Transitioning to Dev/Ops from a Waterfall Web Development Environment at the US Army Corps of Engineers

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Abstract *— The US Army Corps of Engineers needed to upgrade their web development process from a traditional Waterfall approach to a more agile DevOps methodology. Over the course of eight weeks, the project team successfully implemented the necessary changes and achieved a smooth transition to the new development environment. The project involved analyzing the existing Waterfall practice in one project by identifying inefficiencies and designing a DevOps framework tailored to the specific needs of the US Army Corps of Engineers. The team collaborated closely with technical leads, including developers, testers, and operations personnel, to ensure a seamless integration of DevOps principles and practices. Throughout the project, the team encountered challenges related to cultural shifts, infrastructure changes, and training requirements. However, through effective communication, training programs, and change management strategies, these challenges were overcome, and the organization experienced improved collaboration, faster deployment cycles, and enhanced software quality.*

Key Terms *— Collaboration, DevOps, Waterfall, and Web Development*

INTRODUCTION

This project aided the US Army Corps of Engineers (USACE) software development team process in which it had been facing challenges with deployment and efficiency. The communication and collaboration between the development and operations teams had not been as efficient as they could have been, leading to longer deployment times and reduced efficiency. To address these issues, the management decided to implement DevOps in their software development work environment.

The software development team at the US Army Corps of Engineers is responsible for building and maintaining the organization's software applications. Their development process followed a traditional approach (Waterfall method) where the development team worked in isolation from the operations team. Unfortunately, this approach had resulted in delays and inefficiencies in their development process. However, with the introduction of DevOps, they could streamline their development process, reduce the time taken to deploy software applications, and create a more collaborative and efficient work environment.

By adopting DevOps practices, the US Army Corps of Engineers facilitated a smooth flow of communication and collaboration between their development and operations teams, thus eliminating the need for lengthy handovers and reducing the risk of errors. They could also automate their software delivery pipeline, allowing them to deliver new features and functionality to their users at a faster pace while maintaining a high level of quality.

The objectives of this project were to:

- Modernize the software development processes by implementing DevOps practices.
- Reduce the time taken to deploy software applications.

WATERFALL VS DEV/OPS

The waterfall method and DevOps are two different approaches to software development and project management.

The waterfall method is a traditional, sequential approach to software development. It follows a linear process (as seen on Figure 1) where each phase of the project, such as requirements gathering, analysis, design, coding, testing, and deployment, is completed before moving on to the next phase. The

waterfall method emphasizes extensive planning and documentation upfront and presumes that requirements will remain stable throughout the project. This method is characterized by its rigidity and lack of flexibility, as changes or updates to requirements can be difficult to accommodate once a phase is completed. It involves separate teams working on different phases of the project, with a limited collaboration between them.

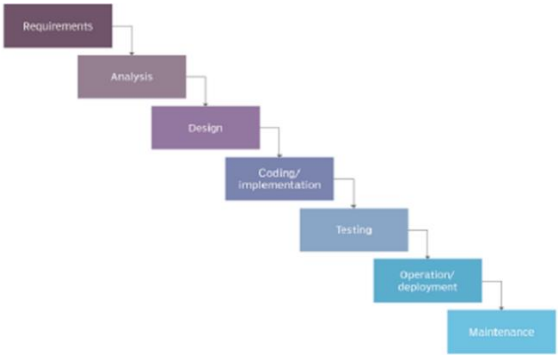

Figure 1
Waterfall Method

On the other hand, DevOps is an approach that aims to bridge the gap between development and operations teams, promoting collaboration and shared responsibilities throughout the software development lifecycle. DevOps emphasizes continuous integration, continuous delivery, and automation to enable faster and more frequent software releases. It focuses on breaking down the barriers between development and operations, encouraging close communication, and promoting a culture of shared ownership and accountability. DevOps also emphasizes the use of tools and technologies to automate processes, such as infrastructure provisioning, testing, and deployment, to ensure efficiency and consistency.

While the waterfall method is more suitable for projects with well-defined requirements and a stable environment, DevOps is better suited for dynamic and agile development environments. DevOps allows for faster feedback loops, shorter development cycles, and the ability to quickly respond to changes in requirements or the market. It promotes collaboration, transparency, and the continuous improvement of processes as shown in Figure 2.

Figure 2
Dev/Ops Method

In summary, the waterfall method follows a sequential, rigid approach with limited collaboration, while DevOps promotes collaboration, automation, and continuous delivery to enable faster and more flexible software development.

METHODOLOGY

The project followed a structured approach consisting of the following steps:

- Conduct an in-depth analysis of the existing Waterfall web development environment to identify pain points and bottlenecks.
- Collaborate with technical leads to define the requirements and goals for the Dev/Ops transition.
- Design a customized Dev/Ops framework tailored to the specific needs of the US Army Corps of Engineers.
- Implement the necessary infrastructure changes to support the new development environment.
- Provide comprehensive training programs to familiarize the teams with Dev/Ops principles and practices.
- Enhance the current communication of the team.

Throughout the project, the team encountered several challenges, including resistance to change, infrastructure constraints, and skill gaps between team members. To overcome these challenges, the project team implemented the following strategies:

- **Implementation:** The implementation of Dev/Ops required a mindset shift from an individual-based to a team-based approach [1].

- **Culture Change:** This is a significant obstacle, as it is human nature to resist change [2]. To address this challenge, the team created a DevOps culture that encourages collaboration, continuous feedback, and a focus on automation.
- **Management Activities:** Conducted change management activities to address resistance to change, emphasizing the benefits of Dev/Ops and involving key technical leads in decision-making processes.
- **Collaborate:** Collaborated with the IT department to identify and address infrastructure constraints, ensuring the necessary tools and technologies were in place to support the new development environment.
- **Training:** Implemented comprehensive training programs to bridge skill gaps between team members, ensuring they had the necessary knowledge and expertise to adopt Dev/Ops practices effectively.

RESULTS AND BENEFITS

After eight weeks of dedicated effort, the project team successfully completed the transition to Dev/Ops from a Waterfall web development environment for a project. Table 1 demonstrates the outcomes or benefits that were achieved:

Table 1
Outcomes and Descriptions

Outcome	Description
Improved collaboration and communication	Increased efficiency and reduced time-to-client for software releases.
Enhanced software quality	Continuous integration, automated testing, and deployment.
Greater flexibility and adaptability	Ability to respond quickly to customer needs.
Streamlined development processes	Faster deployment cycles and more frequent software releases.
Increased job satisfaction and engagement	Empowerment and autonomy provided by the Dev/Ops approach.

CONCLUSION

The US Army Corps of Engineers successfully transitioned a project to Dev/Ops from a waterfall methodology. This eight-week project aimed to transform the software development process within the organization and enhance agility, collaboration, and overall efficiency. Through careful planning, collaboration with technical leads, and the implementation of a customized DevOps framework, the organization achieved a smooth transition from the traditional Waterfall approach to the more agile DevOps methodology.

The project team encountered various challenges, including resistance to change, infrastructure constraints, and skill gaps among team members. However, these challenges were effectively addressed through change management activities, collaboration with the IT department, and comprehensive training programs. The team's dedication and efforts resulted in improved collaboration and communication, enhanced software quality, greater flexibility, and adaptability, streamlined development processes, and increased job satisfaction and engagement among team members.

The successful implementation of DevOps principles and practices has empowered the US Army Corps of Engineers to better meet the evolving demands of software development. This project serves as a valuable example and resource for other organizations considering similar transitions, highlighting the importance of careful analysis, technical lead collaboration, and training in achieving a successful DevOps transformation.

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