Project 1 – DevOps Disruptions

Peixu Xin

Problem Statement – The covered topic and its importance

This paper covers the topic about the development and researches about DevOps.

DevOps is a cultural discipline for integrating the speed of the communication of the development teams and IT workers. DevOps emphasizes the cross-team discussion and the agile methodology.

DevOps is a merged word, which means it combines the "development" and the "Operations" together. The main principle of DevOps is open for others, workflow automation and efficient communications. However, there are no engineers and scholars that give a clear definition to DevOps.

The DevOps movement began after millennium [1] because the traditional ways of development are too low-efficient. Moreover, the old model cannot fit the modern super-sophisticated software. Developers must write code and separate from realistic deployment and run. DevOps are dedicated to integrate these two processes. Therefore, DevOps represents a deep shift in mindset for IT industry. From top to bottom, engineers are able to build the software in an agile and lean way, which makes the collaboration be possible and clearly divide the responsibilities.

Under a DevOps model, operations and development is, by no means, separate. In several companies, these two teams are even merged into one, with engineers working through the entire development and application cycle. From initial development and unit test to running and operations.

Applications

There are some applications in the IT industry that are based on DevOps (Just name a few):

1. Microservices. Microservices architecture is a fast-growing norm for building continuously deployed programs [2].
2. TOSCA (Topology and Orchestration Specification for Cloud Applications) [3]. DevOps artifacts are mainly limited to certain tools, which means different programs have different runtime, which complicate the generosity of the tools. More than that, it makes deployments an annoying thing. TOSCA enables the seamless integration of various kinds of DevOps.
3. Smart Campus [4]. Smart campus meets the fast development requirement, and inherits the former system well. It provides an excellent communication tool to students and parents. The architecture is also incredible—reduce the development iteration time costs, and automate management.
4. BizOps [5]. Virtualization of resources makes the whole system more elastic, but makes system more vulnerable to the environment. BizOps optimizes the performance, while maintains the profitability for system.

When it comes to societal impacts, DevOps is excellent.

According to a survey conducted by Atlassian, 99% of users said that the DevOps has a positive impact on their service. It not only boosts the releases, but also improves the team efficiency, security while

maintain the high quality.

Coins have two sides. There are still some challenges that require people to overcome.

1. It is hard to break the habit. Developers have got accustomed to entrenched in siloed ways of working. Which means many of them are reluctant to give up their ways of developments. Moreover, if there is a combination, everyone should understand the entire value stream. However, domain differences hinder the process of cognition of others.
2. The chaotic distribution of responsibility. The collaboration blurs the responsibility. If some people feel that if they are involved in someone else's project, they will be held responsible for future mistakes, they will tend to reduce their involvement, which will hinder the process of DevOps.
3. The high expense of transforming to DevOps style. Because DevOps is a new design pattern of programming, few companies have adopted the DevOps model decades ago. So, there will be a lot of historical baggage.

Literature review - Streamlining DevOps automation for Cloud using TOSCA

There are many software has their unique runtime environment. It significantly hinders the collaboration. So, the authors are dedicated to complete an integrated and standard modeling and runtime framework. They utilized TOSCA as their base of work on a general metamodel. Firstly, they classified the DevOps artifacts between node-centric and environment-centric. Secondly, they transformed the different kinds of DevOps artifacts to generate TOSCA artifacts, which is a key building block of the framework. The result types can be used to create and enrich topology models for applications in the Cloud and then make them suitable to deploy. Later, they completed a prototype of this framework. Furthermore, they validated their approach by conducting a case study. In the last, they planned to further implement and optimize the user experience.

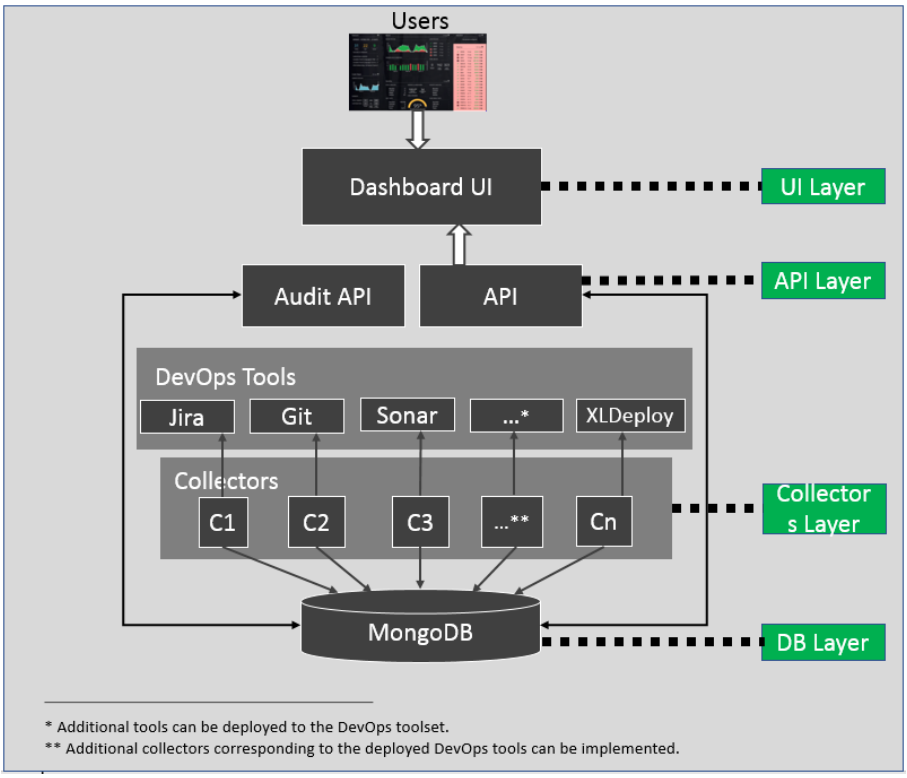
Open source research – Hygieia

URL: https://github.com/hygieia/hygieia

Hygieia is a self-contained dashboard for engineers and executives. In general, Hygieia is an aggregator that receive data from DevOps tools used in developers' CICD pipeline. Hygieia is user-friendly and easy to manipulate. Also, it provides sophisticated insights into multiples of areas.

To name a few: DevOps Maturity (It accelerate the tracking and pipeline speed by automation). Risk management and Investing (It provides a way of understanding of where to invest). Agile Environment (It quantifies DevOps metrics to improve its maturity).

There is an overview of the whole architecture:



(Credit: https://hygieia.github.io/hygieia/media/images/architecture.png)

The UI layer is the front-end layer for the users. Users can configure and view the dashboard.

The API layer is for developers. They can use API to work with the source system data. An abstraction layer.

DevOps tools and Collectors' layer. They provide many DevOps tools such as Jira, Sonar, Git, etc., and fetches data from developers' tools.

Database layer. For the storage and retrieval of data.

Citation

[1] https://about.gitlab.com/topics/devops/

[2] L. Zhu, L. Bass and G. Champlin-Scharff, "DevOps and Its Practices," in IEEE Software, vol. 33, no. 3, pp. 32-34, May-June 2016, doi: 10.1109/MS.2016.81.

[3] Johannes Wettinger, Uwe Breitenbücher, Oliver Kopp, Frank Leymann, Streamlining DevOps automation for Cloud applications using TOSCA as standardized metamodel, Future Generation Computer Systems, Volume 56, 2016, Pages 317-332, ISSN 0167-739X

[4] Pingrong, Lin, Shi Xiaoquan, and Yang Junqin. "Research on the Application of DevOps in the Smart Campus of Colleges and Universities." Journal of Physics: Conference Series 1883.1 (2021)ProQuest. Web. 11 Sep. 2022.

[5] Fokaefs, Barna, C., & Litoiu, M. (2018). From DevOps to BizOps. ACM Transactions on Autonomous and Adaptive Systems, 12(4), 1–29. https://doi.org/10.1145/3139290