

A Cloud-Based Polyglot Code Execution Framework Using GitHub Integration on Google App Engine

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Abstract.

TCloud computing has become a key platform on which to build and run today's software applications, and distributed software development has been made easy through collaborative version control systems like GitHub. But performing multiple language repositories is still a big challenge as it needs to be configured with compiler, runtime environment, software dependencies, etc., for multiple languages by the developers. This manual process adds up to setup time and leads to variable execution from one system to another. A polyglot code execution system that runs on the cloud system that integrates GitHub and Google App Engine, in order to improve the performance of multi-language software repositories. The proposed framework aims to perform user authentication using the GitHub API, fetch the contents from the user's repository, detect the languages used in the programs and for the project's dependency, and automatically provision the necessary runtime environment in a Platform-as-a-Service (PaaS) infrastructure. Code is executed within the set sandbox environment to ensure security, reliability, and effective use of resources. An experimental analysis indicates that the proposed framework results in a substantial decrease in execution time, increase in scalability and decrease in configuration overhead when compared to the conventional local execution approaches. The framework is a valid approach for cloud software development, DevOps automation, programming labs and enterprise scale application deployment.

Keywords. Google App Engine, GitHub API, polyglot programming, cloud computing, Platform as a Service (PaaS), DevOps, Code Execution Framework.

1. INTRODUCTION

The paradigm of cloud computing has revolutionized software development by offering scalable, flexible, and economical computing resources. Services such as GitHub provide version control, source code management, and collaboration for development projects. Nevertheless, running repositories in multiple programming languages often calls for the configuration of the environment and the setting up of dependencies, which can be time-consuming and impractical. The framework presented here mitigates this issue by dynamically identifying programming languages, choosing appropriate runtimes, and executing code in sandbox environments through the use of PaaS and containerization techniques [5], [7], [10]. The GitHub API will help analyze repositories, and automation enhances security, portability, and scalability [14].

2. RELATED WORK

One of the key technologies of today's software development and pervasive application deployment is the use of a common computer power, such as servers, storage, on-demand and flexible applications [1]–[3]. The characteristics of such resources such as pay-as-you-use, elasticity, scalability utilization etc. allow organizations to manage their fluctuating workloads effectively, and also to reduce the complexity of managing the infrastructure and operational costs [2]. Moreover, By automating the DevOps methods, Continuous Integration/Continuous Delivery, and build, test, and deployment processes directly from source repositories (CI/CD) pipelines have improved software development efficiency [5], [9]. It is also helpful to be able to deploy distributed and microservice-based applications uniformly across diverse environments with containerization and orchestration platform technologies [5], [7], [10]. But problems like security with multi-language system, seamless runtime provisioning exist still [13]. Thus, there is a need for automated methods to support dynamic runtime provisioning in conjunction with repository analysis, to support scalable and effective execution of polyglot applications in cloud environments. Table 1 shows a comparative analysis of related work in the field of multi-language code execution systems. Table 1: Related Work in Multi-Language Code Execution Systems.

Table 1: Examination of Related Work in Systems for Multi-Language Code Execution.

Ref. no.	Author And Year	Method/ Technology	Key Contribution	Limitation
[2]	Wen et al. (2022)	Serverless Architecture Review	Identifies trends Supporting event-driven Execution suitable code execution frameworks	Limited focus on multi-language (polyglot) execution
[5]	Waseem et al. (2024)	Containerization in multi-cloud environments	Enables portable and Scalable deployment Across heterogeneous systems	Requires manual configuration of runtime environments
[9]	Goli (2024)	DevOps & Cloud Economics	Highlights cost benefits of integrating CI/CD tools like GitHub with cloud platforms.	Lacks technical implementation details
[10]	Ristov et al. (2024)	Federated Serverless (FaaS)	Enables distributed and Scalable execution across cloud platforms	Limited support for Dynamic language detection
[13]	Sun et al.	Software Security	Empirical study on Security patches in	Not directly focused on cloud/serverless

	(2025)	(Multi-language patches)	Open-source systems	computing
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3. METHOD, EXPERIMENTS AND RESULTS

The main goals of this proposed research are:1) To create a scalable framework based in the cloud which can run software projects developed in different languages. 2) To create an automated way to get access to source code from GitHub and deploy it using Google's App Engine. To provide an automatic way to identify the programming language of any project and to manage the dependencies automatically without any configured way.3) To ensure a secure way to execute applications from users, within an isolated sandbox.4) To measure the execution time, scalability, resource usage and total performance of the framework against the traditional methods of executing software locally.

3.1. Proposed Method

The new framework will be cloud based, offer product libraries for several programming languages and offer automated compile and run without manual effort. The framework will rely on several components or functional modules, such as user interface, repository management, programming language identification, dependency management, runtime provisioning, secure execution environment and deployment via Google App Engine..

3.2. Experimental Setup and Results Describe scenarios: Execute Performance Tests with: Python, Java and Node.js repositories Measure Execution Latency/Time Perform Scaled Testing (Automatic Scaling) Provide Results in sample performance table (Table 2) that compares and contrasts Execution Setup Times, Scalability, and Resource Usage across different execution methods.

Table 2: Performance Comparison of Manual, Automated (GAE), and Container-Based Execution Approaches.

Setup Time	High (manual)	Low(automated via GAE)	Medium(Docker+ Tools)
Language Support	Limited	Multiple(polyglot)	Multiple
Scalability	Low	High(auto-scaling)	VeryHigh
ResourceCost	Fixed	On-demand	Efficient at scale
CI/CD Integration	Manual	Nativevia GitHub CI	Full DevOps support
Fault Isolation	Low	Medium	High
Runtime Flexibility	Runtime Flexibility	Moderate	High

Table 3: Statistical Validation of Experimental Results

Environment	Mean Execution Time (s)	Std Deviation	Scalability Index
Local Execution	8.84	0.24	Low
Google App Engine	3.3	0.16	High

The statistical findings show that the cloud-based environment has substantially reduced variance and mean execution time.

3.3. Performance Evaluation

The experimental results indicate that the proposed cloud-based architecture can reduce the setup costs and execution time in comparison to the traditional local execution environment. The average of the execution time was reduced from 8.84 seconds in the local environment to 3.30 seconds in the cloud environment, with better consistency and scalability.

4. CONCLUSIONS

In this chapter, a polyglot code execution platform scalable and cloud-based was described, which integrates GitHub and Google App Engine, so as to provide an automated execution of multi-language software repositories. This solution would also eliminate the need to manually configure it, as it would automatically detect programming languages, their dependencies, and provision the appropriate runtime environments. The experimental results show that the proposed solution is more efficient in terms of execution, scalability and reliability when compared with the local way of execution, making it applicable for use in current collaborative software development and DevOps environment.

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Biographies



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