

Comparing DevOps Tools You Will Likely Encounter in the Workplace

Justin Arieltan
(arieltan@kth.se)

Ayub Atif
(aatif@kth.se)

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1 Introduction

One key part of the DevOps idea is the use of workflow automation. This article looks at specific tools used for continuous integration, cloud computing, and code repository hosting options. Within continuous integration, the article has compared Jenkins, Travis CI, and Circle CI highlighting tool effectiveness and use cases. As for cloud providers, the article will explore Amazon AWS, Google GCP, and Microsoft Azure focusing on pricing differences. Finally for code repository hosting this article has explored Gitlab, GitHub, and BitBucket in terms of functionality and community. In conclusion, the reader gains more information when making such decisions.

2 Different CI tools

One type of tool that developers can encounter in their workplace is the use of automated continuous integration and deployment. On triggering a CI build, the tool runs integration tests and build an artifact for deployment on success. There are many different software tools that provide this service, the focus will be on Jenkins, Travis CI, and Circle CI. The article highlights the different use cases for the tools and their unique advantages.

Jenkins is an open-source software (OSS) product with an enterprise edition which is supported by CloudBees. It is used by multiple organizations such as Autodesk, Salesforce, and the IRS of the US government [7] [9]. As OSS, Jenkins is free to use unlike most competitors. However, dedicated support is available only with the enterprise edition. A unique feature that Jenkins has is the extensive support of plugins. With the plugins system, developers are able to customize their Jenkins setup to fit their need [18]. This also results in Jenkins supporting more programming languages but the downside to this is the increased complexity with increased use cases so Jenkins is not suitable for small projects. Jenkins is mainly used with large corporations with a DevOps



Figure 1: The three CI/CD tools get the same job done but have distinguishable use cases [28]

team dedicated to building on the Jenkins CI/CD pipelines. Dependency management becomes an issue that needs more attention as plugins grow in number [33]. Legally, as OSS, Jenkins can be used in any project if the original license is included [12].

Travis CI used to be known for providing free service to the open-source community. Some high-profile Travis CI users include BitTorrent, Heroku, and Engine Yard [31]. Travis is no longer a beacon of OSS hope, as OSS-developers in particular recently experienced a decrease in quality with their projects [21]. Travis CI currently supports 35 languages and has strong Docker integration [31]. A unique strength of Travis CI is that it does not require a dedicated server and can run Linux and Mac OS tests in parallel.

CircleCI emerged as a competitor to long-standing CI/CD services with high-profile users which include Spotify, SolarWinds, Coinbase, and Facebook [17]. Customers of CircleCI are promised accelerated code delivery and improved product quality. CircleCI is a good option for teams new to continuous integration using containerization. We can see examples of this with CircleCI offering custom pre-built docker images, testing across docker images, and the ability to run any docker commands on the platform [16]. CircleCI offers private codebases with open-source 'orbs', packages of reusable configuration elements [22]. Furthermore CircleCI supports about 8 languages natively but offers support for other languages with some tinkering [28].

Figure 2: Summary of the 3 CI/CD tools

Criterion	Jenkins	Travis CI	CircleCI
Language Support	plugins based	35	8 natively
Plugins Marketplace	yes	no	no
Parallel Build by Default	no	yes	no
Heavy Containerization Focus	no	yes	yes
Enterprise Support	by CloudBees	yes	yes
Open-Source Software	yes	no	no

3 Different cloud providers

Companies might prefer to not run their own hardware for a multitude of reasons such as reduced upfront cost, staffing cuts, and flexible load capabilities. Companies therefore outsource their needs by purchasing infrastructure and services from cloud providers. The industry leaders are Amazon AWS, Google GCP, and Microsoft Azure and this next section highlights their pricing differences.

AWS has a plethora of high-profile customers including Twitter, Facebook, Netflix, Spotify, and Xiaomi [27]. A free tier is offered by AWS for users to gain some experience with their products. The rate-limited services are offered as either always free, 12 months free, or request-based trials [15]. For its most popular offering EC2 instances, customers can pay with on-demand instances, savings plan, reserved instances, or spot instances. The on-demand option has the least vendor lock-in, while the others help save money for more committed clientele. AWS instances on-demand justify high prices with the long-standing history of the company. The rate-limited pay-as-you-go model is seen in their other offerings such as AWS Lambda which offers server-less HTTP-triggered cloud functions, and Amazon S3 which offers high durability cloud storage. AWS offers all this information in their AWS pricing overview paper, and estimation costs can be calculated using their calculator service [2].

GCP offers a variety of services in Google-managed data centers. GCP has testimonials from many global-scale companies as their clients which include the likes of Twitter, King, Airbnb, Verizon, and Intel [13] [30]. GCP offers a set of modular cloud services alongside accompanying management tools, notably using the same infrastructure as Google’s products like Gmail and YouTube [32]. The geographical allocation of GCP’s cloud resources encompasses 25 regions and 76 zones [5]. These nodes work with Google’s low latency internal network for microservices and big data processing. New GCP customers receive \$300 in free credits and access to over 20 GCP products up to monthly usage limits [14]. Furthermore, Google offers the ability to request free migration and IT cost assessments for interested clients. GCP offers its services with a pay-as-you-go pricing structure with discounted rates of up to 57% by pre-paying. GCP services are per than most competitors particularly for projects using Kubernetes, deep learning, big data processing, or distributed real-time

systems [25].

Azure’s offerings include commonly-needed cloud-provider functionality like their competitors. Azure targets itself more for the manufacturing, retail, government, healthcare and life sciences, and financial services industry [10]. It is currently used by a number of high-profile users such as 3M, CDC, and Starbucks [19].

The service can be paid with two different models, the first is a prepaid account called reservations which is in blocks of either one or three years and can be paid in full or monthly. This option has the benefit of providing discounts compared to the other options which is a pay-as-you-go model [3] [26]. The pay-as-you-go model is where you pay monthly depending on your usage for that month [3] [23]. The last alternative is to pay by using azure credits [20] [3]. Azure offers a free version of their service where you are able to explore within a certain time limit and credit amount [6]. Azure pricing generally falls on the median between GCP’s cost-effective and AWS’s expensive infrastructure.

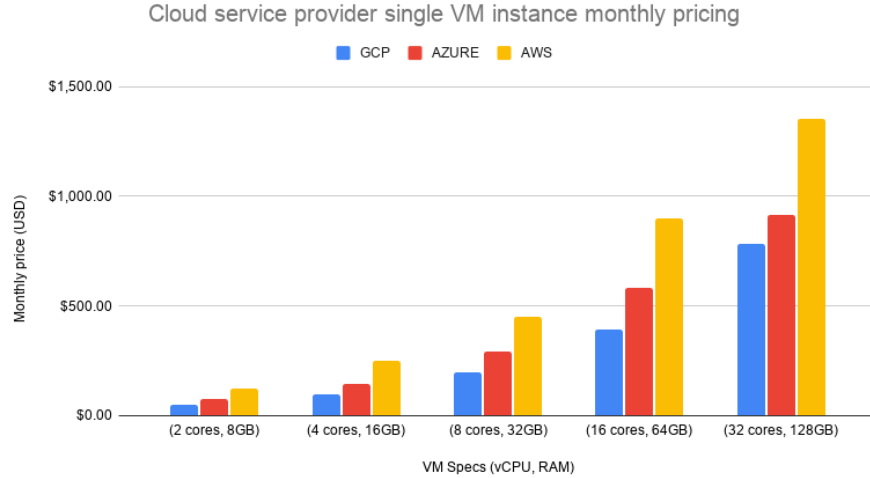


Figure 3: Summary of cloud service providers’ average VM instance costs [14] [24] [1]

4 Different code repositories

Software engineers need a place to store their code conveniently alongside the codebase history and this can be accomplished via code repositories. These code repositories interact with the version control system directly, making the workflow smooth. In this article we will be exploring the services of Gitlab, GitHub, and Bitbucket.

GitLab is a code repository hosting company whose users include Wish, Goldman Sachs, and Nvidia [4]. GitHub is another competitor with similarly high-profile clients such as Ford, Spotify, and Dow Jones [8]. The final company is Bitbucket and its client including Air France-KLM, Redfin, and Arizona State University [29].

All of these code repositories offer the basic service to store code view repository history and change it. This is not the only thing that they offer though, one example is the deep integration of DevOps tools and another is a big and thriving community. When talking about community, GitHub dwarfs its competitors in terms of the number of users and the amount of open-source projects hosted there. Due to this GitHub is a great choice for those who want to contribute to open-source projects [11]. As for DevOps tools, all three offer relevant tools. For CI/CD GitLab offers their GitLab Continuous Integration, Bitbucket with Bitbucket Pipes, and Github with their Github Actions. For more management-oriented features, all three also offer planning boards, Kanban boards, roadmaps, and much more but particularly GitLab's services are the most advanced in this regard.

5 Conclusion

Choosing the best DevOps tool for your project can often lead to choice overload and analysis paralysis. The article has highlighted key differences between the tools and elaborated use cases supported by well-known companies. The article hopes to have shown that all tools support common functionality for most project teams, but each have their own niches such as Jenkins' plugin scaling, GCP's big data synergy, and GitLab's continuous integration perks.

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