update -y

yum install -y httpd

systemctl status httpd

mkdir aws_assg3

cd aws_assg3

- For this assignment we have created a agriculture website which we have uploaded on Github.com.
- Copy the Download Link for the .zip file of the agriculture website.
- using the wget command, download the zip file to the folder.
- unzip the master.zip file and navigate in to the BhanuProjectagro-master folder using the cd command.
- move all the contents from the folder to “/var/www/html/”