

Pull Requests Integration Process Optimization: An Empirical Study

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Abstract. Pull-based Development (PbD) is widely used in collaborative development to integrate changes into a project codebase. In this model, contributions are notified through Pull Request (PR) submissions. Project administrators are responsible for reviewing and integrating PRs. In the integration process, conflicts occur when PRs are concurrently opened on a given target branch and propose different modifications for a same code part. In a previous work, we proposed an approach, called *IP Optimizer*, to improve the Integration Process Efficiency (IPE) by prioritizing PRs. In this work, we conduct an empirical study on 260 open-source projects hosted by GitHub that use PRs intensively in order to quantify the frequency of conflicts in software projects and analyze how much the integration process can be improved. Our results indicate that regarding the frequency of conflicts in software projects, half of the projects have a moderate and high number of pairwise conflicts and half have a low number of pairwise conflicts or none. Furthermore, on average 18.82% of the time windows have conflicts. On the other hand, regarding how much the integration process can be improved, *IP Optimizer* improves the IPE in 94.16% of the time windows and the average improvement percentage is 146.15%. In addition, it improves the number of conflict resolutions in 67.16% of the time windows and the average improvement percentage is 134.28%.

Keywords: Collaborative Software Development · Distributed Version Control System · Pull-based Development · Pull Request · Integration Process Efficiency · Software Merging · Merge Conflicts.

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