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ABSTRACT

In this project, we have developed a CI/CD pipeline for microservices like architectured applications via blue/green deployment. We have also developed the Continuous Integration steps to see fit, which include typographical checking aka “linting”.

After we have completed our Continuous Integration we will set up Continuous Deployment, which will include:

- Pushing the built Docker container(s) to the Docker repository (we will use AWS ECR to create our custom Registry within our cluster).
- We will deploy this Docker container (s) to a small Kubernetes cluster. For our Kubernetes cluster, we will use AWS Kubernetes as a Service.
- And we will be deploying an android application on the play store named Chemist Shop which uses GitHub actions for illustration of the general process of working on a Continuous Integration Pipeline.

To deploy our Kubernetes cluster, we will use Cloud formation. And run these from within Jenkins as an independent pipeline.

Keywords:

Architecture, automation, continuous deployment, continuous development, continuous integration, Cloud DevOps, Cloud Technology, Github Actions

I. INTRODUCTION

At the present, with the advancement in technology, there is a need for automation in general workflow and performance. Agile focuses on communication between customers and developers that’s filling the gap and bring about understanding and smooth working for the accomplishment of set goals.DevOps appears to fill the gap between developers and the information technology infrastructures and operation.

In any Company time, quality and standard are the key factors to be considered; People are willing to modify their systems and operations given that the new workflow will save time and improve quality. With DevOps in the combination of cloud computing, it favors both time and quality.

Time is favored with DevOps given that developers can work together using a repository, building and deploy management tools and automation and continues development which speeds up applications and service delivery whereby cloud technology enables infrastructure to be available from any location hence a team thus developers and information technology operators can work from anywhere.

Quality and Standard applications are developed over time given that a product can be launched and improvement can be made due to customers' feedback and needs after the delivery of the product. Hence DevOps simplifies the process of product improvement and adjustment to keep up with customer needs and the market by automation of the workflow and enabling continuous integration and deployment of the products such as applications and software.

DevOps - Developer (Dev) and Operation (Ops) and cloud computing combination results in a maintainable, cost-effective product, Greater quality, flexible and automated workflow, reduce project risks, and fastening time to mark product delivery.

For an illustration of CI/CD Pipeline, We are developing an android application namely Chemist Shop which will apply Github Actions as a tool for an automatic build.

II. LITERATURE REVIEW

A. DevOps background History

In 2007 Patrick Debois was interested in learning it. He began working on large data center migration where he was in charge of testing. In his project, he was frustrated by the switching during development between the development side and the operation side.

From there, various conferences were held in 2008 Agile Infrastructure occurred with key discussions on how to solve the gap between developers and IT operation but a lot of negative feedback arouse. in 2009 after Patrick Debois streaming a talk entitled"10+ Deploys a Day: Dev and Ops Cooperation at Flickr" he made a gathering of developers and system administrators for the discussion on ways of bridging the gap between them, The event was named DevOpsDays.

In 2011, Cameron Haight of Gartner presented the future outcomes that will result from the use of DevOps, from his presentations, it leads to more attention to the DevOps hence more companies thought and began implementing the DevOps Concept. [1]

B. DevOps Meaning

As defined by **Gartner**:

"DevOps represents a change in IT culture, focusing on rapid IT service delivery through the adoption of agile, lean practices in the context of a system-oriented approach. DevOps emphasizes people (and culture) and seeks to improve collaboration between operations and development teams. DevOps implementations utilize technology— especially automation tools that can leverage an increasingly programmable and dynamic infrastructure from a life cycle perspective."

The key concept in DevOps is the approach and control of the development process. It's used to simplify and make an effective software development lifecycle.

In simple teams, DevOps can be defined in simple English as one of these plain English Analogies.

C. COMPARISON BETWEEN DevOps AND TRADITIONAL IT.

I. TRADITIONAL IT

Traditional data centers consist of various pieces of hardware, such as a laptop, computer desktop computer, which are connected to a network via a

the remote server, and in-network every computer is connected. The servers are installed at the data center location and provide all employees having the hardware, access to the business's stored data and applications in the cloud.

Businesses with this IT model have to purchase additional hardware and upgrades which is very costly as they have to scale up their data storage and services to support more users. Some compulsory software upgrades are always required for the traditional IT infrastructure to ensure failure-safe systems are in place in the organization. For large businesses with IT data centers, there is a need for an in-house IT department to install and maintain the hardware so that the business operations are running smoothly.

The traditional IT infrastructures are considered to be one of the most secure data hosting solutions for a business to rely on for good business operations and it also allows you to maintain full control of your company's applications and data on the local server itself giving privacy. They are a mostly customized, suitable, dedicated system ideal for organizations that need to run many different types of applications that are needed for a business.

Challenges in Traditional IT system

When the Operation team deploys a product be it an application it's possible that what was working in the Development environment might not work in the production environment. Due to various reasons such as the two environments are different or they didn't synchronize.

Various teams might have different work speeds hence such that the operation team might not be able to work with the frequency changes, updates, and releases from the development team.

Production servers many need some changes, updates at the Database or Operation System level for the application to work as to how is designed by the developers but lack of skills or expertise may result in deployment risk

Due to the stated challenges, DevOps is applied to fill the gap. [2]

II. DevOps

Most developers agree that the following capabilities are common to all DevOps cultures: collaboration, automation, continuous integration, continuous delivery, continuous testing, continuous monitoring, and rapid remediation.

Developer

Key roles are to write and debug codes to create software and applications. When the application is deployed in the production environment, the developer is consent to monitoring the overall performance and updating the software base on customer needs and feedback.

Developer aims at the continuous creation of applications and keeps the ones existing updated.

IT Operation

IT administrator is to smoothing the operation making sure everything works optimally. Such as checking the network resources availability and performance, keeping the used infrastructures updated.

Major DevOps Roles

Enables work collaboration and automation.

Improves security, efficiency, and maintainability of software and applications. [3]

III. Cloud DevOps CI – CD Pipeline

Cloud technology gives recourses and infrastructures for the development, deployment of applications and software, creating a runtime environment in a minimal time. Hence cloud acts as a facilitator for continuous development and integration which makes the resources available as needed for the general application life cycle management.

With cloud computing companies don't have to worry about infrastructure thus any tool needed for development can be acquired on time hence it fastens the development process and facilities delivery of the products fast and in time. As well as the updates can be done fast and efficiently.
DevOps is made simpler with the availability of cloud recourses such as the team can collaborate anywhere at any time with recourses needed.

Cloud Migration Statistics

- The public cloud service market is expected to reach $623.3 billion by 2023 worldwide.
- 83% of enterprise workloads will be in the cloud by 2020.
- 94% of enterprises already use a cloud service.
- 30% of all IT budgets are allocated to cloud computing.
- 66% of enterprises already have a central cloud team or a cloud center of excellence.
- Organizations leverage almost 5 different cloud platforms on average.
- 50% of enterprises spend more than $1.2 million on cloud services annually. [4]

IV. TOOLS USED

DevOps is facilitated by various tools and technology, for different infrastructures and platform tools are available in the cloud, mentioned are the tools used in our research.

I. PLATFORMS AND DEVELOPMENT ENVIRONMENT

Docker: Docker containers are used to wrap a piece of software in a complete system that contains everything needed to run code, runtime, system tools, system libraries anything that can be installed on a server using cloud Technologies. This guarantees that the software will always run the same, regardless of its environment, the environment in which it is developed, or in the future is going to be used.

Kubernetes: Kubernetes is an open _source system container platform that is used for automating development, scaling, securing the application, and management of containerized applications, made using docker. It groups containers to make up an application into small logical units for easy management and discovery or you can cluster together groups of hosts running Linux containers, and Kubernetes will help you to easily and efficiently manage those clusters made using Kubernetes.

Jenkins: Jenkins is an open_source automation tool written in Java with plugins built for the Continuous Integration purpose using Industry Standards. Jenkins is used for building and testing the software projects continuously making it easier for developers to integrate changes to the project, getting to know where the code fails and which part leads to building failure, and making it easier for users to obtain a fresh build.

Ansible: Ansible is an open_source IT Configuration Management, Deployment &grouping tool. It aims to

provide large productivity gains for a variety of automation challenges in the Software Industry. This tool is very simple to use but very powerful to automate complex multi-tier IT application environments made for serving millions of customers at a time.

Github Actions: It is a tool in GitHub that is used to customize and automate development workflow. Using this tool enables complete customization of workflow and application of different technology involving CI/CD Pipeline.

Android Studio: It is a tool that supports the development of the android application by giving tools and libraries that simplify the general process of development of android applications in one platform.

Firebase: It is a platform that gives developers powerful features for developing, handling, and enhancing applications in Chemist shop firebase is used for user authentification and database functionality.

II. PROGRAMMING LANGUAGES

Kotlin: It is a programming language used in the development of the android application in the android studio platform.

Yaml: It is a human-readable data serialization language. It is commonly used for configuration files and in applications where data is being stored or transmitted. YAML targets many of the same communications applications as Extensible Markup Language. [5]

V. AREAS APPLIED AND ADVANTAGES OF DevOps

Financial Companies:

Use DevOps in making sure their applications are launched on time and modified as fast as possible to reach customers' needs for insuring fast and reliable services.

Online Financial trading companies, Banks, Mobile, and Web Applications for financial organizations apply the cloud and DevOps technology for strengthening security and on-time delivery of products.

Network Cycling:

Telecommunication companies add security patches regularly due to DevOps facilitations hence updated and maintains has become fast and easy.

Bug Detection and Reductions:

In the present era of technology, here a rape transformation of the design of applications and software be it in all sectors such as education, medical, financial, entertainment and more, hence security, stability are the most important factors to be considered in development. Hence Bugs Analysis and Detection is done effectively and fast with the application of DevOps.

Integration:

Software and Application integration time is minimized and is done effectively with security consideration and availability.

Continuous Operation of Monitoring, Testing, Deployment, and Release:

With the stated Advantages Devops minimize software and application launch time and fastening the release cycle. [6] [8]

VI. CHALLENGES

I. General Challenges

Ambiguous:

Since DevOps is a new concept that's unclear on its definition, goals of adoption, and lack of understanding of its concepts.

Management Structure:

Between developers and operators, they lack management structure as DevOps has not been systematically managed and organized

Training:

As it's a new concept most operators and Developers lack proper training of the whole DevOps operations and Principles hence new technology tools and methods of DevOps are not clearly understood

Experience:

There is a shortage of DevOps experienced individuals hence the whole concept is learned and practices to obtain experience at present time and apply in the project, hence it may result in a long time of its implementation. [7] [9]

II. Challenges in Chemist Shop development process

Payment Method Integration :

Payment integration with the android application has evolved as a challenge because for using the payment integration methods available such as UPI payment and Google pay API, they need payments for the serves used and for the fact that our application is still in Testing Phase hence the payment method are not implemented yet.

Transaction :

Payment of product purchase is not implemented because security features are not yet implemented for ensuring safe transaction hence no transaction is to be accepted for the time being until the application is fully tested and examined for security. [7]

VII. CONCLUSION

Our project briefly aims at computerizing and digitalizing the process of start-up planning and setting some ground rules of budget and success of the application. It also creates a user-friendly environment to make the website more appealing and help the user who visits later using Software Testing.

In the computer system, it is not necessary to create copies of any paperwork as all the required details are filled and managed online only.

To assist the staff in capturing the effort spent on their respective working areas.

In the computer system, the person has to fill in the required personal to make the results efficient and meeting their needs.

To utilize the resources efficiently by increasing their productivity through automation.

It satisfies the user requirement working in any field for complete guidance.

Be easy to understand by the user and the operator. [10]

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