Opportunities and Challenges of Adopting CI/CD Practices in Mobile Apps

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***Abstract*—Mobile applications (*apps*) are widely used in our daily activities, such as completing financial, education, and communication services. With the high competitive nature of mobile apps, developers need to rapidly design, build, test, and deploy their apps to the end users. Over years, Continuous Integration and Continuous Delivery (CI/CD) has gained popularity as a practice that connects development and operation teams to reduce the time needed to build and deliver high-quality systems. Despite the large adoption of CI/CD practices in different organizations, little is known about the current challenges and the potential opportunities to adopt CI/CD practices in mobile apps.**

In this tutorial, our aim is to provide an overview of CI/CD concepts and highlight development practices and research directions to adopt CI/CD practices in mobile apps. The tutorial also describes the state-of-the-art techniques for adopting Artificial Intelligence (AI) in different stages of the CI/CD pipeline for mobile apps.

***Index Terms*—DevOps, CI/CD, Mobile apps, Android, GitHub Actions, AIOps, Google Play Store**

I. Tutorial Length

The tutorial length is 1.5 hours as it will provide a general overview of the current challenges and potential opportunities to adopt CI/CD practices in mobile apps.

II. Tutor Information

Experience Summary: Safwat Hassan (the corresponding tutor) is an Assistant Professor at the **Faculty of Information (University of Toronto, Canada)**. He completed his Ph.D. degree in the Software Analysis and Intelligence Lab (SAIL) at Queen's University. Before starting his Ph.D., he worked as a software engineer for ten years in different corporations like the Egyptian Space Agency (ESA), Hewlett Packard (HP), Vodafone Germany, and Etisalat. During his ten years in the software industry, he worked on different large-scale systems (varying from Web-Based systems to embedded systems) and in diverse project roles (design service, customer support, and R&D) across various domains (e.g., telecommunications and aerospace).

Safwat Hassan has several publications including 3 IEEE Transactions on Software Engineering (**TSE**) papers, 6 ACM Transactions on Software Engineering and Methodology (**TOSEM**) papers, 7 Empirical Software Engineering Journal (**EMSE**) papers, 3 International Conference on Mining Software Repositories (**MSR**) papers, 2 IEEE/ACM International Conference on Mobile Software Engineering and Systems (**MOBILESoft**) papers, and 1 IEEE International Conference on Software Analysis, Evolution and Reengineering (**SANER**) paper.

Research Objective: Safwat Hassan's main research is ***studying mobile apps*** by analyzing data from different mobile app stores (e.g., Google Play Store). His research includes analysis of review platforms [1]–[9], common practices of developers [10]–[20], user-developer interactions [21], [22], CI/CD practices [23], [24], improving software system performance [25]–[29], and adopting mobile apps for high-quality life [30], [31]. Safwat Hassan's research aims to provide techniques and frameworks that improve user experience and the quality of published apps in app stores.

III. Target Audience and Prerequisites

The purpose of the tutorial is to highlight the opportunities and challenges of adopting CI/CD practices in mobile apps. Hence, the tutorial is useful for Ph.D. students, software engineering researchers, and software practitioners. The tutorial requires previous programming experience as recommended prerequisites.

IV. Learning Objectives and Tutorial Outline

This tutorial aims to provide an overview of the CI/CD practices in mobile apps. The main takeaway is that mobile apps have a unique nature in adopting CI/CD practices, such as running emulator testing and the deployment to app stores (e.g., the deployment to the Google Play Store). The tutorial has the following learning objectives:

- To understand the issues and challenges in building, testing, deploying, and maintaining mobile apps.
- To understand the adoption of Artificial Intelligence (AI) techniques in the creation and maintenance of mobile apps.
- To understand concepts and gain insight into the application of Configuration Management (CM) concepts to facilitate collaborations in large-scale organizations.

The tutorial has the following outline:

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1) **An overview of CI/CD concepts.** The author will provide an overview of how CI/CD practices bridge the gap between software developers and operational teams.
2) **Adopting CI/CD practices in mobile apps.** The author will describe the challenges of adopting CI/CD practices in mobile apps [24].
3) **Adopting AI techniques in the CI/CD pipeline.** The author will present an overview of the state of the art research and open directions for integrating Artificial Intelligence (AI) techniques in different stages of the CI/CD pipeline for mobile apps.

V. Overlap Statement

This tutorial has not been presented before, as this is the first time that a session on the details of the CI/CD pipeline and how CI/CD practices are adopted in mobile apps has been provided.

VI. Engagement and Interactivity

The tutorial does not contain hands-on activities. However, the presenter will describe the content with a focus on engaging the audience through multiple techniques, such as: 1) providing practical examples from research and industry, 2) presenting clear insights and recommendations for the practitioner and research community, and 3) involving the audience in open and interactive discussions to reflect on the discussed content.

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