Analysing AWS DevOps CI/CD Serverless Pipeline Lambda Function's Throughput in Relation to Other Solution

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Abstract: DevOps is basically a Software engineering practice, which helps developers collaborate with various teams such as QA, Build & Release Engineering, and IT Teams (Security, Infra, and Operations) to help deliver a quality product continuously. Generally, in any DevOps framework, developers and IT teams collaborate with various teams such as quality control, security, and support as stated above, whose goal is to have a collaborative and cooperative effort to deliver code rapidly, in a seamless loop of continuous integration and continuous delivery (CI/CD) enabled by Continuous testing and Continuous Monitoring (CT/CM).We have seen tremendous growth in DevOps toolchains and Cloud providers in recent times and one such toolchain is AWS DevOps offered by AWS cloud service provider which is one of the most popular services in the market today. However, the transformation of traditional processes and infrastructure from typical On-Premises to the Cloud is not easy, but AWS DevOps offers Speed, Stability, Quality, and Security which also makes the transition for an organization easy to Adapt , Execution of commands in a CI/CD pipeline is handled by a runner, application, which can be configured in different ways allowing for different levels of the quality attributes performance like throughput. In this paper we are going to is about creating a seamless pipeline of e2e CI/CD pipeline using AWS DevOps services such as CodeCommit, CodeBuild, CodePipeline, CodeDeploy, and other services as needed, check its throughput against that of other machines.

Keywords: Cloud Computing, DevOps, Aws.

1.   Introduction:

Cloud computing is becoming one of the most talked about topics in the information technology sector. The key to its success is its ability to provide services on-demand rather than making a full infrastructure, which would need extra investments in things like hardware, personnel, and so on. Broad network access, quick elasticity, measurable service, on-demand self-service, and resource

pooling are the qualities of Cloud Computing. [1,2]. They are three cloud service models available.

IaaS

• Computing, storage, and networking resources are made available to the customer so that they can handle OSes, middleware, runtime, data, and

• applications.

Paas

• The client receives the operating system, middleware, and runtime environment necessary to manage data and applications in this approach. This technique is commonly used by programmers to write specialised applications without having to worry about the underlying system.

SaaS

• SaaS, compared to the previous types, offers customers right away access to the provider's managed applications.

The nature, size, and function of a cloud are only a few factors that determine its deployment architecture.

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Model	Scope	Managed by
Public Cloud	General public and industries	Cloud service providers
Private Cloud	Single organization	Single organization
Community Cloud	Groups whose policy and security concerns align	Multiple businesses or suppliers of cloud-based services
Hybrid Cloud	Public and organization	Public and organization

Table 1: Different types of Cloud Modules, [5]

After jumping out to an early lead in the cloud infrastructure business, Amazon held a 32 percent share of the global market in the first quarter of 2023. The first quarter of 2023 saw a rise of over $10 billion from Q1 2022 in global spending on cloud infrastructure services, bringing the total for the period to $63.7 billion. The cloud market has grown to $237 billion in the past year.
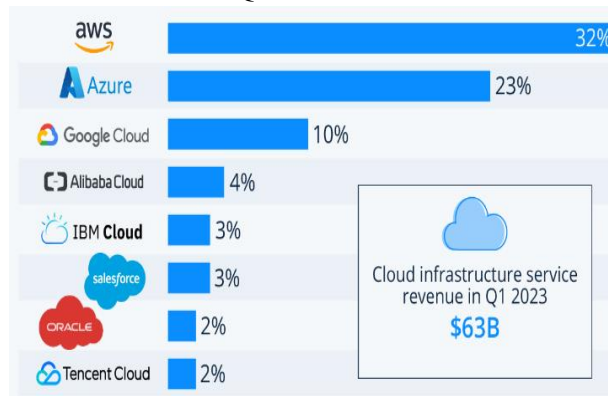

Fig 1: Worldwide Cloud Infrastructure service provider [4]

S.NO	PRODUCT	2021	2022	2023
1	Cloud Business Process Services (BPaaS)	54,952	60,127	65,145
2	Cloud Application Infrastructure Services (PaaS)	89,910	110,677	136,408
3	Cloud Application Services (SaaS)	146,326	167,107	195,208
4	Cloud Management and Security Services	28,489	34,143	41,675

5	Cloud System Infrastructure Services (IaaS)	90,894	115,740	150,254
6	Desktop-as-a-Service (DaaS)	2,059	2,539	3,104
	Total Market	**412,632**	**490,333**	**591,794**

Table 2: Worldwide Public Cloud Services End-User Spending Forecast (Millions of U.S. Dollars) [6]

2. DevOps

The beginnings of DevOps can be traced back to the early 2000s[7], when the Agile software development methodology was gathering traction. Agile emphasized collaboration, adaptability, and constant feedback throughout the software development process. However, despite the benefits of Agile, there was still a disconnect between development and operations teams. Previously, developers would write code and then give it over to operations to deploy and manage in production, resulting in frequent conflicts and delays.

Patrick Debois [7] organized the first DevOpsDays conference in 2009 [7] in Ghent, Belgium, bringing together developers and operations professionals to debate methods to enhance collaboration and streamline the software delivery process. From that point on, the DevOps movement gained traction as more and more organizations recognized the benefits of breaking down silos and fostering team collaboration.

Today, DevOps is an established method in many organizations, backed up by specialist teams, tools, and procedures. Furthermore, DevOps has grown beyond its initial focus on development and operations to include security, testing, and customer support. DevOps's ultimate objective is to deliver high-quality software more quickly and efficiently through collaboration and continuous refinement.
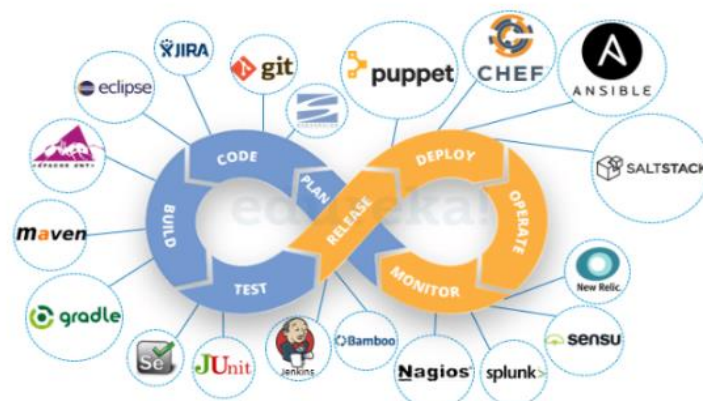

Fig 2: Basic Diagram of DevOps [5]

Continuous Integration, Delivery, and Deployment are new development practices that have garnered significant popularity in the past few years. Continuous Integration involves verifying software as soon as it is verified into source control, basically guaranteeing that software operates and continues to work after new code is written. Continuous Delivery joins with Continuous Integration to make software deployment just one click away. Continuous Deployment then enables Continuous Delivery and automates the entire software installation process for customers.

Automatic would be the single-word summary of Continuous Integration, Delivery, and Deployment. [6,8,16] All three practices have to do with automating the testing and deployment process, minimizing (or eliminating) the need for human intervention, minimizing the risk of errors, and making building and deploying software simpler to the point which every developer on the team can do it. (so you can still release your software when that one developer is on vacation or crashes into a tree). And automation should be done via the appropriate devices and methods. The efficiency and quality of CICD system execution in your project will

have a significant impact on the quality of the softwareyou produce and reduce the time to market for your product. [8,9,10.17]
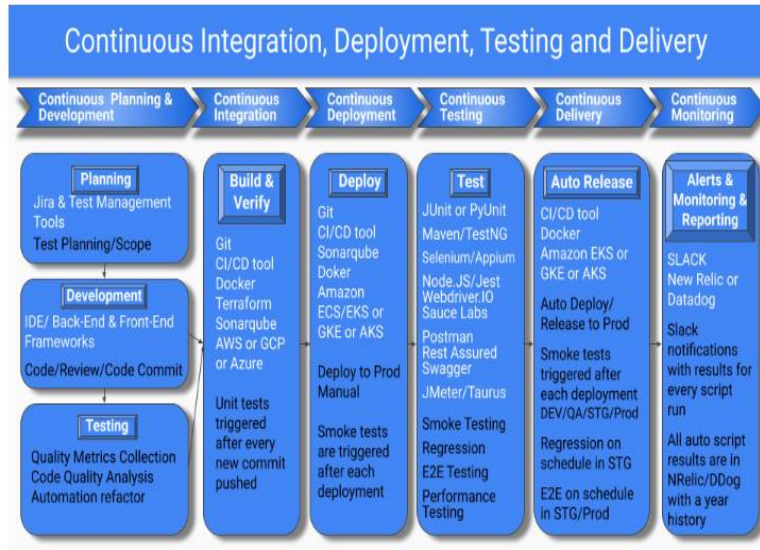

Fig3: CD/CI Process Diagram [11]

The attractive pay-as-you-go pricing model, rapid scalability, and reduced operations overhead are very compelling advantages for any organization's shipping software. While applications migrate to this new computing paradigm, we are frequently left with some legacy infrastructure, such as building servers and nodes. This remains a burden for operations due to the need to perform OS patching, build server updates, manage deployments of build nodes, and monitor server and build node performance and sizing on an ongoing basis. This leaves a potential single point of failure where build servers are shared among multiple services being deployed; server/node outages can cause delivery delays.

serverless CI/CD pipeline on AWS

CodePipeline, CodeBuild, and Cloud Formation. This pipeline will deploy a straight forward Node.js Express application to AWS Lambda [12]
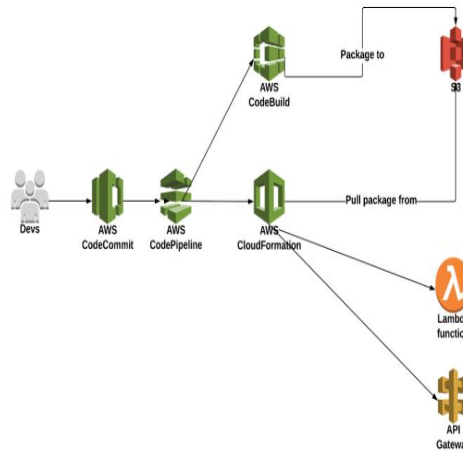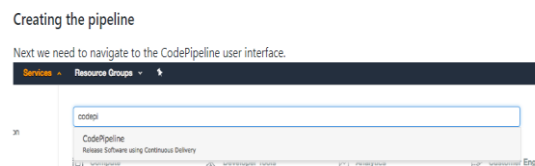

Fig 4 CD/CI with Lambda Function in AWS [12]

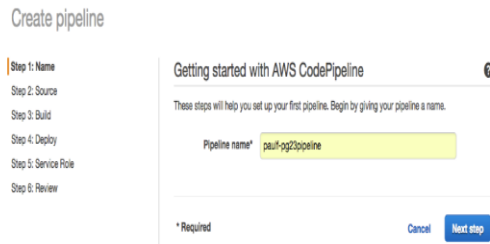**Fig 5** Creating - Pipeline in AWS [12]

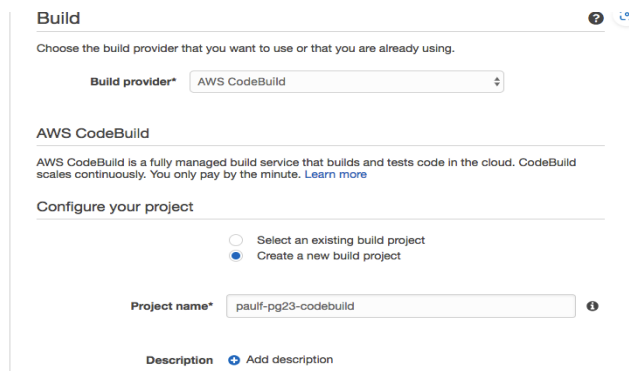**Fig 6** Giving Name - Pipeline in AWS [12]

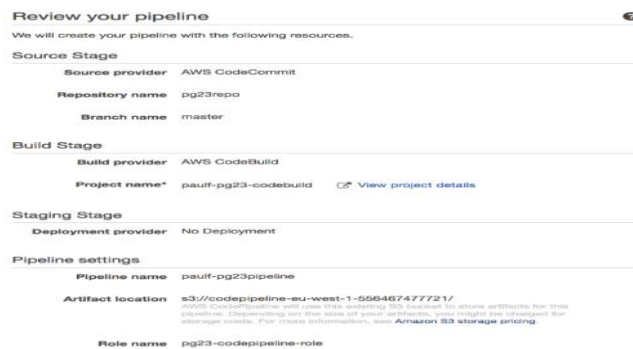**Fig 7** Building Code Builder - Pipeline in AWS [12]

Fig 8 Review of Pipeline - Pipeline in AWS [12]

Fig 9 Test- Pipeline - Pipeline in AWS [12]

Observe that the Permissions tab now lists "AmazonS3FullAccess" in addition to existing policies.
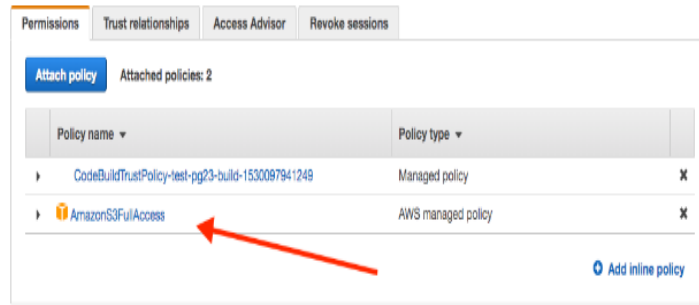

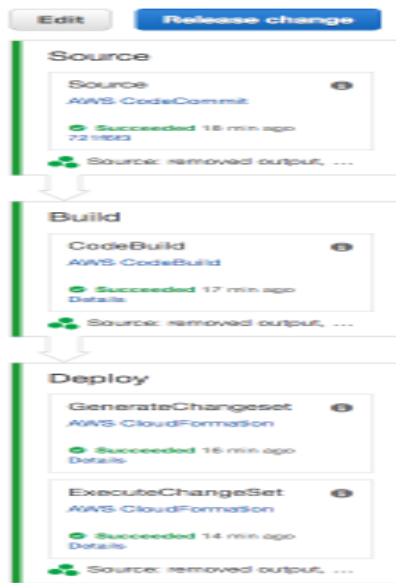**Fig 10** Attaching S3 - Pipeline in AWS [12]

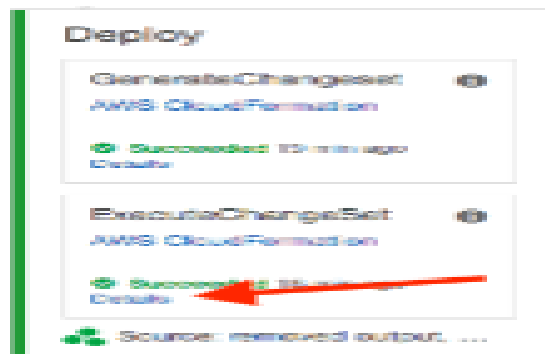**Fig 11** Pipeline Completed - Pipeline in AWS [12]

Fig 12 Pipeline Deployed - Pipeline in AWS [12]

Thus, we now have a pipeline that can continually deploy changes from our master branch to our deployment environment. Other alterations that can be made to this pipeline include additional stages (such as user acceptance testing), manual approval (requiring human intervention in order to proceed), and additional actions, such as conducting tests. Now that you have an understanding of what CodePipeline, CodeBuild, and CloudFormation are capable of, you should be eager to investigate additional functionality.

3. Throughput in Serverless

In order to measure throughput, the CI/CD pipeline and runners were set up to execute as many tasks in parallel as feasible, as was previously explained. Evaluation outcomes on setups with the same The following

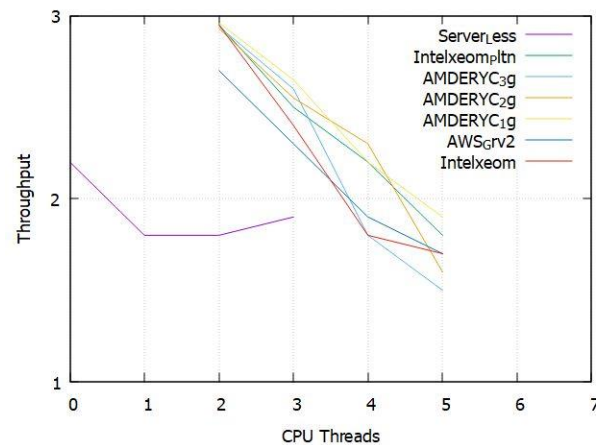diagram depicts processors with varying numbers of virtual CPUs (vCPUs).

Fig 13 Throughput of different Machine include Serverless [13]

Except for the serverless approach, in which throughput was unaffected unless less than one task vCPU was supplied, the stability of each autoscaling method was comparable. The serverless solution was the most reliable since it was either entirely reliable or at least as reliable as the autoscaling methods in those situations when it wasn't.

4. Conclusion

Continuous integration and continuous delivery provide your organization's application teams with an ideal scenario. Your team simply uploads code to a repository. The software will be integrated, tested, deployed, tested again, merged with infrastructure, undergo security and quality evaluations, and be prepared for deployment with a very high level of confidence.

When CI/CD Serverless is put in place, code quality increases and software updates are delivered rapidly and with a high degree of assurance that there are no catastrophic changes.[15] The effect of each release can be correlated with production and operations data. It can also be used to plan the next cycle, which is an essential DevOps technique for your organization's cloud transformation. [14]

5. Future Scope

DevOps is a methodology that improves the cooperation between the Development and Operations teams. Enabling DevOps accelerates delivery in accordance with business and consumer requirements. Particularly, automation in DevOps improves productivity, reliability, and the ability to standardize the process, which plays a significant role in the good delivery process for organizations. Our processes must evolve as the market environment in which we operate is constantly shifting. Thus, the adoption of DevOps in the modern era aids the industry in operating efficiently and delivering products rapidly. By constructing a single-container website using various tools such as git, maven, Jenkins, docker, terraform, and Kubernetes, this project aims to demonstrate how these tools function.

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