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August 8, 2020

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Dear Professor Ollmann:

I am submitting the attached Technical Background Report entitled *DevOps and Trend: How DevOps Impact on Business and Software Quality Assurance.*

The purpose of this report is to provide the information to the graduates from the software engineering program that anticipate landing a job of the software engineer in test and the traditional software testers that are currently doing the manual testing process with a very little or no knowledge of coding. This report is a research about the new solution in the software development cycle: DevOps, and its effects on the software quality assurance. DevOps is a compound of Development and Operations that integrates in the same cycle. Using DevOps in the software development process helps eliminate the communication gaps between the development and operation teams; consequently, this enhances the continuous integration in the software development cycle and the continuous product delivery that support the automation to enable the faster time to market with the faster feedback cycles.

I hope that this report meets your requirements and shares some interesting details of the new trend in the software development. If you have any further questions, please feel free to contact me at thuyvy.hoang@g.austincc.edu.

Sincerely yours,

Vy Hoang

Encl: Technical Background Report on DevOps and Trend: How DevOps Impact on Business and Software Quality Assurance.

Report on

DEVOPS AND TREND: HOW DEVOPS IMPACT ON BUSINESS AND SOFTWARE QUALITY ASSURANCE

Submitted

to

Professor Hilda Ollmann

Austin Community College

by

Vy Hoang

August 2020

This report examines DevOps: the new software development solution, its values and impact on the business organizations and software quality assurance. A comparison between DevOps and the traditional Agile methodology is also analyzed. This results in the effective changes to the quality assurance process in particular and to the entire software development cycle in general. The hiring demand and the interest trend in DevOps are also incorporated in the report.

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DEVOPS AND TREND: HOW DEVOPS IMPACT ON BUSINESS AND SOFWARE QUALITY ASSURANCE

I. INTRODUCTION

What is DevOps?

The term DevOps comes from the combination of development *(Dev)* and operations (*Ops*). It is developed over the Agile principles to bridge the gap existing among the operations, developers and the quality testing team. Its main purpose is to continuously boost the faster delivery of the quality software at the more efficient level in the delivery time and the business demand.

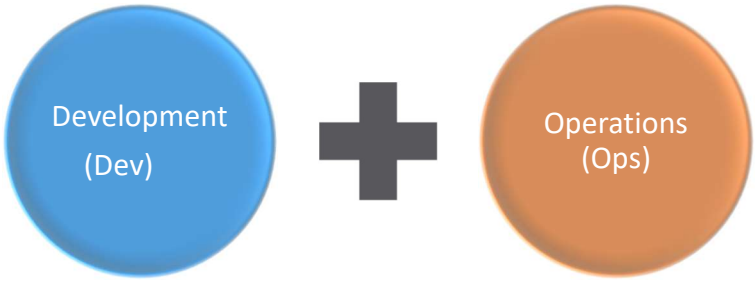

Figure 1. Combination of Development and Operations. *Source:* Vy Hoang

Therefore, DevOps is neither a tool nor a software application that we can download, install, and use it. It is more than just a technology. In fact, there has not been a standard definition for DevOps. It is commonly presented as a set of technical practices and guidelines, a change of mindset and culture for the benefits to the entire software development cycle.

When was DevOps started?

DevOps concept is emerged when companies struggle with the slow production delivery due to the gap in sharing information between the development and the operations. The DevOps movement, however, was initiated by Patrick Debois, a Belgian IT consultant and project manager. Then, he and a group of leaders with the like-mindset in the IT industry held the Agile infrastructure conference and the “10 Deploys per Day: Dev and Ops Cooperation at Flickr” presentation to create “DevOpsDays” in Ghent, Belgium, in 2009 [1].

As a result, the term DevOps was created and officially presented to the IT world.

II. BENEFITS OF DEVOPS

Using DevOps brings the whole system working closer together, breaks the barrier among the development and operation team, and gives more sharing in every stage of the software life cycle. The companies that adopt DevOps platform have reported to gain the significant benefits.

Business Values

The business values of DevOps are proved by the data found from the 2015 State of DevOps Report with 30 times more frequently with 200 times faster in code deployment, 60 times high-performance in production deployments and recovering from failure 168 times faster [2].

	2015 (Super High vs. Low)	2014 (High vs. Low)
Deployment Frequency	30x	30x
Deployment Lead Time	200x	200x
Mean Time to Recover	168x	48x
Change Success Rate	60x	3x

Figure 2. Comparison of IT Performance Metrics between High and Low Performers. *Source:* 2015 State of DevOps Report [2].

Additionally, according to the survey from Right Scale's 2016 State of Cloud Report on DevOps Trends with 1,060 IT professionals, 74 percent of organizations adopting DevOps which is increased from 66 percent reported in 2015 [3].

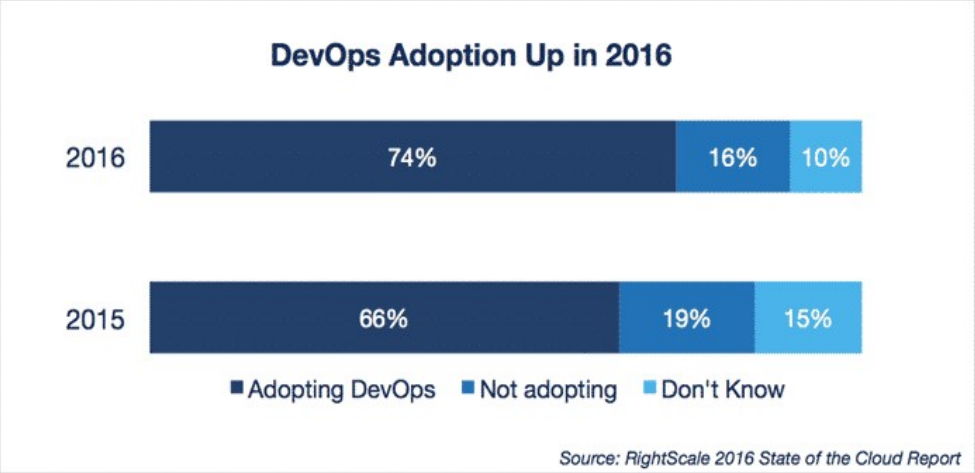

Figure 3. DevOps Adoption Up in 2016. *Source:* 2016 State of the Cloud Survey [3]

The **key values** which make DevOps important and worth for the business organizations:

- Improve the product quality; then, enhance the customer service
- Deploy faster and continuously; then, deliver to the market faster
- Increase the reliability, the stability, and the agility in the working environment; then, result in fewer failures but faster restore service
- Promote efficiency in time and cost savings

Companies with DevOps Application

From the values mentioned above, DevOps have increasingly become the main framework in the worldwide businesses either with small or medium or large size.

Organizations adopting DevOps are able to linearly increase the number of deploys per day as they increase their number of developers that have been done in the companies: Google, Amazon and Netflix.

Below are some examples of the top companies adopting DevOps well [4]:

- **Amazon** engineers deploy code every 11.7 seconds on average which reduces both the number and duration of outages at the same time.
- **Sony Pictures Entertainment** was facing a multiple-month-long delay between the completion of software development and delivery. Hence, they adopted a continuous delivery with the delivery time from months to days. This allows their development team to focus on adding features which results in lower costs.
- **Netflix** use**s** a suite of automated tools that helps the company to automate tests and allows them to proactively resolve issues before they impact their customers. They are able to deploy code thousands of times per day.
- **Airbnb** like Netflix is a third platform company as they leverage social, mobile, analytics, and cloud. This requires them to adopt DevOps to release multiple small deployments quickly and efficiently.
- **Etsy** struggled with slow deployments as they had a lot of siloes and they lacked collaboration between the teams. Initially, they used to deploy code twice a week; however, Etsy now carries over 50 deployments per day, thanks to DevOps.

III. COMPARISON BETWEEN DEVOPS AND AGILE METHODOLOGY

What is Agile?

Agile is a group of software development methodologies referred to iterative incremental development approach that requirements and solutions evolve through collaboration among self-organizing and cross-functional teams.

Agile manifesto consists four core values [5]:

- Individuals and interactions over processes and tools
- Working software over comprehensive documentation
- Customer collaboration over contract negotiation
- Responding to change over following a plan

DevOps Cycle over Agile Methodology

Based on Agile manifesto, DevOps cycle are evolved with the following practices [6]:

- **Customer comes first**: working on software development process that improves the quality of the product designed for the customer's needs.
- **Collaboration and sharing:** working together for the overall goal of the organization to bring the better product into the market.
- **Automation with continuous integration, testing, delivery and monitoring: s**ufficient and viable automation helps eliminate repetitive work, reduce errors, and result in more stable build and code release.

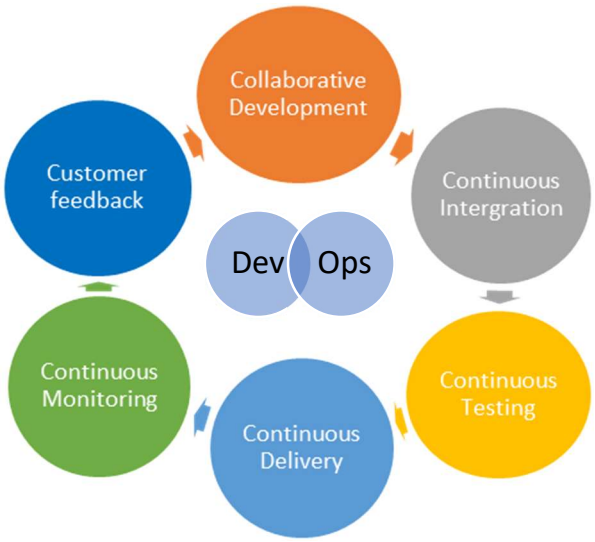

Figure 4. DevOps Reference Cycle. *Source:* Vy Hoang

Difference between DevOps and Agile

Agile addresses the communication gap between customers and developers, while DevOps is supposed to address the gap between the developers and the IT operations. Hence, it is important that Agile core values should be applied to gain the best success in DevOps.

Despite some similarities in the two methodologies regarding the value of the fast software development, there are the following differences between DevOps and Agile.

	DevOps	Agile
Key purpose	Fill the gap between the Development and the Operations and Testing	Fill the gap between the Customers and the Development and Testing
Core components	Focus on Continuous Integration, Continuous Testing, Continuous Delivery and Monitoring	Focus on Continuous Development (changes, features)
Integration and Delivery	Automate the code integration and the product delivery in a more reliable manner and a more quickly and repeatably speed	Delay in the deployment and integration while waiting for the product release date from the operation team
Automation	Key success in DevOps is to automate everything	In Agile, automation is not emphasized
Team working culture	Development and Operation teams share the roles. Development is Operations and Operations is Development	Different people oversee different phases for developing, testing, and delivering software
Team size	Work effectively in a large team size that includes all stakeholders	Break down in a small team size
Time to market	Time to market shorter basing on the released code by hours that is resulted from the automated everything: build, deploy, test, and release process	Time to market longer that is resulted from the released code process by days or weeks or even a month

IV. IMPACT OF DEVOPS ON QUALITY ASSURANCE (QA)

Changes of QA Roles in DevOps Environment

In traditional process, QAs are considered as the gatekeeper between the development and operations. After getting an updated code build in their testing environment, QAs then start the functional and regression testing. This phase remains in the QA testing team for days before the build is approved to release.

In DevOps as an extension of Agile, the process is switched in the QA testing team. According to Aniket Deshpande's article in Software Testing Help, there are changes for QA roles in the DevOps testing [7]:

- Align the efforts with various functions in the DevOps cycle.
- Ensure to automate the test case execution with almost 100% code coverage.
- Standardize the testing environment and automate the code deployment into the production.
- Arrange all the tasks: pre-testing, cleanup and post-testing in the continuous integration cycle.

The role between the QA team with the development and the operation team can be shared around the software development and the infrastructure implementation. QAs should be more collaborated with the development and the operation team; also, they should get more involved and engaged throughout all phases of the pipeline than ever before.

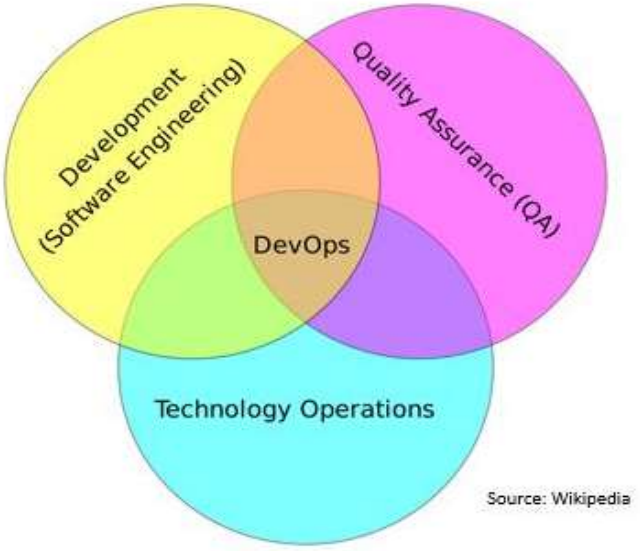

Figure 5. Intersection of Development, Operations and QA. *Source:* https://commons.wikimedia.org/wiki/File:Devops.svg [8]

Required Skills and Tools for QA in DevOps Adoption

Having said that the key element in adopting DevOps is automation. In addition, with the impact of DevOps, QAs may face not only the new challenges in the testing procedures but also the competition among the technology job market.

Required Skills

The following are the guiding skills that QA should perform while working in DevOps [9]:

- Be proactive in more and more automated instead of manual testing. A fully automation in the continuous testing helps relieve the risk, minimize cost, and promote the time to market faster and frequently.
- Be able to work partially in a technical team and support the development team in fixing the error-potential codes.
- Build a strong testing skill set with the usability of various testing tools, methodologies and scripting languages: JavaScript, Python, Ruby.
- Collaborate to reduce the bottlenecks among the team; think more for the organization and the customer first.
- Absorb the mindset on the move from QA tester only to Software Engineer in Test.

DevOps Tools

There are a lot of tools on the market that are used in DevOps. Here are some popular tools collected and suggested by experts [10].

No.	Tools	Description
1	GitLab	GitLab is a web-based DevOps life cycle tool that provides a Git repository manager: wiki, issue tracking and continuous integration/continuous deployment (CI/CD) features with an open source license.
2	puppet	Puppet enterprise tool eliminates the manual work for the software delivery process. It helps developers to deliver software rapidly.
3	Selenium	Selenium is an open source web-based testing tool and the most popular testing tool in automation. It can support automation testing in a wide range of browsers.

No.	Tools	Description
4	Jenkins	Jenkins is an open-source CI/CD server. It is used to automate all tasks relating to building, testing, and deploying software.
5	docker	Docker is a DevOps technology suite. It allows DevOps teams to build, ship, and run the distributed applications. This tool allows users to assemble applications from components and work collaboratively.
6	SoapUI	SoapUI is a cross-platform free open source Application Programming Interface (API) testing tool for the two web service protocols: SOAP and REST. It is widely used for DevOps testing tool to perform the functional and load testing on API.

DevOps Engineer Hiring Trend

Knowing that the industry is gradually replacing the manual work and moving toward the automation, this is exactly what DevOps focuses on. QA testers are expected to know how to code and automate the testing scripts to execute a diversity of software testing that includes integration testing and regression testing.

With the demand of the fast delivery with the high-quality product to the market as the organizations' requirements, QAs with strong skills of working in DevOps are preferred in the hiring process. Moreover, these skills make them indispensable in the long race of the technology job market.

Below is the ranking from the two popular job websites that shows the demand of hiring DevOps engineer in the US market:

- On Indeed ranking in 2017: DevOps engineer was at the #3 with an average base salary of $123,165 on the Indeed list of best jobs in America for 2017, in terms of salary, number of job postings, and opportunities for growth. These positions grew by 106% in the past few years as Indeed found [11].

Indeed's Best Jobs of 2017

Rank	Job Title	Job Titles' # of Postings Per 1M Total Jobs, 2016	Average Base Salary	Average YoY % Change in # of Job Postings, '13-'16
1.	Full Stack Developer	641	$110,770	122%
2.	Data Scientist	360	$129,938	108%
3.	Development Operations Engineer	731	$123,165	106%

Figure 6. Best Jobs in America 2017. *Source:* https://www.indeed.com/lead/best-jobs-united-states-2017

- On Glassdoor ranking in 2020: DevOps job is still getting hired at the top 5 [12].

Figure 7. 50 Best Jobs in America for 2020. *Source:* https://www.glassdoor.com/blog/the-best-jobs-in-america-2020

V. CONCLUSION

Transforming into DevOps is getting more and more visible in the companies in the recent years. It is showing that DevOps helps connect the boundaries between the development and the operations that exist for a long time in the old process. Also, DevOps boosts the business values in an effective process, leading to improve better in the product quality and continuously satisfy the customer and the market.

However, in the DevOps evolution, not all the organizations obtain the smooth path to the success. As mentioned in the above Introduction part, DevOps is not a tool; it is more like a culture. To adopt the new culture, it is usually uneasy and hard to change in the short term. Organizations must consider cultural challenges with sufficient trainings on the transition process in DevOps.

Findings from the Google Trend show the interest growth in the "DevOps" term in the past three years, that is predicted to grow further in future.

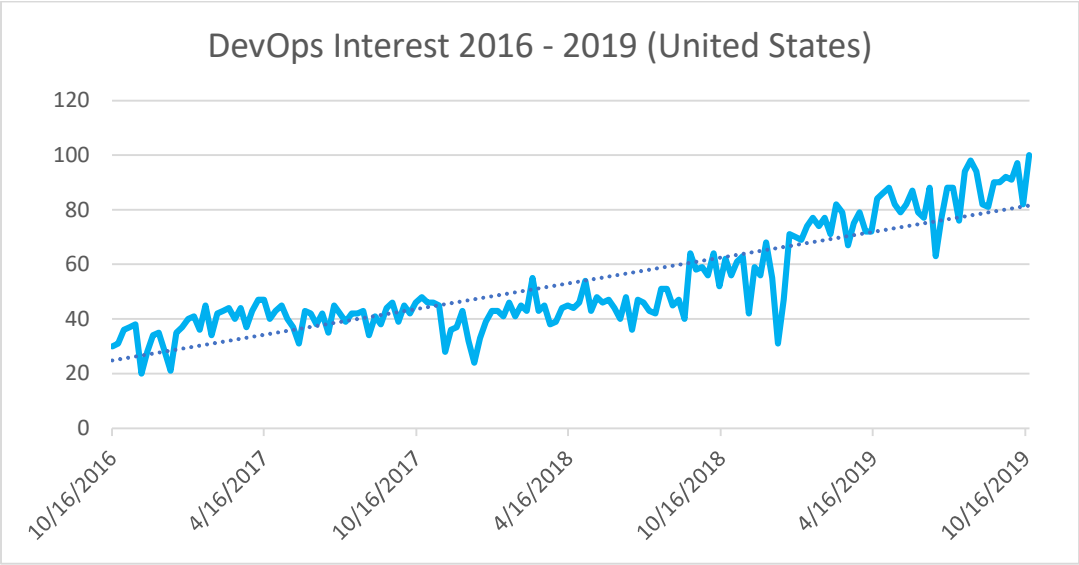

Figure 8. DevOps Interest 2016 - 2019 (United States). *Source*: Google Trend

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